

UNIT-2 CHAPTER-3 SECONDARY STORAGE

INTRODUCTION

Secondary storage devices facilitates storing of information and programs permanently. The information secondary storage device can be accessed, depending upon how the information is stored on the device.

CLASSIFICATION

There are two methods of accessing data from the secondary storage devices:

1. Sequential Sequential access means the computer system must search the storage device from the beginning until it finds the desired information. The most common sequential access storage device is magnetic tape where data is stored and processed sequentially.

Suppose, a tape contains information regarding employees of an organization. For ex. Here, to look for employee number 100's information, the computer will have to start with 1, and then go past 2, 3, and so on, until it finally comes to 100. This data access method is less expensive than other methods because it uses magnetic tape, which is cheaper than disks.

The disadvantage of sequential organization is that searching for data is slow.

2. Direct Direct access, also known as random access, means that the computer can go directly to the information that the user wants. The most common direct access storage is magnetic and optical disks.

In this method, information is viewed as a numbered sequence of blocks. Thus, one can read block 12, then read block 78, and then block 2. There is no restriction about reading or writing in direct access method. It is ideal for applications such as airline reservation systems or computer-based directory-assistance operations.

MANGNETICTAPE

Magnetic tape appears similar to the tape used in music cassettes. It is a plastic tape with magnetic coating. The data is stored in the form of tiny segments of magnetized and de-magnetized portion on the surface of the material. Magnetized portion of the surface refers to the bit value '1' where as demagnetized portion refers to the bit value '0'. Magnetic tapes are available in different sizes.

Magnetic tapes are very durable and can be erased as well as reused. These tapes are cheap and reliable storage medium for organizing archives and taking backup. However, magnetic tapes are not suitable for data files that need to be revised or updated often because it stores data in a sequential manner. Sequential access means that the user must advance or rewind the tape to the position where the requested data starts.

If the tape stretches too much, then it will render it unusable for data storage, and data loss may result. Disk data can be accessed directly, as opposed to data on tape, which can be accessed only by passing all the data ahead of it. Thus, the primary role of the tape drive is limited to backing up or duplicating the data in the hard disk drive to protect the system against loss of data during power failures.

The magnetic tape is divided into vertical columns (frames) and horizontal rows (tracks). The data is stored in a string of columns or frames with one data per frame. Each frame is further divided into rows or tracks (7 to 9 tracks). A bit can be stored in each track, with one byte per frame.

A magnetic tape is physically marked to indicate the location from where reading and writing on tape is to begin (BOT or beginning of tape) and end (EOT or end of tape), which are usually made of short silver strips. On a magnetic tape, data is recorded in the forms of blocks, where each block consists of a grouping of data (known as records) that are written or read in a continual manner. Between these blocks, the computer automatically reserves some blank space called inter-block gap (IBG). One block may contain one or more records that are again separated by blank space (usually 0.5 inch) known as inter-record gap (IRG). In case of data reading from a moving tape, when an IRG is reached, the moving tape is stopped. It remains in immobile motion until the record is processed.

Advantages of Magnetic Tapes

- Magnetic tapes hold high data.

- They have virtually unlimited storage.

- These tapes are easily transportable because they are compact in size, lightweight, and removable. Due to these properties, they are also easy to handle and store.

Disadvantages of Magnetic Tapes

- Data transmission in magnetic tapes is slow as compared to the magnetic disks.

- Magnetic tapes should be kept in a dust free environment and away from corrosive gases and chemicals as they can cause tape-reading errors.

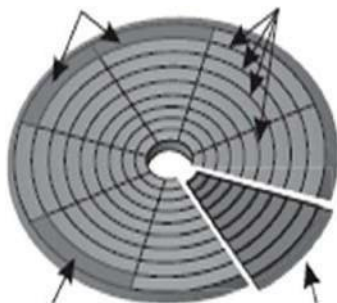
- Magnetic tapes are not flexible as compared to other media types when file updating requires record insertion or deletion.

MANGNETICDISK

Magnetic disks are the widely used popular storage medium for direct access secondary storage. They offer high storage capacity, reliability, and have capability to access the stored data directly. A magnetic disk consists of plastic/metal circular plate/platter, which is coated with magnetic oxide layer. Data is represented as magnetized spots on a disk. A magnetized spot represents a 1 (bit) and the absence of a magnetized spot represents a 0(bit).

To read the data, the magnetized data on the disk is converted into electrical impulses, which is transferred to the processor. Writing data onto the disk is accomplished by converting the electrical impulses from the processor into magnetic spots on the disk.

The data in a magnetic disk can be erased and reused virtually infinitely.



The surface of a disk is divided into imaginary tracks and sectors. Tracks are concentric circles where the data is stored, and are numbered from the outermost to the innermost ring, starting with zero. Disk

sectors refer to the number of fixed-size areas that can be accessed by one of the disk drive's read/write heads, in one rotation of the disk.

An intersection of a track and a disk sector is known as track sector. Generally, a disk has eight or more disk sectors per track. Different types of magnetic disk may have different number of tracks. Today disks are marked (tracks and sectors) on both surfaces, hence they are also known as double-sided disks. Each sector is uniquely assigned a disk address before a disk drive can access a piece of data. The disk address comprises sector number, track number, and surface number (if double-sided disks are used). The track sectors are grouped into a collection known as cluster. It refers to the basic allocation unit for storage on a disk, consisting of one or more track sectors.

Accessing Data from Magnetic Disk Data in a magnetic disk is recorded on the surface of the circular tracks with the help of read/write head.

The process of accessing data comprises three steps:

1. **Seek:** As soon as the disk unit receives the read/write command, the read/write heads are positioned on the specific track on the disk platter. The time taken in doing so is known as seek time. It is the average time required to move the heads from one track to some other desired track on the disk. Seek times of modern disks may range between 6-15 milliseconds.
2. **Rotate:** Once the heads are positioned on the desired track, the head of the specific platter is activated. The average rotational latencies range from 4.2 to 6.7 ms.
3. **Data Transfer:** After waiting for the desired data location, the read/write head transfers the data to or from the disk to primary memory. The rate at which the data is read from or written to the disk is known as data transfer rate.

Magnetic disks can be classified into three types: floppy disk, hard disk, and zip disk.

Advantages of magnetic disk

Magnetic disks follow direct access mode for reading and writing onto the data file.

Magnetic disks are used both as an online and offline storage of data.

Magnetic disks are easily moveable from one place to another because of their small size.

The data transfer rate of disks is much higher than magnetic tapes.

Disadvantages of magnetic disk

Magnetic disks must be stored in a dust-free environment

The cost of magnetic disks storage is more expensive than the cost of magnetic tapes.

OPTICAL DISK

Apart from magnetic tapes and magnetic disks, a new storage medium, which is gaining popularity, is the optical disks. An optical disk is a flat, circular, plastic disk coated with material on which bits may be stored in the form of highly reflective areas and significantly less reflective areas. These disks are capable of storing enormously high amount of data in a limited amount of space. The optical disk storage system consists of a rotating disk coated with a thin layer of metal (aluminum, gold or silver) that acts as a reflective surface and a laser beam, which is used as a read/write head for recording data onto the disk.

Optical disk comes in various sizes and capacities. A compact disk (CD) holding 600-700 MB of information having 12 cm diameter is the most popular means of optical storage. In a single-track

optical disk, storage capacity is calculated by the multiple of number of sectors and number of bytes per sector. Since the storage capacity of an optical disk is huge, the cost per bit of storage is very low.

Storage organization of optical disk An optical disk consists of single long track in the form of spiral shape. This track starts from the outer edge and spirals inward to the centre of the disk. The spiral shape of the track makes the optical disk suitable for reading large blocks of sequential data onto it.

The most common type of optical disk is the CD-ROM, and DVD-ROM, which stands for compact disk read only memory and digital video disk, respectively.

Advantages of Optical disk

Optical disks possess large capacity to store data/information in the form of multimedia, graphics, and video files. They can store more data in less amount of space as compared to magnetic tapes and floppy or zip disks.

- The life span for data storage in optical disks is considered to be more, about 10-20 years as compared to magnetic disks, which have a comparatively lesser life span.
- Optical disks hold more data recording density as compared to other storage media.
- Optical disk is tougher than tapes/floppy disks. It is physically harder to break or melt.
- Due to their small size and lightweight, these disks are easily portable and stored.

Disadvantages of Optical disk

Optical disk is costlier than other storage devices..

- Optical disk is not easy to copy as a floppy disk.
- They possess slow data access speed as compared to the magnetic disks.

MEMORY STICK

It is also known as memory card, is a digital storage device, which is designed to be used with portable electronic devices such as mobile phones, digital cameras, PDAs, iPod, etc. It supports fast data transfer speed and large storage capacity. Memory Sticks with storage capacity of up to 32 GB are available in the market. The Memory Stick can be removed from the portable device and accessed by a personal computer using Memory Stick capable memory card reader.

Several different standards or formats of Memory Stick are available:

Memory Stick PRO: It supports higher data transfer speed and provides storage capacity of up to 32 GB. It is widely used in high megapixel cameras and camcorders.

Memory Stick Duo: It is a small size Memory Stick for small, pocket-sized devices such as mobile phones, music players, digital cameras etc. It provides all the features of the large standard Memory Stick and is smaller in size, but costs more.

Memory Stick PRO Duo: It provides larger memory space (up to 32 GB) and high speed of data transfer to/from the card.

Memory Stick PRO-HG Duo: It provides a higher transfer speed than the Memory Stick Pro Duo.

Memory Stick Micro (M2): It offers large storage capacity ranging from 16 MB to 32 GB and transfer speed of 160 Mb/s.

UNIVERSAL SERIALBUS

Universal serial bus (USB), is a set of connectivity specifications that establishes communication between personal computers and devices such as mouse, keyboard, pen drive, external hard disk drives, etc. Almost every computer or laptop is equipped with one or more USB ports. All USB devices come with a USB connector that is plugged into the USB port on the computer.

PenDrive

A pen/flash drive is a removable storage device that is used to transfer audio, video, and data files from one computer to another. A pen drive consists of a small printed circuit board, which is fitted inside a plastic metal or rubber casing to protect it. The USB connector which is present at one end of pen drive is protected by either a removable cap or pulling it back in the casing.

The pen drive is a high-storage capacity (ranging from 1GB to 32GB) device and is physically small enough to fit into a pocket.

External Hard Disk Drive

External hard disk drive is a type of hard drive that resides in its own enclosure outside the computer case storage capacity of external hard disk ranges from 20 GB to several TBs.

The internal structure and functioning of an external hard disk drive is similar to the internal hard disk drive. Hence, the external hard disk drive is a reliable and high capacity storage media. It is portable and provides the plug and play feature. It means just plug in the connector of external hard drive into the USB interface and access the stored data as well as transfer data to/from the external hard disk drive.

MASS STORAGE DEVICES

These storage media include multiple magnetic tape, multiple arrays of magnetic disks or multiple CD-ROMs as a storage device.

We can categorize mass storage devices into 3 types.

1. Redundant Array of Inexpensive Disks (RAID): The basic idea of RAID is to combine multiple hard disks into an array of disk drives to obtain high performance, large capacity, and reliability. The disk arrays can be made fault-tolerant by redundantly storing information in various ways. Five types of array architectures, RAID 1 through RAID 5, were originally defined; each provides disk fault-tolerance with different compromises in features and performance.
2. Automated Tape Library: An automated tape library comprises numerous sets of magnetic tapes along with their drives and controllers mounted in a single unit. The unit comprises one or more tape drives to perform read/write operations on the tapes in the tape library. The unit with the help of a robotic arm retrieves appropriate tape from the tape library, mounts it on the tape drives for the processing and then returns it to the library after the job has been finished.

3. **CD-ROM Jukebox:** A CD-ROM jukebox comprises numerous sets of CD-ROM disks along with their drives and controllers mounted in a single unit. The unit comprises one or more CD-ROM drives to perform read/write operations on the CD-ROM in the jukebox. In the multiple CD-ROM drive environments; these CD-ROMs can be simultaneously read or write, thus resulting in the speedy rate of data transfer.
Mass storage devices have relatively slow access time, generally in the order of seconds, instead of milliseconds.