OS – Techniques for Device Management

J. FATHIMA FOUZIA

Assistant Professor

Department of CS & IT

Jamal Mohamed College (Autonomous)

Trichy - 620020

TYPES OF DEVICES

- The OS peripheral devices can be categorized into 3:
  - dedicated
  - shared and
  - virtual devices
- The differences among them are the functions of the characteristics of the devices as well as how they are managed by the Device Manager.

DEDICATED DEVICES

- Such type of devices in the **device management in operating system** are dedicated or assigned to only one job at a time until that job releases them.
- Devices like printers, tape drivers, plotters etc. demand such allocation scheme since it would be awkward if several users share them at the same point of time.
- The disadvantages is the inefficiency resulting from the allocation of the device to a single user for the entire duration of job execution even though the device is not put to use 100% of the time.

SHARED DEVICES

- These devices can be allocated to several processes.
- Disk-DASD can be shared among several processes at the same time by interleaving their requests.
- The interleaving is carefully controlled by the Device Manager and all issues must be resolved on the basis of predetermined policies.

VIRTUAL DEVICES

- These devices are the combination of the first two types and they are dedicated devices which are transformed into shared devices.
- For example, a printer converted into a shareable device via spooling program which re-routes all the print requests to a disk. A print job is not sent straight to the printer, instead, it goes to the disk(spool)until it is fully prepared with all the necessary sequences and formatting, then it goes to the printers. This technique can transform one printer into several virtual printers which leads to better performance and use.

DEVICE CHARACTERISTICS

- Hardware considerations
  - Input or output devices
  - Storage devices

I/O DEVICES

- The three main jobs of a computer are Input, Output, and Processing.
- In most of the cases, the most important job is Input / Output, and the processing is simply incidental.
- For an example, when we browse a web page or edit any file, our immediate attention is to read or enter some information, not for computing an answer.
- The fundamental role of the operating system in computer Input / Output is to manage and organize I/O operations and all I/O devices.
- The various devices that are connected to the computer need to be controlled and it is a key concern of operating-system designers.

I/O HARDWARE

- Computers operate many kinds of devices. General categories of devices are input or output device and storage devices.
- A device which communicates with the operating system of a computer by transferring signals over cable or even through the air.
- The Peripheral devices that communicate with the machine through a connection point also called ports- (one example is a serial port).
- A bus is a collection of wires and a firmly defined protocol that describes a set of messages that can be sent on the wires.
- An I/O port usually contains four different registers −
  - (1) control, (2) status, (3) data-in, and (4) data-out registers.

STORAGE DEVICES

- Magnetic Disks / Serial Access Devices
- Magnetic Drums / Completely Or Random Access Devices
- Optical Disks / DASD – Direct Access Storage Devices

MAGNETIC DISKS

- It is a sequential access storage device.
- Magnetic disks provides a bulk of secondary storage in modern computer systems.
- Each disk platter has a flat circular shape like a CD.
- Common platter size ranges from 1.8 to 3.5 inches.
- The two surfaces of a platter are covered with a magnetic material.
- We store information by recording it magnetically on the platters.

MAGNETIC DISKS - Continued

- A read or write flies just above surface of each platter.
- The surface of a platter is logically divided into circular tracks which are sub divided into sectors.
- The set of tracks that are at one arm position makes up a cylinder.
- There may be thousands of cylinders in a disk drive.
- Each track may contain hundreds of sectors.
- The storage capacity of a disk drives are commonly measured in GB.
- A disk drive is attached to a computer through a set of wires called I/O bus.

MAGNETIC DISKS - Continued

- Several kinds of buses are available like
  - ATA - Advanced Technology Attachment
  - SATA – Serial ATA
  - USB – Universal Serial Bus
  - FC – Fiber Channel
- The data transfers on a bus are carried out by a special electronic processors called controllers.
- The host controller is a controller at the computer end of the bus.
- A disk controller is built into each disk drive.
- To perform a disk i/o operation, the operating system places a command into the host controller using memory mapped i/o ports.

MAGNETIC DRUMS

- It is a Direct access, or *random-access*, storage device.
- A magnetic drum, also referred to as *drum*, is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored.
- Magnetic drums were once used as a primary storage device but have since been implemented as auxiliary storage devices.
- The tracks on a magnetic drum are assigned to channels located around the circumference of the drum, forming adjacent circular bands that wind around the drum.
- A single drum can have up to 200 tracks.

MAGNETIC DRUMS - Continued

- As the drum rotates at a speed of up to 3,000 rpm, the device's read/write heads deposit magnetized spots on the drum during the write operation and sense these spots during a read operation.
- This action is similar to that of a magnetic tape or disk drive.
- Unlike some disk packs, the magnetic drum cannot be physically removed. The drum is permanently mounted in the device.
- Magnetic drums are able to retrieve data at a quicker rate than tape or disk devices but are not able to store as much data as either of them.
- Drums were introduced in 1952 on the Whirlwind I computer; by 1961, the Manchester University
- The logical characteristics of the drum are the number of heads and tracks.

MAGNETIC DRUMS - Continued

- The data capacity of each track, and the speed at which the drum rotates, which determines the time to read and write a track or the time to find and read part of a track.
- On later drums, tracks were broken into *sectors* to store more data on drums.
- The actual recording of sectors on a track is similar to the recording of blocks on a tape, with inter-sector gaps separating consecutive sectors of data.
- The waiting time for such a drum access is called the *rotational latency time*.

FIXED HEAD DISKS

- Disks originated as a simple approach to reducing the volume occupied by drum memories.
- Such simple disks are logically indistinguishable from drums, although physically, they consist of a magnetically surfaced platter with heads mounted against it from one or both sides.
- Such a disk is called a *fixed head disk* to distinguish it from a later development, the moving head disk.

MOVING HEAD DISKS

- Both drums and fixed head disks are expensive because of the requirement of one head (and associated electronics) per recording track.
- Moving head disks vary considerably in performance, from low-speed, low-capacity floppy disks, with only one or two recording surfaces, to high speed units with multiple disk platters all mounted on a common recording surface.
- The original moving head disk was developed under the direction of Reynold B. Johnson at IBM's lab.

OPTICAL DISKS

- Optical disk is an electronic storage medium that can be written to or read from a low powered laser beam.
- It was developed by James T. Russel in the year 1960.
- It stores data as micron wide dots of light and dark.
- First, optical storage system uses a powerful backlight to read the dots through a transparent sheet of material on which the dots were encoded.
- In later optical systems, the laser read the dots and data was converted to an electrical signal.
- An optical disk could store much more data than magnetic disk.

OPTICAL DISKS - Continued

- An optical disk is less likely to degrade over time than magnetic medium, so it is often used for archival or cold storage.
- The newest standard Blu-ray offer up to 27GB of storage in a single sided medium.
- All modern formats of optical disks use the same basic sandwich of materials structure.
- A hard plastic substrate forms the base, and then a reflective layer of a metallic foil -- typically aluminum for mass-produced disks -- is used to encode the digital data.
- Next, a layer of clear polycarbonate protects the foil and allows the laser beam to pass through to the reflective foil layer.
- With an audio CD, or software or computer game distribution disc, the digital dots in the foil are physically stamped in from a negative disc image made from nickel, which is itself made from a glass master.

OPTICAL DISKS - Continued

- This enables mass production at a level not possible by individually encoding CDs with a laser, as happens when a CD-ROM is written, or burned, in a computer.
- Optical disks that are intended for storage written by a user include different materials in the sandwich depending on whether the disc is write-once or rewritable.
- A write-once CD-ROM has an organic dye layer between the unwritten reflective foil and the polycarbonate.
- Rewritable optical disks swap the aluminum foil for an alloy that is a phase-change material so it can be erased and rewritten multiple times.

Reference

- S.E. Madnick & J.J.Donovan, Operating Systems, McGraw Hill International Book Co., New Delhi 2017.
- James L. Peterson & Abaraham Silbertschatz, An Introduction To Operating Systems, Addison-wesley Publishing Co., New York, 1987.

THANK YOU