

## Standard I/O Interfaces (PCI, SCSI, USB)

### Types of Standard I/O interfaces

- **PCI BUS**
- **USB BUS**
- **SCSI BUS**

### PERIPHERAL INTERCONNECTION BUS (PCI BUS):-

- PCI bus is a **system bus**.
- It supports the functions found on a processor bus but in a standard format that is **independent of any particular processor**.
- Device connected to PCI bus appears to the processor as if they are **directly connected** to the processor .
- PCI bus is very **low cost** .
- Its design anticipated a rapid growing demand for bus bandwidth to support high speed disks, graphics and video devices, as well specialized **multiprocessor system** .
- PCI pioneered is a **plug and play** capability for connecting I/O devices . To connect a new device , the user simply connects the device interface board to the bus. Then the software takes care of the rest.

#### How PCI BUS operates

- Data Transfer
- Device Configuration
- Electrical Characteristics

#### Data transfer:-

- The PCI bus is designed primarily to support a burst of data than just one word.
- A read or write operation involving a single word treated as a burst of length one.
- A bus supports 3 independent address spaces:
  - >Memory
  - >I/O
  - >Configuration

The **I/O address space** is intended to use with processor such as pentium , that have separate I/O address space.

The **Configuration space** is intended to give the PCI its plug and play capability.

- The PCI bridge provides a separate physical connection for the main memory.
- A 4-bit command identifies which of the three spaces is being used in a given data transfer operation.
- The master maintains the address information on the bus until the slave is selected , it doesn't have to keep it until, the execution is complete.
- The address is needed in the bus for one clock cycle only thus freezing the address lines in subsequent clock cycles. As a result there is significant reduction in **cost**, because the number of wires on the bus is an important cost factor.
- At any given time one device is the bus master. It has the right to initiate data transfer by issuing read and write commands.

#### Device Configuration:-

When an I/O device is connected to a computer, several actions are needed to configure both the devices and software communities with it . A number of switches that have to be set by user to select certain options. Once the device is connected the software needs to know the address of the device .

It should know other characteristics as

- speed
- transmission link
- whether parity bits are used and so on.

The PCI simplifies this process by incorporating in each I/O device interfaces a small configuration ROM memory that stores information about the device . The configuration ROM's of all devices are accessible

in the configuration address space. The PCI software reads these ROM's whenever the system is powered up or reset. In each case it determines whether the device is a keyboard or printer, an ethernet controller or disk controller.

### Electrical Characteristics:-

- The PCI bus has been defined for operation either a 5v or 3.3v power supply .
- Connectors on expansion boards are designed to ensure that they can be plugged inly in a compatible motherboard.

### UNIVERSAL SERIAL BUS (USB):-

- It was developed by several communication companies like compaq , hewlett packard, Intel Microsoft etc.
- The USB supports 2 speeds of connection:-
  - > Low speed (1.5 megabits/ second)
  - > Full speed (12 megabits/ second)
- The most recent version of the bus (USB 2.0) introduced a 3rd speed of operation called high speed (480 megabits/second)
- The USB is designed to meet Several key objectives:

->It provides a simple , low cost , and easy to the interconnection system that overcomes the difficulties due to the limited number of I/O ports available on a computer.

->Accommodates a wide range of data transfer characteristics for I/O devices, including telephone and internet connection.

->Enhance user convenience through a plug and play mode of operation.

### Port Limitation:-

- The Parallel and serial port provide a general purpose point of connection through when a variety of low to medium speed devices can be connected to a computer.
- Only a few ports are available in a computer. To add new ports the user must open the computer box to gain access to the internal expansion and install new interface cards and the user should also know how to configure device and software.
- An objective of USB is to add many devices to the computer system without opening the computer box.

### Device Characteristics:-

->The device connected to a computer cover a wide range of functionality ,i.e,

- Speed
- volume
- Timing constraints associated with data transfer.

->Here the sampling process yields a continuous stream of digitized sample that arrive at regular intervals, synchronized with the sampling clock such a data stream is called isochronous , means successive events are separated by equal period of time.

->Data transfer for images and video require higher bandwidth.

->Larger storage devices such as CD-ROM & hard-disk on their connection to system must provide a transfer speed of 40mbps or 50mbps.

### Plug and Play:-

->Plug and play features means that a new device such as an additional speaker can be connected at any time while the system is operating . The system will detect th existence of the new device automatically, identify the appropriate device driver software and any other facilities required to enable them to communicate.

->It can be implemented in all levels of the system from hardware to the OS(operating system) and the application software.

### USB Architecture :-

- It has low cost, flexibility and high data transfer bandwidth.
- The I/O devices connected must be located at some distance from the computer.
- For higher bandwidth a wide bus can be used which carries 8, 16 , 32 or more bits in parallel.
- Serial transmission format is used for USB because serial BUS satisfies low cost and good flexibility.
- HUB is an intermediate control point between I/O devices and the host. The Root HUB connects the entire tree to the host.
- Connections are established using single point to point links.
- The USB operates strictly on the basis of polling .
- All devices can send a message only in response to a poll message no two devices can send messages at same time.

### Addressing:-

When a USB is connected to a host computer its root hub is attached to the processor bus. The host software communicates with individual devices attached to the USB by sending packets of information which the root hub forward to appropriate device in the USB tree.

Each device on the USB whether its a HUB or I/O device is assigned a 7-bit address.This address is local to the USB tree and is not related in any way to the address used on the processor bus.

### SMALL COMPUTER SYSTEM INTERFACE BUS(SCSI BUS):-

- It refers to a standard bus defined by the ANSI under the designation X3.131[2]
- A controller connected to SCSI bus is one of two types – an initiator or a target.
- An initiator has the ability to select a particular target and to send commands specifying the operations to be performed.
- The disk controller operates as a target. It carries out the commands it receives from the initiator. The initiator establishes a logical connection with the intended target.Once the connection as been established, it can be suspended and restored as needed to transfer commands and bursts of data.
- While a particular connection is suspended , other devices can use the bus to transfer information.This ability to overlap data transfer request is one of the key features of the SCSI bus that leads to its high performance.
- Data transfer on SCSI bus is controlled by the target controller. To send a command to a target, an initiator controller requests control of the bus and after, and , after winning arbitration , selects the controller it wants to communicate with and hands control of the bus over to it. Then the controller starts a data transfer operation to receive a command from the initiator.

### BUS Arbitration :-

- The bus is free when he -BSY signal is in the inactive state. Any controller can request the use of the bus while it is in this state . Since two or more controllers can generate such a request at the same time , an arbitration scheme must be implemented.
- A controller requests the bus by inserting the -BSY signal and by asserting its associated data line to identify itself.
- The SCSI bus uses simple distributed arbitration scheme, in which the controllers uses the bus simultaneously.

### Selection:-

The selected target controller responds by asserting -BSY . This informs the initiator that the connection it is requesting has been established , so that it may remove the address information from the data lines . The selection process is now complete and the target controller is asserting -BSY . From this point onwards the controller has control of the bus , as required for the information transfer phase.

### Information Transfer Phase:-

The information transferred between two controllers may consist of commands from the initiator to the target, status responses from the target to the initiator , or data being transferred to or from the I/O devices . Handshake signal is used to control information transfer in the same manner.

At the end of the transfer , the target controller releases the -BSY signal thus freeing the bus for use by other devices . Later it may re-establish the connection to the initiator controller when it is ready to transfer more data.