2

ISDN links people together with powerful digital connections — quickly, simply and inexpensively. It lets them work together in hundreds of ways that were neither practical nor perhaps even possible before.

Some of the applications now made viable by ISDN are tele-commuting, LAN-to-LAN and LAN-to-host interconnection, remote image retrieval, inexpensive video conferencing, work-group collaborations, high-speed access to the *Internet* and other data sources, extended teleradiology and telemedicine, remote security and telemetry, accelerated links to distant libraries and research systems, and much, much more.

Through standard copper telephone lines, ISDN connections now replace the dialed analog connections of the past with the *dialed digital connections* of the future. The results of this simple fact are significant:
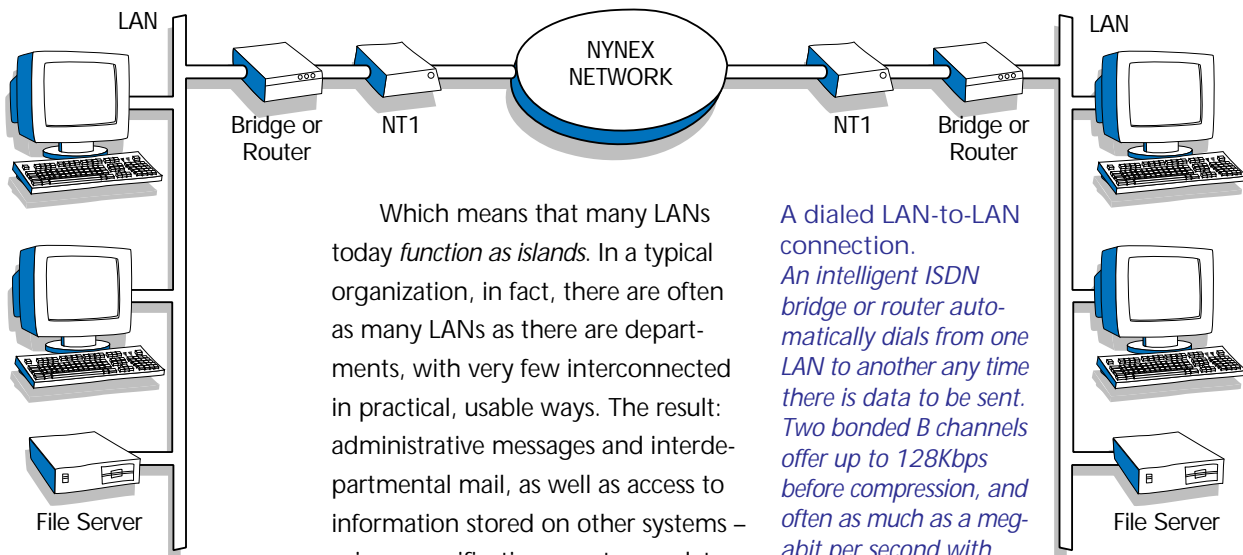
❖ Expensive, dedicated digital lines are no longer the only way to achieve digital transmission speeds.

❖ Modems to convert the digital pulses of computers to analog pulses for an analog network will become obsolete. Digital signals can now flow directly from one digital device (e.g., a PC or ISDN telephone) to another through what is now an inexpensive yet fully digital connection.

Linking LANs Together

One of the most basic connections between people who work together today is the high-speed local area network, or LAN. These small networks typically offer transmission speeds of 10 to 30Mbps (megabits per second) through dedicated fiber optic or coaxial cables.

Unfortunately, LANs also have some serious constraints:

❖ *The size of a LAN must be carefully monitored.* Too many users, or too much traffic, can rapidly overload even the fastest network.

❖ *Physical distances are strictly limited.* Most LANs must be geographically confined to a single floor, or at best to several floors in a single building.

❖ *The costs of extending LANs* or linking them through traditional means can be prohibitive.

LAN — Bridge or Router — NT1 — NYNEX NETWORK — NT1 — Bridge or Router — LAN

File Server   File Server

Which means that many LANs today *function as islands*. In a typical organization, in fact, there are often as many LANs as there are departments, with very few interconnected in practical, usable ways. The result: administrative messages and interdepartmental mail, as well as access to information stored on other systems – prices, specifications, customer data, orders, manufacturing and delivery schedules, inventory levels, engineering drawings and much, much more – are still relegated to mail carts, bulletin boards and a seemingly endless flow of paper.

A dialed LAN-to-LAN connection.
An intelligent ISDN bridge or router automatically dials from one LAN to another any time there is data to be sent. Two bonded B channels offer up to 128Kbps before compression, and often as much as a megabit per second with compression.

ISDN: Dialed LAN Connectivity

ISDN offers a better way. Using single BRI connections dialed through standard telephone lines, a growing array of ISDN LAN bridges and routers offer fast, virtually immediate high-speed inter-LAN connections.

When information needs to be sent to or retrieved from another LAN, an "intelligent" bridge automatically dials and establishes a 64Kbps connection through a single B channel. If higher bandwidths are needed, a second B channel is automatically dialed and bonded into the connection for transmission speeds of 128Kbps before compression.

When transmission is completed, the entire connection is automatically torn down. Users pay only for actual transmission times rather than expensive dedicated digital circuits.

The result is a virtual, on-demand connection to every LAN or host on a corporate campus – as well as most vendor and customer systems – for literally the cost of a dialed telephone call.

Are speeds fast enough? The answer is an enthusiastic yes, especially from users who have in the past tried to link LANs using analog modems or X.25 packet switching. For while the data rates of ISDN do not come close to the raw speeds of a LAN, the unshared bandwidth of ISDN has proved that it can produce almost the same response times that users expect from an office LAN. As B-channel compression speeds continue to increase, user response times should improve just as quickly.

Some typical users of LAN-to-LAN connections include:

❖ *Deutsche Telekom, Inc.*, the North American sales arm of Deutsche Telekom AG in Germany, Europe's largest telecommunications company. LANs in each of its six sales offices in the United States and Canada can quickly and effectively be linked through ISDN. "Any office can get quick access to another, for file sharing, e-mail, database lookup, sales reports and more," says Horst Schad, administrative support manager. "To make a connection, all we have to do is press a function key. Disconnecting takes longer: we have to press a key twice."

❖ *Manchester Equipment Corporation*, a major supplier of ISDN and other telecommunications equipment and services in the New York area. The firm is itself a committed user of ISDN for a range of dialed connectivity, with ten ISDN Intellipath™ lines serving its two buildings in Hauppauge. The dialed connections offer several advantages, according to Ed Hodgson, manager of consulting services. First, they establish high-speed links between LANs in each building. Using Gandalf bridges on each LAN, typical data speeds of about a megabit a second are possible.

"We used to link our LANs with Switched 56 leased lines," he notes. "Today, ISDN gives us twice the speed, and more, for about half the price."

In addition, Manchester Equipment uses ISDN to back up leased frame relay data connections to two sites in Florida, and one in Needham, MA. ISDN has also become a primary channel for video connections between these locations using Intel ProShare equipment.

LAN-to-host connections. *Dialed ISDN links offer enormous savings compared to dedicated digital links.*

Individual Access to LANs

ISDN is also opening LANs to easy, high-speed dialed access by individual users at remote sites – telecommuters at home, sales representatives on the road, engineers or researchers visiting another office. In forthcoming chapters, we'll examine several of these applications more closely – especially the phenomenal growth of work-at-home and video applications.

Perhaps the most dramatic example of how individual systems can be linked to a central site is the trendsetting work being done at *K&B Services*, a large retail pharmacy chain headquartered in New Orleans. Dialed ISDN BRI connections are beginning to link the company's 183 stores, located throughout the Southeast, to a central data center. The connections carry

LAN

LAN

File Server

NYNEX NETWORK

Bridge or Router

NT1

NT1

Bridge or Router

Host
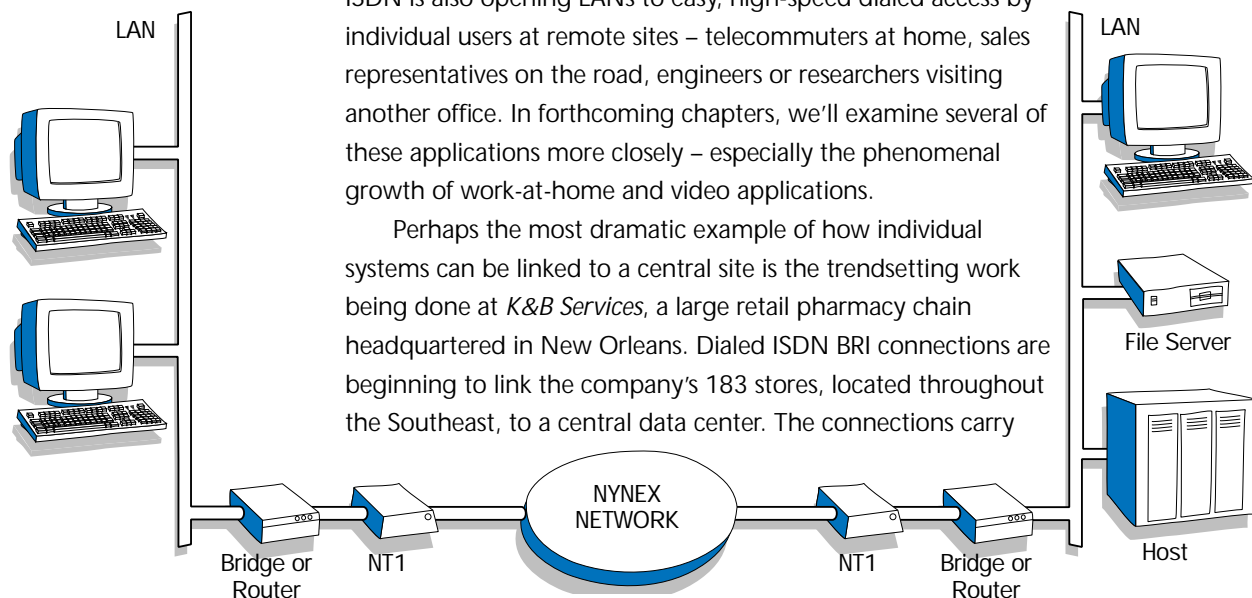
prescription and pharmacy inventory and sales information from RS6000 terminals in each location.

According to Larry Douglas, the pharmacy chain's vice president of management information services, the current links are the first steps toward a major system that will carry comprehensive sales, inventory, payroll and other information from stores to the headquarters, as well as e-mail, administrative and other information from New Orleans to the stores.

K&B's thrust will ultimately link all of its in-store cash registers and other point-of-sale devices not only to the data center, but also to a number of clearing houses for health care insurance adjudication and credit-card authorization and processing – all through a single, dialed BRI connection to each location.

Extending a Backbone

Literally thousands of universities, hospitals, corporate campuses and other multisite locations are today linked by high-speed backbone networks. These wide-area networks most often use dedicated, high-speed telecommunications channels to link many LANs in many locations into a single data network.

The one problem with these backbones, however, is that many smaller locations are often excluded because they cannot justify the cost of installing and maintaining dedicated data channels. Enter ISDN.

At *Northeastern University* in Boston, for example, dialed ISDN connections now give several student laboratories and faculty staff buildings high-speed digital access to the university's campuswide backbone. According to Chris Johnson, assistant director of systems for Northeastern's division of academic computing, dialed ISDN links now bring practical transmission speeds to these smaller locations. Combinet Ethernet bridges automatically dial and bond two B channels for effective speeds of 256Kbps with compression.

Fast, Efficient Worldwide File Transfers

The importance of timely data is hard to overestimate, and the ability to send and receive enormous quantities of information from one place to another is one of the corporate information manager's greatest challenges and responsibilities.

Today, most of these high-volume transmissions travel through dedicated channels. But many MIS managers, especially at companies with strong commitments to ISDN, find that dialed, bonded B channels give a flexibility and economy not offered by standard leased lines.

Typical International File Transfer Costs

New York City to Europe, typical daytime rates, not including taxes.

Twenty Megabit file	Time	Cost
14.4Kbps modem	23.1 minutes*	$27.13
ISDN at 128Kbps	2.6 minutes#	3.15

* Assuming full 14.4Kbps transmission speed
# Assuming 2:1 compression through a single B channel

At several locations in New York City's financial district, for example, daily and weekly updates of *stock quotations* are now forwarded by dialed ISDN links instead of the disks, magnetic tapes, messengers and couriers previously used.
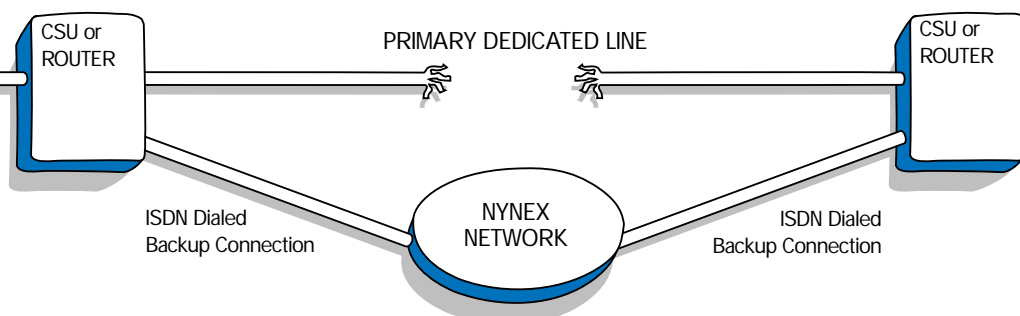
ISDN for Network Overflow and Backup

The worldwide dedicated voice and data networks of many corporations are critical to the orderly, day-to-day conduct of business. A failed connection can often shut down a firm's ability to carry on its business.

For protection, many firms have traditionally maintained two separate networks – one as primary, the second as a backup. Today, however, many organizations find that ISDN lines offer a better alternative: excellent backup and overflow capabilities for either a voice or data network – at a fraction of the cost. Some typical examples include:

❖ *Avis Rent A Car.* The global rent-a-car giant, headquartered in Garden City, Long Island, chose ISDN to back up its critical worldwide reservations and information system. With operations in 140 countries, the Avis "Wizard" system is today online to 33 nations, with new countries added frequently.

The Avis network primarily handles online automobile rental reservations, with an average worldwide response time of about two seconds. It also carries sales orders and reporting, billing data, company-wide e-mail, file transfers and more. The ISDN backup system is currently deployed in eight countries including the U.S.,

ISDN as a backup to critical circuits. Within three seconds of a failure anywhere in a private dedicated network, ISDN can reestablish a corporate lifeline. Unlike dedicated backup circuits, costs are minimal for the high-speed protection offered.

CSU or ROUTER — PRIMARY DEDICATED LINE — CSU or ROUTER

ISDN Dialed Backup Connection — NYNEX NETWORK — ISDN Dialed Backup Connection

and is designed to establish dialed 128Kbps connections in less than three seconds after a network failure occurs.

◆ *William Morris Agency.* ISDN back-up capabilities are also in place for this talent agency's worldwide leased-line network, linking offices in New York, Nashville, Beverly Hills and London. The system lets agents in each office share and access information about clients and bookings.

"We use leased lines for our permanent connections in the United States," said Mike Clark, the firm's network manager, "but we rely on ISDN for backup and overflow of these critical network connections. Dialed ISDN links are also our primary connections to London."

◆ *Little, Brown and Company.* The worldwide publishing firm headquartered in Boston backs up four dedicated T1 connections using ISDN. "We back up only the data channels, ranging from 56 to 128Kbps lines," says Frank Chiacchieri, the company's director of microcomputers. Intelligent Adtran DataProbe switches monitor each channel and automatically dial 128Kbps backup connections within seconds." Chiacchieri adds that in several self-inflicted failures, the system has performed flawlessly.

◆ *Baystate Health Systems.* Baystate Health Systems in Springfield, MA, also protects key elements of its regional backbone network with Gandalf bridges, yet has this same equipment ready to assume a much larger backup role.

"We keep a complete system backup offsite," says Michael Weisse, senior systems programmer at the center, "with data records backed up every day." In the event of a disaster in the computer room – a fire or flood for example – a complete copy of the facility's records would be delivered to *Business Recovery Systems* in Sterling Forest, NY. "They maintain a physical duplicate of our system," Weisse notes, "and we would use dialed ISDN connections to access and use that system. We've tested the set-up, and it works quite well."

> Intelligent switches monitor each channel and automatically dial 128Kbps backup connections within seconds.

High-Speed Group 4 Fax

The ubiquitous fax machine is one of today's most commonly used tools for person-to-person communication. And although facsimile machines have made giant steps forward since the "dark ages" of revolving drums and six-minute-a-page transmis-

sions, ISDN stands ready to make them even more usable, and *significantly less expensive.*

Today, more than 35 percent of all long distance charges incurred by a typical large company are generated by facsimile traffic. According to a recent survey by *USA Today*, the average fax is more than seven pages long, and the average page requires about a minute to transmit.

"Group 4 fax machines and dialed ISDN will probably save the typical company about 30 percent on its monthly long-distance bill."

The dialed, digital connections of ISDN offer a better, faster way to send these faxes. Group 4 fax machines, in fact, are some ten to twenty times as fast as the fastest Group 3 machine in use today. A full page Group 4 fax can be transmitted in from three to eight seconds, and quality is virtually identical to that of a high-quality laser printer.

In addition, several manufacturers now make PC-based fax cards that can send to and receive from both Group 3 and Group 4 fax systems interchangeably, as needed.

"Group 4 fax machines and dialed ISDN connections will probably save the typical company about 30 percent on its monthly long-distance bill," said Marc Josephson, president of *Advanced Digital Networks*, a systems integrator in New York. "But that's just the beginning. Because the corresponding savings in time and effort would probably be about four or five times as great."

According to Josephson, many PC-based systems today offer comprehensive facsimile store-and-forward capabilities, which can significantly cut the waiting time and delays common to sending faxes. These systems also function as fax mailboxes for incoming transmissions, and hold and deliver faxes when and where they're needed – just as voice-mail systems do now.

THE GRAPHIC ARTS

The graphic arts are typical of many industries where people need to come together, exchange images and information, solve problems and reach agreement.

The fact is that virtually every book, magazine, newspaper or advertisement prepared today, as well as every graphic image that appears on television, first began its existence in a computer, or was quickly made part of a larger computer file.

Copy is written and images drawn or scanned on desktop computers. Pages are designed and formatted, photos corrected and separated, and negatives or even final printing plates produced on these or similar desktop systems. Meanwhile, scores of others review, edit, revise and approve the work at almost every step of its development.

And throughout this intense and high-paced community of interest, ISDN is changing the way information gets from one place to another. It has begun to replace the colorful but costly army of bicycle messengers, couriers and account executives in taxis that has traditionally serviced this industry.

Prepress

New York City's *Axiom Design Systems* uses ISDN lines to offer a battery of PostScript imaging services to ad agencies, design firms, publishers and corporate art departments. In fact, today more than half of the material sent to and from the company is delivered electronically.

"When all we handled was text, modems were quite adequate," says Jim Lynch, vice president of the firm. "But modems are a pretty slow way to transmit most of today's large photo, image and layout files."

Axiom Design also uses ISDN to offer bulletin board, e-mail and electronic conferencing services, as well as typefaces, stock photos and illustrations – all of which can be electronically previewed, purchased and downloaded.

Lynch believes that ISDN will also be the catalyst for a growing number of applications, including remote image database management, and the widespread use of a service bureau's high-quality dye-sublimation color printers as an industry-wide resource.

At *Digital Pre-Press International* in San Francisco, Dr. Sanjay Sakhuja heads a staff of specialists who offer high-quality color separation for slides, artwork and illustrations.

"Once these images are in a computer," Dr. Sakhuja says, "ISDN lets us transport even the largest of them across the street or around the world in seconds." DPI serves customers from virtually every area of the country, including many in the NYNEX "footprint." DPI also receives finished computer layouts of ads, magazines, books and more through ISDN, turning them into finished printing negatives – up to 33" x 44" – customized for the printer and press to be used. The ISDN links are also used to return low-resolution copies of a separation to a designer, who then crops and positions it in the final layout. The high-resolution counterpart, stored at DPI, is then inserted into the final version.

At *Parade* Magazine, a simpler but equally time-saving exchange of files takes place each week. According to Esteban Haigler, the publication's technical services manager, Parade works closely with a key advertising agency to insure maximum reproduction quality in the many ads placed by the agency.

Parade first scans black-and-white or color photos to its exacting specifications, and then – using *Easy Transfer* software and Planet Euronis ISDN cards for Macintosh – transmits them through ISDN connections to the agency. The agency then incorporates the photos into ads and returns finished EPS files to Parade, also by ISDN, where the ads are quickly pulled into *Quark XPress* layouts for the nationwide magazine.

"The files can be as big as seven to ten megabits," says Haigler. "We used to send them back and forth using optical cartridges and messengers, but now ISDN gives us a faster, simpler way."

Photo Retrieval Systems

While a growing number of stock photos are being offered on CD-ROM, many time-dependent photos – especially news and sports images –are today being offered through the dialed connections of ISDN.

The photo department of *Business Week* magazine in New York City, for example, is beginning to

High-quality photos
Digital images can now be previewed, selected and downloaded through dialed ISDN connections. The high-resolution four-color JPEG original of this photo is more than 17 megabits in size. Using bonded B channels, it could be transmitted down the street or across the country in about two minutes or less. Photo courtesy of Allsport, Santa Monica, CA.

use ISDN to view, access and retrieve high-quality photos from around the world – from manufacturers, marketers, advertising and public relations agencies, and photo services in the United States and Europe. Michael Hirsch, the publication's picture researcher, says that the higher speeds of ISDN will enable the magazine to greatly extend its reach to a broad range of new sources.

"We measure transmission times in seconds and minutes, rather than hours and days as we did before . . ."

A typical supplier of up-to-the-minute photographic images is *Allsport*, in Santa Monica, CA. The company specializes in high-quality full-color coverage of sporting events around the world, and currently has more than 100,000 images available on-line, with thousands of new images added each month.

Through ISDN connections, editors can view thumbnail-sized pictures, call up full-screen views of selected images, and even try out various zooms and croppings. They can also place orders, and have high-resolution digital copies quickly downloaded, or shipped overnight by courier.

According to the firm's president, Steve Powell, it is relatively easy to use dialed ISDN (or Switched 56) connections to conduct detailed thematic searches, since all images are not only electron-ically stored but systematically cataloged.

Publishing

The *Instructional Publishing Group* of New York's *Scholastic, Inc.* develops and publishes school textbooks for a range of children – from kindergartners to sixth graders. Through the years, the company has developed close working ties with *Integrated Graphic Services* (IGS), a comprehensive prepress facility in Atlanta, GA.

"ISDN lets us maintain an around-the-clock presence in Scholastic's New York office," says Will Weaver of IGS. "In effect, our Atlanta office is actually closer and more responsive to our client than other prepress facilities just down the street. ISDN lets us give Scholastic fast, comprehensive, virtually around-the-clock service." Files transmitted to and from Atlanta through Engage routers range from small text documents and medium-sized page-layout files to multimegabit photographs and other scanned images.

"We measure transmission times in seconds and minutes, rather than hours and days as we did before," said the company's operations manager, Daniel LaBour. "ISDN has significantly reduced the time it takes to move a project from beginning to end." For IGS, the flexibility of ISDN also means that work channeled into IGS can quickly be sent for printing to affiliated companies virtually anywhere in the nation.

Barings Securities is an international brokerage firm with facilities around the world. In the company's Manhattan office, research editor Julia Cronin uses ISDN to send *Page-Maker* files of detailed research reports to printers in London and Singapore.

BARINGS

"We used to use electronic mail, conventional modems, and international couriers," said Cronin, "but ISDN has given us a much faster alternative. Our files can be quite massive, yet ISDN transmits even the largest anywhere in the world in minutes."

Files to printers around the world. Large PageMaker files from Barings Securities are transmitted in minutes via ISDN to printers around the world.

The clients of *Arnold Advertising* in Boston include such names as Volkswagen, Fleet Bank, McDonald's, NYNEX, Stop & Shop, and others. Coordinating the production of ads and other materials can pose major logistical problems, notes Joe Teixera, the firm's executive vice president and chief administrator.

"ISDN is a lifeline," he says. "Instead of sending messengers and couriers all over the Northeast, we now use ISDN to send all of our *Quark XPress* and Adobe *Illustrator* files to clients for review, and to printers and newspapers for actual production."

Bloomingdale's, headquartered in New York City, is a major advertiser in a multitude of publications. Says Chip Pursell, system administrator for the department store giant, Bloomingdale's uses ISDN to transfer files to and from artists and designers, as well as marketing and merchandising executives.

Distributing ads. Bloomingdale's has supplanted messengers and couriers with dialed ISDN connections to send final production files of advertisements to publications throughout its market area.

"We use *Adobe Acrobat*," says Pursell, "with medium JPEG compression that actually enhances much of the black-and-white art." File size for art and finished ads can be as large as ten to twelve megabits. He also uses ISDN to send final, production-ready printing materials to some 15 newspapers throughout the store's marketing area.

At *Ocean Spray* in Lakeville, MA, labels for the firm's growing array of new products marketed in the United Kingdom are actually developed in England, at the company's design firm in Oxford. Sample labels and other Macintosh files are frequently sent back and forth as designs, and the products themselves, evolve.

"We get the right labels at the right time," says David Murray, the company's financial administrator of information services. Murray notes that Ocean Spray is also becoming active in both CAD/CAM and video connections to its other offices in the U.S. and overseas.

Goodbye Couriers; Hello ISDN

"In literally hundreds of areas," says *TeleSystems Marketing Applications*' John Mazalewski, an ISDN systems integrator serving the Northeast, "people still transfer important information physically – on tape, disks and cartridges, by messengers and overnight couriers – because they don't trust analog lines to do the job."

The reason, he notes, is that analog connections are too slow for transferring large files, and too error-prone for critical information.

"The digital connections of ISDN are changing all this," Mazalewski adds. "Soon, in areas that range from printing and publishing to manufacturing and warehousing, transferring data to someone's computer will be as effortless as calling them up to leave a voice-mail message is now."