- Performance
- Storage capacity
- Software support
- Reliability
Why we call it as........

- Hard disk
- Fixed disk
- Winchester disk
Hard Disk Drive Components

- Disk platter
- Read/Write head
- Head arm/Head slider
- Head actuator mechanism
- Spindle motor
- Logic board
- Air filter
- Cables & Connectors
• Disk platter
• The data’s are stored in this media

• Form factor

  ✓ 5.5” - actual size is 5.12”
  ✓ 3.5” - actual size is 3.74”
  ✓ 2.5”
  ✓ 1 1/8”
  ✓ 1 1/3”
  ✓ 1”
• The 5.25” platter were used in earlier days

• Now a days it is replaced by the 3.5” platter

• The 2.5”, 1 1/8”, 1 1/3” & 1” platters are using in the laptop computers

• Among this the 1” platter are known as “Microdrive”
• Substrate

△ The material by which a disk platter is manufactured
  - Aluminum
  - Glass or Glass Ceramic compounds

▪ To hold the data on the substrate, it must be coated with magnetic media
  - Iron Oxide media
  - Thin Film media
Iron Oxide media

- It gives around 30 meu inch thickness
- Looks brown or amber in colour
- Semi liquid coating of the iron oxide compound

Thin Film media

- Very thin coating
- Only 1-4 meu inch thickness
- It is coated over the substrate by using two types of process
Plating process
- The media is produced by electroplating process
- Substrate is immersed in different chemicals

Sputtering process
- It provides better thin film coating
- This provides thinnest, hardest and finest media surface
- 3 substances are coated
  - Nickel phosphorous, Cobalt alloy, carbon coating
- +ve points & cost are high
Read / Write heads

- Ferrite heads
- MIG heads
- TF heads
- MR/AMR heads
- GMR heads
- CMR heads
- TMR heads
Ferrite heads

- For Winchester disks
- Made of iron oxide core wrapped with electromagnetic coils
- It is a U shaped iron core wrapped with electrical windings
- They are not so small in size
- Used in hard disk up to 50 MB
Metal -In- Gap head

✓ Same design as ferrite heads

✓ Added a special metallic alloy on the head

✓ Usually found in hard disks of about 50 MB – 100 MB
Thin Film Head

- Very small & light weight heads
- Instead of iron oxide, iron nickel alloy core is used
- Magnetically more powerful
- It is costly compared to the other two heads
- Usually used in hard disks of 100 – 1000 MB capacities
Magneto Resistive Heads

- Also known as Anisotropic MR (AMR) heads
- It is the key invention that led to the creation of hard disks over 1 GB in size
- Two separate heads, one for reading & one for writing on a single assembly
- Read head based on MR design & write head based on Thin film head design
- Commonly used in hard disks about 1 GB – 30 GB capacities
Giant MR Heads

✓ Works on the same general principles of MR heads
✓ But uses some what different design that makes them superior in several ways
✓ The name “Giant” is not due to the size, but due to the superior technology
✓ By December 1997, IBM introduced their first hard disk with GMR heads
✓ They are more sensitive
✓ GMR are used in latest technology drives which capacities up to 75 GB
Colossal MR Heads

✓ Know the GMR heads are taking over the market
✓ It is more sensitive & powerful than the GMR heads

Tunnelling MR Heads

✓ It is latest head design which will increase the areal density too much
✓ It is still under research
The arm on which the Read/Write head is located

The size of a slider in a 3.5” size hard disk is 0.08*0.063*0.017 inch

Slider of this size is called “Nano Slider”
Spindle Motor

- It is the main motor which rotates the hard disk drive platter.
- It is called Spindle motor because it is directly connected to the Spindle on which the platters are connected.
- Spindle motor rotates at a speed of 3600 to 7200 RPM or more.
Logic Board

✓ An intelligent circuit board is in built to the hard disk in the modern days

✓ It contains the electronic components that controls various sections of the hdd

✓ It also acts as an interface between the hard disk drive and the computer
Air filter

✓ To filter the air

✓ Most hdd will have two air filters

✓ The two air filters are

✓ One is called the Recirculating Air filter & the second one is called Breather filter
Cables & Connectors
- Cables & connectors are used to connect the hdd to the main computer system
- Data/Control interface cable of 40 pins
- A 4 pin Molex power connector

Head Actuator Mechanism
- The Read/Write head is moved on the platter using a mechanism
- Two types of head actuator mechanism
- They are stepper motor actuator & voice coil actuator
Stepper Motor Actuator

- It is a motor which rotates in steps
- Stepper motor turns in a fixed angle
- The smallest fixed angle is called a “detent”
- The stepper motor is connected to the R/W head by using two mechanism
- They are Split metal band mechanism & Rack and pinion gear mechanism
Voice Coil Actuator

✓ In the voice coil actuator head moves in & out in a straight line

✓ It is more faster and accurate

✓ Stepper motor is used in the Open loop disk drive and the Voice coil actuator is used in the closed loop disk drive
Disk Geometry

✓ To arrange the data on the disk surface, the disk surface is divided into different sections called Tracks, Sectors, Cylinders, Sides etc.

✓ Two types of disk geometry

✓ Physical geometry & Logical geometry
Sides/Heads
✓ Each platter of a hard disk will have two sides
✓ Each side will have each heads
✓ Total no of sides = Total no of heads
✓ When addressing either, heads or sides is denoted
✓ Total no of heads may range from 2-256 (in logical geometry)
✓ Total no of sides may range from 2-20 (in physical geometry)
✓ The head numbering starts from 0-…..
✓ It starts from the uppermost of the platter
Tracks

✓ Each side of the platter’s surface is divided into so many concentric circles

✓ The track numbering starts from 0-....

✓ The outermost tracks is given the track number 0 and next 1, next 2 and so on

✓ The innermost track will have the highest number

✓ No of tracks on a platter may range from 300-3000

✓ Modern hard disk will have thousands of tracks on each platter
Cylinders

- Same tracks on different platters or sides forms an imaginary cylinder
- In a hard disk the data is stored in a cylinder by cylinder method
- The reason is due to the single head assembly
- A track & cylinder are two different things, but they are used simultaneously
- Total no of tracks on a side = Total no of cylinders
- The cylinder numbering starts from 0-....
- It starts from the outermost of the platter
Sectors

✓ It is the smallest unit of data storage (in physical geometry)

✓ It can hold up to 512 MB of data only

✓ The sector numbering starts from 1-

✓ The storage capacity of the hdd will vary according to the no of sectors/track present in it
Clusters

✓ A group of sector is called Clusters

✓ It is the smallest unit of data storage which can identified by the operating system
Normal Data Recording
Zone Bit Recording
Interleave Factors
Head Skewing
Cylinder Skewing
Head Parking
Park & Lock
Head Crashes
Floating Height/Head Gap
Formatting
Types Of Formatting
Low Level Formatting
High Level Formatting
Re-Formatting/Re-Initializing
Data Encoding & Decoding

- FM
- MFM
- RLL
- PRML
- EPRML
Hard Disk Interfaces

- ST-506/412
- ESDI
- IDE
- EIDE
- SCSI