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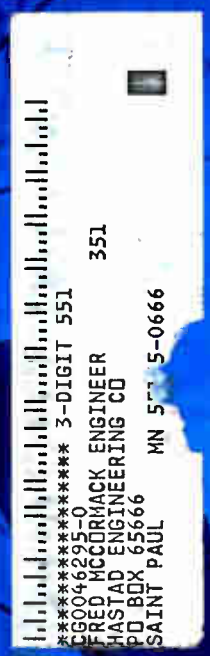

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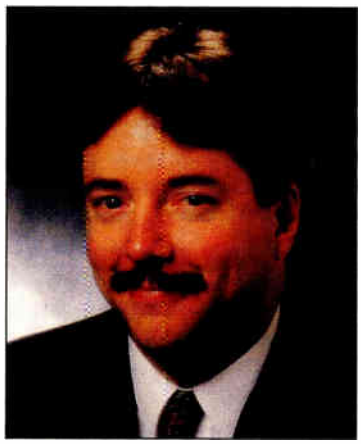

There's a price for freedom of choice

Well, that didn't take too long, did it?

It took literally years of intense lobbying and creative writing to craft a telecommunications rewrite that was palatable to both industry and lawmakers, but it only took a few weeks for industry consolidation to begin.

The presidential signature was barely dry on the telecom reform act when US West announced its plans to merge with Continental Cablevision, giving the Denver-based regional Bell operating company a strong toehold in the video arena. (And if US West ends up controlling Time Warner's cable operations as a result of its lawsuit over the proposed Time Warner/Turner deal, as some have predicted, the RBOC could suddenly be the nation's largest MSO. But that's another story that has yet to be played out.)

A few weeks later, Pacific Telesis and SBC Communications announced they plan to merge their operations through a straight stock swap, bringing the number of RBOCs from seven to six. The combined company will retain the SBC Communications name and will be based in San Antonio, Texas, although new headquarters locations for local telephony, Internet and international operations will be located in California.

But the blockbuster merger deals may not yet be done. Bell Atlantic and Nynex are reportedly still courting each other, and AT&T, finally unshackled to play in any game it wants, has supposedly talked with everyone from US West to TCI about acquiring those companies.

Indeed, Continental's Senior Vice President of Engineering and Technology, David Fellows, predicts that one day there will be only three large RBOCs and a few large MSOs (of course, by then, those companies will lose those acronyms and be known as huge media conglomerates) competing against one another while hundreds of "mom-and-pop" companies fill in the rural gaps to provide telephone and video services. At this pace of merger mania, Fellows could be right a lot sooner than he presently thinks.

So, what effect will this have? Is this good for the consumer, as so many people touted back in February when the telecom bill was signed into law, or does it simply mean that the big get bigger, and the consumer pays more for voice, video and data service?

So far, the consumer is losing. Tele-Communications Inc. has already said it plans to raise rates by as much as 20 percent in some areas–a rate hike it's allowed to have. Similarly, US West has been trying to raise its residential rates throughout its territory, in some cases by as much as 100 percent. This has actually worked against US West, which has actually seen state PUCs cut their rates rather than approve an increase.

Are these rate hikes called for? Are they merely methods to raise the badly needed cash for capital improvements? Will rates go back down when competition truly comes? Will competition get so fierce that companies literally "buy" their customers, much like AT&T and MCI do now with $40 and $50 checks used to incent people to change carriers?

In the unregulated era we're all about to enter, there are myriad questions and few hard answers. But it looks like we all may have to pay to have the freedom to choose.

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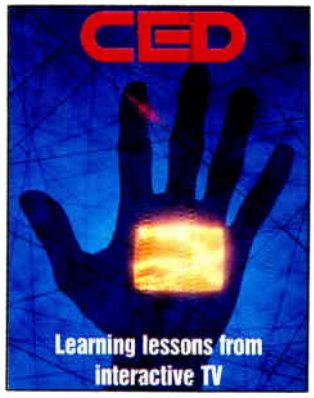

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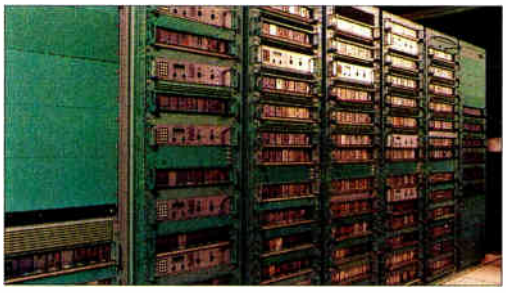

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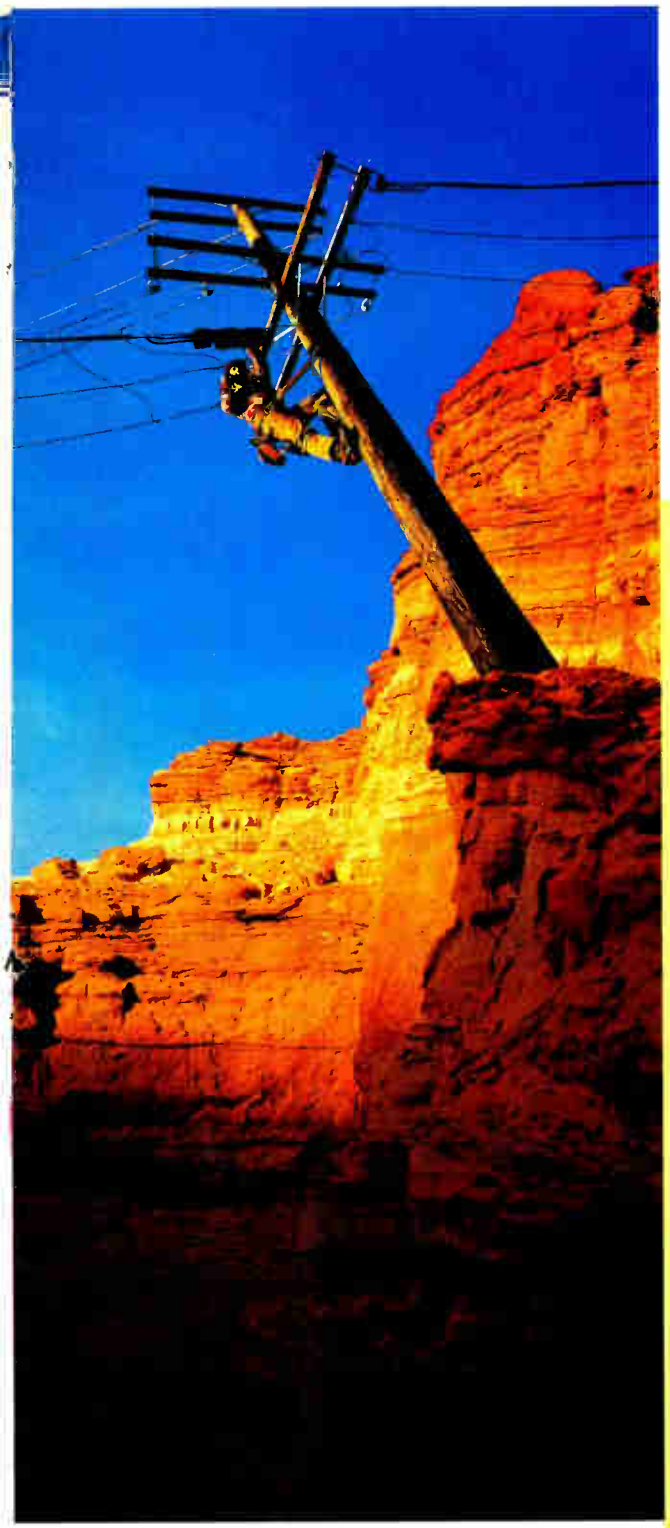

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3Com, Com21 team to develop complete data-over-cable system

When the data networking companies jump into the data-over-cable fray, something must be about to happen. The whole movement toward provision of high-speed data over cable received a huge shot in the arm in late March when networking leader 3Com Corp. announced a plan to work with Com21 to develop a next-generation system based on open standards.

Under terms of the partnership, 3Com will license Com21's cable modem technology and will manufacture its own line of modems. In return, Com21 will receive 3Com's assistance in architectural design and quality assurance and will become 3Com's cable headend controller supplier. Also, 3Com will take an unspecified equity position in Com21 and will be represented on Com21's board of directors.

Observers say the partnership will leverage 3Com's data networking expertise and products, including Ethernet network cards, ATM and LAN switches, routers and network management software, and combine them with Com21's ATM-based cable modems and headend controllers.

Com21's cable modems are presently being field tested. Because they are based on asynchronous transfer mode standards, they allow operators to provide data customers with guaranteed bandwidth-on-demand and provide a migration path to other advanced broadband services, including telephony and desktop video.

Com21 officials say the partnership is committed to providing its customers with products based on open standards, such as those presently being hammered out by Cable Television Laboratories and the MSO consortium known as MCNS, as well as several other equipment manufacturers. While those specs are being decided, however, several companies are hoping to establish de facto standards by marketplace dominance.

"Our ongoing work with cable industry leaders has enabled us to define an architecture that we believe will be rapidly adopted by the industry and truly stimulate the market," said Pete Fenner, president and CEO of Com21, in a statement. "It is our objective to continue working with standards bodies, the cable industry and technology leaders to promote an open standard for transmitting data over cable."

In an unrelated area, Artel Video Systems was recently split off from 3Com Corp. as the result of a friendly management buyout, it was announced. Artel was acquired by a team of managers led by Hal Charnley, the company's new president and CEO.

Artel was founded in 1978 and built fiber optic video transmission products. The company merged with Chipcom in 1994, and became part of 3Com when Chipcom was acquired by 3Com in 1995. It will now operate as an independent, private company.

The company will continue to design, manufacture and sell broadcast-quality fiber transmission gear to a wide variety of customers, including broadcasters, telcos and cable companies.

HP, Stanford will make LMDS system

The prospects for "cellular TV" using the millimeter wave band received yet another boost in late March when Hewlett-Packard and Stanford Telecom pledged to work together to develop a prototype LMDS (local multipoint distribution service) system that would allow fully interactive, all-digital communication to occur.

LMDS is a fledgling, though growing, wireless two-way technology that supports voice, video and data applications such as telecommuting, distance learning, interactive video and videoconferencing, high-speed Internet access and real-time multimedia file transfer.

Because it operates at high frequencies, LMDS technology is expected to offer more upstream bandwidth than cable MSOs or MMDS operators can presently offer. In addition, the technology is digital and can take advantage of low-power transmitters, which improves reception and allows high-speed, two-way communication.

The FCC is expected to begin auctioning 1 GHz of spectrum for LMDS services later this year. The spectrum will be in the 28 GHz region and will be auctioned in 487 basic trading areas.

The HP/ST alliance is focusing on a system that uses AM digital signals–not FM signals that other manufacturers have chosen to use. Signals will be time division multiplexed into channels ranging from 10 to 50 megabits per second in the downstream, and in lower speeds in separate frequency areas in the upstream.

The two companies have had the hybrid fiber/wireless model in mind from the outset, officials say, and the focus on solid-state, low-power equipment will allow operators to deploy compact equipment designed for placement at a fiber node location. On the downside, the AM signals are more susceptible to reflection, making line-of-sight alignment more critical. In addition, more cell sites will have to be constructed. While this improves the customer per cell ratio, the cost of equipment could be more expensive than FM approaches, depending on penetration rates.

HP brings its expertise in microwave and IF subsystem components, including antennas and power amplifiers into the partnership, while Stanford Telecom will provide digital signal processing subsystem components, such as headend/hub modems and subscriber modems.

A more definitive agreement that will spell out marketing, production and sales responsibilities between the two companies should be forthcoming.

Chip makers focus on integration efforts

Just as cable operators are poised to begin transmitting their video signals in digital format, a number of chip manufacturers are busily working to reduce chip footprints, lower their costs and make it easier and more cost-effective for service providers to play.

C-Cube Microsystems introduced its next-generation MPEG-2 encoder chipsets for broadcast quality video encoding, video storage and an authoring encoder. Each chipset is based on the company's third-generation VideoRISC processor, which delivers more than twice as much processing power as previous versions.

C-Cube's new broadcast encoder is designed for DBS, cable, MMDS and enhanced-definition TV applications where quality is of utmost importance. It supports main level/main profile MPEG-2 standards and includes features such as statistical multiplexing, inverse telecine and external bit rate control. The storage encoder and authoring encoder are also based on MPEG-2 standards.

On the decode side, C-Cube announced that Samsung has selected the company's CL9100 set-top video decoder and its CL9110 transport demultiplexor as the engines for Samsung's new set-tops and wide-screen TVs with integrated set-tops. Samsung set-tops will be used to receive DBS and cable services; in fact, its digital set-top is already being deployed by KoreaSAT in the Korean domestic market.

Meanwhile, IBM Microelectronics introduced six new MPEG-2 chips and intends to deploy them in servers, set-top boxes and personal computers. IBM is planning to introduce three single-chip decoders (two video/audio decoders and one video-only decoder) aimed at

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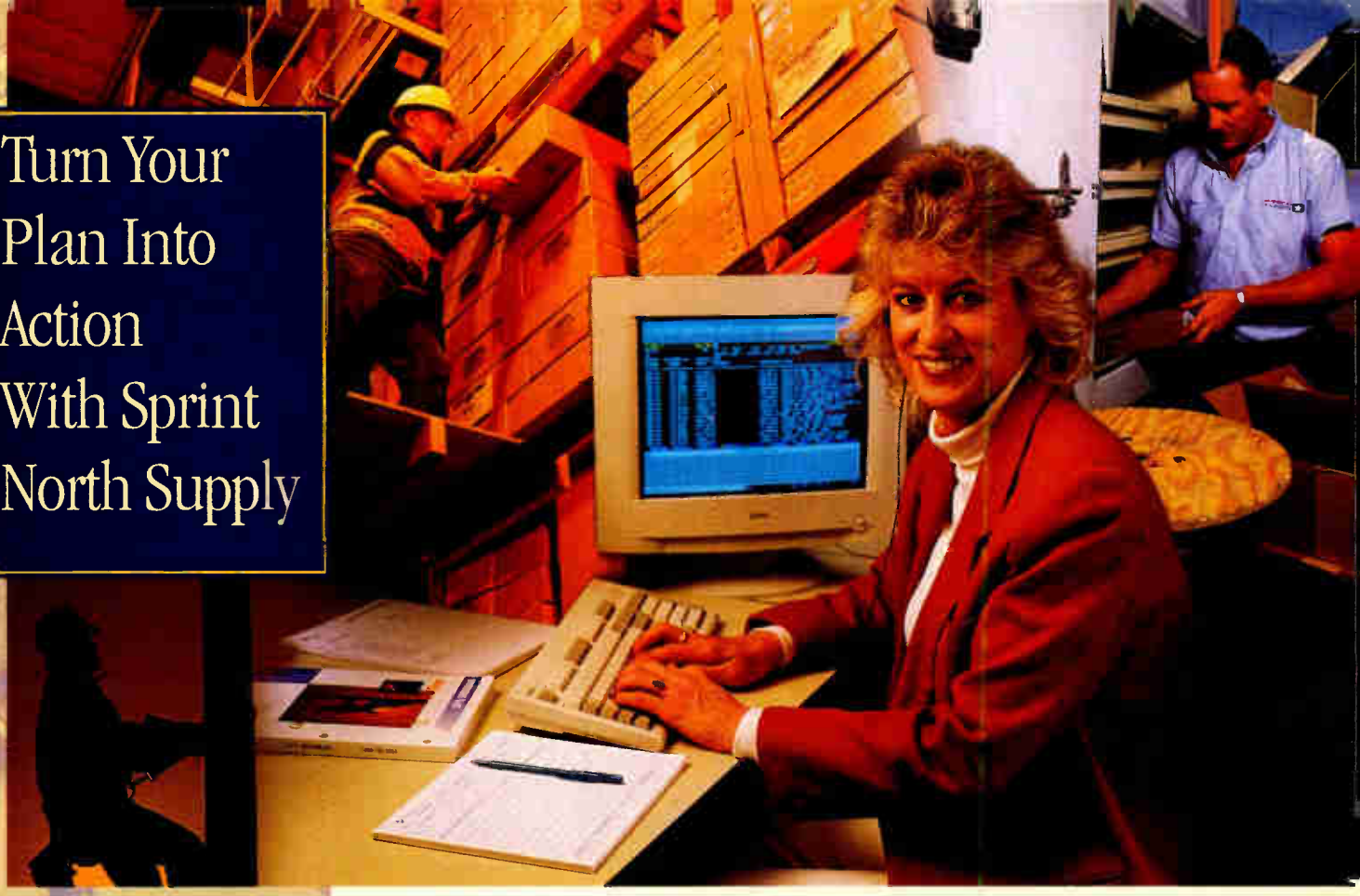

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cable set-tops and multimedia PCs. IBM officials believe these chips, which can be purchased later this year for prices as low as $35 in quantity, could lead to achieving a set-top price point of somewhere between $300 and $500.

In addition, three chips will provide full main level/main profile MPEG-2 compression, for use in digital ad insertion equipment and video servers. Those chips will be priced at $1,500 in quantity for the set. These encoding chips are being provided to Vela Research, 3DO and Wired Inc.

These announcements come on the heels of LSI Logic's recent introduction of a new chipset that the company claimed would dramatically lower the cost of cable set-tops–making the $300 digital box a reality. That announcement was greeted with great skepticism by set-top box manufacturers.

S-A, ADC debut new transport gear

It must be time for a major trade show, because there's a spate of new video distribution gear being debuted. For example, Scientific-Atlanta is touting its new line extender that is based on gallium arsenide-based circuitry, while ADC Video Systems is preparing to show a wide range of new fiber optic transmission equipment.

In anticipation of cable operators rolling out a wide range of new services, S-A has developed a new line extender that will reportedly offer improved performance and reliability, which leads to lower installation and operating costs, says Andy Meyer, director of marketing in the transmission systems division at S-A.

The new LE III replaces conventional silicon-based hybrid circuits with smaller, more efficient ICs based on GaAs technology, which is commonly used in set-top terminals, cellular telephones and other high-frequency devices. By using this technology, bandwidth can be extended beyond 750 MHz while running cooler and drawing 15 percent less current than conventional silicon solutions, Meyer said.

In addition, because the line extenders can be driven harder, operators won't have to buy as many amplifiers, making the total network costs lower. Also, distortions are much improved, often by as much as 5 dB, Meyer added.

The LE III has been undergoing field testing since last autumn and will be available in about 60 days, according to S-A officials. The new GaAs chip is being provided by Anadigics of Warren, N.J. Scientific-Atlanta has placed an initial order for $1 million worth of chips.

Meanwhile, ADC Video Systems is unwrapping the largest collection of new products it has ever debuted at one time, according to John Holobinko, VP of marketing and strategic planning at AVS.

Specifically, ADC has developed a new, externally modulated 1550 nm optical transmitter and optical amplifier that touts improved performance via optical feedforward technology. Unlike other transmitters which have used some sort of signal compensation or "pre-distortion" to cancel unwanted signal impairments, the new HWX 1550 transmitter, the feedforward approach to allow a higher degree of compensation, gives the system greater control over signal distortions, Holobinko said.

Just how much better is it? Holobinko said the transmitter provides a 55 dB carrier-to-noise ratio (before the amplifier) with 80 channel loading. After the optical amplifier is added, the result is a CNR that's 2 dB better over other approaches.

Other new ADC products include support for component serial digital video in its flagship DV6000 digital video transport system; a low-cost optical node for systems needing just one-way service; a high-output option for its optical node, making passive networks possible; and a new release of the company's network management software.

Ortel rolls out PCS microcells

As personal communications systems begin to get designed and deployed, Ortel Corp. is introducing MirrorCell Fiber, a fiber optic-based microcell that allows PCS network builders to centrally locate base stations to distribute RF signals and reduce the number of large sites. The small microcells can be placed on lamp posts and on the sides of buildings, making it easier to acquire sites in heavily populated areas.

Multiple MirrorCell Fiber microcells can be connected to a single base station to create a distributed antenna system, said Hal Zarem, Ortel's business manager for wireless communications.

The new product is the result of combining Ortel's traditional fiber-based technology with the Channel Selective Repeater, which was developed by Avitec AB and acquired by Ortel when the company recently took over Avitec.

The repeater is already being used in places such as Germany, where the product was used to help lower the cost of service roll-out, said Zarem. The product offers PCS operators greater flexibility in matching coverage and capacity requirements and can also be used to fill in "holes" where coverage is obscured by terrain, canyons, buildings and tunnels.

The product has operations, administration and monitoring capabilities to help network operators monitor traffic capabilities and give them the ability to remotely configure the frequency and power at which the repeater operates.

And finally, Ortel has announced a high-power version of the repeater for PCS and GMS applications, known as the MirrorCell Max. This unit is intended to cover large, open areas with full cell site output power, allowing infrastructure costs to be lowered while increasing service roll-out speed.

Cox will test Tellabs equipment

With all the emphasis on developing and deploying high-speed cable data modems, it's easy to forget that cable operators are just as eager to begin offering local telephony service as well. Toward that goal, Cox Communications will be testing Tellabs' CableSpan 2300 cablephone equipment to about 25 single family residences in the company's flagship San Diego system.

The test of direct-dial local and long-distance calling, custom calling features, operator assisted and other services was to have started at the end of April and is scheduled to last until June.

After the technical trial is completed, Cox expects to offer telephone service over its cable network to about 500 homes as part of a marketing trial. As part of the technical trial, Cox is also experimenting with a variety of powering options, according to Tellabs officials.

Cox becomes the sixth large cable MSO to test the Tellabs gear. The others include Time Warner, Adelphia, TeleWest, Viacom and one other unspecified operator. Time Warner currently is using the equipment to deliver telephone service to more than 1,000 customers in Rochester, N.Y. Cox is a member of the Sprint Telecommunications Venture and is an investor in TelePort Communications, as well.

Hughes shows new home DBS systems

Hughes Network Systems Inc. unveiled its new Insight family of digital broadcast home satellite systems recently that includes a DSS system for the reception of direct broadcast satellite television, DirecPC and other products to be introduced during the year. The focus of the product line is to introduce a vision to the future.

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DirecTV—also provides consumer-friendly features such as SeeThru Banner, which provides detailed program information, including title, rating and length of program without blocking the program on the screen; OneLine Guide; LogoBelt; and PreSelect; features that are unique to the industry, as well as easy-to-use on-screen programming guides at the touch of a button.

DirecPC, meanwhile, is already available and offers high-speed information delivery for the computer by downloading information from the Internet at speeds up to 400 kbps, more than 28 times faster than a typical modem. CNN Headline News, Sports Ticker and Financial Ticker are accessible 24 hours a day. Digital package delivery for large bundles of information is also available for receiving data at 3 Mbps. The information is made available by an ISA adapter card and a separate 24-inch satellite dish.

Interactive TV usage up, says study

While interactive TV for couch potatoes has apparently hit a snag, communicating via interactive satellite television appears to be catching on. According to Dallas-based Westcott Communications Inc., companies have contracted for more than $8.5 million worth of services on its Interactive Distance Training Network (IDTN) for this year.

Communicating via interactive satellite television appears to be catching on

Westcott officials say renewal rates for the network, which grossed $8.8 million last year, are running near 100 percent. According to Westcott Executive Vice President Josh Klarin, of the 35 companies that used the system in 1995, 34 will use the network again in 1996.

Westcott surveyed more than 45,000 IDTN participants over a 12-month period to gauge their reactions to interactive training and education. Results of the survey reveal that 95 percent of executives who've used IDTN believe it to be an "effective means of training and communication." In addition, 92 percent of those surveyed indicated they would "like to attend future events delivered via interactive satellite TV."

Companies using IDTN include Oracle Corporation, Compaq, Intel, Eli Lilly, Ernst & Young, Glaxo-Wellcome, Silicon Graphics, Storage Technology, Sun Microsystems, IBM, Bay Networks, 3M, Tyson Foods, Days Inn, and DHL Worldwide.

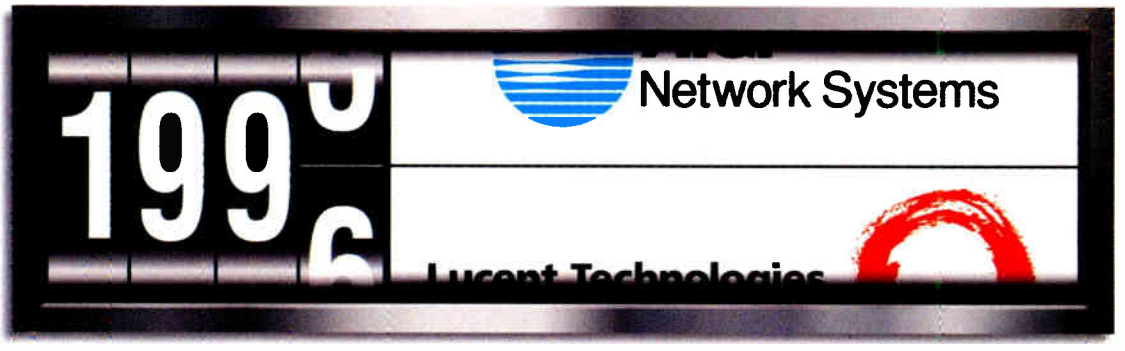
According to Klarin, uses have included new product rollouts; skills, sales, product and content training; market research; strategy sessions; and emergency and crisis communications.

IDTN broadcasts originate live from Westcott's studios in Dallas. Secured broadcast signals are transmitted through IDTN's private satellite network to 45 proprietary "learning suites" located in major cities around the country. Each suite is equipped with special keypads which enable instructors, located at the IDTN studios, to maintain direct video and audio contact with participants.

Westcott has pioneered the delivery of workplace training and education utilizing various multimedia technologies. Westcott provides training, news and information to more than 20,000 subscribers with an estimated population of three million professionals and students in the corporate and professional, automotive, banking, government and public service, education, healthcare and interactive distance training markets.

Jottings

Pacific Bell has chosen to modify and deploy a video interdiction system developed by **Blonder-Tongue** in its California video build. PacBell will install both specially designed single- and multiple-family units of the VideoMask technology in its network, which is now being tested in San Jose. The agreement covers five years and initial shipments are expected later this year. On a related note, Blonder-Tongue Labs announced its first quarter revenues would fall short of expectations because of a two-month production delay on the VideoMask product . . . Meanwhile, in order to prepare for a future which offers interactive broadband services, **PacBell** and **Andersen Consulting** are developing a complete Unix-based billing and customer care system that will accommodate billing, customer care, service negotiation and trouble entry. The new software system, which will be offered to other communications companies, is aimed at overcoming telcos' legacy systems, which often handcuff the telcos when it comes to provisioning new services . . . While many grouse about DBS as a competitor, there's one company that could be an ally for the little guy. **TelQuest Ventures** has applied with the Federal Communications Commission to offer DBS services, but what makes it different is that it plans to offer satellite services to small cable operators, small telcos and MMDS operators. Through a deal with Telesat Canada, the company will use at least 22 transponders on a satellite that will be launched next year and parked at 91 degrees west longitude. Controlling interest in TelQuest is held by Jared Abbruzzese, who is chairman and CEO of CAI Wireless, an MMDS operator . . . **Continental Cablevision** reports that it exceeded by 65 percent its 1995 commitment for capital expenditures under its "social contract" with the FCC. The contract calls for Continental to spend $1.35 billion between Jan. 1, 1995 and the end of the year 2000, with a minimum annual investment of $225 million. In 1995, Continental spent $371 million and expects to drop another $400 million in calendar 1996. Last year, systems serving 460,000 subscribers were upgraded by Continental, raising to 1.4 million the number of subs on systems with at least 550 MHz of capacity . . . **Sanders**, a developer of electronics systems, has licensed Qualcomm's code division multiple access (CDMA) technology for its remote antenna drivers/remote antenna signal processors (RAD/RASP). Sanders will use the CDMA technology in its "PCS-over-Cable" system. Sanders, which is owned by **Lockheed Martin**, intends to use existing cable networks, combined with small transceiver units, to offer PCS services . . . Speaking of Lockheed Martin, the company has been chosen by **Telstra Corp.** of Australia to integrate and manage support services for the interactive broadband services that will be offered to 5,000 subscribers in three different cities . . . **CellularVision** of New York has completed a second LMDS cell site in lower Manhattan. The cell will serve up to 150,000 homes in northeastern Brooklyn as well as residences and offices in Manhattan. The company hopes to build a microcell network throughout the city rapidly . . . **Daniels Cablevision** in Carlsbad, Calif. is installing **Channelmatic's** "Digital Lite" low-cost digital video server for commercial insertion and program playback. The $250,000 deal consists of Daniels Carlsbad (16 channels), Desert Hot Springs (five channels) and a central encoder . . . First there was **Frontier**, then **Time Warner**–and now there's **MFS Communications** offering local telephony services in Rochester, N.Y. MFS Intelenet is targeting small- and medium-sized businesses to serve with its 172 route mile fiber network . . . . CED



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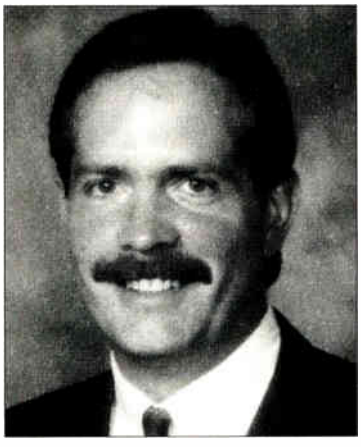

Thomas C. Foster

As any college student can attest, trying to decide on a major field of study is often a wondrous, gut-wrenching, lengthy journey of discovery. Back when he was an undergrad, Time Warner's Tom Foster went through his own personal journey of discovery, first focusing on pre-med, then switching his allegiance to engineering, eventually studying theoretical math and botany, and finally finishing up with a degree in management, with an economics minor.

As it would happen, the multiplicity of disciplines he studied were perfect preparation for Foster's future career. In his present position as vice president of network services and engineering in Time Warner's Rochester, N.Y. cable system, Foster is truly one of the first technical people in the cable industry who is charged with overseeing not only traditional cable television service, but with telephony and high-speed data service added in.

"To be talking about, on any given day, all the certification processes, the cable television business, standby powering, all of those issues–it's what I like about my job," he explains. "I consider myself more of a generalist: I need a lot of different projects going on to keep my interest."

The professional mix works well for Foster. "The fact that Tom has a strong cable background has been invaluable to our success in deploying telephony in Rochester," says Jim Chiddix, senior VP of engineering and technology, Time Warner Cable. In the two short years Foster has been back with Time Warner, he has engineered a facilities upgrade to prepare the company for entry into the telephony business, while later supervising the company's HFC telephony trials; has managed the installation of Sonet rings serving 10 hubsites; and has pulled off the monumental accomplishment of upgrading the cable plant for maximum reliability, which has resulted in network uptime of 99.99 percent. Added to that, the Rochester system and its surrounding systems have grown to roughly 5,000 square miles, and an upgrade to 750 MHz will likely be implemented in the rest of the division as part of a five-year plan.

Foster's most challenging task? System reliability. "From the powering perspective, it's stuff we, as an industry, haven't done before," he notes. "And the return path—the industry probably hasn't paid as much attention to it as it should have." Ensuring a more reliable system has also necessitated a culture change, says Foster. Techs no longer swap out electronics on their own to obtain a better measurement in the field. "Now, all plant outages are evaluated in advance. We have developed some switching equipment where we can bypass sections of plant that we're going to bring down for maintenance. It's just a matter of looking at everything you do differently, from the perspective of the customer," he explains.

Up through the ranks

Tracing his career path, Foster's first introduction to electronics occurred in the U.S. Coast Guard, where he worked on high-powered navigational stations that sent signals to fishing boats so that they could plot their location on maps. After completing his formal education, he took a post as an installer with Capital Cable in Albany, N.Y., eventually working his way up to plant manager in charge of 5,000 customers and 200 miles of plant with American Cablevision of Webster, N.Y. (ATC). During his tenure with the system, it was recognized by the New York State Commission on Cable Television as being one of the best in the state.

Moving on to another of the company's systems—American Cablevision of Indianapolis—Foster was responsible for activating an FM supertrunk and an institutional network which interconnected the largest business districts in Indianapolis.

Serving with ATC for more than 13 years, Foster ended up back in his old stomping ground at Rochester, as director of engineering for Greater Rochester Cablevision. In that position, he rebuilt 3,100 miles of plant, managed the construction of a 25-mile fiber optic trunk and conducted outside plant engineering for a three-mile, self-healing optical network.

And just prior to taking on his present position with Time Warner, Foster worked in a Scripps Howard system in Sacramento, Calif. as director of operations, where he saved the system money by reorganizing its installation department from piece work to hourly compensation and devised a plan to interconnect a remote TVRO site and the system's headend with fiber optics.

Hockey parents

In spite of the demands of his profession, Foster makes time to be with his wife, Colleen, and their three children: ages 12, 14 and 16. The elder Fosters have spent the better part of the past 10 years in hockey rinks, either cheering on the young Gretzkys-in-training, or, in Tom's case, coaching them. His daughter is following in her father's footsteps as a basketball addict. "I can honestly say that I have enjoyed them at all their ages, and they are a lot of fun now, except the oldest one just got a driver's license," notes Foster. "The sleepless nights have started, but I like to worry, anyhow."

The future challenges facing the cable industry should give him plenty to chew on. "In Rochester, we have just had our first full month of better than 99.99 percent uptime, and I think that a lot of systems are going to move toward that. With that type of reliability, the capacities that we are talking about now, and the continued installation of fiber, we will be able to very reliably provide advanced services to our customers," says Foster. "It's a lot of work; it's going to be a challenge; but it's definitely doable."

–Dana Cervenka

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Virtual circuits and the cable cloud

By Wendell Bailey, VP of Science and Technology, NCTA

I recently attended a conference where the main subject of conversation was the coming world of interconnected data networks and how the various technologies would be used by the different potential facilities-based network providers. One of the concepts that was constantly in use by the presenters was the idea of "virtual circuits."

Most of those working in the cable industry should know what virtual circuits are, but have they ever stopped to think about how those circuits might apply to their industry?

Everyone talks about the use of this technique in traditional telephone networks. In that network environment, the idea is that the paths between central offices would be used in a virtual way to conserve resources.

Remember that the idea of a virtual circuit is that there is enough unused time in any communications path that all of the traffic could be arranged so that the total numbers of circuits would exactly equal the amount of time that the communications would consume. Time would not be wasted by unused periods on "dedicated" circuits; it would be used by pieces and parts of other communications needs.

Unused circuit time

The theory teaches that, in the abstract, if there were 100 communicators on one side of a path and one receptor on the other side, and each of the communicators needed a path that was one mile long to reach the receptor, then there would be approximately 100 miles of plant to allow every communicator to send a message to the lone receptor. Imagine instead that a small piece of equipment is placed very near the transmitting end of the 100 paths that are emanating from the communicators.

Also imagine that coming out of that equipment is only one path that travels the remaining distance (let's say seven-eighths of a mile, for example). This would yield a network that has a total of 100 circuits x 1/8 mile = 12.5 miles, and one circuit that is seven-eighths of a mile, for a grand total of 13.375 miles. If the traffic load can all be allocated to timeslots on the one circuit, then this network would serve the same purpose as the one with 100 different paths to the lone receptor.

But what if the traffic load is so high that one circuit will not handle the demands of the 100? Traffic data analysis over many years has shown that there is a relatively large amount of time in multiple circuits that is unused or that carries information that can be gated and delayed by an acceptable amount of time. So even if additional paths were needed from the intermediate point to the receptor to handle all of the traffic demands, there is a good chance that only a couple dozen circuits may be needed, and the savings in physical plant would still be great.

The problem of links between points becomes even more burdensome when it is acknowledged that the 100 communicators would like to send traffic to each other, as well as to the lone receptor. Since the number of links required in such a case is (N-1) x (N)/2 where N is the number of discrete points that need to be connected under this formula (thus, five points yield 10 connections), the needs of the above-mentioned 100 points yields 4,950 connections. The opportunity to save a great deal of plant by using virtual concentration techniques in a large network is even better.

Clouds of circuits

Looking at this concept of virtual circuits, it is apparent that the length of the path from the output of the virtual machine to the receptor is a critical element in how effective this concept is in saving actual plant resources. This, after all, is the physical length that is irreducible, so to speak.

Further, by considering the differences between a typical telco plant (central office with long loops to customer locations) and a cable television plant with the shared part of the plant extending all the way to the property line of the customer, it should be apparent that the use of a version of virtual circuits is more beneficial to cable operators than to telcos.

Think of the design of this beast as a cloud, wherein lies the ability to do virtual circuits, and the customers are connected to physical paths that radiate from the cloud. Imagine that the 100 points above all agreed to be connected to a central point that could switch their traffic to any other point. The total number of links would be exactly 100. A far cry from 4,950 links.

The telco cloud that surrounds the central office has loops that are long. The cable cloud surrounds the entire cable plant, except the drops, which are short (approximately 110 feet per). If an operator wanted to build the most efficient system for using virtual circuits, the larger the cloud (or conversely, the more common plant elements that it surrounds) and the shorter the connecting paths, the better.

A natural advantage

Who knows? Maybe if the cable industry ever gets a chance to provide a large variety of relatively homogeneous traffic elements (such as digital bits representing television signals, data and telephone traffic), perhaps it can find a way to use its natural advantage in the theory of networks to provide the most services to the largest number of customers for the lowest price. The cable television industry is already more than halfway there. The rest, as they say, is a walk. CED

Have a comment?
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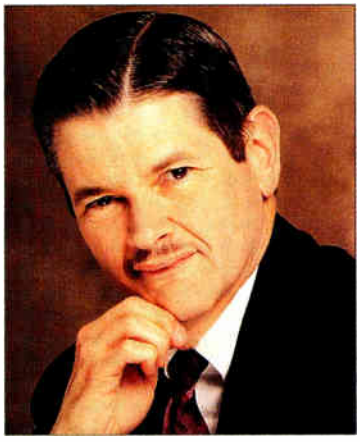
A tribute to Larry: He was one of a kind



By Jim Farmer,
Chief Technical Officer,
Antec Technology Center

Have a comment?
Contact Jim via e-mail at:
jfarmer@ix.netcom.com

Behind every successful engineer there is a mentor, a more experienced engineer who took the youngster under his wing and taught him the ropes of the profession. I was lucky to have had the best and dedicate this column to his memory. Dr. Lorimer Clayton of Scientific-Atlanta was one of a kind.

Larry was one of the most versatile engineers I have ever known. He was equally at home analyzing an electromechanical servo system, showing how the compliance of the gear train affected the transfer function, as he was in writing a computer program to analyze a satellite propagation experiment. Graham Mobley, one of my fellow trainees under Dr. Clayton, proposed that Larry's formal training, in physics rather than engineering, better prepared him to see the similarities in different systems, thus providing him with his versatility.

The cigar method

He was southern, through and through. A man of large stature, he spoke with a refined southern accent, in a low, quiet, calm monotone. I never heard him raise his voice, even when I said the stupidest things. He always had a cigar handy. Because he could find problems that none of the rest of us could, the standard joke was that if you had something you couldn't fix, just drop a few cigar ashes in, and it would start working.

His was the driest sense of humor I've ever known in an American. One day I was checking out an automatic tracking system and couldn't get something to work. Not having cigar ashes of my own, I called Larry. He fussed with the equipment for awhile and got it to work, then proposed a theory of what had been wrong that I had a hard time swallowing. I said, "Larry, surely you don't believe that." Without cracking a smile, he replied, in his slow, deep southern monotone, "When you are desperate for an answer, anything will do."

Years later, he and I were talking about the broadcast pay services that existed for a few years in the early to mid-1980s. He mentioned something about how easy it was to defeat the one being used in Atlanta. I teased, "So Larry, you must have built a pirate descrambler." He replied, in that deep monotone with the southern accent, "Jim, how can you say such a thing about me? How could you possibly even think that I built a pirate descrambler?" Then, as he was walking out of my office, he said, almost under his breath, "I've built three." He wanted to show how easy it was to defeat the system, so he built three different decoders. After he proved that he could do it, he put them aside and went on to other things: he wouldn't give them to anyone else, and he was totally disinterested in the programs himself. It was the challenge of beating the system with simple circuits that intrigued him.

Once, we bought a subsystem that didn't work correctly. He volunteered to fix it and asked the supplier for a schematic. The supplier stubbornly refused, saying that it was proprietary information, so Larry traced the circuit manually. In the process he discovered a design error, which he corrected. When he told the supplier that he'd fixed the problem, the guy got excited and asked him what he did. "Sorry," Larry said in reply, "proprietary information."

Myth and reality

The most famous story was about the night he drove a forklift through the stockroom door. Someone had changed the lock and hadn't given him a new key. He discovered the oversight a few nights later, when he was working late and needed a part. He couldn't get in, so he drove a forklift through the door. I asked him about that story at his retirement party, and he confessed that it didn't really happen. True, the lock was changed, and he had the forklift fired up and was driving it toward the stockroom door, when the guard came up and let him in.

Larry's sense of humor carried over to his prolific writing. He authored a lot of technical notes to train us youngsters. Because the industry had replaced "cycles per second" with "Hertz" as the unit of frequency, Larry decided to refer to angular frequency (Hertz times two pi–a quantity that often comes up in solving the math of engineering) using the units of "Avis." This may be found in a number of technical notes he published internally.

In the early days of satellite transmission in the cable industry, there was a lot of misunderstanding about what "signal-to-noise ratio" really meant, and its significance. Larry sought to shed light on the confusion by publishing an article in a scholarly IEEE journal. He titled it, "How to Obfuscate Signal-to-Noise Ratio."

A true mentor

When Larry learned that he had an incurable cancer, he approached that the same way he approached the rest of life. He joked to our executive vice presidents that they'd better get to work on any projects needing Larry's help, quickly. Then he set out learning everything he could about the disease. When standard treatments proved ineffective, he experimented with non-standard treatments. But on January 9, 1985, the disease became the one problem that he couldn't solve.

I still see his wife from time to time. Anne, a computer science professional herself, is a marvelous woman. Her husband was an inspiration to a generation of young engineers. I shall never forget him, or the roll that he played in bolstering many careers. CED

Digital video copy protection details

By Jeffrey Krauss, digital copycat and President of Telecommunications and Technology Policy

A few years ago, Congress passed a law requiring that digital audio recorders must contain circuitry to prevent unlimited copying of digital audio music and sound recordings. This was the result of a deal between the recorder manufacturers and the recording industry, which was concerned about pirates' ability to make perfect digital copies of CD recordings. Now, a similar deal is in the works for digital video. It directly affects the cable TV industry. It should allow earlier performance windows for hot new movies on pay-per-view, but it could raise the cost of set-tops. On balance, if movies are made available to cable earlier, it seems to me that this is a reasonable tradeoff. But it all depends on the details.

Digital audio copying

The Audio Home Recording Act of 1992 required that digital audio recordings carry a few bits of copy control information, and digital audio recorders are able to make copies only if the proper control bits appear. Under the law, a consumer could make first generation copies of a digital audio recording, but could not make second generation copies. This constrains wholesale piracy but permits consumers to make digital copies of recordings. In addition, blank tapes and digital audio recorders carry a small royalty fee, which goes to the recording industry as a copyright payment.

This deal was negotiated between the Home Recording Rights Coalition (HRRC) and the Recording Industry Association of America (RIAA). The HRRC, a group of consumer electronics manufacturers, had been formed years earlier to fight the copyright infringement lawsuit that was brought by Disney Studios against Sony and other VCR manufacturers. If Disney had won, all home video recording of cable and broadcast programming would have been prohibited. But the HRRC won. You should check out the HRRC web page at http://www.access.digex.net/~hrrc/.

The audio taping legislation covered only recording of prerecorded media, not taping of broadcast or cablecast programming. But the video recording legislation will cover copying of pay, pay-per-view and video-on-demand programming, as well as prerecorded media.

The HRRC is now negotiating a video copy protection bill with the Motion Picture Association of America (MPAA). As I write this, the text and technical details haven't been released yet, but the broad principles have been shared with me.

There would be no restriction on making copies of digital broadcast or basic cable programming. Only first generation copies could be made of digital pay TV programming such as Home Box Office. No copies would be allowed for digital pay-per-view and video-on-demand movies and digital pre-recorded media. And these restrictions would apply to analog recordings of digital video transmissions, not just digital recordings.

So digital video transmissions would carry a few copy control bits, just like digital audio. Digital VCRs would be prohibited from copying PPV, VOD and copies of pay TV programming. Analog VCRs would be prevented from making these copies because digital cable boxes would be required to add Macrovision copy protection signals to their analog output. In addition, copy control codes would have to be added in the vertical blanking interval of the analog output signals. And it is these requirements that could create a cost impact on the cable industry, because they require additional circuitry in set-top boxes.

It is a little troubling to have a law that requires the use of a specific technology. But evidently Macrovision is the only analog copy protection technology available. I've been assured that the cost of Macrovision chips will be low. We'll see. Moreover, since the Macrovision technology is proprietary, Macrovision is entitled to patent royalties. I've been told that any patent royalties will be paid to Macrovision by the movie industry, not included in the cost of the set-top box.

I should point out that this law would affect DirecTV and Primestar boxes as well as cable boxes. They each will have several million digital-to-analog set-top boxes deployed by the time this law is enacted. One important question is whether they would have to make major modifications to their transmission formats in order to carry the copy control codes. And hopefully, the law will not require them to recall all the boxes now out in the market.

I do believe that some version of this bill will be enacted into law, although perhaps not until next year. The MPAA, always a powerful force in Washington, now has tremendous political clout, since MPAA president Jack Valenti convinced the broadcasters to accept the V-chip ratings approach.

Benefits as well as costs

The motion picture industry is the victim of worldwide counterfeiting and illegal copying and sales of recorded movies. The MPAA sees digital video transmission as a new threat, because it permits pirates to make "perfect" copies of movies. Partly as a result, first-run movies are not available on cable PPV as early as they are available at movie theaters. An effective copy protection regime could change this practice.

But the devil is in the details. The details of the proposed legislation have not been released. Nobody has done a cost analysis showing the impact on set-top boxes. The movie industry has not promised to make movies available earlier for cable distribution. The negotiations have been between the VCR manufacturers and the movie studios, not the cable industry. If they force higher costs on us, what do we get in return? For now, we should say, "Sounds OK, but tell me more." CED

Have a comment?
Contact Jeff via e-mail at:
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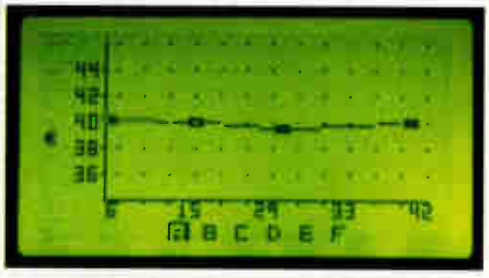

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Fond memories and name dropping

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

Sixty years ago, I accepted a job as "apprentice engineering aide" at the Signal Corps Radio Laboratory at Wright Field in Dayton, Ohio. Peter Murray was my classmate as we pursued B.S. degrees in physics at Antioch College. Pete and I were to alternate 10-week sessions on the job in the work-study program advanced by Arthur Morgan in the 1920s and '30s. We worked on the "blind landing" project developed by C. D. Barbulesco, who later became professor of engineering at Antioch.

"Barby" used to titillate visitors by reporting 20 successful, totally "blind" landings out of 22 attempts. Perplexed facial expressions dissolved only after he explained that a couple of times, the pilot was forced to override and manually abort the landing to avoid other aircraft on the runway.

Sunspots and comm blackouts

After graduation, Pete went on to assume leadership in the military drone aircraft program during World War II. I was offered an entry-level position at the National Bureau of Standards, to participate as an NBS scientist operating ionospheric sounding equipment during an arctic expedition planned for departure from Norway in early summer, 1940. Because of the German occupation of Norway in 1940, the expedition had to be postponed to 1941.

The schooner *Effie M. Morrissey* was chartered instead of the Norwegian vessel and crew originally planned, and the itinerary was rerouted to West Greenland and Baffin Bay. Capt. Bob Bartlett, renowned as skipper of the *USS Roosevelt* for Admiral Peary's 1909 North Pole Expedition, was owner and skipper of the *Morrissey*.

While traveling down Baffin Bay from Etah, in northwest Greenland, a radio message from the Bureau called attention to a very large and active sunspot appearing on the rim of the sun. The message emphasized in no uncertain terms the extreme importance of notifying the Bureau *immediately* upon observing any abnormal ionospheric or tropospheric propagation effects. There were indeed spectacular displays of aurora borealis. But the most profound effect on propagation was that all radio communication was completely shut down for more than a week. The "immediacy" of the report would have to wait.

In 1944, an ad in *Broadcasting* magazine for a position with a "consulting engineering" firm in New Jersey caught my eye. My years with Paul F. Godley represented a fascinating brush with radio engineering history. Paul had worked for Lee DeForest as a lab assistant and as an associate with H. H. Beverage and Edwin H. Armstrong building the long wire "wave antenna" on Long Island. He also partnered briefly with Edmund A. Laport, and George H. "Doc" Brown, pioneers in developing medium frequency (300 to 3000 kHz) AM directional antennas, who later became giants at RCA.

After World War I, Godley manufactured regenerative radio receivers, initially under the name "Zenith," but later changed to "Paragon" after being persuaded to relinquish "Zenith" to Eugene McDonald.

Have slide-rule, will travel

Although I never got a ham radio license, my picture was on the cover of *QST* early in 1945, the issue celebrating the 25th anniversary of Paul Godley's ARRL Scottish adventure. On a cold and bleak Scottish moor in midwinter, 1919-1920, Paul set up a tent to house the 100 meter vacuum tube transmitter, antenna, super-regenerative receiver, and DC power generator for the purpose of demonstrating, on behalf of ARRL, the feasibility of trans-Atlantic communication at wavelengths assigned to amateurs, but considered by "conventional wisdom" to be useless for long distance signaling.

For the *QST* cover picture, I was standing at a drafting table, slide-rule in hand, talking with Paul's new partner, Murray G. Crosby, whose frequency modulation transmission patents were successfully defended by RCA, in the long and bitter litigation of Maj. Armstrong's patent infringement suit filed in 1949.

Back to the West

Living in the West is narcotic, and I was born addicted in Longmont, Colo. My father was the principal of the junior high school there, and later, of the high school.

By 1926, he was unwilling to defer to the increasingly insistent recommendation of friends and colleagues that he join the cross-burning, hooded, anti-Catholic Ku Klux Klan. So, he took his family back East and set about working for advanced degrees in education at Harvard. My secondary education years were spent in Watertown and Belmont, Mass., home not only for cable TV pioneers Tom Shack, Bill Headley, Doug Danser and Dick Leghorn, but also of the infamous John Birch Society and Robert Welch, its founder.

In 1948, unable to get the West out of my dreams, my wife and I, with our two children, migrated to Missoula, Mont., where I hoped I could get enough directional antenna and other radio broadcast engineering work to avoid absolute destitution. Well, that was the year the FCC imposed its allocation freeze on new TV licenses. Everyone knew that when TV came, radio would be dead, with no need for consultants. So, I signed on at the University of Montana as

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Circle Reader Service No.

The time has come for me to complete the oral histories of those who built the cable TV manufacturing business

an assistant in the physics department, part-time, in order to preserve my right to take on the few consulting assignments that might happen to come along. My wife, LaVerne, is a public accountant. She pitched in by filing and winning the election in 1950 as Missoula County auditor. We were fortunate to have a wonderfully caring friend and neighbor provide daycare for our, by then, three growing boys.

Legal battles

These were exciting years, as we fought in the courts to compel the board of commissioners to provide office space, furniture, equipment and staff with which to perform the constitutionally mandated duties of the Office of County Auditor. Before it was over, the county engineer, the chairman of the board and a former commissioner had been tried and convicted of felony misuse of county funds. No wonder they didn't want an auditor!

In one of the many court actions, Judge Comer frequently asked my wife, on the witness stand, if she were all right. You see, at the time LaVerne was giving testimony, the birth of our daughter was about a week overdue.

Eventually, the State Supreme Court ruled in *Taylor v. Missoula County Commissioners* that the Board had abused its discretionary powers, and ordered it to provide a proper budget for the Office of County Auditor. LaVerne was re-elected to a total of four terms in the office.

Incidentally, our daughter Margaret, about whom the judge was so concerned, is soon to be 43 years old, working as a computer analyst for AT&T at Heathrow, Fla.

Building a radio station

One of the first clients for my one-man consulting practice was Associate Justice of the Montana Supreme Court, Lee Metcalf. The justice, along with a prominent physician and a leading merchant, had invested in a venture to establish a new radio station in Helena, Mont. The promoter and manager of the project had been summarily sacked, in lieu of the more traumatic forms of mayhem contemplated, because of misrepresentation to the FCC compounded with embezzlement, adultery and a host of malfeasance.

I was able to help them clear away the FCC problems, and actually build a radio station, although much more modest than originally planned. Local counsel to the venture, Al Dougherty, was an assistant to Attorney General Arnold Olsen and campaign manager for Governor Bonner. Judge Metcalf later became a U.S. senator, and Arnold Olsen became a congressman. Those were exhilarating experiences.

Another one of my earliest clients was an engineering student about to graduate from Montana State College who sought assistance in filing an application for a new radio station in Bozeman. Some time in 1952, after his station had been licensed and was operating successfully, G. Norman Penwell invited me to join him in an airplane he had chartered for a visit to CTV (community TV) systems in Astoria Ore., Centralia, Chehalis and Bellingham, Wash., with a view to organizing and building similar systems in Missoula or elsewhere in Montana. By May 1953, we had incorporated Northwest Video, raised a few thousand dollars and obtained pole attachment agreements with Mountain States Power Co. (not Mountain States Telephone Co.), the utility providing both electric and telephone service in Kalispell, 125 miles north of Missoula.

In 1968, Norman was named the first paid engineering staff member at the NCTA.

We did not seek a franchise, and to this day, I am told that most Montana cable TV systems are still not franchised. It was about 1954 or '55 that Missoula City Councilman John Vance told Jack Zeckman (who had built the systems we visited in Centralia and Chehalis) that, although the city would be happy to receive the fees, franchises were not needed to protect the public. Wherever the right-of-way was subject to a utility lease agreement, the city could hold the utility responsible for the practices of its cable TV lessee.

Founding MTA

Perhaps the most rewarding experience of my professional career was being invited in 1964 to join Martin Malarkey, pioneer and founder of the NCTA, in what was to become Malarkey-Taylor Associates Inc., Management and Engineering Consultants to the Cable Television Industry, for over 30 years. Our association as partners has always been warm and complementary, characterized by mutual respect, and above all, successful.

Back in the late 1960s, I was invited to write a "Technical Tips" column for Bob Huston's periodical, *Cable News*. Stan Searle also asked me to write for *TV Communications*. I declined at that time.

Then in 1985, Gary Kim asked me to write a column for *CED*, and even suggested a list of topics. By then, I was deeply involved in the signal leakage issues and FCC Docket 21006, and accepted. Thus, for more than 10 years, on an almost monthly basis, I have discussed a wide range of technical issues and opinions in the pages of *CED*, except for about a year-and-a-half in *Communications Technology*.

Now, the time has come for me to devote more time to completing the oral histories of the engineers and technicians who built the cable TV manufacturing business, a project undertaken in honor of the late Richard Schneider. Those early pioneers in 1948 until the early 1970s are mostly now retired; a few are gone. Few in the industry today are aware of their creative, ground-breaking, technological, trial-and-error contributions.

Therefore, while I no longer expect to appear regularly in *CED*, I do plan occasionally to submit essays on matters that seem worthy of expression. CED

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Circle Reader Service No. 15

Return path testing part art, part science

Test gear analyzes digital performance

CableLabs has taken a dramatic step forward in fostering two-way digital cable transmission with the development of its CW Tester*, a carrier wave testing device that for the first time allows cable operators to analyze their systems for upstream digital transmission performance.

Dr. Rich Prodan, CableLabs' vice president of engineering, says the CW Tester analyzes the performance of cable systems' return-path digital transmissions by measuring both the quantity of interference and the quality of bandwidth. Prodan says MSOs have a more difficult but achievable task in establishing and maintaining the integrity of cable systems' return path than the forward path as a result of the cumulative effect of noise, ingress and distortion.

Most man-made electrical interference lives below 50 MHz, which can easily corrupt the return path

To date, CableLabs engineers have used the CW Tester to successfully examine two TCI cable systems, one in Hartford, Conn. and the other in suburban Denver. The Hartford system was in the midst of a telephony trial, and the suburban Denver system was preparing to launch various two-way services, Prodan says.

The root causes of interference

Every transmission modulates a carrier wave. An error occurs when an impairment knocks this modulated carrier into a different state than the one transmitted, and the receiver does not recognize this impairment activity.

However, by measuring these disturbances, CableLabs will be able to provide new insight into how cable companies can best avoid return path interference problems. Current trials of two-way services like personal communications services (PCS) or high-speed data are using the return path, but so far, it's been a labor-intensive process and more of an art than a science.

"We need to know how often impairments occur and what they look like," Prodan says. "By more accurately gauging interference within digital transmissions, we can find the root causes. This should lead to efficient solutions that will ensure reliable transmission of two-way services such as telephony, computer networking and interactive video."

CableLabs' engineers test cable systems using the CW Tester by placing a carrier on a cable system within a channel that is not transmitting any information.

They then log every disturbance to the signal they detect onto a computer, which is taken back to CableLabs' headquarters and analyzed.

"When you demodulate an unmodulated carrier, you capture the impairments without any information to complicate the process," Prodan says. "From the data, we can determine several factors, including the duration of the impairment and the time separation between impairments."

CableLabs can break down the information on a second-by-second basis, or as long as on a daily basis. Engineers can even summarize months of data in one lump-sum description to demonstrate how impairments will affect the availability of a given digital service.

"The CW Tester gives us a way of directly predicting the deployment of digital services," Prodan says. "If a vendor needs a 10^{-6} error rate for a successful transmission, we can measure how many seconds are available below that error rate.

"We can also recreate impairments in the lab to test vendors' equipment," Prodan adds. "In effect, we can determine if a certain product or service would be able to operate effectively on a system by manipulating the threshold level."

Prodan says there is no current "off-the-shelf" equipment to measure what CableLabs engineers consider "relevant impairments" because most of the interferences are too brief and erratic.

"The problem is that the interference is very transient in nature," Prodan says. "We have found significant diurnal variations depending on such things as the time of day and the location of the plant. The bandwidth might look good at noon, but at 5 p.m., it will pick up a lot of interference."

CableLabs engineers found that most man-made electrical interference lives below 50 MHz, which easily can corrupt cable systems' typical 5-40 MHz return-path frequency. Interestingly, lab experiments have shown that homeowners' electrical appliances provide the most interference in that 5-40 MHz range.

Prodan cites the National Electrical Code as the main culprit behind interference, saying, "When cable comes into the home, it is grounded at the same point as the utilities for safety, which allows the direct input of electrical noise into the cable lines. Essentially, you are funneling all of this noise and interference from thousands of subscribers' homes into an 'electronic sewer'."

Further complicating MSOs' efforts, Prodan notes, is that the more capacity utilized in a bandwidth by connecting more customer homes, the more interference occurs. Prodan calls the relationship "very statistical."

"The difference between 50 MHz and 1 GHz technology is the difference between a bicycle and a jet fighter," Prodan says. "Also, you would need a guard space of 10 percent between the upstream and downstream signals. For 1 GHz, that would be 100 MHz of wasted spectrum."

CableLabs originally performed a transmission system characterization study of a large number of its member cable systems. However, this initial study only measured interference for one-way, compressed digital video services. CED

This article was written especially for CED *on behalf of Cable Television Laboratories Inc.*

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SCARLET brings Olympics to journalists

Network provides real-time broadcast

By Joe St. Jean, Technical Manager, and Emmet O'Donnell, Director, Program Management, Scientific-Atlanta, Inc.

When the ancient Greeks founded the Olympic Games, most likely, the last thing on their minds was how they were going to provide television coverage to more than 3 billion people around the world. Perhaps even further away was how they could assist more than 25,000 journalists, volunteers and dignitaries in viewing live action as it occurred at more than 30 geographically dispersed venues.

The ancestors of the Atlanta Committee for the Olympic Games (ACOG) didn't need to bother with these details, but in the summer of 1996, access to live video action of the centennial games is a priority. Because the Olympics are continually expanding to incorporate a wider range of sporting events, each typically taking place in a different location within the Olympic city, media outlets that cannot afford to send hordes of staff members to the Games often suffer from a lack of complete coverage. The result–readers and viewers fail to get a true and complete sense of the Games.

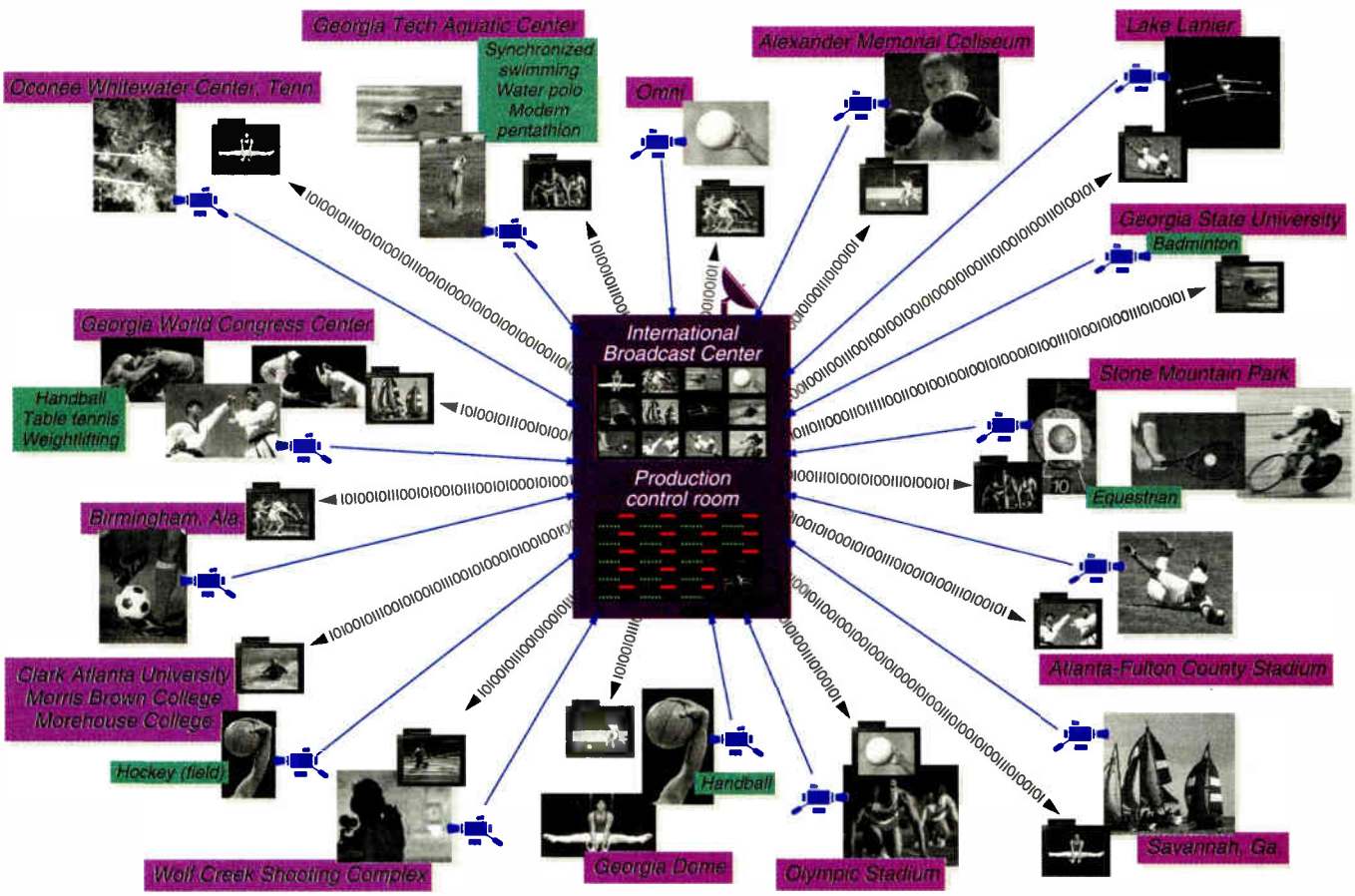
Ensuring that all on-site journalists, both television and print, have access to virtually all events in real-time is a monumental task. That's why ACOG will rely on SCARLET (Synchronous Communications Accessing Live Event Television), a closed-circuit cable television network that will provide real-time, multiple-event broadcasting to journalists, athletes, Olympic officials, hotels and other Olympic customers.

Up-to-the-minute results

Rather than having to physically travel from venue to venue to cover events, all the while taking the risk that important action will be missed, journalists using SCARLET will have the luxury of sitting in front of a single television monitor with a set-top box and remote control to view virtually all events as they happen, regardless of the press center or the venue where they are currently located. In addition, SCARLET includes data channels dedicated to providing up-to-the-minute results for selected sports.

SCARLET was developed by the team of Scientific-Atlanta, Panasonic and BellSouth. The net-

Scientific-Atlanta's Television Distribution Network–1996 Olympic Games



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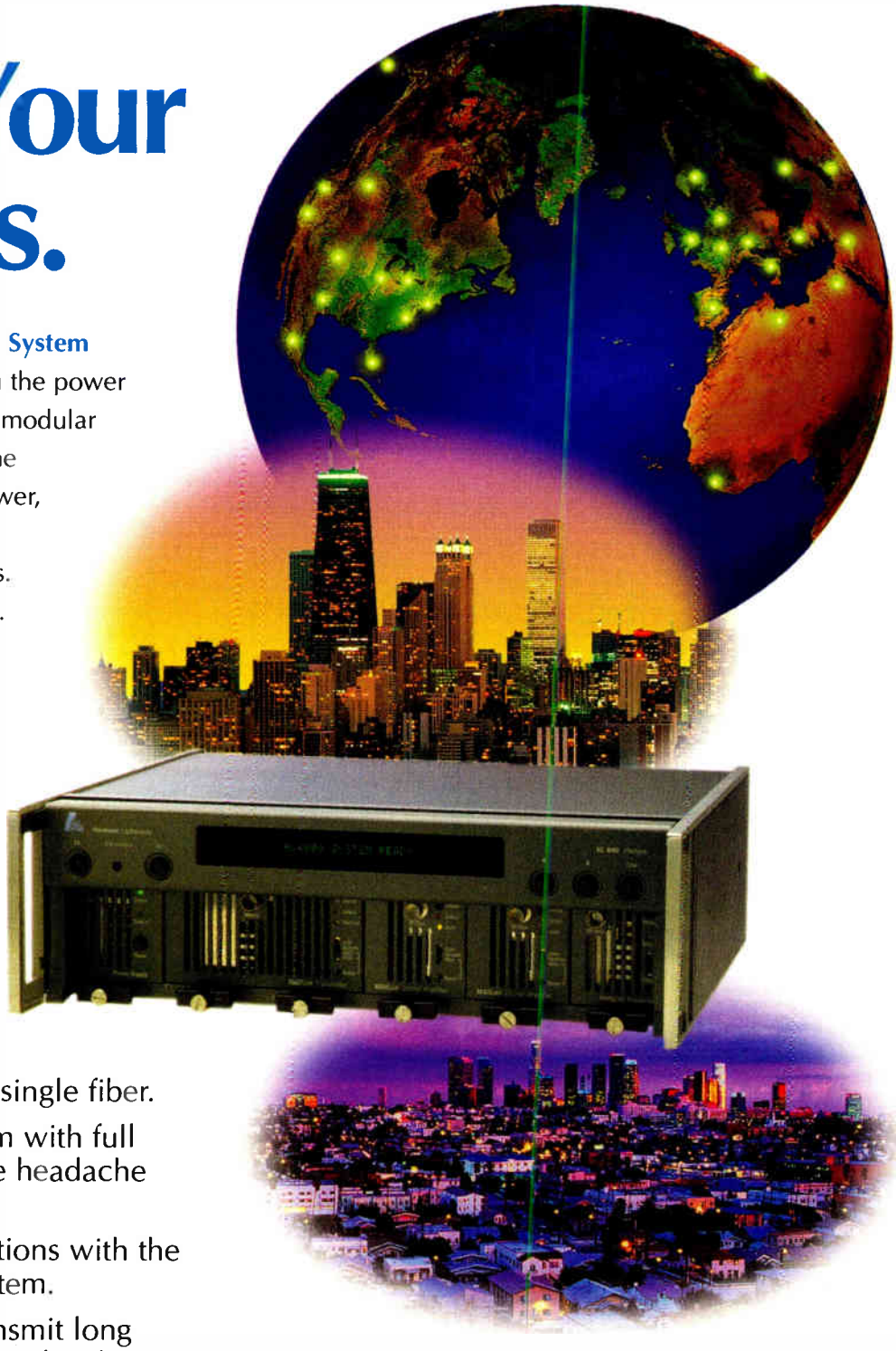

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Circle Reader Service No. 17

A total of 48 video programs will be broadcast to nine digital hubs

work will link competition venues, the Olympic Village and administrative sites via Panasonic cameras and monitors; BellSouth's Sonet fiber optic network; and Scientific-Atlanta's broadband network equipment.

Digital transmission

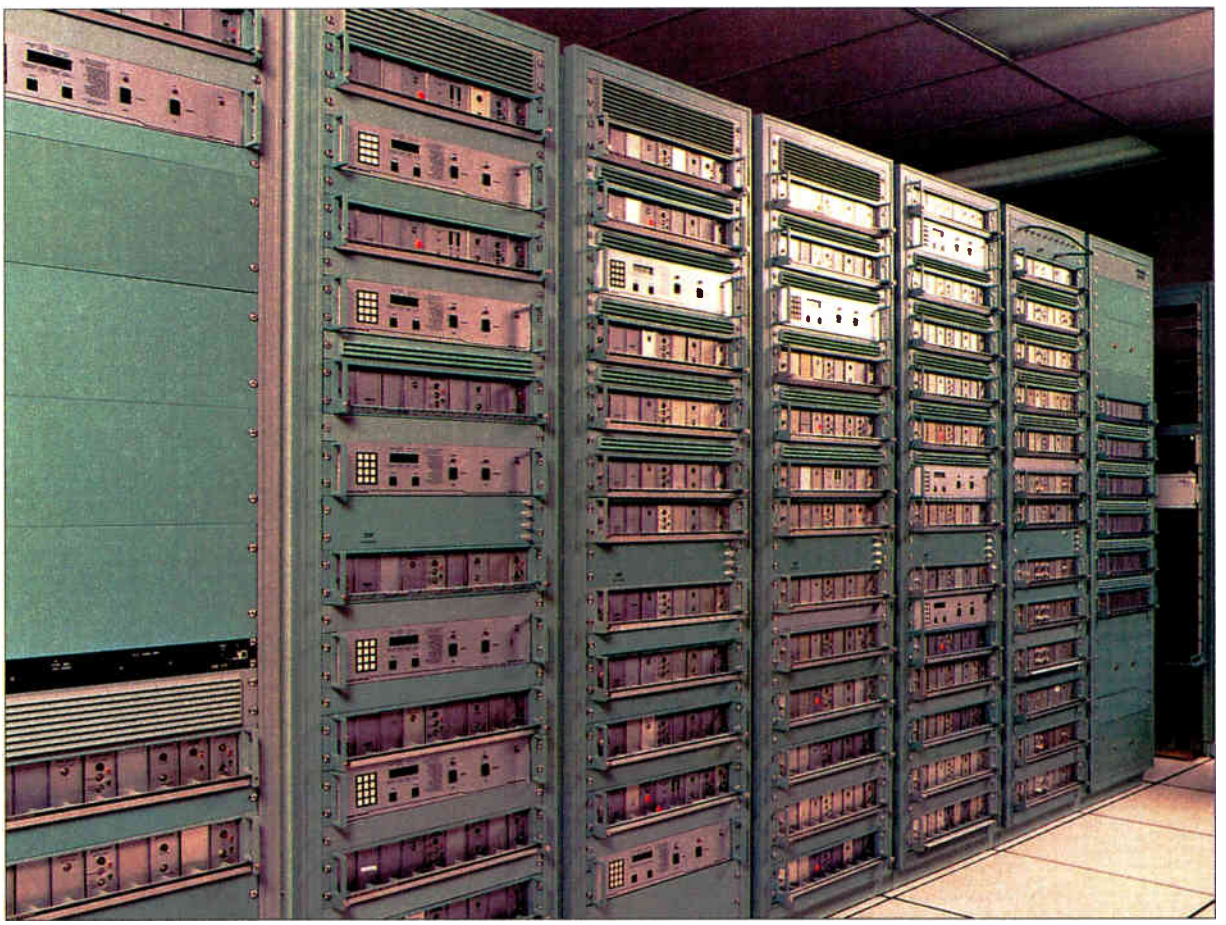
The SCARLET network begins with Panasonic cameras and recorders capturing video and audio at each of the Olympic sites. The video formats are converted into digital signals and are sent in an uncompressed format over the Sonet network to the International Broadcast Center (IBC), which will be located in downtown Atlanta. Because the signals are digital, the noise and distortion normally found in end-to-end analog networks is eliminated.

Once at the IBC, the signals are fed into Scientific-Atlanta's PowerVu real-time MPEG-2 video encoders. Up to 48 video feeds will be MPEG-2 encoded in real-time at 6 Mbps. Because the reliability of the system is a critical consideration, the encoder complex is configured with 1:5 or 1:6 redundancy. A group of five or six encoders have a standby encoder that will be automatically switched into service when a fault is detected by the network management computers.

S-A will provide 6,600 of its 8600X Home Communications Terminals for the Games. The 8600X will be used to select among 48 video channels, and up to 100 Press Data Channels available on the system.

Once compressed, 16 MPEG-2 video streams will be multiplexed into a single MPEG-2 transport stream. Three transport streams will be sent on optical fibers as three OC-3 Sonet payloads. A total of 48 video programs will be broadcast to nine digital hubs using Scientific-Atlanta's BIG (Broadband Integrated Gateway) and BellSouth's Sonet ring.

Upon reaching the digital hub, the transport streams will be demultiplexed into individual programs, again



Scientific-Atlanta will create a digital video distribution system that will transmit more than 40 channels of video and up to 100 data channels to 10,000 television monitors at more than 30 Olympic Games locations. Primary users of the system will be journalists, television commentators and Olympic administrators.

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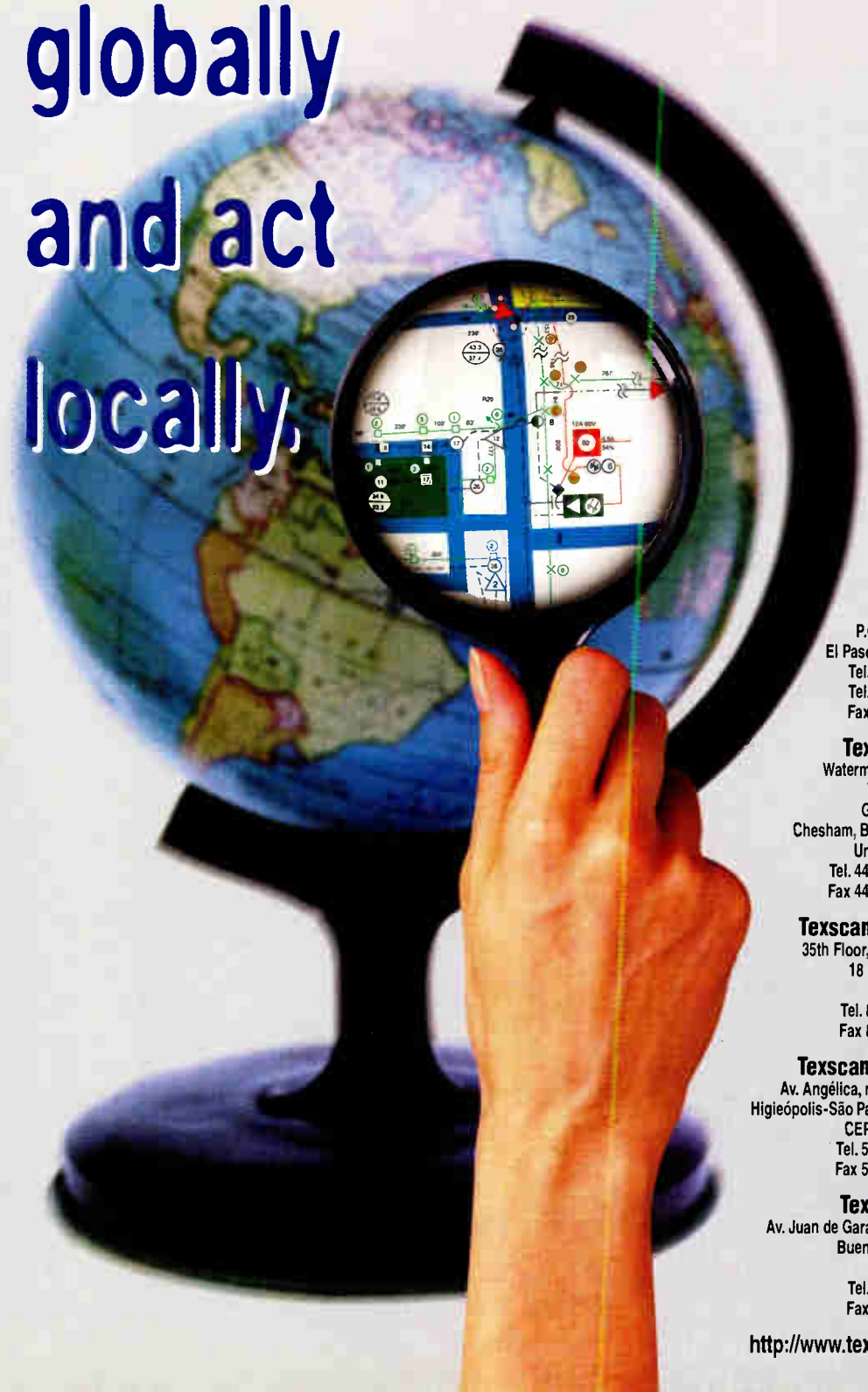

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using the BIG, and then sent to an integrated receiver decoder (IRD). The IRDs decode each MPEG-2 program back into baseband video and audio. The analog video is then RF-modulated and combined in a traditional cable TV headend. At each digital hub, Scientific-Atlanta has installed a cable system complete with a headend and a comprehensive distribution plant. The hubs also provide the video source to adjacent venues using Scientific-Atlanta's fiber optic products.

Programming is accessed at venues by utilizing Scientific-Atlanta's 8600X set-top box. More than 6,600 boxes will provide video to 10,000 Panasonic monitors. The fully addressable boxes provide conditional access and will offer an electronic program guide for the various sports, with direct tuning of events and virtual data channels. The virtual channels, which will appear to users as ordinary channels, are a text service offering real-time results to journalists and other viewers. Data will be embedded in the television signal in the vertical blanking interval, and the information will be extracted and viewed using the 8600X's virtual-text channel.

Up to 100 virtual-text channels will be dedicated to displaying athletes' quotes, metal standings, starting line-ups and results for selected sports. The information will be provided by IBM's token ring results network.

Even though the network's 44 Sonet rings will be dismantled, the fiber will remain, and the equipment will be distributed

Scientific-Atlanta's headend computers will query the IBM databases in real-time and provide formatted text to the 8600X. Within seconds, the results of an event will be displayed on the Panasonic monitor. SCARLET's data channel will provide an alternative for reporters without access to an IBM Info'96 terminal, and subsequently, the IBM Results System.

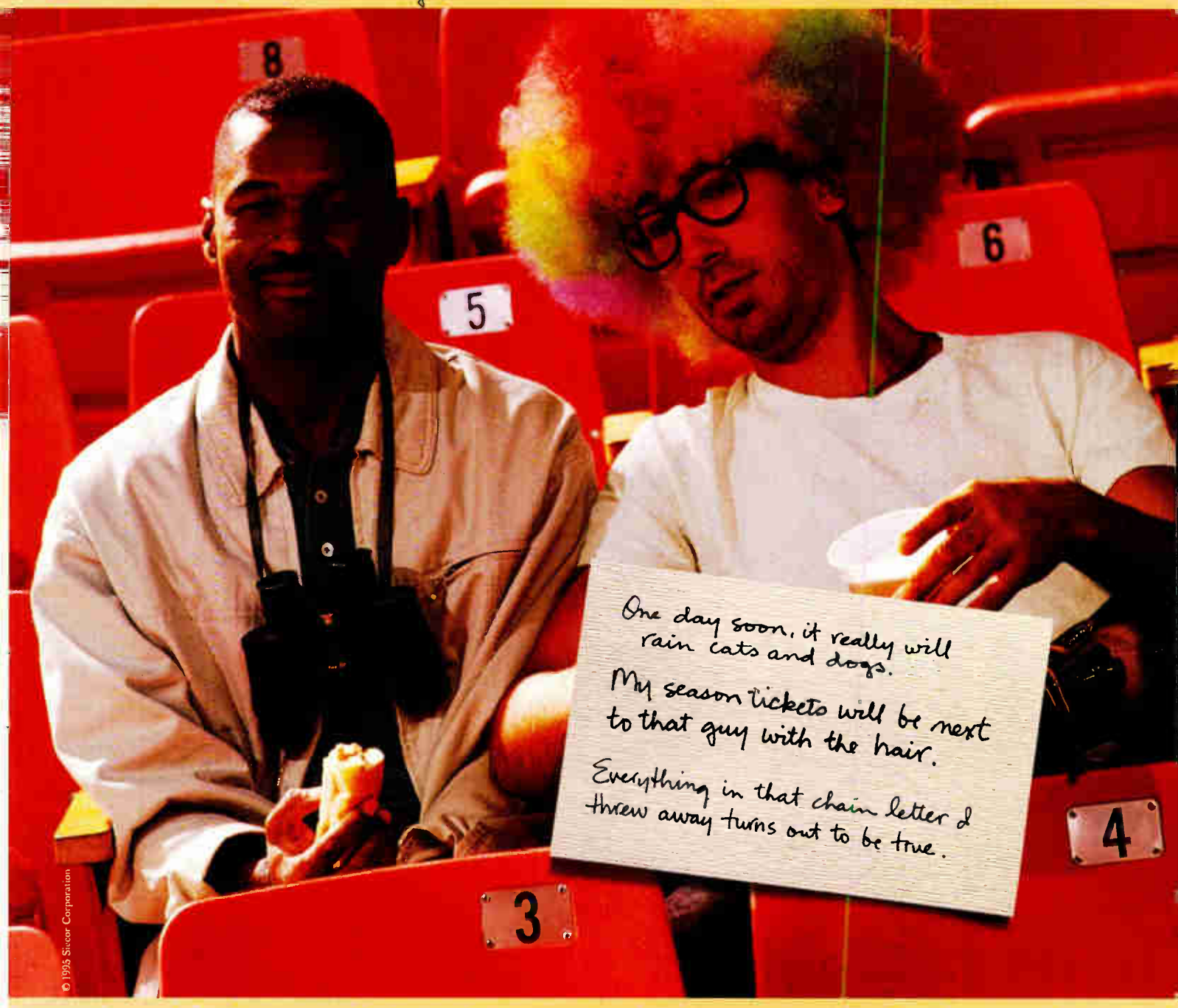
Besides serving the needs of journalists and other VIPs at the 1996 games, SCARLET will continue to benefit Atlanta and the broadband communications industry. For example, even though the network's 44 Sonet rings will be dismantled, the fiber will remain, and the equipment will be distributed throughout the BellSouth network as needed.

Additionally, by virtue of the SCARLET network, these Olympic Games have become a testbed for the commercial potential of compressed video over broadband networks–an experiment which may have a substantial impact on how home television will be viewed into the 21st century–something that probably never crossed the minds of the ancient Greeks. CED

About the authors

Emmet O'Donnell is a director, program management, and Joe St. Jean is a technical manager at Scientific-Atlanta in Norcross, Ga.

THE FEARS OF Roger Wallace, CATV NETWORK TECHNICIAN



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Lessons learned from ITV trials

Ops redefine their interactive strategies in light of new data

By Dana Cervenka

Even as one company announces it's calling a halt to its interactive video trial, another pops up to replace it. Running counter to reports in the media of the "failure" of interactive television trials, faith that interactive services will someday take off is still running high among service providers—albeit, the paths to those services are many, and the process will be much more evolutionary than was perhaps originally conceived.

As US West called a halt to its video dialtone trial in Omaha; as Viacom walked away from its advanced services trial in Castro Valley, Calif; these announcements, and many more like them, did not signal a failure of the technologies involved, nor of the vision of interactive services some day, but instead, they were proof of how the technology and the marketing questions are inextricably bound. Operators are busily analyzing all the data culled from their trials to plan their next step, and are doing what the cable industry has always been best at: hedging its bets.

"Full-blown interactivity, the visions of the computer industry of the massive client/server, interactive, all-digital, all-today [structure], has not come to fruition," notes David Robinson, vice president and general manager, digital network systems, GI Communications Division, General Instrument Corp. "It will be an evolution, it will take time."

Executives with Scientific-Atlanta lay out that evolutionary path as being analog, to advanced analog, to broadcast digital, and finally, to full digital interactivity.

"Starting in the middle of next year, the cable industry will begin deploying digital to the higher-end subscribers, and it will be mostly broadcast," predicts Scientific-Atlanta's director of digital systems, Bob Van Orden. "But the wrinkle that has become clear to us in the last six months to a year is, if you're going to deploy something that is digitally broadcast-focused, it also needs to be provisioned for later interactive services."

There is evidence to support Van Orden's theory.

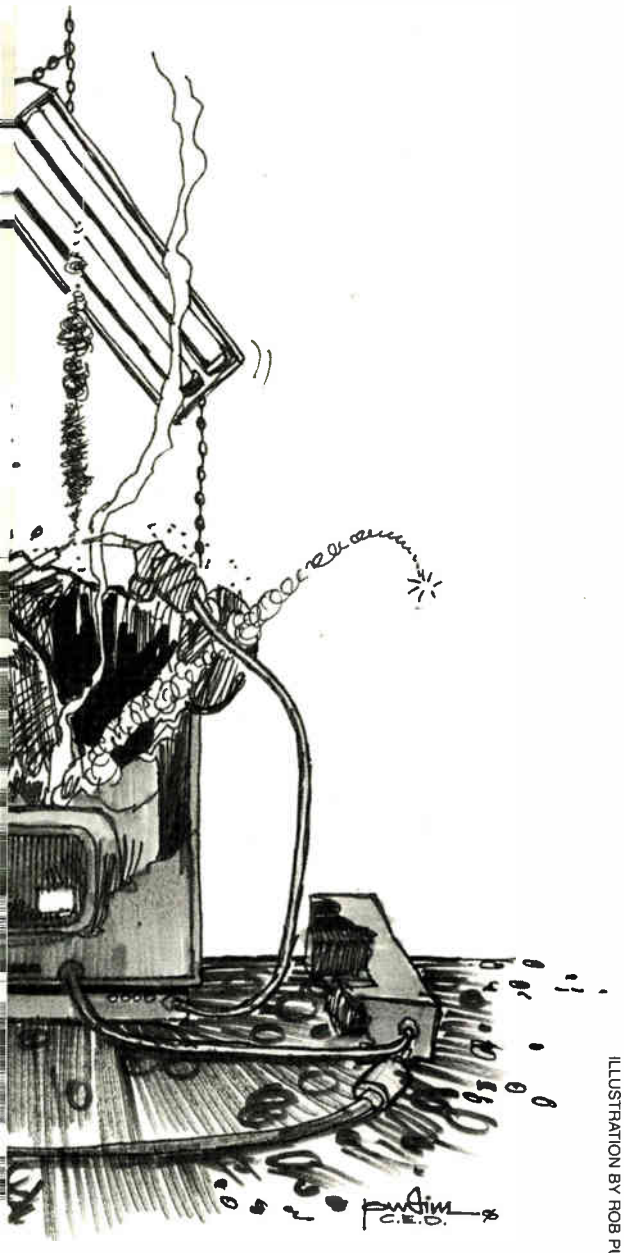


ILLUSTRATION BY ROB PUDIM

Time Warner, for example, launched arguably the most ambitious interactive services project in existence, the ATM-to-the-home, Full Service Network. Noting that while the Orlando project has been "terrifically successful" at allowing the MSO to get a handle on those technical and marketing questions, Jim Ludington, vice president of technology for Time Warner Cable's FSN, explains that FSN findings "will drive our development of software and network architecture going forward, and that's what Pegasus is, that's the first round." Specifically, the company has issued an RFP for a new analog/digital set-top, known as "Pegasus." Because it is "fully software upgradable," the set-top box provides a migration path from a digital, broadcast box, to a real-time, two-way, interactive set-top.

Technology overkill answers marketing questions

Though Viacom Cable learned a great deal from its market trials of advanced services, concluded last February in Castro Valley, Calif., the operator put the interactive TV phase of the trial on hold. Viacom's Doug Semon, director of new technology, believes that occurred for two major reasons: one, the cost of the set-tops would have been "outrageous," and two, content was generally unavailable, and difficult to develop. For example, "How would you create interactive 'Wheel of Fortune'?," he asks. "You have to guess the letters—are you going to type letters with the remote? . . . Use a mouse? Paint a picture of a keyboard on the screen and use the cursor controls to get to the right letter? It's all very complicated and largely unknown," theorizes Semon.

To be accurate on the first count, the prototypical set-tops that were mocked up, but never used in Castro Valley, were not meant to be utilized in commercial deployment mode; they were engineered for "overkill," according to Semon, in order to answer very specific technology/marketing questions.

"We thought it would be necessary to watch one channel while you recorded another, even if both were digital, so the boxes [for] Castro Valley were actually dual digital: they were capable of decoding three, simultaneous MPEG streams, and tuning two analog channels," he elaborates. With that approach, trial participants would, theoretically, never be blocked from doing anything they wanted to with the system, and the data gathered would be that much more valuable.

Part of the Castro Valley advanced services test involved a convenience vs. variety pay-per-view trial, for which Semon built a massive, standalone PPV origination facility, where Viacom originated 16 channels of conventional, analog PPV. The facility was necessary because, at the time, there wasn't enough programming available via satellite to support the trial. Again, the set-up was never meant for mass deployment.

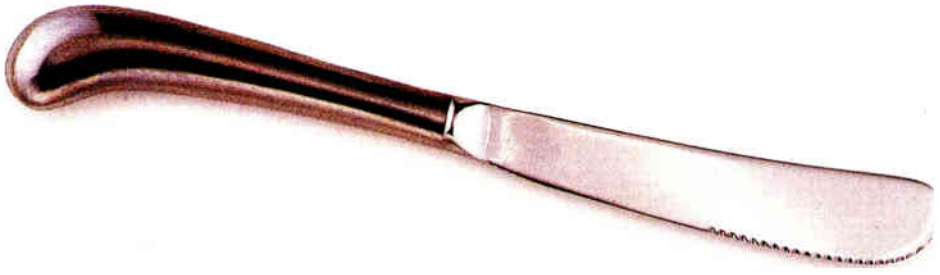
Within a 16 to 20 channel PPV package, operators have to offer at least seven or eight different titles at the same time, according to Viacom's findings. After that, ops can use the additional channels to deliver additional start-times for the top titles, the company concluded.

Back to the lab

US West, which recently ceased its video dialtone trial in Omaha, Neb., is headed back to the lab with the information it gathered there, in a move that is very much a part of its "evolutionary progress," says Nancy Sullivan, executive director for broadband and multimedia services for US West. Sullivan cites the earlier VCTV (Viewer Controlled Cable Television) tests conducted in Littleton, Colo. in conjunction with AT&T and Tele-Communications Inc. That test, which featured employees shoving tapes into VCRs in response to viewer requests, was followed by more research back in the lab, and began to lay the groundwork for the Omaha trial.

"You go out with the consumer, you learn some things, you go back, you take what you learn, you

US West is headed back to the lab with the information it gathered in Omaha



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recreate, you redefine," Sullivan explains. "And then, you go out again with the next generation."

Sullivan, who has been quoted in the media as saying the technology in Omaha "wasn't quite ready for prime time," notes that because many of the technological components of the trial are still in the prototype stage, "the pricing is still quite a bit higher than what we would like to see in a deployment mode." According to sources close to the trial, US West paid about $2,300 per set-top (see *CED*, April 1996, page 4).

The operator also found that the dual, coaxial cable architecture it utilized in Omaha was extremely reliable; however, that reliability also carried a hefty price-tag, making it too expensive for commercial deployment. And that finding led the company to pull its video dialtone applications for the next 10 cities, mainly in a reevaluation of that architecture, says Sullivan. Another hurdle to overcome was the complexity of the end-to-end system integration. US West, serving as its own integrator for the project, found that working with prototypical equipment further complicated the task.

Going forward, US West is evaluating a number of technologies, both wireline and wireless, in the lab, including LMDS (Local Multipoint Distribution Service) and ADSL (Asymmetrical Digital Subscriber Line) for video services.

While operators have cooled on ITV for now, interactive data is the hot new ticket

Personal interaction and data entertainment

There is another path on the road to interactivity which is being explored by operators even as they prepare for full, digital interactivity. Advanced analog set-top boxes–such as General Instrument's CFT 2200 and Scientific-Atlanta's 8600^{X}–offer what S-A executives have dubbed "personal interaction"; in other words, an interactive viewing guide gives consumers more control over their television viewing, while virtual channels provide more information specifically tailored to their interests. "Whether interactivity is on a real-time basis throughout the network or not is, for consumers, mainly an irrelevant issue," notes Steve Necessary, vice president and general manager of analog subscriber systems, Scientific-Atlanta. The advanced analog boxes will deliver text and graphics, inserted into the vertical blanking interval (VBI). "As a rule-of-thumb, we can offer 100 virtual channels in a 750 MHz system," he adds. To date, S-A has shipped more than 800,000 of the 8600^{X} set-tops, beginning in late 1994, and has close to 50 customer sites. The company's largest customers for the boxes include Continental, Time Warner and Cablevision Systems.

To facilitate those virtual channel applications, General Instrument has licensed an interactive software module from Wink Communications, the "Wink Engine," which uses less than 128 kbytes of ROM. The company also produces an authoring tool called "Wink Studio," for the creation of content.

"A lot of the things that some people a few years ago thought could only be done with a digital platform, are now being done with advanced analog," comments GI's Robinson. "And the price point is obviously lower than a hybrid digital/analog box. So it's a very popular way to get the ball rolling."

Wink's senior marketing manager, Barak Kassar, says that although a server is not needed to provide the most basic level of interactivity with the company's system, operators who choose to deploy a server at the local level will reap the benefits of providing, among other applications, viewer-controllable interactive community channels, local news and local interactive commercials.

When it comes to interactive services, would-be providers and manufacturers alike are asking that age-old question: What will people pay for? Well, electronic program guides, for one. Viacom had success in Castro Valley at converting its trial customers to paying a monthly charge for the StarSight program guide, which, in that implementation, was built into the set-top box. StarSight Telecast Inc. has since that time announced a Digital Interactive Navigation System which is slated to be available after digital set-tops become available.

Dallas-based Westcott Communications Inc. has been successful at selling interactivity to the business community, having signed contracts with companies valued at more than $8.5 million in services on its Interactive Distance Training Network (IDTN) for this year. The network's clients include high-tech firms such as Oracle Corporation, Silicon Graphics, EDS and Intel Corporation. IDTN broadcasts are sent from Westcott's studios in Dallas, via satellite, to participants in "learning suites" based in a number of major cities. The interaction occurs when respondents in those suites use their One Touch system keypads (manufactured by a California company of the same name) to ask questions, answer questions, take tests, etc. That data is transmitted over an X.25 line back to the broadcast suite, and there are also three standard phone lines in each remote classroom so that each participant can call the "teacher" using the keypad. Part of the appeal of the service, say Westcott officials, is that companies can save the time and money they would have spent on schlepping employees around the country for "roadshows."

And while many operators have cooled on interactive video in the short-term, interactive data is the new hot ticket, as the success of on-line services has proved that people will pay for data, too. Along those lines, S-A is having some discussions with WorldGate Communications Inc., "a company that has a concept of allowing Internet access through the existing cable system, and through advanced analog set-top boxes," says S-A's Necessary. "This is not meant to take the place of cable modems, either in terms of speed, or certainly not in the ability to download files. But as an entertainment vehicle, and as an e-mail vehicle, it's pretty nice."

The provision of data *now*, and interactive video someday, explains a lot of recent market maneuvering.

"I don't think that interactive television is something that we will have to worry about for the next couple of years," says Semon. "The industry needs to be thinking about modems and telephony, but ITV is out there a little ways." CED

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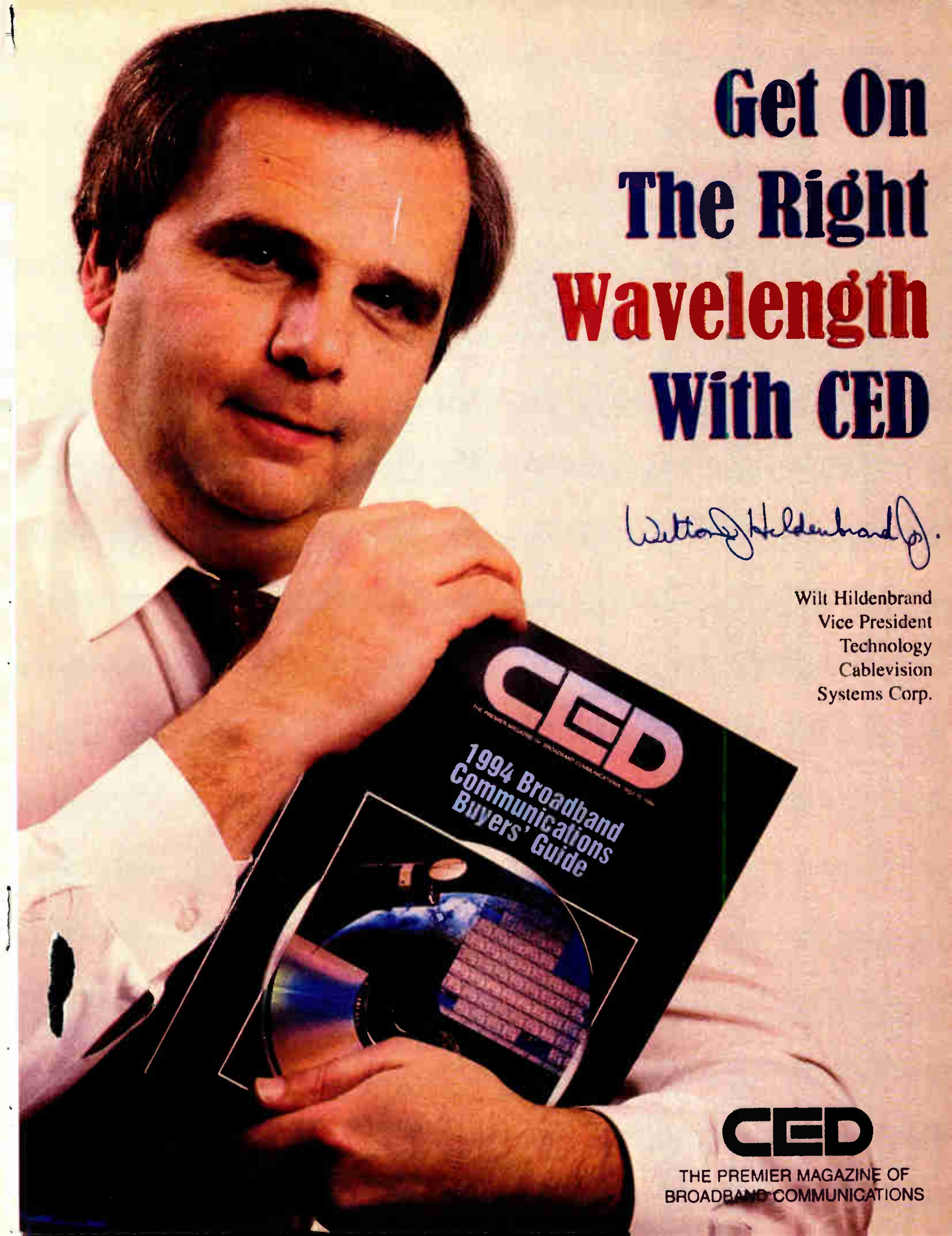

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Managing energy: Utility quandary: partner up, or go it alone Cable's interactive gateway?

By Michael Lafferty

Like many predicted, the Telecommunications Act of 1996 has reshuffled the deck of more than a few industries. Not only are cable operators and telcos desperately trying to figure out how to play the new hands they've been dealt, but various members of the utility industry have taken their seats at the table and are beginning to wager some interesting broadband bets.

Obviously, it's early in the game, and nothing is certain. But, the stakes are high, and the possibilities are endless.

One of the most intriguing scenarios has cable operators and utilities, if not joining hands, at least sharing HFC pipe to usher in a whole new era of two-way energy management services. The increased alliance activity has come about despite some pre-deregulation misconceptions by both parties that still persist to some degree.

Talk is cheap, overbuilds aren't

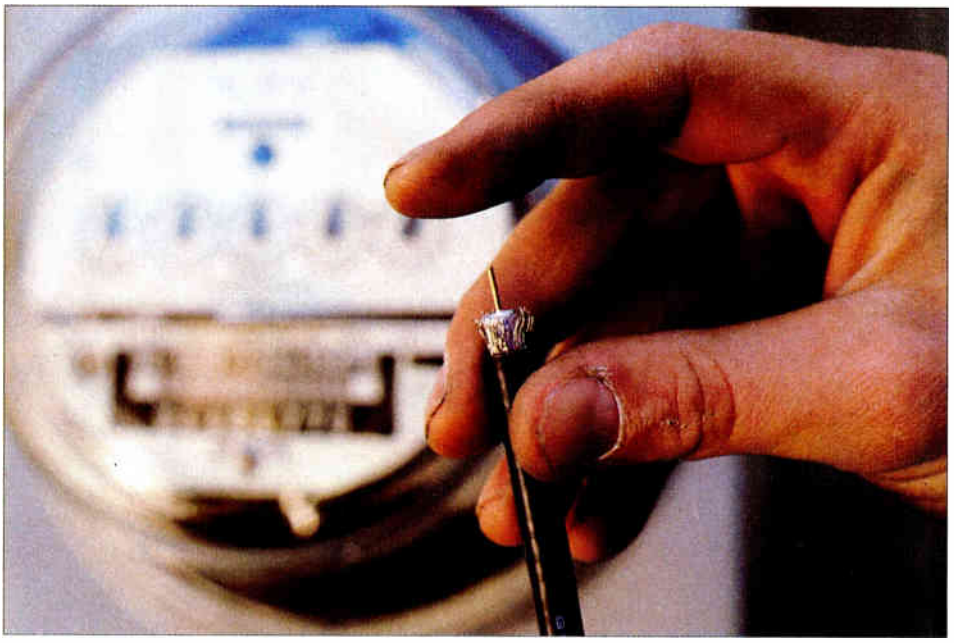
According to some, as the move toward deregulation gained momentum over the past several years, people in both the cable and utility industries had trouble predicting the impact of the pending legislation.

"I think the biggest pitfall, which first came out about two years ago," says Matt Oja, vice president of marketing for Scientific-Atlanta's Control Systems Division, "was that a lot of the cable companies saw utilities as the proverbial pot of gold at the end of the rainbow, just waiting to be picked up. Some operators thought the utilities needed them, and they could charge whatever they felt necessary."

While some cable operators were transfixed by the utilities' legendary deep pockets, some powerco executives thought, and still think, those deep pockets can catapult energy providers into the broadband arena as full-blown, full-service (data, voice and video) providers.

"There is a lot of rhetoric in this arena, a ton of it," says Lester J. Larsen Jr., a TCI consultant and head of Larsen Consulting International. "And you have lots of utilities saying, 'Gee, this looks exciting with deregulation, let's build our own infrastructure.' There are groups within these utilities who want to pursue this direction. But, by the time it gets to the senior executives, most of those plans are killed. It's pure economics, and the economics dictate that this is a huge investment. Most utilities are not going to try and take the telephone and cable companies head-on."

While Larsen's view rings true for many, if not most, utilities, there is ample evidence that utilities are not going to be held hostage by the up-front economics of building a two-way, interactive network–and cable operators are beginning to realize that.



As S-A's Oja notes, "I think they (cable operators) have become a little more pragmatic about it now. What they are beginning to realize is that the utilities are serious, and if the cable companies can't establish a working relationship with them, they'll do something else, either with someone else or on their own."

The concept of establishing automatic or two-way, interactive energy management services, at least from a utility's perspective, goes far beyond getting some unexpected value from a technological gimmick. For utilities, it doesn't get more basic. It comes down to economic survival.

For the first time, utilities can go head-to-head and compete with each other. "Lean and mean" has become the mantra of the industry. To do that, they have to cut costs and retain customers by providing not only better service, but more services. As a result, the number of trials and installations of automated equipment and systems in the industry continues to surge.

In its latest, biannual *Trials & Installations Report* (Dec. 1995), the Automatic Meter Reading Association (AMRA) notes that more than 180 utilities "report deploying (in 1995), or planning to deploy (in 1996), almost 10 million units for automatic meter reading, load management, distribution automation, supervisory control and data acquisition, and outage and tamper detection, as well as (to) provide other automation capabilities."

Of that total, AMRA reports the vast majority (9.9 million units) are actual installations, as opposed to trials (63,678 units). The driving force behind these installations and trials is reduction of labor-intensive meter-reading costs through automatic meter reading (AMR). Even many utilities are staunch proponents of the "more is less" philosophy when it comes to operating costs to stay competitive. By providing more two-way, interactive services, they've come to realize there is a potential to save literally tens of millions of dollars that are currently slated for expanding power generation and/or transmission facilities.

Fortunately, a number of cable companies have already seen the light and are more than

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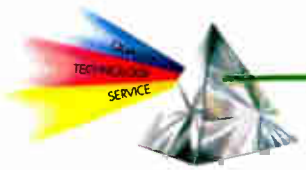

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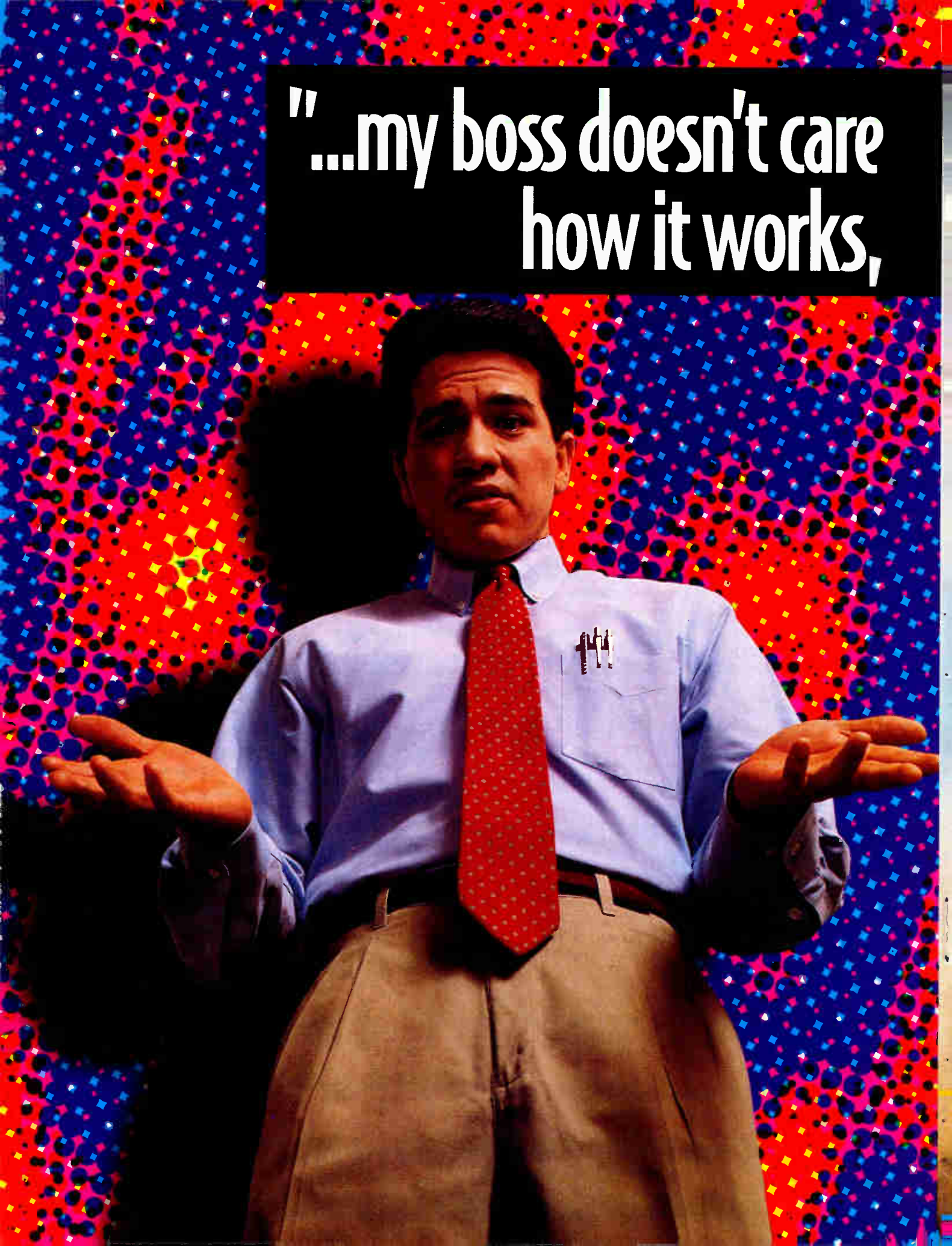

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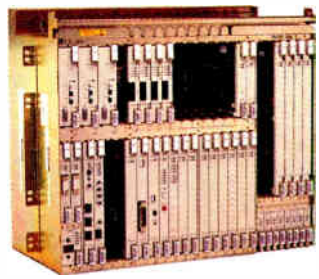

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willing to help utilities get into their "lean and mean" routine.

It takes two to tango

Tele-Communications Inc. (TCI), Microsoft and Pacific Gas & Electric (PG&E) are moving ahead on the development of their Energy Information Services (EIS) system trial in Walnut Creek, Calif. Begun in 1995, the trial currently has 50 homes up and running on a system that incorporates PG&E's software, Microsoft's "point and click" operating system and TCI's digital set-top and wireless remote. System capabilities allow consumers to: view energy usage in real time; schedule heating/cooling systems in several modes (i.e., normal, temporary, vacation); control lighting schedules; track energy billing at any time (and actually pay bills in the trial's third phase); and program the system to react to pricing signals sent by the utility so that various services (e.g., heating/cooling) turn off or turn on according to the cost of energy during high or low energy use periods.

The EIS system is currently using a television interface, but is switching to a PC interface as it expands into nearly 1,000 homes later this year. While stating, "Eventually, we want to get back to the TV when the interactive networks are in place," Steve Phillips, director of EIS at PG&E, says for now, the PC interface will operate through TCI's @Home service accessed through cable data modems.

Phillips reports there's "not that much" retrofitting to bring homes on line to the EIS system. However, they do replace the electric meter and the register on the gas meter. "We're trying," states Phillips, "to lower the entire cost of the installation down to between $300 and $400. That's our goal. Right now, we're somewhere around $2,000."

The trial, says Phillips, has set three goals for itself and its partners. The first goal is to determine the value of EIS through target-marketing services consumers are willing to pay for, documenting both the demand side management (DSM) component's ability to shift peak loads and the reduction in operating costs resulting from elimination of manual meter reading and billing.

Secondly, the trial is trying to develop a network-independent interface and a business case for national deployment of the system. The third goal is to determine how they might bundle services. This might include determining basic and premium packages, developing new high-value, low-cost applications and determining whether there is any new technology needed to complete the system.

All together or step by step

With all the various utilities, cable operators and vendors scurrying around to develop interactive energy management equipment and systems for HFC networks, there's also the question of just how comprehensive these solutions should be. Some are taking the incremental approach, while others seem to be pursuing a more ambitious one-box-does-all approach.

Cox Communications Inc., Nortel and Virginia Power have joined forces to see if they can get it all together–voice, data and video–in one box. Initiated nearly a year ago, the trial will have roughly 24 units in the field by this summer. The three partners are working on developing an integrated communications device that incorporates Nortel's Cornerstone cable modem technology, to pro-

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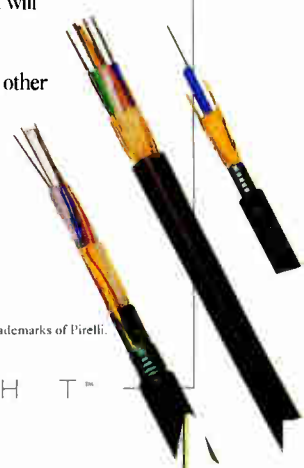

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"The idea," explains Steve Becker, Cox's director of broadband communications, "is that you put one box on the side of the house. If you've got a voice customer there, you plug in a voice card. If you've got a data customer there, you plug in the data card, etc. With one service it's basically the same price as the stand-alone solution. With two services, it's cheaper than buying two individual solutions because you're sharing a lot of the same resources."

Meanwhile, Scientific-Atlanta, whose Control Systems Division has been developing load management products for the electric utility industry for the past 20 years, is taking a slightly different approach that's aimed specifically at cable-powerco alliances. S-A's new Maingate System, which is scheduled to debut this coming fall, is aimed at cable operators and utilities that are looking to initiate new revenue streams sooner rather than later.

A key part of this approach, says S-A's Oja, is giving cable operators and utilities an incremental buildup of services, instead of trying to provide an expensive box that does it all. Maingate, explains Oja, is "meant to work on an HFC backbone for the utility's benefit, but not necessarily require that a cable company invest extra dollars beyond what is required for the utility."

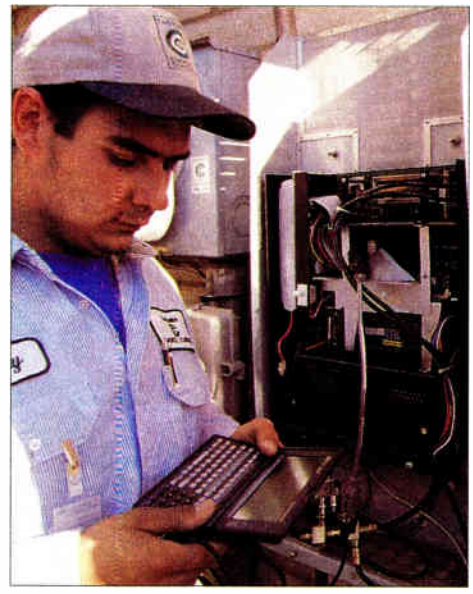
Oja believes utilities are looking for business models that make sense, and partners that are in it for the long haul. And while there are some wireless ways for them to deliver energy management services, for utilities, "There is nothing that gets their attention like high bandwidth, two-way broadband networks. Nothing."

Going it alone

One of the nation's most ambitious energy management trials is the result of a utility holding company striking out on its own "to help utilities position themselves for the future" with its own integrated communications-based network.

CSW Communications, a subsidiary of Central and South West Corp., has attracted nationwide attention with its development of what it calls the Customer Choice & Control™ (CCC) service. The ongoing CCC program began nearly two years ago in Laredo, Texas. Even though CSW's network now passes 5,000 homes, the trial currently involves 1,000 homes, with 2,500 homes targeted for trial buildout. According to William (Bill) Morrow, CCC managing director, when CSW was planning the $9 million trial, it looked around the country and was uniformly unimpressed with the scale of what was being done at the time.

What the company saw was "small potato" trials (with 50 homes or so) and CSW officials had serious doubts about what could be learned on such a small scale. "Plus," notes Morrow, "you have your Ph.D.'s installing the equipment when you're doing so few, and you can go broke doing that. So, our approach was, let's go to Laredo. Let's build our own network. Let's do about 2,500 homes. Let's build in a subdivision that's 20 years old, one that's 15, one that's 10, one that's five years old and two that are brandnew. Let's a get a different range of what it takes to build networks across areas, as well as get different demographics. We go from middle-lower income to middle, to middle-upper, all the way up to high-income households."



CSW's Customer Choice & Control service includes: FPN's PowerView Intelligent Utility Unit (top); control/monitoring devices for key appliances (middle); and Raytheon's multi-task energy control unit (bottom).

The trial, which includes First Pacific Networks Inc. (FPN), American Innovations, Scientific-Atlanta, Echelon, Raytheon and Light Media, runs over CSW's own bi-directional 750 MHz HFC, CSMA/CD, mid-split network. While Morrow readily admits that a sub-split network may be needed for its upcoming Austin project which may include cable television (see below), he says the mid-split system in Laredo has taught the utility a great deal about return path dynamics.

Once the system is installed, customers use a Raytheon energy control unit, which is about the size of a battery-operated video game and can be plugged in anywhere in the home. Morrow says CSW worked closely with Raytheon to refine the design of this unit which took its cue from the ubiquitous ATM machines. While many people may still have trouble programming their VCRs, he notes the bulk of the population can go to an ATM and in 20 seconds get all the money their account will allow.

"We did a lot of focus groups in the design of the interface," explains Morrow. "We put a unit in front of them and said, 'Make this room hotter.' And if they hit the wrong key consistently, next time we did a focus group, that was now the 'right' key. That's what made sense to them."

With unit in hand, consumers take control of their energy consumption. A sliding kilowatt-hour (kwh) price scale has been established that varies with the overall demand on the utility's capacity. Conventional rates average out to about eight cents per kwh. In the CCC trial, the lowest price is 5.5 cents per kwh during off-peak hours, while the most expensive rate is 35 cents per kwh at peak periods, for example, between 4 p.m. and 5 p.m. weekdays.

The pricing schedule, notes Morrow, was not set arbitrarily by the utility. Focus groups were also used here. Surprisingly, focus group participants picked the most aggressive schedule with the highest prices during peak hours, because, says Morrow, it also offered the lowest prices during off-peak hours.

With the energy control unit, consumers can pre-program various appliances (AC, water heater, etc.) to shut down or scale back operations during peak hours. And the consumer always has the option to override the system by pressing just a few buttons. The unit, which offers both English and Spanish displays, can also be used to control water heater tempera-

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Building the info highway brick-by-brick

A broadband migration path

By Ed Moura, Vice President of Network Systems, Hybrid Networks Inc.

It will take both time and money for network service providers to build the broadband information superhighway, and it isn't realistic to assume that everyone will be able to get symmetric broadband connectivity immediately. But this shouldn't stop them from starting to build the superhighway. The best answer is to start building a system that works with the existing infrastructure and then provide a gradual and graceful migration path to the future as the demand for "broadband" services grows.

The sane strategy for building the broadband information superhighway does not require the rewiring of America with fiber optic cables going to every home, school and office. The existing infrastructure, which includes cable TV, telephone lines and wireless, is more than sufficient to begin. Fiber optics will be used primarily in the backbone to create the transport portion of the system. Also, future broadband wireless technologies will eliminate the need for extra wires in the local loop.

In addition, existing wide area network (WAN) and local area network (LAN) technologies are not sufficient to build the superhighway. New metropolitan area network (MAN) technologies are needed. This paper describes the role of MANs and the present state of the MAN industry. Various MAN architectures are presented, and their potential roles in building the highway are reviewed. Finally, a Split Channel Asymmetric Networking (SCAN) architecture is presented as the most effective platform to build the superhighway. SCAN helps to leverage the existing cable TV and telephone network infrastructures and to migrate those networks in a modular and scalable fashion.

Here's a brief summary on how to build the information superhighway using the SCAN architecture:

✔ Build a broadband point-of-presence (PoP)–Find a suitable location within a particular region or metropolitan area to create this centralized network facility. Just like the telephone network where one has a central office (CO) with telephone switching and transmission equipment, the PoP provides centralized broadband networking equipment, management and control.

✔ Create independent transmit and receive links–SCAN splits the transmit and receive communications links into independent downstream and upstream transmission paths with independent link protocols. It is very important to be able to mix and match various media and transmission speeds. With this capability, SCAN can support various hybrid configurations such as: (a) downstream cable TV and upstream telephone lines, (b) downstream wireless or satellite and upstream telephone lines, (c) downstream and upstream cable TV, and (d) downstream and upstream wireless, among others.

✔ Connect the PoP to the headends, wireless transmitters and/or distribution hubs–Once a PoP has been built, it is then necessary to interconnect the PoP to the various cable TV headends in the region in order to deliver, at a minimum, the downstream broadband transmission path. Alternatively, the PoP may connect to various wireless transmitter sites throughout the region (or to a satellite uplink). It is then the particular network service provider's prerogative to determine the favorite broadband network topology. SCAN is flexible in this area. Today, the preferable and most cost-effective way to interconnect the PoP to the various headend locations is to use analog "RF" transmission equipment via fiber optics.

Once the backbone broadband network infrastructure for the SCAN architecture is created, as described above, the network service provider is ready to offer broadband services in that particular region. A more compre-

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hensive description of the SCAN architecture and how it compares to others will be described later.

The Metropolitan Area Network industry

It is not possible to build the broadband information superhighway with WANs and LANs alone. First, it is necessary to build MANs. The MAN industry, or "the last mile," has been subject to major controversy since the break-up of the telephone monopoly in the 1970s. Essentially, the break-up of AT&T left the local loop as a regulated monopoly for the Regional Bell Operating Companies (RBOCs). In parallel, another monopoly was growing in the last mile industry. Small cable TV operators were being acquired by the large multiple system operators (MSOs) to eventually create an unregulated monopoly for cable TV distribution (later, the Federal Communications Commission regulated the cable TV industry to control rates, among other things).

In the midst of these two monopolies, competition has now started to grow in the MAN industry. Competitive access providers (CAPs) like Metropolitan Fiber Systems and Teleport Communications Group are clear examples of this new trend. CAPs are competing primarily with the RBOCs, but, the MSOs themselves are now also seeing strong competition from direct broadcast satellite (DBS), and on a somewhat smaller scale, from wireless cable TV operators.

Unlike the WAN and LAN industries, cable TV plays a key role in the MAN industry. RBOCs want to get into the cable TV business, while MSOs want to get into the telephony business. But, until recently, data communications has been ignored. At the present time, the only cost-effective alternative for remote data access in the local loop has been conventional, low-speed (e.g., 14.4 Kbps, 28.8 Kbps) telephone modems. Only recently, with the success of the Internet and on-line services, have the MSOs and RBOCs acknowledged the need to offer high-speed (broadband) data services to connect PCs in metropolitan areas. Previously, the driving application to build the superhighway was interactive television and video-on-demand.

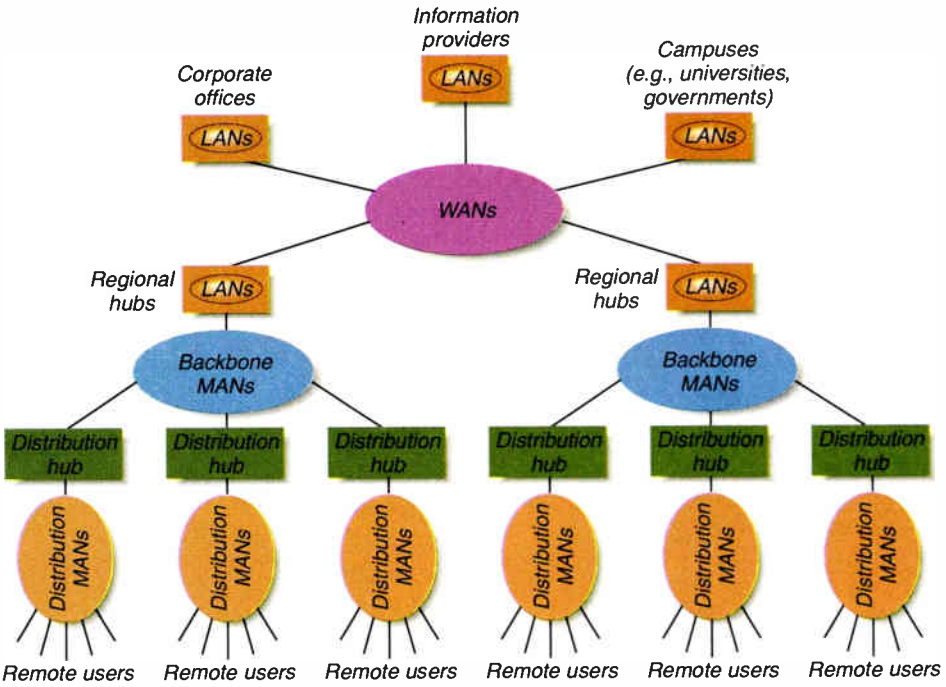


Figure 1: *Interconnectivity between MANs, WANs and LANs*

Conventional wisdom suggests that competition will continue to grow in the last mile. However, it will take time before the natural competitive forces are able to untangle the various business opportunities for the last mile. Nevertheless, building the broadband information superhighway represents a clear opportunity for the MAN industry and all the local loop players.

The MAN architecture wars

Broadband remote access network architectures remain the most controversial area in the MAN industry. Essentially, existing traditional local loop access technologies such as telephony and cable TV access are not sufficient to handle the broadband requirements of a full service network. The MAN industry is roughly where the LAN industry was in the early 1980s. LAN architectures were being pressured by PBXs on one end, and by modems and multiplexors on the other end. When Xerox, Intel and DEC developed the Ethernet specification, and IBM developed the PC LAN and the token ring specifications, the LAN industry exploded. The IEEE then blessed those specifications (with minor modifications) to make the IEEE 802.3 and 802.6 standards.

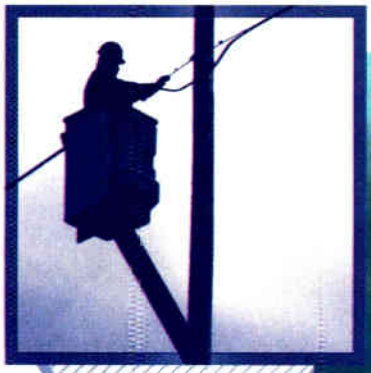
Because the LAN and WAN industries are still evolving, some people are trying to force LAN and/or WAN architecture concepts into MANs. This is clearly not the proper approach because MAN business requirements are much different from LANs and WANs. In other words, MANs are being driven primarily by residential users, small business offices, remote field offices and schools.

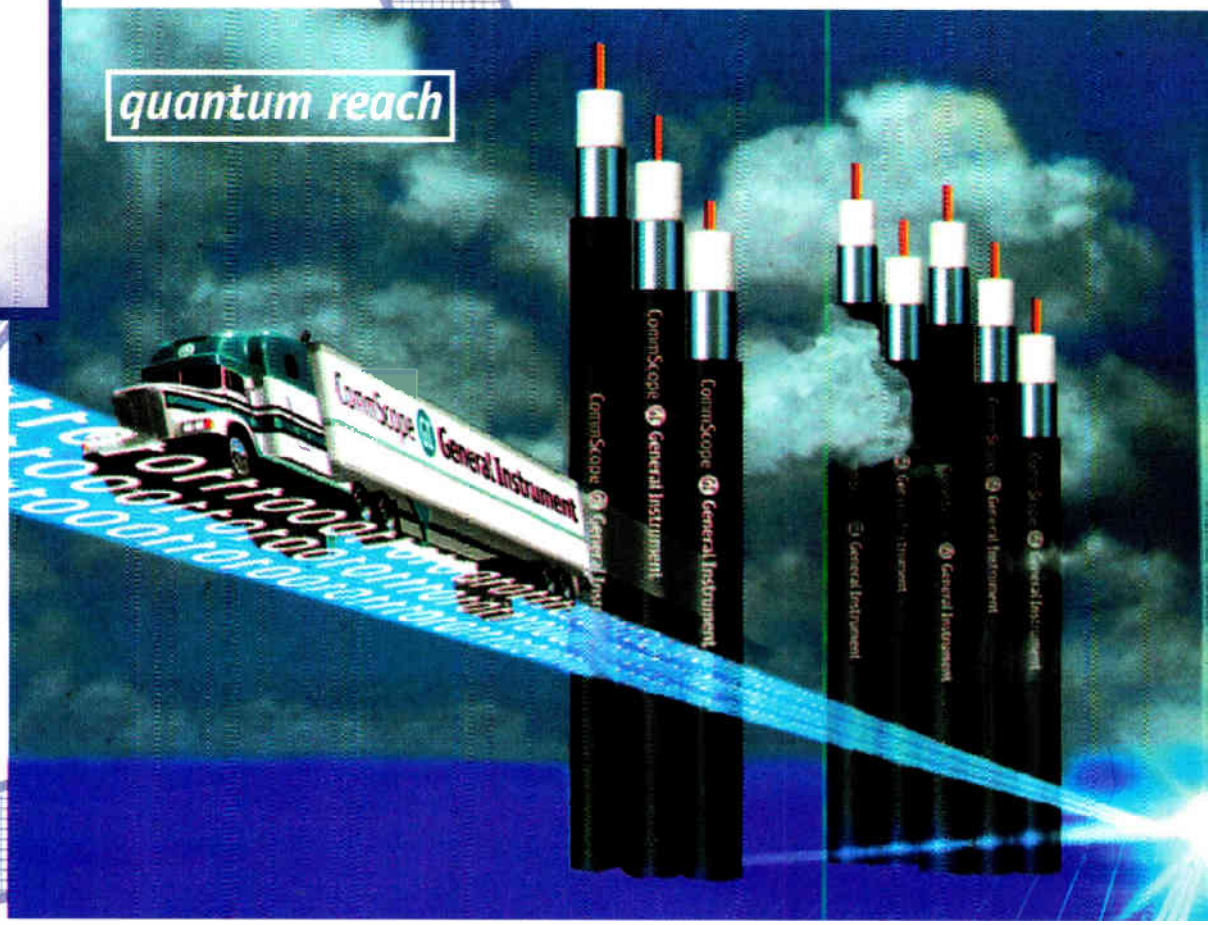
LANs have grown primarily inside large corporate offices and campus environments (e.g., universities and government) for business applications. WANs are more diverse than LANs, because they address both corporate needs and consumer needs, but their strong traditional "telephony" roots make them difficult to change. Essentially, traditional WAN technology was designed primarily for telephony and, therefore, it is not suitable for MANs. At the same time, the new WAN technologies (e.g., ATM) are not yet cost-effective, field proven and/or mature enough to be useful in the dynamic MAN industry.

So what are the major alternative architectures for MANs? In the long term, many people believe that a switched Asynchronous Transfer Mode (ATM) transport over Synchronous Optical Network (Sonet) architecture is the best solution. This architecture is in tune with the evolution of the WAN industry, which means transporting ATM cells (voice, video or data) through an "all digital" fiber-to-the-curb (FTTC) MAN, all the way to a "point of entry" module at the side of the house. This module would then provide voice, video and data interfaces to telephones, TVs and PCs throughout the house. However, this grandiose vision may not be cost-effective and practical in the foreseeable future.

At the present time, hybrid fiber/coax (HFC), SCAN and ISDN, to a certain extent, are the only practical architecture alternatives for MANs. Note that SCAN is a "hybrid" architecture that encompasses both HFC and other technologies.

The notion of introducing "interim" MAN architectures and strategies scares most people.





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When LANs started, most people wanted the digital PBX to do everything in the local area. Ethernet and token ring were viewed as an "interim" strategy. Because the MAN industry is still in its infancy, many people want to stretch LANs and WANs to do everything in the metropolitan area. This way, they don't have to build new technology.

If anything can be learned from history, it is the idea that "one solution fits-all" is not practical or even acceptable. Because MANs are an emerging technology, there are no such things as interim architectures. The future of MANs will be based on the deployment success of the early architectures. For example, the evolution path to FTTC will, most likely, continue to use "analog" transmission between the curb and the home. In other words, analog transmission techniques and many other early concepts will continue to be used, even in future MAN architectures.

Transport vs. distribution

MAN architectures can be divided into two sections: the distribution MAN and the transport (backbone) MAN. Transport is often confused with distribution. Distribution means delivering signals to individuals or small groups of remote users at home, schools or small business offices within a particular metropolitan area. The distribution side of the MAN is usually not well-suited for corporate offices and LAN-to-LAN interconnections. The network service provider would have to put a significant burden on its distribution MAN to support the requirements of corporate networks.

Transport means delivering signals from large regional centers to various distribution hubs (e.g., headends) throughout the region. Transport is the backbone portion of the MAN. Fiber optic lines are usually needed in the backbone in order to scale the overall MAN system within a specific region. In the future, transport MANs may also be used for corporate-to-corporate interconnections. Figure 1 shows an overall view of MANs and how they relate to WANs and LANs.

HFC MANs

Currently, HFC is the most popular broadband MAN architecture for distribution. Most existing cable TV networks in the world are HFC or will be upgraded to HFC. These networks are cost-effective and ideal to deliver analog broadband signals to remote users. The majority of the existing HFC networks are still one-way only. They deliver multiple 6 MHz analog signals in the downstream direction. However, many cable TV operators have already started the process of upgrading the networks to offer bidirectional services. Most modern, two-way, HFC cable TV networks are sub-split; that is, they employ the 5-42 MHz range for upstream delivery and the 50-450 MHz (or sometimes 50-750 MHz) range for downstream delivery.

In addition to cable TV operators, some RBOCs have decided to implement HFC networks for their broadband service offerings. A clear example is Pacific Bell, which publicly announced its intention to create such a broadband network throughout California. It is the author's belief that, in the foreseeable future, HFC will remain the predominant infrastructure used to build metropolitan area broadband networks.

HFC for both transport and distribution

Although HFC is more prevalent in the distribution side of the MAN, it can also be used in the transport side. Advancements in fiber optics transmission make it possible to transport analog signals up to 100 miles or more. For many applications, using HFC for both transport and distribution, the overall network is more cost-effective. Using this technique, distribution hubs (headends) and nodes become passive network elements. Standard analog channel processors and/or other similar RF equipment are used at the distribution hubs to re-align the channels that need to be transmitted in either the downstream or upstream directions. At the node, standard broadband analog fiber to coax transmitters and receivers are used to pass through the entire analog bandwidth in both directions.

In order to support these HFC configurations for both transport and distribution, the network service provider may need to allocate some of its reserved transport "dark fiber" to be used for analog transmission. Figure 2 shows how HFC can be used for both transport and distribution. Note also that for these configurations, the headend locations (distribution hubs) will only need to include standard RF equipment. Most metropolitan area network service providers are familiar with this type of equipment and do not need additional training to support HFC broadband networks for both distribution and transport.

Digital transport and HFC for distribution

In the past, because of distance limitations, many HFC networks were limited to the distribution portion of the MAN. This, coupled with the desire to migrate toward integrated "all digital" voice, video and data broadband MANs, has encouraged some network providers to start deploying digital transport backbones.

Using digital transmission technology for the transport side of the HFC MAN has both pros and cons. The main problem is cost. Using this architecture and existing technology, the headends now need to house more complex digital network equipment, including various combinations of routers, bridges, servers, switches, multiplexors and modems.

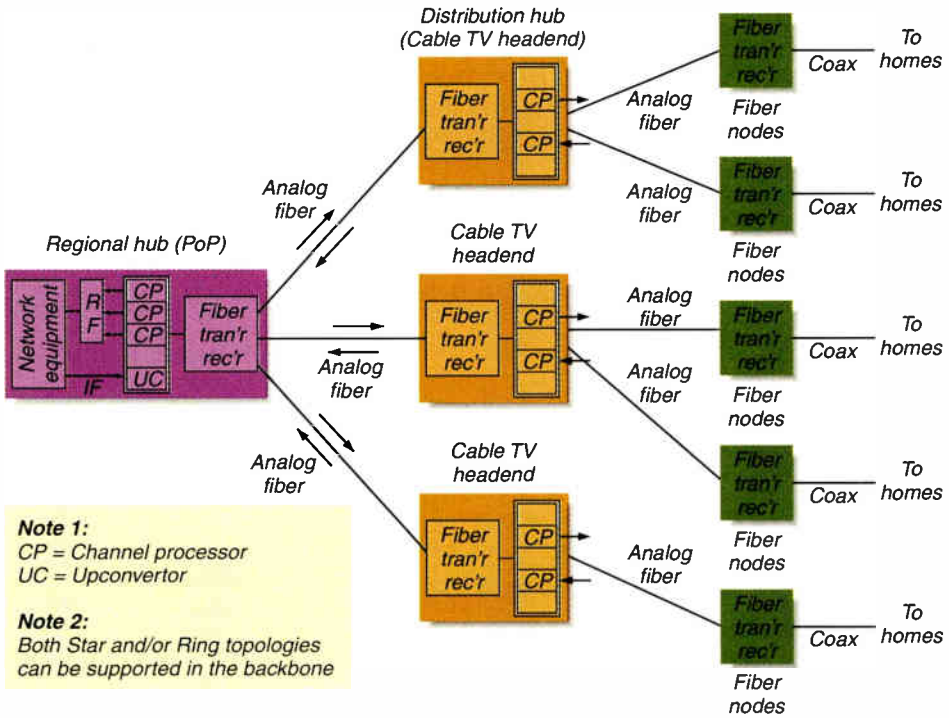

Figure 2: A typical HFC MAN for both transport and distribution

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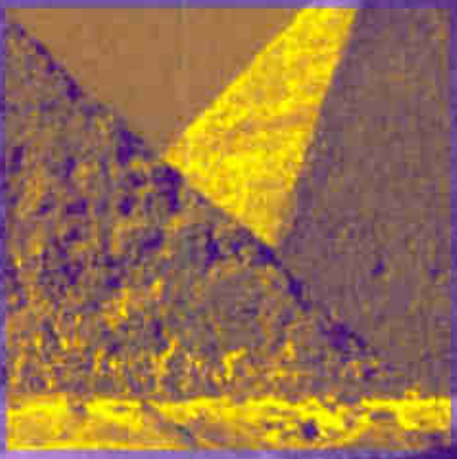

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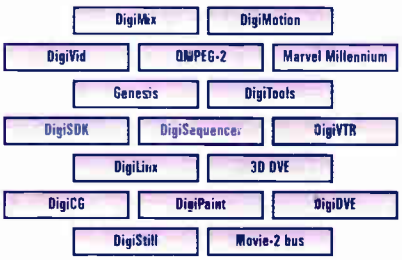

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The other key problem is flexibility and scalability limitations. Many MAN operators want to employ Sonet for transport, but this standard, while proven for telephony in WANs, is still not proven for running separate high-speed data and video distribution MANs. It is difficult to justify such an expensive MAN transport technology when advanced integrated distribution services will not be offered for at least another five years. Most MAN operators will continue to run parallel and separate networks for voice, video and data services until they can cost justify doing both integrated "all digital" transport and distribution networks.

Operating digital transport alone is not sufficient in most cases. On the other hand, the advantage of using digital backbone MANs, at the present time, is that it will help train the operators on the integrated broadband digital networks of the future. Some operators will start with more cost-effective "proprietary" digital transport technologies which will need to be upgraded in the future, but the experience will be invaluable. Figure 3 shows a typical MAN with digital transport and HFC for distribution. Note that new digital transmission and network equipment is needed in potentially already crowded headend locations.

Integrated Services Digital Network

ISDN can be used for MANs as an upgrade to the existing public switched telephone network (PSTN) service. High-end standard telephone modems are presently V.34 (28.8 Kbps). While ISDN can offer 64 Kbps and/or 128 Kbps, these speeds are far slower than the multi-megabits per second speeds that can be achieved with other MAN technologies and therefore, do not qualify ISDN as a "broadband" MAN service. Nevertheless, ISDN is becoming available in more locations and is now being considered as a feasible alternative by many remote users for telecommuting and Internet access.

While ISDN is available in most metropolitan areas now, the process for ordering and installing the service is still quite complicated. Another issue is that many ISDN data terminals are not compatible across multiple vendors. ISDN adapters may not work with certain network service providers' central site equipment. It is important to remember that even though ISDN is a standard, there are no interoperability standards (other than the Point-to-Point Protocol–PPP) for the manufacturers of ISDN equipment. In addition, ISDN gear is still costly and not readily available. Finally, ISDN service rates are still not suitable for consumer multimedia applications. Typical ISDN rates are around $50 to $100 per month per line for most subscribers.

On the positive side, ISDN is, at the present time, the only available higher speed MAN alternative. For professionals who are looking for immediate higher speed remote access, ISDN is the only cost-effective alternative available in most places. Without ISDN, remote users either have to remain with telephone lines and telephone modems or expensive telephone leased line alternatives.

FTTC MANs

Bell operating companies and other network service providers believe that FTTC (also sometimes referred to as Fiber-In-The-Loop or FITL) and fiber-to-the-home are the ultimate broadband technology solution for MANs. These MAN technologies come from the "old school"

of thought of offering fully switched symmetric broadband network connections to every subscriber so that they can send and receive multi-megabits per second. Essentially, everyone has their own personal switched broadband voice, video and data communications channel. This will clearly take many years to deploy.

FTTC MANs bring full duplex broadband signals to optical network units (ONUs) at the curb. The ONUs then extend the switched broadband connections to a small group of homes (typically eight homes) via both coax and twisted pair wires. Twisted pair wires are used primarily for telephony, while coax is used for both video and data. Unlike HFC networks, FTTC assumes an all digital transmission network solution. In this case, the transport network goes all the way to the curb. The distribution side of the network is only within the last few hundred feet between the curb and homes.

The transport side of FTTC has now been standardized on Sonet/ATM, but the real problem with FTTC is that the distribution portion of the network has never been clearly understood.

To have maximum flexibility in the placement of the ONUs, the service providers that favor FTTC have been looking at various technology alternatives for the distribution side (e.g., HDSL, ADSL, multi-tone, digital coax, etc). Many of these service providers are RBOCs which do not have coax in the last mile. Therefore, they prefer twisted pair-based broadband technologies in the local loop.

In general, twisted pair-based broadband transmission techniques are new in the local loop. They are presently used with LANs (e.g., 10BaseT, FDDI), but the local loop has different characteristics in terms of distances, number of twisted pair wires used in a bundle, type of wires used and many other differences. Also, because the operators were unsure about their own level of commitment toward FTTC, many of these transmission techniques such as ADSL and HDSL have been designed for direct end runs from the central office (up to 18,000 ft.) to the home over nonloaded local loop wires. This would allow many operators to deploy broadband MANs without needing fiber and ONUs.

In either case, none of these transmission techniques, deployed with or without ONUs, has proven to be cost-effective. Another key problem with FTTC is getting the industry to agree on the equipment that goes in the home. Is it a set-top box? Is it a point of entry module? Until recently, video dialtone (VDT) was the driving force behind FTTC. However, recently, this application has been losing momentum. In addition, because technology is changing so fast, the network operators that favored FTTC can no longer agree on the best technological and marketing strategy for the local loop. Many of these operators have been buying wireless MMDS networks as another immediate "broadband" alternative. This state of confusion has clearly given the edge to HFC networks.

Sonet/ATM transport

Sonet/ATM is presently the closest thing to a MAN standard. This MAN technology standard has been adopted for the transport section of the network by most of the FTTC proponents. It is important to note that this "standard" does not directly apply to the distribution side of the MAN. MPEG-2 compressed video signals and digital telephony can be directly mapped on to Sonet in their native format. However, most recently, industry expectations are to carry

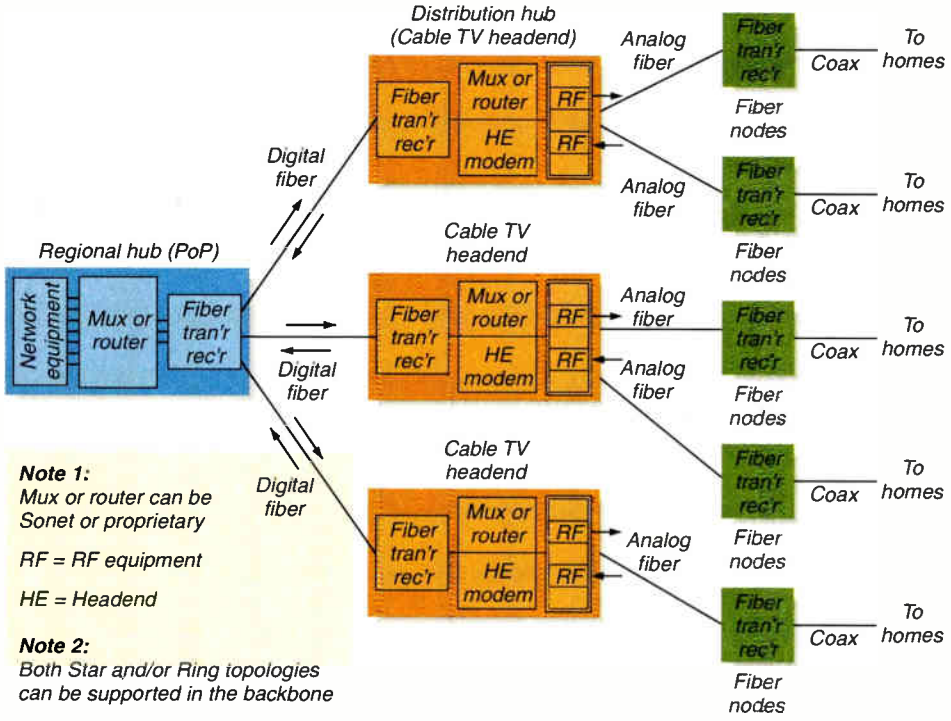

Figure 3: A typical MAN with digital transport and HFC distribution

compressed MPEG video streams, digital telephony and data using ATM cell formats over the FTTC Sonet transport, all the way to the ONU. For reference, several Bellcore standards describe these techniques at length.

At the centralized regional hub locations, Sonet/ATM interfaces are now being deployed and integrated to most of the broadband network switches. The problem remains at the ONU. Many vendors suggest that the operators should carry the ATM cell formats all the way to the home, but over what medium? And where does it terminate at home? Without being able to answer these questions in a consistent manner, across multiple vendors, FTTC will remain a trial curiosity, rather than a real business alternative. Figure 4 shows a typical FTTC MAN trial deployment.

HFC to FTTC migration

Many operators today are deciding to deploy HFC MANs instead of FTTC due to costs, lack of standards, availability of equipment and many other business and technology related reasons. Above all, HFC networks are field proven and can be extended to offer telephony, data services and broadband multimedia services in addition to the more typical broadcast video services. HFC networks have clear and well-defined analog transmission standards for the distribution side of the network. It is easy to envision a scenario where operators start with HFC and then migrate to FTTC. A good migration strategy here is to eventually bypass, when it is cost-effective, the analog transport and most of the analog distribution portion of the HFC network with FTTC digital fiber all the way to the curb. At the curb and ONU, the home interface units would then need to include analog-style HFC transmission in order to continue to support the HFC subscribers. New "all digital" distribution transmission techniques to the home could then be deployed.

SCAN

SCAN, also sometimes described as the Asymmetric Broadband Communications (ABC) system, is a MAN architecture which allows service providers to build MANs using their existing network infrastructure. In addition, SCAN allows operators to migrate from today's network to tomorrow's integrated full service network requirements. SCAN decouples the downstream transmission channels from the upstream channels. In this way, it achieves complete flexibility to "mix and match" different transmission technologies transparently to the subscriber and the applications.

SCAN takes full advantage of standard HFC analog transmission in the downstream direction. Because many HFC networks are not yet "two-way" capable, it is also possible to use standard PSTN or ISDN telephone lines in the upstream direction. Another advantage of decoupling the transmission links is that it becomes possible to operate at different speeds in both directions.

SCAN follows a client/server network model, unlike the more traditional peer-to-peer LAN architectures. The client portion of the network resides in the "Remote Link Adapter" (RLA) at the subscriber's home. The server portion of the

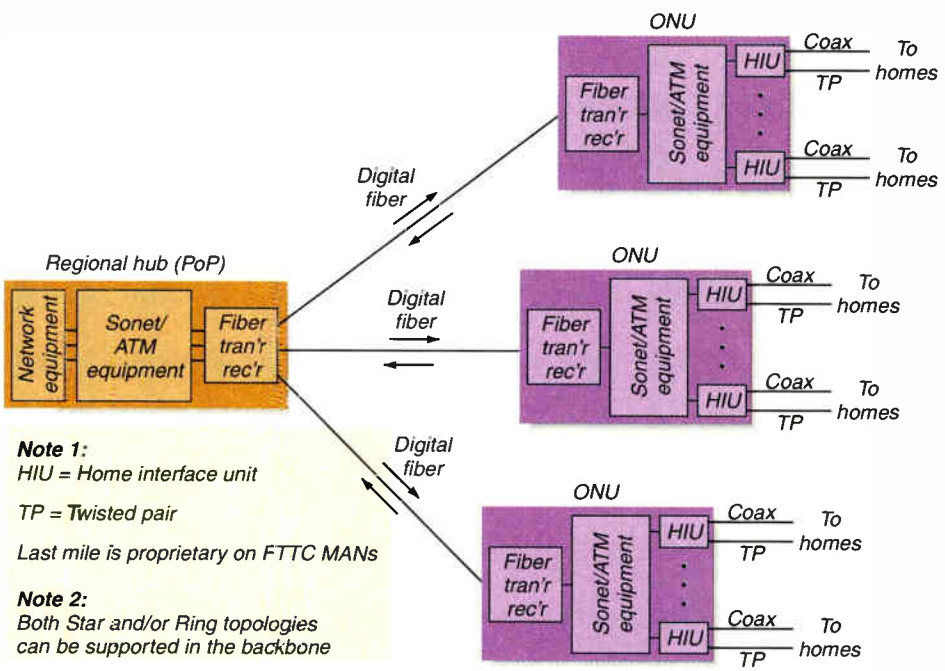

Figure 4: Typical FTTC MAN

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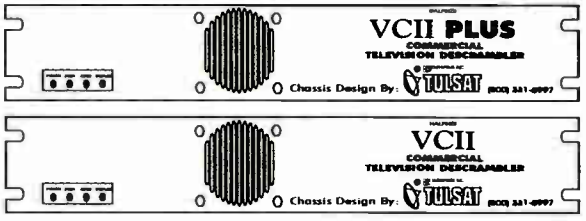

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network resides at a centralized facility known as the PoP, which can be located at various centralized places or, in some cases, colocated at the headends of cable TV networks.

However, in many early installations, the PoP facilities are being located at a Regional Hub (super headend) in order to interconnect more than one headend. These early installations use HFC transport and distribution facilities.

Most popular SCAN configurations

Because SCAN allows an operator to mix and match various media and speeds, there are many different types of SCAN configurations. The two most popular SCAN configurations are:

✔ Two-way on cable TV configurations for HFC networks. This addresses most broadband MAN requirements. The first release for this configuration provides data services for PC subscribers. Future releases will continue to support enhanced PC data services, but will also provide video and telephony services. The system uses independent 6 MHz channels in the downstream direction which operate at 30 Mbps using 64 QAM modulation. In the upstream direction, the system uses independent narrowband channels (e.g, 75 kHz or 300 kHz) which operate at multiples of 128 Kbps (up to 2 Mbps) using VSB modulation. QPSK and other robust modulation techniques for the upstream direction will be supported in subsequent releases.

✔ One-way on cable TV with upstream telephone return line. This addresses the needs of most existing cable TV operators who have yet to upgrade their HFC networks to two-way capabilities. With this configuration, operators can start offering broadband MAN services using their existing infrastructure. They can then upgrade their plants whenever they have enough subscribers to justify the upgrade expense. The cable adapters shipped for this configuration may also include built-in two-way cable TV capabilities in order to minimize the problems associated with subscriber upgrades. Most likely, this configuration will only support data services for PC subscribers. This configuration also uses independent 6 MHz channels in the downstream direction which operate at 30 Mbps using 64 QAM modulation. In the upstream direction, this configuration uses independent PSTN or ISDN return lines which operate at typical telephone modem speeds (e.g., 9600 bps, 14.4 Kbps or 28.8 Kbps) if using PSTN return lines or at 64 Kbps or 128 Kbps, if using ISDN return lines. For subscribers who do not have existing modems, the PSTN return line (telephone modem) can be built-in to the cable adapters. ISDN return lines will initially be only supported via a separate ISDN box or adapter.

If one cable TV headend is two-way and the other is one-way, a cable adapter can be configured to operate with both two-way and one-way cable TV networks. For the one-way configuration, telephone modems are used in the upstream direction to complete the full duplex connection.

An emerging popular SCAN configuration consists of using downstream wireless TV links, such as unused, low-power, UHF-TV channels, Multipoint Multichannel Distribution Service (MMDS) and LMDS wireless cable TV channels, with upstream telephone return links. A few of these wireless configurations have already been tested in several locations throughout the country with excellent results, showing a lot of promise to deliver broadband multimedia data services to small businesses, schools and mobile users. Also, for a completely wireless extension of this SCAN configuration, the return telephone links can use cellular telephone wireless channels, instead of wired telephone lines.

Another strategy to implement two-way wireless SCAN configurations is to choose a combination of both broadband and narrowband wireless PCS spectrum. Essentially, a SCAN configuration of any kind combines low cost, broadband TV broadcast technology with low cost, narrowband telephone-like technology. From a PCS point of view, it is possible to deploy and co-locate the broadband and narrowband PCS wireless channels in the same cell sites. PCS cells can then be initially interconnected based on traditional cellular/PCS telephone backbone technology, until user demand requires additional bandwidth. At that stage, PCS cells will need to be individually addressed with dedicated broadband bandwidth (e.g., fiber optics) for the transport side of the MAN, in order to scale the SCAN system.

The most important requirement to be able to deploy this PCS-based SCAN system is to have access to PCS spectrum. The SCAN system will, most likely, require at least a contiguous broadband 2 MHz channel for the downstream traffic. In order to avoid potential interference among adjacent cells, 6 to 12-MHz of bandwidth will need to be reserved for downstream traffic. For upstream traffic, the SCAN system will be able to use the same narrowband PCS telephony channels and PCS equipment.

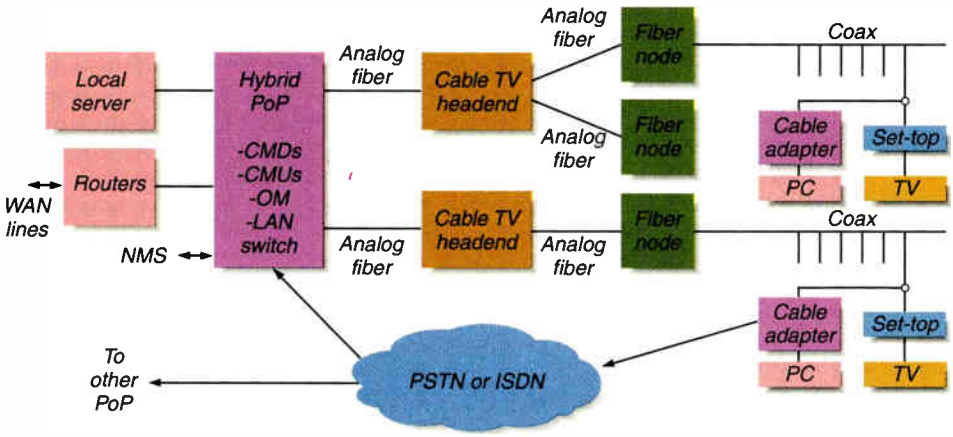

Figure 5: *The two most popular SCAN configurations*

Conclusions

This paper presented the best strategy to build the broadband information superhighway by identifying the use of MANs. The state of the MAN industry was reviewed, and various MAN architecture alternatives were presented. It then provided a clear migration strategy between today's existing TV and telephone networks to tomorrow's full service networks, where SCAN plays a very important role in this migration strategy.

Building the superhighway is not a panacea, but it can be done in a logical, step-by-step (brick-by-brick) basis without having to create a major gap between the present and the future. The main concepts being presented in this paper are already being tested in the field, and the results are promising. Hybrid has teamed up with other companies to implement and deploy these SCAN systems in various configurations in order to create immediate broadband network solutions that work with existing infrastructures. The future superhighway will be based on the successes or failures of these early trials and deployments and not on "primarily academic" speculations on alternative technologies and architectures. CED

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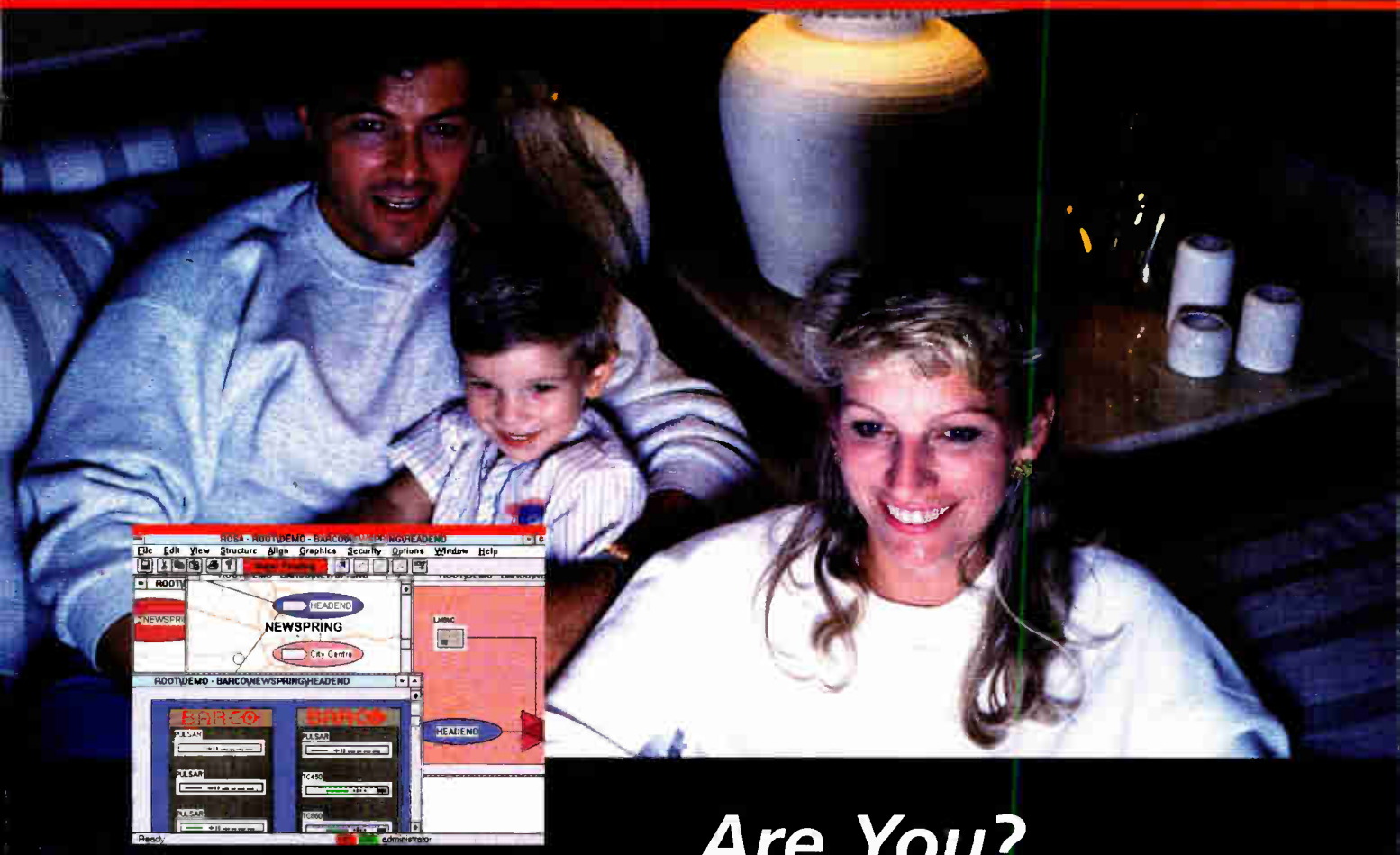

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The residential gateway: a home traffic cop

Enabling future networks

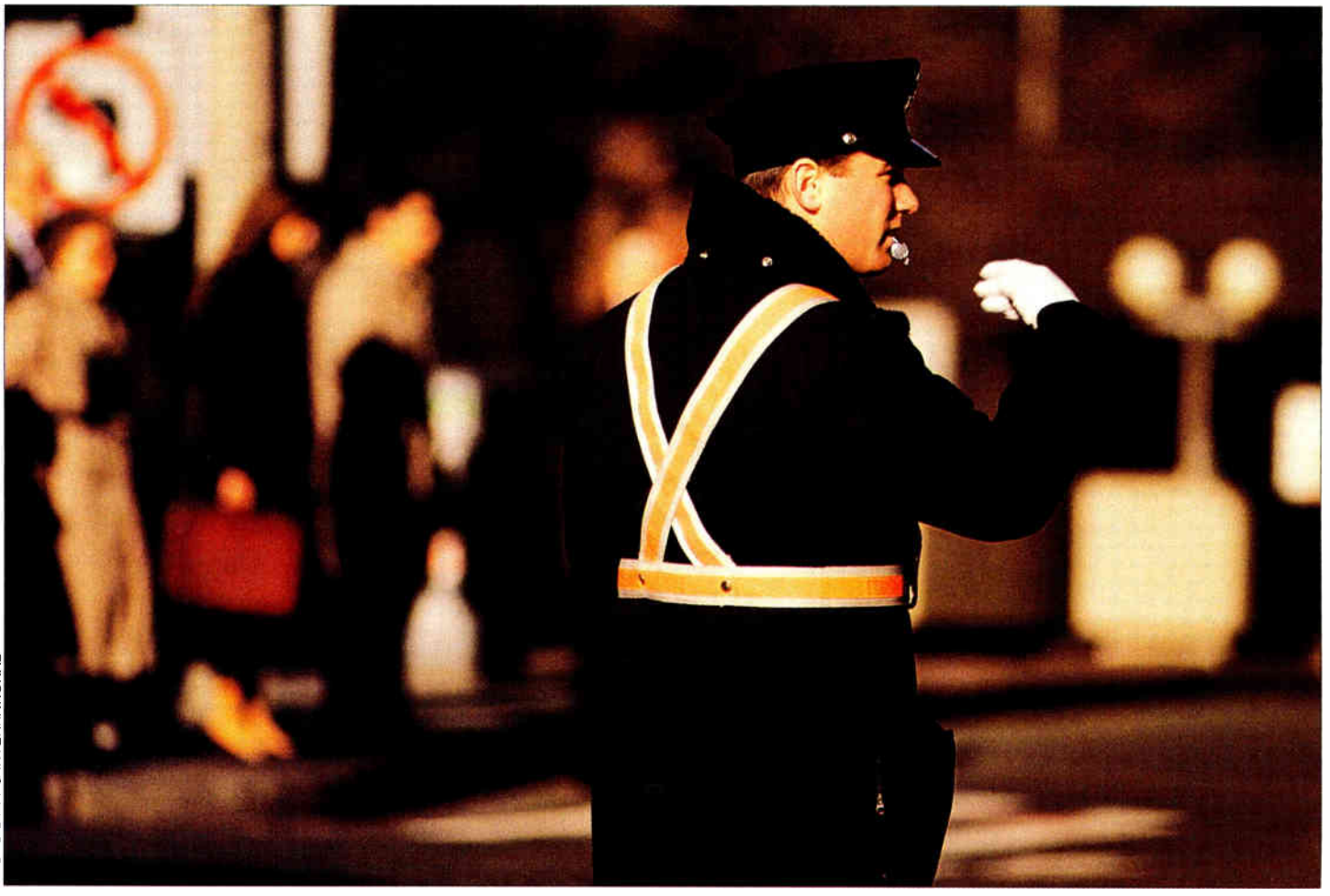
By Clifford R. Holliday, P.E.

Around the world, deregulation of the telecommunications industry is resulting in competition among telephone carriers, cable TV services, utilities and other newcomers. One effect of this competition is the sudden emergence of not one, but several actual and potential broadband communications networks into homes and small businesses. This was spurred initially by the goal of interactive video services. In the last year, however, it has been shown that interactive video will not, by itself, pay for the infrastructure investment. Other services must be provided over these broadband residential access networks in order to justify the investment. These services include high bandwidth access to the Internet and to private networks, voice telephony, electronic games, home automation, home security, utility monitoring and utility control, and many other, as yet unimagined applications.

For the last several months, a group of individuals from a variety of firms involved in the development of the network of the future has initiated a new concept that is a basic enabler for that network. This concept is so important to the realization of a multiple provider, competitive, residential environment, that it is necessary. Otherwise, that envisioned future will have no realistic chance of occurring. This concept has been dubbed the "Residential Gateway." It is similar, in part, to other work that is going on in various standards bodies, such as DAVIC, ATM Forum, EIA, VESA and IEEE 802.14. The Residential Gateway is not meant to compete with, but integrate into, these implementation groups. However, the Residential Gateway concept uncompromisingly takes the position of the consumer in viewing and ultimately interacting with network services. Also, this approach is dedicated exclusively to residential requirements, rather than compromising those needs with business and institutional related concerns.

Residential gateway concept

To understand what the Residential Gateway concept is all about, let's step back and consider what is (broadly speaking) proposed for the near future. Several different networks to the home are planned. These will include the existing twisted pair, telephone network, and the coax (and fiber), cable TV



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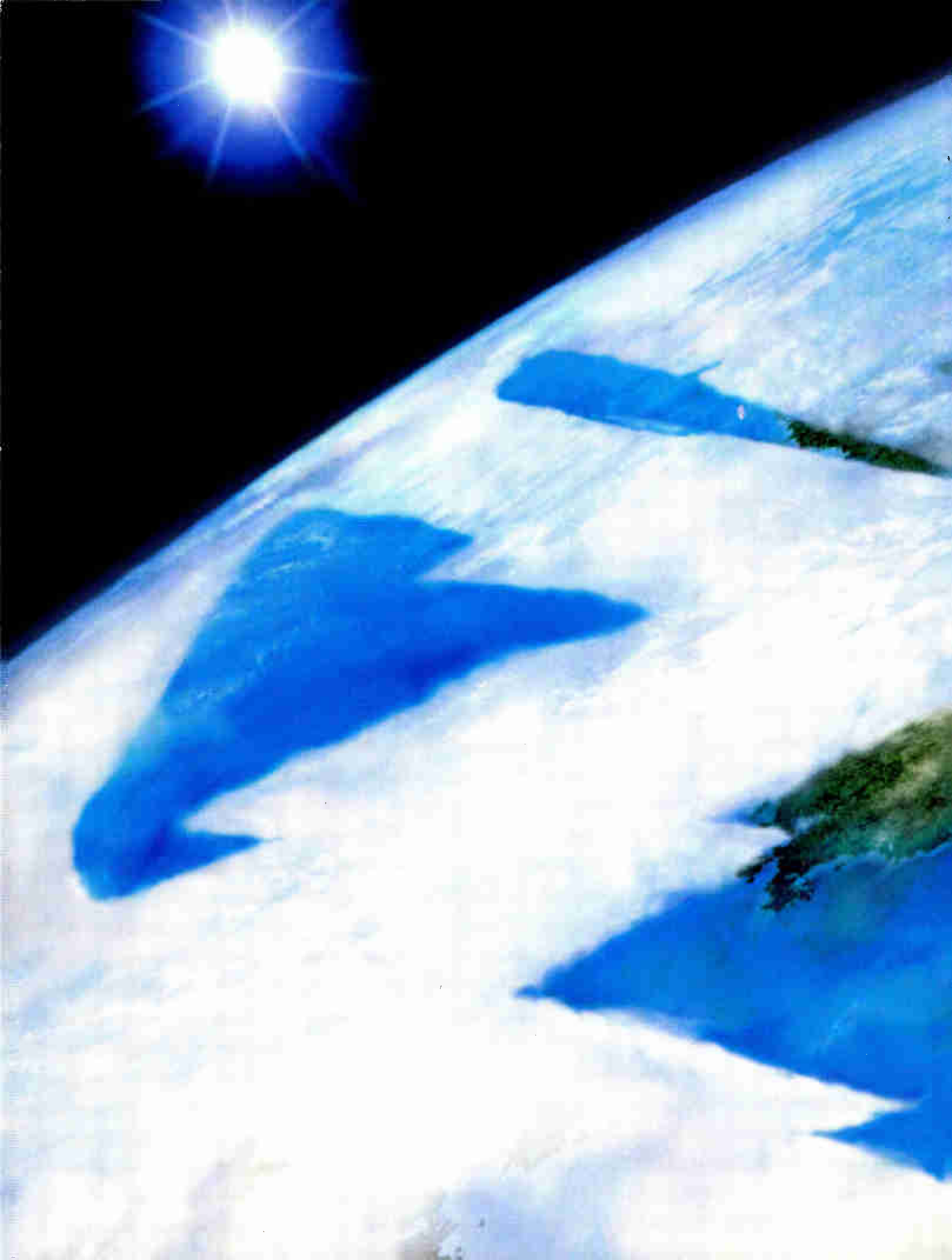

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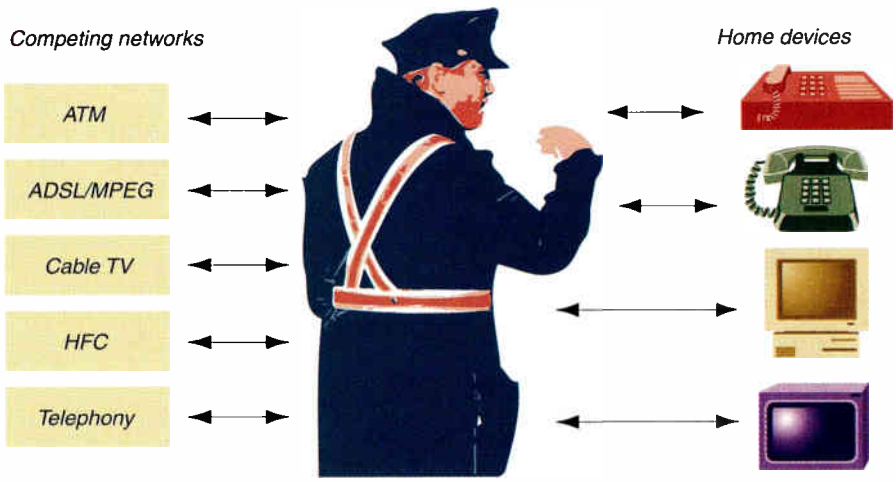
Figure 1: The residential gateway as a traffic cop



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networks. In addition, there will be (not all necessarily at the same place and same time–although that coincidence is not precluded) DBS networks, hybrid fiber/coax networks, fiber-to-the-home networks, ADSL networks, ATM networks, switched digital video networks, PCS networks and probably others. Not only are these competing networks, they are incompatible at various levels of the OSI model (i.e., they are incompatible in more than their basic physical interface characteristics).

This incompatibility and the competition (among the networks in functions, price, availability, and in other areas) mean that ultimately residential customers will be faced with the prospect of dealing with a very complicated multi-node switching problem. These same customers have trouble programming a VCR (surveys indicate that up to 70 percent of the adults, in fact, can't program a VCR). It is inconceivable that they will be able to deal with this problem. If they cannot, there are only two options; either give up the stated model of the future (which is unrealistic because it is already beginning to be put in place), or devise a technology solution that will handle this function and hide the complexity from the consumer. The Residential Gateway is an answer to this dilemma. It inserts a control function between external networks and in-home networks and devices. The Residential Gateway serves a "traffic cop" function–controlling and routing traffic so as to allow maximum use of all facilities. See Figure 1 for a depiction of the Residential Gateway serving as a traffic cop for the home.

The idea of the Residential Gateway, then, is to hide all of this complexity from the consumer and perform the needed functions in the background, similar in concept to the devices now available to automatically program VCRs. The Residential Gateway provides an intelligent device capable of terminating all of the proposed networks bound for the home. It also is capable of terminating all of the in-home networks (twisted pair, coax, X-10, security, HVAC, data/LAN, audio, video, etc.), and provides for seamless (and painless) interconnections between inside and outside networks as well as providing a user-friendly control interface. Ultimately it allows the customer to operate his in-home devices over the network(s) of his choice, at the highest level of functionality, and without concern as to the switching and interface complexities involved.

The Residential Gateway achieves this by an adaptation of the classical PC design. A bus connects network interface units (NIUs) and customer premise interfaces (CPIs). NIUs are installed on a one-for-one basis to match the desired incoming networks. Thus, there are ATM, DBS, telephony, cable TV, etc. NIUs. The CPIs, likewise, are provided to match the devices providing the services desired in the home. Thus, there will be television, VCR, telephone, computer, etc. CPIs. See Figure 2 for a depiction of this arrangement.

All material is converted to digital to cross the Residential Gateway bus. On the home side the material is converted back to analog if necessary. Eventually all material coming into the Residential Gateway will be digital and will require no A/D conversion. The Residential Gateway therefore is thought of as a bridge device that will allow for a graceful move from today's networks and devices to tomorrow's.

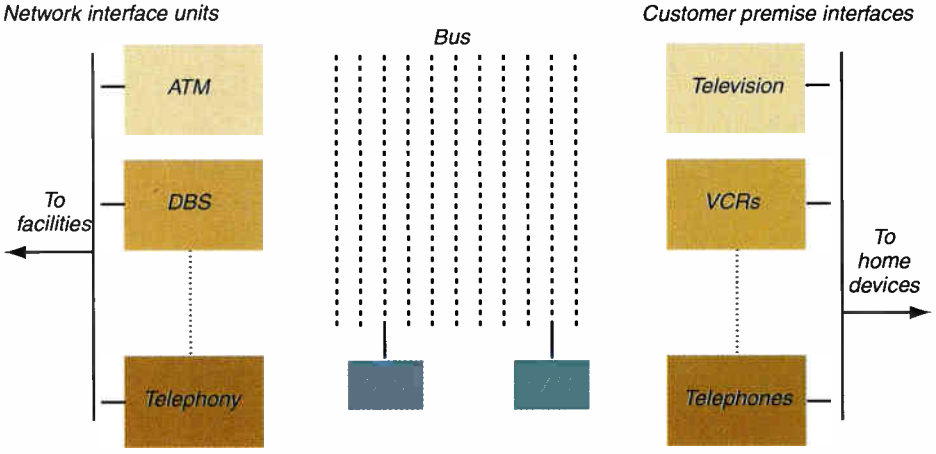
In today's world, the Residential Gateway is possibly an overkill (although some of the desirable multiple device capabilities would be difficult and expensive to achieve in currently available ways). However, in the evolving world of multiple networks (with multiple protocols) providing source material for these home devices, the Residential Gateway will be a necessity, not a convenience. It will hide the complexity of the multiple sources to multiple (and incompatible) sinks problem.

Other benefits

While the Residential Gateway concept is primarily aimed at filling needs for the consumer, it also meets the needs of network operators and device (consumer electronics) designers. The main concern for these latter two groups is in having a standardized interface point for their operations and for their design efforts. The Residential Gateway will greatly simplify the problem of network and CPE (customer premise equipment) device designers by the standardization of interfaces, while still leaving the opportunity for functional innovation for competitive differentiation.

The development of new services will no

Figure 2: Residential gateway system layout



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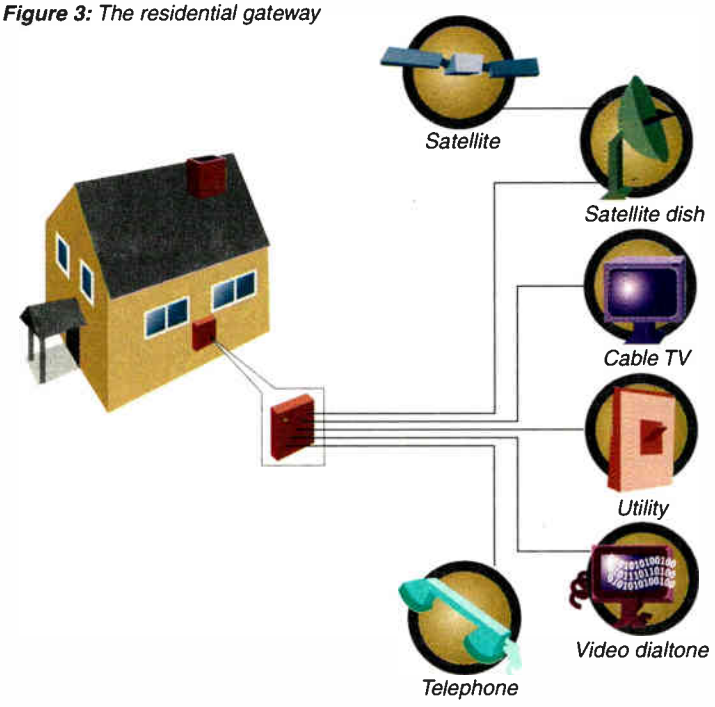
longer require that network and CPE developments take place at the same pace. New and innovative end customer services will be achieved by the design of new CPE, and where necessary, by the design of new CPIs (customer premise interfaces–the cards in the Residential Gateway looking toward the home). The addition of MPEG/ADSL, ATM, or other networks will be accommodated by simply adding a network card of the appropriate type. With the approach outlined, the full capability of those networks will be available to a wide variety of home devices with full flexibility.

As noted above, the Residential Gateway concept will provide advantages to customers, network operators and designers. The following is a listing of the more important advantages this concept will provide to each of these groups.

Figure 3: The residential gateway



Customers would gain both equipment and service advantages, including:

✔ Reduces set-top requirements. Most American households have more than three TV's. The RG approach is more cost-effective than an expensive TV set-top box, and provides for the future requirements of interactivity. The trend among television and PC manufacturers is to move the digital decompression (MPEG) technology into the device. The RG represents an opportunity to centralize–and cost reduce–the network interface.

✔ Makes changes (network or services) easy. The RG plug-and-play approach provides the consumer the ease of use he demands.

✔ Hides complexity and facilitates multiple networks. The average home user has a great deal of trouble dealing with currently available home electronics. The introduction of multiple, competing networks providing various services will exponentially raise the complexity level. Without a simplifying approach, this envisioned future will be a disaster.

✔ Added service options. If an approach that is truly user-friendly can be developed, then many more average consumers will be able to take advantage of the vast options that can be made available on these future networks.

Network providers would also benefit from the migratable nature of the Residential Gateway concept in the following ways:

✔ Meets analog and digital needs. A single, flexible, extensible intelligent interface is ideal to satisfy both short term "analog" needs, along with high bandwidth "digital" services, such as Internet access, HDTV and services yet to come. The RG approach provides this intelligent interface and has many inherent advantages.

✔ Standardizes home interfaces. There is a need for standardization of customer premise equipment (CPE) which allows the service provider to flexibly offer new digital application services. The RG approach provides a common core set of protocols in a one box design.

✔ Works with existing business models. Service providers easily can extend their current business model for the RG approach, and offer emerging technologies and services, such as access to the Internet.

✔ Enhances servicing activities. One service provider can perform all security and network diagnostics from the external network interface. The RG will be easier to service and maintain than currently proposed TV set-top approaches.

✔ Improves remote diagnostic capabilities. The RG approach enables remote software diagnostics and extensive network monitoring to be performed, resulting in substantial labor savings in field service calls.

For designers, the RG approach offers the following:

✔ Defines network interfaces. Currently, device designers generally know the type of network to which a given home device will be connected. For example, a VCR is going to be connected to a network that will provide NTSC signals (or line level video), even if it comes from a variety of physical sources. In the future, this VCR may need to be connected to an ADSL channel carrying some (MPEG-1, MPEG-2, etc.) compressed signal. The Residential Gateway will provide a standard interconnection for the VCR and will thus eliminate this problem.

✔ Defines home device interfaces. Network designers have the same problem. What will the home devices that will be on the business end of their networks look like? Without a standardized design, they must guess or provide multiple interfaces.

✔ De-couples network and end device development. Development of network technologies and home device and applications technologies are driven by different forces and are on very different timelines. The Residential Gateway concept will de-couple advances in one area or the other, thus reducing false obsolescence and increasing advancement opportunities.

In summary, deregulation and the telecommunications bill being re-written will have a dramatic impact on the U.S. consumer. On the one hand, consumers will see the benefits of technology developments quickly integrated into consumer products. On the other hand, consumers will have to pay for previously subsidized services, and bear the full costs of bringing this new technology into the home. This influx of rapidly advancing technology will bring great complexity to the home as well as unanticipated costs.

The consumer must be brought to the prime focus of any future network plans. To do so, a standardized interface must be developed for the home. This interface must simplify the control and operations to the consumer, while simultaneously allowing him to take advantage of the vastly expanding capabilities of the competing networks. It also must simplify the network operators' and the designers' jobs. The Residential Gateway, as proposed, will achieve these goals, while offering the opportunity to all concerned players to competitively pursue their business plans. CED

About the author

Clifford R. Holliday, P.E. is the owner of B& C Consulting Services. His background includes 30 years spent at GTE, where he was in charge of long-range network architecture. Holliday can be reached via e-mail at C.holliday@ieee.org.

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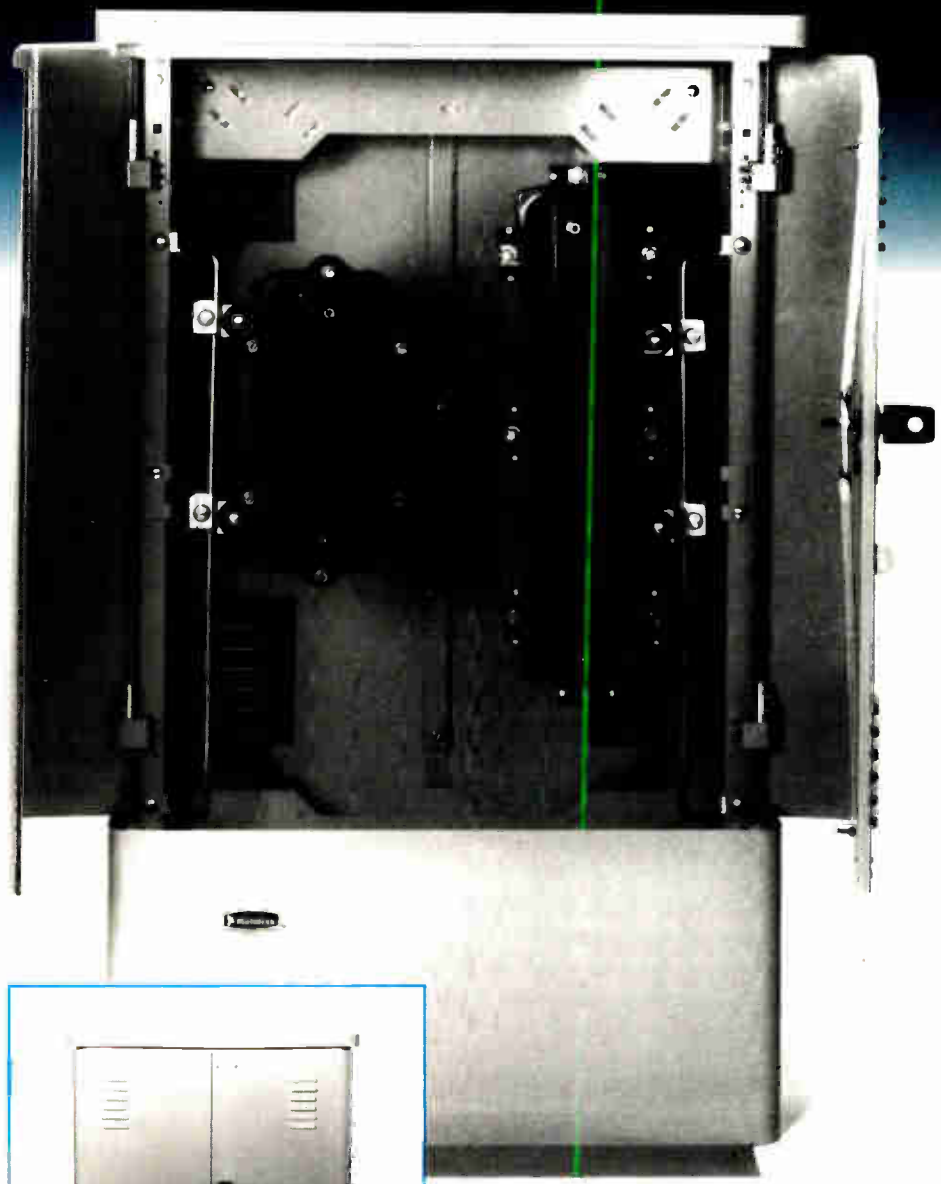

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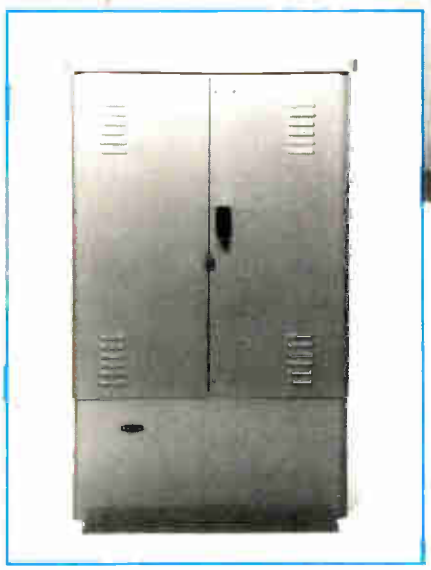

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Map-based field automation for broadband

Improving efficiency, customer service

By Kerry McFall

It's clear that map-based field automation–engineers and maintenance workers in the field using current, accurate, geo-referenced computer-based maps on handheld computers–isn't far off for everyone in this industry. The potential is exciting; the benefits are real, but operators have been through enough information system overhauls by now to know that this is another opportunity fraught with challenge.

Dumbauld & Associates recently cooperated with PenMetrics Inc., a leader in GIS/CAD field automation, to study the potential of the technology for its broadband fielding, node bounding and design activities. Using this study as a model may enable companies to:

✔ create a model to assess the true impact of field automation on operations throughout the company, not limited to just field activities;
✔ provide reliable, quantifiable predictions about cost savings;
✔ identify ways to improve worker efficiency;
✔ identify opportunities for improved customer service.

Step 1: Focus on target ops

Dumbauld & Associates performs subcontracted work pertaining to the collection of as-built plant information, the design of broadband networks and the drafting of this information for use by the customer. Some customers require as-built information only; others require design maps as well. Its primary customers are cable television services, although the new fiber optic network technology has increased contacts with the telecommunications industry.

The first step in conducting the study was to get a "close-up" of the target operations, which meant a thorough analysis of Dumbauld's current operations. The goals of this close-up were to:

✔ Determine when and how maps and geographically referenced data (data with map coordinates such as latitude and longitude or state plane X and Y) were, or could be, used during the process;
✔ Pinpoint every spot on the flowchart where map information had an impact on information used by other departments or individuals within D&A's organization or within customer organizations.

The study created a process model for each aspect of its operations. Briefly, there are three key activity centers at Dumbauld & Associates (D&A): fielding, drafting, and design. These support D&A's two main functions: as-built mapping and broadband design.

Figure 1 provides an overview of this process. The scope of the full study is beyond this article, but a detailed examination of the path of a work order through fielding, the initial phase of the mapping process, is enlightening.

The process begins with base mapping. The customer may be able to provide a base map, or D&A may be able to obtain a landbase from a municipality or other utility; occasionally, some validation of the landbase is done in the field. If no base map exists, the existing landbase must be digitized from paper or mylar media to AutoCAD.

Using the base map, fielding can involve address validation, strand mapping, make-ready mapping and as-built mapping. Much of the fielding work is as-built fielding, which involves noting existing plant conditions and locations in relation to the lot lines on the base map. Using a shape template, straightedge and other drawing tools, the footprints of the building are adjusted as needed, the proper symbols for the hardware are drawn in, and lines showing cable paths are placed on the map. All of these notes must be consistent across all fielders to enable the drafters to quickly and accurately create the as-built maps.

As-built fielding is subdivided into residential (R1) and multiple dwelling unit (MDU)

Exhibit 1: *Activity labor cost analysis*
Dumbauld & Associates

Cost pool	Activities	% of time	Dumbauld annual cost*	Cost driven by each activity	Relevant annual cost in each cost pool
Fielding	Receive area assignment	2.00%	$ 456,976	$ 9,140	
	Travel to work site	10.00%	456,976	45,698	
	Locate and note main connection	10.00%	456,976	45,698	
	Collect field information	60.00%	456,976	274,186	
	Prepare data entry sheet	10.00%	456,976	45,698	
	Prep field map for drafters	5.00%	456,976	22,849	
	Send info to data entry & drafting	3.00%	456,976	13,709	
					$ 456,976
Data entry	Receive data entry sheet	2.00%	20,280	406	
	Enter field information	95.00%	20,280	19,266	
	Transfer file to drafting	3.00%	20,280	608	
					$ 20,280
Drafting	Receive field map & entered data	2.00%	301,600	6,032	
	Place data and update map	50.00%	301,600	150,800	
	Quality check plot of map	45.00%	301,600	135,720	
	Send plot to appropriate next stage	3.00%	301,600	9,048	
					$ 301,600
Design	Receive drafted map	3.00%	268,320	8,050	
	Key punch map info into Lode Data	10.00%	268,320	26,832	
	Create design	45.00%	268,320	120,744	
	Update paper map	20.00%	268,320	53,664	
	Quality check design	20.00%	268,320	53,664	
	Return map to drafting	2.00%	268,320	5,366	
					$ 268,328
				Total activity labor cost	$ 1,047,176

* All annual costs include taxes and benefits where necessary.

Fielding annual costs consist of 13 fielders making $35,152 per year. Data entry costs consist of one person making $20,280 a year. Drafting annual costs are made up of 10 people earning $30,160. Design annual costs consist of six people earning $44,720.

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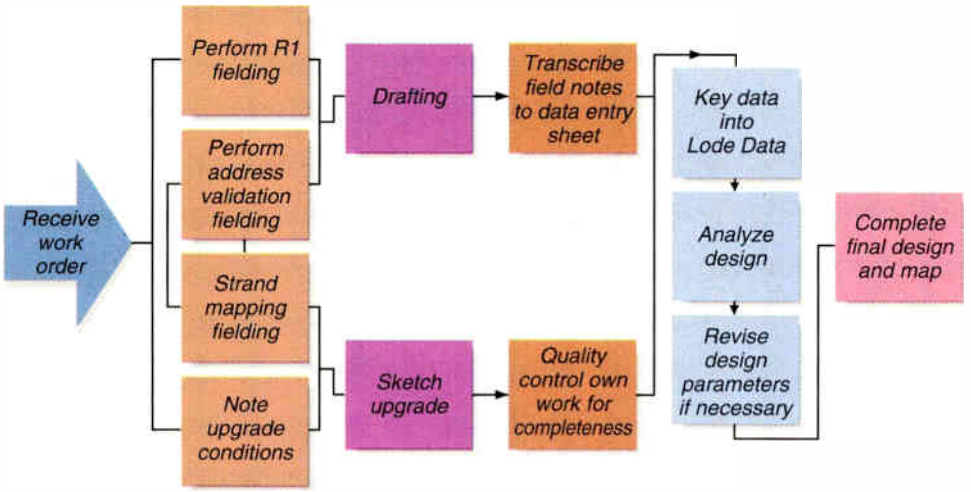
Figure 1: Fielding, design and base map generation process



fielding at D&A. R1 fielding takes place before MDU fielding–an R1 fielder works independently, measuring trench footages, estimating drop footages, recording house counts, recording device descriptions and noting discrepancies (areas where the equipment is damaged or the system is not up to current specs and needs to be repaired). An R1 fielder covers a lot of ground, but the information is quite repetitive. Generally, there are 200-plus locations on a map, and this can be done in two or three days. They also note any MDUs, and those areas are highlighted pink if they need to be assigned to an MDU fielder, and green if they do not require fielding. The R1 fielder often validates addresses, as well. As the R1 fielder completes an area, he or she notes the conditions on a base map, and gives each location a unique, sequential location number, specific to the map. These numbers may be specified as decimals ("dot locations") to capture the important connectivity path from point to point; each decimal number identifies a particular type of connectivity.

Upon returning to the office, the R1 fielder transcribes the field notes to a data entry form.

The MDU fielding process is very similar. Occasionally, upgrade drawings are also required, which show what the building looks like at present, and what it will look like with the new equipment attached to it.

The information from the data entry forms is entered via keyboard into a database, which, along with an AutoCAD extension, provides symbols for the drafter to place on the as-built map. This data entry populates a database with location numbers, footages, house counts, devices, discrepancies and other information. This information is grouped by location number in the system, and approximately 100 locations can be entered in an hour. This data entry process also generates a report showing all of the discrepancies, which is sent to the customer.

The potential for introduction of errors is high throughout this model: some information is invariably overlooked in the field, other information may be missed as the fielder transcribes from the maps to the data entry form; and errors also occur when data is entered from the data entry form into the computer. Often, errors are not discovered until after the drafter begins drafting the map. Meanwhile, the clock ticks on, and the original fielding data has gotten "cold." The fielder is less likely to remember specific attributes that may come into question, and subsequent field visits may be required.

Once entered into the database, records are processed into a manageable space-separated ASCII file, and the AutoCAD drafter can then import the proper symbol by simply referring to the paper map and typing in the unique location number. Once the symbols are placed, and the map is cleaned and annotated, it is checked for completeness. Omissions of location numbers and footages are discovered and must be added before the draft is complete. This as-built map may be either the final product or an intermediate product to design.

Step 2: The big picture

PenMetrics' president Sam Lanahan emphasizes, "Every map-based field automation application is unique. We've seen that most applications are really a collection of small 'applets,' mini-applications that touch many people, departments and other applications throughout a corporate structure. In order to understand the full impact of field automation, you need to have the big picture." The Dumbauld & Associates study was no exception. Because of the interrelationships highlighted by the close-up examination of broadband operations, it was necessary to "step back" and re-focus on the big picture, the corporate vision. Anticipation of demands relating to the bidding, speed, accuracy, volume and format of the information which Dumbauld provides to its customers drives its interest in map-based field automation technology. Continually, the amount of information required by the customer increases, and D&A feels that database records in and of themselves will eventually become important to their customers. As competition in this field grows, competitive bidding will be essential, driving the use of map-based field automation to compile historical information on time, costs, etc. to support bidding decisions.

A pen computer application was suggested to include validation and verification

Step 3: Identify re-engineering opps

The study uncovered re-engineering opportunities for map-based field automation which touch many people and departments within Dumbauld & Associates. Based on the perspectives gained from the close-up analysis of the broadband operations and the big picture of the corporate vision and objectives, the study recommended automating all aspects of the fielding activities–i.e., putting accurate computer-based maps in the hands of the field-

FieldNotes represents a typical software package used in field automation.

ers for "front line" entry of field data. This would enable the digital collection of field data, and bypass the transcription to data entry forms and hand-drawing steps in the current method.

To assure the return of a completed engineering drawing from the field, a pen computer application was suggested to include validation (forcing the data to be in the correct location, layer and format) and verification (cross-checking for consistency and completeness). This combination would generate accurate

Exhibit 2: *Labor cost analysis*
Dumbauld & Associates

Estimated effect of field automation

		Possible				Conservative			
Cost pool	**Activities**	% change	% of time	Cost driven by each element	Adjusted relevant cost of each element	% change	% of time	Cost driven by each activity	Adjusted relevant cost of each activity
Fielding	Receive area assignment	0.00%	2.00%	$9,140		0.00%	2.00%	$9,140	
	Travel to work site	0.00%	10.00%	$45,698		0.00%	10.00%	$45,698	
	Locate and note main connection	-5.00%	9.50%	$43,413		0.00%	10.00%	$45,698	
	Collect field information	-5.00%	57.00%	$260,476		0.00%	60.00%	$274,186	
	Prepare data entry sheet	-100.00%	0.00%	$0		-100.00%	0.00%	$0	
	Prep field map for drafters	-100.00%	0.00%	$0		-100.00%	0.00%	$0	
	Send info to data entry & drafting	0.00%	3.00%	$13,709		0.00%	3.00%	$13,709	
		Total dollar change: ($84,541)			$372,435	$ change: ($68,546)			$388,430
Data entry	Receive data entry sheet	-100.00%	0.00%	$0		-100.00%	0.00%	$0	
	Enter field formation	-100.00%	0.00%	$0		-100.00%	0.00%	$0	
	Transfer file to drafting	-100.00%	0.00%	$0		-100.00%	0.00%	$0	
		Total dollar change: ($20,280)			$0	$ change: ($20,280)			$0
Drafting	Receive field map & entered data	0.00%	2.00%	$6,032		0.00%	2.00%	$6,032	
	Place data and update map	-50.00%	25.00%	$75,400		-25.00%	37.50%	$113,100	
	Qualify check plot of map	-44.44%	25.00%	$75,400		-22.22%	35.00%	$105,560	
	Send plot to appropriate next stage	0.00%	3.00%	$9,048		0.00%	3.00%	$9,048	
		Total dollar change: ($135,720)			$165,880	$ change: ($67,660)			$233,740
Design	Receive drafted map	0.00%	3.00%	$8,050		0.00%	3.00%	$8,050	
	Key punch map info to Lode Data	-100.00%	0.00%	$0		-75.00%	2.50%	$6,708	
	Create design	0.00%	45.00%	$120,744		0.00%	45.00%	$120,744	
	Update paper map	-100.00%	0.00%	$0		-50.00%	10.00%	$26,832	
	Quality check design	-20.00%	16.00%	$42,931		-10.00%	18.00%	$48,298	
	Return map to drafting	0.00%	2.00%	$5,366		0.00%	2.00%	$5,366	
		Total dollar change: ($91,229)			$177,091	$ change: ($52,322)			$215,998
				Adjusted total relevant cost	$715,407			Adjusted total relevant cost	$838,167
				Current total relevant cost	$1,047,176			Current total relevant cost	$1,047,176
				Annual cost savings	**$331,769**			**Cost savings**	**$209,009**

** All annual costs include taxes and benefits where necessary.*

Fielding annual costs consist of 13 fielders making $35,152 per year. Data entry costs consist of one person making $20,280 a year. Drafting annual costs are made up of 10 people earning $30,160. Design annual costs consist of six people earning $44,720

map layers for use throughout the company. These specific opportunities for the fielding functions were also identified:

✔ Collection and modification of information in the field would eliminate the need to draft paper work prints or re-draft changes, freeing the drafting employees for reallocation.

✔ Reallocate the resources used for data entry of the field information.

Step 4: The bottom line

The activity-based costing method used to conclude this study is described and illustrated on page 76. It shows the real savings to be made through the implementation of map-based field automation technology; these savings are easily measured, and the method is as objective as possible.

What is less readily apparent are the derivative benefits of the technology, the true value of current and accurate information, not as easily measured but having just as great an impact on the bottom line. For example, this study did not calculate the impact for D&A of decreasing the time elapsed between issuing the original work order and providing the customer with completed maps.

Activity-based costing estimates relevant costs. Relevant costs are those that are different among alternative courses of action. In this case the alternative course of action is the implementation of map-based field automation technology. The vast majority of relevant costs consist of labor expenses; labor time requirements are directly affected by field automation, where the expense of, for example, driving a truck to the work site is not affected. Overhead expenses will obviously change,

An employee of Dumbauld & Associates searches for buried cable.

and may even be reduced, but no conclusions were made in this area.

Labor cost analysis was done for those processes judged to be most affected by field automation, shown in Exhibit 2. Extensive interviews were conducted with D&A personnel, and individuals assigned to the relevant processes were asked to estimate the time spent on each major activity. This time estimate was then multiplied by the annual cost for each main process, or cost pool (i.e. trimming supervision), to arrive at the cost driven by each activity. The annual cost was derived using D&A job title and salary records. For example, a "fully loaded" salary for the people involved provides the basis for

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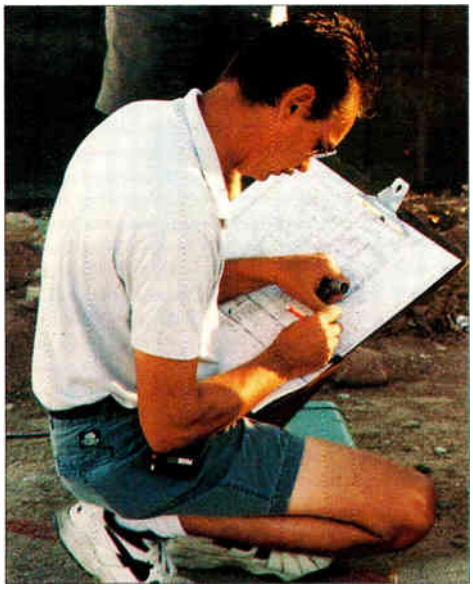

At present, cable company employees conduct manual updates to maps.

the annual cost of each cost pool. The annual costs for the fielding cost pool is based on 13 fielders, each costing $35,152 per year. These numbers are then summed to find the total activity labor costs associated with the current processes.

Two estimates of the effects of field automation are made in Table 1, possible and conservative. The possible percentage of time estimates was determined through discussion with PenMetrics Inc. field automation application designers; conservative estimates are based on the same logic as the possible estimates, but represent a "worst-case" scenario. Considerable restraint was used in this conservative estimate as PenMetrics Inc.'s experience shows that the obstacles to a fully automated work force are generally underestimated. The percentage of change column shows the direction and amount of the change in the percentage of time estimates from the activities as they currently stand to the activities as affected by field automation.

This study did not address an implementation plan for the re-engineering opportunities, but Lanahan offers this advice: "For a complex, interrelated system of 'app-lets' such as that of Dumbauld & Associates, there is no magic, off-the-shelf monolithic package. Look for a package with a strong development foundation which incorporates a rich set of tools that will allow you to customize as you go. Build the system around your business model, not vice-versa." CED

Table 1: Results of implementing field study recommendations

	Possible	Conservative
Annual savings:	$330,000	$210,000
Currently measurable savings over a 3-year period:	$990,000	$630,000

Source: Dumbauld & Associates

Acknowledgements

Pam Schreiner and Robb Wiltbank performed the Dumbauld & Associates study for PenMetrics Inc. as part of an industry survey of current field practices and use of technology. This article was condensed from their study by Kerry McFall, a technical writer specializing in GIS and map-based field automation. For a complete copy of the study, contact PenMetrics Inc., in Corvallis, Ore.

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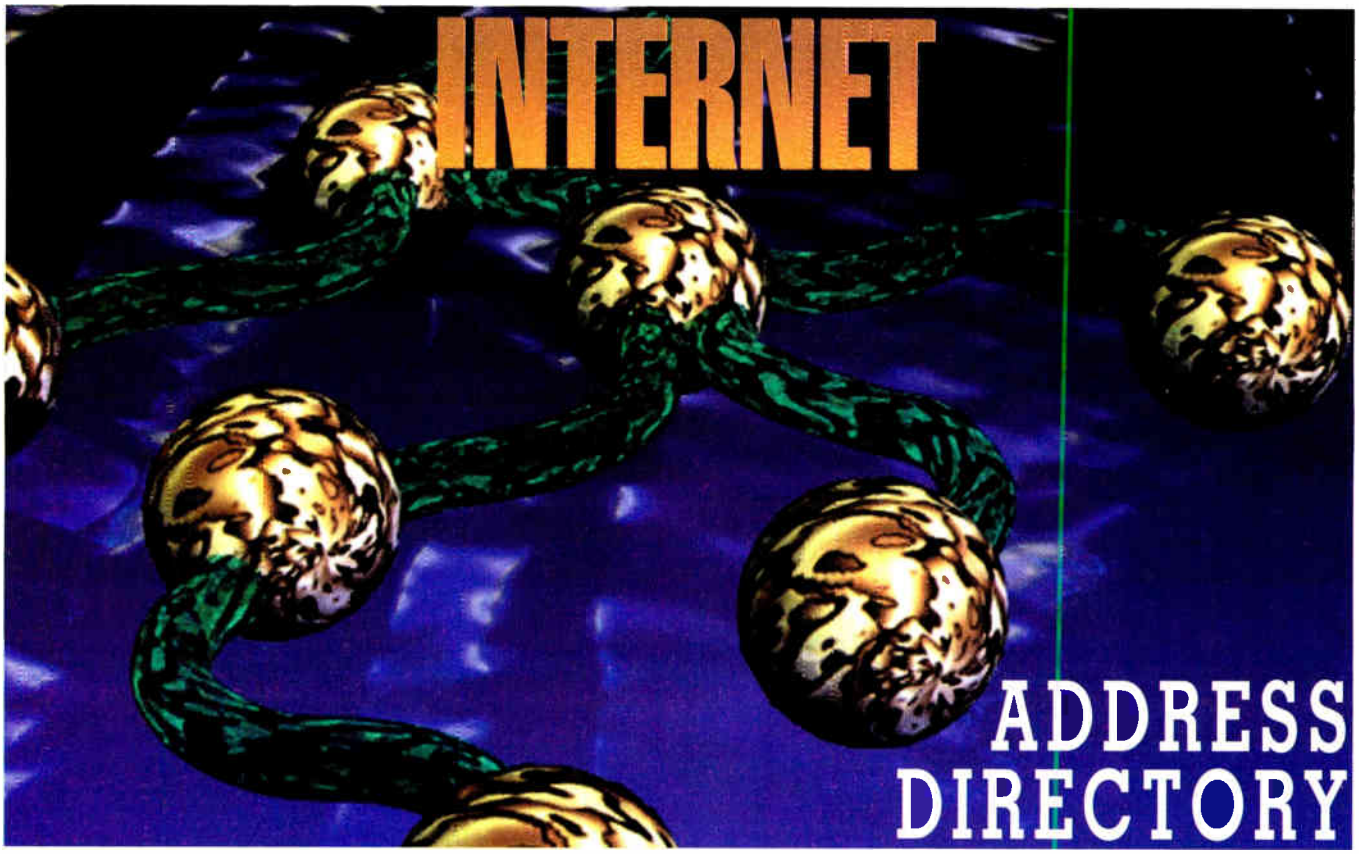

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Cost-effectively delivering broadband access

It requires a "software" touch

By Marty Glapa, Architecture Planning Director, Lucent Technologies

With Internet growth projections approaching 20 million subscribers, on-line service providers growing at 50 percent per year and the increasing demand for advanced work-at-home solutions, it's not surprising that access providers are turning their attention to how they can best provide subscriber access. Many are looking at ways to improve on current access with high-speed transport over broadband by deploying high bandwidth, hybrid fiber/coax (HFC) networks. While this is a significant first step toward realizing the promise of new data capabilities, there's still more work to be done.

Until now, the communications industry has largely been focused on the hardware issues surrounding broadband access. While this is of utmost importance, the software that will run these networks is no less critical. This is especially true given that an access provider's broadband data infrastructure will be required to carry a wide variety of applications and services that interface with multiple customer premise devices. And, these systems will not only need to be interoperable from a physical level, but from an operational level, as well.

Subscriber demand for interactive applications will drive the deployment of broadband data networks. The asymmetrical client-server architecture of the HFC network is a significant breakthrough that will facilitate applications deployment, broadband data deployment and the provision of data separately based on the ability of the access provider's networks (Figure 1). Splitting the upstream/downstream path helps to avoid the collisions of data common to Ethernet LANs and gives the access provider the freedom to cost-effectively scale the network in modules as demand warrants. An asymmetric type of offering is also appropriate for residential subscribers who are receiving more information than they are sending.

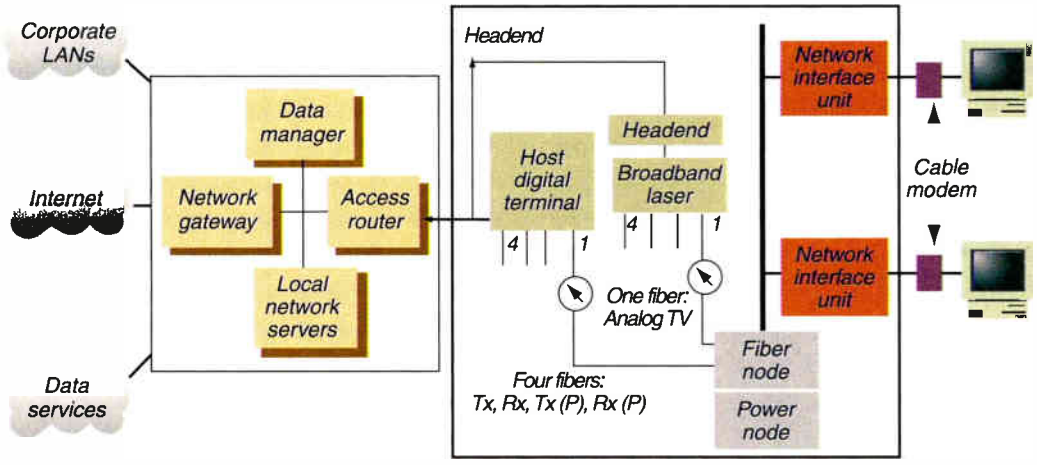
The cable modem portion of the broadband access solution, which allows access to a multiplicity of personal computers (PCs), are external devices equipped with an Ethernet connection. The reason for this is that PCs, as well as other work stations, must be able to communicate with an external modem through the assigned Medium Access Control (MAC) layer or Internet Protocol (IP) addresses. Also, by making cable modems an external device initially, PCs can be installed using standard Ethernet adapters–eliminating the need for access providers to physically make a service call to a subscriber's PC to initiate service. Future versions will integrate modem and Ethernet functionality into internal plug-in cards.

Because the HFC platform is flexible enough to support multiple access architectures, only the connection between the subscriber and the headend changes. As access providers are evaluating and deploying various access solutions to meet the subscriber's specific needs, they are assured that it can be easily worked into this overall broadband data solution.

Signals on the cable plant must next be converted so that they can interface to the data network. This conversion, part of the access router functions, occurs between radio frequency (RF) signals in an HFC architecture and IP packets which are switched through the data network. The data manager works with the access router to manage bandwidth and spectrum, provide a logical routing function to ensure that subscribers are routed to proper network gateways, collect data on subscribers and monitor network performance.

The switch is used to communicate and route the packets from multiple access routers to the network gateways. Local Area Network (LAN) interfaces and Wide Area Network (WAN) interfaces are used to provide connectivity between the switch and access routers, and the switch and the data network. For example, if a subscriber wants to access the Internet at a certain speed, he might be routed via a T-1 span. On the other hand, if another subscriber has a higher demand for accessing information applications, he would utilize the network gateway via a high-speed OC-3 (or Sonet connection) into a WAN ATM connection. The third network gateway connection (shown in Figure 1) could serve as an alternate access mechanism for different on-line applications.

Figure 1: *PC broadband data solutions for HFC*



Putting software on the line

Taking the broadband data solution to the next level, there will be the need to manage these multiple elements. A centralized monitoring and control facility is necessary if the access provider is to monitor the health of its entire network, as well as gain access to information on usage statistics, error rates, blocking statistics and alarms.

Client-server software no doubt will play an increasingly important role in minimizing start-up costs of broadband access networks. This will be especially true if a wide array of com-

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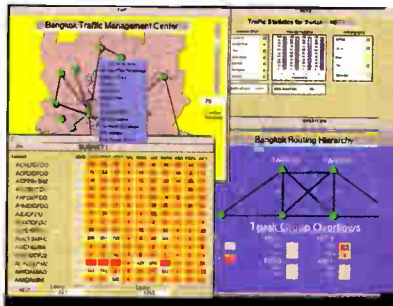

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pelling applications and content are to be provided while, at the same time, minimizing the cost of subscriber devices during initial roll-outs.

A subscriber device, for example, should be able to handle multiple applications. At the same time, applications software should be able to run on a variety of different subscriber devices without the need for software changes. Additionally, services that are transparent to subscribers–and are used as shared resources by client applications–should be able to be partitioned dynamically between subscriber devices (usually the clients in the client-server model) and servers.

The number of devices new applications will run on initially is expected to be limited (i.e., only cable modems and PCs). Over time, however, that base of customer devices must evolve to handle numerous software applications. For the access provider to minimize subscriber costs, it will need to incorporate an efficient, highly optimized software platform. Client-server software will be pivotal in distributing application intelligence between devices.

The author's company, for example, is working on a new client-server "software suite" designed to deliver highly interactive applications. This software suite will be machine independent "middleware" that rides on top of device hardware and hardware drivers. Software modules in this layer would provide the application programming interfaces (API) and the programming environment for developers to create interactive applications.

The most unique attribute of this client-server software suite will be its ability to support a wide range of subscriber devices from simple and inexpensive (i.e., minimal memory, processing and graphics power requirements) to complex devices. Through run-time configuration, the self-adapting software suite will self-configure. The device's capabilities are first assessed, then software modules to support those capabilities are loaded. This facilitates application portability between different devices. The application's subscriber interface will be presented based on the device's capabilities. For example, an application running on a low-end inexpensive device may be presented as textual, while the same application running on a higher-end device may be presented as combined text and graphics.

And, because memory requirements to present applications to the end-user will be minimal, application developers will be free to develop applications without concern for the type of customer devices and intelligence used by their subscribers. The benefit of developing an application only once, regardless of the variety of subscriber devices, will allow providers and developers to reduce overall initial development costs and on-going software maintenance costs.

Typical broadband access business models

By now it's evident there are certain applications (shopping, electronic mail, file transfer, bulletin boards, etc.) that subscribers will want access to. It's also clear that there are multiple ways in which subscribers can gain access to these applications. Therefore, the access provider must first decide what level of broadband access service it wants to offer.

For example, will the provider be in the business of just providing access, or will it want to compete with content and application providers? The ideal model will depend upon a number of factors, including size of the access provider, subscriber demographics, competition and agreements with on-line application, service and content providers.

Three data access business models currently under consideration by access providers include:

✔ Access provider (high bandwidth access over HFC). This model simply provides subscriber connectivity to on-line application providers through the access provider's network.

✔ Value-added access provider (high bandwidth access to on-line providers with some value-added functions). This model can include gateway access to multiple on-line application providers, billing, network management/monitoring and similar types of functions. Network-based services used by applications as opposed to subscribers, such as naming services, could also be provided. In this scenario, the value-added provider might partner with content or application providers and offer these value-added services.

✔ On-line provider (access to local on-line application and service providers as well as access to the Internet). In this model the on-line provider could also provide local services primarily of interest to the community.

Regardless of which business model is chosen, client-server software will play a pivotal role in the provision of cost-effective and compelling solutions.

–MG

Another challenging–and critical–software issue tied to the successful deployment of broadband access systems is a comprehensive, low-cost scalable Telecommunications Management Network (TMN) compliant network and operations management system. The TMN architecture provides for abstraction of applications from the element management level up through the TMN network management and service management layers. This type of architecture defines operations building blocks which enhance provider flexibility. For example, an application abstraction frees business support systems from knowing the details of an implementation in a specific vendor's network elements. As another example, this flexibility enables a billing system vendor to focus on the breadth of applications and real-time billing needs, both essential to success in a competitive environment.

The pursuit of a common architecture and set of protocols will afford access providers maximum flexibility in selecting a broadband data system. Common protocols will allow operators to mix and match cable modems and network elements from different vendors on the same broadband network. From an economic standpoint, a common protocol will rapidly lower component costs for operators planning to launch services in 1996. Additionally, the push toward open specifications offers all access providers the investment protection they need to upgrade to future generation products.

The issue of security must be addressed, as well. Due to the short-comings of present Internet security measures, multiple forms of security will be required to ensure subscribers are guaranteed secure access, as well as for the secure exchange of information. Forms of security for data are expected to include Internet firewalls, link encryption and user authentication.

Going forward, certain requirements for interoperability also must be established–sooner than later. For example, the industry is working to:

✔ *Specify the interface between modem and subscriber appliance*–the modem can be internal to the appliance or external to the appliance.

✔ *Specify operational interfaces*–to ensure common network management operations across multiple vendor products. Interoperable physical interfaces by themselves do not ensure interoperable logical and operational interfaces. Interoperable interfaces for functions such as billing, provisioning, monitoring/ surveillance, performance, etc. will allow an access provider to put the same operational and procedural processes in place regardless of the vendor.

✔ *Specify medium access control (MAC)/physical layer interfaces*–defined as the interface between the modem and the signal conversion equipment in the point-of-presence, it must be agreed to and built by multiple vendors. For HFC systems, this includes the RF interface (such as 64 QAM downstream, QPSK upstream, etc.), frequency assignments, multiplexing and contention control techniques.

Lucent Technologies, Hewlett-Packard Company, Hybrid Networks, Inc. and Intel Corporation have already begun working to develop and promote an open specification for interoperable products delivering high-speed data via broadband networks. The companies, dubbed the "broadband link team," are encouraging other vendors to join in their effort to minimize fragmentation of the marketplace while deploying products and services quickly. Their proposal will be worked with a number of other interface specification activities, including Multimedia Cable Network Systems Partners Ltd. (MCNS) to ensure consistency and interoperability between vendors. CED

The sue me, sue you blues

The new anthem of telecom deregulation?

By Michael Lafferty

If you listen closely, you may hear a melodic, barely audible refrain wafting through the turbulent airspace surrounding the telecommunications industry these days. It's got a good beat, and it seems a lot of people are dancing to it.

While legal wrangling has never been a stranger to the broadband communications industry, the recently deregulated environment seems to have raised the adversarial pitch, if not the actual number, of telecommunications-related cases bouncing around the courts.

Boardroom bosa nova

Clearly, one of the most watched and widely-reported legal clashes in the industry has been the recently concluded hearings regarding the suit and countersuit between US West Inc. and Time Warner Inc. The warring partners are sparring over US West's objections to Time Warner's $7.5 billion acquisition of Turner Broadcasting Inc., and Time Warner's assertion that its RBOC roommate put the kibosh on some potentially profitable telephone deals and an @Home Internet venture.

This unique clash between two of the industry's biggest players has garnered the lion's share of attention from court watchers both inside and outside the industry. The stakes are high, and the impact of the Delaware court's ruling, expected this spring, could be far-reaching. No matter what the outcome, and legal eagles say it's too close to call, the luster of both corporate images has been dulled considerably under the harsh courtroom lights and the stark, often conflicting testimony of leading executives from both boardrooms.

The enactment of the Telecommunications Act itself will have boardrooms all over the country brushing up on their legal briefs. Mike Schooler, former NCTA legal counsel, notes that the act has already raised some constitutional red flags in regard to indecency and the implementation of the so-called V-chip technology. And that, says Schooler, is just the beginning.

"Anytime there is a new piece of legislation or regulation put in place," explains Schooler, "there is a need for the process to work itself out in order to find out what the statutes and the regulations mean. On the telecommunications side, where there's a whole new set of rules and requirements in place with respect to their interconnection requirements and resale and access requirements, there's sure to be disputes from day one as to whether the implementation of those requirements by particular carriers meets the standards of the act or Commission (FCC)."

In other words, standby for action in the courts and hallways of the FCC.

Meanwhile, closer to home...

While the titans of telecommunications and the various industry interest groups slug it out on partnerships and await rulings from on high (i.e., Washington, D.C.), there's lots of legal activity going on closer to the home front that could have a potential impact on industry professionals.

Before the United States reaches telecommunications nirvana, where all the scattered communications technologies of today converge in the distant future, it's obvious more than silicon and software are going to have to come together to make it a reality. Technological convergence depends heavily on the cross-pollination of personnel as well.

Cable operators need telephone and computer people. Telcos need broadband techni-

cians and marketers. Internet propeller heads need marketers, content providers and broadband communicators. And, vendors trying to anticipate and supply the various converging industries need them all.

The tip of this legal iceberg floated into view recently when a Texas jury awarded DSC Communications Corp. a $369.2 million judgment against Next Level Communications Corp. (NLC), a wholly owned subsidiary of General Instrument Corp. The jury found that NLC's co-founders, Messrs. Eames and Keeler, who were former DSC employees, had violated various provisions of their employment agreements, and misappropriated a DSC corporate opportunity and DSC's trade secrets, among other things.

Of course, DSC officials hailed the decision, and NLC and GI officials panned it and vowed to fight it all the way to who-knows-where. This particular case will eventually be resolved. But in the overall scheme of things, with personnel moving helter skelter over the HFC landscape, this case may portend a vast legal quagmire looming ahead.

"What seems to be happening," says Michael Wein, principal of Media Management Resources, a Denver-based executive search firm specializing in telecommunications industries, "is that there is so much development taking place in so many different places for the same framework of need, that a great deal of what is being developed is being developed commonly in a lot of different places, particularly on the software side. And because it's being asked to do the same things, it's going to end up looking very similar. And I think the issues relevant to the ownership of that technology are going to become far more complex and far more difficult."

Wein thinks that because telecommunications has essentially crossed over from a hardware-based to a software-based industry, the legal complexities get even worse. "You're talking about lay persons at the court level," he says. "They're not technocrats. I really think it's an issue of interpretation that's going to become far more difficult."

He also points out the problem companies face now is how do they protect themselves, whether they've just lost a key person or just hired one. "For example," explains Wein, "a guy goes from Bellcore to CableLabs to Sharp Electronics Laboratory. He's (now) knowledgeable about three separate types of businesses that could have some overlapping interests. He's going to carry that knowledge forward. He's going to do everything he can *not* to use it, but it may get used in one form or another. How does one protect oneself from that type of situation?"

You're in, you're out

The telecommunications industry is certainly no island. The rate of corporate takeovers, mergers and buyouts at least mirrors, if not outpaces, the general economy. That means staff changes, voluntary and not-so-voluntary.

Mark Blunda, an attorney with the New Jersey law firm of Sills Cummis Zuckerman Radin Tischman Epstein & Gross P.A., is currently representing Frank DeJoy, former vice president and general manager of Suburban Cablevision, in a federal employment discrimination suit against Comcast Corporation of Philadelphia. The unresolved suit alleges violations of federal age and disability laws by Comcast when DeJoy was removed from his position in December 1994 when Comcast took over the cable system.

"Other than the sexual harassment cases," says Blunda, "which have become the newest lawsuit in terms of employment law, I think clearly age discrimination suits emanating from downsizing, reorganizations, mergers and acquisitions are the largest percentage of employment cases out there now.

"A new company," he explains, "thinking they want to take some new direction with new personnel, often have people in a protected age category who wind up being the incumbents. Far too often, the people who replace them are much younger and often (hired) at much lower salary."

Blunda notes the law in this area is "pretty clear and pretty well established." But the cases are very complex, especially in merger and acquisition cases where "there are literally reams and reams of documents" that may relate to a particular case.

However, Blunda says there may be an "upside" for plaintiffs who have qualms about taking on huge corporations in such lawsuits. "I guess the upside for plaintiff's council is that if you prevail, you get your attorney's fees and costs. And in fact, the court cases say they can and will, if it's been a very difficult case, increase the award over what the normal hourly rate would be. So, there's a pretty significant lawyer's bar out there that will take these cases against the biggest corporations in the world."

While the "Sue Me, Sue You Blues" may just be a jingle now, the fully orchestrated version may debut sooner than anyone thinks. CED

Making arcane R&D pay off in a big way

The "other" Cable Labs is doing just fine

By Roger Brown

What could have been nothing more than a gratuitous overture in exchange for more cable systems has actually blossomed into one of the cable industry's best-kept secrets, it seems. With five years of history and the wind at its back, the Canadian Cable Labs Fund is alive, growing and making a real contribution to the research efforts of the broadband industry. What is the Canadian Cable Labs Fund? In overall terms, not much, really. But to date, it's the only cable industry tie to the academic research world–and it's beginning to bear real fruit.

When it comes to research and development, the cable industry has never set the world on fire. In fact, the early entrepreneurs who started the industry typically eschewed formal research, preferring instead to test equipment and ideas through trial-and-error, often celebrating their successes or taking their punishments in the public limelight.

But as networks have become more complex and pressures to lower operating costs have grown, there's a new urgency to design and construct bulletproof networks as cheaply as possible. That's one reason why Cable Television Laboratories, based in Louisville, Colo., has been supported so strongly.

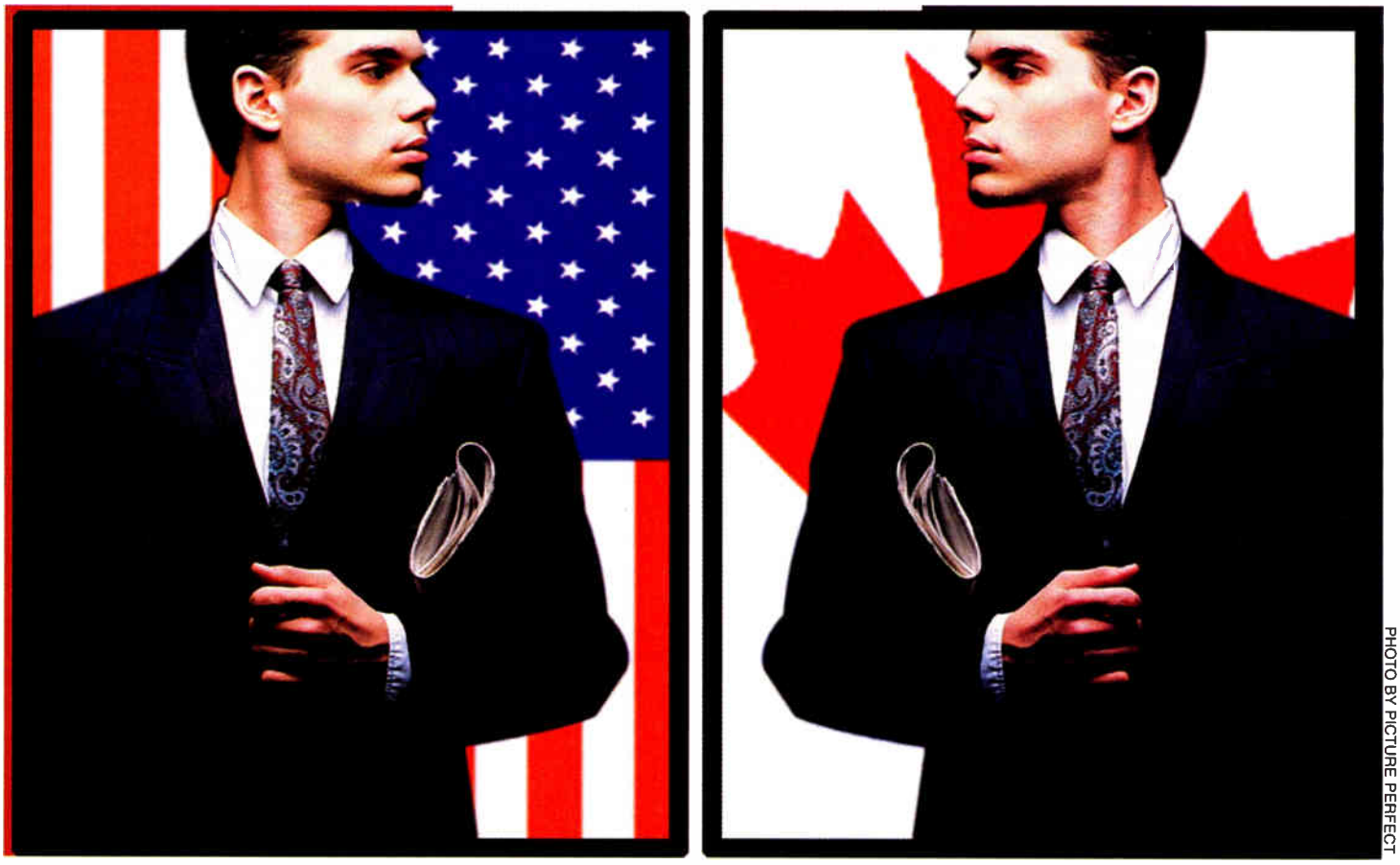
But while the U.S. CableLabs is focused on developing business models, examining competitive threats and transferring technology from the lab to the marketplace, the Canadian Cable Labs Fund was chartered to foster research into real science issues at the academic level.

Further, it could be responsible for bringing some very bright minds into the industry after they graduate from the colleges that have been supplied with grant money.

Humble beginnings

The Fund was created by Rogers Cablesystems President and CEO Ted Rogers back in 1990 as a quid pro quo for Rogers' acquisition of Western Cablevision, a British Columbian cable MSO. While the CRTC (the Canadian regulator roughly akin to the Federal Communications Commission) intended the Fund to provide a "significant public benefit" in exchange for Rogers' takeover, few would have dreamed of the success of the organization.

Since its humble beginnings (the Fund was launched with a $372,000 check to the University of Victoria), Rogers has pumped $3.5 million (Canadian) into the Fund, which



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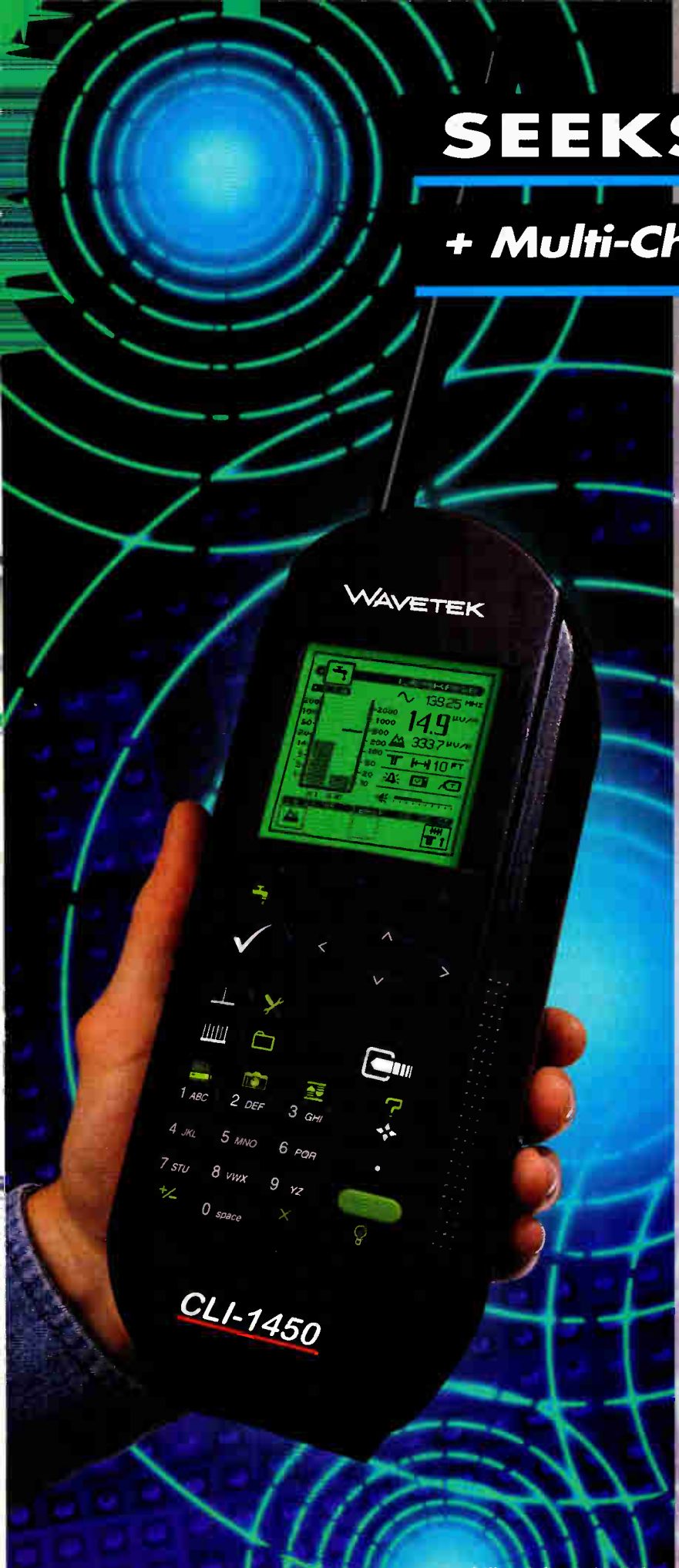

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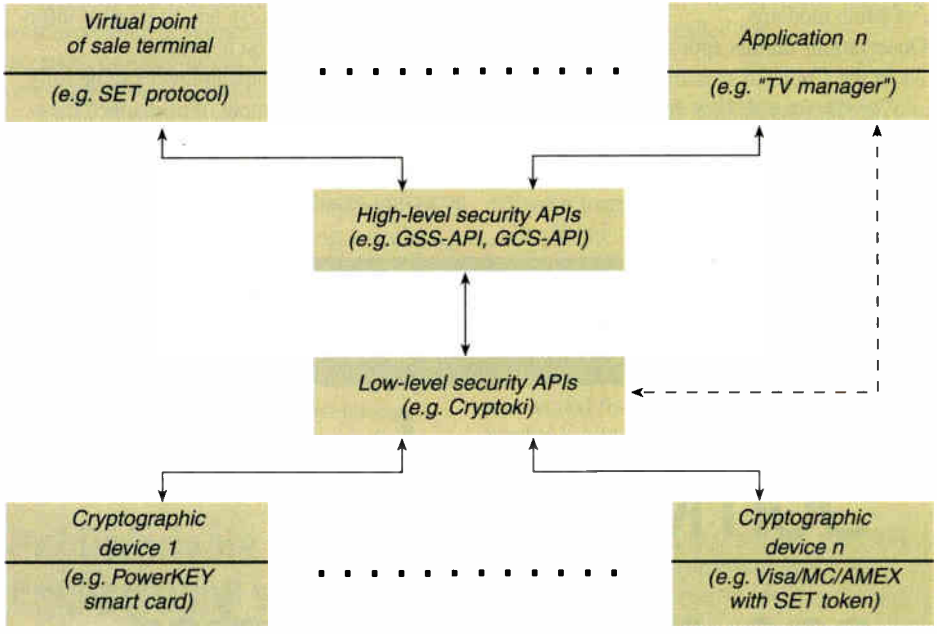
Figure 4: Crypto-services model for set-top terminal



New ways to address security issues

It may not be long before many cable operators face the security issues involved in the scenarios described above. New applications call for new security measures that are beyond the capabilities of conventional conditional access approaches.

Analog video signals are protected through scrambling. Only digital signals can be encrypted, which is a much stronger means of protection than analog scrambling. However, even in analog systems, digital cryptography can deliver benefits.

As a result of market realities, both digital and analog services will coexist for many years, so conditional access systems must support both in a seamless manner. Digital set-tops can contain an analog part, which will share advanced digital cryptography for messaging and entitlement control distribution. With hybrid set-tops, the control of what mode of scrambling is in use–such as video inversion or sync suppression–can be digitally encrypted. Therefore, messages authorizing analog signals to these hybrid boxes can benefit from sophisticated digital conditional access systems.

The attributes of a practical, effective conditional access system for modern broadband networks include:

✔ provides seamless integration of analog and digital services in either broadcast or interactive environments

✔ enables many classes of applications–including video and data access–from a common security approach

✔ combines appropriate elements of public and secret key methodologies (See sidebar, page 96.)

✔ provides means to securely identify the sender and authenticate the content of a message using the proper protocols, integrates all critical cryptographic elements, including key generation, encryption/decryption, digital signature, and authentication

✔ implements security algorithms, logic and key storage in a tamper-proof module (such as a "smart card")

✔ ensures renewable physical security by providing replaceable functions for common "attack points": key management, entitlement storage, entitlement messaging and set-top personalization.

The potential exists to transform every set-top into a point-of-sale terminal in the subscriber's home

Without performing any cryptographic functions directly, the subscriber can still be assured of excellent security and privacy. Public key technology allows placement of the conditional access identity mechanisms in the set-top itself, which can generate a public/private key pair. Neither the manufacturer, the end user, nor anyone in between needs to know the private key. The set-top can "publish" its public key while keeping the private key in secure memory.

There are some network housekeeping functions associated with public key approaches. For example, the integrity of public keys must be maintained. Digital certificates provide a non-forgeable, tamper-proof way of certifying the validity of published public keys. Digital certificates are issued, verified and revoked by a certifying authority, which can be any trusted party for central administration. Some organizations planning to provide certificate services are Verisign Inc., GTE and the U.S. Postal Service.

Putting cryptography to work

Public key cryptography is an enabling technology for new information and entertainment services in emerging digital networks. It can also make existing applications and operations more secure. It does so by providing rigorous means to verify the identity of both network users and service providers, by authenticating the integrity of data exchanges and by simplifying the distribution and management of user keys.

Using this same security platform, cable systems will have the ability to support electronic commerce applications. In conjunction with soon-to-be-standardized security protocols, the fundamental encryption, authentication and digital signature services of cryptosystems will be the crucial foundation of cybertrust relationships.

The potential exists to transform every set-top into a point-of-sale terminal in the subscriber's home. Alternative approaches to authentication do not support direct two-party transactions, which are required for the spontaneity and scalability of the electronic marketplace.

An end to credit card fraud

Further, the benefits of true public key approaches are not limited just to service providers and network operators.

Wouldn't it be nice to have your ATM or credit card be able to verify the ATM machines into which you insert them or securely identify the "merchant" at the other end of the network, so that fraudulent attempts to steal card numbers and PINs could be prevented? Such capability would seem to make it a truly "smart" card. CED

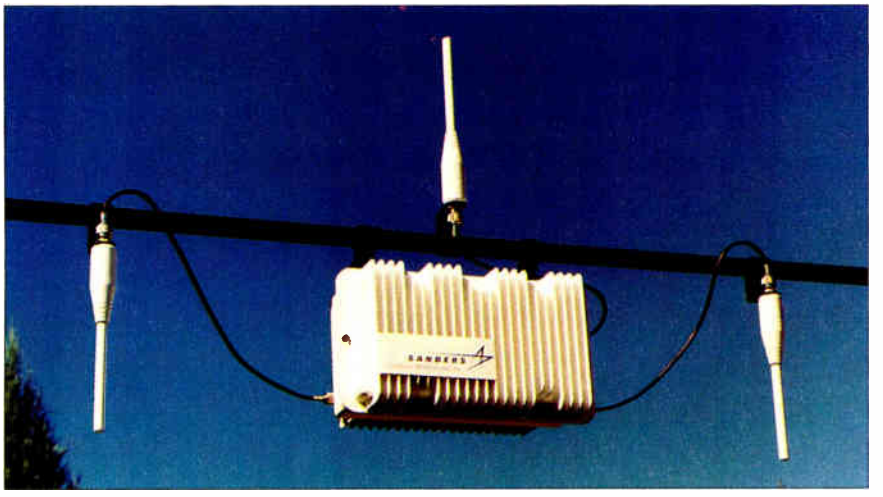
MSOs search for a role in PCS delivery

Wireline platform better than towers

By Fred Dawson

The shifting interplay of technical and strategic developments in PCS is redefining the cable industry's options in telephony, posing both a challenge and an opportunity to MSO strategists.

Where much of cable's focus has been on making wireline delivery of telephony technically and commercially viable as a prerequisite to deep involvement in wireless services, developments on the wireless front suggest cable's biggest opportunities may lay in the direction of providing transport for services that avoid a wireline connection to customers altogether.



This Cable Microcell Integrator (CMI) transceiver was designed and built by Sanders Telecommunications Systems to provide the air-to-cable interface for a cable TV-based implementation of Personal Communications Services (Photo courtesy of Sanders).

Nothing better illustrates the new possibilities than the strategy on which NextWave Telecommunications has built its group-leading $3.8-billion bid for personal communications services spectrum in the FCC's "C" block auctions. "We intend to be a carrier's carrier," says NextWave CEO Allen Salmasi, explaining that NextWave will be a "wireless factory" that sells spectrum and new features software to retail service providers for both fixed and mobile access.

"The way we've architected our network, we'll be able to offer PCS as an extension of wireline service," Salmasi says, noting that mobile capabilities will be added later.

Most significantly, from a cable perspective, NextWave is predicating its gambit on the use of transmitter/receivers mounted on coaxial cable links in conjunction with premises-mounted devices to eliminate the need for wireline drops to households.

The design envisioned by NextWave makes use of many other technical innovations as well, including distributed switching components that add intelligent network features on top of basic switching supplied by the public network, thereby maximizing operator control over service features while minimizing capital and even transport costs. For example, Salmasi notes, the design achieves greater bandwidth efficiency by using modular switches to handle all traffic across the several fiber nodes within any given mobile switching center, which means signals can remain in the 8 or 13 kilobit-per-second PCS format without consuming DS-0 (64 kbps) bandwidth.

Even though the NextWave strategy relies on use of HFC networks, Salmasi says local exchange carriers are the largest block of players negotiating for NextWave's services, owing to their recognition that fixed wireless access will offer them a low-cost way to expand network capacity to support demand from service resellers. "The LECs see coax distribution with RADs (remote antenna drivers) as a very appealing option," he says, noting that while there is interest among some MSOs, "the big problem there is they don't have a business plan that fits the opportunity."

Indeed, cable operators have been wary about jumping into wireless when, to do so, they must rely on the untried RAD or, as it is now being labeled by some, CMI (cable microcell integrator) technology. "We've had people tell us they're convinced our technology is solid, but they don't want to be the first ones to put it in the field," says Derek Spratt, executive vice president and a co-founder of PCS Wireless Inc., the original provider of RAD technology that has joined with ADC Telecommunications in a 50-50 venture known as "PCS Solutions."

This is one reason the Sprint venture, which had touted CMI-based PCS as a core part of its strategy, jumped to an all-wireless approach to PCS deployment late last year, Spratt notes. Equally important, he adds, the venture's MSO partners wanted to ensure they could deliver fixed wireline service in tandem with PCS, which meant PCS would have to wait for the resolution of difficult technical issues on the wireline side.

"There's been a real letdown since the Sprint deal came apart," Spratt says, in reference to cable enthusiasm for telephony. "But the Sprint business plan was out of date the moment they came up with it, because they were focused on making wireline telephony work as a prerequisite to adding wireless."

Fixed wireless access

With "150 minutes of wireline use for every minute of wireless, compared to 139 a year ago," as Salmasi puts it, clearly, the correct strategy isn't to abandon fixed access in favor of mobile. But it may be that choosing fixed wireless over wireline access can overcome the technical hassles that have stymied cable's push into telephony, possibly expanding cable's service marketing and affiliation options as well.

As Rebecca Diercks, an analyst with Business Research Group of Boston, notes, NextWave isn't alone among PCS bidders in pushing for a fixed wireless

access approach.

"Many of these companies are shell companies who expect to resell their spectrum to new entrants in the local exchange market, but others are looking to create their own 'extended cordless' service as an alternative to mobile services," she says.

"Licensees will definitely be looking to spend as little as possible on their networks after what they've had to pay for spectrum," adds Ira Brodsky, president of Datacomm Research Co. "People are expecting there will be competition in local telephone service, which means there will be demand for wireless access owing to the anticipated resistance to multiple wireline networks at the community level."

In late January, the FCC proposed a rulemaking which would allow commercial mobile radio licensees to provide fixed wireless local loop service, leaving for further discussion the question of how this route to competing with the local exchange carriers would be regulated. "This proposed rulemaking has altered the whole equation in calculating what C Block spectrum is worth," says an executive with one would-be licensee, asking not to be named.

What applies to new PCS licensees applies to the general telecom landscape as well when it comes to the rapidly changing technical scenario in fixed wireless access. "There's a new phase in development of wireless local loop technology that's focused on markets where wireline service already exists, such as the U.S.," says Jack Scanlon, executive vice president and general manager of Motorola Corp.'s Cellular Infrastructure Group. "We'll have a lot to say about this in the near future."

"We are working with a number of (PCS) operators to develop services that would take advantage of a low-cost, fixed-wireless access approach to the business," adds Bill Marsh, a digital products manager in Scanlon's group. "Some operators are going to have to look at that, because a given region is not necessarily going to support five to seven pure mobile plays."

The biggest problem with fixed wireless access in the minds of cable operators and U.S. telcos alike has been its failure to supply the intelligent management functions envisioned for next-generation wireline networks, leaving the impression that fixed wireless is strictly an off-shore product for startups in underserved countries. But, in Hungary, Motorola is taking initial steps toward changing that perception by supplying a wireless local loop system that can remotely manage devices at the customer premises.

"You can view the box, which has a (jack) connection on one side and an antenna connection on the other, as the beginning of the subscriber side of the network or as the end of the outside infrastructure," Scanlon says. "Operators want to deal with it as the end of the infrastructure."

Moreover, he adds, Motorola has found a way to allow the network operator in Hungary to provide power to the premises equipment in the wireless environment, though he won't say what the method is at this point. In any event, he adds, customer-supplied power isn't a drawback in the U.S. the way it is in less well off countries, so long as there is reliable battery backup to ensure lifeline service in the event of power failures.

Another firm responding to demand for wireless access solutions is start-up Dynamic Telecommunications Inc. Based in Germantown, Md., Dynamic will begin producing intelligent wireless access units for digital cellular systems by June, moving to PCS spectrum interfaces as demand develops, says CEO Paul Kline.

Using such systems, operators will be able to communicate over the wireless connection to the home-mounted terminals to find out the condition of premises gear and power supplies and to modify service options, among other things. Says Kline: "There is nothing you can do to manage telephony over wires that can't be done in the wireless mode, so why not extend that capability all the way to the premises?"

The mobile side

As market conditions encourage new thinking about wireless fixed access, the push for a cable-based solution on the mobile side is heating up again, owing in large measure to the problems PCS licensees are having in securing sites for their transmitters. Wireless trade publications and industry sources are reporting widescale procedural delays as municipalities begin to focus on the issues raised by construction of multiple PCS networks, in some instances, adopting new zoning restrictions, and in others, tying up the process while they weigh their options.

"The situation is only going to get worse when you consider all the PCS licensees in any given market who are going to be trying to get transmitter site permits," Spratt says. Perhaps most important for cable's near-term perspective on use of CMI technology, Sprint, after deciding upgraded cable plant wouldn't be available on a broad enough scale soon enough to support its PCS rollout schedule, has renewed its search for a cable solution in the wake of encountering unexpected problems in arranging for antenna sites throughout its territories.

Sprint has renewed its search for a cable solution

"Directors from all 20 plus Sprint PCS markets are reporting zoning and leasing problems, often at sites where they thought they had it wrapped up," says a cable industry official, asking not to be named. Spratt concurs, saying, "They're reporting about 30 percent of the sites they'd expected to secure in '96 aren't going to be ready in that timeframe, and they're projecting it could go to 50 percent in '97."

A Sprint spokesman rejects such assertions. "We're making great headway in site selections, and our presentations before zoning boards are proving to be very fruitful," says Mark Bonavia. "We're very confident things will move at the pace we've set."

But Sprint is acting on the cable option with new urgency, setting up a test of CMI technology with Cable Television Laboratories and Tele-Communications Inc. in Lakewood, Colo. west of Denver. "There's an empha-

sis on using cable plant wherever possible," says Scott Burnett, project manager for wireless technology at CableLabs. "These tests should make it easier to determine the right approach in any given market."

Where, previously, Sprint and others had taken an all or nothing approach to using cable networks, now, the emphasis is on PCS system designs that would take advantage of upgraded cable plant in pockets within a market, mixing use of CMIs and tower- or roof-mounted transmitter/receivers in whatever arrays make the most sense. "A lot of cable systems are like the Denver system, where some segments are upgraded to state-of-the-art specs at 750 MHz with a lot of fiber, and others are still operating at lower capacity," Burnett says.

In addition to the field trial, CableLabs will conduct lab tests using a newly developed apparatus that simulates various operating conditions and types of cable plant to "determine where any given system falls apart," Burnett says. "That gives everybody a sense of what the tradeoffs are between upgrading cable plant for PCS or using standard transmitters."

The cable industry is looking at two categories of strand-mounted CMIs, one with power output at one-half to one watt, and another at 2.5 watts. The difference in radial coverage range between the two versions is about 900 feet versus 2,500 feet, depending on local conditions.

The Lakewood field trial will largely replicate what's already been done by Cox Communications in the San Diego area, Burnett says. The MSO's PCS operation, winner of a pioneer's preference license for the southern California major trading area, has begun commercial construction and recently completed its first calls over the new segment.

"Cox is very busy getting ready to launch services and doesn't have the time or resources to share its findings with the rest of the industry on a regular basis," Burnett says. "We'll be able to do that, plus we'll be operating in a different environment, which will broaden the industry's experience with variations in terrain and RF usage characteristics."

New supplier

Another factor contributing to the improved prospects for use of CMI technology in cable is the emergence of a second supplier in the field. Sanders Telecommunications, a division of Lockheed Martin Corp. with experience in CDMA (code division multiple access) technology for the military, has chosen the HFC platform as the most promising market arena for its move into commercial systems and is already delivering product for field trials.

"We realized there was going to be tremendous competition for cell sites in network buildouts by as many as six licensees per market," says Chris Cole, manager of marketing for telecommunications systems. "It's hard to imagine anybody would be allowed to put up enough towers in any market to support all these systems, which is why cable represents such a great opportunity."

Sanders officials also note cable makes a good fit for their technology because of CDMA's usefulness in overcoming the upstream noise problems of coax. "The spread spectrum waveform is designed to operate below the noise floor in the over-the-air environment, which allows it to get through the ingress in the cable upstream as well," says Michael Orr, program manager for CMI products.

In fact, notes CableLabs President Richard Green, PCS is a bit easier to accommodate

PCS is a bit easier to accommodate over cable systems than wireline telephony

over cable systems than wireline telephony, given the robustness of the spread spectrum CDMA signal. "The standard has been designed to noise specs that are tougher than the noise impediments in the cable plant return path," he says.

Sanders, which expects to move to full production for commercial PCS deployments starting in the third quarter, is in the market with production gear ahead of PCS Wireless, which will have equipment in production later in the year and should be first to market with a 2.5-watt power version of CMIs, according to Spratt. "We've delivered over 200 RADs in various (air interface) flavors, working with the cable industry to sort through the best approaches," he says.

"Lockheed Sanders focused on nothing but CDMA and so was able to get a product to market a little ahead of us."

But Spratt quickly adds that Sanders' entry is good news for PCS Wireless. "We look on Lockheed Sanders' entry as a positive thing, because it lets the industry know the idea has backing from another credible source," he notes.

It's only a matter of time before PCS providers recognize the advantages of using CMIs, says Bruce Crair, vice president and general manager of Cox of California PCS. "It takes less than a week to put in the CMIs to provide coverage equivalent to that of a macrocell," Crair notes. "It takes 12 to 24 months to do it with a macrocell transmitter."

Moreover, adds Cole, PCS network construction using upgraded cable facilities should cost 50 percent of what it would cost to build an all-wireless network. "Our calculations show there's a phenomenal market potential for this technology," he says.

Modular switching

Complementing the CMI and fixed wireless access in opening new approaches to telephony over cable are the modular switching systems that have entered telecommunications as adjuncts to telcos' Class 5 central office switches. Over the past decade, ever more computing power in microprocessors, along with new software, made it possible for LECs to add intelligent network features by tying PC-based switches to the main switches, and to do so on an incremental targeted market basis that minimized costs.

"We can put together a starter kit, including hardware and software, for $45,000-$65,000 that will get you going with service over 1,776 time slots (voice circuits)," says Anthony Squeglia, investor relations director for Summa Four Inc., one of the leaders in the market. The firm's switches can be linked to manage up to 30,000 time slots, he adds, noting that AIN (advanced intelligent network) capabilities are built into the switch.

Excel Inc., another leading supplier with a similar approach to programmable switch arrays, supports combinations of individual multi-port units into a PC-controlled platform that operates as a single logical switch, says Russell Levesque, director of product management. "Operators can stack up to eight switch controllers to support as many as 128,000 non-blocking ports at a service node," he says.

Officials at both companies say the big growth area for their products is wireless, where cellular companies are expanding service features and new PCS players are looking to tie mobile and fixed wireless access capabilities together. "Business has been fairly flat on the wireline side, but it's growing by leaps and bounds in wireless," says Squeglia.

A hint of where things might be going in using such switches to expand wireless service into the home can be found in Southwestern Bell Mobile Systems' use of distributed computing from another supplier, Celcore Inc. SBMS is preparing to introduce a combination cellular/cordless, one-number service throughout its territories in the second quarter, says Mark Webster, director of wireless products.

The analog service employs "personal base stations" in the home in combination with a Celcore-supplied network management unit that interfaces the base stations with the mobile network through the public telephone switched network. When the customer is off-line at home, the call is routed through the wireline network to the base station and transmitted to the cellphone over the standard 800 MHz cellular frequency. When the phone is outside the reach of the base station, the service switches over to the mobile network.

SBMS plans to charge a flat monthly "feature charge" of between $4.95 and $8.95 on top of the regular cellular rate for its service, Webster says. There is no charge for air-time on incoming or outgoing calls when the phone is used as a cordless, he notes.

Dubbed "FreedomPlus," the service represents the next step "in the natural evolution to anytime/anywhere communications," Webster says, noting the company is talking with vendors about extending the capability into the digital domain in conjunction with introduction of TDMA (time division multiple access) air interface services in the cellular and PCS modes. "We see this service as especially viable for the work-at-home and small business markets," he says.

SBMS' move comes as the pioneer in the field, GTE MobileNet, prepares to expand its long-running Tele-Go one-number service to all 11 of its territories. With more than 200,000 Tele-Go customers in six territories at year end, GTE has demonstrated tremendous market appeal for the service, says Jeff Keller, spokesman for GTE MobileNet.

While one-number service has yet to be embraced by other carriers in the analog mode, it is an essential part of the PCS vision, notes Motorola's Scanlon. Only, with the wireless loop capabilities his company and others are developing, the service provider will be able to bypass use of the public wireline network altogether.

Whether or not cable networks become the key to enabling this bypass remains to be seen. But, based on the breadth of interest in HFC-based wireless deployment represented by players such as Sprint and NextWave, it's hard to imagine cable operators won't take a long look at a wireless approach that combines fixed access with mobile services. CED

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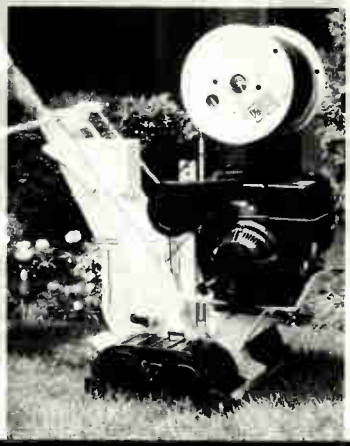

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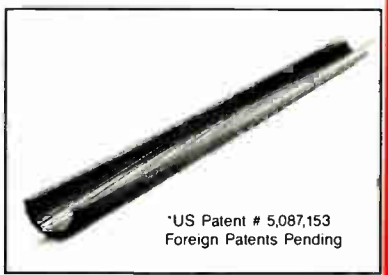

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CED

Literature & Source Guide–Spring '96

FONS Corp. Cable Assemblies

FONS Corp is a leading manufacturer of fiber optic communications products, including patch panels, cable assemblies, adapters, attenuators, fiber management software, and transmission products. Operating primarily in the cable television, telecommunications, and data communications markets, we supply regional and national cable systems, RBOCs and large corporations with engineered solutions for flexible, modular, easy-to-install, and cost-effective communication systems. For more information, call **FONS** at 508-393-4268.

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Blonder Tongue's Full Line Product Catalog

For over 40 years, **Blonder Tongue Laboratories, Inc.** has been manufacturing professional quality, commercial cable television products. Our catalog includes product photos, descriptions, specifications, and application notes for our entire product line. Look for extended frequency range to 750 MHz on our complete family of headend and distribution products, 13 and 18 GHz microwave systems, and VideoMask, our new interdiction system. Call or fax today for a FREE copy. Tel: (908) 679-4000 Fax: (908) 679-4353

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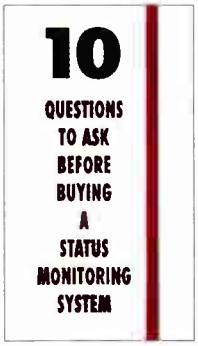
Cheetah's Answer to Monitoring

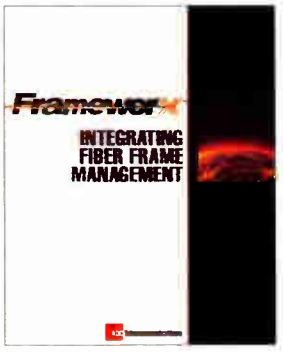
Cheetah™ provides an integrated network monitoring solution that is designed to evolve with your network requirements. This solution offers flexibility, reliability and the ability to integrate equipment from multiple vendors. Cheetah provides status monitoring of headends, fiber nodes, power supplies, amplifiers and end-of-lines. For the "10 Questions You Need To Ask Before Ordering A Status Monitoring system," call **Superior Electronics Group** at (941) 756-6000.



Circle Reader Service No. 123

ADC Frameworx Fiber Frame Architecture

This complete package contains information on ADC's integrated approach to total fiber distribution frame cable management. Frameworx is a platform on which service providers can build a total fiber distribution frame management system that provides automated record keeping, remote test capabilities, patch cord traceability, optical amplification and advanced circuit schematics such as signal monitoring, switching, attenuation and wavelength division multiplexing. **ADC Telecommunications** (800) 366-3891.



Circle Reader Service No. 124

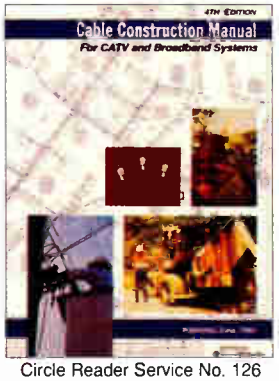
Headend-to-Home Power Solutions™

This new application brochure provides overview information on Alpha's complete line of cable television power products. Headend, office and studio power protection as well as both distributed and centralized node outside plant power solutions are represented. **Alpha Technologies** is the first name in reliable communications power, and offers complete "headend-to-home" power solutions. Call 360-647-2360 for more information.

Circle Reader Service No. 125

Cable Construction Manual for CATV Broadband Systems

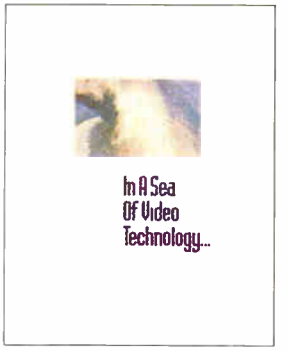
CommScope is now making available a revised and updated edition of its widely distributed and use Cable Construction Manual for CATV and Broadband Systems. The new manual includes sections on storage, testing and construction procedures for coaxial trunk and distribution cables in aerial and subsurface applications, fiber optic cables as well as safety procedures. For more information, call **CommScope/GI** (800) 982-1708.



Circle Reader Service No. 126

Vela Research for Video Servers, Encoders and Decoders

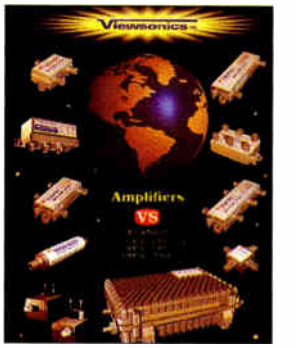
Vela Research Inc. designs and manufactures video servers, encoders and decoders. Their Perspective 2000 video server stores digitized video (movies, video clips, commercials, etc.) in a compressed digital format (MPEG-1, MPEG-1+ and MPEG-2) and can deliver multiple NTSC or PAL video outputs. Vela's MPEG Encoder can compress and multiplex audio and video signals into MPEG compliant data streams. Vela's MPEG decoder boards are designed for a wide range of video applications. Contact Vela Research at (813) 572-1230.



Circle Reader Service No. 127

NEW! Amplifier Catalog

Viewsonics Inc. full color catalog contains photos and specifications of all of their amplifiers, including their newest low noise models with the figure at 3dB and 3.5 dB, depending on the gain, as well as several new 2-way models. You'll find their amps all over the world including places you've never heard of, so call 1-800-645-7600 and/or fax 407-998-3712 for your free Viewsonics Amplifier Catalog today.



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Optical Links and "Simple to Use" Remotes

Call ABC Cable Products for more information on their wide range of **fiber optic transmission systems** and **CATV remote control units**. Their family of fiber optic products can transmit a single channel up to 110 channels per fiber using Frequency Modulation and Amplitude Modulation technologies. ABC also offers cost-effective, **dedicated**, and **universal remote controls** that have the capability of operating CATV converters, TV's and VCR's. Call **1-800-777-2259 extension 562** for a catalogue or product specifications.

Circle Reader Service No. 129

FREE Handbook

The FREE pocket size Cable TV Power Supply and Battery Handbook contains 125 pages of information for installers, maintenance technicians, system designers and cable TV engineers. Subjects such as power supply evaluation, plant layout, installation, maintenance and common problems encountered in the field are fully covered. Included is a special section on battery selection, management and testing. **Performance Cable TV Products**, Roswell, GA 30077-0947 (800) 279-6330 e-mail to: jud.williams@industry.net

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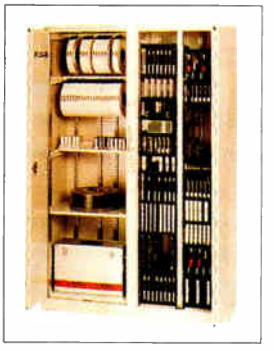
Plug-In Storage Systems, Inc./PSSI manufactures the highest quality Protective Storage Systems. Pictured is our ESD Protective Double Storage Cabinet. The cabinet creates a faraday cage which protects against ESD, EMI/RFI. PSSI's Product Brochure contains a complete line of ESD Cabinets, Workstations, Containers, Matting, Training and Grounding (personnel and equipment). For your free catalog phone and/or fax PSSI at 800-231-5952/800-532-2999 Fax.



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Automated and Remote VCR & Routing Switcher Control

Contact LEIGHTRONIX for literature and information on automated and remote VCR control and video/audio switching. Event controller models MINI-T-PRO, PRO-8, PRO-16 and TCD-1000 provide affordable and simple solutions for automated equipment control. The C-VOICE telephone remote controller provides VCR and routing switcher control via telephone. **LEIGHTRONIX, INC.**, 2330 Jarco Drive, Holt, MI 48842 (517) 694-8000 FAX (517) 694-1600

Circle Reader Service No. 132

NCTI Spanish/English CATV Illustrated Dictionary

The National Cable Television Institute (NCTI) offers a new Spanish/English illustrated dictionary of cable television and broadband technology terms. The first section presents English terms with Spanish translation and Spanish definition. The second section offers Spanish terms with English translation and English definition. Cost $29.95 plus S/H; quantity discounts. Please contact: **NCTI**, 801 West Mineral Ave., Littleton, CO 80120-4501, (303) 797-9393, Fax (303) 797-9394.

Circle Reader Service No. 133

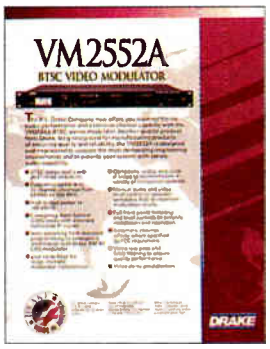
New Catalog from TRILITHIC

From signal level meters to leakage detectors, from frequency counters to calibration equipment, the new Instruments Catalog from **TRILITHIC** has all of the products you need to test and maintain your CATV/Broadband distribution system. Updated in September, the catalog now includes such popular new instruments as the TRICORDER II and III and the SUPER PLUS leak/ingress locator, and the current price list. Trilithic Inc., 9202 E. 33rd St., Indianapolis, IN 46236 Phone (800) 344-2412

Circle Reader Service No. 134

Drake VM2552A EAS Ready Stereo Video Modulator

Enhance your system with stereo audio and bring your system up to FCC regulations with the Drake VM2552A Stereo Video Modulator. The VM2552A modulator incorporates BTSC stereo encoding providing significant cost savings when compared to purchasing separate components. The VM2552A is EAS (Emergency Alert System) "ready," meaning that you can be prepared to meet the FCC regulations governing emergency alert broadcasts. The frequency agile VM2552A features frequency coverage up to 550 MHz. For more information, contact Phil Hawkins, **R.L. Drake Co.** 513-847-4523.



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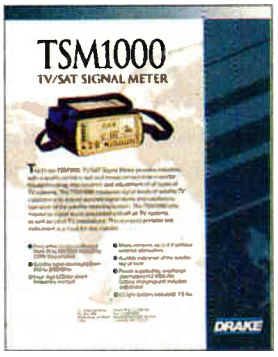
Drake TSM1000 TV/SAT Signal Meter

The Drake TSM1000 TV/SAT Signal Meter provides installers with a quality portable test and measurement instrument for troubleshooting, maintenance and adjustment of all types of TV systems. The TSM1000 measures signal levels of satellite delivered programming to ensure accurate signal levels and proper operation of the receiving system. The TSM1000 also measures signal levels associated with off-air TV systems, as well as cable TV installations. **R.L. Drake Co.** (513) 847-4523.



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Eagle Telephone and Ingress Suppression Traps

Need to activate your sub low spectrum for telephone or other two way communication? **Eagle** has the answer, no matter how complex your return system may be. A complete line of high pass filters for the non-return subscriber or high pass filters with return window for the active-return customer. In addition, tier traps of every variety, audio reduction traps and the latest in positive filters, Side Band interdiction. Call 1-800-448-7474 or Fax 315-622-3402 for literature or free samples.

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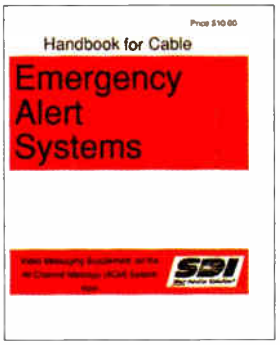
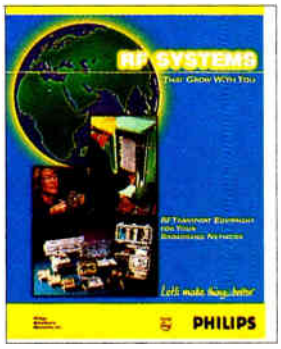
IAS offers complete EAS systems with the widest range of hearing impaired options, including Baseband and IF switching. The model 701 also provides video messaging on all channels with the SDI All Channel Message (ACM) system. The ACM, installed in over 200 locations, further minimizes signal interruption. Everything you need to know economically and functionally comply with the EAS ruling is contained in this handbook for Cable. Call SDI at (800) 231-1349 or IAS at (801) 943-4443.



Circle Reader Service No. 138

New Brochure Details Philips Broadband's RF Systems

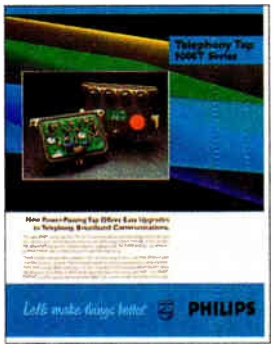
Philips Broadband Networks, Inc., an ISO 9001-certified manufacturer, introduces a comprehensive brochure on the company's over 200 RF line and distribution systems, all of which meet CENELEC standards. The brochure features the Diamond Net™ optical node amplifier and the full Spectrum 2000 line. Also described are Philips' multi-taps, including the new telephony tap, and line passives. For literature or additional information when calling in the U.S., phone 800-448-5171 (in NYS 800-522-7464). Internationally, 315-682-9105.



Circle Reader Service No. 139

Philips Offers Data Sheet on 900T Series Telephony Tap

Philips Broadband Networks, Inc. has launched a series of product data sheets, including one detailing the company's 9000T Series power-passing telephony tap, featuring the Tel-Spot, Philips' unique reflective indicator for quickly identifying a telephone-ready tap from ground level, even at night. To request literature or for additional information when calling in the U.S., please phone 800-448-5171 (in NYS 800-522-7464). If calling internationally, please call 315-682-9105.



Circle Reader Service No. 140

Zenith's MetroAccess™ System

MetroAccess is a complete, cost-efficient family of RF data communication products from **Zenith Electronics Corporation**. It uses proven, high-speed technology for hybrid fiber/coax systems linking businesses, communities, schools and residences for a wide range of applications, including work-at-home, distance learning, real-time video conferencing, Internet access and on-line services. For more information, call 1-800-788-7244.

Circle Reader Service No. 141

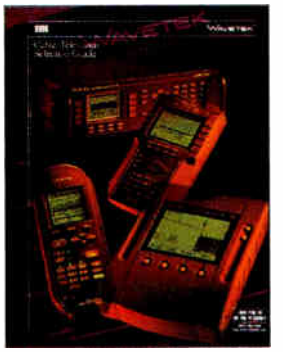
Zenith's Broadband Solutions

With more than 15 years of experience in the Network Systms areas, **Zenith Electronics Corporation** has extensive development and deployment expertise in advanced analog set-top decoder technology, including video and audio scrambling, real-time two-way cable systems, digital transmission technologies and computer networks, and is the industry-leading supplier of high-speed cable modems to more than 300 cable systems worldwide. For more information, call 1-800-239-0900.

Circle Reader Service No. 142

FREE: Wavetek's New 1996 CATV Selection Guide

The new 27-page *Cable Television Selection Guide* presents a full line of sophisticated test equipment designed to meet cable television's specific system testing needs. The guide features **Wavetek**'s new leakage meter and combination leakage/signal level meter, the CLI-1450. The new CMS 1000 Central Monitoring System is included, along with info on the complete line of MicroStealth signal level meters. In addition, the popular Stealth System Sweep, Flash Mini OTDR, and other test equipment are featured. **Call 800-622-5515.**



Circle Reader Service No. 143

New CABLESPAN™ Brochure from Tellabs

A new, full-color brochure from **Tellabs** describes the benefits of the company's CABLESPAN 2300 Universal Telephony Distribution System, which allows cable television operators to provide telephone and data services using the existing CATV infrastructure. Alternate-access providers will also find the CABLESPAN system to be a unique, innovative approach to providing business and residential telecommunications services around the world. To receive a copy of the brochure, call 1-800-445-6501.

Circle Reader Service No. 144

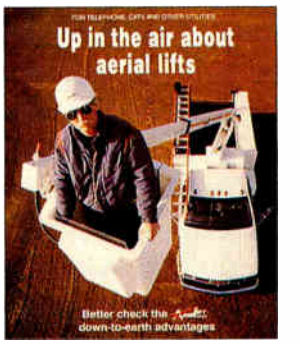
Free Sprint North Supply CATV Catalogs

Sprint North Supply is a leading nationwide provider of integrated solutions for voice, data, teleconferencing and CATV product needs through its 11 strategically located distribution centers. We offer more than 30,000 products from over 1,200 manufacturers. Let us show you a sample. Ask for our new broadband catalog containing thousands of products from 97 suppliers. Ask, too, about the following catalogs: Fiber Optics, Outside Plant, Tools, Test and Supplies, and Security Products. 800-639-CATV, FAX 800-755-0556.

Circle Reader Service No. 145

Up in the Air About Aerial Lifts?

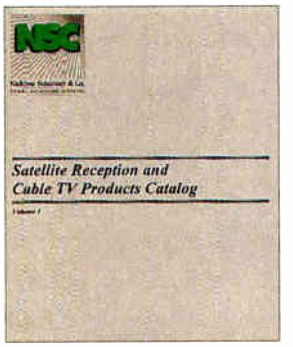
ARMLIFT, the aerial lift that provides you with years of dependable service–lifts built tailored to your needs. With up to 34' working height, Armlift offers a variety of power sources, two speed operation on all units, gravity or hydraulic bucket leveling, choice of buckets and 720 degree non-continuous rotation. Truck or van mounts with a full line of equipment options. **Armlift, Div. of TG Industries,** Inc. Call (712) 864-3737.



Circle Reader Service No. 146

NSC, Your Headend Headquarters

Nickless Shirmer & Co. offers a complete line of RF signal and video processing equipment from the industry's leading manufacturers. And with years of RF experience, NSC representatives can recommend the best products to fit your application. Whether you need a receiver, satellite antenna or a complete satellite or headend system, NSC provides the best combination of quality equipment, knowledgeable service, fast delivery and low cost. For a copy of our latest catalog call 1-800-543-1584.



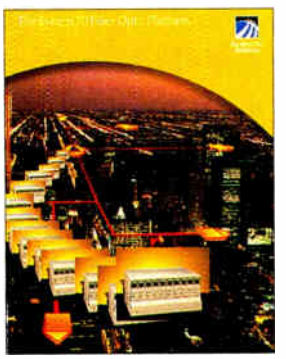
Circle Reader Service No. 147

Monroe Electronics designs, manufactures and markets–to worldwide customers–a full line of electronic manual programmable audiovideo switching, timing and remote control equipment. These products are used by the cable, wireless, broadcast and telephony industries. Monroe's products have a time proven record of reliability and we are eager to assist customers with their standard or custom switching product needs. For support you require on our products or services, call (716) 765-2254 or (800) 8921-6001, Fax (716) 765-9330

Circle Reader Service No. 148

SA'S New System 70 Engineering Kit

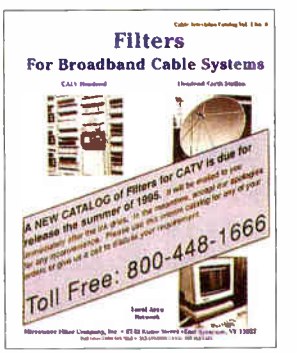
Scientific-Atlanta's new System 70 Engineering Kit is available by calling 800-433-6222. The System 70 Fiber Optic Platform allows system operators to take advantage of new revenue-generating opportunities. This system supports interactive services such as voice, data, video-on-demand, telephony-over-cable, narrowcasting, and work-at-home applications. The upgradeable System 70 is designed to support your migration strategy and cost effectively addresses broadcast video and 1310 nm or 1550 nm regional interconnect applications in a single chassis.



Circle Reader Service No. 149

Free Catalog–Filters/Traps for Broadband Systems

Catalog Vol. 1 No. 4 describes a complete line of filters and traps for CATV featuring the full line of "brickwall" filters deleting single or multiple channels without sacrificing adjacent channels while passing up to 1 GHz. A selective line of bandpass filters is also described which suppress adjacent channel, off air interference while maintaining low loss in the passband. Other products are: notch and bandpass filters, co-channel eliminators, pay-TV traps, bandsplitters, CARS band filters and terrestrial interference filters. Call **Microwave Filter Co.** (315) 437-3953.



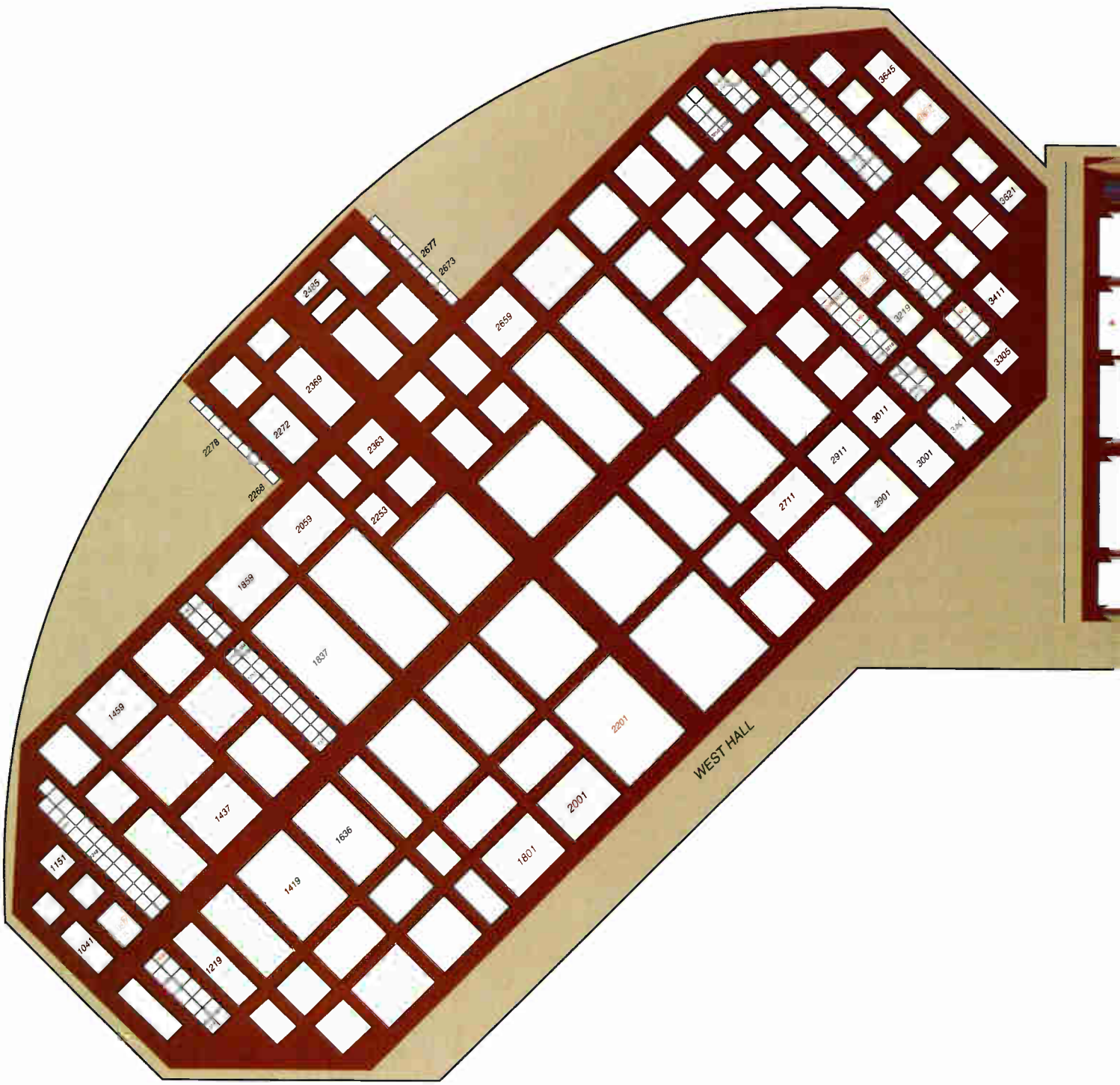
Circle Reader Service No. 150

Technical Sessions Monday, April 29

2–3:30 p.m.
Cable Telephony: Design and Delivery
Moderator: Robert Luff, TV/Com International Inc.; Speakers: Bouchung Lin, Scientific-Atlanta Inc.; Douglas Hohulin, Motorola, Pan American Wireless Infrastructure Division; Patrick White, Ph.D., Bell Atlantic Corp.

Operational Improvements in Existing Cable Systems
Moderator: David Large, Media Connections Group; Speakers: Dan McNamara, California Eastern Laboratories; Robb Balsdon, P.Eng., M.B.A., Rogers Cablesystems Ltd.; Ernest Tsui, Applied Signal Technology Inc.; Darryl Schick, RDL Inc.

4–5:30 p.m.
Successful Digital Video Carriage
Moderator: John Vartanian, Viewer's Choice; Speakers: Brian James, CableLabs; Bronwen



Lindsay Jones, Ph.D., Auditory & Visual Perception; Jeff Mitchell, Rambus Inc.; Richard Prodan, Ph.D., CableLabs; Oleh Sniezko, TCI Communications Inc.

Network Powering Issues: Reliability, Safety and Economy
Moderator: Charles Merk, Philips Broadband Networks; Speakers: Doug Combs, TCI Communications Inc.; Paul Brooks, Time Warner Cable; Peter Deierlein, Philips Broadband Networks Inc.; Steven Johnson, Time Warner Cable.

FLOOR PLAN

Tuesday, April 30

11:30 a.m.–1 p.m.

Data Over Cable–Why Wait for Connectivity?
Moderator: Dan Pike, Prime Cable; Speakers: Esteban Sandino, P.Eng., Rogers Cablesystems Ltd.; Frank Koperda, Scientific-Atlanta Inc.; Mark Laubach, Com21 Inc.; Shlomo Rakib, Terayon Corp.; Terry Wright, Convergence Systems Inc.

Meeting Return Path Challenges
Moderator: Tony Werner, TCI Cable Management Corp.; Speakers: Bill Morgan, Hewlett-Packard; Jim Chiddix, Time Warner Cable; James Farmer, Antec Corp.; Kerry LaViolette, Ph.D., Philips Broadband Networks Inc.; Paul Brooks, Time Warner Cable.

1:30–3 p.m.

Fiber Refinements
Moderator: Alex Best, Cox Communications Inc.; Speakers: Dogan Atlas, Ph.D., Scientific-Atlanta Inc.; Donald Raskin, General Instrument Corp.; Henry Blauvelt, Ph.D., Ortel Corp.; Venkatesh Mutalik, Philips Broadband Networks Inc.

Digital Transport
Moderator: Russell Murphy, The Family Channel/FIT TV; Speakers: David Fellows, Continental Cablevision Inc.; Mukta Kar, Ph.D., CableLabs; Caitlin Bestler, Zenith Electronics, Network Systems; Michel Fortier, Ph.D., eng., Nortel; Michael Adams, Time Warner Cable.

3:30–5 p.m.

Reliability and Availability: Expectations, Issues and Solutions
Moderator: Bradley Johnston, Johnston Consulting Group; Speakers: Pete Gatseos, TCI Communications Inc.; Kiran Babu, Philips Broadband Networks Inc.; Ronald Wolfe, Time Warner Cable; Nick Hamilton-Piercy, Rogers Cablesystems Ltd.

Competitive Intelligent Networks
Moderator: Tanzy Wallace, Nortel; Speakers: Bill Hartman, ADC Telecommunications; Gaylord Hart, XEL Communications Inc.; Louis Williamson, Time Warner Cable; Thomas Elliot, TCI Cable Management Corp.

Wednesday, May 1

9-10:30 a.m.

Virtual Techno-Policy
Moderator: Wendell Bailey Jr.; Speakers: Jay Vaughan, Time Warner Cable; Robert Rast, General Instrument Corp., Robert Luff, TV/Com International Inc.; Walter Ciciora, Ph.D., Technology Consultant.

The following technical companies will be exhibiting at the National Show Cable '96, as of March 30, 1995:

@ Home 2369

ADC Telecommunications

ADC Video Systems

ADC Video Systems 2711
Phone 800-366-3891
ADC has created a live end-to-end video, telephony and data transport and distribution network at Booth 2711. The real-world display demonstrates how a live signal feed is transported through a working headend, over a distribution network and into an actual home. Equipment includes digital video supertrunks and SONET nodes, a complete headend area that integrates video, voice (with PCS wireless capabilities) and data onto an HFC distribution network, an outside plant area displaying optical nodes and a wireless PCS antenna, and a residential services area that includes video, voice and cable data modem demonstrations.

ADcom Information Services 3645
AEL Industries, Inc. 2673
AM Communications, Inc. 6019
AT&T (Skynet Sate. Services) 1041
ATM Forum, The 4565

ATx TELECOM SYSTEMS, INC.

ATx Telecom Systems, Inc. 6014
Phone .....
ATx Telecom Systems will demonstrate the Javelin™ Series of fiberoptic video transmission solutions. The Javelin 1550 Series provides a full network of 1550 nm equipment including transmitters, high power EDFAs, and receivers. Ideal for supertrunking, distribution, and headend consolidation architectures, the Javelin 1550 Series offers unprecedented power and low cost per mW. With output power of 80 mW, the Javelin 1300 Series transmitter is the high power, low-cost 1300 nm solution for architectures with high split ratios.

Alcatel Telecomm. Cable 1755

ALPHA TECHNOLOGIES

Alpha Technologies 3227
Phone 360-647-2360
Alpha Technologies is the leading supplier of reliable communication power solutiions. Widely used in cable television, telecommunication and data network applications throughout the world, Alpha products have earned a reputation for reliability and performance. Alpha's power products include: standby, non-standby, and uninterruptible power supplies, surge suppressors, enclosures and batteries. In addition, Alpha's complete line of Broadband Power Systems provide the latest powering technology to today's most challenging requirements. Alpha Technologies is the first name in reliable communications power, and offers complete "headend-to-home" power solutions.

Amphenol CATV Connectors 1801
Andersen Consulting 1119

ANTEC

ANTEC 4401
Phone 847-439-4444
ANTEC Corporation (NASDAQ: ANTC) is an international communications technology company that specializes in the design and engineering of broadband networks and the manufacturing, materials management and distribution of products for fiber and coaxial broadband networks. ANTEC integrates technology into products, products into systems and systems into networks. Through development of the Cable Integrated Services Network (CISN), ANTEC established a migration path for broadband system operators to upgrade to interconnected networks and the public switched telephone network using the SONET platform. CISN offers operators a revenue-driven building approach that requires new capital investment only where the market can support new services. The ANTEC divisions include: Keptel, Power Guard, Telewire Supply, Antec Network Technologies, Antec Digital Systems and Communicaciones Broadband.

Applied Signal Technology 6207
Arrowsmith Technologies, Inc. 1255
Augat Comm. Products Div. 3011
Belden Wire & Cable Company 4961
Bellcore 1037
Blonder Tongue Labs., Inc. 4965
Business Systems, Inc. 3228

C-COR® ELECTRONICS INC

C-COR Electronics, Inc. 5123
Phone 814-238-2461
C-COR's display includes a wide range of network solutions: FlexNet® 750 MHz and 862 MHz amplifiers, AM Fiber Optics, digital fiber optics, Cable Network Manager, modems, passives, and 90 Volt powering options.

CADDStar Group, Inc. 6319
CSG Systems, Inc. 2059
CTI Data Solutions (USA) Inc. 5155
CUO, Inc. 1419
Cabelcon Connectors 5045
Cable AML, Inc. 1047
CableData 1419
Channel Master 3115
Channell Commercial Corp. 3325
Channelmatic Inc. 3219
ComSonics, Inc. 3119

CommScope
GI General Instrument

CommScope-General Instrument 4701
Phone 704-324-2200
800-982-1708
Internet .....hptp://www.commscope.com/
CommScope-General Instrument is an ISO 9001 registered quality manufacturer of cables for telecommunications and other digital applications, the only US manufacturer of a complete line of coaxial and fiber cables for use in hybrid fiber/coax networks and a world leader in cable innovation. CATV products include: NEW Power Drop™, Optical Reach®, Quantum Reach®, Parameter III®, and a full line of drop cables including many that are available in EZ Pak® packaging.

DSC Communications Corporation 4035
DX Communications, Inc. 3621
Data Voice Systems, Inc. 6513
Digital Equipment Corp. 4535
Digital Video 4401

EAGLE COMTRONICS INC.

Eagle Comtronics 3129
Phone 315-622-3402
800-448-7474
Come see us at the National Show, Booth 3129, and let us show you: Improved ESN Series of negative

traps, improved ESD jamming carrier decoding filters; newest positive (non-jamming carrier) decoding filters called Sideband Interdiction Systems (SIS), and a wide variety of encoders, channel droppers, metal shields and telephone traps. Let Eagle Comtronics show you the solution of an industry wide problem–"Elimination of offensive language of premium services"–by offering split tuned traps.

ELECTROLINE

Electroline Equipment Inc. 4667
Phone 514-374-6335
Electroline, number one worldwide in Broadband Off-Premises Addressable Systems, will be unveiling its "ADEX", an Addressable Drop Extender. Featured will be its 1 GHz "SuperTap" that can be used as a standard multitap or, with a simple change of faceplate, as an addressable tap. Electroline will be demonstrating its "CLEARPath" that locates reverse path ingress immediately. It will be showing its 1 GHz ultra low-noise drop amplifier ("DROPAmp"), as well as its Compact Addressable Tap ("CAT"), an addressable splitter. On exhibit will be Electroline's state-of-the-art Multitier Security System, aimed at MDUs and resort applications.

Exide Electronics 2363
First Pacific Networks 4837
FrameRate Labs, Inc. 6313
France Telecom 3101

Fujitsu 4201

FUJITSU

Phone 214-479-7762
Fujitsu Network Transmission Systems Inc., is a leader in developing, manufacturing and marketing fiber optic networking platforms for delivering voice, data and video services to residential and business users. Fujitsu also develops software that allows customers to perform in-service management and monitoring of the network. Customers include competitive access providers, cable TV operators, local exchange carriers and interchange carriers.

GE American Communications, Inc. 2911

GI General Instrument

General Instrument Corp. 4701
Phone 800-523-6678
Once again General Instrument is emphasizing the cutting-edge live demonstrations taking place both in its own booth area and in others that are supported by GI technology. Under the banner of **GI Live!** will be demonstrations of digital TV with signals supplied by HITS and others. The DCT-1000 will be operating throughout a wall of TV sets using GI's digital compression technology, which is standards-based and interoperable. GI's cable modem, SurfBOARD will also be functioning, as will the CFT-2200, advanced analog terminals, along with a host of interactive services. Other demonstrations include SEGA Channel equipment, HFC Telephony, network management system, and a headend of RF and Optical Transmission equipment.

Gilbert Engineering 4773
Great Lakes Data Systems, Inc. 1765

Harmonic *Lightwaves*

Harmonic Lightwaves, Inc. 4645
Phone 800-788-1330
Harmonic Lightwaves is a leading supplier of highly integrated fiber optic transmission systems for the delivery of video, voice and data over hybrid fiber-coax broadband networks. Harmonic's products include the MAXLink™ 1550 nm transmission system, the PWRLink™ DFB transmitter, the YAGLink™ transmitter, optical receivers and accessories for bi-directional communications and a sophisticated Windows-based network management system.

HEWLETT PACKARD

Hewlett-Packard 1137
Phone .....
Hewlett-Packard will have on display a comprehensive offering of cable TV test and measurement products as well as a wide variety of products that will enable customers to enjoy two-way services in the home. At our booth you will find our HP CaLan 8591C cable TV analyzer along with the HP CaLan 3010 signal level meter. Also on display will be cable modems, video servers and more.

Hughes Communications, Inc. 4545
Hybrid Networks, Inc. 3363
Hyperparallel Technologies 4562
IBM-Telecommunications & Media 6013
IPITEK 6012
Intel Corporation 1859
Interaxx TV Network, Inc. 4867
International Billing Services 1419
Iris Technologies, Inc. 2272
Kennedy Cable Construction, Inc. 3111
Keptel 4401
LANcity Corporation 2485
Lemco Tool Corporation 1854
Lindsay Electronics 1737
Lockheed Martin 1751

Lucent Technologies
Bell Labs Innovations

Lucent Technologies 1219
Phone 908-582-3275
Lucent Technologies–formed as a result of AT&T's planned restructuring–designs, builds and delivers a wide range of public and private networks, communications systems and software, consumer and business telephone systems and microelectronics componentts. Bell Laboratories, recognized worldwide for its scientific discoveries and technological innovation, is the research and development arm for the new company.

Macrovision Corporation 5049
Matrox Electronic Sys., Ltd. 6310
Micropolis Corporation 3358

Microsoft®

Microsoft Corporation 5323
Phone 206-936-7533
Founded in 1975, Microsoft (Nasdaq: MSFT) is the worldwide leader in software for personal computers. The company offers a wide range of products and services for business and personal use, each designed with the mission of making it easier and more enjoyable for people to take advantage of the full power of personal computing every day. For additional information on Microsoft, please visit the Microsoft home page at http://www.microsoft.com/. Additional NCTA information can be found at http://www.microsoft.com/advtech/ncta.htm

Microware Systems Corporation 5101
Mitsubishi Elec. America, Inc. 4444
Motorola 4745
Motorola 5355
National Digital TV Centra-HITS 4955
Nortel 4209
Objective Systems Integrators 5336
Ortel Corporation 1151
PPC 3305
Phasecom Ltd. 6317
Philips Broadband Network 4923
Photonic Components Inc. 3259
Pico/Pico Macom 4661
Pioneer New Media Technologies 1837
Pirelli 4055
Power Guard 4401

PowerTV 2901
Raychem Corporation 2677
Ripley Company 5148
SCTE .....SL#4
Sadelco, Inc. 3311
Samsung Electronics Co., Ltd. 6417

Scientific Atlanta

Scientific-Atlanta, Inc. ....2001 South Hall
Phone 800-433-6222
Visit our booth to learn how to prosper in a more competitive world. Based on our cost-effective hybrid fiber/coax network, our end-to-end system will allow you to provide video, data and voice services. You'll be positioned to not only provide new services to compete, but to quickly gain the necessary return on your investment. Let us show you:
• Cable modem for telecommuting and high speed access to the Internet and on-line services.
• 8600^{X}™ advanced analog terminal with interactive viewing guide, easy VCR programming, virtual channels, and other revenue generating features.
• CoAxiom™, our telephony over cable product that requires a small investment to get you in the telephone business and grows as your service grows.
• LE III, the world's first line extender for commercial deployment using integrated chip technology for more reliability and lower installation and operational costs.
• System 70™ fiber optic platform to support a wide variety of interactive services such as CoAxiom, and narrowcasting and work-at-home applications.
• A range of other headend, transmission and subscriber products that allow you to use the full capabilities of broadband networks to compete successfully.
• Even an advanced video network for the Olympics this summer in Atlanta to show what the future of television will look like.

SeaChange International

Sea Change Technology 3553
Phone .....
SeaChange International provides video servers and integrated systems for the television industry. Through its advances in dta networking, software engineering and service performance, SeaChange International is the leader in video server-based systems Booth visitors will see demonstrations of its Media Cluster extensible disk system, ad insertion, and movie deliverywith its partner IPC Interactive.

SENCORE

Sencore, Inc. 2278
Phone 800-736-2673
Sencore has been in the business of designing and manufacturing test instruments for the electronic service industry for over 45 years. During that time one aspect has always been of the utmost importance. "Provide a quality, highly accurate and reliable instrument that will be a benefit to the technician at a price they can afford." Sencore's new line of cable analyzed testing equipment feature innovative tests specifically designed to give the engineer or technician the information they need for complete system performance testing or just getting the customer back on line. Sencore knows the importance of keeping your customer satisfied with your service, after all they've been doing it for over 45 years. If you have questions about any of Sencore's new line of cable system analyzing equipment call **1-800-SENCORE** today.

Shoreline Prof. Video Systems 6008
Siecor 3218

SIEMENS

Siemens 2001
Phone 407-955-5000
http://www.ssc.siemens.com
Siemens with its partner Scientific-Atlanta will feature CoAxiom™, their jointly developed cable telephony product. In addition to CoAxiom, Siemens will be demonstrating an IMMXpress™ solution that brings video and full featured voice services over a single coax network. Siemens also provides a full range of telephony solutions from advanced switching services with EWSD®, to PCS via PACS Edge™, all managed by Siemens ServiceCoordinator™.

Sony Electronics 5301
Standard Communications Corp. 3411
Stanford Telecom 5055

Cheetah™

Superior Electronics Group, Inc. 3637
Phone 941-756-6000
Superior Electronics, through its Cheetah product line, offers a complete network monitoring solution for video and data applications. Cheetah solutions include status monitoring for headend and active devices throughout the cable plant including fiber nodes, power supplies and amplifiers. Cheetah monitors all major manufacturers devices. Cheetah also provides performance monitoring capabilities including spectrum analysis in the headend and end-of-line. FCC Proof-of-Performance are fully automated the Cheetah System.

Synchronous Marketing, Inc. 2659
TELECT 2268

TV/COM INTERNATIONAL

TV/COM S1230
Phone 619-451-1500
Have you kept up with TV/COM lately?...Neither has our competition. At Booth S1230, TV/COM will be exhibiting its latest technology. You can view the digital and analog product lines:
Digital:
• Compression NetWORKS™ System Architecture
• MPEG-2 Audio Compressors
• System Multiplexer
• MPEG-2 Video Compressors
• Transport Scrambler
Analog:
• SIGMA 2002 Decoder
• TecSat Decoder
• SIGMA Satellite Decoder
• SIMEX Receiver
• SIGMA MMDS Decoder

Telecorp Systems, Inc. 1636
Telewire Supply 4401

tellabs®

Tellabs 2251
Phone .....
Tellabs is a global company applying leading-edge technology to worldwide communications problems. Our CABLESPAN™ telephony-over-cable system allows cable operators to deliver traditional telephone (and other new) services to residential and business customers. TITAN® cross-connects economically provide SONET capability at headend, hub or point-of-presence locations provide a scamless, end-to-end SONET solution.

Terayon Corporation 1249
Texscan Corporation 5311
Time Warner Cable Full Ser. Nt 4223
Times Fiber Comm., Inc. 1801
Titan Information Sys. Corp. 4568
Toner Cable Equipment, Inc. 4655

Trilogy COMMUNICATIONS INC.

Trilogy Communications, Inc. 3224
Phone 800-874-5649
Manufacturer of exceptionally high quality, low loss, MC^2 air dielectric trunk and feeder cables, ideal for fiber-rich architectures aimed at Telco and CATV applications. Also offering a full line of quality drop cables including UL listed and corrosion protected, as well as Radiating and 50-Ohm hardline cables for wireless and RF communications.

Ubiquinet Inc. 6409
VLSI Technology, Inc. 6316

Viewsonics inc.

Viewsonics, Inc. 3414
Phone 800-645-7600
Viewsonics of Boca Raton, Florida, will be exhibiting their full line of amplifiers, including the **low noise** and **two-way** models. Their newest member of the amplifier family will be exhibited, as well, the low noise, 2-way amp in a **universal housing**. Also being shown are their 600 MHz and 1 GHz passives, filters, oscillators and their famous patented **Lockinator Locking System**. Viewsonics has been manufacturing these and more than 200 other products for over 22 years with sales in the US and worldwide.

Vuescan, Inc. 4245
Vyvx 3001
Wavecom Electronics, Inc. 6006

WEST END
A Newbridge Company

Wegener Communications, Inc. 5144
West End Systems Corp. 5137
Phone 613-623-9600
WEST END Systems Corp., an affiliate of Newbridge Networks Corporation, develops and markets ACCESS and TRANSMISSION products for the Cable TV and Telecommunications industries. Its WestBound 9600 Broadband Access Platform incorporates an advanced RF transmission technology (OFDM) to deliver voice and data communications to business and residential users via BROADBAND HYBRID/FIBER COAX networks, and its Janua series of Modular Packet Access Feeders provide managed access to frame relay, X.25 and ISDN networks. West End has corporate offices in Kanata, Ontario, Canada, regional offices in Herndon, Virginia, USA and Newport, Wales, UK, and R&D facilities in Arnprior, Ont., Canada.

Zenith Electronics 5109

Next Exit: Manhattan

CONVERGENCE™ Magazine's Digital Television & Internet Conference

May 21, Sheraton New York

Featuring ITA's Market Research Conference — May 20

ITA Interactive Television Association

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Fax: 303-329-3453

The issue: Indoor cable connections

The SCTE Interface Practices Subcommittee is seeking input on indoor cable connections. What are your thoughts regarding the ubiquitous F-connector?

The questions:

1. Has your system experienced damage to F-ports on consumer electronics as a result of pulling on the cable or jumpers?

☐ Significant damage ☐ Some damage
☐ Little damage ☐ No damage

2. Has your system experienced damage to consumer electronics (e.g., broken back panels or F-ports spun in the chassis) as a result of overtightening F-connectors?

☐ Significant damage ☐ Some damage
☐ Little damage ☐ No damage

3. Some say the number of service calls could be reduced by having the F-port more securely fastened in consumer electronics gear. Do you:

☐ Agree? ☐ Disagree? ☐ Don't know?

4. What are the most common causes of F-connector/cable related service calls inside the home in your system? (Mark only three choices)

☐ Connector pulled off cable ☐ Loose connectors
☐ Spun/overtightened F-ports ☐ Broken F-ports
☐ Poorly installed connectors ☐ Connector pulled off equipment
☐ Other (specify)_____

5. What are the most common causes of service calls that are not related to the drop or F-connector? (Mark only three)

☐ Poor splitters ☐ Poor amplifiers
☐ Wired wrong ☐ Trap problem
☐ Convertor ☐ Distribution system
☐ Shielding or isolation problem

6. On average, how many F-connectors are in the typical home:

Today_____ 5 years ago_____ 10 years ago_____

7. Some say consumers should have easier access to high-quality cable, connectors and tools. Do you:

☐ Agree? ☐ Disagree? ☐ Don't know?

8. What types of interfaces would be more user-friendly in the home?

☐ Push-on F-connectors ☐ BNC connectors
☐ Push and lock F-connectors ☐ Knurled coupling
☐ F-connectors are fine ☐ Audio-type connectors
☐ Winged coupling nut

9. Should F-connectors designed for consumer installation require a special tool?

☐ Yes ☐ No ☐ Don't know

10. Does your system offer custom wiring services, including audio and home theater?

☐ Yes ☐ No ☐ Don't know

11. Who pre-wires new homes in your area?

☐ Cable system ☐ Builder ☐ Cable contractor ☐ Homeowner

12. Do your personnel check for signal leakage after activating a pre-wired home?

☐ Yes ☐ No ☐ Don't know

Your comments:

Fax us at 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.

*Every month, we'll pick one response from those we receive and award $50. See official rules below.

Names won't be published if you request your name to be withheld, but fill out the name and job information to ensure that only one response per person is tabulated.

Your name and title

_____

_____

_____

System name:

_____

Location:

_____

Your MSO:

_____

Your job function:

_____

Daytime phone #:

Official rules: No survey response necessary. Enter by returning the completed survey via fax or mail to the locations indicated above, or print the words "CED Return Path" on a 3"x5" card and mail it along with your name, address, daytime phone number and signature. To be eligible for the drawing, entry forms must be received by 5 p.m. on June 30,1996. CED is not responsible for lost or misdirected mail. One entry per person. Forms mutilated, illegible or not in compliance with these rules shall be considered ineligible in the sole discretion of the judges. Odds of winning depend on the number of entries received. A random drawing from eligible entries will be held on or about July 1, 1996. Winner will be required to provide his/her social security number and proof of identification and is solely responsible for all federal, state and local taxes incurred. Prize is not transferable to any other person. Sweepstakes participants agree to waive any and all claims of liability against CED magazine, Capital Cities Media Inc., Capital Cities/ABC Inc. and its affiliated and independent contractors for any injury or loss which may occur from participation in this sweepstakes or receipt of the prize. Winner consents to publication of his/her name for publicity purposes without further compensation. Participants must be 18 years of age or older. Employees of CED magazine, Capital Cities Media Inc., Capital Cities/ABC Inc. and its affiliated and subsidiary companies, and their respective employees, agents and independent contractors, and their immediate families are not eligible to participate. Void wherever prohibited, license required, restricted or taxed by law. Sweepstakes sponsors reserve the right to change or modify the sweepstakes rules while the sweepstakes is in progress. Participation in the sweepstakes constitutes acceptance of all sweepstakes rules.

RESULTS

The issue: Outages

As cable companies enter a competitive era with other service providers, one key to eventual success or failure could be network reliability and outages. This month, we review your thoughts on the strides you're making to reduce outages and bolster reliability.

Most of the cable systems that responded to the survey have taken specific steps to reduce the number of outages they experience, but most respondents say they could do even more.

The typical system, according to the above data, still experiences between three and five outages per month, but more than half of the causes are from events operators have little or no control over. Interestingly, eight out of 10 respondents say their outages are caused by cable cuts or events "other" than weather, traffic accidents or electronic failures. The most often cited reason? Power company failures.

In spite of that, most systems have not worked with the local utility company to reduce those outages, even though most say their utilities are reliable and easy to work with.

Also, most systems say they have performed surveys to determine subscriber attitudes about outages and most also believe their HFC networks can be made as reliable as the phone company's network.

Congratulations to Greg Morley of TCI in Dillon, Mont. for winning our latest $50 drawing. To make yourself eligible, fill out the questionnaire on the previous page and fax it in!

The results:

1. Assuming that an "outage" is defined as a loss of signal for any length of time, how many outages does your system suffer in a typical month?

0-2	3-5	6-9	10+
19%	**52%**	**15%**	**15%**

2. Of those, how many are caused by system testing, maintenance or other internal operational policies over which you have control?

None	Few	Half	Most	All
11%	**56%**	**26%**	**4%**	**4%**

3. Of those outages you have no control over, what are they most typically caused by?

Weather	Cable cuts	Electronics	Traffic accidents	Other
22%	**41%**	**11%**	**4%**	**41%**

4. Has your system taken specific steps within the last 12 months to reduce the number of outages it suffers?

Yes	No	Don't know
81%	**15%**	**4%**

5. Do you think your system could do even more than it already has to reduce outages?

Yes	No	Don't know
74%	**22%**	**4%**

6. In comparison to two years ago, has your system reduced the number of outages it suffers, on average?

Yes	No	Don't know
81%	**19%**	**0%**

7. Has your system worked with the local power utility to reduce outages?

Yes	No	Don't know
41%	**56%**	**3%**

8. Overall, would you consider your local power company to be reliable and easy to work with?

Yes	No	Don't know
78%	**19%**	**3%**

9. Has your system performed surveys to determine subscriber attitudes about service interruptions?

Yes	No	Don't know
52%	**37%**	**11%**

10. In your opinion, can your system's cable network be made as reliable as the local telephone network?

Yes	No	Don't know
67%	**30%**	**3%**

Your comments:

"Out of 55 main line power supplies, we have only three on battery back-up. Can you guess why we have a problem here?"

– George Rezendes, TCI of Calif.

"Installing fiber with standby power at node locations has proven to be our biggest asset in outage reduction."

– Terry Draper, Flagstaff Cablevision

"Outages have decreased dramatically since we implemented an outage reduction program. These systems can be made as reliable as the phone system."

– Lyle Weimer, TCA Cable

"A fiber-to-the-feeder system, with quality-minded construction crews, has had a dramatic effect on our outages. After a year, we're still awaiting our first one!"

– George Goodrich III, Trans-Video, Northfield, Vt.

2-3 Fiberworks: Broadband Cable Television Technology (BCTT), produced by Antec. Location: Antec Training Center, Denver, Colo. Call (800) FIBERME for more information.

6-7 SCTE Regional Training Seminar. Topic: Introduction to telephony, with SCTE director of training Ralph Haimowitz. Location: Quality Hotel–Central, Phoenix, Ariz. Call SCTE national headquarters (610) 363-6888.

7-10 Fiber Optic Training, produced by The Light Brigade. Location: St. Louis, Mo. Call Pam Wooten (800) 451-7128.

7-10 Fiberworks: Fiber Optic System Training (FOST), produced by Antec. Location: Antec Training Center, Denver, Colo. Call (800) FIBERME for more information.

8-9 Planning for Cable Telephony, produced by Scientific-Atlanta Institute. Location: St. Louis, Mo. Call Bridget Lanham (800) 722-2009, press 3 to register.

8-10 SCTE Regional Training Seminar. Topic: Introduction to fiber optics, with SCTE director of training Ralph Haimowitz. Location: Quality Hotel–Central, Phoenix, Ariz. Call SCTE national headquarters (610) 363-6888.

13-16 Fiber Optic Training, produced by The Light Brigade. Location: Huntsville, Ala. Call Pam Wooten (800) 451-7128.

13-17 Broadband Communications Network Design, produced by General Instrument. Location: Portland, Ore. Call Lisa Nagel at (215) 830-5678.

14 Michiana SCTE Chapter, Technical Seminar. Topic: Standby powering and status monitoring, with Steve Skoufalos of Alpha Technologies. Location: Comfort Inn, New Buffalo, Mich. Call Russ Stickney (219) 259-8015.

14-16 Telecommunications Network Engineering for Technicians, produced by General Instrument. Location: Portland, Ore. Call Lisa Nagel at (215) 830-5678.

15 Pocono Mountain SCTE Chapter, Technical Seminar. Topic: The Internet and cable TV, with speakers to be announced. Location: Holiday Inn, Hazleton, Pa. Call Robert Trently (717) 454-3841.

15-17 Fiberworks: Introduction to Digital Communications (IDC), produced by Antec. Location: Antec Training Center, Denver, Colo. Call (800) FIBERME.

18 Razorback SCTE Chapter, Technical Seminar. Call Jack Trower (501) 327-8320.

20-23 Hands-on Fiber Optic Installation for Outside Plant Applications. Produced by Siecor Engineering Services Training. Location: Hickory, N.C. Call (800) SIECOR 1, ext. 5539 or 5560.

21 Convergence magazine's Digital Television & Internet Conference. Location: Sheraton New York, Manhattan. Call Fax-on-demand at (800) 488-1396, or Gary Lemons at (303) 393-7449 for additional information. Featuring the Interactive Television Association's Market Research Conference, May 20. Call (202) 408-0008.

22-23 Understanding Hybrid Fiber/Coax Design, produced by Scientific-Atlanta Institute. Location: San Francisco. Call Bridget Lanham (800) 722-2009, press 3 to register.

23 T1 Technical Seminar, produced by ADC Telecommunications. Location: ADC Corporate headquarters, Minneapolis, Minn. Call (800) 366-3891, ext. 2040 to register or for more information.

23 Big Sky SCTE Chapter, Technical Seminar and Testing Session. Location: Jackson Creek Saloon, Helena, Mont. BCT/E and Installer certification exams to be administered. Call Marla DeShaw (406) 632-4300.

27 San Diego SCTE Chapter, Technical Seminar. Location: To be determined. Call Kathleen Horst (310) 438-0295.

28-31 Fiber Optic Training, produced by The Light Brigade. Location: Philadelphia, Pa. Call Pam Wooten (800) 451-7128 for more information.

Trade shows

June

2-5 Canadian Cable Television Association's Annual Convention & Cablexpo. Location: Edmonton, Alberta. Call Christianne Thompson of the Canadian Cable Television Association at (613) 232-2631.

10-13 SCTE Cable-Tec Expo '96. Location: Nashville, Tenn. Call SCTE headquarters (610) 363-6888.

23-27 Supercomm '96. Sponsored by USTA and TIA. Location: Dallas, Texas. Call (800) 278-7372.

July

10-12 Wireless Cable '96. Location: Denver, Colo. Call the Wireless Cable Association Convention Services office at (202) 452-7823.

August

20-22
Great Lakes Cable Expo. Location: Indiana Convention Center, Indianapolis, Ind. Call (317) 845-8100.

25-28 Rocky Mountain Expo 1996. Location: Snowmass, Colo. Call the Colorado Cable Television Association at (303) 863-0084.

Zenith links Alabama docs with modems

GLENVIEW, Ill.–Utilizing cable modem technology from Zenith Electronics Corp.'s "MetroAccess" product line, more than 80 Alabama area physicians in 20 different sites have been linked to Huntsville Hospital, a 900-bed teaching hospital serving Huntsville and north central Alabama. The network connects physicians' offices, diagnostic laboratories and other related services. The schedule calls for an expansion to more than 400 physicians by the end of the year.

The high-speed modems enable doctors in the network to send and receive patient records, test results, and scheduling and billing information, according to Walt Langley, development director, information products for Teledyne Brown Engineering, a systems integrator that assisted the hospital in selecting and deploying Zenith's "HomeWorks Universal" cable modems.

Corning sets fiber transmission record

CORNING, N.Y.–Corning Inc., working in cooperation with Siemens, AG, recently announced the results of a test in which 80 gigabits per second (roughly equivalent to one million voice channels) were transmitted more than 350 kilometers over a single Corning SMF-LS non-zero dispersion-shifted fiber. The combination of the data rate and the distance is considered a transmission record over a single, uncompensated optical fiber system, according to Corning.

The experiment, conducted at a Siemens test facility in Munich, Germany, was designed to transmit eight channels at 10 Gbps per channel for 360 km. The signal was optically amplified at intervals of 90 km.

Corning's SMF-LS (Long Haul System) Fiber is a negative-dispersion fiber that has been optimized to allow the transmission of multiple, high bit rate channels in the 1550 nm window.

ComSonics, Falcon ink repair agreement

HARRISONBURG, Va.–ComSonics Inc. has signed a cable TV equipment repair partnership agreement with Falcon Cable, one of the top 30 MSOs in the United States. Under the terms of the corporate-wide agreement, ComSonics will service and repair all of Falcon Cable's cable television line, headend and test equipment from each of its cable systems in 43 regions of the U.S.

CADCO opens new facility

GARLAND, Texas–CADCO Systems Inc. (formerly CADCO Inc.) has moved to a new facility at 2363 Merritt Drive, Garland, Texas 75041-6174. Administrative offices, manufacturing and customer service are all located at the same address. The telephone numbers (800-877-2288; 214-271-3651) and fax (214-271-3654) remain the same.

Tellabs will expand in Bolingbrook

BOLINGBROOK, Ill.–Tellabs will expand its three-year-old manufacturing and research and development facility in Bolingbrook to more than 500,000 square feet, investing $33 million to complete the addition in mid-1997.

With the expansion, Tellabs projects an increase of 500 new jobs or more over the next four years.

Construction on the new 307,000 square-foot addition is expected to begin this spring. It will adjoin the present 236,000 square foot facility that was opened in the fall of 1993 on Tellabs' 50-acre site in Bolingbrook's Remington Lakes Business Park.

ADC signs MOU for China alliance

MINNEAPOLIS, Minn.–ADC Telecommunications Inc. has signed a memorandum of understanding (MOU) to work cooperatively to increase the availability of voice, data and video services throughout China.

ADC's partners in the alliance include China United Telecommunications Corp. (China Unicom), the Ministry of Electronics Industry (MEI) and the China Communications System Corporation (ChinaCom). Both China Unicom and ChinaCom hold a license to provide telecommunications services in China. ADC will work with China Unicom and ChinaCom to accomplish the goals set forth in China's five-year plan for deploying telecom services throughout the country. During the next five years, China will install between 75 million and 100 million new lines of telephony service; a significant portion of these services are expected to be delivered over a hybrid fiber/coax network.

The multi-phase agreement calls for lab and field trials, followed by deployment of ADC's Homeworx system in China. Lab trials are scheduled to begin in the spring of 1996, followed by a field trial this summer. Initial deployment of the Homeworx system is slated to begin in the second half of 1996, with large-scale deployment to follow. Customers served by the alliance will include cable TV operators, telephone operators, private network users and multi-national service providers. The agreement also provides that ADC will manufacture its hybrid fiber/coax telephony products in China. Shanghai ADC Telecommunications Equipment Co. Ltd. will provide the Homeworx system video equipment.

Optus Vision awards contract to Motorola

SYDNEY, Australia–The Motorola Multimedia Group has won a contract to provide Australia-based Optus Vision with more than $100 million of telephony interface equipment.

The agreement with Motorola, according to Optus Vision CEO Geoffrey Cousins in a prepared statement, re-affirms that the joint venture is on track to provide local telephone services beginning in the middle of this year.

Motorola will begin delivering its CableComm telephony equipment to Optus Vision in the second quarter of this year. It will provide access lines in one-, two- and eight-line units.

Optus Vision will begin commercial deployment of its broadband multimedia services in the second quarter of this year. Australian cities targeted for the commercial roll-out of the company's telephony, video and data services include Brisbane, Sydney, Melbourne and Adelaide.

Optus Vision is a joint venture between Optus Communications, Continental Cablevision, Publishing and Broadcasting Limited and the Seven Network Limited. It is building a broadband cable network that will pass 2.3 million Australian homes by the end of 1996.

Ando, Amphenol will do joint marketing

ROCKVILLE, Md.–Ando Corp. has reached an agreement with Amphenol Corp.'s Fiber Optic Product Group for the joint marketing of selected portions of Ando's fiber optic test and measurement products in the United States.

The agreement calls for Amphenol to supply Ando's mini-OTDRs, power meters, light sources and fiber optic talk sets.

"With the increasing diversity and broadening of the fiber optic customer base, it makes sense to align ourselves with an industry leader who supplies complementary products, enabling both companies to better serve their customers' needs," according to Michael Griffin, general manager, Ando Measuring Instruments Division.

Thomson picks ComStream for front-end

SAN DIEGO, Calif.–Thomson Consumer Electronics has chosen ComStream as its exclusive supplier for front-end technologies and products for the Tele-TV project. Thomson is the prime contractor for Tele-TV Systems' MMDS, designed to deliver up to 100 television channels to about 3 million homes beginning late this year. ComStream will supply the receiver front-ends, enabled by its custom components, receiving digital MMDS signals. The company will also supply modulators for the headends. CED

People on the move

J. Bowmar (Bow) Rodgers has been named chief operating officer at PowerTV Inc., a subsidiary of Scientific-Atlanta Inc. (S-A). Rodgers, who joined PowerTV as vice president of marketing in October 1995, will oversee the company's participation in a number of digital trials nationwide and pursue additional industry partnerships with content developers and hardware manufacturers.

S-A has also announced the appointment of **Patrick M. Tylka** as president, North American and Latin American sales, for its Broadband Communications Group. Tylka joined the company in 1988 as the U.S. northeast regional sales manager and was promoted to vice president of sales in 1991.

Patrick Tylka

James W. Davis, a former 25-year executive at IBM, has been named chief executive officer of Interaxx Television Network. A pioneer in VLSI design, silicon compilation and microprocessor architecture, Davis also earned recognition and honors for his efforts in the creation, development and marketing of IBM's popular PS/2 E personal computer. Interaxx has also promoted Kenneth Angle, formerly Interaxx senior vice president, to chief operating officer.

Lucent Technologies, formerly AT&T's systems and technology business, has named **Arthur P. Mederios Jr.,** as president of its Caribbean and Latin America region for its Network Systems business. Previously, Mederios was a 22-year veteran at Nortel, where he held a number of senior positions in sales, business development and marketing. He will be based in the company's regional headquarters in Coral Gables, Fla.

Lucent has also appointed **David C.W. Rogers** as president of its Network Systems business in Europe, the Middle East and Africa. Most recently, Rogers was chief executive of AMSTRAD Plc, a consumer electronics business in the United Kingdom.

PCS Solutions, a 50/50 joint venture company formed by PCS Wireless and ADC Telecommunications earlier this year, has named **Richard M. Lee** as its president and general manager. Most recently, Lee was executive director of engineering at PCS PrimeCo/US West. Lee will direct PCS Wireless' efforts in developing and manufacturing cable television-based microcellular products based on distributed antenna array technology for use in hybrid fiber/coax networks.

Digital Broadcast Corp. (DBC), a burgeoning wireless cable system operator, announced the election of **Emile Nerlinger**, a 45-year veteran in the fields of broadcasting, publishing and advertising, as its new chairman and chief executive officer. DBC has also appointed **Joel A. Strasser** as its vice president of marketing and corporate communications. Upon his appointment, Nerlinger noted that DBC has wireless cable licenses and system agreements in place for markets totaling over 2 million line-of-sight homes, and that its goal "is to achieve 10 to 15 percent penetration over the next five to seven years" in those markets.

General Instrument Corp. has welcomed one of its own back into the fold with the announcement that **Dr. Woo Paik** has rejoined the company as executive vice president of technology for its communications division, western operations. During his previous 17 years with GI, Paik became one of the key inventors of GI's VideoCipher II system, as well as co-inventor on more than 20 U.S. patents in the areas of digital video compression, transmission and signal processing. "It's great to be home," said Paik after the announcement was made. "I'm pleased to rejoin my friends and associates of so many years, and I look forward to continuing our exciting work."

Meanwhile, over at TCI International Inc., **Wayne Gowen** has taken over as senior vice president of telecommunications. In this new position, Gowen will oversee the implementation of telecommunications services in the company's worldwide cable operations. The company is a partner in cable network ventures in 16 markets, including the United Kingdom, Japan and Argentina. Most recently, Gowen was managing director of telecommunications for Comcast Europe, which owns and manages cable systems covering more than 1.5 million households in the United Kingdom.

U.S. Computer Services (USCS) has appointed **Claudia Coleman** as vice president of corporate development, where she will be responsible for identifying and recommending new acquisitions, joint ventures and business alliances. A 20-year financial professional with extensive experience in strategic planning, finance and corporate development, Coleman has been an investment banker for 10 years with Alex Brown and Sons.

Claudia Coleman

USCS' subsidiary, International Billing Services (IBS), has named **Dawne Chandler** as its vice president of business improvement and quality. She will serve as an internal business improvement expert to maximize IBS quality and productivity. Prior to joining IBS, Chandler was manager of quality and business processes for IBM Corp. in Sacramento, Calif.

Dawne Chandler

Cox Communications Inc. has appointed **James H. Renken** as its new director of telephone operations. In this new position, Renken will be responsible for the coordination and oversight of Cox's telephony trials, and will direct the planning of the MSO's system-wide telephone roll-out. He brings nearly 20 years of experience in broadband services deployment with SBC Communications to his new role at Cox. While at SBC, Renken served in a variety of management activities dealing with residential, small business and public telephone services, as well as strategic planning for consumer sales.

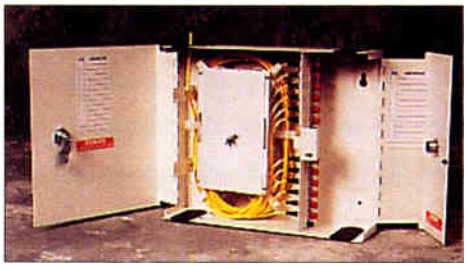
Hunter Shaw has joined Rifkin & Associates Inc. as its director–new business development. Formerly director of new business development with TCI Great Lakes Division, Shaw will spearhead Rifkin & Associate's efforts in data networking, advanced PPV, distance learning and telephony, among others.

Barco has announced the appointment of **David Wright** as eastern regional sales manager. In his new position, Wright will be responsible for sales of the company's cable TV products in the eastern United States. He is based in Winter Park, Fla. and brings more than 20 years of experience in the communications industry to his new position. Prior to joining Barco, Wright was a district sales manager for Panasonic Broadcast and Television Systems, where he managed sales of digital video products to the cable industry, television stations and post-production facilities. CED

Wall mount panel for tight spaces

LIBERTY LAKE, Wash.–Telect has announced the introduction of its new LANLINXS II Wall Mount Panel designed for outside plant, riser and building cable applications.

The smaller, lockable design has been specially configured for those applications where space is limited. The panel is user configurable for different fiber counts (12 or 24 fiber capacity) and allows for complete independent access for utility and customer compartments with its double-door design.

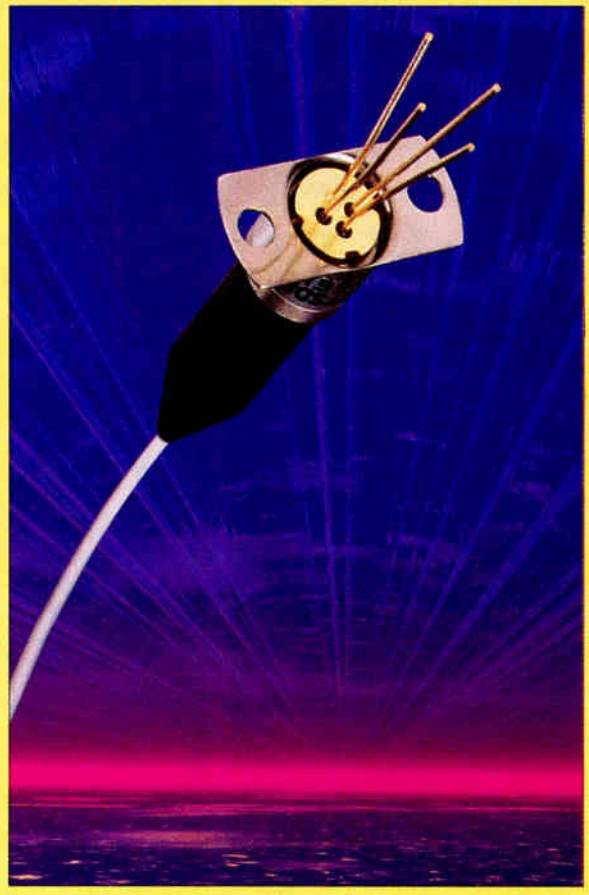


Telect's LANLINXS II Wall Mount Panel

Cable routing arcs provide ample room for routing cable, and cable entry grommet covers help seal the panel from dust and debris, as well as decrease maintenance by protecting connectors and splices. The panel also has an external cable clamp option that secures cable externally for improved internal cable routing.

Circle Reader Service number 58

Return path laser module

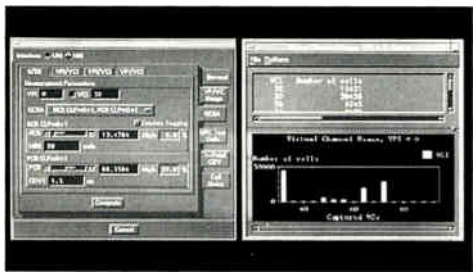


SAN JOSE, Calif.–The Electronic Device Group of Mitsubishi Electronics America Inc. is introducing one of the first distributed feedback (DFB) laser modules designed for video and data return path applications in cable television systems.

The module has been designed with the increased bandwidth demands from the home in mind as more applications, such as telephony,

ATM traffic policing module

PALO ALTO, Calif.–Hewlett-Packard Company has introduced its new Policing and Traffic Characterization Test Application module (HP E4223A) that enables both ATM switch manufacturers and network operators to verify that the policing functions of network equipment are operating correctly.



Sample menu from HP E4223A test module

Network operators can use the module to detect traffic policing problems for research, as well as for troubleshooting applications (e.g., to resolve customer-service issues by verifying that traffic policing is performing properly and traffic contracts are being met).

CPE (Customer Premises Equipment) manufacturers can use it to verify and validate the traffic-shaping implementations of equipment, such as ATM network-interface cards. ATM manufacturers can use it to test their equipment's policing implementation and performance.

The new software application runs on the E4209A/B cell protocol processor (CPP) of HP's Broadband Series Test System (BSTS) and works with all ATM line interfaces supported by the CPP. It also provides easy-to-use stimulus-and-response testing capability for both single and dual leaky-bucket traffic policing implementations, as defined by the ATM Forum specifications UNI 3.0, 3.1 and ITUT I.371.

The HP E4223A module allows users to define and generate both conforming and non-conforming cell streams for all types of line interfaces using the BSTS' traffic-shaping mechanism. Policing conformance then can be verified on the receiver side by entering specified Generic Cell Rate Algorithm (GCRA) parameters, such as peak cell rate (PCR), cell-delay variation (CDV), sustainable cell rate (SCR) and maximum burst size (MBS). The software also computes and provides counts of tagged cells, discarded cells and discard violations detected during testing.

Circle Reader Service number 59

Fiber protection equipment

CONOVER, N.C.–Norscan Inc. is now offering a full line of fiber optic cable protection equipment for the outside cable plant.

Norscan's line of fiber protection equipment

The company's high-voltage protection equipment is used at offices and field splice points to protect both personnel and electronic equipment from high voltages caused by lightning or power lines and reduces all levels of induced 60 Hz voltages.

The 2745 Sheath Grounding Unit (SDU)

Mitsubishi's DFB coaxial package return path laser module FU-427SDF

data, games and other interactive services become a reality.

Mitsubishi's return path laser module, FU-427SDF, uses advanced multiple quantum well (MQW) laser technology and features an optical isolator to reduce reflected noise.

The new module utilizes a small coaxial package and has a wide operating temperature of -40°C to +85°C. The module is scheduled to be available in the second quarter of this year and will be priced at $800 for quantities of 100.

Circle Reader Service number 57

offers protection, as well as easy access to the cable armors and earth ground at splice points in below-grade housing.

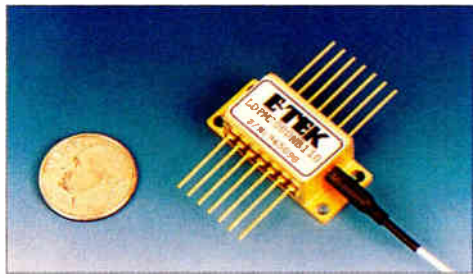
All Norscan outside plant protection equipment is also compatible with rack-mounted, long-range tone location systems. Other packages are available, such as the 3200 CORAM, which mounts above-ground in pedestals for easy access and protection equipment mounting.

Circle Reader Service number 60

Variable attenuator

SAN JOSE, Calif.–E-TEK Dynamics Inc. has announced the Miniature Fiberoptic Variable Attenuator (MFVA), a polarization insensitive tool for adding attenuation to optical fiber paths. The attenuation is adjusted with a few turns of the set screw. It uses reflective optics to reduce size and provides a board-mountable package. The MFVA is a repeatable, stable device for laboratory or field use.

The company has also introduced its new 1550 nm Laser Diode Power Module (LDPM), which delivers more than 20 mW of power. It includes a distributed feedback (DFB) laser diode, thermoelectric cooler (TEC), monitor photodiode, isolator and pigtailed singlemode



1550 nm laser diode power module

(SM) or polarization maintaining (PM) fiber. The package is a hermetically-sealed 14 pin Dual In Line (DIL) or butterfly style. The laser modules are designed for high-power continuous wave (CW) optical sources for analog applications using an external modulator.

And finally, E-TEK has introduced a new eight-channel Bandpass Wavelength Division Multiplexer (BWDM). The filter has a wide passband which allows for relaxed laser wavelength tolerances. A stable interference filter with a nearly square shape bandpass spectrum is packaged individually for each specific user selected wavelength. The individual filters are cascaded and assembled in a single housing. A minimum 25 dB channel isolation is guaranteed over the eight wavelengths, with channel spacing of 3.2 nm.

The cascaded filter construction allows E-TEK to vary the filter sequence, matching filter insertion loss to EDFA wavelength dependent system losses, for a balanced power output at the eight channels. The packaging uses proven isolator packaging techniques, says the company. All filters are epoxy free in the optical path.

The BWDM is designed for dense WDM applications. It is used for narrowband, high capacity communications systems up to 20 Gigabits, which are now being designed and deployed. The unit is bidirectional, and thus, can be used as either the multiplexer or the demultiplexer.

Circle Reader Service number 61

Composite cables

RICHMOND, Ind.–Belden Wire & Cable Company has announced a new series of Composite Cables that incorporate multiple twisted pairs with high-quality coaxial cable. Targeted at telecommunications and cable television companies, Belden's new cable is designed for applications that require simultaneous transmission of video, data and voice.

Users can choose from a variety of coax sizes, shields, twisted pair counts, gauges and special configurations. Coax size choices include Series 6, with a 189 AWG center conductor; Series 7, with a 16 AWG center conductor; and Series 11, with a 14 AWG center conductor. All center conductors are copper-covered steel. Coax shield choices include Belden's Duobond II, Duobond III, Duobond Plus and the high performance Duobond IV (quad shield). Twisted-pair options include 2-, 3-, 5- or 6-pair constructions, with either 22 AWG or 24 AWG solid copper conductors, in either shielded or unshielded configurations.

For underground applications, the cables can be specified with filled coax and twisted pairs. For self-support aerial applications, they can be ordered with high-strength galvanized steel messenger wire. All cable configurations are available with either polyethylene or PVC jacketing.

Circle Reader Service number 62

Hard rubber pads

NEW BEDFORD, Mass.–Fiber Optic Center Inc. is now offering a line of hard rubber pads for machine and hand polishing of singlemode and other fiber optic connectors.

The new pads are available in a range of sizes including 4, 5, 6 and 8 inches, all with a 3/16-inch thickness. Connectors that can be polished using these pads include FC/PC, SC/PC, ST (an AT&T trademarked product), as well as angle or APC versions of all those mentioned. The pads may also be used in high-power laser, medical, sensor, spectroscopy, instrumentation, research and testing, and applications for curved surfaces on SMA and other fiber optic connectors.

Circle Reader Service number 63

Single chip ASIC modulator

SUNNYVALE, Calif.-Stanford Telecommunications Inc. and its Telecom Component Products Group has introduced a new modulator chip for hybrid fiber/coax (HFC) cable television networks. The new chip, STEL-1108, is a key component in the transmission of digital video, telephone and data from subscriber premises to cable television headend equipment.

Designed as an upgrade of the STEL-1103, the STEL-1108 provides better performance in clock rate, duty cycle and burst capability, as well as posting lower power consumption. The chip can operate in continuous mode, allowing for use in both burst and point-to-point systems.

The STEL-1108 is a complete QPSK modulator on a single chip that features clock speeds up to 126 MHz and operates at up to 12.6 Mbps in QPSK mode. A 126 MHz Quadrature NCO provides digitally modulated carriers from DC to 50 MHz continuous mode, which simplifies upconversion of signals to higher frequencies.

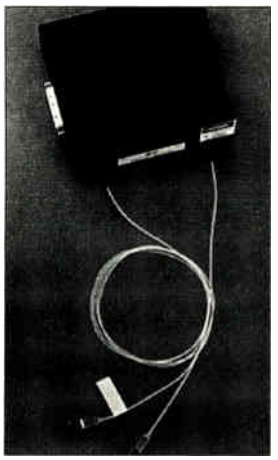
The device has dual 32-TAP FIR filters that are programmable for digital spectral shaping.

Circle Reader Service number 64

Fiber optic series

BERKELEY HEIGHTS, N.J.–Lucent Technologies (formerly AT&T's systems and technologies business) has introduced a series of new fiber optic products.

A new laser module and an optical amplifier let cable television and network providers build larger networks with substantially lower costs per subscriber, according to Lucent. Both components, the 270-type laser and the 1720 erbium doped fiber amplifier (EDFA) were designed by Bell Laboratories.



1720-type EDFA

The high output power of the 270-type, Astrotec 1.3 micron multifrequency multiple quantum well (MQW) laser module can achieve data rates in excess of one gigabit per second (Gbps). The 270-type laser module contains a hermetically-sealed laser capsule with a backfacet monitor photodiode and is packaged with an industry-standard singlemode fiber pigtail. The pigtail is available with an 8-degree angled polished connector to reduce system reflection.

The 1720 EDFA is designed for cable TV networks, enabling them to split video signals among more users at farther distances, thereby reaching more subscribers per transmitter at a lower cost per subscriber. The optical amplifier operates at high optical powers, up to 16 decibels per milliwatt (dBm).

Lucent has also announced six new optical fiber grating products for use within lightwave component systems. The fiber gratings can selectively reflect or transmit various wavelengths of light. They are embedded within optical fibers and allow for improved performance of fiber optic devices. The new gratings are a 980 nm stabilizer; 980 nm and 1480 nm pump reflectors; a YAG reflector; a 1550 nm signal reflector; and an amplified stimulated emission (ASE) suppression filter.

Finally, Lucent has announced a line of space-saving, low-power components that have been added to the Astrotec product family. Designed by Bell Laboratories, they are compatible with high-speed Sonet/SDH applications. Two of the devices, the Astrotec 1227Y transmitter and Astrotec 1229 distributed feedback transmitter (DFB), break new ground, says Lucent. The newly-designed DIP (dual in-line packaging) laser transmitters support Sonet 60 km long-reach requirements and operate over a -40 to +85 degrees C temperature range without requiring thermoelectric coolers. Different connectorized options are available.

A 1330-type Astrotec receiver rounds out the offerings.

Circle Reader Service number 65

High-power photodiode

SAN JOSE, Calif.–Ortel Corp. has announced a new high-power photodiode with "dramatic" improvements in the gain, noise and dynamic range of optical links used extensively to remote radio frequency (RF) and microwave antennas. The high-power photodiode has the ability to accept 750 percent higher optical input powers without damage or distortion.

The new photodiode accepts optical powers of up to 15 mW rather than the approximate 2 mW for typical high frequency photodiodes. Higher optical power results in higher RF gain, higher RF power and higher dynamic range.

Ortel's proprietary approach provides quality performance even at frequencies up to 15 GHz, according to the company.

Circle Reader Service number 66

Flaw detector

ROCHELLE PARK, N.J.–Anritsu America has introduced the KL801A, a flaw detector that quickly and accurately identifies lumps and neckdowns in coated optical fiber, according to the company. Using a triple axis detection method, the KL801A detects partial flaws that are more than 60 degrees in circumference, 5 µm high, and 500 µm long in optical fiber running as fast as 1,000 meters per second.

For accurate measuring, the KL801A simultaneously monitors three separate measurements. Each axis performs measurements in 20 µs detection periods, for 50,000 times sampling per second. The flaw detector has a measuring area of 2.0 mm over a range of 0.1 to 1.0 mm.

The KL801A uses high-speed scanning laser beams, rather than the method of change of light quantity. As a result, the unit's measurements are not affected by fiber vibration and fiber-position change and are independent of flaw shape. An analog output option allows the KL801A to determine not only the location of the lump or neckdown within the optical cable, but also the size.

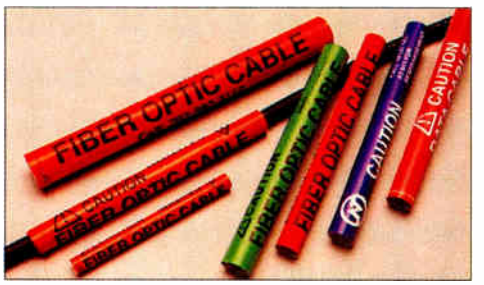
The KL801A consists of an optical unit and a processing unit. With a press of a button, the optical unit measures the optical cable and sends a signal to the processing unit. The exact location of the fiber being measured is clearly displayed on the processing unit.

Circle Reader Service number 67

Fiber grabbers

HOUSTON, Texas–VIP Products has announced three lines of Grabbers designed for quick fiber optic identification. Made of rigid plastic, the markers are partially unrolled and then easily snapped around innerduct, conduit or fiber optic cable.

The tight mechanical grip allows the Grabbers to be used on ribbed or corrugated



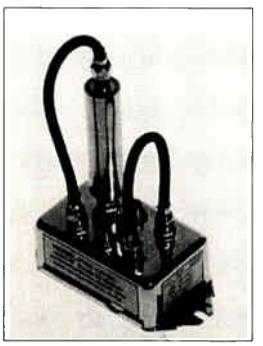
Grabbers for quick fiber ID

cable where adhesive labels fail, according to the company. Stock markers conform to industry and government specifications as to size, colors and legends. Stock OD dimensions range from 0.375 inches to 2.00 inches, with lengths from 4 inches to 8 inches. In addition, the orange background meets APWA color code for telecommunications. Custom grabbers are available in larger sizes, any color, and with custom legends.

Circle Reader Service number 68

Coaxial transfer switch

EAST SYRACUSE, N.Y.–Communications & Energy Corporation Inc. has introduced the Model 7001, a voltage-operated coaxial transfer switch. The DPDT switch has two selectable "loop circuits." When activated, the switch transfers one loop into the line, while disconnecting the other loop. Either an RF device or a coaxial jumper may be used in either of the loops, hence the switch will connect or disconnect a variety of devices either into or out of a coaxial cable line.



Coaxial transfer switch

The transfer switch operates on 12 VDC and requires 90 mA. Passband is 0 to 1 GHz, with an insertion loss of 0.5 (typical). Maximum passband insertion loss is 1.0 dB. Isolation is 50 dB (minimum). Connectors are 75-ohm, Type F. The unit measures 2 x 2.5 x

5 inches and weighs one-and-a-half pounds.

Circle Reader Service number 69

Multiple tool kit

PHOENIX, Ariz.–Jensen Tools has introduced the Multi-Tool Kit. The kit includes the SOG Paratool, the Mini Maglite and a miniature 4-in-1 screwdriver in a sturdy, Cordura Plus three-pocket pouch with a belt loop.

Multi-Tool Kit

The Paratool features needle-nose pliers, a 3-inch straight point blade, a 3-inch serrated sheepfoot blade, three flat-head and one Phillips screwdrivers, a can/bottle opener, awl, file (fine, coarse edge cut), thumb tab/lanyard hole and measuring scale. The length open is 6.4 inches; closed, it's 4 inches.

Circle Reader Service number 70

BTSC video modulator

MIAMISBURG, Ohio–The R.L. Drake Company has announced its VM2552A BTSC stereo modulator, a vestigial sideband modulator that accepts video and audio baseband signals from a satellite receiver or similar audio/video equipment. The unit is designed to provide systems with stereo audio capability and reliable operation in a densely crowded cable environment.

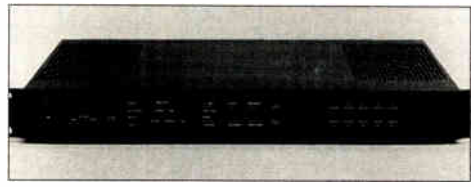
Beginning in 1997, the FCC will require many cable systems to be equipped for the Emergency Alert System (EAS). The EAS broadcast gives viewers instructions on where to go and what to do in the event of an emergency or disaster. Drake has designed the VM2552A to be EAS ready with alternate composite IF inputs. The unit's EAS ready system can be used by operators to broadcast emergency information.

The company has also launched its TSM1000 TV/Satellite Meter, a tool for the cable installer and service technician. The TSM1000 is a portable test set also designed for measuring and optimizing satellite receiving systems direct from the LNB. It measures cable television signal levels, and signal levels on terrestrial TV installations in FM broadcast, VHF and UHF bands. The measurement range of 20 µV to 3 volts in all VHF and UHF bands makes it easy to verify the operation of an antenna or cable system, without the need for external attenuators, according to the company. Both AM and FM audio demodulation is also provided in these bands. Measurement scales are selectable by front panel push buttons in steps of 10 dB, while frequency is indicated by a four-digit LCD display.

Circle Reader Service number 71

Demodulators

POTTSTOWN, Pa.–Videotek Inc. has released a new version of its DM-154 Demodulator. The unit is a 154-channel, high performance, cable-ready agile demodulator. It lends itself to broadcast video testing due to its Zero Carrier Chopper Mode, its ICPM Quadrature Output, its IF Loop Capability and its Composite Audio Out for stereo testing or remodulation. It's also suitable for cable FCC Proof of Performance tests and industrial video measurement requirements.



DM-154 Demodulator

New features and functions consist of a composite audio output; this audio output is user-selectable via internal jumper to 4.5 MHz aural, or wideband audio outputs. These new features simplify remodulation techniques for cable headends and other environments.

It contains features beyond standard tuners, including RS-232 remote control capabilities, synchronous detection, and MTS Stereo and Second Audio Program (SAP) decoder outputs.

Videotek has launched another new product to its demodulator family, the DM-145, a 154-channel, agile cable ready demodulator. The unit lends itself to the monitoring of broadcast and cable channels and provides simultaneous Stereo Audio and Second Audio Program (SAP) outputs.

Some of the unit's features include agile tuning capability, synchronous detection and two baseband video outputs. Within the specification are left and right BSTC (MTS) XLR audio outputs, simultaneous SAP output, front panel LED channel display and HRC/IRC offset tuning capability.

Circle Reader Service number 72

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Providing access to the universe

By Thomas G. Robinson, Director of Regulatory Affairs and Technology Development, River Oaks Communications Corp.

Have a comment?
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When I look at the Telecommunications Act of 1996 ("1996 Act"), it appears to me to be somewhat like Comet Hyakutake in that both have been hailed as spectacular events, but to the naked eye, it all seems a bit fuzzy. Additionally, there are some people who hope that Congress and the subject of telecommunications don't get in close proximity to each other for another 15,000 years.

Although the focus is squarely on promoting vigorous competition in a variety of telecommunications marketplaces, there are several provisions targeted directly at the public interest in the 1996 Act. One of these is the section pertaining to universal service, especially the language in Sections 254(h)(1) and (2) that provides for preferential access to basic and advanced telecommunications and information services for elementary and secondary schools, libraries and health care providers. As the Conference Committee pointed out, this provision is designed to promote universal access which "will assure that no one is barred from benefiting from the power of the Information Age." Specifically, the intent of the section is that health care providers, K-12 classrooms and libraries will have "affordable access to modern telecommunications services that will enable them to provide medical and educational services to all parts of the Nation." Such modern telecommunications services could include dedicated data links to information resources and other public institutions. The use of such services would, in turn, lead to the presentation of "new worlds of knowledge, learning and education to all Americans–rich and poor, rural and urban."

The FCC, the recently appointed Federal-State Joint Board and the various state Public Utilities Commissions (PUCs) have a significant amount of work to do to implement these provisions over the coming months. It is likely that the rulemaking proceedings generated by these groups will see extensive comments filed by the affected entities: school districts, libraries, health care organizations and telecommunications providers. The hope is that the ultimate goal of the provision–at least one point for everyone in this country to access and benefit from continually advancing telecommunications services–will not be lost in all the potential bureaucratic wrangling. As noted in the March 1996 issue of *American Libraries*, Betty J. Turock, president of the American Library Association, feels that this provision will enable libraries to "provide information to all Americans who need it," and that it will further the Clinton Administration's goal of Information Superhighway access for every library and school by the year 2000.

The importance of universal access to advanced telecommunications services as a stepping stone to true universal service, and its potential to help close the gap between information haves and have-nots, is pointed up by the success of a number of universal access projects currently in place around the country. One such endeavor, Access America, a project of the Fairfax Cable Access Corporation (FCAC) in Fairfax, Va., is especially notable in that it represents a public access television and radio center expanding its role in public access to cyberspace. Officials at FCAC and other public access centers across the nation believe that this type of access is the next logical step in turning traditional public access television centers into broad-based community telecommunications access and learning centers.

Computer literacy and advanced services

There are many reasons why this type of project is important. First, for many people, something as simple as accessing the Internet initially seems as complicated as understanding Comet Hyakutake's origins. Facilities like Access America allow the public the ability to obtain computer literacy in a non-threatening environment.

Second, continual, ready access to a personal computer and a connection to the Internet are still not the norms for most Americans. As for other forms of education, socioeconomic status plays a role in levels of computer literacy, as well as ability to access telecommunications services. Access America helps equalize this situation by providing training, computers and free access to the Internet at its facility for any that need it. Third, the Access America project is facilitated in large part through partnerships with private industry. Such facilitation indicates, as Congress discerned, that private participation in universal access efforts, through partnerships and preferential or no-cost service access, can have significant positive effects in fostering the public interest in this area.

The City of Fort Collins, Colo. Public Library's public access computers project offers a good example of how local governments and their public libraries can work to help facilitate universal access. In the fall of 1995, Fort Collins launched the project by providing two computers, shared T-1 Internet access and educational classes on the use of computers and Internet research tools. To date, this project has been very successful.

The computers are in continual use; so much so that a private sector grant was obtained to double the number of available computers. As with Access America, the focus is to provide computer literacy and access to advanced services to the community, and here again, it's clear that assistance by the private sector to public sector efforts can play a major role in helping these efforts evolve.

When you employ special measures, even one as simple as a pair of binoculars, Comet Hyakutake becomes a lot more than a cosmic fuzz ball. With a telescope, it even becomes a spectacular celestial event. Similarly, if the special measures provided for in the 1996 Act are employed in the appropriate way, it will help ensure clear access to the coming universe of telecommunications services for all members of the public. CED

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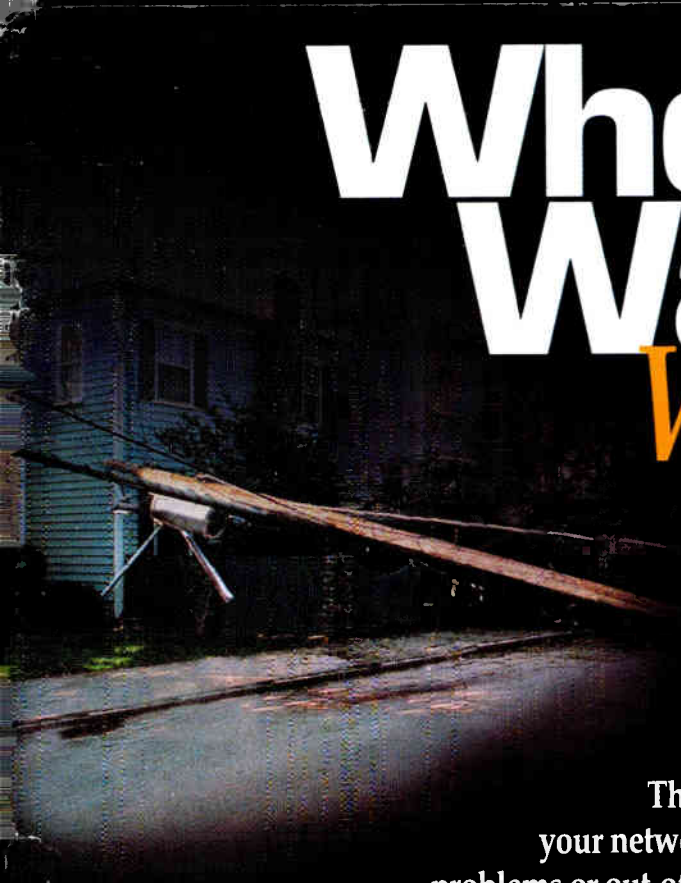

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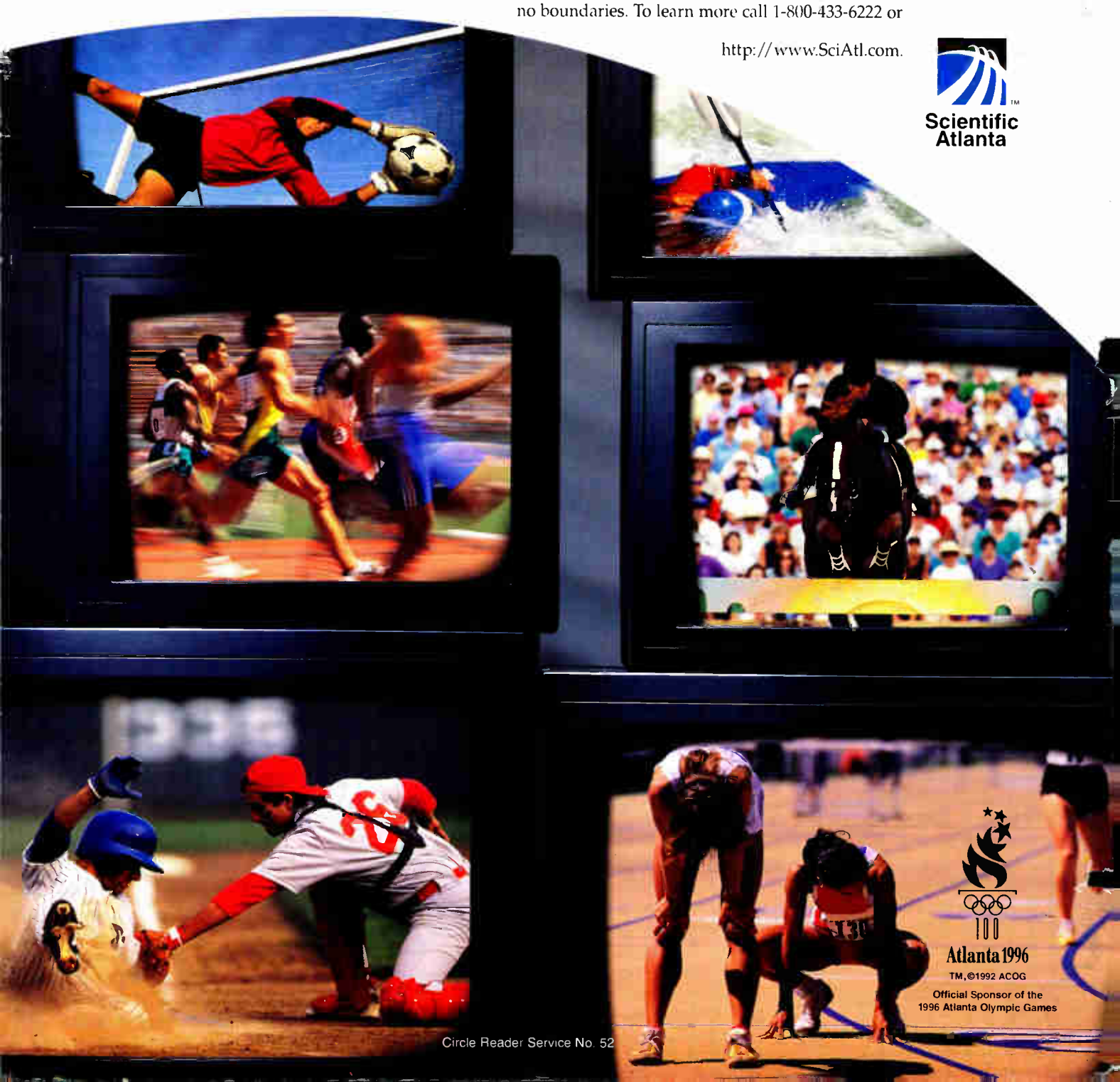

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