**Batch: A4 Roll No.:16010122083**

**Experiment / assignment / tutorial No\_\_\_\_\_\_\_**

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| **TITLE:** Study of PCI and SCSI. |

**AIM: To Study and learn PCI Bus and SCSI Bus**

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**Expected OUTCOME of Experiment : CO 1**

**Books/ Journals/ Websites referred:**

1. [**https://www.techopedia.com/definition/8815/peripheral-component-interconnect-bus-pci-bus**](https://www.techopedia.com/definition/8815/peripheral-component-interconnect-bus-pci-bus)
2. [**https://www.techopedia.com/definition/331/small-computer-system-interface-scsi**](https://www.techopedia.com/definition/331/small-computer-system-interface-scsi)
3. [**http://www.csun.edu/~edaasic/roosta/BUS\_Structures.pdf**](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: In brief**

* Peripheral Component Interconnect Bus
* It supports the functions found on a processor bus but in a standardized format that is independent of any particular processor.
* First introduced in 1992.
* An important feature that the PCI pioneered is a plug and play capability for connecting I/O devices.
* The bus supports three independent address spaces: memory, I/O and configuration. Out of this the configuration space is intended to give the PCI its plug and play capability.
* In today’s computers, most memory transfers (read or write operations) involve a burst of data rather than just one word. The PCI is designed primarily to support this mode of operation.
* The PCI bus has been defined for operation with either 5V or 3.3V power supply

**SCSI bus: In brief**

* Small Computer System Interface (SCSI). It refers to a standard bus defined by the American National Standard Institute (ANSI) under the designation X3.131.
* It has versions SCSI-2, SCSI-3. A narrow SCSI has 8 data lines, a wide SCSI has 16 data lines.
* The bus may use single ended transmission (SE), where each signal uses one wire, with a common ground return for all signals. In another option, differential signalling is used, where a separate return wire is provided for each signal. Earlier versions use 5V (TTL levels) and are known as High Voltage Differential (HVD). A 3.3V version has been introduced and is known as Low Voltage Differential (LVD).
* Because of these various options, SCSI connector may have 50, 68 or 80 pins.
* The maximum transfer rate in commercial devices was varying from 5 megabytes/sec to 160 megabytes/sec. Now it must be much more.
* Maximum transfer rate on a given bus is often a function of length of the cable and number of devices connected, with higher rates for a shorter cable and fewer devices.
* Devices connected to the SCSI bus are not part of the address space of the processor.
* The SCSI bus is connected to the processor bus through a SCSI controller.
* The main phases involved in the operation of the SCSI bus are arbitration, selection, information transfer and reselection.

**Post Lab Descriptive Questions**

**Q1 . Differentiate between PCI and SCSI Bus** (Include points other than what is given in above theory)

**1. Purpose and Functionality:**

* **PCI Bus:** The Peripheral Component Interconnect (PCI) bus is a general-purpose bus that provides a standardized way to connect various components like expansion cards (graphics, network, sound, etc.) to the motherboard. It is designed to connect internal components and peripherals directly to the CPU.
* **SCSI Bus:** The Small Computer System Interface (SCSI) is a versatile bus primarily used to connect storage devices (hard drives, tape drives, CD/DVD drives) and other peripherals to a computer. It's focused on high-speed data transfers and is known for its flexibility in supporting a wide range of devices.

**2. Devices Supported:**

* **PCI Bus:** PCI primarily supports expansion cards that enhance a computer's functionality, such as graphics cards, network cards, sound cards, and more. It is not exclusively designed for storage devices.
* **SCSI Bus:** SCSI is designed for storage devices like hard drives, CD/DVD drives, tape drives, and other high-performance peripherals. While it can support other types of devices, its main strength lies in storage connectivity.

**3. Plug and Play:**

* **PCI Bus:** PCI pioneered the concept of plug and play, making it easier to connect and configure new devices without the need for manual configuration. This feature simplifies device installation and setup.
* **SCSI Bus:** While SCSI does have plug-and-play features in some versions, it may not be as user-friendly as PCI in terms of automatic configuration and device recognition.

**4. Addressing:**

* **PCI Bus:** PCI devices are assigned device numbers by the system BIOS during startup. These numbers are used for addressing devices on the bus.
* **SCSI Bus:** SCSI devices are assigned unique IDs manually using jumpers or software settings on the device itself. These IDs are used for addressing devices on the bus.

**5. Transfer Rates:**

* **PCI Bus:** PCI offers high-speed data transfer rates, but its performance may vary depending on the specific version of PCI (PCI, PCI-X, PCIe) and the number of lanes used.
* **SCSI Bus:** SCSI also provides high-speed data transfer rates, and its performance is often associated with the SCSI version being used (e.g., SCSI-2, SCSI-3) and the specific implementation.

**6. Connector Types:**

* **PCI Bus:** PCI connectors come in various sizes and shapes but are generally designed to accommodate expansion cards directly inserted into slots on the motherboard.
* **SCSI Bus:** SCSI connectors vary depending on the version and implementation. They can have different numbers of pins and configurations, and they often connect to external devices.

**Q2. List two applications each of PCI and SCSI Bus**

**PCI Bus:**

1. **Graphics Cards:** PCI slots are commonly used for connecting dedicated graphics cards, allowing computers to display high-quality visuals and support advanced graphics rendering.
2. **Network Cards:** PCI-based network interface cards (NICs) are used to add wired networking capabilities to computers, enabling them to connect to local area networks (LANs) or the internet.

**SCSI Bus:**

1. **Storage Arrays:** SCSI buses are frequently used in high-performance storage arrays where speed and reliability are crucial, such as in data centers or server environments.
2. **Digital Audio Workstations:** SCSI can be employed in audio production setups, connecting devices like external hard drives and CD/DVD drives to store and retrieve large audio files quickly.

**Q3. Briefly explain about USB.**

USB, or Universal Serial Bus, is a widely used standard for connecting and communicating between devices, peripherals, and computers. It was designed to simplify the connection process and provide a common interface for various devices. Here's a brief explanation of USB:

* **Purpose and Functionality:** USB enables the connection of a wide range of devices, such as keyboards, mice, printers, external hard drives, cameras, smartphones, and more, to a computer. It allows data transfer, device charging, and power supply.
* **Types of USB Ports:** USB comes in various versions, including USB 1.1, USB 2.0, USB 3.0 (also known as USB 3.1 Gen 1), USB 3.1 (also known as USB 3.1 Gen 2), and the latest USB 4.0. Each version offers improvements in terms of data transfer speeds and capabilities.
* **Plug and Play:** One of the key features of USB is its plug-and-play capability. Devices connected via USB are typically recognized and configured automatically by the operating system without the need for manual driver installation.
* **Hot Swapping:** USB devices can be connected or disconnected ("hot swapped") while the computer is running, without the need to restart the system.
* **Power Delivery:** USB can deliver power to connected devices, which is especially useful for charging smartphones, tablets, and other portable gadgets. USB Power Delivery (USB PD) is a specification that allows for higher power delivery for charging larger devices.
* **Connector Types:** USB connectors vary based on the version and the device type. Common connectors include Type-A (standard USB connector), Type-B (used for printers and some peripherals), Type-C (a reversible, versatile connector), and micro-USB (commonly used for smartphones and other small devices).
* **Data Transfer Rates:** The different USB versions offer varying data transfer rates, with USB 3.1 Gen 2 and USB 4.0 providing high-speed data transfer suitable for tasks like file copying and video streaming.
* **Applications:** USB is widely used in consumer electronics, office setups, data storage solutions, audio, and video equipment, and more due to its versatility, ease of use, and widespread compatibility.

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**