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Signal theft: $3 billion a year down the drain

—page 28

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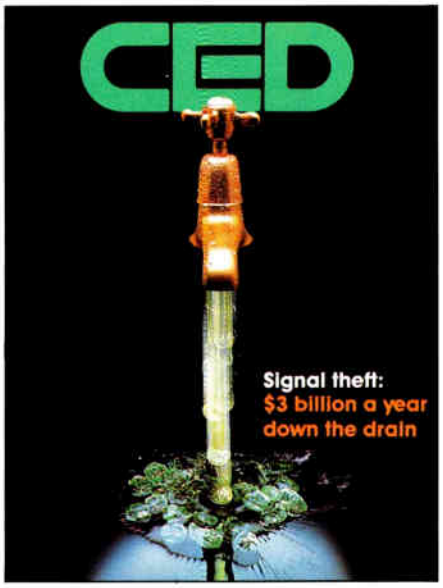

About the Cover:
An estimated 11 million signal thieves steal cable services each year. Photo by Tony Stone, Worldwide.

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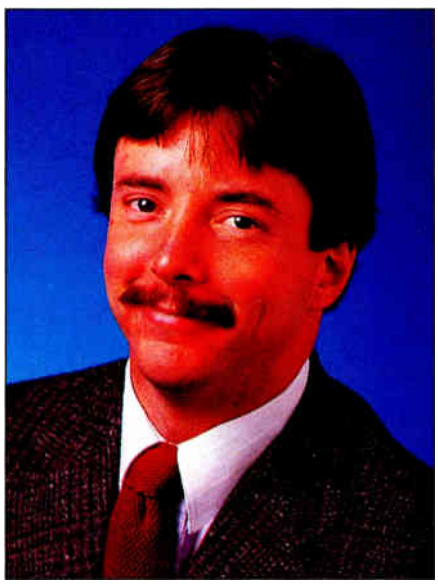
Where are all the entrepreneurs?

It came across my desk as a seemingly innocuous press release: Cablevision Systems chooses addressable tap technology for two systems on Long Island. Cablevision engineers, when queried, were likewise reticent to make much of the announcement—choosing instead to note the field trial is as much a test of the technology as the operational savings it promises.

But just like the ATC Brooklyn/Queens deployment of 1 GHz of bandwidth and Jones Intercable's roll-out of interdiction in Elgin, Ill., the test represents another operator willing to move beyond a philosophical discussion into testing and deployment.



There are a number of key technological leaders in cable TV. And when you sit them down to talk technology, a gleam comes to their eye. They talk about compression and 150 channels, interactive television, HDTV, etc. with a certain *excitement*.

But, inevitably, cost issues come into play and the dream fades into a discussion of what is pragmatic and prudent. Technology costs money and money is always in short supply.

Another limiting factor is peer pressure. Everyone wants to be the first to do something because it garners a lot of attention. But when you get right down to it, the engineering community within the CATV industry is a close-knit group and no one wants to fail in front of their friends. Secrets don't stay secrets long. Consequently, seemingly "offbeat" ideas often aren't fully explored for fear they won't work. And that's too bad.

That's why it's encouraging to see operators try new things. Technology is opening a lot of new doors. They shouldn't be slammed shut because there is disagreement over implementation issues. We need to recapture the entrepreneurial spirit that lead to so many new ideas. Sure, some failed—miserably. But others were accepted and became the norm.

The key concept to remember is that nothing is perfect everywhere. Individual systems have specific needs. Interdiction isn't right everywhere. Neither is compression. There are still plenty of systems that don't, and won't, have any fiber for the foreseeable future. Is that necessarily wrong?

Roger J. Brown

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Circle Reader Service No. 5

Cablevision Systems will test Dropguard addressable tap

Amid all the confusion over interdiction, digital video compression and the consumer interface, Cablevision Systems Corp. is testing yet another alternative—the addressable tap.

The Long Island-based MSO has elected to purchase an unspecified number of Dropguard addressable taps from AM Communications of Quakertown, Pa. and will install them in two locations. Cablevision plans to use the devices, which are little more than standard taps that can be remotely enabled and disabled, in areas of high churn and in environments with high concentrations of multiple dwelling units.

According to Wilt Hildenbrand, vice president of engineering support and customer relations, Dropguard will be installed in Westchester and East Hampton, Long Island. Those two areas were chosen because the latter is a resort area with high seasonal traffic, and the former is mostly high-rise apartments prone to a high percentage of signal theft.

Less theft?

Hildenbrand is most interested in determining if the taps result in less theft and increased operational efficiencies because of their ability to be turned off remotely without dispatching a truck. He downplayed the significance of the deal with AM, but said if the units "work as advertised, we'll probably deploy them elsewhere." He also said the field trial would be test the technology as well as the theory of operational savings.

The functionality of devices like Dropguard fit in well with Hildenbrand's philosophy of working toward a "permanent drop system" that, once it is installed, is left largely intact. By performing fewer physical connects and disconnects, it is believed that less money will be spent on drop cable, connectors and other hardware. It is also thought to impact signal leakage, the majority of which comes from the drop system.

While Cablevision largely downplayed the announcement, officials at AM were ecstatic. David DeLane, vice president of marketing at AM, believes Cablevision's adoption of his product may spur others into similar projects. DeLane notes that unlike interdiction systems, addressable taps can be easily deployed in pockets of addressable systems without impacting power consumption or system design. "We're putting a lot of effort into (supporting the roll-out at Cablevision). I think it's safe to say we're betting the farm on (the technology)."

While AM may bet the farm, the wager is considerably less for others. However, the idea of controlling video signals somewhere other than inside the home is receiving a lot of interest. Look for many other operators to use the simple technology for university, MDU and resort areas.

Telephone on coax cable?

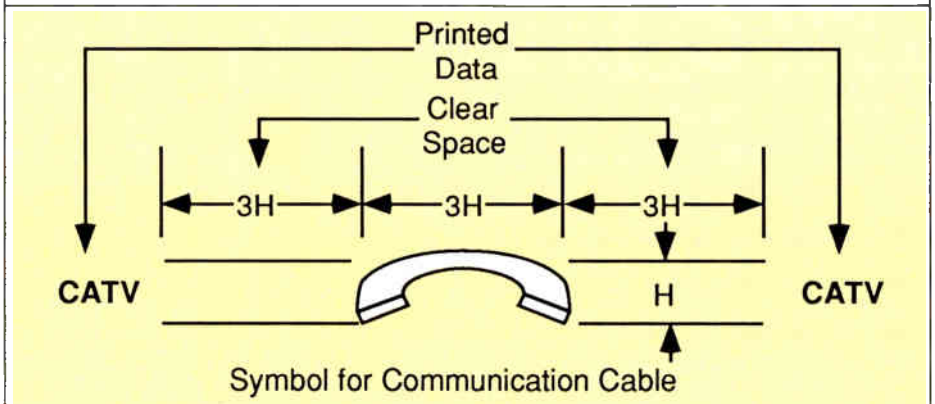
In an ironic twist that won't be missed by many, a new provision of the National Electrical Safety Code may mandate that all underground communication class cables, including those used for CATV, be marked with a telephone handset for identification. The proposed requirement is part of the 1993 Code, which is in its final review stage (comments are due no later than September 30).

According to Jim Kearney, director of engineering at Malarkey-Taylor Associates and NCTA's representative to the NESC, the handset symbol was chosen because the NESC only distinguishes between communications and supply cables, and not between *types* of communication providers. However, an additional, optional symbol could be used to identify CATV cables. A possible cable TV symbol might be simply "CATV" (see Figure 1).

Under the proposal, underground supply cables will be imprinted with a lightning bolt. In either case, the identifications will be imprinted or embossed on the outermost jacket at 40-inch intervals.

Kearney notes that another proposal makes it more likely for power companies, especially smaller, municipally owned entities, to consider providing television, data and telephone services. The proposal, advanced by the power industry, permits expanded use of communication cables in the supply space of utility poles. This proposal removes the present-day "exclusive use" requirement, which reserves the supply space on the pole for power company data and communications only. While the proposal preserves the 40-inch neutral space between supply and communication attachments, it would also allow customers or entities other than the power companies to be served by a power company-installed and maintained communication cable.

Persons or organizations wishing to file comments on the proposal are urged to contact Kearney (202) 835-7800 or write, no later than September 30, to: NESC Committee at the IEEE, 445 Hoes Lane, P.O. Box 1331, Piscataway, N.J. 08855-1331.



NESC Proposed Marketing for Underground Cables

AT&T shows new EDFA

A new line of erbium-doped fiber amplifiers (EDFA) designed for voice, data and cable TV was unveiled in late

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July by AT&T Microelectronics at the Optical Society of America's meeting.

The addition of fiber optic amplifiers allows cable operators to take the stronger signal and split it to numerous receivers, thereby reducing the cost of a laser/receiver link. The device can also be used simply to extend the reach of a television signal.

The device is designed to amplify signals sent in the 1550 nm window. To date, however, most cable operators have chosen to deploy their systems using 1310 nm hardware because those devices have been available longer.

The M1701-Type "Thinpak" amp module houses both the optics and electronics in a 3-inch by 6-inch metal package. It is priced in the low-$30,000 range and is primarily intended for laboratory and developmental use. The device uses a high-power 1480 nm pump laser to boost signals.

AT&T joins several other manufacturers of EDFA's with its product, but is one of just a few developed with the CATV industry in mind. Corning Inc. displayed its amplifier module during the SCTE Cable-Tec Expo in Reno in June. To date, however, Cablevision Systems is the only MSO that has publicly committed to use of the 1550 nm window for video delivery.

Compression Labs aligns with ATRC

As the testing and selection process for a national HDTV standard gets underway, system proponents are striking strategic alliances they hope will give them a leg up on the competition.

The latest deal involves Compression Labs Inc. (CLI) and the Advanced Television Research Consortium (which consists of the David Sarnoff Research Center, Philips Consumer Electronics, Thomson Consumer Electronics and NBC). The two have agreed to integrate CLI's technology into both ATRC systems. (The ATRC is presently planning to attack the selection process on two fronts via its Advanced Digital Television system and its NTSC-compatible, "extended definition" system, called Advanced Compatible Television, which was under test at the Advanced Television Test Center as of press time).

Graceful degradation

According to an ATRC spokesman, CLI was brought in to help the consortium deliver a signal with maximum coverage and "graceful degradation" of the digital signal. This would eliminate the sharp signal cutoff thought to be characteristic of digital systems. Compression Labs also created the compression algorithm used by Skypix for its DBS service.

The ATRC consortium has chosen to pursue both "true" HDTV and enhanced NTSC because it believes the widescreen, 16-by-9 picture is what will attract viewers to HDTV. By spurring sales of widescreen televisions (and programming) now, the evolution to HDTV will be less painful, the consortium believes.

HDTV broadcasts planned in Canada

With testing of HDTV underway, the next question is: Will anyone buy it? To help spur interest, several companies and organizations have announced plans to broadcast HDTV to the public. Japan's NHK has been showing an hour of HDTV every day for almost two years; CableLabs announced its plans to show HDTV via cable systems (but so far no details have been made public) and now, Canada will show HDTV in bars.

Skyvision Entertainment, a division of John Labatt Ltd., has put together a network of pubs and bars to show sports programs via satellite. It is expected that between five and 10 venues will be networked together within six months.

GI chooses Macrovision to protect PPV

In what must come as a major blow to rival Eidak, Macrovision was selected by General Instrument as the copy protection technology for its DigiCipher digital video compression system.

DigiCipher compresses as many as five standard NTSC signals into a single 6-MHz slot. The technology is being considered by many cable operators to be the vehicle to cost effectively deliver multiple channels of pay-per-view in a near-video-on-demand environment.

Macrovision's PPV protection technology builds upon the anticopy process that has been used on millions of videocassettes. It incoroprates two anticopy process to degrade copies of the programming offered via PPV. Of course, the original programming is unaffected and can be watched normally.

The Macrovision technology will be integrated by GI into its decoder and can be activated by the rights holder in a program-by-program basis. No pre-programming or previewing is necessary to protect pre-recorded programs and live events require no special equipment for protection.

Macrovision officials expect the technology to be embraced by the DBS, cable, TVRO and hotel industries to protect programming.

Jottings

Scientific-Atlanta scored a major coup by snatching **Bob Luff** away from Jones Intercable. Luff joins S-A's broadband group this month as vice president of strategic operations. He was with Jones for five years (and was just recently named the MSO's chief technical officer) after stints with United Artists and the FCC... Speaking of **S-A**, that company has rolled out its new addressable converter with on-screen graphics. More than 50,000 model 8600 set-tops are expected to be shipped to 20 different systems by the end of October... In case you think the cable industry is slow to catch on to new ideas, get this: A survey conducted by The Professional Video Marketplace shows that broadcasters and cable operators are among the leaders in adopting desktop video technology (and cable operators even beat out the broadcasters). The same survey showed that nearly every broadcaster surveyed said DBS was the most significant development to them... **International Cablecasting Technologies**, the digital audio service delivered via CATV, was on the receiving end of a $12.5 million infusion of cash from **Scientific-Atlanta** and **KBL Services Inc. (KBLCOM)**, a subsidiary of Houston Industries. The two firms purchased discounted ICT stock... Some 60 U.S. and Canadian communications firms have joined together to form the **Switched Digital Services Applications Forum**. The group will promote and develop switched digital products. For info, call (703) 689-5654.... ■

—Roger Brown

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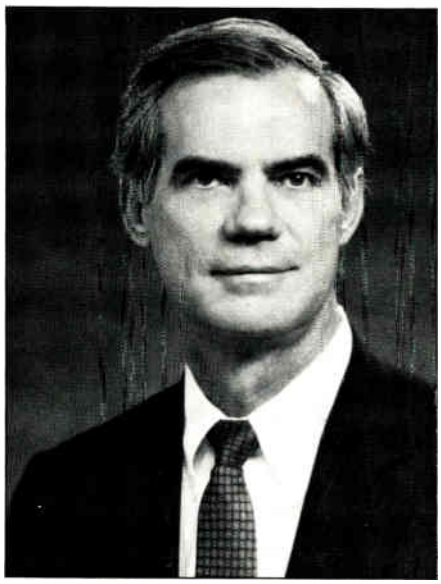

Earl Langenberg

A welcome ally

The cable television industry couldn't ask for a better guy to be working for the competition. As VP of engineering for US West's Cable Communications division, Earl Langenberg is a devoted and knowledgeable 18-year cable veteran—one look around his office confirms it.

The walls are adorned with a series of CATV-related photographs, including one of a cow entering what looks like a barn—but on closer examination, the barn is really a makeshift cable headend. Plaques and knick-knacks from cable industry groups are smattered about; a segment of a patented piece of cable sits prominently on a shelf. A mug given as a gift from his colleagues at Rogers Cablesystems sits beside it.

A premeditated leap

Why did this well-seasoned engineer, with a resume citing engineering stints at Systems Wire and Cable, Rogers Cablesystems and American Television and Communications, choose to "cross the fence" into the telco world?

"Two reasons. First, I was interested in US West's involvement in the United Kingdom—it's the only place in recent history where cable television and telephone licenses were granted to the same owner operator. That's intriguing," Langenberg explains.

"Secondly, they have a tremendous amount of resources—not to say that cable doesn't," Langenberg quickly adds, almost protectively. "I could—and do—argue very favorably in favor of cable television."

When asked about the differences between cable and telcos, Langenberg is thoughtful. "The only place I can find where our two industries are at real odds with each other anymore is at the association level," Langenberg says.

"The reason is that they're each protecting turf. Our game plan is to keep cable operators out of our business; and cable operators are trying to keep us out of their business—when in fact, it's a common business," Langenberg emphasizes. "I feel that the two industries will come together as partners, not as adversaries."

Langenberg has an expansive vision for the telco/cable partnership, which he foresees happening within 15 years. As the engineering visionary for US West's cable arm, Langenberg's crystal ball depicts a partnership hinged on existing and future fiber/coax architectures.

"The cable television network and the telephone network will look the same, eventually," Langenberg predicts. "Because cable's fiber optic tree-and-branch architecture will liken telco's physical star/logical bus architecture—to the point where the two are very near, if not identical. Then, I think active and passive devices will only be used to maintain a usable two-way communications path, as opposed to processing.

"I guess I should say at this point that 'my views do not necessarily reflect those of US West,' " Langenberg laughs. "Most telephone engineers today will tell you that there is a need for intermediate electronics that actually do signal processing in the network.

"That's where the difference lies," Langenberg adds. "They want to do processing in the middle. I think that's too expensive."

Perhaps it's Langenberg's extensive cable background that keeps cost concerns paramount. It's obvious during his description of the cable/telco network of the future. "The fiber optic network will be subdivided into hubs to cost-effectively handle current requirements.

"As these requirements increase over time, hub sizes can again be subdivided. These hub requirements will soon be in a 1,000 to 500 homes passed range," Langenberg says.

Why a partnership?

"A cable-telco partnership will clearly, happen, though," Langenberg asserts, "because the cable television partner brings operating expertise in programming and entertainment services. The telco partner provides expertise in marketing and managing switched voice and data."

To Langenberg, an eventual cable/telco alliance "just makes sense. You use the expertise of the individual players. You use the resources and the money available. You work collectively. It's common sense," Langenberg says.

Common sense seems to be another element that means a lot to Langenberg, particularly when discussing future technologies. "What seems to be the *most* real, I think," Langenberg says, "is a network that accommodates cable television entertainment video, local access telephone, cordless telephone, cellular telephone, and (power) load management."

And it's the network that combines video, voice and data that Langenberg cites as his greatest forthcoming challenge.

Aside from that, Langenberg is working on a seemingly mundane, but highly important project that will cost-effectively water seal active and passive cable television components and protect them in underground installations. "I'm really interested in it," Langenberg explains, "because it's never successfully been done. I think that with the help of the folks at United Artists, we'll successfully do that in the U.K. within a year."

Married to the industry

When not traveling back and forth from the United Kingdom, Langenberg is an avid golfer, skier and boatsman. Interestingly, his wife Barbara is the director of planning and analysis for United Artists Entertainment. "I'm literally married to the cable industry," Langenberg laughs. "Barbara represents the management side of cable, and I represent the engineering side in our relationship"—which must make for some lively dinner discussions.

The NCTA, SCTE and IEEE round out Langenberg's professional affiliations. But wait a minute—why no telephone trade associations? "Good question," Langenberg sheepishly answers. "That'll change. But none right now." ■

—Leslie Ellis

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Between the lines

The events of the week of July 22, 1991 will have Washington lawyers and politicians all abuzz for months (or even years) to come. During this week, the Honorable Judge Harold Greene ruled that the restrictions that kept the regional Bell operating companies (RBOCs) out of information services must be lifted.

Judge Greene (as all *CED* readers should know) is a judge who presided over the divestiture of the old Bell system. At the time of his ruling (modification of final judgment, or MFJ), the RBOCs were prohibited from a wide range of activities.

Some of these were called the "line of business restrictions," and a more specific issue was and is that of "informational services." Prior to the actions of this week, the RBOCs were not allowed to provide the *content* of information services, nor were they allowed to change, manipulate, edit, own or otherwise influence the flow of information. They could, however, act as carriers of the information services of others.

From virtually the beginning of the life of the MFJ, the RBOCs have been petitioning the court to release them from the various restrictions. Now, it seems, they have succeeded in convincing the court to let them have their own way.

The good Judge did, however, stay the effect of his ruling in order to allow for the expected appeals to be filed and ruled upon, a process that is estimated to take about a year.

By Wendell Bailey, Vice President Science & Technology, NCTA

Required reading

The actual document is "must reading" for anyone with an interest in this issue. If one were to ignore the cover page, he would be shocked to find at the end of 53 pages that the Judge had ruled to remove the restrictions.

Indeed, the Judge himself says, on page 53, that "...it would hardly make sense or be in the public interest to cancel an important part of an antitrust decree forged after several decades of on-and-off litigation, and turn a key ingredient of the emerging information society over to corporations who not so long ago were involved in major violations of antitrust laws, and who even now seem ready to engage in anticompetitive practices whenever the opportunity presents itself. Indeed, it would be difficult to conceive of a step that would be less in the public interest."

The entire ruling is absolutely filled with careful analysis of the issues on a point-by-point basis. The comments cover not only the activities of the RBOCs, but the filings of the Department of Justice as well. The findings are insightful and articulate and hard (if not impossible) to refute with logic or evidence, and they (the findings) uniformly and without exception find the claims of the RBOCs to be "in error," "false," or "ridiculous." Greene's comments regarding the Justice Department are more polite but equally critical and disbelieving.

Judge Greene notes time and time again the facts that are the record prior to 1984 (when divestiture occurred) as well as the factual evidence of the behavior of the RBOCs since divestiture. He cites the overwhelming evidence of anticompetitive behavior of the old Bell system as well as the countless examples of monopolistic behavior since the MFJ.

The clearest and most disturbing undertone in the proceeding is the plain fact of the good Judge's own concern for the welfare of the American public and of the loss of a sharp, competitive marketplace that he believes is alive and well today.

If the picture is as I have painted it, then by now you must be asking yourselves why on earth the Judge ruled the way he did. I wondered that too. Several pages of the decision are taken up with a detailed explanation of why the Judge felt that he *had no legal alternative*. It seems that in late 1990, the appellate court that handled an appeal of an earlier ruling on this matter by the same judge, stated two very important principles as its main reasons for remanding the earlier case back to Judge Greene.

These two principles are the crux of the matter. One issue that the higher court directed comment to was on the amount of "weight" that the district court judge should give to the filing by the Department of Justice. The higher court insists that the government agency's finding should be given "special weight and deference." As I have previously mentioned, Judge Greene found the pleadings of Justice to be unpersuasive in general and downright incorrect in several areas.

The other issue was how the burden of proof should be weighted. Judge Greene felt that if the outcome of a particular ruling was highly likely or probably based on an analysis of his findings, then that was the correct standard to apply. Sort of like "guilty beyond reasonable doubt."

The appellate court preferred the test of certainty. That test is this question: Was (or is) the court absolutely certain that the problems that it believed would follow a ruling in favor of the RBOCs going to occur? Judge Greene, being a thoughtful and honest man, said that he could not in good conscience state that any future action would occur with certainty.

Impossible standard

The Judge went on to say that he felt that the test of certainty was a greater burden for the court to bear than would be required in a murder case. He termed it "an impossible standard to meet." Consequently, forced by an honest opinion of the appellate court's power over the district court, Judge Greene felt that he had no choice but to free the RBOCs from these previous restrictions, even though he firmly believes that great harm will befall potential competitors in the marketplace. In Washington, many times it seems that the facts are much stranger than fiction.

This entire process is fascinating reading and I sincerely hope you will get a chance to see it. I'm sure there will be more comment and debate to follow on this case and in this magazine. ■

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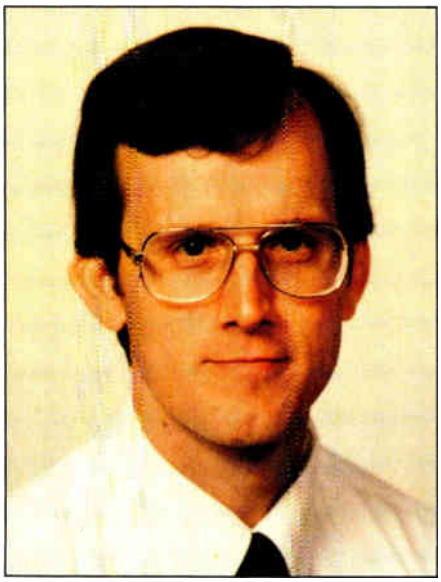

Digital video: Some thoughts

The theory behind the basic modulation techniques of QPSK and 16-QAM remain the same regardless of whether the video compression system being used is based on Vector Quantization (VQ) techniques or the Discrete Cosine Transform (DCT), or any of the other techniques like Fractals or Wavelets being explored in research facilities throughout the world.

Therefore, it has been easy to present the information in an unbiased and non-competitive manner—something I have strived for, no matter what the topic.

One day, (maybe next month) I'll summon the courage to attempt a column on the basics of VQ and DCT—the other half of the equation. This month, I'll shift gears a little, and briefly digress from discussions of the technology and think instead about a few of the business constraints that must be weighed in the selection of any video compression technology.

Ultimately, if cable is to successfully implement video compression in any of it's forms, it will require a hard look, not just at the technology itself, but at the overall end-to-end system from a business perspective. After all, what is the real goal? Have the goals changed from what they've always been? We're simply trying to deliver high quality video, audio and data services through an entire distribution network to customers at a cost per channel and revenue per channel that will allow for a business to be made out of it.

By Chris Bowick, Vice President Engineering for Headend Equipment, Scientific-Atlanta, Inc.

Any potential compression system (including compression and modulation) must be evaluated on its merits and cost/performance tradeoff throughout the entire system architecture, including the studio, C-band headend feeds, C-band delivery to the backyard, Ku-band DBS, and of course, delivery through the cable plant to the home. For the cable industry, however, it seems obvious that the most important driver in the selection of a video compression system architecture and technology is the economics and performance of delivery of video to the home.

A logical order

It is therefore important that the tail (satellite delivery) isn't allowed to wag the dog (cable delivery). The compression system that will ultimately be selected for the cable industry must be the one which offers the best cost/performance tradeoff for delivery via the cable plant to the home. The system must provide the data-rate flexibility, data multiplex structure and overall system architecture to allow the operator to provide a mix of secure full-motion NTSC-type video including sporting events, film (movie) services, near CD quality audio services, a host of data services, as well as a migration path toward HDTV.

This must be accomplished while providing the capability of low-cost local control of conditional access, ad-insertion, and local live video programming. And, of course, it would be nice if the cable delivery technique and satellite delivery technique were a simple subset of the other, thereby minimizing headend translation costs as well.

If we try to envision a likely scenario for the successful introduction of compressed digital video into the cable plant, we certainly wouldn't see a revolutionary flash-cut from analog to digital technology. Instead, we would likely envision an architecture that takes an evolutionary approach by creating a digital overlay (perhaps for near video-on-demand) on top of existing analog services.

Such an architecture will allow, and in fact require, that the new digital services coexist with existing technologies, thus preserving the existing user's investment, and focusing any additional investment that may be required on the actual users of the new service. In many cases, from an MSO's viewpoint, these costs must be weighed not only against the potential revenue for the services to be provided, but also against the cost of providing such services using the only technique he has had to consider up to this point—the simple expansion of analog bandwidth either through upgrade or rebuild of the existing plant.

But regardless of the initial cost of implementation, eventually digital technology for the transmission of compressed digital video to the consumer will make its way into the cable architecture. As a result, it's important that the operator continue to prepare and evolve his plant for the gradual implementation of these new technologies.

Improvements today add up

This preparation will most likely include continued bandwidth expansion in order to allow the operator to keep his existing analog services, while simply adding a potential new digital tier of near video-on-demand. Fiber upgrades will remain important in order to improve not only the system noise performance, distortion performance, redundancy, and reliability for the benefit of the existing analog channels, but for the digital channels as well.

After all, as we begin to deal with the very high data rates and sophisticated modulation schemes required for the transmission of digital HDTV or compressed NTSC, the better the plant's noise and distortion performance must be for successful transmission. Anything that is done today to improve the performance and reliability of the existing analog plant will have a direct impact on the successful future implementation of any future coexisting analog and digital overlays with respect to performance and reliability.

Upgrading to 550 MHz and beyond, use of conventional amplifier and fiber technology will provide the operator with the number of conventional analog channels that will be required to satisfy his existing customer's needs, allow for some growth in analog channel bandwidth, allow for the creation of a digital overlay and improve the performance and reliability of the analog as well as the potential digital tier. ■

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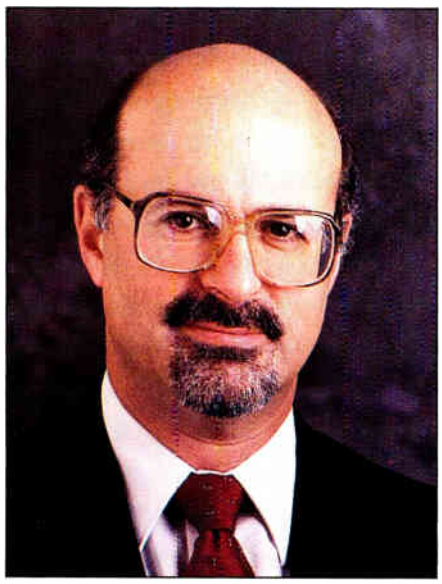

Audio for HDTV

There has been a general agreement that any HDTV format should include high quality audio, but few people seem to care what that might mean. There is no agreement on the number of audio channels. Because of the limited channel capacity and tradeoffs between picture quality and coverage area, devoting more channel capacity to audio will either degrade picture quality or limit coverage area.

HDTV channel capacity limits

The FCC decided that HDTV must fit into the existing 6 MHz TV channels. Each of the four digital HDTV formats uses a transmission rate about the same—around 20 Mbits/sec—to fill the 6 MHz channel. That data stream consists of video information, audio information, ancillary signals such as closed captioning and access control, and error correction coding. Each of the proponents devotes about 0.5 Mbits/sec to audio information to four sound channels. Not everyone thinks that four channels is enough.

In order to understand these issues, some background on digital sound coding might be helpful.

The quality of HDTV audio should be comparable to compact disc quality. The CD uses traditional pulse code modulation, with a CD sampling rate of 44.1 kHz and 16 bits per sample. This gives a data rate of about 700 kbits/sec, or 1.4 Mbits/sec for stereo.

Pulse code modulation is not necessary for digital sound, however. Digital audio compression techniques can be used to lower the data rate. The Dolby Adaptive Delta Modulation coding system operates this way. It can compress CD-quality sound into 256 kbits/sec for each channel, or 512 kbits/sec for a stereo pair. This system has been in use for a number of years and is employed by Digital Cable Radio.

Several digital audio coding techniques that achieve even greater compression have recently been developed. They use Discrete Cosine Transform or sub-band coding techniques. They also make use of "audio masking" techniques that eliminate the need to transmit sounds that the ear is unable to hear.

Two sound coding approaches that use these techniques are the Dolby AC-2 system and the Musicam system developed in Europe. Both of these approaches can achieve CD-quality sound at 128 kbits/sec for each channel, or 256 kbits/sec for a stereo pair. AC-2 has been chosen by the American TeleVision Alliance (General Instrument Corp. and MIT) for its DigiCipher HDTV format. Musicam has been specified by the Advanced Television Research Consortium (Thomson, Philips and NBC) for its Advanced Digital TV format.

If 500 kbits/sec is available for HDTV sound, then either of these approaches will support four sound channels or two stereo pairs. These four channels could be used for stereo sound in two languages, or for a four-channel Surround Sound system.

How many channels of sound?

The FCC's Advisory Committee on Advanced Television decided early on that it would not require HDTV proponents to provide a minimum number of sound channels. The Advanced Television Systems Committee, another industry group, has a specialist group working on sound formats. But it may be too late to include an ATSC recommendation in a final FCC standard for HDTV, because the HDTV proponents have already made their decisions on what sound formats to supply.

ATSC is in the process of refining a recommendation on HDTV audio prepared originally by Tom Keller, now a consultant to CableLabs. It calls for main program audio of four channels, and a "separate audio program" capacity of two channels. The four channels of main program sound would be used for left, right, center and rear (Surround). The SAP capacity would be used for foreign language sound. In addition, it proposes a 128 kbits/sec monophonic sound channel for "descriptive video," a service that provides a description of the video action for the visually impaired.

In the current ATSC recommendation, the total of seven sound channels would take up a channel capacity of 7 x 128 kbits/sec, or 896 kbits/sec. This requirement of 896 kbits/sec is far more than any of the HDTV proponents plan to provide for audio capacity, and some have used the term "extravagant" to describe its allocation of channel capacity.

The latest development is the Dolby AC-3 sound system. Dolby says that the film industry will begin using a film soundtrack format that carries six channels of sound: left, right, center, left Surround, right Surround and subwoofer. (The subwoofer channel is very narrow, with only 100 Hz bandwidth.) Corresponding to this film standard, Dolby has developed a digital sound compression system for HDTV called AC-3, which can fit these six sound channels into a data. rate of about 320 kbits/sec.

This is far less than the 512 kbits/sec that would be needed for four channels of sound using AC-2 or Musicam. This additional compression is feasible because the six channels are not independent of one another—there is some redundancy that can be removed and some additional masking that can be achieved. But AC-3 is new, untested, and has not been adopted by any HDTV proponent.

At this point, it is hard to say how many channels of sound we will eventually get with HDTV. The HDTV proponents have designed their systems to include four channels of CD-quality sound at 128 kbits/sec for each channel, and that is what will be tested. Dolby and CableLabs are pushing for more sound channels. The FCC doesn't care. The broadcasters recognize that devoting more capacity to sound channels could mean lower picture quality or smaller coverage area. And probably only a very small minority of TV viewers even care whether they get two, four or six channels out of their two-inch, low-fidelity speakers. ■

By Jeffrey Krauss, Independent Telecommunications Policy Consultant and President of Telecommunications and Technology Policy of Rockville, Md.

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Standards

Standards are adopted by regulatory bodies and trade associations to achieve one or more of the following objectives:

- System interoperability
- Avoidance of injury
- Product quality.

System interoperability

Facsimile was invented in 1842 by Alexander Bain. Until the International Telegraph and Telephone Consultative Committee (CCITT) adopted a worldwide set of interoperability standards in 1980, facsimile was little more than a hobby—a toy. Now, we can hardly function without FAX.

Dominant users or suppliers, such as the pre-1982 Bell Telephone System and, until recently, IBM, are able to establish de facto standards without government intervention. Worldwide telephone service would not be possible without voluntary compliance with interoperability standards developed primarily through CCITT. Noncompliance imposes its own penalties.

For years, IBM so dominated the personal computer field that other suppliers simply made their equipment "IBM compatible." This is no longer the case, and the personal computer industry is finding the inertia of interoperability standards to be a severe impediment to technological progress. More and more companies like Apple, DEC, AT&T, Hewlett-Packard, and Compaq are moving ahead rapidly with different incompatible versions of the "Open System" architecture.

Under General Sarnoff's dominant influence, the U.S. television broadcasting industry led the world in developing the compatible color television standards recommended by NTSC and adopted by the FCC in 1952. Several modifications to NTSC standards were adopted later in the U.K. and France as PAL and SECAM.

The U.S. became locked into the 525-line standard in 1941 when it progressed significantly from 441 lines. Because the U.S. developed television many years ahead of Europe, we have not been able to follow them to 625 lines. Even in the U.K., it took more than 25 years to abandon the obsolete 441-line monochrome standard.

In 1949, RCA introduced the 45 rpm 7-inch audio disc changer, which it hoped would replace 78 rpm for popular music and become a universal standard. For a brief time, it did. However, it never surpassed the popularity of 33 1/3 rpm discs and both were eventually eclipsed by cassettes and compact discs in retail distribution.

HDTV has opened the door to a totally new set of TV standards. Will even this be flexible enough to accommodate still further technological advance? Or will we once again be locked in while others move ahead? That is a key unanswered question.

Injury avoidance

Electromagnetic interference and safety protection for life and property are proper subjects for standards, either mandatory or voluntary. The vast majority of mandatory FCC standards relate to interference issues, except in broadcasting where interoperability is also featured. Electrical safety standards are generally voluntary, unless mandated by state or municipal authorities.

Radiation hazards and workplace safety standards are mostly governmentally mandated. It is hard to quarrel with safety standards, although they can sometimes be unduly onerous.

Product quality

This is perhaps the most controversial standards issue. Does anyone provide mandatory standards for TV set picture quality performance? VCR performance? Automobile performance? Who tells you that Bufferin and Tylenol and Advil and others must meet specified standards of pain relief? Who sets performance standards for Chevrolet, Ford, Mercedes, Jaguar, Cadillac or Lincoln Continental? Yes, there are some standards, but they usually relate to interoperability (e.g. metric) or public safety (including pollution control and health hazards), not often to product quality.

Perfect TV

In a sense, cable TV may be the victim of its own somewhat overblown claims of "perfect TV." While our performance objectives represent high quality and are generally realistic, they may not be achievable 100 percent of the time, nor at 100 percent of subscriber terminals. Neither the FCC nor city councils are equipped, or positioned, to assess and maintain the complex balance between product quality and price. Regulators are increasingly turning to competition in the so-called "free market" to make these decisions.

But, regulators cannot have it both ways: Encouraging competitive enterprises like MMDS, DBS or telco entry, while at the same time regulating both product quality and price. The free market presumes that customers will pay the established price for satisfactory service, and decline to pay so much for service that the customer alone judges to be unsatisfactory.

Enforcement

Finally, no standards should be adopted without realistic means of enforcement, including methods of measurement that are consistent with the mandated standards of performance. No operating system can afford to shut down completely while using the NCTA CW method mandated for proving compliance with the proposed FCC intermodulation standard (53 dB noncoherent; 47 dB coherent).

The alternative NCTA method, using modulated carriers, requires raising all carrier levels by 3 dB and sets performance objectives 6 dB higher than for the CW method. If carrier levels are not increased by 3 dB, the equivalent performance objectives should be 12 dB greater, i.e., 65 dB non-coherent, and 59 dB coherent.

Standard performance levels should not be set without defining an appropriate method of measurement. ■

By Archer S. Taylor, Senior Vice President, Engineering Malarkey-Taylor Associates, Inc.

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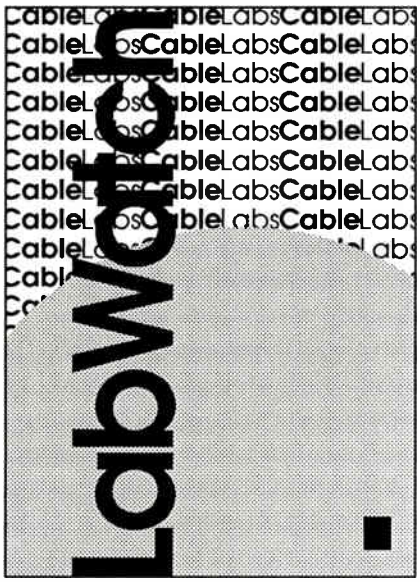

Major issues in network design

Editor's note: *Stephen Dukes, director of advanced network development at Cable Television Laboratories Inc., the industry-funded R&D consortium based in Boulder, Colorado, provided this overview of major current issues in network design.*

In designing cable networks, it is important that we use as a starting point the basic distinction between network architecture and network design.

What we call network architecture are those aspects of the network that are independent of changing technology. By contrast, network design refers to the building and upgrading of individual cable systems—a process which at any given time is completely dependent upon available technology.

Having a network architecture that is consistent for both large and small systems—and that does not change as technology changes—makes it possible to anticipate and plan for a variety of possible migrations, over a number of years, without affecting the base that already has been developed.

Fiber optic design

The single area drawing the most attention today in network design is fiber optics. It should first be acknowledged that quite a few systems may never deploy fiber. But even operators of those systems can make use of performance parameters in assessing and improving their systems.

Perhaps the major question in any fiber migration plan is just how far fiber should be deployed out into the network—with estimates ranging anywhere from 200 to 1,000 homes passed per fiber trunk.

CableLabs is currently assessing the need for optical amplifiers which operate at the 1550-nanometer wavelength. We are also assessing whether pump fiber systems can be used to extend the reach of fiber transmission systems. The bulk of the research and development to date has focused on 1550-nanometer wavelength for optical amplification, however, there now appears to be more research being conducted for 1310 nanometer optical amplification. Most cable systems have deployed singlemode fiber with a zero dispersion wavelength at 1310 nanometers. However, optical amplification may not be an issue once fiber is deployed to fiber optic hubs serving smaller numbers of homes passed.

Some cable engineers desire uniform system design parameters. Relevant to this are our current efforts to define the characteristics of the Local Distribution Area (LDA), which is the fundamental building block in any network architecture. For example, coming out of the headend we can go 10 dB to 12 dB before a fiber optic hub is required. But what about design parameters for the area within 10 dB to 12 dB of the headend, an area served not by a hub but directly from the headend by coaxial cable? The unifying concept of the LDA is useful in analyzing such issues.

Power and loss budgets

Progress also is being made in the establishment of uniform power and loss budgets for fiber optic and coaxial cable. CableLabs is currently conducting a study of the power budget, and will be examining fiber optic and coax loss budgets in the future.

Spectrum allocation

Given that a uniform channel distribution is not possible, what degree and form of standardization is possible? One step is to work toward a general uniformity of spectrum allocation.

For a 1-GHz system, the spectrum allocation may look like this:

5 MHz to 30 MHz: Upstream analog channel (low-bit-rate data for signaling purposes, etc.)

50 MHz to 450 MHz: analog NTSC channels.

450 MHz to 550 MHz: digital NTSC.

550 MHz to 1 GHz: digitally compressed advanced television and (probably for some time) digitally compressed NTSC.

For a 550-MHz system, the spectrum may be allocated as follows:

5 MHz to 30 MHz: upstream analog.

50 MHz to 450 MHz: analog.

450 MHz to 550 MHz: digital.

For a 450-MHz system, the spectrum allocation may be:

5 MHz to 30 MHz: upstream analog.

50 MHz to 350 MHz: analog.

350 MHz to 450 MHz: digital.

For a 350-MHz system, the allocation could be:

5 MHz to 30 MHz: upstream analog.

50 MHz to 250 MHz: analog.

250 MHz to 330 MHz: digital.

It appears that in cable network design, operators will have to separate or prevent spectral overlap of analog and digital signals or be faced with interference. It also is clear that digital signals cannot be interspersed with analog signals; no mixing and matching of analog and digital signals is to be allowed.

The drop

The drop to the home continues to be an area that needs major attention. Fiber-to-the-hub and the other configurations employed in network design today do not resolve the current problems of the drop. As system operators, we must look at improving the quality of the coax that we deploy to the home so we can improve on its current reliability as a video distribution medium. Fortunately, the drop does not impact on PCS, which is wireless for its last few hundred meters.

Beyond these network design issues, CableLabs is focusing research on a number of points considered integral to the evolutionary development of the cable network. The goal is to determine how cable operators may use these concepts and functions to improve service reliability, signal quality and to provide customers with additional services.

Network migration

Many of the technologies we read about in trade journals do not become

By the CableLabs staff

available as commercial products as quickly as we may have anticipated—if at all. As an integral part of network design, the tracking of new technologies from inventions to commercially deployable products is a critical element of network migration. It is possible to assess new technology and plan for it well in advance—instead of reacting to it—only by having an overall network architecture as a reference point.

Interactive functionality

Any future adoption of interactive functionality has the potential to undo a major advantage enjoyed by cable operators. Until now, we have been able to locate the electronic components with the greatest technical complexity at both ends of the network—i.e., in the headend and in the consumer electronics equipment in the subscriber's home. This has meant that the consumer has paid for the switching equipment.

To hold down costs, it is desirable that any adoption of interactive functionality be accomplished without relinquishing this cost advantage that is now enjoyed. Currently projected network design provides for the routing/switching of video and the switching of PCS to be two separate systems.

Network management

As we improve system reliability and technology changes in ways that increase the complexity of network operations, network management (ranging from simple on-line testing to dynamic routing) is playing a growing role in network design. If we decide we must operate an on-line, 24-hour-a-day network with no downtime, we may even consider creating redundancy through active standby equipment. Network management could also provide automated failure and reconfiguration control. An example of this is dynamic reconfiguration or, at least, manual reconfiguration that is accomplished from a centralized point in the network. Adoption of such measures could enhance system quality and reliability.

Digital network design

The advent of digital transmission brings with it, of course, the capability for digital compression and encryption. To date, discussions have centered on compression rates of about 4-to-1. Compression will make it possible to carry more channels—both ATV and NTSC—in the spectrum (probably between 450 MHz and 550 MHz or 550 MHz and 1 GHz) that is allocated to digital.

Some kind of digital protocol is required in order to hand off the signal going into and out of the headend, and to interface with other networks. A particularly interesting issue here is this: If a compressed and encrypted digital signal is coming into the headend, should you decompress and decrypt it at the headend for ad insertion and then recompress and re-encrypt it to send it out again? Or, do you encrypt and compress where the source originates, and then decrypt and decompress at the home?

Those are issues that any digital protocol will address. But the critical component of the protocol is that it will make possible a uniform deployment of digital equipment in the network.

Continued on page 57

highly guarded and sensitive aspects of the signal theft problem. "Many of the add-on products we're seeing are imports from Pacific Rim countries, mainly Taiwan and South Korea," Allen says. "Other than that, pirates have been known to infiltrate third party equipment brokerage or equipment repair facilities. They use all sorts of schemes in order to portray themselves as legitimate cable system owners or operators."

For example, Allen says, a pirate group commissioned a local garbage collector to pick through the dumpster of a legitimate converter repair facility. Whatever salvageable pieces the trash collector found were promptly turned over to the pirate for re-use.

Verbal slip ups

In some cases, pirates have attempted to buy direct from manufacturers. "Usually, they slip up within the first few minutes," comments one engineer from a converter manufacturing facility. "They'll call, pretending to be involved in an MMDS application, but won't know the first thing about what they need. They'll ask for something that wouldn't work in that sort of application. Then we're onto them."

Cable pirates divert an estimated $3 billion a year.

But that doesn't always work. In one case, a vendor unknowingly sold several thousand boxes to a pirate before discovering the gaps in the story. "He was very, very clever," the engineer recalls. "He had been a previous customer, and as such knew some of the ins and outs of the company." As part of the charade, the pirate went to extreme lengths to imitate the actions of a legitimate operator, including spending over $50,000 on ancillary equipment and providing bills of lading "proving" that the merchandise was leaving the country.

The supply houses often advertise their wares in low budget, black-and-white pamphlets. One of the catalogs even offers "dealer pricing" for quantities of 10 or more. Just about every known security method, including baseband, phase modulation and video sync suppression have been compromised, if what the pamphlets advertise is true. The advertised prices range from $89 to $395, depending on the unit.

Clearly, the supply houses operate on the "look the other way" philosophy —what they don't know can't hurt them. They shine the apple, hold it out, offer a warning, accept payment and quickly exit the picture before seeing if the purchaser takes a bite.

Stopping theft

But cable is biting back. According to Allen, more than 50 cases were pending as of press time. Cooperation between the Federal Bureau of Investigation (FBI) and local authorities is at an all-time high, and cable systems are

Inside the pirate's brain

Ever talk to a cable "pirate"? Well, in preparation for this article, *CED* did—and the experience was rather illuminating, if not somewhat predictable.

CED called 10 suppliers of "cable descramblers" whose advertisements appear regularly in a popular electronics hobbyist magazine. Three of the 10 were no longer in operation (one being Global Cable Network, recently raided in what the FBI is calling the "largest, most comprehensive raid to date.")

The advertisements themselves are intriguing. "Why pay sky high monthly fees?" one asks. "Cable descramblers—stop paying rental fees," and "Save money. Don't rent," suggest others.

Big contradiction

Almost all of the advertisements offer toll-free numbers for more information. *CED* called, pretending to be a disgruntled cable subscriber tired of paying high premium fees. The responses were nothing short of contradictory. Here's an example:

CED: "I'm not going to get in trouble for doing this, am I? I've read in the paper about people being arrested for this."

Supplier: "No, not if you abide by the rules of our company."

CED: "Oh, I see. And what are the rules of your company?"

Supplier: "That's something I really can't get into."

Compared to other conversations, though, that particular receptionist/order taker was clearly a rookie. Some of the other companies had a much slicker line.

Legal, illegal purposes

When the same question was posed to another order taker, his more savvy answer was, "There are legal purposes for this equipment, and there are illegal purposes. The legal purpose is that if you're already paying for everything, and if you want to hook up a second or third TV in your house, you can buy this and hook it up and receive those same channels in a different room, instead of having to rent the second or third box from your cable company.

"Now, some people don't pay for the full service and hook it up, and they're going to receive the pay channels regardless," he continued. "And they're sort of on their honor to notify their cable company that they're doing that. If they don't, they're wrong. They're in the wrong, then."

CED's reply: "So you're saying that I pay $250 for your equipment, and then pay for all the premium services anyway? That doesn't seem to make a whole lot of sense."

Supplier: "Read between the lines here: That's what I **have** to tell you. You follow me?"

CED: "But the reason I want to buy this is to avoid paying those high premium fees. So you're saying that to do that, I'm in the wrong."

Supplier: "I don't *want* to know what you're doing."

Apparently the "honor" argument is what keeps the suppliers legal. A third order taker informed *CED* over the phone that the consumer is "on his

honor" to contact the local cable company before ordering the descrambler. And after receiving catalogs from three of the seven suppliers, all included disclaimers regarding theft of service.

The catalogs offer every known cable converter/descrambler, with the exception of Oak Industries' Sigma line. Noting the exclusion of that particular line, *CED* called back, asking how to procure an Oak Sigma model. "That's not available. You can only get that box from your cable company," the woman offered. When asked for another source for the box, she slipped up a bit. "No. You can't get that anywhere. It's not on the market. It's not on the market because it hasn't been cr(acked). Well, it's just not available," she blurted.

Talking with a CEO

After more investigation, *CED* tracked down the president of one of the descrambler operations, who agreed to discuss his business if his name and his company's name was excluded. "Basically, it's like this: Our customers want to get all the cable channels. We offer them a way to do that. If they don't contact their cable company, it's not like we didn't tell them to. It's called covering your ass," he stated.

And what about the estimated $3 billion cable loses to operations such as his? "I guess that's cable's (expletive) problem," he laughed. "This is free enterprise. I have a right to supply a product that people feel they need. And," he was quick to add, "it's not illegal for me to provide that service. What people choose to do with it—whether they choose a legal or illegal path—that's their business. I can't be blamed for that."

Connections?

When asked where he obtained his inventory of illegal converter/descrambler devices, the executive was remarkably candid. "A lot of it we have made for us, somewhere else. Not in this country. And the other part of it we get from sources (people in the cable industry) think are legitimate," he offered.

Interestingly, one descrambler source let its answering machine pick up incoming calls. After the standard "thanks for calling/we value your business" line, the voice said, "oh, and if you're calling the Office of Security, you have the wrong number."

How ironic. ■

—Leslie Ellis

taking a closer look at the problem.

In a recent Cable Poll survey, 81 percent of the respondents acknowledged making system audits on a regular basis in an attempt to stop theft of service. Similarly, 35 percent have filed legal charges against signal thieves.

Not surprisingly, vendors are doing their part, too. General Instrument's Jerrold Communications Division unleashed its "electronic bullet" in Queens, N.Y. earlier this year with remarkable success. And most other vendors acknowledge having their own type of "bullet" in the works. "Security is no longer just a benefit in a converter product (when selling to) operators," explains Tony Wechselberger, executive VP of Oak Communications, "It's a feature; a necessity."

And in June, the OCST and the FBI confiscated more than 50,000 units in a raid in the cities of Reno and Las Vegas, Nev. and San Francisco. "The largest federal criminal seizure prior to that was somewhere in the 18,000 to 20,000 unit range," Allen explains.

But even the efforts of the OCST and the FBI don't necessarily stop the thieves. In a recent court battle in Grand Rapids, Mich., for example, the pirate won. "We ran into a situation where the judge disallowed some information about the 'shady' business habits of this person," says Assistant District Attorney Julie Woods.

"The judge dismissed the information as prejudicial in nature. Then we ran into a problem proving 'specific intent' to steal cable services. It's very difficult to prove that an entity has the specific intent to enable his customers to steal services, particularly when there are disclaimers printed all over his company's literature and order forms discouraging theft of cable service."

"A large part of the problem, I think," says Zenith's Brugliera, "is that in urban areas, there are other crimes of much greater significance going on. Murders, and so forth. So what if a guy is stealing a couple hundred dollars worth of service when there may be someone getting murdered two doors down. Which will the police think is more important?"

Another large part of the solution, Allen says, is educating subscribers about theft of service. "There needs to be a multi-faceted approach to this problem," says Allen. "The three major components are technical countermeasures, legal recourse and education," Allen continues. "We've just developed an educational kit for operators across the country. It deals not only with educating our own industry and employees, but community leaders and the public at large that this is indeed an economic crime which impacts what this industry can do.

"People don't understand that this is clearly a lose-lose-lose situation," Allen continues. "The programmers lose. The operators lose. Then the honest paying subscribers lose, because as in any business, prices reflect theft."

"Obviously, it will be extremely difficult to try to completely eradicate or eliminate theft of service," Allen concludes. "But we definitely need to step up our efforts and continue developing programs to deal with this on a regular basis—whether it be on a local level, corporately or cooperatively through associations. We need to reduce it to its lowest possible level." ■

—Leslie Ellis

From Vision to Reality-Our

February, 1988

March, 1988

April, 1988

June, 1988

February, 1989

March, 1990

July, 1990

October, 1990

March, 1991

ONI has pioneered the use of fiber optic technology in the cable TV industry. Along with AT&T and Bell Labs, we've developed the infrastructure that will carry fiber optics far beyond the applications of today's cable systems. But ONI is more than a resource for product development.

Our staff of engineers provides RF and optical system engineering and design, total system project management and 24-hour technical support while our relationship with AT&T's R&D group and Bell Lab engineers keeps us at the forefront of technology and products.

Circle Reader Service No. 33

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Anixter and AT&T agree to develop analog optical transmission networks for cable TV

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First LXE™ fiber optic cable developed for aerial applications

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First hybrid AM/FM system activated

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500th Laser Link activated

Laser Link integrated into the first fiber to the feeder system

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Integrating fiber technology into cable systems provides not only outstanding performance but also opens the way to a whole new generation of revenue producing services. PCN's (personal communications networks), interactive digital systems and alternate access for voice and video will bring cable systems into the 21st century. ONI enables you to choose the directions that work best for you and your subscribers.

Your vision of the future demands technologies, products and services. ONI can make that vision a reality. Call us at 1-800-FIBER-ME.

ONI OPTICAL NETWORKS INTERNATIONAL

CORPORATE HEADQUARTERS: OPTICAL NETWORKS INTERNATIONAL, 8101 E. Prentice Avenue, Suite 210
Englewood, Colorado 80111 • 303-694-9220 • Fax 303-694-0127

The return of status monitoring

Technology gets better, operators taking another look

Everyone who uses a computer lives in fear of them. They lay dormant, waiting for just the right command to bring them to life. When they wake up, they often leave destruction, confusion and mayhem in their wake. They can be eradicated, but often by the time they are discovered, the damage has already been done.

"They" are computer viruses and almost everyone has been infected (or knows someone who has). The stories run from the humorous to the dangerous, from simple annoyances to massive and expensive computer system foul-ups.

Cable bugs

Similarly, unchecked "bugs" live in CATV systems. Often they lay low, undetected, until just the right combination of circumstances allow several bugs to converge. The resulting problems can be difficult to correct, yet can keeping the service line lit up with telephone calls from subscribers.

The answer is, of course, some sort of early warning system. Cable equipment vendors have known this for years; it is what gave rise to status monitoring. Historically, however, status monitoring has failed to live up to its promises. It was expensive option offered with distribution gear, but was plagued by poor reliability (it was often less reliable than the system it was designed to monitor). Furthermore, it required a cable operator to utilize the noisy return band. Consequently, status monitoring was rarely implemented.

Now, with the advent of fiber optic networks, the status monitoring debate has been rekindled. Predictably, two schools of thought exist. The first says that fiber optics is inherently more reliable, so why spend thousands to watch a sleeping dog sleep? The other suggests that operators should protect their expensive investments, especially when subscribers demand better pictures and grow increasingly less tolerant of cable outages.

Some vendors have developed new status monitoring software/hardware systems in an attempt to capitalize on the resurging interest. Others, notably the largest suppliers of distribution gear, have moved more slowly, seemingly unwilling to invest money into what is little more than a niche market.

Clearly, operator inquisitiveness in status monitoring systems is resurging. Although purchases remain low, vendors like AM Communications, Magnavox and Superior Electronics all report widespread interest in their status monitoring packages.

While each vendors' equipment and software varies, the concept is the same. Devices called transponders are located in various locations throughout a cable system and asked to monitor the performance of various parts of the system. The transponders are polled at regular intervals and told to report their findings. These devices are typically located in the headend, at trunk amplifier stations, power supply locations, and increasingly, at fiber optic nodes and at the end of a trunk or feeder line.

Why the renewed interest?

So what's happened to renew operator interest in status monitoring?

Plenty, according to the vendors. The advent of fiber optics, threatened reregulation, pay-per-view, the possibility of offering personal communications, and improved product are the key drivers, they say.

"The service aspect of CATV is taking on a new dimension," says David DeLane, vice president of marketing at AM Communications. He says that as subscribers complain about the lack of service to their elected officials, the heat is turned up back at the cable system's office. As a result, more operators want to know about potential problems before they occur.

DeLane adds that the day when the telcos are allowed to compete with CATV is moving closer and cable will be forced to promote the image of a caring, knowledgeable industry. "Telcos are very status monitoring conscious," he says. "Cable will have to have the same kind of image."

Uwe Trode, product specialist at Magnavox CATV Systems, believes the interest comes from cable operators who have just spent thousands for fiber optic lasers and receivers and want to know what they're getting for their investment. Consequently, he hears from operators who want to monitor the video signals immediately after they're converted from light to RF energy.

Money earmarked

Over at Superior, company President Chris Krehmeyer says the interest comes for many reasons. But he has detected a true "mental change" in the past year to where operators recognize they need status monitoring. Consequently, money is now going into budgets for later purchase.

Today's status monitoring system isn't cheap, but they aren't unreasonable either. For example, each of the vendors contacted talked in round numbers of about $1,000 per module (transponder device), plus headend costs of between $5,000 and $10,000 (including the personal computer) to get started. So, for the cost of a few hundred addressable converters, a good snapshot of system performance can be taken on command.

The embrace

The importance of status monitoring isn't lost on the engineers at Jones Intercable, an MSO noted for its quality. "We want to embrace status monitoring (as a concept)," says Ken Wright, director of engineering and technology. "But it needs to be different (than past versions)."

Jones is among a growing number of operators who are beginning to ask distribution equipment manufacturers to include data ports in their products, Wright says. He is most interested in placing monitoring devices at fiber nodes, immediately after the launch amp. Wright notes that while there is no official company policy regarding status monitoring use, he agrees the equipment is more reliable than earlier generations and the return path is much cleaner now that fiber (which is immune to signal ingress and other degradations) links are in place.

Wright also sees value in having status monitoring in remote, unattended headends. "If it saves man-

STATUS MONITORING

POWER GUARD
C-COR
SCIENTIFIC-ATLANTA
LECTRO
AUGAT
ALPHA
JERROLD

Multiple Strengths, Single System...LANguard.

Expanding Horizons... AM's strength is our proven ability to respond to CATV market needs with dependable status monitoring systems. We can tailor an efficient monitoring solution regardless of your system's amplifiers, power supplies or even its architecture.

Status Monitoring That Works!... We have perfected the art of gathering vital data for CATV systems using virtually any brand of active equipment - even mixed systems...

running on COAX *and* FIBER. Plus, if you have already invested in other monitoring transponders, chances are we can incorporate what you already own into one effective, comprehensive system.

The Payback...LANguard's amplifier, power supply and special end-of-line monitors take critical signal measurements of every important parameter throughout your system. Our powerful software interprets and displays this information in a clear, easy-to-use form... presenting either a global view of your system, or just a small portion of interest.

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LANguard also makes compliance to FCC regulations more manageable.

Invest In Status Monitoring That Won't Ever Become Obsolete... With hundreds of LANguard status monitoring systems installed throughout the world, we encourage you to ask our customers how completely dependable our monitoring solutions are, regardless of the situation or system design.

For today's CATV systems, and for the systems of tomorrow...the watchword is LANguard. Call **1 (800) 248-9004** for ultimate, single-system status monitoring.

AM COMMUNICATIONS

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1900 AM Drive • P.O. Box 9004
Quakertown, PA 18951-9004

Tel: (215) 536-1354 Fax: (215) 536-1475

1 (800) 248-9004

Circle Reader Service No. 20

power and/or improves reliability, we'd be fools not to" implement it, he says.

TCI's about-face

Count among the converted Dave Willis, director of engineering for Tele-Communications Inc. Prior experience with status monitoring systems that gave him very little information kept him from buying much hardware. But now that systems can tell him more than if the plant is on or off, he's opening his mind.

TCI is presently evaluating a status monitoring system in one of its larger cable plants, Willis says. The experience will tell him a lot about what he should do next. He says he's still pushing vendors to give him more information about operating parameters like signal levels, etc. but, he adds, a couple of devices are "real close to what we need."

Willis also says it's important to monitor fiber systems simply because they are more reliable. He explains that contradiction this way: If a system has historically delivered poor pictures and experienced a lot of outages and you improve the picture and eliminate most outages, viewers are more likely to call and complain when problems reappear. Therefore, it's important to monitor the plant and attempt to take data that is predictive of an outage, says Willis.

When?

So, will status monitoring ever be a business? "I don't know," says Bob Young of Jerrold Communications. "Operators are talking about it more, but we're not getting any more orders."

"I think this is a niche business now that has the potential to be a mega-business because when operators see (what status monitoring) can do, they believe it," says Krehmeyer. He says status monitoring is much like standby power was years ago; operators wondered why they'd need it, but now it's a standard piece of cable equipment.

"I don't think this will ever be a mega-business," says DeLane. "We're just hoping to get most of the market and make it a nice business for us."

It may be unclear how big the potential market for status monitoring is, but it seems clear the technology's time has come. If systems perform as they're advertised and offer true operational savings, status monitoring could indeed shed its poor reputation and come out a winner. ■

—Roger Brown

STATUS MONITORING CALLBOOK

The following companies have paid a fee to have their listing appear in the Status Monitoring Callbook.

Amplifiers

AM COMMUNICATIONS
We're Keeping Watch!

AM Communications, Inc. .(800) 248-9004
FAX . . . . . .(215) 536-1475
1900 AM Drive
Quakertown, PA 18951-9004
PERSONNEL: David L. DeLane, Vice President/Marketing & Sales; Mark Carter, Sales Manager
DESCRIPTION: AM offers a proven family of status monitoring transponders for many of the popular brands of trunk amplifiers. AM units replace and typically surpass the original manufacturer's module in terms of features and performance. AM now also has monitoring solutions for fiber nodes as well.Call AM for more information.

MAGNAVOX
CATV SYSTEMS, INC.

Magnavox CATV . . . . . .(315) 682-9105
Systems, Inc.
FAX . . . . . .(315) 682-9006
100 Fairgrounds Drive
Manlius, NY 13104
PERSONNEL: Uwe Trode, Product Manager, Status Monitoring
DESCRIPTION: Manufacturer of hardware and software based status monitoring systems for fiber and cable networks worldwide. Remote trunk and fiber monitor performs slope, gain, laser level and bias measurement with automatic fault isolation and standby power supply interfacing.The stand-alone line monitor (MLM) can be accessed via cable or telephone link to provide highly accurate frequency response measurements.

WE MEASURE THE BEST!™
Cheetah

Superior Electronics . . . .(813) 351-6700
Group, Inc.
FAX . . . . . .(813) 351-9193
2237 Industrial Blvd.
Sarasota, FL 34234
PERSONNEL: Chris Krehmeyer, President; Mike Mills, National Sales Manager; Nick Ackerman, Director of Development
DESCRIPTION: The Cheetah™ Status Monitoring System is a valuable tool for detecting accumulated amplifier distortions by use of its unique measuring technique. Cheetah™ has the ability to detect distortion products such as Carrier to Noise, Hum Modulation and Composit Beats without interfering with the integrity of system amplifier stations. Positioned at strategic points along a trunk or feeder run, Cheetah™ can quickly aid the operator in locating defective amplifier equipment.

End of Line

AM COMMUNICATIONS
We're Keeping Watch!

AM Communications, Inc. .(800) 248-9004
FAX . . . . . .(215) 536-1475
1900 AM Drive
Quakertown, PA 18951-9004
PERSONNEL: David L. DeLane, Vice President/Marketing & Sales; Mark Carter, Sales Manager
DESCRIPTION: The flagship of AM's end-of-line monitor family is the new TMC-9015 designed for CATV systems. With its 40 to 550 MHz range, the TMC-9015 monitors the amplitude of 100 channels measuring both video and audio carrier levels. The TMC-9015 also features spectrum analysis and sweepless sweep capability.

MAGNAVOX
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100 Fairgrounds Drive
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Superior Electronics . . . .(813) 351-6700
Group, Inc.
FAX . . . . . .(813) 351-9193
2237 Industrial Blvd.
Sarasota, FL 34234
PERSONNEL: Chris Krehmeyer, President; Mike Mills, National Sales Manager; Nick Ackerman, Director of Development
DESCRIPTION: The Cheetah™ is at its best as an End-of-Line or AML Monitor for analyzing overall system performance. Cheetah™ measures and responds to system abnormalities 24 hours a day through Auto-Read and Auto Alarm. Cheetah™ monitors AGC action, provides a true spectrum with visual and aural carriers and peak to valley measurements. Cheetah™ operates over a broad temperature range of -40F° to +140F°.

Headend

AM COMMUNICATIONS
We're Keeping Watch!

AM Communications, Inc. .(800) 248-9004
FAX . . . . . .(215) 536-1475
1900 AM Drive
Quakertown, PA 18951-9004
PERSONNEL: David L. DeLane, Vice President/Marketing & Sales; Mark Carter, Sales Manager
DESCRIPTION: The AM TMC-9015 is available with an optional module which enables this transponder to be used as a headend monitor to measure video carrier frequencies. This inexpensive monitor is precise to within 100 Hz.

NEXUS
ENGINEERING CORP.

Nexus Engineering Corp. .(604) 420-5322
FAX . . . . . .(604) 420-5941
7000 Lougheed Hwy.
Burnaby, BC V5A 4K4
PERSONNEL: Barry Kryski, CATV Account Representative; Gary Zywiecki, Director of R&D
DESCRIPTION: The Nexus Series 2000 headend is the most advanced headend system available in the world. The Series 2000 offers fully redundant powering and computer controlled agile backup modulators in conjunction with a complete remote status monitoring system. Technological breakthroughs include an unsurpassed Carrier-to-Noise ratio of 67 dB at the combiner output and up to 1 GHz bandwidth.

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Superior Electronics . . . .(813) 351-6700
Group, Inc.

FAX . . . . . .**(813) 351-9193**
2237 Industrial Blvd.
Sarasota, FL 34234
PERSONNEL: Chris Krehmeyer, President; Mike Mills, National Sales Manager; Nick Ackerman, Director of Development
DESCRIPTION: The Cheetah™ HE-4650 Headend Monitor is without a doubt the best Status Monitor available for the price. Standard, IRC or HRC Channels are monitored continually for level and frequency stability. If any carrier exceeds preset limits in either domain, the Auto-Alarm system will notify the operator via computer, phone or pager of any discrepancy. Typical time to retrieve current frequencies and levels in a 50 channel system is a record breaking 30 seconds. There is nothing faster than Cheetah™.

Test Equipment

CALAN, Inc. . . . . . .**(717) 828-2356**
WATS (National) . . . . . .**(800) 554-3392**
FAX . . . . . .**(717) 828-2472**
1776 Independence Drive
Dignmans Ferry, PA 18328
PERSONNEL: Sydney Fluck, President; Paul Chudoba, Vice President; Phyllis Thompson, Major Accounts; Teresa Fox, Sales Coordinator
DESCRIPTION: CALAN, Inc., manufacturers top of the line CATV and LAN instrumentation. The product line consists of a Integrated Sweep Spectrum Analyzer, STAR 2010 Signal Level Measurement System, COMET remote monitoring system and the ALAN, automated, system for signal leakage monitoring. CALAN has implemented state-of-the-art hardware and software concepts with the new easy-to-use instrumentation line. All products are compatible with CATV and Broadband Data Networks.

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Superior Electronics Group, Inc. . . . .**(813) 351-6700**
FAX . . . . . .**(813) 351-9193**
2237 Industrial Blvd.
Sarasota, FL 34234
PERSONNEL: Chris Krehmeyer, President; Mike Mills, National Sales Manager; Nick Ackerman, Director of Development
DESCRIPTION: The Cheetah™ is unique for testing CATV systems with the qualities of a signal level meter and frequency counter. Cheetah™ provides easy to understand visual displays of various CATV system and AML parameters. The data base features allow for accurate trend analysis. Cheetah™ replaces the RM Test boxes at AML receive sites. Test Data is compared to norms and if any readings are out-of-spec, the Cheetah automatically informs the system operator of the discrepancy.

Power Supplies

AM COMMUNICATIONS
We're Keeping Watch!

AM Communications, Inc. . .**(800) 248-9004**
FAX . . . . . .**(215) 536-1475**
1900 AM Drive
Quakertown, PA 18951-9004
PERSONNEL: David L. DeLane, Vice President/Marketing & Sales; Mark Carter, Sales Manager
DESCRIPTION: To meet the needs of the cable industry AM offers dependable, high performance power supply monitors developed with the cooperation of the manufacturers of the most widely used brands of backup supplies. AM units are designed to fit neatly inside the supply cabinet.

alpha
ALPHA TECHNOLOGIES

Alpha Technologies . . . .**(206) 647-2360**
FAX . . . . . .**(206) 671-4936**
3767 Alpha Way
Bellingham, WA 98226
PERSONNEL: Bob Bridge, Sales Manager; Jeff Geer, Product Manager
DESCRIPTION: Alpha offers two monitoring systems: The powering-dedicated RSM under AlphaSoft control, and RPM interfacing for amplifier and end-of-line systems. RSM packages include workstation, software, modems and interfaces, single-sourced by Alpha. A new universal (USM) interface for Alpha's XP will support any monitoring requirements via simple firmware changes.

MAGNAVOX
CATV SYSTEMS, INC.

Magnavox CATV Systems, Inc. . . . . .**(315) 682-9105**
FAX . . . . . .**(315) 682-9006**
100 Fairgrounds Drive
Manlius, NY 13104
PERSONNEL: Uwe Trode, Product Manager, Status Monitoring
DESCRIPTION: Manufacturer of hardware and software based status monitoring systems for fiber and cable networks worldwide. Remote trunk and fiber monitor performs slope, gain, laser level and bias measurement with automatic fault isolation and standby power supply interfacing.The stand-alone line monitor (MLM) can be accessed via cable or telephone link to provide highly accurate frequency response measurements.

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Superior Electronics Group, Inc. . . . .**(813) 351-6700**
FAX . . . . . .**(813) 351-9193**
2237 Industrial Blvd.
Sarasota, FL 34234
PERSONNEL: Chris Krehmeyer, President; Mike Mills, National Sales Manager; Nick Ackerman, Director of Development
DESCRIPTION: Not only does Cheetah™ monitor standby power supplies in 2-way systems but it also has a cost effective method to measure and report power supply status in 1-way systems. Now any system can afford it. Quick pay-back of status equipment is achieved by eliminating costly labor intensive maintenance programs. The Cheetah™ Power Supply system will inform the operator automatically of all available status conditions of Alpha Standby Supplies. More importantly, Cheetah provides your subscriber with quality service that comes with minimum or no downtime from premature standby failures.

Organizing for Outages,

Part III

Are your customers outraged by outages? If so, we can outmode these outage outbreaks with this outspoken outlook on some outstanding methods of outsmarting outages. Here is the outline:

- Grounding and bonding—Why do we do it?
- Fuses—the weakest link—too slow—what to do.
- Smart fuses—unloading trunk powering.
- The new MOVs—How long do they last?

All of the above need to be reviewed in order to justify the conclusions and will be supported by third party lab tests which were conducted in August.

Grounding and bonding

We ground and bond first because we have to, secondly for safety reasons and thirdly in the belief that grounding will solve all our lightning and transient related problems. The first reason is a given, and we must adhere to all NEC, NESC and the local inspector's rules.

Regarding safety, the aim is to try to keep the power neutral, telephone plant and cable all at the same potential so that no one working on any of the plants gets "hung up" during fault conditions. However, it is these very cross connections and common grounds that make us involuntary partners in providing paths for the power company's unbalance and fault currents.

Remember that large currents of the order of 2,000 amps flowing through an unattainable ground rod with only 1 ohm resistance would, by Ohm's Law, cause the plant at that point to go 2,000 volts high! And remember that the average lightning strike is 20,000 amps!

If we place our own private grounds at poles separated from utility grounds, which is the most effective use of additional grounding, we create potentials between our plant and the others. This is definitely frowned upon, if not outright prohibited and we certainly don't want to create more safety hazards than we already have, either for ourselves or the utility companies.

By Roy Ehman, Director of Engineering, Jones Intercable, and Tom Osterman, Director of Research and Design, Alpha Technologies

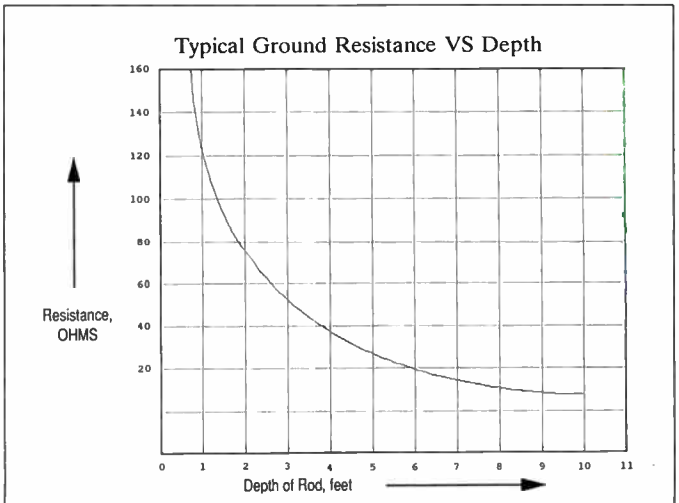


Figure 1

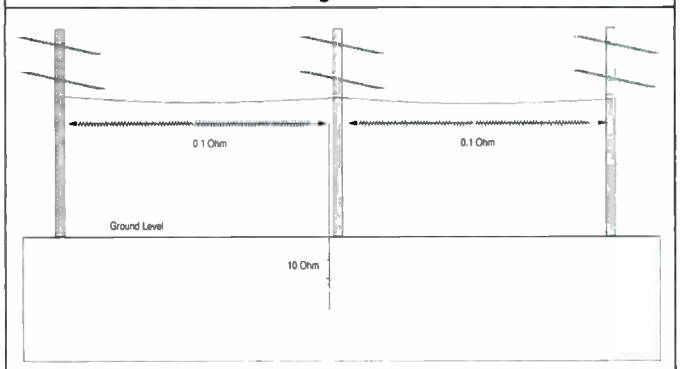


Figure 2

FUSES

- THE WEAKEST LINK (by definition)

ELIMINATE OR STRENGTHEN

1)Replace with "Slow-Blow"
2)Increase values incrementally

FUSES ARE TOO SLOW TO PROTECT ACTIVES

Figure 3

In a soon-to-be-published paper[1] on grounding and bonding, Ray Rohrer, director of engineering for Warner Cable, states that "it is not unusual to find from 50 to 150 amperes of (utility) neutral current under normal conditions."

Using data from a power company, it has been found that a specific span of the CATV strand plus cable may carry as much as 2,000 amperes of the total fault current for up to three full A/C cycles (16 to 48 milliseconds), before the power company breakers can interrupt the flow.

And according to an article[2] published by Jerrold Communications as long ago as 1975, it is pointed out that these heavy sheath currents find their way into the center conductor by virtue of the small but finite resistance in the aluminum cable sheath.

Also, any other minute resistances found elsewhere, such as in loose or oxidized connectors, will cause similar problems. With a 1,000 amp fault current in the sheath it only takes 10 milli-ohms (one hundredth of an ohm—a very small resistance), to produce a 10 volt potential. This voltage can add or subtract from the 60 volt power supply voltage depending on the phase relationship.

If the power injected into the system in this manner is "dirty"—that is, containing significant amplitudes of lightning, switchingor other transients, our active devices will be in jeopardy.

Spikes of 2,000 volts have been

recorded on 120-volt lines from the following sources of polluted power:

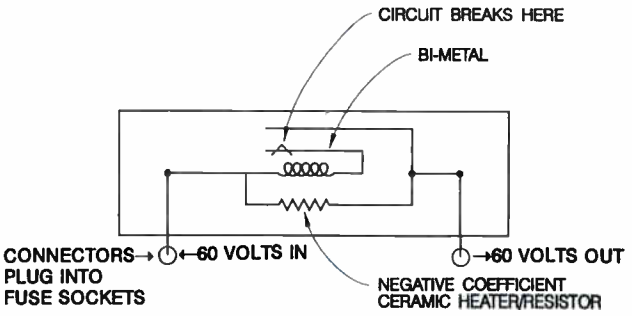
- Pumping stations.
- Power switching centers.
- Elevators.
- Furnace ignitors.

Note that the excessive sheath currents, lightning and other transients do *not* come onto the plant through the saturated ferroresonant transformer of the power supply, which does a great job of attenuating both longitudinal and transverse perturbations by as much as 60 dB.

One idea to get an amplifier out of this fault current stream is known as the "Florida" or "static" jumper and consists of a number six copper wire from the strand in front to the amp to the strand behind the amp. This does help a little and does not violate any rules, but it is only a partial solution since it does not deal directly with the cable but rather the strand. It has been tried often with only marginal success.

The next approach that many folks then fall back on is to beef up the plant grounding. Many of us have grown up with the mental picture of the "ground" being a thick, infinite copper plate, when in actual fact it is more like a large resistive, porous sponge. Figure 1 shows what you can expect from a single ground rod under average conditions.

"SMART" FUSE



ISOLATES TRUNK POWER FROM DISTRIBUTION
SHORTS - DOES NOT PROTECT ACTIVES

Figure 4

Let's look at a segment of aerial cable plant in isolation from the other services on the pole. In his grounding and bonding article, Rohrer tells us that a typical span consisting of strand plus 0.750 and 0.500 cable has a resistance of 0.042 ohms (42 milliohms), but let's be very generous and make the arithmetic easy by saying that the first span shown has a resistance of 0.1 ohm. Being "generous" again, let's assign a value of 10 ohms to the ground as shown. (Don't we wish we could get grounds like this all the time; summer and winter and for years and years without deterioration?)

Contemplating our cable plant, what we have is a simple voltage/current divider with a top arm of 0.1 ohm and a bottom arm of 1 ohm feeding into the next section. Since we are speaking only of 60 Hz A/C longitudinal sheath currents we need not consider the negligible impedances.

For lightning and other steep-fronted phenomenon the situation would be different. So we now have a 100:1 ratio and are in fact tapping off 99 percent of the voltage/current into the next section—not very effective! There are of course other paths which are similarly ineffective. Replicating this over several poles with our own individual grounds would improve matters very little and would cause potential differences between the utilities, especially under fault conditions.

Driving multiple grounds a ground rod length apart, or use of chemical ground rods would get the resistance below, say, 10 ohms but would not change matters much. And, now we are getting into a thoroughly uneconomic situation when there are other simpler, less expensive solutions. Remember too that ground rods must be measured and/or replaced periodically. In some areas they are eaten away leaving a copper shell in as little as 18 months.

Fuses

Fuses are, by definition, the weakest link in the chain (see Figure 3). When a fuse lets go, you have a guaranteed, irreversible outage which will require localizing and replacement by a technician—often under inclement and hazardous conditions. Manufacturers of actives and other equipment typically fuse lightly to be on the safe side in protecting their equipment and hence their reputation. Bear in mind too, that even the fast blow fuses typically found in actives are far too slow to protect

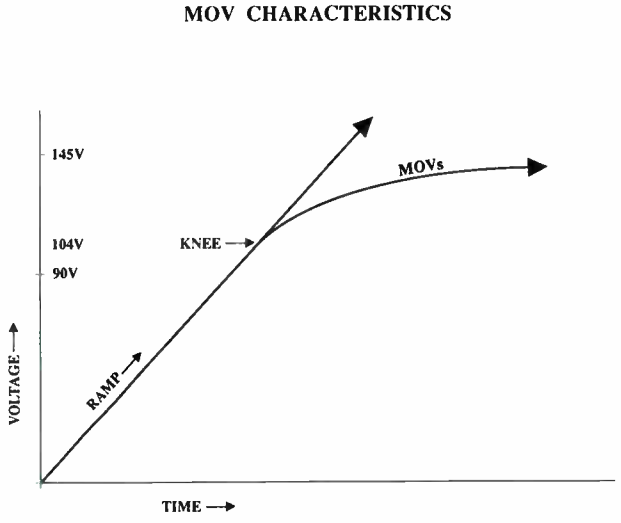


Figure 5

amplifiers from fast rise transients. The fuse may blow, but the damage will already have been done.

Certain other equipment—notably ferroresonant power supplies and some power inserters—come supplied with fuses. The reason a power supply has a 15 amp fuse in it is that the manufacturers cannot get UL/CSA approval without it!

However, ferro supplies can operate indefinitely into a dead short without harm because of the limiting effect of the ferro. The short circuit current from a 15 amp supply, for instance, limits at around 23 amps.

This is called the foldback current and because of this limiting action, any of these properly designed and manufactured ordinary or standby ferro supplies can operate very well with a 30 amp fuse or a piece of aluminum rod.

As for the fuses in the actives, good results have been obtained by many systems and MSOs by replacing the OEM fast blow fuses with slow blow (MLD) fuses.

The smart fuse

Some years ago we had available a little glass encapsulated circuit breaker which was self-resetting. It worked with a heating coil and a bi-metal contact. The theory was that when the current passing rose into an overload range, the bimetal bent and broke the circuit. This would stop the current through the coil—the bimetal would cool and reclose the circuit and the cycle would repeat until the problem was cleared.

Of course, it left customers with a cycling service which many assumed was being done deliberately by an incompetent cable system.

Enter the "smart fuse"—a considerably more sophisticated device (see Figure 4). In addition to the heating coil and the bimetal contacts, it has a negative coefficient ceramic heater which bridges the bimetal contacts, so that when the contacts open the ceramic resistor is energized. On short shorts, such as that which would be made by an installer changing a tap plate and inadvertently taking 60 volts to ground, the bimetal would open and reclose fairly promptly, causing a minimum disturbance to the system.

In the case of a sustained short however, the ceramic gets hot enough to hold the bimetal contacts open. This is a form of latching. When a long-term short is found and removed it takes about 20 minutes to unlatch. The procedure then is for the tech to locate the smart fuse and pull it for a few seconds (being careful not to burn fingers) and then replace it for immediate normal system operation.

The primary purpose of the smart fuse is to isolate distribution plant from the trunk powering so that the trunk power cannot get dragged down by a short in the distribution, thereby eliminating the possibility of a major trunk impairment or outage due to one or more power starved amplifiers. Note that the smart fuse cannot, and is not, intended to protect equipment from the killer spikes, transients and overvoltages.

Current thinking at CableLabs and elsewhere is that all distribution should be fed from separate power supplies anyway. Studies by a CableLabs Outage Reduction Working Group have shown that this powering scheme has, in some cases, allowed as much as a 50 percent reduction in the trunk standby power supply cascade, allowing better and more often maintenance TLC for the remaining standbys and their batteries.

This standby power supply maintenance factor has been identified as significant in reducing the number of outages.

OUTAGES

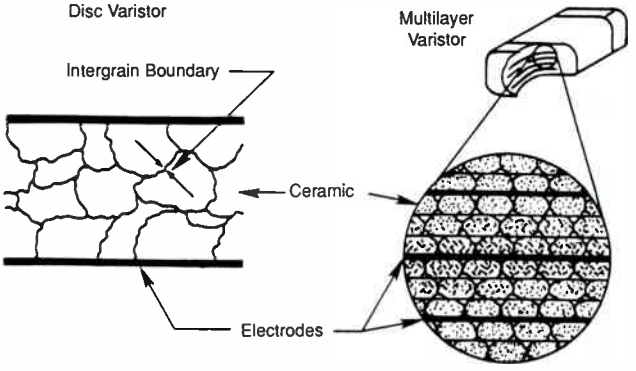


Figure 6

MOV IIs

A MOV is a Metal Oxide Varistor. It is a negative resistance resistor which, at normal specified operating voltages conducts very little current of the order of microamps. As the terminal voltage is raised, its resistance drops and more and more current is drawn. This tends to hold down any increase of voltage across its terminals, including fast rise time transients. This is called "soft limiting."

The MOV reaction time is adequate but unfortunately, it neither clamps nor shorts out the transients, because the voltage across it does rise to some extent, as shown in Figure 5.

Unlike the Zener and the Silicon controlled Rectifier (SCR), the MOV does not have a sharp knee. So what it actually does is reduce the amplitude of spikes and over-voltages.

The MOVS we speak of are a new breed, manufactured to closer tolerances with higher capacities and longer life. Yes, the life is "finite" and here's why: A MOV is a sandwich consisting of two little metal plates and in between is a very carefully formulated paste. The whole is then fired or baked. The particles in the sandwich are essentially molecular sized diodes and all the paths between the tw plates are naturally in parallel. When the MOV does its work, the current travels along the intergrain boundaries as shown in Figure 6.

Like lead/acid batteries in parallel, the paths (voltages) cannot be made absolutely equal. In the case of the batteries, one will ultimately discharge through the other.

In the case of the MOV, a preferred path is developed. This path keeps developing over thousands of "hits," carrying more and more current until the device ultimately destroys itself. The proper name for this is the Tunneling Phenomenon. Under severe repetitive transients, as frequently encountered in cable plant in the vicinity of pumping or switching stations, the life of MOVs is limited.

The MOVs therefore do not provide complete clipping/shorting/protection from spikes, and since the life is limited, MOVs should be considered primarily as devices affording some protection for consumer equipment through the warranty period.

Next month we will consider the CableLabs sponsored tests and offer a generic overall discussion with actual digital plots of the IEEE tests performed on some of the devices especially crowbars. ■

References

1. Ray Rohrer, *Grounding and Bonding*, Warner Cable
2. J.C Herman and J. Shekel, *Longitudinal Sheath Currents In CATV Systems*, Jerrold Electronics Corp.

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PCNs: Issues and alternatives

It has been over six months since the excitement about Personal Communication Services hit the cable industry. In this period, many cable operators have filed for and received experimental licenses, but few have actually placed hardware in the field.

Perhaps that is the most significant result of the past six months: We're beginning to understand what we need to find out.

The personal communications opportunity still looks large, although there is a need to sort out the application domain for PCS. The business wireless communications arena is currently served by cellular telephone with nearly 4 million subscribers generating about $4 billion in revenue.

Wireless telephony standards are beginning to emerge for various applications. Figure 1 gives an overview of the evolution of first and second generation wireless technologies for residential, mobile and business communications through PCN.

We're all familiar with the first generation cordless telephones (now called CT-1) which migrated to the 46/49 MHz frequency range in the mid-1980s.

Second generation cordless

These phones have useful range of 750 feet or less from a home basestation and their analog technology is subject to noise, interference and interception. Despite these drawbacks, millions are in use with 1991 sales still over 1 million units. Second generation cordless telephones (CT-2) were introduced in the United Kingdom in 1987 and have been a less spectacular success. The *Financial Times* recently stated that less than 5,000 telephones have been sold to date.

However, the CT-2 technology offers significant performance and feature enhancements over the more widely used CT-1. First, it is a digital technology which provides for noise and interference free communication within the 600-750 foot radius coverage area. An undesired side effect of this is that the user loses feedback when he has moved to the fringe of the coverage area, resulting in calls dropped suddenly if he moves beyond the boundary.

The CT-2 home basestation is a highly featured unit which can support multiple portable phones. Incoming calls can be routed to these phones in accordance with a predetermined priority. Calls can also be transferred from one phone to another and the system provides an intercom function allowing one portable phone to call another.

The phones operate at 10 mW power output, which results in a small handset and provides reasonable battery life. The major added feature, however, is the telepoint which allows calls to be placed while the user is away from home. Telepoints are located in public areas such as shopping areas, pubs, hotel lobbies and subway stations. These service areas are denoted by an easily recognized sign. Portable phone users need only move to within a few hundred feet of the sign and place their call. They are billed for the call at pay phone rates, which are below the prevailing cellular telephone rates.

The greatest amount of CT-2 activity to date has taken place in the United Kingdom, where four carriers including British Telecom, Mercury, Ferranti and Byps compete for the telepoint. Until recently, each used their own over-the-air protocol, which meant that although some 25,000 telepoints were installed in Greater London, each handset could only communicate with a fraction of them.

Recently, the carriers have agreed on a common air interface (CAI), which provides for the much needed standardization. A re-launch of the technology is should be underway when this magazine reaches you.

Like the U.K., Singapore and Hong Kong are using the 864-868 MHz band for CT-2 deployment. Both countries are beginning their rollouts; the Hong Kong results should be particularly interesting since the country boasts the

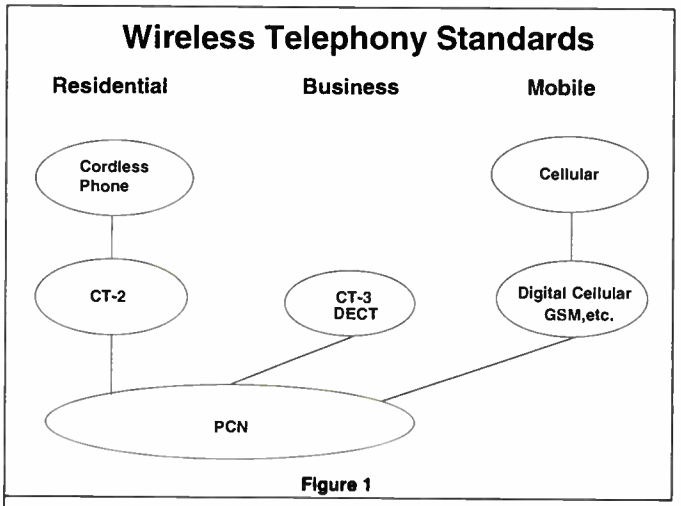
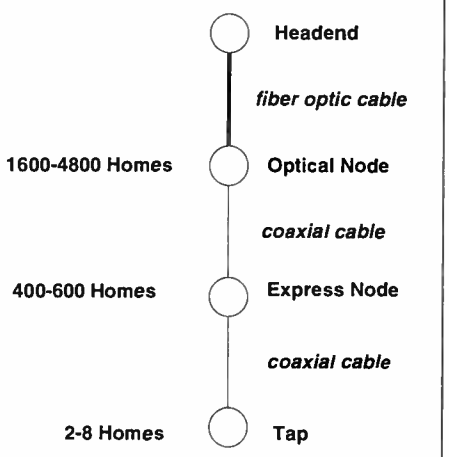
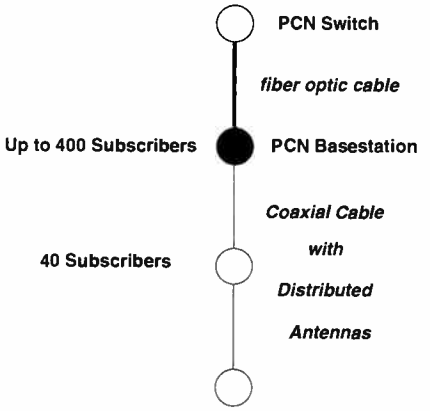


Figure 1



Fiber-to-the-Feeder Architecture

Figure 2



PCN Architecture at Start-up

Figure 3

B Geoffrey S. Roman, Vice President, Strategic Marketing, Jerrold Communications

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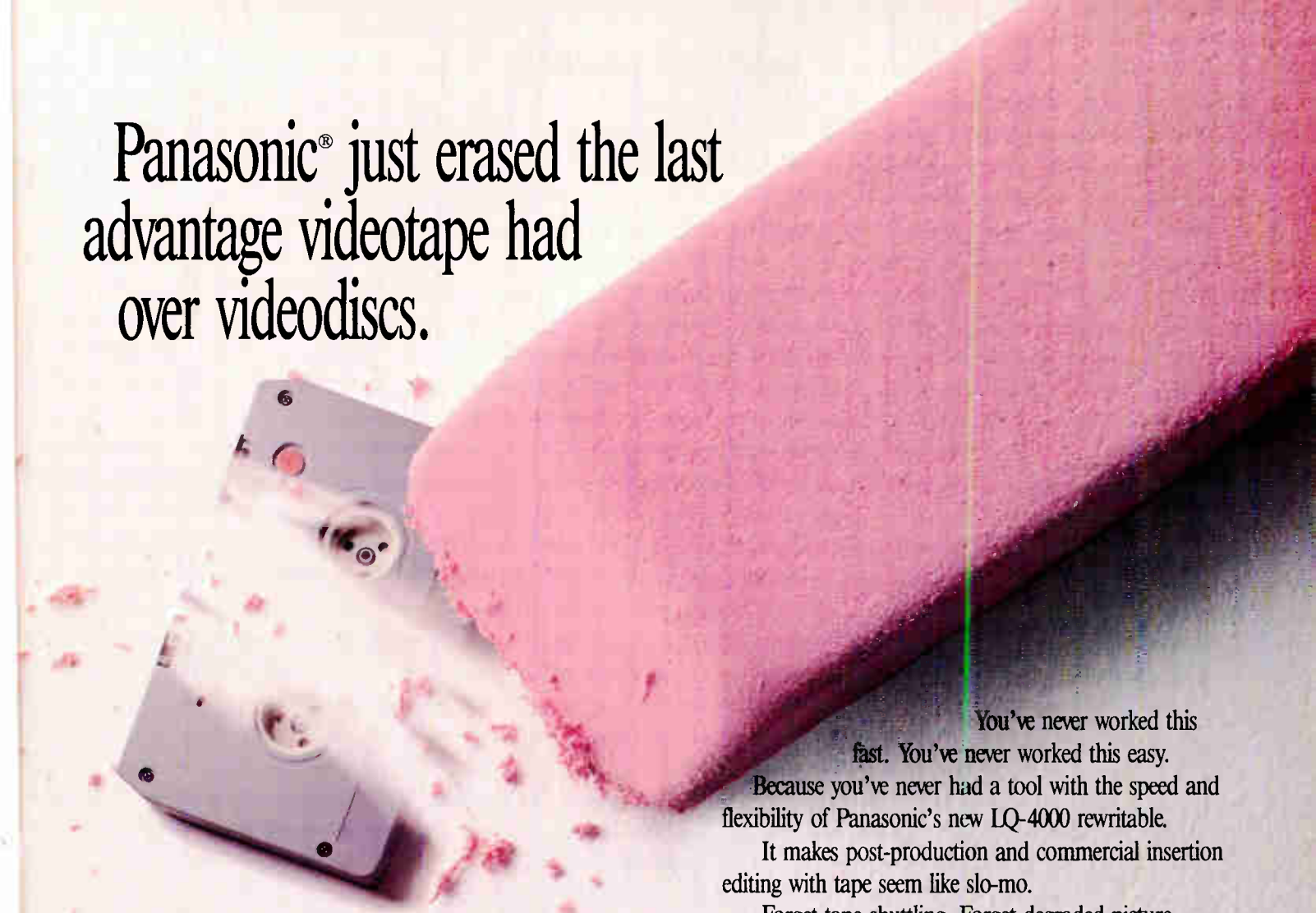

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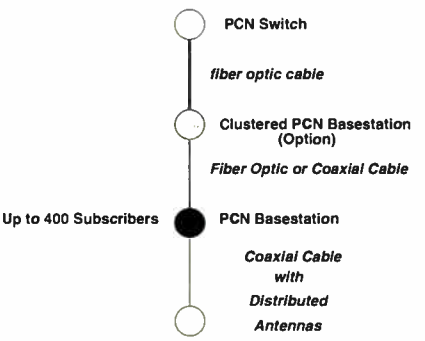
most widespread cellular usage in the world. Malaysia and Thailand are also slated for CT-2 implementation prior to the end of 1991. In the U.S., several RBOCs have experimented with CT-2-like technology with mixed results. BellSouth Enterprises has tested modified CT-2 equipment at the University of Georgia. In Canada, Rogers is testing CT-2 technology in several cities.

Serving the other end of the market, cellular telephone is a wireless technology with about 4 million users in the U.S. and is well positioned as a technology based from which PCS could develop.

Unlike the CT-2 telepoints, cellular technology supports full two-way calling, meaning that mobile and portable telephones can receive as well as originate telephone calls. Cellular operators have an extensive database system which allows users of one cellular system to operator their phones in areas served by another carrier. Currently, most incoming calls to roaming customers require the caller to know the roamer port telephone number of the system where the roaming customer is located.

However, several carriers now offer a service where the roaming customer enters a code which instructs his home cellular system to forward all calls. In the U.S., there are presently over 300 metropolitan and over 400 rural service areas for cellular service. Cellular telephone currently uses the 824-849 MHz frequency range for transmissions to the basestation and the 869-894 MHz range for transmissions from the basestation.



PCN Architecture at Higher Penetration

Figure 4

This allows the wireline and the non-wireline cellular carriers to each have 416 channels, 395 of which are used for voice traffic and the remainder of which are used for control purposes.

Cellular telephones operate with between 0.6 and 3 watts of power, which makes battery life and size significant issues in handheld telephone design.

The capacity of cellular systems is becoming an issue in dense metropolitan areas like New York and Los Angeles. To increase the number of conversations that can be simultaneously supported, a move to digital technology has begun, with several cellular carriers using a portion of their spectrum to handle several time division multiple access (TDMA) channels in the spectrum normally used for a single analog conversation. Code division multiple access (CDMA) approaches have also been proposed as a means for increasing capacity.

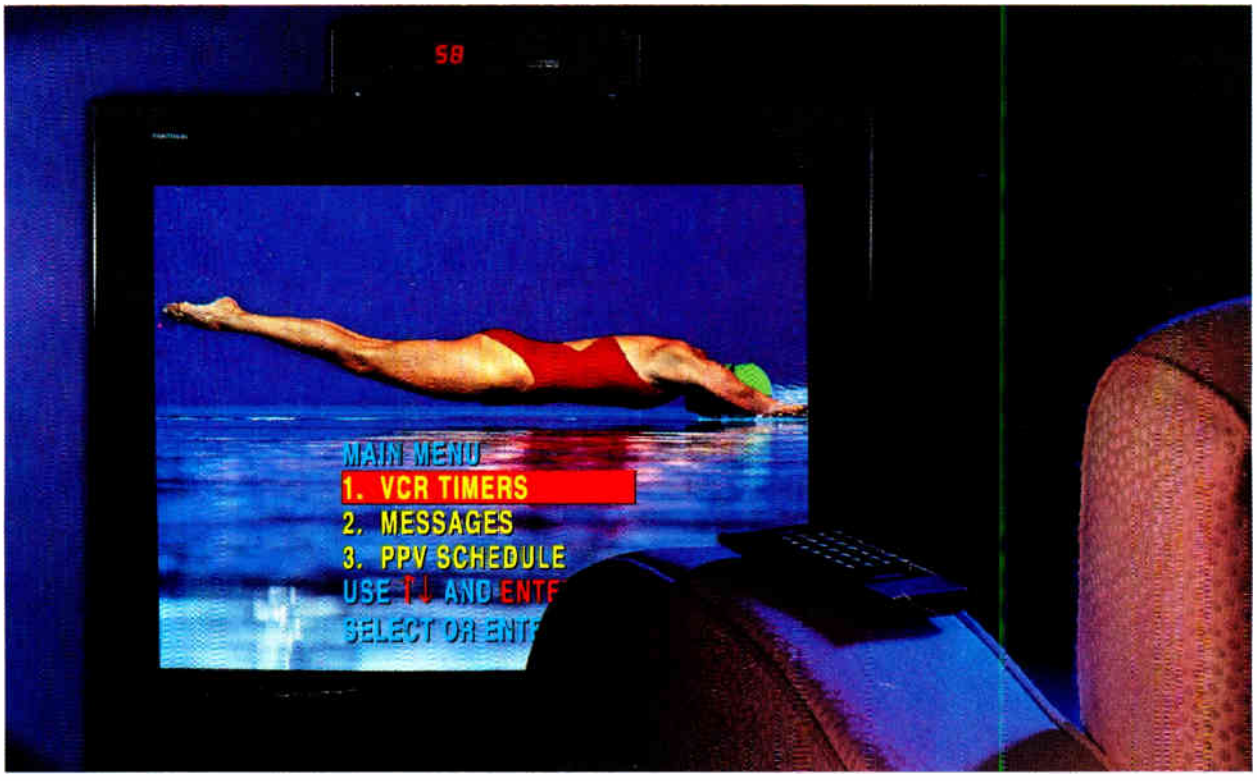
Standards

As yet, standards have not been developed including those for the telephones themselves. The digital implementations are at this time more power hungry than their analog counterparts, limiting their use to mobile applications where the automobile battery is available. This plus the installed base of analog telephones will yield a coexistence of the technologies.

The initial cellular rollout in Europe uses a variety of standards, most of which operate in the 400 MHz band. The European Telecommunications Standards Institute has developed the Group Speciale Mobile (GSM) specification as a unifying standard for second generation digital cellular transmission using digital technology. The system provides for 1,000 channels in the 890-915 MHz/935-960 MHz frequency range. Tests of the technology are now underway.

From this discussion of wireless technology, it is clear that there are many technologies and architectures to be discovered. The cable industry, as it works to develop a standard for PCS deployment, must consider the goals of basic communications systems deployment. The first such goal is to provide service at a low cost. The mandates a low cost infrastructure and/or an infrastructure that can share resources with another service. It also requires a low-cost handset; the price of some of the better cordless phones (around $150) is probably a good target.

The handset and the service must be customer-friendly—small size, long battery life and easy to operate. The ideal personal communications service



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would expand the realm of wireless telephony to users for whom the present alternatives are either too expensive are impractical. PCS should be configured as an incremental telephone service, not a duplicate of what already exists.

Toward that end, there are a number of alternatives under consideration. One is the use of cellular microcells, which involves low power cellular basestations placed at 1,000 to 2,000 foot radii. These low power basestations would communicate with low powered handsets which could be smaller and have longer battery life than the present portable cellular phones. This service could capitalize upon the existing cellular switching and database infrastructure, and by using the smaller, lower powered cells could support an increased number of simultaneous conversations through greater frequency re-use.

The concept includes handoffs between microells and embodies lower priced service when microcells are used. A seamless interface could be provided to allow users to migrate to the higher powered cells at higher rates when travelling by car; this would allow the user to keep one phone number for both applications.

Another alternative being considered is CT-2 Plus. This concept was developed by Northern Telecom with support from Motorola and GPT. It also is a two-way service and offers some basic enhancements to the CT-2 technology, yielding a more desirable service without all the cost burdens of some of the more exotic approaches. Others are considering the integration of CT-2 and paging, eliminating what many feel is CT-2's greatest weakness—you can't receive calls away from home.

Regardless of what PCS approach is selected, the small cell radii results in the need for an extensive wiring infrastructure to connect the basestations to the switch. Cable television operators can develop this infrastructure as the backbone of their PCS networks or

Figure 5. Infrastructure Cost

Scenario	Quantity	Item	Unit Cost	Cost/Sub
Distributed Antenna				
Startup	1	40 Ch. Basestation	$15K-$35K	$40-$85
	90	Antenna Interface	$250	$56
			Total	$96-$141
1600 Subs.	4	40 Ch. Basestation	$15K-$35K	$40-$85
	90	Antenna Interface	$250	$14
			Total	$54-$99
Traditional Approach				
	90	Basestation	$1K-$3K	
		Total at Startup (400 Subs)		$225-$675
		Total at 1600 Subs.		$56-$168

Figure 5

are in a good position to supply this infrastructure through partnership arrangements, even if they chose not to be PCS providers themselves. The deployment of fiber to the feeder and beyond further strengthens the cable industry's position by creating additional bandwidth in the network and allowing greater frequency re-use of limited RF return frequencies.

Residential, wireless PABX

Two principle applications have been identified as having the greatest chances for early payback: Residential and wireless PABX. CATV's infrastructure is best positioned for residential applications and needs additional development in many areas to properly address areas of the franchise without a significant residential population.

The fiber-to-the-feeder architecture shown in Figure 2 results in an optical node serving every 1,600 to 4,800 homes depending on subscriber density. The remainder of the distribution network is based upon coaxial cable technology and extends to taps within 150 to 200 feet of the average residence. During the early stages of the PCN rollout, it is likely that fewer than 400 subscribers would be located in the service area served by a single fiber optic node. This would allow placement of a 40-channel PCN basestation at the optical node location as shown in Figure 3. Traffic statistics used by telephone companies in residential areas network design provide for one circuit for each ten subscribers. The feeders served by the optical node are used to support distributed antennas throughout their service area. Distributed antennas must be installed to provide geographic coverage despite the number of subscribers actually using them.

As the number of subscribers increases beyond the number that can be supported by a single basestation, additional capability must be added. Electronics can be added at the original basestation locations and the feeders allocated among the co-locatrd modules. This approach allows the use of common housing and standby power, which could yield cost savings. Alter-

natively, basestations could be located at express node locations, as shown in Figure 4, which is consistent with the next step of CATV's fiber optic evolution. Both approaches use the distributed antennas installed in the first phase.

This evolutionary approach allows deployment of system intelligence on an incremental basis consistent with subscriber growth. Figure 5 shows the changes in cost per subscriber for the infrastructure as the number of subscribers increases.

This analysis assumes an 8,000 foot fiber optic node radius and a 1,000 foot coverage radius for the distributed antenna. A cell coverage overlap of 30 percent is assumed to reduce handoff requirements and assure continuous coverage. The cost of the PCN basestation is based on estimates of manufacturers of related products. The distributed antenna elements contain RF conversion and amplification functionality and are assumed to be similar in complexity and cost to line extenders.

For comparison, costs are shown at the same points in the evolution for an architecture with conventional basestations located throughout the service area. In this alternative, intelligent basestations have reduced capacity compared to those employed in the distributed antenna scenario. Correspondingly, they offer a lower cost. The distributed antenna approach has significant cost advantages when penetration is low, such as during the early phase of service offering. This advantage is less pronounced at very high subscriber penetration.

Cell size

A significant issue in determining the infrastructure cost is the cell size. Cell size is influenced by propagation characteristics, power and traffic requirements. Propagation characteristics are in turn influenced by the frequency, modulation and antenna height and location. At the candidate frequencies for PCS, the higher the frequency selected, the more difficult propagations becomes, and the shorter the reliable transmission range becomes. Also, the impact of objects between the system antenna and the handheld transceiver becomes more sever. Further complicating signal propagation is the height of system antennas, which are likely to be at strand level.

A means of overcoming some of the propagation limitations without resorting to much higher power is spread spectrum transmission. Spread spectrum relies on the aggregate of information transmitted over a bandwidth significantly larger than the message bandwidth to recover the message, and results in successful transmission over paths which would obliterate less robust techniques. Code division multiple access (CDMA) is a technique which allows multiple signals to share the same spectrum, improving the bandwidth usage efficiency of spread spectrum communications. The price for this improved propagation is added complexity and cost, at least initially.

There are still many issues to be resolved before PCS becomes a reality. Many MSOs are planning field trials during the remaining 15 months of their experimental licenses. In these trials, many of the technical hurdles will be addressed and solutions proposed. Marketing issues including determination of target customer groups and positioning of PCS among the array of communication products becoming available also must be addressed. ■

Expanding cable's bandwidth

How high do we go? And when?

Looking back at the technological history of cable television, one aspect that stands out very clearly is the steady progression of bandwidth capabilities over the last couple of decades. Bandwidth expansion could be seen growing incrementally with industry needs and desires for additional programming. Yet the advent of new technologies changed this incremental progression. With promises of potentially unlimited capacity, optical technology, coupled with digital compression now offers the chance at an exponential leap of bandwidth capacity.

Now, as the interest in higher bandwidth is being renewed, and as '750 MHz amplifiers are being deployed, one of the questions concerning expansion has become a reflective "Should we be putting in expanded bandwidth taps and passives today, and if so, how high should we go?"

Compression and expansion

There is little doubt that 1 GHz is necessary in today's systems, even with compression technology. Current channel capacity demands along with future business scenarios dictate that bandwidth be available for use. To many in the industry, the ability to squeeze two, four, or even eight NTSC channels into 6 MHz of bandwidth promises to fulfill the need for additional bandwidth.

But the fact remains that it is still necessary to put in as high a capacity of taps and passives, from a bandwidth perspective, as you possibly can. One simple reason for this is industry precedence. If we, as an industry, say we're going to move forward in bandwidth, there needs to be upgradeability and expandability. And the cost of implementing a 1 GHz plant today, in preparation for future needs, is incidental to the cost required to change out a system at a later date.

Secondly, indicators show that there may be a need for a lot more channels, if for nothing else but pay-per-view (PPV). And with the fairly innovative, refreshing ideas as to what kinds of programming can be added to channel lineups, compression will not dismiss the need for 1 GHz capabilities. As an example, let's lay out a possible scenario for bandwidth.

Frequency (MHz)	Services Offered
54	Off-air broadcast plus FM band
78	*(15 channels; 90 MHz + 20 MHz FM)*
102	
126	
150	
174	Satellite delivered basic and expanded basic
198	*(35 channels; 210 MHz)*
222	
246	
270	
294	
318	
342	
368	
390	Multiplex premium services
414	*(12 channels; 72 MHz)*
438	
462	Niche primiums services plus local access
486	*(8 channels; 48 MHz)*
510	Analog pay-per-view
534	*(10 channels; 60 MHz)*
558	Digital audio *(30 channels @ 600 KHz each; 18 MHz)*
582	High Definition TV
606	*(20 channels; 120 MHz)*
630	
654	
678	
702	Top tier: Near Video-On-Demand
726	*(40 compressed channels; 30 MHz)*
750	Second tier: Near Video-On-Demand
774	*(40 compressed channels; 30 MHz)*
798	Switched Video-On-Demand
822	*(400 compressed channels; 300 MHz)*
846	
870	
894	Other options:
918	*--PCN*
942	*--Narrowcasting*
966	*--Interactive channels*
990	
1014	

First of all, start with off-air channels. In major metropolitan areas, especially where franchising authorities dictate newbuilds or rebuilds at 550 MHz, off-air requirements can be anywhere from 10 to 15 channels. Then there could conceivably be an expanded basic tier, satellite delivered, that would consist of 35 channels. This already gives a system a possible 45 to 50 channel basic tier, which is not unusual these days.

Next would be movie services. Assuming that HBO and Cinemax are going to persist and be successful in their multiplex scenario, and that Showtime and The Movie Channel are going to match that, the requirements for mainstream movie channels has moved to approximately 12 channels.

Following this would be the more niche-oriented pay programming—Disney, Playboy, regional sports networks and so forth. That's another four to six channels. Add local access to this and there's another two channels, or whatever the franchise requires.

The probability also exists there will still be a strong need for analog pay services, simply because operators will not want to put a decompression device in every home. With that thought, figure another 10 channels for an analog PPV tier.

Beyond the first level

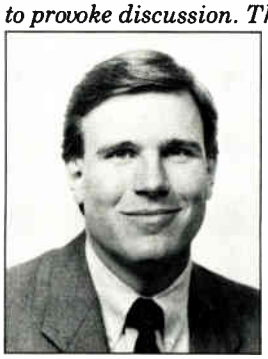
Now that the system is filled with 80 traditional analog NTSC signals, let's take a look at an 8:1 compressed digital service capability (using the figures AT&T provided to CableLabs in its response to CableLabs' request for information on compression.) The obvious service in many minds when talking compression is high definition television (HDTV). Supposing there will be some duplication of movie services, ESPN or the networks, figure 20 (6 MHz each) channels of HDTV.

Next would be near video on demand (NVOD). Although NVOD has a dozen different definitions, let's categorize it into two different tiers—the hot titles and the close-to-hot titles. Digital audio services also need to be included in the bandwidth scenario. Most of the services available use approximately 600 kHz per channel, with an initial offering of around 30 channels. For a starter, a cable system would need another three 6-MHz slots for audio services.

With the talk of expanded bandwidth has also come a renewed interest in interactive services. One drawback to some of the interactive services proposed is the need for additional bandwidth. On the other hand, in a compressed system, the prospect is not so overwhelming. But let's figure three

By Steve Necessary, President, Regal Technologies Ltd.

Editor's Note: *This editorial is provided to provoke discussion. The views of the author do not necessarily represent the views of the staff and management of this magazine. Reply comments are invited.*



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sports channels, or superstations, using four channels of interactive programming for a sporting event.

New opportunities

If the industry were to go with a 4:1 compression scenario, the total number of channel figures would almost double. Add those numbers to the first level of 80 analog channels and you can see we're either fast approaching full usage of the 1 GHz spectrum or have met our limit.

The last few business opportunities are difficult to figure in terms of actual bandwidth capacity. Of course, any debate on bandwidth will eventually lead to the discussion of niche programming. Whether it's educational, religious, political or infomercials, compression allows for true narrowcasting in a way never before possible. The number of channels required is only limited by programming imagination.

The last possibility, again looking at a five-year time frame, would be true video on demand (VOD) or switched video services. Let's say VOD will be predicated on a fiber to the feeder (FTF) architecture with the area served by the FTF design being 2,000 homes. If there are 2,000 homes and the system was built for 20 percent maximum utilization, there would be 400 homes that might want to watch some switched video service simultaneously. Those 400 channels divided by an 8:1 compression ratio is 50 compression packages. Multiply that times 6 MHz and the end result is another 300 MHz for VOD. (See Figure 1 for an overview of the bandwidth layout.)

Now, obviously, the variable here would be the percentage utilization—perhaps it's 15 percent, maybe it's only 10 percent. Clearly, the phone company does not build for 100 percent loading, and there is no need for the cable industry to calculate that high a percentage. Depending on channel capacity needs, the percentage of utilization is a system variable.

	2-Port Tap	4-Port Tap	8-Port Tap	2 Way Splitter	3 Way Splitter	Directional Coupler
Average units per mile	6	10	17	2	0.06	0.76
Total required*	7,440	12,400	21,080	2,480	74	942
UPGRADE COSTS IF FUTURE EXPANSION BEYOND 600 MHz IS REQUIRED						
Hardware**	$6.00	$6.50	$15.00	$20.00	$21.00	$20.00
Labor	$15.00	$15.00	$15.00	$15.00	$15.00	$15.00
total/Unit	$21.00	$21.50	$30.00	$35.00	$36.00	$35.00
Total*	$156,240	$266,600	$632,400	$86,800	$2,664	$32,970

* Assumes 1,240 miles
** Estimated

Grand Total = $1,177,674

Economic rewards possible

After all this, if we could look into our crystal ball, however cloudy it may be, and see that it is possible to fill a 1 GHz spectrum, even with using compression techniques, why would 600 MHz be considered sufficient for the tremendous opportunities that lie ahead for the cable industry?

Naturally, there is an element of doubt when looking at this type of commitment to bandwidth capabilities. Yet, when considering a rebuild or upgrade, there are positive economic rewards to be gained by planning for a 1 GHz system now, as well as being technologically prepared for future opportunities.

Let's take a look at the cost of a tap changeout. As an example, let's look at an actual system that started with 600 MHz. Five years later, the system decided 1 GHz was necessary. At best case, the system was able to use the existing tap housing and just change out the faceplate. As an estimate, figure labor costs at $15 each with hardware costs being almost the same as the tap itself.

Assuming that five years in the future, operators can buy 1 GHz product for what 600 MHz product would cost today, and keeping a conservative assumption on the hardware front, a changeout in the future would cost an additional $1.18 million. (See Table 1)

Even considering net present value and bringing it back to today's dollar, using a 12 percent discount rate, the present value is $670,000, which when considering present approximate product costs, would still save the system $210,000.

1 GHz now

So what's the answer? If the industry continues to examine new business opportunities, if technological advancements continue at the present rate, the industry needs a 1 GHz tap and passive foundation, at a minimum, to be prepared for the future. Indeed, the industry needs to visualize, plan and build cable plant to meet future goals. The industry shouldn't be asking if 1 GHz capability is needed, but rather, why haven't we implemented it now? ■

Continued from page 27
In addition, it will also position cable for interfaces/interoperability with other digital sources, in that we can define the interface to the cable infrastructure and those providing a source must conform to that interface. It will not be to our advantage to allow someone else to define that interface for us.

Video routing/switching

We have video routers in some systems today. Can these video routers pass digital signals? Testing will be done to answer this question in order to avoid stranded investment.

Using the word "switching" is perhaps misleading, because we are not referring to switching in the telephony sense of the term; we are referring, rather, to the routing of video source within the network. This routing is particularly important for such applications as a pay-per-view service that would access a video library. With a library containing, say, 1,000 sources, a video router could be used to transmit to individual hubs, thus serving demographic pockets much more efficiently than by simply broadcasting to the entire subscriber base.

To accomplish this, we are looking at both Asynchronous Transfer Mode (ATM) technology and frame relay technology. The video router, as it is presently conceived, is basically a one-way switch that could become two-way if necessary. At some time in the future, if PCS migrates into the network, the switching functionality needed for PCS and the video routing functionality might migrate into one system (assuming the integration of voice, data and video).

But in order for PCS to begin, or for the video routing of pay-per-view or near-video-on-demand types of applications to begin, we presently advocate initially using the lowest-common-denominator design for each separate application, as opposed to attempting to integrate them from the outset.

Interfaces/interoperability

CableLabs is evaluating how the ATM protocol would interface with the cable infrastructure. We know that ATM and synchronous optical network (SONET), which is the approach the telcos are embracing, interface directly with each other; the question is how well the version of ATM that we pursue will interface with SONET. We do not anticipate major problems here. In addition, we need to address the topic of PCS interfaces: At one end, between the cable headend and the public switched telephone network; at the other end, between the cable facility and the radio base station.

Video storage

A component that goes along with video routing/switching is the video storage medium or video library. The Time-Warner test in Queens, N.Y., is originating its pay per view programming from a manually-operated array of Super-VHS tape machines. But as the number of channels provided for pay-per-view originating from video libraries increases, the need arises for an automated, dynamic storage system. This is a particularly important area that we are just beginning to look at. Beyond the basic approach of an array of stacked VCRs, there are several alternative solutions, some of them quite elegant and complex.

Standards

The cable industry is actively monitoring and attempting to influence and direct activities relating to the setting of standards. CableLabs is currently a member of the T1 Committee of the American National Standards Institute (ANSI), and is involved within that committee with the T1S1.5 Broadband Network Architectures and Video Services Working Group. We need to understand how the telcos plan to implement this technology and what interfaces the standards committees arrive at, because they will be the interfaces that define the SONET and ATM interfaces with our network.

To date, the standards groups have devoted little attention to point-to-multipoint-type applications within the SONET or ATM structure—a sign that we probably have our work cut out for us if we intend to influence the standards. We have asked the Society of Cable Television Engineers (SCTE) to develop a working group that will assist CableLabs in standards discussions. CableLabs and the NCTA, based on their charters, are in a position to establish only guidelines, not standards; SCTE, because of its open forum membership rules, can establish standards.

We are also working with the Electronic Industries Association on the CEBus and other aspects of consumer electronics, and we are also looking at working with the IEEE on some of the standards it is developing. Internationally, CableLabs President Richard Green heads one of the advanced television groups in the CCIR, and eventually we will probably become involved in some activities and some working groups in the CCITT.

Conditional access

A final issue is conditional access and the need to control the connect and disconnect capability of subscribers remotely. To date, we have not been able to drive the cost of such remote units down to a point where they can be deployed in large volumes. Implementing such technology would be extremely labor saving, and would make possible better control over subscribers' viewing. With such technology, whether dealing with non-paying customers or those desiring more services, we could respond without rolling a truck. This is an area we will be working on.

The many issues summarized here are being analyzed in the context of the network architecture and the network design processes.

Above all, our focus is on the crucial network design issue of proactively managing the influx of new technology. ■

The CABLE POLL™

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Operators aware of signal theft; 74% taking preventative steps

"There are a lot of temptations to take a shortcut, but when you cheat in any form, all you're doing is cheating yourself," said Ted Turner earlier this year at a Tufts University commencement exercise.

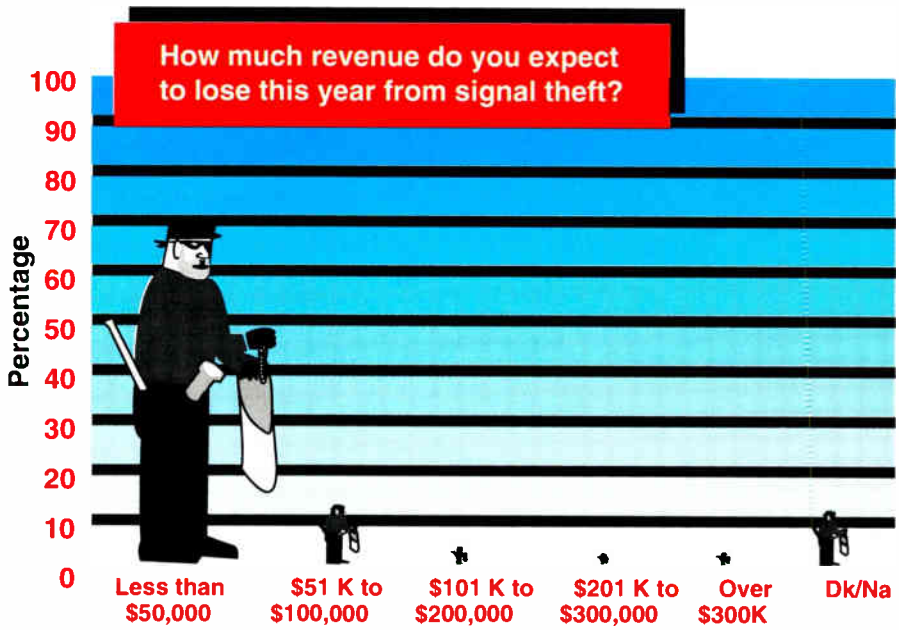
Apparently cable operators are tuning in to Turner's philosophy, at least in part, in an attempt to curb theft of cable signals. According to a June 1991 Cable Poll, system executives are increasing the regularity of system audits, installing theft-deterrant technology and filing legal charges against discovered signal bandits.

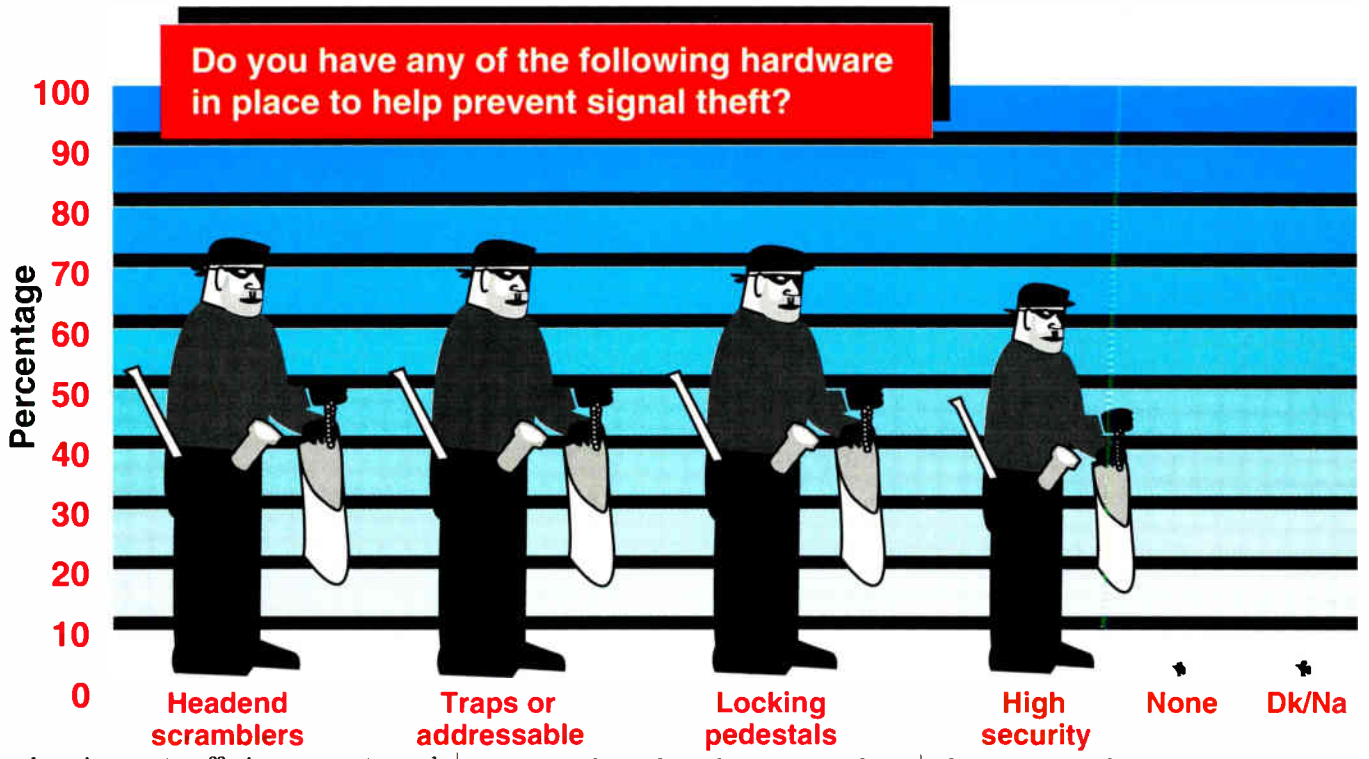
And although the National Cable Television Association's Office of Cable Signal Theft estimates stolen cable revenues at $3 billion, operators are a bit more conservative–71 percent put a price tag of $50,000 or less this year on the stolen cable channels.

Accordingly, though, larger systems anticipate larger losses. Whereas none of the respondants operating systems with less than 10,000 subscribers anticipated losses over $50,000, 14 percent of systems managers servicing 50,000 or more subscribers foresaw this as a grim possibility.

To that end, 81 percent of system executives are beefing up system audits this year. Notably, 28 percent of systems with more than 50,000 subscribers plan to or have hired a security person. Overall, eleven percent of systems polled will add a "cable cop".

Systems are counting on subscriber tips, too, with 28 percent offering some type of amnesty program for those "illegal" subscribers that turn themselves in. For example, Cox Cable of Greater Hartford, Conn. recently took out local newspaper





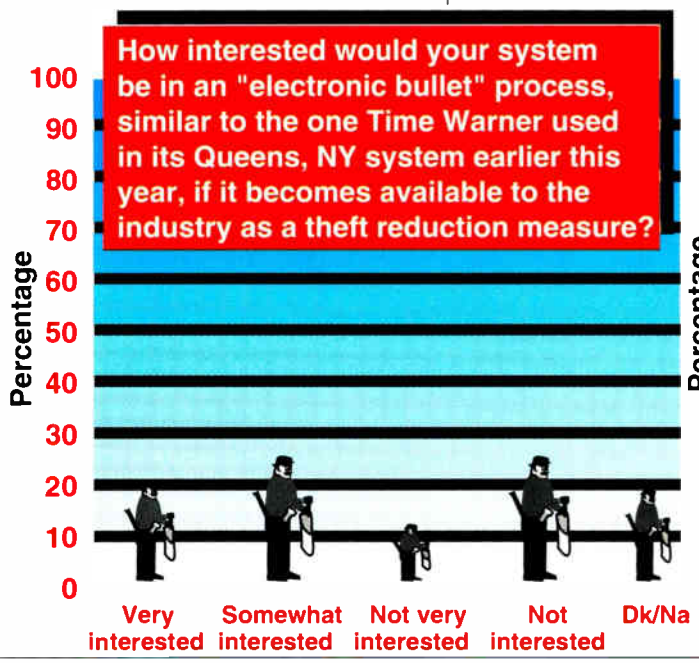
advertisements offering amnesty and a refund to those subscribers who returned illegal converter boxes that had been purchased from a convicted pirate-box supplier. "No questions asked," the ad copy read.

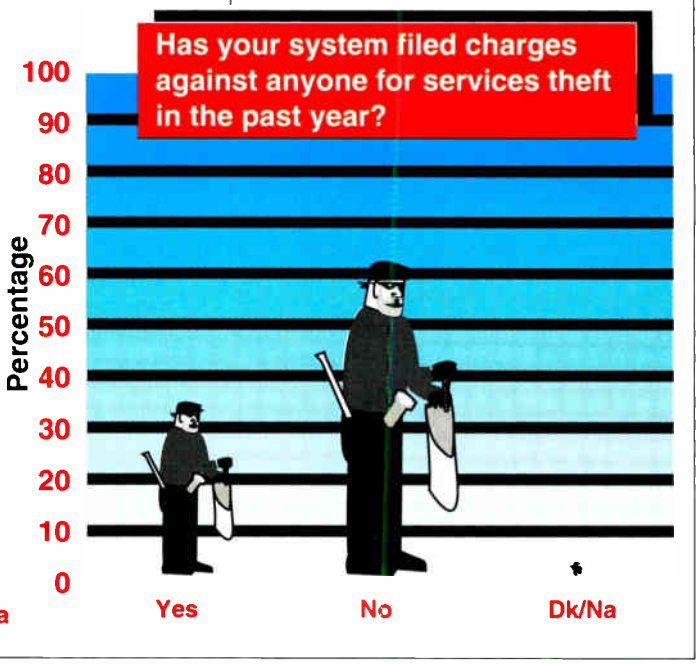
Most operators, however, seem to feel that prevention is the best roadblock to signal theft. Headend scramblers, traps and addressable converters are securing 74 percent of systems overall, with locking pedestals representing a close 73 percent. Along those lines, more than a third–35 percent–of system executives polled plan on upgrading their current converter security system this year.

The majority–62 percent–of systems polled haven't filed charges for service theft within the past year. However, more than half (55 percent) of those system executives in the Northeastern portion of the U.S. have wound up in court. Similarly, 52 percent of those systems serving more than 50,000 subscribers have pressed charges.

According to the Cable Poll, operators nationwide don't seem terribly intrigued by the "electronic bullet" process that singled out 317 signal theives in Time Warner's Queens, N.Y. system earlier this year. In fact, only 20 percent described themselves as "very interested." Those "somewhat interested" and "not interested" tied at 25 percent.

– Leslie Ellis





Product news

New couplers, WDMs, enclosures

New from **Ipitek** is a singlemode series of couplers and wavelength division multiplexors (WDMs). Splitting ratios are selectable from 50:50 to 95:5 in either the 1310 nm or 1550 nm wavelength range. The WDMs offer other wavelength combinations for short wavelength applications and erbium doped optical amplifiers, company officials say.

Ipitek's coupler enclosure

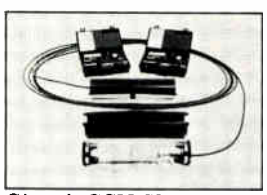
Product specifications include less than 0.1 dB excess loss and a close tolerance on coupling ratio, resulting in low total insertion loss. All couplers are available with connectors, including low back reflection FC/PC, ST/PC, SC/PC and Super PC polish. Enclosures and rack-mounted versions for the connectorized couplers and WDMs are also available.

Customization and product brochures are available by calling Ipitek's Applications Center at (619) 438-8362, or fax inquiries to (619) 438-2412.

Self-supporting aerial cable

New from **Siecor** is the SCN fiber optic splice closure, an addition to the company's ERK kit for fast, temporary repair of damaged fiber optic cables in outside plant applications.

Each ERK kit now includes two SCN-003 closures as well as 30 meters of spare loose tube optical cable, two tool kits, and no-epoxy CamSplices. The closures are pre-drilled for two or three cable entries, and specially designed sleeves size the entries to cable diameters.



Siecor's SCN fiber optic splice closure

The new closure design significantly reduces installation and repair time, Siecor officials say. Closure and end caps have been redesigned to be installed with a common socket wrench, eliminating the need for special closing tools. A throw-away gauge is also provided, to ensure that the end cap is properly closed. The sealing system of the SCN closure incorporates reusable end cap sealing gaskets made of silicon rubber.

Lectro's new standby power

Lectro has announced its new modular common ferroresonant standby power supply, the Uni-Max. Available in both two and three battery versions, the Uni-Max utilizes the company's exclusive "cool core" heat sinking technique to ensure a cool running transformer.

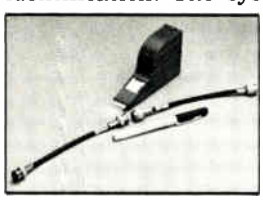
Lectro's Uni-Max

The modular design allows customization with a wide range of options and features including either flashing LED or digital displays, RF transponder interfaces, input and output circuit breakers and input and output surge arrestors.

For more information, contact Lectro at (800) 551-3790.

Write-on tape system

Jenson Tools has introduced a write-on tape system for labelling wire and cable. Made by **3M**, the system creates durable, self-laminated labels for system documentation and future identification. The system includes a tape dispenser, pressure sensitive tape and a marking pen. As the tape is dispensed, a label area appears in the dispenser window and provides a smooth, flat writing surface.



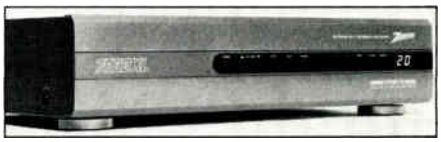
Jenson Tool's write-on tape system

The tape itself is resistant to dirt, oil and heat. The system is priced at $17.95 (250 labels/roll). Replacement pens and tape refills are also available.

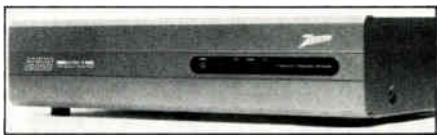
For more information on Jenson's products or for a free catalog, call (602) 968-6231.

Zenith Electronics has introduced a new integrated receiver decoder (IRD) that offers "simplified operation and unique styling", company officials say. The new 7000XL and 2500 models offer extended threshold sensitivity circuitry to produce a better picture.

And, a new UHF Space Command remote control has been added. Also new on the 7000XL is a sleep timer menu and improvements that allow for easy reprogramming when satellite locations change. The feature, called the "Move channel," moves the channel and other related settings when satellite broadcasters move their programs from one satellite or one channel to another.



Zenith Electronic's 7000XL



Zenith Electronic's 2500

The 7000XL, with a $1,799 price tag, also includes stereo, programmable VCR timer/clock, terrestrial interference filter, 200 favorite program capacity, sleep timer and subcarrier stereo in the discrete format.

The 2500, priced at $1,499, includes a built-in antenna controller, parental contrl and the ability to move the satellite antenna east to west via the remote control.

Also, source switching, 50-satellite memory, automatic peaking and synthesized audio and video tuning come with the 2500 model.

For more information, contact Zenith at (708) 391-8181.

New from **Wiltron Co.** is the 5400A Scalar Measurement System, designed for applications including direct broadcast satellite communications, terrestrial communications and military radar. The system integrates an advanced scalar analyzer with a built-in, swept microwave source. Company officials say that the unit is cost effective because it offers the stability and accuracy of a synthesized sweeper for the cost of a typical analyzer/sweep generation combination, and is conveniently packaged in one box.

Wiltron Co's 5400A

Although the system comes with a monochrome display, an external VGA color monitor output is also provided to allow large screen color viewing. The system offers 71 dB dynamic range, smoothing, averaging markers and cursors, trace memory, complex limit testing, custom X-axis capabilities and buffered print and plotter outputs.

For more information, contact Wiltron at (408) 778-2000 or fax inquiries to (408) 778-0239. ■

Industry faces

Steve Yajima

Steve Yajima has been named chief engineer of **Yuasa Battery America**. Yajima comes to American from the company's Tokyo, Japan division, where he was assistant manager in the International Trade Division. He has been with the company 19 years.

Three additions have been announced by **Digital Cable Radio** (DCR). **James R. Martin Jr.** has been added to the company's staff to assist with marketing and sales to cable system operators. Martin will also develop marketing programs to assist system operators with DCR sales to subscribers.

Also, DCR has announced the addition of **Anne Thiede** to regional sales manager for the central U.S. Thiede will be responsible for selling DCR to cable system operators in an eight-state area. Before joining DCR, Thiede was the affiliate relations manager at the Financial News Network.

And in a final announcement, **Mary Tartaglione** has joined DCR as an account executive for the western U.S. In her new role, Tartaglione will assist local cable system operators with installation, training and marketing as operators begin to deliver DCR to subscribers. Prior to joining DCR, Tartaglione was the national director of recruiting and training for Public Storage Inc., where she conducted nationwide training seminars for management personnel and published monthly and quarterly newsletters.

Riser Bond Instruments has appointed **Tim Gilkerson** to the newly created position of LAN marketing manager. Gilkerson will be responsible for promoting, developing and expanding the use of Riser Bond cable fault locators and related test equipment within the computer arena.

Tim Gilkerson

Sheryl Anderson

Also, Riser Bond has announced the addition of **Sheryl B. Anderson** as the company's media coordinator. In her new role, Anderson will coordinate all sales, marketing and promotional materials for the company. She will also be responsible for the production of promotional and instructional videotapes.

Keith Huff has been added to the management staff of **Recreational Sports & Imports** (RS&I) to run the company's new San Antonio, Texas office. Huff's background is in the satellite industry.

Keith Huff

Two promotions have been announced by **Magnavox CATV Systems**. **Stephen Schoen** has been named national accounts manager, and will be responsible for servicing major targeted MSO accounts. Schoen has been with Magnavox since 1981 in various sales positions. He began his cable career in 1962 at TCI, where he served a as director of franchising.

Also, **Eric V. Himes** has been promoted to western regional sales manager. He succeeds Schoen. In his new position, Himes will be responsible for supervising account coverage in the western U.S. Himes has been with the company since 1983.

Tektronix has appointed **Bill Thompson** to the role of audio products marketing manager, Television division. Thompson is responsible for developing and implementing a marketing strategy for the division's growing family of audio products. Previously, Thompson was the product marketing manager for audio and video converter products at the Semiconductor division of Analog Devices Inc.

Bill Thompson

ANTEC has named **Kathy Berlin** technical writer, based in the company's Denver, Colo. product development and research lab. In her new role, Berlin will serve as editor of ONN, a technical newsletter published by **ONI** and **AT&T**, and will provide technical communications support for all of the companies under ANTEC.

Prior to joining ANTEC, Berlin was a contributing writer and managing editor of this magazine.

Our best wishes to you for continued success, Kathy. ■

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PLANT MGR–Attractive SE location needs a good blend of technical knowledge and people skills. $45K
TECH MGR–SE loc top MSO. $40K
PLANT OPS MGR–Major MSO needs engineering administrator. SE $42K
CIRCUIT DESIGN ENG–Multiple opportunities nationwide. $40-50K
TECH MGR–Resort setting, East coast location. $45K
STAFF ENGINEER–BSEE a must, corporate position for a mid-sized MSO. $50K
DIST ENG–Regional in scope mid-west location. $38K
RF ANALOG ENG–Major mfg, circuit design of next generation convertors. $50K
MGR/CHIEF TECH–Multiple opportunities nationwide. $26-32K
CHIEF TECH–Top MSO Southern location, optical technology. $28K
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SERVICE AND LINE TECHS–Opportunities nationwide call for geographic preferences. $9-16/hr.

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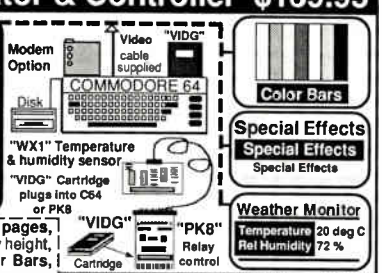

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Advertiser's Index

Interface complexity: Where do we go?

Direct pickup interference or DPU (sometimes called DPI) is the oldest cable consumer interface problem. It is the original reason for the invention of the cable converter. The first converters didn't tune any more channels than the TV receiver. These converters provided better shielding to avoid DPU. They also were designed to accept adjacent channels and a fully loaded spectrum. All three of these characteristics do not exist in the broadcast environment.

There are two critical elements to this issue which need to be resolved. The first is fundamental. We need a repeatable, accurate method of measuring DPU performance. Without this, no progress can be made. Once an agreed-to test method is developed, we need to know the parameter value for DPU immunity. How much is enough to solve most of the problem? Once these two pieces are in place, we can work toward a commitment to solve the problem. The proper place for this activity is in the EIA/NCTA joint engineering committee.

The EIA is the Electronic Industries Association and is the trade group for the consumer electronics manufacturers. The EIA/NCTA joint engineering committee is a rather unique organization of engineers from two industries working together for the betterment of their customers. This committee enjoys the full and energetic support of CableLabs. The same industry people are active in both the NCTA engineering committee and the work of CableLabs.

But this is not enough. It has become clear to a number of those active in these committees that engineering solutions to problems are a necessary but not sufficient condition to an improvement of the situation. We need the product planning and strategic planning elements of both industries talking together. We need a commitment and a plan to implement the engineering solutions. This can only come from these other quarters. Ways of getting that involvement and commitment are being explored.

By Walter Ciciora, Vice President of Technology, American Television and Communications

Electronic Program Guides

An example of where efforts on multiple formats is required is in the Electronic Program Guide (EPG). In the ideal solution, a technical standard for the delivery of data on an appropriate carrier would be struck by the engineering committee. Then cable industry planners would commit to carrying the data and consumer electronics planners would commit to making TV receivers and VCRs available with the appropriate circuitry. Both sides would promote the EPG. With just an engineering solution, we'll have another MultiPort—a technical solution that does not get implemented. The biggest loser will be the customer.

Exceptional challenges are ahead in trying to accommodate Near Video on Demand (NVOD), HDTV and video compression. As already explained, these involve technical hurdles and require some solid engineering effort. Then they require a planner's commitment to implement.

Another issue has not been mentioned. This is the need for better transparency in TV and VCR tuners and intermediate frequency amplifiers and detectors. These circuits must not introduce a signal quality penalty when compared with baseband inputs to the receiver from a video disk machine, VCR or DBS receiver.

If these circuits do cause noticeable degradation, the cable operator will be forced to introduce a set-top unit with baseband outputs and a quality RF chain in order to provide competitive video. This has not received adequate attention in the past. It is something causing cable engineers increasing concern.

Explain the root causes

I believe it's important for the cable technologist to be able to explain the root causes of the cable/consumer electronics interface difficulties. This is not a blame allocating or finger-pointing exercise. Recall our discussions in previous columns. The root cause is simply the fact that new technology nearly always starts out with the difficult human interfaces. This is because the technology is usually first introduced when it can just barely support the new functionality. There is no spare capacity to support easy interfaces.

Secondly, the human interfaces are the most difficult to work out. Often, years of trial and error are required to sort them out. As the technology matures, it becomes more capable at affordable price and the human interface becomes simultaneously better understood. Then the usage can become nearly transparent. This is an ordinary part of technological development, introduction and maturation.

In the case of cable and consumer electronics, the wide variety of opinions available make the situation difficult to understand—even for a technologist. The affordable technology makes the choices possible, but only now is able to ease the human interface. Only now are we beginning to be able to afford enough computing power, memory and on-screen display capability to significantly assist the interface.

VCR maze

Don't hesitate to point out that the most complex part of the whole consumer electronics interface issue is the VCR and how it fits into the maze of wires and button pushings. Anyone who can master the setting of his VCR for time shifting can also understand the use of a cable converter.

The opposite is not necessarily true. Be sure to point out the good news. New VCRs are getting easier to use because of maturing technology. Just as the VCR interfaces are improving, so will the interfaces with cable.

Things should rapidly improve over the next five to 10 years if the two industries work together. If they don't, each will introduce new technologies without addressing the interface problems. The customer will lose out. ■

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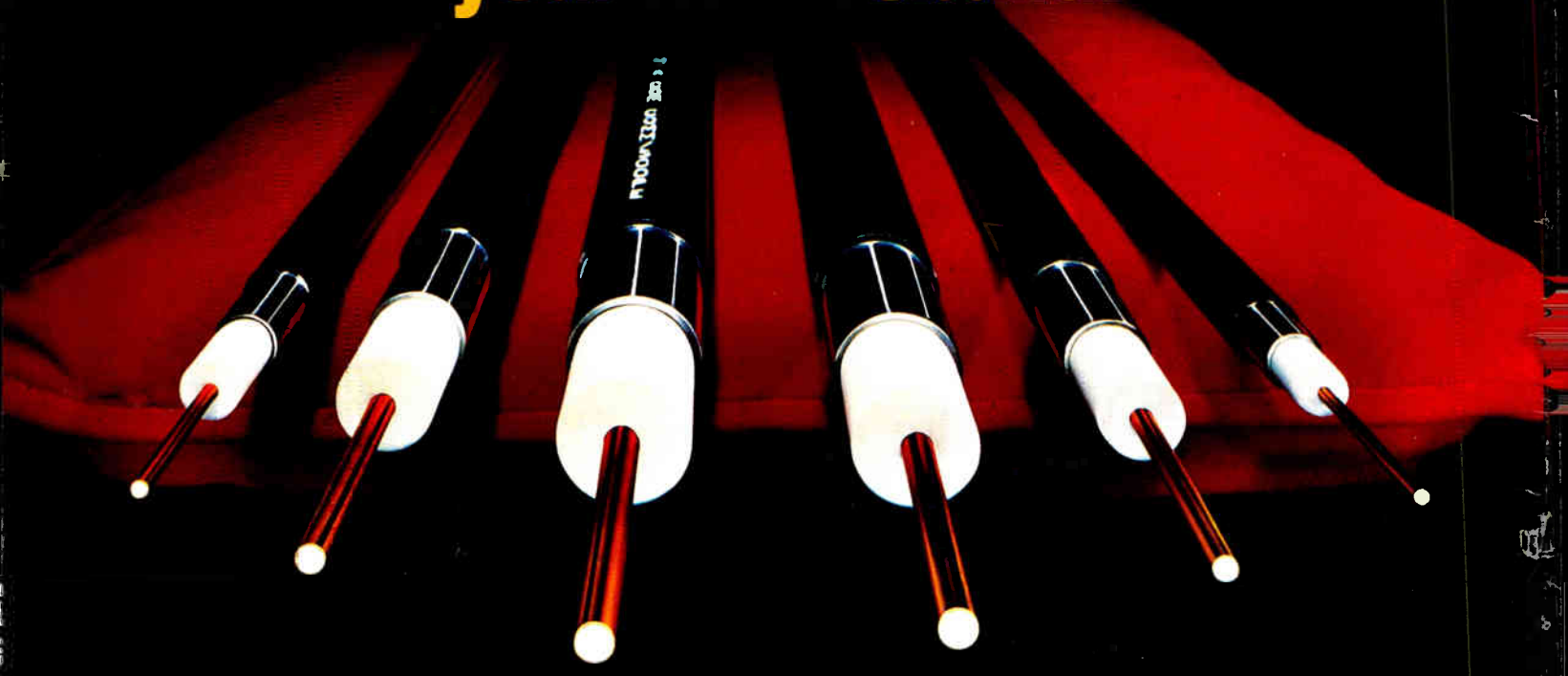

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