Welcome to Section 3

Computer Hardware

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Types of Computers

- Personal Computers (PC)
  - In 1981, IBM introduced its first personal computer, termed as the IBM PC
  - It is mostly for personal or individual use
  - It is best for internet surfing, running small applications and playing games
  - You can run Windows, Linux or MAC as an OS.

- Desktop

- Laptops

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Types of Computers

- Workstation
  - A workstation is simply a desktop computer that has a more powerful processor, additional memory, high-end graphics adapters and enhanced capabilities for performing high end tasks
  - Typically, big companies buy these workstations for their employees.

- Notebook
  - They are pretty much same as laptop
  - Notebooks are generally manufactured to be sleeker, smaller computers with screen sizes of 15-inches or less. Typically weighing less than 5 lbs. and measuring less than 3 inches thick
  - Notebooks keep their supreme lightweight portability advantage over laptops.

Personal digital assistant

- Mobile, Handheld or PDA computers
  - A hand-held computer is a portable computer that is small enough to be held in one's hand
  - Examples of handheld computers are smart phones, tablets, ipads etc.
  - These computers are mostly used for very small applications.

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Types of Computers

- Server
  - In computer world there is a client and a server. Client sends a request whereas Server serves that request (e.g. webserver, database server etc.)
  - Servers usually have powerful processors, lots of memory and large hard drives
  - Typically, a server is racked horizontally on a computer shelf at a datacenter
  - Some of the big manufacturers of servers are HP, Dell, Cisco, IBM etc.

- Mainframe
  - In the early days of computing, mainframes were huge computers that could fill an entire room or even a whole floor
  - As the computing power increased in computers the mainframe became more like a server.

- Supercomputer
  - This type of computer usually costs hundreds of thousands or even millions of dollars. Although some supercomputers are single computer systems, most are composed of multiple high-performance computers working in parallel as a single system

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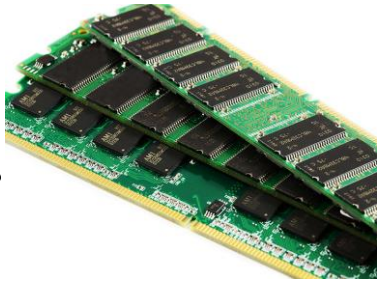
RAM (Memory)



- RAM stands for Radom Access Memory
- The data stored in RAM can be accessed almost instantly regardless of where in memory it is stored, therefore it is very fast. That is why it has the word random in it
- RAM allows your computer to perform many of its everyday tasks, such as loading applications, browsing the internet, editing a spreadsheet, or playing game. Memory also allows you to switch quickly among these tasks, remembering where you are in one task when you switch to another task. As a rule, the more memory you have, the better
- RAM gives applications a place to store and access data on a short-term basis, meaning when a computer shutdown, everything in RAM is flushed. Hard disk is a long-term memory
- If your system has too little RAM, it can be slow and sluggish
- RAM size comes in multiple of 2s (e.g. 2, 4, 8, 16, 32G and so on)

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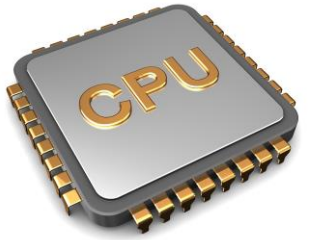
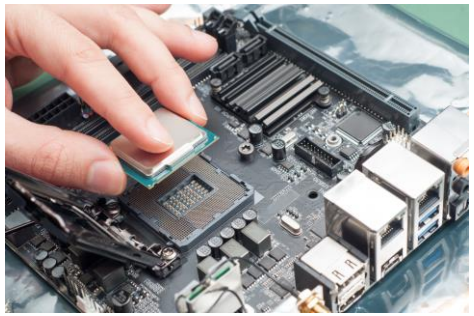
CPU



- CPU stands for Central Processing Unit
- It is a chip that sits on motherboard
- It is the brain of the computer which processes the instructions that come from programs, the operating system, or other components in your PC

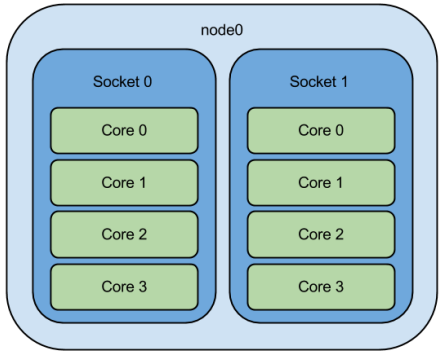


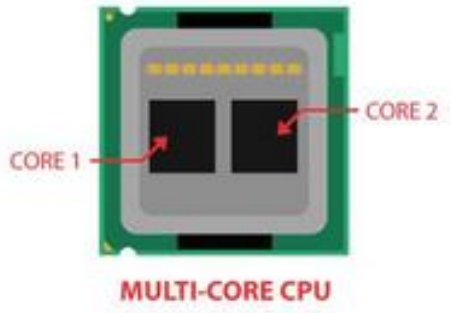
Socket:

- It is the actual socket on the motherboard where CPU resides

Core:

- A multiple CPU which sits on one single socket





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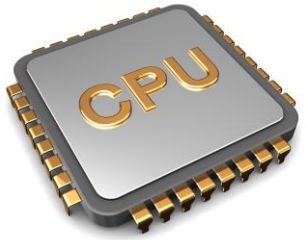
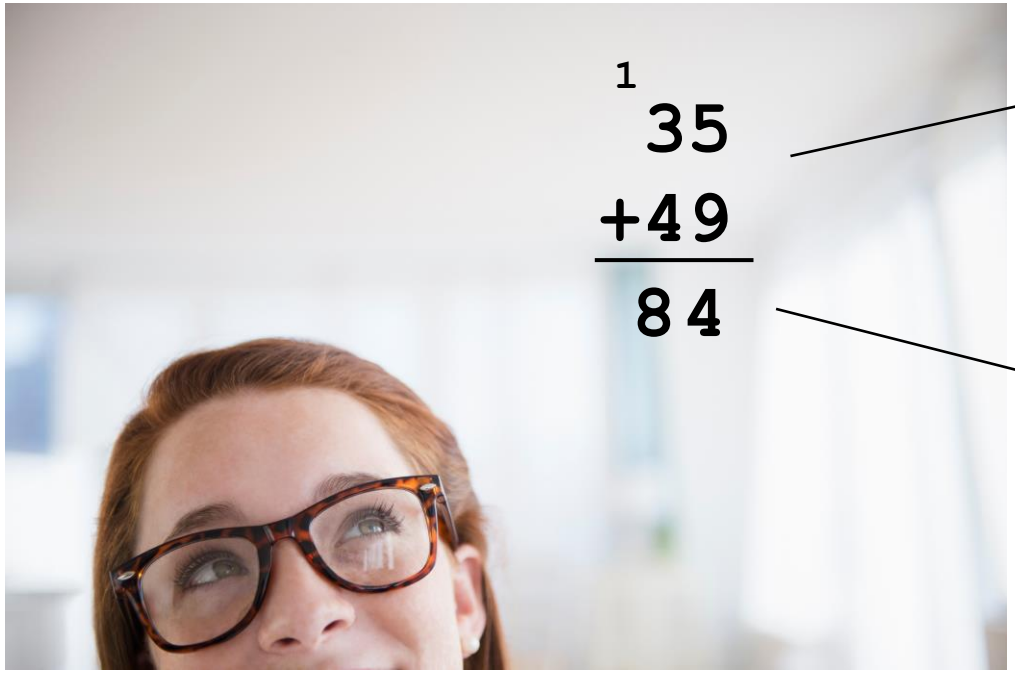
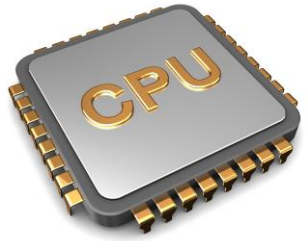
CPU

- 2+2 = 4
- 35+49 = 84





$$\begin{array}{r} {\scriptstyle 1} \\ 35 \\ +49 \\ \hline 84 \end{array}$$



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GPU

- GPU stands for Graphical Processing Unit
- It allows graphics programmers to create more interesting visual effects and realistic scenes with advanced lighting and shadowing techniques
- GPU unlock new possibilities not only in gaming or graphic world but also in content creation, machine learning, AI and much more…
- It is specifically designed to accelerate computer graphics workloads

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GPU

- There are 2 types of GPUs:
  1. **Integrated:**
     - Built into the motherboard and cannot be upgraded or replaced
     - It does not come on its own separate card and is instead embedded alongside the CPU

  2. **Discrete:**
     - It is mounted on a graphics card that attaches onto a computer's expansion slot on the motherboard
     - This kind of graphics card is replaceable so it can be upgraded, this way your computer won't be obsolete
     - The graphic card is like a smaller version of motherboard with its own memory and cooling fan

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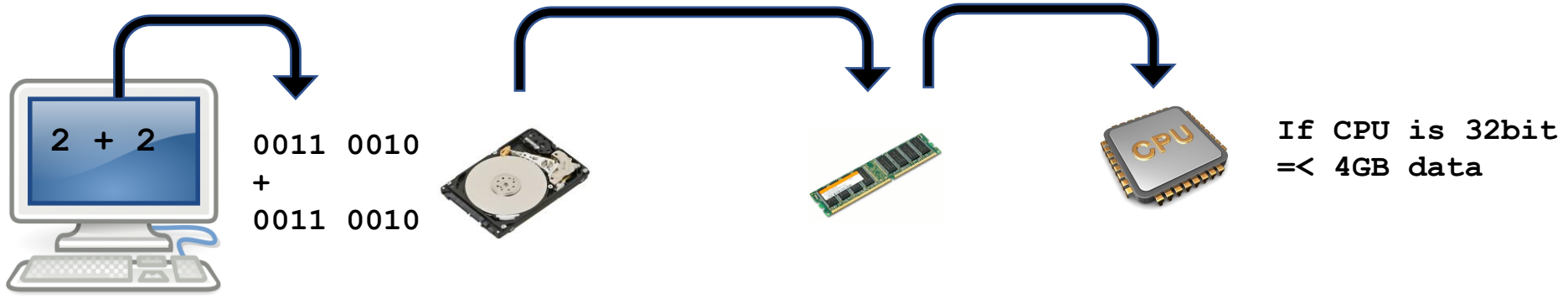
32 vs 64bit Processor

- Processor is same as CPU which processes the instructions that come from programs, the operating system, or other components in your PC
- CPU gets the unit of data from RAM to process it. If your computer is 32bit processor then it can only process 2 power of 32 (2^{32})memory addresses (i.e 4G of RAM)
- In computers there is only binary: 0 and 1. Each one is considered a "bit." That means for 1-bit computing, you get two possible values; 2-bit means four values; then at 3 bits you double that to eight

8 bits = 1 byte

1024 bytes = 1 KB
1024 KB = 1 MB
1024 MB = 1 GB
1024 GB = 1 TB



If CPU is 32bit =< 4GB data

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32 vs 64bit Processor

Power of 2 Expo-nent	Binary Bit Weight in Decimal
2^0	1
2^1	2
2^2	4
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128

History:

- The Intel 8080 chip in the 1970s supported 8-bit computing
- In 1992, Windows 3.1 was the first 16-bit desktop version of Windows.
- AMD shipped the first 64-bit desktop chip in 2003.
- Apple made Mac OS X Snow Leopard entirely 64-bit in 2009
- The first smartphone with a 64-bit chip was the iPhone 5s in 2014

- Keep going exponentially and you eventually get 32-bit (2 to the 32nd power) worth 4,294,967,296 (4.3 billion)
- 64-bit (2 to the 64th power) is worth 18,446,744,073,709,551,616 (18.4 quintillion and change)

$$4{,}294{,}967{,}296 \,/\, 1024 = 4{,}194{,}304 \text{ KB}$$

$$4{,}194{,}304 \,/\, 1024 = 4096 \text{ MB}$$

$$4096 \,/\, 1024 = 4 \text{ GB}$$

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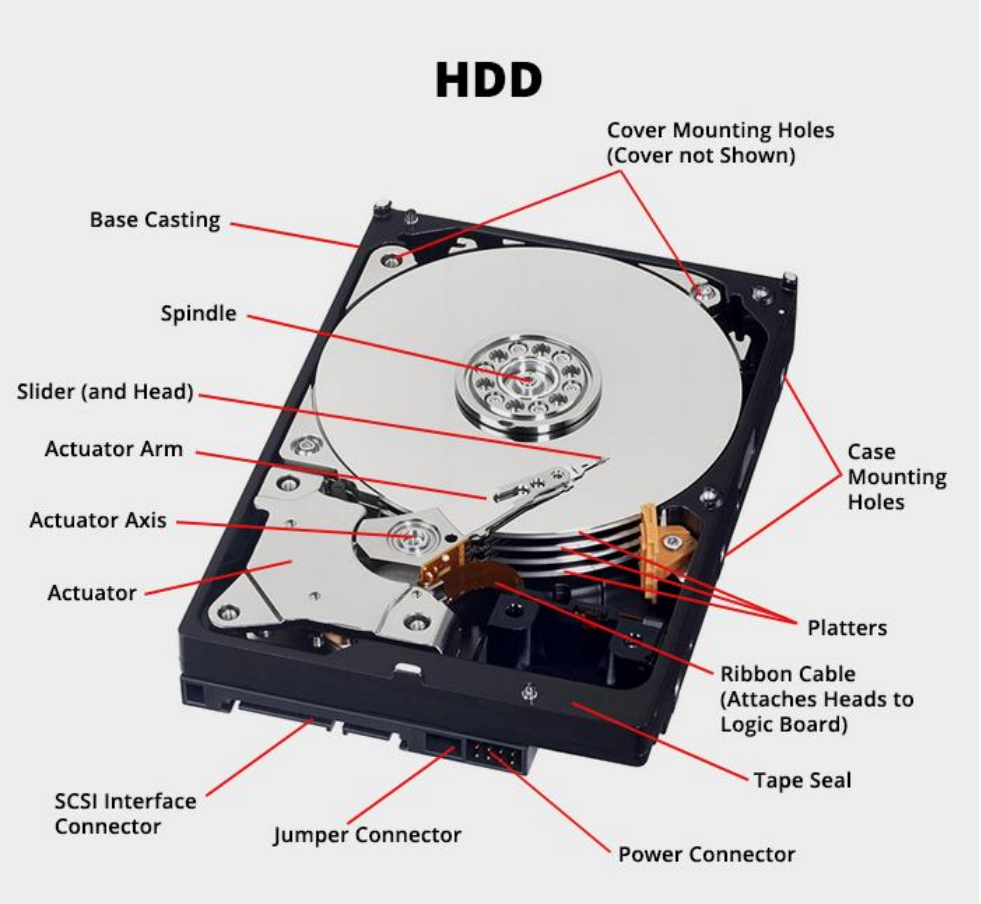
Hard Disk Drive

- A hard disk drive (HDD) is an electromechanical data storage device that uses magnetic storage to store and retrieve digital information using one or more rigid rapidly rotating disks (platters) coated with magnetic material. *(Wikipedia)*

- A hard drive is the hardware component that stores all your digital content, such as documents, pictures, music, videos, programs, applications and operating system

- Hard drives can be external or internal

- It is a long-term memory as opposed to RAM.



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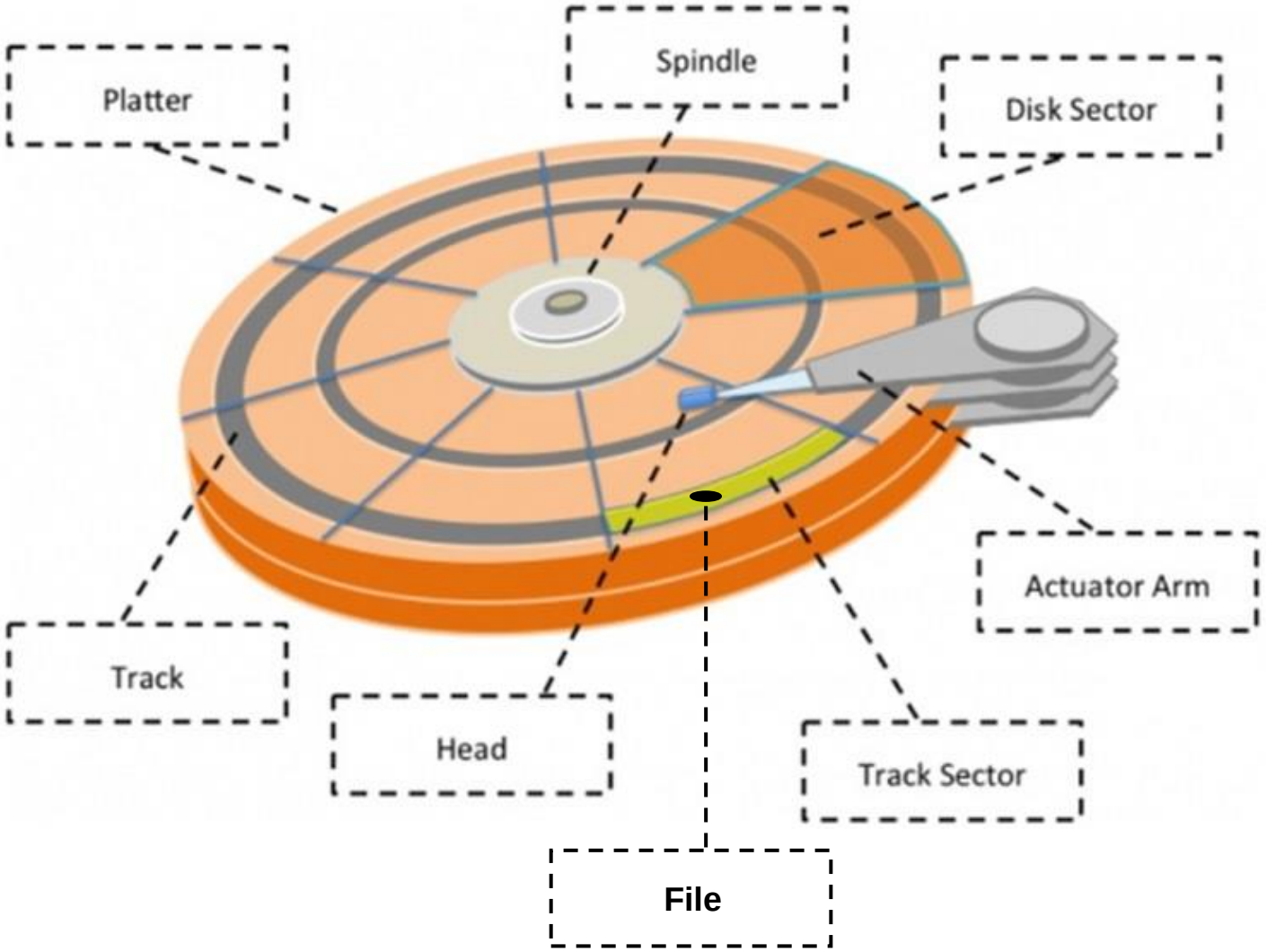
Hard Disk Drive



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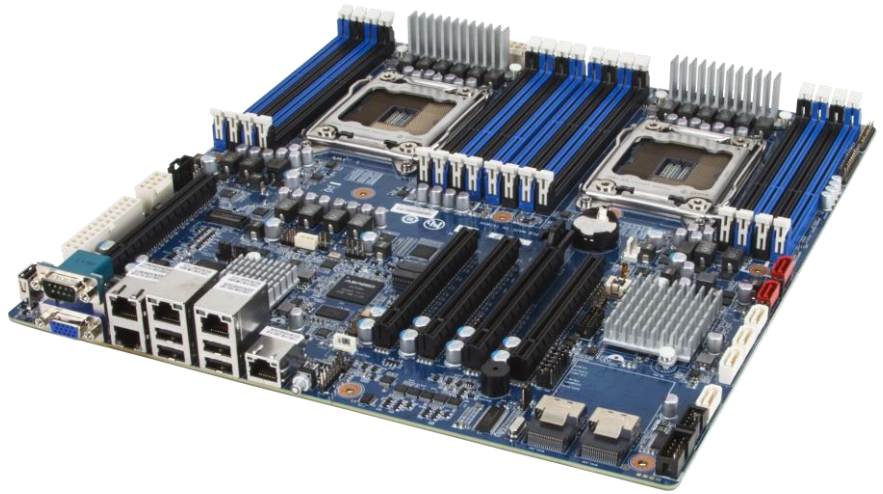
Motherboard

- The motherboard is the backbone that ties the computer's components together at one spot and allows them to talk to each other. It is the main circuit board inside a computer
- It connects the CPU, RAM, HDD, optical drive, video card, sound card and many other internal components
- The motherboard is also responsible to distribute power to the various components of the computer
- It is also referred as main board, system board, logic board etc.



Popular Manufacturers

Following are the popular manufacturers of the motherboard.

- Intel
- ASUS
- Aopen
- ABIT
- Biostar
- Gigabyte
- MSI

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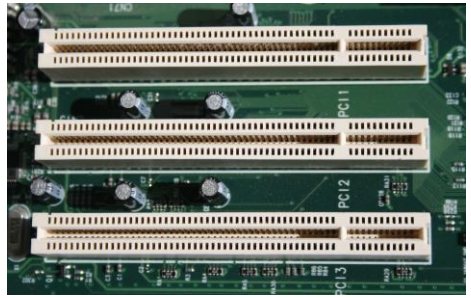
Other Internal Parts of a Computer

- Fans

- Video cards

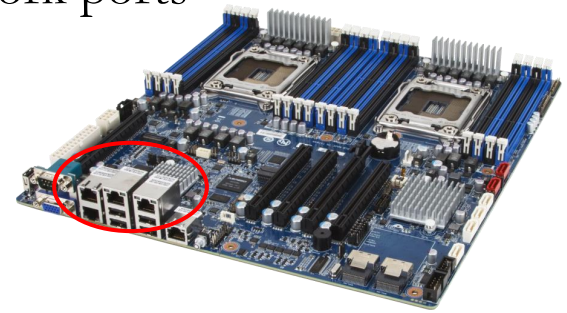
- Power Supply

- PCI expansion slots



- CDROM drive

- Network cards or built-in network ports



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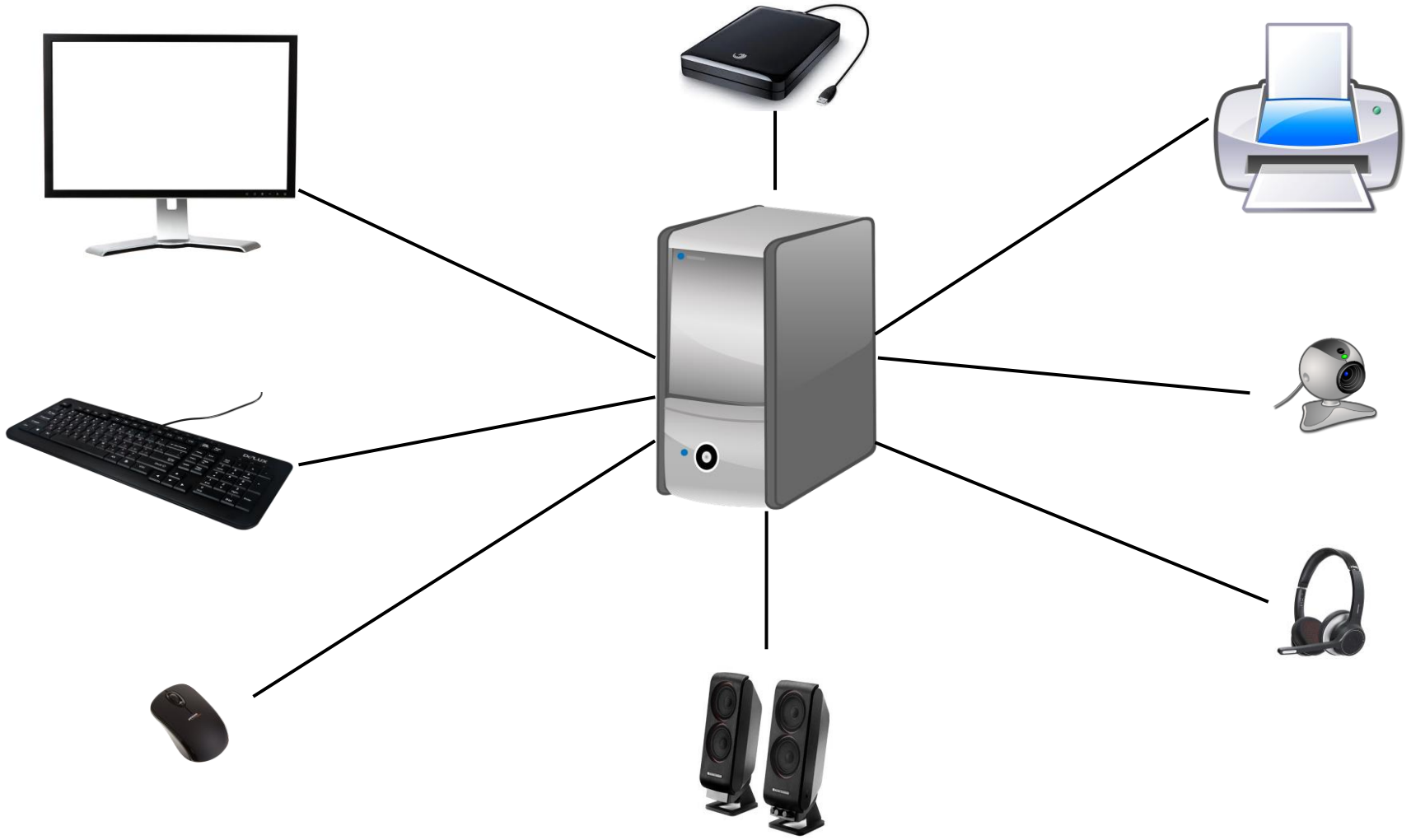
External Components of a Computer



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Hardware Vendors

- **Dell/EMC**
  - Dell is an American multinational computer technology company that develops, sells, repairs, and supports computers and related products and services
  - Founded by Michael Dell in 1984.
- **HP**
  - An American multinational information technology company headquartered in Palo Alto, California, that developed and provided a wide variety of hardware components
  - It merged with Compaq in 2002
  - Founded by David Packard, Bill Hewlett in 1939.
- **IBM**
  - International Business Machines Corporation is an American multinational technology company headquartered in Armonk, New York, with operations in over 170 countries
  - Founded by Charles Ranlett Flint in 1911.
- **Cisco**
  - Cisco Systems, Inc. is an American multinational technology company headquartered in San Jose, California, in the center of Silicon Valley. Cisco develops, manufactures and sells networking and compute hardware, software, telecommunications equipment and other high-technology services and products
  - Founded by Sandy Lerner and Leonard Bosack in 1984.

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Hardware Vendors

- **Oracle**
  - Oracle Corporation is an American multinational computer technology corporation headquartered in Austin, Texas
  - Oracle acquired Sun microsystems in 2009
  - Founded by Larry Ellison, Bob Miner and Ed Oates in 1977.
- **Lenovo**
  - Lenovo Group Limited, often shortened to Lenovo, is a Chinese multinational technology company. Incorporated in Hong Kong
  - Founded by Liu Chuanzhi in 1984.
- **Hitachi**
  - Hitachi, Ltd. is a Japanese multinational company headquartered in Chiyoda, Tokyo, Japan
  - Founded by Namihei Odaira in 1910.
- **Intel**
  - Intel Corporation is an American multinational corporation and technology company headquartered in Santa Clara, California
  - Founded by Gordon Moore and Robert Noyce in 1968
  - Not only they hold the biggest share in CPU market, but they have started manufacturing high-end servers.

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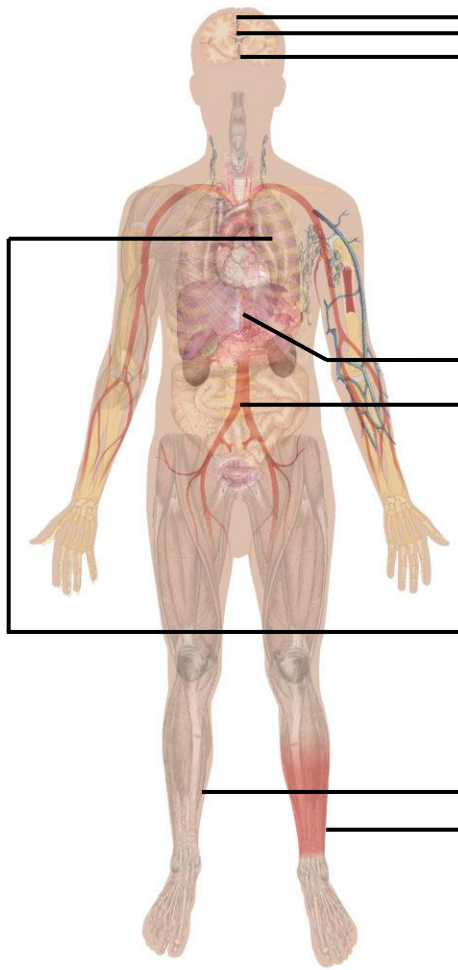
Computer Comparison with Human Body



Long-term memory/HDD

Short-term memory/RAM

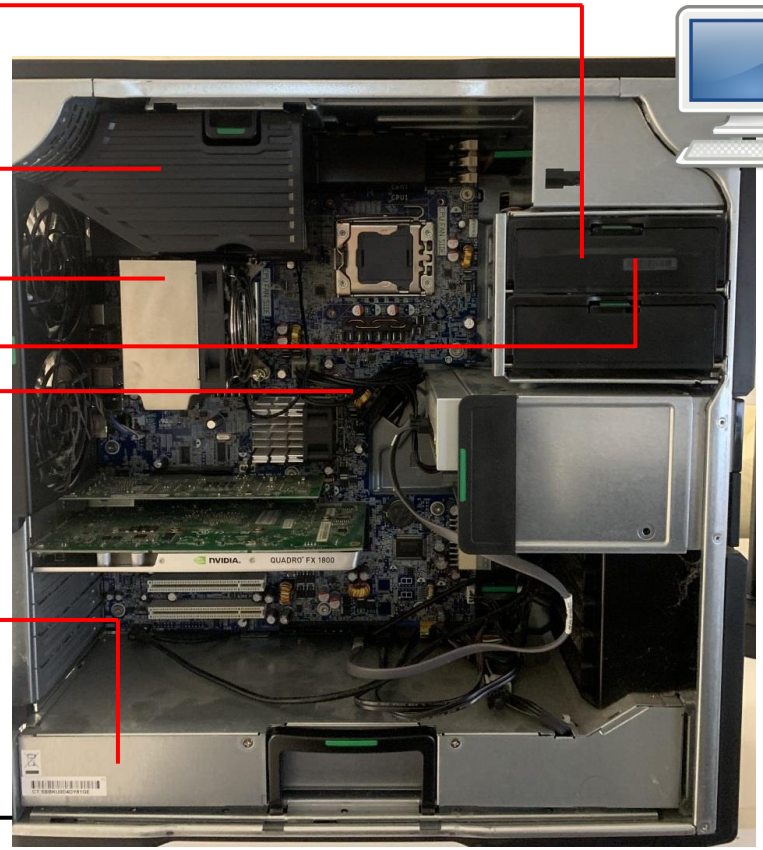
Brain/CPU

Soul/Operating System

Backbone/motherboard

Heart/Power

Body/Chassis



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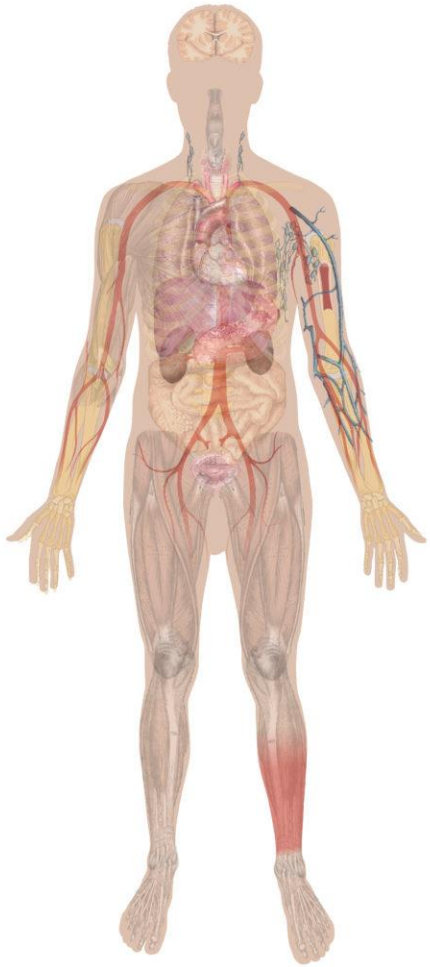
Computer Comparison with Human Body



5 Senses

- Sight = eyes
- Sound = ears
- Touch = Body
- Smell = nose
- Taste = tongue

- Artificial intelligence
- Virtual reality

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Most Common Computer Connection (USB)

- **USB**
  - USB stands for Universal Serial Bus and often referred as plug and play
  - As per Wikipedia, USB is an industry standard that establishes specifications for cables, connectors and protocols for connection, communication and power supply (interfacing) between computers, peripherals and other computers
  - In simple words, a USB connection is a standard connection between a personal computers and most of the consumer electronics devices such as (mouse, keyboard, speakers, storage flash drive, printers and many more…)
  - Ajay Bhatt who was the brain behind the technology worked together with many tech companies and developed USB in 1996
  - It has replaced interfaces such as serial ports and parallel ports
  - One of the advantages of USB connected devices is that the software driver is automatically installed on your PC when connected.

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Common Display Interfaces/Cables

- 6 display interfaces/cables
  - VGA
  - HDMI
  - DVI
  - DisplayPort
  - USB-C
  - Thunderbolt.

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Common Display Interfaces/Cables

- **VGA**
  - VGA stands for "Video Graphics Array". It is an analog interface between a PC and monitor that was widely used prior to DVI, HDMI and DisplayPort
  - VGA was introduced on the IBM PS/2 in 1987
  - It was common to see VGA connectors on televisions, laptops, computer monitors, projectors, and other devices
  - VGA port/cable only carries visual. Another source needs to be connected for audio signals.

  - The port is 15pin **female** D-sub port
  - The 'D' shape ensures that VGA cables will only fit one way round, and it is often colored blue or black.

  - The cable is 15pin **male** D-sub port
  - The computer unit and the monitor both should have female ports in order to use the cable

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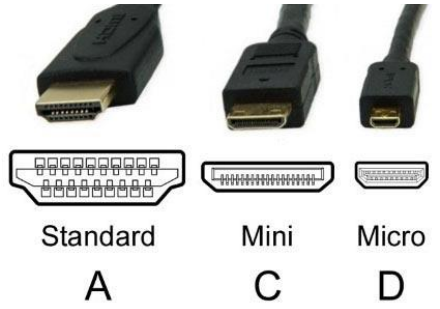
Common Display Interfaces/Cables

- **HDMI**
  - HDMI stands for high-definition Multimedia Interface and is the most frequently used HD signal for transferring both high-definition audio and video over a single cable. The HDMI is mostly found on TVs, video projectors, PC monitors, DVD, Blu-ray, Ultra HD players, cable/satellite boxes, DVRs, home theater receivers, media streamers, game consoles, PCs, laptops, digital cameras, camcorders, and smartphones
  - HDMI is much better than VGA, for several reasons. Not only is HDMI capable of transferring more data it also carries audio.

- **Mini and Micro HDMI**
  - There are 3 type of HDMIs
    - Standard = Type A
    - Mini = Type C *(mostly found on cameras, camcorders and tablets)*
    - Micro = Type D *(mostly found on compact mobile devices such as smartphones)*.



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Common Display Interfaces/Cables

- **DVI**
  - Stands for Digital Visual Interface. It is a video display interface developed by the Digital Display Working Group (DDWG). It is used to connect a video source, such as a video display controller, to a display device, such as a computer monitor

  - It was developed with the intention of creating an industry standard for the transfer of digital video content

  - DVI connection is starting to die out, although it is still on every graphics card, the video signal is basically the same as HDMI, just without the audio
  - Single-link DVI-D connectors have 19 pins (18+1) & dual-link DVI-D connectors have 25 pins (24+1). The more the pins the higher bandwidth and resolution

- **Mini and Micro DVI**
  - There are 3 type of DVIs just like HDMI
    - Standard, mini and micro

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Common Display Interfaces/Cables

- **DisplayPort**
  - The interface is primarily used to connect a video source to a display device such as a computer monitor, and it can also carry **audio**, USB, and other forms of data
  - DisplayPort was designed to replace VGA, and DVI
  - The interface is backward compatible with other interfaces, such as HDMI and DVI, using either active or passive adapters

- **Mini DisplayPort**
  - Early versions of Mini DisplayPort (mDP) can display the same maximum resolution as the original size DisplayPort
  - Newer versions can now carry more bandwidth and provide higher resolution

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Common Display Interfaces/Cables

- **USB-C**
  - Stands for **Universal Serial Bus Type-C.** It is the most advance technology that can be found on most of newer laptops and mobile devices
  - USB-C is a relatively new connector for delivering data and power to and from computing devices
  - When you connect your mobile device to a USB-C computer, you can transfer data such as photo, video, and audio files at up to 10 Gbps
  - USB 3.1 cables can deliver 4K (UltraHD) video, and audio, from your laptop, phone or tablet to your HDTV or monitor
  - The USB-C standards include both DisplayPort and HDMI, so you'll want either a USB-C to HDMI/DisplayPort or, if you have a very new monitor, USB-C to USB-C

- **Thunderbolt**
  - Thunderbolt or thunderbolt-3 ports look the same as USB-C ports, and the connector is physically the same from a plug-in perspective
  - Thunderbolt 3 lets you transfer data at up to 40Gbps. That's twice as fast as the 20Gbps maximum throughput speed of the fastest USB-C ports

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