

VII

Network Myths and Realities

“When in doubt, use a bigger hammer.” Dobbins’ s Law

The personal computer revolution provided an individual with a stand-alone computer. Almost overnight an individual did not have to rely on a central computer, wait overnight for the systems staff to process files in batch operations, or wait in line to use a terminal. The PC cut the individual’s dependence upon a centralized information services function.

Only a handful of people anticipated the tremendous increase in computing power that the PC would achieve in less than a decade. It seems as if the next generation of central processing chips is announced every six months. No sooner do we adjust to the power of the Intel 80386 or the Motorola 68020 than we learn about 80486s and 68040s.

The personal computer has evolved to mini- and mainframe-computer power. As processing power in-

creased and prices dropped, the number of PCs has risen as well. Consequently, organizations have tried to maximize the return on these personal computing resources, which now include a wide range of advanced hardware and software features.

One of the most important technical developments in the last three or four years has been the ability to link computers--to network them. The Microsoft CD-ROM Extensions (MSCDEX) allows the CD-ROM drive to operate as a magnetic disc drive. Systems professionals can more easily tie CD-ROMs to a network.

The Network Opportunity

With the increase in computer power, libraries have an opportunity to tap the information resources represented by CD-ROMs. With some careful planning and study, it is now possible--technically and financially--to use CD-ROM discs as a shared central information source. Think of it as a mini-Dialog or mini-Mead.

Information consumers can access one or more CD-ROM discs from workstations within the library or by connecting a PC to a system offering dial-up access to the data stored on CD-ROMs. The appeal of multiple or remote access to a bank of CD-ROMs is the broadening of the audience for the information. A typical CD-ROM is a stand-alone installation usually limited to one person's query at a time. The ability to allow two or more people to use the CD-ROM simultaneously changes the economics of the CD-ROM acquisition. Clients or patrons can use their own or relatively inexpensive PCs to obtain information. The

costs of the CD-ROM drive, disc, software, and interface is distributed over more users.

An Unbeatable Combination

CD-ROMs and networks go together. They are two of the more powerful technologies available today. Both are expensive. Both appear to offer increased productivity to individuals. And both are making significant inroads in the offices of specialists and generalists.

CD-ROM provides a means to distribute large files economically. It stands to reason that if an expensive CD-ROM is limited to one individual's personal workstation, others cannot make full use of the investment. It is generally difficult for an organization to justify a significant investment for a single employee other than in exceptional circumstances. As a result, there is consider-

Figure VII.1 LANs Compared

Cost per User	Speed	Ease of Installation	Linking with Other Networks
<i>Higher</i>	<i>Faster</i>	<i>Harder</i>	<i>More flexible</i>
IBM Token Ring	Ethernet	Ethernet	Ethernet
Ethernet	IBM Token Ring	IBM Token Ring	IBM Token Ring
Starlan	ARCNET	Starlan	Starlan
ARCNET	Starlan	ARCNET	ARCNET
<i>Lower</i>	<i>Slower</i>	<i>Easier</i>	<i>Less flexible</i>

able interest in networking **CD-ROMS** in the marketplace. In marketing parlance, market pull exists for networking solutions.

The challenge is to allow for access to the data on the **CD-ROM**, which is a form of media not yet widely supported by vendors of major networking hardware and software or an organization's computer center.

Thus, networking for **CD-ROMS** at this time more generally means providing access to data in a work group, not in a company-wide or international information transfer system.

Networks and Multi-User Systems

What Is A Network?

A *network* is a combination of hardware and software which allows computers to share resources. Some of the advantages of networking are:

- Electronic messaging, also known as electronic mail or E-mail.
- The ability to share specialized hardware, most often a laser printer or plotter but can include **CD-ROM**.
- Remote and multi-user access to data.

For an information resource facility such as a library, it is wider access to databases **on CD-ROMS** which often triggers the need to think about networks. The reasons for interest in a network are partly economic and partly practical.

The Local Area Network (**LAN**) gives each user his or her own computer with memory, disk storage, and such peripherals as a printer and modem. Computers linked on a **LAN** may share a laser printer or a special purpose fixed disk like the **CD-ROM**. Each user is able to perform operations independent of the **LAN** or use the resources provided by the **LAN** as the user sees fit.

LANs have the advantage of allowing each user to access his computer as a *separate* device. This reduces the demand on the network. In the event of **LAN** failure the individual computers continue to operate. **LANs** work best when more than eight people are connected.

What Is a Multi-User System?

A multi-user system is synonymous with time sharing. The term is applied to a central computer server--for example, an 80386 CPU--and dumb terminals, which lack a **CPU** and extended memory resources, connected to the central computer or, in computerese, the sewer.

The single, powerful **CPU** of the server can simultaneously support many people. While the computer is waiting for one user to enter a command, the **CPU** can be processing another command and transmitting data to yet another person's dumb terminal.

The main feature of the multi-user system is that only one computer is required. All of the resources associated with the use of a personal computer are attached to the network server or a user's PC itself. There are a number of arrangements possible to allow easy access to such peripherals as printers, fixed disks, data, and modems.

One requirement of the multi-user system is that all users be concentrated within a small area; for example, a single office or a single building. To bridge geographic distances greater than this, the **CPU** must be larger. With the increase in size, the multi-user system becomes a timesharing mainframe.

Multi-user systems are dependent upon the single **CPU**. If it fails, the entire system is down. Extensive tests conducted by the staff of *PC Week* revealed that significant reduction in data-transfer speeds occur when multiple workstations attempt to access data on the same **CD-ROM** simultaneously. Even in larger networks, it is unlikely that users of **CD-ROM** databases will all try to access the same or even different data at the same time.'

In a typical office setting, multi-user systems work best when fewer than eight people are connected. Now that 80386 computers can run the UNIX operating systems, multi-user systems may grow in popularity.

Two Minutes about Network Types

Hardware Protocols

In order for **PCS** to communicate with each other and to access central resources, like **CD-ROM**, they must have the appropriate network interface card or **NIC**. Once the card is installed inside of the **PC**, cables can connect each microcomputer to the network. From the point of view of the end-user, the hardware portion of the network is transparent. The protocols described below all operate at approximately the same speed, so that this should not be a factor when considering which protocol to install. More useful buying criteria are cost, ease of installation and

administration, and applicability to the current network configuration in use.

The four most common types of LANs are:

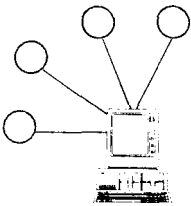
- ARCnet.
- Ethernet.
- Starlan.
- IBM Token Ring.

Without getting mired in technicalities, let's characterize each of these approaches, so you can have a general familiarity with each of these LANs:

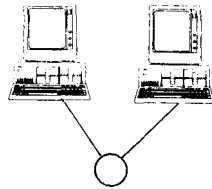
ARCnet

More than 10 years ago, Datapoint Corporation developed ARCnet. It has a 2.5 Mb/second throughput

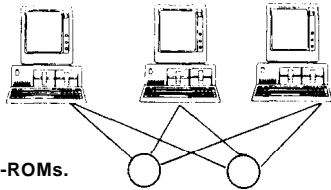
Figure VII.2 Ways of Sharing CD-ROMs



One PC to several CD-ROMs.



Multiple PCs to one CD-ROM.



Several PCs to several CD-ROMs.

capacity, and the LAN can support up to 75 users if demand is low. Its principal strength is its reliability. The most common installation has a central-server computer connected to individual PCs.

Ethernet

This LAN is more than a decade old, and it was pioneered by Xerox and Digital Equipment Corp. It is found in high-demand environments, particularly engineering and graphics applications. It offers a 10 Mb/second data throughput speed and a wide range of interconnect options, including linking different LANs. Ethernet comes with several different cabling options. The twisted-pair Ethernet can use existing copper wires in a telephone system, for example.

Starlan

AT&T developed the Starlan. It offers a low-cost per user and allows users to be linked in different ways. It can use existing copper wires. It has a throughput of one Mb/second. It is relatively easy and economical to install. It offers moderate interconnectivity.

IBM Token Ring

This is a sophisticated LAN developed by IBM. It uses a technology known as the *token ring* to allow the central server to provide the specific computing service required by each workstation. The token is nothing more than a code which tells the central server what a workstation wants and when the central server is ready to accept another instruction. It has a throughput speed of 4

Mb/second and is one of the fastest growing types of **LANS** in the marketplace today. It has a high degree of fault tolerance.

Information Products Raise Issues

The cost of **CD-ROM** hardware and software makes the purchase of multiple versions of a single information product impractical. A few institutions will have the resources to provide multiple workstations accessing one **CD-ROM** product, but the majority will have to find less costly ways to provide access to the information.

At the present time, **LANS** are getting the lion's share of attention in the **CD-ROM** product arena. Networks also address some of the practical issues concerning **CD-ROMS**. With the data discs in one location, a network can minimize the number of different individuals handling the discs themselves and operating the drives. Mechanical failure of the optical drives often comes from an inexperienced user forcing the loading mechanism. Careless handling the discs and the disk caddies (carriers) used by some vendors are almost eliminated in a network environment.

Some hopes and expectations for networks outrun the ability of the hardware and software to meet everyone's needs at the present time. The fact is that networks represent another technological hurdle for libraries to clear. Placing large databases on a network--whether in the form of a **CD-ROM** or some other electronic medium--is a different undertaking from a close technological cousin, the online catalog.

To the network manager, CD-ROM products raise these issues:

- CD-ROM drives are slower at data transfer than fixed discs.
- Controller and interface issues vary from drive supplier to drive supplier.
- Publishers of CD-ROM information products often provide idiosyncratic solutions to technical problems which means special solutions must be developed.
- Computer support staff are less familiar with CD-ROM drives than other types of hardware, which translates to a longer learning curve and a trial-and-error approach to problem solving for even minor difficulties.
- Lengthy processing time for complex searches and data transfer may reduce the functionality of the system rendering multiple, simultaneous accesses impractical, thereby making the investment in the network unproductive.

Sharing Discs

Some vendors will use somewhat imprecisely the term *networking*. They often refer to one PC accessing multiple CD-ROM discs. Strictly speaking, this is not widely accepted as networking, which requires network hardware or software. Be aware that *networking* as a general concept is commonly applied to these types of CD-ROM disc sharing:

- Multiple personal computers accessing one CD-ROM disc.
- Multiple personal computers accessing multiple CD-ROM discs.

In terms of difficulty, one personal computer can access multiple CD-ROM discs...at a price. The technological challenges are few, but the hardware costs can be significant. In fact, Information Access Co. and University Microfilms are two of more than a half-dozen companies shipping personal computers with multiple CD-ROM drives.

Unfortunately, this type of networking is not what the users and purchasers of CD-ROMS want. They want to have networks which provide multiple personal computers access to one or more CD-ROM discs.

The Challenge

There are dozens of technical problems associated with installing and operating a network. In terms of CD-ROM we can focus our attention on two key points.

- Can technically trained individuals skilled in more traditional media--nine-track tapes and mainframes--engineer systems that smoothly integrate CD-ROM?
- Can non-technical users make the system work in a responsive, flexible way?

Recall the definition of the word *network*: the ability of more than one user at a time to access information at the same time and to communicate with each other. It also

provides a vehicle for data sharing from a central database. The pivotal concept of the network is the ability to exchange data and share resources. Ideally, data transfer should occur at a speed which allows the users to continue from **CD-ROM** their tasks at their normal working pace.

To achieve this, the following components must be in place:

- Hardware that allows access to the **CD-ROM**.
- Network software in the file server.
- Network hardware and software in each personal computer on the network.
- Cables and wiring.
- Staff to manage the network.

A Network Plan

Before launching into a network, have a network plan which integrates with your strategic plan for electronic information products. In addition, at the earliest possible moment, begin to tap the resources of your organization's Computer Center, **MIS** Department, and a telecommunications organization.

Most organizations and institutions today have standardized on one or two networks. Many of the companies in the network business are relatively unknown in the library market, and even their names--Novell, 3-Corn, **TOPS**® (Sun Microsystems), or Corvus--may be unfamiliar. Be prepared to *learn from* your organization's computer staff and *teach* yourself about the network products on the market today.

In those initial conversations, there are nine topic areas that may spark heated discussion if not disagreement:

- Network Management
- Vendors
- Contracts
- Funding
- Hardware requirements
- Software requirements
- Access and security
- Maintenance
- Scheduling and timing.

Let's look at each briefly so you know what to expect.

Network Management

Who will assume responsibility for planning, implementing, and operating the network? Networks bring the type of centralized back-up, maintenance, and operation that are characteristic of the central computer facility. The early days of the network are likely to be the most politically attractive. The actual operation of the network is not a glamorous job. Headcount is difficult to increase and technical resources are overstretched. As a result, the biggest issue is commitment and follow through.

Vendors

The organization's computer staff will have one set of vendors, and the library will have another with whom it does business. It is highly unlikely that the names which have a track record in the library and information center world (Dialog Information Services, SilverPlatter, H. W. Wilson) will have name recognition among computer center staff. Similarly, the vendors who have provided the organization's networks, regardless of size, are probably unfamiliar with the demand characteristics of online data retrieval of indexed, abstract, and full text files.

The principal misunderstanding is in the use of the concept *online*. Online in the computer center's jargon means access to centrally-stored data, the majority of which is numeric, and use of **computing** resources which are limited to files for specific management functions like accounting and inventory. The computer center's network vendors will be unfamiliar with the **library's** concept of online with regard to the **CD-ROM** product.

Contracts

Fees and contracts for networked **CD-ROM** products are still in the developing stages. Terms and conditions have to be negotiated and very clear guidelines drawn. Is there a financial benefit to networking the **CD-ROM** product, or should that cost be balanced with individual **PCs**, **CD-ROMs**, or tape leases?

Funding

Networks are what the computer center wants because they allow the computer center management to

bring order to the chaos of individual stand-alone applications. Most organizations allocate money for network operations in both departmental and computer center line items. When the computer center budget pays for the network, it owns the network. It is essential that the library obtain funding for the network it needs and retains control of the funding for the network; otherwise, the implemented network will be responsive to the needs of the computer center and not to the needs of the library.

Hardware Requirements

Most libraries are hardware poor. If adding a network is the goal of the library, personal computers (or terminals) and CD-ROM drives must be acquired according to a technology plan. The equipment should conform to network requirements. Although significant strides have been made to link personal computers from Apple with personal computers compatible with IBM standards, homogeneous equipment greatly reduces the installation and maintenance problems of the machines on the network.

The hardware required to link several personal computers in one room with several CD-ROMS demands one type of solution. Linking multiple personal computers at geographically-distributed locations with multiple CD-ROM requires a different approach. There are networks providing a wide range of capabilities. The low-cost LANtastic network product may be satisfactory for one library application and be unworkable when computers are scattered over ten locations in a four-story building.

The hardware must be compatible with the library application but conform to the hardware endorsed by the central computer staff. This, however, is not always possible. Without familiar hardware, neither the computer center nor the library staff will be able to troubleshoot network problems related to the hardware that is installed.

Software Requirements

Typical network software is invisible until it malfunctions. Network operating systems or NOS have a multitasking (simultaneous operations) and multi-user (more than one user at the same time) architecture. Networks, therefore, have more in common with minicomputer or mainframe operating systems. Network software consists of a number of different modules which recognize users, match access privileges, and route and process commands. The majority of the LANs for personal computers license code from Microsoft which offers a product called MS-Net.

In addition to network software, **CD-ROM** products require text retrieval software. The basic input-output software is called *NETBIOS*. In most cases, this software is resident on the computer linked to the **LAN**. **NETBIOS** is the communications protocol developed by IBM. It has become the network interface standard among PC LANs. **NETBIOS** stands for **NET**work **B**asic **I**nterface **O**utput **S**ystem. It is a software interface between the network and networking software, and it allows devices to communicate with each other. Note that not all environments use **NETBIOS** as the communications protocol. Most **CD-ROM** network systems rely on the **NETBIOS** protocol but an increasing number are using Novell **NFS** (**N**etwork **F**ile **S**ystem) and Novell **NetWare** **IPX/SPX**.

Access

The key issues are: Who can access the data and who manages the security? One of the points of vulnerability for **CD-ROM** networks offered today is that they are easily compromised. Although the data on these systems may not be sensitive, unauthorized access can bring the system down. Computer center staff will be interested in the security levels built into the system. Expect them to be highly critical of the open architecture the first and second generation systems being offered to the library market. As vendors upgrade the **CD-ROM** network products, security and access will be less of a problem. At the present time, however, both can cause computer center staff to resist the **CD-ROM** solution offered by a vendor not on the list of those approved as suppliers to the organization.

Maintenance

Standards for **CD-ROM** and networks are woven into the fabric of these products from the major companies offering hardware and software to the Library. However, implementation of these standards may vary slightly from vendor to vendor and within products produced by a single vendor at different points in time.

Computer center staff typically take one of two positions with regard to maintenance. The first is that they will take responsibility for system maintenance. The benefits to computer center staffs managing the function are that the library will not have to allocate resources to keep the system functioning. The downside is that the computer center may impose suppliers and operating conditions on the library.

The second approach is that the library will provide the maintenance itself. The benefit is that the library retains control of its application. The downside is that the library will have to allocate resources to network maintenance and manage technical problems as they arise.

Timing

Networks typically take longer to implement than expected. The critical factor in staying on schedule is preparation. The strategic electronic information plan is the foundation on which to schedule accurately and against which to measure progress.

In general, the following factors create significant scheduling problems and therefore should be given additional attention:

- Hardware specifications
- Software specifications
- Installation instructions
- Troubleshooting.

Another rule of thumb in scheduling is that the larger the number of vendors involved, the greater the time required to get problems resolved. Each vendor has a tendency to believe that the other vendor's hardware or software is flawed. Only after each of the other components proves its worth will the vendor step forward and take responsibility.

No matter who in your organization has responsibility for scheduling, the amount of time required for all aspects of the job will be greater than the original estimate. There-

fore, set realistic checkpoints and prepare management for changes in target dates based upon performance-related benchmarks. This means that if something doesn't work, adjust the schedule to reflect accurately when the system will be available.

Networks Now!

In April 1987, *Optical Insights*, published by the Boston Computer Society, noted that CD-ROM devices had not yet been embraced by the major personal computer LAN suppliers as single-drive network services.²

Today a library has the choice of a number of networking options, offered by the vendors of CD-ROM discs and companies specializing in meeting the market's appetite for some form of multiple access to CD-ROMs. Among the companies with network products are Online Products (Germantown, Maryland), whose Optinet[®] product has been well-received. The company is a part of Reed Telepublishing, which owns R.R. Bowker Bowker Electronic Publishing and Books in Print Plus. The other company is Meridian Data, Inc. (Capitola, California).² For purposes of this overview, we'll take a quick look at Opti-Net 1.1.

Online Product's Opti-Net

Opti-Net 1.1 provides network access to CD-ROMs using a software-only solution. Online Products Corp. sells Opti-Net as a complete package which can be loaded on any workstation. When the Opti-Net software is installed on a workstation, it appears that CD-ROMs are

attached to that specific PC. Any computer which works with MSCDEX can be used.

The current release, 1.1, supports up to 100 users. The software is compatible with NETBIOS and Novell's IPX/SPX based systems. These networking options are widely accepted as standard architectures in a large number of organizations in the U.S. and elsewhere in the world.

Opti-Net's approach treats CD-ROM servers and CD-ROM discs as *database servers* and *databases*. The network administrator assigns a number to the CD-ROM server. The Opti-Net approach avoids cryptic redirection statements found in many other CD-ROM network software packages.

The administrator gives a name to each CD-ROM or group of CD-ROMs; for example, ERIC. When a workstation needs access to a specific CD-ROM database, it is opened by name. A network monitoring program shows these names and other information regarding which CD-ROMS are being used. This program makes it easy to reconfigure the CD-ROM server.

The Opti-Net product is compatible with High Sierra and ISO 9660 formatted CD-ROM discs.

Although prices are subject to change, in January 1990, an eight-user license cost \$795 and a 100-user license cost \$1,495. These prices include both IPX and NETBIOS versions and Microsoft CD-ROM Extension licenses.

The specific features of the Opti-Net approach include:

- Software-only solution. ❑ additional network hardware is required.

- Rapid data transfer rate. (First read data transfer rate of 91 kilobytes per second under `IBM'S LAN Support Program NETBIOS`. Second read rate: 159 kilobytes per second.) This, according to PC Week, is nearly 20 kilobytes per second faster than the performance obtained by testing a `CD-ROM` attached directly to a 386 computer.
- Support for up to 100 simultaneous users.
- User-friendly network management utilities.

Factors to keep in mind when analyzing the Opti-Net system are:

- Greater demands on workstation and server memory.
- Installation program is not fully automatic; for example, `CONFIG.SYS` files are altered on the server's `C:` drive regardless of the drive on which the software is installed. Changes must be made by the system administrator.

Online Products Corp. has been increasingly accepted as a `CD-ROM` network solution. The company has been successful in working with `CD-ROM` publishers and companies which manufacture write-once and read-write optical systems. We recommend that anyone wanting to network `CD-ROMS` take a look at the Opti-Net software.

SilverPlatter's MultiPlatter

`CD-ROM` vendors offer network solutions bundled with their discs. Among the companies providing these products and services are University Microfilms, Informa-

tion Access Co., and Disclosure. One group which has been active in networking CD-ROMS is the Massachusetts-based SilverPlatter organization.⁴ MultiPlatter[®] used Meridian Data's CD Net as its basis until November 1989. CBIS's CD Connection and CD Server now provide the MultiPlatter CD-ROM with the software and hardware needed to access CD-ROM data. CBIS is currently working with SilverPlatter to provide an upgrade solution for MutiPlatter's existing customer base, so that present installations can take advantage of CD Connection and CD Server software without having to replace previously-used hardware. SilverPlatter is obviously committed to its new CD-ROM network partner as it intends to upgrade all existing installations of MultiPlatter to CD Connection and CD Server.

CBIS CD Connection is a software program which allows CD-ROM users to access multiple drives simultaneously over a LAN. This product runs on top of Ethernet, ARCnet, Token Ring, and other network systems and provides networking capabilities to CD-ROM drives.

CD Server is the hardware piece of the CBIS network. The computer CBIS provides is a DOS machine, and, therefore, it can act as a stand-alone PC whenever it is not being used as a CD-ROM server. The CBIS system can connect as many as 14 drivers to one dedicated server. This makes the product ideal for large work groups that need fast access to multiple databases.

The product is available in two versions: one for CBIS's Network OS LAN operating system, and one for Novell's NetWare. The \$5,300 price includes a complete package with an 80286-based PC, a Toshiba drive, and

software. The **CBIS** system is unique because it does not require that each **PC** on the network Microsoft Extension software loaded. This allows each workstation to free up as much as 13 Kb of **RAM** per workstation. For this reason and because of **CD Connection's** rapid access to multiple discs *PC Magazine* chose the **CBIS** system as an Editor's Choice product. Contact **CBIS** in Norcross, Georgia, at 404-446-1332.

SilverPlatter adds value to the **CBIS** products by including software that allows users to build menus and maintain usage statistics.

The principal advantages of this system are:

- **Security.** It offers a secure environment for **CD-ROM** access. The discs, software, and network servers can be stored away from the end user.
- **Multiple users.** More than one user can access the same **CD-ROM** at the same time.
- **Access to multiple discs without changing discs.** You can mount as many as 21 **CD-ROM** discs so that they can be accessed by any **PC** in the **MultiPlatter** system.

Some factors to consider about this approach include:

- **CD-ROM** drives which are currently being used cannot be added to **MultiPlatter**. You can still use them on individual **PCs**.
- Only High Sierra/ISO 9660 **CD-ROM** products can be used on the **MultiPlatter** system.

- Speed of access to discs is affected as users are added.
- You cannot integrate the **MultiPlatter** system into your current network. IF you try to do this, the **MultiPlatter** maintenance contract will become void.

Other **CD-ROM** products can be used on the system in addition to **SilverPlatter** products. However, **SilverPlatter** does not provide support for these products. The typical price for an 11 **CD-ROM** drive system is about \$28,000. The basic system includes:

- One network server, expansion chassis.
- Networking software, four Ethernet Network Interface Cards.
- **MS-DOS** for file server, **MS-DOS** Extensions for all **PCS**, six months hardware maintenance, and one year software support.

For more information, contact **SilverPlatter** in Wellesley, Massachusetts, at 800-343-0064 or 617-239-0306.

Special CD-ROM Considerations

Regardless of the network approach taken for **CD-ROM** products, multiple drives are required. Unless you are able to buy all of the needed drives at one time from one supplier, you will have a variety of drives and controller cards. The mixed equipment environment sets the stage for a range of technical challenges. Among the most common are:

- Controller cards and cables for each drive must be matched; even drives from the same manufacturer have different requirements. For example, the same drive shipped by one manufacturer at a different time may have a different controller card. Controller cards must be kept with drives, and they are usually not easily interchangeable unless the technical staff has significant experience with the Microsoft Extensions requirements and commands.
- Software must be configured to work with each driver/controller combination.
- Even in the most sophisticated **CD-ROM** networks, only one user can access one **CD-ROM** at a time. The networks achieve the look-and-feel of multi-user access by lining up requests and processing them one at a time.
- A single personal computer may only be able to activate the search software for a single publisher's **CD-ROM** product at one time. Switching from one publisher's product to another's product may require reconfiguring the personal computer with a different **AUTOEXEC.BAT** and **CONFIG.SYS** file. Some vendors like Information Access Co. and SilverPlatter easily accommodate different data disks; others, like UMJ, are less forgiving.
- A network consumes available memory on the personal computer. If the memory required by the network and the **CD-ROM's** software exceeds the

capacity of the personal computer, the system will not operate on that single machine. Thus, additional memory and software to manage memory may have to be added to workstations.

- Multiple-user access to a **CD-ROM** product escalates computing demands on the local and network server. If response time is unacceptable, a more powerful network server may be needed, or workstations may be disconnected from the network. Either alternative can enhance response time.
- Many network vendors will test the entire **CD-ROM** network before installing it at your facility and will give you an idea of the response time for differing numbers of users on the system at one time. Double check this response time carefully and be wary of any claims which cannot be verified on the installed network.
- Verify that the network can be expanded and understand what hardware and software modifications are needed to accommodate more workstations. For example, if an institution has decided on a network for 20 users. The next year the manager wants to add 20 more workstations. Will the network software be able to handle the extra users? How will it affect your costs and the costs to the users in terms of additional hardware? Can the contract and charges for the **CD-ROM** be adjusted to reflect the change?

Network Challenges

A recent report from Chipcom, a network vendor in Waltham, Massachusetts, reports that the typical LAN is down six percent of the time or six out of 100 days of operation.⁵ Other Chipcom findings are:

- Cable breaks are the most common problem in networks. If redundant cables are not in place, the break must be located and repaired.
- Hardware or network electronic failures are the second most common problem. If a network does not have automatic switch over to back-up systems, the network is unusable until the defective component can be located and replaced.
- Power supply failures are the third most common problem. If a power supply fails, the device is inoperable until a replacement can be obtained, installed, and tested.
- Physical and technical limitations are the fourth most common problem. The network cannot be changed without significant hardware and software modifications.
- The fifth most common problem is inadequate budgeting. Money to make necessary modifications is not available. Network administrators must keep the system operating, not solve hardware and software problems.

Chipcom's report calls attention to many issues which network vendors do not talk about unless asked. Institu-

tions considering a network to allow access to information on CD-ROM may want to explore other options.

Other Avenues to Explore

Networks may not always be a practical solution for your organization. Different ways to obtain electronic information are available.

Database Leases

Leasing a nine-track tape from a database producer is an increasingly popular way to bring the data to many users at one time and provide cost efficiencies that individual subscriptions to CD-ROM do not.

Loading a commercial database on an in-house system is often more difficult than database producers, customers, and software vendors realize.

Commercial timesharing vendors have professionals who check each tape to make certain that the record format matches the load program. Changes in the record structure or a faulty tape cause the load process to fail. Most staff working at in-house computer centers are not equipped to respond on short notice to load program recoding.

Other considerations include:

- Special search-and-retrieval software is required to access the information. It is important to keep in mind that computer center staff may suggest that it is more economical to lease data tapes and load them on the mainframe than use a network to access CD-ROMs. When this idea comes up, con-

tribute to the discussion that most tape leases do not include retrieval software. A functional search-and-retrieval software package for a mainframe application can easily reach six figures, not including the annual maintenance fee. Although mainframe text retrieval software is outside the scope of the discussion here, the packages with the highest visibility among computer center staff are **DM @** (formerly **BASIS**) from Information Dimensions and **STAIRS II**[®] from **IBM**.

- A network is needed to make optimal use of the leased database.
- As usage increases, hardware to allow additional ports or telephone lines must be purchased. The cost of this hardware has been declining, but access to data stored on a mainframe is a complex process which involves components and software unique to the mainframe environment.
- Textual databases often require that their indices be maintained in a separate file. The fastest search and retrieval is achieved by querying the index file. A database like **ABI/INFORM** often has every word in every record stored in the index file, a procedure which doubles the storage requirements for the database. Thus, the disk space required for a commercial database increases with each reload. Similarly processing time is required to rebuild the index file each time a new tape is received.

Database leasing is becoming a significant issue. Before embarking on a leasing program, make certain that you involve the computer center staff in your discussions. The success or failure of the database lease depends upon technical expertise over the term of the lease.

Special Online Pricing Deals

A second option getting attention today is special pricing. The major timesharing companies have made an effort in the last two years to give their heaviest users discounts for agreeing to purchase a specific dollar amount of information in a 12-month period. The advantage to the timesharing company is that they can provide high-speed data lines and plan their network usage. The advantage to the client is that they can budget their online charges.

These pricing deals are going to play a larger part in timesharing companies' marketing in the next 12 to 24 months. The downside of bulk pricing is that the organization or institution must pay for any usage over that purchased. Another issue is that many libraries cannot purchase the minimum required to qualify for the discounts. Checking with the various timesharing companies to determine the current bulk-pricing plans is a useful exercise. For some applications, the bulk purchase provides significant savings without the costs associated with in-house networking of the data.

Public Access Catalogs

The most interesting variation on database leasing is public access catalog databases. A number of public access

catalogs provide gateways to commercial databases or accommodate a database on the library's **PAC** computer. Most of the **PAC** sources--for example, NOTIS--offer commercial database access as an option.

The benefits of this approach are that users can access commercial databases through the library's **PAC** system. A second network is not required. **PAC** access is a fairly new approach. Therefore, a careful analysis of costs and investigation of technical and legal issues is appropriate.

The rapid developments in technology ensure that other options will be available. The one attribute CD-ROM networks, database leasing, bulk pricing, and **PAC** access share is that require multi-user, network thinking. Networks are the foundation of data access in the 1990s.

Points to Remember:

- Choose the right medium for your situation. CD-ROM, tape, microfilm, print, online, or a combination.
- Evaluate the stability of the media. Will users outgrow the medium, or will it outgrow the users?
- Form a strategic partnership with the computer center or Information Systems Department and with vendors.
- Track costs closely. What are the economies of scale? How do they compare with other media's costs?
- Can you recover costs or cost-share with another department or group? Should you bill your net-

work users? Will users be required to make their own investment into hardware and software to access **CD-ROM** through the network?

Notes

¹ "Software Broadens Access to **CD-ROM**," *PC Week*, January 8, 1990, p. 23. A thorough analysis of network hardware appears on pp. 23-32 of this issue.

² Boston Computer Society, *Optical Insights*, Fall 1987, page 1.

³ Online Products Corp., 2051 Century Boulevard, Germantown, MD 20874

⁴ SilverPlatter, One Newton Executive Park, Newton Lower Falls, MA 02162-1449.

⁵ A copy of *Imagine a Network that Never Lets You Down* is available directly from Chipcom Corporation, 195 Bear Hill Road, Waltham, MA 02154.