CS418— Operating Systems

Lecture 7

Device Management

Textbook: Operating Systems
by William Stallings

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.
  - 3. Allocate devices.
  - 4. Deallocate devices.
- 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 This is already outdated.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.
  - 3. Search time: rotational delay.
  - 4. Transfer time: data transfer time.

4. Device Handler Seek Strategies

- First Come First Serve (FCFS)

- Shortest Seek Time First (SSTF)

- SCAN

- LOOK

- C-SCAN

- C-LOOK

- N-step-SCAN and FSCAN

5. Search Strategies: Rotational Ordering

- Rotational Ordering

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.