DATA STORAGE TECHNOLOGIES & NETWORKS

(CS C446, CS F446 & IS C446)

LECTURE 09 – STORAGE

Magnetic Memories

- Hard Disks
  - Hard cased
  - Originally meant for PCs and mainframes
    - 14 in. diameter for mainframes in 60s
    - 3.5 in. diameter for PCs from 80's
  - Now available in various shapes:
    - Mini disks (2.5 in. dia.) for laptops, gaming consoles and as external pocket storage
      - 2.75 in × 0.275–0.59 in × 3.945 in (69.85 mm × 7–15 mm × 100 mm) = 48.895–104.775 cm^3
      - laptops 9.5mm and desktop 12.5mm
    - Micro disks (1.68 in. or 1.8 in. dia) for iPods / Cameras / other handheld devices
    - 0.85 in. form factor – mobile phones [SD/MMC slot compatible HDD optimized for video storage on 4G handset]

Magnetic Memories

In Use HDD form factors

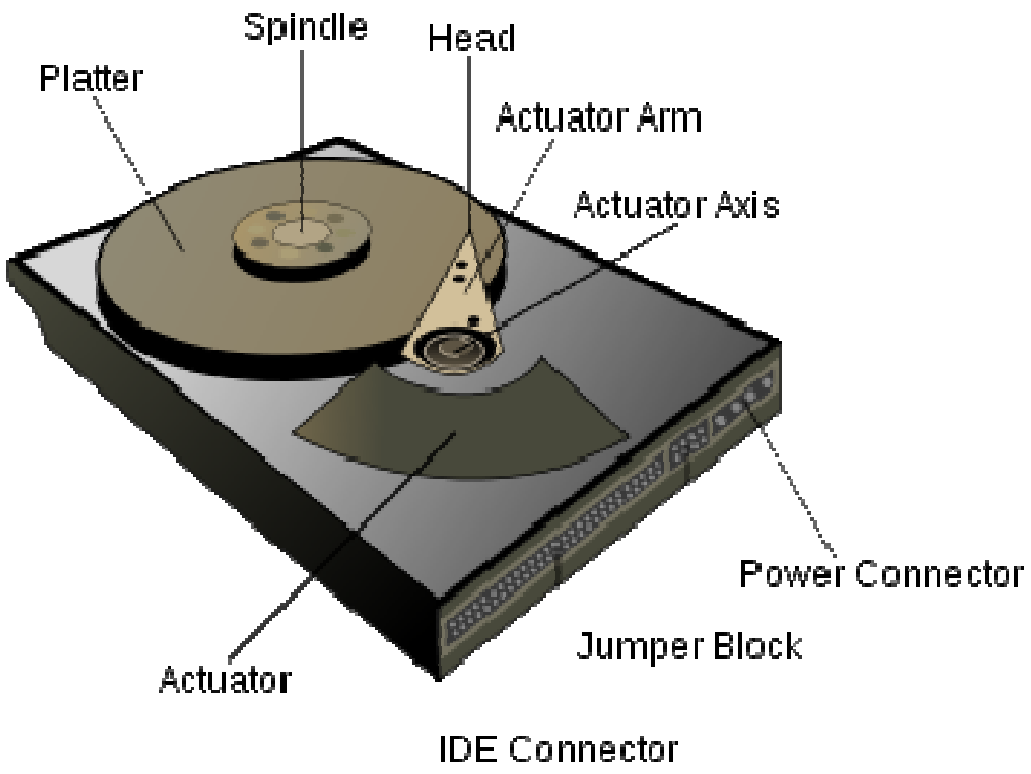
Form factor	Width	Height	Largest capacity	Platters (Max)
3.5″	102 mm	25.4 mm	4 TB (2011)	5
2.5″	69.9 mm	7–15 mm	1.5 TB (2010)	4
1.8″	54 mm	5, 8 mm	320 GB (2009)	3

Obsolete HDD form factors

Form factor	Width	Largest capacity	Platters (Max)
5.25″	146 mm	47 GB (1998)	14
5.25″	146 mm	19.3 GB (1998)	4
1.3″	43 mm	40 GB (2007)	1
1″	42 mm	20 GB (2006)	1
0.85″	24 mm	8 GB (2004)	1

Hard Disks - Geometry

Hard Disks - Geometry

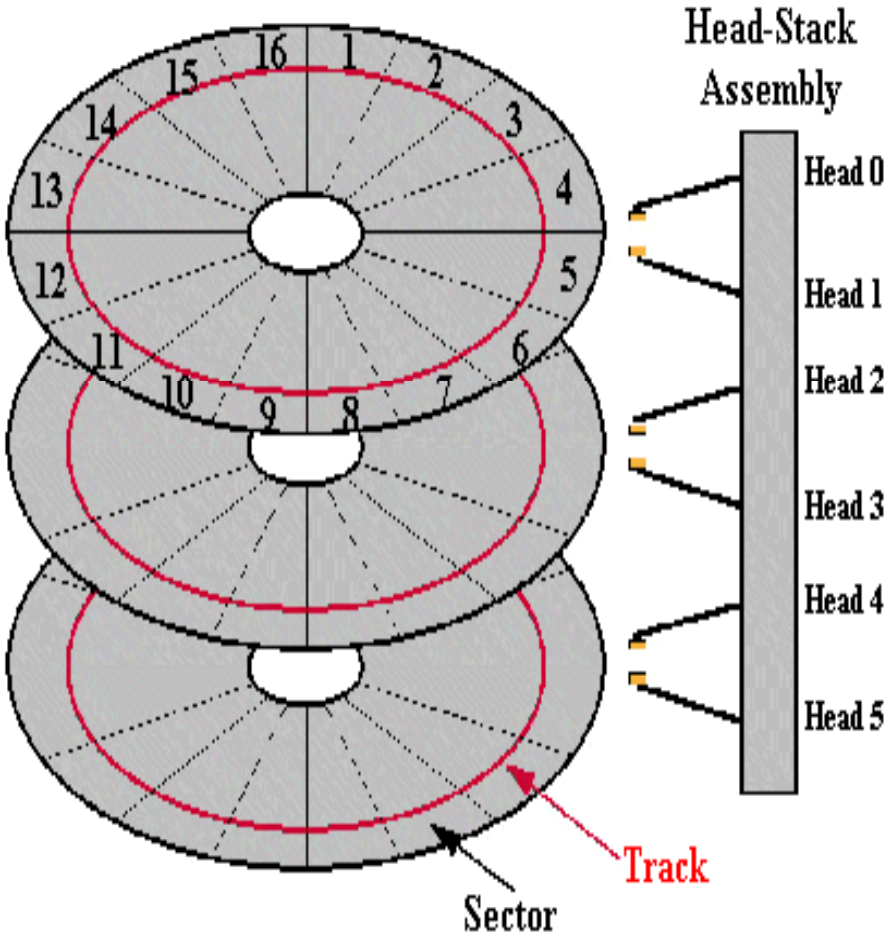


Source: Data Clinic (dataclinic.co.uk)

Hard Disks - Geometry

- Disk Geometry
  - Made of platters – each platter has two sides/surfaces
    - The platters are made from a non-magnetic material, usually aluminum alloy, glass, or ceramic
    - coated with a shallow layer of magnetic material typically 10–20 nm in depth, with an outer layer of carbon for protection
      - Magnetic region's magnetic state may loose because of thermal effects.
      - Sol: the platters are coated with two parallel magnetic layers, separated by a 3-atom layer of the non-magnetic element ruthenium, and the two layers are magnetized in opposite orientation.

Hard Disks - Geometry



Hard Disks - Geometry

- Disk Geometry
  - Platters are stacked on top of each other in a cylinder
  - A rotating spindle in the centre spins the platter at a fixed rotational rate
  - Each surface has a read/write head that is attached to an actuator arm
    - radial movement of the arm allows access to a specific track

Read / Write Head

- R/W head changes the magnetic polarization on the surface of the platter when writing data
- R/W head never touches the surface of the platter
  - There exist a microscopic air gap [known as head flying height] between the R/W head and the platter
- The air gap is removed when the spindle stops rotating
  - R/W head rests on a specific area of the platter
    - Near the spindle
    - Called landing zone
    - Coated with a lubricant to reduce friction
- Head crash
  - Head touching anywhere other than landing zone
  - Results in scratching the magnetic coating of the platter
  - R/W head may damage and the data loss may occur

Actuator Arm Assembly

- R/W head is mounted on it
- Positions R/W head at the location on platter where data needs to be R/W
- All R/W heads [2 per platter] are attached to one actuator arm assembly and move across the platters simultaneously.