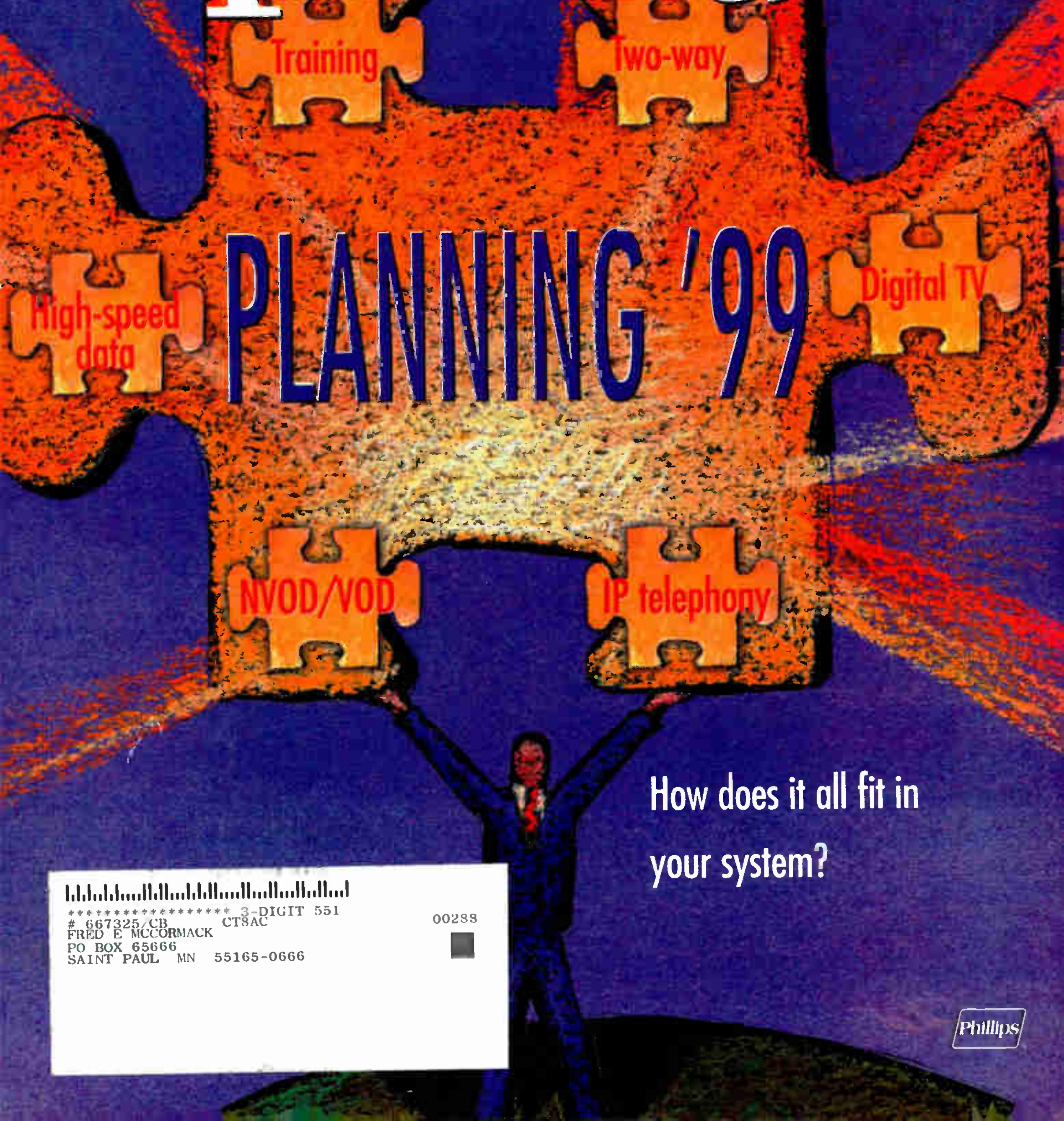
Communications Technology

OFFICIAL TRADE JOURNAL OF THE SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS

OCTOBER 1998



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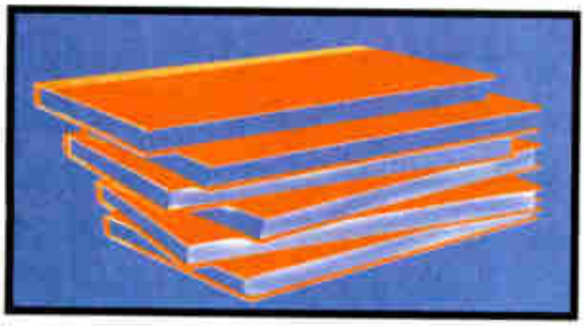

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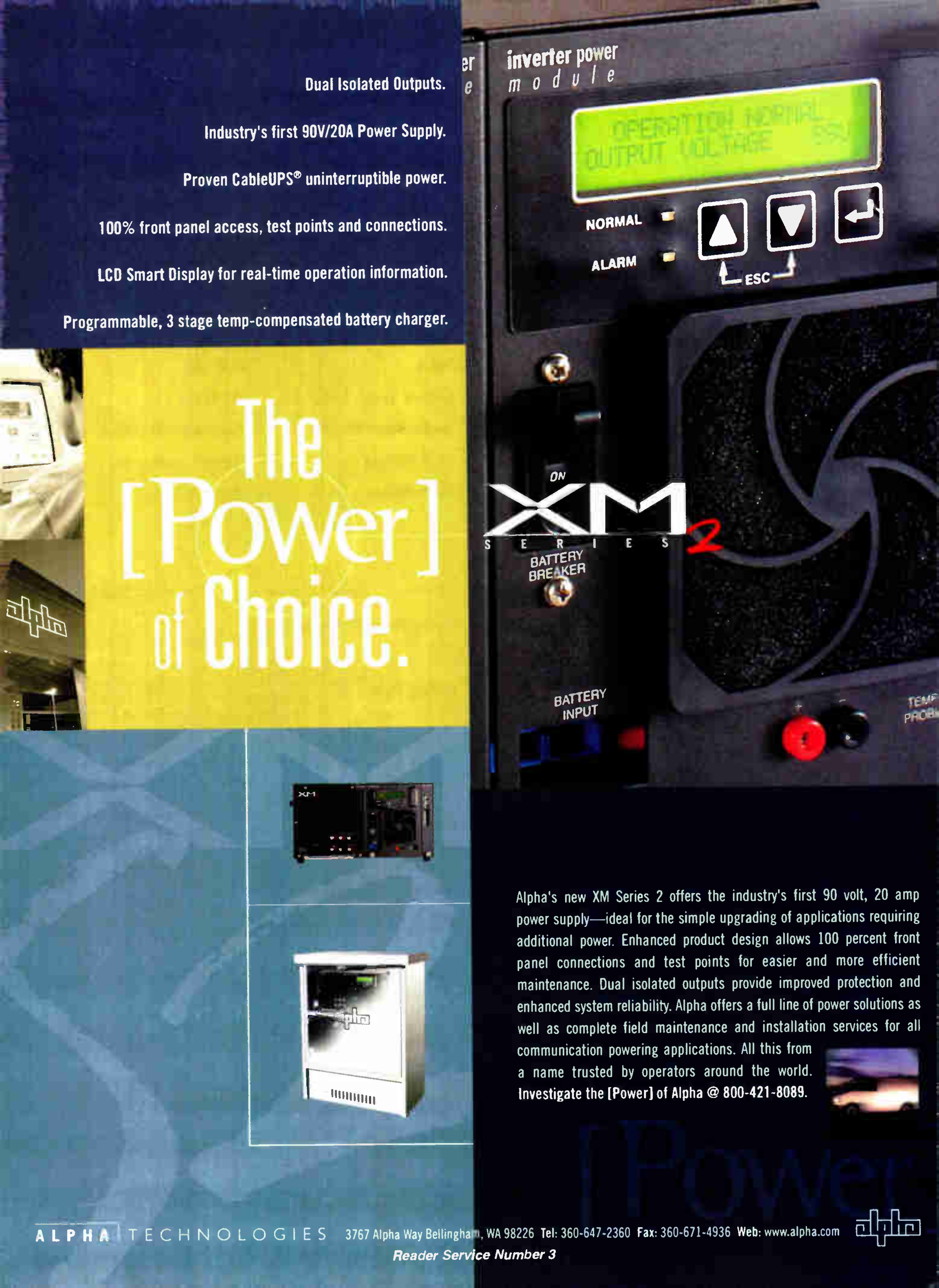
 Communications Technology™ (ISSN 0884-2272) is published monthly, except twice in May, by Phillips Business Information Inc., 1201 Seven Locks Road, Suite 300, Rockville, MD 20854, USA. Editorial and sales offices located at 1900 Grant St., Suite 720, Denver, CO 80203 USA, (303) 839-1565. October 1998, Volume 15, Number 11. Periodicals postage paid at Rockville, MD, and additional mailing offices. POSTMASTER: Send address changes to *Communications Technology*, P.O. Box 3230, Northbrook, IL 60065-9647.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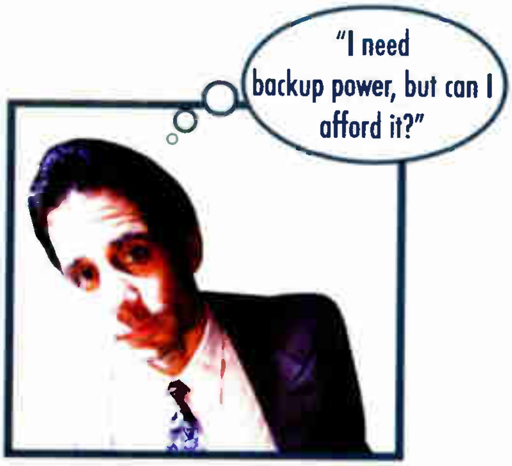

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By Rex Porter

There's a Hole in the Middle

TCI merges with AT&T. Time Warner Telecom forms a partnership with IXC for nationwide business long distance services. The rush is on for deployment of new services for cable's customers.

When we built cable systems throughout the United States, we designed systems to cover the residential communities. There was no need to string cable (or fiber later on) into the business community right in the center of the towns and cities. With the exception of perhaps a sports bar, restaurant or hotel/motel, it was unlikely we could ever have enough customers to cover the costs. So, in almost all cases, we built each system like a doughnut—with a hole in the middle.

Now, with the introduction of "business data," these system-centers will become very important to our future plans. You would think that we would start laying some fiber into the city centers even if we leave them dark. The business centers will become more important to other companies wishing to enter the cable communications business.

I can imagine an entrepreneur starting a new business by approaching city councils with the following presentation: "You granted a franchise to the local cable company 20, 30, 40 years ago. During all this time, the incumbent cable company has shown no interest in providing service to the business community. My company is interested in providing a new, modern and needed data network for the business community. I am not asking to overbuild the local cable system. The cable system hasn't even located cables or fibers where I want to serve. I request a franchise to serve the modern business needs within the downtown area."

Even if one of the members of the council were to suggest the idea that the incumbent system might need to tie in with the businesses at some future time, the entrepreneur could agree to lease service from his system back to the incumbent cable system at a fair rate.

Someday, there will be more income from business data with a small investment in lines within the small city center than from all of the residential areas. We cannot give away this part of our systems.

Our fate is in our own hands, and the solution is at the center of our systems. Some thought and planning needs to start about protecting the heart of our networks and possibly the biggest financial asset we have as we move into the 21st Century.

Rex Porter
Editor

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Website: www.ctinfosite.com

By Greta Durr

S-A Explores Digital Frontier

A slew of announcements from Scientific-Atlanta celebrating recently forged agreements and revved-up production indicate that the company's long-term digital strategies are paying off.

"Our focus is clearly on going after the major metropolitan areas in the country," said Bill Wall, chief scientist and technical director of Scientific-Atlanta's subscriber networks about the Explorer 2000 advanced digital set-top.

The set-top was first conceived several years ago with Time Warner and the Pegasus program, said Wall. Now, the supplier of broadband systems and satellite-based networks has several leading MSOs on the line. S-A said it may double production at its Mexico facility where the set-tops are manufactured.

"Back in 1993, Time Warner had a vision of where the world was going. A large number of people had vision." The industry is now seeing that vision come to fruition, Wall said. "Now, we're shipping in volume."

Jim Chiddix, Time Warner's chief technology officer said the MSO plans to introduce new digital services in stages on its interactive systems, starting with digital broadcast TV video-on-demand (VOD). Plans for e-mail, Web browsing and e-commerce also are on the MSO's agenda.

"The Explorer set-top and network components are undergoing intensive testing, and we're now preparing for a vigorous 1999 launch schedule by deploying digital headends in a significant number of our systems by this year-end," Chiddix said. S-A calls the rollout North America's first widespread deployment of digital networks capable of client/server applications and services.

The National Digital Television Center, a subsidiary of TCI Ventures Group, has agreed to deploy an undisclosed quantity of the new set-tops and network equipment, S-A said. This marks the first commitment by TCI for S-A's advanced digital set-tops and supporting networks. S-A said that shipments are slated this year for Salt Lake City, where TCI has 190,000 subscribers.

Cox chose the set-tops and interactive network components for some of its clustered cable systems over the next three years, S-A said. The equipment will dominate the MSO's digital scene in some of its largest markets. With 580,500 subscribers, Phoenix hosts Cox's largest metro cable system. In San Diego, the MSO serves 486,000 subscribers, and in Oklahoma City, Cox has 121,000 subscribers.

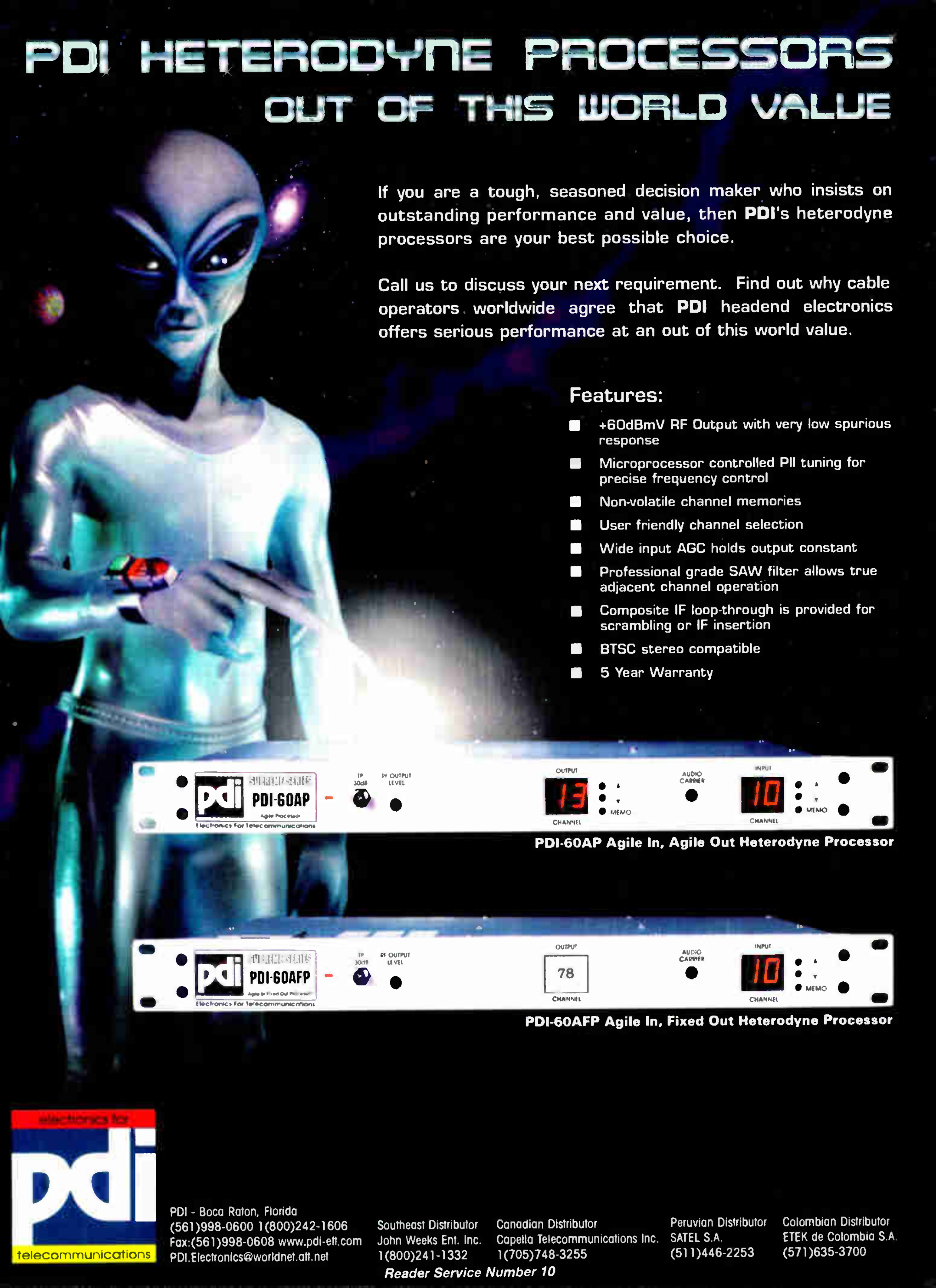
Comcast also has jumped on S-A's interactive digital services bandwagon. S-A said the MSO agreed to offer the set-tops and interactive network services to 80,000 subscribers in Charleston, SC. ■

Vendors Swim in DOCSIS Pool

A new CableLabs specification creating a royalty-free pool for intellectual property rights will reward participants in the Data Over Cable Service Interface Specification (DOCSIS) by enabling the standard's implementation and expediting deployment.

Vendors that aided in creating the DOCSIS specification were the first to join. By doing so, 3Com, Bay Networks, Broadcom and General Instrument contributed nonexclusive licenses for any intellectual property essential to the DOCSIS standard. In return, they received licenses for all of the intellectual property contributed by others in the pool.

The pool does not, however, contain the technology by which the involved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companies are implementing the standard. Any company aiming to make its equipment DOCSIS-compliant may join.

Enhanced TV Unites

CableLabs announced a draft specification for enhanced TV programming in collaboration with a cross-industry group called the Advanced TV Enhancement Forum.

Cable programmers, broadcasters, TV stations, cable and satellite service providers, and representatives from the consumer electronics, personal computer (PC) and software industries joined mighty forces to write the specification. Authors hope it will empower enhanced programming over any form of transport, to any kind of specification-compliant receiver.

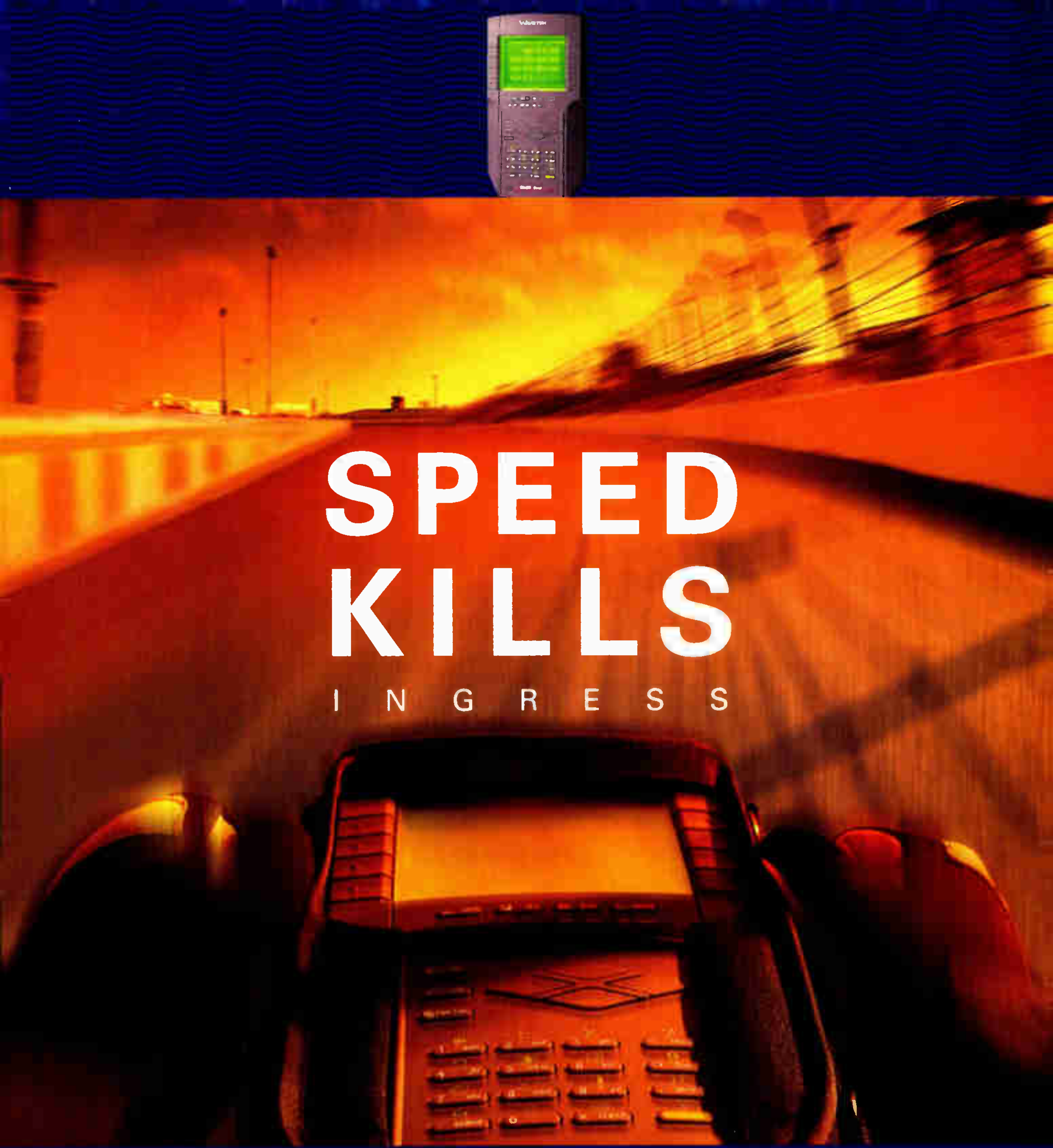
CableLabs said that representatives from CNN, DirecTV, Disney, Discovery, Intel, Microsoft, NBC, NCI, Network Computer, NDTC Technology, PBS, Sony, Tribune, and Warner Bros. are so far co-operating to make the specification happen. Cable and Wireless Communications, Digital Renaissance, the Fantastic Corp., the Weather Channel and Wink Communications also have expressed interest in the forum.

Authors say this specification should accelerate the creation and distribution of enhanced TV programs and make it more affordable to consumers. Also, it will offer content providers and distributors choices in delivery methods and business models.

News Bites

- Broadband Communications Products and Science Applications International Corp. announced an alliance to jointly sell and integrate BCP's fiber-optic products.
- ICTV, an early provider of commercial Internet and multimedia via cable, announced a five-year contract with St. Joseph Cablevision to provide interactive TV services to 25,000 potential subscribers in Missouri. Initial rollout of the ICTV systems is slated for later this year.
- Comcast and Jones Intercable announced last week that Comcast Corp. will acquire Glenn Jones' approximately 2.9 million shares of stock in Jones Intercable sooner than anticipated. CT

Greta Durr is assistant features editor at "Communications Technology" in Denver. She can be e-mailed at gdurr@phillips.com.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Setting the Record Straight

I'm writing in response to reports that Time Warner was unhappy to be mentioned as a participant in the cable Outside Plant (OSP) Alliance. To my knowledge, no one at Time Warner has complained about the mention of our company in *CT's Pipeline* article on the Alliance. (*Editor's note: The OSP Alliance has changed its name to the HFC Management and Control Interoperability Specification Standards Group.*)

Time Warner has, in fact, entered into a dialog with some of the Alliance members about our priorities in this area. It is true that we have been, and remain, quite skeptical about adding status monitoring circuitry to amplifiers, nodes, and special end-of-line monitoring devices as a practical and cost-effective means of improving plant reliability and reducing time-to-repair.

We believe that some type of monitoring is required with standby power supplies. We do not, however, think standby supplies are warranted in most upgraded hybrid fiber/coax (HFC) systems to support today's services: analog and digital entertainment, video, and cable modems.

HFC architectures break our systems into such small segments that utility outages are likely to impact the same homes served by affected power supplies, and the reliability gained from the power backup is likely to be offset by the failures of the standby supplies themselves, owing to their complexity.

When our coax trunks had 30 to 40 amplifiers in cascade and ran for many miles, standby power was quite helpful. We have yet to be convinced that the same is true when passive fiber trunks serve neighborhoods of a thousand homes or fewer. Standby power may be required for cable telephony, depending on how that service is positioned in the marketplace. The economic burden of standby should be carried by that business if that is the case.

Our fundamental view is that we should achieve "reliability through simplicity." Reducing parts count and modularity in active equipment reduces the complexity that both adds cost and increases failures. Further, minimizing the impact of failures through the deployment of HFC deep into the plant dramatically improves reliability as observed by any given customer. As a result, we expect to benefit from reductions in both initial capital spending and ongoing operating expenses.

All of this notwithstanding, we need to have very short response times in repairing those failures that inevitably do occur. The question is how to pinpoint failures so that technicians can be dispatched to the right piece of equipment immediately, without time-consuming iterative "bracketing" of the problem.

Historically, an experienced repair dispatcher could send a technician to the right general area, based on the areas

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HEWLETT PACKARD

Reader Service Number 14

where trouble calls from customers were originating and knowledge of the route of the cable transmission plant. I believe that we are entering an era when this process can become highly automated and much more accurate.

The cable industry is about to spend billions of dollars to place real-time two-way terminals of various sorts into our customers' homes and businesses. This investment will be fully justified by the incremental revenue from the new services delivered. A side benefit of this massive deployment will be "free" real-time status monitoring of our plant.

As we launch cable modem, telephony and interactive digital TV businesses, some argue that we must improve reliability by monitoring most or all of our active devices, as well as many "end-of-line" points. I would counter that these businesses bring inherent monitoring as a function of the nature of the terminals used.

It seems to me that there is a real opportunity for vendors and operators to develop and deploy cable transmission system network management based on integration of information from various terminal element managers and a geographical database of all critical active and passive system components.

By relating each transmission component to the range of addresses it serves and relating an address to each terminal, failures could be instantly pinpointed to a single system component (or very small number of them), based on the addresses with terminals reporting loss or impairment of communications. This provides a path to status monitoring without significant capital investment or increased plant complexity. I believe it would let us keep our field equipment cheap, simple and "dumb," and yet allow us to monitor it very intelligently indeed.

The missing element in the realization of this benefit is not low-cost standardized status monitoring modules, but a network management system that can do the necessary integration of information from the various systems we deploy.

Encouraging vendor development and interoperability of such network management systems is something we feel the Alliance should seriously consider, and we will continue to discuss this within the Alliance. We would be happy to participate in the Alliance if it decides to include an aggressive approach to integrated network management systems in its charter.

Jim Chiddix
Chief Technical Officer
Time Warner Cable

Write to Us

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CT reserves the right to edit letters for clarity and/or space.

DEPLOYMENTWATCH

By Greta Durr

All kinds of changes are in store for the way the cable industry conducts its business. It's no small wonder that operators of all shapes and sizes are suffering myriad growing pains.

This month, "Deployment Watch" focuses on how those pains may be minimized. Whether it happens through new equipment or new alliances, it's all really about making growing easier.

DWDM Is the Future's Wave

With the pressure to rapidly expand bandwidth capacity at an all-time industry high, more MSOs are opting for dense wave division multiplexing (DWDM) as a long-term investment to offer subscribers the latest in advanced analog and digital services.

TCI executives are touting advanced DWDM as a means of maximizing their hybrid fiber/coax (HFC) networks while allowing them to shrink their hubs. The MSO reports it is considering DWDM upgrades for its top 14 markets, which represent 1,000 hubs.

With the proliferation of quadrature amplitude modulation (QAM) digital TV, cable modems and Internet protocol (IP) telephony, a lower signal-to-noise ratio (S/N) is acceptable and within reach of the new DWDM systems. Harmonic Lightwaves officials said that a typical hub with 20 nodes can cost up to $250,000 to upgrade. For TCI, the specialized architectures from Harmonic Lightwaves, ANTEC and General Instrument will pay off in the long term.

TCI has so far deployed Harmonic's METROLink in four of its systems, passing nearly 250,000 homes, confirming sentiment that there is no time like the present to commit to this technology.

The MSO's largest METROLink deployment to date is in its Dallas system, boasting one headend, six hubs and passing more than 135,000 homes. In Baton Rouge, LA, TCI has the system in one headend with two hubs that serve nearly 30,000 homes.

Combined, this technology is actively serving nearly 100,000 TCI customers in Washington. Two of the MSO's five hubs in its Olympia system are outfitted with METROLink, and in nearby Vancouver, it boosts one of the system's two hubs.

Bringing HFC Telephony Home

In the race for telephony via broadband HFC networks, several cable operators are teaming with an alliance that's helping them work toward smarter, faster and better deployment of what is, for most, a new frontier in telecommunications.

Arris Interactive is involved in a joint venture that combines ANTEC's flair for HFC product development, manufacturing, management and distribution with the expertise only a telecom giant such as Northern Telecom (Nortel) can bring to the table. Nortel designs, builds and integrates digital networks for information, entertainment, education and business purposes worldwide.

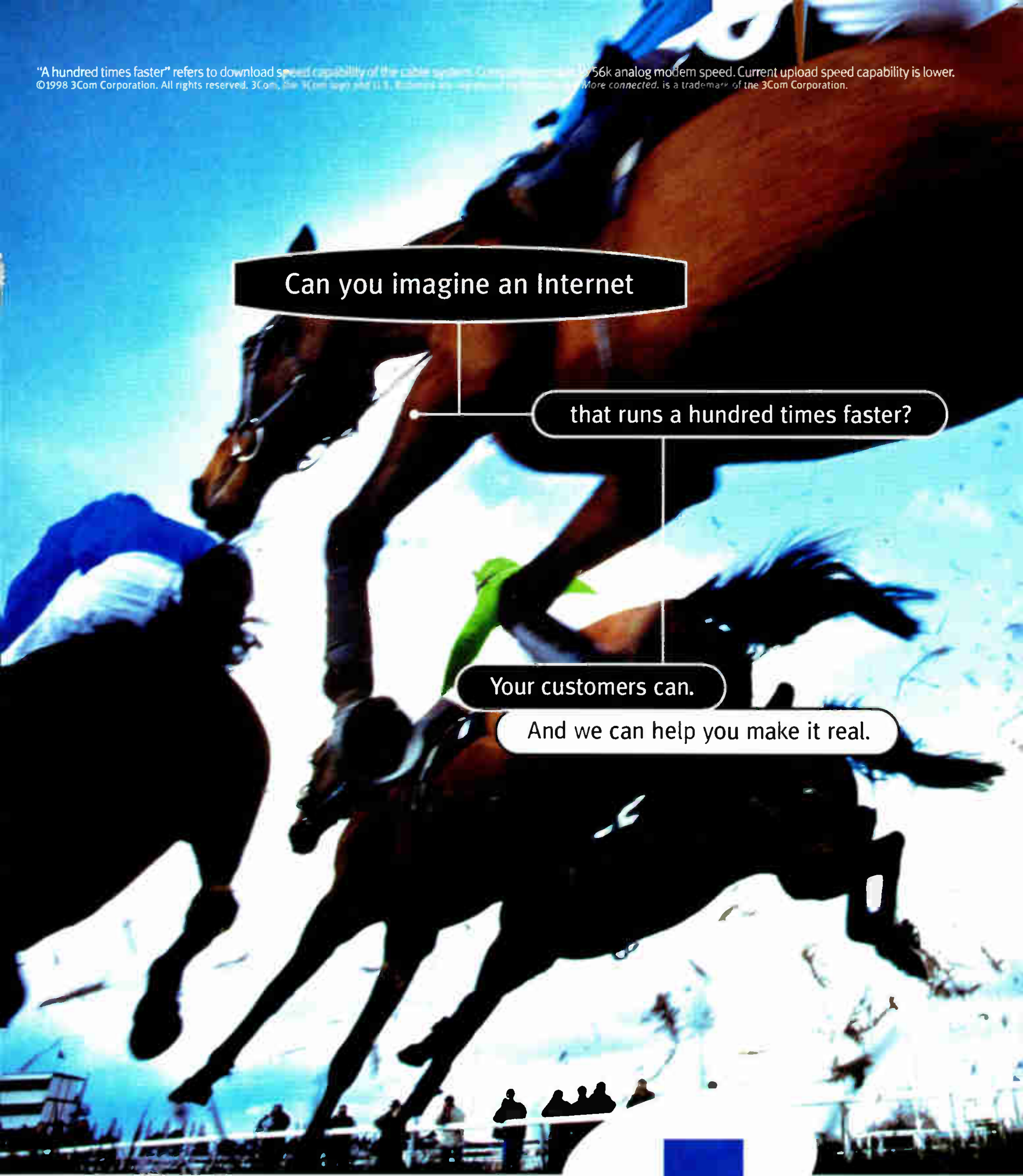
Together, they are selling cable operators on Cornerstone's coax telephony systems. Listed are recent HFC telephony deployments. More than a dozen additional operators are in the planning or testing process to provide HFC telephony service in their systems, Arris officials said.

- With plans in the works for more of its systems, Cox has deployed the service in its Orange County, CA; Omaha, NE; and New England systems.
- Time Warner is providing the service in Rochester, NY.
- TCI offers the service in Hartford, CT.
- Cablevision Lightpath has the service in its Long Island, NY, system. CT

Greta Durr is assistant features editor at "Communications Technology" in Denver. She can be contacted via e-mail at gdurr@phillips.com.

Recent Developments: Who's Deploying What

- TCA Cable TV announced its second major order for Terayon cable modems, this time to the tune of 10,000 cable modems with accompanying headend equipment. Company officials say this brings them nearer to their goal of surpassing 15% cable modem market penetration. A Terayon spokesman attributed part of the product's popularity to the fact that a technician isn't necessary for 80% of installations. TCA's network passes 1.2 million homes in Texas, Arkansas, and Louisiana. The company said the systems will provide high-speed access for both business and residential customers.
- Time Warner Telecom has begun nationwide deployment of branded long distance telephony services under a two-year agreement with IXC. Domestic and international long distance, 800, operator assistance, directory assistance and calling card services also will be available. Under the contract, TW will receive end-user billing, back office support and customer services for its fiber facilities-based competitive local exchange carrier (CLEC) that offers telephone services exclusively to businesses in 19 U.S. cities. Currently slated for long distance deployment are cities in New York, Texas, Ohio, North Carolina, Florida, Tennessee, Wisconsin, California and Indiana.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SCTE Eases EAS Implementation

The Society of Cable Telecommunications Engineers has eased Emergency Alert System (EAS) implementation with the release of its newest training videotape.

"The Emergency Alert System and the Cable Operator," which debuted at Cable-Tec Expo '98 in June, was developed to help cable systems comply with the Federal Communications Commission's revamped EAS regulation. This edict requires that cable systems serving 10,000 or more customers comply with the rules by Dec. 31 of this year.

Under the direction of SCTE Subcommittee Chairman Steve Johnson, representatives from the FCC, FrontLine/IAS, MegaHertz, Sprint North Supply and Trilithic created this training resource to educate cable operators in the intricacies of this EAS requirement.

Johnson comments: "This program has all the information you need on regulatory and technical requirements to prepare for purchase and installation of your system. Even if your system is smaller and not required to participate in these regulations until 2002, now is a good time to begin preparing for implementation."

Topics addressed include:

- Who must participate in EAS
- What EAS participation entails
- When you must participate
- The nature and content of the EAS signal
- Testing of the EAS system
- Methods/techniques of implementing EAS
- Truck switching/spectrum replacement
- Intermediate frequency (IF) switching
- Crawl messages
- Combination of techniques
- Utilizing your existing equipment
- Positive ways to turn your EAS investment into a revenue generator
- What to do next

For more information about this and other SCTE training materials, contact the Society's product fulfillment department at (610) 363-6888, or visit the Society's Web site at www.scte.org.

SCTE Chapters Offer Tech Training

The SCTE will partner with three of its local groups this fall to offer broadband professionals several technical training opportunities.

The SCTE North Country Chapter will host "Telephony for Technicians" on Oct.19-20 in Columbia Heights, MN. This two-day workshop is for technicians and engineers who need to understand the basics of telephone system operations, telephone networks and customer equipment.

This group also is sponsoring "Data Technology for Technicians" on Oct. 21-22. This seminar will offer attendees an introduction to the concepts utilized in deploying data over broadband networks. Program topics include analog-to-digital conversion, modems, multiplexing digital data and more. To obtain further information and registration for either of these North Country Chapter events, contact Dan Shea at (612) 572-9290.

The SCTE Razorback Chapter will host a "Technology for Technicians II" workshop on Nov. 9-11 in Little Rock, AR. This advanced broadband seminar is designed for experienced plant and maintenance technicians, system designers and chief technicians. Topics include mathematical formulas and measurements, amplifier systems, powering, coaxial cable, common cable system faults, system operation and maintenance concepts, as well as signal leakage/cumulative leakage index (CLI) tests and measurements.

The SCTE Piedmont Chapter will conduct a "Cable 101" seminar on Nov. 16-17 in Charlotte, NC. This training workshop was created to give nontechnical personnel at all levels an overview of the fast-paced technologies in the broadband industry. The seminar will take people who have not been involved with the technical side of this industry and give them the knowledge to make sound business decisions.

To register for either of the Razorback or Piedmont Chapter training opportunities, contact Jessica Dattis in the SCTE national conferences department at (610) 363-6888, ext. 239.

For more information about the Society's Technical Training Seminar Series, contact SCTE Director of Regional Training Ralph Haimowitz at (828) 264-8310, or you can e-mail him at rhaimowitz@scte.org.

SCTE Reworks Regional Seminars

Regional seminars represent another way the Society provides training to its members and customers.

SCTE is reworking the content in these seminars to assure they fit more closely with the deployment of new services and technologies. The Society also has added new regional seminars to include "CATV 101" and a "Train-the-Trainer" course.

"CATV 101" can be delivered in a one- or two-day format. The target audience includes system managers, salespeople, customer service employees, financial people and other nontechnical folks. The course explains the basic technical theory of traditional cable system operations and then introduces the new technologies and services that will be delivered over the broadband platform.

"Train-the-Trainer" helps teach trainers and supervisors how to more effectively present training. The course uses SCTE-developed Leader Guides to demonstrate effective training techniques specifically for technical employees.

The Society of Cable Telecommunications Engineers is a national nonprofit professional organization serving the broadband industry's technical community.

SCTE currently has more than 13,500 national members from the United States and 70 foreign countries and offers a variety of programs and services for the industry's educational benefit. SCTE has 72 chapters and meeting groups and has technically certified more than 3,000 employees of the cable telecommunications industry. CT

Interview with a Leader

By Rex Porter

Dr. Strangeleak, Mad Scientist Ted Hartson, Part 2

Ted Hartson

Ted Hartson is so well-known in cable that he hardly needs an opening biographical sketch. From his debut as chief engineer when CableCom General properties were acquired by Cap Cities, Ted moved with other acquisitions and mergers, ending his MSO career as vice president with Post Newsweek Cable in Scottsdale, AZ. Ted's career includes leadership in training engineers and technicians on cumulative leakage index (CLI), chairmanship of the 1995 Society of Cable Telecommunications Engineers Cable-Tec Expo and numerous Emerging Technologies seminars, and induction into the SCTE Hall of Fame in 1995. Following his move from Post Newsweek Cable, Ted formed a research and development company, Scottsdale TV Labs. Part 1 (September 1998) of this interview took us through Ted's early years as a technician and MSO engineer. In this second segment, Ted explains why he left MSO engineering to start his own company and shares his views on the future of cable telecommunications.

Communications Technology: *What happened to lead you away from MSOs?*
Ted Hartson: There was something eating at me all along. I had been successful at managing the engineering group for the company, working with really great people, spending more and more time making business presentations, spending more and more time in operational issues and spending less and less time doing what I like to do—I'm just a radio man at heart.

So I decided at first to take a little bit of time off. I asked my boss (and it's really interesting because I've had some great bosses—leaving Post Newsweek was one of the hardest things I've ever done because I had one of the nicest bosses) for three months' sabbatical. That was sort of, "Take the three months off, you still have a job, you're still our pal, come in once in a while," fully compensated.

However, that period of time absolutely spoiled me. I went back and announced that I was going to leave and did. It's been two or three years. I started Scottsdale Television Labs. The idea here was to do strategic consulting to take advantage of engineering things I knew or thought I knew and to help people look at things technically in a little different light.

Communications Technology: *OK, so you started a brand-new business?*
Ted Hartson: We got into the Labs and had some clients, and we still have some clients, and we enjoy them—at least we try not to chase too many of them away. But we got caught up in our own stuff.

About three years ago, Walt Ciciora and I were traveling in the East, and I said one of the things I would like to work on, that I thought there was an opportunity to take advantage of modern technology and the fact that the old TV spectrum and the NTSC waveform had a lot of green space, like Swiss cheese—a lot of holes in it. I said, "If I could work on anything I wanted, I'd work on that."

Then one thing led to another, and by the winter of that year, Bob Dickinson and I were together, and I said, "Well, I think I know a way to do something in this space," and he said, "I think I know a way to do something with this space, too." I said, "I don't know what your idea is, but

I'm sure mine is better than yours."

We decided we would work on this together. A day later, we decided we wanted Walt Ciciora to be in on the deal with us. So, that's how the three guys put themselves together, first in a company that didn't have a name that we called Calzone. You know what a calzone is—we used to say you never know what's inside until you take a bite, but in this case, byte.

Then we decided Calzone needed a sexier name, so we called it Incamera. My grandmother was a Latin teacher, and when a judge hears something "in camera," they say he hears it "privately, within chambers." So, we bastardized that into a trade name, EnCamera Sciences Corp. That has been taking nearly all of my time for the last two years.

Bob Dickinson and his company have done a lot of development work. We've done a lot of the development work here. Walt has spent endless hours working on the patent. What started out to be a consulting company has now turned out to be my own development company.

Communications Technology: *When did you start loading up your garages with laboratory gear?*

Ted Hartson: 1958. I had a garage, my dad's Battle Creek, MI, garage, and I had all of the stuff that would fit in there. I built a broadcast band transmitter, put about 400 feet of wire on it, didn't have a car, so I talked a pal of mine into going for a ride with me. We drove down damn near to Fort Wayne, IN. We got about 80 miles away from this thing, and we could still hear the alarm clock ticking on it.

That's how I decided I needed a commercial license, so I got one the next year. I mean, that was a real radio. You could walk around in the back yard and see the neon lights come on. That was the first garage. I always had a garage full of stuff.

At the time I invented the sideband interdiction filter that Eagle builds, it was invented in my garage in Scottsdale, which is kind of a "high-toned" neighborhood where people wondered, "What is that madman doing in there?" because in a three-car garage in Scottsdale, AZ, in the summertime it gets to be about 110°. I had a big swamp cooler stuck in the door, and I was working in my shorts.

Communications Technology: *Everyone talks about digital and high definition TV (HDTV) now. What happens to analog TV?*

Ted Hartson: On one hand, you can say that the answer I am going to give you is self-serving. But on the other hand, I would say that the whole vision of EnCamera hiding a digital signal inside of analog evolved from the appreciation that the analog market isn't going to go away. There are 250 million analog TV sets in the United States. There's about 25 digital. That's one more than two dozen.

It's that appreciation that causes me to look at this old TV camera, which was made in 1946. I'm also looking at an old TV set, made in 1948. And they still work on the same standard. They don't get color. They don't get stereo. But they still work on the same standard. The idea that suddenly all of these old TV sets are going to vanish is baloney. I think that analog

TV will be around for a long time.

When I was in the TV shop selling TV sets back in the early '60s, I'd be out running service calls. I'd say, "Mrs. Kupinski, you need a new TV set. Why don't you come down? I'll show you the new color sets. Come down Wednesday night." She'd say, "I don't know if I can come down Wednesday night; I can come down Thursday." I'd reply, "Now, I'm bowling on Thursday night, but if you come down on Wednesday night, I'll show them to you." And you knew damn good and well that you didn't want anybody coming down to see a color TV on any night other than Wednesday because "The Virginian" was on Wednesday night, and there wasn't any other color. At least they could take that TV set home and watch black-and-white on it if they wanted to. But until you reach some critical mass in digital, I just don't know how the digital gets to first base. I don't know how you sell an $8,000 TV set to a customer and tell them that there are one or two channels.

I heard last week that the Jay Leno show is going to be produced in high definition next year. And I thought, "Gee, that's great, except I like David Letterman better." In the old days, when Sarnoff ruled the whole damn world (had NBC, RCA) he had control of so many things. Sarnoff spent $100 million just making the prime-time season of 1967 all-color. And before then, you could just barely give away a color TV set because there wasn't enough programming. But that really caused the up-tick for people to get excited about color.

So when you think about people immediately embracing digital—until there's programming, and then you think about the "chicken and the egg," that there's not going to be programming at outlets until there are sets—it's a more complicated issue. So I think analog is going to be around for a long time.

Communications Technology: *Let's talk about the must-carry rules.*

Ted Hartson: I have to say this. I was caught up in a very contentious period a couple of years ago, dealing with the consumer electronics people on this so-called cable TV interface or cable-consumer interface—and this is a digression, but only for a little bit. Being right in the middle of that, we used to go around the room and introduce ourselves, and I used to say, "Ted Hartson, everybody's friend."

I would like to be everybody's friend, and I think the broadcasters have conducted themselves less than honorably on occasion, and I'm not so sure that the cable TV industry hasn't also. I guess I'd like to be everybody's friend in this regard. It's an extremely difficult position, and what I think about it doesn't really matter.

The one thing is, whoever wins—if the broadcasters win the first round, cable is going to appeal. And if cable wins the first round, broadcasters are going to appeal. There are likely to be several years of litigation so that kids yet unborn may well graduate from college going to school on tuitions paid for by the litigation in this.

Underlying it all should be that the customers should get what they want. If the customers want to get standard definition TV from a broadcast station, piped over cable, they ought to be able to do that. It's an interesting dilemma because cable has a finite resource. We only have so much pipe, and the pipe is already full. Where you are going to carry these additional stations? I don't know.

I listened to Joe Collins talking to the Senate on C-SPAN, and he said that to carry the 14 high definition stations that are expected to be on in New York City, he'd have to take 14 channels off the air. I wouldn't want to be the guy to do that. If I took 14 channels off the air, I'd want to have someone start my car for me.

Communications Technology: *What are your impressions about Bill Gates getting into the cable industry?*

Ted Hartson: Well, $1 billion is a lot of money. But the last time I read, that means he's got 39 of them left. I'm glad Bill Gates is finally interested in cable TV.

About five years ago, we held an Emerging Technologies Conference right here in Phoenix. I was the program chairman, and I got it in my head that I wanted Bill Gates to come and speak to this group. And I begged and cajoled and wrote letters, and the best they could do was come up with Craig Mundie, or Tuesday, or Wednesday or some of the Craigs from their marketing group. So it never happened. I guess we were just slightly ahead of our time.

What does it mean? I know exactly what it means. My old bosses at Cap Cities taught me that lesson well. "He's buying a place by the campfire." Even if he never laid a management hand on his $1 billion investment, Brian Roberts and company would make sure that investment does not go down.

On the other hand, he's bought complete entry to the thought process of the cable TV industry. Having that thought process will allow him to head his future activities in directions that more closely align with cable.

Communications Technology: *With Motorola and Teledesic putting up satellites, what's their future interface with cable?*

Ted Hartson: It's interesting because when I wound up the last comment, I said, "He buys entry and that helps him steer his business." And I was just thinking, "Do I want to get into McCaw, Gates and Teledesic?" I think there is a very real probability both the Iridium and the Teledesic system, at some time, will stream entertainment traffic. Now, whether that entertainment is data or pictures, or both, time will tell.

When I got in the cable business in the mid-'60s, there was this really effete group of the telephone company, which had their own trucks and drank their own coffee and had their own tools and their own building. They were the Teletype repairmen. Some of them talked like God's lips to man's ears, you know. You don't see these guys around anymore because, in the digital world, it doesn't matter too much whether these bits are voice bits or data bits. They are all going through the same wire, and they don't have Model 15s or Model 28s stuck on the end of them.

I think it's entirely likely that anybody who has bandwidth will be into everybody else's business. I don't necessarily believe in the "two wires to every home" solution. There may be two wires in some markets and maybe one wire in one market and a different kind of wire in another market. I just hope the Feds leave their hands off it and let the marketplace work.

Communications Technology: *Do you believe we will soon learn how to tap fiber and have pure fiber into the home?*

Ted Hartson: One reason fiber became popular in cable was that eventually we got to where the transmit equipment was effectively a light bulb, and the receiver was a photo cell. You could shove RF down one end, and when you got it out on the other end, it looked like RF again. It treated the system in an analog way.

Fiber was around; the telephone company was using it many years before we started using it. We said systems couldn't afford the terminal equipment. I think it's a long time before TV sets have S-connectors on them instead of F-connectors. That could happen, but it's got to drive the cost way down. Tom Elliot is fond of saying that any chip only costs $5 if you build enough of them. It's just the trick of building enough of them.

I think the coaxial bandwidth is a sweet bandwidth. It's inherently bidirectional. I guess that 10 years ago, at one of the engineering conferences, a quote that I'd kind of like to be remembered by was, "The cable TV industry has more bandwidth by accident than telephone companies have on purpose." I believe that coax and fiber will have a very long life.

Communications Technology: *And finally, what one technology do you think had the greatest impact on cable TV?*

Ted Hartson: It's hard not to mention the satellite because the satellite gave us programming alternatives we could bring back into the urban markets. In the old days, if you were in the urban markets, you had all the television you could stand. But, if you were in the rural markets, you wanted to get the urban market signals. So there was nothing to sell to the urban markets, pre-satellite.

You can't ignore fiber for its potential to get reliability out to long range service. I was asked that question not too long ago in a different context. I would still answer the same way. I think one of the biggest impacts on the cable TV industry was that thing right there, a hybrid amplifier.

Before then, depending on the spot market on transistors, every other amplifier was a little different from the previous one. There was no consistency in quality. You knew things. You'd say, "That's a good line extender. That's a good trunk station. Those things are susceptible to lightning." You'd go through all these things and no steps. "They are great amplifiers, but they can't handle lightning". Now, starting with the chips, Motorola, TRW, Hewlett-Packard with the gold dot to begin with, that brought about a consistency in the amplifier, which allowed reliability and cascadability. I think it was the hybrid chip and being able to make good low-distortion gain, slope amplifier; these are little things, they're not as sexy as fiber or satellite. But if it hadn't been for the hybrid amplifier, I think the cable TV industry would have languished.

I think the next technological breakthrough will be doing exactly what we've been doing. I think that getting more channels to the customers will always be important. People constantly ask, "How many channels is enough channels?" You remember when three or five was enough. I remember when 12 was enough. I had 12, and I could have a

Tyler weather-watch and a fish bowl and an AP news channel, which was a camera looking at a Teletype machine.

One thing the 30-odd years in cable have taught me is to not try to set the limits for the customer. If the customers want more channels, we should give them more channels. And we should continue to give them more channels until they are unwilling to pay for more new channels.

I think it's not necessarily a breakthrough in cable, but a breakthrough technologically in the home. I think the personal computer (PC) and TV set will get very close together. I'm not sure either one will be the victor. We are always looking for the "killer" application. I never thought that cable TV was a "killer" application. I got into cable because it seemed like something that was exciting. When I was a kid, I thought it was great to play with radios when television was revving up in the late '40s. And, just about by accident, I wound up in the hottest thing happening. I don't know what the hottest thing is to happen next. It may not be in the classic telecommunications field.

When you think about cable TV, in general, God built the ionosphere, Sarnoff built the TV sets, and we didn't even know we needed Jerrold's amplifiers in the middle. We thought it was a complete structure. Then we said: "Wait a minute. If you got a little ionosphere, and you got a little TV set, and then you put a little coax in the middle of it, here's a whole new industry." Consequently, there could be a piece, and I think there is going to be convergence. But I'm not sure that anybody wins. I'm not sure that anybody loses.

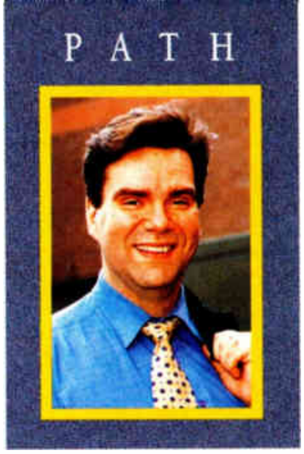
I think that convergence is kind of a melting pot, and I think that trying to sell it from the top down is a huge mistake. I think that Bill Gates' saying people need CE or the cable industry trying to say what you need is a DOCSIS (Data Over Cable Service Interface Specification) modem or an OpenCable set-top converter is selling from the top down.

I think that having grown up in that radio shop I told you about earlier, and having been raised by my grandfathers (one of whom was a barber and the other a butcher—you talk about people in businesses who live or die by the tongue), they listened to their customers because if they didn't listen to their customers, their customers wouldn't be back. I think it borders on shameful, what cable TV has let happen to its image, some of which was because of callousness, some of which was debt service.

I think we should let our customers tell us what they really want, if they will really pay for it, and I think we should get in the back shop and build that hardware. Then I think we should get that "shiny-suit" salesman out and sell that system right back at them. CT

Rex Porter is editor of "Communications Technology." He can be reached via e-mail at tvrex@earthlink.net.

By Alex Zavistovich



Cable Modems: Fanfare for the Common Man

The other day, my lawn care guy told me his company "didn't have the bandwidth" to mow my lawn this week. That's when I knew for sure that cable modems will be a huge success as a consumer product.

Many industry observers have wondered whether the penetration rate of cable modems is growing fast enough to create a legitimate consumer market for the devices. Take it from me, it is.

Technospeak and market awareness

When you start hearing words like "throughput," "bandwidth" and "killer app" being thrown around by the average Joe, you begin to get an idea of how firmly entrenched computers are becoming in American culture. People who don't know a soft boot from a combat boot are talking about "killer apps" for everything from software to cigarette lighters. (For the record, the killer app for cigarette lighters is lighting cigarettes. Let's move on.)

This infiltration of technospeak into popular vocabulary has been around probably since the earliest beginnings of technology itself. Not that far back, when stereo audio came into its own, all of a sudden the phrase "hi-fi" was attached to everything from record players to cigarettes. I'm not kidding. Back in the early 1960s, Mike Wallace was stumping in TV ads for Parliament cigarettes, "with the hi-fi recessed filter."

How can a cigarette filter be hi-fi? Good question. The answer is, it can't, but it doesn't matter. It sounds cool, and someone decided that was enough. Never mind that it doesn't make sense. Since when does making sense have anything to do with advertising?

Hi-fi. Mach speed. Downlink. Cyberspace. When technology gains a foothold, its language passes into popular speech. And that's happening more quickly than ever in the Information Age. The general public has become aware that there is such a thing as "bandwidth," and that having a lot of it is good. Guess what? They're creating their own cable modem market awareness.

The long road to instant fame

The other thing to keep in mind about cable modem development is that there's already a heck of a lot of product out there. I know some analysts may dispute that, but you know what? They're wrong. For proof, you don't have to look any farther than the Sony Mini-Disc.

In consumer circles, people are talking about this latest technological novelty as if it just came out of R&D yesterday. In fact, Mini-Disc technology is at least six to eight years old. It was introduced in San Francisco at an Audio Engineering Society convention. At the time, both Mini-Disc and digital audio tape (DAT) were jockeying for position as an alternative to CDs, with the advantages of cassettes. In fact, marketing at the time focused on prerecorded Mini-Discs. The first commercially available Mini-Disc recording was the last album by Journey; the little plastic-cased goody was polybagged with copies of *Rolling Stone* magazine. Remember that?

Nobody else does, either.

Prerecorded Mini-Discs occupied the same level of hell as New Coke when it came to market oblivion. The bottom fell out of the technology altogether.

Life imitates business

Both Mini-Disc and DAT had to take the same difficult overland route to consumer acceptance: The professional marketplace. DAT and Mini-Disc recorders both became relatively widely used as field recording devices for journalists and radio producers. Ultimately, the DAT developed a loyal following among professional recording engineers, while Mini-Disc changed its marketing strategy from a low-fi alternative to CDs for prerecorded music to a higher-fi alternative to cassette tapes for personal consumer music mixes. That's the real story behind Mini-Disc—not its "overnight success."

So to have several hundred thousand cable modems in the field after three years actually is a pretty big deal. With retail rollouts scheduled through the year, and everybody from your lawn guy to your Uncle Irv talking about "bandwidth" and "throughput," market demand is there.

Another lesson you can learn from the whole Sony Mini-Disc saga is that nothing drives demand for consumer products like professional applications. It's reassuring that cable companies are making a play for the business-to-business marketplace, because if people use cable modems at work, they're more likely to try to get them for home use, too. A little more focus on enterprise-oriented networking can only help matters.

So the next time you hear someone question the long-term viability of cable modem technology, lay the whole Mini-Disc analogy on them. It can take years to be an overnight sensation. CT

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

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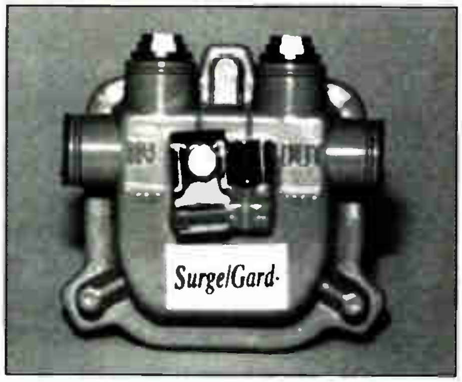

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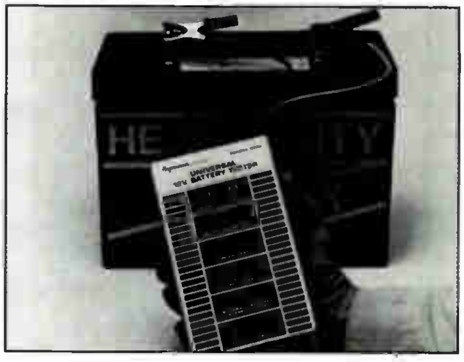

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Reader Service Number 26

By Ron Hranac

Camp Jeep

Lessons in Customer Service

I just returned from a weekend in Colorado's high country where my daughter, her boyfriend and I attended a Chrysler Corp. event called Camp Jeep. This was the first time at Camp Jeep for all three of us, so we really weren't quite sure what to expect.

Held at Camp Hale, CO, originally the training site for the U.S. Army's 10th Mountain Division during World War II, Camp Jeep is an annual gathering for owners of Jeep vehicles. I don't have official attendance figures, but I was told that an estimated 6,000 people and 2,100 Jeeps were on hand, having come from 44 states plus about a half dozen countries.

Before you ask if *Communications Technology* is changing its name to *Communications Technology and Four Wheel Drive Magazine*, read on. There's a point to all of this.

We arrived in Vail, CO, Thursday afternoon, checked in at our hotel, then dropped by the Dobson Ice Arena for the *Business Week*-sponsored "Jump Start" registration event. There, we dropped off liability waiver and photo/name release forms, picked up name tags, and got last minute updates on the weekend's activities.

Early the next morning, we drove to Camp Hale to participate in the first full day's schedule of events, some of which we signed up for when pre-registering several weeks earlier.

Activities by the bunch

The first activity we went to was called Jeep 101, where attendees had an opportunity to drive brand-new 1999 Grand Cherokees around an obstacle course. One fun part about this was the fact that Camp Jeep participants were the first members of the general public to drive the redesigned Grand Cherokee, well before the new model shows up on dealers' lots this fall.

Later in the morning, the three of us attended a photography seminar, which was taught by well-known *National Geographic* photographer Adriel Heisey.

> "Before you ask if *Communications Technology* is changing its name to *Communications Technology and Four Wheel Drive Magazine*, read on."

Camp Jeep had far more activities available than time to attend them all, so we picked several of interest. Among my favorites was a chance to meet with factory engineers to ask technical questions, talk about vehicle likes and dislikes, and discuss ideas for future vehicles.

Company representatives

Several companies that make major components and accessories for Jeep vehicles, such as Dana/Spicer (axles and differentials), New Venture Gear (transfer cases), along with manufacturers of seats, upholstery, audio systems, air conditioning parts, electrical and fuel system components, tires and wheels, and so forth, also had exhibits and personnel in the engineering tent. As you can imagine, I spent a lot of time there.

There was an interesting exhibit of vintage Jeeps that have been built over the years, going all the way back to some of the original MB versions used in World War II.

Yet another tent had several concept vehicles, some of which have been on display at car shows around the country and have been featured in the major automotive publications.

One of the fun ones was a late-model Wrangler with a nitrous oxide injected 5.2 liter V8 engine. Probably not too practical for serious rock crawling, it would nonetheless be a kick in stoplight drags. A representative from the company that builds Chrysler's concept cars said the little Jeep produces about 900 horsepower when the nitrous button is engaged.

Fun times

Friday afternoon, we went on a U.S. Forest Service-guided hike along part of the Colorado Trail a few miles from Camp Jeep. After returning to Camp Hale, we enjoyed listening to a traditional Western/bluegrass band at one of the main tents. In between the day's activities, we spent time wandering through the parking lot, admiring many of the modified Jeeps and gleaning new ideas for tweaking our rigs.

Saturday we went on a full-day guided trail ride (using our own vehicles, of course). Camp Jeep had arranged to provide guided off-highway trail rides on 30 different area four-wheel-drive roads of varying difficulty each day

through the weekend. Being Colorado residents and avid four-wheelers, this sort of activity is regular weekend recreation for our families.

By the way, forget the commercials you've seen on TV showing four-wheel-drive vehicles racing through the back-country tearing up the environment. When I drive my Jeep off-highway, I'm often passed by folks on mountain bikes. This is true for most responsible four-wheelers. Much of the time, you can walk faster than we drive.

Anyhow, our particular group had about 20 Jeeps, and we had a fun time. Saturday evening back at Camp Jeep, we enjoyed one of the weekend's major events, a live concert featuring singer Kenny Loggins.

Seminars

Sunday was Camp Jeep's last day, and we managed to squeeze in a family outdoor survival science course and a friction fire building course. (Yes, they taught participants how to start a fire by rubbing two sticks together, as well as more conventional bow and spindle methods.)

Warn Industries offered a brief but informative winching demonstration, and I spent more time with some of Jeep's engineers. One pleasant surprise occurred when we arrived at Camp Hale early Sunday morning. Officials asked if I would mind parking my Jeep for the day in an area reserved for the display of owner-modified vehicles. That was definitely unexpected.

Camp Jeep offered activities for all ages, including small children. There were a lot of families present, and I can't imagine that anyone didn't have a good time.

Well, except maybe the guy who rolled his Grand Cherokee into the creek near the entrance to Camp Hale. Seems he got distracted trying to swat a bee inside his Jeep. Fortunately, he didn't injure anything except his pride. Heck, he wasn't even able to go back home and boast that he'd trashed his rig on some dangerous four-wheel-drive trail. I suppose that's a bit like going skiing and breaking your leg in your hotel room instead of on the slope.

The moral of the story

OK, now to the point of all of this: building customer loyalty. I came away from Camp Jeep with a good feeling about Jeep's commitment to developing and maintaining customer loyalty.

All of the Camp Jeep staff—from parking area attendants to the factory's engineers—maintained a great disposition during the weekend, were always polite and helpful, and appeared to be genuinely interested in seeing that participants had a good time. I'm on my third Jeep, and after an event like this, I'll definitely consider another Jeep in the future.

Why can't cable operators do something along the lines of a Camp Jeep as a means to build customer loyalty? No, we don't have to go out in the woods and set up four-wheel-drive excursions. But why not do something at the system level over a summer weekend, maybe at the system office or an area mall, where our customers can come and meet the local staff?

Here are some more ideas: Have the system engineering staff available to answer technical questions; bring in reps from the programmers (maybe even a movie star or sports figure to sign autographs); sponsor a concert and a barbecue; set up marketing forums to listen to the good, bad and ugly comments from subs; set up a mini-demo of the cable industry's history; offer headend tours if convenient; even have some good-natured competition similar to Cable-Tec Games.

I'd be willing to bet that most systems could get other local media and businesses to cosponsor some of the activities. Larger systems might even be able to get the help of major media and other companies, much like Camp Jeep's arrangement. Why not try to have the likes of *National Geographic* provide a photographer to teach basic photography seminars?

I think something like this would go a long way toward helping to build customer loyalty. I know Camp Jeep certainly worked from my perspective. CT

Ron Hranac is senior vice president of engineering for the Denver-based consulting firm Coaxial International. He also is senior technical editor for "Communications Technology" magazine. He can be reached via e-mail at rhranac@aol.com.

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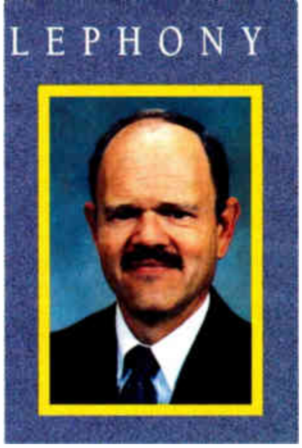
By Justin J. Junkus



Internet Protocol Tidbits

IP Telephony's Challenges and Applications

IP telephony certainly is the hot topic of the year in the industry. So much has happened since the last time this column discussed it in November 1997, that I figured it was time for an update. This discussion comes in two parts: the challenges and the applications. Before we begin, however, a brief summary of what we're talking about is in order. IP telephony is the transmission of packetized voice over an internet. For the fun of it, take the previous sentence apart word by word to get a feel for the technology without being an expert.

IP stands for Internet protocol, which is the set of rules used at the third level of the open system interconnection (OSI) protocol reference model for the communication of data over a set of networks. It is the "universal" set of rules governing the way parties on the Internet communicate with each other. IP includes rules for addressing and error checking or correction.

Telephony, according to Harry Newton's *Telecom Dictionary*, is "the science of transmitting voice, data, video, or image signals over a distance greater than you can transmit by shouting." I would have stopped at voice, but I guess if you include all the things that can go over a telephony modem, I can agree with Newton.

Transmission is the sending of signals over some medium to a destination.

"Packetized" means the content of that transmission has been converted from analog to digital by sampling, quantizing and encoding, and then compressed and put into data "envelopes" (units of data, or datagrams). The envelope consists of a finite number of bytes for information and a header for routing and control. (OK, one level deeper—sampling is looking at the analog data at twice the rate of its highest frequency component. Quantizing is rounding the sample value to the closest value in a predetermined set of numbers you have chosen to represent the range of the signal. Encoding is taking that rounded number and converting it from a decimal number to a binary number.)

> "If the average consumer has to relearn how to make a phone call, IP telephony will remain a hobbyist's toy."

Voice is the range of frequencies somewhere between approximately 300 Hz and 3,400 Hz. (Sure, we know that's only a subset of the "voice" we hear, but this is telephony, not hi-fidelity audio.)

Internet (oops, that's internet with the lower case "i") is a set of interconnected networks. The capital "I" is appropriate only when we are talking about the set of networks accessible by the general public (that is, *the* Internet), as opposed to the ones owned and managed by private parties, with access restricted to employees.

Challenges

Many of the challenges of IP telephony have been solved. Others need more time. Here are some examples of those that are solved or nearly solved:

- Convert a dialed number to an address on a data network nearest to the telephone number's physical location. Several variations of a device called a gateway accomplish this.
- Communicate between the data network and the public switched telephone network (PSTN), including instructions such as when to ring a phone and how to send call progress signals. This one still is being worked out, and although only partial solutions now exist, enough of the pieces are there now to allow basic call setup to occur.
- Packetize the voice information. No problem. The gateway or the user's terminal device can do this now.

All of which leaves the big unsolved problem of sending the packets from one end of a very large network of networks to the other end and reassembling them in the same order they left, without losing

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any of them enroute. This can be the show-stopper, especially on the Internet (capital "I").

How IP works

Here's the reason. The Internet is a hierarchy of networks, which no one entity controls or manages. End users get into the Internet by subscribing to access via an Internet service provider (ISP). ISPs have networks that range in size from one router to a full, national network of routers and switches, such as that of America Online.

The ISP accesses yet another network, called a regional network. These are operated by public carriers. Finally, the regional networks access the national Internet backbone at network access points (NAPs). The backbone network is a high-speed interconnection of the regional networks and is operated by a collection of companies that include Worldcom and AT&T.

Each packet sent across the Internet can take its own path through this hierarchy. Data applications are smart enough to buffer and rearrange the packets as they arrive, and delays in arrival of any one packet are not noticeable because of the buffering and the fact that the intelligence comes to the user as part of a large package of information, such as a page of text. (Think of how you wait for a screen to paint when you search on the Internet).

Regular phone calls

A telephone conversation, on the other hand, is received by humans in a totally different manner. You don't get a page at a time. You get "talk spurts," which may not even be complete words. If you miss more than 25% of them at any one time, you notice "clips" in the conversation. So the packets carrying the talk spurts need to arrive reasonably close to each other. Crossing the network, they contend with other packets, including data packets, for the opportunity to reach the next point in the journey.

Quality of Service

The guarantee that no packet will be delayed more than some fixed time interval is called the quality of service (QoS) guarantee, and the Internet just does not yet have one. On the other hand, internets (with the small "i") do provide this guarantee. Hence, IP telephony works well on private corporate networks and tends to be less reliable on the Internet.

The problem is being studied by many groups, and so far the solution leans toward a "managed Internet," which really is a special case of internet. PacketCable is one such solution.

Real applications

Given that a private intranet is the only solution that guarantees voice quality similar to that of the PSTN, there are still a number of practical applications for IP telephony today. The most obvious is a company that is large enough to have its own voice and data networks.

The traditional way to manage both types of traffic was to have two networks. Voice was routed through switches called private branch exchanges

(PBXs) at the customer's location to the PSTN, and data went over routers and other data switches to the corporate data network. Now, there is a new generation of "un-PBXs" that includes gateway capability, such that voice calls will automatically take the most economical route through either network.

This type of network can be extended as we discussed last month to include work-at-home employees or small remote offices, using a combination of the PSTN, the "un-PBX" and PBX extenders.

Gateway

Gateway technology also is available for network-based switches (those that are owned and operated by a public carrier). These gateways can be on either the access line side or the trunk side of the network switch.

On the line side, they provide a terminating connection for the Internet or internet of choice for calls that have bypassed the PSTN.

On the trunk side, they can be used by the service provider to offer a "least cost routing" solution that provides a choice of using an IP telephony path through an internet or sending the call over trunks on the PSTN.

Don Lemley of Tellabs pointed out to me that this trunk side gateway application is a neat solution for the cable industry to offer, if you look at a situation where the cable operator owns the network switch. It allows for a strategy of offering telephony via a switched architecture over a hybrid fiber/coax (HFC) network, while still offering the subscriber the benefits of IP telephony.

Access to the network switch works the same as it does for conventional HFC telephony. The choice of completing the call at the switch on outgoing trunks via IP or switched telephony becomes automatic. Routing is done by translations in the switch, based upon the customer's stored routing preference for calls to various locations, at various times of day.

Making it user-friendly

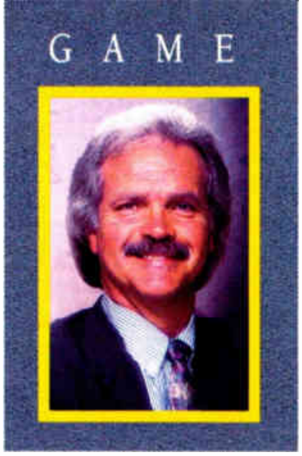
The customer doesn't need any new equipment (such as a new phone set or an adapter between a cable modem and the standard telephone set) because the interface is through the switched HFC system. If quality degrades too much, the switch can provide an alternate path. As Lemley put it, "Grandma can now make an IP telephony call just like any other telephone call."

And that's the bottom line for widespread use of IP telephony. If the average consumer has to relearn how to make a phone call, IP telephony will remain a hobbyist's toy.

On the other hand, if an IP telephone call can be completed with a standard telephone set and no new consumer equipment, we have a saleable product. CT

Justin J. Junkus is president of KnowledgeLink Inc., a consulting and training firm specializing in the cable telecommunications industry. To discuss this topic further, or to find out more about KnowledgeLink, you may e-mail him at jjunkus@aol.com.

By Terry Wright



Modems, Momentum, Money

Some Questions to Ponder

Modems are devices that modulate and demodulate information onto and off of a physical transport medium. Momentum is a force that starts off small and generally lasts a long time. Money essentially is value, and even if you start off with lots of it, it generally lasts only a short time. These three outwardly dissimilar concepts are intimately related in today's cable TV/broadband network operator industry.

The simplest explanation usually is best: With cable modems, an operator can create advanced telecommunications services momentum, which could lead to substantial amounts of money.

Of course, we all know this, and from what I hear, most of you would like to pursue this general formula. With the Western Show right around the corner, the timing certainly seems right to discuss not only what seems to holding most of us back, but also what might be holding us back the most.

Standards evolution

In the August "Data Game," I advanced an argument that technical standards, while very important for enabling vendor independence, lower cost, and some form of a retail distribution model, do not represent a static environment once their impact on the industry is felt.

This simply means that, as have many other standards before it, the Data Over Cable Service Interface Specification (DOCSIS) probably will evolve to define additional features and functionality as technology permits and as the market demands.

A good example of this evolution is Ethernet. It has, since its inception, advanced into Institute of Electrical and Electronics Engineers Standard 802.3, then International Standards Organization/International Electrotechnical Commission 8802-3, and defined various physical media types (10BaseT, 10BaseFL, 10Base5, 10Base2) and performance (100BaseT, 1000BaseT).

"With cable modems, an operator can create advanced telecommunications services momentum, which could lead to substantial amounts of money."

The relevance of how a technical standard evolves, applied to the current DOCSIS 1.0 standard, is at the root of one of the major obstacles to the "modems, momentum and money" route.

Future directions

To prevent any misunderstanding, you should know that I admire what CableLabs has done with regard to mustering support for the DOCSIS standard and initiating the OpenCable and PacketCable efforts. These efforts have played a vital role in helping the cable industry move forward on the data and other advanced services fronts.

However, part of my job is understanding where the industry is going and why, what will characterize its primary value proposition, when it will achieve major milestones, and what obstacles confront it. This line of thinking is behind the "modems, momentum and money" theme. It also raises a few questions for which I can't find rational answers.

I'd like to think that most agree that the cable industry is headed toward a blend of entertainment and advanced telecommunications service provisioning. With its superior transport capacity, it's hard to imagine an area of advanced telecommunications services where cable cannot be a serious player.

However, in order to be a serious contender, the industry must overcome many challenges associated with departing from its traditional business. These range from new disciplines to new business models associated with delivering high quality telecommunications services. Overcoming these challenges will enable the industry to gather momentum in the telecommunications space. Or will it?

Control issues

In the evolution of Ethernet-related standards (and related product implementations), vendors driving implementation of the standards ensured that their products conformed to something called a protocol implementation conformance statement (PICS).

Aside from internal and collaborative vendor testing with each others'

compliant products, there was no formal certification procedure required to claim conformance to published standards. Had there been such a procedure, I firmly believe Ethernet's evolution would have been significantly slower, and it may never have achieved the momentum necessary to become the global standard it is today.

I believe the effort invested by so many in DOCSIS merits the same potential for global success as Ethernet. Indeed, modems compliant with DOCSIS should help the cable TV industry achieve serious momentum in the advanced telecommunications services space. But will the industry be robbed of this potential momentum by the process imposed by a CableLabs-controlled certification procedure?

Questions to ponder

As I mentioned earlier, I have several related questions for which I can find no rational answer. Given that we expect DOCSIS to evolve, as did Ethernet and many other standards before it, as the market identifies (and technology enables) new features and functions, here are the questions for which I can't seem to find good answers:

1) Considering the absence of such a certification procedure with other successful standards such as Ethernet, why is a certification procedure required for DOCSIS?
2) Since being the first vendor to complete the CableLabs certification process will give that vendor an advantage in the marketplace, how is the sequence of vendors undergoing the process determined?
3) As DOCSIS evolves, are we to expect each new vendor offering to have to undergo a time-consuming "re-certification" process against evolved versions of DOCSIS (with development of new test suites and test beds implied)?
4) How does the certification procedure help generate momentum for the cable industry in advanced telecommunications services?

Terry Wright is chief technology officer at Atlanta-based Convergence.com Corp. He can be reached at (770) 416-9993 or via e-mail at tlwright@convergence.com.

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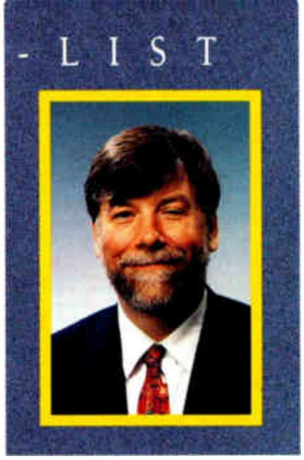
By David Devereaux-Weber



How to Use List Archives

This is my second column about SCTE-List, an Internet e-mail list for the discussion of cable TV topics. The big news this month is the upgrade to the Listprocessor software and the computer that runs the List.

The previous system has been unchanged in the four years that SCTE-List has been running. The new systems will improve reliability, speed up the flow of messages and offer a World Wide Web interface.

Archives

Last month, I promised to discuss several archives of SCTE-List messages. One of the shortcomings of e-mail lists is that once messages are sent out, they are stored on your computer. If you try to keep copies of all of the messages, they will occupy a significant amount of space on your computer. Another problem is how to see messages that were sent by others on the List before you subscribed. To solve this problem, List messages are archived. There are four archives that I know about:

- The listserver itself
- The Cable Addict's Broadband Lounge, www.cabl.com/
- Reference.com, www.reference.com/
- Core Networks Archiving and Retrieval System (CARS), www.corenetworks .com/scte

Using the Listprocessor

The Listprocessor keeps archives of messages and has features that allow these archives to be searched. This is done by sending commands to the Listprocessor in e-mail messages. For example, we recently had a thread of messages about using citizens band radio as a tool for finding ingress in the upstream spectrum of a cable system. The subject line of that thread was "Return Aberrations."

To get a list of all the archives that contain messages with that subject, send the command find scte-list "Return Aberrations" to the address listserver@relay.doit.wisc.edu. You will get a message back from the listserver listing the monthly archives that contain the keywords.

For example, the messages containing those keywords might be in archives 9807 and 9808. Send the command get scte-list 9807, 9808 to the same address, and you will receive those archives. Then you will need to search the individual archives for the messages.

As you can see, using an e-mail user interface is not the easiest method of searching the archives. (The new version of the Listprocessor has several World Wide Web features, but we haven't yet turned on the archive interface features.)

Web-based archives

Since the e-mail List was invented, the World Wide Web has burst upon the Internet. A graphical user interface with hyperlinks that can search for individual messages is much easier to use than the crude method built into Listprocessor.

There are three World Wide Web archives of the SCTE-List that I know about. Rick Goldeck was the first to offer a Web-based archive of the SCTE-List. It's on his own Web site, the Cable Addict's Broadband Lounge, www.cabl.com/. There is no official connection between these other Web sites and the SCTE-List. Web site operators like Goldeck run their archives without remuneration in hopes that users of the utility also will learn about their companies and products.

Reference.com, www.reference.com, is another SCTE-List archive. This site hosts archives and a search engine for e-mail lists and USENET news groups. They are advertiser-supported.

Core Networks Archiving and Retrieval System (CARS), www.corenetworks.com/scte, is another advertising-supported archive with search capabilities. Again, there is no official connection between Core Networks and the SCTE-List. Core Networks' site has an unusual twist—it puts e-mail addresses in a graphics file to prevent "spammers" from harvesting e-mail addresses for sending out bulk e-mail "junk mail," also known as spam.

Happy birthday

Jonathan Kramer passed along greetings on the fourth birthday of the SCTE-List. Jonathan posted the first message on August 11, 1994. Thanks to Jon and all our subscribers for your continued support. CT

David Devereaux-Weber, P.E., is a network engineer at the University of Wisconsin-Madison. He is a senior member of the SCTE and can be e-mailed at djdevere@facstaff.wisc.edu.

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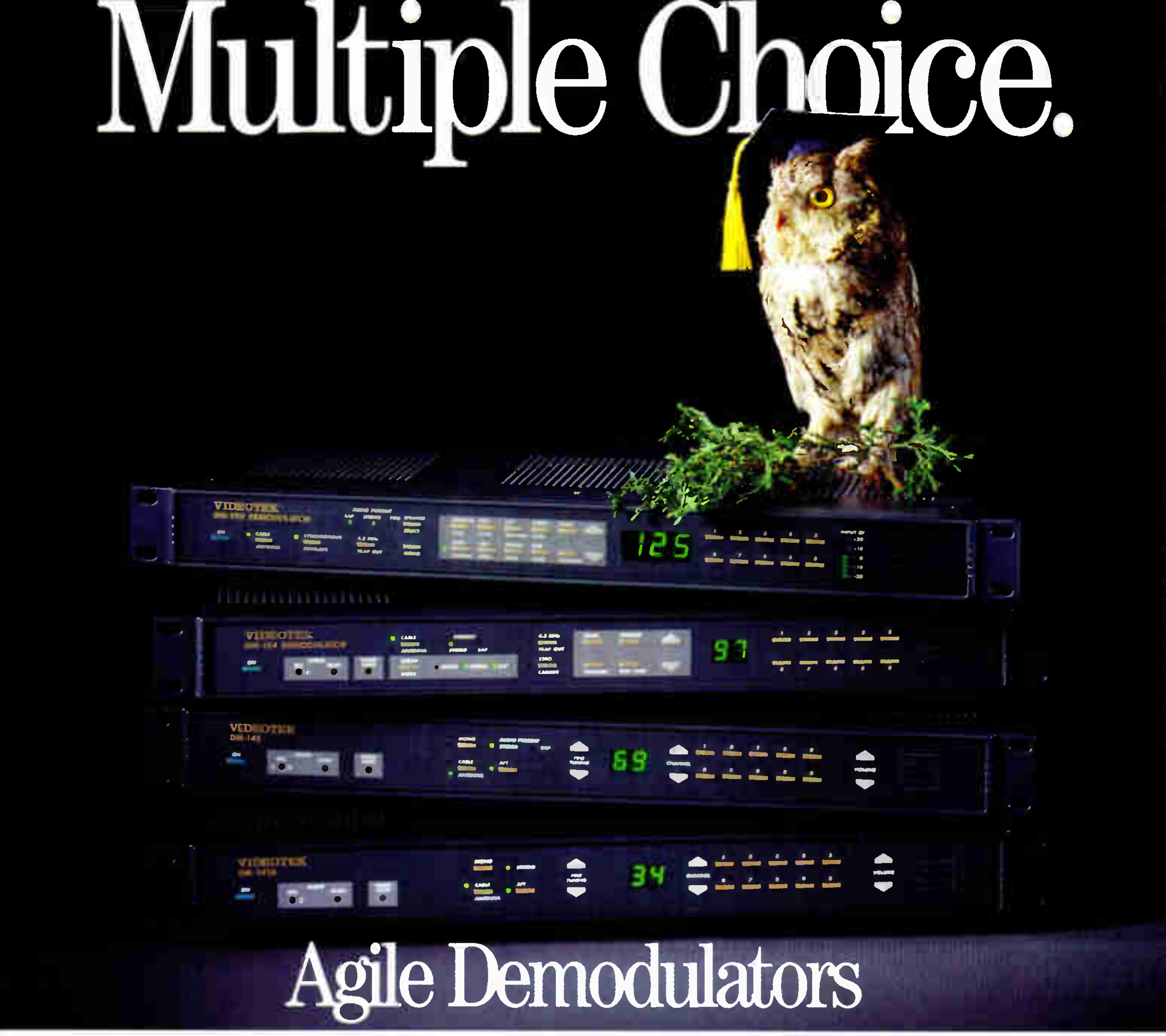

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Reader Service Number 36

By Alan Babcock

Technology Improves Training

Computer Platforms Augment Instructors

Computer-based training (CBT), compact disc read-only memory (CD-ROM) training, computer aided instruction (CAI), Web-based training, and other technology-based platforms are the latest wave of efforts to improve the world of training. Some of these have been available for several years, while Web-based training has become available on a wide scale only in the last couple of years. I remember attending a symposium in the late 1980s where CD-ROM and CBT were demonstrated by military contractors.

CBT and CD-ROM training are very similar. They really differ only in the storage medium used for the training content. CBT generally refers to a training program that has been completely stored on a computer hard drive, while CD-ROM training operates from a disc like many games. The CD usually holds the video and audio segments for the training because of the significant storage needed for digitized video. Similar learning experiences can be expected from either CBT or CD-ROM.

Computer enhancements

The advantages of CBT and CD-ROM training are many. The best programs provide simulations of job tasks that provide practice opportunities. For example, one CBT program from Scientific-Atlanta trains technicians to align trunk amplifiers. Another program soon to be released by the Society of Cable Telecommunications Engineers presents several opportunities to practice troubleshooting skills.

These types of programs use graphics and text to prompt the student through appropriate steps as the training is presented. Students then practice the various actions on their own and get immediate feedback from the program about how they are doing. The obvious strength of this training lies in the ability to practice tasks that normally would require space, equipment or disruption to customers. Learners progress at their own pace without the fear of peer ridicule that can occur in classroom settings.

> "These types of simulations can prove very valuable and are improvements on the old classroom technique of role playing."

Other CBT and CAI programs may be used to enhance traditional text-based education. The "Telecom Technologies" and "T1 Basics" programs available from SCTE are examples of CBT used to provide knowledge rather than specific job skills.

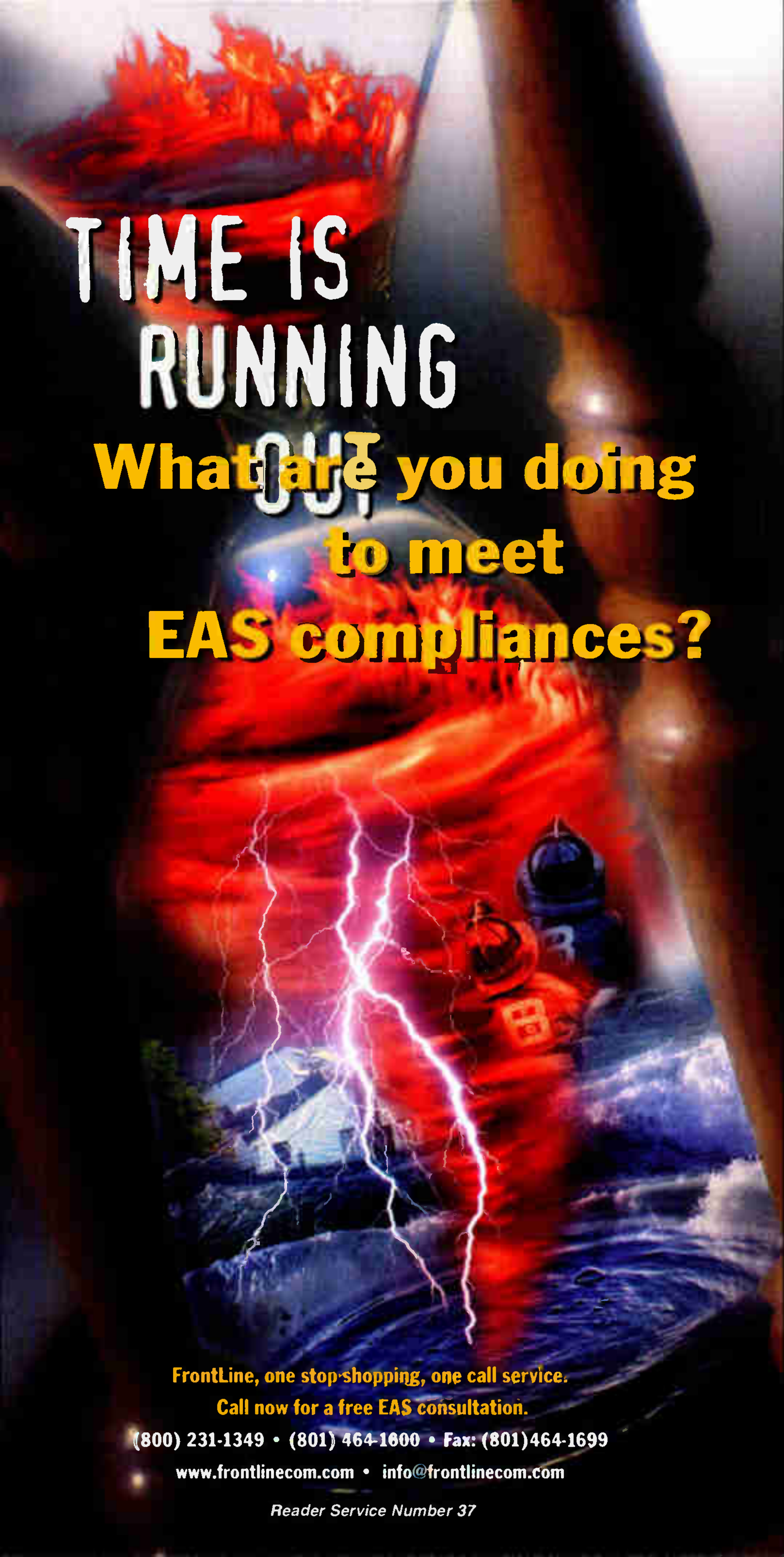
Programs of this nature add animated graphics and immediate feedback as the student progresses through the course. The programs tend to be text-intensive, but the additional animation and interactivity make the program more enjoyable. The student is encouraged to successfully complete one section before moving on. This ensures that the participant actually learns the material and makes this type of training more effective than books alone.

CD-ROM training usually takes CBT to another level of sophistication by adding video. While CBT frequently includes audio or animated graphics, CD-ROM or newer digital versatile disc (DVD) programs can add full motion video to further enhance the training experience. This addition of video can be utilized in many ways.

Some of the most effective CD-ROM programs I have seen provide a type of interviewing between the student and an expert on the screen. As an example, I have experienced one program where the student had to take a "final exam" by interviewing different potential customers and finally selecting the appropriate telecommunications solution for their combined needs. If the student failed to ask the right questions, the final solution would be incorrect.

These types of simulations can prove very valuable and are improvements on the old classroom technique of role playing. Highly sophisticated programs today even allow audio interactivity through a microphone.

For example, my son uses a CD-ROM program to learn Spanish. He listens to the pronunciation and speaks back to the computer through a microphone. The computer provides feedback through a graph showing how closely



The winds of change are upon us. On December 31, cable and wireless operations must be in compliance with the new Emergency Alert System requirements. For you, it means more work and some new equipment.

Don't panic.

FrontLine has everything you need. We're the EAS specialists, and we can advise on and supply the best solution for your operation—whether it's baseband switching, IF, text messaging or a combination of these.

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FrontLine is dedicated to innovations in EAS technology. For instance, we are the only company offering a Digital EAS system. And we're rising to new levels with Audio-Tag™, providing revenue generating sponsorship of EAS tests and alerts as a standard feature, and FrontPager™, an automatic EAS paging system.

FrontLine: the source for all your EAS needs.

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COMMUNICATIONS
MAXIMUM INFORMATION
MINIMUM INTERRUPTION

his pronunciation matches the computer. The graph scale is marked in novice, tourist and native scales.

The Web

The popularity of the Internet and intranets has expanded delivery of technology-based training programs. The Web also has added the capabilities of real-time audio and video. Virtual classrooms have been created via the Web. Distance learning has expanded, and the creation of a virtual classroom no longer depends on expensive video teleconferencing equipment and long distance phone lines.

A virtual class is created with a camera and microphone at any computer terminal. An instructor can present the course content through the Web using a rapidly growing set of software tools. The instructor can see participants and hear their questions.

Tools also are available to allow the instructor to draw or write on a virtual whiteboard visible to the students at their terminals. Students can even write questions or edit the information on this whiteboard, and all other students can see the comments.

The Internet certainly has impacted the way the world communicates. We have only begun to experience what the Web can do for training.

In a nutshell...

All of these technological solutions to training have advantages. They:

- Provide consistent delivery of the training
- Provide opportunities for immediate feedback
- Encourage self-paced study and comprehension of each topic before moving on to new information
- Usually include tracking tools so students or a trainer can track progress and mastery
- Expand the ability of an instructor to share knowledge without being physically present in a classroom

Technology also has its disadvantages, however. For example:

- It can be expensive to author programs to be delivered via any of these formats.
- Unstable Internet connections can easily cause students and instructors to lose contact.
- Students must have access to the appropriate computer hardware.
- Students may not have the ability to get immediate answers to questions if those answers have not already been programmed into the training.

While technology will not soon replace the need for the stand-up instructor, the application of technology to training delivery certainly is improving the ability to get information to a more diverse student population. CT

Alan Babcock is director of training development for the Society of Cable Telecommunications Engineers. He can be e-mailed at abacock@scte.org.

The End of the World as We Know It?

By Laura K. Hamilton

Have you seen this acronym yet? TEOTWAWKI: It's one of those trendy terms that's been popping up on the Internet lately. According to many who use it, the end of 1999 will signify "The End Of The World As We Know It."

And if you look at some cable operators' plans for 1999, it does seem that, at least in part, TEOTWAWKI—in a positive way, that is—certainly could happen on the cable technology section of the planet. If all the system upgrades and advanced services deployment plans operators have in the hopper happen, the world of cable engineers and technicians in '99 could be extremely different from the world that came before it.

But before we get to that, let's look at the TEOTWAWKI acronym a little more closely, and Y2K.

Are you Y2K-ready?

TEOTWAWKI is actually born of the Year 2000 Bug scare, Y2K. Some hardcores have started hoarding food and heading for remote bunkers encircled with barbed wire. They fear crashing computer systems will take down practically everything from transportation to the electrical system to the stock market to military systems. They fear TEOTWAWKI—in a very bad way, that is.

Others, including the head of President Clinton's Year 2000 Conversion Council, reportedly have made predictions that a lot of people won't even notice when we roll over to the Big Double-0.

By now, you know that Y2K anxiety comes from the fact that unless the "00" glitch is taken care of by the end of 1999, significant ambiguities could cause "choking" by hardware and software systems that store the calendar date using only two digits.

But what does this mean as cable operators make their plans for '99? Since it's the last chance to take care of this 00 business before it's upon us, engineers and their equipment vendors have lots of questions to ask about their hardware and software.

Will automated test equipment used for logging outages and checking Federal Communications Commission proof-of-performance asphyxiate on the two zeros? Will commercial insertion systems fail to insert ads? Could addressable decoders authorize incorrectly? Will pay-per-view (PPV) orders have bloopers on the date/time stamps? Will scheduling software slate installation appointments incorrectly? And so on.

As for commercial insertion, Doug Semon, director of network operations at Louisville, CO-based CableLabs, and staff liaison to the Labs' Y2K working group, says he understands that all the newer digitally based server systems are either already OK or can be very quickly and inexpensively upgraded to be Y2K-ready. He's less confident about the older analog systems when he adds, "My sense is that this will be a trigger mechanism for some of them to be replaced with server-based systems."

Semon does point out that it isn't CableLabs' role to make Y2K compliance announcements for any particular vendors' equipment. But in general, he says that it's all basically good news when it comes to addressable set-top boxes, emergency alert systems and cable modems. For the most part, they seem ready for the next millennium, mainly because they all are of relatively recent vintage.

T&M equipment is looking good as well. "Personally, I think the test equipment manufacturers are all in really good shape right now," says Semon. He explains that vendors can easily ship new firmware that can be popped into signal level meters (SLMs) or spectrum analyzers to squash the Y2K bug.

"That's quite a different scale of a problem than having your billing service provider come out and basically redo all the software on your mainframe billing system, or upgrading the addressable controller or its software or both to be compliant," points out Semon, "You don't just stick a floppy disk in the drive and reboot the system controller and think that your addressable system is going to be OK."

Despite the complicated nature of Y2K in cable, Semon says he's very optimistic, based on vendor responses to Y2K and his knowledge of what CableLabs members are doing. ➤

Skill sets required for new headend and NOC equipment, like MediaOne's (pictured above and inset), demand an entirely different approach in the world of cable telecommunications training.

The Word on Training in 1999

Thomas Gorman of Jones Communications says: "It's difficult to find new associates for business as usual, let alone new technologies. In some cases, we're 'growing our own,' and in others we're able to find people from other high-tech industries."

"Programs have to start to move to competence-based training," says TCI's Tony Werner.

Marwan Fawaz of MediaOne says: "Staffing has been our biggest challenge. We're competing with a lot of high-tech companies for new talents to support new services."

Alex Best of Cox Communications says his greatest fear for cable is a shortage of trained technical workers.

But he does add a caveat: He thinks it would be naive to say that there won't be any problems. And it would be unwise to say that nothing will be overlooked or that there won't be some implementation errors.

However, Semon believes that the cable industry is ahead of Y2K game compared to others. "From what I've seen and read of other industries, I think we're in pretty good shape here, but it's going to require some effort. It's not trivial."

In particular, older cable equipment could pose some of the more hulking Y2K difficulties. First off, consider that some vendors that made certain products are no longer in business or no longer produce the equipment. "Frankly, there are some things that are not going to be able to be upgraded. They're going to have to be replaced," notes Semon, "But in all of those instances, and I'm not aware of a single exception, there is a functional equivalent available on the market today."

As an example, he cites character generators. While many companies have been in that business over the years, only a handful remain today. "There are a whole bunch of character generators that we own that cannot be upgraded. They will

TIMES-LINE

Times Fiber and the Cable Industry Celebrate their 50 Year Anniversary

1948

Times Wire and Cable is Established! First supplier of coaxial cable to the CATV industry.

1968

Times introduces low-loss cables to the industry.

1969

Times introduces copper clad center conductors saving the industry millions of dollars.

1976

Times introduces first commercial fiber optic system for CATV use, installed in NYC, using fiber manufactured by Times.

1978

Times Wire and Cable announces name change to Times Fiber Communications, Inc.

1979

Times advances dielectric state-of-the-art by introduction of low-loss gas-injected foamed polyethylene dielectrics.

Times develops 400 MHz expanded coax for CATV.

1981

Times establishes the world's first fiber optic earth station link.

Times introduces the fiber based MiniHub I.

1983

Times is first to introduce triple bonding for coaxial cable.

1984

Times is first to introduce a full line of CATV coaxial cable with 600 MHz capability.

1985

Times introduces lifeTime, its exclusive non-flowing floodant for aerial, underground and indoor applications.

Times introduces TX low-loss coaxial cable.

1986

Times leads the industry again in introducing a full line of 1GHz cables.

1996

Times is first to develop RF capable 50 Ohm coaxial power cables for the CATV industry.

1998

50 year anniversary of Times Fiber Communications, Inc. and the cable industry.

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have to be replaced, but the good news is that you can go out today and buy a more capable and very inexpensive character generator," says Semon.

The real problem could be budgeting for these types of equipment buys. Have you stopped to think that you might have to replace three character generators in 1999?

You should already be working on Y2K

Semon's bottom line on Y2K is to encourage cable engineers to work interdepartmentally within their systems on Y2K.

"I would feel very bad if anybody assumed that everything was going to be taken care of for them by CableLabs or anybody else," Semon says.

He emphasizes that you need to be very proactive in 1999, and as a matter of fact, you should already be working on Y2K issues. Do an inventory of everything you have. Check out vendor and supplier responses to CableLabs' request for information on Y2K at www.cablelabs.com. Contact your vendors directly.

"When it comes right down to it, most of this work is going to be done at the cable system level, not at headquarters, and not here in Louisville," stresses Semon.

Digital and two-way

Besides Y2K, cable's technical community obviously has plenty of other issues to think about in '99. Upgrades to higher bandwidths. Digital deployments and digital must-carry. Competition. Two-way services like high-speed data and Internet protocol (IP) telephony.

Plans for hybrid/fiber coax (HFC) upgrades and talk of 750 MHz abound, and digital deployments should continue at a quick clip. Time Warner Chief Technology Officer Jim Chiddix reports, "We're now preparing for a vigorous 1999 launch schedule by deploying digital headends in a significant number of our systems by this year-end." TW plans to introduce advanced services in stages, which includes video-on-demand (VOD) on the agenda.

And digital must-carry issues will continue to be a focus. TCI's Executive Vice President of Engineering Tony Werner sums it up with, "Must-carry could be detrimental in certain markets, especially if it comes at a time when bandwidth burdens are high such as one channel of high definition (HD) per 6 MHz, instead of three to four channels per 6 MHz, which is where cable systems should operate."

In addition to the digital buzz we'll hear in '99, excitement over two-way services will grow louder. TCI's John Malone recently said that he expects data services to explode around Thanksgiving, which will in turn facilitate subsets of the technology, such as IP telephony.

And TCI's Werner predicts, "Two-way activation in 1999 should reach an all-time high."

Other MSOs also seem on the two-way fast track. Senior Director of Engineering Thomas Gorman at Jones Communications reports, "We're planning on implementing two-way services across approximately 50% of the systems in '99, with the remainder completed in 2000."

"All of our 1999 upgrades will be two-way active," says Marwan Fawaz, vice president of engineering, western region, at MediaOne, "By the end of 1999, over 60% of our network will be two-way certified for telephony and high-speed data."

As for an industry ballpark estimate, Coaxial International Senior Vice President of Engineering Ron Hranac guesses that 30% to 40% of systems will have some two-way capability by the end of 1999. "And it may even be as much as 50%," he says, suggesting that by 2000 or 2001, we'll see the majority of cable systems offering some kind of two-way operation.

Training is tops

But with all these exciting plans, there comes most a need for training. And judging from the fact that virtually every engineer interviewed for this article named training as a main area of concern for 1999, it's topic that's at the very forefront as they plan the year.

At the last Society of Cable Telecommunications Engineers Cable-Tec Expo, Alex Best, senior vice president of engineering for Cox Communications, confessed that

his single greatest fear for the industry is shortage of trained technical workers.

And Best isn't alone.

Fawaz of MediaOne says, "Staffing has been our biggest challenge. We are competing with a lot of high-tech companies for new talents to support new services like digital."

Comcast's Jim Kuhns, midwest regional director of technical services, agrees: "Staffing is the most critical issue we face as an industry. Networks have become so complex, and the skill sets to maintain them so diversified, that it is no longer feasible to have one person who can maintain the network from end-to-end."

Kuhns explains that many new people in the industry have not come up "through the ranks" and don't have "headend-to-house" understanding that other personnel have. "This tends to create a tiered caste structure of employees that can sometimes be detrimental to operations."

With the rapid state of technical change, BellSouth's Keith Hayes (who nabbed this year's SCTE Member of the Year Award) warns, "Today's operator that scrimps on training will be tomorrow's embattled competitor."

"Train early and train often," Hayes advises.

Perhaps Coaxial International's Hranac puts the whole training/staffing issue most concisely when he quips: "This is a major problem. Can you say paradigm shift?"

Training plans

So what's being planned to take care of training?

"Programs have to start to move to competence-based training, whereby we are certain that an individual is capable to perform the task they are assigned," recommends TCI's Werner. "If they can be there with minimal training, great, but at the same time if they cannot perform the task even after extensive training, then we need to get them onto something else."

Staffing concerns at Suburban Cable outside of Philadelphia have exponentially accelerated the pace of hiring and training efforts. Christopher Patterson, vice president of engineering there, reports that a mix of smart hiring, in-house training and utilization of third-party labor is key. "Within our Information Services group, we have the networking skills as well as the Internet skills. Our field operations have been in training, and we have utilized contract labor to address computer skills."

The time required to "learn from scratch" has become unacceptable, says Comcast's Kuhns, because of competition and the pressure to deploy a new service first in a market. He suggests vendors as an excellent resource so you're not starting from square one: "Vendors can help you supply this training to your staff since nobody knows their equipment like they do."

In addition to the training that manufacturers can supply, it looks like the SCTE will continue to play an important educational roles, especially at the local level. Hugh McCarley of Cox, who's also SCTE chairman, encourages all engineers and technicians to get involved at the local SCTE chapter level as an excellent way to keep up their knowledge base. He suggests that there is no better value for your "training dollar" than to take advantage of these local meetings.

In addition to putting more dollars toward training, you've got to think about putting more dollars toward paying technical staff who probably should have more education from the day they start as "entry-level." And as BellSouth's Hayes puts it, "How do you sell a vo-tech school graduate 24-hour-a-day operation, pole climbing in all weather, surly customers and productivity demands when he or she can likely make the same or more money installing network cabling or troubleshooting auto electronics in an air-conditioned office or shop?"

"We're going to have to be going after graduates of two-year electronics schools," says Coaxial's Hranac, "We're going to have to pay them more. But if these data services and cable modems generate the additional revenue that we think they're going to, that training is going to be easily paid for." CT

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

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Reader Service Number 45

Get Smart

Education Picks for the New Technology Engineer and Technician

By Laura K. Hamilton

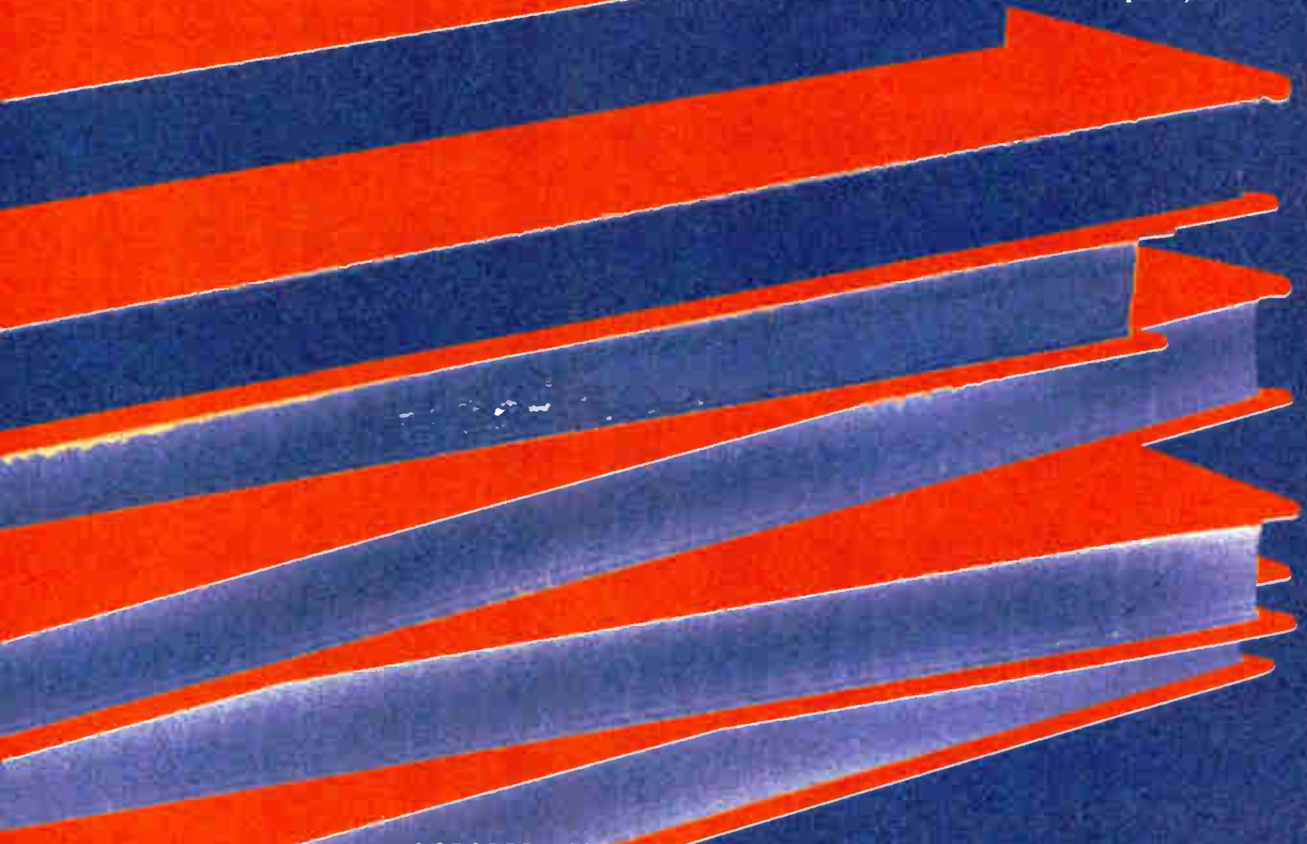
The cable engineering community is clearly stewing about advanced training issues. It seems that you can't swing a piece of coax at any industry confab without hitting a speaker who ends with, "But we've got to make sure our work force is trained correctly if anything I've just talked about is going to happen."

And they're not just talking about training installers here. Everyone, including chief techs and vice presidents of engineering, know they've got to keep their knowledge base up or get left in the digital dust. However, time set aside to read the trade publications, and dollars tagged for attending technical conferences, often are taken back by the immediate concerns of actually running your system today. You've got to pick and examine your educational opportunities carefully from an overwhelming number of choices.

Certainly if you're serious about staying smart in this engineering atmosphere, you do your best to attend the Society of Cable Telecommunications Engineers Cable-Tec Expo as well as the Emerging Technologies Conference. And if you've checked the industry classifieds lately, you'll notice that more and more cable telecommunications employers ask for SCTE Broadband Communications Technician/Engineer (BCT/E) certification. These are some of the obvious picks for advancing your cable know-how, but what are some of the less obvious ones?

Picks for engineers

Alan Babcock, SCTE's director of training development, quickly lists



off several opportunities at smaller conferences and meetings when asked for his "don't miss" picks for upper level engineers. These include:

- Get involved at standards meetings. Specifically, Babcock touts the Hybrid Fiber/Coax (HFC) Management and Control Interoperability Specification Standards Group (formerly known as the OSP Alliance) that is trying to create standards for interoperability among status monitoring and network management devices/software. *(Editor's note: HFC-MCIS is not an SCTE standards body, but it has begun the application process to become one.)*

  "We can't continue to rely on calls from our customers to let us know we have a network service problem," says Babcock, "We also can't continue to sit back while manufacturers and vendors try to create new legacy systems that won't communicate with other platforms."

  Babcock recommends these types of standards meetings as an important resource for staying up to date. If HFC-MCIS isn't one of your main areas of interest, Babcock points out, "Other standards work is extremely important as well, and issues are broad enough that anyone can find something that should interest them."

  For more information on getting involved with standards groups, you can point your browser to SCTE at www.scte.org and CableLabs at www.cablelabs.com.
- Attend CableLabs Summer and Winter Conferences. These conferences are exclusive to CableLabs members (unless you want to pay an extremely high registration fee for nonmembers). Babcock recommends them because, "the forward-thinking folks at CableLabs generally do a good job of presenting the short- and long-term future of where technology is taking us."
- Speak at a regional SCTE seminar. "I have always held that the best way to learn something is to have to teach it to someone else. You can learn a lot by attending local or regional activities hosted by SCTE, but you will learn even more by volunteering to teach or present information at one of these meetings," Babcock says. "Chapter meetings can be used as warm-ups for formal presentations you may make at larger shows," he adds.

Speaking of larger confabs, Babcock recommends a couple that aren't always thought of as "musts" in the technical arena. These include:

- The Western Show. "This show has the tradition of being a 'programmers' show,' but many new technologies and technology applications are often premiered," explains Babcock. Particularly, he points to the CableNet exhibit at the Western Show as a valuable resource for understanding some of the long-range thinking that is going on in the industry.
- Consumer electronics shows. "The cable industry has learned that we need a better relationship with the consumer electronics people," Babcock says, "Likewise, they realize they need to deal with us to make all of the enhanced services work for the consumer."

  Obviously, the two industries will learn more from each other if engineers from both attend each other's shows.

Finally, Babcock asks: "When did you, the engineer, last attend an installer or service technician training class? Installers and

technicians (many of whom don't even have a personal computer at home) are trying to install the latest services and explain them to customers." Babcock adds, "It's very valuable for the engineers to occasionally spend time with the troops."

Picks for advanced technicians

OK, so there are some good resources if you're an engineer, but what about the people who work for you out in the field?

If they're beyond the installer, installer/technician or service tech level and looking to take the next step, the National Cable Television Institute is an excellent resource for pushing cable telecommunications knowledge higher.

Of particular interest to advanced technicians are the following:

- System Technician. "Activating, Testing and Troubleshooting the RF Trunk Distribution System." This follows the NCTI's Service Technician Course. It teaches a trained NCTI service tech how to activate, test and troubleshoot the RF distribution system. It also covers RF trunk and distribution amplifier theory of operation and setup procedures and more.
- Fiber-Optic Technician. "Fiber-Optic System Design, Installation and Maintenance." Among the knowledge this course provides is current information on fiber applications, rack-mount optical transmitters and receivers, forward and return optical node operations and activation, fiber-optic design topologies, fiber system design, fiber construction, tests and documentation, and optical test equipment.
- Advanced Technician. "Communication Electronics and Maintaining Headend Equipment." This teaches a trained NCTI system technician the essentials of how to set up, operate and maintain the headend. The assumed cable system knowledge/skills for enrolling in this course are those in the NCTI System Technician Course.

> "You've got to pick and examine your educational opportunities carefully from an overwhelming number of choices."

For enrollment information or details on other techniques and principles taught in these courses, contact the NCTI at (303) 797-9393. CT

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Reader Service Number 48

Two-Way

RETURN PATH '99

How to Test for the Three Major Types of Interference

By Chris Loberg

Many cable systems have big plans for deploying two-way services this next year. And one of the biggest challenges to making that happen is interference. Interference is the single biggest threat to the return path operation, especially for digital services. Although digital signals are robust, they do not degrade gracefully like their analog counterparts. That means they either work or they do not, making it imperative that any threats to the digital signal integrity in the return path be quickly and effectively corrected. ➤

For example, sufficient interference can cause telephony transmission over the hybrid fiber/coax (HFC) network to have unpredictable dropouts. Or if the return path is being used with cable modem services, interference can cause sessions to end abruptly for no apparent reason. It also can increase the time it takes to establish communications with an Internet service provider (ISP) and transmit information because of the high bit-error rates (BERs) that in turn require retransmission of the data packets.

> "If the return path is being used with cable modem services, interference can cause sessions to end abruptly for no apparent reason."

If the return path is being used for digital interactive video services, errors will prevent the customer from establishing communications between the server and the set-top box, causing confusing transmit errors.

Return interference also can have a significant effect on the laser diode inside the optical transmitter even though fiber is ingress-free. As interference in the coax portion is carried upstream, it will combine with other signals of the same frequency, causing a noticeable increase in the noise floor. The combined carriers eventually cause the laser diode at the node to begin clipping, affecting the entire return band for that node.

Threats to return integrity

Three major types of specific interference are found in the return path: over-the-air ingress, impulse noise and common path intermodulation distortion (CPID). These all can cause major disturbances in signal quality, affecting the reverse path operation. Each requires different test approaches for acquiring and analyzing the interference.

1) *Over-the-air ingress:* Any entry of unwanted and interfering signals into the coax plant is defined as ingress. The most common sources of ingress are the many known over-the-air frequencies that share the same frequency range as the return path—typically 5 MHz to 47 MHz.

These sources of ingress—such as amateur radio transmission, citizens band (CB) activity, over-the-air TV and pager interference—can have very high field strength and significantly disturb the return path. Most RF analyzers have the ability to demodulate AM and FM signals, allowing you to listen to the broadcast and, with any luck, identify the source.

The majority of all ingress in the return path comes from the customer premises. Loose F-connectors, poorly shielded drop cable, unshielded TV tuners and even safety grounds can all let ingress enter the return band. A small percentage of ingress comes from the trunk and distribution plant. However, good plant maintenance helps prevent these problems from reaching significant proportions.

As the technicians gain experience, they will come to easily recognize the different signatures of the various types of ingress. For example, paging signals have their own unique sound that once known can be readily identified. By listening to these over-the-air signals with an RF analyzer, you sometimes can determine their call signs and/or location.

2) *Impulse noise ingress:* A particular kind of ingress noise is impulse noise caused by electromagnetic interference (EMI). Typically, this noise comes from motors with brushes found in common household appliances such as hair dryers, mixers, power tools and vacuum cleaners. Therefore, this noise usually is intermittent and of short duration, creating bursts of random noise. Capturing this type of noise requires the RF analyzer to have a max or peak hold along with a peak detection mode.

Since this type of interference is intermittent, you also will want an RF analyzer than can be set up to sweep continuously or at intervals—several minutes apart, storing any ingress violations that occur. That way the analyzer can be left monitoring the plant, and any suspicious behavior can be captured and stored even if you are not there. Potentially, thousands of violations can be stored, each with the frequency, amplitude and time information.

3) *CPID:* This is second- and third-order distortion products from downstream signals caused by nonlinear elements in the plant. These nonlinear elements cause a portion of the forward energy to be reflected back down the line. CPID has a unique signature when viewed with an RF analyzer, appearing as spurious signals evenly spaced at 6 MHz (System M) or 8 MHz (Systems G/D/K) intervals throughout the return path spectrum.

Typically these nonlinear elements are caused by poorly installed connectors, corrosion, dissimilar metals or cracks in rigid coax. Since CPID interference tends to come and go, it is hard to find. A gentle breeze, for example, may cause a loose seizure screw to generate small impedance mismatches, creating reflections that are then amplified by the return amplifier and sent upstream.

The average detection mode in an RF analyzer combined with max hold will enable you to view this elusive kind of interference. CPID usually hides in the noise floor, so once the noise is averaged out, this interference becomes obvious. One thing to remember is that CPID can go from noise floor to ceiling in a matter of seconds. This type should be corrected as soon as possible because it causes havoc in an HFC network.

Pinpoint leakage

Troubleshooting the return path is different from troubleshooting the forward path. In the forward path, problems are isolated by the number and location of complaint calls received. In the return path, the customer complaining about his return path services may not be anywhere near the actual cause of the problem.

While not all HFC architectures are the same, the basic elements of troubleshooting them are similar. The goal, of course, is to isolate the leakage to a given subscriber loop and fix it. To do this, the technician needs to move down the network until the ingress is no longer present, then go back to a tap that is halfway between the two amps and determine if the ingress is

BOTTOM LINE

A Robust Return Path

With the proliferation of digital interactive services, there is a growing need to use the return spectrum and develop a new awareness of its problems.

There are three major types of specific interference found in the return path—over-the-air ingress, impulse noise and common path intermodulation distortion (CPID). These all can cause major disturbances in signal quality, affecting the reverse path operation. Each requires different test approaches for acquiring and analyzing these interferences.

Over-the-air ingress: These sources of ingress—such as amateur radio transmission, citizens band (CB) activity, over-the-air TV and pager interference—can have very high field strength and significantly disturb the return path. Good plant maintenance helps prevent these problems from reaching significant proportions.

Impulse noise ingress: Typically, this noise comes from motors with brushes found in common household appliances. Capturing this type of noise requires the RF analyzer to have a max or peak hold along with a peak detection mode.

CPID: This is second- and third-order distortion products from downstream signals caused by nonlinear elements in the plant. Since it tends to come and go, it is hard to find. The average detection mode in an RF analyzer combined with max hold will enable you to view this elusive kind of interference.

upstream or downstream from there. By continually splitting the distance in half this way, the source of the leakage can be isolated quickly.

Troubleshooting the return path, therefore, starts at the headend and moves down the plant. Using an RF analyzer, you should connect to a test point at the fiber receiver in the headend. Here you can observe all of the signals in the return spectrum, and any distortions found at this point are then used as a reference.

You also can identify the type of interference at this time—whether is over-the-air, impulse noise or CPID. This reference signal should be stored or printed for comparisons, especially if there are multiple levels of interference that could stem from several different sources.

The next step is to examine the node that is feeding the optical receiver. Connect the tester to one of the RF output ports, being careful to compensate for any attenuation in the node. Once the meter is set up, check each trunk until the problem is isolated to one or more trunks. Now follow the problem trunk to the next amplifier

> "Return interference also can have a significant effect on the laser diode inside the optical transmitter even though fiber is ingress-free."

in the cascade and examine each of the RF output ports until ingress has been identified. Continue down the trunk until the ingress is isolated to a tap distribution leg.

The best approach at this point is to "ride out" each distribution leg in question, looking for leakage, before proceeding to the next passive or active device.

To do this, simply attach an antenna to the RF analyzer and set its frequency to that of the ingress being tracked. Then drive down the plant. Leaks will show up as an increase in field strength. There is a good chance you will find sources of the leakage during this ride-out, thereby allowing you to eliminate some or all of the interference.

If interference still exists, then it needs be isolated to a specific device in the tap distribution leg. Use an impedance matching probe to examine the output of the tap. Impedance matching probes have a high-impedance side that goes on the seizure screw and a low impedance side that connects to the tester. This probe minimizes loading of the cable plant by the instrument, while providing a mechanical connection through the seizure screw port.

After connecting the probe, if interference is still present, then the problem is on the output side of the tap. Otherwise, look at the input of the tap.

Finally, if the interference is at the input port, then begin disconnecting each house drop connected to the tap one by one until you get the interference to clear up.

Once the problem is isolated to a single home, the technician should carefully examine each point looking for leakage. Start at the ground blocks because they are often major sources of ingress.

If that does not solve the ingress problem, then keep looking, examining all the splitters and equipment that the subscriber has connected to the system. In this manner, the problem will finally be isolated and readily solved.

Although troubleshooting the return path is challenging, if you understand the types of interference in the return path and adopt a methodical approach to tracking down leakage, you can quickly and effectively eliminate troublesome problems in the plant.

Chris Loberg is U.S. business development manager at Tektronix. He may be reached via e-mail at christopher.j.loberg@tek.com.

Divide and Conquer

A Tale of Two Troubleshooting Scenarios

By John J. Downey

Thinking about possible outages to come over the next year probably is the last thing you want to do right now. And, of course, the best way to resolve an outage is to prevent it in the first place. However, some outages are inevitable and unavoidable. The following information has been prepared to make troubleshooting these power outages as quick and as painless as possible.

This article discusses the following points in further detail and is a quick step-by-step procedure for troubleshooting power outages:

- Make an educated guess of the fault location.
- Utilize self-resetting fuses and various measurement equipment.
- Use the 50/50 technique to "divide and conquer."
- Localize the fault to affect as few subscribers as possible.
- Reinstall service promptly.

Equipment list

Tools that may be essential for troubleshooting are: self resetting fuses (circuit breakers), volt-ohm meter (VOM), signal level meter (SLM), pin to F-housing connector, wire jumper with alligator clips, fuses, bus bars, and a fuse puller. Other tools that should be available include: clamp-on ammeter, time domain reflectometer (TDR), oscilloscope, replacement RF components, and a portable power supply/generator.

Human equipment

Take advantage of your God-given tools such as sight, sound and smell. Look at the power meter on the main line power supply. Is it spinning fast or slow? Is this different from normal operation?

Listen to the hum of the supply. Some lightly loaded supplies may hum louder than a heavier loaded supply or vice versa.

Use your nose to determine if any components have burnt up in an active or passive. Burnt electronics often will leave a very distinctive smell.

Troubleshooting the system

The first step in troubleshooting any type of outage is to think before you react. Try to make an educated guess of the outage location and/or cause before you start chasing your tail.

Talk to the customer service representatives, use computer databases and call centers, look at system maps, and/or call subscribers who have called in about outages. These sources can tell you the areas affected, which will aid in pinpointing the most logical starting point.

Figure 1 shows a reasonable guide for troubleshooting a power-related outage within a system.

Inside the amplifier

If a fault is localized to one specific amplifier, a few steps can be taken to further determine the cause of the outage and restore service as quickly as possible. These steps consist of measuring continuity, current draw, regulated DC voltage, and AC voltage.

Check the stinger and center seizure screws for tightness and contact. Check power paths and fuses for continuity. Check the power pack operating voltages. Regulated DC (24 VDC/B+) is the most important. If B+ is OK, then AC must be adequate.

Figure 2 (on page 74) shows a logical process for troubleshooting a power problem once it has been localized to a specific amplifier.

First scenario

Many different powering and fault scenarios exist. The first scenario we will discuss is shown in Figure 3 (on page 76). In this scenario, the system manager decided to slug the whole trunk line except for one fuse. This fuse happens to be in the power inserter (PI).

Let us suppose a fault is located after Amplifier 7 and the following sequence of events takes place.

A call is received about multiple outages, and there are no RF signals present in the entire nodal area. This may be caused by any of the following:

1) No power from the main line power supply (MLPS) or the utility company
2) No optical or RF input to the node
3) A bad node
4) The power inserter fuse feeding the node has blown. ➤

Figure 1: Guide for troubleshooting a power-related outage

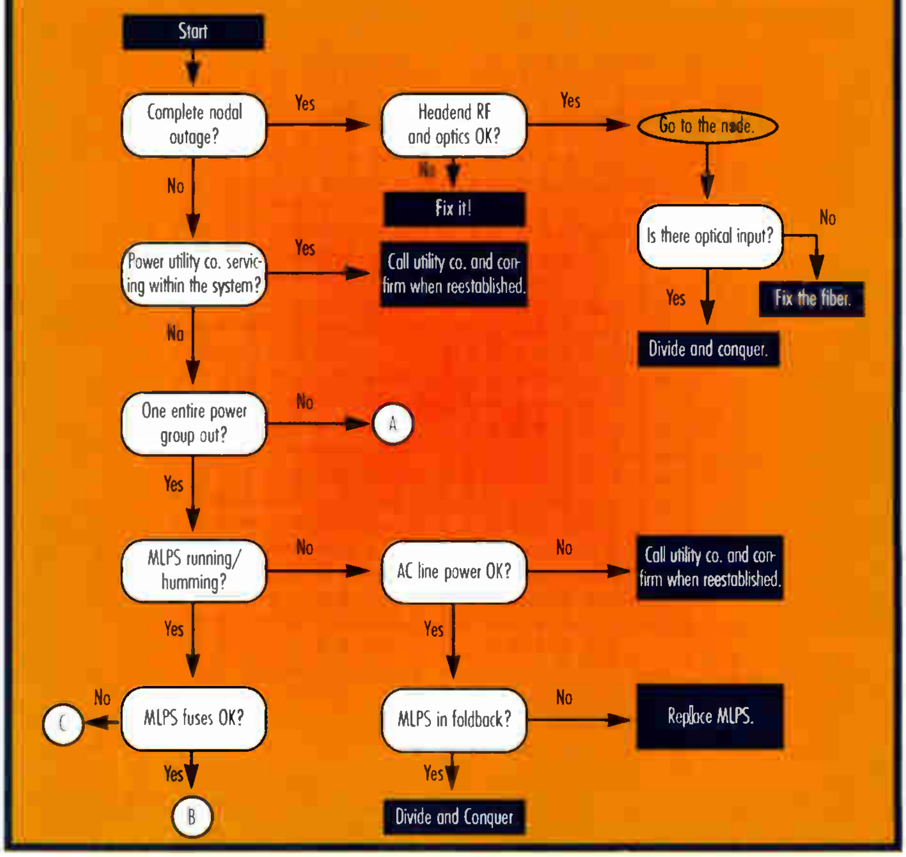
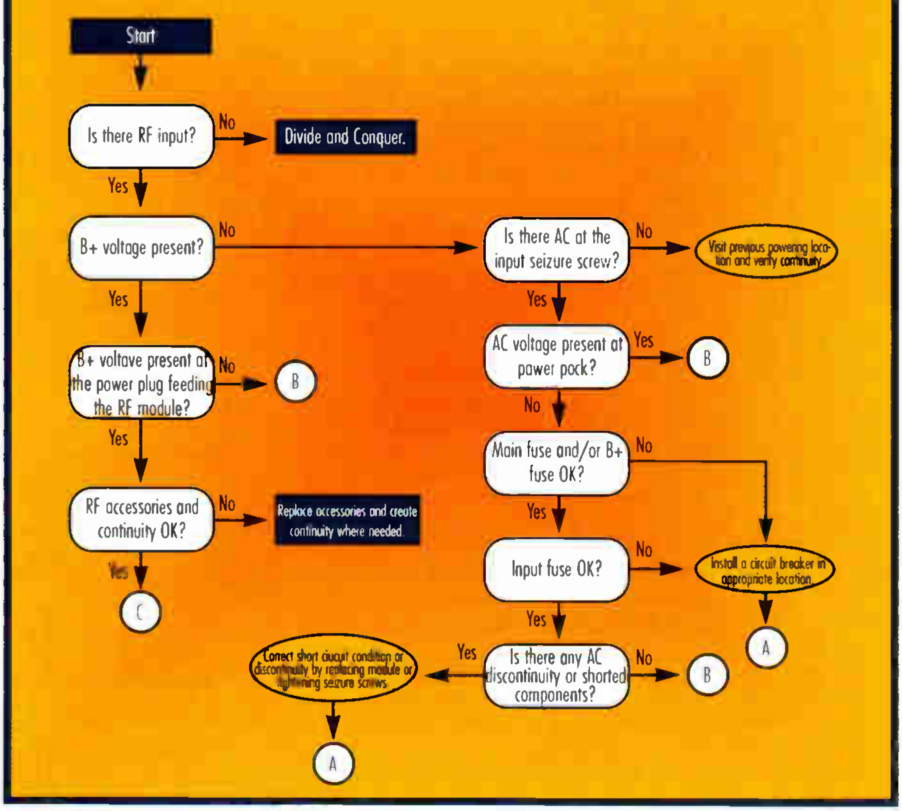


Figure 2: Guide for troubleshooting a power outage localized to an amplifier



Since any of these problems is possible, we decide to get some additional information and use the system flow chart. This sets our starting point at the node (See Figure 4 on page 78).

The following steps are taken to achieve a quick recovery of customer services. Refer to Figure 3 again during this troubleshooting process.

1) We verify that the optics coming into the node are fine, but there is no AC on the input seizure screw. We will call this our starting point and label it A.
2) We decide to proceed to Point B and pull the power inserter faceplate. We notice the fuse feeding the node has blown.

Here's a tip: The use of self resetting fuses (circuit breakers) can be very beneficial for locating a short. The use of these circuit breakers eliminates destroying more fuses than necessary when replacing a blown fuse and also saves a trip back to the fusible link location until the problem is rectified. Use a low-valued circuit breaker for troubleshooting because the

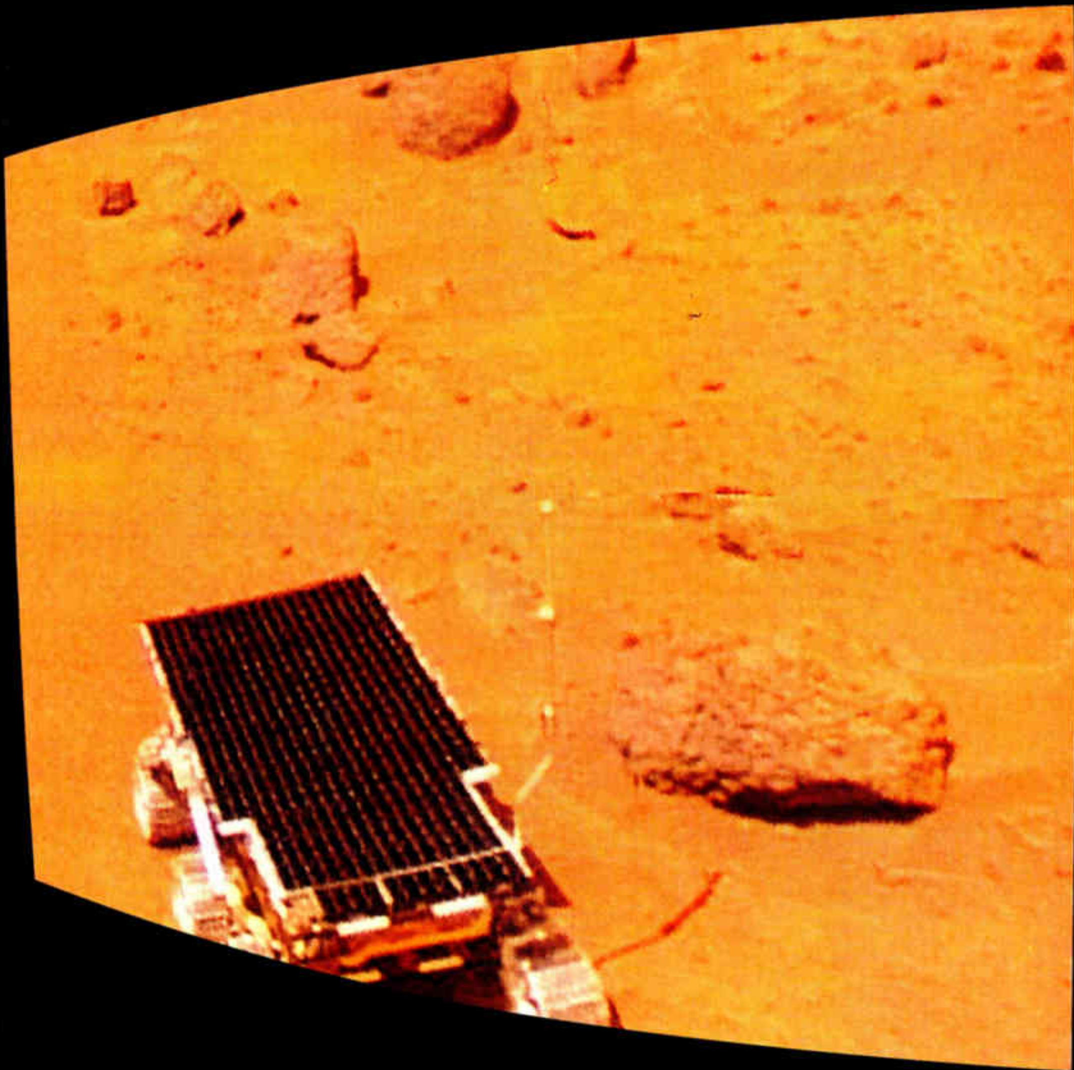


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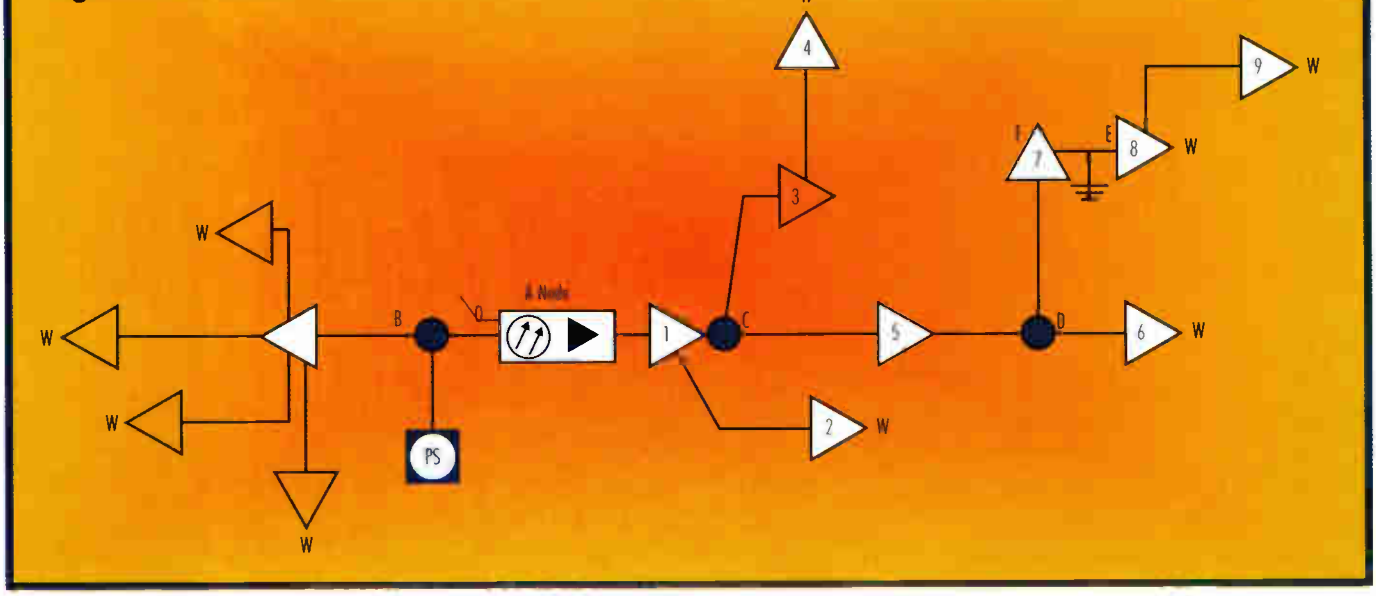
Figure 3: Scenario 1



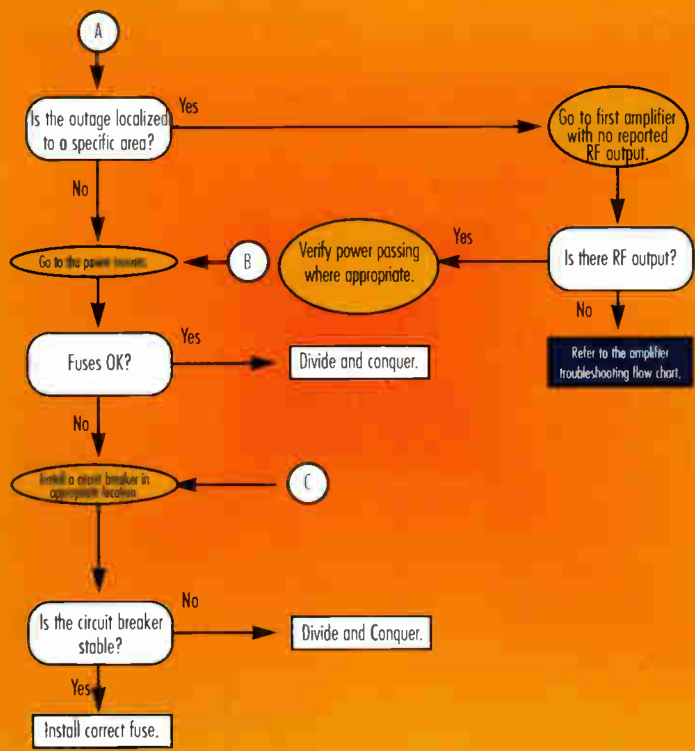
trip current can be as high as 200%. The circuit breaker size should be relatively close to the normal current draw.

3) We install a circuit breaker in the blown fuse location and notice it clicking/resetting. This indicates that there is a serious fault farther down the line and not just a temporary problem.

4) We "divide and conquer" to bisect the system and eliminate wasted time, which takes us to Point C.

Here's another tip: A main line passive is a very good place to disconnect the continuity by pulling the faceplate. A jumper wire with alligator clips can be

Figure 4: Flow chart for Scenario 1



used to energize a specific power path and further determine the bad leg. It also is possible to use an ammeter to measure current and create the continuity. Caution is advised when doing this because the ammeter may have a current limitation of its own.

5) At Point C, we disconnect continuity to certain branches to determine the bad leg. By disconnecting continuity to the fault, the circuit breaker should remain closed and a constant voltage and RF observed.

A voltmeter is used to check AC voltage stability. An SLM can be used to check RF intermittence depending on the fault and powering scenario. See if the intermittent RF signal becomes stable after disconnecting continuity. If the RF signal stabilizes, the problem is farther down that branch.

6) We proceed to Point D where we observe the same outcome as that observed at Point C. This indicates that the problem is still farther down, and we decide to visit Point E.

7) At Point E, we pull the output bus bars

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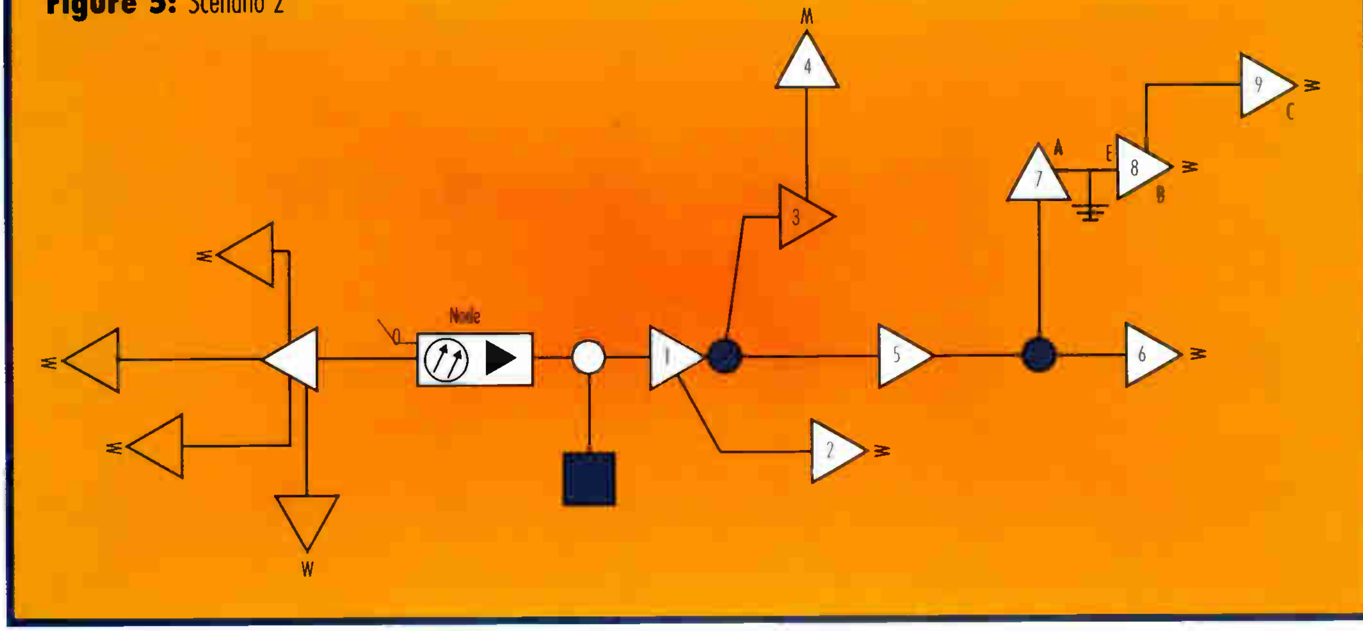
Figure 5: Scenario 2



and then the input bus bar. We note that the AC voltage is either nonexistent or intermittent on the input seizure screw. This indicates that the problem is previous to this location.

8) We backtrack to Point F and pull the output bus bar. We note that the circuit breaker in the power inserter has stabilized. We have now targeted the fault between Amplifier 7 and 8.

After localizing a fault to a smaller portion of the plant, keep the fault disconnected at the branch-off point. This may be at Point C or D. This will allow the rest of the system to operate undisturbed

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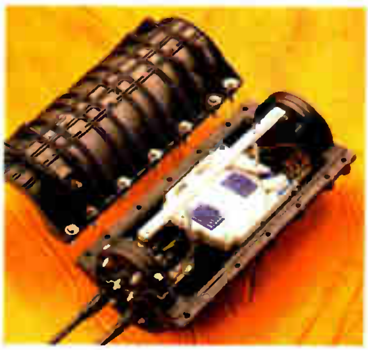

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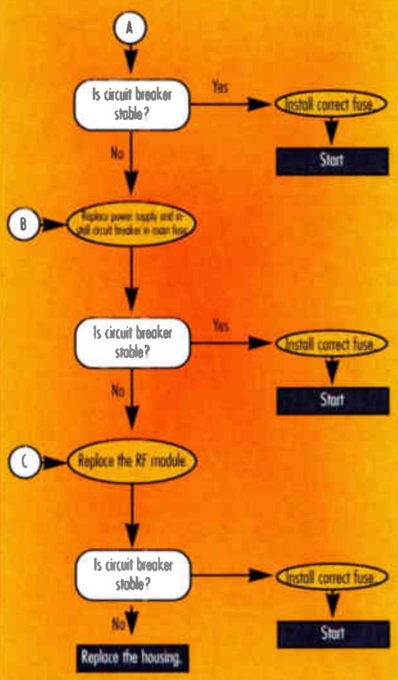
Figure 6: Flow chart for Scenario 2



while you troubleshoot this smaller area.

Utilize a portable power supply with a circuit breaker for further troubleshooting. If a portable power supply is not available, you may want to "ohm out" the cable between amplifiers. Check the integrity of the cable and passives between two amplifiers by removing the modules and checking for continuity between the outer and center conductors. If you have continuity where there should be none, then the short is somewhere between these two actives.

9) We visually check the integrity of the cable and connectors and replace defective components where appropriate. It may be warranted to use a TDR to further determine the fault location, especially for underground plant.

10) After the problem is fixed, the proper fuses or bus bars are reinstalled to connect all discontinuities.

Second scenario

Figure 5 (on page 80) represents another scenario where every active in the system is fused. Let's assume the power supply in Amplifier 8 has been damaged by lightning and the main fuse has blown in Amplifier 7.

We have received a call from the customer service representative about an outage that affects customers located off Amplifiers 7, 8, and 9.

After looking at our maps and going through our system flow chart, we decide to start at Point A (See Figures 5 and 6.)

1) We verify that there is RF on the external input test point and decide to open this housing. We determine that the main fuse has blown, causing this outage.

2) We install a circuit breaker and notice that it is stable. We then install the proper fuse and check RF output. While we are here, we measure current draw through the output port to determine if all actives down the line are functioning.

Tip: A common bus connects all fuses. Set a voltmeter to measure current draw; attach one probe to an unused fuse clip on the common bus, and use the other probe to touch the output fuse clip to measure current draw through that port. Use a fuse puller to remove one side of the fuse. This will allow no interruption in service when trying to obtain an AC current reading.

If the current draw is reasonable, we will go to Point C to verify correct RF levels at the end-of-line. We notice that the current is considerably low and decide to proceed to Point B.

3) At Point B, we notice the input fuse and main fuse have blown and smell a distinctive odor of burnt electronics.
4) We install a circuit breaker in the input port and note that it is stable.
5) We then install a circuit breaker in the power supply. We note that it is stable, also, but there is still no B+ voltage.
6) After going through the amplifier flow chart, we check continuity from the input seizure screw to the power plug and determine there is an open circuit within the module.
7) We change the module and notice the circuit breaker in the power supply main fuse location is clicking. From this, we conclude that the power supply needs to be replaced.
8) We replace the power supply, note the circuit breaker stability, and install the proper fuses.
9) We check output current draw and RF levels.
10) We then verify end-of-line RF levels at Point C are satisfactory. We also may decide to call affected subscribers to verify service has been reinstalled.

Possible deterrents

There are a few things that may inhibit your ability to troubleshoot an outage and are listed as follows: jacketed cable, sheath currents, interruption of service, power passing passives, and the main line power supply (MLPS) foldback current.

Let's go over each one separately:

1) Jacketed cable can under some conditions intensify sheath currents. Sheath currents will induce current on the center conductor and affect the readings.
2) Interrupting service to subscribers is extremely frowned upon. If a technician is not allowed to disconnect service for a limited amount of time, it could make troubleshooting that much more difficult.
3) Some passives still have power continuity when the faceplate is pulled. New "multimedia" passives are designed to provide continuity even when the faceplate electronics are removed. This could affect the efficiency of your troubleshooting, especially for TDR usage.
4) After an MLPS folds back, very little voltage is supplied, and it could make measurements unattainable. This in turn also could influence your troubleshooting practices.

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Powering


"I need backup power, but can I afford it?"

Want to Worry Less About Power This Year?

Survey Indicates Trends, Concerns

By Rick Marcotte

Nobody in the cable industry likes to think about backup power supplies. That, of course, is why power supply companies make them — so that cable engineers and their customers can worry less about power problems.

But for some cable professionals (system designers and engineers), thinking about powering issues and uninterruptible power supplies (UPSs) is an important part of their jobs. Every working day, they see the challenges posed by operating, maintaining and powering these complex, far-flung cable TV networks. They've peered into the future and looked for ways to improve service and cut costs.

To find out what those cable industry professionals think about their backup power systems and how they see those systems evolving, a survey of 75 cable industry professionals was commissioned to discover the challenges they face and some of the trends they see shaping their decisions about powering issues.

Reliability

Not surprisingly, reliability proved to be a primary concern for these cable executives. Roughly 88% of them said reliability and standby capabilities are among the industry's biggest future powering challenges, and 61% said reliability was one of their top three criteria when choosing a standby power supply for their cable network.

> "Reliability and standby capabilities are among the industry's biggest future powering challenges."

The focus on reliability reflects the growing numbers of cable TV operators who are expanding into advanced broadband offerings, such as high-speed data connections and local telephone service. In fact, 70% of those responding said that five years from now, they expect to be powering some level of telephone service via their cable TV networks, compared to only 23% today.

But with a failure rate as low as many UPSs have (some of today's models have reliability ratings of greater than 99%), quantum leaps in reliability are virtually impossible. Although reliability is important, it's not always the deciding factor when choosing a standby power supply. "We often look at products that we consider to be pretty equal," says Terry Blackwell, director of engineering for Dallas-based Marcus Cable. "If the products are equal, cost and warranty become more important."

Cost

Blackwell isn't alone. More than half (53%) of those surveyed said that cost, or value, of the power supply was a critical factor in their decision. "Our networks are expensive, and powering is a significant component of that expense," says another cable executive, whose responsibilities include evaluation and development of network architecture for a major national cable operation. ➤

One of the biggest costs of owning and operating a standby power system is maintaining and replacing the batteries that provide backup power. They need a lot of attention and, even if they get it, they don't last long, particularly in hot climates. More than half (51%) of the survey respondents said their system technicians perform preventive maintenance on power supply batteries four times a year or more, and 58% said they replace each battery at least once every three years.

"Our networks contain tens of thousands of batteries, so if we have to replace them every three years, it's a huge operational burden," says one cable executive.

Another executive presents a fairly typical case. He oversees a network that serves 400,000 cable customers in the eastern United States. In one state alone, he operates a system that uses 4,800 power supply batteries. Each is serviced twice a year and replaced every three years. "At $80 a battery, that adds up to close to $400,000 every three years," he says.

Status monitoring

But cable system designers aren't interested only in saving money. They are

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Cost-Effective Backup Power

Reliability, to nobody's surprise, tops the list for cable engineers evaluating backup power supplies. And as cable TV providers push into telephony and Internet access, the need for reliability is unlikely to diminish.

But many of the 75 cable system executives who participated in a recent survey say they perceive similar reliability among major power supply manufacturers, so cost is a major factor in choosing uninterruptible power supplies (UPSs). And the cutthroat competition ahead in broadband services means operators need reliability at reduced prices.

To improve reliability, many operators are turning to software that helps them monitor power supply status and respond to minor problems before they become major. To cut costs, many cable TV operators would like to reduce their dependence on batteries.

One of the greatest costs of owning and operating a standby power system is maintaining and replacing batteries. More than half of the survey respondents said they perform preventive maintenance on power supply batteries four times a year or more. More than half also said they replace each battery at least once every three years, which can cost hundreds of thousands of dollars.


EXCITE

continuously upgrading their systems and looking for better ways to prevent network failure. In particular, they want better and quicker feedback about the condition and performance of their power supply systems. Surprisingly, few use status-monitoring software to monitor their power supplies today. Approximately 61% say they do not use status monitoring, but that percentage is expected to grow over the next two years. By the end of 2000, 79% expect to be doing some level of power supply status monitoring.

One professional expects his network to move from about 10% now to 80% at the end of 2000. "We hope, through internal diagnostics and network monitoring, we can reduce the cost of maintenance and repair," he says. "It would be nice if we didn't have to visit the equipment until the equipment tells us it needs it."

For another professional, status monitoring is a crucial weapon in the escalating battle for telephone customers. His standby system is capable of providing him with only 2.5 hours of backup power, compared to the 8-hour norm in the local telephone industry. A quick response to power outages is essential to allow cable systems to perform as reliably as traditional telephone networks. Within two years, he expects his network to move from no status monitoring to full status monitoring. "We need to know the minute that power supply goes into standby mode," he says.

Increased awareness

As cable TV providers push into new markets, they must go toe-to-toe with formidable competitors. Now, more than ever, they need reliable backup power supplies, but the increased cost-consciousness of a competitive environment means they will need reliability at reduced prices.

One way to improve the reliability of backup power supplies is to increase management's awareness of the condition and performance of those power supplies through status monitoring software. That allows managers to find and fix small problems before they become major ones.

Achieving cost savings without sacrificing quality might prove to be a difficult balancing act, however. Batteries are prime targets for cost cutting because they are such a large component of a power supply's cost, but cable TV operators don't want quick fixes.

Cheaper batteries could reduce capital costs, but if they require more maintenance than other batteries, or need replacement sooner, they could increase operating costs, thereby increasing the overall cost of battery ownership. "We would like to minimize our dependence on batteries and get more life out of them," says one executive. CT

Rick Marcotte is director of sales and marketing for the Communications Systems Group of Exide Electronics Group Inc. He can be e-mailed at marcotte@email.exide.com.

What is MPEG?

Origins, Applications and the Future

By Arun Ramaswamy

After years of research and development, and years of perfecting tools and techniques to code (or represent) audio and visual information in compressed digital formats, the next step was standardization — that is, grouping and standardizing the tools to make the application centric.

JTC1, a Joint International Standards Organization/International Engineering Committee (ISO/IEC) technical committee, was established in 1987 and given the title "Information Technology." SC29, a subcommittee of JTC1, was established for addressing "Coding of Picture, Audio, Multimedia and Hypermedia." A working group of SC29, WG11, was specifically mandated with the title "Coding of Moving Pictures and Audio." WG11 held its first meeting in Ottawa, Canada, in May 1988 and has since come to be known as MPEG, or Moving Pictures Expert Group. Since then, it has produced two standards: MPEG-1 and MPEG-2. It is currently completing the third standard, MPEG-4, and embarking on a brand-new standard, MPEG-7.

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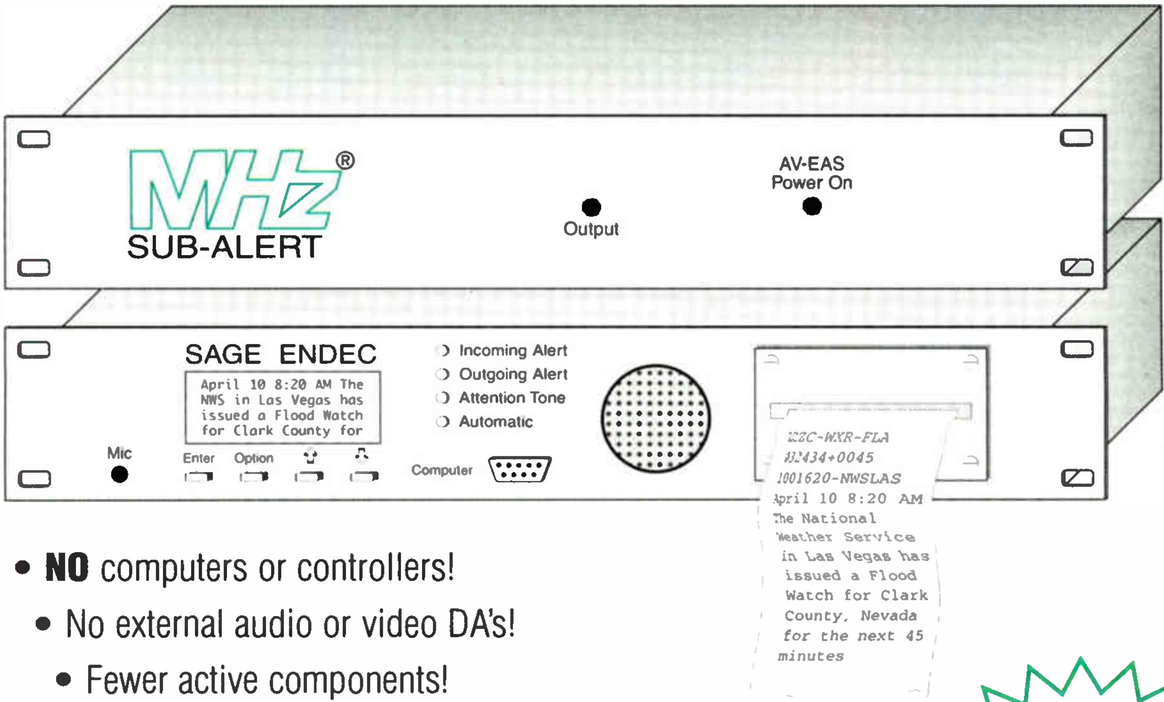

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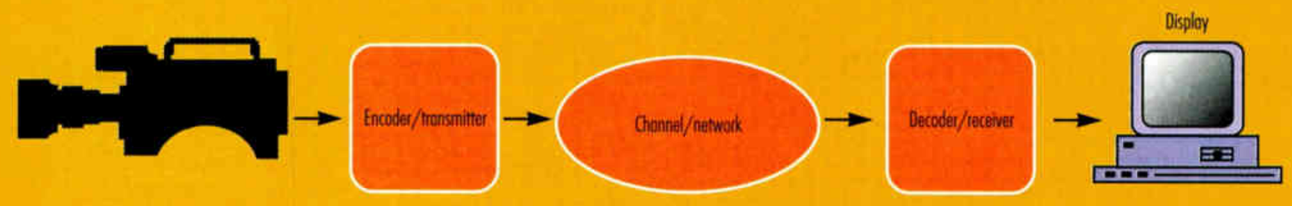
Typical communication paradigm



Overview

When we talk about coding moving pictures and audio, what exactly do we mean? In the abstract, we are talking about information. In the actual world, we are talking about signals—which really are, simply, entities that change their mathematical values with space and time. To convey information, these signals require a finite number of parameters for representation. In many instances, however, this fixed number is prohibitively large for any practical use—that is, there is too much information to transmit or store with existing technology. The compression process attempts to convey the information by cleverly employing less than the full set of parameters.

To understand how MPEG works, let's take the example of a typical communication paradigm. Audio and video sources are information. If the information is analog, then it is digitized first. The information then is compressed and coded to binary streams (strings of 0s and 1s) by a device called an encoder.

The video and the audio parts of the MPEG standard specify the compression tools and the binary stream syntax. Encoded audio and video streams have a common time base and are combined into a single multiplexed stream before delivery to a decoder via a delivery medium such as a transmission network. Even in cases where the channel is absent, the model remains intact. The MPEG systems part provides the specifics for the multiplexed stream.

On the receiver side, this stream is demultiplexed into its individual elementary streams, which then are decoded by the appropriate audio and video decoders. The resulting decoded information then is displayed to the user with full audio/video synchronization. (See the accompanying figure.)

Why it works

Visual information, video signal, is really a sequence of time-varying images or frames. Each sample point in a frame is called a pixel. The complete set of parameters necessary to convey the information includes pixels per line, number of lines per frame, aspect ratio and the frame/field rate. Audio information is a temporally varying signal, which also is sampled in time.

A big problem with these sources is their huge bandwidth/storage requirement, which makes them quite impractical for most multimedia applications.

The logical solution to this problem is compression. Compression exploits the different redundancies present in the information and aims at reducing the total number of parameters required to represent the signal, while maintaining perceptually good quality.

Visual redundancies include spatial, temporal, psychovisual and coding. Spatial redundancy occurs because neighboring pixels in each individual frame of a video signal are related. In other words, they have some degree of correlation. The pixels in consecutive frames of a signal also are correlated, leading to substantial temporal redundancy. To add to it, the human visual system does not treat all the visual information with equal sensitivity. For example, the eye perceives changes to a greater extent in the luminance than in the color. The eye also is less sensitive to high frequencies.

Finally, not all parameters occur with the same probability in an image. As a result, they would not require an equal number of bits to code them, leading to coding redundancy. MPEG exploits these redundancies with its impressive array of tools that include, among others, the discrete cosine transform (DCT), predictive coding, Huffman

BOTTOM LINE

MPEG: The De Facto Industry Standard

In today's information age, audio and video information needs to be conveyed, stored and retrieved in an efficient manner. Information "handling" has come to encompass everything from content creation and delivery to storage—and can even be applied to the end-user interactions.

The growth of digital information technology has brought these diverse areas together by integrating video, computer and telecommunication technologies on a single multimedia platform. Audio/video compression is a key factor in this binding, with the Moving Pictures Expert Group (MPEG) standard now the de facto industry standard. The worldwide adoption of MPEG standards has opened the door for some exciting applications such as digital TV, interactive set-top boxes and digital video disc (DVD). The future promises many more advanced developments, all dependent on the continuing development of MPEG compression technology.

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Coding and adaptive quantization.

For audio, MPEG includes high-performance perceptual coding schemes, where the encoder analyzes the spectral components of the audio signal in conjunction with a psychoacoustic model to estimate the noise level. This also is coupled with a smart bit-allocation scheme to the various channels depending on the bit rate and masking requirements.

Standards

All the MPEG standards are generic and universal in the sense that they merely specify a compressed bitstream syntax. This, in effect, unambiguously defines the decompression process. The standard, however, does leave room for smart implementations of the encoder, compression algorithm and the decoder.

MPEG-1, the first standard, addressed the coding of the combined audio/visual information at a bit rate around 1.5 Mbps. The driving force behind this effort was desktop multimedia applications such as storage and retrieval of data from CD-ROMs and digital audio tapes (DATs). Other applications include videoconferencing, electronic publishing, games, videomail and the videophone.

> "All the MPEG standards are generic and universal in the sense that they merely specify a compressed bitstream syntax."

At this low bit rate, before compression, video usually is decimated to standard image format (SIF) resolutions, 352 x 240 for NTSC and 352 x 288 for phase alteration line (PAL). The video coding algorithm allows for only frame-based prediction. The standard specifies a family of three audio coding schemes, simply called Layer-1, -2,-3, with increasing encoder complexity and performance (sound quality per bit rate). The standard also allows for audio coding at bit rates between 32 kbps and 384 kbps.

MPEG-2 compresses CCIR Rec. 601 video at bit rates between 4 Mbps and 15 Mbps for a whole range of telecommunication applications that need broadcast-quality video. Its applications include, among others, cable TV, high definition TV (HDTV), digital video disc (DVD) and direct broadcast satellite (DBS). The video compression algorithm for MPEG-2 is superior to that of MPEG-1, since it allows for improvements such as field-based prediction, better entropy coding schemes and better quantization tables.

On the systems side, the standard offers the MPEG-2 transport stream,


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Internet: http://www.tonercable.com
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which is well-suited for error-prone environments. By arranging its tools and features into levels and profiles, MPEG-2 is more application-centric. For example, the main profile at main level is employed for commonly used broadcast applications, while the 4:2:2 profile is employed for high-quality studio applications, with its support for higher chroma resolution and bit rates up to 50 Mbps.

MPEG-4, the newest standard, is geared towards low bit rate applications such as video-over-Internet and mobile multimedia, including the videophone and interactive video games. MPEG-4 has attempted to provide a more integrated and flexible multimedia solution. For example, from the content creation perspective, MPEG-4 allows the integration of natural video with 2-D and 3-D graphics with animations, text, natural and synthetic audio, and World Wide Web pages.

For network service providers, MPEG-4 provides a generic quality of service (QoS) parameter set applicable for the diverse MPEG-4 media. This would help choose a transmission network depending on a stream's QoS requirements. For the end-user, the standard provides a new level of user interactivity.

To facilitate these new features, MPEG-4 has, in a sense, departed from the traditional MPEG-1 and MPEG-2 approaches for coding. For example, MPEG-4 has adopted an "object-based" coding scheme, where each audio/video (A/V) object is isolated from a scene and coded potentially at an appropriate bit rate depending on its complexity. These streams may then be multiplexed together for delivery or transmitted individually, depending on whether the receiver "requests" it.

Also accompanying these A/V objects is a "scene description" stream, which helps in compositing the various objects once they are decoded on an MPEG-4 terminal. Like MPEG-2, MPEG-4 also supports the concept of profiles and levels.

MPEG-7 is targeted toward identifying and searching for multimedia content that exists in different forms today. MPEG-7 will specify a standard set of descriptors for various types of multimedia information. All this will allow fast and efficient searching for multimedia material of interest to a given user. This material may include still pictures, graphics, 3-D models, audio, speech, video and information about how these elements are combined in a multimedia presentation.

The trends are clear. The technology is improving steadily, providing better and more efficient compression, with new innovations, and the result is a richer multimedia presentation. Examination of the MPEG standards, in essence, shows the progress of the technology and points to where we will be in the future. That future promises to be one of new and exciting multimedia products with the ability to interoperate universally.

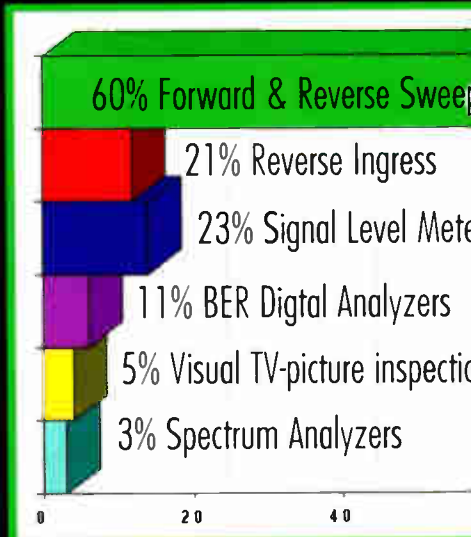
Arun Ramaswamy is a scientist at Vela Research. He may be reached by calling (813) 572-1230.

CATV N

Headend and System-Wide Problems

Which Tools Find
Cable System Faults?

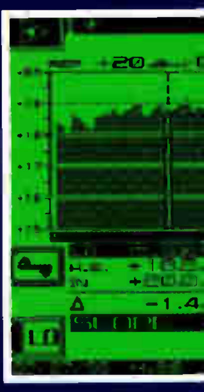
- – Signal Levels
- – TILT
- – Gain / Loss
- – Suck-outs (notches)
- – C/N
- – HUM
- – CTB/CSO Intermodulation
- – CPD - Forward and Reverse
- – Reverse Ingress
- – BER / MER
- – Reflections & Standing waves



Source: Research 11/97 - 2/98 Market survey with 200

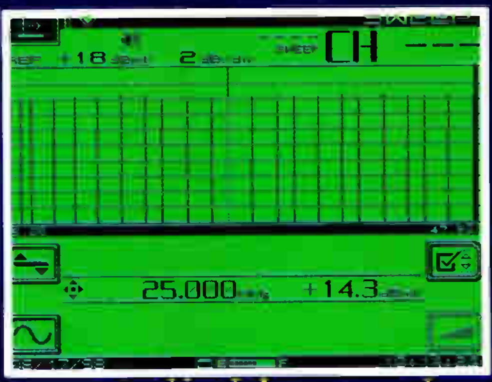
Cascade and Amp/Line Extender Problems

Optical Node Reverse Measurements



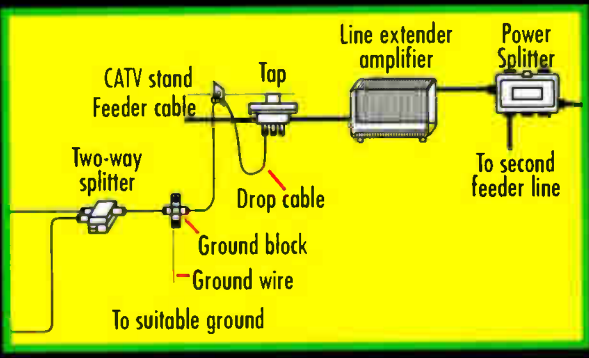
The reverse sweep levels must be correct for reverse. Using sweep (relative) is not enough — use Reverse Alignment Mode to check absolute levels received at the headend.

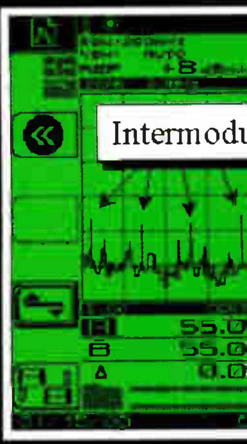
Problem here is the reverse laser driver level (closed loop signal).



Good levels from reverse lasers

Drop/Tap Problems





Bad Reverse spectru
intermodulation beat

Common path distortion can result from corrosion or oxidation on connectors
metals. This causes a diode-effect. When it occurs, it introduces potentially
intermodulation beats every 6, 7 or 8 MHz (depending of your forward cha
on the reverse path. When connector fails small beats appear, but will increa
paths are combined together at the reverse node.

Without looking at the reverse spectrum in the field, this problem is hard to
recommended method is to use a 5-42 or 5-65 MHz low-pass filter in front o
like StealthTrak or SAM4040D. The filter removes the forward path signals t
instrument's RF electronics.

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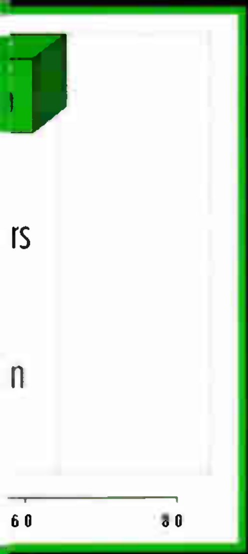
etwork "



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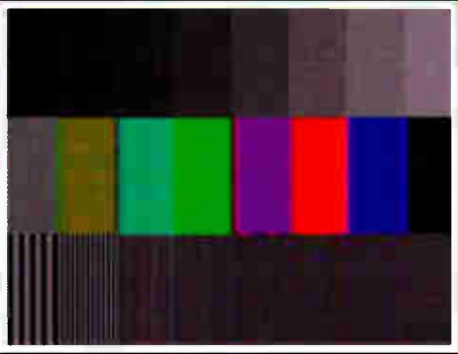
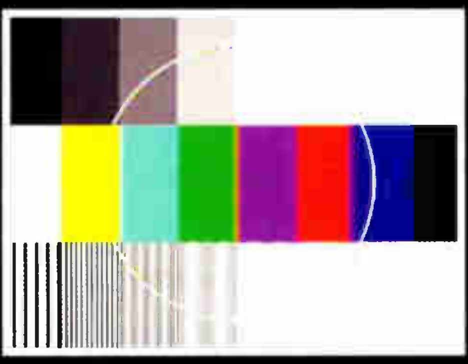
S and European CATV operators



Not enough contrast

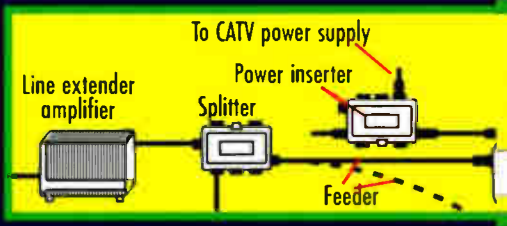


Too much contrast

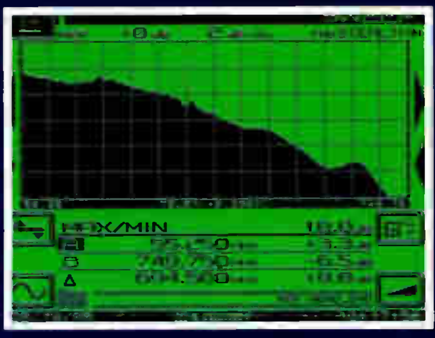
Check Modulators using the Depth of Modulation Measure

- Too low? TV pictures are too dark
- Too high? TV pictures are too brig fade, too pale. You may also hea the audio.
- Make sure that all TV-channels ha Depth of Mod (87.5% - NTSC / 9

Problems in Trunk Amplifiers & Line Extenders



Bad forward sweep trace

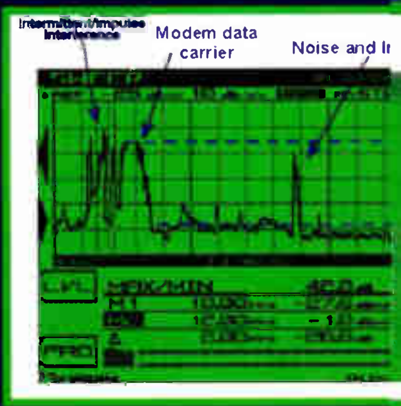


- Sweep traces look like this for forward or reverse when the amplifier is ove driven, or if the Tilt alignment is off.
- If in the forward path the amps are overdriv or Tilt is bad, bad intermodulation (CTB/CSO bad C/N results.

Connecting to find ingress problems: view headend-reverse-ingress-spectrum in the field.

Use reverse sweep to find bad reverse ingress. Reverse ingress at the node causes:

- over-driving of the reverse laser (clipping)
- Bad Carrier to Ingress "C/I" or bad Desired to Undesired "D/U" (cable modems).



trace showing

hat have dissimilar armful 2nd and 3rd order nel-plan). These appear e when several reverse

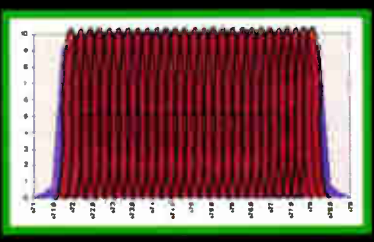
nd and fix. The an HFC analyzer at interfere with the

Making Accurate Digital Average Power and Performance Measurements

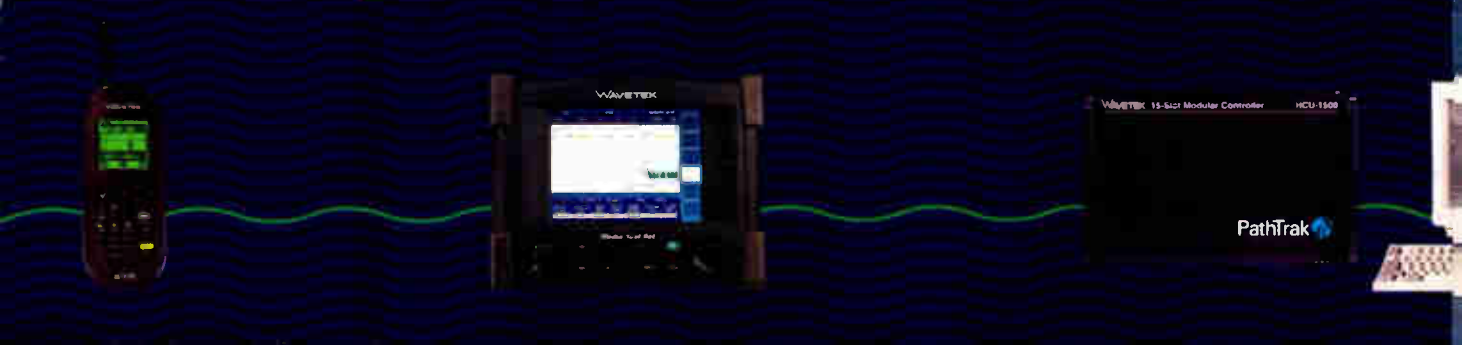
Digital Video Broadcasting

- The StealthTrak spectrum analyzer view is an excellent tool to see discrete RF-carriers. Seeing the signals is crucial to troubleshooting digital carrier problems.
- The digiCheck™ average-power method takes small slices of the integrated RF-energy, summing them together to one total power reading. This method of measuring the total integrated power under the haystack is very accurate. Using an instrument that uses one slice of the haystack, or peak hold in spectrum mode, may be less accurate.

Analog and digital (broadca The delta in level should be average power level mode).



Summing slices of the total in



Find and F

ment

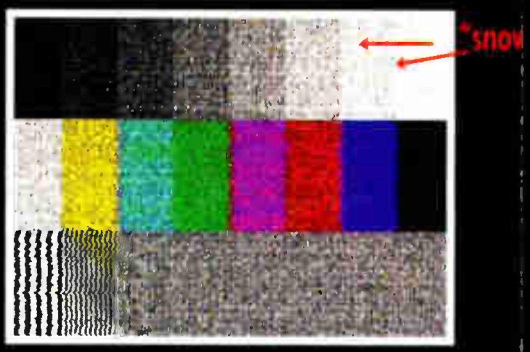
poor contrast
ht and colors
clicking in

ve the same
% - PAL).

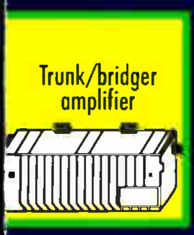
Hum Problems

- Hum problems appear as one horizontal bar (50 / 60 Hz) or two bars (100 / 120 Hz).
- Causes of HUM problems:
  - — Bad power supplies in amplifiers
  - — Earth-loops on coax cables
  - — Bad ground blocks
  - — Bad connection to ground Earth-loops in headends, interfering with the modulator's power supply.
- Hum measurements can be made in-service without interfering video carriers.

Carrier-to-Noise Problems

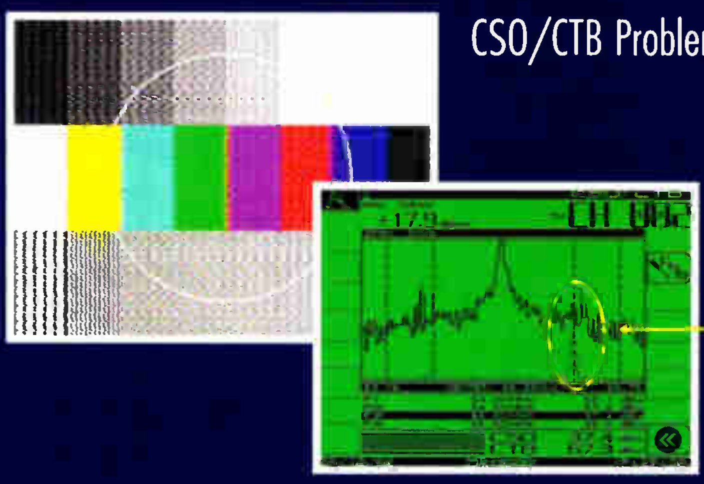


- Bad C/N appears as "snow"
- Causes of C/N problems:
  - – TV-carrier levels too low
  - – Not enough amplifier gain.
- Tools to find and fix C/N problems:
  - – Use SWEEP-mode to find gain/loss
  - – Use SCAN-mode and/or LEVEL-mode individual level problems.

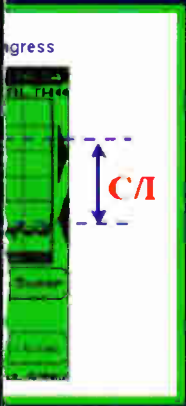


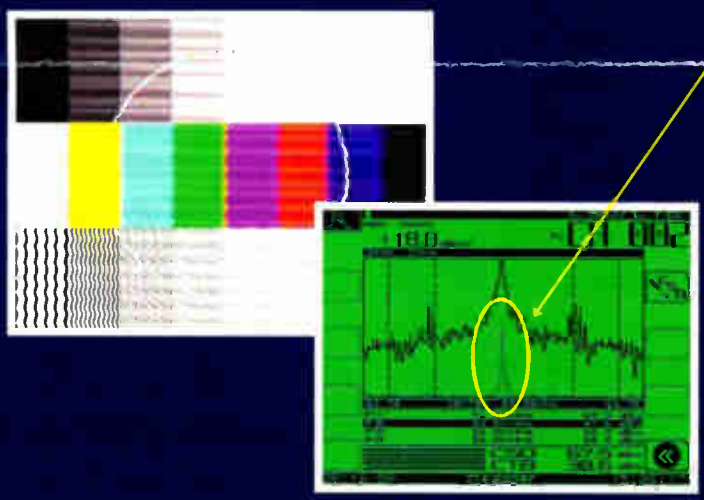
n,
or

CSO/CTB Problems in Trunk Amplifiers/Line Exte



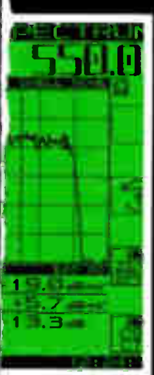
- CSO
  - – Composite Second Order
  - – 2nd order intermodulation
- CTB
  - – Composite Triple Beat
  - – 3rd order intermodulation



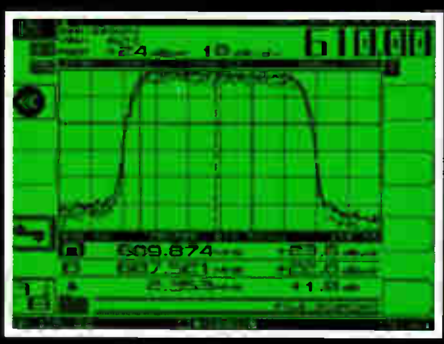


Note that it is difficult to see the difference in TV-picture quality, but it is easy to see the difference in the measurement screens.

Analyzing Cablemodem Digital TDMA Signals Using Time Domain.

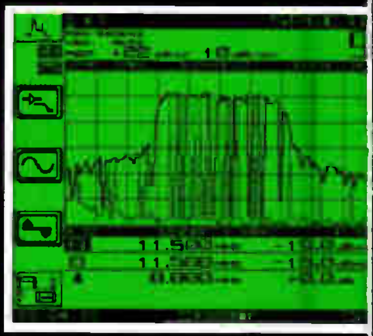


Forward digital cable-modem signal.



Use Spectrum Mode to view signals in forward and reverse.

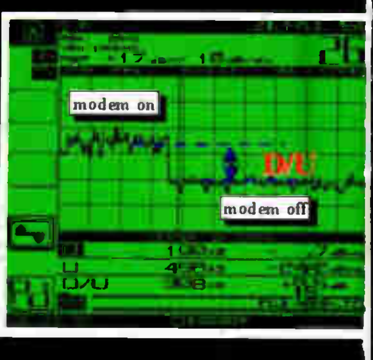
Reverse digital cable-modem si



st) signal.
10 dB (in

egrated energy

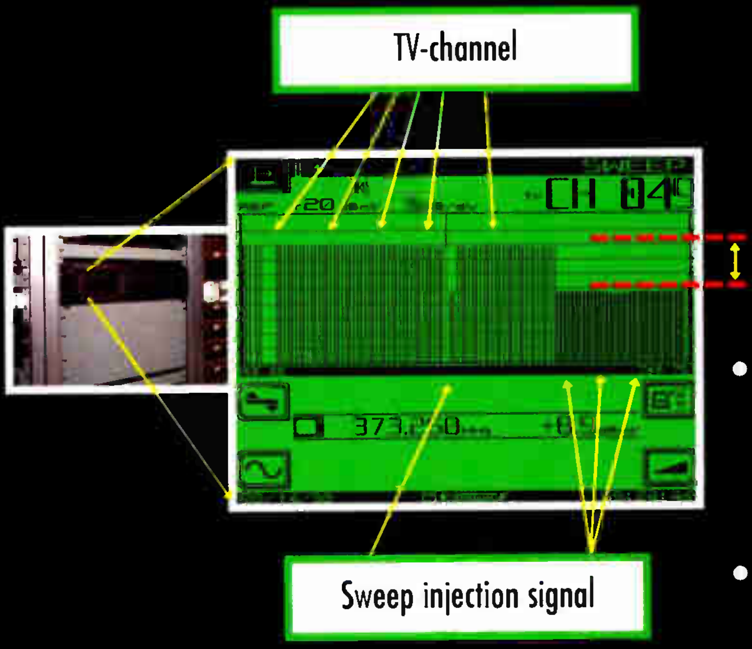
Use Zero-span to see live, in-service Carrier-to-Ingress



Select the modem's reverse operating frequency, then switch to Zero-span mode to see it in time domain. With this mode, it is easy to measure timing errors, average power level (related to the correct measurement bandwidth), and Carrier to Interference or Desired to Undesired "D/U". All these measurements should be in-service.

ix" Guide

Start with good signals in the headend. Channel levels must be correct after the forward combiner. Signals with levels too high cause intermodulation (CTB/CSO) problems, signals too low cause deterioration of C/N performance.

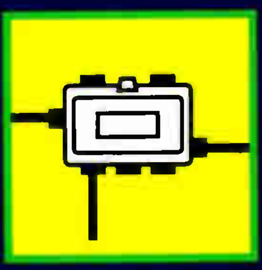


- Using 3ST's Sweep Mode check the delta between the TV-carriers and the sweep injection points
- The level difference in TV-carrier and sweep injection points should be 10 to 15 dB. This eliminates interference with TV-carriers.

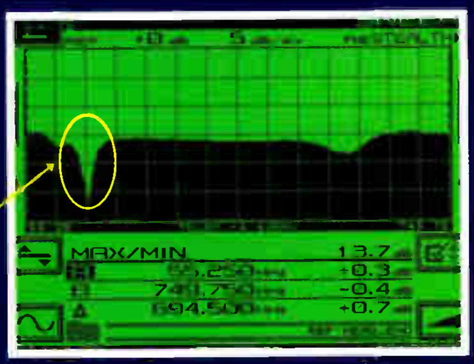
problems
to find

enders

Tap and Connector problems

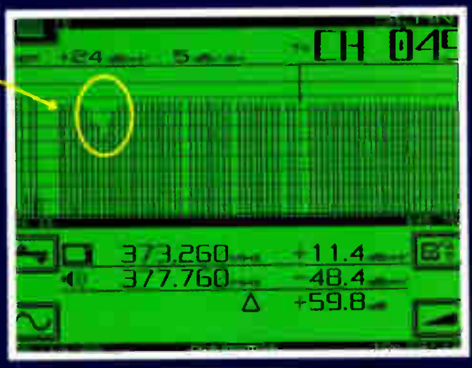


- Bad taps or connectors can cause a suck-out (notch) in frequency response.
- Suck-outs can cause individual & adjacent channel impairments.



Bad forward sweep trace - suck-out

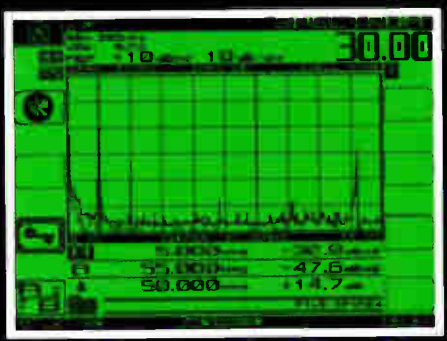
- Sweep is a very efficient way to locate bad taps or connectors. Scanning the channels works sometimes, but the impairments are less visible.
- Causes are:
  - Humidity problems
  - Bad connector mountings/housings
  - Small RF leaks to ground
- Note! Checking "levels only" will miss a suck-out if it occurs at a frequency where no channels currently exist. Use Sweep.



Displaying the suck-out in a SCAN is harder to detect

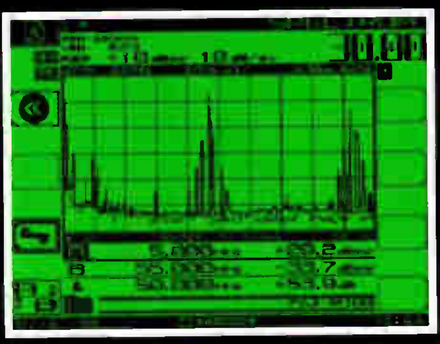
gnal.

Catching Reverse Intermittent Ingress Signals

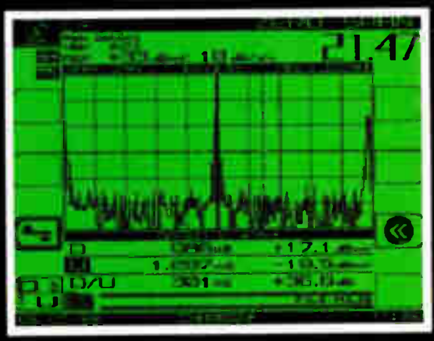


Reverse ingress spectrum trace after 30 sec. using short dwell-time

- Always compare the headend noise spectra to the local test point's spectrum in the field. Comparing these allows easy, accurate diagnosis.
- Use the selectable (long) dwell time in spectrum analyzer mode to see infrequent or "fast-bursty" ingress. Using fast dwell times will miss 'click' and 'pop' noises that impair HFC Telephony service.
- Use the StealthTrak's built-in pre-amp and low-pass filter at 20- or 30-dB-down test points to detect 'real' ingress lost in the noise floor.



Reverse ingress spectrum trace after 6 sec. using long dwell-time of 20 ms.



Reverse Ingress Zero-SPAN-mode

For additional copies call
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WAVETEK

Reference Chart

to a set-top's OOB tuner no matter what the user is doing with the in-band tuner at the time.

Virtual hard drive

The broadcast file system (BFS) in the headend makes use of digital storage media command and control (DSM-CC) data carousels. The carousels interleave and continuously broadcast data or application files, along with a file directory of all carousels in the system, to all set-top terminals on the network. Any set-top can tune into the directory at any time to download a particular file. By using the BFS, applications and their associated data reside on the network. This mechanism allows the network to look like a virtual file system that is attached to the set-top's operating system. ➤

BOTTOM LINE

Applications Drive Digital Networks

Five years ago, most cable engineers had little reason to be interested in a set of computer industry tools and standards called Internet protocol (IP). Now IP has emerged as the cornerstone of today's interactive digital cable network.

The new IP-based network is a client/server local area network (LAN) where the thin-client computers are advanced digital set-tops. Think of the network itself as a giant "hard drive" loaded with executable applications, all ready to be called at any time by any set-top.

Executable applications, associated data files, and a directory are broadcast continuously by data carousels. To download a network application requested by a subscriber, the set-top simply tunes to the quadrature amplitude modulation (QAM) channel listed in the directory; no upstream communications are involved. This approach makes it much easier for both operators and developers to add new applications to the system.

›r video, audio and data. The user con-·ected to this stream has complete con-ol back to the server for manipulating ıe stream. The more manipulation or ıteraction needed, the stronger the case › have this direct connection. (See debar on page 103.)

etwork "client computers"

The first digital set-tops to be deployed ere broadcast-only set-tops that assume ·ery service is either a video service or an audio service. These set-tops face early obsolescence.

In contrast, newer set-tops embrace the application paradigm: They can associate an application program with every service. While the most commonly used applications such as electronic program guide and pay-per-view (PPV) applications will be resident in the set-top, more advanced applications (such as games, Web browsing or video-on-demand) will reside on the network for broadcasting in a manner to be described later.

When the user requests an application that resides on the network, the operating system on the set-top automatically downloads the application program and launches it. The application uses the network as the storage medium for the data required for a particular service. The conditional access system (CAS) provides security for user privacy and permits the network operator to determine if a particular set-top is enabled to download an application and its associated data.

To work as the client computer in this LAN-like network, the digital set-top must have dual tuners, in-band and OOB. With an OOB tuner, the set-top can communicate with the network no matter where the in-band tuner is tuned. The client portion of an application on the set-top always has a way to talk to the server portion. For example, for an IP telephony application, the application server can always send a ring

Figure 1: The broadcast file system makes use of data carousels, which continuously broadcast data files, application files and a file directory to all set-tops on the network

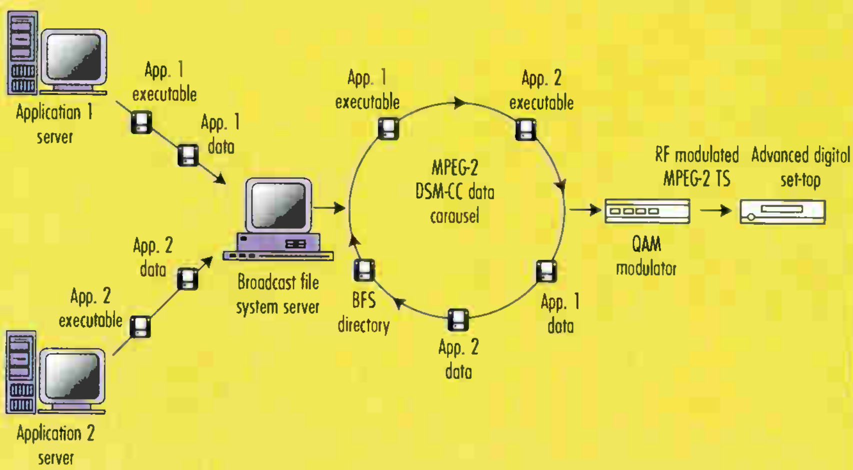
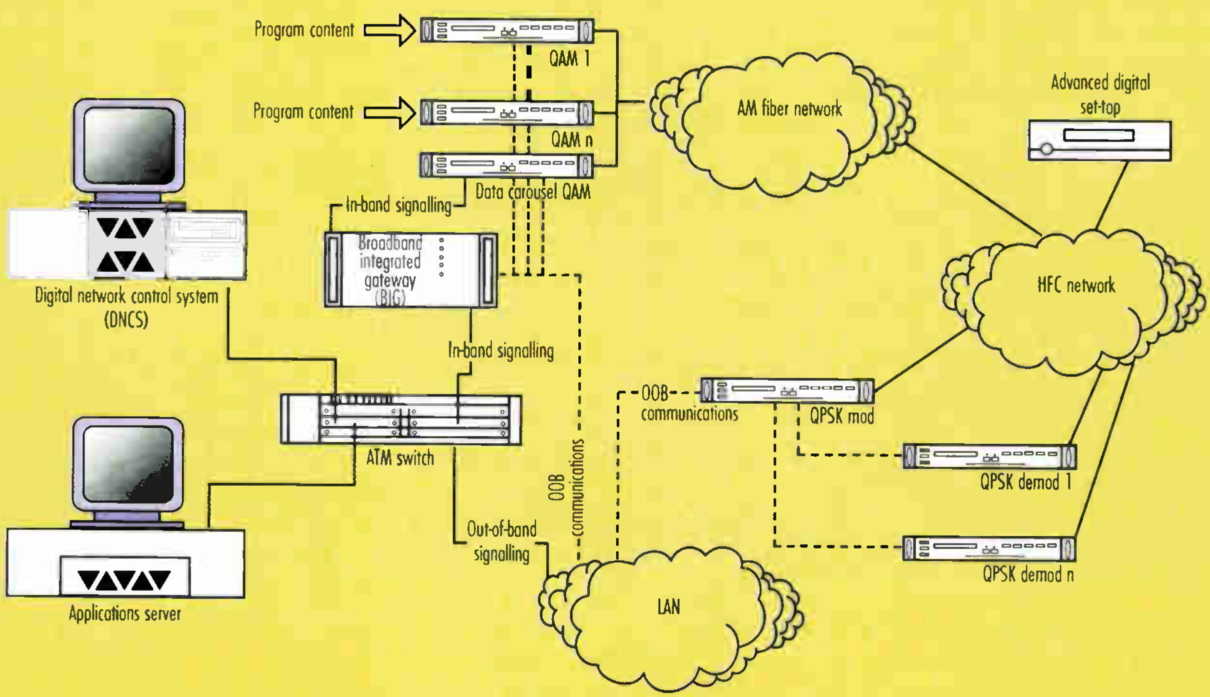


Figure 2: The network optimizes control and applications by use of in-band and out-of-band signaling



Digital Networks Really Are Giant LANs

Application Paradigm Is Changing Service

By Hal Benner and Bill Wall

An interactive, Internet protocol (IP)-based digital network resembles a standard local area network (LAN) in functionality. The network itself functions as a "hard drive," working hand in glove with a powerful client (a two-way digital set-top) to enable real-time, interactive services. Like the LAN, the hybrid fiber/coax (HFC) network provides high-speed communications in both directions and routes information to specific terminals.

This article examines the heritage of today's interactive digital network and a new "application paradigm" that has emerged. Roles of key components in the network are described. In addition, attention is focused on how the set-top accesses the network for applications, and how the network interconnects with new or existing LAN networks to support multimedia applications.

The application paradigm

Set-tops, and the network they're connected to, need to "think" differently nowadays. Traditionally, set-tops perceive a service as being a broadcast video or audio channel. But in the cable industry, a service no longer means a TV program. It can mean anything that involves some combination of voice, video and data. Operators who design their networks accordingly can create sustainable competitive advantages.

The application paradigm abstracts the idea of a service into a new, somewhat revolutionary definition: A service is really an application plus data.

- In the case of a video broadcast, the service consists of a "watch TV" application in the digital set-top and instructions from the viewer to tune to a certain channel.
- In the case of receiving e-mail, the service is a "get mail" application and instructions on where to get it.
- In the case of Web browsing, the service is a "Web browser" application and instructions on what pages to contact.

What makes this approach so powerful

> "The application paradigm abstracts the idea of a service into a new, somewhat revolutionary definition: A service is really an application plus data."

is that it places no limits on what the application is. Nor does the application paradigm dictate whether the application resides in the set-top or the headend.

That's why the application paradigm is ideally suited for what's happening with cable networks today: The contemporary cable network has become a client/server environment that, like the personal computer (PC) environment, will support a range of applications and perform functions that were never before possible.

IP-based, TV-centric networks

Competition for the entertainment and information dollar has greatly expanded the scope of services that the cable network can potentially deliver. Meanwhile, the means to deliver these services have been enhanced by advances in network architectures and equipment.

In 1994, before the onset of widespread commercial Internet use, several leaders in the cable and computer industries were looking for a suitable network architecture for a new generation of advanced digital set-top boxes. The companies concluded that IP, as an open architecture without proprietary ties, would support efforts in developing a variety of interactive services.

This IP-addressability is now the enabling force that allows a wide range of TV-centric Internet services on advanced digital set-tops. Just as the TV set has quickly become the focal point for the convergence of digital entertainment and Internet access, IP has transformed digital set-tops and systems into a virtual LAN enabling a host of interactive applications transported on interconnected networks.

For two-way applications, IP enables direct downstream connections via a Moving Pictures Expert Group (MPEG-2) transport stream between an application server and the client application in the set-top and allows for two-way connectivity out-of-band (OOB). This allows dedicated streaming and control

The directory of files is broadcast continuously over an OOB channel via a quadrature phase shift keying (QPSK) modulator. (See Figure 1 on page 99.) To download the application, the set-top simply tunes to the quadrature amplitude modulation (QAM) channel listed in the directory; no upstream communication is involved.

This approach, which has been proposed for adoption as part of the OpenCable specifications, enables an operator to easily add new services to the system. Moreover, the BFS allows application developers to concentrate on creating applications without concerning themselves with how the data is delivered over the network. This is particularly appealing to developers of Internet-based applications.

Other key players

Digital network control system (DNCS): Successful implementation of two-way, interactive services requires sophisticated control software and hardware at the headend. The "brain" of the network is the DNCS. It integrates such jobs as handling traffic and contention, managing sessions, reserving bandwidth and frequency allocations, assigning paths, providing authorizations, and network monitoring.

The DNCS plays a vital role in network scalability. It makes sure that bandwidth and frequency resources are smoothly assigned as an operator deploys more interactive services on the network and two-way traffic increases. Other functions of a sophisticated DNCS include element management, security system management, and interfaces with billing and other related systems.

An operator's control system should be involved only at the outset of a transaction. Without IP connectivity embedded in the architecture as described earlier, anything that needs to be converted to IP must be routed through the control system. If the signals to and from the set-top are routed through the control system continuously, performance will suffer and bottlenecks can be expected as demand grows and more services are added.

Broadband integrated gateway (BIG): The BIG provides a mechanism for multiplexing data from application servers into MPEG-2 transport streams, which are transmitted over the RF network via the

QAM modulators. This data may include application executables, application data and IP datagrams, as well as traditional audio and video streams.

QPSK modulators and demodulators: The QPSK devices provide two-way communication between the set-tops and the hub. The QPSK modulator also serves as the link to an operator's LAN for two-way communication with the DNCS and application servers. Communication between the set-tops and the hub is over the RF HFC network; communication with the LAN is 10/100BaseT Ethernet.

Figure 2 (on page 99) is a diagram of an interactive, IP-based digital network that includes these components. The cable operator may have some of equipment needed for two-way communications already existing as part of a LAN such as routers, switches and fiber.

Conclusion

An interactive digital network resembles a standard LAN in functionality. IP enables cable operators to interconnect with data networks and operate an interactive network delivering a host of interactive applications to subscribers.

Like a client/server LAN, the HFC network provides high-speed communications in both directions and routes information to specific terminals. The network itself functions as a "hard drive," working hand in glove with a powerful client, a two-way digital set-top, to enable real-time, interactive services.

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IP Connectivity: The Network's Glue

Internet protocol (IP) is the common ground for a number of tools, protocols, and standard languages that enable the interconnection of data and video networks. The IP "toolkit" may be unknown in traditional video networks, but it is essential for interactive digital networks.

IP is the standard that supports most networking technologies. IP provides a standard way of packetizing data along with both the source and destination address (IP address) so that messages may be efficiently routed from an origination point, over multiple diverse networks, to a termination point. The related transmission control protocol (TCP) rides on top of IP and provides guaranteed delivery of messages through acknowledgements. TCP/IP provides the foundations for almost all data internetworking.

IP may be encapsulated in Moving Pictures Expert Group (MPEG) transport packets using the protocols standardized in MPEG Part 6 (International Standards Organization/International Electrotechnical Commision 13818-6), also known as digital storage media command and control (DSM-CC) for routing over the hybrid fiber/coax (HFC) network. These protocols provide the ability to set up, allocate and control resources used by a service at the server, set-top and network. These resources include bandwidth, routing and MPEG-2 program information. DSM-CC protocols enable the setup of client/server data sessions over the quadrature amplitude modulation (QAM) channels and the use of broadcast data carousels in the network.

Use of tools such as simple network management protocol (SNMP) and management information base (MIB) enable a traditional video network to be monitored and managed through an existing LAN or data network. MIB is a directory listing the logical names of all information resources that reside in a network and are pertinent to network management. The widely-deployed SNMP, which operates on top of the IP, was designed as a network management architecture for disparate networks joined together with bridgers or routers. It is a TCP/IP standard protocol, but its transport independence means it is not limited to TCP/IP.

Operators also can now use IP-based network protocols rather than traditional serial interfaces for billing, monitoring and control activities.

Examine Your Digital Fiber Options

By Kenneth Regnier

Fiber-optic transmission often is used to upgrade and expand cable TV system capacity. With new services such as Internet access, computer network interconnects, interactive programs and telephony, this leads to new digital signal formats' being transported within a system. Digital fiber-optic transmission sometimes is the logical choice as the backbone transport for these new multimedia services.

Digital fiber systems generally include the three major functions shown in Figure 1. There are different types of digital systems, with the key differences usually being in one or more of these three functions. It is helpful to understand these differences when evaluating which type of system best suits the application. Digital transmission in this context refers to systems using binary pulse code modulation (PCM) formats.

High-capacity systems are of the most interest in cable TV, and the two most common types are synchronous optical network/synchronous digital hierarchy (SONET/SDH) and proprietary architectures. The primary differences in these systems lie in their multiplexing, transmission coding and control overhead. Both types are synchronous in that their multiplexing functions depend upon all signal data being frequency synchronous with a master clock source.

SONET/SDH systems

A SONET (North America) or SDH (worldwide) system is based on standards that include specification of a multiplex structure, a hierarchy of channel data rates and transmission coding. SONET/SDH systems primarily are used in telephony networks that transport two-way telephone circuits; thus, they are symmetrical in that they operate bi-directionally with equal channel capacity (bandwidth) in each direction.

Since a fully-compliant SONET/SDH system is symmetrical, it has more reverse direction (upstream) capacity than often is needed for cable TV applications, where high downstream capacity is required to broadcast many video channels. However, cable TV upstream capacity usually is limited to lower speed data signals and/or a limited number of video channels.

The SONET/SDH multiplex is designed to accommodate digital telephony data rates easily. Lower data-rate channels are "mapped" into higher data-rate channels by a method that makes them easy to add or drop without decoding the entire transmission channel. This mapping also compensates for slight frequency variations on the input channels.

Standards for SONET/SDH define the payload and overhead portions of a channel. The payload portion carries actual traffic data, and the overhead portion

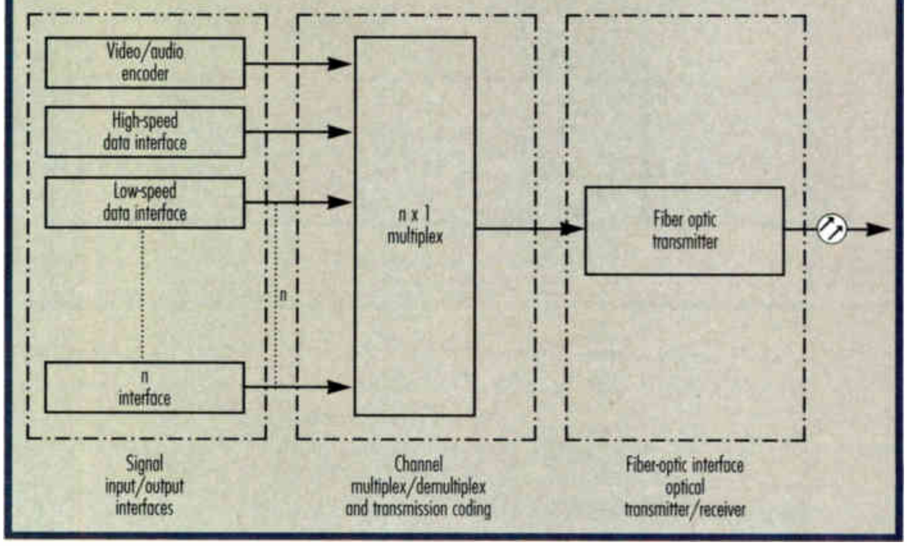
> **BOTTOM LINE**
>
> ### Multimedia Transmission
>
> The days are numbered for cable systems that send a few TV channels one way.
>
> Operators need two-way networks that can handle digital and analog signals. Digital fiber systems are good for new networks because they carry digital data signals in their "native" baseband format together with a lot of video and audio channels.
>
> Switching to digital fiber is a major investment that varies with type of system and architecture. Making the right choices ensures the proper investment level to meet current and future needs. Here are some tips in evaluating systems:
>
> Key differences among systems usually are found in the following functions. To make the best choice, it's important to understand and evaluate:
>
> - Signal interfaces
> - Multiplexing and coding
> - Fiber transmit/receive interfaces
>
> The two most common types are synchronous optical network/synchronous digital hierarchy (SONET/SDH) compliant and vendor proprietary. The primary differences are in their multiplexing, transmission coding and control "overhead." Both types are "synchronous" in that they operate from a master clock.
>
> Digital systems also can be set up in many ring and star combinations without worrying about signal degradation.

contains control information for network management and payload structure. (See Figure 2 on page 106.) Since the overall channel data rate is fixed, the relative sizes of the overhead and payload sections are important. More channel capacity required for overhead means less available capacity for revenue-producing payload.

SONET/SDH channels have substantial overhead, which enables good network management capability but reduces payload capacity. Modest increases in payload are possible by a technique called concatenation, which links together some of the data structures within a SONET/SDH transmission channel.

Because of their flexible multiplex structure, SONET/SDH systems are attractive for multimedia transport, but input/output interfaces must be considered. Some analog signals found in cable TV plants such as video, scrambled signals and RF-modulated signals are not easily adaptable to digitizing at telephony data rates. Video often is compressed to DS-3 (45 Mbps), which is more costly than uncompressed video interfaces, and the compression process does not easily accommodate scrambled or modulated signals.

Figure 1: Major elements of digital fiber-optic systems



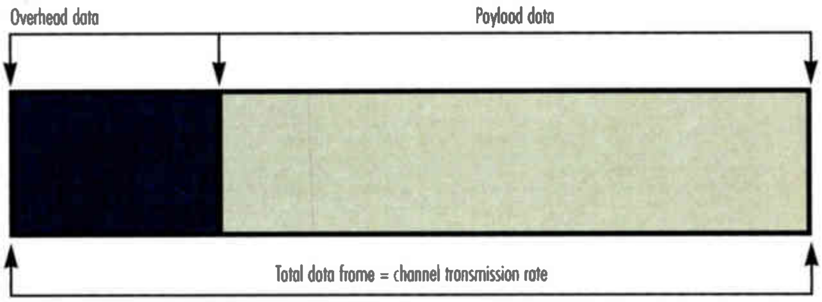
Proprietary systems

Digital fiber-optic systems with proprietary architectures do not conform to SONET/SDH standards, except possibly in transmission data rate. Their multiplex structures are optimized for transport of high data rate uncompressed video channels, and each manufacturer's multiplex can be different. Most proprietary systems can implement bi-directional operation but are not required to be symmetrical. Downstream (broadcast) and upstream (reverse) capacity can be tailored to fit specific system needs.

Proprietary multiplex structures usually have multiple, fixed data rate ports that accept one channel of digitized, uncompressed video with its associated audio and/or digital data. Most proprietary multiplexers can drop channels easily for local decoding and distribution as well as add or repeat channels for retransmission to the next node. Unlike telephony networks, video systems typically do not require separate access to the low data rate channels that are embedded within the higher-rate transmission channel; thus, the data mapping of SONET/SDH is not required, resulting in less multiplex overhead.

Proprietary systems also have payload and overhead within a transmission channel, but their relative sizes vary with each manufacturer's system structure. In general, payload sections are maximized because of the high data rate requirements of uncompressed video. Proprietary systems

Figure 2: Typical transmission data frame composition



also can have network management capability with status and control either built into the channel overhead or as an external communication function.

Proprietary systems are well-suited for multimedia transport because their multiplex structures accept different types of digital signals. Most systems offer input/output interfaces for many of the signals used in multimedia applications. These interfaces synchronize incoming digital data to a system clock reference and, for analog inputs, also perform analog-to-digital (A/D) conversion.

Some typical signals in cable TV multimedia services include:

• Video/audio signals

1) Analog baseband video/audio, clear or scrambled

2) TV-IF modulated signals

A) Quadrature amplitude modulation (QAM) and quadratue phase shift keying (QPSK) modulated formats for compressed video

B) TV-IF scrambled signals

3) Serial digital interface (CCIR 601—270 Mbps)

• Data signals

1) DS-3/E-3

A) High-capacity telephony channels in DS-3/E-3 (North America/CEPT)

B) Compressed digital video (DS-3/E-3 coding or MPEG-2 multiplex output)

2) T-1/E-1

A) Telephony access channels

B) Compressed videoconferencing channels

3) Ethernet

4) RS232

These video and data interfaces can be intermixed within most systems that also include drop/add/pass channel switching as well as bidirectional operation, redundant system elements and network management.

Network configurations

Digital fiber systems easily are configured into "ring" or "star" networks as well as point-to-point links. Key factors in their networking and expansion capabilities include the ability to drop, add or repeat channels at any node without signal degradation, as well as the ability to span long distances, including repeats, also without signal degradation. These networking capabilities essentially are part of the multiplex/coding and optical interface functions and are independent of signal interfaces. Therefore, all types of multimedia signals (video, telephony and data) can be transported within a digital network with equal performance and operability.

Figure 3 (on page 108) shows a redundant closed-ring configuration, often called a "counter-rotating" ring. Not only does this architecture allow flexibility to add or drop channels at any node, it also provides signal path redundancy. In the event of a fiber cut or other failure, all channels remain simultaneously available at all nodes.

Figure 4 (on page 108) shows a point-to-multipoint star configuration. The main advantage of this architecture is that it allows maximum capacity to each node from the central site, along with completely independent paths from the central (or headend) site to each node—especially

Figure 3: Counter-rotating digital ring network

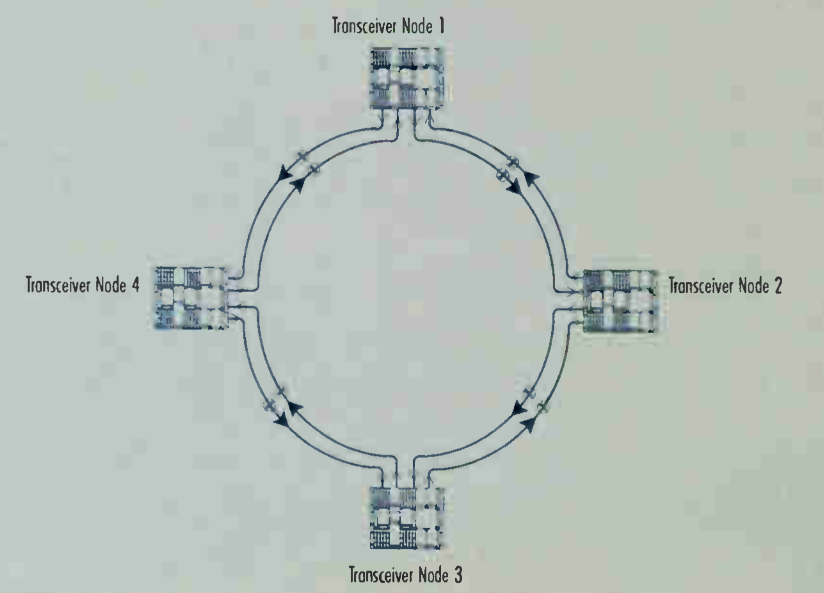
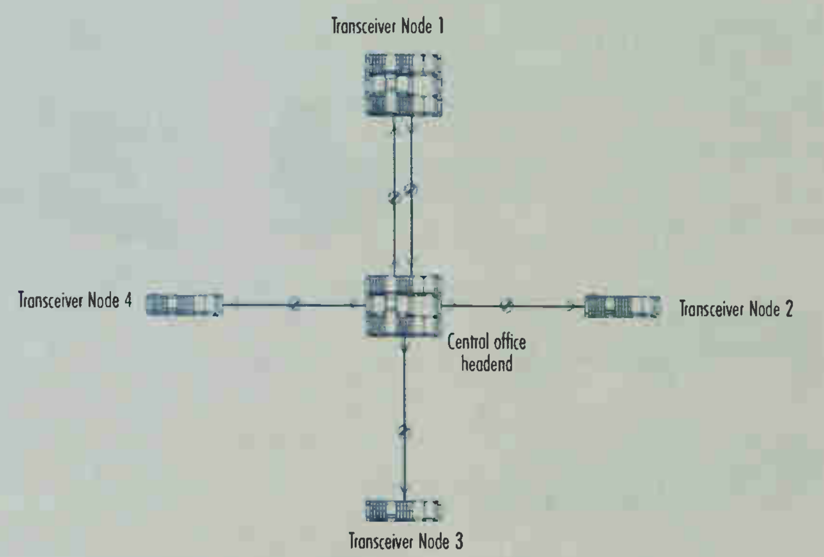


Figure 4: Digital star network



useful if different programming is required at each node location.

Star and ring networks also can be combined, such as a backbone ring feeding separate legs branching out from each ring node. This combination provides an all-digital network with the drop/add/pass and redundancy advantages of a regional backbone ring, while at the same time providing the flexibility of independent links for local coverage.

There are different types of digital fiber systems, with three major functional elements that should be evaluated in each type of system to allow the user to determine the best type of system for the required application. Digital systems can be configured in a flexible variety of ring and star configurations, without concern for signal degradation or lack of expansion potential, and they are well-suited to transport an array of multimedia signals such as digital data, telephony and multiple video formats. CT

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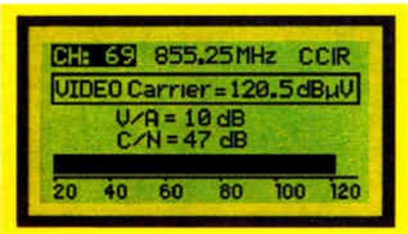
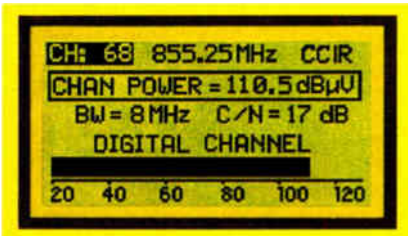


The equipment can also be configured for measurements on digital channels, giving us the value of the digital CHANNEL POWER as a figure and also on the graphic bar.



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Reader Service Number 86

Receiving Antennas for Digital TV

Digital Will Change Antenna Needs

By Peter Carr

Years ago, cable TV systems filled their meager channel cards with signals from the local area and distant cities. Since then, satellite-delivered signals have greatly expanded the geographic and program variety of the lineup.

Now, the Federal Communications Commission has approved rules to change local signals from analog to digital transmission format. The transition of these signals will mean changes in the way cable headends receive and process these channels.

Countdown to digital

So far, well over 20 stations nationwide have indicated that they will begin digital transmission by Nov. 1. FCC rules require affiliates of the four major networks to begin digital service by May 1, 1999. Analog station licenses will be reclaimed by the FCC on Dec. 31, 2006, unless digital reception has not made significant penetration in the majority of households.

In this transition period, both analog and digital signals will be broadcast by TV stations. Each station in the VHF band is assigned a UHF channel. Most UHF stations also are being assigned UHF channels specifically for digital. In very rare situations, UHF stations have been assigned VHF channels, but the FCC action is to move television out of VHF. After

2006, VHF licenses will be invalid, and the move should be complete.

Cable TV systems will need to expand their lineups to make room for the new channels. This requires that tower space be devoted to the installation of new antennas aimed at the new digital transmitters. As an example, in Ohio, Ch. 5 in Cincinnati is assigned Ch. 35 digital. Ch. 53 in Chilicothe is assigned Ch. 46 digital. An exception to the rule is Ch. 40 in Toledo, which is assigned Ch. 5 digital.

Antenna types

Antennas used for VHF reception usually are Yagis, named after their Japanese inventor Yagi Uda. These antennas consist of a driven element that is half the wavelength of the desired frequency, a reflector mounted behind the driven element and several directors mounted in front.

Calculations for a half-wavelength are different in free space than in metal because of the different velocity of propagation. (See Table 1 on page 112.) The idea is that the driven element bandwidth is widened by the slightly off-tuned reflector and directors. Their spacing from the driven element and their number influence the forward gain and front-to-back ratio of the antenna's pickup pattern.

The driven element usually is mounted second from the rear on the boom, which makes the antennas easy to recognize. The resulting pickup pattern resembles a baseball bat. The butt of the handle is similar to the rear lobe of the pattern. The front part

BOTTOM LINE

Picture This

For years, over-the-air channels have been treated with benign neglect. Now the digital age is coming to a channel near you. It's time to brush up on old-fashioned antenna technology and get ready for all those ones and zeros.

More channels: TV stations will broadcast on two channels at once. Is there room on the tower for more antennas? How many of what type? We discuss Yagi and Log Periodic antennas along with special types used at UHF frequencies. Impedance and RF connectors are 50 ohms, so baluns must be used to match these antennas to preamplifiers and downleads.

Grab a calculator: The size of an antenna and its spacing from the tower and supports is a function of its operating frequency. Using some simple math we can determine if a given antenna will fit on the tower among existing hardware. By using parabolic reflectors, UHF antennas can achieve greater gain than single antennas alone.

High mounting locations will reduce ghosting while high operating frequencies resist co-channel interference.

Table 1

One wavelength in space:	$\lambda \text{ (inches)} = \frac{11{,}811}{\text{Freq. MHz}}$
One wavelength in solid coax:	$\lambda \text{ (inches)} = \frac{7{,}783}{\text{Freq. MHz}}$
One wavelength in foam coax:	$\lambda \text{ (inches)} = \frac{9{,}565}{\text{Freq. MHz}}$
Half wavelength driven element length	$1/2\,\lambda = \frac{492 \text{x} K^*}{\text{Freq. MHz}}$

* K factor compensates for conductor diameter

Table 2

VHF antenna spacing chart

Channel	A $1/2\lambda$	B $2/3\lambda$	C 1λ	D $1/2\lambda$
2	113	138	208	104
3	101	125	188	94
4	91	115	172	86
5	78	100	150	75
6	72	93	139	70
FM	72	80	120	60
7	40	44	67	33
8	39	43	65	32
9	37	42	62	31
10	36	40	61	30
11	35	39	59	29
12	34	38	57	29
13	34	37	55	28

A = Minimum horizontal spacing between tower and antenna boom
B = Vertical spacing of antenna for 3 db gain
C = Horizontal spacing between antenna booms
D = Minimum spacing between antennas of different channels

(Number is for lowest frequency)

of the bat is toward the TV station. The sharpness of this pickup pattern is measured by the intensities on either side of the front lode where -3 dB points are located.

Another type of antenna widely used in cable TV is the Log Periodic antenna. Its pickup point is at the end of the boom nearest the TV station. Elements are much wider at the rear and taper toward the front. These features make the Log easy to recognize.

Electrically, these antennas are very different. Yagis are good for about 6 MHz bandwidth and show significant rolloff in gain above and below the desired channel. A Log antenna is able to receive three or four channels with excellent gain flatness. Yagi antennas usually are equipped with a mount at the middle of the boom. Framework needed to mount one or more Yagis must be large enough to stand the antennas away from the tower to prevent distortion of the pickup pattern. Logs generally are end-mounted to the tower, which makes installation easier. The downside of this is that the feedpoint is at the far end of the boom so that the antenna must be dismounted for service.

Either type of antenna may be stacked or combined for extra gain or interference rejection. Combining identical antennas in groups of two, four or eight will narrow the -3 dB beamwidth pattern in the vertical or horizontal planes or both. Table 2 (on page 112) shows the required spacing between identical antennas and also their spacing from the tower and supports.

> "One of the benefits of working with UHF signal paths is relatively low co-channel interference."

UHF characteristics

UHF antennas usually are Logs, which also can be stacked for greater gain. As the desired channel number increases, antenna size decreases. This means that Logs in the UHF band are much smaller physically and easier to mount. It also means that parabolic reflectors can be used.

UHF antennas normally have a pickup impedance of 50 ohms. Cables from the pickup point have "N" type connectors and require an impedance matching balun to connect to 75-ohm preamplifiers or the downlead. Weatherproofing on these connections is best handled by coating connector threads with silicon grease to prevent seizing, then applying shrink tubing. An impedance mismatch will occur if grease is used inside the connector, so the center should be left dry.

One of the benefits of working with UHF signal paths is relatively low co-channel interference. As Sun Spot Cycle 22 gains strength, this increased immunity to co-channel will be even more valuable. Also, ghosting caused by reflections from hills, buildings and similar objects is far less frequent and intense. High towers with UHF antennas mounted near the top will increase the angle of reflection, which decreases undesired signal intensity. This illustrates the need to consider antenna types, their number and their position above ground level for consistent signal quality.

While antennas are only the first part of the signal delivery chain, they set the carrier-to-noise ratio (C/N) for that channel, define signal quality and must withstand severe weather conditions. If carefully chosen and properly installed, they will be a reliable part of your headend equipment. CT

Peter Carr, WW3O, holds Extra class Amateur radio, General Radiotelephone and Marine Telegrapher licenses and is a senior member of SCTE. He is director of engineering at Cable Link Inc. He can be reached at (800) 399-1371, ext. 212.

An HFC Ethernet Application For Cable Modems

By Dave Jones

The main objectives behind refining hybrid fiber/coax (HFC) architectures in cable TV are to shrink the area fed by coaxial cable, improve the reliability of cable TV plant and allocate more bandwidth to the customer for advanced services. This is accomplished in various ways.

One way widely used in Europe and that is becoming more popular in the United States is to deploy optical hubs remotely from the headend and feed HFC service areas of 2,000 or fewer homes from these hubs.

A typical hub

A hub typically consists of a communications equipment vault or building in which repeaters or Erbium-doped fiber amplifiers (EDFAs) feed star couplers, which feed the HFC optical nodes. Reverse receivers also are located in these hubs to collect the signals from the return path.

Since the nodes feed a small service area, and a small number of node reverse paths are combined, the amount of reverse noise collected at the hub is reduced, and the reverse path is no longer something to be dreaded. Also, the ability to narrowcast signals to small, specific service areas lends itself well to the implementation of interactive data services such as those obtained via cable modems for high-speed Internet access.

In a hubbed architecture, the cable modem HFC interface equipment (translators and remodulators) is located out away from the headend in the hub. The HFC interface equipment processes the cable modem RF signals, discards errored packets and noise, and also provides the network interface to the headend core switch.

The core switch is a high-speed Ethernet switch with an asynchronous transfer mode (ATM), synchronous optical network (SONET), or Gigabit Ethernet uplink that connects to a high-speed wide area network (WAN) for Internet access. ➤

Cost comparison

Broadband		Ethernet		
Reverse laser	$6,000		10 Mbps	100 Mbps
Block conversion system	$20,000	Remote	$1,250	$2,000
Optical receiver	$1,300	Headend transceiver	$1,250	$2,000
Total	$27,300	Remote switch	$1,500	$1,500
Plus maintenance	extra	Total	$4,000	$5,500

BOTTOM LINE

Toward a Rock-Solid Transport System

Bringing cable modem information from the subscriber back to a hub on the reverse path is effective when the number of nodes combined is small. Combining small numbers of node reverse streams improves the noise performance and reliability of the return system.

Transmitting the entire reverse path from each hub back to the headend can be very maintenance-intensive, requiring delicate and frequent balancing of return levels, plus costly transport equipment. This makes for a fragile system.

By separating good packets of data and discarding noise and errored packets at the hubs and transporting this data via fiber-optic Ethernet to the headend, the problems of maintaining a broadband transport system are eliminated. Once installed, the fiber-optic transport system is rock solid, and reverse noise from one node cannot take the whole system down.

Furthermore, changes to one portion of the network will not affect any other portion. Technicians need only be concerned with maintaining the broadband reverse path from the nodes to the hubs. In addition, the entire system becomes more manageable through off-the-shelf simple network management protocol (SNMP) software, which works with some status monitoring technology.


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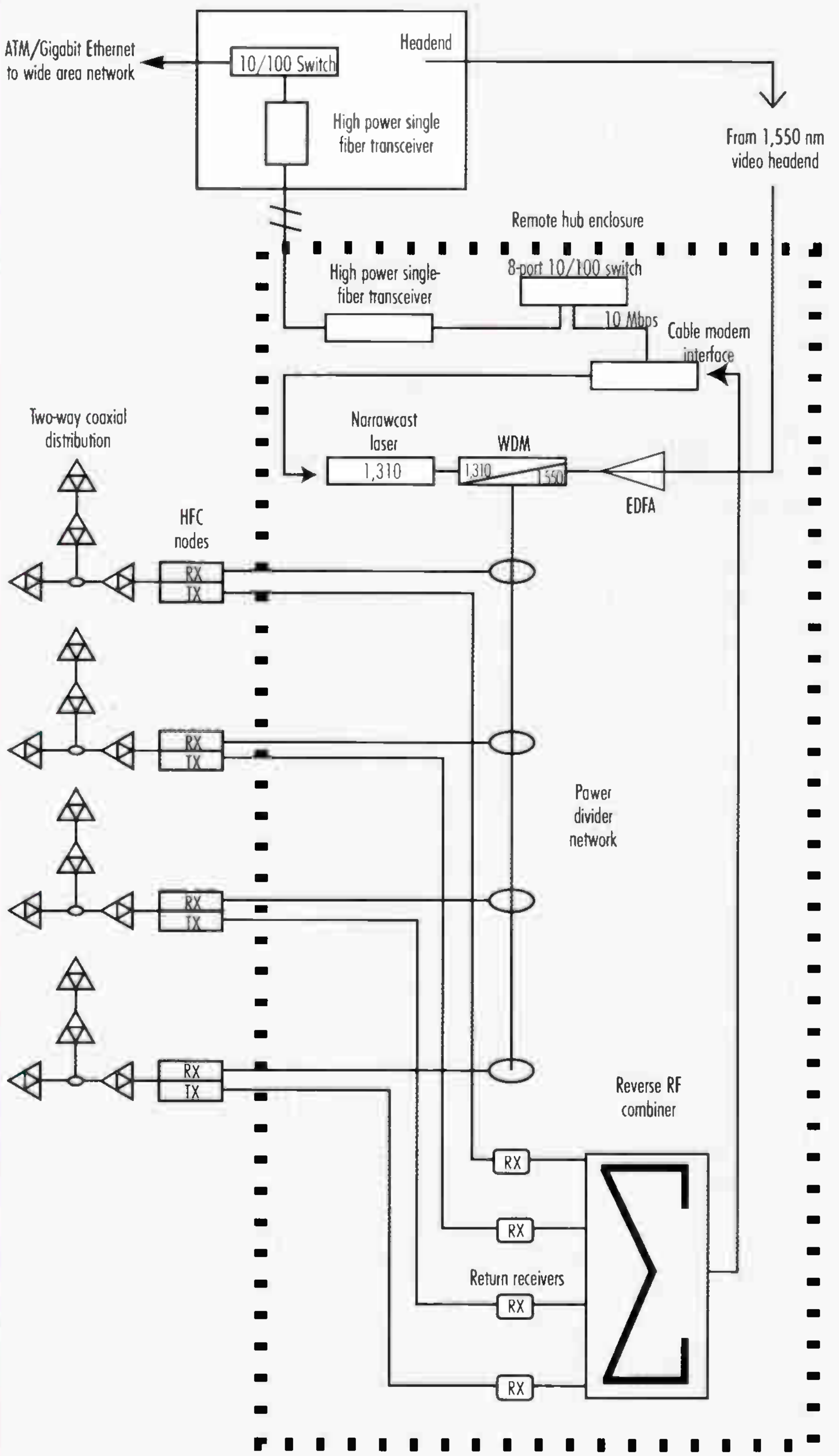
COMPRESSION
How It Works In Plain Language

Figure 1: 1,550 nm Erbium-doped fiber amplifier (EDFA) hub using wavelength division multiplexing (WDM) for data



Ethernet transport

Using Ethernet as the transport medium posed problems because of the 2 km distance limitation of the carrier sense multiple access with collision detection (CSMA/CD) protocol. The distance limitation is removed by using a full duplex Ethernet format, which allows simultaneous bidirectional transmission of the data signals without the possibility of collision.

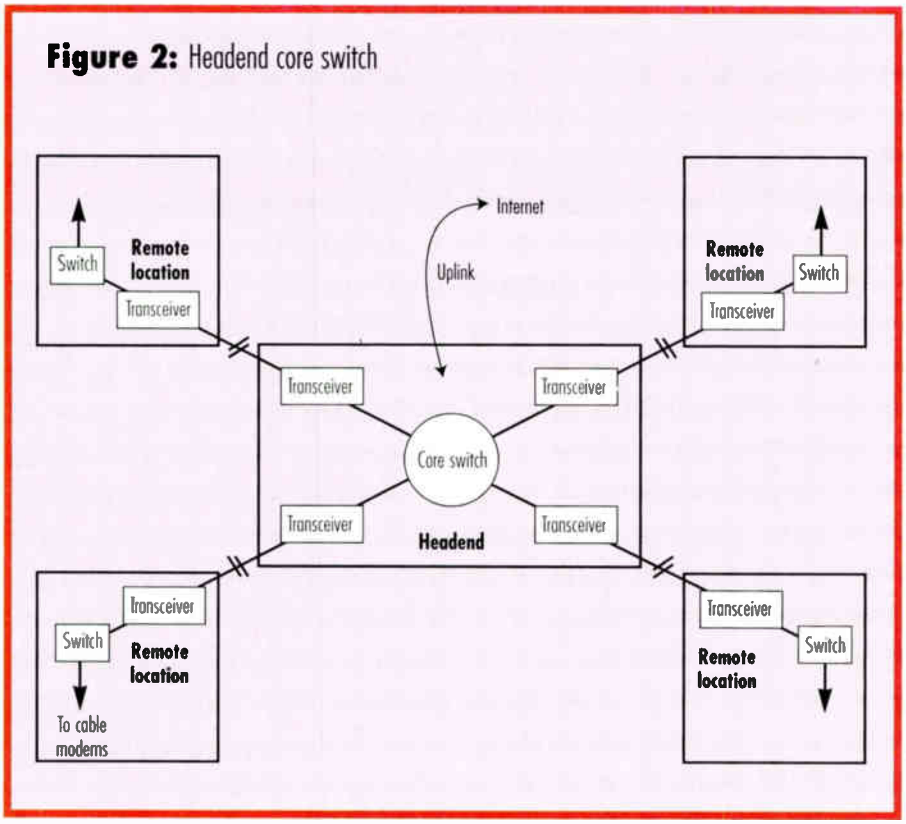
> "The core switch or router acts like a traffic cop and directs the data traffic from the Internet to the individual subscriber."

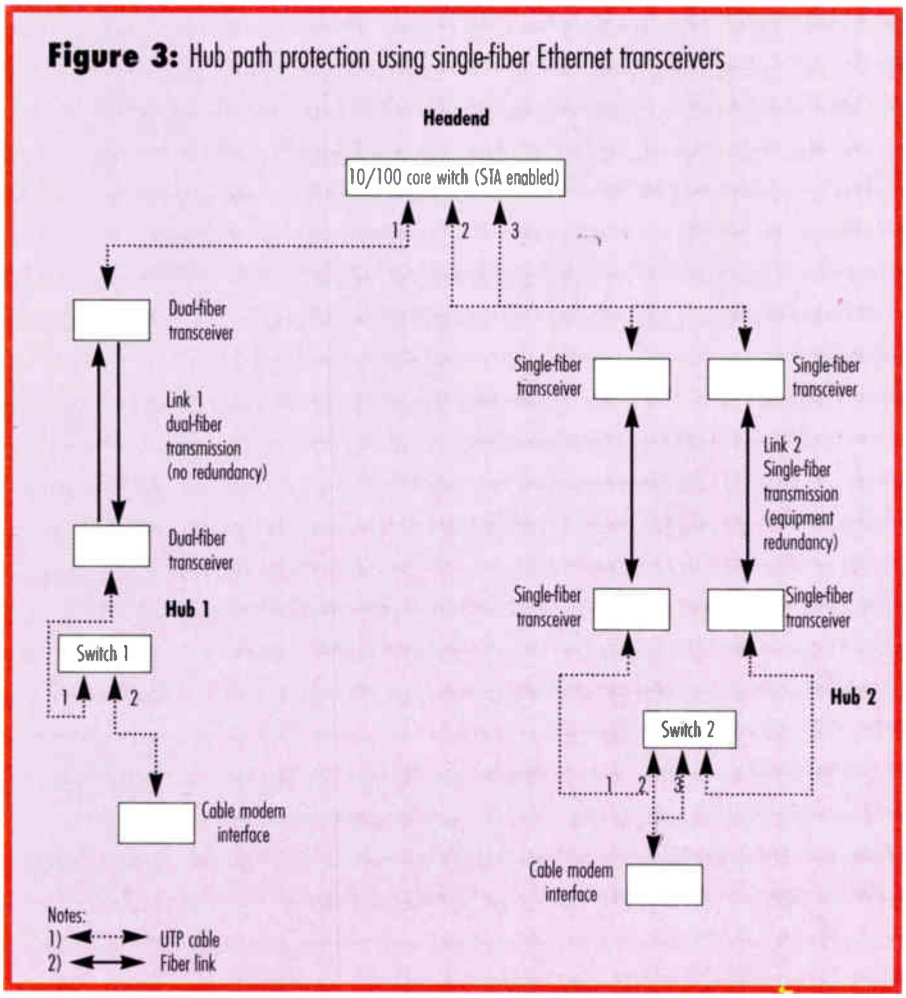
Figure 1 shows a 1,550 nm EDFA hub using a wavelength division multiplexing (WDM) technique to narrowcast the data services to the HFC optical nodes in the 550 MHz to 860 MHz spectrum. The cable modem HFC interface equipment delivers Ethernet to a 10/100 Ethernet switch. The reason for using a 10/100 switch is to provide an easy upgrade path to 100 Mbps (Fast Ethernet). However, either 10 Mbps or 100 Mbps Ethernet can be utilized with this type of switch.

The switch at the remote location performs the half-to-full duplex Ethernet conversion. From this switch, the full duplex Ethernet signal is uplinked to the headend via a pair of high-powered Ethernet transceivers. At the headend, the transceiver at the other end of the full duplex link converts the optical signal back to an electrical full duplex Ethernet signal, which is fed into a 10/100 port of the core switch. (See Figure 1.)

The core switch in the headend is connected in this manner to every hub in the cable network. It is itself connected to the Internet server located at the Internet service provider (ISP). Typically, the uplink connection is made

Reader Service Number 93





via a high-speed fiber-optic link.

The core switch or router acts like a traffic cop and directs the data traffic from the Internet to the individual subscriber. The core switch must have several very important features. It must be very fast (> 3 Gbps switching fabric) with a large buffer memory (> 2 MB per port) and have a large media access control (MAC) address table (> 8,000 addresses). The larger the system, the more important those features become. (See Figure 2.)

Single-fiber vs. dual-fiber Ethernet

There are several reasons to use single-fiber Ethernet transmission rather than two fibers. One is economic. At a typical installed cost of $450 per fiber mile (multi-fiber bundle in non-urban overhead construction, including fiber cost, installation, right of way, pole rental and so on) a 20-mile run can free $9,000 worth of fiber by using one fiber instead of two.

Besides economics, there are many occasions where fiber is in short supply, particularly in older fiber builds. Single-fiber Ethernet transceivers are available for distances up to 80 km (48 miles) and even further using premium optics.

Also, single-fiber transmission effectively doubles the capacity of existing fiber counts. In many instances, the excess fibers can be used for route protection. Where a primary and protection path previously used four fibers, the same level of service now occupies only two fibers. (See Figure 3.)

Comparing costs

We believe that the previous facts clearly demonstrate that transmitting Ethernet over fiber from the hubs to the central headend is much better from a technical standpoint. What will be shown in the accompanying table (on page 114) is that this solution costs less, much less when you consider the increased maintenance cost associated with reverse path broadband transmission. CT

Dave Jones is vice president of international sales for Radiant Communications. He can be reached at (800) 969-3427, ext. 202 or via e-mail at dvjones@ix.netcom.com.

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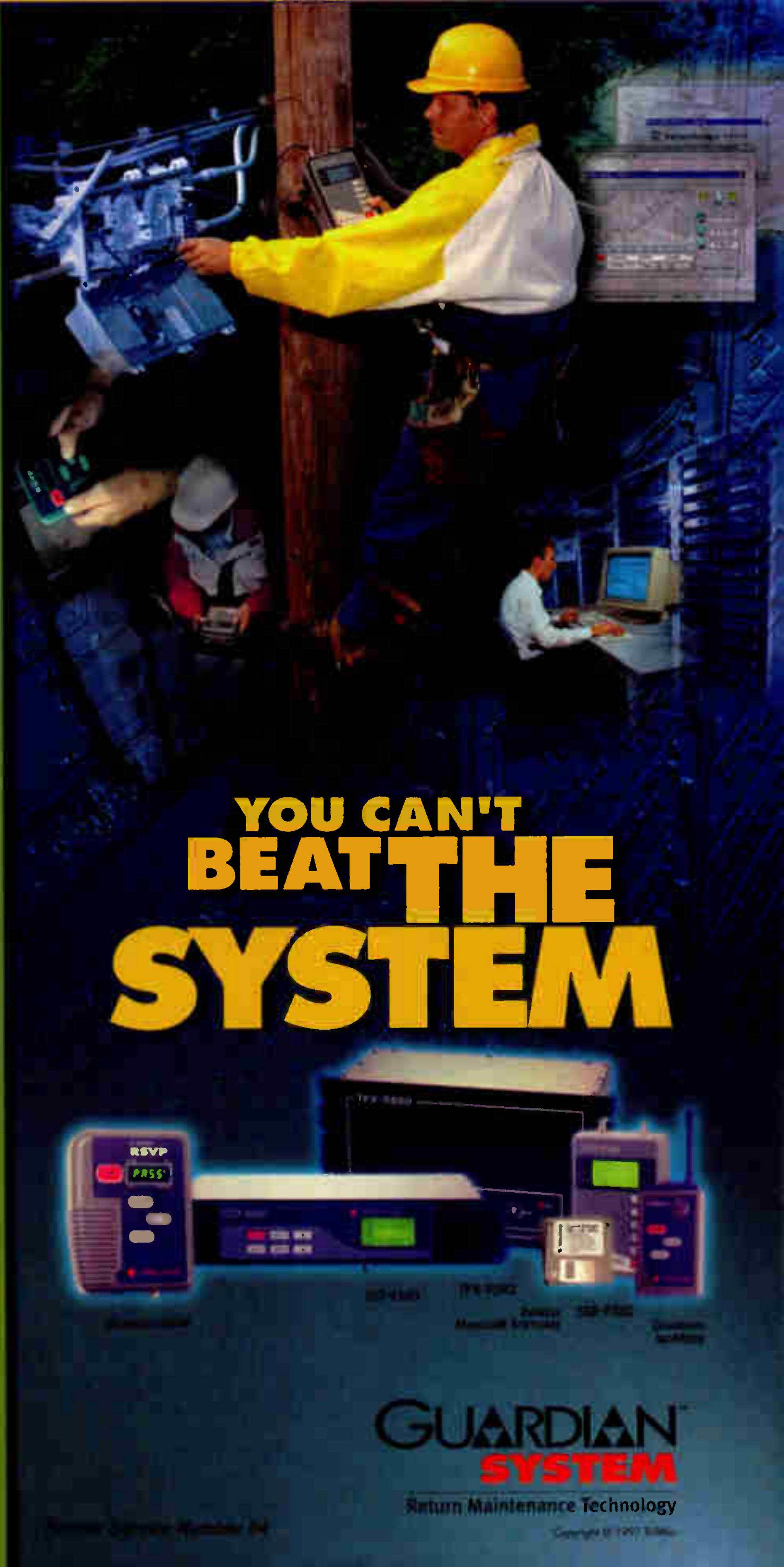
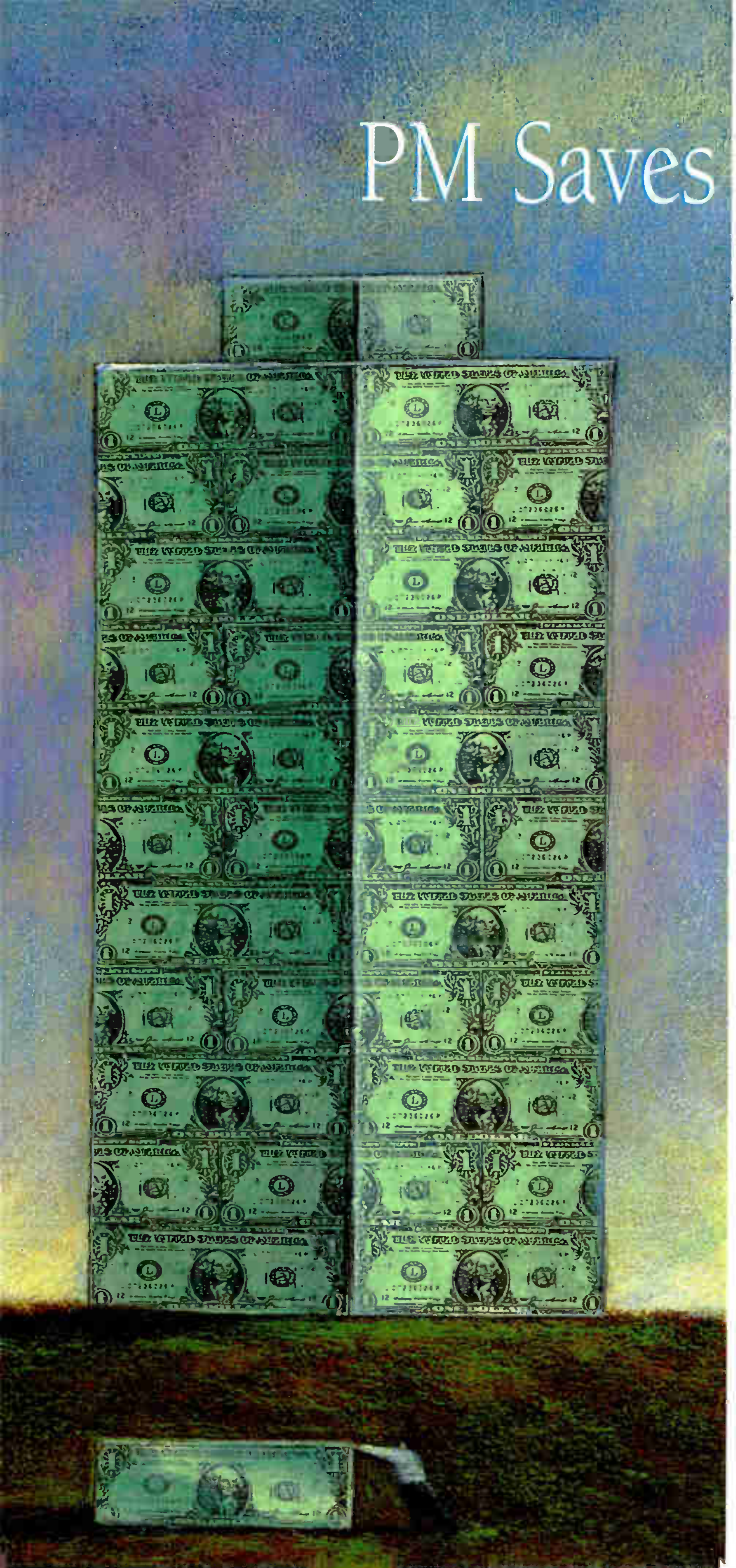




PM Saves Cash

...And Other Reasons a 30-Year-Old System Stays Competitive

By Laura K. Hamilton

"It's not too often that you see a 30-year-old system running 75 analog and 36 digital channels," says Woody Cash, system technician and crew chief at TCI-San Jose.

And that's exactly what that system is doing.

So what's the secret? Well, as you might expect, it's nothing glamorous: In large part, it's commitment to preventive maintenance (PM).

Eight years ago, TCI-San Jose instituted its present PM program, which Cash had a large part in establishing. And while Cash says that the hardest part of engineering is measuring results in dollars, he adds that the PM work has paid for itself many times over.

The system

With 186,000 subscribers, the TCI system serves San Jose, Campbell, and parts of Santa Clara County in California. The network is made up of just over 2,500 strand miles of plant. It is dual cable, running 37 channels on each side.

And this system is far from being alone in the multichannel TV delivery business in its market. Customers can pick up 21 over-the-air channels with an outdoor antenna, and direct broadcast satellite (DBS) is available in the region as well. In that kind of competitive atmosphere, keeping the customer happy often means finding the problem before it happens. In other words, PM is a key to competing effectively.

The PM program

Cash and his team take the following steps to ensure the continued reliability of the network:

- All optical nodes are swept every three months.
- All trunk amplifiers are swept every year.
- All feeder amplifiers are swept every two years.
- During field tests, techs place a sticker inside every amplifier, so the next time a technician returns to that point, he or she will know what to expect.

This maintenance program is not just a sweeping, but a proofing of the system, according to Cash.

"We set up a sweep reference at the headend," he says. "Then we sweep the optical link and check frequency response, carrier-to-noise (C/N), composite triple beat (CTB) and composite second order (CSO) distortions at each node. The process is recorded and kept on a database as a history of the active network, from which reports can be developed."

Two-way

While most of the testing at the San Jose system has been downstream, Cash is learning about testing the return path as well. He tests the returns on systems serving Sunnyvale (hybrid fiber/coax) and Cupertino/Los Altos (fiber hub). The latter was built as a fully two-way system and is being used for impulse pay-per-view (IPPV). Return alignment is routinely tested in that part of the network, specifically level balance and ingress elimination, reports Cash.

It's just good engineering

"A service call is a poor and costly substitute for good engineering practices." That motto made it onto Cash's Technician of the Year for Northern California and Nevada award a couple years back.

And to take that saying a little further, we can confirm some of the benefits of PM. That is, PM reduces truck rolls, fewer truck rolls save cash, good engineering practices make for happy customers, and happier customers stay put.

Consulting Editor Alex Zavistovich contributed to the research and writing of this article.

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

BOTTOM LINE

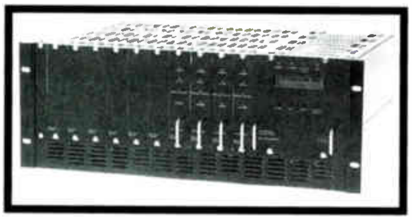
Preventive Maintenance For 1999 and Beyond

In this era of dizzying possibilities spawned by digital and two-way, and in this age of competition from the likes of direct broadcast satellite (DBS), you've got to keep your eyes on one of the least glamorous but most important back-to-basics practices: preventive maintenance (PM).

In the end, a good PM program saves a lot of dollars at TCI-San Jose, reports the aptly named Woody Cash, system technician and crew chief. It also helps the system keep up the pace against plenty of competition in the region, he adds.

TCI-San Jose, with 186,000 subs, set up a successful PM program eight years ago. In part, it involves the following:

- All optical nodes are swept every three months.
- All trunk amplifiers are swept every year.
- All feeder amplifiers are swept every two years.
- During field tests, techs place a sticker inside every amplifier, so the next time a technician returns to that point, he or she will know what to expect.



Family of Headend Gear

WaveCom Electronics has introduced its MA 4000 series of modular headend components, including the MA 4100 analog multichannel multipoint distribution service (MMDS) transmitter, the MA 4200 digital MMDS transmitter; the MA 4300 reverse path stacker and destacker, the MA 4400 upconverter, and the MA 4500 quadrature amplitude modulation (QAM) digital modulator.

The stainless steel MA 4000 chassis features active cooling and is 19 inches wide and 4 rack units high, housing up to 10 card modules. The family offers remote management of frequency agility, RF and IF power levels, QAM digital modulator setup, and alarm functions.

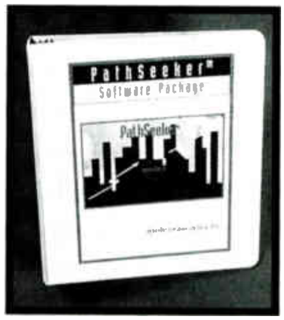
Reader Service #309

90V, 20 Amp Power Supply

Alpha Technologies has announced the industry's first 90V, 20A power supply, the XM Series 2 CableUPS. The high current available allows for simple upgrading of applications requiring additional power, as well as simplified system design. The unit also features dual isolated outputs, providing improved protection and isolation as well as enhanced overall system reliability. New product design includes 100% front panel access to all connections and test points for easier and more efficient maintenance. The unit design incorporates complete generator compatibility, flexible system control and advanced status monitoring options. It also will display suggested troubleshooting hints under alarm conditions.

Reader Service #312

Fiber-Tracking Software



The Pathseeker fiber-optic database platform software package from Molex Fiber Optics provides software support for end-to-end optic fiber tracking of all network locations. The software uses a Windows 95 operating platform, stores fiber data for cable TV networks, traditional telephony networks and broadband applications. This allows users to track fiber routings by setting up network locations and identifying splicing or termination points.

Pathseeker provides fiber tracking and frame administration for fiber interconnect systems, cable and location routings for documenting outside plant cable routes and database management for optical time domain reflectometer (OTDR) traces. This software features fiber administration for frame graphics and an intelligent jumper running between frames.

Reader Service #311

Test Set

Progressive Electronics has introduced the Model 402K cable tone test set for identifying coaxial drop cables at their distribution points. The design allows the transmitter to send tone through any passive device, and it can be set to produce one of four distinct tones so technicians can use up to four transmitters for tracing multiple cable runs. The high-output transmitter also will support tone signal on a cable with up to 45 dB loss.

The receiver picks up signal three ways: electrostatic pickup for nonterminated cables, electromagnetic pickup for terminated or shorted cables and direct connection for identification in the presence of passives.

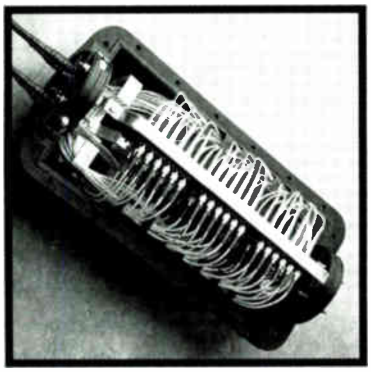
Both receiver and transmitter are equipped with female F-connectors, and adapters allow the unit's use on other cable sizes.

Reader Service #310

Cable Identifier

Intending to promote an easy way to identify twisted-pair, coax and electrical cables, Tempo Research has introduced its Voice Response Tagger Model TR1185. It identifies eight conductors with a verbal response of "one" through "eight." It's equipped with a tone generator and a talk circuit. Pair identification is delivered via Tempo's Hunter Probe, handset or conventional headset.

Reader Service #308



Drop Enclosure

Performed Line Products' Coax Drop Line Closure is intended to simplify coax cable repairs. The unit is a secure, watertight environment for direct-buried coax cable splicing. Universal closure halves snap together, requiring no special tools.

Once installed, cable alignment tabs keep the cable straight and the unit securely in place. To ensure that the closure is watertight, Poly-Bee sealant is used inside for maximum protection from the environment. Each unit comes prefilled and ready to use. It comes in two sizes and holds a variety of standard coax connectors and couplers. The small closure accepts coax drop cable up to 0.3-inch diameter along with its associated connectors, while the large closure accepts coax drop cable up to 0.45-inch diameter and its associated connectors.

Reader Service #307

Distribution Cable

TX Flexible Feeder, a new coaxial distribution cable from Times Fiber, is designed with the low loss and high mechanical flexibility attributes necessary for installation in areas with little space. It's intended for multiple dwelling units (MDUs) and high cable-count conduit runs. Versions intended for indoor, aerial and underground construction are available.

Reader Service #306

Cable Industry Guide

Communications Technology has added the Phillips Business Information *Cable Industry Directory* to its stable of broadband publications. The *Directory* will be relaunched as a two-part publication. A comprehensive buyers' guide version will be mailed to the entire *CT* readership, and an enhanced version featuring industry research and analysis will be sold to interested buyers.

Reader Service #305

The following listing covers several of the books and videotapes currently available by mail order through the Society of Cable Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers must add 20% when ordering.

- *Introduction to Light*—This video seminar deals with topics covered in Chapter 23 of the third edition of *Cable Television*. Topics include theories of light, the photon, alternating waves, electromagnetic/light spectrum, frequency vs. wavelength, velocity of propagation (VOP), reflection, diffusion, refraction, color-related terms, dispersion, diffraction, absorption, scattering and more. (50 min.) Order T-1170, $45.
- *Light as a Transmission Carrier*—This program covers and expands upon material in Chapter 24 of the third edition of *Cable Television*. Topics include illumination, incandescence, luminescence, transparency, propagation of light, radiant energy, modulation, introduction to lightwave transmission systems and more. (25 min.) Order T-1171, $45.
- *Introduction to Optical Fibers*—This program deals with subject matter covered in Chapter 25 of the third edition of *Cable Television*. Topics include propagation modes, numerical aperture, modal dispersion, pulse dispersion/broadening, refractive index, system distortion, waveguide dispersion, material dispersion, intersymbol interference, multimode and single-mode fibers. (45 min.) Order T-1172, $45.
- *Light Transmission in Optical Fibers*—This program's content expands upon the material presented in Chapter 26 of the third edition of *Cable Television*. Topics covered include distortion/noise, analog vs. digital applications, light scattering in fibers, light absorption in fibers, attenuation mechanisms, optical transmission levels, signal-to-noise ratio (S/N), bit error rate (BER), bandwidth and rise time, digital multiplex equipment, distortion in digital signals, modulation, optical transmitter and receiver designs, light emitting diodes (LEDs), lasers and APDs. (50 min.) Order T-1173, $45. CT

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

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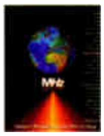

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Radiant Communications introduces the Series VC-500, a high quality video codee that interfaces with standard analog video/audio signals and converts them to digital signals, whichcan be transmitted if used with Radiant's Ethernet Systems and can be sent up to 100km over singlemode fiber to any PC on the network. The VC-500 also can be used over ISDN lines.

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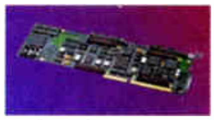

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Scientific-Atlanta provides end-to-end solutions to enable two-way, interactive HFC architectures. Products include the Prisma™ Digital Transport System, Continuum™ Headends, Prisma DWDM, 1310/1550nm optoelectronic transmitters and nodes, RF coaxial electronics and Drop Network components, and comprehensive Element Management.

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Silicon Valley Communications' advanced products are ready to satisfy the reliability and flexibility needs of expanding, interactive HFC networks. SVC manufactures a complete family of modular, high performance 1310nm and 1550nm fiber-optic communications products, including forward and return path transmitters, receivers, EDFAs and user-configurable 1RU/3RU chassis.

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Reader Service No 179

Stanford Telecom supplies modulator and demodulator products for subscriber and headend interactive HFC equipment. We provide a full function modulator/ demodulator on a single ASIC chip for subscriber modems, and burst demodulator assemblies for reception of upstream signals at the headend.

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The RB Clip Gun Systems from ***Telecrafter Products*** offer the safest method of fastening single or dual cable. Specifically designed for the telecommunications industry to install coaxial cable, the clip gun fires clips containing two galvanized nails-not staples-for a perfect, long-lasting installation that will never pinch or pierce the cable, or compromise signal integrity in any way.

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Product and Data Showcase

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The SCTE Installer Certification Program was created to establish minimum skill requirements for CATV installers and installer/technicians. Participants in the program must successfully complete practical examinations in the areas of cable preparation and meter reading, as well as a written examination on general installation practice. The program is being administered by local SCTE chapters and meeting groups under the guidance of SCTE national headquarters. All candidates for certification in the program are recognized as SCTE members at the Installer level, and receive a copy of the *SCTE Installer Manual*.

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26	52	78	104	130	156	182	208	234	260	286	312

A. Are you a member of the SCTE (Society of Cable Telecommunications Engineers)?

01. ___ yes
02. ___ no

B. Please check the category that best describes your firm's primary business (check only 1):

Cable TV Systems Operations

03. ___ Independent Cable TV Syst.
04. ___ MSO (two or more Cable TV Systems)
05. ___ Cable TV Contractor
06. ___ Cable TV Program Network
07. ___ SMATV or DBS Operator
08. ___ MMDS, STV or LPTV Operator
09. ___ Microwave
10. ___ Telecommunications Carrier
11. ___ Electric Utility
12. ___ Satellite Manufacturer
13. ___ Satellite Distributor/Dealer
14. ___ Fiber Optic Manufacturer
15. ___ Data Network
16. ___ Commercial TV Broadcaster
17. ___ Cable TV Component Manufacturer
18. ___ Cable TV Investor
19. ___ Financial Institution, Broker, Consultant
20. ___ Law Firms or Gov't Agencies
21. ___ Program Producer or Distributor & Syndicators
22. ___ Advertising Agencies
23. ___ Educational TV Stations, Schools and Libraries
24. ___ Other (please specify)________

C. Please check the category that best describes your job title:

Technical/Engineering

25. ___ Vice President
26. ___ Director
27. ___ Manager
28. ___ Engineer
29. ___ Technician
30. ___ Installer
31. ___ Corporate Management (Chairman, Owners, Presidents, Partners, Executive/Senior Vice Presidents and Treasurers)
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D. In the next 12 months, what cable equipment do you plan to buy?

37. ___ Amplifiers
38. ___ Antennas
39. ___ CATV Passive Equipment including Coaxial Cable
40. ___ Cable Tools
41. ___ CAD Software, Mapping
42. ___ Commercial Insertion/Character Generator
43. ___ Compression/Digital Equip.
44. ___ Computer Equipment
45. ___ Connectors/Splitters
46. ___ Fleet Management
47. ___ Headend Equipment
48. ___ Transmission/Switching Equipment
49. ___ Networking Equipment
50. ___ Vaults/Pedestals
51. ___ MMDS Transmission Equipment
52. ___ Microwave Equipment
53. ___ Receivers and Modulators
54. ___ Cable Modems
55. ___ Subscriber/Addressable Security Equipment/Converters/Remotes
56. ___ Telephone/PCS Equipment
57. ___ Power Supplies (Batteries, etc.)
58. ___ Video Servers

E. What is your annual cable equipment expenditure?

59. ___ up to $50,000
60. ___ $50,001 to $100,000
61. ___ $100,001 to $250,000+

F. In the next 12 months, what fiber-optic equipment do you plan to buy?

62. ___ Fiber-Optic Amplifiers
63. ___ Fiber-Optic Connectors
64. ___ Fiber-Optic Couplers/Splitters
65. ___ Fiber-Optic Splicers
66. ___ Fiber-Optic Transmitter/Receiver
67. ___ Fiber-Optic Patchcords/Pigtails
68. ___ Fiber-Optic Components
69. ___ Fiber-Optic Cable
70. ___ Fiber-Optic Closures & Cabinets

G. What is your annual fiber-optic equipment expenditure?

71. ___ up to $50,000
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H. In the next 12 months, what cable test & measurement equipment do you plan to buy?

74. ___ Audio Test Equipment
75. ___ Cable Fault Locators
76. ___ Fiber Optics Test Equipment
77. ___ Leakage Detection
78. ___ OTDRs
79. ___ Signal Level Meters
80. ___ Spectrum Analyzers
81. ___ Status Monitoring
82. ___ System Bench Sweep
83. ___ TDRs

I. What is your annual cable test and measurement equipment expenditure?

84. ___ up to $50,000
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87. ___ over $250,000

J. In the next 12 months, what cable services do you plan to buy?

88. ___ Contracting Services (Construction/Installation)
89. ___ Repair Services
90. ___ Technical Services/ Eng. Design

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L. Do you plan to rebuild/ upgrade your system in:

95. ___ 1 year
96. ___ more than 2 years

M. How many miles of plant are you upgrading/rebuilding?

97. ___ up to 10 miles
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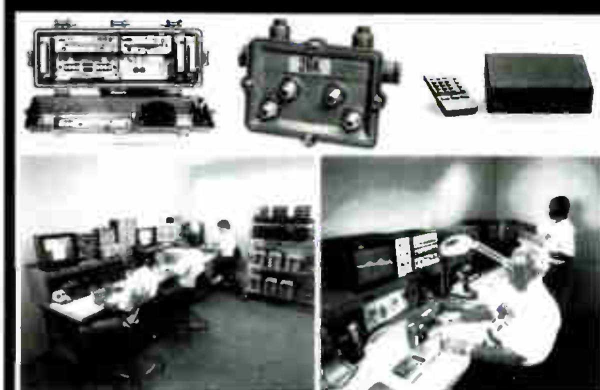

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CALENDAR

October

3: Llano Estacado SCTE Chapter vendor show, LISD-TV offices, Lubbock, TX. Third Annual Cable-Tec Games will be conducted. Contact Bob Baker, (505) 763-4411.

4-7: VidTrans '98, Miami. Fax to (770) 745-1426.

5-7: International Engineering Consortium National Communications Forum, Chicago. Call (312) 559-4600.

7: International Engineering Consortium IP Telephony ComForum, Chicago. Call (312) 559-4600.

13-15: Mid-America Cable Show Overland Park Convention Center, Overland Park, KS. Cable-Tec Games, test equipment demonstrations and other activities sponsored by the SCTE Heart of America Chapter. BCT/E certification examinations to be administered. Contact Dan Mulvenon, (913) 599-5900.

15: Ohio Valley SCTE Chapter testing session. Installer, BCT/E, service technician and telephony certification examinations to be administered. Contact Gia Phelps, (800) 769-1441.

Oct. 16-18: Fiber U and Wire U, Las Vegas. Call (800) 537-8254.

19-21: 21st Annual Newport Conference on Fiber-Optics Markets Newport, RI. Call (800) 343-4035.

19-22: SCTE Regional Training Seminar Minneapolis. Sponsored in cooperation with the SCTE North Country Chapter. Topic: "Telephony for Technicians" with SCTE Director of Regional Training Ralph Haimowitz followed by "Data Technology for Technicians" with SCTE Vice President of Technical Programs Marvin Nelson. Contact SCTE headquarters, (610) 363-6888.

Oct. 26-28: Eastern Cable Show. Orlando, FL. Call (404) 255-1608.

26-28: Chattahoochee, Central Florida and South Florida SCTE chapters technical seminar and testing session, Orange County Convention Center, Orlando, Fl. Technical program offered in conjunction with the Eastern Show. BCT/E certification examinations to be administered. Contact Guy Lee, (770) 321-0133.

27-29: Philips Broadband Networks' Mobile Training Center, Richmond, VA. Contact Sarah London at (800) 448-5171, ext. 2273.

29-30: Communication Design Engineering Conference, San Jose, CA. Call (415) 538-3848. CT

Planning Ahead

Nov. 4-5: OSP Expo '98, Cincinnati. Fax (847) 639-9542.

Nov. 17,18: International Engineering Consortium Wireless Engineering ComForum, Richardson, TX. Call (312) 559-4600.

Dec. 1-4: Western Cable Show, Anaheim, CA. Call (510) 429-5300.

Feb. 24-26: Texas Cable Show '99 San Antonio. Call (512) 474-2082.

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

C. Please check the category that best describes your job title: (check only one)

19. ❑ Corporate Management
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22. ❑ Vice President
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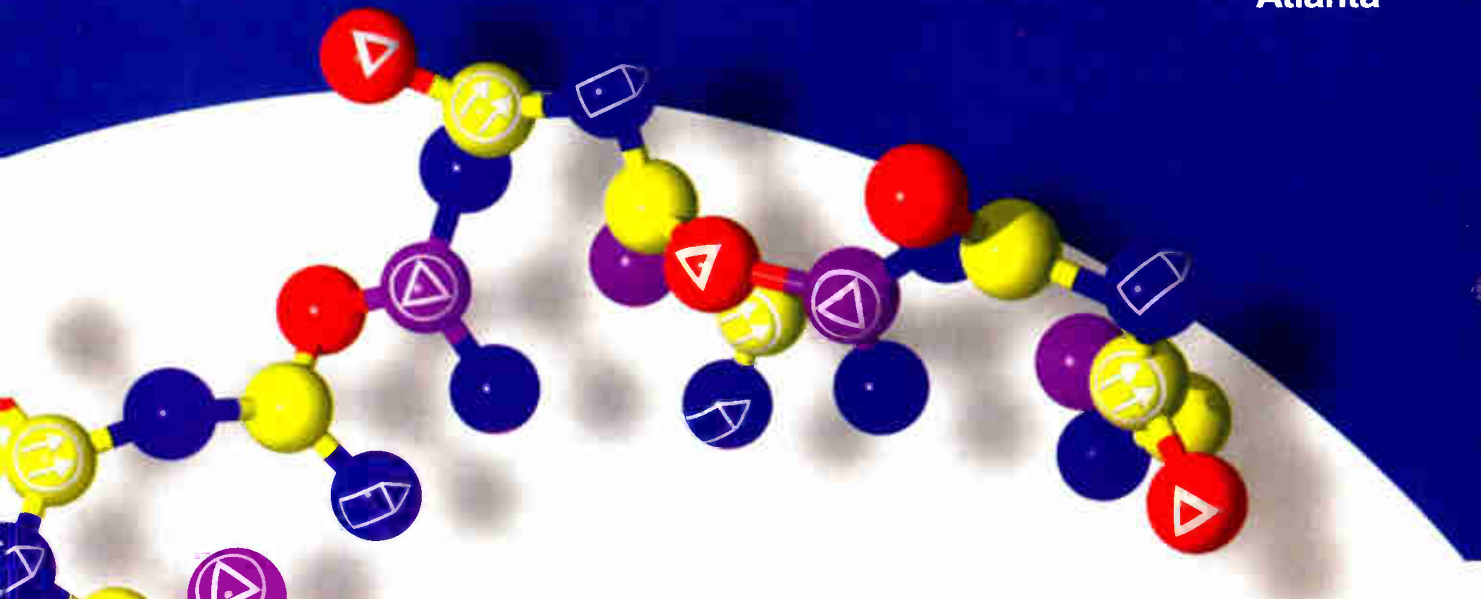

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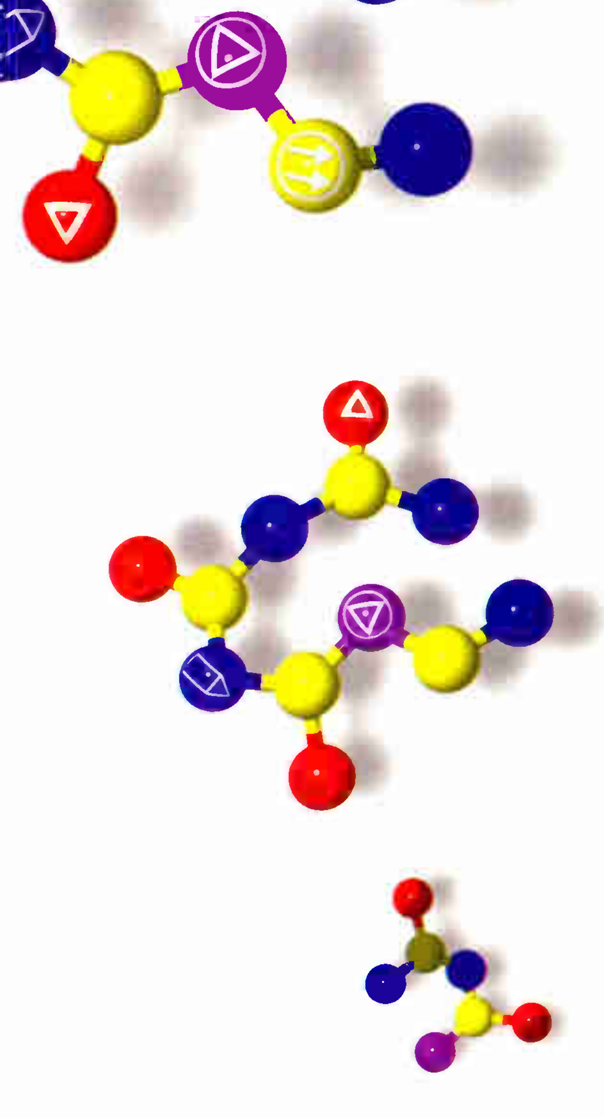

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TRAINING

By the NCTI

Troubleshooting Hum Modulation, Part 1

This month's installment begins a series on troubleshooting hum modulation. The material is adapted from a lesson in NCTI's Installer Technician Course. © NCTI.

To intelligently troubleshoot a hum modulation problem in the customer drop, it is necessary to understand what hum modulation is, what it looks and sounds like, and what causes it. It also is necessary to know what test equipment to use to measure its severity and how to systematically isolate its cause.

Recognizing hum modulation

Hum is the amplitude modulation of broadband video and audio carriers by 60 Hz or 120 Hz AC voltage. It may be visually identified by either one (60 Hz) or two (120 Hz) horizontal bars (hum bars) as show in Figures 1 and 2 respectively.

The degree of lightness, darkness, and width of the hum bar varies with the percentage of modulation.

A high percentage (greater than 5%) of hum produces a distinct white or black, wide hum bar (Figure 2), while a low percentage (2% to 5%) of hum produces a weak or faint, white or black, narrow hum bar (Figure 3).

Hum bars introduced after the headend are always over the picture and are not a part of the picture. They may be stationary or slowly moving from the bottom of the screen to the top. Moving bars are the most common.

In severe cases, there may be horizontal pulling in the TV picture and hum bars, and vertical rolling of the picture as the hum bar moves to the top of the screen and overrides the vertical sync pulse.

Quite often, if hum is visible in the picture, it may also be audible in the sound. The loudness of the hum tone may or may not vary as the volume control on the TV set or remote control is adjusted. Hum can be frequency-dependent and more visible on some channels.

Always make hum measurements on an unmodulated video carrier. Hum cannot be accurately detected by a signal level meter when measuring a channel with a modulated video carrier, because the hum modulation is obscured by the video carrier modulation.

Some signal level meters (SLMs) can read hum on an audio carrier, because the audio carrier is frequency modulated. Thus, this modulation does not obscure the presence of hum.

An SLM indicates hum as a percentage. Hum modulation is the ratio of the peak-to-peak voltage level of the low frequency (60 Hz or 120 Hz) AC interfering signal to the peak voltage level of the unmodulated RF video carrier.

The percentage of hum is calculated by dividing the peak-to-peak interfering AC voltage by the peak unmodulated RF video carrier voltage and multiplying that resultant by 100.

For example, a 0.2 mV peak-to-peak 120 Hz low frequency interfering AC signal can cause a 10% hum on a 2 mV peak unmodulated RF video carrier level as show in the following equation:

$$\frac{0.2\text{ mV peak-to-peak AC voltage}}{2\text{ mV peak unmodulated video carrier voltage}} \times 100 = 10\%\text{ hum modulation}$$

An SLM hum reading of less than 2% usually is acceptable. Hum greater than 2% can cause noticeable interference on the TV picture, depending on the TV set.

The next installment will identify the possible causes of hum modulation and begin a series on procedures for systematically isolating various specific causes of visible hum bars.

Figure 1

60 Hz hum bar

Figure 2

120 Hz wide, black hum bars

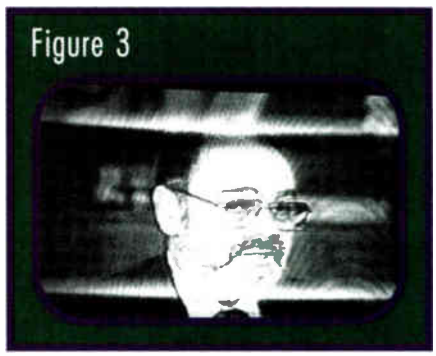

Figure 3

120 Hz narrow, white hum bars

The Colorado-based NCTI is the largest independent provider of broadband communications training in the world. NCTI is located at 801 W. Mineral Drive, Littleton, CO 80120. For more information on this or any other of its training materials, contact the NCTI at (303) 797-9393. CT

By Hugh McCarley

SCTE: "E" Is for Education

You may recall that in August's "Chairman's Message" I discussed the Society's participation in an industrywide initiative called "Cable Technology Week." The project was scheduled to occur in late September or early October to promote and demonstrate the benefits of broadband technology to the global marketplace.

If you're wondering why you haven't seen or heard anything about it lately, it's only because the program has been postponed until Spring 1999. But while the event itself is several months away, its focus on education is something that all of us can work on today.

Education, all the time

The concept of utilizing our industry's resources to promote the pursuit of knowledge is not at all new to the Society of Cable Telecommunications Engineers. SCTE has been dedicated to the technical training and further education of its members for many years, and we continue to offer a variety of programs and services for the industry's educational development and benefit.

Especially over the past year, the Society has done a great deal to develop outreach programs that promote higher learning, both as a tool to enhance careers within cable telecommunications and as a way to build greater public awareness of what our industry is about.

One such program is our Technical Training seminar series. These educational workshops provide attendees with the latest information on new services and technologies in a two- or three-day format at a location that's probably close to your area.

Next year alone, we are offering more than 30 regional seminars on a variety of topics, for a variety of audiences. From "Data Technology for Technicians" to "Train the Trainer," every working professional in this industry, whether engineer or administrative assistant, can benefit from these seminars.

Continuing education

In today's competitive marketplace, the more you build upon your knowledge base, the more effective your job performance will be, whatever your title or responsibility. But building that knowledge base requires a lot of time, resources and dedication to the learning process. The value of our regional seminars as training tools lies in the fact that they help students acquire a working knowledge of the information many jobs require without the time commitment of a more formal education.

Outside partnerships

Several educational organizations have recognized the significance of our training in its flexibility and cost-effectiveness and have incorporated our programs into their own curricula.

Building relationships with nonindustry institutions has, until now, been somewhat overlooked in our industry. In fact, research indicates that many operators and colleges are unaware of the advantages that administrators, cable systems and students can enjoy from such partnerships.

SCTE is taking steps to bring these types of coalitions to the forefront of operators' minds as we head into a new telecommunications era by exploring nontraditional delivery avenues through public schools, post-secondary institutions, Job Corps and Urban Leagues.

One example of this type of partnership exists with the Long Beach, CA, Job Corps, which soon will incorporate the SCTE Installer Certification program into its curriculum as a way of helping young people get back on their feet.

On the other side of the country, in New Jersey, an organization called National Cable TV Construction is developing a local job placement program that also is based on our installer training. This organization, in conjunction with the Urban League and area churches, will help unemployed individuals re-enter the job market with a competitive edge.

Two of our local chapters already work with school systems in their areas to aid in the dissemination of technical information. The SCTE North Country and Wheat State chapters have both taken advantage of the distance learning facilities available through their local colleges, and both have contributed substantially to building public awareness of the Society and the many services our industry can provide.

While this type of relationship may look good on paper, your cable system still might be unsure how to approach its local college or university. That's why SCTE developed "Campus Communications Networks: A Potential Land of Opportunity," which explores the economic and educational benefits of collaboration among local cable systems and some 1,000 college communities nationwide. This 40-minute videotape illustrates some of the many opportunities that already exist in your own backyard.

So, although I look forward to participating with the National Cable Television Association in "Cable Technology Week" early next year, I encourage all of you to begin learning, and teaching, today. T

Hugh McCarley is chairman of the Society of Cable Telecommunications Engineers board of directors. He can be reached via e-mail at hugh.mccarley@cox.com.


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