Communications Technology

Official Trade Journal of the Society of Cable Telecommunications Engineers

November 1997

Signal Security

Lock Up Your Conditional Access Strategy

Planning '98, Part 2

Get Ready For Enhanced Services

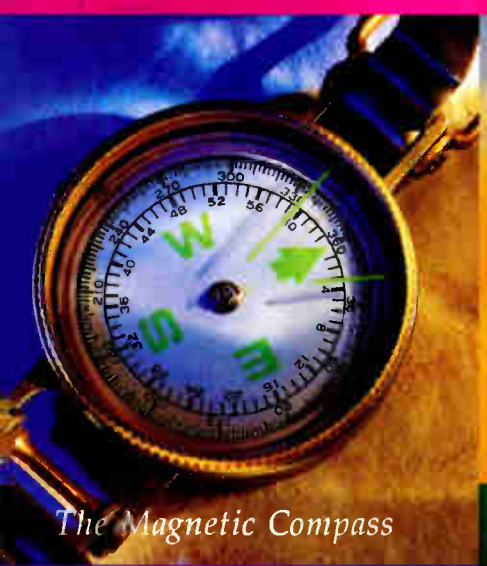
ONLY A FEW THINGS IN LIFE ARE THIS RELIABLE.

As sure as the sun rises, you can count on the Continuum™ Headend System for exceptionally dependable video delivery. Advanced hardware design features like gold plated interconnections and a fully passive back-plane ensure continuous service and peak performance. For proactive headend management, Continuum's Headend Management System (HMS) provides full remote control, status monitoring and automatic backup 24 hours a day. Make your headend one to count on—call 1-888-HEADEND today for a complete information package.

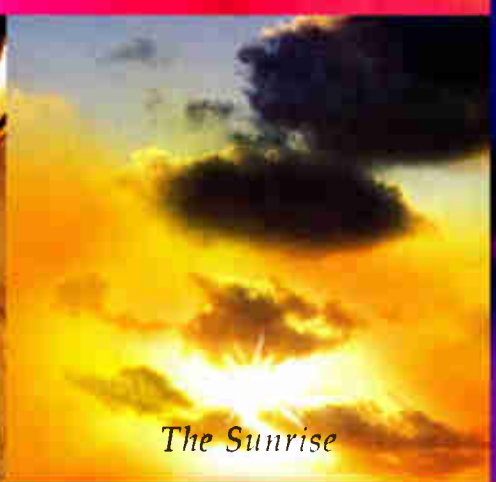
http//www.sciatl.com

Scientific Atlanta™

The Atomic Clock

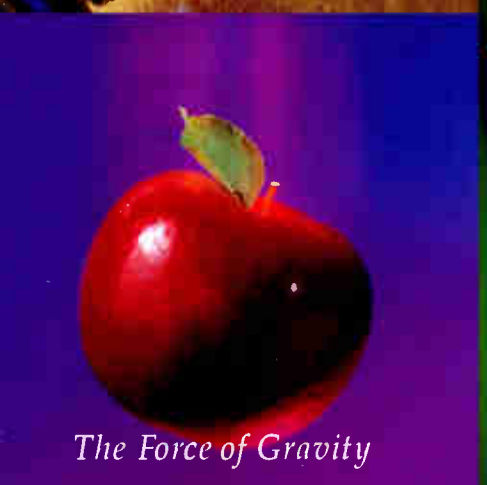


The Magnetic Compass



The Sunrise

The Bloodhound's Nose



The Force of Gravity

The Continuum Headend System

CONTINUUM HEADEND SYSTEM

Platform for the 21st Century

Reader Service Number 200

Not All QAM Signals Are Measured The Same

Sencore's New QAM Analysis Meters Provide:

- Full Frequency/Channel Tuning
- Digital Power/Level Measurements
- Exclusive Estimated BER Testing
- Digital Equalization Measurement
- Quick Good/Bad Visual Test For Acceptable Levels
- All Weather Proof Design

Includes Sencore's Exclusive 3-Year Warranty.

Sencore offers a QAM Analysis meter designed specifically for your system and its unique testing requirements. To find out how we can solve your digital testing needs, simply call us at 1-800-SENCORE.

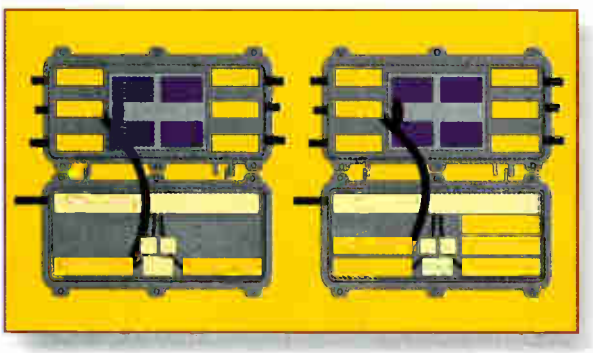
SENCORE

Reader Service Number 144

contents

FEATURES

Conditional Access • 34

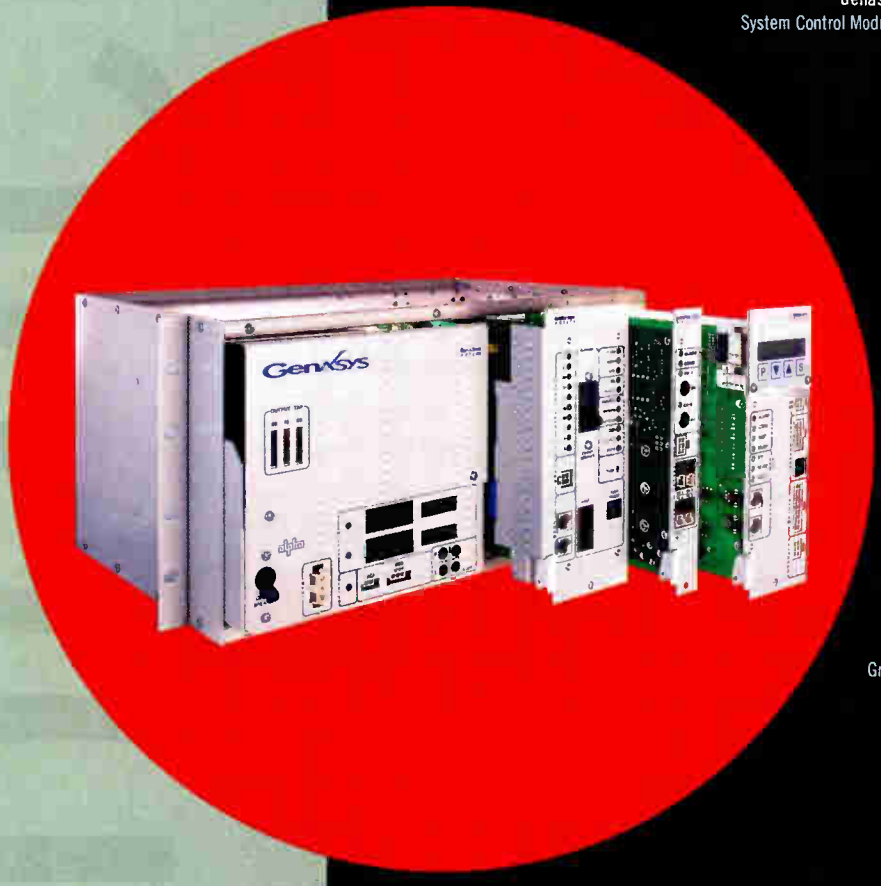


Upgrading Nodes • 46

The [Power] of Choice.

Plug & Play.

Alpha's Genasys® based broadband power systems support complete plug-and-play expandability. Additional power modules as well as enhanced reliability options easily plug in place. Simply swapping the Genasys LCM transformer assembly module increases the nodes total output power rating by nearly 50%. **Investigate the [Power] of Choice @ 800-421-8089.**



Genasys
System Control Module

Genasys
2000 LCM Module

GTS
Multiple Utility
Grid Transfer Switch

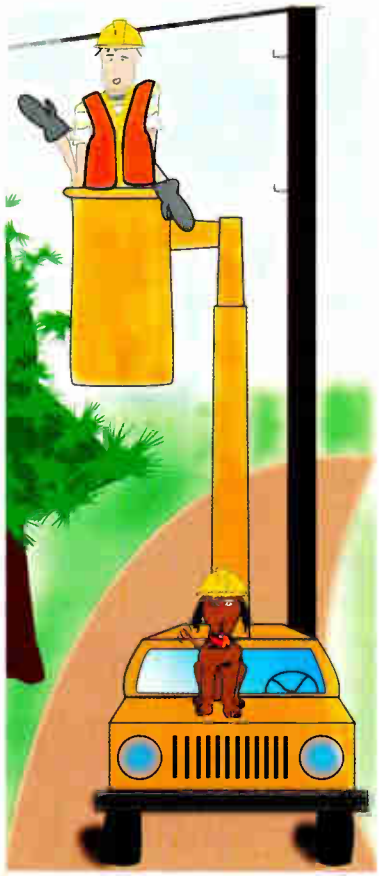
DCIU
Generator / Battery Interface

ALPHA TECHNOLOGIES 3767 Alpha Way Bellingham, WA 98226 **Tel:** 360-647-2360 **Fax:** 360-671-4936 **Web:** www.alpha.com

Reader Service Number 15

contents

PLANNING '98
Part 2



DEPARTMENTS

NEWS & OPINION

REFERENCE

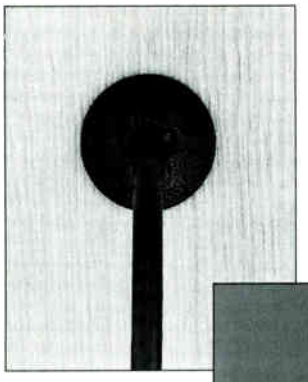
COLUMNS

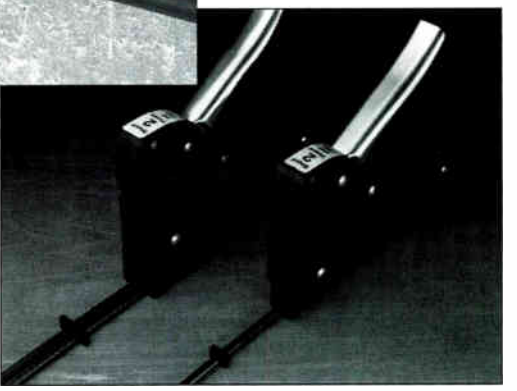
Universal Cable Markers

...still the best.

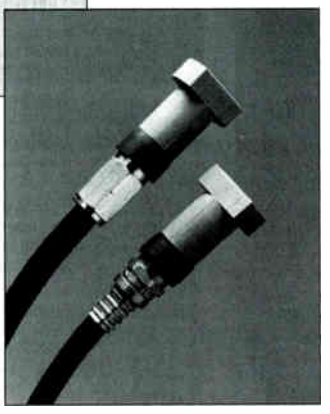
Flex Clips
...stress-free installations for better transmissions and longer lives.

Feed-Through Bushings
...for multiple access – now or in the future.





RB Clip Gun Systems
...tried and true, cannot impair the cable.



Fitting Savers
...the most versatile and efficient method of avoiding costly fitting replacements.

Telecrafter Products

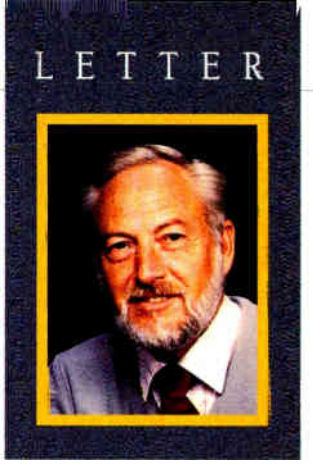
Direct merchants to the telecommunications industry

800-257-2448 or FAX **303-986-1042**

Reader Service Number 156

By Rex Porter

Always on The Defensive



The best defense is a good offense! Be proactive—not reactive! Seems like I've heard this throughout my career in business. But did the National Cable Television Association staff grow up never hearing this? Or, do they simply not believe in these principles?

Here we are, again, in front of the Federal Communications Commission fighting a freeze of cable rates.

Why haven't we carried a positive message about cable rates to the public instead of waiting for a broadside from a group calling themselves the Consumers Union and another calling itself the Consumer Federation of America?

Who are these people? They purport to speak for the consumer and we consumers don't even know them and have never, ever, spoken to them; never have been asked our opinion (except perhaps on a street, or along the Capital Beltway, in Washington, DC).

I am a consumer and I don't want these groups telling our elected officials that they represent me.

I paid $5.95 per month to receive three channels of cable TV back in the early '60s. That works out to about $2 per channel. I was delighted to pay the $5.95 per month.

I don't remember Gene Kimmelman, the Consumers Union or the Consumer Federation of America arguing for a cable rate freeze then.

Consumer advocates? Have these people ever worked in a real job?

Shame on our industry for waiting around until groups, such as these, come out of the woodwork to put us on the defensive. NCTA President Decker Anstrom is correct when he says, "We're in a transition period. A price freeze would stop still in its tracks investments in new programming and technology."

But we have done a terrible job of getting this message out to our customers. Instead of promoting good will with customers who have been on the cable for years, our promotion efforts have read something like, "If we're late to connect a NEW subscriber, that installation charge is free."

How about a promotion that recognizes a customer who's been on the cable for the past 20 or 30 years? That customer is probably responsible for getting that new subscriber to hook up to the cable in the first place!

Over the past two years, cable has begun providing some great new services for our customers. So has cable's competition. But cable's competition toots their horn constantly.

With my monthly telephone bill from US West comes a half dozen flyers reminding me of new services that I may not even care for. But I certainly remember they have "call waiting," "improved voice messaging," "last call retrieval," etc.

And those constant reminders tend to make me forget that my relatives back home in Tennessee are still using "pulse" rotary telephones.

Gee, a good proactive public relations program works, after all!

Rex Porter
Editor

What you need when you need it.

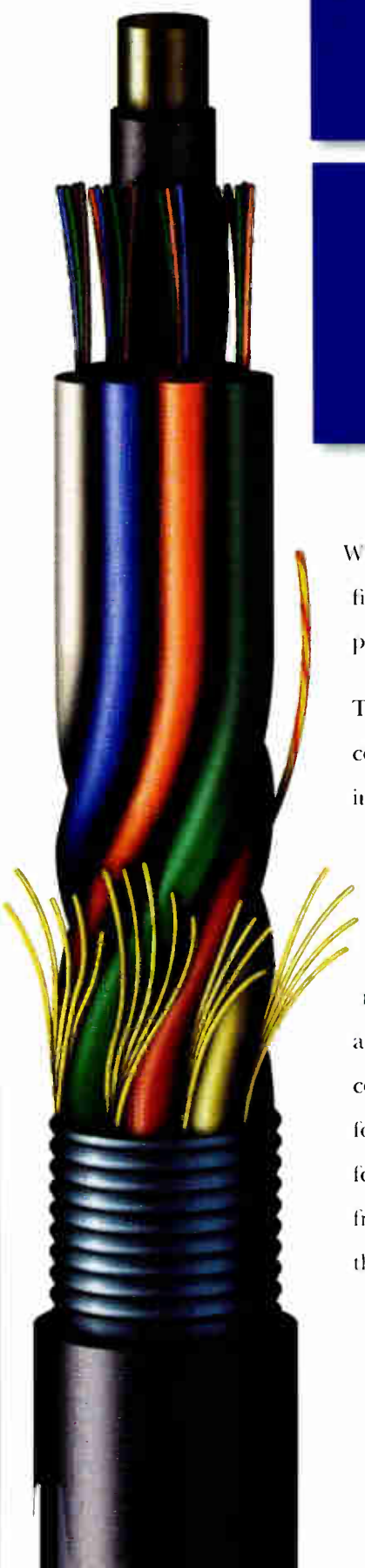
TeleWire Supply offers immediate, in-stock delivery on AFC3 fiber with Alcatel's exclusive ColorLock™ feature. Built to perform and actually strengthen over time, its benefits include:

- Lifetime color consistency and vibrancy
- Guaranteed colored fiber mechanical performance, strength and reliability
- The only coating that actually improves and strengthens with age
- Industry leading geometry for colored fiber
- 100% tensile testing at 1% strain
- Excellent LID compatibility
- Fully compatible with industry fusion splicers
- Fully compatible with heat and mechanical stripping tools
- Meets or exceeds industry requirements

Satisfaction is always in stock.

TeleWire SUPPLY
AN ANTEC COMPANY

1-88-TeleWire
http://telewiresupply.com



True blue

When your technician can't distinguish the blue fiber from the aqua fiber, you're looking at a potentially expensive mismatch waiting to happen.

That's why we think Alcatel's exclusive AFC™ fiber coating with ColorLock™ is the brightest new idea in optical fiber since, well, optical fiber.

Instead of applying color to the outside surface of a coated fiber, Alcatel integrates color into the coating. There are no inks to wipe off, and no inconsistent or uneven applications of ink affecting color or geometry. ColorLock guarantees consistent color throughout the length of the fiber, for the life of the fiber. Call TeleWire Supply today for immediate delivery of AFC3 with ColorLock from Alcatel. One look, and we're sure you'll see the light.

ALCATEL
PUTTING YOU IN THE BEST LIGHT

Reader Service Number 35

Communications Technology

EDITORIAL
EDITOR, Rex Porter
EXECUTIVE EDITOR, Alex Zavistavich
SENIOR EDITOR, Laura K. Hamilton
ASSISTANT MANAGING EDITOR, E. Brooke Gilbert
FEATURES EDITOR, Toni Barnett
SENIOR TECHNICAL EDITOR, Ronald J. Hranac
TECHNICAL CONSULTANT, Michael Smith
INTERNATIONAL EDITOR, Alex Swan

ADVERTISING/BUSINESS
GROUP PUBLISHER, Scott Chase
PUBLISHER, Nancy Maynard
SENIOR PUBLISHER, Paul R. Levine — (303) 839-1565
SENIOR VICE PRESIDENT, GROUP PUBLISHER, David Shaw
NATIONAL SALES MANAGER: Tim Hermes, (301) 340-7788, ext. 2004
MIDWEST: Mike Elmer, (303) 839-1565, ext. 34
WEST: David Gillespie: (303) 839-1565, ext. 35
NORTHEAST: Joel Goron: (301) 340-7788, ext. 2106
SOUTHEAST: James Bahi: (301) 340-7788, ext. 2060
CLASSIFIEDS: Nicole Bovre (301) 839-1565, ext. 33
ADVERTISING PRODUCTION COORDINATOR: Denise Papathakis

DESIGN/PRODUCTION
SENIOR GRAPHIC DESIGNER, Maureen Gately
CREATIVE DIRECTOR, Rob Hudgins
PRODUCTION DIRECTOR, Hank Janowsky
DIRECTOR OF OPERATIONS, Jim Calford

MARKETING
DIRECTOR OF MARKETING, Ann Coffey
MARKETING MANAGER, Allan Rubin
ADMINISTRATIVE ASSISTANT, Cathy Walker

CIRCULATION
DIRECTOR OF CIRCULATION SERVICES, Maxine Minar
FULFILLMENT DIRECTOR, William Wynne
SENIOR CIRCULATION MANAGER, Sylvia Sierra
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
GROUP BUSINESS MANAGER, Kathleen De Franco
GROUP EDITORIAL DIRECTOR, Dave Jensen
GROUP CIRCULATION DIRECTOR, Maxine Minar
DIRECTOR OF OPERATIONS, Jim Calford
DIRECTOR OF MARKETING, Ann Coffey
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 D'Brien
SENIOR VICE PRESIDENT—Finance, Frederick Moses
SENIOR VICE PRESIDENT—Strategic Marketing, Kismet Toksu Gould

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
THOMAS C. THOMPSON, President — Phillips Business Information Inc.
THOMAS L. PHILLIPS, President — Phillips Publishing International Inc.
FREDERICK MOSES, Chief Financial Officer — Phillips Publishing International Inc.

CORPORATE OFFICES
Phillips Business Information Inc.
1201 Seven Locks Road, Suite 300, Potomac, MD 20854
(301) 340-1520 Fax (301) 340-0542

Website: ctinfosite@phillips.com

SCTE BOARD OF DIRECTORS
At-Large Directors
RON HRANAC, Coaxial International
ANDY SCOTT, NCTA
WENDELL WOODY, Sprint/North Supply

ADVISORY BOARD
RICHARD GREEN, CableLabs (chairman)
JIM CHIODIX, Time Warner
RICHARD COVELL, Ipitek
H. ALLEN ECKER, Scientific-Atlanta
JIM FARMER, Antec
RON HRANAC, Coaxial International
BOB LUFF, TV/COM International
DAN PIKE, Prime Cable
BILL RIKER, Society of Cable Telecommunications Engineers
MIKE SMITH, Adelphia Cable
TONY WERNER, TCI
WENDELL WOODY, Sprint/North Supply

REGIONAL DIRECTORS
RALPH PATTERSON (Region 1), Patterson Communications
STEVE JOHNSON (Region 2), Time Warner
NORRIE BUSH (Region 3), TCI
M.J. JACKSON (Region 4), Gilbert Engineering
LARRY STIFFELMAN (Region 5), CommScope
ROBERT SCHAEFFER (Region 6), Technology Planners
JAMES KUHNS (Region 7), Comcast
STEVE CHRISTOPHER (Region 8), Augat
HUGH MCCARLEY (Region 9), Cox Communications
MAGGIE FITZGERALD (Region 10), DAVI Communications
DENNIS QUINTER (Region 11), Time Warner
JOHN VARTANIAN (Region 12), Viewers' Choice

SCTE NATIONAL HEADQUARTERS
(610) 363 6888 Fax (610) 363-5898

AMERICA'S BUSINESS PRESS · Phillips · SCTE · BPA INTERNATIONAL

INGRESS PROBLEMS SLOWING YOU DOWN?

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

See us at Western show Booth #4882

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

*In Canada call 1-800-387-3154, program number TMU 355.

www.hp.com/go/catv

HEWLETT® PACKARD

Modulation the Hot Topic at HFC '97

There seems to be at least as many network architectures as there are vendors of the technology in the cable industry. That point was again made clear at the HFC '97 seminar held recently in Phoenix, AZ.

A session on advanced modulation schemes for enhanced HFC two-way services drew the most active participation from the audience of 175 engineers who converged on the Wigwam Resort for the joint Society of Cable Telecommunications Engineers/Institute of Electrical and Electronic Engineers conference. Rod Gross of Ultracom Communications presented a variety of candidates for the advanced physical layer (AdvPHY). These AdvPHY candidates, as Gross dubbed them, include variable constellation multitone (VCMT, used by Multicom), orthogonal frequency division multiplexing (OFDM, used by ADC), synchronous discrete multitone (S-DMT, from Amati), discrete wavelet multitone (DWMT, the architecture used by Aware), and synchronous code division multiple access (S-CDMA, Terayon's choice).

In all, 26 papers were presented during HFC '97, covering return plant performance; cable initiative on status monitoring; telephony, security and architecture; and advanced modulation and processing.

In the first session, on hybrid fiber/coax (HFC) return path performance, Richard Prodan of CableLabs discussed the CW tester. This device was developed by CableLabs to test channels on a network to guard against impairments that cause errors for any services to be transmitted on that channel.

An overview of measurements and modeling of noise impairments on cable modems was presented by Dan Howard of the Georgia Institute of Technology. David Large of Media Connections Group discussed average frequency/time unavailability (AFTU) as a way to quantify discrete carrier upstream interference.

Specification and design parameters of reverse path active components were detailed by Oleh Sniezko of TCI. Reverse path components should be optimized for uncontrolled impairments, he said.

Antec's Jim Farmer outlined signal level management on the return path, and high-speed data systems architecture was explained by Mark Laubach of Com21. *Communications Technology*'s editor, Rex Porter, delivered the luncheon speech, titled "Where HFC Has Been and Where It Is Going."

Other papers presented during the conference included an analysis of reverse path laser loading in HFC networks by Lamar West of Scientific-Atlanta, a discussion of how status monitoring is used in the network by Tom Elliot of CableLabs, and a physical layer description from Dean Becker of Superior Electronics.

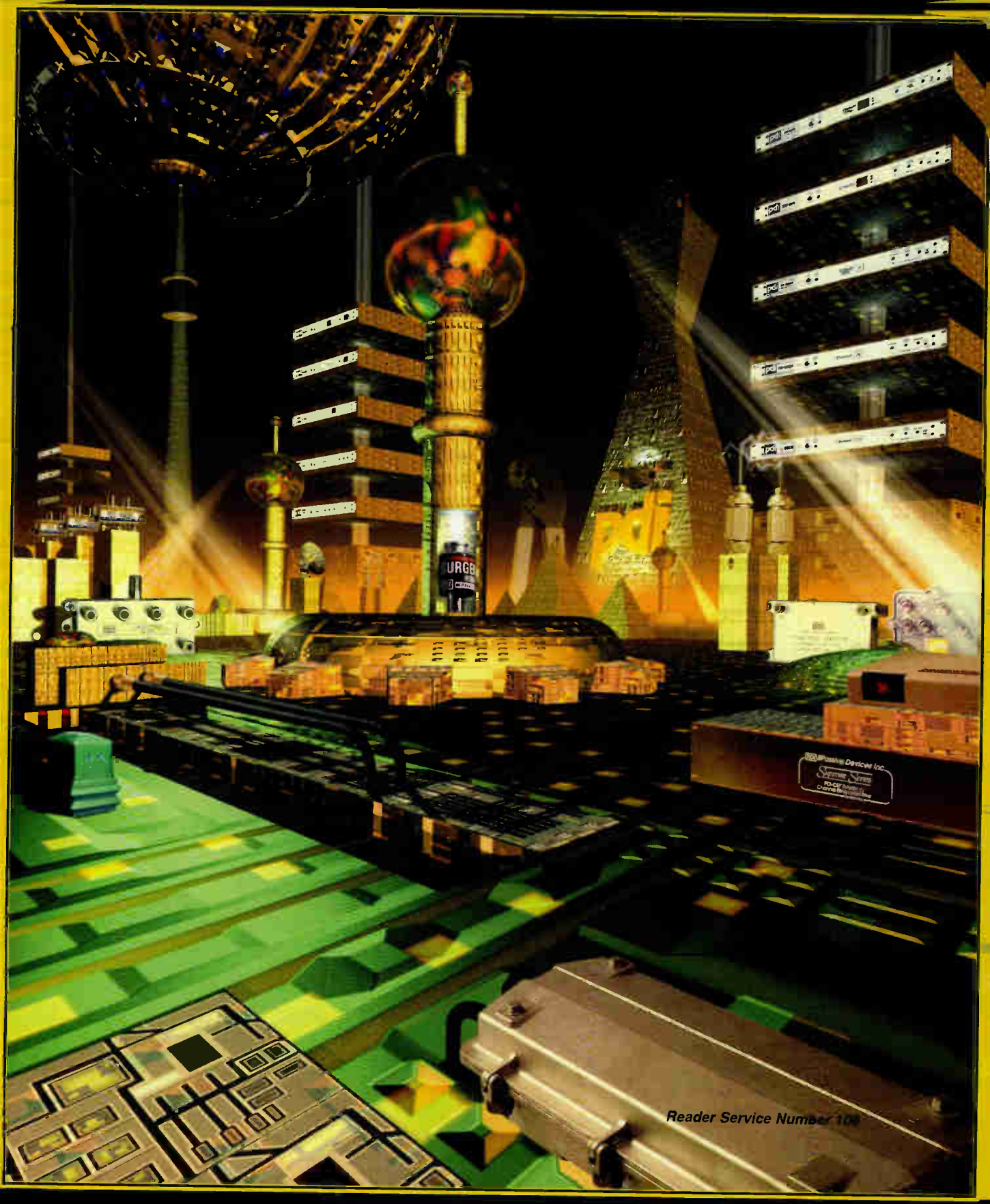
A framework for the management of HFC networks' outside plant equipment was offered by Gordon Bechtel of Stout Technologies. A new open spec for outside plant status monitoring equipment has been established by CableLabs and its member companies, using frequency shift keying transmission and a combination of poll-response and contention-based multiple access systems.

C-COR's Peter Bradshaw presented a description of the media access control (MAC) layer. Open standards in the cable plant were addressed by Roger Draper of Alpha and Jim Ostrosky of Tollgrade. Tom Piette of Tellabs offered insight into deploying HFC telephony, while M.C. Matteau of Arris asked whether cable telephony can achieve the 53 minute per year maximum downtime that's considered the standard for reliable telephony performance.

The need for security in advanced HFC-based services was discussed by Sid Gregory of TCI). Digital architectures for advanced services were reviewed by Lu Rovira of Scientific-Atlanta, and integrated video/data networking was explained by Jim Forster of Cisco Systems. ➤

PDI

ELECTRONICS FOR TELECOMMUNICATIONS



Reader Service Number 104

PREPARED FOR THE 21st CENTURY

(800)242-1606 (551)998-0600 Fax(561)998-0608 PDI.Electronics@worldnet.att.net www.pdi-ef.com

Wavetek does more than just put you in the neighborhood. The hardest part of fixing a return path problem has always been finding it. Wavetek can help. No company works harder to help you find and fix system problems. And we do it with systems and technology that saves you time and money. Count on Wavetek for: • Complete partnership through every phase of system problem diagnosis. • Diagnostic equipment for Installers to Technicians to System Engineers. • Full forward and reverse path testing, from

the headend to the fiber node to the drop. • Convenient service and CarePlan options that maximize productivity. • Signal level, leakage, proof of performance, monitoring, multi-user sweep and ingress detection products. If you're looking for trouble, we'll help you find it. — Call Wavetek for complete CATV testing solutions. 1-800-851-1202. Visit us on the web at www.wavetek.com.

Reader Service Number 184

WAVETEK

Ted Woo of the SCTE gave an update of the SCTE Standards Board Subcommittee's work. In January 1996, Woo noted, total standards documents numbered 44; as of September 8, 1997, that number has grown to 111. Woo recommended that questions regarding specific information on SCTE standards should be directed to him at (610) 363-6888, or by e-mail at twoo@scte.org.

In Harmony

NextLevel Systems Broadband Networks Group and Scientific-Atlanta reached an agreement to cross-license relative technology royalty-free. Through the "Harmony" platform, the companies will work together to provide operators with products that are developed based on a common set of agreed-upon standards.

FCC Announces New EAS Deadline

Cable systems with 10,000 or more subscribers must have Emergency Alert System (EAS) installed, with audio and video messages on all channels, by December 31, 1998. A recent Federal Communications Commission Report and Order rejected a proposed exemption based on system size—that would be "inconsistent with our statutory mandate," the FCC report read.

NEWS BITES

- The deadline for submitting a one-page technical paper abstract for the National Cable Television Association's Cable '98 convention is Dec. 16. To qualify for consideration as a technical session speaker at the May 3-6 conference, send a one-page synopsis of your paper or speech to: Katherine Rutkowski, NCTA, 1724 Massachusetts Ave., NW, Washington, DC 20036-1969; fax (202) 775-3698; e-mail: KRUTKOWSKI@NCTA.COM.

- Objective Systems Integrators and Positron Fiber Systems have teamed up to offer synchronous optical network (SONET) interoperability solutions for competitive access providers (CAPs) and competitive local exchange carriers (CLECs). Positron's SONET products will be integrated with OSI's NetExpert network management software. CT•

National Release of Programs

The Society of Cable Telecommunications Engineers has announced next month's national release of its much-anticipated Telephony and Service Technician Certification Programs. The new certification programs are available to SCTE local chapters and meeting groups for national testing. In a trial run, the Society's New Jersey Chapter administered a successful round of beta testing.

SCTE Director of Training Development Alan Babcock said, "It has taken a long time to get these programs finalized for our membership, but both certification levels were sorely needed in this industry." SCTE Vice President of Technical Programs Marv Nelson commented on the enthusiastic response that the Service Technician program, in particular, has already received. "A number of multiple-system operators (MSOs) have expressed a great deal of interest in implementing this program into their internal job structures."

Babcock agreed. "Both of these new certification programs will become a significant part of career advancement and training within several MSOs," he added. The Service Technician Certification Program was designed to bridge the gap between the Installer and Broadband Communications Technician (BCT) Certification levels. The two-level program will focus on troubleshooting, particularly the half-split, or "divide and conquer," method of locating distribution problems, as well as providing a reinforcement of installation skills and the overall knowledge that a service technician should possess.

Technical Sessions Scheduled

The SCTE will coordinate six technical sessions at The Western Show in Anaheim, CA, this December. SCTE will present these sessions during the four-day "30 Years of Change" event, to address some of the most important challenges facing today's broadband industry professionals. On Wednesday, Dec. 10, SCTE President Bill Riker will lead a discussion on new technical regulatory developments being considered by the Federal Communications Commission. Representatives from the FCC and the National Cable Television Association will be on hand to review compatibility issues relating to broadband telecommunications.

SCTE At-Large Director Ron Hranac will moderate a session titled "Two-Way Plant: Traveling Down the Road to Success, in Reverse." Hranac, vice president of engineering for Coaxial International, plans to open the discussion on designing and maintaining a two-way cable system. Industry experts will offer solutions to some of the problems encountered while building and operating a reverse path system. ➤

Jay Junkus, president of KnowledgeLink and an SCTE member, will mediate a discussion titled "Cable Telephony Today: Are the Phones Ringing?" Junkus, who facilitated the development of the Society's monthly digital newsletter, *Digipoints*, and other top telecommunications experts will provide information to help cable operators prepare for the growing collaboration between the telephone and broadband industries.

A roundtable discussion of network management, led by TCI Director of Advanced Network Management Van Macatee,will feature the newest information on implementing a proactively managed network.

A hot item on everyone's mind these days, cable modems, will be the focus of a technical session led by Ron Wolfe. Wolfe, regional director for cable engineering, will moderate a panel discussion about the necessary skills and short- and long-term strategies for dealing with a complex new set of job skills.

Alan Babcock will proctor written examinations for Installer and all categories of the Society's Broadband Communications Technician/Engineer (BCT/E) Certification Programs. Western Show attendees also can test their knowledge in SCTE's newest certification programs, Telephony and Service Technician. T

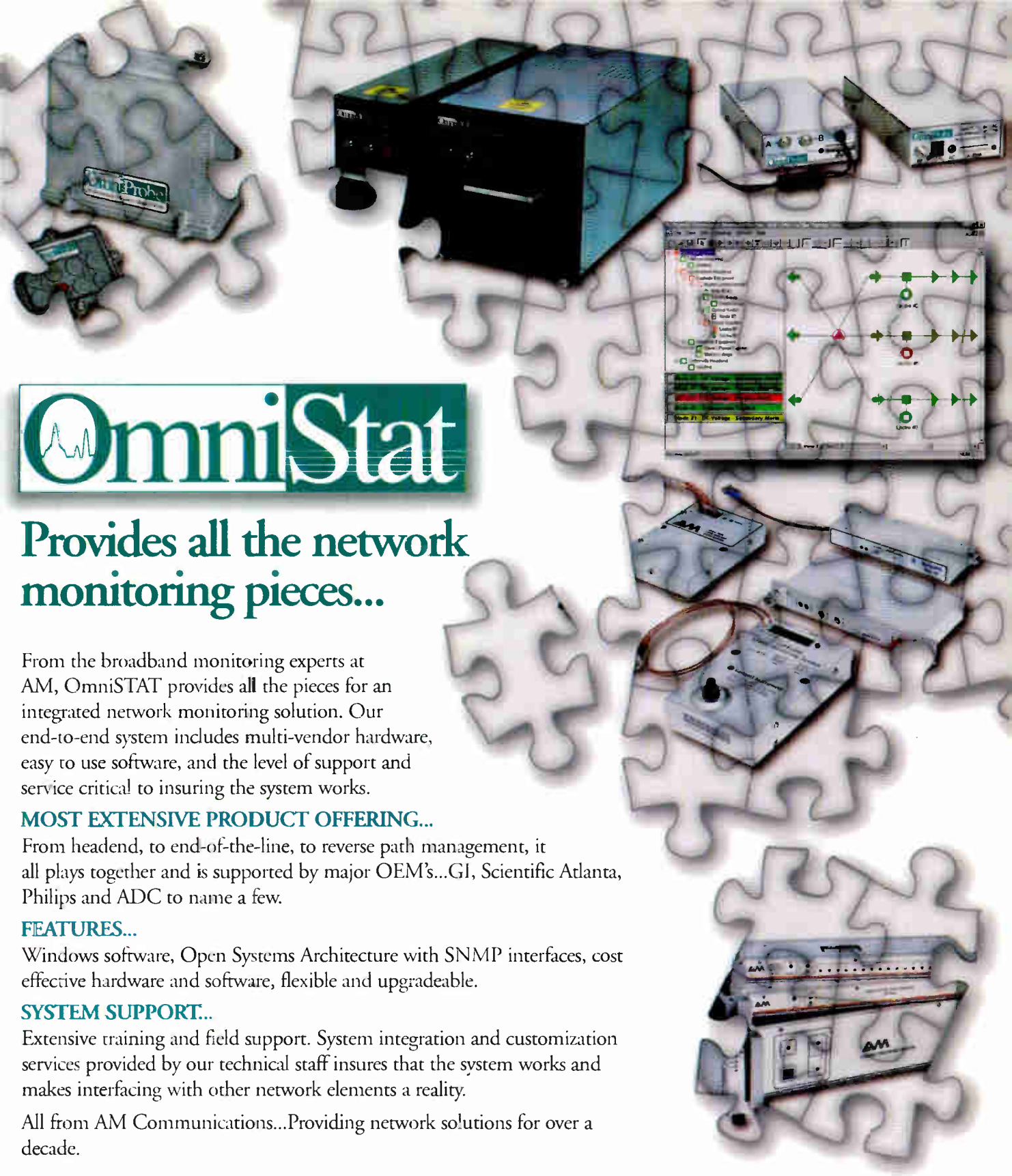
Call for Cable-Tec Expo '98 Papers

The SCTE is now seeking proposals for technical papers to be presented at its 1998 Cable-Tec Expo to be held June 10-13 in Denver. The annual conference, which attracted more that 8,200 attendees this year in Orlando, FL, enjoys a reputation as the broadband industry's leading hardware trade show. Expo '98 will offer telecommunications professionals an exclusive forum to interact on the challenges facing the broadband industry.

Submission topics should address the technical decisions that will not only shape today's industry, but that also will play a key role in the future of broadband technology. Topics may feature cutting-edge research and development, including data transmission and digital technologies, advancements in engineering, as well as other technological changes that will greatly affect telecommunications now and in the next millennium. The deadline is Dec. 1, 1997.

Submissions should include a title, author's name, presenter's name, affiliation, full address, telephone/fax numbers, e-mail address and a one-to-two-page abstract detailing the technology or issue and its significance to the industry. Proposals may be sent via mail, fax or e-mail to: Roberta Dainton, SCTE, 140 Philips Road, Exton, PA 19341-1318; Fax: (610) 363-5898; e-mail: rdainton@scte.org.

The SCTE Cable-Tec Expo Program Committee will announce the selected presentations in early 1998. Accepted authors must be prepared to submit a camera-ready manuscript to SCTE by early May 1998 for publication, as well as present a 15-20 minute oratory based on their chosen conference.



OmniStat

Provides all the network monitoring pieces...

From the broadband monitoring experts at AM, OmniSTAT provides all the pieces for an integrated network monitoring solution. Our end-to-end system includes multi-vendor hardware, easy to use software, and the level of support and service critical to insuring the system works.

MOST EXTENSIVE PRODUCT OFFERING...

From headend, to end-of-the-line, to reverse path management, it all plays together and is supported by major OEM's...GI, Scientific Atlanta, Philips and ADC to name a few.

FEATURES...

Windows software, Open Systems Architecture with SNMP interfaces, cost effective hardware and software, flexible and upgradeable.

SYSTEM SUPPORT...

Extensive training and field support. System integration and customization services provided by our technical staff insures that the system works and makes interfacing with other network elements a reality.

All from AM Communications...Providing network solutions for over a decade.

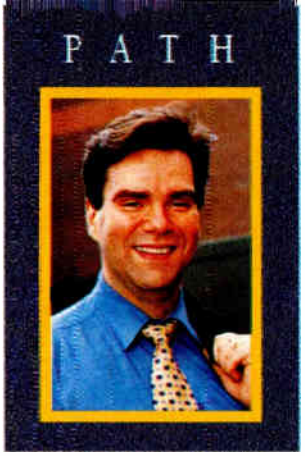
AM

Guardrails for the Information Superhighway

100 Commerce Drive • Quakertown, PA 18951-2237 • (215) 538-8700

Reader Service Number 20

By Alex Zavistovich



The Wild, Wild Western

A Survival Guide

It's hard to believe, but just a few weeks from now the Western Cable Show will be taking place at the Anaheim Convention Center. Despite the glitz of the latest programming promotions, this is the show that equipment vendors use to introduce the latest technology.

Whether you're new to the industry or an old hand, here is some valuable advice to enhance your enjoyment of this show and any other convention you may attend.

Work from the back of the show to the front. At the Anaheim Convention Center, start at the rotunda first. It's easy to leave that room for the closing day, but last year some of the most cutting-edge stuff was going on there, including the CableLabs display of data transmission products. Don't just whip through it.

Starting from the back of the exhibit area means you'll be going in the opposite direction of the flood of floor traffic all morning long. Work smarter, and leave all that milling around to the lemmings.

Bonus: By the time you've made it back to the beginning of the exhibits, it'll be lunch time, and you'll be first in line. Hey, you're going to spend $10 for a bratwurst, a bag of pretzels and a bottle of water. You won't be in any mood to be standing behind a bunch of type-A blue-suiters asking whether the chicken Caesar has more chicken in it than the chicken salad does.

Use a floor guide. A must for finding your way around the show floor is either the pocket guide in your registration materials or the floor map from the convention daily. The pocket guide is good if you're traveling light, but reading it is no picnic. The convention daily is a little more bulky, but easier on the eyes. Just detach the map and use that for reference. Keep the rest of the daily in your bag to read while you're waiting in line to use a telephone.

Wear comfortable shoes. Wearing new shoes to a convention is a rookie mistake. After eight hours of walking around on a hard concrete surface, your feet already feel like canned hams; all you need are a few blisters on top of that to really feel like crawling back to the hotel. I recommend sneakers. If people are judging your footwear, they've got way too much time on their hands.

"Despite the glitz of the latest programming promotions, this is the show that equipment vendors use to introduce the latest technology."

Some things to pack with you as a part of your survival kit include:

Adhesive bandages. These are especially important if you forgot to bring comfortable shoes. They also make excellent short-term repairs to hems and cuffs that have come undone.

Talcum powder. Two words: "chafing" and "ouch." Especially for us bigger guys, hot lights and wool suits are a bad combination.

Medication. Bring lots of aspirin and sinus medicine. If you're coming from the east, the sudden change in barometric pressure in Anaheim, CA, can give you a headache like you've only read about in medical textbooks.

Aspirin is an anti-inflammatory (good for your back). Sinus medicine is a god-send. It keeps you from snoring too much. If you're sharing a hotel room, your roommate is less likely to beat you over the head with your own pillow in the middle of the night. Take my word for it.

Express mailers. Unless you're built like Lou Ferrigno or don't mind living with searing back and shoulder pain, don't carry around a bag full of accumulated marketing materials, press kits and give-aways. Last year I came home with 50 pounds of paper. Send some back each day, and sift through it all when you get back to the office.

A final bit of advice to new convention-goers: *Don't wait in line for give-aways.* Come early or stay late if you really need that coffee mug, T-shirt or plastic yo-yo. If you have enough time to stand in line for a Polaroid with the women from the Playboy Channel or the Spice Channel, you have enough time to sit in on a press conference or technical session and advance your career a little.

(A special note to guys: You and I will never be anything more than a tiny ripple in a sea of faces to those ladies. Don't stand there giggling like you just snuck out of Catholic school. Somebody somewhere is introducing a new cable modem or network monitoring system. Find out more about it.)

See you in the press room. CT

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

You know what you need. Now you know the one place to find it all.

Changing technology places new demands on CATV suppliers. That's why it's good to know there's a new choice. iCS. The reliable partner you need for the full range of products and repair services. You can depend on quick delivery of all the top brands. Plus materials management, financing, equipment leasing and exchange.

Ask iCS to simplify your life.

- All General Instrument linegear and addressable converters including digital
- All Scientific Atlanta linegear & addressables
- All CommScope P3, QR and drop cables, plus fiber
- All Digicipher MPEG-2 receivers
- Lectro and Powerguard power supplies
- Full line of drop materials to 1GHz
- Full line of refurbished gear
- 3M fiber products including splice enclosures.
- PPC and Gilbert connectors
- Repair of out-of-warranty GI, SA and other converters
- Authorized GI warranty repair facilities in North and South America
- All Diamond poleline hardware & installation materials
- DX Communications headend equipment

Sales
Deerfield Beach,Florida
800-327-4966
Carson, California
800-222-0052
Cleveland, Ohio
800-858-0830
Dallas, Texas
1-888-427-1144
Denver, Colorado
800-728-9887
Atlanta, Georgia
800-787-2288
Mt. Laurel, New Jersey
800-817-4371
DX Communications
954-427-5711

Repair
Prospect Park, Pennsylvania
800-352-5274
Milwaukee, Wisconsin
800-555-8670
Deerfield Beach, Florida
800-865-3692

International Sales & Services
Buenos Aires, Argentina
54-1-582-9695
Santiago, Chile
56-2-335-2070
Sao Paulo, Brazil
55-11-246-9994

iCS
ITOCHU Cable Services Inc.

Integrity, Commitment, Service

Reader Service Number 84

By Ron Hranac

Making Two-Way Work—Part 2

This is the second part of an overview of some of the material from the workshop Tom Staniec and I taught at this year's Society of Cable Telecommunications Engineers Cable-Tec Expo in Orlando, FL.

In this installment, I'll cover additional upstream impairments such as impulse noise, signal clipping, transient hum modulation, and intermittent connections, along with data carrier RF levels and setting upstream levels in the network.

Most upstream data transmission errors have been found to be caused by bursts of impulse noise. Impulse noise is characterized by its fast risetime and short duration—generally less than 100 microseconds—although most has been found to be below 10 microseconds duration. The short duration, fast risetime characteristics of impulse noise means that it contains significant broadband energy, often throughout much or all of the upstream spectrum.

Common sources of impulse noise include vehicle ignitions, neon signs, static from lightning, power line switching transients, electric motors, electronic switches (thyristors can be especially bad), and household appliances such as hair dryers, thermostats, garbage disposals, aquarium heaters, and electric blankets. The following will give you an idea of just how much of a problem some appliances can be.

A few days ago, as of this writing anyway, I was overseas providing two-way training to one of my company's clients. During that training we found that an alternating current (AC) operated electric screwdriver they use is a great source of impulse noise. So much so, in fact, that while there I devised a pickup loop for the screwdriver so that its impulse noise could be intentionally injected into the upstream spectrum of their lab's two-way cable equipment for test purposes. I also used that same electric screwdriver to demonstrate the effectiveness of coiled-cable common mode chokes. But I digress (or is that ingress?).

RF ingress—discussed in last month's column—and impulse noise can cause signal clipping in upstream active components. Excessive signal levels from in-home devices such as pay-per-view converters can cause signal clipping, too. Signal clipping, also known as compression (not to be confused with digital compression), can occur in upstream amplifiers and fiber optics equipment. Upstream lasers are most susceptible to clipping, especially low-cost Fabry-Perot types.

Most energy that causes signal clipping is in the 5-15 MHz range, although higher frequencies can be involved. When clipping occurs at one frequency, it usually affects all other frequencies. This is known as cross-compression. Clipping is less likely to occur in upstream amplifiers because of the greater headroom in the coaxial network. It's most prevalent in upstream lasers. When laser clipping occurs, data throughput usually decreases.

Transient hum modulation manifests itself as a low frequency disturbance to carriers on the network, and is thought to be generated when high current in network passive devices causes the devices' ferrite materials to saturate.

A similar problem that has been observed in some networks is noise and harmonics from amplifier switching power supply modules. When this happens, it often can be reduced or eliminated by tightening chassis and module mounting screws inside of amplifier housings.

Intermittent connections have been found to disrupt upstream data transmission. Intermittent connections can be self-induced (whoops). For example, when a technician changes upstream amplifier pads and equalizers, or changes upstream amplifier modules, the brief interruption will affect the upstream signal path. Other causes of intermittent connections are usually craft-related, and are due to loose or damaged connectors, and poor quality installations.

Setting upstream signals to the correct level can be very difficult when those signals are digitally modulated carriers. In the downstream network, analog National Television System Committee TV carrier levels are measured in terms of the root mean square (RMS) value of the video's instantaneous synchronizing peak level. This is easily done with a cable TV signal level meter or spectrum analyzer.

Digitally modulated carriers are most often measured in terms of their average power level. Because the digital signals have characteristics similar to broadband noise, traditional signal level meters (SLMs) cannot be used to accurately measure a digitally modulated carrier's amplitude (an exception is some newer SLMs that have digital carrier measurement functions available).

One accepted method is to use a thermocouple power meter, which will display a digitally modulated carrier's average power level. If you have only one carrier to measure, this is fairly easy to do. However, if you attempt to use a power meter in the presence of multiple carriers, the power meter will measure the total power of all of them. In this situation, you will need to isolate the desired carrier with a high quality bandpass filter at the input to the power meter, and take into account the filter's insertion loss, flatness, and bandpass characteristics.

Other possibilities include test equipment that has been designed to accurately measure the amplitude of digitally modulated carriers. Some spectrum analyzers can be used for this measurement, as long as the result can be correlated with a thermocouple power meter measurement. Another factor

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.

to consider is how to measure "bursty" digital signals. Many types of digital carriers are on very briefly, making it much more difficult to capture and analyze those types of signals and measure their amplitude.

Using a digitally modulated carrier's average power level is acceptable for low peak-to-average signals such as quadrature phase shift keying (QPSK). However, if the upstream (or downstream for that matter) carries high peak-to-average signals such as quadrature amplitude modulation (QAM) or code-division multiple access (CDMA), it is much more difficult to accurately measure and set levels. This is because the digital carrier's peak level can be several dB higher than its measured average power level. Make sure you take this into account when setting digital carrier levels. For example, 64-QAM has a peak-to-average ratio around 5 dB; orthogonal frequency division multiplexing (OFDM)-64-QAM is about 7 dB; and CDMA may be in the 9-13 dB range. If the levels are incorrect (even though the average power levels seem right), this discrepancy between average and peak power levels may cause laser clipping. Discuss this with the manufacturer of your system's data transmission equipment, as well as with the manufacturer of the test equipment you're using to measure digitally modulated carriers.

The easiest way to set upstream signal levels is to establish what is called the X level. This is a headend upstream signal level that occurs as a result of providing the proper level at the input to the last upstream amplifier (the first amplifier or node out of the headend). To establish the X level, go to the first downstream amplifier or node location. Here you should inject a signal into that location's reverse amplifier module input at a level known to be correct (make sure the upstream fiber link has been properly adjusted before you do this). This will result in a signal at the headend that is measured and defined as the X level. By the way, you can use just about any headend upstream test point to set the X level, although I would discourage the use of the upstream fiber receiver output or its test point. Try to establish the X level test point closer to the input of a cable modem router or your upstream sweep receiver.

Assuming your system was designed for unity gain operation, when you go to the next amplifier location and inject the proper amplitude test signal there, the resulting signal at the headend should be the same as the original X level. If it's not, you can make necessary adjustments and install the proper output pad and equalizer to achieve the correct input level at the first amplifier (or node) location, which will then give you the desired headend X level.

OK, class dismissed for now. Next month I'll continue this discussion with some other thoughts about two-way operation. CT

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

The best TDR just got better!

No smoke.
No mirrors.
No wizardry.

A TDR with a true sub-nanosecond pulse width for superior cable fault location.

A sub-nanosecond pulse width can identify small, often unsuspected faults that can be within inches of each other.

Seeing is believing.

1205C, 2 nanosecond, 128x gain

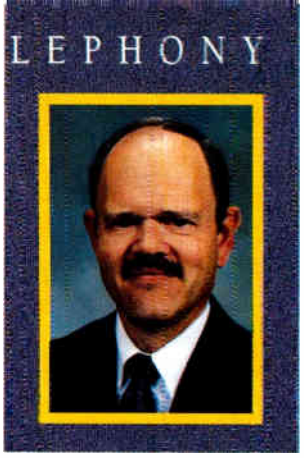
1205CX, sub-nanosecond, 60x gain

Model 1205CX TDR

Toll Free: (800) 688-TDRs
Telephone: (402) 466-0933
Fax: (402) 466-0967
E-mail: email@riserbond.com
Web Site: http://www.riserbond.com

Riser Bond INSTRUMENTS

By Justin J. Junkus



The Internet Isn't Just Data

You might consider it strange to see a column on the Internet in the "Focus on Telephony" spot. Think again. Telephony over the Internet is becoming more widespread, and some cable companies have even gone so far as to seriously consider it as their option for offering telephony service.

While I wouldn't recommend this route as the primary way of getting into the telephony business, it does show you that Internet telephony is a lot more than a toy for the data-over-literate.

Let's look at the investment the user must make. First, you need some basic equipment—a personal computer equipped with a sound card and software for voice digitization, a microphone and a headset. Many folks already have the basic multimedia PC, so there's no additional cost here. You also need the applications software that gives you the telephony interface. Many of the basic phone packages are free for the downloading from Internet Web sites. Even those with more enhanced features run around $50 from a computer outlet. Of course, you must be able to connect to the Internet, via an Internet service provider (ISP). There are now a number of ISPs to choose from. Some provide only basic Internet connection and search, while others, such as Prodigy and America OnLine, are sources for multiple services that supplement Internet access, such as special interest groups and chat lines. Unlimited Internet access is typically available for around $20 per month, if you shop around. That's in addition to the local phone charges you will incur if you use a dial-up telephony modem, or any additional charges for high-speed data access from your friendly cable company, if you go with a cable modem. So far, this is still a bargain, considering you can literally call the world over the Internet.

The user interface to the "phone" typically comes in the form of a graphic display on the user's PC. Many of the software packages create a screen that looks a lot like a cellular telephone. Instead of pushing buttons, the user moves the mouse pointer to the appropriate telephone key and clicks.

How about quality? Most people who have used Internet telephony claim the transmission sounds at least as good as an analog telephone. There are, however, some caveats. The PC running the application must, at minimum, have a Pentium processor, and the connection must be at least 28.8 kbps. Score one for cable. Dial-up telephony modems usually negotiate line rates upon setup, and

"Most people who have used Internet telephony claim the transmission sounds at least as good as an analog telephone."

it's not always possible to get a 28.8 kbps connection, particularly on long loops or over older facilities.

The feature capability of this technology is not quite comparable to a standard telephony system, but it is more than adequate for most cases. One package I've seen offers a full suite of business features, including call transfer, voice messaging, and incoming call restriction. That particular vendor also is promoting a migration to video conferencing, by adding a digital camera to your PC.

So what's the drawback? Connectivity and contention are the biggest possible problems. To make a connection, it is necessary for both parties to be on line to the Internet at the time of the attempt to connect. That's because routing information over the Internet requires source and destination addresses for the parties involved. To understand how this becomes a challenge to Internet telephony, you need to understand some of the basics behind Internet addressing.

All computers attached to the Internet have an Internet address while they are attached. The address is called an Internet protocol (IP) address, and consists of four sets of digits, separated by periods. 198.37.22.26 is an example. These numbers are assigned by a centralized group that is part of the National Science Foundation to parties such as ISPs and large corporations, who in turn can reassign them to their customers or users. As you might guess, although the possible number of these addresses is large, so are the number of potential computers. In order to conserve addresses, the NSF has ruled that dial-up connections do not get permanent IP addresses. Rather, the ISP must dynamically assign the address from a pool of available addresses when the dial-up connection is made. To reach you with an Internet phone call, my software must have some way of knowing that assigned address. There are a couple of ways to do this.

To make it easier, some systems use a "meet-me" type of arrangement, where the calling and called parties agree to log-on to

HARRIS

Your Source for Network Management Solutions

Ensuring uninterrupted network performance is crucial in any business these days—especially yours. It is critical for network managers to quickly detect, evaluate, and respond to changing network conditions. Harris Corporation's response to the need for a fast and efficient system to monitor and troubleshoot networks is Harris Network Management—HNM. HNM manages your telecommunications' infrastructure. Whether your network includes fiber, microwave, satellite communications or environmental equipment, HNM is your source for network management solutions.

Harris is the only enterprise Network Management System (NMS) provider who is a telecommunication service provider, manufacturer, and systems integrator who uses its own NMS to manage its global network.

- Turnkey solutions
- The most cost-effective interface to support equipment
- Proven systems engineering
- Multiprotocol environment
- Distributed architecture, scalable, multiplatform environment
- Open systems
- Customer modifiable tools

HNM
HARRIS NETWORK MANAGEMENT

1-800-4-HARRIS ext. 4703
407-727-9207
www.harris.com/telecom

Member of the Network Management Forum (NMF)

an ISP at some predetermined time and then bring up the telephony application program. Notice that although this saves long distance telephone charges, it can be inconvenient. Another way of doing this is for the telephony programs to attempt call setups using e-mail addresses. This method requires routing telephony call requests to a specialized server attached to the Internet, which searches the Internet to see if the called party is on line at the time. When the called party is not on line, a message is returned to the caller. It is even possible to carry this technology one step further, and complete the call via the public switched telephone network using gateways to the public switched telephone network (PSTN).

"Contention enters the scene when there is congestion in the network."

Contention enters the scene when there is congestion in the network. While data on the Internet can be stored and forwarded when there are delays, voice conversations are real-time. Delays in moving voice information must therefore be minimal. Once again, there are ways to resolve this problem. Protocol data units carrying voice information can be tagged with higher priority than data protocol data units, and therefore be allowed through the network ahead of other information.

Like I said in the first paragraph, I would not recommend a cable company enter the phone business solely with Internet telephony, and expect to compete head-on with a telephone company for a subscriber's entire telephony bill. On the other hand, this is certainly one way to offer an interesting telephony alternative to your high-speed data customers. 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, you may e-mail him at jjunkus@aol.com.

Turn on *New* Customers *with* Fujitsu's *Turnkey* Network Solutions.

Make the Switch to a Single-Source Provider.

As every Competitive LEC knows, gaining new customers requires delivering the latest technology and services better and more quickly. Fortunately, everything you need for a faster, more advanced and more efficient network is available through a single source–Fujitsu Network Communications. We're your complete solution, from survivable DS0-based services and hicap circuits to LAN services for high-speed Internet access and data communications. And we're with you every step of the way, from engineering and installation to turn-up and testing to ongoing operations.

The Power to Build Revenue.

Today, you have to increase market share while keeping your network as cost-effective as possible. That's why it makes sense to choose a partner who can help you do both. We have the experience, technology and service capabilities to optimize your network resources and bring in new sources of revenue. To find out more, call Fujitsu Network Communications, Inc. at 1-800-777-FAST or e-mail us at fast@fujitsu-fnc.com. We'll show you how to really put your network to work–building a bigger customer base.

Reader Service Number 21

FUJITSU

Building Networks *that* Build Your Business.

www.fnc.fujitsu.com

By Laura K. Hamilton

The Splice is Right, or Maybe Not

So did you hear the one about the guy who made the cataclysmic error of breaking a small piece of fiber-optic cable off in his hand?

Seems it got into his bloodstream and caused a heart attack. Cable urban legend? Industry myth? Simple hogwash? Jim Hayes (20-year fiber veteran and president of Fotec) doesn't believe the story for a second.

What about the fact that all fiber light will burn you or zap your eyeballs? That's not exactly fact either, says Hayes.

Fiber's magical and complex reputation has made it virtually impossible for even the most conscionable FO technologist to keep up with it all: white papers, magazine articles, Web pages, conferences, engineering manuals, training seminars, and so on.

And as everyone loads up on their knowledge cache of fiber ammunition, we've got an environment primed for conjecture, debate and sometimes all-out rumor.

LID vs. VPA

Here's a friendly little fiber discussion that popped up on the Internet SCTE-List recently: Local injection and detection (LID) vs. virtual profile alignment (VPA).

So, when it comes to a method of fiber alignment for fusion splicing, are you adamant about which method is "better"? According to one SCTE-List posting on the topic, some feel that "using a LID system when splicing gives one a better, more consistent splice." So does it really?

"I am not aware of any study that showed either method was better," says Hayes, who in addition to being the president of Fotec is co-founder of "Fiber U," and author of *Fiber Optics Technician's Manual* (Delmar, 1996).

According to Hayes, "Either method of fiber alignment for fusion splicing works equally well, but all are relative, not absolute, measurements."

He explains that these methods are designed to look for a situation that indicates a maximum amount of light transmission (or minimum loss), but since no way exists to determine an absolute reference or the exact amount of light coupled into or out of the fiber, no absolute measurement of loss is possible.

An optical time domain reflectometer (OTDR) can make that measurement if it is used in two directions and averaged, to remove the directional sensitivity to mode field diameter and scattering coefficient.

Dispelling light's myths

So LID vs. VPA is relative, which leads to healthy opinion and debate. But what about "fiber facts" floating out there that aren't even relative—they're simply wrong?

Hayes lists the following as a couple of examples of misinformation and suspect techniques he's seen bandied about:

- Requiring OTDR data for cables too short to be seen on an OTDR.
- Loss testing at wavelengths inappropriate for the fiber (like 850 nm for single-mode or 1,550 for multimode).
- Requiring tests of installed cable plants with backreflection testers that are used for patchcords, giving worthless, or at best questionable, data.

"Most of the mistakes occur because the majority of material written on fiber optics refers to long distance telephone installations, which is quite different from CATV or premises cabling," says Hayes.

His battle cry for combating fiber misinformation is often heard in our industry: "Training, training and more training!"

However, the cable telecommunications technical community needs to be careful about what and how it teaches its teachers. (Hayes said the story that started this column was told in a training class!) "We need to train and certify trainers. That is a big project for the FOA," he adds.

SCTE and FOA training courses

The SCTE offers an "Introduction to Fiber Optics" course all over the country. For details on this or many other fiber training resources, contact: (610) 363-6888.

The following training courses are approved by the Fiber Optic Association:

- *Lincoln Trail College Fiber-Optic Courses.* Contact John Highhouse via e-mail: hihouse@midwest.net.
- *Fiber U.* Contact (800) 537-8254 or e-mail: info@fotec.com.
- *Eric Pearson Fiber Optic Courses for American Research Group.* For information, e-mail: FiberXpert@aol.com.
- *C+W Fiber Optic Courses.* Customized training on site and at various locations. Contact Dave Chaney or Paul Walker at (805) 529-1920, (805) 529-1943 (fax); or e-mail Cwfibropt@aol.com.

If you haven't heard of it, the Fiber Optic Association Inc., has been organized as an international nonprofit professional society with a charter to develop educational programs, certify fiber-optic technicians, provide lists of approved fiber-optic training courses and promote the technology.

Check out the Web site at http://world.std.com/~foa/, or you can contact the FOA at (617) 469-2FOA; (617) 396-6395 (fax); or foa@world.std.com (e-mail).

For details on Society of Cable Telecommunications Engineers fiber seminars or FOA-approved courses, see the sidebar. CT

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

Built for speed.

[OF DEPLOYMENT]

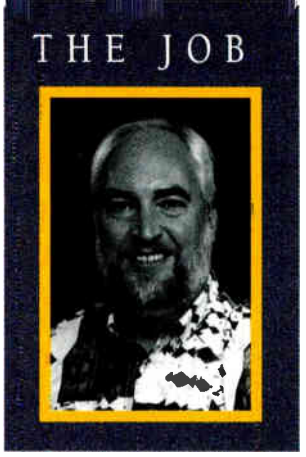
While you're busy managing site acquisition and zoning details for your rebuild, Oldcastle is already under way on the precast structure to house the electronics. In fact, we'll have it completed and ready for inspection in as little as two weeks after notification to proceed. Compare this to the months required for conventional "from the ground up" designs...and it's easy to see how Oldcastle structures let you turn on the revenue stream much sooner. Your Maxi-Mod™ structures will be installed on schedule, regardless of whether you are deploying five units or twenty, in one city or in multiple locations. For consistency, each structure is designed with a common look and layout. At the same time, its modular construction lets you vary the square footage to match your equipment needs. Get up to speed today.

Reader Service Number 106

Oldcastle™

Northeast—Tel: 860/673-3291 Fax: 860/675-1294
Southeast—Tel: 770/493-5420 Fax: 770/493-5425
West—Tel: 602/963-2678 Fax: 602/899-1937
www.oldcastle-precast.com

By Alan Babcock



Ready for Change? Is Your Staff?

Let's see: You've tried to read *Communications Technology* magazine (and others), attended Cable-Tec Expo '97 in Orlando, FL, and you even found an old textbook on digital communications from your days in electronics school.

Your manager has informed you that your system will incorporate digital TV at the end of the second quarter in 1998, cable modems will go in during the third quarter and corporate is still thinking about telephony. Although the system was designed for reverse, you haven't dropped the modules in yet. This is enough to make technical operations managers lose significant quantities of hair.

If this sounds like your situation, you're not alone. Over 50% of the cable systems in the United States are expected to install reverse capability in 1998. Of course, the driving motivation is the implementation of data, telephony and maybe even interactive digital TV.

The question is this: How will your staff handle the change? Do they understand quadrature amplitude modulation (QAM), quadrature phase shift keying (QPSK), noise funneling in the reverse system, time-division multiple access (TDMA), and code-division multiple access (CDMA)? Do they know how to access the Internet or even have computers in their own homes? What happens when a customer loses his digital TV picture? How will your technicians find the solution? What test equipment will they use to find problems?

The answer, at least in part, is training and education. Training can help with some of the skill and knowledge deficiencies; education can help with even more. Only experience can fill other voids. Preparing yourself and your staff for technological change is a daunting task. You will find that those who are educated will adapt well. Those who have not been trained will adapt, but it will be more difficult for most of them.

What is the difference between education and training? Training helps people learn skills or increase knowledge specific to a required task. Education provides underlying foundational knowledge to help people grasp fundamentals and apply that knowledge in varying circumstances. For example, you can *train* someone to use a calculator to find the answer to a mathematical problem but he or she must be *educated* in mathematics to be able to understand why the answer they got is right or wrong. You also can train your technicians to properly align the amplifiers in your forward cable plant, but unless they have been educated in the fundamentals of system design, noise addition, automatic gain control (AGC), or unity gain, it will be difficult to adapt the learned skills to the operation and maintenance of the reverse cable plant.

"Over 50% of the cable systems in the United States will install reverse capability in 1998."

Many operators today see the lack of training as a significant obstacle to the deployment of new services. Many individuals have acquired their experience in the field and do a tremendous job of maintaining the existing system that provides entertainment to the millions of cable TV customers. Most individuals that have learned by experience are now facing another challenge because the technology is changing rapidly. We don't have time for a lengthy learning curve before implementing the new reverse-capable hybrid fiber/coax (HFC) networks.

Educational opportunities abound but it takes an incredible amount of personal motivation to push yourself to take advantage of them. It is very hard to find time or energy for night classes, correspondence courses, or even Society of Cable Telecommunications Engineers chapter meetings.

It is very difficult to admit you do not have the background education necessary to fully grasp the new technologies being deployed. I find I must make time in my day to read, research and study those things I don't comprehend. That means I have to sacrifice, such as occasionally studying a textbook instead of watching a football game on Sunday afternoon.

The pace of technological change is not slowing. It is accelerating, rapidly. If you feel behind now, it will be even worse tomorrow unless you do something today. The SCTE is only one source of up-to-date training and education materials designed to help you stay current in your knowledge of the broadband telecommunications industry. Many colleges, universities, community colleges, and technical trade schools offer programs as well. The training and education is available. The motivation to use the materials or attend classes needs to be yours. CT

Alan Babcock is director of training development for the Society of Cable Telecommunications Engineers. He can be reached by e-mail: ababcock@scte.org.

BIG NEWS FOR BIG SYSTEMS

EAS UPDATE
FCC'S SECOND REPORT AND ORDER RELEASED.
December 31, 1998

If your cable system serves 10,000 or more subscribers, the time has come to act on EAS compliance—Trilithic makes it easy.

Trilithic's modular EASy™ system offers you an EAS solution that can be quickly and seamlessly integrated into literally any headend architecture, no matter how complex or sophisticated. With the EASy system you save time and money with bolt-on simplicity and the security and convenience of single source manufacturing and support. And with EASy, EAS compliance is as easy as mixing and matching the specific capabilities you need:

- IF substitution
- Crawls and all-channel messaging
- Video substitution
- Control of remote hubsites

EASy™ SYSTEM
EAS Compliance Technology

Call now at ***1-800-344-2412*** *for Trilithic's free EAS compliance videotape.*

Visit Trilithic's web site for a full download of the FCC's Second Report and Order: ***www.trilithic.com***

Don't wait, call Trilithic today for the good news on EAS. Not only will you receive our free videotape on EAS compliance, you'll also receive a free system quote and free EASy product descriptions and specifications. Call 1-800-344-2412.

YOU CAN'T BEAT THE SYSTEM

TRILITHIC
The Best Thing On Cable.

317-895-3600 FAX 317-895-3613
Reader Service Number 250

Interworking Conditional Access

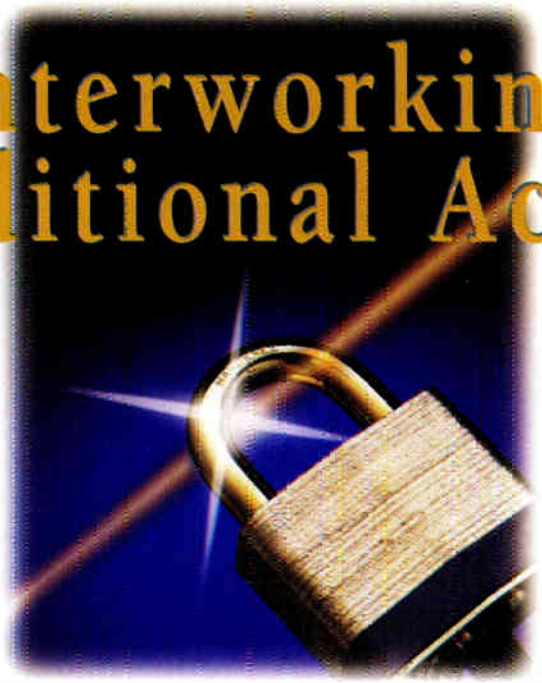


Photo by Bob Sullivan

Security Locks Onto MPEG, DAVIC, CableLabs

By Michael Adams and Tony Wasilewski

The following was updated and modified for publication in "Communications Technology" with permission from the National Cable Television Association. It was adapted from a paper presented by Michael Adams in the "1997 NCTA Technical Papers."

Existing conditional access (CA) systems, by their very nature, have tended to be proprietary. However, cable operators would like to have the choice of set-top terminals from many different suppliers. One approach would be to settle on a single system design and have all manufacturers license that one system. This would have negative implications for all parties concerned, however, because there is little incentive for feature innovations from the alternate suppliers, since they are locked into a single design.

The digital age offers the promise of supporting a highly standard, multi-vendor environment. This includes the possibility of having more than one conditional access system at work within the same network simultaneously. Because the industry has focused on and agreed upon the use of standards such as Moving Pictures Experts Group (MPEG-2) and Digital Audio-Visual Council (DAVIC)[1], it is now feasible to finalize agreements that permit complete interworking of products from different suppliers while still reaping the benefits of digital compression.

The MPEG-2 systems layer[2] provides various hooks to support the coexistence of multiple CA systems within the same digital channel. This allows decoders, using different CA systems, to gain access to the same services with no need to simulcast the MPEG-2 payload.

So that the MPEG-2 payload need only be sent once, it must be encrypted with a standard "service" encryptor. The multiple CA systems then effectively provide different key and entitlement delivery systems. Because only the CA key and entitlement delivery information needs to be simulcast, this adds relatively little overhead. We will show that, in practice, this is less than 1% per CA system.

First we will describe some requirements of a contemporary single CA system before turning to multi-CA systems.

Modern CA requirements

Traditionally, CA systems for broadband networks have been intended to protect primarily against signal theft for the benefit of the network operator. With the advent and migration to digital compression and two-way services, security issues have greatly expanded and so has the list of beneficiary parties. For example, content owners, service providers, billing providers and end users now all have security concerns in addition to network operators. In addition to signal security, examples of these emerging concerns include:

- Sensitive or private data accessed and transmitted in cable modem applications.
- Authenticating service providers in a multi-provider network.
- Multiple entitlement agents ("gatekeepers") in one decoder.
- Authenticating messages in forward and reverse directions.
- Protecting software and application downloading to set-top terminals (STTs), including virus protection.

- Two-way services.
- Shopping services and "e-commerce" and "e-cash."
- Subscriber identification and digital signature.
- Subscriber privacy, for example, credit card numbers.

These new service requirements can be met with an approach that combines both public key and secret key cryptography. The use of public key cryptography allows the addressing of the issues discussed before in a unique way that traditional secret key-only CA systems cannot match.

The requirements of a robust, contemporary CA system may be met by the following system components:

- Stream encryption and entitlement control message (ECM) streamer module
- Control suite
- Transaction encryption device (TED)
- Service decryptor module
- Security manager
- STT secure element

Entitlement management messages (EMMs) may be sent on this "out-of-band" path. In fact, since EMMs may be encapsulated within Internet protocol (IP) packets, they can be selectively routed to specific broadcast centers. This not only conserves EMM broadcast bandwidth, but considerably complicates the business of the "clone pirate," since there may be many broadcast centers. The "pirate" must maintain legitimate STTs in each of these broadcast centers to enable clone reception.

A typical CA system employs a multi-level key hierarchy. Control words are fast-changing keys used to encrypt the services (video, audio, data). Mid-level keys are used to protect the control words so that they can not be discovered in transmission, except by authorized units. The multi-session keys are sent to individual decoders using messages (EMMs) that are usually encrypted. If the EMMs are encrypted with the RSA public key algorithm, they also may be digitally signed by an entitlement authority.

CableLabs agreement

In October 1996,[3] some major elements of an interoperable digital cable systems specification were agreed upon by CableLabs and its members. The agreement was based on existing standards—data encryption standard (DES) and MPEG-2 systems layer. Also, the agreement was deliberately defined to be the minimum intersection of multiple CA systems:

- The adoption of a standard service encryption algorithm based on DES standards.[4,5]
- A common control word generation method.
- Use of existing features in the MPEG-2 systems layer to allow multiple CA systems to coexist within a single digital channel.

> "DES would not be an appropriate choice for long-term secrets but that does not mean that it is now a useless cipher."

This agreement represents the final and the most difficult step in the long history of standardization for digital systems. Because the CA system is typically the most feature-rich, it significantly differentiates one vendor's product from another. By separating the CA system into two parts (the service encryptor and other components), each vendor is still able to innovate and add features to its CA system without introducing incompatibilities at the service encryptor level.

A note about the DES

Over the years and in recent times, there have been reports of the "breaking" or "cracking" of the DES algorithm. Both differential and linear cryptanalytic attacks have been devised, but are not practical because of the large amounts of data that is needed to attack even a single key. Thus, the best known attack today against DES is "exhaustive key search."

In this attack, the adversary tries every possible DES key until one is found that causes the ciphertext to produce an intelligible plaintext or if matching plaintext is available, produces the matching answer. This key can then be used to quickly decipher other blocks that were encrypted with it. This is a daunting task since there are 256 or 72 quadrillion keys to test!

However, computing power is constantly increasing and becoming less expensive and the Internet provides a relatively easy way to amplify that power. In a recent response to RSA Data Security Inc.'s DES-breaking challenge posted on the Web (http://www.rsa.com/rsalabs/html / challenges.html), a group of volunteers arranged for tens of thousands of computers from industry, universities and government to work on the Challenge Problem. The method was straightforward: Divide the key space into many parts and give a small part to each of the volunteer computers.

After a four-month search and with 24.6% of the key space searched (approx. 18 quadrillion keys) the winning key was found. This shows that DES would not be an appropriate choice for long-term secrets (such as the formula for Coca-Cola or diplomatic communiqués) but that does

BOTTOM LINE

Multiple Conditional Access Systems

There are a number of well-developed standards currently being used to deliver digital video over cable systems in the area of modulation, forward error correction, transport and compression.

However, encryption and existing conditional access systems have been traditionally, by their very nature, highly proprietary systems. This presents a road block to the support of multi-vendor set-tops in cable systems.

One possible solution, for digital systems, is the adoption of a common, standard, service encryptor at the lowest level combined with multiple conditional access systems that provide key distribution and control functions.

There are, of course, technical challenges in building multiple conditional access systems. In practice, specific standards are required to support cost-effective deployment of multi-vendor set-tops.

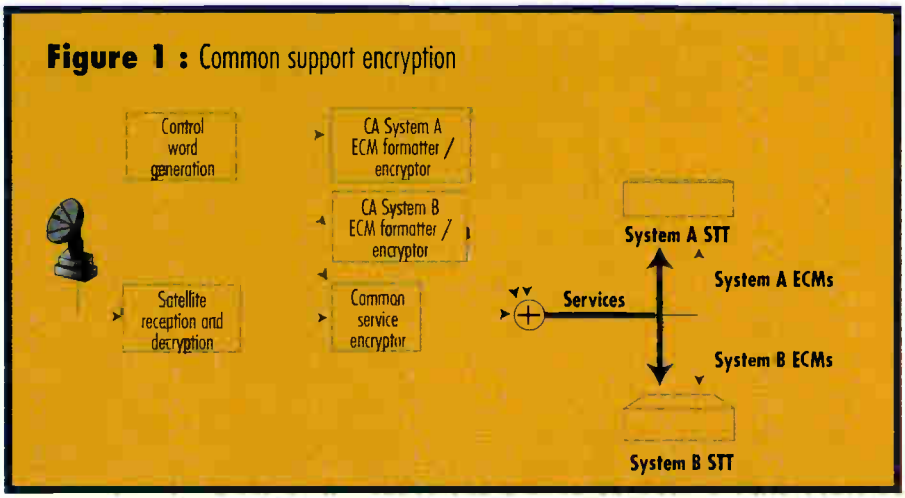


Figure 1 : Common support encryption

not mean that it is now a useless cipher. Quite the contrary, since the "strength" of DES has been so well characterized and it has been subject to intensive "attack" for over 15 years with nothing more practical than a "brute force" attack being discovered. It is an excellent choice for commercial encryption use. Coupled with appropriate key management and suitably chosen key lifetimes, DES can still provide robust protection against both real-time and off-line attacks against digital services.

Figure 1 illustrates an example multiple (dual) conditional access system. A common control word is used with a common service encryptor to encrypt the MPEG-2 payload. Each of the two conditional access systems independently delivers the control word (using different key delivery mechanisms) to the two set-top terminal (STT). Each STT receives and operates only on the ECM stream that it "understands."

Figure 2 on page 38 illustrates how the MPEG transport layer supports multiple conditional access systems. The conditional access table (CAT) provides pointers to multiple EMM streams. The program map table (PMT) provides descriptors to multiple ECM streams.

Each piece of CA information contained in the CAT and PMT is labeled with a field called the "CA System ID" so that the parameters from different systems may be distinguished from one another.

Thus, the necessary information to support multiple CA systems can be combined into the service-bearing multiplex and can be easily identified, parsed and used by the corresponding digital terminals. EMMs sent in out-of-band channels can be differentiated by similar or other methods, such as frequency division multiplexing.

Increased overhead of dual-CA system

What is the overhead of operating a dual-CA system? If we assume 100 kbps for the

additional ECM stream, this amounts to less than 0.4% of the digital channel. Taking an estimate of 100 kbps for the additional EMMs, this also amounts to less than 0.4% of the digital channel. (Note that in a cable system, EMMs are typically delivered in an out-of-band, QPSK, quadrature phase shift keying, channel.) Therefore, the total overhead is less than 0.8%.

In any case, it is the exception rather than the rule, that both CA systems would be active in a single system at the same time. The benefits of a multiple CA strategy of second sourcing, CA system evolution and CA replacement are more important than placing two set-tops, which require different CA systems, side-by-side in the cable system.

Future work

Much work still remains to be done to develop multiple conditional access

Definition Of Terms

The following terms are used in this article:

- **Conditional access (CA) system:** The software and other components necessary to provide for selective access or denial of specific services in a network. The CA system is used to establish the means by which subscription or other payments may be collected from users of a network for use of a service. A conditional access system includes mechanisms for payload encryption, secure key delivery, addressed messaging, secure entitlement delivery and appropriate links to administrative gateways or billing systems.
- **Key delivery:** The mechanism by which various keys are delivered to the set-top terminal in a secure manner (so that the service cannot be pirated).
- **Key hierarchy:** Usually defined in a broadcast security system. At the lowest level is the control word, which is the key used with the service encryptor.
- **Service encryptor:** The encryption algorithm performed on the MPEG-2 payload bytes. Note that the MPEG-2 transport system packet headers and adaptation headers are always sent in the clear.
- **Control word (CW):** The key used with the service encryptor to provide confidentiality of the delivered services. It is changed at a rapid rate to increase the security of the content.
- **Entitlement control message (ECM):** Private conditional access information that specifies control words and possibly other, typically stream-specific, scrambling and/or control parameters.
- **Entitlement management message (EMM):** Private conditional access information that specifies the authorization levels or the services of specific decoders. They may be addressed to single decoders or groups of decoders.

systems including:

- CA system interworking: There are many problems to solve here. Program schedules and program guide information need to be synchronized. Program guide information must be delivered in a form that all STTs can access. Billing interfaces must become more standard so that the two conditional access systems can be supported by a single billing system.
- Security extensions: A standard application programming interface (API) is needed to support secure applications, for example, secure Web transactions, electronic commerce, games, etc.

Summary

The framework to implement multi-CA systems was initially established by the MPEG-2 systems layer and has been further defined within the CableLabs agreement. However, there is still much work that remains to be done.

There is only a minimal and reasonable overhead to operate a dual-CA system. This represents less than 1% in a cable system.

The conditional access system significantly differentiates one vendor's product from another. By separating the CA system into two parts, each vendor is still able to innovate and add features to its CA system without introducing incompatibilities at the service encryptor level. Therefore, multiple conditional access allows interworking without reducing CA to the lowest-common denominator.

References

1 Digital Audio-Visual Council (1996), *DAVIC 1.1 Specification Part 8: Lower Layer Protocols and Physical Interfaces* (Draft as of September 1996).

2 ISO/IEC 13818-1 (1994), Information Technology, *Generic Coding of Moving Pictures and Association Audio: Systems.*

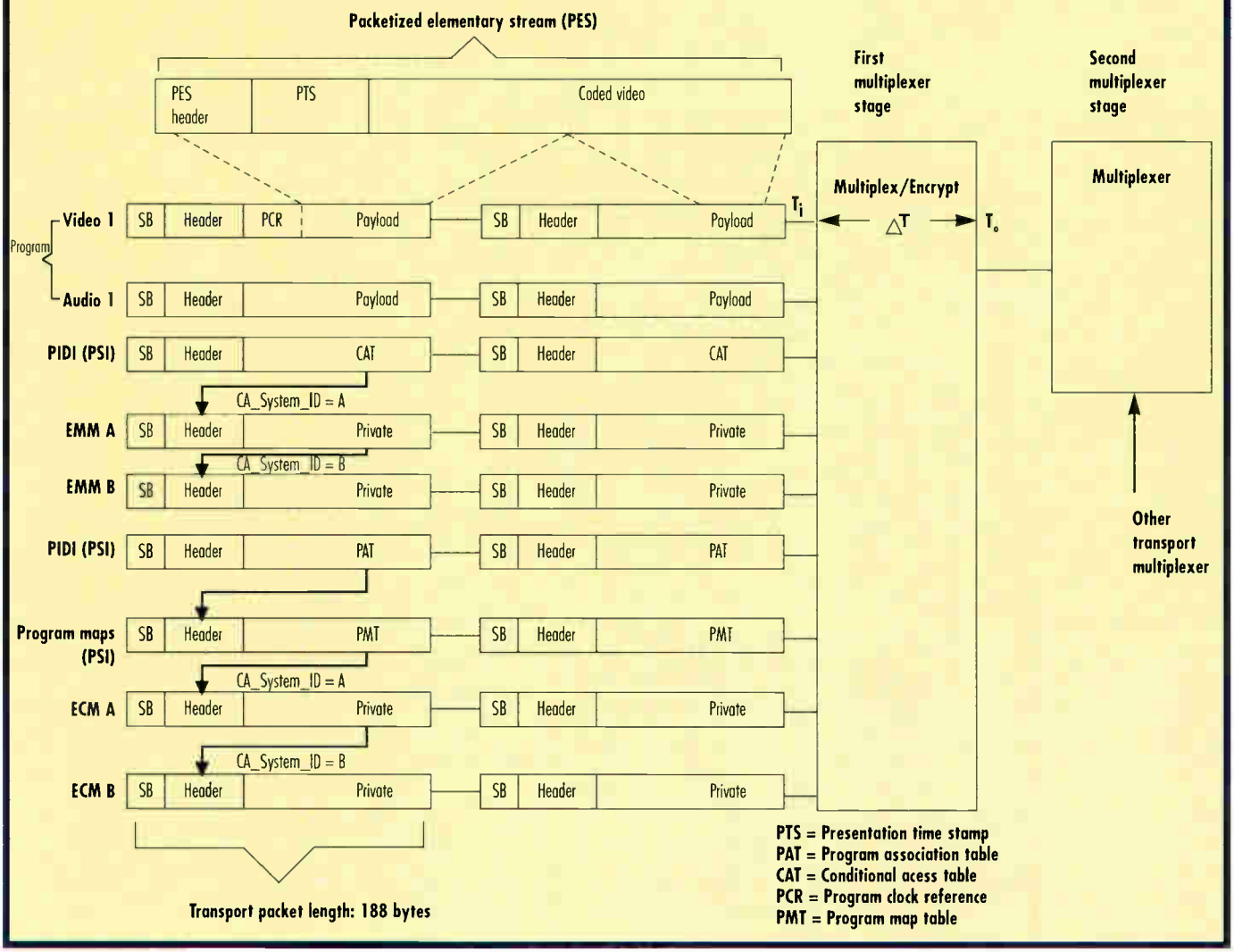
3 "Cable Industry Agrees on Key Elements of Digital Systems Specification," CableLabs press release, Oct. 3, 1996.

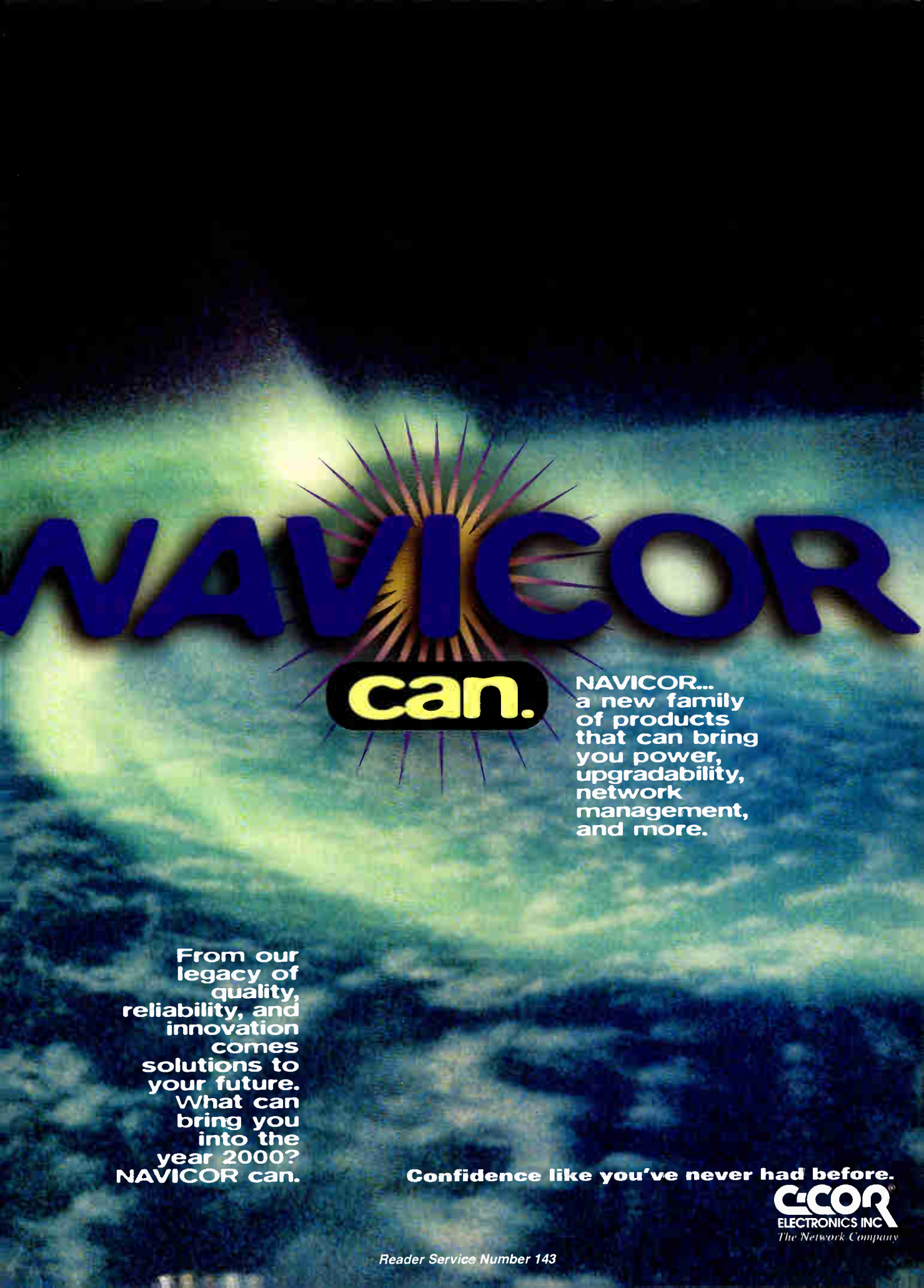
4 Data Encryption Standard (DES), *NIST FIPS PUB 46-2*, January 1988.

5 DES Modes of Operation, *NIST FIPS PUB 81*, December 1980.

Michael Adams is senior project engineer, advanced engineering, for Time Warner Cable. He may be reached via e-mail at michael.adams @twcable.com. Tony Wasilewski is chief scientist, software systems at Scientific-Atlanta. He may be reached via e-mail at tony.wasilewski@sciatl.com.

Figure 2 : MPEG-2 (ISO/IEC 13818-1)transport stream





PLANNI

Considering

By Rex Porter

In Part I, of Planning '98, we discussed the importance of planning. Here in Part II, we discuss some of the major topics that must be considered in that planning. We have also talked with some of the leading engineers and MSO chief technical officers. We asked them to tell us what industry logic should shape the thinking of engineers and technicians as they prepare for the new year.

NG '98

Competition

First, I think it is important we realize there is competition planning to deliver every new service we want to provide in the coming years, as well as those basic services we have always thought to be ours by birthright. TV broadcasters have always felt we had no right to provide TV service, at least not in their coverage areas. Telephone companies have always felt cable has no right to provide telephone service. Cable operators have always felt telephone companies or direct broadcast satellite (DBS) companies have no right to provide cable service. I don't know what rights any of us felt multichannel multipoint distribution service (MMDS) had—perhaps to service the foreign markets. But there is competition waiting to steal your customers.

Jim Farmer of ANTEC has this to say about competition: "Cable is becoming aware that competition is here and here to stay. We must adapt to this new paradigm if we are to survive. One thing this means is that customer service has got to be outstanding. Another thing it means is that we have to exploit our strengths against the other guy's weaknesses. One of our strengths is the return path. We have got to tame it and make it work, and we can do so."

Ron Hranac of Coaxial International also commented on competitive forces, "We can't let our guard down regarding the competition, especially DBS. The growth of DBS has slowed, the EchoStar/News Corp. merger fell apart, and one provider went dark. Still, that industry counts more than five million customers. We face existing or potential competition on other fronts as well. Ameritech's overbuild activities in the Midwest are on the upswing; local multipoint distribution service (LMDS) is poised to go beyond the NYC trial stage once spectrum auctions are complete; and the MMDS has finally topped the 1 million customer mark. Now is not the time to get complacent."

Our business is an integral part of the communities we serve. We need to stress this more in 1998. Jim Farmer calls this a competitive weapon and says, "Another competitive weapon is localism. Smaller nodes again allow us to do this better and better, and even the fact that we are local to the community is a competitive advantage over the satellite guys. We need to start capitalizing on these advantages."

Tony Werner of TCI reminds us, "The Multiple Cable Network Systems (MCNS) modem and cost-effective two-way implementation will be critical in 1998. The MCNS standard modem will provide for improved operating performance, but more importantly, it will provide for MSO inter operability and a retail strategy for modem sales. Cost effective two-way strategies are required to provide ubiquity to cable modem service. High-speed data services must be a product that can be offered by all MSOs and systems, not left exclusively for large or recently rebuilt systems."

Dan Pike of Prime Cable speaks of the importance of planning for the future, "Today the digital platform holds as much opportunity for the industry as the satellite platform did 20 years ago. Planning for '98 should consider all available and appropriate action on these new business ventures."

If you have been in our industry for more than 20 years, you will understand what Dan is telling us. Thirty years ago, I sold an MSO and various independent cable systems and was delighted to sell them at $300 per subscriber. Ten years later, the satellite platform allowed system owners to value their systems at $2,000 to $3,000 per subscriber. MSOs and system owners recognized the added value of these new services and planned for their addition to cable menus. The addition of channels such as HBO, Showtime, Turner Broadcasting, CNN and others, via satellite, did not come without costs in time, manpower, equipment and negotiations. But the return on that investment will pale in comparison to returns to

full-service networks, especially e-mail and data delivery. Allen Ecker of S-A comments, "Providing the broadband, two-way platform for Internet services such as Webcasting, Internet browsing, e-mail and Internet protocol (IP) communications is critical to the future of the cable industry. The open cable initiative by CableLabs and the Cable Industry Task Force can be an important factor in defining the open cable digital platform."

If you don't belong to CableLabs, you should plan to join immediately.

As the technical training becomes more complex, we must consider manpower needs as we move into new services on the networks. Ron Hranac addresses this problem: "We must plan now for what could be a manpower shortage in the future. The cable modem business is starting to take off, and our subscribers have been very pleased with the high-speed capabilities cable modems can provide. As that segment of our service grows, we may find ourselves faced with a shortage of qualified installation personnel. To date, many companies have used two installers per cable modem installation: A traditional installer installs the cable outlet to the computer, and a computer-type installs the modem and its software. If cable modem popularity takes off, where will we get more qualified computer-types for that phase of the installation?"

Jim Farmer touches on this subject, noting, "This means a continuing trend toward smaller nodes, better drops and better installations in the home. This latter is partly a training issue and partly an issue of making the right stuff available to subscribers, since we don't control home wiring." Farmer also says, "Yet another advantage is our analog delivery, in that we can serve every TV set in the house a lot easier than can the competition. We need to push this one hard!"

Hranac notes that "As we upgrade or rebuild our networks for new services, we have to consider the drops. Too many operators spend millions upgrading or rebuilding the headend and distribution network, and forget about the subscriber drops. An additional 8% to 12% of the network cost will, in most cases, cover the cost of replacing or upgrading drops to the quality necessary for two-way operation."

"A more concise understanding of the effects that loading on the reverse path may have on our network is essential to our successful deployment of Time Warner interactive services. During 1998, we will continue our Roadrunner cable modem service deployment, and will begin to launch digital video services delivered through a real-time,

THE CHALLENGE

Create a multichannel transmission system that allows high-speed transport of original quality headend signals over long distances

THE SOLUTION

LYNX Supertrunk System from Barco

Your multichannel, high-speed, digital transport solution

LYNX provides undistorted IF to RF output at the decoder and is an ideal solution for multi-hub site network applications using a redundant fiber ring.

- LYNX Transmitter provides two 194 MB outputs—allowing multiplexing of 32 channels per fiber and bidirectional transport in one unit
- LYNX Receiver has two 194 MB inputs, allowing simultaneous reception from both fiber rings
- 12-bit sampling for best recreation of original analog signal
- LYNX receivers feature auto-switching to minimize out of service time if signal loss from one path is detected
- Distributing IF signal eliminates the need for additional scramblers for stereo encoders at the hub site
- Frequency agile models for automatic backup are available
- Unlimited cascading to connect as many hub sites as your system requires
- Advanced drop/add/pass capabilities at any hub site

Find Out More!

LYNX 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, LYNX 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

Reader Service Number 23

fully interactive, addressable home terminal. These services will be very successful, but they place a significant demand on our reverse spectrum. We must understand the impact that increased loading will have on all elements of our return transmission system, including amplifiers, lasers, and optical receivers, and the effects of the coexistence of various kinds of modulation systems,"

was a message from Time Warner's Jim Chiddix directed to engineers inviting them to consider how multiple services should be successfully deployed.

Just when I thought everyone else thought me deranged for complaining about our reluctance to investigate other frequencies for the return path, Sruki Switzer responds from Bogota, Columbia, where he is moving his wireless subscribers over to a new hybrid fiber/coax (HFC) system. Sruki warns, "The persistent high cost of linear lasers drives system designers to use as much linear fiber network as we can afford and to complete the network with lower-cost linear coaxial plant. By linear, I mean network that operates like synthetic spectrum supporting multiple RF carriers in FDM mode—like radio space. The result is HFC networks. Two-way in the fiber component is much more difficult. Dual-coaxial is judged by most designers to be too expensive. Duplex operation of a single coaxial cable requires allocation of available cable spectrum into forward and reverse bands. In principle, this allocation is a simple and practical way to build a two-way, single-cable component of an HFC network. In practice, the designer is severely constrained by regulation. An unrestrained design decision would allocate spectrum between forward and reverse on expectations of volume and value of traffic in each direction. The present 5-40 MHz allocation for reverse is ridiculous. It forces designers into uneconomical small service nodes and an uneconomical division of HFC network between fiber and coaxial cables. Network designers in other parts of the world are not similarly restrained. A 65 MHz return is common in Europe. Even higher return path crossovers are practical in other parts of the world. The present sub-low return path allocation is causing an enormous waste in system design in this country. It should be changed—by changing the regulations (must carry) that impose it, or by literally buying back the low-band so that it could be used more usefully for return path purposes."

Michael Smith of Adelphia Cable Communications summarized, "1998 will offer many opportunities and much excitement as the industry continues to deploy cable modems and digital converters. Fiber intensive rebuilds and/or upgrades will gain momentum to meet the competitive challenges and deliver the new services scheduled."

Plan well because after the planning is done, the ongoing struggle for superiority continues on the poles, in the headend, the trenches, and at the customer premises! CT

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.

PLANNING '98

By Steven H. Doherty

How to Expand Without Imploding

Six Steps to Cost-Effective Node Upgrades

Should you upgrade your network? The answer is probably yes. But how should you upgrade your network to expand service while protecting your capital investment?

Many different types of upgrades to wider bandwidth all-coaxial or hybrid fiber/coax (HFC) distribution networks are being undertaken in the United States today. One is the upgrade of the traditional coaxial cable-based RF networks typified in smaller MSO plants with bandwidth capacity of under 550 MHz. These systems are in the process of rebuilding to two-way, HFC networks in order to enhance their current program offerings as well provide the delivery of new services and applications. In the process, they are improving the quality, performance and reliability of their services and networks.

HFC networks are already in wide use by major system operators. Most of these systems provide basic video services with some form of pay-per-view (PPV) programming. Some are offering two-way data services. The strategy for most HFC network operators, if not all, is to upgrade to two-way systems capable of supporting new and expanded services like high-speed data delivery.

Both upgrade paths involve some critical infrastructure decisions based on expandability requirements, service area size, network deployment costs and equipment performance. Understanding and identifying current and future needs will provide a good basis for the selection of an optical node platform.

Ideally, a truly modular RF amplifier/optical node platform would meet the full range of network upgrade strategies when used in business models anticipating future growth. Typical designs for system RF upgrades to HFC, which replace RF amps with an optical node, would go one step further and replace the first RF active after the node with a modular RF amplifier that is part of the node platform. By adding one optical receiver module, upgrades from RF amplifier to an optical node would be quick and cost-effective. As part of the node platform, all upgrade possibilities of the optical node would be available for the RF amplifier as well. And, since the coax to the RF active is in place, providing backup to those locations is simple. (See Figure 1 and 2 on page 48).

Upgrade considerations

In upgrading a distribution node, current service demand as well as potential service offerings must be considered. Although it is difficult to predict what services will be available in the future, care can be taken to ensure that the node platform is designed to allow scaleable addition of bandwidth and capabilities in a quick, easy and nonintrusive manner.

- Easy expansion. Decisions on node serving area size vs. bandwidth per subscriber requirements will provide an outline of possible migration path needs for both the forward and return frequency bands.

Selecting a platform that allows graceful, incremental additions via split node (multiple receivers and reverse transmitters on dedicated fibers), wavelength division multiplexing (WDM) and dense wavelength division multiplexing (DWDM), and/or block conversion

BOTTOM LINE

Expand Service While Protecting Capital Investment

A distribution node platform should provide two things: 1) a foundation for building present networks, and 2) the capability to easily and incrementally offer new services to match changing subscriber demands. Upgrading to advanced levels of service should include the six following considerations: 1) Return path; 2) Status monitoring; 3) Split node return; 4) Ingress management; 5) Individual returns; and 6) Redundancy.

WE'VE GOT YOU COVERED!

Toner

Our new European Headquarters and Storehouse is fully stocked. We are now shipping Cable-TV Equipment to all parts of Europe.

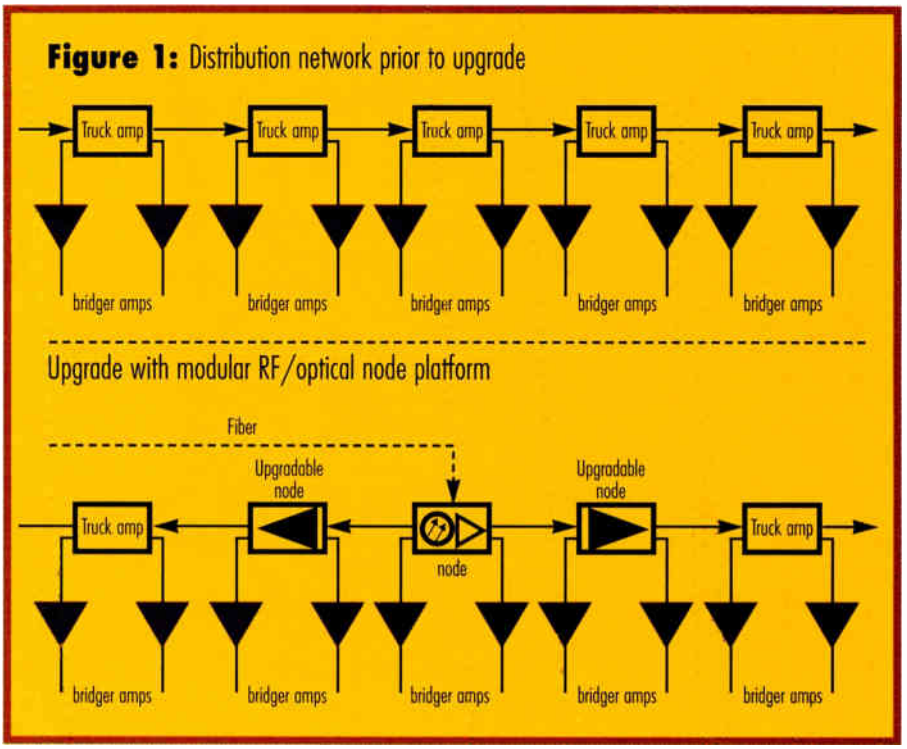
Give us a call!

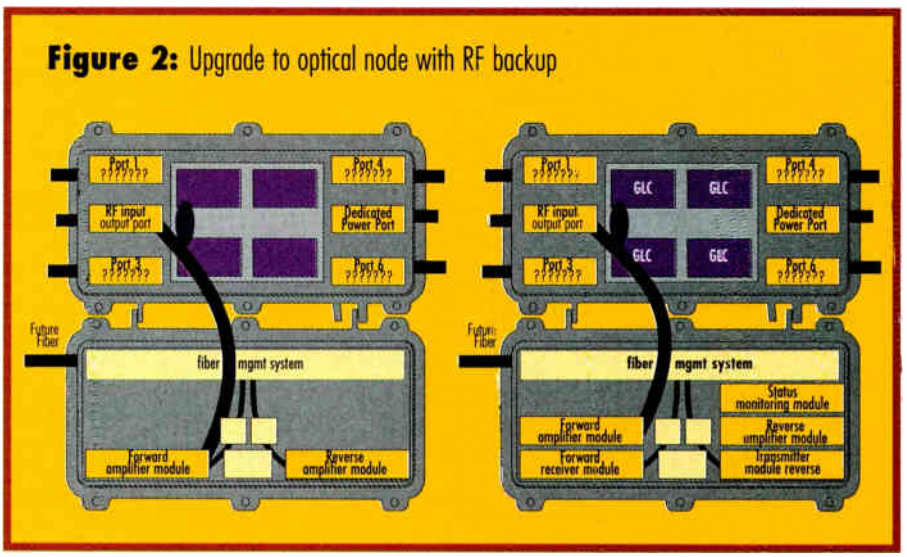
Toner

Your supplier of choice!

Toner Cable Equipment UK Ltd.
Unit 1 Portman Centre, 37-45 Portman Road
Reading, Berkshire RG30 1EA • England
Tel: +44 0118 959 6116 • Fax: +44 0118 959 9550
E-mail: toneruk@aol.com
Internet: http://www.tonercable.com

CE
CERTIFIED
We comply with the EMC directive for electromagnetic compatibility
en 50083-2





options within the same deployed casting, provides significant cost-savings now.

- Allocating bandwidth for your service area. New services and applications with longer connect times and larger bandwidth, such as video-on-demand (VOD), Internet access, and videoconferencing, require that system operators understand the allocation of bandwidth to subscribers. Shortages arising when subscriber demand exceeds bandwidth capability will result in lost revenue and dissatisfied customers—customers who have become used to fast immediate responses in their technology interactions.
- Lowering network deployment costs. Labor is a significant, sometimes overlooked, contributor to overall network costs, and a potential source of savings. Costs associated with tech-hours during initial deployment, operational setup, maintenance and upgrade should be reviewed as part of the platform selection. Finally, upgrades that can be achieved rapidly, effectively, and with minimal additional hardware purchases will produce greater returns, quicker, once new service offerings are rolled out.
- Permanent castings eliminate equipment concerns. The casting (the box or

base of the node) is the foundation of the overall platform. The goal should be to deploy a casting that will allow growth via modular features and performance improvements.

Once deployed, no plant modifications between the headend and the casting outputs should be needed. Is the casting prepared for future technology implementations? The answers on heat dissipation, power consumption and powering efficiencies will provide insight on the platform's ability to handle 1 GHz components, cooled and/or isolated return transmitters, block conversion, split mode options, future powering schemes and other possible upgrade requirements. The answers will also give a good indication of the unit's reliability and life cycle costs—also a part of the overall cost modeling.

Six steps to upgrading

The upgrade path discussed is based on a full service RF/node platform, designed to provide both forward and reverse path capability of subscriber counts from 200 to 2000 homes and upgradeable modularly.

Initially, the platform, RF or optical, is configured as forward only, distributing basic video services. Upgrades to higher levels of performance can be made in the following discrete steps that match service offerings and subscribers' demand—matching capital improvement costs with the revenue stream.

1) Return path. The first upgrade will be to deploy reverse transmitters. In a single transmitter configuration, each of the four ports combine to feed the same reverse transmitter with the 5-42 MHz spectrum shared among the entire serving area.
2) Status monitoring. A possible next stage is to add status monitoring capability. Implementing a status monitoring system aids the operator in providing quality, reliable performance throughout the network.
3) Split node return. With status monitoring in place, the next upgrade step might be installation of a second reverse path transmitter to provide enhanced telephony and integrated services. A 100% increase in available reverse bandwidth can be achieved by quickly reconfiguring the single four-port RF feed into two separate two-port signal feeds and adding a second reverse transmitter.
4) Ingress management. Return paths, no matter how clean and well maintained, contain some amount of ingress (that is, spurious noise and signals generated from home-based sources such as radios, motors, computers, and appliances) that leaks into the return path network. Depending on the type and source of the ingress, degradation of the return path may occur in a serving area only or throughout the network. Adding ingress isolation management via modular gate level controllers (GLCs) can help find and limit the number of subscribers impacted by reverse path ingress and set-top converter.
5) Individual returns. Gate block converters (GBCs) provide full migration from a basic receive-only broadcast node to a node delivering the full array of integrated digital services. GBCs dedicate a separate, discrete 5-42 MHz return path for each of the four reverse path ports, increasing return path bandwidth by 300% over the original deployment.
6) Redundancy. A final step in a serving area upgrade path might be to implement forward and reverse redundancy. Backing up the optical paths in high revenue traffic areas can minimize network downtime and lost revenues caused by fiber cuts and electronic failures.

The future

A distribution node platform should provide two things: 1) A foundation for building present networks, and 2) The capability to easily and incrementally offer new services to match changing subscriber demands. It should be flexible, allowing the system operator to design the system to meet the needs of varied serving areas. Finally, it should be upgradeable, allowing the system operator to implement future bandwidth-intensive services and capture added revenues without modifying the cable plant. CT

Steven Doherty is product line manager for Homeworx Broadband Transmission at ADC Broadband Communications. He may be reached at (203) 630-5700.

PLANNING '98

By Kevin Oliver

Make Up for Lost Time

Integrating Meters and Monitoring Cuts Hours to Minutes

Anyone who has tried to implement and operate advanced services such as high-speed data or telephony by activating the return plant of a hybrid fiber/coax (HFC) network can attest to the learning curve challenges maintenance personnel must endure.

Ingress and common path distortion are on the collective mind of the engineering community more than ever before. They are difficult and time-consuming to find, troubleshoot and maintain with traditional equipment and practices. As a result, some operators are struggling to meet aggressive deployment schedules.

Meter/monitoring solution

New advances that link field test meters and performance monitoring systems appear as one solution to this situation. Operators planning future maintenance practices can achieve lower maintenance costs, faster activations and better quality service by integrating field test equipment and monitoring into a "systems-based" approach to return path maintenance and management.

The keys to this approach are to empower field technicians and operations managers with more information and to speed routine tasks and analysis. The tie between roving field meters and permanently-mounted performance monitoring equipment is a natural step toward more efficient management and maintenance of network performance.

Imagine for a minute a technician being able to tap into any field test point in the network and quickly view systemwide performance data with his field test meter—something he is already carrying. This could be ingress on individual return paths as received at any hub.

How much faster and easier is it to track and find problems in the field? The technician might even be able to quickly and remotely analyze the situation without travel time.

How many new problems and how much wasted troubleshooting time could be avoided altogether by allowing the technician to quickly check if any changes he makes in one location have an adverse affect on performance at other points? Also, by recalling historical test data, a technician has a baseline from which to compare current performance. He can then act more intelligently and answer the following questions:

- Has the performance changed since last month?
- Do I really need to make any changes?
- Did I fix the system back to its original condition?

With the right information at the right time, it could be possible to cut hours or days from the maintenance process.

The same integrated system that gives the field technicians the power to more effectively and efficiently find and fix problems can give others the ability to better manage the maintenance process. An integrated system would allow accumulation of a wide amount of network performance test data in one place. With continuous, intelligent analysis, managers or central operation

BOTTOM LINE

The Meters/Monitoring Integration Solution

Operators planning future maintenance practices can achieve lower maintenance costs, faster activations and better quality service by integrating field test equipment and monitoring into a "systems-based" approach to return path maintenance and management.

What are the benefits? You can find and fix problems faster; technicians are more productive; you can better manage and measure maintenance process; techs can identify minor problems before major outages; and you can minimize self-inflicted downtime.

Advanced Network Monitoring Solutions

Meeting the Reliability Challenge

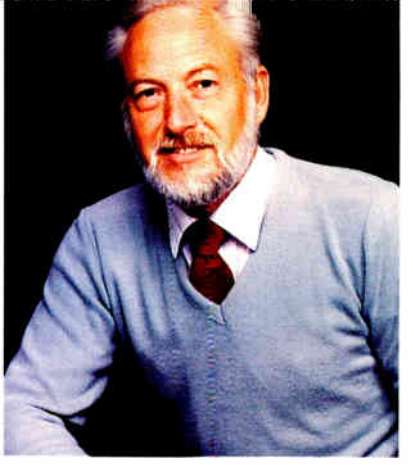
A SPECIAL SUPPLEMENT TO

Communications Technology

Cheetah™

SUPERIOR ELECTRONICS GROUP, INC.

The Importance of Status Monitoring



By Rex Porter
Editor-in-Chief
Communications Technology magazine

Managing hybrid fiber/coax (HFC) networks requires constant monitoring of every return path in a system. Not only must each return path be monitored, but data must be accumulated so that an analysis can be made of that particular path's potential failure and corrective actions can be taken, before the failure occurs.

The introduction of digital services presents a unique challenge to the cable industry. Data signals must use a 5 to 40 MHz spectrum where noise is a constant companion. With software available for monitoring specific points in the network, engineers can choose a monitoring program which can grow as the system becomes more sophisticated, expanding services from analog TV to data, digital TV and/or telephony.

The Down Side of Digital

Analog video signals can stand degradation and continue to be watchable by subscribers until the problems with signal strength or disruption are corrected. Digital signals, however, can disappear completely when their signal strength falls below their threshold level. A modern status-monitoring system will help alert the engineer long before digital signals fall to threshold strength. Diagnostics can be performed on particular problem paths to ensure optimum performance.

Communication along the Internet is in deplorable shape, owing to the limitations of telephone architecture. Busy signals prevent customers from connecting. Customers also can be disconnected because of overloaded telephone circuits. Downloading is excruciatingly slow. When the public becomes aware of cable's solutions to these telephone-related problems, they will demand a better system—the cable system. That will require cable operators to optimize their networks' reliability, which will require the implementation of a Network Operations Center (NOC) for every system.

Although small- to mid-sized systems may not be able to afford a NOC in as grand a scale as major-city systems, every system expecting to deliver digital TV, data and telephony to its customers will be forced to acknowledge the importance of status monitoring. Headend and line equipment to allow such monitoring should be a part of planning for full-service networks.

Easing the CLI Burden

Another important reason for status monitoring is that cumulative leakage index (CLI) testing will continue to be required as part of ongoing FCC tests. Status monitoring may ease the burden of continual CLI repairs, since modern status monitoring can allow maintenance before the network path's reliability is degraded. Individual return paths must be monitored; and eventually every cable system will have some type of NOC, if only a single monitoring computer screen manned by a Status Monitor Technician. Whether the system is large, mid-size or small, location of the status monitoring equipment at the headend, the fiber nodes and the coaxial cables, will probably be similar in all.

What are some considerations when planning status monitoring? Although systems may wish to limit their program at the start, you must plan a system to be expandable for additional services in the future. The status monitoring system should be "friendly" to any of the leading suppliers of amplifiers and headend devices. In addition to monitoring the performance of the total HFC network, status monitoring can aid in production of required FCC tests, printing test results for storage of critical data.

Today's cable television systems will be tomorrow's full-service networks. The speed of modern HFC networks can be the future of a new information superhighway. But the cable industry will not replace the present telco architectures in delivering telecommunications services unless we are prepared to properly and continually monitor the operational status of our systems. ■

A SPECIAL SUPPLEMENT TO
Communications Technology

PUBLISHER: Nancy Umberger
EDITORIAL SUPERVISOR: Alex Zavistovich
EDITOR, CT: Rex Porter
SPECIAL PROJECTS DIRECTOR: Bill Wynne
DESIGN: Dennis and Sackett Design

Meeting the Network Reliability Challenge

By Brett Price
Senior Vice President
Superior Electronics Group, Inc.

As new data and telephony services are offered over HFC networks, reliability becomes an integral part of network design and operations planning.

Status monitoring systems are useful because they turn large amounts of data into actionable information. This information is playing an important role in improving construction practices, installation procedures, plant maintenance procedures and customer service. Most importantly, operators are now notified in real-time of a hard failure in the network, and operators are dramatically cutting the time to restore service. Engineering and technician resources now can be focused on preventing problems and fixing problems as quickly as possible.

However, monitoring the status of network elements is just one part of the plant picture. It is equally important to maintain a clear picture of the signal quality being delivered to subscribers. This aspect of a monitoring system—performance monitoring—has become a critical element in providing the cable operator with the information necessary to characterize the state of the entire network.

An important addition to the capabilities of monitoring and management systems has been the identification of ingress on the return path. Given the sporadic nature of ingress it is highly unlikely that ingress can be caught using manual techniques. An automated solution is required—the equipment must scan for ingress 24 hours a day. In addition, by integrating this return path analysis function with a network wide management system, alarms can be piped to a central manned location. A beeping computer in an unmanned hub does little in the fight against ingress.

Integration with other software applications is another key requirement. The adoption of open standards such as the Simple Network Management Protocol ensures compatibility between software vendors and minimizes the integration effort.

A successful network management system needs to create value. This includes visibility into network performance, immediate response to impending failures, more efficient use of resources, and higher reliability of the plant and services.

As cable operators deploy the infrastructure of status and performance monitoring systems, new and powerful network data is becoming available. The network monitoring system is playing a crucial role in gathering, filtering, correlating and distributing this data, and cable operators are re-evaluating their business and network management practices to fully leverage the new information. ■

Tips for Building a Complete Network Monitoring System

Use these component guidelines when planning your system.

Advanced Software System.
Look for software that:
- Monitors the entire plant, from headend to end-of-line.
- Monitors the entire HFC domain—transmitters, lasers, amplifiers, fiber nodes, etc.
- Operates on Windows NT or UNIX platforms.
- Communicates with fleet management, billing applications, etc. through standard open systems interfaces.

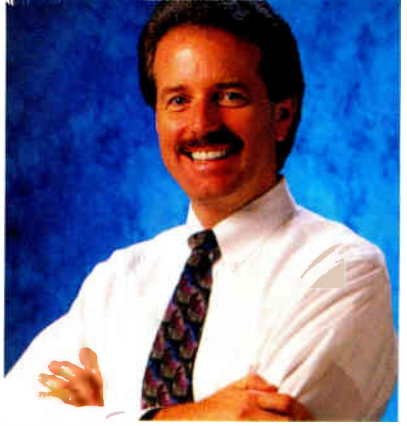
Status Monitoring System.
Your field hardware will need to:
- Monitor power supplies first. The number one cause of signal loss is commercial power outages.
- Monitor the status of several vendors' devices. Most HFC networks incorporate network elements from more than one vendor.

Forward Path Monitoring System.
Are you transmitting at proper frequencies and levels? Heed this advice:
- Ensure a clean signal leaves the headend.
- Verify the signal as it travels the plant. You need to ensure that a quality signal is being distributed throughout your network.

Return Path System. Establishing new services as successful revenue generators requires a return path clear of ingress.
- Automate the process and remotely analyze return path frequencies.
- Choose an ingress management system flexible enough to expand as networks grow.
- Centralize return path monitoring efforts, monitoring return paths in the headend and hubs from one terminal in a central location.
- Speed is essential. Look for a monitoring system that sweeps the return path in a fraction of a second.

Putting Network Monitoring in Place

A Guide to Deployment



Jay Price

You've decided that your two-way network needs a comprehensive network monitoring system to ensure reliable delivery of video, data and telephony services. How do you incorporate the system into your existing network structure?

According to Jay Price, corporate account director for Superior Electronics, implementation of a CheetahNet network monitoring system has several distinct phases:

1. *Site survey phase.* This earliest phase of implementation begins once a network monitoring system has been chosen. Superior sends specialized network applications engineers to the customer's site to review the current network and determine how the monitoring system will be incorporated. Both the applications engineers and the customer reach agreement as to how they'd like to implement the entire system.

2. *Certification phase.* The video, data and telephony services provided by an operator require network monitoring and performance monitoring protection at various levels. To optimize the performance of the network monitoring system, Superior's engineers usually start in an area or node that has been certified for that type of service. Certified nodes are those that have been balanced, swept and designated as operational.

Superior compiles its site survey information in a detailed system implementation plan covering all facets of the deployment. This plan includes network schematics, return and forward combining paths, the points along the network at which the CheetahNet system components will be inserted, specific equipment operating levels, and the resources required for deployment.

"THIS IS AN INFORMATION SYSTEM, NOT A DISTRIBUTION SYSTEM. WE HAVE TO EDUCATE OUR CUSTOMERS ON HOW TO USE THE SYSTEM TO GAIN ADDED VALUE."

In some cases, Price said, customers need some basic training on the advantages of their newly-acquired network and performance monitoring equipment. "This is an information system, not a distribution system," Price points out. "We have to educate our customers on how to use the system to gain added value."

3. *Network element deployment phase.* Either Superior or the customer will deploy the system, as preferred by the customer. If the customer chooses to deploy the product, Superior will train the staff in what's required for proper deployment.

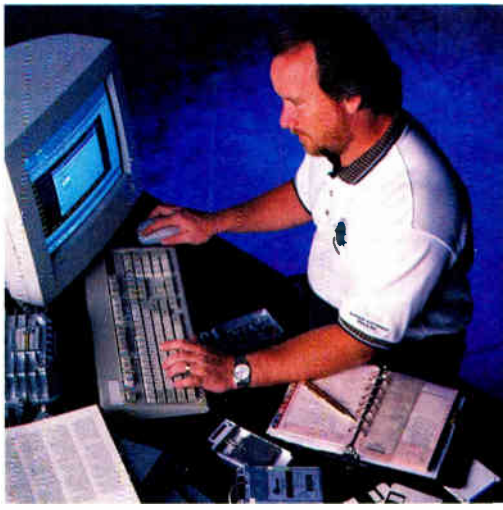
A comprehensive network monitoring system includes automated software and hardware components designed to communicate across the entire HFC domain.

During network element activation, components in the plant and headend are brought online, and software is installed by Superior personnel. System deployment is fairly intensive but moves along quickly, Price said. Essential to the activation is a validation process. Superior and its customers go through the certified area on a node-by-node basis, verifying equipment operating parameters as elements are activated. The customer formally signs off on the testing at the conclusion of the validation process.

The customer often learns a lot about his system at this point, Price said. In some cases, engineers may uncover problems in the network's active devices of which they were previously unaware.

"FOLLOWING THESE PROCEDURES, PRICE ESTIMATED THAT A NETWORK MONITORING SYSTEM SUCH AS CHEETAHNET COULD BEGIN TO PAY FOR ITSELF ALMOST IMMEDIATELY."

4. *Qualification or operational deployment phase.* The areas certified for CheetahNet now are turned over to the customer's network operations center. This is a critical part of deployment, Price stressed. At this point, Superior's deployment team no longer has responsibility for the operation of the nodes. The customer must now monitor the system; the responsibility of resolving any alerts, alarms, events now falls to the customer.



CheetahNet software isolates faults and analyzes network performance.

Price had several suggestions to make network monitoring deployment easier and more efficient. Foremost, Price advised that customers allocate personnel and financial resources specifically for network monitoring.

Certification also is essential for Price. Operators must be certain that the portions of the network in which the monitoring system will be used are certified, swept and balanced. If necessary, Superior can supply a team of experts to sweep and balance an entire set of nodes.

Following these procedures, Price estimated that a network monitoring system such as CheetahNet could begin to pay for itself almost immediately. He cited an example of a major outage that occurred in one customer's 16-node area.

CheetahNet identified the outage and notified the network operations center before even a single service call was reported. The network was back on line in 15 minutes, and a subsequent power supply failure was identified while the truck was still in the area, saving the operator the expense of an additional truck roll. ■

MAKING AUTOMATED NETWORK MONITORING WORK FOR YOU

Monitoring the status and performance of the hybrid fiber/coaxial (HFC) domain helps improve overall plant performance and increase network reliability ratings. By monitoring your HFC network, you can realize considerable improvements in the following areas:

1) **Identifying failures before service is disrupted.** The most common network failures are due to powering problems. In large networks the layout of power grids may make a power failure in part of the system invisible in the headend. A monitoring system immediately informs you that power supplies have switched into standby mode.

2) **Cleaning the return path.** An automated return path monitoring system not only alerts you to ingress, but enables you to measure it and identify the source down to a node level. With this feature, you can target truck rolls to the problem area while maintaining communications with all other nodes.

3) **Finding slowly degrading signals.** Testing for signal distortion, as well as levels, gives you a more complete picture of what your subscribers are seeing. Measuring distortion parameters on a non-interfering basis at many points in the network, tracking this performance over time, and analyzing it for degrading performance will allow you to target trouble areas before service distortions become visible to your subscribers.

4) **Speeding repairs by finding the root cause of a failure.** Simple monitoring systems may not have the capability to identify the cause of a failure. A comprehensive solution with an expert system filters alarm storms and allows you to target truck rolls directly to problem areas.

5) **Monitoring the most critical part of your plant—the headend.** When a failure occurs in the headend, the entire plant may be affected. An advanced network monitoring system immediately alarms on failures in laser transmitters and other critical headend devices from a variety of vendors.

6) **Simplifying FCC compliance and test year-round.** You need an automated monitoring system that will continuously test your plant and ensure high-quality performance—at or above FCC requirements. This will save you time and improve network reliability.

Bell Canada Puts CheetahNet To Work

Two cities in the Canadian provinces of Quebec and Ontario are the sites of residential broadband trials conducted by Bell Canada. Comprising digital cable TV and interactive high-speed services, the Bell TotalVision™ trials will help Bell Canada better understand what's required to most effectively deliver leading edge digital cable TV services and how to implement and operate an interactive broadband/broadcast service.

Monitoring the hybrid fiber coaxial network over which these services will be distributed is an important part of Bell Canada's implementation plans. The company has chosen CheetahNet from Superior Electronics to do the job.

According to Geoff Nokes, Bell Canada's associate director for operations development, the decision to use network monitoring was easy. "For a telecommunications company like Bell Canada, network monitoring is a fundamental element in our operational paradigm on the network side," Nokes explained. He stressed the need to monitor continually the health of the network, from a network status and performance perspective. "Our objective is to resolve problems before our customers are impacted," he added.

Several key features went into Bell Canada's choice of the CheetahNet system. For example, the system had to have software and hardware architectural compatibility with Bell Canada's IT architecture. Without that compatibility, Nokes said, "systems can't talk to other systems, and this communication problem can quickly become a serious impediment to effective and efficient operation." This compatibility included client/server architecture and flexibility in hardware and operating system support.

Nokes also was looking for the capability of interfacing with external support systems. "An operations center looking at a large network, of which the HFC is just one part, needs to be able to see end-to-end," he said. "It must provide a 'whole view' of what's going on in the physical network and how it relates to what's going on in the headend."

Multi-user access from multiple operations centers was another key feature. While the entire network is monitored from centralized operations centers, Nokes explained, varying requirements of service provisioning and service assurance require technicians to have simultaneous access to the monitoring system from multiple stations in more than one operations center.

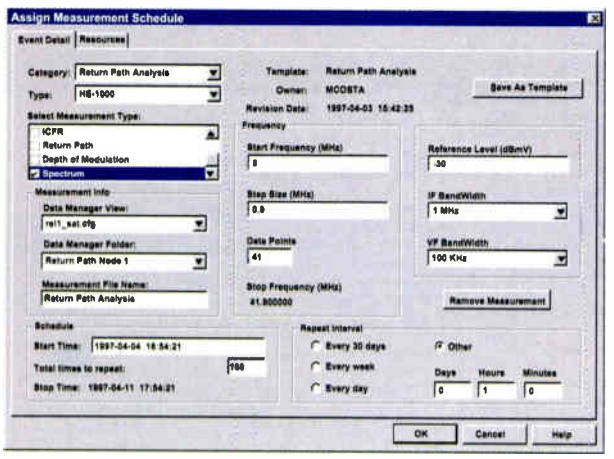
CheetahNet provided Nokes with the flexibility Bell Canada needed in a network monitoring operating system. "Their software strategy lined up with what we were looking for," he said. "It was definitely the 'best of the breed' in terms of our requirements."

"BELL CANADA'S CHEETAHNET SYSTEM IS USED TO MONITOR THE QUALITY OF THE SIGNAL AS IT LEAVES THE HEADEND, AND TO MONITOR THE OPERATION OF THE HFC NETWORK."

Bell Canada's CheetahNet system is used to monitor the quality of the signal as it leaves the headend, and to monitor the operation of the HFC network.

"If there's any active in the HFC outside plant that's not working as it should, CheetahNet provides us with alarms," Nokes said. "More importantly," he added, "it provides us with signal quality information. Given all the external influences on the HFC environment, monitoring the quality of the distributed and return path signal is essential."

The bottom line for Nokes is simple. "In today's environment, network monitoring is key for any telecommunications or broadcast offering that wants to meet the quality of service standards Bell offers and our customers expect. It allows us to be one step ahead to deliver our commitment to our customers." ■



CheetahNet enables you to regularly schedule network measurements.

MediaOne Boosts Customer Service With CheetahNet

Computer networks have always been managed using simple network management protocol (SNMP). Wouldn't it be great to have cable products also be SNMP-manageable?

That was the question that sparked MediaOne's interest in network monitoring. According to Robert Strickland, senior VP for information systems at MediaOne in Boston, MA, the company was looking for ways to monitor the performance of the devices used in its HFC networks—the amplifiers, power supplies and other hardware that comprise the physical network itself.

Strickland was also looking at the bigger picture. "Network tools are not just for engineers looking at the network," he said. "The real value here is to provide engineers with the information they need to fix the problems and to alert upstream customer service agents, marketing people and other non-technical personnel, so that how we care for customers can also come into play."

The proving ground for this approach was MediaOne's Enterprise Network Operations Center (NOC), the command center for the company's LAN/WAN service for business customers. (In some ways, MediaOne has become its own first customer, running its own internal networks over its HFC plant.)

MediaOne first deployed the CheetahNet system earlier this year, in the company's Northeast service region. The decision to run CheetahNet was easy. "Superior Electronics products were in four out of six of our regions. We had already signed an enterprise agreement with Superior for products and services.

"Superior then came up with the CheetahNet software to manage our devices."

One challenge MediaOne offered Superior was to create a more open interface. Another company's network management software had also been implemented in the network. "We asked Superior to partner with us to allow this other network management system to view Superior Electronics' devices," Strickland said. "Superior has been very accommodating in evolving their product to integrate with our overall network management architecture."

The CheetahNet system started working for MediaOne right away, Strickland recalled. At the grand opening of the Enterprise NOC, an alarm went red in Watertown, MA. Through the CheetahNet software, engineers at the NOC were able to analyze the alarm.

"Our end game here is to have the software go back through a trouble-ticketing system and a dispatch system to alert our customer sales people," said Strickland. "Instead of having to dispatch a dozen technicians, here we can have a rifle-shot approach to repairs. We can know exactly where the problem is, what's going on and how many times the devices have failed previously. It's wonderful."

Strickland is optimistic about the early performance of CheetahNet. "HFC networks have never been managed at all, so we're doing baby steps here. I think we have a very positive first step: Bring the Superior product up, get it going, using it within the framework of an enterprise NOC."

The CheetahNet startup screen.

Engineers in the Northeast region are delighted with the product and its potential, Strickland said. CheetahNet fits into MediaOne's overall customer service plan, he added.

"There's been a general push in the cable industry to pursue network management from an engineering perspective, which has merit," he noted. "But network management also should be used in a proactive measure to deliver higher quality customer service.

"MediaOne is working with companies like Superior to incorporate the hooks required for customer service to be able to communicate with these network management products as well," Strickland maintained. "It's another step toward improving the public's perception of customer service in the cable industry." ■

"SUPERIOR HAS BEEN VERY ACCOMMODATING IN EVOLVING THEIR PRODUCT TO INTEGRATE WITH OUR OVERALL NETWORK MANAGEMENT ARCHITECTURE."

CheetahNet™ ... The Difference is Striking

Examine CheetahNet™ carefully and you'll see that its speed, reliability and inspired design are striking. CheetahNet is exactly what you need for fault detection and network performance analysis. Featuring a powerful, open-systems architecture, CheetahNet integrates with third-party software systems and monitors multi-vendor HFC plants.

Versatility

Whether you prefer the power of UNIX or the ease-of-use of Windows NT, CheetahNet is compatible. It works equally well on either platform.

Speed

CheetahNet collects and cross-correlates analog parameters from third-party systems, performance monitoring data and multi-vendor network status. You'll identify degrading systems, instantly detect faults and determine the root cause of major failures.

Reliability

From the headend to end-of line, CheetahNet monitors the entire plant. Even on the return path, CheetahNet automatically isolates sources of ingress.

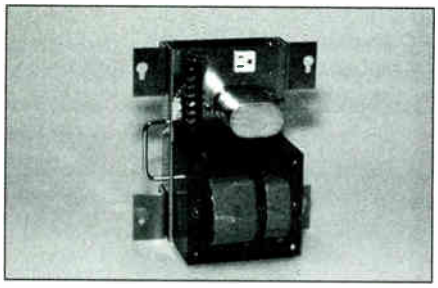
CheetahNet fills a critical gap in network monitoring. No other system even comes close. Extraordinary innovation has made the Cheetah System the standard for monitoring the world's largest broadband networks.

(941) 756-6000

SUPERIOR ELECTRONICS GROUP, INC.

6432 Parkland Drive • Sarasota, Florida 34243 • (941) 756-6000 • FAX: (941) 758-3800

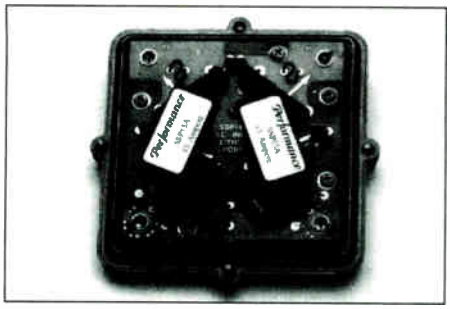
Cheetah™



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 101



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 116

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.

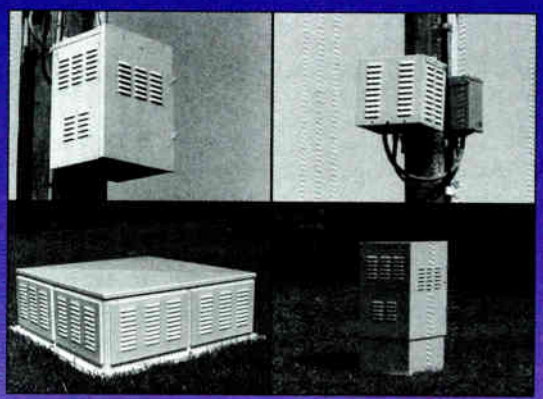
Reader Service Number 117

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 118

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 140

centers could be alerted when performance deviations occur. In addition, remote analysis of network performance could be done from a desktop to help research problems, correlate historical performance to other network events, and provide assistance to field technicians.

The system could allow users to more actively manage the maintenance process and change control. Managers and network monitoring centers could be kept aware of active maintenance being performed on the plant and be able to better control unnecessary or ineffective changes by field technicians. These more proactive and effective management and maintenance procedures can improve an operator's ability to provide quality services without rupturing the budget. CT

Kevin Oliver is product marketing manager at Wavetek. He can be reached via e-mail at oliverk@wavetek.com.

Five reasons or integrated return maintenance

What are the top five reasons to plan for an integrated return path maintenance system?

1) **Find and fix problems faster.** By viewing individual return path data at the headend from field test points with a single system, manpower and time is saved.
2) **Technicians are more productive.** Technicians do not have to drive back and forth from field test points to hubs or headends to check performance conditions. Also, they can quickly store network performance data on a single, central database from the field without driving to a headend to download field test data to a PC.
3) **Better manage and measure maintenance process.** With an integrated maintenance system, operations and network managers can easily view summary reportsm, of system performance, identify problem areas, correlate past or current network performance to other events and problems, monitor field maintenance activity, and assist in the problem troubleshooting and identification process.
4) **Identify minor problems before major outages.** Intelligent spectrum monitoring and flexible notifications can advise where and when performance problems are beginning to develop so proactive responses can be organized.
5) **Minimize self-induced downtime.** Adjusting one part of a two-way network will have effects elsewhere in the system and, with the return path especially, problems may have multiple sources.

THERE ARE 300,000,000 REASONS
TO INSTALL THE "SUB-ALERT"
EMERGENCY ALERT SYSTEM

IF, 4.5 MHz & Baseband and Comb Generator Switching

Remote Editing

Protect Your most Valuable Assets - Your Subscribers

Longest Warranty

No Ad Insertion Crashes

Available with Live Audio/Video Switching Control

Compatible with Data, Telephone & Internet Services

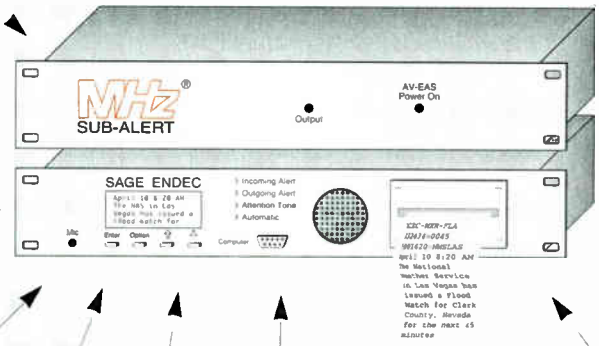
Increase Subsciber Good Will

NO Computers or controllers Required

Alpha Numeric Channel Mode

6 Monitoring Inputs

Highest Technical Specifications in the Industry



Genlock

Increase Subscriber Retention and the Sub-Alert is basically free

Compatible with SA, IRIS, IDEA/ONICS Trilithic & EAS Switching & Products

FCC Compliance Guaranteed

Elimination of NOAA 1050 Hz Tone

Non Interfering

Remote Hub Site Control

Local Franchise Compliance w/ Audio Only or Audio and Video

FCC Video Specifications

Automated Weekly Tests on All or the Details Channels Only

Telephone Access w/Voice Response and Time-Out Feature

Channel Sharing with EAS Details

No Bandwidth Limitations

Now With Multiple or All Channel Crawl!!

All EAS Systems are not created equal!

MHz® MEGA HERTZ®

Established 1975

http://www.megahz.com

"Unique" Products For the 21st Century!

DENVER ,CO
800-525-8386
FAX 303-779-1749

ATLANTA, GA
800-962-5966

ST. LOUIS, MO
800-821-6800

OCALA, FL
800-922-9200

INDIANAPOLIS, IN
800-761-7610

PHOENIX, AZ
800-883-8839

PLANNING '98

By Paul Gray and Jeffrey Walker

IP Multicast: A Key to Advanced Services

As cable operators expand their Internet and other high-speed cable data service offerings to consumers and businesses alike, IP multicast will be key to enabling efficient bandwidth and server utilization. IP multicast is an open technology that offers a revolution in transferring data and is essential to the future expansion on the Internet.

IP multicasting is an extension of the Internet protocol (IP) used to handle Internet data. As a protocol, IP multicasting can be used to distribute packets of data to one or more receivers. The method is suitable for Internet users as well as those on corporate Intranets.

Multicasting is a great advance from the previous unicast model when sending the same information to many receivers. In the earlier unicast system, an individual copy of each piece of data is sent from sender to each receiver. (See Figure 1 on page 56.)

In contrast, with multicast the sender needs to transfer only one copy of the data. Network routers handle the task of distributing the information to the individual hosts. To receive multicast data, the user's client machine needs to run a multicast application, allowing the client to join multicast sessions. One such application is the session directory (SD) tool.

The user selects membership in a multicast host group by selecting the area of interest. As an example, a user could join the NASA select coverage of the ongoing Space Shuttle mission and receive live video and audio, simply by choosing the NASA-STS selection from the list of sessions shown in the session directory tool. The selection made is then sent on to the local area network (LAN) router. When joining a session, the local host's network interface card (NIC) will start filtering for the LAN-specific hardware data-link layer (DLL) address associated with the new multicast group address.

As the wide area network (WAN) router delivers the requested multicast datagrams to the LAN router, the LAN router will build an outgoing frame (an example would be building an Ethernet frame) using the host group address. The receiving NIC card that is listening for these group addresses passes the multicast messages to the TCP/IP protocol, which then in turn processes them and presents them to the client application.

To send multicast data, the sending server will send data to a class-D Internet protocol (IP) address. (Class-D IP addresses are reserved for IP multicast.) These datagrams are seen by multicast-enabled routers on the network. The multicast routers on the networks forward the datagrams based on their multicast forwarding tables. This means that the multicast router will pass the multicast group session data only onto links that have active group members.

IGMP's critical role

The Internet group management protocol (IGMP) is used by multicast to keep informed of which multicast sessions are active. Routers learn the active group membership of hosts attached to their local LAN segments through unsolicited or solicited membership reports.

As the router receives membership information back, it keeps record of what multicast sessions are currently active. (Note: The router doesn't care about how many hosts are involved with a particular group session, only that there is at least one active member in a group.)

The process to keep the multicast router up-to-date with membership information is important, so one multicast router per subnet (called "designated querier") will periodically send an IGMP query to all IP end nodes. Each host will then wait a random amount of time before sending its host group membership report back to avoid a flurry of reports back to the router.

During the random wait period, if a host "hears" another report that contains the same group membership information being sent from another host, then the local host will determine that it does not have to

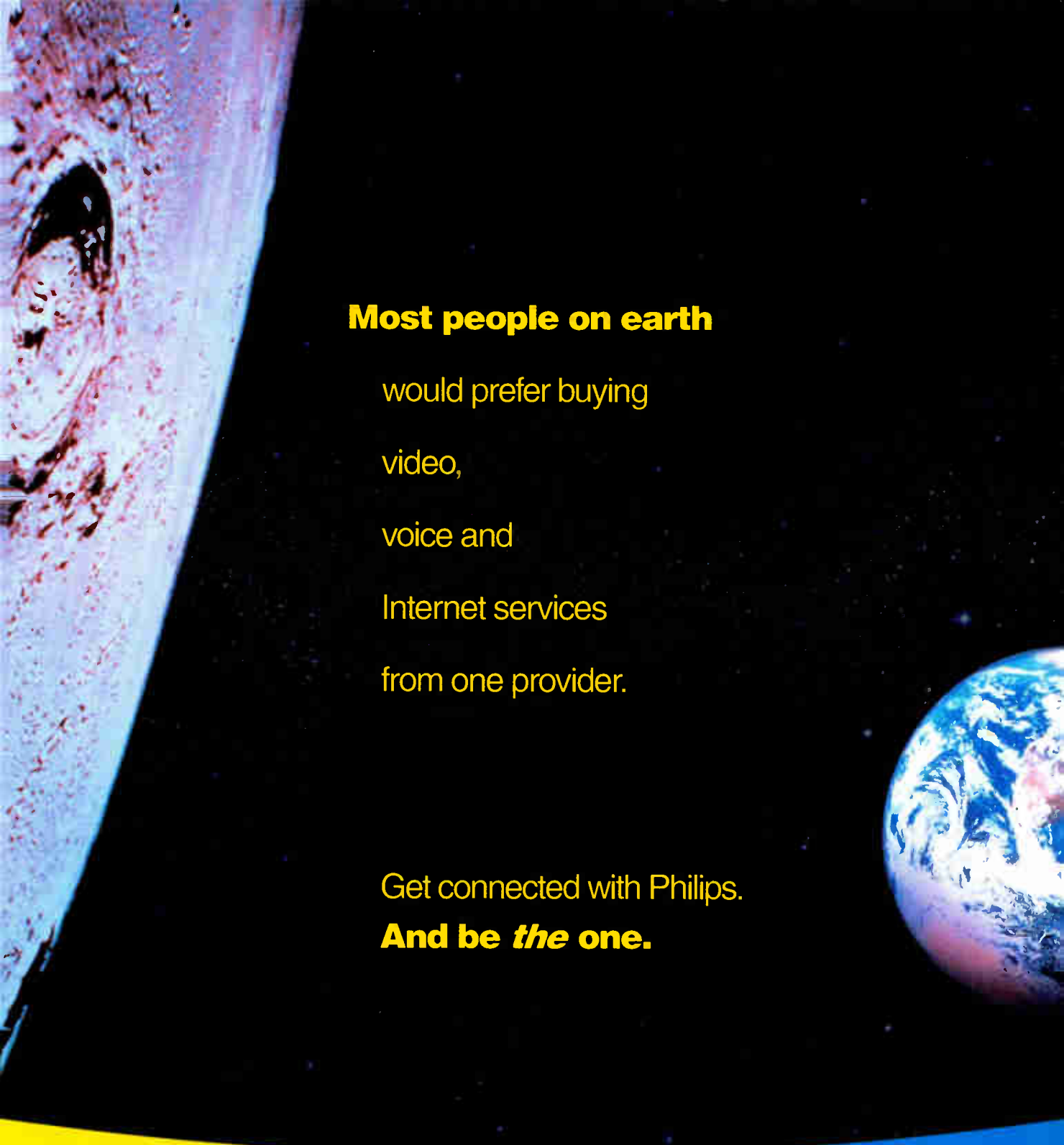
BOTTOM LINE

Understanding IP Multicasting

What is it? IP multicasting is an extension of the Internet protocol (IP) used to handle Internet data.

How is it better than unicasting? In the unicast system, an individual copy of each piece of data is sent from sender to each receiver. with multicast the sender needs to transfer only one copy of the data.

How does it keep track? The Internet group management protocol (IGMP) is used by multicast to keep informed of which multicast sessions are active.



Broadband HFC infrastructures are the most efficient and flexible pipelines for a total range of video, voice and data services. And Philips' new **Crystal Line**™ broadband telephony and data system is a breakthrough platform that allows HFC operators to reliably deliver two-way voice and data services, in addition to traditional video broadcasting. This "pay-as-you-grow" system enables broadband network operators to add or upgrade equipment as customer demand and revenues increase.

Get connected with Philips. The reliable choice.

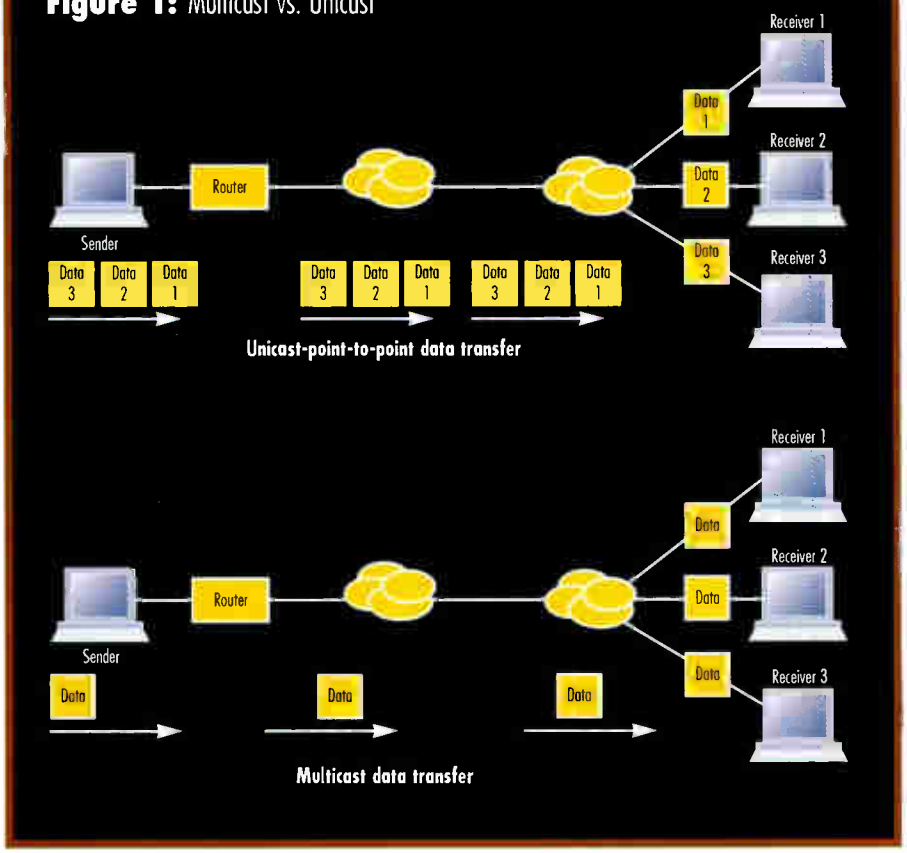
Philips Broadband Networks. 800-448-5171; 315-682-9105; www.be.philips.com/pbn

Reader Service Number 145

PHILIPS

Let's make things better.

Figure 1: Multicast vs. Unicast



report the requirement for this group membership, and will terminate its timer. Otherwise, the host sends its host group membership report to the router and the router keeps track of all the active memberships required on the LAN segment.

Routing IP multicast

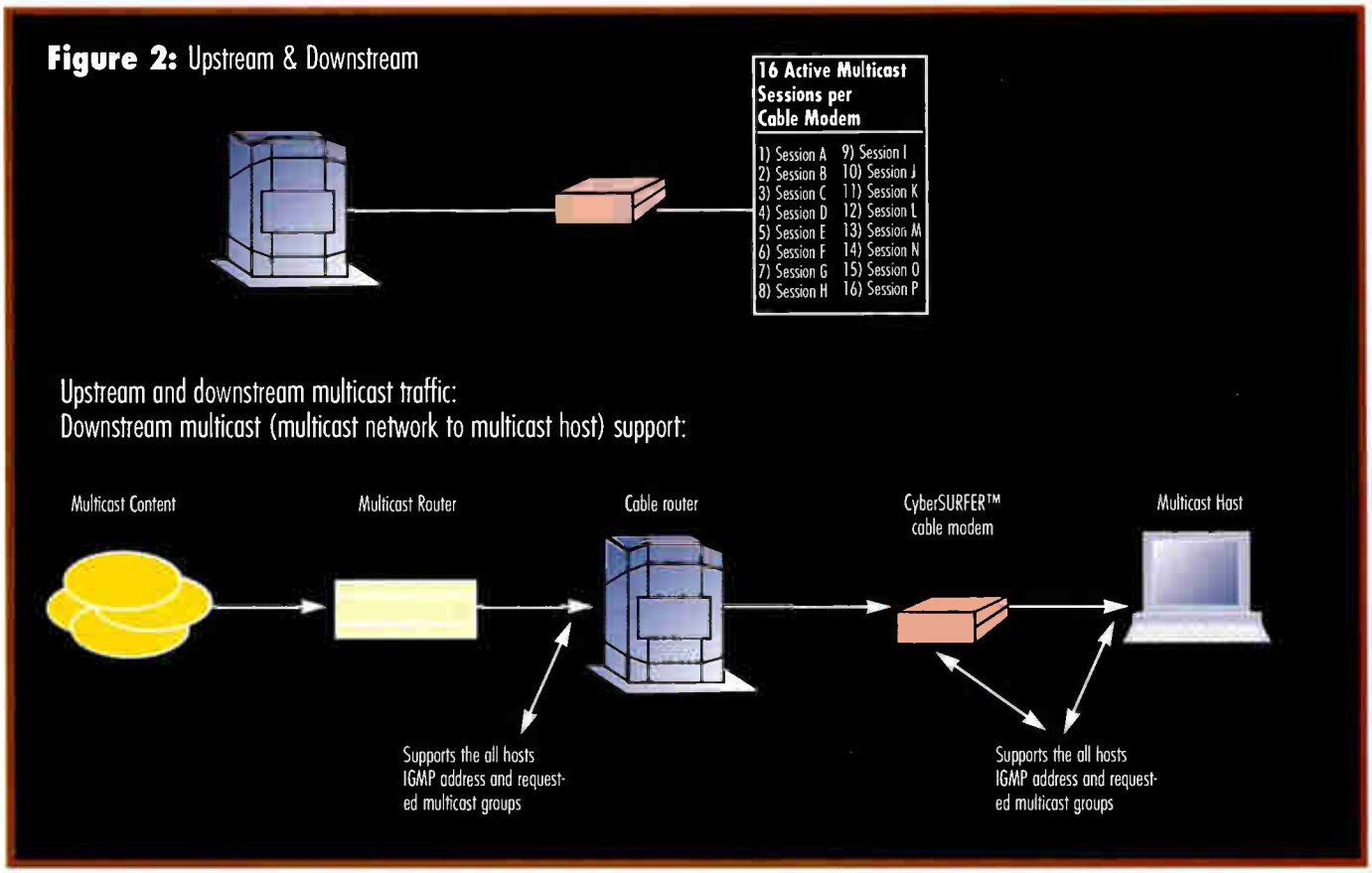
The routing methods for distribution of IP multicast data follow one of two approaches depending on the distribution of members throughout the network.

In situations where there are a great many multicast group members (dense mode) the assumptions are that most hosts belong to the group and the bandwidth is plentiful. Dense mode multicast routing protocols rely on frequent flooding of the network with multicast traffic to keep the multicast network requirements understood.

Dense mode routing protocols include the distance vector multicast routing protocol (DVMRP), the multicast open shortest path first (MOSPF) and the protocol-independent multicast-dense mode (PIM-DM).

For situations where the group members are sparsely separated (sparse mode) and bandwidth is not necessarily available, a different approach to routing multicast

Figure 2: Upstream & Downstream

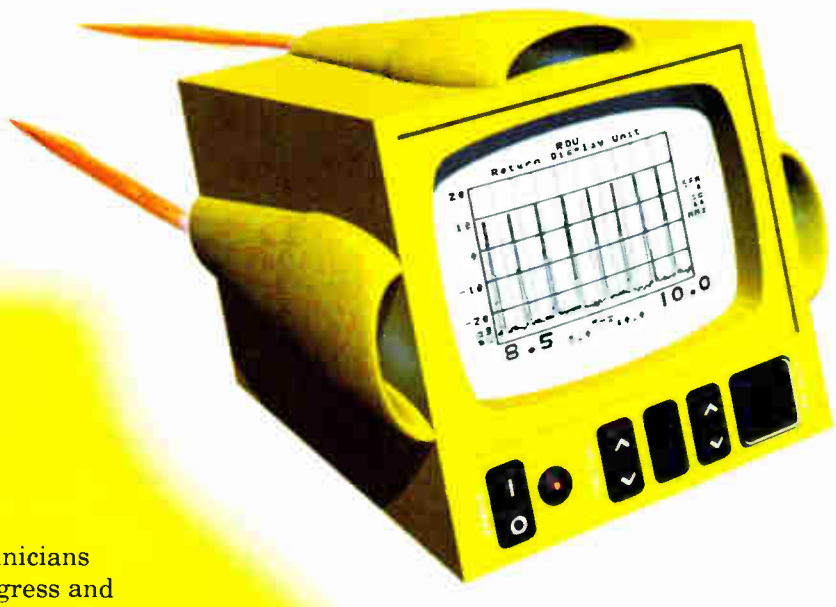


RDU ©

The Return Display Unit

Return System Operations made Simple...
A Key to 2-Way Success

- *HE Space Efficient*
- *Easy to Implement*
- *Cost Effective*
- *Stable and Simple*



RDU: patent pending

The RDU is a new piece of test equipment. It allows technicians to monitor the return system from any point in the cable system without the traditional and cumbersome HE spectrum analyzer / camera setup.

The RDU allows system installers and technicians to view on any TV screen, the RF levels, Ingress and Noise present back at the HE from a subscriber's home, system amplifier, feeder tap or fiber node.

The RDU processes the X / Y output data generated by an internal spectrum analyzer and converts it to NTSC video for input to a standard CATV modulator.

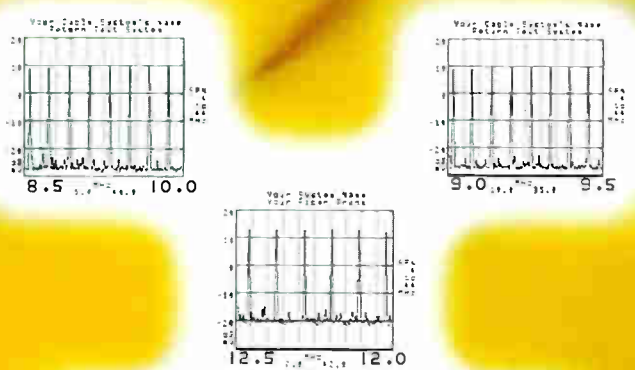
The RDU displays noise, ingress and RF carriers, the same as a spectrum analyzer.

In addition, the RDU displays HE return levels on any 2 carrier frequencies in the 4-44 mhz bandwidth with a .5db resolution.

All controls for the RDU are software driven, no accidental changes in analyzer settings. The RDU is a stable environment for return monitoring and testing.

RDU allows test carriers and ingress / noise levels to be easily documented from every installation and service call.

The RDU is an efficient new tool to activate and maintain broadband return networks.



Above are samples of a TV screen that system installers or technicians would "see" in the field.

CABLE RESOURCES INC.

35M Hoffman Lane
Islandia, NY 11722
FAX 516-234-4436

Call 800-537-9995
for Sales and Service

data is taken. Areas of the Internet (bottlenecks) would really suffer by periodic flooding of the network, so sparse-mode multicast routing protocols use more selective ways to discover and maintain the multicast tree structure. Sparse-mode routing protocols include core based trees (CBT) and the protocol-independent multicast-sparse mode (PIN-SM).

Multicast in an HFC

The hybrid fiber/coax (HFC) cable environment has the potential to bring a broad set of multicast applications to many subscribers at very high speeds, but also has some unique characteristics.

In a typical broadcast media, a host that needs to respond to an IGMP query from a multicast router with a host group membership report can "hear" the reports from the other's hosts and make the determination if it needs to send a report or not.

In the cable data architecture, for security and efficiency reasons, it is not advisable to have users send broadcasts to other users because they are sharing a public network with other users and not a private LAN. So the subscriber's host/PC will receive an IGMP query from the multicast router, but it cannot "hear" the responses back from the other hosts' PCs; the upstream path in the cable system is a nonbroadcast media. Figure 2 on page 56 shows the IP multicast data flow both downstream and upstream in an HFC environment.

With IP multicast's more efficient use of bandwidth, the way is cleared for more advanced services via the Internet or corporate Intranets, including:

- *Corporate messages to employees.*
- *Specialized audio programming.*
- *Remote conferencing.*
- *Live interactive classrooms.*
- *Stock services.*
- *Remote telemedicine.*
- *Virtual bike tours.*

IP multicasting is a groundbreaking way of delivering data. It distributes packets of data to one or more receivers, and is suitable for Internet users as well as those on corporate Intranets. The bandwidth efficiency it offers will pave the way for many additional services we can't even imagine today. CT

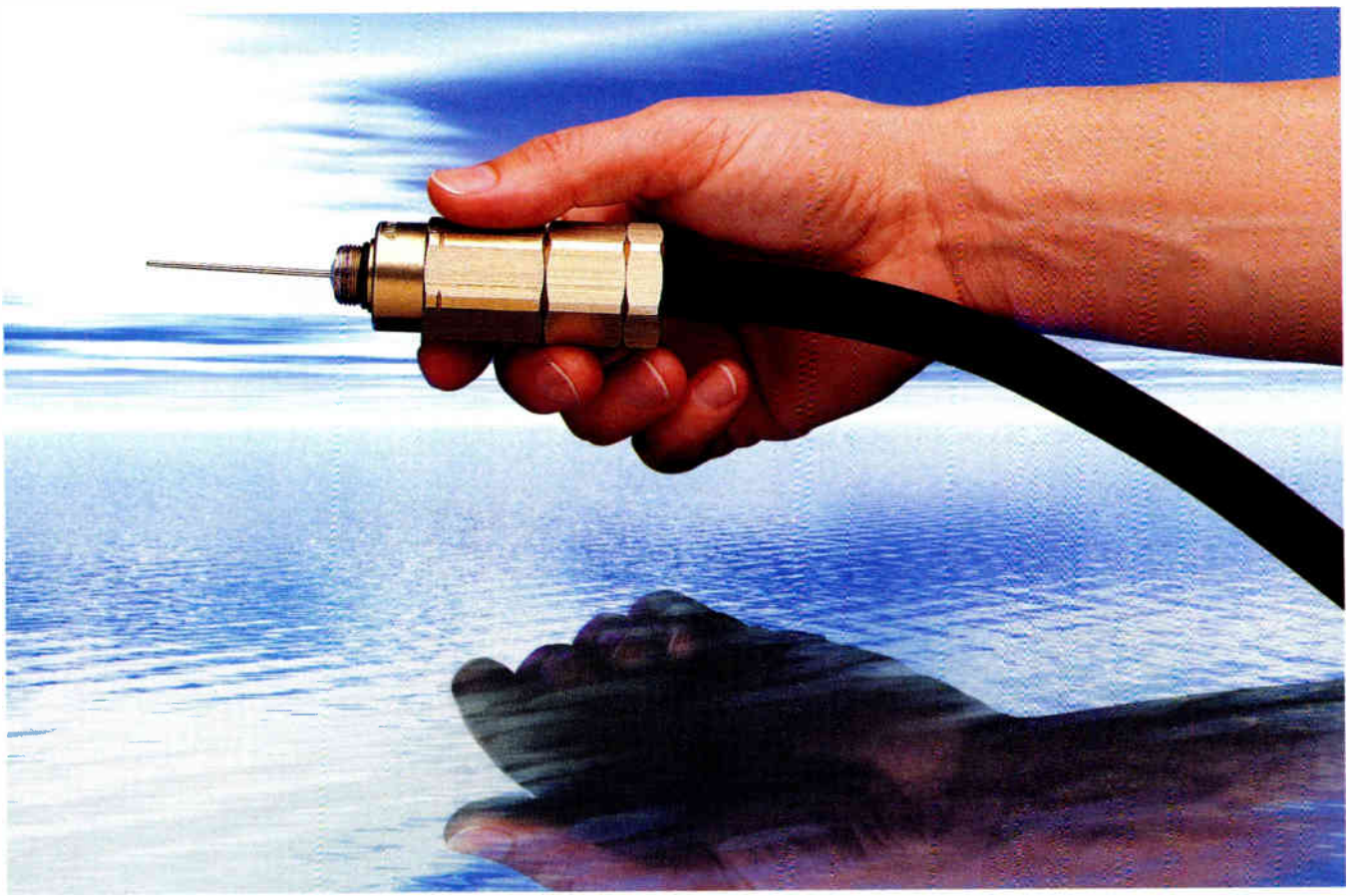
Paul Gray is senior engineer for Motorola. He can be e-mailed at paulg@dma.isg.mot.com. Jeffrey Walker is senior manager of marketing for Motorola. He can be e-mailed at r15926@email.mot.com.

Are You Cable Modem Ready?

Now that cable modem service is a reality, cable operators are looking to upgrade and prepare their systems for 1998. Here are a few steps to help you get up and running next year.

1) Understand the subscriber installation process.
2) Optimize laser input level.
3) Control return path/upstream ingress noise.
4) Aggressively upgrade cable plant to support two-way services.
5) Select a vendor early.
6) Offer different service packages.

No Reflections



Amphenol Broadband Connectors... now you can send and receive secure signals with no reflections.

- **Clear Connections**
  Amphenol Broadband Connectors provide an unprecedented 40 dB return loss up to 1 GHz with less than .1 dB attenuation. The result: unmatched RF performance, secure two way interactive data transmissions and no ingress or leakage in the critical 5 - 40 MHz range.

- **Built to Last**
  Three piece aluminum construction provides superior corrosion protection. Brass internal components lengthen service lifespan and reusability of the connectors and your system.

- **No More Twisted Cables**
  The multiple slotted brass grips provide unmatched gripping strength during installation. This eliminates unwanted cable suck-out, ensures correct insertion alignment, and enables easy access for equipment servicing.

- **No Upgrades Required**
  The advanced design and 40 dB return loss ensures your connections survive the test of time and advancing technology. Installing Amphenol Broadband connectors today saves you upgrades tomorrow.

Amphenol®

Broadband Connectors. When Clear Connections Count.

ISO 9001

Communications and Network Products Division
One Kennedy Avenue, Danbury CT 06810
Tel:1-800-881-9913 • (203) 743-9272 • Fax: (203) 796-2032
Visit our Web site at: **http//www.amphenolcnp.com**

Times Fiber Communications, Inc.
Division of Amphenol Corporation
358 Hall Avenue, P.O. Box 384
Wallingford, CT 06492
Tel:1-800-677-CATV • (203) 265-8500 • Fax: (203) 265-8422

Come see us at The Western Show Booth # 2322.

PLANNING '98

By Laura K. Hamilton

Channel Capacity '98

No More Digital Excuses?

Joe Cable Sub wants digital. But he doesn't really know what digital is exactly.

He more than likely hasn't kept up with the digital standards-setting efforts within the cable industry. He's never heard of bit error rate. He's not real sensitive about your engineering upgrade budget. He doesn't care about all those VIAs (very important acronyms) we're so found of tossing around in cable telecommunications. QPSK, QAM, DAVIC, DSM? *Whatever.*

The thing is, even if he doesn't know the 64-QAM constellation from the Little Dipper, he's far from ignorant about what digital can do for him. He wants 150-some-odd channels and he wants all those crisp and amazing pictures he's heard about. Now.

And of course, he desires all this no matter if he's a big MSO's customer or if he's getting service from a small cable op. He knows it's available because he's seen those direct broadcast satellite (DBS) commercials. And Joe's not skittish about putting one of those small dishes on his house...

Plus, everything's digital now, anyway—isn't it?

As Bob Luff, vice chairman of TV/COM International, put it at a recent conference on set-tops, "There's been a global shift from low-cost ubiquitous analog products in everyday life to digital platforms."

He cites stereos, telephones, wireless telephones, answering machines, video games and so on. Digital device manufacturers built it, and the customers came. Joe Cable Sub has got a taste for digital, so how are you going to keep him happy on plain old analog?

Luff describes digital as riding two waves. The first was driven by business. The corporate need for efficient operations started the computing trend and business data bases increased the need for digital storage. Spreadsheet programs pushed PC computing power and publishing drove printing and computer graphics. "The first wave of digital brought digital devices into our businesses," says Luff, "The second wave of digital will bring interconnected digital devices into our homes."

That is to say, the second wave of digital is driven by entertainment, and entertainment is cable's bread-and-butter forte. Consumers want higher quality—that means digital quality audio and video.

You're well aware of where that takes us: Infrastructure investments to provide bandwidth and functionality, and digital consumer device upgrades.

Analog isn't dead

In 1997, digital was seen as a "tier," not the end for analog, points out Scientific-Atlanta's Robert Van Orden, director of digital marketing.

Advanced analog set-top technology has been mass deployed, offering subscribers a look at program guides, impulse pay-per-view (IPPV), virtual channels and VCR control.

And this has had an interesting effect that will perhaps smooth a digital transition:

"Cable subscribers love the set-top again," says Van Orden.

He explains that your subscribers probably don't mind that once-loathed device as much as they used to because they "perceive the service or feature, not the box. Typically the cable set-top must deliver something the TV set or VCR does not, for example program guides."

Retail set-tops?

So, if customers love set-tops, does that mean they might be willing to go out to their local electronics superstore and buy their very own digital boxes for cable?

The benefits of that for engineers looking to go digital is self-evident. If you didn't have to take into account the cost of the set-top into your digital upgrade, how much easier would that be to sell to system management?

Dwight Sakuma, director of consumer products and services for NextLevel, points out another benefit of cable boxes being sold at retail: "Additional sales and marketing efforts tied to the sale of set-tops will increase consumer awareness that will result in higher sales."

"Both retail and cable could market digital attributes and how high definition TV (HDTV) and digital cable will coexist to the benefit of the subscriber and potential subscriber."

S-A's Van Orden foresees a mixed retail/industrial distribution but emphasizes that a set-top "is not a PC." It must

be much cheaper and it must be much simpler for the user.

So in other words, you can't plop a $1,000 computer on top of your subscribers' TV sets. No one wants to pay for that.

Smaller systems and digital

Wait a minute, you say. You're not even thinking all the way down to digital set-tops yet. You're an engineer at a small system owned by a small system operator. Digital plans are for the big boys right now, right?

Well, maybe not. Take Buford Television, which operates 275 systems serving 150,000 subscribers in Arkansas, Missouri, Louisiana and Texas.

Ron Martin, executive vice president and chief operating officer, says, "Our systems, which tend to be smaller systems in rural areas, were going to be in need for upgrade. We had to make a decision whether to do that via analog or whether to do that via digital."

Buford recognized that a percentage of its subscribers were leaving to go to the competition. For instance in 1996, it had about a 1% disconnect rate that went to DBS. Buford needed more channel capacity to create new revenue streams.

"On the hardware side, we assumed we needed an 80-channel upgrade. We would have to go to at least a minimum of 550 MHz," explains Martin, "We also recognized it was going to be at least a $10,000 a mile proposition to upgrade our plant to 550."

"A huge stumbling block for digital cable efforts in the past was standardization in the vendor community."

He says that assumed the company would be able to save a lot of the existing coaxial cable and just primarily do electronic upgrades.

"The nice thing about digital was you deployed capital in the direct relationship primarily to how many customers were coming on generating new revenue streams," he continues, "You got to deploy capital more on a variable level as opposed to fixing your capital up front."

Martin's bottom line is this: "Digital implementation allows for incremental deployment of capital, thus lowering financial costs." In Buford's case, the low fixed and high variable costs of digital ended up more cost-effective than the high fixed and low variable costs of analog.

What about standards?

A huge stumbling block for digital cable efforts in the past was standardization in the vendor community. But recent efforts like the NextLevel and S-A "Harmony" pact show the industry is serious about getting digital rolled out. Under this deal, both companies will produce products based on standards including Moving Pictures Experts Group (MPEG-2) video, Dolby Digital audio, MPEG-2 transport, Advanced Television Systems Committee (ATSC) system information and ITU-J83B modulation. CableLabs has given the nod to all Harmony specs and most have be adopted by the Society of Cable Telecommunications Engineers.

On another front, CableLabs is leading the push by making available to its members summarizing proposals in the OpenCable initiative to develop next-generation interoperable set-tops.

Take a look at these and other digital standardization efforts. Add to that the digital vs. analog cost studies like the Buford Television example covered earlier in this article. Think about how much your subscriber is aware of the benefits of digital, mainly through the marketing efforts of the competition.

What's holding your digital plans for 1998 back? CT

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

A CABLE INTERNET SYSTEM THAT BRINGS HIGH-SPEED INTERNET ACCESS HOME.

Interactive Services

Information Retrieval

Transactional Shopping

Entertainment on Demand

Distance Learning

Toshiba Cable Modem

Toshiba Signal Conversion System

Connectionless Access
- Fairness
- High Speed (8Mbps Downstream, 2Mbps Upstream)
- High Throughput

High Efficiency
- "Transmission Timing & Signal Level Adjustment"

Protocol
- Ethernet over Cable
- TCP/IP

Security
- Link Level Encryption

Reliability
- FEC (Forward Error Correction) against Ingress Noise

Scalability
- 100's to 1000's of simultaneous users

Reader Service Number 245

For immediate information, contact:
Multimedia Systems Division
Toshiba America Information Systems, Inc.
9740 Irvine Blvd., Irvine CA 92618
(714) 461-4740
webmaster@toshiba.com

In Touch with Tomorrow
TOSHIBA

TIME WARNER INC.
ROAD RUNNER

EXCLUSIVELY FOR:
- San Diego
- Portland, ME
- Albany (Summer 97)
- Tampa (Summer 97)

POWERED BY TOSHIBA

PLANNING '98

By Roger Holleger

So You Want to Provide Dial Tone Delivery?

Nothing is more attractive for a cable operator than the desire to compete head-to-head with those Baby Bells who have been claiming they can do it better for all these years. Just how hard is it to deliver dial tone? It really depends on how you go about it. In Alexandria, VA, Jones Communications is providing local telephone to multiple dwelling units (MDUs) utilizing a facility-based telephone network. The company is positioned to leverage off of this network to offer single family telephone. Here are some of the basics if you are contemplating competing for the local loop.

Become a telephony generalist—Develop your organization to have a good grasp of all the three areas of service: switch, transmission, and customer premise equipment. This sounds easy; however, most experience in the industry come from extremely functional telephone operators. Switch engineers know their switch, and transmission engineers know synchronous optical network (SONET), but as a general rule are not fluent outside their area of expertise.

In the cable industry we have had to be versatile in many areas of engineering, which has allowed us to keep our organizations flatter and cost-effective. In offering telephone service, it is imperative that you keep the organization as small and efficient as possible. Keeping the overhead low helps insure cash flow.

Keep it simple—Choose a manufacturer that can supply all your equipment needs—switch, transmission, and customer premise. Then standardize on the equipment you will use under that brand. By doing this, you take advantage of the expertise within the company, and you are assured of alleviating issues of compatibility between functions. With your organization being general in nature, you will only be 80% efficient in your acquired knowledge, use the vendor for the specialized expertise that you can't afford to have on your staff.

The second benefit is that it is easier to train your associates to support your network when all of the equipment is the same. Yes, there may be savings in mixing equipment or in using different techniques, but it's just not worth it when you have trouble maintaining it.

Employ a scaleable solution—Work with your vendor for a system that is scalable. Delivering dial tone is a capital-intensive business. Deploy your network so that the equipment in use amounts to an 80% utilization efficiency. This helps ensure that capital money doesn't sit out there for the potential.

Strategic deployment of network—When deploying your transmission nodes, ensure that they are placed so that the locations will best fit your business plan of the areas to be served. As an example, a particular node may serve 672 telephone lines. If your business plan calls for 30% penetration, then place the node to service 2,250 passings. Analyze the cost per passing and maximize the deployment of copper plant to extend the usefulness of the node.

Negotiate the software up front—Most equipment suppliers will deal with their hardware. The unseen expense comes from the software, and software support that accompanies your equipment. When setting up your telephony product, take time to research the software packages that you may need. Work with your vendor on purchasing only the software you need for the operation of the switch, and services being offered to your customers.

Train—You will be asking your customer contact associates to learn a whole new business. Even though customer care parameters remain the same, understanding the processes involved in delivering dial tone is necessary to give associates confidence in dealing with problems as they arise. Make sure that you have a

LEARN FROM THE LEADERS

As the broadband industry has evolved over the past 50 years, so have we. Whether you know us as Jerrold, General Instrument or, soon as NextLevel, all are synonymous with achievement and excellence in communications. We are recognized as the pioneers of the industry and will continue this commitment as we move to the next level.

When it comes to transmission solutions, we wrote the book. With over 1 million miles of Broadband Networking behind us, no other company in the world can match the credentials of our transmission experts.

Here is your opportunity to learn from the best. We are offering *NETadvantage*™ Technology Training Courses to enhance your skills:

- **Broadband Communications Network Overview**
- **Design Basics**
- **Digital Network Systems Overview**
- **Headend Maintenanace and Performance Testing**
- **Plant Maintenance, Proof of Performance and Signal Leakage**

Register now.

Learn the latest technologies that will help you expand your competitive future. When tomorrow comes, you won't have to stand in line. You'll be in front with the leaders.

GI General Instrument

NextLevel Broadband Networks Group

1-888-436-4678 www.GI.com

Reader Service Number 141

continual improvement process in place in order to address the changing environment telephone brings you.

Quality assurance—Installations are no harder and may be easier than cable. But training your installation team requires that you give them instant feedback when you discover quality issues. Again, because it is different, you need to ensure there is consistent review and feedback.

Protect your systems integrity—You are going to need a provisioning department to fill customer parameters, telephone numbers, features offered, etc. They will also be needed as a field support desk when problems arise. Limit the number of associates who have direct access to your switch and transmission systems. Don't scrimp on your training and auditing here! Your system integrity can be compromised if care is not taken it this area.

Market—Capitalize on your churn. Existing customers are difficult to convert because of number changes or in their understanding of interim number portability. Launch in your service area by taking advantage of the generated excitement resulting in the build process. Continue to run acquisition campaigns. Our experience has shown a 12.5 to 15% penetration at launch, and a monthly growth rate of 1.5 to 2% per month. Highest penetration to date in one apartment complex is 53%.

Network—Make contacts with as many competitive local exchange carriers (CLECs) as possible. We all have the same issues and are continually trying different approaches to the business. And those acronyms. Don't be afraid to ask what someone is saying when using a three-letter word. The only way you can join this elusive club is continue to ask questions and you will eventually learn. But don't be surprised, new ones are being thought up every day!

In summary, limit your personnel to keep your overhead down. Hire your personnel to be cross-functional and cross-train to ensure success. Stay clear of the way the incumbents are organized. While it is nice to have their depth, you simply cannot afford it at this time. It is OK to be 80% efficient. That last 20%—it does not have to be customer-effecting, and could end up costing the organization its profit margin, and possible failure. CT

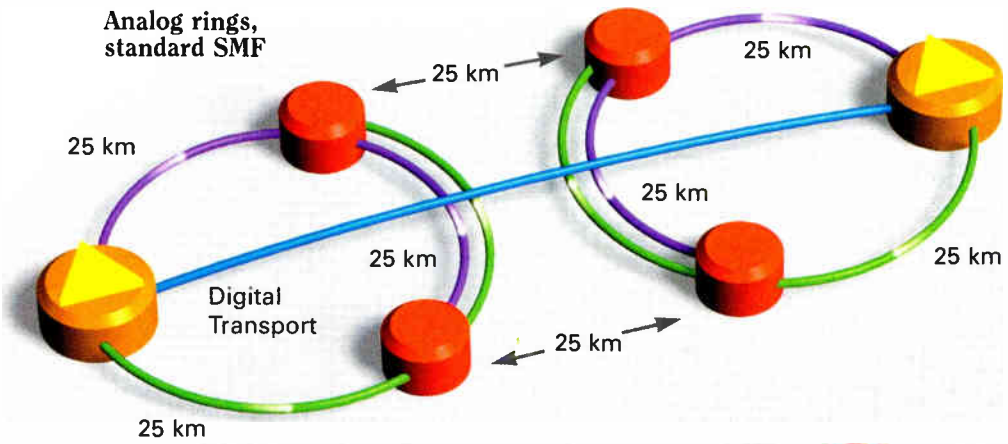
Roger Holleger has worked in the cable industry for the last 26 years. Holleger is vice president of telephone and data for Jones Communications working in the company's Washington, DC cluster. He may be contacted at (301) 918-8305.

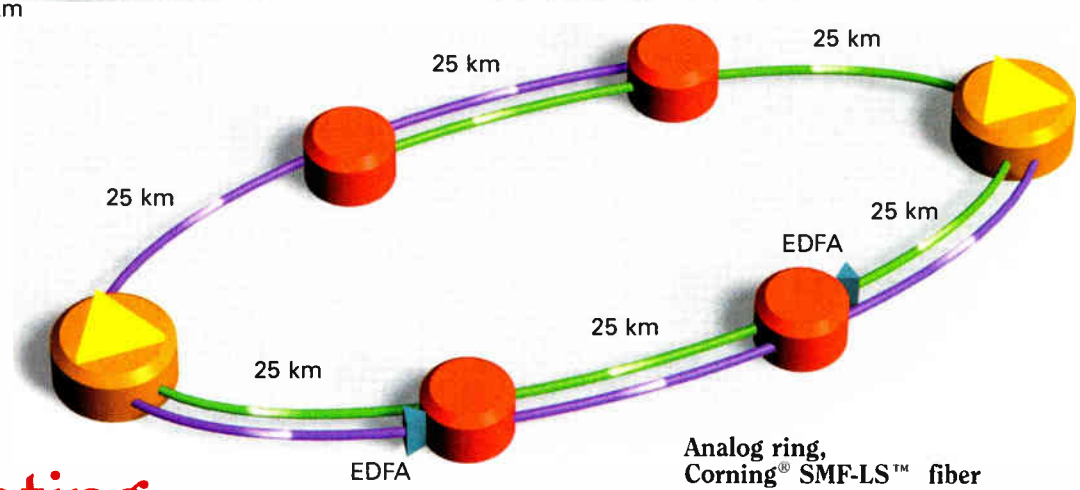
BOTTOM LINE

Telephony Pointers

Remember these pointers if you are preparing to offer telephone service:

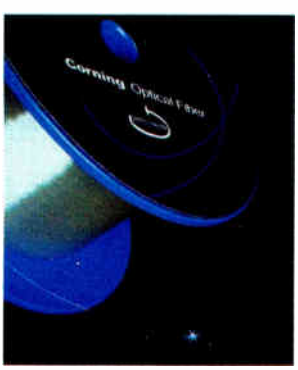
- ***Concentrate your business*** on these three major areas of service: ***switch***, ***transmission***, and ***customer premise equipment***.
- ***Choose a manufacturer*** that can supply all your equipment needs.
- ***80% utilization efficiency*** is the goal to achieve in your equipment deployment.
- ***Transmission nodes*** should be placed so that the locations will best fit your business plan of the areas to be served.
- ***Research the software packages*** that you may need and work with your vendor on purchasing only the software you need for the operation of the switch and services being offered to your customers.
- ***Train customer contact personnel*** in the dial tone delivery process
- ***Implement a consistent review*** and feedback program.
- ***Create a provisioning department*** to fill customer parameters, telephone numbers, and features offered.
- ***Market your new service.***
- ***Network*** with as many CLECs as you can.





Analog ring,
Corning® SMF-LS™ fiber

Are You Consolidating Systems?



We could save you the cost of digital transport equipment with AM-VSB transmission over Corning® SMF-LS™ single-mode optical fiber.

For more information or FREE analysis of your current system call the Corning Optical Fiber Information Center at **800-525-2524** ext **529** and find out how Corning SMF-LS Optical Fiber can save you money.

Count on Corning® Fiber™

CORNING

www.corningfiber.com

Reader Service Number 90

PLANNING '98

By Darryl Parker

Implementing EAS

What are some features that make Emergency Alert System (EAS) encoder/decoder installation easier?

When selecting an EAS encoder/decoder, a cable operator needs to consider how quickly a headend technician can "customize" the unit for a particular community while minimizing service interruption and complying with Federal Communications Commission requirements.

Look for detailed front panel design to help with setup. Logical setup steps, including key prompts or liquid crystal display (LCD), are useful features.

Full-featured numeric keypads are key for storing Federal Information Processing System (FIPS) codes, system IDs, events and locations for message forwarding, and other information. Keypads with less functionality require the installer to scroll through numerous menus to enter information, or in some cases have him carry a computer to make modifications to the system.

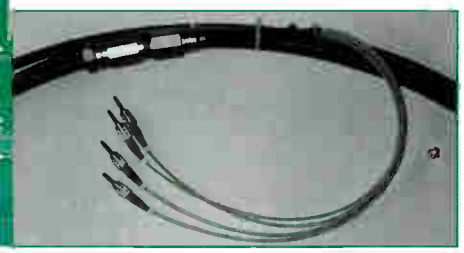
Are there any features that make EAS tests or emergency alerts easier to report? For tests, both monthly and weekly, keeping keystrokes to a minimum will make the system easy to maintain in the field. That's another front panel and keypad issue.

The front panel design of the encoder/decoder also is important when the cable operator originates messages or tests. Although most of the time cable operators will automatically forward messages from emergency management authorities, a cable system may need to originate an EAS message at the request of local public officials. Here again, a well-laid-out front panel can help the operator through the process by prompting him at appropriate times.

Which "events" will interrupt my system? With the exception of national level events and monthly tests, only those events determined by the cable operator will interrupt a system. A list of events can be tailored to a particular system with a few simple keystrokes and may be changed without the use of an external computer.

What are my responsibilities for the deaf and hearing impaired? Cable operators have special requirements under Part 11 of the FCC rules to "provide a method to alert hearing impaired or deaf subscribers to EAS messages." One method is a device installed in the subscriber's home that will provide a visual alarm, an audible alarm, and a contact closure for connection to a bed or pillow shaker or light fixture. This type of device can be programmed to respond only to certains zones in a cable system that correspond to subdivisions of counties as provided for in FCC rules. Only those areas "at risk" in a particular emergency situation will be alerted. CT

Darryl Parker is vice president of sales and marketing for TFT, Inc. of Santa Clara, CA. He can be reached at (408) 727-7272.



Fiber Optic CATV Drop Cables

Radiant offers a full line of fiber optic cable plant products. The company guarantees drop cables with back reflections of –60dB for ultra polish terminations and –70dB for angle polish terminations. Available from two to twelve fibers with customer specified node connector. Also available are fiber optic assemblies, couplers, fiber management systems and the industry's first and best low backreflection attenuators— both fixed and variable.

Reader Service Number 157

Cost-Effective Systems Transmit Baseband Video/Audio Over Fiber

Radiant Communications has supplied more Fiber Optic Baseband Video/Audio Systems to the CATV industry than all other suppliers combined. Many more options are now available...single channel systems that meet RS250 medium or short haul specifications. Systems with stereo audio or RS232 data. Bi-directional systems over one fiber, two or four baseband channel systems and digital video systems are also available.

Reader Service Number 159

New Unique Fiber Optic Ethernet System Eliminates Data Collisions

Radiant introduces the most cost effective and technologically advanced method of connecting remote ethernet hubs together. The series DL200 allows transmission distances up to 100Km and data throughputs of 100MBS. It can be used for any size system...large or small. Typical applications include interconnecting large metropolitan school districts or remote college or industry locations. Budgetary cost is less than $3000 per location. Now available on one fiber.

Reader Service Number 63

Switches and Servers

Consider Your Choices in Headend Data Equipment

By Chet Birger and Wayne Mackey

This article surveys the headend equipment required to provide data-over-cable services. We present this survey in the context of the functional components outlined in the Multimedia Cable Network System (MCNS) reference architecture for data-over-cable services. In addition to identifying the categories of headend networking equipment that implement the architecture's functional components, we consider system design options.

Design flexibility will provide each MSO with significant opportunity to tailor an implementation of the MCNS architecture to its specific service and facility requirements.

MCNS reference architecture

The MCNS consortium developed data-over-cable service interface standards of which wide acceptance has accelerated the design, development and deployment of high-speed data communications on cable TV systems. The data service supported by the MCNS specifications allows transparent, bidirectional transfer of Internet protocol (IP) traffic between the cable system headend and customer locations over an all-coaxial or hybrid fiber/coax (HFC) cable network. Figure 1 (on page 72) is a high-level block diagram of the data path between headend and customer site.

MCNS defines a reference architecture for data-over-cable services that identifies the functional components of the MCNS data-over-cable solution and its interfaces. The MCNS interface specifications describe

the characteristics of these interfaces and the message sets and signaling sequences carried across them. Without delving into the details of the reference architecture, we can identify the following functional divisions within it:

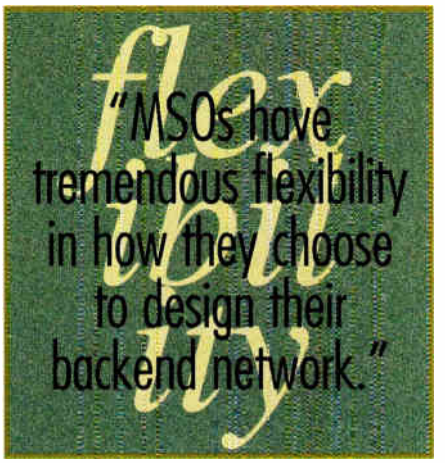
- Local and remote servers
- Headend network and wide area network (WAN) interface to a backbone network
- Cable modem termination system (CMTS)
- Cable network
- Cable modems (CM)
- Customer premises equipment

This article focuses on the first two bullet items.

The headend network is home to a variety of networking devices supporting the delivery of data services and content to data-over-cable customers. The headend network has WAN connectivity to backbone networks, across which remote servers can be accessed, thus supporting a hierarchical, distributed network architecture.

Headend networking equipment falls into two broad categories:

- Data switches, which support the networking infrastructure within the headend and WAN connectivity to a backbone network.



- Servers, which both support the operations of the network and provide the data content and services to subscribers.

While some of these devices are specific to the MCNS data-over-cable architecture (that is, provisioning and security servers), the majority of them are generic data networking devices employed extensively within corporate enterprise networks and the public Internet infrastructure.

MSOs have tremendous flexibility in how they choose to design their "backend" network, which includes both the headend network, centralized data centers and the WAN backbone connecting them. While backend networks will be built from a common set of networking components (switches and servers), MSOs will be faced with many design alternatives.

Next we will quickly survey the types of network equipment from which these backend networks will be built. That will be followed by a discussion of the design issues and options that will influence how network designers choose to assemble these components into operational networks.

Networking devices

1) ***Data switches:*** Local area network (LAN) switches and routers are the two

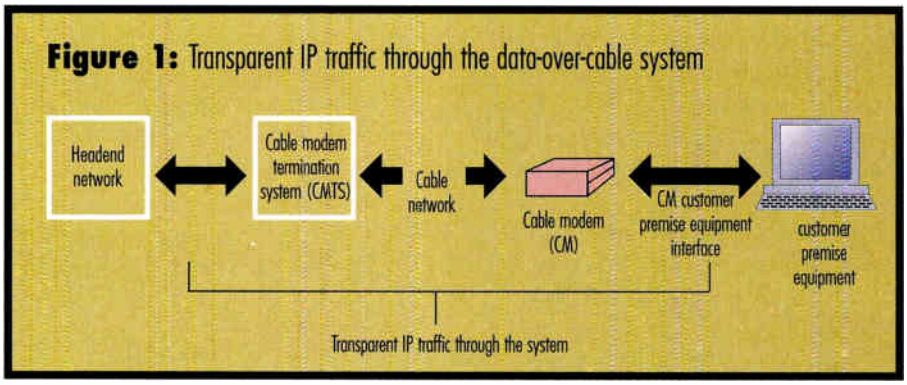


Figure 1: Transparent IP traffic through the data-over-cable system

principal classes of data switches to be used within the headend and centralized or regional data centers. Both classes of switches typically contain multiple ports, which connect to a variety of network interfaces. For example, these include Ethernet, 100 Mbps Ethernet, fiber distributed data interface (FDDI) and 155 Mbps asynchronous transfer mode (ATM). LAN switches and routers both switch traffic between these network interfaces. They differ in how they make their switching decisions.

Data packets transported across a data-over-cable service carry two levels of addressing: data link layer (OSI Layer 2) and network layer (OSI Layer 3). LAN switches make packet forwarding (that is, switching) decisions based on data link layer addressing, that is, a frame's Institute of Electrical and Electronic Engineers media access control (IEEE MAC) destination address. Routers make packet forwarding decisions based on network layer addressing; for IP-based traffic. This will be the IP addressing within a packet's IP header. In addition to examining an IP packet's addressing, routers are required to do additional packet processing that makes their forwarding logic more complex than that of LAN switching.

Since LAN switching is more "streamlined" than routing, LAN switches tend to have lower cost/performance and cost/port ratio than routers. Routers with their more sophisticated switching logic, and IP's hierarchical address space vs. the "flat" IEEE MAC addressing, provide a greater degree of control over network data flows.

The headend network is LAN-based and can employ and combine a wide variety of LAN transport technologies and switches. An MCNS-compliant CMTS connects to the headend network across one of several supported network interface types (10Base-T Ethernet, 100Base-T Ethernet, FDDI or ATM).

In addition to forwarding data packets between network ports based on packet addressing, LAN switches and routers also may filter packet flows across network interfaces. A LAN switch or router may block a particular traffic flow, based upon an explicitly defined rule. Only clients with IP addresses in a particular subnet might be permitted to access a specific server. Quite often the filtering function is moved off of the LAN-switch/router into a separate device, called a firewall. Firewalls typically have two ports, and control the flow of traffic between those ports by implementing specific security policies (filtering rules).

2) *Servers:* A data-over-cable service will employ a variety of servers, supporting the operations of the network and providing data content and services to subscribers. These servers can run on a variety of platforms (typically UNIX or NT systems) and multiple software-based services may run on a single hardware platform.

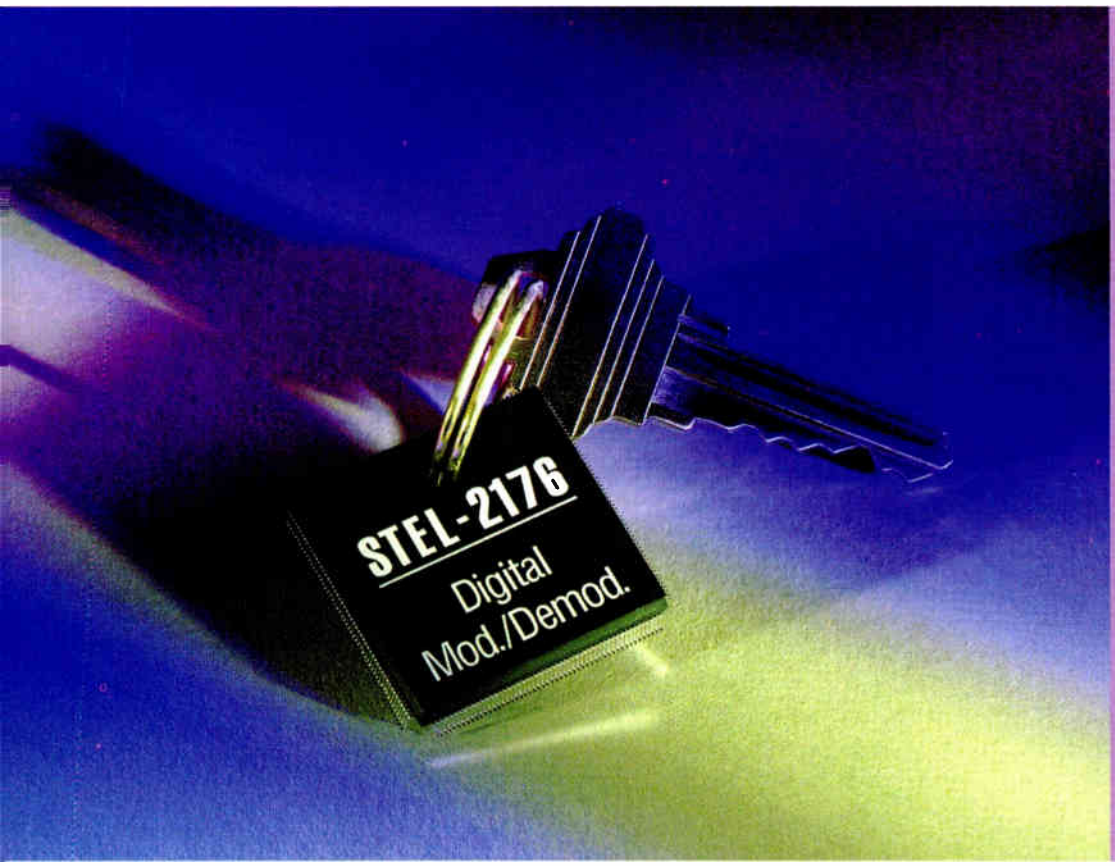
Servers supporting network operations include:

- A dynamic host configuration protocol (DHCP) server used to distribute IP addresses and additional host configuration data to IP stations in the network.

MCNS-compliant cable modems employ DHCP at boot-up to obtain an IP address and other parameters needed to establish IP connectivity. The DHCP server's response to a CM's DHCP request includes the name and location of a file that contains additional configuration parameters required by the CM. An MSO also may choose to employ a DHCP server to distribute IP addresses to customer premises equipment, as an alternative to statiscally configuring a subscriber's host. ➤

Announcing a Technology Breakthrough

OUR NEW STEL-2176 IS THE *key* TO *cost effective* SUBSCRIBER *cable* MODEMS



Features

- 16/64/256 QAM receiver — Highest acquisition speed
- QPSK/16 QAM transmitter
  — Direct digital synthesis modulator for broadband RF transmission (U.S. patent #5,412,352)
  — High performance, efficient utilization of upstream spectrum
- Compatible with MCNS, IEEE 802.14, DAVIC/DVB standards
- Integrated 10 bit/165 MHz DAC and 10 bit ADC
- On-board dual mode Annex A & B FEC
- 0.35 micron, 3 volt CMOS technology

The fully integrated STEL-2176 Digital Modulator/Demodulator ASIC provides an extremely cost effective means for receiving 16/64/256 QAM signals and for sending QPSK and 16 QAM modulated signals. The STEL-2176 is designed specifically for the reception and transmission of data over broadband coaxial cable networks for Internet access, interactive CATV and digital telephony-over-cable applications. It provides optimal spectral shaping and fine tuning resolution across an output bandwidth of up to 65 MHz. The STEL-2176 is worldwide standards compliant.

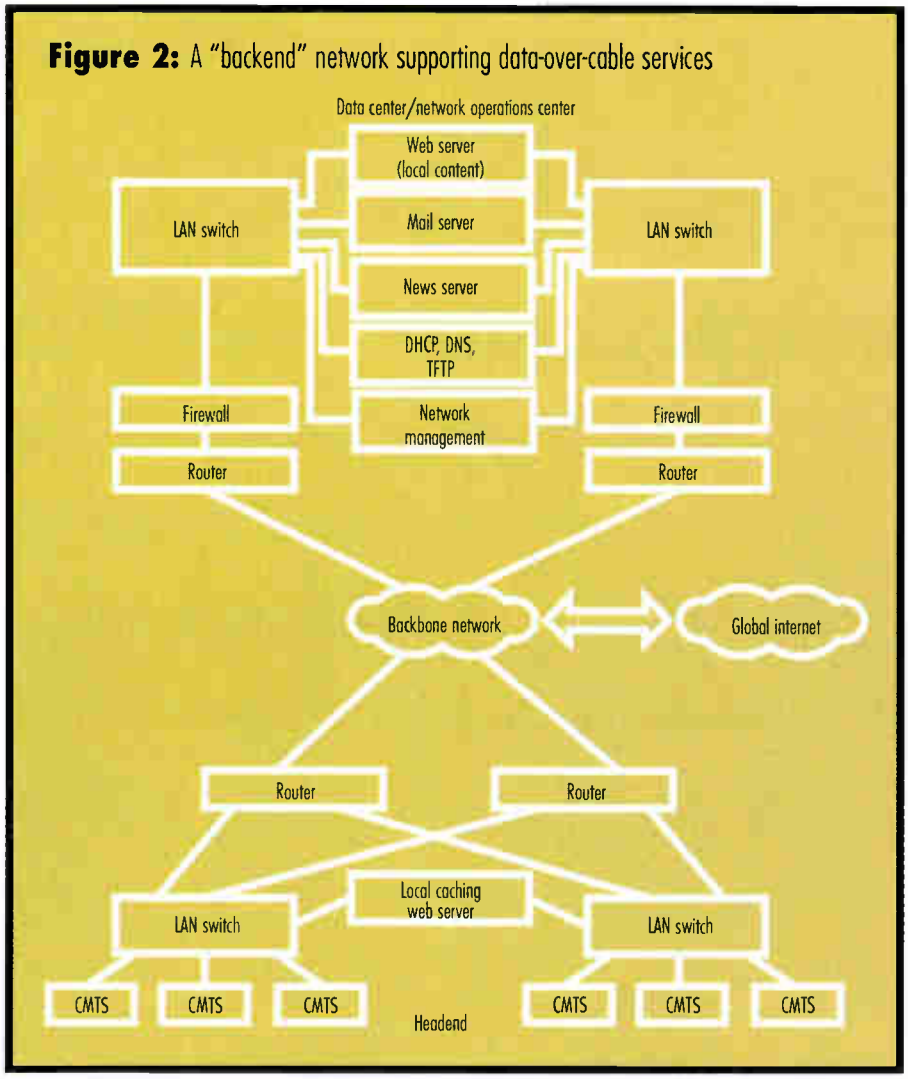
As a companion product, the STEL-9257 provides QPSK demodulation at the headend. Contact us today for complete information on the STEL-2176 modem "super-chip" and other companion products for HFC Cable.

STANFORD TELECOM®

480 Java Drive, Sunnyvale, CA 94089
Tel: (408)745-2660 Fax: (408)541-9030
e-mail: tpg.marketing@stelhq.com Internet: www.stelhq.com

Reader Service Number 148

Figure 2: A "backend" network supporting data-over-cable services



- A domain name server (DNS) to maintain a database of plain text domain names (e.g., www.whitehouse.gov) and their associated IP addresses. The DNS server furnishes these IP addresses, on demand, to requesting clients.
- A trivial file transfer protocol (TFTP) server to distribute configuration files to CMs. CMs learn the name and location of these files through their DHCP exchange.
- A provisioning server and any accompanying database systems used to generate the configuration data downloaded to CMs and CPE via the DHCP and TFTP servers.
- A security or access server used to control who has access to the network and its services.
- While formally functioning as a "client" rather than a "server," a simple network management protocol (SNMP)-based network management system is a host-based system for monitoring and controlling the data-over-cable system.

Servers supporting the distribution of data content, or the provision of specific data services to customers, include:

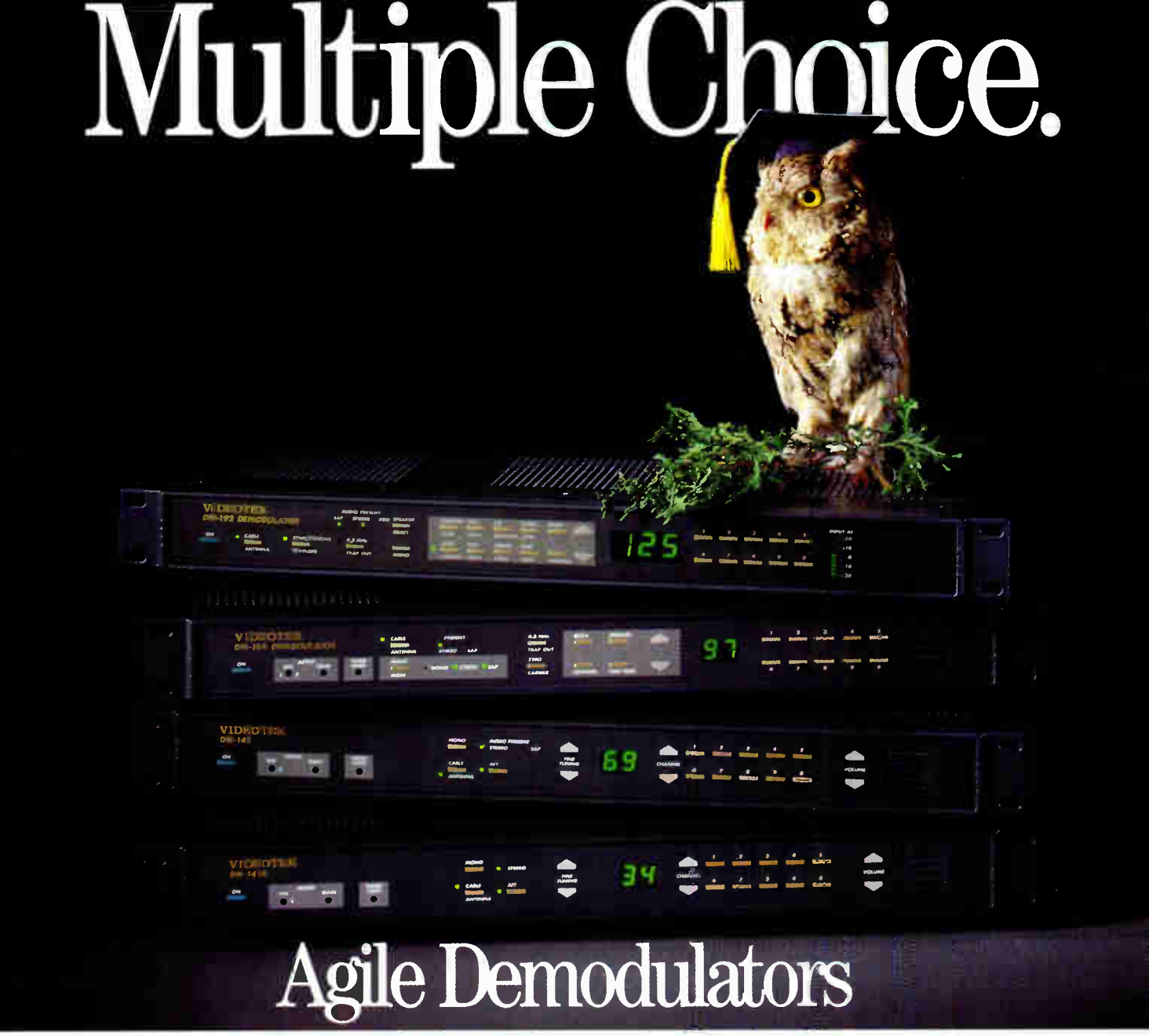
- World Wide Web servers containing a cable operator's local Web content. Proxy Web servers may be employed, which provide local caching of Web content originating from remote servers. The benefits associated with employing caching proxy Web servers within the headend network include performance improvements, reduction of data traffic across the headend network's WAN interfaces, and the ability to collect comprehensive subscriber usage statistics of Web-based data content.
- Mail servers providing electronic mail boxes and outbound mailing services for subscribers.
- News servers providing subscribers with access to USENET news groups.
- Internet relay chat (IRC) servers providing subscribers with access to the Internet's multi-user chat service.

Network design

The issues influencing the design of backend networks are no different from those faced by designers of corporate networks. They include:

- Performance
- Reliability
- Ease of administration

Multiple Choice.



Agile Demodulators

Be wise... and choose from our family of agile demods.

- *WHO offers the greatest selection of agile demodulators in the industry?* VIDEOTEK
- *WHO is the largest agile demod supplier in North America?* VIDEOTEK
- *WHO offers a full range of versatile features?* VIDEOTEK
- *WHO combines premium quality & intelligent design with smart prices?* VIDEOTEK
- *WHO offers a FREE 30-day trial?* VIDEOTEK

With two new choices in agile demodulators, you have more reasons than ever to choose Videotek. At half the price of our competition, this foursome of demods with full front panel control, brings in up to 192 channels and has features that include Pro channel, zero carrier pulse, synchronous and envelope detection, simultaneous stereo and SAP capabilities, plus two baseband outputs.

Two of the models, the DM-192 and DM-154 have been ***specifically designed*** for FCC compliance testing. For other applications, the DM-145 and DM-141A round out our product family.

Innovation in agile demodulators has been our specialty for two decades, making Videotek the wise choice.

Premium Quality, Intelligent Design, Smart Prices... That's Videotek.

Call today to take advantage of our FREE 30-day trial or to receive a copy of the white paper report "Agile Demodulators in the Cable TV Industry." Contact Joy Bozeman at 1-800-800-5719 or e-mail your request to 104472.577@compuserve.com.

VIDEOTEK
A Zero Defects Company

243 Shoemaker Road, Pottstown, PA 19464 1 800-800-5719 (610) 327-2292 Fax: (610) 327-9295

Reader Service Number 178

- Security
- Cost

To address these issues, network designers make use of these design components:

- Distributed hierarchical architecture to centralize and simplify administrative tasks, and reduce costs.
- Use of caching servers to locate data content close to the user, improving transaction times and reducing traffic flow.
- Use of redundant switches and network connections to improve network reliability and performance.
- Efficient employment of LAN switching and routing. This includes LAN switches to handle high bandwidth LAN-to-LAN traffic within the headend network and within the remote data centers, routers to handle WAN traffic interconnecting headend networks to remote data centers.
- Inclusion of firewalls to prevent unauthorized access to backend network resources.

Figure 2 on page 74 shows one example of a backend network architecture incorporating the previous design components. CT

Chet Birger, Ph.D., is a consultant in network analysis and engineering. Birger may be contacted at (617) 860-7933. Wayne Mackey is senior product manager of the LANcity product family, Broadband Technologies Division of Bay Networks Inc. Mackey may be reached at (508) 682-1600.

BOTTOM LINE

What You Need in Your Headend For Data Delivery

MSOs (multiple system operators) offering data-over-cable services require a "backend" data network, encompassing headends, data and network operations centers, and a backbone network interconnecting them. Backend networks are constructed from several building blocks, falling into two broad categories: data switches and servers.

Routers, LAN switches or both? Routers and local area network (LAN) switches make up the two principal classes of data switches used in backend networks. LAN switches have lower cost/performance and cost/port ratios. Routers can exercise morecontrol over traffic flows. Backend networks will typically employ a combination of the two.

Are you being served? A data-over-cable service employs a variety of data servers. Dynamic host configuration protocol (DHCP), trivial file transfer protocol (TFTP), domain name server (DNS), provisioning and security servers support network operations. Web mail, news and chat servers provide data content and services to subscribers.

How is it all put together? Although working with common building blocks, MSOs have flexibility in how they construct their backend network.

You've got to see this...

It's HOT!!

and...

- It's hands free...
- It's voice activated...
- It's for field technicians...
- It beats anything you have ever used...

and...

...once you have used it, you will never use another

or

See it at
ComSonics
Booth #1638
Western Show

Reader Service Number 100

ComSonics, Inc.
We set the standards.
P.O. Box 1106 • Harrisonburg, VA 22801 USA
(540) 434-5965, In USA: (800) 336-9681 Fax: (540) 432-9794
or visit our web site at http://www.comsonics.com

Six Steps to Reverse Path Success

By John Sciberras and Terry Wright

Not too long ago, cable operators were focusing only on the forward plant. Now, in the wake of the wired broadband distribution segment of telecommunications (cable TV), cable operators are faced with the challenge of establishing reverse plants.

Like any new technology, the upstream path also faces technical barriers, including signal degradations such as stationary, transient and multiplicative impairments. Household appliances such as noisy blenders, hair dryers and washing machines also contribute to signal degradation. These noises often enter the plant through open terminations, faulty shielding or even a partially connected connector. Operators also should beware of opportunities for noise to invade the system through loose hardware in their subscribers' households.

The common impairments produced by noise sources include: intermodulation distortion, ingress noise, thermal noise, spurious, impulse noise, common path distortion and hum modulation. These impairments can devastate an upstream plant.

Design considerations

The initial planning of the upstream plant is critical to its success. (See Figure 1 on page 80.) Typically, reverse path plants are factored into the design and documentation criteria for new builds. Upgrades, however, can be a bit more complicated.

When an MSO acquires or merges with another company, it is not unusual to encounter unmatched engineering practices in the systems, including poor documentation and lack of standard measurement and engineering practices. To upgrade the plant to two-way, the MSO must document the plant with "as-built" drawings before it can begin to design the upstream plant. During the documentation process, sources of impairments are commonly discovered in amplifiers and receivers, which may have been mismatched as the system grew. Furthermore, the design criteria used for the forward path will not work in today's environment, where both the forward and reverse paths must be considered together as a system.

The reverse path will carry digital carriers with a multitude of modulation schemes (the most prevalent being QPSK or quadrature phase shift keying). Varying power levels and various carriers are important factors to consider when laying out the reverse path. Therefore, the power density of each contributing carrier is important to calculate. Consider the following:

$$P_d = RF_{Total} - 10 \log BW_{Total}$$

Where: P_d = Power density
RF_{Total} = Total RF power
BW_{Total} = Total bandwidth

Most upstream plants use the 5-40 MHz portion of the spectrum. If the reverse laser requires an optimum input RF power (Figure 2 on page 80) of +32 dBmV, the power density in the reverse path can be calculated as follows:

$$P_d = RF_{Total} - 10 \log BW_{Total}$$
$$= 32 - 10 \log 35 \times 10^6$$
$$= 32 - 75.44$$
$$= -43.44 \text{ dBmV/Hz}$$

The reverse channel can support any number of digital carriers over the spectrum. Maintaining the proper power density is critical to designing a balanced

BOTTOM LINE

Down the Reverse Path

Your reverse system is going to require a very stringent setup and field testing program. In your reverse path, you will encounter some of these common impairments produced by noise sources, including *intermodulation distortion, ingress noise, thermal noise, spurious, impulse noise, common path distortion and hum modulation.* Learn how to identify and correct them by trying the following six-step process:

1) **Check the headend** to make sure that the system is operating properly.
2) **Check for noise** after the combining network.
3) **Track the noise.**
4) **Leap-frogging:** Use a two-person team and begin at the last amplifier in the cascade. Use at least four, preferably eight tones, or a sweep to hit the reverse amplifier at a flat 20 dBmV. The person at the next amplifier will indicate if the reverse amplifier needs to be turned up or down to achieve a flat 20 dBmV.
5) **The new plant will already be clean** if the reverse balancing method is used to tie into the active plant.
6) **Check all the system's legs** to ensure that the amplifiers are balanced properly.

MAKING REALITIES OF YOUR VISION

QUICK TURNAROUND TIME

TRI-VISION

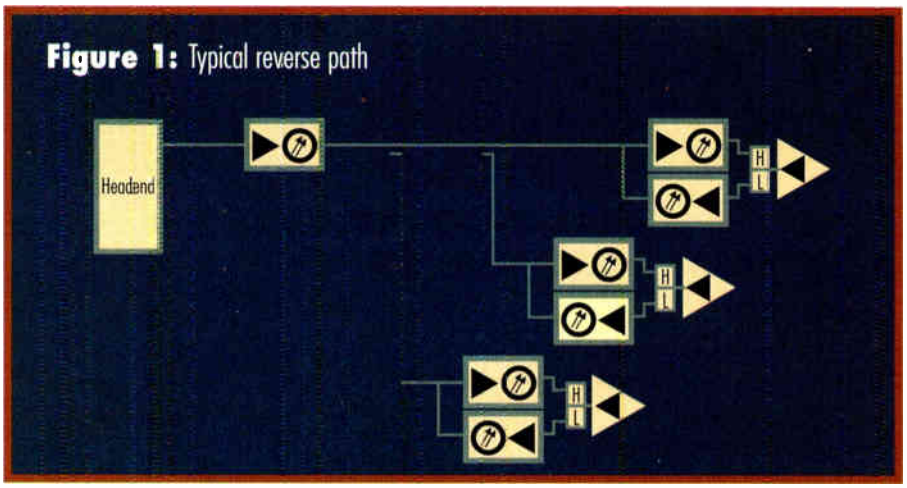
WORLD LEADERS IN IR/RF REMOTES

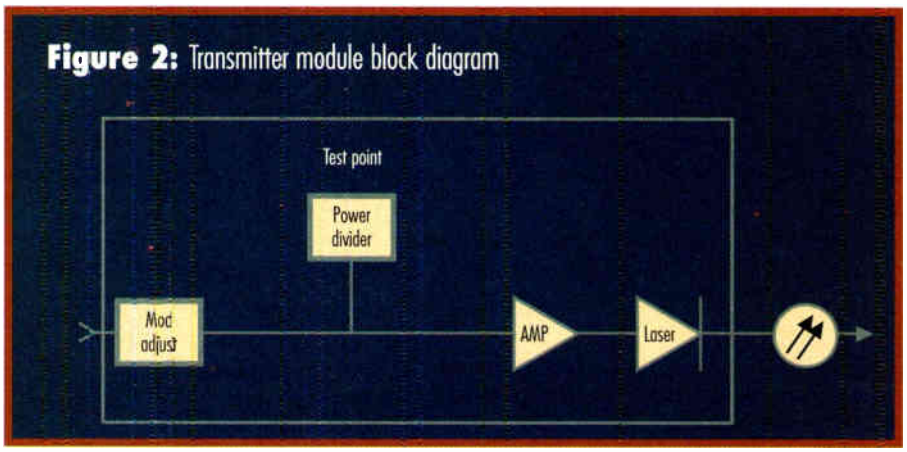
Head Office

41 Pullman Court
Scarborough, Ontario
Canada M1X 1E4
Tel.: (416) 298-8551
Fax: (416) 298-7976

e-mail: tri-vision@tri-vision.ca

INNOVATIVE





upstream path. The previous computation assumes that the entire return path is occupied by return signals. If only a portion of the return path is occupied, then that portion should have the entire signal power contained within, and make an allowance for ingress noise.

A noisy environment

Noise is generated by many different situations. Intrinsic interference is generated by the active equipment in the cable plant and/or is an inherent characteristic of the cable plant. The best precaution is to design a good system. Following are typical types of noises:

Thermal noise. This type of noise, often found in active devices, is caused by the random excitation of charged carriers in a conductor. In conductors above absolute zero, the electrons stay in a random motion dependent on temperature. A movement of temperature can cause the electrons to increase motion, which precipitates an instantaneous current within the device. In addition to thermal noise, active electronic devices also add excess noise. Therefore, it is best to avoid adding too many amplifiers in the reverse path. Devices with low noise figure (the measure of the excess noise added) are desirable.

Intermodulation noise distortions. Inherent in every multichannel system, these distortions, along with thermal noise, are a significant factor in the design of forward and return paths. For example, the composite triple beat (CTB) combines all third order beat frequencies, or odd order distortion products, that mix or beat against each other. Also, composite second order distortion (CSO) is a combination of second order beat frequencies, or even order distortion products created by one or two signals that mix, or beat against each other.

Crosstalk. This is generated inside the cable plant equipment. Internal equipment isolation problems often cause this type of noise.

Discrete ingress. Although it generates externally, it affects the RF section of the cable plant. Ham radio and local broadcast stations are often the cause of this type of noise.

Impulse noise ingress. Nonpredictable in nature, this also generates externally

and affects the RF section of the cable plant. Sources include electrical appliances, automobile ignitions, lightning and poor electrical insulators in high voltage lines.

Internal impulse noise. Generated in the cable equipment, sources include ground faults in active equipment, arching connectors and overloaded lasers.

Common path distortions (CPD). Generated in the cable equipment, sources include poorly installed or faulty hardline coax connectors; the interface between the connector and the cable equipment (actives and passives); and problems with F-connectors.

Hum modulation. Modulation distortions at power frequencies are known as hum modulation. Hum modulation affects the amplitude of the carrier, causing a "hum" bar to appear on the TV screen. Most hum disturbances are power line related; however, low frequency (under 400 Hz) also is considered a hum.

Sources of hum modulation include incorrect line voltage on an amplifier; failing filter capacitor; bad power supplies; and loose connections. A common source of hum modulation is the process of separating the power frequencies from the RF frequencies in amplifiers and taps. Capacitors used to couple the RF signals can have their capacitance modulated by the power frequencies, and the inductors used to couple power can have their inductance modulated by the current in them. The effect of both phenomena is to introduce hum on the RF carriers, both upstream and downstream. The effect is often greater in the return spectrum than in the downstream spectrum.

Field testing

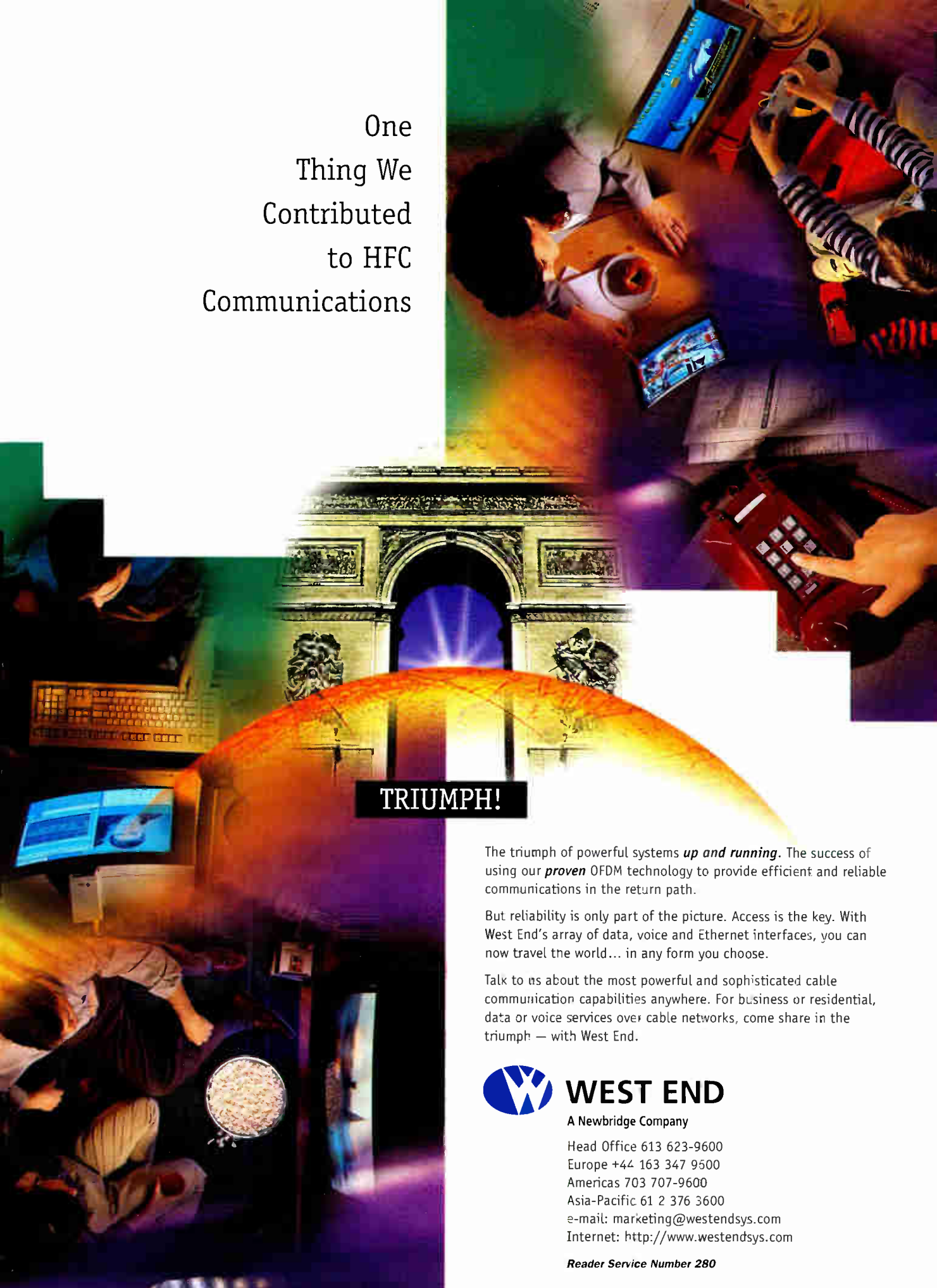
All systems will encounter noise, regardless of their design. Therefore, it's important to conduct field tests immediately after the system is installed and activated. Various methods can be used to check the reverse path for minimal noise. Consider the following six-step process for field testing. (Note: This method assumes a cable modem solution that uses a reflective headend. The assumed headend contains a signal reflector that translates upstream signals to the downstream spectrum.)

Step 1. *Check the components and the connections.* Check the headend to make sure the system is operating properly. Also, ensure that all F-connectors are placed tightly. If fiber is in the headend, check the fiber receivers to ensure that they are not turned up all the way then padded down (RF side). Check the translator to determine that a sufficient signal is being transmitted from the cable modem equipment. Install directional couplers at the input and output of the headend cable modem equipment to use as test points.

Step 2. *Check for noise after the combining network.* Then, separately review each leg to identify what part of the aggregate noise can be traced to each leg.

Step 3. *Track the noise.* Tracking noise on the reverse differs greatly from tracking ingress on the forward plant. Ingress begins at the headend and travels into the plant on the forward frequencies. It

One Thing We Contributed to HFC Communications



The triumph of powerful systems ***up and running***. The success of using our ***proven*** OFDM technology to provide efficient and reliable communications in the return path.

But reliability is only part of the picture. Access is the key. With West End's array of data, voice and Ethernet interfaces, you can now travel the world... in any form you choose.

Talk to us about the most powerful and sophisticated cable communication capabilities anywhere. For business or residential, data or voice services over cable networks, come share in the triumph — with West End.

WEST END

A Newbridge Company

Head Office 613 623-9600
Europe +44 163 347 9500
Americas 703 707-9600
Asia-Pacific 61 2 376 3600
e-mail: marketing@westendsys.com
Internet: http://www.westendsys.com

Reader Service Number 280

cannot go back through an active. By contrast, reverse noise begins in the plant and goes back to the headend. This noise is then broadcast onto the forward channel.

Use a spectrum analyzer on each amplifier to find the origination point of noise. Continue to work back toward the headend, one leg at a time. This cleaning procedure should be used throughout the entire reverse spectrum. Remember: noise and ingress do not always originate from the same plant problems. Therefore, the discovery of noise does not always indicate an ingress problem. Likewise, the discovery of ingress does not always mean that there is a noise problem.

Examine products in the field that cause noise: loose F-connectors, bad drops, loose or poor connectors, holes or cracks in cable, poor taps, faulty reverse amplifiers, poor grounding, incorrect housing-to-housing connections and reverse amplifiers that are maximized in gain. (See Figure 1 on page 82 for proper operating gains.)

Step 4. *Achieve unity gain.* A two-person team is necessary to achieve unity gain from each amplifier. Beginning at the last amplifier in the cascade, inject a high frequency and a low frequency into the reverse output.

While two-tone testing is a common practice, it can achieve unsatisfactory results. Use at least four, preferably eight tones, or a sweep to hit the reverse amplifier at a flat 20 dBmV. The person at the next amplifier will indicate whether the reverse amplifier needs to be turned up or down to achieve a flat 20 dBmV. This method should continue in a leapfrog fashion down the line. Do not set the reverse amplifiers for the same outputs as the forward path.

Step 5. *Use reverse balancing.* The new plant will already be clean if the reverse balancing method is used to tie into the active plant. Also, cleaning the noise before tying into the active plant prevents subscribers from losing active data service.

Step 6. *Check for balanced amplifiers.* Check all the system's legs to ensure that the amplifiers are balanced properly. At the end of the cascade, inject high and low test frequencies into the output of the last amplifier at 20 dBmV. Read the cascade's level to make sure that the signal is reaching the headend at the same level as the other cascades.

A reverse system requires stringent setup and field testing procedures. For example, an ongoing leak detection program is a must. Also, the reverse spectrum must be checked for noise on a regular basis. Typically, video problems can be corrected in a timely fashion, whereas data on the reverse can be lost instantaneously. The upkeep of an upstream plant is ongoing, but the benefits are numerous. CT

John Sciberras is systems engineering manager for ANTEC Network Technologies in Norcross, GA. Terry Wright is chief technical officer for Convergence Systems Inc., also in Norcross, and author of the "Communications Technology" column "The Data Game." Sciberres can be reached at (770) 734-0100, ext. 8560 and Wright can be reached at (770) 416-9993.

ARROW®

MODEL T59™

The all steel WIRING TACKER that shoots UL® Insulated Staples

The Arrow T59™ is a hard hitting all steel tool. It incorporates the same rugged construction, easy compression span handle and patented jam-proof mechanism of the Arrow's world-renowned T50® Tacker. The T59 is finished in durable chrome to withstand the bumps and scratches of professional use.

The Arrow series of insulated staples are specially coated to provide three times the holding power. Insulation is made of super impact-resistant plastic that remains strong even under extreme low temperature conditions. The staples are available in 3 different inner dimension insulator sizes: 1/4 x 1/4 (6mm x 6mm), 5/16 x 1/4 (8mm x 6mm), 5/16 x 5/16 (8mm x 8mm). Just select the size for your job, load it into the T59's chamber and your Arrow Wiring Tacker is ready to secure a wide range of wire and cable up to 5/16" dia. (8mm). Perfect for RG59 and RG6.

A WIRING TACKER FOR EVERY JOB

There is always a need for tackers that shoot non-insulated staples. As one of America's oldest and most respected names in the fastening business, Arrow has an extensive range of wiring tackers for just about every assignment:

T18™ – For wires up to 3/16" dia.
T25™ – For wires up to 1/4" dia.
T37™ – For wires up to 5/16" dia.
T75™ – For wires up to 1/2" dia.

NEW! FOR NM SHEATHED CABLE. The Arrow 7514S and 7510S staples, made exclusively for our T75 tacker, have been awarded both a UL and a Canadian C-UL listing for installing NM Sheathed Cable up to #12 3-Wire with Ground. These important additions to every electrician's and cable installer's inventory are specially coated for extra long holding power.

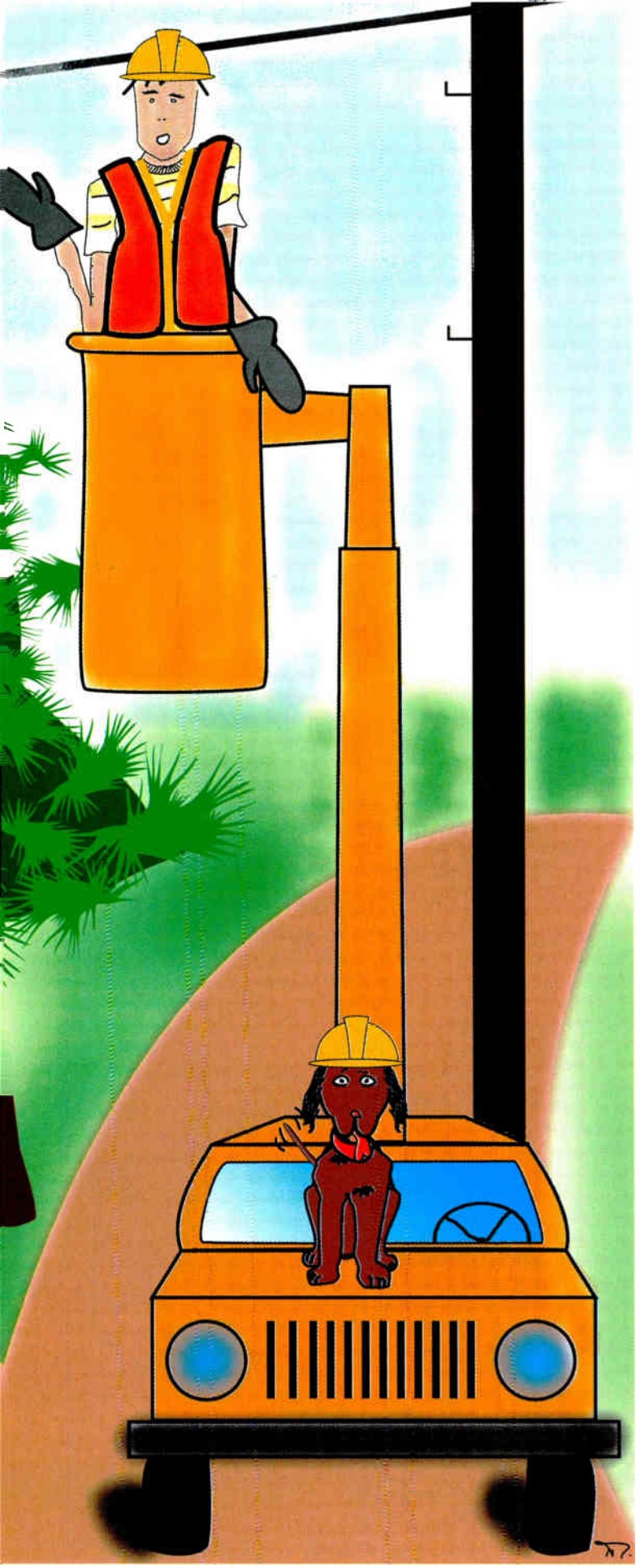
Whatever your wire or cable installation task — TV, HiFi, Alarm System, Plastic, Wire Conduit, Computer, Multi-Conductor, Control Wiring, Hollow Tubing, or any NM Sheathed Cable — there is a reliable Arrow Tacker and Arrow Staple to make your job easier, faster and more secure.

All Arrow Tackers and staples are built in the U.S.A. under the strictest standards of quality assurance. It's been that way for over half a century!

MADE IN USA

ARROW FASTENER COMPANY, INC.
271 MAYHILL STREET, SADDLE BROOK, NEW JERSEY 07663
UNITED KINGDOM: ARROW FASTENER (U.K.) LTD., 14 BARCLAY ROAD, CROYDON, SURREY CR0 1JN
CANADA: JARDEL DISTRIBUTORS, INC., 6505 METROPOLITAN BLVD. EAST, MONTREAL, QUEBEC H1P 1X9

See your Arrow wholesaler for the full line of Arrow wire and cable tacking equipment.



Keep on

I have been receiving a lot of phone calls following the publication of the news release on fall arrest systems and this seems to be an excellent time to clear things up. It is a fact, in general, workers in the telecommunications industry do not have to wear a fall arrest system with deceleration devices and a full body belt. We can still use the old tried and true safety belts with safety straps. However, as of January 1, 1998, those safety straps must have locking snap hooks. This holds true for climbing and working on poles and ladders in the performance of our jobs. This information comes directly from the project officer of CFR 29, part 1926, subparts 500 through 503, including Table "M" of the rules.

Rooftop installation

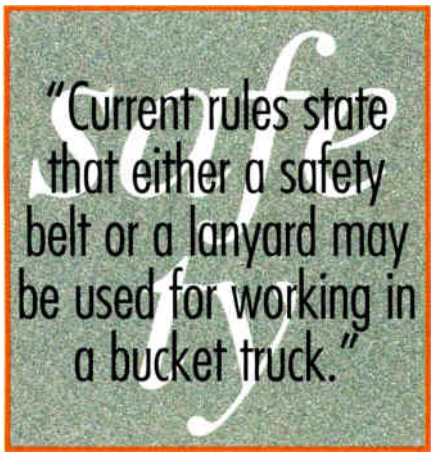
Fall arrest systems will apply to the installation of direct broadcast satellite (DBS) systems such as PrimeStar where the receiving satellite antenna is mounted on a roof. That is why a large number of DBS antenna installations are now being placed on ground-level poles where the mounting can be done from ground level or a step ladder. Another solution to the rooftop installation is a device that mounts permanently to the peak of the roof of a building and the attachment device is removed after installation of the antenna has been accomplished.

This device comes in a kit that contains a full body harness, a 3-foot shock absorbing lifeline, a roof mounted base unit with a detachable fall arrest fastening section, and a

Truckin'

By Ralph Haimowitz

canvass bag that holds all of the items listed. The best part of this system is that the securing device is detachable so that no one but those who have that specific part can connect to the base system. Cost of the kit is around $300 and additional base units are available for a much lower price. The device was invented by EPS of Denver at the request of Ray Lehr, Chairman of the Society of Cable Telecommunications Engineers Safety Subcommittee. Contact Craig Shure at (303) 932-0477 for additional information.



Bucket trucks

Another area that is not quite as clear or well defined deals with bucket trucks. According to Richard Fairfax of the Occupational Safety and Health Administration construction division, the basic rules for bucket trucks goes back almost 30 years and should be updated to meet today's needs. Current rules state that either a safety belt or a lanyard may be used for working in a bucket truck. Where the problems begin with this is that the safety belt must be fastened to the safety ring on the mid-back using a safety strap with locking snap hooks on the safety strap or lanyard, and be short enough to ensure that the wearer can not free fall out of the bucket more than 2 feet. Otherwise, you must use a safety harness where the retaining ring is located in the center of the back on the harness between the chest strap and the waist strap, and attached to the retaining point with a deceleration device to reduce the speed of the free fall and stop within 6 feet. Most of the cable TV safety people I have talked with have decided to "bite-the-bullet" and install the fall arrest system on the buckets. First, it is a safer method for the employee and, second, there is a good possibility that this rule will be changed for fall arrest systems only.

Did you know that your bucket truck operators should have the appropriate training and proof of training to meet the safety requirements? This training may be available from your bucket truck supplier. In addition, we are planning to have two bucket truck training sessions at CableTec Expo '98 in Denver next June for anyone who lacks this certification.

One further item of food for thought is that Fairfax said he would like to see a system where the retaining ring was located in the floor on the bucket back near the floor and a safety strap or lanyard that would be long enough to allow the worker to do his job, but short enough to keep the worker from falling out of the bucket. Installing the retaining ring would have to meet the strength and weight requirements for buckets. In his opinion, this solution exceeds the present rule requirements and should be acceptable. CT

Ralph Haimowitz is director of training for the Society of Cable Telecommunications Engineers. He can be contacted at (704) 264-8310.

BOTTOM LINE

Safety Methods Revisited

The real bottom line is that you don't have to use fall arrest systems for working on poles or ladders; the tried and true old safety belt with a safety strap will do just fine. If you install antennas on roofs, you will need a fall arrest system and, with bucket trucks you have one of the choices listed below:

- Wearing a safety belt
- Wearing a lanyard
- Install a fall arrest system on the bucket

Expect to see some new regulations on fall arrest systems for working on towers and the antennas on towers in the near future.

Multiport Device Testing

The new HP 87075C multiport test set developed by Hewlett-Packard is coupled with an HP 8711C series network analyzer and tests devices up to 1.3 GHz. The test system also eliminates the process of connecting and reconnecting a device to measure all of its signal paths.

Reader service #307

Cable Modem Transceiver

Libit Signal Processing has released the LBT 4030, a standards-compliant cable TV transceiver chip for cable modem applications. The product is a highly programmable chip for high-speed, two-way data transfer at the subscriber end of hybrid fiber/coax (HFC) cable networks and includes a complete downstream and upstream physical layer.

The LBT 4030 integrates a downstream quadrature amplitude modulation (QAM) modulator, an upstream quadrature phase shift keying (QPSK)-16-QAM modulator, and analog-to-digital (A/D) and digital-to-analog (D/A) converters. Downstream supports 64/256 QAM modulation formats with up to 42.4 Mbps in a 6 MHz channel.

Reader service #311

Bandwidth Manager

The Harris media bandwidth manager developed by Harris Corp., digital telephone systems, is for voice/data networks and provides highly flexible bandwidth allocation and voice compression. Network administrators can integrate multiple data and voice streams onto a single pipe while providing toll quality voice over just 16 kbps.

The manager is available in three cabinet sizes supporting a broad range of applications—from simple, point-to-point networking to large, integrated, mesh networks. A set of feature modules enables the configuration of the Harris media bandwidth manager in building block fashion to meet a variety of requirements. Modules include voice compression, low- and high-speed data, intergrated services digital network (ISDN), frame relay, local area network (LAN) internetworking, router functions and videoconferencing.

Reader service #309

CABLE INNOVATIONS PRODUCTS SHOWCASE

PLS-125™, PLS-225™, PLS-220™ Power Line Surge Suppressors

The PLS-125, PLS-225 and PLS-220 reduce outages and customer complaints by eliminating breaker outages, blown fuses in power supplies, and damage to power supplies due to voltage transients, surges, spikes, and lightning. The PLS-125, PLS-220, and PLS-225 also protect expensive headend equipment from overvoltage related damage.

Reader Service Number 301

DLPS-15D™ Drop Line Power Suppressor

Developed and patented by Cable Innovations, the 1 Ghz., UL approved DLPS-15D protects drop line electronics from damaging faults due to surges, transients, spikes, and lightning. The DLPS-15D, using dual direction Sidactor technology, protects both directions (from the house and into the house). With a trigger sensing time of one nanosecond, the DLPS-15D will virtually eliminate damage to drop line electronics caused by overvoltages.

If you are currently using Zener diodes, gas discharge tubes, MOV's or just a ground block, you are taking unnecessary risks with your equipment and with your subscriber's electronics. The DLPS-15D offers a longer life, greater current handling capacity and faster response than any other type of protection.

Reader Service Number 302

DLPS-15DF™ High Pass Filter/Drop Line Power Suppressor

The DLPS-15DF is an essential ingredient in achieving the reliability and subscriber satisfaction necessary in those systems that need to eliminate return path noise and protect both their equipment and the subscriber's electronics.

The DLPS-15DF offers the same suppression as the DLPS-15D, taking any overvoltage directly off the center conductor and zapping it to ground instantaneously before any damage can occur to cable line electronics or the subscriber's electronics.

The DLPS-15DF offers a wider and deeper filter, longer life, greater current handling capacity and faster response than any other type of protector/filter.

Reader Service Number 303

GB-401™ Direct Pickup Filter

Eliminates ghosting and diagonal lines due to direct pick problems The GB-401 (Ghost Buster) is a patented filter used to solve direct pickup problems caused by cable ready TV's and VCR's (ghosting & diagonal lines). A high percentage of "cable ready" televisions and VCR's are manufactured with a shielding deficiency problem. Most brandnames and models are susceptible to this problem, regardless of how new or expensive the set is. These poorly shielded units may experience degraded picture quality because strong local TV signals get into the tuner and mix the cable signals inside the set. When a television receives two channels at once, the picture will have interference in the background. The GB-401 eliminates this problem.

Reader Service Number 304

Transmission Systems

Physical Optics Corp. has produced the POC220, a bidirectional, fiber-optic transmission system, which includes the following applications: remote multimedia studio interconnection, remote monitoring, media retrieval, distance learning and audio/video/data conferencing.

The product provides simultaneous transmission of digital-stereo audio, full-bandwidth video and narrowband data over single fiber and fiber pair. The system transmits and receives two audio signals or one stereo audio pair, one baseband video channel and one serial data channel in one direction.

For singlemode fiber, front-panel connectors provide video, line-level audio (terminal block), DB 9 serial data and FC-type connections. For multimode fiber, the panel offers ST-type connections. The transmission systems meets complex, user-defined fiber-optic ring architectures.

Reader service #295

Fiber-Optic Link

The new fiber-optic transmitter and receiver pair for broadband wireless system configurations developed by Anacom Systems Corp. offers a low loss means to transmit the RF signal between the antenna and the base-station. The AC 102 is a RF to fiber converter and operates transparently in wireless and RF systems.

Reader service #293

Center Spine Cable Tray

Thomas & Betts has introduced a center-spine cable tray system to assist with cable-tray installation. The system simplifies field modifications, customization and work around installation obstacles. The modular assembly is said to eliminate shipping damage and to make handling, transport and storage more efficient. The tray is available in three primary strut designs to optimize loading requirements—standard spine, deep-spine and shallow-spine—and is compatible with conventional metal framing accessories.

Reader service #294

Horizontal Analyzer

The HA2500 universal horizontal analyzer developed by Sencore provides a frequency lock and variable horizontal frequency system to service all horizontal circuits no matter the frequency (15 kHz-125 kHz). The unit also conducts a "horizontal output load test" to ease setup and testing. The HA2500 incorporates the "ringer" test for analyzing IHVTs, flybacks and yokes. Another feature of the analyzer is its variable-current limited and protected B+ substitute supply, which allows a technician to test and troubleshoot when the power supply is dead.

Reader service #297

Wire and Cable ID

VIP Products has announced the availability of Wrap-Up wire and cable markers, designed to provide an inexpensive solution to the problem of fast and permanent field identification. The markers are available in widths from 1.5 inches to 6 inches to fit virtually any size cable or wire, and come in eight colors.

To use, the field technician employs a marking pen, ball-point pen or typewriter to write the appropriate legend on the Wrap-Up. When applied, the clear film of the product covers and laminates the written portion, ensuring permanent protection against dirt, oil and water.

Reader service #296

Communications Technology's
Product and Data Showcase

AM Communications

AM Communications

AM Communications is a leading supplier of monitoring systems for HFC transmission networks. AM's OmniStat product offers solution for virtually every brand and kind of network equipment.

PHONE: (212) 538-8700
FAX: (212) 538-8779
www.amcomm.com

Reader Service Number 20

Hukk Engineering

Hukk Engineering manufacturers digital test equipment for the CATV industry providing bit error rate measurements for QAM and QPR modulated digital signals. The new CR1200 provides users with pre-and post-FEC bit error rate information, signal-to-noise, and shows the constellation. It also does traditional analog testing like signal level, carrier-to-noise and hum.

PHONE: (888)236-8948
FAX: (770)446-6850
www.hukk.com

Reader Service Number 101

Amphenol

Amphenol Amphenol Corporation is one of the largest man ufacturers of interconnect products in the world. The company designs, manufacturers and markets CATV cable and connectors, electronic connectors, fiber optic connectors, RF coaxial cable, flat ribbon cable and interconnect systems. Amphenol connectors enable systems to send and receive secure signals with no reflections. . . especially in the critical 5 - 40 MHz range.

Amphenol
Broadband Connectors. When Clear Connections Count.

PHONE: (203) 743-9272
FAX: (203) 796-2032
www.amphenol.com

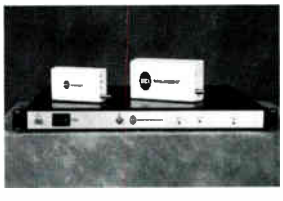
Reader Service Number 121

Klungness Electronic Supply

KES distributes the "Little Oscar" hand held signal generators permitting **easy activation of the return path** using two independently controlled CW carriers. Oscar-II has fixed frequencies at 6 MHz and 39 MHz. Oscar-IV is frequency agile from 5 MHz to 50 MHz. A companion unit to the Oscar, Model RPC-III is installed at the headend and translates the return carriers to downstream carriers. Using "Little Oscar" and the technician's field strength meter, one technician can align and maintain the return path.

PHONE:(800) 338-9292
FAX: (906) 774-6117
www.ccikes.com

Reader Service Number 47



RF Connector

The V-Bite RF connector developed by Bomar Interconnect Products is available in PCB mount BNC and TNC styles, in addition to the original PCB mount "F." The V-Bite design allows high anti-rotation abilities plus a stable and durable connection for cable TV applications.

Reader service #304

VSAT Modem

Designed for Internet access and rural telephony, the VSAT STEL-9260 modem from Stanford Telecom, provides a solution for mid-range data rate applications. The transmitter section of the modem has direct RF output covering the 52 to 88 MHz IF range, and programmable power levels from -5 to -25 dBm. The receiver is a true variable rate demodulator that is user programmable from 19.6 to 1024 kbps BPSK and 64 to 2048 kbps QPSK.

Reader service #292

Fiber Attenuator

Alliance Fiber Optics Products' new family of fiber attenuator series in FC and SC configurations are fiber type attenuators with standard loss values of 5 dB, 10 dB, 15 dB and 20 dB. The products are available in male-male, male-female and female-female versions.

Reader service #301

One-Box Solution

Tektronix has introduced the BasePak distance-to-fault software package that brings antenna measurement capability to the Advantest U3641 portable spectrum analyzer. The BasePak-equipped U3641 is an integrated solution for cellular and personal communication service (PCS) base station installation and maintenance measurements. The product provides tests for base station installation and maintenance.

Reader service #298

Refurbished IRD's VCII's VCRS's PLUS

switchable
DSR 1500
vcrs & mpeg I

Standard
2001's VCII
$699

DSR 2200

DX 647
VCII
$649

SA 9650
VCII Plus VCRS

Nexus IRD2

UNIDEN
VCII
$399

Hey, Did you know that Tulsat has hundreds of refurbed IRD's in stock?

UNIDEN
VCRS
$599

Pico
3200's

G.I. 1000
switchable

Drake VCII
IRD 1240
$599

ISS VCII
$499

G.I. 1450
VCII
$549

DX 747

New IRD's IRD Cards VCII VCRS PLUS

DSR 4500
SA 9660
Drake 1260
Standard 2001

NEW

DX 747
G.I. 1450
G.I. 1000
Nexus IRD2

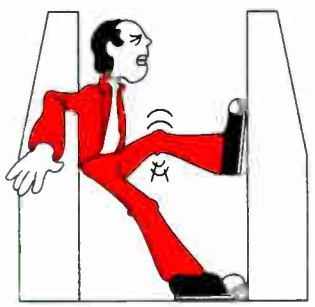
NEW

DSR 4400
BT 6185
Drake 1245
Standard MT630

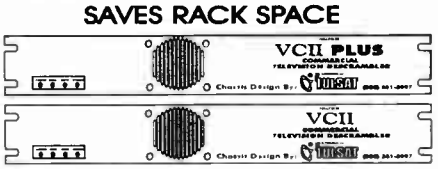
Is your headend cramped for space?

Try our half-sized chassis for FREE FREE FREE

(With Purchase of VCRS)
(Limit One Per Customer)



$139.00
HALFSIZE VCII CHASSIS
THERMOSTAT CONTROLLED FAN
SAVES RACK SPACE



WE SELL, REPAIR & PURCHASE HEADEND & LINE EQUIPMENT

*VCRS PLUS
*UPGRADES & EXCHANGES

WE REPAIR IRD CARDS

MOST REPAIRS $93.00

1605 E. Iola
Broken Arrow, Ok 74012

TULSAT 800-331-5997

©VCRS is a registered tademark of general Instrument

BOOKSHELF

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

- *Video and Audio Signals and Systems (BCT/E review course)*—Category II Curriculum Committee Chairman Paul Beeman presents this overview of Category II of the Broadband Communications Technician/Engineer (BCT/E) Certification Program. Emphasis is placed on audio and video terminology, plus test and measurement procedures. This video is from Cable-Tec Expo '86. (1-1/2 hrs.) Order #T-1029, $45.
- *Basic Electronic Fundamentals in the Analysis of Cable System Powering*—Ray Rendoff discusses the fundamental characteristics of AC and DC voltage, AC standby power supplies, coaxial cable and various amplifier configurations that establish overall system powering requirements. Mathematical calculations using Ohm's law are performed on a sample system powering configuration. Typical powering problems and corresponding troubleshooting techniques conclude this technician level program on system powering analysis. (1 hr.) Order #T-1030, $35.
- *Channel Deletion and Reprocessing Networks*—This video, produced by Microwave Filter Co. for the SCTE Product-Specific Tele-Seminar Program, explains the construction of RF filters and their applications in cable system headend processing. (30 min.) Order #T-1051, $30.
- *Standby Power Supply Maintenance*—Alpha Technologies produced this in-depth program on this important topic, which features company representative Bob Bridge, for the SCTE Product-Specific Tele-Seminar Program. (1 hr.) Order #T-1052, $35.
- *RF Field Strength: Principles and Practices*—An effective presentation of the basics of an RF field, relating what it is and how it reacts both inside and outside of a cable. Ron Adamson covers the principles of shielding, wavelength and the use of a dipole antenna for detection. In addition, the terminology of the Federal Communications Commission's "microvolt per meter" is discussed in relation to cable's "dBmV." (1 hr.) Order #T-1053, $35.
- *Fiber-Optic Testing*—Mark Connor and Louis Williamson discuss fiber-optic test equipment and its use during installation and maintenance of a CATV system. (1 hr.) Order #T-1087, $35.
- *Painless Technical Writing*—Bill Cologie and Rikki Lee address the issue of overcoming the fear of writing and putting ideas on paper. They also discuss preparing memos, reports and technical articles in a CATV-specific environment. (1-1/4 hrs.) Order #T-1089, $45.
- *Signal Leakage Equipment Calibration*—Don Runzo and Steve Windle focus on different aspects of signal leakage equipment calibration, including receiver measurement accuracy, setting up a calibrated leak and calibrating the vehicle-mounted leakage test system. Internal and external calibration and wave propagation are covered. (1 hr.) Order #T-1090, $35.
- *Video and Audio Measurements*—Ron Hranac and Steve Johnson demonstrate headend video and audio measurements, covering video level, video depth of modulation, audio level and audio deviation measurements with actual test equipment. (1-1/4 hrs.) Order #T-1091, $45. C_T

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.

Train your staff for $345!

Newly Expanded Teletutor® Computer-Based Training.

SCTE is offering CBT-01, Telecom Technologies and CBT-02, Transmission Basics at an introductory price of $345 each, available until December 31st, 1997.

To order at this special price, use the order form below. For further information, contact SCTE at 800-542-5040; fax to 610-363-5898; or e-mail to info@scte.org.

TO ORDER: All orders must be prepaid. Shipping and handling costs are included in the Continental U.S. Foreign orders will require an additional shipping charge. All prices are in U.S. dollars. Orders without full and proper payment will be returned. SCTE accepts MasterCard, Visa and American Express. NO CASH

MAIL TO: SCTE, 140 Philips Road, Exton, PA 19341-1318; or FAX with credit card information to: 610-363-5898.

SHIP TO: Name: _____

Address: (NO P.O. BOXES): _____

_____

Phone: _____-_____-_____ Date: _____/_____/_____ Member #: _____

❑ Please send me the following items in the quantities indicated:

_____ copies of CBT-01, *Telecom Technologies* ❑ Member: $345

_____ copies of CBT-02, *Transmission Basics* ❑ Member: $345

(Pennsylvania residents add 6% sales tax).

❑ A check or money order in U.S. funds for the appropriate amount shown above and made payable to the Society of Cable Telecommunications Engineers is attached.

❑ I wish to pay by credit card (please check one). ❑ MasterCard ❑ VISA ❑ American Express

CT1197

CALENDAR

November

3: Tektronix's seminar series on emerging video and telecommunications technologies, Gaithersburg, MD. Contact (800) 763-3133.

5: SCTE Great Plains Chapter, technical seminar, "Test Equipment" with speakers to be announced, Bellevue, NE. Contact Herb Dougall, (402) 597-5666.

Nov. 12-Jan.15: Hewlett-Packard return path seminar. Call for dates and locations (800) 765-9200.

13: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program, "Fiber-Related Issues," Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Contact SCTE national headquarters, Janene Martin, (610) 363-6888, ext. 220.

17-18: Wireless Cable Association International's fourth annual technical symposium, San Diego. Contact (202) 452-7823.

17-18: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to Telephony," Sacramento, CA. Contact SCTE national headquarters, (610) 363-6888.

19-20: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to Data Communications," Sacramento, CA. Contact SCTE national headquarters, (610) 363-6888.

20-21: IBC broadcast event, "The Digital Widescreen Television" forum, London. Contact Suzi Morris, +44 171 453 2700.

December

1: Scientific-Atlanta Institute technical course, "Introduction to Digital Video Systems," Atlanta. Contact Kim Davis-Mitchell, (800) 722-2009.

2: 1997 CDMA North American Regional Congress, Orlando, FL. Contact (619) 535-8252.

2: The Light Brigade training course for installers, maintenance personnel and engineer designers, "Introduction to Fiber Optics—the Basics," course. Contact (800) 451-7128.

2-4: Converging Technologies Expo & Conference, Los Angeles. Contact John Golicz, (203) 256-4700, ext. 121.

3: SCTE Heart of America Chapter, technical seminar, "Cable Modems/Local Internet Projects," "DBS/HITS Update," and "Digital Compression Update," Independence, MO. Contact Ken Covey, (816) 795-8377.

4-5: IBC broadcast event, "Broadband Strategies: The Battle for Customer Access," London. Contact Suzi Morris, +44 171 453 2700.

6: InteropNetswitch '97 tour—one-day seminar on switched network design, Newark, NJ. Contact (800) 506-9517.

10-12: The Western Show, Anaheim, CA. Contact the California Cable Television Association, (510) 428-2225.

11: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program, "Data Over Cable (Part One)," Galaxy 1R, Transponder 14, 2:30-3:30 pm. ET. Contact SCTE national headquarters, Janene Martin, (610) 363-6888, ext. 220.

11: SCTE Delaware Valley Chapter, technical session, "Troubleshooting the New System (digital, two-way, HFC)," Horsham, PA. Contact Chuck Tolton, (215) 961-3882.

13: InteropNetswitch '97 tour—one-day seminar on switched network design, Toronto, Canada. Contact (800) 506-9517.

18: SCTE Shasta/Rogue Chapter, testing session, BCT/E and Installer certification exams to be administered, Medford, OR. Contact Mike Smith, (541) 779-1814.

26-28: Southern Cable Telecommunications Association's 1998 Eastern Show, Orlando, FL. Contact Patti Hall, (404) 255-1608. CT

Planning Ahead

Jan. 8: SCTE Satellite Tele-Seminar Program, "Data Over Cable (Part Two)," Galaxy 1R, Transponder 14, 2:30-3:30 pm. ET. Contact: SCTE national headquarters, Janene Martin, (610) 363-6888, x220.

Jan. 28-30: SCTE Conference on Emerging Technologies, San Antonio. Contact: SCTE national headquarters, (610) 363-6888.

March 4-6: Global TMN Summit '98 and Vendor Showcase, sponsored by Vertel and HP OpenView Telecom, Orlando, FL. Contact www.vertel.com or www.hp.com/go/ovtelcom.

May 12-14: Pacific Equipment & Technology Expo, Orlando, FL. Contact Robert Morock, (800) 525-7383.

Communications Technology

CT 11/97
X7K101

November 1997 Issue

Return this card for Free Information • Free Subscription

Mail or Fax today to 413-637-4343

The information at right must be completed to process your request.

To receive a free subscription to *Communications Technology*, please sign below.

Name_____ Title _____

Company_____

Address_____

City_____ State_____ Zip _____

Phone_____ Fax _____

E-mail Address _____

Signature_____ Date_____

(Signature and date required by U.S. Postal Service)

Circle Numbers for Free Information

1	27	53	79	105	131	157	183	209	235	261	287
2	28	54	80	106	132	158	184	210	236	262	288
3	29	55	81	107	133	159	185	211	237	263	289
4	30	56	82	108	134	160	186	212	238	264	290
5	31	57	83	109	135	161	187	213	239	265	291
6	32	58	84	110	136	162	188	214	240	266	292
7	33	59	85	111	137	163	189	215	241	267	293
8	34	60	86	112	138	164	190	216	242	268	294
9	35	61	87	113	139	165	191	217	243	269	295
10	36	62	88	114	140	166	192	218	244	270	296
11	37	63	89	115	141	167	193	219	245	271	297
12	38	64	90	116	142	168	194	220	246	272	298
13	39	65	91	117	143	169	195	221	247	273	299
14	40	66	92	118	144	170	196	222	248	274	300
15	41	67	93	119	145	171	197	223	249	275	301
16	42	68	94	120	146	172	198	224	250	276	302
17	43	69	95	121	147	173	199	225	251	277	303
18	44	70	96	122	148	174	200	226	252	278	304
19	45	71	97	123	149	175	201	227	253	279	305
20	46	72	98	124	150	176	202	228	254	280	306
21	47	73	99	125	151	177	203	229	255	281	307
22	48	74	100	126	152	178	204	230	256	282	308
23	49	75	101	127	153	179	205	231	257	283	309
24	50	76	102	128	154	180	206	232	258	264	310
25	51	77	103	129	155	181	207	233	259	285	311
26	52	78	104	130	156	182	208	234	260	286	312

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

01. ___ yes
02. ___ no

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

Cable TV Systems Operations

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

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

Technical/Engineering

25. ___ Vice President
26. ___ Director
27. ___ Manager
28. ___ Engineer
29. ___ Technician
30. ___ Installer
31. ___ Corporate Management (Chairman,Owners, Presidents, Partners, Executive/Senior Vice Presidents and Treasurers)
32. ___ Management (Vice Presidents, General Managers, Systems Managers & Directors)
33. ___ Programming (Vice Presidents & Directors and Managers & Producers)
34. ___ Sales (Vice Presidents, Directors & Managers and Sales Representatives)
35. ___ Marketing (Vice Presidents, Directors & Managers and Sales Representatives)
36. ___ Other (Company Copies & Other Titles & Non-Titled Personnel, please specify)_____

D. In the next 12 months, what cable equipment do you plan to buy?

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

E. What is your annual cable equipment expenditure?

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

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

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

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

71. ___ up to $50,000
72. ___ $50,001 to $100,000
73. ___ $100,001 to $250,000+

H. In the next 12 months, what cable test & measurement equipment do you plan to buy?

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

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

84. ___ up to $50,000
85. ___ $50,001 to $100,000
86. ___ $100,001 to $250,000
87. ___ over $250,000

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

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

K. What is your annual cable services expenditure?

91. ___ up to $50,000
92. ___ $50,001 to $100,000
93. ___ $100,001 to $250,000
94. ___ over $250,000

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

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

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

97. ___ up to10 miles
98. ___ 11-30 miles
99. ___ 31 miles or more

To subscribe via Internet, send e-mail to CT.SUB@Reply.Net. A form will automatically be sent to you.

Communications Technology

CT 11/97
X7K102

November 1997 Issue

Return this card for Free Information • Free Subscription

Mail or Fax today to 413-637-4343

The information at right must be completed to process your request.

To receive a free subscription to *Communications Technology*, please sign below.

Name_____ Title _____

Company_____

Address_____

City_____ State_____ Zip _____

Phone_____ Fax _____

E-mail Address _____

Signature_____ Date_____

(Signature and date required by U.S. Postal Service)

Circle Numbers for Free Information

1	27	53	79	105	131	157	183	209	235	261	287
2	28	54	80	106	132	158	184	210	236	262	288
3	29	55	81	107	133	159	185	211	237	263	289
4	30	56	82	108	134	160	186	212	238	264	290
5	31	57	83	109	135	161	187	213	239	265	291
6	32	58	84	110	136	162	188	214	240	266	292
7	33	59	85	111	137	163	189	215	241	267	293
8	34	60	86	112	138	164	190	216	242	268	294
9	35	61	87	113	139	165	191	217	243	269	295
10	36	62	88	114	140	166	192	218	244	270	296
11	37	63	89	115	141	167	193	219	245	271	297
12	38	64	90	116	142	168	194	220	246	272	298
13	39	65	91	117	143	169	195	221	247	273	299
14	40	66	92	118	144	170	196	222	248	274	300
15	41	67	93	119	145	171	197	223	249	275	301
16	42	68	94	120	146	172	198	224	250	276	302
17	43	69	95	121	147	173	199	225	251	277	303
18	44	70	96	122	148	174	200	226	252	278	304
19	45	71	97	123	149	175	201	227	253	279	305
20	46	72	98	124	150	176	202	228	254	280	306
21	47	73	99	125	151	177	203	229	255	281	307
22	48	74	100	126	152	178	204	230	256	282	308
23	49	75	101	127	153	179	205	231	257	283	309
24	50	76	102	128	154	180	206	232	258	284	310
25	51	77	103	129	155	181	207	233	259	285	311
26	52	78	104	130	156	182	208	234	260	286	312

A. Are you a member of the SCTE (Society of Cable Telecommunications Engineers)?
01. ___ yes
02. ___ no

B. Please check the category that best describes your firm's primary business (check only 1):
Cable TV Systems Operations
03. ___ Independent Cable TV Syst.
04. ___ MSO (two or more Cable TV Systems)
05. ___ Cable TV Contractor
06. ___ Cable TV Program Network
07. ___ SMATV or DBS Operator
08. ___ MMDS, STV or LPTV Operator
09. ___ Microwave
10. ___ Telecommunications Carrier
11. ___ Electric Utility
12. ___ Satellite Manufacturer
13. ___ Satellite Distributor/Dealer
14. ___ Fiber Optic Manufacturer
15. ___ Data Network
16. ___ Commercial TV Broadcaster
17. ___ Cable TV Component Manufacturer
18. ___ Cable TV Investor
19. ___ Financial Institution, Broker, Consultant
20. ___ Law Firms or Gov't Agencies
21. ___ Program Producer or Distributor & Syndicators
22. ___ Advertising Agencies
23. ___ Educational TV Stations, Schools and Libraries
24. ___ Other (please specify)_____

C. Please check the category that best describes your job title:
Technical/Engineering
25. ___ Vice President
26. ___ Director
27. ___ Manager
28. ___ Engineer
29. ___ Technician
30. ___ Installer
31. ___ Corporate Management (Chairman,Owners, Presidents, Partners, Executive/Senior Vice Presidents and Treasurers)
32. ___ Management (Vice Presidents, General Managers, Systems Managers & Directors)
33. ___ Programming (Vice Presidents & Directors and Managers & Producers)
34. ___ Sales (Vice Presidents, Directors & Managers and Sales Representatives)
35. ___ Marketing (Vice Presidents, Directors & Managers and Sales Representatives)
36. ___ Other (Company Copies & Other Titles & Non-Titled Personnel, please specify)_____

D. In the next 12 months, what cable equipment do you plan to buy?
37. ___ Amplifiers
38. ___ Antennas
39. ___ CATV Passive Equipment including Coaxial Cable
40. ___ Cable Tools
41. ___ CAD Software, Mapping
42. ___ Commercial Insertion/Character Generator
43. ___ Compression/Digital Equip.
44. ___ Computer Equipment
45. ___ Connectors/Splitters
46. ___ Fleet Management
47. ___ Headend Equipment
48. ___ Transmission/Switching Equipment
49. ___ Networking Equipment
50. ___ Vaults/Pedestals
51. ___ MMDS Transmission Equipment
52. ___ Microwave Equipment
53. ___ Receivers and Modulators
54. ___ Cable Modems
55. ___ Subscriber/Addressable Security Equipment/ Converters/Remotes
56. ___ Telephone/PCS Equipment
57. ___ Power Suppls. (Batteries, etc.)
58. ___ Video Servers

E. What is your annual cable equipment expenditure?
59. ___ up to $50,000
60. ___ $50,001 to $100,000
61. ___ $100,001 to $250,000+

F. In the next 12 months, what fiber-optic equipment do you plan to buy?
62. ___ Fiber-Optic Amplifiers
63. ___ Fiber-Optic Connectors
64. ___ Fiber-Optic Couplers/Splitters
65. ___ Fiber-Optic Splicers
66. ___ Fiber-Optic Transmitter/Receiver
67. ___ Fiber-Optic Patchcords/Pigtails
68. ___ Fiber-Optic Components
69. ___ Fiber-Optic Cable
70. ___ Fiber-Optic Closures & Cabinets

G. What is your annual fiber-optic equipment expenditure?
71. ___ up to $50,000
72. ___ $50,001 to $100,000
73. ___ $100,001 to $250,000+

H. In the next 12 months, what cable test & measurement equipment do you plan to buy?
74. ___ Audio Test Equipment
75. ___ Cable Fault Locators
76. ___ Fiber Optics Test Equipment
77. ___ Leakage Detection
78. ___ OTDRs
79. ___ Signal Level Meters
80. ___ Spectrum Analyzers
81. ___ Status Monitoring
82. ___ System Bench Sweep
83. ___ TDRs

I. What is your annual cable test and measurement equipment expenditure?
84. ___ up to $50,000
85. ___ $50,001 to $100,000
86. ___ $100,001 to $250,000
87. ___ over $250,000

J. In the next 12 months, what cable services do you plan to buy?
88. ___ Contracting Services (Construction/Installation)
89. ___ Repair Services
90. ___ Technical Services/ Eng. Design

K. What is your annual cable services expenditure?
91. ___ up to $50,000
92. ___ $50,001 to $100,000
93. ___ $100,001 to $250,000
94. ___ over $250,000

L. Do you plan to rebuild/ upgrade your system in:
95. ___ 1 year
96. ___ more than 2 years

M. How many miles of plant are you upgrading/ rebuilding?
97. ___ up to10 miles
98. ___ 11-30 miles
99. ___ 31 miles or more

To subscribe via Internet, send e-mail to CT.SUB@Reply.Net. A form will automatically be sent to you.

Please send Communications Technology to the following individuals in my company:

Name_____Title _____

Name_____Title _____

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO.788 PITTSFIELD MA

POSTAGE WILL BE PAID BY ADDRESSEE

Communications Technology

PO BOX 5360

PITTSFIELD MA 01203-9190

Please send Communications Technology to the following individuals in my company:

Name_____Title _____

Name_____Title _____

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO.788 PITTSFIELD MA

POSTAGE WILL BE PAID BY ADDRESSEE

Communications Technology

PO BOX 5360

PITTSFIELD MA 01203-9190

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

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.

Alpha Technologies
3767 Alpha Way
Bellingham, WA 98226
(360) 647-2360; Fax: (360) 671-4936
Eric Wentz
alpha.com

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 #15

Altec Industries, Inc.
210 Inverness Center Parkway,
Suite 130
Birmingham, AL 35242
(205) 991-7733; Fax: (205) 991-7747
Altec.com
Julie Walden

Alden 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 #6

Amherst International, Inc.
63 Sarasota Center Blvd.
Sarasota, FL 34240
(941) 925-9292;
Fax: (941) 925-9291
AmherstFO@aol.com
Scot K. Ware
(941) 925-9292

Amherst is the distributer of Ericsson fusion splicer, cleaver, and preparation tools for use in telephony, CATV and manufacturing applications.

Reader Service #8

AM Communications, Inc.
100 Commerce Blvd.
Quakertown, PA 18951-2237
(800) 248-9004; (215) 538-8700
Fax: (215) 538-8779
amcomm.com
David L. DeLane
(215) 538-8703
sales@amcomm.com

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 #20

Antec Network Technologies
5720 Peachtree Parkway, N.W.
Norcross,GA 30092
(770) 441-0007; Fax: (770) 441-2460
Brad Halverson
Brad.Halverson@antec.com

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.
Reader service #14

Arcom
sales @arcomlabs.com
(315) 426-1455; Fax:(315) 422-2963

Arcom has been manufacturing high quality filters used in cable television since 1980. Recent innovations in addition to some patented return products are Surface Accoustic Wave (SAW) negative traps and the new SAWDEC passive scrambling system.

Reader Service #103

Arrow Fastener Company
271 Mayhill Street
Saddle Brook, NJ 07663
(201) 843-6900; Fax: (201) 843-3911
Mel Stevens

Arrow Fastener Company has an extensive range of wiring tackers and staples for all wiring and cable installation tasks, including the all steel T59 wiring tacker that shoots insulated staples.

Reader Service #45

BARCO
3240 Town Point Drive
Kennesaw, GA 30144
(770) 218-3200; Fax: (770) 218-3250
barco-usa.com
Earlene Bentley
EBBARCO@AOL.COM

BARCO hardware and software improve 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 #60

C-COR Electronics, Inc.
60 Decibel Road
State College, PA 16801
(814) 238-2461;
Fax: (816) 238-4065
c-cor.com
Sally Thiel

C-COR's RF amplifiers, AM headend equipment, digital fiber optics, and customized service and maintenance provide global solutions for your network.

Reader Service #123,143

Cable Innovations, Inc.
130 Stanley Court
Lawrenceville, GA 30245
800-952-5146;
Fax: (770) 962-6133
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 the UHB-2001 Universal House Box.

Reader Service #75

Cable Resources, Inc.
85 M Hoffman Lane
Islandia, NY 11722
(516) 234-1411; Fax: (516) 234-4436
Maura O'Riodan

Cable Resources has introduced an efficient new tool to activate and maintain broadband return networks. HFC networks require a concrete and repeatable test for reliable two-way operations.

Reader Service #80

Channell Commercial Corporation
26040 Ynez Road, P.O. Box 9022
Temecula, CA 92589-9022
(909) 694-9160, 800-423-1863;
Fax: (909) 694-9170
channellcomm.com
Andrew M. Zogby, V.P. of Marketing

Channell Commercial Corporation is a leading designer and manufacturer of precision-molded, thermoplastic and metal fabricated enclosures supplied worldwide to telecommunications network operators.

Reader Service #44

Corning Inc.
35 West Market Street
Corning, New York 14831
800-525-2524; Fax: (607) 974-4473
corningfiber.com
James Bratton (607) 974-7243
brattonjl@corning.com

Corning Inc., is a manufacturer of single-node, multimode, speciality optical fiber and fiber-optic components.

Reader Service #90

DX Communications
A Division of Itochu Cable Services, Inc.
1143 W. Newport Center Drive
Deerfield Beach, FL 33442
Toll Free:888-294-5856
(954) 427-5711; Fax: (954) 427-9688
DXCKM@aol.com
Ken Mosca

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

Reader Service #9

Fujitsu Network Communications
2801 Telecom Parkway
Richardson, TX 75082
(800) 777-FAST;
Fax: (9732) 479-6900
Fast@fujitsu-fnc.com
Greg Wortman (972) 479-7726
g.wortman@fujitsu-fnc.com

Design, manufacture and marketing of high-speed switching and transmission equipment.

Reader service #21

General Machine Products Co., Inc.
3111 Old Lincoln Highway
Trevose, PA 19053
(215) 357-5500; Fax: (215) 357-6216
GMPtools.com
Douglas H. Clemens

General Machine Products Company is a manufacturer of specialty tools and equipment utilized in the placement of aerial or underground cable. The GMP Cable Lashers continue to be the product of choice for lashing cable to the supporting messenger.

Reader Service #76

Harris Corporation
1025 West NASA Blvd., C-99
Melbourne, FL USA 32919
(407) 724-3828; Fax: (407) 724-3947
harris.com
Gary Pacilio
gpacilio@harris.com

Harris is a leading provider of advanced network management systems for large, multimedia telecommunication networks. Harris Network Management is scalable software, with dynamic customizable graphics, that allows network operators to quickly make real-time evaluations and respond to changing network conditions.
Reader Service #29

Hewlett-Packard Company
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 Company 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 #33

iCS-ITOCHU Cable Services Inc.
1143 W. Newport Center Drive
Deerfield Beach, FL 33442
(800) 327-4966
(954) 427-5000;
Fax: (954) 427-0934
Alex Firmino
(954) 452-5000, ext. 63

iCs Inc. is a leading full-service stocking distributor for NextLevel, SA, PPC, Joslyn, Diamond, DX and many more. ICS operates ten sales offices and nine warehouses conveniently located in North and South America.
Reader Service #84

Integral Corporation
1424 Barry Avenue
Dallas, TX 75223
(214) 818-5100;
Fax: (214) 823-4845
Meiching Chou

Integral Corporation, an ISO 9002 certified conduits manufacturer, has invented a flexible pre-assembled Cable-In-Conduit system—Cablecon, serving CATV, telephony and electrical industries.
Reader Service #39

KES (Klungness Electric Supply)
P.O. Box 885
101 Merritt Avenue
Iron Mountain, MI 49801
(906) 774-1755;
Fax:(906) 774-6117
(800) 338-9292
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 #47

Lindsay Electronics
50 Mary Street West
Lindsay, ON K9V
(705) 324-2196
(800) 465-7046;
Fax: (705) 324-5474
lindsayelec.com
David Altman
sales@hq.lindsayelec.com

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 #61

MHZ MEGA HERTZ
6940 South Holly Circle, Suite 2000
Englewood, CO 80112
(303) 5779-1717; (800) 525-8386
Fax:(303) 779-1749
megahz.com
Steve Grossman
TUGSO8A@Prodigy.com

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 #73, 77, 79, 81, 83, 87

Microwave Filter Co., Inc.
6743 Kinne Street
East Syracuse, NY 13057
Toll Free:800-448-1666
(315) 438-4700;
Fax:(315) 438-1467
microwavefilter.com
Elizabeth Buck
(315) 438-4718

Passive electronic filters and filter networks for signal processing and interference suppression.
Reader Service #93

Multilink
580 Ternes Avenue
Elyria, OH 44035
(440) 366-6966;
Fax (440) 366-6802
multilinkinc.com/multilinc
Steve Kaplan
multilink@ix.netcom.com

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 #110, 115

NextLevel Broadband Networks Group
2200 Byberry Road
Hatboro, FPA 19040
(215) 830-5554
awetzel@nvl.com

The Broadband Networks Group of NextLevel Systems, Inc., designs and manufactures end-to-end broadband telecommunications systems, including digital and analog programming encryption /decryption systems and end-to-end addressable transmission systems like consumer descramblers and set-top terminals
Reader Service #141

Oldcastle Precast, Inc.
4478 Greer Circle
Stone Mountain, GA 30083
(770) 493-5420;
Fax: (770) 493-5425
oldcastle-precast.com
Rick Sauer
(770) 493-5444
rick.sauer@oldcastleprecast.com

Oldcastle is a leading manufacturer of precast concrete products used in the construction of telco, CATV, PCS, and other communications networks.
Reader Service #106

PDI-Electronics for Telecommunications
6353 West Rogers Circle #6
Boca Raton, FL 33487
(561) 998-0600;
Fax: (561) 998-0608
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 #108

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 #140

Philips Broadband Networks
100 Fairgrounds Drive
Manlius, NY 13104
be.philips.com/pbn
Jim Brady
Jbrady@pbni.attmail.com

Philips Broadband Networks, a longtime supplier of broadband RF and fiber optic transport equipment and systems used in video entertainment, is a leading global provider of advanced systems used to access broadband telephony, the Internet and other high-speed interactive data services.
Reader Service #145

Quality RF Services, Inc.
850 Parkway street
Jupiter, FL 33477
(800) 327-9767; (561) 747-4998
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 #126

Radiant Communications
5001 Hadley Road
P.O. Box 867
South Plainfield, NJ 07080
(800) 969-3427;
Fax:(908) 757-8666
Radcom.com
Jean Harding
(908) 757-7444
Radiant3@ix.netcom.com
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 #180

Ripley Company
46 Nooks Hill Road
Cromwell, CT 06416
(800) 528-8665
(860) 630-2200;
Fax:(860) 635-3631

Ronald Cote
Ron@ripley-tools.com

Ripley Company is the leading manufacturer of cable preparation tools for the CATV and Telecommunications Industries. Our tools have been used by contractors and installers to prepare all types of cables for more than 30 years.

Reader Service #190

Riser-Bond Instruments

5101 N. 57th Street
Lincoln, NE 68507
Toll Free:800-688-8377
(402) 466-0933;
Fax:(402) 466-0967
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 #136

Sadelco, Inc.

75 West Forest Avenue
Englewood, New Jersey 07631
(800) 569-6299
International:(201) 569-3323
Fax:(201) 569-6285
Mr. Leslie Kaplan, V.P.

Designs and manufacturers signal level meters and calibrators.

Reader Service #195

Scientific-Atlanta

4261 Communications Drive
Box 6850
Norcross, Georgia 30091-6850
(800) 433-6222
(770) 903-6306;
Fax:(770) 903-3088
sciatl.com
Bill Brobst
Bill.brobst@sciatl.com

Scientific-Atlanta is a leading supplier of broadband communications systems, satellite-based video voice and data communications networks and worldwide customer service and support.

Reader Service #200

Sencore Inc.

3200 Sencore Drive
Sioux Falls, SD 57107
(605) 339-0100;
Fax:(605) 339-0317
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, handheld signal level meters designed for QZM digital signals, and video performance test instruments.

Reader Service #144

Stanford Telecom

480 Java Drive
Sunnyvale, CA 94089
(408) 745-0818;
Fax:(408) 541-9030
stelhq.com
tpe.marketing@stelhq.com
William Patton
(408) 745-2685
bill.patton@stelhq.com

Stanford Telecom produces modulator and demodulator ASICs and board level assemblies for transmission and reception of return path data in HFC systems. Included is a subscriber modem modulator/demodulator on a single chip.

Reader Service #148

Superior Electronics Group, Inc.

6432 Parkland Drive
Sarasota, FL 34243
(941) 756-6000;
Fax:(941) 758-3800
cheetahnet.com
Pamela Girardin
(941) 756-6000, ext. 1340
Pamela.girardin@cheetahnet.com

Through its internationally established Cheetah product line, Superior Electronics provides broadband status and performance monitoring solutions to world leaders in cable TV and telecommunications.

Reader Service #152

Synchronous Group, Inc.

77 Las Colinas Lane
San Jose, CA 95119
(800) 659-6750
(408) 362-4800;
Fax:(408) 362-4286
syngroup.com
Dennis Donnelly
(408) 362-4286, ext. 4114

Synchronous is a major supplier of 1550 nm and 1310nm AM fiber optic systems for supertrunking and distribution. Synchronous also has a complete line of return path fiber optic products.

Reader Service #215

Telecrafter Products

12687 W. Cedar
Lakewood, CO 80228
(800) 257-2448;
Fax:(303) 986-1042
Ronnie Cox and Jim Marzano
Teleprod@compuserve.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 #156

TeleWire Supply

94 Inverness Terrace East
Englewood, CO 80012
(303) 799-4343
Fax:(303) 64304797
telewiresupply.com
Mark Howard

TeleWire Supply is the distribution of ANTEC Corporation and a leading nationwide distributor of products needed to build and service a broadband communications network.

Reader Service #35

Toner Cable Equipment, Inc.

969 Horsham Road
Horsham, PA 19044
(215) 675-2053;
Fax:(215) 675-7543
tonercable.com
Dianne Rowland
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 #166, 168, 151

Tri-Vision Electronics

41 Pullman Court
Scarborough, Ontario M1X 1E4
(416) 298-8351;
Fax:(416) 298-7916
Todd Grundberg and Ali Siddiqi

Manufactures and sells connectors, decoders, addressable pay TV and pay-per-view systems, infra-red, radio frequency remotes. Plus, we sell refurbished headend equipment.

Reader Service #133

Trilithic Inc.

9202 East 33rd Street
Toll Free:800-344-2412
(317) 895-3600
Fax:(317) 895-3613
trilith.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 #250, 137

Tulsat

1605 E. Iola
Broken Arrow, OK 75012
Toll Free:800-331-5997
(918) 251-2887
Fax:(918) 251-1138
Mark Schumacher and David Chymiak

Tulsat is stocking distributor for Blonder Tongue, Drake and California Amplifier. 70,00 square feet of complete repair facility and warehousing.

Reader Service #255, 260

Videotek, Inc.

243 Shoemaker Road
Pottstown, PA 19464
Toll Free:800-800-5719
(610) 327-2292;
Fax:(610) 327-9295
David C. Hirsch
dchirsch@videotek.com

Located in Pottstown, Pennsylvania, Videotek, Inc., is a leading manufacturer of rest and measurement equipment, video demodulators, routing and production switchers, color correctors, and related equipment for the professional video and television broadcast markets.

Reader Service #178

Wavetek Corporation

5808 Churchman Bypass
Indianapolis, IN 46203
(317) 788-9351;
Fax:(317) 782-4607
wavetek.com
Gary Culbertson

One of the top ten test measurement companies in the world, Wavetek corporation designs, manufactures and markets worldwide a broad line of electronic test and measurement instruments for the cable television, telecommunications, wireless communications, radio, video, LAN, ATE and metrology markets.

Reader Service #184

West End Systems Corporation

39 Winner's Circle Drive
Arnprior Ontario Canada K752G9
(613) 623-9600;
Fax: (613) 623-0989
westendsys.com
Roger Magoon
rmagoon@westendsys.com

West End Systems Corporation: Products incorporate advanced RF transmission technology (OFDM) to deliver robust, reliable voice, data, Ethernet, Internet communications.

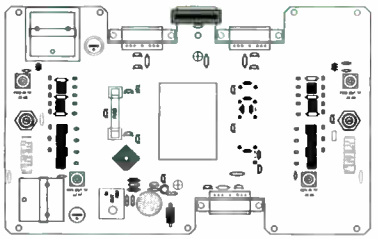
Reader Service #280

QRF installs any kit below for just $29 over kit cost!

QRF supplies headend laser driver & isolation amplifiers

NEW Circuit Boards for SA LE & DA join our Pathmaker, Magnavox & Jerrold Upgrades

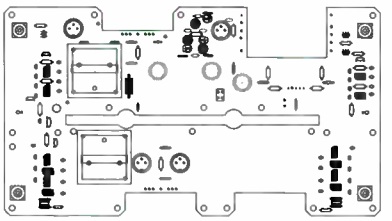
NEW QRF Designs for Scientific Atlanta Line Extenders & Distribution Amplifiers



QSALE155 Kit fits all SA plastic cover LE-1 modules. Push-Pull / Power-Doubled • 550 / 600 MHz forward bandwidth • 5 - 40 MHz reverse bandwidth with integral diplex filters • Use original transformer, frame and plastic cover.

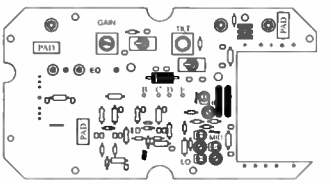
550 MHz Forward / 5-40 MHz Return

QSADA155 Kit fits all SA 450 / 550 MHz DA frames. • 550 / 600 MHz forward bandwidth • 5 - 40 MHz reverse bandwidth with integral diplex filters • Replace half-board amp with full two-way kit • Reuse existing 550 Hybrids.

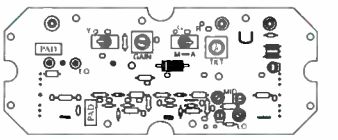


Feedforward or Power-doubled

NEW QRF Designs for Magnavox 450 / 550



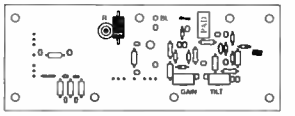
QMAGTF155 Kit for 8T450 module upgrade to 550 MHz.



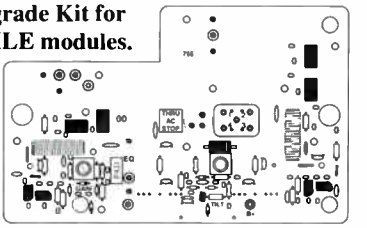
QMAGT155 Kit for all 5T & 6T modules, upgrade to 550 MHz.

QRF Provides 5-MC Chassis Upgrade Kits to 550 MHz

QMAGB155 Kit for 5B bridger modules, upgrade to 550 MHz.



QMAGL155 • 550 MHz Line Extender Upgrade Kit for 5-MLE modules.

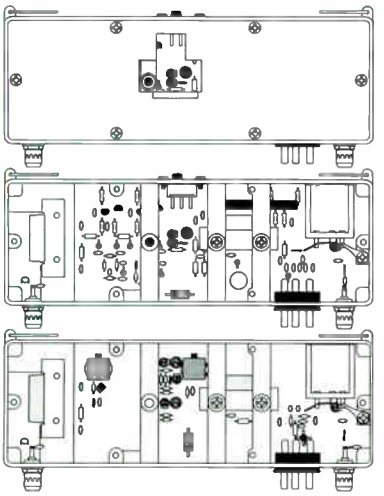


QRF 450 / 500 MHz for Pathmaker Push-Pull and Power-Doubled Output Many gain models fit 152 & 211 frames.

QSYLA
Auto/Manual Trunk Module shown with new QRF lid cover.

QSYLA
Auto/Manual Trunk kits fit ALL three-bar castings as shown. (152, 163, 255)

QSYLM
Manual Bridger / LE kits fit ALL three-bar castings as shown. (211, 231, 233, 241, 243)

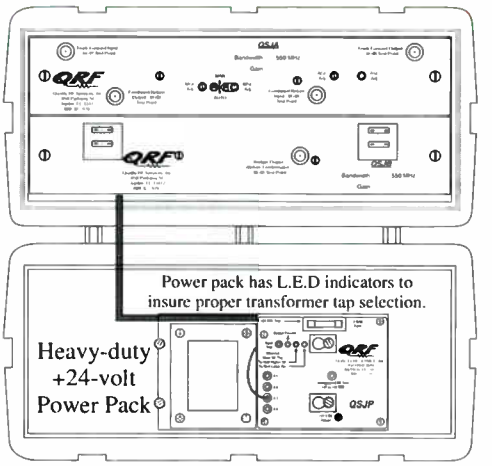


505 Chassis can be modified to 450 MHz

NEW QRF 550 MHz Modules & Chassis For Jerrold SJ Housings

AGC Trunk Module

Bridger Module



New QRF 450 MHz modules available for SCD-2W chassis in Push-pull/Power-doubled, Slope , Manual & Bridger Modules

QRF has 550 MHz LE Modules for SLR Housings

EQs & Pads in stock for all major brands of CATV equipment • Repairs to all types of hybrid amplifiers

VISA MasterCard For inside USA Shipments only.

800-327-9767

American Express cards are accepted for ALL World-Wide Shipments!

QUALITY RF SERVICES, INC.
850 PARKWAY STREET
JUPITER, FL 33477
561-747-4998
FAX 561-744-4618

Reader Service Number 126

CABLE TRIVIA

Communications Technology welcomes Frank Baxter as Cable Trivia "Guest Guru." Baxter is now retired in Ormond Beach, FL. His service as an MSO engineer spans about 45 years. (The last "Cable Trivia" ran on page 108 of the October issue.) The person supplying the most correct answers will be awarded a special Trivia T-shirt.

Answers should be postmarked (or faxed) by the 20th of the month of the issue date that the trivia test appears in. Good luck! Send answers to: The Trivia Judge, *Communications Technology*, 6565 E. Preston, Mesa, AZ 85215 or fax: (602) 807-8319.

Trivia #18 answers

1) Plastoid Corp.
2) Dallas
3) 16th anniversary
4) Chicago
5) 1975
6) Arvin
7) 1976
8) $165
9) SKL
10)Theta-Com Cable
11) C-COR
12) Jerrold Corp.
13) Roy L. Bliss

Trivia #19

1) The first microelectronic chip used in a CATV amplifier was manufactured by:
   A) IBM
   B) Hewlett-Packard
   C) Texas Instruments
   D) Motorola
2) One of the first products made by Jerrold was:
   A) an FM-Wobulator
   B) a Ch. 12 booster
   C) a signal level meter
   D) F-connectors
3) CATV job descriptions and educational requirements were published in 1973 by:
   A) Federal Communications Commission
   B) Society of Cable Telecommunications Engineers
   C) U.S. Department of Commerce
   D) National Cable Television Association
4) C-COR Electronics was originally known as:
   A) Palmer Enterprises
   B) Community Engineering
   C) State College Electronics
   D) Happy Valley Electronics
5) An FM-Wobulator was an instrument used to:
   A) measure FM deviation.
   B) measure FM thresholds.
   C) produce electronic music.
   D) sweep aligned IF systems.

And the winner is...

At press time, there was no winner for Cable Trivia #18. The winner will be announced in an upcoming issue. CT

CATV Engineering and Training

Blonder Tongue has multiple openings for technically qualified CATV engineering associates. Successful candidates will train and assist Blonder Tongue's customers to specify, design, and implement Blonder Tongue products into CATV and private cable systems.

Qualified candidates will have a minimum of 10 years CATV technical and three years of classroom instructional experience in several of the following areas: satellite and broadcast TV headend signal processing, trunk and feeder broadband distribution, CARS band or 18GHz AM microwave, or addressable interdiction systems. Candidates must be able to teach with confidence, clearly convey technical concepts and present a professional image. Supervision of technical associates can substitute for instructional experience.

Education Criteria: Minimum of a High School diploma and formal technical education. Candidates with BS in engineering and partial or full SCTE BCE certification get preference. At least one position requires fluency in Spanish or Portuguese. Travel requirements range from moderate to extensive, depending on the position

HERE'S HOW TO APPLY.

Blonder Tongue offers highly competitive salaries and comprehensive benefits including a 401K plan.
For consideration please send your resume to:

BLONDER TONGUE LABORATORIES, INC
The Standard Of Quality In TV Signal Distribution

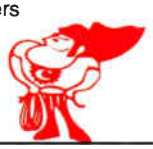
Blonder Tongue Laboratories, Inc.
1 Jake Brown Road, Old Bridge, NJ 08857.
Fax No. 732/679-4353.
An Equal Opportunity Employer.

Wanted!

Experienced long term help for Southeast rebuilds/upgrades

Aerial Crews
Underground Crews
Splicers
Installers
Field Engineers

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



TESINC

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

tesinc
A Dycom Company

CATV IMMEDIATE OPENINGS in CA & FL

RF ENG's
LODE DATA
MDU

INSPECTORS
AERIAL UG
MDU

DRAFTERS
AUTOCAD
CATV & TELEPHONE

TECHNICIANS
HEAD END
SWEEP/FCC PROOF
SERVICE

Call Judi: 1-800-800-7886

3rd Largest CATV Provider

Comcast is the 3rd largest CATV provider in the U.S. Our commitment to emerging technologies and service excellence has positioned us for continued growth, offering excellent career opportunities for experienced professionals.

General Manager

For our **Detroit, MI** system you will be responsible for planning, organizing and directing cable system staff to reach maximum customer satisfaction and profitability. Qualifications include BS degree or equivalent work experience/self study; 3-5 years experience in 100,000+ urban subscriber system to include 3 years management experience; strong leadership, communication and organization skills.

We recognize the contributions of our staff with a generous compensation package which includes a 401(k) plan and medical coverage. For consideration, send resume with salary history to: **Comcast Cablevision-Human Resources, 29777 Telegraph Rd., Suite #4400-B, Southfield, MI 48034.**

An Equal Opportunity Employer.

COMCAST

Cable Search Associates

Professional Search and Placement

Engineering • Management • Technicians • Sales • Marketing • Construction

Call or Write
WICK KIRBY
Office (630) 369-2620 FAX (630) 369-0126
P.O. Box 2347 • Naperville, IL 60567
Fees Paid

CATV SYSTEM TECHNICIAN

Cable U.S.A., Inc. has an immediate opening for a CATV system technician. Three years min. CATV experience required. Good communication and interpersonal skills a plus. We offer a competitive salary with full benefits. Cable USA, Inc. is an equal opportunity employer as well as a drug/smoke free environment.

Send resume to:
Stuart Gilbertson, Manager
Cable USA, Inc.
P.O. Box 1448
Kearney, NE 68848
You may fax your resume to:
(308) 234-6452

PARAMOUNT DESIGNS

NOW HIRING:
SWEEP TECHS
POSITIONS AVAILABLE IN PHOENIX & SAN DIEGO
GREAT PAY + BENEFITS

1439 N. FIRST STREET, PHOENIX, AZ 85004
PHONE: (800)894-5601
FAX: (602)254-9309

CABLE CONSTRUCTION

Experienced upgrade splicers, sub-contractors and linemen needed in Northeast.

Call 1-800-233-7350

By the NCTI

Troubleshooting the Drop System: Part 3

This month's installment continues the series on troubleshooting hot chassis conditions. The material is adapted from NCTI's Installer Technician Course, complemented by performance training suggestions to reinforce the material in a hands-on classroom setting. © NCTI.

Defective electronic device — If a hot chassis condition is suspected and if the AC receptacle wiring polarity is correct, disconnect AC power from one electronic device at a time to determine which device is causing the hot chassis condition.

Set up and connect a VOM to measure AC voltage between the wall plate's F-81 barrel connector threads and the disconnected input cable's F-connector nut (Figures 1-3). When no AC voltage is measured between the wall plate and the F-connector body, the device that is currently disconnected from the AC wall outlet is causing the hot chassis condition. The device must be repaired prior to using it.

Also, it's a good idea to check for AC voltage on the drop. With the cable connected only to the wall plate, use the multimeter to check for voltage between the F-connector nut and the cable's center conductor. If AC voltage is present, inform your supervisor and do not reconnect the input cable to any device.

Next month's installment will cover troubleshooting abnormal signal levels caused by a drop cable. CT

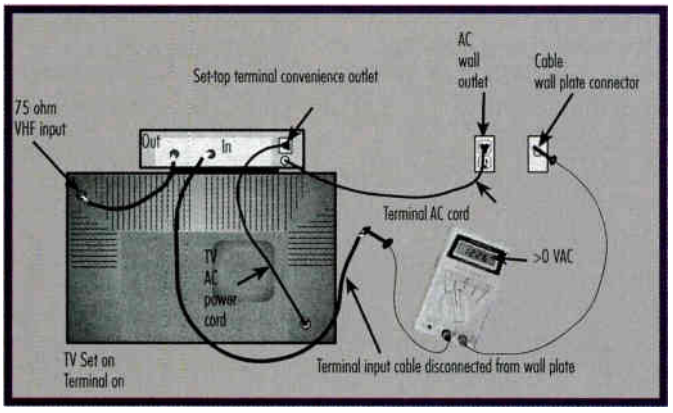


Figure 1: Presence of AC voltage between input cable F-connector nut and F-81 barrel connector threads indicates hot chassis condition at either TV set or set-top terminal

Hands-on performance training

Proficiency objective: *Determine which device is causing a hot chassis condition.*

Ensure that you have enough work stations with a live AC outlet, cable wall plate receiving signals, and correctly operating set-top terminal and TV set for your number of students.

Demonstrate using a multimeter to identify if an electronic device is causing a hot chassis condition and explain what the meter would read if there was a defective device causing a hot chassis condition. Also demonstrate using a multimeter to check for AC voltage on the drop cable. Have students practice the procedures.

Verify that each student can correctly check if an electronic device is causing a hot chassis condition and if there's voltage on the drop cable.

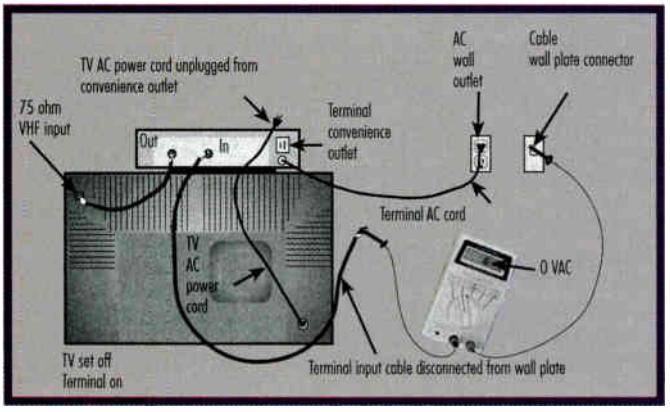


Figure 2: No AC voltage between input cable F-connector nut and F-81 barrel connector threads indicates hot chassis condition at TV set

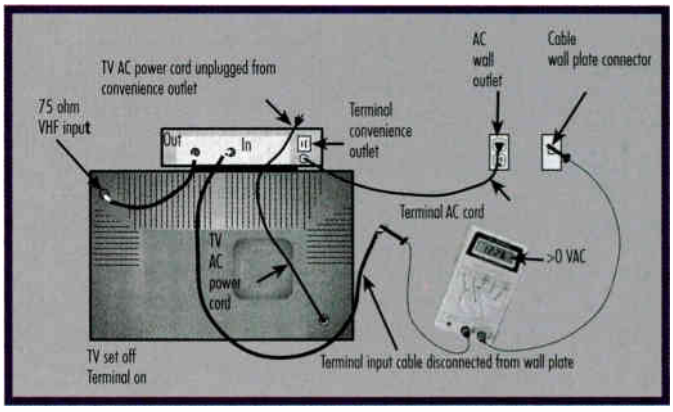


Figure 3: Presence of AC voltage between F-81 barrel connector threads and input cable F-connector nut indicates hot chassis condition at set-top terminal

WHEN IT COMES TO

RETURN PATH MAINTENANCE

CAPTURE INGRESS

With the sheer multitasking power of the Guardian 9580 SST Return Path Analyzer, you'll capture and locate ingress events as short as 12.5 milliseconds on individual nodes or expand your monitoring configuration to any number of nodes by combining 9580 SSTs with 9580 TPX Test Point Expanders. Ingress Manager PC Software runs the show, detecting and recording ingress outbreaks and monitoring alarms.

BALANCE AND HARDEN YOUR DISTRIBUTION SYSTEM

The advanced Guardian system puts more diagnostic muscle in the hands of your technicians. The battery powered Guardian SSR transmits reverse sweep signals to a 9580 SST in your headend; displays reverse sweep graphs and calculated values for GAIN and TILT pads, even shows you ingress spectrum graphs. All measurements are updated every 7/10 of a second, even with up to 6 SSR's accessing a single SST.

STOP INGRESS AT THE SOURCE

The Guardian RSVP Return Path Evaluator stops ingress where it starts: the subscriber's home. Up to 200 RSVPs can communicate with each Guardian 9580 SST in the headend to verify that the return path meets requirements. Working with a Guardian IsoMeter Reverse Leakage Detector, the RSVP verifies the shielding integrity of the home wiring, hardening your system against ingress with every installation and maintenance visit.

CALL NOW FOR A FREE WHITE PAPER

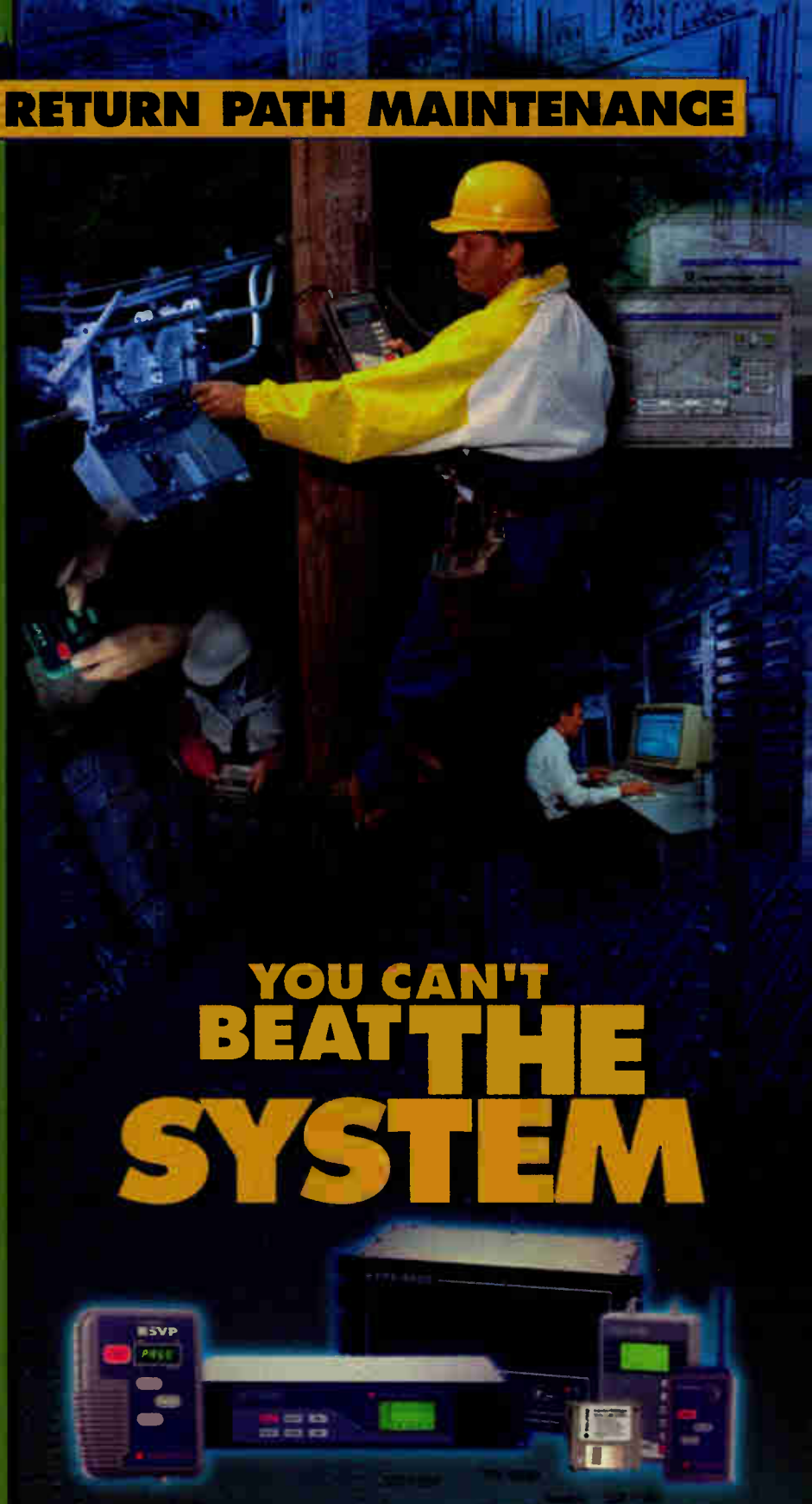
(800)344-2412

(317)895-3600 (317)895-3613 Fax

www.trilithic.com

TRILITHIC

The Engineering Guys



YOU CAN'T BEAT THE SYSTEM

GUARDIAN SYSTEM

Return Maintenance Technology

By Bill Riker

Members First

Whenever someone asks me what makes the Society of Cable Telecommunications Engineers so successful (and many people do), my answer is simple: Its members.

Since 1969, when the Society sprang forth from a simple idea, members have been the driving force behind SCTE. From the beginning, it was the members' spirit of volunteerism that lead to the creation of local chapters and meeting groups, quality training programs for industry personnel, and national conferences like Cable-Tec Expo and the Annual Conference on Emerging Technologies.

Even today, with more than 15,000 members worldwide and a growing professional staff here at national headquarters in Exton, PA, it remains the technicians, installers and engineers who volunteer their time, knowledge and experience to their fellow SCTE members that make the Society a leader in broadband telecommunications training. Our members take time out of their busy schedules to contribute to the growth of the Society, dedicating their evenings, weekends and vacations toward evolving the broadband telecommunications industry.

Honoring members

To recognize this tremendous amount of time and energy that our members put into the Society, these volunteers are being celebrated in the *1997 SCTE Membership Directory and Yearbook*. This 360-page chronicle, coming soon to a mailbox near you, is dedicated to those in the industry who have chosen to spend their extra time helping their peers by working to improve cable telecommunications, both technically and mentally.

The directory has been redesigned, reformatted and rearranged to reflect our appreciation of the membership; we honor not only their advancement of the industry, but their continuing willingness to lend a hand, without question, to meet the needs of the Society. The '97 yearbook showcases member accomplishments, be they individual achievements or successes as a group.

Several pages have been set aside to commemorate the broadband professionals who have earned awards in the last 12 months. Special award recipients include the newest inductees into the SCTE Hall of Fame, 1997 Field Operations Award winners, 1997 Member of the Year, David Devereaux-Weber and 1997 Chairman's Award recipient, MediaOne.

"The Year in Photos" clearly illustrates the hard work that SCTE members have dedicated to the Society's mission of, "Training, Certification, Standards." From Broadband Communications Technician/Engineer (BCT/E) and Installer Certification Program candidates to our national board of directors, all of our volunteers have been very busy in recent years developing new ideas and adapting old ones—ideas like the new Telephony and Service Technician Certification Programs, cable modem interoperability and the SCTE Website, all possible through our members' zeal to positively impact the industry. Photographs of local group activities include moments from the popular Chapter Vendor Days, training meetings, technical demonstrations and social events.

The third component of our motto, standards, has been a key area of activity for the membership in recent years. Since SCTE was designated in 1995 as a standards development organization by the American National Standards Institute, our members have intensified their efforts, through participation on engineering subcommittees, to develop and adopt standards in a variety of technical areas for use by the industry. If the *1997 Standards Development Annual Report* is any indication, our members are capable of bringing about great change in the industry. For those of you who missed it when it was distributed at Cable-Tec Expo '97, the annual report has been included, in its entirety, in this year's membership directory.

Of course, highlights from the record-breaking Cable-Tec Expo '97 in Orlando, FL, and the 1997 Conference on Emerging Technologies in Nashville, TN, also will be included in the membership directory, as well as memories from our first collaborative event with the Institute for Electrical and Electronic Engineers Communications Society, the High Integrity Hybrid Fiber/Coax technical workshop (HFC '96).

Member reference

As always, one of the primary purposes of the annual yearbook is to provide a convenient reference for our members. New to this year's directory is the inclusion of professional designations after member names. Now, members who have achieved BCT/E or Installer Certification can be easily identified by industry peers for their accomplishments.

The member listing also has been updated to reflect the way many of us communicate today: the Internet. Member addresses will include e-mail information, making it easier for members worldwide to discuss challenges facing our industry.

While the Internet has made the world smaller through a global communication network, SCTE, too, has united men and women from 77 countries under one goal: to help broadband telecommunications help the world. Our international activities, including our first official chapter outside the United States, Terra Nova (based in Newfoundland, Canada), also will be featured in the membership directory.

The *1997 SCTE Membership Directory and Yearbook* is our way of thanking you, the members, for making the Society what it is today: strong through volunteerism, and getting stronger each and every day. CT

Bill Riker is president of the Society of Cable Telecommunications Engineers.

Cheetah Monitors Farther...
Than The Eye Can See

Cheetah™ offers clear visibility into the performance of your plant, everywhere, at all times. A fully automated and comprehensive system, Cheetah isolates faults, monitors plant performance, troubleshoots problems and improves network reliability.

MONITOR MULTI-VENDOR PLANT

- All major OEM products supported - lasers, nodes, power supplies and amplifiers
- Advanced digital transponder technology
- Enhanced control capabilities

AUTOMATE SYSTEM TESTS

- Monitors RF levels and distortions at headend and end-of-lines
- Non-interfering measurement techniques
- Interactive spectrum analyzer displays

CATCH ELUSIVE INGRESS

- Automated monitoring of each return path
- Spectral plots for analysis and trouble-shooting
- Scalable and cost-effective for large and small systems

ANALYZE YOUR NETWORK

- Cheetah software provides data analysis and fault isolation
- Price/performance scalability - from Windows NT to UNIX
- Open system architecture for an integrated solution

SIMPLIFY SYSTEM INSTALLATION

- Customer Service teams for installation, turn-up and on-site support
- Formal user training courses
- Integration expertise makes your systems work together

For more information, please call
(941) 756-6000
or access our website at www.cheetahnet.com

Cheetah™

One System, One Solution
for Monitoring Your Entire HFC Domain.

SUPERIOR ELECTRONICS GROUP, INC.

6432 Parkland Drive • Sarasota, FL 34243 • (941) 756-6000 • Fax (941) 758-3800 • www.cheetahnet.com

Reader Service Number 152

Converter Totes™

Protect Your Digital and Analog Converter Investment

- Easily transportable.
- Protection from physical abuse or shock.
- Keeps converters out of sight.
- Lockable security.
- Easy to maintain/washable.
- Cell/inserts are replaceable.
- Has an attached cover.
- Highly durable.
- Stackable.

Customizing Available

Converter Bags

Roach Chambers

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

Reader Service Number 115