CED

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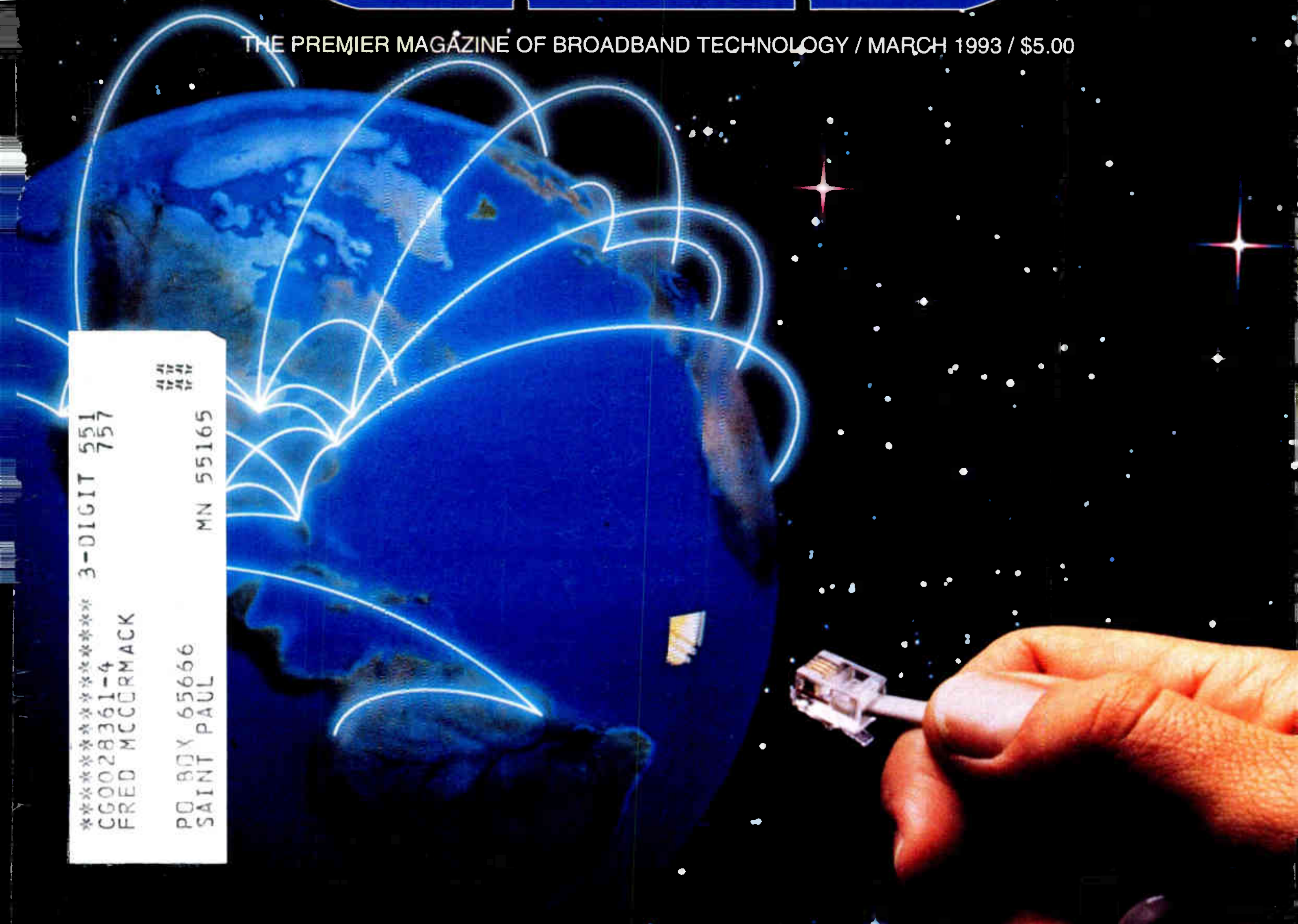

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March 1993 CED Volume 19, Number 3

Telephony over cable: Does it make sense? 32
With TeleWest and Time Warner both getting more than just a little serious about offering telephone services over the cable network, the whole issue certainly warrants a closer look. Fred Dawson, editor of the *Cable/Telco Report* and president of Dawson Communications, examines the viability of telephony services over cable, paying particular attention to the recent moves made by TeleWest and Time Warner Cable.

How one operator got into the alternate access biz 38
Not long ago, Time Warner's Kent Vermillion thought a T-1 was something related to the game of golf—and he's not afraid to admit it. In this comprehensive article about starting a competitive access business, Vermillion describes how his Indianapolis-based system became knowledgeable about the business.

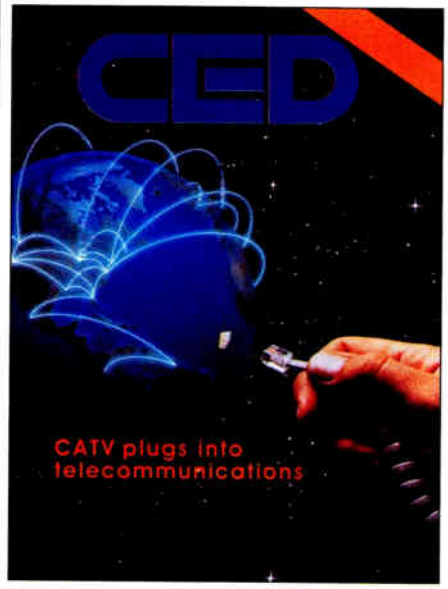
Cable/telco topology chart 41
Cable television and telephony networks have separately evolved toward fiber-rich, redundant topologies in order to deliver advanced services to customers. This chart graphically illustrates how each industry is migrating toward the same network layout.

More on the Sammons/N.J. Bell deal 58
Recently, Sammons Communications made headlines when it signed a controversial deal with New Jersey Bell. In the agreement, Sammons leases 60 channels of video from N.J. Bell over the next 10 years, while New Jersey Bell constructs a new, state-of-the-art, digital broadband fiber network in the area. *CED* Editor Roger Brown details the ramifications of the announcement.

Telephony tutorial 62
Ever wonder what happens from the time you pick up the telephone to place a call until someone answers it on the other end? Wonder no longer. Kristi Furer of First Pacific Networks outlines the basics of how a telephone call is accomplished.

Independent cable/telephone operators: An update 64
The nation's rural heartland functions as a microcosm of cable and telephone activity, with several small independent companies operating both networks out of the same "headquarters." *CED*'s Leslie Ellis examines the plight of the rural independent operator.

Glossary of telephony terms 75
At last: A guide to the many acronyms and buzzwords that make up telephone jargon. Although it's just a partial list, we think you'll find this section a useful tool. Compiled by Gary Kim.



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Are voice services next for cable?
Photo provided by FPG, International

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to comply with the new set of standards, operators will be required to conduct baseband video proof-of-performance tests. Specifically, these will include chrominance-luminance delay inequality, differential gain and differential phase measurements.

In order to create a uniform, nationwide scheme, the FCC said its standards will preempt local standards. However

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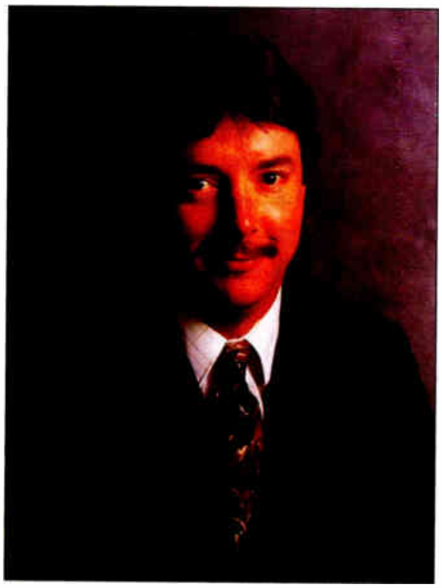
Tracking the evolving cable plant

The predictions and warnings of cable/telco/computer industry convergence have been coming for a long time, but it's now safe to say the era of integrated telecommunications industries is finally upon us.

First, the Federal Communications Commission, under chairman Al Sikes, conceives of an idea dubbed "video dial tone" that allows telephone companies to carry video over their networks, provided they have no control over the content of the programming.

Then, in rapid succession, telephone companies announce plans to upgrade their networks to broadband capability in order to deliver video to the home and cable companies announce plans to implement digital technology and add fast-packet switching capabilities.



In the past 90 days, the following watershed events have occurred:

- The RBOCs announce plans to test the video dial tone concept via new and improved broadband networks consisting of fiber optic technology into neighborhoods (or to the curb) with coaxial cable feeding video into the home. US West says it will spend $13 billion to upgrade its entire network over the next two decades to offer video on demand, telecommuting, etc..
- TCI singlehandedly drives the digital video compression market by announcing it's intent to purchase one million decoders and deliver 500 channels of video to the home.
- Time Warner says it plans to build its Full Service Network, a fiber-rich, digital video network that utilizes fast-packet switching in Orlando, Fla. by the end of 1993. One of the stated goals: to pursue PCS, provision of long-distance services and telecommuting *(see related story, pg. 22)*.
- Southwestern Bell purchases the Washington, D.C.-area cable systems from Hauser Communications.

The traditional lines separating telephony and video industries are being erased at a pace few would have fathomed just a few short years ago. That's exactly why *CED* this month devotes it's entire issue to the changing cable/telco relationship.

To help educate the thousands of CATV technical personnel, we're offering a wide range of informational articles written by both traditional cable and non-traditional voices. Inside this issue, you'll see:

- Illustrations of how telcos and cable companies are building essentially the same type of network, but were driven to do it by different needs;
- An introductory glossary of telco terms to help readers sort out the maze of acronyms and telco industry jargon;
- An explanation of why Sammons Communications decided to lease fibers from New Jersey Bell instead of building its own network;
- Discover the lessons learned by TeleWest, a joint partnership of TCI and US West, as it integrates telephony and cable TV services on the same network in the United Kingdom;
- And lots of other news and views about what lies ahead for both cable operators and telephone companies.

We hope you enjoy this issue—*CED*'s initial foray into the digital telephony/video world. There will be more to come.

Roger Brown
Editor

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Time Warner plans Full Service Network test in Orlando system by end of year

Executives of Time Warner Cable gained widespread press coverage by announcing its plans to develop and construct a "Full Service Network" in portions of the MSO's Orlando, Fla. system by the end of 1993. The new network, which T-W calls a "two-way electronic superhighway into the home," will be capable of delivering a wide range of interactive video and telephony services to subscribers.

Time Warner Cable Senior Vice President of Engineering and Technology Jime Chiddix said the concept will serve as a model for other Time Warner systems. "This is the initial deployment of the system of tomorrow," he told *CED*. He also said the FSN goes beyond simple digital compression and delivery of near video-on-demand to include ATM switching and digital storage of movies to make them available at the push of a button.

Time Warner plans to roll out the system to about 4,000 subscribers by the end of 1993. Services expected to be offered include: interactive, full-motion video education services; VOD that includes movies, sports, cultural events, documentaries and educational programs; interactive video games and video interactive home shopping. Also, PCS, long distance telephone access and Picture Phone will be offered along with competitive access, videoconferencing and high-speed data transfer.

While complete technical details are still being sorted out, Chiddix said the digital storage needed to make 500 movies available on demand would be about 1 terabyte (1,000 gigabytes). He also said the company is counting on high-speed packet switching technology based on asynchronous transfer mode (ATM) protocols to make the switching functions a reality.

ATM technology is presently quite expensive, but Chiddix said prices will fall dramatically because the market will be spurred by this and perhaps other annpuncements. "What ATM has lacked is a mass market," said Chiddix. "We think this is the beginning" of creating that type of market for the technology. Chiddix added that he believed the technology will be affordable for cable television use.

The adoption of ATM technology by the cable industry is being recommended by several manufacturers as a way to gain interoperability with the data communications market. It will allow entire communities to compete head-to-head in interactive video games.

Requests for proposals for network components—including taps and actives, fiber termination equipment, amplifiers utilizing a return band of 850 MHz to 1 GHz, digital storage devices and switching hardware—were scheduled to be sent out the middle of February, according to Chiddix.

Time Warner may have a chance to test it's "point of entry" side of the house concept in the Orlando upgrade, according to Chiddix. "We haven't ruled out POE on this project—we may deploy both (set-top terminals and side-of-the-house addressable control)."

US West plans broadband plant

US West Communications may have been one of the last regional Bell operating companies to articulate its video dial tone plans, but the Colorado-based company's plan is the most comprehensive announcement made by an RBOC to date.

US West announced last month a long-term, $13 billion plan to upgrade its network to broadband capability utilizing digital technology in order to offer a variety of video services, including video on demand, telecommuting, telemedicine and distance learning.

Coming just one week after Time Warner Cable detailed its plans to build a "digital superhighway," the US West plan signals the company's intention to aggressively pursue video services delivery throughout its 14-state region. That stance is an apparent reversal of the company's previous public statements of having no intention of overbuilding existing cable operators because the costs were too high.

But last fall, US West issued a request for information regarding upgrading its network to broadband capabilities and came away with pricing information that showed an overlay network could be built at costs competitive with all-copper technology, according to a US West spokesman.

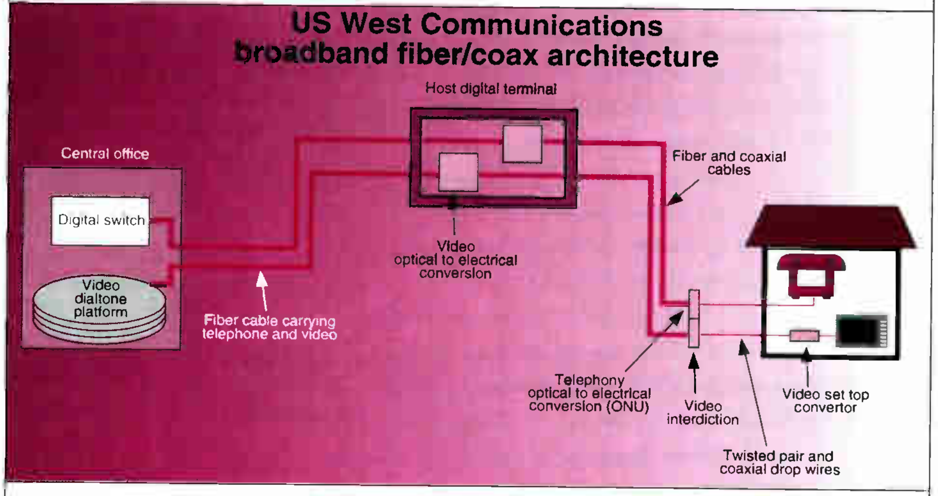
US West has been considered by many observers to be a "cable-friendly" RBOC and is involved with TCI and AT&T in a video on demand market test in the Denver area. This announcement is not expected to affect the test, according to sources from both companies.

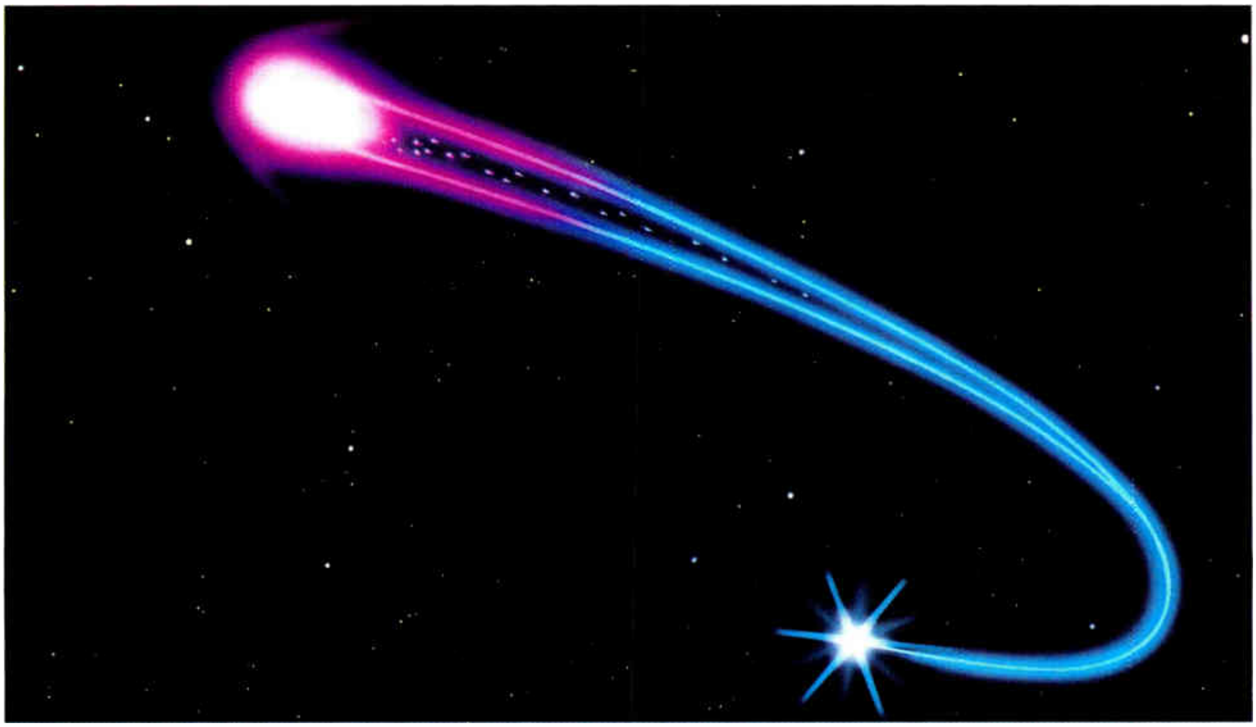
While making the announcement, US West spokesmen said the company has issued a request for proposal to several companies for the network components needed to upgrade the plant to carry voice, data and video. The proposals are due by March 23.

The company said it expects to conduct a technical trial of the new network later this year and expects about 100,000 customers to be using it by the end of 1994. By 1995, the company expects to add 500,000 customers per year to the network through the end of the decade.

The new network, which is being built primarily to serve residential customers, is expected to utilize a hybrid fiber/coax/copper topology capable of delivering between 70 and 100 channels of video to each home (without compression). The RFP requires that three channels of video be available to each home.

Interestingly, the topology chosen is





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similar to the approach cable operators have migrated to over recent years. Tom Elliot, vice president of engineering and technology at TCI, termed US West's announcement "gratifying" because it "confirms that our (cable's) infrastructure is the right infrastructure. It's also interesting to note that we have ours in place while there's is at least 10 years away."

SCTE files EBS comments

The Society of Cable Television Engineers recently filed its comments on industry participation in the Emergency Broadcast System with the Federal Communications Commission.

In the 20-page filing, the SCTE made several recommendations related to cost and implementation issues, including:

- SCTE suggested that EBS equipment purchases should not be made mandatory unless state and/or federal funding is available. In the Notice of Proposed Rule Making, the FCC seeks to make participation in the new EBS system voluntary—but also seeks to make equipment purchases mandatory. The SCTE cites a potential cost of $10,000 to $50,000 per facility to purchase the necessary equipment. According to Ken Wright, director of engineering at Jones Intercable, this would result in a total industry expenditure of between $100 million and $400 million. Without some assistance, rural headends simply could not afford to implement the program.
- Any currently installed override equipment should not be obsoleted by the new system, which could potentially cost the cable industry between $144 million and $587 million, "depending on the requirements."
- The SCTE's comments also included a discussion of compressed, digitized video signals, which it says will "not initially be able to insert information or override the programming on."
- Also, the SCTE asks that the FCC specify only one device, in an attempt to minimize development costs and delays. The device would contain "basic features common to all participants."

The comments also ask that unattended operation be allowed, because most cable headends are unattended. A gradual phase-in period, instead of a mandatory compliance deadline, was also requested.

Wright says he expects the FCC to issue its proposed rulemaking sometime this spring.

Medical fund established

Jeremy, John, Barbara and Brianna Figal (from left) in a recent photo.

Cable industry colleagues have set up a medical fund for John Figal, a 42-year-old cable television engineer from Denver and 15-year veteran of the cable industry, who has been hospitalized since early December following the rupture of an aortic aneurysm and subsequent cardiac arrest. Emergency repair of the aneurysm required 44 pints of blood, which the Denver cable community replaced with a special blood drive at Tele-Communications Inc.

Figal is slowly improving, but side-effects of some of the life-saving medications compromised circulation to his extremities, resulting in the amputation of Figal's lower legs.

The cost of medical treatment at Denver's Porter Hospital is rapidly approaching $1 million, the limit of Figal's health insurance. Further surgery and extensive rehabilitation will be needed.

Figal began his cable career in the late 1970s with Cable Comm General, then moved on to United Cable Television (and United Artists after the merger) in the 1980s. In 1991, Figal joined Synchronous Communications. He is a member of SCTE and IEEE.

Figal's contributions to the industry have been many—including measurement techniques resulting in more meaningful equipment specifications and testing; improved hardware/firmware for addressable convertors that made sophisticated features more user-friendly; and generally helping raise the industry's technical conscience regarding realistic expectations from CATV equipment and systems.

The "Figal Family Caring Fund" has been established to benefit John, his wife Barbara, 16-year-old Jeremy and 13-year-old Brianna. Contributions may be sent in care of the fund to: Norwest Bank, 66 West Springer Drive, Highlands Ranch, Colo. 80126; or call (303) 791-0344.

Cablevision buys interdiction gear

In one of the largest contracts for interdiction gear announced to date, Cablevision Systems Corp. has announced plans to purchase $6.5 million of equipment from Scientific-Atlanta for deployment in about 40 of the MSO's systems as a way to deliver a broadcast-only tier of channels. The broadcast tier will consist of local TV stations and public access, education and government (PEG) channels.

Unlike most other announced deployments of interdiction, Cablevision will deploy single-port units and power them through the cable drop from customers' homes.

Interdiction provides addressable control of video services in a user-friendly and consumer electronics compatible manner. Video signals are sent "in the clear" from the headend and then scrambled by the local interdiction unit, rendering the pictures unwatchable.

Cablevision chose interdiction because it will be forced to offer the basic tier of programming as a provision in recently enacted legislation and it needed a way to offer the tier without changing channel lineups. "This paves the way for us to offer more secure services in commercial establishments and in high churn areas," said William Quinn, Cablevision's president of cable operations.

Jottings

KBLCOM spent $5.8 million to acquire an equity interest in **InSight Telecast**, a California-based developer of an electronic program guide. KBLCOM joins Viacom, Tribune Co., Spelling Entertainment, Sumitomo and PBS as investors. KBLCOM viewers will be offered the InSight service over the next two years . . . **Texas Instruments** and **C-Cube Microsystems** will jointly develop integrated circuits for digital audio and video compression . . . **HBO** signed the agreement with **General Instrument** for DigiCipher video compression gear. CED

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Studied inefficiencies

The formative years of my working life were spent with the largest company in the world, that being the old "Bell System." During the years that I toiled there, the company employed about 1 million people. These men and women were kept busy in a bewildering number of subsidiaries which were themselves located in thousands of areas in this country and abroad.

As a Bell employee, if you were lucky enough to be sent to one of the Bell System schools (and a surprisingly large number of people were), then you not only got a dose of intensive training in the subject at hand but you also got a subtle lesson in the culture and structure of the old gal—Ma Bell—herself.

Telco: Rational inefficiencies

During this time, all was right with the world (the telecommunications world, at least) and the biggest issue was the periodic need to enter into collective bargaining with one or more of the unions that represented the workers. The effect of the enormity of the company and the power of the unions was to create some very strange and inefficient practices that seemed perfectly rational at the time. Every worker's job assignment was given according to seniority and every little thing that needed to be done had to be done according to those rules.

For instance, if two people were assigned to the test board (because of seniority) and two others were working in the equipment bays, the needs of the customer were placed second to the need to abide by the work rules. If a customer circuit was tested and found to be faulty and the trouble was determined to be in the equipment at the local end, then the test board operator called the person in the equipment bays and had them check or replace the appropriate device.

Let the customer wait?

So far this sounds perfectly fine, but if the workers in the equipment bays were busy on some other problem, you (and the customer) had to wait. This was true even though people were trained and qualified to walk over to the equipment bays and make the necessary adjustments or repairs themselves. Indeed, the abiding mindset was: "The customer can wait."

I bring up this bit of trivia in order to illustrate a key point about the changes that are beginning to occur in the telcom marketplace. The primary management outcome of the rigid company and union work rules was one of general inefficiencies. That is, it took more people to do things than was strictly necessary. In the world and era of Rate of Return (ROR) earning rules, this was not only OK but was actually good for the bottom line—and thus good for the stockholders.

Under the ROR, a company earns a return based on some percentage of the investment in the business (this includes labor and all attendant costs). As you can see, if five people (or testboards or trucks) could do the job that one or two could normally handle, then the return would actually be higher (14 percent of $2 million is more money per year than 14 percent of $1 million). There is no built-in incentive to be frugal, you see.

Inertia breakdown

The world has changed since those heady days and that change will likely affect those of us in the cable industry. The RBOCs (the seven pieces which made up the bulk of the operating side of the old Bell System) are doing everything they can to push the envelope of regulation out to a shape that allows them to be in any business that they can make work on their network. This network will have to be changed to handle some of the services they would like to sell.

Therein lies the first of several problems that the RBOCs face.

In order to get the capital they need to upgrade their networks to handle new services, the RBOCs need to accelerate their plant depreciation. This shows up on the *expense* side of the balance sheet and is thus deducted from taxes, leaving more profit. The money from this source is to be used to finance the introduction of new network technologies.

These new investments will have a higher price tag than the old plant. Thus, under an ROR type of plant, the RBOCs would be able to raise their rates.

The world, however, has not stood still. The major move in rate regulation is toward one of price caps. In this plan, a company is required to charge a certain rate. The profit the company is allowed to earn is the difference between the actual costs to provide the service and the price that is allowed.

The first question is whether the price cap as set for the old style network is the base point for any newly-deployed network. A second question relates to whether or not these new technologies will generate efficiencies that will result in increased margins that can be used to finance development in yet newer services and networks.

The old Bell system lasted over 100 years, and in the last 25 years before divestiture, the management style made little or no progress into the modern world.

The biggest question that the RBOCs and the cable industry have to answer is whether or not the heavily ingrained ethic of studied inefficiency will last into the new era and whether or not the cable industry can take advantage of the inertia of that system to deploy the new services that customers want on a network that is already deployed and rapidly accepting new technologies now.

Reinvent yourself

As new competitors come to woo our customers, the best and most potent weapon to deploy is to re-invent yourself in ways that provide more and better services and services to the market. We have the advantage if for no other reason than the fact that we have inertia on our side.

The way to make that fact work for us is to find ways to give our customers what they want—before someone else does. CED

By Wendell Bailey, Vice President, Science and Technology, National Cable Television Association

Determining local CAP potential

In this ever-changing business, technology and regulatory climate, we can no longer consider ourselves to be in the CATV business. Our very survival as an industry, over the long haul (no pun intended), will likely dictate that we consider ourselves to be in the telecommunications industry, with the transport of video entertainment services as being only a part (albeit a large one) of our overall product offering.

The hybrid fiber/coaxial infrastructure that we build and rebuild in the future will certainly be capable of offering a plethora of services that are unmatched in the telecommunications industry today. Competitive access is simply one of those services. But how do you determine if there's a need? Let's examine the practical side of determining whether or not there is an opportunity in your franchise area to tap into this market.

Establish a relationship

As in any market, one of the first issues to consider is the development of an excellent relationship with your customer. In the competitive access market, you will ultimately have two customers that need to feel that you are offering them a valuable, reliable and competitive service to that which is being currently provided by the local exchange carrier (LEC). These customers include the entrenched inter-exchange carrier (IXC) and the end user. In most cases, your customer will be the IXC, and it will be you, through the IXC, that will provide the needed route diversity and competitive access to the end user.

It is absolutely crucial that you develop a strong professional relationship with all of the major IXC's including AT&T, MCI, Sprint, etc. AT&T, for example, has indicated that within the next five years, it will be spending around $1 billion annually with competitive access providers (CAPs). I

Once it has been determined this is a business you would like to be in, and you have begun to develop relationships with the IXC's, the next step in the process will be to determine which franchises offer the best financial opportunity, and rank them accordingly. There are several criteria that should be used to rank the market, and to determine how you will play in that market including: the location and amount of long distance traffic in and around your franchise areas; the location of the IXC points of presence (POPs); the location of the LEC central offices (COs); the location of your existing (or planned) fiber optic facilities, and whether or not there is an existing CAP in your market. It is possible, after all, that instead of becoming a CAP, to lease your fiber optic facility to an existing entrenched CAP.

Request "Demand Sets"

The location and amount of long distance traffic in and around your franchise areas can be determined by working with the various IXCs and by simply driving out the system. The first step in the process is to request Demand Sets from the IXCs. A Demand Set is a listing of the IXC's customers in a given geographic location, complete with their address, and the amount of traffic they utilize (DS-1, DS-3, etc.).

This is obviously proprietary information and must be treated as such. Demand Sets will typically not be provided by the IXC without first signing a non-disclosure. They are typically provided as a database file on disc, or as a listing on paper. In addition to this customer information, the Demand Set will also indicate traffic flow, i.e. to which POP location the particular customer's traffic is routed.

POP and central office (CO) locations must also be found. AT&T's POPs, because they are a regulated utility, are a matter of public record in a document called AT&T Tariff 10. The POP locations for MCI, Sprint and other IXCs are not in the public record, and must be obtained directly from the IXC. Hence another reason to develop a good working relationship with them.

Once this information is obtained, the next step is to go through the tedious and time-consuming process of plotting each of these locations on a map of both your and the adjoining MSO's franchise areas. This process will give you an immediate, and quite powerful, visual indication of the market potential, and precisely where it falls relative to your current (or planned) fiber infrastructure. It is critical that you look at both your franchise areas as well as those of your adjoining MSO's, because in many cases, it will be possible for you to work together to expand the market potential.

In some cases, for example, the Demand Sets will identify a number of large users in your franchise area, but the POP locations to which they must be connected will fall in an adjoining MSO's franchise area. Another possibility is that you might find the vast majority of traffic originating outside your franchise area, but there might be several POPs located in your franchise area. Somehow, these two entities must be interconnected with a fiber optic path.

This would obviously be an excellent opportunity to work closely with your adjoining MSO(s) by interconnecting your fiber optic facilities where it makes good business sense, and creating an equitable split in the revenue generated. As you might imagine, it is the "equitable" portion of the business relationship that is sometimes the most difficult to work out. It's fairly easy, on the other hand, from a purely engineering perspective.

If there is already an entrenched CAP in your franchise area, it probably wouldn't be a bad idea to begin discussions with it on the potential for the lease of existing dark fiber within your franchise area, especially if it has not yet built-out its system. Or, if you are planning a major rebuild that includes an extensive amount of fiber, it might not be a bad idea to begin negotiations with the CAP on the potential routing of that fiber to suit its needs. If you have done your homework and plotted the information contained in the Demand Sets, and if you have sound maintenance and restoration plans in place with a passion for, and history of, excellent customer service, the CAP will probably be interested in talking to you—especially if it views you as a potential competitive threat who knows the business. CED

By Chris Bowick, Group Vice President / Technology, Jones Intercable

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Full service network

The Full Service Network, Time Warner's electronic superhighway into the home, is the culmination of Time Warner's vision for its cable television systems. It provides a platform on which Time Warner's customers will have access to a huge array of entertainment, education, information and communications services and demonstrates the potential of today's cable television delivery system to evolve quickly and cost-effectively into the communications infrastructure of tomorrow.

Built on a coax foundation

The foundation of this vision is the existing coaxial network which, over a period of several decades, has been brought to the property lines of virtually all of the homes in the Time Warner Cable franchise areas. The network currently delivers television service to about 60 percent of those homes. Today's cable television network architecture limits its capacity to the distribution of a few dozen television channels throughout a neighborhood. But the potential capacity of the coaxial cable already in place is far greater than that.

One step beyond Quantum

The first major step in the process of evolving these systems to a much more powerful network was demonstrated a year ago in Queens, N.Y., with the launch of Quantum cable service to several thousand customers. By taking advantage of fiber optic technology to install fiber trunks to small neighborhoods of a few hundred homes, a dramatically different architecture was implemented. The initial impact of that new architecture was to allow the delivery of 150 analog television channels to all customers, making the Quantum service possible, with a broad selection of standard cable services, as well as a large number of choices of pay-per-view movies and events.

Another key event has been the development over the last year by a number of vendors of practical digital video compression technology. This development opens the possibility of transmitting hundreds of television channels on the existing coaxial network. However, when compression technology is combined with the fiber-to-the-neighborhood architecture of Quantum, the enormous digital channel capacity in each neighborhood is multiplied by the number of fiber trunks serving a cluster of neighborhoods.

Digital storage

Two additional technologies beyond fiber optics and digital video compression enable this network to offer infinite capacity. One is truly high-capacity digital video storage. It is estimated that a digital "library" large enough to store 500 two-hour movies might require one terabyte of memory—that's 1,000 gigabytes or one million megabytes. To put that in perspective, today's personal computers typically have hard disk memory with a capacity of between 20 megabytes and 80 megabytes.

> The Full Service Network will provide virtually any kind of interconnection service.

In addition to very large memory capacity, it also is necessary that tens of thousands of customers be able to access information from memory—often the same information—simultaneously. These very large, multi-access digital storage systems, or "servers," represent a technology which is just beginning to mature. The Full Service Network will make use of exactly this kind of digital video library.

ATM switching

The other necessary element to realize the Full Service Network is the switching capacity required to route digital information, whether it be video, voice or computer data, from the digital libraries to individual customer terminals. This requires a distributed form of high-speed packet switching.

A great deal of work has occurred around the world refining a protocol for this switching. It is referred to as ATM (asynchronous transfer mode) switching. Time Warner expects to use this technology to route digital information through the Full Service Network.

The servers will interface to the ATM switch network, as will the feed points for each fiber trunk to each neighborhood. The terminal in each subscriber's home will be an ATM terminal, capable of receiving and reconstructing information from high-speed digital packets addressed to it. This terminal also will contain digital video decompression technology to regenerate an analog picture for display on the subscriber's television set.

In addition to video, the terminal will be capable of receiving and transmitting virtually any other kind of information which can be digitized.

Other applications

Once this digital switching capability is in place, it also can be used to route information through the network to enable such things as PicturePhone, wireless personal communications networks, direct access to long distance telecommunications carriers and high-speed computer interconnection.

In summary, the Full Service Network will provide virtually any kind of interconnection service which consumers or businesses require. It can be built virtually as quickly as demand is demonstrated, and certainly much more quickly than other networks which require the rewiring of America. It can be constructed at reasonable cost and, most importantly, can be deployed on an evolutionary basis, with investment paced against the development and acceptance of new services which generate supporting revenues. CED

By James A. Chiddix, Sr. Vice President, Engineering & Technology, Time Warner Cable

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Space Requirements	Two 19" rack spaces	One 19" rack space [2]
AC Power Consumption	325 W	140 W [3]
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[1] Broadband capability is not a feature which benefits end users in single frequency applications.

[2] Are you replacing amplifiers or looking for more rack space, and at what cost?

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Passive Optical Network architectures and applications

Passive Optical Networks (PONs) have generated considerable interest for telephony applications, and this architecture has been claimed to be very suitable for distribution of video signals as well. The term PON covers an array of design variations (e.g. two fiber vs. one fiber), and several trial networks have been built using different designs.

This paper describes a number of current approaches to PON design, and typical parameters are given. The characteristics of a typical PON video delivery systems are described in terms that allow network operators to evaluate the applicability of this technology to their networks.

Optical fiber is an almost ideal transmission medium. It has huge bandwidth potential, it is almost inert, it is available in cables which are small, light and easily handled compared to metallic cables, and it has very low transmission loss which does not vary significantly with temperature.

Its major drawbacks are that splicing is more difficult than for copper cables and the cost of optoelectronic transducers is high. These drawbacks are steadily yielding to technological improvements.

Optical fiber transmission has been the technology of choice for long distance digital transmission for a decade, and is steadily becoming cost effective at shorter and shorter distances. In CATV networks, FM fiber optic supertrunk systems have been in use for many years, and AM fiber systems have supplanted coaxial trunking in most new- and rebuild construction in the past two years.

In telephony applications, the long term goal is to take fiber all the way to the customer. This approach is usually called "fiber to the home" (FTTH). It will give the transmission benefits of fiber and the "future protection" provided by the bandwidth potential of fiber.

However, it is not economically feasible at present. The cost of fiber optic systems makes it necessary for a number of customers to share each fiber network terminal. This approach is usually called "fiber to the curb" (FTTC).

Figure 1: PON Architecture

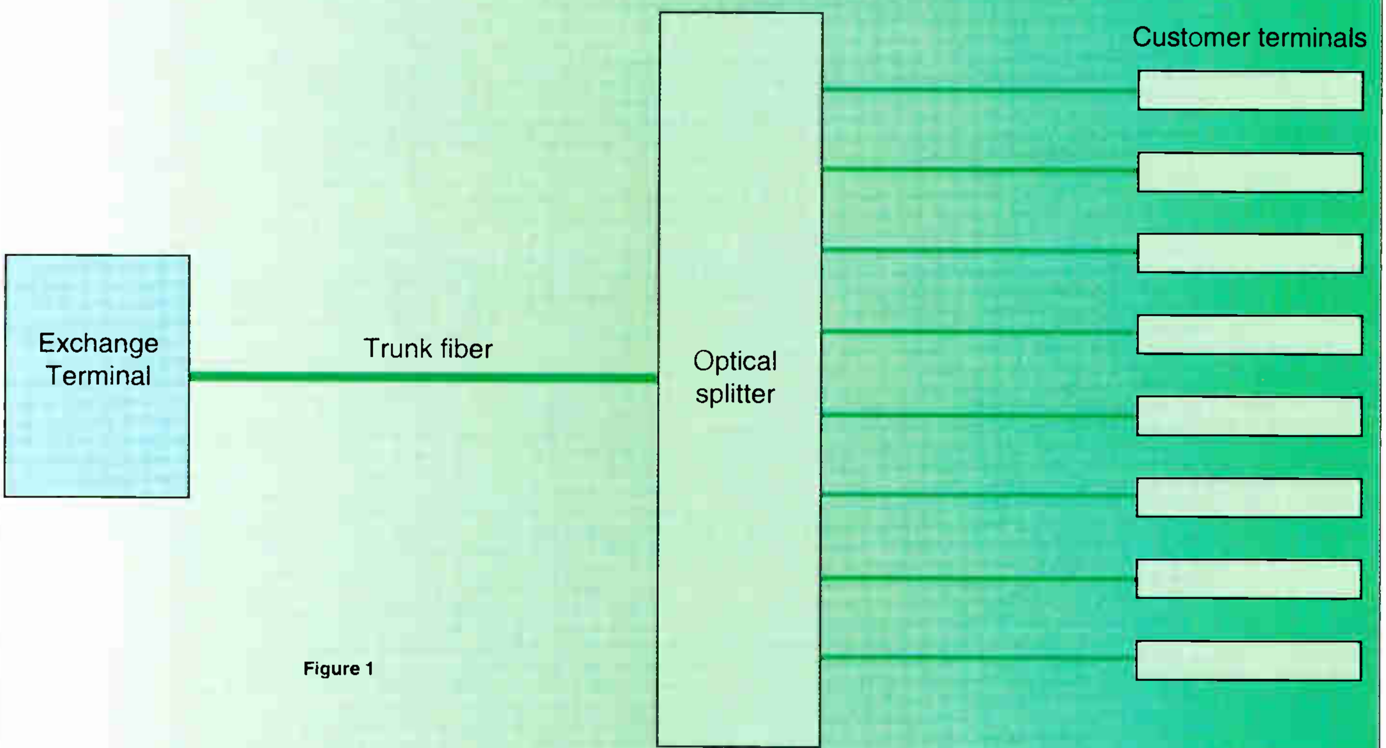
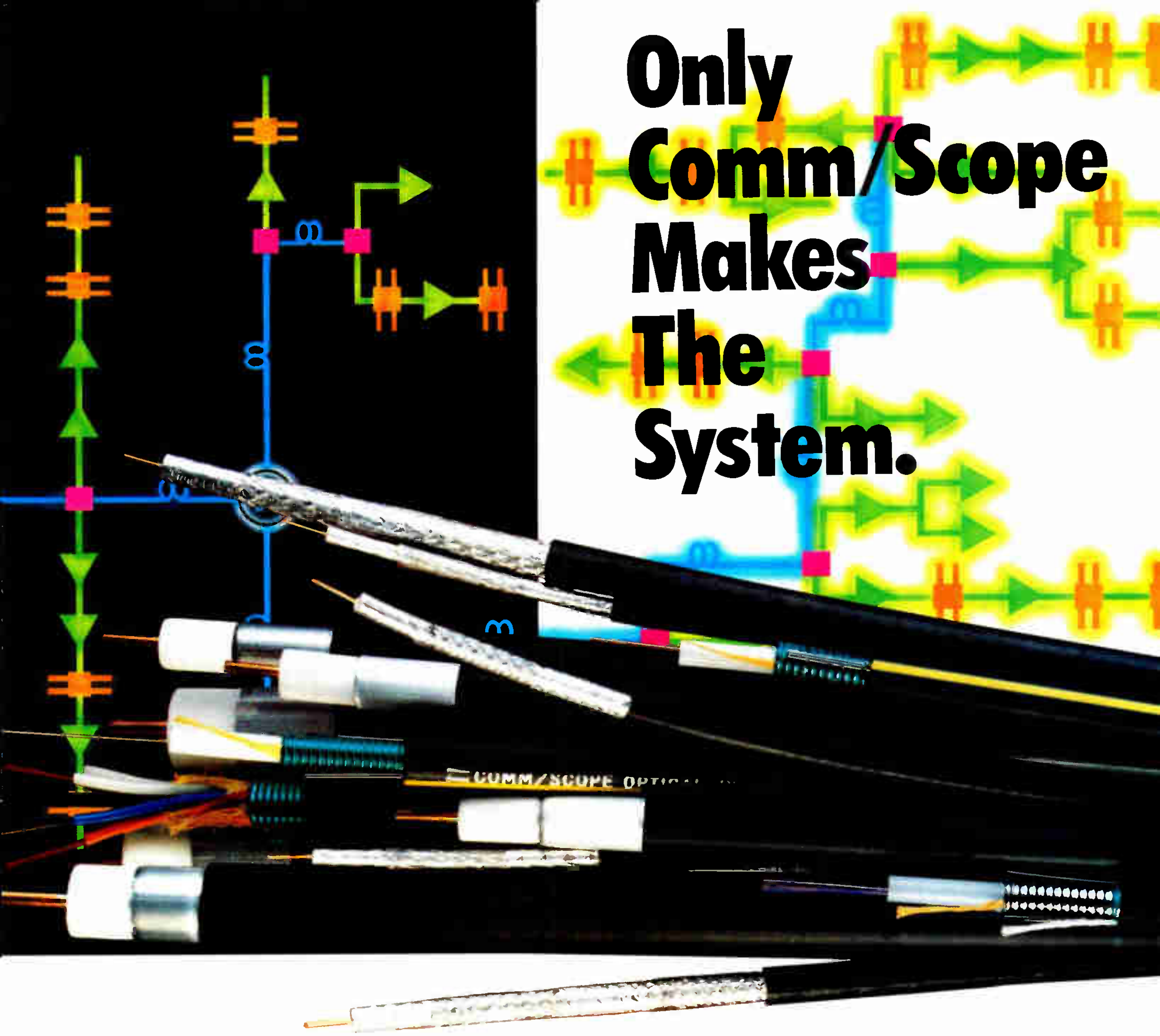


Figure 1

By C.E. Holborow, P.P. Bohn, and S.K Das, AT&T Bell Laboratories

Terminology

A variety of terms for the two terminal types in a PON network appears in the literature. For readability, this discussion is written in FTTH terms, but it applies with obvious changes to FTTC networks as well. The term "exchange terminal" is used for equipment that is located in the telephone exchange (or



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central office) and the term "customer terminal" is used for the equipment located at the customer site (or at the curb). "Downstream" is from the exchange to the customer, and "upstream" is from the customer to the exchange. In a CATV application, the exchange terminal would be the headend.

In the literature, the exchange terminal is variously called Exchange Terminal (ET), Central Office Terminal (CST), Subscriber Loop Terminal (SLT), or Optical Line Terminal (OLT). The customer terminal is usually called the Optical Network Unit (ONU), but other names such as Network Termination (NT) and Distant Terminal (DT) can also be found.

Motivation and issues

The PON approach to telephony access networks is an attempt to reduce costs by taking advantage of the following:

1. Most access network links are short (optical loss budget a few dB).

2. Low and medium rate (low power consumption) digital communication systems can accommodate loss budgets much greater than typical access networks.

3. Residential and small business access customers can be served by an average of less than three lines per customer. Even medium-sized businesses only require a 24-line trunk to connect to a PBX. Low rate digital systems can easily serve tens of customers at this rate.

4. Cost savings can be realized by sharing the exchange transmitter laser over multiple customers.

5. Sharing feeder fibers is also possible if splitters are placed in the field close to the customers.

6. Sharing laser and feeder fiber over more than 20 customers means that network cost is dominated by the customer terminal, so higher splitting ratios yield only small extra savings.

These points suggest an architecture which has a single "low rate" transmitter (say 20 Mb/s to 40 Mb/s line rate) broadcasting to 20 or more customer terminals, with each customer using only part of the total bandwidth. The signal travels on a single feeder fiber to a point near the customers, where it is split and routed down separate fibers to each customer terminal (see Figure 1). Clearly, this is a point-to-multipoint transmission architecture which is logically, but not physically, the same as that used in the present CATV network. The classical telephony architecture is a point-to-point structure. The PON equipment design is optimized where possible to reduce the cost of the customer terminal.

Many major issues must be addressed to complete the design of a fully functional network:

• The discussion above addresses only the downstream (exchange to customer) link. The upstream (customer to exchange) link must also be implemented at low cost. The upstream fiber network is assumed to be the same topology (and in some cases the same network) as the downstream network. The loss budgets in the two directions are the same and only a single exchange receiver is needed. Sharing upstream bandwidth is more complicated than sharing downstream bandwidth because customer terminal transmissions must be timed to avoid collisions.

• Privacy. Signals must be secured and customer terminals must be monitored and controlled to ensure that data for one customer is very difficult for another person to intercept.

• Operations and maintenance. The whole network must not be taken out of service to add a new customer or to service a faulty customer terminal. This and other operational issues require careful design of control software and operational procedures.

• On-line bandwidth allocation. Because customer service requirements change, it must be possible to change the bandwidth allocated to a customer without interrupting service to other customers.

• Power savings. To conserve power, customer terminals must have a "sleep"

Figure 2: Use of 2 x 2 couplers to allow different NB and BB splitting ratios

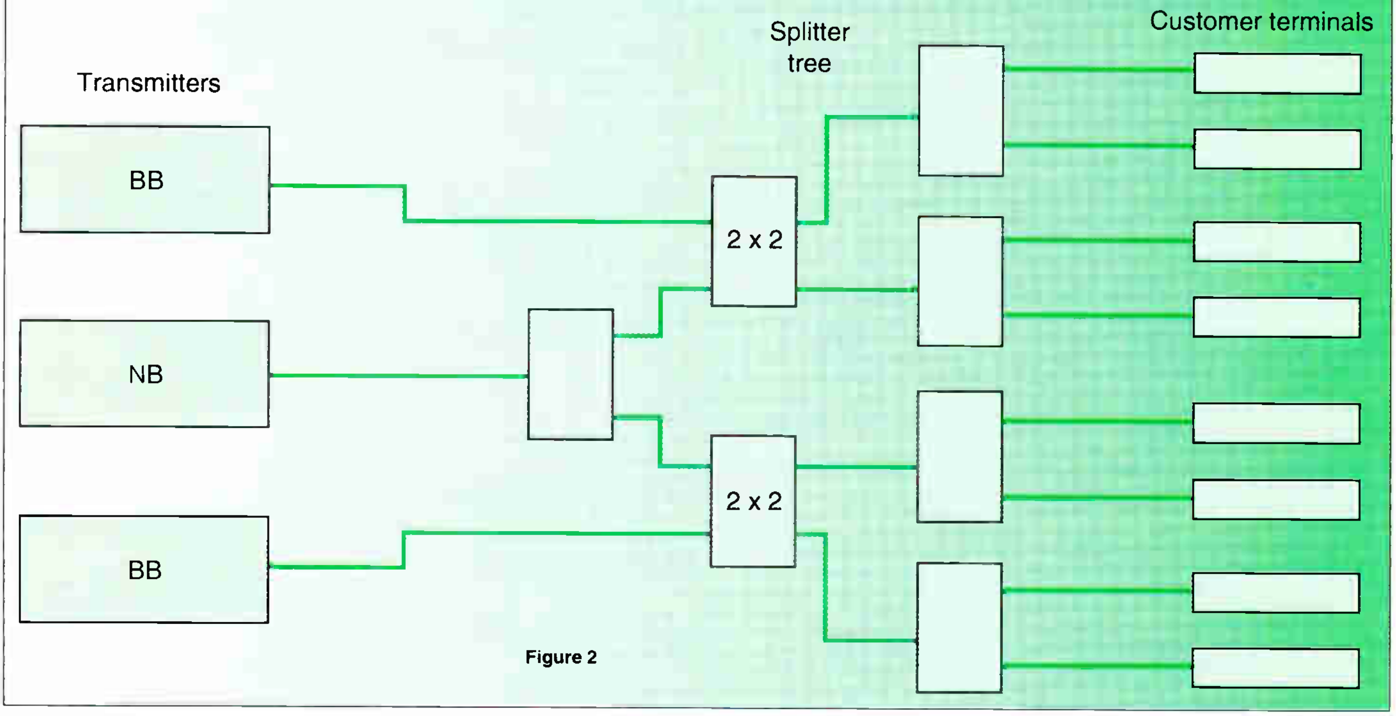

Figure 2

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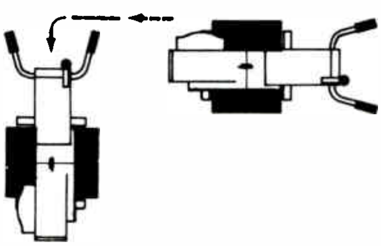

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mode which they enter when there is no active traffic for them. (This is important for telephony services, where battery backup at the customer terminal is usual.)

• Fiber breaks. How do you locate a fiber break between splitter and customer terminal without interrupting service on the network? Ideally one would prefer to do this from the exchange terminal. This may be feasible using a wave division multiplexer (WDM) to separate optical time domain reflectometer (OTDR) signals from traffic signals on the network.

The OTDR dynamic range must be high to cope with the splitter loss. the OTDR display will show superimposed traces because each customer line will generate a separate reflection. If the fault cannot be seen among the superimposed traces, fault location must be done from the customer end. If service personnel do not have access to the customer end, it is necessary to work from the splitter by opening up a splice.

• Measures must be taken to prevent a faulty customer terminal transmitter from jamming the network with continuous transmission. The obvious requirement is global and addressable commands which instruct all (or one) customer terminal(s) to stop transmitting, and redundant transmitter disabling circuitry in the customer terminal.

PON choices

A wide variety of PON architecture implementations have been suggested, and several trial systems have been demonstrated using very different techniques. The main choices (which are interrelated) to be made are:

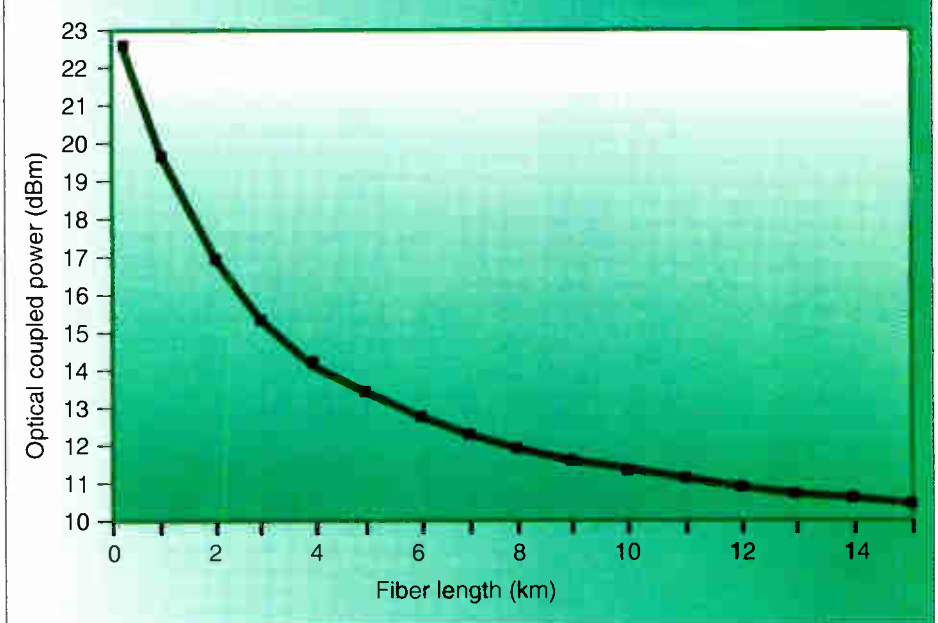
1. How many fibers should go to each customer?
2. What line protocols should be used to share downstream and upstream bandwidth?
3. What wavelengths should be used for downstream and upstream transmission for narrowband and broadband service?

These questions are probably best understood by enumerating possible answers. While the discussion thus far has centered on narrowband (NB) telephony service, any viable architecture must also be capable of carrying broadband (BB) broadcast CATV service. It is desirable that normal AM CATV should be possible, for the same reasons that AM is used in CATV coaxial distribution.

Number of fibers. Some possible answers to question 1 are:

A. Two fibers: One for each direction, wave division multiplex (WDM) NB and BB downstream.

Figure 3: SBS threshold for CW laser vs. length



The broadband signal will suffer loss because of the WDM, but this is only a small part of the loss budget. Isolation of the customer BB receiver from the NB signals must be excellent to prevent degradation of BB performance.

B. Two fibers: One for NB (bidirectional), one for BB (one-way).

There is a choice here with the NB on one bidirectional fiber. The line can be full duplex using a WDM or directional couplers, or half-duplex allowing only one end to transmit at a time. If a WDM is used, the isolation must be high enough to prevent the transmitter from interfering with the co-located receiver. If directional couplers are used, the optical reflections must be kept low so that near-end crosstalk does not interfere with reception. If the optical loss budget is high and the network generates optical reflections, it is possible for the level of the reflected transmitted signal to be comparable to the signal received from the far end[1]. Using a half-duplex approach, where the exchange terminal transmits a long burst and then each of the active customer terminals transmits a short reply burst, most concerns about optical reflections on the NB fiber are eliminated, but the data transfer rate possible for a given line rate is also roughly halved.

C. One fiber: Bidirectional with WDM of NB and BB to customer.

Use of one fiber is clearly more economical, but it is also more complicated because it involves both WDM of the downstream signals and bidirectional use of the fiber. In addition to the points mentioned, at the customer terminal the isolation between the upstream transmitter and the downstream broadband receiver must be excellent. However, all of this is within the capability of existing optics technology.

Line protocol. Downstream traffic must be multiplexed into a single bitstream. The bandwidth allocated to each customer must be changeable on-line to cope with changing customer needs. To best utilize the system capacity, it is highly desirable that bandwidth unused by one customer be available for allocation to other customers. The protocol must also address many operational details such as bringing a new customer terminal into service, verifying that a new terminal is authorized to be on the network, as well as detecting and isolating faults.

The upstream traffic must be time division multiplexed in such a way that the bursts from the customer terminals do not collide at the exchange receiver. This is accomplished by measuring the range to each customer terminal and giving each terminal a delay time to wait after it receives the end of the exchange transmission before commencing its transmission. The range measurement requires a guard interval in the return path time allocation so that a new terminal of unknown range can be brought into service.

Various degrees of interleave of the customer terminal transmission have been proposed, from bit interleaving to full burst interleaving. Longer transmissions reduce the number of guard intervals, so there is less dead time (or more data for a given line rate).

Bit interleaving requires very accurate ranging: To within a small fraction of a bit if guard intervals are to be avoided altogether. This is necessary because so many guard intervals would be needed that data throughput would be too low. It also requires control of the customer transmitter laser power by the exchange terminal, together with an advanced exchange receiver, because consecutive bits from different customer transmitters will not be the same amplitude but must be nearly so in order to be received without error.

Burst interleaving requires fast clock acquisition by the exchange receiver, but is otherwise more robust. However, it is less efficient in terms of data rate for a given line rate.

Another tradeoff to be made is in the choice of frame length, where one frame is one complete cycle of transmissions by the exchange and all customer terminals. A short frame reduces the delay through the network. However, a short frame also reduces the efficiency of transmission because the proportional loss of bandwidth attributable to network overhead and guard times is higher. The loss of efficiency may require a higher data rate.

Wavelength choice and WDM. To keep costs low, an uncooled laser should be used in the customer terminal and both the line protocol and wavelength choice must allow for this.

For telephony applications, the normal wavelength for narrowband data is the 1300 nm window. This is a reflection of the maturity (and low cost) of devices at this wavelength. For the exchange laser, the choice is arbitrary, and the 1550 nm window could serve as well, particularly because dispersion on the short links will have no effect on digital signals but may have major impact on AM wideband signals.

Because the customer terminal transmitter cost is a major item in the network cost, 1300 nm uncooled lasers are preferred for this function. Wave division multiplexing is possible to allow simultaneous use of both windows. At present, dense WDM using several closely placed transmitters in the same window is not economic, but this possibility remains open for future use.

Typical narrowband parameters. Typical parameter ranges for narrowband PONs are:

• Range: Up to 10 km (six miles)
• Splitting ratio: 8, 16 or 32
• Number of 64 kb/s channels: 150-400
• Optical loss budget: 20 dB to 30 dB
• Optical line rate: 20 Mb/s to 40 Mb/s

Broadband PON design. The optical loss budgets above are suitable for FM or digital CATV transmission systems. The application of these two technologies to PONs is straightforward but use of either of them today would make a customer terminal expensive and provide insufficient channels for a broadcast CATV service. The advent of compressed digital television will make digital CATV delivery on PONs much more attractive.

Typical PON loss budgets are far beyond the reach of AM technology using DFB laser transmitters. Lower splitting ratios must be used for broadband distribution with these systems. This is easily achieved if the splitting tree uses 2x2 couplers, with multiple AM systems feeding into the splitting tree at lower splitting ratios than the NB transmitter (see Figure 2).

The need for multiple transmitters and "trunk" fibers increases the cost of the system. The high cost of broadband distribution is fundamental to the use of AM fiber optic systems: Such systems require high receiver power levels compared with digital or FM systems.

For a carrier-to-noise ratio of 48 dB at the customer terminal, a typical AM system must have a received optical power of about -7 dBm. (Receiver noise current 6 $pQ/\sqrt{Hz}$ and four percent optical modulation index assumed.) A typical DFB transmitter operates at 6 dBm, so the optical loss budget of the system is 13 dB. If 6 dB is allocated for connectors, fiber loss and splice loss the splitter loss can be 7 dB, which allows a four-way split.

The only option to support higher splitting ratios is to increase the transmitter power. This suggests consideration of externally modulated systems or optical amplifiers. These technologies have not been widely deployed to date, and there are some limitations on how they can be used.

External modulation systems currently operate mostly in the 1300 nm band. They use a narrow line source laser, and stimulated Brillouin scattering (SBS) limits optical power in the trunk fibers to less than 15 dBm for a short fiber and less than 12 dBm for a longer fiber (see Figure 2 [2,3]). Higher power transmitters can be used, but the optical signal must be split at the exchange to keep the level in the multiple trunk fibers below the SBS threshold.

Available optical amplifiers operate in the 1550 nm band. On standard fiber, dispersion will cause excessive second order distortion unless compensation is used[4]. While optical amplifier repeaters could be used in the outside plant, the network would no longer be passive.

Summary

This paper has described the motivation for and typical characteristics of passive optical networks for telephony services. It also examined the delivery of CATV services on networks of this type.

While the optical power demanded for AM fiber optic transmission of CATV signals makes it uneconomic to consider PON service to the customer, some current applications of AM fiber systems in CATV trunking can be regarded as PONs, with the termination points being the optical nodes where conversion to coaxial distribution takes place. The current splitting ratios are limited by the power available from the transmitter to values much lower than those used in digital telephony PONs. CED

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Telephony over cable: Is it viable?

Not long ago, the thought that a cable system could be transformed into a telephone network with the attachment of modems at either end of the line would have met with howls of laughter among cable engineers.

But, while no one is ready to say it's quite that simple, the past few months have witnessed a tremendous vote of confidence in the possibilities emanating from Time Warner Cable, TCI and U S West, not to mention a growing lineup of manufacturers who are looking at ways to meet anticipated demand for such capabilities.

"We're getting a lot of inquiries (stateside), though nobody has made any commitments," comments Andy Paff, president of Optical Networks International, which, with AT&T, is developing a voice-over-cable system for TeleWest, the U.K. joint venture between TCI and U S West.

Not only cable companies but telcos as well are intrigued at the prospects, Paff adds. "It's easy to see why they're taking a look at this," he says. "If, as we anticipate, you can put POTS (plain old telephone service) and broadband video on a fiber/coax network at $800 to $1,000 per customer, you're getting an interactive broadband plant for what it would cost you to put in a copper ADSL (asymmetrical digital subscriber line) and for less than it would cost you to put in a POTS FTTC system."

TeleWest International, the joint venture between TCI and U S West, has been testing a similar product developed by First Pacific Networks and will begin a large-scale deployment of the ONI/AT&T system in the second quarter next year.

Time Warner's tests

The first MSO in the U.S. to put such technology to test over a real cable system is Time Warner Cable, which is just beginning what promises to be a long-running market trial of voice, including discounted long distance, and a bevy of other new services over its 150-channel Queens system. Time Warner officials, in the recent announcement of plans to roll out "full service networks" companywide (see related story, pg. 22), made it clear that they would be exploring "cablephone" services on a broader scale next year, when they turn up the 4,000 household segment of the new network design in Orlando.

The beauty of the technology, which really involves a variety of technical approaches, depending on the vendor, is that it could help establish a foundation for delivering virtually any type of advanced service one might imagine, says Jim Ludington, project director for advanced cable systems at Time Warner Cable.

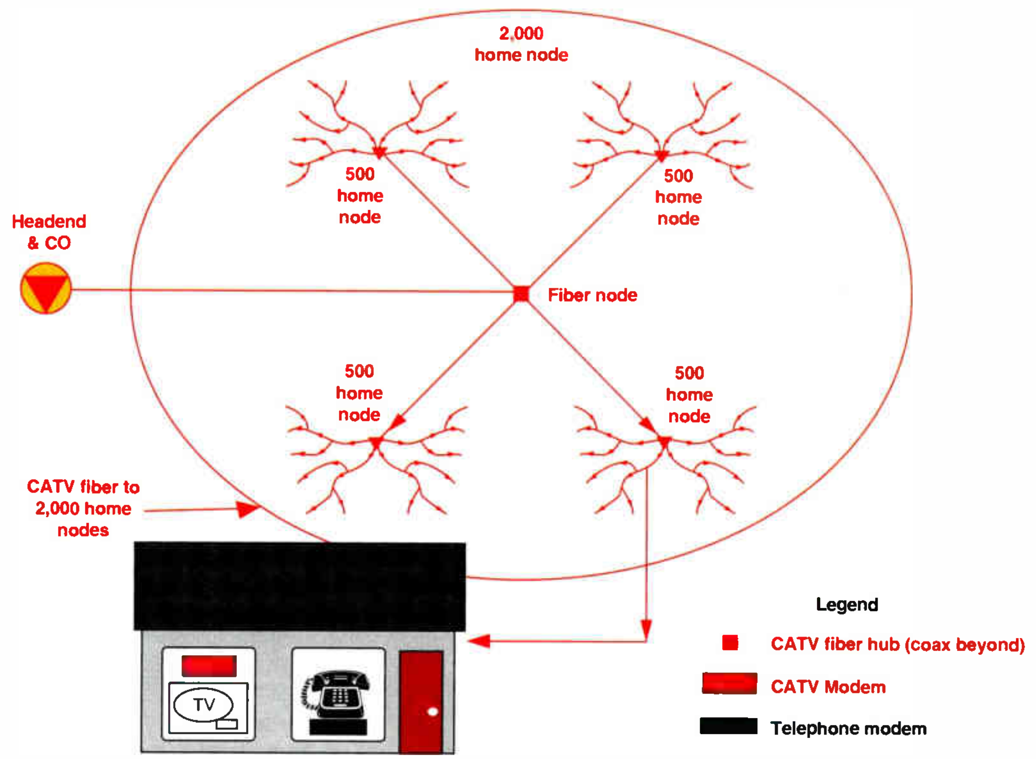
"We, like many other cable companies, are looking at providing any type of service that one might associate with the concept of video dialtone," Ludington says. "Once you turn the information into bits with time slots you can squirt anything you want up and down the line."

Time Warner Telecommunications President Dennis Patrick says discounting of long distance services, such as the testbed with MCI in Queens, N.Y., has the potential to be an important part of the new revenue stream generated by full service networks. However, Jim Chiddix, senior vice president of engineering and technology for Time Warner Cable, cautions against reading too much into the video aspects of the multifaceted Queens trial. "This is just another of the service applications we intend to look at," Chiddix says. "It's real early to say how the market for this technology is going to evolve."

The first step in setting up the system for the types of market trials that T-W

By Fred Dawson, Editor, Cable / Telco Report and President of Dawson Communications

TeleWest integrated network



plans to conduct entails testing the distributed switching system developed by First Pacific Networks. FPN is one of several vendors working on equipment that will enable voice delivery over fiber/coax star/bus cable networks.

Officials emphasize that the FPN system was selected for preliminary testing, with final vendor selection for the market tests to be made later. "We're using FPN gear at this point simply because it is available," Chiddix submits. "There are lots of ways to carry this type of information over our networks."

Indeed, a growing number of vendors are indicating interest in the possibilities including Philips Broadband Networks, ADC Telecommunications and Siemens. The last two are telephone industry suppliers with little or no involvement in U.S. cable.

LUDINGTON

"Once you turn the information into bits with time slots, you can squirt anything you want up and down the line."

Paff says the cablephone project has been one of the largest endeavors yet undertaken with AT&T, although he won't elaborate on the technical details of the project.

However, there was much to be learned about the company's evolving thinking on the advanced networking front in comments made by Earl Langenberg, vice president for engineering and technology at TeleWest during the SCTE's recent Emerging Technologies conference in New Orleans, La.

Top management nods

While U S West appears to be shying away from the cablephone approach even as it embraces cable's fiber/coax design for its broadband domestic networks, Langenberg's and other's comments in New Orleans leave little doubt that the approach has won top management endorsement as the strategic foundation for expansion at TeleWest. And it appears to match thinking at TCI and Time Warner, as well.

Langenberg, echoing Ludington's remark quoted earlier, described a highly flexible evolutionary path for cable networks that would permit cable operators to "plug and play" virtually any type of service without resorting to adding switches or other large-scale electronic components to the plant in the field.

Further, Langenberg said his company will be implementing the new design ideas throughout its properties in the U.K. to facilitate the delivery of telephony, cable entertainment and every other type of service over a single hybrid fiber/coax network.

"It has become almost a given that cable operators in the U.K. won't provide telephone services over twisted-pair wire," Langenberg said at the Conference. "There is recognition now of an overwhelming need to integrate all services over a single broadband network."

"Everything we're doing in Britain has obvious implications stateside," adds Ed Callahan, senior vice president for technology at ONI.

"I would agree with much of what Earl said," comments David Fellows, senior vice president of engineering for Continental Cablevision, which is partnering with TCI, Cox Enterprises and Comcast Corp. in Teleport Communications Group, an alternate access provider. "The feasibility of offering voice services over cable systems is an important part of our thinking in the Teleport deal."

The network strategy outlined by Langenberg in a paper jointly written with Callahan not only signals the growing viability of cablephone technology—it also offers an approach to combining frequency multiplexing over service-specific modem-like devices with use of a new "hub divider" network component which permits low cost extension of fiber to whatever penetration levels make sense for a given type of service.

Langenberg cited addressable cable converters and digital music boxes as examples of modem-like units presently in use by the cable industry. Similarly, he says, modems now in production for voice communications, data transport and other applications will permit dedication of various frequencies within the cable network transmission spectrum to such services.

LANGENBERG

> "There is a recognition now of a need to integrate all services over a single broadband network (in the U.K.)."

The passband approach

The idea of dedicating specific points on the cable channel spectrum to different types of services, which Langenberg referred to as the "passband" approach, provides cable systems the flexibility to employ whichever transmission modulation schemes make sense for a particular service in isolation from the techniques used for other services.

AT&T's cable hardware group, which is working with ONI to develop a 1-GHz delivery platform for cable, is hoping to persuade the industry to use asynchronous transfer mode (ATM) technology to maximize the flexibility of the passband approach. Carl McGrath, supervisor of the AT&T Bell Laboratories CATV Systems Group, says the packetized format will provide an interface between incoming signal streams and the channel package delivered to subscribers that would permit increases or changes in subscriber services without major electronics changeouts.

Chiddix, in describing plans for Orlando, says Time-Warner will seek bids on household hardware as well as network equipment that will accommodate exploitation of ATM capabilities to the fullest extent. He says it is unclear how the box functions will be allocated in the home, but that it looks like there will be a separate unit for handling voice traffic, possibly offering some advanced cordless connections as well, while a digital compression/ATM unit will process entertainment and data services.

Langenberg notes the possibilities for ready adaptation to new services through the use of passbands "include but are not limited to: time division multiple access, frequency division multiple access, code division multiple access, synchronous data, asynchronous data, isochronous data, fast packet data, switched multimegabit data, cell relay data, frame relay data, asynchronous transfer mode, single channel per carrier or multiple channels per carrier."

While there are similarities in the approaches to "cablephone" technology among various vendors, the products also have important distinctions, Langenberg notes. One key point of departure concerns vendor approaches to concentration of voice circuits, where users contend for connection over a channel in a cluster that is some fraction of the total user base.

Cablephone variations

"For the local exchange telephone carrier, concentration is affected at the central office switch, where there are fewer trunk circuits than residential/business lines," Langenberg says. "Integrated telephone modems (for cable) come with and without concentration, and of those that concentrate, some incorporate a distributed switching capability and others do not. Cablephones that do not switch require a class-5 type of central office switch to provision a switched service."

Along with dedication of channels for specific types of modems, the cable strategy entails different levels of fiber penetration for different types of services, Langenberg says. He uses three examples—broadcast cable service, video on demand and voice—to illustrate the variations in fiber topology that will be required by an advanced cable network.

Because everyone within a targeted group gets the same set of broadcast cable services, the optical service area can be very large for this category of service, Langenberg notes. For example, he says, an externally modulated laser with a 20 dB optical "budget" would serve several fiber links, reaching a total of 50,000 households.

Where video on demand is concerned, the number of households comprising a service area depends "on the available channel capacity for the service, the degree of acceptable contention, expected service penetration and expected buy rate at the busiest time of the busiest season."

Langenberg, using calculations provided by Jerrold Communications President Hal Krisbergh, says that at a level of fiber penetration representing 2,000 households per area served by a single laser, VOD would require dedication of 24 channels to the service, assuming 60 percent of the homes passed by cable take basic service and 50 percent of those subscribe to VOD at an average buy rate of 200 percent per month, with a peak usage rate of eight percent. At the other extreme, without any contention for channels, which is to say without the possibility that all VOD users might go on line simultaneously, the number of homes served would be limited to 80.

For voice, the service area segmentation depends on the degree of concentration of circuits at the central network locations, Langenberg notes. In his examples, he assumes 30 percent of households would be subscribers to the phone service and used typical telephone industry use and blockage rates (one call out of 100 blocked; approximately 11 users per circuit).

It was possible to piece together some of the details of the emerging cablephone products from comments made by Langenberg in combination with information supplied by the paper that accompanied his talk in New Orleans.

Apparently, the AT&T/ONI "cable loop carrier" system, without employing concentration of circuits at points up the line in the network, will require fiber penetration to 500-home nodes, assuming 30 voice circuits per 1.5 MHz of bandwidth and dedication of only two 6 MHz channels to voice service systemwide. (Again, assuming 30 percent of the households are taking the service.)

The FPN system, offering 56 voice circuits over two 5.5 MHz channels and employing some degree of concentration, would require fiber penetration at the level of 2,083 homes per node. The new Philips "digital highway" system envisions transmitting a 30 Mbit/sec data stream on a single 6 MHz channel, with a high level of concentration that expands the market base to 10,200 households per hub.

"Each of the three cablephone products known to be in current development have unique attributes that affect overall cost and performance," Langenberg says. "The ability to concentrate or not concentrate, switch or not switch must be analyzed against a framework that includes service quality, reliability, cost effectiveness and network flexibility."

But he made clear that whichever approaches to voice, VOD and other services are taken, TeleWest will have the flexibility to adjust fiber penetration to meet specific service design and demand requirements without over-committing to use of fiber at the outset. The key to this flexibility is the hub divider, Langenberg says.

For example, the fiber/coaxial interface for the broadcast cable services might be at a point where each node services 2,000 households, but it might be necessary to extend fiber deeper to provide adequate voice capacity. This would require that the fiber carrying the voice service extend beyond the primary node to intersection points along the coaxial portion of the distribution path.

The hub divider, which could be mounted in the lid of a coaxial RF amplifier, would terminate this extension of voice-carrying fiber, supplying an optical receiver and RF amplification for the downstream signal and an upstream transmitter to put the signal onto the fiber from the coaxial line. In addition, it would employ a notch filter to block the voice signals traveling on the coaxial line from the previous node, thereby allowing reuse of the frequency for the users on the line beyond the hub divider.

Langenberg says his company hopes manufacturers will adapt their amplifier housings to accommodate hub dividers. "Should this occur," he says, "it would be a simple process to replace the amplifier with a hub divider and pull new fibers to that location or, where available, to use existing pre-provisioned fiber spares."

Attractive as all this might seem from a cable perspective, U S West, which earlier indicated it wanted to learn more about cablephone technology as a possible alternative to standard POTS delivery as it moves into broadband networking, now says it has doubts whether cablephone would pan out, given the scope of telephone service advances now hitting the telcos.

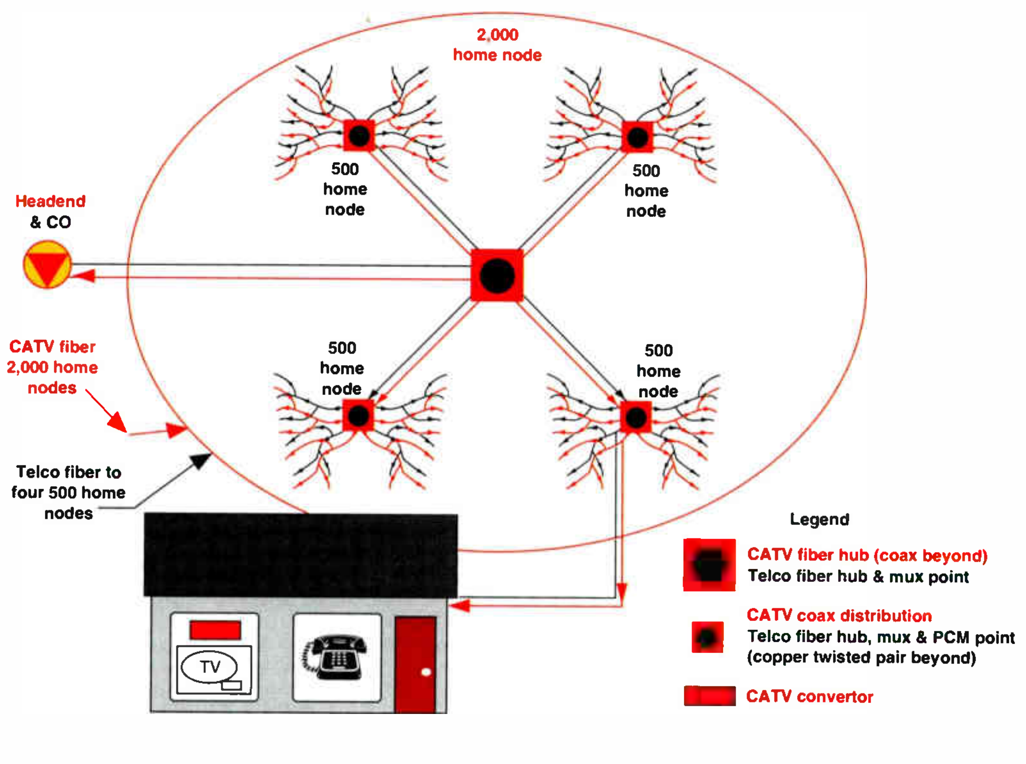
John Czak, executive director of network and systems planning for the RBOC, says the company had left open the option for respondents to its newly-issued broadband RFP to "offer alternatives" to the fiber-to-the-curb POTS design which he says he now favors. But he seems skeptical that any such ideas would force a change of course.

Czak says that while such systems might work fine for traditional POTS, he was concerned over how readily such technology could be used to expand service offerings. He declined to elaborate on what the presumed drawbacks might be.

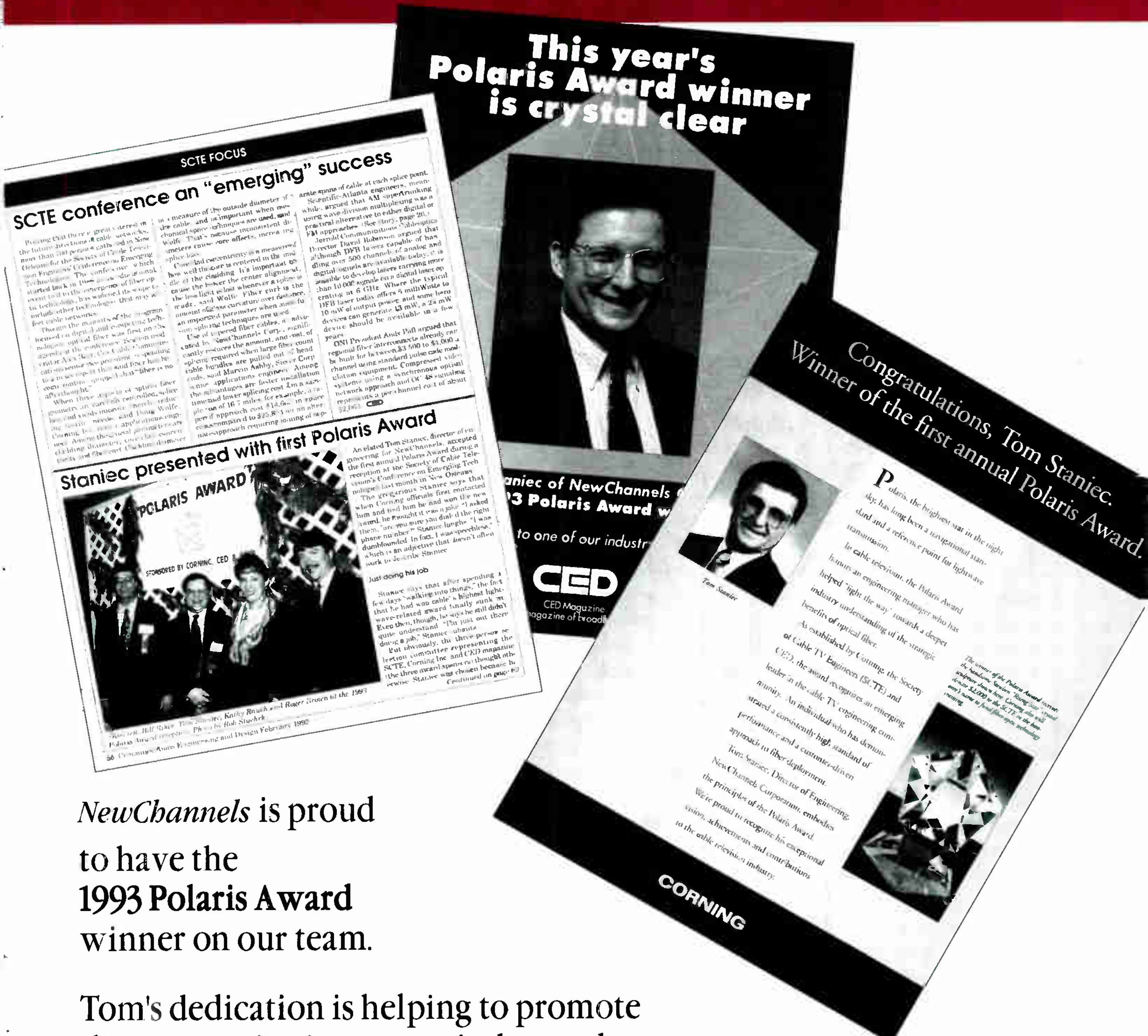
Czak's remarks ran counter to the mood of many vendors who had responded to last year's request for information. For example, an official at Siemens, prior to receiving the new RFP, says his company was discussing the possibilities of working with First Pacific Networks to weave together the two companies' technologies into a hybrid fiber/cable-based means to delivering voice at the performance levels sought by U S West.

ONI officials, meanwhile, decline to discuss their intentions vis a vis the RFP, other than to say they were "continuing to focus on cable." CED

TeleWest overlay network



THANKS TO EVERYONE WHO HELPED SHARE OUR GOOD NEWS.



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Tom's dedication is helping to promote the progressive image our industry deserves.

We salute **Tom Staniec's** achievements in *fiber optic technology.*

NewChannels

Circle Reader Service No. 48

Fiber: Not just for breakfast (or cable)

Since 1985, the Indianapolis Division of Time Warner Cable has been utilizing fiber optic technology to generate revenue sources outside the traditional cable television business. Two of the most challenging applications have been in advertising insertion and long distance alternate access.

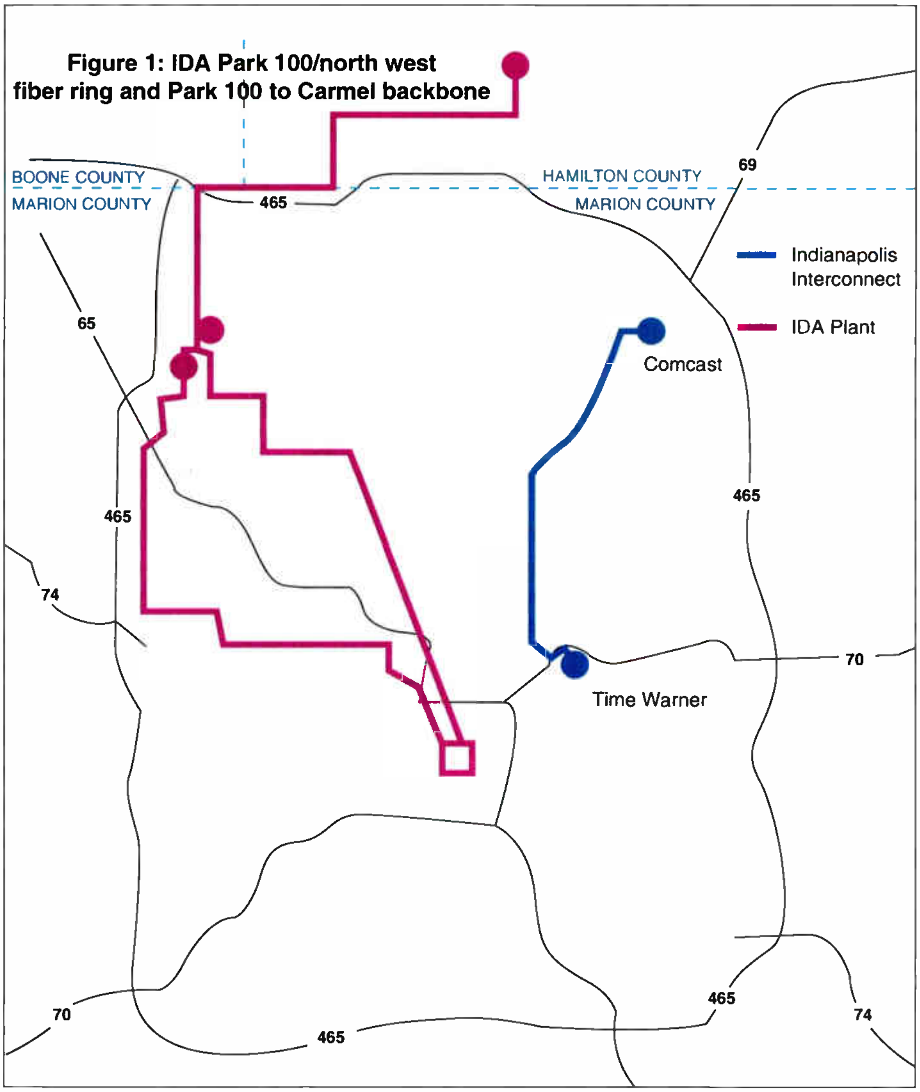
Granted, ad insertion in cable programming is nothing new, but I believe the way it is done in Indianapolis is unique. Long distance alternate access (LDAA) is a complete departure from cable tradition. In fact, LDAA is the telephone business. This is a brief history of our adventures in non-CATV fiber optics in Indianapolis.

The Indianapolis Interconnect

Greater Indianapolis is served by two cable operators in a "doughnut and hole" configuration. Comcast operates the doughnut; Time Warner operates the hole. Late in 1984, the two operators decided they could sell more advertising if they could provide advertisers with access to all the cable homes in Indianapolis from a single point. It was agreed that Comcast would manage the advertising and Time Warner would provide an interconnect between the two systems.

By Kent Vermillion, Engineering Manager, Indianapolis Division, Time Warner Cable

At TW, we evaluated FM supertrunking, microwave, and fiber optics against the criteria of maintenance costs and reliability. The construction costs for fiber fell in between the other two options, and although fiber did not have a track record at that time, the projections for minimal maintenance and high reliability were so tempting we decided to risk using the new technology.



The system chose to use Catel FM gear as the modulation equipment because it felt comfortable. We already had a 30-channel FM supertrunk. Belden, our long-time supplier of drop wire, had been making fiber optic cable for years. That felt comfortable, too, so we ordered six reels of four-fiber cable.

The two headends are 7.8 strand miles apart (See Figure 1.) We overlashed the fiber to existing cable plant in both franchise areas. There were five splice locations along the route, and we contracted with Indiana Bell to do the splicing, because they had a fusion splicer. The splice loss specification was a stringent 0.25-dB or less (very difficult to achieve in those days). It took a whole day to splice the first location, and we had to accept one splice loss of 0.3-dB! In spite of that outrageous splice we have had only three fiber-related outages in eight years, and those were catastrophic damages to the cable.

When the Indianapolis Interconnect (as it is now called) was activated, Comcast sent commercials for eight channels via the fiber from its master switching unit to the slave unit in our headend. Initially, we had problems with the linearity of the 1985 vintage lasers. Sending eight channels on one fiber did not provide the carrier-to-noise ratio (CNR) we expected. We discovered that sending four channels per fiber on two fibers improved the CNR by 3 dB.

In addition, intermodulation products were pretty severe, and they were inherent in the lasers. FM channel spacings had to be calculated to fall between intermod beats, and the four chan-

nels/fiber scenario made it easier to dodge them. The Interconnect has since been upgraded to 12 channels, all on a single fiber, thanks to a newer, more linear laser. Now advertisers can put their products and services in front of 200,000 cable customers in the Indianapolis area.

Indiana Digital Access (IDA)

Puffed up with the success of our initial venture into the optical world, we scanned the horizon for other applications. Over in Hawaii, Jim Chiddix and company were building a digital headend-to-hub interconnect with fiber, but our FM supertrunk worked just fine for our single hub site. And at that time, there was no such thing as a broadband AM fiber link. But we kept an ear to the ground and learned that Dave Pangrac and some folks in Kansas City were exploring opportunities with data transmission over fiber. We threw our line in the water in Indianapolis. It took almost a year, but in 1987 we finally got a bite—from a long distance telephone company.

One Call Communications is a provider of regional long-distance service. One of the early meetings between them and us went something like this:

One Call said, "We provide long distance service to an office building in downtown Indianapolis." I nodded. I was familiar with office buildings downtown.

"We want to get eight tee ones to our pop, which is also downtown." I felt sorry for them, but I failed to see how we could help their dad with his golf game. It occurred to me that we might not be speaking the same language.

"What's a pop?" I asked.

"It's our point of presence in Indianapolis. It's the point at which local phone traffic can jump onto our long distance network." My face lit up.

"Oh, it sounds just like a trunk/bridger!" Blank stare. We definitely did not speak the same language.

It turned out that a T-1 was telephone nomenclature for 24 duplex voice circuits. Eight T-1s meant the equivalent of 192 (8 x 24) telephone lines. Until they met us, One Call had only one way to get those telephone lines to its POP. It had to pay the local phone company. What we were discussing was a means of alternate access from the office building to the POP. We had access to rights-of-way in downtown Indianapolis. What One Call wondered was whether we could provide them a path to their POP at a cheaper rate than the phone company. We said we wondered, too.

Aside from becoming our first successful LDAA project, it was also our first and last foray into the realm of multimode fiber. The reason we chose multimode technology was because the path was only 2.4-km long and the lightwave equipment is much less expensive because the source is an LED instead of a laser.

First axiom of telephony

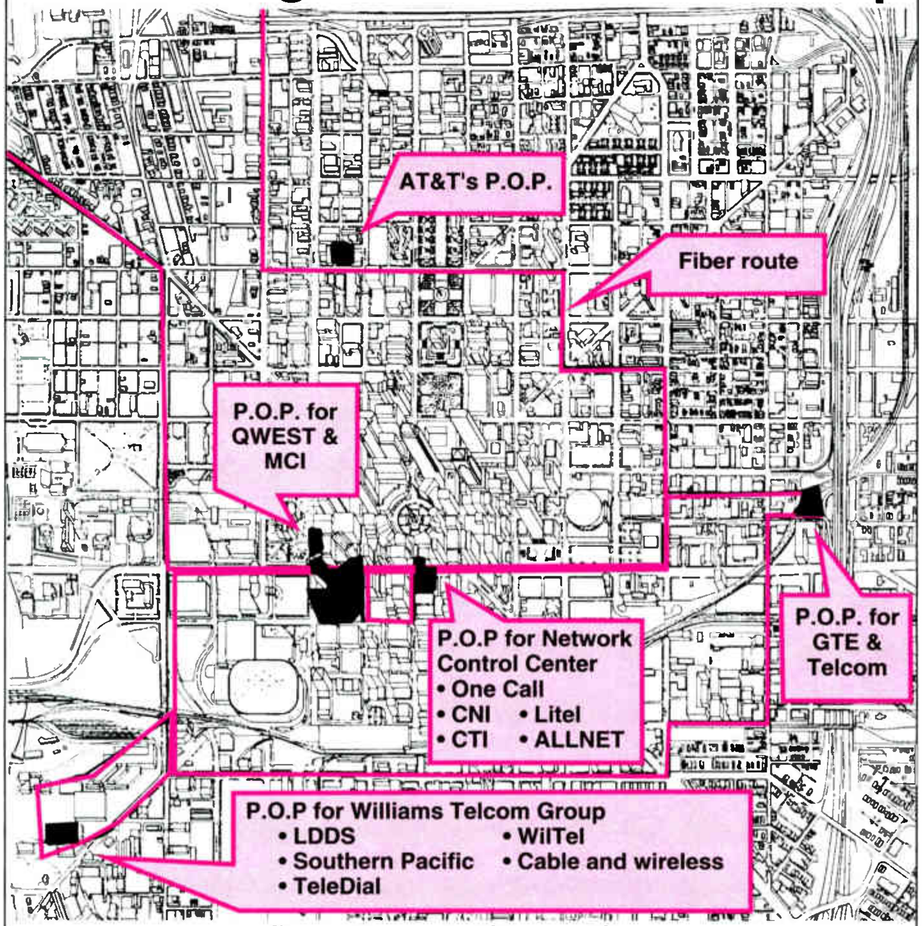
The reason we decided not to use multimode again is a by-product of the First Axiom of Telephony: They always want more. Telephone traffic always increases, so the pipeline must be able to expand with the flow of traffic. Our multi-mode pipeline had severe limitations to expansion. The inefficiency of modulating an LED source and the effects of modal dispersion in the fiber itself conspire to create a finite bandwidth that is inversely proportional to distance. Thus, a multimode fiber with a bandwidth of 400 MHz at 1 kilometer will only have a 200 MHz bandwidth at 2 kilometers. As we are all aware, the bandwidth of single-mode fiber is theoretically only limited to the bandwidth of the lightwave equipment and connectors.

Once we realized that we were officially in the LDAA business, we also realized that we knew very little about it. One early development helped significantly. We teamed up with a provider of telecommunications equipment to form Indiana Digital Access (IDA). We knew how to build a fiber pipeline, and they knew how to light it up. The significance of this partnership was that we could learn the new business while it developed and produced revenue.

After that, each new project became a clinic for us. We learned that a T-1 at 1.544 megabits/second (Mbps) was at the slow end of the high-speed world of digital communications. The next layer up was the DS-3 at 44.7 Mbps—the

Continued on page 57

Indiana digital access carrier loop



Downtown Indianapolis

CED cab

The evolving local loop

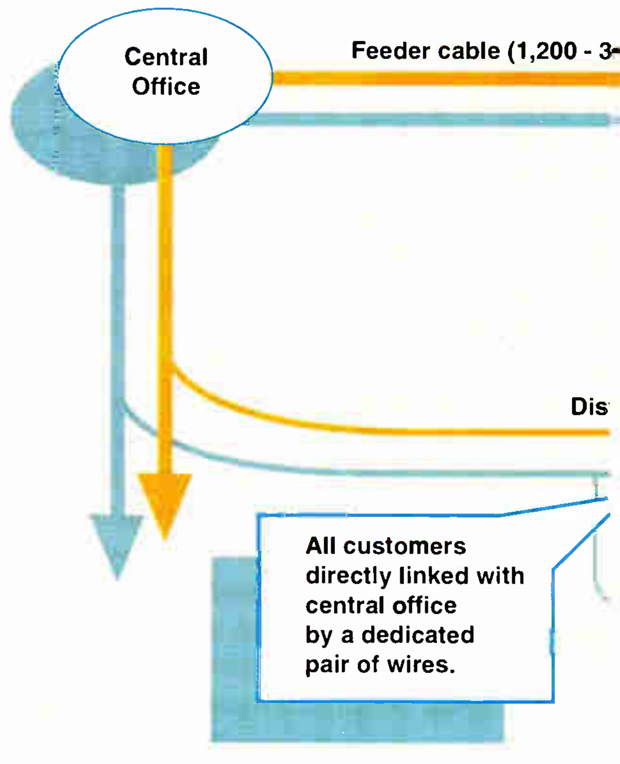
The traditional local portion of the telephone network involved stretching a dedicated set of wires from a central office or wire center out to each customer premises. By the late 1970s, though, telephone network designers had begun to use a new concept, that of the "serving area," to reduce the amount of capital investment required in a new-growth area. The idea was to plan, in advance, for network resources sufficient to serve an area containing several hundred to 3,000 homes, but to defer actual installation of plant until new housing construction created an immediate demand.

The "carrier serving area" was further developed with the advent of digital loop carrier, a method of gaining more channel capacity without adding new wiring to the existing plant. This type of upgrade involves the use of digital transmission at 1.544 Mbps on a single pair of wires that formerly could carry only a single voice conversation. Such capacity represents 24 voice circuits. A DLC network replaces the serving area interface with a remote terminal featuring circuitry to convert signals from analog to digital form, multiplex and demultiplex them.

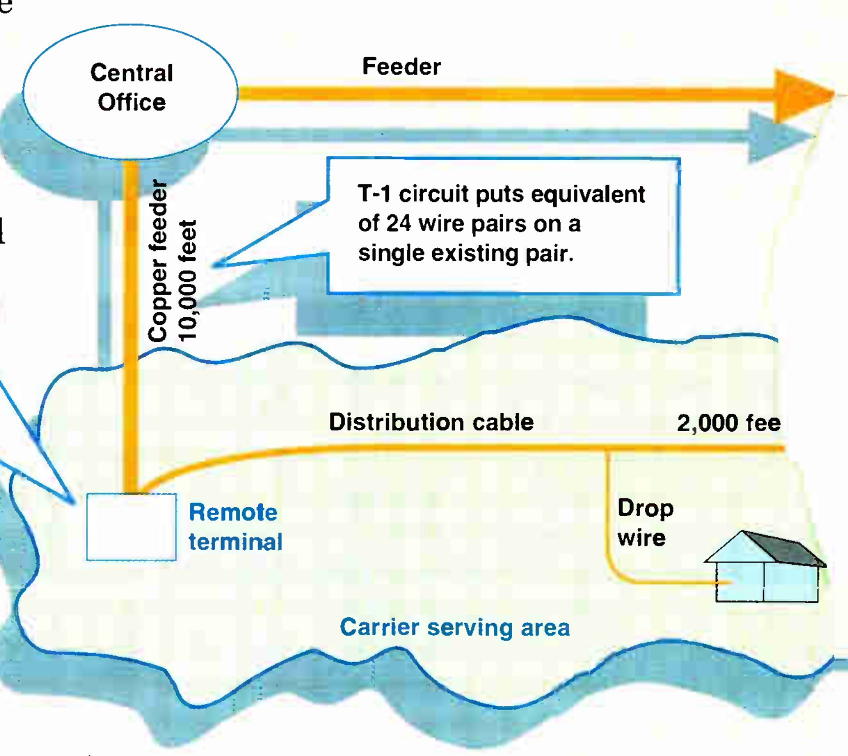
Optical loop carrier essentially substitutes optical fiber media for the older copper wire running between the central office and the RT. The future fiber-to-customer network will move fiber closer to the customer location, to the curbside in some cases, to neighborhoods of a few hundred homes in other cases.

Note that the cable TV "fiber-to-feeder" design mirrors the optical loop carrier network. Though the physical topology of the distribution network (cable TV feeder) may be different, the logical topology of both networks can be identical.

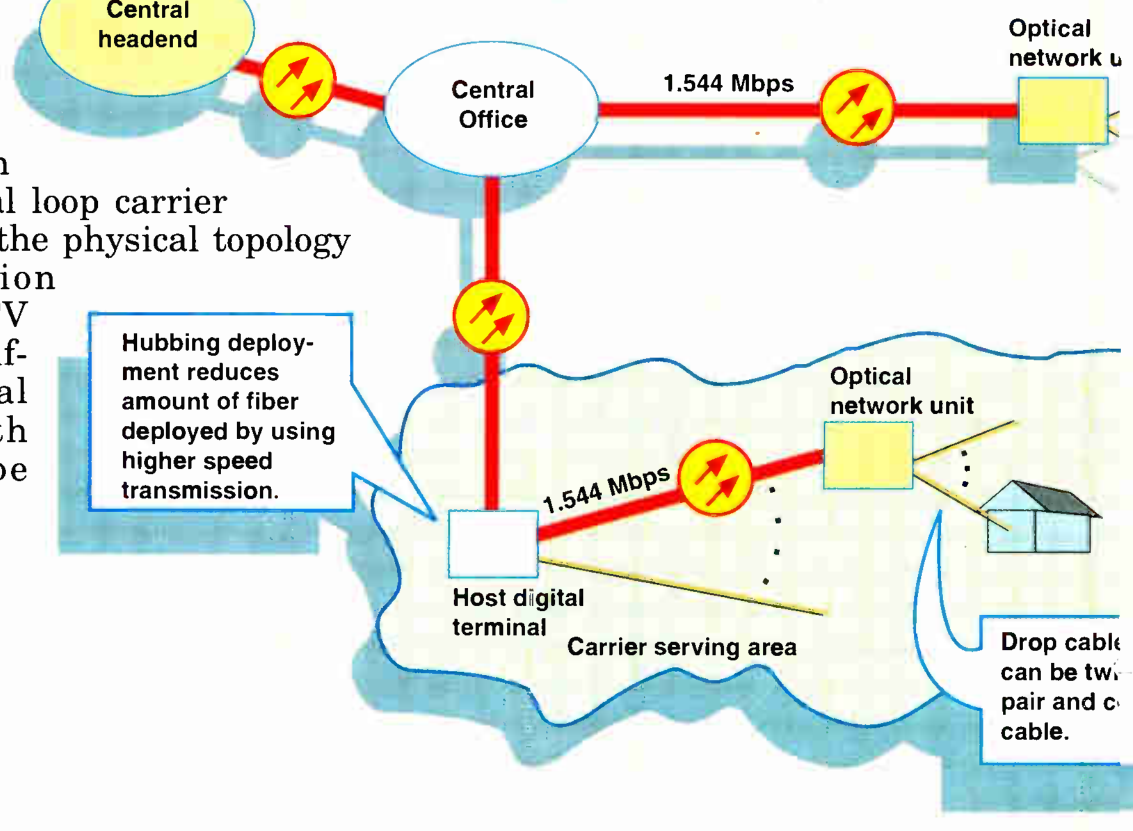
Traditional local lo



Digital loop carrier



Fiber-to-curb network



Cable/telco comparison chart

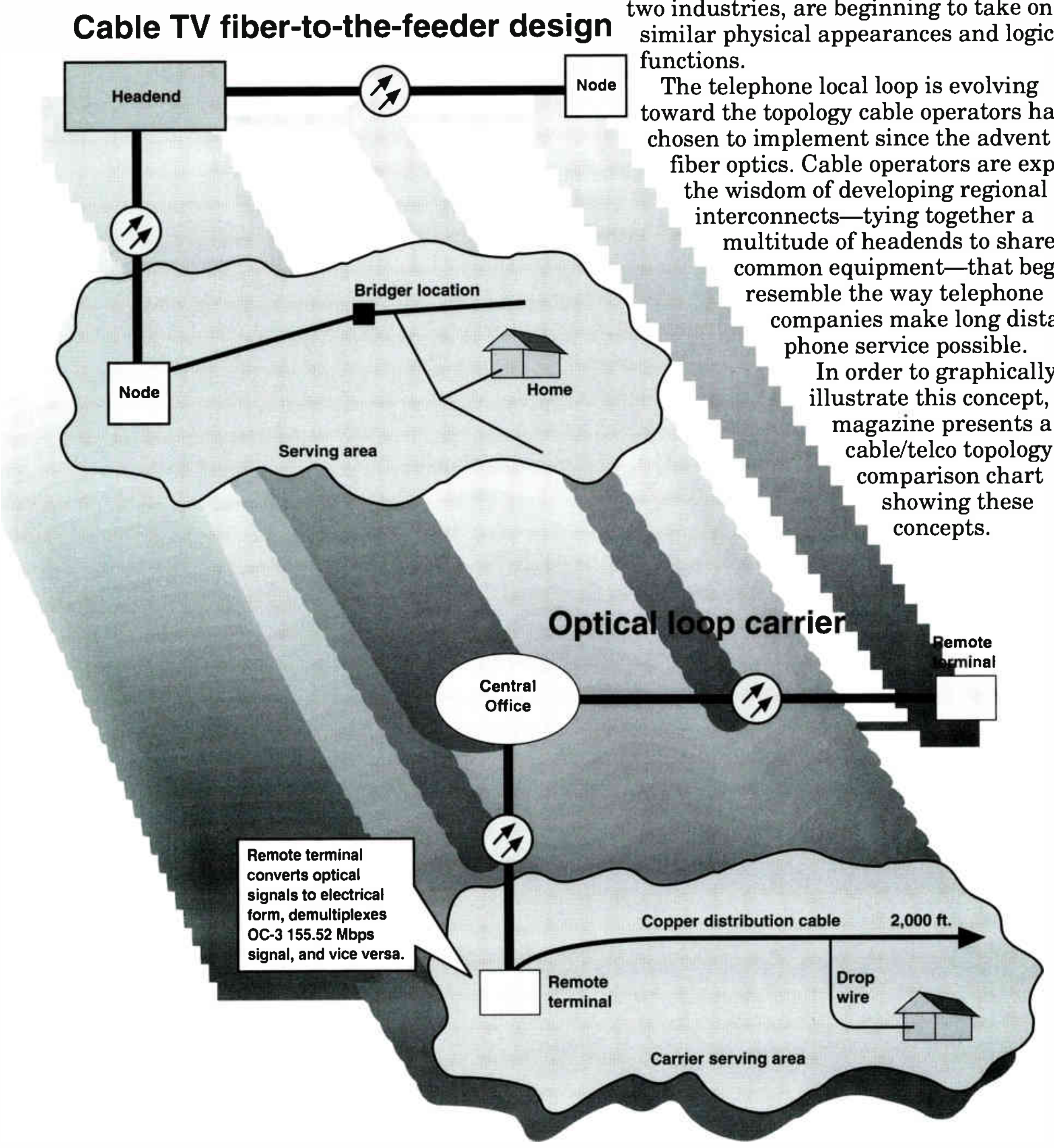
Throughout the 1990s, headlines will be made by cable companies planning to upgrade their networks with digital video compression, fast packet switching capabilities and digital video servers—all in an attempt to reconfigure their networks to provide a wide variety of on-demand programming to television viewers.

Meanwhile, the telephone companies will be making news by installing thousands of miles of new fiber into neighborhoods, then entering the home on coaxial cable and/or traditional twisted pair copper wire. This broadband capacity will also be used to deliver a dizzying array of new video services to consumers.

The fact is, cable companies and telephone companies are embarking on voyages that will take different routes but probably end up in the same place. Network topologies, though given different names by the two industries, are beginning to take on similar physical appearances and logical functions.

The telephone local loop is evolving toward the topology cable operators have chosen to implement since the advent of fiber optics. Cable operators are exploring the wisdom of developing regional interconnects—tying together a multitude of headends to share common equipment—that begin to resemble the way telephone companies make long distance phone service possible.

In order to graphically illustrate this concept, *CED* magazine presents a cable/telco topology comparison chart showing these concepts.



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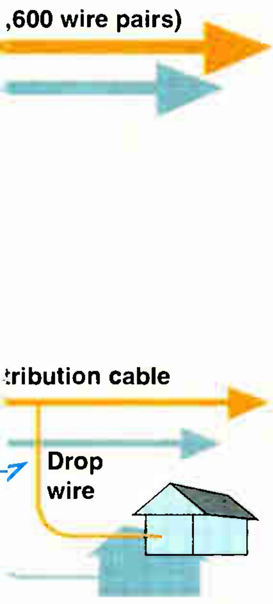
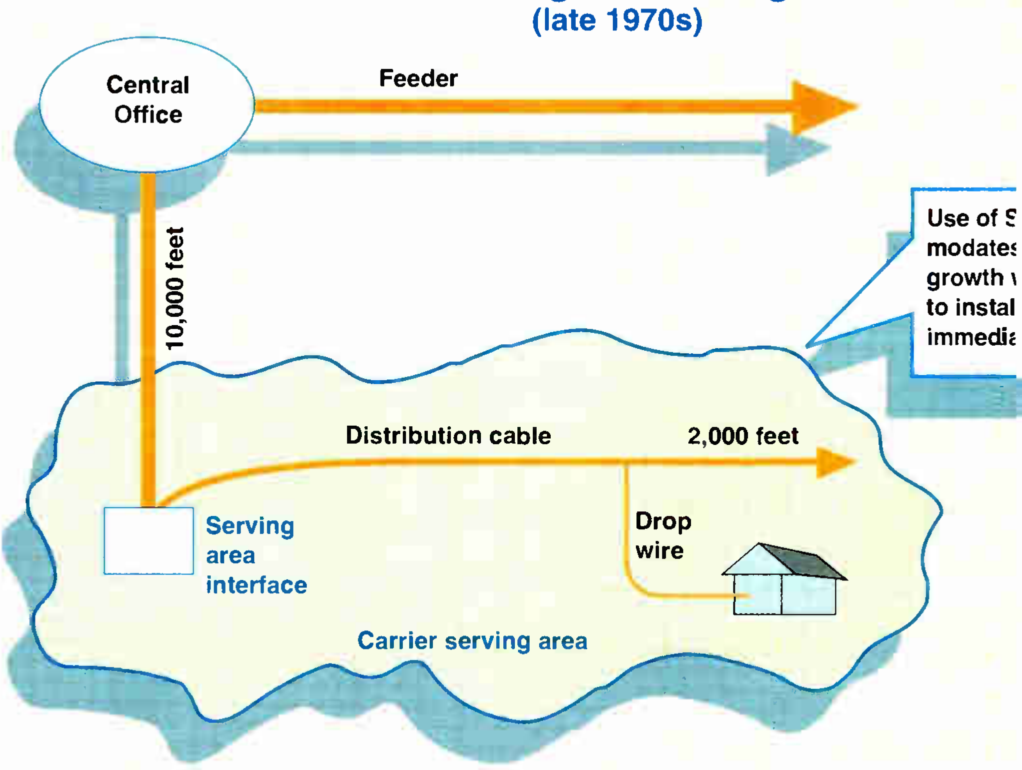
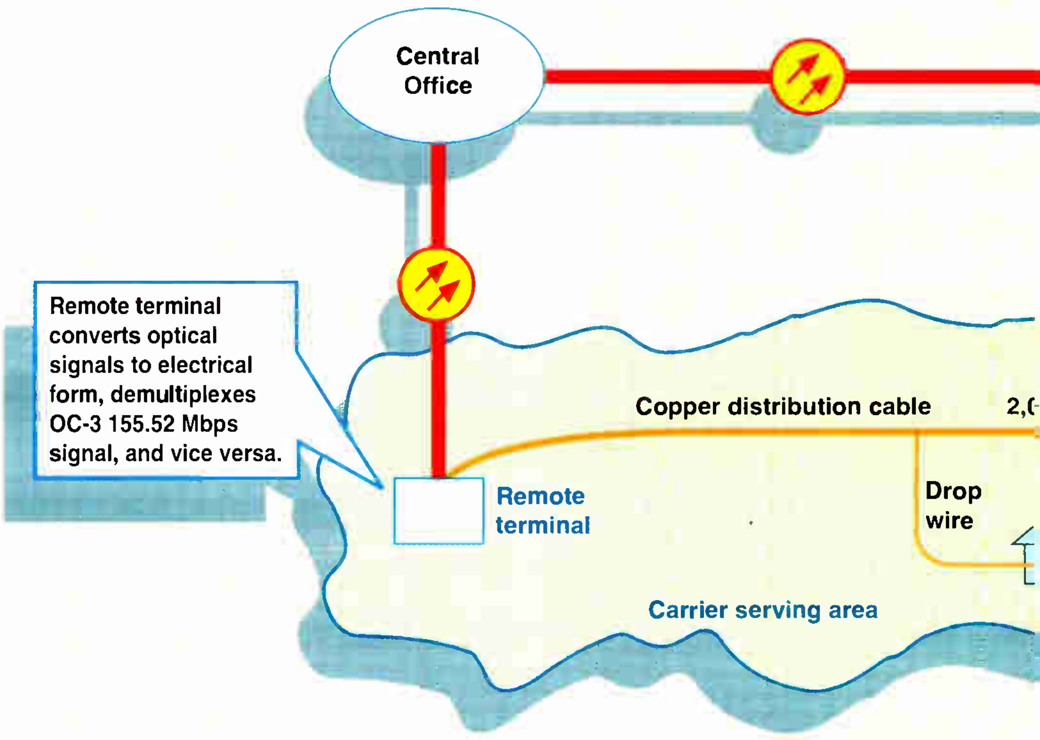


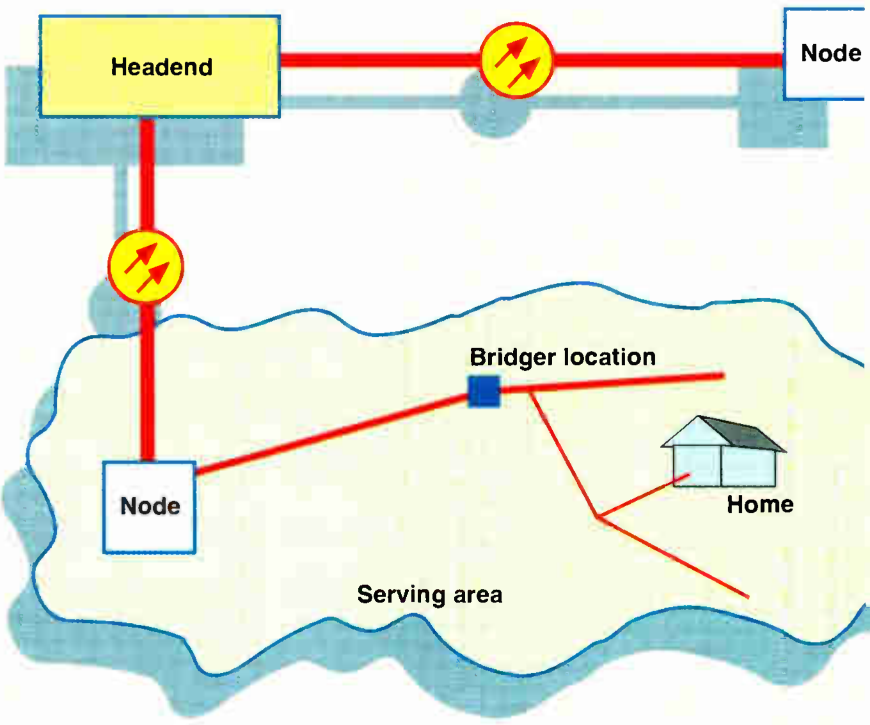
Serving area design
(late 1970s)



Optical loop carrier



Cable TV fiber-to-the-feeder design



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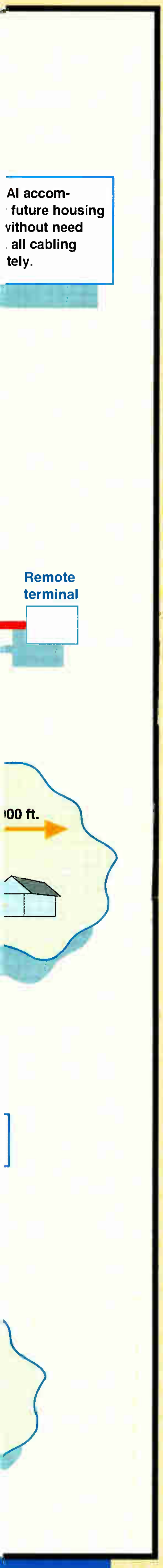
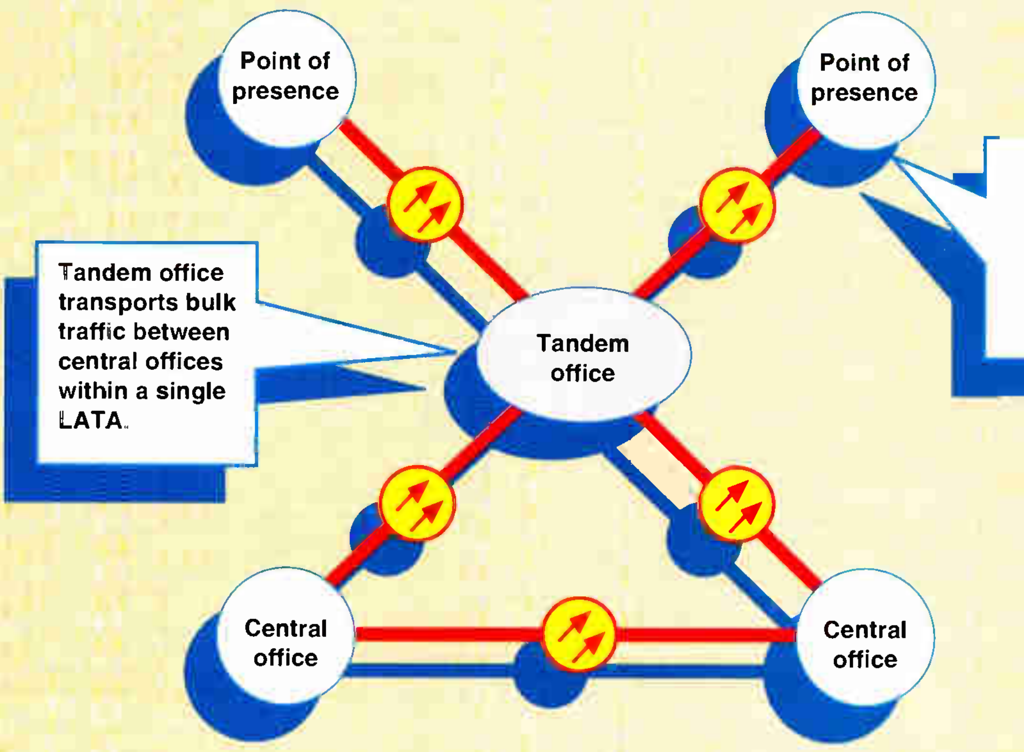
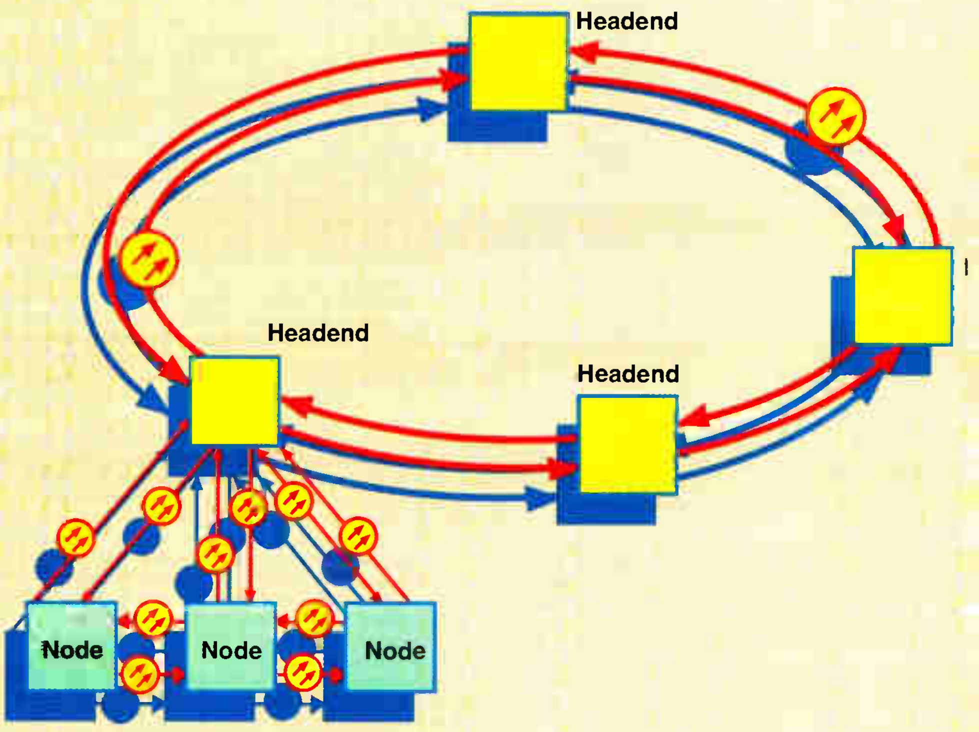


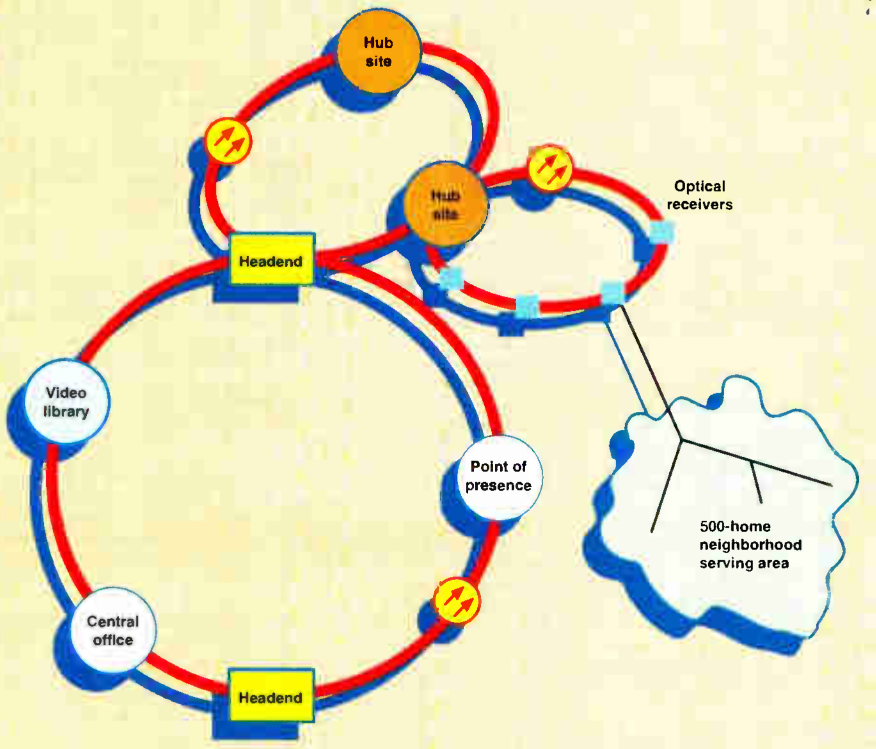
Current local exchange network



CableLabs' Network Architecture



Time Warner full service communications netw



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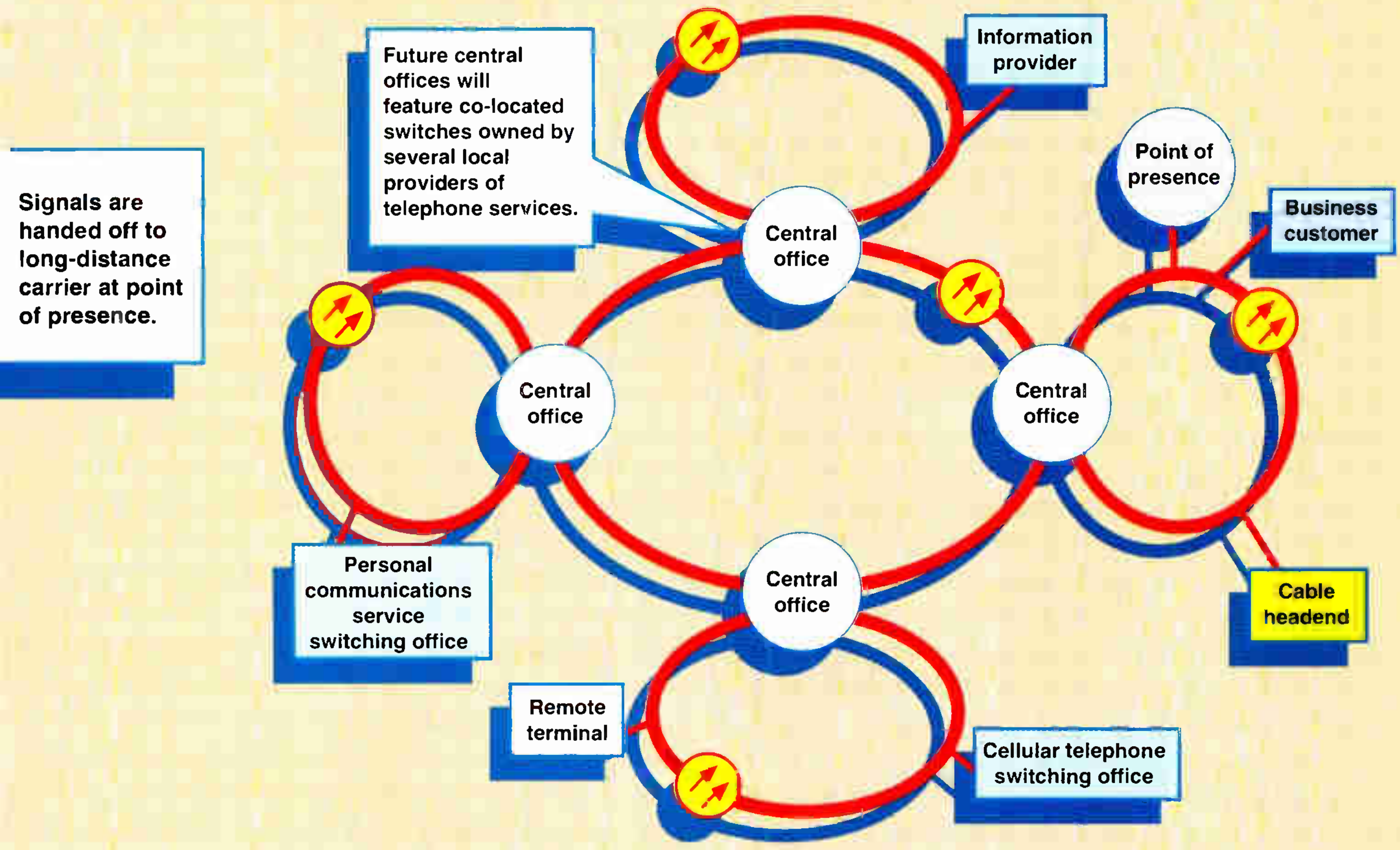
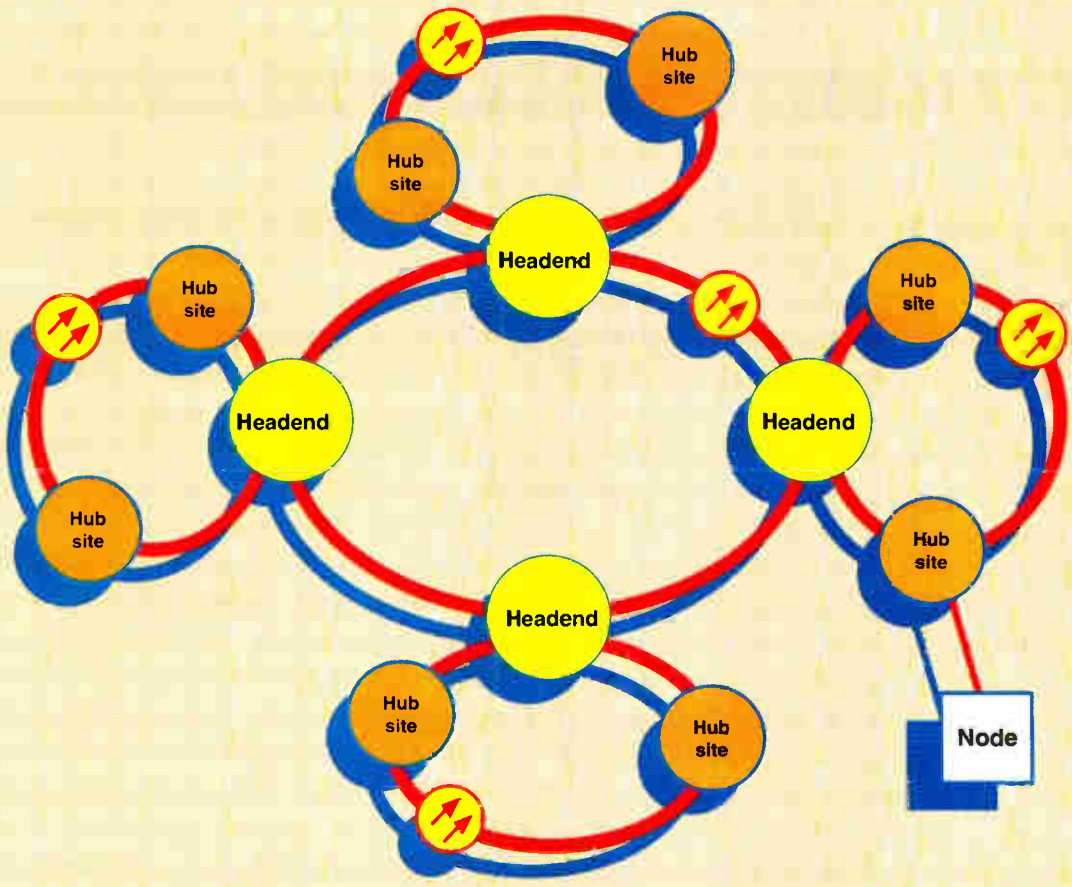
Future local exchange network



Rogers network architecture



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Interconnecting central facilities

This series of diagrams shows that a similar change in physical topology (network layout or design) has been occurring in both local telephone and cable TV networks. Where telephone central offices, analogous to headends, originally used a sort of mesh design, entailing point-to-point connections, the latest thinking is to connect COs using a ring topology. That provides network redundancy (backup signaling paths) and simultaneously reduces the sheer bulk of cabling needed to connect the offices.

Note the similar thinking within the cable TV industry, beginning with the Rogers Cablesystems design, also based on the ring concept. Cable Television Laboratories and Time Warner Cable Group also advocate the use of ring architectures to connect cable headends, hubs and other facilities as well. Again, the point is that the physical structure of a modern cable TV or local exchange carrier network is fundamentally alike, suggesting that each might be capable of carrying signals now transported by the other type of network.

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ermission

Continued from page 40

equivalent of 28 T-1 circuits. Most of our customers, who are other long distance providers, wanted one or more DS-3s. In 1987 the newest equipment out was capable of multiplexing data at a rate of 565 Mbps—the equivalent of 12 DS-3s, 336 T-1s, or 8,064 basic voice circuits—over a single fiber.

During our learning/customer acquisition process we developed the Second Axiom of Telephony: Once they decide what they want, they want it now. They could easily take nine months to make a decision about what they wanted, but once they decided, we had to respond at a frantic pace. Trying to convince a potential customer that it was worth waiting six months for something they could have tomorrow, if they called the local phone company, was daunting.

Compounding that difficulty, our success relied on being able to provide the same service at a lower price. But in order to guarantee a return on our investment, we had to ask for a long-term commitment. So, not only were we asking them to wait to get the service, once they got it, they had to keep it for two to five years. IDA developed slowly.

The IDA "network" has gradually evolved from a series of point-to-point hops. Interestingly, the hops took on a remarkable similarity. It turns out that our customers are customers of each other. For this reason, they like to locate their POPs in close proximity to each other (see Figure 2). Sometimes they are even in the same building. They utilize each other's local and long distance networks to provide their own service.

Route diversity

As an example, it might make more sense for One Call to send traffic to another city by using MCI's network than to do it themselves. Guess who provides the fiber between the two? It became apparent that a loop through all of the POPs would be advantageous to all parties. With each successive project, fiber was routed to take advantage of the loop concept. Today the IDA loop in downtown Indianapolis interconnects the POPs of 13 long distance companies.

As IDA grew, so did the scope of the projects. MCI moved an operator service center to Indianapolis in 1989. The facility is located in the northwest part of the city. The MCI POP is 14 miles away in the middle of downtown (see Figure 1). Live operators are a critical part of MCI's customer service provisions. They required 100 percent reliability from the network. Thus, we were introduced to route diversity. Just like that, the size of the project doubled. A 28-mile loop shoots out from the downtown loop.

> It seems that light years have passed since we first saw video delivered by fiber from a headend eight miles away.

At its northwest extremity the loop passes through a few business complexes that have provided additional customers for IDA. With minimal construction, they can have their digital traffic brought into the loop.

The growth of IDA has also provided benefits to the cable side of our business. A handful of our cable technicians have become fiber optic technicians. We're very proud of them. They have developed their expertise in fiber splicing, activation and troubleshooting to such a degree that other Time Warner systems in the Midwest have utilized them to activate AM fiber projects for cable service. When we deploy fiber for cable-TV in Indianapolis, our staff will already be trained. Another benefit is that until we deploy fiber for cable we have enough experience to strategically place fiber now so it will benefit both businesses later.

It seems that light years (pun intended) have passed since we first saw video delivered by fiber from a headend eight miles away. Fiber optic technology has improved dramatically since 1985. We just bought a battery operated miniature fusion splicer and a portable computer with a laser diode/detector card and software that allows the computer to operate as an OTDR. Neither existed in 1985.

Have you read the articles about the telcos getting into the cable business? We have been in the telephone business since 1987. We have met the competition, and he is us. CED

Sammons answers New Jersey Bell's call

The next time you receive an unsolicited letter in the mail addressed to "Cable operator," don't throw it away.

Executives of Sammons Communications didn't, and it resulted in the first cooperative agreement made between a cable operator and a local telephone company under the Federal Communications Commission's video dial tone rules.

Under terms of the agreement, Sammons will for the next 10 years lease 60 channels of video from New Jersey Bell, which is constructing a new, state-of-the-art, digital broadband fiber network in Morris County. The network, which will utilize BroadBand Technologies' Fiber Loop Access (FLX) system to deliver both voice and video signals over a hybrid fiber/coax topology, will be offered to nearly 12,000 telephone customers and more than 8,000 Sammons cable-TV subscribers in Madison, Florham Park and Chatham Borough, N.J. The three communities are located about 10 miles west of Newark.

Bell Atlantic, the parent company of New Jersey Bell, is arguably the most aggressive RBOC (regional Bell operating company) when it comes to pursuing opportunities in video signal transport. The company also tenaciously lobbies both local and national regulators, seeking control over video content, which it is presently barred from doing by the 1984 Cable Act.

New Jersey's legislature and Board of Regulatory Commissioners has given New Jersey Bell (NJB) the green light to upgrade its aging copper twisted-pair network with an advanced digital fiber system under a proposal known as Opportunity New Jersey. That agreement allows NJB to spend $1.5 billion between now and 1999 to upgrade its plant—provided NJB doesn't raise its basic telephone rates to fund the project.

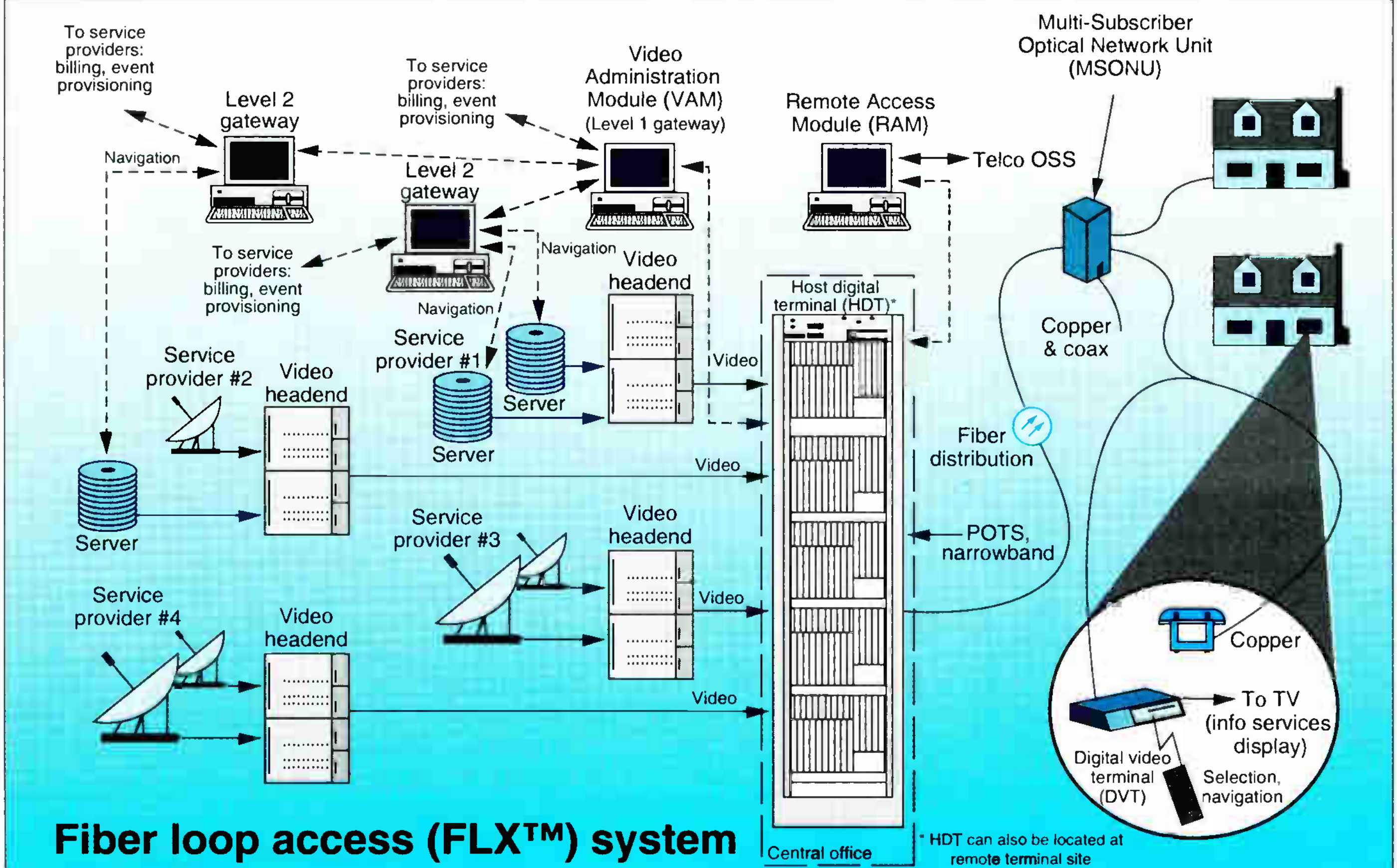
While the New Jersey Cable Television Association fought for more than a year to deny NJB that right, operators such as Sammons "felt it was going to happen anyway," comments Edwin Comstock III, Sammons' vice president of operations and the person who negotiated the arrangement with NJB.

Unsolicited solicitation

Discussions between Sammons and NJB were precipitated by a solicitation letter sent by Bell Atlantic to every cable operator in New Jersey more than a year ago, says Comstock. That letter apparently sought a cable partner to lease video delivered via a fiber-to-the-curb telephony network.

After Sammons showed initial interest in such an arrangement, it took between six and eight months of negotiation over terms and concepts to arrive at a workable understanding, Comstock says.

Madison, Florham Park and Chatham Borough were chosen because they were



Fiber loop access (FLX™) system

three municipalities that could be easily broken out from Sammons' Dover Cable system, which services the area. Furthermore, Dover Cable was due for a rebuild anyway and design work had already commenced. In fact, the balance of the Dover Cable system will be undergoing a rebuild from 36 channels (300 MHz) to 60 channels (450 MHz) with a fiber backbone at the same time NJB builds its network and offers it to Sammons for lease.

"Several other communities were openly discussed" by NJB and Sammons as possible candidates for the new network, but the three chosen were singled out because they featured aerial construction and served primarily residential areas, says Comstock.

> Sammons prefers to call its arrangement with New Jersey Bell a "trial," although the project spans 10 years and 8,000 homes.

While Sammons prefers to refer to its arrangement with NJB as a "trial," it clearly goes beyond that in both length and breadth—10 years and 8,000 homes. Yet Comstock says this venture will be the benchmark that determines whether other Sammons systems are added to the fold.

What Sammons gained

Why would an established, respected cable operator enter into such a cozy arrangement with a telephone company that so openly espouses its intentions to compete with the cable industry? How did Sammons overcome antagonistic attitudes that have existed between the cable and telephone industries since the first pole attachment fights? What does Sammons gain by agreeing to give up ownership of the cable plant?

"Our interest lies in the potential of

this network as the platform to deliver innovative information services," says Comstock. "This test is part of Sammons' continued commitment to provide quality service to our customers. The cooperative effort with New Jersey Bell will allow us to develop and deploy new services and advanced services to our mutual customers as the network evolves. Through this test we hope to maximize the potential of what we may provide our customers in the future."

Part of the deal calls for Sammons to work with NJB to test market information services such as video-on-demand, home banking, home shopping, education and health care services.

It was this mutual interest in providing information services that allowed Sammons and NJB to essentially check their guns at the door when negotiations opened. "I see synergy working with them," Comstock notes.

So why not build it themselves? Cost was the primary factor, according to Comstock. The New Jersey Bell construction plan calls for fiber to the curb and utilization of digital switches—expensive equipment, especially when compared to traditional CATV construction methods.

> Sammons will handoff baseband signals from its Dover headend to the New Jersey Bell hardware co-located in the headend for delivery throughout the area.

How it works

Obviously, the key to making all this work is the hardware that is put in place. According to Comstock, Sammons will handoff baseband signals from its Dover headend to NJB hardware co-located in the headend for delivery throughout the area serviced by NJB. From there, the telecommunications equipment built by BroadBand Technologies (BBT) takes over.

According to BBT, the FLX system uses multiple 64 kilobit-per-second data streams to deliver narrowband services (voice and low-speed data) and multiple one-way 45 megabit-per-second switched data streams for the broadband (video) services. BBT hardware presently embeds one digital video channel in each 45 Mbps data stream, but can be upgraded to carry multiple channels in the future.

The FLX system consists of several pieces of hardware (see Figure 1), including:

- A Host Digital Terminal, which can be placed at the central office or at a remote terminal. Each HDT serves about 300 subscribers and provides up to 378 voice channels and 64 broadband information streams.
- A Multi-Subscriber Optical Network Unit (MSONU)—installed curbside, this device terminates the fiber distribution system and feeds twisted-pair copper wire and coaxial cable with telephone and video services, respectively. Each MSONU serves up to eight houses or living units.
- Digital Video Terminal. This set-top terminal converts one or two digital signal into an NTSC signal for use by a

television receiver. The DVT takes commands from a handheld remote control and digitally transmits commands upstream to the switch.

• Video Headend. A baseband "headend," located at each video source, performs analog to digital conversion of the video signals while signals that have already been digitized are simply multiplexed with the others and sent to the HDTs. MPEG technology will be utilized to increase the capacity of each 45 Mbps data stream to 24 video channels, resulting in a capacity of 1,536 video channels.

Sammons will lease 60 channels of video from New Jersey Bell, which is constructing a digital broadband fiber network.

• Remote Access Module (RAM) and Video Administration Module (VAM). These software-controlled, computer-based subsystems provide telephone and cable TV interface to the FLX system. RAM provides provisioning, testing and performance monitoring of the telephone network while VAM interfaces to CATV billing and event provisioning systems.

Along with the network come several advantages that are derived out of built-in digital intelligence. For example, the address of each DVT set-top unit is tied to a physical location, so if the box is disconnected, it cannot be used in another location. Furthermore, an internal alarming system will alert the system operator when a box is disconnected. The idea is to reduce theft of service as well as theft of hardware.

The BBT system delivers three channels of video the house, allowing for any three channels to be watched in any combination in each and every home. Or, viewers will be able to watch one premium channel while tape recording another and still watch yet another channel on a second receiver. This is something that presently can't be done on cable decoders, which descramble and deliver just one scrambled channel at a time.

Because the video is switched, the BBT system can provide a record of each and every channel change performed by subscribers. While that information will be held in confidentiality, metering services such as Nielsen and Arbitron have been seeking this capability for years as a way to effectively track viewing trends.

Other system capabilities include flexible tiering (which will become important under the provisions of the new cable legislation enacted last year) in which every user could be offered a custom combination of channels; full impulse pay-per-view ordering; narrowcast programming targeted to geographical pockets as small as 250 subscribers; and complete relief from signal leakage from trunk and feeder plant (because it's optical).

Comstock sees the relationship between Sammons and New Jersey Bell as advantageous for both parties. He says a future filled with a wide range of advanced telecommunications services "will require some common bonds" in order to have those services delivered effectively. "Economies of scale will be an important issue." CED

By Roger Brown

Inside the PSTN realm: A telephony primer

To handle the tremendous volume of telephone traffic, the U.S. telecommunications network or Public Switched Telephone Network (PSTN) has become very large and complex. The PSTN can be divided into two general sections: the *local exchange network*, which provides local transmission service, and the *interexchange network*, which provides long distance transmission services.

The local exchange network

Local exchange telephone companies (LECs) provide service within designated areas assigned by state Public Utility Commissions (PUCs). These areas are known as Local Access and Transport Areas (LATA). Within its LATA, each LEC provides a myriad of services that can be divided into two categories: *exchange services* and *exchange access services*.

Exchange services are the telecommunications services provided within a service area, ranging from simple dial tone to specialized customer services and system features such as hunt groups, call waiting, call forwarding, and Centrex services. Exchange access services, on the other hand, connect the local exchange network to the interexchange network, allowing local telephone customers to connect to long distance carriers.

The traditional interexchange portion of the network is controlled by long distance or *interexchange* carriers (IXCs). IXCs offer a variety of services, including various options for voice and data transmission such as toll-free and Wide Area Telecommunications Services (WATS) services.

The customer's perception

When a customer picks up the receiver on the telephone, a signal is sent through the wiring inside the customer's premise, through local loop, to the telephone company's local CO. The local CO receives the message that the customer's telephone is "off hook" and indicates by sending a dial tone back to the customer's receiver that a call may be placed.

The customer enters the telephone number of the party to be called based on the "National Number Plan" (the nationally coordinated scheme for telephone numbers), which enables the local CO to interpret the telephone number as a specific address and route the call to its destination. If the call is going to a destination served by the local CO, the routing is direct via that central office. If the call destination is within the LEC's LATA, the call will be routed from the originating local CO switch, through a Tandem switch that connects the LEC's multiple local COs together by way of a trunk line.

If the call crosses a LATA boundary, it must be routed via trunk lines through a toll switch by a long distance carrier such as MCI, AT&T, or US Sprint before being routed to the ultimate call destination. The status of called party's line is interpreted by the terminating CO and if the phone is not being used the calling party will receive a signal indicating that the line is idle. A special signal is sent to the called party's telephone which causes it to ring. The ringing circuit is cut when the receiver is picked-up or off hook. Once the called party picks up the receiver the communications circuit is complete and the conversation can begin.

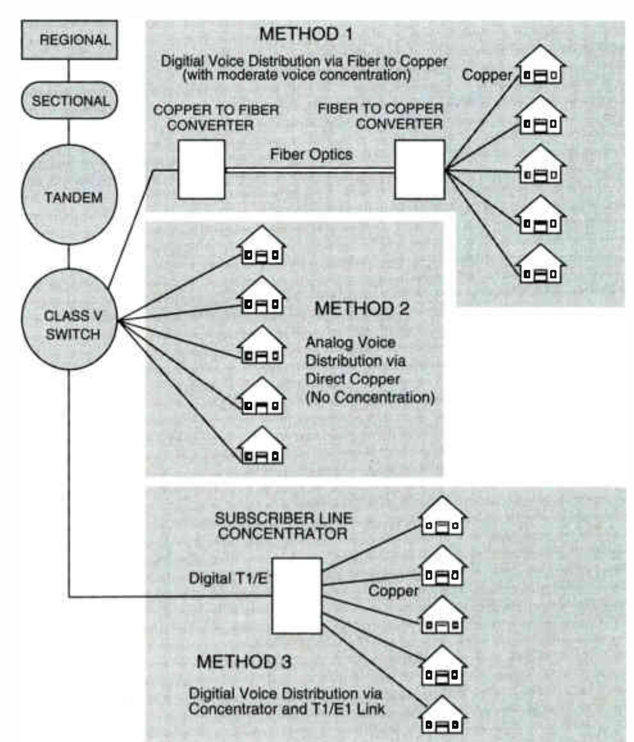
Evolution of the PSTN

The limitation of today's telephone network is the "last mile" that connects from the customer premise equipment (CPE) to the network. Generally, the wire that connects each user with the local CO is twisted pair or copper wiring. Although twisted pair was adequate in the past, it is inherently limited in capacity and flexibility since it was designed to serve one function only: the delivery of voice.

Many telcos are attempting to protect their investment in twisted pair by utilizing compression technologies so as to maximize the limited bandwidth inherent to the twisted pair architecture. Unfortunately, however, this is a short-term solution that lacks the capacity and capability to accommodate the market demand for emerging applications.

Trends in technology and customer needs clearly indicate that twisted pair is inadequate and unacceptable to address new multimedia and interactive applications. The requirement today is to provide users with the capacity to access any communications service (voice, video, and data) without the cost

Figure 1: Conventional voice distribution methods



For all methods, data transmission limited to narrow-band due to the effects of load coils, media, etc.

By Kristi A. Furrer, First Pacific Networks

and complexity of installing and maintaining separate networks.

The optimum last mile solution is one that CATV operators and MSOs already have in place: the existing cable television coaxial and/or fiber network. This network provides the ideal medium to create a multimedia communications highway into the home or office. Then, the only remaining issue is how to access and manage the bandwidth.

These tasks can be performed with intelligent switching technology, through systems which serve as the so-called on- and off-ramps,lanes and traffic managers of the communications highway. The goal is to deliver a fully distributed digital switching architecture that enables cable companies to deliver voice quality switched telephone service over existing networks.

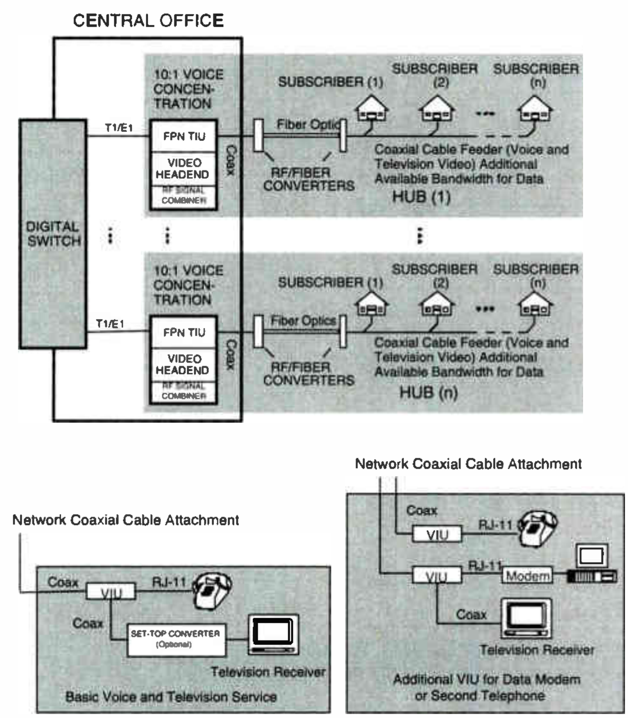
In addition to resolving the last mile issue, systems such as the one shown in Figure 2 can lessen the expense of installing and maintaining multiple incompatible wiring systems.

The system consists of a "smart box," also referred to as a VIU, a class five central office-like switch that connects to the existing coaxial network. A "connection box" is located at the network operator's facility. A standard telephone, TV and personal computer can plug into the other side of the VIU.

The connection box, or TIU, connects all the home or business VIUs together into a hub. The hub consists of one VIU for each individual user, and one TIU that supports hundreds of users concurrently. The TIU connects these hubs to the existing public or private networks such as the PSTN or the cable television network.

The result is people who can plug any communications device into any communications outlet, much as they connect any electrical device into any electrical outlet. CED

Figure 2: PX distributed voice/data/video



TYPICAL RESIDENTIAL SUBSCRIBER FEEDER CONNECTIONS

What's happening under the cross-ownership fence

Small operators of both cable and telephone systems have similar challenges and questions

Call for phone service in Center Junction, Iowa and chances are you'll hook up with John Heikin, a delightful country gentleman who'll be glad to sign you up. And while you're on the phone, chances are he'll ask whether or not you'd like cable TV, too. After all, the room in which he sits amiably chatting is both a cable headend and a telephone central office.

Such is the case in many sections of the nation's heartland. Small, independent telephone companies are offering both telephone and cable service to their subscribers. Illegal? Not under the rural exemption to the telco/cable cross-ownership restrictions. And while larger cable operators and MSOs across the nation strain their collective ears to hear how the telcos plan to send voice, video and data over their networks, it's interesting to note that these companies–albeit little–have the same problems and challenges, only on a much smaller scale.

Most of them are using fiber, for example. They're looking at headend consolidation. They know about DBS, cable in the classroom and cumulative leakage index (CLI). Indeed, they're a hearty and bilingual group of people who are eager to chat and are hip on both cable and telephone acronyms and jargon.

The independent operators cite a varying list of challenges, including keeping up to speed on changing technologies, regulations and routine plant maintenance (sound familiar?). Following is a look into some of the challenges and questions posed by independent cable/telco operators:

Cowboys and Indians

Roger Hovda started out in life as a farmer selling wheat in Parshall, N.D. After attending college, he returned to Parshall and went to work for the local telephone company. Now, he's the central office supervisor for the Reservation Telephone Co-op, which operates 15 phone exchanges and six cable headends. Both cable and telephone networks are 100 percent underground, Hovda says. The company has about 3,500 telephone subscribers and 900 cable subscribers, spread out over six communities.

Cable in the classroom

Last fall, Hovda installed a fiber route between seven local schools for an interactive, long-distance learning application–"so one teacher can sit in one town and teach other schools in other towns," Hovda says. On the telephone side, Hovda has installed fiber to link six exchange offices to the toll network. "You bet we're using fiber," Hovda says with pride. "Right now our cable and telephone plant is separate, and I suspect it'll stay that way for a while. It'll be a long time, too, before you see fiber to the home out here, because we have little pockets of people and then nothing for a few miles. The population per square mile is low."

> The independent operators cite a varying list of challenges, including keeping up to speed with changing technologies, regulations and routine plant maintenance.

His biggest challenge? "Keeping up with all the new satellites that are being launched. Last summer we put in 12 dishes, just to cover the changes," Hovda explains. But perhaps the most unique challenge facing the Co-op has nothing to do with cable or telephone technologies.

The central office is located on the grounds of the Fort Berthold Indian Reservation, which is fuel for an ongoing dispute with the local Native Americans, who want to tax the company for any of its cable or telephone plant located on the reservation. "I've lived here all my life, and there's always these jurisdiction problems," Hovda laments. "But it's getting pretty bad."

Progressive

Meanwhile, over in Winthrop, Iowa (population 850), supervisor Jim Tieg recently completed a fairly progressive headend consolidation project for independent operator East Buchanan Telephone. The system has roughly 600 cable and 1,300 telephone subscribers, Tieg says.

"We had our cable TV set up over two different headends, but we just changed that to where we have the one here in Winthrop and another served over fiber optic cable," Tieg says. "We put the fiber optic cable in over the last two years, and cut over last April. So our cable signal and our toll traffic goes through on the same piece of cable."

East Buchanan Telephone is a cooperatorive, which Tieg explains is a membership-type phone service. "Our subscribers purchase a membership in the telephone company, which costs them about $10. They get a dividend after ten years," Tieg explains. "The actual amount varies with how much usage they have on cable and telephone."

Tieg says his goal is to ultimately take fiber "as deep as it'll go" into his cable/telephone network. "I'd like it to go all the way to the customer's residence, if possible," he says. "Ideally, we'd like to get one piece of wire to the house that carries both video and telephone." Tieg submits that the management and the board of directors for East Buchanan are "definitely up on technology," and that the company takes a progressive stance whenever possible. "The nice thing about the independents is, there's not so many bosses and directors to go

through to get something done," Tieg says.

Third generation phone guy

Then there's Tim Bittinger, the third generation of Bittingers who has run Clarks Telephone Co. of Clarks, Neb. "After going to college, I started here full-time in 1977," Bottinger says. "In 1983 I built the cable television system." The system now has about 130 cable subscribers out of a possible 160 (in passings), while the phone system has "about 500" subscribers.

Cost savings

The underground CATV plant was installed more than a year before it came on-line, Bittinger says, because he completed it "about the same time" he was upgrading the telephone cable. "We took our time and put the cable system in very carefully. Everything is buried at a certain depth, and every home that's wired we did ourselves. As a result, we don't have many problems—maybe five trouble calls a year," Bittinger comments. Also, Bittinger says, spreading the cable plant installation over time saved on cost.

Indeed, independent cable and telephone operators like Bittinger can do a lot to save on cost, like sharing resources.

"We share a lot of the pedestals; we share the building; we share a lot of other things," Bittinger says. The cable plant, because of its small size, was designed with five line extenders in lieu of trunk amplifiers, and Bittinger says there are no plans to integrate fiber into the network at this point.

"We're as modern as we can get, right now, both on cable and telephone," he says, pointing out that Clarks Telephone also uses digital switching equipment for its telephone exchange.

However, next year Bittinger plans to add DBS services to his plate of offerings for non-cabled Nebraska residents. "We applied for and were granted three counties (in which we can be the DBS provider)," Bittinger explains.

Iowa's smallest system

Even tiny Center Junction Telephone, billed in a newspaper article last year as "the smallest cable company in Iowa," is considering a fiber build this year, according to John Heikin, general manager. "We want to put fiber in for our toll traffic," Heikin says. "We're an Iowa Network Service town, which means that we're one of 137 telephone companies in Iowa that went together to provide equal access (to alternative long distance carriers such as MCI and US Sprint). That's done by a switch in Des Moines.

"We all zero in on Des Moines and our toll traffic goes from there out," Heikin continues. "Right now, the Iowa Network Services comes out to all the toll centers with fiber. The next step is to get directly to INS—right now we're still going through U S West." To do that, Heikin says he's considering the installation of fiber to the closest hand-off point, then going direct with the toll traffic.

HARRISON

> "The problem is, with phone you're talking about reasonably basic DC electricity types of things. Video and large bandwidth applications, like cable, are more exotic."

Heikin says that everyone in the 73-house town of Center Junction knows one another, which he says is good.

"In fact, if somebody calls me up on Sunday afternoon and says the phone's not working, why, I'll jump in the truck to come in and fix it. Same thing with cable TV," Heikin says.

But because only the town of Center Junction is wired for cable—and Heikin lives "out in the country"—he's looking forward to the DBS service that will be provided in his area next year.

"I'm second on the list for a DBS hookup," he laughs, explaining that the owner of the company which won the bid for DBS service is first on the list.

A friendly bunch

One thing is certain: Independent cable/telco operators certain are a friendly bunch. Ask Gary Harrison, CO supervisor for Missouri Telephone, where Stockton, MO is, and he offers directions. "We're about 25 miles north of I-44, on State Highway 13," he says. On a more general level, Stockton sits in the southwest corner of Missouri, and has roughly 500 cable subscribers and 1,300 telephone subscribers.

Harrison, who's been in the telephone industry since 1964, says FCC regulations are an ongoing concern. "The telephone industry has been regulated fairly heavily, so there's always a concern of how to do it, and how to do it right."

Technical training needed

But technical training tops his wish list, Harrison says. "The problem is, with phone you're talking about very basic or at least reasonably basic DC electricity types of things. Video and large bandwidth applications, like cable applications, are a lot more exotic," Harrison says. "Because of that, it's important to hire employees who are able to shift gears."

"Most of the employees we're going after are capable of doing both (cable and phone functions). But it takes a little more training for the cable side of things to really know what's going on.

"For example," Harrison continues, "when you mess with one phone cable, you affect one person. When you get out there and mess with the cable plant, you can cut off a large section of customers," Harrison says.

Some of the technical staff people at Missouri Telephone have taken NCTI and other correspondence-type courses to enhance their knowledge of cable television.

Rural subs don't like outages, either

And, Harrison says, the customers really complain when the cable goes off. "Believe me, being on the cable and the telephone sides of things, I hear it all—and when that TV picture goes off, they holler a lot louder than when the phone doesn't work.

"Think about it–after a long day's work, you could care less whether the phone rings at your house. But miss your favorite TV program?" Harrison asks rhetorically. "We can definitely see a difference. The phones begin to ring something serious if there's been a problem with the cable TV. But with the phone, they may not even think to report it until the next day." CED

By Leslie Ellis

Glossary of telco terms

Editor's note: As cable operators move more into the realm of telecommunications, we though it would be helpful to provide a partial summary of commonly used telephony terms and acronyms.

Asynchronous transmission

Traditionally, asynchronous transmission is a digital transmission method where the individual characters are encapsulated by "start" and "stop" control bits that identify the beginning and ending of each character. It features lower data throughput than synchronous transmission methods, but without the need to maintain precise timing relationships between transmitter and receiver.

More recently, though, the term "asynchronous," at least when referring to broadband ISDN, has tended to mean the use of statistical multiplexing and packet switching technology to transmit a discontinuous steam of data.

By way of contrast, synchronous transmission, in the B-ISDN sense, has tended to mean the transmission of a constant stream of data, using time division multiplexing and circuit switching.

ATM (Asynchronous Transfer Mode)

Asynchronous transfer mode, or ATM, is an international packet switching standard established by the Consultative Committee for International Telegraph and Telephone, in which the network routing instructions and control information are part of the message itself.

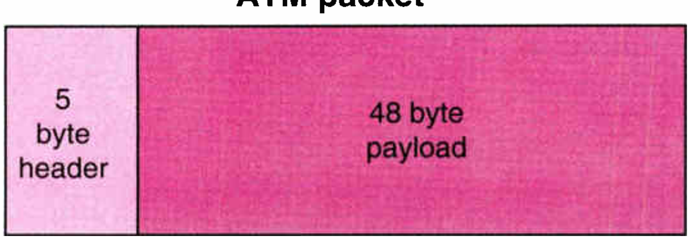
ATM will operate at speeds up to 2 Gbps and features the transmission of uniform cells of 53 bytes length each. Of that total, 48 bytes represent the payload while five bytes represent the header.

The header portion of the message unit identifies the owner of the transmitted information. ATM headers also identify the circuit number to which the message is sent.

The header also contains error control information. Because each of the cells (which may be thought of as "packets") are of identical length, whether completely full of data or empty, they can be switched quickly through a network. In part, that advantage arises because the work doesn't have to spend time examining each packet to read its address information and assess the length of the packet.

Cell relay systems, such as ATM, are desirable when transmitting video or voice messages because the time delay is of shorter duration, and more importantly, perhaps, of predictable duration, than frame relay-based systems which use variable-length messages.

ATM packet



B-ISDN (Broadband ISDN)

Broadband ISDN is a high-bandwidth version of ISDN intended to support applications such as full-motion video and image. It uses a basic signaling rate of 150 Mbps and expected to support additional bandwidth in increments of about 50 Mbps, up to about 600 Mbps.

Cell relay

A packet switching technique that uses cells of uniform length. Such techniques are well suited for video or voice transmissions,

in contrast to frame relay techniques, which are better optimized for bursty data communications. Asynchronous transfer mode is a form of cell relay. So is the IEEE 802.6 standard and SMDS.

Central office

A telecommunications facility where telephone calls are switched. In the local exchange, a central office generally represents a 10,000-access line service area.

A long-distance carrier's central office represents an access point to pick up and drop off traffic bound for, or originating from, a local exchange area (LATA).

Circuit switching

A type of switching system, historically used to establish voice connections between two or more speakers, using a dedicated physical circuit path between the callers for the duration of the call or session.

CPE (Customer premises equipment)

Customer premises equipment includes terminating equipment,such as telephones, facsimile machines, modems or other equipment owned by the customer and attached to the telephone network.

CSU (Channel service unit)

A channel service unit is a digital interface between a customer's equipment and the digital telephone company local loop. Generally, a CSU is required whenever a DS-1 circuit is provided to a customer.

DACS (Digital Access and Cross-Connect)

A DACS is a multiplexer/demultiplexer used to convert a T-1 (1.544 Mbps) data stream into 24 DS-0 (64 kbps) signals, typically for routing to another T-1 line. DACS units cannot handle digital streams of less than 64 kbps, and feature only manual signal routing.

Digital loop carrier

The digital loop carrier is a digital transmission technology originally developed by telephone companies as a way of extending the bandwidth of installed copper-based local loop facilities. Digital signals are sent from central offices to remote terminal sites that may serve 500 to 3,000 dwellings.

Signals are converted from digital to analog format at the remote terminal and sent to homes and offices over twisted-pair copper wiring. Transmission from central offices to remote terminals can be by optical fiber or copper wiring. DLC features the use of 1.544 Mbps circuits, each of which can serve 96 or more subscriber lines from a single remote terminal.

DS-n (Digital signaling at level n)

The digital signaling hierarchy set by the ISDN standard features several bandwidths, including:

DS-1: 1.544 Mbps
DS-2: 6.312 Mbps
DS-3: 45 Mbps
DS-4: 274 Mbps

In Europe, a DS-1 circuit represents a signaling rate of 2.048 Mbps.

DSU (Data service unit)

A data service unit, or DSU, is a device used to connect a channel service unit (owned by a network operator) to a data terminal such as a computer, protocol translator or multiplexer.

FDDI (Fiber Distributed Data Interface)

The fiber distributed data interface is a data communications standard based on a 100-Mbps, token-passing ring topology and optical fiber cabling (though versions running on copper wiring have been developed).

FITL (Fiber in the Loop)

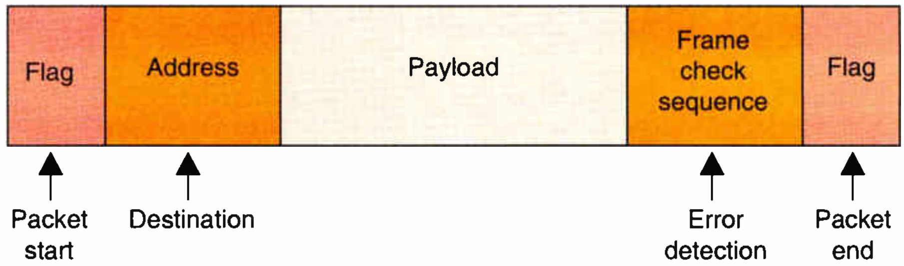
"Fiber in the loop" is a generic term referring to the deployment of optical fiber transmission technology in a local exchange carrier's plant. It encompasses a variety of scenarios, including fiber-to-the-curb and fiber-to-the-home for residential customers.

Loop fiber deployments also include dedicated point-to-point runs installed from central office sites directly to business customer sites.

Fractional T-1

Different combinations of sub-T-1 service, including a one-eighth T-1 (192 kbps), one-fourth T-1 (384 kbps), or one-half T-1 (768 kbps). The service was developed as a way of offering business customers higher-bandwidth telephone connections without paying for an entire T-1 circuit (24 DS-0 access lines of 64 kbps each).

Frame relay frame



Frame relay

A data transmission technique similar to X.25 and based on the use of statistical multiplexing to dynamically allocate bandwidth. It achieves greater throughput by eliminating error checking at each intermediate network node, as does X.25.

Host digital terminal

The host digital terminal is the central office end of a digital loop carrier transmission line, containing multiplexing and demultiplexing circuits as well as optical transmission gear (for optical loop carrier systems). HDTs

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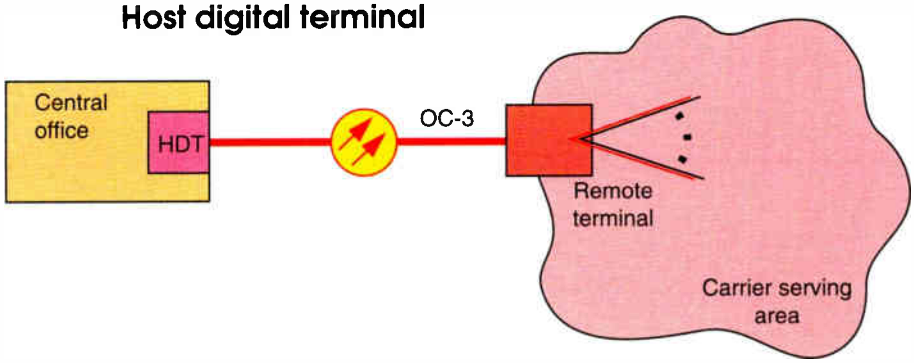
Host digital terminal



sometimes are called central office terminals and commonly can transmit data at the OC-3 rate of 155 Mbps.

Future fiber-rich local telephone networks, featuring a fiber-to-the-curb design, may place an HDT out at a carrier serving area location now represented by a remote terminal.

In that application, the former remote terminal moves to a curbside location and feeds a group of four to 12 homes and is called an optical network unit.

ISDN (Integrated Services Digital Network)

Integrated services digital network (ISDN) is an international standard for dial-up digital transmission over a public telephone network. ISDN uses a Basic Rate Interface and Primary Rate Interface.

The BRI, also known as "2B + D," consists of two bearer channels and one data channel. Each bearer channel represents a 64-kbps channel.

Each data channel represents a 16-kbps signaling and control data stream. The PRI, also known as "23B + D," features a 1.544 Mbps data stream. In Europe, the PRI is a "30B + D" data stream of 2.048 Mbps.

IXC (Interexchange carrier)

An IXC is a long-distance telephone company, authorized to pick up intra-LATA traffic from a local telephone company and transport it to another of the 161 U.S. LATAs or another telephone network outside the United States.

LATA (Local access and transport area)

A LATA, or local access and transport area, is one of 161 local telephone exchange areas created as a result of the AT&T divestiture. All traffic within a single LATA can be carried by the local exchange carrier. All traffic bound for other LATAs must be handed off to an interexchange (long-distance) carrier.

LEC (Local exchange carrier)

A local exchange carrier, or local telephone company, is the owner of the transmission facilities stretching from any customer's premises up to a central office, as well as associated equipment and cabling linking local central offices within a defined local service area called a LATA (local access and transport area).

A local exchange typically is defined as an area served by a single switch and containing 10,000 access lines, identified by a common three-digit area code and the first three following digits of the telephone number. More broadly, a local exchange encompasses the entire local service area defined by a single LATA.

Local loop

The local loop is the set of transmission facilities owned by a local exchange carrier, or local telephone company.

The term "loop" doesn't refer to the existence of a physical wiring running between a central office and a customer's location, but rather is an acronym that stands for "local operations, outside plant."

Metropolitan area network

In a generic sense, a metropolitan area network, or "MAN," is a communications system covering an entire city. Specifically, it is a type of telecommunications network intended to carry video, data and voice traffic at 100 Mbps or higher rates over a citywide area using a protocol sanctioned by the Institute of Electrical and Electronics Engineers (IEEE).

The IEEE 802.6 standard uses a technique called "distributed queue dual bus." It features a bus network topology and transmission in opposite directions (counter-rotating rings or buses) to provide message redundancy.

Local exchange carriers also market a MAN service known as "switched multimegabit data service" (SMDS), intended for use as a local area network interconnect.

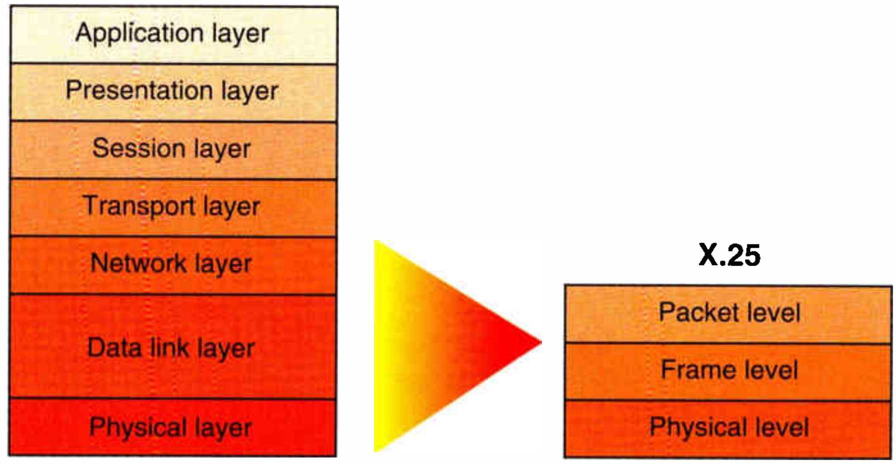
OAM & P

A telephone industry acronym referring to operations, administration, maintenance and provisioning.

The term refers to software required to generate the reports and commands needed to control all network equipment.

OSI model

OSI model



The Open Systems Interconnection model, developed in 1977, outlines a seven-layer, modular method of breaking up activities required to establish and maintain a communications link between computers and computing devices, even when the machines are of different types and made by different companies. Each of the seven layers performs a distinct part of the interaction, allowing the internal operations of each layer to be changed or modified without affecting the operation of the other layers.

The physical layer defines electrical and mechanical properties of interfaces, especially the detection of electrical voltage levels and the pin structure of interfaces.

The data link layer performs error detection and is responsible for determining when a transmission block begins and ends. It structures the received bitstream for reading by the network layer.

The network layer performs switching functions by routing packets among different pathways. Its job is to create a virtual circuit that is transparent to the other layers.

The transport layer handles those details related to moving data between one network and another. Multiplexing and error correction, for example, are handled at this layer.

The session layer establishes and

maintains half-duplex or full-duplex connections as needed, and provides data flow control operations.

A half-duplex connection uses one channel to connect two speakers, allowing only sequential transmissions (in one direction at a time only).

The presentation layer handles syntax issues, rules for representing data. The application layer is the communications interface to those portions of an end-user program concerned with file management, printing operations and virtual terminal emulation.

PCM (Pulse code modulation)

The traditional process by which an analog signal is converted to digital form for transmission over a digital telephone network.

The sampling process involves sampling of analog voice signals 8,000 times a second. The sampled amplitudes are represented by discrete eight-bit words, leading to the standard 64,000 bits per second (64 kbps) digital signaling standard for voice.

POP (Point of presence)

A POP, or point of presence, is a switching facility owned by a long-distance (interexchange carrier) and used to pick up and deliver traffic from one LATA to another.

RBOC (Regional Bell operating company)

One of seven regional companies created by the AT&T system breakup as holding companies for local telephone companies within their service regions. The "seven sisters" include Ameritech, Bell Atlantic, Bellsouth, NYNEX, Pacific Telesis, Southwestern Bell and US West.

Remote terminal

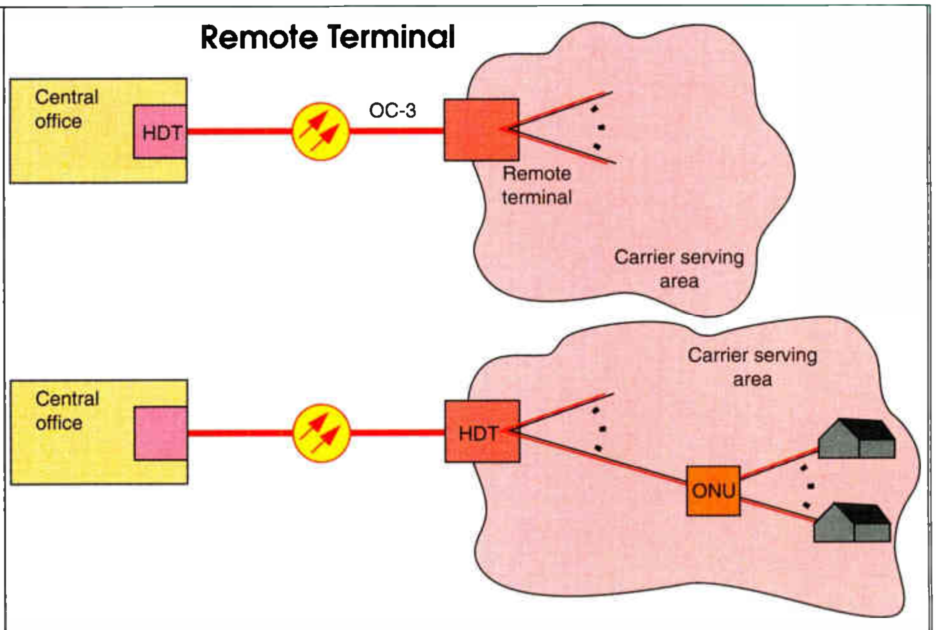
The subscriber plant end of a digital loop carrier transmission line, typically containing opto-electronics equipment (for optical loop carrier systems), multiplexing and demultiplexing equipment and cross-connect functions. An RT can be configured to serve 100 to 4,000 telephone lines.

Sometimes, an RT serves 3,000 lines in an area called a "carrier serving area." Each CSA might then be subdivided into distribution areas of 500 to 600 lines each.

An RT can be located 12,000 to 15,000 feet from a central office, while any customer served from an RT can be located within about 12,000 feet of the RT location.

Sometimes, an RT communicating with a host terminal at OC-3 rates (155 Mbps) itself becomes a hubbing point, connecting subsidiary remote terminals over transmission lines featuring 1.544 Mbps capability.

In advanced fiber-to-the-curb networks, a host digital terminal may replace the RT in the carrier serving area. An FTTC host terminal then would feed curbside optical network units (each functionally representing a smaller version of the RT) feeding four to 12 homes.



SMDS packet

Header 36 bytes	Payload up to 9,188 bytes	Trailer 4 bytes

SMDS (Switched multimegabit data service)

SMDS is a high-speed data transmission service developed by the regional Bell operating companies as an alternative to private network data transmission. SMDS, initially operating at the DS-1 (1.544 Mbps) and DS-3 (45 Mbps) transmission rates, is capable of picking up LAN traffic at 100 Mbps from networks using the Fiber Distributed Data Interface protocol. On the network side of a customer premises interface, data is transported using the IEEE 802.6 standard.

SONET (Synchronous Optical Network)

An international telephone industry digital transmission standard featuring a basic signaling rate of about 150 megabits per second and higher, using building blocks of about 50 Mbps.

The standard was set by the CCITT (Consultative Committee for International Telegraph and Telephone) as a way of harmonizing international public telephone networks and tie them together as one functional network. SONET defines a transmission hierarchy ranging from OC-1 (optical carrier one) through OC-48. Among the standard rates are:

OC-1 = 51.84 Mbps = 28 T-1s
OC-3 = 155.52 Mbps = 84 T-1s
OC-9 = 466.56 Mbps = 252 T-1s
OC-12 = 622.08 Mbps = 336 T-1s
OC-18 = 933.12 Mbps = 504 T-1s
OC-24 = 1244.16 Mbps = 672 T-1s
OC-36 = 1866.24 Mbps = 1008 T-1s
OC-48 = 2488.32 Mbps = 1344 T-1s

The OC-1 (51.84 Mbps) signal is known as an STS-1 (SONET Transportation Signal Level n),consisting of two parts, the synchronous payload envelope and associated overhead.

The SONET frame is a 90-column by 9-row matrix with each matrix cell containing an 8-bit byte of information. The frame is repeated every 125 microseconds and is synchronized to a central clock.

The first three columns contain control information, with about 49 Mbps reserved for the actual message (payload).

SS 7 (Common channel signaling system 7)

Common channel signaling system 7, typically referred to as SS7, is an advanced network control system now being put into place by long-distance and local exchange carriers. It makes possible advanced call routing services.

Tandem office

A central office facility directly connecting two or more serving central offices (COs whose cabling networks connect directly to customers). A tandem office switches traffic on the network, but does not directly forward traffice to residential or business customers.

Wire center

In essence, a smaller version of a central office, containing one or more switches and terminating access lines to customer sites. Also known as a serving wire center.

X.25

An international standard for packet switched data on public telephone networks. The X.25 standard is set by the Consultative Committee on International Telegraph and Telephone and is based on the first three layers of the Open Systems Interconnect model.

The OSI model breaks all operations required to establish and maintain a data communications link into seven separate modules, each operating independently of the other layers.

The concept allows for upgrading or changes to software in any one of the seven layers without disturbing the operation of the other layers, and is intended to establish a universal method by which programs and machines from many different companies can communicate with each other.

X.25 traffic can be transmitted at speeds from 2400 kbps to 9600 kbps using standard dial-up telephone lines. Transmission at 1.544 Mbps is possible when using dedicated circuits. The standard X.25 packet is 128 bytes long. CED

RETURN PATH

Proof of performance testing

This month we'd like your thoughts about your efforts in January to comply with the new FCC proof-of-performance tests. This round of tests is the first step toward compliance with a wide range of signal quality issues mandated by the FCC last year. This round of tests will be repeated during the summer months and will then be required twice each year.

To respond to the survey, simply make a copy of this page, fill out the questionnaire and return the survey to our offices (via fax to 303-393-6654 or mail to 600 South Cherry Street, Suite 400, Denver, CO 80222). We'll tally the information and print the overall results in a future issue.

So, if you've ever wanted to add your input to the industry's conventional wisdom surrounding these issues, now is the time to do it.

Please answer the following questions as honestly as you can. Remember, no names will ever be used.

	Yes	No	Don't know
1. Has your system completed the FCC mandated proof-of-performance test for January?			
2. Do you feel you were given enough time by the FCC to organize your testing procedures?			
3. Do you feel your supervisors kept you adequately informed about the testing deadline?			
4. Did you personally closely monitor the FCC's actions related to the proof tests?			
5. In general, do you believe you had the proper resources (test equipment and manpower) to adequately perform the tests?			
6. Do you think your system personnel had adequate training on how to perform the tests?			
7. Did your system purchase new test equipment specifically to perform the mandated tests?			
8. If so, was it delivered from the manufacturer in time to perform the testing procedures?			
9. Does your local franchisor have a staff engineer or technical representative with whom you must work?			
10. Do you have a good relationship with your local franchise authority's technical representative?			
11. Have you ever been visited by an FCC inspector?			
12. Do you personally believe there was a need for new cable system technical standards?			
13. How do you think your system performed last month?			
Excellently			
Very well			
Adequately			
Marginally			
Needs a lot of work			

Please provide the following information:

Your title ______________________________

Your job function ______________________________

The size of your system (# of subs) ______________________________

The length of your CATV career (years) ______________________________

The state in which you work ______________________________

Your MSO (optional) ______________________________

RETURN PATH

Customer service: Under control?

In spite of widely reported public dissatisfaction with the customer service offered by cable operators, cable employees give their own efforts to provide good service generally high marks, according to the Return Path survey taken last December.

The vast majority of the cable systems represented in the survey typically don't answer the phone later than about 6 p.m. (a couple answer the phone until 11 p.m.). About one-half of those surveyed said their business offices are not open on Saturdays and less than 10 percent said they were open on Sundays to help subscribers. Furthermore, only one-quarter of those answering said they have ARUs or answering machines in operation during off-hours. How do subscribers get in touch with the cable company if they have problems over the weekend or during prime-time hours?

During normal business hours, when humans are answering the phone, CSR staffing levels vary widely. The fewest number represented in the survey was six, and the high was 17. When broken out on a per-subscriber basis, again the answers varied widely from one CSR per 1,100 subs to one per 7,300 subs.

To give credit where it's due, 82 percent of those sending responses back said their systems have a policy to complete all service calls within 24 hours of the time they're logged. Also, every system represented here said they offer subscribers a choice of what time they'd like to have service performed. Finally, nearly three-fourths said they routinely schedule service calls later than 5 p.m.

The survey showed an even split between systems that offered employee incentives to provide good customer service and those that did not. However, 82 percent said their systems are providing ongoing effective customer service training to the employees.

When survey respondents were asked to grade how their system's management felt about customer service, nearly half gave perfect marks (10 points out of a possible 10) and the average was just over 9.

(Answers shown in percentages.)

	Yes	No	Don't know
1. How many subscribers does your system serve? **(Low = 6,500; high = 118,000)**			
2. How many customer service representatives does your system have on duty during its peak time? **(Low = 6, high = 17)**			
3. Does your system have live CSRs answering telephones later than 5 p.m.?	91	9	0
4. If so, how late is the phone answered?			
5. Is your business office open on Saturdays?	55	45	0
6. Is your business office open on Sundays?	9	91	0
7. Do your CSRs have authority to adjust customers' bills when they are disputed?	100	0	0
8. Does your system use an automated response unit during normal business hours?	0	100	0
9. Does your system use an automated response unit overnight and during weekends?	27	73	0
10. Does your system have a policy to complete all service calls within 24 hours?	82	18	0
11. Does your system offer subscribers a choice of when they'd like to have service performed?	100	0	0
12. Does your system perform routine service calls after 5 p.m.?	73	27	0
13. Does your system offer its employees incentives for providing good customer service?	45	45	-
14. Does your system offer effective customer service training on an ongoing basis?	82	18	0
15. On a scale of 1 to 10, with 10 being highest, where do you think customer service ranks as a priority to your system's management? **(Average = 9)**			

SCTE®

Following is a list of SCTE technical seminars with contact name. If available, location and seminar topic are also listed.

March 4 *Heart of America Chapter* BCT/E exams to be administered in all categories at the technician level. To be held in Kansas City, Mo. Call Don Gall, (816) 358-5360.

March 6 *Tip-o-Tex Chapter* "Basic Electronic Theory and System Powering" With Raul Cano of TCI, and "Amplifier Sweep, Test Equipment and Procedures," with Juan Solis of TCI. To be held at TCI Cablevision, McAllen, Texas. Call Joe Lopez, (512) 425-7880.

March 9-11 *Technology for Technicians Seminar* Hands-on technical training program for broadband industry technicians and system engineers. To be held at the Hyatt Regency, Minneapolis, Minn. Call SCTE National Headquarters, (215) 363-6888.

March 9 *Desert Chapter* Installer and BCT/E exams to be administered in all categories at both levels. Call Greg Williams, (619) 340-1312, ext. 277.

March 9 *Magnolia Chapter* "Equipment Repair" with Steve Whitaker of Sawtre and "Satellite Retrofits and Troubleshooting" with Brian Wilkes of Rainbow Satellite. To be held at the Ramada Coliseum, Jackson, Miss. Call Steve Christopher, (601) 824-6010.

March 9 *Wheat State Chapter* Call Lisa Hewitt, (316) 262-4270, ext. 191.

March 10 *Bluegrass Chapter* "Hands-on Installer and Technician Troubleshooting" with Billy Grubbs of Telecable and Jack Wheeler of Simmons Cable. To be held at Howard Johnson's, Elizabethtown, Ky. BCT/E exams to be administered in all categories at both levels. Call Alan Reed, (502) 389-1818.

March 10 *Heart of America Chapter* To be held in Kansas City, Mo. Call Don Gall, (816) 358-5360.

March 11 *Satellite Tele-Seminar Program* Galaxy I, Transponder 14. Programming TBA. Call SCTE National Headquarters, (215) 363-6888.

March 11 *Badger State Chapter* "FCC Rules and Measurements." To be held at the Holiday Inn in Fon du Lac, Wisc. Call Gary Wesa, (414) 496-2040.

March 11 *Gateway Chapter* Call Chris Kramer, (314) 949-9223.

March 11 *Penn-Ohio Chapter* Installer and BCT/E exams to be administered in all categories at both levels. To be held in Warrendale, Pa. Call Marianne McClain, (412) 531-5710.

March 11, 15-16 Wheat State Chapter BCT/E exams to be administered in all categories at both levels. To be held in Wichita, Kan. Call Lisa Hewitt, (316) 262-4270.

March 13 *Palmetto Chapter* Installer and BCT/E exams to be administered in all categories at both levels. To be held in Columbia, S.C. Call John Frierson, (803) 777-5846.

April 8 *Satellite Tele-Seminar Program* Galaxy I, Transponder 14. "Customer Service and Safety Issues, Part II," from Cable Tec Expo '92. Call SCTE National Headquarters, (215) 363-6888.

SIECOR

Siecor Corp. will again be holding its popular "Fiber Optic Installation, Splicing, Maintenance and Restoration for Cable TV Applications" course throughout 1993. The four-day course is designed to prepare cable television personnel for all aspects of fiber optic cable installation and maintenance, including cable placement, fusion and mechanical splicing, cable termination (pigtail splicing) and acceptance testing.

The course is recognized by the SCTE as a preparation source for the fiber optics portion of the BCT/E Category III exam. Class size is limited to eight, and is priced at $1,385. Following are this month's dates and locations:

March 2-5 Hickory, N.C.

March 9-12 Cincinnati, Ohio

March 16-19 Hickory, N.C.

March 23-26 Hickory, N.C.

March 23-26 Keller, Texas

March 23-26 San Francisco, Calif.

For more information, call Siecor officials at (704) 327-5000.

Bellcore
Bell Communications Research

Bellcore has announced a comprehensive lineup of **telecommunications training videos** on subjects including ISDN, fiber optics, loop electronics, T-carrier fundamentals, SONET, multimedia, SS7, SMDS high speed wide area services, digital techniques and telecommunications networks—among others. Prices for the videotapes vary. For more information or a catalog, call Bellcore at (800) 527-1080 or fax inquiries to (201) 740-6882.

Scientific-Atlanta has lengthened its distribution course to two days and its fiber and headend courses to two and one-half days, with more hands on training, officials say. The upcoming schedule is as follows:

March 22-23 *Distribution*, San Antonio, Texas

March 24-26 *Headend and Earth Station*, San Antonio, Texas

April 12-13 *Design Considerations and System Sweep and Balance*, Atlanta, Ga.

April 15-16 *8600 System Operation*, Atlanta, Ga.

For more information, call Bridget Lanham at (800) 722-2009 or at (404) 903-5516.

Philips Broadband Networks has announced its '93 schedule for training courses in its mobile training center, scheduled to hit 18 U.S. cities this year. In the classes, instruction is combined with extensive hands-on training to help attendees learn about basic concepts as well as advanced theories and methods. Course content consists of RF and video distortions, headend basics, amplifier applications and operation, and record keeping/maintenance. The agenda also includes courses on interdiction methods and PCN applications, system architectures, fiber optics and digital compression.

The upcoming schedule is as follows:

March 16-18 *Mobile, Ala.*

March 23-25 *Kansas City, Mo.*

March 30-April 1 *Dallas, Texas*

April 6-8 *Albequerque, N.M.*

April 13-15 *Phoenix, Ariz.*

April 27-29 *Los Angeles, Calif.*

A $350 tuition fee covers presentations, hands-on training, manual and lunches. To register, call (800) 448-5171 or, in N.Y., call (800) 522-7464.

The **George Washington University** has announced its continuing education engineering courses for 1993. The upcoming classes are as follows:

March 23-25 *Introduction to Communication Systems for Non-engineers*, Washington, D.C.

March 15-17 *Local Area Network Technology*, Washington, D.C.

March 29-April 1 *Communication Satellite Systems: The Earth Station*, Washington, D.C.

For more information, call George Washington University at (800) 424-9773 or at (202) 994-6106.

Conferences & trade shows

March 30-31 *Advanced Intelligent Network ComForum* To be held in Denver, Colo. Call the National Engineering Consortium (312) 938-3500 for more information.

April 1 *Signalling System 7 TecForum* To be held in Denver, Colo. Call the National Engineering Consortium at (312_ 938-3500 for more information.

April 5-7 *Cable and Satellite Europe '93* To be held in Olympia, London. Call Reed Exhibitions, 011-44-21-705-607

April 21-24 *SCTE Cable Tec Expo* To be held in Orlando, Fla. Call National Headquarters at (215) 363-6888.

May 9-12 *Canadian Cable Show* To be held in Toronto, Ontario. Call Christiane Thompson, (613) 232-2631.

June 1-9 *CATV Seoul '93* To be held in Seoul, Korea. Call CATV Seoul Management at 011-82-2-551-1141.

June 6-9 *The National Show* To be held in San Francisco, Calif. Call the NCTA's Roanne Robinson at (202) 775-3669.

Have an upcoming technical education program? Send all relevant information to **CED** Magazine, 600 S. Cherry St., Suite 400, Denver, CO 80222.

The CABLE POLL

Midwest CATV • CED • Cablevision

Cable ops go after access rings

Editor's note: The Cable Poll is conducted for Midwest CATV, CableVision, CED *and* Multichannel News *magazines by Ryan-McGinn-Samples Research, Inc. Telephone interviews were conducted between January 4-6, 1993 with a random sample of 205 system management personnel obtained from the CableFile Research database.*

Sometimes big things do come in little packages—like the news that 18 percent of the general managers surveyed in the most recent edition of the Cable Poll say they're offering alternate access telephone service to local businesses.

Sure, 75 percent said they weren't offering telephone service. But considering the access business speculatively represents several billion dollars in revenue, 18 percent is fairly meaty.

Most of those (46 percent) that *aren't* currently tapping the access business cite a lack of marketplace demand. Others (12 percent) blame prohibitive entry expense or lack of expertise in the area (9 percent).

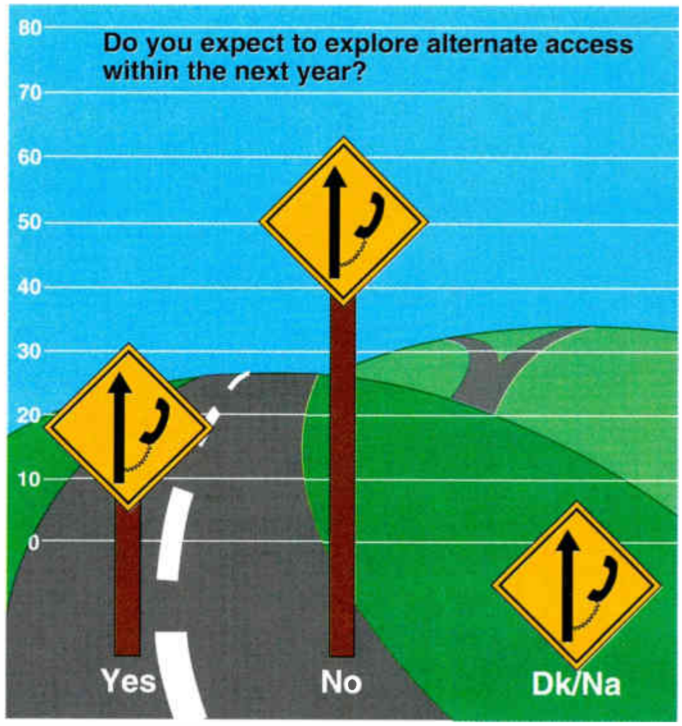
Nearly a third, however (31 percent) say they plan to explore alternate access opportunities sometime this year. Half that amount, at 15 percent, have already contact the local telephone company to explore jointly offering enhanced telecommunications services.

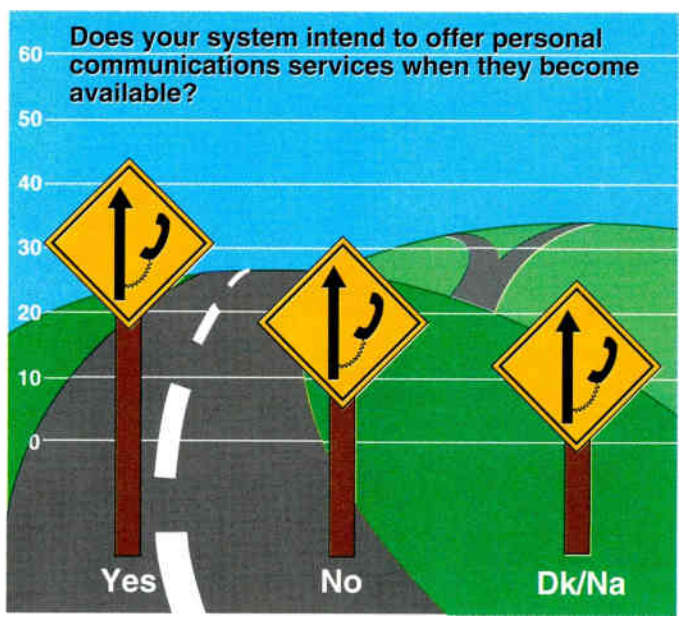
And opinions seem to be rising on the subject of personal communication services/networks (PCS/PCN). Where last year, conversations about PCS-type services wrangled more questions than answers, this year almost half of the GM's polled (44 percent) say they intend to offer personal communication services when they become available. Almost a third (31 percent) say they will not, and a quarter aren't yet sure whether they'll offer tetherless telecommunication services.

Responses were spread regarding ongoing PCS experimentation. Almost a third, at 27 percent, submit they have not monitored nationwide experiments at all. Another 23 percent say they've been following the tests "very closely," while 22 percent submit to monitoring PCS/PCN tests "somewhat closely."

The main reason GMs aren't monitoring the PCS/PCN results? Lack of local interest, according to 31 percent of the managers. Another 26 percent say they're not equipped to do PCS/PCN, even if it were available, six percent say it's too expensive, and 22 percent have concerns that fell outside the parameters of the Poll. CED

By Leslie Ellis



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PERSONNEL: Bobby J. Payne, Chairman; Scott A. Stevens, President
DESCRIPTION: Full-service telecommunications contractor, including as-builts, upgrades, rebuild and new build construction (coax/fiber/telephone–aerial and underground); fusion splicing and testing; subscriber installations; existing cable (system) engineering evaluations; FCC compliance testing; complete sweep/repair services; on-line project management.

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BT&D Technologies.............(215) 444-6819
WATS ....(800) 545-4306
FAX.......................................(215) 444-6868
500 N. Walnut Road
Kennett Sq., PA 19348
PERSONNEL: Ken Miller, Sales Engineer; Ray Taylor, Business Manager, UK
DESCRIPTION: BT&D's new 1x6 broadband monolithic coupler offers a small footprint, low cost, second sourcing. Enhanced singlemode multiport coupler arrays for multichannel splitting and combining, single window 1x2/2x2 fused couplers, broadband 1x2/2x2 fused couplers, feature a wider industry standard temperature range and excellent temperature stability.

Dist./Suppliers/Reps

FIBERTRON CORP.................(714) 871-3344
FAX.......................................(714) 871-5616
1405 E. Orangethorpe Ave.
Fullerton, CA 92631
PERSONNEL: Marlene Spiegel, President; Henry Cohen, Vice President; Marc Spiegel, Vice President Sales/Mktg.
REGIONAL OFFICES: East Hanover, NJ (201) 515-9200, Fax (201) 515-9269
Norcross, GA (404) 409-1700, Fax (404) 409-1702
DESCRIPTION: A full service stocking distributor of fiber optic cable, cable assemblies, connectors, couplers, closures, distribution equipment, innerduct, modems, multiplexers, splices, test equipment, tools, tool kits, outlets, and supplies. Value-added services include: standard and custom cable assemblies, applications assistance, and customer training.

Moore Diversified Products, Inc.
In Kentucky.........................(606) 299-6288
Outside Kentucky...............(800) 769-1441
FAX.......................................(606) 299-6653
1441 Sunshine Lane
Lexington, KY 40505
PERSONNEL: Jim Phelps, President; Liz Robinson, Sales Service Manager
DESCRIPTION: Moore Diversified Products, Inc., a precision metal manufacturer of CATV security enclosures for over 8 years, introduces a series of products designed for fiber optic installation. The product line includes underground vaults, aerial fiber storage racks, overlash rollers, and electronic cabinets. New in 1993 is a complete line of fiber distribution systems, fiber termination and splicing hardware, premise distribution systems, and racks and cabinets.

Drop/Pole Line Hardware

Sachs Comm. Inc. ....(404) 382-4114
WATS ....(800) 829-7224
FAX.......................................(404) 386-5482
Canada ....(514) 636-6560
WATS ....(800) 267-2247
FAX.......................................(514) 636-0794
211 Stonewall St.
Cartersville, GA 30120
PERSONNEL: Etta Nix, Inside Sls. Mgr., Telco; Sam Zilber, Inside Sls. Mgr., CATV; Jim Emerson, Mktg. Dir.; Jack Sachs, Pres.
DESCRIPTION: Manufacturer of innovative, high quality hardware products for the construction and installation of telephone, cable TV and other telecommunications plant. Products include suspension, attachment, specialty tools, plus approved grounding hardware for pole line, drop line, multiple dwelling and underground applications. All products meet the highest specifications; ASTM and CSA for hot-dip and mechanical galvanic plating, UL and CSA for grounding and bonding. Value-added services include material management, single-point sourcing, custom product design and installation training.

Enclosures

Cable Security ....(205) 742-0050
WATS (National) ....(800) 288-1506
FAX.......................................(205) 742-0058
801 Fox Trail
PO Box 2796
Opelika, AL 36803-2796
PERSONNEL: Mike W. Springer, Vice President of Sales; John Demos, National/International Accounts
REGIONAL SALES OFFICES: Northeast: Richard Simile (302) 832-1190; Midwest: Don Imbody (513) 878-9300; Southeast: Ernie Cope (800) 288-1506; West Coast: Matt Arnoldus (805) 379-0034
DESCRIPTION: The industry's number one manufacturer of high security, low maintenance apartment boxes and custom CATV enclosures. Our Beast™ lines of boxes will eliminate theft of service and the additional expenses that illegal hookups create. Theft of service through cheap apartment boxes is a multi-million dollar problem. Don't sell your system short–invest in the best–The Beast™.

Champion Products Inc......(417) 736-2135
FAX.......................................(417) 736-2662
Rte. 1, Box 422
Strafford, MO 65757
PERSONNEL: Carl Tiedt, Vice President, Operations; Roger Jones, Fiber Optic Sales
DESCRIPTION: Manufactures a complete line of fiber distribution enclosures, headend racks and patch panels. We will also custom design products to your specific requirements. Our features include rugged heavy gauge mill galvanized steel with proprietary paint finish and stainless steel hardware. We offer excellent quality and design at the lowest price.

Reliance Comm/Tec
Reliable Electric Co. Div. ....(708) 455-8010
FAX.......................................(708) 451-5516
11333 Addison St.
Franklin Park, IL 60131

PERSONNEL: Tom Coyne, Product Manager, CATV Products; Paul Zoba, Product Manager, Fiber Optics
DESCRIPTION: Reliance Comm/Tec, a manufacturer of CATV products for three decades, offers the industry's widest range of high quality, high performance outdoor enclosures for CATV/fiber optic equipment such as nodes, lasers, repeaters, amplifiers, and other electronic equipment requiring protection. Enclosures are available in both plastic and metal versions. Additionally, the Access 360 degree pedestals permit complete access to internal components.

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Aeroquip Corp. ....(703) 629-5318
WATS ....(800) 445-2192
FAX ....(703) 629-1264
Rivermont Road
Bassett, VA 24055
PERSONNEL: Robert Comstock, National Sales Manager; Starlett Hedrick, Inside Sales Manager
DESCRIPTION: Aeroquip manufactures and markets a full line of products for maximizing fiber cable systems and installation including FoDuct multichamber innerduct. FoDuct maximizes duct optimization by dividing four inch conduit into 4, 5 or 6 chambers, three inch conduit into 2 or 4 chambers and two inch conduit into 2 separate chambers, as well as co-occupancy with existing cable. Aeroquip also has a full line of cable and duct installation products and equipment as well as Underground Products conduit spacer systems.

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FAX ....(916) 636-5750
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PERSONNEL: Bob Crowley, Vice President, Marketing; Eric Jungemann, Sr. Vice President and General Manager
DESCRIPTION: CableData offers integrated subscriber and telephony management systems and billing services which provide savings through operational efficiencies and avenues for improved customer satisfaction. CableData's state-of-the-art statement production and mailing facility provides high speed statement turnaround for the cable and telecommunications industries and is the largest centralized First-Class mailer in the United States.

EDS

EDS ....(908) 781-4985
FAX ....(908) 719-4556
500 Route 202/206 North
Bedminster, NJ 07921
PERSONNEL: Ted Ehling, Vice President Sales
DESCRIPTION: Combining industry expertise and technological know-how has made EDS the premier information technology services provider to the communications industry. In addition to cable TV providers, EDS serves long distance, local exchange and wireless carriers around the world. For over 30 years we've been providing the tools these companies need to take advantage of change. Our focus is on providing a full range of systems and services including billing platforms, operational and customer support technologies, financial services, telemarketing, training services, consulting, systems development, systems integration and systems management.

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ONI ....(303) 694-9220
WATS ....(800) 342-3763
FAX ....(303) 740-9420
8101 E. Prentice Ave., Suite 210
Englewood, CO 80111
PERSONNEL: Mike Sparkman, Vice President Sales; Jack Bryant, Vice President Marketing
REGIONAL OFFICES: 4905 E. Hunter Ave., Anaheim, CA 92807, (714) 779-0550, FAX (714) 777-1527; 2100-A Nancy Hanks Dr., Norcross, GA 30071, (404) 840-0121, FAX (404) 840-7902; 888 Thomas Dr., Bensenville, IL 60106, (708) 350-7788, FAX (708) 350-7840; 321 Richard Mine Rd., Wharton, NJ 07885, (201) 328-0980, FAX (201) 328-1267; 1620 Crosby Road, Suite 115, Carrollton, TX 75006, (214) 446-2288, FAX (214) 242-8421
DESCRIPTION: Optical Networks International is a system integrator of complete fiber optic networks for video, voice, and data. ONI develops innovative products with manufacturing partners worldwide. ONI provides a wide range of services to meet the specific needs of each customer including system design, project management, contract splicing, training courses, and 24 hour technical support and emergency restoration.

Raynet

Raynet Corp. ....(415) 324-6400
Brussels 011-32-16-271700
FAX ....(415) 324-6666
155 Constitution Dr.
Menlo Park, CA 94025
PERSONNEL: Gilles Vrignaud, Director-Video Marketing; Ken Pyle, Manager-Video Marketing; Michael Triboulet, Director, International Video Marketing
DESCRIPTION: The Raynet Video System (RVS) from Raynet Corporation is a fiber bandwidth transport and distribution system for AM, FM, or digital n. QAM signals in FTTC and FTTLA applications. RVS is designed to offer state-of-the-art performance for compressed digital video channels or up to 80 AM video channels and is compatible with all conditional access systems and all transmission standards such as NTSC, PAL, SECAM, D2MAC and HDTV.

Optoelectronics

AMOCO
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Amoco Laser Company ....(708) 961-8400
FAX ....(708) 369-4299
1251 Frontenac Road
Naperville, IL 60563
PERSONNEL: Juan Cerda, Mark Demos
DESCRIPTION: Amoco Laser Company, the leading producer of diode-pumped, solid-state laser products for fiber optic communications, features microlasers targeted for use in externally modulated applications, providing large optical power budgets for use in headends or distribution links. Standard 1.3µm and 1.5 µm products feature output powers up to 175 mW. Amoco's rack -mount 1.5-micron optical fiber amplifier combines saturated output to 24 dBm and gain to 50 dB for repeaterless transmission across 400 kilometers.

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Forty years ago, we felt the hot breath of the telcos on our necks as they sought to lay claim to television as their divine right. Today, the heat is on both cable TV and telco as telecommunications moves inexorably toward competitive enterprise.

ComNet '93

The recent ComNet Conference and Exposition at the Washington Convention Center (February 1-4) attracted thousands of computer and networking personnel. These people are, rather tentatively, attempting to court cable TV, about which they understand even less than do the telcos. A key feature of the Conference was billed as a "Town Meeting: Telco Entry Into Cable, Information Services and Manufacturing."

The moderator and conference chairman was Richard E. Wiley, chairman the Advanced TV Advisory Committee to FCC, and a former FCC chairman. Panelists included representatives of an RBOC, MCI and GTE, along with FCC Commissioner Ervin S. Duggan, the Chairman of the Public Utility Commission, and the President and CEO of the Newspaper Association of America. Not surprisingly, there was general agreement on the panel with the idea that entry into cable would be in the public interest.

However, GTE wanted a more "level playing field" on which all players observed the same rules.

Since there were no cable executives on the panel, it took a voice from the floor to point out that the field was already tilted by exempting telcos from the obligations of a franchise. Commissioner Duggan said that had been a close call at the FCC, and may well be reversed in the courts.

At a splendid over-the-air demonstration of the improved Zenith/ATT digital spectrum compatible HDTV system, an ATT representative was touting the high contrast of a large screen CRT projection display. The room was darkened, and indeed the contrast was good, so long as the viewer was seated, not standing. What would it be like in the daytime? Well, you shouldn't be watching TV in the daytime. Do you ever watch football? Never. Does anyone in your family ever watch soaps? Never. What can I say?

Telco people have a lot to learn

Many telco people seem to believe that what can be done technologically will automatically be saleable, especially if it seems to be "neat" and "high tech." Frequently, they overlook the critical matter of "who will pay, and how much." Services still seem to be priced on the basis of cost plus an assured profit. They still fail to distinguish between "subscribers" and "homes passed."

> Today, the heat is on both cable TV and telco as telecommunications moves inexorably toward competitive enterprise.

There is no way telco can compete with cable TV without being exposed to competition for its historic dominance of plain old telephone service, known as POTS. There is no rational way to allocate between regulated and competitive services the investment in the expensive integrated switched fiber optics plant. Look at the conflict of interest: If most of the cost were allocated to video services (perhaps according to bandwidth requirements) it would be hard to compete profitably; but reducing the video share to permit competitive pricing would shunt the burden onto the rate payers (known as cross-subsidy). So, after fighting this battle at FCC, and in state PUCs, the courts and Congress, the matter will ultimately be turned over to the competitive marketplace.

Cable people have a lot to learn

Is cable ready for this? The Time Warner announcement is certainly in the right direction. TCI, Continental, Cox, Comcast, Adelphia, NewChannels and others are on a more or less similar course. Nevertheless, many cable people also have a lot to learn.

For instance, full duplex communication is not the same as the sub-split two-way capability of the past decade or two. Cable TV thinking has been locked into the multichannel concept: the more the better. Cable needs to figure out how to package and market its service to people who do not want 50 or 1000 or 500 channels, whether it is *a la carte*, or PPV, or video on demand, or some form of video dial tone.

In fact, the present dependence of both cable and broadcasting on discrete channels and time segments is likely to change.

The consumer will have "more choices" (as James Earl Jones puts it), within limits, from among particular movie titles, documentaries, news reports, games, information retrieval, interactive education, weather, sports or even E-mail without waiting for scheduled times and programs.

The deep pockets

While telcos have deeper pockets than cable, they are also saddled with an enormous organizational inertia and an embedded infrastructure that is rapidly becoming obsolete. IBM's deep pockets were not enough to overcome the young innovative activity at Silicon Valley, where the desktop clones have gone way beyond the copying stage.

This is what is so provocative about the Time Warner announcement, coming as it does on top of so many other constructive responses to the issue of telco entry into cable that is fast congealing into a *fait accompli*. CED

By Archer S. Taylor, director and senior engineering consultant, Malarkey-Taylor Associates, Inc.