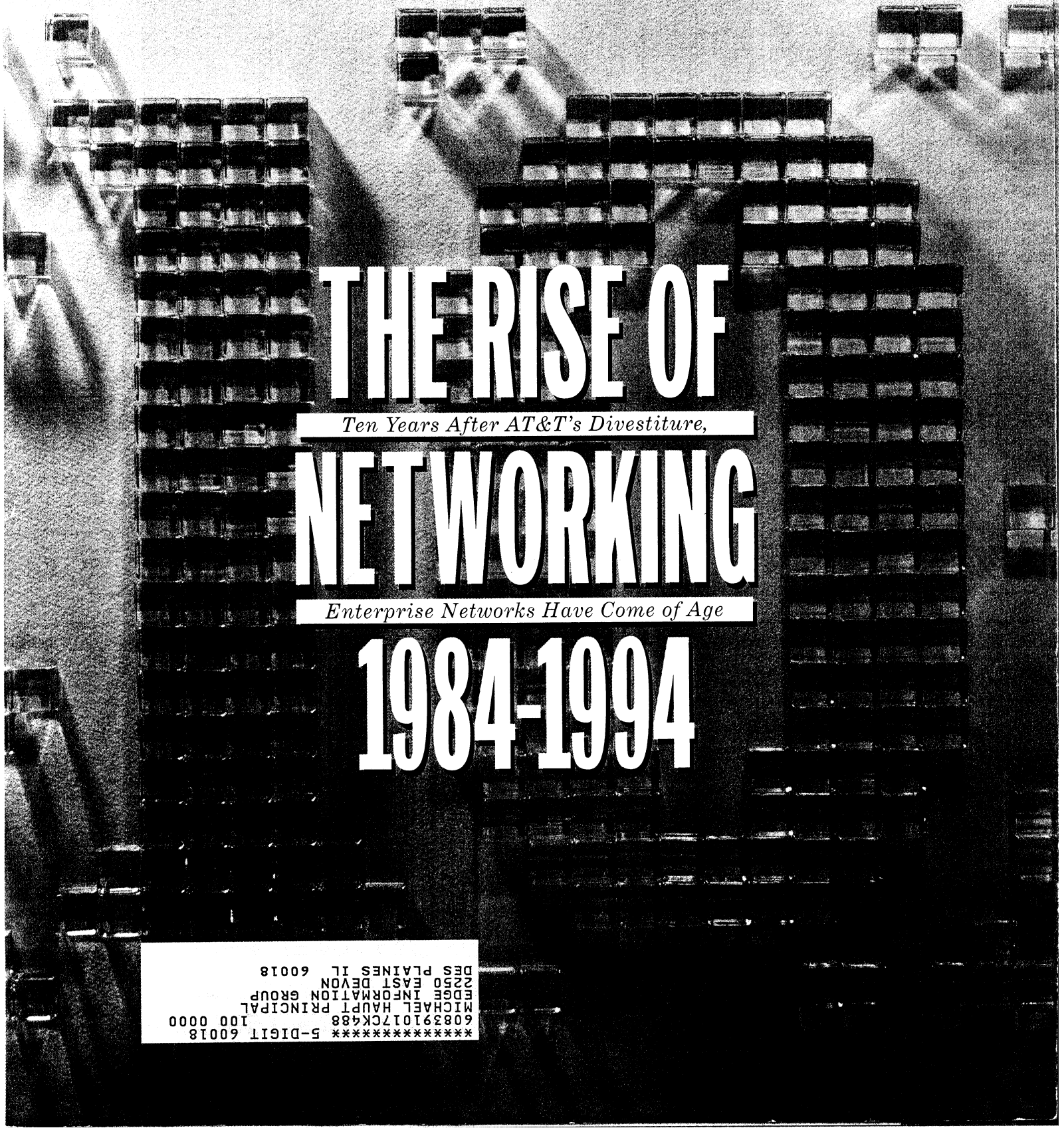
COMMUNICATIONSWEEK

TENTH ANNIVERSARY ISSUE



THE RISE OF NETWORKING

Ten Years After AT&T's Divestiture,

Enterprise Networks Have Come of Age

1984-1994

Photography: KERRY KEHOE

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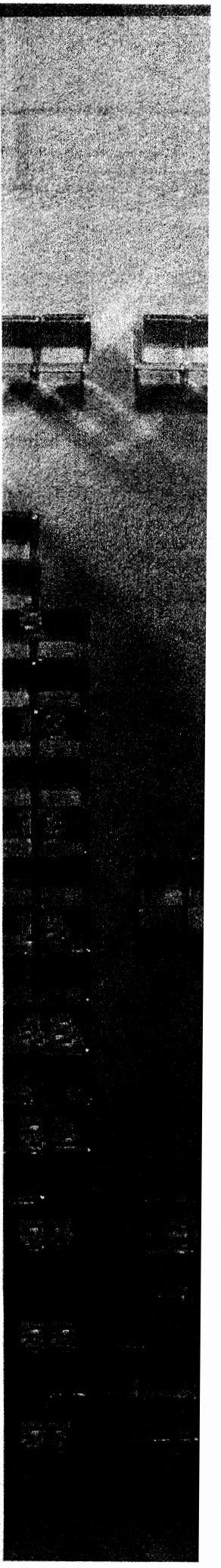


Enterprise networking has come of age. Gone is the struggle for network managers to sell the idea of networking; today's questions are when, how and how much. Organizations need networking to compete in the information age. No network, no win–it's that simple.

Things were different a decade ago. *Communications Week* was created in January 1984 in part to help explain the consequences of dismantling the Bell System. Users were cast on a maiden voyage of controlling their own networking and communications decisions.

AT&T's divestiture unleashed powerful forces of competition, which resulted in a technological revolution. Public network providers have spent $100 billion over the past decade upgrading their networks. This has resulted in new service options for users. And best of all, prices have dropped. Users are the clear winners.

During the same 10 years, we've witnessed the explosion of desktop computers, LANs and internetworks. As futurist Paul Saffo points out in this issue, the PC is being transformed from a stand-alone machine into an access device that gathers information from across an enterprise.

A byproduct of all this change is the shifting role of the network manager. Many organizations are now creating a new position–the chief networking officer–to provide visionary and tactical leadership in managing the network. The CNO is at the forefront in helping organizations re-engineer business processes via the network and applications. This is an exciting time career-wise to participate in this process.

For this 10th anniversary issue of *Communications Week*, we have put together a package to help make sense of the dramatic changes over the past 10 years.

It begins with a look at the major trends and events that have shaped networking since divestiture. That's followed by an article on the rise of the enterprise network as a strategic resource in corporate America. Other features include a series of oral histories, and prognostications from futurists Saffo and Alvin Toffler.

And lest you fear us shortchanging news coverage, you can find your weekly diet of breaking stories and other coverage beyond the special features section.

Big projects like this take lots of time. My thanks are due to the *Communications Week* staff, especially executive editor John Foley who spearheaded the project.

We invite you to sit back and enjoy this celebration. The lessons learned will help you to prepare your networks and applications for the next millennium. It's bound to be a wild ride, but take heart: *Communications Week* will be there to help you keep on top.

David J. Buerger
Editor in Chief

Ten Years of Change

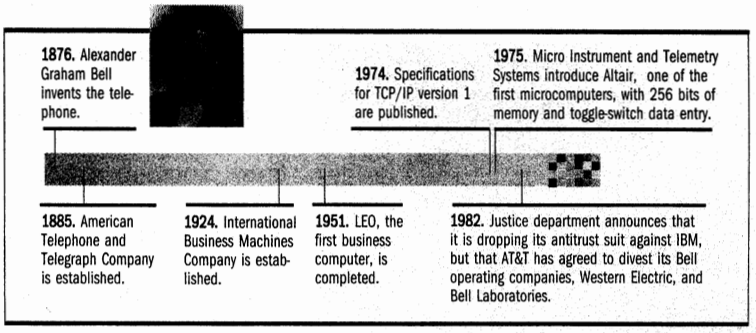
By JOHN T. MULQUEEN

When 1984 began, the Berlin Wall was standing, the Soviet empire was rock solid, Japan's economic sun was rising, IBM ruled the computer industry, and the biggest company in the world, AT&T, had been just been torn apart.

How things have changed in 10 years. The wall is gone. The empire has crumbled. Japan is struggling to revive its technology base. A floundering IBM is being run by a former tobacco salesman and consultant who wears blue shirts.

But a resurgent AT&T is on the verge of recreating a national communications company, built around wireless as well as wired circuits. And its former divisions, the regional Bell holding companies, are romping around the world in cable television, entertainment, and wireless communications, in addition to their basic telephone operations.

It would take a giant leap of the imagination to make divestiture responsible for many of the dramatic changes the world has witnessed over the last 10 years, but the breakup of AT&T had repercussions that are still being felt. It was one of those epochal occurrences that shape events beyond their immediate environments and far into the future.



Divestiture led to an infusion of energy and capital into the communications industry that has helped spread the deployment of advanced technology around the world.

"The pervasiveness of communications technology means that governments can no longer control information, and in the process capitalism has exploded," says Maria Lewis, an analyst at Cowen & Co., a Boston investment brokerage. "The growth in telecommunications—message volume, subscribers added, the number of new carriers—can all be dated to that event [divestiture]."

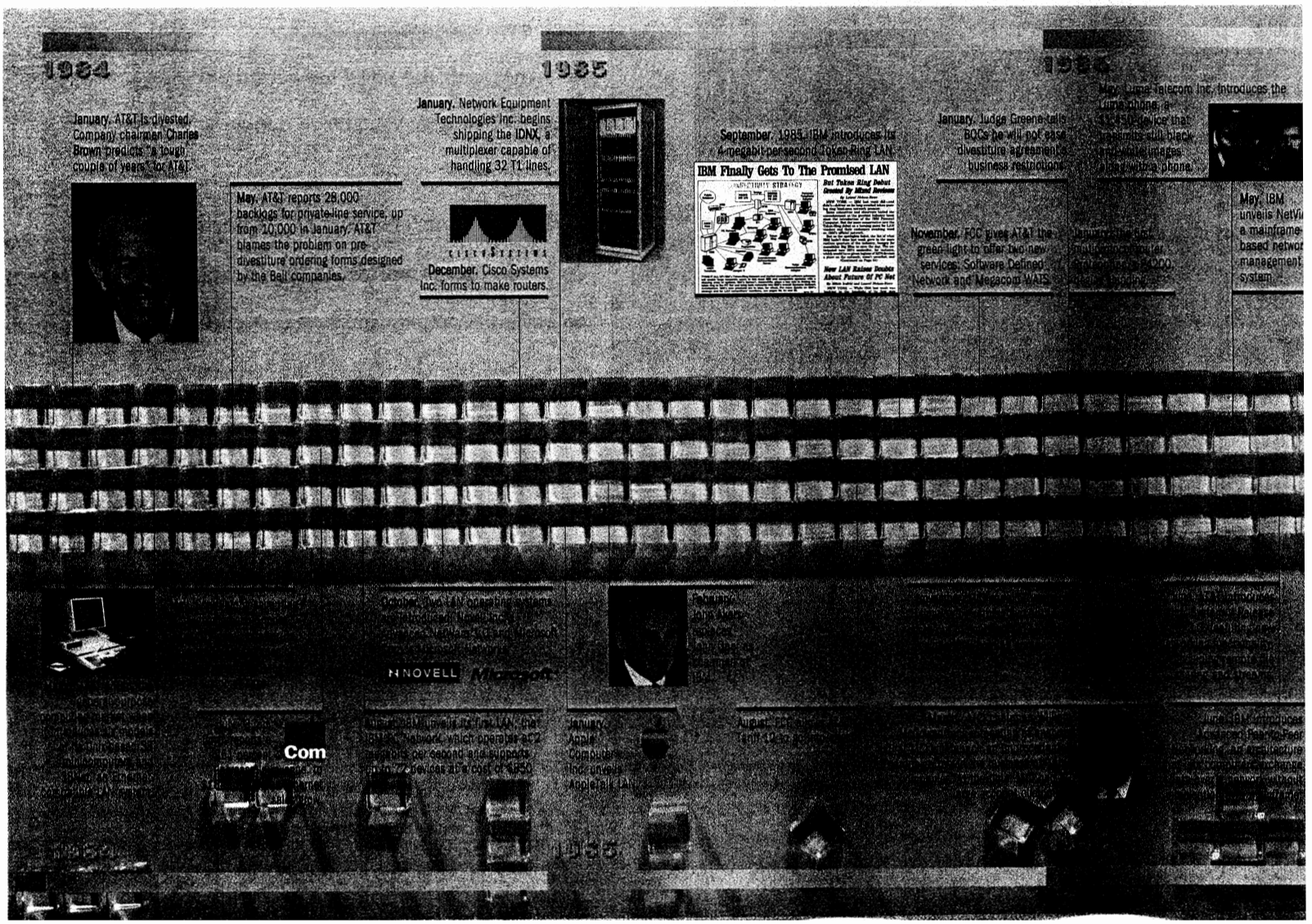
Coincidentally, changes in the computing industry paralleled the transformation of the telecommunications industry. Around 1983, the microcomputer began to emerge as a credible tool, with applications that businesses could use for key operations. By April 1984, Lotus Development Corp.'s Lotus 1-2-3, the first PC software package popular with business, had topped the software bestseller list for 12 months in a row. Microcomputer sales in the United States, a $7.5 billion business in 1983, grew to $22 billion in 1993, according to the Computer and Business Equipment Manufacturers Association, a Washington-based trade group.

But there were miscues. The integration of voice and data, for one, never happened as predicted. The voice-data workstations that many vendors developed—little more than telephones attached to a PC or terminal—flopped early.

PCs to LANs to Internets

But PCs were here to stay, and networking companies were pulled along in the wake generated by PC sales. Early in 1984, 3Com Corp. raised the money it needed to fund its growth with an initial public offering of stock. Its major competitor, Novell Inc., followed suit in 1985.

Today, Novell has built a billion-dollar business selling LAN operating systems, while Santa Clara, Calif.-based 3Com has become one of the leading suppliers of LAN hubs. Some 43 million PCs are installed in business offices in the United



States, and 59 percent of them are connected to LANs, according to Danielle Danese, a securities analyst with Salomon Brothers Inc., New York. Worldwide sales of adapter cards, file servers, network operating systems and application software exceeded $13 billion last year, she estimates.

The need to segment, interconnect and manage LANs spawned the internetworking industry.

Established vendors and start-ups moved quickly to provide bridges and routers—and network managers were eager recipients of such equipment.

Fremont, Calif.-based Vitalink Communications Corp., now a division of Network Systems Corp., spearheaded the market in 1984 when it shifted from producing satellite communications devices to making bridges, says Douglas Whitman, a securities analyst with Montgomery Securities, San Francisco. In December 1984, Cisco Systems Inc. was formed to build routers.

Router Leaders

Today, Menlo Park, Calif.-based Cisco and Wellfleet Communications Inc., Billerica, Mass., are the major suppliers of multiprotocol routers, a market that should exceed $1 billion this year. With their ability to screen traffic, routers have become the instruments of choice for building wide area data networks in the early 1990s.

Over the years, PCs have become commodities, but battle lines have formed around competing desktop operating systems. Unix, which came out of the scientific engineering community, was supposed to be the open system that would displace proprietary operating systems. The Unix community itself, however, was bifurcated in May of 1988, when a number of vendors formed the Open Software Foundation to develop a standard version of Unix that would compete against AT&T's Unix. Just last March, Unix vendors pledged to develop a "unified Unix" built around the Common Open Software Environment. But it will be months, and probably even years, before their vision is realized.

Microsoft Corp., meanwhile, has won mindshare among PC users. For all its limitations, MS-DOS is still the operating system on most PCs, and the company's Windows graphical interface is in the process of taking its place. Microsoft has had a tougher time selling Windows NT, the operating system it introduced in May of last year. IBM's revived OS/2 promises to give Windows NT more of a run for its money than might have been expected from the first implementations of OS/2.

The software architecture for linking and managing networks was supposed to have been the International Organization for Standardization's seven-layer Open System Interconnection model. Users and vendors, however, never fully embraced OSI. "OSI has become the flash in the pan," says John Leong, director of computer services at Carnegie-Mellon University, Pittsburgh. "TCP/IP has come from nowhere to dominate."

The TCP/IP protocol stack had its genesis in the Department of Defense Advanced Research Projects Agency's internetwork, Arpanet. It was publicly available, easy to implement, and actually supported interoperability between networks, devices and applications. In 1987, a fledgling trade show on TCP/IP attracted 675 attendees. That show grew to become INTEROP, which today draws tens of thousands annually to different venues in the United States and abroad.

Move Toward Open Networks

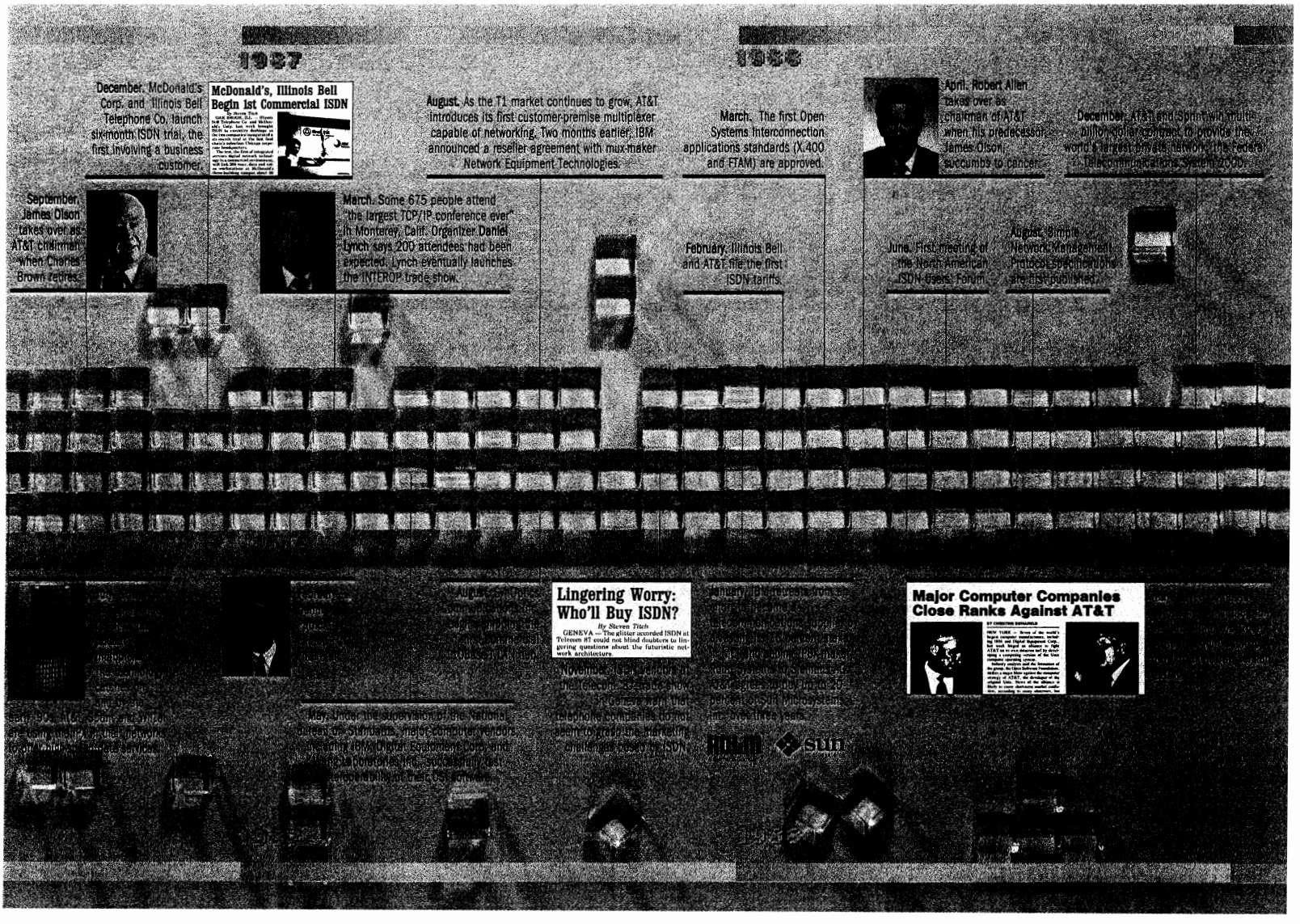
TCP/IP's popularity comes at the expense of IBM's Systems Network Architecture and Digital Equipment Corp.'s DECnet protocols, as users continue to move away from such proprietary schemes toward open networks that can support any vendor's products.

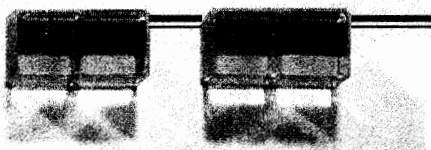
IBM, the largest computer company in the world, has been on the defensive for most of the past 10 years. Big Blue has always seemed a step or two behind the downsizing trend. It unveiled its first LAN in 1984, but its Token-Ring technology couldn't really compete in either performance or price. In contrast, LAN supplier 3Com's revenues were already growing more than 250 percent annually by 1984.

The Showdown That Wasn't

IBM was also supposed to fight AT&T in the converging worlds of computers and communications, but the computer giant never did become a serious player in the telecommunications market. In 1986, IBM sold its interest in Satellite Business Systems, McLean, Va., to MCI Communications Corp. In 1988, IBM divested its 16 percent stake in MCI and announced plans to sell PBX maker Rolm to German conglomerate Siemens AG.

For its part, Big Phone—as Wall Street traders like to call AT&T—could do little right for the three or four years after divestiture. Indeed, it took AT&T years to shake off the bureaucratic legacy of the old Bell System. Steven Levy, an AT&T





account manager in 1984 and now a securities analyst with Hambrecht & Quist Inc., San Francisco, remembers how it could take up to 18 months to get a T1 line installed for a customer. Immediately after divestiture, there was a huge backlog of private-line orders, a situation AT&T blamed on old order forms designed by the Bell companies.

AT&T Hardships

AT&T's problems, though, were not limited to dealings with the Bells. A network-based data processing service called Net 1000 flopped badly and was pulled off the market in 1986 after users, including Ford Motor Co., rejected it. AT&T's PBX unit was a money loser throughout most of the past 10 years.

AT&T's 1-megabit-per-second StarLAN product, introduced in 1984, was too slow and lost out to 10-Mbps Ethernet. Despite the fact that AT&T, in cooperation with SynOptics Communications Co., developed the technology for 10Base-T Ethernet LANs, it has been SynOptics, Cabletron Systems Inc. and others that have cashed in on the hub bonanza.

AT&T's computing operations stumbled through years of red ink before the company spent $7.5 billion in 1991 to acquire NCR Corp., Dayton, Ohio. But real synergies between NCR's computers and AT&T's networking offerings have yet to appear, and AT&T now is cutting NCR's staff by up to 15 percent in an effort to earn something on its investment.

Divestiture had a huge impact on the long distance business. Competitors already had begun eating away at AT&T's market share when, in July 1984, the beginning of equal access opened the floodgates to real competition.

MCI, which had built its business around a nationwide microwave network, started deploying a fiber optic network in 1984. And it paid off: MCI's revenue in 1984 was $1.9 billion; by 1993, it had grown to more than $11 billion.

Sprint was growing so fast in 1984 that, for a period, it had to stop accepting new orders in 35 markets because its network had reached capacity.

In 1985, Williams Inc., a gas pipeline company, entered the long distance business by reselling capacity on fiber it installed in right-of-ways adjacent to unused pipeline. Today, Williams' Tulsa, Okla.-based WilTel unit is the nation's fourth-largest long distance carrier.

To meet the competition, AT&T was forced to rapidly upgrade its network, writing off billions of dollars worth of old equipment and spending billions more on new. In 10 years, the total public network investment among all local and long distance carriers surpassed $100 billion, according to Northern Business Information/Datapro, a New York consultancy.

Built for Speed

Through the years, the emergence of fiber and advances in electronics boosted transmission speeds over the public network: from 45 Mbps to 90 Mbps, then to 540 Mbps, then to 1.2 gigabits per second and now to 2.4 Gbps, according to Salim Bhatia, chairman of BroadBand Technologies Inc., Research Triangle Park, N.C. "The cost of bits has basically gone through the floor," Bhatia says.

And users have benefited. According to the FCC, the annual price index for interstate calls fell every year between 1983 and 1991. AT&T estimates that long distance prices dropped 43 percent in the six years following divestiture.

Under orders from the FCC, AT&T tariffed T1 service in 1983. Originally called High Capacity Terrestrial Digital Service, it was renamed Accunet T 1.5 in April 1984.

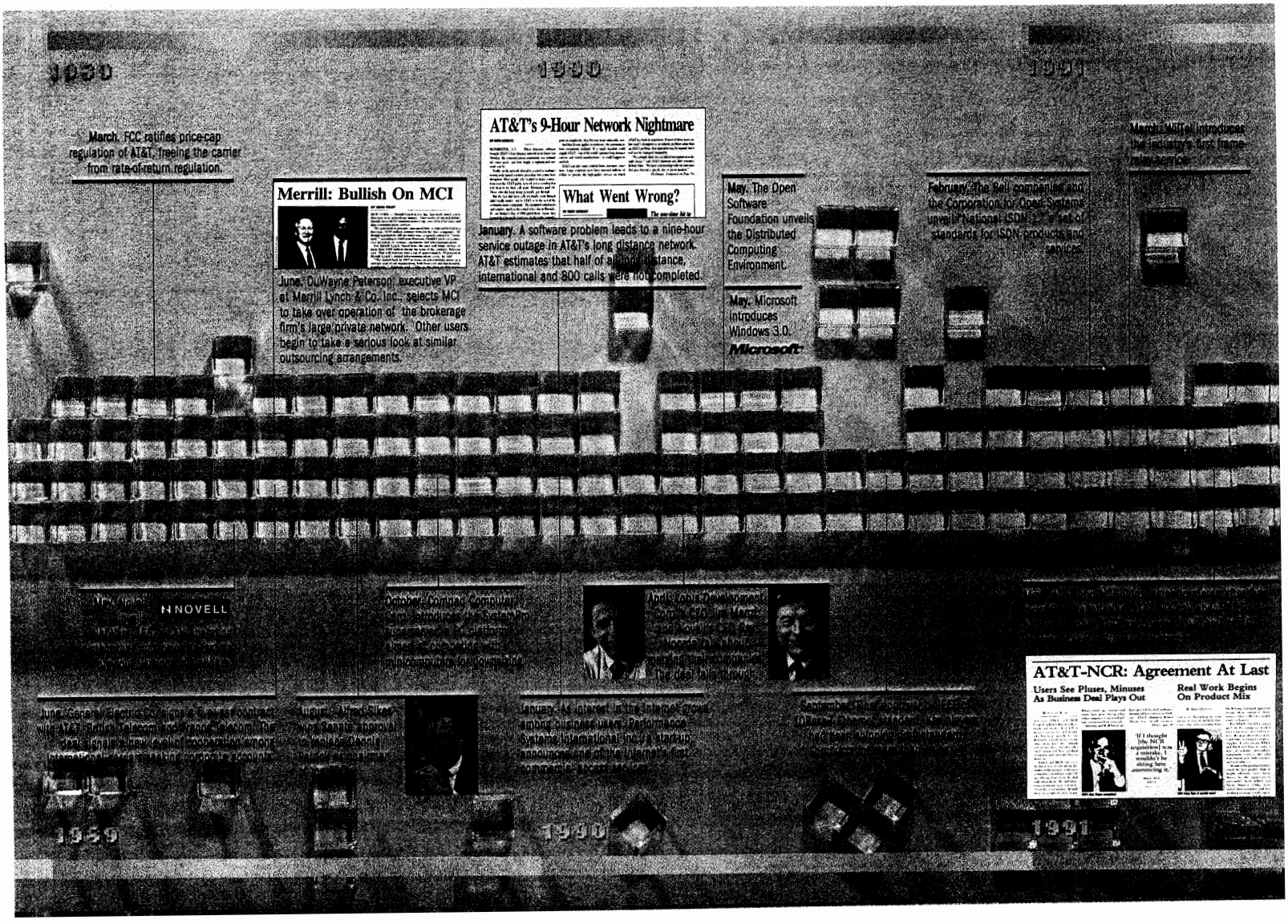
"AT&T priced a 2,500-mile T1 circuit at $86,000 a month. It thought there was no way in the world anyone would buy it because it was more expensive than 24 DS-0s [64-Kbps lines]," says Richard Malone, a principal with Vertical Systems Group, a Dedham, Mass., consultancy. "But Timeplex, NET and other manufacturers developed multiplexers that could carve out bandwidth and allow users to place more devices on a network."

Ascom Timeplex Inc., Woodcliff Lake, N.J., introduced its Link/1 multiplexer in 1983. Network Equipment Technologies Inc., Redwood City, Calif., was formed in 1983 and began shipping its IDNX multiplexer in January 1985. Both companies would flounder later in the decade, when corporate users decided it was too expensive to man private networks and moved voice traffic back onto public networks.

But competition in the long distance market has continued to drive T1 costs down. The 2,500-mile connection that cost $86,000 per month in 1984 can be had for $9,000 per month today, Malone says.

In the late 1980s, competition also intensified between AT&T, MCI and Sprint for large contracts with corporate customers. Network managers were able to shave millions of dollars off their telecommunications bills simply by signing three- or five-year contracts under such programs as AT&T's Tariff No. 12.

"Our long distance cost has dropped from 27 cents a minute to 9 cents a minute



since 1983," said David Evans, vice president and director of MIS at J.C. Penney Co. Inc., Dallas.

Divestiture, however, did not have the same impact on local phone prices, which have risen since 1984. The regional Bells, long insulated from real competition, are only now beginning to feel it. Teleport Communications Group Inc., formed in 1983, and Metropolitan Fiber Systems Inc., formed in 1987, have had success selling services over metropolitan-area fiber networks. More recently, cable TV companies have begun trials with an eye toward carrying telephone calls over their entertainment networks.

Telling It to the Judge

The Bells spent much of the past 10 years trying to convince U.S. District Judge Harold Greene, the overseer of the AT&T divestiture agreement, to let them into the information services, long distance and equipment manufacturing businesses. It wasn't until 1991 that Greene acquiesced and, with "considerable reluctance," let the Bells into information services. They have done little with that privilege, though they still are fighting for the right to carry long distance traffic and make equipment.

While many companies have profited from the boom in data networking since 1984, the Bell companies have not been among them. Their most notable failure has been in trying to sell ISDN. First tariffed in 1987, Basic Rate ISDN services operate at 144 kilobits per second over standard telephone lines—a quantum improvement compared with a 2.4-Kbps modem. But ISDN has floundered because of the Bell companies' continued inability to sustain a unified deployment and marketing effort.

Other flops include central-office-based LANs and X.25 services. It may be too early to judge the potential for success of the Bells' newest data transmission offerings, frame-relay and switched multimegabit data services (SMDS). But it's clear that the Bells will have to do things differently if they want users to take them seriously as data service providers.

The Bells' data services "have been really pretty boring," says Carnegie-Mellon's Leong. "We are still waiting for ISDN. There are a lot of trials of frame-relay and SMDS, but generally, they are not inspiring."

Nevertheless, as data volumes continue to grow, corporations have become highly dependent on the public network—a fact underscored in recent years by some of the worst breakdowns in its 100-year history. In 1988, a major fire in an Illinois Bell Telephone Co. central office in Hinsdale, Ill., left some businesses and residents without service for weeks. And in January 1990, a software problem led to a nine-hour, nationwide service outage in AT&T's network.

The result of these and lesser failures was a shot in the arm for companies like Comdisco Inc., which offers disaster-recovery services for data and voice networks. Prior to the Hinsdale fire, Comdisco had one backup facility. It now has 16, according to John Schledweiler, vice president of information technology and enterprise networking at the Rosemont, Ill.-based company.

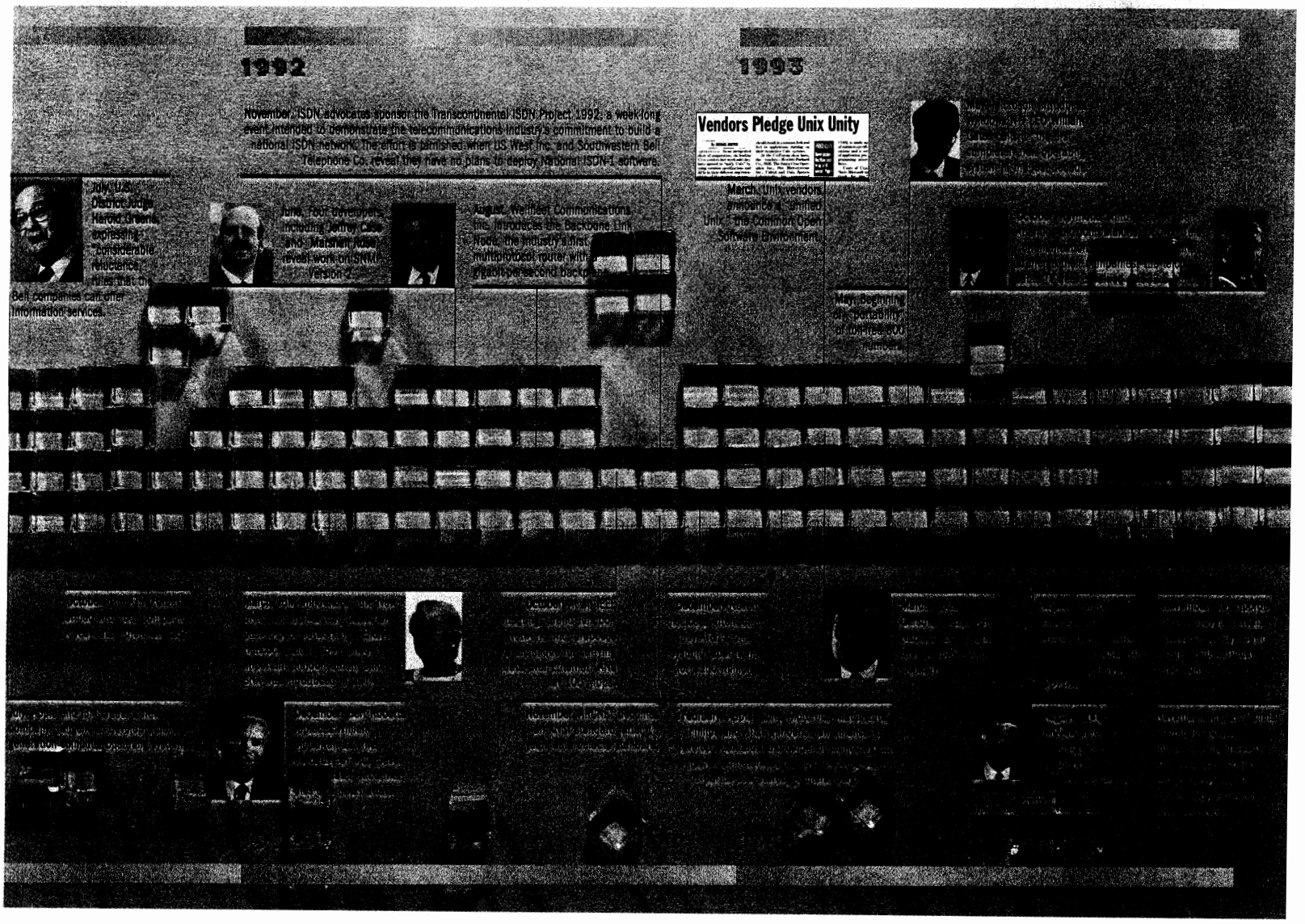
Choice: A Mixed Blessing

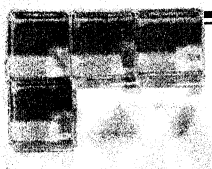
Many corporations have come to rely on their networks to a degree that few could have imagined in 1984. And this is a trend that seems irreversible, as network managers constantly look for new methods to extend connectivity and add bandwidth.

Technology options are multiplying—but it's a mixed blessing. Network managers have to do all they can to keep up with the number of choices and the pace of change. Much attention is focused currently on asynchronous transfer mode (ATM) as a way to upgrade LANs. But there are many competing choices, including traditional LANs, Unix-based networks, Windows NT, Fast Ethernet and the Fiber Distributed Data Interface. For wide-area data networks, there are private lines, X.25, frame-relay, SMDS, ATM and software defined networks, not to mention the new generation of wireless services just beginning to emerge on the scene.

It's hard to imagine how the networking industry will look in another 10 years. The decade following AT&T's divestiture ended with a flurry of billion-dollar deals, as carriers and cable TV companies positioned themselves to offer interactive, multimedia services. But the business applications of these services are murky. Other companies are scurrying to offer wireless data services. It's unclear, too, how widely they will be accepted. Meanwhile, software developers are busy building operating systems and applications, the advantages of which are mostly theoretical.

Yet one thing is certain: The divestiture of AT&T turned loose technological, financial and intellectual forces that continue to reshape the way people around the world work and live every day. ■





The Network Comes of Age

By ROBERT PRESTON

The enterprise network will go down in history as a pivotal development in American business.

The trend is clear: Corporations can build and leverage enterprise networks to their competitive advantage by bringing experts together, delivering goods and services faster and responding to customers more efficiently.

Whereas in the past only telecommunications carriers advertised their networks, now a few bold users like United Parcel Service Inc. have begun public campaigns to associate their corporate identities and the quality of their services with the quality of their networks.

To understand this dynamic, you have to go back 10 years, to the divestiture of AT&T. At the time, a corporate network was generally a rudimentary assemblage of communications equipment and point-to-point facilities from a single supplier—AT&T. Now, it is a multimedia, multisite matrix, interconnecting many different kinds of computers and other software-driven systems so that tens of thousands of employees can share information and serve customers.

Getting from there to here has been an experience few were prepared for. Michael Disabato, manager of network strategy development at McDonald's Corp., calls it "a long, strange trip."

The AT&T breakup jump-started competition to a degree unparalleled in the history of capitalism. Hundreds of companies turned out thousands of products and services to fill the same need—letting people and computers communicate, any to any.

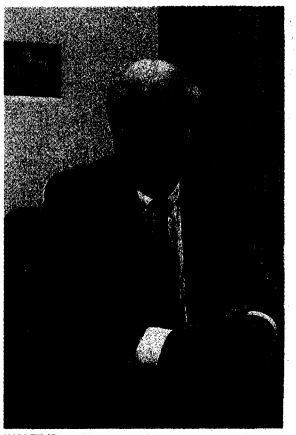
Disabato and others that are building and managing enterprise networks look at divestiture's effects in concrete terms: It brought myriad product choices, more leverage with suppliers and improved customer service, they say. It also unleashed market confusion.

"There's good news and bad news," Disabato says. "The good news is we have a lot of choices and a whole lot of flexibility in what we can do to make an enterprise network. So, that term itself suddenly comes to mean an infinite number of things. The bad news is we have lots of choices and can do whatever we want to make an enterprise network. I sometimes long for the days when all I could do was get AT&T."

The rise of the enterprise network from its pre-divestiture simplicity has been a function of simple economics: soaring demand for data communications more than offset by an abundance of circuit supply and connectivity products.

Before the Bell System breakup, AT&T priced bandwidth as a scarce resource. Only the largest corporations could afford to link their sites with private circuits, and those were mostly low-speed lines for voice communications. Regardless of whether a company ran Systems Network Architecture data over private lines or relied on public X.25 carriers, data communications was terminal-to-host.

Data communications started to change—and expand—in the early 1980s in step with newly decentralized corporate structures. As PC prices plunged and processing power proliferated, divisions scattered around the country or world no longer were captive to the headquarters mainframe. Desktop-to-desktop connectivity via client/server architectures became a staple of corporate communications. Downsizing was unstoppable.



WALTRIP: *'A new data architecture to manage.'*

Trav Waltrip, vice president of telecommunications at the Travelers Corp., a Hartford, Conn.-based insurance group, says the LAN was the "catalyst" in transforming the enterprise network.

"For once, we were able to do several things within our properties—have the high delivered bandwidth of the local area networks, as well as the ability to manage within the properties," Waltrip says. "Local area networks then tied to wide area networks, bringing us a capability of overall system management. And with that, coupled with the prices of PCs dropping like a rock, we had an entire new data architecture to manage and build."

Today, bandwidth on the Travelers backbone is about 80 percent data and 20 percent voice—roughly reverse what it was 10 years ago, Waltrip says.

The Supply Quotient

Divestiture, meanwhile, changed the supply equation. AT&T's Accunet T1 transmission service, tariffed in 1984, unbundled the digital lines used in Ma Bell's public network for offer to individual corporations. After discounts, a 2,500-mile circuit fetched about $80,000 a month in 1984—still out of reach for most users—but here, too, prices plunged and provision times shortened with carrier competition. Today, the same line costs about $9,000 after discounts, according to Vertical Systems Group, a Dedham, Mass.-based consultancy.

Simultaneously, divestiture was spawning technological innovation, mostly by start-ups. A time-division multiplexer market sprouted around T1, making it possible for small- and medium-sized users to cram all kinds of media and bandwidth onto these 1.544-megabit-per-second lines. The router was invented to let geographically dispersed LANs based on different protocols swap data. The VSAT welcomed remote branches into the enterprise network. The hub later came along to concentrate LAN and WAN wiring in the premises, and with it came a new level of management. Internetworking became an industry within an industry.

Customer premises data equipment is still the hottest communications industry sector. LAN software vendor Novell Inc., router leader Cisco Systems Inc., adapter and hub vendor 3Com Corp. and hub suppliers Cabletron Systems Corp. and SynOptics Communications Inc. still are growing between 40 percent and 100 percent a year. The smallest of them, SynOptics, will approach $500 million in revenue this year. Meanwhile, schools of applications-software developers and niche equipment suppliers are feeding off this growth frenzy.

"So, we have new players, new services, new products, lower costs and a much greater variety of choice—and the ability to tailor services," says Douglas Fields, vice president of telecommunications at United Parcel Service, Atlanta. "Before divestiture, if it was a PBX, it was an AT&T PBX. If it was a modem, it was an AT&T modem."

But this maturity has not been without its growing pains. As executives at every corporate branch and managerial level bought PCs during the 1980s and hooked them into departmental LANs, they did so without regard for a comprehensive "information systems" strategy, says John Daniels, vice president of the IBM Consulting Group. Each autonomous site set up its own applications. And scattered PCs are not as secure or as easy to manage

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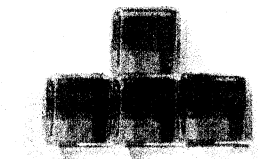


Today networking, instead of one of the last decisions you have to make, is one of the early, enabling decisions you have to make.

William O'Connor
Ascom Timeplex

NETWORK
The Coming of Age of The Enterprise Network

Continued from page 13

as a central mainframe.

Other downsizing legacies that corporate MIS/network managers now must deal with include a proliferation of backbone protocols and a level of data "burstiness" they never anticipated—all of which is driving the need for protocol unification (TCP/IP is gaining favor over OSI) and bandwidth reallocation (the world is moving toward ATM, shunting ISDN, SMDS and frame-relay to the background).

Mobility—whether it be via cellular phones, pagers, laptop computers, personal communications terminals, personal digital assistants or portable faxes—is creating a whole new set of challenges.

Besides having their hands full with connectivity issues, network managers now find themselves ankle-deep in a new generation of software: workgroup applications. They soon will be wading through these and other kinds of network applications as companies seek to find new ways to let people work together.

Networking: First and Foremost

Most companies now realize that networking no longer can be an afterthought.

"It used to be that the network itself was a decision that could be made at the lower end of a hierarchical scale of decisions," says William O'Connor, president of Ascom Timeplex Inc., a Woodcliff Lake, N.J.-based internetworking equipment maker. "First, you had to decide what your applications and tools were, and the network was almost predecided by whoever the host supplier was. Today, networking, instead of one of the last decisions you have to make as you're putting your information technology together, is one of the early, enabling decisions you have to make."

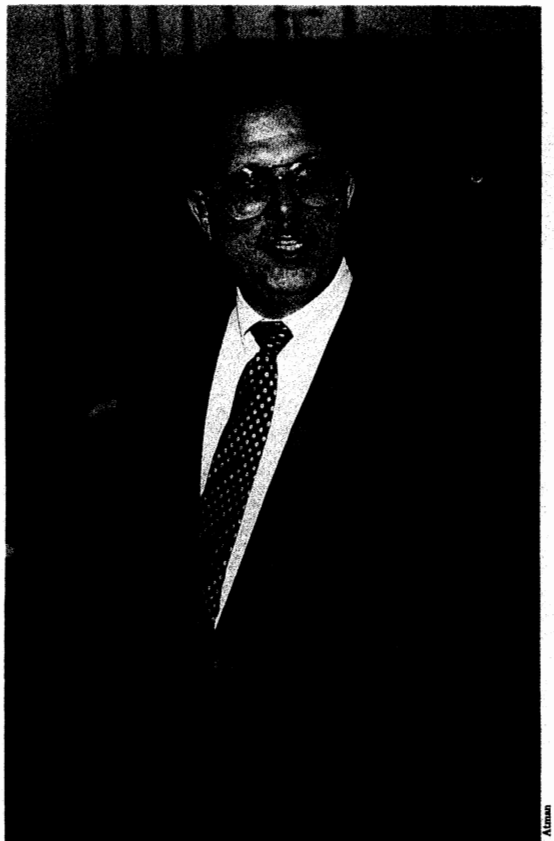
As part of that rethinking, many senior managers see a new role for enterprise networking. Networking departments no longer function in isolation from strategic management, but work with it to bolster—sometimes even create—markets.

In financial services, the companies that transmit, process and analyze information the fastest stand to make the most money. So, it's easy to understand why network managers at Wall Street firms like Bear, Stearns & Co. are at the forefront of deploying new networking technologies.

In manufacturing, Chrysler Corp. was first with a mini-van and pioneered "cab-forward" car design not because it has a monopoly on innovation, but because it turned ideas into products quickly by networking its purchasing, design, engineering and marketing enclaves.

As part of a business restructuring that Chrysler says let it get new cars to market almost a year faster than before, the company has assembled "platform teams" that work on similar-model cars at the Chrysler Technology Center in Highland Park, Mich. To support such teams, the functions of all Chrysler subnetworks were made available to all team members over a Fiber Distributed Data Interface backbone. For instance, computer-aided design applications previously run on IBM hosts and available only to car designers and engineers now run on Unix-based workstations so they can be distributed across the backbone to all team members.

In the package-delivery business, UPS keeps prices down and service up by using its network to track packages and related information, Fields says. UPS has assembled a national mobile data network using services from 80 cellular companies, to provide communications to 40,000 vehicles. The network lets UPS staffers track both air and ground shipments and confirm package deliveries on the spot. UPS is also on-line with business partners, such as financial institutions, customs organizations and suppliers of weather and flight-scheduling data for operation of the UPS airline.



Ed Altman

DISABATO: *The evolution of enterprise networking has been a 'long, strange trip.'*

"Electronic relationships with our business partners, our customers and our fellow UPSers are worldwide," Fields says. "I have daily interaction with operations, marketing, finance and accounting, as well as various operations groups—air and ground. I also get daily conference calls from organizations that have responsibility for supporting information technology around the world. So, we're no longer operating in isolation."

For some network managers, being a partner with management means not getting in the way.

"Enterprise networking for us just enhances the experience in an invisible way," Disabato says. "The best thing that I could ever do is for somebody to say, 'I didn't know we had a network group.' "

Regardless of how integral networking is to a corporation's daily operations, network managers no longer come strictly from telecommunications backgrounds. They must know computer systems, LANs, internetworking and applications in addition to carrier offerings. They must merge the WAN legacy with the newer LAN culture. And whatever they add to the network must exist with older equipment and software.

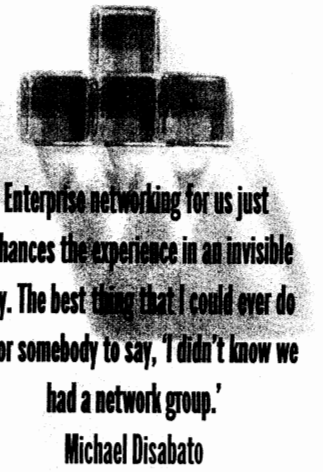
"Divestiture has made my job harder," UPS's Fields says. "You have to be more sophisticated. You have to be more of an entrepreneur than a technologist. You have to be able to deal with the proliferation of choices to find the things that have the right price, the right life and the right performance characteristics to meet your business needs."

With this responsibility has come clout and respect—both within the network manager's organization and from suppliers. Travelers' Waltrip talks about "the intellectual talent that we put into the act." Indeed, some companies have created a new slot, "chief network officer," to bring that talent into the ranks of senior management.

Network managers have had a profound impact on the quality of telecommunications in this country. Users built test equipment in the early days after divestiture to demonstrate to carriers that their circuits were rife with errors and other reliability problems, Waltrip says. "Because we kept beating them about the importance of availability, it's come to a point where it's remarkable. There just basically are no errors on digital circuits," he says. "Ten years ago, you couldn't even dream of that."

This new user influence produced another phenomenon: custom-service agreements. Under these agreements, corporations consolidate all their long distance traffic with a single vendor in exchange for bulk discounts and performance guarantees that surpass the basic tariff. Modeled after AT&T's Tariff No. 12, introduced in 1987, these agreements often involve 30 percent to 40 percent of a company's annual telecom budget and reduce expenses by an average 25 percent, says Gerard Cunningham, a New York-based principal with consultancy Deloitte Touche Tohmatsu International.

Cunningham has advised many of the more than 250 large corporations that have signed these agreements. One of the pioneers, Merrill Lynch & Co. Inc., New York, signed a five-year, $150 million contract with MCI Communications Corp. in 1989 covering private-line, toll-free and virtual-network services. But Merrill Lynch, like other users, stopped short of handing over management—and thus control—of its network, Cunningham notes.



"The biggest problem in trying to make the leap from a pricing and performance agreement to an outsourcing agreement is that it places more pressure on the quality of your performance standards," he says. "You have to know what you're spending today, how you're spending it, how many activities are being performed by your people, at what speed, etc. Then you have to ask your vendor to make a proposal based on that. Most people today have difficulty articulating what it is their own staffs do."

Price Persuasion

The falling costs of carrier services—as well as the headaches associated with managing private networks—have persuaded most corporations to move their voice traffic back to the public network under virtual or software-defined offerings. Some users believe that private data traffic will go the same way, provided by value-added carriers. But technology, not price, will drive the data migration. That technology is ATM, or asynchronous transfer mode, a cell-switching technique that carriers just have begun to deploy in the public network.

"Once we're able to have ubiquitous ATM service in the United States, then we will be paying for bandwidth utilized, or bandwidth on demand," Waltrip says. "And that'll change the entire economics. You're going to find in large corporations an entirely different approach to contracting for voice and data."

ATM-based switches are also available for local and campus networks, making it possible for the first time to design enterprise networks that use a common technology from desktop to desktop, across LANs and WANs. With ATM, network managers theoretically will be able to support the wave of the future—full-motion interactive multimedia applications.

It could be years before that vision is realized. But enterprise network managers agree that whatever industry developments are ahead will pale in comparison to the tectonic economic shifts produced by the AT&T divestiture. ■

THE ROLE OF NETWORKING

Better communication has always led to greater democracy and greater economic growth. That is our challenge.

By AL GORE

LAST MONTH, WHEN I was visiting Central Asia, the President of Kyrghyzstan told me a story. He said that recently, his 8-year-old son announced that he wanted to learn English. When asked why, he replied, "Because, father, the computer speaks English."

I think this is just one more example of how the global information revolution, spurred by U.S. technology and industry, is changing the lives of people around the world.

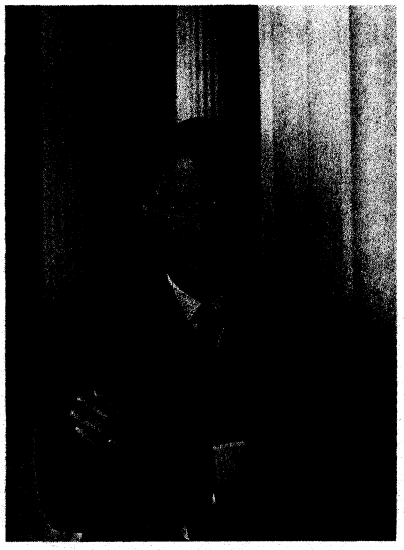
This is a very exciting time for those of us involved in telecommunications, whether as equipment manufacturers, service providers, policy makers or users. I imagine it's a particularly exciting time for publications like *Communications Week*, which must stay abreast of all the new technological and political developments in this area. Almost every day there are announcements of new breakthroughs and new services. It is clear that as *Communications Week* enters its second decade, there will be no shortage of news to report.

Since I first became interested in high-speed networking almost 15 years ago, there have been many major advances in the technology of telecommunications and in public awareness of it. Today, you cannot visit a newsstand without seeing two or three cover stories on high-speed networks. Even the Doonesbury comic strip has discovered the Internet. Someday soon we can expect to see Snoopy and Garfield on-line as well.

In the early 1980s, as a member of the House of Representatives, I called for the creation of a network of national "information superhighways." The only people interested, though, were the manufacturers of optical fiber. Back then, of course, a high-speed network ran at 56,000 bits per second. Today, high-performance networks are capable of carrying over a billion bits per second. As Robert Lucky at Bellcore is fond of pointing out, that's equivalent to the difference between smoke signals and the fax machine. That's the kind of change we've seen in just 10 years—and the kind of change we can anticipate in the next 10.

Of course, while bandwidth is important, what really matters is what we are able to do with it. No one says, "Let's use the telephone." They say, "Let's call Grandma."

Not everyone can keep that in mind. When the telephone was invented, stockbrokers in London said, "Who needs so many



telephones? We have messenger boys."

It didn't take long to see that there were some things messenger boys could not do—transmit both ends of a conversation, for example. We figured out new uses each time the telephone changed, from big wooden boxes on the wall, to desk phones, to the car phones and cell phones which allow us to talk while we drive or walk.

A similar thing happened with the first computer networks, which were created to exchange computer files and allow remote users to log on to central mainframes. What was not anticipated was the invention of electronic mail, which today, 25 years later, is a billion-dollar industry.

Likewise, as more and more applications have developed over the last decade, we have seen networking technology spread into more and more aspects of our lives. It's not just telephones any more.

Just take the example of the Internet. It started as a research network, developed by computer scientists for computer scientists. It was not long before other scientists realized that it could be a very powerful research tool in other fields. Today, the Internet is being used by millions of people in thousands of different ways. Scientists, engineers, teachers, students, librarians, doctors, business people, and even Congress and the White House rely on the Internet and similar networks to communicate with their colleagues, receive electronic journals, and access bulletin boards and databases.

But the Internet provides just a glimpse of what is to come. In just a few years, it will be as easy—and inexpensive—to convey two-way video as it is to make a telephone call today. That will require a large increase in network capacity and capability, but we already have the technology—the fiber optics, advanced wireless technology, faster digital switches and sophisticated software—to make that happen.

We are in the midst of a global transformation—one as profound as those caused by the invention of the printing press and the steam engine. When digital telecommunications networks are coupled with the power of advanced computers, these networks will enable people throughout the world to share almost unlimited amounts of information—text, data, images, video and sound. Used properly, these technologies will change the way we live, learn, and work—for the better.

That is why the Clinton administration is so committed to ensuring that the United States is poised to become the leader of this global transformation. We are working with industry to accelerate the development of information highways. We are working to develop forward-looking government policies that will encourage investment and innovation. And most importantly, we are working to ensure that all Americans enjoy the benefits—in terms of better jobs; better health care; better, more responsive government; and better education for ourselves and our children—that this technology can help provide.

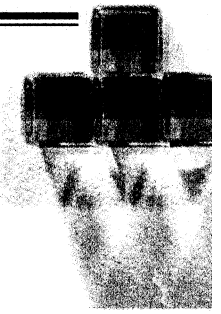
Although we cannot predict how these technologies will evolve and what uses they will be put to, we do know that better communication has always led to greater democracy and greater economic growth. That is our challenge. That is what this administration and the nation—will achieve.

There's a story about Michael Faraday, the inventor of the electric generator. Once, he was showing Benjamin Disraeli through his lab, taking great pleasure in demonstrating the effects he could produce. And at the end of the tour, Disraeli said, "Well, what good are all these things?" Faraday answered, "What good is a baby?"

If we take the narrow view, it looks like telecommunications is well out of infancy. But if we cast our eyes ahead a few decades, we see that it's barely out of diapers. We need to look ahead and to protect it when it needs protecting, but not get in the way when it needs to walk alone.

If we do that, then much more than the telecommunications industry will grow strong. This country and much of the human race will grow strong, as well.

Al Gore is vice president of the United States.



10 ORAL HISTORIES

JOHN ZEGLIS
Senior Vice President
AT&T

JANE VIDETICH
Systems Development Manager
R.J. Reynolds Tobacco Co.

RAYMOND SMITH
Chairman and CEO
Bell Atlantic Corp.

JACK HAVERTY
Internet Architect
Oracle Corp.

RAY NOORDA
President, Chairman and CEO
Novell Inc.

BILL YUNDT
Director of Networking
Stanford University

BERT ROBERTS
Chairman and CEO
MCI Communications Corp.

ELLEN HANCOCK
Senior Vice President
IBM

PAUL SEVERINO
President
Wellfleet Communications Inc.

JIM MANZI
President, Chairman and CEO
Lotus Development Corp.

Depending on how you look at it, 10 years can seem like a very long time, or just a blip. In *Ulysses,* James Joyce took 500 pages to write about a single day in the life of Stephen Dedalus. An encyclopedia, on the other hand, may devote a few paragraphs to the 300-year Ming dynasty. History thus becomes a function of space and relativity.

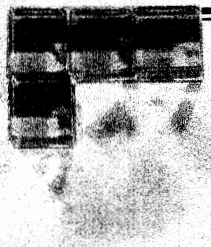
Communications Week has published more than 25,000 pages since it was launched 10 years ago. That is arguably the most voluminous record of enterprise networks in the world. On the occasion of our 10th anniversary, we thought it would be a good idea to step back from this vast archive and ask, "What does it mean?"

To answer the question, we turned to some of the industry's most prominent men and women. They are people who develop network technologies, use them or sell them. We asked them to provide first-person accounts—oral histories—of the events of the past decade. As you'll see on the following pages, our historians were candid, and they covered a lot of ground. Through their recollections, they weave together the most important stories of the past 10 years, creating a tapestry that the rest of us can study and try to understand.

These narratives include anecdotes that would not otherwise have made it into the pages of *Communications Week.* John Zeglis, a member of AT&T's legal team in the early 1980s, confesses that he played with a Rubik's Cube while other members of the team worked furiously preparing for trial because he knew, and they didn't, that AT&T's chairman had agreed to divest the company. Ray Smith, president of two Bell operating companies at the time of divestiture, tells of how he hired the Philadelphia Mummers to sing and dance in celebration of the event.

As these interviews show, history is not only a function of space and relativity, but also of what we remember.

—John Foley



JOHN ZEGLIS

Senior Vice President/General Counsel
AT&T

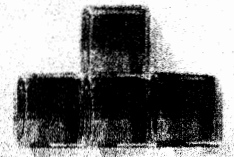
The same nanosecond that AT&T divested $100 billion of assets, they acquired me. I had been with the law firm of Sidley and Austin in Chicago. I started working in 1979-1980 on United States vs. AT&T.

There was a period, for many months, where the lights at the trial headquarters never turned off. It was one of the most intense, tiring and exhilarating times of any of our lives. I was sure I would never forget an instant of it; and yet, I have.

It was really exciting. I say that to set my mood just before I learned that AT&T's chairman and general counsel were negotiating seriously and were close to, and eventually did, reach an agreement with the Justice Department to enter the divestiture decree. No intense litigator likes to hear that your client has settled the case when you are barreling down the track at 90 miles an hour, and you're coming up on your last six weeks of trial.

By the end of December 1981, two other lawyers and I were in the know about the decree and that it would be announced. But this massive trial team was assembled in a hotel room in Washington, and in order to safeguard the news, we had to keep that trial team running, getting ready to produce witnesses and evidence that we knew would never happen.

So, we'd open the door far enough to stick in a trial plan for the first week of trial when it resumed, and then we would go back to doing our Rubik's Cubes. That was the year when Rubik's Cubes had just hit the market. And so we spent about a week sliding notes and instructions under the door to the trial team and clicking these Rubik's Cubes around; we never really mastered that, but that's kind of a footnote to the history. That's how I spent the first week of 1982.



We ought to be credited, I think, with a splendid job of divestiture itself. People compared it to taking a 747 apart while it was flying and putting it back together without anything crashing. That's exactly what happened.

The only thing that would not signal some massive change in course was to proceed with business as usual. We had over 100 more witnesses and maybe 10 times that many documents still to go in our case. We were set to resume in the middle of January, so all that work had to continue.

There was just a very small group of people who knew this was about to happen, of which I was one. The Bell presidents out there didn't know anything until [AT&T chairman] Charlie Brown made his conference call. At first, these people were stunned, but, you know, five minutes later, it was all, "Okay, now we've got to move on."

I was certain that the Bell System and the network would just stop. People said, "What's the use. We're going to break up. This is not what we've been fighting for all these years. [We have] one system, it works."

But they turned on a dime and began to do what you'd hope the Bell System people would do: Figure out how it's going to work in the new world; who's going to be separate; who's going to be together; who's going to share; what new access tariffs have to be filed; what marketing plans have to be laid.

For me personally, it's a touching story to remember how the Bell System, a million strong, responded to this thing. Never missed a beat. Service actually improved on the service indicators over the two years between the time divestiture was announced and effected.

The actual decree, the taking apart of the Bell System, came to a head on January 1, 1984. We ought to be credited, I think, with a splendid job of divestiture itself. People compared it to taking a 747 apart while it was flying and putting it back together without anything crashing. That's exactly what happened.

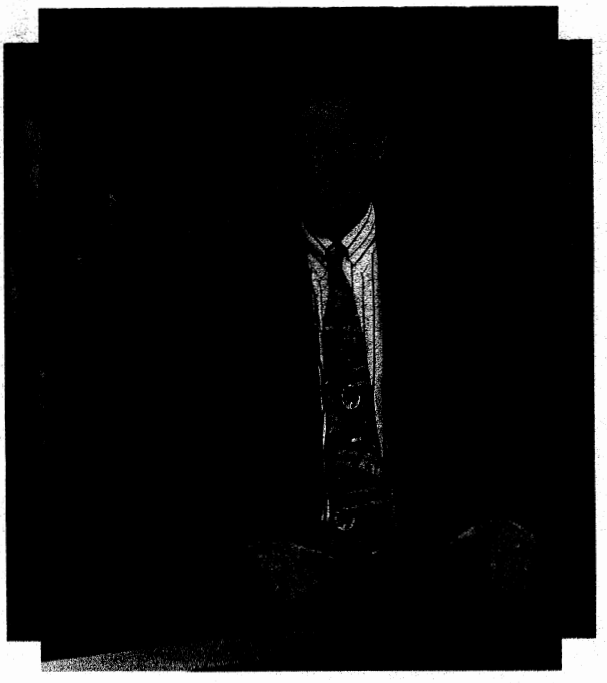
New companies were formed, and new management teams and new systems were in place. That work climaxed on the day of divestiture. It wasn't until some time later in 1984 that the real significance of having divested all the monopoly businesses and having been left with only competitive businesses really hit home. Then, it really sunk into people the changes, the adaptations and the new way of life that would be required: in short, how hard it was going to be to make money in that market.

The intensity of markets, the speed, the pace, the pressure on costs, the imperative of quick-time-to-market, the day-in, day-out planning and executing, and the focus on customers: These came with such an intensity, such a force.

Starting in September 1984 and rolling across the nation for two years, equal access was a huge event, and the competition was intense during and following it. It was intense to the 10th power, and it spawned a forever-intensity in long distance competition.

I think wireless services added a genuine new dimension to the industry. This notion that we will call people, not places, is huge for our industry, and it is now in full flower. What seems so logical now was probably unpredictable, at least by me. I didn't know, wouldn't have guessed at the time that we divested all our cellular licenses, that less than 10 years later we would have negotiated a merger back into wireless communications.

A wireless network doesn't substitute for the local exchange. You still have to have a local exchange to complete virtually all wireless calls. The only kind of wireless call that doesn't use a local exchange facility is if you're calling from one car to another car that happens to be in the same cell. Otherwise, you are always calling locally, and it gets into the local network and finishes; or you're calling long distance, and it has to be passed up through the local network to the long distance carrier of your choice. It puts AT&T into another aspect of communications, but not local exchange. It puts us into mobility.



Ed Alman

I wouldn't have predicted that I would be engaged in AT&T's first and only hostile takeover—of NCR Corp. I couldn't have predicted then the shape of the company, although it seems, in retrospect, logical. We talked of computing and communications converging and the need to be in the computer business. It hardly seems radical now that

Zeglis, *page 42*

JANE VIDETICH

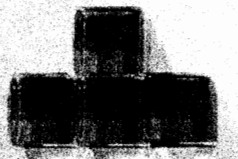
Systems Development Manager
R.J. Reynolds Tobacco Co.

In January 1984, I was interviewed by *Business Week* and the *Wall Street Journal*. Divestiture was the big news item of the year, and it was the only game in town. I thought it quite appropriate that it coincided with Orwell's *1984*. Perhaps Huxley's *Brave New World* would have been more appropriate.

Prior to joining R.J. Reynolds Industries in 1980, I had been working for an independent telephone company in North Carolina. I was involved in the sales, provisioning, billing and division of revenue of intercity services. The way our service worked with AT&T, Southern Bell [Telephone Co.] and other companies was precisely the way service would be provided post-divestiture. That experience proved to be invaluable.

Early in my career, I decided to get involved with user organizations and to actively work to affect product and service evolution in the marketplace. My experience has helped me understand suppliers from both a political and technical perspective and allowed me to cut through bureaucracy when required.

In January 1984, I was manager of voice operations at R.J. Reynolds and managed one of the large ETNs [electronic tandem networks]. I was also president of the ETN Users Organization, which consisted of many of AT&T's large users. ETNs were elaborate, hard-wired networks that used both AT&T network facilities, as well as customer premises equipment. It seems funny now, but there was fierce competition between AT&T Communications [Services] and AT&T-IS [AT&T Information Systems Inc.] over ownership of the network.



Dealing with those companies most affected by divestiture was quite painful, as they sought to find themselves. The president of AT&T-IS in the mid-1980s was Dick Holbrook, who was a friend of mine. I had a sign in my office that said, 'If all else fails, call Dick.' All else failed quite a few times.

Voice networking was much more fun in those days, as the design of networks was almost an art form. Entrepreneurs like Jim Jewett, who was a professor at Vanderbilt University, emerged to fill a niche with a wonderful product that allowed users some control over network design. Telco Research [Corp.] grew and was sold to Nynex [Corp.] and later resold.

As time passed, ETNs became dinosaurs, as switched prices tumbled and private-line prices increased. One of the most prolonged battles fought by users during the 1980s was over the issue of strategic pricing, which related to artificial pricing to force migration to other services.

If I look at the first years after divestiture, equate it with confusion, false starts and searching for a place in a world where the rules had changed. In a speech in Washington in 1984, I said, "Divestiture is when you know that you called the right company, but they don't." There was tremendous fear of violating legal aspects of the Modified Final Judgment.

The early years were difficult as companies came and went, merged, bought or were bought. There was a tremendous waste of resources as different marketing concepts were tried as newly divested unregulated companies looked for an approach that would work. Few of the unregulated ventures have been financially successful. Users were confused, as they did not understand rules that were changing constantly.

Dealing with those companies most affected by divestiture was quite painful, as they sought to find themselves. The president of AT&T-IS in the mid-1980s was Dick Holbrook, who was a friend of mine. I had a sign in my office that said, "If all else fails, call Dick." All else failed quite a few times.

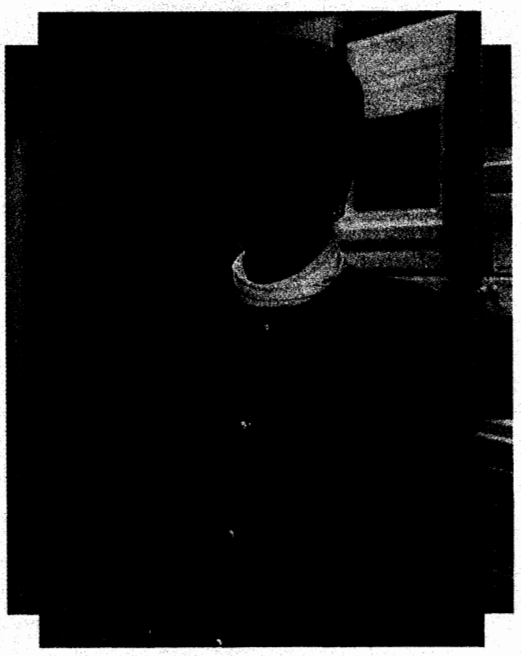
But the ink was hardly dry on the MFJ before all interested parties began to try to reverse, overturn, amend or change the rules.

The number of players that have emerged has changed. There are more politics than before, and the stakes are higher. Prior to divestiture, users mainly were concerned with the FCC and state public utility commissions. By default, the MFJ involved the Justice Department in a big way. Added to those three are the executive branch, with NTIA [National Telecommunications and Information Administration] and the emerging National Information Infrastructure; the House and Senate communications subcommittees; the Commerce Department; the state legislatures; and even the press.

Many of the aspects of the MFJ were very subtle and hard to interpret. None was more confusing than the many battles over inside wiring. In 1985, we bought our inside wire in our office complexes. The return on investment was tremendous. The last person who had to sign the capital appropriation was my vice president. He called and said, "Jane, I have read this and have difficulty understanding what we are doing." I told him that the simplest thing would be to consider that we were buying the horizontal wiring but were prohibited by law from buying the vertical wire.

In looking back at divestiture, one contemplates landmark decisions and wonders how the world might have turned out if AT&T had told Tom Carter that he could plug his Carterphone on the network and that a small company called MCI [Communications Corp.] could run a few microwave lines from St. Louis to Chicago, but not make a habit of it.

In the early to mid-1980s, MCI and Sprint were not the companies they have become. The access methods that they generally used were not good. But, I believe that mid-1980 policies of AT&T inadvertently worked to its disfavor. After the conversion to AT&T Communications and AT&T-IS, relationships with users underwent a change as AT&T adopted a policy of trying to ensure that its National Account Representatives positioned themselves as high in the user organization as possible. Often, this was done at the expense of the relationship with the telecom manager.



This was in direct contrast to an early method of IBM that I believe has served it well. IBM partnered with its users. IBM positioned them within their companies, trained them and helped them get above-average compensation. Subsequently, it was next to impossible to go into a "blue" shop and introduce a different mainframe.

AT&T, by alienating itself from the telecom manager in an attempt to position itself with senior management, caused a backlash in many instances that forced the choice of a non-AT&T supplier.

The second half of the decade has brought an explosion of technology. Speeds that were a gleam in someone's eye 10 years ago are now attainable and often on twisted-pair. Today's user is forced to keep

Videtich, *page 43*

RJ Reynolds

RAYMOND SMITH

Chairman and CEO
Bell Atlantic Corp.

In January 1984, I was president of The Bell Telephone Company of Pennsylvania and Diamond State Telephone Co. I lived and worked in Philadelphia, and I saw AT&T's divestiture as the future starting that day. It was a very exciting day. I arranged to have the Philadelphia Mummers, the ones that wear feathers and dance around and sing "Oh, Dem Golden Slippers," visit the telephone companies. All did the Mummers Strut. It was a day of celebration.

I knew for sure that we could not survive as just a telephone company and that we had been entrapped in a marketing myopia of seeing ourselves as such. But that was the day, in my opinion, we became a communications company. No one can predict the future, but one thing that was clear—it was going to be much brighter than the past.

During my time as the president of Bell of Pennsylvania, I never once had a phone call from my boss. I was never once asked what kind of strategies were required or involved in discussing the priorities of the Bell System. And I had 30,000 employees. That's how bureaucratic it had become. All of a sudden, I was on the Executive Policy Council, and my boss was Tom Bolger and I talked to him virtually every day.

On January 1, 1985, I became vice chairman of Bell Atlantic [Corp.]. January 1, 1988, I became president and vice chairman. In 1989, I became chairman.

Early in the game—the end of 1985—it was clear that we could not exist as an independent organization with rate-of-return regulation in the states, being regionally bound, judicially restricted and congressionally limited. So, all those changes had to be made, or we would not survive as a company to the year 2000. We undertook a massive long-term process to get out from under the Cable Act [of 1984] and information-services regulation, to change the Computer [Inquiry] II rules in the FCC, the pooling arrangement and to undertake real rate-of-return reform. This was really an invasion of Normandy on our part.

We thought we had the answers back then. Who was going to provide access to the home? Well, it was going to be the telephone company. What were the services going to be? Well, there was going to be voice and maybe data. Who was going to partner with whom? What do you mean, partner with whom? It was never considered. Partner, shmartner. We were from the old Bell System heritage, we did everything.

We're relatively free from where we were 10 years ago. We're out from under the restrictions that didn't permit us to be in any other businesses. We won that in the triennial review in an appeal. Bell Atlantic appealed information services and the Cable Act. Then we're allowed in other lines of business. That enabled us to at least begin to become a real company. But the fact that we're still restricted in terms of manufacturing is astonishing to me. It makes absolutely no sense. And it is disappointing that we still have long distance restrictions.

About 1989, we concluded that we would divest all non-strategic assets, return to our roots and become the world's best information and communications company. We sold all the retail stores and beeper companies and got out of real estate. We've made a number of investments since then, and all of them have been network companies, and all of them were successful. Prior to that, none of them was a network company, and none of them was successful.

Technologically, the industry is evolving just as we thought it would—digital, fiber, intelligent-network-based systems, fully interconnected to all the other networks in the country. Regulation, however, has moved much slower than I thought it would, especially if you look at the country as a whole. We still have a lot of rate-of-return regulation in the states.

The thing that I was not prepared for back in 1984 was that we would be clearly competing with one another as directly as we now are. Southwestern Bell [Corp.] competes with us in wireless. BellSouth [Corp.] competes with us in equipment sales—against centrex. Everybody competes with us in Yellow Pages. The gloves came off a little faster than I thought they would.

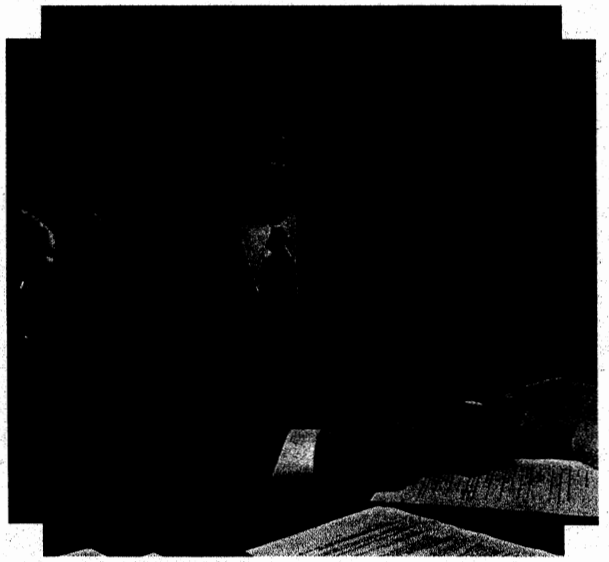
Part of the amazing thing is we have held the political coalition together. In those areas where we have a common interest, such as the MFJ [Modified Final Judgment] restrictions, the group is as tight as ever despite the fact that we face each other across scrimmage lines here and there.

It sounds corny, but we established a vision, which is to be the world's best communications and information company, then we carefully defined what we meant by "world, best and communications and information."

Clearly, in communications and information, it meant we had to be a data transport company. We tested ourselves regularly to see if we were true to the vision. We continued our investment in ISDN, fiber, the intelligent network and other capabilities right through the recession. We were willing to take short-term earnings hits because we knew that sooner or later the recession would end, and we would be equipped much better to compete.

We thought we had the answers back then. Who was going to provide access to the home? Well, it was going to be the telephone company. There was no question. What were the services going to be? Well, there was going to be voice and maybe data. Who was going to partner with whom? What do you mean, partner with whom? It was never considered. Partner, shmartner. We were from the old Bell System heritage, we did everything.

The difference is that the questions were answered back then. Now, they're not. Therefore, the prospects of the industry, that is the Bell regionals and GTE [Corp.], are so much greater.



John Tsiolis

We will be in all information software: that is, we will deliver it, and create it; we will package it, and merchandise it. One of the information services is entertainment, another is home education. Then there's voice and videophone, which will be big.

The integration of these becomes very clear. There are two different platforms, and we are just approaching the inevitable interactive network from two different points of view. We've increased our footprint across the United States to go from one Bell regional to some 40 percent of the country. Each telephone company is the second cable company, and each cable company is the second telephone company.

It's key when you look at how these services are going

Smith, *page 44*

JACK HAVERTY

Internet Architect, Network Products Division
Oracle Corp.

January 1984 was right after the initial rollout of TCP/IP technology from a research environment into an operations environment. Actually, January 1, 1983 was when the Arpanet itself was cut over. In the years following, we put the same technology into the Defense Data Network, which became and is now the underpinning for all government communications and the Department of Defense—a real operational kind of environment.

In that same time frame, there was another research effort going on that would take advantage of TCP/IP's capabilities of interconnecting different kinds of networks. At Bolt Beranek and Newman Inc., I ran the project that created the first operational router on the Arpanet, which interconnected the Arpanet with a lot of networks around the periphery; that is, Ethernet networks, radio networks and so on. And since there was also quite a lot of interest in doing more advanced things, there were two satellite networks, one called Satnet and one called the Wide Band Network, which were different-speed satellite networks.

I was part of the project that hooked together the various European research communities into the United States via the Satnet satellite link, using TCP/IP. The Wide Band Network was also satellite-based, but it was much faster. It spanned across the United States and was being used for experimentation and research in how to send voice and video in real time across a wide area. So, there were really two thrusts going on: One was to take the early technology of TCP/IP and roll it out into an operational environment—the largest of which was the Defense Data Network; and the other was the breakthrough work to put new technology and new kinds of applications in place to become what is now called the Internet.

It was a very interesting time because we found lots of things that were not really technology issues, but more pragmatic and operational issues. We used to have machines that literally were scattered around the world that could communicate with the different satellite receiver units. And since those receiver units were computers, we could put interesting programs in them. One of the programs we used all the time was something that would let us monitor what was happening on another machine 8,000 miles away. This was revolutionary technology—being able to look across the world using a network, and being able to monitor and measure things from such a distance.

A lot of the things came out of that time of discovery. For instance, the Simple Network Management Protocol at one point was called NMP. I remember we had a discussion as to whether the "simple" referred to simple network, simple management or simple protocol. I still don't have the answer to that.

Basically, I was very involved in researching new technologies and then putting the routers in place to transition [the technologies] out to a non-research, end-user kind of situation. However, it soon became pretty clear that although these technologies were very powerful, they were also very difficult to use.

As we built more and more of these systems, we learned how to do it. We formed a kind of methodology of how to go about putting things together and getting them to work. So, I got that going as a kind of servicing business.

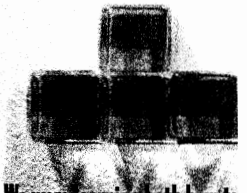
Then, about four years ago, I noticed that there were a lot of things going on in the networking industry. The technology was advancing; protocols were being put into chips; and a lot of the activity began to focus on what I think of as "optimizing." This is bringing out new things, like ISDN, frame-relay, and cell-relay, but fundamentally, they all do the same thing. But the situation I noticed was that although we had lots of networks, we didn't really have many people thinking about how to use them in any significant way.

Even if you look at Internet statistics, the bulk of the traffic mostly involves things like remote log-on, file transfer and electronic mail—the same three applications that were built in roughly 1970 and used in the Arpanet. So, in a sense, the industry has come quite far, but the way networks are used is the same it was 20 years ago.

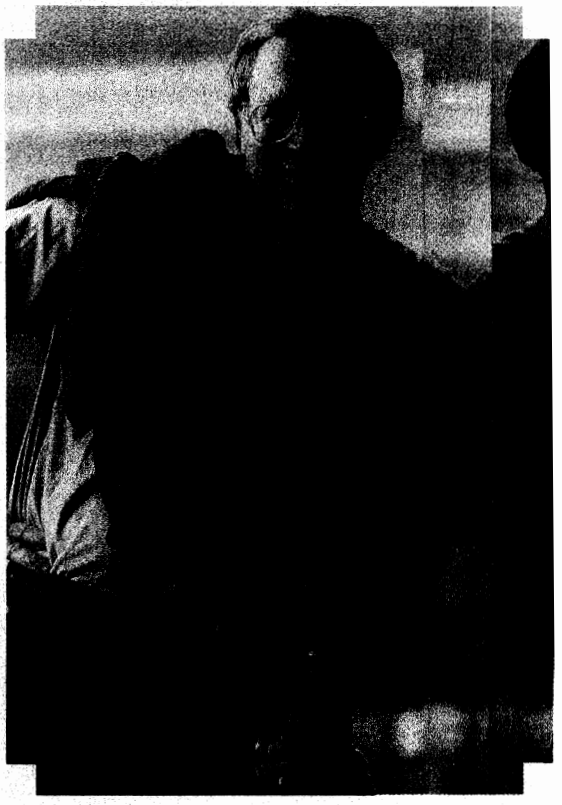
That's how I became involved with Oracle Corp. in mid-1990. Oracle actually came in from the other direction. At that time, Oracle had been employing databases for systems mainly in commercial environments where the database activity was a core business function. People would work on a big machine, which would run their data for operating the business. Eventually, these customers noticed all this network activity happening on the research side, and thought, "Boy, look at these people doing all this neat stuff. How can I get that?"

Looking back on the last 10 years, I'd have to say that one of the major events influencing the networking industry was the whole TCP/IP effort. A lot like the router industry, which didn't exist 10 years ago, TCP/IP basically came out of nowhere, simply from the fact that it provided the ability to do something that people really wanted to be able to do. And it took off on its own.

The other things that really made a difference in the networking industry were the advances on the computer side. Now computers are distributed much more widely. So, instead of just having terminals going across communications lines to some big machine, the personal machines create the ability to have computers much more widespread and interconnected. I think we're still reacting to this situation. I figured out the other day that there's more disk space and memory on my laptop than was available in the entire campus when I went to college.



We were learning both how to operate networks and how to use networking technology to do things like operate and monitor networks. There was a kind of two-edged network situation that basically continued through the 1980s.



The biggest surprise to me was the way that the standardization didn't happen. There are a lot of good reasons to have a kind of a cohesion, a single standard, but it never really came to pass.

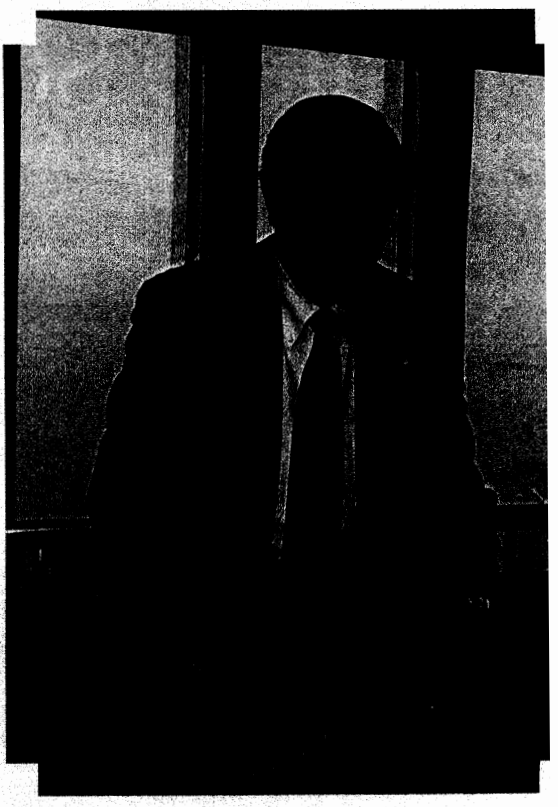
Now I've switched over to thinking that it's probably a good idea that there isn't a winner, because it creates an environment in which there's more competition. The marketplace can decide what's important and what's not.

In the next 10 years, I think we'll see the completion of the shift from focusing purely on the movement of data into more of the handling and processing of it. And it would be nice to see more attention to interoperability issues. ■

Robert Foudeamp

RAY NOORDA

President, Chairman and CEO
Novell Inc.



My earliest encounter with Novell Data Systems was in the first part of 1983. I had been introduced to the company by Jack Messmer [of Safeguard Scientific, an early investor in networking companies].

That's not quite accurate; actually, I knew the folks because it had been founded by others who had worked for me—a fellow by the name of Jack Davis in particular. He'd worked for me at General Automation.

I had started a company called Reliable Data Systems. I had grown fascinated with the need in the manufacturing environment for fault-tolerant systems. I started that company with another man who had done some consulting work for me. My idea was to put together a configuration, at that time, of minicomputers, two Altos boxes, with a box we were building in between that we called the "fault-tolerant connector" that would keep small companies "up."

I had been doing that for several months. About the time that we thought we were moving ahead quite well—in the latter part of 1982—the Safeguard Scientific people called me and asked me if I could meet them at what is now Comdex, in Las Vegas. So, I met some of the folks at the company exhibit, which had [networked] PCs and some terminals. But they had it operating, and I asked some of the key people if they ever considered doing a fault-tolerant configuration of these things, could they do it, and could their software be ported from their server into other environments. They said "yes, yes and who knows?" That was in November 1982.

Then the Safeguard people, namely Jack Messmer, called me and said they had another guy who was going to do this, so don't bother. I said, "Oh fine, I got plenty to do." Then just before the holidays they called me and said the other guy decided he wasn't going to do it, couldn't do it or something, and could I come back to see him and talk about the possibilities [of Ray working with Messmer's company].

I didn't have any information on the business, so before I went back, I talked to him a little bit. I said that based on what I'd heard and seen, if what they said can be done, I'd be willing to come back and take another look at it to figure out if it was worthwhile doing. So I did, right after the holidays. It was the second, third or fourth day of January 1983.

I went over [to Safeguard] and took this guy with me who was helping me out at Reliable Data Systems. I went into this room where they'd gathered all the employees, and they introduced me as the president! I guess they assumed that since I was president of three or four other companies, why couldn't I be president of another one?

Of course, there was absolutely no reaction from the 20 or so people who were there, because they'd already had three or four of them [presidents]. That sort of started the process more seriously [of my involvement with the company]. Then, I went to the Safeguard people and structured a deal. I went on a crapshoot, said I'd put some money in and take an interest in the business, and we'd work out the plan later.

They had to consider what kind of financial organization it would be, who should own what. I wasn't really all that excited about all of that. I'm not a detail man when it comes to doing a deal. So, we structured a deal, and I started spending two or three days a week there while I was winding down some of these other companies. Eventually, my wife and I sold our house in Cupertino [Calif.], and moved to Utah.

I had to shut down Reliable Data Systems. We actually had some real progress going, but it wasn't moving ahead as fast as I thought this other [effort at NDS] could. I tried to keep them both going for a while, but I just ran out of funds.

They [Craig Burton, Drew Major and NDS' original SuperSet programming team] were all young people who had been Mormon missionaries. They had some common feelings for what to me was the real key part I wanted to focus on because of my interest in system fault tolerance: Can we get to system fault tolerance based on standard equipment and a simple but extensible operating system that can take us into broader areas than pure local area networks?

It was clear, even as I was running some of these other companies, that multiplant, multilocation, multisystem management was going to be a necessity. There were other people already doing some local area networks. I got involved in and briefly was president of Bridge Communications Inc. [an early networking vendor].

I recognized that sooner or later, Unix was going to be a very significant part of this portability issue. I saw what the interconnectivities could be if we just got all the Unix guys to work together—a fairly simple thing!

It was going to be Unix, or it was going to be something else that would provide the capability to have portable software and interconnectivity among different platforms. From that standpoint, I always had this interest, [but] it's a vision that I and other people have had. It's certainly not exclusive to me.

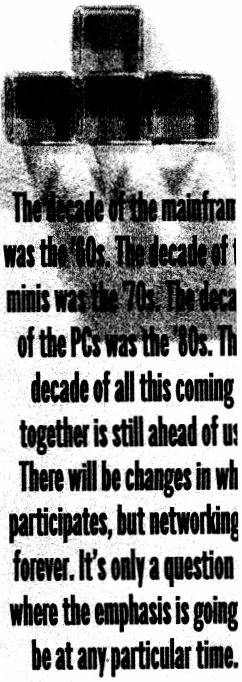
It [my connection to Novell] was purely luck. It wasn't one of these traumatic things. It was another of my little, speculative, "Who knows what's gonna happen" deals.

You may have heard that management is a bunch of four-letter words—"make cash," "ship fast," "hard work," "play some." When you make a list of them, the only ones that matter are "good luck."

I like change a lot. If I wasn't involved in change, I wasn't happy. If it wasn't possible for somebody else to make a change, I would cause a change. I'm just a restless kind of a person.

I'm not that deeply attached [to Novell]. I could have gone three or four years ago. My wife often wonders how it is so easy for me to move from one company to another. I move typically when the job is done. But in this networking business, you don't know when it's done. It's been just continual changes.

The decade of the mainframe was the '60s. The decade of the minis was the '70s. The decade of the PCs was the '80s. The decade of all this coming together is still ahead of us. There will be changes in who participates, but networking is forever. It's only a question of where the emphasis is going to be at any particular time. ■



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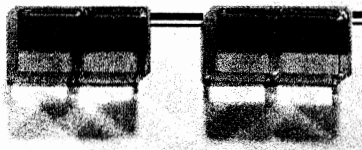


BILL YUNDT

Director of Networking and Communications Systems
Stanford University

I have been at Stanford University, in various roles, since 1969. By 1984, I had moved from computing into computer networking.

In the early 1980s, we were building the university network, which currently has 15,000 computers connected to it and is itself connected to the Internet. I worked on the development of the Internet in Northern California, called BARRNet [Bay Area Regional Research Network]. It was the first all-T1-based Internet backbone, and it is now very widely used throughout the industry and at research and education enterprises in Northern California, Nevada and Oregon.

The period between 1984 and today has been one of enormous change in our industry, and I suspect the greatest change seen by any industry. The period up to 1984 was characterized by mainframe systems dominating business applications and providing computer services through MIS organizations. The early 1980s was the beginning of the era of PCs and distributed-computing power, which has resulted today in the empowerment of individuals to do a lot of their own computing. It was the heyday of time-sharing development, which, of course, has given way entirely now to individual desktop and client/server computing.

In those days, the communications environment was oriented toward a small amount of data moving back and forth from a user and a large machine, and all the computational work was done on the large machine. The bandwidth required was not great and communications were simple because control was all under the hands of a single processor for a large group of users who had common interests.

We have put a piece of dynamite in the middle of the large processor and blown it to smithereens, scattering the pieces all over the world. Now, we have to connect the pieces with much higher bandwidth in order to accomplish the same thing we used to accomplish with our single, large machines. Empowering individual users to use their individual piece independent of other people initially created lots of islands that couldn't communicate.

In the beginning of [the 1980s] until the middle part of the decade, there was a lot of investment in trying to reconnect these islands. We developed new technologies, like Ethernet and token-ring, to connect those islands and allow them to communicate and share resources more effectively.

In 1981, we completed a study of computing at Stanford that had three recommendations. One was to build a campus-wide network; second was to bring together our disparate database management systems into a common database management information retrieval system; and the third was related to very large-scale computing and the need for supercomputing in a research university.

We began to see on campus the results of the revolution of personal computing. Within a small number of years, the population of [desktop computers] on campus grew from about 200 minicomputer time-sharing machines to 12,000 or so PCs, Macintoshes and workstations. From 1984 on, we were engaged in building the network at Stanford—prior to the time that any of the Internet facilities had been built.

At Stanford, the phenomenon of Xerox Corp.'s PARC [Palo Alto Research Center] and the Alto and Star workstations that were developed at PARC spread like a fever in this institution. This resulted in some of our own students and faculty trying to develop another generation of products like that, for use on the Stanford University network. That product was called SUN—the Stanford University Network workstation. It was developed largely by a graduate student named Andreas Bechtolsheim, who, along with an MBA student at Stanford, Scott McNealy, became a founder of Sun Microsystems Inc. They teamed together with software folks from the University of California at Berkeley. That was right around 1984-85.

Sun wasn't the only company coming out of Stanford. There was a string of others. Cisco Systems Inc. came out of the development of router technology at Stanford. Initially, we built all our internal network with routers and bridges that were designed, constructed and deployed here. They were, in fact, the precursor products for Cisco's architecture.

In terms of how the industry changed in unanticipated ways, if I look at the number of people I had contact with in 1984, and the people I am in contact with now, the number certainly has exploded. And the variety is different. In those days, there were maybe two companies that we talked to frequently: Digital Equipment Corp. and IBM. Now, there are dozens, if not hundreds, that we deal with regularly. The principal suppliers of our computing power scarcely existed then.

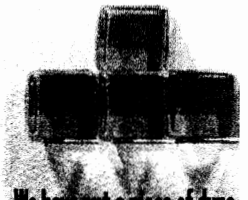
Over the years, there were several milestone events. Of course, from our standpoint, the commercialization of the router with Cisco and the Sun workstation were major milestones. The advent of communications chips for high-speed networking technology was a milestone.

Another interesting characterization of the past decade is the rate of obsolescence, or the increase in power and price performance of processors. The rate at which we drive to new technology is without parallel in any kind of other experience in the industrial world. There were also all kinds of great promises in that time period when much of the world believed that mainframe computers were going to get bigger and bigger, and that was the way everybody was going to be doing computing for ever and ever, amen. Those flopped pretty miserably.

When it comes to integrating voice and data and now multimedia, I've been hearing that probably for 10 years now. The industry terribly underestimated the kinds of bandwidth that would be required to do all that. The next decade will bring as much change as the previous has brought. We are looking at the infrastructure needed to support another three decimal orders of magnitude.

Overall, we have done remarkably well in covering up the complexity of computing. The worst nightmare is that it all will collapse like a house of cards, which is not that far-fetched if you are talking about some large systems or the Internet, which is a very fragile and extremely complicated network of networks.

From a personal point of view, the way that I work has changed so that I would scarcely recognize it or the workplace of 10 years ago. Today, I go home and I can see my desktop at Stanford from my office at home. ■



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BERT ROBERTS

Chairman and CEO
MCI Communications Corp.

It was January 1982 when the actual court decision was announced that AT&T's divestiture would happen. So, by the time January 1984 came around, it actually was happening. I was the president of a subsidiary that we had at the time called MCI Telecommunications Corp. It probably represented 90 percent of revenues and 150 percent of MCI's profits at the time.

We began to invest a significant sum of money into our network. It was disproportionately more than we should have been investing if you looked at our revenues at the time and at what the company's growth was projected over the short term. But there was a feeling that we would face this opportunity only once in a lifetime.

The way we actually generated capacity during that period was with an enhanced analog technology called single-side band. We got a lot of criticism for that. It was a technology that was quickly obsolete; it was still analog and not digital. But it was the only way that we could quickly generate capacity.

We also knew that to take advantage of this opportunity we had to structure this company differently. It was my belief that the correct way for MCI to go after this opportunity of equal access was to be totally focused geographically—put senior management in charge of those geographic divisions and align the divisions with the regional Bell companies.

What we needed out there was an aggressive front line group of people that could make this happen. We took the top seven senior executives of this company out of headquarters and put them out there.

We had an active marketing group to go after the largest businesses, but, during that time, we were weak in that area. We certainly had national account teams out there, but our penetration into the very largest businesses during that window of time wasn't nearly as substantial as going after the small and medium businesses and the consumer business under equal access.

That's why we changed the organization again, in the 1987 time frame. We needed to shift the focus of this company back toward gaining market share in the largest accounts.

At that point in time, we had a relationship with a lot of large accounts, but our penetration in the national account market was about 4 percent. Our challenge was to try get those companies that already had a relationship with us to do more business with us and to try to get them to focus on MCI as a legitimate second, and eventually primary, vendor of long distance traffic.

We [considered ourselves] winners if we convinced the large account community to go to the two-vendor approach. We didn't need 100 percent of their business.

I suspect that history will look at this 10-year period after divestiture as one of the most dynamic transitions of an industry that has ever been accomplished. We have gone from a virtual monopoly—long distance—to a wide open, intensely competitive field that has benefited consumers and small, medium and large business. At the same time, we have set the stage for the way the rest of the world is going in terms of competition.

It used to be, maybe a little longer than 10 years ago, people treated the telephone like lights. Now, it's a strategic tool. PCs in 1983 virtually didn't exist. In the 1982-1983 time frame, there were 50,000 total computers in the world. Now, they're shipping 50,000 a day. Communications is an underpinning of that.

Look at something like fax. In 1983, it took six minutes to send a fax. The paper corroded your fingers, and it cost you a fortune on the cost of the call. Today, it is cost-effective, great quality, and it transmits fast.

Electronic mail is another thing that I think we are just scratching the surface of. It will be difficult in the future to tell the difference between an E-mail message and a piece of multimedia information coming over what used to be an E-mail system.

Things seem to be accelerating, in terms of the blending of markets and the blending of industries. Even as fast as I am used to this industry changing and as responsively as MCI is dealing with change, I think things are starting to happen on an accelerated basis that is just mind-boggling if you start to extrapolate.

It's dramatic, what has happened. In some ways, if you look at our success, people may read this and say, "Oh yeah, that's really tough—MCI grew from a couple of hundred million dollars, to a billion dollars. It really has it rough." Well, it didn't come easy, that's all I can say. [MCI founder] Bill McGowan fundamentally knew when divestiture was announced that this was an opportunity that was unprecedented in corporate history. Bill McGowan was always an individual that could see the forest while the rest of us were trying to chop down trees. He knew the extent of this industry in a way that I think no other person did. Bill McGowan was a visionary.

My biggest challenge right now is to keep this company thinking small, entrepreneurial. The thing that has made us successful in the past is that this is a company that from day one was like a small entrepreneurial company. We delegate a lot of authority. Everybody has to carry their weight. No bureaucracies; there's no time for them.

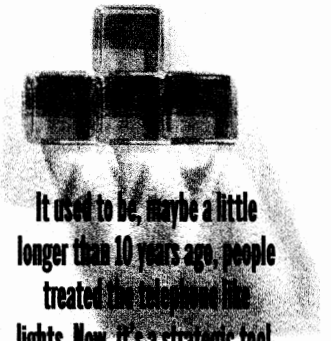
Many of the premiere companies of the past have failed for two reasons. One, they imploded internally under the weight of their own bureaucracies. The distance of decision-making between what was required for the customer and the ultimate decision slowed the process down.

The second reason they failed is not because of what was happening in the industry around them, but because they didn't focus on their own strategic vision of how they had attacked that industry. They started to rest on their laurels.

You have to blame yourself for those things. I can't let that happen to MCI. We can't let this company be any less flexible, any less able to react to change. That's my number one goal.

I've also got to drive the new strategic visions of this company. What industries are we going to go after? How are we going to pick our partners? How are we going to deal with some of the changes we see going on out there?

That's a different challenge than [AT&T's chairman] Bob Allen has. He's done a good job. His company is becoming a much more aggressive competitor. It took him 10 years. Am I worried about the cable companies and Bell operating companies? They're all monopolies. It's going to take them 10 years to become competitive. ■



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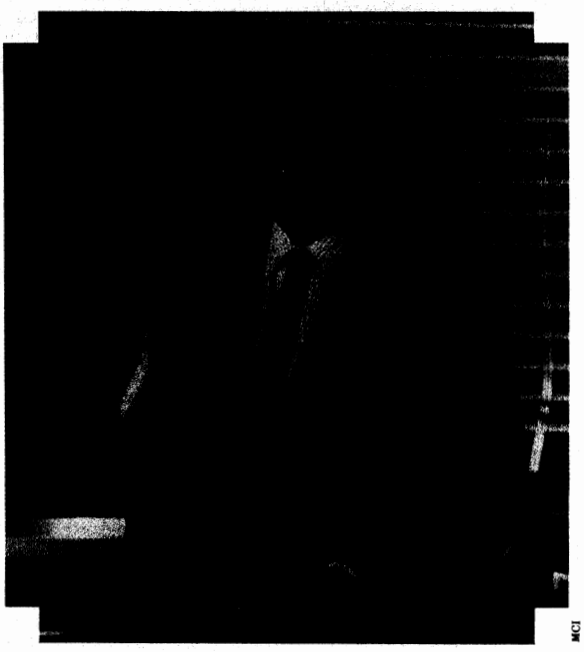


MCI

ELLEN HANCOCK

Senior Vice President and Group Executive for Networking Systems
IBM

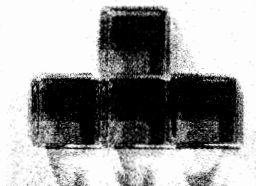
In 1984, I was in Raleigh, N.C. I was a division vice president at IBM, and I was responsible for a group called Communications Programming. It was part of what was then called the Communications Products Division. I left Raleigh around the middle of 1984 and went to work for Jack Kuehler, who did all the marketing and development at the time.

In going back to what was happening in the industry then, one thing stands out: the breakup of AT&T. That was a seminal event. It changed the playing field in many different ways in terms of customer choice.

Another absolutely tremendous effect was the existence of fiber and the move toward digital networking. Right now, as we look at the changes that are occurring in that area and compare them to the changes occurring in telecommunications, the telecom changes are astronomical. So, the existence of all this fiber, the access to bandwidth, has made a distinct change relative to how we all talk about things.

The availability of the PS/2 and other machines also changed the landscape, because it gave us computer power, memory and everything else to be able to manage many customer applications and the communications among those applications. The impact of micro-miniaturization fueled that same effort, which says we all have availability of chips, availability of memory and storage to do things that 10 years ago we thought were only possible in a 390-class machine.

There was a growth of competition in this area; the number of competitors increased dramatically in 10 years. That meant more opportunities for customers, but it also meant that networks were now multivendor, heterogeneous networks. We needed to respond to that, which is why you see so much emphasis on network management. And clearly, the availability of the bandwidth was dramatic and will shape us for the next ten years.



A lot of us spent time on international standards. Some of us did believe that OSI was going to take over as the networking protocol. That didn't occur. Many of us invested heavily in ISDN, and it did not occur the way we thought it would. We also invested in voice/data integration, and, again, that didn't occur to the extent that we thought either.

We developed de facto standards throughout the past 10 years, and so there are products and technologies that establish themselves as standards. TCP/IP would be one; APPN [Advanced Peer-to-Peer Networking] would be another; and CICS certainly would be another. IBM's DB2 from the database area, and products like the network operating systems, including Novell Inc.'s NetWare also were key.

In addition, there were a lot of us in the industry working on international standards, and many of us spent a lot of the past 10 years dealing with those discussions. Customers grew a lot of their networks with many different products, selecting some standards and selecting some de facto standards. There was just explosive market growth.

A number of technologies have had tremendous impact on the industry over the last 10 years; for example, fiber, digital networking, LANs and work tions. The whole LAN explosion, with LANs, bridges, routers hubs, has been fairly dramatic, and I believe that the next r important event is going to be the availability of ATM [asynchro transfer mode]-based networks. In terms of telecom fiber and existence of digital networking, ATM is probably one of the big things that has happened.

The availability of fiber with high bandwidth, the availabili LANs and then the availability of the engines—such as the engine or PowerPC—yielded practically everything else. These y ed some networking protocols, the hubs and routers and high-b width switches.

We didn't anticipate a number of things. A lot of us spent tim international standards. Some of us believed OSI [Open Syst Interconnection] was going to take over as the networking prot That didn't occur. Many of us invested heavily in ISDN, and it dic occur the way we thought it would. We also invested in voice/ integration, and, again, that didn't occur to the extent that thought either.

Remember Telecom '87? It was all ISDN. Every single booth ISDN. And even when we went back [to the event] in 1991, pe still were saying, "Well, ISDN's here." I said, "Where? What do mean it's here?" We do have some ISDN products, and we're investing in ISDN, but I think it's fair to say that it didn't dom the way that everyone assumed it was going to dominate.

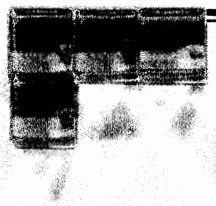
LANs also grew much larger than most of us anticipated in early part of the 1980s. And the growth of the Internet and TC as well as the continued focus on SNA [Systems Network Arch ture], are things we probably would not have anticipated.

Standards were not accepted as much as we thought they going to be in the 1980s. It is still important for all of us to together, and hopefully we will do that as we go through ATM clear that customers voted their dollars for the products that resp ed with the functions they needed, versus products that conform a particular standard, and I think that was a surprise. There was a belief in the industry that Unix really was going to be more engineering workstation. And it's clear that for several reas both technology and investment on the part of vendors—that U being used in a wider scope, not just for engineering.

The battle between IBM and AT&T didn't quite happen t extent that some predicted. AT&T had its competition, and w ours; and they weren't even necessarily the same. There are things that AT&T invested in that we had been in and decided th should get out of, suc PBXs. I'm convinced tha company who has PBXs should have central switches, and Rolm have that.

We're very much in the networking business; that strength. It's important fo vendors to sit back and out what we think our cor petencies are. Certainly, networking, data archite SNA, token-ring product controllers all play into wh think we bring to the tab

AT&T has its own str We beat them sometime often we're a very larg tomer of theirs, or the very large customer of ou many cases, we work to to respond to customer So, it never could be qui war that everybody was pating. We still treat AT a competitor, but the didn't quite match what occurred. ■



PAUL SEVERINO

President
Wellfleet Communications Inc.

In January 1984, I was the president of Interlan Inc., which was an early Ethernet-oriented company that I started in 1981. By 1984, it was clear that Ethernet LANs were an important technology, but it was yet unclear as to how this technology really was going to develop in terms of individual companies being able to provide solutions for customers. I think the whole environment was still one of "this is important technology," but the extent to which its importance is shown today wasn't quite evident at that time.

For me, the real issue was in 1981—just picking up and starting a company that was in LANs, which were really in an early technology cycle. We actually sat down and said, "This is an important new technology. It is important enough to the future of computing that I should start a company here." To be honest with you, I knew what the first products were, but I wasn't quite sure what the second set of products were.

If I think about my next phase, when I sold Interlan in 1985 and started Wellfleet Communications Co. in 1986, one of the key elements to starting a LAN internetworking company was the fact that there was this T1 capability available for us to be able to go out and build products that allowed users to interconnect LANs. So, the whole concept of growing networking and the growth of networking really was based on the ability of customers to get access to bandwidth that was very high-performance, as compared to what they had before. The concept of digital services, such as T1, was clearly very important to the growth of networking in general.

The interesting thing is that in 1984, there was almost no LAN interconnection going on. Vitalink Communications Corp. was just beginning to shift remote bridges, and people were starting to use them, primarily in environments that were Digital Equipment Corp.-oriented.

In the last 10 years, there clearly have been a lot of things that have affected our marketplace. I think probably the major thing has been the adoption of client/server technology, moving away from SNA [IBM's Systems Network Architecture]. And I think that kind of movement is the basic concept of customer computing at the desktop, versuscomputing at the mainframe. It has affected very positively, because it basically forces the need for infrastructu enterprise-wide networking. It's also affected other people ve negatively, people who are the other side of that paragon.

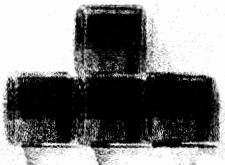
It's got nothing to do with what goes on in a wide area [networ it's what goes on on the desktop. Our belief has been from the ve beginning that our business is not driven by wide area networks; i driven by the desktop.

I think the biggest surprise for all of us in the early days of the LA business was what happened with the XNS [Xerox Networking Syste protocol. We all kind of believed in XNS; we all put it in our produc And TCP/IP became the primary transport and Internet program.

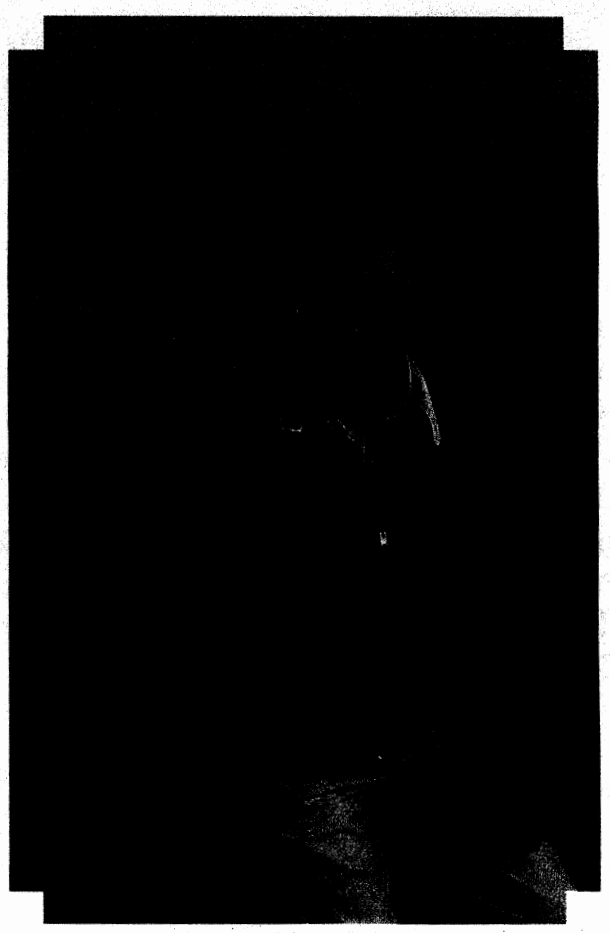
Another surprise was that Fiber Distributed Data Interface nev really took off as everybody thought it would. Long term, it's not contender for the desktop. And now we're in the middle of asynchr nous transfer mode.

I would say that we're just at the point where we've enabled tl client/server model to be successful in large companies because nc there's a network infrastructure that can be built quickly. There a powerful computers on the desktop, and now there are applicatio that people want to use in those environments to run their businesse And those applications take on a different form than the applicatio that were on the mainframe.

This allows users to do their jobs better, and accessing a bunc of database information is just something that happens. It's ther you go get it. This is something that you could never have planne or dreamed or imagined 10 years ago.



If you look back at history at people who built the first telephones and the first radios, it was a very exciting time. Well, we've had the same situation in the last 10 years in our industry in terms of the LAN and communications business. It turns out that we've been a part of this incredible change that's going on in computers and communications.

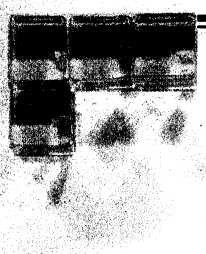


The interesting thing client/server wasn't generate by one company. It was gene ated by a group of companie that have taken leadershi roles in different parts of thi infrastructure. There are plat form companies, applicatio companies and networkin companies.

Competition is the bes thing that could ever happe to any market. The custome wins when there's competi tion, and we're seeing tha time and time again. We'r seeing it all over the place. think all of us who have bee in this industry have bee very fortunate. It's being a the right place at the righ time.

If you look back at history at people who built the firs telephones and the first ra dios, it was a very excitin time. Well, we've had the same situation in the last 1(years in our industry in terms of the LAN and communica tions business. It turns out that we've been a part of this incredible change that's go ing on in computers and com munications.

I think that's probably been the most exciting part of this whole thing—to be a part of an industry from its early stages and to not only take part in its growth, but also to have some impact on it. I think that's been something that's been very satisfying for a lot of us. ■



JIM MANZI

President, Chairman and CEO
Lotus Development Corp.

In January 1984, I was the vice president of marketing and sales at Lotus. Way back then, it was a spreadsheet company, and it was the one-year anniversary of Lotus 1-2-3. Lotus 1-2-3 was driving the entire PC explosion at the time. We had just closed the books on a $53 million year when the business plan predicted it would be a $3 million year. Symphony was coming out in the middle of the year, which was our second product.

Divestiture created a whole new sense of vibrancy in the telephone company space. The good news is that the dynamism in the private sector is more than enough to build not just one, but multiple national information superhighways.

The computer industry milestones, meanwhile, clearly were the successive release of microprocessors. The [Intel] 80x86 started the whole thing, but the [Intel] 386 was a gigantic event. I think the growth of networking as led by Novell [Inc.], the explosion in that business and now the explosion in thinking about not just networking, but wide area networking [are milestones]. And intercompany communications extended enterprise [networks] and mobile computing, all of which are fundamental communications issues, not computing issues, which is why we are communications-centered, as opposed to PC-centered and spreadsheet-centered.

A thrust of our strategy is around mobile computing, and mobile computing is about communications. It's not about calculations. It's not about computations. So, if we do our job right and build a dominant position in the communications space, then we will use that as the thrust by which we differentiate ourselves in the market. It seems to be working.

Looking at the software industry, the big pieces were obviously DOS and, more importantly, 1-2-3. Obviously, other important applications include D-base, Windows, Notes and WordPerfect.

And NetWare has been so fundamental to everything we're talking about here. What are the two pieces of software that are defining the intersection of computing and communications? At the structural level, or the systems technology level, clearly, it's NetWare. At the applications and applications development layer, it's Notes. Netware isone of the watersheds in the whole business.

Nobody got a return [on investment] when they had an individual personal computer. Yeah, you got to do fancier letters and fancier memos, and you transformed your individual work space, and you were personally more productive. But you would be hard-pressed to say you were doing anything for your organization. Your organization was hard-pressed to calculate on the investment. The fundamental idea behind things like NetWare and Notes is the process of connecting people together so they can work together and do things differently.

Prior to the 1980s, and certainly prior to the 1990s, people were organized in vertical hierarchy. As we go through the 1990s and into the next century, people are going to be organized very, very differently around horizontal teams and this whole idea of virtualization of the organization. All of this is a function of communications technology. Whether it's LAN or WAN, it's all communications that's driving the transformation of how people work.

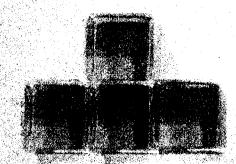
In terms of networking, clearly Novell and others laid the plumbing in place that allows people like us to make applications and application-development environments like Notes. They were giving us more and more capacity to ship ever increasingly large objects around on networks, local and wide area. That's a phenomenal tribute to the capacities that are being built in at the plumbing level. We're in the business of providing water, meaning the applications, not the plumbing.

If Ray Ozzi [whom Manzi worked with on Notes] did historical market research and said, "I'm thinking about this product that can connect people on a network that you don't now have, and you'd be able to share documents based on any kind of data, including text and graphics and sound and imaging, to build applications," I think people would have glazed over. This was clearly a brilliant insight, energized by a view of how people might use it; and, yes, there were some early adopters of the technology who saw instantly what they could do with it. Now, there are lots of people who are seeing instantly what they could do with it.

Switching and routing technology, meanwhile, is extraordinary compared to what it was five years ago. The single biggest interesting factoid in the entire marketplace is that, starting about a year ago, the rate of growth in communications capacity is outstripping the rate of growth in processing. The advances in chip design for the first time in history will be slower than the rate of growth in bandwidth.

It [bandwidth] is available in large scale, and we don't have to concern ourselves with bandwidth availability on an ongoing basis because the rate of growth is so extraordinary. Those are some fundamental reasons why it will be a communications-driven 1990s, not a computationally driven 1990s.

I don't break out into warm glows thinking about technology. I break out into warm glows thinking about how customers will use our stuff to improve their business. ■



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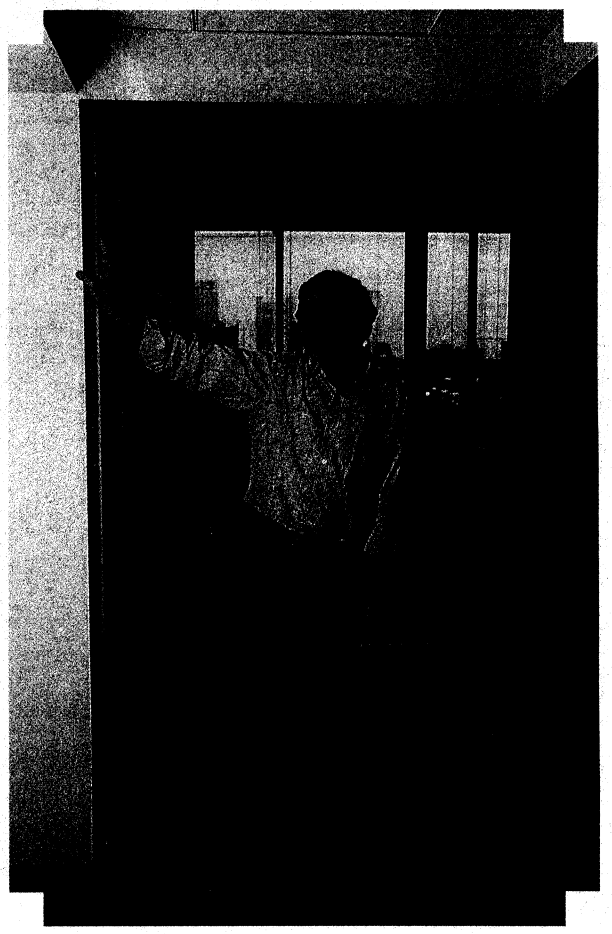


Rick Friedman

ZEGLIS
AT&T's General Counsel Remembers Divestiture

Continued from page 21

we have merged with a fairly large-sized computer company. Communications, if you look at our mission statement, is anytime, anywhere, anyplace. That anyplace would include where people are, not just where wired phones are. It seems very logical, in retrospect, although standing 10 years ago, no, I would not have predicted that.

I'll tell you, though, I think the most important fundamental and lasting changes have been what's happened to the people and the focus and the pace around AT&T. We thought we knew our costs and that they were low, and we didn't know our costs, and they weren't low. We had to go to work like we never knew what work was to get the price-value equation right for the market. The shift in culture, if you will, from consensus and avoiding mistakes to more individual empowerment and risk-taking was such a difficult thing to do. This reorientation was terrible at times; the number of people that had to be separated from their roles during this period of focus and cost-cutting was massive.

I may recite all this in a nostalgic way, but I think about it as a wonderful thing that happened to the company and the employees and its shareholders and probably the nation, too. AT&T has come out of the past 10 years in fighting-trim condition. It was a cold shower, and it's been pretty painful, but it's one of those things where if it hadn't happened to you, you might wish it had been invented.

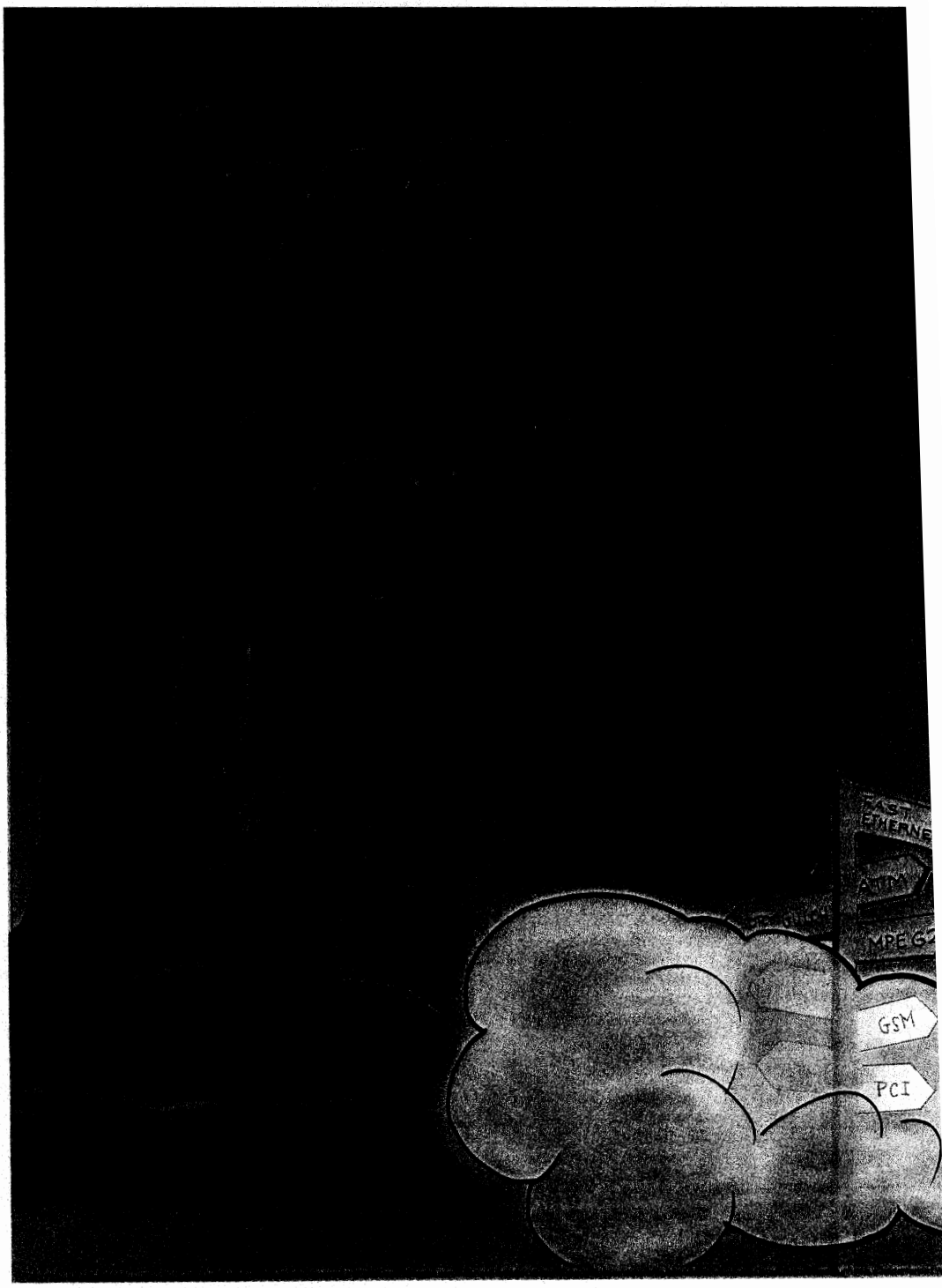
I am, in more recent years, surprised at all of the talk that local competition that will someday break [the local exchange] monopoly. I emphasize talk because we've had actually none of it yet, that is local competition where one regional company drives a truck across the state line and attacks the other, even in a very rich access market.

It's just not done yet in terms of the regional Bell companies competing head-to-head. The wireless revolution has not broken the bottleneck because the way cellular systems work is that they merely extend the local exchange by an extension cord that happens to be wireless. You move from your wireless device into the local exchange and it is still a bottleneck facility for finishing the call. I'm a little surprised to see this fast, this soon, so much talk about local competition. We hope it does develop. We hope that someday we enjoy the same discipline on the supply of access in the local markets that is disciplining our supply of long distance in the interexchange markets.

I think there are extraordinary consumer benefits that have flown from the divestiture of AT&T. It created, and still creates, a much messier marketplace. Lots of choice, lots of different colors and models.

People will still come up and say, "Boy, I never supported that decision. Wasn't that a shame the government broke AT&T up?" But you know, even if we had won the antitrust case, the problem wasn't solved. The problem was that you still had monopolies connected to competitive businesses that depended on the monopolies to reach customers. And as long as you had one of the competitors and the monopolies in the same enterprise, every success of that affiliated competitor could be laid to an abuse or a misuse of the monopoly. You just couldn't get out of this. Even if you'd won the case, you still had the next 10 cases coming right behind. You still had a mountain of regulations piling up. You still had legislations being introduced to create a level playing field, even while you maintained the Bell System.

So, we weren't going to solve anything by winning that case. It was a problem insoluble by the courts, the regulators and Congress; and by this one surgical fi not only eliminated a controversy, b brought competition, and with it all price reductions, features, product productivity. Solve the controvers duce the regulations by a factor of 1(promote competition by a factor of with all the consumer benefits that from it. That's a pretty good résumé single divestiture. ■



VIDETICH
One User's Recollection of The Past Decade's Events

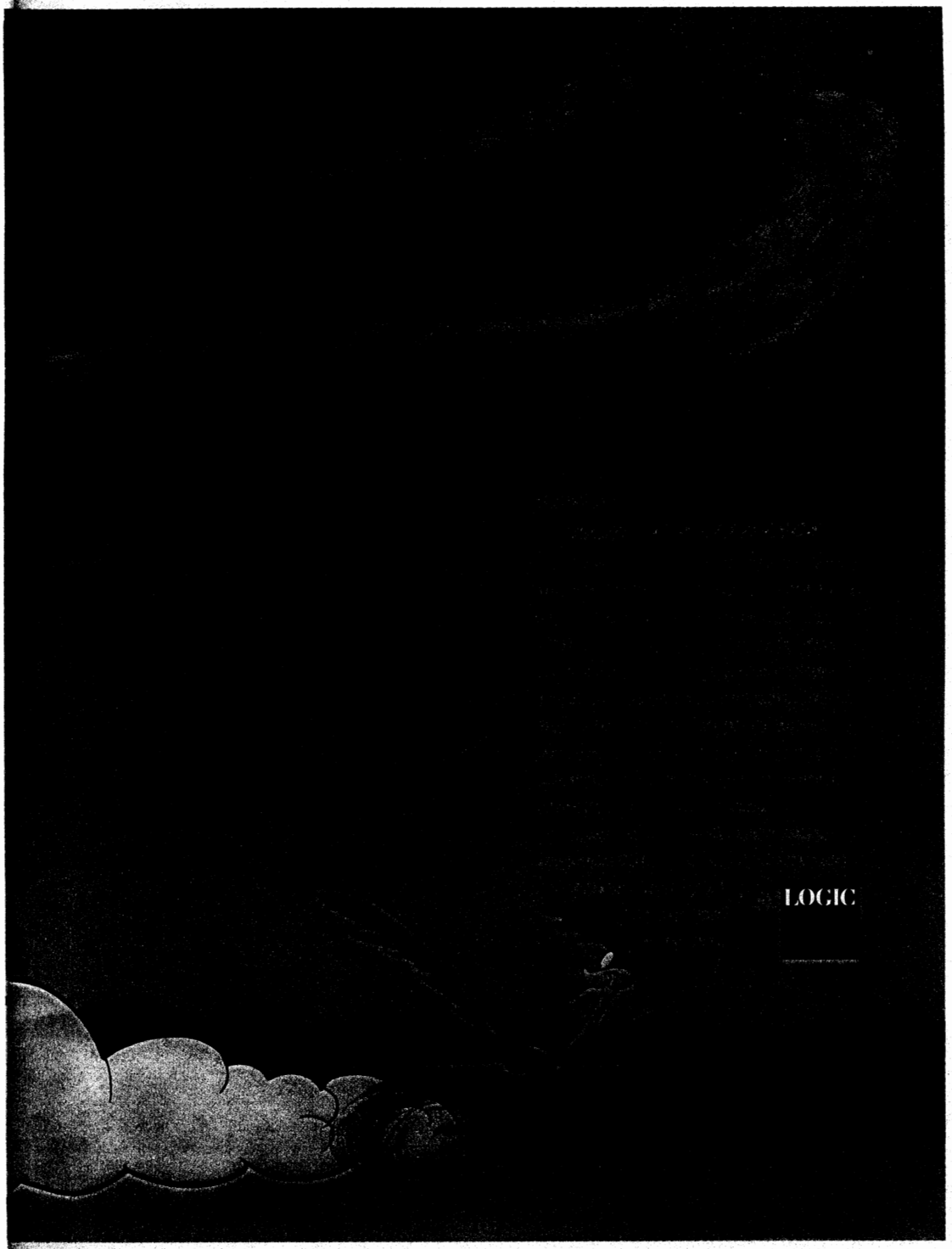
Continued from page 28

his or her head above water with a smaller staff.

Users have several choices of carriers that provide quality transmission. The differentiators have in many instances become the flexibility of billing plans and service. It is interesting to see information-resources capability affect the market in this industry.

Hard-wired data networks have survived much longer than voice networks because of the requirements of speed or capability. The last few years have brought about a plethora of new switched services, such as FDDI, ATM, SMDS, frame-relay and others, that have emerged and will forever change the netowrking landscape.

I personally have always refused to play the latest technology game. Whenever a new technology is introduced there is a media push to determine and publish who is using that technology. Technology is a wonderful thing, but not for technology's sake. The technology has to make sense for your company and fit your business need. We have to tread carefully as we evaluate new technology to make sure that it is defined enough not to be "bleeding edge"—to ensure that we are not getting in too early and to ensure that we maintain the flexibility to adjust to changing business needs.



Often, technology has been announced years before it is available in the market and, for a national or international company, before its ubiquitious availability in the market. What is available in San Francisco may not be available in Winston-Salem, N.C. The technology may never gain acceptance. ISDN, for example, has been utilized in niche applications but has never gained the widespread market position that was thought several years ago. OSI [Open Systems Interconnection] has been a concept for more than 10 years but has yet to take over the market. SMDS [switched multimegabit data service] may be overrun by ATM [asynchronous transfer mode] long before it is generally available.

This brings us to another consideration. Who bears that cost in a regulated environment for the [technology] investment? The most recent white paper published by the ICA [International Commuications Association] explored the economics of investment in the infrastructure. Should companies like the regional Bell holding companies invest in a "field of dreams" approach: If you build it, they will come. Who pays if they never come? Or should companies have the capability to invest to match market demand?

An ability that I picked up from [working for a] telephone company was the capability to understand tariffs. For several years, I have served as the chairman of the Telecommunications Subcommittee of the Carolina Utility Customers Association. CUCA monitors and intervenes as required in gas, electric and telecommunications filings within North Carolina. I firmly believe that users must take responsibility to get involved and ensure that they receive equitable rates in a timely fashion that do not artifically drive the market.

So, what happened to the average telecom professionals along the way? Different things, depending on their skill set and where they worked. Many found themselves poorly equipped to cope in this "brave new world" and lost their jobs. The long-touted voice versus data merger never really occurred, as both were absorbed into Information Resources in most companies.

The movement of information is becoming more critical in an increasingly complex world. I think that professionals who can somehow cut through the clutter of operability problems will have great career opportunities in the decade to come. I hope a good portion of the 25 positions on the advisory committee for the National Information Infrastructure will be people who buy the services.

I do believe that users are better off today than they were 10 years ago. There is an amazing array of technology, competition and choice in the marketplace. Users must continue to push to have their voices heard. We are, after all, the people who use the services. ■

SMITH
Bell Atlantic's CEO Discusses Convergence

Continued from page 25

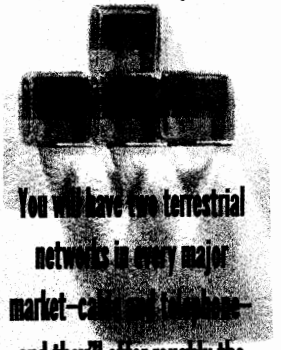
to be marketed. You will have two terrestrial networks in every major market—cable and telephone—and they'll offer roughly the same things. That's good. A duopoly [of two wireline providers], plus between three and six wireless networks, will give a great deal of variety and choice to customers.

So, the question is: How do you increase your footprint? Well, we couldn't buy another telephone company. If we could have, we might have, to increase our footprint. No company in this country is going to be successful unless it has a national brand.

When did I fully understand that we were going to have two terrestrial networks providing the same services? Two years ago. No company was going to be able to be a first-class information and communications company if it did not have the ability to package wired, w voice, data, video and imaging on a al platform with global connectio global partners.

Business users can expect to [merged Bell Atlantic-Tele-Comn tions Inc.] company that will provi vices across the United States. We of the dividend trap as a company means that we can operate much mc a company with higher levels of re and development, product develc and customer responsiveness. Th expect to see new innovations, esp the smaller and medium-sized busir that they would not have seen othe Large businesses will be less affecte small and medium-sized businesse we are going to try to deliver thes vices to before others do. They'll very aggressive company with exp investment into new technologies.

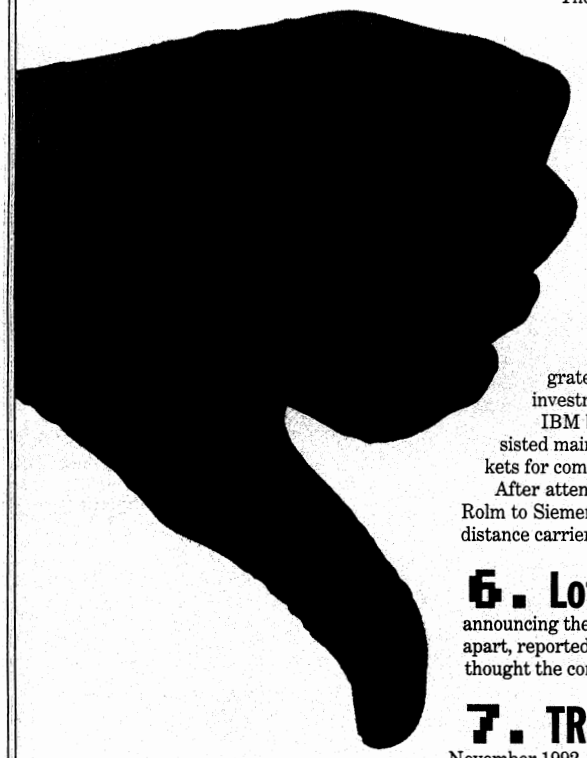
In the TCI territories, we'll be m into business services in the major kets, and we'll be offering those se through any number of our new subs ies. We're associated not just with



cable plant, but with Teleport [Comm cations Group Inc.] and companies of sort. Those are the kinds of things we'll be offering, systems integratio pecially. That's a part of our business we're expanding. Companies now coming to us and saying, "Can you tak this project?" There is no question longer, or there won't be when this closes, that we are a nationwide comp

This merger [Bell Atlantic and TC drawing alliance partners to the ex that would delight the soul of any CEO we will have alliances, joint ventures, search arrangements with any numbe companies that are going to provide capabilities. The imaging business I th is going to be a very big business, example, and can be delivered over platform.

We'll be both partner and competit with the other Bells companies. There's old phrase that says the definition of in ligence is being able to hold two conflict ideas in your mind at the same time. will be able to forge partnerships in c tain lines of business while we compete other lines of business. That's also sor thing new in the telephone company c tural mindset. ■



THE DECADE'S BIGGEST FLOPS...

1. SAA

IBM's Systems Application Architecture was a grand scheme to bring cohesion to IBM systems—PCs, minicomputers ar mainframes. But SAA bombed, at least in part because third-party developers chose to write their applications to more open environments.

Under the SAA banner, IBM introduced OfficeVision, a series of products intended to unify Big Blue's disparate office automation pack Yet the popular mainframe-based Profs package remained largely unchanged under OfficeVision, and new packages for PCs and LANs rec a dismal reception, forcing IBM to offer third-party software from Lotus Development Corp.

2. ISDN

Basic Rate ISDN has gained little market acceptance since it was first tariffed by Illinois Bell Telephone Co. in 1987. ' concept of providing two 64-kilobit-per-second bearer channels and one 16-Kbps signaling channel over a standard telephone line has alway a certain appeal. After all, ISDN's 144-Kbps capacity is more than 10 times faster than a standard modem. But users have not embraced Ba Rate ISDN for two key reasons: Service is not widely available, and ISDN hardware is relatively expensive.

3. Public Network Reliability

A number of infamous disasters in recent years shattered any illusion we once held about the invulnerability of the public telephone network.

The first was a fire, on Mothers' Day in 1988, that destroyed Illinois Bell Telephone Co.'s Hinsdale, Ill., central office. S customers served by that central office—a hub for 30 other exchanges—went weeks without phone ser Approximately 50,000 T1 lines terminated at the Hinsdale office. The fire caused Illinois Bell, other carriers and u to re-evaluate their network designs and contingency plans.

AT&T suffered some of the worst network failures in the company's 108-year history. The biggest occurre Jan. 15, 1990, when a software glitch led to a nine-hour service disruption. AT&T estimated that half the long tance, international and "800" calls attempted were not completed.

4. Manager of Managers

For years, users talked about finding a single network management system that could manage an entire multivendor network. A few products emerged that pretend to do this task—most notably, AT&T's Accumaster Integrator. As it turned out, however, most of these produ could only monitor a network, not manage it. One by one, users came to the realization that a true "manager of managers" might never emerge. Most seem to have given up on the idea.

5. IBM's Telecom Strategy

Hoping to grab a foothold in the anticipated market for in grated voice and data technologies, IBM purchased Rolm, a leading manufacturer of mid-sized PBXs, and made an equity investment in long distance carrier MCI Communications Corp.

IBM bought Rolm at the height of the PBX frenzy, when price cuts and discounting ran rampant. Rolm's customer base sisted mainly of small and medium-sized businesses that didn't fit well with IBM's high-end customer base. What's more, the n kets for computer-PBX integration and other integrated voice-data systems did not materialize.

After attempts to change Rolm's fortunes by making managerial and other changes, IBM eventually sold a controlling interes Rolm to Siemens AG. And IBM chose not to exercise its option to increase its investment in MCI, and sold its shares back to the l distance carrier.

6. Lotus-Novell Merger

In April 1991, Lotus Development Corp. and Novell Inc. startled the industry by announcing their intention to merge, making Novell a wholly-owned subsidiary of Lotus. About a month and a half later, the deal fel apart, reportedly because of conflicts over who would have control. The failure of the deal to go through disappointed many people v thought the combined companies would be an effective $1 billion competitor against Microsoft Corp.

7. TRIP '92

The Transcontinental ISDN Project 1992 was staged by the Bell companies and other ISDN advocates November 1992—ostensibly to demonstrate industrywide commitment to standards-based ISDN. Users, however, were soon disappointed to learn that two of the regional Bell companies, US West Inc. and Southwestern Bell Corp., had no plans to deploy software bas on the National ISDN-1 standards. That meant the much-touted "national ISDN" would only be available east of the Mississippi River.

8. System One

System One was an ambitious attempt by Eastern Air Lines Co. (which later became Texas Air Corp.) and Continental Airlines Holdings Inc. to develop a computer reservation system that would include enough bandwidth to let the airlines resell telecommunications services. The plan collapsed with the bankruptcy of Texas Air in the early 1990s. Continental Holdings eventually sold off most of the reservation-system technology to Electronic Data Systems Corp.

9. MAP/TOP

The Manufacturing Automation Protocol, developed by General Motors Corp. for manufacturing environments and the Technical Office Protocol, developed by Boeing Computer Services for technical and office environments, were the first implementati of the Open Systems Interconnection standard. MAP/TOP, however, was never widely accepted.

The technology was expensive because it required companies to replace existing hardware and software. GM, which was MAP/TOP's bigg cheerleader, didn't buy as much of the technology as it originally had promised.

10. Central-Office-Based LANs

In the early to mid-1980s, telephone companies tried to sell users on the co cept of central-office-based LANs. The idea was to provide PC-to-PC connectivity through the public switched network. The CO-LAN, howev was hurt by the fact that LAN decisions were not being made by telecommunications managers. Ethernet and token-ring technologies prevailed, and the CO-LAN disappeared.

...AND HOTTEST TECHNOLOGIES

1. E-mail

More than any technology since the invention of the telephone, electronic mail has changed the way business people communicate. The proliferation of interoperable E-mail systems and services has made it possible to send a message across the hall or across the world—and get a response in minutes or in hours, whichever is convenient.

E-mail has helped corporations flatten old management hierarchies and opened doors that used to be closed. E-mail's main drawback is a function of its success: Some users wade through hundreds of messages each day.

2. 10Base-T

Few standards have been adopted as rapidly or as widely as 10Base-T, which defines how Ethernet (802.3) runs at 10 megabits per second over twisted-pair wire.

During the mid-1980s, Ethernet typically was found only in engineering and factory environments, running over coaxial cable in bus configurations. In July 1987, the Institute of Electronics and Electrical Engineers began investigating the possibility of extending Ethernet beyond its bus architecture by creating star-and-hub topologies. 10Base-T was the answer.

The 10Base-T standard was deemed stable by March 1988 and passed by the fall of 1990. Among other things, 10Base-T brought structured wiring to the LAN environment, helping to solve the management mess caused by coaxial cable. Hub vendors Cabletron Systems Inc., SynOptics Communications Inc. and 3Com Corp. have thrived selling 10Base-T systems.

The IEEE is currently working on a standard to boost Ethernet speed tenfold, to 100 Mbps, potentially extending the lifespan of 10Base-T technology well into the future.

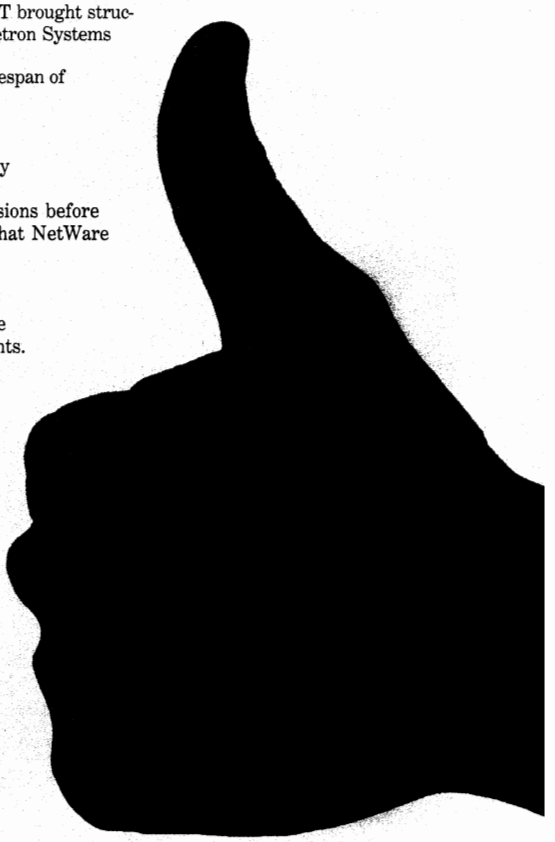
3. NetWare

Novell Inc.'s NetWare has evolved from a simple set of extensions to DOS to the most widely deployed LAN operating system in the United States.

Introduced in 1983, NetWare originally allowed simple sharing of files and printers. It went through several versions before offering a combination of features that appealed to a broad range of LAN users. Today, industry analysts estimate that NetWare accounts for between 60 percent and 70 percent of installed LANs.

4. Routers

Designed to link different types of LANs, routers have emerged as the linchpins in enterprise networks. The guts of routers are the routing algorithms and tables that direct LAN data between different network points. The Internet global network is a prime example of how routers let millions of users communicate, regardless of the kind of computers they use. Cisco Systems Inc., Wellfleet Communications Inc. and others have cashed in on the router's success. Router sales are expected to exceed $1 billion this year.



5. TCP/IP

TCP/IP, long a bastion of the scientific, engineering and government environments, has become the industry's fastest growing network protocol. Perceived by many users as the industry's only "open" transport protocol, TCP/IP has become the protocol of choice for multivendor, multiprotocol router networks. The popularity of the Internet has brought the protocol to sites that had never used it.

6. SNMP

One of the Internet Engineering Task Force's most popular standards is the Simple Network Management Protocol, which defines communications between network management systems and the devices they manage. SNMP, developed in the late 1980s and now in its second version, is used in most network management systems available on the market.

7. Switched 56-Kbps Services

For many users, switched 56-kilobit-per-second services have eliminated the need for costly dedicated lines. Affordable and widely available, switched 56 has become a staple in enterprise networks for data communications and videoconferencing. Carriers have built on the acceptance of switched 56 to offer switched 384-Kbps and switched T1 services.

8. Cell Switching

As data volumes continued to grow during the 1980s, it became clear that older LAN and WAN technologies eventually would have to be replaced with something better suited for high-speed, distributed networks. For many, the new technology of choice is cell switching.

In 1986, StrataCom Inc. introduced a precursor to the cell switch with its IPX "fast packet" multiplexer. By the early 1990s, the IPX was being used by such carriers as AT&T, Sprint and WilTel to offer frame-relay services.

Industry attention now is focused on asynchronous transfer mode. When the ATM Forum was formed in October 1991, there were four members. Today, there are more than 400. ATM-based products are not yet widely used, but many industry experts believe these products will be the foundation for tomorrow's multimedia networks.

9. Facsimile

The pace of business picked up with the advent and adoption of fax machines. No longer did companies have to wait for postal delivery. With fax machines, documents could be transmitted across town or around the world in seconds. Many organizations have begun to integrate fax capabilities right into PCs and LANs, making it possible to send a data file from a PC to a fax machine, or vice versa.

10. Windows 3.0

Introduced in 1990, Microsoft Corp.'s Windows 3.0 gives users point-and-click access to an array of applications—including those that reside in systems other than the user's PC.

In fact, Windows 3.0 was full of bugs. It was the next release, Windows 3.1, that users embraced. Either way, Windows applications are generally easy to use on networks. And because Windows 3.0 has built-in network interfaces, software developers can write Windows applications without worrying about network connectivity.


CommunicationsWeek

Back Order Delivery Problems Are Plaguing Bell Regionals

FCC Affirms Its Move To Delay $2 Access Charges

United Telecom Expresses Interest In CSO


CommunicationsWeek

A Looming Challenge For Enterprise Networks

Covia Rejects IBM NetView

Fiber LAN Standard Stalled

ISDN Trial's Tribulations


COMMUNICATIONS WEEK

New Breed Of Net Mgm't Applications

Prepare For Gigarouters

Does Econ Connect?

New 3Com Router To Include High-End Features, Low Price


CommunicationsWeek

Low Price to Drive Compaq Server Push

NetWare Users React To Security Threat

100-Mbps Ethernet? Start-Up Says 'Yes'

Novell Routes Over SNA

Users Hit Snags Deploying OSPF

THE PAST: *The look of Communications Week has changed a number of times. Above are front-page reproductions from 1984, 1989, 1991 and 1992.*

The History of Communications Week

In 1983, as AT&T's divestiture approached, entrepreneurs knew an unprecedented opportunity was coming their way. Among them was a handful of people at CMP Publications Inc. who realized that the communications industry would need a newspaper to guide it though the chaos that was about to follow.

CMP launched *Communications Week* in January 1984. The premiere issue set the tone for the kind of coverage that would follow over the next couple of years. It was rife with stories on the aftershocks of divestiture: AT&T scrambling to keep service levels up; local exchange carriers eyeing new lines of business; vendors positioning to supply voice and data equipment to whomever needed it; users sorting through the options; and regulators trying to manage the new environment.

"Everybody got caught up in the excitement of the industry," says Paul Travis, *Communications Week*'s managing editor, domestic, at the time and now a contributing editor to *Communications Week*'s sister publication, *InformationWeek*. "Hard news was our forte, and there was plenty going on to report."

As in any business, the key to *Communications Week*'s success has been its people. None of the editors who launched the publication is still with it, though many remain with the parent company, CMP.

Al Perlman, *Communications Week*'s editorial director in 1984, is now publisher of *Network Computing*, a CMP publication. Elliot Kass, managing editor, international, in 1984, is with *InformationWeek*. Laurel Nelson-Rowe, Karen Lynch and Bob Violino, reporters in 1984, now work for *Open Systems Today*, *CommunicationsWeek International* and *InformationWeek*, respectively. And Barbara Kerbel, a reporter in 1984, is now director of corporate communications with CMP.

Many other *Communications Week* staffers have moved on to other positions of influence in journalism. John Keller, a senior editor when *Communications Week* was launched, now covers telecommunications for *The Wall Street Journal*. Tim Race, who left as executive editor in 1989, is business technology editor for the *New York Times*. Stanley Gibson, a department editor when he left in 1992, is now department editor of networking for *PC Week*.

Today, with 35 people, *Communications Week*'s editorial staff is the biggest it has ever been, and it has the broadest technical background. The current team has largely been assembled by editor in chief David J. Buerger, who joined *Communications Week* in 1991. Buerger reports to *Communications Week*'s publisher Beth Ruffenach.

Communications Week has changed in step with the industry. In the mid-1980s, the focus turned to large users, as network managers began to build T1 backbones to carry voice and data traffic.

By the late '80s, it was clear that data networking was going to be the challenge of the '90s. *Communications Week* always had covered data connectivity—the premiere issue included a "Data Communications and Networks" section. By 1989, however, data networking became our primary focus, and the "Computer Networking" section was created and positioned at the front of the paper, immediately following the news section.

In the early '90s, as network managers became increasingly preoccupied with LAN internetworking, *Communications Week* redoubled its coverage of hubs, bridges and routers. It was not uncommon for *Communications Week* to report on a new product development months before the company was prepared to announce it.

In 1993, it became increasingly clear that network managers were grappling with two new trends: networked applications and mobile computing. *Communications Week* responded by moving its "Applications" section to the front of the newspaper (immediately following "Top of the News") and adding three subsections: "Workgroup," "Enterprise" and "Databases and Tools." And late in the year, we added a "Mobile Computing" section.

If *Communications Week* was at the right place at the right time in January 1984, it seems equally well positioned today. The enterprise network, *Communications Week*'s raison d'etre, increasingly is being recognized as a key to corporate success. The network no longer is merely a support function for information systems—it has become a strategic force in its own right. The need for information about networking is greater now than it ever has been.

Recognizing this trend, other trade newspapers and the general press have stepped up their coverage of network technologies and issues.

No history would be complete without a few anecdotes. My favorite is of the time a senior member of the editorial staff fell asleep during a one-on-one interview with a vendor. That editor is no longer with the publication, though no cause-and-effect should be drawn.

Another is the time *Communications Week* enjoyed 15 seconds of fame with a nationwide TV audience on "Saturday Night Live." During his news-roundup skit, comedian Dennis Miller held up a copy of *Communications Week* that had been mailed to him, with the headline "Miller Elected Wang Head." The story was about Wang Laboratories Inc.'s president and CEO Richard Miller.

As *Communications Week* enters its second decade, our challenge is to sort through the overwhelming amount of information that is being generated and report on it in a way that adds value for network managers. If it is anything like the past 10 years, our next decade promises to be a lot of hard work and loads of fun. We hope you'll stay with us along the way.

—John Foley
Executive Editor


COMMUNICATIONSWEEK

Sprint Takes Lead in ATM Service Race

Leaders Ally to Meld NetWare, Hubs & ATM

SunConnect To Use DME As a Model

DEC Targets Work Groups

Users Skeptical of Mega-Merger Payoff

THE PRESENT: *The newspaper's current design.*

What Divestiture Has Wrought

AT&T & Bells emerge strong from the upheaval

By JOHN T. MULQUEEN

AT&T and the regional Bell holding companies are poised to be leaders in the coming age of interactive, multimedia communications, but 10 years ago they had far different images.

Then, they were little more than telephone companies—bureaucracies with reputations for substandard service and slow responsiveness. Indeed, the year 1 A.D. (After Divestiture) produced a litany of complaints about degraded service from AT&T and the liberated Bell companies.

In June 1984, after six months of complaints from corporate users of miscues and confusion, *Fortune* magazine asked "AT&T: What Was It We Were Trying To Fix?"

By Dec. 3, 1984, *Business-Week* asked "Did It Make Sense to Break Up AT&T?"

Two weeks later, *The Wall Street Journal* reported "A Year After . . . The Benefits Mostly Remain Elusive."

There was substance behind the headlines. In October 1984 there was a backlog of some 40,000 private lines that users ordered but couldn't get from AT&T.

And service was not always reliable over the lines they could get. Thomas Maile, vice president of telecommunications at CBS Inc., remembers that the company he worked for in 1984, Equitable Life Insurance Co., had to abandon several T1 lines between two U.S. cities because "we could not get them to stay up."

AT&T was unable to explain the problem, he said. "No one had very good diagnostics then. We narrowed it down to a 200-mile segment but we could never tell if the problem was in the local loop or the [AT&T point of presence] or what," he said.

Barry Zweibel, vice president of telecommunications at the Chicago Mercantile Exchange, said that the provisioning of DS-0 circuits took from six to eight weeks in 1984. Today, it's about four weeks, he said.

Turnaround

It is a measure of how much things have changed in 10 years and how AT&T's reputation has improved that *Fortune* last year asked "Could AT&T Rule The World?" *BusinessWeek* is so enamored of AT&T Chairman Robert Allen's aggressive acquisition program that it dubbed him "800 Guts" in a cover story this year.

The upbeat headlines simply reflect the common assessment that Allen and his managers have transformed AT&T into one of the most powerful companies in the world. It is involved in everything from computers and telecommunications to cable television, wireless technologies and multimedia.

The regional Bell companies, meanwhile, have taken on their own identities and strategies, making it increasingly difficult to treat them as a group.

At the same time, all of the Bells are looking to broaden their revenue bases away from the slow-growing local telephone markets, which are becoming increasingly competitive. They have done so by investing in telephone companies overseas, expanding their cellular operations both domestically and internationally, and most recently by investing in cable television companies, whose revenues are growing faster.

Slow Going

There have been plenty of false starts and stops for AT&T and the Bell companies.

For instance, skeptics point out that AT&T's computer business, despite the acquisition of NCR Corp. for $7 billion in 1991, is still a disappointment. There are even those who believe that AT&T paid too much last year when it moved to acquire McCaw Cellular Communications Corp. for $12 billion.

Charles Nichols, a Boston-based money manager who predicted five years ago that AT&T was becoming the "sugar daddy" of the industry by paying top dollar for questionable properties, is even more skeptical today. "From a purely financial perspective it it is difficult to justify some of these thing on a three-to-five-year basis," he said.

But that is a minority view. Allen is generally admired for the job he has done in turning AT&T around since he became chairman in 1988. He did it by creating business units whose managers were held accountable for profitability, hiring talented outsiders where necessary, writing off $6.7 billion worth of analog equipment in 1988, and laying off thousands of workers.

Those moves led to the most profitable year in AT&T's history—1991, when the company earned $2.8 billion.

Financial analysts are optimistic about AT&T because it seems well positioned to raise prices while cutting costs. Last year, for instance, AT&T raised rates twice, despite a $250 million reduction in the access costs it pays local exchange carriers. Many expect AT&T will use McCaw's cellular network and alternative access carriers such as Teleport Communications Inc. to further reduce its access charges by bypassing local exchange carriers.

An economic upturn could also increase traffic on AT&T's network. Add to that the opportunities in international markets, strong sales of telecommunications equipment, and the financial benefits of getting into the fast-growing cellular communications market and AT&T's prospects look good.

"From a strategic point of view AT&T is still well positioned," said Nichols. "It can cut costs more easily than MCI Communications Corp. and Sprint, and everybody wants to be aligned with it because it is so powerful."

Investments in small companies such as Eo Inc. ensure that AT&T "will participate in all the technologies that feed the pipeline," he said.

Telecom-Heavy?

Analysts point out that AT&T is still heavily dependent on its telecommunications business. Reingold notes that long distance services account for 80 percent of AT&T operating income.

AT&T revenues from long distance services have grown 35 percent from $15.8 billion in 1984 to $21.5 billion at the end of 1992. Analysts estimate 1993 long distance service revenues at about $22.5 billion.

By comparison, MCI's revenues jumped to $10.6 billion in 1992 from $1.7 billion in 1984 and Sprint's revenues rose to $5.7 billion from $1 billion in those same years.

AT&T's share of the interstate market dropped to 60 percent today from 80 percent at the end of 1984, according to the FCC. MCI's has about 20 percent of the long distance market; Sprint, 12 percent.

One of the major threats AT&T may have to deal with could come from its former subsidiaries, the Bell operating companies, according to Michael Kennedy, an analyst at Arthur D. Little Inc., Cambridge, Mass. The Bells could skim off very profitable traffic that now goes to AT&T by building regional long distance companies to serve major cities in their service areas, he said.

But they would need permission from U.S. District Judge Harold Greene or Congress to be able to provide long distance service, even on a regional basis.

CBS's Maile said that if such permission were granted, he would favor long distance service from a Bell company. "This is all a commodity, whether it is long distance minutes or data-circuit miles, and there is no reason we should not get it for the best price we can," he said. "If the quality of service is there and the price is right, I would have no

Divest, *page 64*

AT&T, THE BELLS AND GTE: THEN AND NOW

AT&T, the regional Bell holding companies and GTE have been among the most acquisitive corporations during the past decade. With revenue bases in the billions, these companies have not been afraid to reach around the globe to buy companies in whole or in part.

AT&T

	Dec. 31, 1983	Dec. 31, 1984	Jan. 1, 1994
Revenues	$70 billion	$60.3 billion	$66 billion
Employees	964,000	365,200	373,000

Major deals: Paradyne Corp. (1989), EasyLink (1990), NCR Corp. (1991), McCaw Cellular Communications Inc. (pending)

Ameritech

	1984	1993
Revenues	$8.4 billion	$11.4 billion
Employees	77,514	67,000
Access lines	14.3 million	17.3 million

Major deals: *Applied Data Research (1986), CyberTel Financial Corp. (1991), ** Hungarian PTT (1993)

Bell Atlantic

	1984	1993
Revenues	$8.09 billion	$12.9 billion
Employees	79,500	73,200
Access lines	14.7 million	18.5 million

Major deals: *CompuShops (1985), Tele-Communications Inc. (pending)

BELLSOUTH

	1984	1993
Revenues	$9.5 billion	$15.9 billion
Employees	96,000	97,000
Access lines	14.04 million	19.2 million

Major deals: Mobile Communications Corp. of America (1989), †RAM Mobile Data Inc. (1991), **QVC Network (pending)

NYNEX

	1984	1993
Revenues	$9.5 billion	$14 billion
Employees	94,900	79,425
Access lines	13.2 million	15.7 million

Major deals: *IBM Product Centers (1986), ††AGS Computers Inc. (1988), **Viacom International Inc. (1993)

PACIFIC TELESIS Group

	1984	1993
Revenues	$7.8 billion	$10.3 billion
Employees	76,881	60,000
Access lines	11.1 million	14.8 million

Major deals: Communications Industries Inc. paging and cellular properties (1986), five cellular properties (1987)

Southwestern Bell Corporation

	1984	1993
Revenues	$7.2 billion	$10.6 billion
Employees	71,900	60,200
Access lines	10.6 million	13.2 million

Major deals: Metromedia Corp. (1987), *Mobile Media Paging Systems (1993), Cox Cable Inc. (pending)

USWEST

	1984	1993
Revenues	$7.3 billion	$10.8 billion
Employees	70,765	61,000
Access lines	10.9 million	13.7 million

Major deals: **Time Warner (1993)

GTE

	1984	1993
Revenues	$13.5 billion	$20.7 billion
Employees	185,000	130,000
Access lines	12 million	17.2 million

Major deals: Southern Pacific Communications Corp. (1983), Southern Pacific Satellite Co. (1983), *GTE Sprint (1986), *GTE Telenet (1986), Contel Corp. (1991)

NOTE: All deals were acquisitions unless otherwise noted. * Subsequently sold ** Partial investment † Joint venture †† Some divisions subsequently sold

Source: Communications Week Chart by Doren Berge

PREVIEW
Downsizing to Drive User Efforts in '94

Continued from page 57

can centralize data and have just one support staff to take care of it, why would you have multiple machines [at multiple locations]?" said William Nowacki, division director for systems and planning at the American Medical Association, Chicago.

Middleware products—communications software that fits between applications and the underlying operating systems and networking protocols—will become a key enabling technology, observers said.

Additionally, this will be a key year for workflow and workgroup software products that distribute data to specific users, , said Ronnie Marshak, editor of the *Workgroup Computing Report* at the Patricia Seybold Group, a Boston-based consultancy.

Marshak said a lot of workflow features and functions, including conditional and sequential routing, now found in dedicated workflow products will become part of other mail-enabled desktop applications.

The underlying E-mail infrastructure will play an important role. Vendors are expected to improve addressing, directory synchronization, ease of use, scalability and interoperability.

Pilot Networks

Users also said that more and more companies will build pilot networks this year to test multimedia applications on LANs, preceding efforts that encompass the enterprise.

"We will probably look for multimedia storage on our LAN and give people access to sound and video," said Dan Keane, director of safety and security at Sterling Winthrop Inc., a New York-based pharmaceutical company currently running a multimedia pilot.

Also, new, affordable video conferencing systems for desktop computers are being introduced by traditional PC vendors.

LAN Trends

To support client/server and other emerging applications, users are expected to begin deploying new network, as well as desktop, operating systems.

The new breed of operating systems, such as Novell Inc.'s NetWare 4.x, Microsoft Corp.'s Windows NT and IBM's OS/2, offer support for more heavy-duty applications, sophisticated directory services and simplified management schemes.

More network features will continue to creep into PC operating systems. But the new operating systems, which have multitasking capabilities and use 32-bit processing, come at a price: PCs must have the fastest processors, large amounts of hard-disk storage and RAM to run the operating systems.

Unix Interoperability

Unix vendors will continue their efforts for interoperability on two fronts this year—for interoperability between Unix versions themselves as well as with traditional PC operating systems.

As it relates to the network infrastructure, many issues remain unresolved as well. A variety of fast desktop connection options exist, such as 100-megabit-per-second versions of Ethernet, 100VG AnyLAN, and ATM, but few users say they're ready to commit to high-performance LAN delivery to all users' desks.

"There's not one correct path—too much keeps coming out," said John Chapman, senior technical consultant for Planning & Technology in Information Systems, Amoco Corp., Chicago.

Source: Communications Week

The same is true for the internetworking market, which also is expected to be the hottest networking industry segment in terms of acquisitions, mergers and new stock offerings, according to industry analysts.

Life Extensions

Next-generation products provide users with much needed extra bandwidth at modest cost increments and let them preserve and extend the life of their existing internetworking equipment, according to Charles Robbins, director of communications research at the Aberdeen Group Inc., a Boston-based consultancy.

The trend to maximizing investment with stable technologies also will occur on the wide area networking front, particularly with frame-relay and ISDN products and services, once again downplaying ATM. These products will not only be used to interconnect LANs, but also legacy mainframe computers into sprawling enterprise networks.

"In 1994 some vendors will take a contrary position regarding ATM. Users are not leaping forward to new technologies, but are leaping back to technologies that have already established and proven themselves," said Thomas Nolle, president of Cimi Corp., Voorhees, N.J.

The size of frame-relay networks will grow from about 40 sites to about 100 during this year, noted Richard Malone, principal with Vertical Systems Group, Dedham, Mass.

"Just when the industry was ready to do a post mortem on ISDN in the United States, the patient will get off of the bed and run down the street," said Ryan James, analyst for the Yankee Group, Boston. "All the attention paid to ATM will give rise to people who are willing to buy ISDN today."

"The hype of ATM put everyone in a holding pattern where it is going and to s really the next product going to be here for a lon said John Faccibene, ser president of Garban Ltc York. "If that turns out t case, then I believe there a mass exodus over to A

Carriers and equipme viders seeing the opp will continue to announc products that show the m starting to mature.

Mobile Computing

Another area where us likely experiment with ne eration products while more mainstream ones is computing.

Several companies are ed to announce new p digital assistants, while will improve the enterpri working connections for e ones. Much of the b though, will focus on n computers and softwar both wired and wireless s to connect those users int prise networks.

In terms of giving use control of enterprise ne this year will be a year of dation of and communicat tween existing products. N management applications pected to be a major hot

"The platform business i to be less discussed in 1994 was in 1993," said Abe Robbins. "The issue will how good are the applicati how tightly coupled are th

"Vendors have a lot c products out there," sa Queen, director of enterpri working for Enron Gas S Co., Houston. "Now they'r to have to work on getting t talk to each other." ■

DIVEST
What Divestiture Has Wrought

Continued from page 61

problem with that."

"It makes sense," said Zweibel at the Chicago Mercantile Exchange.

Kennedy said that Nynex Corp. would go after the Boston to New York traffic; Pacific Telesis Group, the California market; Southwestern Bell Telephone Corp., the traffic between cities such as St. Louis and Dallas, and so forth in each region.

Indeed, Peter Sarelli, telecommunications manager at Brown Bros. Harrriman and Co., a New York-based investment brokerage, said he is waiting for Nynex to include a long distance connection to Boston in its Enterprise Network Services offering.

As perhaps the first step toward becoming a regional carrier, Nynex last year began marketing all of its services under the "Nynex" label. Previously, Nynex subsidiaries New England Telephone & Telegraph Co. and New York Telephone Co. marketed their services separately.

Other Bell regionals certainly plan to be in the long distance business. Ameritech has asked for permission to offer such services in its region. And PacTel Corp., the cellular mobile arm of Pacific Telesis Group, said that it may connect its customers across LATAs (local access and transport areas) using a microwave network or an exclusive contract with a long distance carrier.

PacTel will have to wait until it is spun off by Pacific Telesis in the middle of this year before it can legally do that.

Jay Batson, an analyst with Forrester Research Inc., a Cambridge, Mass., consultancy, predicts it will be a long time before the Bells win permission to offer long distance services. They would be better off competing against each other in the local services market by using the new cable TV networks they are buying or investing in, he said.

For example, U S West Inc. will announce within 9 months that it will offer frame-relay and high-capacity voice trunk service to businesses over Time Warner's fiber optic network, according to Batson. U S West owns 25 percent of Time Warner.

Other Bell regionals, such as Bell Atlantic Corp., will do the same through their investments or acquisitions of cable companies, Batson predicted. Bell Atlantic, Philadelphia, last year announced plans to buy Tele-Communications Inc., Englewood, Colo., for $32.5 billion.

The need to diversify operations has also led the Bells to make major investments overseas in cable operations, cellular companies and even local telephone companies.

For example, Nynex owns or has an interest in 19 cable TV companies in the United Kingdom, making it the largest cable company in that country. Nynex and BellSouth Corp. are trying to buy into the television programming business through investments in Viacom Inc. and Paramount Communications, respectively.

And Southwestern Bell is Cox Cable Co.'s partner in cable operations in both the United Kingdom and the United States.

Elsewhere, Southwestern Bell owns 10 percent of Telefonos de Mexico. Bell Atlantic and Ameritech and two local partners bought Telecom Corp. of New Zealand Ltd. for $2.4 billion.

The international inve and acquisitions by the Be panies were matched by activities in the United S

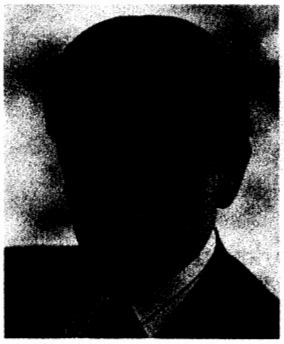
Ameritech, one of th aggressive companies i area, paid $215 million in 1 Applied Data Services, th it two years later to Co Associates Inc. for $170 r

The Bells have also inve computer stores, PBX di torships, software deve consulting, market resear real estate.

GTE Corp., Stamford, seems to have learned the to concentrate on the tel service business it knows b has sold its long distance tions, its equipment mar turing business and its li products operations. In 1 acquired Contel Corp. in billion merger, until the largest merger in the hist the industry. ■

NETWORK APPLICATIONS

Client/Server and PBX-to-Computer Applications, Databases, Multimedia, Videoconferencing



Taligent, Inc.

Tellabs

GUGLIELMIS: *Their lives mirror changes in the computer industry.*

BROTHERS IN NETWORKING

By JOHN T. MULQUEEN, Manhasset, N.Y. • Joseph and Peter Guglielmi are brothers whose résumés are virtually road maps of the turns taken by the computing and telecommunications industries in the past 10 years.

The sons of an Italian immigrant who came to this country when he was 17 years old and is now retired in Italy, the Guglielmis are also prime examples of the classic American success story.

By Way of Background

Joseph is chairman and chief executive officer of Taligent Inc., based in Cupertino, Calif. A lifelong IBMer, he joined Taligent when it was formed in 1991. At 52, he is the older brother.

Taligent is a joint venture between IBM and Apple Computer Inc. that is developing a new computer operating system.

Peter, 50, is the chief financial officer of Tellabs Inc., Lisle, Ill. The company is one of the leading suppliers of digital cross-connect switches, T1 multiplexers and other switching and transmission equipment for carriers and private companies.

Peter is also the president of Tellabs International Inc. and Tellabs Communications Canada Ltd., both of which are subsidiaries of the parent company.

Peter began his career in 1962 working for Bell Laboratories

Brothers, *page 87*

Lotus: From 1-2-3 to $1B

By SAROJA GIRISHANKAR

Few start-up ventures can boast the kind of success that Lotus Development Corp. has had in the past decade.

From a shoestring operation with eight employees and $1 million in venture capital in 1982 to a booming company with more than $1 billion in sales this year, Lotus' success has been largely driven by the company's shrewd business and product strategies. The company has successfully taken advantage of the PC boom in the early 1980s and, unlike many of its contemporaries in the PC software business, it has tracked the emergence of networking technology in the late 1980s and early 1990s.

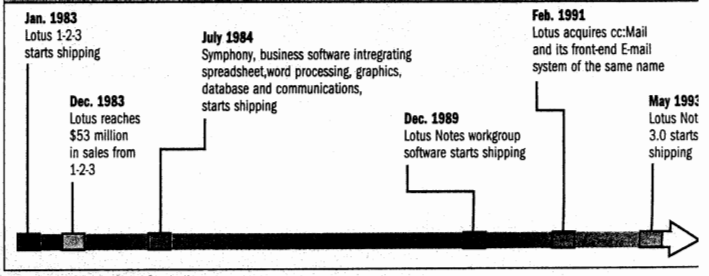
"We were largely a single-product company in the '80s and our growth to a $500-million company by the end of the decade was driven by the explosion in the shipment of PCs," said win Gillin, chief financial off at Lotus, Cambridge, Mass.

Its first and most popular p uct has been the Lotus 1 spreadsheet. Edwin said Lotus 3 raked in $53 million in sale 1983, the first year it was availa

Lotus, *pag*

LOTUS MILESTONES

Lotus Development Corp.'s first major success in the PC software industry was delivering seminal applications for the mass market and now recently in helping to define a new class of software, the workgroup application with its Notes workgroup management and messaging software.



Source: Lotus Chart by Cheryl Gormandy

Distributed Apps Pose Challenge

By JOHN COX

Distributed applications that exploit desktop computers, multiple servers and wide area networks are still in their infancy, and MIS groups that are working on them still face daunting challenges.

To meet the promises of distributed applications, MIS workers will have to take a more systematic and strategic view of distributed technologies and how these technologies will affect the total business organization, according to industry experts.

One of the driving forces for distributed applications has been the explosion of desktop computing power. "The driver is price-performance," said Aaron Zornes, vice president of application development strategies at The Meta Group Inc., a Westport, Conn.-based market researcher. "As corporations downsize [applications], they have to distribute the processing more than they did in the past."

Using the Network

Distributing means using the network and that means rethinking applications. "The term 'client/server' is really a misnomer," said Myke Miller, a manager with Chicago-based Andersen Consulting, who has finished shifting a large m frame application onto a cli server framework. "It's re 'client/network/server.' You l to think of the network as pa the [total distributed] soluti

Ironically, experts said, very network technology makes distributed applicat possible has been their big stumbling block. "What's hol back client/server computing is poor network implementati network traffic [loads], and many [old] PCs," said Rob I president of Database Server tems Inc., a South San Franc based systems integrator.

The result so far, accordin Bolt, has been distributed a cations that focus rather nar ly on one-to-one communicat between one client and one s er. "The next big step is dist uting the application logic ac numerous machines," he s "Conceptually, the vision pe have is . . . [a collection] of di ent machines with different c

Apps, *pag*

E-Mail Evolves Into Integral Network Tool

By TORSTEN BUSSE

Ten years ago, few businesses were using electronic mail. Face-to-face meetings, the telephone and traditional mail dominated.

In 1984, electronic mail was a slow, little-understood mainframe- or minicomputer-based communications tool that limited users to intracompany communications—more of a high-tech novelty than an effective business tool.

"In 1984, people didn't understand what electronic mail was," said E-mail pioneer Walter Ulrich, co-founder of the Electronic Mail Association and director at the Los Angeles branch of Cambridge, Mass.-based Arthur D. Little Inc., a systems integrator and consultancy.

"Back then, E-mail was terribly unfriendly. It was slow, and you were storing messages, rather than sending them," Ulrich said.

In the early 1980s, IBM's mainframe application, Profs, dominated the E-mail scene, not because people loved it, but because it was the only game in town. LAN-based E-mail market leaders—Lotus Development Corp.'s cc:Mail, WordPerfect Corp.'s Office and Microsoft Corp.'s MS Mail—didn't even exist, and electronic data interchange and directory synchronization weren't even issues.

Ten years later, things are radically different. Some E-mail users don't even depend on a wired connection anymore. Almost half of all PC users are networked and move around in a globally inter- and intraconnected E-mail world.

In 1984, analysts counted only

E-Mail, *page 82*

In Brief

UNIX-NETWARE E-MAIL BRIDGE

Computer Mail Services Inc., Southfield, Mich., is now shipping version 2.0 of its S-Bridge gateway to connect Novell Inc.'s NetWare Message Handling Services to Unix Simple Mail Transfer Protocol-based electronic-mail programs. With the new version, users can add multiple attachments to a message. The software supports NetWare MHS 1.5 and NetWare Global MHS 2.0. Version 2.0 sells for $2,999. (313-352-6700.)

E-MAIL COMM GATEWAY

Wolf Communications Co., Houston, this month will launch its WorldCom international public communications network, which connects users of Lotus Development Corp. Lotus Notes and cc:Mail, and, via X.400, connects users to the Internet. Companies with multiple servers will be charged $28.50 per hour of connect time; single-server access is $50 a month for 100 minutes of connect time. (800-774-2220.)

E-MAIL FILTER FOR CC:MAIL

E Ware, a division of Visual Cybernetics Corp., New York, next month will ship its eNote application, which lets users of Lotus Development Corp.'s cc:Mail filter and route messages. eNote, priced at $49, also offers text-to-speech capabilities. (800-743-8645.)

FORMS APP TOOL UPDATED

Brio Technology Inc., Mountain View, Calif., is now shipping version 2.0 of DataEdit, its client/server application development tool. DataEdit lets users of Apple Computer Inc. Macintosh and Microsoft Corp. Windows build forms-based applications for networked Structured Query Language-based databases. DataEdit has been available for the Macintosh since last May. Version 2.0 is the first release for Microsoft Windows. (415-961-4110.)

Videoconferencing Is Poised for Growth

Conferencing systems will come of age over the next decade

By MARGIE SEMILOF

Emerging desktop video and data conferencing systems may finally get the respect that traditional videoconferencing hardware could never earn when they were costly, room-based units.

PC conferencing products from companies like Compression Labs Inc., IBM, PictureTel Corp., Sun Microsystems Inc. and others are making it possible and more affordable for large companies to reach small locations or individuals on their workstations or PCs.

Many experts agree that the desktop presents the most potential in terms of offering the right medium for workgroup video applications. "You could only bring people to the meeting rooms for so long," said Richard Doherty, director of Envisioneering Group, a Seaford, N.Y.-based product test lab.

The next wave of videoconferencing products, which will be software-based and run on commodity hardware, will change the whole model for success in videoconferencing, Doherty said.

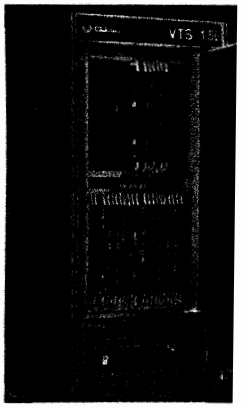
There have been videoconferencing products as far back as the mid-1960s, but the first hardware was large and cumbersome. The primary users were big corporations or government agencies who could justify spending hundreds of thousands of dollars for a dedicated videoconference room.

A wave of smaller, less expensive products emerged in the mid-1980s from companies such as Compression Labs, PictureTel, Sony Corp. and a host of others. These systems, which used robot cameras, still had to be mounted in a conference room and connected by satellite or T-carrier.

"If you were Ford Motor Co., you had your three systems, and that was it," Doherty said.

CLI introduced the first commercially viable videoconferencing product in 1980 when it unveiled the VTS-1.5 coder/decoder (codec) which required connections of 384 kilobits per second to 2.048 megabits per second. CLI's algorithm became the basis for some of today's compression standards.

A traditional drawback to videoconferencing products was the inability to communicat one another. However, late 1980s, vendors began ing codecs that supporte proprietary and ITU-T



VTS-1.5: *CLI's first codec w size of a small refrigerat*

Video, *p*

APPS
Distributed Apps Pose Challenges

Continued from page 78

bilities, with applications and operating systems smart enough to split up code around the network."

This step will require, some experts said, a corporate information systems architecture that uses a message-based communications layer—dubbed middleware—comprised of programming interfaces that can automatically handle the connections between applications on multiple network nodes in a multiprotocol environment.

With such a layer, corporate MIS can deploy applications that are independent of specific vendor's solutions.

But fully embracing distributed applications will require more than mere technology. It will require major changes not only in MIS groups but within the corporations they serve, experts said. To be able to take that step, some companies will have to spend much more for staff training; forgo the security blanket of relying on a single large vendor to give them cradle-to-grave support; and rethink how the company does business.

"The implementation level is a real headache," said John McCarthy, director of technology programs with Forrester Research Inc., a Cambridge, Mass.-based market researcher. "The benefit is that you get the to choose different products, but the cost is you have to make all the choices work for you."

Users will simply have to live with more risk. "When you think about distributed computing, you can think about all the things that aren't there: security, network management, system management and so on," said Cary Serif, manager of distributed technologies, Huntington Bancshares Inc., a regional bank holding company based in Columbus, Ohio. "If you want that, you have to do these things yourself, and they cost a lot, or you have to accept the business costs [of not doing so]." ■

GUIDEPOSTS FOR DISTRIBUTED APPS

Some recommendations for users who want to deploy distributed applications:

- **Identify and rate** the business risks associated with each application.
- **Apply existing staff** skills, and retrain where needed.
- **Rethink and rework** established business processes.
- **Create an applications** architecture that is vendor-independent.
- **Plan on upgrading** network connections, support and management.

Source: Communications Week

E-MAIL
E-Mail Evolves Into Integral Net Tool

Continued from page 78

about 1 million E-mail users; in 1993, they estimate that more than 20 million people use electronic mail to communicate and conduct business.

The growing popularity of the Internet, which experts say carried half of the 1.1 billion E-mail messages transmitted last year, is one reason why E-mail use has risen. "The Internet is beginning to capture a tremendous market share," said Steve Glagow, director of electronic messaging at BIS Strategic Decisions, Norwell, Mass.

In 1993, BIS estimated that only half of all intercompany messages were transmitted by private E-mail carriers such as AT&T or MCI Communications Inc. The remaining 545 million messages probably were transmitted over the Internet, which amounts to $430 million in lost revenues for private carriers, Glagow said.

For many, however, E-mail is more than a convenience—it is a necessity. "I don't know how a modern consulting firm could exist without E-mail or voice Ulrich said, noting that E- critical for someone who ways traveling and dealin many customers simultan

Although its acceptanc longer than expected, ob said the definition of the standards in 1984 and 1988 move the industry forwar

"The X.400 standard the promise of intercon disparate E-mail system rich said.

What's Still Needed

While it has become easie different E-mail systems means have we reached a world, users said.

"We need more coo between the players," s Gilbert, director of info services at The America leum Institute, Washingt need better addressing. easier and bigger directo need to be able to move over X.400 backbones encryption and security. need better and scalable ment tools."

Looking ahead, analy dict that E-mail will be parent and integral pa networking infrastructu E-mail applications emb PC and network operat tems and accessible fro any desktop application

NETWORK APPLICATIONS

DATABASES & TOOLS

In Brief

EXPANDED DB SUPPORT

Cognos Corp., Burlington, Mass., is now shipping Impromptu 2.0, a new version of its Structured Query Language-based querying and reporting tool. The upgrade provides links to Information Builders Inc.'s Enterprise Data Access/SQL and Micro Decisionware Inc.'s Database Gateway. Prices for Impromptu 2.0 start at $495. (800-426-4667.)

PUMPING UP

Trinzic Corp., Portsmouth, N.H., last week released InfoPump 1.1, a new version of its data routing and connection software to Lotus Notes. The upgrade will provide network connectivity to Banyan Systems Inc.'s Vines and Digital Equipment Corp.'s PathWorks networking protocols and access to IBM's DB2/2. It runs on an IBM OS/2 server and costs $25,000. (800-952-8779.)

Middleware Tool Has Workflow Manager

By JOHN COX

NEWPORT, R.I. A new message-based application-development product incorporates a workflow manager to seamlessly connect client programs with multiple IBM mainframe databases.

Early, Cloud & Co.'s Message-Driven processor (MDp) acts as an intelligent communications layer between client and server programs. Like other middleware products, it offers a set of interfaces that eliminate the need for developers to write communications code for different protocols.

Many middleware products focus on shipping messages between client and server programs, said Edward Boulay, director of marketing for Early, Cloud, based here. MDp goes further: It accepts simple requests from clients running IBM's OS/2 or Microsoft Corp.'s Windows, breaks the requests down into separate tasks and routes these to multiple back-end servers. MDp then collates the results and ships back a single response to the client.

MDp runs on MVS mainframes with IBM's CICS transaction monitor.

MDp accepts simple requests from clients, breaks the requests down into separate tasks and routes these to multiple back-end servers.

MDp is shipping now. Typical systems are in the $400,000-to-$500,000 range, officials said.

Early, Cloud can be reached at 800-322-3042. ■

Vendor Ships Upgraded Tools For Building EIS Applications

By THERESA RIGNEY

LITTLETON, COLO. Planning Sciences Inc. has released a new version of its object-oriented tool set for building executive information system applications.

Gentium 1.6 adds IBM OS/2 and Novell Inc. NetWare IPX/SPX to its list of supported platforms, which includes Microsoft Corp. Windows 3.1 and Windows NT, NetWare NLM, NeXT Inc. NeXTStep-486 and NeXTStation, and Unix. Applications built with the product can be interpreted on any of these platforms.

In addition, Gentium provides object-oriented tools and interfaces to build complex analytical applications, according to William Hopkins, vice president of marketing for Planning Sciences, based here. The tool set is based on, but does not require, NeXTStep's object-oriented programming environment.

Gentium provides a built-in Common Object Request Broker Architecture-based messaging system, which understands and maintains information about the relationships between clients and servers. Since the objects that make up one application may be distributed onto different nodes, the request broker keeps track of object location.

Easing Data Access

Gentium has its own multidimensional database and CORBA-compliant object storage facility, and can retrieve data from any legacy or relational database that can be accessed via Structured Query Language using Information Builder Inc.'s Enterprise Data Access/SQL gateway. It also can access any data source with a Microsoft Open Database Connectivity Driver via Q+E Software Inc.'s Q+E Database Library 2.

Gentium 1.6, which supports TCP/IP and Novell NetWare protocols, is available now. Prices begin at $1,000 per seat.

Planning Sciences can be reached at 303-794-8701. ■

WORKGROUP

In Brief

WINDOWS IMAGES

Lead Technologies Inc., Charlotte, N.C., has unveiled an image-management application for end users and imaging professionals. Leadview 3.0 for Microsoft Corp. Windows offers a handful of image-related functions, including compression, communications support, conversion between various file formats, editing tools and scanner support. The software sells for $99 and is shipping now. (800-637-4699.)

HOST IMAGES

4i Solutions Inc., Lake Forest Calif., has announced image-processing software for host-based systems. 4Site Seamless Integration Technique version 1.2 lets users add images to a host database. It is available now; pricing was not disclosed. (714-586-4445.)

LOTUS From 1-2-3 to $1B: Taking Stock of Lotus

Continued from page 78

Gillin said Lotus quickly separated its spreadsheet offering from competitors' by providing a capability that was a winner with PC users—a macro language that let end users write simple programs.

Lotus moved quickly to take advantage of users' appetites for desktop applications, and in 1985 it shipped Symphony, which let users integrate spreadsheets, word processing, graphics, databases and communications.

Meanwhile, Novell Inc., the leader in the network operating systems market, released NetWare and catered to PC users' eagerness to share files and print services. Lotus, in turn, took advantage of network communications infrastructures and started work on its Notes groupware.

After four years of development, Notes shipped in December 1989. Once again, Lotus was ahead of its competitors in what now is a hot item in the software market—groupware.

Notes has gradually evolved to become the premier player in the workgroup software market, leaving many Lotus competitors, including Microsoft Corp., playing catch-up.

In the past 12 months, Lotus has tried to position Notes as an environment to build networked applications for large enterprises. A whole suite of Notes application programming interfaces has been published to let third parties connect their software to Notes.

Lotus made another shrewd move in 1991 by acquiring cc:Mail, a front-end electronic-mail system, from cc:Mail Inc. This established Lotus as the leader in the E-mail market.

"Lotus made the shift from individual [desktop] applications to groupware and their paradigm shift has led the market since then," said Jeff Leopold, director of integrated computing at the Yankee Group, a Boston-based marketing consultancy. ■

IBM Debuts Forms Ware for Work Groups

By SAROJA GIRISHANKAR

DUBLIN, IRELAND In an effort to strengthen its place in the burgeoning workgroup market, IBM last month introduced electronic-forms software that automates paper-based routine business tasks for work groups.

IBM's object-oriented software, dubbed FormTalk, runs on the company's OS/2 operating system and uses the underlying services of electronic-mail servers that comply with the Vendor Independent Messaging scheme.

FormTalk lets users design and fill in electronic forms and offers basic preprogrammed and dynamic routing features.

FormTalk lets users design and fill in electronic forms and offers dynamic routing features.

"Our [FormTalk] product is geared at departmental LANs," said Stuart McBean, head of IBM's Workgroup Strategy and Product Management unit, based here, which developed FormTalk.

An IBM spokeswoman said that FormTalk will ship this quarter and cost slightly under $150 per user.

McBean said the FormTalk is based on IBM's Systems Object Model object-oriented design, as is the company's FlowMark for OS/2 workflow software.

IBM can be reached at 800-426-3333. ■

INTERNETWORKING

Hubs, Bridges, Routers, Gateways, Premises Switches, Modems

In Brief

FAST-ETHERNET EFFORT GROWS

Cabletron Systems Inc., Rochester, N.H., has become the latest of 12 vendors to join the Fast Ethernet Alliance. The group of networking vendors is creating specifications for 100-megabit-per-second Ethernet based on existing Carrier Sense Multiple Access with Collision Detection technology.

SHIVA UPGRADES NETMODEM/E

Shiva Corp., Burlington, Mass., has announced version 1.5 of its single-port NetModem/E remote LAN access device. Version 1.5, which includes remote-control capabilities through the licensing of Symantec Corp.'s Norton PCAnywhere software, will be available this quarter, the company said. It costs $1,699; existing NetModem/E users will pay $75 for a software upgrade. (800-458-3550.)

CASCADE & CISCO TEAM

Cascade Communications Corp., Westford, Mass., and Cisco Systems Inc., Menlo Park, Calif., have announced a partnership under which they will jointly develop software that binds routing and switching functions across Layers 2 and 3 of the Open Systems Interconnection stack. The software, which will be for Cascade's XTDX wide-area switches, will be ready in the second half of the year, the company said. Pricing was not available.

3COM SIGNS WIRELESS PACT

3Com Corp., Santa Clara, Calif., has inked a technology-licensing agreement with Pacific Monolithics Inc., whose radio technology lets wireless LANs operate at 10 megabits per second. The agreement will result in a "wireless Ethernet" extension to 3Com's EtherLink III Parallel Tasking LAN technology. (800-638-3266.)

The Decade of the Internetwork

By LAURA DiDIO

Judging by the proliferation of corporate networks based on bridges, routers and intelligent wiring hubs, the past 10 years can be called the decade of the internetwork.

In the early 1980s, corporate users began building departmental LANs. The natural progression and outgrowth of the departmental LAN spurred the rise of internetworks, which link disparate networks within a building, campus, or across wide area network.

Once users had departmental LANs in place, the next logical step was to interconnect them via bridges, routers, gateways, hubs to form one virtual enterprise network.

Initially, users linked LANs with simple Ethernet-to-Ethernet bridges and dumb multistation access units, the forerunners of hubs or wiring concentrators.

These first-generation bridges and MAUs usually had two or four ports, and were devoid of any value-added features or network management capabilities. Still, they served their purpose at the time, according to industry analysts.

"They were as good as they had to be and they served the early users just fine," said Doug Gold, director of communications research at International Data Corp., Framingham, Mass.

The internetworking market as we know it today first began to emerge in 1986, Gold said. From 1986 to 1988, sales of local and remote bridges, PC-LAN gateways and routers totaled a relatively modest $109.4 million, according to IDC statistics.

In 1987, router sales tallied $15.4 million, which equaled about 14 percent of the fledgling internetworking market. By 1990, router sales rose to $235 million. They doubled in 1991-92 and increased 62 percent in 1992-93.

Decade, *page 102*

New Use for Old Gear

By MICHAEL CSENGER

SAN FRANCISCO While the industry awaits next-generation technologies to facilitate multimedia applications, some users already are bringing tomorrow's technology to the table by combining yesterday's equipment with business skills.

Such is the case with Entertainment Digital Network (EDnet), which serves the entertainment, music and advertising industries. The company addressed a problem that most industries share—the pressures of time to market—and solved the peculiar logistic problems that studios face when trying to gather many performers together at one place and time.

FINISHED PRODUCT: *EDnet helped produce Gloria Estefan's latest recording.*

EDnet ties together recording studios, ad agencies, film editors and corporate decision-makers over a virtual network of T1 and ISDN links that are used on a per-project basis.

EDnet sets up the wide-area connections, provides studios with the necessary networking equipment and ensures network compatibility.

Frank Sinatra's *Duets* and Gloria Estefan's *Christmas Through Your Eyes* recordings were produced with EDnet's help. Musicians recorded their tracks, which were then transmitted to the appropriate studio, said David Gustafson, vice president of marketing for EDnet, based here.

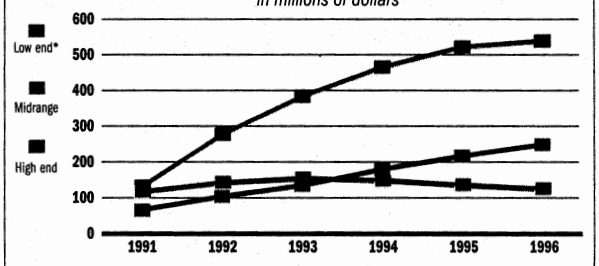
For locations requiring only two user ports, EDnet uses the Larscom Inc. Access-T200 integral CSU/DSU multiplexers. For locations that require more than two user ports, it uses CoastCom channel banks from Coastcom.

The equipment links Dolby AC2 Encoder/Decoder Systems for audio recordings, a video coder/decoder, or a router for data applications.

"The kinds of technology we're using are not necessarily advanced, but the application to this industry is new," Gustafson said. ■

THE RISE OF THE ROUTER

Forrester Research predicts that growth of low-end and midrange routers will continue for the next several years while high-end growth will see a downturn.



NOTE: 1991 AND 1992 FIGURES ARE ACTUAL; OTHERS ARE PROJECTED. Source: Forrester Research Chart by Cheryl Gormandy

ATM Forum Studies Options For Compressed Video

By MICHAEL CSENGER

MOUNTAIN VIEW, CALIF. The ATM Forum is weighing whether to develop a new ATM Adaptation Layer that would accommodate the compressed-video standards being defined by the Motion Pictures Expert Group.

An AAL accommodates different types of user data being sent across an asynchronous transfer mode network. forum wants to determine whether it needs to adapt an existing AAL or create one to handle compressed video, said forum president Fred Sammartino.

"We're at the dawn of a revolution, finally understanding the realities of this [compressed video] technology," Sammartino said. "There are probably more uses for it than anyone originally conceived, and this is why the whole issue needs extra analysis."

The cable TV industry has endorsed MPEG's proposal to develop a standard for general-purpose video transport. While MPEG could run over existing AAL1 or AAL5, at issue is the signaling required to synchronize video with voice and control data streams.

According to Sammartino, MPEG is now defining a transport layer to handle that synchronization. MPEG wrote its video-transport specifications with ATM in mind.

If MPEG figures out a way to map the video signaling directly to ATM, the forum would like to have an AAL to support such a scheme, Sammartino said. ■

DECADE
Ten Years of Growth For Internetworking

Continued from page 95

In 1993, internetworking sales in general climbed to nearly $2 billion, with router sales accounting for 77 percent of that total. Router revenue in 1993 totaled $1.5 billion, Gold said.

Users turned from bridges and gateways to the more sophisticated routers as their need to support multiple protocols and wide-area connections grew. They also needed increased network management functionality to help deal with the growing multiprotocol networks.

Over the last seven years, the availability of routers and intelligent wiring hubs have let users migrate from mainframe-only environments to LAN-based environments. The Westchester County district attorney's office in White Plains, N.Y., for instance, recently completed a $1 million project that moved it from the mainframe to internetworking world.

"We couldn't have LANs without the internetworking setup," said Greg Albanese, deputy chief investigator and one of the project's main architects.

"Remote connectivity to our branch offices and courthouses is the lifeblood of the Westchester County DA's office," he said. "We process 35,000 criminal records a year, the majority of which come through our branch offices, so internetworking is absolutely crucial."

The DA's office uses bridge-routers from Microcom Inc. and hubs from NetWorth Inc. Law enforcement officers and lawyers can send information to each other and access court records and police files over 56-kilobit-per-second leased lines, Albanese said.

'Remote connectivity to branch offices and courthouses is the lifeblood of our office.'

—Greg Albanese, Westchester DA's Office

"Our networks and internetworking equipment has literally made crime-fighting more affordable," he added.

Albanese's experience typifies what many of today's users are finding, said Matt Plociak, executive vice president of Net-LAN Inc., a New York-based reseller.

Changing Needs

In the mid-1980s, users shopped for a single-vendor solution, Plociak said. Today, they're looking for the best solution to fit their individual needs.

"In many cases, we're seeing users going to vendors and requesting specific features, and interoperability with certain platforms. In a general sense, vendors are responding to users demands for increased performance, reliability and standards-based products," Plociak said.

Network management rates high on users' wish lists. According to Plociak, they want support for the Simple Network Management Protocol, as well as support for at least one of the large host environments, such as IBM's NetView, Hewlett-Packard Co.'s HP OpenView or Sun Microsystems Inc.'s SunNet Manager.

These days, switching hubs are garnering user attention, the industry watchers said. Switching hubs give users dedicated bandwidth to the desktop.

"Nearly everyone is interested in switching hubs because users are seeking to extend their infrastructures and increase their bandwidth," Plociak said. "It also helps that the reliability on switching hubs from vendors like Kalpana [Inc.] and Synernetics [Inc.] are very high," he said.

"Fault-tolerant switching hubs are the best insurance we have against network outages, which are never acceptable in a high-volume trading environment," said Rick Ackbarali, assistant vice president of network design and implementation at Barclays Bank of North America, New York.

The bank uses fault-tolerant EtherSwitches from Kalpana, Sunnyvale, Calif., to ensure maximum uptime in its mission-critical trading environment. ■

■ **Interviews**

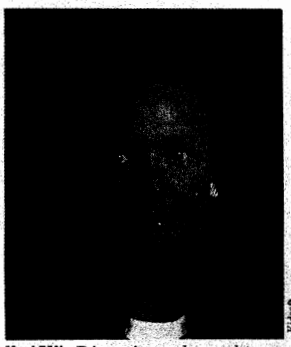
Two Experts Trace the History of T1

Network Equipment Technologies Inc. and StrataCom Inc., each in a different way, helped spur the evolution of the networking industry.

Redwood City, Calif.-based NET, which came into the networking arena upon the breakup of AT&T, helped users create the T1 corporate backbones that still serve at the heart of most businesses. StrataCom, San Jose, Calif., entered the picture several years after NET and its competitors already had established considerable presence among users building circuit-switched-based T1 networks. StrataCom, however, brought with it a cell-based T1 multiplexer that eventually became a critical platform for frame-relay switching. Both companies—NET through its Adaptive subsidiary—played key roles in spurring the asynchronous transfer mode movement.

In separate interviews with Communications Week *reporter Michael Csenger, NET and Adaptive co-founder Audrey MacLean and StrataCom president Richard Moley discussed the roles the companies have played.*

NET founder talks of past and future



Kidsoft

MacLEAN: *Divestiture brought on competition for leased lines.*

Comm Week: Network Equipment Technologies Inc. was one of the first companies to deliver a T1 multiplexer and help users build private networks. What were your motivations as one of the company's founders?

MacLean: Before NET I worked for TymShare, a TymNet Data Communications subsidiary that has since passed hands to BT.

If you roll the clock back to 1981, Washington was tuned in way ahead of Silicon Valley as to what the fallout from the breakup of AT&T would be. We [TymNet managers] had already started to put together a network to get 1 megabit per second to the user, mostly addressing the last mile, when 56 kilobits per second was still considered big time.

That led to us looking at the idea of packet switching over T1 facilities.

We were aware that the first result of post-divestiture competition was going to be the availability of leased T1s, the first bulk bandwidth available to corporate America. We knew that large corporations were going to get good prices on T1 links. And we knew from our efforts that there were no products out there to link up those T1s.

So I left TymNet in July of 1982, and we officially formed NET in May 1983—the time in between was completely absorbed putting together the team, our business plan, and raising venture capital.

Comm Week: How did corporate America initially react to the idea of private T1 networks? What were some user concerns?

MacLean: First was economics. There was almost immediately a cost-savings, but all the cost-savings in the world wouldn't matter if it increased your reliablity exposure. Reliability was the overwhelming consideration in how they evaluated the technologies.

The other motivator that emerged was that corporate users for the first time realized that they had to step up to the management of their networks.

Comm Week: How adversarial was the carrier climate?

MacLean: I'm not sure it was adversarial so much as a whole new game. AT&T woke up pretty quickly to what was necessary.

We found early on that there were published tariffs, but that you could go in for specialized deals, aggressive bidding. It was one of the first places where we saw competition at work, post-divestiture.

Comm Week: Was the T1 market immediately competitive? Was there room for all who cared to play in the market?

MacLean: When you're talking about the kind of revenue growth necessary to propel a start-up company, then absolutely there was enough market room. The largest companies ignored us—the T1 market was too small for them. But absolutely, it was hard-fought. We had to prove ourselves.

Comm Week: What was the early attitude toward fast-packet technology? Why did NET not embrace it from the start?

MacLean, *page 103*

StrataCom exec traces rise of fast-packet

StrataCom

MOLEY: *'I was a circuit-switched bigot.'*

Comm Week: What were you doing during the AT&T breakup?

Moley: Rolm brought me on from Hewlett-Packard Co. in 1973 to help bring it into the digital PBX market. That was the start in the shift from analog to digital, in the early 1970s.

The key decision that made the CBX [Rolm's digital PBX] possible was deregulation of PBXs, starting with the Carterfone Decision, so that competition by the time of divestiture was already free market.

Then in 1984, Rolm was acquired by IBM [and since sold to Siemens AG]. It was an amicable situation—we had approached IBM and others to help us integrate voice and data. But unfortunately IBM in those days was very rigid and couldn't tolerate diversity. We realized after 18 months that this was the case, that Rolm could not maintain an independent sales and marketing initiative under IBM. I decided to leave in 1986.

Comm Week: You've said before that you weren't interested in StrataCom until you saw its switch work in action. Until then, how did you expect circuit switching to evolve?

Moley: Yes, I was a circuit-switch bigot: I accepted the conventional wisdom. I had witnessed an experiment at IBM where it tried packet voice, and it was just awful.

In January of 1986, when I was approached by StrataCom's engineers, I told them I first wanted to listen to this packet switch they had. When I heard it, and it worked, I thought, this is fantastic. I knew that just as analog had been driven out of the market, this packet technology would also drive out TDM [time-division multiplexing].

Comm Week: What type of criticism did StrataCom face, and how did you overcome it?

Moley: It's too much a buzzword, but the paradigm shift is awfully tough to pull off. Everybody is naturally against you because their revenue streams are deeply entrenched in what they're already manufacturing. Fortunately for us, the United States is a big enough economy with more than a few risk-takers, and we were able to get a start in private networking. Intel Corp. was one of our first customers.

The carriers were steeped in circuit switching. We made a couple of attempts to sell into them. They had a list of questions for us to answer, all TDM questions. So of course we had to answer "no" to all of them—we didn't do the things TDM does—at which point the conversations were usually terminated. It was like speaking foreign tongues.

In time we saw that frame-relay was a glorious application for our fast-packet switch. We offered it to the carriers, and for the first time they were interested. They saw the market for data applications, LAN interconnect. WilTel was very courageous: In April of 1991, it offered a frame-relay service using our IPX [Integrated Packet Exchange, a cell-based

Moley, *page 103*

MacLEAN
NET Founder Talks Of Past and Future

Continued from page 97

MacLean: Look at the real issue: What is the standard technology, and what is the scalable technology going forward? I don't think that a proprietary, lower-speed technology was the choice for going into the next century.

It was clear that the carriers were going to build synchronous optical networks with an asynchronous transfer mode overlay. Anything we would have developed that violated that premise was not in anyone's long-term interest.

[With NET's blessing,] Adaptive was founded [by MacLean and Charles Giancarlo, also from NET] in 1988 to build an enterprise mirror image of what the carriers are laying out this decade. We [Adaptive] also founded the ATM Forum.

So today when you ask anybody what's the next technology, they'll all answer ATM.

Comm Week: Was there an effort to try and make circuit switching into a fully integrated voice-data technology, to see it provide the services that ATM now promises, or was it deemed inadequate from the start?

MacLean: We saw circuit switching as the optimal technology for transmission management. If you look, you have the switching network and then the transmission network underlying it. You see the same thing now with ATM.

Comm Week: Will ATM last us into the next century?

MacLean: I think there's no going back once you've been exposed. ATM is a technology that takes us further than we've ever been. It's permanent. ■

MOLEY
StrataCom Exec Traces Fast-Packet Rise

Continued from page 97

T1 multiplexer with frame-relay switching].

The carriers started buying our switch, and they saw that we fit into their long-term ATM [asynchronous transfer mode] broadband plans. And now those frame-relay services are taking off. I understand that AT&T's InterSpan service is increasing its orders 30 percent monthly. You don't have to do that for long before it becomes an enormous offering.

Comm Week: Some people say the efficiencies of TDM may yet find a place in the ATM environment, that the two will work side by side. Do you agree, or will TDM ultimately be replaced?

Moley: Our narrowband approach is still attacked by circuit switching. Cell overhead is the usual argument, but I always point out that in the circuit-switched world you still need dedicated lines to serve occasional bursts of traffic.

The only application where circuit switching is better is full-motion video. But all of this effort to bring video to the home requires compressed video. Video is usually thought of as a great TDM application, yet compressed video is actually an incredibly bursty application. So there's a lot of work underway, and compression techniques will change to take advantage of ATM.

Comm Week: When will we see the next shift, and what will it be?

Moley: It's funny when people ask in the midst of ATM, "What's next?" There's still a lot left to do, and I think this is going be pretty good for the rest of my career.

It's very seductive to be embedded in a successful thing. That's why these shifts are so dangerous to the well-entrenched. You're doing well, yet here's this little monster growing on the sidelines. Even if you see the intellectual sense of it, if one is looking for an excuse to ignore it, they're easy to find. But I really have no vision beyond ATM. ■

Tariff Trends for T1 Services Tell a Tale

By JOHN T. MULQUEEN

Competition is great for consumers. Any economist would hardly find that news, but it still makes headlines in the telecommunications industry 10 years after the breakup of AT&T.

In its soon-to-be-published annual industry study, the North American Telecommunications Association notes that the overall cost of telephone service for business and residences has fluctuated somewhat but is moving in a downward trend.

"In the 1984-to-1990 period, interstate toll continuously decreased, but in recent years the rates increased," NATA said. "The overall price level for telephone service should be stable for the near term as long distance rates drop slightly, offsetting possible increases in local rates."

Business users have certainly benefited from these long distance pricing strategies for the high-capacity circuits—those operating at 1.544 megabits per second—in which they are most interested and where competition has been strongest. A comparison of T1 circuit prices over the past several years illustrates this (see chart).

In addition to competition, new services—software defined networks and Tariff No. 12-type offerings among them—has lead to lower pricing.

J.C. Penney Co. Inc., Dallas, uses AT&T's Software Defined Network offering for its voice network and a Tariff 12 contract for both voice and data networks. It has been able to eliminate a private network that included 10 satellite dishes, switching equipment and trunk lines, said David Evans, vice president and director of MIS.

"That allows us to have a private dialing plan, to do volume purchases, and it is easy to switch suppliers for all or a share of our business by simply punching key numbers into a telephone," Evans said.

Under Tariff 12, AT&T bundles 56-kilobit-per-second lines from Penney's 1,100 stores onto T1 and T3 trunks for delivery to Penney's data center. AT&T manages the circuits, which Penney can reconfigure if it wants. Penney also uses MCI for about 5 percent of its lines.

Users with shorter-distance T1 circuits have not fared quite as well as users with long-haul T1 circuits. AT&T and MCI raised their prices for 25-mile, 50-mile and 100-mile T1 circuits in the last year, while continuing to cut rates on the longer circuits. Sprint raised rates on 25-mile and 50-mile T1 circuits, but continued to lower them on other circuits, CCMI said.

The Bell operating companies, which face far less competition than the long distance carriers, have not been as aggressive with their price cuts. To determine pricing trends for intrastate inter-LATA (local access and transport area) T1 circuits, CCMI averaged the rates the services providers charged in five states. It studied prices charged by both the long distance carriers and the Bells.

For a 500-mile intrastate, inter-LATA T1 circuit, AT&T charged $7,065 in October 1993, down 35 percent from $10,887 in 1989, according to CCMI. MCI dropped the rate 33 percent, to $6,085 last year. Sprint tariffed the same circuit at $6,190, or 40 percent less than in 1989.

By comparison, the Bell company rates averaged $14,020 for a 500-mile intrastate, inter-LATA T1 circuit. That average reflects a decline of 38 percent from 1989, but is still considerably higher than the long distance carriers' charges.

At $2,033, AT&T charged the most among long distance carriers for a 100-mile inter-LATA T1 circuit. MCI was second with a fee of $1,827 and Sprint lowest with $1,768. On average, the Bells charged $2,890, CCMI said.

The Bells also were the high-cost providers for 50-mile circuits. On average, the Bells charged $1,490; AT&T, $1,399; MCI, $1,232; and Sprint, $1,216.

Interestingly, the Bells charged the least, at an average of $813, for 25-mile circuits. MCI charged $925; Sprint, $939; and AT&T, $1,076.

The Bells have reduced prices for special access T1 circuits, CCMI's David said. The rates have dropped dramatically since 1989, in large part because of heat from competitive access providers, he added.

DOWN, DOWN, DOWN

Although some circuits have risen within the past year, rates for T1 services have declined significantly over the past several years.

	AT&T	MCI	Sprint
	Monthly cost for 1,000-mile T1 circuit		
Jan. 1989	$13,800	$15,070	$20,320
Jan. 1990	$9,530	$8,570	$12,230
Oct. 1993	$6,250	$5,080	$5,620
	Monthly cost for 500-mile T1 circuit		
Jan. 1989	$7,800	$9,815	$10,964
Jan. 1990	$5,775	$5,195	$6,975
Oct. 1993	$4,425	$4,010	$3,980
	Monthly cost for 100-mile T1 circuit		
Jan. 1989	$3,000	$3,913	$3,575
Jan. 1990	$2,775	$2,497	$2,775
Oct. 1993	$2,965	$2,874	$2,668

Source: CCMI Chart by Cheryl Gormandy

The Bells have slashed average special access tariffs for T1 lines between 51 percent and 86 percent since 1989, CCMI said. The price drops decline as the circuit lengths grow, indicating that competition from the CAPs is strongest for the last-mile linkage.

The average monthly price the Bell companies charged for a two-mile T1 line dropped 86 percent, to $104.50, between 1989 and October 1993, David said. The cost of a six-mile circuit fell 79 percent to $189.90, and the charge for a 15-mile circuit slid 70 percent to $375.60. A 20-mile circuit was 67 percent less expensive at $479.80 and a 40-mile circuit 59 percent cheaper in 1993 at $916.80.

The cost of a 60-mile T1 special-access circuit fell 55 percent to $1,314 in that time period and a 100-mile circuit dropped 51 percent to $2,149, CCMI reported. ■

CAPs
Competitive Carriers Assert Themselves

Continued from page 105

cated] access circuits," said Royce Holland, president and chief operating officer at MFS Communications, Omaha, Neb.

Garban Ltd., New York, exemplifies the changing nature of relationships between users and CAPs. In the last seven years, the financial services firm has reduced its business with Nynex Corp., formerly known as New York Telephone Co., from 100 percent to between 40 and 50 percent, said John Faccibene, senior vice president of technology at Garban.

Faccibene said the CAPs quickly proved that his initial concerns about their ability to maintain a high-quality service were unwarranted. "At the time, there was no bureaucracy. They were flexible and offered better prices."

Burcik also would like to use alternate local access services, but can't get competitive local dial-tone services yet. Burcik recently discussed his options with Teleport, which is installing and an AT&T Network Systems 5ESS central office switch plans to begin offering service in Detroit.

"Our initial conversation was about backup and disaster-recovery service, but my main interest is in using it as an alternate provider of dial tone. If it can provide centrex service that is compatible with my CPE [customer premises equipment], I'm interested," Burcik said.

Additional Services

Due in large part to regulatory victories that have pitted them against the Bell companies, the CAPs can now offer to a greater range of services. Some offer LAN interconnection and centrex services, for instance.

"Nowadays, you can actually talk about CAP services," said Tom Nolle, principal of Cimi Corp., a Voorhees, N.J., consultancy. "It used to be in the past that every one of the CAPs went out and almost built their networks one customer at a time."

Going forward, the CAPs may even partner with wireless services providers to gain a bigger chunk of the local loop, said John Ahsler, analyst for The Eastern Management Group, Parsippany, N.J. Some CAPs already have relationships with cable TV providers, although the status of any CAP-cable TV teams may change in the wake of the recent mergers among telephone companies and cable TV operators, he said.

Beyond Local Access

Alternative long distance providers such as MCI also have come a long way since the mid-1980s, Wayne State's Burcik said.

Wayne State signed up for MCI service about eight years ago, but Burcik said he soon moved the school's interstate traffic to Sprint and its intrastate calls to AT&T because he was unhappy with the way MCI operated.

Last year, however, Wayne State switched the traffic back to MCI, whose marketing organization had changed and beat its competitors' prices.

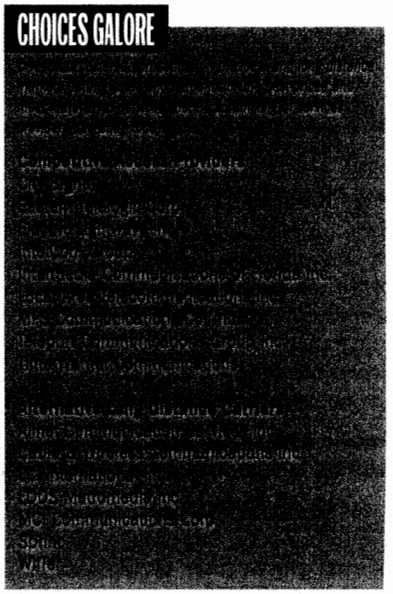
Like the CAPs, the alternative long distance providers have expanded their service portfolios since divestiture.

"In 1984, [alternative long distance providers] offered a lot of specialized WATS programs and in many instances, they were reselling the capabilities of AT&T. They did not have their own networks and could not control their own product development," Ahsler said.

"They offered analog data services that could carry 9.6-kilobit-per-second traffic and you would occasionally see some T1 service, but it was a miniscule portion of the market and very niche-oriented," he added.

Since then, alternative long distance providers have built their own networks and established their own customer bases, not only for voice but also for data services. Ahsler pointed to WilTel, Tulsa, Okla., which was the first carrier to offer frame-relay service. ■

CHOICES GALORE



MOBILE COMPUTING

Portable and Hand-Held Computers, Client Software, Wireless Data Services

In Brief

EO EXPANDS SUPPORT

AT&T's Eo Inc., Mountain View, Calif., has expanded service and support for users of the Eo 440 and 880 Personal Communicators, the company said. AT&T Eo has contracted National TechTeam, which has a service center in Southfield, Mich. The center is linked to Eo's Sunnyvale, Calif.-based technical support group, where calls on complex problems are transfered. (415-903-8100.)

NYNEX UNVEILS NEW SERVICE

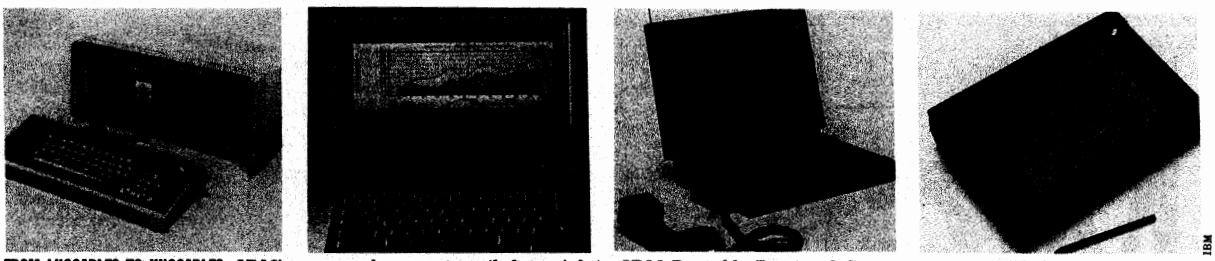
Nynex Mobile Communications Inc., White Plains, N.Y., has officially announced its new modem pooling service. The free service, which enables wireless modems to transmit data to land-line modems, is called Wireless Modem-access. It is available now in greater metropolitan New York. The service will be available in Albany, N.Y., Boston and Rhode Island soon. (914-365-7200.)

SOFTWARE FOR MOBILE ACCESS

Telepartner International, Farmington, Conn., has unveiled TeleServer software, which gives mobile-PC users access to host computers via several options, including asynchronous dial-up, X.25 and wireless services. Client software, available for DOS, Macintosh and Windows PCs, is priced at $295. (800-935-3270.)

WIRELESS IMPLEMENTATION

Transus, an Atlanta-based trucking company, will start to equip its fleet of 100 trucks with wireless communications capabilities this month. Transus' wirless data implementation initially will focus on its headquarters trucking terminal. Ultimately, dispatchers in all of the company's 44 trucking terminals in 11 states will use wireless technology to exchange mission-critical information with drivers.



IBM

FROM LUGGABLES TO HUGGABLES: *IBM's personal computers (left to right)—IBM Portable Personal Computer, 1984; PC Convertible, 1986; ThinkPad models, 1993*

The Evolution of Portable Computers

By JEFFREY SCHWARTZ

If a user requested a 7-pound portable computer with a full-color display and fax-modem 10 years ago, the information systems manager may have thought the user had overdosed on "Star Trek" reruns.

The idea of traveling with a computer was just surfacing 10 years ago. In 1984, Compaq Computer Corp. and IBM introduced some of the first portable PCs, which weighed 30 pounds, had detachable keyboards, built-in cathode ray tubes (CRTs) and needed to be carted on hand trucks.

"The thought of having to travel with a computer wasn't a real pleasant one 10 years ago," said Jane Landon, a systems vice president at New York-based The Chase Manhattan Bank N.A.'s credit card business unit. "At the time, I worked for a company where moving a computer meant having several engineers come with me for three days to make sure it would work."

IBM marketed its first portable, the IBM Portable Personal Computer, as a "lighter, smaller model of the IBM [desktop] PC." The portable unit weighed in at 30 pounds, more than five times the weight of today's IBM ThinkPad notebook computer. The starting price of the Portable PC was $2,795; the ThinkPad is priced at $3,199.

"They were luggable desktop machines with wheels on them," said James Bartlett, worldwide product line executive for IBM's mobile computing business. He witnessed the emergence of portable computers while working for NEC America Inc., Melville, N.Y., and Zenith Data Systems, Buffalo Grove, Ill.

Besides its weight, the IBM Portable PC had limited appeal for other reasons. The system had no hard drive, required AC current and only supported large, external 1.2-kilobit-per-second modems that required a nearby electric outlet.

"We had people who had those luggables but they were too tough to use," said Michael Allred, information systems planner for the government's Office of Planning and Budget in the state of Utah.

Slow Growth

Bartlett said product innovations were few and far between during the 1980s. IBM released the PC Convertible, the company's first laptop computer, in 1986.

PCs, *page 114*

Vendors Team for One-Stop Shopping for Wireless Needs

By JEFFREY SCHWARTZ

Companies that employ field technicians who need to communicate using wireless products and services will have a new option beginning this month.

Software developers Astea International Inc. and WindSoft Inc. have teamed with New York-based RAM Mobile Data Inc. to offer users one-stop shopping for wireless devices and connectivity to host dispatch systems.

Astea, Chalfont, Penn., and WindSoft, Denville, N.J., will jointly offer offer ServLink, a turnkey service that includes hand-held devices, custom applications and communications software, and unlimited use of the RAM Mobitext packet radio-based network.

"It's not only more expensive to build these applications on your own, but it's more time consuming because it requires that an organization build a customized system from scratch," said Clark Stillman, a RAM product manager.

The service will be available this quarter at a flat rate of $250 to $350 a month, RAM said. ■

Wireless Services Are Growing Strong

By ANNIE LINDSTROM

As the demand for remote access escalated during the past decade, carriers began to offer both wired and wireless services for the mobile worker.

About 15 million people subscribe to cellular services today. Of those, about 3 percent use the services to transmit data, according to Herschel Shosteck, principal of Herschel Shosteck & Associates, a Silver Spring, Md.-based market research firm. Analysts say they can't quantify what portion of low-speed, dial-up services are used for mobile applications. But long distance carrier Sprint said that remote access applications account for the majority of the 10 percent annual growth in these services.

Carriers, including AT&T, BT North America Inc., CompuServe Inc. and Sprint have been targeting the mobile work force with low-speed, X.25-based dial-up services for years. The majority of mobile workers use wired services like these to communicate, analysts said.

While dial-up services target mobile workers as well as those in branch offices, wireless services focus strictly on mobile workers.

In 1982, the FCC awarded cellular licenses to both a wireline and non-wireline provider in each market. By 1984, cellular service was available in 30 U.S. markets and a total of 85,000 people were using the service, Shosteck said. By 1989, service was available in all U.S. metropolitan service areas.

Cellular growth began to ex-

Wireless, *page 114*

PCs
Evolution of Portables

Continued from page 113

An internal data modem was optional for the 12-pound unit.

Two years later, NEC announced its ProSpeed line of laptop computers, one of the first that could accept LAN connections, he said. But the slots for Ethernet and later token-ring cards were proprietary and were three times the size of today's PCMCIA configurations. During the next few years, vendors made only minor alterations on their units.

The second version of PCMCIA standard, which was completed in 1992, "had a dramatic impact" on network connectivity for portable computers, Bartlett said. That version of the PCMCIA standard provided a standard for hard drives, modems and network cards for mobile computing devices.

Early this year, IBM will ship its first PCMCIA-based Wireless Communications Module for the ThinkPad, which will let users transmit data and faxes and make phone calls over cellular networks.

Other companies, including Compaq, NEC and Toshiba America Inc. also have been proactive about releasing new portables. The new portable PC will weigh about six pounds, have 4 megabytes of RAM, a 120-megabyte hard drive and a 9.6-Kbps fax modem.

In the late 1980s, portable computers accounted for about 5 percent of all PCs sold, Bartlett said. This year, IBM expects roughly 25 percent of all PCs sold to be portable.

With the proliferation of PC-based electronic-mail and network workgroup applications, such as Lotus Development Corp.'s Notes, users said they need to tap into the host network while traveling.

Chase's Landon said she uses her IBM ThinkPad and docking station as her primary computer: "It was an investment decision. 'Should I have a regular PC on my desk plus a laptop, or should I just buy one thing?' "

"It's incredible what's happened over the last 10 years," Landon said. "We've gone from needing engineers to having something that you can throw in your trunk, bounce around and have your data come up with no problem. It's great."

Needless to say, Landon doesn't travel with engineers these days. ■

WIRELESS
Wireless Services Are Growing Strong

Continued from page 113

plode in 1986 and 1987, when the price of terminal equipment fell below $1,000. What has followed is a 40 percent annual growth rate of cellular service subscribers, Shosteck said.

During the past year, the industry has witnessed an increased interest in wireless communications, most notably with the merger of AT&T and McCaw Cellular Communications Inc., Kirkland, Wash.

The ability to transmit data over cellular networks has always existed. But in the early 1990s, Ardis, Lincolnshire, Ill., and RAM Mobile Data Inc., New York, began building nationwide, private radio frequency, wireless data networks. The two companies serve fewer than 100,000 users combined, but usage is expected to rise now that they have completed network expansions, according to analysts.

Ardis rolled out its service out in 1991, when Pitney Bowes Inc., Stamford, Conn., began looking for wireless services for its dispatching and database access system according to Chuck Holiday, manager of application development for Pitney Bowes' Information Systems Division.

"Ardis' solution was more expensive than a dial-up solution, but we were able to identify key elements that would offset the costs of having real-time, two-way, interactive communication and we felt that it was a better environment," Holiday said.

Today, RAM and Ardis are poised for battle with the cellular providers. About eight cellular providers have teamed up to develop the cellular digital packet data specification. ■

In Brief

LOCKING UP

Trend Micro Devices Inc. has announced a new version of its StationLock security hardware. Version 1.6 provides audit trails for PC data and can blank PC screens to prevent unauthorized users from viewing secure information. Version 1.6 of the hardware product is available now for $129, according to the Los Angeles-based company. (310-782-8190.)

LICENSE TO MANAGE

Tivoli Systems Inc. has announced an open licensing program for the Tivoli Management Framework 2.0, its object-oriented systems management framework. Under the new program, users and developers can obtain a published specification for the framework's application programming interface that will make it easier to implement source code and binary licenses for TMF 2.0. The API is available now, according to Tivoli, Austin, Texas. The code will be available early next year; pricing will be announced then, the company said. (800-284-8654.)

A WIDER SPECTRUM

Cabletron Systems Inc. has begun shipping its Spectrum for Element Managers software. The software offers many of the same features of the company's Spectrum network management software, but runs on non-Cabletron management platforms, according to Cabletron, based in Rochester, N.H. (603-332-9400.)

CHAMELEON LEAPS INTO SMDS

Tekelec has announced a protocol-decoding feature for switched multimegabit data services on its Chameleon Open LAN/WAN protocol analyzer. The new feature is available as an upgrade at no charge, according to Tekelec, Calabasas, Calif. (800-835-3532.)

Decade of Standards & Competition

By TIM WILSON

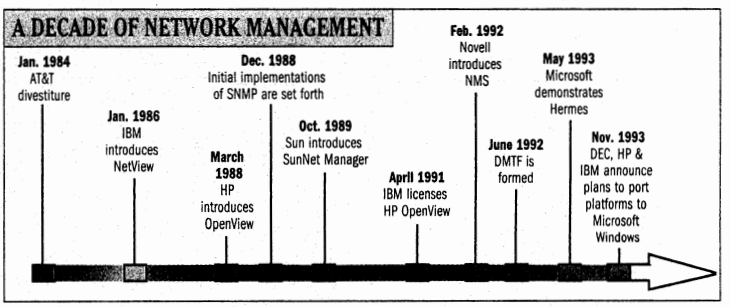
When AT&T was divested in January of 1984, the cry of "Be your own Bell company!" sounded across the industry. But as users accepted the task of building and managing their own networks, they discovered a critical need for a new capability: enterprise network management.

Ten years later, a new class of hardware and software built specifically for managing corporate networks has emerged. Tools for monitoring and troubleshooting elements of the network have evolved, as have standards for integrating the management of those elements.

Since IBM's introduction of the proprietary, mainframe-based NetView network management system in 1986, the industry has seen the rise and fall of many management architectures and systems.

Today, most analysts say that they believe the industry will consolidate on one or two platforms that will serve as the base systems for a plethora of management applications.

Over the decade, users watched with interest as the list of enterprise network management systems expanded and contracted. But although the choices today are better than they were, most users agree that the currently available network management systems still do not offer the fully integrated management features they seek. Vendors say management technology will continue to evolve until those needs are met.



Source: Communications Week Chart by Cheryl Gormandy

In the late 1970s and early 1980s, "network management" generally meant calling the telephone company to report an outage. Most voice networks were managed by the carriers, and separate data networks were only just beginning to emerge.

The divestiture of AT&T forced users to make decisions about their network providers, and the invention of technologies such as ISDN made it possible to build private networks capable of handling both voice and data. But solutions for managing those networks were scarce, as most carriers kept their management technologies to themselves.

In 1986, IBM introduced a package of mainframe-based utilities called NetView, which let users manage large networks of computers and terminals linked via dedicated lines and IBM's proprietary SNA protocols.

Most of NetView's functions—such as fault detection and configuration management—were not new to the industry. But because it was packaged as a separate system capable of managing a variety of devices and

Mgm't, *page 120*

VisiSoft Ships New LAN Mgm't Software

By SHARON FISHER

ATLANTA VisiSoft Inc. is shipping a version of its VisiNet LAN management software that provides a hierarchical view of the network immediately upon installation.

The software lets network administrators manage a variety of PC network operating systems, including Artisoft Inc.'s LANtastic, IBM's LAN Server, Microsoft Corp.'s LAN Manager and Novell Inc.'s NetWare. It offers many of the same features available on more expensive and complex Unix-based network management systems, according to early users.

"The thing just absolutely allows me to look at everything," said Harry James, owner of Harry James Consulting, New Orleans. The new version of VisiNet lets users create new alarms and alerts, making it possible for James to create and manage a virtual print queue for a printer on a peer-to-peer network, he said.

James had high praise for VisiNet's mapping features. "I love the fact that you can put your backgrounds in it," he said. "You can take an AutoCAD [computer aided design] drawing of the floor plan of your building, and put [devices] on the right place [on the map]." VisiNet lets users manage network objects on a department-by-department basis.

LAN, *page 124*

COMMUNICATIONSWEEK INTEROPERABILITY MONITOR

VisiSoft Inc.

Product: VisiNet 2.5 LAN management software

Purpose: Manages LANs and attached PC and Macintosh clients

Available: Now

Application: Microsoft Windows; manages LANs running NetWare, LAN Manager, LAN Server and LANtastic

Management: SNMP MIBs I and II

Transport: WinSock API over TCP/IP

Media: Token-ring, Ethernet

Source: VisiSoft SEE PAGE 64 FOR ALL MONITOR PARAMETERS

Hewlett-Packard Prepares New Version of OpenView

By SHARON FISHER

PALO ALTO, CALIF. Hewlett-Packard Co. later this month will ship an enhanced version of its HP OpenView Network Node Manager network management software, according to the company.

HP OpenView Network Node Manager 3.3 will offer about 100 enhancements over its predecessor, particularly in the area of event handling, according to Gordon MacKinney, OpenView program manager for HP.

The company hinted at the new version of its popular network management platform during the HP OpenView Forum users conference in November (*Communications Week*, Nov. 8, 1993). At that time, HP said it had not yet determined the formal name of the product or when it would be available.

MacKinney would not provide details on the product's enhancements, but HP engineers at the user conference said the new features would include automated filtering, configuring, customizing, and extending of events and alarms. The new version also is expected to offer improved performance, improved mapping and discovery of devices, and more categories and colors for devices on the network management map.

The HP Network Node Manager software runs on the Unix operating system and complies with the industry-standard Simple Network Management Protocol, HP said. ■

MGM'T
Standards & Competition

Continued from page 119

software, NetView became the first "enterprise network management platform." It still is used by more than 10,000 licensees worldwide, according to IBM.

NetView's early popularity led to competition, as other vendors sought to put their own products in control of customer networks.

By the end of 1988, three of the industry's largest voice and data systems vendors—AT&T, Digital Equipment Corp. and Hewlett-Packard Co.—had announced architectures and plans for enterprise network management.

As these early network management players fought for supremacy in the market, each developed its own interfaces to link third-party devices with the systems that managed them. As a result, third-party vendors were being asked to write separate interfaces to AT&T's Accumaster Integrator, DEC's PolyCenter, HP's OpenView and IBM's NetView, among others.

The International Organization for Standardization, a worldwide standards body, began work on a standard protocol to link management systems with managed devices in the mid-1980s.

Using its Open Systems Interconnection model for data communications standards, ISO created the Common Management Information Protocol, the first global network management standard.

Careful Scrutiny

Like many other OSI standards, CMIP was carefully scrutinized in a series of highly structured meetings that involved representatives from companies and countries all over the world. The process was painstakingly slow.

Back at home, customers were impatiently demanding standards-based management products for their multivendor networks. Their businesses simply could not wait for the standards to be complete.

In response, several vendor consortia—including the Corporation for Open Systems, the OSI/Network Management Forum and the National Institute of Standards and Technology—attempted to speed the availability of products through

Most users agree that the currently available network management systems still do not offer the fully integrated management features they seek.

joint implementation efforts.

The scientific/engineering workstation community took a different tack. In the late 1980s, the Internet Engineering Task Force began work on a simpler, less elegant set of standards called the Simple Network Management Protocol. SNMP was easy to implement, simple to use and available at a low cost. By the early 1990s, SNMP had replaced CMIP as the management standard of choice among both users and vendors.

Platforms for the Future

SNMP's popularity caused a shakeout in the network management market. Sun Microsystems Inc. beat its competitors to the punch when it became the first vendor to ship an SNMP-based system, called SunNet Manager, in 1989. An SNMP-based version of HP OpenView followed soon after.

IBM, with its huge installed base of mainframe NetView users, developed its own SNMP system in April 1990, but the product was limited in scope and functionality. In an unusual move, IBM licensed HP OpenView in April 1991. The HP

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product became the platform for IBM's NetView/6000 and, in turn, NetView/6000 became the platform for DEC's SNMP-based PolyCenter NetView product in an agreement announced in August of 1993.

AT&T also acquired an SNMP-based management product when it purchased NCR Corp., maker of the StarSentry line, in 1991.

But analysts say they believe that eventually, most network management applications will run primarily on two platforms: SunNet Manager, which will incorporate technology from NetLabs Inc.; and the HP OpenView-based products from HP, IBM and DEC.

Reference Point

SNMP also is providing a reference point for many other network management developments. The Desktop Management Task Force, a vendor group that was formed in June 1992, is working on ways to link desktop systems and software to SNMP management systems. Leading LAN management products—such as Novell Inc.'s NetWare Management System and Microsoft Corp.'s Hermes—will offer interfaces to SNMP.

All of the current SNMP management platforms run on Unix workstations, but that trend may change, according to platform vendors. IBM, DEC and HP already have announced plans to offer their platforms on Microsoft's Windows NT operating system, which began shipping last year. ■

LAN
VisiSoft Shipping New LAN Mgm't Software

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VisiNet offers features comparable to those of Novell's NetWare Management System, but it can also manage other network operating systems, said Jamie Lewis, president of The Burton Group, a consultancy based in Salt Lake City.

"NMS is designed only to manage NetWare," Lewis said. "I don't think it does all of the things NMS does, but it does a lot of them, and it manages LAN Manager as well as NetWare. It's clearly designed for people with multiple network operating systems." Digital Equipment Corp.'s ManageWorks is the only comparable product on the market, he said.

The new version of VisiNet lets administrators scan for both PC hardware and software, according to VisiSoft, based here. "It can recognize more than a thousand applications and versions," said Chip Standifer, president of the company. "It's so people know which software they own. You zoom into a workstation and discover that it has the following disk drives, and also all the software on it."

Improved Interface

VisiNet also offers an improved interface to Microsoft Windows Dynamic Data Exchange that makes it easier for VisiNet LAN administrators to use other applications such as Microsoft Excel, Standifer said.

VisiNet complies with the industry standard Simple Network Management Protocol and uses the standard WinSock application programming interface to link Windows and TCP/IP.

It costs from $795 to $2,495, depending on the size of the network and the options selected.

VisiSoft can be reached at 404-320-0077. ■

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