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SEPTEMBER 1997

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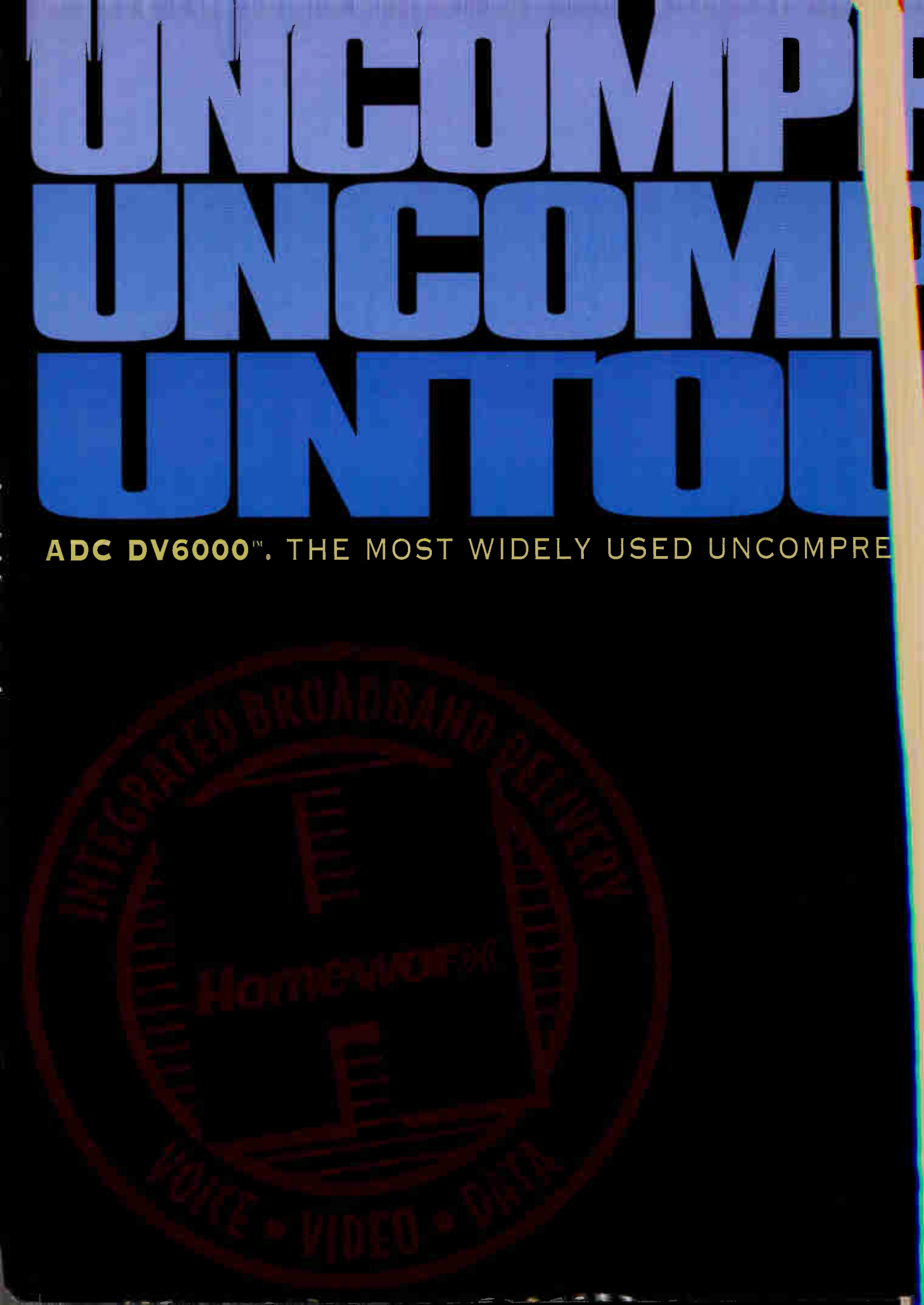

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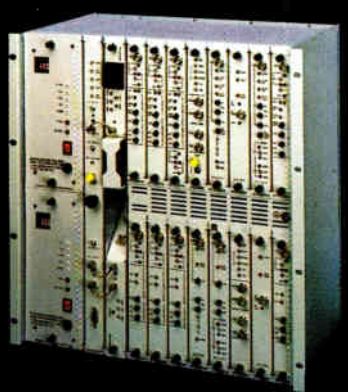

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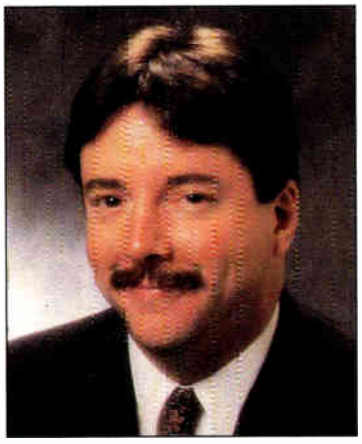

US West: Playing hardball in the majors

When MediaOne announced last month that it was shifting its corporate headquarters from Boston to Denver, it certainly ruffled some well-groomed feathers (and forced the resignation of a key visionary to boot), but the future will show that the contentious move was one that simply had to be made.

Yes, it's true that the abrupt change of strategy within US West Media Group (the parent company of MediaOne) will throw some lives out of kilter and force some hard decisions among MediaOne employees who are native Bostonians faced with relocation. After all, when the media giant acquired the former Continental Cablevision last fall, company CEO Bud Hostetter was assured the company headquarters would remain at the unique and newly-renovated Pilot House (the problem is, the contract never specified how long that would remain to be the case).

Hostetter became so angry he resigned. Others certainly won't be making the trip West to what is now inarguably the Cable Capital, and their talents will be sorely missed. The old Continental HQ team was a good one–it set new standards for how a cable company should be run. The public relations team was in a class of its own. Industry associations and trade publications all regularly heaped awards on either Continental individuals or the company in toto.

But in this age of instant communications–where e-mail, fax, videoconferencing and the telephone mean we're never an island unto ourselves–the physical separation of the Mother Ship in Denver and its newest prized possession in Boston simply became too much to bear. Decisions that used to be made at the Pilot House suddenly needed one more sign-off–from Denver.

The result was stagnation. Decisions were taking longer. Even the shortest face-to-face meetings took at least two days after travel time was factored in.

Now that relocation has been mandated, the real challenge begins. The company has already demonstrated it won't tolerate management gridlock or unwarranted delays, indicative that it understands that form of thinking is a prescription for failure in the future. But can US West foster the same chemistry and offer the same environment that obviously worked so well in Boston? As MediaOne shifts from being a technology-driven company to a marketing-driven entity, can it win consumer loyalty? Or will US West's well-documented history of customer service snafus infect those at MediaOne? Those questions will be key as MediaOne struggles to gain a national identity and play ball with the other big boys on the block.

Roger J. Brown

Roger Brown
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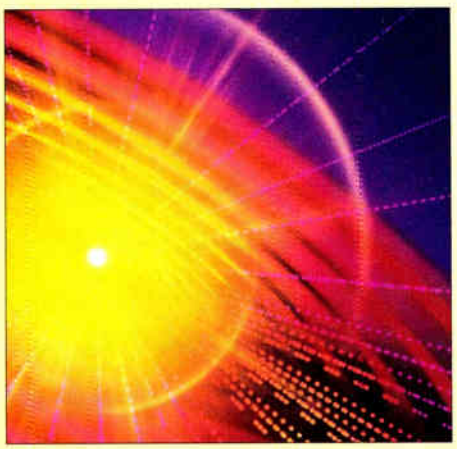

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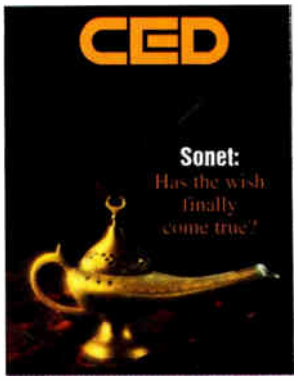

About the Cover

Photo by Myron J. Dorf, The Stock Market

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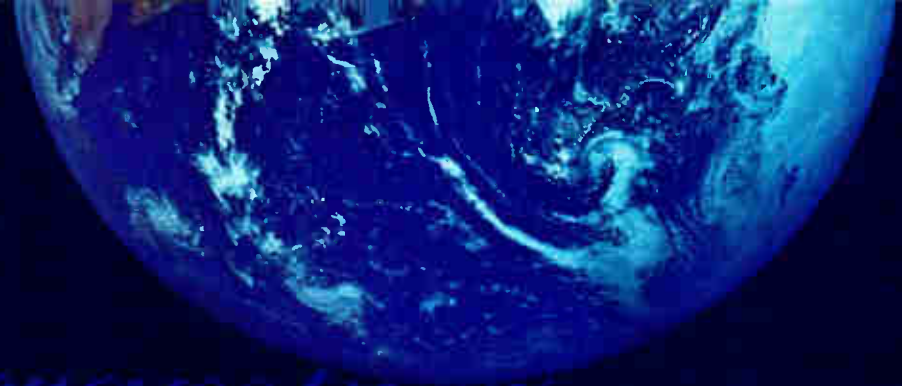

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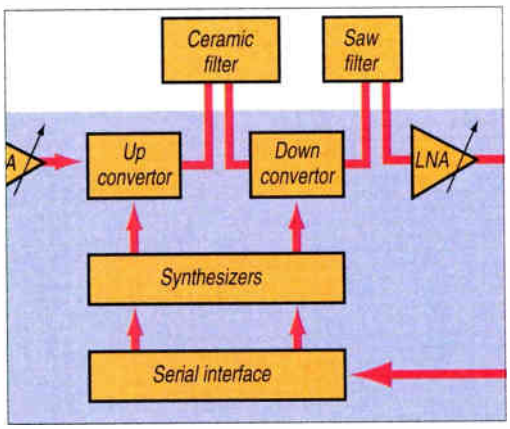

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INGRESS PROBLEMS SLOWING YOU DOWN?

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

A comprehensive, flexible field tool.

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

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

Highlights of the HP CaLan 3010R/H include:

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

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

HP CaLan 3010R field unit

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Reader Service 6

MediaOne kicks off branding; unveils Detroit control center

US West's MediaOne took its act to the Motor City recently, unveiling a new, state-of-the-art headend to support not only its traditional offering of networked video, but high-speed data and perhaps telephony as well.

As the third largest MSO in the country, MediaOne, under the direction of Chuck Lillis, US West Media Group president and CEO, has committed itself to an ambitious upgrade plan that will eventually bring high-speed data, digital television and telephony to its more than 5 million subscribers in 19 states. The plan calls for a $5 billion upgrade effort by the year 2000 to bring its systems up to 750 MHz two-way service capability.

Sparing no expense, MediaOne lifted the curtains on its new Master Control Center as the opening act for the company's debut as a co-sponsor (with ESPN) of a nationally televised pre-race (the MediaOne 200) for the U.S. 500 at the Michigan Speedway. The new 2,800-square-foot headend facility consolidates the old metro Detroit cable system control centers so the system can be monitored from a central location.

The center features two Sun Microsystems 5000 servers (with a maximum 378 gigabits of storage with current generation technology), two Sun Netra servers, four Ultra Enterprise 2 servers, and a host of Cisco routers (7500 series) and switches (Catalyst 5000).

According to Lillis, MediaOne's debut on the national stage with the MediaOne200 event was just as important and signals a significant milestone that is indicative of the importance of marketing for the company and possibly the industry itself. "It's the first time we've had anything with the brand that's come out nationally," says Lillis.

Lillis says the company's aggressive, yet measured rollout of high-speed data will continue unabated, and that the popularity of the high-speed service will eventually be used as a springboard for more service offerings like digital television and telephony.

The MediaOne executive reports the company will use the expertise it has gained in Australia to trial and then launch telephone service in Atlanta this fall. "We'll probably go up to 3,000 or 4,000 customers and then launch" says Lillis. "We are selling the best trial we have on an HFC network in Australia where we're signing up between 500 and 800 customers per week for telco service.

Cable data modem schedule on track

Cable operators and vendors alike are still feeling good about having a plentiful supply of interoperable high-speed data modems available as soon as early next year, following a three-day test of interoperability in mid-July.

The testing, which took place at Cable Television Laboratories, was a "major, major hurdle" that was successfully cleared, according to Jacob Tanz, VP of North American sales and marketing at Libit Signal Processing, a supplier of integrated circuits that was on hand during the testing.

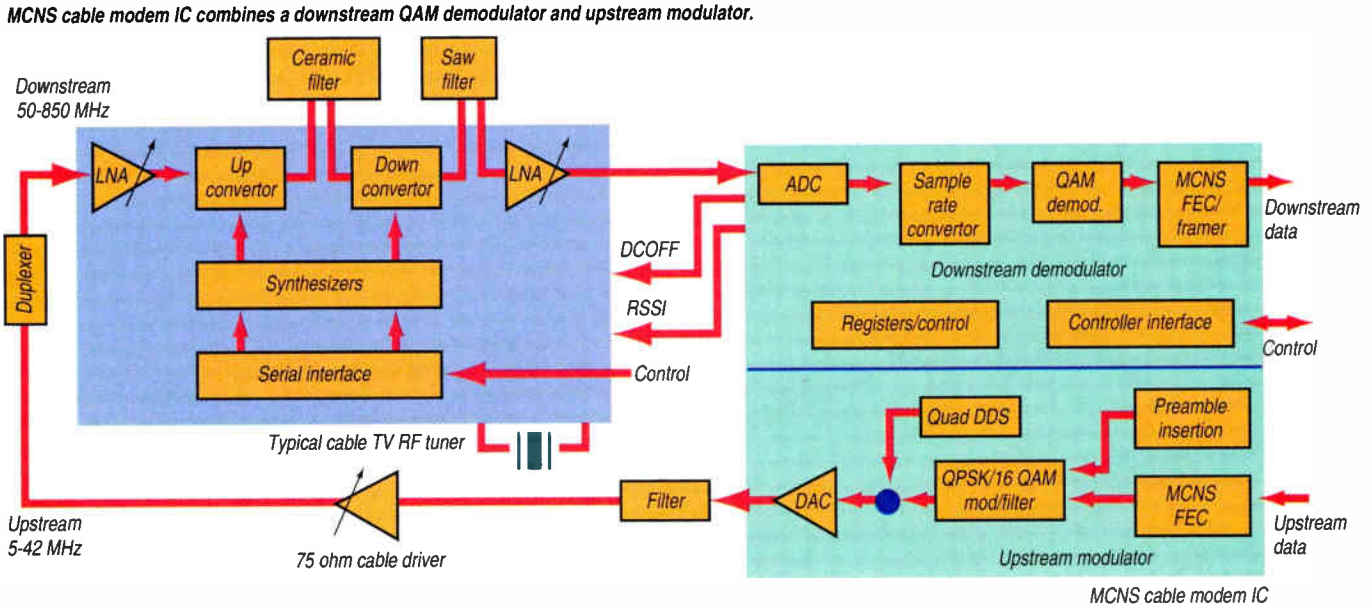
Specifically, the testing was undertaken with prototype equipment from several vendors. Libit, a four-year-old company founded by Israeli engineers, brought equipment that supported both up- and downstream signal transmission. The downstream solution was based on both 64 and 256 QAM with ITU Annex B forward error correction, while the upstream modulator supports 16 QAM and QPSK.

Several other vendors also participated, including Harmonic Lightwaves and Stanford Telecom. Harmonic brought along its new downstream QAM modulator, making good on its recently announced intention to "provide standards compliant, interoperable digital headend equipment to the cable industry," according to Harmonic executives.

Harmonic's modulator can support both annex A and annex B modes of the ITU standard via software command.

Stanford Telecom tested its subscriber modulator chip as well a headend demodulator assembly that supports return transmissions. Stanford officials, in a statement, said the tests "prove we are on track toward assuring that cable modems to be provided by our customers are compatible with the MCNS specification requirements."

MCNS cable modem IC combines a downstream QAM demodulator and upstream modulator.



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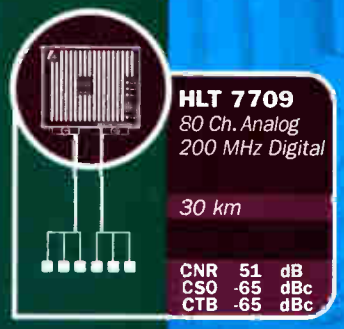
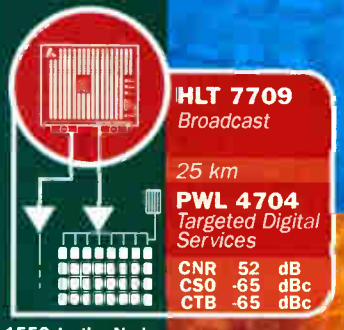
The new MAXLink HLT 7709 improves upon Harmonic's current 1550 nm transmission system by increasing the dual complementary outputs to 9 dBm, without requiring optical amplifiers. This means new solutions to both old and new system topologies. Who says you can't have it all?

The high combined output power of the new MAXLink enables efficient 1550 nm distribution. The high signal output allows for remote location of the optical amplifier, producing high signal quality in the new fiber-to-the-node transport architectures. In supertrunking applications the new transmitter increases efficiency and improves CNR due to elimination of the optical amplifier. And no matter how you look at it, this all means better economy–in either long-distance or fiber-dense environments.

As television, telecommunications and high-speed telecomputing converge into one compatible digital domain, Harmonic will be there in every headend, hub and node with products that keep you online. Simpler, faster and better.



Efficient Distribution



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Reader Service 7

Everyone associated with the tests agreed that they showed interoperability is possible, but all also agreed that much work is yet to be done. CableLabs will soon perform a second round of tests designed to determine the functionality and performance of modem equipment.

Libit officials were ebullient in their optimism. In fact, the company recently announced a pact with Analog Devices to develop and manufacture MCNS compliant integrated circuits for cable data modems, putting them in competition with Broadcom as a supplier of ICs for that application and giving cable modem manufacturers a second source of components.

"This opens the market for competition and innovation," said Tanz. He said IC samples would be available in the fall of 1997, and production quantities would follow in late autumn or early winter at prices that are "competitive."

Barco acquires optical technology

Barco recently expanded its optical video product line and filled a technology void by agreeing to acquire from C-Cor Electronics the technology associated with its digital optical transmission terminal products.

As a result of this agreement, Barco now owns the rights to the 3.1 Gbps 16-channel optical terminals, which will be married with Barco's "Lynx" digital supertrunk transmission system. The terminals will be manufactured in Barco's Belgium-based Communications Systems division and will conform to Barco quality standards. Financial terms of the agreement were not disclosed.

Lynx includes Barco 12-bit codecs, combined with 3.1 Gbps 16-channel digital optical terminals at the transmit and receive sites. A specially developed Lynx interface unit permits unlimited cascading of optical links. The Lynx system will provide undistorted IF or RF output at the decoder and is suited for network applications that require the linking of multiple hub sites via a redundant ring.

Each Lynx transmitter outputs two 194 MB signals, saving space and allowing a single unit to provide 32 signals for bidirectional transport over the redundant fiber rings. In addition, the Lynx receivers feature two 194 MB inputs, allowing them to receive signals from both fiber rings. In the event signal is lost on one ring, the Lynx receiver automatically switches to the other ring to maintain signal continuity.

TWC, Wink team to enhance programs

Cable industry staple The Weather Channel became the latest broadcaster to commit to using software developed by Wink Communications to add interactive on-demand weather information to its national signal, but it's the first to say it will use it 24 hours per day, seven days per week.

Wink's interactive programming, which is compatible with standard cable TV signals, works on TV sets and standard cable set-top boxes that have been outfitted with the Wink ITV Enhanced Broadcasting standard. This provides cable operators an advantage in a competitive world, in that the enhanced service is not currently available through direct broadcast satellite services.

The Weather Channel's new services will include:

✔ On-demand interactive weather information via interactive video overlays that cable viewers can access with a standard remote control.

✔ A virtual channel called "The Weather Channel Interactive" that can be offered to viewers with a distinct channel number but does not require additional bandwidth to transmit. Viewers can tune to this new service at any time by clicking its channel number or they may hyperlink to it from The Weather Channel.

In addition, The Weather Channel will offer advertisers interactive commercial opportunities, such as: in-program interactive advertising, virtual channel advertising and interactive enhancements to national and local commercials.

General Instrument, Scientific-Atlanta and Pioneer currently are building a range of analog and digital equipment to support the Wink technology, and in Japan, Sony, Toshiba and JVC already are marketing TV sets and related products that receive and record Wink ITV broadcasts, and Matsushita has announced it will ship Wink-enabled products under the Panasonic label later this year.

Wink's software does not require major changes to televisions and set-top boxes, therefore adding almost no cost, even to a $300 TV set or $150 cable convertor. In addition, Wink enhancements require no dramatic upgrades to existing cable, telecommunications, broadcast or direct satellite infrastructure.

Hughes debuts new satellite dish

Hughes Network Systems debuted a new satellite dish designed to allow customers to receive both video and data over satellites. With the introduction of the DirecDuo 21-inch elliptical dish, consumers can now access Hughes DirecTV subscription television service, as well as the DirecPC high-speed data service.

The antenna is capable of supporting multiple Digital Satellite System set-top boxes for television programming, as well as a DirecPC card installed in a computer for the 400 kilobit-per-second Turbo Internet access. Both the TVs and the PC can be located in different rooms on separate floors.

According to Hughes officials, the biggest challenge in developing the DirecDuo dish was designing a stationary antenna capable of receiving signals from two separate satellites–something that was accomplished by packing two low-noise amplifiers inside the housing at the end of the antenna's "arm."

DirecDuo will be available immediately to consumers across the continental U.S. in major retail chains and from independent dealers.

Existing DirecTV and USSB customers can upgrade their systems by purchasing a DirecPC card and DirecDuo antenna for $599. These customers may also elect to purchase the fully functional DirecDuo kit if they wish to add a second Digital Satellite System receiver to their home, thereby giving them the ability to independently watch DirecTV and USSB on separate TVs.

The complete DirecDuo hardware/software package, ranging in price from $899 to $999, includes a 21-inch elliptical dish with a "tri-mode" LNB and a universal mount, a 16-bit PC card, Microsoft Windows '95-based software and one of three Hughes-brand Digital Satellite System receivers.

Existing DirecPC customers can upgrade their systems to receive satellite television by adding a simple enhancement to their LNB configuration and a DSS receiver, for a total cost ranging from $599 to $699.

Marcus gains pole grief relief

Marcus Cable Associates won some pole attachment relief after the Federal Communications Commission declared unlawful several efforts by Dallas-based Texas Utilities Electric Company to block Marcus' ability to provide non-video communications services. These efforts were the subject of a complaint brought by Marcus against TU Electric.

Specifically, the FCC struck down as unlawful the utility's efforts to: secure propri-

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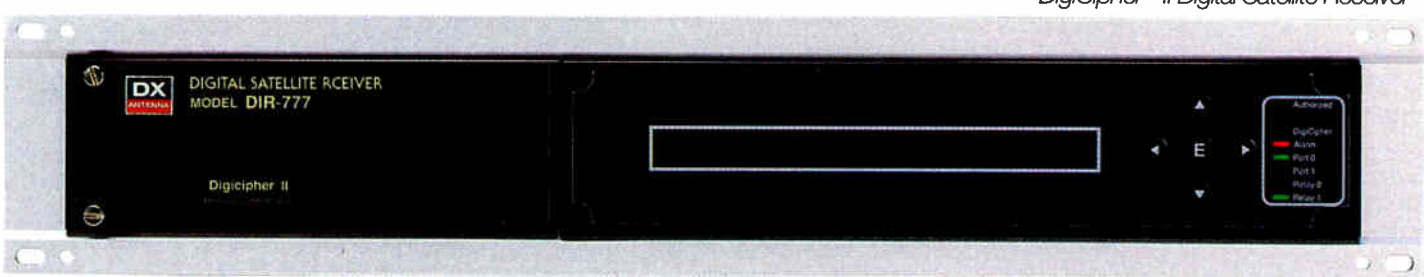

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Reader Service 8

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etary, competitively sensitive information concerning the identity of Marcus' non-video customers; disparage the quality and dependability of Marcus' facilities and services through forcing Marcus to compel its non-video customers to sign a "poison pill" customer release; and compel Marcus to provide a portion of its non-video services revenues over and above the maximum pole attachment rental rate that TU is permitted to charge.

TU Electric is affiliated with PrimeCo Personal Communications, a competing supplier of telecommunications services throughout the Dallas-Ft. Worth area.

Commenting on the Marcus decision, Meredith J. Jones, Chief of the Cable Services Bureau, said, "This is a very pro-competitive, pro-consumer order. Unreasonable pole attachment rates and unreasonable conditions in pole attachment contracts can only hold back the availability of emerging telecommunications services to consumers. With this order, we are removing another barrier to fair competition."

In reaching its decision, the FCC noted the clear competitive relationship that exists between the two companies and declared that TU Electric's unlawful requirements "seem to exist only to interfere with, if not destroy, Marcus' relationships with (its) customers" and that the requirements "appear to be an attempt by TU Electric to interfere with the provision of telecommunications services by a potential, or actual, competitor."

Finally, the FCC stated that because of "the standardized nature of TU Electric's pole attachment agreements," it was terminating the provisions in all existing pole attachment agreements with cable operators that contained the "poison pill" release and that required cable operators to disclose their provision of non-video service.

Ortel offers new EDFAs

Distributed feedback laser pioneer Ortel Corp. has introduced four new erbium-doped fiber amplifiers (EDFAs) for OEM manufacturers and system integrators. The new 1550 nm EDFAs offer high performance, greater output power and lower noise, according to company officials.

Ortel's new products include a 16 dBm EDFA that features improved performance in noise figures; a low-power 14 dBm EDFA; a 17 dBm model that provides lower noise for certain applications; and a 20 dBm EDFA that offers higher output-power performance. Each of these new EDFAs features adjustable output power over a 3 dBm range from the front panel, and all utilize Ortel's 980 nm pump laser. Internal optical splitters are available to provide multiple outputs from a single EDFA.

The EDFAs are available either with or without optical isolators at the input. Input isolators can be omitted when connected directly to Ortel's 1550 nm transmitters, thereby improving the EDFA noise figure, resulting in links with higher carrier-to-noise ratio.

NextLevel invests in ACTV, WorldGate

NextLevel Systems Inc. Broadband Networks Group, hoping to jump-start applications for both its advanced analog and digital set-tops, recently made major monetary investments in both ACTV Inc. and WorldGate Communications.

ACTV, through proprietary programming technology, "individualizes" the television viewing experience. For example, the individualization of hockey coverage includes unique features that recap the game's hardest hits, a compilation of the game's best saves, isolated shots of the game's featured players, a summary of all goals scored throughout the game, on-demand instant replays and in-depth statistics.

Working with Fox Sports Net, ACTV produced more than 250 individualized sporting events which were delivered to customers of TCI Cable of Ventura County over the past two years. Under an existing license agreement, a sports-based individualized regional network is slated to be launched later this year.

NextLevel's DCT-1000 set-top is the only interactive digital terminal capable of delivering ACTV's individualized programming. To date, NextLevel has shipped more than 300,000 digital consumer set-tops and has delivered more than 60 digital headends, reaching more than six million homes in North America.

WorldGate, which allows television viewers to access the Internet via a traditional cable set-top, also received an unspecified shot in the arm from NextLevel. Both companies will also receive marketing support from NextLevel as well.

FCC finally sets LMDS auctions

After months of delay, the Federal Communications Commission set December 10 as the date it will begin auctioning spectrum to be used for local multipoint distribution service (LMDS). This largest swath of spectrum ever to be auctioned can be used to deliver high-quality, digital, two-way, voice, data and video services to consumers and businesses.

It is expected that major media and Internet companies will be active bidders for this spectrum. Services expected to be offered include telephone, high-speed Internet access, and subscription television service.

"We are delighted that the FCC has set and announced the dates for the auction of LMDS spectrum," said Shant Hovnanian, Chairman and CEO of CellularVision, USA. CellularVision was the first company to bring the LMDS capabilities to the attention of the FCC and is the only company currently offering services using this spectrum.

CellularVision is the exclusive FCC-licensed local multipoint distribution service in the United States, with rights to the 1,100-square-mile New York Primary Metropolitan Statistical Area, which encompasses 8.3 million people.

Iridium now has 17 birds flying

As if wire-based cable and telecom providers didn't have enough to think about already, progress on the Iridium satellite system is proceeding as expected. Recently, a McDonnell Douglas Delta II rocket carried five additional Iridium system satellites to low-Earth orbit. The launch was the second in a planned series of eight Delta II launches that will place in orbit a total of 40 out of 66 operational Iridium satellites that comprise the Iridium system.

The first five Iridium satellites were launched on May 5, 1997 on a Delta II rocket. Another seven Iridium satellites were launched on June 18 aboard a Proton rocket. The balance of the 66-satellite network is scheduled to be deployed throughout 1997 and into early 1998, with worldwide commercial service introduction planned for late 1998.

Think that's expensive? It is–Iridium has a $3.45 billion fixed-price contract with Motorola Inc. to manufacture, launch and operate the Iridium satellite network, as well as to construct various ground control facilities to manage the orbiting satellite constellation. In addition, the company executed a $2.88 billion follow-on operations and maintenance contract with Motorola for ongoing maintenance of the Iridium network, including additional satellite manufacture and launches for replenishment of the satellite constellation through 2002. CED

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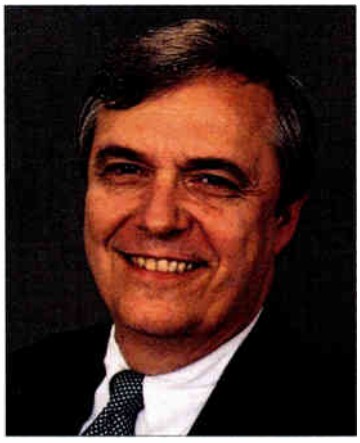
These days, Craddock is digging in bigger bins



Steve Craddock

Comcast's Steve Craddock began his career in communications as a young boy growing up in Alexandria, Va., where he would often root around in big, industrial trash bins, looking for electrical wire. He targeted one company's bins, in particular, because their garbage "made great speaker wire." Unbeknownst to Craddock, the company with the good electrical garbage was his local telco, and he had been raiding the trash cans behind one of its central offices. It was probably preordained, then, that his first job out of college was with C&P Telephone (Chesapeake & Potomac), one of the original Bell systems, as an outside plant engineer.

Now, as Vice President of New Media Development for Comcast Corp., Craddock is still exploring in technology bins. Currently, he's evaluating various forms of interactive multimedia–whether delivered over a TV, over a computer, or a combination of both; he's working on Comcast's strategy for tackling the commercial data-over-cable market; and he's trying to find a way to make IP voice (or IP telephony) into a commercial-quality venture for the company.

"I think that IP voice is doable at the right price point," notes Craddock. "It's not there yet, but I am very encouraged by what I have seen. And there are a lot of neat businesses you can spawn from that," like second-line residential telephony, among others.

And Craddock, who was recruited from Bell Atlantic to help Comcast implement its first data-over-cable trial, has been instrumental in the startup of the company's Online Services Division, including Comcast's participation in @Home Network.

He's bullish about the cable industry's "18-month window of opportunity" to grab the high-speed data business, espousing the belief that cable's technology is superior to that of the Bell companies; however, Craddock firmly believes that such a grab will require a shift in the industry's mindset. "If you are at home when the HBO goes out, you get miffed, but the GM might give you a credit, and everything's fine," he explains. "But when it's your business that depends on reliable communications being up all the time, companies have to be able to deliver."

Craddock has high standards for any new service his company evaluates, but that's to be expected from a man who installed a Windows NT LAN in his own home, linking up seven of the family PCs.

He has also been the technical presence behind many of the seminal events in the early days of convergence–while working for Bell Atlantic in the early '90s, Craddock helped establish the company's Video Services Division. During more than 20 years spent with BA, he was the video exec who cut the deal with FutureVision Inc. for cable TV in Tom's River, N.J.; and he provided the technical backup for Bell Atlantic's successful First Amendment court case challenging the Cable Act's restriction on telcos providing video programming. Rising out of that challenge, Craddock and associates filed the first 214 video dialtone application, and went on to help create the "Stargazer" interactive multimedia product.

Eventually rising to the position of vice president for Broadband Network Development and Alliances for the corporation, he also had responsibility for ADSL and switched digital video development.

Early on in his days with BA predecessor C&P Telephone, Craddock did "a lot of spook stuff," in our nation's capital. Working in concert with TCI, Craddock was responsible for the design and construction of a cable TV system for the city of Washington, D.C.

But eventually Craddock, who was a network VP by the time he left Bell Atlantic, had grown weary of telco bureaucracy, and leapt at the chance to enter the entrepreneurial cable environment.

The fruits of technology

An engineer by education and trade, Craddock is an Honors and Distinguished Military Graduate of the Virginia Military Institute, an institution which not only trained George Marshall and boasted Stonewall Jackson as an instructor, but which also produced actor Dabney Coleman, Craddock wryly notes.

An avid computer buff, Craddock ran a software development company for 12 years alongside of his Bell Atlantic activities, in order to finance his addiction to PCs. The company specialized in custom financial software solutions for service companies, as well as computer simulations of accidents and other catastrophes that were used in court cases to educate juries.

Married to wife Sherrie for 24 years, Craddock says that their youngest son, 15-year-old Bill, is following in his computer hacker footsteps, creating his own Web pages to generate spending money. Their 19-year-old daughter, Lori, attends Penn State, while eldest son Dave, 21, is preparing to enter Temple Film and Media School.

Craddock enjoys technology not just for its own sake, but for its fruits as well. In one example of that, the self-professed movie buff owns about 2,500 videotapes and plays and collects classic electric guitars, ranging from a Gibson Les Paul custom to an electric 12-string.

Taking a cue from his art director father, Craddock has been known to draw a caricature or two (it's rumored that a number of Bell Atlantic execs have been thus victimized), and collects Golden and Silver Age Comic books.

From a perspective as both connoisseur and architect of technology, Craddock spends his days thinking outside the boundaries of linear cable, and has concluded that cable companies can become much more than just entertainment video providers.

"Slowly, the top-five companies are moving from being cable companies into becoming communications companies," says Craddock. "And if that happens, they have a really bright future." *–Dana Cervenka*

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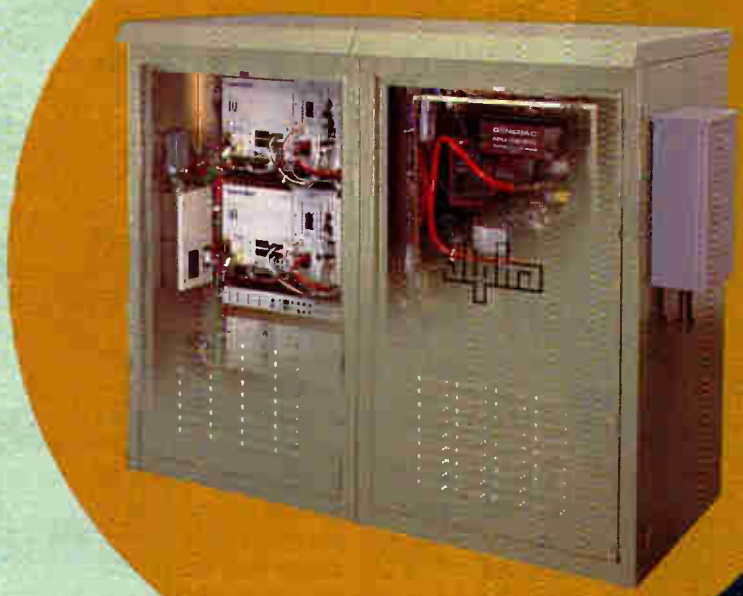

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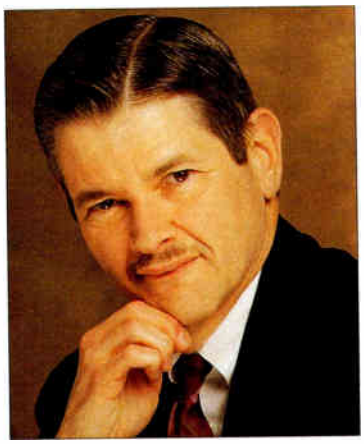
Revealing the mystical 'S' curve

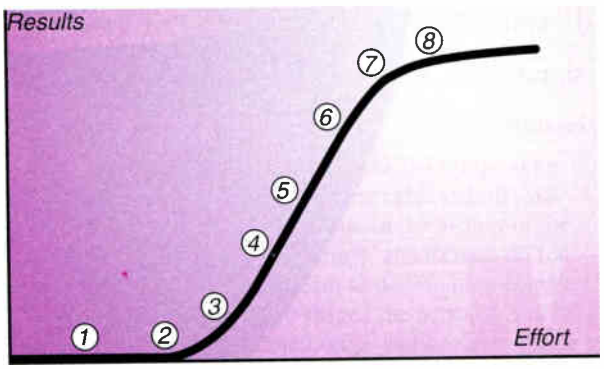


By Jim Farmer, Chief Technical Officer, Antec

The "S" curve is a concept that I've found useful in evaluating the likely progression of a particular technology. I know that it's not really a scientific formula, and its exact shape is arguable. I also haven't included any quantitative scales (which is no accident), and I'm not even sure what the axes represent. This may seem strange coming from an engineer who likes his world very specific and unambiguous, but such is life.

The horizontal axis in the diagram below represents the effort you put forth in the development of a particular technology, including time, money or sweat. The vertical axis represents the results that you get from your effort. When any technology is new (on the left), you tend to put forth a lot of effort, while seeing relatively little progress. In region 3, the technology begins to take off. This is the period when progress is usually fast and the rewards for incremental effort are very high. A lot of non-participants rise to claim credit. Then, the technology matures, somewhere around region 7, and progress again slows, though the curve never flattens completely.

A technology sometimes matures when it has become good enough that the market won't pay for anything better. In my opinion, NTSC television technology is around region 7, or maybe just past that, because it is equally limited as much by economics as by technology. There are things you can do to an NTSC picture to make it better, but the marketplace won't pay for it. Hmmm, this may be a warning for HDTV.



AM and FM radio are even higher on the curve, but we still see improvement from time to time (i.e. phase-locked detectors are now being used for AM detection). In the '60s and early '70s, telephone technology probably entered region 7 for economic reasons. It got a shot in the arm when the telephone industry was remade at the behest of Congress, putting telephony on something of a second "S" curve.

Everyone talks about computers these days. My guess is that computer technology is around a 5 now, so we are seeing some pretty spectacular gains over short timeframes. But computers will stall out someday. A good measure of computer technology is chip density, which refers to the number of transistors on a chip. Moore's Law, as originated by Gordon Moore, President of Intel, states that chip density doubles every 18 months (or 12 months, depending on where you see him quoted). According to Moore, in about 10 years, we will likely see a technology barrier to the continued advancement of computers (*Electronic Engineering Times*, May 19, 1997, page 35).

Several factors support this theory. Known diffusion technologies are approaching theoretical limits; propagation of signals in interconnects is becoming the limiting factor in speed; and heat is getting harder to remove. Solutions exist to carry us for maybe another 10 years, but then we may find ourselves limited by fabrication technology, unless something unanticipated appears. Even if there is a breakthrough, an argument exists that there may not be economic justification to continue the present push to newer technology.

Bloatware

Computer technology may level off when nobody wants to pay for the latest technology. Right now, we are accustomed to buying a new computer every few years to get the latest features. However, someday we will get tired of this, and equate it to being asked to buy a new TV to watch the newest programs. The computer folks have already suggested this, thus proposing a new, highly counter-intuitive branch of consumer economic thought.

In my opinion, software (at least common office software) is approaching region 7. The software people have even coined the term "bloatware" for what software is becoming, possibly indicating a leveling off that has not been recognized.

Those of us who have taken a sufficient leave of the sane world to practice cable television, tend to spawn a lot of mini "S" curves. When we hear rumors of a new technology that may help solve a problem, we grab it at region 2 and try to force it up to region 5 before understanding what it can do. Sometimes we have a winner, but it's delayed, and we take a lot of heat from the broader society for hyping it too soon (e.g., digital television and modems). Other times, we promise something when it is around region 3. Then no matter how much we push it, we can't get it up the curve, because the underlying technology hasn't matured sufficiently, or there is no economic justification (so far, interactive entertainment video has been in this category).

Technologies, like fads, have a way of coming back every so often, and sometimes, we'll get an unexpected winner the second or third time around. Stay tuned, as they say, for the next exciting episode. CED

Have a comment?
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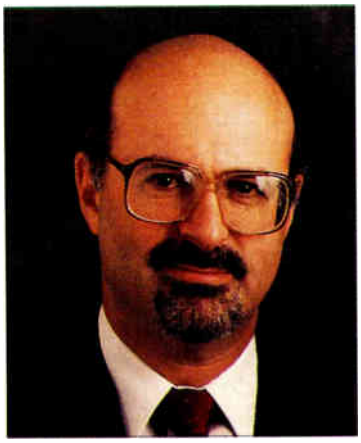
Satellite plans pose new competition



By Jeffrey Krauss, satellite skywatcher and President of Telecommunications and Technology Policy

Have a comment?
Contact Jeff via e-mail at:
jkrauss@cpcug.org

Just two months ago, this column contained an overview of recent satellite plans, and already, it's out of date. So today I'm reporting on two important developments, a new low earth orbit ("LEO") system, and a proposal to carry local TV stations to home dishes at Ka-band.

First, a review. Geostationary satellites ("GEO") orbit the Earth in a circular orbit at an altitude of 36,000 km, with an orbital period exactly equal to the 24-hour rotational period of the Earth, so they appear to be stationary as the Earth rotates. (What I said in my July column about balancing of gravitational forces was wrong; the satellite's centrifugal force balances the Earth's gravity.) On the other hand, LEO satellites can have stable orbits that are elliptical rather than circular, or circular orbits at distances less than 36,000 km.

C-band satellites operate at 6 GHz (uplink) and 4 GHz (downlink). Ku-band satellites operate at 14 GHz (uplink) and 12 GHz (downlink). Ka-band, the newest, will operate at 28 GHz (uplink) and 18 GHz (downlink).

Motorola's Ka-band LEO proposal

I reported on Teledesic's LEO fixed satellite system, with hundreds of orbiting satellites communicating with fixed earth stations on the ground. (Satellite systems like Teledesic and Hughes Galaxy that work with fixed earth stations are called fixed satellite systems—"FSS"—while those that work with mobile earth stations, like Motorola Iridium, are called mobile satellite systems—"MSS." Both FSS and MSS systems can use either LEO or GEO satellites.) The specific frequencies within the Ka-band for this LEO network are slightly different than the frequencies for the Ka-band GEO satellites, because it is difficult for LEO and GEO satellites to share the same frequencies without interference. (It's not impossible, but the proposals for avoiding interference are too complicated to describe in this column.)

Until recently, the Teledesic system was the only satellite system slated to use the portion of Ka-band set aside throughout the world for LEO fixed satellite systems. But then Motorola rained on Teledesic's parade by filing an application for a LEO FSS network called Celestri. Celestri consists of 63 satellites that circle the Earth at an altitude of 1,400 km, compared with Teledesic's network of 840 satellites that orbit at an altitude of 700 km. Meanwhile, Teledesic has made a deal with Boeing for launch services and will redesign its network, probably by cutting the number of satellites to less than 300.

The challenge here will be for both of these networks to operate in the same frequencies without interference. Satellites and earth stations may need to be shut down momentarily in order to avoid interference to the other network. Each network control center will need precise knowledge of the locations and movements of all the satellites in the band.

Video at Ka-band

Meanwhile, Microspace (a subsidiary of Capitol Broadcasting, owner of KRAL-TV Raleigh and the Durham Bulls baseball team), has revealed plans for using a Ka-band FSS satellite to distribute TV stations as well as cable programming. Recall that earlier this year, Rupert Murdoch and Charlie Ergen announced a similar plan using the Echostar broadcast satellite system, but that evaporated when the Murdoch-Ergen deal collapsed.

At that time, there were not only technology questions but also legal questions, because of the copyright laws. Cable TV systems have the blanket right to retransmit the copyrighted programming carried on TV stations because of a "compulsory copyright license." (This goes beyond "must-carry" and "retransmission consent" regulations.) But satellite systems do not have the automatic right to retransmit copyrighted TV programming.

Here are some technical details about the Microspace plan. There are 211 designated market areas ("DMAs") for TV stations in the country, and they plan to use 61 spot beams on the satellite to cover them. There will be three beam sizes. The receive dishes will be 24 inches in diameter. For those who worry about rain attenuation on the 18 GHz Ka-band downlink, the system will be designed for 99.7 percent availability (average of 4.5 minutes of rain outage per day).

The receive dish size is controlled by interference considerations. Antenna beamwidth is related to antenna size; the smaller the antenna, the wider its beamwidth, and the more likely it will receive interference from a satellite in an adjacent orbital slot. These Ka-band FSS satellites will be spaced 2 degrees apart, just like the Ku-band FSS satellite used by Primestar. But antenna gain and directivity increase as the frequency increases, so a 24-inch dish at 18 GHz performs about the same as a 36-inch dish at 12 GHz. In contrast, the DirecTV and Echostar broadcast satellites are spaced at 9 degrees, so they can use smaller antennas.

I was told that Microspace is negotiating with Hughes, GE Americom and Loral, each of which has received Ka-band orbital slot assignments. I took a look at the GE satellite application, filed in 1995, to see whether 61 spot beams and 24-inch dishes are plausible. It calls for 44 spot beams over the country, each covering an area 300 miles in diameter. So 61 spot beams would not be unreasonable. Earth station antennas would be as small as 30 inches, but that was for transmit-receive earth stations. Receive-only stations could be smaller. Yes, a 24-inch dish seems plausible.

So it appears that the big challenge to Microspace would be legal, not technical, changing the copyright laws and perhaps other laws as well. I would expect the cable industry to fight these changes, because a satellite system that carries broadcast stations as well as cable programming would be a serious competitive threat. CED

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Lab focuses on modem interoperability

CableLabs plans three-phase testing

This article was prepared specially for CED *by Robert Wells on behalf of Cable Television Laboratories Inc. (CableLabs).*

The cable industry modem specification-writing phase is winding down and a new phase, focusing on interoperability testing, has begun.

Some 35 vendors have vowed to produce–and most MSOs intend to buy and specify–cable modem systems compliant with the Data Over Cable Service Interface Specifications (DOCSIS). Many of the separate elements of this specification have been defined through lengthy collaboration between CableLabs and its member companies which include MCNS, MSO technical representatives and vendors.

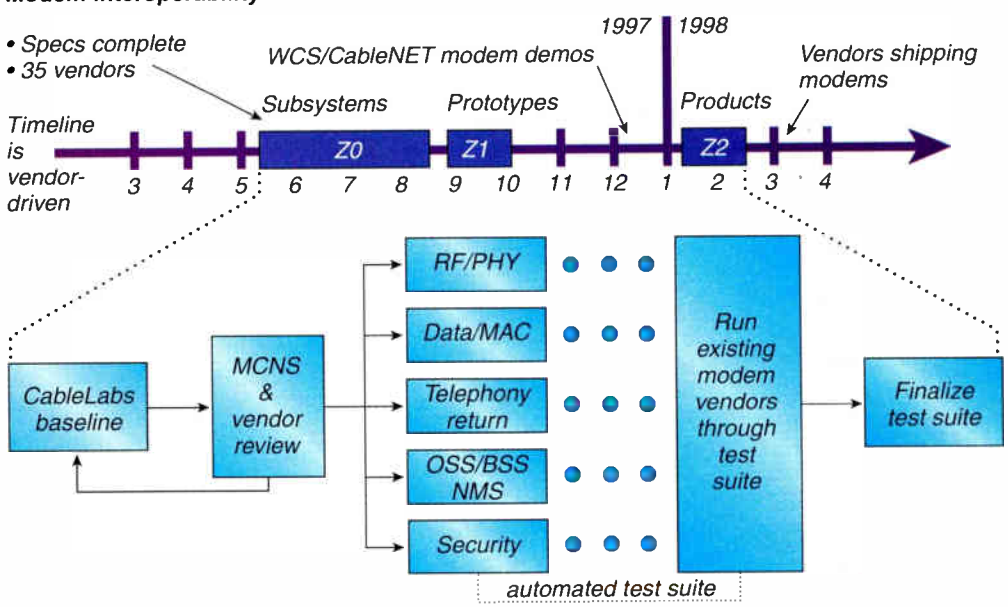
But a remaining problem, as perceived by CableLabs officials a few months ago, was that vendors might retreat to their labs and build equipment that wasn't as fully interoperable as MSOs would like it to be.

Thus was born, last spring, the "cable modem interoperability incubator" project at CableLabs. Rapidly gaining steam, the project has spawned a "DOCSIS Test Team," comprised of seven working groups, whose intent is first to define tests for subsystems, then prototypes, and finally, by early next year, productized cable modem systems.

Bob Cruickshank, CableLabs director of digital network technologies, calls the on-going MSO-vendor collaboration–which focused first on rolling together a "best of breed" set of specs, then on assuring spec-compliant products–"a new paradigm for cooperation that's never been seen in the communications industry." It's cable's secret weapon, he says, for avoiding the confusion over incompatibility that has slowed introduction of such services as telco ISDN and 56 Kbps modems.

The project already has 22 people involved at least part-time (or 15 full-time equivalents) and is likely to grow to 40 to 45 people, at its busiest, Cruickshank says. Nine CableLabs staffers are involved. Six visiting engineers from MSOs and vendor companies are on-site at CableLabs, and more are expected, staying for periods of up to two years. More than a dozen vendors have already indicated they'll put their equipment on site at CableLabs to work through the testing phase.

Modem interoperability milestones



The timeline shows, in months, the three phases of modem testing. The flow chart at the bottom shows five working groups' efforts converging on the testing of end-to-end systems.

Source: ©1997 CableLabs

Three rounds of testing

The figure above summarizes how the test team, led by Cruickshank, intends to roll out the multi-phased effort over the next eight to 10 months (the timing is flexible depending on vendors' progress). The schedule, announced at a late June team meeting, is a succession

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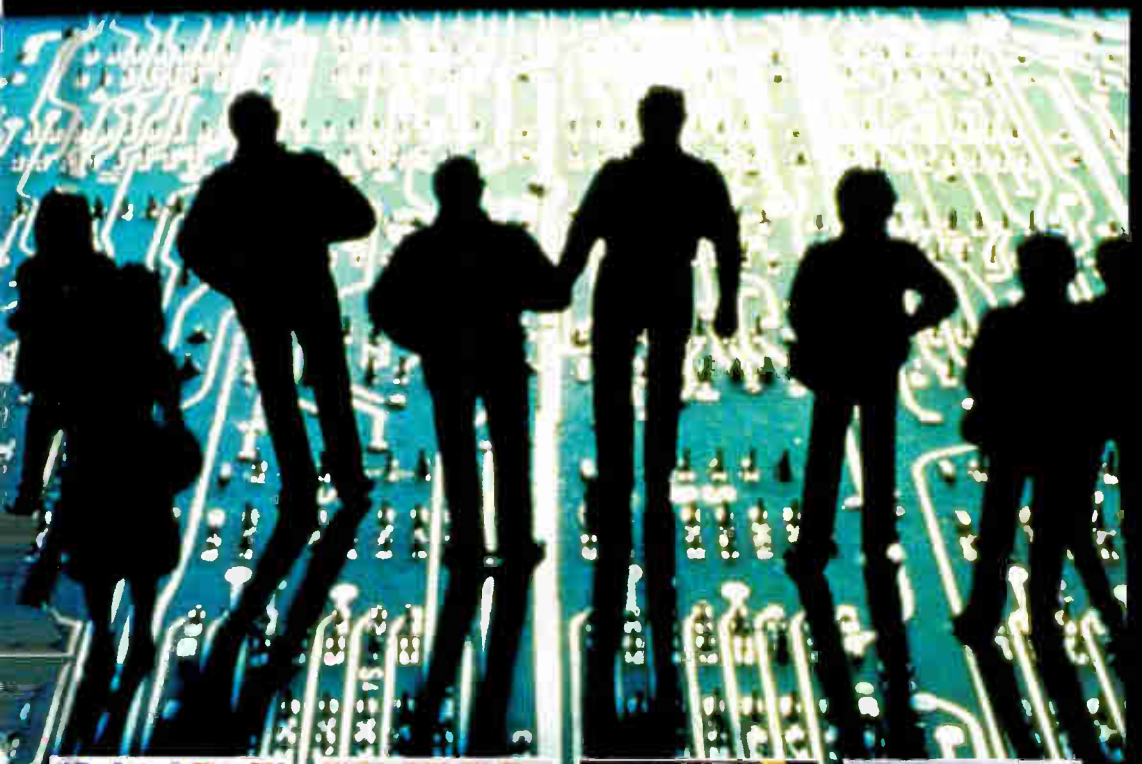

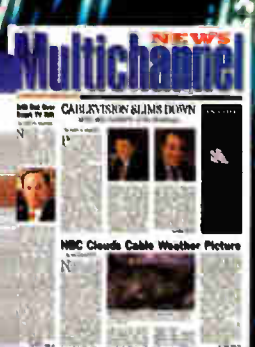

The Chilton Communications Group

Chilton

A major focus rests on wooing vendors to participate

of Zs–Z0, Z1 and Z2:

✔The already begun Z0 phase, called "Subsystem Interoperability Demonstrations," and lasting roughly three months, is when vendors bring in subsystems for testing.

The first round of these tests, conducted during the week of July 14, was of physical layer (PHY) systems. Each vendor shipped to CableLabs a complete transmission system consisting of downstream and upstream transmitters and receivers, cable plant and supporting equipment such as PCs and test equipment. "We split the vendor groups into two teams, put them in separate laboratories, asked them to hook their equipment to each other and test for any interoperability issues that needed to be worked out," Cruickshank says. Another week-long round of testing–this time of both the PHY and the media access layer (MAC) subsystems–is scheduled for late summer.

✔The Z1 or "Prototype Interoperability Testing" phase, is for testing early models of complete modem systems and is scheduled for the September–October timeframe. The Z1 phase also will be the trial run for a "test suite" consisting of dozens of measurements of system interoperability, conformance and performance. This phase, says Cruickshank, "is an iterative process in which we're looking at the equipment, while at the same time, refining the test suite."

Then, during a gap of about three months between Z1 and Z2, vendors are expected to be making their prototypes into production models while CableLabs is refining and automating its test suite, Cruickshank says. A second milestone during that gap will be demonstrations of interoperating modem systems on the CableNET '97 network at the Western Show in Anaheim, Calif. in December. Modems will be demonstrated as interoperable only if they have received the approval of Cruickshank and his teams.

✔The final or Z2 phase, "Production System Interoperability Tests," begins around January 1998. In this phase, it is hoped the testing will confirm that multiple vendors' consumer-grade products are interoperable and ready for commercial deployment, Cruickshank says.

Test suite is critical

As of mid-July, the automated test suite was still a 40-page document, "DOCSIS System Test Suite," partly fleshed out but with a lot of detail still to be defined. Vendor engineers expert in different areas have volunteered to help devise many of the tests. The tests are grouped into four main categories:

✔**Interoperability testing:** verifying that equipment from different vendors works together;

✔**Conformance testing:** verifying adherence to the letter of the spec.

✔**Performance testing:** measuring how well the conformant and functional equipment operates, using such gauges as throughput and latency.

✔**Functionality testing:** verifying that all the conformant elements of the spec work together as a smoothly functioning system.

The seven working groups, each headed by a CableLabs or MSO staffer, are the scene of intense discussion and negotiation about how the specs should be interpreted, clarified or reworded. Five of the groups focus on subsystem issues:

✔**MAC or data transport,** headed by Andrew Sundelin of CableLabs;

✔**PHY or RF,** headed by Bill Kostka of CableLabs;

✔**Operational Support Systems (OSS)/Business Support Systems (BSS)/Network Management Systems (NMS),** headed by Jason Schnizter of Shaw Communications;

✔**Security,** led by Claude Baggett of CableLabs; and

✔**Telephone return,** which is an open position on the team.

The possibility that disputes may arise among vendors at the Z0 stage "is probably where the process is most vulnerable," says Cruickshank. He's hoping that such disputes can be quickly resolved by "a vendor-neutral, MSO-driven arbitration process."

The two additional working groups, Z0 and Z1/Z2, focus on testing issues.

Telecollaboration

In addition to weekly conference calls and monthly in-person meetings, the working groups are telecollaborating via e-mail reflectors. These reflectors may be used to introduce topics that may then be commented upon by group members, with the entire record stored on a searchable World Wide Web database. E-mail "turns out to be a good place for raising new issues and getting people thinking about them," says Cruickshank. "But face-to-face meetings are much better for coming to closure. Combining the two works very well."

A major focus by Cruickshank and his team is on wooing vendors to participate. The test suite needs to be ready by the time vendors have prototype systems ready, says Cruickshank, but ironically, CableLabs can't develop the test suite without those same vendors' know-how.

It's a high-stakes game, Cruickshank observes: "Failure to achieve interoperability means failure to go to retail [with modems], and failure to reach the cost points you need because you don't have the economies of scale in production. If that happens, some competing technology–ADSL, satellite or whatever–could just take us out.

"At that point, the argument ceases to be the usual one about getting a big piece of a little pie, or a little piece of a big pie. It could be a big pie vs. no pie." CED

Updates on the Web

Note: Updated information on the DOCSIS Test Team project–who's participating, how it's progressing and the results of compliance testing–will be posted to a CableLabs-maintained, open-access Web site, www.cablemodem.com.

1000 MHz Headend Grade Spectrum Analyzer

Blonder Tongue proudly announces the introduction of its new high dynamic range (70 dB) headend grade spectrum analyzer model BTSA 8558C. The BTSA-8558C analyzer is a light weight, battery operated spectrum analyzer that has a wide array of controls that allow for quick setup and measurement, including coarse and fine frequency tuning, digital frequency counter readout, 3 resolution bandwidth settings, including 30 kHz for composite triple beat distortion testing, 8 frequency span settings including ZERO SPAN for setting depth of modulation, 50 or 75 Ω input impedance, variable sweep rate, and "bright dot" center/marker frequency display. An optional calibrated noise generator is also available for sweeping frequency selective devices.

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Blonder Tongue Laboratories, Inc.

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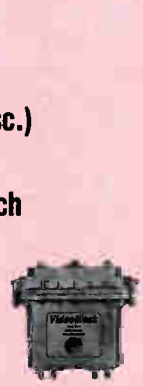

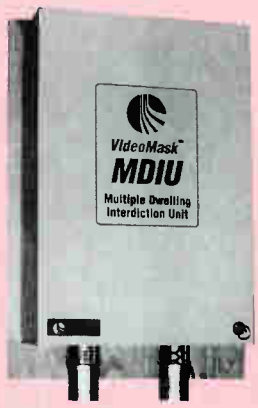

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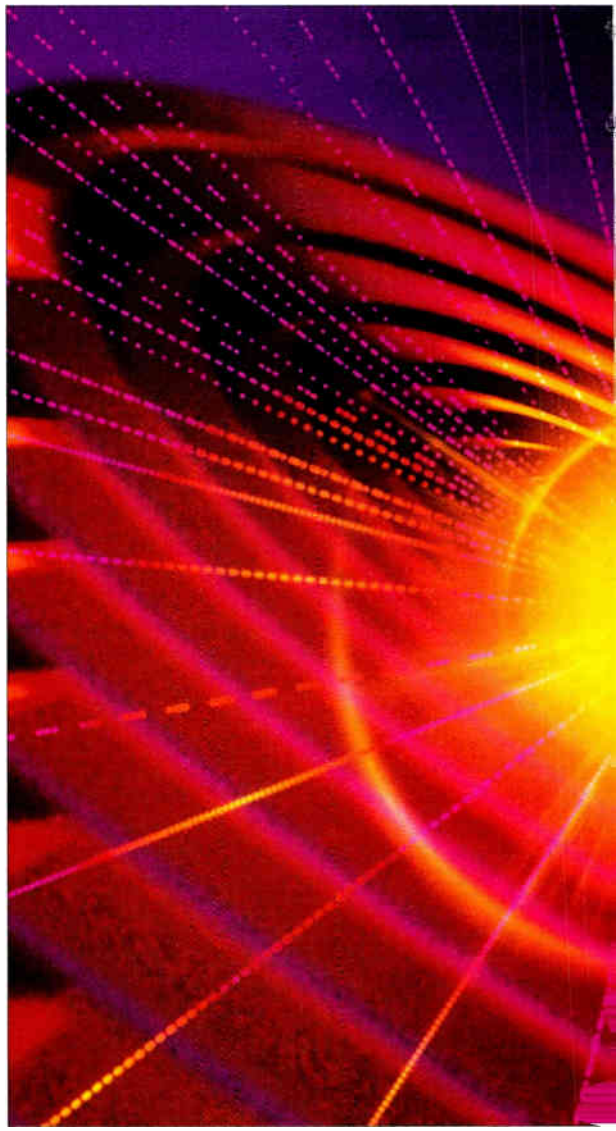
The great Sonet debate: Primed for video?

Operators, vendors discuss pros and cons



By Dana Cervenka

Sonet equipment, long the darling of the telco industry, is now being embraced by cable operators for the transport of new, high-speed data services, as well as for a support platform for their forays into voice services. But while the Sonet (synchronous optical network) platform has long been optimized for voice and data, the question remains–will Sonet soon see its day in the sun as a video transport platform for the cable industry?

The answers to that question are as varied as the respondents, and many cable operators still seem to be gathering enough data to answer the many, unresolved questions they have about the technology's suitability for video transport.

Cox Communications will soon have Sonet transmission gear "sitting in every single hub site" it owns for the transport of its ATM data traffic and its competitive access and residential telephony traffic, according to Mark Davis, director of engineering, telephony technology; however, the company still has one major concern about the technology's suitability for video transport: cost.

"We are still struggling with the cost of Sonet for pure video transport, and there is a good reason for that," says Davis. "Sonet is a baseband video transport, when you use the codecs that are available today. The fact that you have to remodulate that signal at every single hub site back to an AM signal, that is where the costs are. If you just looked at it on a transport-only basis, then the time has come. But when you factor in the additional signal processing, the modulation and the scrambling, things that you must do at every hub site with baseband video, it is still more expensive than doing a proprietary solution, or even analog 1550 fiber optics."

In fact, Cox recently announced that it has chosen ADC Telecommunications to supply digital video

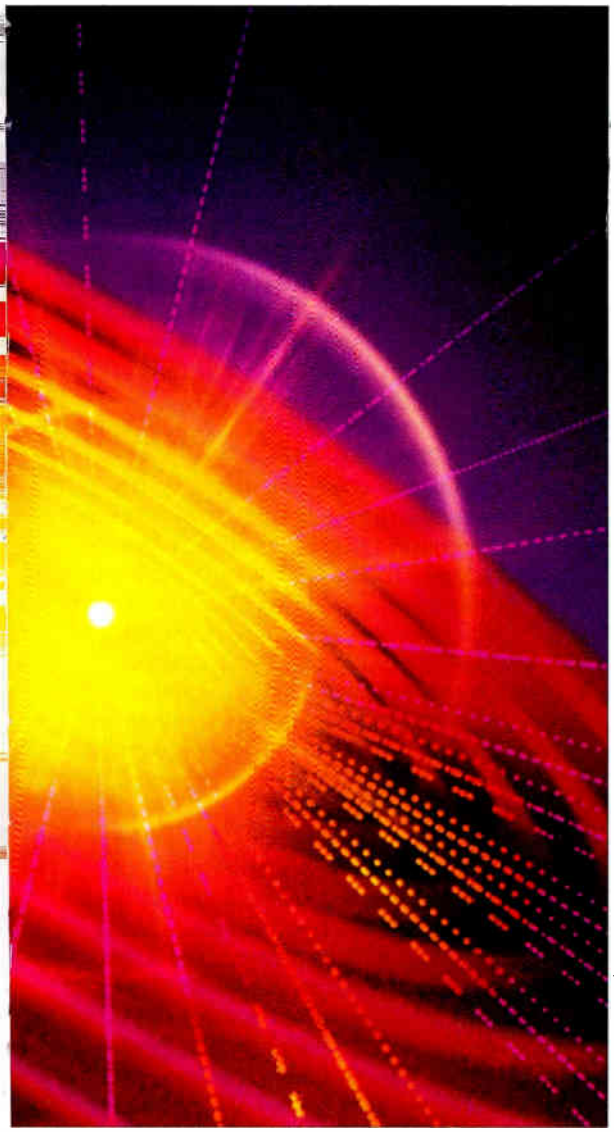


PHOTO BY STEVEN HUNT, THE IMAGE BANK

transport equipment (gear that is not Sonet-based) for a deployment in some of its large clusters in the U.S. The MSO will deploy the company's DV6000 equipment as part of a contract award estimated to be worth more than $10 million over the course of three years.

In its Phoenix system, though, Cox does own a five-hub, dual OC-48 backbone that is dedicated to video transport, courtesy of Times Mirror, which had installed the equipment before the system was purchased by Cox. And, the MSO has been taking a closer look at Sonet for video, says Davis, in light of benefits such as redundancy and high reliability, as well as flexibility.

"It also gives you other nice things, such as the ability to cross-connect channels on the fly, and you can do subtending rings off of fiber rings, which can help in some of your hub configurations."

But Davis also remains optimistic about progress in pushing the cost of Sonet farther down, noting that the technology is "a lot closer than it has ever been, price-wise" to making good sense for video.

Shaking hands with the outside world

InterMedia Partners Inc.'s Chief Technical Officer, Ken Wright, agrees that the platform is looking better and better for video, but is still uncertain whether the train has actually arrived at the station. Right now, the MSO is wrestling with the question of which technology to use for a digital interconnect it plans in Tennessee, which will link up about a quarter of a million subscribers in Nashville and six surrounding counties. InterMedia is in the process of rebuilding and interconnecting the systems, which have stood alone for years. To that end, the operator has put an RFP (request for proposal) out on the street for using a digital solution to interconnect the systems (replies were due just after press time). Until the replies are in and analyzed, the operator is in a wait-and-see mode about whether to use Sonet for the interconnect, or some other digital solution.

Why would InterMedia want to use Sonet for the Tennessee interconnect? "The reason is to have interconnectivity to the outside world," explains Wright. "As long as all we are using it for is transporting our own traffic internally, it's not that big of an issue whether it's proprietary or Sonet-based. If we ever wanted to connect to an adjacent operator, as long as we had the same pick on a proprietary vendor, it would be OK. (But) once we want to connect to a long distance carrier or a local telephone company that we want to hand off voice and data traffic to . . . then it certainly makes life a lot easier if we are using a standards-based approach."

On the cost side, Wright says that vendors are telling him that Sonet is now competitive in price with other digital solutions. "There is a little bit behind that statement. I think that they are saying (the technologies) are competitive on an apples-to-apples approach. We are hearing that once you factor in the number of fibers and the route miles, they are cost-competitive on an end-to-end basis, rather than just comparing (Sonet) equipment to (non-Sonet) equipment."

Other than cost, another issue that requires close examination is the ability of Sonet-based approaches to transport different types of signals, says Wright. Specifically, how well, and by what means, will the platform be able to transport scrambled video or BTSC-encoded signals?

"At least one vendor says it will have (a solution to the scrambling issue) in six months," adds Wright.

Regardless of the answers it receives from its RFP, by the end of this year, InterMedia will have its digital interconnect in place in Tennessee.

Vendors respond to system trends

Equipment suppliers such as NextLevel Systems (formerly known as General Instrument) say that part of the rationale behind their entry into the Sonet video market is a response to architectural trends within the cable industry. In one example, it's becoming more and more common for cable systems to cluster their systems, and

Davis remains optimistic about progress in pushing the cost of Sonet down

Canadians bullish on Sonet

By James Careless

As early adopters of fiber optic technology, Canadian cable operators are now looking to Sonet-based fiber networks as a critical component to their future. That's because the industry's plans for delivering digitally compressed video, Internet access and telephony all rely on the technology for carriage.

This is why "the big five or eight cable companies in the country are all pursuing some measure of fiber construction," says Brian Nelson, vice president of Fundy Telecom, a division of cable MSO Fundy Communications. "Certainly Videotron, Shaw and Rogers are pursuing fiber builds very aggressively."

Of course, the actual amount of fiber installed varies by company. Fundy Communications has put in about 1,875 linear miles of fiber across Nova Scotia and New Brunswick and recently completed a high density OC-48 Sonet ring supplied by Alcatel. The company also uses Lucent OC-48 and OC-12 fiber installations both to cover its territory, and to tie into conventional telcos such as AT&T Canada and Sprint.

The fiber has two purposes, says Nelson. First, it allows the company to compete with the established local telco in providing business telephony. That's a market worth about U.S.$150 million, he estimates. Second, the network is also used to supply digitally compressed video from various TV studios or third parties "and feed it to all our headend distribution."

Meanwhile, Rogers Communications Inc., the parent company of Rogers Cablesystems, has essentially wired together all of its systems with fiber. What this means is that "with the exception of one or two smaller systems, everything we have is accessible from either our Toronto or Vancouver main headend," says Roger Keay, RCI's vice president of technology and strategic planning. So well-fibered is its network, in fact, that the company was able to survive the failure of a Canadian satellite a few years ago. While other cable companies were running blank screens, Rogers was still offering live video.

In Quebec, cable MSO Videotron is busy upgrading all of its networks with fiber. "We're bringing them up to 750 MHz," says Director of Public Affairs Sylvia Moran.

Currently, the company relies on 1,500 miles of fiber to deliver cable TV, two-way Internet access and business telephone services. "We put in basically what the client wants," says Moran. "If you want T-1, we just bring fiber directly into the building. Then we connect it to our extensive fiber optic network, which already covers Montreal, Quebec City and other urban areas in the province."

However, Videotron has other plans for its fiber–namely, local telephony. A current PCS trial with provider Microcell Telecommunications has Videotron feeding Microcell's PCS signals down its network to pole-mounted transmitters. These then provide the final link to telephone subscribers via wireless. The stakes here are high: if practical, this PCS strategy could give the company an economical way to break into local residential telephony.

Finally, Cogeco Cable Inc. is also moving ahead with hybrid fiber/coax architecture, installing Sonet fiber rings in southern Ontario. "The purpose is to be able to provide competitive data services, and eventually, telephone services to local business," says Denis Belanger, Cogeco's vice president of engineering and development. "We also want to prepare to go digital on our systems, in order to provide more programming choices," as well as compete with DBS and others in providing DTV in the future.

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◆ Cover Story

(Continued from page 32)

equipment that you have from one Sonet vendor with video transport from another Sonet vendor," adds Raskin.

Scientific-Atlanta has also entered the Sonet-video arena, with the announcement of its Prisma Digital Transport platform. In contrast to NextLevel, the company will offer a system that utilizes uncompressed digital transport "in a Sonet-compliant format," according to information released by S-A.

"In addition to the traditional Sonet low-speed interfaces, we have a number of low-speed plug-ins that are optimized to interface video–just like the proprietary systems," says Tim Wilk, director of strategic planning, Terrestrial Network Systems, Scientific-Atlanta Inc. "The big difference is, we are mapping (those interfaces) directly into Sonet. We've taken the concept of video encoders and decoders from the linear digital systems, and have merged them with the key aspects of Sonet transport technology."

For a variety of reasons, S-A is very bullish on Sonet's prospects for the delivery of multiple services, including video. Key among those is the competitive edge it can provide to cable operators concerned about system reliability.

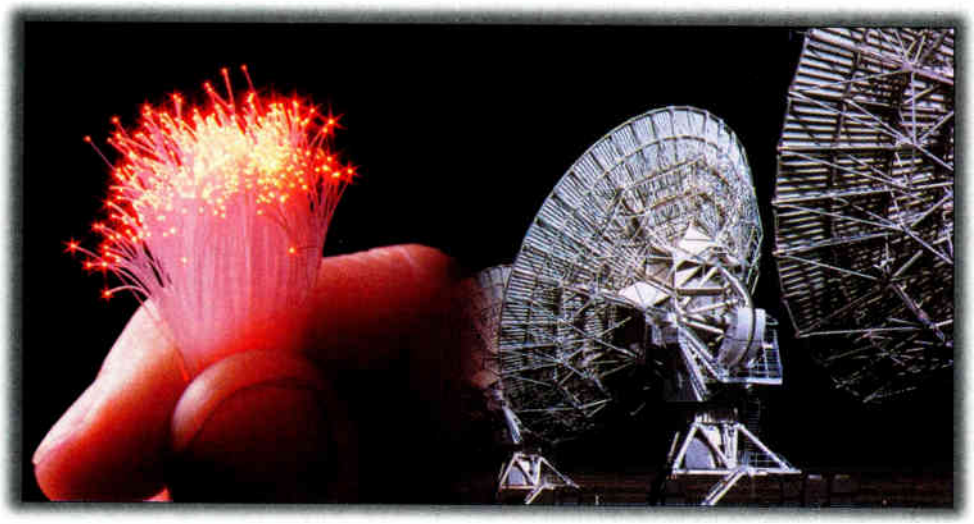
"Sonet is introducing a high degree of intelligence into the interconnect network," says Wilk. "You can really provide superior performance monitoring and a self-healing capability, if there is a fiber cut, or an electronic failure."

"Sonet is also able to direct traffic in a cost-effective way," says Wilk. "Sonet can do drop/add/pass very cost-effectively. It doesn't have to demultiplex its whole digital stream to try to find one channel."

Not surprisingly, there are varying cost estimates for Sonet vs. other digital solutions coming out of the vendor community. For example, executives with ADC Broadband Communications say that because a Sonet-based, compressed video system requires more equipment than a non-Sonet, uncompressed digital video system, a user would most likely incur an additional cost of 30 to 40 percent.

"Sonet is really designed for a lot of people talking to each other," says Wes Simpson, director of ADC Broadband's Digital Video Business Unit. "A true video network is designed to take mass quantities of video and give them to a site economically."

Universal uncompressed digital video networks, say ADC executives, enable the cable system to carry scrambled signals and vertical blanking interval information (VBI) intact, which translates into a cost savings because the processing equipment is centralized, instead of



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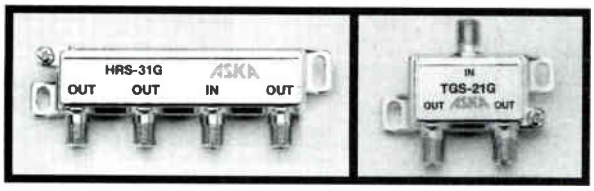

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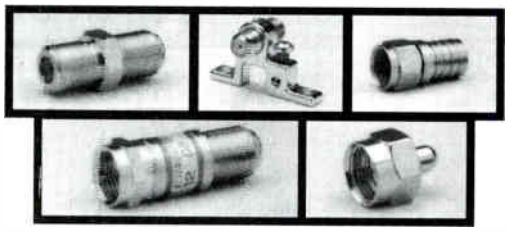

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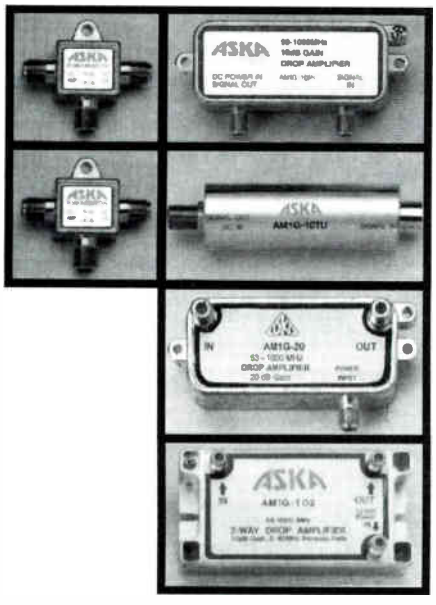

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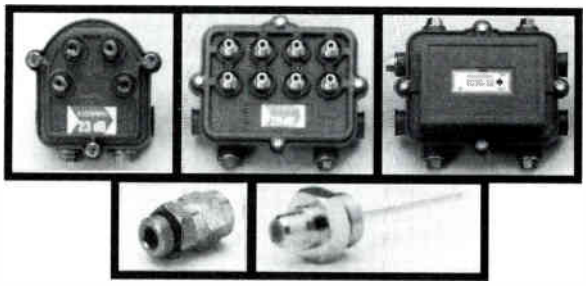

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distributed at each hub site. In addition, because the video is uncompressed, its quality will be higher, they say.

But the company is by no means anti-Sonet. Bob Harris, marketing manager, Digital Video Business Unit, notes that the company has developed a variety of standard voice and data interfaces to hook its system up to a Sonet platform. And Simpson continues, "For voice and data, Sonet makes a lot of sense, because those are almost always two-way services."

Scientific-Atlanta's Prisma Digital Transport, an enhanced OC-48 Sonet/SDH multiplexer

But the very attributes that make Sonet so well-suited for voice and data delivery make it unsuited for video delivery, says Harris. "A true Sonet network, with its full duplex bidirectional capabilities, is actually wasting a great deal of bandwidth on the return path coming back, because most of your video is going down uncompressed or slightly compressed off of hub sites. That's an economic (factor)."

When to make the move?

The cable industry is well-known for making the most out of its available resources, whether that means personnel or equipment. To that end, operators have continued to push the envelope of what analog technology can do, rather than make the move to digital fiber at all.

"Some operators, if they need to go a greater distance, will go to 1550 fiber," notes Mediacom Senior VP and COO Joe Van Loan, who adds that, "for the most part, we get where we need to be with 1310 nm analog fiber."

The Sonet debate will undoubtedly continue for some time, as operators and manufacturers evaluate the synergies between various digital fiber platforms and cable operators' forays into new, advanced service offerings. But what was once seen only as "that telco technology" is looking brighter for video. CED

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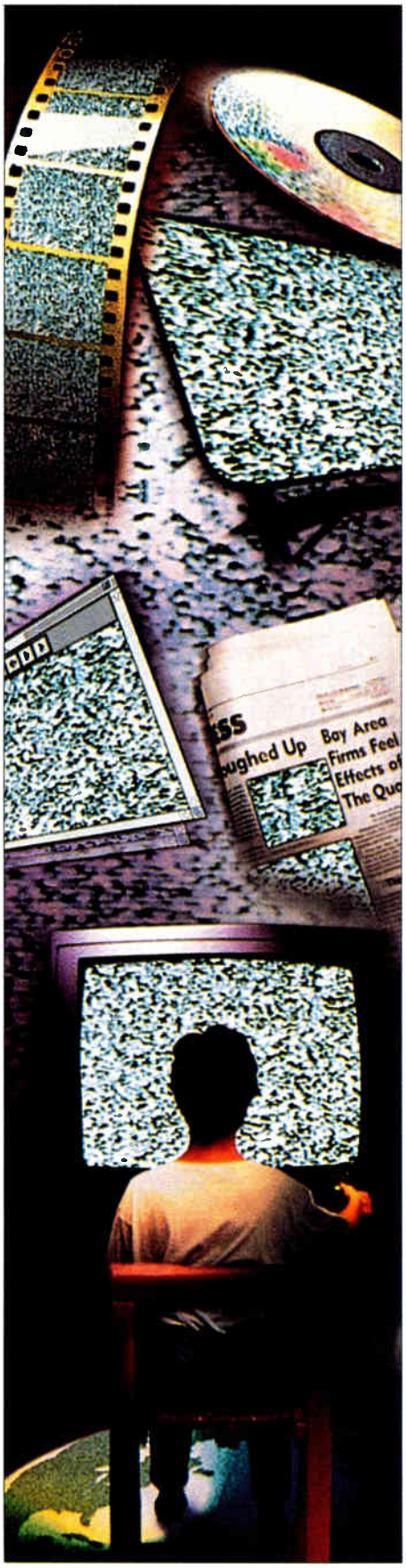

ILLUSTRATION BY KEVIN GHIGLIONE, SIS

How to migrate from HFC to a Sonet network

Sonet makes sense in a multimedia world

By Gary Briggs, Competitive Carrier Sales Manager, Fujitsu Network Communications, g_briggs@fujitsu-fnc.com

Soon there will be two classes of cable network operators–those in the traditional downstream video business, and those aggressively adding services such as telephony, Internet and data transmission to their product mix. The convergence of video, voice and data services is the hottest market opportunity for cable operators in the next decade.

Many multiple system operators (MSOs) are taking their next steps as they move to position their businesses for convergence, with a network built on standards-based Sonet technology.

Because Sonet (synchronous optical network) is a solid standard for optical network elements providing modular building blocks, fixed overheads, integrated operations channels and flexible payload mappings, it makes the most sense for a network architecture. It offers the extremely high reliability that customers demand.

In the past, the concern of most operators was that investing in a Sonet network was equivalent to buying a sports car when a compact would do. With the market screaming for more services, the need for cable operators to roll out scalable networks no longer falls into the luxury class. These networks will determine the "haves" and the "have-nots" in the communications industry.

Most MSOs will get started by overlaying simple OC-12 (622 megabits per second) rings on their existing HFC network, turning up existing dark (unused) fiber. (Sonet's basic building block is an OC-1 channel–51.8 megabits per second.)

To offer high-speed data, a typical MSO will have a large server for the headend and proxy servers at the remote sites. The two servers communicate over an OC-3c (155 megabits per second) Sonet pipe to move the data between them.

The MSO deploys several separate OC-12 rings throughout its service area, depending on its anticipated traffic requirements. An option is to run OC-12 (equivalent to four OC-3c circuits) from the headend to the hub sites. One of the beauties of Sonet is that it is easily expandable to OC-48 (2.5 gigabits per second) as customer demand grows, for greater bandwidth.

High-speed data access at the OC-3c rate is the basic building block that transports the information from hub sites to the headend. For smaller HFC systems, a basic OC-12 Sonet multiplexer is a perfect introductory product. It provides four OC-3c circuits between the hub sites and the headend. For larger HFC systems, an OC-48 product with 16 OC-3c circuits may be required. This allows connection of 16 hub locations back to the headend. Each hub will serve 15,000 to 20,000 people.

Capacity planning is a key factor in building any network. The MSO must gain some idea of the expected data traffic requirements of its potential customers. Video needs are a given; it is the data and telephony traffic that presents the challenge. These traffic estimates can be gained from server vendors or through methods such as market studies or focus groups.

Sonet, however, is quite forgiving of underestimates in the network. It is possible to upgrade when demand dictates, allowing the MSO to simply add equipment to more fully use the OC-12 capacity or to expand beyond it.

Many MSOs are undergoing headend consolidation, with three or four networks aggregated into one "super" headend. This results in one ubiquitous control center. Running the whole operation from one center gives better control, reduces the number of trouble reports, minimizes dispatches, generally reduces the number of management headaches, and keeps revenues up. It also plays right into the Sonet ring strategy.

Two-way communication is a different animal from the existing HFC, modulated, RF networks. These older networks were perfect for delivering one-way video content. The beauty of Sonet networks is that they can be layered on top of the existing network. In many cases, all that is required is to light the

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dark fibers with Sonet multiplexers to provide high-speed data services.

Leading MSOs realize the time has come to bundle a host of two-way services for their customers. Today, there is a crying need from the public for bidirectional communications services provided at the highest quality, with no downtime, and at a reasonable cost. Quality and reliability are the key words—a customer expects dialtone or 911 service to be available all the time, without fail. Cable companies have come a long way in increasing their quality of service levels, but can still do better with a Sonet infrastructure.

To their credit, telephone companies are obsessed with network reliability. The fact that they have taken it to exemplary levels has led customers to accept nothing less. The telephone companies achieved that with a fiber-optic, standards-based Sonet network.

Most MSOs are at least evaluating telephony services for their near-term business plans. The possibility that they will offer these services justifies the deployment of Sonet to match the reliability expectations of customers. The Sonet equipment can easily be installed next to other HFC equipment. Although on separate fibers, both are linked to the hub sites that deliver the total portfolio of services.

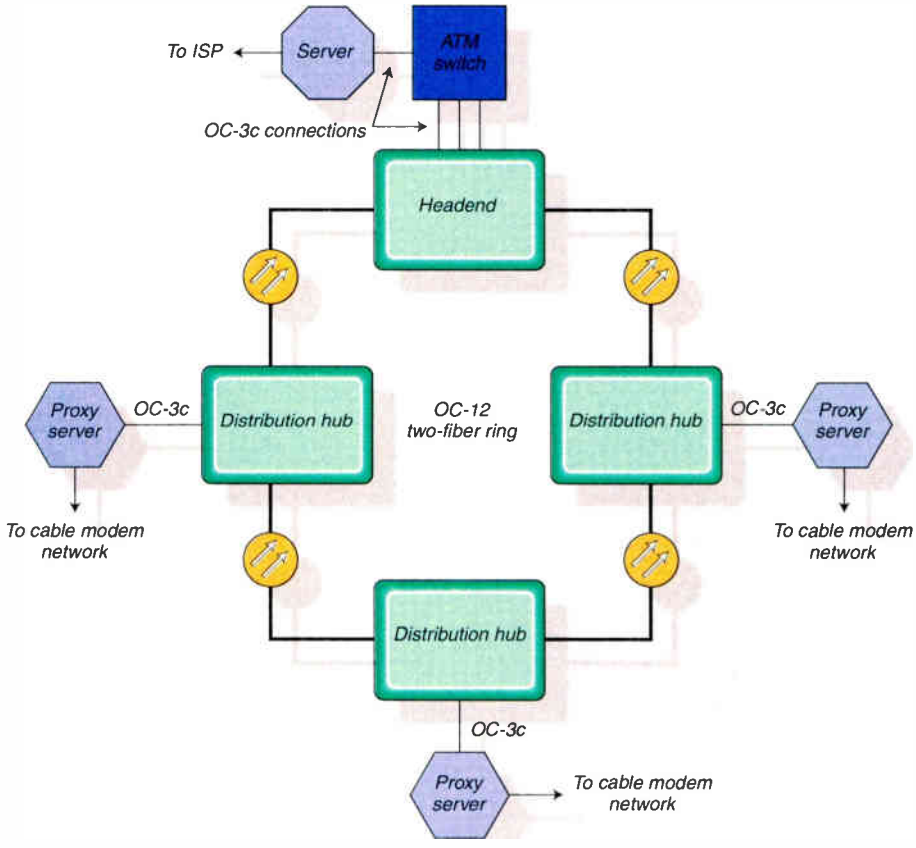
Four key drivers, as noted by Donald Raskin and Curtiss Smith of NextLevel Communications,[1] are:

✔Increasing importance of Internet data services to the overall cable operation;
✔Need to increase bandwidth readily as service penetration grows;
✔Opportunity for interconnection to public networks for video delivery;
✔Desire for sourcing from multiple vendors.

With demand for Internet access accounting for the lion's share of telephony traffic growth, this plays into the hands of cable operators. MSOs can offer data connections at rates 200 times faster than a typical 28.8 kilobits-per-second modem for only a few dollars more than what the consumer is paying to a relatively slow Internet service provider (ISP). A cable modem will speed data to the user at 6 to 8 Mbps.

The pace of work and home life has conditioned customers to despise slow response times in general, but especially when it comes to the Internet. Phone companies' copper twisted pair infrastructure limits their ability to offer fast Internet access. Even

Figure 1: Sonet overlay network. Internet and Intranet services.



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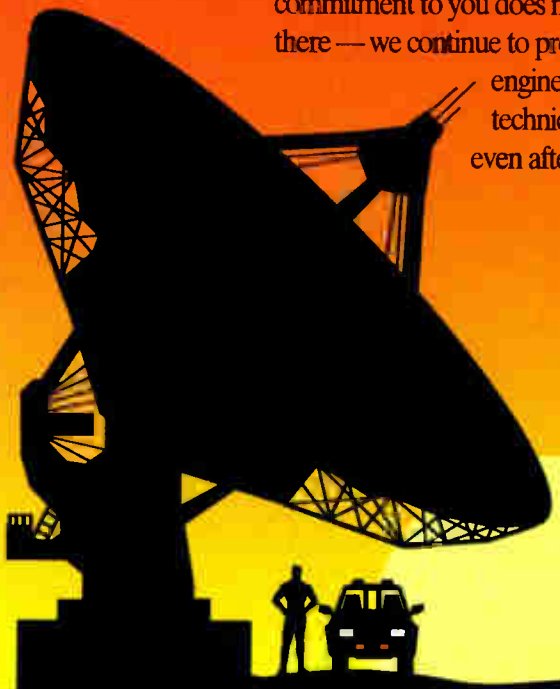
- Installation
- Field Service



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Digital delivers Robust, economical multi services over long distances

By Tim Wilk, Director of Strategic Planning, Terrestrial Network Systems, Scientific-Atlanta Inc. tim.wilk@sciatl.com

Two emerging trends are dominating the evolution of today's broadband architectures: network regionalization and the introduction of two-way digital service content. Both developments rely on fiber ring interconnects at the heart of the network to provide the most robust, economical transport of services.

As broadband operators strive to reduce costs while expanding services, fiber ring interconnects play a key role. But they also place severe strain on network performance. The application of Sonet (synchronous optical network) technology will provide the most robust, economical means of interconnect transport of uncompressed digital video, data and voice services.

Market drivers

✔**Network regionalization.** In order to reduce costs and achieve important economies of scale, most broadband operators are consolidating local networks into large, regional systems. This is done by interconnecting their system franchises with fiber rings.

Where each system may once have had its own headend, now these multiple systems are tied into a regional network consisting of one or two primary signal source "super headends" and several distribution hubs. Economies of scale are achieved by consolidating video headend equipment such as scramblers and stereo encoders, as well as the digital switching and routing equipment for high-speed data and voice services.

A single regional network may link multiple cities in a giant ring system that spans hundreds of miles. This places stringent demands on the performance and reliability of the network to ensure the optimal delivery of a high-quality signal.

✔**Expanding service offerings.** As network operators introduce interactive digital services such as high-speed data and telephony, regional fiber ring interconnects must be two-way capable. This has been addressed by building an overlay network of Sonet or SDH (synchronous digital hierarchy) equipment.

Selecting the optimal interconnect

Today, the two main technology choices for transporting video signals within fiber rings are analog and digital. Many factors influence this selection, which is bounded by the cost comparison of alternative technologies and the fundamental performance objectives of the network. Key variables include:

✔**Targeted ad insertion.** Most broadband operators now strive to target local advertising to the smallest geographic segment that is cost-feasible. The largest practical segmentation in a region for a local ad tends to follow the sizing of the hubs. Ads are inserted into a video channel in a baseband format.

"Super analog" (super AM) technologies, which carry a broadband RF signal, must insert ads at the primary headend, resulting in a dedicated transmitter serving each hub location. Digital systems, in contrast, have the flexibility to carry either duplicate channels (each with a unique ad) to targeted hubs, or to carry the video channel in a baseband format that enables local ad insertion at targeted hubs.

✔**Custom channel line-ups and local origination.** One of the fallouts of regional headend consolidation is that hub channel line-ups likely will differ from those in the master headend. To address these differences, super AM technologies must dedicate costly individual transmitters to each hub, whereas digital solutions allow channel frequencies to be assigned locally at the hub.

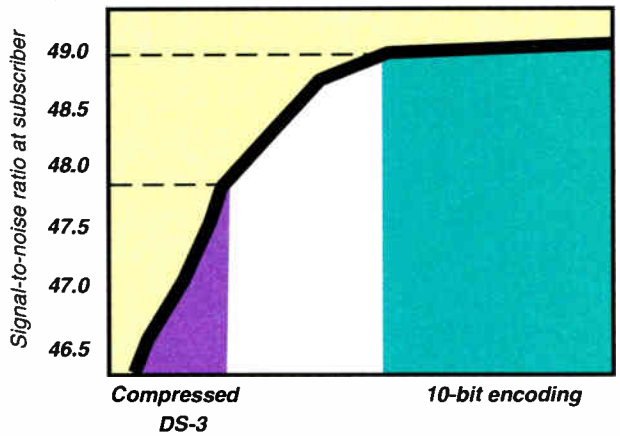
In addition, many hubs have channels that originate locally. If these channels are to be shared over multiple locations, digital technologies allow channels to be inserted into the ring, whereas super AM technologies require a different interconnect scheme.

✔**Long-distance transport.** Metropolitan area fiber interconnects will require fiber rings to span significant geographical distances, typically exceeding 100 miles. As operators begin to tie these metropolitan rings into regional networks interconnecting several cities, rings exceeding 1,000 miles can be envisioned. The high-quality, low-distortion performance of digital transport makes it an ideal technology to address these distance requirements. Digital systems typically reach nearly 65 miles over a single span length, and are capable of multiple repeats or cascades.

Because of video's extreme sensitivity to jitter and wander errors which accumulate over long distances, a caution should be noted with the treatment of video in a digital transport format. Without any adjustments, many digital systems may be limited to two or three repeats when transporting a digital video signal, compressed or uncompressed. (Note: an exception to this is compressed MPEG video, which corrects for significant jitter and wander errors in its basic structure.)

To avoid undesirable video artifacts induced by jitter and wander, a digital transport scheme must perform some type of error correction. Sonet and SDH technologies inherently address these types of errors with pointer adjustments, but these corrections are insufficient for video, particularly with external DS-3 video codec equipment. By

Figure 1: Effect of interconnect performance on subscriber picture quality. Uncompressed video transport in an interconnect delivers a higher quality signal at the subscriber drop than DS-3 compressed video.



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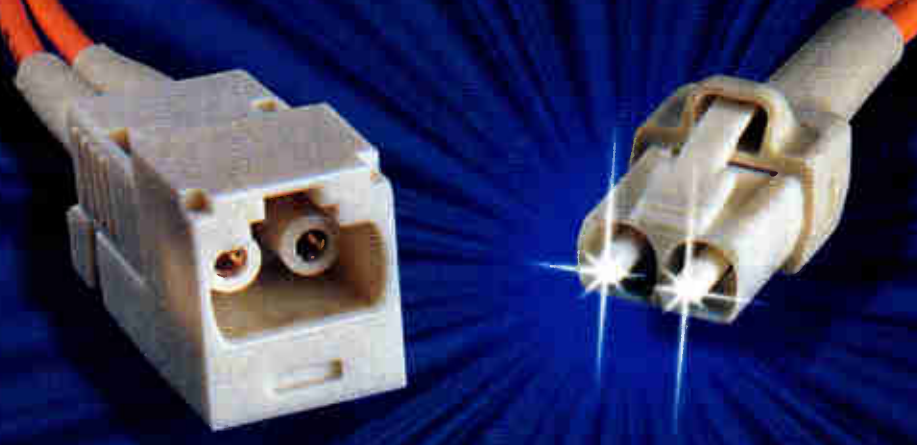

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synchronizing the digital video payload directly to the Sonet clock and introducing an elastic storage on the encode and decode circuits, video bit errors can be held well within the control of Sonet pointer adjustments.

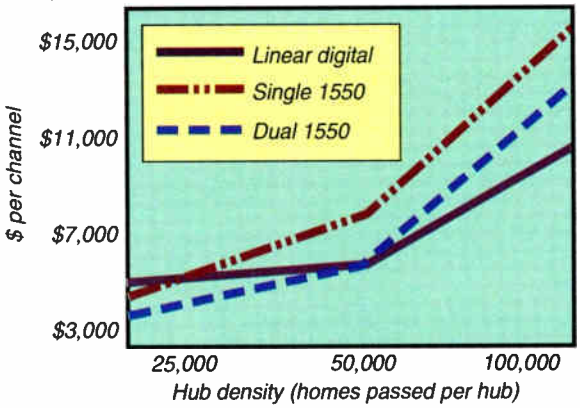
✔Video performance objectives. Perhaps the most significant factor influencing the technology of the interconnect network is the performance required to achieve desired end-of-line performance.

Network performance is a derivative of both the hub interconnect and the hybrid fiber/coax (HFC) plant. This means that decisions on the hub interconnect cannot be made independently of the HFC design, either for performance or cost reasons. For example, a low-cost/low-performance hub link may drive a high-cost/high-performance nodal transmitter requirement.

This is especially true with larger hub sizes where the nodal portion is the majority contributor to the fiber-optic investment, as in hubs with 50,000 homes passed. On the other hand, if the nodal links are already installed, the technology decision process for the hub interconnect frequently becomes "whatever works"—which may or may not be the correct strategy in the context of the total network.

The highest-quality video performance is achieved by transporting video in an uncompressed format over digital systems. Utilizing 10-bit sampling (approximately 136 Mbps of bandwidth), a high signal-to-noise performance of 75 dB is possible. On the other hand, greater signal compression means greater signal degradation. Video encoded at 8-bit sampling will typically achieve a signal-to-noise ratio of 67 dB, while the highest-performance DS-3 (44.736) video codecs approach a signal-to-noise ratio of 56 dB (see Figure 1).

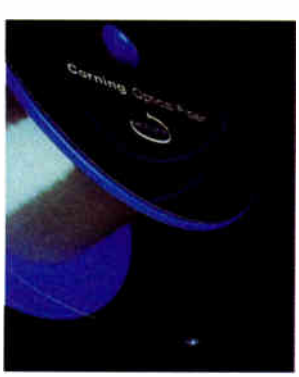
Figure 2: Interconnect economics. 80 channels of video with node transmit cost. For systems with higher density hubs, linear digital becomes a lower-cost solution than single or even dual 1550. This makes uncompressed digital well-suited for metropolitan headend to primary hub interconnects.



Model notes:

- *80 channels analog, only*
- *100 homes passed per plant mile*
- *1 Headend/ 2 hubs*
- *15.5 miles between headend/hub*

What company made light talk?



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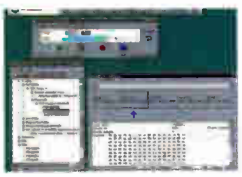

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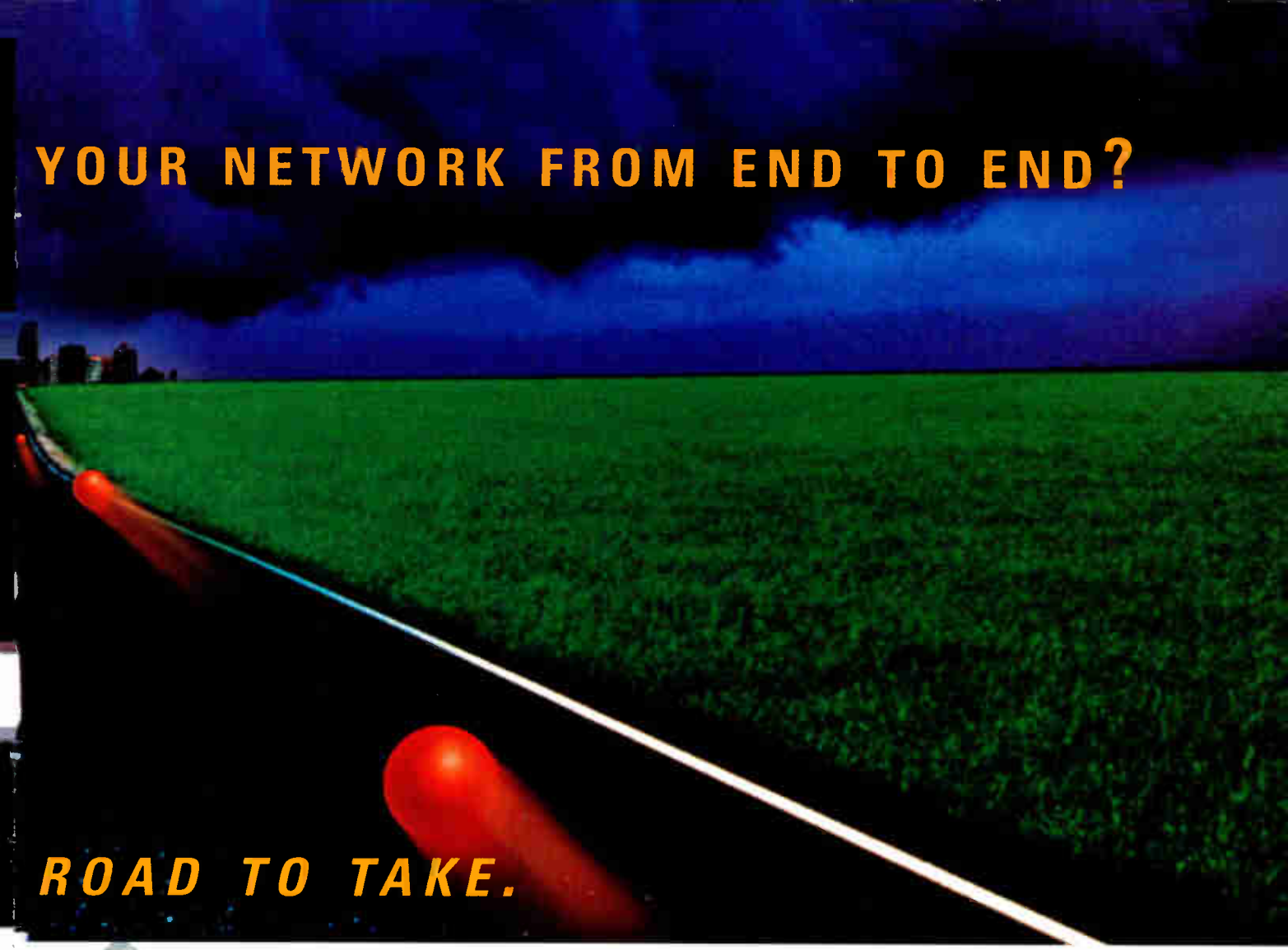

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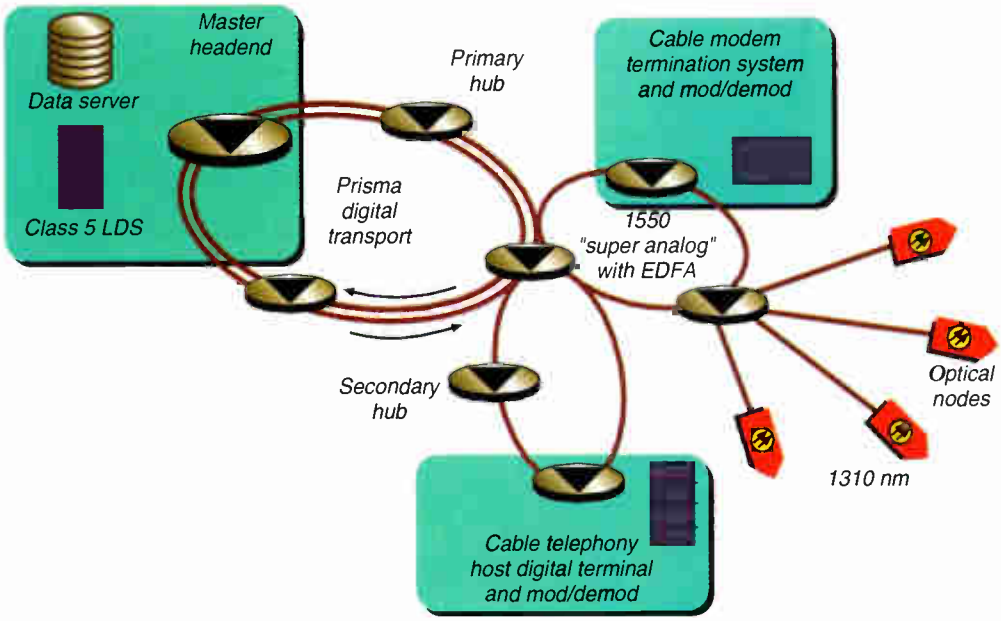
Figure 3: Prisma digital transport. Though 1550 super analog technology is generally sufficient for shorter secondary rings serving smaller communities, digital transport provides the most robust, economical means of transporting uncompressed video and two-way services over long distance interconnects.



Super AM systems, such as a high-powered 1550 nm laser used with an erbium-doped fiber amplifier, can reach 56 dB when deployed in a dual-tier arrangement. But they introduce distortions, such as composite triple beat, which are not found in digital transport. As a result, super AM technologies are better suited for shorter secondary interconnects serving smaller communities.

As regional rings begin to serve hubs that exceed 25,000 homes passed, a high-performance digital backbone will create substantial savings relating to the cost and performance of the nodal transmitters (see Figure 2).

Combining video, data, voice

Integrating video and two-way data and voice services in a single network has traditionally posed problems for broadband operators.

Existing digital transport sys-

tems capable of carrying uncompressed, multichannel video operate in a one-way, broadcast-only mode. For operators wishing to add two-way services to a video-only broadband network, this has mandated an early capital investment in an expensive, standalone Sonet or SDH overlay.

Additional costs for craft training, spares, and network monitoring and control are also introduced.

For operators of two-way Sonet/SDH networks who wish to add video, a significant investment in video compression equipment at headends and hubs has been required.

Traditional Sonet/SDH multiplexers are a proven, robust transmission protocol for data and voice, offering a superior networking capability with full add/drop multiplexing and open standard interfaces. But they are not efficient for video transport. Video compression protocols cannot accommodate scrambled video or stereo encoding. In addition, they produce a signal-to-noise ratio that is inferior to uncompressed video, leading to less-than-optimal subscriber picture quality. Finally, Sonet is not capable of monitoring the quality of the analog video signal which has been digitized and compressed into a DS-3 format.

The solution to this problem is to combine the best of both—the superiority of uncompressed video performance with the advantages of traditional Sonet technology—for regional interconnects. The key to optimizing standard Sonet technology for video transport is to expand the Sonet low-speed interfaces from traditional telecom DS-3 and OC-3 rates to include direct uncompressed video encoders and decoders. Uncompressed digital video fits well into the Sonet STS-3 building blocks. Specialized video cards address the necessary scrambling compatibility, synchronization and video monitoring objectives, while simultaneously avoiding the high cost of Sonet with external video DS-3 codecs.

Uncompressed digital video fits well into the Sonet STS-3 building blocks

Products that feature these codecs will be able to transport video channels and voice and broadband data services over long distances in a single, multi-service platform (see Figure 3). These multiplexers avoid the undesirable effects of video compression by transporting channels in a 10-bit, uncompressed format.

Some will be upgradable to full two-way operation and will seamlessly support a mixture of two-way DS-3 and Ethernet-based services.

By optimizing standard Sonet technology for uncompressed video transport, digital transport allows broadband operators to place a single digital interconnect system that can handle all current and future services, including interactive services such as data and voice. This will result in less training and equipment spares, more efficient use of fiber, and lower capital costs to introduce interactive services. CED

Feedforward fine tunes fiber transmitters

Practical designs are now a reality

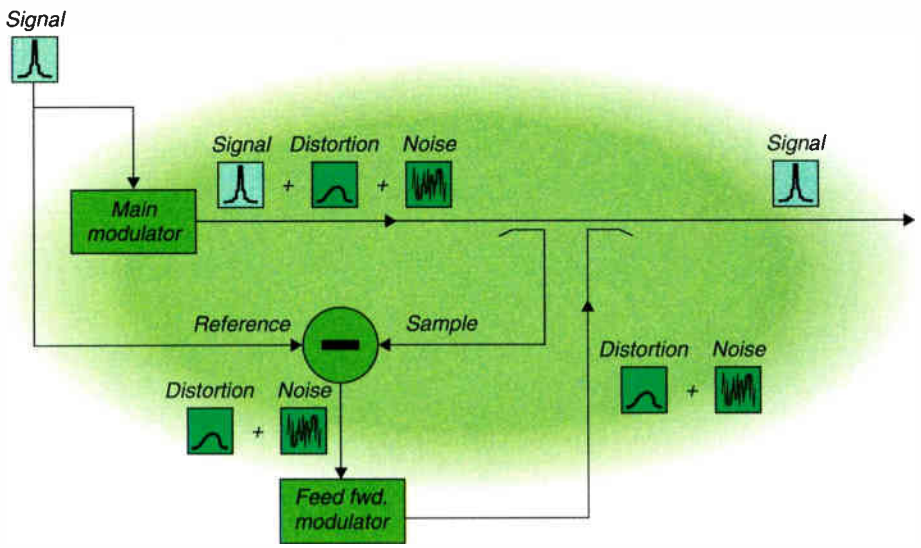
By Jim Farina, Director of Technology, Broadband Communications Division, ADC Telecommunications Inc. jim_farina@adc.com

The most demanding application in the field of AM fiber-optic transmission is for analog cable television signal transport. System requirements and economics have forced the technical community to develop fiber optic transmitters with low noise and extremely good, large signal characteristics. Linearity has become the focus of much of the work being done in both 1310 nm and 1550 nm applications. The advent and acceptance of erbium doped fiber amplifiers (EDFAs) for 1550 AM systems have resulted in the preferred use of transmitters based on external modulation of relatively high power constant wave (CW) sources.

The problem is that any modulator exhibits nonlinearities far in excess of acceptable limits. Linearization of most integrated optical modulators can be accomplished quite successfully because of the predictability of the intrinsic modulator nonlinearities. Typical approaches for linearization involve harmonic correction through electronic predistortion or cascading modulator sections to form a "linearized modulator." In fact, these approaches work reasonably well for low order nonlinearities resulting in 2nd and 3rd order distortion products. However, economic pressures have forced transmitter manufacturers to operate at higher and higher modulation depths where distortion products resulting from 4th, 5th and higher order nonlinearities are present and which practical predistortion and linearized modulators do little to correct.

As the nonlinearities become of higher and higher order, the need for an approach that is not harmonic in nature is required. The feedforward approach has been used in radio frequency (RF) applications where large signal multichannel performance is required, so one might expect to see it emerge as the most viable for similar fiber optic transmitters in cable television applications. In fact, there have been attempts to realize feedforward as true error correction in externally modulated systems as shown in Figure 1. However, because of some technical hurdles peculiar to feedforward, only recently has a practical single wavelength fiber optic transmitter been developed for cable television and like applications.

Figure 1: *Feedforward is capable of true error correction of all harmonics and non-harmonic degradation of signal quality.*

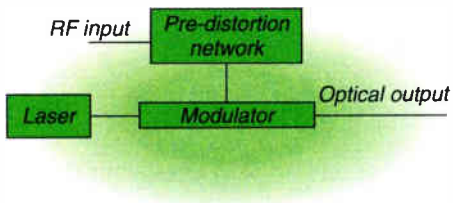


The feedforward approach

Unlike predistortion and linearized modulator approaches, feedforward error correction does not rely upon prior knowledge of the device nonlinearities, but instead, simply compares the input to the output, generates an error signal and feeds it forward to the output where it subtracts from the distorted signal to produce a more accurate reproduction of the input. The feedforward and harmonic correction techniques are illustrated in Figures 1 and 2, respectively.

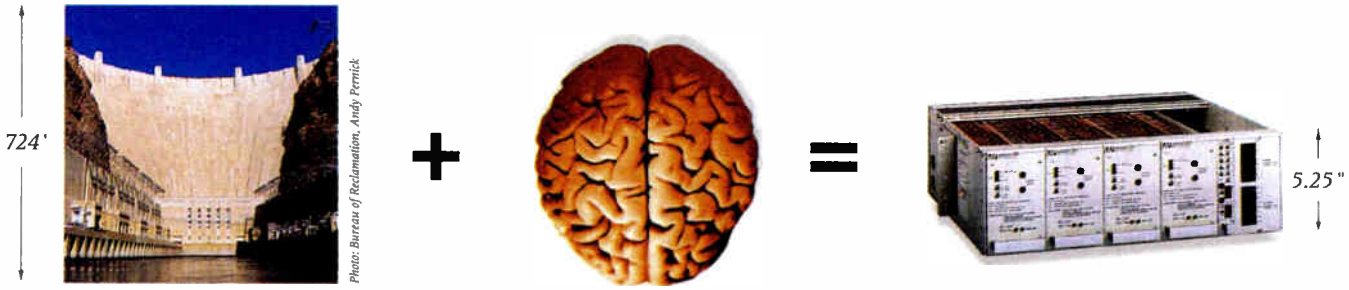
As in feedforward RF amplifier design, an RF signal is applied at the input and is split to serve as both the drive for the main modulator and a reference for an error sensing network. In the error sensing network, the light output from the main modulator is subtracted from the input reference signal and amplified. The result of this subtraction is the difference between the input and output of the main modulator. This consists of whatever the differences are regardless of whether the discrepancies are harmonic in nature or not.

Figure 2: *Harmonic error correction like predistortion relies upon the ability of the predistortion network to mimic exactly the inverse nonlinearities of the modulator.*



This amplified error is then used to drive the feedforward modulator, thus generating an optical signal that, when combined with the output of the main modulator, will cancel out any discrepancies in the output. In this manner, feedforward strives to replicate the input at the final output of the transmitter.

The feedforward optical signal source can consist of a variety of devices. Because of the need to maintain relatively small phase shifts between the main and error optical signals throughout the system, dispersion effects in the fiber even for moderate lengths dictate the use of a single wavelength for both optical signals. In the single wavelength transmitter, the feedforward optical signal source consists of an external modulator fed by a portion of the main CW light source as shown in Figure 3. While this ensures a single wavelength, the fact that the optical signals impinging upon the



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final optical combiner are coherent gives rise to instabilities and improper addition of the main and error signals. In the ideal conditions, the signal after the final coupler, I_{out}, is given by,

$$I_{out} \propto \underbrace{Signal}_{\text{Main}} + \underbrace{Distortion}_{\text{Feed forward}} - \underbrace{Distortion}_{\text{Feed forward}} + \underbrace{R \times \cos(\phi)}_{\text{Coherent cross terms}}$$

The coherent cross terms, in this expression, are proportional to a phase, ϕ, which is the result of optical path length variations as well as phase noise in the laser. To alleviate these cross terms, a differential phase shift at a sufficiently high frequency (>2 GHz) can be used. Figure 4 illustrates one method that can be used to accomplish this. Analysis shows that if this phase shift is of an amplitude corresponding to the zeros of the Bessel function, J_o, all of the coherent interaction in the band of interest, 0-1 GHz, completely disappears, allowing the optical beams to combine incoherently for all practical purposes. This technique works quite well, is easy to control and brings the added benefit of raising the stimulated Brillouin scattering (SBS) threshold.

The optical feedforward architecture mimics exactly its RF relative and so its basic characteristics. The result is a very linear, low noise, fiber-optic transmission technique that relies on a simple comparison of the distorted and input signals to linearize its performance. In this manner, feedforward is the only technique capable of tracking distortions of very high order, up to 9th, and non-harmonic distortions including noise mixing products equally well. In addition, the notion of a "sweet spot" of operation common with most predistortion techniques does not exist. Therefore, the operation of the transmitter, above and below nominal operating input drive levels, results in the normal distortion scaling relationships right up to the clipping limit.

While feedforward will correct for almost any signal error, the amount of correction is limited by the tolerances in the relative phase and amplitude between the actual error and the correction signals. Obviously, correct phase and amplitudes are required to reduce the error in the signal. Therefore, practical considerations limit the amount of feedforward correction available, and if more correction is necessary, additional measures need to be pursued. In fact, under normal operation, the amount of composite triple beat (CTB) generated in a typical integrated optic modulator is so high that the hope of canceling it to levels acceptable for system performance, in a practical and stable manner, is small. Figure 5 shows a measurement of a carrier with the distortion product (CTB) both corrected and uncorrected using feedforward alone. As can be seen, cancellation in excess of 30 dB is required. Relief can easily be attained through the addition of a predistortion "head start" in front of the main modulator. Because the feedforward approach corrects whatever comes out of the main modulator, the addition of any predistortion or gain for that matter can only aid the linearization process. Using this approach, the phase and amplitude tolerances are opened up to well within practical limits.

With the additional help of predistortion, the requirements for the phase and amplitude tolerances imposed on the error signal path are relaxed to the point at which a design, stable over time and temperature, can be achieved. However, cost reduction and manufacturing ease are improved through the use of a simple servo loop to stabilize the system in case of variations in error signal path gain. In essence, this loop uses a tone injected into the modulator, but not the RF input. The feedforward system will cancel this signal because it does not appear at the input and does appear to be a distortion or other corruption to the input signal. Monitoring this tone at the final output and minimizing it will ensure that the feedforward cancellation is optimized.

Figure 3: *Feedforward transmitters using a single optical source are not subject to degradation in distortion cancellation performance due to dispersion in the optical fiber.*

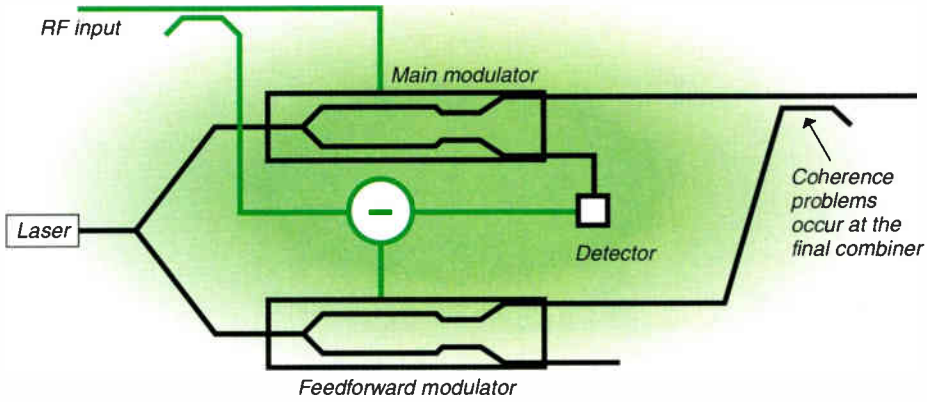
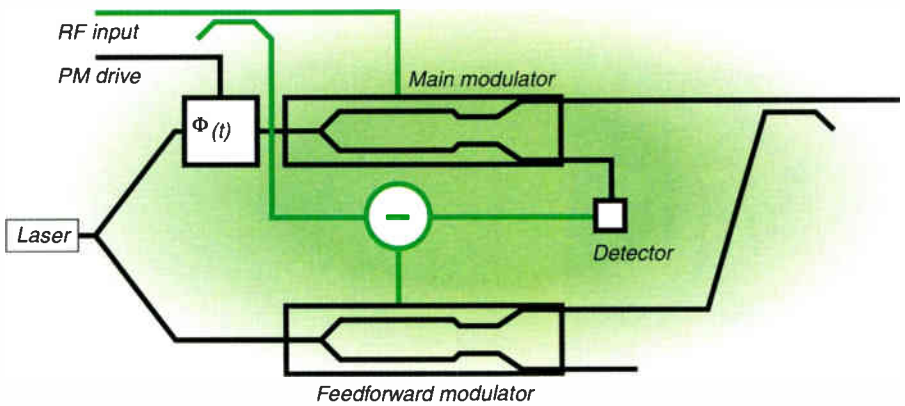


Figure 4: *Proper addition of the main and error signals can be achieved with a single optical source only if the coherent interaction at the final coupler is eliminated. One method is to impart differential phase modulation between the main and feedforward optical paths.*



System performance

Measurements of feedforward transmitters confirm the expected superior performance over a variety of operating parameters. National Television System Committee (NTSC) measurements of carrier-to-noise ratio (CNR), CTB and composite second order (CSO) are typically in excess of 56 , 70 and 70 respectively for 80 channels on a single fiber with 0 dBm received optical power. Measurements at alternative channel loading are commensurate with the number of channels. Typical applications require the use of an EDFA at the output of the transmitter. The CNR performance of this configuration is degraded by only 1.25-1.5 dB with 4 dBm into the EDFA and 17 dBm out. The reason for this relatively small degradation lies in the intrinsic nature of feedforward. One inherent characteristic of the feedforward approach is a noise figure that is determined by the reference detector and not simply the laser noise.

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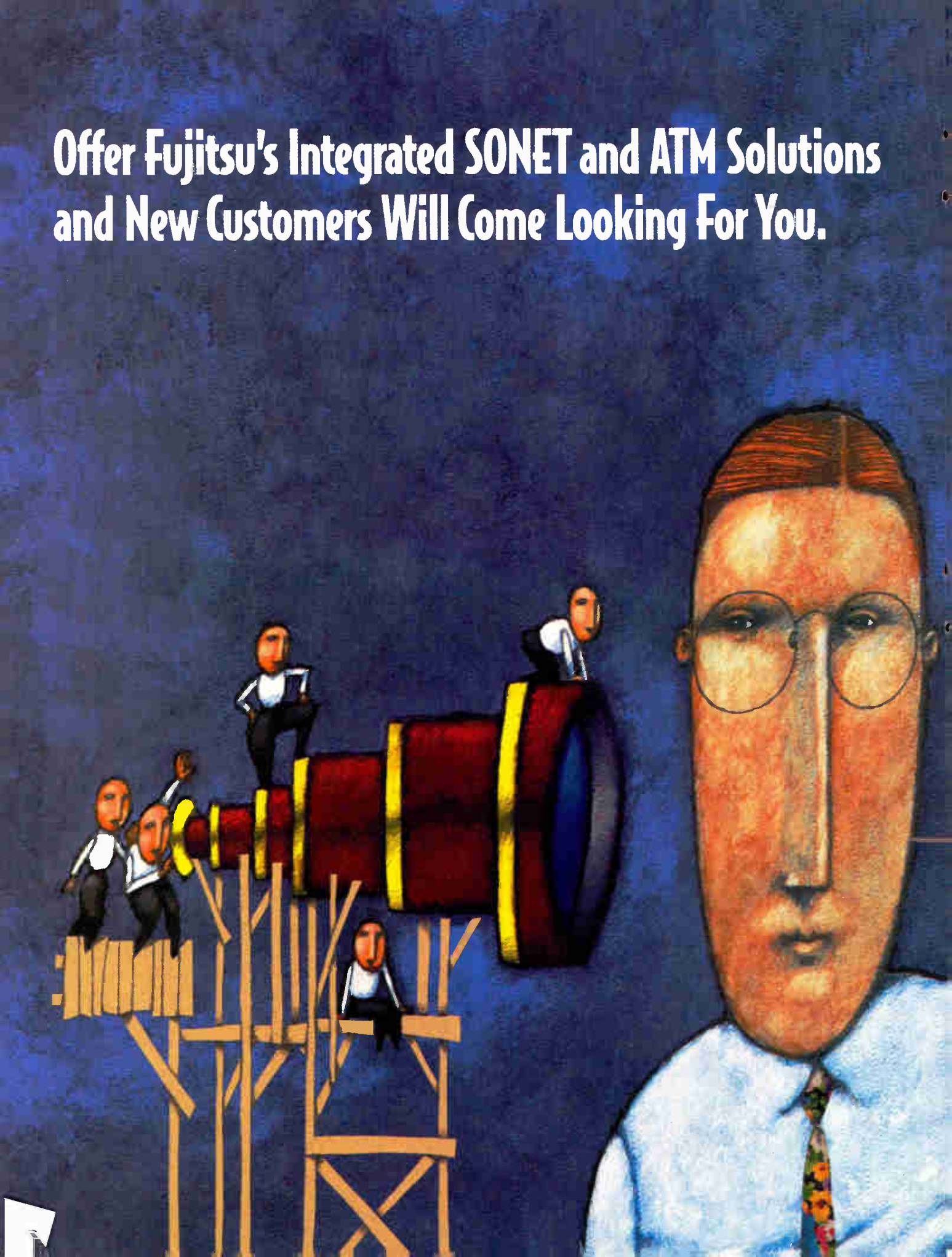

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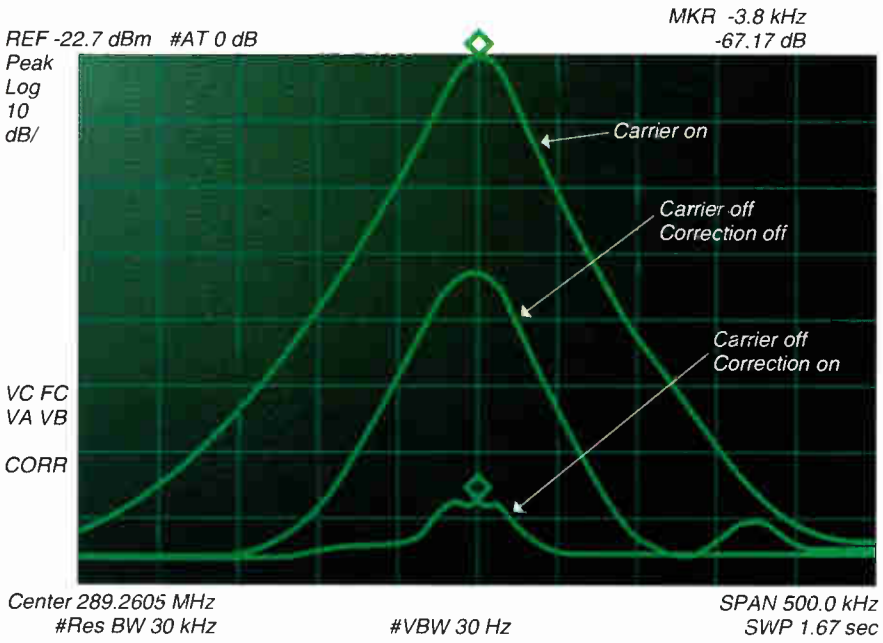
Reader Service 35

Figure 5: As illustrated for 80 NTSC channels, feedforward is capable of deep cancellation of distortion products.



The effect of this is to raise the relative intensity noise (RIN) (~2 dB) of the transmitter. While much work has gone into reducing the RIN of laser sources, high transmitter performance in the face of higher RIN has definite benefits, including smaller degradation in CNR for both EDFA use and reductions in received optical power.

Conclusion

Practical designs of fiber-optic transmitters based on feedforward are now a reality and can provide high performance in cable television applications. Furthermore, transmitters based on this technology demonstrate excellent distortion and CNR performance over a variety of operating conditions, making it a very robust approach. Its ability to correct for non-harmonic as well as higher order harmonic distortions makes it stand out in high performance cable television applications. In addition, its performance, when cascaded with EDFAs, is not degraded to the same extent as transmitters based on alternative technologies, thus making them ideal for trunking and supertrunking applications. CED

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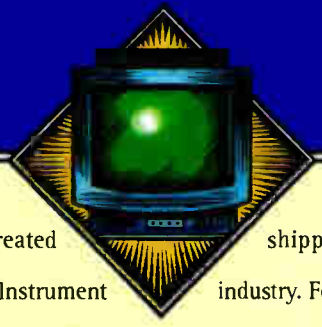

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Reader Service 36

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What comes first? The human or the machine?

Survey shows ops focusing more on technology

By Michael Lafferty

As many in the industry have come to find out recently, telecommunications competition is a very sharp, two-edged sword. While it supposedly invigorates market forces and spurs innovative services, it can also cause a considerable amount of upheaval in individual companies scrambling to improve their competitive edge.

Witness the recent revolving door and system divestiture activity at TCI as CEO Leo Hindery endeavors to get that company's house in order. Or, even more unsettling, cable icon Amos Hostetter Jr.'s abrupt departure over "irreconcilable differences" with US West's MediaOne cable division about its decision to move corporate headquarters from Boston to Denver, lock, stock, and possibly without a barrel of its most talented executives.

According to respondents in *CED's* 1997 Salary and System Survey, these two widely publicized examples of turmoil in the ranks only hint at the rumblings going on below the surface. In an industry that's trying desperately to tighten down the financial hatches, while developing and deploying new technologies just to stay afloat, something has to give.

Seemingly, for many who responded to this year's survey, what's being jettisoned is a strong commitment to the people who are working in the front lines of the industry. Making matters worse, competitive broadband providers continue to stalk the cable industry's perimeter. Respondents say these companies are stealing away cable professionals at all levels with better pay and benefits, or simply by recognizing and respecting their skills, talent and experience.

Despite public pronouncements of "localizing" system management by such cable behemoths like TCI, many respondents complain that corporate meddling and micro management are hobbling local operations and unnecessarily (if not dangerously) raising the frustration and stress levels of the rank-and-file.

It's not so much that this year's respondents represent some vocal minority that's performing some perennial bitch session. The fact is that they love the work they do, and they know the potential is there to make it even better.

Bottom line, for many of those who answered this year's survey, the primary decision the industry has to face is whether it will make the investment and put the proper people in place, either by retaining and motivating those already in its ranks, or hiring and training new, dedicated people to keep both established and ground-breaking technology working.

Questions and answers

This year's survey contained a number of format changes. In order to optimize *CED's* current reader profile, five job categories were used, instead of the previous four. As a result, a proportional mailing was conducted to garner more responses from those managers and supervisors who make up a majority of *CED's* readership.

This year's respondents were also fairly representative in the size of systems they work for in the industry. The system sizes represented in the survey replies included 10.1 percent from systems of less than 1,000 to 9,999 subscribers; 50.1 percent from systems of 10,000 to 79,999 subscribers; and 38 percent from systems of 80,000 or more subscribers.

Those who answered this year's survey were, on average (see Figure 1), older and have worked in the industry longer than those who responded to previous *CED* surveys. And, on the whole, while they have been with their employers longer than respondents of the past, they were relatively new in their most current positions, underscoring the fact that companies seem to be busy these days shuffling their personnel.

This year's survey also altered the types of questions asked. The survey was broken up in three basic sections. The first section dealt with respondent statistics like job classification, salary, salary increases, and industry/employer/job tenure. The second section asked for responses about developments

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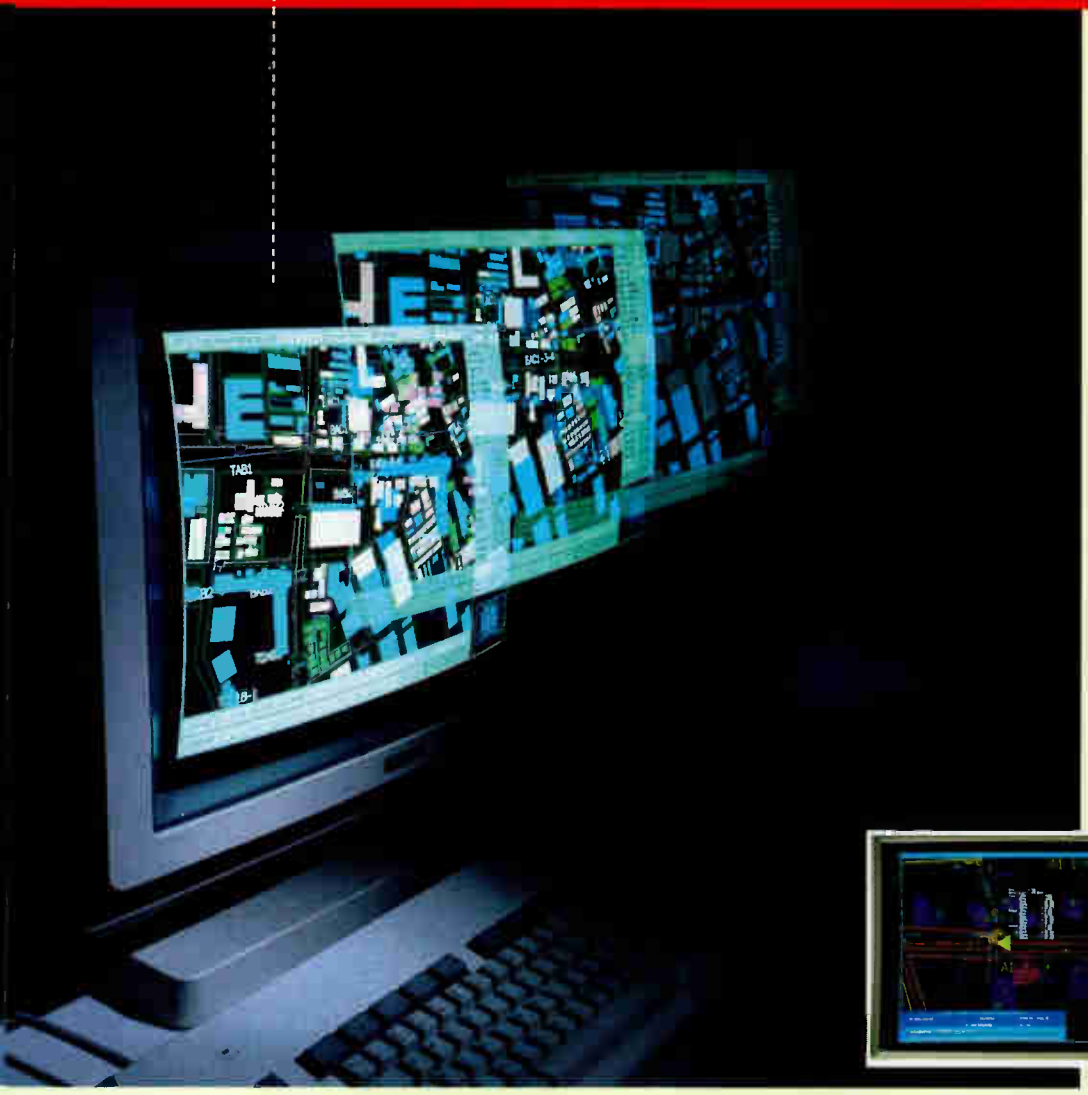

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Figure 1: 1997 CED Salary & System Survey "typical" respondent profile

Management*
Avg. age: 47.8
Tenure in industry: 20+ yrs.
Tenure in job: 1-3 yrs.
Tenure w/ employer: 1-3 yrs.
Avg. # of subs: 120,000+
** e.g. VPs, GMs, Asst. Mgrs., Area Mgrs., Directors, etc.*

Engineering Management*
Avg. age: 45.7
Tenure in industry: 20+ yrs.
Tenure in job: 1-3 yrs.
Tenure w/ employer: 20+ yrs.
Avg. # of subs: 120,000+
** e.g. Corp. Engs., Sr. Engs., VPs Eng., Eng. Dir. or Supv., Chief Engs., etc.*

Technical Management*
Avg. age: 47.8
Tenure in industry: 20+ yrs.
Tenure in job: 1-3 yrs.
Tenure w/ employer: 1-3 yrs.
Avg. # of subs: 120,000+
** e.g. Dir.-Tech Ops., Chief Techs., CO-Sys. Mgrs., MTS, Installation Mgrs./Supv., Tech Supv., etc.*

Engineering*
Avg. age: 40.1
Tenure in industry: 15-20 yrs.
Tenure in job: 1-3 yrs.
Tenure w/ employer: 20 yrs.
Avg. # of subs: 40,000-79,000
** e.g. Engs., Staff Engs., OSP Engs., etc.*

Technical*
Avg. age: 40.8
Tenure in industry: 20+ yrs.
Tenure in job: 1-3 yrs.
Tenure w/ employer: 20+ yrs.
Avg. # of subs:: 120,000+
** e.g. Headend Techs., Sys. Techs., Line/Bench Techs., Techs., Installers, etc.*

or events in individual systems, while the third section focused on the respondents themselves and their particular jobs.

Know thy enemy

When it came to rating the most immediate threat to their cable systems, respondents were given a choice of direct broadcast satellite (DBS) services, wireless TV services (e.g., MMDS), RBOC/telephone companies or any other they cared to list.

Despite assertions to the contrary from corporate cable headquarters around the country, survey respondents, by a wide majority (61.7 percent) laid the "most immediate threat" label on DBS service providers. Far behind the DBS leader, were RBOCs (19.1 percent) and then wireless TV services (13 percent).

While respondents were clearly cognizant of the competitors they face, they were equally aware of what it's going to take to combat these alternate broadband providers. One perceptive technical respondent from a mid-sized system in New England summarized his system's situation and their response to the DBS threat. "Our system," he says, "is trying to educate the customers as to the differences between our cable service and DBS service. We offer local channels, where DBS doesn't. We have a 59-minute guarantee if they lose their picture. We also offer free additional outlets. With DBS, they need to buy another receiver.

"If we do lose a customer, we will call them back in two to four weeks and offer them a free reconnect. We also recently rebuilt our system, going from 300 MHz to 750 MHz. And, we have an excellent customer service program."

A technical management respondent from a large system in the South notes his system faces the prospect of going head-to-head with BellSouth's MMDS service in the near future. Yet, his confidence in cable's ability to meet that threat is unshaken. "Our main strategy," he says, "is to continue to focus on service excellence. High-tech offerings will come on their own without the need for accelerated timelines. Besides, we want the products we launch to be quality ones that won't generate negative consumer perceptions."

The career crystal ball

Over the past several years, a considerable amount of grumbling and dissatisfaction has been expressed on a variety of topics. One of the most constant themes seen in the forms sent back to *CED* were cable professionals openly questioning whether, for whatever reason, they would remain in the industry. This year's survey decided to face the situation head-on and pose an interesting "what if" scenario.

When asked point-blank whether they expected to be in the industry three years from now, a solid 89.7 percent replied in the affirmative. Just 10.3 percent replied negatively. Those who believe that they will be somewhere else in three years' time, had a variety of reasons.

One respondent said, "Benefits (are) not keeping up with demands. The cable industry is using re-regulation and change as excuses to erode pay and benefits." While one cable professional stated that there was "limited opportunity for continued financial growth and security," another simply said, "This job is not fun anymore."

Interestingly, the 90 percent who expressed support for staying in the industry is not as solid as it would first seem. Given a hypothetical situation where all things were equal (e.g., pay, professional standing, job location, etc.), we asked if they could find a comparable job outside the industry in the next three years, would they be inclined to take such a job.

Figure 2: Average salaries and average percentage of salary increases of respondents by job classification and region

Region (overall regional avg. salary increase %)	Management / (Avg. salary increase %)	Engineering Management / (Avg. salary increase %)	Technical Management / (Avg. salary increase %)	Engineering / (Avg. salary increase %)	Technical / (Avg. salary increase %)
New England (2.6%)	$70,375 / (2.7%)	$66,000 / (N/A)	$45,601 / (3.7%)	$32,000 / (N/A)	$30,000 / (N/A)
Mid-Atlantic (5.6%)	$56,650 / (3.1%)	$68,925 / (7.1%)	$42,638 / (5.7%)	N/A / (N/A)	$30,062 / (4.1%)
South (4.0%)	$57,081 / (10.4%)	$62,420 / (3.9%)	$40,626 / (3.8%)	$40,200 / (5.4%)	$31,000 / (5.1%)
Midwest (4.2%)	$64,050 / (4.6%)	$47,375 / (5.6%)	$41,665 / (5.0%)	$44,425 / (4.8%)	$33,767 / (1.8%)
West (6.2%)	$61,587 / (5.1%)	$72,923 / (5.6%)	$48,649 / (4.5%)	$46,500 / (3.3%)	$37,327 / (5.0%)

Notes: N/A = statistical sample too small to tabulate
New England: ME, NH, VT, MA, RI; Mid-Atlantic: NY, NJ, PA; South: DE, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, AL, MS, AR, LA, OK, TX; Midwest: OH, IN, IL, MI, WI, MN, IA, MO, ND, SD, NE, KS; West: MT, ID, WY, CO, NM, AZ, UT, NV, WA, OR, CA, AK, HI.

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Reader Service 38

More than a third (39.8 percent) said they would.

The reasons given offer some interesting, if not blunt, insights and reveal a common thread:

"To get away from the bullshit that the corporate office passes on each day. Corporate forgot their basic role should be support, not a dictatorship."

"Concerned about downsizing; most stress I've ever been under–always giving more and more; family life starting to suffer."

"Overworked. Underpaid. Constant standby."

"Because at this time, we are not paid commensurate with our job knowledge, skill level and level of work. We're overworked and underpaid. A five-year telephone installer makes as much as a 15-year maintenance technician."

How much is too much?

This year's survey decided to take a close look at the oft-repeated theme of too much work and not enough pay. When asked, on average, how many hours a week they worked, it seems as if most of the respondents had never heard of a 40-hour work week (see Figure 4).

In four out of five job classifications, only about a third of any one group had work weeks in the 40 to 49 hour range. The notable exception was technical workers, where nearly two-thirds (62.5 percent) said their work totaled 40 to 49 hours per week.

In fact, most of the respondents in the top four job classifications had work weeks of 50 or more hours. Management types, however, were even more excessive in the time they put in for work. While 80.1 percent of them claimed they put in more than 50 hours of work a week, fully a third of them stated they worked more than 60 hours per week.

Even more telling was that two-thirds (66.5 percent) of all respondents received no additional consideration and/or compensation (e.g., extra time off, extra pay, etc.) for these extra hours. While majorities in both engineering (61.5 percent) and technical (54.2 percent) jobs did receive some sort of extra compensation/consideration, large majorities in the other three job classifications did not. More than two-thirds of the respondents in each of those job classifications (i.e., management/69 percent; engineering management/73.8 percent; technical management/71.2 percent) reported they did not receive any extra compensation/consideration.

Stress? Who's stressed?

It doesn't take a rocket-scientist to figure out that long hours at work can lead to an increase of stress-related problems. When asked if job-related stress was becoming a matter of concern to them personally, overwhelming majorities in each job classification answered in the affirmative. Technical management types led the way with 78.9 percent expressing concern about stress. They were followed (in descending order) by engineering (71.4 percent), technical (66.7 percent), engineering management (64.3 percent), and management (61.3 percent).

Respondents were also asked to determine the severity of the personal stress they were experiencing. Roughly a quarter (28.6 percent) said it was either "periodic" or occurred just "once in a while." The vast majority rated their stress levels either as a "growing concern" (45.1 percent), "very high" (22.6 percent), or downright "terrible" (3.7 percent).

Respondents were then asked to choose the top three causes for their personal stress. Their choices included: unrealistic deadlines for projects, not enough resources (money and/or personnel) to do jobs right, not enough/appropriate equipment or tools to do jobs right, improper personal training to do jobs right, staff not trained properly to do jobs right, too much "meddling" by corporate/management types, or excessive indecision or "flip-flopping" by management.

Far and away, the top cause (44.7 percent) for personal stress among respondents was not having enough resources (money and/or personnel) to do jobs right. One engineering management respondent from a large system in the South likens cable's personnel problem to that of America's favorite pastime.

"We seem to lose people across the board," he states. "People who have been here a long time tend to stay. Those we hire in the competitive marketplace through headhunters, etc., are always looking for the next move.

"While the cable TV industry is upgrading and even making incursions into other revenue-making communications efforts, the labor market will be like major league baseball–high salaries and (lots of) mobility. We have a great loss in new hires at the most basic customer service and technician trainee levels. We also have a moderately heavy turn-over in mid-management folks. Most of that movement is probably stress and pressure related."

Coming in at second place as a cause of personal stress was excessive indecision or "flip-flopping" by management. In third place, respondents say unrealistic deadlines for projects is having an impact.

Corporate communications, or the lack thereof, seems to be a recurring theme that effects a range of perceived problems in many of the respondent surveys. As one engineering management professional puts it, when "communications flow is situational," it's highly problematic that much will get accomplished.

"The military," he says, "would call it 'need to know.' The problem seems to be who's making the decisions or how the criteria is formed when determining who may 'need to know.' This organization, as a matter of policy, keeps info at the highest levels it can, without passing it down.

"I don't think this is from malice, as much as from having comfort with a certain management style–a style that flies in the face of what is proclaimed as their 'style goal'–teamwork and team play.

"The result of this communications gap is extraordinary pressure in certain kinds of jobs. Rather than team solutions, mandated solutions which address symptoms keep the pressure on certain jobs.

"I don't think higher management sees the problems the way many of us do. They also have promulgated a pretty consistent image of

Figure 3: Average salaries of respondents by job classification and age

	Management	Engineering Management	Technical Management	Engineering	Technical
Under 35 yrs. old	N/A	$47,000	$37,882	$34,833	$31,505
35-45 yrs. old	$61,376	$62,592	$43,605	$41,029	$33,591
Over 45 yrs. old	$61,218	$67,154	$43,544	$46,750	$38,100

Notes: N/A = statistical sample too small to tabulate

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May 21, 1997

Mr. Joe Wu, President
TFT, Inc.
3090 Oakmead Village Drive
Santa Clara, California 95051

Dear Mr. Wu:

In a recent survey of actual users of EAS encoder/decoders, the TFT EAS 911's sequentially lighted keyboard was preferred 7 to 1 for purchase over the competition. The survey was conducted by telephone between April 29 and May 16, 1997, to determine customer reaction and preferences from a sample of over 1,000 users in broadcast and emergency management.

During the two weeks of calling, CableFile was able to speak to 9.2% of the sample group who were identified as having used both the four-key and the 50 sequentially-lighted-key EAS units. Among the qualified respondents, the TFT 50-key products was overwhelmingly reported to be easier to use on a day-to-day basis by 54.2% who favored it.

Most respondents found both units easy for initial setup, but 95% said that the TFT was easy to setup, a full 20% more than the other type. 89% of the users told researchers that the TFT was easier to setup. For day-to-day operations, 83% of the qualified respondents preferred the TFT front panel design. When asked "If you had to add more EAS encoders/decoders to your system, which would you buy?" the TFT was once again the clear favorite. 68.5% said they would purchase the TFT. Only 8.5% said they would purchase the competition's product to the exclusion of TFT.

TFT provided CableFile with 1,000 names derived from its product registration cards to sample. Later in the surveying, TFT provided an additional 75 names of association presidents to broaden the sample. Out of the 75 names on the EAS association presidents list, 32% were unqualified, 40% were unavailable, and 28% were contacted; 14.2% of these contacts had used both systems.

Based on the above results you will find that of those we called who purchased emergency alert systems, TFT was the definitive choice.

(more)

User Survey Shows TFT EAS 911 Preferred 7 to 1

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'shooting the messengers.' So, it's risky to make basic management problems known."

When it comes to assessing stress levels within the systems or departments they work in, survey respondents are more united. Big majorities in all five job classifications say system/departmental stress is becoming a concern. Technical management types lead the way (84.1 percent) in making this assessment. And, not too far behind were engineering (78.6 percent), engineering management (73.8 percent), technical (70.8 percent) and management (64.5 percent).

The causes for this system/departmental stress can be found primarily from three factors. The top cause, as it was with personal stress, is not having enough resources to do the job right. And, similarly, the second most common cause is excessive indecision or "flip-flopping" by management. The third cause, say respondents, is that the staff is not trained properly to do jobs right.

While the fact that stress is on the rise comes as no surprise to those either in or out of the industry, what does seem alarming is that few cable companies recognize the problem, let alone are taking any steps to lessen its impact. According to this year's survey respondents, 80 percent said their companies are not taking any positive steps to reduce job-related stress.

Those who claimed their companies are instituting measures to reduce stress were asked to briefly describe what their company was doing in this regard. The answers, while varied, showed some companies are finally taking the situation seriously. Stress alleviators included:

"Developing self-managed work teams to provide ownership of the department."

"Training, time management. Appreciation - picnics, dinners, off-site activities."

"Employee Assistance Program (EAP). Stress management classes, wellness care, fitness center membership reimbursement."

"Stress counseling; training programs; graceful understanding about mishaps and

Figure 4: Average hours worked per week / overtime compensation b

Job Classification	Average hours	40-49 hours
Management	54.8 hours	20.0%
Engineering Management	52.2 hours	38.1%
Technical Management	50.1 hours	37.3%
Engineering	51.8 hours	38.4%
Technical	46.0 hours	62.5%

Figure 5: Technology/service deployment

	Still discussing	Decided to deploy
Activating reverse path	15.7%	42.2%
Cable modems	26.6%	35.7%
Advanced analog set-tops	12.6%	21.7%
Digital set-tops	28.7%	28.7%
TV-based Internet services (WorldGate, WebTV, etc.)	18.3%	11.3%
Digital ad insertion	12.6%	33.0%
Telephony	21.7%	12.2%
Rebuilding system	13.5%	50.4%

classification			
50-59 hours	60-69 hours	Over 70 hours	Receive extra consideration/ compensation for overtime? (% Yes / % No)
46.7%	26.7%	6.7%	31.0% Yes / 69.0% No
38.1%	16.7%	7.1%	26.2% Yes / 73.8% No
50.0%	11.8%	<1%	28.8% Yes / 71.2% No
38.4%	7.7%	15.4%	61.5% Yes / 38.5% No
33.3%	4.2%	0%	54.2% Yes / 45.8% No

errors resulting from stressful environment; increasing workforce; redefining work roles and responsibilities."

"We are splitting the crew and working four, 10-hour days alternating weeks. This gives them a four-day weekend every other week."

Making the right decisions

CED readers were also queried on what services or technologies their systems were deploying or thinking about deploying (see Figure 5). When it came to actually having bitten the bullet, more than half who responded to this question (50.4 percent) said their companies had decided to rebuild their systems. Of that total, nearly two-thirds (61.9 percent) said their systems were being rebuilt to 750 MHz configurations.

Other areas where operators had gotten off the dime and taken action included (in descending order) activating the reverse path (42.2 percent), cable modems (35.7 percent), digital ad insertion (33 percent) and digital set-tops.

According to survey respondents, their systems were still in the discussion stage on a number of technologies and/or services. The top five topics of conversation around the country, according to survey respondents, included (in descending order) digital set-tops (28.7 percent), cable modems (26.6 percent), telephony (21.7 percent), TV-based Internet services (18.3 percent) and activating the reverse path (15.7 percent).

Dealing with the powers that be

Survey respondents were also asked to rate their system's overall relationship with its franchising authority. While 3.2 percent believed that relationship to be "terrible," only 11 percent said there was "occasional trouble."

Just over a fifth of the respondents (20.1 percent) termed their relationship as "satisfactory." The biggest majority, 47.5 percent, typified their franchise relationship as "generally very good." And, nearly another fifth of the respondents (18.3 percent) gave their franchise relationship an "excellent" rating.

As a follow-up to the overall rating question, respondents were asked which issues tend to be most contentious between them and their franchiser.

Not too surprisingly, a whopping majority (71.9 percent) of the respondents said the number-one issue was rate increases. Pulling out ahead (32.9 percent) of all the others as the number-two issue was video service offerings, like the number of channels or programming. The third most vexing problem, according to *CED* survey respondents (noted by 21.9 percent), was the slow pace of deploying new services like high-speed data.

Putting training to the test

While respondents continued their call for increased training in other sections of the survey, the vast majority (92.9 percent) noted their employers had established policies for paying for job-related education or training outside of regular working hours. Of that majority, 85.7 percent said their employers would reimburse 80 to 100 percent of the cost of additional training taken outside the job.

A similar number (81 percent), said their employers provided on-the-job training as well. Respondents were then asked to rate the training they received in certain areas using a 1 to 5 scale (i.e., 1 being low, 5 being high). Of those who took job-related safety training, the vast majority (81.7 percent) rated that training satisfactory or above.

A common theme among the respondents was their frustration in trying to manage others. When asked about training in this area, nearly half (47.7 percent) said the training they received was very good. And, while over a quarter (25.6 percent) of those who took this training found it at least satisfactory, nearly a quarter (23.2 percent) also found it either unsatisfactory, or at best, only somewhat useful.

When it came to basic technical training, it was almost evenly divided for more than two-thirds (70.3 percent) of those who took such training and judged it to be either satisfactory or very good (34.8 percent and 35.5 percent respectively). Yet, among the technical job ranks, this same type of training was equally split (40 percent each) between those who found it either very good or better and those who found it only somewhat useful or worse.

Challenge free-for-all

One of the few open-ended questions in the survey asked respondents to list the three biggest challenges their systems face in the next 12 to 18 months. There were a wide range of answers, but a few topics did get the lion's share of attention. By far, worries over system rebuilds and upgrades dominated the replies on this question. Many related those upgrade concerns to the challenge they felt was being posed by competitors like DBS and MMDS services.

High-speed data rollouts and activation of the return path also garnered considerable attention. Motivation, morale and workforce levels was a topic triumvirate that appeared repeatedly in replies to this question. In fact, in a related question about workforce levels, respondents were asked whether their systems had increased, decreased or maintained their technical workforce level this past year.

Figure 6: Technical workforce levels

Increased technical workforce/ Avg. # positions added	*Maintained technical workforce*	*Decreased technical workforce/ Avg. # positions eliminated*
45.4% / +13	*35.3%*	*19.3% / -9*

Despite all the gnashing of teeth over no staff/no money concerns in this poll, as well as surveys in the past, 45.4 percent of the respondents replied that technical workforce levels had increased, by an average of 13 people (see Figure 6). Yet, more than half the respondents said their workforce totals remained static (35.3 percent) or were actually decreased (19.3 percent). Those systems that reported decreases, on average, lost nine technical workers each.

Can't get no satisfaction?

Finally, respondents were asked to rank their level of satisfaction in a variety of areas on a 1 to 5 scale. The areas they were queried about include: financial compensation, opportunities for advancement, job security, challenging/interesting work, overall employee environment, relations with supervisors/management, quality of equipment and/or tools, standard employee benefits (i.e., medical/life insurance, vacation, etc.) and employee "perks" and/or incentives (e.g., comp time, performance incentives, etc.).

When all the responses are averaged, it seems most respondents are on the same wavelength when it comes to what pleases them most. Four out of the five job categories find the challenging work in the industry to be its biggest asset. The sole exception are technical types who, on average, think their relationship with their supervisors/management is the biggest plus in their job.

In expressing their displeasure among these areas, the respondents, on average, fall into two camps. Management, engineering management and engineering types find opportunities for advancement to be the least desirable side of the business they're in. Technical management and technical types seem to think employee perks or incentives like comp time and performance incentives is where their job falls shortest.

Putting priorities in place

Throughout this year's survey, as it was readily evident in the past as well, cable professionals are pleading with the powers that be to get their respective operations in order. Simply put, they're asking operators to set a priority on people. It's not easy. It's not cheap. But by most accounts from those on the front lines, as well as those further up the cable feeding chain, operators are courting even more trouble if they ignore this plea and focus on technology alone.

As one upper management type for a large operator put it, shifting the workload to a static or reduced workforce for potential short-term gain with the deployment of new services solves nothing. "The very first asset that must be put in place," he says, "is people to run the business. Trying to add it (additional work) to the workload of existing folks will simply mean a poorly promoted business, as it will be in second place to the core business (of video delivery).

"Management (and I are one) must make the commitment to hire and pay the right people or be stuck with mediocre results. The new businesses are not a gold mine and actually will take a lot of hard work, intelligence and capital to develop. They will not (be) cash flow positive in year one, and it must be realized that they are not an add-on to the core business like PPV or new product tiers. They are separate businesses marketed to new and different residential and commercial customers." CED

Editor's Note: Special thanks to Gary Lemons who spent many hours hunkered over his computer entering and collating survey responses and statistics for this report.

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Reader Service 42

Proper care and feeding of the headend

More maintenance tips to ensure competitive quality

By Linc Reed-Nickerson, Product Development Manager, TV/Communications Test Business Unit, Tektronix Inc.

In the first part of this series, we looked at the performance expected from the headend, as well as some basic ways to better manage headend operations. In this part, we will discuss more ways to assure that picture and sound quality will be competitive with DBS.

The conclusion of Part 1 briefly mentioned the importance of maintaining proper levels. In fact, the three most important things to get right in a cable system are levels, levels and levels–RF levels, video levels and audio levels. Levels are the Holy Grail of cable TV. If the levels are right, it seems everything else will fall into place. Technicians working on a cable system are usually very aware of the importance of maintaining proper RF levels, beginning at the headend. Maintaining audio and video levels, however, is just as important.

***Figure 1:** The expected video sync and burst levels are shown.*

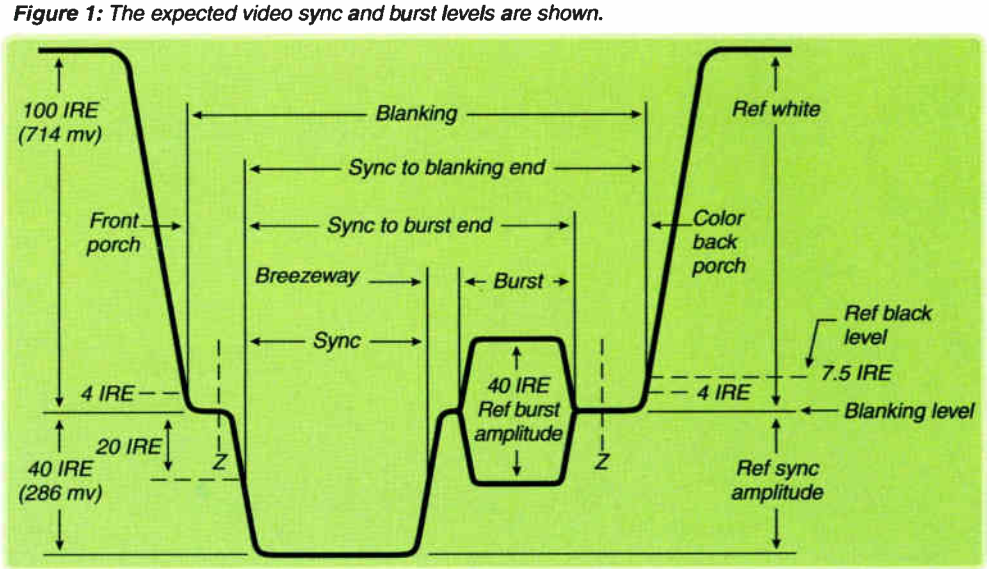


Figure 2: Shown is 87.5 percent depth of modulation using a demodulator with a zero carrier reference pulse on a waveform monitor.

Maintaining video levels

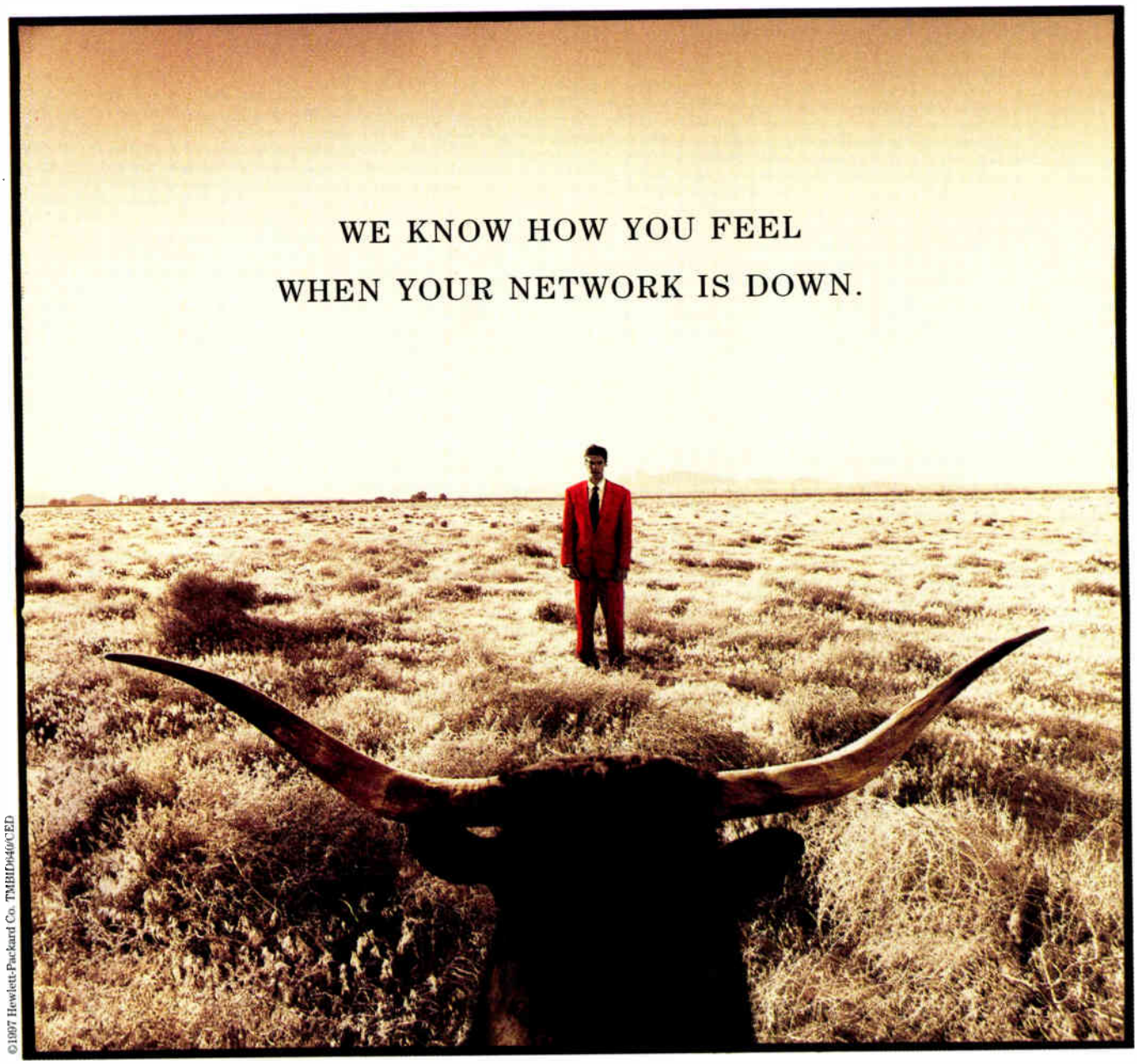
Equipment manufacturers have a specification for levels in and out. Video will almost always be 1 volt peak-peak (p-p). Audio is typically 0 dB across 600 Ω. Most equipment will have a level adjustment. Video levels are often only adjusted at the modulator when setting depth of modulation. Often, this is done without knowing the video level supplied to the input of the modulator, which is not good practice. Use a waveform monitor at the output of the satellite receiver or IRD to be certain 1 volt p-p is present (140 IRE units on the waveform monitor), as shown in Figure 1. Be certain that the correct level is being fed to a VideoCipher from a satellite receiver, and so on through the chain. Commercial inserters are looking for 1 volt, and usually have adjustments to balance the playback units so that all video is set for 1 volt. When you are certain you have 1 V at each point in the system, you can now adjust the modulator for 87.5 percent depth of modulation.

Remember, a low video level throughout the chain affects video signal-to-noise, which can result in a noisy picture. A low video level could also mean low depth of modulation, which can produce a "dull and lifeless" picture. The FCC baseband tests do not require making video noise measurements. You may have passing carrier-to-noise, but still have a poor quality picture because of noise present in the baseband video. A video level that is too high may cause clipping in the system which can result in a picture that is washed out and lacking detail in the bright areas. High video levels will often cause differential gain or phase problems, as well. When differential gain and phase measurements fail, it's often because of high video levels.

The misunderstanding about setting video levels properly is further compounded by failure to understand how to set depth of modulation. Unfortunately, many technicians erroneously assume the video level is correct if there is an indication that depth of modulation is set correctly. However, an audit of a number of systems indicates that depth of modulation is often not 87.5 percent.

Let's go back to basics. First, most cable TV headend equipment is designed to work with 1 volt p-p. In fact, consumer video equipment uses that as a standard as well. In video, as in RF systems, 75 Ω impedance is nominal; however, various types of connectors are encountered. Typically they are BNC, "F" fittings, or RCA jacks. Most cable techs are expert at making up "F" fittings, but RCA and BNC may present a challenge. The easiest, and most reliable, are crimp-type connectors. Several manufacturers make excellent connectors and crimp tools, but be certain you have the right connector for the cable in use!

RCA jacks always require a soldering iron and some care in making up. Beware of cheap RCA jacks. They can be just as bad as the cheap consumer "F" fittings that we have been working to eliminate for years. If you consider making up RCA and BNC connectors to be too challenging, there are a number of sources for pre-made cables. Again, watch out for inexpensive solutions. A long run of brand X cable with poor



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Reader Service 43

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connectors may degrade video frequency response.

That being said, let's look at how to set up video levels within a headend. The most important tool is a waveform monitor. First, be sure it is properly calibrated so that 140 IRE units equal 1 volt. You can use an oscilloscope in lieu of a waveform monitor, providing the scope has a TV trigger. Be certain the video signal is properly terminated with 75 Ω. Failing to terminate the video signal or double terminating it will result in wrong levels displayed on the oscilloscope or waveform monitor. Caution—some sets may not lock, which will result in the subscriber seeing a black-and-white picture.

If your satellite receiver is driving an external VideoCipher, you will still want to look at the output of the satellite receiver, but use the "IRE" setting on the waveform monitor to remove the high frequency components of the signal. VideoCiphers can get "flaky" if not fed the proper level. Next, check the output level of the VideoCipher. There is a multi-turn port for video adjustment. This is also a good time to check the VideoCipher bias voltage.

If you have commercial or cross-promotion

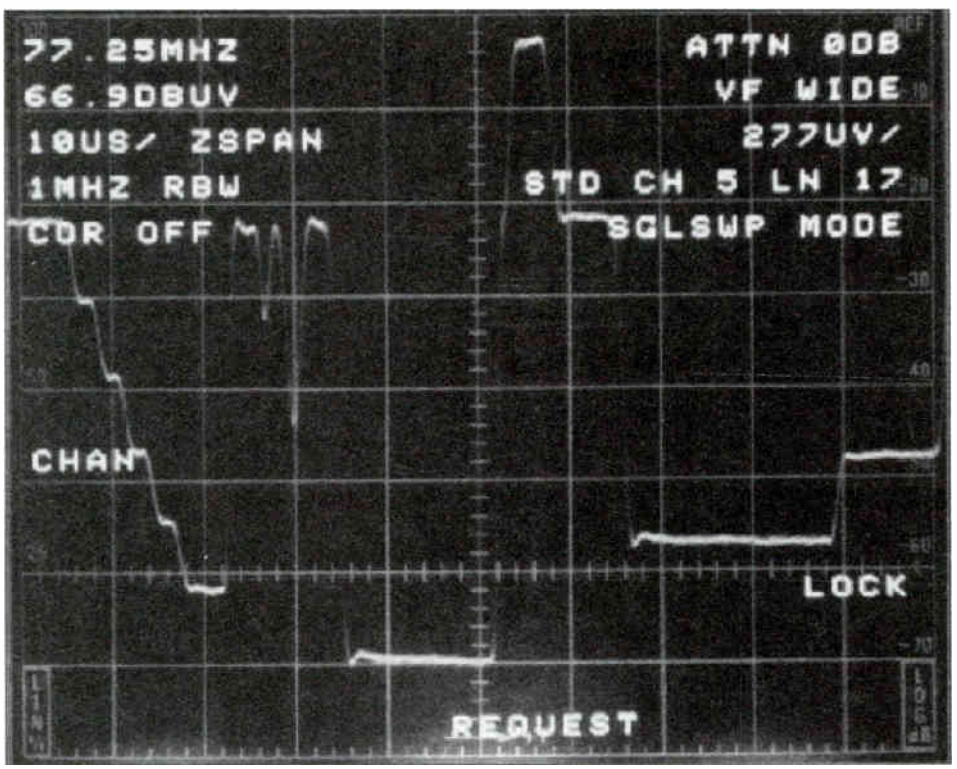


Figure 3. Shown is a depth of modulation measurement using a spectrum analyzer.

equipment is internally terminated. Check to see if the termination can be turned on and off by a switch, or if the termination is always on. Be sure you only terminate once. Now, look at the output of the satellite receiver and/or IRD. Be certain that the right level is available. Many receivers have a video adjustment. Unfortunately, some require removing a cover and some searching to make any adjustment.

When observing the video waveform, be certain that the sync, video and color burst levels are correct. Video should be 100 IRE units (0.714 Volts) and sync and color burst should be 40 IRE units (0.286 volts). In most cases, you only have control of the entire signal. If the ratios are wrong by more than 10 to 20 IRE units, the equipment may need to be sent out for service. If the color burst is too low, some insertion equipment, be sure to check levels here as well. This may require some balancing, as often playback devices will need to have levels set. There may also be adjustments within the insertor. Remember, use the satellite signal as a reference. If there is any other switching within the chain, check it for unity gain. Finally, see that 1 volt is getting to the modulator. These tests are easier if you have a waveform monitor with line select, and the source has VITS (vertical interval test signal). Use the FCC Composite or NTC7 Composite test signal white bar as your reference for the 100 IRE unit signal.

Not every channel has the VITS signals available, so you may have to use your judgment to make proper settings. Simultaneously look at the picture and the waveform monitor to make sure you see enough bright areas in the picture to properly determine that 100 IRE units of video are present. Checking the sync and burst level while adjusting for peak white is usually valid. If both the sync and burst levels are 40 IRE units, you're probably OK. If not, monitor the signal for a while to see if you can get the ratio correct. If you can't get sync, burst and video level ratios correct, you may have an equipment problem.

Once you have determined that 1 volt of video is being delivered to the modulator, it is time to set depth of modulation. You can use one of two methods to correctly set depth of modulation, either a spectrum analyzer or a demodulator with a zero carrier reference pulse (ZCP) and a waveform monitor. The demodulator must have a ZCP or you cannot use it for setting depth of modulation. Many of the considerations we talked about in setting levels apply.

First, let's clear the air on two common misconceptions about depth of modulation. The first is the belief that setting the modulation level until the red peak light comes on, and then backing it down is a good way to set depth of mod. It usually isn't! In fact, this practice only tells you when the peak clipper is active. If it is, and if you have a picture with enough white content, it can get close to the proper setting. But those are two big "ifs."

The second misconception is looking at the video output of a receiver or demodulator and setting it for 1 volt, but WITHOUT a zero carrier reference pulse. You must have a ZCP set to 100 percent or 120 IRE units, with tip of sync set to 0 percent or -40 IRE units as shown in Figure 2. Many waveform monitors are supplied with a graticule for setting modulation depth to make this easier. Now you can adjust the white bar on the composite signal or peak white video for 87.5 percent or 100 IRE units, and sync tip to -40 IRE units, and you will be correct. If you don't have a demodulator with a zero carrier pulse, use a spectrum analyzer in the zero span mode for setting depth of modulation.

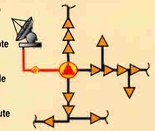
Most modern cable TV spectrum analyzers are equipped with a depth of modulation measurement or a way to get a video field or line. I prefer the line display if a VITS combination signal is available; the field display, if not. You can directly read depth of modulation by placing the tip of sync at the top of the screen and setting peak white to the first graticule from the bottom, as shown in Figure 3. Most spectrum analyzer displays have scales with eight divisions, so the value between the divisions is 12.5 percent. One division from the bottom is 87.5 percent (100 - 12.5 = 87.5). If you have wondered why the United States chose 87.5 percent instead of a round number such as 90 percent (used in some European systems), you now know the answer. The reason we don't modu-

1997-1998 Fiber Topologies Comparison

Fundamental fiber optic topologies for cable TV

Supertrunks

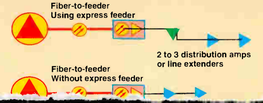
Transport high-quality video signals on a point-to-point basis. Examples include interconnects between remote antennas and headends, headend interconnects for program sharing and multiple system interconnects for advertising insertion. Also could be used to provide route diversity for data delivery, personal communications, alternate access, etc.

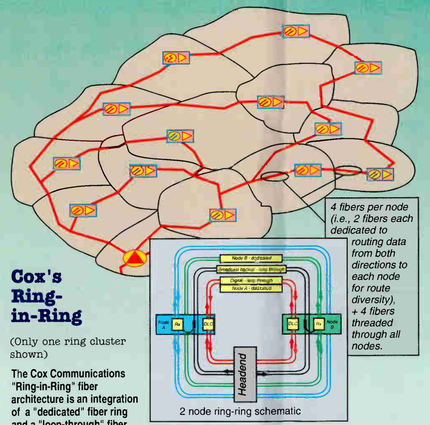


Fiber Backbone

Used primarily to reduce length of broadband amplifier cascades to improve carrier-to-noise ratio and distortion performance while reducing network maintenance. Designed for system upgrades and rebuilds to higher bandwidths. Defined by Time Warner Cable as having fewer than four amplifiers in cascade on any trunk run.

Hybrid Fiber/Coax

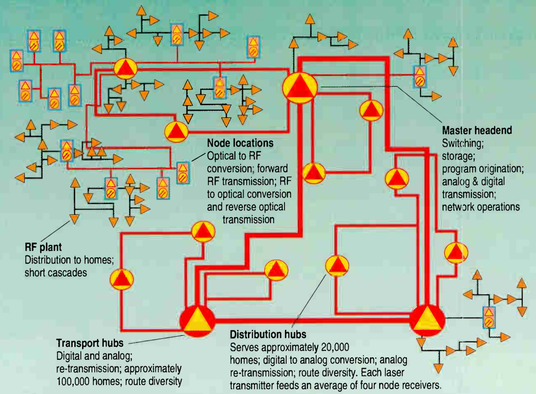




Cox's Ring-in-Ring

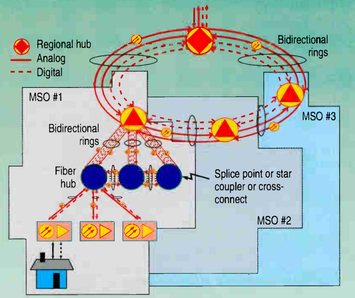
(Only one ring cluster shown)

The Cox Communications "Ring-in-Ring" fiber architecture is an integration of a "dedicated" fiber ring and a "loop-through" fiber ring that gives cable operators a highly reliable and flexible network for the future. By using diverse routing and redundant electronics, it can provide uninterrupted video, voice and data service to a fiber node in the event of a fiber or electronic component failure. The dedicated ring carries video to individual nodes, providing "broadcast" as well as programming and data targeted to an individual node. The loop-through ring interconnects the nodes in a series fashion, delivering voice and data using an "add-drop" technique. The network is flexible enough to allow subdividing nodes into smaller serving areas as demand for these new services results in the need for greater bandwidth.



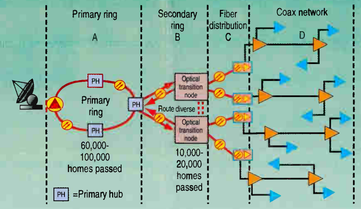
Time Warner Cable's Residential Network Architecture

Time Warner Cable's Residential Network Architecture is designed to deliver analog video, voice and digital video and data services to customers. The architecture has been designed to allow a great deal of flexibility to expand the capacity of the network without adding significant amounts of additional fiber, and without the need to reconfigure the RF/coaxial portion of the network. In addition to the network illustrated, it is common for a second network, designed and constructed for business users, to share some of the routes and facilities shown in this diagram. Note: the combination of a node transmitter/receiver and the RF plant it feeds are typically referred to as HFC (hybrid fiber/coax) or Fiber Rich.



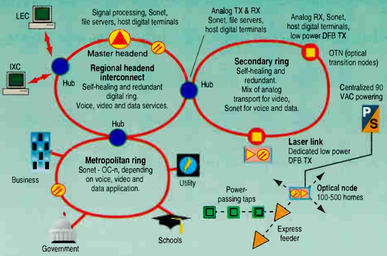
CableLabs' Structured Network Architecture

Designed by Cable Television Laboratories to accommodate a variety of network concepts to avoid making any existing networks obsolete while providing an incremental upgrade path. Topology includes centralized "regional hub" to share the cost of advanced television and communication equipment among several operators as well as secondary fiber hubs. Connections between central headend and fiber hubs, as well as hub-to-hub interconnects, provide "virtual" ring capability and route diversity. Passive coaxial distribution to the home (made possible with in-home amplification) improves reliability of the network.



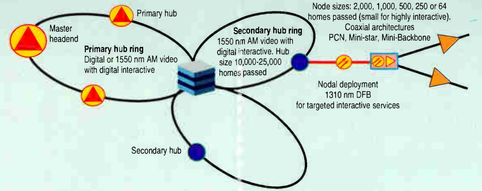
TCI's Dual Ring Star/Bus

The network is best described as a scaleable architecture that is configured as a dual ring, star/bus. The primary ring (A) is either a Sonet-based or a proprietary-based digital technology. It feeds a route diverse Super AM ring for the secondary fiber network (B). In some markets this ring will also employ Sonet technology. The fiber to the serving area network (C) feeds scaleable optical nodes. These routes are selected so that a fiber cut cannot affect more than 4,000 homes passed. These nodes in turn feed RF buses that are limited to 300 homes passed. Each bus is configured so that it can be activated as an individual node.

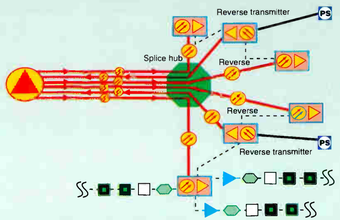


ANTEC's Point-to-Multipoint Systems

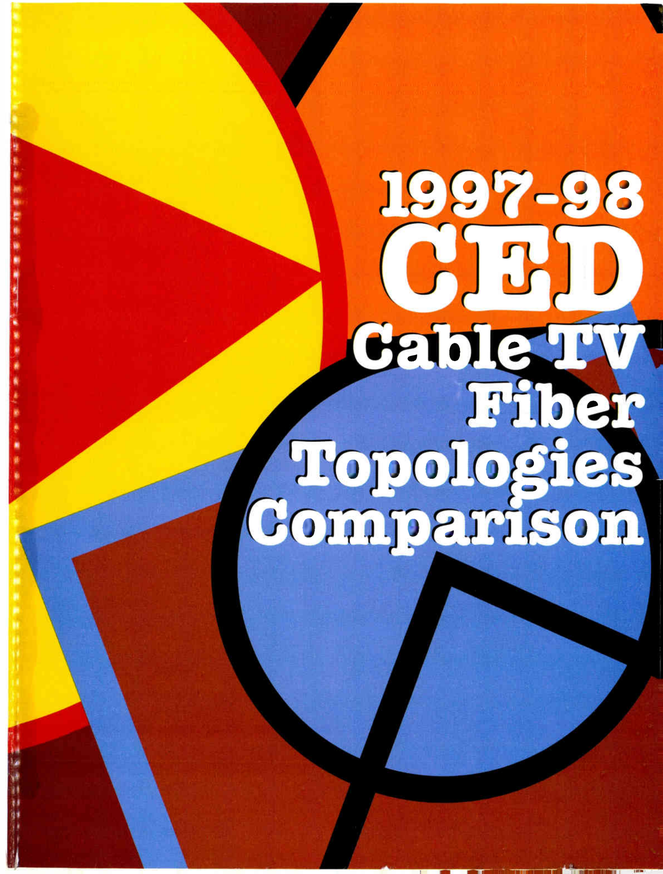
Existing headends are interconnected via a self-healing redundant digital ring. The first stage of the ring might encompass a mixture of LPCM and/or 1550 nm equipment for analog video, and Sonet for voice and data transport. As video programming is received in a compressed digital format, the MPEG video signal is mapped onto the Sonet ring along with voice and data and transported to the hubs and onto the optical transition nodes. At the hub and OTN, basic video services are converted back to analog and combined with digital video, voice and data services and transported to the optical node with a dedicated low-power DFB laser. The distribution system utilizes centralized 90 VAC power supplies and power-passing taps to power the NIDs. LECs and IXCs are interconnected to the headend for voice and data services. A metropolitan ring is also interconnected to the regional headend interconnect for interaction with schools, business, government and utilities.



Scientific-Atlanta's Metropolitan HFC Network With Upgrade or New Build Coaxial Architectures



Adelphia Cable's

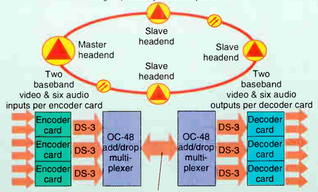

1997-98
CED
Cable TV
Fiber
Topologies
Comparison

2 to 3 distribution amps
or line extenders

Originally designed for complete system rebuilds, now used increasingly in upgrades. Replaces nearly all coaxial trunk cable with fiber cable. Reduces amplifier cascades to no more than three active devices, typically. Coaxial "express" feeder serves area immediately adjacent to headend and optical receivers. Concept originally termed Fiber Trunk and Feeder by ATC engineers. Also known as All Fiber Trunk and Fiber to the Bridger.

Basic Sonet For Video

Diagram provided by NextLevel Systems Inc.



A fully loaded OC-48 transmits up to 96 analog channels.

Legend

- Headend
- Fiber node
- Bridger
- Fiber cable
- Secondary hub
- Line extender
- Coax cable
- Trunk or distribution amp
- Splitter
- Cluster tap (64 port)
- 8 port tap
- Standard tap

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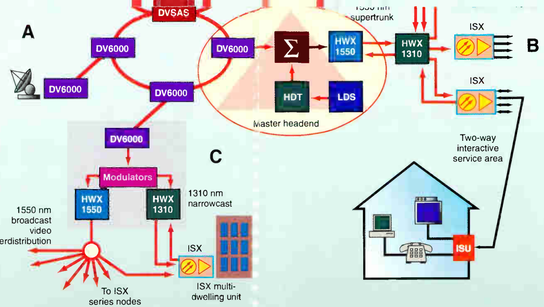
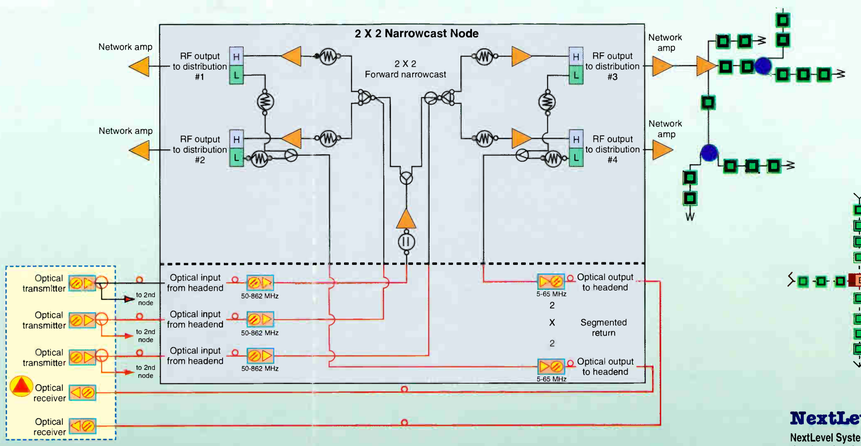


ADC Telecommunications' Full Service HFC Architecture

ADC's full service HFC architecture is designed to be "future-proof," offering service providers the opportunity to build a network for today and expand as business conditions dictate tomorrow.
A. A Sonet network feeds a DV6000 digital ring, connected to a second DV6000 ring via the DV6000 synchronizer and switch (DVSAS). Signals are then modulated, combined with telephony signals from the local digital switch and fed into the HWX 1550 transmitter for a 1550 nm supertrunk out to a hub receiver in another HWX shelf.
B. The HWX 1310 nm transmitter sends the optical signals to the ISX series optical distribution nodes. Inside the nodes, optical signals are converted to electrical signals and distributed to the customer sites via coax. If needed, the ISX nodes can be configured with reverse path transmitters to send return path information back through the node on to the headend for processing or redistribution. For areas of high demand, the return path can be split, doubling the available return path bandwidth.
C. This area features a DV6000 digital supertrunk out to a remote hub site. Signals are modulated and retransmitted via 1550 nm broadcast video superdistribution directly to the neighborhood ISX series nodes. A 1310 nm HWX transmitter overlays signals to a second receiver inside the ISX node, offering narrowcasting to areas where demand dictates.

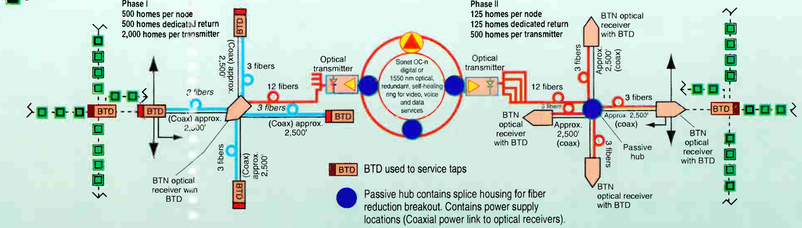


Philips Broadband Networks' Diamond Telecommunications Network

This architecture is designed to optimize the deployment of targeted advanced access services. The optoelectronic node accommodates forward-path narrowcasting and reverse path segmentation, enabling broadband operators to target specific services in the forward path while increasing the network's return bandwidth availability per subscriber. Increased return bandwidth is accomplished using two transmitters in a 2x2 configuration to provide cost-effective reverse-path segmentation capabilities.

Passive Coaxial Network

Designed by Adelphia Cable Communications engineers to be a cost-effective method of eliminating all active components from the cable network, the true passive architecture places a node every half-mile or so, while the modified design, above, covers 1.5 miles of plant per node on average.



NextLevel Systems Inc.'s Broadband Telecommunications Architecture

NextLevel Systems Inc. provides an integrated end-to-end system solution. The highest layer of the network architecture can be a Sonet digital transport platform specifically developed and optimized for cable TV video applications. 1550 nm transport is also an option for an optical ring that is self-healing and provides redundancy for the transport of video, voice and data services.
The BTA architecture was specifically developed to minimize initial installation costs while redefining system operational capacity without relocating devices or re-cabling.
The architecture is shown in two phases serving as many as 500 homes per node and as few as 125 homes per node. The BTA offers low active counts and flexible migration paths for both forward and reverse services. NextLevel's Broadband Layered Architecture Strategy to Enhance Reliability (BLASTER), while not depicted here, is another step in our evolution of the HFC network.

Star Light, Star Bright, This is Who I Really Like

Call for Nominations 1998 Polaris Award

For the past five years, when it comes to the deployment of fiber optic technology, the Polaris Award has been the guiding light in the broadband communications industry. We'd like your help in pointing out the star that you feel deserves this high honor this year.

Nominations are now being accepted for the individual you think has displayed remarkable commitment, dedication and innovation in the aggressive deployment of fiber optics technology in the industry.

Considering the high caliber of individuals who've won in the past, we're certain there are other dedicated professionals who belong in their stellar ranks. Please fill out and mail or fax the card below NO LATER THAN FRIDAY, SEPTEMBER 26, 1997.

Former Polaris Award Winners

Tom Staniec - 1993

As director of engineering for NewChannels Corp., Staniec earned the first Polaris Award for his innovative design and implementation of fiber networks for alternate access, distance learning and service for rural cable television networks.

Jim Ludington - 1994

Serving as Time Warner's vice president of technology, Ludington received the Polaris Award in recognition of a decade's worth of work pre-engineering and installing "thousands" of sheath miles of optical fiber in some 20 TW divisions, including its Orlando-based Full Service Network.

Hugh McCarley - 1995

McCarley's work as Cox Cable Communications Inc.'s director of corporate engineering, where he was closely involved with the design, construction and implementation of the company's national fiber deployment, including it's innovative Ring-in-Ring architecture, earned him the 1995 Polaris Award.

John Brouse - 1996

As Jones Intercable's director of network development, Brouse's instrumental work in the design and deployment of Jones' creative fiber optic architectures in Broward County, Fla. and Alexandria, Va. put the coveted Polaris Award on his mantel in 1996.

Oleh Sniezko - 1997

Sniezko earned his fiber credentials working for two innovative MSOs, Rogers Cablesystems Ltd. and TCI Communications Inc. As director of transmission engineering at TCI, Sniezko was singled out for Polaris honors as a "next generation" fiber innovator for his work in developing optical fiber cable standards and manufacturing requirements.

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Mail or fax (303-393-6654) your nomination by September 26, 1997. (Please type or print clearly)

Nominee's name _____ (For additional background on nominee only. Anonymity will be respected if requested)

Title _____ Your name _____

Company/MSO _____ Co. Org. _____

City, State _____ Tele _____

Tele. _____ E-Mail _____

Brief description of nominee's contributions in fiber optic deployment _____

Figure 4. Lost elements on an antenna can degrade its performance, not only in gain, but in frequency response as well. Note the missing element on the top antenna.

late to 100 percent like AM broadcasters is that TV sets use the visual carrier as a reference for both picture and sound. If you modulated to 100 percent (or higher), the carrier could go to zero at peaks. Loss of carrier will cause a buzz in the audio in intercarrier TV sets.

Improving off air reception

Another area where many headends that are in otherwise excellent condition fail to perform as well as they could is receiving off-air signals. You can take several steps to improve off-air reception. At the top of the list, which is usually somewhere near the top of the tower, is the antenna system. There has been a lot of dialogue on the Internet cable TV list relating to degraded performance because of antenna damage. One operator could not get the visual-to-aural carrier ratio correct from a broadcast station. A check with the broadcaster indicated he was operating properly. Further investigation, standing on the ground and looking up at the antenna, revealed that a number of elements had been lost in a storm. Lost elements (Figure 4) degrade the performance of an antenna not only in gain, but in frequency response as well.

Be certain your off-air arrays are both properly oriented and working properly. This includes making sure phasing harnesses are correctly installed on multiple antennas such as diamond arrays. One operator was never able to achieve near the projected signal level from a station that was important to his system–a station that carried the popular sports team. The signal, even with a preamp, was poor. Investigation revealed the harness on the array was not properly installed when the antenna was erected. Once changed, the signal level was as predicted.

When making calculations, it is always a good idea to be certain the signal level at the connector at the processor or demodulator is what you expect, taking into consideration line loss. About once a year, check that the level has remained constant. If you have a tower that gets climbed frequently, be sure no damage has been done to the feedline from the antenna. This type of damage happens all too often.

Antenna orientation is important. Don't just point for maximum signal. Use a TV set to view the picture and a waveform monitor to look for the best chroma-luma delay if a VITS signal is available. Monitor the 12.5T modulated pulse in the FCC composite test signal. Try to achieve a nearly flat base on the pulse to minimize both gain and delay problems. Make sure the top of the 12.5T pulse is the same level as the white bar. Figure 5 shows the effect a faulty antenna can have on the 12.5T pulse.

Most processors and demodulators will have an optimum operating range, as specified by the manufacturer, which is usually -20 dBmV to +30 dBmV. It is important to be within this range. Too much signal can be as bad as too little. 0 to +10 dBmV will usually provide optimum performance. Don't be afraid to pad the input if the level is on the high side. If you are importing a signal from a distant market, you may need to use a channel filter or preselector if there are strong local signals on adjacent channels. This is especially important if you are using any preamplification.

Low band VHF suffers from impulse noise and seasonal co-channel interference in many locations. Endless battles with power companies usually result in only temporary fixes. Co-channel interference is a weather phenomenon we can't control. Some equipment manufactured today can significantly reduce the problems, but may add artifacts to the picture. Following the manufacturer's recommended practices will minimize the artifacts. Most subscribers don't see the artifacts, but they are very quick to call about the impulse noise or interference. As subscribers become more sophisticated, especially as they become accustomed to the quality of digital services, complaints about artifacts will probably increase.

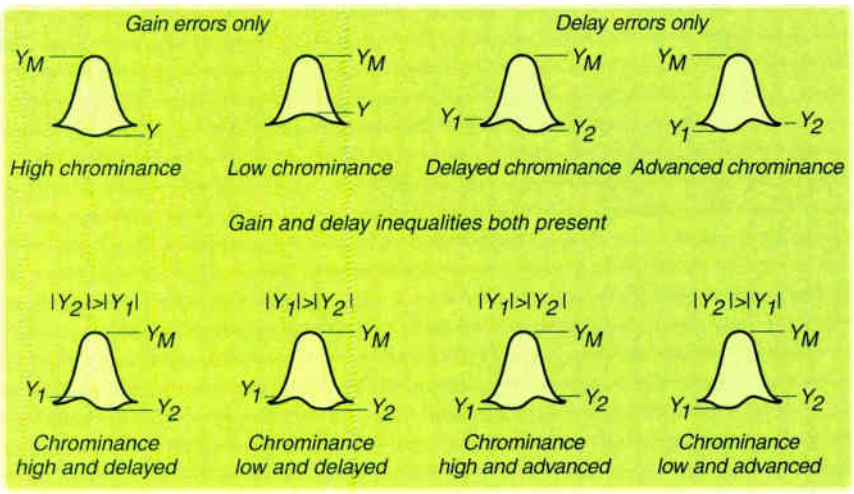
One last item. Every headend should have a "search" antenna, a good quality UHF/VHF antenna located on the tower or separated mast with a rotator. This can be a life saver if there is damage to a main receiving antenna. The "search" antenna can verify that the station is on-the-air if you aren't sure if you have a processor problem. If the TV receiver attached to the search antenna has audio and video output, it could be used in an emergency to feed a modulator, keeping a signal on the system in the event of a processor/demodulator failure.

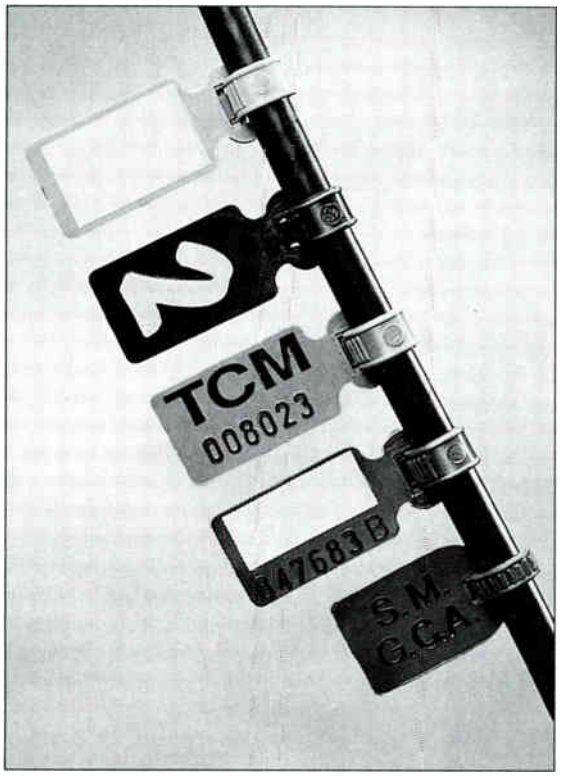
A number of the good practice issues we have talked about for off-air also apply to satellite. A bit of fine tuning here can result in better pictures and sound. Be certain feeds have not deteriorated, and the coax and connectors are in good condition. I've found more than one filled with water! Also, it's a good idea to use redundant power for your *LNBs*.

These are a few suggestions to make your video as good as the competition's. There are many effective procedures that can be used.

We'll talk about quality audio in the next installment. CED

Figure 5: *An improperly oriented or damaged antenna, or a poor feed line can cause distortions in the 12.5T pulse.*





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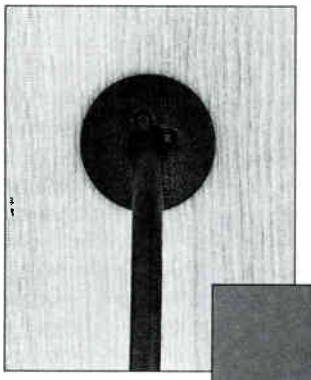

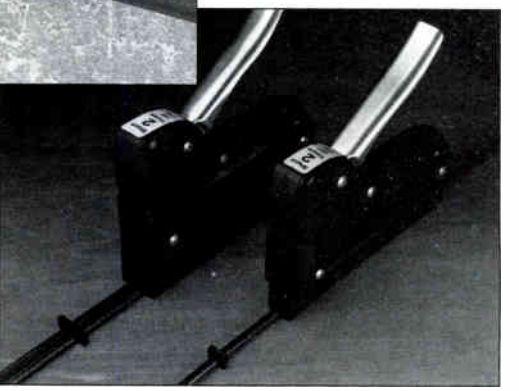

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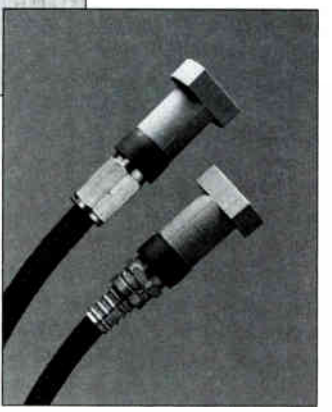

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Cracking into the lucrative commercial market

Cable MSOs can compete, Part 1

PHOTOGRAPHY BY MARK SIMS

By Leo A. Wrobel, CEO and President, Premiere Network Services Inc., premiere@dallas.net

Recently, executives from a defense systems company which was busily reengineering its business by beating its swords into plowshares, showed off a new box which they were quite proud of. After being asked what the box did, they explained, "This box delivers TV programming on twisted pair telephone cable, or, it delivers telephone service on coaxial television cable. We are ready for whoever wins the fight."

While amusing (and true), this shows that the battle lines are now being drawn between cable and telephone providers, who are laying the groundwork to raid each other's territory. The ultimate result will be an industry shake-down, the likes of which has not been seen for years.

This article is geared toward enlightening the reader as to the trends which will bring these changes about, and how to position a cable services provider to garner the maximum advantage from this once-in-a-decade opportunity.

The Telecommunications Reform Act of 1996 is the catalyst that started it all. This piece of legislation will be remembered for bringing about the most far-reaching changes in telecommunications in the 12 years since the AT&T breakup. Volumes can be written about this legislation alone. For purposes of this article, however, these are the most germane portions of what the legislation will change.

✔The telephone companies (telcos) will be allowed to raid each other's territory. It will be possible, for example, to get GTE service in Southwestern Bell territory, or Ameritech service in BellSouth territory, etc.

✔Long distance carriers are being allowed back into local telephone services. Already, people are signing up for AT&T and MCI local telephone service. Conversely, GTE has already signed up more than a million long distance customers.

More important to you, cable companies are entering the telephone business. One market already being exploited in many areas is the "multi-tenant sharing" arena, where apartment buildings and high rises are being wired for not only cable TV, but telephone service as well. Likewise, however, the telcos are being allowed to provide cable TV service. Already, AT&T and others are marketing "DirecTV" mini-dishes, and cable companies are marketing ultra-high bandwidth Internet connections and data transmission services. Dozens of cable companies are filing for telephone certification in all 50 states, and the battle for customer control is underway.

These items only begin to scratch the surface of everything that is in the new legislation; however, they stir interest among technol-

ogists, particularly in the areas of new, cheaper and faster services which competition will bring. It will be quite a ride. Ten years from now, there may only be three phone companies, and it might be quite a surprise to see who the survivors are. Imagine if the big three turn out to be AT&T, British Telephone and Disney, for example. Sounds crazy, but it's possible.

Cable television providers will be well-situated to tap much of the market, primarily because they already have high bandwidth into a large percentage of households. Even so, there are formidable obstacles, including immature network diagnostic tools, and a distribution network which is often one-way only. Cable is under increasing competitive pressure at a time when it must make major capital investments. It's difficult to think about capitalizing expensive telephone switching equipment, for example, when competition from direct broadcast satellite dishes lures away premium customers. Nonetheless, money is exactly what will be required, but combined with customer-oriented packaging and marketing savvy which produces quality, high bandwidth services customers will buy.

Don't expect the telcos to sit by idly while this happens. Already, the telcos are exploring competitive offerings to meet the cable challenge head-on. Know your adversary. The telcos are planning a broad range of widely-available services which are designed to compete head-to-head with cable for the hearts, minds and wallets of customers. These include:

ISDN

Integrated services digital network is a 15-year-old standard for carrying two 64 Kb "bearer" channels, which can be used for data or voice, along with a single 16 Kb "delta" channel for signaling and other data. That's why you often hear of it referred to as "2 B + D."

Because ISDN requires only the same old copper wire that's already out there, but carries a digital signal, ISDN will be the vehicle (for the telcos at least) which brings digital technology to the masses. ISDN installations are skyrocketing, primarily because of the Internet. The Internet has been the principal "killer application" that has finally brought ISDN to life. In many parts of the country today, the local telcos are doing a land office business in this technology. And why not? Having an aggregate of about 128 Kbps is at least five times faster than the swiftest modems on the market today.

In addition, a user can also talk over one B channel, and send data at 64 Kbps over the other. Indeed, the ability to switch ISDN service almost anywhere via the public telephone network, and the fact that it can be a replacement for regular telephone service (as opposed to an add-on service) are two of its biggest selling points.

Using ISDN, true collaboration can take place between remotely situated users. The user can point to items on a screen using a program package like Intel Proshare, while conversing with the other user at the same time (over the second B channel). This is possible with modem technology as well, but it can be clumsy and slow at modem speeds. Additionally, anyone using H.320 compliant video equipment can send moving images at speeds as low as 64 Kbps. At that speed, they are not really high quality, but are passable, especially when reduced to a small matchbook-sized window on the user's screen. At 128 Kbps, with today's compression technology, the picture is not network broadcast-quality, but does not look bad at all for desktop conferencing applications.

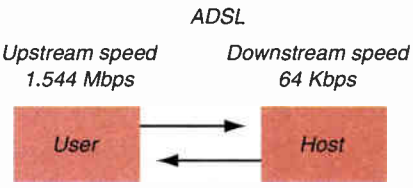
Needless to say, traditional Internet and BBS (bulletin board system) file transfers are a breeze in comparison to modems.

ADSL

What better service to a copper-rich local telephone company than one which utilizes copper? ADSL is the most direct response the telcos have to a cost-effective network solution which rivals the bandwidth of coaxial cable. Indeed, one of the major advantages to this technology is the fact that it can use the same old copper wire which delivers local telephone service for high-speed data. ADSL, or asymmetric digital subscriber line, gives telephone companies a shot at the high bandwidth market previously thought to be the exclusive domain of cable companies.

Because ADSL uses the same telephone facilities as traditional telephone service, it allows use of existing analog modems, fax machines and telephones while maintaining a high-speed data connection at the same time. ADSL does this by carrying three separate frequencies over the same line. The first set of frequencies carries the subscriber's telephone service, while another carries a 16 to 640 Kbps data signal (depending on the product utilized) for upstream information from the home to the connection point, such as the Internet. The third signal is a high-speed, downstream connection, which runs anywhere from 1.544 Mbps up to about 9 Mbps.

Figure 1: *Emerging services*



- *Standards still emerging*
- *Limited availability*
- *50 times faster than 28.8 modem*
- *10 times faster than ISDN*
- *Cheap–$60 - $100 (US West)*

ADSL is asymmetrical; that is, it is a higher speed connection in one direction than the other. That makes ADSL potentially the telcos' "poster child" for Internet access because users typically download much more information from the Internet than they transmit to it. Using ADSL, a 64-Kb channel is used to "request" a download, which can be made at speeds of 1.544 Mbps or higher. ADSL could in fact be the Websurfer's dream, providing the equivalent of a T-1 or better into the home or small office.

Therefore, think of ADSL as a small pipe for delivering requests, combined with an ultra large pipe used for receiving the requested information. It can be cheap, too. US West is reportedly pricing ADSL at between $60 and $100 per month, including POTS service. It's also easy for the telco to deploy because it works on regular telephone wire-pair cable. Expect this service to drop significantly in price to a level approximating a phone line, because that's about all it ultimately costs a telco to deploy it.

To use ADSL, a user must purchase an "ADSL modem." A typical unit has three connectors. The first, of course, would go to the telephone company interface. The second is a standard RJ-11 telephone jack used to plug in the phone. The third is an RJ-45 Ethernet connector, which connects the service to the per-

sonal computer or local area network. In other words, users can simultaneously access their traditional telephone service and a high-speed Internet connection.

These modems are expensive today ($1,200) but are expected to drop in price as they proliferate. A number of field trials are underway at this time. For example, GTE in Dallas has launched one of the most aggressive trials of ADSL service, locally in public libraries, bookstores and with some GTE employees. The equipment currently being tested will transmit at speeds from 64 to 500 Kbps and receive at speeds of 1.5 to 4 Mbps. Higher speeds are possible, however, with speeds of up to 9 Mbps available soon.

Emerging services

✔VDSL. For the truly bandwidth hungry, another similar technology referred to as VDSL (very high data rate subscriber line) promises even higher speeds. VDSL can operate at rates of between 13 and 55 Mbps, but distance limitations are more of a factor than with ADSL. In the case of VDSL, a subscriber loop can only be approximately half the distance as with ADSL. Present technology limits the distance of ADSL to about 12,000 feet from a telephone company central office. This distance is greater than the maximum distance T-1 lines allow (6,000 feet), but less than that for ISDN (18,000 feet).

Expect initial deployments of both VDSL and ADSL to be bundled with equipment packages by the telephone companies. That's another thing they are allowed to do under the liberalization of the regulatory picture. For example, many of us envision a "video jukebox" service whereby a customer can deliver up to four television signals, simultaneously, on a DSL link. The link would always have access to up to 200 channels of programming, but would cut the bandwidth required by only carrying, for example, the last four channels the subscriber watched. The slower upstream data channel would signal the equipment at the telco to send down another channel on demand. Sports events could take on new dimensions by allowing the user to view the football field, the view from the blimp, the announcer and the cheerleaders all at the same time, on demand, on a single VDSL link.

Cable's response

With the entrance of cable companies into the telecommunications business, one of the first offerings will be ultra high-speed data connections available on a broad basis. This is not to say the market is there for the taking, or that things are rosy for the cable companies. Competition to these companies from the satellite dish dealer is acute, and it cuts right into the cable companies' core business. For this reason, cable can be expected to embrace non-traditional technologies such as data services and telecommuting, which will encourage users to utilize their service. Like the telcos, high-speed Internet access may be one killer app they are looking for.

Cable modems are not exactly new: In 1985, the author ran T-1 traffic over local cable TV facilities

Cable modems are an area of promise for the telecommuter and small office as well, because many homes and small offices have access to cable television facilities. The cable modem concept is not exactly new: the author personally undertook a project in 1985 to run T-1 traffic over local cable television facilities. At that time, Scientific-Atlanta broadband cable multiplexers were used to take a 750 kHz segment of cable bandwidth and insert a T-1 circuit on it. This is, of course, the equivalent of stone knives and bear claws in comparison to what is available for equipment or under development today.

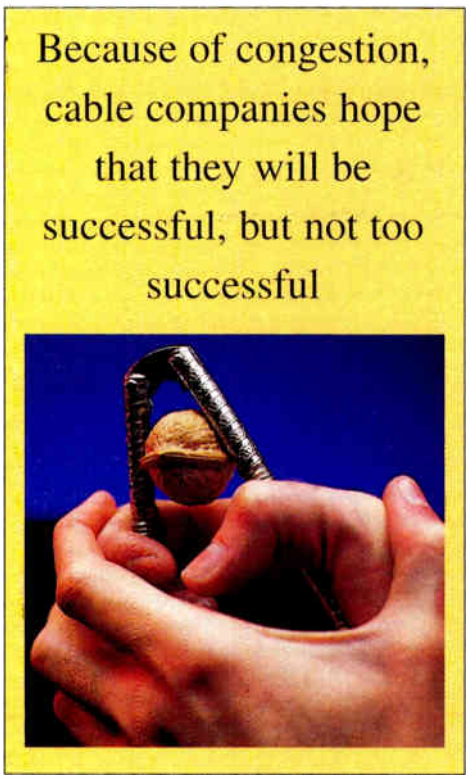
Over the years, other commercial users have attempted the same, but the ability for a homebound user to order a data circuit was virtually impossible. You had to be a large user, and even then, it was difficult. And even for large users, results varied, and horror stories abounded.

In the example described above, the T-1s carried by the cable television franchise had a

very good service record for the three years they were utilized. Other subscribers who made similar efforts had more dismal results primarily because the quality of cable systems (and attendant support and troubleshooting systems) vary greatly by company and by franchise area. For example, sometimes a cable company isn't staffed to provide 24-hour support. That kind of service is optional for a TV watcher, but absolutely necessary for a data service user.

Other times, the cable systems are only set up for one-way transmission. Two-way amplifiers are an expensive upgrade. Support systems and troubleshooting tools also lag. These are all still issues. What is changing, however, is that the cable companies are hitting these concerns head-on with massive spending to upgrade their networks, add data capabilities, add telephone switches and bag the lucrative data service customer. They are also filing "COAs," or Certificates of Operating Authority, in most all states to compete head-to-head with the local telephone companies. In many, they are already approved. This is occurring while their revenues decrease because of satellite competition.

Sophisticated cable modems are making a comeback today, in part because of regulatory changes which allow cable television companies to get into the telephone business. The concept behind the cable modem is still essentially the same as it was years ago, in that it takes a specific frequency range in the cable spectrum and runs data over it. However, cable facilities have a much higher bandwidth than copper facilities, so speeds of multiple megabits per second are possible. This is cable's biggest advantage, and one which must be fully exploited.



One popular cable modem today, Motorola's CyberSURFR modem, transmits at 768 Kbps but receives at full Ethernet speeds of 10 Mbps per second. One of the best uses of cable today is for receiving large files from the Internet. At least, that's where the manufacturers of cable modem equipment are putting their money. Cable modems are being deployed with an Ethernet card on one side that connects to a local area network or personal computer. As far as the computer is concerned, it is hooked directly to the Internet via an Ethernet cable. In fact, it's not even necessary to dial a telephone number. The user enjoys speeds varying from 500 Kbps to 30 Mbps, which far surpasses anything else available, at least at the time of this printing. The same facilities, presumably, will be used to deliver television programming, interactive games and telephone service. Quite a tough package to beat, if deployed correctly.

Direct satellite service

Cable is not alone in the high bandwidth business. Direct broadcast satellites are one-way devices, just like cable. However, scenarios are already being devised for a low-speed data channel to an Internet service provider where an ISDN or standard telephone can act as the "upstream" channel and trigger data downloads of multiple megabits per second using a high-capacity satellite link as the downstream channel. The pricing dynamics of this scenario would be awfully tough to be beat, because there is no investment for outside plant. The only investment, again, would be in the small satellite dish to go on the roof of the user. These are up, running, and available at the time of this printing.

Cable engineering pitfalls

Typical cable systems serve between 500 and 2,500 homes per fiber node. A typical TV channel, used strictly for data, will deliver gigabytes of data to hundreds of individuals with Ethernet quality throughput. However, as users begin to proliferate, bandwidth and congestion problems can be expected. This has already been experienced in some universities where dormitory buildings are wired for high-speed access, and the resulting congestion problems cause

throughput to the user which is not a whole lot better than a 28.8 kilobit modem.

This puts the cable companies in the position of hoping that they will be successful, but not too successful. Think about it. The telephone companies have had 120 years to learn how to traffic-engineer their networks, yet they still get caught with their pants down when anomalies cause network congestion. There will be a learning curve for cable in this regard as well.

Cable modems, being fairly new technology, differ significantly in their data transmission specifications. Modems from different manufacturers are most often incompatible. This is a concern if a user moves to another city, for example. It would probably be necessary to lease another cable modem from that local cable company. Standards are on the way, however.

Think about it–one day you might be tuning into the "Internet Channel" on your television set. Some problems do stand in the way, however, in deployment of cable modem technology, including financing. Some cable companies are experiencing severe cash crunches today, yet are being forced to be make major capital investments to provide data and telephone services, all while revenues from their mainline operations are falling. All the more reason to work smarter, and tailor services to cash-rich high profile users.

With regard to cable-based data connectivity, a few hurdles exist before high-speed connections are commonly available from cable television companies. One hurdle is centered around training. Just as the phone companies are struggling with providing ISDN and advanced data services, cable operators also must come up the learning curve regarding sophisticated data services. Lastly, there are technical support hurdles.

While it will be at least months and perhaps years before cable modems are available in your local retail store, access to the 'Net will become a major catalyst in driving the success of exciting high bandwidth solutions such as these.

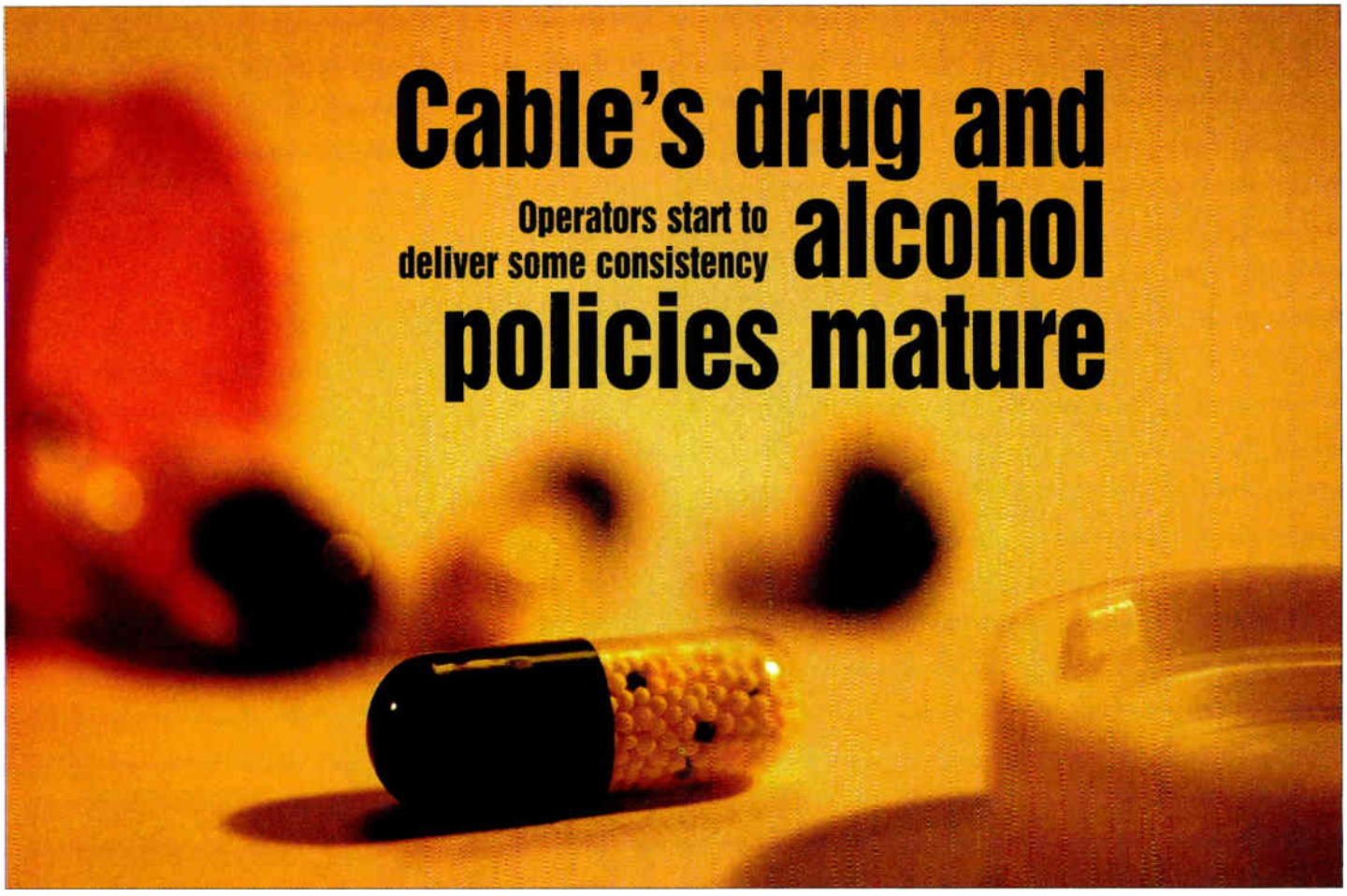
ADSL and VDSL face similar start-up problems, combined with a natural trepidation on the part of the local telephone companies to embrace an expensive technology which may be easily made obsolete by competing technologies. ISDN is a safe bet for now, because it is relatively inexpensive for the local carriers to deploy. ADSL and VDSL can be easily eclipsed by cable modems and other media. Look for a slow, cautious, but steady rollout of these services. Remember, ADSL and VDSL are copper-based and also relatively inexpensive to deploy.

Direct broadcast satellite systems are yet another wild card. It is quite feasible to use a landline to an ISP (Internet service provider) to initiate requests for downloads beamed in by satellite at speeds eclipsing even the fastest cable modems. It is simple technology; so simple, in fact, that systems are already on display in a few retail organizations and satellite TV shops. But these systems will not easily provide telephone service, and in fact, require an outboard dialtone line to work. Nonetheless, they can't be ruled out as effective market entrants.

So what's the correct course of action? How can cable companies exploit their inherent advantages in crafting customer solutions for a high-profit corporate user? Find out next month, when part 2 of this series shows the different market segments which are ripe for exploitation, and how cable can position itself to do so. CED

About the author

Leo A. Wrobel holds degrees in Telecommunications Systems Technology, Electronic Systems Technology and Business and Public Policy. www.dallas.net/~premiere



Cable's drug and alcohol policies mature

Operators start to deliver some consistency

By Craig Kuhl

The use of drug and alcohol tests for pre-employment screening and post-accident cases, along with the availability of employee rehabilitation programs through a company's employee assistance program, has in the past five years become a staple policy for a growing number of cable systems.

Yet, with cable's continued growth and its on-going convergence with other industries, developing a comprehensive, well-defined and consistent policy, while at the same time, maintaining an employee's right to privacy, remains a challenge for cable operators.

Inherent to the business of cable are millions of vehicle miles per year and the relatively high risks for installers and technicians in the field, and with the era of convergence still in play, establishing a consistent drug and alcohol policy has become an important part of a company's culture, because one company's policy may be just another company's fledgling idea.

A case in point is Dave Brenkamp, a 17-year former installer at Jones Intercable who was terminated after failing his drug test at TCI following a system swap between the two companies. "In the midst of trading systems, we were told we would be absorbed into TCI. At the time, Jones had a policy where if you had an accident, you had a choice of going to re-hab. TCI had the same policy, but only if you worked for TCI. So all I can figure is that we were tested as new hires, and if you didn't pass the drug test, you were fired," explains Brenkamp.

Tricia Runzel

Brenkamp had a good record during his 17 years at Jones, and is an example of how drug and alcohol policies differ from company to company, and how an employee can get caught in a "catch 22." "I know why they do drug testing, and I agree they should probably test new hires and after accidents, but I think we should have been offered some counseling and re-hab. We felt we were just moving to TCI," says Brenkamp. "Why let someone with 17 years of experience and a good record just walk away?"

Most companies include in their drug and alcohol policies a clear-cut choice for an employee who fails a drug test: Re-hab or termination. According to Brenkamp, however, his case wasn't that clear. "The impression I got was that we would be absorbed into TCI as current employees, not new hires. So why didn't they ask if I wanted counseling?"

TCI and Jones have had drug and alcohol policies for several years, with TCI's policy being inspired by the 1991 Drug Free Workplace Act. "We developed our policy in 1991 in response to the Act and are now revising it," says Virginia Lindgren, manager of corporate employee relations and policies and practices for TCI.

TCI's policy includes five testing "occasions" which are very similar to other cable company policies. They include testing for:

1) Pre-employment
2) Post-accident
3) Reasonable suspicion
4) Promotions
5) Random follow-up (being implemented).

"Drug and alcohol testing are not hard once they are put in place, but the challenges are privacy and confidentiality. Those are the two big issues because we need fair and reasonable means for testing," Lindgren says.

According to Lindgren, employees, for the most part, favor testing. "Employees really haven't been resistant. In fact. to the contrary. Anyone applying at TCI knows they have to take a drug test, and employees seem supportive, especially in safety sensitive and customer sensitive positions."

TCI, Lindgren adds, has an additional challenge in complying with statutory laws in the 50 states where it does business. "More and more states are requiring companies to develop drug and alcohol testing policies, so we're on top of it and bringing it (policy) up to date."

Jones, which implemented its substance abuse program in 1995, had a different challenge. "What drove our current program was that we were getting lots of applicants who had been turned down at other cable companies because those companies had drug testing," says Bob Schultz, performance counselor for Jones International.

Jones has since developed a policy similar to the Department of Transportation's, considered one of the most comprehensive and fair policies in use today. "We wanted our policy to mirror DOT's," Schultz said.

Jones' policy includes pre-employment testing, post-accident testing, tests for cause, and follow-up testing. Each is a staple element to the company's overall policy and critical to the organization's goal of a safer, healthier work environment, and according to Schultz, it's working. "The numbers I've seen show that the rates have been coming down since 1992, and we track favorably vs. other companies since we began our program. If people know they'll get tested, they'll be more careful. In business today, you just can't afford to not have these programs, and not have re-hab."

Ralph Haimowitz, director of training at SCTE, agrees. "We highly recommend that companies have drug and alcohol policies–not only health related, but safety related. Different sized systems have different policies, but they all should have policies tailored to their individual needs, including help and recovery programs, so they don't lose valuable, skilled employees."

At the smaller Daniels Cablevision (approximately 57,000 subs), it was an increase in the number of employees voluntarily asking for help that led to its current policy, now one year-old. "Over the years, quite a few employees have come to us for help and that has caused us to develop our policy," says Tricia Runzel, human resources manager for Daniels Cablevision.

'Most of our employees who have tested positive for drugs come back to work'

Daniels' policy, which was initiated after polling an employee group, the legal department and sample policies from other companies, includes pre-employment and post-accident testing, promotions and transfers, reasonable cause and random testing, along with re-hab opportunities. "If an individual comes to us with a problem, we give them every opportunity to re-hab, which includes an agreement that we will randomly test them following their re-hab," says Runzel. The company automatically terminates an employee who tests positive after a vehicle accident.

Daniels uses the National Institute of Drug Abuse laboratory for testing and certain policy matters, Runzel says. "This policy is becoming more of a standard. The test costs are reasonable, $35, and the results are valid."

The results of drug testing vary from company to company, but most companies suggest that drug and alcohol policies, specifically testing and re-hab, are lowering accident rates and providing employees with a healthier, safer workplace. However, with the constantly changing dynamics of a growing, converging cable industry, drug and alcohol policies must be monitored carefully.

"With the sales and trading of systems today, the stress level is very high, and the number of accidents, especially vehicle accidents, increases ($1.4 billion in work-related vehicle damage nationally last year). Drug testing seems to have reduced vehicle accidents, but only reported accidents. However, employees are probably more cautious today because of the testing," says Dewey Wagner, division manager for the National Cable Television Institute.

TCA Cable in Tyler, Texas is convinced of the value of drug testing, says Gail Dorough, human resources coordinator for TCA. "Because of our growth, we have increased our company-wide random drug testing to 50 per month, and it's really helped. We were at four percent positive results over a full year, and the national average is eight percent."

TCA currently includes in its policy pre-employment testing, post-accident, and random testing, along with help and recovery. TCA, Dorough adds, is contemplating a company-wide awareness program for employees to update them on TCA's drug and alcohol policies. "We'd like to start creating an awareness among employees, alerting them as to how many were tested, how many were positive and the number of (those) randomly tested. We want to identify the habitual users," says Dorough.

TCA also offers re-hab to employees through an accredited re-hab program, and according to Dorough, most return to work. "I've found that most of our employees who have tested positive for drugs come back to work," she notes.

The purpose of any drug and alcohol policy is to create a safer, healthier workplace for employees, and assist them with any personal problems they may have with drugs or alcohol. With a growing awareness among operators of the expanded policies being implemented throughout the industry, and a growing consistency from system to system, there are likely to be fewer Dave Brenkamp cases.

Concludes TCI's Lindgren: "We want to give every employee a chance for help, and maybe it's what they really need." CED

Building an efficient headend for data

Multi-tiered services, scalability and WANs

By Adrian Jones, Director, Strategic Channel Development, Terayon Communication Systems adjones@terayon.com

This is the second part of a series addressing the major headend architectural and operational issues in deploying data services over a broadband cable network. These articles examine ways to optimize the headend architecture for broadband data services, the major ingredients in designing a headend to support such services, key considerations when deploying data services and ways of integrating data services into your existing cable TV systems.

This second part of the article series discusses:

✔*Multi-tiered services:* considerations in setting up a headend to provide multiple classes of service, for maximum revenue generation.

✔*Scalability:* how to architect the headend to allow the operator to scale services efficiently from initial small systems to large-scale services.

✔*Wide-area network interface:* how to interface the headend most efficiently to a wide-area network that supports Internet, Intranet and other data services.

There is considerable interest in providing superior Internet access services to the residential customer through the high speeds available from cable modems. However, little attention has been focused on the significant opportunity in addressing the needs of the small office, home office (SOHO) and corporate business customers. In order to support such services, robust cable modem systems, such as those based on S-CDMA (synchronous-code division multiple access) technology, have a distinct advantage. S-CDMA provides high upstream bandwidth, with the resilience to operate in high noise environments, while providing support for operator-defined multiple service tiers–from best-effort residential Internet access to guaranteed premium business services.

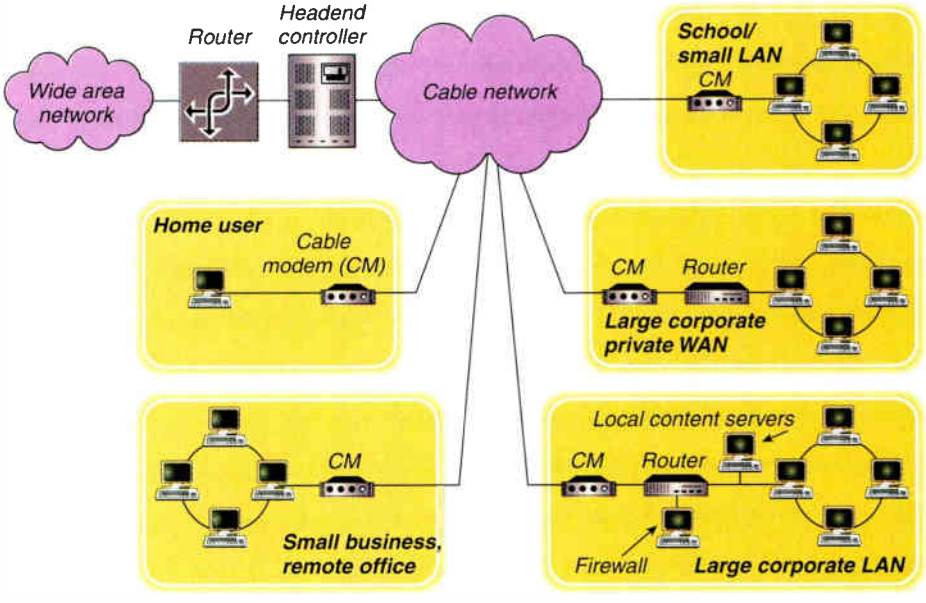
Such services may be tailored to the specific requirements of the customer, designed to reflect usage, value and demand. High-end premium services for the business customer are typically less cost-sensitive and command higher revenues than residential best-effort IP-based services [1].

Within the cable network, multiple tiers of service allow the network provider to offer guarantees of bandwidth minimums and maximums, as well as priorities. At the time of service provisioning, the service class is established to define how the headend controller allocates bandwidth to the user and to provide appropriate parameters for billing. The use of ATM transport technology between the router and cable modem enables flexible management of guaranteed minimum and maximum bandwidth, traffic latency and priority to accommodate constant bit rate (CBR), unspecified bit rate (UBR), and unique combinations of both services.

Cable modem systems based on advanced transmission technology provide the transport robustness, reliability and high bandwidth to support high data rates and multiple tiers of premium services simultaneously.

It's important that the quality of service required by the end user extends beyond the bandwidth control within the cable network and into the IP network. This requires that the provisioning server provides information to allow the mapping of the user's IP address to pre-defined address ranges, such that the IP routed network can apply class of service forwarding (such as filtering/firewall protection, prioritization, policy routing) in the backbone or WAN.

Figure 1: *Examples of residential, small business and corporate service configurations.*



Service configurations

Figure 1 illustrates some of the configurations that may provide an expanded set of differentiating data services to different customers.

✔*Home user/single PC and telecommuting.* IP addresses are allocated to each user's PC using centralized DHCP (dynamic host configuration protocol) servers which dynamically allocate addresses from multiple IP address "pools." The network operator may provide different IP address pools through the provisioning server, reflecting operator-defined tiers of service for particular groups of customers. By mapping like groups of customers into different IP address ranges, conventional IP routers can provide filtering, prioritization and forwarding control. Telecommuters can use specialized

Editor's note: This article is part 2 of a series. Part 1 appears in the August issue, page 76.

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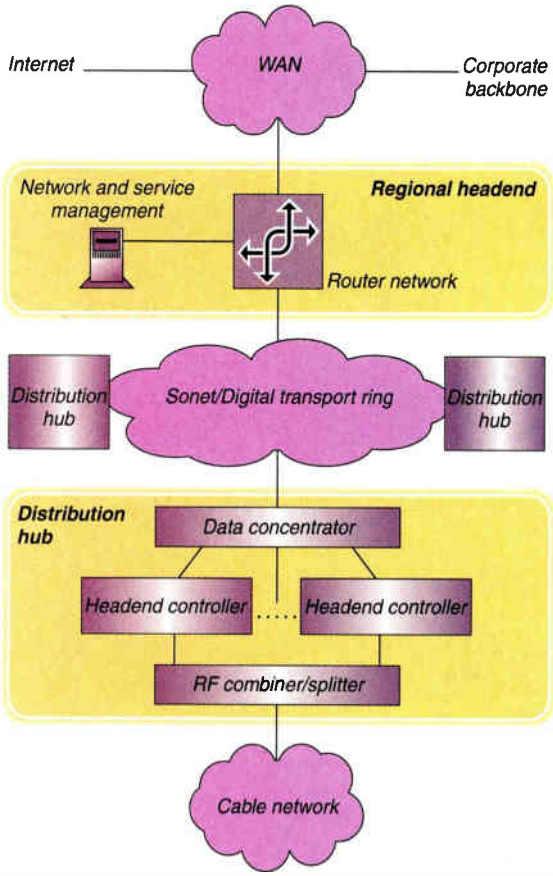
client software, such as the point-to-point tunneling protocol (PPTP) [2] to establish a private and secure IP tunnel to their corporate backbone.

✔*Small office, home office (SOHO) and remote office.* Smaller organizations require Internet access from a large portion of their LAN, such that the modem provides an interface between the headend equipment and the corporate backbone across the cable network. Security issues may be mitigated through application-level security client-server software available through third-party providers using standards-based cryptographic specifications. Once again, premium service tiers provide the quality of service required by such users.

✔*Isolated school LAN/small LAN.* A group of PCs that requires no firewall are connected to the cable modem to provide access to the Internet. Two examples of this type of customer are a small, isolated school classroom LAN and a business that operates a LAN with Internet content servers only. Each PC is configured with its own unique IP address through the same mechanism as for the home user with a single PC.

Figure 2: *A hierarchical and scalable fully routed network.*



In the special case of the business that provides Internet content, the bandwidth asymmetry normally associated with typical Internet applications (e.g., Web-browsing) is reversed. Only the unique combination of S-CDMA and ATM-based managed grade of service control allows the network operator to offer the high levels of upstream bandwidth required.

✔*Large business/corporate–private virtual network.* Any large organization may use the cable network and Internet to form a virtual private network (VPN) between its national or regional sites. With this size business, the modem connects to the customers' own router, which may provide a termination point to an IP tunnel established between it and the corporate backbone network. IP-based applications such as virtual private networks and point-to-point connections can be offered by the network operator to provide specialized, connection-oriented and secure IP services. A network address translator, as part of the firewall, may be used to translate between the public Internet and the privately managed corporate LAN/WAN IP address space.

Scalability

Network operators need to ensure that the cable modem system follows a scalable path that tracks the level of subscriber penetration and the nature of the services being offered. It is thus essential to consider both network architecture and physical placement of the data service equipment.

Figure 2 shows a hierarchical cable TV network with a high-speed data service overlay. As discussed in the first part of the article, the ability to grow in a cost-effective, incremental and graceful manner requires that the architecture supports enhancements in capacity and capability, such that all deployed equipment is upgradable as system needs evolve.

RF concentration promotes the efficient use of the limited return spectrum, allowing the network operator to move under-utilized and heavily capital intensive fixed costs to service-driven variable costs. Data-carrying RF channels can be added as additional capacity is required.

Robust and highly reliable transmission technology allows the operator to spread the cost and bandwidth capacity of the headend controllers over a large user population (on both large tree-and-branch coaxial networks or through HFC node aggregation). Robust S-CDMA-based systems offer a uniquely high level of node aggregation, allowing operators to add headend equipment gradually as it is required. Because equipment is kept to the minimum necessary to satisfy the service requirement, operations and capital costs, and headend space are also reduced.

As service penetration rises, the capacity and complexity of the data network also increases. It is essential that the data network accommodate the growth in an incremental fashion that does not force continual rearrangement and disturbance of the network. A fully routed, hierarchical IP network allows a well-understood and standard approach to manage the complexity of packet routing across the cable and backbone networks. In a similar manner, management of the data network and service provisioning must also scale with the increasing number of users. Access systems based on S-CDMA allow operators to scale systems efficiently, because the same headend controller and management equipment that supports early subscribers can grow as subscriber penetration increases.

WAN interfaces

The connection to the wide area network provides connectivity between the network operator's private domain and the Internet and other service providers. Several standards and specification development bodies have defined the data link and physical layer combinations used to carry IP-based data traffic to and from the backbone and wide area networks: ATM over STS-3c and DS-3; FDDI; 802.3 over 10BASE-T and 100BASE-T; Ethernet over 10BASE-T and 100BASE-T.

Operators should use a standards-based approach to accommodate future system growth. Cable modem systems based on advanced modulation technology provide the robustness, high bandwidth and service management capabilities to address the broadest market with the greatest efficiency. CED

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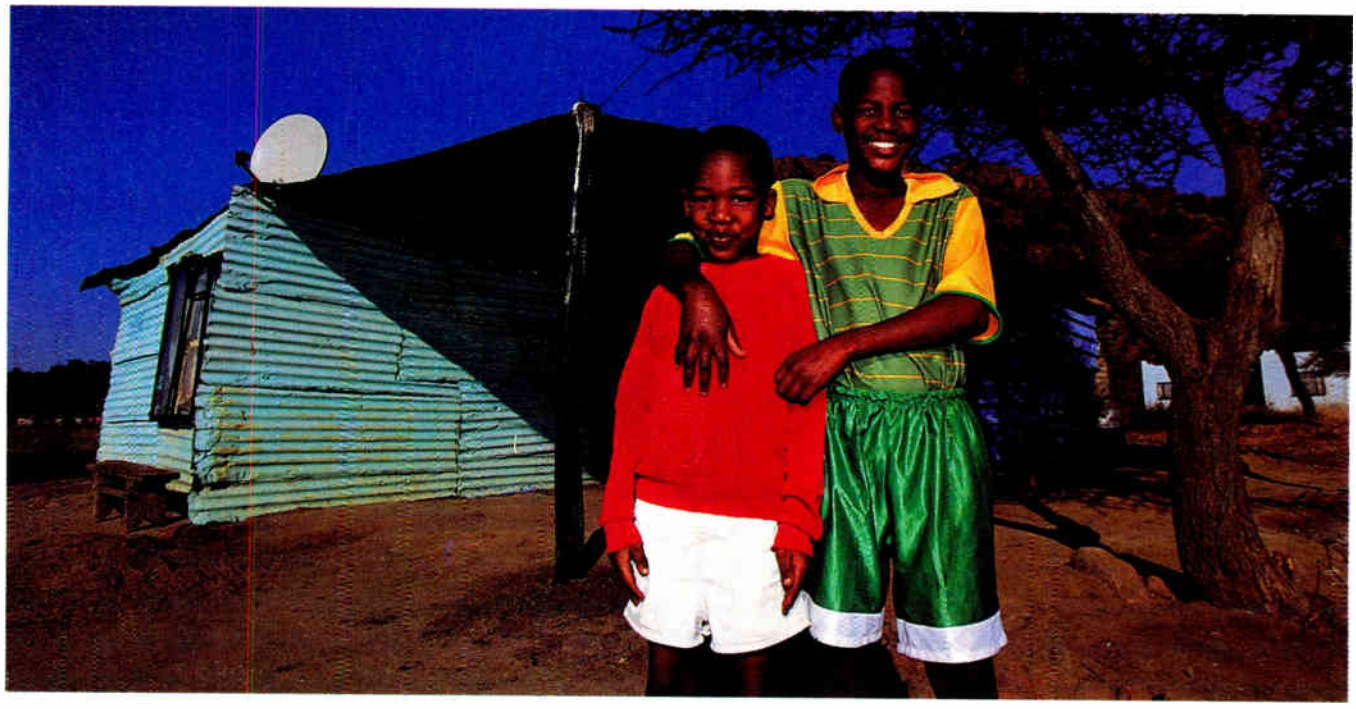

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Video perks give data a sharper image

New software tools and new standards

By Fred Dawson

The prospects for adding innovative and highly advanced types of video-enhanced content to high-speed data channels have brightened considerably in recent months, thanks to emergence of new software tools that not only support video distribution, but greatly alter the functionality within the data feed.

Already, cable companies are putting some of these new APIs (applications program interfaces) to use in conjunction with the distributed network architectures they've implemented in their data service rollouts. And much more is in store as cable taps into the developments taking shape within and beyond the Microsoft and Netscape Communications multimedia alliances.

For example, sources report Time Warner, Tele-Communications Inc. and others are in the final stages of forming a venture that will apply streaming and other new technology to facilitate distribution of content formatted for CD-ROM and other platforms over high-speed data networks. "You'll see Time Warner go to offering things like (the CD-ROM video game) Quake this fall, where people who download the high-speed on-line version can play with each other over the cable system at much faster speeds than would be possible over dial-up lines," says an executive close to the discussions, asking not to be named.

The key to reformatting such material for high-speed access is a new Internet standard known as "Common Internet File System," presently nearing completion under the auspices of the Internet Engineering Task Force. CIFS, like the other new standards associated with IP applications, offers developers the opportunity to put content together in one coherent process for multiple applications and distribution media, allowing them to move forward on the high-speed front without having to create content from scratch.

One measure of just how fast and far the functionality of video-based multimedia services might go can be found in expectations surrounding on-line games that will one day be provided over high-speed data networks. Along with very high-end graphics and fast interaction among players, such services will support participation by hundreds or even thousands of players in a single game and direct voice connections among players who want to communicate with each other, says Charles Moldow, vice president of

Interactive Pictures Corp.'s technology allows users to view graphic displays in three dimensions.

business development for @Home Network's @Media group.

"It's in our best interest to program very robust game services," says Moldow. "The question is, when is the right time to do it." Not yet, he adds, but he believes the capabilities he describes will be part of the picture within two years.

Such claims have been made before, most notably in the runup to the big interactive TV bust; but this time there are real market activities where some of these capabilities, as well as others, are being put to use in the narrowband domain as well as cable data domains. Where games are concerned, on-line gaming has already reached a point where demand is having a significant impact on sales of established CD games like Quake, Doom and Diablo that have been especially adapted for playing over connections to the Internet.

Developers report such adaptations are boosting retail sales of popular CD games by as much as 30 percent. "Network gaming over this past year has salvaged a lot of what was a down year for the PC (game) market and kept it at a competitive advantage against the (video game) console market," says Steve Dauterman, director of game production at Lucas Arts.

The new generation of games features 3-D graphics in which the player's perspective shifts through 360 degrees in any direction as he or she maneuvers through the changing scenes, propelling forward and turning by pushing cursor keys on the computer keyboard. Some games require graphics accelerators with the CD-ROM attachment, but many don't.

With these dynamics in play, the '99 timeframe is looking very good for introducing low-latency multiplaying over high-speed data networks, Moldow says. "We've found that the roundtrip latency over our network coast-to-coast is about 50 milliseconds," he adds, noting that this is only twice the theoretical latency minimum set by the speed of light. "You only need to be at sub-100 millisecond latency to do good 'twitch' action games."

Much needs to be done to get to the level of game playing depicted by Moldow, including most especially standardization of protocols that support interactive, multi-participant sessions linked to IP voice connections, but the pieces are rapidly coming together. "Games represent the biggest content category when it comes to requests from customers for broadband-enabled content," says Doug Perkins, director for Internet and high-speed services in MediaOne's Florida division. "We're actively looking for development of applications from the electronic games community."

MediaOne is working closely with video streaming and conferencing software developer VDOnet Corp., in which MediaOne parent US West has a significant equity stake.

VDO, a key player in the Microsoft alliance, just introduced new software that enhances tie-ins between videoconferencing and streaming for applications such as catalog shopping and on-line gameplaying, marking a first step toward the integration of IP telephony and video content that is vital to cable's evolving data service picture.

Where previous iterations of VDOPhone software were tailored to work in the low-bandwidth environment of dial-up access, version 3.0 is scalable from low- to broadband access levels, says Steve Chambers, vice president of marketing at VDO. This means that the transmission between any two Internet connections will automatically adjust to bandwidth capacity, making it possible for people on high-speed data links such as cable offers to see each other in high resolution without the herky-jerky motion associated with low frame-rate transmissions.

While VDO is using a proprietary system that requires that all users be equipped with its client software, the new version is designed to work within the standards framework being established for Internet telephony by the Internet Engineering Task Force. For example, implementations of VDOphone 3.0 in various applications by software developers will interface with the same applications using other videophone software that is compliant with the H.323 Internet video telephony standard, Chambers says.

The new version of the VDOnet system also comes with a software developers toolkit which will soon include the interfaces that make it possible to link video streaming and videophone applications in broadband-enhanced services, Chambers says. "We'll be formally announcing these capabilities in the near future," he notes.

Chambers sees the release of VDOphone 3.0 as "a proof of statement" that it is now possible to bring together the multimedia and two-way communications components that can enable the types of applications Perkins, Moldow and other cable data executives are looking for. "What we're saying is that the tools are here to develop content that really distinguishes broadband connections from other connections," he noted.

One of the first applications of the new software will be for call centers at a large travel concern, where people calling in over the Internet will be able to converse "face-to-face" with travel representatives and then be shown video clips of hotels and destinations, depending on their interests. "This is just one of a wide range of applications you'll be seeing involving use of call centers in conjunction with video streaming," Chambers says.

With H.323 and related standards moving to implementation in software, the development of commercial call center applications is moving forward on several fronts beyond VDO's efforts. MCI, for example, is developing Internet interfaces with its call centers that will allow people connecting to the carrier's home page to click on an icon and be connected to an operator, notes Harvey Kaufman, president of NetSpeak Corp., developer of the Webphone, a "smart" device that supports Internet voice and video applications without use of a PC.

"We can do least-cost, least-latency, least-hop or closest-geography routing," Kaufman says. "The plan in this environment is to take the call and give the caller the best connection or experience possible."

While the gameplaying pieces are coming together,

People calling in over the Internet will be able to converse 'face-to-face' with travel reps

(Continued on page 94)

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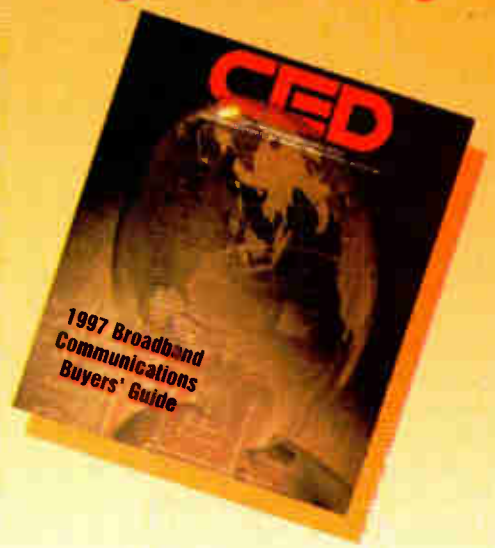

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(Continued from page 91)

IPIX technology (above) offers views of the walls, ceiling and floor of a room with the click of a mouse.

MSOs are moving forward on other multimedia tracks with content enhancements making use of such emerging protocols as IP Multicasting and Real Time Streaming Protocol. @Home, for example, plans to use audio and video streaming software from Progressive Networks Inc. in combination with new multicasting capabilities built into its network to deliver a wide range of new content, such as trailers from feature films, news and sports clips and broadcast of special events.

"Multicasting technology is a smarter networking scheme," says Milo Medin, network VP for @Home, in a prepared statement. "It not only provides savings in network and server resources; it enables exciting new applications not feasible with unicast technologies."

Multicasting is a newly standardized means of distributing content mapped to the packetized format of the Internet Protocol that allows a single data feed from a server port to go out to multiple users at the same time. This approach greatly reduces congestion at the server and makes it easier to manage the flow of bandwidth-consuming video over the hybrid fiber/coaxial network, where delivering video to many users contending for dedicated bandwidth at the same time can result in an overall slowing of access speeds for everyone within a given coaxial serving area.

@Home's network is ideally suited for multi-casting applications, which require that all routers in the end-to-end connection be equipped to recognize and give special treatment to packets tagged with the protocol's API, notes Jeff Huber, director of server and network products for @Home. "This is something that can only be done at this point over corporate and other private networks, like @Home's," he says.

The multicast can begin from any point with a direct connection to one of @Home's 13 regional data centers in the U.S. and Canada, Huber says. Once the packet flow reaches the RDC, it can be multicast throughout the @Home customer base via distribution across @Home's backbone to other RDCs and then into the local networks or it can be distributed for local storage and later multicasting, in a process known as "distributed multicast."

"We're deploying our server software supporting multicast and distributed multicast in a number of enterprise networking applications," says Philip Rosedale, general manager of the applications group at PNI. "It's a very efficient way to make use of available bandwidth, especially if you're delivering video at, or near, 30 frames per second."

While, as noted last month (p. 82), there is growing synergy between the cable industry's digital TV and on-line agendas as high-speed data moves to embrace video content, there are major differences in how the tools will be applied by the groups within the DTV and on-line arenas. "This isn't video-on-demand, like watching Terminator 2," Huber says.

Instead, multicasting supports two types of delivery paradigms where everyone shares the same data stream in applications that are more like broadcast television. In one case, a specific event is distributed at a pre-set time, with users tuning in at the beginning or while it's in progress, much as they would a TV broadcast program. The other approach involves con-

tinuous repetition of content loops, such as the four- to five-minute movie trailers, with updates of the material as the supplier sees fit.

@Home is working with content partners to create a number of applications in both categories, Huber notes. Where special, time-specific events are concerned, the company is looking at local and national sports and concerts, among other things. Some of these events might be accessible exclusively through @Home, while others might be more broadly available through TV or other venues, with @Home offering special features unique to its version, he says.

"Our near-term focus will be on national events, such as rock concerts," Huber adds. "We can deliver content suited to special interests within our subscriber base and provide access to chat sessions specific to the events."

@Home is taking advantage of the latest advance in PNI's RealVideo software, which supports delivery of high-quality video at up to 30 frames per second, with audio close to CD quality at data rates of 100 to 400 kbps. "This is very close to broadcast quality video, with full-screen display, but with bit rates low enough to minimize bandwidth consumption," Rosedale notes.

The ability to deliver this level of video quality at low bit rates rests on use of proprietary compression algorithms. PNI makes use of its own as well as compression systems from other suppliers, rather than using the more bandwidth-hungry MPEG-2 that is employed in digital TV.

@Home will also use another approach to delivering video in the future as it continues to expand its content capabilities, relying on high-speed connections to deliver bursts of video data files to users, rather than streaming the content. While multicasting is ideal for live events or repeating loops of material such as sports and finance information or movie clips, the rapid file downloads made possible by high-speed access over cable links are ideal for interactive applications such as game playing.

The company will also use multicasting for some types of games, such as multiplayer games where hundreds of users join at the start in a network-wide event. "People playing Quake, for example, would have a very different experience from what they have today, where the latency (in reaction times among players) is very low because everyone is sharing the same data flow as it is multicasted over the network," Huber says.

Time Warner, along with working on applications suited for multicasting such as Quake and live events that are likely to be introduced this fall, has taken another first step toward expanding appeal of high-speed data content with use of a new software tool in conjunction with launch of its Road Runner service in the Capital District region of New York. The "photobubble technology" supplied by Interactive Pictures Corp. allows users to view graphic displays in three dimensions, as if they were turning around within the "bubble" of a graphic that offers views of all the walls, ceiling and floor of a room on command from the PC mouse.

The first application involves a Web site developed by the Albany Institute of History, where cybervisitors can go to rooms and click on any point from within the bubble to get a closer look at the displays. "With this site, we've demonstrated a 2 megabyte file containing graphics and audio can be downloaded in three to five seconds, offering users a completely new on-line experience," says Jeff King, president of Time Warner's Albany division. "Now our challenge is to work with other local content providers to help them make use of this capability."

IPC, employing technology originally developed at Oak Ridge National Laboratory in Tennessee for remote robotics applications in defense and space exploration, offers a means of navigating in cyberspace that applies not only to still graphics, but to action sequences as well, including live video, says former Motorola Corp. executive James Phillips, who is CEO, president and chairman of IPC, which previously operated as Omniview Inc. "There's a lot of talk about teleportation in cable data applications, and that's what we're about," Phillips says.

The cable involvement will go well beyond the type of implementation initiated by Road Runner in Albany, Phillips notes, though he declines to identify participants or specific projects. But he describes future plans for his firm's technology that make clear what the potential cable applications might be.

IPC has developed virtual reality headsets that allow the user to be "in" the three-dimensional bubble rather than viewing the graphic on a PC screen, Phillips says. In addition, the company's software will eventually support three-dimensional navigation through real-time or stored video graphics, where the viewer can change the camera angle to zero in on any point in the picture.

For example, the IPIX software, working in conjunction with new high definition TV cameras that use wide-angle lenses to capture a scene across an angle of 180 degrees, will be able to reconfigure the data at any point in the picture to fit the dimensions of a directly focused picture in real time, Phillips says. "Millions of people will be able to change the camera angle to focus on whatever point of action they choose, independently of each other," he adds, noting that IPC is working with @Home Network and Cox Communications as well as Time Warner in fashioning applications for cable data services.

Such developments are clear signals that the software community is finally beginning to realize cable's high-speed data connection represents an outlet for new content that can't be overlooked. Cable can only do so much to seed such content, given the immense costs associated with upgrading networks and implementing high-speed data services, so general recognition of the opportunity among developers is vital to rapid exploitation of the new tools now at hand.

"The cable modem could enable delivery of product that is not available today," says Brian Apgar, COO of Mpath Interactive, a leading supplier of multiplayer gaming services over the Internet. "The biggest implication in this is that developers should start thinking of selling large binary files to customers, rather than being constrained by the distribution and capacity limitations of CD-ROM. Getting that bandwidth to the home is going to have a profound impact on the on-line game market." CED

Apgar: 'The cable modem could enable delivery of product that is not available today'

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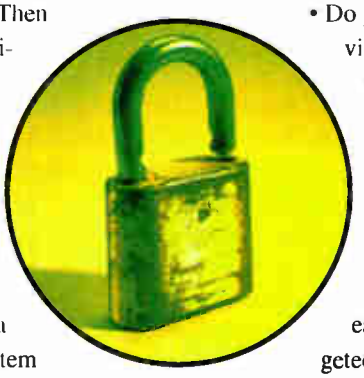

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CABLEfile

Philips supplies TW rebuilds in NY

MANLIUS, N.Y.–Philips Broadband Networks will provide more than 500 miles of fiber optic and RF transport equipment and systems for two Time Warner rebuilds in Central New York. The systems, based in Oswego and Oneida, N.Y., will incorporate Philips RF amplifiers, as well as new fiber optic equipment, including the Diamond Marquise four-port optical node amplifier and the Diamond Transport system with advanced transmitters and receivers.

The Diamond Marquise optical node amplifier features four active outputs with full analog capabilities, allowing the operator to reduce overall active count and improve system reliability.

Time Warner using IPIX technology

STAMFORD, Conn.–Time Warner has officially launched its high-speed, on-line service, Road Runner, in New York State's capital region of Albany, Troy and Saratoga.

The recent service debut featured a 3D, interactive Web site for the Albany Institute of History which utilizes IPIX technology by Interactive Pictures Corp. IPIX creates a spherical image that offers users a complete field of view, from earth to sky, floor to ceiling, horizon to horizon. The user is able to travel within the image sphere and click on selected points of it to examine objects in greater detail.

The Road Runner service will be available to more than 200,000 homes in Albany, Rensselaer and Saratoga Counties.

By the end of the year, Time Warner anticipates that Road Runner will be up and running in 17 Time Warner cities, passing more than 2.4 million homes.

Alpha expands operations in U.K.

BELLINGHAM, Wash.–Alpha Technologies has expanded its operations in the United Kingdom. This latest expansion more than doubles the operation's manufacturing and service capability and includes "significantly expanded" local technical and engineering resources.

Alpha has been active in the U.K. market for most of the company's 20-year history, including the powering of the industry's first combined cable TV/telephony delivery network in the early 1990s.

Local staff includes a technical salesforce as well as engineering, customer service, production and administrative support personnel.

TV/Com awarded ISO 9001

SAN DIEGO–TV/Com International Inc., a subsidiary of Hyundai Electronics, has received certification to ISO 9001 Quality System requirements. Intertek Services, a third-party registrar, performed the company's registration by assessing its compliance to the quality system requirements.

The Geneva-based International Organization for Standardization (ISO), a worldwide federation of national standards bodies with members from more than 100 countries, was founded to promote the development of international standards.

S-A, Punwire build relationship in India

ATLANTA–Scientific-Atlanta Inc. and Punjab Wireless Systems Ltd. (Punwire) have announced an agreement for sales, service and manufacturing of S-A's broadband network products in India by Punwire.

The agreement between the two companies leverages Punwire's experience in the Indian market and S-A's products and technology, according to information released by

PUNWIRE

Scientific-Atlanta. Punwire, based in Mohali, Punjab, is a public limited company and a key player in the India telecommunications industry. The company manufactures, sells and services a variety of telecommunications equipment, including VHF/UHF wireless products, radio trunking systems, microwave network equipment, pagers and telephones.

As a result of S-A appointing Punwire as its distributor in India, the manufacturer's customers will gain access to Punwire's country-wide sales and service operations. Products covered by the distribution and service arrangement include S-A's headend, distribution and optoelectronic equipment, taps and passives, and analog video systems. In addition to the sales and service functions, Punwire will manufacture selected Scientific-Atlanta products at its plant in Mohali.

Shaw picks SeaChange SPOT system

MAYNARD, Mass.–Shaw Communications has selected SeaChange International Inc.'s SPOT System, in a transaction worth $1 million (U.S.). Shaw will use the SeaChange system, in conjunction with its satellite network, to digitize, store, manage and distribute promotional material and other content to its cable TV headends throughout Canada.

At the operator's Calgary master control center, the analog video material will be digitally encoded and transmitted to geographically dispersed locations for playback in various regions.

"By leveraging the SeaChange SPOT system with our satellite network, we will distribute MPEG-2 video content across Canada to our customers, which will provide us with significant advantages in marketing new programs and services," says Jim Shaw Jr., president and COO, Shaw Communications.

InterMedia taps CableData

RANCHO CORDOVA, Calif.–CableData Inc. and InterMedia have announced a multiyear contract that will consolidate all of InterMedia's cable TV customers onto the vendor's DDP/SQL customer management and billing system.

Under the agreement, InterMedia will utilize the system to support business operations such as order processing, collections, charging and billing, transaction management, financial reporting and certain marketing support tasks.

InterMedia serves more than 840,000 customers located primarily throughout the Southeastern U.S., including Tennessee, Georgia, North and South Carolina, Kentucky and Maryland. Currently, 550,000 of the operator's subscribers are managed by CableData's DDP/SQL product. Under this agreement, the remaining customers will be converted from their existing provider to the CableData system by the end of the first quarter of 1998.

Superior to monitor nets for Bell Canada

SARASOTA, Fla.–Bell Canada recently selected Superior Electronics Group Inc. as the supplier of network monitoring equipment for Bell's hybrid fiber/coaxial plant in its residential broadband services trials in the provinces of Quebec and Ontario.

With Superior's Cheetah monitoring software and hardware, Bell Canada will monitor its broadcast services HFC plant–including power supplies, fiber nodes, amplifiers and signal quality. Superior will supply its CheetahNet software, CMA transponders and Cheetah performance monitoring products.

The Cheetah System will provide Bell Canada with comprehensive status and performance monitoring. Bell system operations personnel will be able to use the Cheetah System to isolate faults anywhere in the HFC domain, monitor signal quality and characterize and test plant performance.

Bell Canada is a member of Stentor, an alliance of Canada's major telecommunications companies. CED

RESOURCE CENTER

Advanced Networking

Antec/Network Technologies
Specializes in the manufacturing, materials management and distribution of products for hybrid/fiber coax (HFC) broadband networks.
p. 90-91, Chart

C-COR Electronics, Inc. Circle # 23
C-COR's RF amplifiers, AM headend equipment, digital fiber optics, and customized service and maintenance provide global solutions for your network. p. 41

NextLevel Systems, Inc./Broadband Networks Group Circle # 18
GI/NextLevel Broadband Networks Group is a worldwide market leader in digital and analog set top systems for wired and wireless cable television networks. p. 35

NextLevel Systems, Inc. (Corp. HQ) Circle # 36

Panduit Network Systems Group Circle # 27
Complete line of fiber optic and network cabling solutions, including PAN-NET ™ Network Cabling Systems, PAN-WAY ™ Surface Raceway Systems and PAN-CODE ™ Network Identification Products. p. 47

Construction Equipment

ASKA Communication Corp. Circle # 20 p. 37

Cadix International Inc. Circle # 37
Develops design and management software solutions for Fiber, RF & Telephony. Our new CX-P21 "Light-Speed Design System" includes an integrated ODBC database and full featured CAD functionality. p. 63

CommScope, Inc. Circle # 6
CommScope: ISO 9001 registered manufacturer of a comprehensive line of coaxial and fiber optic cables for all telecommunications applications. p. 10-11

Telecrafter Products Circle # 4 , 45
Supplies drop installation products for CATV, DBS, and wireless operators, single and dual cable fastening products, identification tags, residential enclosures. p. 8, 77

Datacom Equipment

Bay Networks, Inc. Circle # 9 p. 17

Hayes Microcomputer Products, Inc.Circle # 55 p. 87

Distribution Equipment

Alpha Technologies Inc. Circle # 10
World leading manufacturer of power conversion products, widely used in cable television, telecommunications, and data networks around the world. Offer a complete line of AC and DC UPS systems. p. 19

Exide Electronics, Emerging Technologies Group
Our Lectro brand is the industry's first true uninterruptible power supply, provides innovative decentralized and centralized power solutions for CATV and high speed data networks. p. 26-27

Lindsay Electronics Circle # 15, 57
Our revolutionary new technology creates 1 GHz communication amplifiers, passives, taps, and subscriber materials to solve system problems before they become subscriber problems. p. 32 , 92

Philips Broadband Networks Circle # 31 , 32
A global supplier of broadband RF and fiber optic transport equipment, is also a leading provider of advanced systems used to access broadband telephony and data services. p. 52, 53

Trilogy Communications, Inc. Circle # 22
ISO-9001 manufacturer of low loss coaxial cable. Full line including air dielectric trunk and feeder, UL listed and corrosion protected drop, radiating and 50 ohm for wireless/RF. p. 39

Distributors

Budco Inc. Circle # 61
Marketing and distribution company for installation tools, construction supplies, marking identification, and security products for cable plant. Exclusive distributor of taplocks, the industry leader for marking drops. p. 93

ITOCHU Cable Services Circle # 8
iCS, Inc. is a leading full service stocking distributor, operating ten sales offices and nine warehouses conveniently located in North and South America. p. 15

Sprint North Supply
Materials Management Services include Engineer, Furnish & Install, Vehicle Provisioning, CPE Fulfillment, Project Management, and Model Programs. Reduce your cost to compete. p. 90-91, Chart

TeleWire Supply Company Circle # 11, 50
TeleWire Supply is a leading nationwide distributor of products needed to build and service a broadband communications network. p. 21, 83

Fiber Optic Equipment

Corning Incorporated Circle # 29, 40
The Corning Optical Fiber Information Center gives you FREE access to the most extensive fiber-optic library in the industry. p. 49, 69

Fotec, Inc. Circle # 21
FOTEC, Inc. offers test equipment for fiber optic networks, including low cost "FOtest'R" for troubleshooting. Also "Fiber U" fiber optic training. p. 38

Pirelli Cable Corp. Circle # 34
Leading manufacturer of fiber optic cables and supplier of connectivity systems including connectorized cable assemblies, drop cable, distribution panels, adapters, and optical fiber access tools. p. 57

Siecor Corporation Circle # 26
Celebrating its 20th anniversary, Siecor Corporation is a leader in telecommunications technology for voice, data and video applications. Siecor - At Your Service.
p. 44-45, 90-91, Chart

Synchronous Group, Inc. Circle # 16
The Actair and Antares 1550nm external modulation transmitters offer outstanding performance and the best specifications in the industry. Perfect for super trunks and direct distribution. p. 33

Headend Equipment

ADC Telecommunications, Inc. Circle # 1
Leading global supplier of transmission and networking systems. Holds a preeminent market position in physical connectivity products for fiber optic, twisted pair, coaxial and wireless networks worldwide. p. 2-3

Barco, Inc. Circle # 38
BARCO's Gemini Upconverter is an ideal alternative to conventional modulators for hub site headends, accepts digital or analog IF inputs and saves cost and space. p. 65

Blonder Tongue Laboratories, Inc. Circle # 14, 41
Quality manufacturer of headend equipment (including pre-fabricated headends), reception, distribution, MDU interdiction products and test equipment. p. 29

Dawn Satellite Circle # 25
Technical information and competitive prices on products such as: satellite "dish" antennas, satellite receivers, digital ready LNBs, modulators, processors and a wide variety of related products. p. 43

Harmonic Lightwaves, Inc. Circle # 7
A worldwide supplier of highly integrated fiber optic transmission, digital headend and element management systems for the delivery of interactive services over broadband networks. p. 13

Microwave Filter Co., Inc. **Circle # 58**
Passive electronic filters, traps and filter networks for interference elimination and signal processing at the TVRO, headend and distribution equipment. p. 93

Monroe Electronics, Inc. **Circle # 60**
We supply rack mounted or cased cue tone encoders/decoders. Also, timers, A/V and RF/IF switches and other control products. p. 93

Scientific-Atlanta **Circle # 91**
Scientific-Atlanta's new Continuum™ Headend System for analog and digital applications. Features a vertical packaging design which allows for up to forty front-loaded modules to fit into a standard 70" rack. p. 116

SkyConnect **Circle # 42**
SkyConnect meets the demands of the growing cable advertising industry by offering the most complete digital advertising solutions available. p. 71

Standard Communications **Circle # 3**
The industry's leading manufacturer of rebroadcast quality satellite reception and RF broadband products. Delivering programs to thousands of CATV and SMATV systems. p. 7

TFT, Inc. **Circle # 44**
Manufactures and markets through CATV OEM's & system integrators (EAS) Emergency Alert Systems. p. 67

Trompeter Electronics Inc. **Circle # 48, 94**
The leading manufacturer of RF interconnects for broadcast and telecom applications. p. 81

Spectrum **Circle # 24**
The Sub-Alert utilizes the advanced features of the Sage Endec for total automation and will interface with your headend by IF, baseband video or comb generator. p. 42-43

Services

National Cable Television Institute (NCTI)
Circle # 39
National Cable Television Institute (NCTI) is the world's largest independent provider of broadband industry training; both technical and non-technical. p. 68

Stark & Associates, Inc. **Circle # 56**
Broadband cable systems training, design & engineering, and marketing consultants. p. 92

TCS Communications **Circle # 47** p. 80

Subscriber Equipment

Pace MicroTechnology **Circle # 92** p. 89

Telecom Equipment

Fujitsu Network Communications **Circle # 35**
Manufactures and markets advanced SONET transport and access equipment which mazimizes network operational capacity and services. Add/drop multiplexer and supporting hardware and software. p. 58-59

Argus Technologies **Circle # 33**
Argus Technologies manufactures DC power systems, switchmode rectifiers, DC-DC converters (12, 24, 48, 130r) and various DC power components for telecommunications applications. p. 55

Test Equipment

AM Communications, Inc. **Circle # 90** p. 115

Cable Leakage Technologies **Circle # 19**
With the FCC imposing stiff fines for leakage, CLT presents operators with the only sure, comprehensive method of locating and documenting the nearest street address of system faults/signal leakage. p. 36

Cable Resources, Inc. **Circle # 17**
CRI manufactures "original tools for cable operations". Tools include converter container lock boxes, foam shelves, converter bags and return test equipment. p. 34

GN Nettest, Laser Precision Div. p. 90-91, Chart

Hewlett-Packard Company **Circle # 5 , 30, 43**
Hewlett-Packard offers a comprehensive range of test equipment to keep your entire broadband system at peak performance - from headend to subscriber drop. p. 9, 50-51, 73

Noyes Fiber Systems **Circle # 49**
Manufacturer of fiber optic test equipment including mini-OTDRs, light sources, power meters, visual fault identifiers, network simulators, microscopics, optical fiber indentifiers, talksets and test kits. p. 82

Sadelco, Inc. **Circle # 46**
Sadelco, Inc. manufactures SLMs for CATV. Minimax meters can now provide accurate reading of the average power of all digital channels. p. 79

Sencore **Circle # 12**
Sencore designs and manufactures a full line of CATV, Wireless CATV, QAM and MPEG-2 test instruments. Each instrument is designed to meet your system analyzing and troubleshooting needs. p. 23

Trilithic, Inc. **Circle # 13**
Manufactures test equipment for the CATV and LAN industries and components for aerospace and satellite communications. Key products are SLMs, leakage detectors, and return test equipment. p. 25

Wavetek Corporation **Circle # 2**
Manufactures equipment for CATV, telecommunications, wireless, and general purpose test. CATV equipment includes signal level, analysis, and leakage meters, sweep and monitoring equipment. p. 5

Companies in this issue

The following companies are cited in articles and features in the current issue. Page numbers refer to where the initial mention takes place in a particular story. Listings do not include some departments.

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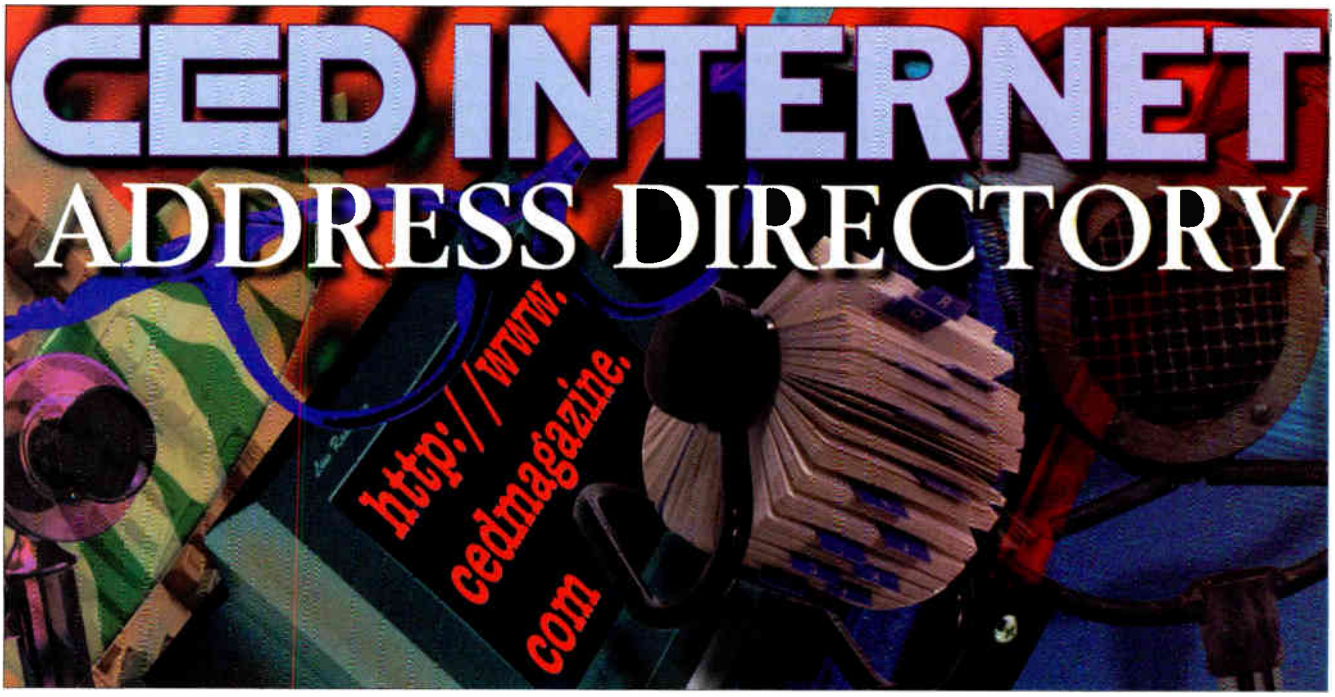

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GN Nettest, Laser Precision Div.
http://www.gnlp.com

Harmonic Lightwaves, Inc.
http://www.harmonic-lightwaves.com

Hayes Microcomputer Products, Inc.
http://www.hayes.com

Hewlett-Packard Company
http://www.hp.com/go/catv

Microwave Filter Co., Inc.
http://www.ras.com/mwfilter/mwfilter.htm

Monroe Electronics, Inc.
http://www.monroe-electronics.com

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http://www.ncti.com

NextLevel Systems, Inc./Broadband Networks Group
http://www.nlvl.com

NextLevel Systems, Inc. (Corp. HQ)
http://www.nlvl.com

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SEPTEMBER

6-10 NATOA Conference (National Association of Telecommunications Officers and Advisors). Location: Tucson, Ariz. Call (202) 429-5101.

7-9 HFC '97, High Integrity Hybrid Fiber/Coax Networks, Second Annual Technical Workshop, jointly sponsored by the SCTE and the IEEE Communications Society. Location: The Wigwam Resort, Litchfield Park, Phoenix, Ariz. Call Anna Riker (610) 363-6888.

8-9 CDMA System Engineering & Optimizations Workshop, produced by WIT. Location: Dallas. Call (510) 490-6459.

11-12 Bellcore's Competitive Local Access Seminar. Location: Richardson, Texas. Call (800) 832-2463.

11-12 Operating RF-IPPV Systems, produced by Scientific-Atlanta Institute. Location: Atlanta. Call (800) 722-2009, press "3."

15-19 Broadband Communications Network Design, produced by NextLevel Systems. Location: San Francisco. Call (215) 674-4800.

16 Network Reliability & Interoperability Council ComForum, presented by the International Engineering Consortium. Location: Hyatt Regency, Reston, Va. Call (312) 559-4600.

16-18 Digital Network Engineering Training, produced by NextLevel Systems. Location: San Francisco, Calif. Call (215) 674-4800.

23-25 i+e intranet + extranet Conference & Exposition, sponsored by Gartner Group. Location: Moscone Convention Center, San Francisco. Call (203) 256-4700.

24-26 Fiber Optic Network Installation, produced by Pearson Technologies Inc. Location: Morristown, N.J. Call Eric Pearson (800) 589-2549.

24 Southern California SCTE Chapter, Technical Seminar and Testing Session. Topic: Transportation Systems. BCT/E certification exams to be administered. Location: Lincoln Properties, Alhambra, Calif. Call Charles Harper (714) 816-0570.

24-26 SCTE Regional Training Seminar. Topic: Introduction to Fiber Optics. Location: Manchester, N.H. Call SCTE headquarters (610) 363-6888.

26 Wheat State SCTE Chapter, Testing Session. BCT/E Certification exams to be administered. Location: Great Bend, Kan. Call Vicki Marts (316) 262-4270.

OCTOBER

6-8 Technology Forecasting for the Telecom Industry, produced by Technology Futures Inc. Location: The Renaissance Hotel, Austin, Texas. Call Diane Sanso (800) 835-3887; or (512) 258-8898.

20-24 Fiber Optic Splicing and Testing, produced by Nynex. Location: Nynex Learning Center, Marlboro, Mass. Call (800) 239-3300.

22 Analog Headend Design, produced by Scientific-Atlanta Institute. Location: Atlanta. Call (800) 722-2009, press "3" when prompted.

23-24 Operating Analog Headend Systems, produced by Scientific-Atlanta Institute. Location: Atlanta. Call (800) 722-2009, press "3" when prompted.

27-29 Rocky Mountain SCTE Chapter 2nd Annual Cable TEC Symposium. Location: Holiday Inn, Ft. Collins, Colo. Call Hugh Long (303) 603-5236.

27-11/7 Outside Plant Engineering–Basic (OPE-BX), Bellcore TEC Training from Nynex. Location: Marlboro, Mass. Call (800) 832-2463 or (708) 960-6300.

28-30 Digital Network Engineering, produced by NextLevel Systems. Location: Hatboro, Pa. Call (215) 674-4800.

NOVEMBER

7-8 Operating RF-IPPV Systems, produced by Scientific-Atlanta Institute. Location: Atlanta. Call (800) 722-2009, press "3" when prompted.

17-21 Hands-On Fiber Optic Installation for Local Area Networks (Multimode and Singlemode), produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671, ext. 5539 or 5560.

18-20 Cable Television Technology, produced by C-COR Electronics Inc. Location: Fremont, Calif. Call C-COR Technical Customer Services (800) 233-2267, ext. 4422.

DECEMBER

8-11 Hands-On Fiber Optic Installation for Outside Plant Applications, produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671, ext. 5539 or 5560.

15-18 Hands-On Fiber Optic Installation, Maintenance and Restoration for CATV Applications, produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671, ext. 5539 or 5560.

Trade shows

September

10-12 PCS '97 (Personal Communications Showcase). Location: Dallas, Texas. Call PCIA at (703) 739-0300 for more information.

21-25 NFOEC '97. Location: San Diego, Calif. Call (619) 467-9670.

28-30 Atlantic Cable Show. Location: Baltimore, Md. Call (609) 848-1000.

October

8-10 Private & Wireless Show, produced by National Satellite Publishing Inc. (NSP). Location: Wyndham Anatole Hotel, Dallas, Texas. Call (713) 975-0030, ext. 28; or (800) 555-0224.

20-22 Eastern Cable Show. Location: Atlanta, Ga. Call the Southern Cable TV Association (404) 255-1608 for more information.

21-23 1997 National Communications Forum/InfoVision97. Location: Chicago. Call (312) 559-4600.

December

10-12 The Western Cable Show. Location: Anaheim, Calif. Call the CCTA at (510) 428-2225.

January

28-30 SCTE Emerging Technologies Conference. Call SCTE (610) 363-6888.

The issue: Set-top boxes

The digital era. It's finally here, but set-top manufacturers report strong sales of advanced analog set-tops as the industry retools its infrastructure and waits to see if digital's economics make sense. What plans does your system have when it comes to set-top deployment?

The questions:

1. Does your system presently use addressable set-top descramblers?

❑ Yes ❑ No ❑ Don't know

2. How old are the set-tops you presently use in your system, on average?

❑ Less than 1 year ❑ 1-3 years

❑ 4-7 years ❑ 7+ years

3. Is your system more inclined to use the new "advanced analog" set-tops (such as GI's CFT2200 or S-A's 8600x) or the new digital boxes?)

❑ Analog ❑ Digital ❑ Don't know

4. What new set-top features do you think are most important to consumers?

❑ Program guides ❑ On-screen messaging

❑ Virtual channels ❑ More channels ❑ Other

5. Do you think digital set-tops should be standardized so that consumers can buy them at retail outlets?

❑ Yes ❑ No ❑ Don't know

6. How soon do you expect to begin deploying new digital set-tops to subscribers on your system?

❑ Next 6 months ❑ Next year ❑ 1999 or later

7. Several companies are working to allow Internet access via set-tops instead of personal computers. Are you interested in providing such a service?

❑ Yes ❑ No ❑ Don't know

8. Are you at all concerned that competitors like DBS, the telcos and MMDS operators will have digital equipment in the field before the cable TV industry does?

❑ Yes ❑ No ❑ Don't know

Your comments:

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RESULTS

The issue: Powering

As cable operators begin to load up their systems with ever-more services (high-speed data and telephony are two leading candidates), network powering issues are becoming more important. It's critical that cable operators have a clear powering plan devised when it comes to future rebuilds and upgrades. This survey asked respondents for their plans.

The results:

1. Is your system currently involved in, or planning for, an upgrade or rebuild?

Yes	No	Don't know
88%	**12%**	**0%**

2. How likely is it that telephony services will be added to your system in the near future?

Very	Somewhat	Not at all
25%	**38%**	**38%**

3. How likely is that high-speed data and Internet access services will be added to your system in the near future?

Very	Somewhat	Not at all
62%	**0%**	**38%**

4. What power voltage will your company's newbuilds and rebuilds utilize?

60V	75V	90V
88%	**0%**	**12%**

5. What is the optimum size (in number of homes) of fiber nodes in your system?

500 homes or less	1,000 homes
75%	**12%**

>1,000 homes	>2,000 homes
0%	**0%**

6. How much of your system presently uses standby power?

Less than 10%	10-24%	25-50%
25%	**12%**	**12%**

51-75%	Over 75%
0%	**50%**

7. Would you favor using a centralized power approach in your newbuilds?

Yes	No	Don't know
50%	**25%**	**25%**

8. When it comes to reserve power, how much do you think will be adequate in the future?

2 hours	4 hours	8 hours	Other
0%	**38%**	**50%**	**12%**

9. When it comes to power supply companies and technologies, what are the key requirements you look for?

Price	Reliability	Quality
25%	**100%**	**62%**

Modularity	Switchover time	Other
38%	**12%**	**0%**

10. Are you familiar with alternative powering options such as flywheels, natural gas generators and others?

Yes	No	Don't know
75%	**25%**	**0%**

11. Are you interested in testing or hearing about new forms of powering?

Yes	No	Don't know
88%	**12%**	**0%**

Your comments:

"I'm sold on the technology and application of central powering at a node. The hard part is selling the idea to a community to place a big, green monolith in a residential neighborhood."

– Barry Egan, Falcon Cable TV, Atascadero, Calif.

"Come on, people. We all need 100 percent standby power. (Telcos are!) Makes good customer sense."

–James Hughes Sr., Charter Communications, Kingsville, Texas

A small return sample probably skewed the results of this survey, but one conclusion does stand out: a large majority of cable systems are either planning for or presently undergoing an upgrade/rebuild as they retool to offer interactive programming to blunt competition from other network providers.

In fact, large percentages of respondents said they'll be adding high-speed data and/or telephony services over their networks.

Bucking conventional wisdom, however, the number who said they're switching to 90-volt power was miniscule, while at least half said their systems are already using standby power in large numbers.

When it comes to centralized vs. distributed powering architectures, the industry is decidedly split on the issue. Other findings: half feel they'll need eight hours of battery back-up in the future; the key requirements of those shopping for power are quality, modularity and reliability (not price!); and most are aware of new research that's underway in the powering industry.

Congratulations to Gene Neary of Adelphia Cable in Plymouth, Mass., who won $50 for his response. To make yourself eligible for a future drawing, fill out the form on the previous page and send it in!

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More Career Opportunities On Pages 110 & 111

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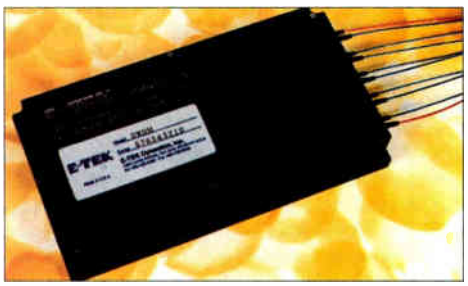
Dense WDM solutions

SAN JOSE, Calif.–E-TEK Dynamics Inc. has introduced a new Dense Wavelength Division Multiplexer (DWDM), an eight- or 16-channel module for increasing fiber capacity in a WDM network.

The DWDM's ITU channel wavelengths are narrowly spaced at 200 GHz apart, with a low typical insertion loss ≤ 4.5 dB, and high typical



E-TEK's DWDM

adjacent channel isolation ≥ 30 dB. A low polarization dependent loss less than 0.1 dB is guaranteed, and the device's optical path is always epoxy-free, says E-TEK.

The module uses thin-film interference filters combined with proprietary packaging methods to separate or multiplex optical transmission signals. The filters are very stable, with only 0.003 nm/degree C thermal wavelength drift, and 0.005 dB/degree C thermal stability. The product is suited for dense WDM systems, optical fiber amplifiers and cable TV applications.

Also new from E-TEK is a Dense Wavelength Division Multiplexer Filter (DWFI) which can achieve 200 GHz narrow linewidth filtering at ITU wavelengths with low insertion loss and high channel isolation.

Circle Reader Service number 66

Cleaning system

MILWAUKEE, Wis.–Tyton Hellermann Corp. has unveiled its new handheld fiber optic connector cleaning system. The Fiberclean system is a refillable dispenser which contains 10 feet of "ultra-white," nonwoven, lint-free film for complete removal of dust, dirt, oil and grease from fiber and ferrule end faces. The system's dispenser keeps the film clean and dry and holds it in place during the cleaning process. Three "figure-8 strokes" with the connector to the material cleans the surface. Used material is directed out the back of the unit, where it can be torn off at a perforation and thrown away.

Circle Reader Service number 67

Time domain reflectometer

BEAVERTON, Ore.–Tektronix Inc. has announced the availability of a new product for coaxial testing applications in hybrid fiber/coaxial networks. The CableScout TV220 is a high-performance time domain reflectometer for cable television and broadband applications. The TV220 features TestWizard automated testing that makes the unit easy to use, say Tektronix executives.

Waveguide couplers

MOUNTAIN VIEW, Calif.–Wave Optics Inc. has announced a new line of 1xN pigtailed planar waveguide couplers. Planar waveguides are integrated optical devices with an optical pattern generated within the material via a photolithographic process. Pigtailed

Wave Optics' planar waveguide couplers

planar waveguide couplers are uniform, repeatable, and offer a wide operational wavelength range. Conventional methods of cascading fused 1x2 couplers become complicated with PM fiber because of the unpredictable stress patterns generated at each fusion junction. The advantage of pigtailed planar waveguide couplers is evident in 1x8 and 1x16 coupler configurations. Wave Optics manufactures these couplers with 1300 nm and 1550 nm singlemode and polarization maintaining fibers with fast or slow axis alignment.

Circle Reader Service number 68

Fusion splicer

BLUE BELL, Pa.–Aurora Instruments Inc. has introduced the new FW312 Automatic Fiber Optic Fusion Splicer, which provides low splice losses with singlemode fiber. All features are combined inside a single, compact, rugged, self-contained package.

The FW312 is based on the company's FW310 automatic fusion splicer; however, it is more rugged, according to the company. In drop tests conducted at the factory, an FW312 automatic fusion splicer endured three drops of one foot each (on its bottom, back and side), followed by three drops of three feet each, all onto a concrete floor. Following the six drops, and with no adjustment or repair, the splicer immediately made an automatic singlemode fiber alignment and splice with a loss of 0.00 dB.

The FW312 splicer achieves an average splice loss of 0.016 dB with matched singlemode fiber, and its loss estimates are accurate

Tektronix Inc.'s CableScout TV220

The unit displays a high signal-to-noise ratio trace using a 400 MHz high bandwidth front end. This means that the TV220 can easily locate events lost in the noise of other cable testers. It also finds the subtle and small faults that can prevent the cable TV system from operating as expected.

The TV220 is able to identify components that are close together, recognizing events that are less than two feet apart because of its short 1 ns pulse width. This is particularly important when troubleshooting drops, because splitters and ground blocks can be very close together.

The unit automatically adjusts and optimizes gain, averaging and pulse width to provide a trace of the cable, with the events clearly marked.

The TV220 also accurately marks the location of multiple faults on the coaxial cable, allowing the operator to spend more time repairing faults, and less time operating the instrument.

Circle Reader Service number 65

within 0.02 dB 90 percent of the time. The process, including automatic fiber cleaning, alignment, gapping, fusion and loss estimation, typically takes 35 seconds. Other new features include lockable case latches and new, more user-friendly operating software.

Aurora's fusion splicer

All accessories and parts, including built-in heat shrink oven, precision cleaver, RS-232 data port, battery, charger, power cord, cleaning materials, spare electrodes, canned air, manual and fiber strippers, are included within the self-contained ruggedized case. The system includes a unique pigtail port system which allows quality testing, as well as automatic splicing and loss estimation, of fiber cable pigtails using any standard fiber optic connector.

Circle Reader Service number 69

Power meter/tester

HICKORY, N.C.–Siecor Corp. has introduced its new OTS-300 Express Series that includes a power meter, light sources and testers that test and store dual wavelength power and attenuation measurements simultaneously.

The unit has been designed to maximize testing efficiency by synchronization of the OTS-300 meter and source that continually updates the fiber data. By pressing a button, dual wavelength measurements are stored, then the next fiber is measured. This feature prevents costly errors from mismatched source and meter wavelengths.

Siecor's OTS-300 Express Series

Storing up to 900 dual wavelength measurements, the OTS-300 eliminates field paper work and makes documentation easier. In addition, stored measurements can be viewed and edited while in the field, and professional loss test tables can be generated by LinkLoss Windows-based software. The software simplifies the creation of bidirectional testing results, prints data files in an easy-to-read report form and allows further processing in other spreadsheet applications.

The power meter features selectable resolution optimized for field (0.1 dB) production and lab environments (0.01 dB). The units are calibrated at 850, 1300, 1310 and 1550 nm with a standard measurement range of +3 to -70 dBm.

Circle Reader Service number 70

Monitoring transponder

QUAKERTOWN, Pa.–AM Communications released its "Echo" Model 9013 End-of-Line Monitor, which has been designed to verify the presence of RF at end-of-line locations.

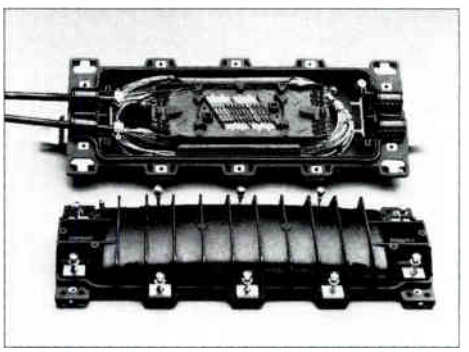
Installed much like a multi-port tap, the Echo takes its operating power and RF directly from the coax distribution network. It supports downloadable firmware with user-definable alarm limits for the forward RF signal level, the return RF signal level and the system AC voltage. It monitors these parameters and sends an alarm if a signal malfunction occurs.

Circle Reader Service number 71

Splice case

AUSTIN, Texas–3M Telecom Systems Division has unveiled its new 2178-S Fiber Optic Splice Case. The compact case has been designed to protect fiber optic splices in small spaces for underground, buried, hand hole, pedestal, cabinet and aerial outside plant applications.

The rigid, non-filled case is constructed from a new chemically-resistant material that has been tested for severe operating conditions including moisture, vibration and impact, cable stress and flexing, as well as temperature extremes. It is easy to install and re-enter and accommodates lower fiber counts in butt or in-line splice configurations.



3M's 2178-S Fiber Optic Splice Case

Its unique strength member clamp assembly complies with Bellcore recommendations for minimization of cable sheath movement during temperature changes. The case also features various port sizes to accommodate all common trunk and feeder cable sizes, thereby reducing the need for inventory. It also has a pressurization valve to allow for convenient flash testing.

The 2178-S accommodates two fiber optic splice trays and up to 96 single fusion splices or 48 "Fibrlok" brand splices using 3M's 2523 large fiber splice tray.

Circle Reader Service number 72

Power supply

PPT's Model MF2000

ROSWELL, Ga.–Performance Power Technologies has introduced the Magnum Ferro Model MF2000, a high-powered ferroresonant power supply. The MF2000 has three field selectable outputs of 60V @ 24A, 72V @ 20A and 90V @ 16A, which translate into 1440 volt amperes of power.

Circle Reader Service number 73

Survey–said! Focus on purchaser preference

By Thomas G. Robinson, Director of Regulatory Affairs and Technology Development, River Oaks Communications Corp.

Have a comment?
Contact Tom via e-mail at:
tomgrob@rivoakscom.com

By the time you read this, I'm sure hoping that the big UPS strike is over, because it's only a few days old as I write this, and it's already playing havoc with some of my deliverables and receivables. You know, I'm a company man from way back, and generations before me were company men. My grandfather, in fact, a now long-retired coal miner, is the epitome of the company man (just think of Tennessee Ernie Ford's song "16 Tons," and you'll get the picture). So I've got a bit of a feel about the turmoil the strikers are going through, especially the long-timers–proud of their association with "Big Brown" but increasingly concerned about how that association is changing.

I introduced my column this month in this way for two reasons. First, being a good company man, I'll be relocated back East in the land of cheese steaks, Liberty Bells and William Penn's heirs. Second, in reviewing what's happening in the industry today and in looking at trends that will shape my market focus on the East Coast, I see a lot of good company people leaving their organizations or being moved out, and I wonder about the changing association between the companies in our industry and their long-timers. Is it an increasingly competitive environment, differences in market philosophies, financial pressures, different perspectives on when to adopt new technologies, conservative vs. aggressive growth-styles, or some other reason? The answer is, probably all of the above.

"It's time to play the Feud . . ."

After surveying the landscape and spending some time pondering (good company men ponder, you know), I believe we're in what I call the "Family Feud" era of telecommunications industry development. There are myriad examples when you think about it–internal (look at TCI), intra-industry (TCI [again] vs. seemingly the rest of the industry regarding upgrade strategies), media giant squabbles (News Corp. vs. Echostar, Time Warner, etc.), the regulated vs. regulator (seemingly everyone vs. the FCC, cable operators vs. franchising authorities), etc.

Well, you remember how Richard Dawson used to solve family feuds–with a survey, and the one who correctly determined the respondent preferences won. Because at the heart of the moves and countermoves being made in the industry is the desire to sell services, information that provides a good handle on the service purchaser's preference may be the key to moving us all beyond the "Family Feud" era.

I've done a significant amount of survey work on subscriber preferences, and I believe that there are several major trends that bear watching. They also point squarely toward architectural components in both the near and long term that can help develop the markets indicated by these trends. Some of the major points can be summed up as follows:

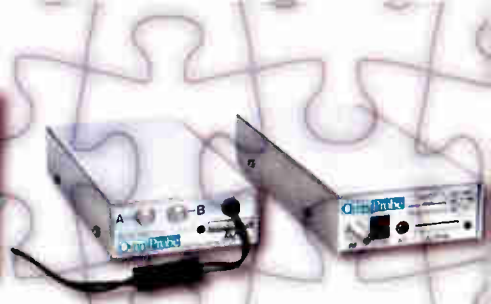
✔**Digital compression is not the whole answer**–Yes, subscribers want more of the same types of programming but, according to surveys, that is not nearly the sum total of their expressed needs. They also need options in the way programming is acquired, they need new types of services and they need improved picture quality. Thus, digital compression can only be a piece of the architectural puzzle, with physical plant and capacity upgrades, fiber optics, extensive system segmentation, etc., being equally important pieces.

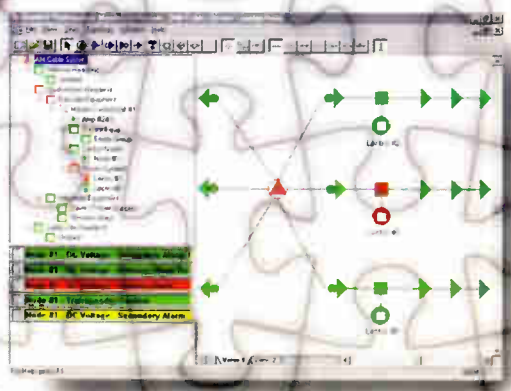
✔**The reports of video-on-demand's (VOD) demise are greatly exaggerated**–Some market research and trials of VOD indicate that subscribers may be just as happy with near-video-on-demand (NVOD), especially when it comes to pay-per-view type movies. Sifting through the larger body of research, though, would suggest that as you offer more programming choices through VOD (such as programs from a vast menu-driven programming library), and as the decreasing cost of VOD technology over time may make it more pocketbook friendly, then the favorability rate increases sharply. Additionally, even the term "VOD" is still fuzzy for most subscribers and potential subscribers. In fact, in one series of surveys, replacing the terms "video-on-demand" or "movies-on-demand" with a phrase like "programs you want to watch, when you want to watch them," increased the favorability rate tenfold. Thus, the industry should continue to place an emphasis on future VOD offerings in the development of current architectures and current terminal equipment specifications.

✔**Access to data has to be part of the equation**–The industry's institutional and business users want to provide it, residential subscribers want to access it, and companies like Microsoft want to invest in it, so it's easy to do the math on data-over-cable applications. As subscribers increasingly desire electronic access to a wide range of services, as the costs of Internet access devices continue to go down, as such devices become as easy to use as the telephone and, correspondingly, as Internet use increases while TV net use starts to fall, the industry must have the architectures and services in place to take advantage of these shifts in the marketplace.

Can a strong focus on service purchaser preferences reduce family feuding and move the industry forward? The number-one answer is yes. Just look at old adversaries Apple and Microsoft. They wouldn't have recently buried the hatchet unless they thought it would help both of them better meet service needs (and thus drive revenues).

Well, I'm off to the City of Brotherly Love, and when I get there, I have to buy a new computer. Who knows? I might end up with a new MS Mac or Microtosh or whatever they're gonna call it. And I hope that those "Big Brown" trucks will be back on the road to deliver it. CED





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

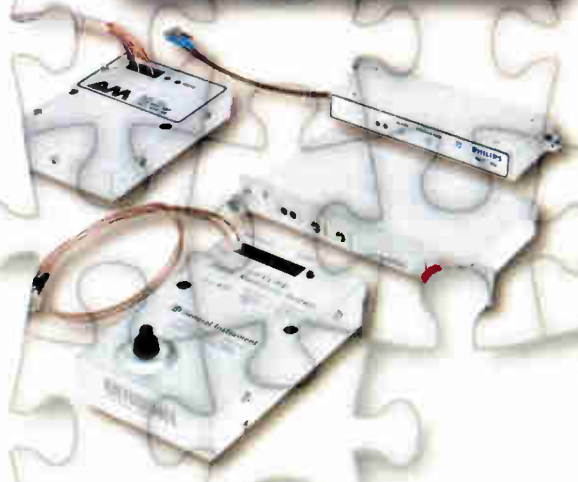
FEATURES...

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

SYSTEM SUPPORT...

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

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



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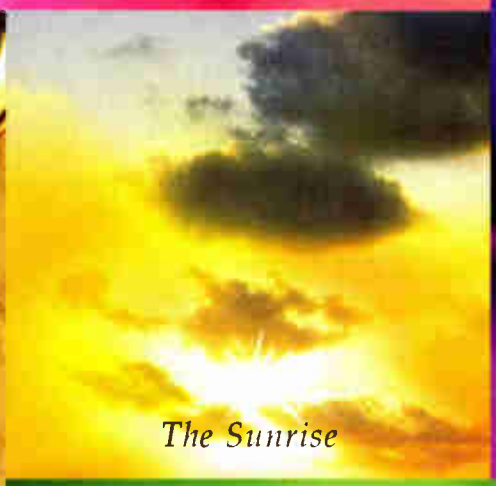
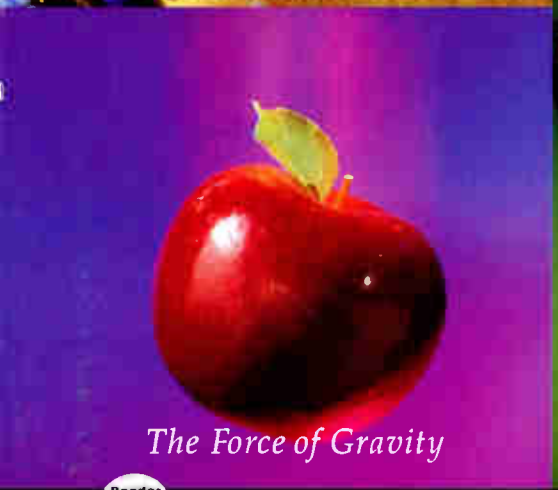


The Sunrise

The Bloodhound's Nose



The Force of Gravity

The Continuum Headend System

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