Device Management
1. Basic Concepts

• Device Manager manages every peripheral device of the system.
  – 1. Track the status of each device.
  – 2. Determine which process will get a device & for how long.

• System Devices
  – 1. Dedicated devices: those assigned to only one job at one time. Example: tape drivers, printers, plotters.
  – 2. Shared devices: those can be assigned to several processes. Example, disk pack or any other direct access storage device.
  – 3. Virtual devices: combination of the 2, e.g., printer with a queue.

• Storage Media
  – 1. Sequential access media: store records sequentially, one after the other.
  – 2. Direct access media: store either sequential or direct access files.
2. Sequential Access Storage Media

- **Paper**: printouts, punch cards, and paper tape. This is already outdated.

- **Magnetic tape**: now mainly used for routine archiving and store back-up data.

- **Blocking**: an alternative way to group the records into blocks before recording them on tape.
• Advantage of blocking: I/O is more efficient and Less tape is wasted

• Disadvantage of blocking: Overhead: block/deblock/record keeping and Buffer space may be wasted if you need only one logical record but must read the whole block to get it
3. Direct (random) Access Storage Devices

- Direct Access Storage Devices
  - 1. Those with fixed read/write heads.
  - 2. Those with movable read/write heads.
- Fixed-head drums/disks

- Movable-head drums/disks
• Optical Disc Storage (CD-ROM)

• Access Time

  – 1. Seek time: time required to position the read/write head on the proper track.
  – 2. Search time (rotational delay): time it takes to rotate the drum/disk until the requested record is moved under the read/write head.
  – 3. Transfer time: time to transfer the data to main memory.
- **Access Time for fixed-head devices**
  - 1. Access time = Search time + Transfer time.
  - 2. Access time depends on the rotational speed and the position of the record relative to the position of the read/write head.

- **Access Time for movable-head devices**
  - 1. Access time = Seek time + Search time + Transfer time.
  - 2. Seek time: arm movement time, usually is much longer than search time and transfer time.
  - 4. Transfer time: data transfer time.
4. Device Handler Seek Strategies

- First Come First Serve (FCFS)
• Shortest Seek Time First (SSTF)—the request at the track closest to the one being served is the next to be served.
• SCAN—almost like round-robin.
• LOOK—similar to SCAN, except that it won’t go all the way to track 0 (or the highest track) unless there is a request.
• C-SCAN—similar to SCAN except that only when the head moves inward (toward the center) the requests are served.
• C-LOOK—similar to LOOK except that only when the head moves inward (toward the center) the requests are served.
• N-step-SCAN and FSCAN
5. Search Strategies: Rotational Ordering

- Rotational Ordering—Once the read/write head is positioned as some track, re-order the requests to optimize the search time.
6. RAID (Redundant Array of Independent Disks)

- Motivation and key idea
  - 1. To close the widening gap between processor speeds and relatively slow disk drives.
  - 2. Instead of using large-capacity disk drives, we use multiple smaller-capacity drives.
  - 3. Distribute data to enable simultaneous access to data from multiple drives.
  - 4. Improve I/O performance and allow easier incremental increases in capacity.