

IV

Technology Essentials

"It is the Age of Machinery, in every outward and inward sense of the word." Thomas Carlyle, *Signs of the Times*

The CD-ROM is the result of almost 30 years of technological evolution. The earliest optical information product was the videodisc, which was first introduced in the 1950s as an alternative to film. A range of problems--including cost and compatibility--prevented this technology from being much more than a suggestion of what could be developed when computer power increased and prices fell. The early optical storage systems required massive lasers and a roomful of computers. Now CD-ROM devices can be carried as portable stereos or built into personal computers.

The basics of optical storage are little more than 1s and 0s. A laser beam burns a pit into a target surface. The combination of unmarred surface and pits allows data to be digitally encoded. Reading the data on the surface of the encoded target requires another laser application which converts the unmarred surface and the pits into a

form which can be used by a personal computer or audio system. **CD-ROM** is nothing more than an advanced type of floppy disc.

It was in the late 1970s that a more compact, cost efficient, and useful format emerged. A number of technological factors made progress possible. Computers were smaller and more powerful. Lasers were miniaturized and their power requirements reduced. Almost 20 years ago, **RCA** marketed a 12-inch disc which provided color and stereophonic sound. But the high-cost of the disc and the playback unit limited the product's appeal. One early indication of the volatility of the **CD-ROM** industry was **RCA's** dropping out of the optical product race even though its laboratories pioneered the application of the technology.

The audio recording industry was the first successful commercial application of **CD-ROM**. The technology for encoding sound on a compact disc was developed by Philips and Sony in 1980. After many squabbles over standards for optical videodisc systems, these two companies reached a working arrangement which enabled these firms to help provide leadership and practical standards for music applications. **CD-ROM** technology revitalized the music business and gave rise to a multi-billion dollar market for players, discs, and accessories.

At about the same time, a practical optical videodisc system called Laservision emerged. But it wasn't until 1985 that commercial compact-disc read-only memory information products began to appear at library trade shows and information industry meetings.

A Still-Emerging Technology

The technology for optical products is among the most exciting because of the amount of data that can be stored in a form that resists damage from mishandling and environmental factors.

You have probably heard many analogies which relate the quantity of data that can be stored on a plastic disc a bit less than five inches in diameter--4.72 inches. If you can imagine a shelf of library books or a case of floppy discs, you have a working picture of 600 megabytes of data. But new ways of encoding the data on the discs will allow for even higher storage densities.

Each evolutionary change in technologies which make the **CD-ROM** possible has the potential for rendering today's application, hardware, and software obsolete.

To provide some stability in this high-stakes game, there are now standards that provide assurance that the product purchased in 1989 will be fully functional four or five years in the future. There are four current standards for **CD-ROM** technology.

The Red Book

Produced by Philips and Sony, this standard specifies the physical and electrical characteristics of **CD-DA** (compact disc-digital audio).

The Yellow Book

Philips and Sony produced this standard for preparation and accessing digital data in read-only fashion on a

compact disc. The Yellow Book standard relates to CD-ROM hardware.

High Sierra

This standard applies to the logical formatting of the data files on the disc. It is now recognized as ISO standard 9660 (Volume and File Structure of CD-ROM Information Interchange) and can be read by all CD-ROM drives and operating systems *compatible with the standard*.

Green Book

This standard applies to a set of specifications for the physical characteristics of compact-disc interactive (CD-I) and readers.

Microsoft Extensions

Microsoft Corporation, sponsor of the major CD-ROM conference and exposition, has made a significant contribution to the stability of the CD-ROM information product platform.

The company, working with other companies producing CD-ROM products, developed what are called the Microsoft CD-ROM Extensions or MSCDEX. This software allows the disk operating system in an IBM-compatible personal computer to overcome its file-size limitation and access the CD-ROM discs.

Vendors of CD-ROM drives license the Extensions from Microsoft, adapt them to their hardware, and can provide a copy of the software with the CD-ROM drive. Check with the vendor from whom the CD-ROM was pur-

chased to make certain the MSCDEX (Microsoft Extensions) files are included.

Three Essential Questions

- Does this product adhere to the High Sierra standard (*ISO 9660*)? If a product does not, you will not have the reassurance that comes with acquiring a product that conforms to the standard that most of the major CD-ROM publishers use.
- Does a copy of Microsoft CD-ROM Extensions come with the product? Does it have to be installed separately by the purchaser or is it bundled into the installation software? Will there be an additional charge for the Extensions?
- Will the CD-ROM product run on any CD-ROM drive or just a selected few? Some CD-ROM product software may only run with certain drives or on particular computers.

System Components

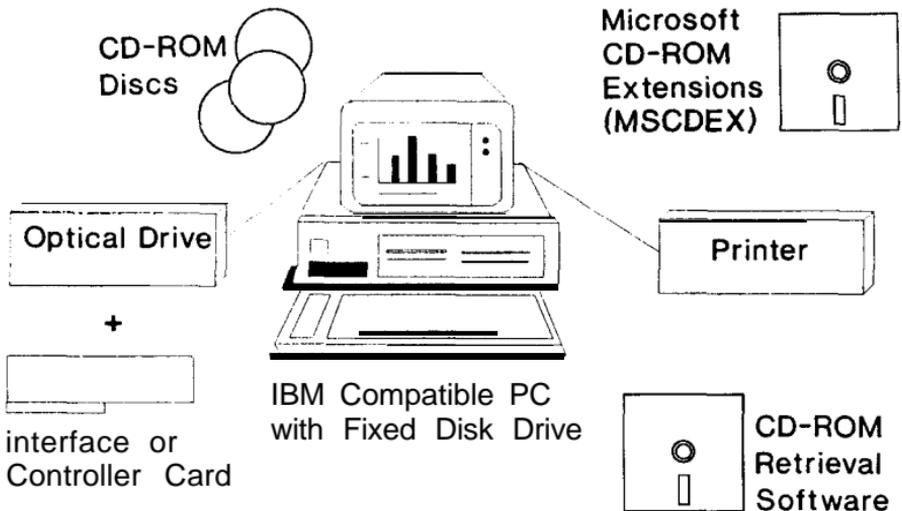
The basic components of a CD-ROM system are:

- IBM or IBM-compatible personal computer; 80286 or 80386 recommended but not mandatory. The 8088- or 8086-based computer may have an unsatisfactory response time.
- A CD-ROM optical drive. Appendix A to this chapter lists a number of the most popular drives available in 1989.

- A card which plugs into one of the expansion slots inside the personal computer's case. This creates a port for the cable to connect the PC to the CD-ROM drive.
- Retrieval software, which can be provided either on the CD-ROM itself or on magnetic floppy discs. The most common practice at this time is to provide the software on separate floppies which gives vendors greater flexibility to update the software.
- A CD-ROM information product.

Certain CD-ROM applications may require a specific type of monitor. Graphics-oriented products like the Chadwyck-Healy map product require high-resolution monitors. The PC may require a VGA or video graphics array monitor and card to permit legible text and a larger palette of colors allow the CD-ROM application appear on the monitor as its publisher intended.

Figure IV.1A A Typical CD-ROM System



The Disc Drive

The **CD-ROM** system consists of a disc drive or player and disc. In the drive, the **CD-ROM** disc spins initially at about 150 **RPM**. Once underway, the rotating speed of a **CD-ROM** disc ranges from 200 **RPM** at the outer edge of the disc and 530 **RPM** at the disc's inner track. The mechanical devices needed to compensate for the rotational difference and to read the data which are placed on the disc in a continuous spiral contribute to the higher cost of the optical drive.

Access time--that is, the time it takes the optical head to read and transfer data to the personal computer--of the disc is directly related to the speed with which it is rotating. **CD-ROM** drives rotate less rapidly than the average fixed or hard disc drives, which spin at about 3,600 **RPM**.

The Data Disc

The compact disc is reliable, permanent, and durable. A single disc has a storage capacity of up to 600 megabytes or 200 books with 1,000 pages each or 1,500 5.25-inch, 360 **K** floppy disks or more than 350 1.2 **Mb** floppy disks.

As mentioned earlier, the compact disc carries a single spiral track that starts at the center of the disc and works its way outward. Machine-readable information--the 1s and 0s of digital data--is stored on the disc as a series of *pits* or grooves and lands or flat spaces. When a disc is inserted into a **CD-ROM** drive, these microscopic pits appear as bumps from beneath the disc and scatter the light from the laser. Lands (the flat places) *reflect* the light from the laser. This scattering and reflecting process is converted and translated into a digital signal inside the **CD-**

ROM drive. Error correction routines ensure that no data are misread. These error correction techniques are more stringent than the error correction routines for audio CD players. The cost of the optical drive for an information product carries a higher price than the consumer audio CD player.

The Personal Computer

The CD-ROM drive is attached to a microcomputer as an add-on peripheral. Information is retrieved from the disc by software included on the disc and installed in the PC.

Although there are a number of CD-ROM products for the Apple Macintosh[®] and Apple II GS, the majority of the CD-ROM products aimed at the corporate and library market require an IBM-compatible PC. The PC should use PC-DOS or MS-DOS, not UNIX or OS/2 for the operating system.

Most users attach CD-ROM drives to a general purpose personal or microcomputer.

Interfaces and Cables

Physical interfaces between the CD-ROM drive and the PC present a compatibility problem at present. Each manufacturer of a CD-ROM drive constructs its own controller board. This board must be inserted into the PC to act as an interface to the PC. A cable then connects the interface card to the CD-ROM. These cables are specially designed for the CD-ROM application and are not generally available from the local computer store. It's a good idea to have back-up cables for the optical drive.

The two types of controller boards or interfaces most commonly encountered today are:

- SASI or Shugart Associates Standard Interface. This type of interface waits for a peripheral--the CD-ROM--to execute a command before going to the next task. The technical name for this approach is *bit serial*.
- SCSI or Small Computer System Interface. This term is pronounced *scuzzy* by the CD-ROM hardware and software crowd. The SCSI interface does not wait for a CD-ROM to execute a command; it goes promptly to the next operation. The technical name for this approach is *byte parallel*. SCSI is becoming the preferred CD-ROM interface for many drive manufacturers because it offers some performance advantages. It is the approach used by all Apple-compatible CD-ROM drives.
- Cables. A cable is used to connect the controller board or interface installed in the PC to the CD-ROM drive.

There are several important questions to ask before you buy any CD-ROM product. The primary ones to answer first are:

- Does this drive have a SCSI interface?
- Is assistance provided in installing the controller board or card into the PC? You will have to take your PC apart in order to install the controller card.

- Is a cable provided to connect the **CD-ROM** drive to the **PC**? If not, find out what you need and where you can get one.
- Does the **CD-ROM** install itself? If the answer is yes, find out what the installation program will do to the computer's **AUTOEXEC.BAT** and **CONFIG.SYS** files. Some installation programs modify or rename and replace your **AUTOEXEC.BAT** and **CONFIG.SYS** files. Changing these files may affect the operation of the **PC** when started again or reboot it. In *VI Trial Installation*, there is further discussion of the **AUTOEXEC.BAT** and **CONFIG.SYS** files.

Software

Questions about the software associated with **CD-ROM** must be asked, and the vendor must provide complete, understandable answers. The software is the most personal aspect of the **CD-ROM** system because users will experience it each time the machine is used.

Interface and Menus

The most important features to examine are the search software and user interface. To assess the software, you must, of course, use it yourself.

CD-ROM interfaces vary widely. In fact, when comparing the three disc versions of **ERIC:**, for example, the principal differences among the products are the interfaces. The majority of today's disc products use some type of a menu to allow the user to access the data. A *menu* is essentially a selection of options from which the user

picks. There is no standardization in menu design. Some are horizontally placed across the top of the screen following the approach taken by Lotus 1-2-3. Menus can appear across the bottom of the screen as well. Others use a single list of options in the center of screen, a technique used with great effect by **UMI**. A third approach is a technique borrowed from the Apple Macintosh with pull-down menus. The user highlights a word or icon and a box opens on the screen showing other selections. A few **CD-ROM** products allow the user to enter commands directly. The Dialog OnDisc[®] products provide this feature to allow experienced searchers to break free of the menu structure which can limit search flexibility.

The issue of user interface is a complex and important topic. It is essential that each CD-ROM product's interface be experimented with. Searchers need to evaluate the interface and make notes about the strengths and weaknesses of the software. These evaluations can provide valuable information about ease of use, retrieval sophistication, problems, and flexibility.

After developing some familiarity with **CD-ROM**, evaluate the software by answering these questions:

- Are the interface instructions and menus easy to read and understand?
- Does the interface allow users to type the first letter of the choice or must arrow keys be used to make a selection?
- Do menu choices provide a *window* offering more in-depth explanation?

Commands

Most search software allows users to enter commands comparable to those used for Dialog's Information Services online system or a similar system. Evaluate the command system by answering these questions:

- Are the commands clear or in jargon?
- Do they require a keyboard template to identify functions? Is it provided along with the software?
- Is there a **HELP** feature to highlight function keys?
- Do commands provide a *window* offering further explanation?
- Is there enough on-screen explanation to make documentation unnecessary or at least optional?

Search Features

CD-ROM users often want to use an earlier version of a search late in the search session. Many CD-ROM products do not allow the user to take shortcuts which can greatly reduce keystrokes and lessen the time required to complete a search. Evaluate save and search features by answering these questions:

- Can search strategies be saved for later use?
- Is Boolean search capability offered?
- Can truncation be used in search terms?
- Is field searching an option?

- Does the system provide a *status* on the percent of the search completed?

Downloading Features

With increasing computer literacy, CD-ROM users do not want to capture the results of their search on a paper print out. Instead they want to download the results of their search to a floppy disc. Evaluate the CD-ROM product's downloading features by answering these questions:

- Is downloading offered?
- Can information be downloaded in a variety of formats including ASCII?
- Is the download procedure easy to follow for a novice user?
- Can a *portion* of a collection or search be downloaded?
- Are there prompts or help screens to ensure that downloading is directed to the appropriate drive in the PC?
- How fast is downloading completed?
- Does the system provide a *status* on the percent of the download completed'!

Enhancements

The newer CD-ROM products are offering features that make the system more responsive to the needs of the users. Evaluate the system under consideration by answering these questions:

- Does the software indicate where the data comes from? This is particularly important when several databases contribute information to a single CD-ROM.
- Does the software have editing capabilities for information retrieved?
- Is there a *screening* feature that allows information retrieval based on pre-selected criteria; for example, sales, geography, or line of business?
- Are wide reports sent to the printer in a compressed format, or do printer specifications have to be changed?
- Are communications enhancements provided, allowing connection to an online database?
- Are security, client usage, or charge-back features offered?
- Can users see titles or full text?
- Is *Key Word in Context* (KWIC:) display provided?

Minimum CD-ROM Capabilities

No CD-ROM is perfect; compromises are necessary to balance features, information, and budget. When a CD-

ROM system is acquired, make certain that it provides these basic functions:

Reliability

The system must have a proven performance track record. Talk to others who have acquired the same system. Be certain that these components have an excellent record of reliability:

- The data.
- The software.
- Downloading and printing capabilities.
- Ease of use.
- On-disc help.

Explanation of the Installation Procedure

As mentioned before, the installation procedures can be automatic or manual. Regardless of the approach the vendor takes, make absolutely certain that you know what the installation requires you to do and what the impact of the installation will be on your computer. If you do not know what your **AUTOEXEC.BAT** and **CONFIG.SYS** files are, get help from the vendor or from someone in your organization. Make certain that the **CD-ROM** has at least these features:

- Quick-start instructions.
- In-depth documentation.

- Telephone help line, preferably an 800 number. Make certain you know the time zone the help staff are in.

Technical Do's and Don'ts

- Make sure you get current specifications and that you understand them. Seek help from the vendor if you don't.
- Don't buy without trying. The vendor should be willing to install for you or bring a demonstration version to your location.
- Have some familiarity with **MS-DOS**. Get a simple, easy to understand manual with a complete index. The basic documentation that comes with the **PC** is written in a peculiar form of prose which defies translation by most of us. Supplement your reference shelf with one of the books listed in the *IX For Further Reading*.
- Know how to modify your **MS-DOS** files. Get an editor that's easy to use, preferably one which lets you use the full screen. We recommend the public domain editor **TED.EXE** available without charge on many bulletin board systems, CompuServe[®], and BIX[®] or Pathminder[®], Version 4.11 from Westlake Data Corp.' The key to the editor you use is that it be able to produce **ASCII** files.
- Make sure that your system works before you install the **CD-ROM**. This includes your hard drive, the printer, and other peripherals. If you encounter

problems with the `CD-ROM` installation, troubleshooting can begin with the `CD-ROM`. Technical support people will always suggest that the problem is caused by a component other than the one they sold you.

- You can save money by buying pieces separately, but you will have to put them together yourself and deal with multiple vendors. The less technical knowledge you have, the more difficult this approach is. The more technical knowledge you have, the more advantageous this approach is.
- Know what kind of equipment you have. This includes the type of `CD-ROM` drive and the specific controller card it uses. Have the type of hard drive and the type of controller it uses, the model of the printer you will use, and the memory configuration of your computer system at hand as well. A real plus is being able to test your printer and `CD-ROM` drive during the installation process to verify compatibility.

Some Final Thoughts

The `CD-ROM` system is not a garden-variety personal computer. A number of tricks and traps await anyone who installs and uses a `CD-ROM` product. The key to success is patience and preparation.

Do not undertake the installation of a `CD-ROM` product unless you can answer *yes* to these statements:

- I know what the `AUTOEXEC.BAT` file is, and I can change its settings to meet my operational require-

ments. (See Appendix C: Sample AUTOEXEC.BAT and CONFIG.SYS Files.)

- I know what the CONFIG.SYS file is, and I can add or remove device drivers as necessary.
- I know the components of my system, including their model numbers.
- I have opened my computer's case and installed peripherals before.
- I have an MS-DOS or PC-DOS reference manual and have read it.

Note

¹ *Pathminder* is the brand name of an elegant hard-disk manager. The program provides a Lotus-style interface which gives the user access to most of the DOS file and directory commands. In addition, *Pathminder* provides a directory view of the hard disk; a fast, easy-to-use text editor, and dozens of touches that make hard-disk management effortless. Contact Westlake Data Corp. at P.O. Box 1711, Austin, TX 78767; telephone: 512-328-1041.

Appendix A: Common CD-ROM Drives

CD-ROM Drive	Controller
Amdek LaserDrive 1	CD-IF14
Denon DRD-55X/25X	ASC88SCSI
Denon DRD-55X/25X	Xebec card
Hitachi CDR-1503S	CD-IFI4
Hitachi CDR-2500	CD-IF14
Hitachi CDR-1502S	CD-IF13
Philips CM1 10	ASC88scsi
Philips CM210	ASC88SCSI
Philips CM100	CM.153
Philips 201	CM153
Philips CM100	CM155
Philips CM201	CM155
Sony CDU-100	CDB-200
Sony CDU-5002	CDB-200
Sony CDU-510	CDB-210
Toshiba xm Series	ASC88SCSI
Toshiba xm Series	Toshiba

Appendix B: Equipment Checklist

1. Personal computer required:

IBM PC
XT (8088 or 6086)
60386

PS/2 Model
AT (80286)
Other

2. Specific compatible

Brand _____
Model Number _____

Type _____
Manufacturer _____

3. Fixed (hard) disk requirements

Size _____

Access speed _____

4. RAM required

640K

Other _____

5. Monitor required

Monochrome
EGA

VGA
Oversized

6. Floppy disk drives required

360 K
720 K

1.2 Mb
1.44 Mb

7. Modem required

1200 baud internal
1200 baud external
Other _____

2400 baud internal
2400 baud external

8.. CD-ROM drive

Brand _____
Model Number _____
SCSI interface
Other specifications _____

Type _____
Manufacturer _____
SAS interface

9. Network considerations

Network type _____

Network software _____

10. Printer

Type _____
Manufacturer _____

Model Number _____
Serial/Parallel _____

11. Software required

MSCDEX
Screen capture
Spreadsheet

Text retrieval
Word processing
Other _____

12. Special requirements _____

Appendix C: Sample AUTOEXEC.BAT and CONFIG.SYS Files

Sample AUTOEXEC.BAT

```
Cls  
Echo Off  
Date  
Time  
Path = C:\App  
$p$g  
MSCDEX.Exe/d:mscd000/M:8  
Cls  
Menu
```

Sample CONFIG.SYS

```
LastDrive = Z  
Files = 20  
Buffers = 20  
Device = Hhitachi.sys/D:mscd000 /u:2
```