Batch: C3	**Roll No.: 16010123217**
Experiment / assignment / tutorial No. 1	

TITLE: Study of PCI and SCSI.

AIM: To Study and learn PCI and SCSI

Expected OUTCOME of Experiment : (Mention CO/CO's attained here)

Books/ Journals/ Websites referred:

1. https://www.techopedia.com/definition/8815/peripheral-component-interconnect-bus-pci-bus
2. https://www.techopedia.com/definition/331/small-computer-system-interface-scsi
3. http://www.csun.edu/~edaasic/roosta/BUS_Structures.pdf
4. W.Stallings William "Computer Organization and Architecture: Designing for Performance", Pearson Prentice Hall Publication, 7thEdition. C.

Pre Lab/ Prior Concepts:

Microcomputer buses which communicate with a peripheral devices or a memory location through communication lines called buses.

The major parts of microcomputers are central processing unit (CPU), memory, and input and output unit. To connect these parts together through three sets of parallel lines, called buses. These three buses are Address bus, data bus, and Control bus.

Address Bus:

The address bus consists of 16, 20, 24, or more parallel signal lines, through which the CPU sends out the address of the memory location. This memory location is used for to written to or read from. The number of memory location is depends on 2 to the power N address lines. Example, a CPU with 16 address lines can address 216 or 65,536 memory locations. When the CPU reads data from or writes data to a port. The port address is also sent out on the address bus. This is unidirectional. This means that the CPU can send data to a memory location or I/O ports.

Data Bus:

The data bus consists of 8, 16, 32 or more parallel signal lines. The data bus lines are bidirectional. This means that the CPU can read data from memory or from a I/O port as well as send data to a memory location or to a I/O port. In a system, many output devices are connected to the data bus, but only one device at a time will be enabled to the output.

Control Bus:

The control bus consists of 4-10 parallel signal lines. The CPU sends out signals on the control bus to enable the outputs of addressed memory devices or port devices. Typically control bus signals are memory read, memory write, I/O read and I/O write. To read a data from a memory location, the CPU sends out the address of the desired data on the address bus and then sends out a memory read signal on the control bus. The memory read signal enables the addressed memory device to output the data onto the data bus where it is read by the CPU.

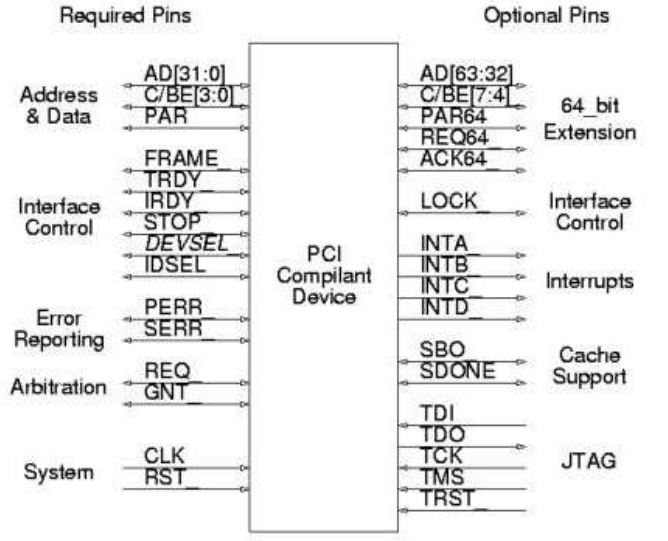
PCI Bus

Ans . PCI stands for Peripheral Component Interconnect.

Features of PCI Bus:

- High-speed Data Transfer: PCI can move data way faster compared to older systems like ISA.
- Multiple Device Support : You can connect several peripheral devices to just one bus. Each device gets its own address space, which is neat.
- Plug-and-Play compatibility: With PCI, you can add or remove devices without restarting your compute if your operating system supports.
- Bus mastering: This means that devices can take control of the bus for data transfer without CPU intervention, enhancing efficiency.

Pin Diagram of PCI Bus:



Architecture of PCI Bus:

- The PCI bus uses a shared setup, meaning devices share a common pathway (the bus) for moving data around.
- Every PCI device has its own configuration registers to control things and set them up. The PCI controller manages this part.
- This bus design helps the CPU comminicate efficiently with peripheral devices through direct memory access (DMA) and interrupts.

Versions of PCI Bus:

- PCI: This is the first standard that runs at 33 MHz with a 32-bit data path.
- PCI-X: It's an enhanced version that goes faster (up to 133 MHz) and has wider data paths (64-bit and 133 MHz).
- PCI Express (PCIe): This is the current standard. It features scalable bandwidth options (1x, 2x, 4x, 8x, 16x, 32x) and improved data transfer rates (up to several GB/s per lane).

Advantages of PCI Bus:

- Faster Data Transfer: Compared to older standards, PCI offers higher bandwidth and faster speeds.
- Scalability: With PCI-X & PCIe, provide scalable options for all kinds of performance needs.
- Backward Compatibility: We can still use those old PCI devices on newer systems.

Disadvantages of PCI Bus:

- Shared Bus Limitation: As devices on same PCI bus must share bandwidth, this might lead to performance issues.
- Limited Bandwidth: Older PCI standards may not meet the bandwidth requirements of modern high-performance devices.
- Complexity: It can get complicated by managing multiple devices on a shared bus, especially for larger systems.

The PCI bus has changed a lot since it first showed up. It's adjusted to meet the growing needs of modern computing but still works well with older hardware.

SCSI bus:

Features of SCSI Bus:

- High-Speed Data Transfer: SCSI offers high-speed data transfer rates suitable for servers & high-performance computing needs.
- Multiple Device Support: You can connect lots of devices (up to 15 or more depending on the SCSI variant) They can be daisy-chained or set up in a bus layout.
- Wide Device Compatibility: It works with many devices like hard drives, tape drives, scanners, printers, & many others.
- Flexible Configuration: We can swap devices while the system's running. Plus, each device gets a unique ID to keep things organized on the bus.

Pin diagram of SCSI Bus:

Pin	Name	Dir	Description
1-25	GND	—	Ground
26	DB0	↔	Data Bus 0
27	DB1	↔	Data Bus 1
28	DB2	↔	Data Bus 2
29	DB3	↔	Data Bus 3
30	DB4	↔	Data Bus 4
31	DB5	↔	Data Bus 5
32	DB6	↔	Data Bus 6
33	DB7	↔	Data Bus 7
34	PARITY	↔	Data Parity (odd Parity)
35	GND	—	Ground
36	GND	—	Ground
37	GND	—	Ground
38	TMPWR	↔	Termination Power
39	GND	—	Ground
40	GND	—	Ground
41	/ATN	←	Attention
42	n/c	-	Not connected
43	/BSY	↔	Busy
44	/ACK	←	Acknowledge
45	/RST	↔	Reset
46	/MSG	→	Message
47	/SEL	↔	Select
48	/C/D	→	Control/Data
49	/REQ	→	Request
50	/I/O	→	Input/Output

Architecture of SCSI Bus:

- Bus Arbitration: SCSI devices use a priority-based arbitration scheme to determine which device can access the bus at any given time.
- Command Set: SCSI uses a standardized command set for device communication, allowing for consistent data transfer protocols across different devices.
- Termination: It's super important to have proper bus termination in SCSI setups. That way, you avoid problems from signal reflections & keep data safe.

Versions of SCSI Bus:

- SCSI-1: Original standard with 8-bit data path and speeds up to 5 MB/s.
- SCSI-2: Improved with 8-bit and 16-bit data paths, faster speeds, and enhanced command set.
- SCSI-3: Brought us Wide SCSI & Ultra SCSI variants which are even faster. Plus, they added neat features like packetized data transfer.
- SCSI-U320 and beyond: Ultra320 SCSI and later versions saw even faster speeds. They also introduced LVD (Low Voltage Differential) for stronger signal integrity.

Advantages of SCSI Bus:

- High Performance**:** SCSI's got high data transfer rates keeping CPU overhead low. This makes it great for demanding applications.
- Scalability**:** It can handle lots of devices all in one chain or bus. That's perfect for complicated storage setups.
- Reliability**:** Its strong protocol & termination practices ensure reliable data transmission.

Disadvantages of SCSI Bus:

- Cost**:** SCSI peripherals and controllers usually costs more than other interfaces such as SATA or SAS.
- Complexity: Configuring and managing SCSI devices, especially in large installations, can be more complex compared to plug-and-play interfaces.
- Limited Host Support: Not all consumer devices support SCSI as much as they do for other interfaces. This can make compatibility an issue in certain situations.

SCSI is still a solid option for high-performance computing & storage needs where reliability & speed are super important despite newer interfaces like SATA and SAS gaining popularity in mainstream computing.

Post Lab Descriptive Questions

Q1 . Differentiate between PCI and SCSI Bus

Difference Between SCSI and PCI:

Characteristic	PCI	SCSI
Bus Type	Backplane	I/O
Data bus width	32-64	8-32
Arbitration	Centralized parallel	Self-selection
Clocking	Synch 33-66 MHz	Asynch & Synch 5-10 MHz
Max Bandwidth	133-512 MB/Sec	5-40 MB/Sec
Typical Bandwidth	80 MB/Sec	2.5-40 MB/Sec Synch 1.5 MB/Sec Asynch
Max Devices	1024	7-31
Max Bus Length	0.5 meters	2.5 meters

Q2. List two applications each of PCI and SCSI Bus

Ans.
Applications of PCI Bus:

Graphics Cards: PCI (Peripheral Component Interconnect) buses are super common for linking graphics cards to a computer's motherboard. These cards need fast data transfer rates, which PCI buses provide, helping images & videos render smoothly.

Network Interface Cards (NICs): Another typical use for PCI buses is in network interface cards. These cards connect computers to networks, & the high bandwidth from PCI lets data flow efficiently over the network.

Applications of SCSI Bus:

Hard Disk Drives: SCSI (Small Computer System Interface) buses are often found in servers and powerful workstations to connect hard disk drives. SCSI's ability to support several devices & provide rapid data transfer rates makes it suitable for applications that need lots of data.

Scanners and Printers: SCSI also connects peripherals like scanners & printers to computers. It has strong performance and can handle many devices, which makes it a great fit for these peripherals, especially in professional or industrial settings.

Date: 19/7/24