Introduction To Computer Hardware

Lecture 2

Hafijur Rahman

What is a Computer ?

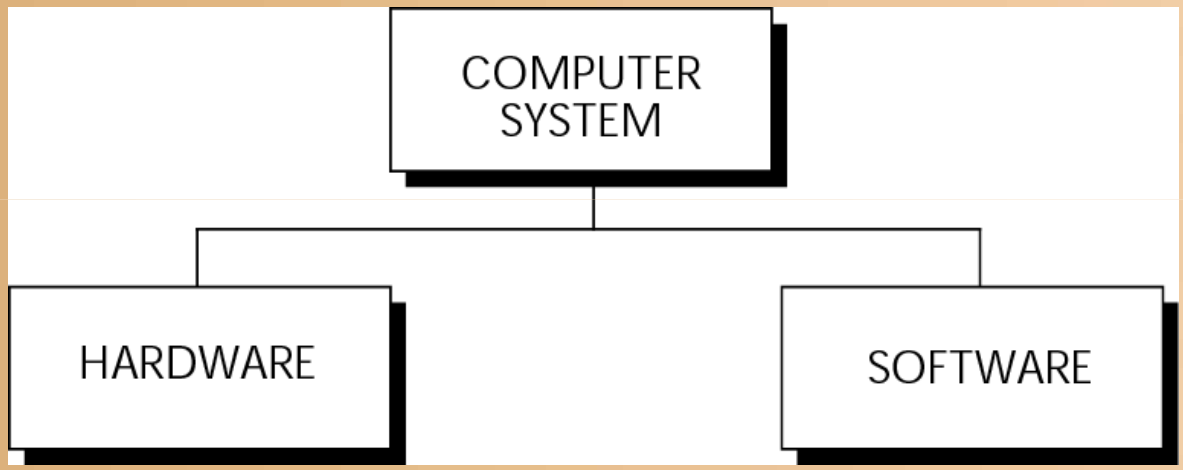
- **A computer** is an electronic device, which can input, process, and output data.

- **A computer** is a machine that stores data, interact with devices, and execute programs (provides **computing** capabilities to its users).

  A computer is an electronic device that stores, retrieves, and processes data, and can be programmed with instructions. A computer is composed of hardware and software, and can exist in a variety of sizes and configuration.

Major Components of a Computer System

- A computer system consists of two main parts: hardware and software.

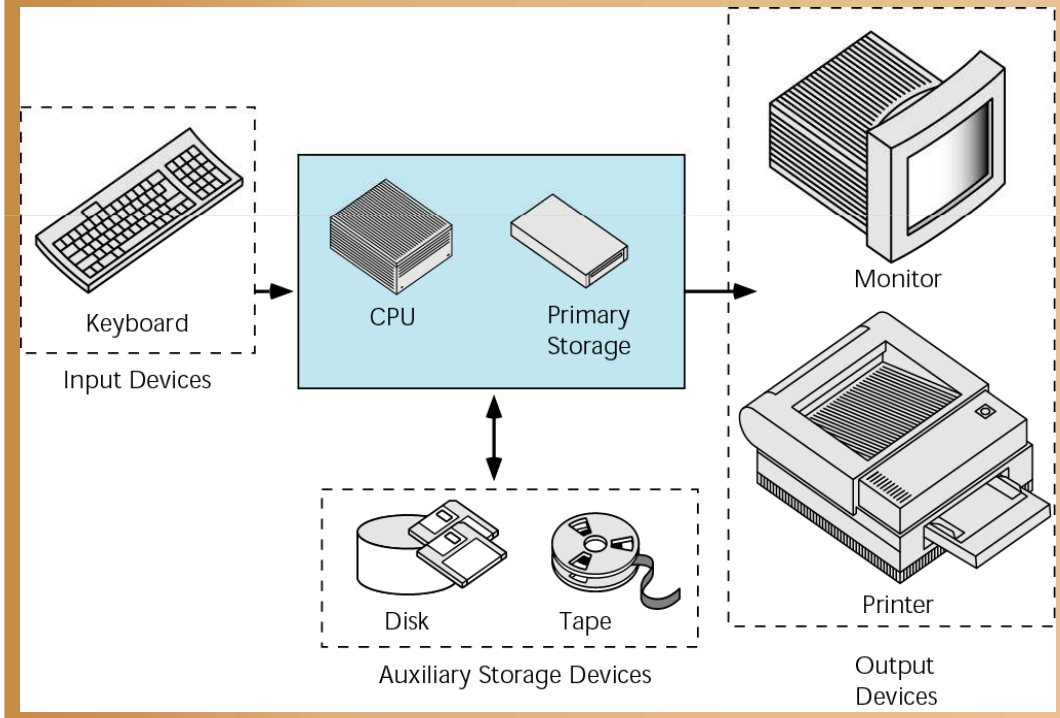


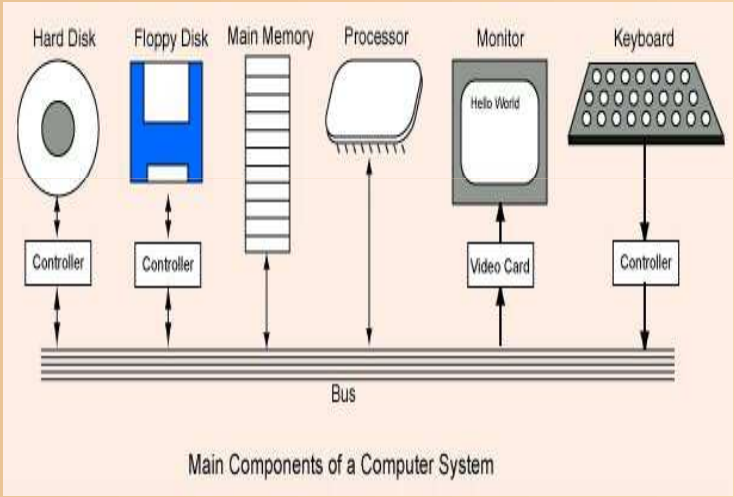
- ***Hardware*** is the electronic and mechanical parts of a computer system.
- ***Software*** is the data and the computer programs of a computer system.

Computer Hardware

Computer hardware is divided into three major Components:

1. The Central Processing Unit (CPU)
2. Computer memory
3. Input/Output (I/O) devices





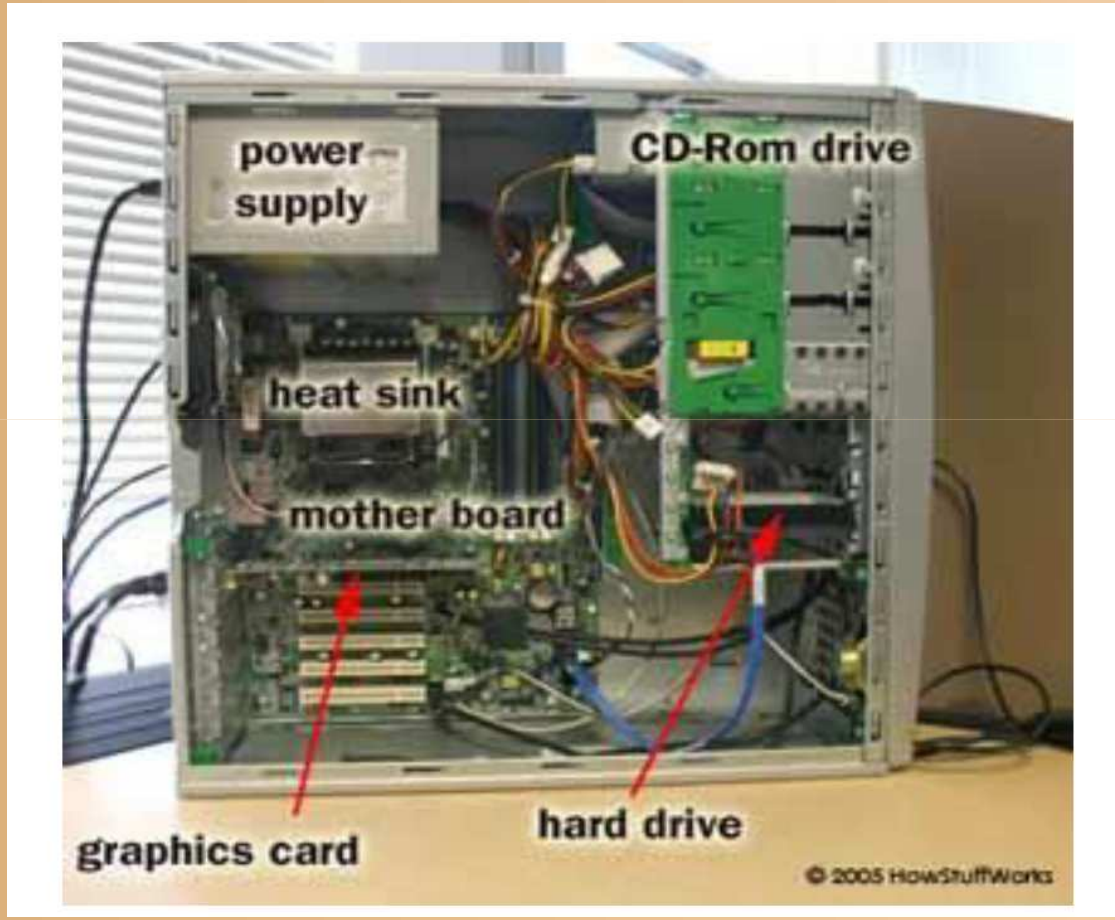
Basic hardware components

Computer Hardware

Main Components of Computer

- **CPU – Central Processing Unit** also called “The Chip”, a CPU, a processor, or a microprocessor
- **RAM – Random Access Memory only Memory**
- **Main Board / Motherboard**
- **Hard Disk and/or other Storage Devices**
- **Power Supply**
- **Input/ Output devices**
- **Peripheral devices**
- The first Four, plus the bus speed, are essential to the understanding of the performance of the computer.

Processing Unit



CPU

- The **CPU** is the "brain" of the computer system.
  - It does the fundamental computing within the system
  - It directly or indirectly controls all the other components
- The **CPU has a limited storage capacity**. It relies on memory to hold data and programs and to save results.
- The performance indicator of the processor is the frequency of operations(Hz).
- There are various types of processors, by different manufactures.
  - Intel
  - AMD

CPU

fan on top of processor

CPU speeds range from 600 megahertz (MHz or million cycles per second) to 4 gigahertz (GHz or billion cycles per second).

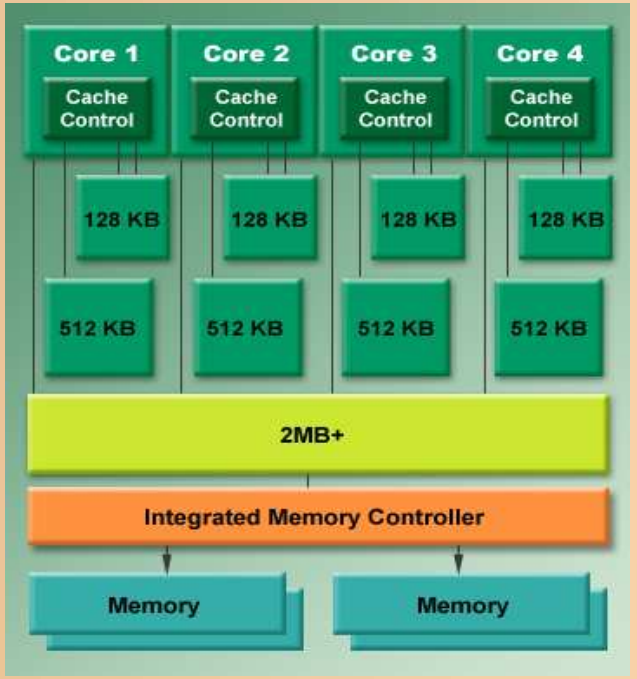
Multi-core systems

- **Multi-Core systems** (ie Intel Core Duo) connect two CPUs together to the same die on the motherboard.
- A dual-core processor with two cores at 2GHz may perform very nearly as fast as a single core of 4GHz
- Intel core i7 – Six cores

Intel Core 2 Duo E6750 is a dual core processor

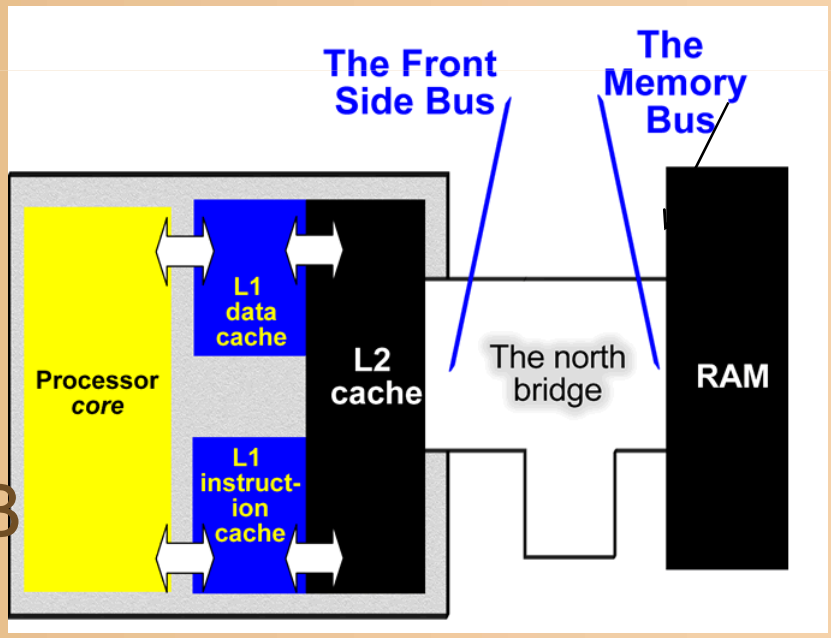
Processing: CPU Cache

- A temporary storage area for frequently/recently accessed data
- A **CPU cache** is a cache used by the central processing unit of a computer to reduce the average time to access memory.
- When the processor needs to read from or write to a location in main memory, it first checks whether a copy of that data is in the cache. If so, the processor immediately reads from or writes to the cache, which is much faster than reading from or writing to main memory.
- Measured in megabytes (MB) or kilobytes (KB), such as 512 KB



Processing: CPU Front Side Bus

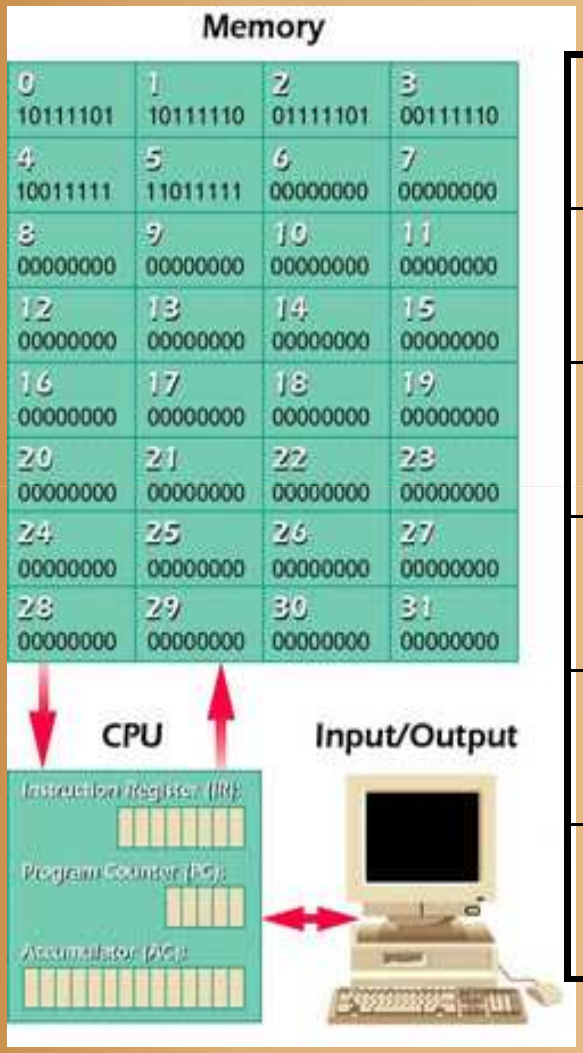
- The connecting path between the processor and other key components such as the memory controller hub.
- Bus speeds are measured in GHz or MHz.
- QPI – Intel “Quick Path Interface – Replaces FSB



Computer Memory

- The main function of computer memory is to **store software**.
- Computer memory is divided into primary memory and secondary memory.
- **Primary memory** is divided into **random access memory (RAM)** and read-only memory (ROM):
  - RAM holds the programs and data that the processor is actively working with.
  - ROM contains software that is used in Input/Output operations. It also contains software that loads the Operating System in Primary Memory.
  - The CPU can read and write to RAM but it can only read from ROM.
  - RAM is *volatile* while ROM is not.
- **Secondary memory** is used for long-term storage of programs and data.
  - Examples of secondary memory devices are: hard disks, floppy disks and CD ROMs.

Primary Memory



UNIT	SYMBOL	POWER OF 2	Number of bytes
Byte		2^0	1
Kilobyte	KB	2^{10}	1,024
Megabyte	MB	2^{20}	1,048,576
Gigabyte	GB	2^{30}	1,073,741,824
Terabyte	TB	2^{40}	1,099,511,627,776

Primary Memory RAM Modules

- "Waiting room" for computer's CPU.
- Holds instructions for processing data, processed data, and raw data.
- Measured in type, size, speed,
  - Size: 1.0 GB +
  - Speed: 600 MHz +

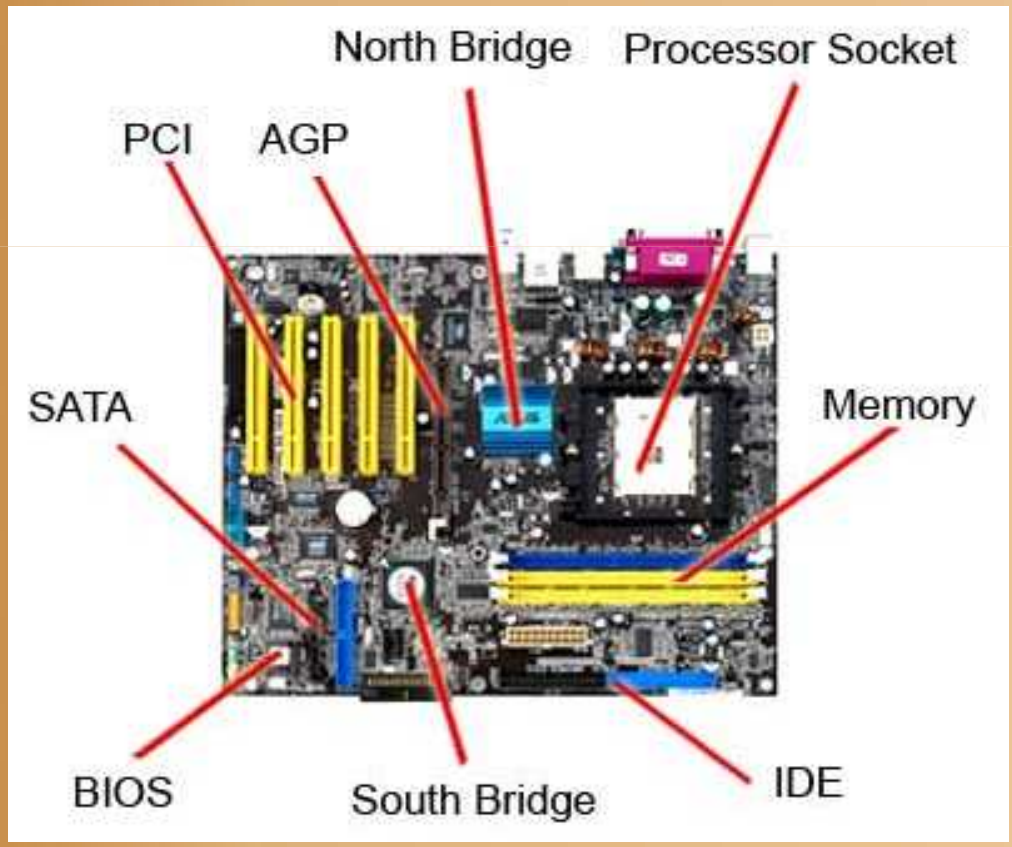
- Amount of RAM installed will determine.
  - Which software applications will run (efficiently)?
  - How many software applications can be open simultaneously (multitasking ability)?

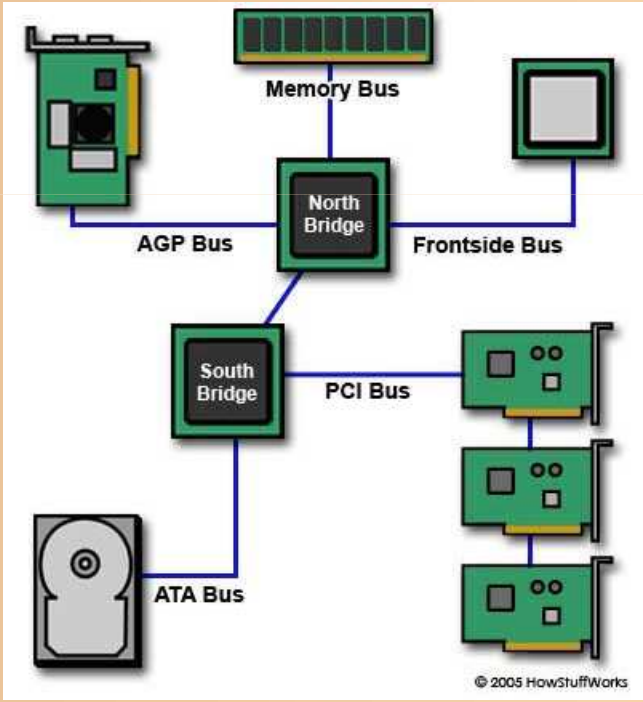
Primary Memory
RAM Modules

Processing:RAM Types

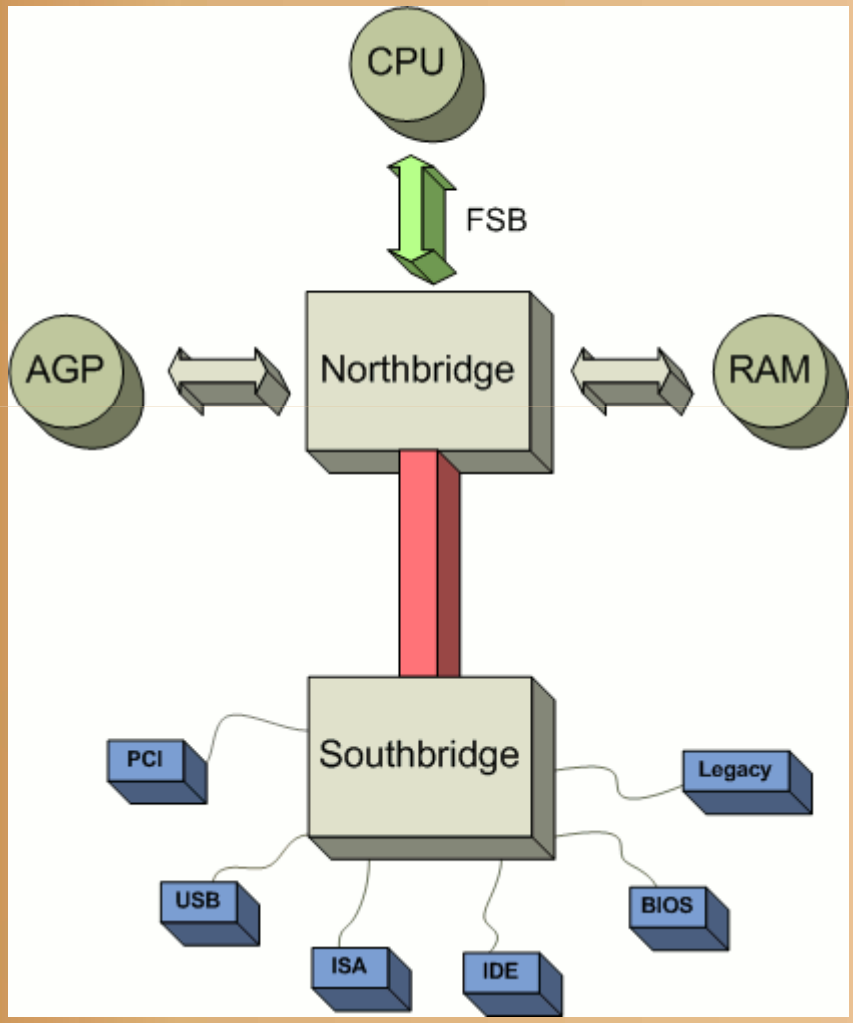
- **DDR SDRAM** (double data rate synchronous dynamic RAM) takes all the features of ordinary SDRAM and increases the frequency bandwidth to improve system performance and speed.
- **DDR2 SDRAM** (double-data-rate two synchronous dynamic random access memory) Its primary benefit is the ability to operate the external data bus twice as fast as DDR SDRAM.
- **DDR3 SDRAM** (double-data-rate three synchronous dynamic random access memory) much faster than DDR2 RAM.

Mainboard / Motherboard





Mainboard / Motherboard



Switching Mode Power Supply (SMPS)

Primary and Secondary Memory Comparison

Primary memory	Secondary memory
Fast	Slow
Expensive	Cheap
Low capacity	Large capacity
Connects directly to the processor	Not connected directly to the processor

Storage Devices

- FDD : Floppy disk
- HDD : Hard disk
- CD-ROM / CD-RW : Compact disk
- DVD : Digital Video disk
- USB Flash disk / pen drive

Hard disk

- **This is a Magnetic storage devices**
  store data by magnetizing particles on a disk or tape. They have a limited life-span of 1 to 5 years, depending on the device.
- Typically permanently installed.
- Used to store operating system, application software, utilities and data
- There are three architectures of disks
  - IDE, PATA, an old system
  - SATA, used in most modern systems
- When a computer can use IDE, you see two forty-pin connectors on the motherboard.
  - These are the primary and the secondary IDE channnels. They are usually labelled.
  - To each channel, you can attach two disks.
    - One is called the master.
    - The other is called the slave.

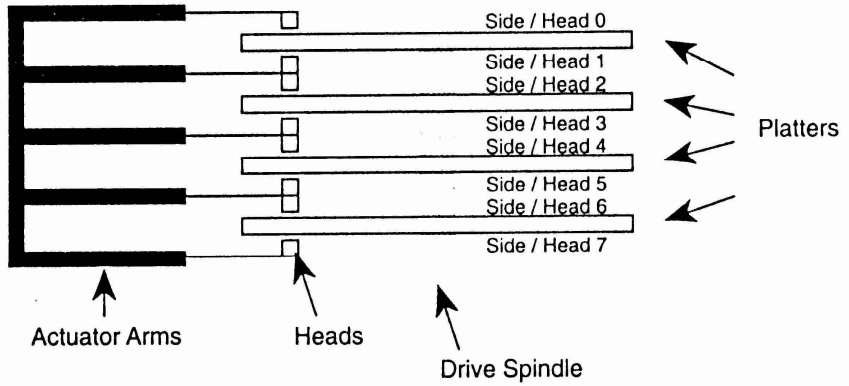
Storage Capacities

Hard disk	80 GB to 2 TB
Compact disk	700 MB
Digital Video disk	4.7 GB
Floppy disk	1.44 MB
USB Flash Disk	1 GB to 128 GB

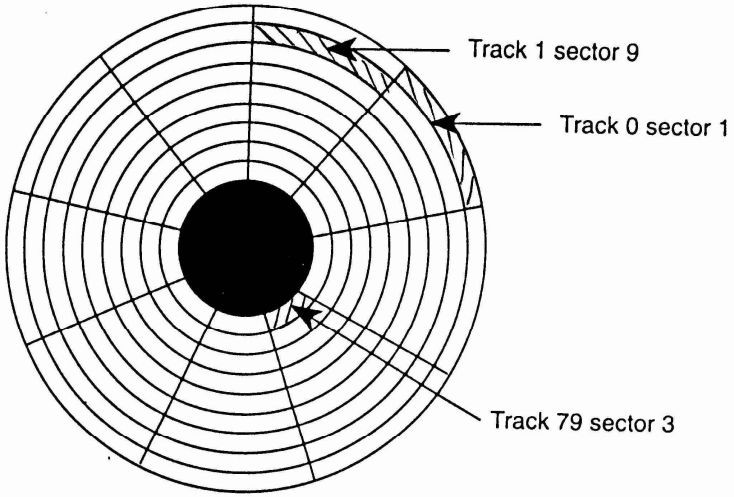
Facts about HDD

Data rate	20 - 30 MB/sec
Interface types	SATA, IDE
Motor speed	10000 rpm
Formatting	FAT, addressing
Partitioning	Multiple OS
Defragmentation	Space utilization

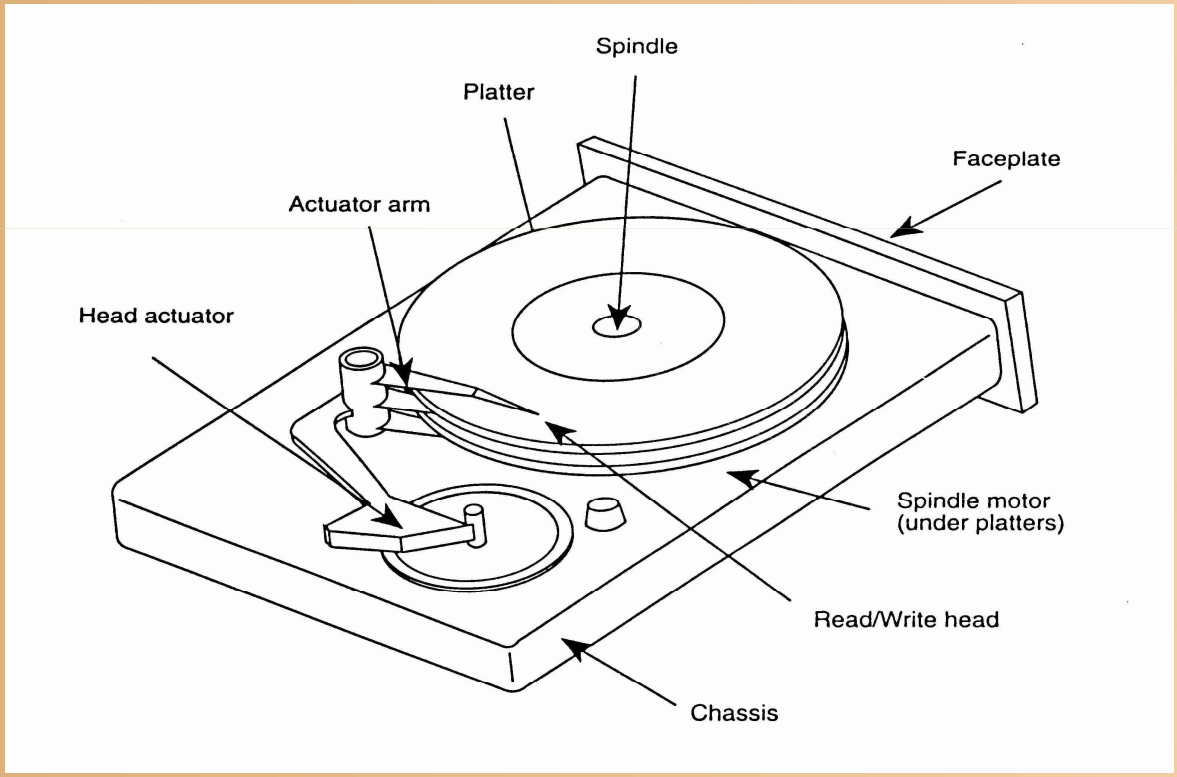
Sectors - Tracks - Cylinders



Arrangement of platters in a hard disk drive



Internal Construction of a HDD



Internal Construction of a HDD

HDD : Platters and Heads

Power and Signal Cables

Optical Disk Drives

Optical storage devices store data as light and dark spots on the disk surface. They have an unlimited life-span.

DVD

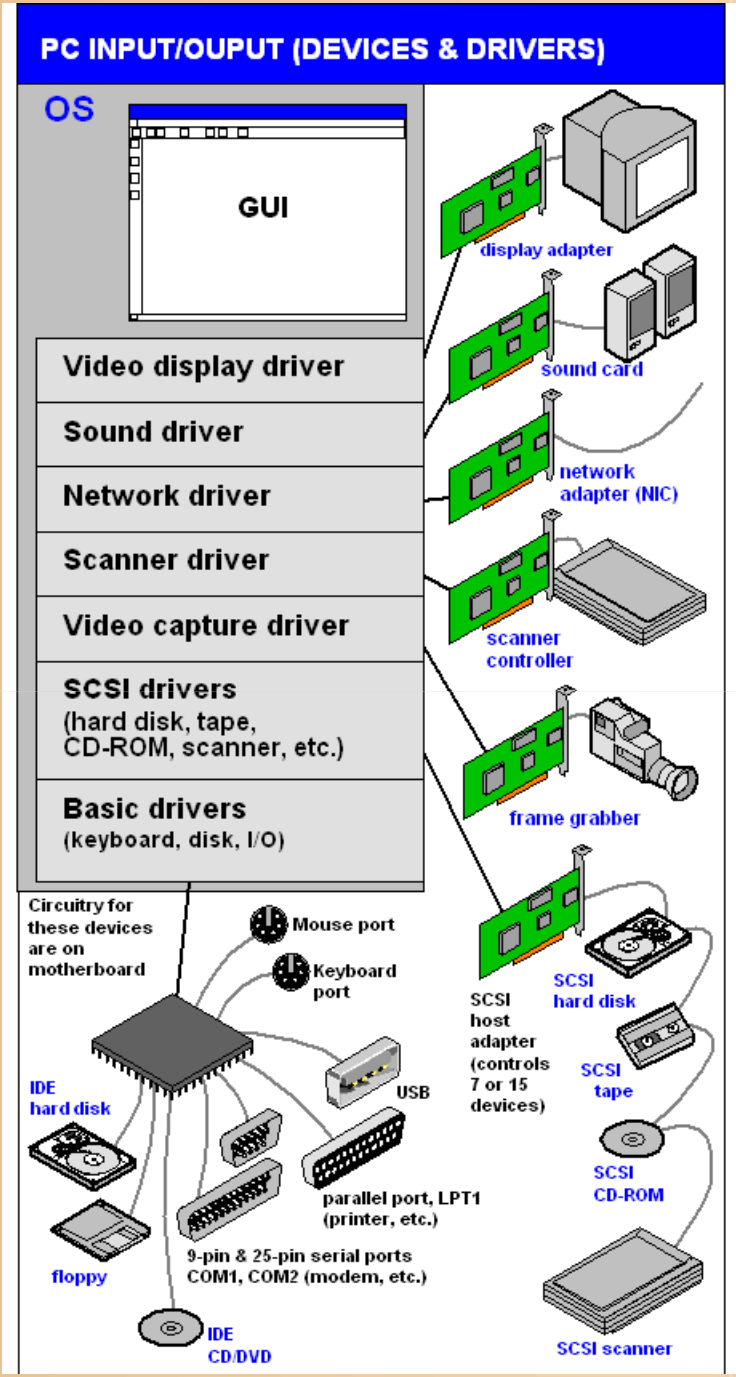
I/O (Input/Output)Devices

- **Input devices** are used to enter programs and data into a computer.
  - **Examples**: keyboard, mouse, microphone, scanner, webcam, digital pen, bar code reader, etc.
- **Output devices** are where program output is shown or is sent.
  - **Examples**: monitor, printer, and speaker.
- An I/O device is directly connected to the System, but through a device controller.

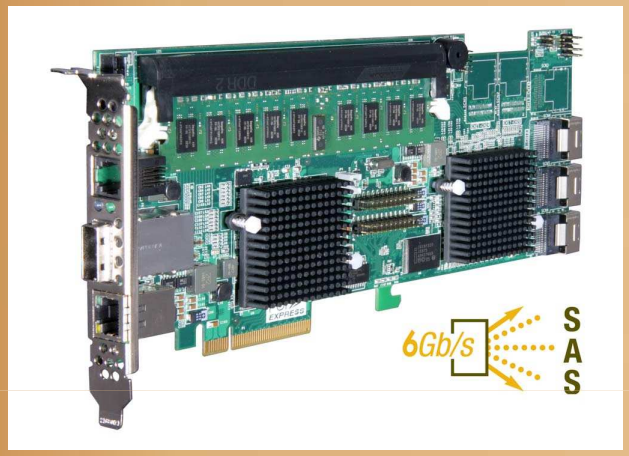
Input/Output devices

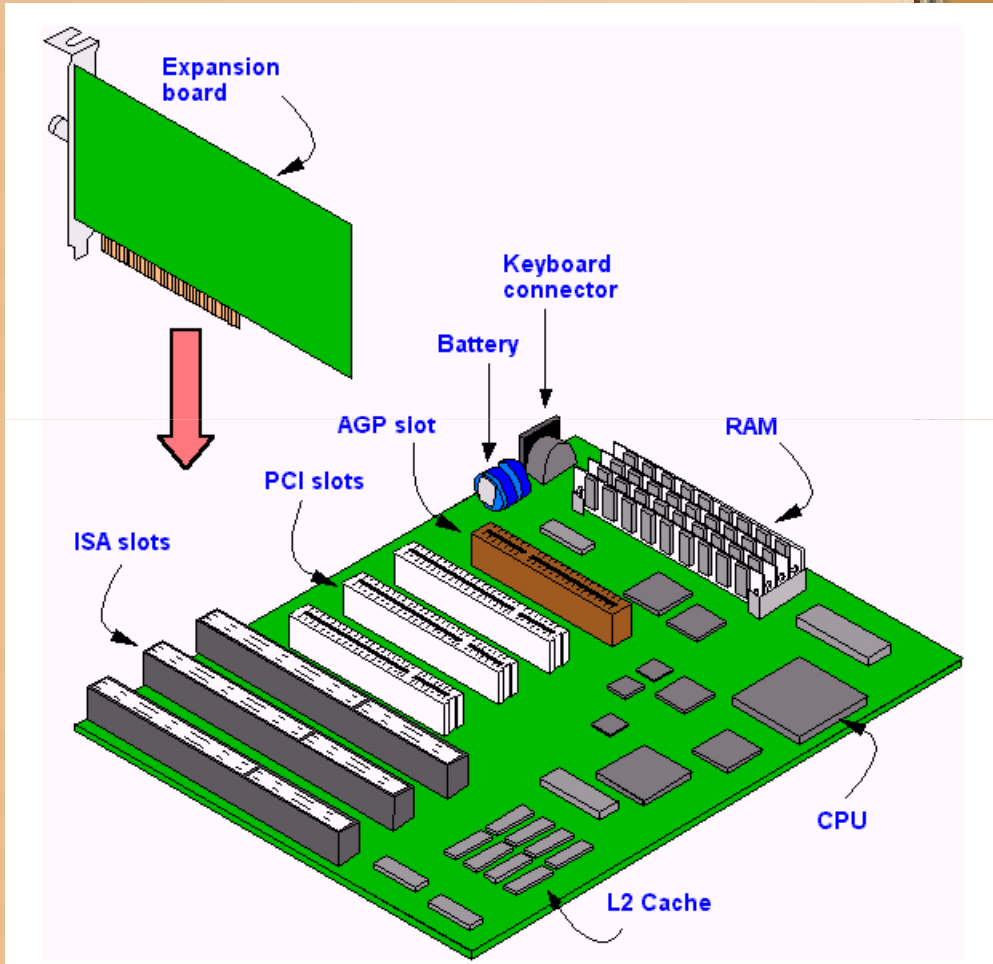
Output devices

Peripheral Devices



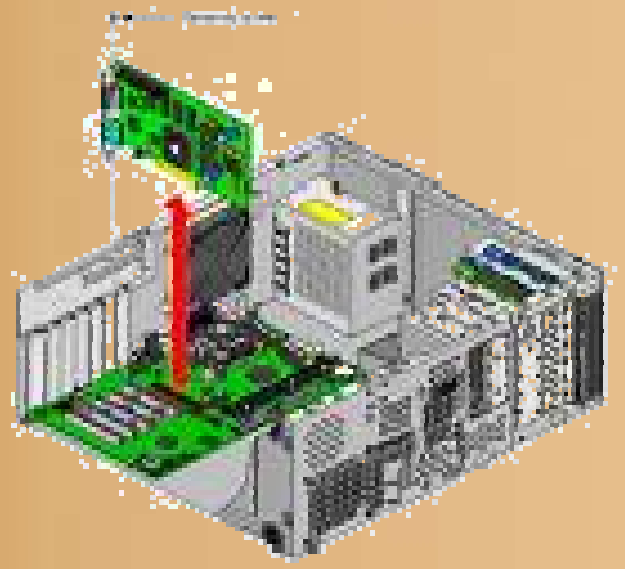
Peripheral Devices

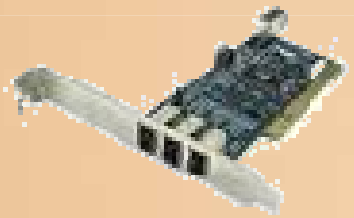




Processing:
Expansion slots and cards

- An **expansion card** is a circuit board that can be inserted into an expansion slot of a motherboard to add additional functionality for video, audio, or other uses:

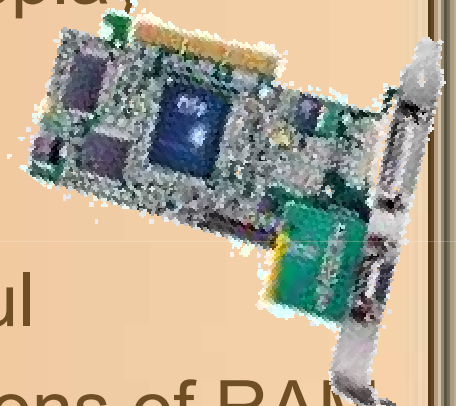




•AGP Slot (for video cards)
•PCI Slots (misc devices and ports)
•PCMCIA (for laptops)

Processing:Video Cards

- Generates and outputs images to a display
- Old Standard = 32 Megabytes
- New = 256 MB – 1GB+
- Dedicated Graphics card most powerful
- Integrated graphics solution uses portions of RAM for graphics



Sound card

- The most important part of sound system of computer is sound card.
- It is a circuit board that converts sound from analog to digital form and vice versa.
- It has both input and output function.

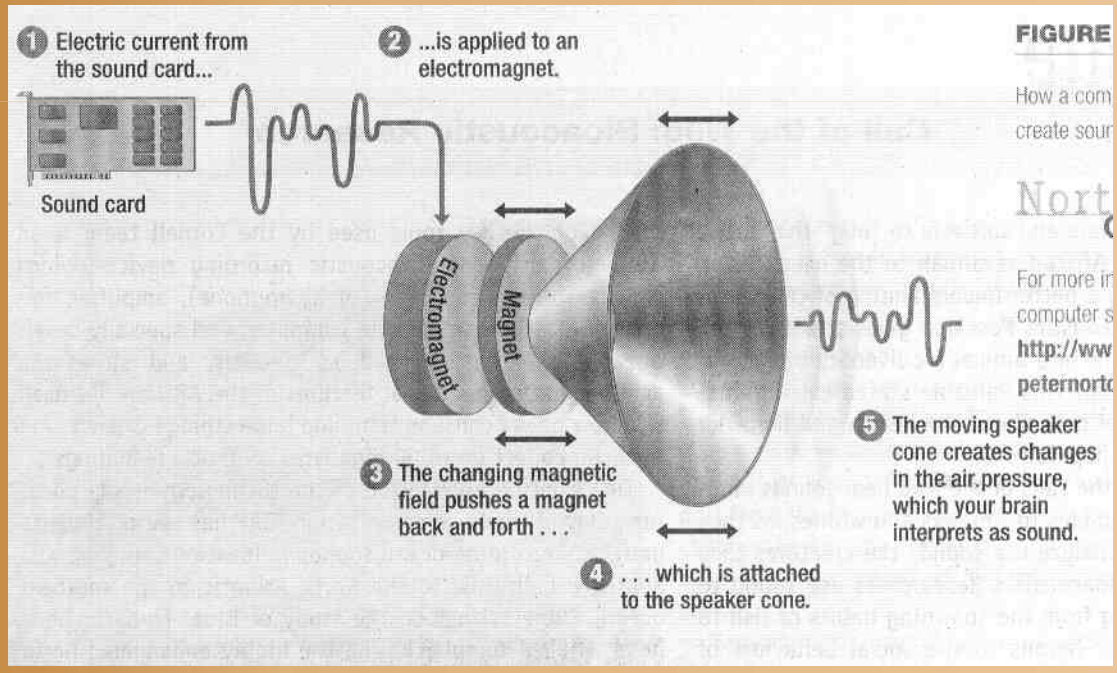


Fig : How a computer uses a speaker to create sound.

THANKS