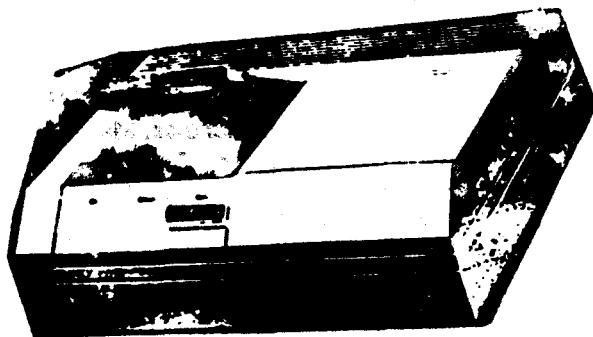


COMPACT DISK: A REVOLUTIONARY STORAGE MEDIUM

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Compact Disk Read-only-Memory (CD-ROM), is one of the laser-based mass data storage devices that came into being as a contender for an alternative to magnetic tape, which runs into miles for the same quantity of data recorded. Tremendous strides in finding applications for laser made CD-ROM a versatile medium for storage of large mass of information. CD-ROM technology which uses laser, rather than electromagnetic methods for recording and/or playback, is generally known by its generic name, optical storage media.



Compact Disk Player

2. OPTICAL STORAGE MEDIA

2.1 Inception and Development

The genesis of the optical storage media (OSM) goes back to 1925, when John Logie Baird tried to record video signals on a disc and to reproduce them. He was not successful in recording and reproducing the data due to the lack of

appropriate technology. Recording and reproduction became possible with the invention of laser during 1960. By the middle of 1970s, intensive investigations on digital mass storage techniques were initiated. However, it was only by the year 1984 that the technique could be perfected.

2.2 Kinds of Optical Storage Media

Optical storage media can be categorised into the following four groups:

- (a) Compact Disk (CD)
- (b) Video Disk (VD)
- (c) Digital Optical Disk (DOD)
- (d) Laser Card (LC)

3. COMPACT DISK PRODUCTS

Currently, there are three established products of Compact Disk CD-Audio (CDA), CD-Read-Only-Memory (CD-ROM) and CD-Interactive (CDI).

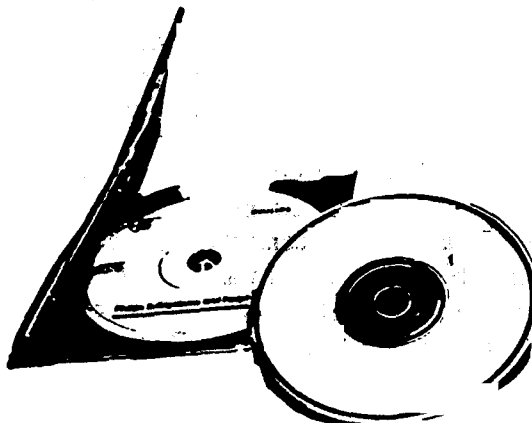
CDA is mainly used for recording sound. CD-ROM, as the name indicates, can store data in the form of text, graphs, maps and images. On the other hand, CDI can be used for storing sound, data as well as images in an integrated form. Further unlike CDA and CD-ROM, CDI is an interactive system. The entire disk consists of four layers. The reflecting and recording layers are sandwiched

between protective layers. Recording is done on the recording layer. The reflective layer helps in reading the recorded information.

Presently, CD-ROM cannot be used as a mass storage medium for volatile data on stock exchange rates, weather data etc., because after recording data on the disk it can neither be updated nor erased. Hectic R & D work is going on all over the world for designing a mass data storage medium that can be updated or erased. We describe here some prominent features of CD-ROM.

3.1 Physical Format of CD-ROM

Compact Disk is a circular, 12 cm diameter disk made up of plastic resins, on which optically readable information tracks are provided. The optically readable information bits are formed on the disk by exposing it to modulated laser light.



Compact Disk

The storage capacity of an optical disk is enormous. A 12 inch video disk can store as much as 60,000 frames of information on a single side. One frame may be occupied by a picture, or a page of a conventional document. A Constant Linear Velocity (CLV) optical video disc can store as much as 30 million bits of information.

3.2 Making of CD-ROM

Storing of information on master disk is technically known as "Mastering". Mastering of CD is a complex process involving enormous expendi-

ture. For example, mastering facility at 3M Company (USA) cost about 15 million dollars. Establishing such mastering facilities is beyond the financial capabilities of most of the small/medium users. Utilizing mastering facility offered by other establishments is the only option left to many users.

The text, graph, map or other material to be recorded on a CD is scanned by a scanner and the digital signals are recorded on a half-inch 9 track magnetic tape formatted according to the specifications given by the company. After the company receives the formatted tape, error correction codes are added to it and then the tape is sent for mastering.

The master disk generally consists of a glass material on which digital data from the tape is transferred through a laser recording system. Once the master disk is prepared, copies are stamped out of it. The replica is a disk made of plastic resin material. The process of making plastic replica is much simpler than making a master disk. Mastering a 540 MB compact disk costs US \$ 5000, whereas preparing its replica costs only US \$ 5. The scanner used in mastering is a fax-like machine which scans data at 200-400 dpi (dots per inch). The scanner gives a digital output which is fed to the recorder. Inside the recording unit incoming data in the form of zeros and ones actuates the laser recording head, which, in turn, burns the surface of the disk accordingly. The recorded data can be checked for errors and if any correction has to be incorporated the only possible way is to record the corrected data on the remaining space on the disk.

4. WHY OPTICAL STORAGE MEDIA?

This question is relevant, particularly when storage media like paper, microforms and magnetic tapes are in co-existence. The choice of optical storage media in preference to all others is justified when we see the range of benefits offered by them.

4.1 Advantages

The degree and nature of benefits of OSM vary with the application. Prominent among the potential benefits are:

- i) CD has the capacity to retain the information stored on it for longer duration compared to conventional storage media;
- ii) CD can store text, sound, images and graphics in an integrated manner;
- iii) The storage capacity of CD is very high compared to that of other media; and
- iv) The use of laser protects CD from dust and mechanical reading head.

4.2 Disadvantages

- i) It is a read-only medium;
- ii) Only single disk can be operated at a time;
- iii) The technology is yet to be standardised, and
- iv) Data access speed is less compared to that of magnetic media, such as Winchester type record disk.

5. HARDWARE AND SOFTWARE DEVELOPMENT

5.1 Hardware

The playback system of CD-ROM essentially includes a disk drive interfaced with a microcomputer through standard interfaces, such as Small Computer System Interface (SCSI) or RS 232 C, choice of which varies with the model. Most of the disk drives now in the market can be connected to IBM-compatibles. Retrieval commands are given to the drive system through the computers. The disk drive interfaces and workstations available are listed in Table 1.

Table 1-CD-ROM Drives with Interface Boards

SL No.	Model	Interface	Computer
1.	Hitachi CDR-15025	8 bit parallel	IBM PC, MS-DOS
2.	Hitachi	8 bit parallel	IBM PC, MS-DOS
3.	LMSI CM-201	Proprietary bus	IBM PC, MS-DOS Apple IIC
4.	LMSI CM-201	Proprietary bus	IBM PC/XT/AT
5.	Sony CDU-100	40 pin Sony bus	IBM PC, MS-DOS
6.	Sony CDU-5002	40 pin Sony bus	IBM PC, MS-DOS
7.	Sony CDU-200	SASI	IBM PC or with SASI compatibility
8.	Toshiba XM-2000	SASI	IBM PC or with SASI compatibility
9.	Philips CM-100	SCSI-750	IBM PC/XT/AT

5.2 Software

Most of the software now in use with compact disk player for search and retrieval has originated from microcomputer environment. The user will obviously feel frustrated when he comes to know that the software he uses for one machine will not work on a machine manufactured by another company. To overcome the expenditure involved in developing the software as well as to problem of incompatibility, a CD-ROM standardisation group called 'High Sierra Committee' formulated standards based on the Sony and Philips CD-ROM disk player/disk system. If their standards are accepted by the manufacturers all over the world, the problem of disk player incompatibility will be solved.

6. PUBLICATIONS IN CD-ROM FORMATS

As a new papyrus, the compact disk has become a new publishing medium for a large number of publishers. Groliers Academic Encyclopedia is an example of a widely marketed CD-ROM product. Some of the publications on compact disk available in the market are listed in Table 2.

Table 2-Publications Available on CD-ROM

Sl.No.	Publication	Contents and Software used	Hardware Reqd
1.	Electronics Encyclopedia	20 volume, 30,000 article knowledge retrieval software	IBM PC 256 K RAM
2.	Books-in-Print Plus	Tri-star (OCS)	IBM PC
3.	Ulrich's Plus	Tri-star (OCS)	IBM PC
4.	LISA	Silver platter	IBM PC
5.	Dissertation Abstract	TMS software	IBM PC

7. APPLICATIONS OF OPTICAL DISK

7.1 For Education and Training Purposes

Optical disk caught the attention of educationists and managers due to its interactive nature. As a training tool, optical disk system has much more to offer than what a conventional medium like overhead project or slide projection and video recorder could do.

Laser video disk and compact disk interactive media are two important training tools widely used now.

The computer controlled video disk system has many advantages in creating new capabilities for education and training functions.

7.2 For Information Centres

The tremendous storage capacity of an optical disk has been established beyond doubt. According to the data available, a 12 cm CD-ROM disk can replace 2,75,000 A4 size pages. This will rid the librarians of their constant worry about the ever increasing volumes they have to accommodate in

the available space. If multi-volume 'Books in Print', dictionaries, handbooks and encyclopedias become available on handy CD-ROM disks, there would be plenty of space left in the reference section. The entire concept of a conventional library will thus change with the use of compact disks.

The electronic library is round the corner. The library user need not go to library to search for the needed material. Instead he can browse on his terminal at home, which will be linked to the main storage system of the library. When the user gets the desired part of the information, he can get a copy on the printer attached to his terminal. The main advantage accruing to the user can be measured in terms of the time saved, a precious entity for a scientist engaged in R & D activities.

8. FUTURE TRENDS

In the immediate future, new formats of optical disk technology may appear that will be the read-only versions of high-performance alterable optical disk formats. Within the next few years, CD-I, CD-IV, CD-X, laser cards and erasable optical disks will provide higher data rate, faster access and finer addressibility compared to CD-ROM.

It is not clear whether any of the alterable media currently under development can provide a direct functional facility equivalent to the conventional magnetic media.

It is likely that Magneto-Optic (MO) medium drives will be introduced soon, probably in 5 1/4 inch format. MO drives can be much of the work now done by Winchester, if their data transfer rates and access times are comparable. Their high capacity and smooth media removability will add to the advantages of these devices.

FURTHER READING

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Language and the faculty of speech is the immediate gift of God.

--Webster

Speech is the representation of the mind, and writing is the representation of speech

--Aristotle