Operating system

UNIT-5
Input/Output hardware
&
Applications of Input/Output Interface

INPUT OUTPUT HARDWARE

An I/O system is required to take an application I/O request and send it to the physical device, then take whatever response comes back from the device and send it to the application. I/O devices can be divided into two categories −

- **Block devices** − A block device is one with which the driver communicates by sending entire blocks of data. For example, Hard disks, USB cameras, Disk-On-Key etc.

- **Character devices** − A character device is one with which the driver communicates by sending and receiving single characters (bytes, octets). For example, serial ports, parallel ports, sounds cards etc

DEVICE CONTROLLER

The Device Controller **works like an interface between a device and a device driver**. I/O units (Keyboard, mouse, printer, etc.) typically consist of a mechanical component and an electronic component where electronic component is called the device controller.
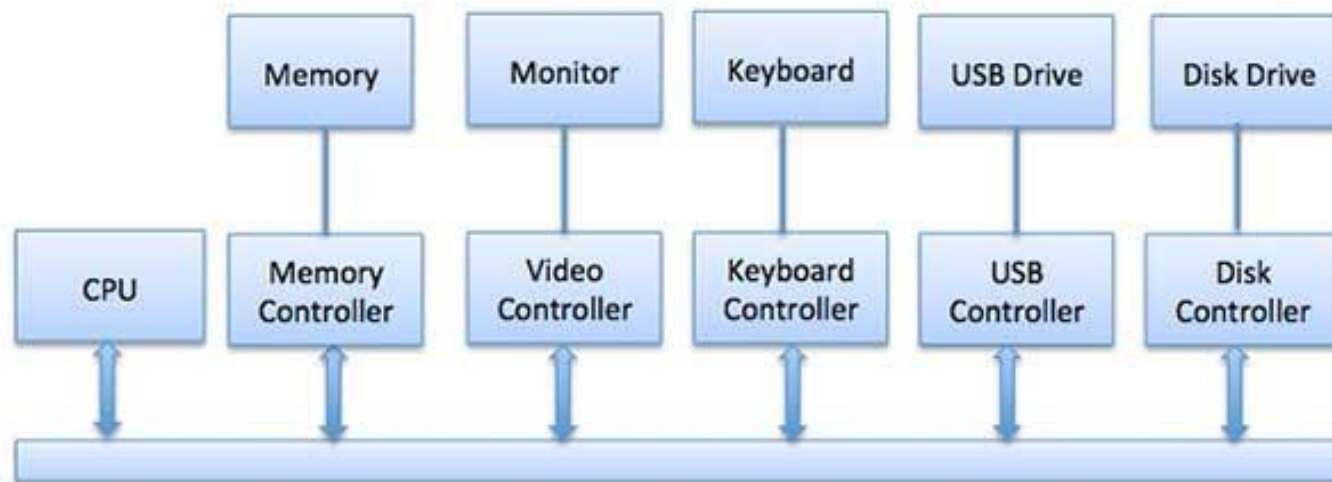
Communication to I/O Devices

The CPU must have a way to pass information to and from an I/O device. There are three approaches available to communicate with the CPU and device.

- Special instruction i/o
- Memory-mapped I/O
- Direct memory access (DMA)

Special Instruction I/O

This uses CPU instructions that are specifically made for controlling I/O devices. These instructions typically allow data to be sent to an I/O device or read from an I/O device.

Memory-mapped I/O

When using memory-mapped I/O, the same address space is shared by memory and I/O devices. The device is connected directly to certain main memory locations so that I/O device can transfer block of data to/from memory without going through CPU.

- While using memory mapped IO, OS allocates buffer in memory and informs I/O device to use that buffer to send data to the CPU. I/O device operates asynchronously with CPU, interrupts CPU when finished.

- The advantage to this method is that every instruction which can access memory can be used to manipulate an I/O device. Memory mapped IO is used for most high-speed I/O devices like disks, communication interfaces

Memory-mapped I/O
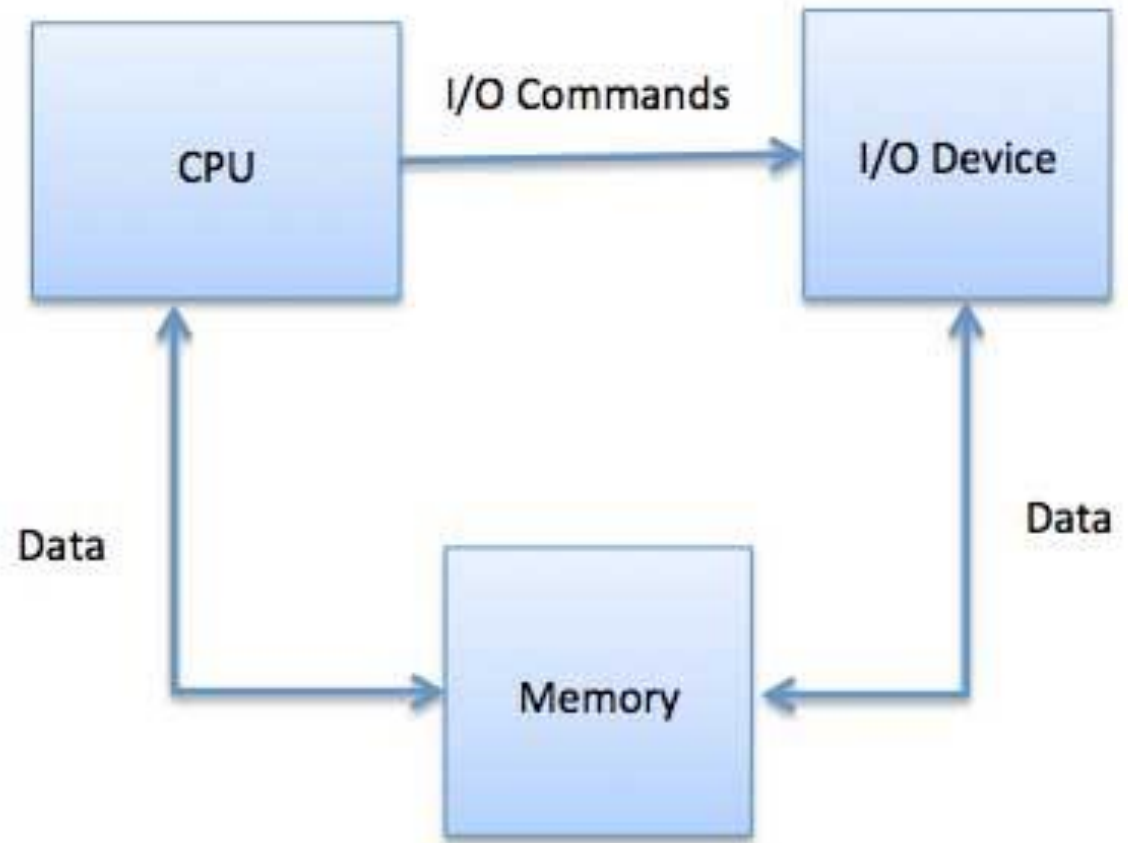
DIRECT MEMORY ACCESS(DMA)

Direct Memory Access (DMA) means CPU grants I/O module authority to read from or write to memory without involvement. DMA module itself controls exchange of data between main memory and the I/O device. CPU is only involved at the beginning and end of the transfer and interrupted only after entire block has been transferred.

Direct Memory Access(DMA)
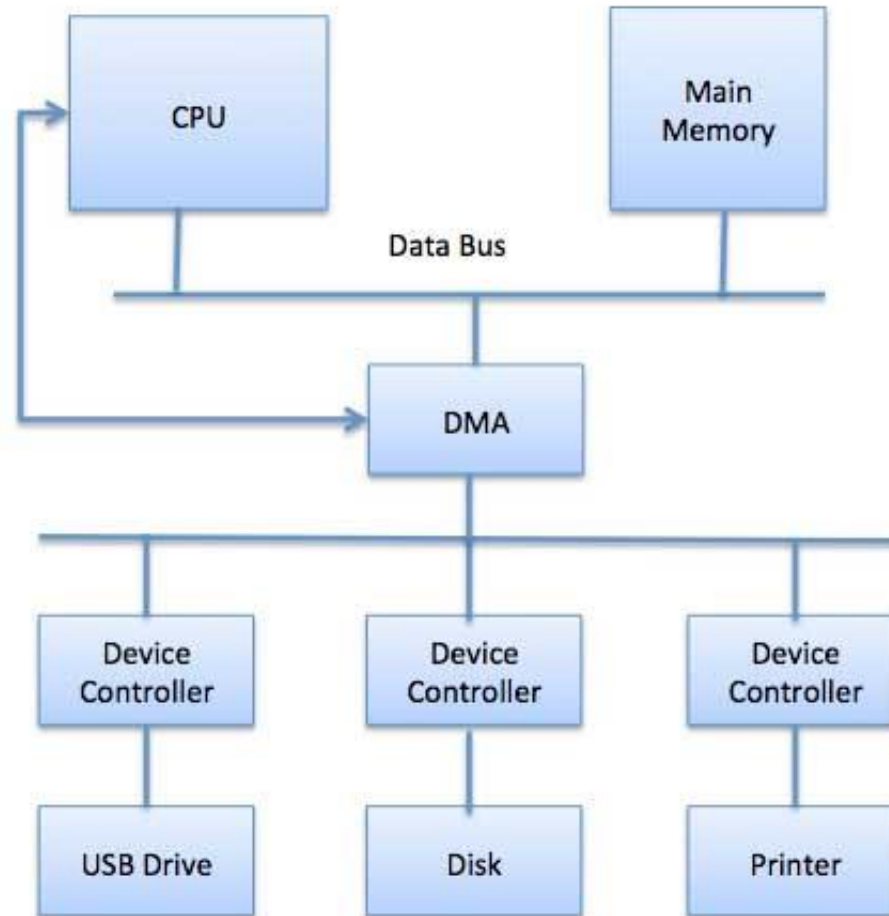
Applications of Input/Output Interface

I/O Interface

There is need of surface whenever any CPU wants to communicate with I/O devices. The interface is used to interpret address which is generated by CPU. Thus, surface is used to communicate to I/O devices i.E. To share information between CPU and I/O devices interface is used which is called as I/O interface.

Various applications of I/O Interface

Application of I/O is that we can say interface have access to open any file without any kind of information about file i.E., Even basic information of file is unknown. It also has feature that it can be used to also add new devices to computer system even it does not cause any kind of interrupt to operating system. It can also used to abstract differences in I/O devices by identifying general kinds. The access to each of general kind is through standardized set of function which is called as interface.

Various applications of I/O Interface

Each type of operating system has its own category for interface of device-drivers. The device which is given may ship with multiple device-drivers-for instance, drivers for windows, linux, AIX and mac OS, devices may is varied by dimensions which is as illustrated in the following table

S.No.	Basis	Alteration	Example
1.	Mode of Data-transfer	character or block	terminal disk
2.	Method of Accessing data	sequential or random	modem, CD-ROM
3.	Transfer schedule	synchronous or asynchronous	tape, keyboard
4.	Sharing methods	dedicated or sharable	tape, keyboard
5.	Speed of device	latency, seek time, transfer rate, delay between operations	
6.	I/O Interface	read only, write only, read-write	CD-ROM graphics controller disk

ALTERATION

- **Character-stream or Block :**
  A character stream or block both transfers data in form of bytes. The difference between both of them is that character-stream transfers bytes in linear way i.e., one after another whereas block transfers whole byte in single unit.

- **Sequential or Random Access :**
  To transfer data in fixed order determined by device, we use sequential device whereas user to instruct device to seek to any of data storage locations, random-access device is used.

- **Synchronous or Asynchronous :**
  Data transfers with predictable response times is performed by synchronous device, in coordination with others aspects of system. An irregular or unpredictable response times not coordinated with other computer events is exhibits by an asynchronous device.

- **Sharable or Dedicated :**
  Several processes or threads can be used concurrently by sharable device; whereas dedicated device cannot.

- **Speed of Operation :**
  The speed of device has range set which is of few bytes per second to few gega-bytes per second.

- **Read-write, read only, write-only :**
  Different devices perform different operations, some supports both input and output, but others supports only one data transfer direction either input or output.