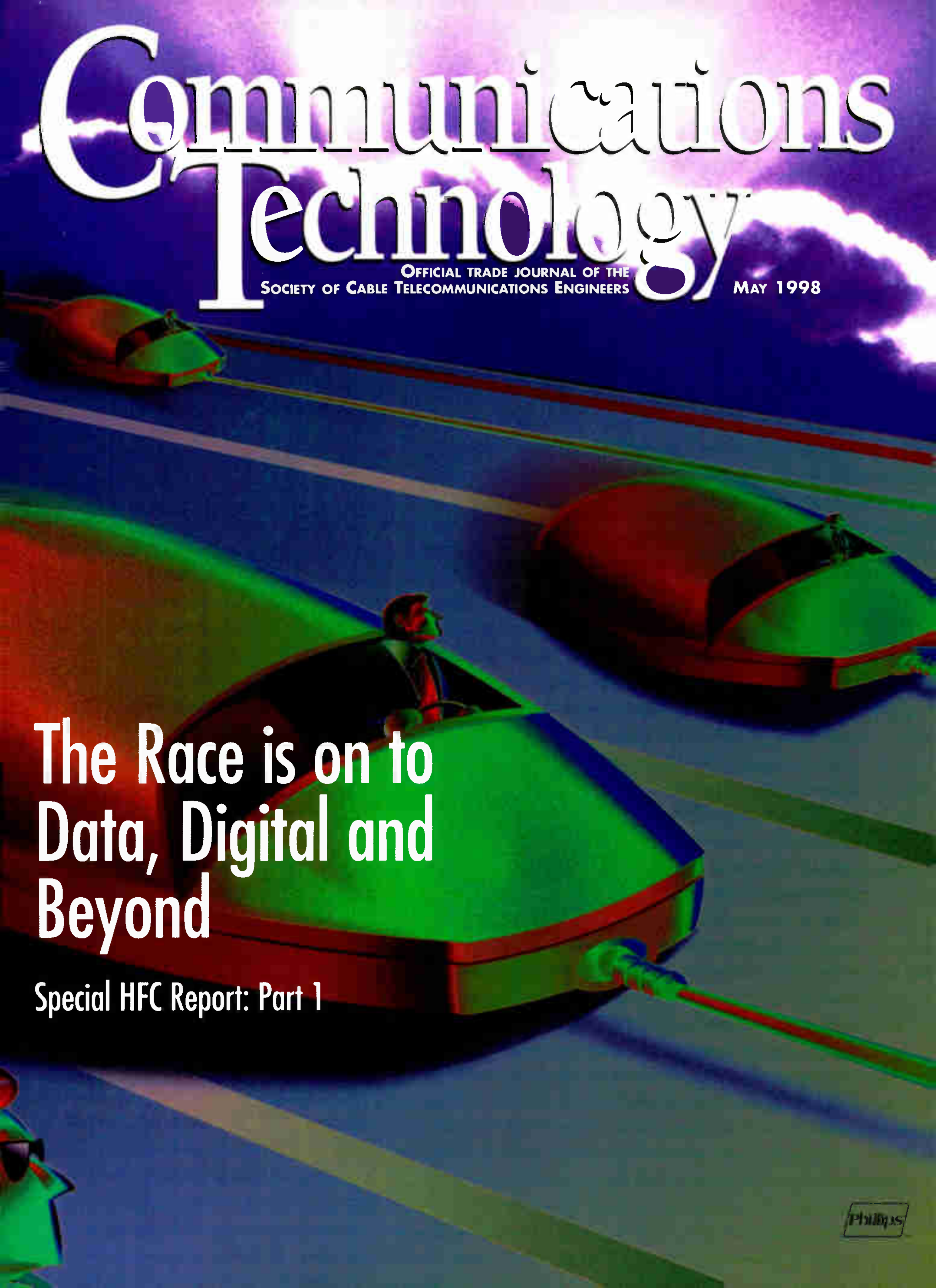
Communications Technology

Official trade journal of the Society of Cable Telecommunications Engineers

May 1998



The Race is on to Data, Digital and Beyond

Special HFC Report: Part 1

MAY 1998

contents

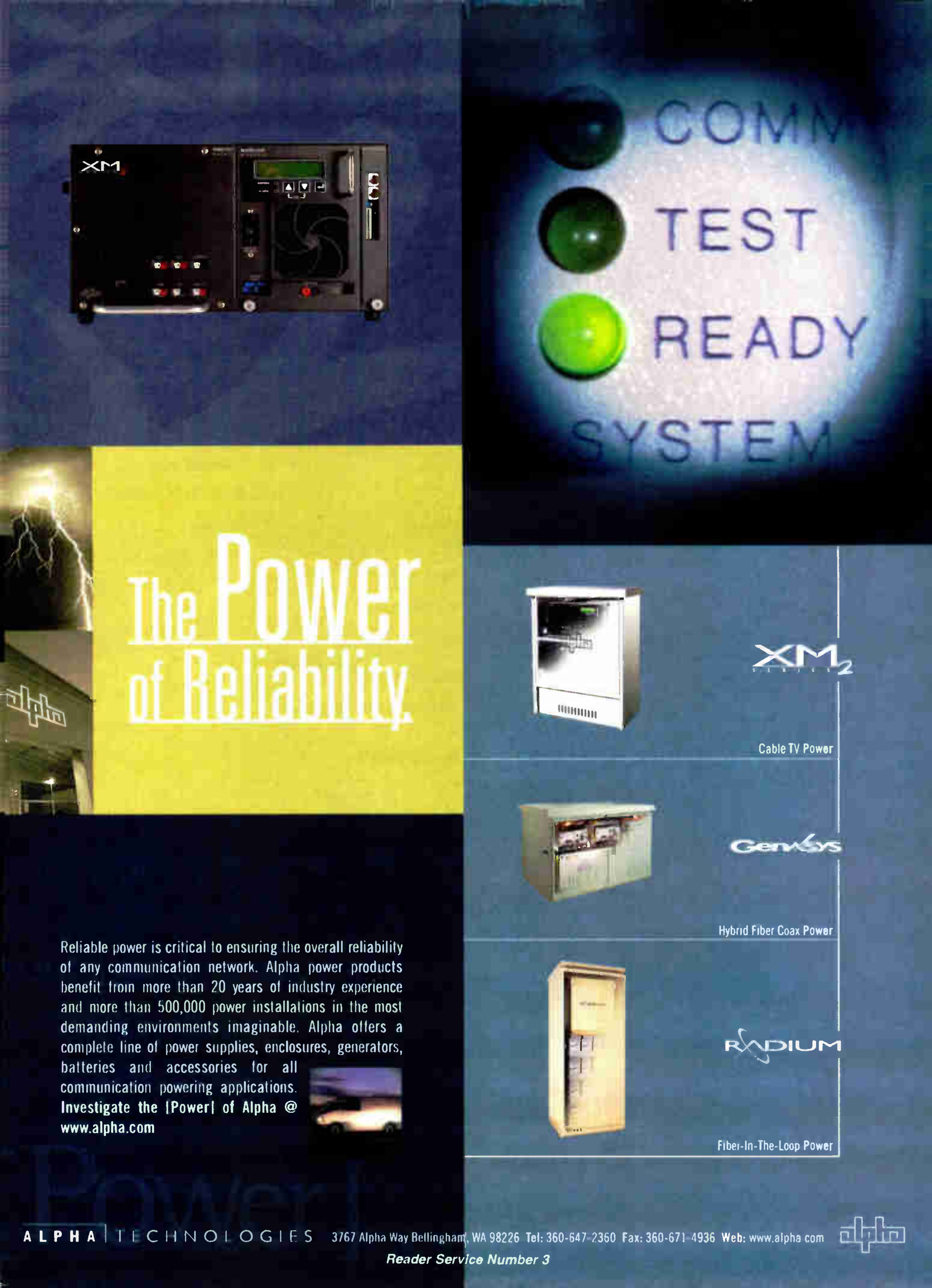
FEATURES

Cover
Design by Maureen Gately
Photo by Superstock

Introduction to CT's HFC Series • 50

Interoperability and OpenCable • 58

Communications Technology™ (ISSN 0884-2272) is published monthly, except twice in July, 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. May 1998, Volume 15, Number 5. 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.


COMM
TEST
READY
SYSTEM
XM
The Power of Reliability
XM2
Cable TV Power
GenSys
Hybrid Fiber Coax Power
RADIUM
Fiber-In-The-Loop Power
Reliable power is critical to ensuring the overall reliability of any communication network. Alpha power products benefit from more than 20 years of industry experience and more than 500,000 power installations in the most demanding environments imaginable. Alpha offers a complete line of power supplies, enclosures, generators, batteries and accessories for all communication powering applications. **Investigate the [Power] of Alpha @ www.alpha.com**
ALPHA | TECHNOLOGIES 3767 Alpha Way Bellingham, WA 98226 Tel: 360-647-2360 Fax: 360-671-4936 Web: www.alpha.com
Reader Service Number 3

contents

Cable and Satellite Digital TV • 80

Interview with a Leader • 20

"I believe we get back into our lives what we put our energy and thoughts into."

Sally Kinsman
Cable Pioneer

DEPARTMENTS

LET TOSHIBA TIE IT ALL TOGETHER.

Electronics, knowledge, support and commitment. Toshiba has it all. As one of the largest system integrators in the cable industry, Toshiba offers cable companies a complete high-speed, turn-key system for data transfer over conventional cable networks.

Our head-end configuration and modems are capable of supporting systems with greater than a million cable subscribers and have already been installed in six major cities for Time-Warner. Installing our system couldn't be easier. Toshiba can provide all hardware and software required to initiate and maintain your network. Toshiba will even help to maintain the system for you and your customers.

So, if you don't want any lose ends with your Internet system, let Toshiba tie it all together. For more information, visit our website, **http://Internet.Toshiba.com** or call us at **(714) 587-6631.** Make sure your internet solution is...

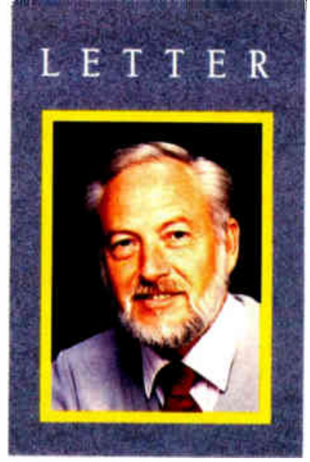
POWERED BY

TOSHIBA
MULTIMEDIA SYSTEMS DIVISION
9740 Irvine Blvd., Irvine, CA 92618-1697

Reader Service Number 4

By Rex Porter

Industry Trade Shows



I recently attended the Society of Cable Telecommunications Engineers Northern California Vendor Days in Concord, CA. This three-day meeting boasted an overflow attendance and more than 100 vendors. Held in the ballroom of the Concord Hilton, vendors were allowed only to place their equipment and catalogs on table tops. There were no curtains between tables, and separate booths were not allowed.

You might think vendors and customers would find this atmosphere unpleasant because of the noise of the floor activities. Well, just the opposite is true—quite a few vendors who registered late for tables, after the cut-off date, were turned away.

The idea of holding more Vendor Days is growing nationwide. SCTE chapters are banding together and setting up meetings in Arizona, Pennsylvania, Colorado, Southern California—actually, in almost every region of the United States.

Musing about this, I became concerned about how this will affect all the state and regional shows planned every year. I always have been involved in regional shows, such as the Eastern and Mid-America. I participate in state shows, such as the Arizona and Texas.

If regional SCTE chapters band together to start Vendor Days, how will state and regional conventions (even with separate booths) attract vendors? After all, vendors can send their people and booths to only so many shows.

I have heard many manufacturers and distributors complain that they "just make the trucking firms rich" by hauling booths across the nation. Moreover, vendors seem to love these vendor meetings, feeling they get great returns on their investment by attending. After all, they don't have to load up and ship booths. A sales person can load the equipment into the trunk of a car and unload it onto a table top. They think the face-to-face meetings with technicians and engineers, who understand and buy the sophisticated system products, are wonderful.

It seems likely that the major conventions will have to provide extra services in the future to compete with these new SCTE meetings. Perhaps convention halls no longer will be able to simply sell booth space.

Perhaps now is the time for some of the state shows to look at combining into regional meetings and selling 10 x 10 and larger secluded booth spaces. And, like never before, convention management certainly will have to ensure access to digital TV, satellite downlinks, data/Internet facilities and other modern services. With the surge of SCTE Vendor Days, vendors will have more choices on how best to spend convention dollars without "lining the pockets of the shipping companies."

I hope there always will be a place for all these shows and meetings. The successful ones will be those that show concern toward vendors and provide the best coverage, attendance of buyers and facilities for vendors to highlight technology, with and through their products.

Rex Porter
Editor

Communications Technology
A CT Publications Product

EDITORIAL
EDITOR, Rex Porter
EXECUTIVE EDITOR, Alex Zavistovich
SENIOR EDITOR, Laura K. Hamilton
ASSISTANT MANAGING EDITOR, Ron Hendrickson
SENIOR TECHNICAL EDITOR, Ronald J. Hranac
TECHNICAL CONSULTANT, Michael Smith
INTERNATIONAL EDITOR, Alex Swan

ADVERTISING/BUSINESS
PUBLISHER, Nancy Maynard
SENIOR PUBLISHER, Paul R. Levine: (303) 839-1565
ASSOCIATE PUBLISHER, Tim Hermes: (301) 340-7788, ext. 2004
CENTRAL U.S. & CANADA: Mike Elmer: (800) 325-0756, ext. 34
WEST: David Gillespie: (303) 839-1565, ext. 35
EAST: James Bahi: (301) 340-7788, ext. 2060
CLASSIFIEDS: Nicole Bavre: (301) 839-1565, ext. 33
CARD DECK: Laralee Provenzano: (813) 797-2827
ADVERTISING ASSISTANT: Susan Carp
ADVERTISING PRODUCTION COORDINATOR: Joann M. Fato
ADMINISTRATIVE ASSISTANT, Cathy Walker

DESIGN/PRODUCTION
SENIOR GRAPHIC DESIGNER, Maureen Gately
CREATIVE DIRECTOR, Rob Hudgins
JUNIOR GRAPHIC DESIGNER, Stephen Deutsch
PRODUCTION DIRECTOR, Hank Janowsky

MARKETING
MARKETING MANAGER, Allan Rubin
CONFERENCE DIRECTOR, Janet Allen
ASSISTANT DIRECTOR - CONFERENCE SALES, Justine Wood
CONFERENCE REGISTRAR, Susan Cuevas
EXHIBIT SALES, Billi Famiglietti

CIRCULATION
CIRCULATION DIRECTOR, Sylvia Sierra
ASSISTANT CIRCULATION MANAGER, Dainia Gammon
FULFILLMENT DIRECTOR, William Wynne
LIST SALES, Susan Incarnato
READER SERVICE COORDINATOR, B. David Fisher
Subscription/Client Services—(800) 777-5006

PBI MAGAZINE, TRADE SHOW & CONFERENCE GROUP
SENIOR VICE PRESIDENT, David Shaw
VICE PRESIDENT & GROUP PUBLISHER, Scott Chase
ASSISTANT VICE PRESIDENT & GROUP BUSINESS MANAGER, Kathleen De Franca
ASSISTANT VICE PRESIDENT & GROUP EDITORIAL DIRECTOR, David Jensen
DIRECTOR OF MANUFACTURING AND DISTRIBUTION, Maxine Minar
GROUP MARKETING DIRECTOR, Anne Caffey
DIRECTOR, NEW VENTURES, Debra Vodenos
MANAGER OF COMPETITIVE INTELLIGENCE, Judy Lawrence
ADMINISTRATOR, Evie Sanchez

PHILLIPS BUSINESS INFORMATION
CHAIRMAN, Thomas L. Phillips
PRESIDENT, Thomas C. Thompson
SENIOR VICE PRESIDENT—Magazine, Trade Show & Conference Group, David Shaw
SENIOR VICE PRESIDENT—News & Information Group, Edward Hauck
VICE PRESIDENT—Information Research Group, John O'Brien
SENIOR VICE PRESIDENT—Finance, Frederick Moses
SENIOR VICE PRESIDENT—Eliot Minsker

CT PUBLICATIONS CORP.
A division of Phillips Business Information Inc.
CT Sales and Editorial Offices
1900 Grant St., Suite 720, Denver, CO 80203
(303) 839-1565 Fax (303) 839-1564

CORPORATE OFFICES
Phillips Business Information Inc.
1201 Seven Locks Road, Suite 300, Potomac, MD 20854
(301) 340-2910 Fax (301) 340-0542
Magazine Group: toll free 888-340-5075

Website: ctinfosite@phillips.com

Speed has never been as important in the race to install and maintain your return path as it is today. So the last thing you need is a problem with ingress. That's where the HP CaLan 3010R/H Sweep/Ingress Analyzer comes in.

A comprehensive, flexible field tool.

The HP CaLan 3010R/H is the one tool that does it all—even in the presence of ingress.

- Forward sweep
- Reverse sweep
- Signal-level measurements (including digital signals)

Highlights of the HP CaLan 3010R/H include:

- ***Ingress Detection***
  When ingress corrupts return path communication, the headend unit transmits a display of the ingress image to the field unit for immediate troubleshooting.
- ***Dual Path Sweep***
  New! One headend box for both forward and return sweep means more efficient use of bandwidth, more space in the headend and less equipment to buy.
- ***Digital Power***
  New! Quickly and accurately measures average power of digital carriers—including return path TDMA (bursted) carriers.
- ***DigiSweep Technology***
  HP CaLan set the industry standard with its 5 µs sweep pulse. It's so fast it can pass through active digital traffic without interference. And now our sweep speed is even faster; measurements can be performed in 650 ms.

When speed counts, there's no faster way to activate your return path and troubleshoot ingress than the HP CaLan 3010R/H.

HP CaLan 3010R field unit

For more information call: 1-800-452-4844,* Ext. 5333.

*In Canada call 1-800-387-3151, program number TMU355.

www.hp.com/go/catv

Reader Service Number 8

HEWLETT PACKARD

High-Speed Links For OpenCable Set-Tops

CableLabs has specified the existing Institute of Electrical and Electronics Engineers 1394 high-speed interconnect for links between OpenCable set-top boxes and TV sets or digital video disc (DVD) players.

OpenCable is an initiative to develop interoperability among set-tops from multiple vendors for use in two-way cable networks.

IEEE 1394 allows high bandwidth connections; it's physically embodied in a four- or six-wire shielded twisted-pair bundle that will plug into future TV sets, including high definition ones, and OpenCable-compliant set-tops. Video carried on IEEE 1394 will be digital, and the interconnect will pass up to 400 million bits of data per second.

ANSI Recognizes SCTE Standards

The Society of Cable Telecommunications Engineers has announced that two of its documents recently became the first broadband test procedures to be recognized by the American National Standards Institute. This latest addition, of "Coaxial Cable Structural Return Loss" and "F-Connector Return Loss," doubles the number of SCTE documents approved by ANSI. SCTE also plans to develop standards in digital, cable modems and OpenCable.

Wavetek Plans Merger

Wavetek says it has agreed in principle to merge with Wandel & Goltermann Management Holding GmbH. Subject to usual agreements and approvals from stockholders and regulators, the pact would create the world's second largest communications test company.

Modem Forum Set For the National Show

The Cable Broadband Solutions Forum plans to hold its second meeting at this month's National Cable Television Association National Show. The nonprofit MSO group, which held its first meeting in Redmond, WA, at MicroSoft, was established to promote cable modems. CBSF members include executives form TCI, Time Warner, Comcast, MediaOne and @Home. The forum's partnership fund-raising program comprises 35 service providers and vendors, each joining with a $10,000 donation. Members include Bay Networks, Cisco, General Instrument, Intel, MicroSoft, Motorola, NEC, Phasecom, Samsung, Scientific-Atlanta and Sun.

Blonder-Tongue to Buy S-A Interdiction Business

Blonder-Tongue plans to acquire all of Scientific-Atlanta's interdiction assets, including the products, inventory, manufacturing assets, and intellectual property of the business. S-A will receive $19 million in cash, plus Blonder Tongue stock worth about $1 million and an option to acquire additional shares.

S-A says the sale will allow it to focus more closely on the advanced analog and digital system part of its business. S-A has been in the interdiction business since 1989. Last year, the company introduced a family of 750 MHz addressable interdiction products.

Road Runner Set for Oregon Launch

The Road Runner data service is launching on Bend Cable Communications in Bend, OR, this spring.

The operator serves 19,000 customers in Bend, Sisters and Black Butte in central Oregon. Motorola's CyberSURFR high-speed cable modems will be used in the customer premises.

"We have been actively upgrading the cable system platform for several years in preparation for high-speed data services,"

Continued on page 16

Without Wavetek's PathTrak™ system, you could look at this return path puzzle forever and still not find the solution. Return path trouble. The problem is right there, somewhere between the home and the headend, but there's no way to know when it started or where it's coming from. Until now. Introducing Wavetek's PathTrak Performance Monitoring System. The only system that gives you the entire return path picture. Only Wavetek's PathTrak Performance Monitoring System

Continued from page 12

says Byron Cotton, high-speed data services manager for Bend Cable.

Residential Road Runner service will be offered to cable subscribers at $34.95 a month, with an additional $10 a month for cable modem rental. The fee for non-cable customers will be $44.95 plus the modem rental. The one-time installation fee will be $129.95.

HTML Considered for Set-Tops

Hypertext markup language (HTML), the open programming language of the Internet, has attracted the notice of digital set-top manufacturers who wish to incorporate interactive data capabilities in their boxes.

Nokia, a digital set-top vendor for cable and satellite, recently licensed software from Web browser Spyglass for up-front Web technology to be built into each box. Nokia intends to modify the Spyglass Device Mosaic Web Browser to allow developers to create advanced interactive and online TV services, including Internet access and Web browsing, e-mail, interactive advertising, home shopping and home banking, video-on-demand (VOD), and pay-per-view (PPV).

Nokia set-tops presently comply with European DVB (digital video broadcasting) specifications. Nokia says its boxes also will comply with the U.S. OpenCable effort spearheaded by CableLabs.

$4 Million San Francisco Digital Deal

Bay Cable Advertising recently signed a $4 million deal with SkyConnect to "ease the transition to digital-to-digital ad insertion in the Bay Area."

The eighth largest interconnect in the United States, Bay Cable serves more than 1.4 million subscribers in 10 regional zones. The interconnect bought the SkyConnect Digital Insertion System for 37 headends in the company's San Francisco service area.

The digital ad insertion system uses 64-bit chip technology, boasting handling capacity of up to 40 channels in a single equipment rack. Moving Pictures Experts Group (MPEG-2) video compression, quick distribution turnarounds and zoning capabilities, SkyConnect says, deliver digital quality that could lead to increased ad sales and reduced advertiser volatility.

SCTE Annouces FaxBack Service

The Society of Cable Telecommunications Engineers has made it even easier for members to obtain the information they require with its newly improved FaxBack Service.

Through this new service, which links the Society's voice mail and computer systems, members and other interested parties now can obtain the latest calendars of training and testing events, registration materials for SCTE's national conferences and membership information 24 hours a day, seven days a week.

Some of the resources available through FaxBack include:

- Membership information and application forms
- Cable-Tec Expo '98 registration details
- An index of SCTE technical publications and videotapes
- An up-to-date SCTE calendar of events, which includes activities sponsored by the Society and its 73 local chapters and meeting groups
- A chapter and meeting group contact list
- A listing of available standards documents

To access this service using a touch-tone telephone, call SCTE national headquarters at (610) 363-6888 or (800) 542-5040. If you reach an SCTE receptionist, ask to be transferred into the voice mail system. When the automated attendant presents the initial menu of service options, request Option #3 for the FaxBack Service, and then follow the prompts to access up to three documents.

Users outside the United States and Canada are required to enter their area code beginning with "011," followed by the country and city codes. This will ensure that the FaxBack Service recognizes the entry as an international call, rather than as a domestic call.

For more information about the SCTE FaxBack Service, or to make suggestions for additional resources that can be made available to users, contact Janene Martin at (610) 363-6888, ext. 220, or info@scte.org.

SCTE Upgrades Internet Presence

The Society enhanced its presence on the Internet last month with the launch of the newly revamped SCTE Website (www.scte.org).

The new interactive site, which will be updated daily under the direction of SCTE Webmaster Steve Zonsa, has several brand-new features that will make accessing information about the Society's programs and services even easier.

Now, site users can get the latest information on training opportunities, certification programs and standards development, as well as a current calendar of the Society's national and local events. For added convenience, a search engine has been installed to allow users to browse the site for specific topics.

For the Society's latest activities, users now can click on "News" for current press releases, a complete archive of past announcements, SCTE's most recent media coverage and Web updates. The complete Cable-Tec Expo '98 registration package also is online here.

This easy-to-use site will allow SCTE members to update their own records, stay abreast of new member benefits and provide feedback to the Society's staff. In addition, SCTE President Bill Riker will give his thoughts on the Society's role in the broadband industry in his monthly essay titled "From the President."

For more information about our newest service, contact Steve Zonsa at national headquarters or at webmaster@scte.org.

SCTE Welcomes Curriculum Development Manager

SCTE recently welcomed Hugh Long to its professional staff as manager of curriculum development.

In his new role, Long will be based in Denver and will assist with the development of new training materials, as well as working with contract writers and developing materials himself. His first project will be the creation of training materials to support the new Service Technician Certification program.

Long has spent his entire 12-year cable career with Tele-Communications Inc., where he began as an installer and worked his way up to technical supervisor and, most recently, technical trainer. For the past 18 months, he has written and delivered a significant number of training programs for technicians in the Denver area, as well as in Wyoming, New Mexico and many systems in Colorado.

Reflecting on his background in training, Long said: "I find that there is a great feeling of accomplishment when you can pass your knowledge on to others. Seeing that 'light' light up when someone understands something new is a great feeling."

A member of the Society since 1991, Long has been very active with the SCTE Rocky Mountain Chapter, having served on its board of directors for the past two years. He was recently selected to a second term on the chapter's board and was nominated to be president, a position he now will relinquish.

Long's current projects include updating the SCTE Installer Certification Manual, which is in the final stages of editing.

Long said, "It's an exciting time here at SCTE, and I'm glad to be a part of it."

SCTE Enhances In-house Technical Training Support

The Society has enhanced its popular "Basic Broadband Technology Course" with a new series of 31 student workbooks and leader guides based on William Grant's textbook, *Cable Television* (3rd Edition). These new materials will provide a solid framework for in-house training programs, advancing industry personnel from entry level employees to fully-trained broadband technicians for as low as $250 per student.

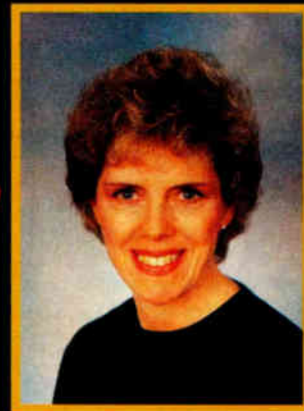
SCTE Vice President of Technical Programs Marv Nelson said: "Operators are constantly needing to train new hires or newly promoted technicians. This course forms the foundation for understanding broadband technology."

For more information about SCTE technical training materials, call national headquarters at (610) 363-6888, fax (610) 363-5898, or e-mail to info@scte.org. Updated information also can be found on the Society's web site: www.scte.org. CT

Interview with a Leader

By Rex Porter

Cable Pioneer Sally Kinsman Shares Her Experiences



Sally Kinsman

W Sally Kinsman is a graduate of the University of Colorado with a B.S.in business (Magna Cum Laude). She has completed various courses with the Society of Cable Telecommunications Engineers and National Cable Television Institute, while completing industry training seminars at General Instrument, Wang, Philips and others.

She has served as instructor for the SCTE and Women In Cable. Sally is a senior member in the SCTE, serving on the national board of directors from 1983 to 1987. She was honored as 1985's SCTE Member of The Year, was the 1985 Accolade recipient from Women In Cable and was inducted into the Cable TV Pioneers in 1996.

Communications Technology: *Sally, the first time I remember seeing you was during a trip to ATC, and you were supervising the design of cable system maps. How did you learn to design systems?*

Sally Kinsman: I didn't start as a designer at ATC. Actually, my first job was at Boeing as an engineer's aide working in the 747 stability and control department. This was back before the 747 existed past an idea on a sheet of paper. I had no experience other than two years of math and art at the University of Washington (and lots of fraternity parties).

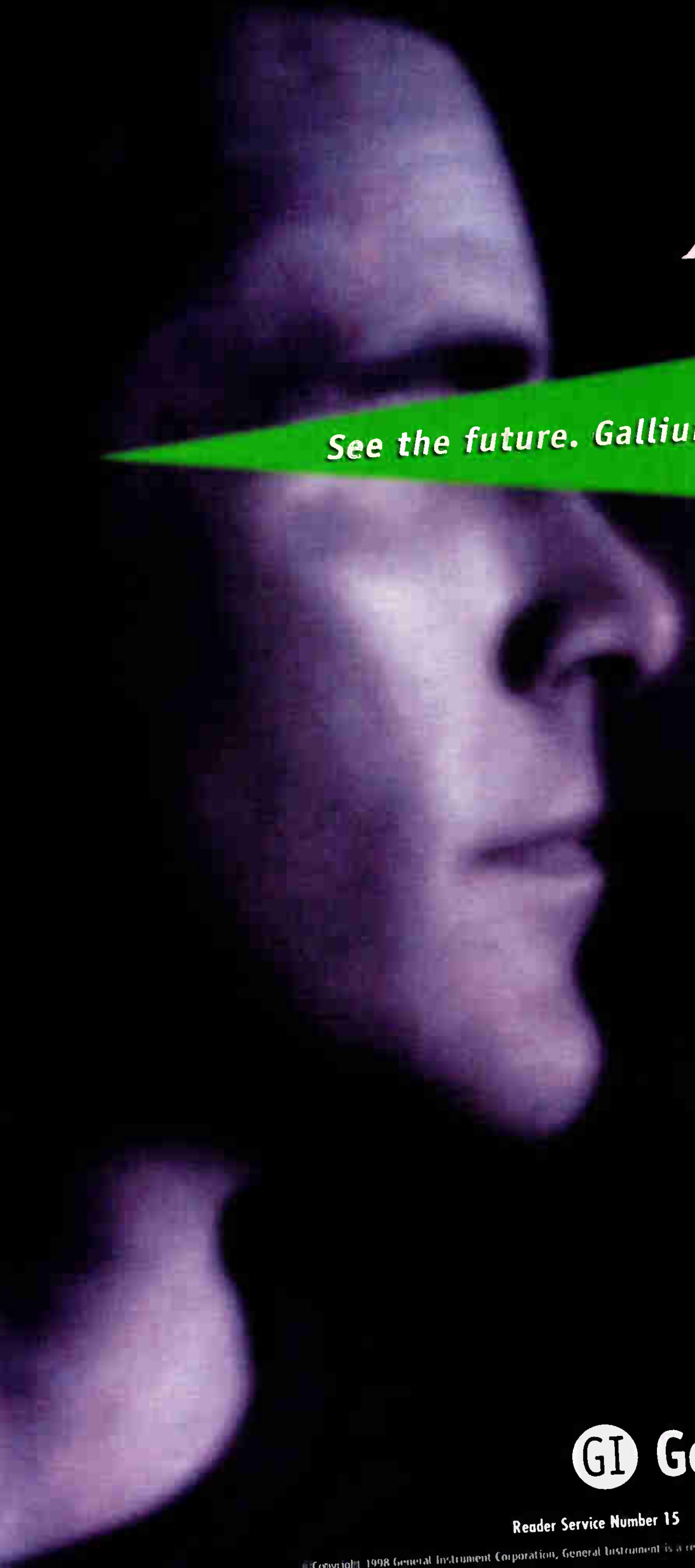
Lady Luck was with me because the department supervisor who hired me turned out to be my dad's co-pilot in WWII. (My dad was a Navy Commander, flying PBYs in the Aleutians.) He put me on probation for three months, and I was determined not to let my dad down. I was the only woman in a staff of many from around the world, and I enjoyed my four years there. I've been working hard ever since.

I moved to Denver in 1970 and found a job as a geological drafter, again with no experience other than one of the three partners went to a rival high school in Seattle (Lady Luck), and he put me on a three month probation (no problem). In 1972, I saw a "blind" post office ad for a draftsman, and I sent my resume. It turned out to be ATC.

I interviewed with Terry Hulseberg, and he hired me because I'd used a Wang computer at Boeing and he'd just purchased one (again, Lady Luck). I was on a three month probation and, again, worked very hard to succeed. I asked a lot of questions of Terry about what I was drafting, and he gave me a chance to start designing within about six months.

I loved it and really was able to succeed at it. I was blessed with a quick mind and patient people at ATC. Our bosses included such talented engineers as Ed Callahan, Jerry Marnell, Hugh Bramble, Bud Campbell and Larry Janes (No one has seen Larry since he sold his Radio Shack in the mountains.) They all taught me the basics in amplifier and plant operation, distortion calculations, and just supported me to become a success.

Terry gave me the basic skills to become a great designer because of his unique approach at that time. We designed amplifiers as individual "black boxes" and optimized each location. Once an area was done, we would then connect the "black dots" with trunk cable. This provided a very cost-effective design with very low amplifier usage per mile. The only flaw was not paying attention to trunk cascades in the early days, which was pointed out by the system techs and vendors. This obviously became a design correction very quickly. ➤



This is exactly the same philosophy I've used even today with hybrid fiber/coax (HFC) designs, connecting some of the "black dots" with coaxial cable and then one long piece of fiber back to the headend, connected to a cluster of "black dots"—very simple and effective.

Communications Technology: *The next thing I knew about you was that you had taken over the supervision of that department. How'd you move up so quickly?*
Sally Kinsman: I became the manager of corporate system design when Terry Hulseberg left to start up Coaxial Analysts with Bob Fanch and Ross MacPherson. It was a great honor, although part of me missed doing the daily system design functions, which were replaced with managing a department of designers and drafters.

ATC had no bias toward (or against) my promotions because I was a woman. They just gave me as much work and responsibility as I was willing to take and provided all the resources needed. That's pretty amazing for the mid-70s. I also was going through a divorce, and the career challenge filled a large void in my personal life.

I was at a unique company during a crucial growth period in the cable industry, working with such incredible people as Monty Rifkin, Joe Collins, Doug Dittrick, Dave Van Valkenberg, Trygve Myren, Dave Kinley, Jerry Maglio and Bob Fanch, just to name a few.

It was a very hard decision to leave, but I basically thought I'd reached the top of my career there without completing two more years of college. Therefore, I resigned one month before ATC was purchased by Time Inc. (At this point, Lady Luck seemed to turn against me.)

Communications Technology: *How difficult was it to go from basic drafting and design over to the CAD system?*
Sally Kinsman: All of the system design done in the 1970s at ATC was performed using a Wang computer, which was programmed by Terry Hulseberg. There was no CAD drafting function connected to CATV system design back then. Everything was drafted in ink using a lettering template and drafting tape.

Terry's program was probably the most advanced at the time because of the vast array of functions he incorporated, like automatically selecting directional couplers (DCs) and stacking them inside other DCs. That probably seems like a silly and simple thing today, but back then none of the existing programs had these types of functions, which allowed fast and effective system design.

> "I believe we get back into our lives what we put our energy and thoughts into."

Once, a well-funded start-up company approached Terry because they'd just programmed a large computer (I think it was an IBM) that would automate all system design (including CAD drafting) and eliminate the need to hire personnel other than keypunch operators. Terry had them go against me, and I think I beat them by $150/mile. They spent weeks trying to find out what was wrong with their program. The flaw was their design function only calculated in the order the data was input and had no ability to "think" like Terry's successful Magic system, incorporated about 10 years later.

Communications Technology: *Then, you left ATC to follow Terry to Coaxial Analysts. Tell us about that move.*
Sally Kinsman: When I left ATC, I joined Coaxial Analysts as a senior system analyst. I had just started back to school, part time, at the University of Colorado. I had sent Doug Dittrick a letter asking about career opportunities within cable, and he was kind enough to have Chris Derrick, who worked for him at the time, talk with me during a stop-over in Denver.

Chris stressed how important he thought it was for me to finish my degree, and I was so impressed with his business sense that I decided to obtain the same degrees he had (B.S. in business/marketing and M.B.A. in finance). I quit working except quarterly breaks, sold my ATC stock, and invested in my education, carrying almost a double load.

I graduated with a B.S. in business in less than one and a half years and didn't even know I'd been awarded Magna Cum Laude until the degree arrived in the mail. I had earned all but the last 30 hours toward the M.B.A. in finance when I took a break to attend the 1980 National Cable Television Association Convention in Dallas, and thus Kinsman Design was formed. I never completed the M.B.A. program. (Kinsman Design Associates became my M.B.A. program.)

Communications Technology: *What happened at the convention to make you decide to start Kinsman Design?*
Sally Kinsman: At that NCTA Convention, I was one of the 3,000 at the Jerrold party. We were bused to a "dude ranch." During a cloudburst, Jack Forde got me aside under the tent and said he would "give me all the business I could handle" if I would start a system design firm, which obviously had to produce good and accurate quality.

Jack had worked with me during my five years at ATC in his various jobs at Jerrold and had more faith in my capabilities than I did. Flying back on the plane, I decided on the name, Kinsman Design Associates. (The Inc. was added thanks to my lawyer's advice and help.)

I believe I was one of the first in the industry to name a company after themselves. I thought it sounded a little conceited, but all I really had was my name, and it seemed to make sense. I remember soon after Monty Rifkin started Rifkin and Associates, I wrote to compliment him on his good choice.

I got back to Denver, rented a Wang computer with a $1,000 loan from a very concerned father and wrote a great system design program. It calculated everything—more than all the programs I'd worked with before. I had no computer programming experience and taught myself Wang Basic 2. Every day, I'd try to complete another subroutine.

Later, a professional programmer happened to be looking over my

DX ANTENNA

It Can Receive Satellite Signals In A Microsecond.

Sending It To You, However, Takes A Full Day.

The DIR-777
DigiCipher® II Digital Satellite Receiver

INTRODUCING DX COMMUNICATIONS QUIKSHIP DIGITAL SOLUTIONS.

ORDERED TODAY. DELIVERED TOMORROW.

For years, you've trusted DX for the finest satellite reception products and we've always delivered. Now, with the introduction of our first digital line, DX provides a comprehensive, one-stop solution for all your analog AND digital needs. The DIR-777 represents a powerful addition to your headend configuration— the next generation in a long line of breakthrough products from DX, the world's leading supplier of CATV delivery products. For pricing and vital statistics, call DX Communications now. DX Communications, at the leading edge in digital reception.

DX Communications: 1143 West Newport Center Drive Deerfield Beach, Florida 33442 (888) 293 - 5856

DX Communications is a Division of Itochu Cable Services Inc.

Reader Service Number 16

programs and commented how badly they were structured, but all I cared about was that they worked great and I was able to open my business. Besides, I was never very strong in English, as compared to math. It took me six solid weeks of nonstop programming to complete the task of writing just the system design program.

Later, I added in programs for bills of materials, quality assurance, powering and level analysis. Jack kept his word, and my first job was 1,500 miles of system design for United Cable's Denver suburbs.

Communications Technology: *While continuing KDA, didn't you move back to the Seattle area?*
Sally Kinsman: From August 1980 until the day I closed the doors in 1991, I always had more than enough work for myself and the associates. I owe everything I know about the cable industry to all of those I worked with and for. I felt like I'd been given a great opportunity to pay the industry back, and I was determined to provide quality work at a reasonable price.

Unfortunately I'd found the perfect vehicle to success, and I literally worked myself into ill health. After three major operations in the mid-1980s, I decided to listen to the "inner child" instead of the medical profession and moved back home to Seattle in 1988.

My grandmother was 96 years old, and I kept telling her not to die before I came home. I decided I was running out of time. Just after I arrived in Seattle, she had her first stroke and went into a nursing home. I visited her every night for a year and a half and played cribbage with her. During the days, I kept KDA open by doing all of the system design myself and using up to three of my Denver drafters—doing ink drafting.

Communications Technology: *Did you shut down Kinsman Design because you moved back to Seattle?*
Sally Kinsman: I shut down KDA in 1991 for a variety of reasons, after completing almost 20,000 miles of system design for almost every major MSO. When I lived in Denver, I was at the center of the engineering community and was supported on a daily basis with all current industry technologies.

Up in Seattle, I was too far away, especially since that was the start of the fiber-optic revolution. I began doing system design consulting for Augat (now Thomas & Betts), which is located in the Seattle area, and they were developing a line of fiber nodes.

They also were looking for a product manager. I hadn't a clue what a manufacturing company did or what a product manger's job entailed, but, just like every other job, I jumped in. I had a terrific boss, Bill Ellis, who is an industry legend in his own right, and he taught me a lot in the beginning and still does today.

As the broadband product manager, I had a great job being on the ground floor of a company just entering the fiber node business (Optiflex), and we also bid and won a large MSO RF amplifier contract six months after I joined them. We designed and shipped, within a three- or four-month window, a totally new product (MiniFlex), including a new casting, which provided up to 1 GHz potential of RF amplification. (Welcome to the world of manufacturing!)

I was in charge of forecasting, literature, product definitions, coordinating customer desires (orders) with product-shipped, etc. I traveled around the United States and Canada, supporting the sales force with product demonstrations. I also have traveled to Australia, Japan and South America. Life was good and hectic. In the four years that I held the position, we grew the business about tenfold.

Communications Technology: *You left Augat for a short period and joined Texscan. What's the story on that move?*
Sally Kinsman: I joined Texscan in 1995 as director of technical sales to gain a different perspective on the business. They were merged into ANTEC the same week Augat was merged into Thomas & Betts, in late 1996. I decided to rejoin Augat (T&B) as director of technical customer support, and this brought together my previous product management experience, technical sales experience and system design solution expertise.

Instead of focusing on how to get the customer together with the correct product, the job is to make sure the customer understands how to use what they've received. This involves having a well-trained and experienced field engineering group (reporting to me) along with a system designer and good training materials.

I did not travel nearly as much as with my previous job. However, this should change with the new position I am taking in mid-March with General Instrument as the program manager, working for their director of marketing.

I am really excited to be joining GI at a time when it is making so many positive announcements with new products and programs. However, I am starting to feel like a person making too many career moves. While I may be losing some security issues such as pensions, I am making so many incredible friends and gaining such experience along the way that I can't really find fault with my decisions.

Communications Technology: *Would you ever go back to system design of digital and data systems, full time?*
Sally Kinsman: I don't know. I loved the design process because every day I would have a new mathematical and graphical puzzle to solve. It was one of the few jobs I've ever had that I constantly felt mentally challenged. No system was ever the same, and they say an active mind keeps Alzheimer's away! I enjoy people too much, but never say "never." Maybe when computers can talk!

Communications Technology: *In a field dominated by males, looking back, do you think you would have been less, equally or more successful if you had not been a female?*
Sally Kinsman: In the first place, I have tried not to reflect on this aspect because I believe we get back into our lives what we put our energy and thoughts into. Even a thought like, "I'm the first woman elected to the SCTE national board (Barb Lukens was the first to serve, when she was appointed to fill a vacancy) and to receive the SCTE Member of The Year (of both of which I am extremely proud)," sets me apart

from being just one of the many members of the technical community.

Terry once asked my help in writing an ad for ATC to attract more women applicants. I told him to change the job title from draftsman to drafter, a subtle change, but it worked. I hired mostly women at KDA because they work hard and are dependable and are eager to find challenging work. It might just take a little extra work on the part of an employer to find them, but they are out there waiting to be discovered.

My work ethic is to work hard, tell the truth and treat everyone the way I would like to be treated. I think I am doing a better job each year as I gain wisdom. The mid-1980s were a watershed time in my life, personally and professionally.

It also was the period of time I gave a lot of myself back to the industry through the SCTE. When I joined the national board in 1983, the SCTE was about $75,000 in debt and on the verge of disappearing. Through the hard work of the entire board at that time, especially Tom Polis, we turned the Society around, hiring Bill Riker, and the rest, as they say, is history. The four years I was on the national board were almost as exhilarating as starting my own business.

Communications Technology: *Finally, Sally, you have always been so outgoing and the center of attention at all of our industry functions. Any funny stories you might share with our readers?*

Sally Kinsman: I can't share most of them because I was usually in the middle of them, and I won't admit in a public forum to all the crazy things I did. Boy, were they fun! Let's just say that one of the really great aspects of being a woman in the technical cable community is that I am usually surrounded by lots of good-looking men who have included me in as "one of the guys" for the past 25 years.

A couple of cute stories I will share, from the early '80s are:

One time a vendor's sales force stole the biggest floral arrangement I've ever seen from their company's hospitality suite at the Western Show. They brought it to my motel room, knocked on the door, waking me and my girlfriend, handed it to us and left. It was so large it hung over the edges of the entire dining table. We turned the lights off, only to hear a loud "thud" a few minutes later. I turned the lights on to find this beautiful arrangement upside down on the carpet with water everywhere. And that poor sales force got royally chewed out the next day for their actions.

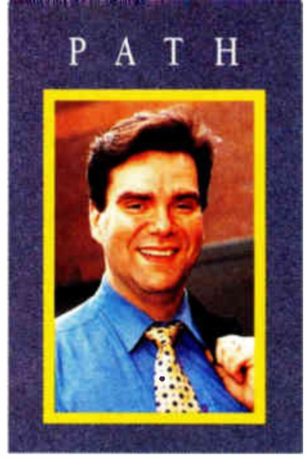
Another time, another vendor's sales team was in Denver at the Sheraton. A bunch of us were in their room, enjoying some liquid refreshments. Someone got the bright idea to launch paper airplanes from their balcony into the indoor plaza below. The only paper we could find was the proposal they were going to present to a major MSO the next day. The following morning, the same sales force was down in the garden area, retrieving paper airplanes, trying to press the pages flat to present to the customer.

"Those were the days, my friends; We thought they'd never end." Then we got older and maybe wiser (or are we just too tired?!).

Rex Porter is editor of "Communications Technology." He can be reached in Mesa, AZ, at (602) 807-8299 or via e-mail at tvrex@earthlink.net.

Reader Service Number 19

By Alex Zavistovich



The Drench Connection

Any new home owners out there? You'll appreciate this tale of woe. As for me (the guy it happened to), all I can say is it gave me a real appreciation for a project Jones Communications completed recently. The company connected its headends in Alexandria, VA, and Prince George's County, MD, by boring under the Potomac River, just outside of Washington, DC.

In March, my wife and I bought a 30-year-old French Colonial house in the same Prince George's County neighborhood where my parents live. With a really good windup, you can practically hit my parents' property with a rock (hmm, not a bad idea...).

It turns out the 30-year-old sump pump in this 30-year-old house gave up the ghost the night before we moved in—a night of the most drenching rains in recent memory. Our finished basement was flooded. (I've come to learn that P.G. County has an unusually high water table—the place is basically reclaimed swampland. Without a sump pump, you can count on your basement's constantly being filled with...sump, I guess.)

In this less than hospitable environment, right off the Outer Loop of the Capital Beltway (motto: "Los Angeles Traffic's Got Nothing On Us"), Jones decided to bore a continuous five-inch diameter hole under the Potomac River. The project would run fiber between the company's two headends, creating a high-profile dream network to deliver advanced telecommunications services.

They probably didn't know it at the time, but the folks at Jones may have chosen the toughest area around to make the connection, law-wise. That stretch of the

Potomac is terminated on one end by affluent Olde Towne Alexandria, where lawyers outnumber dogs, and on the Maryland side by the Middle American Democratic stronghold of Prince George's County, which is to political bureaucracy what knots are to macramé.

Jones wanted to start the bore on the Virginia side, but the dog-walking lawyers of Olde Towne protested the disruption the project would cause to the city park they use to walk their pets. (I've been there. The biggest disruption at that park is avoiding the landmines the dogs deposit all over the place.) Anyway, Maryland it was, and a permitting nightmare began.

Some horse-trading started right away with the Maryland State Highway Administration. In return for permits to build in a Maryland right-of-way, Jones agreed to provide one 12-count fiber to the state for installation on traffic control cameras along the beltway. It took nearly eight months to get this part done alone. The permit needed to be signed by Maryland Governor Parris Glendening himself!

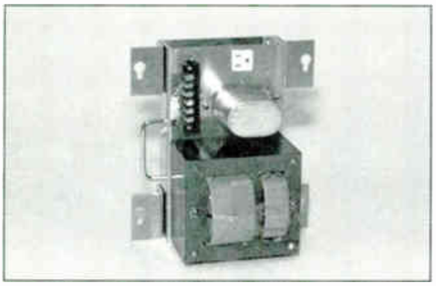
Another approval had to come from the Maryland Wetlands Department. There's such a tree-hugging frenzy in southern Prince George's County that some people can't improve their property because it's been declared a protected "wetland." Business plans have failed over disputed wetlands. I don't need the county to tell me I live in wetlands; I just had 300 gallons of wetlands pumped out of my *basement*.

If you think that's excessive permitting, check this out: The Virginia Park Authority owns the dirt *under* the river, but the U.S. Park Authority owns the water *in* the river. That's two more permits, one local and one federal.

Even the Department of Corrections got into the approval act. Apparently someone once planned to build a prison in the middle of the river, like a mini-Alcatraz. Not a bad idea, I suppose, until you realize that the bottom of the Potomac River, except for a fairly deep channel on the Virginia side, goes down only about three feet in many parts. Nobody's ever going to write about "the icy depths of the Potomac"—you can encounter icier depths in the shallow end of a community swimming pool. I'm not so sure that a terrifying three-foot plunge into the mighty Potomac would be much of an escape deterrent for convicts, unless they forgot their hip waders.

There's far more to this story than I can describe in this short column. I'll give you more next time. In the meantime, for a more detailed account, read the article by Jones Communications' Tom Gorman in the May/June issue of *Communications Construction* magazine. Just remember, if you're planning a project like this, that permitting can eat up a year by itself. And if you're planning to bore under a river, avoid the wetlands. It's really wet on that end—and all that water can really mess up a basement. CT

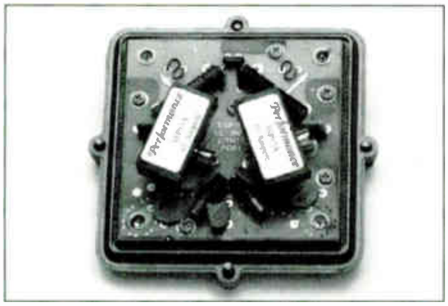
Alex Zavistovich is executive editor of "Communications Technology." He can be reached in Potomac, MD, at (301) 340-7788, ext. 2134.



REPLACEMENT FERRO fits most manufacturers cabinets

The Performance Model FR2000 60V/16A Ferroresonant power supply is designed to replace or retrofit discontinued and obsolete power supplies. It fits most existing cabinet configurations and connects using existing wiring. Price is $299. call 800/279-6330.

Reader Service Number 105



SURGE-GARD protects against nuisance fuse blowing and resets in 60 seconds

Self-resetting circuit breaker fits fuse clips in Jerrold SSP power inserters. The Performance Surge-Gard replaces fuses in locations where they frequently blow for no apparent reason causing unnecessary truck rolls. Merely remove the undependable fuse and snap-in the Surge-Gard. Specify Model SG15A for 15 ampere protection. Cost only $17 (100 & up). Call toll free 800/279-6330.

Reader Service Number 106

VOLTEX CATV-27 Standby battery costs only $64.95

Best high temperature battery available! Normally outlasts valve regulated gelled electrolyte batteries two to one in CATV applications and provides as much as 15% longer run time. By far the best battery value on the market today. Call Performance today for details 800/279-6330.

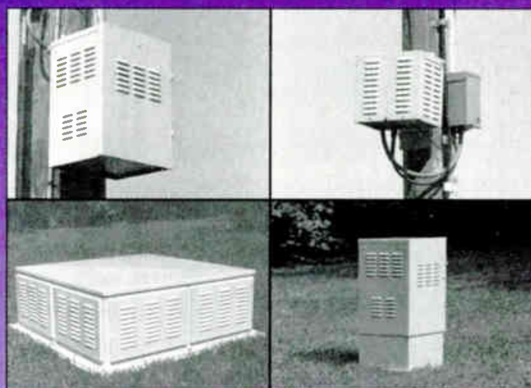
Reader Service Number 107

BATTERY TESTER checks 12 volt standby batteries automatically

The Performance Model BT 1200 universal battery tester checks gelled electrolyte and lead acid batteries in 10 seconds. Since batteries deteriorate gradually, regular testing with this unique device enables you to log changes in voltage levels as they occur. Having this history lets you know when to do preventive maintenance before a critical battery fails. Price is $250. Order today, call toll free 800/279-6330

Reader Service Number 108

Power Supplies So Reliable . . . They're Backed by a Lifetime Warranty !



Reliability is what it's all about when selecting power supplies for your system, regardless of whether they're for an upgrade or a retrofit. Our industry-leading design and reliability assure that our products give years of trouble free service, but that isn't all, our confidence in the integrity of Performance power supplies is so positive,that we back them with a lifetime limited warranty. So call today to find out more about the many benefits of using Performance power supplies. You'll be glad you did . . . for years to come.

PERFORMANCE POWER TECHNOLOGIES

P. O. BOX 947, ROSWELL, GA 30077 • 800-279-6330

AN EDWIN-ROSS COMMUNICATIONS COMPANY

Reader Service Number 24

By Ron Hranac

Managing Reverse Path Ingress
Find and Fix Any Leakage

One of the most common complaints I hear from operators of two-way systems is ingress. Theoretically, we operate closed networks and use frequencies that also are used in the over-the-air environment. When the network no longer is closed for some reason (for instance, because of a loose connector or damaged cable shielding), over-the-air signals can interfere with signals inside the cable. This is known as ingress. Another way to look at it is to think of ingress as outside signals that "leak" into the cable.

Ingress sources, real and imagined

Those outside signals can include discrete interfering carriers such as CB radio or shortwave broadcast transmissions. This is probably what most people think of when they hear the term ingress. But ingress also includes interference from thunderstorm-caused static, electrical noise from electric motors, power line switching transients, neon signs, household appliances, thermostats and automobile ignition systems. All of the previously mentioned signals exist nearly continuously in the over-the-air environment and are especially prevalent in the frequency range below about 30 MHz or 40 MHz. The trouble occurs when they get inside our networks, especially in operating two-way systems. Most two-way systems use the 5 MHz to 40 MHz spectrum for upstream transmission, so ingress in that frequency range can be particularly troublesome.

So what happens when a neighborhood CBer's 27 MHz transmission finds its way into the reverse path? A few operators might think it's time to go have a chat with the "offending" CBer because he's "probably operating illegally with a 100-watt linear amplifier." Maybe you call the Federal Communications Commission and bust his chops. Well, maybe the CBer is using an illegal amplifier, he does get busted, and that particular interference problem is solved. For now. But maybe he's operating perfectly legally. Now what? What happens when a ham radio operator down the street starts transmitting at 14 MHz with a perfectly legal 1,500 watts? Do you try to convince him not to transmit at all because he is interfering with your system?

> "If you've got a leak—any leak—you've got a point where something on the outside also can get in."

OK, this sounds ridiculous and isn't a very effective way to manage ingress, but I've actually talked to some operators who have the attitude that the source of the interfering RF signal is the problem. In other words, they blame the CBer or ham operator. I am not making this up. You and I know the problem is whatever is allowing the interfering signal to enter the system in the first place, be it a loose connector, cheap non-bonded foil drop cable, poor quality passive, a cracked feeder cable or a poorly shielded TV set in some subscriber's home.

What to fix

So, how can we effectively manage ingress?

The answer is simple: By managing signal leakage. "What?" you ask. "Has Hranac been chugging too much caffeine?"

Nope. Think about it for a second. After all, what is ingress but the opposite of egress? That's right, if you've got a leak—any leak—you've got a point where something on the outside also can get in.

Here's another shocker. If your system just meets the FCC signal leakage limit of 20 µV/m (some operators only fix leaks down to, whoops, 50 µV/m), then I'll wager a cup of fresh Starbucks coffee that you've got reverse path ingress. Ideally, you need to get your system to the point where you have no detectable leakage. That's a pretty tall order, so a better place to start is to set your downstream leakage threshold at 5 µV/m for both the drops and the network. This is roughly 12 dB tighter than the 20 µV/m limit imposed by the FCC. It's also a threshold that many operators have claimed results in nearly ingress-free reverse path operation. And it does so without high pass filters on any but the occasional problem drop.

If you monitor Ch. 16 (C) for leakage, a 20 µV/m leak will produce about -42.9 dBmV at the terminals of a resonant half-wave dipole antenna. Moving the

threshold down to 5 µV/m puts the signal you need to be able to measure at roughly -54.9 dBmV. Let's just call it -55 dBmV. Can your leakage detection equipment measure a signal that low?

It might be a bit tough with just a dipole and signal level meter (SLM). Considering that many SLMs can measure down to only about -35 dBmV or so, this setup would require a moderate gain (probably around 25 dB) low noise preamp in conjunction with a bandpass filter centered on the measurement frequency.

I suggest that you contact the major signal leakage detection equipment manufacturers and ask about the availability of products that can reliably and accurately measure to -55 dBmV and lower. The equipment is available, by the way. Tell them that you want to be able to measure field strengths in the vicinity of 5 µV/m or less, along with the usual 20+ µV/m leaks.

Another thought would be to use police scanners or portable VHF ham radio receivers for low level leakage monitoring. Many of these have sensitivity performance that allows detection of VHF midband signals as low as -70 dBmV to -75 dBmV, which corresponds to field strengths of about 0.5 µV/m. That's not a typo; it really is less than 1 µV/m. While not particularly suitable for accurate measurements, scanners and VHF ham receivers are great for listening for the presence of low-level leaks. If you can drive out your system and not pop the squelch on a VHF ham receiver connected to an external antenna, you've got a pretty tight system indeed. Trouble is, I've found only a few systems that can do this.

How to fix it

So, just how do you get your system's leakage performance that good? Well, think back to the late '80s and early '90s, when you were trying to get your system to meet the then-new leakage requirements. If you'll recall, you had to sort of "peel the onion." That is, you started with the really big leaks first (John Wong, please skip the next sentence or two), say 200 µV/m to 300 µV/m and larger, because they masked all the smaller leaks.

As you fixed the biggest leaks, it then became possible to measure the next level of leaks, those in the 100 µV/m to 200 µV/m range. After those were fixed, you could concentrate on trying to get things quiet down to 50 µV/m to 75 µV/m, and finally you started working on the 20 µV/m to 50 µV/m leaks. From then on, you and your staff got into a leak maintenance mode, working on all leaks greater than 20 µV/m.

To tighten your system further, you need to resort to the onion approach again. Work on the leaks in the 10 µV/m or 15 µV/m to 20+ µV/m area first. When the bulk of those have been taken care of, go after the 5µV/m to 15 µV/m leaks. Finally, work on everything at or above 5 µV/m in your leak maintenance mode. Of course, this is easier said than done because you will be working on both network and drop leaks, especially drop leaks. This means you'll be fixing a lot of stuff inside subscribers' homes. It can be done. There are success stories out there, but they took some pretty hard work to get to that point.

The key to effective ingress management is to make low-level leakage a high-level priority in your system, so high that every employee from the manager to every installer must be part of the leakage monitoring effort. Put leak detectors in everybody's company vehicle. (This recommendation comes from two-way guru Tom Staniec, by the way.) Do leakage measurements during every service call and install. While everyone gets to monitor for leaks, you need to have a dedicated leakage measurement and repair crew, even if it's only a couple techs. Rotate all of your staff through leakage repair crew duties, so everyone can appreciate the causes and cures for leakage and ingress. It might take a year or two to get your system to meet the 5 µV/m threshold, but your reverse path will thank you for it. 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.

New System Combines Video, Ethernet and T1

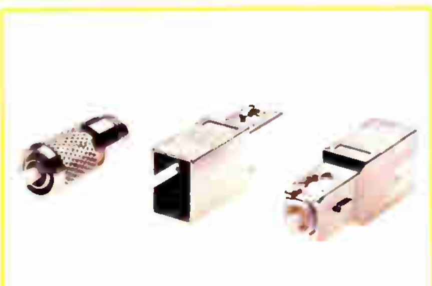
A unique new multiplexer, the Series 7000 Supermux will multiplex one baseband video channel, two audio channels, Ethernet, T1 and RS232 data. The product, developed by Radiant Communications, combines information via a high speed TDM system and transmits both ways over one or two fibers for up to 70Km.
New Feature — 30 channel broadband can be added.

Reader Service Number 100

Video Codec

The Series VC500 allows bi-directional video/audio to be added to any digital network — Ethernet, ISDN, T1 FDDI, ATM, etc. This is a very high quality, low cost system that is easy to use on any PC. Typical applications include intra-system or inter-system communication, video conferencing, etc. This will even work over high speed internet hookups. Prices start at $3,000 list.

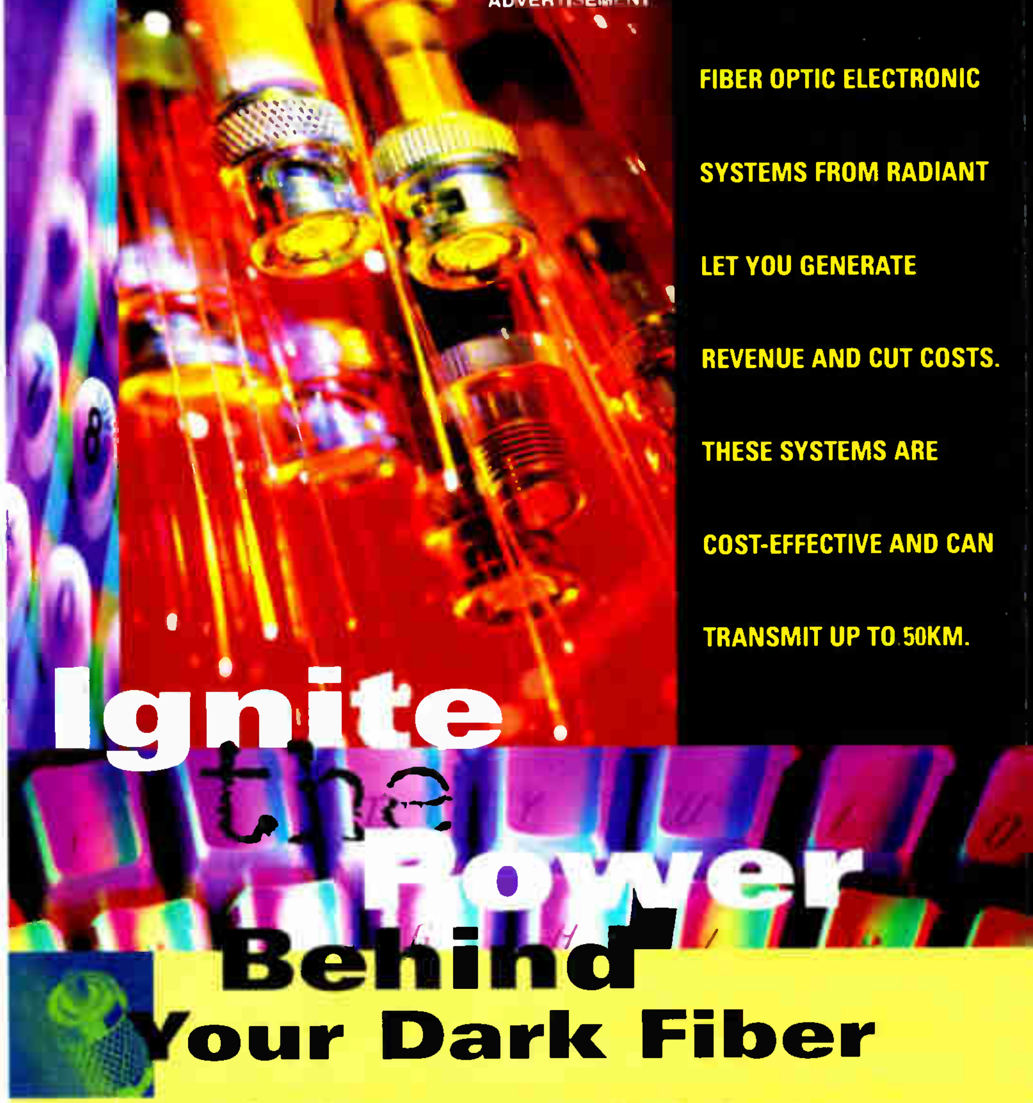
Reader Service Number 101



Fiber Optic Attenuators

Radiant offers a full line of fiber optic cable plant products. Pictured above are our new Series ILBR Attenuators. They are available in one dB steps for FC/PC, FC/APC, SC/PC and SC/APC with guaranteed back reflections of -55dB. Also available are Customer Premise cabinets, couplers, WDMs, and fiber optic assemblies for drop cables, pigtails and jumpers.

Reader Service Number 102



- Fiber optic single-channel baseband video systems ideal for distance learning applications with schools, direct broadcast pick-ups and remote antenna sites. Four channel systems and bi-directional versions also available, providing two-way transmissions over one fiber.
- Fiber optic systems for status monitoring and control compatible with all manufacturers to replace leased phone lines.
- Fiber optic Ethernet systems with high throughput (up to 100MBS) and no distance limitations (up to 100 Km)...now available on one fiber.
- New high-speed TDM transmits video, T1 and Ethernet at very low cost...VL7000 Supermux.
- Video Codec — high quality, low cost product adds video to any digital network — Ethernet, ISDN, ATM, etc.

Radiant Communications Corporation
P.O. Box 867
South Plainfield, NJ 07080

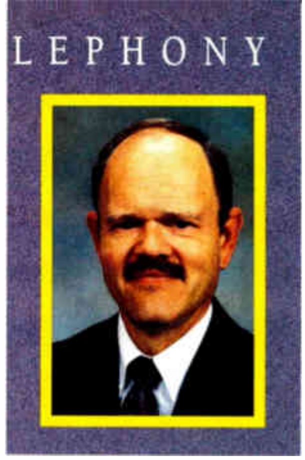
1.800.WOW.FIBR
in NJ 908.757.7444
Fax 908.757.8666

Reader Service Number 27

www.radiantcommunications.com

By Justin J. Junkus

Diversity Is Cable's Telephony Strength



Maybe one of the reasons some analysts have difficulty finding telephony growth in the cable telecommunications industry is that they really don't understand telephony. This month, I want to point out some basic facts about the telephony business today and lead you to an expanded vision of where tomorrow's telephony business participants are going to earn their livings.

Let's begin by recognizing how history can be the source of some false impressions. Prior to 1969, the telephony industry was pretty much homogenous. Both Bell and the independents provided local phone service, and AT&T (then part of the Bell System) provided long distance service for everyone. In the decade from 1970 to the divestiture of the Bell companies from AT&T, the interexchange carrier (IXC) market was opened to competition, and businesses began to recognize alternate carriers as viable providers of long distance services. With a proven track record in business, AT&T's competition expanded to the residential market, to the point where today's consumers shop for the best phone deal and receive continual marketing encouragement to do so.

The local phone service market, however, was not truly open to competition until enactment of the Communications Reform Act of 1996. Encouraged by the way competition grew in the long distance market, legislators expected the same to occur even more rapidly for local telephone service. Their expectations were in large part fueled by our industry's ownership of another path into the consumer's home. Cable telephony therefore was synonymous in their minds with competitive local telephone service.

Business, not just technology

Cable operators are first and foremost business people, and successful business people define their business markets in the broadest terms. Telephony therefore is not just local phone service, but the entire spectrum of connecting a call between subscribers. The best strategy for entering a new business is to come from a position of strength, and this broad definition of telephony gives operators a number of choices to get into the business. Besides having a path into the home, what other strengths could a cable operator leverage as a new telephone company?

> "Telephony ... is not just local phone service, but the entire spectrum of connecting a call between subscribers."

Most cable operators already have experience in high-speed trunking because of their fiber-optic distribution plants. They understand technologies of fiber-optic interconnections and have trained technical staff in those areas. They already have made the investment in hardware and, to some degree, in operations systems to monitor the plant. They are strong in transmission technology and the associated training.

A few cable companies have the advantage of early entry into a specific type of residential local access market, the multiple dwelling unit (MDU). Perhaps this was because certain state regulators saw this market as being more like a business than a single-family residence. It could, after all, easily be argued that building owners typically contracted for services to the building, such as heating and air conditioning. There were distinct advantages to the building owner in having a similar single provider—a single point of contact—for all communications services in the building. For whatever reason, some cable companies were successful in entering this market in the mid-1990s and gained valuable experience in another required area of strength—customer service and reliability.

Range of telephony opportunities

Different core strengths thus have become the basis for different points of market entry, and telephony in the cable industry now has become a set of diverse offerings. Single-family residential local service is only a part of cable's telephony business. A look at where we are today gives some indication of our industry's direction for the future.

There was a plethora of local residential telephony trials in 1996 and 1997, but only a handful of local commercial offerings in early 1998. Those companies that made the commitment to commercial local residential service offerings did so because they had more experience than could be provided by trials alone. MediaOne, for example, now offers single-family telephony service as part of its broadband offering in Atlanta, after having been a service provider for telephony

in MDUs in Atlanta and Florida. Cox is another example, as it expands to the single-family residential market, while continuing to grow its substantial Los Angeles MDU market. These companies are fulfilling the legislators' expectations, but only because it makes business sense. They have trained staffs, business processes and field experience with customers of local phone service gained by phased market entries. Most likely, these companies will continue building local phone service businesses in new markets.

Other cable companies are coming into the telephony business from their own strong areas. Adelphia, for example, has worked the interexchange interconnect market for some time now. When you look at the Adelphia Web page, therefore, you should not be surprised to see them marketing their own brand of long distance service. Their definition of telephony probably will continue to emphasize alternate network access.

"The best strategy for entering a new business is to come from a position of strength."

Time Warner is another example of a cable company growing network-based telephony, albeit in yet another direction. Their 19 switches serve business customers in locations spread across the country. Their strength as a competitive access provider gives them experience in the network arena, with a base of business customers who subscribe to transport services ranging from digital lines through fiber-optic based synchronous optical network (SONET) private lines. Providing local dialtone to this base of business customers, rather than attempting to penetrate a new residential market, is a logical business decision.

Then, there's the entire area of wireless service. One could argue that this technology has a lot more in common with cable than landline telephony, albeit there still are the issues of customer service. On the other hand, the general public seems much more tolerant of cellular fades and outages than it is of the corresponding landline problems. So there is a potential match of technological strength and more time for a reliability and customer service learning curve compared to traditional phone service. Several companies have seen potential here, including Cox and Comcast.

What about the future?

Smart cable operators will continue to grow their telephony businesses in directions that build on experience and strength. For local telephone service, that means growth will come not only from companies in business now, but also from new entrants as they (and their investors) gain confidence from the experiences of working, profitable role models with successful local cable telephony offerings. This particularly holds true for residential local service.

I also believe that those operators offering local service will find new revenue-producing applications that continue to blur the lines between telephony, data and video. In the data arena, both Philips and Tellabs already have introduced products that move the functionality of the cable modem to the network interface unit (NIU) that is installed for telephony service. The Philips product even removes the need for a network interface card (NIC) in the subscriber's computer. With this type of hardware, high-speed data becomes an extra-charge telephony option.

One application that may prove very interesting is messaging services. Next month, I will discuss how this application may be offered as part of voice, data or digital video and how it might be used to entice a customer to subscribe to more than one type of service. CT

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

Reader Service Number 30

By Laura K. Hamilton

Can Subs Self-Install Digital Boxes?

When TCI began offering digital video to many of its subscribers, the MSO experienced a classic symptom of a new successful service: There was a huge influx of requests, and installs started to backlog — three to four weeks in some areas, and five to six in larger markets.

One solution TCI hoped would help, at least in part, involved offering subscribers the opportunity to install the digital cable terminals (DCTs) themselves. "We wondered what would happen if we created a self-install kit for those people we believe are technically astute and comfortable enough with the electronics in the home to self-install," says TCI Vice President of Digital TV Colleen Abdoulah.

At that point, TCI initiated preliminary research with some of its subscribers. Abdoulah reports that 15-25% of consumers said they felt pretty adept at installing in-home electronics themselves. "As a matter of fact, they preferred it," she adds.

The tests

TCI test marketed the idea in its systems in Tulsa, OK, and Springfield, MO. In Tulsa, TCI took the list of pending digital installs and offered those customers the opportunity to self-install. In Springfield, the option was offered transactionally as TCI sold digital to the subscriber. About 10-15% of subscribers wanting digital said yes to the self-install.

Interested subscribers were asked a series of qualifying questions. TCI needed to know if the sub already existed in the database as having a converter, how many outlets the customer had (and how many were wanted), and the proximity of the phone to the TV set. Obviously, the last question was necessary when a plant was not yet two-way capable and the telephony return was

in use for such services as pay-per-view (PPV) buys.

The kit

After subs passed the qualifiers, arrangements were made for them to pick up the self-install kits. These kits, developed by TCI engineers and General Instrument, included the digital set-top, a remote control, cable, and a phone wire for the telephony return connection. Also included was an installation manual and an instructional video describing how to use the navigation system.

How did they do?

"We were concerned about additional truck rolls and that people would have difficulty with the kit for whatever reason," Abdoulah says, "But we did not find that to be the case."

And it didn't take subs very long to do. On average it took them from 20 to 30 minutes to perform the digital self-install.

Kelly Carper, product manager at TCI, adds that truck rolls and trouble calls tended to stem from equipment or system problems rather than the install actions of the subscribers themselves. Carper lists the need to replace wiring, a nonfunctioning DCT, a bad remote and problems with the phone jack as typical reasons for a failed self-install.

"It wasn't really anything on the subscriber's part. The self-installation kit worked well, and the customers had no problem in hooking it up," Carper explains.

As a matter of fact, on quality assurance call-backs to customers, the question was posed, "Were the written instructions easy to understand?" The answer was unanimous. They all said yes.

10% projections

TCI announced that it hoped to offer this install option nationally to all of its digital systems by the middle of last month. However, Abdoulah reports that initially it will be more heavily promoted in systems with backlogged digital installs. "If we find it goes over really well, we may market (the self-install option) in a very targeted fashion, maybe in a bill insert."

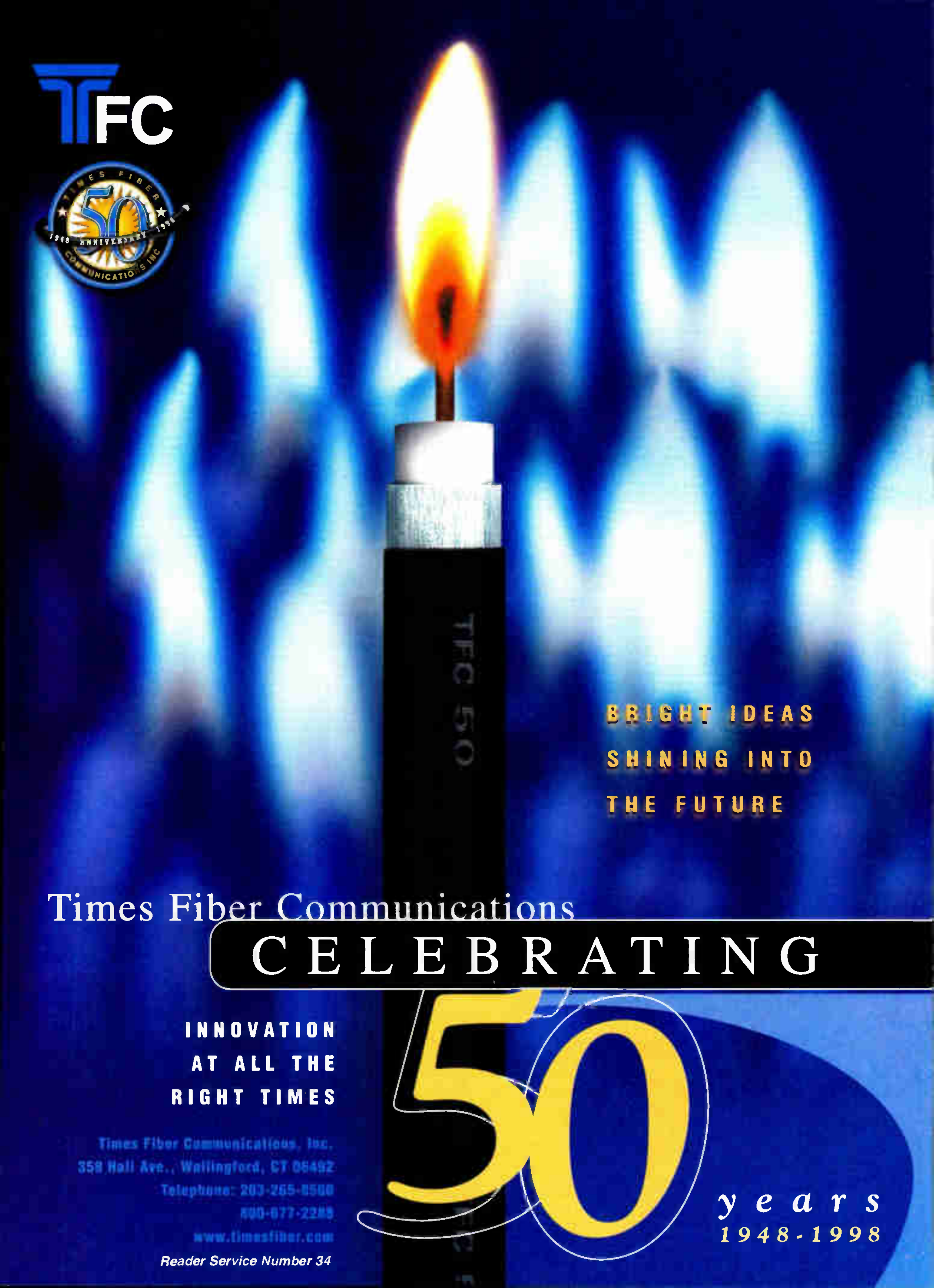
"We're being very conservative in our initial projections of how many people will take advantage of this. We're projecting around 10% will actually opt for a self-install opportunity," she adds.

A step toward retail boxes?

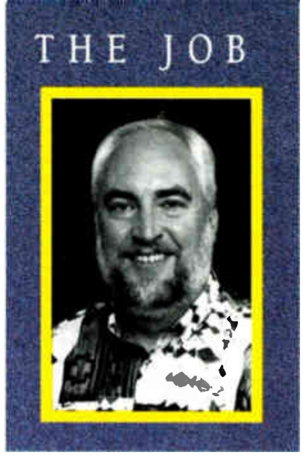
So if cable subscribers are offered this option more and more, and as they get comfortable with the idea of hooking up their own in-home terminals, is this a hint toward consumers' being able to buy digital set-tops at electronics stores and self-installing them?

Abdoulah is conservative in her answer: "Retail sales of digital is something we definitely want to get into as the advanced set-top box process matures. But all this does in relationship to that is it provides a good database of which of our customers are comfortable in doing this themselves." T

Laura Hamilton is senior editor at "Communications Technology" in Denver. She may be reached via e-mail at lhamilton@phillips.com.


TFC
Times Fiber Communications Inc
50
1948 Anniversary 1998
TFC 50
BRIGHT IDEAS
SHINING INTO
THE FUTURE
Times Fiber Communications
CELEBRATING
INNOVATION
AT ALL THE
RIGHT TIMES
Times Fiber Communications, Inc.
358 Hall Ave., Wallingford, CT 06492
Telephone: 203-265-8500
800-677-2288
www.timesfiber.com
Reader Service Number 34
50
years
1948-1998

By Alan Babcock



A Question of Style

Last month I discussed the work necessary to create your own training materials, such as 40 hours' development time to create just one hour of instruction, as well as components of good instructional design. This month, I'd like to take this discussion a step further.

Learning styles

Let's consider the learner and his or her ability to absorb information. Learning styles generally fall into three groups: auditory, visual and kinesthetic.

Auditory learners prefer to learn by hearing. If you like "books on tape," have a large CD or tape library, or like lectures, you likely are an auditory learner.

Visual learners tend to respond best to visual stimuli. For example, if you look at pictures in a magazine before reading the articles or prefer movies on the "big screen," you likely are a visual learner.

Finally, kinesthetic learners have to do it, touch it or feel it. My younger brother always took his toys apart to see how they worked. He was a kinesthetic learner.

For some, one learning style dominates. For others, a balance exists between two or even all three styles. Most effective trainers have a good balance between all three learning styles. We also change our learning styles based on the environment but then revert to a predominant style.

Think back to the first time you put on hooks and learned to climb a pole. Regardless of your preferred style, you learned kinesthetically as you felt the pole (even through your gloves), felt the gaff sink into the wood and began the ascent.

Now recall how you reacted as you watched others climb. Did you hear their gaffs jab into the soft pine or watch the angle of the leg to assure the knees weren't too close? Did you watch the

careful placement of the safety strap around the pole or listen for the snap of the hook as it engaged the D-ring?

As you climbed, you learned kinesthetically. As you observed, you reverted to a primary style, perhaps auditory or visual.

Most (about 75%) of the technicians I have trained are kinesthetic learners. They learn best by touching, feeling and doing. Training for these learners should include lots of hands-on and application exercises. Training for kinesthetic learners should include short "chunks" of learning, which include movement, experimentation or other physical activity.

We can't design training for just kinesthetic learners, though. Auditory or visual learners will "check out" and not get the necessary information if we don't include delivery methods that address their style.

New tools

Training materials being created by the Society of Cable Telecommunications Engineers address all three styles. For example, the Broadband Technology Course includes videotapes, textbooks, leader guides and student workbooks. Many videotapes will appeal to auditory learners, as a video version of a "book on tape."

The more visual videotapes, such as T-1135 (*Signal Level Monitoring*) and T-1001A (*TV—Your Primary Diagnostic Instrument*), address visual learners. T-1001A demonstrates many impairments possible in a cable system. Examples of hum, intermodulation distortion and poor carrier-to-noise ratio (C/N) are shown on typical TV sets.

Applications and hands-on exercises are described in the leader guides.The student workbooks include worksheets for recording answers, calculations and other activities to tie the learning to the job.

Effective training must engage all learning styles. Likewise, the trainer must consider how best to implement the training's various aspects.

Training styles

Most trainers have a preferred training style, which may be the same as the predominant learning style or may be a learned behavior. "We tend to train the way we were trained" is one influence on a trainer's style.

Since most of us received lectures in school, lecture tends to dominate many training styles. What learning style does lecturing serve best? Is it predominant in our technical ranks? A disparity appears between training and learning styles here.

SCTE recently introduced a train-the-trainer program. This three-day seminar addresses adult learners and helps trainers effectively deal with diverse learner needs. This program is offered as a regional seminar through our network of chapters. To schedule a Train-the-Trainer seminar in your region, have your chapter representative contact national headquarters at (610) 363-6888.

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

It's time to take the bull by the horns.

The HP E6000A Mini-OTDR keeps your optical telecom and LAN/WAN networks up and running by pinpointing network faults and degradation faster. With the new ultra high-performance module, you get an unmatched, guaranteed dynamic range of greater than 40 dB, allowing longer measurement ranges than ever before. Over shorter ranges, you can reduce measurement time from 180 seconds to under 10 seconds. All this means the HP E6000A gives you serious capital and time savings—and a competitive edge.

As if that wasn't enough, the HP E6000A has one-button operation, an award-winning* intuitive user interface, and a superior scan trace algorithm for quick, repeatable measurements. And a brand-new color display means even new users can quickly make advanced, reliable OTDR measurements on the first try—all at a price that fits your budget surprisingly well.

Finding faults has never been faster. Or more affordable.

There is a better way.

*To find out how the HP E6000A can keep your network charging ahead, call us at 1-800-452-4844,** Ext. 5197, or visit our Web site at* ***http://www.tmo.hp.com/tmo/datasheets/English/HPE6000A.html***

*iF Product Design Award and iF Interface Design Award 1997, by Industrie Forum Design Hannover, Germany.

**In Canada call 1-800-387-3154, program number TMU325.

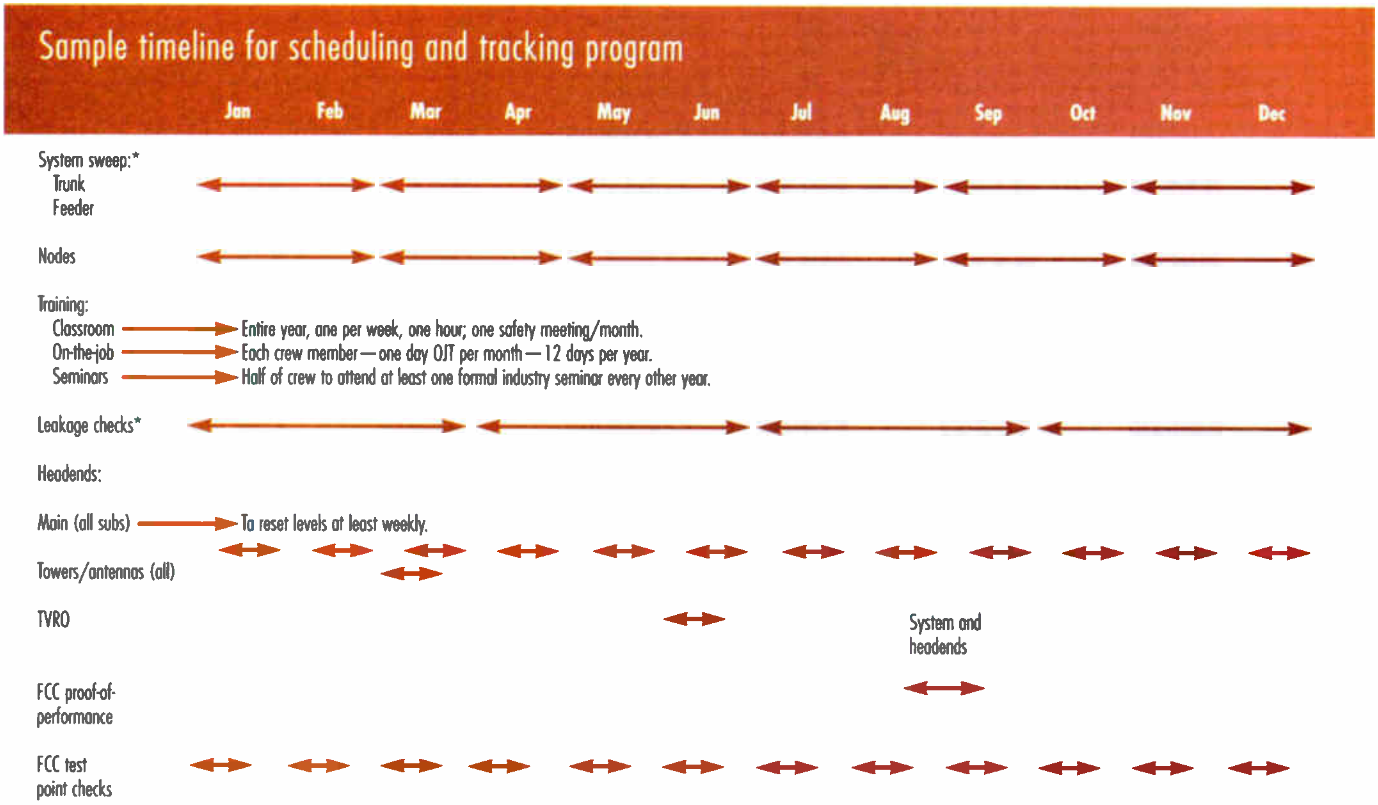
An Ounce Of Prevention

Five Steps to Improved Network Performance

A carefully planned program of preventive maintenance (PM) can ensure peak system performance, which leads to improved network reliability, less downtime and increased customer satisfaction. A preventive maintenance program can improve the performance of the entire system, including the upstream path, and save money at the same time.

Take the example of a 50,000-subscriber system with average revenue of $30 per subscriber per month. That's $18 million per year in total revenues. What are the savings, if any, this system operator could hope to realize? The answer may surprise you. Here are some of the immediate advantages:

- Reduced maintenance costs. Maintenance costs typically equal 10% of revenue. In our example of an $18 million network, that's $1.8 million per year. By some studies, preventive maintenance can save 15% of overall maintenance



* Entire distribution system

Timeline concept courtesy of Ron Hranac

costs. The net savings in this case would be $270,000 per year.

- Increased customer satisfaction. The benefits here are easy to identify: Lower customer turnover, more services ordered and greater market share. If the system's improved quality generates even $1 more per subscriber per month in revenue, the result is $50,000 per month, or $600,000 per year.

Now let's add up the total annual return on the investment of a preventive maintenance program: $270,000 on reduced maintenance costs; $600,000 on increased customer satisfaction. That's a net return of $870,000 (amortized deployment expense, give or take some incremental support expense)!

Although your individual system's savings may vary, it's clear that a thorough and careful preventive maintenance program really can help your bottom line. Other benefits to cable operators include:

- Increased reliability
- Decreasing service calls and reducing overhead
- Decreasing system failures by identifying potential problems early ➤

BOTTOM LINE

Make Preventive Maintenance Work for You

Broadly speaking, the five points outlined as follows should get you started planning your own preventive maintenance program.

Step 1: Manage your assets. Know what equipment you have deployed, and where it is located.

Step 2: Maintain a history. Log serial numbers, pad and equalizer values for amplifier stations. At hubs, end-of-lines, and all other appropriate locations, use test and measurement gear to record levels, distortion parameters, ambient temperature and the date and time when maintenance was performed last.

Step 3: Plan routine inspections. Make plans of daily, weekly, monthly, semi-annual and annual inspections and procedures to be performed. Establish checklists or integrate your plans into a network monitoring software program.

Step 4: Compare your results. Check the data from your test equipment against your history of previous activity.

Step 5: Be proactive. As you review or process the data, look for trends and schedule corrective action.

THE CHALLENGE

Design a headend for high signal quality that also minimizes out-of-service conditions and lowers corrective maintenance costs.

THE SOLUTION

PULSAR Modulators from Barco

High signal quality, automatic back-up and remote monitoring in one intelligent modulator

PULSAR modulators provide complete software control, allowing you to monitor and manipulate all modulator functions from a central location. In the event that lost or degraded signal is detected, you can remotely route the signal to a back-up modulator without the expense or delay of dispatching a technician to the headend.

Even better, your subscribers won't experience an extended loss of service.

- Available in fixed frequency or tuneable versions to provide maximum flexibility
- Phase Locked Loop techniques assure long term signal stability
- An intelligent "white limiter" and video AGC prevent overmodulation and automatically optimize the modulation depth for various nonstandard video input signal levels
- Available with BTSC encoder
- Full remote control with ROSA software

Find Out More!
PULSAR is just one of the many BARCO headend solutions that make broadband CATV networks more flexible, efficient and reliable.

And, like all BARCO headend equipment, PULSAR can be remotely monitored and controlled by ROSA, BARCO's CATV network management software. For additional information, visit our Web site at www.barco-usa.com or call 770/218-3200.

BARCO

3240 Town Point Drive
Kennesaw, GA 30144
Tel: 770/218-3200
Fax: 770/218-3250
www.barco-usa.com

See BARCO at NCTA Booth #5362

Reader Service Number 42

- Improving picture quality
- Preparing your system for competition in two way telecommunications

Five steps to improved reliability

Use the following step-by-step overview to make preventive maintenance work for you. Broadly speaking, the five points outlined as follows, together with the accompanying sample timeline for scheduling and tracking (see the accompanying figure on page 52), should get you started planning your own program.

Step 1: Manage your assets. Know what equipment you have deployed and where it is located.

Step 2: Maintain a history. Log serial numbers, pad and equalizer values for amplifier stations. At hubs, end-of-lines, and all other appropriate locations, use test and measurement gear to record levels, distortion parameters, ambient temperature and the date and time when maintenance was performed last.

Step 3: Plan routine inspections. Make plans of daily, weekly, monthly, semi-annual and annual inspections and procedures to be performed. Establish checklists or integrate your plans into a network monitoring software program.

> "Remember, the key to preventive maintenance is solving minor problems before they become major ones."

Step 4: Compare your results. Check the data from your test equipment against yourhistory of previous activities.

Step 5: Be proactive. As you review or process the data, look for trends and schedule corrective action. To establish the importance of your PM program with your staff, recognize employees who find and fix problems.

One last note: Don't forget the obvious. Check routinely on standby power supplies, batteries, fuel for motor generators, pole hardware, grounding connections, heat and air conditioning for the headend, lights, safety equipment, manuals and test procedures, loose antenna elements, tower guy lines, paint and so on. Remember, the key to PM is solving minor problems before they become major ones. Fix the small stuff. CT

This article was adapted from a "Communications Technology" supplement, which was produced with Hewlett-Packard.


Let us put you...
...on
the
Return
Path.
VS
Viewsonics inc.
6454 East Rogers Circle, Boca Raton, Florida 33487 USA
1 800 645-7600 1 561 998-9594 Fax 1 561 998-3712
E-Mail: viewson@ix.netcom.com Web: www.viewsonics.com
Reader Service Number 44

The Goal Is Interoperable Set-Tops

The Way Is OpenCable

By Laura K. Hamilton

In recent years, standardization has been a huge intangible glowering above the seemingly unlimited potential of advanced services over cable's hybrid fiber/coax (HFC) networks. But the industry certainly isn't just sitting around as the recent push toward standardization on various fronts attests.

Take, for example, OpenCable. If you've had a serious talk about set-tops recently, the term probably came up repeatedly.

You know it's spearheaded by CableLabs and that it's an effort aimed at obtaining digital set-top boxes that are interoperable—friendly boxes from various vendors, if you will. The effort is to include an intellectual property pool and a certification process for testing vendor compliance.

Further, you most likely have heard that CableLabs intends to present specs to date for OpenCable boxes at this month's National Show. Also to be announced is publication of OpenCable software application programming interfaces (APIs), letting companies begin apps for the boxes.

But how did we get to OpenCable? While it was officially announced last September, it's been years in the making.

"Actually, at CableLabs we've been working on this process dating back to the late '80s," says Tom Elliot, senior vice president of technical projects at the Labs. "If you don't have a feel for how the analog-to-digital processes evolved, it can all be very confusing."

HDTV

So to avoid some of that confusion, let's start with the initial hybrid analog/digital high definition TV (HDTV) filings presented to the Federal Communications Commission in the late 1980s. As you'll recall, things changed quickly once an all-digital scheme was filed in 1989. That led the FCC to request that initial filings be withdrawn and resubmitted as all-digital filings.

"That's when this process really started to head downstream," says Elliot.

"CableLabs was coming into being about that same time. And we decided the thing to do was to look at the standard definition of television—application of digital to NTSC," he adds.

MPEG

Now add the Moving Pictures Experts Group.

"In the early days, the MPEG video

Name ____________________
Company ____________________
Address ____________________
City ____________ State ______ Zip ______
Phone ____________________
Fax ____________________

PLACE
STAMP
HERE

MEGA HERTZ
6940 South Holly, Suite 200
Englewood, CO 80112

Name ____________________
Company ____________________
Address ____________________
City ____________ State ______ Zip ______
Phone ____________________
Fax ____________________

PLACE
STAMP
HERE

MEGA HERTZ
6940 South Holly, Suite 200
Englewood, CO 80112

Name ____________________
Company ____________________
Address ____________________
City ____________ State ______ Zip ______
Phone ____________________
Fax ____________________

PLACE
STAMP
HERE

MEGA HERTZ
6940 South Holly, Suite 200
Englewood, CO 80112

Amplifiers
Antennas (Off Air), (Satellite)
Cable
Character Generators
Commercial Insertion
Connectors
Converters/Batteries
Distribution Passives
Demodulators
Emergency Alert Systems
Enclosures/Racks
Fiber Products
Generators/Inverters
Headend Products
LNA/LNB/Block Converters
Modulators
Molding
Pedestals/Apartment Boxes
Power Supplies/UPS/Batteries
Processors
Satellite Receivers
Stereo BTSC/FM Processors
Switching
Televisions/Monitors
Test Equipment
Traps/Filters (Specialized)
Video Products

MEGA HERTZ ®

DENVER
800-525-8386

ST. LOUIS
800-821-6800

ATLANTA
800-962-5966

OCALA, FL
800-922-9200

INDIANAPOLIS, IN
800-761-7610

PHOENIX,AZ
800-883-8839

quality was lousy, and you saw some good video quality in the proprietary techniques," Elliot says.

So it looked like a choice between not-so-great MPEG and proprietary offerings. However, Elliot says that in mid-1993 MPEG started turning up the quality curve quickly, and by the end of that year, virtually the entire cable industry had decided that the right thing to do was to get behind MPEG.

"So what we've been doing all along here is chipping off pieces," says Elliot.

In other words, this and other platform standards were being developed along the way, with wide-scale economic support. CableLabs' members were getting behind those standards, and they eventually would become elements of OpenCable.

OpenCable

In Spring 1997, the CableLabs Executive Committee (which is made up of CEOs of most of the major MSOs) had a number of meetings with computer industry, consumer electronics and traditional cable suppliers.

"There were very open discussions about the next generation of services and platforms required to provide those services," says Laurie Schwartz, project director, digital video technology at CableLabs. "As a result, our industry decided it was very important for us to come up with a common, standard approach for these new platforms and services. That was the birth of OpenCable."

These talks went a long way in convincing the other industries that cable very much could and should be included in developing standards for future digital services and platforms, reports Schwartz.

Elliot adds, "What we got out of that process was a shift in the thinking of primarily the folks at Intel and Microsoft. Publicly, prior to that time they had been somewhat negative about the cable industry being able to participate."

As you'll recall, soon after those talks, Microsoft and Intel came out very publicly in support of the cable industry.

"We're comfortable that the best minds in the world are now participating in the process. We feel we're going to come up with the best platform that there could possibly be developed at this point in time," says Elliot.

Patterned after DOCSIS

When OpenCable was first announced, it was reported that it was patterned after the industry's successful Data Over Cable Service Interface Specification (DOCSIS), which continues within CableLabs.

"With respect to the fact that we have members participating heavily in the authoring of the document and that we expect to go through a common process of review and publication and standardization—that is similar to DOCSIS," says Schwartz.

However, DOCSIS deals with emerging business for cable, not today's core business, explains Elliot. OpenCable deals directly with the current flow of business.

"One thing that makes OpenCable different is the legacy issue associated with existing set-top boxes, both analog and digital, that are being deployed today," Schwartz says. "How do we include those in the OpenCable process and family of set-tops? To that end, it's slightly different because it's not a desert start."

The specs

CableLabs predicted a mid-year completion of the initial OpenCable specification, and, as was stated earlier, the Labs said it intended to present specs to date at the National Show this month in Atlanta.

Of course, this is just another step along the way in a procedure surrounded by the many and varied technological and business desires of the cable, computer and consumer electronics industries.

"Our number one priority right now is getting consensus among our members, and we're making a lot of excellent progress in that area," says Schwartz. "The next step, which is going to lead to a number of iterations—and the timing for that is a little less clear—is getting vendor comments. That's what's going to lead us to a complete spec."

"We're working together with a lot of existing, cross-industry efforts to define software environments. We're making some good progress there, as well as on our high definition strategy, which is another key element that we're focusing on right now," she adds.

Elliot emphasizes that there'll be a tremendous amount of activity after the specs are announced: "We have stages that we're moving through to make sure that our members are on the verge of having a series of products that from a platform perspective serve all of these different industries' needs."

"It's fun to be involved in something like this, and you can feel the momentum here. On the other hand, sometimes it feels like a tiger that's a little hard to ride," Elliot says. "We've got work to do." *(Editor's note: A related OpenCable story runs on page 60.)* CT

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

BOTTOM LINE

Toward the Interoperable Set-Top Standard

The sometimes staggering potentials of advanced services over cable's hybrid fiber/coax (HFC) networks mean that industry standards are more important than ever before. Take for example, digital set-tops. The power and possibilities of what these boxes can deliver reach far beyond just traditional cable technology.

OpenCable's birth: Last September, CableLabs and its members established OpenCable, a project aimed at obtaining interoperable set-tops. This initiative has been years in the making and will continue to occur in many stages.

Coming on fast: CableLabs said it plans to present specs to date for OpenCable boxes at this month's National Show in Atlanta. Also slated is the publication of OpenCable software application programming interfaces (APIs), allowing companies to begin applications for the boxes.

OpenCable: Behind the Scenes

How User Applications Will Affect Component Design

By Jon Stilwell

You probably know that cable subscriber equipment "front-end" (tuner and modem) discussions are underway to standardize products for digital cable and data. It's called OpenCable. What you may not know is how OpenCable considerations will affect these products and other components in the network.

The OpenCable initiative will increase the promotion and deployment of digital cable TV and data services. The effort builds on the CableLabs Multimedia Cable Network Systems (MCNS) Data Over Cable System Interface Specifications (DOCSIS) standardization and interoperability efforts for broadband cable data modems. As with MCNS, the OpenCable project can enable vendor competition, lower prices, ensure equipment portability and move product into the retail channel.

But what little issues may be creeping in and possibly affecting actual implementation of OpenCable? One specification decision requires a tradeoff between complexity of routing of signaling data at the headend vs. the cost of subscriber equipment. Another will affect retail availability of the products.

And which OpenCable products should be built–set-top or PC card? Television only? Selectable TV/MCNS cable modem? Simultaneous TV and MCNS cable modem? With HDTV support? When? The OpenCable initiative gives remarkable flexibility, so equipment users and vendors will need to make disciplined selections to best satisfy end users. Knowing the underlying differences in components may help make the decision somewhat easier.

Let's look at three planned models of OpenCable product and what it means for the components needed in subscriber products.

Three possible models

The OpenCable concept allows for a range of capabilities to serve various subscribers. A broad range of subscribers could be served by the three set-top architectures shown below:

"Basic TV" users. The primary application of this product is reception of digital and analog TV programs. The block diagram for such a product, emphasizing the front-end physical layer (PHY) processing, is shown in Figure 1 (on page 62). A number (typically 3 to 10) of Moving Picture Experts Group standard (MPEG-2) digitally encoded programs are multiplexed and transmitted via 16-, 64- or 256-quadrature amplitude modulation (QAM) over a single 6 MHz TV channel.

As shown, such a box requires two downstream channels: one "in-band" (IB) and one "out-of-band" (OOB). The IB channel is used for MPEG-2 packets of video/audio "payload." The OOB channel is frequency-agile but typically fixed within a given fiber node or neighborhood. This dual-downstream system offers the key advantage that the user does not lose contact with the OOB data when making TV channel changes. System management messages including security, electronic program guide, electronic alert, software "patches" and other narrowband data are sent via this channel.

After processing by the PHY, the data is passed to the MPEG-2 transport and media access control (MAC) circuitry that control, respectively, demultiplexing/decoding and interactivity.

"TV Plus" users. In addition to receiving digital TV programs, one new product will add both graphics and central processing power. This will enable new applications such as interactive games, home shopping and others. Optionally, such a product could allow for MCNS (or MCNS-like) cable modem functionality within a TV set-top box. The block diagram for this product is shown in Figure 2 (on page 62).

As with the Basic TV product, such a box requires reception of two downstream channels (IB and OOB). When the optional functionality of an MCNS cable modem is added, separate MAC and backend interface circuitry is required. At any given instant, the user selects either "television" or "data" reception, with the tuner moving to an appropriate RF channel. After PHY processing, the IB data is routed to the appropriate back-end circuitry for processing.

"TV and PC" users. As with the TV Plus product, this product includes advanced features. In addition, a complete MCNS cable modem is included. The block

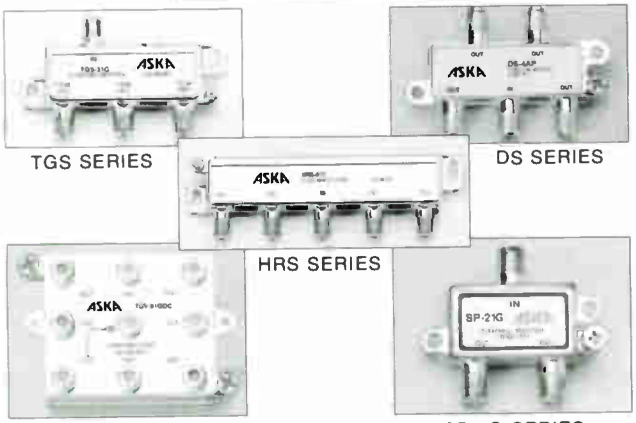
FULL RANGE SOLUTIONS . . .

PASSIVES FOR: CATV & SATELLITE

ASKA COMMUNICATION CORP.

CATV • 1 GHz PASSIVES

SPLITTERS



TGS SERIES

DS SERIES

HRS SERIES

TGV SERIES

SP-1G SERIES

A VARIETY OF SELECTIONS TO MEET YOUR NEEDS

- NON POWER PASS AVAILABLE IN: SOLDER BACK (SP-1G), ALL HORIZONTAL (HRS) AND VERTICAL (TGV) CASE DESIGN.
- ALL PORTS POWER PASS AVAILABLE IN: TONGUE & GROOVE CASE DESIGN.
- ONE PORT POWER PASS AVAILABLE IN: SOLDER BACK (SP-1G), AND VERTICAL (TGV) CASE DESIGN.

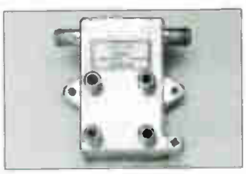
- **All above available In: 2-Way, 3-Way & 4-Way, Except Vertical (TGV) & Solder Back (DS-1G) which is also available in: 6-Way & 8-Way.**
- **Tongue & Groove Case Design: (DS), (HRS), (TGS) & (TGV). *SP-1G Solder Back Only.**

DIRECTIONAL COUPLERS - SOLDER BACK

DCM1G
MINI COUPLERS

DCW1G
WALL MOUNT COUPLERS

DC21G
2-WAY COUPLERS



DC41G
4-WAY COUPLERS

SATELLITE • 2 GHz PASSIVES

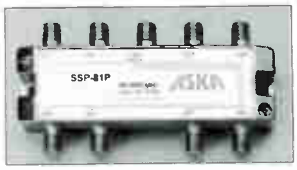
950-2050 MHz SPLITTERS

AVAILABLE IN:
ONE PORT DC PASSIVE &
ALL PORTS DC PASSIVE

AVAILABLE IN:
TONGUE & GROOVE
ONE PORT DC PASSIVE
ALL PORTS DC PASSIVE
AND DIODE STEERED

Above Available In: 2-Way & 4-Way

40-2050 MHz SPLITTER



ONE PORT DC PASSIVE &
ALL PORTS DC PASSIVE

**Available In:
2-Way, 4-Way, 6-Way
& 8-Way**

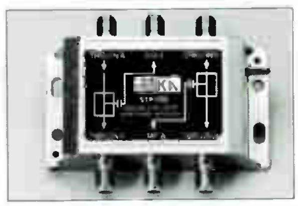
UHF/VHF SATELLITE DIPLEXER

SCS-1	STANDARD WITH GROUND
SCS-2	MINI CASE
SCS-3W	OUTDOOR/MAST MOUNT
SCS-4TG	TONGUE & GROOVE CASE WITH GROUND
SCS-5WP	WALL PLATE COMBINATION WITH PHONE JACK

40-2050 MHz TAPS

DIRECTIONAL TAPS

**Available In:
1-Way, 2-Way & 4-Way
In 10, 15 & 20 dB**



1-WAY 12 dB TAP
DUAL POLARIZATION

Corporate Office:
Ph: (800) 317-6625 or
(954) 486-0039
Fax: (954) 486-0202
www.askacom.com

ASKA
COMMUNICATION CORP

National Sales Office:
Ph: (800) 840-6350 or
(508) 730-1065
Fax: (508) 677-2511

Reader Service Number 45

Figure 1: OpenCable Set-Top Box "Basic TV"

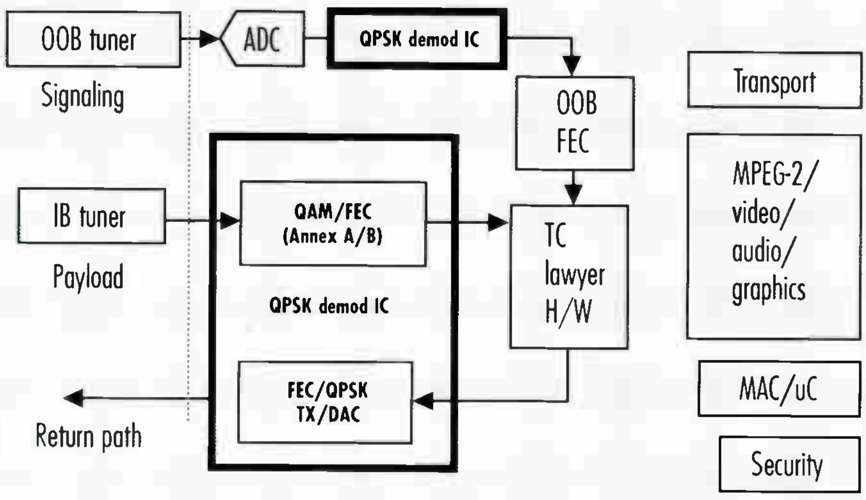


Figure 2: OpenCable TV Set-Top Box "TV Plus/MCNS Option"

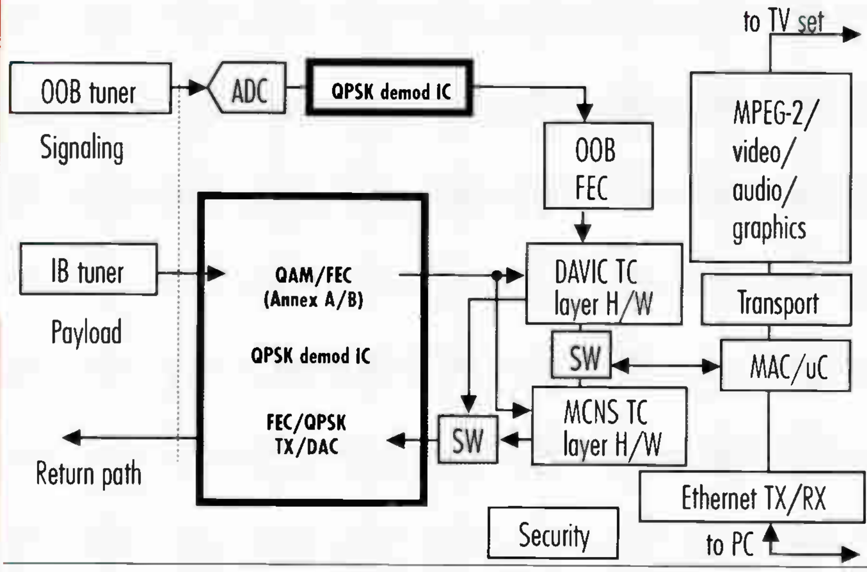


diagram for this product is shown in Figure 3 (on page 64).

A key benefit is that two users could have simultaneous broadband access to digital TV and MCNS data and not be forced to choose (as with the "TV Plus/MCNS option" product). However, such a product requires an extra 6 MHz tuner and IB demodulator; therefore, the cost of the product is higher.

When considering one model versus the next, some customers will pay for the added functionality. Of course, the key questions for vendors and operators are: "How much?" and "How many customers will pay for it?"

Some users will want OpenCable products in a PC card, to receive digital TV along with cable modem service. Depending on how much video and data processing can be done in software, such an architecture could be the lowest cost for the functionality.

The OpenCable specification allows for PC card versions of some models, to encourage PC card makers to continue to serve the cable "PC TV" market as operators go digital.

Technical issues

As this is written, the OpenCable specification is being finalized. Items under

BOTTOM LINE

OpenCable: Three User Models

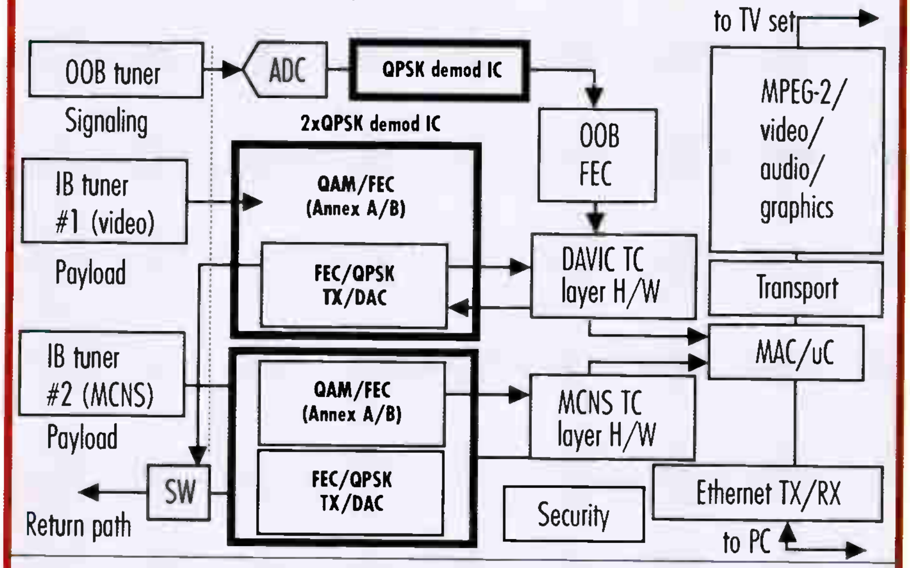
What is OpenCable and what does it mean to your engineering team, your management...oh yes, and your customer?

Discussions have centered around three application models:

- *"Basic TV" users.* The primary application of this product is reception of digital and analog TV programs.
- *"TV Plus" users.* In addition to receiving digital TV programs, this new product will add both graphics and central processing power. This will enable new applications such as interactive games, home shopping and others. Optionally, such a product could allow for MCNS (or MCNS-like) cable modem functionality within a TV set-top box.
- *"TV and PC" users.* With a complete MCNS cable modem included, a key benefit of this scheme is that two users could have simultaneous broadband access to digital TV and MCNS data and not be forced to choose (as with the "TV Plus/MCNS option" product). However, such a product requires an extra 6 MHz tuner and IB demodulator; therefore, the cost of the product is higher.

The OpenCable specification is being finalized. Items under discussion include operating system and software support, microprocessor capability and compatibility, security, "look-and-feel," picture-in-picture and graphics. Several factors could affect the PHY layer, include signaling for the high-end (TV and PC) product, interface specifications between products, and upgradeability to high definition TV.

Figure 3: OpenCable TV Set-Top Box "TV and PC"



Table

OpenCable component comparison summary

Model #	Tuners	# IB demodulators	# MAC processors	Notes
Basic TV	2	1	1	Digital + analog TV
TV Plus	2	1	1 (base model)	Advanced features
	2	1	2 (w/ MCNS)	MCNS optional
TV and PC	3	2	2	Advanced features MCNS integrated

discussion include operating system and software support, microprocessor capability and compatibility, security, "look-and-feel," picture-in-picture and graphics. Several factors that could affect the PHY layer include:

Signaling

In the case of the high-end (TV and PC) product, three downstream channels are required: one for OOB data, one for (TV) IB data, and one for (MCNS) IB data. It has been argued that the second (MCNS) IB QAM demodulator could be dual-use and receive not only the IB data but also the narrowband OOB data.

Such an "embedded signaling" approach would eliminate a tuner and demodulator and therefore is attractive in terms of subscriber hardware cost. However, it requires replication of OOB data into all MCNS IB data streams at the headend, complicating system implementation at the headend. Because data is replicated on multiple channels, it also is less bandwidth efficient, raising the cost per bit transmitted.

NRSS-B POD module interface specification

One of the key goals of the initiative is that subscriber product ("host") can be made available through the retail channel. Consumer electronics manufacturers would manufacture this host product. The hardware included in the host would include mostly off-the-shelf components such as modem integrated circuits (ICs), MPEG-2 decoding, video, and audio and graphics processors.

Separately, a point-of-deployment (POD) module would be required. This module would include functionality, most notably security, specific to each cable operator. The hardware and firmware in the POD would include mostly proprietary circuitry (usually application specific integrated circuits from the POD manufacturer).

The POD module and the host can come from different vendors; therefore, interface specifications become critical. As of this writing, the Electronic Industries Association and National Cable Television Association have a joint effort underway to create an interface specification (NRSS-B). After this specification is agreed upon, and POD modules are available, new consumer electronics manufacturers will be able to enter the market and sell OpenCable product at retail.

Regarding components, some of the functions that currently reside on consumer PHY ICs targeting the host likely will move to the POD module. This will result in a temporary duplication of some circuitry until new PHY layer IC components are developed specifically for OpenCable products implementing the POD module.

High Definition TV (HDTV)

OpenCable will allow for features to be added as market demand warrants. One important consideration is HDTV. Upper-end models will include some HDTV support. These products likely will include an IEEE1394a ("Firewire") interface for providing the HDTV information to a TV set.

Also, HDTV requires a different type of demodulation (vestigial sideband, or VSB, in the United States) from the QAM used in digital cable today. This demodulation could be done at the headend, the set-top, or the HDTV receiver. In any case, component and equipment vendors therefore will need to prepare so OpenCable products can support HDTV.

These issues, along with others, will be resolved shortly so OpenCable products can be deployed in volume in 1999. CT

Jon Stilwell is the central US sales manager, cable, for Stanford Telecom. He can be reached at 919-929-5833 or by e-mail at jon.stilwell@stelhq.com.

25 Years of Brilliant Messages

For 25 years, Video Data Systems has been delivering industry leading display and control systems – character generators, titlers, keyers and automated playback systems. Whether you're producing simple text crawls, bulletin boards, or still-image advertisements with graphics, we have a system to meet your needs.

MCM-96

Power in multichannel messaging – Perfect for EAS

With the power to display keyed text or billboards on up to 96 channels, you'll be surprised at how cost effective this messaging system is. Its applications include everything from EAS text overlay, pay-per-view interstitial overlay and cross–channel promotion to logo insertion, among others.

- *Four font styles*
- *Inserts any size logo (optional), soft or hard keyed, 256 colors*
- *Colored text & backgrounds*

LogoSTAR

Specialized for logo insertion

The new LogoSTAR lets you key bitmap logos anywhere on the screen. You can display one large logo or up to 32 smaller logos. The key level is adjustable for a transparent or hard keyed image. Bitmap images can be changed remotely. And when you need to add a bit of pizzazz, LogoSTAR even gives you the tools for logo or palette animation and options for time and temperature.

VidSTAR

Creative, automated information displays

VidSTAR meets the challenge of the most demanding text/titling and graphics creation and display scheduling needs. Not only does it provide creative flexibility when working with text and graphics, it gives you complete schedule and playback automation control for a variety of devices.

- *Text or image backgrounds*
- *Unlimited True-Type fonts*
- *Up to five independent display regions*

Photo Imaging System with Audio

Using digital camera snapshots and high impact graphics (accepts all standard file formats), create eye-catching ads and local channels. VidSTAR Photo Imaging gives you everything you need to create your own advertising channels, such as real estate or classified ad channels, local advertisements and informational channels for corporate, community or cable local origination.

800 Series

The economical workhorse of character generators

Thousands and thousands of these rugged little systems are installed world-wide. Why? Because they provide a powerful basic feature set at a very economical price. Choose a system for crawl or page titling, color billboard displays, and more. Options include remote Windows PC access, weather instrumentation and realtime event control.

VIDEO DATA SYSTEMS

40 Oser Avenue, Hauppauge, New York 11788
Voice (516)231-4400 • Fax (516)231-4405
www.videodatasys.com

Reader Service Number 47

Cable for HFC Upgrades

Why Powering Shouldn't Impact Your Choices

By Mark Alrutz

System operators today often are faced with the responsibility of upgrading a plant they didn't build or specify. That plant may have been upgraded and extended in the past and probably contains a variety of coaxial cable types and sizes deployed over the years. As you review that plant and try to determine which areas need repair or replacement, you need to be confident that the cable you choose to upgrade your plant will suitably replace older constructions in all aspects while providing you reliable future performance for multiple applications.

Powering performance is one important consideration in modern hybrid fiber/coax (HFC) networks, which will be called upon to deliver many services beyond broadband video. You may be considering 60V or 90V supplies, in a centralized or distributed design. Fortunately, powering performance in an HFC upgrade is relatively unaffected by cable choice, so you can select the powering system you want and base your cable decision process on more critical performance areas like RF attenuation, mechanical reliability and relative cost.

Powering performance is unaffected by cable choice because the important issue is system performance, not cable loop resistance. If you are at all familiar with coaxial cable specifications, you know that DC loop resistance can vary widely between designs. This is due to the varying size and metal usage in different cable types.

Low-loss cables, for example, are optimized for attenuation and typically will be smaller than traditional cables. Smaller cables contain less metal and exhibit higher DC loop resistance. This DC loop resistance figure is used by designers to estimate power supply usage and voltage levels throughout a build. These are the issues of importance in a cable installation–the current draw on power supplies and how much voltage is available. Cable DC loop resistance simply is a means of conservatively estimating system performance.

> "Powering performance is unaffected by cable choice because the important issue is system performance, and not cable loop resistance."

Design review

To assess the impact of various coaxial cable designs on current draw and voltage availability in an HFC upgrade, we reviewed design areas with a variety of densities and node sizes. These designs were developed to represent "typical" design areas. Each design area was built or upgraded with a traditional coaxial cable and then a low-loss cable, which offers significant economic and performance advantages but has disparate DC loop resistance, as shown in the table on page 68.

The design scenarios reviewed included traditional HFC broadband delivery at 750 MHz and 60V, as well as urban, suburban and multi-tenant designs that have been telephony enabled and operate at 60V and 90V.

The broadband upgrades were evaluated at 5% and 15% cable replacement rates. We found that the power supply current draw difference attributable to cable type selected was in the range of 0.5%. Most power supplies exhibited no appreciable difference in current draw. The short span lengths and relatively low current draw within the cable plant made variations in DC loop resistance inconsequential to system operation.

The graph in Figure 1 (on page 68) shows current draw of 39 individual power supplies spread over 19 nodes. The current draw difference between a plant built with traditional cable and that built with low-loss cable is insignificant. ➤

Figure 1: 15% cable replacement

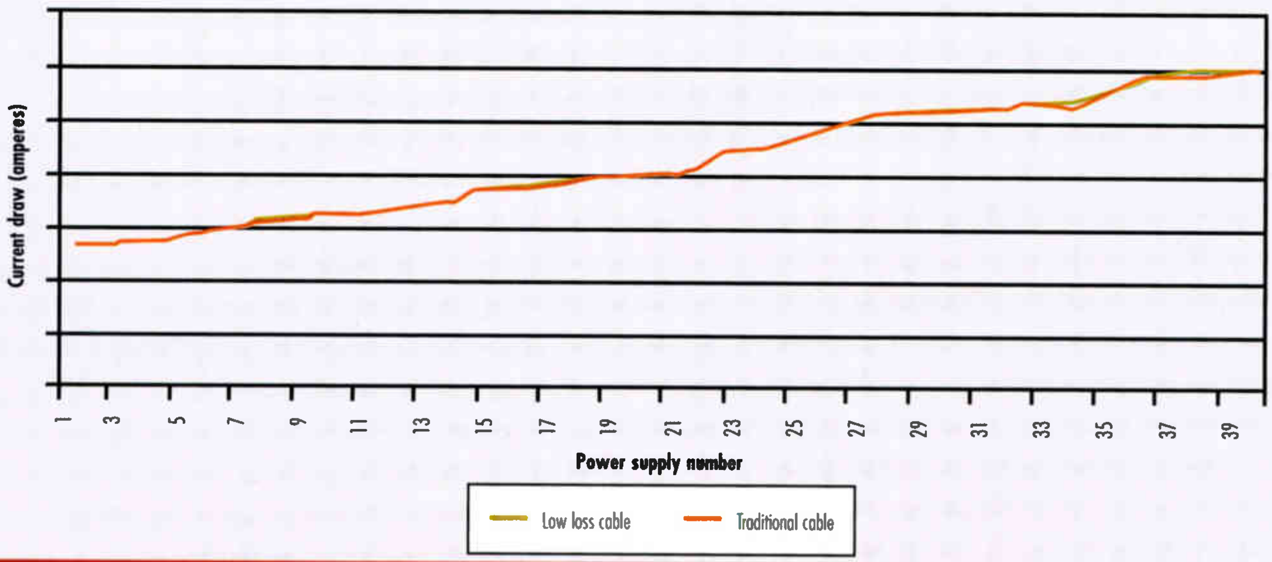
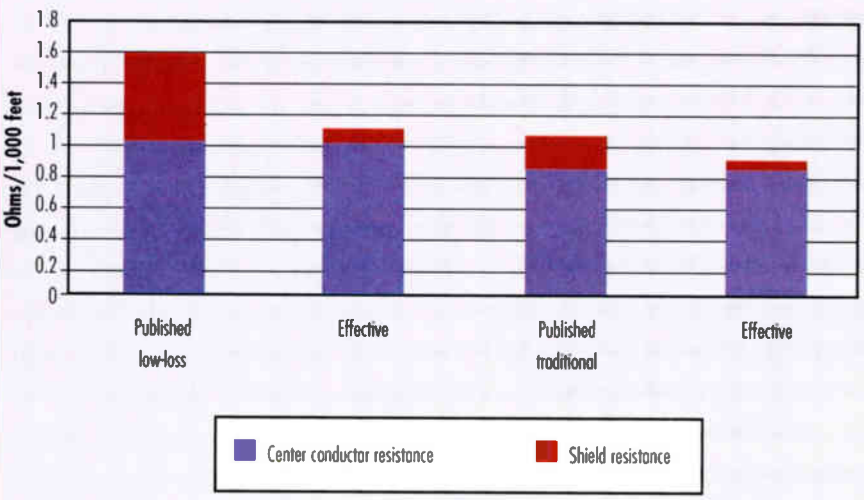


Figure 2: Impact of multiple return paths on DC loop resistance



Table

DC Loop Resistance, Ohms/1000 Feet

	Traditional	Low-Loss
Trunk	0.55	0.72
Feeder	1.10	1.61

In all the design work we reviewed, no additional power supplies ever were required in any upgrade or rebuild when cable types were varied. The current draw differences between cable types were so small that the addition of a supply never was required. As for cost impact of additional current draw, the incremental kilowatt hours (kWh), if any, amounted to only pennies per month. In the unlikely case that any of this cost actually is realized, it is so much lower than the capital savings achieved by utilizing low-loss cable that you will find yourself at a financial advantage for generations.

Telephony

Let's look at telephony-enabled designs, specifically at penetrations up to 100%, at 60V and 90V, and with densities ranging from suburban to multi-tenant. Adequate voltage was present at the network interface unit (NIU) in all scenarios, and available voltage varied little from one cable type to another. In particular, when 90V powering was employed, end of line or NIU voltage levels on a total low-loss cable plant varied less than 3V from voltage levels on a total traditional cable plant. In a typical upgrade, where small quantities of cable are replaced, even these small voltage differences would not occur.

Design assurance aside, engineers prefer to err on the conservative. A system is expected to perform better than specified, which will be the case in powering as well. The reason a powering design is overly conservative is that it doesn't take into account multiple current return paths. Once installed, a coaxial cable becomes part of a complex circuit. The center conductor remains a dedicated forward path for current, but the shield is bonded in parallel to strands, neutrals and grounds. These parallel return paths reduce the effective resistance of all coaxial cables, which reduces system current draw and voltage drops below that predicted by design. The net result is that any powering differences predicted by design, as small as they are, become even smaller, or even immeasurable, in the installed plant.

The graph in Figure 2 shows how the

BOTTOM LINE

Powering and Cable: Any Connection?

In today's rapidly changing environment, you may find yourself upgrading systems with a variety of cable types installed, and you need to be assured that the cables you choose for your upgrade will give you the best performance.

Design data collected on a variety of rebuild and upgrade areas of varying densities has shown that powering capability simply is not an area of differentiation between cable types in a system upgrade. Cables with widely varying DC loop resistance have been shown to draw less than one-half of one percent more or less design current in a typical upgrade.

High current draw telephony enabled systems have been shown to provide adequate and roughly equivalent end-of-line voltage with all cable types. Beyond design data, multiple current return paths in installed plant reduce these powering differences even further.

This being the case, coaxial cables can be selected based on relative cost, RF and mechanical performance without concern for powering. Choose the cable you prefer to use, and rest in the confidence that your powering design will succeed.

loop resistance of low-loss and traditional cables is reduced by the presence of multiple current return paths. Low-loss cables are more strongly impacted, since they have a higher shield resistance to begin with. Once installed, low-loss and traditional cables exhibit similar resistance. This data was generated from voltage and current measurements performed on active aerial and underground plant. CT

Mark Alrutz is director, technical services, for CommScope. He can be reached at (704) 323-4985.


12:46
SELECT
CH
VOL
CH
DIGITAL.
Street Long Beach CA 90810 USA


MENU

How to Shrink the Hub With DWDM

By John Trail

Increasing numbers of cable customers are looking for directed services such as fast access, high-speed data transfer, near-video-on-demand (NVOD) and telephony. To provide these directed services, operators now are making significant investments in network upgrades and in equipment such as routers, servers, cable modem termination systems (CMTS), quadrature amplitude modulation (QAM) modulators, multiplexers and more.

At issue is not so much whether or what to install, but rather where it should be located. Traditionally it has been expected that this additional directed service equipment will be located in the secondary hub where the major distribution branching occurs. In practice, the availability of space and technical support at the secondary hub often are problematic.

In this article I'll discuss how dense wave division multiplexing (DWDM) enables the cable operator to locate most of the sophisticated directed service equipment in the headend, and increase overall network bandwidth, without costly RF plant upgrades. By using this innovative DWDM architecture, the operator can achieve a reduced hub size, lower technical support costs and improved reliability, all of which can result in more cost-effective provision of directed services.

> "At issue is not so much whether or what to install, but rather where it should be located."

Traditional architecture

A typical current implementation of narrowcast or directed service is shown in Figure 1 (on page 74). In this architecture, the broadcast information is transmitted optically from the headend to the hub where it is converted back to RF, then split and RF combined with fiber-specific narrowcast information. The combined broadcast and narrowcast information then is transmitted down a dedicated fiber to a node or subsection of a node. (See "Scalable Nodes" in *Communications Technology*'s January 1998 issue.) Traditionally, the distribution is performed using 1,310 nm distributed feedback (DFB) transmitters.

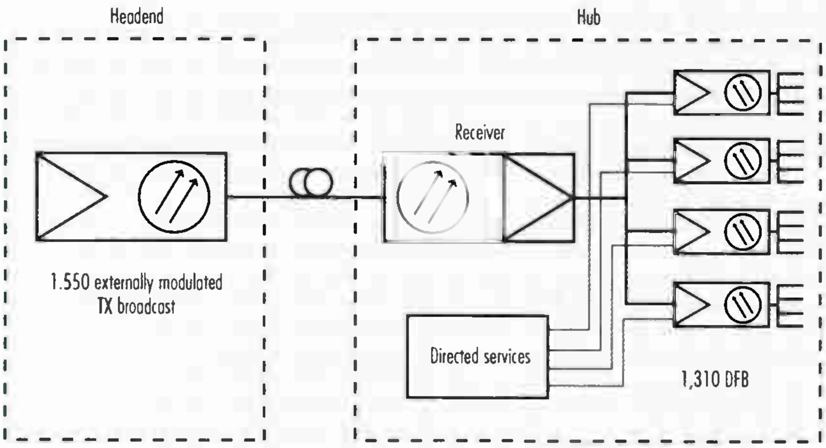
In systems using a 1,550 nm-to-the-node architecture, narrowcasting from the hub can be performed using coarse wavelength division multiplexing (CWDM). In this arrangement, the narrowcast information is routed through a 1,310 nm DFB transmitter and the output then optically combined with the 1,550 broadcast signal using a "coarse" 1,310/1,550 optical multiplexer.

Now consider what is required to add cable modem access/data service to these systems. Assume each hub serves 20,000 homes passed, that there is 10% penetration of cable modems, and that 25% of the cable modem subscribers are online at any one time. This adds up to 500 subscribers online at peak operating times.

Expect, at least initially, the average subscriber downstream data rate to be 400 kbps and the average upstream rate to be less than one tenth of that. The hub, therefore, needs to supply downstream data at a rate of 200 Mbps. This rate can be supplied with eight QAM modulators each contributing 27 Mbps of data (64-QAM) and each occupying a 6 MHz channel bandwidth. The upstream bandwidth requirement of 20 Mbps would require at least 10 quadrature phase shift keying (QPSK) channels, each occupying 1.5 MHz of bandwidth.

Implementing such a service would require the following hardware in addition to the transmitters and combining network:

Figure 1: Typical narrowcast service



- 200 Mbps data link (Two OC3 links)
- Data router
- Eight QAM modulators
- Eight media access control (MAC) cards
- Eight burst demodulators

Even in a very compact implementation, this equipment would take up at least 24 rack units (RUs). That is almost 4 feet of rack space. Also, this implementation provides only the most basic level of data service. More sophisticated services would include local caching, which would need servers, plus multiplexers and such for provision of advanced digital video. Most direct service implementations can be expected to require significantly more than 4 feet of rack space.

Not only is substantial hub space needed to house this hardware, but additional technical support of the hub also is necessary to monitor and service the additional equipment. ➤

BOTTOM LINE

Got Hub Space and Bandwidth Challenges?

Your customers have had enough of snail-paced access using telephony modems and are demanding cable modem service. You want to provide this service, but hub space and plant bandwidth are limited, and you want a solution for the long term, something that can accommodate expected demand for several years to come.

If this sounds familiar, then dense wavelength division multiplexing (DWDM) may be the solution you've been looking for. Using 1,550 nm DWDM enables the cable operator to locate most of the equipment necessary for and data service at the headend. The hub now can remain small, perhaps simply a cabinet, and maintenance requirements can be lower—all of which translates to cost savings for the operator.

With DWDM, present customer demand for bandwidth often can be supplied with initial installation of only a single wavelength to carry the directed services. Future expansion needs can be met with minimal impact to the hub by progressively adding wavelengths and increasing the cable modem termination capacity in the headend.

So, before calling the construction crew and expanding that hub, take a look at what the latest innovations in optical transmission provide as an alternative solution.

DWDM

With the use of DWDM it is possible to move much of the directed service equipment to the headend, and increase overall network bandwidth, without costly RF plant upgrades. The DWDM architecture is shown in Figure 2 (on page 78).

In the downstream direction a transmitter operating at 1547.7 nm provides broadcast of 80 analog channels in the 50 MHz-550 MHz band. The downstream directed service information is QAM modulated and upconverted onto RF subcarriers. The RF signal then drives additional DFB transmitters operating at wavelengths on the International Telecommunications Union (ITU) grid above 1,550 nm. The optical output from several different transmitters is combined with an optical multiplexer onto a single fiber for transmission to the hub.

At the hub site, a single optical demultiplexer "unbundles" the different wavelengths. Each narrowcast wavelength is then separately optically com-

With the DWDM architecture, the rack space requirement in the hub drops significantly.

bined with the broadcast signal and sent down one or more fibers to specific nodes or node subsections. At the node the received power of the narrowcast wavelength is several dB below that of the broadcast wavelength, resulting in minimal degradation of the broadcast signal to noise while achieving low bit error rate (BER) of the narrowcast signal.

The return path back to the headend is a key element of this architecture. It is necessary to combine the return signals at the hub and transmit the combined return back to the headend with minimum fiber count. This can be accomplished by RF combining several nodes and then either RF frequency stacking the signals and transmitting over a single transmitter, or by again using multiple ITU grid 1,550 DFB transmitters and using an optical multiplexer to combine them onto a single fiber.

With the DWDM architecture, the rack space requirement in the hub drops significantly. The router, QAM modulators, MAC cards and burst demodulators are transferred to the headend. The hub now contains only optical amplifiers, passive optical components, return path receivers and transmitters. For the previous example, this equipment can fit into 9 RUs—significantly less than previously required. The hub now can fit easily into a cabinet rather than requiring a dedicated building. The reduced quantity and lower complexity of the equipment also should increase the reliability of the hub and result in reduced service costs.

In terms of cost it is only very recently that 1,550 DWDM has had major commercial use, primarily in the telecommunications industry. We can expect that costs for the ITU grid transmitters and passive optical elements will drop quickly in the next few years as volumes of units continue to rise.

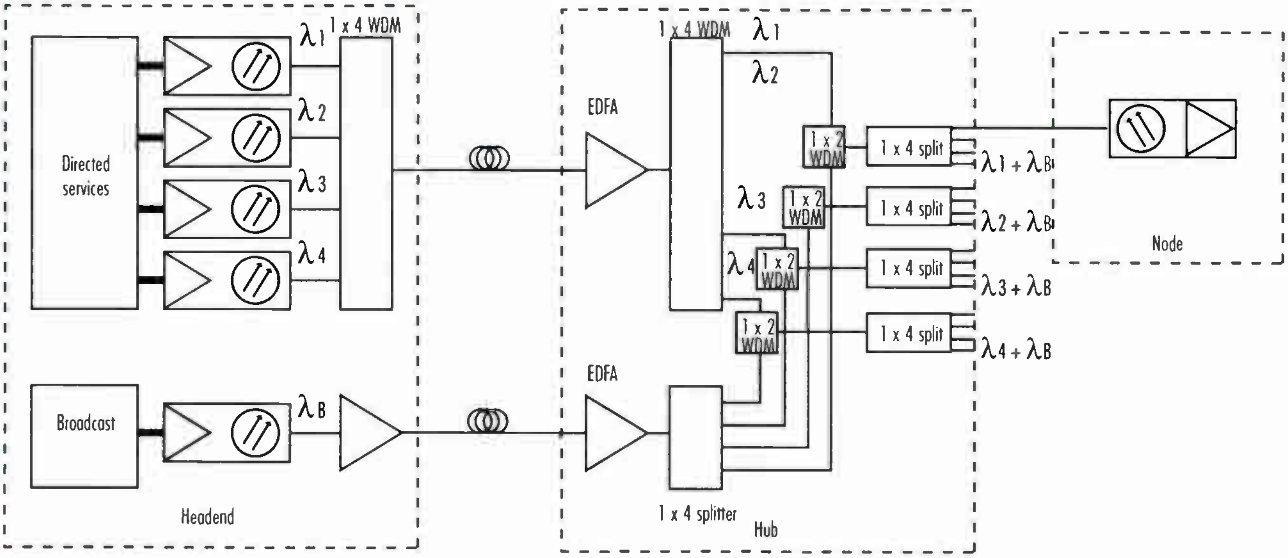
Cost can be minimized further by taking advantage of the scalability of the architecture. Initial deployment could consist of a narrowcast wavelength feeding eight or more nodes. In fact, the previous example requires only a single wavelength to supply the entire hub demand of 200 Mbps.

As the demand for directed services increases, the operator can add capacity by adding wavelengths and reducing the number of nodes fed by each wavelength. This scenario gives the minimal initial equipment investment and properly defers expansion until required at some future time, when costs will be even lower.

This increase in capacity by wavelength addition requires minimal additional equipment at the hub—typically only changing passive optical splitters and optical multiplexers/demultiplexers, with perhaps an increase in optical amplifier power. ➤

Reader Service Number 56

Figure 2: DWDM architecture



Conclusion

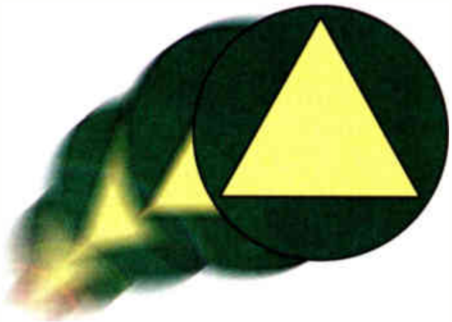
As the cable industry continues its evolution toward more varied, sophisticated service offerings, there are several possible ways to upgrade current networks to meet higher bandwidth demands. DWDM is a scalable, robust architecture that makes possible the delivery of broadcast analog video and two-Multimedia Cable Network System (MCNS)-compatible digital services within a conventional hybrid fiber/coax plant. It has the advantages of smaller hub size, increased hub reliability, decreased need for technical support at the hub, and a scalability that enables future expansion with minimum impact at the hub.

DWDM is not necessarily the solution in every situation. But for an operator seeking to offer new directed services with the minimum hub cost, DWDM just might be the wave to catch. CT

The author wishes to acknowledge the contributions of Alan Nilsson, David Piehler, Oleh Sniezko and Xingyu Zou.

John Trail, Ph.D., is product manager, transmitter systems, at Harmonic Lightwaves. He may be reached at (408) 542-2641.

Cable



and Satellite Digital TV

Toward the Truly Modular Compression System

By Ozell Bailey

Digital TV (DTV) service providers, both cable and satellite, require solutions in their broadcast centers that optimize their spectrum utilization. This dictates that technology suppliers become competitive in order to offer open and flexible solutions. One common worldwide standard that supports this objective is the digital video broadcast (DVB) standard, which supports the interoperability goal between DVB technology suppliers, thus leveraging economies of scale.

This article will focus on how a common compression headend can support the distribution of content via cable and satellite. I will describe in general how content is sent, or processed, through the compression headend, then we will explore the features of the individual products that make up the larger system. This detailed description will highlight the system's flexibility, from receiving analog and digital content to be compressed to the development and transmission of single and multiple DVB-compliant transport streams.

End-to-end compression

The accompanying figure (on page 83) shows a simplified block diagram depicting the major functions in a digital video compression headend.

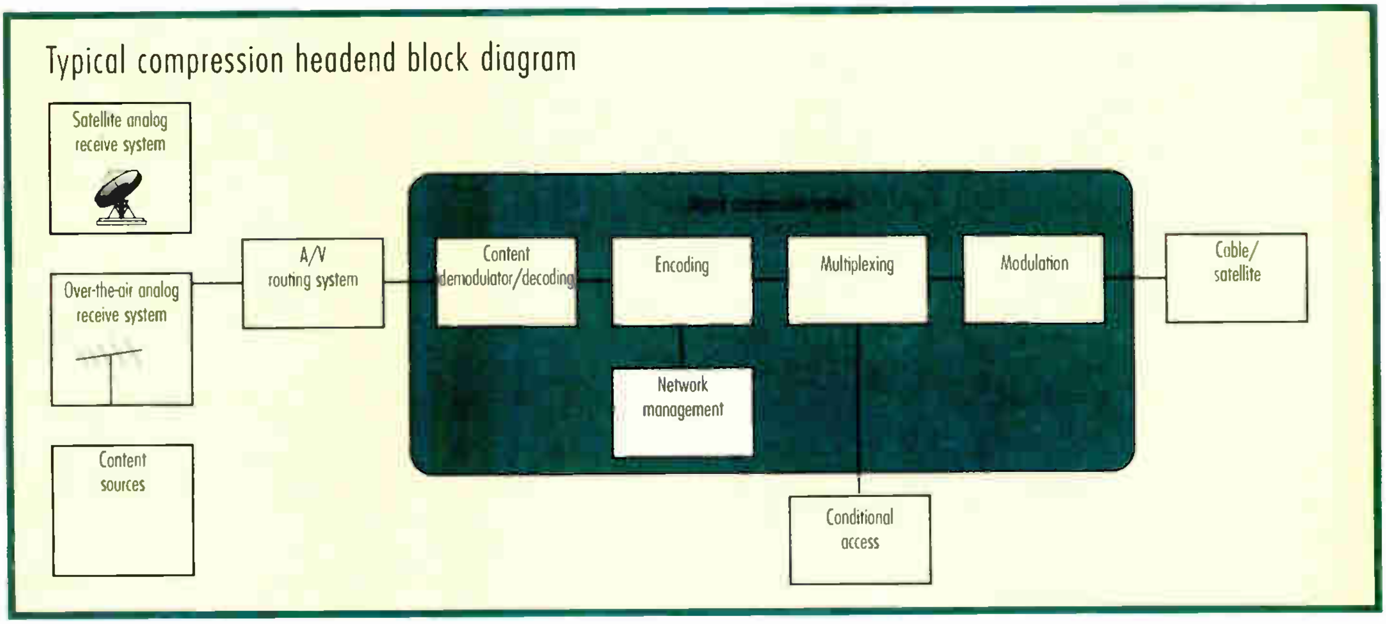
Content, in analog or digital format, is routed into the satellite transmission facility or headend via an audio and video (A/V) switching network. From the A/V switching network, the signals are routed

BOTTOM LINE

Truly Modular Compression

Today's digital video compression systems support the delivery of cost-effective, broadcast quality video and data to consumers and business users. Manufacturers of compression equipment now can focus on developing data solutions that easily augment digital headends to provide new, revenue generating services to their subscriber bases.

Encoder technologies will continue to provide increased performance with compression efficiencies. In the future, compression systems will become truly modular, capable of interfacing with numerous terrestrial, wireless and satellite transmission interfaces.



to the digital compression system. At the encoder, the source programs are compressed into a Moving Pictures Experts Group (MPEG) transport stream.

These single program transport streams then are routed to the multiplexer. The multiplexer adds conditional access (CAS) information, scrambles the MPEG transport streams, and combines the signals into a combined multiple program transport stream. These streams then are fed to quadrature phase shift keying (QPSK) modulators and delivered to the direct broadcast satellite (DBS) transmitter system for uplink and eventual transmission to the subscriber's set-top box. *Editor's note: In the case of a cable headend, quadrature amplitude modulation* (QAM)

is used for transmission over the cable network. QPSK signals received via satellite are converted to QAM in an integrated receiver transcoder. The set-top demodulates, descrambles, and decodes the signal for viewing.

Decoders and encoders

Now that I have described the high-level functionality of an end-to-end compression system, let's take a closer look at the key pieces in the chain. We'll focus on the "subsystems," including a professional integrated/receiver decoder, MPEG-2 encoder, multiplexer and a network management system controller. Each of these pieces performs a number of complicated tasks during video signal processing.

Professional decoders represent the first stage of compression signal processing. After content exits the A/V routing system, it is routed to decoders where the signals are demodulated, demultiplexed and descrambled. Decoders can receive single channels or multiple channel inputs. It is very common that they will have options supporting various CAS systems from various vendors. Current decoders include options such as phase alteration line (PAL)/NTSC, closed-captioning, vertical blanking interval and DVB teletext. Next-generation decoders likely will support advanced features such as 4:2:2 processing and high definition TV (HDTV).

Encoders truly are the heart of a compression system. Their function is to take an analog signal and compress—or digitize—audio, video and data content into a DVB-compliant transport stream.

Encoder technology has advanced over the last decade with research and development beginning in the late '80s. The first commercial units were available around 1993. Over the last five years, there has been an explosion in this technology with a thrust toward improving quality and compression efficiency. Most encoders today accept serial digital and composite video as input sources. Efficiency is the most important feature of an encoder. This means that, as an operator, you want to optimize bandwidth (squeeze in as many channels as possible within a given transport) while maintaining picture quality.

StatMux

Another important feature for TV service providers is the ability to perform statistical multiplexing. Also known as StatMux, this is a function that ensures bandwidth is allocated to channels that require it (like complicated, data-intensive frames of video such as sporting events) and not wasted on channels that represent still or slow-moving pictures.

The encoder receives bandwidth (bit) requirements to be utilized while compressing the source input. Currently, advanced compression techniques are being used, which implement technologies such as multipass encoding. It analyzes and refines a signal before it is sent on through the system. It is projected that encoder technology will continue to advance with a focus on improved quality and efficiency.

Multiplexers typically receive their input from the encoder in the case of dynamically compressed content. Alternatively, a multiplexer can receive data (audio or video) that has been compressed previously, thus bypassing the encoder stage. Some multiplexers also have a raw data input that allows them to receive data types such as transmission control protocol/Internet protocol (TCP/IP). When performing statistical multiplexing, the multiplexer allocates bits, as requested, to channels on a predetermined basis or dynamically. In other words, the encoder and multiplexer work together in tandem in statistical multiplexing.

A network manager/system controller usually includes a computer and suite of tools that manage all of the resources in a typical compression system (like professional decoders, encoders, multiplexers, modulators and so on). An operator can monitor and reconfigure assets as required from a central console.

As personal computers and network servers have evolved, service providers have demanded that a system controller offer a graphical user interface (GUI) that is intuitive and user-friendly. If the GUI is easy to use, operators can save training time and realize cost savings. Features expected of system controllers today include standards-based systems, modular/distributable systems, fault detection, redundancy switching and automatic sensing of hardware configurations.

Conclusion

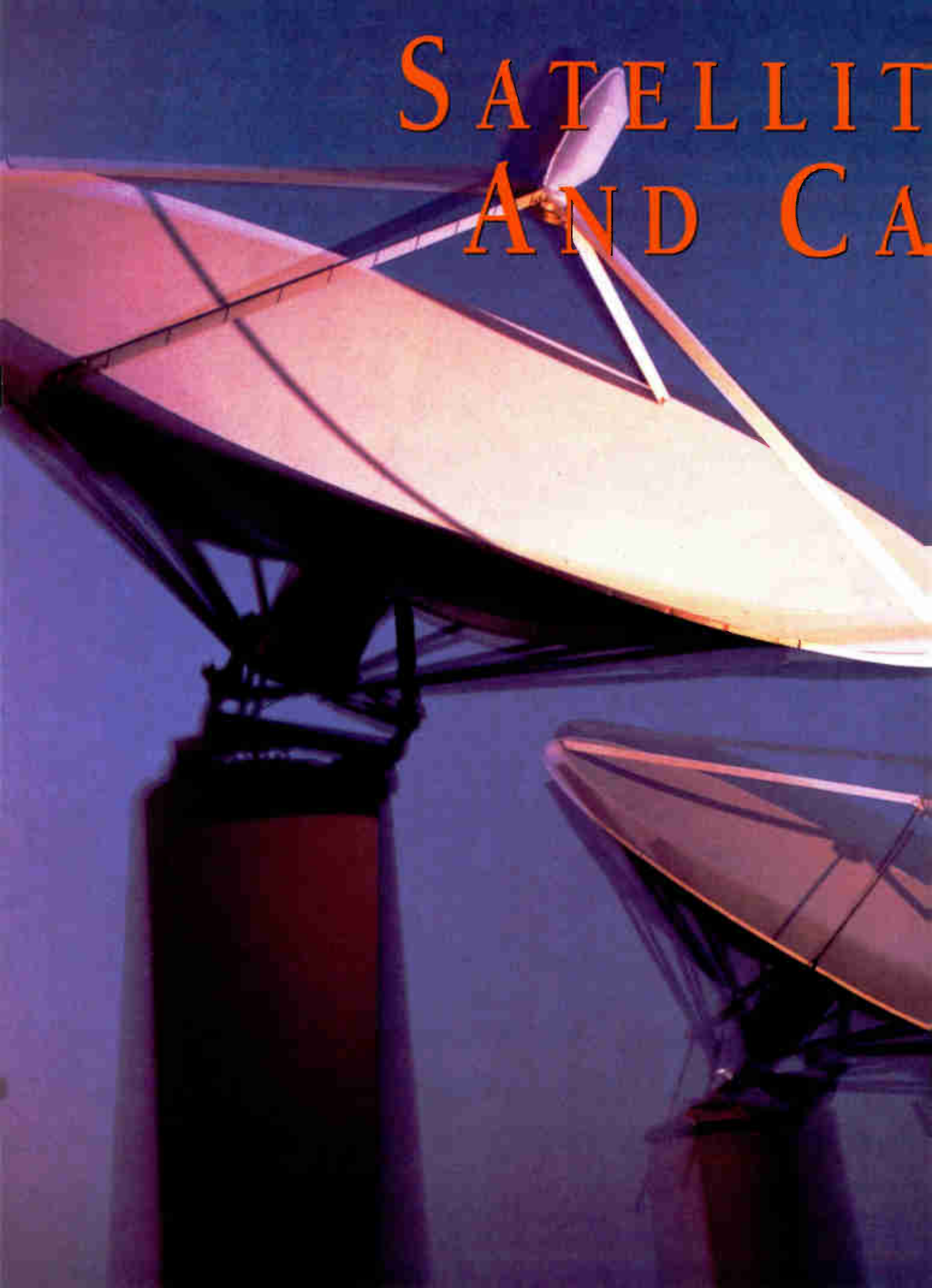
In summary, today's digital video compression systems support the delivery of cost-effective, broadcast quality video and data to consumers and business users. Encoder technologies will continue to provide increased performance with compression efficiencies. In the future, compression systems will become truly modular, capable of interfacing with numerous terrestrial, wireless and satellite transmission interfaces.

As the business plans of cable and satellite digital TV service providers become more diverse, we will see a greater number of video compression systems that support both video and data applications. Being able to offer additional services will allow service providers to realize a return on investment in a shorter period of time. Manufacturers of compression equipment now can focus on developing data solutions that easily augment digital headends to provide new, revenue generating services to their subscriber bases. CT

Ozell Bailey is market segment manager, satellite applications, at DiviCom Inc. He can be reached at (408) 490-6850 or obailey@divi.com.

Reader Service Number 64

SATELLIT
AND CA



E TECHNOLOGY BLE NETWORKS

What System Engineers Should Know

By Robert A. Nelson

To the system engineer who works with satellite receiving equipment on a regular basis, the satellite may be regarded as simply a signal source in the sky.

However, for a full appreciation of how a satellite signal is transmitted to the receiver, an understanding of the parameters and processes that characterize the system is needed.

Orbit

The altitude regimes of satellite orbits are divided by convention into three categories: low earth orbit (LEO), medium earth orbit (MEO) and geostationary orbit (GEO). The range in altitudes for LEO may be taken to be between 500 km and 1,500 km, such that the orbit is above the sensible atmosphere but below the first Van Allen radiation belt. The range of altitudes for MEO is approximately between 5,000 km and 15,000 km, or between the first and second Van Allen belts.

The geostationary orbit is a unique, circular orbit in the plane of the equator, of which its period of revolution is equal to the period of rotation of the earth, or one sidereal day (23 hours, 56 minutes, 4 seconds). Consequently, a geostationary satellite appears to remain over a fixed point on the equator. The altitude of GEO is 35,786 km. The primary advantage of the geostationary orbit is that there is fixed earth satellite geometry and the satellite does not require tracking.

The first satellite to be successfully placed in geostationary orbit was Syncom III, which was launched in 1964. Since then, approximately 270 satellites have been launched into GEO, of which about 190 satellites presently are operational.

The geostationary orbit is not without disadvantages. Because a satellite is over the equator, the elevation angle to earth stations is small at high latitudes. Large, fixed earth station facilities established in areas free of topography and buildings have no difficulty in seeing the satellite, but it is a potential problem for small antennas in metropolitan areas. Also, because of the high altitude, the round trip path delay (called latency) can exceed one half second. This delay can have an adverse effect in telephone conversations and exchange of high speed data.

Another category is high earth orbit (HEO), which is above the second Van Allen belt, or above about 20,000 km. The acronym HEO also has been used to denote "highly elliptical orbit," in which the apogee can be above the geostationary orbit altitude, such as the 12 hour, 1,006 km x 39,362 km Molniya orbit. The advantage of an elliptical orbit is that the dwell time is maximum at apogee, which can be placed over the region of primary coverage. However, to cancel earth oblateness perturbations and maintain a stable apogee position, the orbital inclination must be 63.4° for direct orbits or 116.6° for retrograde orbits.

Antenna

The most conspicuous part of a satellite communication system is the earth terminal antenna, which can be tens of meters in diameter or a small portable dish. The gain of the antenna may be defined qualitatively as the measure to which the antenna concentrates the electromagnetic energy in a particular direction. The gain of an antenna is therefore fixed by the size of the beam, as determined by the half power beamwidth, or in the case of a satellite antenna, the geographic area to be covered. The gain is proportional to the physical area of the antenna reflector and to the square of the frequency. Thus for a given size antenna, the gain increases as the frequency increases, and for a given frequency the gain increases as the area increases.

An important parameter of a transmit antenna is the equivalent isotropic radiated power (EIRP). This parameter is the power that would be required by a hypothetical antenna that radiated power uniformly in all directions so as to produce the same received power per unit area as the actual antenna. The EIRP is equal to the product of the power at the input terminals of the antenna and the antenna gain.

An equally important parameter of a receive antenna is the so-called figure of merit. This parameter is a measure of the efficiency with which the antenna receives the desired signal. The figure of merit is equal to the ratio of the antenna gain and the receiver system temperature. The system temperature is a measure of the noise power accepted by the receiver. Although the gain and system temperature individually depend on the point where they are calculated in the receiver chain, their ratio is independent of where it is calculated. Thus, the figure of merit is a constant for the receive antenna.

Link budget

Engineers use a link budget to calculate the available carrier to noise power ratio. The principal parameters that enter into this calculation are the transmit antenna EIRP and the receive antenna figure of merit. Another important parameter is the free space loss. This quantity is analogous to the loss suffered in a transmission line. It is proportional to the square of the slant range between the satellite and earth station and is inversely proportional to the square of the wavelength.

Link budgets are conveniently calculated using decibel values based on logarithms, since they convert mathematical operations of multiplication and division to operations

BOTTOM LINE

Satellite Characteristics and Tradeoffs

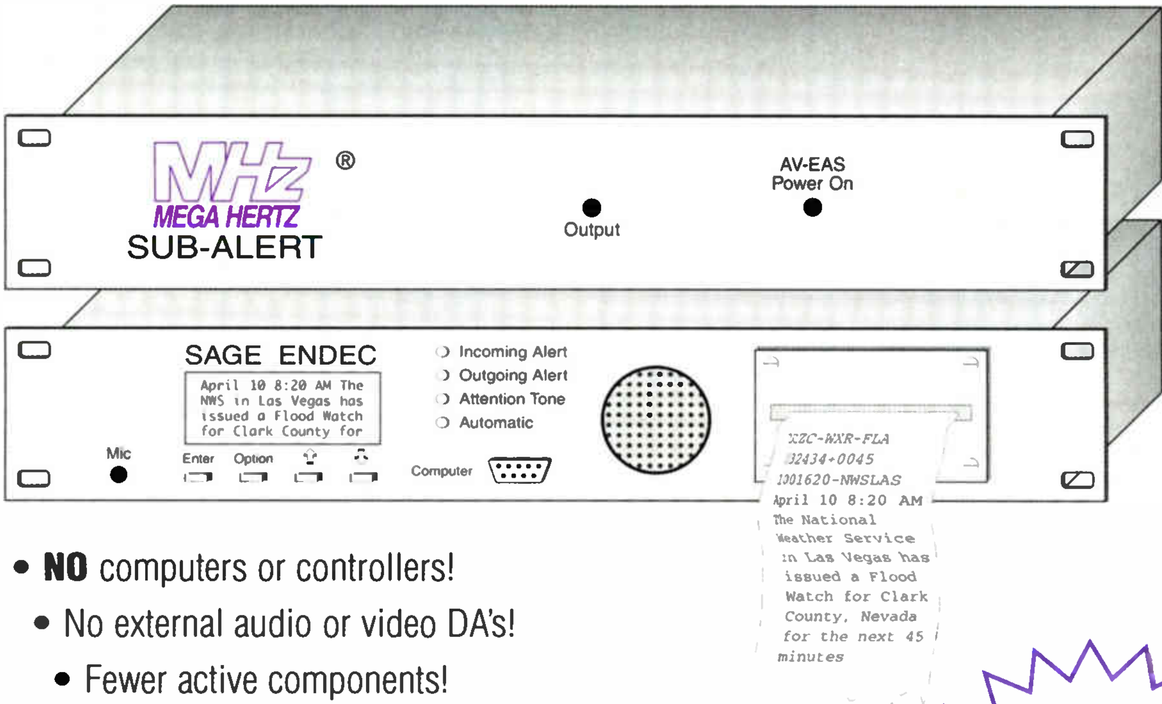
The following considerations are fundamental to a satellite system:

- Orbit. The orbit can be low earth orbit (LEO), medium earth orbit (MEO), geostationary orbit (GEO) or high earth orbit (HEO).
- Link parameters. The equivalent isotropic radiated power (EIRP) of the transmit antenna is the product of the input power to the antenna and the antenna gain. The figure of merit of the receive antenna is the ratio of the antenna gain to the system temperature. The free space loss is another important parameter depending on slant range and wavelength.
- Multiple Access. Methods include frequency division multiple access (FDMA), time division multiple access (TDMA), and code division multiple access (CDMA). FDMA can be either analog or digital but requires backoff. TDMA is inherently digital. It permits higher power and offers greater flexibility. CDMA has the potential for large capacity.
- Modulation. Most satellite communication systems use some form of phase shift keying (PSK) modulation. Quadrature phase shift keying (QPSK) is most often used because, for a given bit error ratio, it requires the same power as BPSK yet only half the bandwidth.
- Coding. There are two types of forward error correction (FEC) codes: block codes and convolutional codes. Sometimes both are used, one as an outer code and one as an inner code.

THE "SUB-ALERT"

Emergency Alert System Challenge

CAN ANY OTHER SYSTEM STAND-UP TO OUR CHALLENGE?



- **NO** computers or controllers!
- No external audio or video DA's!
- Fewer active components!
- **Selective channel switching by event!!**
- Highest technical specifications in the industry!
- Fewer "IF" or baseband cables!
- Fewer connections!
- Will display: tests in green, watches in yellow, and warnings in red!
- "Only" professional rackmounted switching!
- The only EAS system that can be completely balanced w/o disconnecting any EAS cables!!
- The only EAS system with the extraordinarily powerful SAGE "ENDEC"!!
- Longest warranty available!

ALERT
All **EAS** Systems are not created equal!

SCTE Booth #949

Now With Multiple or All Channel Crawl!!

(24/7 - 24HRS/DAY 7 DAYS/WEEK)

MHz ® ***"Unique" Products For the 21st Century!***

MEGA HERTZ ®
Established 1975
http://www.megahz.com

DENVER ,CO	*ATLANTA, GA*	*ST. LOUIS, MO*
800-525-8386	***800-962-5966***	***800-821-6800***
FAX 303-779-1749		
OCALA, FL	*INDIANAPOLIS, IN*	*PHOENIX, AZ*
800-922-9200	***800-761-7610***	***800-883-8839***

of addition and subtraction. The numerical values of very large and very small quantities also become easier to handle.

Frequency bands

Until recently, most geostationary satellites have been designed for the Fixed Satellite Service, linking large, fixed earth stations. The primary frequency band used for this service was originally C-band, with the uplink at 6 GHz and the downlink at 4 GHz.

During the mid-1980s, Ku-band became popular. In this band, the uplink is at 14 GHz and the downlink is at 12 GHz. Because it is at a higher frequency, this band permits the use of smaller antennas. However, it is susceptible to rain fade and so higher power is usually required.

In recent years, satellites in the Broadcast Satellite Service have entered the market, such as DirecTV, Primestar and Echostar, to provide direct-to-home (DTH) TV. These satellites use the 17/12 GHz portion of Ku-band.

Transmit and receive equipment

The devices in the transmitter chain typically consist of the multiplexer, the modulator, the upconverter, a high power amplifier and the antenna. The multiplexer combines individual channels onto a single carrier and may be either digital or analog. At this point the information bit stream can be encrypted and encoded with a forward error correction code. The modulator generates an intermediate frequency carrier, usually at 70 MHz, and modulates the baseband signal containing the desired information onto the carrier. The upconverter changes the modulated intermediate frequency (IF) signals to the modulated radio frequency (RF) signals used to transmit the signal, such as C-band (6 GHz) or Ku-band (14 GHz). The high power amplifier (HPA) amplifies the modulated RF signals from the output of the upconverters to the power levels corresponding to the required EIRP at the antenna. The HPA can be either a narrowband klystron or a broadband traveling wave tube (TWT). At C-band, the HPA can be located at some distance away from the antenna, such as in the master control building, but at Ku-band it must be near the antenna because the losses in the waveguide are higher at higher frequencies. Finally, the antenna transmits the amplified RF signal to the satellite.

The receiver equipment basically reverses this process. The antenna receives the modulated RF signals from the satellite. A low-noise amplifier (LNA) amplifies the received RF signals. To minimize noise introduced by waveguides, the LNA is mounted on the antenna itself. Large antennas usually have a subreflector, of either the convex hyperbolic Cassegrain type or the concave ellipsoidal Gregorian type, so that the LNA looks toward the cold sky instead of the warm earth. The downconverter changes the received RF signals to IF signals for the demodulators. The information is extracted from the received IF signal by the demodulator and is decoded and decrypted. The demultiplex equipment then distributes the baseband information to the customers. *Editor's note:*

Most cable TV satellite downlinks use a low noise block converter (LNB), which combines an LNA and downconverter in a single antenna-mounted package. The satellite receiver in the headend contains a second downconverter, whose IF output is demodulated to baseband.

Multiple access

Multiple access is a concept that refers to the method of utilization of the remote satellite resource. The following three primary methods are used.

1) Frequency division multiple access (FDMA) is a technique in which the available spectrum is divided into subbands that are assigned to each user. The FDMA signals can be either digital or analog. However, a satellite transponder is a nonlinear device. Thus when multiple FDMA carriers share a transponder, it is necessary to reduce the input power to the transponder so as to operate in the linear region of the transfer characteristic and thereby limit intermodulation products. The reduction in power is called backoff. It is typically about 6 dB, which corresponds to a reduction in power to one-fourth of the power at saturation.

2) Time division multiple access (TDMA) is a technique in which each user is assigned a time slot within a repetitive time frame. This is an inherently digital process, since the information bit stream from each user must be stored in a buffer and burst up to the satellite at a much higher rate during the assigned time slot. TDMA has the major advantage of permitting much higher power than FDMA, since during any time slot only one user occupies the transponder and backoff is not required. It also has great flexibility, since user access can be assigned by changes in software instead of hardware.

3) Code division multiple access (CDMA), or spread spectrum, involves the modulation of the desired signal by a unique pseudorandom noise (PRN) code that has a bandwidth several orders of magnitude greater than the baseband signal. The ratio of the spreading bandwidth to the information bit rate is called the processing gain. With this technique, all users occupy the entire available spectrum simultaneously. The receiver generates a replica code, which extracts the desired signal by autocorrelation. It simultaneously spreads all the other signals, which appear as white noise. CDMA has the potential of greater capacity than FDMA or TDMA, provided that the signals from all users appear to be equal through interactive power control. A major advantage claimed by CDMA proponents is greater capacity. The capacity of the system has no fixed limit, since the received signal quality degrades slowly as users are added to the system.

Modulation

A sinusoidal signal has three characteristics: its amplitude, frequency and phase. Any of these properties can be modulated to transmit information. For satellite systems, amplitude modulation is not practical. Frequency modulation (FM) of analog signals is still widely used for television,

primarily because of the availability of standard equipment. For digital signals, frequency shift keying (FSK) is occasionally used, in which a binary one or zero is represented by one of two frequencies over a specified bit period.

By far the most prevalent method of transmitting digital signals is through M-ary phase shift keying (PSK). In this method, a binary symbol is represented by one of M phase states of the carrier. With binary phase shift keying (BPSK) the carrier can have a phase of either 0 or 180°, representing a one or a zero. In quadrature phase shift keying (QPSK), there are four phases representing the four symbols 11, 01, 00, and 10. A QPSK modulator is equivalent to two BPSK modulators out of phase by 90°. Consequently, QPSK modulation requires only half the bandwidth as BPSK modulation.

It can be shown that for a given bit error rate, both QPSK and BPSK require the same power. Moreover, QPSK and BPSK require less power than any other form of modulation. Therefore, QPSK modulation is generally used in digital communication systems.

Occasionally, however, 8-PSK may be used to reduce the bandwidth if additional power is available. The bandwidth for 8-PSK is one-third the bandwidth for BPSK and two-thirds of the bandwidth for QPSK. On the other hand, BPSK may be used in instances where a smaller bandwidth is not desirable.

Coding

Forward error correction (FEC) codes can detect and correct a limited number of random errors. These codes are either block codes or convolutional codes. For a given bit error rate (BER), FEC codes increase the required bandwidth but reduce the required power. The difference in power with and without coding is called the coding gain.

With block codes, a given number of information bits are accepted by the encoder at one time and parity bits are added to form a code word. The code rate is the ratio of the number of information bits accepted per block and the number of bits in the code word. Common types of block codes include the Hamming, Golay, BCH, and Reed-Solomon codes. A block code is characterized by the number of information bits, the number of coded bits, and the so-called minimum distance that determines its random error correction capabilities.

In a convolutional code, there is a steady stream of bits through the encoder. The number of bit periods in which a given bit occupies the encoder is called the constraint length. The code rate is the reciprocal of the number of symbols generated from all the bits in the shift register per bit period. Since the same bit will affect the formation of several coded symbols, a convolutional encoder is said to have a memory. A convolutional code is characterized by its code rate and the constraint length. The optimum method of decoding uses the Viterbi soft decision algorithm.

It is now common to find both an outer block code, such as a Reed-Solomon code,

and an inner convolutional code. The outer code reduces the effect of bursty-type errors.

Geostationary systems

Geostationary satellites in the Fixed Satellite Service typically have been simple repeaters, or "bent pipe" satellites, in which the signal is received, amplified, translated in frequency and retransmitted. During the 1980s a typical satellite had a total power from between 1,000 watts to 2,000 watts. The number of transponders was about 24, with a typical output power of 10 watts each. The satellites were either spin-stabilized or three-axis stabilized. There was also significant management of maneuvers by ground personnel for stationkeeping and attitude control.

The size, power and complexity of satellites has steadily increased. Today a power of 10 kilowatts is standard and 15 to 20 kW is foreseeable in the near future. For such high power, only large satellites with three-axis stabilization are possible. The number of transponders can be 48 or even close to 100.

There also has been a trend to use ever higher frequencies in order to exploit unused spectrum and permit the use of smaller antennae. In May 1997 thirteen geostationary systems, representing 73 satellites, were licensed by the Federal Communications Commission for services in Ka-band (30/20 GHz). This past September, a dozen companies filed applications for systems in the new V-band (50/40 GHz).

These systems reflect new trends in the satellite industry, including services oriented toward the consumer market, instead of exclusively for common carriers, and large bandwidths that permit high data rates. The paradigm for these broadband systems is Internet access via satellite from ubiquitous fixed and portable small terminals.

Signals at such high frequencies are particularly susceptible to attenuation by rain. Thus the availability will necessarily be not as high as at C-band or even Ku-band, without mitigating techniques.

Nongeostationary systems

Over the last decade, constellations of satellites in LEO and MEO have been designed to provide additional services aimed at the consumer market. These nongeostationary systems provide high angles of elevation that reduce blockage and short paths that reduce path loss and delay time.

The so-called "Big LEO" satellite systems have been designed for worldwide mobile telephony and will operate in L-band (1.6 GHz) and S-band (2.0 - 2.2 GHz and 2.5 GHz). The frequencies are as low as practical to maximize the wavelength and the received carrier power in the mobile handset. These systems include Iridium and Globalstar, developed in the United States, and London-based ICO. Iridium and Globalstar are LEO systems, in which the satellites are visible to a user for only about 10 minutes. Thus frequent handover is required. ICO is an MEO system and will have 10 satellites at an altitude of 10,355 km. At this higher altitude, fewer satellites are required for global coverage, and the dwell time is much longer, at about two hours per pass.

The "Little LEO" satellite systems have been designed for messaging and data gathering. These systems will operate at UHF frequencies below 1 GHz.

The most recent nongeostationary satellite systems have been designed for broadband applications. The best known is Teledesic, which will consist of 288 satellites in low earth orbit. It will operate at Ka-band and provide Internet access and high speed data transfer to small terminals.

Celestri, a system proposed by Motorola, consists of a network of four geostationary satellites at Ka-band called Millennium, a 72-satellite LEO system in the 40 GHz band called M-Star, and a 63-satellite LEO constellation at Ka-band and V-band. Celestri will offer broadband services for high-speed data transfer to fixed terminals.

Another broadband example is the Hughes Starlynx constellation. This is a hybrid V-band constellation with four geostationary satellites and 20 MEO satellites at an altitude of 10,352 km. Starlynx will provide two-way data connectivity to portable terminals, such as notebook and desktop computers, using small, flat, electronically steered antennas. CT

Robert A. Nelson, P.E., is president of Satellite Engineering Research Corp. He can be reached at (301) 657-9641 or via e-mail at RobtNelson@aol.com.

Reader Service Number 73

Improve Your Network's Efficiency

Integrated Video, Voice and IP Architecture Can Save You Money

By Jim Forster

If you're puzzled about how to offer video, voice and Internet access over your cable network architecture, read on. This article suggests an integrated approach to delivering the services, which means equipment types and subsystems are kept to a minimum. Using common equipment for all three services also may mean your purchase and operations costs will be lower.

Equally importantly, this approach enables you to offer a new interactive TV service, built with open standards, and existing infrastructure, content and tools, by using the Internet, hypertext markup language and transmission protocol (HTML/HTTP), standard digital TV and Multimedia Cable Network Systems (MCNS) standardized technology.

A range of services

The network proposed here will provide integrated access to video, voice and data services. These services will be available in a consistent manner across a range of equipment, and will include:

- Broadcast video
- Internet access
- Integrated video and Internet access
- Voice service
- Alternate video (video material complementing the 100-500 broadcast channels, for applications like distance learning)
- Video conferencing and collaborative applications
- Radio and home management

Broadcast video service is supported unchanged by the integrated architecture. This consists of both analog and digital video sold as basic, premium, pay-for-view (PPV), and video-on-demand (VOD).

Internet access is provided by MCNS protocols using both two-way and telco-return mechanisms. This service is provided to personal computer (PC) users via network interface cards (NICs) and Ethernet-based cable modems; additionally, it will be provided to set-top boxes and other appliances.

> "Using common equipment for all three services may also mean your purchase and operations costs will be lower."

Integrated video and Internet access is the hallmark service of the integrated architecture. This service requires an Internet Web browser integrated into a traditional set-top box function. Using this architecture, it should be easy to move between the passive viewing of video and the active participation in the Web.

Voice service can be quite similar to plain old telephone service (POTS), except that hybrid fiber/coax (HFC)-based voice service initially may not provide lifeline support for high reliability in the event of regional power outages.

An architectural overview

This architecture divides the network into three main sections: a backbone network, an access network and a subscriber premises network. Headends connect outside services to the backbone. Hubs connect the backbone network to the HFC access network.

Subscriber premises equipment, including set-top boxes and residential gateways, connect the HFC access network to the subscriber premises network.

The backbone network protocols and equipment are designed for maximum reliability and flexibility. Equipment is divided primarily between headends and smaller hubs. Satellite and over-the-air video is received in the headend, encoded with MPEG-2 if necessary, and then injected in digital format into the backbone network along with Internet data over synchronous optical network (SONET) transmission equipment. Hubs receive digital signals from the backbone and transform it into the format used by the access network. ➤

MAIN LINE A LEADER IN THE DISTRIBUTION OF NEW AND REFURBISHED EUIPMENT FOR TEN YEARS, IS NOW MANUFACTURING A COMPLETE LINE OF:

REPLACEMENT PADS,EQUALIZERS AND PLUGINS FOR:

SCIENTIFIC ATLANTA,TEXSCAN
GENERAL INSTRUMENTS/JERROLD
PHILIPS /MAGNAVOX

FORWARD-REVERSE-THERMAL COMPENSATORS
VARIABLE REVERSE-DIRECTIONAL COUPLERS

FORWARD, REVERSE AND CABLE SIMULATORS

YELLOW AND BLUE PADS

TEXSCAN AND PATHMAKER PADS AND EQ.'S

INTERSTAGE'S THERMAL'S COMPENSATOR'S

SPLITTERS JUMPERS D.C'S

- o ALL M.L.E.'S P.C. BOARDS ARE PRODUCED TO MIL-SPEC STANDARDS IN ACCORDANCE WITH OUR STRICT ELECTRICAL TOLERANCES.
- o ALL P.C. BOARDS ARE SOLDER MASKED TO INSURE BOARD PROTECTION, LONGEVITY AND RELIABILITY.
- o MLE USES THE NEWEST SURFACE MOUNTED DEVICES (SMD) AND ASSOCIATED TECNOLOGY IN MOST OF OUR DESIGNS,INSURING THAT WE BUILD THE MOST RELIABLE PRODUCTS POSSIBLE THAT MEET OR EXCEED ORIGINAL FACTORY SPECIFICATIONS.
- o ALL OF OUR PINS ARE GOLD PLATED TO INSURE THE BEST INTERCONNECTION POSSIBLE.
- o OUR CUSTOM DESIGNED TEST SYSTEMS AND 100% TEST AND Q.A. SYSTEMS INSURES THAT YOU WILL RECEIVE THE BEST PRODUCT AVAILABLE IN THE MARKETPLACE TODAY.
- o ALL OUR PRODUCTS ARE BUILT IN OUR FACILITY IN CARSON, CA.. THIS ALLOWS US COMPLETE CONTROL OVER ALL OUR MANUFACTURING PROCESSES AND INSURES YOU OF THE HIGHEST QUALITY PRODUCTS.

52E SERIES

G.I. FORWARD EQUALIZERS

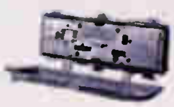
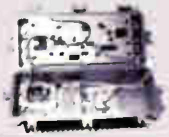
G.I. REVERSE EQUALIZERS

52E-300 AND 550 EQUALIZERS

9A/SXP/SXP PADS CUSTOM VALUES AVAILABLE

REMEMEBER M.L.E FOR ALL YOUR NEW AND REFURBISHED LINE GEAR, PASSIVES FIBEROPTICS AND CONVERTERS.



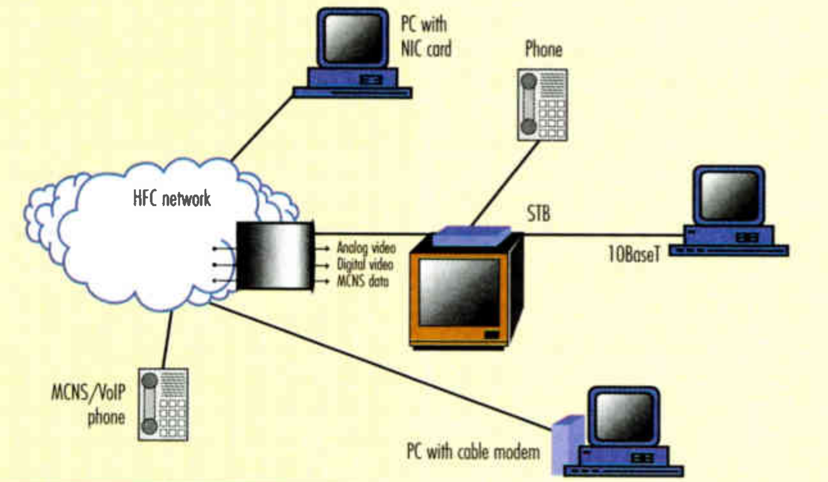





MAINLINE

1-800-444-2288
837 Sandhill Ave. Carson, CA 90746
310-715-6518 FAX 310-715-6695

Reader Service Number 74

Figure 1: Subscriber premises network



The access network is designed such that the subscriber's equipment cost is the minimum required to deliver the network services. Equipment in the access network includes RF modulators, HFC lasers and fiber, fiber nodes, and RF amps. Ad insertion can be done either in the headend or in the hub, or potentially at the client device with HTML.

The subscriber premises network consists of set-top boxes, cable modems, PCs, networking appliances, and interconnecting media such as Ethernet.

This architecture overview describes the equipment and configurations of the network, starting in the subscriber's premises, and progressing through the access network, the hubs, the backbone network and the headend.

Figure 1 depicts the subscriber premises network. The subscriber interfaces to the cable network by a coax connector carrying video, voice and data services over the RF signal. Within the subscriber's premises, appliances such as cable modems and set-top boxes may access some or all of these services and convert them into convenient forms. Other possible appliances include voice-over-Internet protocol (IP) phones, video conferencing devices (videophones), network computers and WebTV-like devices.

Video received on RF is converted to either separate video and audio on RCA jacks, or S-Video, and then connected to a TV set or to a video cassette recorder (VCR).

Voice is converted to POTS twisted pair format (Tip and Ring) and an RJ-11 connector, or processed in a PC or IP phone device directly between analog audio and voice on IP (VoIP).

Data may be converted to Ethernet format, usually 10BaseT, or optionally any other IP compatible format, including 100BaseT Ethernet. Few residences are wired for Ethernet or are prepared to add Ethernet wiring. It's likely that additional home "wiring" solutions, including wireless, local area networking (LAN) on telco wiring, and power line based networks will emerge and become viable. These can be supported easily by variations of standard cable modems and set-top boxes.

Access network

The Access Network (Figure 2 on page 104) supports three delivery mechanisms over the common HFC infrastructure:

- Analog video
- Digital video
- IP-based services

The IP-based services are voice, Internet/Web access, and alternate video content (streaming video on IP). The IP services are out-of-band with respect to the digital video RF channels.

Analog video is the mainstream delivery mechanism for the current broadcast video service. This should be supported well into the future as a lowest common denominator service, supported by all existing set-top boxes, cable-ready TV sets and VCRs. Regional differences exist in the video modulation format (NTSC, PAL, SECAM) and the particular RF frequencies, but the approach is similar.

Digital video uses the existing MPEG-2

and 64/256-QAM (quadrature amplitude modulation). Regional differences may exist in the forward error correction used: The United States is expected to use Annex B, while Europe will use Annex A. There is basic agreement on the MPEG compression, the MPEG transport stream encoding and the encryption methods to use; however, there is no widely-adapted

BOTTOM LINE

Why Integrate Video, Voice and Data?

Broadcast video, whether it is broadcast over the air, from satellites, or over cable, is about to become digital video. PCs and networks have been steadily getting faster and cheaper, while the total market grows due to the benefits and economics of open standards and other market forces. Digital video equipment and networks are built using the same types of equipment as PCs and network equipment and will benefit from the same type of open and common standards that they use.

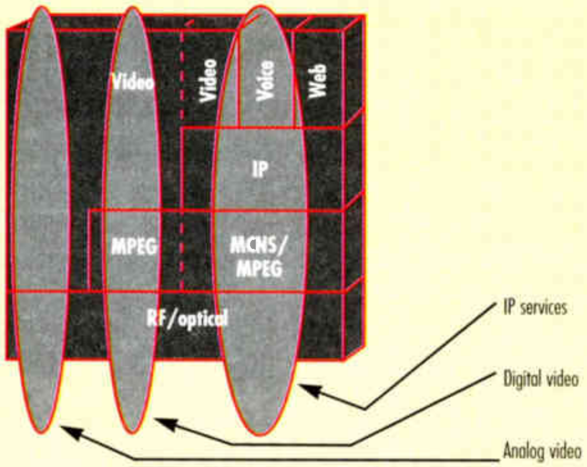
Data bandwidth is rapidly overtaking voice bandwidth. Internet traffic is easily doubling every year. Even without including fax usage as data, certain transoceanic paths are now supporting greater amounts of data than voice traffic. This trend is expected to continue for the foreseeable future, driven by the rich resources of the Internet and enabled by continuing improvements to the access technology.

As bandwidth is growing and getting cheaper, open standards that led to the success of the Internet are appearing in the video and cable sector. Open standards such as those for digital TV and data over cable, together with the large and growing Internet market, are attracting the interest of consumer electronics manufacturers. Over the next 10 years, TV manufacturers plan to replace all the existing TV sets with digital models. This large shift will create new categories for both products and services.

Reader Service Number 76

Reader Service Number 77

Figure 2: Access network



standard for conditional access (CAS) control systems.

IP is implemented using MCNS methods and protocols: a contention/reservation Media Access Protocol, 64/256-QAM downstream modulation, and quadrature phase shift keying (QPSK)/16-QAM upstream modulation. MCNS should be internationalized easily by supporting ITU J.83 Annex A and the use of 8 MHz channel spacing. Web, e-mail, and other Internet access use the widely deployed standards HTTP, HTML and simple mail transfer protocol (SMTP). Voice will use the same H.323-based protocols as used in the backbone network. Video over IP can use either the RFC-2038 standard, or any of the several streaming video systems in common usage today. Support in Web Browsers for RFC-2038 video will enable selected backbone network video streams to be available as secondary channels on IP.

MCNS-based IP also is used for command and control of the digital video set-top box. Subscriber requests for premium video services, such as PPV, are sent as IP messages. This has the advantage that the conditional access systems now can be located freely anywhere in the network, as they do not need access to the RF or MPEG signal stream.

While MCNS does require a second agile RF tuner in the set-top box, this configuration allows the IP services to be provided to PC users at the same time the set-top box is used to command and control the digital video broadcast service and allow the viewer to watch a selected video channel.

Hubs

The hubs contain equipment that transforms the signals carried on the backbone network into the appropriate delivery mechanism. Today's video transmission equipment uses analog methods, which is efficient and cost effective for transmission up to a certain distance, approximately 100 miles, before analog transmission impairments degrade the signal.

Video on the backbone network may also be carried as MPEG-2 video on IP over SONET. This form of video transport is particularly useful for switched video, including VOD and two-way video. In the access network, video may need to be delivered as analog video, traditional digital video (MPEG-2 on QAM), or as video on IP using MCNS. Furthermore, individual MPEG program streams may need to be extracted from one MPEG transport stream (MTS) and combined with others to form a new MTS. Most of this re-multiplexing likely will be done in the headend.

Depending on economics and system design, it may be convenient to bring some over-the-air or satellite video directly to the hub and modulate it into an analog video RF signal, or in the case of digital delivery, multiplex it with other digital video signals received from the backbone network.

The hub also is a good location for ad

insertion as it allows matching the advertisement to the demographics of the hub serving area.

The hub normally would be connected to the SONET rings of the backbone and thus to the primary or backup headend. The SONET ring ensures continued service even if a backbone fiber is cut.

Headend and backbone

The principle role of the headend is to bring external services—satellite video, over-the-air video, Internet backbone and voice—into the cable network, transforming them as necessary to be carried over the backbone network.

Backbone

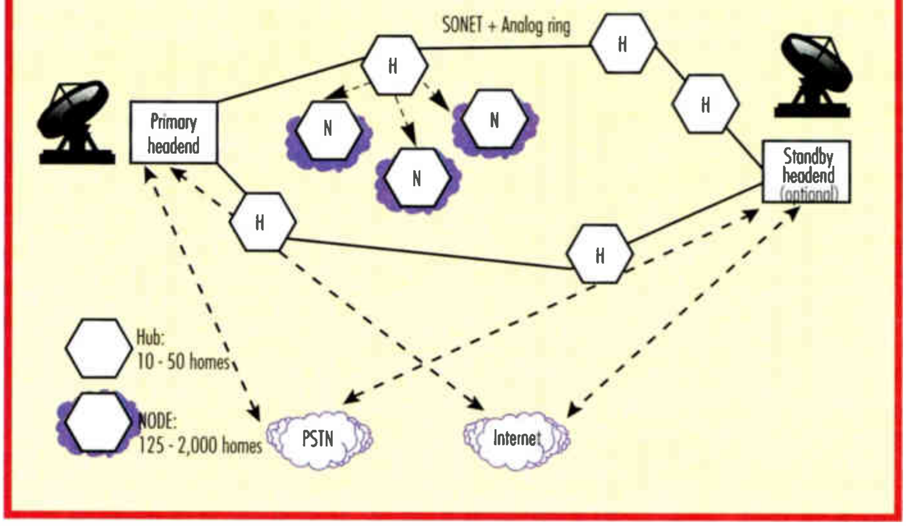
The backbone network (Figure 3 on page 106) connects headends with hubs. In most cases this must be done with a fault tolerant design that will withstand fiber cuts. In some cases the headend will be duplicated to a standby headend. In other cases several headends will be used, each with different video content and voice and Internet connectivity roles.

Current practice in the cable industry is to deploy video, voice and data in the backbone via separate infrastructures. Video is driven directly on the optical fibers, either in analog format or in simple digital formats. A SONET network also is set up over separate fibers and is used to create circuits for voice and data. Data is primarily IP-based, but asynchronous transfer mode (ATM) can be provisioned on the SONET circuits as well. To be fair, in most cases neither voice nor data is deployed yet, and in many cases data is deployed directly over optical fibers without use of SONET equipment.

While these configurations are economical for simple cable systems, the video equipment used does not conform to any widespread standard and must be configured on a point-to-point basis. This makes changing the video delivery system a manual process.

An improvement can be made if some kind of networking can be employed. SONET, ATM and IP all have some elements of networking in that once equipment is deployed, service can be routed over several fiber-equipment-fiber hops conveniently from one location. SONET

Figure 3: Backbone network



alone is not suitable because it offers only fixed-bandwidth circuits, and large-scale data networking requires packet-switching networking elements. ATM was designed by the telephone industry to support these requirements.

The chief problem with this architecture is that ATM has not achieved ubiquitous deployment, and there are no indications that it ever will. In particular, in the desktop/enterprise area, Ethernet and LAN switching continue to dominate. The combination of Ethernet switching, fast Ethernet and Gigabit Ethernet have ensured a steady advance of economical bandwidth. The availability of economical bandwidth has reduced the need for careful quality of service management. Consequently, many organizations are starting to use their PCs with their Ethernet and IP-based networks for intra-campus, multimedia applications, such as VOD access to training materials and video conferencing. For the most part, this is being done without the use of end-to-end ATM.

A new backbone architecture (IP transport architecture) retains the use of SONET, but places the IP layer directly above the SONET layer and supports the deployment of Video and Voice in protocols above IP. Advances in IP switching speeds and economy, and the development of IP-based voice and video products that have been brought about by the tremendous growth of the Internet, have made this configuration possible only in the last year. IP will use RFC-1619, PPP over SONET/SDH, an Internet/IETF standards-track protocol for encapsulating IP datagrams on SONET/SDH circuits.

Video will use RFC-2038, RTP Payload Format for MPEG1/MPEG2 Video, a protocol for encapsulating MPEG on IP. This standard supports both video generated or stored within a computer, such as a video server, and MPEG information from a native MTS system, such as a real-time encoder.

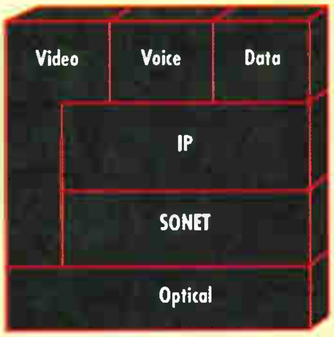
Voice will use the H.323-based protocols and agreements of the Voice Over IP Forum. Equipment now being sold will gateway the voice from the IP network to the public switched telephone network (PSTN).

Data applications will be sent over IP as usual.

While IP directly over SONET has substantial efficiency advantages over the use of ATM, many of the benefits of this architecture still are possible if IP is used over other lower level systems, such as IP over ATM.

While the IP transport architecture is elegant, it is likely that it will be too expensive for some time, when compared to the final alternative. The backbone architecture advocated by this paper retains the analog video transmission equipment as shown in Figure 4. RF signals are transformed by analog methods to optical signals for simple broadcast video when the distance limitations can be met. IP and SONET are used for switched and two-way video, and any broadcast video that must be

Figure 4: Final backbone architecture



carried for a long distance with no signal degradation.

Conclusion

By enabling the use of many common elements to deliver the various required services, the architecture outlined in this article can be used to minimize equipment types and subsystems, both in your network and in your subscriber's equipment. There is, for instance, only one type of data handling equipment (MCNS Data Over Cable) used in the headend to support Internet access, digital set-top box command and control, and voice access. Similarly, one subscriber device can support these same services.

The opportunity to provide the new services described is real and can be achieved in an evolutionary manner—that is, without awaiting the development of any new technologies and making good use of existing equipment as the network evolves. The authors propose that the members of the cable, computer and networking industries discuss and come to agreement on this kind of architecture, and it is hoped that the present article will facilitate that process.

This article was adapted from a paper titled, "An Integrated Architecture for Video, Voice and IP Services over SONET and HFC Cable Systems" presented on behalf of Cisco Systems at the 1998 Emerging Technologies Conference of the SCTE. Forster credits numerous other contributors in the full text. The complete article can be found on the Internet at www.cisco.com/cable. Jim Forster can be reached at Cisco Systems: (408) 526-7854.

Efficient Digital Video

Answers for Statistical Multiplexing, Grooming and Switching

By Reed M. Burkhart

Cable operators, large or small, must aim for the highest picture quality, most flexible, bandwidth-efficient and cost-effective digital video implementations to reach their various goals.

These goals include:

- Adding desirable new programs (channels) of interest to viewers
- Using bandwidth efficiently to permit introduction of other services
- Performing digital insertion of local advertisements and programs
- Filtering satellite-contributed program statistical-multiplexes efficiently to select only desired programs, called grooming

The key to each goal is stand-alone statistical (re-) multiplexing.

The most efficient Moving Pictures Experts Group (MPEG) digital video representation reduces a program bit rate by encoding (compressing, spatial and temporal redundancy, and ignoring some not-too-perceptible picture detail). Interestingly, compression of video by encoding spatial and temporal redundancy comes at the cost of introducing spatial and temporal dependency. Spatial dependence means that any super-position or alteration of images is not possible. Temporal dependence, which is discussed later, means that switching is more difficult.

The required bit rate that results from MPEG encoding varies according to the level of detail in the picture. When the picture is decoded, the spatial and temporal redundancy portion is restored.

Remember, the encoder has judged which details were to be encoded and which not-too-perceptible details would be ignored (and therefore not encoded) and lost forever at the encoder. This is one source of digital artifacts. Therefore, variable bit rate (VBR) encoding as shown in Figure 1 (on page 111) must be employed in order to achieve the most efficient MPEG representation of a video source, typically averaging 1-to-4 Mbps, but as much as 8 Mbps for bursts of picture information.

> "Compression of video by encoding spatial and temporal redundancy comes at the cost of introducing spatial and temporal dependency."

It is best to encode only once since multiple encodings lead to generational loss in picture quality. Some experts estimate about 30% quality loss for one re-encoding. In order to use VBR encoding, statistical multiplexing, or statmuxing, is

BOTTOM LINE

Understand Your Digital Tools

The revolution in digital video has been a long time in coming for cable operators. But as a new generation of digital tools arrives, 1998 is shaping up as the year when this revolution is finally hitting with gale force.

Growing legions of programmers including HBO, Showtime, Disney, Discovery, Turner and MTV are expanding their program lineups with digitally compressed tiers.

In order to accommodate these new program services, and a host of new applications, cable operators need to understand what new tools allow for an efficient digital video implementation.

According to the premise detailed in this article, cable operators will be able to use their spectrum most efficiently (between 1 and 4 Mbps average variable bit rate per program) if they use a stand-alone MPEG statistical-remultiplexer, combined with a selecting switch. A key feature of this approach is that encoders are not required to create the multiplex.

This uniquely enables the operator to add a digital tier (including the ability to select individual programs from received multiplexes and perform local digital ad insertion) so that ad inserted basic program services can be included in the digital tier and transmit adjunct data within spare multiplex capacity.

required to fit multiple VBR programs, usually eight to 20 or more according to video complexity and quality desired, onto a fixed bit rate channel. This typically modulates about 27 Mbps or 36 Mbps over 6 MHz with 64-QAM (quadrature amplitude modulation) or 256-QAM, respectively.

Compromises

Current statmuxes fit programs in the channel bit rate by controlling a set of encoders, one for each program. The result is an efficient encoder-affected multiplex so long as all of the programs are available unencoded at the location of the statmux. Since many cable programs already are being delivered in an encoded form via satellite, the use of encoder-affected statmuxes involves one of the following compromises:

- Decoding and re-encoding the remotely encoded programs, so as to have a full complement of encoders to do the statmuxing, which is costly and causes generational quality loss
- Allocating to remotely encoded programs a fixed bit rate equal to their maximum bit rate, which is very inefficient
- Leaving satellite-delivered statmuxes untouched, which may mean inefficient program packaging and precludes ad insertion on those programs

These compromises are intrinsic to encoder-affected statistical multiplexers—and a better method is in demand.

Stand-alone statmux

Companies now are developing a stand-alone statmux that avoids these pitfalls, enabling the most efficient use of cable capacity, and permitting local ad insertion, local program insertion, grooming of received multiplexes and the inclusion of adjunct data.

The stand-alone statmux does all the things a good multiplexer should do. It shares the transport stream statistically among all programs in the multiplex, including advancing or retarding program packets when multiple programs peak simultaneously to avoid exceeding the aggregate channel bit rate, while closely watching decoder buffer conditions to avoid violations.

Only when all other means for fitting the programs in the multiplex have been exhausted does the stand-alone statmux adjust quantization levels and other encoding parameters so the channel bit rate is not exceeded. Such an autonomous statmux is expected to be the most efficient, highest quality, lowest cost approach to statistical (re-) multiplexing.

By preceding such a stand-alone statmux with a buffering switch, the combination permits on-the-fly reconstitution of the multiplex, which is useful for ad insertion or local program insertion. In order to accomplish local ad insertion on remotely encoded programs that are to be statistically remultiplexed, a stand-alone statistical multiplexer is necessary to avoid generational quality loss. An additional requirement for switching is to manage the temporal dependence of the bitstream.

MPEG switching

To understand the MPEG switching challenge and one approach to dealing with it, we need to go one step deeper into understanding the MPEG encoded stream structure. MPEG's redundancy encoding is implemented in three different ways for three different

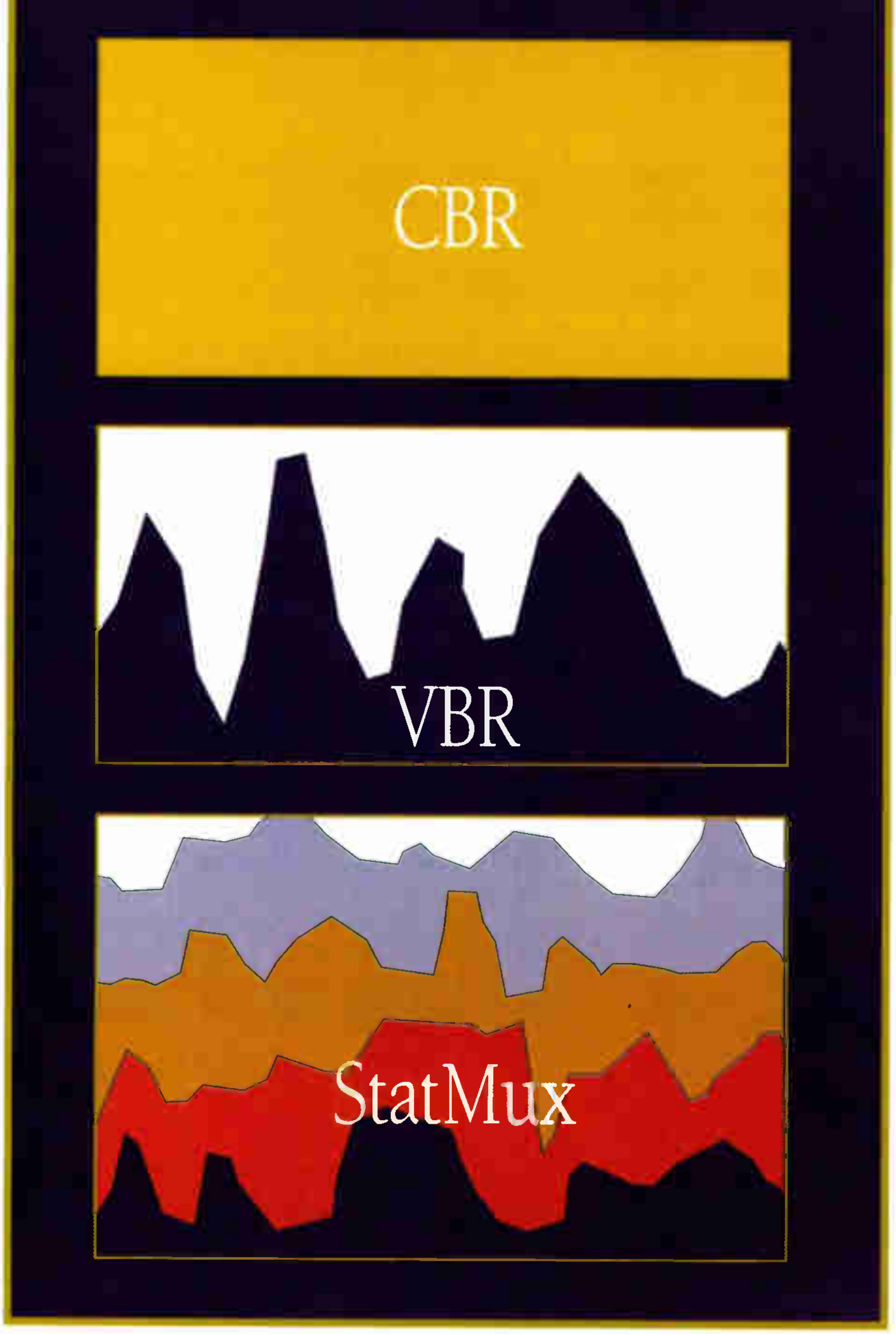


Figure 1: StatMux using variable bit rate encoding for highest efficiency.

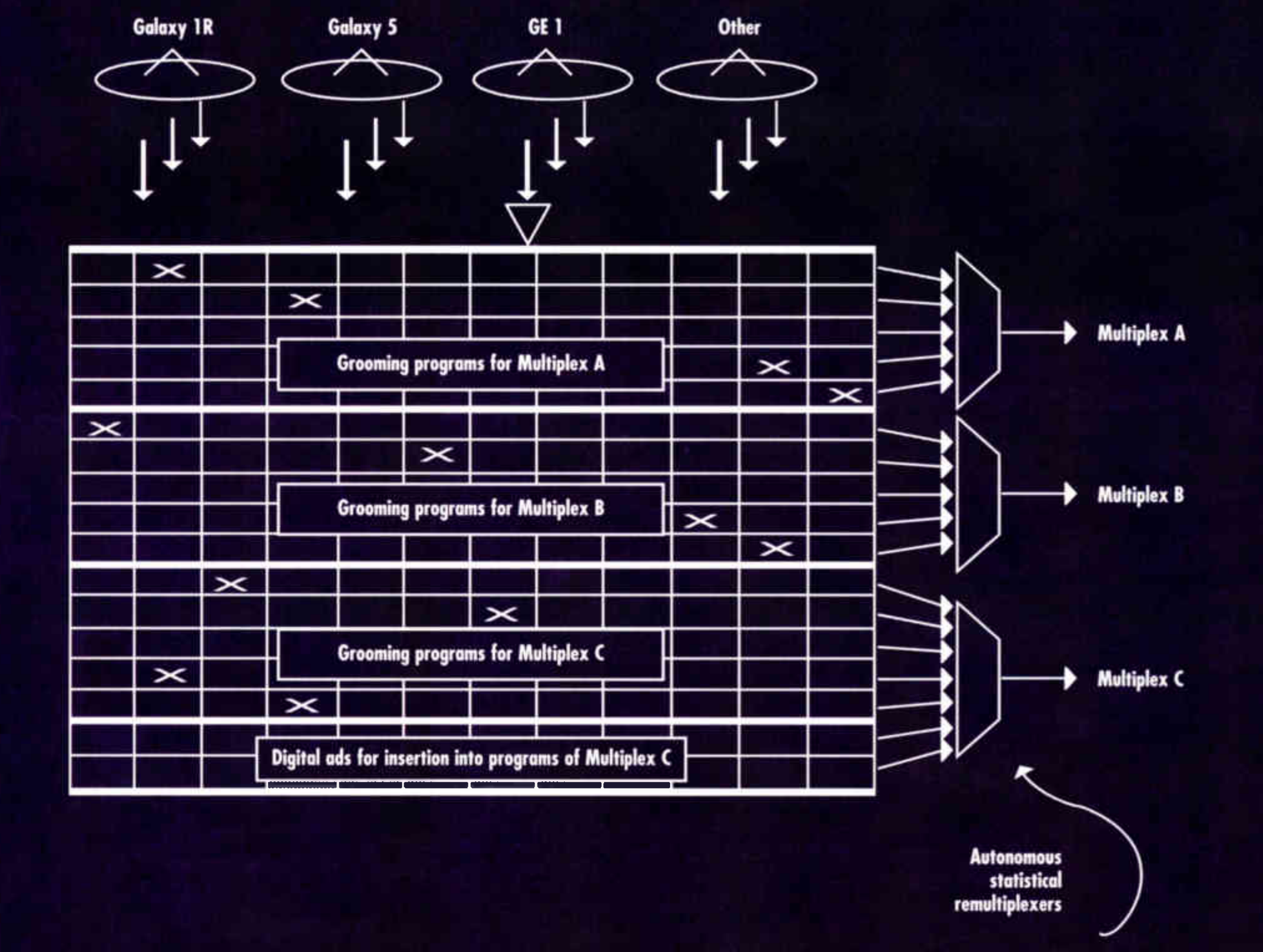
frame-encoding modes.

First, only frame-internal references are used for I-type frames with no motion prediction. Second, internal- and past-frame references are used for P-type frames; and third, internal-, future- and past-frame references are used for B-type frames.

Future- and past-frame references involve MPEG's motion prediction feature. The use of motion prediction for B and P frames creates temporal dependency in the MPEG bitstream, making bitstream switching more difficult. The problem arises when the stream is switched between a B frame and the I or P frame to which it is referenced. In this case, the B frame loses its reference, and the original frame can not be reconstructed.

It is common to use a repeating pattern of, for example, one I frame, followed by two B frames, followed by a few triplets of PBB, then repeating the entire pattern. ➤

Figure 2: Configuration of compressed digital headend for grooming and ad insertion using autonomous statistical remultiplexers



The frames from one I frame to the next are called a group of pictures (GOP), such as IBBPBBPBBPBB (followed by IBBPB...).

In fact, the more efficient the MPEG encoding, the longer the periods of bitstream interdependency (GOP lengths, between successive I-frames) and the more difficult the bitstream is to edit or switch. Some implementations of MPEG have sacrificed efficient encoding by employing frequent I frames in order to simplify bitstream switching.

Depending on the application, flexible switching may mean switching at the nearest I frame, or at an arbitrary frame, which is possible, but more difficult to accomplish smoothly. Since a decoder has to wait for an I frame to begin constructing a new program that it has begun to receive, the inserted program will always begin with an I frame. A terminating program may be terminated just before transmission of either an I or a P frame.

The simplest switching technique involves buffering both streams enough to introduce them to one another at such appropriate switching points. It is important to emphasize that the problems of switching and multiplexing are related and require a common solution. (See Figure 2.)

The efficiency—quality, quantity and cost—of current implementations of MPEG digital transmissions is limited by the use of constant bit rate encoding, frequent I frames, constant-bit rate multiplexing, or encoder-affected statistical multiplexing.

Advanced techniques, including a stand-alone (re-)multiplexer, currently are being developed to allow digitally encoded transmissions from source to destination, including grooming of incoming multipexes, MPEG-switching for ad insertion or local program insertion, and multiplexing of latency-insensitive adjunct data without the current compromises of regenerational loss, bandwidth inefficiency or single-vendor compatibility.

These techniques include novel transformation of an encoded bitstream bit rate and novel statistical multiplexing addressing the most challenging implementation areas—encoding and multiplexing—for a cable digital video transmission system. CT

Reed Burkhart is director of sales for Imedia. He may be reached at (415) 975-8023 or e-mailed at rburkhart@imedia.com.

RDU®

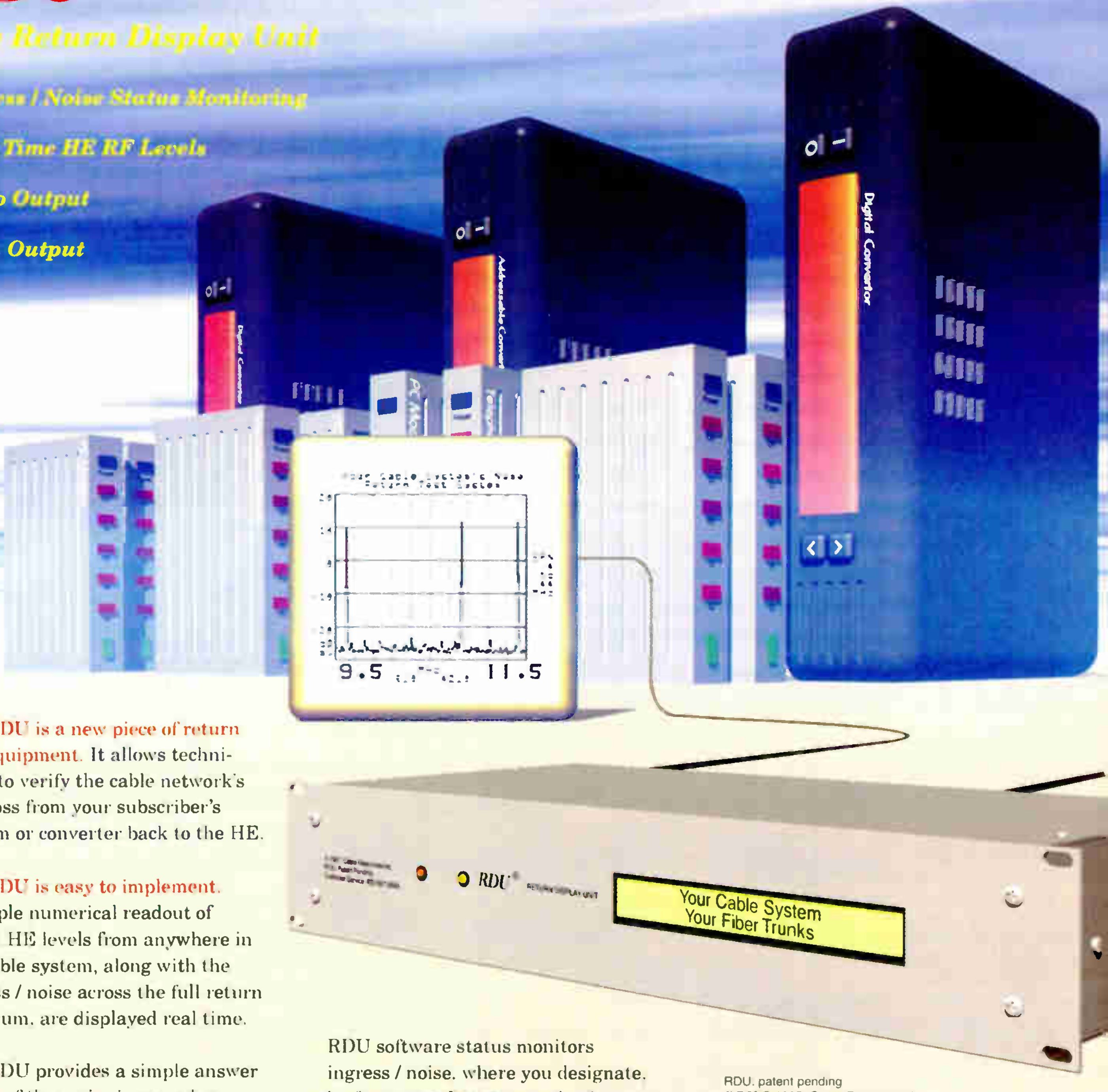
The Return Display Unit

Ingress / Noise Status Monitoring

Real Time HE RF Levels

Video Output

Data Output



The RDU is a new piece of return test equipment. It allows technicians to verify the cable network's link loss from your subscriber's modem or converter back to the HE.

The RDU is easy to implement. A simple numerical readout of actual HE levels from anywhere in the cable system, along with the ingress / noise across the full return spectrum, are displayed real time.

The RDU provides a simple answer to one of the major issues when RF modems have problems. Is it the RF link or the software?

No need for a HE engineer on the phone with your field installer. No making a judgement call on critical ingress / noise to carrier levels. The RDU provides the answers in a simple easy to understand format. The RDU saves valuable time. It finds the marginal installations so the subscriber gets troublefree service from the start.

RDU software status monitors ingress / noise, where you designate, by frequency. It averages the data and displays an ingress / noise number, real time, creating simple benchmarks for profitable two way cable system operations.

The RDU is an efficient new tool to maintain broadband networks. Test carriers can be documented from every installation and service call. See your return system on a video channel and or use the data output and access the RDU over a modem. Keep it simple to succeed.

Reader Service Number 87

RDU, patent pending

CABLE RESOURCES INC.

85M Hoffman Lane
Islandia, NY 11722
FAX: 516-234-4436

Call 800-537-9995 for Sales and Information!

VENDOR CONNECTION

Vendor Connection is *Communications Technology's* resource for up-to-date information on the industry's leading technology suppliers. These vendors have advertised in this issue. Check their ads for products and services that will improve your cable system's reliability, efficiency and capacity.

3-Com
5400 Bayfront Plaza, MS-2203
Santa Clara, CA 95052
(408) 764-5000
Donna Sellers
Reader Service #28

Alpha Technologies
3767 Alpha Way
Bellingham, WA 98226
(360) 647-2360; Fax: (360) 671-4936
www.alpha.com
Baily Shewchuk
Alpha Technologies is a world leading manufacturer of application-specific powering solutions for voice, video and data communication systems. Alpha's products include: UPSs, line conditioners, surge suppressors, batteries and accessories.
Reader Service #3

Altec Industries Inc.
210 Inverness Center Parkway
Suite 13
Birmingham, AL 35242
(205) 991-7733; Fax: (205) 991-7747
www.Altec.com
Julie Walden
Altec Industries Inc. features the Altec AP38 Aerial Cable Placer designed to place fiber and coaxial cable along with the Altec AT235FSB Telescopic Aerial Device mounted on a fiber splicing body.
Reader Service #20

AM Communications Inc.
100 Commerce Blvd.
Quakertown, PA 18951-2237
(800) 248-9004; Fax: (215) 538-8779
www.amcomm.com
sales@amcomm.com
David L. DeLane (215) 538-8703
AM Communications is a leading supplier of monitoring systems for HFC transmission networks. AM's OmniStat product offers solutions for virtually every brand and kind of network equipment.
Reader Service #14

ANTEC Network Technologies
5720 Peachtree Parkway NW
Norcross, GA 30092
(770) 441-0007; Fax: (770) 441-2460
www.antec.com
Brad Halverson
brad.halverson@antec.com
ANTEC Network Technologies, the Atlanta-based manufacturing division of ANTEC Corp., designs, manufacturers, distributes and markets a wide range of active transmission, powering, passives, and interconnection products for fiber optic coaxial and twisted pair networking, worldwide. ANTEC Corp., headquartered in Rolling Meadows, IL, is an international communications technology company.
Reader Service #19

ASKA Communications Corp.
3540 NW 56th Street, Suite 206
Fort Lauderdale, FL 33309
(800) 840-6350; (508) 730-1065
Fax: (508) 677-2511
www.askacom.com
sales@askacom.com
Debbie Okamoto
ASKA Communication Corp. offers full range solutions with a variety of connectors, adaptors, splitters, tools for broadband drop applications, and other accessories. Whatever your needs ASKA has the solution.
Reader Service #45

Avantron Technologies Inc.
8596 Pix IX Blvd.
Montreal, Quebec H1Z 4G2
(800) 297-9726; Fax: (514) 725-5637
www.avantron.com
Rick Jaworski (317) 574-9557
info@avantron.com
Avantron manufactures test equipment for the cable TV Industry. With innovative low-cost high-quality products like the AT2000R Spectrum Analyzer, Avantron is making it possible for a large number of field technicians to have the tools they need to solve today's challenges.
Reader Service #36

BARCO
3240 Town Point Drive
Kennesaw, GA 30144
(770) 218-3200; Fax: (770) 218-3250
www.barco-usa.com
Earlene Bentley
ebbarco@aol.com
BARCO hardware and software improves the quality and reliability of signal delivery BARCO CATV equipment incorporates advanced capabilities to remotely monitor and control signal distribution system-wide, maximizing up-time and subscriber satisfaction.
Reader Service #42

Blonder Tongue Laboratories Inc.
One Jake Brown Road
Old Bridge, NJ 08857
(732) 679-4000; Fax: (732) 679-4353
www.blondertongue.com
cpalle@blondertongue.com
Emily Nikoo (732) 679-4000, Ext. 213
For over 40 years, Blonder Tongue Laboratories Inc. has been manufacturing professional quality, commercial cable television products. Products include: Reception, Headend, Microwave, Analog & Digital Distribution, Fiber Optics, Interdiction, Test Equipment, Residential and Specialty Equipment.
Reader Service #25

C-COR Electronics Inc.
60 Decibel Road
State College, PA 16801
(814) 238-2461 (800) 233-2267
Fax: (814) 238-4065
www.c-cor.com
Sally Thiel, Manager, Corporate Communications
C-COR offers AM headend equipment, AM fiber nodes, RF amplifiers, element management systems, and more for communication networks worldwide. Services include network design, training and emergency repair service. C-COR is ISO 9001 registered.
Reader Service #93

Cable Innovations Inc.
130 Stanley Court
Lawrenceville, GA 30245
(800) 952-5146; Fax: (770) 962-6133
www.cableinnovations.com
Nick Haralson
Haralson@rightmove.com
Cable Line, drop line, and power line surges suppressors, including the CLPS-3009PI, DLPS-15D and PLS-125. And new from Cable Innovations is the UHB-2001 Universal House Box.
Reader Service #85, 86

Cable Leakage Technologies
1200 Executive Drive E. #136
Richardson, TX 75081
(972) 907-8100; Fax: (972) 907-2950
www.wavetracker.com
Perry Havens
phavens@wavetracker.com
CLT, inventors of automated positional leakage analysis test tools of software for the cable telecomm industry.
Reader Service #12

Cable Resources Inc.
85 "M" Hoffman Lane
Islandia, NY 11722
(800) 537-9995; Fax: (516) 234-4436
Maura O'Riordan
Cable Resources offers a new line of test equipment to maintain return networks in the cable TV environment. Simple and easy to implement, the RDU shows the big picture: ingress, noise and carrier levels for real-time analysis of 5-40 MHz return networks.
Reader Service #87

CommScope
P.O. Box 1729
Hickory, NC 28602
(800) 599-9265; Fax: (704) 459-5099
www.commscope.com
Gina Foy
Coaxial and fiber-optic cables featuring New Power Feeder, Cable-in-Conduit, PIII, QR, and a complete line of drop cables including several available in EZ-PAK packaging.
Reader Service #17

ComSonics Inc.
1350 Port Republic Road
Harrinsonburg, VA 22801
(800) 336-9681; Fax: (540) 432-9794
www.comsonics.com
Roy Weitzell 540-434-5165 ext. 228
marketing@comsonics.com
ComSonics is a 100% employee-owned manufacturer of cable TV field test equipment. We have a network of domestic sales people, sales reps and an international network consisting of 19 distributors.
Reader Service #18, 40

DX Communications
A Division of Itochu Cable Services, Inc.
1143 W. Newport Center Drive
Deerfield Beach, FL 33442
(888) 293-5856; Fax: (954) 427-9688
Ken Mosca
dxckm@aol.com

Manufacturer of quality headend equipment. Products include; digital satellite receivers, IRDs, agile modulators, satellite receivers, combiners, FM modulators, combiners, LNBs and accessories.
Reader Service # 16

FrontLine Communications
404 West Ironwood Drive
Salt Lake City, UT 84115
(801) 464-1600 (800) 231-1349
Fax: (801) 464-1699
www.frontlinecom.com
Bill Robertson
info@frontlinecom.com
FrontLine provides complete EAS systems covering IF, baseband and the only patented, proven All Channel Message system available. Affordable for any size system with applications beyond EAS. We invite comparison!
Reader Service #90

General Instrument Corp.
101 Tournament Drive
Horsham, PA 19044
(215) 323-1000 Fax: (215) 956-6497
www.gi.com
Geoff Roman, Sr. Vice President
General Instrument is the world leader in analog and digital systems that provide video, audio and high-speed Internet/data services over cable and satellite television networks.
Reader Service #15

Harmonic Lightwaves Inc.
549 Baltic Way
Sunnyvale, CA 94089
(800) 788-1330; (408) 542-2500
Fax: (408) 542-2511
harmonic-lightwaves.com
info@harmonic-lightwaves.com
John Dahlquist
Harmonic Lightwaves is a worldwide supplier of highly integrated fiber-optic transmission, digital headend and element management systems for the delivery of interactive services over broadband networks.
Reader Service #46

Hewlett-Packard Co.
Test and Measurement Organization
P.O. Box 50637
Palo Alto, CA 94303-9511
(800) 452-4844 ext. HPTV;
Fax: (303) 754-4990
hp.com/go/catv
hpcatv@aol.com
Hewlett-Packard Co. offers a comprehensive range of test equipment to keep your broadband system at peak performance—from manufacturing through the headend and into plant maintenance.
Reader Service #8, 38

Hukk Engineering
3250-D Peachtree Corners Circle
Norcross, GA 30092
(770) 446-6086; Fax: (770) 446-6850
Gene Faulkner
gene.faulkner@hukk.com
Hukk Engineering Digital Test Equipment for the CATV Industry. This equipment gives bit error rates and other tests for QAM and QPR digital services.
Reader Service #37

iCS Inc.
1143 W. Newport Center Drive
Deerfield Beach, FL 33442
(800) 327-4966 (954) 427-5000
Fax: (954) 427-0934
Rod Hicks, Senior Vice President
iCs Inc. is a leading full-service stocking distributor for General Instrument, Scientific Atlanta, PPC, Joslyn, Diamond, DX and many more. iCS operates ten sales offices and nine warehouses conveniently located in North and South America. iCS provides repair of converters, materials, management and financing.
Reader Service #22, 65

Idea/onics
Box 369
Mayville, North Dakota 58257
(701) 786-3904; Fax: (701) 786-4294
Austin G. Kramer
Manufacturer of RF & IF Emergency Alert Systems (EAS) to meet the FCC mandate. Manufacturer of the first RF comb generator. Sales of complete EAS systems starting under $5,000
Reader Service #52

Keptel Inc.
56 Park Road
Tinton Falls, NJ 07724
(732) 389-8800; Fax: (732) 460-5485
www.antec.com
Keptel, an Antec Company, designs, manufactures and markets a wide range of telephone, data and CATV interconnection equipment such as network interface devices, fiber splice closures and fiber management systems.
Reader Service #35

KES (Klungness Electronic Supply)
P.O. Box 885
101 Merritt Avenue
Iron Mountain, MI 49801
(800) 338-9292; Fax: (906) 774-6117
Greg Michaud (906) 774-6621, ext.276
Distributes a full line of broad band products/delivers construction equipment, executive level stocking distributor/complete system integrator specializing in interdiction, data, internet integration, CATV, load management distance learning/substation/ distribution management.
Reader Service #31

Learning Industries
15339 Barranca Parkway
Irvine, CA 92618
(800) 4-Leaming; Fax: (714) 727-3650
www.leaming.com
Laura Klepitch
lic@leaming.com
Manufacturer of BTSC Stereo/SAP encoders,BTSC Stereo/SAP decoders for rebroadcasting off-air signals, audio AGC, FM modulators/demodulators/ upconvertors, CATV/SMATV audio-video modulators.
Reader Service #48

Lindsay Electronics
50 Mary Street West
Lindsay, ON K9V 4S7
(705) 324-2196; (800) 465-7046
Fax: (705) 324-5474
www.lindsayelec.com
sales@hq.lindsayelec.com
David Atman
Focused on the last mile, our revolutionary new technology creates communication equipment to solve system problems before they become subscriber problems. This is achieved through applied ISO continuous improvement disciplines, innovation, and strict attention to details.
Reader Service #33

Main Line Equipment Inc.
837 Sandhill Avenue
Carson, CA 90746
(800) 444-2288; (310)-715 6518
Fax: (888) 4mainline (310) 715-6675
www.mle.com
mainline@worldnetatt.net
Mark Lipp
Buy, sell and distribute new, excess, and refurbished fiber optics, active electronics, converters, and passives. We manufacture a complete line of replacement pads, equalizers and plug-ins for most major manufacturers that meet or exceed original factory specifications.
Reader Service #74

MHZ MEGA HERTZ
6940 South Holly Circle, Suite 200
Englewood, CO 80112
(303) 5779-1717; (800) 525-8386
Fax:(303) 779-1749
www.megahz.com
TUGS08A@Prodigy.com
Steve Grossman
MEGA HERTZ represents or distributes: off air or satellite antennas; character generators; commercial insertion products; emergency alert systems; fiber Tx/Rx; stand-by generators; headend electronics; satellite electronics; stereo processors; test equipment; custom traps and filters.
Reader Service #26, 32, 49, 53, 57, 66, 72, 76, 79, 82

Molex Fiber Optics Inc.
5224 Katrine Avenue
Downers Grove, IL 60514
(630) 512-8750; Fax: (630) 512-8777
www.molex.com
Renee Mousavi
rmousavi@molex.com
Molex Fiber Optics Inc. a leading worldwide supplier of fiber-optic products, offers a full range of active and passive solutions, serving the CATV, telecommunication and data-communication markets.
Reader Service #71

Moore Diversified Products Inc.
1441 Sunshine Lane
Lexington, KY 40505
(606) 299-6288; Fax: (606) 299-6653
www.MooreDP.com
mooredp.com
Gia Phelps and Bob DeMuth
Moore Diversified Products, Inc. is a manufacturer of metal and plastic products that store, organize and protect fiber optic and coaxial cable in outside plant construction.
Reader Service #96

Multilink
580 Ternes Avenue
Elyria, OH 44035
(440) 366-6966; Fax: (440) 366-6802
www.multilinkinc.com/multilinkinc
mulink@ix.netcom.com
Steve Kaplan
Multilink is a leading manufacturer of cable television supplies. Multilink manufactures plastic enclosures, metal enclosures and splice closures as well as fiber-optic and telecommunications products.
Reader Service #5, 98

National Cable Television Institute (NCTI)
801 W. Mineral Avenue
Littleton, CO 80120
(303) 797-9393; Fax: (303) 797-9394
www.ncti.com
Yolanda Gonzales
30 Years as a leader of independent broadband training with comprehensive distant learning courses. Technical and non-technical courses available.
Reader Service #23

Norscan

301-F3 10th Street NW
Conover, NC 28613
(704) 464-1148; (704) 464-7608
www.norscan.com
John Chamberlain (704) 464-1148
jc@norscan.com
Norscan manufacturers a full line of fiber-optic preventative maintenance and monitoring equipment.
Reader Service #43

North American Cable

893 S. Matlack Street, Suite 170
West Chester, PA 19382
(610) 429-1020; Fax: (610) 429-3060
Stuart Lindsay
stunacle@aol.com
Full line stocking distributor of Satellite Dish, Private Cable, and CATV installation materials.
Reader Service #94

PDI-Electronics for Telecommunications

6353 West Rogers Circle #6
Boca Raton, FL 33487
(561) 998-0600; Fax: (561) 998-0608
www.pdi-eft.com
Johathan Edelman (561) 998-0600
PDI.Electronics@worldnet.att.net
PDI manufacturers and distributes every product that any type of cable system may need. From high-tech headend products to passives and tools, PDI has it all.
Reader Service #10

Performance Power Technologies

P.O. Box 947
Roswell, GA 30077
(770) 475-3192; Fax: (770) 343-8492
Jud Williams
Batteries-Standby, Battery Chargers Test Equipment, Diagnostic Monitoring Systems, Power Conversion Products, Power Supply Products, Test Equipment. Power Supplies for Cable and Telecom featuring the "Magnum UPS" 90 volt 32 Amp HFC Centralized Node Powering System with "Smart/Gard" output protection.
Reader Service #24

Philips Broadband Networks

100 Fairgrounds Drive
Manlius, NY 13104
(800) 448-5171; Fax: (315) 682-9006
www.be.philips.com/pbn
C. Murray (315) 682-9105 ext. 2271
Philips Broadband Networks, known for broadband RF and fiber-optic transport systems, is also a leader in advanced systems used to provide telephony and high-speed data services over your HFC video network. The company also supports wireless cable and digital video communication systems. Get connected with Philips—The Reliable Choice.
Reader Service #68

Pico Macom Inc.

12500 Foothill Blvd.
Lakeview Terrace, CA 91342
(800) 421-6511; (818) 897-0028
Fax: (818) 834-7197
www.piconet.com
Dan Ward
pico@piconet.com
Pico Macom offers a full line of quality headend components including satellite receivers, agile modulators and demodulators, signal processors, amplifiers and completely assembled headends. Pico also manufactures the complete line of Tru-Spec 1 GHz drop and installation passives, splitters, couplers, switches and connectors for CATV/MMDS /SMATV and DBS installation.
Reader Service #56

Pioneer New Media

2265 E. 220th Street
Long Beach, CA 90810
(310) 952-2111; Fax: (952) 2990
www.pioneerusa.com
George Applegate
gapplega@pnmt.com
For more than two decades, Pioneer's mission has been to engineer technology that expands the limits of cable television. At Pioneer, we deliver the innovative products that system operators require.
Reader Service #51

Power & Telephone Supply Co.

2673 Yale Avenue
Memphis, TN 38112
(901) 320-3080; Fax: (901) 320-3082
www.ptsupply.com
Mary Bowen
Provides material distribution services to the communications, network and CATV industries.Full-line stocking of cable, fiber optics, hardware tools and CATV industries.
Reader Service #69

Quality RF Services Inc.

850 Parkway street
Jupiter, FL 33477
(800) 327-9767; Fax:(561) 744-4618
Jerry K. Thorne
Quality RF Services manufactures RF amplifiers and equalizers for bandwidth upgrades of CATV systems, laser drivers and isolation amplifiers for the Headend, high-quality amplifiers for the MDU, hotel/motel industry and the home. CATV repair service is our specialty.
Reader Service #84

Radiant Communications

5001 Hadley Road
P.O. Box 867
South Plainfield, NJ 07080
(800) 969-3427; Fax:(908) 757-8666
www.Radcom.com
Radiant3@ix.netcom.com
Jean Harding (908) 757-7444
Manufacturer of fiber-optic distance learning systems, baseband and broadband video/audio/data transmission systems, and high quality fiber optic components such as couplers, attenuators, adaptors, connectors and assemblies.
Reader Service #27

RELTEC

6221 N. O'Connor Blvd., Suite 105
Irving, TX 75039
(972) 501-3432; Fax: (800) 800-1280
www.relteccorp.com
Mark Wise (972) 501-3248
RELTEC is a leader in the design, manufacture and sale of a broad range of telecommunications systems, products and services to wireline and wireless service providers and OEMs around the globe in three categories: Access Systems, Integrated Wireless Solutions and Network Components and Services. RELTEC operates manufacturing plants in North America, Europe, Asia/Pacific and Latin America with over 5,250 employees worldwide.
Reader Service #67

Riser-Bond Instruments

5101 N. 57th Street
Lincoln, NE 68507
(800) 688-8377; Fax: (402) 466-0967
www.riserbond.com
John Ramus (402) 466-0933
jrasmus@riserbond.com
Riser-Bond Instruments is a leader in manufacturing TDRs with unique and exclusive features to quickly and easily locate and identify faults and conditions in any metallic two-conductor cable.
Reader Service #13

Sadelco Inc.

75 West Forest Avenue
Englewood, New Jersey 07631
(800) 569-6299 International: (201) 569-3323
Fax:(201) 569-6285
www.sadelco.com
Mr. Leslie Kaplan, V.P.
sadelco@aol.com
Designs and manufacturers signal level meters and calibrators.
Reader Service #63

Scientific-Atlanta

4261 Communications Drive
Box 6850
Norcross, Georgia 30091-6850
(800) 433-6222; Fax:(770) 236-7770
www.sciatl.com
Uwe Trode
Scientific-Atlanta is a leading supplier of broadband communications systems, satellite-based video voice and data communications networks and world-wide customer service and support.
Reader Service #1

Sencore Inc.

3200 Sencore Drive
Sioux Falls, SD 57107
(605) 339-0100; Fax:(605) 339-0317
www.sencore.com
Brad Johnson (605) 339-0100, ext.123
sales@sencore.com
Sencore will be exhibiting a full line of CATV and Wireless cable test instruments, including: MPEG-2 Transport Stream Analyzers, hand-held signal level meters designed for QAM digital signals, and video performance test instruments. Each unit is designed to meet all your system's analyzing and troubleshooting needs.
Reader Service #2

Silicon Valley Communications

931 Benecia Avenue
Sunnyvale, CA 94086
(408) 739-8800; Fax: (408) 245-9873
www.svci.com
Ed Feghali (408) 245-8800
sales@svci.com
Silicon Valley Communications Inc. offers the most comprehensive line of optical transmission products including 1310 and 1550 nm transmitters, high performance optical amplifiers, indoor/outdoors receivers, and Network Management System.
Reader Service #91

SkyConnect

1172 Century Drive, Suite 200
Louisville, CO 80027
(303) 218-9100; Fax: (303) 218-9112
www.skyconnect.com
Lindsay Combs (303) 218-9108
lcombs@skyconnect.com
SkyConnect meets the demands of the growing cable advertising industry by delivering the most complete digital advertising insertion solutions available. SkyConnect's product line is based on Digital Equipment Corporation's 64-bit Alpha+ server.
Reader Service #70

Sprint North Supply

600 New Century Parkway
New Century, KS 66031-8000
www.sprintnorthsupply.com
Rachel Volk (913) 791-7273
Reader Service #58

Stanford Telecom

480 Java Drive
Sunnyvale, CA 94089
(408) 745-2685; Fax: (408) 541-9030
www.stanfordtelecom.com

William Patton
Bill.Patton@stelhq.com
Stanford Telecom produces modulator and demodulator ASICS and assemblies for transmission and reception of return path data in HFC systems. Included is a subscriber modem modulator/demodulator in HFC systems. Included is a subscriber modem modulator/demodulator on one chip.
Reader Service #39

TeleWire Supply
94 Inverness Terrace East
Englewood, CO 80112
(1) 88-TELEWIRE; Fax: (303) 643-5797
www.telewiresupply.com
Mark Howard
TeleWire Supply, a division of ANTEC Corporation, is a leading international supplier of products needed to build and service a broadband communications network.
Reader Service #6

Telecrafter Products
12687 W. Cedar
Lakewood, CO 80228
(800) 257-2448; Fax:(303) 986-1042
Ronnie Cox and Jim Marzano
mail@dropsupplies.com
Supplier of drop installation products for CATV, DBS, and wireless operators, including drop cable fastening products for single or dual cable, cable identification markers, residential enclosures and more.
Reader Service #7, 9

Times Fiber Communications Inc.
358 Hall Avenue
Wallingford, CT 06492
(203) 265-8500; Fax: (203) 265-8749
www.timesfiber.com
(203) 265-8477
Rosemary O'Hanlon
The oldest and one of the largest and most technically advanced manufacturers of state-of-the-art coaxial cable, we can supply cables that meet the quality, durability and consistency you need to make your customers' business grow.
Reader Service #34

Toner Cable Equipment Inc.
969 Horsham Road
Horsham, PA 19044
(215) 675-2053; Fax:(215) 675-7543
www.tonercable.com
Info@tonrcable.com
Toner Cable Equipment has 26 years of RF experience as a single source supplier of equipment to the television distribution industry, providing headends, satellite receivers, meters, modulators, taps, splitters and fiber optics.
Reader Service #30

Toshiba
9740 Irvine Blvd.
Irvine, CA 92618
(714) 461-4654; Fax: (714) 583-3597
www.internet.toshiba.com
webmaster@toshiba.com
Steve Rasmussen (714) 587-6631
Toshiba offers MCNS modems and MCNS gateway solutions, plant and market analysis, system design, installation and maintenance. Toshiba's systems are operating in 6 major markets actively servicing over 12,000 cable subscribers.
Reader Service #4

Trilithic Inc.
9202 East 33rd Street
(800) 344-2412; Fax:(317) 895-3613
www.trilithic.com
Bob Jackson (317) 895-3600, ext. 152
bjackson@trilithic.com
Trilithic designs and manufacturers: Portable HFC test equipment; ingress monitoring systems; EAS compliance systems; RF and microwave components.
Reader Service #59, 61, 62, 92

Trilogy Communications Inc.
2910 Hwy. 80 East
Pearl, MS 39208
(800) 874-5649; (601) 932-4461
Fax: (601) 939-6637
www.trilogycoax.com
Scott Nelson (601) 932-4461
info@trilogycoax.com
Manufacturer of MC2, the first low-loss, exceptionally high quality trunk and feeder coax, which is ideal for CATV hybrid fiber coaxial (HFC) networks. Trilogy also offers a full line of quality MVP drop cables. ISO-9001 certified.
Reader Service #54

Trompeter Electronics
31186 La Baya Drive
Westlake Village, CA 91362
(818) 707-2020; Fax: (818) 707-0190
www.trompeter.com
Dale Reed (818) 865-6538
dale.reed@trompeter.com
Established in 1960, Trompeter is a USA manufacturer of high value wireline coax, triax, and twinax transmission line connectors, cable, and the tools required for assembly. In addition, the company has a broad line of patch panel insertion-controlled interconnect modules and a rapid response cable assembly business. The firm is ISO-9001 and enjoys an international presence in the Telecommunications, Broadcast, and Mil/Aero markets.
Reader Service #41

Tulsat
1605 E. Iola
Broken Arrow, OK 74012
(800) 331-5997; Fax:(918) 251-1138
Mark Schumacher and David Chymiak
Tulsat is stocking distributor for Blonder Tongue, Drake and California Amplifier. 70,000 square feet of complete repair facility and warehousing. Refurbished headend and line equipment, taps, traps, pin connectors and cable.
Reader Service #60, 73

Viewsonics Inc.
6454 E. Rogers Circle
Boca Raton, FL 33487
(561) 998-9594; Fax: (561) 998-3712
viewsonics.com
viewson@ix.netcom.com
Cynthia Ackerman
Designer & manufacturer of more than 200 products for the CATV & MMDS industries for over 23 years.
Reader Service #44

Wavetek Corporation
5808 Churchman Bypass
Indianapolis, Indiana 46203
(317) 788-9351; Fax:(317) 782-4607
www.wavetek.com
Gary Culbertson
One of the top ten test measurement cor[illegible]s in the world, Wavetek Cor- [illegible]lesigns, manufactures and m[illegible]orldwide a broad line of ele[illegible] test and measurement instruments for the cable television, telecommunications, wireless communications, radio, video, LAN, ATE and metrology markets. As the world leader in CATV test, Wavetek offers signal level, analysis, leakage and home wiring meters, sweep systems, headend monitoring and bench sweep equipment.
Reader Service #11

CABLE TRIVIA

Our history guru (aka Editor Rex Porter) has provided these trivia questions on the cable industry. Answers to the last set of questions appear first. (The last "Cable Trivia" ran on page 92 of the February issue.) The person supplying the most correct answers will be awarded a special Trivia T-shirt. You may win only once per calendar year.

To be in the running for a prize, your answers need to be postmarked or faxed to us by the 20th of the month of the issue date in which the specific trivia test appears. Good luck! Send your answers to: The Trivia Judge, *Communications Technology*, 6565 E. Preston, Mesa, AZ 85215 or fax: (602) 807-8319.

Trivia #21 answers

1) Today, we immediately recognize the acronym "EAS" to mean Emergency Alert System. In the early 80s, this company provided an addressable subscriber system composed of three units: a microprocessor control (EAS-1024), a decode (EAS-64) and a multitap switch assembly (EAS-16). The company's name: Electroline
2) Resigning his position as Federal Communications Commission commissioner in January 1995, he became president of the National Cable Telecommunications Association. He was: Fred Ford
3) A gin-pole is used to: construct a tower
4) A Canadian-made antenna that found use in the United States for long distance, wide-azimuth VHF TV reception was called: Terminated Rhombic
5) Rack-mounted, plug-in modular headend equipment was introduced by: CAS
6) U.S. TV broadcasting was debuted by: RCA at the New York Worlds Fair in 1939
7) The man who was editor/publisher of *Cablecasting/Cable TV Engineering* directed the actions of the engineers who formed the Society of Cable Telecommunications Engineers. He was: Charles Tepfer
8) Because there was no scholarship program available from the SCTE, he personally donated $2,500 in 1986, and the NCTI agreed to match his donation, dollar for dollar. He is: Rex Porter

Trivia #22

1) On Monday, July 8, 1997, Bill Gates met with top cable executives to demonstrate Microsoft's new set-top box. The software that Microsoft's system would use is:
   A) Windows 2000
   B) Windows CE
   C) CableSoft
   D) MicroWorks ➤

2) The 1994 SCTE Cable-Tec Expo was held in:
A) St. Louis
B) Nashville, TN
C) Orlando, FL
D) San Francisco

3) The 1995 SCTE Conference on Emerging Technologies was held in:
A) St. Louis
B) Nashville, TN
C) Orlando, FL
D) San Francisco

4) In 1994, these two giants scrapped their $4.9 billion deal, citing changes in FCC rate rules as the reason. They are:
A) TCI and Bell Atlantic
B) Cox and Southwestern Bell
C) EchoStar and NewsCorp
D) SNET and Cablevision Inc.

5) The FCC has selected, as cutoff date for TV stations transitioning from analog to digital broadcasting, the year:
A) 2006
B) 2010
C) 2008
D) 2005

6) The word "bit" is so named because:
A) Its value is so small.
B) It's a contraction of binary and digit.
C) It is used to bore into embedded messages.
D) It was given the name after Eugene Bittledorf, an early computer expert.

7) The Japanese word "Karaoke" means:
A) sing-along
B) unaccompanied
C) empty orchestra
D) with gusto

8) The digital encoding of the amplitude of a signal is known as:
A) PCM
B) scrambling
C) replication
D) quantizing

9) A byte contains:
A) 8 bits
B) 5 bits
C) 6 bits
D) 10 bits

10) In digital systems, a technique that rearranges the data in a specific way, usually to cause bursts of transmission errors to be spread out in the data, is called:
A) interlacing
B) intraframing
C) interleaving
D) hypertexting

And the winner is...

The winner for Cable Trivia #21 (which ran in the February issue) is Stephen Sherer of SLM Telkom Engineering, based in Rockford, IL. Congratulations, Stephen! CT

SCTE'S BROADBAND TECHNOLOGY COURSE

SCTE put the ducks in a row... ...to help you get your training needs off the ground.

SCTE will help your staff to train effectively in the classroom and in the field. SCTE's Broadband Technology Course gives your in-house training a running start.

All visual aids, videotapes, Leader Guides and Student Workshops are based on the Cable Television textbook. Student materials are available for less than $250 per person.

Help your training programs fly! Contact SCTE for further information by calling 610-363-6888, fax to 610-363-5898 or e-mail to info@scte.org.

Multi-mount UPS

Alpha Technologies has announced its Nexsys Multi-Mount UPS (uninterruptible power supply) for telecommunications applications. The UPSs are available in 600 VA, 900 VA and 1,250 VA ratings and can be set up in rack-mount, wall-mount or tower configurations.

The unit features high efficiency power conditioning and up to 30 minutes of run time, which can be extended via external battery packs. All batteries are hot-swappable and automatically charged, even when an external battery pack is connected.

Reader Service #308

Video Encoders

Analog Devices' ADV7175A and ADV7176A are intended for digital video disc (DVD) players, TV-output in DVD-equipped personal computers (PCs), PC multimedia video editing systems, digital set-top boxes, digital still cameras, video phones and professional studio and broadcast systems. The encoders comply with digital video industry standards and anti-copy protection.

The encoders provide more than 80 dB of signal-to-noise ratio (S/N) and differential gain and phase of 0.4% and 0.4 degrees, respectively. The units are designed to operate from either 3- or 5-volt supplies and drive 35 mA video-level signal at 75-ohm loads.

Reader Service #311

Scalable DWDM System

Ciena Corp. announced it will begin shipping its next generation of dense wavelength division multiplexing (DWDM) system for long-haul networks, the MultiWave 4000. The system delivers 40 channels in commercial production and 50 GHz channel spacing, half that of many current DWDM systems. The MultiWave 4000 can be upgraded from 40 to 96 channels on a channel-by-channel basis.

The system provides dynamic management of the optical layer and high stability for increasing channel densities. Its open architecture lets carriers mix synchronous optical network/synchronous digital hierarchy (SONET/SDH), asynchronous transfer mode (ATM) and Internet protocol (IP) networks. It also features short-reach interfaces, optical add/drop multiplexers, Erbium-doped fiber amplifiers (EDFAs), network management and the ability to scale in-service one channel at a time.

Reader Service #312

Down-sized Transmitters

Harmonic Lightwaves has introduced its PWRLink II line of compact 1,310 nm distributed feedback (DFB) laser transmitters. They're half the size of the company's earlier PWRLink transmitters, but offer the same performance.

The units are intended for operators who need to add all the extra equipment associated with providing more targeted services, such as Internet access. The new transmitter's small size yields more rack space without having to physically enlarge the hub to make room for additional equipment.

Reader Service #305

Multimode Terminators

The dataMate Division of Methode Electronics has introduced multimode terminators for wide ultra 2 SCSI (small computer system interface) systems, allowing longer cables and data transfer rates up to 80 Mbps.

The terminators' circuitry lets the bus switch between low voltage differential and single-ended devices. The units are available in SCSI II, III and .8 mm form factors and include shielding and thumb screws. The DM2750-01-LVD-SE series is designed for SCSI II and III. The DM800 series has the "D" shaped offset to the main body for side-by-side stacking in the small form factor.

Reader Service #310

Wave Division Multiplexer

Telebyte Technologies has introduced a wavelength division multiplexer (WDM) to expand the available bandwidth of existing fiber cables. The Model 381 WDM is passive and single-mode, doubling the carrying capacity of a fiber pair, and is protocol- and speed-independent. The stand-alone unit contains two WDM modules for full duplex from separate data sources. Its insertion loss is less than 0.3 dB for both channels, and isolation is at least 15.5 dB, with bandwidth at each wavelength within 40 nm. The unit is available with ST, SC or FC connectors.

Reader Service #309

AD INDEX

Reprints	(301) 340-7788, ext. 2009
List Sales	(301) 340-7788, ext. 2026
Customer Service	(800) 777-5006
Merchandise/Back Issues	(800) 877-5188
Editorial	(301) 340-7788, ext. 2134
Advertising	(301) 340-7788, ext. 2004

SCTE INSTALLER PROGRAM INFORMATION REQUEST CARD

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*.

☐ Please send me information and an application for the SCTE Installer Program

Name ______________________________

Address ______________________________

Phone (   ) ____________________ FAX (   ) ____________________

SCTE®

The Society of Cable Telecommunications Engineers
"Training, Certification, Standards"

Mail to:
SCTE
140 Philips Rd., Exton, PA 19341-1318
OR FAX TO: (610) 363-5898

The following lists of some of the videotapes available by mail order through the Society of Cable Telecommunications Engineers. Prices listed are for SCTE members only. Nonmembers must add 20% when ordering.

• *Fiber-Optic Architectures and Construction Practices*—This presentation covers fiber-optic design and construction. Topics include trunk and feeder, backbone fiber, fiber-to-feeder, fiber-to-service area, neutral network, passive network, procedures to initiate fiber construction, fiber-optic placement, aerial/underground, direct bury duct and installating fiber cable in ducts. (70 min.) Order T-1144, $45.

• *Test Procedures Under Technical Reregulation*—This program provides an overview of testing required by the Federal Communications Commission, as well as recommendations on how to perform these tests. Topics include carrier frequency, signal levels, signal level variations over time, in-channel response, carrier-to-noise (C/N), distortions, hum, baseband video and leakage. (70 min.) Order T-1146, $45.

• *Digital Compression*—This presentation is an introduction to digital video and compression. Topics include: weaknesses of analog NTSC video, why digital, why compression is necessary, intraframe compression vs. interframe compression, vector quantization concept, discrete cosine transform (DCT), how digital compression may be implemented cost-effectively in cable TV systems, where will the digital signals be located in the frequency spectrum, what will the next generation of digital set-top converters be like, and digital audio. (105 min.) Order T-1147, $45.

• *Fiber Optics, A Practical Approach*—This program covers the "pros and cons" of working with fiber, how to implement fiber and what to expect. Topics include: why use fiber, what architectures are best, fiber backbone, cable area network (CAN), flexible CAN, fiber-to-the-service area (FSA), fiber intermediate terminating trunk (FITT), fiber-to-the-feeder (FTF), how many fibers to run, where to expect significant labor costs, and how to plan for system and/or bandwidth expansion. (120 min.) Order T-1148, $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.

Shipping: Videotapes are shipped UPS. No P.O. boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: a $15 surcharge will be collected on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required, or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 140 Philips Rd., Exton, PA 19341-1318 or fax with credit card information to (610) 363-5898.

CALENDAR

3-6: NCTA National Show, Atlanta. Call (202) 775-3669.
4-8: Networld + Interop, Las Vegas. Call (415) 578-6900.
5: **Great Plains SCTE Chapter** technical seminar, JD Porterhouse, Bellevue, NE. Topic and speakers to be announced. Contact Daniel Karnish, (402) 597-5665.
5-7: **Philips Broadband Networks'** Mobile Training Center, Winnipeg, Manitoba, Canada. Contact Sarah London at (800) 448-5171, ext. 2273.
6: **Wheat State SCTE Chapter** testing session-Wichita, KS. BCT/E certification examinations to be administered. Contact Joe Cvetnich, (316) 262-4270.
12-14: **Philips Broadband Networks'** Mobile Training Center, Minneapolis. Contact Sarah London at (800) 448-5171, ext. 2273.
14: **SCTE Satellite Tele-Seminar Program**, Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Topic: "The American Campus, Opportunity or Not." Contact SCTE national headquarters, Janene Martin, (610) 363-6888, ext. 220.
18-20: **National Cable Television Center and Museum**, with the University of Denver, data/Internet business conference, Denver. Call (303) 871-4885.
18-21: **Canadian Cable Television Association** Convention & Expo, Toronto, ON. Call (613) 232- 2631.
20: **Oklahoma SCTE Chapter** testing session, Edmond, OK. BCT/E, Service Technician and Telephony certification exams to be administered. Contact Tom Heddlesten, (405) 348-5750, ext. 312.
20: **Piedmont SCTE Chapter** technical seminar and testing session, Charlotte, NC. Topic: "FCC Issues, Color Testing, Proof, EAS Standards" with speakers to be announced. BCT/E certification examinations to be administered. Contact Mark Eagle, (919) 829-2630.

Planning Ahead

June 7-11: SuperComm, Atlanta. Call (202) 326-7300.
June 10-13: SCTE Cable-Tec Expo, Denver. Call (610) 363-6888.
July 8-10: Wireless Cable Show, Philadelphia. Call (202) 452-7823.
July 20-23: New England Cable Television Association, Newport, RI. Call (617) 843-3418.
July 27-31: Fiber U & Wire U, Boston. Call (800) 537-8254.
Sept. 22-24: Great Lakes Cable Expo, Chicago. Call (317) 845-8100.
Sept. 30-Oct. 1: Private & Wireless Show, Dallas. Call (713) 975-0030.

20-23: **Southern California SCTE Chapter** testing session, Alhambra, CA. BCT/E certification exams to be administered. Contact Charles Harper, (714) 816-0570. CT

Real-World

Technology

Solutions

for the

Serious

Cable

Engineering

Professional

Serious

Show Daily

This year's SCTE Cable-Tec Expo promises to be SCTE's biggest ever, with more booths, attendees, product demonstrations and training sessions than ever before. How can you pre-plan your days and get the most from your limited time on the show floor?

Communications Technology's Cable-Tec Expo '98 Show Daily can help. Printed each morning of the show, the glossy, full-color *Daily* brings you the news, announcements and events you can't afford to miss, including:

- New Product Announcements
- Breaking News from the Show Floor
- Product Demonstrations
- Session Wrap-Ups
- Show Floor Maps
- Exhibitor Listings
- Schedule of Events
- Post-Show Activities

Make the most of your time in Denver. Pick up your FREE copy each morning!

Distributed All 3 Days At:

- Selected Show Hotels
- Every Cable-Tec Session & Workshop
- Publication Bins
- CT's Booth—#309

Advertisers—There's still time to reach thousands of Cable-Tec attendees each day of the show. But hurry—sales close May 18!

Contact: Tim Hermes, Associate Publisher
Tel: 301-340-7788 x 2004
Fax: 301-340-0542
E-mail: thermes@phillips.com

Communications Technology

Phillips

Phillips Business Information, Inc.
1201 Seven Locks Road › Potomac, MD 20854
Subscriptions: (800)777-5006 › Advertising: (301)340-1520 x2004
URL: *http://www.ctinfosite.com*

NORTH AMERICAN CABLE EQUIPMENT, INC.

Your Source For Commercial And Residential
CATV And Satellite Equipment
Call For Our 176 Page Catalog

- Belden
- Blonder Tongue
- CommScope
- Gilbert
- Sadelco
- Qintar
- Winegard
- Chaparral
- Videonics
- Nextwave
- KTI
- DLS
- Video Mount Products
- Microwave Filter Co.
- Force, Inc.
- Thomas & Betts
- Cable•Tronix
- Pico Macom
- Holland Electronics
- Sony Satellite
- Atlas/Soundolier
- Champion
- California Amplifier
- Grundig
- Spaun
- Norsat
- Tyton
- Telecrafter
- Middle Atlantic
- Newpoint
- Arrow Fastener Co.
- West Penn Wire

PHONE: (800) 688-9282
FAX: (610) 429-3060
3 Locations To Serve You NV, TX, PA

Quality Cable & Electronics Inc.

1950 NW 44th Street, Pompano Bch., Fl. 33064
Tel: (954) 978-8845 Fax: (954) 978-8831
Internet: http://www.QualityCable.com

Scientific Atlanta
Holland
Eagle
Belden
Jerrold

Magnavox
Comm/Scope
Pico Macom

Cable-ing the world....

Headend / Line Equipment / Drop Material / Converters

(800) 978-8845

WE BUY & SELL
SURPLUS NEW & USED

Connectors, Taps,
Headend, Line Gear, Misc.

TM BROKERS

5402 Highway 95 - Cocolalla, ID 83813
Tel: (208) 683-2797 or (208) 683-2019
Fax: (208) 683-2374
SEE INVENTORY ON HOME PAGE
EMAIL:moorst@comtch.iea.com
HOME PAGE:http://www.iea.com/-moorst
We Accept M/C or Visa

When You Need Quality and Dependability, You Need

RITE CABLE CONSTRUCTION, INC.

Specializing in

Telecommunications Construction – Including Strand Mapping, Asbuilt Mapping, Fiber Optic Routing & Design, Splicing Schematic, Map Digitizing, System Design, Project Management, Fiber Splicing & Testing, Aerial & Underground Construction, Coaxial Splicing & Activation, System Sweep & Proof of Performance Testing, Complete Residential Installation, MDU Pre-Wire/Post Wire & Material Management.

"Do it the RITE way the first time."

Les Smith, President
P.O. Box 3040 (32723-3040)
1207 S. Woodland Blvd., Suite 1
DeLand, FL 32720

1-800-327-0280
Fax: 1-904-738-0870

INSPECT • PAINT • REPAIR • RE-GUY • LIGHTING • ANTENNA
FEEDLINES • ANALYSIS • ERECT • DISMANTLE • LINE SWEEPING

HERMAN J. JOHNSTON
PRESIDENT
MOBILE (502) 830 2584
RES (502) 830-9246

NATIONWIDE TOWER COMPANY

BROADCAST • C A T V • MICROWAVE
CELLULAR • PCS • WIRELESS TOWERS

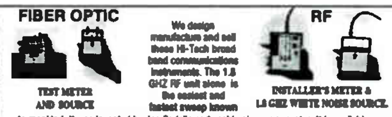
P O BOX 130 • POOLE, KENTUCKY 42444
TEL (502) 533-6600 • FAX (502) 533 0044

FREE 44pg Catalog & 80 Audio/Video Applic.

OPAMP LABS INC (213) 934-3566
1033 N Sycamore Av LOS ANGELES CA, 90038
http://www.opamplabs.com

FIBER OPTIC

RF



We design manufacture and sell these Hi-Tech broad band communications instruments. The 1.8 GHZ RF unit alone is the easiest and fastest sweep known to mankind. It was invented by Joe Sadel's early cable pioneer ancestor. It is available with facility for producing gigabit simulated digital packets for system testing.

Our Service department can troubleshoot, repair and calibrate all your electronic processors, modulators, etc. From the headend to the home. Call for a quotation.

CALL JOE SADEL
Santa Barbara, CA 93105
TEL/FAX 805 682-3341

TECHNICAL SUPERVISOR

RESPONSIBLE FOR OUTSIDE PLANT - INCLUDING HEADEND FOR 2,000 ADDRESSABLE SUBSCRIBERS. CONTACT GENERAL MANAGER AT 719-576-2387 OR FAX RESUME TO 719-579-8231.

CHARTER COMMUNICATIONS
CABLE TV OF FORT CARSON, CO
EOE

New Construction • Installs • Balancing • Splicing

Bigham

Cable Construction, Inc.
Performance Built Our Company
Specializing In Rebuilds and
Fiber Optic Installation & Splicing

Harold Bigham
(850) 932-6869

P.O Box 903
Gulf Breeze, FL 32562

JONES BROADBAND INTERNATIONAL

WE BUY AND SELL QUALITY CATV EQUIPMENT

LINE AMPLIFIERS, TAPS, CONNECTORS
CONVERTERS - ALL TYPES AND MAKES
HEADEND EQUIPMENT

USA • (760) 631-2324 • Fax (760) 631-1184

CableTools CADD

Get FREE design tools on the Internet - **www.cabletools.com**

1-800-465-5652
(609) 346-2778

GoldCom Inc.
www.goldcominc.com

System Design / CAD Software - Simple, Powerful, Affordable

BRIDGEPOINT

COMMUNICATIONS INC.

Aerial	Underground
New Build	Rebuild
Fiber Placement	Upgrade Splicing
Installations	Splicing

(800) 766-2188

DALLAS • HOUSTON • PHOENIX • BOSTON • HONOLULU

NEW YEAR CLEARANCE SALE

remotes — topcases — converters — parts — accessories

compatible remotes for all models in stock

remote controls	brand new	from	$2.95
bezels & lenses	brand new	from	$0.75
batteries (all sizes)	bulk rates	from	$0.14

brand new topcases for SA converters

SA 8600	with lens	new	$2.95
SA 8590 phase II	with lens	new	$2.95
SA 8520	with lens	new	$2.95
SA 8500	with lens	new	$2.95

full-featured new converters at cut-rate prices

99 channels	infrared remote	favorite channel
switched AC	parental lockout	skip channel
last channel	sleep timer	auto fine-tune
550 mhz	channel memory	ch. 3 output

new converters....from $45 with volume......from $69

CALL NOW! 800-644-6682 LOWEST PRICES!

CCI CABLE CONSTRUCTORS, INC.

COMPLETE TURNKEY CONSTRUCTION 1-800-338-9299

- Coaxial and Fiber
- Mapping and Design
- Member SCTE
- Splicing and Activation
- Fusion Splicing
- Aerial, Underground & Fiber Construction
- Material Supply
- Emergency Fiber Restoration
- System Sweep
- Proof of Performance
- Turnkey Headend
- Complete Turnkey Project Management

quality service performed on a timely basis

E-MAIL cci@cableconstructors.com • http://www.cableconstructors.com

PDI SURPLUS EQUIPMENT

We Buy, Sell and Trade! New or Refurbished

- Trunk Amps
- Line Extenders
- Taps
- Converters
- Test Equipment
- and much more!!!

All equipment is refurbished and tested in PDI's state of the art test facility.

1 year warranty on all surplus equipment!!

1-800-242-1606 (561) 998-0600 FAX: (561) 998-0608
http://www.pdi-eft.com E-Mail JonPDI@aol.com

White Sands

Jumper Cables

CUSTOM MADE CABLE ASSEMBLIES INCLUDING:
F to F, N to N, BNC, RCA, F-81

Gilbert AHS	RG-56	Belden
LRC	RG-59	Times
Off Shore	RG-11	Comm/Scope
PPC	RG-213	Intercomp
	RG-214	

We will make any cable assembly. Quick delivery on all colors and lengths.
Fax: (602) 582-2915, PH: (602) 581-0331
335 W. Melinda Drive, Phoenix, AZ. 85027 USA

CDS CAD DRAFTING SERVICES, INC.

Charles Wright
(815) 698-2564
Rt. 116 & I-57, Central Plaza
Ashkum, IL 60911

- Base Mapping
- Strand Mapping
- Digitizing Services
- As-Built Mapping
- System Design
- System Walkout

Specializing in high volume precision drafting.

"Quality service for all your cable drafting and design needs."

Call for literature.

BUSINESS DIRECTORY

PTL Test Equipment, Inc.

100's of Items in Stock!

- Quality Pre-owned, Current Models
- Hundreds of items just arrived
- Guaranteed to meet OEM Specifications
- Volumn Discounts Available
- HP, Tektronix, Wavetek, Trilithic, Calan, ect.

- ✔ Signal Level Meters
- ✔ Video Testing
- ✔ Network Analyzers
- ✔ TDR's
- ✔ Bench Sweeps
- ✔ Spectrum Analyzers
- ✔ Leakage Detectors
- ✔ Sweep Systems
- ✔ Return Alignment
- ✔ Fiber Optics

Phone: (561) 747-3647 **Fax: (561) 575-4635**

BUY-SELL-LEASE-TRADE

Colorize Your Trays

Use *ColorTubes*™ to organize splice trays with COLORED FURCATION TUBING

End the frustration of finding identifying tapes & tags piled in the bottom of the tray

Call JAC at (800) 262-2929
Ask for ColorTubes™
color-coded furcation tubing

Industry Service Since 1966

ROCKY MOUNTAIN JUMPER CABLES
P.O. Box 9707 • Helena, MT. 59604

Custom Made Jumper Assemblies
All Brands Fittings/Cable

- F Male
- F Female
- BNC
- PL
- RG - 59
- RG - 56
- RG - 11
- Other

Our jumpers never leave our plant during construction, insuring inspection of each phase of construction. Our quality control insures you of the lowest RF leakage possibe.
Call for pricing and free sample. (406) 458-6563

Bought too much material for a job? Order Cancelled? Stuck with short length reels?

Turn That Excess Inventory Into Extra Cash Today!

We are always offering you the highest prices for all your surplus wire and cable. Fax or mail us your inventory!

ALWAYS BUYING • ALWAYS SELLING

LIVE WIRE & CABLE

We guarantee that all stock material is priced lower than the factory and is always new and unused. Remember to call Live Wire with all your wire and cable needs, because in this very competitive marketplace, a call to Live Wire could make the difference between writing an order and losing one. Selling exclusively through distribution. All materials subject to prior sale.

1-888-897-6008
847-577-LIVE • FAX: 847-577-5485
(5483)
E-Mail: LIVEWIRECS@AOL.COM

---

dB-tronics

Supporting Broadband Networks Worldwide

BUY | SELL | REPAIR | RMF

Free Pickup & Delivery Service Available

864-574-0155
Fax 864-574-0383
sales@dbtronics.com
http://www.dbtronics.com

- **PPV Set-tops**
- **Custom Manufacturing**
- **S-A & C-COR 750MHZ EQ's**
- **Mag 550MHZ Upgrades, Reverse Ready**
- **Addressable Control Replacement for SM4/5**
- **Integration Services for Advanced Technology**

Scientific Atlanta

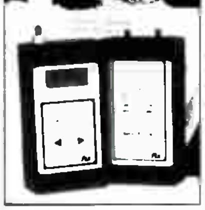
Accepting Mastercard and VISA

FIBER OPTIC TEST SET

Test With Confidence

- *A hand held custom built set for LAN, Telco & CATV Applications.*
- *Zero Set Power Meter*
- *Select a dual/single LED or Laser Light Source*
- *User's choice Adapter, ruggedized rubber holster & 9 volt Alkaline battery provided*
- *Packaged in a field carrying case*

Starting at $695



For More Information Call

1 800 5000 fis

FIBER INSTRUMENT SALES INC.
BUILDING YOUR NETWORK
161 Clear Rd. Oriskany, NY 13424 • Tel: 315-736-2206
Fax: 315-736-2285 • www.fisfiber.com • www.fis@borg.com

BUY • SELL • TRADE • REPAIR • UPGRADE • BUY • SELL

MAIN LINE EQUIPMENT INC.

WE BUY, SELL, AND REFURBISH PRE-OWNED LINE GEAR, CONVERTERS, PASSIVES AND FIBEROPTIC EQUIPMENT

WE STOCK NEW, ACTIVE ELECTRONICS AND PASSIVES
SCIENTIFIC ATLANTA, TEXSCAN (T-SERIES/PATS)
GEN. INST./JEROLD, PHILIPS/MAGNAVOX

SEE OUR FULL PAGE AD ON PAGE 101

TOP DOLLAR PAID FOR YOUR OBSOLETE INVENTORY!
WE MANUFACTURE REPLACEMENT PADS, EQUALIZERS AND PLUG-IN'S

PH: 800.444.2288/310.715.6518 • FAX: 888.4.MAINLINE/310.715.6695
EMAIL: MAINLINE@WORLDNET.ATT.NET • WEBSITE: WWW.MLE.COM

UPGRADE • REPAIR • TRADE • TRADE • REPAIR • UPGRADE

BUY • SELL • TRADE • REPAIR • UPGRADE • BUY • SELL

TESINC

6523 N. Black Canyon Highway
Suite 200
Phoenix, Arizona 85015
(602) 242-8110 FAX (602) 242-8227

t•e•s•i•n•c
A Dycom Company

CATV IMMEDIATE OPENINGS in CA &

RF ENG's	INSPECTORS
LODE DATA MDU	AERIAL UG MDU
DRAFTERS	**TECHNICIANS**
AUTOCAD CATV & TELEPHONE	HEAD END SWEEP/FCC PROOF SERVICE

An Equal Opportunity Employer

Call Judi: 1-800-800-7886

Wanted!

Experienced long term help for
Southeast rebuilds/upgrades

Aerial Crews
Fiber Optic Crews
Underground Crews
Splicers
Installers
Field Engineers

CABLE MAN, INC.
Call (601) 374-5832
Fax: (601) 374-2198

CABLE SEARCH ASSOCIATES

Professional Search & Placement

Engineering
Management
Technicians
Sales
Marketing
Construction

Call or Write:
Wick Kirby
P.O. Box 2347
Naperville, IL 60567
630-369-2620
630-369-0126 fax
wickkirby@aol.com

FEES PAID

Adelphia

REGIONAL TECHNICAL TRAINERS

Don't let a rewarding opportunity pass you by...consider Adelphia for a challenging career opportunity. Adelphia has several openings for Regional Technical Trainers in several locations. Adelphia offers excellent benefits, a 401(k) plan, competitive salaries and a fully paid relocation package.

The Regional Technical Trainer will actively work with all technical employees in establishing technical skills and performing audits.

To qualify, a high school diploma or equivalent is required. Certification in safe pole climbing and ladder handling skill are required. Five years experience as a Field Technician with the cable communications industry is preferred. A strong background in installation, service and maintenance procedures and practices will be helpful when troubleshooting. Computer skills are preferred. Must demonstrate proficiency in CATV equipment used for testing and measurements such as multimeter, signal level meter, spectrum analyzer, and sweep receiver. Must be able to climb poles (using gaffs) and ladders, carry, setup and extend ladders weighing up to 70 pounds, lift up to 100 pounds.

Successful applicants must pass drug test, physical, criminal background check and driving record check.

Resumes will be accepted until May 31, 1998, or until filled thereafter. Qualified applicants should submit a resume to the following address:

ADELPHIA
c/o Recruiting Dept.
CC7093-A
Main at Water Street
Coudersport, PA 16915

Adelphia is an EEO Employer

CATV PROJECT MANAGERS

We are a leader in the Telecommunications Industry, looking for dedicated and successful Project Managers, who are committed to excellence. Project Managers will be responsible for the completion of upgrade and rebuild projects. Construction projects will include aerial and underground placement of fiber and coaxial cable, node activation as well as power supply construction. Managers must have demonstrated successful planning, directing and coordination of construction projects. Please forward resumes to:

Project Manager CTM
PBI, 1900 Grant Street, Suite 720
Denver, CO 80203

Garden State Cable TV

is MOVING FAST

and NOT LOOKING BACK!!!

If you are ready to enter the millennium with a company that prides itself on cutting-edge technology, then Garden State Cable TV is where you want to be. We have an exciting opportunity available:

HUBSITE TECHNICIAN

(Greater Philadelphia)

Garden State Cable TV is seeking a Hubsite Technician. We are a progressive company operating 4,000 miles of a 750 MHz 2-way active plant. Our signals pass 300,000 homes serving 210,000 customers. An advanced, fully redundant, digital/analog fiber optic network connects a master headend to multiple hubsites. In addition to providing conventional television signals, Garden State provides high speed Internet access to 130 schools, and high speed point-to-point data links to commercial customers. Garden State has been offering impulse PPV for 14 years utilizing three different addressable systems, which support advanced analog capability.

Garden State CABLE TV

The successful applicant will have formal electronics training and a minimum of 5 years experience in headend maintenance. Strong RF and video background is a must.

Garden State Cable TV offers a superb benefits package and compensation. For immediate consideration, please fax your resume to: (609) 795-4916 and reference job number: 98-17. Equal opportunity Employer.

GET READY FOR RESULTS... FAST!! WITH Communications Technology CLASSIFIEDS.

FAX YOUR AD OR CALL
NICOLE BOVRE AT
303-839-1565 extension 33
303-839-1564 fax

FIBERTECHS

For Excellence in Fiber optics

Splicing • Testing • Restoration

Qualified Technical Crews on-site Overnight
Excellent references - Competitive Pricing
Call today for more information!!!

800-704-0444 Call about Job Opportunities!

Peter Froehlich & Co. executive search

SCTE Sustaining Member

P.O. Box 339 Weatherford, TX 76086
(800) 742-4947 FAX (817) 594-1337
email: pfsearch@flash.net
web: http://www.flash.net/~pfsearch

All levels of Technical Positions - Corporate to Hourly. Operators and Manufacturers

Call or Write. Fees Paid.

Since 1975 we have served the cable-tv industry by matching talent with opportunity

Jim Young & Associates
One Young Plaza, Weatherford, Texas 76086
Call (800) 433-2160 • Fax (817) 599-4483 • E-mail: jyoung@staffing.net

BARCO — CATV Application Specialist

BARCO Communication Systems, located in Kennesaw, GA, seeks CATV Application Specialist as key contact to provide demos, product applications, seminars, system training, trade shows, problem resolution, monitor CATV standards development. Some travel required. AET or BSEE + 5-10 yrs. experience in cable head-end design / maintenance. Excellent communication skills required. Please forward resume and salary requirements to BARCO, Inc. 3240 Town Point Drive Attn: HR-SP, Kennesaw, GA 30144 or fax to 770 218-3357

SALES REPS

Fibertek **PULLTAPE™ & TRACERTAPE™** products are looking for aggressive TELCOM/CATV reps calling on OSP CONTRACTORS in selected territories. Excellent commission structure and the best factory support you have ever had. Call factory for details. Pete Kutz or Jim Friel 615-794-1400

FIBERTEK

With *Communications Technology* Classifieds you hit the mark every time!

We connect you with the buyers of cable system equipment & hardware

Call Nicole Bovre at 1-800-325-0156, extension 33

for *your* Classified Advertising

Break the Bank

[Not your Budget]

- **Want to generate solid sales leads while staying within your budget?**

Phillips mailing lists are the affordable solution!

With over 30 different high-tech lists from which to choose, Phillips will **maximize** your profits while **minimizing** your costs!

Access the industry's most influential decision-makers...

Call Susan Incarnato today at (301)340-7788, ext. 2026 or fax (301)738-7581 to find out why Phillips is your affordable mailing list solution!

Phillips Business List Sales
Your Direct Response Solution!

CUSTOMER SERVICE

At Communications Technology The Customer is Always #1

Phillips Business Information, Inc.
Client Services
1201 Seven Locks Road, Suite 300
Potomac, MD 20854

- Subscriptions
- Additional Products
- Back Issues
- Address Changes
- Comments or Requests
- Bulk Orders

FAX US YOUR COMMENTS TODAY!

Your opinions and feedback are important to us.

Name ______ Date ______
Company ______ Title ______
Phone ______ Fax ______

FAX COMMENTS BACK TO (301) 340-7136. THANK YOU!

BUSINESS DIRECTORY

Troubleshooting Drop Reliability, Part 2

This month's installment wraps up the six-step technique for drop troubleshooting. The material is adapted from a new lesson in NCTI's Installer Technician Course. © NCTI.

Six-step troubleshooting technique

- ☐ 1. Identification
- ☐ 2. Analysis
- ☐ 3. Location
- ☐ 4. Diagnosis
- ☐ 5. Repair
- ☐ 6. Testing

As covered in Part 1, this troubleshooting technique includes: (1) identification, (2) analysis, (3) location, (4) diagnosis, (5) repair and (6) testing. The following focuses on Steps 3 through 6.

Locating the problem

In most instances, using the divide-and-conquer approach helps narrow down your search and isolate the source of the problem. Basically, keep "dividing" the drop system in "half" while making measurements on smaller and smaller sections until locating the source of the problem. It is during this process that your list of suspected causes can efficiently direct your attention to specific areas or components.

Selecting a reference measurement point—Verifying that a drop system's signal source is good is critical to troubleshooting. For drop systems, the tap is considered the signal source. However, going right to the tap port feeding that customer premises to make measurements is usually less efficient than measuring signal levels first at the ground block (especially with aerial drops or where the pedestal is in another yard). If the signal levels are wrong at the input to the ground block, then go to the tap. Measure the signal levels for the symptoms (no measurable signal or signal impairments) already identified. If the same symptoms appear at the tap, notify your supervisor that the problem's cause appears to be upstream of the drop system.

Finding the problem span or device—Providing your reference measurements show the signal is acceptable, systematically move downstream, check a point approximately halfway between the point of the reference measurements (the ground block or tap) and the outlet where the problem was originally identified. In reality, halfway is not a measure of distance, but rather points of demarcation (tap, ground block, splitter, directional coupler, wall plate, set-top terminal, TV set). Keep checking and moving downstream until the problem symptoms are present again. Next, working back upstream, check the signal level at a point halfway between the point of demarcation where the symptoms reappeared and the last point that checked out OK. Repeat this process until there are no more demarcation points between where there is a proper signal level and the point downstream from there where the problem symptoms first appear.

Diagnosing the problem

Once the problem's location is isolated, determining what's wrong with the suspect cable span, connector or other device enables you to perform an effective repair. Knowing how each component in the drop should perform enables you to diagnose the problem accurately. This diagnosis involves thoroughly inspecting and testing the suspected problem source. Measuring signal levels for abnormal through-loss in a span or device can reveal the extent of the problem. Temporarily removing or replacing the defective component(s) and rechecking for the problem symptoms will confirm the diagnosis.

Repairing the problem

It may be necessary to notify the customer of your findings and plans to correct the situation before starting repairs. In any case, assemble the necessary tools and replacement parts, and effect a permanent resolution of the problem according to your system's policies and procedures. Before proceeding to the final step, always clean up the work area(s).

Testing to ensure problem is resolved

An important final task is returning to the original outlet where the problem was first identified to ensure the problem is, in fact, resolved. Once you are convinced the problem is fixed, always confirm that the customer is satisfied with your efforts.

Hands-on performance training

Proficiency objective: Successfully resolve reliability problems in the drop system using the six-step troubleshooting technique.

Ensure that you have enough test equipment and a sufficient number of workstations for the number of students to practice troubleshooting on. Each workstation should have a live broadband signal feed and simulate either a complete drop system or a portion of it (segment the drop system at points of demarcation). Install known defective or purposely compromised drop system component(s) in selected/all workstations. For the identification step, take on the role of the customer or provide printed scenarios for students to use.

Demonstrate how to effectively use the six-step troubleshooting technique. Explain/demonstrate the importance of checking the obvious first and that going through all six steps may not be necessary in every case.

Have students practice troubleshooting some/all types of problems affecting drop system reliability.

Verify that each student can successfully resolve reliability problems in the drop system using the six-step technique. CT

MOORE

Fiber Optics/Power Supply And Network Distribution Enclosure

Cross Connect Cabinet

This engineered enclosure is specifically designed by Moore to house fiber optic cable, standby power supply equipment and the electronics found on digital loop architectures used to support the delivery of voice, data, video and information services.

Internal support and storage components can be custom selected based on the specific electronics and powering designs. Overall dimensions vary depending on system requirements.

Call today to learn how Moore solutions can benefit your business.

1441 Sunshine Lane • Lexington, KY • 40505-2918 • Phone: 800-769-1441
Fax: 606-299-6653 • Internet: http://www.mooredp.com

Reader Service Number 96

By Bill Riker

SCTE: 1998 and Beyond

The next millennium. The 21st century. A new era. Whatever you're calling it these days, the reality is that the year 2000 is only 19 months away. Looking into the future, where will you be professionally at that important milestone?

Regardless of whether you're a member of the Society of Cable Telecommunications Engineers today, by the year 2000 you should be. And, in light of the way technologies, industries and companies are converging now, I'd even venture to say that to keep up with our business's lightning pace, you will have to be. Why will the Society play such a crucial role in your future? I'll give you three reasons: technical training, professional certification and industry-leading standards development.

More than just being the Society's mission statement, "Training, Certification, Standards" is synonymous with the growth of broadband telecommunications. During its semi-annual meeting held here in Exton, PA, in March, the SCTE Board of Directors carefully evaluated how each of these entities can be factored into the professional success of all cable employees in some way.

Members of the board and national headquarters staff alike took the "bull by the horns" and set a new precedent for the Society. Throughout the week, combinations of these two groups converged to pave the Society's way as an invaluable resource to the broadband community into the next century. From standing committee meetings to the day-long staff planning and team-building sessions, the synergy of these conferences produced countless numbers of new ideas that we hope to implement soon, as well as new approaches to our existing programs and services.

SWOT

For starters, all eyes were on the future of SCTE during the intensive "Strengths, Weaknesses, Opportunities and Threats" (SWOT) analysis in which the board and select staff members discerned exactly where the Society is headed in the next 19+ months. I'd like to personally thank association consultant Joe Simonetta for facilitating what was a highly productive SWOT planning session. With his help, we were able to set many goals to the benefit of our members and the industry at large.

Improved communication

First and foremost on that list of goals: SCTE will become an even more communicative organization to its members. We already have taken steps to make this happen by offering several brand-new services that allow you to take charge of your role within the Society—all day, every day. For example, our recently revamped Web site includes a search engine and new user-friendly features, as well as a multitude of opportunities for interaction with the Society's professional staff and local groups. For the first time, our members can update their own records and stay abreast of new member benefits, all with a few clicks of the mouse.

Another relatively new service designed to make obtaining information about your Society much easier is the SCTE FaxBack service. Linking the Society's voice mail and computer system, FaxBack provides access to our latest training and testing calendars, registration materials for SCTE's national conferences and membership information 24 hours a day, seven days a week.

Improved survey

An improved membership survey is yet another way the Society has opened the door to change. In fact, it's probably sitting in your in-box right now. This annual survey gives you the unique opportunity to tell us what you really think of the Society. Take a moment and fill it out; you'll be doing your peers a favor by making SCTE a stronger force in the industry.

One of the reasons we encourage you to participate in this survey is so that you can help us improve our programs and services. Your feedback is very valuable to us in helping to meet our objectives. For example, one of our goals is to update our Broadband Communications Technician/Engineer (BCT/E) Certification Program by early 1999. We also intend to be 20,000 members strong by the start of Cable-Tec Expo 2000 in Las Vegas. We're taking our technical training to new heights through the introduction of new materials, new methods and new information. And we're making great strides in the area of standards development. Your opinions and suggestions can help shape our long-term plans to meet and exceed these goals.

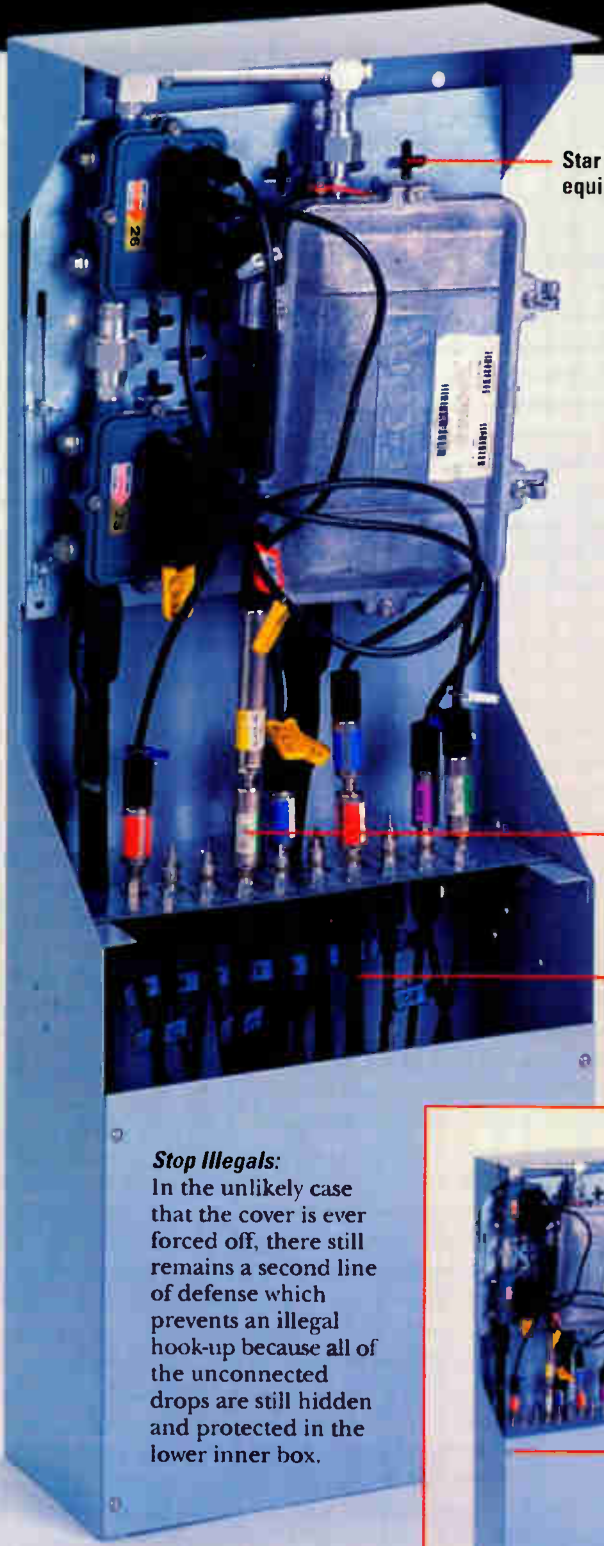
As you can see, we've got our work cut out for us, but we're already well on our way to making these plans a reality. The end result is that the Society will continue to guide you through the changes and challenges of broadband telecommunications.

So, whether you're a vice president of engineering with years of technical experience or a new customer service representative with no technical background, SCTE can provide you with the latest information to make you more knowledgeable in your job and, in turn, a more effective player in the industry. We're here for you—in 1998 and beyond. CT

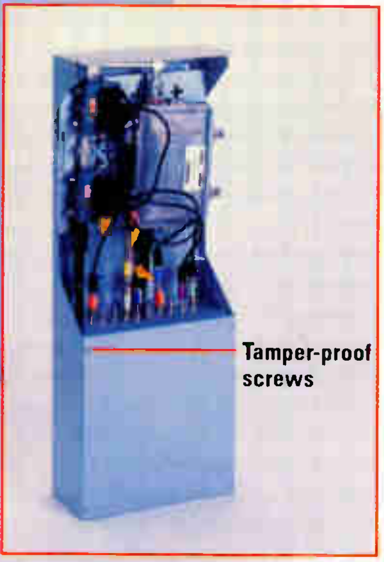
Bill Riker is president of the Society of Cable Telecommunications Engineers.

High Security Protection

Tom Ped Double Box Pedestal



Stop Illegals:
In the unlikely case that the cover is ever forced off, there still remains a second line of defense which prevents an illegal hook-up because all of the unconnected drops are still hidden and protected in the lower inner box.

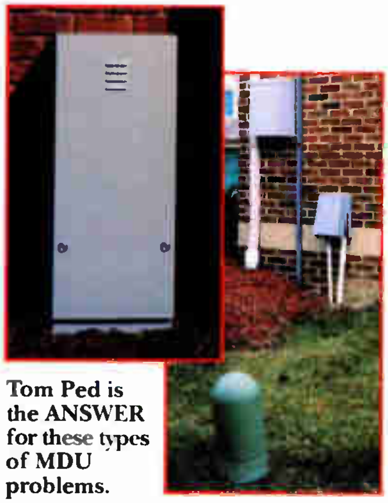


Patent Pending

Increased Security
Decreased Cost
Cleaner Installation

The only hybrid high security box-in-a-box and pedestal enclosure in one. Designed for broadband multimedia systems.

The concept offers two levels of high security against illegal hook-ups and keeps your cable well managed. Can be firmly bolted to the wall or staked to the ground.



Tom Ped is the ANSWER for these types of MDU problems.

For More Information Contact:

Multilink™
Technologies Group
580 Ternes Avenue
P.O. Box 955, Elyria, OH 44035
Phone (440) 366-6966 **FAX** (440) 366-6802
Internet:
http://www.multilinkinc.com/multilinkinc
E-mail: MuLink@ix.netcom.com

24 Hour Voice Messaging
Worldwide Distribution