System Resources:- Every thing in a PC is a resource such as Processor, Processor speed, Memory capacity, hard Disk Storage Space etc. However there are special resources in a System which doesnot comes under the Hardware resources but they enable the communication between the different part of computer. These resources are known as logical resources. Although the logical resources are not exactly the physical part of the system but they need some hardware to generate the information as well as some set of instructions to initiate the task. They are logical part of system because they control how external devices will ~~the~~ communicate with the CPU or with the memory.

Some System resources are as follows:-

1. DMA Controller
2. Interrupt Controller
3. RAM buffer
4. Interrupt Request channel (IRQ)

~~1. DMA Controller~~:- The System resources are important because they are shared by the device in the Computer. The system resources are primarily use for communication and information transfer between various devices. System resources are also the communication channel, addresses and other signal hardware device used to communicated on the bus.

Resource Conflict:- As we add more no peripheral to the System it become difficult to the computer System to find enough resource in order to satisfy all the requirement. It may ~~lea~~ lead to

~~Interrupt~~
resource conflict. Resource conflict is one of the problem while configuring new PC's. The interrupt request Cause more problem than DMA As the System Complexity increase (Hardware) the chances for the resource conflict increase.

Interrupt: It is like a message from one part of the computer to the other part to tell the system that it requires to stop but it is doing and execute Something else

(2) An IRQ is an interrupt request. It is the name given for the actual signal that is used when a peripheral request an interrupt for the services of memory or processor.

(3) Interrupt request channel or hardware interrupt are used by various hardware devices to signal the motherboard that a request must be fullfilled.

(4) Interrupt play an important role in how the processor peformed input output processing. It interfaces every peripheral in the computer from the keyboard and mouse to hard-disk

(5) Interrupt processing are done by two way.
- Pooling
- Interrupt

- Pooling: ~~The~~ In this technique the processor goes to each device turn by turn and ask the devices needs to do anything. This is called pooling of the device. However this method is not used as it waste time in Checking every device

Interrupt: In this technique the processor checks if any device requesting services through the interrupt Controller. An interrupt is generated whenever a device need service. The processor than Stops the Current execution & give Services to device. If at a time more than one device are requesting service, then depending upon priority of interrupt can be Serviced.

Interrupt are of 2 types
1. Hardware interrupt
2. Software interrupt

1. Hardware interrupt: The Hardware interrupt are physical pins provided on the chip. we need to apply signal to these pins to interrupt the processor. Generally Hardware interrupt are prioritized by their number with Some exception. The highest priority interrupt has the lowest number. An interrupt with highest priority will be serviced first.

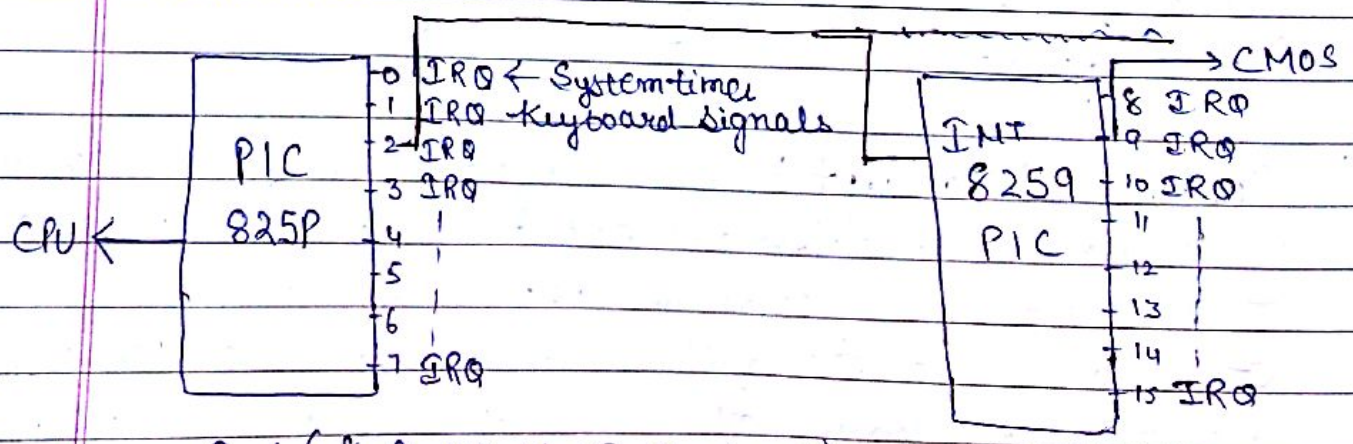
1. The Hardware interrupt are also called as Maskable interrupt it means that the interrupt can be mask or turned off for the short time while the CPU is used for other critical operation. Masking is obtained by clearing that particular interrupt bit.

2. Software interrupt: It is used by software program in response to different events that occurs as the operating System & application run. It allow one program to access other program without knowledge of where it reside in memory

(2) The interrupt channel are represented by the Group of wires, buses on motherboard and in the slot Connector.

Response to interrupt: Whenever an interrupt is invoke a special routine called as interrupt Service routine takes over the System, it first saves all the CPU register content in stack and then directs the system to interrupt vector table. The interrupt vector table consists of a list of memory addresses that corresponds to interrupt channel. Depending upon interrupt invoke the program Corresponding to the channel is run.

Interrupt Controller: The device interrupts ~~that~~ that are fed to the processor using a small piece of hardware called an interrupt controller.
8259 is a programmable interrupt controller (1) It is used as an interrupt controller. It has 8 input line that takes request from one of the 8 different devices.
(2) The controller than passes the request ~~on th~~ to the processor, telling the processor which device issued the request.
A Computer System can have multiple interrupt Controller.



0, 1, (8, 9, 10, 11, 12, 13, 14, 15) 3, 4, 5, 6, 7

IRQ	Busline	Priority	Default Use	Other Common uses.
0	No	1(highest)	System Timer	— (it cannot handle any common device)
1	No	2	None	—
2	No	Not Applicable	None (because it is used as cascade input for IRQ8-15)	Very old video card, Modem, Serial port
3	8/16 bit	11	Second Serial port	It can be used for Com-2 port, serial port, Modem, Sound card, Network card.
4	8/16 bit	12	first Serial port	first ~~ser~~ Com-3 in case of Modem, sound card, N/W
5	8/16 bit	13	Sound Card.	LPT2 Second IIel port, 3 IIel port, Com 3 & Com 4 Serial port ~~Sound~~ or N/W card
6	8/16 bit	14	floppy disk Controller	Tape Cards
7	8/16 bit	15	LPT1, device Connected to Parallel port 1	LPT2, Com-3 & Com-4 N/W Card & Sound card
8	No	3	In case of search area it handle Real time Clock.	None
9	16bit	4	None	N/W Card & Sound card, Rerouted IRQ-2 request
10	16 bit	5	None	N/W card & Sound card IDE channel. PCI-devices.
11	16 bit	6	None.	N/W card Sound Card VGA vedio Card, Tertiary IDE-channel, PCI-devices
12	16 bit	7	PS/2 Mouse	N/W card, Sound card, VGA Vedio card, Tertiary IDE channel PCI-devices
13	No	8	floating point Calculation it will handle interrupt	None
14	16 bit	9	Primary IDE Channel ~~SCSI host adapter~~	SCSI host adapter
15	16 bit	10	Secondary IDE channel	N/W card & SCSI-4 adapter

General format for representation for IRQ :

1. IRQ no – The no of IRQ 0 to 15
2. Priority – The priority level of interrupt 0 is highest priority and IRQ-15 is lowest priority

3. Bus line : It indicate wheather or not this particular IRQ available to other devices on system bus as well as it indicate whether that IRQ uses some external buses or not

4. Default use : for which type of Interrupt it handle specifically meant for particular use

5. Common user : Generally where IRQ used.

DMA Channel : Direct Memory Access is an important part of PC's because the DMA allows computer component access the main memory directly without having to manage the data flow through the processor. This is an important functionality because in many system the processor is having a dataflow bottleneck and if imp it would slow down the System Considerably because the processor has to handle every memory transaction and the overall throughput of the System decrease so the DMA Controller chip i.e 8237 is used

This DMA chip can also be used to move large block of data between two memory location or it can be used move blocks of data from a peripherial device to memory. DMA channel are also responsible to mange the data transfer b/w primary memory and secondary memory whenever DMA is to be established the DMA Chip should request the control of bus from the CPU

and once it has control over the memory buses the CPU may not access the bus of any reason and CPU will continue operating on the instruction that are stored in its cache or in its registers, but once the cache is empty or once a memory access instruction is encounter the CPU must wait for DMA operation to complete. The DMA can manage the operation much more quickly then the CPU can. The DMA chip has upto 8 DMA channels and one of these channel can be used to cascade & a second DMA chip. Each channel can be programed to read from a specific source, to write a specific source etc. because of this the DMA has no of input output addresses available for writing to a necessary control register or reading from the register when two DMA chip are cascaded total no of 14 channel can be available.

DMA Data transfer Modes: There are three data transfer Mode:

1. Brust or block transfer DMA
2. Cyclic stealing or single byte transmission
3. Transparent or hidden DMA

Advantages of DMA channels: Transparent or hidden DMA: CPU executes some instructions or control signal regarding that instructions and at that time only the control bus is required by the CPU during this time, the CPU is isolated from other two system bus. The DMA controller transfer data between memory & I/O device during this phase. This operation is transparent to CPU. This is the slowest DMA transfer

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Reso Advantages of DMA channel:

1) DMA channel are used by the communicating devices to send and recieve information at high speed
2) DMA channel are the path that are used to transfer the information directly to and from memory.
3) Use of DMA channel save the CPU time.
4) Multiple network adaptor or sound cards can be handle at the same time by cascading DMA chip.

Resource Conflict & Resolving the conflict of resources:
The no of resources in the system are limitted. But the demand on thous resource are unlimitted As more no of peripherals or adapter cards are added to the system, the potential for resource conflict increases

When more than one device attempts to use the same resource, the resource conflict arises. resource conflicts can exhibit themselves in different ways. Some conflicts can be easy to recognized while other can be difficult to find.

Example of resource conflict: Typically one of the device in the system stops working
Eg: The mouse doesnot work (mouse pointer hangs up refusing to move & moving suttering pressure).

- The system hangs or lock ups particularly while using a peripheral device.
- The sound card doesnot sound quite right
- Junk material is begin printing by the material

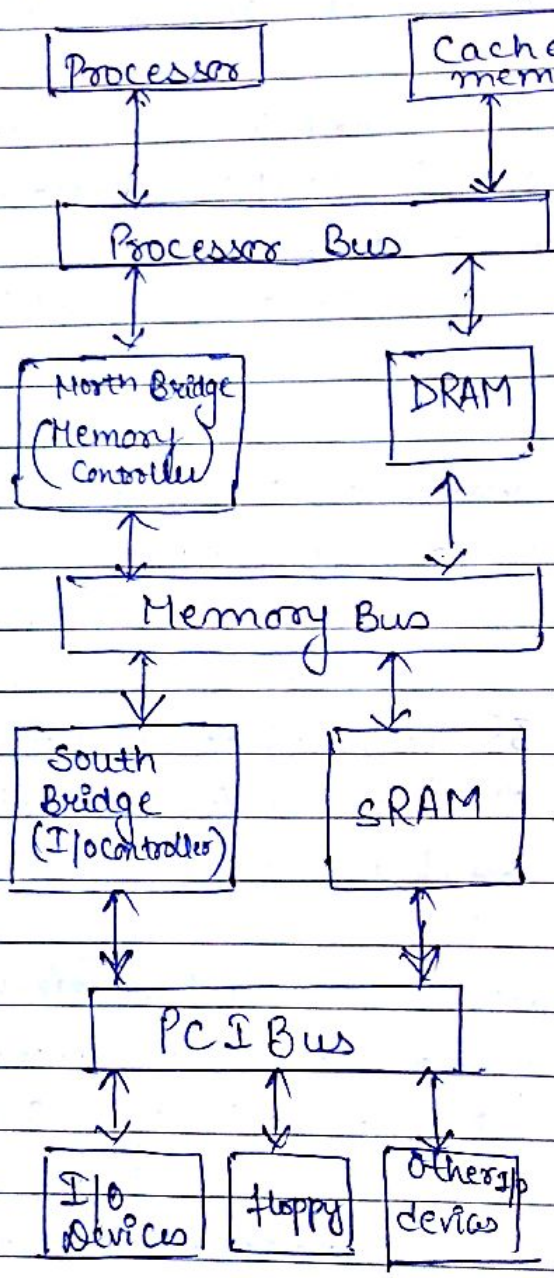
- A pendrive or floppy disk cannot formatted
- The PC begins in sleep mode or can start only in last known.
- Some time this process may not be resource conflict
- If one suspect a resource conflict a various check must be performed to be ensure server that system is clean & it can save several hours of work

I/O Port:- These are also known as I/O address or as combinely I/O port. It allows the software driver to communicate with hardware devices on our computer motherboard or external to the motherboard. In any computer there are 65535 ports that are numbered from 0000H to FFFFH. The I/O port assignment can be made either manually by DIP switches. (Dual inline Package)

(DIP are Dual inline Package or manual electrical switch which is used to enable or disable any pin for a particular I/O address) or Automatically using PNP (Plug and plays) when configuring the I/O port of any device in our computer. It is important that it does not share the same I/O port address with some another device. otherwise a conflict will arise that conflicts is known as hardware conflict

How to view I/O addresses:- ① open the device manager
② Click view at the top of device manager window.
③ Then click resources by type.
④ Then select I/O
⑤ This will give available I/O devices.

I/O Buses : Multiple bus design approach :



1) Processor
2) Memory
3) Expansion Slot (I/O Bus)

Because of the wide ~~the~~ range of speed of computer and to eliminate the bus bottleneck. A multibus design approach has been implemented in PC because some components such as CPU & cache memory run faster than ROM and floppy disk. Generally a ~~multiple~~ multibus design approach consist of 3 type of buses

(1) Processor Bus (2) Memory Bus. (3) Expansion or I/O Bus

Processor Bus: It is a communication path between the CPU and chip set. The North Bridge path of chipset or memory controller chip set maintain the direct communication with the processor through the processor bus which is also known as front side Bus (FSB) It is highest speed bus in a system and consist of data address and control Bus. It runs at 66MHz, 100MHz, 133MHz, 200MHz, 400MHz, 533MHz, 800MHz. It is 8 byte mean 64 bit ~~by~~ wide.

Cache Bus: It is again a high speed bus. It is a dedicated bus use for accessing system cache. It

Memory Bus: It is second level system Bus. It connect the memory subsystem to ~~en~~ the chipset and the processor. It is used to transfer info. between CPU & main memory RAM in the system. Memory bus is actually a part of processor bus itself but usually it is implemented seperately by the North Bridge of the chipset (that is responsible for transferring info. between the processor bus and memory bus)

Expansion Slot / IO bus: It enables the computer to communicate with the peripheral devices

Expansion slots are required because

1) Additional devices like sound card, video adapter SCSI host adapter can be added to the system. However the devices may not be built into the motherboard chip set.
2) They may be configured as additional chip install in board. They used to I/O bus to communicate with C.P.U
3) The I/O bus helps the user to add device to a computer system in order to expands it capabilities.

4) Expansion Slot provide special signal to synchronize the working of ADD-ON card with the rest of computer.

Types of Expansion Slot or I/O Buses on motherboard:

1) ISA
2) MCA
3) EISA
4) Local Bus → VESA Local Bus.
→ PCI Bus.
→ PCI Express.
→ AGP.

ISA: Industry Standard ~~Arch~~ Architecture in 1980 by IBM. The original IBM PC that was introduced in 1981 include the 8 bit subset of ISA bus. In 1984 IBM introduced the first full 16 bit implementation of ISA Bus. 8 bit ISA bus run at 4.77 MHz, 16 bit ISA run at 6 MHz to 8 MHz. Later on 8.33 MHz was decided as ~~a~~ maximum standard speed for 8 or 16 bit version of ISA bus. Some computer have capability to run ISA bus faster than 8.33 MHz. But some of the adapter card (video adapter card) may not properly operate at such high speed. Generally the ISA data transfer need 2-8 cycles with max. speed of 8.33 MHz.

$$\frac{8.33\,MHz \times 2\,bytes}{2\,cycles} = 8.33\,Mbps$$

The bandwidth of 8 bit ISA bus 4.17 Mbps. ISA is the oldest architecture but todays computer still have ISA bus Interface in the form of ISA slot on the motherboard. ISA has 8 or 16 bit standard along with 32 bit version of EISA. All standard operate at 8 MHz approximately.

→ Types of IDE interface
→ ATA standards from 1 to 7
→ Advantage of & Limitation of SCSI & ATA.
SCSI-1 & SCSI-2, SCSI single & SCSI differential,
Difference

- 8 bit ISA Standard: 1) 8 bit ISA bus architecture provide 8 data line, 20 address line and 6 interrupt line with 3 DMA channel.
2) Input output data transfer rate in 8 bit ISA architecture required 2-8 cycles.
3) It run at 4.77 ~~Hm~~ MHz with 4.77 Mbps speed.
4) It has an adapter card with 62 pin on its bottom edge plug into a slot on the motherboard that has 62 matching context
5) 8 data line & 20 address line enable the slot to handle 1 Mb of memory.

Limitation of 8-bit ISA:
1) Low data transfer rate
2) Complex expansion board installation.
3) very limitted IRQ handling.
4) Less DMA channels.

- 16-bit ISA bus: In 1984 IBM introduce 286 processor which is the 16 bit implementation of ISA bus. 16 bit ISA bus has an additional connector attach behind the 8 bit character.

1) It has 8 additional data bit or data lines
(2) It provide more than 5 DMA Channel and additional interrupt request signal.

Limitation of 16 bit ISA:
(1) A System vote has access to IRQ line, DMA Channel and data lines creates problem when expansion boards are used (due to I/O address conflict)

(2) ISA bus doesnot have any central registery from where the system resources can be assigned to expansion boards

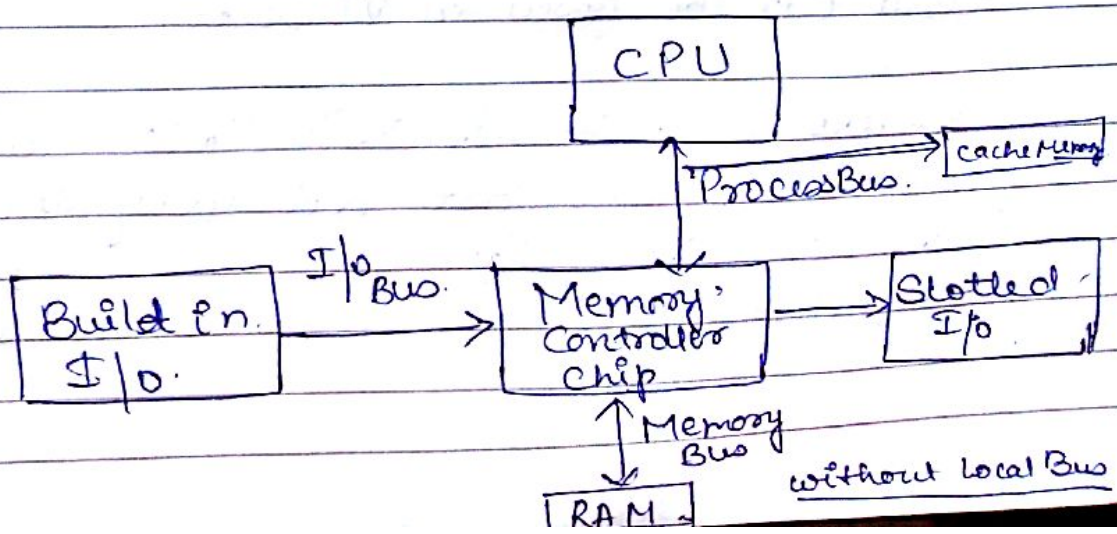
II) EISA: Extended ISA It has a 32 bit data bus. but still operate at 8 MHz
- EISA was develop in September 1986 by IBM.

Feature of EISA:
(1) It is used for 80386, 80486 processor
(2) EISA bus is rarely used (mainly as a video graphic adapter) or disk controller
(3) It support higher data transfer rate for DMA devices
(4) It support automatic configuration of system and expansion board.

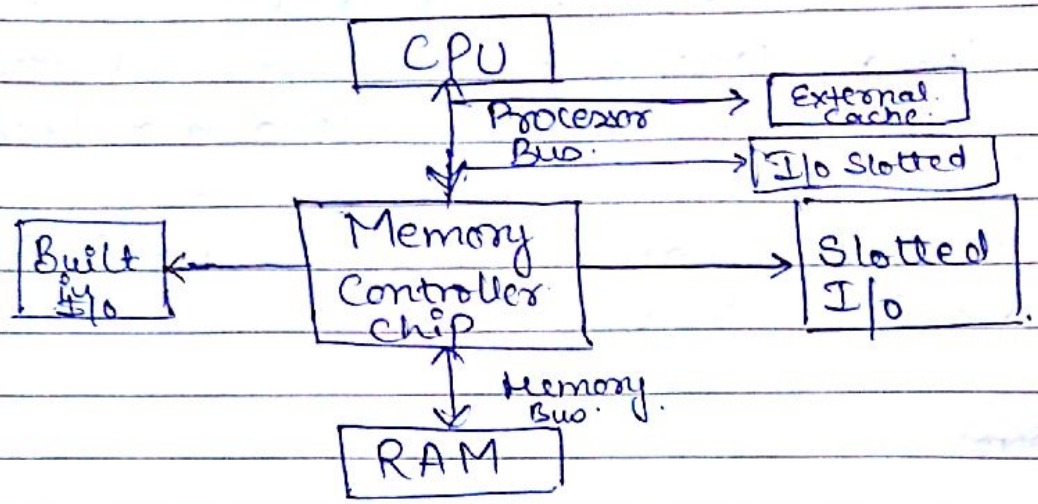
Local Bus:- The ISA, MCA and EISA buses are presently of slow speed. Hence the I/O buses that were develop after these buses are known as Local bus.

There are three main local bus found in PC system
(1) VESA Local Bus (VL Bus)
(2) PCI Bus
(3) AGP Bus.

Why local bus is required:-
(1) Speed limitation of ISA, MCA or EISA arises the need of local bus
(2) Slow bus speed was a problem in application that required speed like video or disk controller or that require communication through keyboard or mouse.
(3) Also these I/O buses are capable of transfering of data at the rate of 8MHz whereas the processor has a processor bus capable of transfering data at the rate of 66MHz to 450MHz or faster. So overcome the problem associate with EISA, ISA It was decide to move the slotted I/O block to an area where it could access the faster processor bus or external cache



without Local Bus



With local Bus:

VESA : It was design in 1992 as an extension to ISA bus. VESA Standard for video Electronic Standar association

2) Initially it was used for video cards to improve video performance

3) It is a 32bit bus and it is a direct extension of ~~486~~ ext 486 processor or memory bus. It can move data upto 32 bits at a time

4) It enable the data to flow b/w the CPU and a Compatiable video ~~Sy~~ subsystem

5) Max data rate of VL bus is 133 mbps

The VL bus is extension of ISA bus. Hence the ISA Card can be used in VL bus slot.

VL bus Slot can be easily slotted to the 486 motherboard and at very low cost but today the VL bus is Obselete for new System

The latest for 486 motherboard use PCI & AGP buses

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. PCI bus:- Stands for peripheral component Interconnect
2) PCI is a local bus which has a high performance for interconnecting chip, expansion board.
3) It is also known as processor independent bus because it can act as processor bus and peripheral bus which support various high speed device.
4) It was orginally design by INTEL in early 1990. Unlike some earlier standard of buses the PCI buses is designed to be easily interfaced with different microprocessor family, main memory and a very wide range of I/O device
5) PCI bus maintain a sperate block which synchronize the action of diff. I/O device, memory unit with the CPU.
6) A 32 bit PCI bus connector consist of 124 pins arranged in dual inline fashion with 62 pin on each side

Features of PCI bus:-
1) PCI bus support synchronous bus architecture
2) It is a processor independent 32 bit or 64 bit local bus.
3) PCI slot support interrupt sharing
4) The maximum clock rate of PCI bus is 33 MHz
5) PCI bus support 64 bit addressing
6) It support bus mastering (It mean that the device on the bus acquire complete control of the bus and do the data transfer directly)
7) The PCI bus arbitration is hidden because it does not consume clock cycle (when ever a device need to communicate with another device i.e connected to the motherboard, it require a bus.

The bus is shared amongst all the device. A method is used for deciding which device will get control of the bus. The method used to determine which device gets a assest to a bus is called as bus arbitration.)

8) The address and data bus are multiplexed this reduces the size and no of signal on the PCI Connector.

PCI Express :- PCI Express was first developed in April 2002. It is design to support the increasing bandwidth need in ~~Pers~~ PC's. It is an extension of PCI bus. The Previous PCI bus had a life of 10 to 15 year where as the PCI express bus architecture has more service period

Features of PCI express :-
1) It is compatible with existing PCI and all the existing software device drive.
2) It support power management capabilities
3) PCI express ~~bus~~ is a fast serial bus and it used 8 bit to 10 bit encoding scheme

AGP :- Accelerated Graphics port :- It is a new bus created by INTEL. It is designed for high performance graphics and video support basically AGP is an extension of PCI bus with one difference. AGP allows the speed of the video card to pace the requirement for high speed 3D graphics. AGP contain ~~seve~~ several addition and enhancement and it is logically, electrically and physically independent of PCI

bus. The speed of AGP is 66 MHz. It can carry 32 bit at a time.

→ What is the use of terminator in bus architecture?

→ A terminator is a ~~device~~ designed to minimize the potential for reflection or noise on the bus as well as to create a proper load for the bus transmitter circuit. Terminator are placed at each end of the bus to minimize the noise problem. Two types of terminator can be used on the bus at each end

1. Passive terminator
2. Active terminator.

Single Ended SCSI and differential Ended SCSI :

Single Ended SCSI : A single wire contain the single between the ~~traget~~ target and initiator.

2) It allow connection upto maximum ~~to~~ 6m. If the length is more the data rate reduces
3) The Single Ended SCSI Electrical interface is the most popular type for PC System
4) It consumes less power and cheap as compaire to differential SCSI.
5) It is acceptable to interferences

Differential SCSI : Differential SCSI uses driver on both initiator and target end on the bus. and makes each signal work in push & pull arangement rather than a ground arrangement (which is used in single ended SCSI)

2) It enable much greater cable length and eliminate the problem with termination It can connect upto 25m and is independent of data rates

3) High voltage differential SCSI is not normally used in PCI environment but is very ~~power~~ popular with mini computer

4) It is expensive because it needs high power consumption

5) It uses a sensor line for protecting the driver from interference and damages.