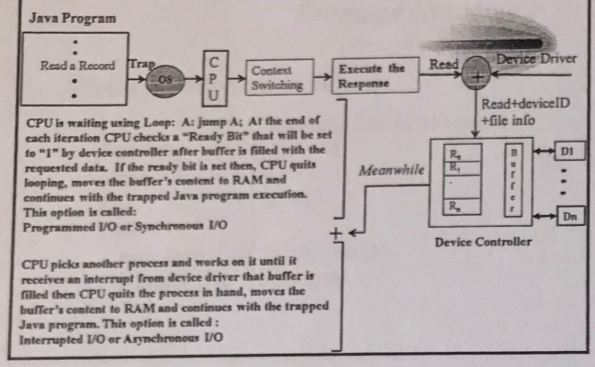
How an I/O operation takes place



I/O Structure

How an I/O Operation takes place

Synchronous (Programmed I/O)

Ready bit

Asynchronous (Interrupt-driven I/O)

- Device status table

Improvement of I/O Operations

Memory Mapped I/O

DMA

I/O Operations

Memory Mapped I/O

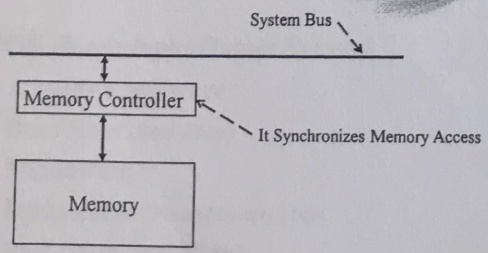
Makes the registers of the device controller as part of the main memory.

I/O Operations

DMA (Direct Memory Access)

Use of a small CPU located inside the device controller that moves the content of buffer into RAM without interruption of the computer's CPU.

Storage Structure



Storage Structure

RAM

ROM

PROM

EPROM

EEPROM

Storage Structure

Hierarchy of Storage Devices:

	Access time (in ns, 10^{-9} second)
Registers	0.25 - 0.5
Cache	0.5 – 25
RAM	80 – 250
Disks	
Solid State Disks	25,000 – 50,000
Magnatic Disk	5,000,000

Storage Structure

Cache Memory (*CPU Cache Memory: L1, L2, L3, and L4*)

- **Caching**
- **Hardware caching (Pipelining)**
- **Coherency**

Steps in using a computer system

For a computer to run:

- **Boot strap the system.**
- **Follow the event-driven behavior of the OS.**

Boot strapping

Boot strap program is used to:

- **Initialize all aspects of the system, and**
- **Locate, load, and run the OS kernel.**

Boot strap program

BIOS *(Basic Input/Output System)*

- **A built-in software**
- **Boot Rom** (Rom Chip)
- **Shadowing**
- **Updateable** (*Flash Memory chip*)
- **PnP (Plug-and-Play)**

Boot strap program

On PCs, the BIOS contains all the codes for controlling the keyboard, display screen, disk drives, serial communications, etc.

MS-DOS only dedicates one sector 512-byte to BIOS.

Event-driven behavior of the OS

- **OS reacts to the requests arriving from the events.**
  - **When OS is handling an interrupt, then the incoming interrupts are disabled.**