**UNIT-IV**

# FILE SYSTEMS AND I/O SYSTEMS

**Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface – File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.**

## I. Mass Storage system

### 1. Overview of Mass Storage Structure

**Mass Storage system:**

Mass Storage refers to systems meant to store large amounts of data. Mass storage system is where the operating system is stored, where all our PC programs are kept and where we keep the stuff we create and collect.

### 1. Magnetic Disks

**Magnetic disk** provides bulk of secondary storage for modern computer systems.

Traditional magnetic disks have the following basic structure:

One or more ***platters*** in the form of disks covered with magnetic media. ***Hard disk*** platters are made of rigid metal, while "***floppy***" disks are made of more flexible plastic.Common platter diameters range from **1.8 to 5.25 inches.**

The two surfaces of a platter are covered with a magnetic material. We store information by recording it magnetically on the platters.

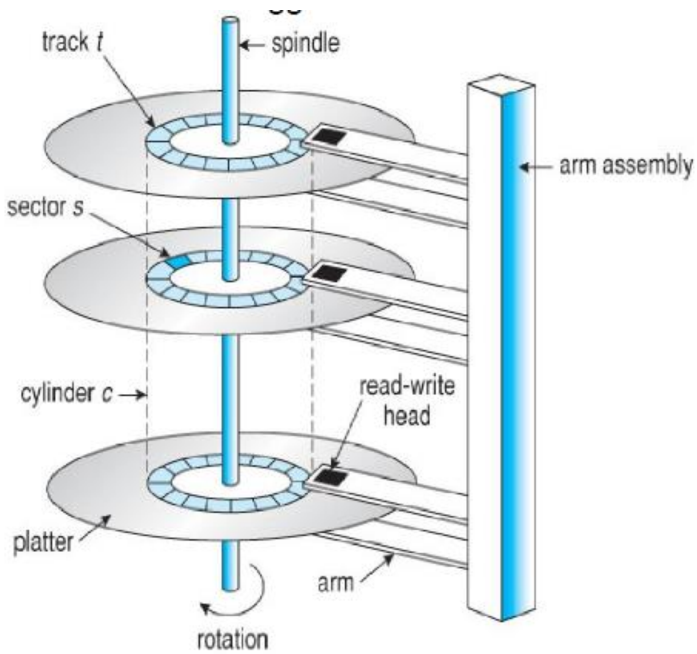
Each platter has two working ***surfaces.*** Older hard disk drives would sometimes not use the very top or bottom surface of a stack of platters, as these surfaces were more susceptible to potential damage.

Each working surface is divided into a number of concentric rings called ***tracks.*** The collection of all tracks that are the same distance from the edge of the platter, (i.e. all tracks immediately above one another in the following diagram) is called a ***cylinder***.

Each track is further divided into ***sectors,*** traditionally containing **512 bytes** of data each, although some modern disks occasionally use larger sector sizes. The data on a hard drive is read by read-write ***heads.*** The standard configuration (shown below) uses one head per surface, each on a separate ***arm***, and controlled by a common ***arm assembly*** which moves all heads simultaneously from one cylinder to another.

The storage capacity of a traditional disk drive is equal to the number of heads(i.e. the number of working surfaces), times the number of tracks per surface, times the number of sectors per track, times the number of bytes per sector.

**In operation the disk rotates at high speed, such as 7200 rpm (120 revolutions per second.) The rate at which data can be transferred from the disk to the computer is composed of several steps:**




**Moving-head disk mechanism.**

The ***positioning time***, the ***seek time*** or ***random access time*** is the time required to move the heads from one cylinder to another, and for the heads to settle down after the move. This is typically the slowest step in the process and the predominant bottleneck to overall transfer rates.

The ***rotational latency*** is the amount of time required for the desired sector to rotate around and come under the read-write head. This can range anywhere from zero to one full revolution, and on the average will equal one-half revolution. The ***transfer rate***, which is the time required to move the data electronically from the disk to the computer. Disk heads "fly" over the surface on a very thin cushion of air. If they should accidentally contact the disk, then a ***head crash*** occurs, which may or may not permanently damage the disk or even destroy it completely.

Floppy disks are normally ***removable***.Hard drives can also be removable, and some are even ***hot-swappable***, meaning they can be removed while the computer is running, and a new hard drive inserted in their place.

Disk drives are connected to the computer via a cable known as the ***I/O Bus.*** Some of the common interface formats include Enhanced Integrated Drive Electronics, EIDE; Advanced Technology Attachment, ATA; Serial ATA, SATA, Universal Serial Bus, USB; Fiber Channel, FC, and Small Computer Systems Interface, SCSI.

The ***host controller*** is at the computer end of the I/O bus, and the ***disk controller*** is built into the disk itself.The CPU issues commands to the host controller via I/O ports. Data is transferred between the magnetic surface and onboard ***cache*** by the disk controller, and then the data is transferred from that cache to the host controller and the motherboard memory at electronic speeds.

**2. Solid-State Disks**

Sometimes old technologies are used in new ways as economics change or the technologies evolve. An example is the growing importance of **Solid-State Disks**, or **SSDs**. Simply described, an SSD is non-volatile memory that is used like a hard drive. There are many variations of this technology, from DRAM with a battery to allow it to maintain its state in a power failure through flash-memory technologies like single-level cell (SLC) and multilevel cell (MLC) chips.

**3. Magnetic Tapes**

**Magnetic tape** was used as an early secondary-storage medium. Although it is relatively permanent and can hold large quantities of data, its access time is slow compared with that of main memory and magnetic disk. In addition, random access to magnetic tape is about a thousand times slower than random access to magnetic disk, so tapes are not very useful for secondary storage.

Tapes are used mainly for backup, for storage of infrequently used information, and as a medium for transferring information from one system to another. Some tapes have built-in compressions that can more than double the effective storage. Tapes and their drivers are usually categorized by width, including **4, 8, and 19 millimeters and 1/4 and 1/2 inch.** Some are named according to technology, such as LTO-5 and SDLT