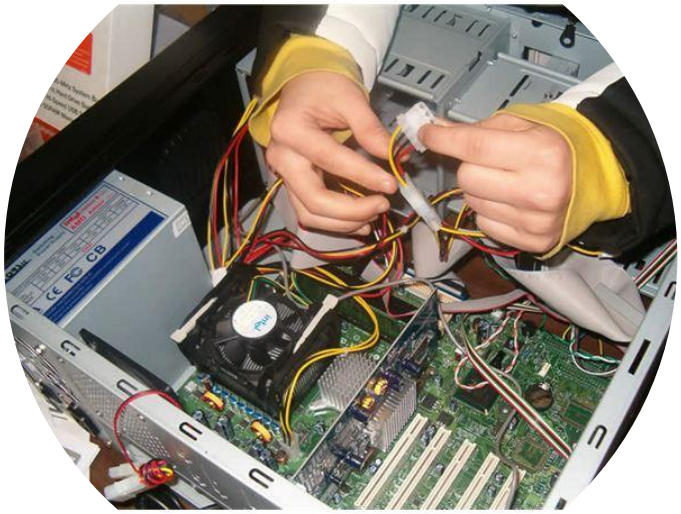
Chapter 4

Power Supply & Storage Devices , Motherboard, Assembling th r System



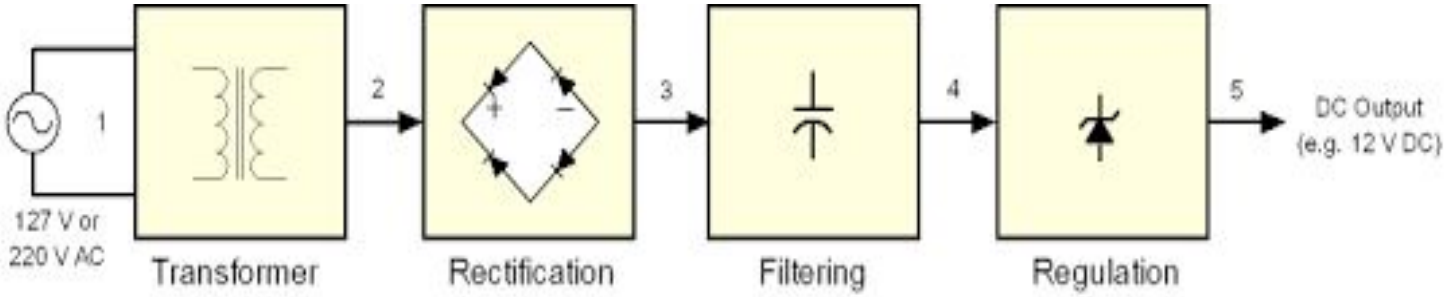
Nehal Patel (I.T.

Outline

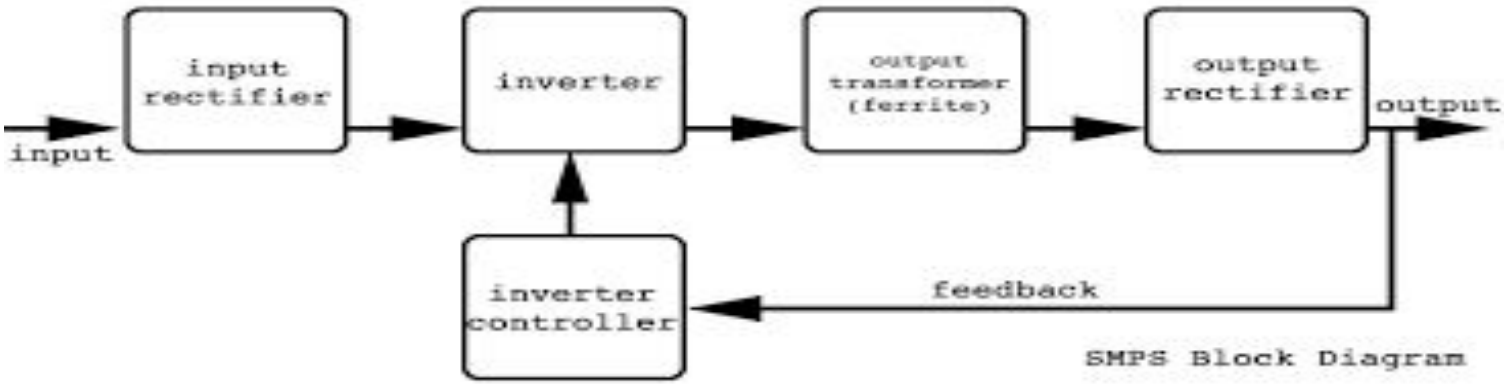
- ❑ SMPS
- ❑ Working Principle Of SMPS
- ❑ Block Diagram Of SMPS
- ❑ Difference Between Linear Power Supply And UPS
- ❑ Output Connectors Of SMPS
- ❑ Faults Of SMPS
- ❑ UPS
- ❑ Stabilizer
- ❑ Types of Memory
  - ➢ Primary storage: Registers, Cache, RAM
- ❑ Other Storage Devices
- ❑ Motherboard
- ❑ Assembling the computer system

WHY DO YOU WANT TO BUILD A SWITCHING POWER SUPPLY?

❑ Linear power Supply Design



❑ Switch Mode power supply Design



Phases of SMPS

1. **Input rectifier stage**: It is used to convert an ac input to dc. A SMPS with dc input does not require this stage. The rectifier produces unregulated dc which is then passed through the filter circuit.

2. **Inverter stage:** – The inverter stage converts DC, whether directly from the input or from the rectifier stage described above, to AC by running it through a power oscillator,.

3. **Output transformer:** - If the output required is to be isolated from input then it converts the voltage up or down to the required output level on it's secondary winding.

4. **Output rectifier:** - If the dc output is required, the ac output from the transformer is rectified.

5. **Regulation:** - Feedback circuit monitors the output voltage and compares it with the reference voltage.

SMPS ?

- SMPS means Switch Mode Power Supply.
- This is used for A.C to D.C conversion.
- This works on the principle of switching regulation.
- The SMPS system is highly reliable, efficient, noiseless and compact because the switching is done at very high rate in the order of several KHz to MHz
- It transfers power from a source, to a load, while converting voltage and current characteristics.
- Voltage regulation is achieved by varying the ratio of on- to-off time.

Advantages of SMPS over Linear Power Supplies:

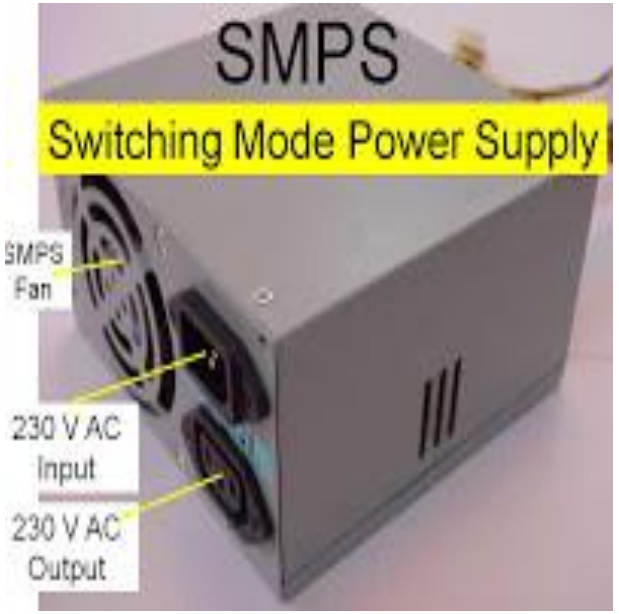
- Lower weight
- Smaller size
- Higher efficiency
- Lower power dissipation
- Wide ac input voltage range
- Reduced costs

Disadvantages of SMPS:

- Complexity of the circuit

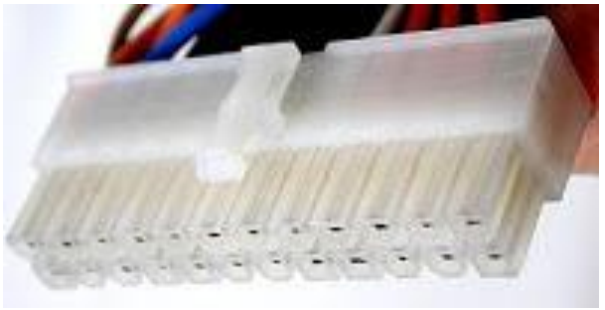
Output Connector

- SMPS (Switching Mode Power Supply) has different connector for motherboard, disk drives and floppy drives. so we have to know all the SMPS connectors and its purpose.



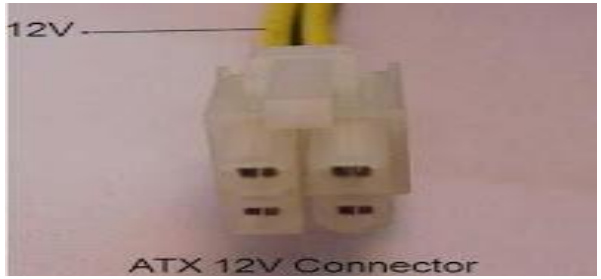
Continue…

ATX power connector:
Below is the 24pin ATX power connector, this is latest model smps power connector. it has 20pins or 24pins.



12V ATX connector:
Below is the 12v ATX connector. It has 4pin. yellow carries 12v. so this is called as 12v ATX connector.

Floppy Power Connector:
it is different from all other connectors. now a days no one use floppy drives.



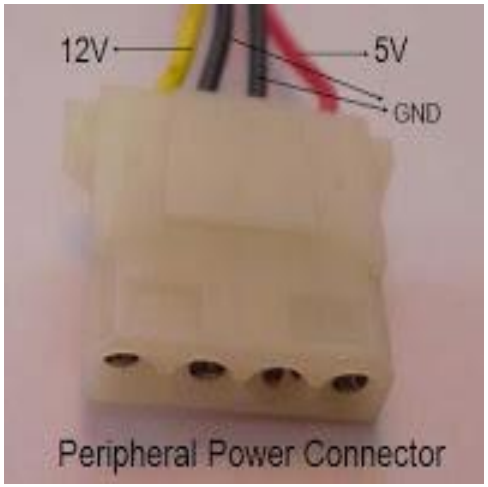
Continue…

Peripheral Power Connector:

It is IDE power connector. it has 4 pins. yellow carries 12 volts, red carries 5 volts and black is the ground wire.

Every motherboard supports 4 IDE devices such as hard disk drives and CD or DVD drives.

latest motherboard supports only 2 IDE drives. so that latest SMPSs have 2 peripheral power connectors for connecting 2 IDE drives.



SATA Power Connector:

it has 7 pins. It is only for Serial ATA drives such as SATA hard disk drives and SATA CD or DVD drives.

latest SMPSs have this connector.

All SMPSs have 2 SATA power connectors.

Faults of SMPS

- **Damaged SMPS components…** Inspect every section carefully to see if there's any broken/loose/totally detached component.

- **Is the power IC working correctly?** -- Take out your UC3842 IC Tester unit to measure the power IC. Damaged capacitors is also one the most common SMPS problems so check those as well.

- **Main circuit board problems…** --Noticed the power supply LED blinking/dim/ shutdown? If yes, then you should measure each component in the main area of SMPS and also do check the secondary area as well.

- **Fan problem…**
  Inspect the fan? If the fan doesn't work properly, then excessive heat will occur, resulting in complete shutdown of your ATX SMPS.

- **Soldering problem…**

Difference between linear and SMPS Power Supply

- A linear power supply supplies constant voltage while a switched power supply constantly varies (doesn't).
- A linear power supply is much simpler than a switched mode power supply.
- A switched mode power supply is more power efficient than a linear power supply.
- A switched mode power supply is more likely to create interference than a linear power supply.
- The main disadvantage of a switched mode power supply compared to a linear power supply is noise. The voltage oscillations and the constant connecting and disconnecting from the source create too much electrical noise that can interfere with other nearby electronics.

UPS

- Uninterruptible power supply (UPS) or battery backup, is used to provide a backup power source to important desktop computer hardware components.

- UPS is a device that allows your computer to keep running for at least a short time when the primary power source is lost.

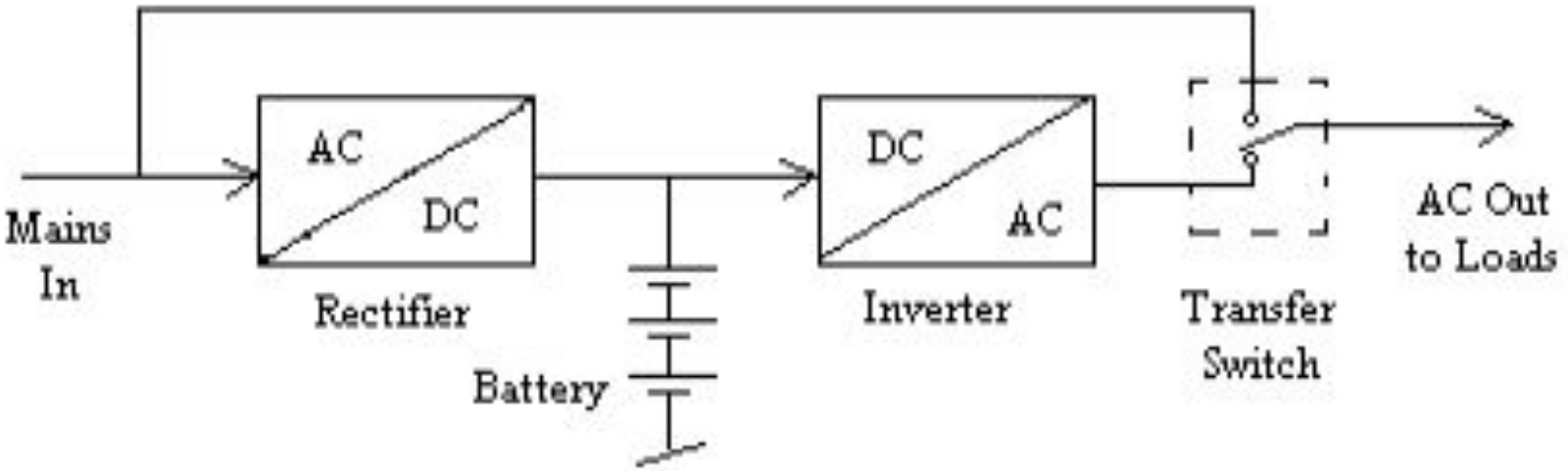
- UPS notifies you of the power loss, you have time to save any data you are working on and exit gracefully before the secondary power source (the battery) runs out.

- Many UPSs now offer a software component that enables you to automate backup and shut down procedures in case there's a power failure while you're away from the computer.

Need of UPS

- Modern Electronic gadgets and computer systems are highly sensitive to the power fluctuations
- Disruption of power may lead to Data loss/corruption/ malfunction etc.
- Starting the generator takes a few minutes.UPS is mainly used as a Power Backup for the above few minutes
- UPS maintains power instantaneously by switching to battery in the event of a power failure or a dip (brown out)
- Two basic types of UPS systems: **s**tandby **p**ower **s**ystems (SPSs) and on-line UPS systems.
- An SPS monitors the power line and switches to battery power as soon as it detects a problem.
- The switch to battery, can require several milliseconds, during which time the computer is not receiving any power. Standby Power Systems are sometimes called *Line-interactive UPSes*.
- An on-line UPS avoids these momentary power lapses by constantly providing power from its own inverter, even when the power line is functioning properly. In general, on-line UPSs are much more expensive than SPSs.

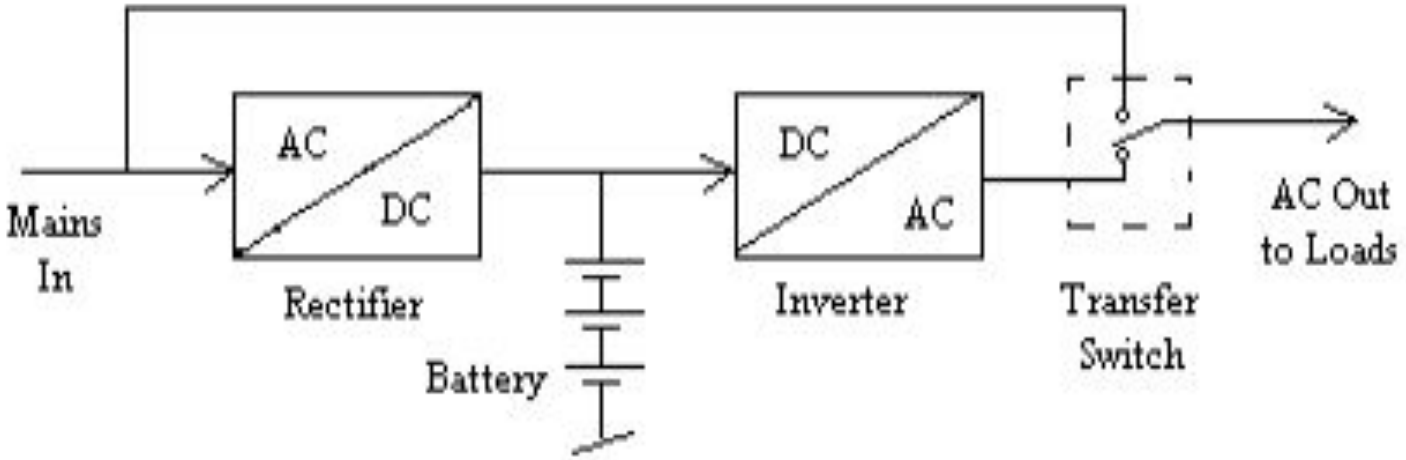
Block diagram of UPS



Offline UPS

- The mains to battery changeover time or battery to mains changeover time in offline UPS is very low as compared to inverter.

- Typically, changeover time in inverters is **500 milliseconds** & Offline UPS has change over time of **3-8 milliseconds**.



Offline UPS

- In a time, when mains ac is present, Inverter provides the output as is the input mains.
- While, Offline UPS has **built in Automatic Voltage Regulator (AVR)** to regulate the output voltage close to **220V ac**.
- Offline UPSs are normal weight UPSs and are widely used for **domestic computers**.
- In this type of UPS, the system always remains on battery, whether mains ac is present or not.
- When mains ac is present, it provides **power to DC supply** of inverter section as well as charges the battery simultaneously.
- When mains ac is not present, it will run the connected load till the **battery has a recommended dischargeable level**.

Stabilizer

- The function of a volt stabilizer is to maintain a constant voltage level.
- It contains electromechanical or electronic components to regulate one or more AC or DC voltages.
- Electronic voltage stabilizers stabilize DC voltages used by electrical elements in gadgets and devices thus protecting household appliances from voltage surges that destroy it.

Continue…

- The purpose of a voltage stabilizer is to maintain an output that is close to the normal mains voltage as possible, under conditions of fluctuation.

- Different voltage stabilizers are used for different appliance according to the specification and usage of each device.

- There are TV Stabilizers, Refrigerator Stabilizers, Stabilizers for washing machines, music systems, and specialized voltage stabilizers for digital TV's, LED TV's and LCD TV's.

Types of Memory

- Computer memory is broadly categorized into two types:
  - Primary Storage i.e Main Memory, and
  - Secondary Storage i.e Auxillary Memory
- **Primary storage** is closely connected to the CPU and is used for *temporary* storage of data and instructions during processing.
- **Secondary storage** is relatively *permanent* but ``further away'' from the CPU.
- **Primary storage** is *fast*; secondary storage is *slow* (relatively).
- **Primary storage** is *volatile* (i.e. contents are lost when power is removed); **Secondary storage** is *non-volatile*.
- **Primary storage** is based on *electronic* technology; **Secondary storage** is usually based on *magnetic* (or *optical*) and *mechanical* technologies.

Primary Storage

RAM (``Random Access Memory'').

Called ``RAM'' because any location in the memory can be directly accessed in the same amount of time as any other location.

ROM (``Read Only Memory'').

Is what it says: contains programs and/or data ``burned in'' at the time of manufacture.

Commonly used to contain programs to ``boot up'' the computer when it is switched on.

PROM (``Programmable Read Only Memory'').

ROM which is ``blank'' and into which programs and/or data can be written, but only once.

EPROM (``Erasable Programmable Read Only Memory'').

PROM which can be erased, usually by exposure to UV light through a transparent window above the chip.

Secondary Storage

Secondary storage for computers is non-volatile (i.e. does not require electrical power to retain its contents.

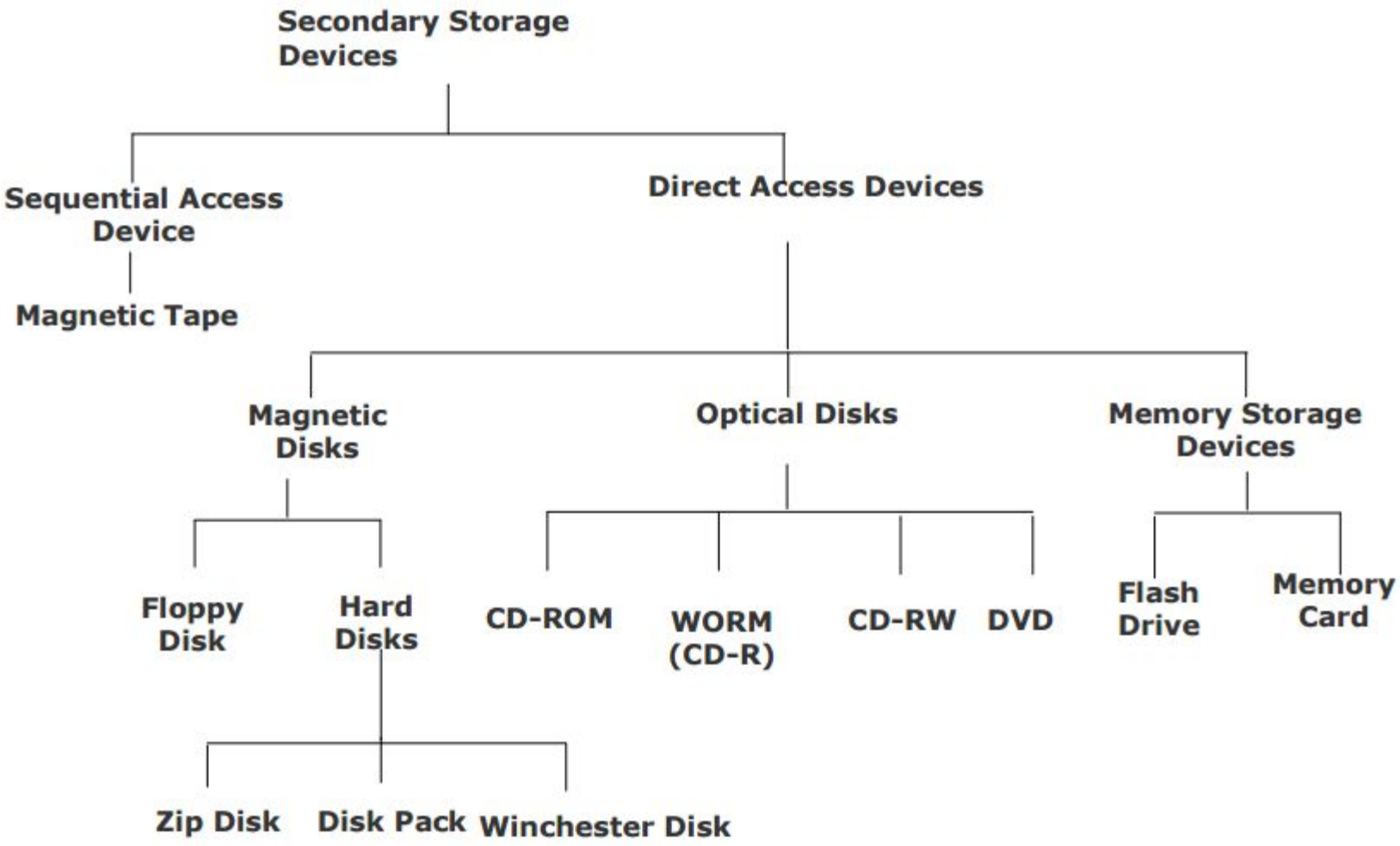
The basic types of secondary storage are:

- magnetic tape

- magnetic disk (``hard'' and ``floppy'')

- optical disk (CD-ROM, WORM, MO).

Classification of Secondary Storage Devices



Sequential Access Storage Devices

- Arrival at the desired storage location may be preceded by sequencing through other locations.
- Data can only be retrieved in the same sequence in which it is stored.
- Access time varies according to the storage location of the information being accessed.
- Suitable for sequential processing applications where most, if not all, of the data records need to be processed one after another.
- Magnetic tape is a typical example of such a storage device

Magnetic Tape

- Commonly used sequential-access secondary storage device.
- Physically, the tape medium is a plastic ribbon, which is usually ½ inch or ¼ inch and 50 to 2400 ft. long.
- Plastic ribbon is coated with a magnetizable recording material such as iron-oxide or chromium dioxide.
- Data are recorded on the tape in the form of tiny invisible magnetized and non-magnetized spots on its coated surface.
- There are several varieties of magnetic tape:
  - 14" reels of 1/2" wide tape (2400' long)
  - Cartridges of 1/4" tape
  - Cassettes (very similar to audio cassettes)
  - Digital Audio Tape (DAT).

Continue

Advantages

- Provides archival or backup storage.
- They are inexpensive.
- They can be used for large files or copying from disk files.
- They are robust, reusable,light,compact and easy to store on racks.

Disadvantages

- It only allows access to data sequentially and is therefore very slow compared to other secondary storage technologies.
- May need manual intervention to mount/dismount.
- Stored data cannot be easily updated.

Direct Access Storage Devices

- Devices where any storage location may be selected and accessed at random.
- Permits access to individual information in a more direct or immediate manner.
- Approx.equal access time is required for accessing information from any storage location.
- Suitable for direct processing applications such as online ticket booking systems, online banking systems
- Magnetic, optical and magneto-optical disks are typical example of such a storage device.

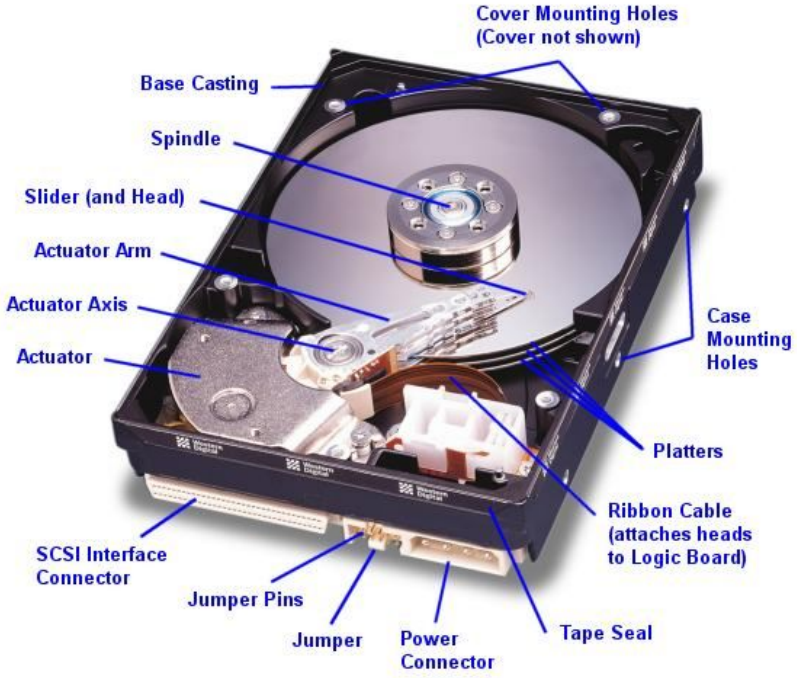
Magnetic Disk

- This is the most common form of secondary storage used today. Magnetic disks come in two forms:
  - *hard* disks
  - *floppy* disks

- Hard disks are (usually but not always) permanently mounted inside the computer. All magnetic disks have a magnetizable iron oxide coating and read/write heads that can move over the surface of the disk, which is spinning underneath it . The disk head works in a similar way to the head in an audio tape recorder. The read/write head in a floppy disk drive actually contacts the magnetic disk, but that in a hard disk ``flies'' a few thousandths of an inch above it.

Hard Disk

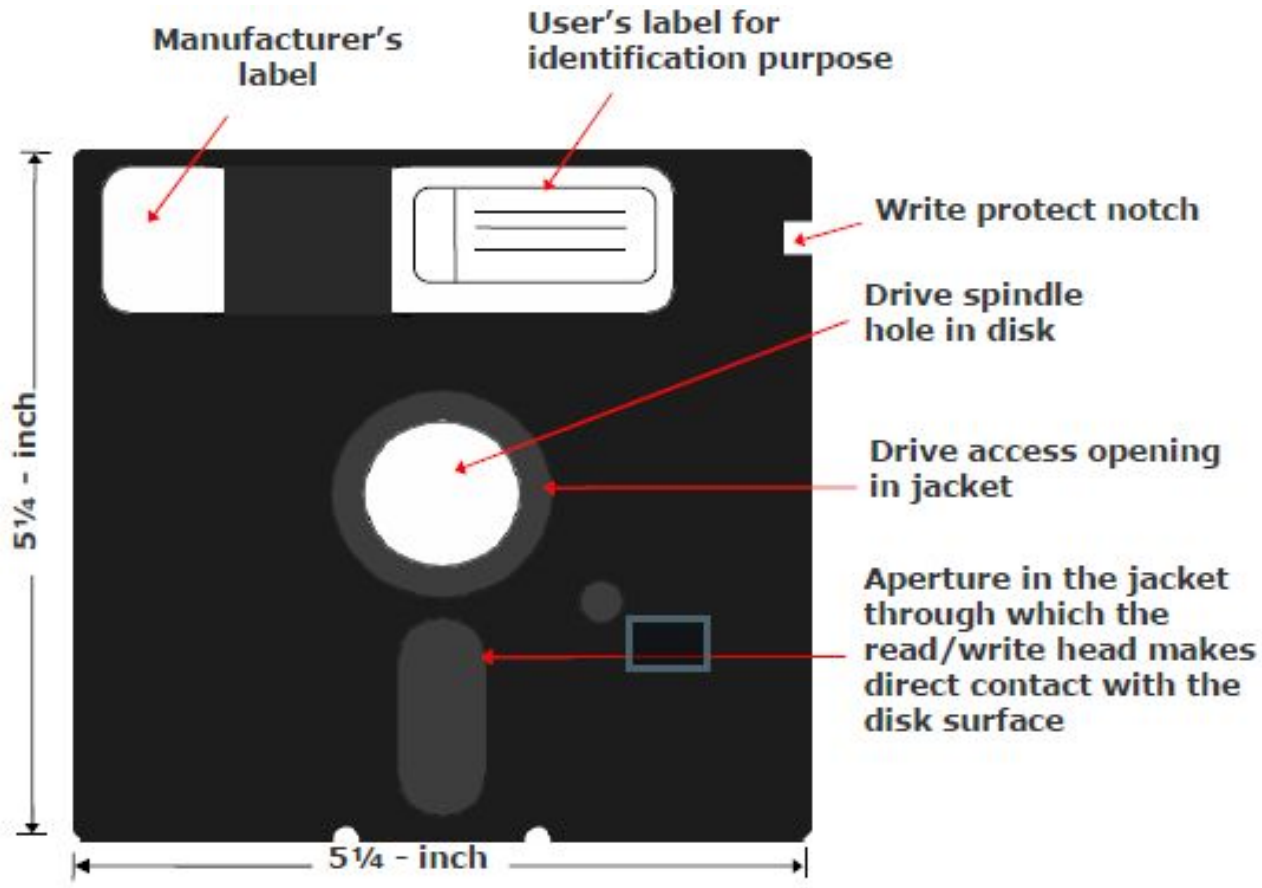
- Round, flat piece of rigid metal (frequently aluminum) disks coated with magnetic oxide.
- Comes in many sizes, ranging from 1 to 14-inch diameter.
- Depending on how they are packaged, hard disks are of three types:
  - Zip/Bernoulli disks
  - Disk spaces
  - Winchester disks
- Primary on-line secondary storage device for most computer systems today.



Floppy Disk

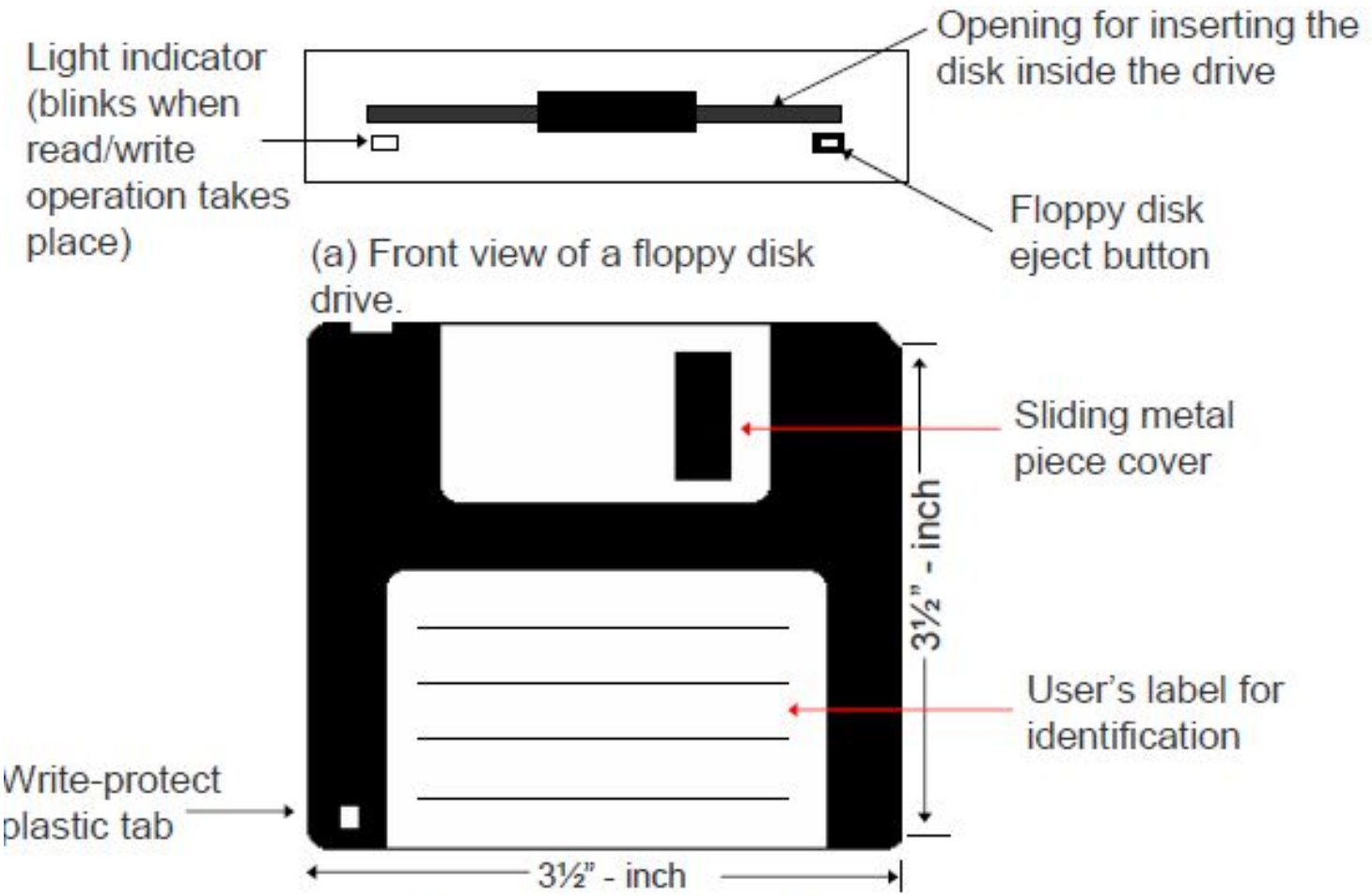
- Round, flat piece of flexible plastic disks coated with magnetic oxide.
- So called because they are made of flexible plastic plates which can bend.
- They are also known as floppies or diskettes.
- Plastic disk is encased in a square plastic or vinyl jacket cover that gives handling protection to the disk surface.
- The two types of floppy disks are:
  - 5 ¼ - inch diskette, whose diameter is 5 ¼ - inch. It is encased in a square, flexible vinyl jacket.
  - 5 ½ - inch diskette, whose diameter is 3 ½ - inch. It is encased in a square,hard plastic jacket.
- Most popular and inexpensive secondary storage medium used in small computers.
  -

A 5 ¼ -inch Floppy Disk



A 5 ¼ -inch floppy disk enclosed within jacket.The drive mechanism clamps on to a portion of the disk exposed by the drive access opening in the jacket

A 3 ½ -inch Floppy Disk



Continue

Advantages

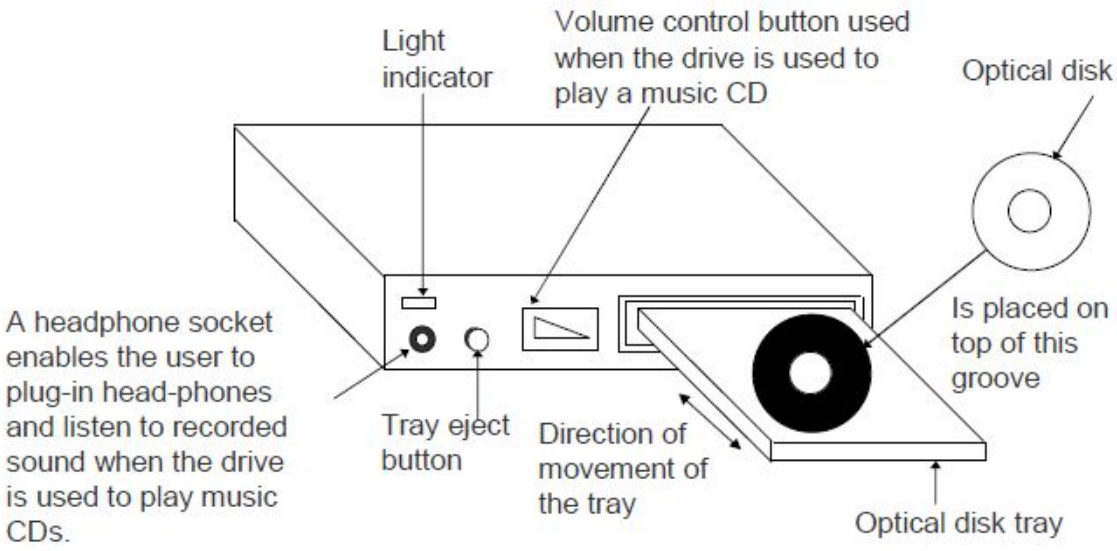
- More suitable than magnetic tapes for a wider range of applications because they support direct access of data.
- Random access property enables them to be used simultaneously by multiple users as a shared device. A tape is not suitable for such type of usage due to its sequential-access property.
- Suitable for both in-line and on-line storage of data.
- Very large amount of data can be stored in a small storage space.

Disadvantages

- Although used for both random processing and sequential processing of data, for applications of the latter type, it may be less efficient than magnetic tapes.
- More difficult to maintain the security of information stored on shared, on-line secondary storage devices,as compared to magnetic tapes or other types of magnetic disks.

Optical Disks

- Consists of a circular disk,which is coated with a thin metal or some other material that is highly reflective.
- Laser beam technology is used for recording/reading of data on the disk
- Also known as laser disk/optical laser disk,due to the laser beam technology.
- Proved to be a promising random access medium for high capacity secondary storage because it can store extremely large amounts of data in a limited space.



Types of Optical Disks

The types of optical disks in use today are:

CD-ROM

- Stands for Compact Disk-Read Only Memory
- Packaged as shiny, silver color metal disk of 5 ¼ inch diameter, having a storage capacity of about 650MB
- Disks come pre-recorded and the information stored on them cannot be altered.
- Pre-recorded by their suppliers, by a process called *mastering*.
- Provide an excellent medium to distribute large amounts of data in electronic form at low cost.
- A single CD-ROM disk can hold a complete encyclopedia, or a dictionary etc.
- Used for distribution of electronic version of conference proceedings, journals,etc
- Used by software vendors for distribution of s/w to their customers.

Continue

WORM Disk/CD-Recordable (CD-R)

- Stands for Write Once Read Many. Data can be written only once on them, but can be read many times.
- Same as CD-ROM and has same storage capacity.
- Allows user to create their own CD-ROM disks by using a CD-recordable (CD-R) drive that can be attached to a computer as a regular peripheral device.
- Data to be recorded can be written on its surface in multiple recording sessions.
- Information recorded on them can be read by any ordinary CD-ROM drive.
- They are used for data archiving and for making a permanent record of data.

Continue

CD-Read/Write (CD-RW)

- Same as CD-R and has same storage capacity.
- Allows user to create their own CD-ROM disks by using a CD-recordable (CD-R) drive that can be attached to a computer as a regular peripheral device.
- Data to be recorded can be written on its surface in multiple recording sessions.
- Made of metallic alloy layer whose chemical properties are changed during burn and erase.
- Can be erased and written afresh.

Digital Video/Versatile Disk (DVD)

- Looks same as CD-ROM but has capacity of 4.7 GB or 8.5 GB.
- Designed primarily to store and distribute movies.
- Can be used for storage of large data.
- Allows storage of video in 4:3 or 16:9 aspect-ratios in MPEG-2 video format using NTSC or PAL resolution.

Continue

Advantages

- The cost-per-bit of storage for optical disks is very low because of their low cost and enormous storage density.
- The use of single spiral track makes optical disks an ideal storage medium for reading large blocks of sequential data, such as music.
- Optical disks have a data storage life in excess of 30 years. This makes them a better storage medium for data archiving as compared to the magnetic tapes or magnetic disks.
- Due to their compact size and light weight, optical disks are easy to handle, store, and port from one place to another.

Disadvantages

- It is largely read-only storage medium. Data once recorded, cannot be erased and hence the optical disks cannot be reused.
- The data access speed for optical disks is slower than magnetic disks.
- Optical disks require a complicated drive mechanism.

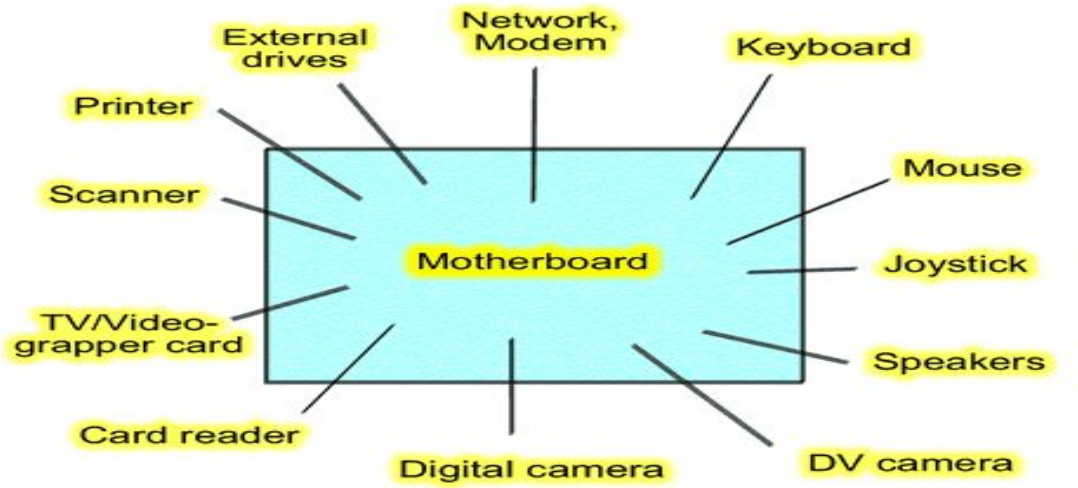
MOTHERBOARD

Abbreviation

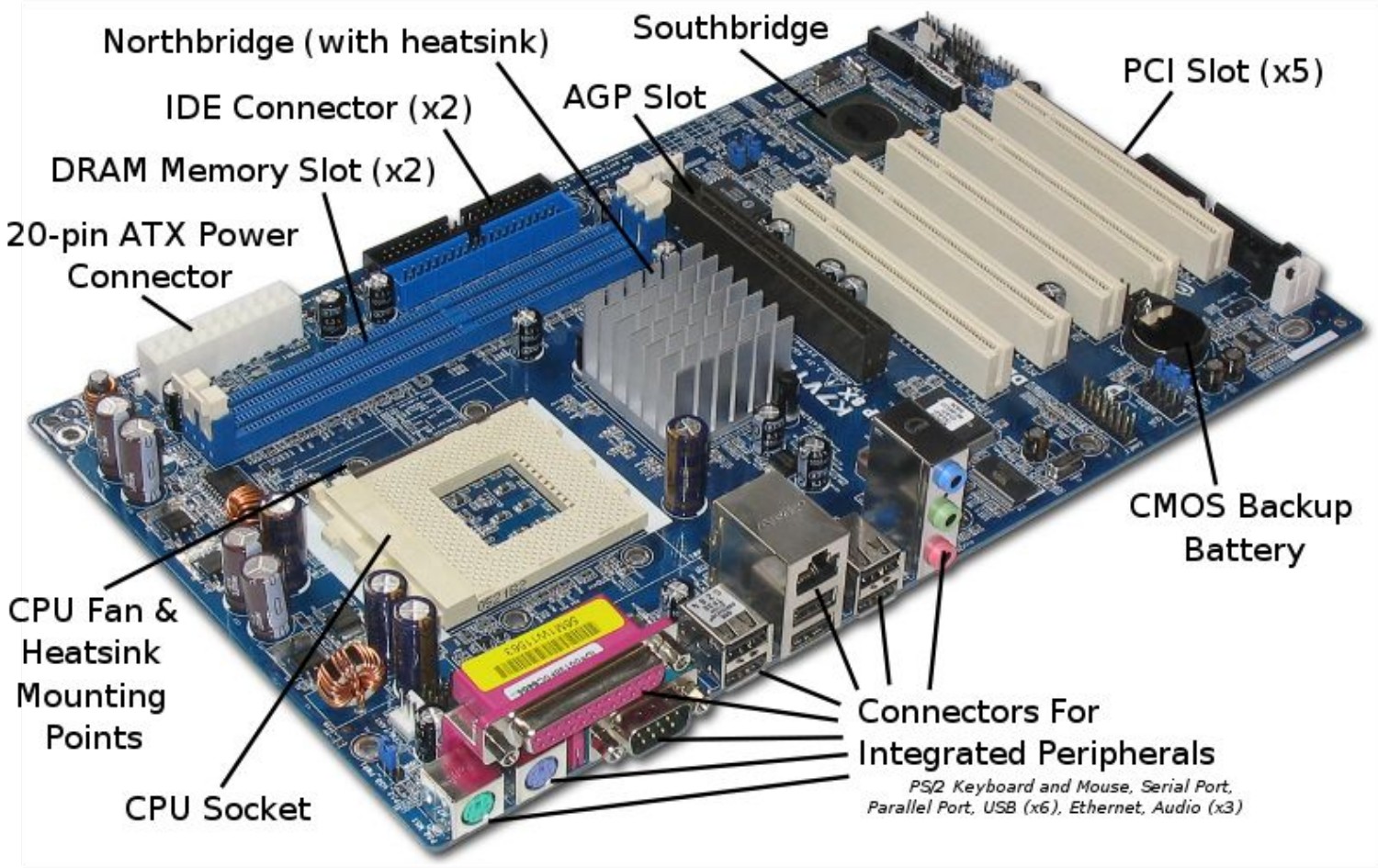
- PCI - Peripheral Component Interconnect
- AGP - Accelerated Graphics Port
- IDE - Integrated Development Environment
- SATA - Serial Advanced Technology Attachment
- ATA - Advanced Technology Attachment
- RAID - Redundant Array Of Inexpensive Disks
- CMOS- complementary metal-oxide semiconductor
- BIOS - Basic Input Output System
- SCSI – Small Computer System Interface

Motherboard

- It is a **Printed Circuit Board (PCB)** where all the components of a system are connected.
- The Central Processing Unit (CPU), hard drives, memory and every other part of a system is connected to the motherboard by means of slots, connectors and sockets.
- The motherboard chipset is a series of chips that are a part of the motherboard.



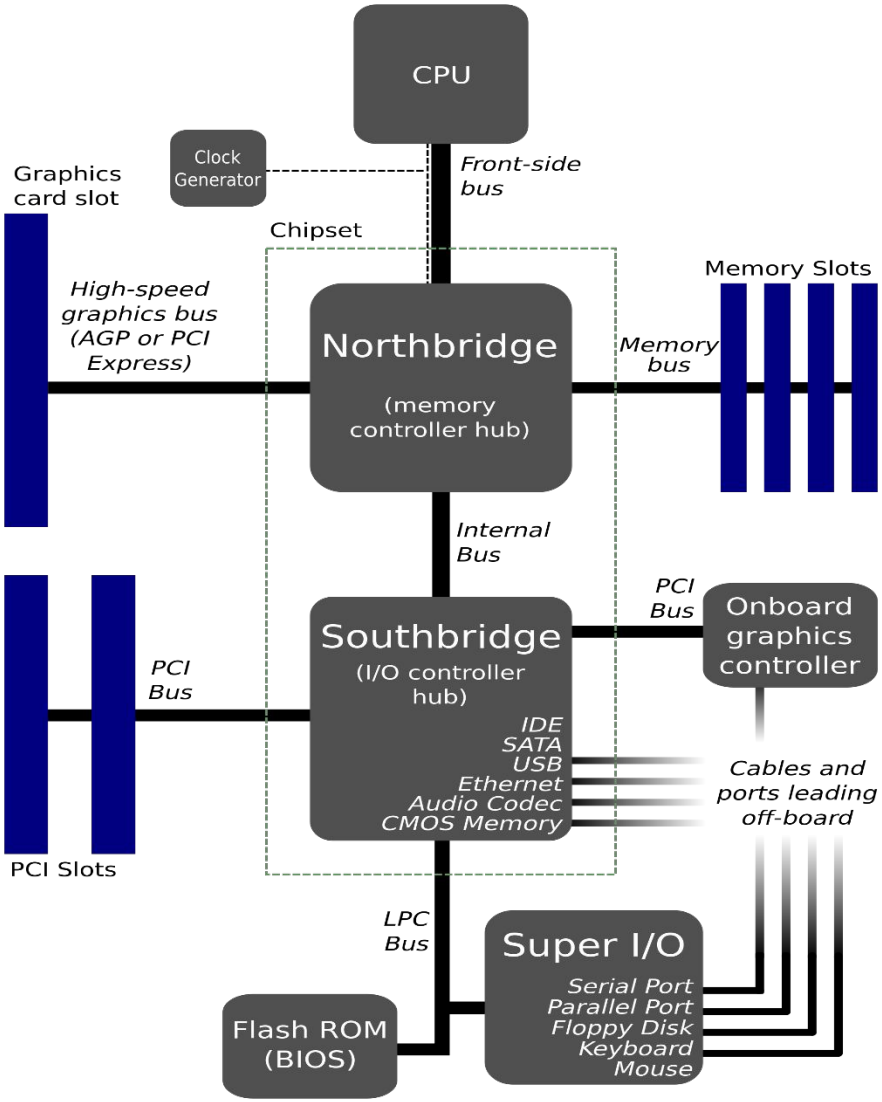
Motherboard



Types of Motherboards

Types of Motherboard	Description
AT	Oldest type of motherboard still used in some system Uses P8 and P9 power connections Measures 30.5 cm x 33 cm (12 x 13 inches)
Baby AT	Smaller version of AT. Small size is possible because motherboard logic is stored on a small chip set. Uses P8 and P9 power connections. Measures 33 cm x 22 cm (12 x 8.7 inches)
ATX	Developed by intel for Pentium System. Has a more conveniently accessible layout than AT boards. Includes a power-on switch that can be software enabled and extra power connections for extra fans Uses P1 connectors Measures 30.5 cm x 24.4 cm (12 x 9.6 inches)
Mini ATX	An ATX board with a more compact design Measures 28.4 cm x 20.8 cm (11.2 x 8.2 inches)

Functional block diagram of motherboard



North Bridge (Host Bridge / North Chipset)

- A north bridge or host bridge is a microchip on some PC motherboards and is connected **directly to the CPU** (unlike the Southbridge).
- The Northbridge is usually **paired** with a **Southbridge**, also known **as I/O controller hub**.
- In systems where they are included, these two chips manage communications between the CPU and other parts of the motherboard, and constitute the core logic chipset of the PC motherboard.
- It is **responsible** for control of high speed components like CPU, RAM, and Video Card.

CPU

- The Central Processing Unit (CPU) is the chip on the motherboard that acts as the **"computer's brain"**
  - It does calculations, and coordinates the other motherboard components
  - **CPU examples**: Pentium, core i3, i7.

- The CPU is also known as the **processor or microprocessor.**

CPU Socket

- A CPU socket or CPU slot is a mechanical component that provides mechanical and electrical connections between a microprocessor and a printed circuit board (PCB).
- This allows the CPU to be placed and replaced without soldering.

Some Processors (CPUs)

Pentium Chip

Chip Fan

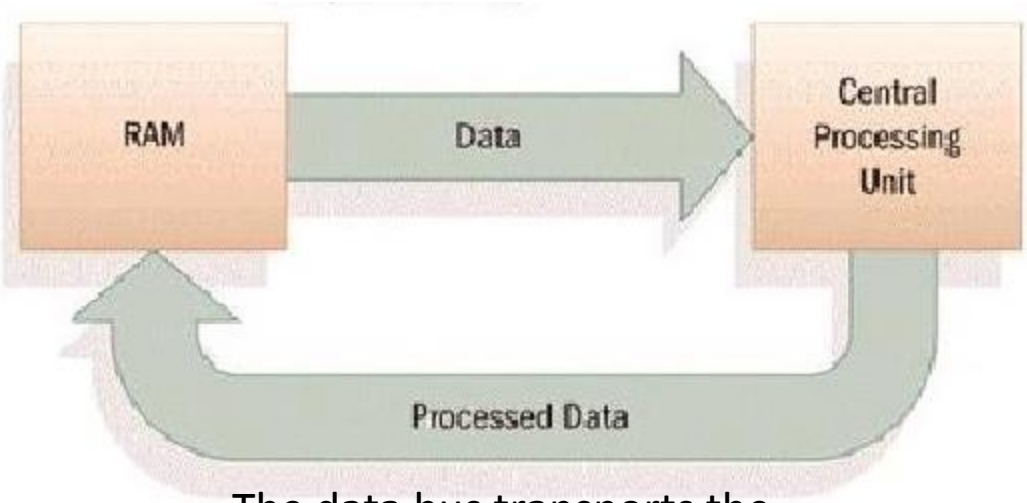
PowerPC Chip

- The first microprocessor was the Intel 4004 that was released November 15, 1971 and had 2,300 transistors and performed 60,000 operations per second.

- The Intel Pentium Processor shown on this slide has 33,00,000 transistors and performs around 18,80,00,000 instructions per second.

The CPU and RAM

The RAM contains data and programs.



The CPU processes data.

The data bus transports the processed data to the RAM so
it can be stored, displayed, or output.

BIOS

- A BIOS **(Basic Input/Output System)** is an electronic set of instructions that a computer uses to successfully start operating.

- It gives basic information about how to interact with some critical components, such as drives and memory.

- The BIOS contains all the code required to control the keyboard, display screen, disk drives, serial communications, and a number of miscellaneous functions

BIOS

AMIBIOS NEW SETUP UTILITY - VERSION 3.31a

- ▶ Standard CMOS Features
- ▶ Advanced BIOS Features
- ▶ Advanced Chipset Features
- ▶ Power Management Features
- ▶ PNP/PCI Configurations
- ▶ Integrated Peripherals
- ▶ PC Health Status

- ▶ Frequency/Voltage Control
- Set Supervisor Password
- [illegible] Password
- Load High Performance Defaults
- Load BIOS Setup Defaults
- Save & Exit Setup
- Exit Without Saving

F1:Help T↓:Select Item +/-:Change Values F7:Setup Defaults
Esc:Exit ↔:Select Menu Enter:Select ▶Sub-Menu F10:Save & Exit

Set Time ,Date ,Hard Disk Type ...

CMOS Memory

- CMOS **(complementary metal-oxide-semiconductor)** is the term usually used to describe the small amount of memory on a computer motherboard that stores the BIOS settings.

- A computer needs a **semi-permanent** way of keeping some start-up data
  - e.g. the current time, the no. of hard disks
  - the data may need to be updated/changed

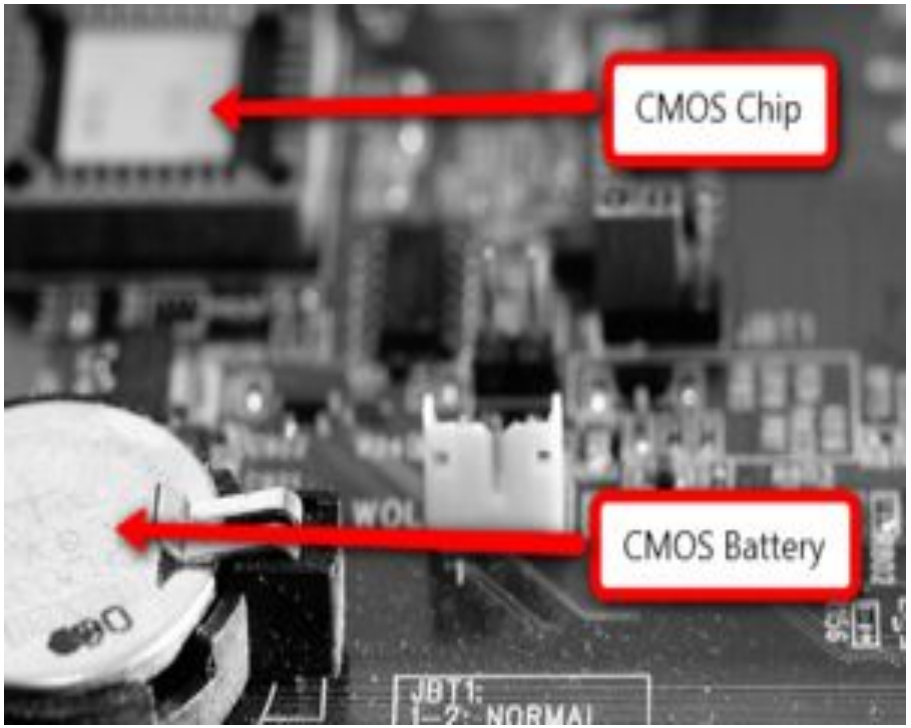
- **CMOS memory** requires (very little) power to retain its contents.
  - supplied by a battery on the motherboard.

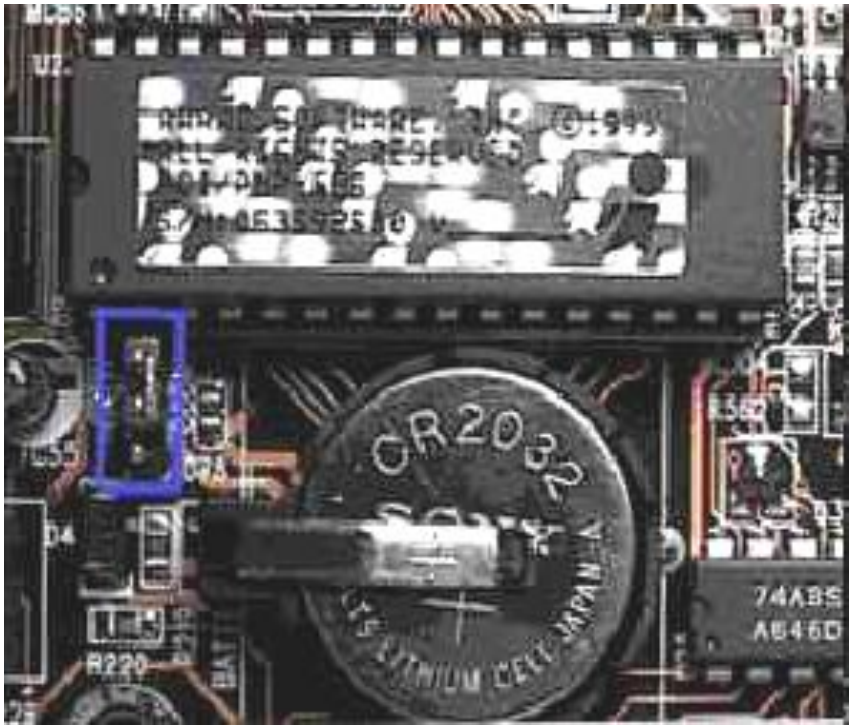
Cont..

- The CMOS is usually powered by a CR2032 cell battery.

- **Incorrect or slow system** date and time and **loss of BIOS settings** are major signs of a dead or dying CMOS battery.

CMOS Memory





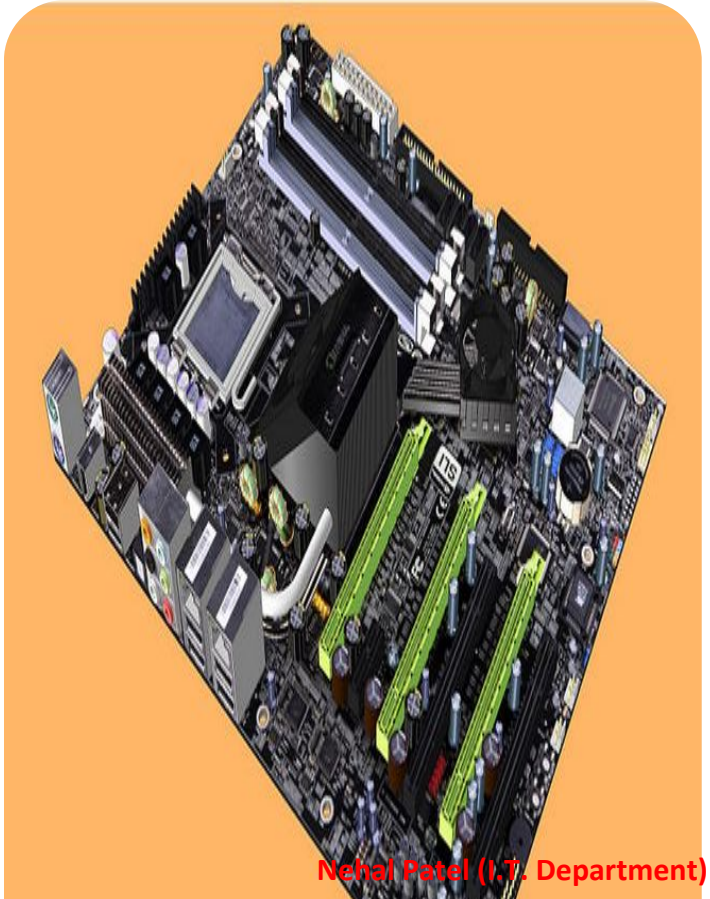
Faults of Motherboard

- Not enough power
- Improperly installed components
- Short circuit
- No case power button connection
- BIOS hardware incompatibility

How to Build Personal Desktop Computer

Step:1

Prepare the Mainboard (motherboard)

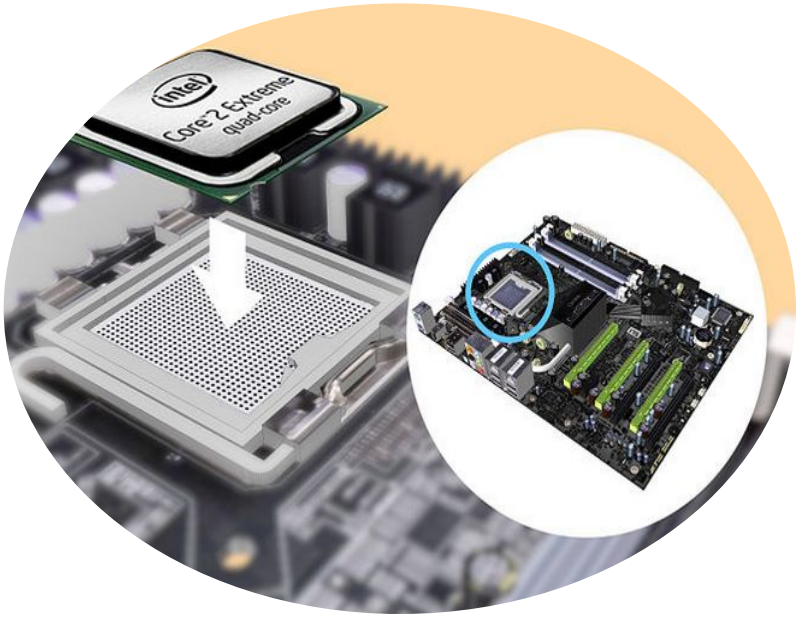


Cont..

Step:2

Mount the CPU in the socket of the Mainboard.

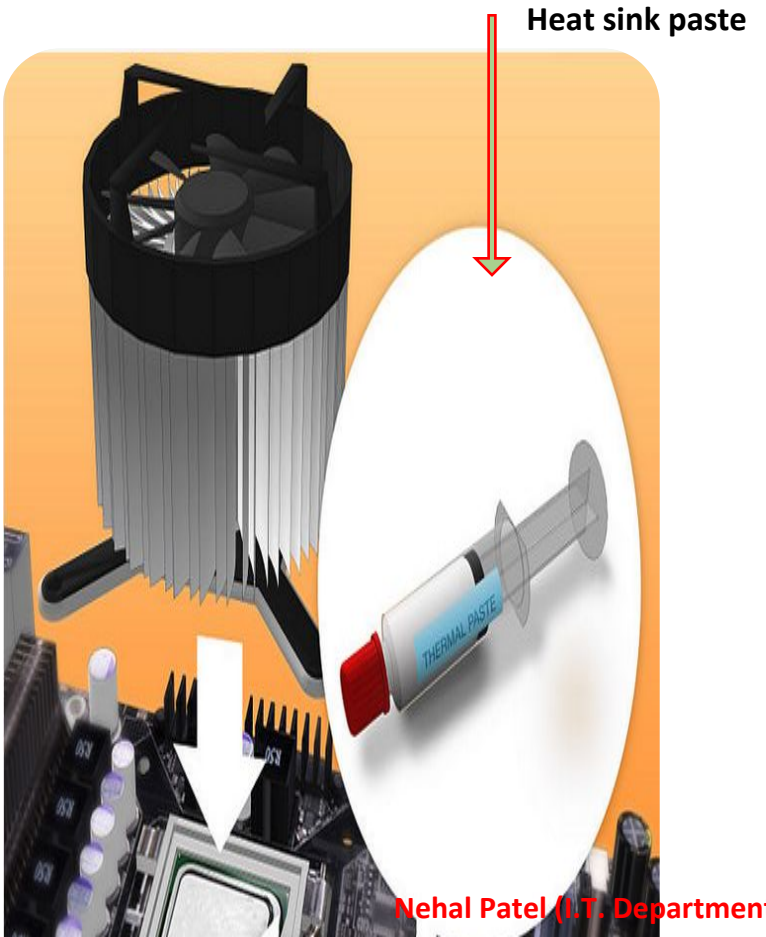
- You must choose the correct CPU for your motherboard, and install it according to it's instructions.



Cont..

Step:3

Connect the CPU cooler to the Mainboard.

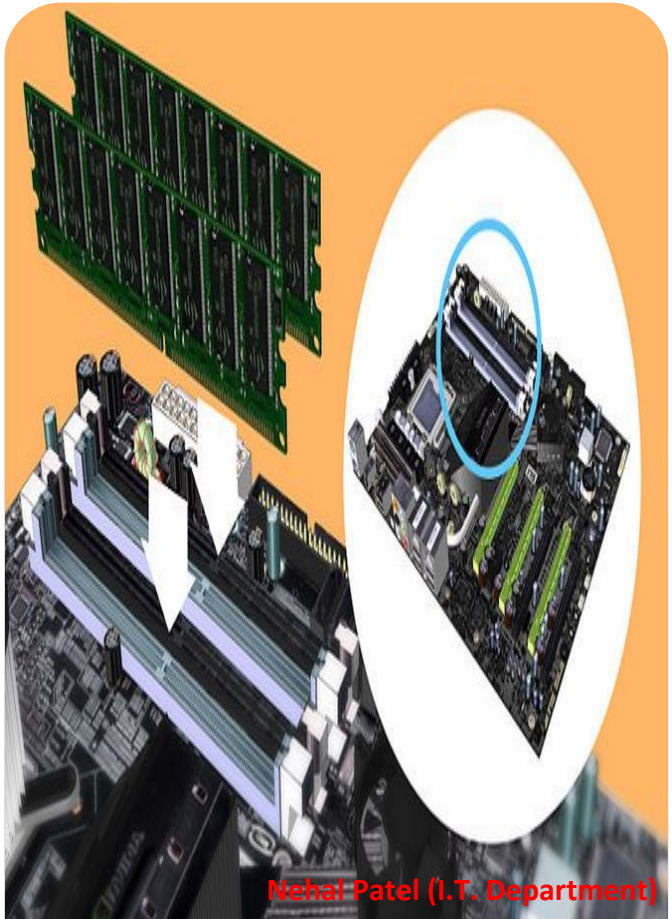


Cont..

Step:4

Attach the RAM(memory) modules in the corresponding slots.

- The motherboard should have rows of slots that have 2 or 3 sections that are different lengths.
- Make sure the pins on the RAM cards line up with the pins on the motherboard connector.
- Don't get the RAM slots mixed up with PCI slots. The PCI (Peripheral Component Interconnect) slots are usually wider.



Cont..

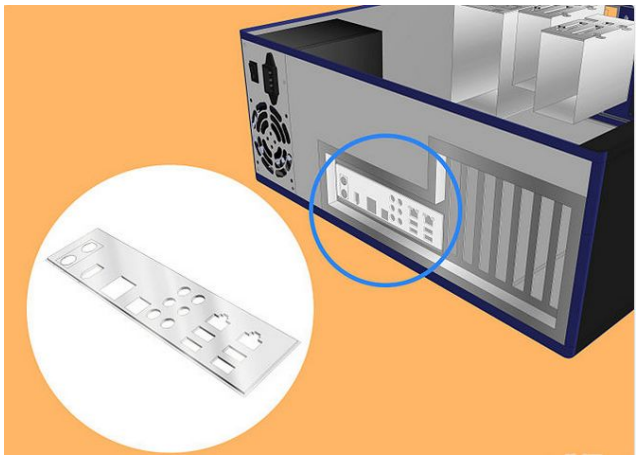
Step:5

Open the case and mount the power supply which is M-ATX (Micro Advanced Technology Extended) type.

Cont..

Step:6

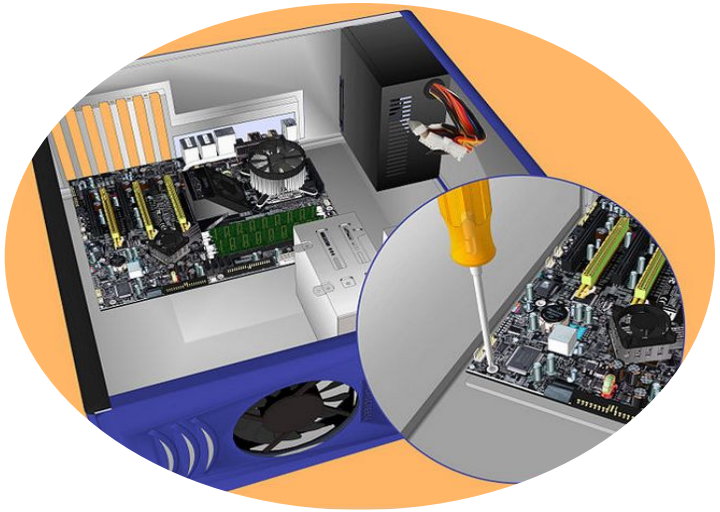
Attach the Mainboard back plate to the case and check the Mainboard mounting positions.



Cont..

Step:7

Suitably position the Mainboard in the case.

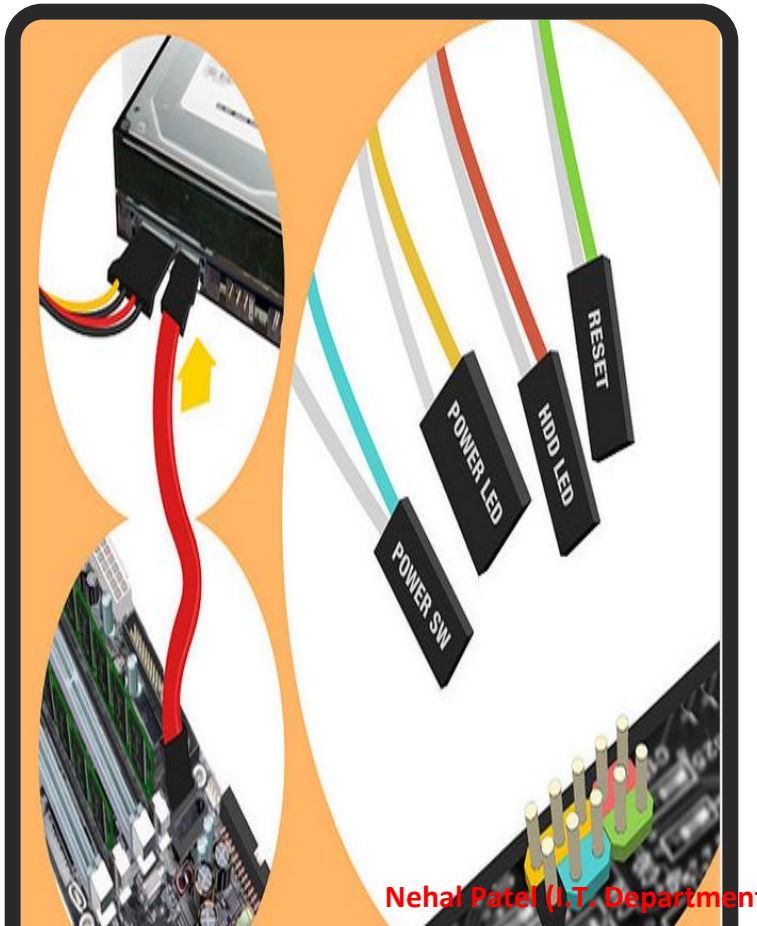


Cont..

Cont..

Step:9

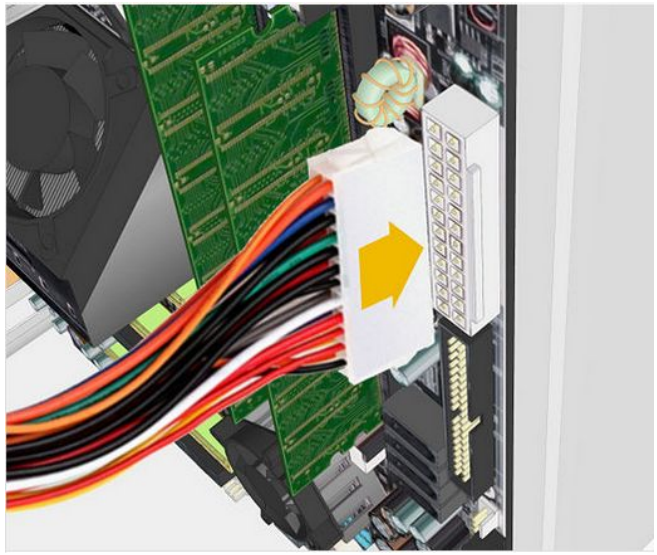
Suitably position the Mainboard in the case.



Cont..

Step:10

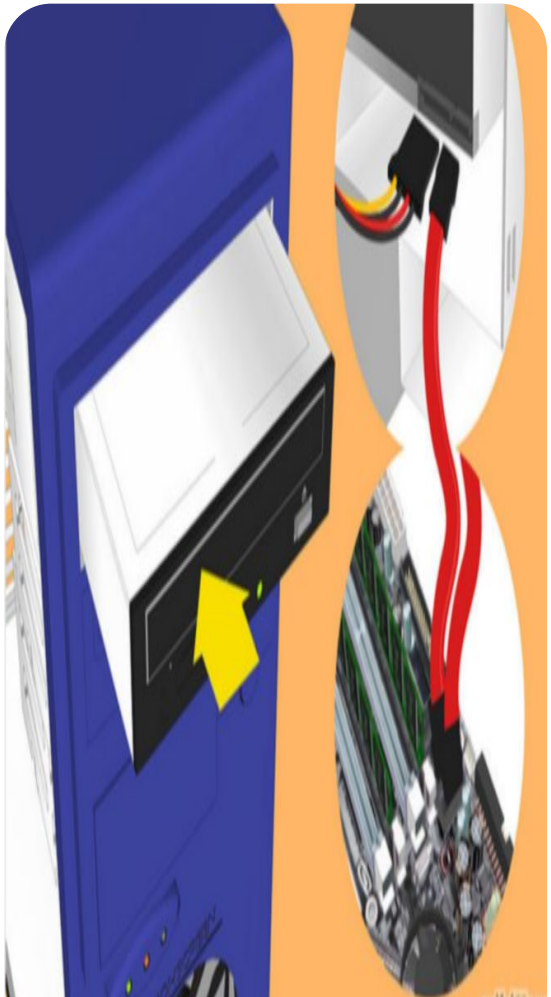
Connect the 20 or 24 pin ATX connector and the 4-pin power supply control connector to the motherboard.



Cont..

Step:11

Mount the DVD-ROM drive.

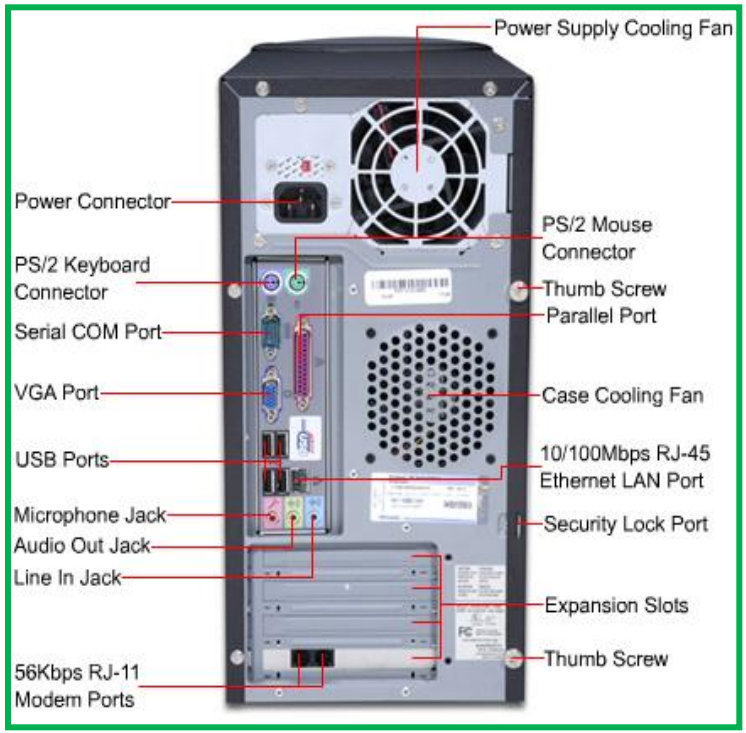


Cont..

Step:12

Finally, select a compatible operating system, and follow the instructions to install.

Different Types of Cables



Power Connector

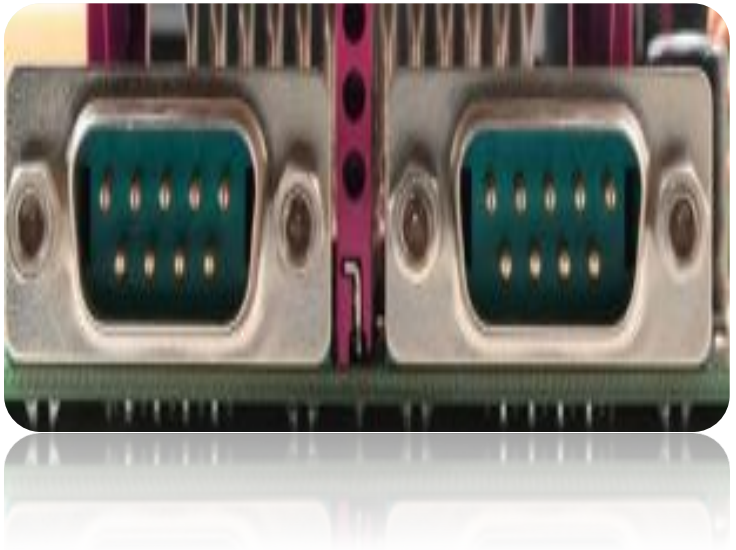
- Connect one end to: AC power socket
- Connect other end to: power supply unit, computer monitor

PS/2 Ports

- Connect one end to: PS/2 keyboard, PS/2 mouse
- Connect other end to: PS/2 ports on computer
- **Purple** PS/2 port: **keyboard**
- **Green** PS/2 port: **mouse**

Serial Ports

- A serial port can only transmit one bit of data at a time.
- The serial port is a type of connection on PCs that is used for peripherals such as mice, gaming controllers, modems, and older printers.



Parallel Ports

- A serial port can only transmit one bit of data at a time.

- The serial port is a type of connection on PCs that is used for peripherals such as mice, gaming controllers, modems, and older printers.

VGA (Video Graphics Array) Monitor Port

- VGA connections can be identified by **15 pins** arranged in **3 rows** with 5 on each row. Each row corresponds to the 3 different color channels used in display: **red, green, and blue.**
- And other than connecting a computer to a monitor, you may also use a VGA cable to connect your laptop to a TV screen or a projector.
- Also known as **D-sub cable.**

Ethernet Port

- Ethernet cables are used to set up local area networks.
- They are used to connect routers to modems and computers.
- **Cat 5 cables** are the most basic type and provide speeds of either 10 Mbps or 100 Mbps.
- **Cat 5e**, which means Cat 5 Enhanced, allows for faster data transmission than its predecessor. It caps at 1,000 Mbps.
- **Cat 6** is the latest and offers the best performance of the three. It's capable of supporting 10 Gbps speeds.

USB (Universal Serial Bus) Port

- A protocol for transferring data to and from digital devices.
- **USB 1.0/1.1** can transmit data at speeds up to 12 Mbps.
- **USB 2.0** can transmit data at speeds up to 480 Mbps and is compatible with older versions of USB.
- **USB 3.0** can transmit data at speeds up to 4.8 Gbps. It is compatible with previous versions of USB.

Thank you…