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Mass storage technology; Management advisory services special report

American Institute of Certified Public Accountants

A Management
Advisory Services
Special Report

Mass Storage Technology

A special report for CPAs seeking to become familiar with methods for efficiently storing and retrieving large volumes of data.

AICPA
American Institute of Certified Public Accountants

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Preface

The modern computer's ability to process larger and larger amounts of data in both connected and stand-alone environments has led to the need to store as well as retrieve ever-increasing volumes of data. Once measured by the number of punched cards in a file drawer, today's data volumes are measured in the trillions of bytes.

Data storage media have ranged from punched cards, punched paper tapes, steel tapes, magnetic drums, magnetic cards, magnetic tapes, and magnetic disks to today's emerging optical disc technology. This technology provides an ideal data storage environment when audit trails are necessary.

Combined advances in hardware and software will enable practitioners to store and access larger volumes of data with increased speed and efficiency. Such advances will have a major impact on the accounting profession.

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Mass Storage Technology: A Brief Overview

Volatile versus Nonvolatile Storage

The storage of information has become critical in modern data processing. Data was once stored on punched cards. The advantage to using the cards was that data punched into a card was stored forever. But cards had drawbacks: changing the data required rekeying, processing was slow, and physical storage was difficult. Enter nonvolatile magnetic storage media: disks, drums, and tapes. Like the old punched card, nonvolatile magnetic storage media do not lose what is stored on them when the power to the computer is interrupted.

The advent of semiconductor technology brought with it volatile storage, which requires a constant power source to maintain the information. Volatile storage is primarily used for short-term purposes, such as storing a program and its variables while the computer is executing an operation. Volatile semiconductor storage is widely used in spite of its nature and because of its operating speed.

Nonvolatile Storage Media

Magnetic Tape

Magnetic tape is a nonvolatile storage medium that can store upward of 100 Mbytes (megabytes) of data sequentially. At one time, magnetic tape, although much slower than magnetic disks, was more important in data processing because of the high cost of disk technology. As magnetic disks became more affordable, tapes were phased out of all but the most data-intensive applications. Tapes, however, offer an advantage over fixed magnetic disks in data backup, recovery, and portability. Often, the contents of large magnetic disks are routinely backed up onto tape, which is then stored at an off-site location.

Hard Disks

A hard disk consists of a rigid, nonvolatile magnetic platter. A single platter or a bank of several platters may serve a computer, depending on the information-handling needs of the system. On each side of the rotating platter, one or more freely moving devices (heads) retrieve and store information (read from and write to the disk). Unlike tape, which allows sequential access only (as with audiotape and videotape), disk access can be random as well, permitting much faster operating speeds.

Hard disk capacity is measured in megabytes, and total capacity can range from 10 Mbytes to 300 Mbytes or more. Some hard disks can be removed from their drives, but typically hard disks are fixed in place and cannot be removed. Early hard disk configurations were over three feet high and required twenty or more platters to store only 5 Mbytes. Today, up to 40 Mbytes can be stored on a single hard disk platter small enough to fit on a card (a printed circuit board fitted with a standardized set of connectors) that can be plugged into a narrow expansion slot, or receptacle, within a microcomputer.

Floppy Disks

What is now commonly called a floppy disk is a nonvolatile magnetic disk enclosed in a flexible plastic mounting. The floppy disk gained credibility as a storage medium with early minicomputers, but its use became more widespread with the advent of the microcomputer. Storage capacity has steadily increased, along with a concomitant reduction in physical size. At one time, floppy disks were available only in an 8-inch format that could store 128 Kbytes (kilobytes) of data. Then came 5¼-inch floppy disks; current high-density versions of this format can store up to 1.2 Mbytes of data. Recently, a 3½-inch microfloppy disk that can store up to 2 Mbytes of data has become popular. The latter represents an eightfold increase in capacity in a space less than half the size of the original 8-inch disks. Moreover, a rigid plastic housing encloses the 3½-inch disk, providing better protection for the disk's contents than do the larger formats.

Optical Discs

The optical disc is a nonvolatile storage medium that can provide greater storage capacity—from 200 Mbytes to 650 Mbytes of digital data—than either magnetic tapes or disks. Optical discs are read by a low-power laser. A current example of this new technology is the compact disc (CD) player. Optical discs have some of the drawbacks of punched cards. As with the cards, the disc contents, once written, cannot be changed. Furthermore, the average access time of optical discs is 100 msec (milliseconds) or more, much slower than the magnetic disk's average access time of 23 msec or less. The optical discs are portable, however. They could someday displace magnetic tape from its long-held position as the backup medium of choice, since they have greater storage capacity than tape and require only a small amount of physical space for long-term warehousing.

Advances in Mass Storage Technology

Mass storage technology continues to develop at a rapid pace. In 1987, many in this field could only stress the benefits of advances in mass storage technology, whereas in 1988 most people had real products to talk about. Developers have demonstrated new and better optical systems, and several manufacturers are now offering major software support for the systems.

Hard disks continue to fall in price and improve in performance and storage capacity. For example, recent reports describe an experimental magnetic disk that can hold 10 Gbytes (gigabytes). Given the faster access speeds, such increased capacity should allow magnetic disks to remain competitive with optical discs.

Advances continue to be made in magnetic tape media. Large computer installations are using cartridge tape units in an effort to replace reel-to-reel tapes. The new cartridge tape units have higher transfer rates, greater capacity, and minimal storage-space requirements. High-density cartridge tape units will likely be available soon as backup devices for minicomputers and microcomputers.

Optical Storage Media

Reading about the different optical storage technologies can become a little confusing because of the alphabet soup of acronyms used to designate them. This section describes some of the more commonly mentioned technologies, including audio CD, CD-ROM, CD-I, CD-V, DVI, WORM, and MO. The section concludes by discussing the typical components found in optical storage systems.

Audio CD

Most consumers have come in contact with optical storage technology through exposure to audio compact discs, or CDs. An audio CD stores music digitally on a 4.72-inch rigid plastic disc coated with reflective metal. Using a low-power laser, the CD player reads the digital information on the disc and converts the information back into an analog signal, which is sent to an audio amplifier.

CD-ROM

A compact disc with read-only memory (CD-ROM) works much like an audio CD but without converting the digital information to an analog signal. CD-ROMs have a storage capacity of 650 Mbytes, and the data on the CD-ROM cannot be changed, added to, or deleted. CD-ROMs have been used primarily with personal computers to complement rather than replace other means of mass storage. In 1983 Sony Corporation and Phillips, N.V., introduced CD-ROMs, but no one took a serious look at the new medium until 1985. Lack of standards appears to be the greatest barrier to user acceptance.

The High Sierra standard for CD-ROMs was developed in 1985 by the largest manufacturers of CD-ROM players, media, and software. The standard allows a CD-ROM to be used on any player, just like an audio CD. But the High Sierra standard does not address the problems of interfacing the CD-ROM player and the computer or designing software to control the interface. By the end of 1987, some thirty thousand CD-ROM drives had been installed in the United States. The total world market for all optical drives in 1988 was $300 million.

Video Compact Discs

Video compact discs use the same storage disc medium as audio CDs and CD-ROMs. Three formats are available for recording video information on compact discs: compact disc-interactive (CD-I), compact disc-video (CD-V), and digital video interface (DVI). These formats are sometimes described as interactive. The markets that video compact disc manufacturers have targeted include home entertainment, education, self-improvement, toys, and other consumer applications.

Differences exist among the three video formats: CD-V stores video as an analog signal, and the others store data digitally. CD-I is the only format that can store audio, video, text, and software on the same disc. Moreover, CD-I offers multichannel audio, permitting video presentations to be recorded in several languages. Consequently, of the three formats, CD-I holds the most promise for use in interactive learning applications.

WORM Discs

Write-once read-many (WORM) discs, unlike CD-ROMs, have the potential for replacing other methods of mass storage, such as microfiche, microfilm, and tape. Like microfiche or microfilm, WORMs record the full document image (text and pictures) but, unlike those media, also allow random-access retrieval instead of time-consuming sequential access. Devices called jukeboxes can be used with WORMs. Jukeboxes, like their audio predecessors, can hold from twelve to one hundred optical discs, providing hundreds of gigabytes of available on-line random-access information. The IRS recently tested a system that will access a taxpayer's return in thirty seconds rather than the typical six weeks it currently takes.

Erasable Magnetic-Optical Discs

Erasable optical discs are sometimes referred to as magnetic-optical (MO) devices. In erasable disc technology, lasers record information by heating magnetized areas coated with various metals. The polarity of the magnetized materials can then be read by another laser. Shooting a more powerful laser at the disc erases the data by reversing the established polarity.

Some view erasable discs as the ultimate in mass storage technology because the method combines the high-storage capacity of optical media with the reusability of magnetic media. The major challenge for erasable discs concerns the choice of materials to use; several different types are being tested at this time. True erasable discs have become readily available in 1989. Contrasted to the advances in magnetic disk storage capacity, *erasable* optical discs may offer only the advantage of being removable.

Optical Storage Components

Optical storage systems comprise four main parts: the disc drive, the interface between the drive and the computer, the storage medium, and the software that makes it possible to use the system.

Disc Drives

The optical disc drive receives an optical disc and houses the laser and supporting mechanical and hardware systems. The size, complexity, and price of the drive depend on the format of the optical disc and the type of technology used, such as CD-ROM, WORM, or erasable MO disk.

Interfaces

Most optical disc drives use the small computer system interface (SCSI). This interface can also be used for other devices, such as magnetic disks or tape drives.

Media

CD-ROMs are 4.72-inch rigid plastic discs with a reflective metal coating. The metal coating is made uneven by a recording laser and is later read by low-power lasers that convert the depth of unevenness into a digital signal. WORM discs are similar to those used for CD-ROMs except that they are enclosed in either 5¼-inch or 12-inch cartridges. Erasable discs have a covering of magnetic material; a focused laser beam creates the heat necessary to magnetize regions on the disc.

Software

Two types of software are necessary for optical storage: a device driver containing the operating instructions for interaction between the optical drive and the processing unit and the actual application software that processes the information on the optical disc.

The software is not all that different conceptually from the software used with standard magnetic disks. In the case of WORM discs, however, media defects can be detected only after writing to the disc. Therefore, device driver instructions must include reading the data after writing to assure that it was written correctly. Some optical disc device drivers use a technique called direct read during write (DRDW) to speed this verification process.

Opportunities for the Accounting Profession

Optical disc storage technology offers an opportunity to develop many new and unique applications. Each optical medium has its own characteristics that will determine the kinds of applications for which it is most suitable.

The accounting profession will benefit from CD-ROMs and WORMs because they enable practitioners to access databases that previously were maintained and available only on larger computer systems. Some devices will provide, on one cartridge, the equivalent of forty 10-Mbyte hard disks. The primary benefits to the profession will be in the following areas:

- Analytical review
- Reference databases
- Document image storage and retrieval
- Archival storage
- Training

Analytical Review

An auditor performs many steps during the analytical review process. One is comparing a client's operational statistics with norms in the client's industry. The collection of industry data can be a time-consuming task. Currently, many CPAs utilize on-line databases as the source for such data. CD-ROM technology in combination with personal computers will give auditors immediate desktop access to many published databases, either in their own offices or at their clients'. Many of these on-line databases – for example, Lotus's One Source – are already available on CD-ROM.

One Source CD-ROM offers a choice among eight widely used databases:

1. Compustat is a historical database covering over sixty-five hundred companies. It provides twenty years of annual data and forty quarters of quarterly data.
2. Daily Stock Price History Database provides stock prices and dividend information on some twenty-five thousand issues and includes earnings, descriptive fundamental data, significant equity, and fixed-income market indices. The

database also provides opening, high, low, and closing prices; trading volumes; dividends; and stock split adjustment factors for the last two years.

3. I/B/E/S is an earnings estimate database covering some three thousand companies. Projections of quarterly and annual earnings per share and long-term growth rates are obtained from over twenty-five hundred security analysts and tabulated to create a consensus forecast for each company contained in the database.
4. Media General Database contains eleven years of annual data and twenty-five quarters of data obtained from financial statements.
5. Value Line Database covers approximately eighteen hundred companies. Over four hundred data items for each company are generated from financial statements and market information.
6. Ford Investor Services provides two databases, both containing stock valuations, earnings momentum, and selected fundamental data.
7. Bonds is an extensive fixed-income database covering over ten thousand government and rated corporate issues. It provides information such as price, coupon, yield, duration, maturity, bond rating, and so on.
8. The Disclosure Database covers over ten thousand companies and contains selected income statements and balance sheet items, growth rates, and a range of analytical statistics expressed as ratios derived from financial statement data.

Reference Databases

With many applications currently available and several more in development, CD-ROM is expected to grow into a premier reference tool in the 1990s. It is estimated that CD-ROM will take the place of many of the large on-line reference database systems.

CPAs often turn to a reference library to obtain information for reports, workpapers, and other written documents. CD-ROM will be very useful in permitting the CPA, while preparing a document by using word processing software, to easily access the reference library contained on a CD-ROM, extract pertinent information, and move it into the document.

The following are some examples of available reference databases:

1. Microsoft's Bookshelf, a collection of ten reference sources and writing tools, features–
   - *The American Heritage Dictionary.*
   - *Roget's Electronic Thesaurus.*
   - *The World Almanac and Book of Facts.*
   - *Bartlett's Familiar Quotations.*
   - *The Chicago Manual of Style.*

- A spelling checker.
- A zip-code directory.
- Sample forms and letters.
- A word usage checker.
- A reference to business information sources.

2. Educational Resources Information Center (ERIC), once a heavily used on-line database, is now available on CD-ROM. It provides full references and summaries of thousands of papers on preschool through postgraduate education. Typical users include undergraduate education majors, graduate students in education and related areas, and professional educators, as well as many professionals in such related fields as psychiatry and child development.
3. *Grolier's Encyclopedia,* now available on CD-ROM, is called the electronic encyclopedia. The disc holds the full text of the *Academic American Encyclopedia.* It is fully searchable, allowing users to find more information more quickly than they can by using the printed encyclopedia.

Document Image Storage and Retrieval

The systems emerging today use both optical discs and microfilm because each has its own strengths. Microfilm has typically been used for cost-effective storage of image-intensive information—tax returns, practice manuals, correspondence, and the like—because it can store vast quantities of information compactly. However, ease of access to information has become very important, and here optical discs have an advantage. After an image is digitized for optical disc storage, it can be accessed immediately; microfilm, on the other hand, requires taking a picture at the speed of light and then developing it before it is available for use. In addition, digitized optical discs are always ready for transmission over communications networks, whereas microfilm must be converted to digital form for each transmission.

Currently, microfilm costs one-half to one-quarter as much as optical discs. Another important factor in comparing microfilm to optical discs is that global microfilm standards exist, whereas standards for optical discs are still emerging.

Archival Storage

The write-once read-many (WORM) disc may emerge as a storage alternative to both microfilm and magnetic tape. In certain circumstances, the WORM disc may even be a cost-effective alternative to magnetic disks. Optical storage systems that can easily offer gigabytes, even terabytes (1 trillion bytes), of on-line storage may present a desirable alternative to magnetic disks.

A WORM drive is identified by the computer as simply another disk drive. This means it can be used in the same way as a hard disk for storing, retrieving, and processing information.

The WORM disc can provide a medium on which to off-load the complete accounting database of a large client. The data could then be manipulated using audit software. The advantage of the technology is that it enables an auditor to permanently capture the client's year-end data and have access to it as if it were on the client's computer.

The tax area represents another use for this technology. WORM discs can provide permanent storage for a client's yearly tax returns and the software used to process them. A 120-Mbyte WORM disc can store approximately four years of data and software for three hundred clients.

Training

A common drawback in using computers for training is the lack of interactive audio and pictures. CD-I is expected to solve this problem at competitive prices. It will be possible to configure the CD-I player as a peripheral to a personal computer, thus allowing information or data retrieved from the CD-I disc to be stored on the computer's magnetic disks. CD-I therefore has the potential to provide all the courses in a school curriculum as well as meeting corporate and professional training requirements. Each subject can be contained on a CD-I disc so that students can progress at their own pace. If educational software developers are willing to make the required investment to produce top-quality courses, this technology could revolutionize current methods of training.

Future Prospects and Issues

Optical technology has arrived. Usage is expected to increase as standards are resolved, hardware costs stabilize, and more applications become available. This section highlights the technology's prospects and some issues it raises. The section looks at future desktop applications, effects on auditors, and optical imaging. Issues discussed include standards, costs, internal control considerations, currency of data, and security.

New Desktop Applications

There are over one hundred CD-ROM desktop applications. Some were outlined earlier; more are expected in the future. Several publishers have announced plans to release tax services on CD-ROM within the next year. These services include statutes and regulations, court opinions, IRS rulings and procedures, IRS administrative documents, Treasury correspondence, legislative histories, international materials, and selected articles. These CD-ROM applications may change the operations of a tax practice. For instance, adding a CD-ROM drive can allow down-loading (transferring) of tax information from a network to individual workstations, thus eliminating the need for a firm to maintain volumes of printed tax practice references.

Some CPA firms are currently developing audit toolbox-type products consisting of a firm's policy and procedures manual, industry statistics, and reference materials. Similar tools are likely to be developed in the future for industry and smaller practice units.

Impact on Auditing

Widespread adoption of optical disc technology will have a significant effect on the availability of the tools practitioners can use during the audit. Auditors will become more self-sufficient and less dependent on MIS professionals and client accountants to assist in gathering and analyzing data. For instance, there may be an increase in the development of electronic audit tools that will allow an auditor to

obtain client data from an optical disc connected to a network and review the data electronically. The auditor will be able to (1) examine and update electronic audit data files using electronic note and tick mark reference-tracking software, (2) research issues using the computerized firm's policy and research files, and (3) archive final audit data files on optical discs.

Optical Imaging Possibilities

Besides archival storage, the fastest-growing application for large optical discs is in full-scale image and document processing systems with sophisticated data retrieval software and jukebox configurations. Where microfiche and microfilm had provided alternatives to storing reams of paper documents, optical image storage is now becoming the chosen method for many paper-intensive organizations, such as insurance companies, the Internal Revenue Service, and the National Archives. Systems are now available to digitize, index, archive, retrieve, display, print, and electronically transmit stored document images. Retrieval is getting easier too, as software lets users search files by typing in one or more keywords. Documents in digital form can be sent over telephone lines via modem or through LANs (local area networks) to other PC workstations.

Media Standardization Outlook

The optical disc industry has been mired in controversy concerning standards. As noted earlier, the High Sierra standard for CD-ROM, which was originally proposed in August 1985, received approval by the ISO (International Standards Organization) only in 1988. The standard allows CD-ROMs to work on any CD-ROM drive.

Standards for WORM drives are being worked on by three different groups: ANSI (American National Standards Institute), ECMA (European Computer Manufacturers Association), and ISO. Debate focuses on several areas, three of which are format, size, and software.

- *Format.* Currently, three formats exist: sampled servo, continuous servo (the most popular), and IBM's format.
- *Size.* WORM discs are now developed in 3½-inch, 5¼-inch, 12-inch, and 14-inch sizes, with the most popular being the 5¼-inch and 12-inch sizes.
- *Software.* At present there are no standards for file management or retrieval software.

In February 1988 Phillips and Sony, coinventors of the CD, released their specifications for a writable CD, which may serve to resolve the various standards issues. The CD-WO, as it is known, encompasses both audio CD and CD-ROM applications. The disc can contain prerecorded and user-recorded material.

The lack of standards has prevented WORM technology from being widely accepted. As a result, erasable optical discs have become commercially available. Erasable optical discs are believed to pose a threat to magnetic media because of the optical discs' high density, removability, durability, and low cost per megabyte. However, this threat may vanish unless standards become available in the near future.

Driver and Media Costs

CD-ROM drives are made by a number of manufacturers and range in price from $599 to $1,600, depending on the vendor and the features and capacities of the drives. Applications software and reference materials on CD-ROMs vary in price. The magazine *CD-ROM Review* contains useful reviews of CD-ROM products. Prices start at less than $100 for a disc containing more than nine hundred public domain and shareware programs for IBM PCs and compatibles operating under MS-DOS (Microsoft Corporation's disk operating system software). However, some products with updates cost more than $40,000.

WORM drives are also available from a number of vendors and range in price from $1,000 when integrated into a PC to million-dollar jukeboxes. Price may not be a barrier to some corporations looking for record management savings. Disc capacities range from 120 Mbytes to 3.2 Gbytes on discs varying from 5¼ to 12 inches. Disc prices are nominal in comparison to drive cost and generally average a few hundred dollars. CD-ROM and WORM prices will likely decrease and shipments increase as standards evolve and more software becomes available.

Erasable disc manufacturers have issued a number of announcements in 1989, and erasable discs are beginning to become commercially available. Initial pricing announcements indicate the drives will range in cost from $4,000 to $6,000.

Impact on Internal Control

The use of optical technology introduces a number of internal control issues. Optical technology promises gigabytes and even terabytes of on-line storage. Coupled with the increased use of networking systems, this technology places a lot of computing power in the hands of the end user. End-user computing increases worker efficiency but may also raise internal control concerns. More and more processing will be done by end users, which will create a need for methods of evaluating the efficiency and effectiveness of the systems once they are in place.

Optical images and paperless-stored transactions can impact the audit function, particularly since the courts have yet to rule on the legality of images stored on optical discs.

Widespread use of optical scanning may give rise to systematic irregularities and fraud. Perpetrators may attempt to alter either the devices that produce the optical

information (bar codes or characters) or the devices that read and interpret the optical information (both hardware and software). The auditor will need to understand the strengths and limitations of optical hardware and software and continually monitor, test, and evaluate their reliability.

WORM discs hold massive amounts of data and possess the invaluable control feature of being virtually immune to alteration after information is initially recorded on it. At the same time, they are portable and thus subject to theft.

Data Currency

CD-ROMs are primarily used for wider distribution of reference material. As information is updated, some companies may disseminate it by issuing a new series of discs. Many companies involved in data distribution provide on-line databases to users to supplement data that has not been updated on CD-ROM.

WORM discs are best utilized as an archival medium and as an alternative to image storing on microfiche and microfilm. WORM discs are not suitable if the data is regularly updated. The ability to obtain the last version of a (current) data record is important when a user is looking at historical snapshots of data. WORM technology offers this ability, just as it offers the ability to track document revisions due to its nonerasable properties.

Erasable discs, with overwrite capabilities, will be important in situations that require data updating on a regular basis. As with magnetic media, the ability to provide up-to-date, accurate information is the focus of both technologies.

Security Concerns

Optical technology has a drawback in the area of security. In developing methods of protection, organizations using the technology must consider the characteristics of the data, the degree of its strategic importance, and the cost of protection. Key issues to address are password protection schemes and access control, methods of encryption, physical storage of the media, and backup alternatives. These issues are similar to those that arise with magnetic media, but the volume of data on optical discs and their portability put the latter in a class of their own. A security question for the profession to consider is this: What control mechanisms should an organization place on the physical access to an 800-Mbyte WORM disc that has a hundred-year life, holds over five years' worth of a company's records, and yet is stored on a removable 12-inch disk?

Conclusion

Many benefits are expected from the advances being made in mass storage technology, particularly in the optical disc area. The latter's high capacity and low cost per stored megabyte result in a cost-effective storage solution. The removable disc cartridge protects the media and, once standards are established, any disk drive will be able to read the data. The recorded data is tamperproof, and manufacturers project media life ranging from ten to one hundred years, making the media ideal for archival purposes. The industry also expects to develop device drivers that will enable the computer to recognize and use most off-the-shelf software without modification.

Using WORM technology, discs may be written on but not erased, thus providing an ideal storage medium if audit trails are required. From an auditor's viewpoint, WORM technology will allow for the capture of larger amounts of client data in a convenient form, giving the auditor greater flexibility in the use of the data. The auditor will no longer depend on the client's processing system or technical resources and instead can use the client's data in a manner convenient to the auditor, utilizing software tools or aids with which he or she is comfortable. Querying of specific data will be more prevalent, given the advances and standardization in distributed relational database storage and access methodologies. The expectation is that such data access will be made even easier with artificial intelligence technology.

The accounting profession needs to plan today for the technology of the future. Using proper strategic planning, practitioners can determine how best to integrate this technology with their work in the years ahead.

Glossary

bus That part of a microcomputer used to move data between its components (for example, memory, storage devices, and communication devices).

CD-I (compact disc-interactive) A technical specification proposed jointly by Phillips and Sony for a consumer product based on CD-ROM technology. CD-I can store data, sound, and video. Systems use this technology to interactively access data. CD-I players will connect to home entertainment equipment.

CD-ROM (compact disc with read-only memory) A computer peripheral that employs compact disc technology to store large amounts of data. The storage capacity of CD-ROM discs is approximately 650 Mbytes, or about 300,000 typewritten pages.

CD-V (compact disc video) Full-motion video and sound recorded in an analog mode and played back on a stand-alone video disc player.

compact disc (CD) A technology for storing large amounts of digital data on a 4.72-inch plastic disc. A low-power laser is used to read the information stored on the disc. The CD is best known as a recording medium for ultra-high-fidelity music.

DVI (digital video interactive) The standard for CD-ROM-based interactive video. Full-screen, full-motion digital video and audio is stored on a CD-ROM and played back on a PC equipped with DVI.

Gbyte (G, GB, gigabyte) 1 billion bytes.

High Sierra Group A working group, named after its first meeting place, of CD-ROM service companies, vendors, and manufacturers. The High Sierra Group has been the major source of activity in setting standards for CD-ROM data format and compatibility.

jukebox A device containing one or more CD-ROM drives and capable of housing multiple CD-ROM discs. Its operation is analogous to the musical jukebox popular in the 1940s and 1950s.

Kbyte (K, KB, kilobyte) 1,024 bytes.

LAN (local area network) A group of devices (for example, minicomputers, microcomputers, terminals, and printers) linked together by a communications channel that allows the transfer of data and programs among the devices in a local environment.

laser (light amplification by stimulated emission of radiation) A device that produces a narrow, coherent beam of light. In a CD-ROM drive, a tiny laser provides the light source for reading data from CD-ROM discs.

Mbyte (M, MB, megabyte) 1 million bytes.

msec (millisecond) A unit of time equal to 1/1,000 of one second.

SCSI (small computer system interface) For interconnecting computer systems and peripherals.

Tbyte (T, TB, terabyte) 1 trillion bytes.

transfer rate The speed at which data can be read from a mass storage device.

WORM (write-once, read-many) An optical disc technology in which the user may write to the disc as well as read from it. Once written, however, the data on the disc cannot be erased.

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