MAY 1997

CED

COMMUNICATIONS ENGINEERING & DESIGN
THE PREMIER MAGAZINE OF BROADBAND COMMUNICATIONS

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1997 CED Orbital Arc Chart

Cable Telephony:
Will operators *ever* get connected?

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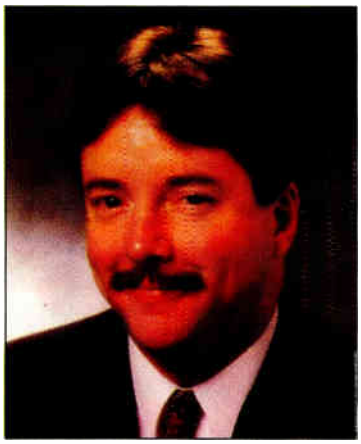

Backlash is music to an operator's ears

Think you've got it rough when it comes to dealing with your local franchisor? Read this, and you might think again.

Take a look at the nascent personal communications services industry. Remember how excited everyone got when this new service was proposed? It seemingly had something for everyone–smaller cellular telephones with longer battery life, digital modulation, and cheaper prices, to boot. Along with the service came the vision of one person/one phone number and a host of other intriguing possibilities.

Everyone bought in. Major telecommunications companies (including several of the nation's largest MSOs) spent billions of dollars to garner licenses in the major trading areas around the country. The high-profile and lengthy spectrum auction was covered by virtually every media outlet. Everyone, it seemed, was happy.

Until the networks started to be constructed, that is. The problem is, a conventional PCS system requires large, unsightly towers for the transmit and receive electronics. Lots of them. And people don't like them.

Already, a groundswell of opposition is being felt across the country. According to recent press reports, no fewer than 170 communities have instituted moratoria on new cell tower construction, including 26 in the lucrative California market alone. Court challenges are underway almost everywhere.

Make no mistake: the opposition isn't just about aesthetics. More and more people are increasingly concerned about the health risks posed by cell tower radiation. In fact, a group of residents in south Florida became so upset about an agreement between their local school district and a PCS provider that they lobbied the local government to place a 90-day moratorium on tower construction.

Predictably, some wireless operators are fighting back in an effort to carry out the very thing they bought the rights to do–build a network. They're being perceived as bullies and "arrogant," according to one story I read.

With opposition mounting, some companies are having a hard time getting the financing they need to finish construction. In response, the FCC recently decided to relax its March 31 deadline for license fee payments.

But maybe there is a solution: PCS over cable TV lines. An upgraded hybrid fiber/coax network can be used to transport wireless voice services as well as the video signals everyone is familiar with. Such systems have already been deployed, and more will be soon.

The wary cable system designer and operator would be smart to investigate the possibility of offering PCS services, either as a carrier or as a full-fledged operator. This time, you might actually have the strength of public opinion on your side.

Roger J. Brown

Roger Brown
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Reader Service 2

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Illustration by Rob Pudim

34 Will cablephone ever take off?

By Michael Lafferty

While some have labeled HFC cable telephony as a "dead duck," others are continuing to develop technology, trials and roll-outs for the day cable telephony takes flight.

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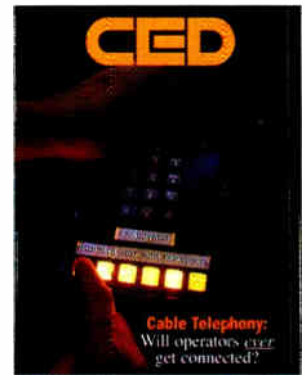

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Photo by Mark Sims

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By John Kenny, Antec Technology Center

This article focuses on understanding how over-driven optical transmitters degrade digitally modulated carriers. Analysis and experimental findings have uncovered several factors which influence the performance of reverse path optical transmitters used for transmitting digitally modulated carriers.

52 Plotting a standards course

By Robert B. Russell, 802.14 Working Group

The IEEE 802.14 committee is busily charting a course to develop standards for the transport of high-speed data over networks. The Working Group's chairman explains the group's goals, and provides an update on the status of its work.

58 Cox launches telephony in Orange County

By Dave Woodrow, Cox Communications; and Guy Gill, Nortel

While some MSOs are shying away from telephony, at least for the moment, Cox Communications is going full-speed ahead with the launch of wireline telephony services to residents of a development in Orange County, Calif. This case study reveals the company's roll-out schedule and equipment platform, as well as insights from Cox's executive engineering staff and others involved in the project.

66 Putting data under lock-and-key

By Gerry White, Bay Networks Inc.; and Chet Birger, Internetworking and Security Consultant

Simply by virtue of being a shared-medium communications channel, the hybrid fiber/coax-based data network is vulnerable to attack via forgery, theft of service and eavesdropping. The good news is that cryptographic techniques can address all of these security issues–and cost-effectively. The trick is balancing security and cost. Part 2 of 2.

72 Safety as profit preserver

By Craig Kuhl

Heard the expression, "There's safety in numbers"? Well, the converse is also true–there are numbers in safety. Sound safety practices not only boost employee morale and improve the workplace, but they also improve the bottom line. Cable companies are saving millions of dollars by implementing new safety programs, and are improving their image, to boot.

76 Telecom Perspective

By Fred Dawson

Next-generation Ka-band fixed satellite services (FSS) scheduled for launch in 1999 and beyond may alter the competitive equation. While they can't, by themselves, challenge regionally ubiquitous HFC networks, they do have the power to boost other competitors to cable.

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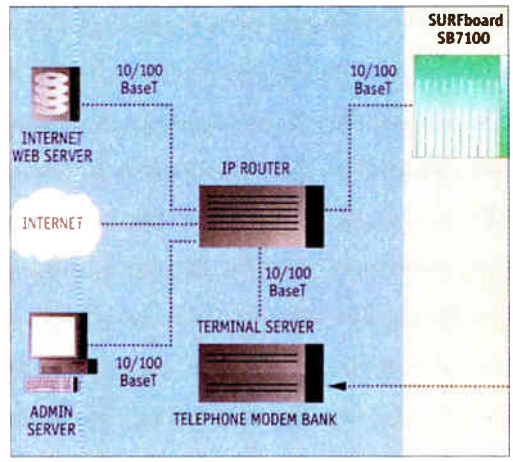

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Can the direct-to-home satellite industry offer all the local programming that subscribers really want? Robinson doesn't think so.

Is ingress making your return path a road to nowhere?

Ingress is the major roadblock to getting your return path up and running. Fortunately, there's the new HP CaLan Sweep/Ingress Analyzer. It's the only test gear that allows you to quickly and accurately troubleshoot your system, regardless of the presence of ingress.

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Reader Service 6

TCI names digital box 2nd source; S-A licenses Sun's chip technology

It's been a long, long wait, but finally there is activity brewing around digital set-top terminals.

After working for roughly two years to get details worked out, TCI Technology Ventures said it found a suitable second source for General Instrument-compatible set-tops–but it had to go overseas to do it.

Pace Micro Technology, a U.K-based manufacturer of satellite TV receivers and the first company to ship MPEG-2 decoders in volume, intends to provide TCI with digital set-tops that conform to GI's DigiCipher specification. The company licensed the technology from GI in February and reportedly has already begun to integrate the system into its own set-top.

TCI recently announced that it was "dramatically accelerating" its rollout of digital set-tops and headend equipment to cover roughly 800 headends within the next year or so. The company is putting all of its muscle behind digital in an attempt to blunt the offensive from direct broadcast satellite providers.

Other licensees of GI's system, which include Zenith, Scientific-Atlanta and Hewlett-Packard, have yet to build terminals that conform to the spec. Reportedly, that's because GI's royalty schedule called for the patent holder to extract about $8 per unit from the selling price.

Meanwhile, Scientific-Atlanta announced in late March it had licensed Sun Microsystems' microSPARC-II RISC processor for use in its Explorer 2000 set-top that will be deployed by Time Warner Cable later this year.

Under the agreement, S-A will develop, manufacture and incorporate large, integrated chips based on the microSPARC-II core. The rest of the chip will include an MPEG-2 system demultiplexer, network interface processing and SCTE/CableLabs standard decryption.

With the SPARC-based processor on board, S-A can port its PowerTV operating system, which enables graphical, audio and data management within the terminal. With DRAM and SBus I/O controllers included in the core, designers need to add only the DRAM and SBus peripherals to complete the system.

And finally, IBM is girding to get into the digital act, not by manufacturing digital set-tops, but by putting together a set-top "design kit" that combines a variety of hardware and software solutions. IBM's intent is to develop a custom chip that combines set-top box functions on a single PowerPC IC.

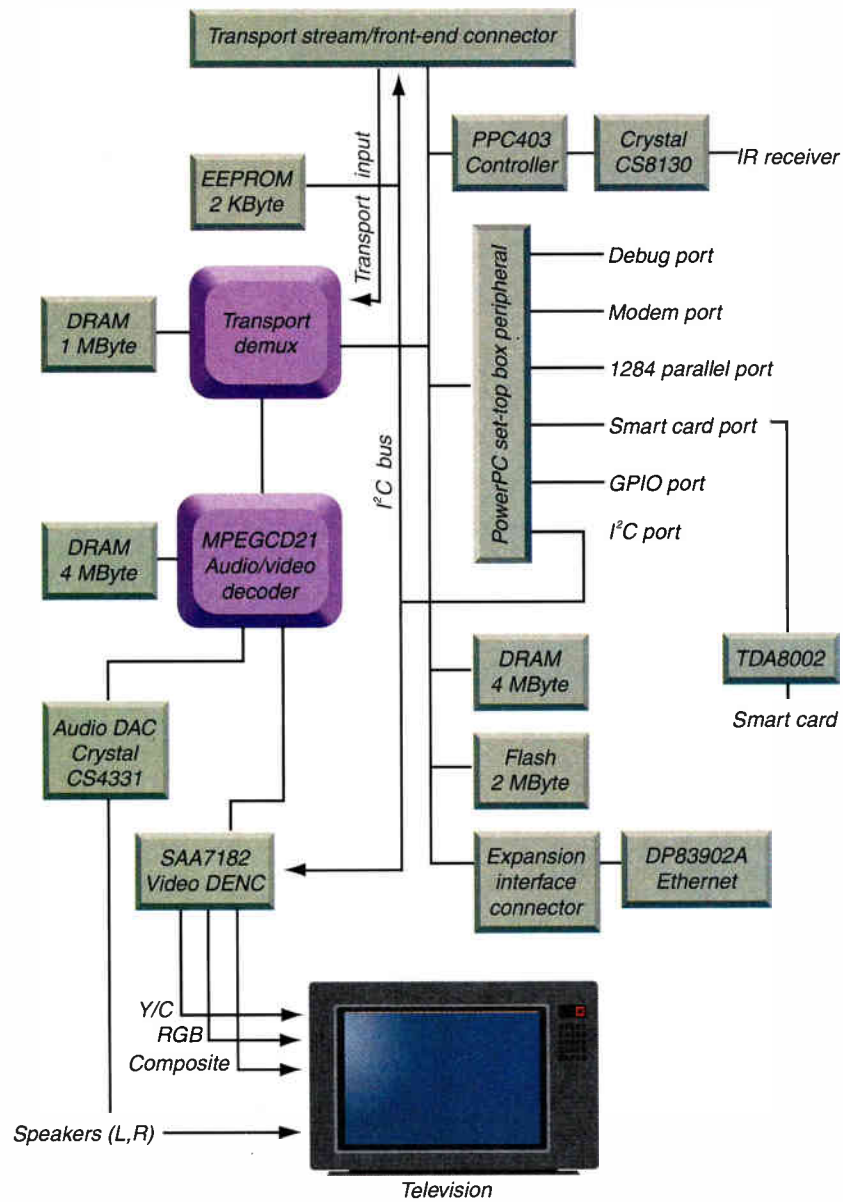
IBM executives flatly deny that they plan to actually build set-tops. Instead, they intend to sell equipment manufacturers their PowerPC-based system. In fact, IBM execs argue they already have—to such consumer electronics heavyweights as Thomson Consumer Electronics, Groupe Sagem and Tatung.

The "all-in-one reference design" (shown in Figure 1), will be helpful for manufacturers who want to quickly bring products to market. At least one analyst predicts that there will be 30 million digital TV receivers in homes around the globe by 2000.

The reference design includes a PowerPC 403GC RISC processor; an IBM CD21 MPEG-2 audio/video decoder chip; an STB peripheral chip for infrared, smart card, parallel and serial interfaces; 4 megabytes of DRAM and video DRAM; 2 megabytes of flash memory; and other functionality.

On the software side, manufacturers can choose a Microware-based solution based on DAVID/OS-9 or an Integrated Systems design with a pSOS real-time operating system.

Figure 1: *IBM Set-top box reference platform block diagram*



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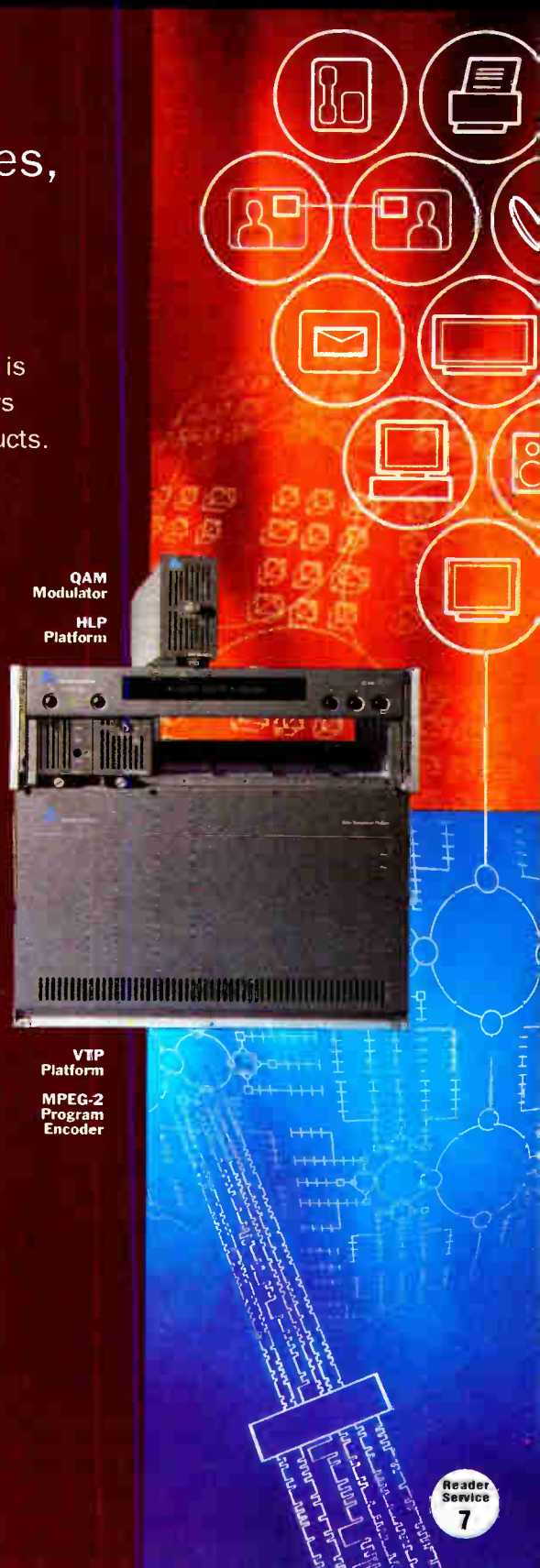

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Reader Service 7

FCC slates debut of digital broadcast

Speaking of long waits, it appears that digital broadcast TV will finally get off the ground as the new millennium gets underway.

The Federal Communications Commission voted unanimously last month to require the nation's broadcasters to "go digital" in stages between now and 2006. Each of the stations owned by ABC, CBS, NBC and Fox in the nation's 10 largest markets will be required to launch digital service by May 1999 (23 stations have already announced they'll be broadcasting in digital by Christmas of 1998—when digital TVs and adapters for analog TVs are slated to be ready).

From there, things accelerate dramatically: by November of 1999, affiliates in the top 30 markets will be digital, and by 2002, stations in small markets will go digital. By 2006, television will only be broadcast digitally, and broadcasters will be forced to return their analog frequencies so that the spectrum can eventually be auctioned to other users.

One key question wasn't answered by the FCC, however. Cable operators don't know yet if they'll have to carry those signals digitally, because the Commission postponed that decision for several months. The FCC deferred its decision, citing the fact that the Supreme Court's must-carry decision was too new to absorb and presented several tough issues that had to be thought through.

The whole process started years ago, when broadcasters lobbied for more spectrum to offer high definition TV. Since then, the development of digital compression has broadcasters more enamored with the fact they can offer several different "channels" of service, instead of HDTV. And, in fact, the FCC mandate does not require broadcasters to transmit in HDTV format.

MCI to test suite of new services

Maybe the vision of a "converged" world where one wire into the home carries all the information you need isn't such a pipe dream, after all. At least, MCI is taking its turn to test such a set-up, partnering with Northwest Iowa Telephone and Northwest Iowa Power Cooperative to form Pioneer Holdings, which will provide voice, video and data services to local distributors on a turnkey basis.

The partnership will leverage each company's facilities and will allow them to test a host of emerging technologies, including xDSL and hybrid fiber/coax networks. Services that will be offered include high-speed Internet access, telecommuting, interactive banking and shopping, video gaming and more.

NIPCO, the power utility partner, will provide its Sonet-based fiber ring, which is presently under construction. When finished later this year, the ring will transport signals at high speeds and increase reliability, as well.

MCI intends to test a variety of other technologies in Sergeant Bluff, Iowa, a suburb of Sioux City. Included in that schedule of tests are telephony-over-cable using Arris Interactive's Cornerstone Voice system, as well as others. In fact, Advanced Fibre Communications Inc. recently completed a 120-day voice-over-cable field trial over NWIT's existing cable TV system. NWIT is an independent telephone company that owns two cable companies in addition to its core telephone network.

The field trial served 15 homes and participants were asked to fill out a weekly survey stating their satisfaction with their telephone and television service during the trial. Service quality was rated very high.

GI a preferred choice for @Home data nets

General Instrument Corp.'s NextLevel Satellite Data Networks Group has been chosen as a "preferred" vendor by @Home Network, opening the door for NextLevel to provide its SURFboard telco return cable modems and related network equipment to cable operators for delivery of @Home's Internet and multimedia services.

Comcast Communications, the nation's fourth-largest cable operator, will be the first operator to use the SURFboard telco return modems, after having signed a letter of intent to purchase 5,000 modems initially, and potentially up to 50,000 units. The operator and @Home will continue a current trial with the modems and a launch of commercial high-speed data service is slated for later this year in Philadelphia.

GI's SURFboard modem network allows operators to provide high-speed data services over a standard 6 MHz cable TV channel at shared transport rates up to 27 Mbps. The modem features a return path via a telephone connection (see Figure 2). The first generation SURFboard cable modem, which is available now, is an internal ISA card that fits into the subscriber's PC. An external version that uses an Ethernet connection to the user's PC and supports laptops, Macintosh and multiuser environments, will be available starting this month. Comcast plans to use both the internal and external models of the modem.

Bradley Dusto, senior vice president of engineering at Comcast, thinks the telco return modem offers a lot of opportunities, whether plant has been upgraded for two-way or not. "We want to use SURFboard to drive early acceptance of high-speed, cable-based Internet services," he said. "@Home is really catching on in our two-way markets, and using SURFboard cable modems to bring downstream speed to our non-two-way areas will allow us to expand our service footprint significantly."

GI officials said the biggest piece of equipment non-two-way plant operators would have to acquire to offer telco-return Internet service is a network hub, which costs approximately $30,000. The 12-slot modular chassis interfaces with the dial-up network and provides downstream information to network adapters. A single hub can be configured with up to three 6-MHz, 27-Mbps downstream channels. The number of users that can be served with a single channel depends on the throughput operators choose to offer.

Election results in; New faces join SCTE

Two new faces will join five incumbents and eight other persons who weren't up for re-election on the Society of Cable

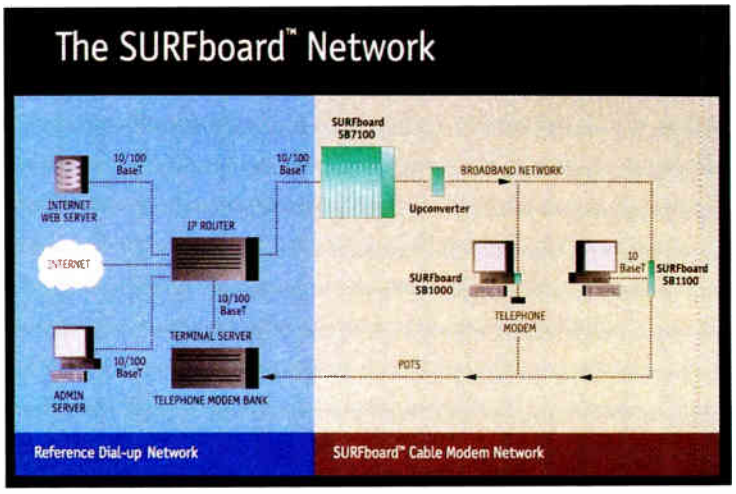
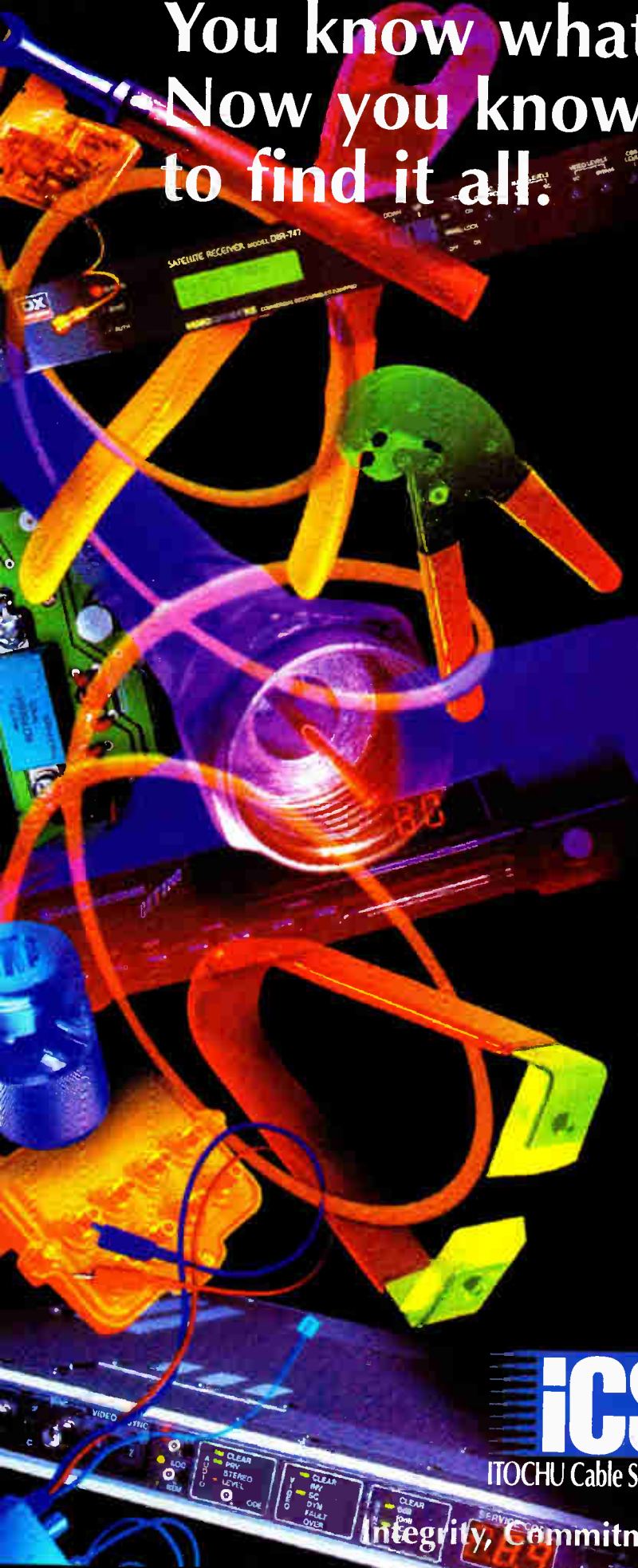


Figure 2: The SURFboard telco return network.



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Telecommunications Engineers' Board of Directors, beginning next month.

NCTA Director of Engineering Andy Scott was elected to fill one at-large seat. He, along with Sprint Executive Director of Broadband Technology Wendell Woody, an incumbent, will represent the entire country. Scott and Woody beat Nick Hamilton-Piercy of Rogers Cablesystems, Rob Marshall of the Mid-American Cable Telecommunications Association and Pete Morse of Cable Technologies International for their seats.

Ralph Patterson, a self-employed manufacturers' representative, is the other newcomer to the board, defeating incumbent Patrick O'Hare of TCI's National Division in the race to represent California, Hawaii and Nevada.

Re-elected to their current posts were: Steve Johnson of Time Warner Cable, who represents Arizona, Colorado, New Mexico, Utah and Wyoming; Robert Schaeffer, who represents Minnesota, North and South Dakota and Wisconsin; Hugh McCarley of Cox Cable, who represents Florida, Georgia, South Carolina and the Caribbean; and Dennis Quinter of Time Warner Cable, who represents Delaware, Maryland, New Jersey and Pennsylvania.

In their quest for re-election, Johnson defeated TCI Director of Technical Training Alan Babcock; Schaeffer beat out Time Warner Cable's Randy Cicatello; McCarley defeated former Time Warner Cable VP of Technology Jim Ludington; and Quinter beat Cablemasters' Bernie Czarnecki.

The new board will be seated on June 3 during the next meeting, which will take place in Orlando, Fla.

Cable pirate fined $25M by court

A U.S. District Court judge threw the book at a cable pirate recently, awarding Scientific-Atlanta Inc. a combined $25.4 million judgment against a major seller of altered cable set-top terminals. Although Scientific-Atlanta expects to be able to collect only a nominal amount, Jeffrey Fenley, an individual doing business as National Electronic Wholesalers of Santa Monica, Calif., was ordered to pay S-A monetary penalties and damages of $21.3 million for violating the Federal Cable Communications Policy Act of 1984, and $4.1 million for infringing on Scientific-Atlanta's trademark and for false advertising.

National Electronic Wholesalers also was issued a permanent injunction barring it from advertising or selling any device for gaining unauthorized access to cable service.

"We believe it is one of the largest judgments against a cable set-top 'pirate' and the first such award for violating the trademark rights of the original set-top terminal manufacturer," said William E. Eason, Scientific-Atlanta's senior vice president and general counsel.

Citing the legal precedents as a result of the judgment, Eason said the judge ruled that the use of disclaimers in ads for altered set-top terminals was not a viable defense, and that a plaintiff does not have to show the defendant "intended" to violate any laws. "These two points had been stumbling blocks in past legal actions of this type, but with this ruling, cable pirates should understand they will be pursued to the fullest extent possible under the law," Eason said.

Theft of cable television service using altered set-top terminals and other means is estimated at $4.7 billion annually, according to the National Cable Television Association's (NCTA) Office of Cable Signal Theft.

LMDS auction rules shut out cable MSOs

The end may finally be in sight for LMDS service provider wanna-bes. After numerous delays, the FCC finally adopted rules for auctioning off LMDS (local multipoint distribution services) licenses. (See "LMDS formula awaits approval," *CED*, July 1996.) However, it appears that cable MSOs won't be invited to the party; the LMDS auction rules partially ban local cable operators and telephone companies from bidding on the largest portion of LMDS spectrum in their primary service areas.

Essentially, the auction rules cover two pieces of spectrum in the 28 GHz range. This includes the allocation of 1.3 GHz of spectrum to a single operator in each of the basic trading areas in the United States. Another 150 MHz of the spectrum will be auctioned off to a second licensee. For the first three years, local operators and telephone companies will not be allowed to bid on or own the largest spectrum chunk in their service areas. They may, however, bid on/own the 150 MHz piece of the spectrum in their service areas. After the three-year period, all in-territory LMDS licenses would be up for grabs as far as local operators and telephone companies are concerned.

LMDS employs a cellular network architecture, with central hub sites which communicate with 18-inch transceiver dishes. The FCC's LMDS spectrum allocation provides ample capacity for bundled telephone, high-speed Internet access, interactive multimedia, video and software distribution services.

David Mallof

The charge on creating the competitive caveat was led by David Mallof, president of WebCel Communications Inc. In an ex parte plea to the FCC last year, the Commission was urged to "include necessary safeguards to avoid outright takeover of another potential competitor and anticompetitive abuses" by local telcos and cable operators. The company stated it believed these local companies had "substantial economic incentives to forestall deployment of LMDS as a direct substitute for their facilities-based monopoly networks."

"This is a watershed action," said Mallof. "As the largest two-way wireless service ever sanctioned for nationwide deployment, LMDS will leapfrog today's slow legacy networks. This is the day we have planned for, and we are ready to go forward. We successfully advocated the need for this landmark auction eligibility provision, and we plan to build our network with the same vigor." Mallof said he believes the auction will most likely take place in early or mid-summer this year.

Jottings

April was a busy month for some of the cable industry's biggest names. First, **Antec** shuffled its executive ranks yet again, creating an Office of the President structure manned by Jim Faust, Gordon "Gordie" Halverson and Lawrence Margolis. The new structure was created to manage Antec's manufacturing and distribution growth plans and help the company meet its financial growth projections. Faust becomes CEO of Antec Network Technologies, the company's manufacturing and R&D division, and will also oversee Antec's international businesses; Halverson becomes CEO of **TeleWire Supply**; and Margolis will coordinate the financial and administrative aspects of Antec. . . **TCI Communications** named Tom Elliot its senior vice president, Technical Projects, and elevated Tony Werner to senior vice president, Engineering and Technical Operations. In this capacity, Elliot will advise TCI on broad technical developments and will also be TCI's day-to-day liaison to CableLabs. Werner will now be in charge of designing and building TCI's video and telecommunications delivery platform and will be responsible for all engineering activities . . . . CED

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Kelso: Capturing cable's fair share

James Kelso

James Kelso wants to see cable operators get a big slice of the mouth-watering, multi-billion-dollar advertising pie, and is working on technology to help make that happen. A relatively new addition to the ranks of digital video system supplier SeaChange International Inc., Kelso is focused on new product development and servicing the industry with existing solutions, in his role as Cable Video Systems manager. Specifically, he's working on projects ranging from finding ways to insert a commercial into a digital stream, to finding more economical ways to distribute commercials from site to site, and creating some cost-effective solutions for small cable operators who find digital playback to be cost-prohibitive.

One big issue cable operators will soon face in ad insertion is how to adapt that technology to function with digital program transmissions. Eager to find solutions, Kelso chaired the Cable Advertising Bureau's Digital Advertising Committee last year, focusing on methods and standards.

"One of the tough things about doing cable ad insertion into a digital stream that's headed to a digital set-top is that everyone's stream and set-top are a bit different," says Kelso. "What we are trying to do is to find a common way of inserting an ad, whether you are using a General Instrument solution, a Scientific-Atlanta or Divicom solution, or what have you. That is going to take a good bit of work."

Kelso would also like to see the cable industry capture its fair share of the more than $60 billion a year national spot advertising market; currently, cable garners less than two percent, though the industry chalks up 24 percent or better viewership. SeaChange and companies like it are working on some back office trafficking and billing software, says Kelso, that will help operators keep track of their inventory—i.e., how many spots they have left to sell—and accomplish dynamic, real-time scheduling as well.

Digital ad insertion technology is also poised to provide operators with some intriguing new ad sales opportunities, says Kelso, including insertion at the neighborhood level. "As cable operators lay more fiber, it becomes easier to look at a specific node," he notes. And in a process that is roughly analogous to direct mail advertising, cable operators could offer potential advertisers the ability to target consumers having a specific zipcode, people who fit a profile of those most likely to buy the advertisers' products. "That is completely doable with the existing cable architecture. However, before digital ad insertion, that would have taken an army of people with a mountain of tapes," says Kelso.

Taking the process down to the next level, Kelso believes that advertising targeted down to the discrete set-top level is probably about five or so years off.

A melting pot of disciplines

A 10-year veteran of the management and engineering of cable television advertising operations, Kelso became intimately acquainted with the technical issues surrounding ad insertion while working for Cox Communications. He started with the company when he was just a college sophomore, as videotape operator and technician, eventually becoming manager for engineering for cable advertising, and later, director of engineering for cable advertising.

In his tenure at Cox, Kelso's accomplishments included helping to introduce digital insertion technology throughout the company; deploying local area networking to every Cox CableRep Advertising site; and building an infrastructure via the establishment of the ad sales engineer program for the company. "Every site now has an ad sales engineer," explains Kelso, "who knows a good bit about video, a lot about local area networking, and at the same time, is in tune with cable advertising clients."

By the time he left Cox in 1997, Kelso was managing the operations for a $100 million cable advertising business in concert with a $9 million capital expenditures budget, while overseeing the implementation of advanced trafficking software for ad sales, plus the development of insertion systems for use with MPEG video streams.

Some of the highlights of his time at Cox:

✔Constructing an OC-12 network in Phoenix to facilitate digital insertion.

✔Creating numerous zoned insertion systems, including those in San Diego, New Orleans and New England.

✔Building the first NewsChannel for Cox, "News on One," in Omaha, Neb.

✔Winning the company's Vision Award for Innovation.

New challenges

Kelso has been with his wife, Caroline, almost as long as his cable industry career. The two are eagerly awaiting the birth of their first child next month, and Kelso is already girding himself for spending many late nights up with the baby, while catching late-night programs on cable. Rounding out the family are a dog, Jake, and two cats. "We take in just about every neighborhood stray," he explains.

Both of the Kelsos are avid readers—"Our house looks like a used book store," he admits—and James enjoys both non-fiction and science fiction.

Currently telecommuting from his home in the Atlanta suburb of Lawrenceville, he enjoys the outdoors, and is looking forward to the day when he can get back to his "boating roots." But a new baby, and his new position at SeaChange, will probably curtail his boating for awhile. For now, Kelso is eager to dive into the challenges of his new job. "Local cable advertising is a $1.6 billion business today," notes Kelso. "It's unregulated, and it has huge potential." *–Dana Cervenka*

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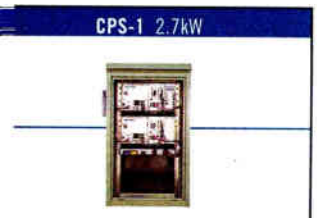

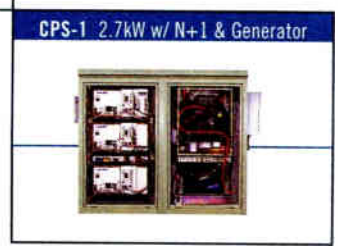

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Operational issues for digital have arrived

By Wendell Bailey, VP of Science and Technology, NCTA

Just a few short weeks ago, the Federal Communications Commission adopted, after an eight-year-plus proceeding, the Report and Order that gives a second, free, over-the-air broadcast channel to every licensed broadcaster that will agree to provide "digital TV service" in its existing market. The FCC rules under which this service is to be offered are rather strict. The broadcasters in the top-10 markets must begin providing a digital signal within two years, and there are different, but strict, timetables for those in the second and lower markets.

The NCTA has, for several years, had a consistent position on how, and under what circumstances this allotment would take place. Needless to say, the FCC did not adopt our stance, but that's not the issue that I want to discuss today.

The $64,000 question

A set of more practical issues for a cable television operating engineer to tackle begins with, "how, exactly, are we going to handle the transmission of the over-the-air signals that will begin to arrive at our headends in the immediate future?"

So many people have called to ask me this question in the past few weeks that, by now, everyone must know my answer: I don't have a clue! It's not just that we have lost the must-carry case (Supreme Court, 5-4 in favor of must-carry), or that the FCC has yet to speak to the issue of whether or not these new digital signals should enjoy must-carry status. No, these are issues that will be worked out eventually, and at that time, we will find that, whichever way it goes, we'll have our options and responses changed by the decision that the FCC makes. The operational issues that will confront us in the next two years are much more prosaic.

If a broadcaster can compress his/her signals at a 5-to-1 ratio on a single, 6 MHz slot, and the cable operator is to use "statistical multiplexing" to achieve a 15-to-1 compression ratio, does this mean that we would have to give up 10 potential channel slots in order to carry one of the new broadcast channels? In the digital world, is it even fair or proper to speak of a television channel as a 6 MHz slot? What about the case where we have come to terms with the carriage issue and are face-to-face with the issue of delivery–we carry the digital broadcast signal to our customer, and he/she only has an analog TV set.

Several questions arise: have we "delivered" the signal? Do we care if the subscriber can see it (it might be a great program)? If we put a digital set-top in the subscriber's home to receive our own digital offerings (64 QAM), will that unit be able to handle the modulation method that the broadcaster uses (8 VSB)? How about if the FCC requires must-carry and does not allow the cable operator to re-modulate the digital signal of the broadcaster, and you (the operator) are sending QAM signals to a subscriber who has a new VSB TV set? Then there is the issue of "re-packing": taking the four or five SDTV (Standard Digital Television) signals that the broadcaster sends out and fitting them into the 12-18 signals that an operator might be able to generate using a stat mux system. See? It gets complicated very quickly.

Chomping at the bit

It seems that we need to have a matrix drawn up just so we can see what we must do once digital signals begin to proliferate. And proliferate they will. The FCC order will no doubt be challenged by someone as too much too soon, but there are stations out there that are anxious to get going with digital signals. There are even a few who are intending to be on-the-air with true digital high definition signals in the mandated timeframe.

This creates another problem for us to fit into a matrix of issues. How do we handle a situation where the broadcaster sends out a high definition signal for a part of the broadcast day, and switches to a group of five SDTV signals for the rest of the day? Does this mean that we in the cable world have to rearrange our channels once or twice a day?

Real, live digital

In the land of cable television, there are already several places where digital signals in groups of six or eight per 6 MHz are being delivered to real, live cable subscribers. The word is that they like what they see. While we have several new services to offer our subscribers, some part of our efforts must be devoted to dealing with the issues above.

Broadcasters have proven that they know how to deliver programs that attract a large number of eyeballs. True, the cable programmers have shown (lately) that they can compete head-to-head for the same viewer and win a fair share of the ratings, but it would be foolish to ignore the track record of the programming that comes to us from the over-the-air source.

Surely there will be offerings in the broadcasters' digital emissions that will appeal to a large portion of our customer base. We will have to find a way to get the signals to them. At the same time, we must run our own digital channels in such a way that we can offer the services that our program community will develop, and that our subscribers will surely want to see.

Once again, the people on the frontline have their work cut out for them. CED

Have a comment?
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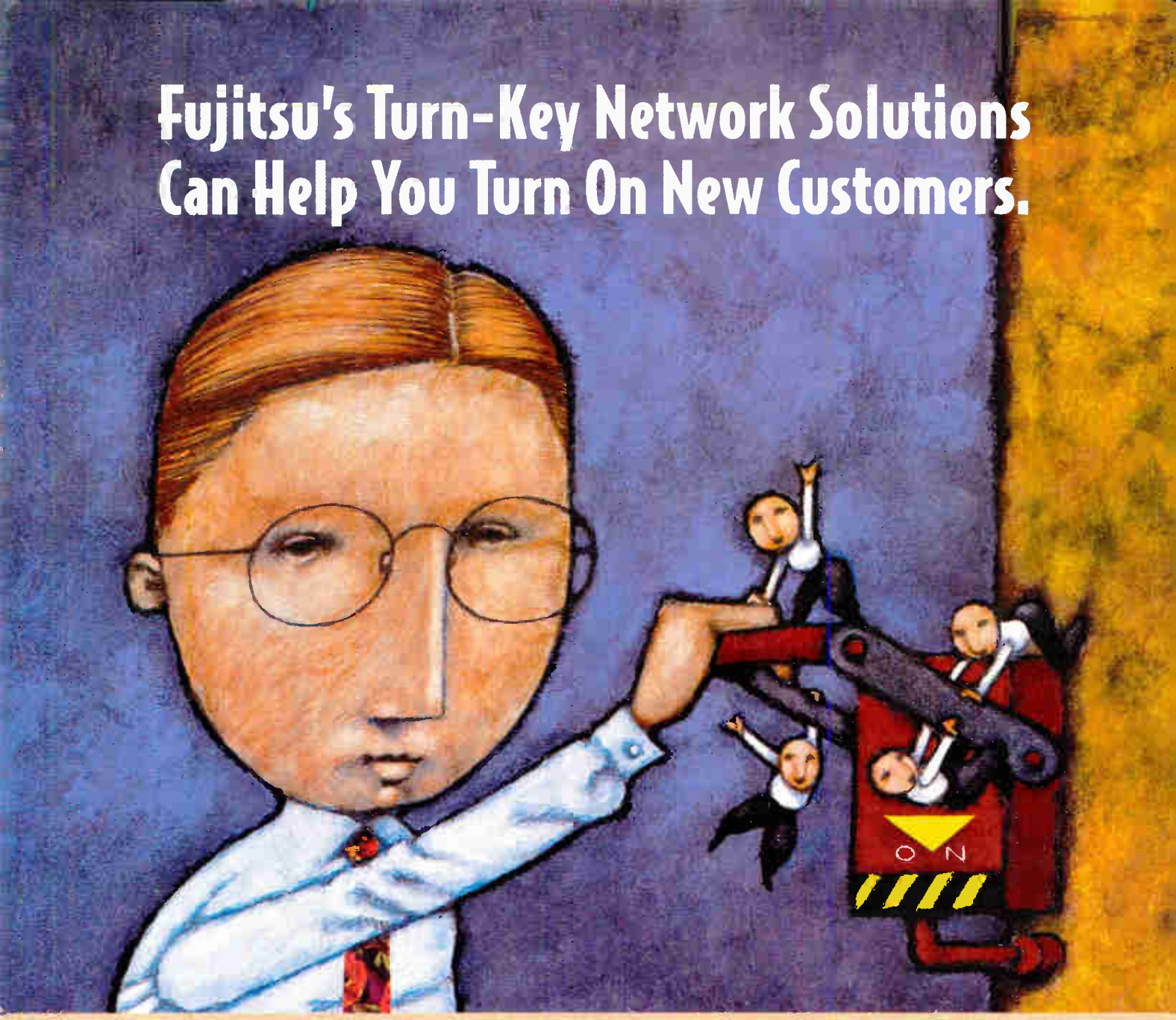

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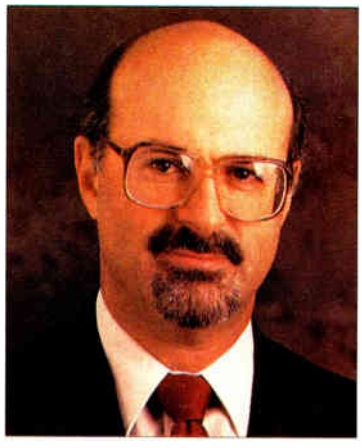
Rain and its effect on microwave spectrum



By Jeffrey Krauss, radio spectrum appraiser and President of Telecommunications and Technology Policy

Have a comment?
Contact Jeff via e-mail at:
jkrauss@cpcug.org

The FCC has raised about $20 billion so far in spectrum auctions, most of it from auctioning relatively small amounts of spectrum for mobile communications services. Over the next year or two, much greater amounts of spectrum will be auctioned, but at much higher frequencies than before. The auction prices will depend on the marketplace opportunity for the service that the spectrum will be used for, but also on the effect of rain.

Upcoming microwave auctions

The major auction in 1997 or early 1998 will be Local Multipoint Distribution Service (LMDS), for a license of 1150 MHz of spectrum at 28 GHz in each of about 500 Rand McNally Basic Trading Areas (BTAs). These will be used for point-to-point and point-to-multipoint communications networks, to carry two-way voice, data and entertainment video programming. By comparison, the earlier auctions were for licenses of only 30 MHz of spectrum, but at a much lower frequency range, around 2 GHz.

Radio propagation

There are a number of factors that affect radio propagation—the distances that radio signals will travel. At frequencies above about 1 GHz, radio signals travel in straight lines and do not easily bend around obstacles, so path blockage is the most important factor. Line-of-sight paths can be blocked by terrain, by foliage and by buildings. Other propagation factors include attenuation caused by rain drops, fog or dust in the atmosphere, absorption due to atmospheric gases (oxygen and water vapor), interference caused by multipath signal reflections, and a variety of other factors. These are described in more detail in ITU-R Recommendation PN.530-5 and in radio communications textbooks.

While many of these factors are always present, rain occurs infrequently, and the heavier the rainstorm, the less frequently it occurs. So the attenuating effect of rain is treated statistically. In engineering a radio link, you decide what percentage of the time you can live with a link outage caused by rain, and then look up in a table the rain intensity in millimeters per hour corresponding to that percentage.

For example, if you demand an availability of 99.99 percent, so that the link outage is less than 0.01 percent of the time, or 52 minutes per year, and you are located in the northeastern part of the U.S., you find that you must design your radio link to overcome a rain intensity of up to 42 mm per hour. But if you can accept only 99.9 percent availability (525 minutes of outage per year), then you need only design your radio link to overcome a rain intensity of 12 mm per hour.

As the frequency increases, the rain attenuation becomes worse. For 99.99 percent availability on a 5 km path length at 10 GHz, the rain typically produces an attenuation of 5.5 dB. At 18 GHz, the attenuation increases to about 17.4 dB. At 25 GHz it is 29.6 dB, and at 40 GHz it is 54.2 dB.

For the same amount of spectrum in different frequency bands, this greater attenuation translates into lower spectrum value in several ways. First, rather than using 5 km path lengths, it becomes necessary to use shorter path lengths, only 2 or 3 km. This translates directly into higher system implementation costs, because it requires more transmitter sites to cover a metropolitan area. For example, a 5 km path at 18 GHz must overcome 17.4 dB of attenuation during rainstorms. But that same attenuation occurs on a 3 km path at 25 GHz. If transmitter sites must be spaced at 3 km rather than 5 km, it takes $(5/3)^2 = 25/9$, or nearly three times the number of transmitter sites to cover an area.

Rain attenuation at higher frequencies can be overcome by using more spectrum, but using it less efficiently to preserve path lengths. A less efficient modulation method is more robust, but at the expense of decreased capacity. This is why, for example, over-the-air broadcast stations must use less efficient 8 VSB modulation, while cable TV can use 64 QAM or 256 QAM modulation and can derive a higher data rate. In addition, for example, 16 QAM modulation can carry a higher payload in bits/sec/Hz than QPSK, but it needs a much higher carrier-to-noise ratio (8 to 12 dB, depending on error coding methods).

The FCC looked at this issue recently when it relocated the Digital Electronic Message Service (DEMS) from 18 GHz to 24 GHz; and decided that DEMS needed typically four times as much spectrum at 24 GHz compared with 18 GHz in order to overcome the effect of rain attenuation, among other factors. Thus, on a dollars per megahertz basis, you could say that 18 GHz spectrum is worth four times as much as 24 GHz spectrum.

Spectrum value predictions

The broadband PCS auctions brought in about $20 billion for 120 MHz of spectrum. The LMDS auction will distribute 1150 MHz of bandwidth, or about 10 times as much spectrum. Will it bring in 10 times as much revenue? I think that $200 billion is far too much to expect. Spectrum auction values do not scale linearly with the amount of spectrum, and the difference in rain attenuation between 2 GHz and 28 GHz is enormous. But because of the amount of spectrum being auctioned, the LMDS service offers the opportunity to compete both with local telephone carriers and with cable TV. Companies that want to jump into these markets could place a very high value on the spectrum, in spite of rain attenuation. We'll see what happens at auction time. CED

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Characterizing return path transmitters

Over-driven optical transmitters can degrade digital carriers

By John J. Kenny, Ph.D., Principal Engineer, Antec Technology Center

Noise loading is becoming an accepted way to characterize the noise and intermodulation performance of return path active components. This article focuses on understanding how over-driven optical transmitters degrade digitally modulated carriers. Analysis and experimental findings have uncovered several factors which influence the performance of reverse path optical transmitters used for transmitting digitally modulated carriers.

Figure 1: *Return path optical transmitter block diagram.*

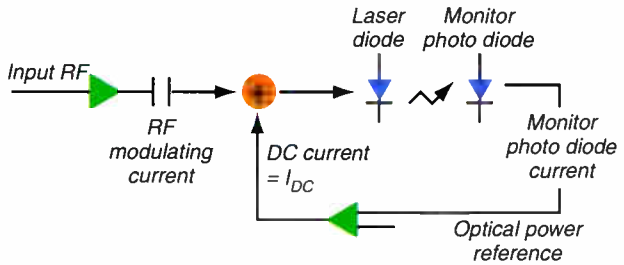
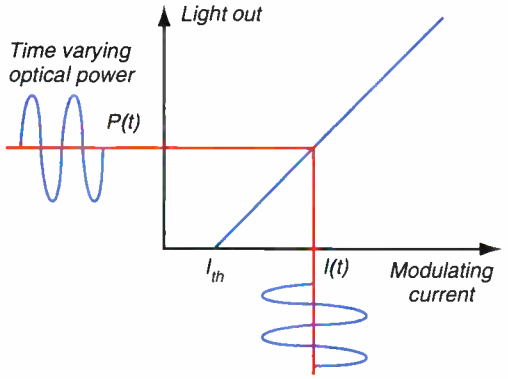


Figure 2: *Laser L-I characteristic.*



Background

Noise loading is becoming accepted as a way to characterize the combined effects of noise and intermodulation on the performance of return path active components[1]. The basis for this stems from the primarily digital transmission use of the return path and the fact that the power spectral density of digital signals resembles the power spectral density of a band of noise. In a situation where the upstream payload consists of many, similar level, digitally modulated carriers, the probability distribution function (pdf) for the amplitude of the composite signal approaches the gaussian distribution associated with thermal noise.

Noise loading, as applied to return path active components, provides guidance to the system operator in the choice of appropriate nominal operating signal levels within the dynamic range of each component. Multiple digitally modulated carriers may then be carried and allow significant tolerance in their levels. Selection of the nominal level may also take into account, and provide headroom for, unaccounted-for signals such as high level ingress.

There is a long history of noise loading of frequency division multiplexed telephony, coaxial cable and microwave transmission systems. Analysis of the resulting noise and distortion characteristics derived from noise loading those systems produced the thermal noise, second order intermodulation distortion and third order intermodulation behaviors as a function of RF drive level[2].

Attempting to analyze return path amplifier and laser distortion characteristics by those methods immediately shows that when the intermodulation distortion exceeds the thermal noise by just a few dB, the device is severely distorted, and the intermodulation noise can not be characterized by second and/or third order intermodulation.

QPSK and QAM signals are characterized by their signal states in the "phase plane," sometimes referred to as a constellation diagram. Noise loading is a scalar measurement. It is related to how much a signaling state of a digital signal is spread, but it will not indicate the direction of that spreading and how close that spreading comes to the decision thresholds in the demodulator. This was the motivation for experimentally investigating the distortion of a signaling state when the laser is over driven.

Distortion mechanisms

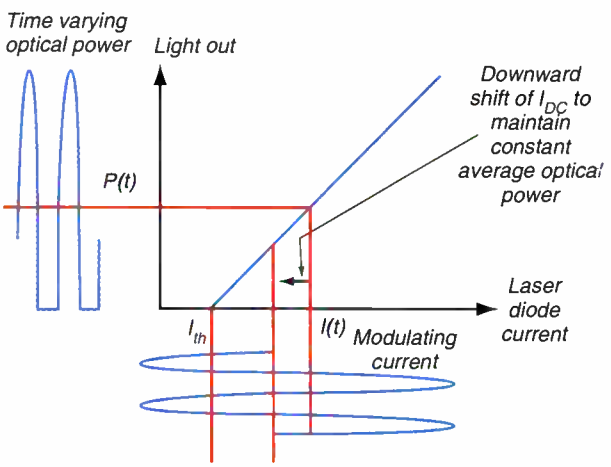
There are several basic impairments in QPSK and QAM transmission that may be viewed with a phase plane or constellation diagram. The usual situation includes some or all of the following properties in the phase plane.

If a laser only experiences tone-like intermodulation products when noise loaded or stressed with high level CW interferences, the signal states would be smeared symmetrically about their undistorted locations.

If there is only compression when the laser is overloaded, the signal states will be moved radially toward the center of the constellation diagram.

The transmitted carrier can undergo a phase shift and cause a rotation of the signal state. For instance, this

Figure 3: *Laser light output when the OMI is greater than 100 percent.*



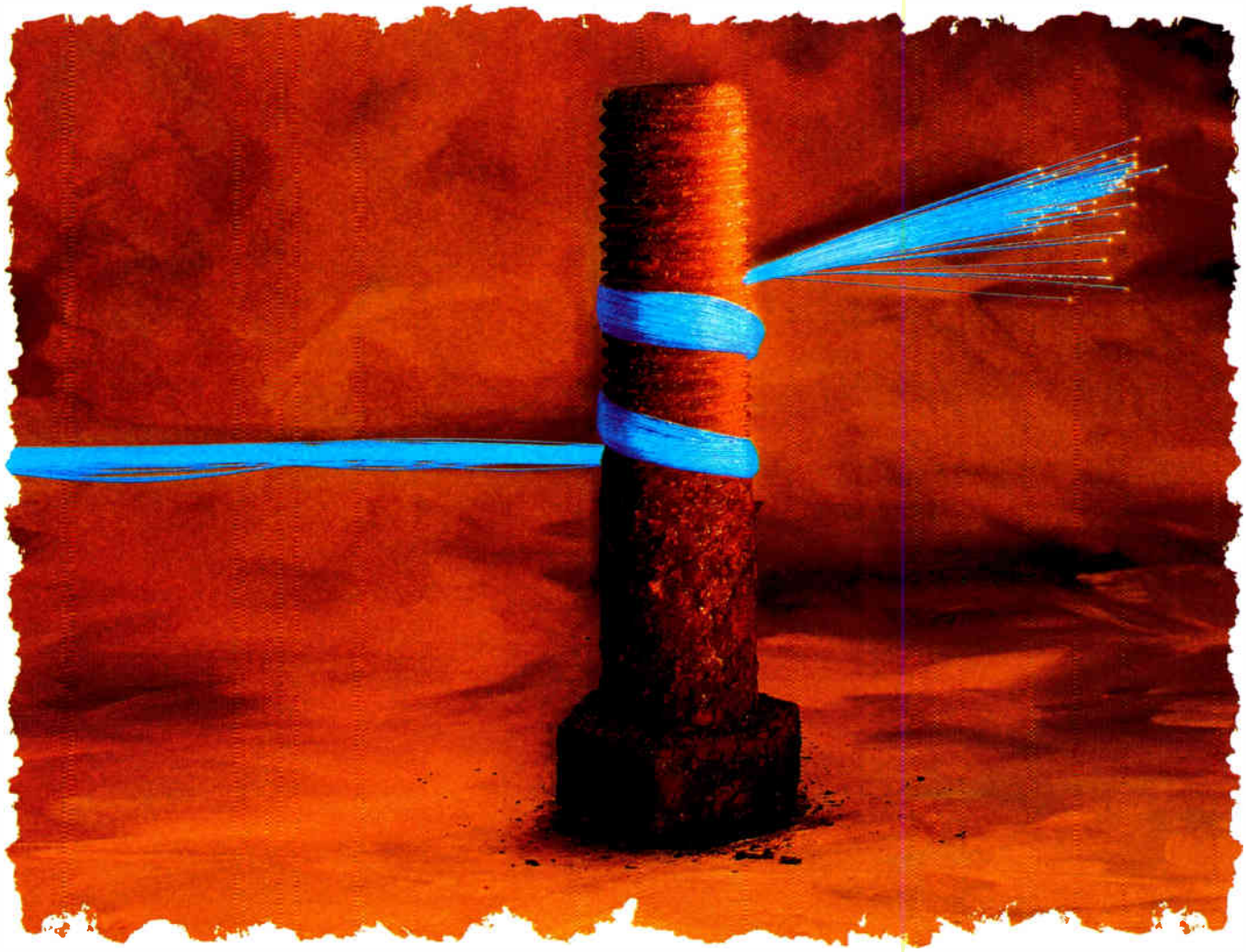


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Figure 4: Experimental test set-up.

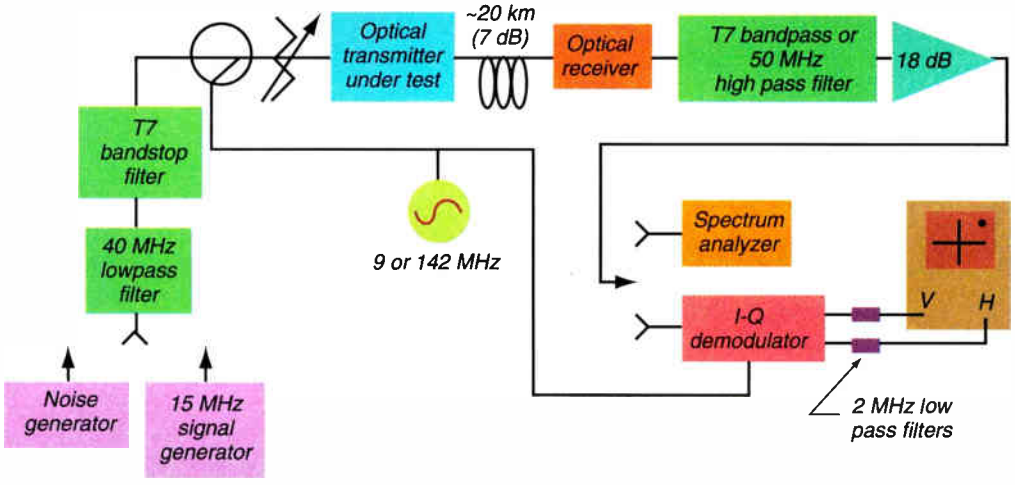
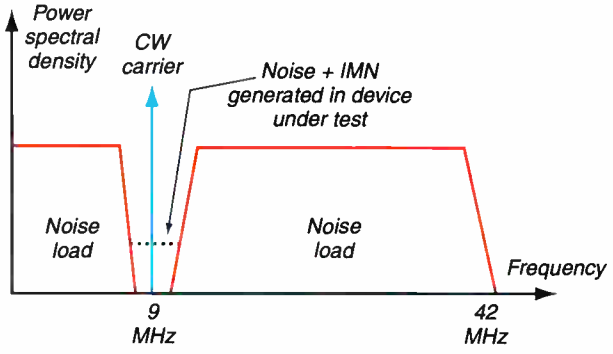


Figure 5: Notched noise plus CW carrier.



could occur if an over driven laser experienced excessive chirp as it clipped the RF. Chirp in conjunction with fiber dispersion can result in a carrier phase rotation.

In a laser transmitter, the laser diode DC current, I_{DC}, is set by a power control loop, and the AC modulating current is superimposed from an RF path. These functions are shown in the block diagram, Figure 1.

Normal level RF carriers will have peak currents less than $I_{DC} - I_{th}$ (see the L-I characteristic in Figure 2), so the laser diode current is in a range such that the laser always emits light. The output light is proportional to the laser diode current above threshold, i.e., P is proportional to $I - I_{th}$. The ratio of the peak of an RF carrier to $I_{DC} - I_{th}$ is called the optical modulation index (omi).

When there is a modulating current comprised of a wanted digitally modulated carrier and a very high level out of channel signal (omi much greater than 100 percent), two distinct effects occur.

1. Intermodulation products are generated, and some may fall into the channel, producing interference.

2. The laser is turned off for part of the negative excursion of the high level interference, resulting in an amplitude compression of the wanted signal.

Generally, both occur, but it is worthwhile to consider them individually.

At first one might say that in the limit of extremely high omi, the laser would be turned off for half of the time, resulting in a 6 dB RF level drop of the wanted signal. This is usually not the case. The power control loop maintains constant average output optical power. This results in a further reduction of the laser's duty cycle, as shown in Figure 3 (see page 26).

Experimental work

An apparatus arrangement as shown in Figure 4 was assembled. It permitted the flexibility to do both noise load testing and signal constellation distortion measurements.

Noise load testing

Three lasers were characterized for carrier-to-noise plus intermodulation noise [C/(N+IMN)] vs. RF drive level in a manner similar to that used in reference 1. Here, however, a 42 MHz band of noise was notched by using a T7 channel deletion filter. A CW carrier

Figure 6: Laser 1, +4 dBm, isolated, uncooled DFB.

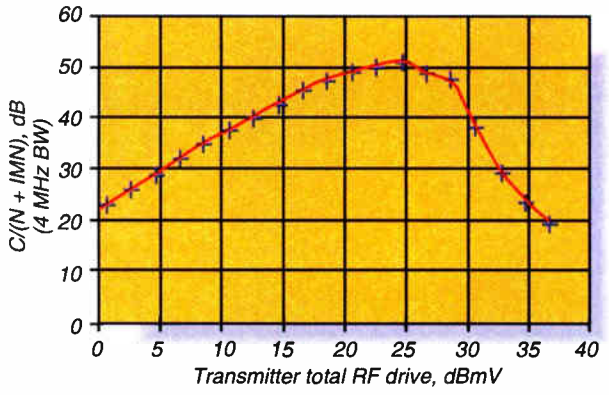
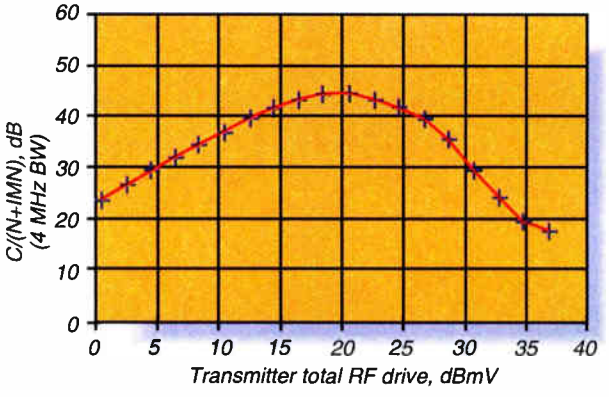


Figure 7: Laser 2, +1 dBm, isolated, uncooled DFB.



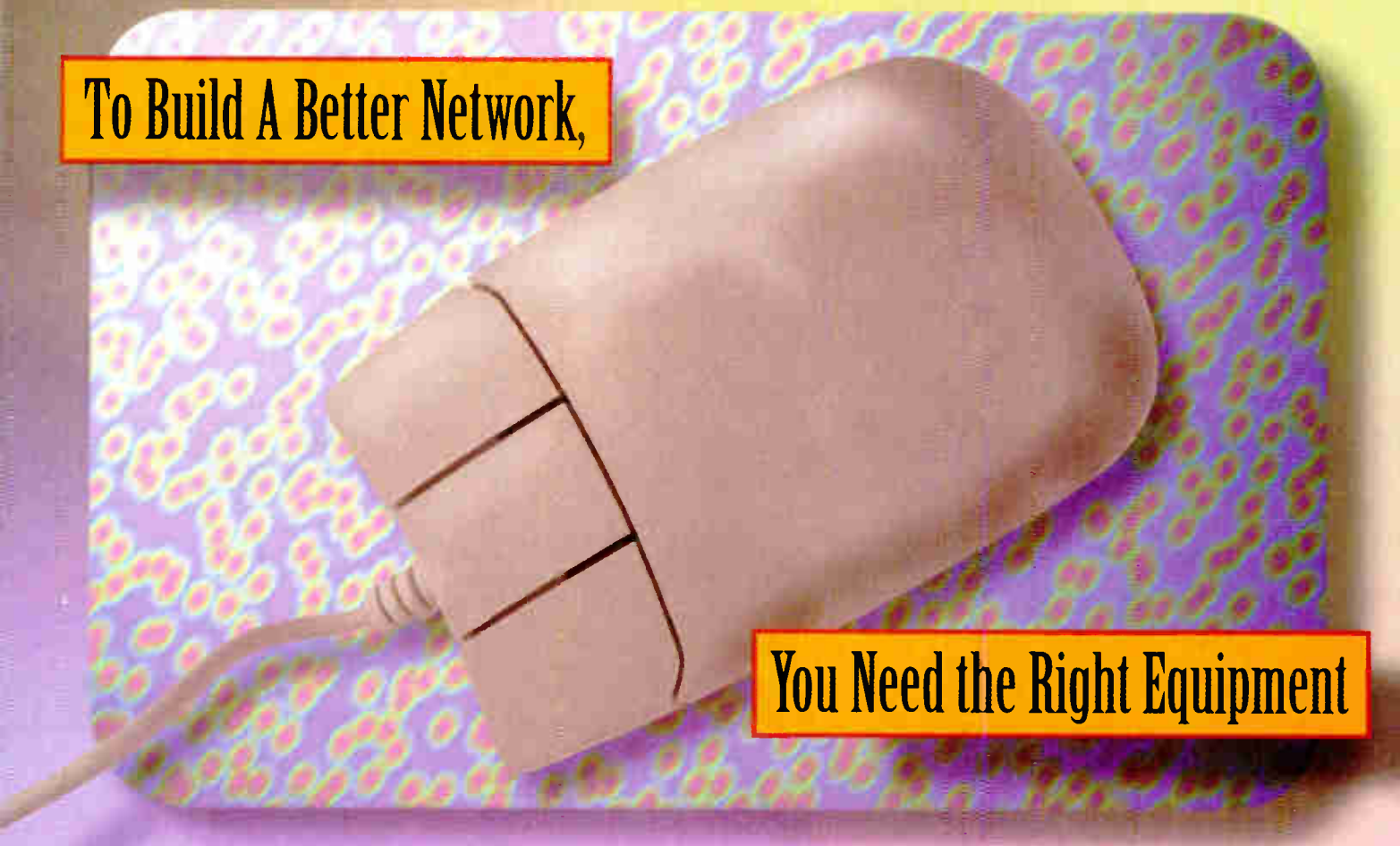


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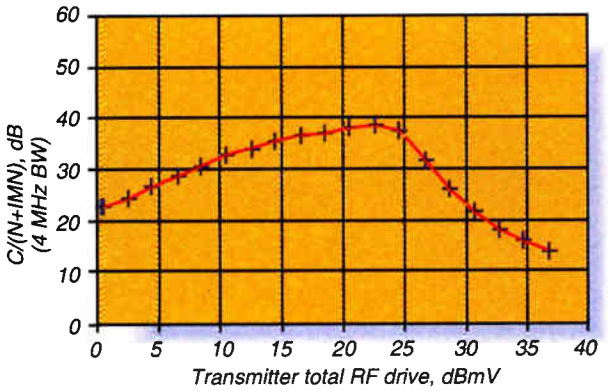
Figure 8: Laser 3, 0 dBm, isolated, uncooled FP.



around 9 MHz was placed within the notch as shown in Figure 5. The level of that carrier was set to equal the noise power missing from the notch. The motivations for inserting the carrier were to provide a reference level and to estimate the potential for digital signal degradation. The noise generator and spectrum analyzer options of Figure 4 were used.

The three lasers (all isolated and uncooled) characterized were: (see Table 1 at the lefthand side of this page).

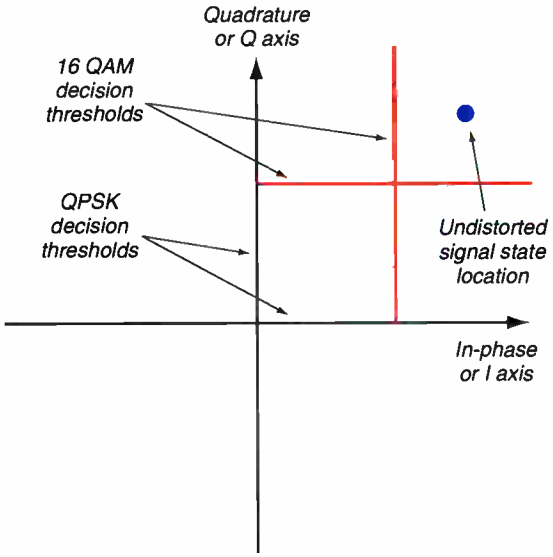
The test results are shown in Figures 6, 7 and 8. To the left of the peak C/(N+IMN). C/(N+IMN) is dominated by relative intensity noise, shot noise, optical receiver front end noise and double rayleigh backscatter noise. To the right of the peak, C/(N+IMN) is dominated by noise-like intermodulation distortion. To the left of the peak, lasers 1 and 2, both DFBs, improve C/N at a rate of about 4 dB per 3 dB increase in RF drive. This occurs because, as the RF drive to the laser is increased, not only is the received RF increased relative to various noise sources, but also, the laser wavelength chirps more and the double rayleigh backscatter noise is reduced. Laser 3, a Fabry-Perot type, improves at a rate of 1 dB per 1 dB increase in RF drive.

The behavior of lasers 1 and 3 for RF drive levels to the right of the C/(N+IMN) peak show rapid decrease of C/(N+IMN) with increasing RF drive and are generally similar to those reported in reference 1. Laser 2, although it exhibits a smaller dynamic range than laser 1, degrades more gradually as the RF drive increases.

Table 1

Laser	Type	Output power
1	DFB	+4 dBm
2	DFB	+1 dBm
3	FP	0 dBm

Figure 9: Signal constellation representation of signaling state showing decision thresholds.



Signal constellation distortion

The IQ demodulator configuration of Figure 4 views the signal constellation in a manner similar to the CW Tester™ reported by Prodan[3]. It displays the location of one signaling state on an oscilloscope. It simulates the continuous transmission of the upper right hand quadrant state of QPSK or the upper right hand quadrant corner state of a QAM signal.

The signal constellation diagram is shown in Figure 9. The signaling state is shown in the upper right quadrant. If it is being demodulated as a QPSK signal, then the decision thresholds are ideally coincident with the I and Q axes. If it is being demodulated as a 16 QAM signal, the decision thresholds are much closer. The digital signal will be correctly demodulated if the effects of noise, interference and distortion do not displace the signal state beyond the thresholds.

When a laser is driven at low RF levels, the signaling state will be somewhat blurred, symmetrically about its intended location. The subject of interest here is what happens to the signal state when the laser is driven at very high levels. Lasers 1, 2 and 3 were driven by a carrier at 9 MHz and the notched noise as shown in Figure 5 at the level of the highest data point of Figures 6, 7 and 8. The C/(N+IMN) was less than 20 dB in each case and dominated by intermodulation noise.

The oscilloscope display in Figure 10 shows significant blurring of the signaling state. All three lasers exhibited similar distortion patterns, i.e., a blurring displaced in the direction of the origin relative to the undisturbed signal state. This shows that the dominant distortions are noise-like intermodulation products and compression.

To more thoroughly search for phase rotation effects, the carrier frequency was raised from 9 to 142 MHz. The results of this test are shown in Figure 11. The distortion characteristics in this case are primarily compression. No phase rotation is noticeable. The elongation of the signal state in the direction of the origin is a very fortunate situation for QPSK.

Another test used a 9 MHz wanted carrier and an approximately 15 MHz, 100 percent amplitude modulated carrier, about 15 dB higher in level. The exact frequency was intentionally chosen so that there were no noticeable beat products within the ±2 MHz bandwidth of the demodulator. The 9 MHz carrier was set

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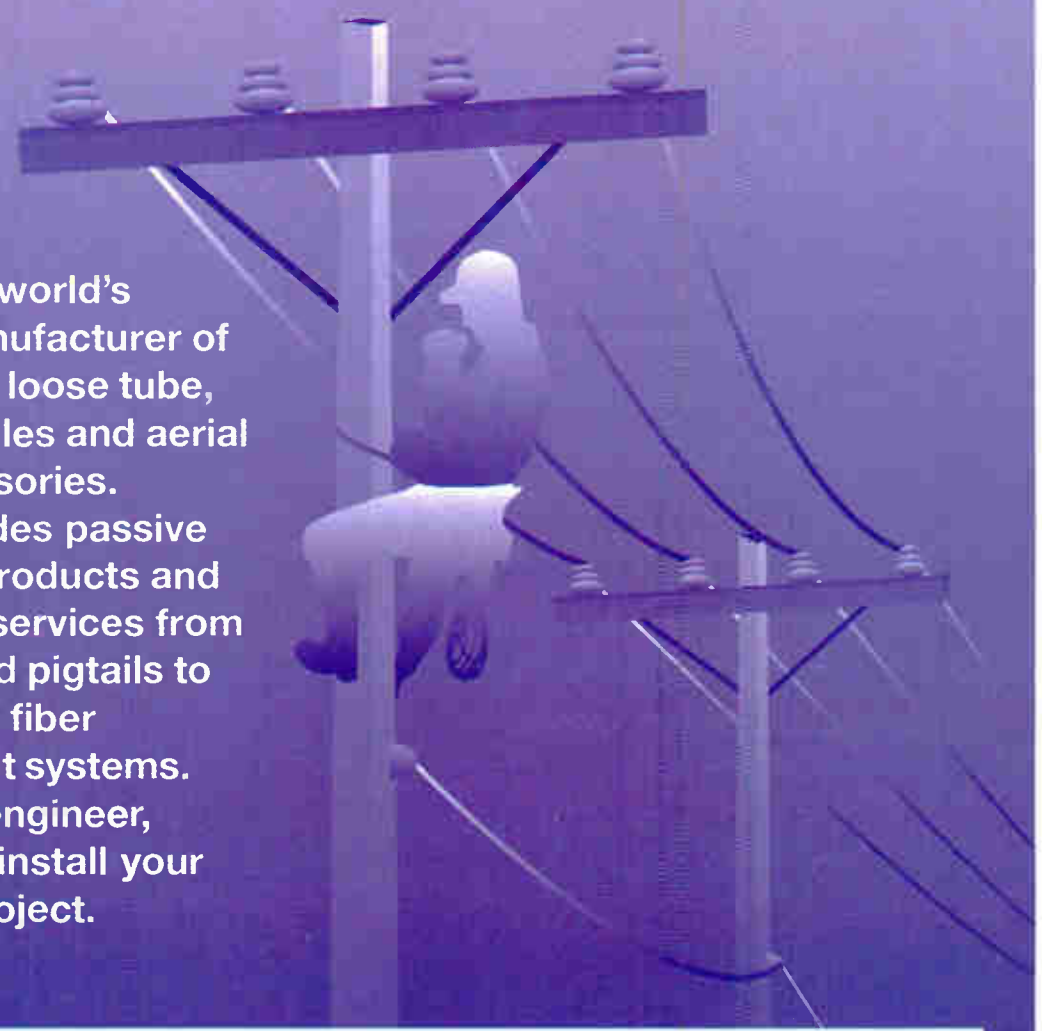

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Figure 10: Signal state spreading of a 9 MHz carrier during noise load testing at high levels.

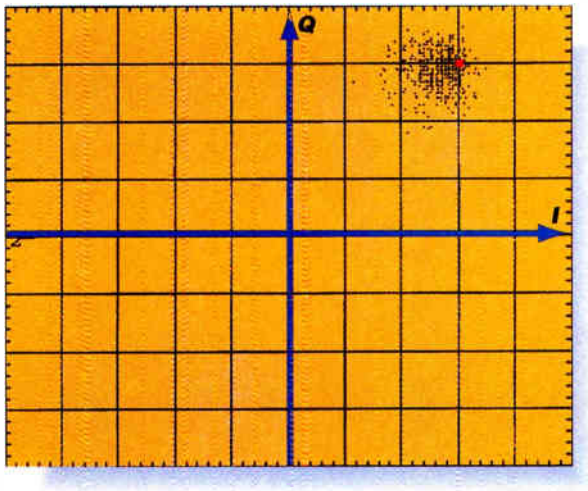
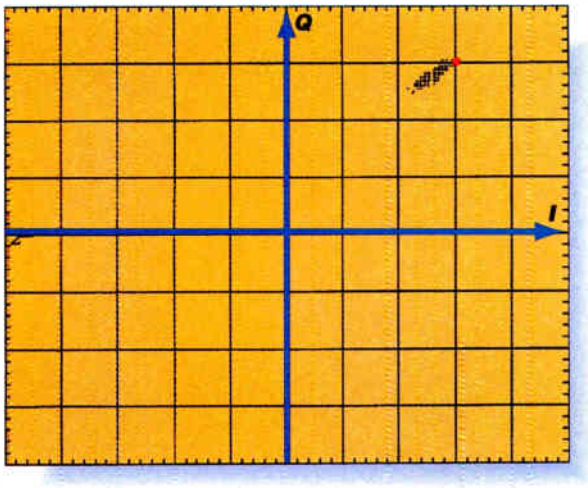


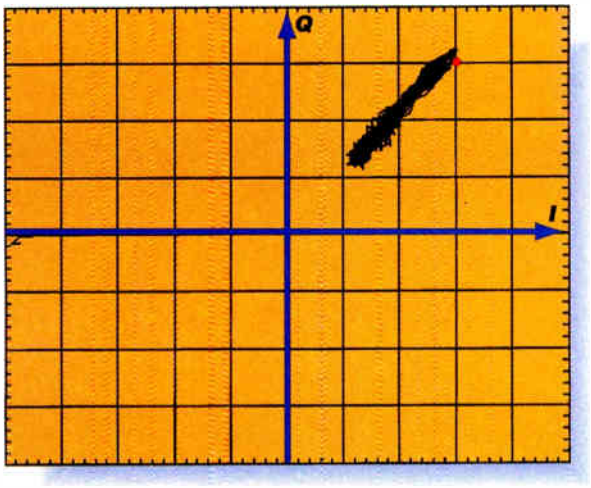
Figure 11: Signal state spreading of a 142 MHz carrier during noise load testing at high levels.



to the normal input level for these transmitters (+18 dBmV). For all three lasers, the effect of this out of channel signal is an almost identical, radial, compression of the wanted signal. An example measurement is shown in Figure 12.

When the envelope of the 15 MHz signal is at its minimum, the signaling state is in its normal location. When the envelope of the 15 MHz signal is at its maximum, the signaling state is displaced towards the origin.

Figure 12: Signal state compression of a 9 MHz carrier in the presence of a high level 100 percent AM modulated carrier.



Lessons learned

Several conclusions can be drawn from this work:

1. Some laser types have "softer" degradation at high RF drives than others.

2. Type testing a return path optical transmitter using a constellation analyzer provides valuable insight into its suitability for carrying digitally modulated carriers.

3. QPSK is extremely tolerant of clipping.

4. Signal constellation impairments during noise loading have shown no peculiar effects. No phase rotations of the signaling state have been observed.

5. Cross modulation in the form of compression can be significant, and this effect is not captured by noise load testing.

6. The reduction of wavelength chirping of DFB lasers at lower RF drive levels increases the slope of the C/(N+IMD) characteristic curve. CED

Acknowledgments

The author thanks Jim Farmer for his continuing support and the members of the SCTE Engineering Subcommittee addressing upstream transportation issues for their open and stimulating discussions. An advance copy of reference number one, sent to us by Oleh Sniezko, provided valuable background information.

My thanks are also extended to James Street, who expeditiously assembled the test facility and collected most of the data.

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2. Technical Personnel, American Telephone and Telegraph Company, *Telecommunications Transmission Engineering*, Volume 1–Principles, 2nd edition, Western Electric Company, Winston-Salem, N.C., 1977, pp. 450-453.

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Cable telephony: Ready to take off?

U.S. ops in HFC holding pattern, international markets rev up

Compiled by CED *staff and written by Michael Lafferty*

Ah, the fickle finger of fate. During the last decade and a half in the cable industry, that finger has been pointing all over the map, and back again, a number of times. Remember the 500-channel universe? Interactive television? Digital television? High-definition television?

How about cable telephony? According to some industry observers (both informed and uninformed), the fickle finger of fate has transformed itself into a thumbs-down position on this once high-flying service/revenue hopeful.

But, a recent series of interviews conducted by the *CED* staff with a variety of operators and vendors tells a different story. Part of the story seems to be that the competitive free-for-all many predicted after passage of the 1996 Telecommunications Act has failed to materialize in the blood-letting many predicted, and some may have even hoped for.

Another overlooked chapter is that HFC telephony technology, while far from perfect, has come a heck of a long way in the last 12 to 18 months. Meanwhile, the deep-pocketed RBOCs seem to have done a Howard Hughes-like disappearing act after having experienced a rough, rumbling takeoff followed by an even faster splashdown in trying to launch their video, voice and data convergence behemoth. (Has the Spruce Goose been superseded by the DSL Duck?)

While cable telephony may have disappeared from some radar screens, it's far from obscure on others. In fact, some predict the last few years of the 20th century will see telephony deployment trajectories heading straight toward RBOC air space.

HFC telephony: follow the leader

While a few may say HFC telephony is progressing quite well indeed both here and abroad, others acknowledge there are some problems. Some feel there are a variety of reasons cable telephony seems to be in some sort of holding pattern. Others believe just one or two roadblocks need to be overcome before deployments begin in a serious way.

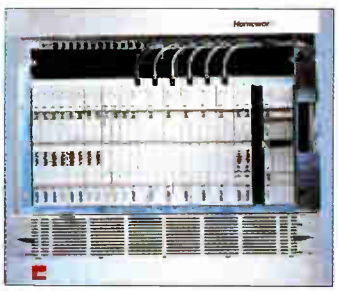
For some, there's a clear difference between those who truly believe in telephony and those who are somewhat more agnostic in their approach. The way Ken Craft, director of marketing for Tellabs' Cablespan product line, tells it, everything is coming up roll-outs. "On the telephony side of things," says Craft, "most major MSOs are saying that they are going to deploy cable telephony this year in anywhere between one to three cities. Almost all are going for at least one. Contrary to what you hear, what we are involved in is, we are getting orders and we are deploying equipment in these cities."

ILLUSTRATION BY ROB PUDIM

Others have a slightly different take on the situation.

"We really see a split," says John Frederick, director of ADC Telecommunications Inc.'s telephone business unit. "We see a couple of operators that are still aggressively moving forward. And we see a number of other major operators pretty much sitting on the sidelines. And I think some of this has to do with their balance sheets and how quickly they feel they can do stuff, given the technology."

Douglas Howell, group product manager for advanced access services at Philips Broadband Networks Inc., thinks the apparent temporary cessation of hostilities between operators and RBOCs will also ultimately work to cable's advantage. "I think, defensively, the pressure is off because the phone companies have backed off," says Howell. "And I think this is giving people a chance to build their infrastructure and wait for that first guinea pig who will really prove you can make money doing telephony.



ADC's Host Digital Terminal supports 28 DS-1 or 24 E-1 inputs.

"Our assumption is that the RBOCs are going to use some kind of DSL technology. And I assume they think that in five, 10 or 100 years, or whenever DSL technology is real and cost-effective, they can always come back to video. That's a guess.

"So, we're seeing some operators that are very committed to going forward (with telephony) and others seem to have slowed. My suspicion is they're in a wait-and-see posture."

Others note that market pressures seem to be diverting cable resources that could be used to develop telephony. "Considering the competition that's hitting all of the MSOs in their base business, for example, from DBS," explains Ron Smith, vice president of operations for Motorola Corporation's Multimedia Group, "I think they're having to retrench and really strengthen up their base business by putting in the digital services that are

Frederick

Braden

going to effectively compete against the competition. That aspect of it, I think, is competing for the capital expenditure dollars that they would normally spend to upgrade their plant and start putting in telephony. So I think that has kind of slowed up the (HFC telephony) market in the United States. But it certainly isn't dead."

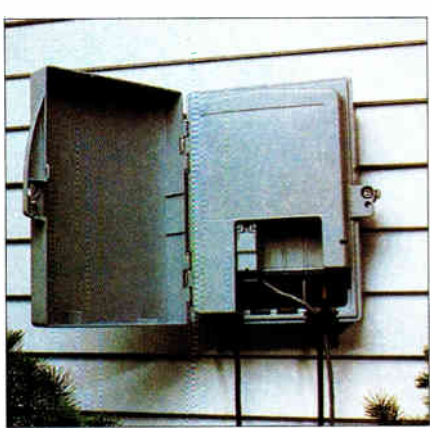
Praise the HFC, and pass the NIUs

Any conversation about cable telephony these days almost immediately focuses on a core group of true believers. One of the most vocal, phone book-thumping proselytizers for HFC telephony is Cox Communications Inc. While others (most notably TCI) have fallen to the wayside or have decided to keep their plans to themselves (e.g., Comcast, which declined to comment for this story), Cox is one of those operators that is keeping the faith, daring to lead the way to the convergence promised land of voice, video and data delivery.

Chuck McElroy, Cox' vice president for residential broadband services, isn't shy about ticking off the varied telephone related projects the company is undertaking. He notes that after having just completed a successful HFC telephony trial in Hartford, Conn., the company is conducting additional trials in San Diego and Orange County, Calif. For the past three years, Cox has also been providing non-switched access services through Cox Fibernet in Hampton Roads, Va., Oklahoma City, Okla., and New Orleans, La.

Yet, the company refuses to put all its eggs in a wireline basket. McElroy points out that the company is a majority owner of the Sprint Spectrum PCS business in southern California, which launched in December 1996. Cox also holds a 15 percent equity stake in Sprint Spectrum, which has launched service in a number of cities throughout the United States.

As far as Cox is concerned, says McElroy, the case for cable telephony is self-evident."Cox believes there is a clear case for providing residential and business customers a competitive alternative to the local telco's offerings," explains McElroy. "Research indicates a willingness among consumers to purchase telephone services from other providers, and there appears to be a strong interest among consumers to purchase all communications services (video, voice and data) from a single provider.



From the factory, ADC's basic Home Integrated Services Unit features one or two POTS lines (expandable to four) and provides for on/off video control.

"We plan to provide multiple dwelling, single dwelling, and commercial video, data and telephone services. Cox is currently planning on being a facilities-based, retail provider of telephony services."

To further that goal, McElroy points out that in its nine major clusters the company is "upgrading its architecture to be 750 MHz, ring-in-ring, two-way networks with 1,000 homes per node." Those clusters, he notes, represent 82 percent of the company's customer base, giving the company a unique advantage over MSOs who have systems scattered across the country.

Another pioneer in cable telephony, Time Warner Communications, is apparently holding back on expanding into other telephony markets, at least when it comes to residential service. "We are going to limit our efforts in residential telephony to Rochester," says Michael Luftman, vice president of corporate communications for Time Warner Cable. "(But) we are going to expand within that market, because we have only marketed to about 10 percent of the Rochester area that is capable of receiving service. Regulations are simply not at a point where we are comfortable." (See "Winning over Rochester," *CED*, March 1996.)

While the company continues to cite a muddled regulatory picture as one of its primary reasons for reining in its residential service effort, other industry observers speculate otherwise. Some wonder if the company's oft-rumored divestiture of its cable holdings and the resulting hesitancy to sink more money into an admittedly expensive venture may be the actual trigger for its residential telephony retrenchment.

Philips' Crystal Line Diagnostics element management system runs on a Windows NT PC platform.

Nevertheless, Luftman points out the company will continue its rollout of switched business service (as a competitive access provider or CAP) in 18 locations around the country. The locations, which cover 10 states from coast-to-coast, include: Texas (Austin, Houston and San Antonio); Ohio (Cincinnati, Columbus and Lima); New York (New York City and Rochester); North Carolina (Charlotte, Greensboro and Raleigh); Florida (Orlando and Tampa); Honolulu, Hawaii; Indianapolis, Ind.; Memphis, Tenn.; Milwaukee, Wis.; and San Diego, Calif.

US West's Continental Cablevision, a current partner in the Rochester effort, is leveraging its newly acquired telco connections (along with its inherent financial strength) in a couple of trials in the South. "We have two trials currently underway," reports Greg Braden, vice president of telephony for Continental. "One in Atlanta and a smaller trial down in Pompano Beach, Fla. The Atlanta trial is taking place in MDUs and will be expanded to include single family residences using full HFC-based telephony. In Pompano, we're in the very early stages of a trial for telephony in MDUs using more traditional telephony platforms, like subscriber loop carriers, as opposed to full HFC-based systems."

Braden says current plans for the four-month-old

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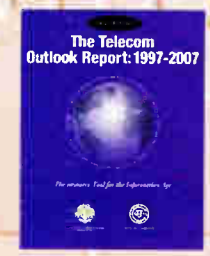

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Atlanta trial would be to come out of the trial stage and begin rolling into phased commercial deployment mid to late third quarter this year. He describes the Atlanta architecture as "a classic hybrid fiber/coax network architecture where...we are building nodes in the 500-home node sizes, which is a kind of targeted average node size. And we're putting in 90V gas generator back-up powering schemes to ensure network reliability for supporting life-line services."

This model (i.e., MDU-to-residential service roll-out), says Braden, is not necessarily the one the company will use in other areas. "I think, once we are confident that we have a stable technology platform and that we've got, more importantly, all the operational support systems in place, then I don't think that you would see us necessarily drawing a distinction between rolling out MDUs first and then single family residences second.

Scientific-Atlanta's CoAxiom Customer Interface Unit can be powered from the network, or locally powered from the subscriber.

"It will be a phased approach in that, of course, we'll be offering the services across those portions of our network that are upgraded to 750 MHz, two-way capability. And those network build plans will continue for a couple more years. But, in a given area where that network upgrade has taken place, we will be pursuing MDUs and single family residences alike."

Over there, over there

The World War II tune, "Over There" could easily be used today to describe how the Yanks are going overseas to develop cable telephony technology as a viable alternative in many developed and underdeveloped countries. Many believe these trials and deployments will help take up some of the developmental slack that's currently being experienced here in the United States because of operator hesitancy about telephony.

ADC's Multi-Dwelling Integrated Services Unit features configurations ranging from 12 to 96 lines and provides remote provisioning of both video and telephony services.

Tellabs' Craft believes conditions overseas are more conducive to a quicker rollout of cable telephony. The faster it rolls out overseas, the logic goes, the faster it will become a reality in North America.

"There are different business and market factors overseas," explains Craft. "The sense of urgency to provide telephony is much higher than in the United States either because of poor service, or in some of these markets, because of no service at all."

Many believe the severe shortage or total lack of telephone service in many developing countries, or "green field" situations as they're called, is fertile ground for cable telephony. GADline Ltd., an Israel-based company, recently announced it's serving as the key equipment supplier to an Israeli-Chinese joint venture that has been formed to provide the installation and management of an expansive public cable telephony system for the northern Chinese city of Tianjin (pronounced 'Ting-ching').

"As we see it," says Laurence Rubin, CEO at GADline, "there are tremendous opportunities for telephony-over-cable in areas where there's a need for telephone service. You take places like India or China, where in many cases, they have a more advanced infrastructure for cable television than they do for providing telephone service. That's what they're doing where we are in China. They're putting in the cable TV infrastructure, both for the short- and long-term, (because) it's cheaper to provide the telephone over HFC than it is to put in the twisted-pair copper."

Back in the U.S. of A.

Meanwhile, back in North America, there seems a fairly broad consensus about what's holding the service back at this particular time.

Time Warner and Cox both site the regulation morass and the resulting interconnection disputes raging around the country. "The biggest obstacle is probably securing sensible and stable regulatory rules and regulations," says McElroy. "The local exchange carriers (LECs) have effective lobbying power over state regulators and that makes the future of telephony regulatory rules unpredictable at best. In addition, the LECs can delay competitive entry through the negotiations and construction of facilities for network interconnection."

McElroy, as well as other operators and vendors, are fairly upbeat about the technology coming around sooner, rather than later. It's what's going on behind the scenes that's got their attention.

"I'd say the biggest (hurdle) is really the backroom functions," explains Continental's Braden. "We think that the kind of new technology aspect of cable telephony—the host digital terminals (HDTs), the network interface units (NIUs)—those are going through the technology curve that any new technology does. But, we're seeing that begin to stabilize and fully expect it will stabilize like everything else does over time.

"Where the real challenges are, are in making sure we have the operational support systems, the backroom operations and the methods and procedures that you need in place to offer this type of service in a high-quality fashion and on an integrated basis with our core business and other new services that we're beginning to offer. And that takes a lot of very detailed thinking, planning and execution. And that all takes time. Those are the things that we focus and work on daily to make sure we've prepared ourselves to operate in that intricate environment."

Many see data as a useful stepping-stone for telephony service, both from a technology/infrastructure standpoint, as well as getting a handle on the vexing back room/OSS issues. "When you go into telephony," says Howell, "you've got billing issues, interexchange agreements, operational characteristics, and you've got

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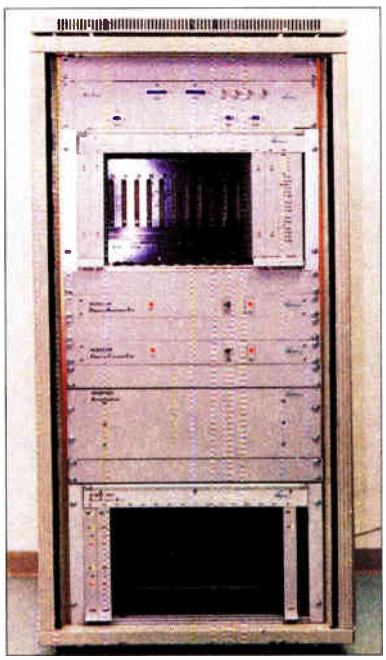

In the headend, GADline features a management interface unit, frequency transvertor and convertor units, a splitter combiner and a trunk interface unit.

to have people on call all the time. It's a mindset change. It's an operations change. It's negotiated agreements all over the place. You just can't provide it all by yourself.

"Whereas, when you do data, it's kind of a nice stepping-stone, because you're getting your reverse path set up and your infrastructure in place. The amount of technology you have to learn yourself is relatively small. For example, you may have to learn about modems and servers, which is relatively easy to outsource if you want. It also has some less demanding operational requirements. So to me, it's a nice stepping-stone to provide telephony."

Rick Haube, Philips' director of marketing, concurs. "In addition to the return path experience," he says, "data requires that you set up additional resources in-house, like help desk or enhanced customer service and provisioning. These customer service issues, as you expand your initial customer service base, may share some similarities from data to telephony."

The technology tango

The HFC telephony solutions circulating in the industry offer a variety of approaches and unique capabilities. While most of the vendors have a tendency to say their particular solution is the best for all concerned (and competitively priced, too), the final decision rests with the operators and the peculiarities of their systems and markets.

GADline's Subscriber Interface Unit 503-B brings voice/data communication into the home where it provides plain old telephone service (POTS). The larger unit features a battery back-up.

ADC believes its modulation scheme and a unique leveraging capability set it apart. "Right now," says Frederick, "I think we're one of the few in the industry using OFDM (orthogonal frequency division multiplexing) at 32 QAM. Most of the industry is using TDMA, QPSK or 4 QAM. And what that roughly translates to is, in 6 MHz, for example, a QPSK system would get maybe somewhere between 72 and 90 DS-0s. We get 240 in that same 6 MHz. So, we have at least double the spectrum efficiency of other systems. And OFDM offers superior voice ingress immunity.

"The other thing that we're doing is that we're able to leverage our Homeworx equipment not only for telephony applications, but also high-speed data. We can take our home unit and supply both data and telephony simultaneously out of that device (estimated cost per line: $200-$500). It's a non-shared type service. We also leverage an operator's investment by integrating both of those services back at the host digital terminal. So you have one piece of headend equipment vs. many."

Philips' new Crystal Line access platform (estimated cost per line: under $350) also touts an ability to offer simultaneous delivery of different services, as well as a unique maintenance capability. "We have a configurable time-out," says Howell, "where if the circuit is actually physically broken, we will hold the call up. This gives the opportunity for somebody to do some very quick maintenance. Obviously, there's no transmission if the circuit's been broken. But it gives you the opportunity to cut in something new without disrupting telephone calls. It's entirely configurable through our element management system.

"We've also spent a lot of time working on our ability to withstand noise in the reverse path. You can actually put a noise carrier right on top of our signal, and we can still maintain the call."

Tellabs' Cablespan product line, according to Craft, offers a number of useful capabilities. "We offer an integrated HFC/DLC solution," says Craft, "that allows operators to provide multiple market segments or multiple applications segments in one unit. We also offer scalable RF path concentration, as well as a singular traffic statistic capability. We have a menu item in the network management system that allows you to get information on call loading, blocking, and you can set alarms as well. You can do this on a system, node or individual modem level."

Jack Mann, Scientific-Atlanta's director of marketing, cable telephony systems, thinks S-A's CoAxiom line and its FDMA single carrier per channel solution provides some benefits as well. "The key point," says Mann, " is that it avoids a lot of different types of ingress and interference because it's narrow. Also, if there is any interference, you potentially don't have to move that many channels. If you have a wide-carrier approach, with say, 24 channels, you have to move 24 voice circuits instantaneously. And that's not easy to do."

Other companies, like Motorola and its CableComm system, continue to refine their technology in trials in the United States and overseas. "Well, basically," says Smith, "we've got commercial systems deployed with Optus in Australia, with TCI in the Arlington Heights/Mt. Prospect area, and (Motorola is) about to go commercial in Malaysia."

The crystal ball, please...

Where's all this leading to? Is it just more technology-in-the-sky hype from the cable industry? For those in the telephony trenches, the forecasts for its widespread debut are surprisingly similar. Most agree that while the RBOCs mull over their convergence technology and strategies (once again), operators are focusing on the more immediate areas of concern like enhanced video delivery (remember DBS?) and the rollout of high-speed data access services. But they believe these preoccupations will pass relatively soon.

Continental's Braden sums up the crystal ball consensus on HFC telephony for like-minded operators and vendors."I think that by mid to late 1998, many of the issues which we kind of wrestle with daily will have stabilized a lot. We will have gone through the learning curve on a variety of important issues. I think it will become more mainstream beginning in 1998, and we'll ramp up from that point in time as MSOs gain greater confidence in it and there's a greater critical mass of upgraded plant that you need to offer these services." CED

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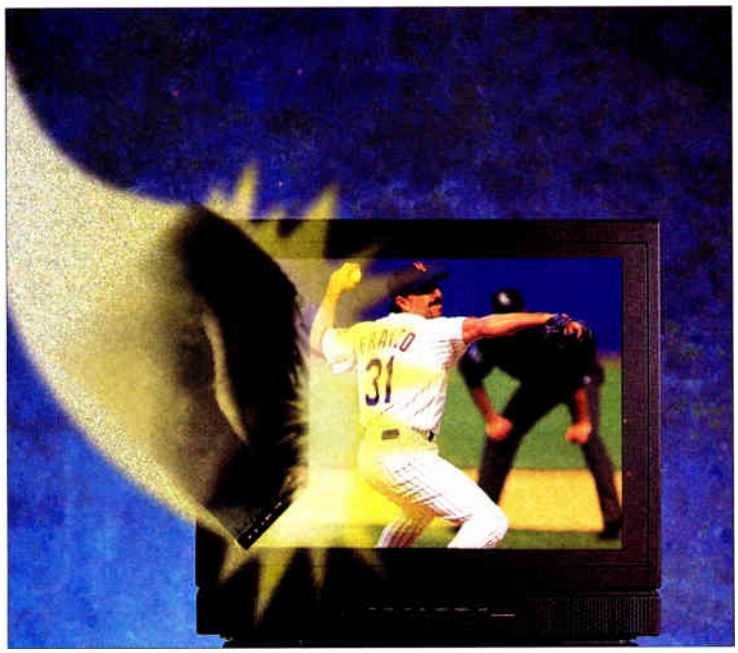
Digital insertion: Can we all work together?

CableLabs courts vendors, standards bodies

By Robert Wells

Rhonda Hilton and her colleagues call it "splicing," a term evoking a scene of tape decks and razor blades that was all-too-common in the pre-digital age. But the task at hand is defining an optimal way to insert one digitized program seamlessly into another–an ad into a travel show, say, or a tornado alert into a baseball game.

The hub of this activity is a subcommittee on Digital Program Insertion (DPI) set up in November as part of the CableLabs Technical Advisory Committee. Jay Vaughan, director of engineering and technology at Time Warner Cable, chairs the group, and Carol Derr, director of advertising technology at TCI Technology Ventures, is vice-chair. Hilton, a senior member of the CableLabs technical staff for new services development, coordinates the Labs' participation.



Tornado photo courtesy of The Weather Channel.

Given advertising's $1 billion contribution to annual cable-industry revenues, the stakes in getting the ability to insert digital bistreams into other digital bitstreams up-and-running are fairly high.

The present situation

The hybrid approach used by MSOs today, widely referred to as digital insertion, is actually an essentially analog process of inserting content stored on a digital server, with the aid of analog routers and switchers, into analog programming. Cue tones are typically sent in out-of-band audio channels. While today's hybrid insertion system output format is baseband NTSC video and audio, there remain interfaces that are not standardized. No two vendors' approaches are compatible.

Vendors are working on specifications for MPEG digital splicing but "you can walk the booths at the Western Show, and they'll readily admit that not everything has been solved yet," notes Hilton. "Vendors, operators and programmers must work together to develop affordable solutions," says Hilton. Among the major factors holding back vendor development efforts is "having received no uniform guidelines from the cable industry." In short, notes Hilton, "it's a chaotic time."

"What's still missing is a digital-standard equivalent of baseband analog NTSC video," says Vaughan. "As the industry rushes to get digital equipment to market, we don't want to overlook the basic building blocks of headend signal processing and baseband digital multiplexing."

The plan of attack

First, a quick look at the subcommittee's work plan. Efforts, now in full swing, focus on participation in two standards bodies and talking with vendors in the context of a Request for Information (RFI).

A key liaison is with the Society of Cable Telecommunications Engineers' (SCTE) Digital Video Subcommittee (DVS), chaired by Dr. Paul Hearty of General Instrument, and its Working Group 3 on Network Architectures and Management, chaired by Michael Adams of Time Warner Cable.

In January, the DPI subcommittee wrote and submitted a technical paper on digital insertion to the Society of Motion Picture & Television Engineers' (SMPTE) Working Group on Switching and Synchronization of Packetized Signals, known as PT20.02.

As Hilton observes, "It's hard to write a standard unless you have a requirements document to work from." Accordingly, the CableLabs subcommittee plans to submit to DVS a member-company draft document on "Digital Program Insertion Requirements."

The subcommittee also was expected to issue by early April an RFI outlining a draft set of requirements, seeking vendor proposals for appropriate interface specifications. Some of the requirements in the document are essential, says Hilton, while others "are more along the lines of a wish list" and may be too expensive to implement, at least initially.

Dr. Richard Prodan, CableLabs' chief technology officer, will lead the team evaluating the expected RFI responses. After evaluation will come a meeting between the CableLabs team and vendors, plus further ongoing discussions.

Another document due out in the same time frame is a white paper providing background on cable advertising insertion for vendors, standards body members and others.

The idea behind all this, of course, is to urge indus-

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try bodies and vendors to close ranks around a common approach. In contrast to the vendor-proprietary world of analog, Derr says, "there's a good chance we'll have open standard interfaces and interoperable products from the outset."

Agreement among vendors and carriers on a set of key specifications and interfaces would be sufficient to move ahead, she adds. Eventually, says Vaughan, as set-tops give way to MPEG-enabled digital TVs, "there probably are elements of this that should go through a formal standards process."

The subcommittee has suggested a middle-ground criterion, 'near-seamless' splicing

Technical issues

CableLabs is seeking an industry consensus on such technical issues as these (examined in turn below):

✔quality benchmarks
✔splices involving differing bit rates
✔defining insertion points
✔synching audio and video, and
✔avoiding detection by "commercial-killer" devices.

The concept of digital insertion lumps together ad insertion, emergency-message insertion and a more generic category of "program insertion." The latter could include top-of-the-the-hour news inserts or school updates–in fact, any content that MSOs or programmers dream up, Hilton says. Although some vendors have suggested the different content classes require different equipment, the subcommittee thinks one set of equipment should suffice, she says.

The MPEG-2 transport stream, says Hilton, "doesn't fully specify how to do splicing, it only has the hooks to do splicing." The CableLabs requirements state that the quality of the insertions should be at least equal to that of analog insertion, she says.

MPEG-2 supports "seamless" and "non-seamless" splicing, the latter meaning that a discontinuity is apparent in the decoder output. The subcommittee has suggested a middle-ground criterion, "near-seamless" splicing, in which discontinuities, while present, aren't perceptible.

The MPEG standard specifies variable-bit-rates (VBR), but constant bit rates (CBR) can be simulated within it, Hilton says. "There are techniques to smooth it out, so essentially, the traffic rate stays constant, such as stuffing null packets into the stream occasionally if you don't have enough material."

A major issue so far, notes Derr, "is how to match bit rates in order to insert program material into a statistically multiplexed bitstream." (Statistical multiplexing is a way of combining multiple channels into one datastream by dynamically allocating capacity to each channel and varying digital compression rates.)

"Suppose you have an ad at 6 Mbps and a movie at 4 Mbps," says Hilton. "How do you just magically switch over and not have freeze-ups or artifacts on the screen? For us, the problem boiled down essentially to buffer management and interfacing with remote decoders."

Achieving interoperable solutions means convincing vendors to support multiple data rates, even if they think imposing one rate would be easier, says Hilton. Further, she says, "The system should accommodate dramatic bit-rate changes, even though the MPEG standard wants you to do nice, gradual ramp-ups so it can properly manage its buffers."

Vaughan says he hopes to explore, through the RFI process, when stat-muxing should be supported and when CBR might be necessary in the name of smooth insertion.

MPEG compression is efficient because it doesn't constantly retransmit complete video frames, just the inter-frame changes, Hilton explains. If a movie is interrupted by a news bulletin, a decoder may be unable to resume the movie afterwards because it hasn't seen the previous-frame information it needs. Thus, another technical issue is "defining some type of guidelines for insertion points–places to do an insertion so that the picture is restored quickly when you go back to the program, vs. just doing it willy-nilly," says Hilton.

A similar issue, she adds, is making sure that audio and video can be synched up when the original program returns. Another related issue is the mixing of key-encrypted content, like movies, with unencrypted material. This must be done in a way that doesn't leave a decoder too confused to display a picture.

Yet another imperative for the system is "to make sure it's not susceptible to commercial-killer devices," says Hilton. "We have to make sure we don't add obvious information to the bitstream, otherwise, someone will come up with a device that can turn the TV off or skip to another channel during the entire commercial sequence."

Conclusion

Most of the near-term activity will consist of inserting national and regional ads, but MSOs may want to insert into digital channels fairly soon, says Hilton, adding: "We don't want cable operators shutting off revenue streams by telling local advertisers, 'Sorry, we can only accommodate you on our analog channels'." Vaughan, too, stresses the need to get systems in place in time to avoid missing out on significant revenues.

Overall, Hilton sees "a wonderful opportunity in the interactive insertion environment—not just advertising-on-demand, but really, information services-on-demand." As a skier, she'd like to be able to "hit the remote and see the satellite weather picture for Colorado." Such content, Derr notes, could be downloaded either in the background, to decoder memory, or on demand, if systems have a return path.

One eventual goal is the ability to support "some type of set-top-addressable insertion," says Hilton.

"We'd like to think that things will move in the direction of addressability, either to smaller nodes, or to individual homes," says Derr. "The concept of complete addressability to the set-top box–where you'd have that level of granularity in targeting your audience–certainly is the dream of many advertisers." CED

This article was prepared specially for CED *by Robert Wells on behalf of Cable Television Laboratories Inc. (CableLabs).*

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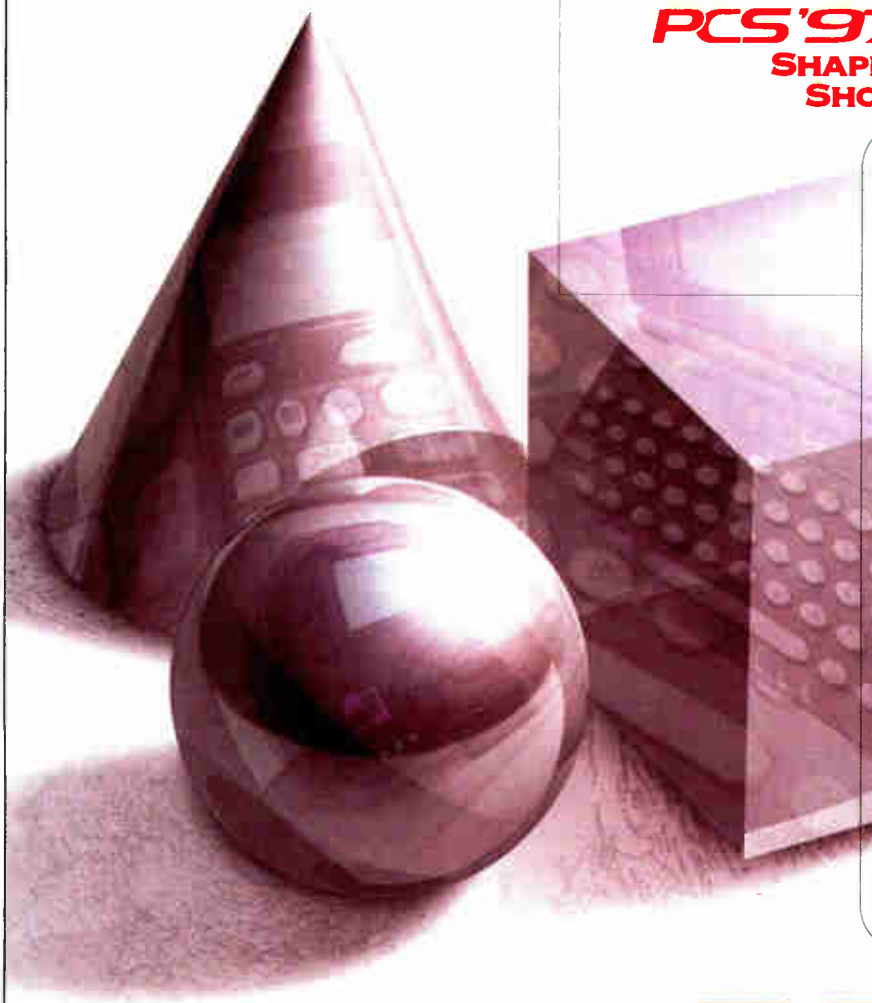

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Time-shifting as DBS' entree to 'local access'

To the Editor:

I have noted how the key difference between DBS operators and cable-based broadband operators is " local access." I have a suggestion for a way that DBS operators could offer local access. This suggestion is based on a number of factors, including:

✔From watching "local TV," I believe the actual amount of truly locally-originated programming is very small. For the sake of argument, let us say it amounts to two hours per day, per station.

✔How local does local have to be? I would say if you chose the top-rated station in the top 100 markets, you would cover virtually all "local" areas in the country.

✔Two hours times 100 stations equals 200 hours. Since a DBS channel can broadcast 24 hours in one day, that means nine channels could present (more than) *all the local news for the entire nation.* For the viewer, it's then just a matter of tuning (or automatically recording) the appropriate two hours from the appropriate channel to get the "local" programming.

✔Much of this could be time-shifted to be more accessible, as indicated in the chart.

This would require that the top-rated station provide two hours of bonafide "local" programming by satellite, either for live insertion or for tape delay. However, seeing that ad space is maintained, I can't imagine anyone not wanting to be included.

Such an arrangement may actually give DBS customers more local choices than "local" customers. I live in Richmond, Ind., an ideal example. I have no "local" stations, but I could take Cincinnati, Indianapolis or Dayton, all less than 80 miles from me. All of them fall in the Top 100 markets, so I could actually pick and choose which I wanted to watch (or even watch them all).

"Local" programming feed schedule

	West Coast viewing	Mountain viewing	Central viewing	East Coast viewing
West Coast feed	**3 p.m.-9 p.m.**	4 p.m.-10 p.m.	5 p.m.-11 p.m.	6 p.m.-Midnight
Mountain feed	9 p.m.-3 a.m.	**10 p.m.-4 a.m.**	11 p.m.-5 a.m.	Midnight-6 a.m.
Central feed	9 a.m.-3 p.m.	10 a.m.-4 p.m.	**11 a.m.-5 p.m.**	Noon-6 p.m.
East Coast feed	3 a.m.-9 a.m.	4 a.m.-10 a.m.	5 a.m.-11 a.m.	**6 a.m.-Noon**

This would, of course, require the dedication of nine channels to this "local" programming. (Actually 216 hours per day, or 108 stations/108 markets.) But the payoff would be that the cable channels could not be penalized for lack of local origination.

Stephen Lampen
Technology Development Mgr.
Belden Wire & Cable Co.

Heartbroken to see history distorted

To Walt Ciciora:

Just thought I would send you a note on your article in the February 1997 issue of *CED*. Technical people often are maligned, just as you noted, especially when others are somewhat intimidated by our mastery of complex and often mystical technology.

The answer, as you so carefully point out, is to have a broader command of topics of interest. TV is of course our "thing," and it is a natural for all of us to know more than the average person knows.

I have the advantage of being born and raised in Schenectady, N.Y. (near Albany), which is where the G.E. Corporate R&D Center is located, and where much of the earliest work on both mechanical and electronic TV was done. In fact, two of my uncles worked for GE in the 1920s and '30s and built a home TV which was used to ge local broadcasts.

Amazingly, few in cable or broadcast TV know much about our industry's origin. I watched a PBS documentary a couple of years ago on TV which was produced with the BBC and was heartbroken to see history so distorted about the important technical work that was done. This show seemed to portray most early TV work as being done in the U.K., when actually, it was done in a number of locations around the world.

Most people are amazed to hear that if we were to take today's 1997 model TV set back to 1938 in or around New York City or Schenectady N.Y., we would actually be able to watch the King of England visit the N.Y. World's Fair on the very first TV network (two stations) transmission. Except for the audio being AM vs. FM, the TV would probably be able to lock up just fine (in black-and-white, of course!).

Such technical facts are often lost in the mass media's portrayal of history. Similarly, the details of history are often even more amazing. For example, one of the books you mentioned, Rhodes' *The Making of the Atomic Bomb*, has a wealth of information in it. One item includes a reference to uncovered Japanese Military High Command orders to their scientific people to attempt to develop an atomic explosive device for use in an attack against the U.S.! This document was dated April 1941! No one I have ever talked with has ever heard of this piece of history, yet we often hear the U.S. use of atomic weapons criticized.

Fortunately, the Japanese were unable to develop the technology, or the military in Japan would probably have used it, probably to attack Pearl Harbor!

Best wishes and congratulations on a fine article!

Dan Whelan
Chief of Video & Broadband Section
N.Y. State Public Service Comm.
(formerly the NYS Cable Commission)

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People on the move

The National Cable Television Association has named **Brian James** as winner of its 1997 Vanguard Award for Science & Technology. The Vanguard Awards are presented to men and women who excel in both business and in personal commitment to their colleagues, and whose accomplishments merit the award of the industry's highest honors. As Vice President, TAC Test Centre, Rogers Cablesystems Ltd. and CableLabs, James is responsible for the management and evaluation laboratory for the cable industry, and provides a liaison between CableLabs and its Canadian members. The laboratory is a joint venture of Rogers Cablesystems and CableLabs. Prior to taking on his duties at the TAC Centre, James was director of advanced television testing for CableLabs from 1990 to 1996. He served as director of engineering in the Science and Technology Department at the NCTA from 1985-90. James is also a senior member of the Society of Cable Telecommunications Engineers.

WASSCO has appointed **Ed Durfey** as president. Durfey was hired as product manager in 1981, advanced to branch manager, marketing manager, controller, and finally, vice president of finance before accepting the position of president.

Durfey

Integral Corp. has appointed **Tony Randolph** as president. He has 22 years of experience in the wire and cable industry. Randolph began his career with Southwire Company, Integral's parent, in 1974.

Harmonic Lightwaves Inc. has appointed **Michel Vaillaud** to its board of directors. Vaillaud most recently served as chairman and CEO of Schlumberger Ltd. Now retired, he is currently a trustee of the Institute of Advanced Studies in Princeton, N.J.

Epitaxx has announced several changes in its management team. **Noboru Hiraguri** has been appointed vice-chairman and CEO of the company and is responsible for the basic policy and overall direction of the company. Hiraguri has been chairman of the board of directors of the company since May 1991, and president and CEO of Epitaxx since September 1994. **Dr. Yves Dzialowski** has been named as president and COO of Epitaxx and is responsible for all operations. He is also a member of the board of directors. And **James Coleman**, VP of Finance and Administration, has also been named as CFO.

Trilogy Communications Inc. has appointed **R. Jeff Morris** to the position of vice president of international operations for the cable television, cellular and SMR (specialized mobile radio) markets. In his new position, Morris will be responsible for increasing Trilogy's worldwide sales distribution network, developing new markets and business opportunities worldwide. Before joining Trilogy, Morris spent more than 15 years serving in various director-level positions with AT&T International and AT&T Outside Plant Systems in Asia, Africa, the Middle East and Central America.

Morris

Time Warner's Excalibur Group has announced the expansion of its technical team based in Stamford, Conn. as the company moves ahead with the launch plan of its *Road Runner* service. **Tom Staniec**, formerly director of network engineering, has been promoted to vice president of network engineering. **Peter Bates** has been promoted to vice president of systems technology. He was previously director of system technology. Meanwhile, **Frank Kist** has been promoted to vice president of network technologies. He was previously director of network technologies. **Howard Pfeffer** has been promoted to vice president of software technologies, and is responsible for the applications and client software. New hires include **Rick Bechtel** as the systems plant engineer, formerly of the SCTE; and **Chris Broccoli** as senior software engineer. He was previously with Prodigy Services Company.

Wes Hanemayer has been appointed as vice president of operations and engineering at Vyvx Inc. He will be responsible for satellite, fiber, teleport and interactive operations; syndication, quality assurance and engineering.

Bay Networks Inc. has named **Karl May** as vice president and general manager of the company's Data-Over-Cable-Division. May will report to Bruce Sachs, an executive vice president and general manager at Bay Networks. He joins the company from Silicon Graphics (SGI), where he led the company's efforts to develop products for the digital television industry. He succeeds Rouzbeh Yassini, founder of LANcity and former general manager of the LANcity Division, now Bay's Data-Over-Cable Division.

Jerry Pittman has been appointed vice president, network planning, for Western Tele-Communications Inc. (WTCI). Pittman has been with the company since 1989, involved in engineering communications systems, project management and new business opportunity development.

Linda Cutler has been promoted to the new position of vice president of investor relations and corporate communications at USCS International, parent company to CableData and International Billing Services. In her new position, Cutler will be responsible for the company's investor relations and internal communications, as well as its charitable and community visibility programs.

Cutler

CSG Systems Inc., a subsidiary of CSG Systems International Inc., has named **Barry Winchell** as vice president systems development for CSG Phoenix Telephony. He brings 20 years of systems development and data processing experience to CSG Systems and will be based in the company's Boulder, Colo. office. Prior to joining CSG, Winchell spent the last 10 years leading systems development activities for Citibank Credit Cards in Sioux Falls, S.D.

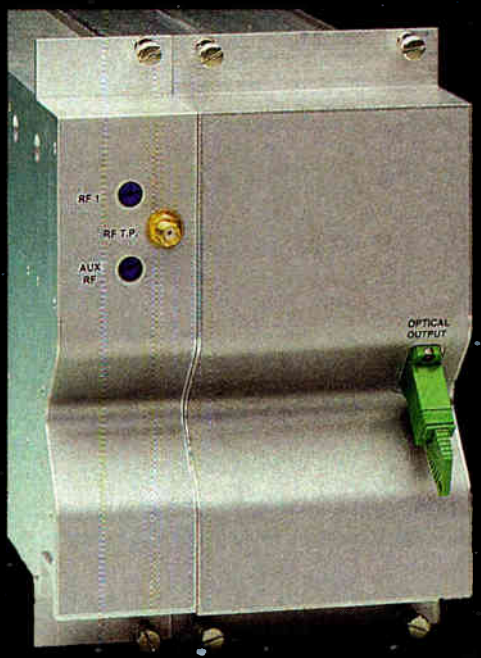
Lucent Technologies has named **Gary Morgan** as its Network Systems regional vice president in Denver, Colo. Morgan comes to Lucent from his former job as vice president, south and western region for telecommunications equipment manufacturer Siemens. He succeeds Dana Zitek, who has moved to Europe to be Lucent's managing director–Network Systems division, United Kingdom.

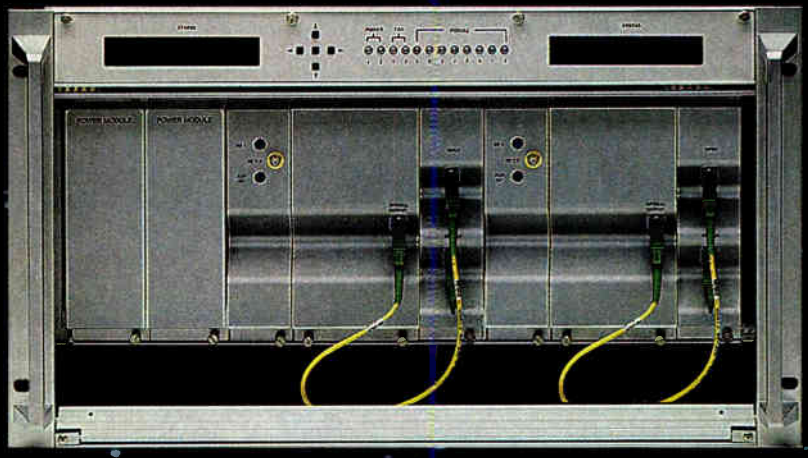
General Instrument Corp. has appointed **D. Douglas Means** as vice president, North American Sales, for the company's NextLevel Satellite Data Networks Group.

Artel Video Systems Inc. has named **Michael Druar** as vice president, North American sales, and **John Curtis** as vice president, international sales. Druar has held management positions at Honeywell and ADC Telecommunications. Before joining Artel, Curtis served as senior VP of Worldwide Operations for Banyan Systems.

Altair & Antares

Superstars of 1550 nm Transmission





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Reader Service 22

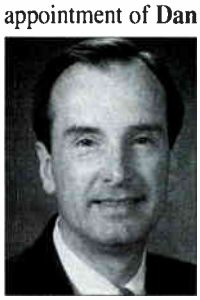
Alan Hulme-Lowe, Ph.D., has been appointed technical director for the 3M Telecom Systems Division based in Austin, Texas. Prior to accepting this position, Hulme-Lowe served as laboratory manager for 3M's Industrial and Consumer Sector Laboratory. He has held technical positions of increasing responsibility throughout his 3M career, including positions in England and Italy. Hulme-Lowe holds a doctorate degree in chemistry from the University of Liverpool. He is also a graduate of the Royal Institute of Chemistry and holds several patents, including inventions in the field of fiber optic technology.


Hulme-Lowe

3M has also named **Scott Evans** as marketing director for its Telecom Systems Division. In his new position, Evans will be responsible for the division's overall marketing and sales strategy throughout North America. A graduate of John Carroll University, Evans began his 24-year career with 3M as a sales representative.

The National Cable Television Center and Museum has named **Kim Dority** as project manager of the Center Library. An executive information specialist and consultant, Dority also will serve as associate director of the Library. The Library will be operated by The Center in partnership with the University of Denver Libraries. **Nancy Allen**, dean of the Libraries, will also serve as director of the Center Library.

Trilogy Communications has announced the appointment of **Dan Hobbs** to the newly-created position of director, domestic sales and marketing for the company's cable TV coaxial products. In this new position, Hobbs will be responsible for managing the company's network of salespeople, manufacturing reps and distributors, as well as directing all marketing activity.


Hobbs

James Collins, Jr. has been named director of sales and marketing at MountainGate, a Lockheed Martin Company. Prior to joining the company, Collins held a number of senior management positions, including vice president of sales for Island Data, national sales manager for Storage Dimensions, and director of Costa Distribution.

Fiber Options Inc. has appointed two people to management positions within the company. **Barbara Butler** takes on new duties as director of marketing and communications, while **Charles Hoeg** takes over as director of engineering.

Butler returns to Fiber Options after holding a marketing-communications management position with an international manufacturer of microelectronic components for the past three years. She holds an MBA in finance and international business and has worked in the marketing-communications field for more than 15 years. Hoeg brings more than 35 years of experience in the electronics industry to his new position with the company. For the last 30 years, Hoeg has been an independent consultant to more than 30 organizations in the New York/Long Island area.

Harmonic Lightwaves has announced two promotions and an expansion of its sales staff. Two of the company's regional sales managers have been promoted to the position of area sales manager. **Michael Carollo** has assumed the position for the Atlantic region, and **Daniel Ambauen** has taken over that position for the Western region.


Carollo


Ambauen

Carollo brings 20 years of experience in RF, microwave, fiber optics and cable TV to his new position. Ambauen is a 20-year veteran of the cable TV industry, having worked most recently for Intermedia Partners in Santa Clara, Calif. before joining Harmonic in 1994.


Thorpe

The company has also named **Thomas Thorpe** as regional sales manager for the company's mid-Atlantic region. He comes to Harmonic from C-Cor Electronics Inc., where he was product manager for the company's AM fiber optic product line.

Meanwhile, C-Cor Electronics Inc. has announced the promotion of **Colin Horton** to the new position of market manager for distribution products. In addition, the company announced that **Daniel Gibson** has been appointed product manager-digital fiber. Horton has more than 18 years with C-Cor and will be responsible for the overall marketing direction for both AM and RF distribution product lines. Prior to joining C-Cor, Gibson was most recently marketing manager for Network Approach Corp.

Philips Broadband Networks Inc. has announced the appointment of two new managers. **Carroll Murray** assumes the post of manager of communications, and **Tony Pierson** has been named group product manager of transmission products.


Murray

Murray, who for 16 years owned and operated her own marketing communications agency, will oversee the company's marketing communications activities, including advertising, public relations, direct-marketing campaigns and trade show support.


Pierson

Prior to joining Philips, Pierson served as marketing manager for a major supplier of broadband transport equipment. In his new position, he will direct all marketing activities for the company's transmission products, which include broadband RF and fiber-optic transport equipment and systems.

Bryon Kasper has been named manager of Ortel Corporation's newly-formed digital modules group. With more than 25 years of RF and optical technology experience, Kasper will oversee Ortel's entry into the digital transmitter and receiver markets.

GTE Telephone Operations has appointed **Kevin Rice** as general manager of Florida operations for GTE Video Services. Rice will be responsible for managing cable systems operations in the Tampa Bay, Fla. area. He will also implement all sales and marketing plans in the area. Prior to this position, Rice was senior vice president-operations for Heritage Communications.

James Kelso, former director of engineering operations for Cox Communications, has been named cable video systems manager at SeaChange International. Kelso has extensive experience in engineering and project management, and advanced knowledge of computer networking, including wide- and local-area network design and implementation. CED

Expo offers wide range of technical training options

The Society of Cable Telecommunications Engineers' (SCTE) Cable-Tec Expo is coming up, slated to land in Orlando, Fla. June 4-7. Several innovations are on deck for this year's 15th Annual Expo and 21st Annual Engineering Conference, including: 16 hours of exhibit time spread over the course of three days; and a Technical Training Center on the show floor, which will feature special equipment demonstrations. For planning purposes, here's a preview of the workshops and sessions (information is subject to change).

Tuesday, June 3, Pre-conference sessions

✔Preparing for Technical Certification at the Service Technician and Telephony Levels. Alan Babcock, TCI; Dennis Quinter, Time Warner Cable; Andy Scott, NCTA; Gary Selwitz, TV Cable of Carlisle.

✔Technical Standards Development. Ted Woo, SCTE; Jim Haag, Integration Technologies; Paul Hearty, General Instrument; Steve Johnson, Time Warner Cable; Rich Pulley, Comcast; Bruce Weintraub, Southwestern Bell.

✔Data Network Protocols and Telephony Acronyms Explained. Bill Winslow, Sprint North Supply.

Wednesday, June 4, Annual Engineering Conference

✔Session A: Preparing for Digital Deployment. Jim Ludington, INT2; Yvette Gordon, Time Warner Cable; Keith Kreager, Antec; Van Macatee, TCI; Todd Ortberg, ADC.

✔Session B: Cable Modem Technology and Product Strategy. Richard Prodan, CableLabs; Doug Jones, US West; Jamie Howard, @Home; Mark Coblitz, Comcast.

Thursday–Friday, June 5-6, Expo Workshops

✔Cable Modems–Are They Plug and Play? Dan Leith, H-P; Angel Orrantia, Intel.

✔Digital System Deployment and Measurements. Zulfakir Ali, GI; Rick Jaworski, Wavetek; Bill Wall, S-A.

✔Inside Wiring Options. J.R. Anderson, Integration Technologies; J. Junkus, Knowledgelink.

✔Making Two-Way Work (Part II). Ron Hranac, Coaxial International; Tom Staniec, Time Warner.

✔New Revenue Opportunities. Tom Donahue, Broadband Networks; Byron Smith, ISC Datacom; Jay Kirchoff, Moore Diversified.

✔Powering for Reliability. Mark Alrutz, CommScope; Steve DuChene, Time Warner; Dan Kerr, Continental.

✔Project Management of Your HFC Upgrade. Walt Colquitt, Optel; Jim Ludington, INT2.

✔Quality Audio in the Headend. John Beyler and Craig Cuttner, HBO; Russ Murphy, The Family Channel; Linc Reed-Nickerson, Tektronix; Dom Stasi, TCI.

✔Return Path Problems and Their Solutions. Dean Stoneback, GI; Tony Werner, TCI.

✔Surge Suppression, Fusing and "Slugging." Jack Coghlan, Transtector; John Downey, C-Cor; Dan McCurry, Scientific-Atlanta; Oleh Sniezko, TCI.

Charting a course for interoperability

What is 802.14 and what does it mean?

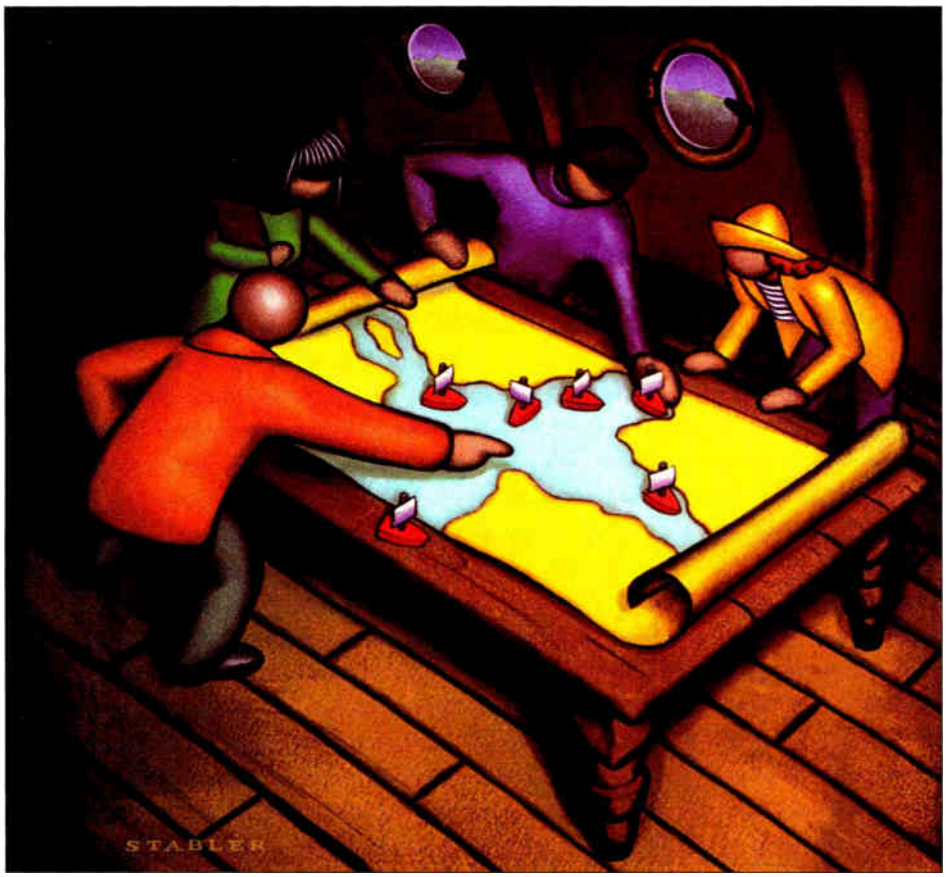


ILLUSTRATION BY BARTON STABLER, SIS

By Robert B. Russell, Chairman, 802.14 Working Group

Editor's Note: Although the MCNS (Multimedia Cable Network System) effort to standardize high-speed cable data modems has received the lion's share of attention from the media, there is another, equally powerful group developing standards for transport of high-speed data over networks. Under the auspices of the Institute of Electrical and Electronic Engineers, the IEEE "802.14" committee has been chipping away at such standards since late 1994. What follows is an explanation of the group's goals, its vision and an update on the status of its work.

The developing IEEE 802.14 cable TV Modem Protocol is more than just a cable modem. The 802.14 protocol offers full integration and access control of multiple frequency and time division "channels" for the delivery of widely different data types, with their unique Quality of Service (QoS) requirements, on a truly public network. This represents a fundamental shift in the delivery and scalability of networks.

The standard defines the interfaces of the Media Access Control (MAC) and Physical (PHY) layers, and also those of internal convergence and media dependent layers. Multiple physical layer solutions can be supported by one MAC. Coupled with MAC layer security, signal flow and public PHY topology requirements, this presents a unique challenge in communications networking. Whereas previous networks and data flows were designed around the protocol, the IEEE 802.14 protocol is being developed to support a wide array of networks and data types.

The IEEE 802.14 protocol is tasked to support voice, video, file transfer and interactive data services across an international set of networks. These are represented by switched data services such as ATM, variable-length data services such as Ethernet (802.3), near-constant bit rate services such as MPEG digital video streams, and possibly very low latency data service such as virtual circuits or STM.

It also supports the combination of "publish and subscribe" architectures with private message delivery. Instantaneous data rates and actual "throughput" are no longer limited by the protocol, but are rather a function of the network traffic engineering and the theoretical limit of the media and modulation scheme themselves. This generates a wide range of QoS parameters that must be supported simultaneously in order to create a scalable, multi-service "gateway." Legacy protocols and architectures can simulate this delivery flexibility but suffer greatly in efficiency, QoS and scalability.

The MAC overview

As overall controller of the actual transmission and reception of information, the MAC must account for the unique physical topology constraints of the network, while guaranteeing each data type its required QOS. The network consists of a multi-cast or broadcast downstream from the headend to individual subscriber groups, and multiple allocated and contention upstream channels.

The downstream channel currently consists of a single "wide band" high symbol rate channel, composed of six octet time allocation units. A single unit can be assigned the idle pattern, or multiple units can be used to create ATM cells, variable-length fragments or MPEG streams. Consideration is given to allow for multiple simultaneous downstream channels as well.

The upstream consists of multiple channels divided in time into a series of "minislots." These represent the smallest orthogonal unit of data allocation. Within one minislot is enough time for the transmission of eight octets of data plus PHY overhead and guard time. Multiple minislots can be concatenated in an upstream channel to create larger packet data units such as ATM cells, variable-length frag-

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9 = Classic Sports Network
10 = Prime Sports *Southwest* (VC II)
11 = Network One (N1)
13 = Sportschannel *Chicago* (VC II)
14 = KUSA-TV (Denver/NBC affiliate) (VC II)
15 = Sportschannel *Ohio* (VC II)
Sportschannel *Cincinnati* (VC II)
16 = Prime Deportiva (DC)
16.1 = Prime Ticket San Diego (DC)
17 = Sportschannel *Florida* (VC II)
Prime Sports *Rocky Mtn.* (VC II)
Prime Sports *Upper Midw.* (VC II)
Prime Sports *Midwest* (VC II)
22 = Prime Sports *Northwest* (VC II)
23 = KWGN-TV (Denver/Independent) (VC II)
24 = Sunshine Network (VC II)

13 = The Travel Channel (VC II)
14 = FIT TV
15 = WWOR-TV (Secaucus, N.J./ Independent) (VC II)
16 = Request 1 (VC II)
17 = MTV *East* (VC II)
18.0 = Hot Choice (DC)
18.1 = Continuous Hits 3 (DC)
18.5 = Continuous Hits 1 (DC)
18.6 = Continuous Hits 2 (DC)
19 = C-Span 2/Senate
20 = Showtime 2 *East* (VC II)
21 = Discovery Channel (VC II)
22 = FLIX (VC II)
23 = VH1 (VC II)
24 = Country Music Television (VC II)

13.6 = Encore 4-Mystery (DC)
13.7 = Encore 7-WAM (DC)
14 = ESPN Blackout Network (VC II)
15.0 = CNNfn (DC-MCPC)
15.1 = CNNI (DC-MCPC)
15.5 = CNNSI (DC-MCPC)
16 = Turner Classic Movies (VC II)
17 = New Inspiration Network
18.0 = HBO 2 *East* (DC)
18.1 = HBO 3 *East* (DC)
18.5 = HBO Cinemax 2 (DC)
18.6 = HBO 2 *West* (DC)
19 = HBO Cinemax *East* (DC)
20 = HGTV (VC II)
21 - USA Network (VC II)
22 = The Nostalgia Channel
23 = HBO
24 = Global Shopping Network

18 = TV Land
19.0 = Showtime 2 (DC)
19.1 = MTV Latino (DC)
19.5 = FLIX (DC)
20.0 = Product Info. Network (DC)
20.1 = Jones Computer Network (DC)
20.6 = Great American Country (DC)
21 = Comedy Central *East* (VC II)
22.0 = Your Choice Television 1 (DC)
22.1 = Your Choice Television 2 (DC)
22.2 = Your Choice Television 3 (DC)
22.3 = Your Choice Television 4 (DC)
23 = E! Entertainment (VC II)
24 = DMX

18 = The Learning Network (VC II)
19 = USA Network *East* (VC II)
20 = Black Entertainment Network
21 = ME/U
22 = CNN Headline News (VC II)
23 = A&E Cable Network (VC II)
24-A1 = Showtime *East* (MPEG II)
24-A2 = The Movie Channel (MPEG II)
24-A3 = Showtime *West* (MPEG II)
24-B1 = Sundance Channel (MPEG II)

13 = TCI HITS (DC II)
15 = TCI HITS (DC II)
19 = TCI HITS (DC II)
21 = TCI HITS (DC II)
22 = TCI HITS (DC II)

Calculating C/N

C/N = EIRP - Ls + Ga + 228.6 - 10 log BW - 10- log (Ts)
Where:
EIRP = Satellite power (dBW)
Ls = Space loss (dB)
Ga = Antenna gain in dB
Ts = Total effective noise temperature of the system
228.6 = Boltzmann's constant in dB
BW = Receiver noise bandwidth in Hz.
Ts consists of:
1. the antenna, plus feed loss
2. the LNA, plus cable and splitter loss
3. the satellite receiver

950-1450 MHz C-band LNB conversion chart

Transponder number	Downlink frequency (MHz)	Corresponding L-band frequency (MHz)	Transponder number	Downlink frequency (MHz)	Corresponding L-band frequency (MHz)
1	3720	1430	13	3960	1190
2	3740	1410	14	3980	1170
3	3760	1390	15	4000	1150
4	3780	1370	16	4020	1130
5	3800	1350	17	4040	1110
6	3820	1330	18	4060	1090
7	3840	1310	19	4080	1070
8	3860	1290	20	4100	1050
9	3880	1270	21	4120	1030
10	3900	1250	22	4140	1010
11	3920	1230	23	4160	990
12	3940	1210	24	4180	970

Satellite information numbers

Operator	Sun Outages	Center of box info
AT&T	(800) 242-2422	(800) 321-7703
GE	(609) 987-4191	(800) 526-4214
	(201) 827-7746	
Hughes SBS 4,5,6	(310) 525-5471	(310) 525-5725
Hughes Galaxy IR, IIIR, IV	Same	(310) 525-5726
Hughes Galaxy V, VI, VII, IX	Same	(310) 525-5727

CED

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Note: Satellite locations not to scale. Perspective is from outer space.

Programmers' hotline phone list

Programmer	Scrambling	General
Action PPV	(818) 998-1661	(310) 453-4500
AMC / Bravo / Independent Film Channel / Much Music / Newsport / Sports Channel - Florida , New York, Ohio, Philadelphia	(516) 354-0145	Same
A&E	(203) 965-6557	(203) 965-6556
BET	(800) 772-4238	(202) 608-2000
Cartoon Network / CHN / CNN / CNN International / TCM / TNT	(404-827-2458	Same
Classic Sports Network	(800) 410-2964	(212) 529-8000
Country Music Television	(203) 965-6268	Same
CNBC	(800) 366-4046	Same
Court TV / America's Health Network / Northwest Cable News / Outdoor Life	(800) 417-9599	(212) 973-2800
Discovery (TDC)	(301) 986-0914	Same
Disney	(818) 842-2877	Same
Encore / Encore + / Multiplex Channels / Starz!	(303) 267-4011	Same
E! Entertainment Television	(800) 651-5869	(213) 954-2400
ESPN / ESPN 2	(203) 585-2264	Same
Family Channel	(804) 420-9015	Same
IX / IXM	(818) 775-0500	(516) 951-2440
Game Show Network	(818) 998-1661	(310) 280-8919
Golf Channel	(407) 345-4653 bus. hrs. (407) 248-6389 after hrs.	(407) 363-4653

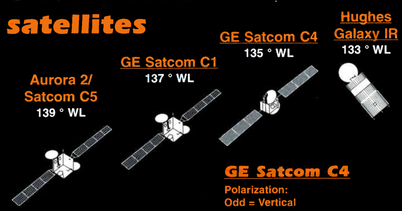
Programmer	Scrambling	General
HBO / Cinemax / Comedy Central	(212) 512-5666	Same
HGTV	(800) 211-6671	(423) 694-2700
International Channel	(303) 267-4015	(303) 771-7700
Lifetime	(718) 706-3629	(718) 706-3515
Nostalgia Television	(Not scrambled0	(202) 289-6633
Playboy / Adult Vision	((800) 672-HELP	Same
Prevue Networks	(800) 725-1233	(800) 447-7388
Prime / HSE / PSN / Sunshine / Sports South	(800) 334-1744	(713) 661-0078
Request 1 & 2	(800) 804-5050	Same
Showtime / Showtime 2 / FLIX / Movie Channel / MTV / MTV Latino / Nickelodean / VH-1	(516) 435-4961	(516) 435-4900
TBS	(800) 523-2363	(404) 827-1717
TNN	(203) 965-6200	(615) 889-6840
TV Food Network	(Not scrambled)	(212) 398-8836
USA / SciFi Network	(212) 408-9180	(516) 361-8292
Viewer's Choice / Continuous Hits 1, 2 & 3 / Hot Choice	(203) 965-6600	Same
Weather Channel / Landmark Networks	(800) 554-7354	Same
WGN	(800) 331-4806	Same
WOR / WSBK	(315) 432-9400, ext. 349 (800) 448-3322, ext. 332	Same
WTBS	(800) 523-2363	Same

Legend

DC = GI Digicipher
DC-MCPC = GI Digicipher MCPC
MPEG II = S-A MPEG II
VC = GI Videocipher
VC II = GI Videocipher II
WEG = Wegener MPEG II

CED ORBITAL ARC CHART

C-band video satellites



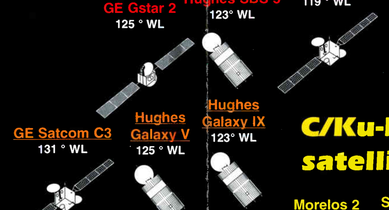
GE Satcom C1

Polarization:
Odd = Horizontal
Even = Vertical
1 = Prime Network (VC II)
2 = KMGH-TV (Denver/ABC affiliate) (VCII)
3 = KRMA-TV (Denver/PBS affiliate) (VC II)
4 = Sportschannel Pacific (VC II)
5 = KDVR (Denver/Fox affiliate) (VC II)
6 = KCNC-TV (Denver/CBS affiliate) (VC II)
7 = Prime Sports *West* (VC II)

GE Satcom C4

Polarization:
Odd = Vertical
Even = Horizontal
1 = AMC (VC II)
2.0 = Request 2 (DC)
2.1 = Request 3 (DC)
2.2 = Starz! *East* (DC)
2.5 = Request 4 (DC)
2.6 = Request 5 (DC)
2.7 = Starz! *West* (DC)
3 = Nickelodeon / Nick-At-Nite *East* (VC II)
4 = Lifetime *East* (VC II)
6 = Madison Sq. Garden Cable Network (VC II)
7 = Bravo (VC II)
8 = Prevue Guide Channel
9 = QVC Network
10 = Home Shopping Network
11 = Speedvision
12 = Starz!

Ku-band video satellites



Hughes Galaxy IR

Polarization:
Odd = Horizontal
Even = Vertical
1 = Comedy Central (VC II)
2.1 = Univision (MPEG II)
2.5 = Galavision (MPEG II)
2.8 = Telehit (MPEG II)
3 = Encore *East* (VC II)
4.0 = TV Food Network (VC II)
4.1 = Outdoor Life (DC)
4.5 = Canal De Noticias (DC)
4.6 = America's Health Network (DC)
5 = Classic Arts Showcase
6 = Z Music
7 = The Disney Channel *West* (VC II)
8 = Cartoon Network (VC II)
9 = ESPN 2 Blackout Network (VC)
10 = MSNBC
11 = ETWN
12 = Valuevision
13.0 = Encore 5-Action (DC)
13.1 = Encore 2-Love Stories (DC)
13.2 = Encore 3-Westerns (DC)
13.5 = Encore 6-True Stories & Drama (DC)

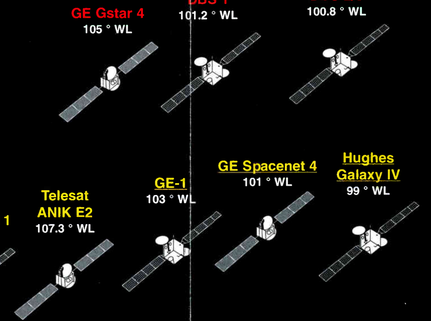
C/Ku-band video satellites

GE Satcom C3

Polarization:
Odd = Vertical
Even = Horizontal
1 = The Family Channel (VC II)
2 = The Learning Channel
3 = Viewer's Choice 1 (VC II0
4 = Lifetime (VC II)
5 = Odyssey
6.0 = Court TV (DC)
7 = C-Span/House
8 = QVC Network 2
10 = Home Shopping Club Spree
11 = Newsport (VC II)
12 = The History Channel (VC II)
13 = The Weather Channel (VC II)
14 = New England Sports Network (VC II)
15 = Showtime East (VC II)
16 = MTV 2
17 = The Movie Channel (VC II)

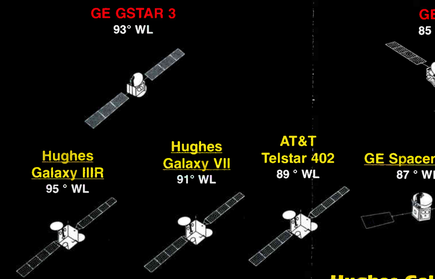
Hughes Galaxy V

Polarization:
Odd = Horizontal
Even = Vertical
1 = The Disney Channel *East*
2 = Playboy TV (VC II0
3 = TBN
4 = Sci-Fi Channel (VC II0
5 = CNN (VC II)
6 = TBS Superstation (VC II)
7 = WGN-TV (Chicago/Independent) (VC II)
8 = HBO *West* (VC II)
9 = ESPN (VC II)
11 = The Family Channel *East* (VC II)
12 = Discovery Channel *West* (VC II)
13 = Consumer News & Business Channel (VC II)
14 = ESPN 2 (VC II)
15 = HBO *East* (VC II)
16 = HBO Cinemax *West* (VC II)
17 = Turner Network Television (VC II)



*Hughes Galaxy IX

Polarization:
Odd = Vertical
Even = Horizontal
7 = TVN Entertainment (DC-MCPC)
9 = TVN Entertainment (DC-MCPC)
10 = TVN Entertainment (DC-MCPC)
11 = TVN Entertainment (DC-MCPC)
13 = GRTV
14 = Sundance Channel (VC II)
15 = Showtime *West* (VC II)
17 = Nickelodeon / Nick-At-Nite *West* (VC II0
18 = The Movie Channel *West* (VC II)
19 = MTV *West* (VC II)
23 = Computer Television Network

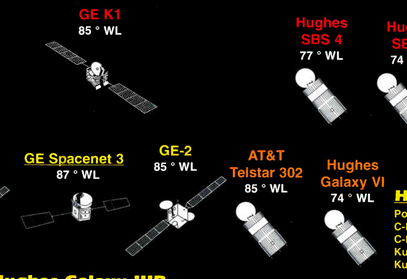


GE Spacenet 4

Polarization:
C-Band (36 MHz/1-6) = Vertical
C-Band (36 MHz/7-12) = Horizontal
C-Band (72 MHz/13-15) = Vertical
C-Band (72 MHz/16-18) = Horizontal
(C-Band/36 MHz:)
6(11) = Encore 8-Starz (VC II)
7(2) = Starz 2 (VC II)
8(4) = Encore *West* (VC II)
9(6) = KNBC-TV (Los Angeles/ NBC affiliate) (VC II)
10(8) = KOMO-TV (Seattle/ABC affiliate) (VC II)
(C-Band/72 MHz:)
17L(18) = Starz! *West* (VC II)
18U(24) = KPIX (San Francisco/ CBS affiliate) (VC II)

Hughes Galaxy IV

Polarization:
C-Band/Odd = Horizontal
C-Band/Even = Vertical
8.1 = Telemundo *East* (MPEG II)
8.2 = Telemundo *West* (MPEG II)
8.4 = Telenoticias (MPEG II)
10 = WJLA-TV (Washington, D.C./ ABC affiliate) (VC II)
11 = U.S. Farm Report
12 = AGDAY
14 = WRAL-TV (Raleigh-Durham, NC/CBS affiliate) (VC II)
21 - WB Television Network
22 = WNBC (New York/ NBC affiliate) (VC II)



Hughes Galaxy IIIR

Polarization:
C-Band/Odd = Horizontal
C-Band/Even = Vertical
1 = TVN Theatervision-Television 1 (VC II)
2 = TVN Theatervision-Television 2 (VC II)
3 = TVN Theatervision-Television 3 (VC II)
4 = TVN Theatervision-Television 4 (VC II)
5 = TVN Theatervision-Television 5 (VC II)

GE Spacenet 3

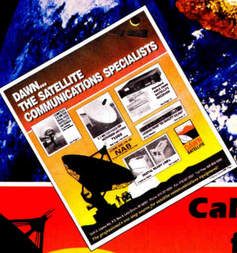
Polarization:
C-Band/36 MHz = Horizontal
C-Band/72 MHz = Vertical
(C-Band/36 MHz:)
2(3) = WSBK-TV (Boston/ Independent) (VC II)
3(5) = Univision (VC II)
5(9) = WPIX (NewYork/ Independent) (VC II)
6 = TVN Theatervision-Television 6 - TVN Widescreen Theater (VC II)
TVN Promo Channel (VC II)
7 = GRTV
8 = TVN Theatervision-Theater 8 (VC II)
9 = TVN Theatervision-Television 9 (VC II)
10 = Adultvision (VC II)
15 = Gospel Music TV (VC II)
16 = HBO 2 *East* (VC II)
17 = HBO Cinemax 2 *East* (VC II)
19 = HBO 3 *East* (VC II)
20 = HBO 2 *West* (VC II)

6(11) = CNNSI
8(15) = KTLA (Los Angeles/ Independent) (VC II)
10(19) = SportsSouth (VC II)
12(23) = Home Team Sports (VC II)
(C-Band/72 MHz:)
16L(14) = CNN
16U(16) = CNNfn (VC II)
CNNI (VC II)

Hughes Galaxy VII

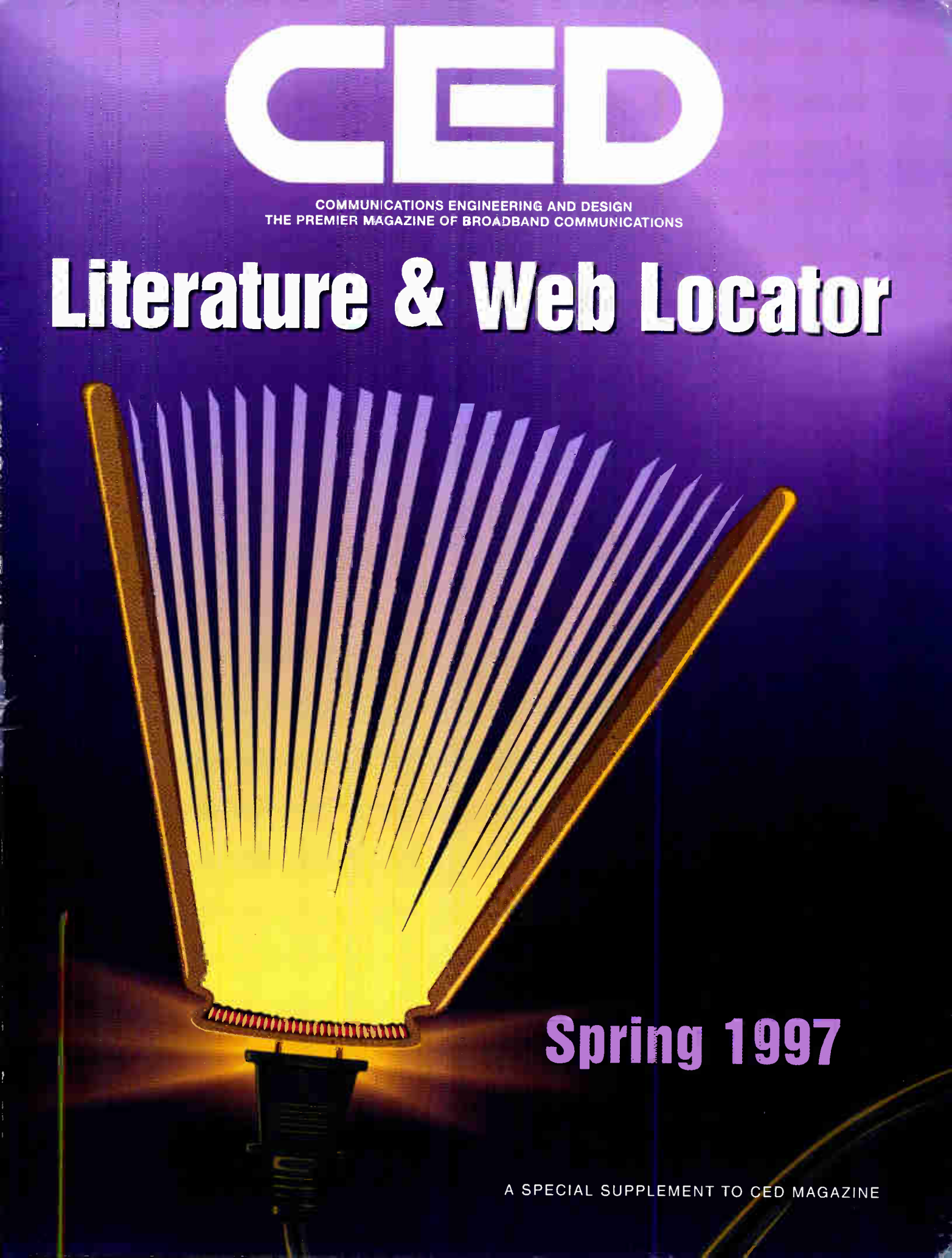
Polarization:
C-Band/Odd = Horizontal
C-Band/Even = Vertical
Ku-Band/54 MHz = Horizontal
Ku-Band/27 MHz = Vertical
(C-Band/36 MHz:)
1 = SEGA Channel (S-A digital data stream)
3 = Action Pay-Per-View (VC II)
4 = FX TV *East*
5 = FX TV *West*
6 = Game Show Network (VC II)
7 = The Golf Channel (VC II)
12 = Romance Classics
13.0 = Kaleidoscope-American Disability (DC)
13.1 = Prime Sports Showcase (DC)
13.3 = Intro Television (VC II)
13.4 = Classic Sports Network (DC)
14 = Independent Film Channel (VC II)
15 = Intro Television (VC II)
16 = Access TV (DC-MCPC)
20 = Fox News Channel
21 = BET on Jazz: The Cable Jazz Channel
23 = IXM (VC II)
24 = International Channel (VC II)
(Ku-Band/27 MHz:)
1 = TCI HITS (DC II)
4 = TCI HITS (DC II)
6 = TCI HITS (DC II)
7 = TCI HITS (DC II)
9 = TCI HITS (DC II)
10 = TCI HITS (DC II)
12 = TCI HITS (DC II)

CED ORBITAL ARC CHART



CED
COMMUNICATIONS ENGINEERING AND DESIGN
THE PREMIER MAGAZINE OF BROADBAND COMMUNICATIONS

Literature & Web Locator



Spring 1997

A SPECIAL SUPPLEMENT TO CED MAGAZINE

Is ingress making your return path a road to nowhere?

Ingress is the major roadblock to getting your return path up and running. Fortunately, there's the new HP CaLan Sweep/Ingress Analyzer. It's the only test gear that allows you to quickly and accurately troubleshoot your system, regardless of the presence of ingress.

When ingress corrupts reverse-path communication, the headend unit (HP CaLan 3010H) senses the problem instantly, and transfers the display of the ingress problem to the field unit (HP CaLan 3010R). That means your technicians can begin troubleshooting immediately.

Now you can troubleshoot your system at all times. No matter how much ingress is present.

And of course, the HP CaLan Sweep/Ingress Analyzer offers DigiSweep, the industry's fastest, non-interfering, digital-services compatible forward and reverse sweep. In fact, reverse sweep measurements can be performed in real-time — even with multiple users.

So don't let ingress slow you down. To find out how HP CaLan's Sweep/Ingress Analyzer can help you identify, troubleshoot, and eliminate your ingress problems, call **1-800-452-4844, Ext. 1748**. Or visit us at: http://www.hp.com/go/catv

Reader Service 500

HEWLETT PACKARD

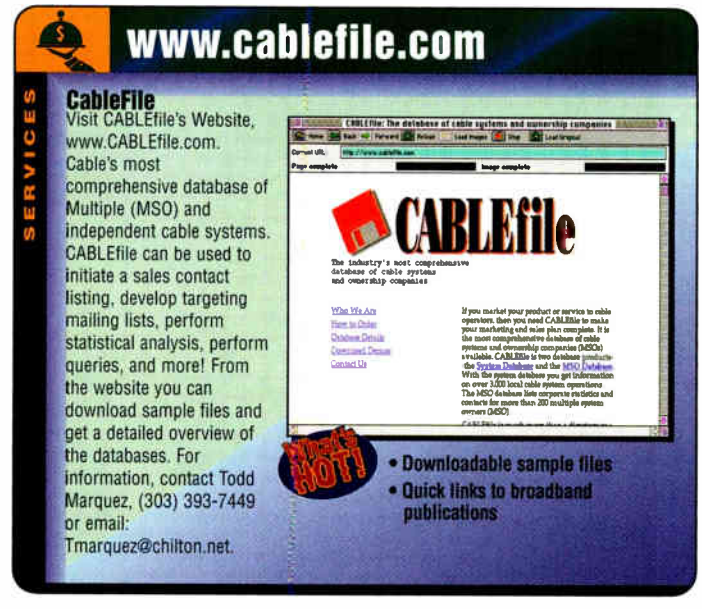
The times they are changin'

In this day and age, the volume of information available to us is astounding. Finding and accessing the specific information you need can be another story entirely, especially without some help.

Ever since 1994, when it was first introduced, the *CED Literature and Source Guide* has been an integral part of the resources we've provided our readers to help them do their jobs better, faster and more conveniently. But, as the guy with the gravely voice once said, "The times they are changin."

Today, all of us have come to expect, even demand, convenience and instant access in all that we do. Whether it's getting money out of the ATM or paying at the gas pump, we want everything now. That's undoubtedly what's making the Internet a major part of our lives.

That's where our new version of the Guide, the *Literature & Web Locator*, is taking its lead from. It has been redesigned to make your search for information even better, faster and more convenient. Our new Web Locator section (featured on pages 12 & 13) lists some of the industry's most informative Internet sites.



The Literature listings now contain:

- a quick-reference icon, and below it, a description that illustrates the general product category of the listing;
- to the right of the icon you'll find a more specific name for the product/service covered in the listing;
- a complete description of the featured material, followed by contact information (phone, fax, etc.);
- a reader service number at the bottom of the listing to make a convenient request for more information.

The Web Locator listings contain:

- a quick-reference icon that illustrates the general product category of the Web site;
- below the icon, the major product emphasis of the Web site;
- to the right of the icon is the Web site address;
- a concise description of the Web site;
- a sneak preview (screen capture) of the Web site itself;
- a summary of the Web site's most important highlights.

To help you along in your search for even more information, we've recruited our own director of internet services to pass along some helpful hints on searching the Internet. (See "Just the FAQ's", page 11.)

With new research indicating three out of four businesses now have Internet applications under development, rest assured, we'll be helping you find the new sites you need to get your job done.

As always, thank you for your continued support of *CED* magazine, and don't forget to visit us on the Internet: @ **cedmagazine.com.** That's where you'll find the electronic version of this Locator, another industry first, as well as extensive editorial archives and a plethora of useful information to give you the edge in these changin' times.

Rob Stuehrk
Publisher

CATV Coax Cable

DISTRIBUTION EQUIPMENT

Trilogy Communications offers a comprehensive 150-page CATV coax cable product and installation guide. Included are complete physical/electrical specs, and detailed illustrations for the company's air-dielectric MC2 trunk and feeder and MVP drop cables; ordering and specifying data; and a useful "how-to" section covering transportation and storage, construction practices, performance testing, splicing and activation, and connectorization. Call now for more information.

(800) TRILOGY

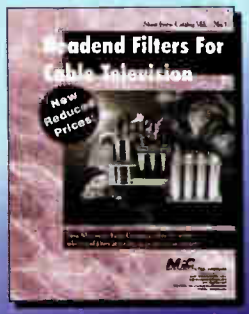
Reader Service 501

Headend Filters

HEADEND EQUIPMENT

At **Microwave Filter Co., Inc.** prices have been reduced up to 30% on most popular filters featured in new short form catalog, "Headend Filters For Cable Television, Vol. 1 #1". It features a full line of "Brickwall" notch filters with passbands up to 1 GHz. Also included are bandpass filters, deletion and reprocessing networks, and TVRO interference filters among others. For more information call today.

(800) 448-1666 or fax
(315) 438-4700



Reader Service 502

Spanish/English CATV Dictionary

SERVICES

The **National Cable Television Institute (NCTI)** offers a 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 or fax
(303) 797-9394

Reader Service 503

Amplifiers

DISTRIBUTION EQUIPMENT

Viewsonics Inc. offers a full color catalog containing photos and specifications for all of their amplifiers, including their newest low noise models with the figure at 3 dB 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. For your FREE Viewsonics Amplifier catalog, call today.

(800) 645-7600 or fax
(561) 998-3712

Reader Service 504

Transmission Systems

FIBER OPTICS

Harmonic Lightwaves: Transcending the Ordinary. Harmonic Lightwaves is a worldwide supplier of highly integrated fiber optic transmission, digital headend, and element management systems for the delivery of interactive services over broadband networks. Products include: MAXLink* 1550 nm transmission system, PWRLink* DFB transmitter family, optical nodes and receivers with return path options, TRANsend* family of digital video compression and modulation equipment, and the NETWatcht element management system. **(800) 730-4099** or fax **(405) 542-2511**

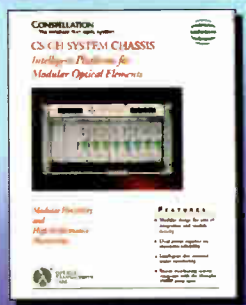
Reader Service 505

Transmission Systems

FIBER OPTICS

Synchronous Group introduces the new Constellation, modular fiber optic transmission system. A common, intelligent platform allows the user to combine up to 8 optical elements. Units include 1550 nm external modulation transmitters for supertrunking and direct distribution, 1310 DBF laser transmitters and Erbium doped fiber amplifiers with powers to 400mW. Call today for more information.

(800) 659-6750 or fax
(408) 362-4826



Reader Service 506

RF Worx™ Products

TELECOM EQUIPMENT

ADC's RF Worx ™ products provide design engineers with the ability to combine, split, distribute, and manage RF signals. RF Worx™ products are suitable for any 5 Mhz to 1 Ghz application, including passive reconfiguration, system balancing, monitoring redundant switching of amplifiers, and signal/cable management. The new RF Worx ™ products catalog contains product descriptions, features/ benefits, and complete application and ordering information.

612-946-3405 or fax
619-946-3086

Reader Service 507

Fiber Panel Products

TELECOM EQUIPMENT

ADC's fiber panel family meets the needs of a wide range of customer applications. All fiber panels feature superior cable management and maintain a 1.5" or 2" minimum bend radius (depending on the panel). The Fiber Panel Products catalog features product descriptions and specifications, as well as application and ordering information for ADC's complete line of fiber panels, components, and accessories.

612-946-3405 or fax
612-946-3086

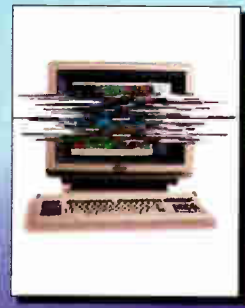
Reader Service 508

Design Software

CONSTRUCTION

CADIX International, Inc. is proud to announce CX-P21 "Light Speed Design System". "Light Speed" is the next generation in Fiber, RF and Telephony Design and Management Software. For Windows 95 and Windows NT, CX-P21 is OBDC compliant. With complete connectivity from headend to subscriber, design is fast and easy. Designs can also be accessed through a remote field computer. Email: cbenes@nb.cadix.com. Call today for more information.

(714) 223-8881 or fax
(714) 223-8871



Reader Service # 509

Headend Equipment

WHOLESALE/DISTRIBUTORS

Nickless Schirmer & Co. offers a complete line of RF signal and video processing equipment from the industry's leading manufacturers. 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. Call today for a copy of their latest catalog.

(800) 543-1584

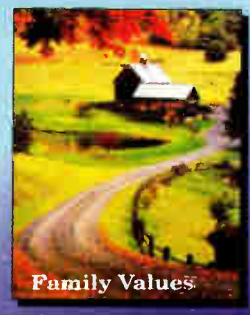
Reader Service # 510

Technical Software

TEST EQUIPMENT

This software family is used by thousands of cable operators worldwide to meet technical dept. needs. MOM (Monthly Outage Management) helps reduce outages. POP (Proof of Performance) documents proof tests. LES (Leakage Evaluation System) is the industry standard for controlling leakage. For details on the complete family, call **FamilyWare** today!

(702) 852-5200 or fax
(702) 852-5255



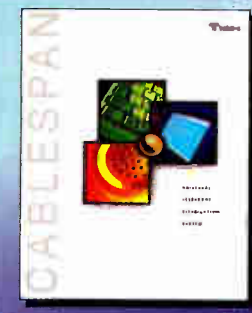
Reader Service # 511

Telephony Distribution System

TELECOM EQUIPMENT

A new, full-color brochure from **Tellabs** describes the benefits of 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 today.

(800) 445-6501



Reader Service # 512

Emergency Alert Systems

HEADEND EQUIPMENT

Albrit Technologies Ltd. offers CABLE ENVOY™, affordable and flexible solutions to EAS-message channel distribution requirements and FCC compliance without dropping program signals.Videotext crawls, page mode displays and audio messaging optional remote telephone message and voice-over capabilities for local emergency officials. RF processor and IF configurations. Modular and upgradeable. Suitable for all CATV systems great and small. Call Ken Lawson at Albrit today.

(801) 942-2207 or fax
(801) 942-5798

Reader Service # 513

Modulators/Demodulators

HEADEND EQUIPMENT

For over 40 years, **Blonder Tongue Laboratories, Inc.** has been manufacturing professional quality, commercial cable television products. The catalog includes product photos, descriptions, specifications, and application notes for the entire product line. Look for extended frequency range to 750 MHz on their complete family of headend and distribution products, 13 and 18 GHz microwave systems, and VideoMask, their new interdiction system. Call today for more information.

(908) 679-4000 or fax
(908) 679-4353

Reader Service # 514

Automated Playback

HEADEND EQUIPMENT

For over a decade, **Tech Electronics** has set the standard for highly reliable and cost-effective controllers for unattended/automated playback. The PVC Family of Controllers offers full functional control for up to 16 VCRs with three channel output. Creating and composing playback schedules is easy with Windows® based scheduling software. Software and two CC Series Control Cables are included with every PVC order. For more information, call today.

(800) 572-4935

Reader Service # 515

Laser Transmitter Module

FIBER OTPICS

Integrated Photonic Technology's (IPITEK) DTX 1310 DFB Laser Transmitter Module is ideal for narrowcast and broadband applications. This versatile and compact state-of-the-art transmitter, with its global 862 MHz bandwidth and 110 channel NTSC rating, is sold to link budget and one of the highest performance lasers on the market. Call today for more information.

(760) 438-8362

Reader Service # 516

Telephony/Data System

TELECOM

Philips' new Crystal Line ™ broadband telephony and data system allows HFC network operators to reliably and affordably deliver two-way voice and data services. Crystal Line features equipment at the headend and subscriber sites, and a unique element management system that monitors and controls components at both ends to support telephony and online multimedia services. Visit our web site at www.pbn.be.philips.com or call for more information.

(800) 448-5171 or outside the U.S.
(315) 682-9105

Reader Service 517

Fiber Optic Systems Equipment

FIBER OPTICS

Philips Broadband Networks' new Diamond™ Series RF and fiber-optic systems and equipment provide a total infrastructure for transmitting video, voice and data services. Several new products are featured, including fiber-optic transport systems (750 and 862 MHz), four-port optical amplifiers, taps and passives, as well as element management systems to control network componets. Visit our Internet site at http://www.pbn.be.philips.com or call for more information.

(800) 448-5171 or outside the U.S.
(315) 682-9105

Reader Service 518

Surge Protector

DISTRIBUTION EQUIPMENT

CITEL manufactures surge protectors for CATV, Broadband, Radios, GPS, PCS systems. They are available with F, N, BNC, TNC, SMA connectors. Email: citel4u@ix.netcom.com, Internet: http://www.CitelProtection.com. For more information, call today.

(800) 248-3548 or
(305) 621-0022 or fax
(305) 621-0766

Reader Service 519

CAD/Design Software

CONSTRUCTION

Blough Enterprises specializes in top quality Drafting and Design Services for CATV. Utilizing Focus and Lode Data software on microstation and Autocad platforms enables Blough to produce some of the best maps in the industry at competitive rates. They have gained a reputation of being a reliable subcontractor because they are committed to meeting their customers goals. Contact Blough today for a free company brochure. E-mail: Blough@shol.com Call for more information.

814-445-5229 or fax
814-445-3967

Reader Service 520

Tools

CONSTRUCTION

Ripley Company's Cablematic® cable preparation tools are used throughout the world for CATV and Telecommunications. Since 1965, Cablematic has been the leader in developing high quality, reliable, cost-savings tools and components. Their free catalog offers tools and accessories engineered and manufactured in the USA, that provide system reliability and consistent cable preparation. Call today for more information.

(800) 568-8665 or
(01) 860-635-2200 or fax
(01) 860-635-3631

Reader Service 521

CATV Test Equipment

TEST EQUIPMENT

Hewlett-Packard's new cable TV test equipment brochure highlights HP CaLan's complete line of test equipment for every task, at the headend and in the field. Featuring HP CaLan's new SWEEP/INGRESS ANALYZER - the industry's most essential tool for two-way system activation and maintenance, and the HP CaLan 8591C cable TV analyzer - the industry's only one-box tester for all non-interfering RF and video measurements. Call HP CaLan today.

(800) 452-4844, x 2009

Reader Service 522

Power Protection Systems

DISTRIBUTION EQUIPMENT

Alpha Technologies' new brochure outlines the company's full range of power protection products for Cable TV Headend applications. Alpha's headend power solutions are designed to protect mission-critical and revenue-generating equipment such as pay-per-view, digital ad insertion servers, signal receivers, modulators, and fiber transmitters. With power ratings from 450VA to 60kVA, there are numerous options to ensure complete power protection for an entire headend facility. Call for more information.

(800) 421-8089

Reader Service 523

Power Protection/Headend Systems

DISTRIBUTION EQUIPMENT

Alpha Technologies' full line of power products for headend applications provide backup power while protecting critical, revenue-generating equipment from damaging power surges, spikes, and power line noise. Protect selected equipment or provide full protection for the entire headend. Call today for more information.

(800) 421-8089

Reader Service 524

Commercial Insertion

HEADEND EQUIPMENT

Sky Connect provides affordable MPEG-2 digital ad insertion solutions for both large and small cable operators. As the Value Added Reseller for Digital's Mediaplex products, SkyConnect gives essential expertise in customer support, T & B integration, and software development. SkyConnect is now introducing a new 4-channel digital insertion unit perfect for even the smallest cable systems. Call and ask about their Zero-down Virtual Capital financing.

(800) 759-2583

Reader Service 525

Aerial Lifts

CONSTRUCTION

You can do both your line maintenance and fiber optic splicing with Armlift's vehicle. The telescoping boom is mounted in super structure and provides access to lines and the body features climate control, natural and fluorescent lighting, and table for your splicing needs. Traditional truck and van mounts are also available. Consult their factory for detailed information today. **Armlift, Division of TG Industries, Inc.**, P.O. Box 108, Armstrong, Iowa 50514. Call today for more information.

(712) 864-3737 or fax
(712) 864-3848

Reader Service 526

Modulator/Demodulator

HEADEND EQUIPMENT

Pico Macom, Inc. manufactures a complete family of high quality cable television products. The new eighty-page 1997 catalog is packed full with exciting new products for cable television. The catalog contains photos, full descriptions, specs, and application information. Look for their new receivers, agile modulators and demodulators, 1 GHz amplifiers, and the new 950-2150 MHz satellite products. Call today for a free copy.

(800) 421-6511 or
(818) 897-0028 or fax
(818) 834-7197

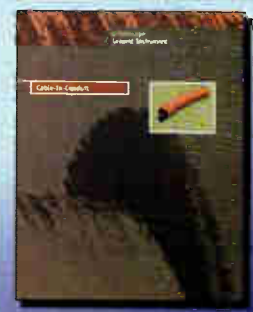
Reader Service 527

Coaxial/Fiber Optic Cables

CONSTRUCTION

CommScope, the only U.S. manufacturer of a complete line of coaxial and fiber optic cables for use in HFC networks now offers NEW Con/Quest ™, a full line of Cable-in-Conduit products. Other products include: NEW Power Feeder ™; Cell Reach ™, the new PCS cable standard; Optical Reach ® and a full line of drop cables. Ask for their renowned Cable Construction Manual. ISO 9001 registered. Visit our web site at http://www.commscope.com or call today.

(800) 982-1708 or fax
(704) 328-3400



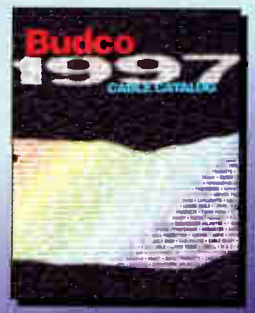
Reader Service 528

Tools, Construction Supplies

WHOLESALE/DISTRIBUTORS

Budco markets and distributes installation tools, construction supplies, marking, identification, and security products to the CATV industry: Aervoe-Pacific, Arrow, BennerNawman, Brady, Cablemaid, CablePrep, CablePro, CableReady, CableTek, DFS, Diamond, Engineering Unlimited, F-Conn, Jameson, Klein, Lemco, M & B, Master-lock, Preformed, Redington, Cablematic, Sargent, Sturgeon Bay, Tyton, and others. And the taplock, the industry standard for marking drops. For more information, call today.

(800) 331-2246



Reader Service 529

Switchers

HEADEND EQUIPMENT

Monroe Electronics designs, manufactures and markets - to worldwide customers - a full line of electronic manual programmable audio/video 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, eager to assist customers with their standard or custom switching product needs. For support or information, call today.

(800) 821-6001 or
(716) 765-2254 or fax
(716) 765-9330

Reader Service 530

Tools

CONSTRUCTION

Innovative features are standard components of every Lemco Corstrip tool - the most durable and long lasting tool available. To learn more about the features of Lemco's splicing tools and other new offerings, call **Lemco Tool Corporation** for a complete catalog.

(800) 233-8713 or fax
(717) 494-0860

Reader Service 531

Fiber Management

FIBER OPTICS

FONS Corp. is a leading manufacturer of fiber optic communications products; patch panels, cable assemblies, adapters, attenuators, and transmission products. Operating primarily in the cable television, telecommunications, and data commun-ications markets, they supply regional and national cable systems, RBOCs and large corporations with engineered solutions for flexible, modular, easy-to-install, and cost effective communication systems. Call for more information.

(508) 393-4268

Reader Service 532

Signal Meter

HEADEND EQUIPMENT

The Drake TSM1000 TV/SAT Signal Meter provides installers with a quality portable test and measurement instrument for troubleshooting, maintenance, and adjustments 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 and measures signal levels associated with off-air TV systems and cable TV installation. Contact **R.L. Drake Co.**

(513) 847-4523

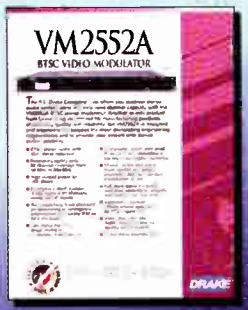
Reader Service 533

Stereo Video Modulator

HEADEND EQUIPMENT

Enhance your system with stereo audio and bring your system up to FCC regulations with **R.L. Drake's** VM2552A Stereo Video Modulator, which incorporates BTSC stereo encoding providing significant cost savings when compared to purchasing separate components. EAS-ready ensures that you can be prepared to meet FCC regulations governing emergency alert broadcasts. The frequency agile VM2552A features frequency coverage up to 500 MHz.
Call today for more information

(513) 847-4523



Reader Service 534

Amplifier

DISTRIBUTION EQUIPMENT

C-COR's 900 Series amplifiers are ideally suited to deliver a combination of analog and digital channels. With the additional bandwidth 862 MHz gives over 750 MHz, 110 NTSC channels can be offered with the remaining bandwidth allocated for digital channels. These amplifiers are housed in the 6-port, 1 GHz platform housing with optional 90B access ports. Visit our Internet site at http://www.c-cor.com or call today for more information.

(800) 233-2267 or fax
(814) 238-4065

Reader Service 535

OTDR Software

TEST EQUIPMENT

A free brochure from **GN Nettest**, Laser Precision, explains how and why the new CMA family of OTDRs are the world's fastest and easiest to use. It also explains the capability of the OTDRs to document tree and branch and other network topologies. The brochure introduces GN NetWorks - advanced OTDR software for emulation and database management. For your free copy, call today.

(800) 443-6154, U.S., or outside U.S.
(315) 797-4449

Reader Service 536

Modulator

HEADEND EQUIPMENT

Barco's PULSAR, a unique microprocessor-controlled modulator, features complete software control and remote monitoring capability via an RS-485 interface and provides control of video and audio RF levels, modulation depth, frequency deviation, and input switching. When used in conjunction with **BARCO's** FMS 860 Headend Supervisor, alignment of RF levels can be accomplished automatically. Call for more information.

(770) 218-3200 or fax
(770) 218-3250

Reader Service 537

Spectrum Analyzer

TEST EQUIPMENT

The 2000 series portable RF Spectrum Analyzer is now available from **Avantron Technologies**, weighing under 19 lbs., including battery. Available options: low level, no interference sweep system, and CATV return alignment package. 1 GHz performance range, >70 dB dynamic range, frequency counter with 200Hz accuracy and color display standard. USA: Cable Tech. Assoc. (800) 437-3100, Patterson Comm. (800) 420-5452, Canada: Capella Telecomm. (800) 668-0175, Avantron Technologies http://www.avantron.com

(800) 297-9726

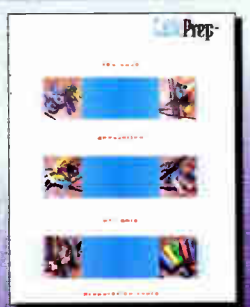
Reader Service 538

Tools

CONSTRUCTION EQUIPMENT

Cable Prep® offers two different catalogs. Their newly printed catalog features updated product sheets and allows you to add their tech-tip sheets and newsletters. Or, their Windows® based Interactive Catalog is also available - just point and click for information! Cable Prep has taken the guesswork out of matching tools to cables and connectors. Action shots in vivid color and printable instruction sheets included. Call the Cable Prep Marketing Dept. to order your copy today.

(800) 320-9350



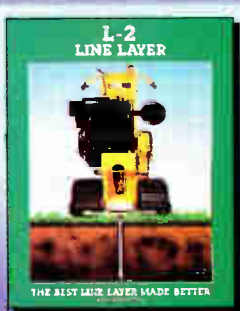
Reader Service 539

Cable Plow

CONSTRUCTION EQUIPMENT

Line-Ward Corp. has been meeting the CATV and telephone industry's buried service wire needs for nearly 25 years with its patented line-layers. The small but rugged L-2 Line Layer was designed specifically for burying drops effectively. It drives on rubber tracks to provide superior traction with minimal lawn damage. A boring attachment adds to the L-2's versatility. For more information, call today!

(800) 816-9621 or
(716) 675-7373



Reader Service 540

Digital Modulators

HEADEND EQUIPMENT

WaveCom Electronics Inc. is uniquely positioned to do research, development and manufacturing of electronic communications products for the cable and telecom markets. WaveCom is a leading designer/manufacturer of CATV modulators, demodulators, satelfite receivers and FM audio modulators. Other products include high-speed spread spectrum modems, bi-directional amplifiers, digital video modulators, frequency translators for Internet on cable, MMDS/LMDS equipment, cable telephony modems and more.

(306) 955-7075 or fax
(306) 955-9919

Reader Service 541

1 GHz Products

DISTRIBUTION/MANUFACTURERS

Toner Cable Equipment Inc. is a manufacturer and distributor of cable television equipment. As a single source supplier, their catalog is a comprehensive collection of the best equipment in the industry. Toner's products and services include RF system design, custom built headends, fiber optics, modulators, processors, satellite IRD's, commercial inserters, RF amplifiers, drop amps, passives, and test equipment. For a copy of the catalog call today.

(800) 523-5947 or fax
(215) 675-2053

Reader Service 542

Tools & Test Equipment

FIBER OPTICS

FIBER OPTIC TOOLS FREE-378-Page color catalog features over 100 standard tool kits for installation, field service, and repair. Fiber optic test equipment includes OTDRs, light sources, power meters, cleavers, strippers & more. Extensive stock case selection. Contains descriptions, specifications, and prices. Call today for more information. **Specialized Products Company.**

(800) 866-5353 or fax
(800) 234-8286

Reader Service 543

CATV Test Equipment

TEST EQUIPMENT

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.

(800) 344-2412

Reader Service 544

Fiber Optic Test Set

TEST EQUIPMENT

Metro Tel Corp. manufactures a complete line of telephone test equipment including T1 analyzers, Subscriber Loop Test equipment, pipe/cable location equipment, Data/Safe buttsets, kick meters, and Fiber Optic test equipment. The FTS 3000 (shown) is the only Fiber Optic Test Set that allows you to test and talk on the same fiber, simultaneously! The FTS 3000 is a precision power meter, talk set, dual wavelength optical source, 2 kHz tone generator and detector and data logger. Email: metrotelco@aol.com. For a copy of the latest catalog, call today.

(408) 946-4600

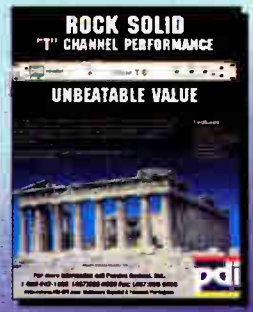
Reader Service 545

Modulator

HEADEND EQUIPMENT

PDI (Passive Devices Inc.), a manufacturer and distributor of electronics for cable and wireless systems announces the expansion of their "Supreme Series" headend line with the new high performance PDI 60 CMT T channel modulator. Available in channels T-7 through T-13, it features two stages of saw filtering, stable pll controlled audio sub carrier and meets all FCC requirements. It's video AGC composite IF loop and stereo compatibility assure picture quality and flexibility. Internet: http//:www.pdi-eft.com Call today.

(561) 998-0600 or fax
(561) 998-0608



Reader Service 546

MODEMS

DATACOM

Com 21's ComUNITY Access systems embedded ATM technology enables MSO's to allocate and build subscribers based on bandwidth needs, provide multiple private networks for work @ home applications, as well as the flexibilty to offer new integrated services like data, voice, and video: all from one common cable modem platform. Com 21's open architecture supports both existing and new hybrid fiber coax (HFC) cable delivery systems.

(408) 953-9165

Reader Service 547

Optical Fiber

FIBER OPTICS

At the Speed of Light video presents an overview of **Corning Incorporated's** manufacturing process, which illustrates how optical fiber is changing the way the world communicates and features an interview with Dr. Donald B. Keck, one of the three Corning scientists who invented the first low-loss optical fiber. Corning invented the first low-loss optical fiber more than 25 years ago, and continues to be an industry leader with the highest quality, most consist glass fiber. For a free copy of this video call the Corning Optical Fiber Information Center at

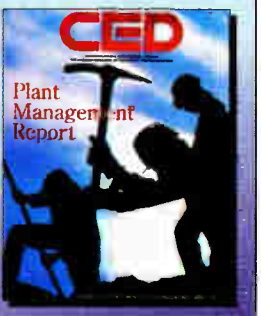
(800) 525-2524 ext: 599

Reader Service 548

Plant Management Report

SERVICES

CED magazine is proud to introduce a new series of reports focused exclusively on the very foundation of an advanced communications network...the physical plant itself! Introducing CED's Plant Management Reports. Having debuted in April, this first report features editorial ranging from "Working with Contractors" to "Empowering Your Employees for Success." It's a must-read for any serious manager of the broadband plant. Request your FREE copy today by circling the reader response number below.



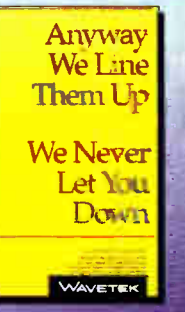
(303) 393-7449

Reader Service 549

CATV Test Equipment

TEST EQUIPMENT

This full color brochure presents a comprehensive matrix of **Wavetek's** CATV test equipment. Along with the matrix, product descriptions and photos are provided. The matrix details the various features of Wavetek's MicroStealth Signal Level Meters, Leakage Meters, SAM 4040 Signal Analysis Meter, Stealth Sweep System, and Headend Monitoring equipment. For a free copy of the matrix, or literature on our new Home Wiring Test System, call today.



(800) 622-5515

Reader Service 550

Network Interface Unit

DATACOM

The WestBound Horizon, by **West End Systems Corp.**, provides HFC network connectivity for voice-band telephony, business data and Ethernet devices to national and international standards. Business data interfaces operate up to 256 kb/s, either transparently or as a Frame Relay stream. The Ethernet port provides a standard IEEE 802.3 10BASE-T interface to an Ethernet LAN. Contact by Internet site at http://www.westendsys.com or call for more information.

(613) 623-9600 or fax
(613) 623-0989

Reader Service 551

HFC Networks

HEADEND EQUIPMENT

West End Systems Corp.'s WestBound 9600 Broadband Access Manager combines functions of an integrated voice and data multiplexer, a digital cross-connect switch and a frame relay access switch for HFC networks. Multiservices platform can be managed locally or remotely from a West End network manager, integrating Time Division Multiplexing and Frame Relay applications with expansion capabilities to SONET/SDH & ATM.

(613) 623-9600 or fax
(613) 623-0989

Reader Service 552

Hybrid Fiber Coax System

ADVANCED NETWORK PRODUCTS

MetroAccess is a complete, cost-effective 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 today.

(800) 788-7244

Reader Service 553

Modems

ADVANCED NETWORK PRODUCTS

With more than 15 years of experience in the Network Systems 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 - industry-leading supplier of high-speed cable modems to more than 300 cable systems worldwide. For more information, call today.

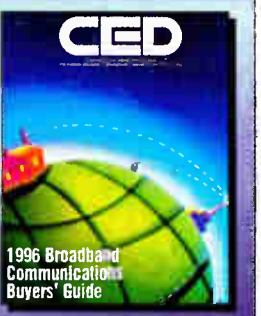
(800) 239-0900

Reader Service 554

1997 Buyers' Guide

SERVICES

CED Magazine is pleased to announce the availability of the 1997 Broadband Communications Buyers' Guide, the industry's most comprehensive and "Original" reference guide. Cover-to-cover full of complete listings of hardware manufacturers, distributors, repair centers and service providers, the CED buyers' guide is "standard issue" for any serious broadband buyer. CED subscribers receive one copy FREE, additional copies are available for purchase.



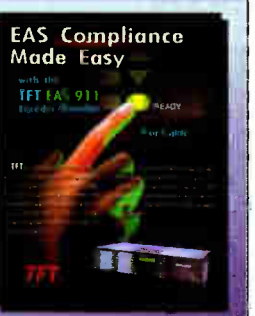
(303) 393-7449

Reader Service 555

Emergency Alert System

HEADEND EQUIPMENT

TFT EAS product family consists of: EAS 922 Encoder/Decoder, EAS 930A Multi-module Receiver, and IHAD In-Home Alerting Device. The EAS 911 has sequentially lighted separate function keys to guide the operator through an extremely intuitive process with speed and accuracy. Nothing could be easier! The TFT EAS 911 is the engine that drives the new EAS system. Remote access encoding and set up is available via modem using a phone or Windows® based PC.



(800) 347-3383

Reader Service 556

By Tom Keenan, Manager of Internet Publishing Services, Chilton Co.

Just the FAQs

Navigating the Web

Why do the Web pages I view on my computer look different than the Web pages on the computer down the hall?

Unlike the print medium, where publishers are accustomed to having complete control over how the final product looks, the Web puts much more control in users' hands. The original intent of the Web technology was to allow users on a variety of computer systems running a broad range of Web browsers to view Web pages and see the logical structure of a document that the author intended. One Web browser may interpret a headline as large bold type, but another Web browser may not be capable of showing various type sizes, so it will show the headline as simply bold. In both cases, however, the author's original intent of making a headline stand out from other type on the page is preserved.

How do I connect to a Web site? What's a URL?

Every computer set up to serve documents to users on the Internet (including the World Wide Web) has a unique address. This is called the URL *(pronounced as U-R-L, not like the name "Earl").* The URL (Uniform Resource Locator) is the address of a computer. In many cases, the URL begins with the letters *www* if it's a Web server. Note that a Web address is different than an e-mail address.

So, if someone gives you the URL for a good Web site to check out, you tell your browser to open a URL either by going under the File menu or clicking on the Open icon that probably appears in your browser window. A dialog box will ask you to type in the URL. To do this, you first type in the protocol that's used on the Web (hypertext transfer protocol [http]) and then the URL. In most cases, you simply type:

http://Type the URL here/

How can I remember the addresses of all the useful Web pages I found and would like to visit again?

Most Web browsers allow you to save the addresses of Web sites you've visited. Browsers call these "bookmarks" or "hotlinks." When you reach a Web page you want to visit again, look under your browser menus for a command along the lines of "add to hotlist" or "Save as hotlink or bookmark." Then, next time you fire up your Web browser, look under the menus for a command that lets you view your list of hotlinks or your hotlist. You'll then see the names of all the Web sites you've saved as hotlinks. Simply click on the one you want to return to.

What if I find a document or file that I want to save? Can I capture it from the screen or print it?

You can print the Web page directly to the printer by going under the File menu to the Print command, on most browsers. If you want to save the file so you can edit it or incorporate it into something else you are working on (provided you don't violate any copyright laws), go under the File menu and look for the "Save" or "Save As" command. You should save it as a Text file if you want to look at the document in a word processor. Don't save it as source or HTML, unless you want to see all of the programming codes that were used to spec how it looks.

Common terms

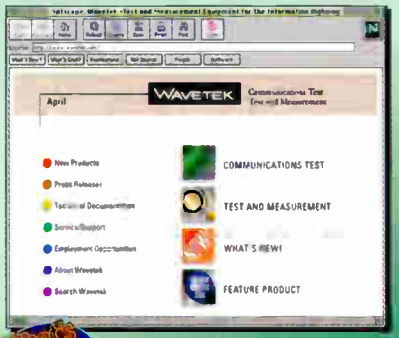
- **Browser:** The software program that you run on your machine which lets you view files on Web servers around the world. Common browsers are Mosaic and Netscape.
- **HTTP:** Stands for Hypertext Transfer Protocol. Web browsers and Web servers must be speaking the same language or protocol in order to communicate. Http is the prefix that is included when connecting to a URL for another Web server.
- **URL:** Uniform Resource Locator. Like the address of a computer on the Internet. Often in the form of www.companyname.com
- **Hypertext link:** These are the phrases or words that appear as blue or red (or whatever colors you've specified) to indicate text that is a hypertext link that if clicked on, will retrieve another file from any Web server, whether it's the one you are currently connected to or another server across the country.
- **Hotlink:** Sometimes called a bookmark, or hotlist item, this is the feature of your browser software that lets you save the URLs for Web pages you've visited so you don't need to remember all the URLs.
- **HTML:** Stands for Hypertext Markup Language. This is the markup language that Web documents must be in to be viewed by Web browsers. HTML is simply a series of tags that enclose blocks of text. The tags tell the browser how to interpret that text and how to show it.
- **GIF:** Stands for Graphics Image Format. This is the type of image file format that many pictures and graphics on the Web are stored in. It's a compressed file format, so that images on a Web page transfer to your machine faster.
- **JPEG:** Another type of compressed file format for images. JPEG images are not recognized by all browsers.

www.wavetek.com

TEST EQUIPMENT

Wavetek Corporation

Wavetek's home page has a new look! You now can find what you need more quickly and easily! You can access technical information, press releases or service information about Wavetek's complete line of CATV products through the Communications Test icon.



WHAT'S HOT!

- Find "what's new" about Wavetek!
- Find Wavetek's full line of test and measurement products

www.adc.com

TELECOM EQUIPMENT

ADC Telecommunications

ADC offers service providers a diverse portfolio of solutions for residential broadband service access, business broadband service delivery and mobile wireless markets worldwide. With expertise in fiber-optics, video and wireless technologies, ADC provides end-to-end network solutions for telecommunications, cable television, wireless and enterprise networks. Visit our Web Site for the most cur-rent information about ADC's products and markets and our latest industry news.

WHAT'S HOT!

- New training course: CATV Applications in Broadband Networks
- Link to all ADC locations and training employment opportunities

www.gnlp.com

TEST EQUIPMENT

Laser Precision Division, GN Nettest

Find the latest information on fiber test equipment from this manufacturer of OTDRs, mini-OTDRs, fault locators, attenuators, fiber identifiers, loss test sets, power meters, light sources, visual fault locators, advanced emulation software and cable administration systems. Also included are a number of technical application notes and information on GN Nettest.

WHAT'S HOT!

- Visit our web page and learn all about the new CMA4000 OTDR
- While visiting our web site, email us for free passes to Cable-Tec, June 4-6 in Orlando, and visit us at booth # 430!

www.tellabs.com

TELECOM EQUIPMENT

Tellabs, Inc.

Tellabs' website provides up-to-date news and information on Tellabs' products and services, career opportunities and special events. Current and future Tellabs customers can take advantage of Tellabs' market-driven approach to customer satisfaction as well as access a range of on-line resources and useful contacts from the website.

WHAT'S HOT!

- Products and Services! www.tellabs.com/ solutions/ solutions
- Career Opportunities! www.tellabs.com/careers/career.html
- News and Information! www.tellabs.com/about/about.html

www.corningfiber.com

FIBER OPTICS

Corning Incorporated

The world's best resource for information on optical fiber is now at your finger tips. Corning Incorporated, the inventor of the first low-loss fiber, has brought the Optical Fiber Information Center to the internet. Here you will be able to access Corning's extensive library that includes case histories, product specifications, manufacturing insights and much more!

WHAT'S HOT!

- New, Updated Cable TV Section
- Be one of the first to visit the Special CED Page (www.corningfiber.com/CED) and receive a free gift.

www.alpha-us.com

DISTRIBUTION EQUIPMENT

Alpha Technologies Inc.

Visit Alpha Technologies on the World Wide Web for the most complete and latest-breaking information on broadband powering. Alpha's site provides detailed information on the company's extensive line of power supplies. UPS systems, enclosures, batteries and accessories. Investigate the [Power] of Alpha at www.alpha.com.

WHAT'S HOT!

- Detailed Product Information
- Fully Hotlinked Site Directory
- Latest Product/Company Announcements

CONSTRUCTION/CONTRACTORS

www.commscope.com

CommScope, Inc.

An ISO 9001 registered quality manufacturer of cables for telecommunications and other digital applications, the only U.S. manufacturer of a complete line of coaxial and fiber optic cables for use in hybrid fiber/coax networks. Products include NEW Power Feeder ™ , NEW QR Express ™, NEW Cable-in-Conduit, Cell Reach ™, Optical Reach ®, Quantum Reach ®, Parameter III ® and a full line of drop cables.

- Complete line of coaxial and fiber optic cables!
- ISO 9001 registered!

SERVICES

www.scte.org

SCTE

Check the SCTE web site for upcoming training programs, certification testing dates or meetings of the standards development committees. Link to Chapter web sites to find out what is happening locally. Learn how to access your Board representative or communicate with SCTE National Headquarters via e-mail. New information is being continually added - so check in often to see what's new. Current high points would include our Cable-Tec Expo ® '97 attendee and exhibitor pages.

- Cable-Tec Expo ® '97, June 4-7
- Standards Committee Meetings on June 3

TEST EQUIPMENT

www.hp.com/go/catv

Hewlett-Packard Company

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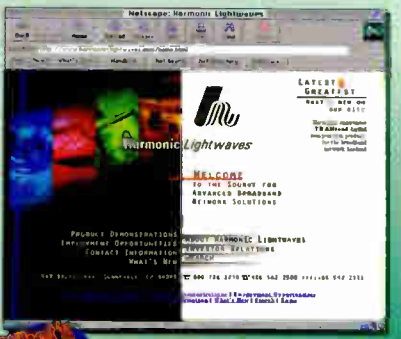

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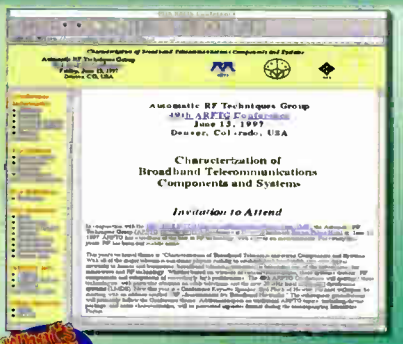

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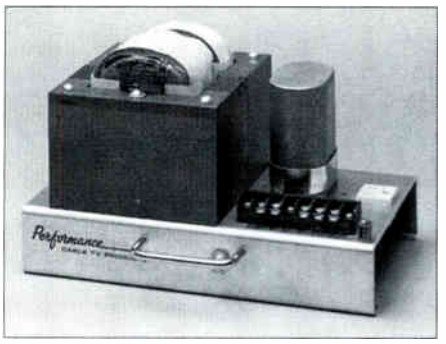

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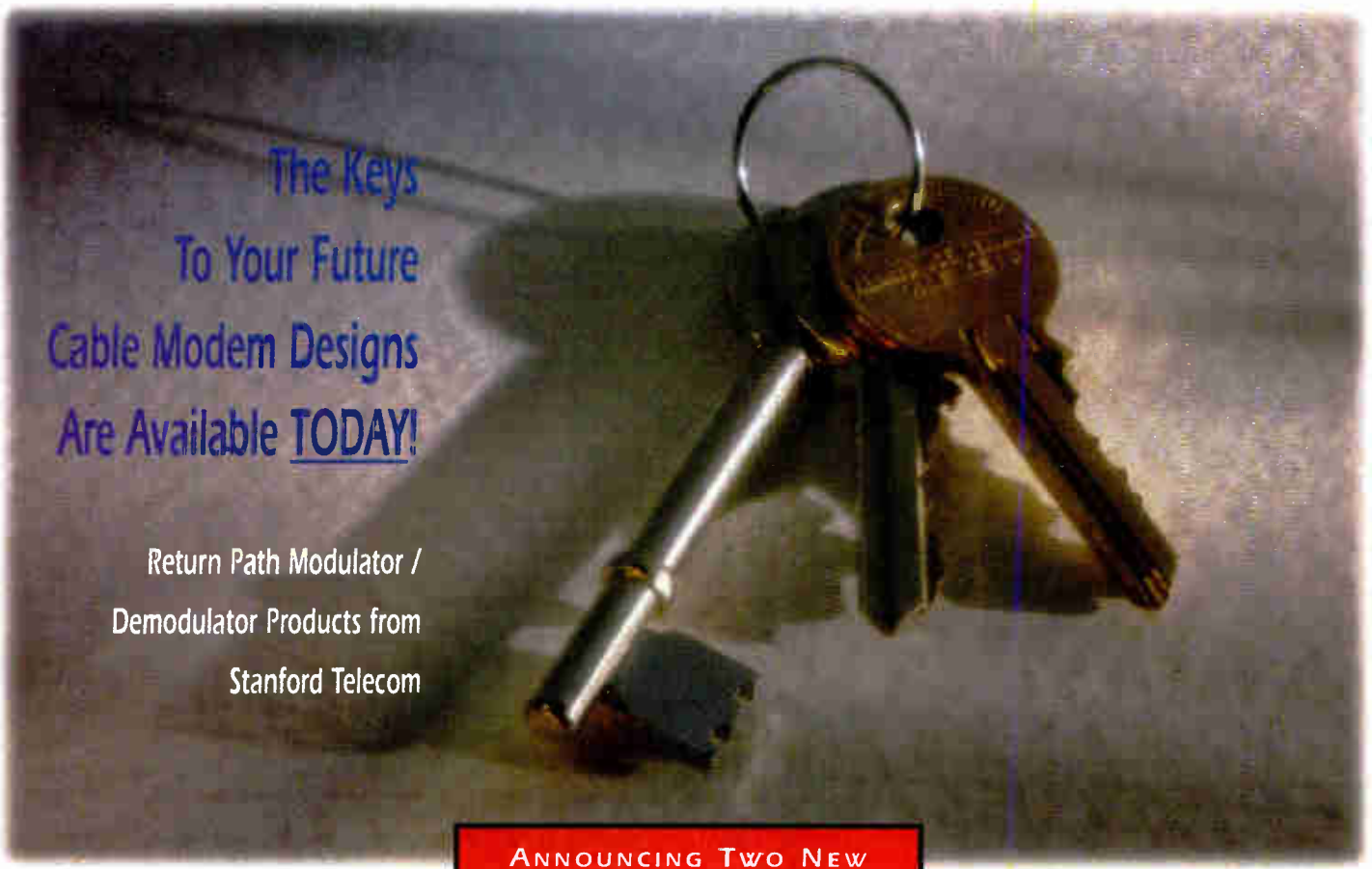

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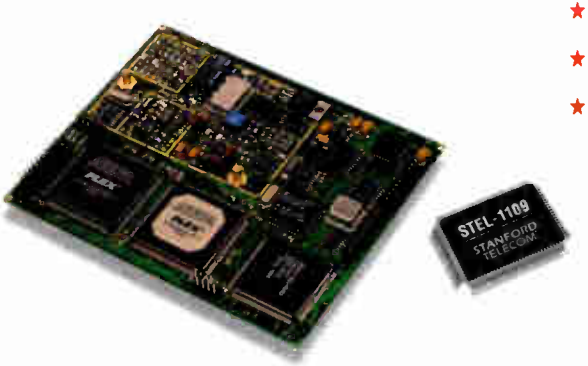

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ments or even MPEG video streams. Because of the varying amount of overhead and guard time required by different physical layers, the number of minislots required to allow transmission of any data stream will vary from one upstream PHY to another.

The use of minislots with independent in-channel/in-band control messaging creates a flexible architecture. This flexibility allows the 802.14 protocol to adapt to the changing traffic flow patterns of the network and to fully integrate multiple channels and time slots.

The Physical Layer (PHY) overview

As with the MAC architecture, the physical topology of the hybrid fiber/coax (HFC) plant allows for a multi-cast downstream and multiple converging upstream paths. Two distinctly different downstream PHYs are supported by the 802.14 protocol. Each type is centered around an existing coding and modulation standard: ITU Standard J83 Annex A/C, as adopted for European cable systems; and ITU Standard J83 Annex B, as adopted for the North American cable systems.

In addition to these standards, the protocol specifies modulation, coding sequence, scrambling method, symbol rates, synchronization, physical layer timing, message length and formats, transmitter power and resolution characteristics. Much emphasis is being placed on characterizing the upstream channel, the quality of transmissions and the discernible resolution.

Contrary to popular belief, the protocol does not specify how a plant should be designed, but rather, the limits to which the modem can operate. Again, the unique feature of the 802.14 protocol is the flexibility to operate on a wide variety of network topologies and noise characteristics.

The standard specifies interfaces, not vendor component design

Flexibility, scalability and true integration of frequency and time division multiplexing are the hallmarks of the 802.14 protocol, which has been designed around the premise that the data types and the resident topology are largely undetermined. Constraints are defined and resolved while allowing the architecture to adapt on a session-by-session basis. This is achieved through the use of minislots and code messages with minimal repeated overhead. Use of a time stamp method for synchronization further allows the 802.14 protocol to adjust its reference to the changing environment.

The 802.14 protocol also allows for scaled down, minimal functionality devices or highly complex integrated devices supporting the entire range of data, voice, video and management services. Because the standard specifies interfaces, not vendor component design, widely diverse products and approaches can be taken to accommodate network operator and consumer demands.

Also, much like its cousin Ethernet (802.3), the 802.14 protocol defines internal interface specifications as well as the external. This allows interchangeable components and upgradability. Work has already begun on advanced physical layer modulation techniques beyond QPSK and QAM that promise greater efficiencies, while retaining the same core functionality. This allows both the net-

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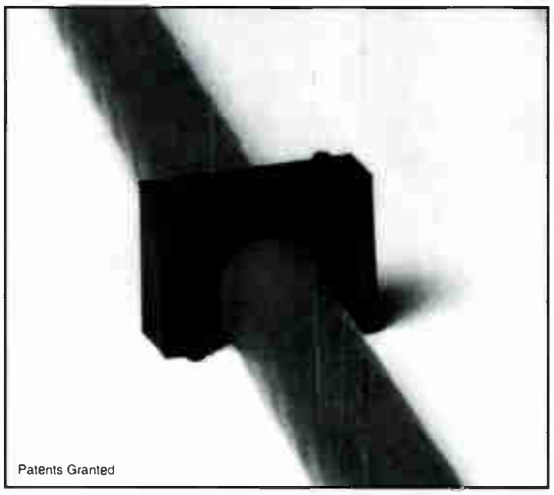

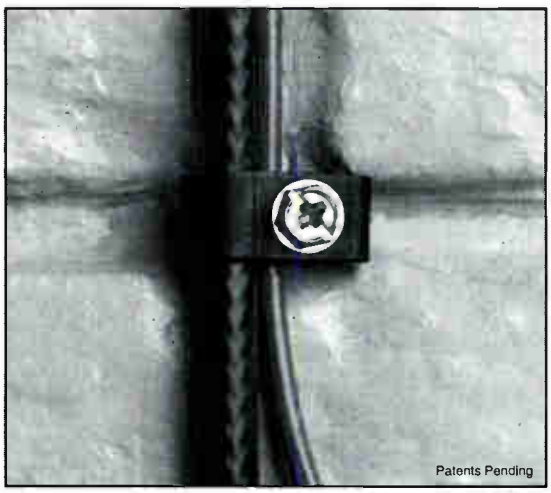

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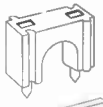

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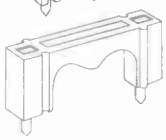

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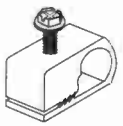

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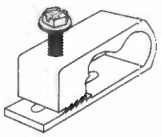

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work operator and subscriber to change with technology without sacrificing previous investment.

What's the status?

The 802.14 working group consists of six sub-working groups of between 120 and 170 participants from 70 to 90 companies, network operators, universities and government agencies. Meetings are held every other month. The working group was authorized at the end of November 1994–and the first order of business was to define the functional requirements of the standard.

With this completed in mid-1995, the committee then received 17 proposed solutions from the participating members. Upon review and evaluation, it was found that no one solution solved the complex task completely, and efforts were made to converge the attributes into a fundamentally new protocol. This took shape as a rough draft in November 1996 and is currently being refined into an approved Working Group Draft, with a deadline of July 1997.

Once approved by 75 percent of the voting committee members, the draft will enter a letter ballot in which written comment is solicited from the members on specific portions of the draft. Upon resolution of any negative comments, around January 1998, it will again be submitted to a ballot of the industry at large and finally submitted through the IEEE as an approved standard.

Though laborious, this process ensures broad acceptance of the proposed standard and ensures tight scrutiny of its specifications. All proceedings, discussion and voting are in a public forum with fair and equitable requirements strictly enforced. Participating members are therefore able to begin product development and design while the standard is being developed. Upon the standard's adoption, therefore, there will exist an established base to provide products directly to consumers.

Figure 1: Fourteen distinct interfaces to standardize.

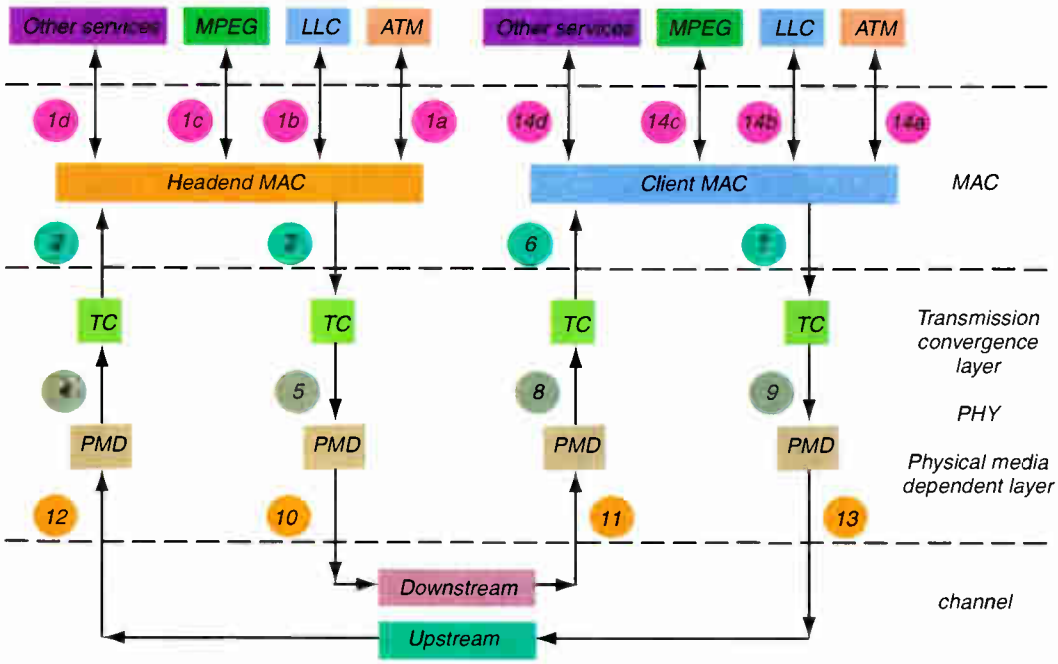
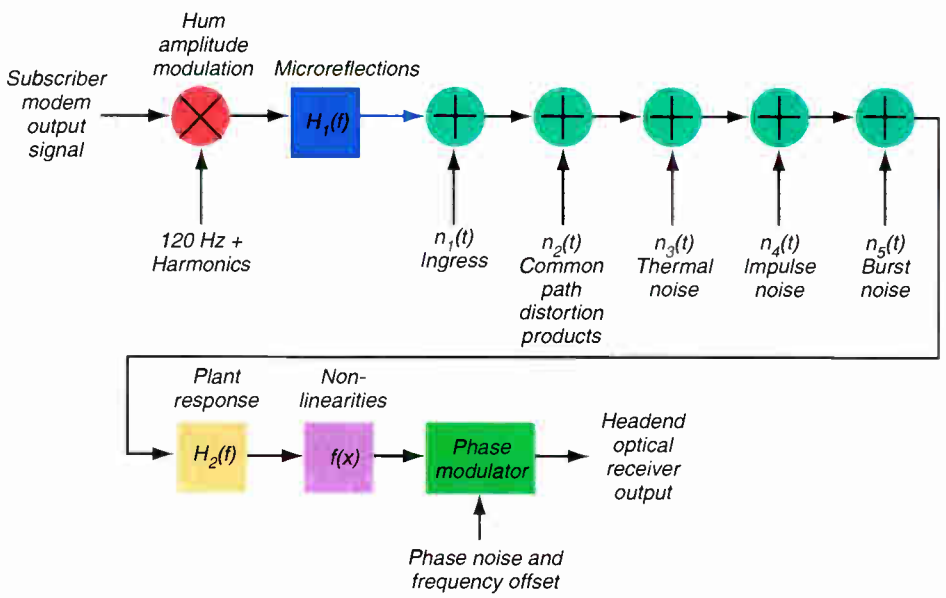


Figure 2: IEEE 802.14 upstream channel model

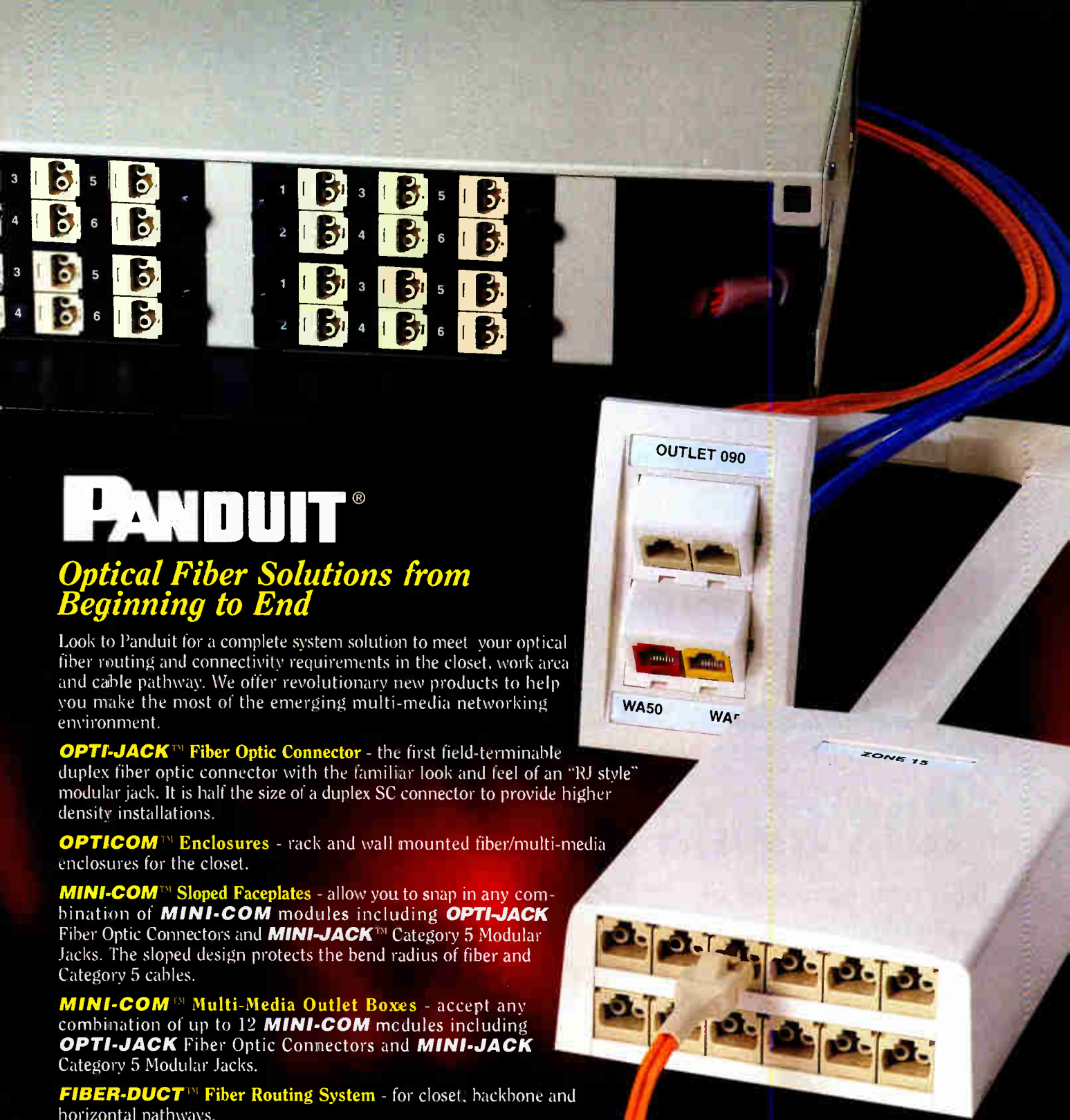


More information

The next meeting of the 802.14 Working Group will be at the Georgia Tech Conference Facilities in Atlanta, Ga., May 19-23. Information is available at two different Web sites: http://802.14.org, or, http://www.walkingdog.com.

Efforts are underway to provide electronic copies of all of the public information, presentations and meeting minutes on the 802.14.org site and should be available by the time this article is published. The working group welcomes anyone to attend and participate in its efforts.

The nature of data architectures has changed and evolved, and protocols must adapt–or they run the risk of adversely affecting the delivery of services to subscribers. Similarly, networks are evolving beyond a single defined application and must be empowered to provide a wide range of applications and their unique Quality of Service requirements. The 802.14 protocol seeks to converge these aspects and create a new foundation upon which to build the information superhighway: adaptability, flexibility and scalability. The participating members of the IEEE 802 standards body and the industry they represent remain committed to providing continued professional support to the evolution of communications networking. CED



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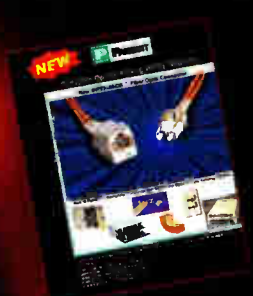

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Cox steps up to the plate with telephony in CA.

Other cable companies are still sitting in the dugout

By Dave Woodrow, Cox Communications Senior Vice President, Broadband Services; and Guy Gill, Nortel Vice President/General Manager, Access Networks

In early 1996, with the ink still damp on the Telecommunications Act, Cox Communications was actively exploring the "hows" and "whens" of providing wired voice services to its cable TV customers.

Its telephony initiative got a jump-start when Westwood Residential, a Dallas-based developer with southern California expansion plans, approached Cox's Orange County operations to find out just how cable franchises were handled in the state. The developer was ready to launch construction of "Sonterra," a luxury complex of 300-plus apartments in Foothill Ranch, an affluent, high-growth area in the rolling hills of southeastern Orange County.

Fast pitch for packaged services

In January, Westwood's agent met with Kimberly Toonen, director of business development for Cox's Orange County system. Toonen works directly with developers to negotiate access agreements for Cox's telecommunications services. "There's a lot of building going on in this part of Orange County, especially in the multifamily product area," states Toonen. "Builders, owners and property managers of these private-property complexes are recognized as the 'gatekeepers' to their tenants. So they're very important to us both as customers and as intermediaries between Cox and our future subscribers."

Westwood traditionally contracted for cable TV services with private cable companies that delivered wired voice off a PBX (private branch exchange) or through a Bell operating company. Now, with deregulation altering the communications landscape, Westwood felt the time was ripe to take a new tack. Its mandate for Cox: deliver a package of services—video, voice and high-speed data—that would satisfy the more sophisticated expectations of a "typical" Sonterra tenant: well-educated and upwardly mobile, with above-average income and a taste for convenience, choice and added value. Unless Cox could deliver, Westwood would go to a competitor.

Toonen knew right from the start that the stakes were high. "We had to deliver a viable alternative—and deliver it quickly—or lose our cable TV customers in the community, as well as future wireline business." Underlining

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the strengths that had made Cox a trusted household word—especially its history of customer service—she convinced Westwood Residential to sign with Cox to provide video, voice and high-speed Internet access for Sonterra, with the promise that telephone service would be up and running when the first phones were plugged in the wall. Westwood's bottom line: its construction timeline couldn't be held up by Cox's development process.

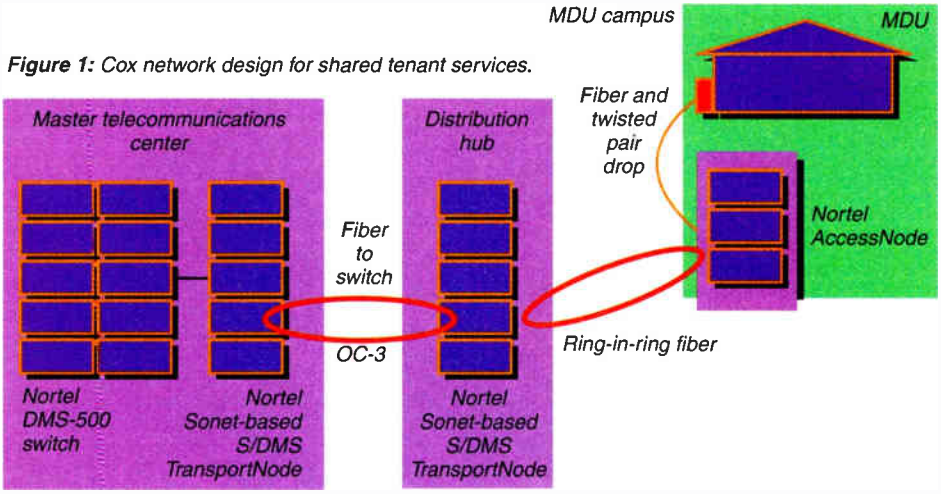


Figure 1: Cox network design for shared tenant services.

Play ball

Ground was broken in early April 1996. Cox installers were, for the first time, running cable *and* twisted pair through joint trenches, and as buildings were framed and roofed, installing inside wiring with dual-port outlets that could handle both coax and twisted pair connections. Eight months later, as construction wound down for the December holidays, Sonterra's first phase (100 apartments) was ready for leasing, as was telephone service.

Equal cause for celebration was the overwhelming vote of confidence by tenants for Cox telephone services, attractively packaged with video and high-speed Internet access services as the "Community of the Future." With initial penetration rates of more than 95 percent, Cox personnel were throwing their hats in the air. "We're so pleased with the response we're getting," says Gordon Williams, director of broadband services for MDU (multiple dwelling unit) markets. "After a year-and-a-half of work, it's great to see it paying off." Steve Becker, vice president of commercial broadband services, underscores that Cox has "transitioned very successfully from delivering just traditional cable to telephony and high-speed data. Especially in regard to telephony, we're launching an innovative service that most of our counterparts aren't doing."

A happy ending for all concerned—Sonterra residents and management, as well as Cox Communications. The behind-the-scenes path to this happy ending is an interesting story that illustrates Cox's sincere commitment to its customers and its prudent attention to long- and short-range planning.

Service roll-out schedule

Cox Communications Orange County products/services

MDU telecommunications services—Voice, video, Cox@Home high-speed data (select MDUs): Now
Cox Digital TV: Spring 1997
Residential/commercial wired telephony: 1997
Sprint PCS: Mid-1997

A few quick statistics:

Homes passed	**282,000**
Customers	**217,000**
Fiber in place	**400 miles**
Cable in place	**2,786 miles**

Completion of 750 MHz rebuild: Mid-1997

Up-front call...no errors allowed

Cox understood that the potential rewards for being one of the first to dive into wireline waters were counter-balanced by risks that had others walking away from the shore. Says Toonen, "We knew we would be scrutinized intensely by builder clients, other cable operators, telephone companies, vendors, analysts, investors, government agencies, and very importantly, current and potential subscribers." Refusing to jeopardize a reputation built on superior customer service, Cox prudently set out to identify and defuse roadblocks that could impact the Sonterra project.

Navigating a maze of regulatory issues was a first priority, according to Williams. "We knew how important it was to get California PUC approval to operate as a competitive local exchange carrier (CLEC). We began working on these issues in 1995, and it took us the better part of a year to resolve them and receive CLEC certification.

"Internally, billing was a significant challenge," explains Williams. "Cable and data services are invoiced on a straightforward monthly basis, with pay-per-view being the only variable. But long-distance telephone service is transactional—so it has to be

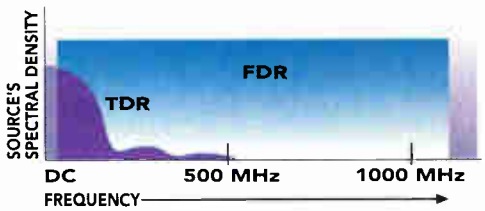
The cost of in-home installation and test can be murder on your budget.

Scheduling appointment times, fumbling through wiring, and finding owner-installed components triples the expense compared to a curb-side test.

Anritsu Wiltron's Cable Mate accurately verifies the entire cable drop, including in-home wiring, from a curb-side test connection.

Cable Mate's advanced Distance-To-Fault mode displays SWR versus distance—clearly indicating the frequency response of all connections and splitters throughout the home. Additionally, a 5 MHz to 1200 MHz synthesized RF sweep verifies SWR specifications.

Unlike time domain reflectometry (TDR), Cable Mate's frequency domain reflectometry (FDR) works at RF frequencies. This enables Cable Mate to accurately evaluate high-frequency performance.



The spectral magnitude of a TDR's pulsed DC output tends to roll off rapidly at high frequencies. Thus, traditional TDR-based tests do not measure at RF frequencies. With FDR, you specify the frequency range to meet the requirements of your system.

Cable Mate's user-friendly display, controls and menus simplify procedures. Up to 40 sweeps can be stored for comparison to historic data. So, if you want to ensure signal quality without the budgetary horror stories, pick up Anritsu Wiltron's Cable Mate.

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More to come

With Orange County growth projections skyrocketing, and approximately 25,000 apartment units as candidates for shared tenant services, Cox envisions a bright future as a full service provider of telecommunications services, with expansion to broader residential markets following very quickly.

By year's end, Cox's Orange County franchise areas will offer their customers digital and analog video, high-speed Internet access, Sprint PCS, and telephony via Nortel AccessNode and DMS-500 technology.

Nationally, Cox plans to begin rolling out wireline services in its largest markets later this year.

metered minute-by-minute, and the billing has to reflect that. Cable Master' is our proprietary billing system, and it's one of the best in the business, but it wasn't designed to capture long-distance transactions. "

Cox's information systems team enhanced Cable Master's software to capture voice, cable and data billing. Cox is currently examining customer feedback and issues before it decides whether all services will be billed on one invoice or separately.

But, says Williams, "If the customer wants all three services on one bill, we have that ability."

A winning game plan

"We knew that the high concentration of potential customers at the Sonterra environment was definitely an advantage for our first foray into wired voice," says Becker. "We expect faster penetration ramp-up in a newly-built MDU because of the opportunity to sell to every new tenant and minimal local number portability issues."

Davis: 'It made sense to push the electronics closer to the subscriber'

Mark Davis, director of engineering for telephony technology, who was responsible for system configuration, underscores that theme. "What was significant here, as in any MDU application, was that we had very high customer concentration, so it made sense to push the electronics closer to the subscriber using a cost-effective, off-the-shelf, fiber-fed, digital loop carrier technology."

Cox's choice was Nortel's (Northern Telecom's) Sonet-based AccessNode with the capacity to provide individual line access (DS-0) for voice service to each apartment. "With the AccessNode," says Davis, "we have a proven, mature product that lets us provide subscribers with all the voice services they're looking for—from basic POTS to advanced services such as digital centrex.

"And, for our high-speed Internet access service with the Cox@Home program, the AccessNode gives us DS-1 and DS-3 connectivity between Sonterra's on-campus LAN (local area network) back to our regional data center and servers. So, using the AccessNode for transport, along with Ethernet routers and hubs, we can provide subscribers with high-speed access to the Internet."

Davis estimates that "right now, about six other apartment complexes are underway in Orange County, and they'll all get AccessNodes. And we'll be deploying many more as we start to crank up." Adds Williams, "AccessNodes will continue to proliferate throughout our network because of the way they serve high-density populations of users."

Located at Sonterra, the AccessNode system connects via Cox's unique ring-in-ring fiber architecture and Nortel's Sonet-based TransportNodes to a Nortel DMS-500 local/long-distance switching system at the Master Telecommunications Center in nearby Aliso Viejo. Able to serve up to 128,000 lines, the DMS-500 has the capacity that Cox needs, and then some. Its compatibility with existing public network equipment means that Cox can establish market operations at the accelerated pace necessary to be competitive with already established incumbent LEC competitors.

No rookie in voice services

Cox was tuned in to the competitive advantages and revenue opportunities of providing telephone services long before it signed up Sonterra. It had, in fact, already chalked up several years of solid telecommunications experience.

Some highlights :

1992—Cox is the first cable company to invest in Teleport Communications Group, a competitive local exchange carrier.

1993—Cox partners with SBC CableComms to deliver cable and phone service in the U.K.

1997—Cox is awarded an FCC Pioneer's Preference award for industry leadership in making the world's first PCS phone call over cable infrastructure.

Today—San Diego residents can subscribe to digital wireless telephony via "Sprint PCS by Cox."

Cox has also chosen to deploy the Cornerstone Voice cable telephony system from Antec. Cornerstone Voice is developed and supported by Arris Interactive, a joint venture of Nortel and Antec.

This product allows telephony services to be delivered over a hybrid fiber/coax network—capitalizing on the more than 2,700 miles of cable already installed by Cox in Orange County.

Pre-season training pays off

"The fact that we're able to aggressively forge ahead in telephony when other companies are pulling back is a reflection of our strategy over the last five years," declares Becker.

"A key element of that strategy is 'clustering'—85 percent of our 3.2 million customers are in our nine biggest markets. That gives us much higher average system size than anyone else in the cable television industry. With such economies of scale, Cox can more easily afford the fixed costs of getting into the tele-

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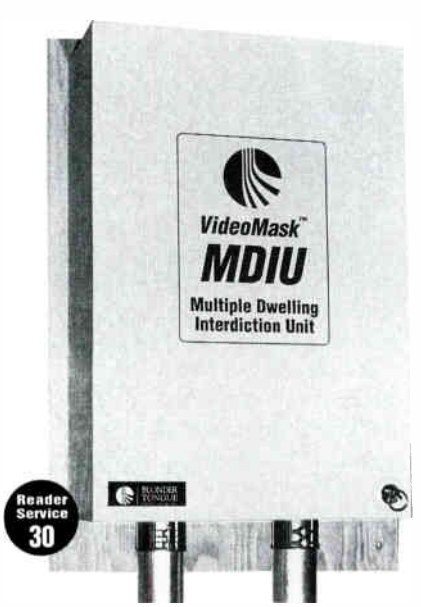
VideoMask™ Interdiction System Multiple Dwelling Interdiction Unit (MDIU)

Blonder Tongue's VideoMask™ Interdiction System is the complete program security solution for today's cable market. The Multiple Dwelling Interdiction Unit (MDIU) is a new member of the VideoMask™ family and is ideal for MDU installations. The MDIU is available in 8, 12, and 16 port configurations and is housed in a rugged, outdoor, steel enclosure. Each MDIU consists of one or more 4-port subscriber groups mounted in an RFI-tight steel inner enclosure. An outer steel enclosure provides excellent protection for outdoor installations, while an integrated lock prevents tampering with the interdiction components.

Available in 8, 12, and 16 port configurations

The MDIU is suitable for wall mounting and includes a backing plate with locating studs for quick installation. A removable bottom panel provides easy access to the entry/exit connections and subscriber drops. Ample room is provided for installing a directional coupler for those system designs requiring cascaded . MDIU's. This work space can also accommodate the installation of L-band components for those systems providing both analog (50-750 MHz) and digital (950-2150 MHz) programming. Blonder Tongue also manufactures these L-band components - please contact our Sales/Marketing Departments for more information.

Blonder Tongue's VideoMask™ Interdiction Unit (VMIU), which serves 4 subscribers from a die cast housing, is also suitable for pedestal based MDU installations. Blonder Tongue has recently begun offering several pedestal mounting kits, including Channell (SPH1320, SPH1212, SPH1010) and Reltec (TV1024) models. These bracket kits allow up to 4 VMIU's (a total of 16 ports) to be mounted in one pedestal, with plenty of room for entry/exit connections and subscriber drop cables. Both the MDIU and VMIU provide identical electrical performance and can be intermixed on properties to increase the efficiency of the system design.



phone business, plus the talented people to help us roll it out. That's been critical to our strategy.

"The Cox standards for customer service and reliability are not just concepts we dug up a few weeks ago to get into the phone business," continues Becker. "They've been a part of what we've done from our very beginnings. Recognition like the J.D. Power award for the highest overall customer satisfaction among all major cable television companies certainly has contributed to the successful penetration rate that we've gotten on our first rollout."

A recent customer survey showed an almost 85 percent approval rating among Cox's customers. Cox's cable service ranks among the highest in the industry for reliability, thanks to fiber deployment and an innovative "ring-in-ring" system architecture that lets the company-wide network exceed the telephone industry's reliability guidelines for 911 lifeline service.

With a delivery network that combines fiber optic and coaxial cables, Cox is positioned as having a broadband pipe into the home with the ability to deliver video, voice and data services over a single platform. The net result of continuously upgrading to fiber means that today, broadband plant passes virtually all homes within the Cox service area, so Cox can realize added revenue from the extensive capacity and flexibility of the existing delivery network.

A good business

The response from Sonterra customers is that they are delighted with telephone service via Cox's "Community of the Future" package. One service provider means one convenient point of contact, lower prices, and enhanced features. The money-saving benefits that Cox offers, such as free repair service, help, too.

From its perspective as builder and apartment manager, Westwood Residential is very pleased, says Williams. "Westwood Residential plans to use Cox again in other developments. They appreciate the close relationship that we develop with the complex as we train leasing agents to present our services, and maintain our high level of customer service."

Gill

Woodrow

For Cox, notes Kimberly Toonen, "a big plus is our exclusive marketing arrangement with Westwood. All new tenants get a guided tour from the leasing manager, along with demonstrations and a brochure that welcomes them to Cox's 'Community of the Future.' They hear about our services first. It translates to a very effective partnership."

Steve Becker sums it up for Cox: "Our decision to provide telephone service that many others can't provide began as almost a defensive measure. Now, having gone through this process, we realize it's much more than that; it's turning out that phone service is going to be a really good business for us. Yes, it's a strategy that retains our cable business, but being in telephony and data makes it a win/win." CED

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1000 MHz Headend Grade Spectrum Analyzer

Blonder Tongue proudly announces the introduction of its new high dynamic range (70 dB) headend grade spectrum analyzer model BTSA 8558C. The BTSA-8558C analyzer is a light weight, battery operated spectrum analyzer that has a wide array of controls that allow for quick setup and measurement, including coarse and fine frequency tuning, digital frequency counter readout, 3 resolution bandwidth settings, including 30 kHz for composite triple beat distortion testing, 8 frequency span settings including ZERO SPAN for setting depth of modulation, 50 or 75 Ω input impedance, variable sweep rate, and "bright dot" center/marker frequency display. An optional calibrated noise generator is also available for sweeping frequency selective devices.

"Chase Beats in the Grass in Real Time"

I am a hard core test instrument addict. Ever since the discontinuation of the HP 8558B and the Tek 7L12 in the 1980s I have had a dream. That dream is to make available a personally affordable high dynamic range spectrum analyzer that is user friendly and provides the appropriate depth of measurement required for headend set up and trouble shooting. The 8558C is that dream come true. Because it is light weight and battery operated, the 8558C is appropriate for use anywhere in the system, especially the headend. The headend technicians job is most challenging in that he is tasked with identifying low level picture impairments and making them vanish. To do this he needs both 70 dB of dynamic range and a real time swept display. With this visibility, the technician can wiggle cables and connections, tap on chassis', tighten and loosen covers while observing improvements on the display. We addicts call this "chasing beats in the grass in real time". This is the first instrument I have seen with this capability, yet priced so that the technician can personally afford to own one.

"Priced So That the Tech Can Personally Afford To Own One"

Interdiction system installation and maintenance also presents the unique challenge of separately verifying the jammer and visual carrier levels. The 8558C is particularly useful for making this difficult measurement. The technician can easily observe both levels simultaneously in real time.

The BTSA-8558C is housed in a compact, rugged case that is at home in the field, on the bench, or in a headend.

Bob Pallé
Blonder Tongue Laboratories, Inc.

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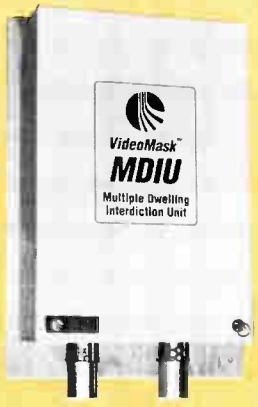

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Implementing security for data-over-cable

Using cryptographic technology

By Gerry White, Consulting Engineer, Data Over Cable Division, Bay Networks Inc., gerry@lancity.com; and Chet Birger, Ph.D, Internetworking and Security Consultant, cbirger@tiac.net

Editor's Note: This is the second article in a two-part series. The first installment discussed the security issues inherent in shared-medium HFC-based networks and discussed the goals and constraints for a security solution.

As a matter of review, in the first article, the authors identified a set of security goals for HFC-based data networks, which included:

✔ensuring privacy, authenticity and integrity of user traffic across the shared-medium HFC network.

✔restricting access to basic unicast service to authorized users.

✔restricting access to "premium" multicast services to authorized users.

Then, the following constraints were placed on a security solution:

✔it must not significantly add to the cost and complexity of cable modems.

✔it must not significantly add to the cost of operating the network.

✔it must not significantly reduce the CMTS (Cable Modem Termination System) and cable modem throughput.

✔it must not complicate "out of the box" cable modem operation.

An analysis of these goals and constraints led to the following functional requirements:

✔encryption of user traffic across the HFC.

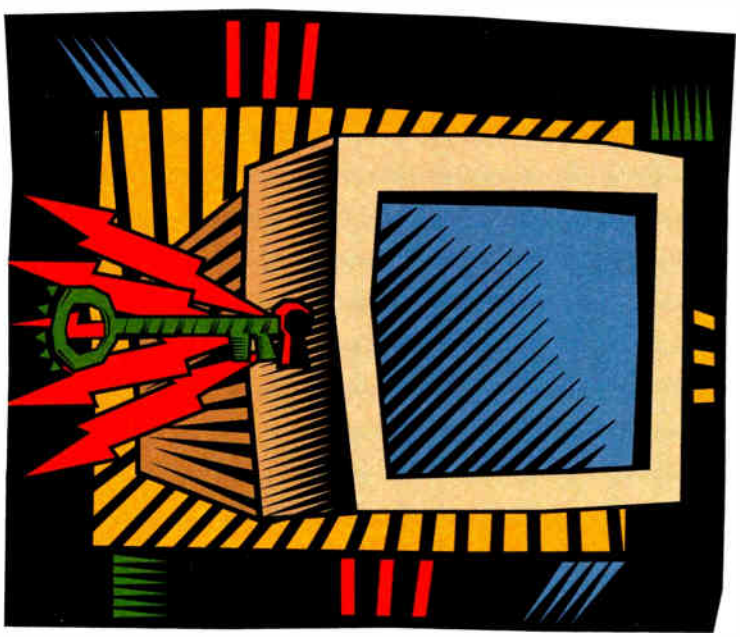
✔authenticated key distribution to CMs (cable modems) and CMTSs.

✔frame data authentication.

Finally, the design issues involved in fulfilling these requirements based on current cryptographic techniques were discussed and a number of design tradeoffs were developed.

This second installment provides a high-level description of a low-cost system that meets the requirements and design goals developed in the earlier article.

What follows is a very high-level description of a relatively simple, low-cost, data-over-cable security solution. It satisfies the functional requirements outlined earlier, while complying with the stated constraints; in particular, the solution does not add significantly to the cost of the cable modem, nor does it significantly reduce effective throughput. While details have yet to be specified, the authors believe this simple approach could satisfy the cable industry's basic security goals in a cost-effective, practical manner.



ANNEY GROSSBERG

Security components

The Access Control System (ACS). This is responsible for distributing master service keys to CMTS and cable modems in its security domain. The ACS must include a strong (in cryptographic terms) pseudo-random number generator for master key generation and generation of its own private Diffie-Hellman key (see sidebar, p. 68). The most likely implementation of the ACS would be an application running on a Unix or NT-based server platform.

The ACS will be placed upstream from the CMTS.

Authentication and public key cryptographic system. This component is responsible for the mutual authentication of the CM or CMTS to the ACS, i.e., the foundation for authenticated key distribution identified earlier as a functional requirement for HFC network security. The component would be based on available public key technology and may be implemented as a tamper-resistant smart card and reader. Cable modems, and potentially the CMTS, will use smart cards. Readers can be built into cable modem devices or be external to them, connected via a standard, low-speed serial interface. An MSO would distribute smart cards to its subscribers.

The smart card contains a public-key/private-key pair unique to that card; a certificate, signed by a certification authority (CA), authenticating the smart card. The certificate contains the smart card's public key, and is time stamped, and the CA's public key.

The smart card is capable of verifying the certificate and generating digital signatures.

Cable modem devices: CMTS and CM. These components are responsible for encryption and decryption of data traffic using a symmetric key algorithm such as DES and for generation of Diffie-Hellman keys. They contain a symmetric encryption/decryption (e.g., DES) engine, which may be hardware-based, or implemented in software, and access to a strong, in a cryptographic sense, pseudo-random number generator.

In this solution, random key generation within the CMTS and CM is only required during establishment of a secure communications channel with the ACS (the Diffie-Hellman exchange). Therefore, the random number generation need not be high-speed (not accessed on a per-frame basis) and can be implemented within the smart card.

Key management protocol. A key management protocol runs between the ACS and

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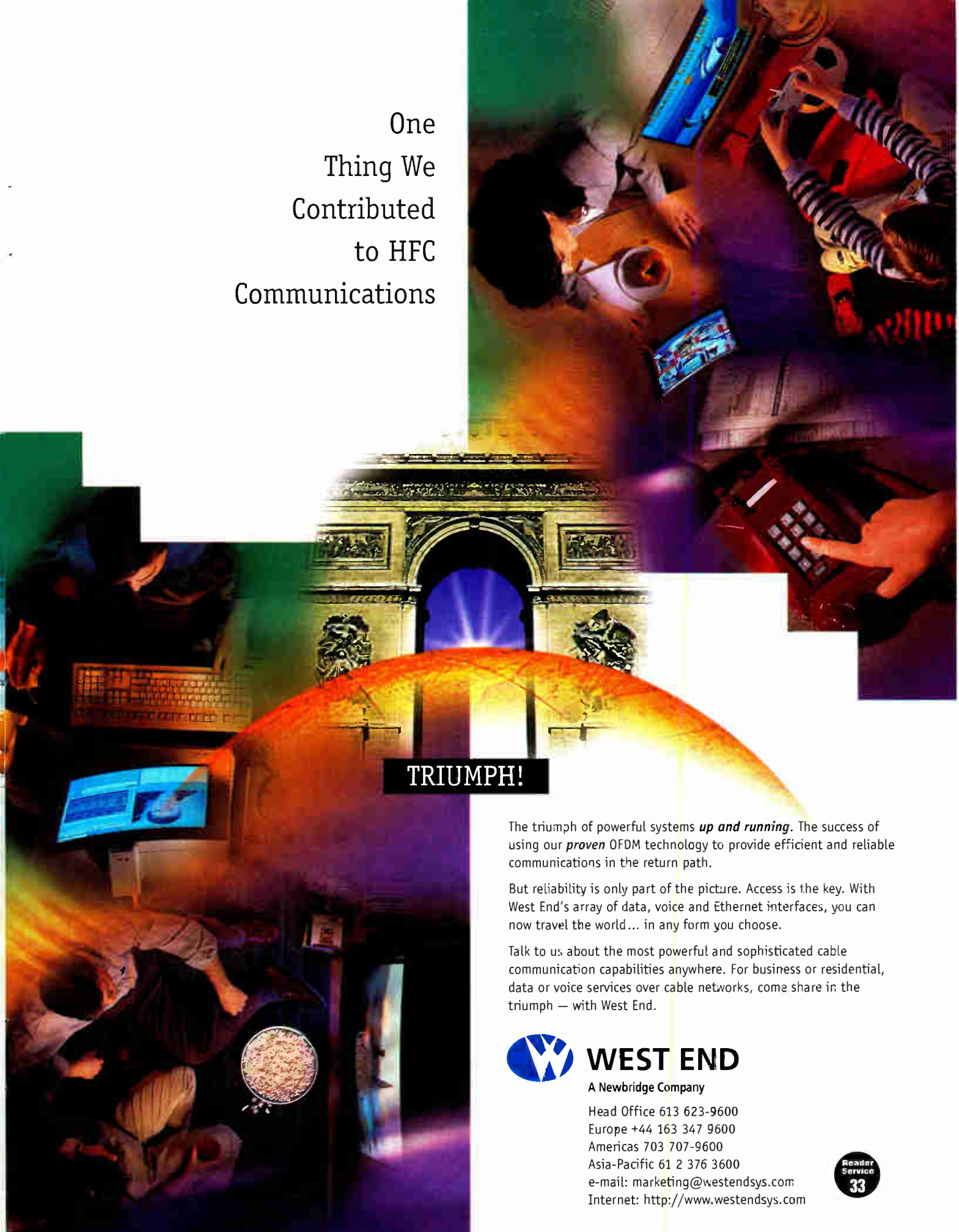

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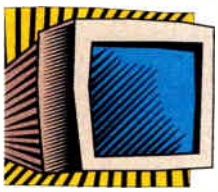


cable modem devices (CMTS and CMs), providing for authenticated, and encrypted, distribution of keying data across the HFC network. It is actually three protocols:

✔an authenticated Diffie-Hellman exchange that allows the ACS and a cable modem device to generate a mutually authenticated, independently computed, shared secret that can serve as a basis for an authenticated and encrypted end-to-end communications channel between the two.

✔IPsec, which, employing the shared secret derived via the authenticated Diffie-Hellman exchange, provides a secure end-to-end communications channel

✔a simple, UDP-based client/server protocol, in which cable modem devices request keying data from the ACS.

Defining the key management protocol over UDP/IP permitted the use of the IPsec protocol for securing end-to-end communications between the ACS and the cable modem device. In addition to the simplification the layered design brings to the overall solution, it allows an HFC security solution to leverage the research and development efforts that have been underway within the Internet community to provide secure IP layer communications channels.

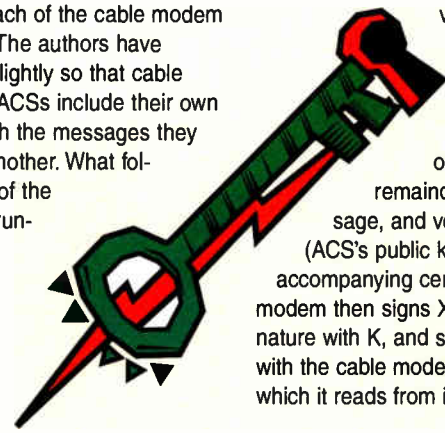
Note that authenticated/encrypted communications between the ACS and cable modem devices establishes secure end-to-end channels for key management in support of link-level encryption on the HFC network.

When transmitted across the HFC network, key management traffic will utilize a management SA (security association) that does not rely on the key management protocols for distribution of its keying data. Because management traffic employs end-to-end security, the management SA could even be "null" (i.e., no link-level encryption).

Details of the authenticated Diffie-Hellman key exchange protocol are provided in the sidebar at the top of this page.

Authenticated Diffie-Hellman exchange

Below is a description of the authenticated Diffie-Hellman key exchange protocol. This protocol has been derived from an authenticated Diffie-Hellman key exchange protocol referenced in Schneier's *Applied Cryptography, Second Edition* [4]. Schneier's protocol would assume that all cable modem devices have a certificate with the ACS's public key, and the ACS has certificates containing each of the cable modem device's public keys. The authors have altered the protocol slightly so that cable modem devices and ACSs include their own certificates, along with the messages they exchange with one another. What follows is a description of the augmented protocol running between the cable modem and ACS; an identical protocol would run between the CMTS and ACS.



1. At boot up, the cable modem generates a large random number x, which serves as its DH private value, and calculates corresponding DH public value X.

2. At boot up, the ACS generates a large random number y, which serves as its DH private value, and calculates corresponding DH public value Y.

3. The cable modem sends its public DH value X to the ACS.

4. The ACS generates the DH shared secret K based on X and y. The ACS then signs X and Y, encrypts the signature using K, and sends it to the cable modem, along with Y and the ACS's certificate CACS.

CACS, Y, EK(SACS(X,Y))

5. The cable modem verifies the certificate it received from the ACS, independently generates the DH shared secret K based on Y and x, decrypts the remainder of the ACS's message, and verifies the signature (ACS's public key contained in the accompanying certificate.) The cable modem then signs X and Y, encrypts the signature with K, and sends it to the ACS along with the cable modem's own certificate CCM, which it reads from its smart card.

CCM, EK(SCM(X,Y))

6. The ACS verifies the certificate it received from the cable modem, decrypts the message and verifies the cable modem's signature using the cable modem's public key, which was contained in the certificate.

All certificate verifications would be done using the smart card, which contains the CA's public key.

Requesting master keys

After cable modems and CMTSs have established secure, IPsec-based communications with the ACS, they each obtain their master keys from the ACS via the simple request/response protocol. If, at any point, message authentication fails, the end-to-end security relationship between the cable modem device and ACS, which is based on a Diffie-Hellman (DH) shared secret between the two, will be terminated. It will be the responsibility of the cable modem device to initiate a new DH exchange with the ACS and re-request all of its keys.

Cable modem devices continually issue their requests, with an appropriate retry period, until receiving a response. It is up to the cable modem devices to obtain the keying information; the underlying secure communications channel authenticates the ACS responses.

A cable modem will receive the following from the ACS:

✔its basic unicast service master key and corresponding security association (SA) identifier.

✔the broadcast master key and SA identifier.

✔the multicast service master keys and the respective SA identifiers which the cable modem (actually, the owner of the smart card) is authorized to receive.

A CMTS will receive from the ACS:

✔the broadcast master key and SA identifier.

✔the multicast service master keys and the respective SA identifiers for all multicast services the CMTS will be expected to distribute across its HFC link.

The ACS does not provide the CMTS, in response to its request for master keys, any unicast service keys and identifiers. The CMTS explicitly requests these master keys as needed. When the CMTS learns source MAC addresses across its HFC port, it also learns the SA identifier associated with traffic from that address. After learning the SA identifier, the CMTS will send a request to the ACS (running over the secure IPsec end-to-end channel) for the master key associated with that SA. It will cache the master key it receives from the ACS for the processing of any traffic associated with this basic unicast service SA. Note that multiple addresses may be associated with this unicast service SA if the cable modem is operating as a work group,

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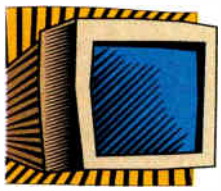


rather than a single-user bridge. If the security association is unknown to the ACS, the ACS could respond with an "invalid SA" master key. The CMTS could cache this "invalid SA" key value for the SA in question, and use it to indicate that all frames associated with this security association should be dropped.

The CMTS will age out its cache of unicast service master keys. This will result in the CMTS being required to periodically re-synchronize each of its unicast service master keys with the Access Control System. The CMTS should also periodically re-request master keys associated with broadcast/flood and multicast services. Because the MSO controls the CMTS, it can ensure that the CMTS enforces key aging and refresh policies. Thus, an MSO can change master keys, and be sure that the conditional access enforced by these new keys will be in place within a specific time frame.

In order to respond to any master key changes, cable modems will also need to periodically refresh their keying data. An MSO cannot guarantee cable modems will do this; nevertheless, because conditional access is enforced by the CMTS and its keying data, a misbehaving cable modem will not circumvent system security.

Figure 2: Encrypted HFC frame

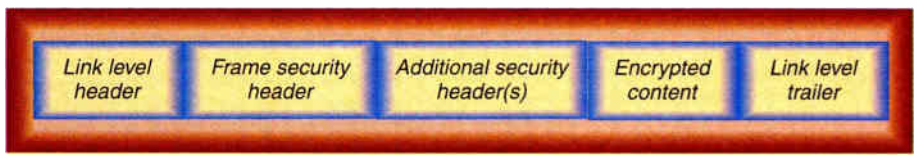
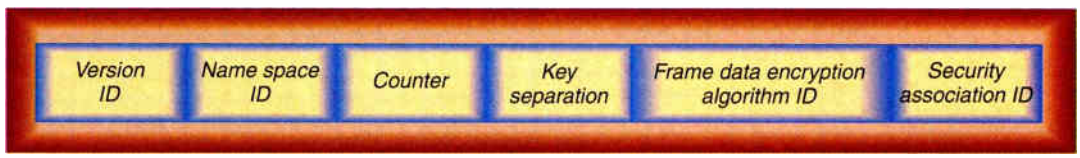


Figure 3: Encrypted HFC frame security header



CMTS and cable modems should rapidly adapt to master key changes initiated by the ACS. By decreasing key cache lifetimes and polling intervals, the convergence properties of this key update mechanism can be steadily improved, but at the cost of increased loads on the ACS. One approach would be to have the ACS send key flush commands to the CMTS and cable modems (which might end up ignoring them, but that is their problem). It's unclear to the authors whether the benefit associated with supporting ACS flush commands is worth diverging from the simple request/response protocol outlined above.

Latencies introduced when cable modem devices request keying data from the ACS will result in packet loss; it is assumed that transport or application layer protocols will be able to recover from these losses, just as they would from any limited packet loss.

HFC frame encryption & encapsulation

Frames on the HFC network will be encrypted. The master keys distributed by the ACS will be used, in conjunction with a synchronized timer, to generate a sequence of frame encryption keys. The CM and CMTS would independently generate these synchronized sequences.

HFC frames would have the following general structure, as shown in Figure 2:

1. Link level header
2. Frame security header
3. Additional security header(s)
4. Encrypted content
5. Link level trailer.

Frame security header

The frame security header would carry, at a minimum, a protocol version ID, the security association identifier and the counter value, n, used in conjunction with the master key to generate the frame encryption key (see Figure 3).

Security header. To allow extension of the protocol to support a variety of cryptographic algorithms and key sizes, one might consider defining the following fields:

✔version ID.

✔name space identifier, used to identify the name space employed by the security association identifier. For example, the name space ID might identify the particular ACS that generated and provided the keying data. This would be extremely useful in a security architecture that employed multiple ACSs for the dual purposes of redundancy and load sharing.

✔a counter, n, which would be employed in a SKIP-like "Zero-Message Master Update Algorithm." This algorithm is used for generating a random sequence of master keys by concatenating a master key with the counter n and then applying a pseudo-random one-way hash function (such as MD5). The current key in the sequence, rather than the original master key obtained from the ACS, would be used as a basis for the frame encryption key.

Note that by only permitting the counter to be incremented, one can prevent re-use of compromised data encryption keys and protect against a playback attack. A stateless counter is easily constructed if n represents time units since an agreed-upon time origin. Time units would be fairly coarse so that cable modem and CMTS clocks need not be loosely synchronized. See the SKIP Internet Draft [5] for additional details. The resolution of the clock might also depend upon the value of the data being secured: more valuable data would call for a higher resolution clock.

✔key separation algorithm ID; typically a cryptographic hash function, the specified algorithm would be used to split the key sequence's current key into an encryption key and an authentication key (hence, applicable if HFC link security includes frame authentication–a message authentication code).

✔frame data encryption algorithm ID.

✔message authentication algorithm ID (if authenticating frame contents).

✔security association identifier ID.

✔next header, identifies the header, and protocol, that follows the frame security header. Typically, the frame security header would simply be followed by the encrypted frame data. If one wanted to support the option of including data authentication, the next header field would be used to flag the option.

In recent years, the Internet community has devoted significant effort to the development of encryption standards for IPv4 and IPv6. The resulting standards have been scrutinized by both leading data communications and data security experts. There are many similarities between the security objectives and design constraints under which the Internet community developed its solution and those faced by the cable industry. For example, in both cases, cost and throughput performance needed to be balanced against cryptographic strength.

The authors recommend that the cable industry take advantage of this prior work with regard to its selection of default encryption

and authentication algorithms and adopt the selections made by the IETF: DES-CBC [6,7,8,9] for encryption, and Keyed HMAC-MD5 [10] for message authentication.

Additional security header

Use of this header would be optional, and indicated by the content of a next header (i.e., next protocol) field in the frame key management header. For example, if one were opting to authenticate encrypted frame data, the additional security header might include a message authentication code.

Key storage in cable modems

To keep costs down and maintain high throughput, symmetric keying data (service keys obtained from the ACS) are stored in volatile, unprotected RAM. To permit the associated weakening of key protection, a solution that reduced the long term "value" of these master keys was adopted, thus eliminating the need to secure them within protected memory.

The ACS will regularly replace master keys for both the unicast and multicast services. The frequency with which these keys will be replaced depends upon the value of the service and the potential losses due to discovery and pirating of these specific keys. In addition, note that any key is only of value to users attached to the RF network being served by the CMTS using that key–at most, 1,000 users.

A simple ACS polling protocol can readily support key changes on the order of once a day. Augmenting the protocol by having the ACS send flush commands to cable modem devices in response to key changes will allow keys to be changed on the order of minutes without any noticeable interruption of service (at most, the dropping of a handful of packets).

The HFC-based data network's shared-medium communications channel makes it susceptible to eavesdropping, theft of service and forgery attacks. Cryptographic techniques, based on existing or proposed standards, can address all of these security issues in a cost-effective manner. By selecting the appropriate balance between security and cost, it is possible to provide secure HFC-based network access services at a competitive cost point. Use of standard algorithms and protocols which have been subject to peer review and operational verification allows a high degree of confidence in the proposed solution. CED

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For cable, there are numbers in safety

Preventing accidents boosts morale and the bottom line

By Craig Kuhl

It's probably safe to say that accidents, especially job-related ones, don't just "happen."

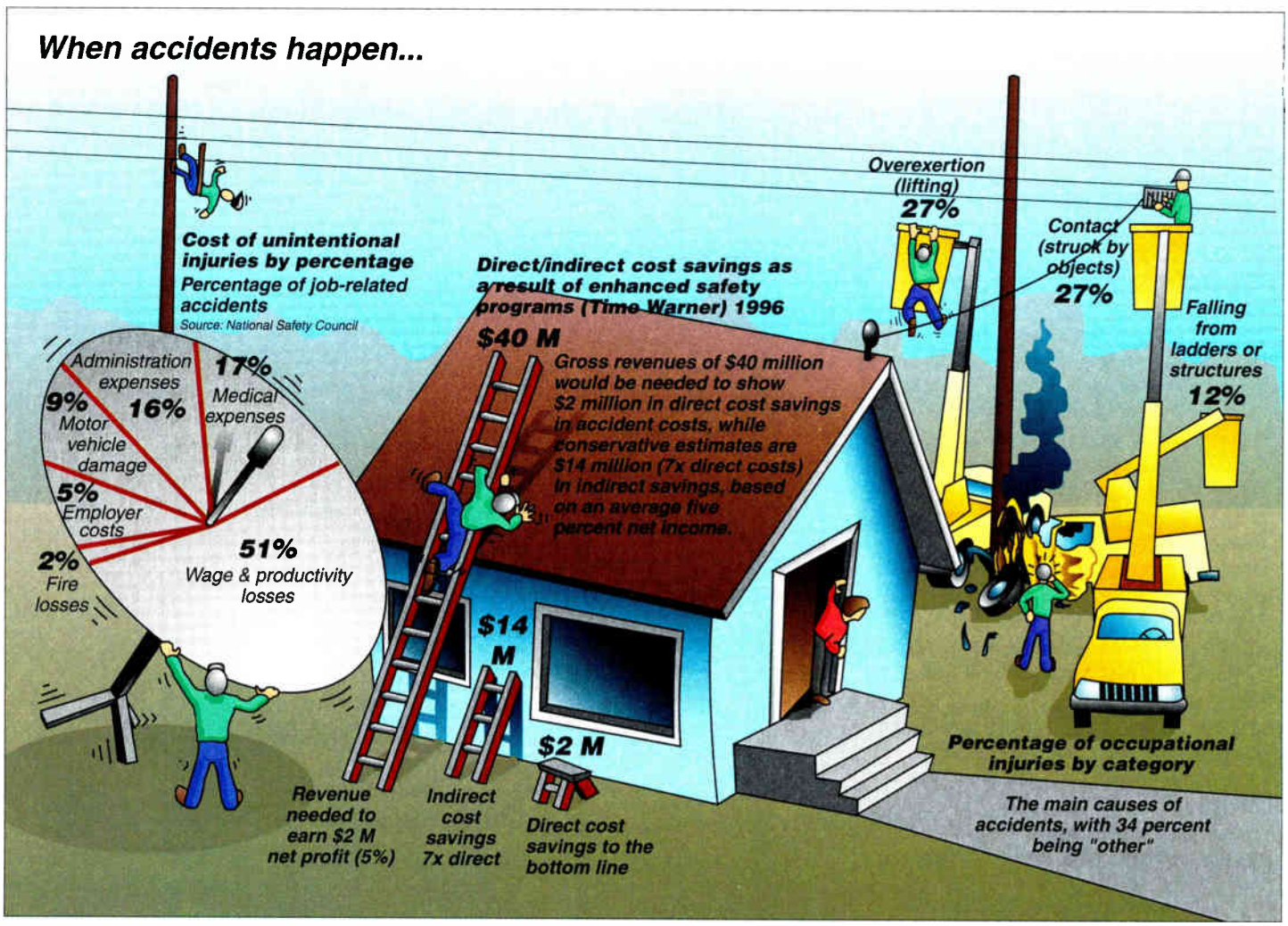
When they do, the ripple effect is felt far beyond the victims, their families, and coworkers, reaching all the way to the company's bottom line.

For the cable industry, getting the job done safely is an attitude with growing pains. The industry has made some gains in regard to safety, but most industry experts agree it has a ways to go to reach the pain-free stage.

The biggest pain, however, could be to the bottom line, with the average cost of an on-the-job injury costing a company approximately $30,000. Yet, the costs of merely winking at on-the-job safety measures go well beyond the direct costs to the company and to victims. It's the simple iceberg theory in play: the huge indirect costs of lax safety efforts by a company and its employees lurk beneath the surface, and are much greater than the visible direct costs–seven times as high is the rule of thumb–with most safety experts insisting that the number is much greater.

As painful as the direct costs of an accident may be to a company and to accident victims, there are greater costs. High-risk worker compensation rates for accident-prone companies, loss of employee time and the cost for a replacement's time, vehicle down-time because of accidents, and damage to a company's public image are just a few of the indirect costs associated with accidents, and even after these costs are factored in, the pain of an on-the-job accident/injury goes on with employee morale, production issues and more.

"If you continue to have a workforce that's not into safety, you've got morale and production problems, not to mention lawsuits and public image issues," says Ray Lehr, corporate director of safety for TCI. "Generally, a manager will see only the direct costs of an accident–the doctors' fees, hospital fees, or how to fix the truck that's been in an accident. They don't see the indirect costs, which are at least seven times greater."



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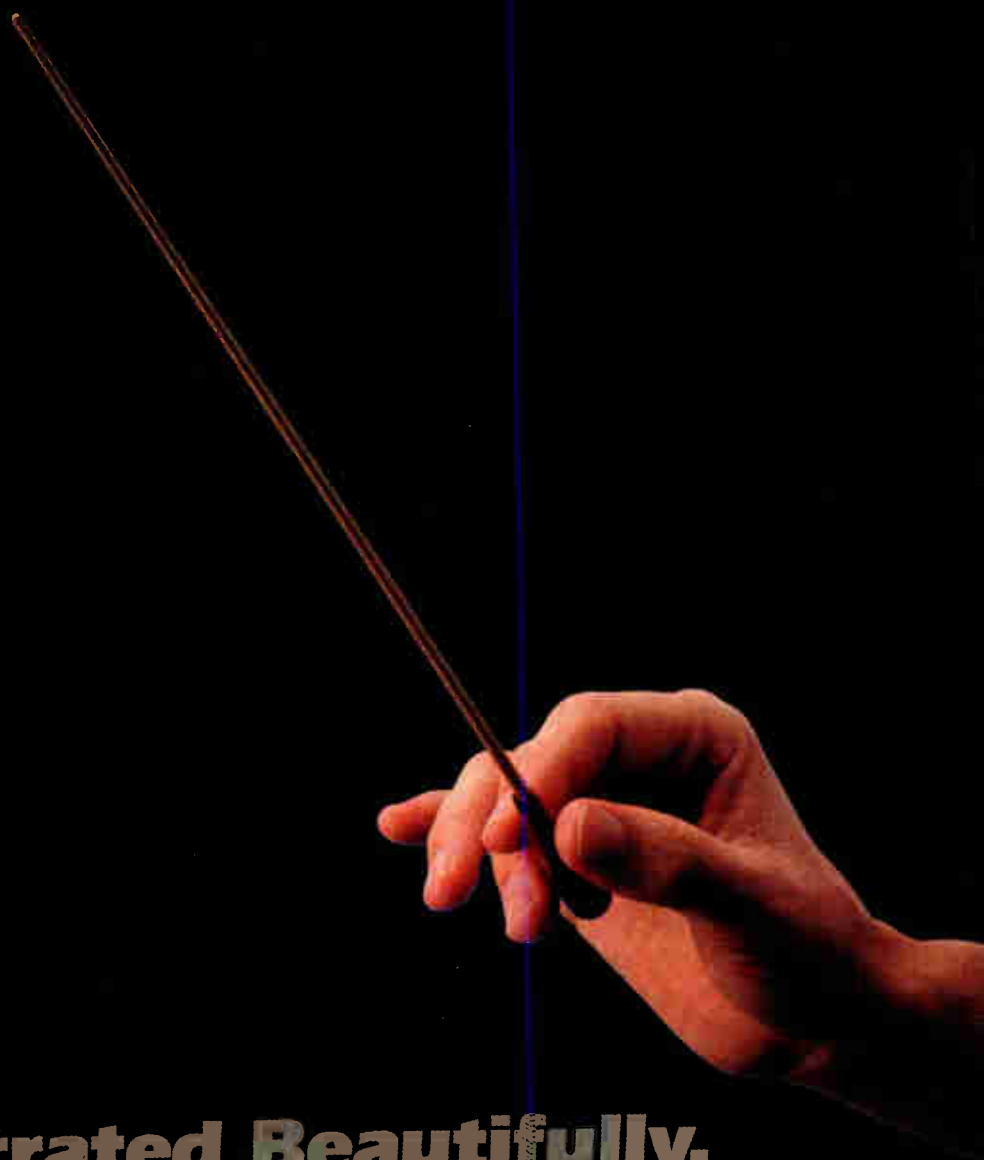

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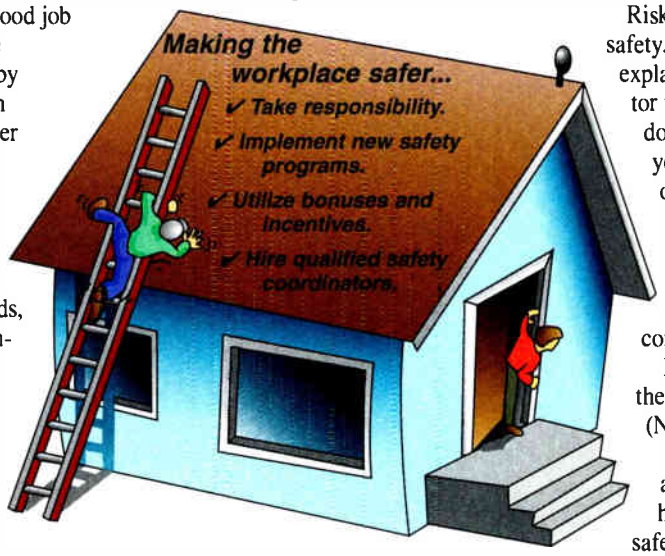
Reader Service 36

Managers share a responsibility with top management to provide a safe working environment for their employees, yet it's the industry as a whole which must do a better job of upgrading its safety standards, according to most industry experts. When that takes place, good things happen to employees–and to the bottom line.

"As an industry, we haven't done a good job with regard to safety. Ten years ago, we couldn't have withstood close scrutiny by OSHA (Occupational Safety and Health Administration), and they're a lot smarter now, and better focused," says John Young, safety and fleet manager, construction division at Time Warner. Young suggests that everyone in the cable industry must take responsibility for upgrading their safety standards, including top management. "When management understands that we're here to help the company make a profit for shareholders by reducing accident costs, safety becomes a no-brainer. By addressing safety issues, we save a lot of money, and get the job done. It just makes good business sense."



Take it to the bottom line

Last year, according to Young, Time Warner saved $2 million in direct costs by initiating several safety programs, and cut the company's OSHA recordables by 70 percent. To earn $2 million in net profit, a company must earn $40 million in gross revenues, assuming a five percent net profit. "That's $2 million available for profit sharing instead of settling lawsuits," Young added.

Reducing the number of lawsuits isn't the only way to save money, either. After assuming a more aggressive role with its risk management, TCA Cable TV in Tyler, Texas reduced its accident claims by one-third over a year's time. It also reduced its subscriber claims by one-third, with both contributing to the bottom line, according to Linda McGuire, director of training and development for TCA. "A year ago, the costs of the risk management segment of our safety program were astronomical. So, we became more aggressive in our defensive driving classes (vehicle accidents represent the highest rate of claims and injuries) and with other safety issues. If we see an increase in moving violations, we put employees through driver's training. We've seen a significant decrease in claims as a result. And, these are hard claim costs that commit to the bottom line."

Employee bonuses and incentives also rate high on the list of changing attitudes toward safety. Buford Television, for example, offers all driver/technicians a progressive bonus beginning at 25,000 truck miles, provided they maintain their vehicles on a regular basis. With vehicle accidents the number-one cause of claims, Buford focused on the cause five years ago, when it was assigned to the costly risk pool insurance rate. Says Kay Monigold, chief administrative officer for Buford Television, "Some years ago, we were in the assigned risk pool. Because of these programs and being aggressive with safety, our accident record is very low, and our worker's compensation is not risk pool, and that affects the bottom line."

Others, such as Jones Intercable, have shown significant decreases in worker's compensation claims as well. Between 1994 and 1996, Jones saw a 46 percent decrease after initiating a number of new safety programs, including defensive driving, pole climbing, its "hot gloves" program, and others. "I think safety is finally at a point where risk management costs are so high, we need to manage them much better," said Kevin McDevitt, corporate safety manager for Jones Intercable. "But, I also think we're still in the infancy stage as an industry when it comes to safety. Just acknowledging safety as an issue is a big step."


McDevitt

Not big enough, according to some. Says Ralph Haimowitz, director of training for the SCTE, "Most companies don't seem to care. Some have hired safety coordinators who are doing pretty well, but most others offer just lip service. I think they're putting the wrong people in as safety coordinators, which is a waste of time. Records keeping is very important to a safety program, so it's an administrative position, not a technical position. And, office employees are at risk, too, but most companies don't think of them (as being) at risk."

Risk and cost are the operative words in safety. The higher the risk, the higher the cost, explains Dan Chilton, national service director for Liberty Mutual Insurance. "Not only do you pay more if you're not safe, but you won't be allowed to compete with other companies for lower rates. Cable, as an industry, may be able to get breaks on its insurance rates, but it needs controls in place which include two key elements: exposure and control."

Dewey Wagner, division manager for the National Cable Television Institute (NCTI), knows all about risk and cost. In 1979, he suffered a serious on-the-job accident which nearly killed him. Now, he is a leading proponent of industry safety measures. "Today, employees are pressured to complete their jobs faster because companies want to run lean, and sometimes, speed becomes more important than safety. But, safety is always economically sound, and not just the right thing to do. Also, the cable industry has lots of veterans who have been doing things one way for many years and look upon safety as a burden, but one second can change their lives forever."

With that mentality, and a clear view of the bottom line, Lehr and TCI enlisted the services of Dr. Robin Herron, professor of ergonomics at Colorado State University in Ft. Collins, Colo., to analyze and recommend ergonomically correct work environments for both in-field and office employees.

"A big part of a successful business depends on efficiency and worker satisfaction. What we found was that in-field cable employees have a very physically-demanding job and want to know what exposures they have and how to protect themselves. And, the bottom line for management is the reduction of injuries and dealing with the rising cost of accidents. It has to be a shared responsibility, and the best way to meet the responsibility is to design out safety problems in the beginning," says Herron.

Designing out rising claims costs to a company's bottom line will require a major feat of engineering. Yet, a growing number within the industry feel there's at least some progress being made in climbing the ladder to safety, one rung at a time. CED

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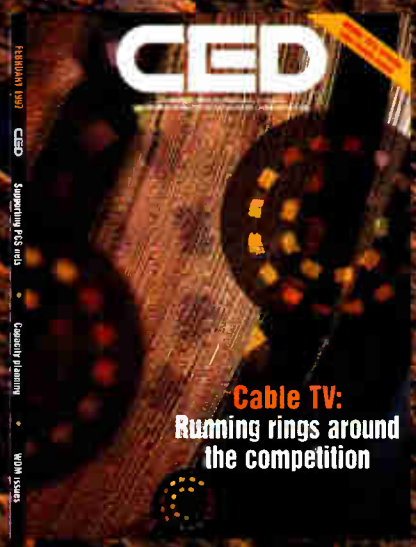


Next-generation FSS may prove formidable

New technology may fill gaps in competitive picture

By Fred Dawson

Terrestrial network strategists researching the business prospects for evolving satellite capabilities can find reasons for both relief and concern, depending on how far out they look.

For operators of wireline broadband networks, the good news is that, even if Rupert Murdoch's much discussed "Death Star" project clears its regulatory and business hurdles, it won't have the technical wherewithall to offer the range and depth of services that will be available over hybrid fiber/coax and all-fiber networks. Even where retransmission of local TV stations is concerned, capacity limitations of News Corp.'s American Sky Broadcasting system, which will include satellites operated by EchoStar, severely restrict the options that will be available in any given locality.

But this leaves no room for complacency on the part of terrestrial network operators, because the bad news for them is that next-generation Ka-band fixed satellite services (FSS) slated to launch in '99 and beyond promise to alter the parameters for satellite participation in broadband communications beyond the turn of the century. While, in and of themselves, Ka-band systems don't have the capacity to challenge regionally ubiquitous fiber or hybrid fiber/coax networks, they have immense power to augment other competitive thrusts against wireline networks, including those already mounted by DBS, and soon to be mounted by LMDS (local multipoint distribution services).

"There is a lot of potential in a link between satellite and LMDS technology," says Shant Hovnanian, CEO of CellularVision USA, the only commercially operating LMDS company in the U.S. Hovnanian says CV is looking at the possibilities of partnering with various entities, including satellite companies, to obtain licenses when the 1.3-GHz LMDS spectrum block at the 28 and 31 GHz tiers goes up for auction, presumably sometime this summer.

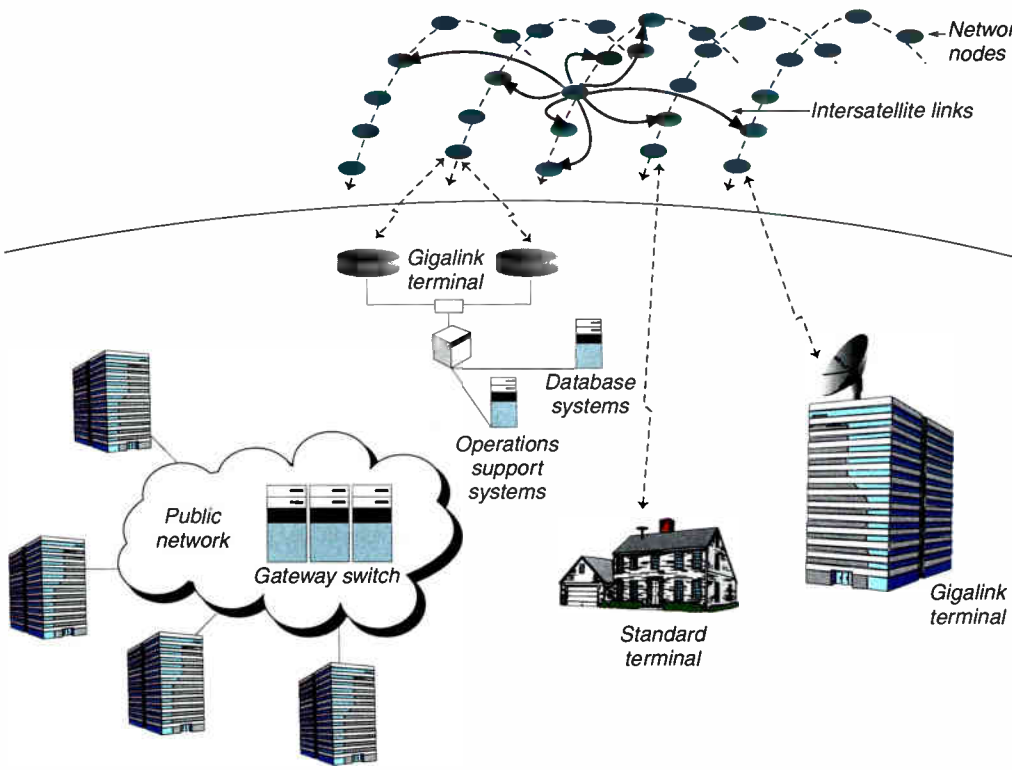
"Satellite systems have the ability to deliver movies and other multimedia entertainment and data to LMDS service areas on a dedicated basis, which could make provision of on-demand type services extremely cost-effective for us," says another player in LMDS, asking not to be named. "When you look at what can be done at Ka-band, you're talking about tight targeting, down to areas a few hundred miles in diameter."

In fact, the target areas may be smaller still in Ka-band. "I've seen plans calling for spot beams covering areas 100 miles in diameter," says Robert Bednarek, senior vice president for engineering and operations at PanAmSat Corp., which is in the process of merging with General Motors Corp.'s Hughes Electronics Corp. "When you get down to those sizes, you're able to focus on metro areas where the service begins to look like a broadcast station service."

Moreover, Ka-band will be a two-way service with uplinks typically running at up to 3 megabits per second, and enough downlink bandwidth available to provide dedicated broadband data feeds (1 megabit per second and higher) to a significant number of simultaneous users within the covered area. What makes these capabilities more potent than most Ka-band business plans would suggest is the maturing of advances that were too new or too proprietary to include in public documents and statements, including, especially, active array antenna technology, which aids in narrowing beam footprints and in maximizing bandwidth efficiency.

All of this is a long way from what Murdoch has in mind, at least in the Ku-band phase of the ASkyB/EchoStar initiative. While much has been made of the spot-beam capabilities of the high-power

***Figure 1**: The Teledesic network.*



satellites to be launched by News Corp. starting at the end of this year, the spots are too large and overlap too much with each other to allow the frequency reuse essential to retransmitting the lion's share of local broadcast stations nationwide, notes Abe Peled, CEO of News Digital Systems, a unit of News Corp.'s News International plc based in England.

"Most of the targeting of local channels to subscribers in their service areas will be done through use of the conditional access system," Peled says. "The spot beams are really more important for their role in making more efficient use of satellite power."

Just what the impact of spot footprint overlap will be on frequency reuse, News Corp. officials aren't saying. But the technical parameters will limit the number of stations News Corp. can deliver, largely to major network affiliates, according to Murdoch, which raises regulatory issues and complicates the business of lining up station affiliates.

While the local station component, even with these restrictions, may boost DBS marketing appeal in the battle with cable, the more significant drawback associated with the technical capabilities of ASkyB is that they aren't enough to support delivery of dedicated data services over real-time interactive connections, Peled says. "We prefer the broadcast or push model for delivering Internet services," he notes, describing real-time sessions as "a very inefficient use of satellite capacity."

A very different picture of satellite service capabilities emerges, however, when the Ka-band side of the equation is factored in. Loral Corp.'s plans for its CyberStar service slated to get underway in 1999 come closest to representing a direct assault on the local consumer and small business broadband access market. The company is proposing an all-data service and is looking at co-locating its Ka-band birds with the Ku-band systems it inherited with acquisition of AT&T's Telstar operation, says Terry Hart, president of Loral Skynet, the Telstar operating unit.

"We've had discussions along those lines, including how we might start something like the CyberStar data service in something other than Ka-band and evolve it to Ka-band as the satellites are put in place," Hart says. "The interactive component combined with DBS broadcast could make a very nice fit for satellite technology."

Loral isn't alone in scouting the linkage between Ka-and Ku-band and the possibility of delivering combined packages to hybrid antenna units from co-located Ku- and Ka-band satellites. EchoStar has applied for two Ka-band slots with such possibilities in mind, sources say, and executives at Hughes

Communications' Ka-band venture, Spaceway, have indicated they're looking at linkups with DirecTV along similar lines.

Spaceway says its two-way Ka-band transmitter/receiver antennas and supporting components will cost under $1,000, and CyberStar is talking about beating the $500 price point. But, as Bednarek acknowledges, most business plans are either very tentative or still evolving, not only because most launches are still two years or more off in the future, but because the technical cost/benefit equation keeps improving with new advances.

"We're seeing an explosion of possibilities as a result of several key advantages associated with Ka-band satellites," Bednarek says. "The question we and everybody else are asking ourselves is, what are the services and the business models that will generate the best returns on this technology."

Satellite interests are coming at the Ka-band option with varying degrees of enthusiasm, though all see a rising global demand for fixed service capacity amid the latest successes in Ku-band as a strong sign of high value for future capacity. "What you're seeing right now is everybody staking a claim for orbital slots, because they know Ka-band is a tremendous resource," says another satellite company executive, speaking on background. "But, frankly, beyond knowing you've got to do it, there's a good deal of uncertainty here and elsewhere as to how we might make use of this technology."

Most of the fixed satellite service (FSS) applications cited in plans filed with the FCC are pegged to direct two-way communications between 26-inch dishes and geostationary satellites, the exception being the $9-billion FSS low earth orbit system planned by Teledesic Corp. For example, Hughes' Spaceway, with two satellites slated for launch in early '99, says it will deliver 108 Mbps of dedicated services to cells in the U.S. measuring about 400 miles in diameter, which means they'll consume a little over one-tenth the land area of the footprint of a typical Ku-band spot beam.

While there will be 48 such beams covering the whole country from Spaceway's two U.S. satellites, frequency reuse is limited to non-contiguous spots because of the overlap problem, meaning that only one-fourth the total bandwidth is available to any one territory within a spot footprint. This is why the throughput is only 108 Mbps per cell over 500 MHz of total FSS bandwidth.

But much higher ratios of bandwidth to potential users are in the offing. Teledesic, for example, says that, starting in 2002, it will offer the equivalent of 19 simultaneous 1.5 megabit-per-second data links or larger numbers of lower-rate connections at a total throughput of 28.5 Mbps to geographical "cells" with diameters of about 20 miles each representing about 1,250 square miles of territory. This means Teledesic's spot beam payload, one-fourth the size of Spaceway's, will be delivered to a target area that is only one one-hundredth the size of Spaceway's.

Teledesic has inspired widespread skepticism over its founders' plans to spend $9 billion on an infrastructure that uses 840 satellites orbiting 435 miles above the earth to provide two-way broadband services of every description to any point on the globe. But at least Craig McCaw and Bill Gates, with a newly issued license in hand from the FCC that their geostationary rivals lack, now have an opportunity to begin selling potential operations and investment partners on the merits of their plan.

"Until we got the license it was difficult to move ahead, but now we are acting on all

fronts," says David Twyver, who recently left a position as president of Nortel's global wireless operations to become president of Teledesic. "Because the lion's share of the cost won't be needed until 2000, the priority now is on lining up our vendors, contractors and operating partners."

Given the fact that broadband network coverage in the U.S. by 2002 will still be far from complete, high-speed data connections for work-at-home and remote site applications should be an important opportunity for Teledesic, Twyver says. "We definitely see business users as an important market segment for our services in the U.S., but it's harder to forecast the market in developed countries than it is in regions that don't have sophisticated telecommunications infrastructures," he notes.

In justifying costs that are three times the amounts projected for geostationary FSS systems, Twyver says that, along with having superior bandwidth efficiency, Teledesic will offer the only true FSS telephony service, which he says gives it a greater market opportunity than its rivals will have. The claim rests on the fact that, at 22,500 miles, the geostationary link distance imposes transmission delays that fall well below the standard for land-based telephony, whereas this isn't the case at Teledesic's orbital height.

Spaceway officials downplay the advantage. "They make way too much of the small delay as a distinction, since much of their as well as our market opportunities are associated with providing voice services where there are no other means available at reasonable costs," says Wendy Green, spokesperson for Spaceway. "The delay is less than what you often get on transatlantic calls." Indeed, a one-half second roundtrip delay in a voice conversation seems a small price to pay for anywhere-to-anywhere connectivity in a global economy. But the issue is certainly a factor in sizing up Ka-band's competitive role in the domestic communications of countries that have strong terrestrial infrastructures.

This is why, from the perspective of possible geostationary FSS applications in the U.S. consumer marketplace, the primary area of concern to terrestrial broadband operators would appear to be the extent to which these satellites might be used to back up Ku-band broadcast service or support LMDS with delivery of truly interactive data services. The potential rests on how much data can be made available on a dedicated, on-demand basis within a given population area.

One place to look for clues as to what FSS might really offer at a moment when many commercial players won't discuss technical details is the National Aeronautics and Space Administration's Advanced Communications Technology Satellite, now in its fourth year of operation. While ACTS had its problems during the first year-and-a-half of operations, critics have largely stopped challenging its credibility on performance in the wake of successful and ongoing connections involving major corporate and financial interests, as well as government and educational entities.

But ACTS is still widely dismissed by engineers outside the satellite business as a hero experiment that, as one senior cable engineer puts it, "demonstrates you can do almost anything if you have a lot to spend and no expectation of a return on the investment." Indeed, to replicate what ACTS is doing using its techniques would be prohibitively costly, even for the likes of Gates and McCaw.

As described by Louis Ignaczac, chief of the ACTS Experiments office, ACTS is capable of delivering dedicated services in simulta-

Adaptive array technology is coming on stronger than expected as a tool for satellite applications

neous data streams across 50 beams from four transponders, using switching and buffering techniques to support what appears to be real-time transmission from the end-user perspective. "We sweep through the beam array at a rate of 1,000 times per second, which allows us to provide continuous data feeds across multiple beams from each transponder," Ignaczac says.

With bursts of data every millisecond briefly buffered at the end user station, there are no discernible delays or breaks in the feed through each beam. Thus, with two beams used for scanning and other purposes, there are 12 fixed beams being served per transponder, as opposed to a single beam per transponder as described in many Ka-band plans.

ACTS uses a cumbersome and extremely costly combination of ferrite switches and waveguides linked to highly-focused horn antennas to achieve these capabilities. But Ka-band strategists can now turn to adaptive array antenna technology that is just now moving into commercial applications on the ground to replicate the type of beam hopping demonstrated by ACTS at what promises to be much lower costs.

In all cases, the basic idea entails use of proprietary algorithms running on digital signal processors to dynamically steer and adapt beams and to eliminate interfering signals. Even NASA, which has to live with the system installed on the ACTS satellite, has found a way to use adaptive array technology by putting such antennas on Air Force jets, allowing them to stay in continuous communication with the satellite as they move across multiple beam paths.

"If we were designing (ACTS) today, we'd use adaptive array technology, which is what a lot of people are doing with Ka-band satellite systems," Ignaczac says.

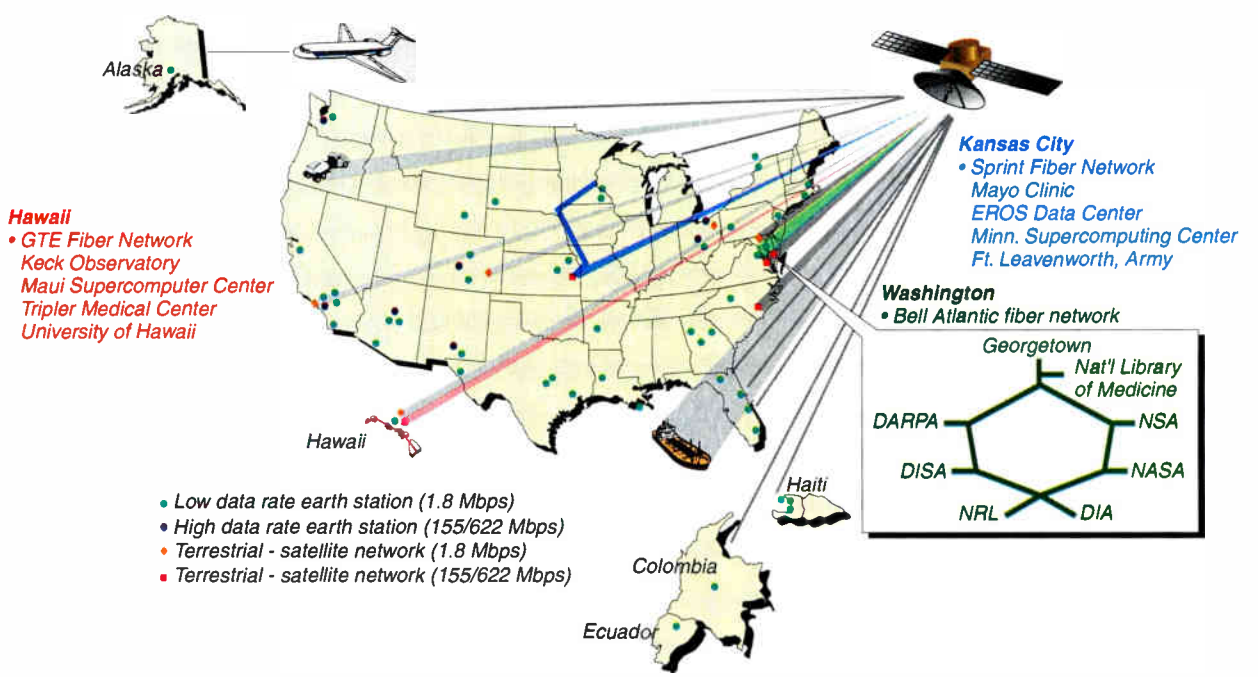
Adaptive array technology, often seen as an option for future rather than present day applications in wireless communications, is coming on stronger than expected as a tool to be used in mobile and fixed terrestrial, as well as satellite applications. "What you're seeing in our case is a technology transfer from military applications to commercial that rests on 15 years of work," says Richard Minthorne, director of business development for Raytheon E-Systems, which is delivering production models of its adaptive antenna system for testing in cellular markets this summer. "It's not well known technology, but it's not new, unproven technology either."

Performance requirements for antennas in mobile applications are different from fixed link requirements, but the physical properties that make smart antennas useful in mobile can be applied in fixed terrestrial and satellite environments as well, Minthorne notes. "We've chosen mobile cellular as a first application opportunity, but really, the opportunities are wide open across all types of fixed and mobile connections, including satellite," he says.

On the satellite front, the first to publicly say that adaptive array technology is a fundamental part of the plan is Teledesic. "I don't think we'll be the only ones to use adaptive array systems," Twyver says.

It remains to be seen how far adaptive array technology can go in allowing satellites to deliver multibeam targeted communications from a single transponder. But there appears to be every reason to expect that previously assumed ratios of dedicated bandwidth to potential users will be eclipsed when Ka-band satellites go into operation. The best defense on the ground would appear to be to build the customer base for broadband as quickly as possible, which means making sure the networks are in place to support digital interactive services within a very few years. CED

Figure 2: NASA ACTS Satellite/Terrestrial Test Network for NII/GII.



The issue: DBS competition

When DBS burst on the video scene, its acceptance was immediate. While the initial growth was explosive, there are now signs that growth is slowing. That didn't keep media mogul Rupert Murdoch from jumping in, however, with his recent merger with Echostar. What do you think of DBS?

The questions:

1. How well would you say DBS is doing at signing up customers–both your subscribers and people who have never subscribed–who reside in your cable system?

❑ Excellent ❑ Good ❑ Fair ❑ Poor

2. How soon do you think DBS will have a measurable impact on your system, in terms of number of subscribers served?

❑ Already has ❑ Within 1 year
❑ 1-3 years ❑ 4 years or more

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

❑ Yes ❑ No ❑ Don't know

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

❑ A lot ❑ Some ❑ Very little

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

❑ Hardware cost ❑ Programming cost ❑ No return path
❑ Broadcast-only ❑ No local programs ❑ Other

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

❑ 1-4% ❑ 5-10% ❑ 10%-20% ❑ > 20%

7. How likely is it that the success of DBS will hasten your system to upgrade to more channels and/or new services like data and interactivity?

❑ Very likely ❑ Somewhat likely ❑ Not at all

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

❑ Yes ❑ No ❑ Don't know

9. Which do you think is a more formidable competitor to your system over the next three years–DBS or the telcos?

❑ DBS ❑ Telcos ❑ Don't know

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

❑ Yes ❑ No ❑ Don't know

11. How interested is your system in implementing digital compression to increase your channel count?

❑ Very ❑ Some ❑ Little ❑ Don't know

Your comments:

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RESULTS

The issue: Outages

Can cable systems be made as reliable as the telephone network, even though the resources to build that network are limited? How do subscribers feel about outages? Are outages a major problem today? These kinds of questions are paramount if the industry is to compete with a host of other service providers. Here's what our readers thought.

The addition of fiber optics to cable TV networks has improved overall system reliability, but nearly 40 percent of our survey respondents say they still suffer three to five outages every month. The good news, however, is that few of those outages are reportedly preventable, while the lion's share are a direct result of weather and cable cuts.

In general, the respondents said their systems are much more reliable today than they were even two years ago, and a wide majority say they have taken specific steps within the last year to reduce outages, including working with the local power utility to jointly combat the problem. That doesn't mean they're finished, however, as three out of four say they could do even more to further reduce outages.

More than half say they found the local utility company to be reliable and easy to work with, and most say they have already worked with the utility. Fewer, though, have actually performed subscriber surveys to determine how they feel about outages.

Bottom line? Nearly 80 percent believe the cable network can be made to be as reliable as the local telephone network. Many, in fact, believe it may already be, but because the TV is used more during the day, video outages are more apparent.

Congratulations to David Walker of Continental Cable in Elyria, Ohio, who won $50 for his response. To qualify yourself, send in the questionnaire on the previous page!

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+
32%	**37%**	**5%**	**26%**

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

None	Few	Half
10%	**63%**	**21%**

Most	All
5%	**0%**

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

Weather	Cable cuts	Electronics
42%	**37%**	**21%**

Traffic accidents	Other
0%	**26%**

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
89%	**10%**	**0%**

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

Yes	No	Don't know
74%	**21%**	**5%**

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

Yes	No	Don't know
89%	**10%**	**0%**

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

Yes	No	Don't know
58%	**37%**	**5%**

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

Yes	No	Don't know
74%	**26%**	**0%**

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

Yes	No	Don't know
53%	**37%**	**10%**

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

Yes	No	Don't know
79%	**21%**	**0%**

Your comments:

"Capital investment is required to make the cable TV network as reliable as a telco. Many outages can be prevented or controlled, but our plant is constructed with inexpensive and unreliable electronics."

– Tim Hall, TCI, Redding, Calif.

"Ninety percent of our outages are caused by power interruptions and underground digging."

– Keith Mains, Adelphia Cable, Plymouth, Mass.

11-14 Canadian Cable Television Association's Annual Convention & Cablexpo. Location: Toronto, Ontario. Call the Canadian Cable Television Association (613) 232-2631.

13-14 Wheat State SCTE Chapter, Testing session. BCT/E certification exams to be administered. Location: Wichita, Kan. Call Vicki Marts (316) 262-4270.

20-21 Understanding Sonet and Other Broadband Technologies, produced by TRA. Location: Adam's Mark, Tulsa, Okla. Call Louis Greene (800) 872-4736.

20-22 Broadband-CATV Laboratory, produced by C-Cor Electronics Inc. Location: State College, Pa. Call C-Cor Technical Customer Services (800) 233-2267.

21 New England SCTE Chapter, Testing session. Installer certification exams. Location: Worcester, Mass. Call Tom Garcia (508) 562-1675.

22-24 SCTE Regional Training Seminar: "Introduction to fiber optics." Location: San Bernardino, Calif. Call SCTE national headquarters (610) 363-6888.

26-29 Fiber Optic Training, produced by The Light Brigade. Location: Toronto, Ontario. Call (800) 451-7128.

9-13 Broadband Communications Network Design, produced by General Instrument. Location: Denver, Colo. Call Lisa Nagel at (215) 830-5678.

10-11 Wheat State SCTE Chapter, Testing Session. Location: Wichita, Kan. BCT/E certification exams to be administered. Call Vicki Marts (316) 262-4270.

10-12 4th Annual Global DBS Summit, sponsored by DBS Digest/Link Events. Location: Hyatt Regency DTC, Denver, Colo. Call C. Ondrias (719) 545-1986.

10-12 Digital Network Engineering Training, produced by General Instrument. Location: Denver, Colo. Call Lisa Nagel at (215) 830-5678.

11 Rocky Mountain SCTE Chapter, Technical Seminar. "Powering/Safety." Location: TBD. Call Hugh Long (303) 603-5236.

13 49th ARFTG Conference, sponsored by Automatic RF Techniques Group (ARFTG), IEEE Microwave Theory and Techniques Society. Location: Denver, Colo. Call Roger Marks, NIST (303) 497-3037.

14 Llano Estacado SCTE Chapter, Technical Session. Topic: Construction practices. Location: Cox Cable Office, Lubbock. Texas. Call David Fielder (806) 793-7475, ext. 4518.

16-20 Plant Maintenance, Proof of Performance and Signal Leakage Training, produced by General Instrument. Location: St. Louis, Mo. Call Lisa Nagel at (215) 830-5678 for more information.

19-20 Understanding ATM Application and Implementation, produced by TRA. Location: Denver, Colo. Call Louis Greene (800) 872-4736.

20 Oklahoma SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: Edmond, Okla. Call Doug Huston (405) 348-4225.

23-24 SCTE Regional Training Seminar. Topic: Introduction to Telephony. Location: Chattanooga, Tenn. Call SCTE National Headquarters at (610) 363-6888 for more details.

23-25 WCA '97, produced by the Wireless Cable Association International. Location: Anaheim, Calif. Call (202) 452-7823 for more information.

25-26 Understanding Hybrid Fiber/Coax Design, produced by Scientific-Atlanta Institute. Location: San Diego. Call SAI (800) 722-2009, press "3" to register or for info.

25-27 Broadband Communications Technology, produced by C-Cor Electronics Inc. Location: Providence, R.I. Call (800) 233-2267 for more information.

25-27 SCTE Regional Training Seminar. Topic: Technology for Technicians II. Location: Chattanooga, Tenn. Call SCTE national headquarters (610) 363-6888.

28 Cascade Range SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: TCI office. Salem, Ore. Call Betty Reed (360) 891-3295 for more information.

21-22 Fiber Optic Network Design, produced by Pearson Technologies Inc. Location: Minneapolis, Minn. Call Eric Pearson (800) 589-2549 for more information.

30-8/1 Fiber Optic Network Installation, produced by Pearson Technologies Inc. Location: San Francisco, Calif. Call Eric Pearson (800) 589-2549.

Trade shows

May

5-9 Networld + Interop '97. Location: Las Vegas. Call (415) 578-6900.

June

1-5 Supercomm '97. Location: New Orleans, La. Call the U.S. Telephone Association (202) 326-7300.

2-5 IEC Communications Forum at Supercomm. Location: New Orleans. Call (312) 559-4600.

4-7 SCTE Cable-Tec Expo '97. Location: Orlando, Fla. Call the SCTE (610) 363-6888.

July

28-31 Jornadas de Television por Cable '97. Location: Buenos Aires, Argentina. Call the Argentina Cable Television Association (011) 54-1-342-3362.

August

18-20 Great Lakes Cable Expo. Location: Indianapolis, Ind. Call (317) 845-8100.

September

10-12 PCS '97 (Personal Communications Showcase). Location: Dallas, Texas. Call PCIA at (703) 739-0300 for more information.

21-25 NFOEC '97. Location: San Diego, Calif. Call (619) 467-9670.

28-30 Atlantic Cable Show. Location: Baltimore, Md. Call (609) 848-1000.

December

10-12 The Western Cable Show. Location: Anaheim, Calif. Call the CCTA at (510) 428-2225.

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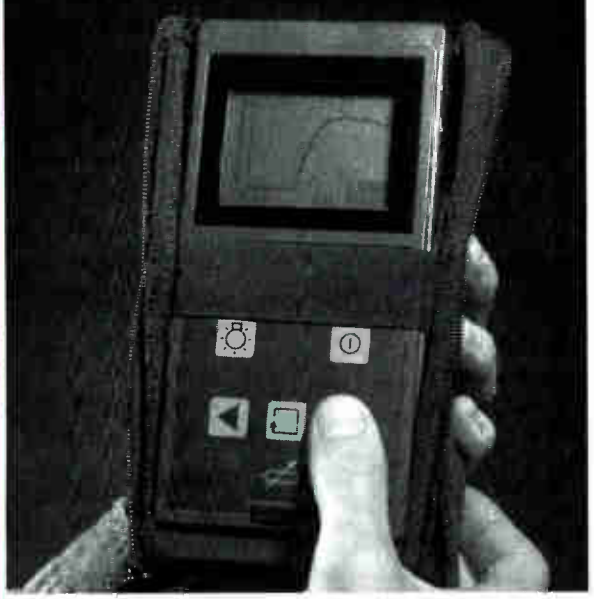

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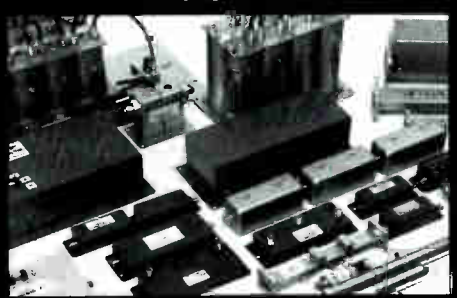

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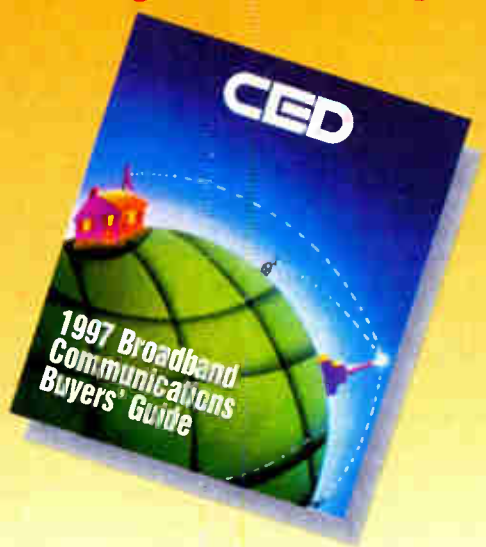

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West End to supply cablephone in Korea

SYDNEY, Australia–West End Networks Ltd. has been selected by Korea Electric Power Corporation (KEPCO) to provide telephony-over-cable services. KEPCO has deployed West End's WestBound 9600 broadband access platform in a bi-directional multimedia trial utilizing its cable television infrastructure. The trial, which is being conducted at the KEPCO Regional Office in the city of Daejon, utilizes the 9600 package to deliver cable telephony service to 60 subscribers.

Part of KEPCO's initiative to supply full, interactive broadband services over its two-way HFC network (which currently covers 70 percent of the Republic of Korea), the trial is a precursor to the planned introduction by KEPCO of interactive services over cable TV networks nationwide. Scheduled for mid-1997, the deployment of these services will be the first of its kind in Korea, according to West End.

Adelphia picks Lindsay passive

LINDSAY, Ontario–Adelphia Cablesystems has chosen Lindsay Electronics' 100 Series Line Passives for its Florida system rebuilds. The multi-year upgrade will allow an increase in usable bandwidth, in both the forward and reverse paths. The product used will be manufactured by Lindsay and distributed through Jerry Conn Associates.

C-Cor ships to Europe, Asia

STATE COLLEGE, Pa.–C-Cor Electronics Inc. announced that it has been shipping I-Flex nodes and bridgers to Europe and Asia for use in various hybrid fiber/coax systems. The equipment will be used for both cable TV and telephony applications in European countries which include Poland, Spain, the United Kingdom, Latvia, Hungary, Belarussia, the Oekraine, Rumania and Russia.

The I-Flex nodes and bridgers will be installed in new-build cable TV and telephony networks in Europe during the next five years.

Amati, TI, jointly develop ADSL technology

SAN JOSE, Calif.–Amati Communications Corp. and Texas Instruments Inc. are jointly developing a "new generation" of ADSL technology, according to the two companies. The technology will use Texas Instruments' new TMS320C6x DSP generation, which features 1600 MIPS and a C compiler.

Combined with TI's DSP will be Amati's standards-based DMT software capabilities.

The combination of Amati's ADSL technology and TI's DSP technology offers an answer to the question of how ADSL can be implemented for applications like Intranet/Internet and video markets, say the two companies.

Optical Cable expands

ROANOKE, Va.–Optical Cable Corp. has completed its newly-expanded manufacturing and office facilities. The expansion, say officials, will enable the company to add more manufacturing equipment and expand its international sales staff.

Pictured in the photo, the right side of the facility is the existing 74,000-square-foot manufacturing and office building. The left side shows the newly-completed "mirror-image"

Optical Cable Corp.'s newly-expanded facility

74,000-square-foot manufacturing and office facility addition on the same site. The addition will provide the company with a total square footage of 148,000 in Roanoke.

SNET picks cable launch site

NEW HAVEN, Conn.–SNET has selected Unionville, Conn. as the site of the launch of its new cable TV service.

Unionville is a section of Farmington, Conn., a suburb to the west of Hartford in the northern part of the state.

In September, SNET became a partner in the Americast consortium; thus, the service to be launched in Unionville will be dubbed "SNET americast."

EXFO partners with Froilabo

VANIER, Quebec–EXFO has formed a strategic partnership with Froilabo, a French manufacturer of laser diode controllers and characterization systems for production testing of active components. By forming the partnership, EXFO's Scientific Division will incorporate a new line of test instruments for manufacturing and laboratory environments.

LIMT, Channelmatic join forces

ALPINE, Calif.–LIMT AB (Local Insertion Media Technology) has purchased IndeNet's two-thirds majority stake in Channelmatic for $10.9 million. The combination of the two companies' product lines will provide a range of digital automation and distribution solutions for all segments of the cable, broadcast and emerging television industries, according to information released by Channelmatic.

Combined with Channelmatic's worldwide sales channels, LIMT has regional sales and support facilities in Stuttgart, Germany; Nice, France; and Cambridge, United Kingdom.

Shanghai CATV uses new server

MANLIUS, N.Y.–Shanghai CATV Station in China has incorporated NetCaptain, a high-speed data server complex developed by Philips Broadband Networks.

NetCaptain is an integrated complex that enables broadband operators to manage and deliver multimedia content at high-speed, says Philips. The complex also provides Internet access to subscribers, while allowing the operator to control access and customize service packages.

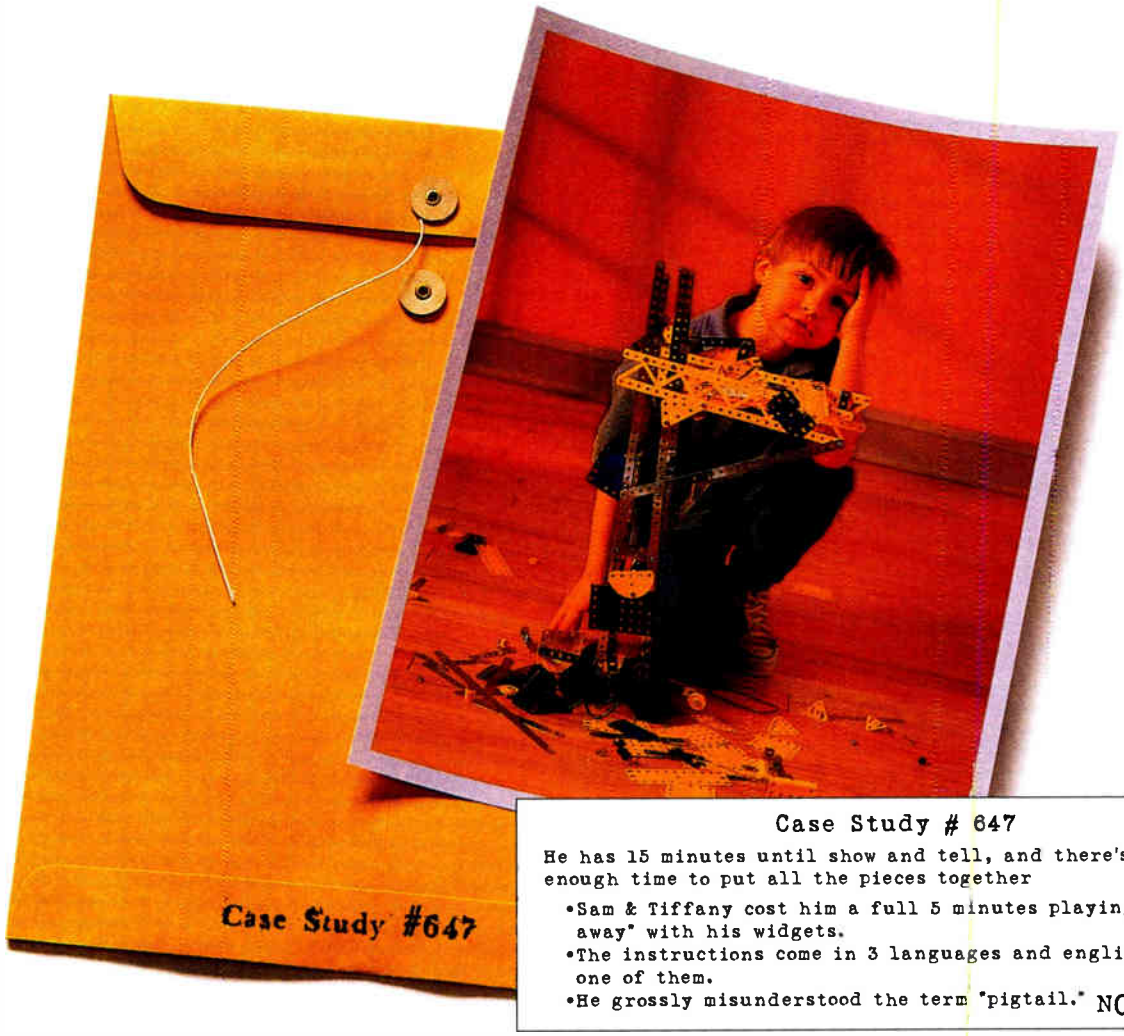
"By integrating various cable modem technologies, NetCaptain has proven to be a highly versatile solution for broadband network operators," said Garry McCarten, general manager of Philips Broadband Networks' International Competency Center in Melbourne, Australia.

NetCaptain's open architecture, client-server software combines user interface, authentication, metering, service management and billing technology. The system also integrates technology from Silicon Graphics, Netscape, Oracle and a variety of data modem manufacturers to deliver an end-to-end solution.

Adelphia launches with SURFboard

SAN DIEGO–Adelphia Communications Corp. has launched its commercial high-speed Internet service, Power Link, in Northern Palm Beach County, Fla. using SURFboard cable modems and the associated network from GI's NextLevel Satellite Data Networks Group.

Adelphia's Power Link service will reach a potential 125,000 homes in North Palm Beach County. In addition, service will be made available throughout Adelphia's South Florida territory to a potential 600,000 homes in Palm Beach, Martin, St. Lucie and Dade Counties within the next six months. CED



Case Study # 647

He has 15 minutes until show and tell, and there's not enough time to put all the pieces together

- Sam & Tiffany cost him a full 5 minutes playing "keep away" with his widgets.
- The instructions come in 3 languages and english isn't one of them.
- He grossly misunderstood the term "pigtail." NOw what?

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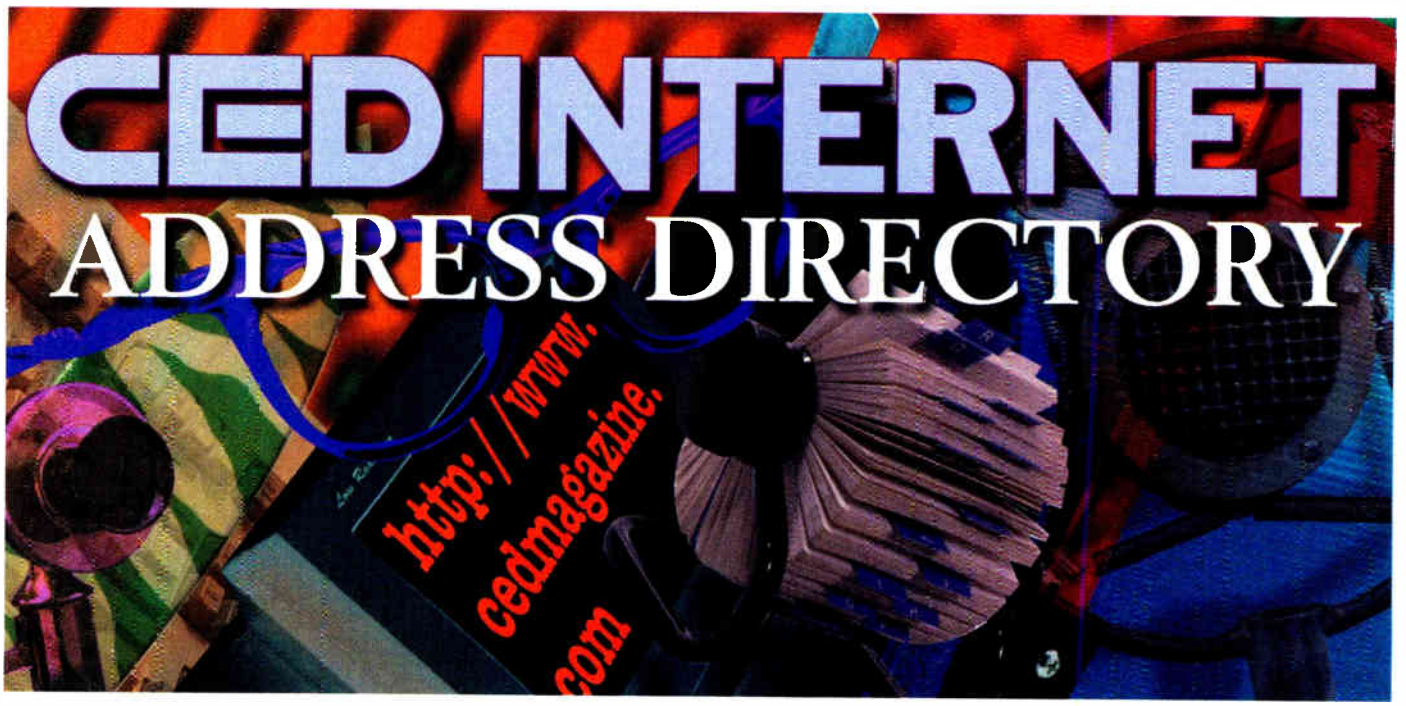

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CED

EDFA optical switch

BOULDER, Colo.–OptiVideo Corp. has announced its 1550 nm EDFA Optical Switch, an all-fiber, low-loss optical switch intended for applications using Erbium Doped Fiber Amplifiers. The switch features low insertion loss plus high isolation between channels, high reliability and status monitoring functions.

OptiVideo's 1550 nm EDFA switch

Because it's based on Corning's MultiClad couplers, the switching system offers good optical linearity, says OptiVideo, important for designers of Dense WDM networks.

The switch is suited for applications such as an input signal selector for EDFAs, hot standby transmitter sites, optical amplifier redundancy, self-healing rings and redundant fiber routing. It constantly monitors the optical signals on the input fibers and has the ability to sense signal degradation or loss. The EDFA switch can automatically switch paths based on the conditions of the inputs, preserving transmission in high reliability networks.

Circle Reader Service number 51

Disk recorder

PALO ALTO, Calif.–Hewlett-Packard Company has introduced the HP MediaStream Disk Recorder for its HP MediaStream Server family.

Designed for on-air applications, the recorder enables high-end, multichannel applications for broadcasters with large server installations.

Scope adapter

ORISKANY, N.Y.–Fiber Instrument Sales Inc. (FIS) has added an eight-degree scope adapter to its product line. The adapter, for use on the AMP fiber optic microscope in the inspection of angled connectors, enables the user to view eight-degree angled FC-style connectors. The microscope adapter enables users to view angled polished connectors in focus, previously not possible with the standard 90-degree adapters for connectors with PC or flat polished ferrule surfaces, says FIS.

FIS' 8-degree scope adapter

Designed for use on the AMP Inspection Microscope, the new adapter offers fiber optic contractors, installers and manufacturing facilities a real solution to inspecting angled connectors when an interferometer is not available.

Circle Reader Service number 52

Net management, optics

CARLSBAD, Calif.–Integrated Photonic Technology (IPITEK) has introduced its new NodeWizard Network Management System and its associated digital interface, the Node Control Processor (NCP). The system provides centralized network control and monitoring functions for IPITEK digital fiber optic transmission systems. Its control capabilities include the configuration of drop/add/pass signal functions at remote nodes. Monitoring functions include fault and status reporting for IPITEK equipment, as well as other user equipment or functions at remote nodes. Typical applications include trunk and ring networks for cable TV, distance learning or data communications.

IPITEK has also announced a family of high-power, externally-modulated, fiber optic transmitters. The products include transmitters that operate in the 1550 nm and 1310 nm regions, with power outputs up to 80 mW for long distance transmission.

Finally, the company has introduced its new IMTRAN DS-3 interface, a data communications module for IMTRAN digital fiber optic transmission systems. When used with IMTRAN CQ-Series systems, the new plug-in module set provides fiber optic transmission of two, 45 Mbps, DS-3 channels for applications such as compressed video transport (DS-3 or multiplexed MPEG-2) or two-way telephony systems.

Circle Reader Service number 53

Remote controller interface

Impulse RCI System

LOUISVILLE, Ky.–Data Voice Systems Inc. has announced the Impulse *RCI* (remote controller interface), which allows both large and small cable operators to provide impulse pay-per-view programming to hotels. The

Hewlett-Packard's MediaStream Disk Recorder

It features from three to five channels and from four to nine hours of integrated RAID (redundant arrays of inexpensive disks)-protected storage.

In a non-RAID environment, the system generally goes black when a drive fails. In addition, all information in the entire array may be lost. RAID technology protects data content on a redundant disk, so that it will not be lost if a single disk fails.

The unit can be used as a stand-alone disk recorder or with the HP MediaStream Broadcast Server. It is the same size as the industry standard for beta-sp tape decks.

The Disk Recorder is scheduled to be available for shipment in June.

Circle Reader Service number 50

unit permits hotel guests to view impulse pay-per-view programs and provides direct hotel guest billing before check-out.

A service bureau-style program, the system serves up to 6,000 rooms and connects directly to a cable network controller or system manager located at the cable operator's headend. No equipment besides a two-way convertor is required at the hotel.

Circle Reader Service number 54

Video headend system

SIERRA VILLAGE, Calif.–Olson Technology Inc. has introduced a new compact, modular, frequency-agile, 12-channel remote control video headend system for video entertainment, hotel distribution, educational and security system applications.

The Olson OT-1200 Series 12-Channel Remote Control Headend System features a 5 1/4-inch high x 19-inch wide rack-mount housing which contains a power supply and can be configured with any combination of video/audio modulator or demodulator cards.

Permitting local tuning or remote control of each card via a serial data link, the modular

Olson Technology's remote control video headend system

headend system is capable of operating at frequencies from 54 to 550 MHz.

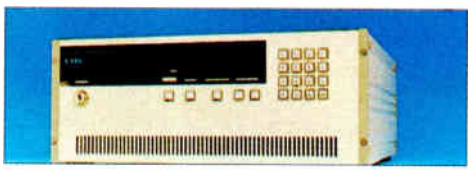
Modulators and demodulators for the Olson OT-1200 Series headend system are available with NTSC, PAL, B/G, PAL I and PAL D standard video formats. The modulator is compliant with FCC requirements for ± 5 kHz stability and frequency accuracy, data rates are selectable to 19,200 baud, and power consumption for 12 modulators is low at 80 watts typical.

Circle Reader Service number 55

Laser characterization

SAN JOSE, Calif.–E-TEK Dynamics Inc. has unveiled its Multi-Channel Laser Diode Controller and new Laser Characterization Systems.

The diode controller features a single chassis that contains an electronic mainframe with 16 user-exchangeable slots and an IEEE-488/RS-232 interface. Interchangeable plug-in



E-TEK's Multi-Channel Laser Diode Controller

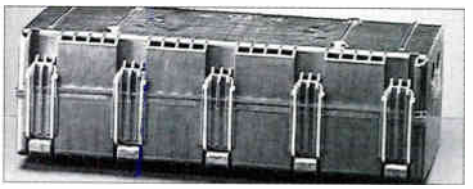
modules have digital controlled and analog stabilized current/power and temperature control boards for independent laser diode control.

The Characterization Systems measure and plot the PV-1 and dP/dI curves, near field, far field profile, and wavelength spectrum (optional) of a laser diode. With this information, users can derive threshold current, slope efficiency and series resistance. Windows-based software controls the positioning, test, alignment and system diagnostics. Both an automated system and manual model are available.

Circle Reader Service number 56

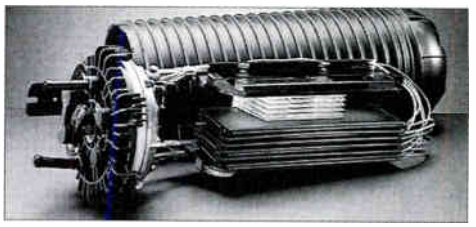
Splice closures

HICKORY, N.C.–Siecor Corporation has introduced its new UCTL and UCAO optical



Siecor's UCAO closure

splice closures. The closures have been designed for easy installation and excellent environmental protection of optical fiber splices. Both can be used for either aerial, direct-buried or underground applications, as



Siecor's UCTL closure

well as handle mid-span and ribbon cable.

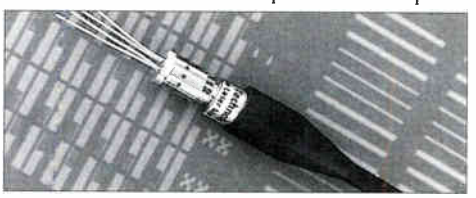
The UCTL is a midsize canister closure with unique and user-friendly approaches into the dome seal and cable entries. It can accommodate up to 192 single fiber splices.

The UCAO is a compact-hinged closure, designed for in-line or drop and insert applications. It can accommodate up to 60 fiber splices.

Circle Reader Service number 57

Uncooled laser

BERKELEY HEIGHTS, N.J.–Lucent Technologies' Microelectronics Group has introduced a new 271-Type Uncooled Laser. The laser offers users low-power consump-



Lucent's 271-Type Uncooled Laser

tion and reduces the amount of board space normally required for lasers.

The uncooled laser can be used as a building block of a full digital transmitter. It will support virtually any digital voice or data application operating at speeds of 2.5 Gbps or greater.

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Advanced Networking

C-COR Electronics, Inc., p. 73:
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Circle Reader Service # 36

General Instrument Corporation, p. 41:
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Panduit Network Systems Group, p. 57:

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Circle Reader Service # 27

Construction Equipment

Telecrafter Products, p. 8, 55:
Telecrafter Products is a supplier of drop installation products for CATV, DBS, and wireless operators and drop cable fastening products for single and dual cables, identification tags, residential enclosures, and more.
Circle Reader Service # 4, 26

Distribution Equipment

Alpha Technologies Inc., p. 19:
Alpha's Broadband Power Systems enable immediate full-service deployment of centralized node powering from a single enclosure. Systems available from 1350 to 6000 watts, integrating power supply components, batteries, and optional generator.
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Exide Electronics, Emerging Technologies Group, p. 45: The Lectro Powernode Series builds on the success of the industry's first true uninterruptible standby power supply (the Lectro ZTT) and configures the ZTT into scaleable centralized power systems which variabilize your power supply provisioning and your costs.
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Lindsay Electronics, p. 54:
Focused on the last mile, our revoluntionary new technology creates 1 GHz communication amplifiers, passives, taps, and subscriber materials to solve problems before they become subscriber problems.
Circle Reader Service # 25

Lucent Technologies Microelectronics Group, p. 10-11:
Circle Reader Service # 6

Moore Diversified Products, Inc., p. 89:
Moore manufactures network construction products to stock. Organize and protect fiber optic and coaxial cable.
Circle Reader Service # 17

Trilogy Communications, Inc., p. 59:
MC2 low loss air dielectric cable. Lower attenuation than competing products of the same size. Sizes available for all classic and HFC architectures. Over two billion feet installed worldwide.
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Fiber Optics

Alcatel Telecommunications Cable, p. 27:
Alcatel Telecommunications Cable offers premium fiber optic cable products for outside plant and indoor environments, including optical fiber, loose tube, central tube, and specialty cables.
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Alcoa Fujikura Ltd., p. 31:
Leading manufacturer of fiber optic cables including All-Dielectric Self-Supporting (ADSS) and Optical Ground Wire (OPT-GW) aerial cables, loose tube, premise cables, and accessories.
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Pirelli Cable Corp., p. 33:
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Synchronous Group Inc., p. 49:
The Actair and Antares 1550nm external modulation transmitters offer outstanding performance and the best specifications in the industry. Perfect for super trunks and direct distribution.
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Headend Equipment

ADC Telecommunications, Inc., p. 2-3:
ADC Telecommunications is a leading global supplier of transmission and networking systems used to deliver voice, data and video services. The company holds a preeminent market position in physical connectivity products for fiber optic, twisted pair, coaxial and wireless networks worldwide.
Circle Reader Service # 1

Barco, Inc., p. 75:
BARCO's Gemini Upconverter is an alternative to conventional modulators that offers savings in both cost and space for hub site headends. Only one rack unit high by a half rack wide, Gemini accepts digital or analog IF inputs (i.e. from a fiber ring) and upconverts the signal for distribution to subscribers.
Circle Reader Service # 37

Blonder Tongue Laboratories, p. 63, 65:
Quality manufacturer of pre-fabricated headends, antennas, earth station receivers, converters, modulators, IRDs, demodulators, power supplies, processors, broadband CATV & MATV amplifiers, preamplifiers, passives, RF test equipment and MDU interdiction products.
Circle Reader Service # 30, 32, 90, 92

Dawn Satellite, p. 29:
Circle Reader Service # 95

Frontline Communications, p. 51:
FrontLine Communications manufactures patented, field proven, Emergency Alert and PC-based Character Generator products to fulfill the needs of cable and other multi-channel system operators.
Circle Reader Service # 23

Harmonic Lightwaves, Inc., p. 13:
Harmonic Lightwaves is a worldwide supplier of highly integrated fiber optic transmission, digital headend and element management systems for the delivery of interactive services over broadband networks.
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Microwave Filter Co., Inc., p. 85:
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Circle Reader Service # 45

Monroe Electronics, Inc., p. 85:
We supply rack mounted or cased cue tone encoders/decoders. Also, timers, A/V and RF/IF switches and other control products.
Circle Reader Service # 44

Scientific-Atlanta, p. 104:
Scientific-Atlanta's new Continuum™ Headend System for analog and digital applications. This features a vertical packaging design which allows for up to forty front-loaded modules to fit into a standard 70" rack.
Circle Reader Service # 77

SkyConnect, p. 69:
SkyConnect provides MPEG-2 digital ad insertion solutions for both large and small cable operators. As the Value Added Reseller for Digital Equipment Corporation's Mediaplex™ products, SkyConnect gives essential expertise in customer support, T&B integration and software development.
Circle Reader Service # 34

Spectrum, p. 21:
Spectrum has the total solution for EAS. The Sub-Alert utilizes the advanced features of the Sage Endec for total automation and will interface with your headend by IF, baseband video or comb generator.

Standard Communications, p. 7:
Standard Communications Corp. is the industry's leading manufacturer of rebroadcast quality satellite reception and RF broadband products. Today our cable television receivers and modulators are delivering programs to thousands of CATV and SMATV systems.
Circle Reader Service # 3

Stanford Telecom, p. 53:
Stanford Telecom, Inc. produces modulator chips for subscriber modems and demodulator assemblies for headend equipment in hybrid fiber / coax cable systems.
Circle Reader Service # 24

TFT, Inc., p. 17:
TFT, Inc. manufactures and markets through CATV OEM's & system integrators (EAS) Emergency Alert System. Products including: EAS 911 Encoder / Decoder, EAS 930A Multi-Module Receiver and (IHAD) In Home Alert Device.
Circle Reader Service # 9

WaveCom Electronics, Inc., p. 79:
Leading designer/manufacturer of CATV modulators, demodulators, satellite receivers, FM audio modulators, high-speed spread spectrum modems, bi-directional amplifiers, digital video modulators, frequency translators for Internet on cable, MMDS/LMDS equipment, cable telephony modems and more.
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West End Systems Corp., p. 67:
Products incorporate advanced RF transmission technology (OFDM) to deliver robust, reliable VOICE, DATA, ETHERNET, INTERNET communications for business and residential applications via HFC (Hybrid Fiber/Coax) networks.
Circle Reader Service # 33

Services

International Engineering Consortium (IEC), p. 37:
The International Engineering Consortium is a non-profit organization dedicated to advancing the field of business and engineering in the information industry through noncommercial and university programs.

National Cable Television Institute (NCTI), p. 64:
National Cable Television Institute (NCTI) is the world's largest independent provider of broadband industry training; both technical and non-technical. The National Cable Television Institute (NCTI) Certificate of Graduation is recognized throughout the communications industry as a symbol of achievement and competence.
Circle Reader Service # 31

Personal Communications Industry Assn. (PCIA), p. 45:
PCS '97 is the world's largest and most respected subscription and educational forum for those who are shaping the future of wireless communications. PCS '97 features more than 500 exhibitors and brings together 25,000 wireless professionals.

Stark & Associates, Inc., p. 84:
Stark & Associates, Inc.: Broadband cable systems training, design & engeneering, and marketing consultants.
Circle Reader Service # 41

Telecom

Fujitsu Network Communications, p. 21:
Fujitsu Network Communications manufactures and markets advanced SONET transport and access equipment which maximizes network operational capacity and services. Add/drop multiplexer and supporting hardware and software.
Circle Reader Service # 11

Test Equipment

Anritsu Wiltron, p. 61:
The Cable Mate cable analyzer is a single, rugged tester for return loss/SWR, insertion loss, RF power and Distance-To-Fault measurements designed for the rigors of field maintenance.
Circle Reader Service # 29

Cable Leakage Technologies, p. 77:
With the FCC imposing stiff fines for leakage, CLT presents operators with the only sure, comprehensive method of locating and documenting the nearest street address of system faults/signal leakage. And it's totally automatic. "WAVETRACKER".
Circle Reader Service # 38

Hewlett-Packard Company, p. 9, 39:
Hewlett-Packard offers a comprehensive range of test equipment to keep your entire broadband system at peak performance - from headend to subscriber drop.
Circle Reader Service # 5, 18

Sadelco, Inc., p. 78:
Sadelco manufactures signal level meters for CATV and MMDS/Wireless.
Circle Reader Service # 39

Sencore, p. 23:
Sencore designs and manufactures a full line of CATV, Wireless CATV, QAM and MPEG-2 test instruments. Each instrument is designed to meet your system analyzing and troubleshooting needs with exclusive tests and measurements.
Circle Reader Service # 12

Superior Electronics Group, Inc., p. 103:
The Cheetah product line is the leading system solution for monitoring your HFC plant - from headend through end-of-line, both forward and return paths. Providing full compatibility with multi-vendor distribution devices and third-party OSS systems, Cheetah will integrate with your network now and in the future.
Circle Reader Service # 76

Tempo Research Corp., p. 85:
Manufacturer of test and measurement equipment for installation and repair technicians, including TDRS, Step TDR, and Coax Tracer systems.
Circle Reader Service # 43

Trilithic, Inc., p. 25:
Trilithic manufactures test equipment for the CATV and LAN industries and components for aerospace and satellite communications. Key products are SLMs, leakage detectors, and a comprehensive line of return test equipment.
Circle Reader Service # 13

Wavetek Corporation, p. 5, 47:
Wavetek manufactures test equipment for the CATV, telecommunications, wireless, and general purpose test and measurement industries. CATV equipment includes signal level, analysis, and leakage detection meters, system sweep, and headend monitoring equipment.
Circle Reader Service # 2, 21

Wholesale/Distributors

Budco Inc., p. 84:
Budco is a marketing and distribution company for installation tools, construction supplies, marking identification, and security products for cable plant. Exclusive distributor of taplocks, the industry leader for marking drops.
Circle Reader Service # 42

ITOCHU Cable Services, p. 15:
iCS, Inc. is a leading full service stocking distributor of General Instrument, CommScope, Digicipher, Scientific-Atlanta, DX Communications, PPC, Diamond and much more, offering 10 sales offices and 9 warehouse for rapid delivery, repair of converters, and financing.
Circle Reader Service # 8

Sprint North Supply, p. 87:
Sprint North Supply's Materials Management Services include Engineer, Furnish & Install, Vehicle Provisioning, CPE Fulfillment, Project Management, and Model Programs. Reduce your cost to compete.
Circle Reader Service # 47

TeleWire Supply Company, p. 71:
TeleWire Supply is the distribution division of ANTEC Corporation and a leading nationwide distributor of products needed to build and service a broadband communications network.
Circle Reader Service # 35

Ultimately subscribers, like politics, are local

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

One of the advantages of writing your column so close to the deadline is that you can incorporate the latest and greatest events concerning fast developing subject areas. And I see by this week's headlines that the ol' "Death Star" people are at it again. They want to charge into cable television's last stronghold, local programming, and thus provide what they believe is an unparalleled package that will dominate the multichannel video services marketplace. But even with multiple satellites and changes in the copyright law, can the direct-to-home (DTH) satellite industry truly offer all the local programming that subscribers believe is important and find attractive? I don't think so.

In many service industries, consumers make choices between competing entities based on three or four main criteria: price, customer service, quality (in this case, signal quality) and service variety and diversity. Cumulatively, consumers will often weigh these factors together to make a price/value comparison that will positively or negatively influence their ultimate choice (e.g., consumers will pay a higher price for what they perceive to be a service with a higher value to them). Using these factors, let's see how cable stacks up with the competition:

✔Price–With double-digit percentage price increases last year and already-announced increases this year, vs. DBS consumer electronic costs that have fallen, this can be a tough comparison for cable.

✔Customer service–This has been a roller-coaster ride for cable, with some systems receiving 90 percent-plus customer service satisfaction marks from subscribers, and others being fined for poor telephone response.

✔Signal quality–Digital video and CD quality audio from DBS providers are a hard combination to beat, especially considering the increasing screen sizes and surround sound systems being purchased by subscribers for their homes. However, HFC upgrades, combined with digitally compressed video, should allow cable to catch up.

✔Service diversity–Most of the same satellite services are provided, but here is where cable can claim a wealth of local programming not found on direct-to-home satellite systems. And even if the DTH industry succeeds in transmitting local network affiliates, cable still has a strong suit with the community access programming that it provides. Recent surveys in a variety of communities indicate that the overwhelming majority of cable subs believe that community access is an important part of their service. Moreover, they indicate that they are willing to support this type of programming with a significant portion of their monthly bill. Thus, they are making a price/value comparison that is worth noting–programming that "hits home" is worth paying for, and its presence will positively influence their choice of multichannel video providers.

In light of this fact, a recent trend for operators to pursue a lessening of local access channels in franchise renewals is very disturbing. Some operators reportedly want to acquire these channel slots to offer more national commercial services in order to "be more competitive" with the number of services offered by DBS providers. Such a move, however, misses the point, because it does not ultimately play to cable's strong suit and the full service diversity that subscribers are looking for. Yes, such a move would enable provision of more of the same, but no, such a move does not help cable positively differentiate itself from DBS.

America's fuzziest home videos

One of the other concerns I have is the tendency of operators to sometimes discount community access programming as "that low quality stuff I have to carry." As an example, one of my industry colleagues terms community access as "America's fuzziest home videos." This type of attitude, again, misses the point. The Alliance for Community Media (ACM) indicates that there are roughly 1,000 access groups in the United States producing more than 20,000 hours of new programming each week. Whether it's high school football, parade coverage, local public affairs programs, adult education, city council land development hearings that affect hundreds of homeowners in adjacent neighborhoods, or local performing arts programming, subscribers find this programming important and valuable to watch.

There are many talented people involved in the production of this programming, and one of the more common complaints from them is related to the age and availability of production facilities and the ultimate transmission quality of the programming. In some cases, access producers are using equipment that was already surplus in the early 1980s, and some access origination locations are connected to headends through dozens and dozens of aging amplifiers.

Taking all this together, I think part of the solution to being competitive is not to throw out one of cable's competitive advantages in favor of bolstering another component, but rather, to improve upon the positive story that subscribers already see. Listen to community access providers when they indicate that upgrades in equipment and facilities are needed, and work with them to provide the highest level of picture quality possible.

For example, assist them in moving into the Betacam and nonlinear editing world that their programming is competing against. Establish origination networks that incorporate low noise and distortion fiber links, so that the programming from access camera to the subscriber's set maintains the highest possible quality. In this way, you'll be working to build on cable's strengths, and not just compete on the price of ESPN and HBO.

Just like all politics are ultimately local, so, too, are all subscribers. Play to cable's local programming strengths, and the challenge of the Death Star can be met. CED

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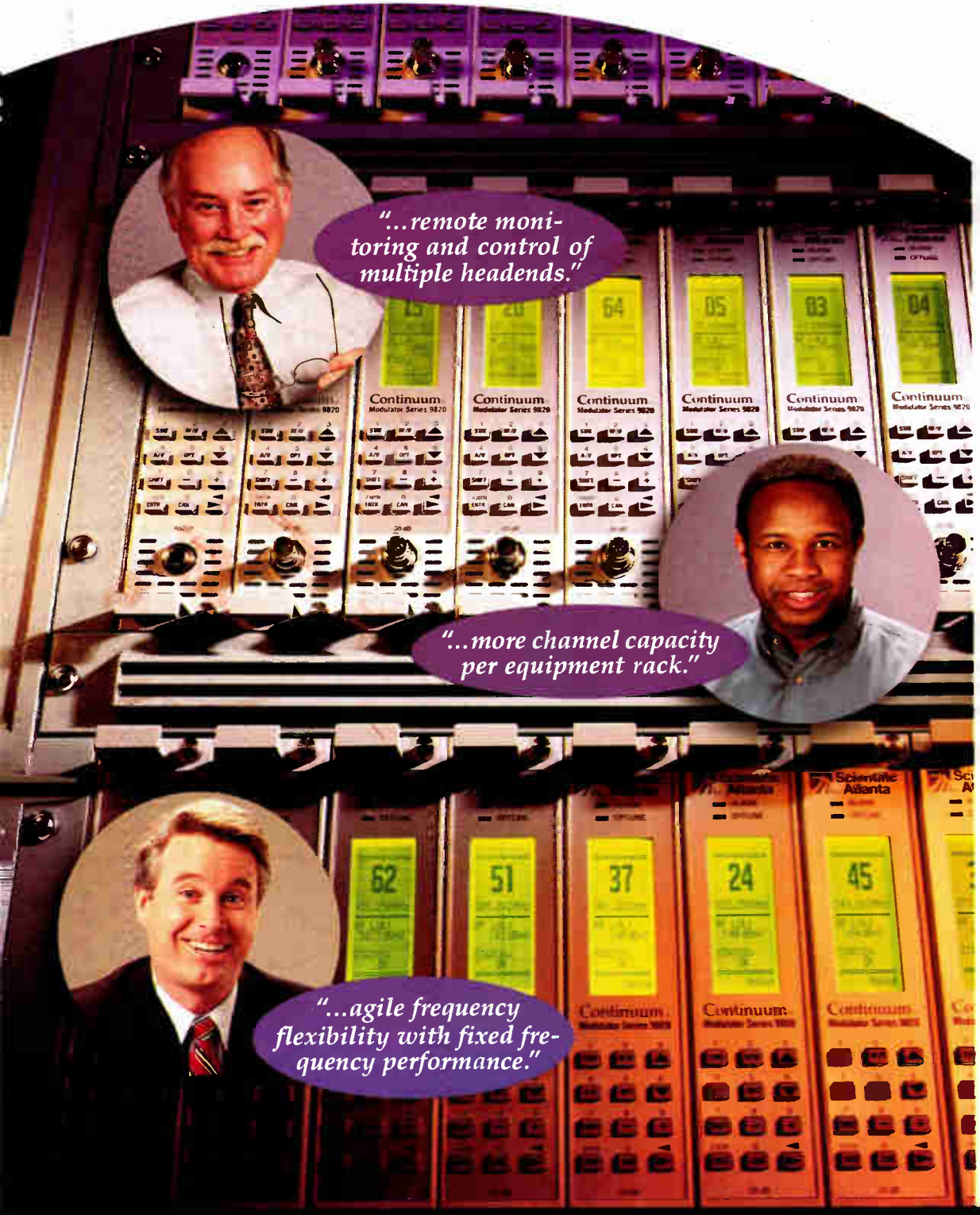

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