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OFFICIAL TRADE JOURNAL OF THE SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS

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Reader Service Number 1

ENGINEER Of Change

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SCTE Member since 1995

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Remote Provisioning • 74

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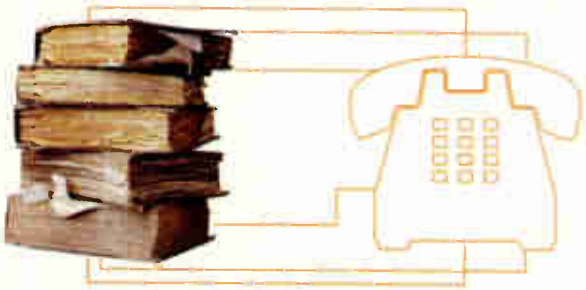

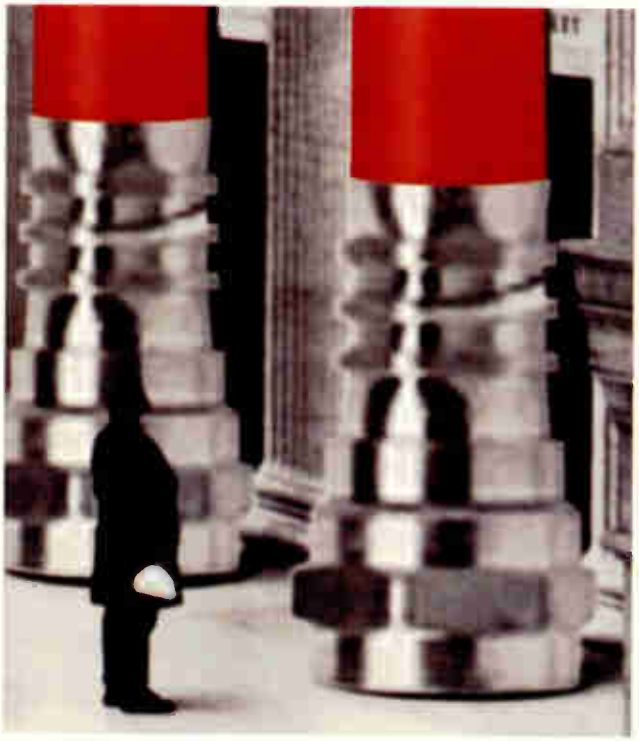

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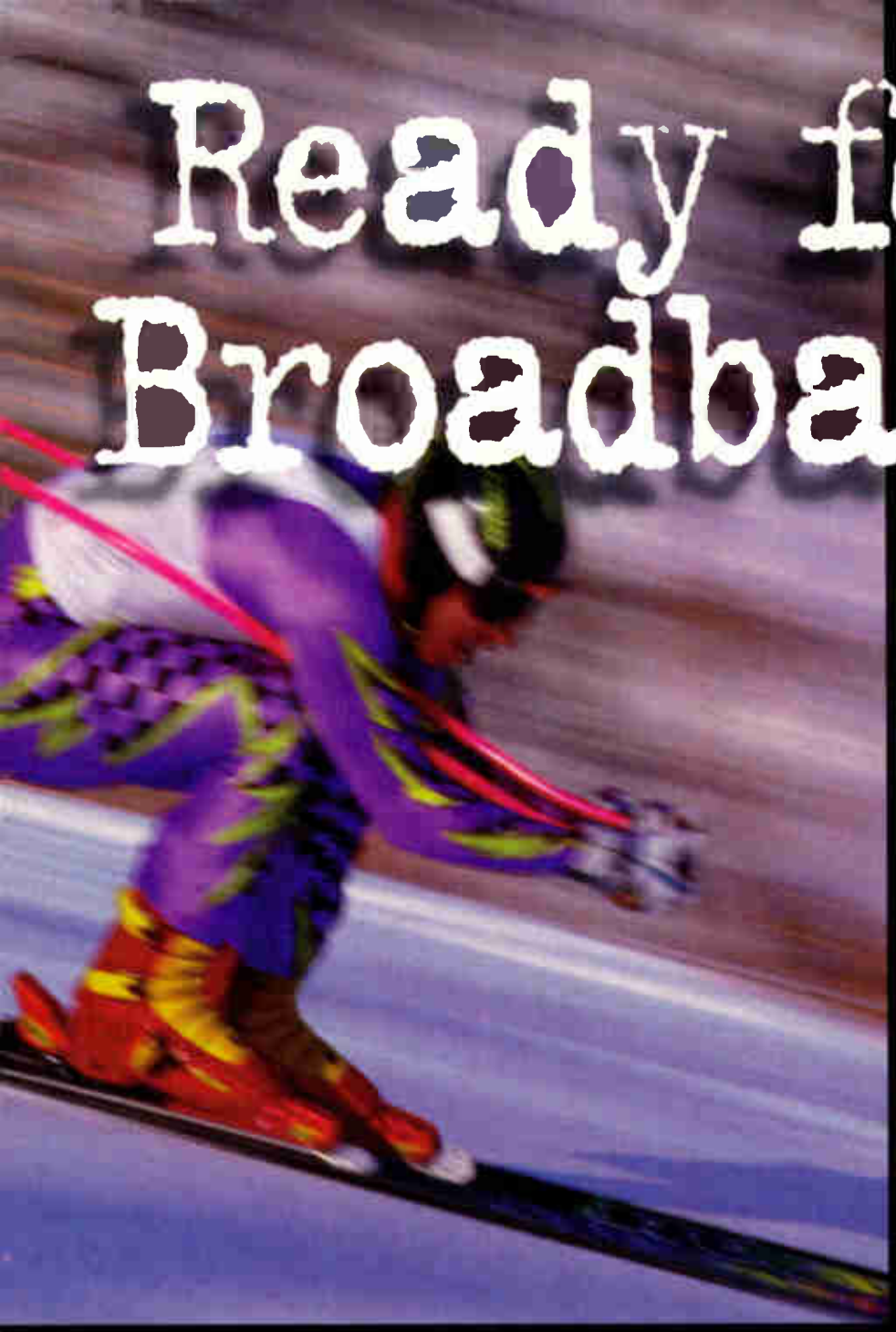

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Reader Service Number 4

LETTERS TO THE EDITOR

Hranac Wins Filter Praise

Ron,

I'm not much in the habit of sending comments to people, but as a fellow writer for *CT*, I have to say good going!

I very much agree with most of your article ("High-Pass Filters Revisited," November 1999, pg. 33) and believe many things within needed to be said to those in the not-using-filters camp.

One problem that I've been unable to substantiate is that filters "may" have a limited lifespan—I've heard 3-5 years. Is this your understanding as well?

Bruce Bahlmann
MediaOne

Editor's response: I think the limited lifespan idea probably goes back to the earlier days of filter and trap designs and manufacturing processes. These days, most outdoor filters and traps have crimped and o-ringed cases, plus they're filled with polyurethane or a similar sealing material during manufacture. As well, better quality parts are used to provide improved long-term stability over frequency and temperature. Regards, —RH

Digital *Is* Different

I just read Ron Hranac's article in the November *Communications Technology* on "Preparing for Digital Deployment."

That's a great article, Ron. I especially enjoyed the section, "Don't Fall off the Digital Cliff." I continue to be surprised in my travels around the country how many people still don't realize that on a digital signal, the difference between working perfectly and not working at all is about 1 dB. It's nice to see articles being written about that. Digital is different than analog!

Congratulations, Ron, on a great article.

Rick Jaworski
Vice President of Marketing
Hukk Engineering

Marketing Ideas

Just read your marketing editorial (November 1999, page 8)—great job! I have often wondered why operators only run other people's ads. Are they too cheap, or didn't they think of it? Maybe your editorial will get them going.

Jim Lepsch
President
Monroe Electronics

Editor's response: I like to think we're all too busy to consider the options. Or perhaps service providers need to rethink how to help the systems they serve. We often think in terms of "We always did it that way." —RP

Expansion Loop History

I enjoyed your article, ("Corral Cable Breakage, December 1999, pg. 138) but as usual, I have something to add.

Some years ago, we experienced severe radial cracking in the bottom of the flat-bottom loops of 0.750 air dielectric cable from a leading manufacturer. The problem occurred when this cable was in spans greater than 100 feet, where only single expansion loops were used. The manufacturer's catalog made no mention of loops. ➤

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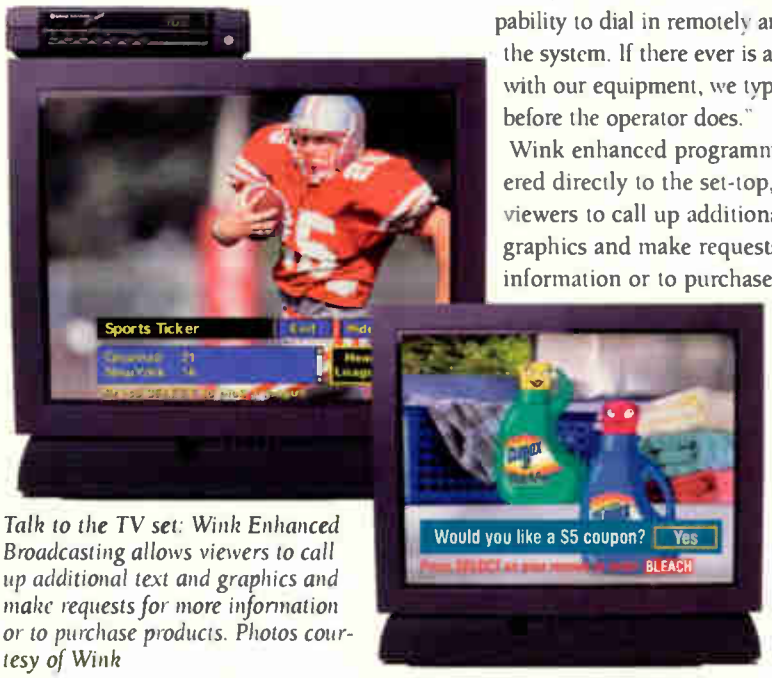
Reader Service Number 9

Charter Launches Wink on Digital Tier

By Art Cole, Contributing Editor

Charter Communications' Fort Worth, Texas, system became the first in the company to roll out the Wink Enhanced Broadcasting system on an advanced digital platform, namely the Scientific-Atlanta Explorer. The company already delivers Wink on three analog systems across the country, so performance in Fort Worth "will be critical" in determining the pace of future digital launches, said Melinda White, Wink's vice president of cable sales.



Talk to the TV set: Wink Enhanced Broadcasting allows viewers to call up additional text and graphics and make requests for more information or to purchase products. Photos courtesy of Wink

Like the analog setups, Wink handles pretty much the entire installation and monitoring of the system.

"It's basically an 'interface and play' operation," White said. "We do the installation and integration into the digital headend. Then we download the client Wink software to a box through the controller system already in the headend."

The system is designed to run with very little direct oversight at the headend.

"It runs itself and has redundant systems built-in," White said. "We also have the capability to dial in remotely and monitor the system. If there ever is a problem with our equipment, we typically know before the operator does."

Wink enhanced programming is delivered directly to the set-top, allowing viewers to call up additional text and graphics and make requests for more information or to purchase products. White said e-commerce is the main focus at Wink because the company is able to share revenue with cable operators, helping to defray the cost of digital network rollouts.

"We're basically displacing the 1-800 number transaction fee that advertisers are charged," White said. "When a viewer clicks on a Wink add, we place the 800 number and charge the advertiser a lower fee than the 1-800 service bureau. We take that fee and revenue-share it with the cable operator. It adds value to the viewer and creates a revenue stream for the operator."

Most of the data associated with a Wink program is unique to the service. Advertisers and programmers utilize a software development tool to create the interactive content. In some cases, however, the content is drawn directly from existing Web pages.

"We help the programmer maximize the content that is available," White said. "At ESPN, for example, we can access their data updates in real time, which is necessary for ever-changing sports scores and the like."

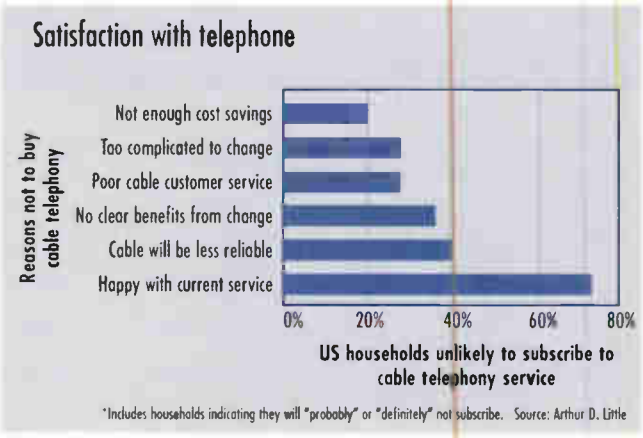
At the headend, a Wink Response Server captures all responses and sends the data to an operations center via the Wink Response Network, which is run through the General Electric Information Service (GEIS). Viewer requests are forwarded to the appropriate source, and information is relayed back to the headend server and ultimately the home.

High-Speed Road to Cable Telephony

By Doug Larson, Senior Editor

Wanna know how to capture a telephony subscriber? Give him a cable modem. According to a recently released report from consulting firm Arthur D. Little, 59 percent of cable modem customers also are likely to subscribe to an operator's telephony service. The corollary to this finding is that the quicker you deploy a high-speed data offering, the better chance you will have at capturing a telephony subscriber before someone else does.

The report cautions, however, that unlike video and data services, cable telephony is a much harder sell for consumers. Of those households unlikely to make the switch to telephony services delivered over cable, 74 percent cited satisfaction with their existing service as the



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primary reason for not changing service providers. (See graph on page 16.) Twenty-one percent cited lack of greater cost savings.

The bottom line? Cost will be a deciding factor in swaying a telephony subscriber from his existing service provider. To make significant inroads into the telephone business, cable operators will need to convince (marketing, marketing, marketing ... get it?) people that switching to their service will provide better value.

According to the Cable Telephony Study, cable operators could attract as much as 34 percent of the market and generate an estimated $14.7 billion in revenues for their telephony service. A similar study conducted by Arthur D. Little in 1994 estimated the demand at 25 percent.

The study, which was conducted for Arthur D. Little by Opinion Research Corp., surveyed 1,004 adults living in private households across the country.

Coming to America

By Doug Larson, Senior Editor

With the recent flurry of mergers, acquisitions and general consolidation within the operator and vendor communities, it would seem that true competition is a thing of the past. Well, almost. Time Warner Cable, an outspoken proponent of multivendor systems, has selected United Kingdom-based Pace Micro Technology as its new set-top box supplier, marking the set-top vendor's first U.S. cable contract.

"The Pegasus strategy is indeed built upon choices," said Mike Hayashi, Time Warner Cable's vice president of advanced engineering. "Choices for set-tops, choices for headend products and most importantly, choices for applications. In considering opening up the market for multiple set-top suppliers, it is critically important to minimize the competitive advantage an embedded conditional access (CA) supplier may have."

The contract brings TWC's total number of set-top suppliers to three, including Pioneer and Scientific-Atlanta.

Under the terms of the 3-year agreement, Pace will supply Time Warner with 750,000 digital boxes. The 80 MIPS (million instructions per second) box, which currently is in development, will be designed to TWC's "Pegasus" box specifications and will include an integrated Digital Audio Video Council (DAVIC) cable modem, PowerTV operating system (OS) and an electronic program guide (EPG). The box will enable more than 150 channels of analog and digital TV and interactive services such as video-on-demand (VOD).

"For Pace, this is hugely significant," said Neil Gaydon, president of Pace America. "We set ourselves a goal of trying to be No. 1 in the world, and the United States is critical to that achievement. We opened the door first of all with a deal with BellSouth ... in February and to now sign with what is considered to be the most technically advanced cable network in the world ... is hugely exciting."

"Pace is a well-established, competitive set-top supplier in Europe," said Hayashi. "We expect them to bring their innovative talent and their position as a cost leader to the U.S. market as well."

Pace's digital cable set-top box for Cable & Wireless Communications.

In addition to its engineering expertise and the range of technologies that the company has already integrated, including more than five CA systems, Gaydon said Pace's market responsiveness was a major deciding factor in its contract with TWC.

"Out of the 21 pay TV operators we support, we launched 19 of them from scratch. We're very rarely late to market, and if we are late it's (only by) a couple of months," said Gaydon.

Unlike its two primary competitors, Scientific-Atlanta and General Instrument, Pace custom-builds its boxes for each individual order. The vendor does, however, have the ability to engineer and deliver a solution for just about any system.

Gaydon said Pace has a GI DigiCipher

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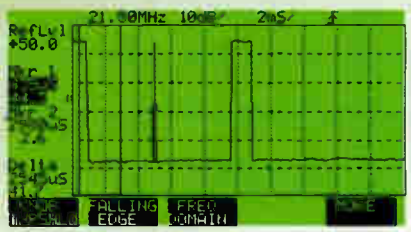

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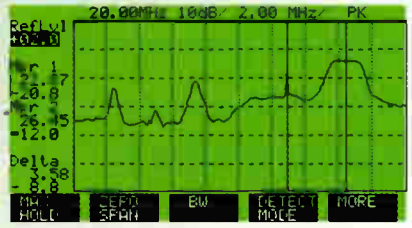

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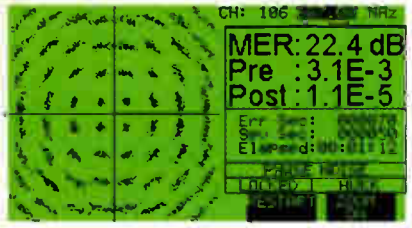

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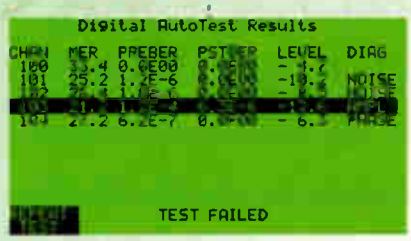

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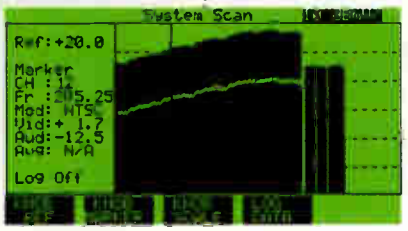

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Reader Service Number 14

II license and manufactured a box for TCI in 1997. While the box did not result in an order from TCI, Gaydon said this experience and its work with TWC gives Pace the ability to service GI, S-A and Pegasus-type networks.

"The Pace agreement is unique because they have elected to take out what is known as a 'technology' license to build set-tops based upon S-A's PowerKey conditional access system," said TWC's Hayashi. "This enables Pace to build set-tops for us from the ground up, including any silicon that may be required in this effort. Scientific-Atlanta should be applauded for pursuing a licensing practice that permits strong competitors to co-exist on their own network."

The first shipment is expected toward the end of 2000.

Cisco Acquires V-Bits, Enters Digital Grooming

By Art Cole, Contributing Editor

Underscoring the broadband future of the Internet, Cisco Systems, the dominant provider of narrowband switchers and routers, has acquired San Jose-based V-Bits Inc. for $128 million.

The purchase gives Cisco access to V-Bits' RateMux system, a real-time rate-conversion and bitstream manipulation device.

According to Carson Chen, vice president of engineering at Cisco, the RateMux system will be integrated into the Cisco Universal broadband router "within a year's time." This will give the router the ability to combine 15 channels of video onto a single bitstream that operators can tailor to their own needs.

"The missing piece that Cisco has not had is the ability to take MPEG (Moving Picture Experts Group) frames, decode them and groom them to other sources," Chen said. "Suppose you're running a digital TV package with 12 channels, but your customers only want two of them. You can groom those two off and send them to subscribers. You'll have null spaces in between the channels where you can insert data and video packets."

RateMux is programmable for future upgrades to allow such services as digital program insertion, video-on-demand (VOD) and data broadcasting. The product competes with Terayon Communications' CherryPicker system.

Cisco also will continue V-Bits' other products, such as the company's Digital Repeater, as standalone units, Chen said.

The goal is to foster the convergence of high-speed data, telephony and video services under Cisco's product line.

"There's been a lot of talk about multimedia services, but it's never been truly available because there has been no broadband access," Chen said. "Now that the infrastructure is in place, it's all about transitioning those analog services to packets, cells and frames."

Chen said Cisco's routers will be fully compatible with the network multiplexing and transmission systems of other heavy hitters in the broadband cable industry, such as Scientific-Atlanta, General Instrument and Harmonic.

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The 9580-SST™. The SST headend unit collects balancing and ingress measurement data from one to eight test points, and transmits updated measurements to the SSR field units, the second component of the 9580 system. The SST operates as an ingress monitor, receiving 80 ingress samples per test point, per second.

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"I don't know if we're at the terabyte level (for storage), but for every 100 users, we're getting somewhere in the range of 100 MB of data per week," Kunkel said.

NEWS BITES

- AT&T to Open System to Competition: In a letter sent to Federal Communications Commission Chairman William Kennard, AT&T outlined its plans to offer consumer choice for Internet service providers (ISPs). Once AT&T's current contract with Excite@Home expires in mid-2002 and technical issues are resolved, customers in AT&T cable systems will have their choice of ISPs. AT&T said it also will provide open access in its fixed wireless systems next year.
- GI Celebrates Digital Milestone: General Instrument Corp. has shipped its 1,000th digital headend. The headend, which was sold to Charter Communications' Jackson, Tenn., system, will serve approximately 24,000 subscribers in the Western part of the state. With this sale, GI's digital system deployments now pass more than 41 million homes.
- 3Com and Cablevision Remove the Middleman: 3Com and Cablevision have teamed to create customer-friendly modem installs for the operator's Optimum Online service in Long Island, N.Y. As part of the agreement, 3Com U.S. Robotics will bundle its Data Over Cable Service Interface Specification (DOCSIS)-certified Cable Modem CMX with an Installation Starter Kit, which features a splitter, cable and an instructional video. Consumers will be able to purchase the modem and installation kit at THE WIZ electronics outlets.
- Adelphia to Monitor DWDM Network With TTC: In a sale valued at nearly $7 million, Adelphia Business Solutions has purchased centralized test management systems and software from TTC to support its dense wavelength division multiplexing (DWDM) network expansion and network control upgrades along the East Coast. The TTC system will enable the turn-up of services from DS1 to optical carrier (OC)-12 at more than 40 Adelphia sites initially. CT

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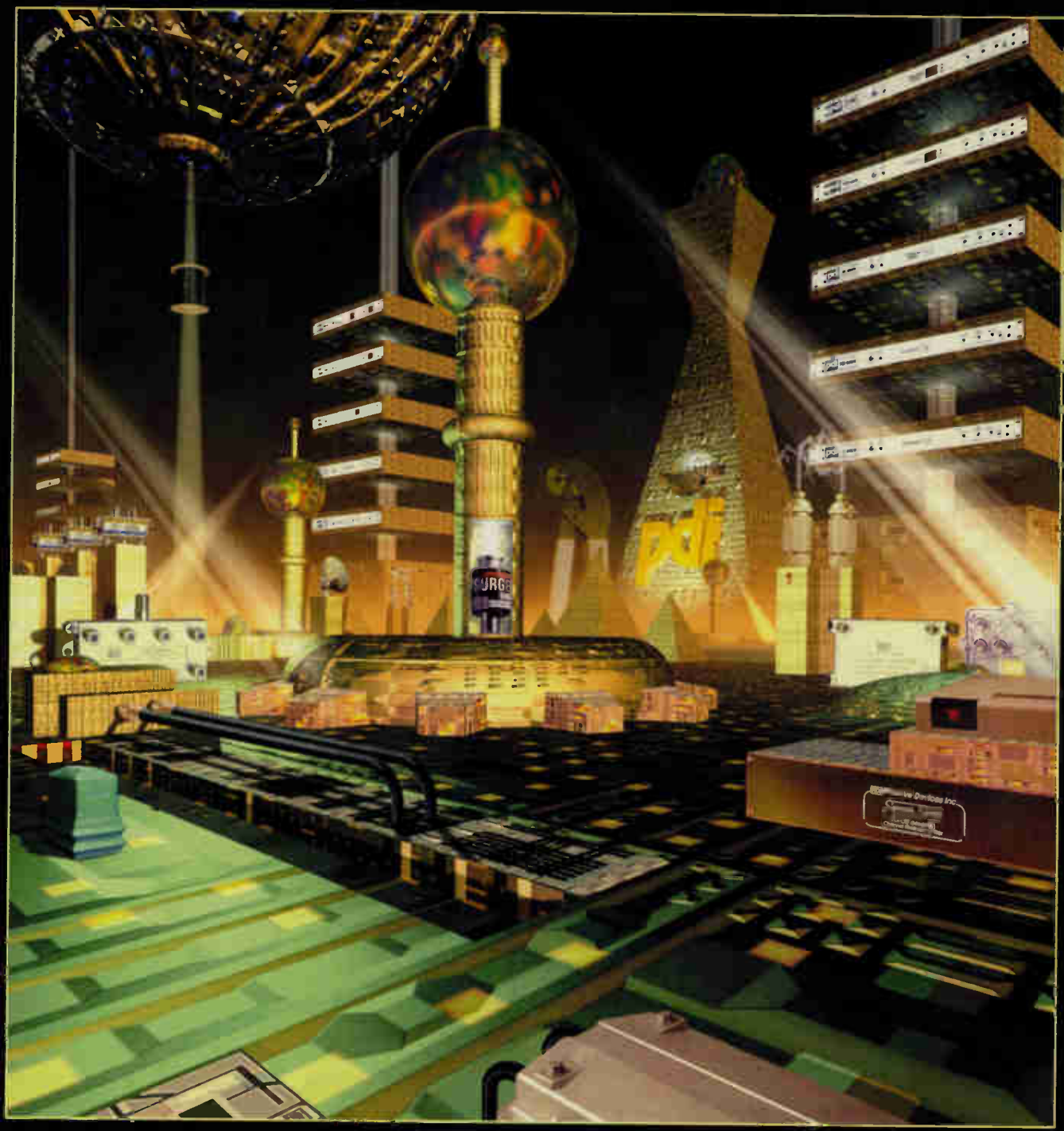

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Reader Service Number 21

By Arthur Cole

Comcast, Lucent Run IP Telephony Test

Internet protocol (IP) telephony over cable still is in its infancy, and early adopters of the technology should expect to get their hands dirty during the installation and integration phase. However, if all goes well over the next few months, expect to see standardized equipment within a year that will make it almost a plug-and-play process.

Comcast and Lucent Technologies are the latest partners to put IP telephony to the test, ushering in a technical trial among 25 or so users in Comcast's Union, N.J., plant. The trial is to gauge the field-worthiness of CableLabs' PacketCable 1.0 spec, which provides for IP telephony under the Data Over Cable Service Interface Specification (DOCSIS).

Because of its real-time nature and the need for rock-solid network reliability, IP telephony thrusts the cable operator into a completely new environment, one of dialing administrators and sophisticated interface technology to exchange carriers. That's why today's trial installations require a certain degree of customization and cooperation between headend personnel and the vendor, unlike some of the other interactive providers, such as Wink and WorldGate, which pretty much handle the entire installation and ongoing system monitoring functions.

Early adopter woes

"We got into this business pre-standard. We still have to work out integration problems in our labs," said Jim Blake, product manager at Lucent. "The (Comcast) headend had to give us a lot of help in understanding their plant and helping us make sure it was real-time ready. Once we get into the DOCSIS era, we can move to a plug-and-play environment."

The real-time aspect of IP telephony is the most crucial part of the service. Unlike most interactive services, where delays or dropped packets can be overlooked, telephony requires full delivery of all data at all times. That will require virtually foolproof backup power as well as a sophisticated status monitoring operation at the headend.

For the Comcast trial, the company installed Lucent's CableConnect Solutions system, featuring the PathStar Access Server and coupled it to Motorola's Cable Router CMTS (cable modem termination system). A pair of workstations for administrative and routing functions rounds out the system.

Interoperability

Mark Coblitz, vice president of strategic planning at Comcast and chairman of the PacketCable committee, said the technical trial likely will progress to a full market trial of several hundred customers and then on to full deployment where the hope is a customer count in the thousands. Right now, the challenge is to make sure IP telephony plays nice with all the other services and data on the network.

"We haven't found anything dramatic," Coblitz said. "We want to make sure the DOCSIS modem comes on- and off-line correctly, that it finds the right channel to go back to. We need to see how channel provisioning works with other services in the same space."

Naturally, as more customers come online, more gear will have to go into the headend. The Motorola Cable Router CMTS handles up to 6,000 lines per box, while the PathStar can deliver up to 20,000 lines. If the service is a huge hit with customers, it might even be necessary to boost the number of trunk lines to the local telephone company.

Other concerns

Coblitz said there are a number of other issues to consider with IP telephony. Chief among them is the connection to the public switched telephone network (PSTN). Right now, Comcast essentially is using an extension of the competitive local exchange carrier (CLEC) phone numbers of the 25 trial participants. When it comes time for a commercial deployment, Comcast will need its own set of numbers on the PSTN and will have to provide network intelligence so that calls can be made to and from anywhere in the world.

"We'll have a constant bit rate (CBR) for IP over HFC (hybrid fiber/coax), which must be converted to PSTN," Coblitz said. "Which technology should you use and what will you use going forward? Those are some key questions. We'll go at it very systematically. The idea is to deliver telephone service with a set of requirements from a customer perspective and a regulatory perspective." CT

Art Cole is a contributing editor to "Communications Technology."

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But we have to warn you... you won't want to settle for less.

New Chapter Champion

The Society of Cable Telecommunications Engineers has named Lilibet Coe manager of chapter and industry relations.

Coe, whose background includes association and nonprofit social services management, will be responsible for providing support to the Society's 73 local chapters. Melissa Hicks, director of membership services, said, "Given Lilibet's diverse experience and knowledge, I am confident that she will have an immediate and long-lasting impact on SCTE's chapter relationships and will be a key resource for chapters seeking to further their success."

Coe's duties will include building recruitment and retention through chapter relations, initiating all communication to and from chapter officers, visiting chapters, and initiating and maintaining relationships with industry organizations. In addition, she will manage the annual elections for the SCTE Board of Directors, scholarship programs and the annual Cable-Tec Games.

"I look forward to meeting with local chapter members," Coe commented, "to listen to their concerns and to work with them to formulate and implement solutions."

ET 2000: Technology on Tap

SCTE will present the latest technical information from industry leaders at its Conference on Emerging Technologies 2000, Jan. 11-13 in Anaheim, Calif.

The conference will kick off with three preconference tutorials addressing the issues of home area networks, digital modulation and the Data Over Cable Service Interface Specification (DOCSIS). Moderated by Rex Bollinger of Excite@Home, the tutorials will feature speakers Rich Annibaldi of Pioneer New Media Technologies, Steve Holmes of Tektronix and Burcak Beser of 3Com.

Top industry leaders will address the following topics during the conference sessions:

- Session A—"Broadband Telecommunications Applications: DOCSIS and Telephony" with moderator Ron Wolfe of Excite@Home
- Session B—"Interactive Services and Advanced Set-Top Applications" with moderator Leslie Ellis of Paul Kagan and Associates
- Session C—"Home Area Networks" with moderator Doug Semon of Time Warner Cable
- Session D—"Network Management Solutions for Digital Broadband" with moderator Jim Ludington of INT2-Internetwork Integration
- Session E—"Advancements in Distribution and Transport Architectures" with moderator Patrick O'Hare of AT&T B&IS

For more information about ET 2000 or for a registration form, please call (610) 363-3822, e-mail info@scte.org or visit SCTE's Web site at www.scte.org.

HMS Closes in on Interoperability

The SCTE standards Hybrid Management Sub-Layer (HMS) Subcommittee has completed Phase 2 of its ongoing interoperability workshops for status monitoring transponders at the Society headquarters in Exton, Pa. The workshops help vendors to continue working toward a standard in designing and building status monitoring transponders.

Participating operators included AT&T Broadband and Internet Services, Time Warner Cable, Cox Cable, Comcast, Rogers and Congecole. This workshop, as with the one prior, offered vendors and operators the opportunity to conduct laboratory testing in a neutral environment.

HMS is an SCTE standards development subcommittee whose mission is to define a standard protocol suite to support cost-effective interoperability and integration of status monitoring transponder hardware and software. The next HMS meeting is scheduled to be held this month in Anaheim, Calif.

For more information on this workshop or the HMS Subcommittee, contact Dr. Ted Woo at (610) 363-6888, ext. 228, or e-mail twoo@scte.org. Information on SCTE's standards subcommittee meetings also is available on the Society's Web site at www.scte.org. CT

Personnel from several vendors and multiple system operators (MSOs) joined forces in Phase 2 of the HMS Subcommittee's interoperability testing for status monitoring transponders at SCTE Headquarters in Exton, Pa..

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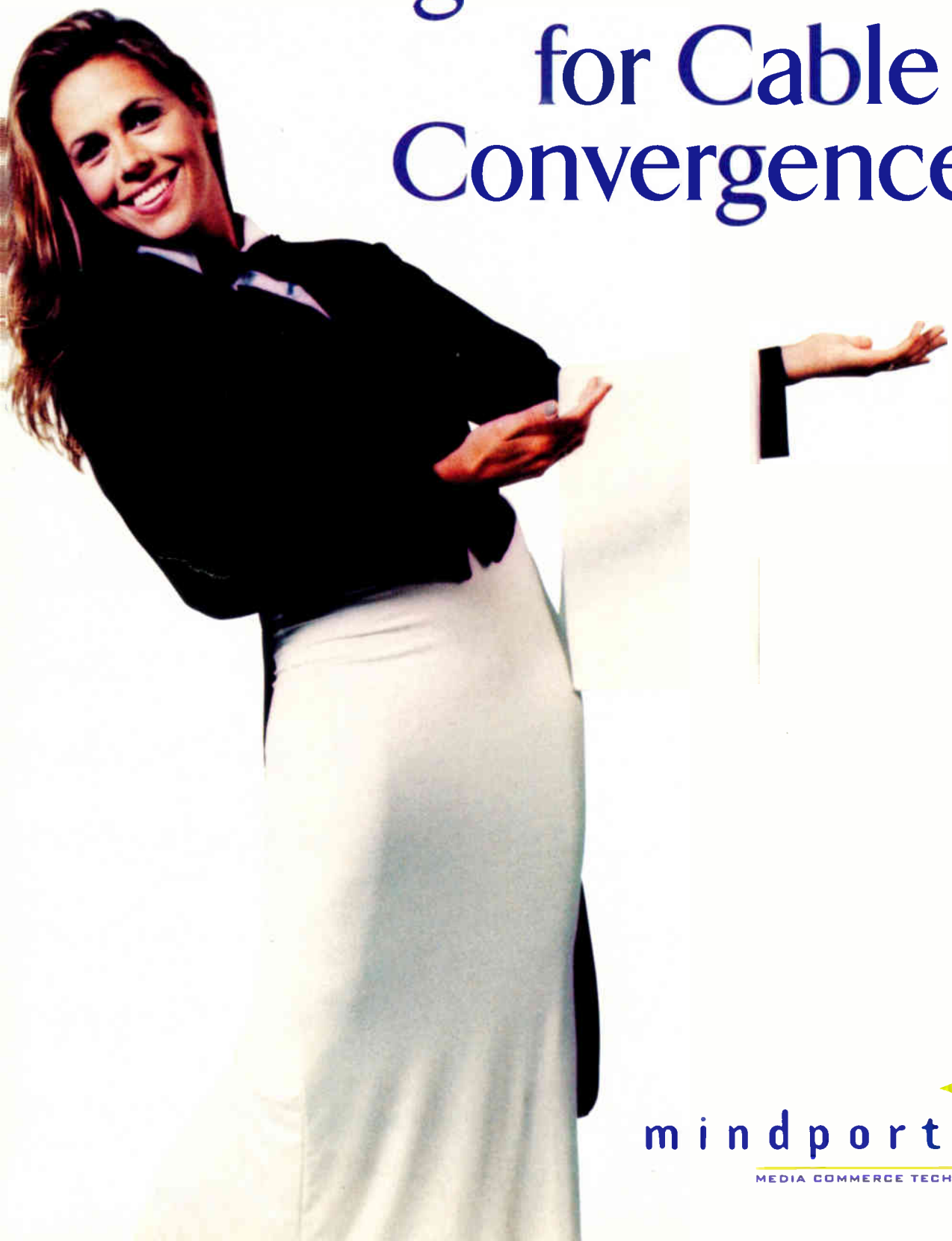

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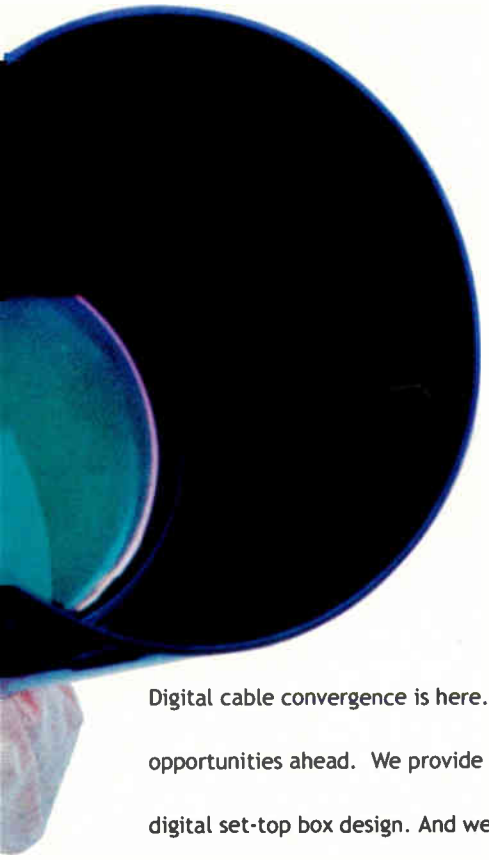

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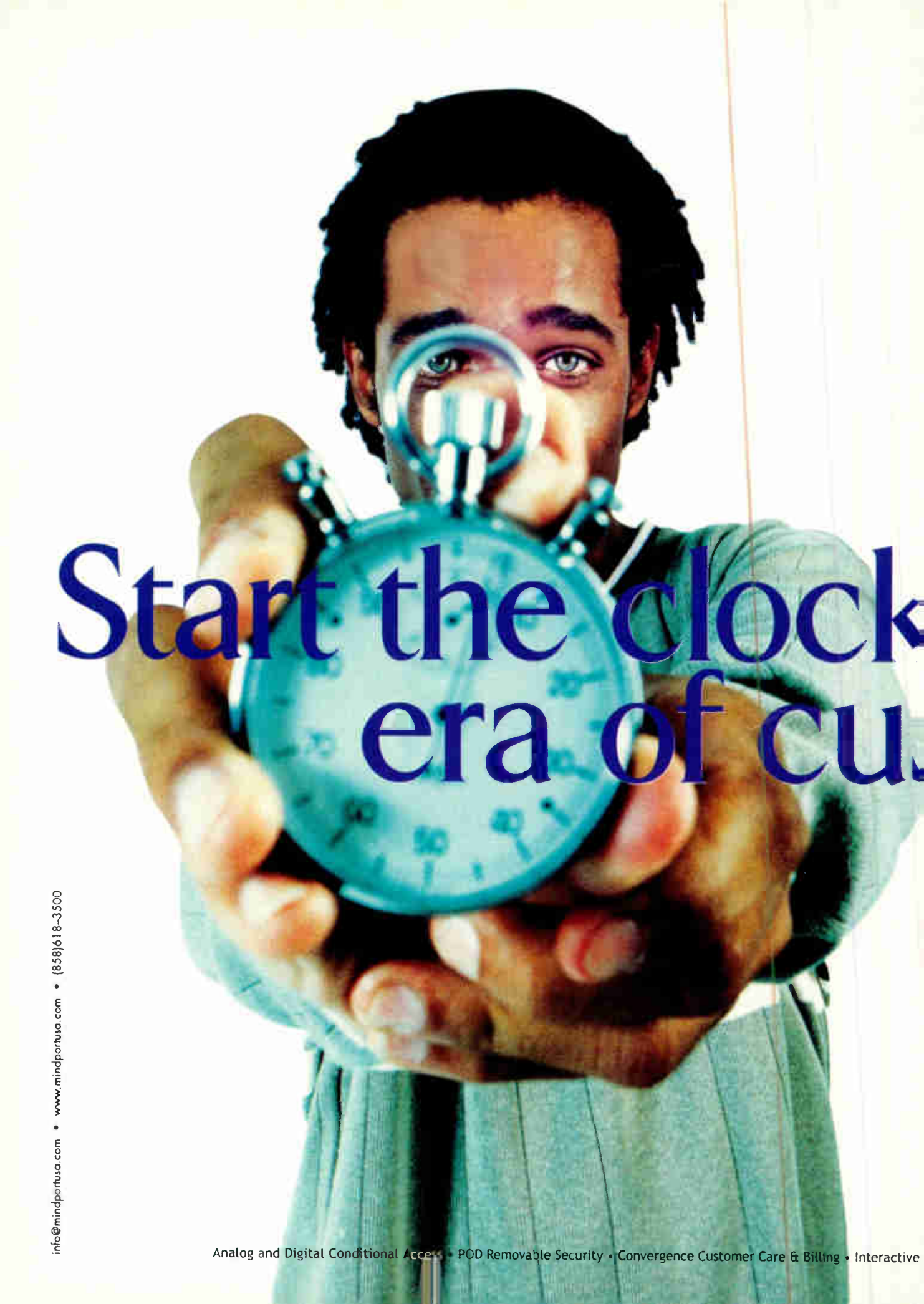

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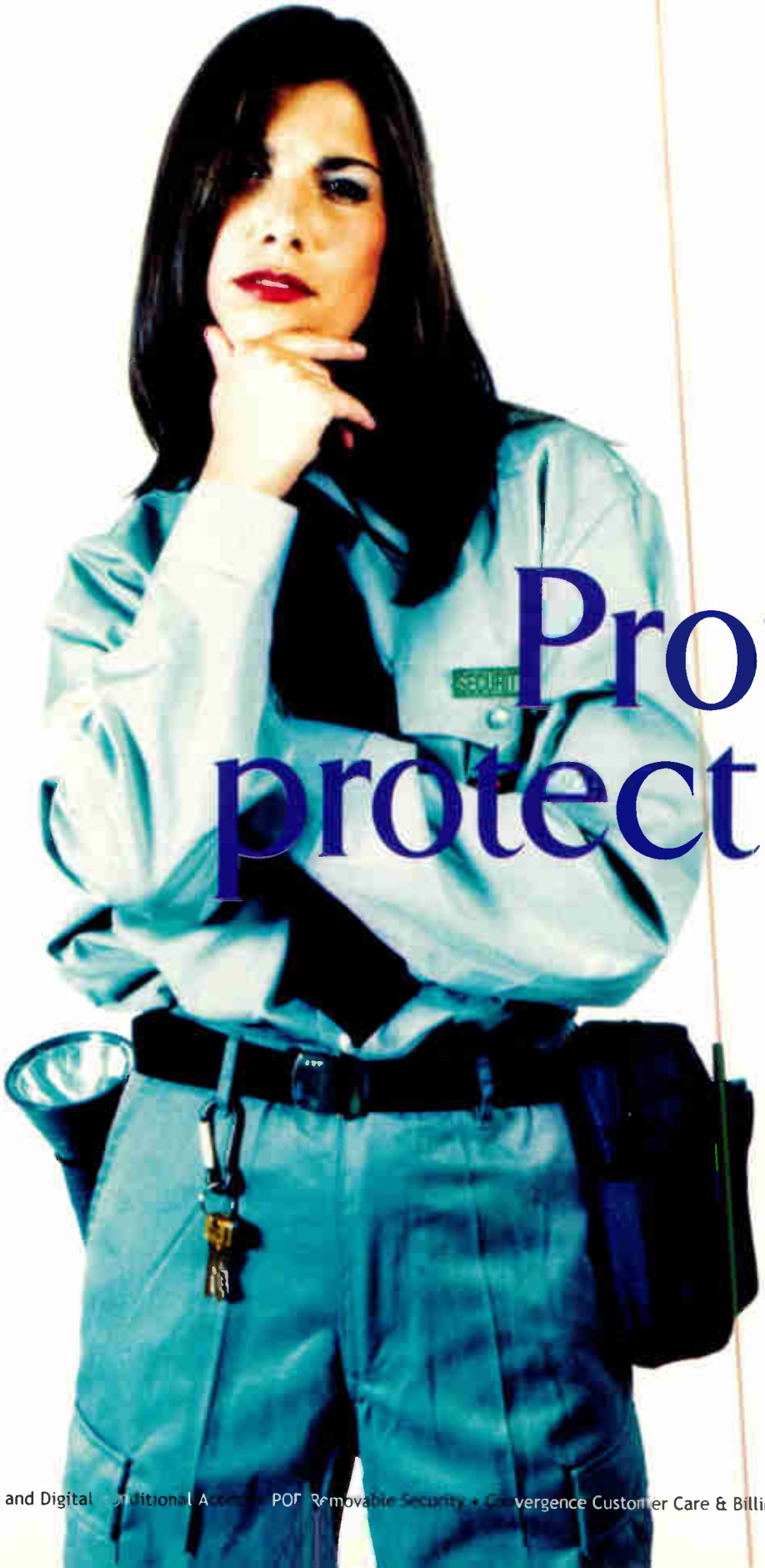

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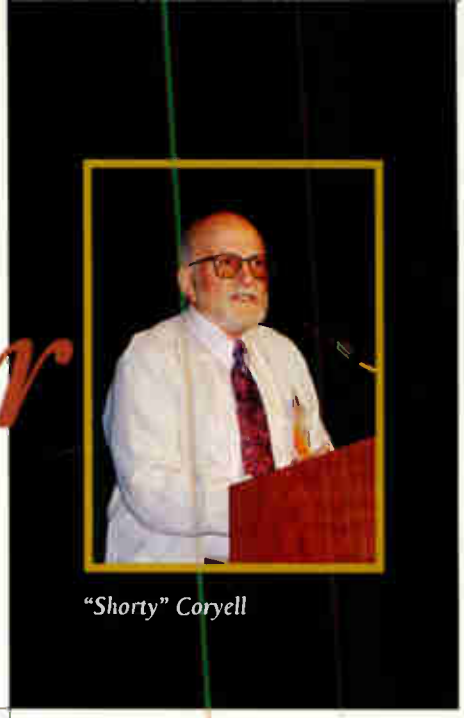
Interview with a Leader

By Rex Porter

SCTE Hall-of-Famer Austin "Shorty" Coryell



"Shorty" Coryell

Austin "Shorty" Coryell is an original. Not only is he a charter member of the Society of Cable Telecommunications Engineers, but SCTE inducted him into the Hall of Fame in May at Cable-Tec Expo '99. I first met Shorty years ago. But it was while I was national sales manager for Times Wire that I recognized Shorty's knowledge and experience.

My boss, Ray Schneider, asked me to go to Kissimmee, Fla. He said Kissimmee wanted to return all the cable we had shipped because their engineers said the cable did not meet their specifications. I arrived in the Kissimmee warehouse and set up my test equipment.

"Look here," I said to Shorty, "every reel I test reads 30 dB or better." "Yes," said Shorty, "but haven't you ever read Ken Simons' *Bluebook* on cable testing? Slow the sweep down. You should know the detector in the bridge is too slow to read the true return loss at high speed over the complete band."

Each time I tested my way, the reels passed. Each time I tested Shorty's way, they failed. I called my boss and told him that Shorty wouldn't accept the cable tested in the traditional manner. Ray exclaimed: "Is Shorty Coryell the engineer there? Well, he used to be my engineer when I was at Teleprompter. Don't argue with him—he knows what he's talking about. Just get the cable loaded back on the trucks, and we'll replace every reel we've shipped."

That's how well Shorty was regarded in the industry. Let's get to know him a little better.

Communications Technology: Shorty, you are a pioneering hero to all of us who came along after you. Tell us about your background before cable.

Austin Coryell: I was born in Shelbyville, Mich. I lived on a farm for 18 years, graduated from Martin High School, then enlisted in the Marine Corps. I was a Marine from 1948 to 1952, in an engineering battalion, spending 16 months in Korea.

After I was discharged, I visited an old buddy up in Williamsport, Pa. Since Michigan was the land of the unemployed, I searched newspaper classifieds and saw an ad for a cable system pole-climber. ➤

> "I didn't have the slightest idea of what a cable TV system was, but the following week I went to work for Lycoming Television."

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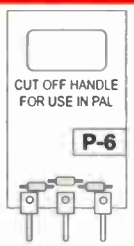

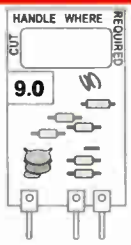

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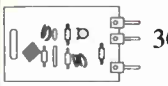

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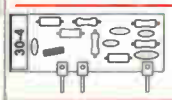

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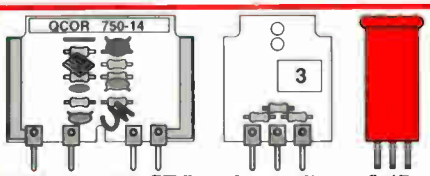

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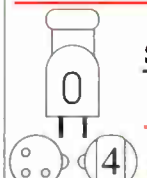

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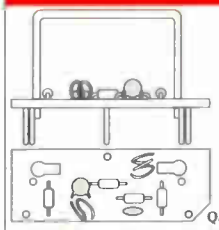

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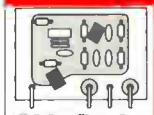

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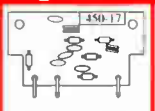

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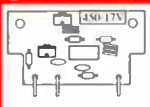

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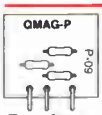

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600 & 750 MHz in 2 dB steps, 0-24 dB

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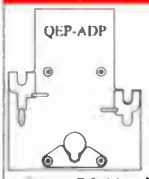

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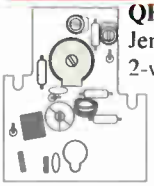

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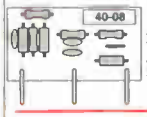

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Reader Service Number 24

I didn't have the slightest idea of what a cable TV system was, but the following week I went to work for Lycoming Television in Williamsport, doing construction. They were just beginning to build their system. At that time, there were actually three cable TV systems, all on the same poles in the same town, so we had lots of competition. Of course, you could expect high penetration because you couldn't get any over-the-air TV in that market.

As we finished most of the plant, we started hooking up subscribers. They needed an installer, so I took that position. Of course, after we got a lot of subscribers, we needed somebody in service, so I became a service tech. I eventually ended up as a maintenance tech at that system.

Later, I left Lycoming to work for one of our competitors, West Branch Television in Williamsport. I spent three years with them, and that system was sold to Williamsport Cable, the largest cable system in that market. I worked nights and weekends on standby service, attending school at Williamsport Technical Institute for two years to increase my knowledge in electronics. In 1962, I finished school and took a position at Elmira Video as chief engineer. We did a lot of new expansions, built plants and also upgraded existing plant. I spent three-and-a-half years there.

CT: Then you worked for TVC, didn't you?
AC: I took a position with Television Communications, which was Al Stern's group. As director of engineering, I took care of the engineering for 18 cable TV systems, located from East to West Coast, and we were rebuilding them from five-channel systems to 12-channel systems.

It was a great experience for me because we rebuilt headends and did a lot of antenna work. We built tropo scatter antennas in Pittsfield, Mass., to pick up New York City channels. We built a 30-foot parabolic antenna for the independent UHF channel from Boston, in Athol-Orange, Mass. I built corner-reflector antennas more than 100 feet wide to pick up Pittsburgh signals in Clearfield, Pa. I did a lot of stacking of antennas for distance channels. I stacked 32 antenna bays, and to phase them all in, we used the azimuth of the transmit location. Then we went out eight or 10 miles from our site and set up a transmitter so that we could use it as a cross signal for phasing antennas in.

I spent so much time traveling that I got sick and tired of it, and TVC sent me to Winterhaven, Fla. There, my mentor was Len Ecker, chief engineer and part-owner of that system. Today, Len is known throughout the industry, having worked for many years at Jerrold as a trainer and developer of people. I am especially proud to have had the opportunity to work with Len at the very start of cable TV.

Shorty works on a pole in Williamsport, Pa., in the '50s.

CT: Who else had a positive impact on your career?
AC: Ray Schneider. When I first went to work for Williamsport Cable, working nights and attending the Williamsport Technical Institute, Ray was general manager. Ray later went on to work as vice president of operations for Teleprompter, and he hired me to be the chief engineer for Elmira Video.

CT: Somewhere along the way, the industry began to depend on your expertise in research and development. How did that start?
AC: In Winterhaven, we set up a research and development laboratory. The prime purpose of the R&D lab was to develop a scramble TV converter with which we would add pay TV to our systems. The project was called Gridtronics. I worked on it with Don Kirk in St. Petersburg, Fla., and had a co-patent with him.

CT: You must have been one of ATC's earliest engineers.
AC: In 1971, I went to work for American Television Communications beginning the construction of systems in the Orlando, Fla., region. ATC had approximately 15 franchises with tight commitments. ➤

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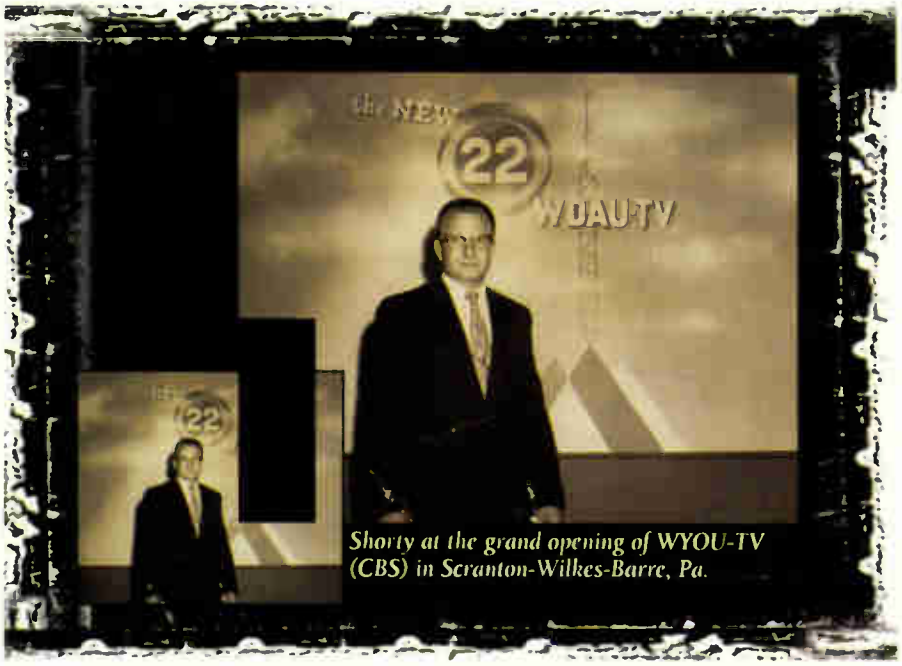


Shorty at the grand opening of WYOU-TV (CBS) in Scranton-Wilkes-Barre, Pa.

I went on board June 1, 1971. By July 1, we were to have 500 subscribers in Winter Park. We met that commitment. By Aug. 1, we were to have 500 subscribers in Orlando. And so it went, from one franchise to another, with tight commitments.

When I arrived in Orlando as regional engineer for the Central Florida Region, I was responsible for Kissimmee and Perry, in addition to a couple of small systems farther south. Later, the Atlantic Coast regional engineer left, and I took on the responsibility for central Florida and the Atlantic Coast regions. I also took care of systems in Melbourne, Cocoa, Ormand Beach and Savannah, Ga. I was responsible for engineering and building the Orlando system, plus taking care of the two regions.

While I was building plant in the Orlando system, I also was heavily involved in franchising around the country. We used Orlando as a model cable system of the future. The system was dual cable, bidirectional activated plant. We had a joint project with EIE (now RCA) called Polycom. Bus loads of people were brought in from Atlanta; Portland, Maine; Birmingham, Ala.; and various other cities.

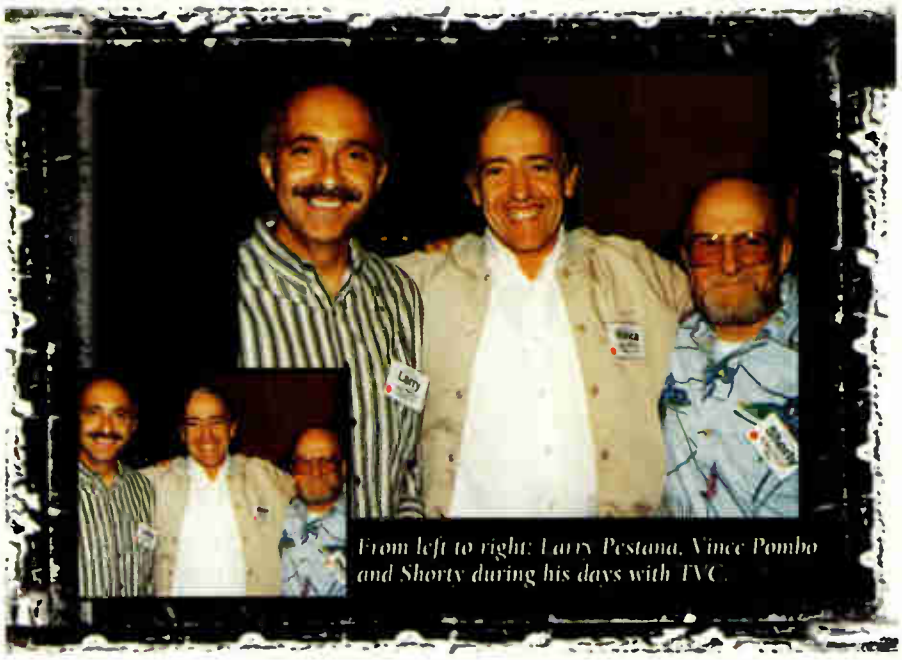
With this dual-cable, bidirectional system, we demonstrated telemedicine, which allowed two-way communications with doctors and nurses from outpatient locations. We demonstrated traffic surveillance and control with cameras incorporating pan, tilt, audio and video. We even had data transcriptions on the systems. We were looking to use successful system

franchising to attract other major franchise acquisitions.

CT: Following your work in Orlando, you seemed to be involved with every ATC system. It seemed like you were everywhere.
AC: While involved in the Orlando work, I made several trips for ATC involved in due-diligence on existing ATC systems. I investigated the adding of new channels and corrected picture quality problems, and I helped establish hub site concepts for Jacksonville, Fla.; Memphis, Tenn.; and Austin, Texas; to build into the larger markets.

In 1978, I became involved in developing a training program for ATC. They were interested in establishing a training group because ATC was having a hard time finding good employees. I developed an installation program, and eventually it was incorporated in the National Training Center for ATC.

While I was in Orlando building the plant and operating the system, we needed to import the independent station from Miami. I oversaw the building of common carrier microwave systems from Miami to Ormand Beach and from Melbourne over to St. Petersburg. With this microwave set-up, we imported the Miami independent, Ch. 6.



From left to right: Larry Pestana, Vince Pombo and Shorty during his days with TVC.

CT: How did you get to Denver?
AC: In 1979, I transferred to ATC's corporate office in Denver. My responsibility was to perform tests and evaluate new products and things like that. When I arrived, ATC was in the midst of heavy

franchising, and I got involved preparing franchising proposals for about six months. Then I got to test and evaluate products.

I also worked with Glen Chambers, developing all the written curriculum for the training program at the National Training Center. After we finished the franchising portion, I got heavily involved in monthly regional training for all of the ATC regions, even while I was also responsible for review and approval of all of ATC's capital purchases.

In the early '80s, ATC decided to decentralize because the company was getting so large. I was heavily involved in evaluating, interviewing and helping to find engineering vice presidents for the divisions. Larry Janes, our VP of engineering, retired, so I interviewed candidates for the VP of engineering within the corporate office.

CT: Then back to the East Coast again?
AC: In 1986, I spent seven months in New York City. In Upper Manhattan, Paragon Cable's VP of engineering had left the company, and they were right in the midst of refranchising. Not only were they preparing for an upgrade-rebuild; they were basically preparing the operating capital budgets for that system.

CT: Then you settled back in the Rockies?
AC: When I finished the stint in Upper Manhattan, I came back to Denver and took the position as VP of engineering for Mile High Cablevision in Denver. Our prime objective was to beat the mission I had earlier established for the system.

We originally figured it would take about three years. That was basically increasing penetration and developing people because they had high turnover in the installation and service group. The employee turnover was about 82-83 percent, and the service techs' was worse, at about 85 percent per year. I developed training/employee development programs for them, plus reorganized and improved customer service and picture quality.

CT: That wasn't your final work before you retired, was it?
AC: No. In 1991, I left Mile High Cable for a position at the National Division working with Lew Suders. As director of engineering, I directed the technical operations in one third of the National Division's systems.

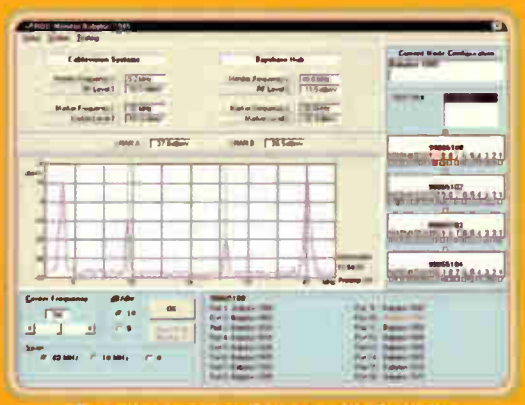
"The employee turnover was about 82-83 percent, and the service techs' was worse, at about 85 percent per year."

As the Full Service Network started up in Orlando, Fla., I spent three months in Orlando assisting John Walsh and initiating programs for upgrading the system and assisting with the Full Service Network implementations.

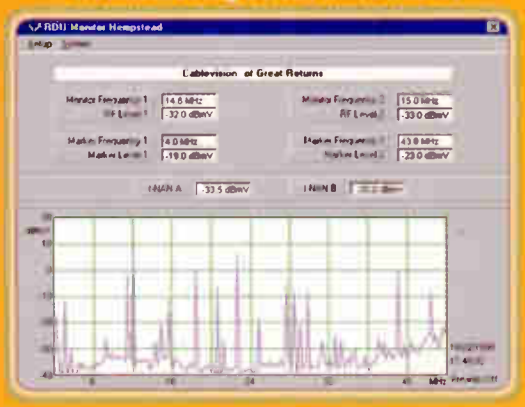
Then I returned to Denver to continue my responsibilities as director of engineering for the National Division. During the prior three years, National had a heavy workload of upgrade/rebuild to meet the Time Warner commitment of getting systems upgraded to "750-HFC."

CT: Well, you certainly deserved to be able to slow down. Have you slowed down since you retired?
AC: I retired Jan. 15, 1999. Since then, I've enrolled in college taking communications technology courses, doing some cable TV-related projects and trying to catch up on a 20-year backlog of "Honey-Dos." CT

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



Troubleshooting Screen with Switches



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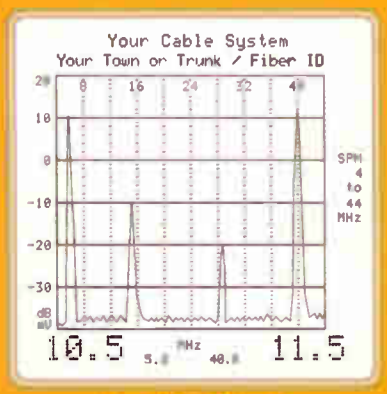

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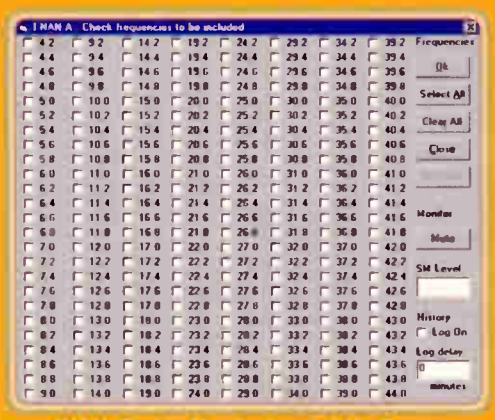

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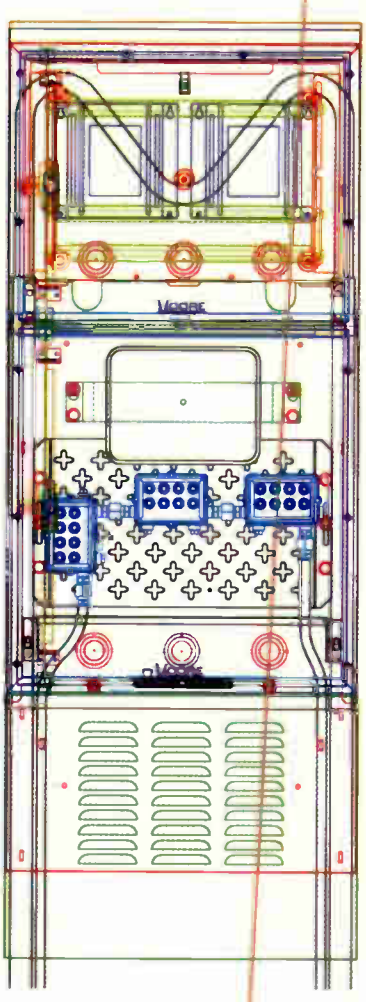

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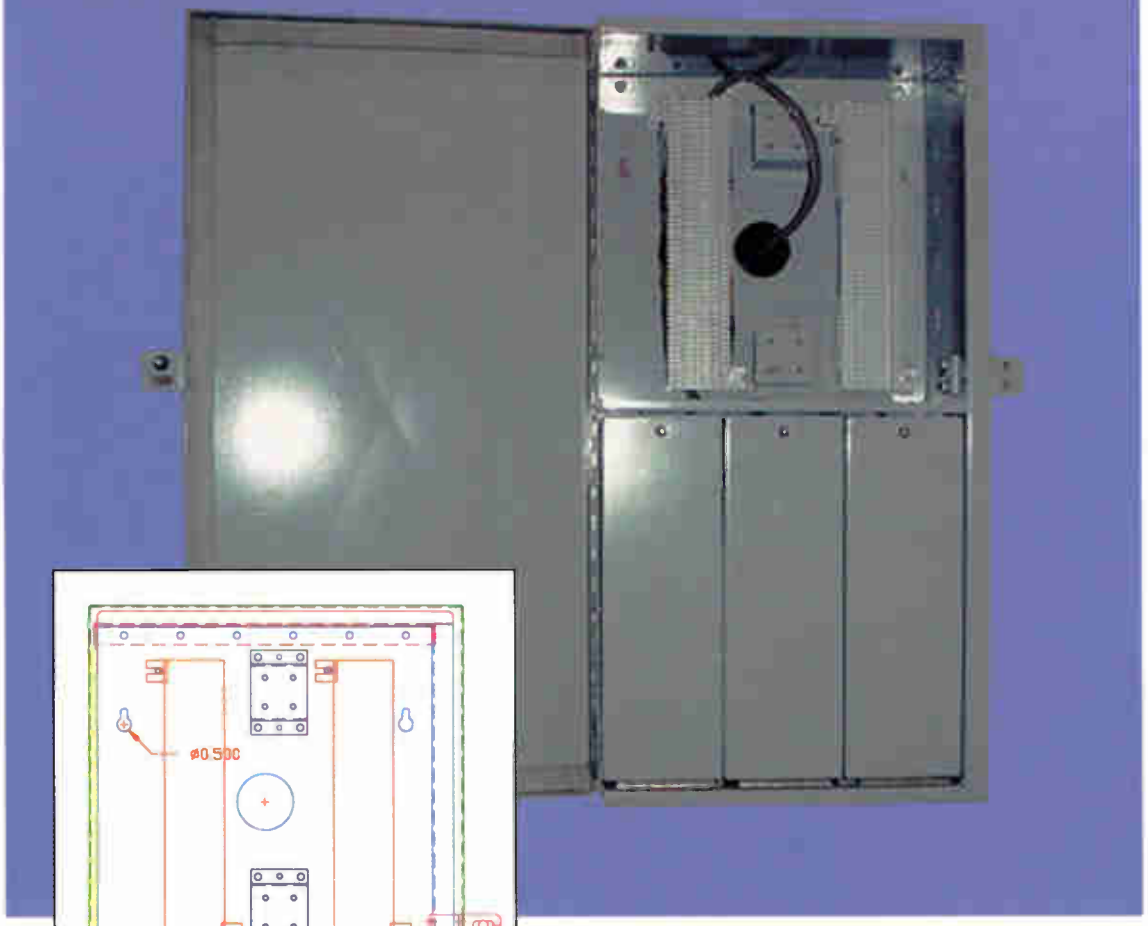

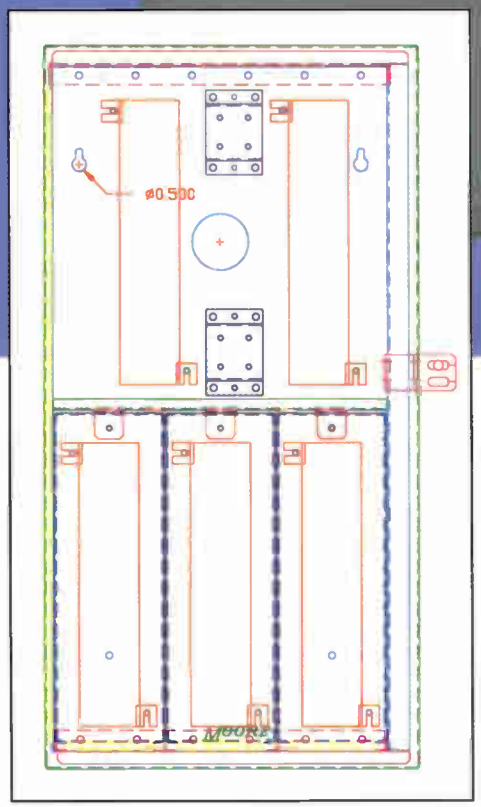

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By Ron Hranac

Millennium? Not!

Now that the noise makers have been put away, the empty champagne bottles tossed out, and the hangover but a painful memory, happy New Year and welcome to 2000!

You'll note that reference to "the 21st century" and "new millennium" are missing from this column's opening sentence. That's because we still have just under a year to go before the end of the 20th century and second millennium. *Editor's note: Hurrah! Someone else knows!*

"How can that be?" you ask. "The newspapers, radio and TV have been making a big deal of the new century and new millennium. I sorta remember celebrating these events a few nights ago, too. It's obvious that Hranac's caffeine level is out of whack."

Not so

Nope. It's our popular media that's out of whack and somehow forgot how to count. Of course, this is the same popular media that brings us horoscopes and other pseudo-science nonsense. As I write this, the popular media is filled with references to Jan. 1 being the first day of the 21st century and the third millennium. Here are a few examples of how widespread the fallacy is.

A *Denver Rocky Mountain News* newspaper advertising insert for OfficeMax, a national office supply chain, says its sale is "the last great office supply clearance of the millennium." Gee, no sales planned during 2000?

CBS's Dan Rather made the comment during a late October "CBS Evening News" feature that "just 64 days remain in this century." Dan needs to replace the battery in his calculator. Someone must have called him on it, though, because he changed his commentary to "days until 2000."

Seemingly countless newspaper and magazine articles discussing the so-called Y2K computer problem have jumped on the "millennium bug" bandwagon. Wrong. Y2K does not equal the next millennium, or any millennium, for that matter. It means "year 2000" and has to do with computer clocks switching from 1999 to 2000 and what may happen to computer hardware and software that live on a two-digit year diet. That clock change from "99" to "00" may be interpreted by some computers as going from 1999 to 1900 rather than 2000. It has nothing to do with the current or next millennium.

What's even more ridiculous is the slew of "new millennium" New Year's Eve concerts, parties, dinners, and celebrations that otherwise sensible people are paying outrageous amounts of money to attend. I seem to recall that our nation's White House was planning a Dec. 31-Jan. 1 "new millennium" celebration of some sort, too. Granted, if folks want to celebrate the coming of the new century and new millennium, they can do it whenever they want. But a year early? Hmmm, maybe those otherwise sensible people weren't all that sensible to begin with.

> "Despite what you may have read or seen on television, the third millennium and 21st century do not begin until Jan. 1, 2001."

I was really disappointed by an e-mail from our respected competition, *CED* magazine, encouraging subscribers to participate in an online survey and provide "your thoughts on what you think a great product for the new Millennium would be." Asking about a great product for the coming year, maybe the coming decade, and—really stretching things—the coming century, I could understand. But how the hell can anyone have any idea of a great product for the next 1,000 years? Photon torpedoes? Hyperspace starships? Bottled water from Mars' polar icecaps? Give me a break.

Even *Communications Technology* hasn't been completely immune to millennium abuse. The Lucent Technologies telephony supplement back in November included a reference to "delivering the next millennium's telecommunications services." The next century's telecommunications services perhaps, but the next 1,000 years' telecommunications services?

Sobriety check

Please read the following two sentences slowly and carefully. Despite what you may have read or seen on television, the third millennium and 21st century do not begin until Jan. 1, 2001. 2000 is the last year of the 20th century and the second millennium. Don't believe me? Get out your calculator and follow along.

History meets simple math

Quick history pop quiz: What calendar currently is in use by most of the Western world?

It's the Gregorian calendar, instituted by Pope Gregory XIII in 1582. He did this to resolve problems with the Julian calendar, which had become out of sync by several days from the solar cycle. The Julian calendar, after 1,600-plus years of service, no

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longer quite jibed with the earth's trip around the sun.

Any idea what the Gregorian calendar's first year was?

The answer is AD 1. That's anno domini, Latin for "in the year of our Lord." The Gregorian calendar also is known as the Christian calendar because it refers to the birth of Jesus Christ as the calendar's starting point. Religion aside, we have to start somewhere, and this point's as good as any. Anyhow, calendrical reckoning before the birth of Christ has for years been identified as "BC," or before Christ.

So, the Gregorian calendar's first year was AD 1, not AD 0. Though the concept of "zero" finally took hold in Western Europe in the late 1400s, ol' Greg didn't use a "year zero" in his calendar; he just did the sensible thing and started counting. Thus, the first century of the first millennium was years AD 1 to and including AD 100. No trick math here, just plain old counting: 1, 2, 3, 4 ... 98, 99, 100. And, no, you're not allowed to count from zero to 99. To illustrate why, hold up a finger. How many fingers are you holding up? If you said "zero," go take a lap and stand by for extra homework.

Anyway, the second century comprised AD 101 through AD 200. Again, nothing more than counting 100 years from one to a hundred. Third century? AD 201 through AD300. Fourth century? AD 301 through AD 400. Keep going, and you'll find that the 19th century was AD 1801 through AD 1900, and the 20th century comprises years AD 1901 through and including AD 2000. That means the 21st century must be AD 2001 through AD 2100. It also means we're in the hundredth and last year of the 20th century, not the first year of the 21st century.

The wayward media

Visit your local newspaper's archives and look up the headlines from Jan. 1, 1901. If your newspaper was in publication back then, you'll likely find that the paper celebrated the beginning of the 20th century on Jan. 1, 1901, not 1900. It's amazing that the contemporary editors of those same newspapers are now telling us that 99 years apparently comprises a century, not 100 years. Last time I looked, a century was still 100 years. Uh, did I miss something here?

Keep that calculator running. Given the previous facts, the first millennium—a 1,000-year period of time—comprised the years AD 1 through and including AD 1000. Again, no trick math, just simple counting: 1, 2, 3, 4 ... 998, 999, 1000. The second millennium is AD 1001 through 2000, and the third millennium comprises years AD 2001 through AD 3000. Ever wonder why Arthur C. Clarke called his book *2001: A Space Odyssey*?

Dig hole in sand, insert head

If you want to believe that 2000 is the first year of the 21st century and third millennium, that's your choice. But in order for that to be true, the Gregorian calendar would have to have started with the year AD 0. It didn't. It started with AD 1. There was no year zero, remember?

Alternatively, maybe the definitions of "century" and "millennium" could be changed to be just 99 years and 999 years respectively. We could call this, say, the Clintonian calendar, in honor of our cigar-totin' president. Or maybe we could call it the Kansas State School Board Revised Calendar.

Sadly, as society continues to dumb down, truly historic events such as the turn of a century and beginning of a new millennium have become little more than marketing gimmicks. The 20th century almost certainly will go down in the history books as one of the most, if not the most, progressive centuries in terms of rapid technological advances. Who possibly could have imagined going from what was barely the end of the horse-and-buggy era of 1901 to "One small step for man, one giant leap for mankind," as Neil Armstrong set foot on the moon in 1969? It's hard to believe the media that reported this historic event are the same media that have been telling us we're now in the 21st century and third millennium. CT

Ron Hranac is vice president of RF engineering for Denver-based High Speed Access Corp. He also is senior technical editor for "Communications Technology." He can be reached via e-mail at rhranac@aol.com.

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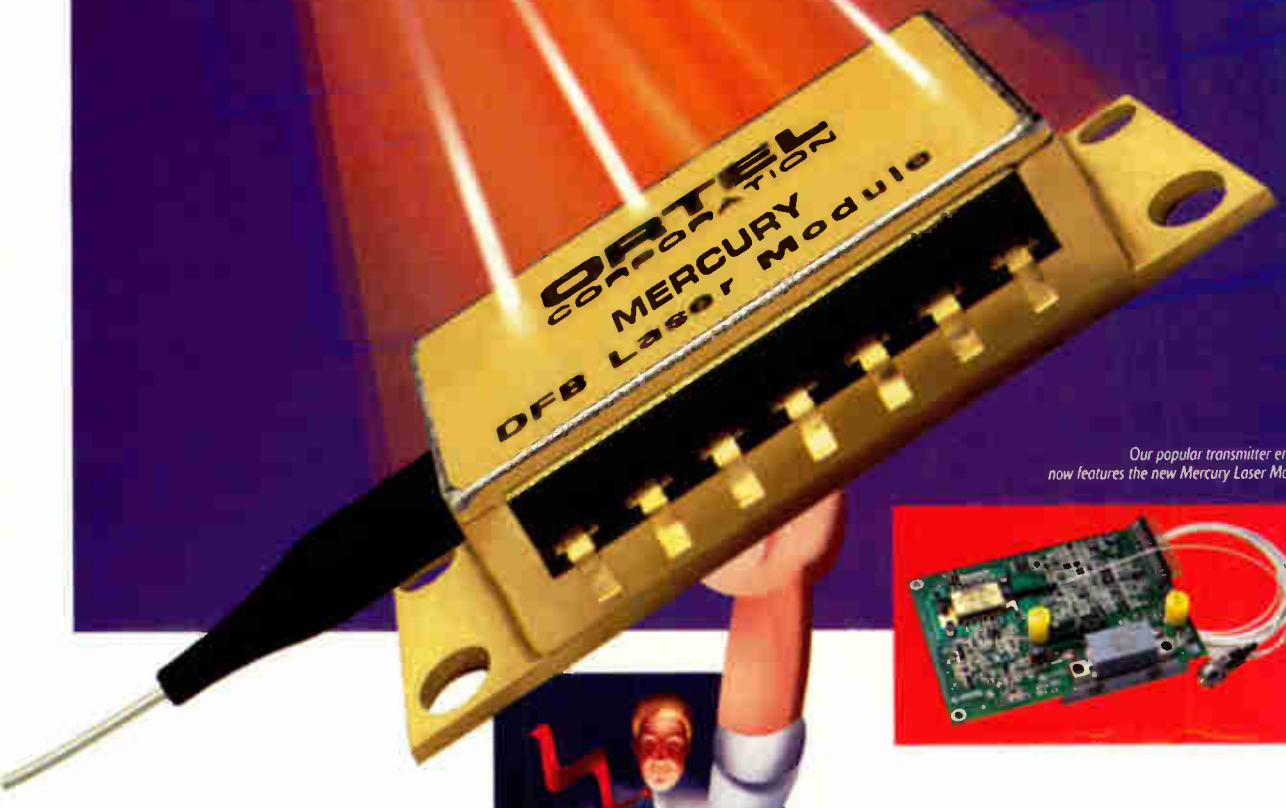

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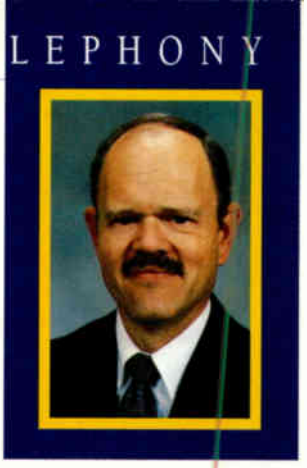


Operations Systems: The Quiet Part of Telephony

Ask nearly anyone in the cable TV industry about cable's role in telephony, and most folks will know enough to have an opinion. Some people will cite intense competitive pressures in a converged communications world. Others will focus an the great Internet protocol (IP) telephony vs. circuit-switched technology debate. Few, however, will start with the need for integrated operations systems.

Element management

Most telephony systems vendors include element management systems as part of their offerings. In today's market, most of these systems provide a graphical user interface (GUI) that either is based on Windows NT or looks and feels very similar to a Windows application program. Technical staff use the system to monitor the health of one or more network elements provided by the vendor. The GUI interface lets the technician zoom in on various components of the network, often with icons that resemble the actual physical unit being monitored.

In addition to monitoring, many systems allow the technician to remotely provision equipment, such as a network interface unit (NIU), for various configurations unique to the particular subscriber. An example might be the use of Tellabs' Element Management System to reserve a certain amount of guaranteed bandwidth for the EXPRESS/Path data capability.

Variety rears its spicy head

The challenge is that providing end-to-end communications capability requires provisioning and monitoring a number of systems from separate vendors. While one vendor's system may allow the technician to get limited information on other network elements that have a compatible interface to the vendor's operations system, the views and capabilities generally differ across vendors.

In addition, an operator may have unique needs that may not have been in the vendor's list. This is very likely in a cable telephony system, given that telephony systems often are created by designers who come from the telephone business, rather than cable.

> "Providing end-to-end communications capability requires provisioning and monitoring a number of systems from separate vendors."

Roll your own? No!

The answer could be for the operator's information systems (IS) staff to develop software that integrates all vendor components and provides a unified GUI for the technical staff. Internal software development, however, is expensive and time-consuming. At least one vendor, Commtech Corp., is attempting to build its business by solving this problem for operators.

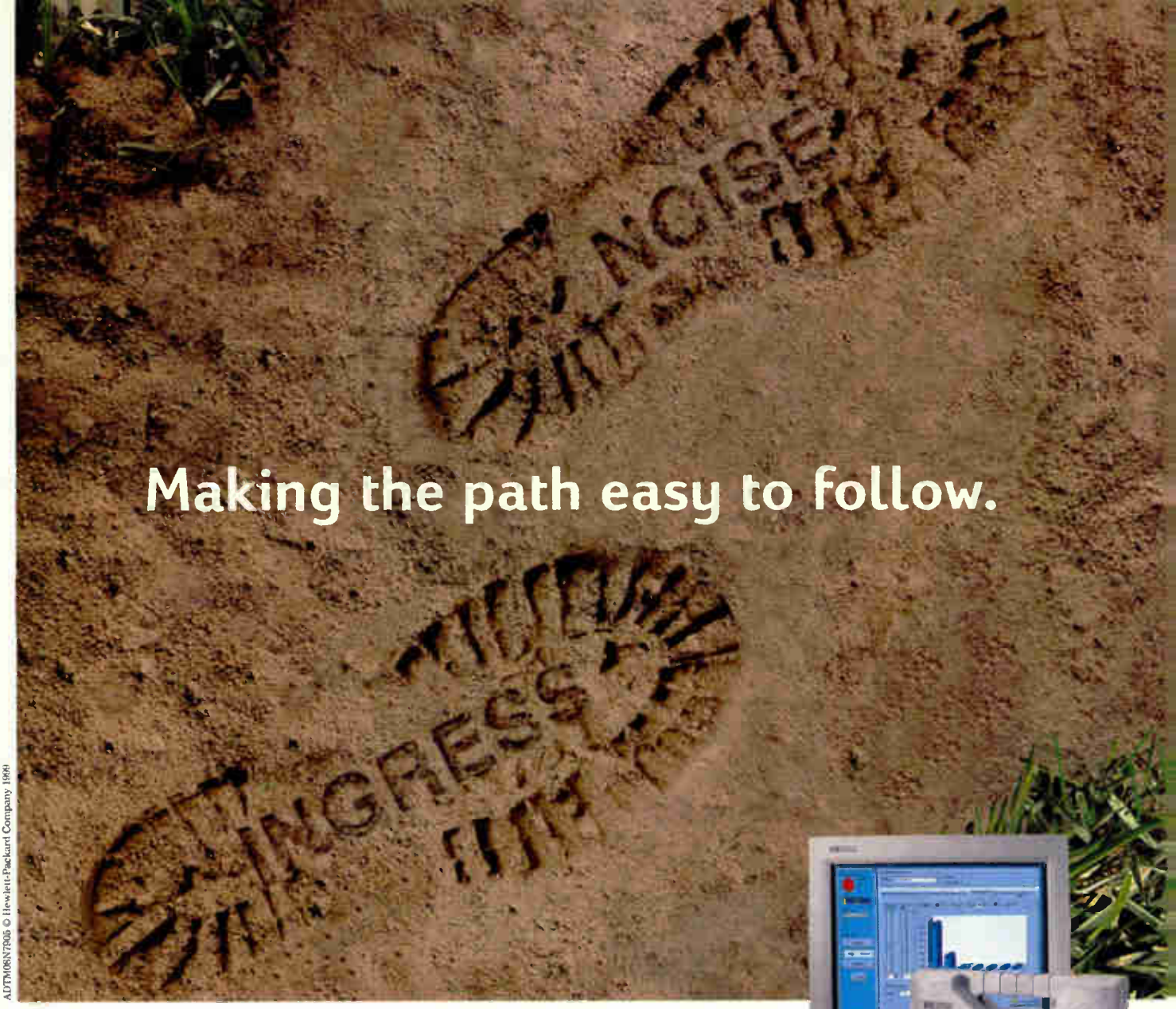
Kristin Baumgartner, Commtech's vice president of marketing, puts it this way: "Whatever your hardware vendor chooses, you want to have more than what they decided to put into the original system."

Commtech is a software shop that provides a telephony product called Fastflow as a solution for integrated order management, product and service provisioning, workforce management, and trouble ticket management. Commtech writes the Fastflow software using object oriented programming (OOP) such as CORBA or JAVA to link vendor-specific processes together and present a unified interface to the technician. The company can customize the GUI interfaces as needed.

Commtech traditionally has built systems for telephony service providers, but is making a major commitment to the cable industry to integrate operations systems capability for circuit-switched hybrid fiber/coax (HFC) network elements and a circuit switch. What this means to the operator is that technical staff will be able to use one system to both activate service in the access system and provision line features in the circuit switch. Baumgartner points out that in addition to the convenience of one interface, there is a substantial advantage in terms of the shorter time required to fill a service order.

Web-based provisioning

Perhaps an even bigger advantage than the singular interface would be the abili-



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ty to remotely access the operations system via the Web. Commtech will be providing this capability for its business customers' enterprise networks early this year, noting enormous advantages to being able to make moves and changes from any Internet access device without lots of advance notice.

While it is unlikely that cable operators would want to give this capability directly to their residential subscribers, it's easy to see the possibilities for technicians upselling additional lines or features at installation. The same technician who sells the upgrade could bring those capabilities up and running prior to leaving the site. Almost instantaneously, that second "plain vanilla" telephone line becomes a higher tier revenue generator.

Security may be an issue, but not an insurmountable one. "There are ways to partition databases so that the operator could control who has access," said Baumgartner. I tend to agree. Most of the data systems vendors, such as 3Com, are selling Web-based network management for data systems where security could be an even greater concern.

Which way to go?

For now, Commtech has not created interfaces for other cable services, for the cable back office work flow processes, or even for all circuit-switched HFC telephony access systems. Its initial product offer is built around the Arris Cornerstone HFC product and a Nortel DMS switch. Regarding the back office, Baumgartner said, "At this point, we need to look at what the various operators have in place today." Many have home-grown and legacy systems that may not contain the necessary hooks into the Fastflow packages.

Given that our industry has been hyping the rapid introduction of new services that integrate voice, data, and video, it seems that operations systems need to be just as versatile. Solutions that integrate today's disparate operations systems are a step in the right direction. CT

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

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Reader Service Number 37

By Jennifer Whalen

Women Meet Technology as Consumers and Employees

As convergence speeds cable's delivery of advanced services, it pays to remember the power of women.

Why? Because as the convergence train gains momentum, it's more than likely that women will decide which new services to buy and whether to choose your technology or that of a competitor. Plus, in an increasingly tight labor market, you can't afford to overlook half of today's workforce, cautioned some of cable's leading female executives at the recent Women in Cable & Telecommunications (WICT) Leadership Summit.

Follow the money

"Women influence 85 percent of all purchases. They buy 81 percent of all products, and 75 percent of all household finances are handled by women," reported Diana Holman, president of Holman Communications and moderator for the panel "Women of Power: Consumers and Leaders." If you want your new services to be successful, you'll need to understand how women use new technologies such as Internet access and interactive TV and what they buy. Then you'll need to target your marketing campaigns accordingly.

"We believe women will be the early adopters of any digital media," said C.J. Kettler, president of sales and marketing for Oxygen Media. "Think of the missed opportunity of cell phones. They were never advertised as being for women. We believe there is a great opportunity to market TV and converged media to women."

Plus, their online numbers are exploding. "Women are the fastest growing audience on the Internet," said Susan Williams DeFife, founder of womenCONNECT.com, adding that they now account for 50 percent of users. "Women will be the drivers of e-commerce."

Why are women a ready market for converged TV and Internet services? They're looking for convenience. According to an industry survey, 88 percent of women go online because it simplifies their lives, 83 percent say it saves them time, and only 55 percent say it saves them money, reported Kettler. "It's not about price; it's about convenience," she added.

Women are looking for information when online. "Women are using it as a tool," DeFife explained. They're looking for an interactive media, discussion groups, and an opportunity to buy. "Make it relevant and simple to use," she added.

Both broadband technology vendors and service providers can benefit from this advice. The higher performance offered by cable modems can be appealing to women looking for convenient access to information. It pays to consider that not only when deciding which interactive content to deploy, but also when designing customer premise equipment for the retail environment and Web interfaces for self-provisioning of services.

Cablevision and Sony apparently understand this need. "They focused on women when deciding how to program the network and how to program the set-top," explained Kate McEnroe, president of AMC Networks.

Changing face of technical employees

Not only are women potential consumers of your products, but they are potential employees as well. "The talent pool is so small that no one is looking at you and saying, 'Are you a man or are you a woman?' You can be a Martian, and it wouldn't matter," DeFife said.

Wage gaps

But just because women are available to enter technical fields doesn't mean that cable will be able to attract them. According to a 1998 salary survey sponsored by WICT, the gap in pay between men and women in technical fields averaged 11.5 percent across the industry. The discrepancy was especially apparent at equipment suppliers, where, according to the survey, women earned 17.6 percent less then their male counterparts.

Consequences

"Women are leaving technical organizations faster than other organizations," said Patti Klinge, senior vice president and chief officer of human resources for MediaOne Group during the session, "Tools for Achieving Salary Parity."

"With competition for talent, this is not a problem that any company can afford to ignore. If they do, it will catch up with them," she said. Klinge added that MediaOne audits its annual merit pay packages, and if the company sees a high performance rating but a low salary increase for any employee, it will investigate why that occurred.

WICT is planning another salary survey at the end of 2000. To contact the organization, call (312) 634-2330. CT

Jennifer Whalen is editor of "Communications Technology." She can be reached via e-mail at jwhalen@phillips.com.

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THREAT

Broadband Satellite Promises

By Arthur Cole

Yes, cable's old nemesis, the satellite industry, is looking to make rapid gains in broadband data services, and it's more than just the direct broadcast satellite (DBS) players looking to get into the market. Along with the well-financed DirecPC—backed by Hughes Network Systems—and EchoStar, a number of other big-money players are looking to get into the game: Boeing, Motorola, Alcatel, Lockheed Martin and even Bill Gates, just to name a few. These guys just might eat your cable modem's lunch for you.

"Under the model we're seeing now, many (satellite) companies are targeting both the residential and the business side," says Christopher Baugh, satellite network analyst at Pioneer Consulting of Cambridge, Mass. "There are many areas where satellite will

TENING IES

igh-Bandwidth Competition

So you're ready to deploy broadband data service, and you've got your eye on the telco competition. But have you looked to the skies recently?

go head-to-head with cable and DSL (digital subscriber line), especially in North America and Europe."

Pioneer is forecasting strong, steady subscriber growth for worldwide broadband satellite. Business subs are expected to go from 30,000 in 1999 to 2.44 million in 2004 and 6.94 million in 2008. The growth curve for residential subs is similarly shaped—only far higher. From 120,000 subs in 1999, Pioneer is forecasting growth to 13.5 million in 2004 and 38.71 million in 2008. Revenue projections closely follow subscriber projections, with total dollars growing from $230 million in 1999 to $16.21 billion in 2004 and $37.66 billion in 2008. (See the accompanying graph on page 65.)

Fortunately, there is a bright side. Broadband satellite, for the most part, is expected to find customers chiefly in areas not served by landlines or at corporations looking to set up a quick local area network (LAN) among disparate locations. That leaves most of the residential market to cable and telcos. And if broadband data services catch on the way most industry analysts expect them to, there will be plenty of business for everyone, wired or otherwise.

The one major advantage that satellite has over cable modems and DSL is bandwidth. A Ku-band service can deliver up to 45 Mbps per transponder, with the higher-power Ka band expected to achieve three to four times that level. Like cable, however, broadband-over-satellite is a shared network, meaning the more users online at the same time, the less bandwidth per user.

On average, the cost for satellite will be roughly the same as cable or DSL: $30 to $40 per month for unlimited use. Business users, especially rural ones, are likely to tap into broadband satellite as a cheap and easy way to connect remote offices.

"The advantage of satellite is that if a corporation has several offices, they wind up with a flat rate," says Michael Keesler, president of Axxess Telecom, an Idaho-based satellite system installer. "If you're out in Moosejaw, Minn., with no T1 line or broadband, you can get what you need at a reasonable price."

So who's going to be your prime competition from the sky? There seem to be

six major players either gearing up or already delivering service.

DirecPC

Your old DBS buddies certainly are not going to sit on their hands when it comes to broadband data. After all, they launched their video services in digital partly to take advantage of what the technology has to offer in the interactive data space.

With a low monthly rate, a fairly easy set-up process and a choice of Internet service providers (ISPs), DirecPC is likely to provide some competition in the residential market. After plunking down several hundred dollars for hardware, $19.99 per month gets you 25 hours' monthly service. There are two major flaws, however. The first is a data rate of only about 400 kbps—faster than an integrated services digital network (ISDN) line, but paltry compared to the 1.5 Mbps or more that cable modem subscribers generally get. The second is that customers need uninterrupted line-of-sight to the south to access the satellite.

DirecPC is aggressively seeking partnerships with the same companies you are in an effort to provide as wide a variety of services as possible. Last June, Hughes Electronics Corp., DirecPC's parent, got a $1.5 billion investment from America Online. Not only is the deal designed to produce unique AOL content for DirecPC users, it also will provide a delivery means for AOL TV, the company's interactive video platform. The companies already have contracted with Intel to develop chipsets for a combined AOL TV/DirecTV receiver.

Hughes also is pumping $1.4 billion into its Spaceway satellite network, due to begin operation in North America in 2002. The system will consist of geosynchronous and nongeosynchronous satellites in low earth orbits (LEOs) to deliver voice, video and data services in a pay-by-the-bandwidth scheme.

DISH Network

Although not quite as advanced in its broadband data rollout as DirecPC, DISH is looking to compete aggressively with wireless and wired providers. Spokesman Marc Lumpkin says the company is offering DishPlayer, a downloadable satellite receiver that is stored on a computer hard drive. Of course, you'll need the actual satellite hardware to take advantage of the software.

Lumpkin says the company could provide a maximum data rate of 30 Mbps, but as part of a shared network, individual rates probably would be much lower.

One edge the company might have is the size of the return path. Instead of using a telco return, DISH customers could be uplinking a fairly broadband signal themselves in the near future, although most likely through a gateway service.

"We opted to wait to launch another satellite so we could do true two-way," Lumpkin says.

Already, the company has debuted an interactive news site called Instant News that provides text-based news, weather, sports and financial information. The company also is working with Open TV to develop an interactive overlay to its video programming.

Teledesic

With the backing of Bill Gates, Saudi Prince Alwaleed Bin Talal, Boeing and Motorola, Teledesic is looking to establish a LEO network of some 288 satellites providing high-speed Internet access, networking and data services. Projected cost: about $9 billion. A launch date is penciled in for January 2004.

Teledesic spokesman David Bowermaster says the network is not likely to bump heads with cable systems in highly populated areas, but it might not be feasible for some of you to extend broadband services to more rural locations—Teledesic and other similar systems could be well-established there by the time you arrive.

"We don't see ourselves as a substitute for (wired) services," Bowermaster says, "but we definitely expect to be in large parts of the world where there is no high-speed capability to buildings and small offices. We're providing the last-mile solution to parts of the world where there are no terrestrial options."

Teledesic's carrying capacity will be pretty impressive if the company can pull it off. The company is planning 64 Mbps on the downlink, with 2 Mbps on the uplink. More expensive high-speed transmitters will deliver a 64 Mbps uplink for real-time videoconferencing and other services. ➤

Broadband Satellite Providers

Company	Backer	Launch	Throughput
DirecPC	Hughes Network Systems	Available now	400 kbps
DISH Network	EchoStar	2001, tentatively	30 Mbps
Teledesic	Bill Gates, Saudi Prince Talal, Boeing, Motorola	2004	64 Mbps
SkyBridge	Alcatel	Not yet set	n/a
AstroLink	Lockheed Martin, Liberty Media, TRW, Telespazio	2003	20 Mbps
KaStar	Kleiner-Perkins, TV Guide	2002	n/a

BOTTOM • LINE

New Twist on the Death Star

Broadband satellite data services are coming and in many ways could outclass cable modem offerings, although most experts don't expect it to take much of the residential market. For the most part, satellite will continue to concentrate on the business and rural markets, which offer plenty of cash flow, especially in developing countries that lack substantial terrestrial infrastructure.

Still, according to Pioneer Research, satellite could take as much as 15 percent of the U.S. broadband market—not welcome news, considering the brutal fight you face with the telcos and their digital subscriber line (DSL) technology.

At the moment, six major broadband satellite providers have plans, and cash, on the table. And not a one appears to be a slouch, either. Among the backers of these systems are world leaders in aerospace, computers, communications and media.

In short, these guys know what they're doing, and although some of these ventures might fail, it's a safe bet that satellite will succeed in the broadband market and continue to be an annoyance to cable.

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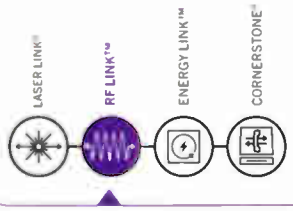

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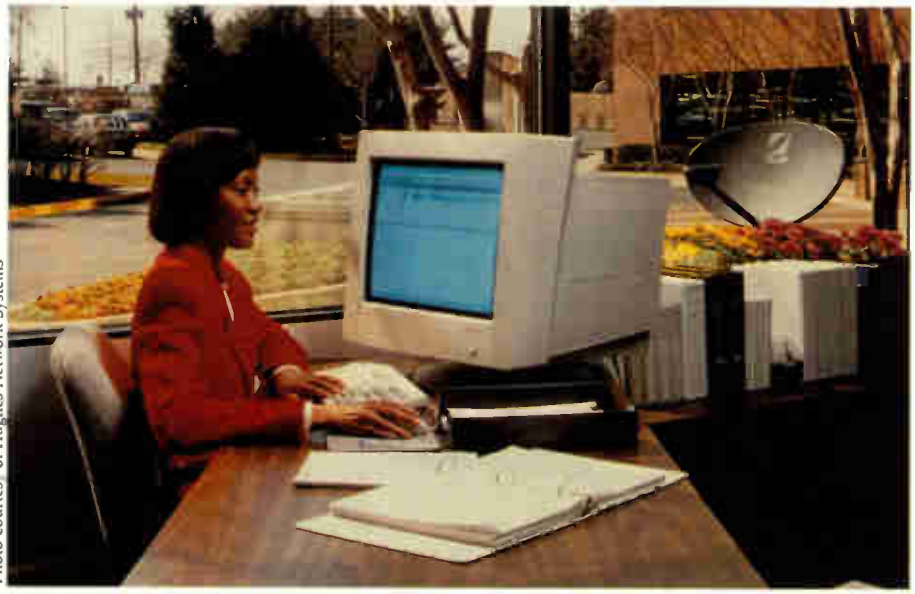


Photo courtesy of Hughes Network Systems

Your competition of the future? Numerous outfits are gearing up to offer broadband data service via satellite, which could pose a threat to cable modem services.

Unlike a traditional satellite service that provides global communications via a series of uplinks and downlinks, Teledesic's switching will be satellite-based. That is, signals will be relayed directly from one satellite to another, rather than between satellites and earth stations.

Teledesic also is basing a large part of its business plan on the Third World, where the need for high-speed data is strong despite a lack of wired communications networks.

"There are pretty good growth markets in areas of the world where you have many small cities and the infrastructure is not at the level of the U.S.," Bowermaster says.

SkyBridge

Teledesic may not offer much competition to U.S. cable providers, but it is expected to go head-to-head with SkyBridge, a European consortium led by international telecommunications firm Alcatel. Already, the two groups have squabbled over frequency allocations and other technical concerns.

SkyBridge is looking to launch its service late next year with 80 Ku-band LEO satellites and a terrestrial network of some 200 gateway stations. Services include everything from high-speed Internet access and multimedia applications to real-time video conferencing, remote LANs and voice communications.

A home terminal expected to cost upwards of $700 likely will limit residential market appeal, especially in the Third World and struggling former Communist states.

AstroLink

Astolink is another consortium of big-money players looking to deliver broadband to rural and Third World business and residential customers, although the U.S. residential market is not out of the question, either.

Lockheed Martin and Liberty Media are the primary backers, each with roughly 31 percent ownership of the $1.33 billion project. Aerospace corporation TRW and Italian telecommunications firm Telespazio share the remainder.

The group tentatively plans to launch the first two Ka-band satellites in 2002, providing broadband data, Internet, LAN capability and other services to the Americas, Europe and the Middle East by early 2003. The third and fourth birds are to be launched the following year, offering service to the rest of the world.

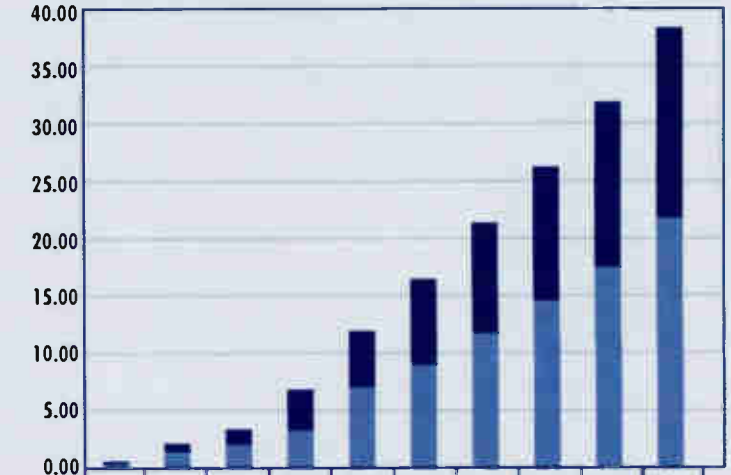
Astrolink will use Lockheed Martin's A2100 satellite, with ground terminals provided by Scientific-Atlanta.

Data throughput is expected to be up to 20 Mbps for the system.

KaStar

The final player is KaStar, developed by Silicon Valley investment firm Kleiner, Perkins, Caufield and Meyers, and TV Guide (also part of Liberty Media). As its name implies, the service will use the Ka-band to deliver broadband service to the United States and Latin America starting in 2002. ➤

Global satellite service revenue: 1999-2008 ($ billions)



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total business revenue	0.15	0.56	1.30	2.96	5.01	7.21	9.52	11.77	13.96	15.96
Total residential revenue	0.08	0.63	1.77	3.10	6.75	9.00	11.38	14.11	17.52	21.70

Source: Pioneer Consulting

Unlike most of the previously mentioned services that are targeting business users, KaStar is aiming at residential customers. But Brad Greenwald, vice president of marketing at KaStar, says the company's target is the 25 million to 30 million households that are not likely to have terrestrial broadband in the next two to three years.

> Broadband satellite will take perhaps 15 percent of the U.S. market by 2008
> —Christopher Baugh, Pioneer Consulting

"Primarily, we will augment the cable modem and DSL infrastructure," he says.

KaStar has not yet released its expected data throughput or other technological details. However, Greenwald says the service will be competitive with other broadband providers.

"We've built this business from the ground up," he says. "We looked at the price point that consumers will want in 2002 and constructed the system from there. We'll offer low-cost premises equipment so upfront costs are similar to today's satellite TV. Monthly service costs will be competitive with cable modem service."

What it means

Pioneer's Baugh predicts that broadband satellite will take perhaps 15 percent of the U.S. market by 2008, including many residents and businesses not serviced by cable. But even if satellite systems are taking 1 percent of your cable modem market, that still is a nasty thorn in your side at a time when you have your hands full with DSL competition.

The best remedy is speed. As it was with door-to-door vacuum cleaner sales, so it remains in high-tech communications: He who gets to the door first usually makes the sale. CT

Art Cole is a contributing editor to "Communications Technology."

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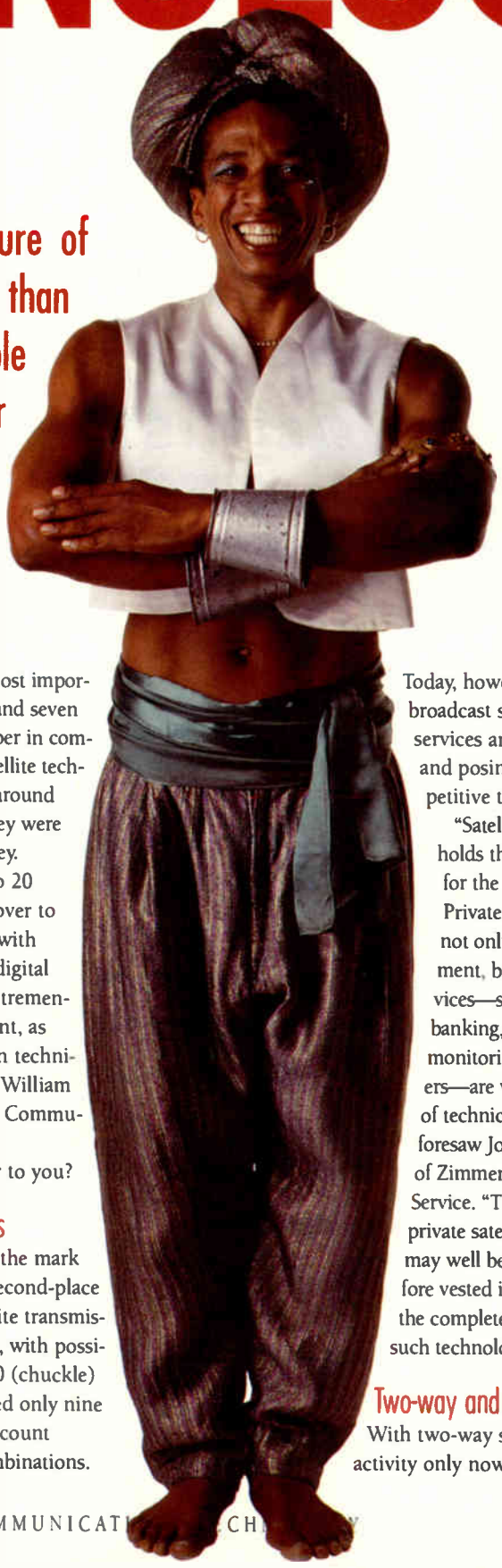
TECHNOLOGY

By the *CT* editorial staff



Can cable engineers predict the future of broadband communications? More than 20 years ago, the Society of Cable Telecommunications Engineers' charter members were asked to do just that: What would be the most important technical innovation by the year 2000?

Naturally, the answers didn't all fit into neat little pigeonholes, but some common themes appeared. Overall, the picture those charter members painted is a fairly accurate representation of things as they are now; one fellow even foretold AT&T's buyout of TCI—up to a point.

Nostradamus? Is that you?

Speaking as a true visionary and doomsayer, John Gort of United Cable TV said: "It is scary to think the telephone companies might gain control of our industry. I'm reluctant to see that." Gort added, "The most innovative event of the future technically will be a breakthrough with fiber optics within the next five years."

Just as Gort did, let's move on to some less-startling predictions of the main technical innovations by 2000.

Foundation in fiber

Most of our engineers answered the question with just two words: fiber optics. For the 65 individuals questioned back in '77, the coming significance of fiber optics was all but obvious; 26 people (including our own Editor-in-Chief Rex Porter) called fiber technology the most important innovation, and seven others guessed fiber in combination with satellite technology. Looking around today, it's clear they were right on the money.

"It'll take 15 to 20 years to change over to fiber optics, but with fiber optics and digital TV, there will be tremendous improvement, as well as burden on technical people," said William Elkins of Liberty Communications.

Sound familiar to you?

Satellite success

Rather less on the mark was the distant second-place prediction: Satellite transmission to the home, with possibly as many as 30 (chuckle) channels, garnered only nine votes—16 if you count fiber/satellite combinations.

Today, however, direct broadcast satellite (DBS) services are proliferating and posing a serious competitive threat to cable.

"Satellite technology holds the great promise for the long-term future. Private terminals with not only TV entertainment, but all other services—such as telephone, banking, security, health monitoring and many others—are within the realm of technical possibility," foresaw John Zimmerman of Zimmerman's Electronics Service. "The economics of private satellite utilization may well be solved long before vested interests permit the complete utilization of such technology."

Two-way and interactivity

With two-way service and interactivity only now beginning to

PREDICTIONS and Wild Guesses

Today Seen From 1977, 2020 Seen From Today

ramp up in a big way, predictions in this area fell short in terms of timeframe. Most respondents said we'd have two-way service on a large scale by now. However, the services predicted closely mirror what we plan to do in the next few years.

"The industry will change from just an entertainment medium to a major communication source, especially with two-way, meter reading, shopping and so forth," predicted Ray Thibodeau of Valley Cablevision.

Cable: ubiquitous or nonexistent?

The very future of the cable industry itself seemed far from certain: Respondents split right down the middle on whether cable would be everywhere or nowhere. The "everywhere" voters hit closer to the mark.

Lloyd Tate of Macro Media Systems said: "Cable will be like the telephone—a necessity and not a luxury, a lot more than just video signals. And the line coming into the home will be doing a lot of things."

For Carl E. Barry, owner of Barry Electronics, the future was less certain. "No guess—there may not even be a cable industry in the year 2000. With technology going so fast, it may well be superceded," he said.

What's in store for 2020?

Because our predecessors did so well with their predictions in 1977, we asked several of today's industry notables to make their best guesses on cable's next 20 years. Here's what they think is coming.

John Clark, SCTE president

"Looking 20 years out is daunting, but I'll act as the old Western hanging judge: 'Often in error, but never in doubt.'

"The biggest technological change will not be in hardware or software terms, but rather in human terms.

"Technology and consumer marketing will blend into a new discipline—consumer technology satisfaction. Technology and marketing managers will have much greater contact, communications, cross-training and partnership. Our industry will have a combined SCTE/CTAM Summit, starting with identifying the latest consumer desires and working backwards as a team to satisfy them.

"Chief technical officers will be as adept in consumer focus and finance as they are in engineering and technology. Providing a full portfolio of entertainment and information services through a cornucopia of platforms will change daily at warp speed, and the management challenge will require greater vision and broader horizons."

Allen Ecker, Scientific-Atlanta

"The digital set-top becomes the high-speed two-way interface to the home for entertainment, information and communication with the TV set as the display. Voice-activated user interfaces will allow easy access to a variety of entertainment and information services and electronic commerce applications.

"Extremely high bandwidth two-way fiber access networks will deliver services to nodes in neighborhoods. These nodes will have either fiber or wireless to the home.

"The home terminal also will be a control system for the home network to various devices and peripherals such as printers and displays in the home.

"Two-way video conferencing from displays in the home over broadband packet networks both to other residences and to the office will become common ways to avoid the major traffic congestion that plagues most metropolitan areas today."

Jim Farmer, ANTEC

"In 20 years, everyone will forget that I blew a bunch of predictions, whereas in one year they might remember.

"Most people will have forgotten what Y2K was all about.

"We probably will be in the process of

phasing out NTSC transmission by then.

"There will be one company delivering a unified voice, data and video connection to your house. You will have the choice of a couple of companies, but you will choose one for all services. There will be no long distance anymore, at least not domestically: You pay a certain amount each month for dial tone, and that includes reaching every phone in the United States and maybe in North America. There might be a nominal charge for overseas calls, but second tier providers, if they still exist, will be offering fixed pricing there, too.

"We will have large flat screen displays for television, and the CRT (cathode ray tube) will just about be retired. Thanks to this, high definition TV (HDTV) will be about ready to take off.

"Politics will not have changed materially. Sorry about that."

Yvette Gordon, SeaChange

"In these past 50 years, all of our efforts were centered around one-way broadcasting and making the content, quality and reliability of that one-way traffic better. The next millennium will be all about two-way traffic and what we can do with a TV set (or set-top box) as a network tool.

"We will have the opportunity to watch whatever programming whenever we want to, but broadcast TV will remain. Being able to rewind, pause and fast forward to real-time events will be available over cable networks directly.

"Internet access, interactive customer advertising, TV viewing will all become one, and viewers will no longer know the difference between a broadcast channel, on-demand channel, Internet channel or interactive application as they all work together. Purchases will be made directly from TV sets for impulse buying.

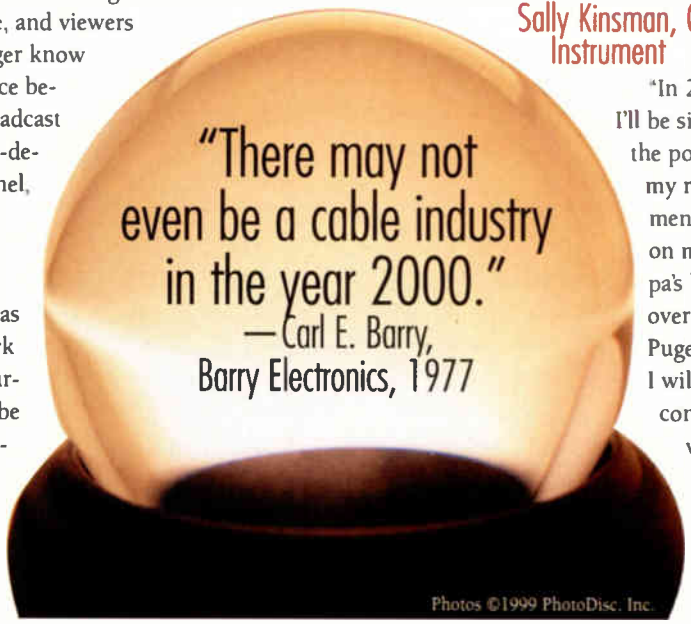
"I do not believe that TV sets will take the place of personal computers (PCs), but I do think that the conveniences of the Internet, especially electronic commerce, will very much become a part of our TV experience. As compression techniques continue to get better, TV-to-TV networking will take shape, including network gaming and even video conferencing."

Ron Hranac, High Speed Access Corp.

"My fearless prediction: All-optical technology will supplant some of today's electronic technology.

"Some of this optical technology is making headway into the marketplace now, but I anticipate that much of what is a combination of optical and electronic today will be all optical in the not-too-distant future. After all, why bother with cumbersome conversions between optical and electrical signals when everything has the potential to be done at the optical level?

"As technology provides the capability, a move from the world of electrons to the world of photons makes sense. Look for widespread use of optical components such as optical integrated circuits (ICs) and other optical 'semiconductors;' equipment such as optical routers, optical switches, optical processors; and full-blown optical systems. For that matter, why not an optical equivalent of the desktop PC? All of these will be based on photons rather than electrons for their major functions."



Sally Kinsman, General Instrument

"In 20 years, I'll be sitting on the porch of my retirement home on my grandpa's land overlooking Puget Sound. I will stay connected with the world and my cable friends via a wireless two-way device resembling a wrist watch.

"It will receive the Internet services of the future, such as VOD (video-on-demand), video telephony and medical scanning. A laser from the watch will scan images onto the retina of my eye, and all responses will occur through voice back to the watch-like device.

"Perhaps a sensor under the skin will replace the laser and voice, and directly communicate with the brain. No need to worry about arthritic hands or poor eyesight that will accompany me being 20 years older."

Dan Pike, Prime Cable

"Predictions involving societal use of technology across two decades are risky indeed, and often, as Schnaars points out, should be made by other than those closest to the technology.

"Nonetheless, we can reasonably predict for fall/winter of 2020 that:

- George Jetson has a cable-ready TV set.
- Several plants approach their 10th renewal/rebuild/upgrade. The concept of highest frequency is replaced by information throughput.
- Paul Maxwell or Paul Kagan starts a newsletter sent directly to the brain on alpha waves.
- Electronic communication has been gradually replaced by photonic communication. Optical signals are tuned like radio signals today.
- TV (imagery) is largely an individual medium, and interactive.
- The cable industry is extensively interconnected, like telephone or power today."

Now we wait

So mark your calendars; we'll want to know how well we did after the 2020 Western Show, assuming it still exists then. In the meantime, though, we'd like to know what you, the engineers and technicians working in the field, have to say. What do you think is coming in the next 20 years? Let us know. When we've got enough responses, we'll write another feature, this time from *your* perspective.

You can reach the *CT* editorial staff at 1900 Grant St., Suite 720, Denver CO, 80203; fax (303) 839-1564; or e-mail rhendrickson@phillips.com. CT

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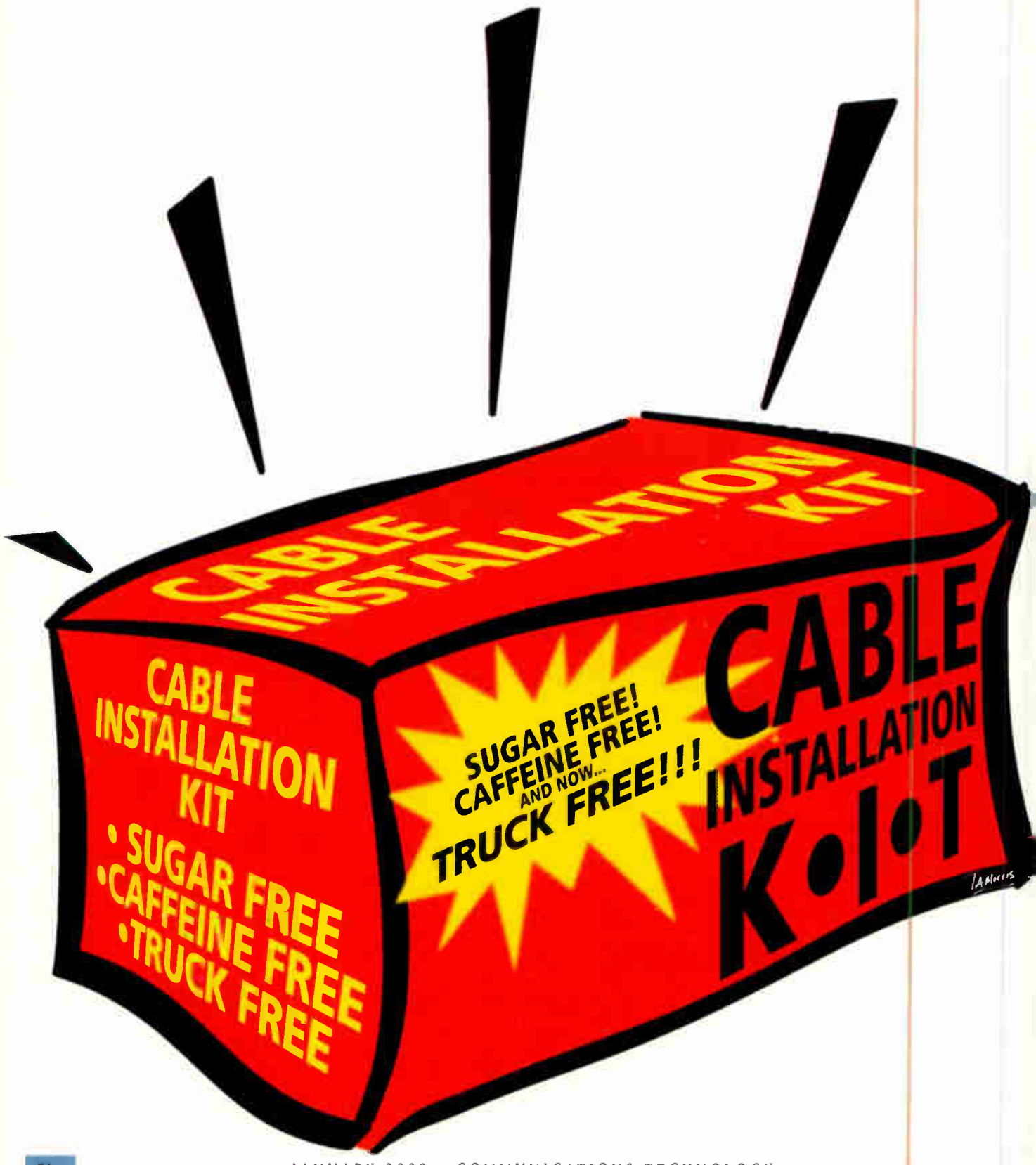
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Automation Relieves Provisioning Woes

By Doug Larson

The data over cable business is booming. But are you keeping up with demand? If you're still performing two-person installs, chances are you've got a backlog of unfilled orders. With competition for high-speed data services rising from telcos and satellite providers you can't afford to keep customers waiting. Automating your provisioning systems may give you the leverage you need.

Projections from a recent Kinetic Strategies report on the North American cable modem market indicate that more than 2.3 million Data Over Cable Service Interface Specification (DOCSIS) cable modems will be shipped this year. Moreover, by year-end 2003, the installed base of cable modem customers is expected to top 15.9 million, generating more than $11.9 billion in service revenue.

Good news, bad news

Great news, right? Well, sort of. You see, these numbers are predicated on a number of conditions, including retail distribution partnerships, the advent of plug-and-play modems and, perhaps most importantly, automated provisioning systems.

Although retail partnerships are sprouting up all over the country and high-speed data installs are at an all-time high, legacy provisioning systems and procedures are fast becoming crippled by the unprecedented demand. In fact, the installation backlog is growing faster than the installed base of cable modem subscribers at many multiple system operators (MSOs).

With cable modem installs expected to almost double from 105,000 a month in 1999 to 200,000 a month this year according to Kinetic Strategies' Michael Harris, the problems will only get worse. Add to this mix the need to manage subscriber life cycle events, such as changes to service or the addition of new services, and the problems become critical.

All is not lost, however. To the rescue have come bleeding edge remote provisioning wares from a host of vendors—many of them new to the cable market. The products offer the promise of lower overhead costs by reducing truck rolls and call center call volume, decreased time to market for new services, and increased revenue from tiered business and residential service offerings.

Slow road to high speed

The industry's provisioning woes are nowhere more evident than in the experience of the leading cable Internet service providers (ISPs). While Excite@Home and Road Runner service operate at blazing speeds, their existing provisioning systems don't.

"The provisioning process that has brought us to the point today where we have 430,000 subscribers has been a successful one, obviously, or we wouldn't be here now, but it's pretty labor intensive," says Ron Dobes, Road Runner's vice president of provisioning and system engineering. "It just won't enable us to scale to the millions of users we fully intend to hit next year and beyond."

Under the current scenario, customers call an 800 number to find out if they are in a Road Runner or @Home service area. In turn, the customer service representative (CSR) walks them through a qualification process to make sure their personal computer (PC) qualifies for the service (CPU speed, disk space, RAM space, operating system version and so on), verifies their credit rating and, if everything checks out, schedules a truck roll. This

portion of the process takes, on average, 10-20 minutes.

At the customer premise, the technician performs all of the necessary RF conditioning, removing upstream filters and so on. The tech then calls the CSR to assign a media access control (MAC) address to the cable modem, configures passwords and e-mail addresses and so on. This process can take between 1-2 hours and often requires an RF and data technician.

Out with the old, in with the new

Both @Home and Road Runner are focusing their initial efforts on reducing the need for this data tech.

To streamline this process, Road Runner has partnered with Cisco Systems and Emperative Inc. (formerly Multiflow Technologies Inc.) to launch an online subscription registration and activate process. This autoprovisioning system, which was scheduled for tests in MediaOne's Minneapolis system in December, will cut out the CSR middleman and allow potential customers to qualify for and remotely activate service via a Web interface.

"From an engineering perspective, this is a fundamental strategic part of the Road Runner architecture," says Dobes. "We are working with the billing vendors to define and implement those elegant, end-all, be-all, two-way interfaces that will enable all of the account information for all types of scenarios to be seamlessly transferred between Road Runner provisioning systems and the back-end billing systems."

@Home also is moving toward remote provisioning in a two-phased approach. According to Richard Holden, @Home's director of product management, the first phase focuses on the data install.

"In this case, it would be what we call a 'bottom up' system where a customer would just plug it in, and the modem would provision itself on the network and tell the system about where it's located," explains Holden. "That would happen automatically, and then the customer would do a software installation."

At this point, @Home's provisioning system would apply restrictive filters to give the modem limited access to the network so that customers could go to an activation page. Using the registration code the customers had been given when they originally ordered service, they then could choose an e-mail address, verify the services ordered and activate their account online. The system then would reboot the modem, apply a new set of filters and give it a globally routable address.

As in the case of Road Runner, Holden says @Home currently is in talks with major billing vendors such as CSG, CableData and Convergys to define the application program interfaces (APIs) to enable this information flow between @Home and its affiliate back-office systems.

In Phase II of the project, Holden hopes to further reduce call center volume.

"They would choose the service plan, let's say @Home basic or a professional version of @Home—or whatever the service plan might be. But they would have a choice to actually create their account online. In that way, we would reduce further the amount of time spent of the phone with Tier 1," says Holden.

"Today, they have some ability to do that online—they can order additional services online, like additional IP (Internet protocol) addresses for multiple computer support, or remote access capability so that they can dial up while they're on the road. But what we're talking about here is the overall basic service itself," says Holden.

Go to the source

While the new @Home and Road Runner provisioning platforms will be available to all of their affiliate MSOs, a number of other vendors out there are targeting operators directly with their multiservice provisioning systems.

Emperative

Emperative Inc., which is providing the prequalification technology for Road Runner's self-provisioning solution, is one such company.

"Going to the Road Runners and @Homes of the world is a very important piece of our strategy, but the ultimate customer is the MSO," says Abraham Gutman, president and chief executive officer of Emperative. "And the reason is the following: The subscriber ultimately is really owned by the MSO; he's not owned by the aggregator. So, the provisioning activity is an activity that is really owned and is critical to the MSO. Our product ... creates a bridge between the MSO and the provisioning systems that the aggregator has. But ultimately, it's the MSO that is really enjoying the fruit of the product."

For Gutman, who formerly was responsible for provisioning, order processing and service management for the Continental Cable (now MediaOne) high-speed data offering, the mission is simple: Remove the service delivery and management bottleneck.

Emperative's provisioning engine, called ProvEn, promises to automate and manage service delivery over the life cycle of the customer. The product, which spans

BOTTOM • LINE

Remote Provisioning, Nearby Benefits

The cable industry's foray into the world of advanced service offerings is in full swing. Estimates from Kinetic Strategies place the installed base of Data Over Cable Service Interface Specification (DOCSIS) modems at more than 15.9 million by year-end 2003, fueled by retail distribution partnerships, the advent of plug-and-play modems and automated provisioning systems.

Although retail partnerships are sprouting up all over the country and high-speed data installs are at an all-time high, legacy provisioning systems and procedures are not able to keep pace with consumer demand. In fact, the installation backlog is growing faster than the installed base of cable modem subscribers at many multiple systems operators (MSOs).

To help relieve these provisioning burdens, a number of new and entrenched vendors are targeting the market with cutting-edge provisioning systems. The products offer the promise of lower overhead costs by reducing truck rolls and call center call volume, decreased time to market for new services, and increased revenue from tiered business and residential service offerings. In some cases, these systems will even help you ensure the integrity of the offering you are providing once your subscribers are up and running on the service.

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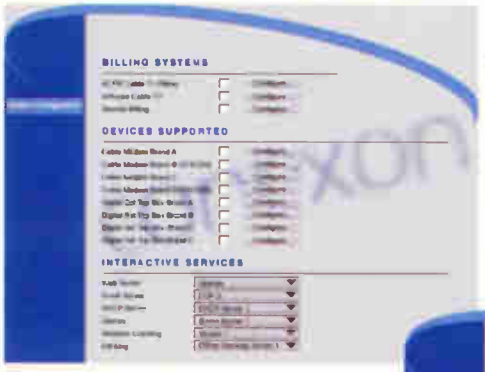

Interactive Enterprise's common user interface enables both subscribers and customer service representatives (CSRs) to view, in real time, a subscriber's account information. IEL's operator configuration screen allows an operator to remotely configure and provision end-user devices such as cable modems and advanced set-top boxes.

information technology (IT) and engineering, includes connectivity to billing, trouble ticketing and customer care systems via protocol adapters, or PADs; libraries of "tasks" on the network side that enable the MSO to configure network devices (cable modems, routers, cable modem termination systems, servers) from multiple vendors; and a provisioning system.

"(The provisioning system) actually manages the conversations between all those systems, in essence creating a plug-and-play situation where you pick your billing systems, you pick your network-side systems and devices, and develop, using a graphical environment, the connectivity required for subscribers to get these services either by calling a call center ... or by directly coming in and self-provisioning in the way that it is being done at Road Runner," says Gutman.

Interactive Enterprise Ltd.

Another company on the leading edge of remote provisioning technology is Dublin, Ireland-based start-up Interactive Enterprise Ltd. Founded in 1998, IEL has developed a product that enables MSOs to accelerate time to market with new products and remotely provision services over the life cycle of the customer. The system currently is in trials with U.S. operators, and the company recently announced a strategic alliance with Nortel Networks in Europe, under which Nortel will market the Conexon Mediation System as part of its Cornerstone cable, telephony and Internet solutions.

Conexon, which resides at a headend or hub, acts as a mediator between back-office systems and subscriber devices, enabling plug-and-play interfaces into cable modems and digital set-top boxes so that end users can self-install and self-subscribe to all of their cable provider's service offerings via a Web-based user interface. (See Billing illustration.) According to Tom Higgins, president and CEO of IEL, Conexon will enable an end-user to self-subscribe to just about any service imaginable, whether that be basic or premium video services, pay-per-view (PPV), video-on-demand (VOD), home shopping, or what have you.

From a self-installation/self-subscription standpoint, Higgins says his product will reduce operator overhead by more than 40 percent. He says it currently takes 43 technicians and 60,000 man-hours at a cost of $2.6 million to install 15,000 cable modems in one year.

Higgins says his product will reduce the one-year costs of installing 15,000 cable modems to 22 technicians and 30,000 man-hours at a bottom line cost of $1.3 million. With a retail model in place and assuming in-home wiring, filters and other RF conditioning issues are taken care of, these numbers are reduced to zero.

On an ongoing basis, Conexon integrates legacy customer management and billing mechanisms to allow operators to remotely manage, provision and "push" services and promotions to customers. Because the system uses a common user interface, customer information can be made available to the subscriber, CSRs, network operation center (NOC) engineers, field technicians or technical CSRs. (See Account illustration.)

"You'll find that most operators, if they talk about autoprovisioning and

Who's Who in Remote Provisioning

Want to find out more about the companies and products soon to be making a splash in the world of remote service provisioning? Here's a rundown of some of the players in this space.

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Broadband Access Systems
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www.basystems.com
Products: Cuda Provisioning Manager and Cuda 12000 IP Access Switch

CableData Inc.
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Products: CyberCSR

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(408) 526-4000
Toll free: (800) 553-NETS
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Products: Cisco Subscriber Registration Center

Core Networks
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Dartmouth, Nova Scotia
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(902) 481-5777
FAX: (902) 481-5799
www.corenetworks.com
Products: CoreOS Broadband Provisioning System

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Toll free: (888) 8CYGENT
www.cygent.com
Products: Fusion

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300 Bear Hill Road
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(781) 890-9899
info@emperative.com
www.emperative.com
Products: ProvEn

Interactive Enterprise
3016 Lake Drive
Citywest Business Campus
Dublin 24, Ireland
+353 1 4660600
FAX: +353 1 4660284
www.iel.ie
Products: Conexon

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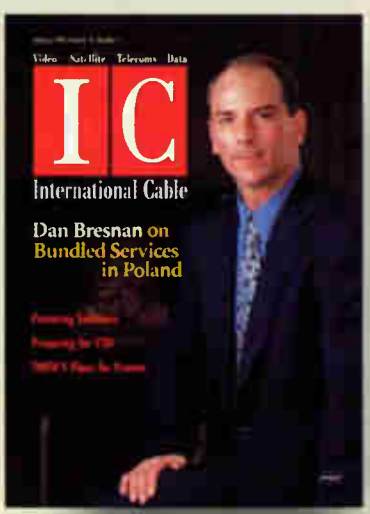

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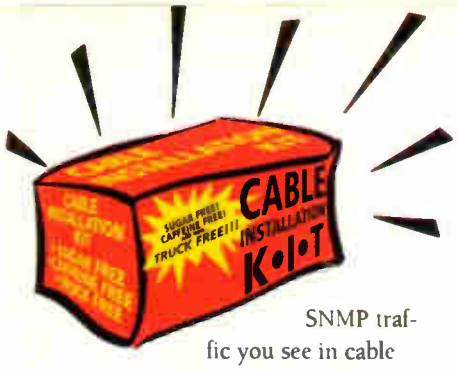

SNMP traffic you see in cable networks," says Campbell. "Traditional tools don't scale well when you get into tens of thousands of end devices. The engine is quite extensible and can interoperate with any SNMP-capable device. As digital boxes roll out across North America, there are real opportunities to deploy a system like CoreOS and use the boxes as data collection devices and extend the status monitoring aspect."

Campbell cites CoreOS's "Out of Spec Modem Report" as an example of this monitoring and reporting capability. This report can alert the appropriate personnel when a modem has exceeded a maximum upstream or downstream transmit power level of 60 dBmV, signal-to-noise ratios (S/Ns) and many other management information base (MIB)-supported variables.

The Network Weather Monitoring portion of CoreOS also enables network management at the IP layer and continuously evaluates round-trip latency and packet loss occurring between test stations and monitoring targets.

Broadband Access Systems

Broadband Access Systems also is jumping into the multiservice provisioning game with a system that supports automatic and dynamic subscriber provisioning and business-class QoS.

BAS's Cuda Provisioning Manager, a software suite designed to work exclusively with the company's Cuda 12000 IP Access Switch, includes a full server suite (selectable on a per-server basis), featuring: DHCP server, TFTP server, time of day (TOD) server, SYSLOG server and LDAP (lightweight directory access protocol) provisioning.

The system, which is fully integrated into a CMTS/edge router platform, is designed to reduce the number of network elements and provides increased security and performance over stand-alone solutions, says Mark Komanecky, vice president of marketing for BAS.

Moreover, he says his provisioning system provides full redundancy of provisioning servers and databases. "This reliability provides increased network reliability, ability to support business-class data and voice services, increased service revenue due to the ability to provide service level agreements (SLAs) and lowers operating costs," says Komanecky.

What's it all mean?

Bundled services clearly are the future of the broadband industry, and to capitalize on the opportunity you must be able to quickly and efficiently provision services to your customers and seize market opportunities today. If you don't, you can bet that someone else will. CT

Doug Larson is senior editor for "Communications Technology." He can be reached via e-mail at dlarson@phillips.com.

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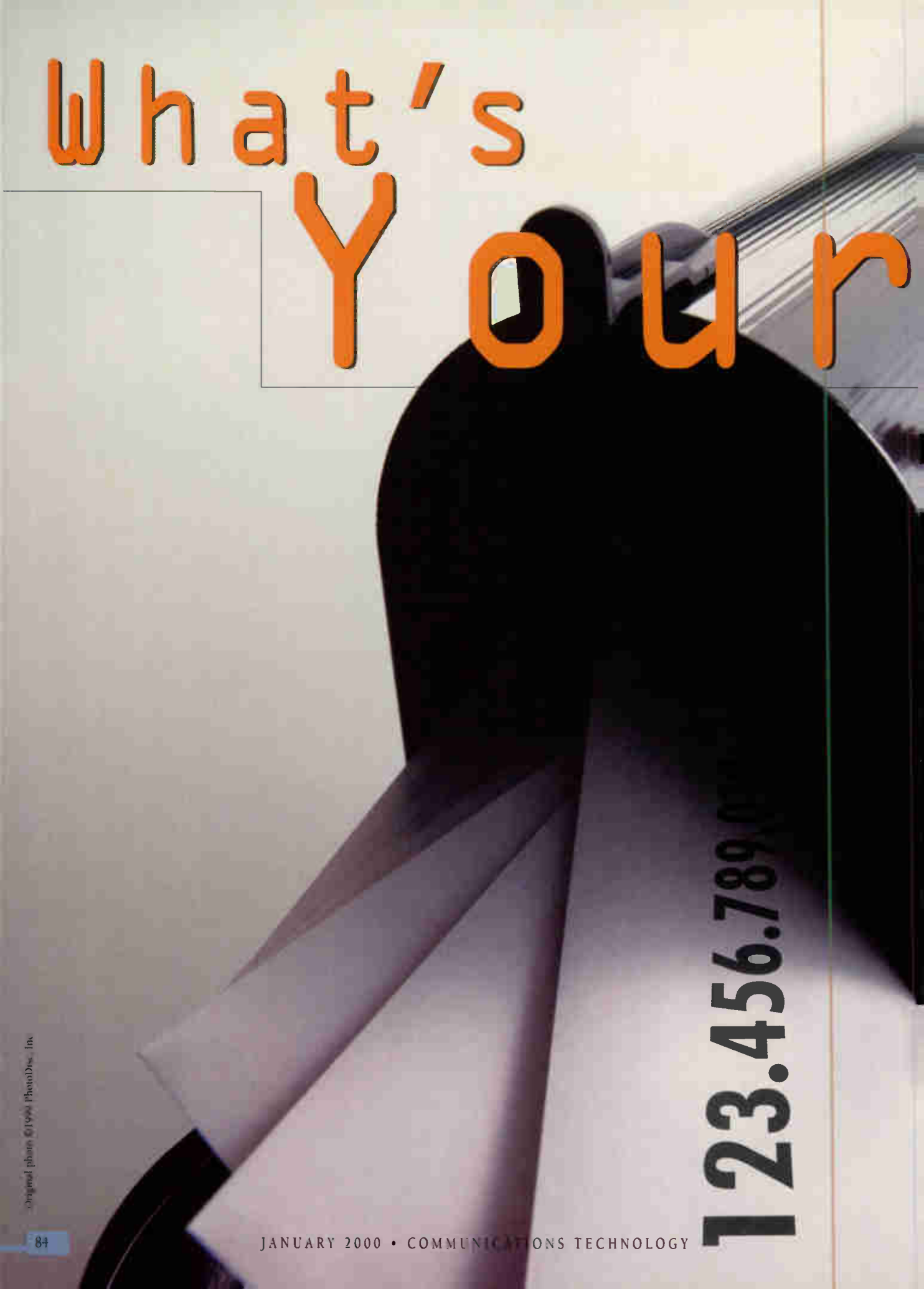


Address?

How IP Provisioning Affects Your Data Service

By Bruce Bahlmann

Operating a successful Internet service over a cable TV system requires a complex marriage between broadband and provisioning systems. Failure to understand the provisioning systems can result in prolonged or abandoned cable modem installs and unnecessary service calls.

The provisioning system provides the foundation from which basic Internet service via cable modems can be activated and maintained. But for many cable personnel, the provisioning system is just an unfamiliar black box. A critical component of the system is the address-provisioning server. Let's look at what it is, how to use it and how it works. In months to come, we'll tackle modem installation, troubleshooting, and monitoring the client experience in a series of articles.

What it is

Provisioning activates a client, the recipient of the process, via some type of electronic network. Provisioning does two things: It identifies (singles out) the client, and it gives the client operating instructions and parameters. Singling out a client is called "registering." The word "provisioning" also is used more generically to mean activating different services. For example, when a customer signs up for high-speed data service, several things have to be "provisioned," including e-mail addresses, personal Web site, network interface card (NIC), cable modem, service level (bandwidth, filtering options and so forth) and remote dial-in access.

Address provisioning involves the management and distribution of Internet protocol (IP) addresses, ensuring that a unique IP address is given to every registered client. Both a cable modem and a personal computer's (PC's) NIC represent address provisioning server clients. These clients are identified by their network interface address, a media access control (MAC) address.

The client's MAC address enables it to communicate with other clients on its network segment (subnet). The MAC address also is the identification component that must be registered with some method of address provisioning to enable each client to access clients outside its subnet—that is, on the Internet at large.

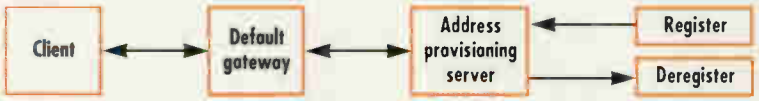
Understanding the basics of address provisioning provides a foundation from which to master modem and PC installation and troubleshooting.

Where it comes from

Address provisioning has evolved through the life of the high-speed data offering. During the early days of high-speed data, we used "static addressing" to configure individual modems and NICs. Static addressing is the oldest method of address provisioning and one of the easiest to implement.

Although a superior address method called "dynamic addressing" was available at the time of the alpha/beta trials (actually being used by several beta customers), the PC operating systems, such as Windows 3.1x, of the day couldn't support it. The hallmarks associated with static addressing are a master list (authority) that

Address provisioning process



Source: Media One

tracks all the addresses, manual assignment of IP addresses to clients, continuous record-keeping for accuracy, high reliability because network access didn't depend on additional hardware/software, and a labor-intensive process.

Static addressing manually tracks the assigned addresses on a master list. Though the medium of the master list can vary (paper, spreadsheet, database), the concept remains the same. Addresses are manually assigned and then handed out to each client on a given subnet, recorded in the list, and then manually entered into the client's network settings.

Assigning these addresses to clients establishes a one-to-one relationship between a given IP address and the client it is assigned. This relationship ensures the client that its IP address is unique, resulting in reliable Internet access.

Note that if any two clients receive the same IP address, only one of them will function properly. Simultaneous access will result in an error or a "race" condition, in which the first client to use the address wins—the other client is denied access.

But static addressing lacked scalability and support for inevitable growth. Doling out a handful of IP addresses a day to support installations works well with static addressing, but doling out thousands would take a whole staff to manage properly.

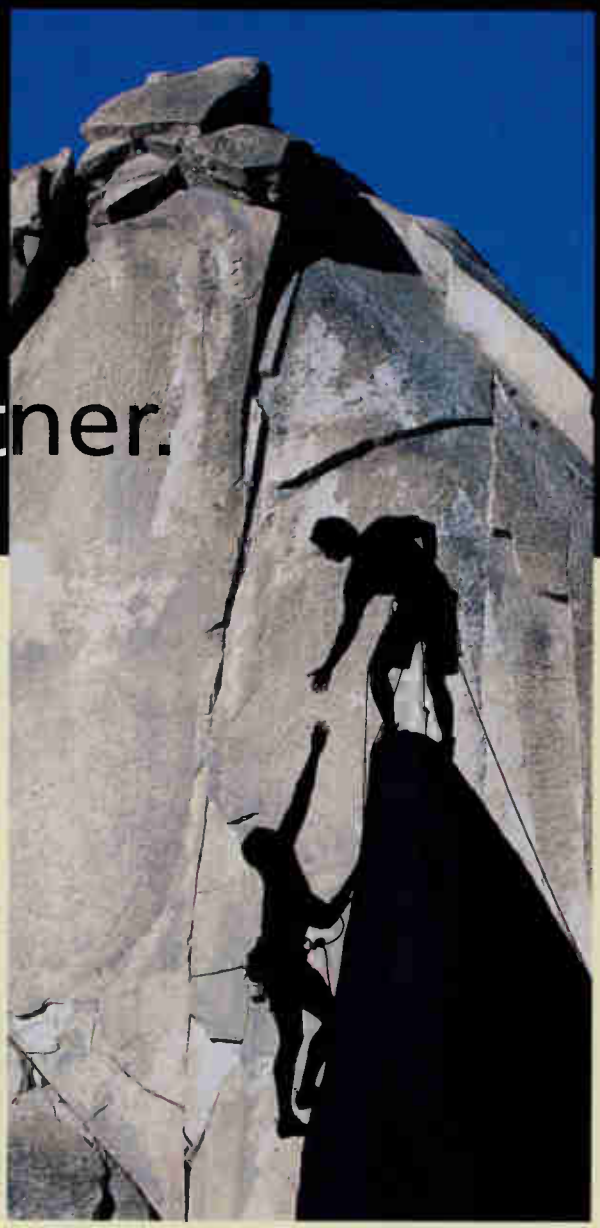
Static addressing also has growth limitations. For example, as demand increases for high-speed data in concentrated areas, the number of IP addresses available in that area eventually would run out. Once the addresses were used up, you'd need to contact customers to instruct them how to manually reconfigure their network settings.

What it's become

By the end of the initial high-speed data trials, minimum standards on PC operating systems were set by dropping nondynamic addressing-compliant operating systems (OSs). The components generally associated with dynamic addressing in today's systems are:

- An application server continuously maintains available pools of addresses.
- Dynamic addressing automatically doles outs correct addresses in the form of a "lease" to registered clients, forming a one-to-one relationship.
- Dynamic host configuration protocol (DHCP) establishes the rules for server-to-client interaction.
- The client depends on interaction with the address provisioning server to maintain Internet access.
- Troubleshooting client problems requires knowing its "current" IP address. ➤

There are moments when you really appreciate a reliable partner.



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How it works

Dynamic addressing uses a database as its master list called a lease database, a server as its manager, and a temporary IP address called a lease. Its operation resembles borrowing money from the bank. The bank performs a credit check and ensures you are who you say you are, you negotiate the loan and sign some papers, and then if everything checks out, the bank lends you money for a specified amount of time.

Using the bank example as an analogy, the address pool is similar to the funds a bank has in reserve for lending. The server is the loan officer. The lease (temporary IP address) is the actual loan, you are the client, and DHCP represents the rules that govern the transaction, as well as the language spoken to negotiate the loan.

The key function that permits dynamic addressing is the concept of a lease, which is an association between a client and an IP address maintained in the address provisioning server's lease database. The resulting association is an IP address that is loaned to the requesting "registered" client for a fixed time. Therefore, a lease is a temporary association that the server establishes at a registered client's request between that client and an available IP address for a finite period.

The server records the lease in its database. The client tracks the lease parameters (renewal, rebind and expiration time) and uses them and the IP address to maintain a consistent IP address.

The client uses DHCP to negotiate the

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Knowledge Breeds Efficiency

During one phase in the cable modem installation process, installers find themselves watching an array of lights on the cable modem waiting for it to activate. Installers often speculate what is going on behind the scenes as they watch these lights because, to them, the provisioning system represents a mysterious "black box." Unfortunately, this lack of understanding of the address provisioning system can result in prolonged or abandoned installs or unnecessary service calls.

Dynamic Internet protocol (IP) addresses are the lifeblood of high-speed data, and the address provisioning server is the heart of the system. Without the heart, the whole system fails, and without the veins (RF plant or network) parts of the system can fail. Often, localized outages are misinterpreted as widespread outages. In a majority of these cases, the actual problem is right in front of the installer—a computer configuration problem, RF wiring issue or bad cable modem.

Having a basic understanding of the address provisioning system reduces the amount of speculation and leads to more productive time spent installing and troubleshooting high-speed data service.

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creation, transfer, and termination of the lease based on the renewal, rebind and expiration time parameters. The renewal time informs the client when it is supposed to validate the lease with the server. Short renewal times enable the server to continually communicate with clients, updating them on possible changes to the network.

Rebind time is an escalated state that tells the client to seek alternate means of contacting an address provisioning server on the network. Request/renewal is a broadcast rather than a unicast. Finally, expiration time informs the client when the IP address it is using is no longer valid—forcing it to request a new address.

The premise behind dynamic addressing is that it allows continued dynamic assignment of IP addresses. For example, when the available IP addresses become exhausted, the server can expand the pool of available addresses without having to manually modify any configurations on the clients.

Well-configured address provisioning servers strive to force lease parameters such that from the client's viewpoint, it has a very short lease, and from the server's standpoint, the client has an infinite lease. This permits frequent transactions between the client and the server and infrequent client IP address changes. The goal is to propagate information from the server to the client quickly and change the client's IP address only when absolutely necessary.

Today's address provisioning system performs several tasks, including cable modem activation and PC NIC activation.

It provisions a cable modem by giving it a dynamic address and a configuration file it must download to operate properly. It provisions a NIC by giving it a dynamic address and some other information, such as a domain name server (DNS).

Provisioning goals

Today's provisioning servers seek to achieve five goals in cable modem and PC NIC support:

Security: An option activated on the address-provisioning server allows only known MAC addresses to communicate with the server. The server "learns" MAC addresses through the registering process that stores a client's MAC address into a registry database in the server. Unregistered MAC addresses will not receive responses from the server.

Roaming: A provisioned modem can work from anywhere on the network. Roaming allows a technician to connect a provisioned spare modem at the customer site to troubleshoot provisioning problems. Without the roaming feature, a technician would need a separate modem for each subnet served. Roaming also allows customer cable modems to become operational at the field-provisioning site before installation at a customer site.

Conservation: An option on the server enables a roaming client to use only one IP address. Without conservation, a single client could consume multiple IP addresses, making it hard to determine which IP address the client currently is using.

Automation: Improvements in DHCP software and operations make changes in operational parameters transparent to the user with little or no down time. For these changes to be truly transparent, there must be synchronization between networking and address provisioning software to enable timely systemwide changes.

Auto-provisioning: An address provisioning server responds to unknown clients differently from known clients. For example,

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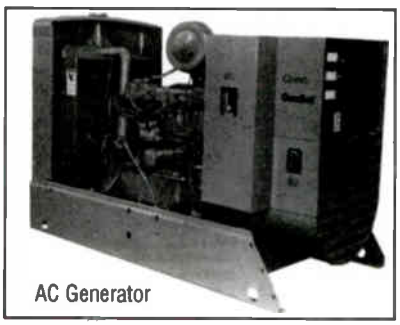

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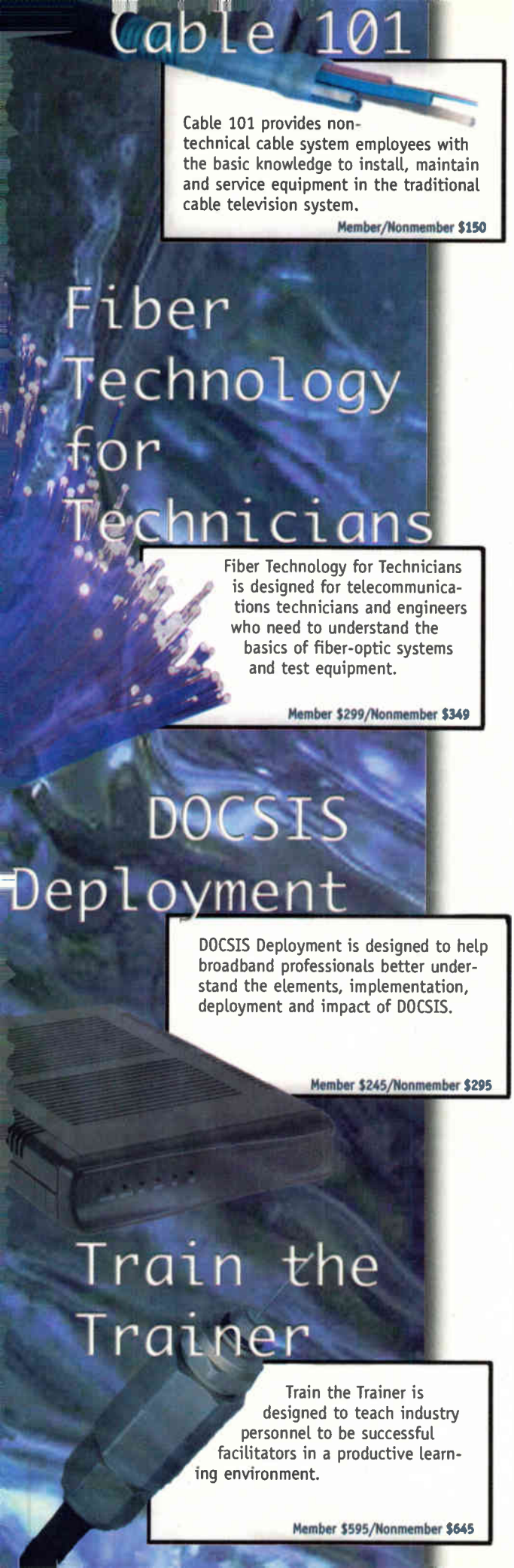

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unregistered clients may be given different IP addresses or different parameters than registered clients. This variation in parameters often is used to restrict unregistered clients' access so they are motivated to register for full use of the connection.

Address provisioning process

This process defines the events leading up to a response (if any) from the address provisioning server. The accompanying figure (on page 86) shows the interaction between various components of the process.

Each request initiated by a client follows this process leading up to the response from the provisioning server. Although the types of request for computers and modems differ in information requested, they both follow this process.

The default gateway enables the address provisioning server to group "similar clients," which have the same operational parameters, such as transmit/receive frequencies. All transactions between the client and the server must funnel through the default gateway (router). This is on the client's subnet and provides passage for server requests by forwarding them directly to the address provisioning server.

From the server's perspective, the default gateway lets the server logically separate requests from clients, enabling it to treat clients from separate subnets differently. With multiple default gateways, you can enable a group of clients that require different operational parameters from others in the same area. That is, you can run two frequency pairs on a single node.

Formulating the address provisioning server's response requires moving through the server's logical process. A set of parameters (DHCP options) are generated to compose the server's response to the client's request. These parameters are set from "general" (defaults) to "specific" (nodes) such that a more specific parameter can override a less specific one.

An operation called de/register allows external applications such as a billing system to remove or add cable modems and NICs from or to the server's registry. De/registering effectively regulates each client's operation by controlling which parameters it gets.

Address allocation and management

The goal of IP address allocation is to formalize the areas where certain addressing methods can reside to streamline troubleshooting and standardize the building-out of the network.

Once a subnet is created for a new city or added to relieve an area where a majority of the addresses are in use, the operations group monitors it to ensure that a certain percentage of available IP addresses exist to sustain new installations. A daily IP address report typically provides the operations group with this information about current IP address utilization.

The operations group pays close attention to the "percent used" and tries to keep it around 70-80 percent. Maximizing the use of existing addresses increases success in requesting additional IP addresses.

When a subnet becomes highly utilized

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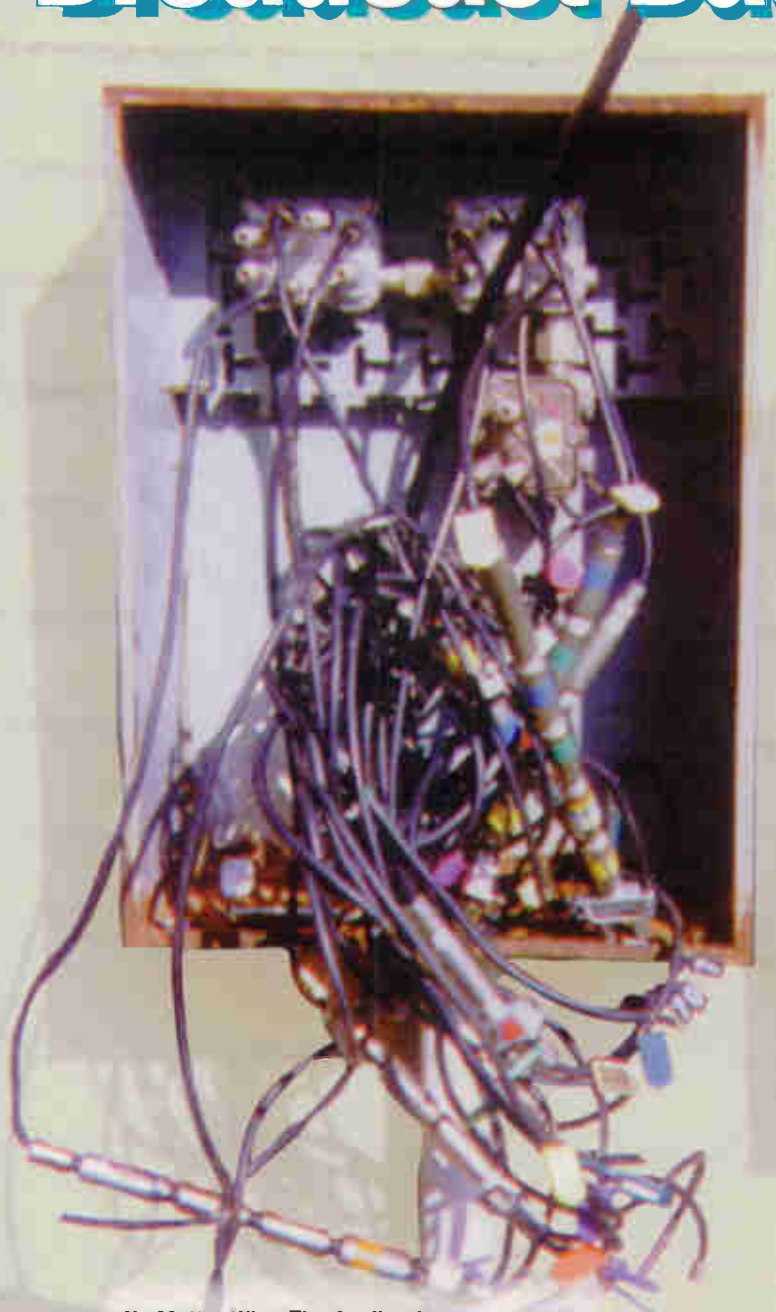

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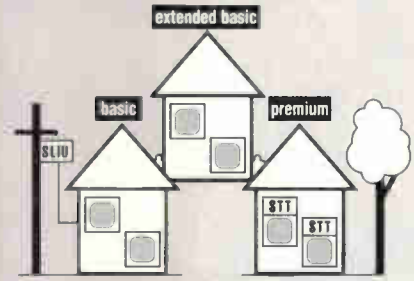

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Reader Service Number 60

(90+ percent), an event called "renumbering" is scheduled. Renumbering is how the address-provisioning server introduces new networks in areas that are low in available dynamic IP addresses.

Renumbering is both a network- and server-initiated event that forces modems and NICs to "roam" to a new network. DHCP assigns clients new addresses on the new network and then frees up previously held addresses.

During a renumbering, customers residing on an existing subnet are divided in half. Half the customers will remain on the existing subnet, and the other half will be moved to a new subnet. Eventually, renumbering events will affect a smaller and smaller number of clients and become almost transparent to the end user.

Clients moved to a new subnet encounter a change in the default gateway. This change temporarily blocks their access to the Internet as well as the route to the address provisioning server. To resolve this issue, clients must either reboot their PCs, or the lease times on the client must be set in such a way as to enable it to recover, say by placing the rebind time seconds after the renewal time.

Cable modems, while also affected by renumbering, are forced to reboot as they experience a disconnect with their cable modem termination system (CMTS). Rebooting forces a "discover" request, which will allow the client to find the address provisioning server using a different route.

Use of private addresses

Unlike dialup Internet service, high-speed data cannot reuse IP addresses of customers who have logged off. This problem is solved through the use of private addressing (10.x.x.x or 10Net) for cable modems. Private IP addresses work similarly to regular IP address except that they are not routable on the Internet.

By using private addresses, high-speed data consumes routable IP addresses only for each NIC on the network. Consequently, cable modem troubleshooting must either take place locally or from some machine that has a local presence but is accessible from the outside.

Wrap-up

As high-speed data service becomes more common, the importance of understanding the basics of IP addressing provisioning increases proportionally. As we've just seen, the topic isn't overly difficult; it's simply unfamiliar to most cable personnel.

When installing and troubleshooting high-speed data service, understanding the system reduces the amount of speculation and leads to more productive use of time. Technicians and installers will be able to tell the difference between hardware problems and connectivity problems, reducing truck rolls and saving time lost to wild-goose chases.

Bruce Bahlmann is a senior systems engineer for MediaOne's Internet Services Group. He can be reached at (651) 634-3246 or bahlmann@bigfoot.com.

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Reader Service Number 62

The Importance of

Optimize Bandwidth Within the Compressed Digital Domain

By Fabrice Quinard

"Be careful what you wish for" could be the watchword for cable operators striving to meet the rising tide of new technologies and changing regulations driven by the conversion to digital TV (DTV). Market-driven, multiple-sourced demands are being made upon operators to deliver customized programming as they seek new revenue sources to offset broadcaster DTV deployment costs.

The competitive challenge

How digital video is managed can create enormous opportunities for the cable operator that can provide services such as ad insertion, Internet access, datacasting, telephony, video-on-demand (VOD), home entertainment and interactivity capabilities. Program variety and choice, superior video and audio quality, and easy interfaces must be offered to consumers to retain and gain subscribers in a competitive TV-broadcasting marketplace.

On the other hand, while operators will have better tools to control programming, the sheer volume of digital video content to manage will exert overwhelming demands on available bandwidth.

Alex Best, executive vice president of engineering at Cox Communications, recognizes that as more digital programs are added, the need to use bandwidth efficiently becomes increasingly important.

"We do bandwidth upgrades, and then we add more channels, and recently, lots of digital channels," says Best. "But as long as we had spare bandwidth, it wasn't quite so critical that we figure out how to recover spectrum that's being taken by the carriage of channels that we don't actually offer."

Delivery of digital video programs starts with a variety of compressed digital sources that include local feeds such as video servers and data servers, tape and live video, and remote feeds such as satellite and broadcast. These multiple sources are received as constant-bit-rate (CBR) or variable-bit-rate (VBR) bit streams.

Alternate options

How have cable operators managed to combine and remultiplex bit streams from these multiple sources? Two alternatives have been in practice up to now.

The first option involves decoding Moving Picture Experts Group (MPEG)-2 video to baseband and re-encode, a digital-to-analog-to-digital process that decodes and re-encodes VBR streams. Decoding to the pixel level is expensive, and a general loss in picture quality occurs at each step.

The second option, CBR remultiplexing, separates VBR streams into stacked CBR streams. Inefficient use of bandwidth reduces compression ratios and the number of programs in the multiplex, decreasing program options.

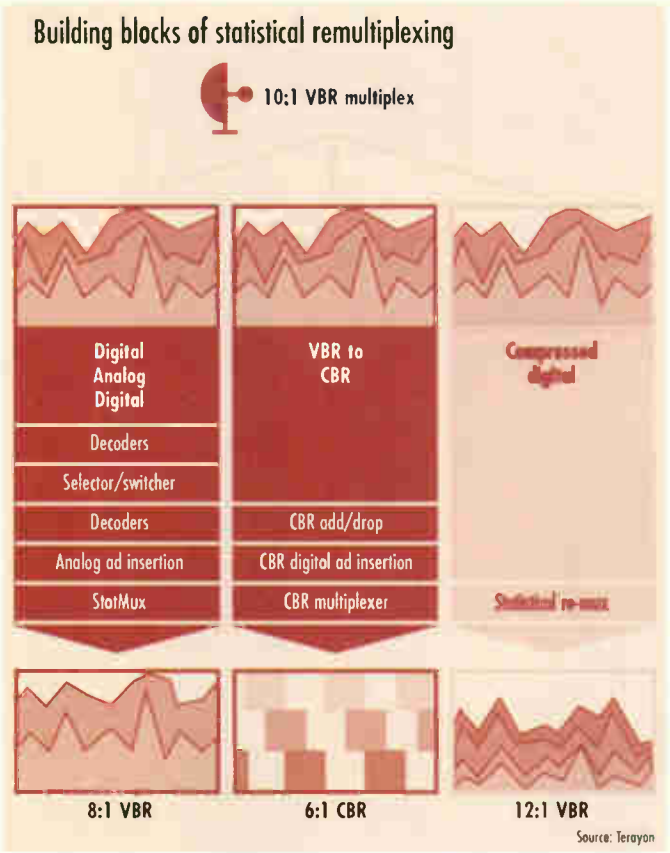
Cox Communications is among those operators that have gained more control over their bandwidth through digital grooming. Says Best, "As we start bumping the top end of the spectrum and the capability of the system, the first step that we take to recover bandwidth is to groom those multiplexes and eliminate those programs that we don't actually intend to offer to our subscribers."

With grooming, the operator can assemble programs from a variety of multiplexes and feeds and create customized programming delivered as single or multiprogram

Good Grooming

transport streams. "To that end, we have started doing that in probably four or five of our cable systems scattered around the country," says Best.

Charter Communications also grooms to achieve better bandwidth management. "The amount of bandwidth that we do have available for the programming, we're trying to send out to our customers. We're trying to preserve bandwidth, and in order to do that efficiently, this is the only means that we have available today," says John Pietre, senior vice president of engineering.



Multiplexing in order to simplify

In the grooming process, MPEG-2 multiplexes from remote and local sources must be processed through a demultiplexer, transcoded and then remultiplexed to form the outgoing multiplex.

To transmit a coherent outgoing program transport stream with good picture quality, this process must include parsing, synchronized scheduling, stream transcoding and splicing, and analysis and service information editing. This supports the capability to groom programs selectively to create a customized statistical multiplex and to transmit it over the space of a single analog channel, enabling operators to:

- Filter satellite program statistical multiplexes to select only desired programs
- Add new programs such as local channels and pay-per-view (PPV)
- Use bandwidth efficiently to permit addition of other services
- Digitally insert local advertisements and programs

The key to each goal is stand-alone statistical remultiplexing. The first step is to input the multiprogram transport stream, represented here by the block arrow. (See the accompanying figure.) Its source could come from real-time encoders, a video or VOD server, or a satellite transponder such as one of the pods on Headend-In-The-Sky (HITS) carrying 12 programs. A program or service is made up of streams that can be composed of video, audio and data streams.

The streams go directly into a parser. The next step is operator input from the scheduler through a schedule-import graphical user interface (GUI), where stream selection and correction processes take place. That's where decisions are made for what's going to be on the output and for controlling the bit rate.

Splice of life

After stream selection and correction, one stream will be spliced into another stream. Seamless MPEG-2 splicing between video and audio streams enables digital ad insertion without black frames in between.

The next block is the recoder, where bit rate adjustments occur. The recoder is required because transponder output bandwidth always is fixed, so the remultiplexer must adjust the bit rates of each individual stream to interlock all of the chosen streams together into the given output bandwidth.

At the heart of the system, the statistical remultiplexer's job is to perform rate control and to monitor how the transcoder and the splicer operate. These three elements collaborate to ensure that relative timing is maintained, that the target decoder buffers are managed correctly, and that all the streams are addressed.

In statistical multiplexing, each program dominates the bit-rate capacity at one point or another, when it takes much more than its "share" of the total bit rate

BOTTOM • LINE

Grooming Optimizes Bandwidth Management

The transition to digital TV (DTV) is in full swing, and it presents cable operators with many lucrative opportunities and substantial challenges. The revenue-generating potential of video-on-demand (VOD), Internet access, enhanced TV, ad insertion and other digital services is compelling, but meeting the need for additional bandwidth can be daunting.

Statistical remultiplexing has emerged as a cost-effective method for operators to maximize available bandwidth and to manage their digital video content and services. The use of statistical remultiplexing to "groom" a customized channel lineup using content from a variety of sources (such as satellite transmission, terrestrial broadcast, local video servers and so forth) is enabling operators to utilize their bandwidth to the fullest and to provide programming specifically tailored for their subscribers.

CherryPicker grooming system installed in TeleGeneve central digital headend in Geneva, Switzerland. Photo courtesy of Terayon

available. To achieve constant picture quality for all streams, the bit rate must vary for each stream so that more complex video programs receive more bandwidth and less complex programs receive less bandwidth. Remultiplexing accomplishes these objectives and maximizes bandwidth efficiency.

A synchronization and timing block serves the critical tasks of monitoring the timing and information between the streams and assuring that all the streams are synchronized together. The information from an analysis block goes to the statmux and also to program specific information editing.

This information must be reconciled and compiled so that the different pieces of information are brought together to describe the resultant single stream. That information is then fed back into the packet addressing system and the remultiplexer and included as part of the outgoing transport stream.

Statistical multiplexing allows operators to filter satellite streams to select only the desired programs.

Tie it all together

These building blocks of advanced digital deployment already enable cable and satellite providers to build value and revenue opportunities by selecting unique combinations of multiple services integrated into one unified stream to serve their customers.

"At least in my own company," says Best, "the next bandwidth recovery need will be to get a digital box in all the pay households and then to drop carriage of analog pay and pay-per-view channels, which comprise somewhere between 10 and 15 analog channels on our cable systems. When we introduce video-on-demand, which we will be trialing this year, certainly we will want to statistically multiplex those codes." CT

Fabrice Quinard is director of engineering at Terayon Communication Systems in Santa Clara, Calif. He may be reached via e-mail at fquinard@terayon.com.

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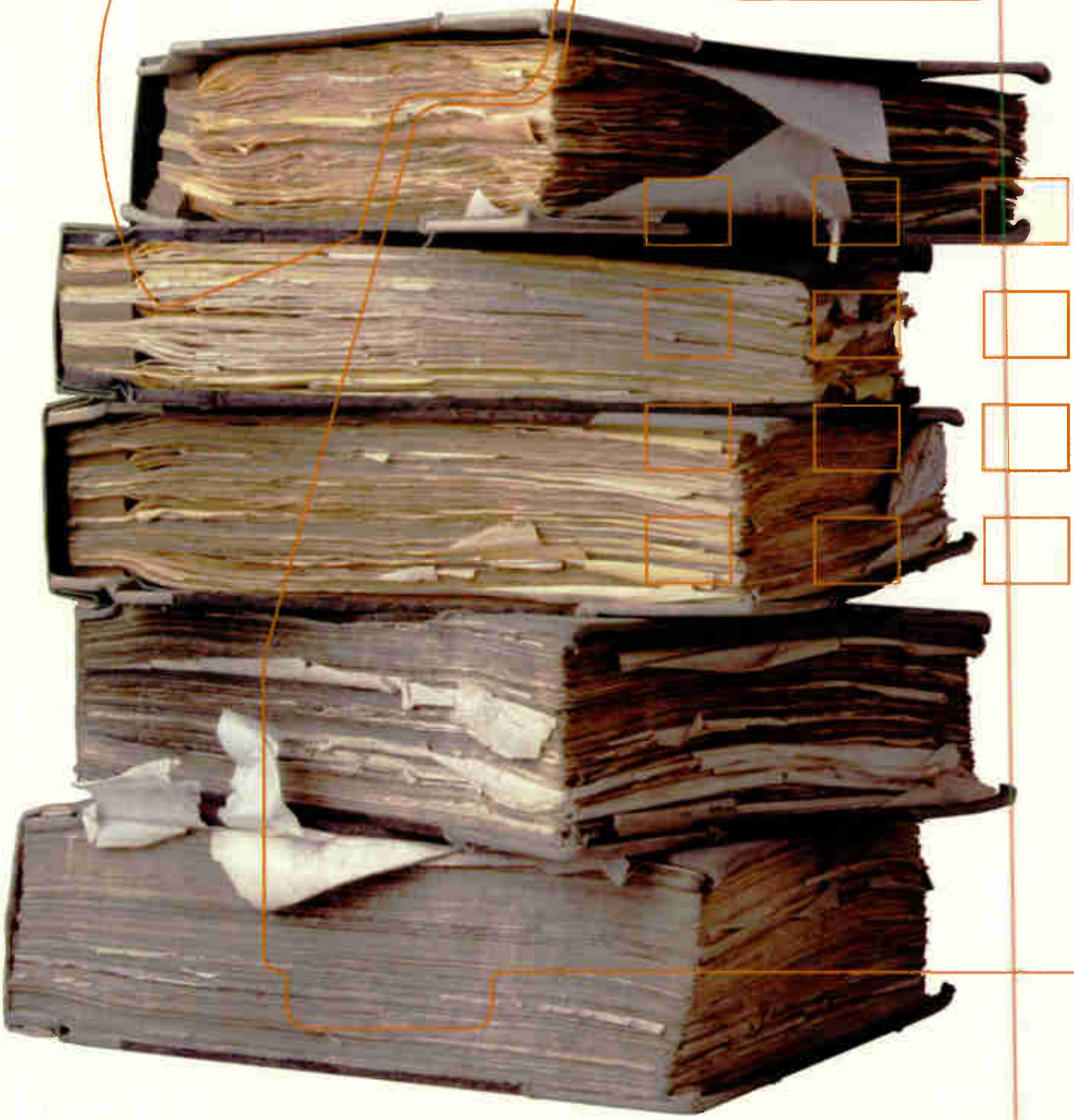

J Want to Offer ephone Services

A Cable Primer for Planning

By Justin J. Junkus

Telephony has become the latest cable buzzword. Put it together with the letters IP (for Internet protocol), and you have the newest call to action within the cable industry. But what exactly is telephony, how does it differ from IP telephony, and how does an operator build systems for one or both of these technologies?

To begin, operators need to mentally separate the word telephony from the adjective IP. Some definitions might help. Telephony is any offering of two-way voice transport or switching services to a customer that allows the customer to complete a telephone call to another party on the public switched telephone network (PSTN). There are several ways to complete telephone calls and several parts to call completion. There are, therefore, a multitude of ways to offer telephony, and a multitude of opportunities. Some involve IP technology, and some do not.

Definitions

The term "IP" comes from the name of one of the layers in the protocol model for the Internet, which was created by the U.S. Department of Defense as a governmental network of networks. IP closely correlates with layer 3 of the Open System Interconnection protocol reference model. In both models, this layer is where manageable units of information called packets are created and prepared for movement across a network.

The concept of segmenting information streams into packets, and giving those packets a header that specifies where to send the information and how long it can remain in the network, have stood the test of time as a prerequisite to communicating on the Internet. IP has thus become a platform for moving many types of information across the Internet, including

multimedia content, network control signals and database records supporting applications using the content.

Given these definitions, a service provider can offer telephony with, or without, IP technology. Offering it with IP technology provides the benefit of building the platform for future services that depend on the Internet. This often is the implied context of the term IP telephony, especially when used by the traditional phone companies. To them, voice over packets plus an IP platform equals new service revenue and less cost to move information.

For this reason, existing telephone networks are migrating toward IP telephony and away from traditional time-division-based circuit-switching. Many of the incumbent telephone companies have publicly stated that they will be buying their last circuit switch within the next year, and after that time, all new networks and supporting infrastructure will be IP technology.

Why forego IP?

So why would any cable company offer telephony without IP? For the simple reason that the market is ready for new telephony carriers now, and the technology for telephony over packets may not be ready for prime time for another year or two. Offering telephony now forces an operator to begin building the infrastructure needed to be competitive in the future. Feedback from initial cable telephony offerings indicates the infrastructure can be at least partially financed by today's telephony revenues: Take rates of 20-30 percent of homes passed are typical.

The infrastructure includes support for customer service, billing, maintenance and administration. It also can be built using IP technology, which makes it easier to tie everything together into a unified system when the service itself becomes IP-based. It is not, however, necessary to begin with all the pieces built on the same technology. In fact, the phone company's part of the PSTN and its support was not built this way, but is rapidly evolving to a unified IP-based technology.

Three parts to a plan

Regardless of the particular path an operator takes to a telephony offering, being a long-term part of the telephone business eventually will require commitment to three components—telephony service offerings, standard IP telephony technology and infrastructure. The particular order of this commitment depends on the operator's strategy and resources.

Service offerings

Telephony services can be grouped into three broad categories: residential, business and transport. Residential service is most closely aligned with cable's traditional market and can be offered to subscribers in single or multi-unit dwellings. Business service, although a departure from traditional cable markets, is a potentially lucrative offering that can leverage cable's existing networks. In addition to telephone line replacement, it can include customer premises switching equipment, line multiplexing and connection to other networks.

Both residential and business telephony services require two-way capable plant to the subscriber. Transport services, on the other hand, do not involve direct connection to a subscriber. Rather, they are the resale of network capacity or media, fiber optic or other, to another telephony carrier.

Both residential and business service need to be available virtually all of the time. This capability, which has become known as lifeline service, requires extremely reliable network power sources. An operator needs to either provide power via the network, or by a connection to local power at the customer's premises. To guarantee reliability, backup powering also is required, which may be a local battery at the customer's premises, or a backup system within the network. These requirements can mean substantial financial commitments by the operator.

Residential or business service can be circuit-switched or packet-based. In the circuit-switched version, the operator provides an alternative to the incumbent phone company's service, using the same time-division-based switching technology as the incumbent phone company's, but with cable access, rather than telco twisted-pair.

Circuit-switched solutions

As shown in Figure 1 (on page 106), the subscriber's existing telephone wiring is connected to the cable company network at the network interface unit (NIU). The connection is continued over the operator's hybrid fiber/coax (HFC) network to a time division multiplexed (TDM) switch, which the operator must either own, or have an agreement to use with another service provider.

Subscriber line features, which are defined and controlled by the switch's

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Internet protocol (IP) telephony has become a hot thing in the cable industry. But what exactly is it, how does it differ from circuit-switched telephony, and how do you build systems for one or both of these technologies?

First, telephony isn't necessarily IP. Telephony is any offering of two-way voice transport or switching services to a customer that allows the customer to complete a telephone call to another party on the public switched telephone network (PSTN). There are several ways to complete telephone calls and several parts to call completion.

You can offer telephony with, or without, IP technology. Offering it with IP technology means building the platform for future services that depend on the Internet. Offering it with circuit-switched technology will be quicker to deploy and get revenue moving.

Regardless of the technology, telephony eventually will require commitment to three components—service offerings, standard IP telephony technology and infrastructure. The order depends on your strategy and resources.

Building a telephone business is not a one-time task. You'll have to re-evaluate service offerings, standards and infrastructure each year. These periodic adjustments might seem worrisome, but they indicate that you can respond to new customer needs and market opportunities.

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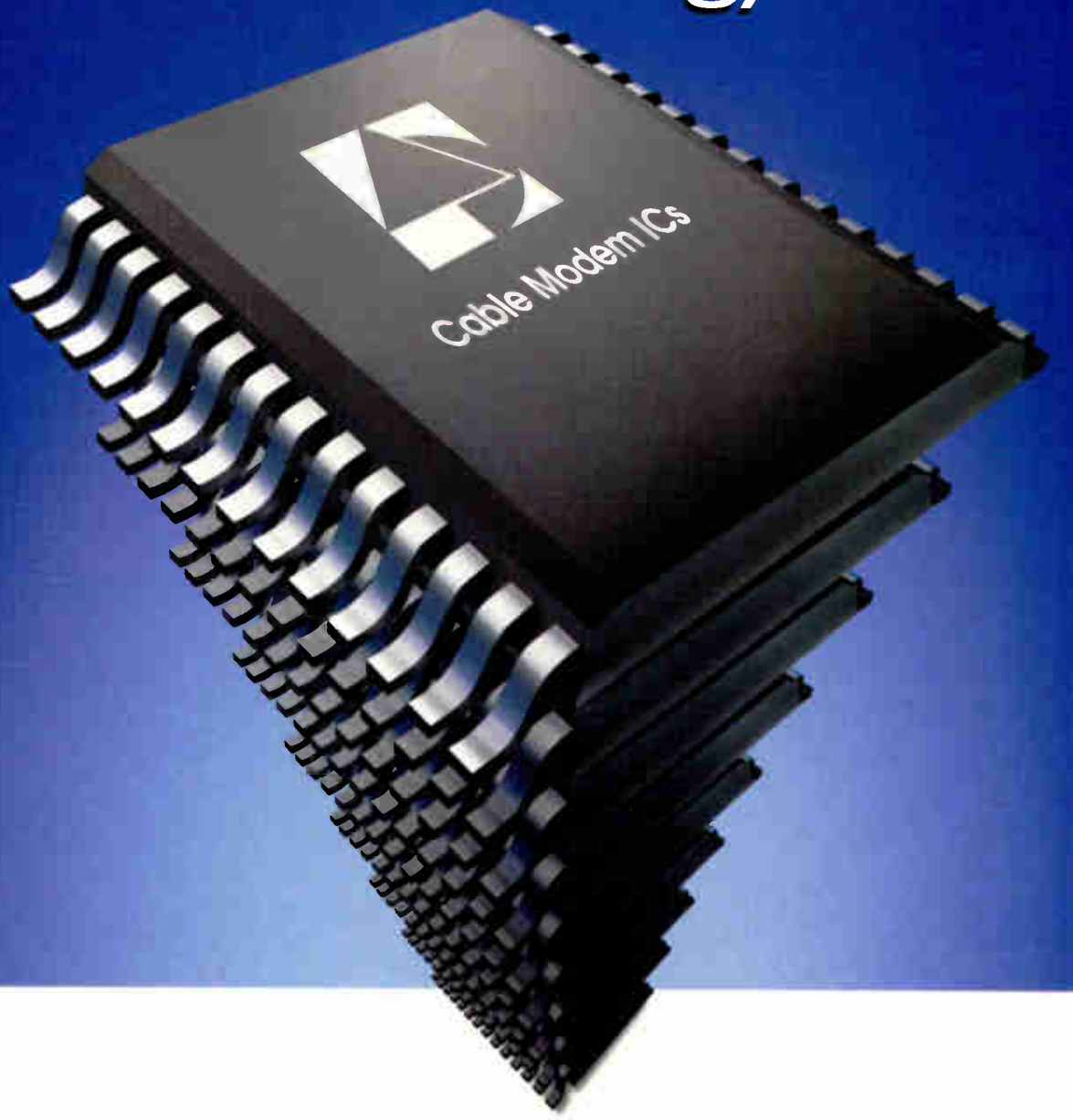

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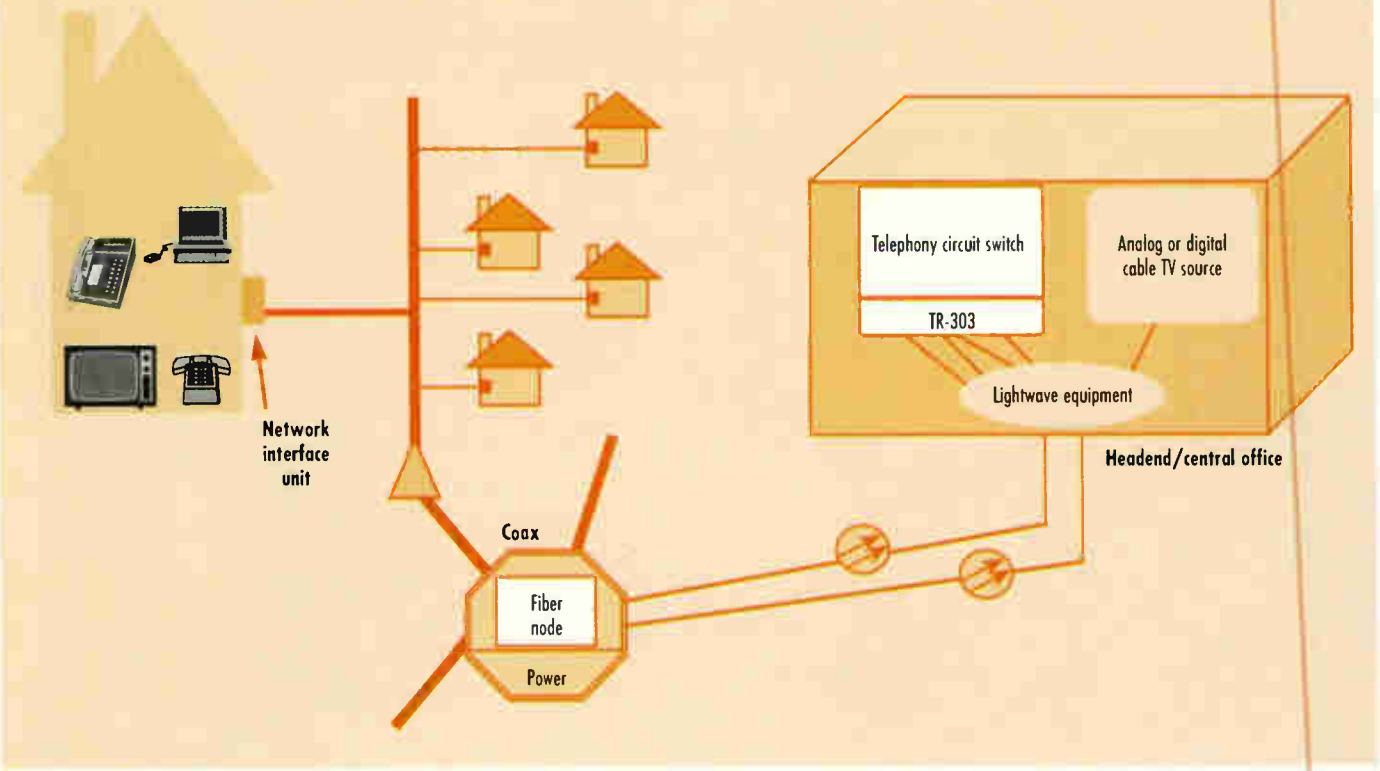
Figure 1: Circuit-switched telephony architecture



software, are offered to the subscriber as part of the service. Examples include the custom local area signaling services (CLASS) foursome of call forwarding, call conferencing, call transfer and call waiting. These features have become an essential part of subscriber expectations for telephony and distinguish true telephony from transmission of voice only.

Circuit-switched service also can include guaranteed bandwidth for data transmission. This offering typically dedicates timeslot channels to data applications and routes data to a network edge device before it enters the circuit switch. You'll need a management system to allocate the dedicated timeslots to data applications.

Packet-based solutions

Packet-based residential service is implemented with different technology than that used for circuit-switched offerings. It is an extension to high-speed data capability and requires an operator also to implement at least some IP technology.

These offerings convert analog voice signals to digital form, compress them and fit them into packets. The packets are input to a cable modem, which prepares them to be transmitted along with other data on the operator's network. As shown in Figure 2 (on page 108), the device that creates the voice packets may be integrated with the cable modem into an NIU on the side of the house, or it and the cable modem may stand alone.

There are several challenges to offering packet-based telephony. The first is that the subscriber must be able to use existing telephone sets. Because existing sets are analog devices, digitizing, compression and packetization must occur in equipment separate from the subscriber set. This extra equipment can increase the cost of the end-to-end connection.

The second is that subscribers demand that voice quality be maintained at the same perceived level as for a circuit-switched call. Although human perception allows for some degradation from the quality of a circuit-switched call, the lower limits to delay and packet loss are difficult to guarantee in public data networks. Control of delay and packet loss are part of the quality of service (QoS) guarantee of a packet network.

Transport services

Yet another way to enter the telephony market is by providing transport services without directly offering subscriber access. You can lease either dark fiber or bandwidth on existing fiber-optic systems to other carriers for connectivity to telephony and data networks. Offering transport services may be a way for operators to begin to build synchronous optical network (SONET) and other high rate optical networks needed to offer business and residential telephony services.

Standard IP telephony technology

In common usage, the term IP telephony tends to be misapplied to any use of a data network, public or private, to transport a voice call. In reality, that application is only voice over a network. The network may or may not be using IP. Even more important, the movement of voice alone is not telephony.

To compete with incumbent telephony service providers, a cable operator's offering of telephony using packet technology needs to provide features such as call waiting, as well as network-grade voice transport. When that has been accomplished, the service can truly be termed "IP telephony."

Many standards and proposed standards attempt to specify how vendor products should provide the system of features and transport that defines IP telephony. In the cable telecommunications industry, the

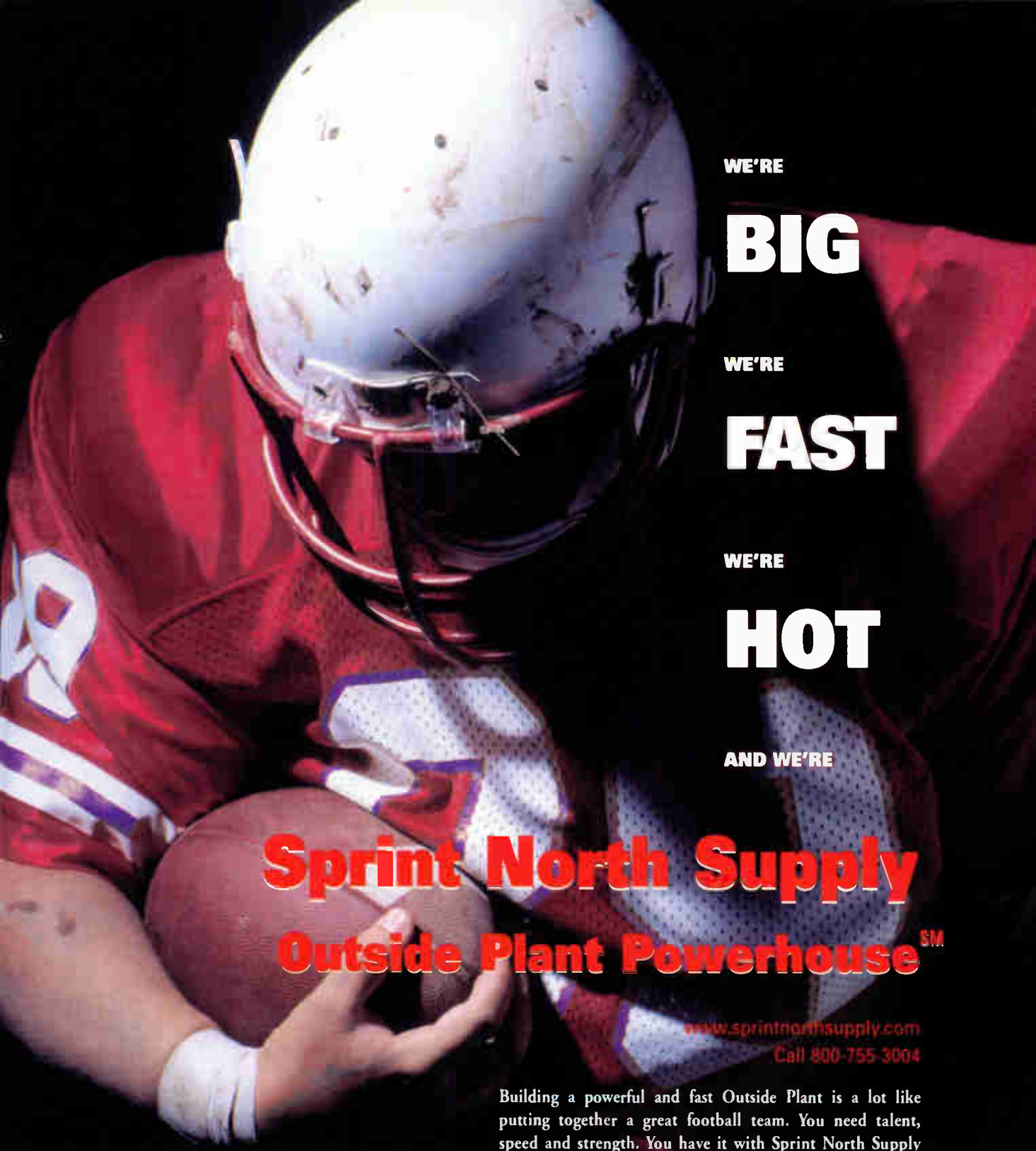


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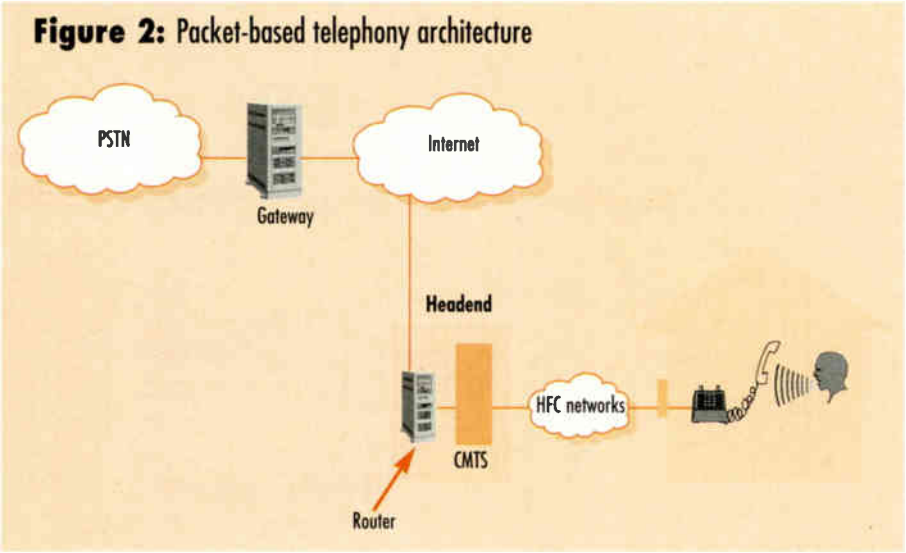
Figure 2: Packet-based telephony architecture



CableLabs Data Over Cable Service Interface Specification (DOCSIS) and PacketCable are cable's guidelines for delivering carrier-grade IP telephony.

DOCSIS issues provide the basic definition of interoperable cable modems and cable modem termination systems (CMTSs). They define an essential part of the physical backbone for carrying high-speed data services, including IP telephony. PacketCable builds upon the DOCSIS foundation by identifying, qualifying and supporting Internet-based voice and video products over cable systems. The products are to be delivered via new service classes, using standard IP. PacketCable goes beyond IP telephony to build a platform for other services that require QoS guarantees.

The first publicly available PacketCable specification, for network call signaling (NCS 1.0), describes a set of rules based upon the media gateway control protocol (MGCP) being defined by the Internet Engineering Task Force. There are four key components to NCS 1.0:

- Endpoints are sources, or sinks, of data. An example is an interface that terminates an analog plain old telephone service (POTS) connection to a phone, key system or private branch exchange (PBX).
- A gateway contains a collection of endpoints. A gateway that terminates residential POTS lines (to phones) is called a residential gateway or an embedded client. Gateways create connections between endpoints, detect events such as a subscriber going off-hook, and generate signals such as ringing.
- An embedded client is a network element that provides two or more traditional analog (RJ-11) access lines to a voice-over-IP (VoIP) network and, optionally, one or more video lines.
- Call agents instruct the gateways to complete their tasks. It is up to the call agent to specify how and when connections are made, between which endpoints they are made, and what events and signals are to be detected and generated on the endpoints.

The NCS 1.0 gateway is a simple device that receives its instructions from a call agent. When new services are introduced or customer profiles are changed, the changes are, therefore, transparent to the gateway. Call agents implement any changes and generate the appropriate new mix of instructions to the gateways for the changes made. Their functionality thus includes the definition of subscriber line features that can be provided in a PacketCable-compliant network.

The full PacketCable 1.0 specification builds upon NCS 1.0. It defines an alternate distributed call signaling architecture that provides for a more intelligent gateway device, QoS, control, PSTN interconnection, security, network management, codec support, billing event messages and network announcements over DOCSIS-enabled cable plants. The complete text of PacketCable specification documents can be found at the PacketCable Web site, www.packetcable.com.

The system operator's challenge in implementing standard IP telephony technology is to sort out a plethora of evolving vendor offerings. While many vendors are claiming compliance with PacketCable specifications, in reality, they often base those claims on preliminary specifications or standards being considered for later inclusion in PacketCable. Often, they are attempting to sell solutions to more than one service provider market, and each market has similar, but different, standards. There is considerable fluidity in the definition of all the standards.

Interoperability, both between vendor solutions within the operator's company and between the operator's systems and connecting networks, will be critical to providing marketable end user applications. Particularly for early implementers, the choices are not easy and require operators and their staffs to draw from business experience, industry direction and technical knowledge, as well as published specs.

Infrastructure changes

Infrastructure involves both processes and people. The people issues grow from the processes, so we will address processes first.

Even before any hardware is installed, support needs to be built for both hardware and software systems and for the customers to be served by new offerings. This support can be viewed as a layered structure that starts with equipment monitoring and maintenance at the lowest level and continues through business strategy at the highest level.

The ITU Telecommunications Management Network (TMN) model is one approach to describing what should occur at each layer to create a total support infrastructure. (See Figure 3 on page 110.) The TMN layers are network element, element management, network management, service management and business management.

Network Element Layer: Network elements are the pieces of equipment that are being monitored. To collect data from each element, devices called transponders are either added to the network element or incorporated in the design.

Element Management Layer: The element management layer is responsible for translating the physical implementations of the network into a form that can be processed and displayed by a mathematically based computer model. One of the tools for doing this is a set of mathematical variables describing network resources. These variables are called "objects." The

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objects are stored in management information databases (MIBs). MIBs also include actions to be taken based upon collected data or caused by external commands.

The element management layer can be physically implemented by several separate element managers, which each are responsible for subsets of network elements. Some examples are a switched HFC system element manager that oversees host digital terminals (HDTs) and NIUs, and a fiber-optic system element manager that has a similar function for fiber-optic lasers. Element managers also are sometimes called operations systems (OSs).

Network Management Layer: The network management layer oversees the operator's entire network, based on information provided by the various element managers. It is the first layer that has a "global" view of the system.

Service Management Layer: The service management layer is the point of contact with subscribers for provisioning, accounting, QoS and fault management. Historically, the databases and computer systems in what is now the service management layer were separate systems, individually maintained by a system operator's management information systems (MIS) organization. TMN requires these systems to be part of network management and to communicate with the adjacent layers.

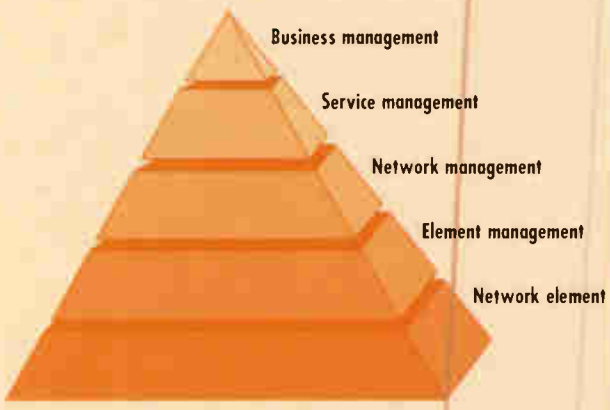
Business Management Layer: The business management layer is the highest layer of TMN and is where planning, budgeting, goal setting and business decisions in general are made. Similarly to the systems in the service management layer, business management systems need to be integrated with the rest of the layers in the structure.

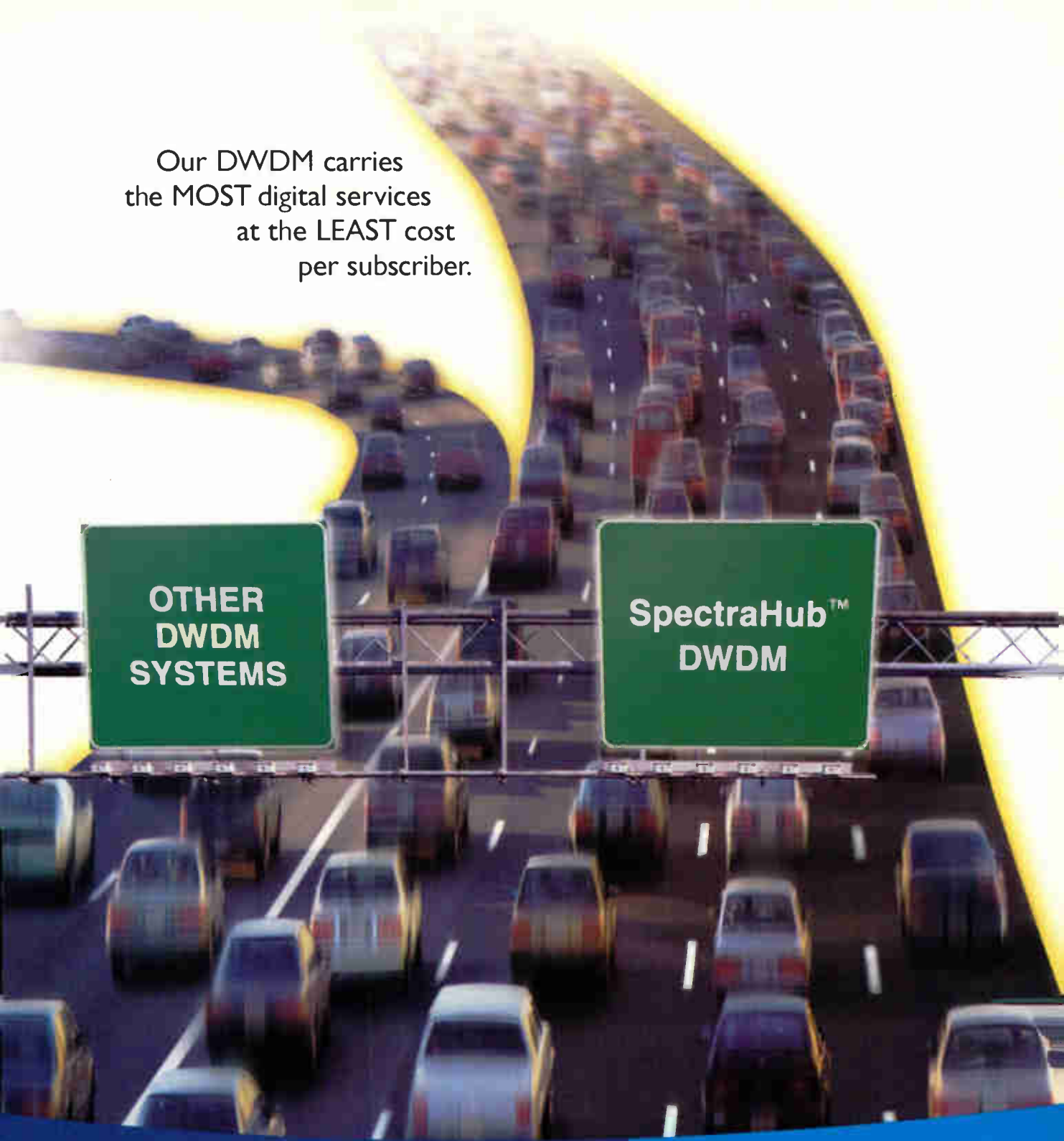
An example of successful integration of the layers would be when the operator's staff is able to directly access data about this year's service revenue, maintenance, customer growth and account turnover to create the business plan for the next five years.

Communication between layers

To make the layered structure work as a support system, all communications between layers must be done using standard

Figure 3: TMN levels





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protocols. Here again, there are several possibilities, but it's a safe bet that IP will be important to unifying the levels and passing information between physically diverse sites. Other protocols, such as simple network management protocol (SNMP) for communication between network elements and a network element management system, will supplement IP at specific layers of the hierarchy.

Training

Training is the key to the people issues in building an infrastructure. At every layer of the infrastructure, the operator's personnel must understand why new systems have been put in place and how to use them correctly. The training will vary with the job responsibilities of individual personnel.

For the technician, it may mean a training class on the operation of a network operations center (NOC). For a chief financial officer, it could be a seminar on integrating information from network management systems into a five-year plan. Because of the differences in job responsibilities and the types of information required to do each job, a training plan for all levels of the operator's organization needs to be developed and reviewed annually to verify that the tools are in place to optimally use the layers of the infrastructure as a resource.

> The term IP telephony tends to be misapplied to any use of a data network, public or private, to transport a voice call.

Managing for the future

Building the components of a telephone business is not a one-time task. Because the communications business is so dynamic, service offerings, standards and infrastructure need to be re-evaluated and tuned each year. The fact that the components of the business need to be adjusted periodically does not indicate that the business is not healthy; on the contrary, it indicates the operator can respond to new customer needs and market opportunities. What does contribute to a healthy business, however, is the ability to create a business system that is flexible enough to evolve within an established framework of services, standards and infrastructure. CT

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

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TELEPHONY PRODUCTS:

Voice and Data Networks Converging

By Justin J. Junkus

As cable enters the digital age, it no longer makes sense to operate separate data and telephony transport networks. Today's voice and data vendors are developing new products at a frenetic pace to help you evolve those separate networks onto a single platform or to construct a converged architecture from scratch.

Most players in communications know that offering services over two separate networks, one for voice and another for data, is not an efficient way to do business. In addition to duplicate paths between service users, separate networks require separate systems for monitoring network health, separate customer service staffs, and separate installation and maintenance forces.

The problem was (and still is, to some extent) that providing Internet protocol (IP) telephony rather than just voice transport over a data network (voice over IP, or VoIP) means delivering toll quality voice, a robust set of features and "five nines" (99.999 percent) reliability. Until

INDUSTRY IN TRANSITION

recently, data network solutions couldn't meet those requirements.

New transport technologies, improvements in data protocols and advances in silicon have helped packet data networks to meet the transmission quality of circuit-switched voice networks. Quality of service (QoS) is becoming less of an issue because vendors are using multilayer protocol stacks to manage packet flows across interconnecting networks.

Features are being divorced from hardware, providing the way for decentralized data networks to gain the functionality of the circuit switches. It is a safe bet that within two years, packetized data networks will be able to meet or exceed every parameter of a circuit-switched voice solution.

The remaining challenge, however, is how to migrate from this two-network environment to a converged architecture. In the interim period when data solutions are being stabilized and tested, the market is demanding that cable operators make telephony offerings now, or step aside to other providers who can move faster.

Circuit-switched implementations are the only near-term tested solutions. In addition, cable's early adopters have already built circuit-switched telephony networks. The circuit-switched hybrid fiber/coax (HFC) telephony vendors are answering the challenge with offerings that can evolve with technology and customer demand.

Access equipment changes most

In the mid-1990s, telephony in cable meant the marriage of an HFC network to a circuit switch. The architecture that emerged consisted of two major hardware units, the network interface device (NID), and the host digital terminal (HDT). The HDT is a combination of next-generation digital loop carrier (DLC) and a set of RF modems, and the NID contains the mirror RF modem to interface cable's plant to twisted-pair subscriber equipment.

Access vendors soon discovered that technology alone did not guarantee market success. Cable's service delivery paradigm of homes served vs. home passed differs from that of its telco cousin, which

must serve every home passed. Cable-centric architectures and transport technologies were required, with corresponding cost reductions.

Vendor offerings consolidated, and the firms that remained in the market offered improved concentration between HDTs and NIDs, and versatile access transport protocols that gravitated away from the cell-based technologies used in the trunking networks of the public switched telephone network (PSTN). With the exception of ADC's orthogonal frequency division multiplexing (OFDM), time division multiplexing (TDM) became the norm for their access technology.

Data comes on board

As high-speed data offerings entered the scene, access vendors scrambled to add data capability. From 1998 on, the promise of VoIP provided another stimulus to make the NID perform like a true cable modem. In the meantime, cable modem vendors were solving the challenge of connecting standard telephone sets to their offerings.

What has emerged is a set of subscriber access choices for the operator. The early telephony system vendors offer availability now and claim graceful evolution, although it appears PacketCable-compliant IP telephony offerings will require a truck roll to all the installations of circuit-switched solutions. The new cable modem vendors counter with claims of a new platform for the future with access equipment that can be installed by the subscriber.

Keeping in mind that it's impossible to cover every cable telephony product on the market, let's take a look at some of what's out there.

ADC

ADC's HomeWorx system is unique in its use of OFDM for delivering access to a possible 233 simultaneous voice users over a single 6 MHz channel. On the switch side of the HDT, up to 28 DS1 (digital service, level 1; 1.5 Mbps) lines or 24 E1 (2 Mbps) lines may be connected. The company's claim is that OFDM is more robust than TDM, which permits more voice conversations to be carried in the 6 MHz channel width, with better tolerance to noisy line conditions.

Doug Smidl, marketing vice president of ADC's broadband networks division, says the company is committed to OFDM technology and will be announcing enhancements early this year that will trade voice circuit capacity for the ability to operate on lower grade return plants.

ADC calls its NID an integrated service unit (ISU), and offers a variety of ISU line sizes. The Home ISU (HISU) features two or four lines, and the Multidwelling ISU (MISU) is available with up to 32 plain old telephone service (POTS) lines. The MISU supports coin-operation, digital data service (DDS), integrated services digital network (ISDN), DS1 and E1 lines. Data service is available from the MISU at up to 8 Mbps and from the HISU at up to 512 kbps, using dedicated DS0 (digital service, level zero; 64 kbps) lines. Data is routed to the operator's data access network at the HDT, without going through the circuit switch.

The company demonstrated a prototype IP ISU at the National Cable Show in mid-1999, which Product Manager Ham Matthews says will be a Data Over Cable Service Interface Specification (DOCSIS) 1.1 cable modem in an ISU housing. The company is working on Multimedia Cable Network System (MCNS)-compliant gateway and routing equipment.

Arris Interactive

Arris Interactive, a joint venture between Antec and Nortel Networks, offers the Cornerstone system as its cable telephony solution. Cornerstone is the most-widely deployed system to date, with more than 350,000 voice ports shipped worldwide.

Its TDM technology fits 24 voice channels into 1.8 MHz. The RF side of the HDT accepts 1,344 simultaneous voice channels, and the switch side of the HDT is capable of 56 DS1 interfaces. With a 5:1 concentration, up to 6,720 voice lines can be served by one HDT. Lines can be moved while in service to an alternate frequency to avoid noise interference. Unlike OFDM technology, TDM based-systems move groups of lines to alternate frequencies, rather than single lines.

The Arris voice NID is called a VoicePort. Residential voice ports are available in two- or four-line versions, and a Multiline Voice Port (MVP) features up to 12 lines and supports analog Centrex services. The four-line residential unit features local power supply monitoring. A Universal Access Port also is available, which provides access to ISDN, foreign exchange and coin-operated services.

Arris does not offer a data module for the VoicePort; instead, it is introducing an IP-based PacketPort unit in early this year that will have four packet voice lines and an internal DOCSIS 1.1-compliant cable modem. Per Arris Director of Marketing Mike Horton, the telephone set interface to the voice lines will be a standard RJ-11 jack. PacketPort uses VoIP gateway software from Telogy to interface with call agents in the network.

The Cornerstone VoIP telephony architecture will include a new IP access gateway. The HDT still will be part of an Arris solution and will direct calls to either a digital switch or the IP Access Gateway. The Access Gateway will support up to 672 simultaneous calls and connect to the IP backbone via a 100BaseT interface. The

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Telephony Vendors Get It Together

It makes no sense to operate separate data and telephony transport networks, and today's voice and data vendors are developing new products to help you evolve those separate networks onto a single platform or to build a single architecture from scratch.

Providing Internet protocol (IP) telephony rather than just voice transport over a data network means delivering toll quality voice, robust features and exceptionally high reliability. Until recently, data networks couldn't hack it.

New technologies, improvements and advances have helped packet data networks meet the transmission quality of circuit-switched voice networks, but the remaining challenge is how to migrate from this two-network environment to a converged architecture. In the interim period when data solutions are being stabilized and tested, the market is demanding that cable operators make telephony offerings now, or step aside to other providers who can move faster.

To help get up to speed, check out the main body of the story to see what the various telephony vendors have going on.

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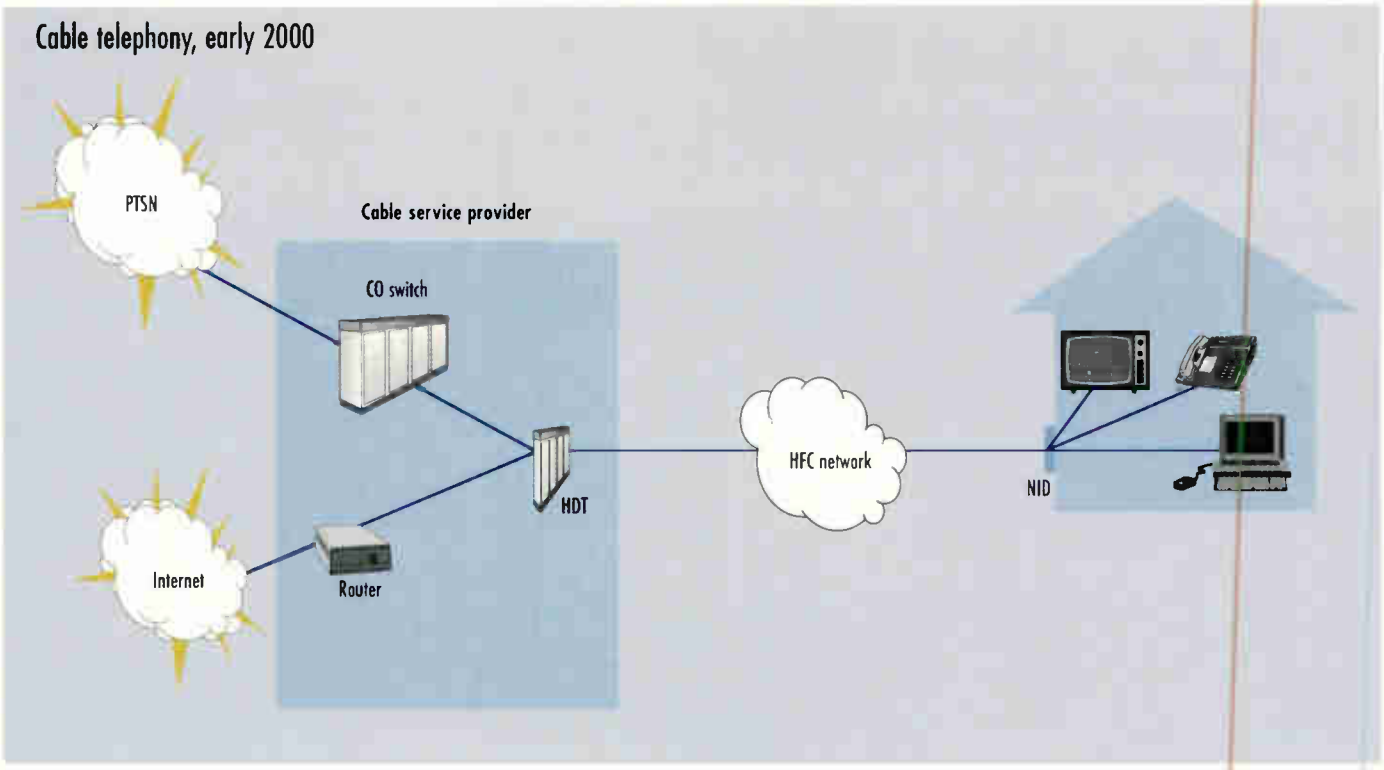

Access Gateway also is scheduled for availability this year.

Tellabs

Tellabs dubs its cable telephony product the CableSpan 2300. It employs TDM technology with 30, rather than 24, DSOs in 1.5 MHz downstream channels, and 1.9 MHz upstream channels. The Tellabs HDT can handle 672 simultaneous DSO conversations, and with a 6:1 concentration, it can serve 3,960 voice lines. Lines can be reassigned while in service to avoid noisy frequencies.

Tellabs' NID is called a remote service unit (RSU). Two- and four-line residential RSUs are offered, as well as a 12-line multidwelling unit (MDU) version. Tom Ruvarac, the company's group marketing manager, says Tellabs is planning to expand the capacity and services that can be provided by the multiunit RSU, to include universal voice grade services, T1, and fractional T1. A high capacity 120-line remote also is planned for the business market.

In mid-1999, Tellabs began shipping its EXPRESS/path feature, which provides up to 2 Mbps data access by allocating DSOs to data service. A minimum data rate can be provisioned. Data is routed to the operator's data access network at the HDT over a 10BaseT interface. Tellabs also is working on a DOCSIS-compliant VoIP platform for interface between the RSU and the HDT.

Switch gear needs to handle data, too

As telephony access is changing, the circuit switch vendors are not complacently accepting the demise of their technology. On the contrary, they are developing migration strategies that extend distributed processing beyond switch hardware to a client-server architecture more like IP data networks. By adding MCNS to the protocol suites of "feature servers" and access modules, they are looking to take on the functionality of IP call agents, gateways and gatekeepers.

In the United States, the dominant circuit switch vendors are Lucent Technologies and Nortel Networks. Both companies are developing solutions to meet the challenges of IP telephony. Before an operator begins counting IP telephony revenues, however, it is good advice to check product availability. Many of the solutions are in trial stages during the first quarter of this year, with general availability later this year or next.

Lucent Technologies

Lucent has a plethora of solutions for VoIP. Its Bell Laboratories research arm has developed an entire software suite called the Softswitch to provide call processing, PSTN gateway capability and feature definition. Softswitch is a pure software, portable to several hardware machines, including Lucent's own line of processors and those of the several firms acquired by Lucent.

Lucent's IP telephony package for the cable industry is called CableConnect Solutions. It consists of a set of products that promise end-to-end IP telephony capability using cable access. The subscriber interface is via cable modem and cable modem termination system (CMTS) technology from Lucent partner Motorola.

Switching and call routing solutions depend on the type of cable system. Smaller systems without a current telephony product can use the PathStar Access Server for line feature delivery and PSTN gateway functionality. Larger systems or systems that already have a 5ESS switch can build their service offerings upon Lucent's 7R/E, which can either be evolved from an existing 5ESS switch. (The E in 7R/E stands for evolutionary) or built from scratch (the R is for revolutionary.)

Back office issues are addressed by a combination of Lucent's Kenan Systems Arbor/Broadband products and integration services from Lucent Netcare.

Lucent also has products to complete the links to the Internet under the PacketStar brand name and a line of products from recently acquired Ascend Communications. ➤

Nortel Networks

Nortel's strategy for IP telephony solutions places the emphasis on evolution. In terms of product, Nortel's IP offerings are broadly grouped into the Succession Network and IPConnect product lines.

The Succession Network has been focused on the trunking gateway interface to the Internet. The Succession product line consists of the Succession Call Server, the Succession Network Manager, a family of Succession Multi-Service Gateways and an asynchronous transfer mode (ATM) core switch.

The Call Server provides call processing, including routing, translations and signaling, between Succession Multi-Service Gateways, legacy TDM circuit switches and an ATM core network. The MultiService Gateways provide the signaling interfaces to the ATM core network from legacy switches and access interfaces. The Network Manager provides fault isolation and troubleshooting, global configuration management, and applications monitoring.

Nortel indicated that the most likely path for a cable company migrating to IP telephony using Nortel products would be to install the Arris Cornerstone Voiceport or Packetport access, connected to a DMS switch. Nortel will integrate Succession call server functionality into the DMS switch some time in the future, by circuit card and software changes. The IPConnect Call Engine will be used to add features from third-party software vendors or from service providers with their own service creation staffs.

Cable modems enter telephony world

Given that IP has roots in the data world, it shouldn't be surprising that data system vendors have been working to extend their product reach to the world of cable telephony. Many of the contenders in the cable modem marketplace also manufacture CMTSs. Some of them have systems that function in client-server applications for enterprise data networks.

Equipped with new software and protocol stacks that are compatible with VoIP and IP telephony standards, these data vendor solutions are promising to become as relevant to cable telephony as those from the circuit-switched technology vendors. Cisco Systems, 3Com and Com21 provide good examples of typical strategies.

Cisco Systems

Cisco's uBR7246 CMTS is a combination of router and cable modem based on DOCSIS standards. The 7246 supports the Resource Reservation Protocol (RSVP), which allows backbone QoS features to be extended to the headend. Cisco also promises a DOCSIS 1.1-compliant system that will support unsolicited grants. This feature causes packets to emulate the constant bit rate (CBR) stream of a circuit-switched voice call, greatly reducing jitter and delay for VoIP.

> "Telephony in cable is still in its infancy. The challenge for cable is that the infant is growing so fast."

The company also offers the uBR924 cable access router, which is a combination cable modem and router for small office/home office (SOHO) applications. The 924 includes a single F-connector to interface with a coax input, four RJ-45 Ethernet ports, two RJ-11 phone jacks, one RJ-11 port for backup POTS service, and one RJ-45 console port to connect to an American Standard Code for Information Interchange (ASCII) terminal or personal computer (PC) for local troubleshooting and reconfiguration.

Although the RJ-11 ports currently only support the H.323 protocol stack, Cisco plans to release a PacketCable-compliant interface in the first half of this year. Cisco also has licensed its cable modem software to other vendors for incorporation into cable modems targeted at consumers.

Cisco depends on Telcordia Call Agent Software for its end user IP telephony solutions, but the Cisco software suite currently includes a Class 4 Call Agent for trunking applications. Cisco is trialing telco-grade IP telephony service with Le Groupe Vidéotron Itee, in Quebec, Canada. Videotron is testing the uBR7246 with the Cisco AS5300 VoIP gateway, 12000 series Gigabit Switch routers, an 8500 Multiservice Switch Router, Telecordia call server, and Samsung cable modems with Cisco software.

Mark Bakies, Cisco's product marketing manager for cable communications, emphasized that the company's strategy relies heavily on partnering with other vendors to integrate Cisco data networking products with traditional telephony hardware, such as the NID on the side of the house.

3Com

Assisting the growth of emerging Internet access applications, including IP telephony, also is important to 3Com's strategy. Phil Robinson, 3Com's chief technical officer of its Cable Access Division, says 3Com is placing major emphasis on developing and promoting its cable modem and CMTS products as Internet edge devices. To make it easy for consumers to migrate away from traditional telco modems to cable modems, 3Com provides free hotline support—at (888) 877-5040—for installation and troubleshooting. Although its current DOCSIS cable modem does not have RJ-11 jacks to attach a standard telephone, the company's prototype for the next model does.

Robinson also indicates that the 3Com CMTS is the only DOCSIS 1.0-compliant CMTS that supports unsolicited grants. Because the 1.0 version of the feature is proprietary, however, it is necessary to use 3Com cable modems to gain this capability. In other developments to support fully featured IP telephony, 3Com is prototyping intelligent clients based on the Simple Internet Protocol (SIP). Houman Modares, 3Com's director and product manager for VoIP, agreed that SIP and the MGCP protocol that is part of PacketCable NCS 1.0 are related to each other but look at network control in different ways. "Protocol mediation will need to be a key part of the 3Com solution," so that all the devices can talk to each other, he said.

Part of that communication also will involve back office solutions. 3Com has a complete line of servers called Total Control, which include support for Lightweight Directory Access Protocol (LDAP). LDAP makes it easier to share information between databases of subscriber and operator information. ➤

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Com21

Com21's product line is focused on network access. Although the company was founded to provide a product to deliver voice telephony in a cable system using packet technology, most of the products deployed have been for high-speed data access. Com21's DOXport cable modem is built upon ATM, rather than IP technology, but John Pickens, Com21's chief technical officer, is quick to point out that "attributes of ATM including managed QoS, fragmentation and header suppression are part of DOCSIS 1.1."

Buck Gee, the company's vice president of marketing, indicated its current cable modem offering has an RJ-11 jack for telephony and that Com21 already has deployed cable modems using the telephony port.

"The next step is voice over IP packet," said Pickens. In the meantime, he said to look for a Com21 DOCSIS 1.1 product that does not rely on ATM to solve QoS "some time in the next year."

Network transport is changing, too

Ironically, the part of telephony that was the first to move to transporting voice over packets is beginning another major change even before IP telephony reaches maturity. Both the Internet backbone and PSTN interexchange carrier (IXC) facilities are built with synchronous optical network (SONET) as the standard and ATM as the protocol implemented on that standard. IP, as a layer 3 protocol, is carried by ATM. Several vendors, including Lucent Technologies, Fujitsu and Nortel Networks, provide parts or all of the high-speed fiber-optic systems built on that model.

With dense wavelength division multiplexing (DWDM), it appears that many efficiencies can be realized by running IP over SONET without ATM, or directly coupling the IP layer to the physical, fiber-optic layer, using high-speed transducers. In the latter case, neither ATM nor SONET is required, although some of SONET's operations overhead structure is being incorporated into the new technology.

Even change is changing

Telephony in cable is still in its infancy. The challenge for cable is that the infant is growing so fast. Five years ago, there were no practical solutions for transporting voice over packets.

Today, there are several contending standards for the technology, and an equal number of vendors offering solutions. The old model of 20-year cycles to maturity for markets and technologies is no longer valid, and operators need to both choose implementations and meet competition by traditional telephony service providers in an incredibly short timeframe. CT

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

the best of silicon and GaAs in terms of performance and reliability.

C-COR.net's new development will use a semiconductor technology that has not been applied previously in the cable TV world, according to Horton.

"It will have the same advantages (as GaAs) without the disadvantages," he says.

The bandwidth question

Amplifiers now are sitting comfortably at 870 MHz. The question everybody would love to have answered is whether more will be needed. Will there be a demand for a 1 GHz RF amplifier?

Horton says it seems unlikely for the time being. This doesn't mean, however, that a 1 GHz amplifier is unfathomable. His company designed a product for Time Warner's 1-GHz trials in New York, but C-COR.net decided not to release it commercially.

"We have heard no requirements to go back to that (1 GHz amplifier).... The digital compression of video signals has really reduced the pressure on bandwidth," Horton says.

This doesn't mean that there never will be a widespread demand for that much bandwidth, says Pierson. The computer industry knows all about the demand for "more, bigger, faster, better," and the cable industry is becoming increasingly familiar with it as well.

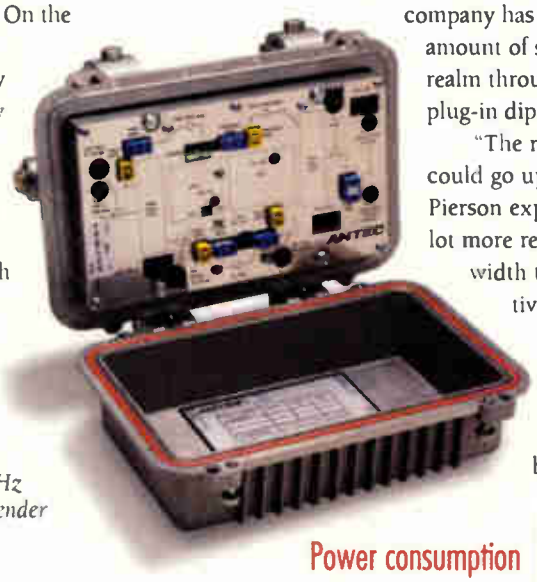
"With more of us becoming content providers, our ability to use more and more bandwidth will be tremendous," Pierson says.

Mountain Cablevision's Marshall agrees.

"(1 GHz) would be ideal," Marshall says. "There still is a need for that even with all the digital channels. It still seems like you are scraping for more bandwidth."

Reverse path requirements

The desire to provide new services such as telephony also has put pressure on manufacturers to enhance the reverse path. Their hands are tied to some extent because of must-carry rules. On the forward path, cable companies currently are required to carry local broadcast services. This often means starting with Ch. 2 at 54 MHz. Thus, the bandwidth available for the reverse path is limited.



Antec 870 MHz Line Extender

Vendors have been working within this restriction. According to C-COR.net's Horton, they have been tightening the filters in amplifiers to make the crossover between forward and reverse smaller. As a result, the past 10 years have seen the subsplit reverse path stretch from 5-30 MHz to 5-42 MHz.

"It's good to have increased capacity on the return side," says Mountain Cablevision's Marshall. "Every little bit we can get out there certainly makes our life a whole lot better."

Pierson says Philips has ensured that its amplifiers are ready to handle even more return path bandwidth should the must-carry rules be changed or eliminated. The company has built in a certain amount of scalability in this realm through the use of a plug-in diplex filter.

"The reverse path could go up to 65 MHz," Pierson explains. "This is a lot more reverse path bandwidth to offer interactive services on. If the rules change, we have built in the extra capability."

Power consumption

Cable companies, including Buckeye Cablevision, have begun changing from a distributed power system to a centralized one. Brown says his company now has only one power supply per node.

"We felt that with centralized power, we could better support telephony down the road and possibly high-speed data from a reliability standpoint," he adds.

With this centralized power system, Buckeye can use permanently mounted generators in the case of a commercial power outage.

More amplifiers stemming from one power source, however, means that the current is greater. Vendors, therefore, have had to increase the current passing capability of RF amplifiers and passive components to at least 15 amperes, says ANTEC's Whittlesey.

Reliability essential

In the end, everything boils down to one word: reliability. In fact, Mountain Cablevision's Marshall says reliability is the

BOTTOM • LINE

Amps Get You There

Cable companies looking to provide new services are seeking RF amplifiers with higher gain and output capability. Simultaneously, they want to use the same number of amps and without an increase in end-of-line (EOL) distortion.

Some manufacturers have decided that the Gallium Arsenide (GaAs) hybrid amplifier is the way to go. Others prefer silicon models or are working on amplifiers that use different technologies.

Nontraditional cable services such as high-speed Internet access and telephony also mean cable companies constantly are looking for return path improvements. Subsplit return path bandwidth has been stretched in recent years to 42 MHz. Manufacturers are producing scalable amplifiers just in case the must-carry rules are lifted, eliminating the current outer limits on return path bandwidth.

Finally, for the forward path, no one is quite sure whether the industry will see a need for 1 GHz amplifiers. While the demand currently is not there, neither manufacturers nor cable companies rule it out, saying that the tendency is to absorb the amount of bandwidth that is available and to quickly seek more.

Gotta get a Gator

Cable **Gator™** *Center Conductor Cleaner*

As a manufacturer of cable installation tools, Ben Hughes/Cable Prep was approached by technicians and linemen throughout the industry to produce a center conductor cleaner. The prevailing factor was the need to eliminate cleaning the bonded dielectric from center conductors with knives or other scraping methods without causing installation problems. By listening carefully to the comments and suggestions offered, Cable Prep has responded with the Cable Gator.™

There is a beveler that performs the pyramid cut to remove the burrs. If the center conductor burrs aren't removed, damage to the seizing mechanism of the connector can occur. Scoring of the copper-clad coating on the center conductor results in signal loss. In two easy steps the Gator bevels the center conductor and removes the bonded dielectric, leaving the cable perfectly prepared and ready for the connector. A perfect prep means no signal loss and no down time.

FEATURES

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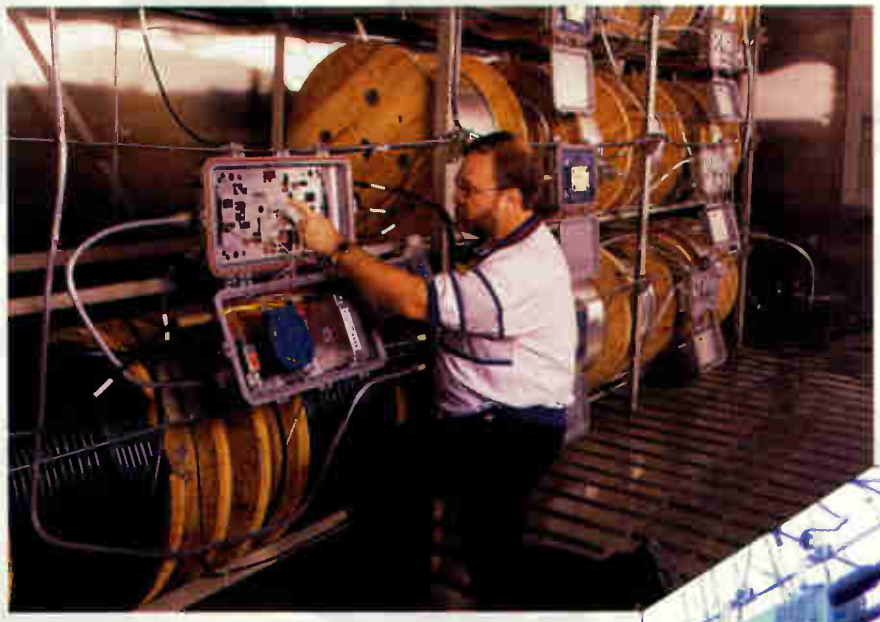


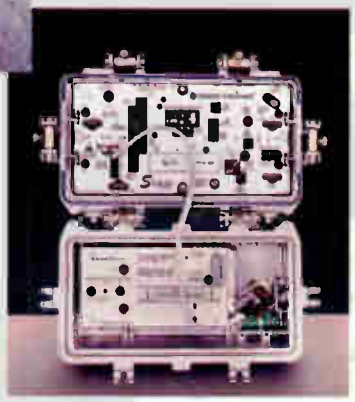
Top: Reliability is critical for today's RF amplifiers. Here, Kevin King, senior product engineer with C-COR.net, tests HFC transmission products in the company's environmental chamber. Photo courtesy of C-COR.net

Bottom: AT&T B&IS personnel in Washington install an S-A GainMaker 870 MHz system amplifier. Photo courtesy of Scientific-Atlanta

"No. 1 issue," and that his company would be willing "in the long run to compromise other technical aspects for a system that gives reliability."

C-COR's Horton says: "If you have high-profile services like telephony on the network, you can't rely on the old system of 'when the outage comes, the customer yells, and you fix it.' You must have a proactive way of preventing it or knowing about it before the subscriber (does)."

In other words, Pierson explains, cable operators want to feel their additional revenue streams are protected from outages and downtime. To help provide this insurance, Philips has built in its RF amplifier an element management system with return ingress protection. If ingress reaches the node, the reverse signal for 500 subscribers could be impaired. Philips' element



Top: Philips Diamond Back RF amp
Bottom: General Instrument GaAs STARLINE Mini Bridger

management system provides automatic shutoff so that the starting point of the ingress can be determined.

"Historically, that functionality was an afterthought," Pierson says. "We made the element management system integral. It plugs into the main board directly."

Horton says all of C-COR.net's trunks and bridgers support element management. These items can self-identify when plugged into the network. In addition, all of the company's RF amplifiers are electronically encoded with the model, serial number and date of manufacture so that managing customer inventory can be done through the element system or plug-in management.

Scientific-Atlanta has adopted a process called highly accelerated life testing (HALT), through which it tests products to destruction, not just to the spec level. The company continually tries to improve the product based on the HALT results, Palazzo says. In a separate phase, the highly accelerated stress audit (HASA), S-A randomly tests a number of devices off the production line to make sure the performance levels determined through HALT are maintained.

The point

In the past several years, cable companies have been asking a lot of their RF amplifiers. They want more bandwidth on both the return and forward paths without needing to place a greater number of amplifiers in their networks and without sacrificing picture quality.

Manufacturers have kept on top of the new services cable companies want to provide, making sure amplifiers are more capable and reliable. And that work continues. Even as we debate whether the industry will eventually need a 1 GHz device, manufacturers are working hard on alternative gain stage technologies. Be sure to keep an eye out for announcements by Philips and C-COR.net on this front. CT

Monta Monaco Hernon is a telecommunications freelance writer based in Arlington, Va.

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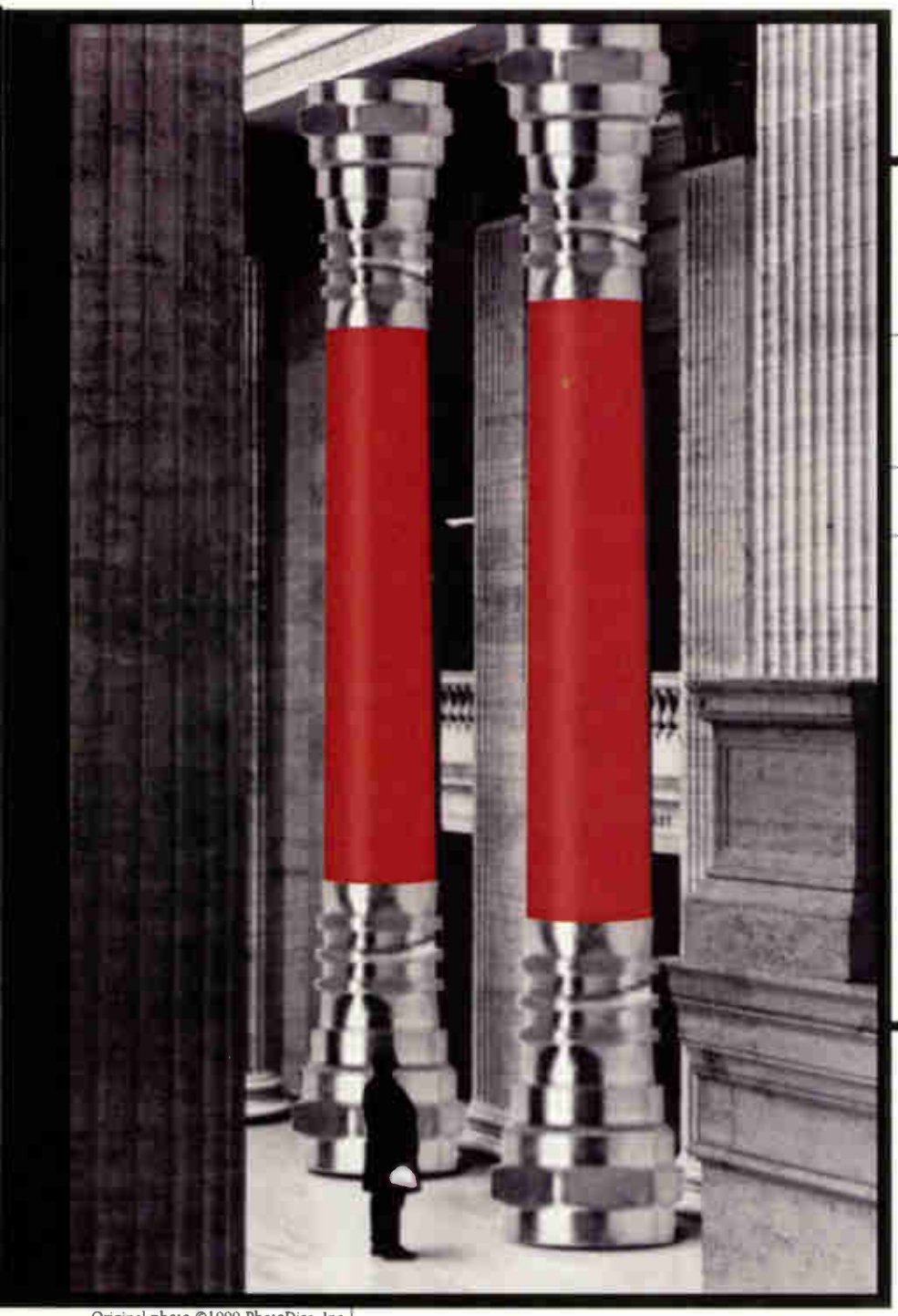

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AX: INDISPENSABLE

Pillars of Cable Support Your Systems

By Ruth Suarez

While coaxial cable seems fairly basic in comparison to some of the high-tech wizardry entering broadband systems, it's difficult to keep anything in the communications industry static. Information traveling at warp speeds calls for transport methods that make constructing infrastructure fast, simple, long-lasting and cost-effective.

All that being so, extending the life of coaxial cable and improving its quality and performance is taking on greater importance throughout the industry. You may have engineered the perfect broadband system, but if corrosion lowers the performance of your drop cable, it doesn't matter how sophisticated your headend may be. Plus all that money you'll spend replacing drops because of environmental or installation damage will have the bean counters at your company in a snit in today's highly competitive market.

But not to worry. New coax products are hitting the market, and vendors are hard at work to beat the natural elements that eat away at your cable.

"In coaxial cable, you find old, established technology," says Richard Ellis, product manager for Neptco, a supplier of component materials to cable vendors. "You're dealing with a plain vanilla product. But people are really paying attention to it now. It's becoming a critical component of communications. In the past, if your cable wasn't working, you just put your rabbit ears up. But with phones (and) multiple system operators (MSOs), it's more important the product be more reliable. If it breaks or malfunctions, you may be shutting down a person's Internet, telephone and video service."

Spotlight on coax

Increasingly, the industry is holding coax vendors up to higher standards. Hugh McCarley, director of engineering technology for Cox Communications, buys from several coax vendors and says that quality is comparable between vendors, so he increasingly looks to delivery, support, service and pricing.

Gone too are the days of lengthy delivery times. In the past, operators such as Cox Communications and Adelphia Cable had problems getting coax delivered when needed during peak construction periods. But vendors have conquered the supply problem. "I haven't noticed that in the last several years," McCarley says.

Most coaxial cable now has 1 GHz or greater bandwidth and has little trouble

with capacity. Today's challenges for coax vendors have been to make the cables more durable and easier to install.

Shut off the water

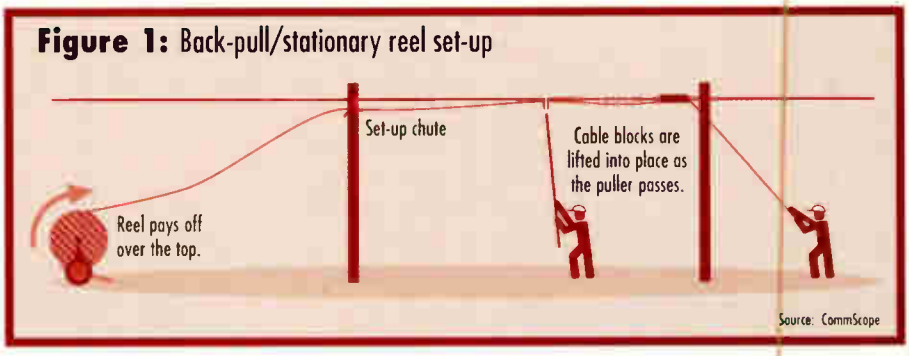
Coaxial cable vendors have been hard at work to lessen the impact of environmental factors such as seaside corrosion and water penetration.

The older a cable is, the more susceptible it may be to water penetration. In the past, coax vendors used gels or greases to block capillaries in cables where water may penetrate. While the gels prevented water penetration and stretched the longevity of the cables, the solution for water blocking made the cables sticky and difficult to handle.

Hoping to give coax vendors an alternative to grease fillers, Neptco manufactures dry-core components for coax cables, which incorporate polymers that absorb water and form a hydrogel, which swells to fill the free volume of a cable waterpath.

Neptco applies the water blocking coating to the shielding tape—a component that drop cable has to have anyway.

Figure 1: Back-pull/stationary reel set-up



Technicians and engineers installing coaxial cables benefit with dry core fillings because they can work easily with the cables without the presence of sticky compounds, reducing the time for cable splicing, decreasing cable weight, reducing the risk of losing adhesion between the outer reinforcing jackets and the sheath, and eliminating the need for rags, solvents and cleaners to prepare the cable for splicing.

No braid, no water

Omega One is also on the water warpath. Its relatively new Pentabond drop cable doesn't have a metal braid; instead, an interlayer of plastic separates two shielding tapes.

Omega One offers the product in a 6 series cable with an 18-gauge copper-clad steel center conductor and an 11 series cable with a 14-gauge copper-clad steel center conductor. The interlayer is bonded to the two tapes. The design is intended to increase the cable's overall strength, prevent jacket slippage, and reduce moisture ingress, making flooding compounds unnecessary for underground applications.

"Pentabond has no braid, so there is no water (migration) path inside of the

Up in the Air

For aerial installations, make sure the cables have been tested and are of the proper length. Ensure cable ends on the reel are capped. Coaxial cable frequently is damaged when unloading from the reel. Make sure trailer wheels are chocked to prevent movements when cable is pulled. Check reel flanges for nails or staples that could damage the cable during pay-out.

When pulling the cable off the reel, adjust reel brakes so the reel will not keep going after you stop pulling. Eliminate mid-span damage by positioning rollers at 25- to 50-foot intervals to provide support. A roller needs to be attached at each pole location after the puller is repositioned from one side of the pole to the other to prevent the cable from coming in contact with the pole.

"You want to use the proper tensions so as to not exceed the pulling capacity of the cable," says Mike Smith, director of engineering with Adelphia Cable's Virginia region. "Sometimes if requirements aren't closely followed, general handling could damage the cable. Some people don't realize what those requirements are. Contractors should use the proper type of cable trailers, equipped with appropriate brakes, sufficient rollers and guides, so cable doesn't sag down and rub against cable and trees and all the other things it can hit."

According to coax manufacturer Trilogy, proper sag and tension during cable installation help maximize cable plant life. Temperature also affects the sag. Trilogy recommends the sag for combined cable and strand be 2 percent of the span length at a temperature equal to the mean climate temperature. Sag increases slightly on hot days and decreases slightly on cold days.

For rebuilding or upgrades, the overlashing method is common. This method requires hanging cable on a strand with existing cable already lashed to it.

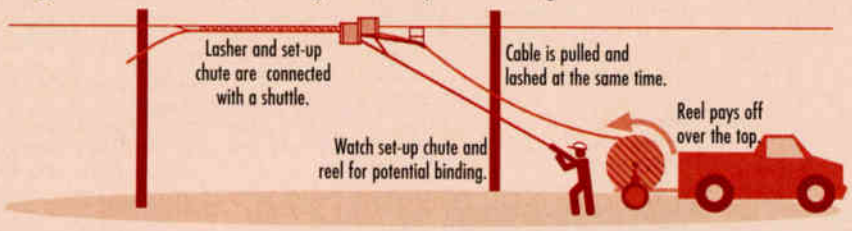
To eliminate the binding effect that could result from the existing lashing wire, use a roller that doesn't lock to the strand. Such a roller would hang on the strand and/or cable, supporting the cable and reducing the pulling tension.

Trilogy suggests the best rollers for overlashing are the type that lock around the cable and strand without locking to the strand itself.

When pulling for the overlash, there is no room for a cable puller to ride on the strand, so attach a long rope to the cable with a pulling grip and pull the rope through the rollers. Give the cable plenty of support, and lay the rope over any roller immediately preceding the cable before it is pulled, with proper back tension maintained. Next comes the lashing. Make sure to maintain proper tension by turning the wheel in order to take up slack as the lasher is pulled.

The messenger cable installation method is used in areas requiring a single cable. Attach the cable with the built-in messenger strand to the poles, being careful with tension and sag limitations. Create expansion loops and slack for splicing.

Figure 2: Drive-off/moving reel set-up and lashing



cable," says Dean Taylor, vice president of sales and marketing for Omega One. "Also, because of the bond, crush performance is better. With Pentabond, each individual layer is bonded."

The braidless design also makes it easier for technicians to add connectors to the cable because they don't have to finger the wire braid. Installation time is thus decreased.

Other vendors also are using corrosion inhibitors. Belden Wire and Cable's anti-corrosion system, TotalGuard, has been available since 1998 for a select group of cables, but only last May did Belden make it a staple in every product. Belden treats both the center conductor and the shield of coaxial cables with the anti-corrosion formula, instead of applying it to only one of the two.

CommScope also applies a corrosion-resistant treatment to the metals in its BrightWire cable during the manufacturing process. The treatment, also a dry filling, chemically combines with metal components to protect the cable from water and subsequent corrosion.

But it's not just water protection that engineers are seeking. "Also, some folks are installing drop cable with higher levels of shielding, to make the return path as clean as they possibly can," says Mark Alrutz, director of technical services for CommScope. "A cleaner path provides a more reliable high-speed data connection."

Never too old for a facelift

The push to upgrade networks quickly to deliver new voice, video and data services has spawned a variety of specialty cables. These combine coax, twisted-pair, fiber and a support messenger all in one jacket. The new cables give engineers designing networks a lot of flexibility in terms of the powering and signal transmission schemes they want to use.

"Telephony-enabled networks require more power, so our Power Feeder cable allows the customer to express power out to the points in the network that need the power," Alrutz says.

The Power Feeder cable, on the market for the past three years, has more metal in the cable than a standard RF coaxial cable, which gives it lower loop resistance and makes it more capable of delivering power. "It's really started to gain popularity recently with a couple of our customers such as AT&T," he adds.

CommScope also upgraded its integrated messenger coax this year, and Alrutz says interest has picked up. Because the messenger strand is built into the cable, operators can save money and time during installation by not having to lash the coax to a separate messenger.

Great in tight spaces

As new competitors continue to enter the communications market, conduit and pedestal space is becoming increasingly scarce. Here too, coax vendors have developed a solution.

Times Fiber Cable engineered its new Flexible Feeder coax for use in strained access points, pedestals and conduit runs. The cable is designed for multiple dwelling units (MDUs) and other establishments requiring tight bends and hard turns.

"It behaves mechanically like a drop cable, but has the electrical attributes of a distribution cable," says Chris Huffman, director of worldwide marketing for Times Fiber Cable.

Flexible Feeder has an inner copper-clad aluminum conductor and a foamed polyethylene dielectric. The first outer conductor is sealed in aluminum-polypropylene-aluminum (APA) tape, the second outer conductor is 60-percent aluminum braid, the third outer conductor is APA tape, and the fourth outer conductor is aluminum braid. The jacket can be ordered in polyethylene or flame-retardant polyvinyl chloride (PVC).

So what's next in the evolution plan for coax? Despite these improvements, coaxial cable isn't a glamorous high-tech product that will look very different in the future, Huffman says.

"One of the things that needs to be understood is that coaxial cable is at its design-end," he says. "The issues with coaxial cable product development are virtually confined to material processing. Broadband service providers, in lieu of cable systems, must future-proof with respect to durability and ease of construction. That's the challenge to the entire industry from a vendor standpoint."

BOTTOM • LINE

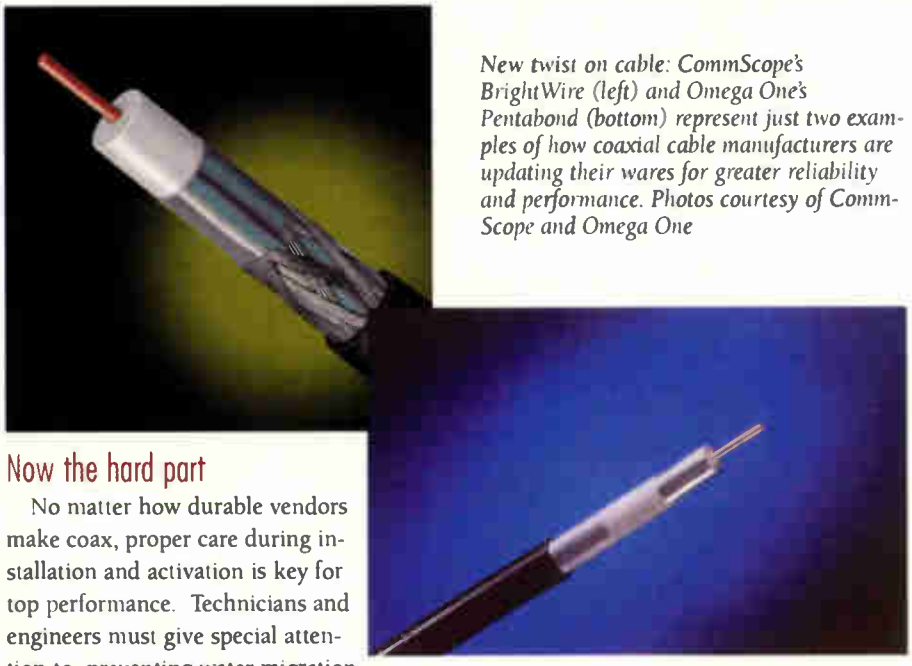
Without Coax, Nothing

Despite all the new goodies entering your increasingly sophisticated networks, the heart and soul of the system still is good ol' coaxial cable. And so it will remain until we figure out a way to cost-effectively run fiber-to-the-home (FTTH) throughout the plant.

All that being so, extending the life of coaxial cable and improving its quality and performance is taking on greater importance throughout the industry. New products are hitting the market, and vendors are hard at work to upgrade existing products.

Manufacturers now offer combination cables that can handle RF, power, integral support messengers and even twisted-pair copper. Also, the messy water and corrosion blockers of the not-so-distant past are giving way to cleaner dry-fill technologies.

But even the best coax can suffer and fail if it's not installed correctly. Be sure to guard your cable against excessive sag and pull tension, as well as rocks and other environmental hazards. And most of all, read and follow the directions that come with your shiny new cable—taking "shortcuts" almost invariably will cost you in the long run.



New twist on cable: CommScope's BrightWire (left) and Omega One's Pentabond (bottom) represent just two examples of how coaxial cable manufacturers are updating their wares for greater reliability and performance. Photos courtesy of CommScope and Omega One

Now the hard part

No matter how durable vendors make coax, proper care during installation and activation is key for top performance. Technicians and engineers must give special attention to preventing water migration in the cables during the installation process as well as during storage; choosing a cable with a flexible polyethylene jacket to prevent cracking or shattering at low temperatures and to protect the cables from rocky terrain and chemicals in the environment; and adhering to vendors' specific instructions on extending cable and connector life when activating cables after installation.

When installing coax in aerial runs, technicians need to be especially careful. Check out the tips on pages 132 and 133 for useful installation tactics.

Read the directions

Last but not least, follow the vendor's specific installation directions, no matter how long you've been in the industry. Take extra precautions when connecting and activating cables after installation.

"Follow established procedures rather than take shortcuts, no matter how tempting," Omega One's Taylor says. "We've tried to take shortcuts, and it ends up being harder to do than following directions. It's more straightforward to do it right the first time."

So take a second look at your ol' friend coax. By choosing a cable that's specialized for your application and physical environment and installing it properly, you'll improve your system's performance, keep customers happy, and save money by avoiding premature replacement of corroded and damaged cable. CT

Ruth Suarez is a telecommunications editor with Phillips Business Information. She can be reached at (301) 340-7788, ext. 2019, or via e-mail at rsuarez@phillips.com.

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Using Powers of Numbers, Part 1

This month's installment begins a mathematics refresher series. The material is adapted from a lesson in NCTI's Installer Technician Course. © NCTI.

Mathematicians often simplify or shorten complicated expressions. For example, we can determine the volume of a cube by multiplying (l) (w) (h) or actually (s) (s) (s), since the sides on a cube are all equal. We can write this as $V = s^3$, and read it as "s to the third power." The 3 is a superscript and also is called an exponent.

Because you'll use powers of numbers in electrical applications, this series will review the three powers most commonly used: the square (power of two), its opposite operation (square root) and powers of 10.

Squaring numbers

The square is defined as the product of a number or quantity multiplied by itself. The square of 6 (that is, $6 \times 6 = 6^2$) is 36, and the square of a (that is, $a \times a$) is a^2. You cannot express an actual numerical value for a^2 until the unknown a becomes a known value.

You will encounter the squaring of a number using Ohm's law, when working with the power formulas $P = I^2R$ and $P = E^2/R$.

Complete the following squares:

(a) 2^2 = ?
(b) 4^2 = ?
(c) 5^2 = ?
(d) 10^2 = ?
(e) E^2 = ? When E is 110 volts
(f) I^2 = ? When I is 0.5 amp
(g) If $P = I^2R$, P = ? watts, where: I = 0.9 amp, R = 124 ohms

The answers are upside down at the bottom of the page.

Although you can multiply a number times itself even 12 times (×12) on a calculator without difficulty, most hand-held calculators have a "square of" function (x^2), and many also have the "exponent" or "power" function (y^x or ∧).

To use the "square of" function on a TI-30X (or equivalent) calculator to find 7^2, press:

Display reads 49

To use the "square of" function on a TI-30X II (or equivalent direct algebraic logic) calculator to find 7^2, press:

49 also is displayed

You can evaluate any power or exponent, such as 2^{12}, using a TI-30X (or equivalent) calculator by pressing:

Display reads 4096

and with a TI-30X II (or equivalent direct algebraic logic) calculator by pressing:

4096 also is displayed

You can combine the squaring function with the multiplication function, as in 0.8 x 10, using a TI-30X (or equivalent) calculator by pressing:

Display reads 6.4

and with a TI-30X II (or equivalent direct algebraic logic) calculator by pressing:

6.4 also is displayed

Next month's installment will continue with determining square roots.

Answers:
(a) 4 (b) 16 (c) 25 (d) 100
(e) 12,100 volts (f) 0.25 amps
(g) 100.44 watts

AD INDEX

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- ❑ 35. Partner

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- ❑ 55. Engineer
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- ❑ 54. Telephone/PCS Equipment
- ❑ 55. Power Supply. (Batteries, etc.)
- ❑ 56. Video Servers

F. What is your annual cable equipment expenditure?
- ❑ 57. up to $50,000
- ❑ 58. $50,001 to $100,000
- ❑ 59. $100,001 to $250,000
- ❑ 60. over $250,000

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- ❑ 78. OTDRs
- ❑ 79. Power Meters
- ❑ 80. Signal Level Meters
- ❑ 81. Spectrum Analyzers
- ❑ 82. Status Monitoring
- ❑ 83. TDRs

J. What is your annual cable test and measurement expenditure?
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VIP Division's self-stick cable and conduit labels offer high visibility and are intended for both indoor and outdoor applications.

"Caution" labels are orange with black lettering and are specifically identified for telephone, cable TV, data or fiber optics. "Danger" labels are red with white lettering and are identified for high voltage, ranging from 120 V to 600 V.

Standard sizes are 0.5 x 2 inches, 1.75 x 3 inches and 3 x 6 inches. Custom designs, sizes and colors also are available.

For more information, contact VIP Division at (800) 950-4921.

Cleaning Wipes

SatWipes from Krell Technologies are presaturated cleaning wipes intended for cleaning optical fibers and connectors prior to fusion splicing or connector mating.

Each is presaturated with 100-percent isopropyl alcohol. The wipes are dispensed individually from a reusable and resealable pop-up canister, and refill packs are available. Each pack contains 185 individual 4 x 4.25-inch 100-percent polyester wipes. They are lint-free and cleanroom Class 100 rated for minimal contaminants.

For more information, contact Krell at (732) 786-1696 or on the Web at www.krelltech.com.

Lashing Machines

If aerial installs are in your future, check out General Machine Products. The company offers four lasher models to fit various needs: the Apollo, C, J2 (pictured) and G.

The Apollo features parallel-pull capability, interference-free overlashing, 12.5-inch diameter and 39-pound weight. It can lash up to 4-inch diameter cable combinations to 0.25 to 0.375-inch strand.

The 33-pound C can lash single or multiple cables up to 1.625-inch diameter.

The 46-pound J2 can lash cables up to 3-inch diameter and features a built-in mechanical brake and automatic drum lock.

The 71-pound G can lash 2.5 to 5-inch diameter cables to larger strand, 0.6875 to 0.75 inch.

For more information, contact GMP at (215) 357-5500 or on the Web at www.GMPtools.com.

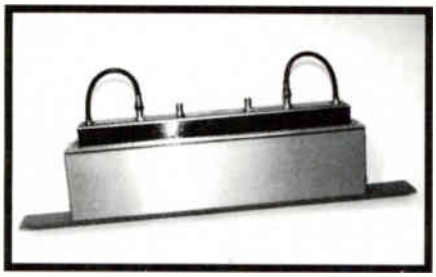
DOCSIS Modem Reference Design

Available only to cable-modem manufacturers, Conexant Systems' CN9420CM cable modem reference design includes all necessary silicon and software to create a complete subscriber modem that can support all popular modem standards. Manufacturers add their own branding, while retaining the flexibility to customize.

For more information, contact Conexant at www.conexant.com.

Deletion Filter

Communications & Energy Corp.'s 2500 series deletion filter is now available for Ch. 2-Ch. 85. It's designed to delete a channel for reuse, leaving adjacent channels in service.



Intended for headends and commercial installations needing low adjacent channel loss, each filter has a standard passband of at least 550 MHz, and Chs. 2-13 can be extended to 750 MHz for an additional charge.

Chs. 23-85 automatically pass above 550 MHz depending on frequency (please inquire with C&E), and through loss typically comes in at less than 1 dB.

Connectors are 75-ohm type F, female and female, and the rack-mountable filter measures 1.75 x 19 inches.

For more information, contact Communications & Energy at (800) 882-1587 or on the Web at www.cefilter.com.

Metallic TDR

Riser-Bond Instruments' Model 1205CXA metallic time domain reflectometer (TDR) improves upon the company's Model 1205CX TDR. Both are designed specifically for cable TV/broadband technicians.

Improvements in the Model 1205CXA include sub-nanosecond pulse width, a larger liquid crystal display (LCD) and a simplified keypad. The unit also features waveform storage, wave viewing software, range-finding, intermittent fault detection, an RS-232 serial port, noise filters, automatic search capability, a rechargeable battery pack and weatherproof packaging.

For more information, contact Riser-Bond at (800) 688-TDRs or on the Web at www.riserbond.com.

Temp Control Module

ILX Lightwave's LDC-3916550 dual temperature control module is an add-on feature for the company's LDC-3916 multichannel controller, which allows up to 32 independent channels of temperature control on one mainframe.

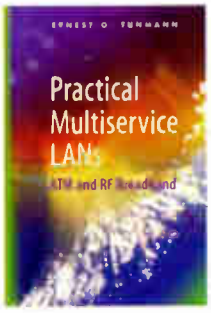
The modules also can be mixed with laser diode control modules for applications that require case temperature control as well as laser current source and internal temperature control. The module can drive up to 1.5 amps in either direction and features adjustable temperature control current limit, voltage measurement, adjustable gain and selectable thermistor current.

For more information, contact ILX Lightwave at (800) 459-9459 or on the Web at www.ilxlightwave.com.

BOOKSHELF

The following is a listing of some of the resources currently available by mail order through the Society of Cable Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers can contact the Society for additional pricing information.

- *Understanding Data Communications* (Sixth Edition) by Gilbert Held—This book includes updated coverage on today's hottest topics, including thin client technology, x2 and 56 kbps modems, voice digitization, and wireless data transmission. *Understanding Data Communications* provides a full scope of information on the evolution and modern developments of data communications for the individual with a moderate communications background. Order TR-45, $40.
- *Video Compression* by Peter D. Symes—This book provides practical and theoretical understanding of video compression options for storage and transmission in digital TV (DTV), Internet video and other technologies. It reviews Joint Photographic Experts Group (JPEG), Moving Picture Experts Group (MPEG)-1 and MPEG-2—today's most widely used image compression standards. It also presents an intriguing glimpse at other systems currently in development. Order TR-46, $55.
- *Practical Multiservice LANs* by Ernest O. Tunmann—This book provides an overview of the evolution of telecommunications technologies and predicts future trends in the long distance segment, the local loop, the wide area network (WAN) and today's transmission network, the local area network (LAN). Order TR-47, $79.



- Residential Broadband by George Abe—High-speed residential networks represent an order-of-magnitude leap beyond today's familiar networks because of the scope of the population they must reach and the variety of services they may eventually provide. This book takes a broader look at the issues of residential broadband services, in particular the issues involving fast networks to the home. Order TR-48, $55.
- *Video Engineering* (Third Edition) by Arch Luther and Andrew Inglis—A tutorial lifesaver for engineers and technicians alike, this complete update of the top references in video engineering technology provides up-to-speed information on the many advances that have remade the industry over the last few years. Loaded with real-life examples, *Video Engineering* helps systems with the task at hand, whether it's choosing new equipment, designing a system or solving a specific technical problem. Order TR-19, $65. CT

By Jim Ludington

ET 2000: Keeping You In Front of Technology

For those who presume that any calamity caused by the Y2K "bug" will be short-lived, travel reservations are in order! If you are ready to discover what's in store for your networks in the coming year, attend ET 2000—the Society of Cable Telecommunications Engineers' Conference on Emerging Technologies—in Anaheim, Calif., Jan. 11-13.

Over the past few months, a handful of your cable industry brethren have been busily sorting, scrutinizing, debating and "e-sponding" in order to select an outstanding set of panels and presenters for ET 2000. If you have watched the progress of this conference over the past decade, you realize that the subject matter that has been presented in many instances becomes an industry reality within just a few years.

Next-generation technology and standards

The topics we've selected for the coming conference are in lockstep with that history. Some panels will focus on the next generation of services and the expected advancements in the technologies we utilize today. Other panels will focus on standards and solutions that must be forthcoming for our industry to define, as well as deliver, an array of high-quality broadband services.

To kick things off, we'll present three preconference tutorials on Tuesday, Jan. 11. Issues that are high on the "What are we gonna do about..." list, drafted by SCTE members and senior technical managers across the industry, are home networking, digital signal quality and various advancements relating to the Data Over Cable Service Interface Specification (DOCSIS).

Panel discussions

You'll also hear from the industry's leaders in a series of panel discussions set for Jan.12-13. These experts will discuss nonproprietary technology or standards that likely will impact the industry within the next one to three years. Following is the slate of ET 2000 sessions, with a few thoughts about each one.

Broadband telecommunications applications: Some folks can pick up a phone that has a dial tone provided by their cable operator to order cable modem service because they saw the cable TV ad that was target-delivered only to homes in their neighborhood. That's pretty good, but not good enough. There are security, capacity and technology obstacles that will substantially limit penetration and service quality unless they are attacked with a vengeance in the coming years.

Interactive services and advance set-top applications: The tasks of creating a video-on-demand (VOD) service are as daunting, if not more so, than those required by telecom services. Press a button or a key to get streaming video. That's the expectation. Success depends upon blending architectural issues ranging all the way from physical transport to set-top box middleware and the application interfaces.

Home area networks: The set-top as the traditional termination point on the cable network gives way to the "net-top" as true broadband arrives in the home. Net-tops will provide the interface between the subscriber and the imminent array of broadband service providers, as well as the in-home network that ultimately will evolve to provide data connectivity throughout the home. The requirement for a set of home area network interface specifications is undeniable.

Network management solutions for digital broadband: While the industry begins the process of adding digital service tiers, we are simultaneously seeking ways to collapse the number of headends and seek ways to centrally manage the network. The challenge is to integrate network components and software systems that reside in multiple locations, run on multiple platforms and are delivered from a variety of vendors.

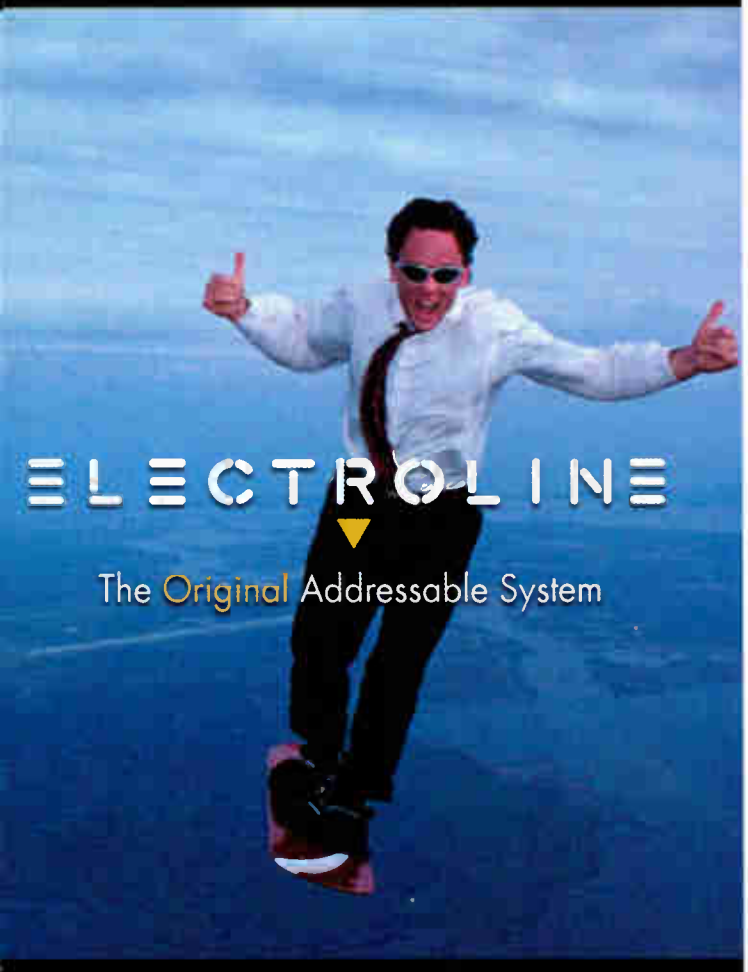
Currently, there is no common set of broadband network management protocols, and the ability to effectively manage issues such as provisioning, fault detection/correction and quality of service (QoS) all depend upon a common infrastructure.

Advancements in distribution and transport architectures: Broadband network engineering can be generalized into a three-tiered process. First, the network bandwidth is created. Then it is allocated to the services to be provided. Lastly, network bandwidth is maximized by taking advantage of compression and modulation technologies. This year, we continue to provide a look at future methods of maximizing the efficiency and reliability of various segments of the network.

See you there

After you survive Y2K, get the information needed to succeed in the coming years at ET 2000.

Jim Ludington is president of INT2-Internetwork Integration and is the chairman of SCTE's Conference on Emerging Technologies 2000 Program Subcommittee. He can be reached at jimmylud@int-2.com.



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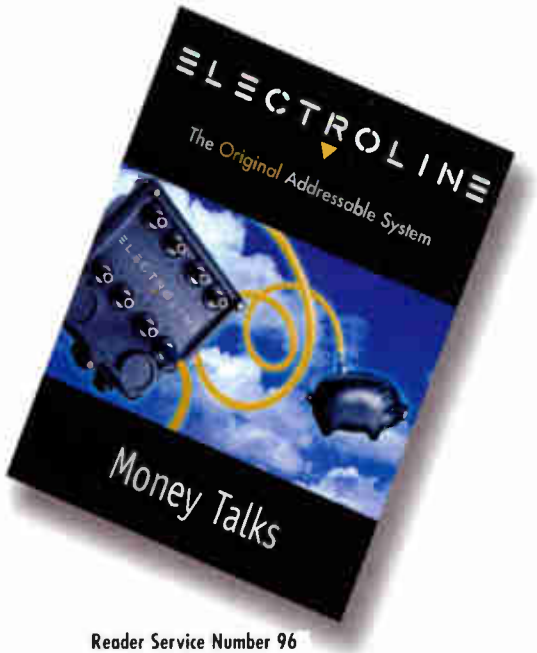

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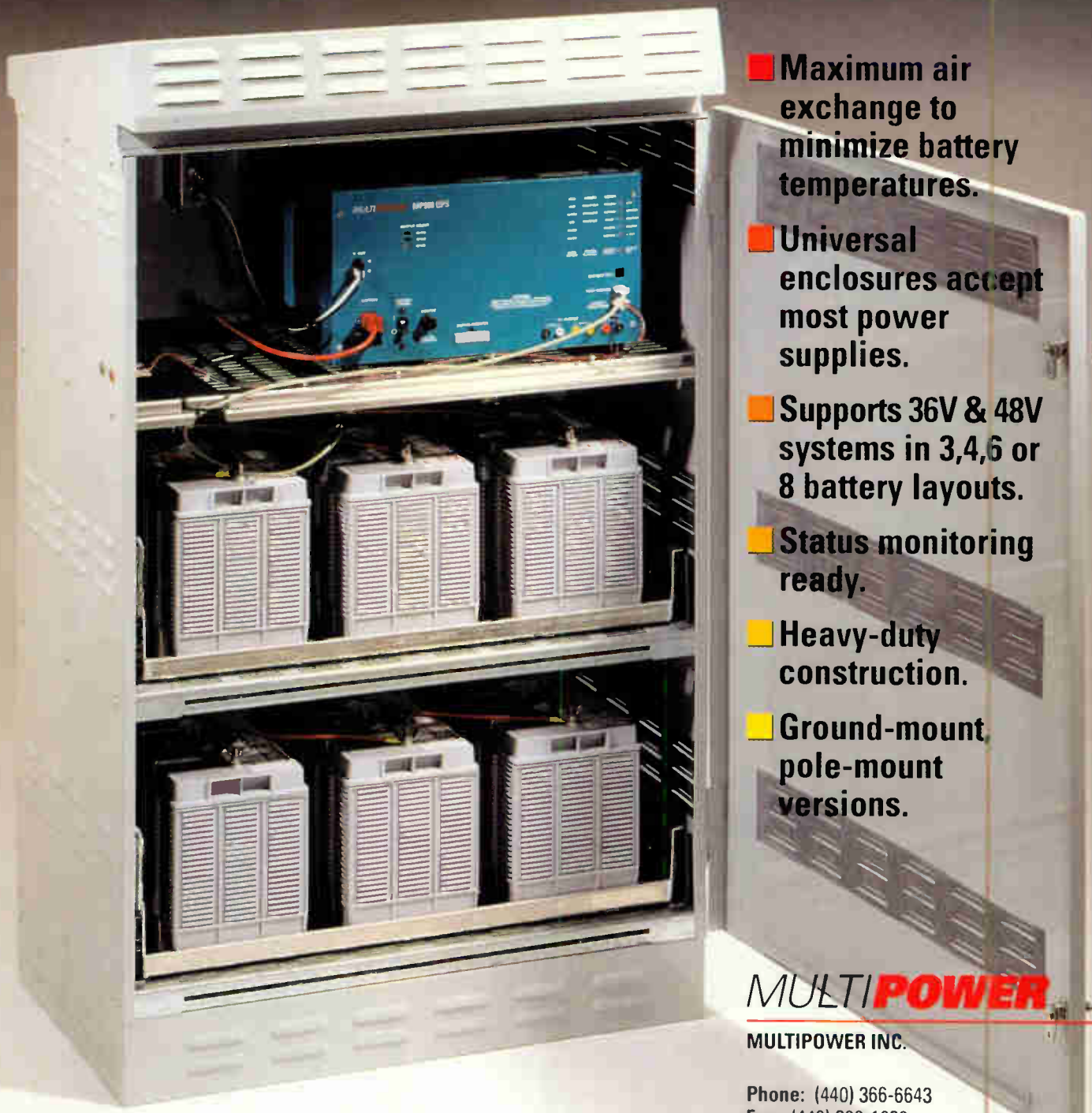

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