# LAB MANUAL

## COMPUTER HARDWARE AND NETWORKING LAB

**CODE: 460**

**COMPUTER ENGINEERING**

**SEMESTER: 6**

# LIST OF EXPERIMENTS

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# Experiment: 1

# MOTHERBOARD

# AIM

To familiarize with motherboard.

# DESCRIPTION

A motherboard (sometimes alternatively known as the main board, system board, planar board or logic board, or colloquially, a mobo) is the main printed circuit board (PCB) found in computers and other expandable systems. It holds many of the crucial electronic components of the system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals. Unlike a backplane, a motherboard contains significant sub-systems such as the processor and other components. Motherboard specifically refers to a PCB with expansion capability and as the name suggests, this board is the "mother" of all components attached to it, which often include sound cards, video cards, network cards, hard drives, or other forms of persistent storage; TV tuner cards, cards providing extraUSB or FireWire slots and a variety of other custom components .

## Chipset

A chipset is a set of electronic components in an integrated circuit that manages the data flow between the processor, memory and peripherals. It is usually found in the motherboard of a computer. Chipsets are usually designed to work with a specific family of microprocessors. Because it controls communications between the processor and external devices, the chipset plays a crucial role in determining system performance.

## ATX

ATX (Advanced Technology extended) is a motherboard form factor specification developed by Intel in 1995 to improve on previous *de fact* standards like the AT form factor. It was the first major change in desktop computer enclosure, motherboard and power supply design in many years, improving standardization and interchangeability of parts. The specification defines the key mechanical dimensions, mounting point, I/O panel, power and connector interfaces between a computer case, a motherboard and a power supply. With the improvements it offered, including lower costs, ATX overtook AT completely as the default form factor for new systems within a few years. ATX addressed many of the AT form factors annoyances that had frustrated system builders. Other standards for smaller boards (including microATX, FlexATX and mini-ITX) usually keep the basic rear layout but reduce the size of the board and the number of expansion slots. In 2003, Intel announced the BTX standard, intended as a replacement for ATX. As of 2009, the ATX form factor remains a standard for do-it-yourselfers; BTX has however made inroads into pre-made systems.

## BIOS

The fundamental purposes of the BIOS are to initialize and test the system hardware components, and to load a boot loader or an operating system from a mass memory device. The BIOS additionally provides abstraction layer for the hardware, i.e. a consistent way for application programs and operating systems to interact with the keyboard, display, and other input/output devices. Variations in the system hardware are hidden by the BIOS from programs that use BIOS services instead of directly accessing the hardware. Modern operating systems ignore the abstraction layer provided by the BIOS and access the hardware components directly.

The BIOS of the original IBM PC/XT had no interactive user interface. Error messages were displayed on the screen, or coded series of sounds were generated to signal errors. Options on the PC and XT were set by switches and jumpers on the main board and on peripheral cards. Modern Wintel-compatible computers provide a setup routine, accessed at system power-up by a particular key sequence. The user can configure hardware options using the keyboard and video display.

BIOS software is stored on a non-volatile ROM chip on the motherboard. It is specifically designed to work with each particular model of computer, interfacing with various devices that make up the complementary chipset of the system. In modern computer systems, the BIOS contents are stored on a flash memory chip so that the contents can be rewritten without removing the chip from the motherboard. This allows BIOS software to be easily upgraded to add new features or fix bugs, but can make the computer vulnerable to BIOS root kits.

MS-DOS (PC DOS), which was the dominant PC operating system from the early 1980s until the mid 1990s, relied on BIOS services for disk, keyboard, and text display functions. MS Windows NT, Linux, and other protected mode operating systems in general do not use it after loading.

## EPROM

An EPROM (rarely EROM), or erasable programmable read only memory, is a type of memory chip that retains its data when its power supply is switched off. In other words, it is non-volatile. It is an array of floating-gate transistors individually programmed by an electronic device that supplies higher voltages than those normally used in digital circuits. Once programmed, an EPROM can be erased by exposing it to strong ultraviolet light source (such as from a mercury-vapor light). EPROMs are easily recognizable by the transparent fused quartz window in the top of the package, through which the silicon chip is visible, and which permits exposure to UV light during erasing.

## RAM

**Random-access memory** (**RAM** ) is a form of computer data storage. A random-access device allows stored data to be accessed directly in any random order. In contrast, other data storage media such as hard disks, CDs, DVDs and magnetic tape, as well as early primary memory types such as drum memory, read and write data only in a predetermined order, consecutively, because of mechanical design limitations. Therefore, the time to access a given data location varies significantly depending on its physical location.

Today, random-access memory takes the form of integrated circuits. Strictly speaking, modern types of DRAM are not random access, as data is read in bursts, although the name DRAM / RAM has stuck. However, many types of SRAM, ROM, OTP, and NOR flash are still random access even in a strict sense. RAM is normally associated with volatile types of memory (such as DRAM memory modules), where its stored information is lost if the power is removed. Many other types of non-volatile memory are RAM as well, including most types of ROM and a type of flash memory called *NOR-Flash*.

## SLOT

The expansion card (also *expansion board*, *adapter card* or *accessory card*) in computing is a printed circuit board that can be inserted into an electrical, or expansion slot on motherboard, backplane or riser card to add functionality to a computer system via the expansion bus.

An *expansion bus* is a computer bus which moves information between the internal hardware of a computer system (including the CPU and RAM) and peripheral devices. It is a collection of wires and protocols that allows for the expansion of a computer.

## Integrated Motherboard

With the steadily declining costs and size of integrated circuits, it is now possible to include support for many peripherals on the motherboard. By combining many functions on one PCB, the physical size and total cost of the system may be reduced; highly integrated motherboards are thus especially popular in small form factor and budget computers.

For example, the ECS RS485M-M, a typical modern budget motherboard for computers based on AMD processors, has on-board support for a very large range of peripherals:

- Disk controllers for a floppy disk drive, up to 2 PATA drives, and up to 6 SATA drives (including RAID 0/1 support)
- integrated graphics controller supporting 2D and 3D graphics, with VGA and TV output

- integrated sound card supporting 8-channel (7.1) audio and S/PDIF output
- Fast Ethernet network controller for 10/100 Mbit networking
- USB 2.0 controller supporting up to 12 USB ports
- IrDA controller for infrared data communication (e.g. with an IrDA-enabled cellular phone or printer)
- Temperature, voltage, and fan-speed sensors that allow software to monitor the health of computer components

## RESULT

Familiarized with motherboard.

# Experiment: 2

# EXPANSION CARDS AND SLOTS

# AIM

To familiarize with Expansion cards and slots.

# DESCRIPTION

## Expansion cards

The expansion card (also *expansion board*, *adapter card* or *accessory card*) in computing is a printed circuit board that can be inserted into an electrical connector, or expansion slot on motherboard, backplane or riser card to add functionality to a computer system via the expansion bus. An *expansion bus* is a computer bus which moves information between the internal hardware of a computer system (including the CPU and RAM) and peripheral devices. It is a collection of wires and protocols that allows for the expansion of a computer

Types of expansion cards in computer

- Sound cards
- Network cards
- TV tuner cards
- Video cards
- Modem
- Interface card

## Sound card

A sound card (also known as an audio card) is an internal computer expansion card that facilitates the input and output of audio signals to and from a computer under control of computer programs. The term *sound card* is also applied to external audio interfaces that use software to generate sound, as opposed to using hardware inside the PC. Typical uses of sound cards include providing the audio component for multimedia applications such as music composition, editing video or audio, presentation, education and entertainment (games) and video projection.

Sound functionality can also be integrated onto the motherboard, using basically the same components as a plug-in card. The best plug-in cards, which use better and more expensive components, can achieve higher quality than integrated sound. The integrated sound system is often still referred to as a "sound card".

TV tuner card

A TV tuner card is a kind of television tuner that allows television signals to be received by a computer. Most TV tuners also function as video capture cards, allowing them to record television programs onto a disk much like the digital video recorder (DVR) does.

## SIO

Super I/O is a class of I/O controller integrated circuits that began to be used on personal computer motherboards in the late 1980s, originally as add-in cards, later embedded on the motherboards. A super I/O chip combines interfaces for a variety of low-bandwidth devices. The functions provided usually include:

- A floppy disk controller
- A parallel port (commonly used for printers)
- One or more serial ports
- A PS/2 keyboard and mouse interface.
- Temperature sensor and fan speed monitoring

A super I/O chip may also have other interfaces, such as a game port or an infrared port. By combining many functions in a single chip, the number of parts needed on a motherboard is reduced, thus reducing the cost of production.

## PCI

Conventional PCI (PCI is an initialize formed from Peripheral Component Interconnect, part of the PCI Local Bus standard), often shortened to just PCI, is a local computer bus for attaching hardware devices in a computer. The PCI bus supports the functions found on a processor bus, but in a standardized format that is independent of any particular processor; devices connected to the PCI bus appear to the processor to be connected directly to the processor bus, and are assigned addresses in the processor's address space.

Attached devices can take either the form of an integrated circuit fitted onto the motherboard itself, (called a *planar device* in the PCI specification) or an expansion card that fits into a slot. The PCI Local Bus was first implemented in IBM PC compatibles, where it displaced the combination of ISAplus one VESA Local Bus as the bus configuration. It has subsequently been adopted for other computer types. Typical PCI cards used in PCs include: network cards, sound cards, modems, extra ports such as USB or serial, TV tuner cards and disk controllers. PCI video cards replaced ISA and VESA cards, until growing bandwidth requirements outgrew the capabilities of PCI; the preferred interface for video cards became AGP (itself a conventional PCI derivative), and then PCI Express.

## ISA

Industry Standard Architecture (ISA) is a computer bus standard for IBM PC compatible computers introduced with the IBM Personal Computer to support its Intel 8088 microprocessor's 8-bit external data bus and extended to 16 bits for the IBM Personal Computer/AT's Intel 80286 processor. The ISA bus was further extended for use with 32-bit processors as Extended Industry Standard Architecture (EISA). For general desktop computer use it has been supplanted by later buses such as IBM Micro Channel, VESA Local Bus, Peripheral Component Interconnect and other successors. A derivative of the AT bus structure is still used in the PC/104 bus, and internally within Super I/O chips.

## RESULT

Familiarized with Expansion cards and slots. .

## Experiment: 3

## SMPS

## AIM

To familiarize with SMPS.

## DESCRIPTION

A switched-mode power supply (switching-mode power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a source, like mains power, to a load, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time. In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight.

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight is required. They are, however, more complicated; their switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor.

## OPERATION

A linear regulator provides the desired output voltage by dissipating excess power in ohmic losses (e.g., in a resistor or in the collector–emitter region of a pass transistor in its active mode). A linear regulator regulates either output voltage or current by dissipating the excess electric power in the form of heat, and hence its maximum power efficiency is voltage-out/voltage-in since the volt difference is wasted.

In contrast, a switched-mode power supply regulates either output voltage or current by switching ideal storage elements, like inductors and capacitors, into and out of different electrical configurations. Ideal switching elements (e.g., transistors operated outside of their active mode) have no resistance when "closed" and carry no current when "open", and so the converters can theoretically operate with 100% efficiency (i.e., all input power is delivered to the load; no power is wasted as dissipated heat).

For example, if a DC source, an inductor, a switch, and the corresponding electrical ground are placed in series and the switch is driven by a square wave, the peak-to-peak voltage of the waveform measured across the switch can exceed the input voltage from the DC source. This is because the inductor responds to changes in current by inducing its own voltage to counter the change in current, and this voltage adds to the source voltage while the switch is open. If a diode-and-capacitor combination is placed in parallel to the switch, the peak voltage can be stored in the capacitor, and the capacitor can be used as a DC source with an output voltage greater than the DC voltage driving the circuit. This boost converter acts like a step-up transformer for DC signals. A buck–boost converter works in a similar manner, but yields an output voltage which is opposite in polarity to the input voltage. Other buck circuits exist to boost the average output current with a reduction of voltage.

In an SMPS, the output current flow depends on the input power signal, the storage elements and circuit topologies used, and also on the pattern used (e.g., pulse-width modulation with an adjustable duty cycle) to drive the switching elements. The spectral density of these switching waveforms has energy concentrated at relatively high frequencies. As such, switching transients and ripple introduced onto the output waveforms can be filtered with small LC filters.

## Advantages and Disadvantages

The main advantage of this method is greater efficiency because the switching transistor dissipates little power when it is outside of its active region (i.e., when the transistor acts like a switch and either has a negligible voltage drop across it or a negligible current through it). Other advantages include smaller size and lighter weight (from the elimination of low frequency transformers which have a high weight) and lower heat generation due to higher efficiency. Disadvantages include greater complexity, the generation of high-amplitude, high-frequency energy that the low-pass filter must block to avoid electromagnetic interference (EMI), a ripple voltage at the switching frequency and the harmonic frequencies thereof.

Very low cost SMPSs may couple electrical switching noise back onto the mains power line, causing interference with A/V equipment connected to the same phase. Non-power-factor-correctedSMPSs also cause harmonic distortion.

## Voltage converter and output rectifier

If the output is required to be isolated from the input, as is usually the case in mains power supplies, the inverted AC is used to drive the primary winding of a high-frequency transformer. This converts the voltage up or down to the required output level on its secondary winding. The output transformer in the block diagram serves this purpose.

If a **DC** output is required, the **AC** output from the transformer is rectified. For output voltages above ten volts or so, ordinary silicon diodes are commonly used. For lower voltages, Schottky diodesare commonly used as the rectifier elements; they have the advantages of faster recovery times than silicon diodes (allowing low-loss operation at higher frequencies) and a lower voltage drop when conducting. For even lower output voltages, MOSFETs may be used as synchronous rectifiers; compared to Schottky diodes, these have even lower conducting state voltage drops.

The rectified output is then smoothed by a filter consisting of inductors and capacitors. For higher switching frequencies, components with lower capacitance and inductance are needed.

Other types of SMPSs use a capacitor-diode voltage multiplier instead of inductors and transformers. These are mostly used for generating high voltages at low currents (*Cockcroft-Walton generator*). The low voltage variant is called charge pump.

## RESULT

Familiarized with SMPS.

# Experiment: 4

# SECONDARY STORAGE DEVICES

## AIM

To familiarize with secondary storage devices.

## DESCRIPTION

### Hard disk drive

Hard disk drive (HDD) is a data storage device used for storing and retrieving digital information using rapidly rotating disks (platters) coated with magnetic material. An HDD retains its data even when powered off. Data is read in a random-access manner, meaning individual blocks of data can be stored or retrieved in any order rather than sequentially. An HDD consists of one or more rigid ("hard") rapidly rotating disks (platters) with magnetic arranged on a moving actuator arm to read and write data to the surfaces.

### Magnetic recording

**Magnetic recording** referring to the storage of data on a magnetized medium. Magnetic storage uses different patterns of magnetization in a magnetizable material to store data and is a form of non-volatile memory. The information is accessed using one or more read/write heads. As of 2013, magnetic storage media, primarily hard disks, are widely used to store computer data as well as audio and video signals. In the field of computing, the term *magnetic storage* is preferred and in the field of audio and video production, the term *magnetic recording*s more commonly used. The distinction is less technical and more a matter of preference. Other examples of magnetic storage media include floppy disks, magnetic recording tape, and magnetic stripes on credit cards.

### Floppy Disk

Floppy disk, or diskette, is a disk storage medium composed of a disk of thin and flexible magnetic storage medium, sealed in a rectangular plastic carrier lined with fabric that removes dust particles. Floppy disks are read and written by a floppy disk drive (FDD).

Floppy disks, initially as 8-inch (200 mm) media and later in 5.25-inch (133 mm) and 3.5-inch (90 mm) sizes, were a ubiquitous form of data storage and exchange from the mid-1970s well into the 2000's.

## Operation

A spindle motor in the drive rotates the magnetic medium at a certain speed, while a stepper motor-operated mechanism moves the magnetic read/write head(s) along the surface of the disk. Both read and write operations require the media to be rotating and the head to contact the disk media, an action accomplished by a "disk load" solenoid.[15] To write data, current is sent through a coil in the head as the media rotates. The head's magnetic field aligns the magnetic particles directly below the head on the media. When the current is reversed the particles align in the opposite direction encoding the data digitally. To read data, the magnetic particles in the media induce a tiny voltage in the head coil as they pass under it. This small signal is amplified and sent to the floppy disk controller, which converts the streams of pulses from the media into data, checks it for errors, and sends it to the host computer system.

A blank "unformatted" diskette has a coating of magnetic oxide with no magnetic order to the particles. During formatting, the particles are aligned forming a pattern of magnetized tracks, each broken up intosectors, enabling the controller to properly read and write data. The tracks are concentric rings around the center, with spaces between tracks where no data is written; gaps with padding bytes are provided between the sectors and at the end of the track to allow for slight speed variations in the disk drive, and to permit better interoperability with disk drives connected to other similar systems. Each sector of data has a header that identifies the sector location on the disk. A cyclic redundancy check (CRC) is written into the sector headers and at the end of the user data so that the disk controller can detect potential errors. Some errors are soft and can be resolved by automatically re-trying the read operation; other errors are permanent and the disk controller will signal a failure to the operating system if multiple attempts to read the data still fail.

After a disk is inserted, a catch or lever at the front of the drive is manually lowered to prevent the disk from accidentally emerging, engage the spindle clamping hub, and in two-sided drives, engage the second read/write head with the media. In some 5 $\frac{1}{4}$-inch drives, insertion of the disk compresses and locks an ejection spring which partially ejects the disk upon opening the catch or lever. This enables a smaller concave area for the thumb and fingers to grasp the disk during removal. Newer 5 $\frac{1}{4}$-inch drives and all 3 $\frac{1}{2}$-inch drives automatically engage the spindle and heads when a disk is inserted, doing the opposite with the press of the eject button. On Apple Macintosh computers with built-in floppy drives, the ejection button is replaced by software controlling an eject motor which only does so when the operating system no longer needs to access the drive. The user could drag the image of the floppy drive to the trash can on the desktop to eject the disk. In the case of a power failure or drive malfunction, a loaded disk can be removed manually by inserting a straightened paper into a small hole at the drive's front panel, just as one would do with a CD-ROM drive in a similar situation.

## CD-ROM

CD-ROM is a pre-pressed compact disc which contains data. The name is an acronym which stands for "Compact Disc Read-Only Memory". Computers can read CD-ROMs, but cannot write on them.Until the mid-2000s, CD-ROMs were popularly used to distribute software for computers and video game Consoles. Some CDs, called enhanced CDs, hold both computer data and audio with the latter capable of being played on a CD player, while data (such as software or digital video) is only usable on a computer (such as ISO 9660 format PC CD-ROMs).

## Operation

Data stored on CD-ROMs follows the standard CD data encoding techniques described in the *Red Book* specification (originally defined for audio CD only). This includes cross-interleaved Reed–Solomon coding (CIRC), eight-to-fourteen modulation (EFM), and the use of pits and lands for coding the bits into the physical surface of the CD.

The data structures used to group data on a CD-ROM are also derived from the *Red Book*. Like audio CDs (CD-DA), a CD-ROM *sector* contains 2,352 bytes of user data, divided into 98 24-byte frames. Unlike audio CDs, the data stored in these sectors corresponds to any type of digital data, not audio samples encoded according to the audio CD specification. In order to structure, address and protect this data, the CD-ROM standard further defines two sector modes, Mode 1 and Mode 2, which describe two different layouts for the data inside a sector. A track (a group of sectors) inside a CD-ROM only contains sectors in the same mode, but if multiple tracks are present in a CD-ROM, each track can have its sectors in a different mode from the rest of the tracks. They can also coexist with audio CD tracks as well, which is the case of mixed mode CDs.

Both Mode 1 and 2 sectors use the first 16 bytes for header information, but differ in the remaining 2,336 bytes due to the use of error correction bytes. Unlike an audio CD, a CD-ROM cannot rely on error concealment by interpolation, and therefore requires a higher reliability of the retrieved data. In order to achieve improved error correction and detection, a CD-ROM adds a 32-bit cyclic redundancy check (CRC) code for error detection, a and a third layer of Reed–Solomon error correction using a Reed-Solomon Product-like Code (RSPC). Mode 1, used mostly for digital data, contains 288 bytes per sector for error detection and correction, leaving 2,048 bytes per sector available for data. Mode 2, which is more appropriate for image or video data, contains no error detection or correction bytes, having therefore 2,336 available data bytes per sector. Note that both modes, like audio CDs, still benefit from the lower layers of error correction at the frame level.

Before being stored on a disc with the techniques described above, each CD-ROM sector is scrambled to prevent some problematic patterns from showing up.[3] These scrambled sectors then follow the same encoding process described in the *Red Book* in order to be finally stored on a CD.

## RESULT

Familiarized with secondary storage devices.

## Experiment: 5

## ASSEMBLING A PERSONAL COMPUTER

## AIM

To familiarize with assembling a PC.

## DESCRIPTION

The first step to building a computer is acquiring the parts. This guide will start with a quick explanation of essential parts and elaborate on them further on.

A computer is made up of a case (or chassis) which houses several important internal components, and provides places to connect the external components, including non-peripherals.

Inside the case go the following internal parts:

- Power Supply/PSU – *power supply unit*, converts outlet power, which is alternating current (AC), to direct current (DC) which is required by internal components, as well as providing appropriate voltages and currents for these internal components.

- Motherboard/main board – As the name indicates, this is the electronic centerpiece of the computer: everything else connects to the motherboard.

- Processor/CPU – *central processing unit*, the "brain" of the computer, most actual computation takes place here.

- RAM – *random access memory*, the "short-term memory" of a computer, used by the CPU to store program instructions and data upon which it is currently operating. Data in RAM is lost when the computer is powered off, thus necessitating a *hard drive*.

Optional components follow: (Components that depend on the function that will be given to the machine)

- Hard Drive/Hard Disk – the "long-term memory" of the computer, used for persistent storage – i.e. the things stored on it remain even when the computer is powered down. The operating system, and all your programs and data are stored here.

- Optical Drive – device for reading/writing optical disks. May read CDs, DVDs, or other optical media, depending on the type. It is essential for installing many operating systems and programs. It may be able to write some of these discs, as well. Some people like to have two such drives for copying disks.

- Video Card/Graphics Card/GPU – does processing relating to video output. Some motherboards have an "onboard" GPU built in so you don't need (but may add) a separate video card. Otherwise, you will need a video card. These plug into a slot on the motherboard and provide a place to connect a monitor to your computer.

- Sound card

On top of the internal components listed above, you will also need these external components:

- Keyboard – for typing on. Many motherboards won't even boot without a keyboard attached.

- Mouse – for pointing and clicking. Unless you chose a text-based operating system, you will likely want one of these.

- Monitor – This is where the pretty pictures go. They come in many forms, the most common being CRT and LCD.

These are the parts that a standard PC will use. We are not considering such esoteric as headless, touch screen, or voice-controlled systems. You might want to make a check list (perhaps using a spreadsheet) of parts to use as you go about your process of research and selection. That way you won't find yourself sitting down with a pile of brand new hardware only to find that you forgot an essential component.

## RESULT

Familiarized with assembling a pc.

## Experiment: 6

## DIGITAL COMPUTER SYSTEM

## AIM

To familiarize with DIGITAL COMPUTER SYSTEM.

## DESCRIPTION

Digital computer, any of a class of devices capable of solving problems by processing information in discrete form. It operates on data, including magnitudes, letters, and symbols, that are expressed in binary form—i.e., using only the two digits 0 and 1. By counting, comparing, and manipulating these digits or their combinations according to a set of instructions held in its memory, a digital computer can perform such tasks as to control industrial processes and regulate the operations of machines; analyze and organize vast amounts of business data; and simulate the behavior of dynamic systems (e.g., global weather patterns and chemical reactions) in scientific research.

### Functional elements

A typical digital computer system has four basic functional elements: (1) input-output equipment, (2) main memory, (3) control unit, and (4) arithmetic-logic unit. Any of a number of devices is used to enter data and program instructions into a computer and to gain access to the results of the processing operation. Common input devices include keyboards and optical scanners; output devices include printers and cathode-ray tube and liquid-crystal display monitors. The information received by a computer from its input unit is stored in the main memory or, if not for immediate use, in an auxiliary storage device.

The control unit selects and calls up instructions from the memory in appropriate sequence and relays the proper commands to the appropriate unit. It also synchronizes the varied operating speeds of the input and output devices to that of the arithmetic-logic unit (ALU) so as to ensure the proper movement of data through the entire computer system. The ALU performs the arithmetic and logic algorithms selected to process the incoming data at extremely high speeds—in many cases in nanoseconds (billionths of a second). The main memory, control unit, and ALU together make up the central processing unit (CPU) of most digital computer systems, while the input-output devices and auxiliary storage units constitute peripheral equipment.

## RESULT

Studied about digital computer system.

# Experiment: 7

# COMPUTER MEMORY

## AIM

To study about computer memory (Primary and Secondary).

## DESCRIPTION

In computing, memory refers to the physical devices used to store programs (sequences of instructions) or data (e.g. program state information) on a temporary or permanent basis for use in a computer or other digital electronic device. The term primary memory is used for the information in physical systems which function at high-speed (i.e. RAM), as a distinction from secondary memory, which are physical devices for storage which are slow to access but offer higher memory capacity. Primary memory stored on secondary memory is called "virtual memory". An archaic synonym for memory is store.

The term "memory", meaning primary memory is often associated with addressable semiconductor memory, i.e. integrated circuits consisting of silicon-based transistors, used for example as primary memory but also other purposes in computers and other digital electronic devices. There are two main types of semiconductor memory: volatile and non-volatile. Examples of non-volatile memory are flash memory (sometimes used as secondary, sometimes primary computer memory) and ROM/PROM/EPROM/EEPROM memory (used for firmware such as boot programs). Examples of volatile memory are primary memory (typically dynamic RAM, DRAM), and fast CPU cache memory (typically static RAM, SRAM, which is fast but energy-consuming and offer lower memory capacity per area unit than DRAM).

## Volatile Memory

Volatile memory is computer memory that requires power to maintain the stored information. Most modern semiconductor volatile memory is either Static RAM (see SRAM) or dynamic RAM (DRAM). SRAM retains its contents as long as the power is connected and is easy to interface to but uses six transistors per bit. Dynamic RAM is more complicated to interface to and control and needs regular refresh cycles to prevent its contents being lost. However, DRAM uses only one transistor and a capacitor per bit, allowing it to reach much higher densities and, with more bits on a memory chip, be much cheaper per bit. SRAM is not worthwhile for desktop system memory, where DRAM dominates, but is used for their cache memories. SRAM is commonplace in small embedded systems, which might only need tens of kilobytes or less.

## Non-volatile memory

Non-volatile memory is computer memory that can retain the stored information even when not powered. Examples of non-volatile memory include read-only memory (see ROM), flash memory, most types of magnetic computer storage devices (e.g. hard disks, floppy discs and magnetic tape), optical discs, and early computer storage methods such as paper tape and punched cards.

## Virtual memory

Virtual memory is a system where all physical memory is controlled by the operating system. When a program needs memory, it requests it from the operating system. The operating system then decides what physical location to place the memory in.

This offers several advantages. Computer programmers no longer need to worry about where the memory is physically stored or whether the user's computer will have enough memory. It also allows multiple types of memory to be used. For example, some memory can be stored in physical RAM chips while other memory is stored on a hard drive. This drastically increases the amount of memory available to programs. The operating system will place actively used memory in physical RAM, which is much faster than hard disks. When the amount of RAM is not sufficient to run all the current programs, it can result in a situation where the computer spends more time moving memory from RAM to disk and back than it does accomplishing tasks; this is known as thrashing.

### Flash memory

Flash memory is an electronic non-volatile computer storage medium that can be electrically erased and reprogrammed. Flash memory developed from EEPROM (electrically erasable programmable read-only memory). There are two main types of flash memory, which are named after the NAND and NOR logic gates. The internal characteristics of the individual flash memory cells exhibit characteristics similar to those of the corresponding gates.

## Cache memory

A cache memory is a cache used by the central processing unit (CPU) of a computer to reduce the average time to access memory. The cache is a smaller, faster memory which stores copies of the data from frequently used main memory locations. Most CPUs have different independent caches, including instruction and data caches, where the data cache is usually organized as a hierarchy of more cache levels (L1, L2 etc.)

## Primary storage

*Primary storage* (or *main memory* or *internal memory*), often referred to simply as *memory*, is the only one directly accessible to the CPU. The CPU continuously reads instructions stored there and executes them as required. Any data actively operated on is also stored there in uniform manner.

Traditionally there are two more sub-layers of the primary storage, besides main large-capacity RAM:

- Processor registers are located inside the processor. Each register typically holds a word of data (often 32 or 64 bits). CPU instructions instruct the arithmetic and logic unit to perform various calculations or other operations on this data (or with the help of it). Registers are the fastest of all forms of computer data storage.
- Processor cache is an intermediate stage between ultra-fast registers and much slower main memory. It's introduced solely to increase performance of the computer. Most actively used information in the main memory is just duplicated in the cache memory, which is faster, but of much lesser capacity. On the other hand, main memory is much slower, but has a much greater storage capacity than processor registers. Multi-level hierarchical cache setup is also commonly used—*primary cache* being smallest, fastest and located inside the processor; *secondary cache* being somewhat larger and slower.

Main memory is directly or indirectly connected to the central processing unit via a *memory bus*. It is actually two buses (not on the diagram): an address bus and a data bus. The CPU firstly sends a number through an address bus, a number called memory address, that indicates the desired location of data. Then it reads or writes the data itself using the data bus. Additionally, memory (MMU) is a small device between CPU and RAM recalculating the actual memory address, for example to provide an abstraction of virtual memory or other tasks.

## Secondary storage

*Secondary storage* (also known as external memory or auxiliary storage), differs from primary storage in that it is not directly accessible by the CPU. The computer usually uses its input/output channels to access secondary storage and transfers the desired data using intermediate area in primary storage. Secondary storage does not lose the data when the device is powered down—it is non-volatile. Per unit, it is typically also two orders of magnitude less expensive than primary storage. Modern computer systems typically have two orders of magnitude more secondary storage than primary storage and data are kept for a longer time there.

In modern computers, hard disk drives are usually used as secondary storage. The time taken to access a given byte of information stored on a hard disk is typically a few thousandths of a second, or milliseconds. By contrast, the time taken to access a given byte of information stored in random-access memory is measured in billionths of a second, or nanoseconds. This illustrates the significant access-time difference which distinguishes solid-state memory from rotating magnetic storage devices: hard disks are typically about a million times slower than memory. Rotating storage devices, such as CD and DVD drives, have even longer access times. With disk drives, once the disk read/write head reaches the proper placement and the data of interest rotates under it, subsequent data on the track are very fast to access. To reduce the seek time and rotational latency, data are transferred to and from disks in large contiguous blocks.

Some other examples of secondary storage technologies are: flash memory (e.g. USB flash drives or keys), floppy disks, magnetic tape, paper tape, punched cards, standalone RAM disks, andIomega Zip drives.

## **RESULT**

Familiarized with computer memory.

# Experiment: 8

# CENTRAL PROCESSING UNIT

## AIM

To familiarize with CPU.

## DESCRIPTION

A central processing unit (CPU), also referred to as a central processor unit, is the hardware within a computer that carries out the instructions of a computer program by performing the basic arithmetical, logical, and input/output operations of the system. The term has been in use in the computer industry at least since the early 1960s.The form, design, and implementation of CPUs have changed over the course of their history, but their fundamental operation remains much the same.

A computer can have more than one CPU; this is called multiprocessing. All modern CPUs are microprocessors, meaning contained on a single chip. Some integrated circuits (ICs) can contain multiple CPUs on a single chip; those ICs are called multi-core processors. An IC containing a CPU can also contain peripheral devices, and other components of a computer system; this is called a system on a chip (SoC).Two typical components of a CPU are the arithmetic logic unit (ALU), which performs arithmetic and logical operations, and the control unit (CU), which extracts instructions from memory and decodes and executes them, calling on the ALU when necessary.

## INTEL 4004

The Intel 4004 ("*four-thousand-four*") is a 4-bit central processing unit (CPU) released by Intel Corporation in 1971. The design was completed in January 1971 by Intel and made commercially available in March 1971 to Buisson Corp. for which it was originally designed and built as a custom chip. In mid-November of the same year, with the prophetic ad "*Announcing a new era in integrated electronics*", the 4004 was made commercially available to the general market. The 4004 was history's first monolithic CPU fully integrated in one chip, i.e. the first microprocessor. Such a feat of integration was made possible by the use of then-new silicon gate technology allowing a higher number of transistors and a faster speed than was possible before. The 4004 microprocessor was one of 4 chips constituting the MCS-4 chip-set, which included the 4001 ROM, 4002 RAM, and 4003 Shift Register. With these components microcomputers with varying amounts of memory and I/O facilities could be built. There were two other CPU chip designs that were done in 1970 and 1971 respectively: the MP944, used in the F-14 Tomcat fighter jet, which used five chips for the implementation of the CPU function, and the Texas Instruments TMS 1000 chip, a limited-performance microcontroller which was first used in a Texas Instrument portable calculator in September 1971.

## INTEL 8085

The Intel 8085 ("*eighty-eighty-five*") is an 8-bit microprocessor introduced by Intel in 1977. It was binary compatible with the more-famous Intel 8080but required less supporting hardware, thus allowing simpler and less expensive microcomputer systems to be built.The "5" in the model number came from the fact that the 8085 requires only a +5-Volt (V) power supply rather than the +5 V, −5 V and +12 V supplies the 8080 needed. Both processors were sometimes used in computers running the CP/M operating system.

The Intel 8085 required at least an external ROM and RAM and an 8 bit address latch (both latches combined in the Intel 8755 2Kx8 EPROM / 2x8 I/O, Intel 8155 256-byte RAM and 22 I/O and 14 bit programmable Timer/Counter) so cannot technically be called a microcontroller. Both designs (8080/8085) were eclipsed for desktop computers by the compatible Zilog Z80, which took over most of the CP/M computer market as well as taking a share of the booming home computer market in the early-to-mid-1980s.The 8085 had a long life as a controller. Once designed into such products as the DECtape controller and the VT100 video terminal in the late 1970s, it served for new production throughout the life span of those products (generally longer than the product life of desktop computers).

## INTEL 8086

The 8086(also called iAPX 86) is a 16-bit microprocessor chip designed by Intel between early 1976 and mid-1978, when it was released. The Intel 8088, released in 1979, was a slightly modified chip with an external 8-bit data bus (allowing the use of cheaper and fewer supporting logic chip), and is notable as the processor used in the original IBM PC.The 8086 gave rise to the x86 architecture which eventually turned out as Intel's most successful line of processors.

## INTEL PENTIUM

Pentium is a brand used for a series of x86-compatible microprocessors produced by Intel. In its most current form, a Pentium processor is a consumer-level product that Intel rates as "two stars",meaning that it is above the low-end Atom and Celeron products but below the faster Core i3, i5 and i7 lines as well as the high-end Xeon processors.

The name Pentium is originally derived from the Greek word *pente* , meaning "five" (as the original Pentium processors used Intel's fifth-generation micro architecture, the P5), and the Latin ending *-ium*. The current Pentium processors only share the name but are in fact based on the same processor chips that are used in the Intel Core but are typically used with a lower clock frequency, a partially disabled L3 cache and some of the advanced features such as hyper-threading and virtualization disabled.

## INTEL PENTIUM II

The Pentium II brand refers to Intel's sixth-generation micro architecture ("P6") and x86-compatible microprocessors introduced on May 7, 1997. Containing 7.5 million transistors (27.4 million in the case of the mobile Dixon with 256 kB L2 cache), the Pentium II featured an improved version of the first *P6*-generation core of the Pentium Pro, which contained 5.5 million transistors. However, its L2 cache subsystem was a downgrade when compared to Pentium Pros. In early 1999, the Pentium II was superseded by the Pentium III.

In 1998, Intel stratified the Pentium II family by releasing the Pentium II-based Celeron line of processors for low-end workstations and the Pentium II Xeon line for servers and high-end workstations. The Celeron was characterized by a reduced or omitted (in some cases present but disabled) on-die full-speed L2 cache and a 66 MT/s FSB. The Xeon was characterized by a range of full-speed L2 cache (from 512 kB to 2048 kB), a 100 MT/s FSB, a different physical interface (Slot 2), and support for symmetric multiprocessing.

## RESULT

Familiarized with central processing unit.

# Experiment: 9

# CABLES

# AIM

To familiarize with different cables used in computer system.

# DESCRIPTION

## VGA

Video Graphics Array (VGA) refers specifically to the display hardware first introduced with the IBM PS/2 line of computers in 1987, but through its widespread adoption has also come to mean either an analog computer display standard, the 15-pin D-subminiature VGA connector or the 640x480 resolution itself. While this resolution was superseded in the computer market in the 1990s, mobile devices have only caught up in the last few years.

VGA was the last graphical standard introduced by IBM that the majority of PC clone manufacturers conformed to, making it today (2013) the lowest common denominator that almost all post-1990 PC graphics hardware can be expected to implement. For example, the Microsoft Windows splash screen, in versions prior to Windows Vista, appears while the machine is still operating in VGA mode, which is the reason that this screen always appears in reduced resolution and color depth. Windows Vista and newer versions can make use of the VESA BIOS Extension support of newer graphics hardware to show their splash screen in a higher resolution than VGA allows.

## Parallel ATA

Parallel ATA (PATA), originally AT Attachment, is an interface standard for the connection of storage devices such as disks, floppy, and optical disc drives in computers. The standard is maintained by X3/INCITS committee. It uses the underlying AT Attachment (ATA) and AT Attachment Packet Interface (ATAPI) standards.

The Parallel ATA standard is the result of a long history of incremental technical development, which began with the original AT Attachment interface, developed for use in early PC AT equipment. The ATA interface itself evolved in several stages from Western Digital's original Integrated Drive Electronics (IDE) interface. As a result, many near-synonyms for ATA/ATAPI and its previous incarnations are still in common informal use. After the introduction of Serial ATA in 2003, the original ATA was renamed *Parallel ATA*, PATA for short.

## SATA

Serial ATA (Advanced Technology Attachment) (SATA) is a computer bus interface that connects host bus adapters to mass storage devices such as hard disk drives and optical drives. Serial ATA[2] replaces the older AT Attachment standard (ATA later referred to as Parallel ATA or PATA), offering several advantages over the older interface: reduced cable size and cost (seven conductors instead of 40), native hot swapping, faster data transfer through higher signaling rates, and more efficient transfer through an (optional) I/O queuing protocol.

SATA host adapters and devices communicate via a high-speed serial cable over two pairs of conductors. In contrast, parallel ATA (the redesignationfor the legacy ATA specifications) used a 16-bit wide data bus with many additional support and control signals, all operating at much lower frequency. To ensure backward compatibility with legacy ATA software and applications, SATA uses the same basic ATA and ATAPI command-set as legacy ATA devices.

## FIREWIRE

The IEEE 1394 interface is a serial bus interface standard for high-speed communications and isochronous real-time data transfer. It was developed in the late 1980s and early 1990s by Apple, who called it FireWire. The 1394 interface is comparable to USB though USB has more market share. Apple first included FireWire in some of its 1999 models, and most Apple computers since the year 2000 have included FireWire ports, though, as of 2013, only the 800 version (IEEE-1394b). The interface is also known by the brand i.LINK (Sony), and Lynx (Texas Instruments). IEEE 1394 replaced parallel SCSI in many applications, because of lower implementation costs and a simplified, more adaptable cabling system. The 1394 standard also defines a backplane interface, though this is not as widely used.

## RESULT

Familiarized with different cables.

# Experiment: 10

# NETWORK HARDWARE AND FILE SYSTEM

## AIM

To familiarize with network hardware and file system.

## DESCRIPTION

Networking hardware may also be known as network equipment, computer networking devices. Units which are the last receiver or generate data are called hosts or data terminal equipment.All these terms refer to devices facilitating the use of a computer network. Specifically, they mediate data in a computer network.

- Gateway: this device is placed at a network node and interfaces with another network that uses different protocols. It works on OSI layers 4 to 7.
- Router: a specialized network device that determines the next network point to which it can forward a data packet towards the ultimate destination of the packet. Unlike a gateway, it cannot interface different protocols. It works on OSI layer 3.
- Switch: a device that allocates traffic from one network segment to certain lines (intended destination(s)) which connect the segment to another network segment. Unlike a hub, a switch splits the network traffic and sends it to different destinations rather than to all systems on the network. It works on OSI layer 2.
- Bridge: a device that connects multiple network segments along the data link layer. It works on OSI layer 2.
- Hub: a device that connects multiple Ethernet segments, making them act as a single segment. When using a hub, every attached device shares the same broadcast domain and the samecollision domain. Therefore, only one computer connected to the hub is able to transmit at a time. Depending on the network topology, the hub provides a basic level 1 OSI model connection among the network objects (workstations, servers, etc.). It provides bandwidth which is shared among all the objects, in contrast to switches, which provide a connection between individual nodes. It works on OSI layer 1.
- Repeater: a device which amplifies or regenerates digital signals received while sending them from one part of a network into another. It works on OSI layer 1.

Some hybrid network devices:

- Multilayer switch: a switch which, in addition v to switching on OSI layer 2, provides functionality at higher protocol layers.

- Protocol converter: a hardware device that converts between two different types of transmission, such as asynchronous and synchronous transmissions.
- Bridge router (brouter): a device that combines router and bridge functionality and therefore works on OSI layers 2 and 3.

Hardware or software components that typically sit on the connection point of different networks, e.g. between an internal network and an external network:

- Proxy server: computer network service which allows clients to make indirect network connections to other network services.
- Firewall: a piece of hardware or software put on the network to prevent some communications forbidden by the network policy.
- Network address translator (NAT): network service provided as hardware or software that converts internal to external network addresses and vice versa.

## Router

Router is a device that forwards data packets between computer networks, creating an overlay internetwork. A router is connected to two or more data lines from different networks. When a data packet comes in one of the lines, the router reads the address information in the packet to determine its ultimate destination. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey. Routers perform the "traffic directing" functions on the Internet. A data packet is typically forwarded from one router to another through the networks that constitute the internetwork until it reaches its destination node.

## Network switch

A network switch (sometimes known as a *switching hub*) is a computer networking device that is used to connect many devices together on computer. A switch is considered more advanced than a hub because a switch will only send a message to the device that needs or requests it, rather than broadcasting the same message out of each of its ports.

A switch is a multi-port network bridge that processes and forwards data at the data link layer (layer 2) of the OSI model. Some switches have additional features, including the ability to route packets. These switches are commonly known as *layer-3* or *multilayer switches.* Switches exist for various types of networks including Fiber Channel, Asynchronous Transfer Mode, InfiniBand, Ethernet and others. The first Ethernet switch was introduced by Kalpanain 1990.

## Ethernet hub

An Ethernet hub, active hub, network hub, repeater hub, multiport repeater or hub is a device for connecting multiple Ethernetdevices together and making them act as a single network segment. It has multiple input/output (I/O) ports, in which a signal introduced at the input of any port appears at the output of every port except the original incoming. A hub works at the physical layer (layer 1) of the OSI model.[1] The device is a form of multiport repeater. Repeater hubs also participate in collision detection, forwarding a jam signal to all ports if it detects a collision.

## Network interface controller

A network interface controller (NIC, also known as a network interface card, network adapter, LAN adapter, and by similar terms) is computer component that connects a computer to a computer network.

Early network interface controllers were commonly implemented on expansion cards that plugged into a computer bus; the low cost and ubiquity of the Ethernet standard means that most newer computers have a network interface built into the motherboard.

## File System

In computing, a file system (or file system) is used to control how information is stored and retrieved. Without a file system, information placed in a storage area would be one large body of information with no way to tell where one piece of information stops and the next begins. By separating the information into individual pieces, and giving each piece a name, the information is easily separated and identified. Taking its name from the way paper based information systems are named, each piece of information is called a "file". The structure and logic rules used to manage the groups of information and their name is called a "file system".

There are many different kinds of file systems. Each one has different structure and logic. Each one has different properties of speed, flexibility, security, size and more. Some file systems have been designed to be used for specific applications. File systems can be used on many different kinds of storage devices. Each storage device uses a different kind of media. The most common storage device in use today is a hard drive whose media is a disc that has been coated with a magnetic film. The film has ones and zeros 'written' on it sending electrical pulses to a magnetic "read-write" head. Other media that are used are magnetic, optical disc, and flash memory. In some cases, the computer's main memory (RAM) is used to create a temporary file system for short term use.

File systems are used to implement type of data store to store, retrieve and update a set of files. "File system" refers to either the abstract data structures used to define files, or the actual software or firmware components that implement the abstract ideas. file systems are used on local data storage devices; others provide file access via a network protocol (e.g. NFS, SMB, or 9P clients). Some file systems are "virtual", in that the "files" supplied are computed on request (e.g. procfs) or are merely a mapping into a different file system used as a backing store. The file system manages access to both the content of files and the metadata about those files. It is responsible for arranging storage space; reliability, efficiency, and tuning with regard to the physical storage medium are important design considerations.

## RESULT

Familiarized with network hardware and file system.