Input – Output management:

- This involves the management of information devices.

- Input devices examples are: mouse, keyboard, scanner, camera etc.

- The input devices will communicate using the operating system through interrupts.

- **Input – Output hardware:**

- This includes the several devices mentioned above.

Different ways used to communicate

- They communicate by sending or receiving information in different ways which include.
  - Block or characters.
  - Sequential or random.
  - Synchronous or asynchronous.
  - Dedicated or shared.

Cont...

- **Block of characters:**
  - For block, it means that information is entered or received in block form.
  - The blocks could be divided into bytes which are received at the same time.
  - For character, information is sent or received in character form where in character form where each character is taken and stored or passed to a given device.
- **Sequential or random:**
  - Sequential information is sent or received in a given sequence may be starting from the first to the last.
  - Random – information sent or received where the sequence is not important.
- **Synchronous or asynchronous:**
  - Synchronous – this requires the sending or receiving to be timed and therefore synchronized.
  - Asynchronous – there is no clock control in the receiving or sending of information by the devices.
- **Dedicated or shared:**
  - Dedicated – this is where a device serves only one process at a time.
  - Shared – this is where several processes could share the device.

Device controller:

- This is the electronics involved in controlling a given device.

- The device itself is mechanical which has to be inserted in a slot on the main board.

- Bu electronic components that form the device is called device controller.

- It consists of registers which receive control information from the OS.

- For instance, a floppy controller can receive several instructions like read, write, format, seek etc.

Polling:

- If a given device is in use then another process that needs to use it has to wait.

- The device could have a status register that indicates the status of the device.

- If it is busy, then the status register could be and if not it could be 0.

- If a process finds the device, then status register 1 then indicates that the device is busy and therefore should continue waiting till register is 0.

- The process of waiting is called polling.

Direct Memory Access:

- Processes are able to access memory without going through the CPU.

- This gives the CPU more time to perform other functions.

- CPU can initiate the process of accessing memory but then it leaves the processes on their own to read or write from memory.

- As the processes are accessing memory, the CPU performs other functions and it could come to process after an interrupt is received from that process.

Input – output software:

- This is the software involved in managing input – output devices.
- Has different sections that include:
  - User level software.
  - Hardware independent software.
  - Device drivers.
  - Interrupt.
  - Hardware.

Layer	I/O reply	I/O functions
User processes		Make I/O call; format I/O; spooling
Device-independent software		Naming, protection, blocking, buffering, allocation
Device drivers		Set up device registers; check status
Interrupt handlers		Wake up driver when I/O completed
Hardware		Perform I/O operation

I/O request

- **User level software:**
  - This deals with I/O calls and spooling.
  - Spooling is where information is stored to be operated on, it is utilized in printer access by processes.
  - Hardware independent software:
  - Deals with allocation, naming, storing (buffering), protection and blocking of I/O devices.

- **Device drivers:**
  - These are used to communicate with OS i.e. act as infrastructure between OS and hardware.
  - For I/O devices, the drivers will be checking whether the registers are free so that they can be used. (Check status).

- **Interrupt:**
  - This wakes up a process that was blocked.
  - It is under software interrupts.

- **Hardware:**
  - This is the lowest level that Performs I/O operations.