Physical File Organization
(The Organization of Hard Disk)

Contents of Lecture:

- Secondary Storage Devices.
- The Organization of Disks.
  - ✓ Platters
  - ✓ Read/Write heads
  - ✓ Arm assembly
  - ✓ Spindle
  - ✓ Arms

Secondary Storage Devises:

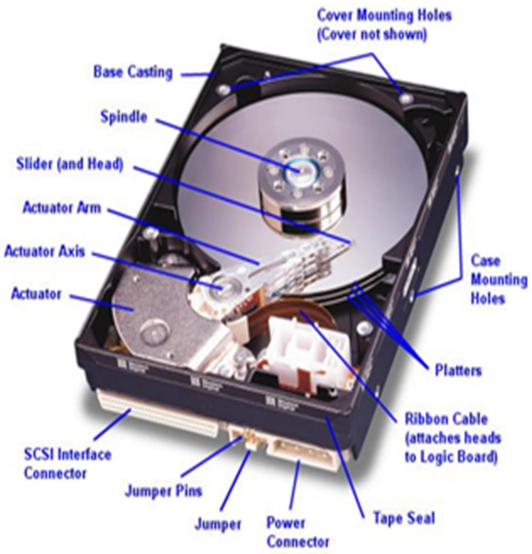
Since secondary storage is different from main memory we have to understand how it works in order to do good file design. Two major types of secondary storage:

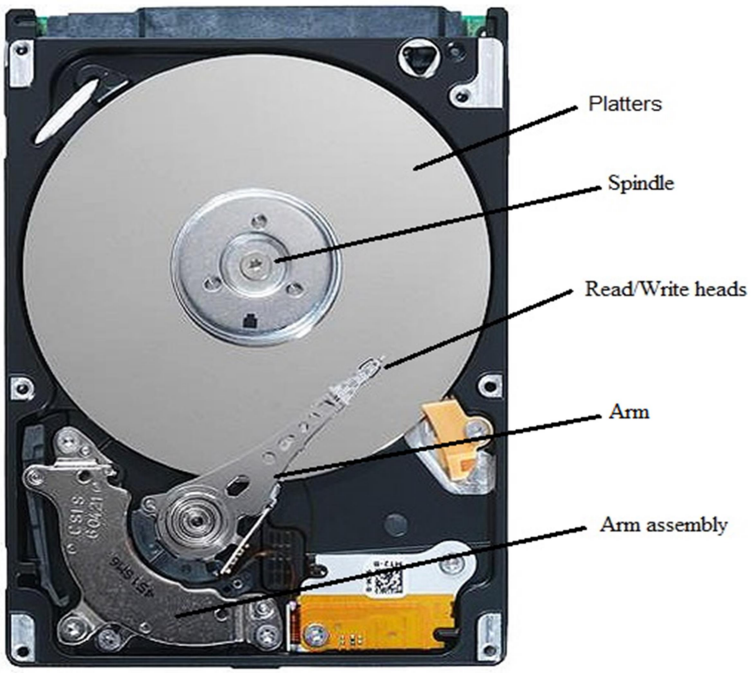
1) **Direct Access Storage Devices (DASD):**
   - **Magnetic Disks:**
     - ✓ Hard Disk.
     - ✓ Floppy Disk.
   - **Optical Disks:**
     - ✓ CD-ROM (Compact Disk – Read Only Memory).
     - ✓ CD-R (Compact Disk – Recordable).
     - ✓ CD-RW (Compact Disk – ReWritable).
     - ✓ DVD (Digital Video Disk).
2) **Serial Access Storage Devices (SASD):**
   - **Magnetic Tape**

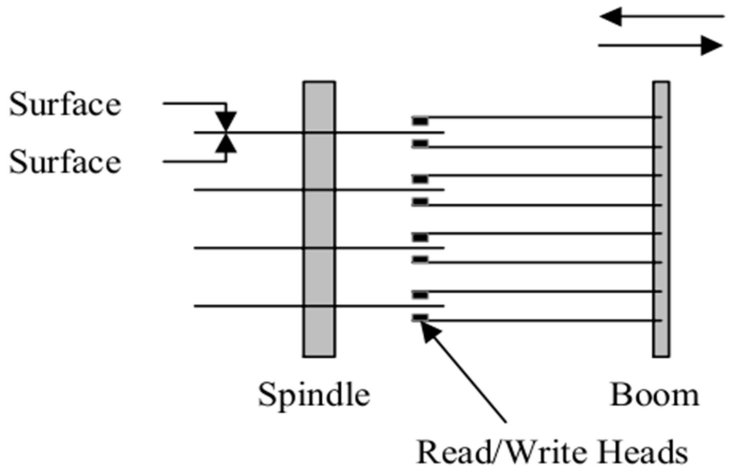
The Organization of Disks:

- We can use disks or Hdd to refer to the hard disks.
- The important components in disks are:
  1. **Platters**
  2. **Read/Write heads**
  3. **Arm assembly**
  4. **Spindle**
  5. **Arms**

- Figure below show the component inside the disks.


Cover Mounting Holes
(Cover not shown)
Base Casting
Spindle
Slider (and Head)
Actuator Arm
Actuator Axis
Actuator
Case
Mounting
Holes
Platters
Ribbon Cable
(attaches heads
to Logic Board)
SCSI Interface
Connector
Jumper Pins
Jumper
Power
Connector
Tape Seal


Platters
Spindle
Read/Write heads
Arm
Arm assembly

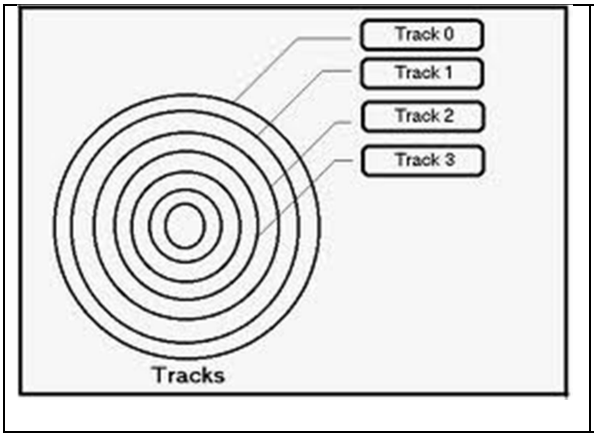


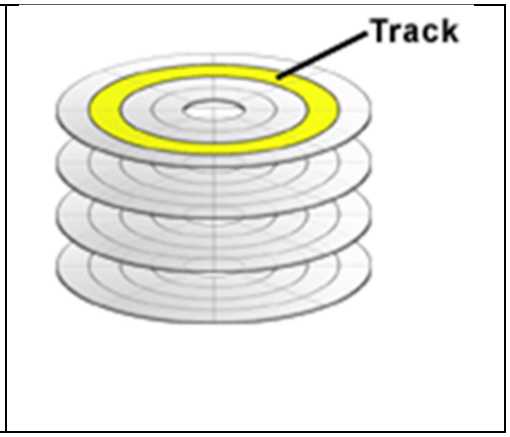
Disk drive with 4 platters and 8 surfaces

1. Platter:

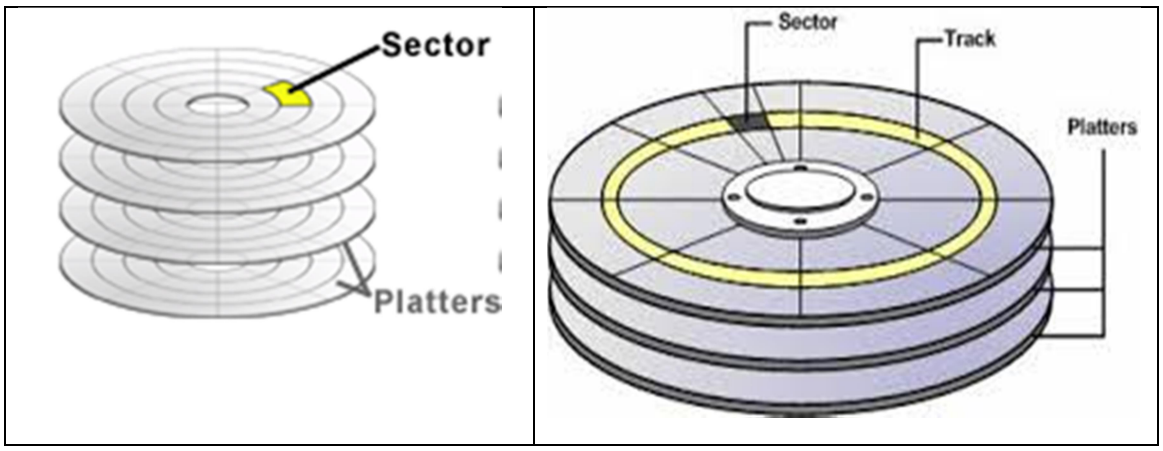
- Platter is the circular disk on which magnetic data is stored in a hard disk drive.
- Platter can store information on both sides (surface) of one or more platters.
- All surfaces have the same components at the same position.
- The platters inside a hard disk are structured to facilitate to storage and retrieval of data.

- Each platter is divided into concentric rings called **Tracks**.
  - ✓ There are thousands of tracks on each platter.
  - ✓ They look like the rings.
  - ✓ The information is stored in successive tracks on the surface of the disk.
  - ✓ **Track Capacity = number of sectors per track * bytes per sector**

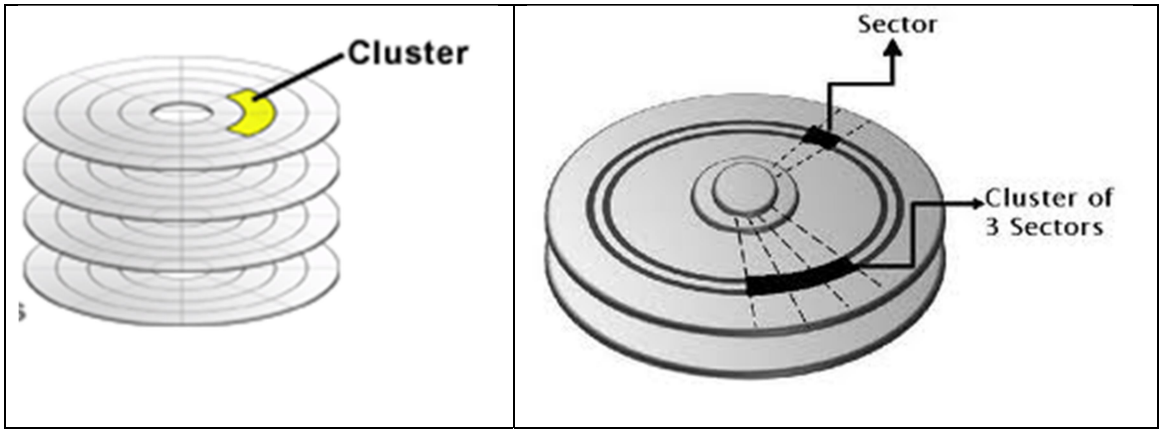


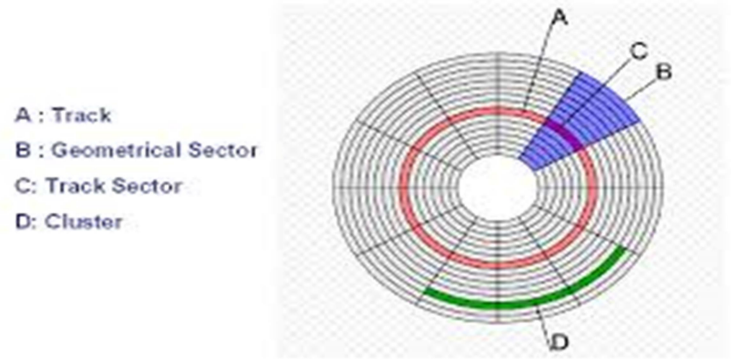


- Each track is divided into a number of **Sectors.**
  - ✓ A sector is the smallest addressable portion of a disk.
  - ✓ As a rule; sector holds **512 byte** of data.



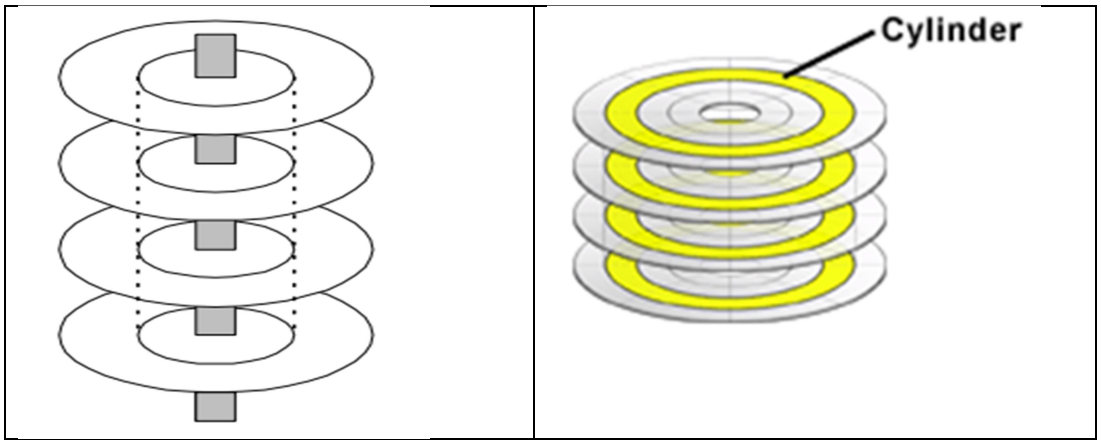
- Another view of sector organization is the one maintained by the O.S.'s file manager. It views the file as a series of **Clusters** of sectors.
  - ✓ A cluster is fixed numbers of contiguous sectors.
  - ✓ **Example**: if sectors size = 512 byte and cluster size = 2 sectors
    the cluster size = 2*512 =1024 byte



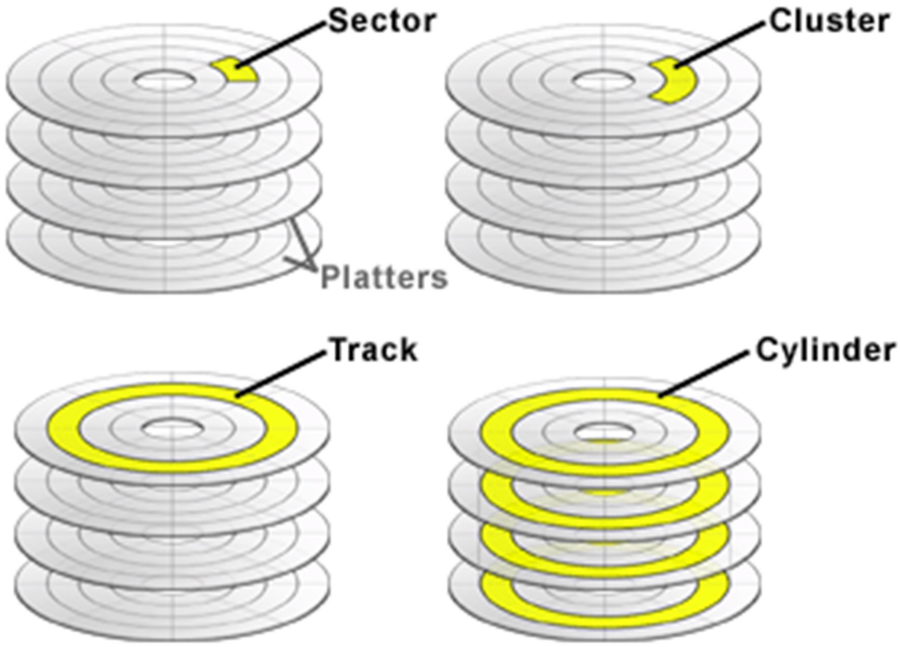


- Cylinder is a set or number of tracks that are directly above /below each other.
  - ✓ All the information on a single cylinder can be accessed without moving the arm that holds the **read/write heads**.

  - ✓ **Number of cylinder = the number of tracks in a surface.**
  - ✓ **Cylinder Capacity = number of tracks per cylinder * track capacity**



- So, platter has four components:
  - ✓ Sector
  - ✓ Cluster
  - ✓ Track
  - ✓ Cylinder



2. Read/Write heads:

- Read/write heads are the small part of the disk, that move above the disk platter.
- Heads only fly above the platter surface with clearance of as little as 3 nanometers.
- A read-write head moves to the track that contains the data to be transferred.
- Each surface has its own read/write head.

3. Arm assembly:

- Arm assembly is an internal set of hard disk component containing arms which contain the read/write head.
- The role of the arm assembly is to read and write information from a set of platters that are coated with a thin magnetic material.
- When arm assembly stops working the drive is failure.

- When a read statement calls for a particular byte from a disk file, the computer's operating system finds the correct platter, track and sector, reads the entire sector into a special area in memory called a **buffer**, and then finds the requested byte within that buffer.

4. Spindle:

- Spindle holds the platters in a fixed position with enough space for the read/write arms to get the data on the disks.
- Also, spindle used to rotate the platters.
- Spindle rotation moves the sector under the read-write head for reading or writing.

5. Arms:

- Arms are used to carry, Gide and move the read/write head.
- Moving this arm is called **seeking**.
- The arm movement is usually the **slowest** part of reading information from a disk.

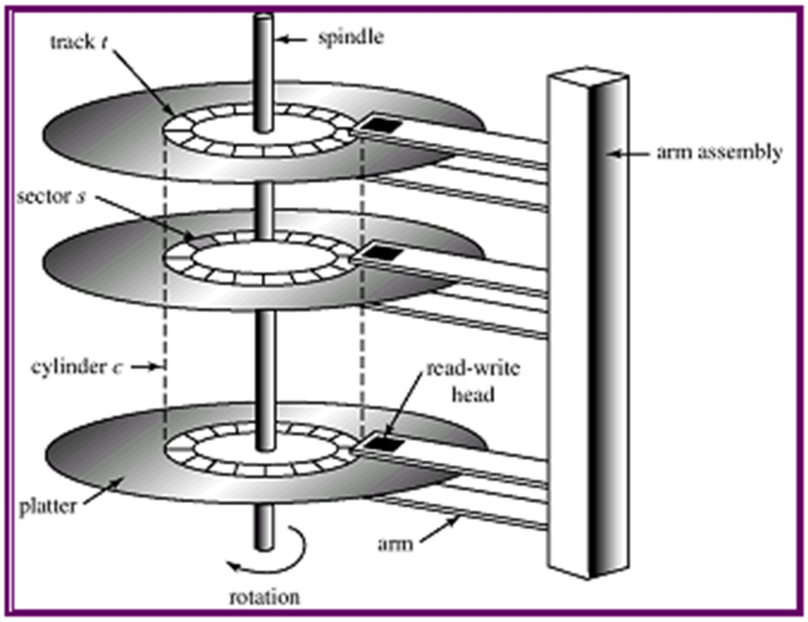
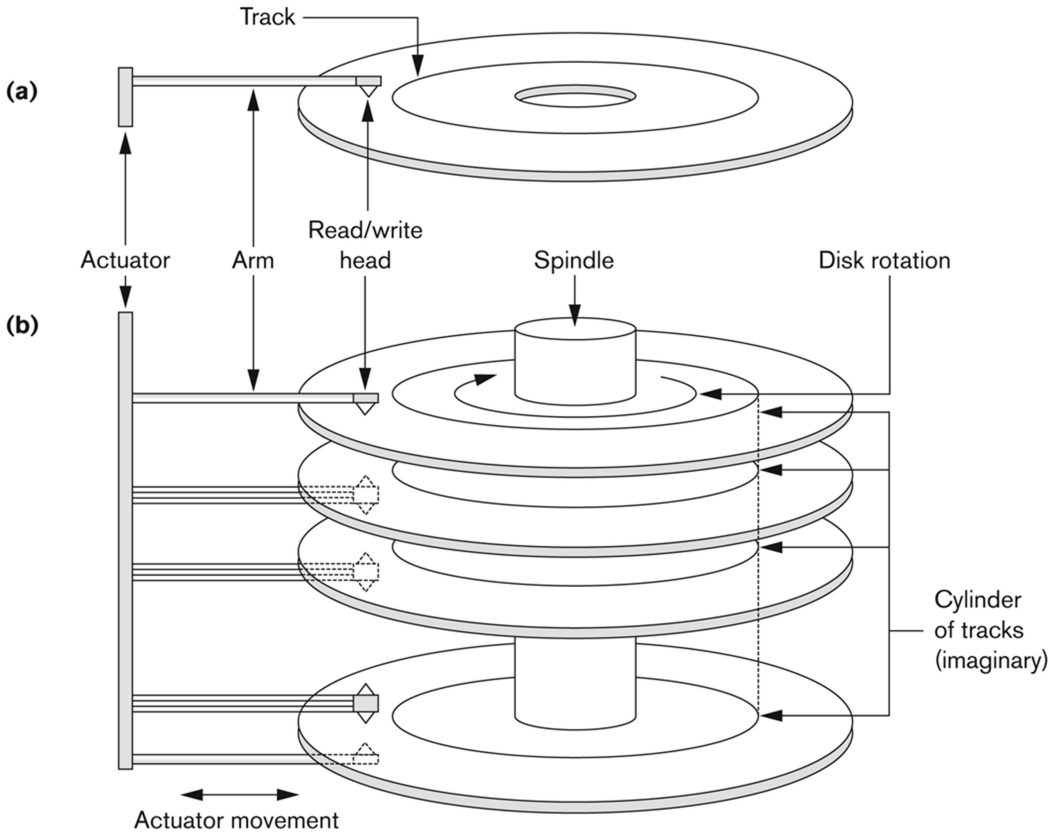



Figure 13.1
(a) A single-sided disk with read/write hardware. (b) A disk pack with read/write hardware.