# PERIPHERAL DEVICES OF COMPUTER

**1. Magnetic Disk Drives: Hard disk Drive organization:**

The modern hard disk drive is a system in itself. It contains not only the disks that are used as the storage medium and the read write heads that access the raw data encoded on them, but also the signal conditioning circuitry and the interface electronics that separate the system user from the details & getting bits on and off the magnetic surface. The drive has 4 platters with read/write heads on the top and bottom of each platter. The drive rotates at a constant 3600rpm.

**Platters and Read/Write Heads: -** The heart of the disk drive is the stack of rotating platters that contain the encoded data, and the read and write heads that access that data. The drive contains five or more platters. There are read/write heads on the top and bottom of each platter, so information can be recorded on both surfaces. All heads move together across the platters. The platters rotate at constant speed usually 3600 rpm.

**Drive Electronics: -** The disk drive electronics are located on a printed circuit board attached to the disk drive. After a read request, the electronics must seek out and find the block requested, stream is off of the surface, error check and correct it, assembly into bytes, store it in an on-board buffer and signal the processor that the task is complete.

To assist in the task, the drive electronics include a disk controller, a special purpose processor.

**Data organization on the Disk:-** The drive needs to know where the data to be accessed is located on the disk. In order to provide that location information, data is organized on the disk platters by tracks and sectors. Fig 13 shows simplified view of the organization of tracks and sectors on a disk. The fig. Shows a disk with 1024 tracks, each of which has

64 sectors. The head can determine which track it is on by counting tracks from a known location and sector identities are encoded in a header written on the disk at the front of each sector.

The number of bytes per sector is fixed for a given disk drive, varying in size from 512 bytes to 2KB. All tracks with the same number, but as different surfaces, form a cylinder.

The information is recorded on the disk surface 1 bit at a time by magnetizing a small area on the track with the write head. That bit is detected by sending the direction of that magnetization as the magnetized area passes under the read head as shown in fig 14.

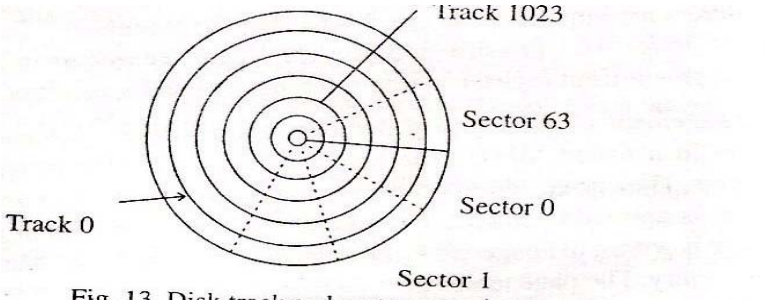

Fig. 13 Disk track and sector organization.

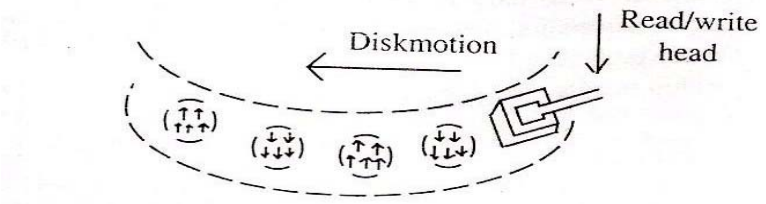

Fig. 14 Individual bits encoded on a disk track.

Fig 5. shows how a typical sector might be organized. The header usually contains both synchronization and location information. The synchronization information allows the head positioning circuitry to keep the heads centered on the track and the location information allows the disk controller to determine the sectors & identifies as the header passes, so that the data can be captured if it is read or stored, if it is a write. The 12 bytes of ECC (Error Correcting Code) information are used to detect and correct errors in the 512 byte data field.

Generally the disk drive manufacturer initializes or formats the drive by writing its original track and sector information on the surfaces and checks to determine whether data can be written and read from each sector. If any sectors are found to be bad, that is incapable of being used even with ECC, then they are marked as being defective so their use can be avoided by operating system.

**The operating system interface:-** The operating system specifies the track, sector and surface of the desired block. The disk controller translates that requests to a series of low level disk operations. Fig 15 shows logical block address (LBA) used to communicate requests to the drive controller.

Head #, Cylinder #, and Sector # refer to the starting address of the information and sector count specifies the number of sectors requested.

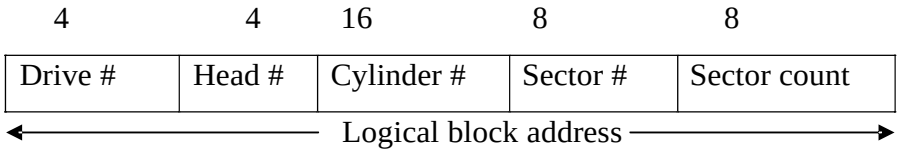


Fig 15. Block address for disk address.

**The Disk Access Process:-** Let us follow the process of reading a sector from the disk

1. The OS communicates the LBA to the disk drive and issues the read command.
2. The drive seeks the correct track by moving the heads to the correct position and enabling the one on the specified surface. The read feed reads sector numbers as they travel by until the requested one is found.
3. Sector data and ECC stream into a buffer on the drive interface. ECC is done as the fly.
4. The drive communicates ‘data ready’ to the OS.
5. The OS reads data, either byte by byte or by issuing a DMA command.

**Disk Drive Dynamic Properties: -**

Dynamic properties are those that deal with the access time for the reading and writing of data. The calculation of data access time is not simple. It depends not only as the rotational speed of the disk, but also the location of the read/write head when it begins the access. There are several measures of data access times.

1. **Seek time: -** Is the average time required to move the read/write head to the desired track. Actual seek time which depend on where the head is when the request is received and how far it has to travel, but since there is no way to know what these values will be when an access request is made, the average figure is used. Average seek time must be determined by measurement. It will depend on the physical size of the drive components and how fast the heads can be accelerated and decelerated. Seek times are generally in the range of 8-20 m sec and have not changed much in recent years.
2. **Track to track access time: -** Is the time required to move the head from one track to adjoining one. This time is in the range of 1-2 m sec.
3. **Rotational latency: -** Is the average time required for the needed sector to pass under head once and head has been positioned once at the correct track. Since on the average the desired sector will be half way around the track from where the head is when the head first arrives at the track, rotational latency is taken to be ½ the rotation time. Current rotation speeds are from 3600 to 7200 rpm, which yield rotational latencies in the 4-8 ms range.
4. **Average Access time:-** Is equal to seek time plus rotational latency.
5. **Burst rate: -** Is the maximum rate at which the drive produces or accepts data once the head reaches the desired sector, It is equal to the rate at which data bits stream by the head, provided that the rest of the system can produce or accept data at that rate

   Burst rate (byte/sec) = rows/sec * sector/row * bytes/sector
6. **Sustained data rate: -** Is the rate at which data can be accessed over a sustained period of time.