Introduction to Computer Hardware and Components

Laptop

- Liquid crystal display (LCD)
- Pointing stick
- Keyboard
- AC adapter
- Battery
- Ports
- Speaker
- Video controller
- Hard drive
- NIC
- RAM
- Touchpad
- Headphone jack
- Express Card
- CD/DVD drive
Desktop PC
There are numerous other devices on the market but this is the general list of parts.
What is a Motherboard?

The motherboard serves to connect all of the parts of a computer together. The CPU, memory, hard drives, optical drives, video card, sound card and other ports and expansion cards all connect to the motherboard directly or via cables.

The motherboard can be thought of as the "back bone" of the computer.

The Motherboard is Also Known As:

mainboard, mobo (abbreviation), MB (abbreviation), system board, logic board

Important Motherboard Facts:

Motherboards, cases and power supplies all come in different sizes called form factors. All three must be compatible to work properly together. Motherboards vary greatly in respect to the types of components they support. For example, each motherboard supports a single type of CPU and a short list of memory types. Additionally, some video cards, hard drives and other peripherals may not be compatible. The motherboard manufacturer should provide clear guidance on component compatibilities.

Popular Motherboard Manufacturers:

ASUS, AOpen, Intel, ABIT, MSI, Gigabyte, Biostar

Motherboard Description:

The motherboard is mounted inside the case, opposite the most easily accessible side. It is securely attached via small screws through pre-drilled holes. The front of the motherboard contains ports that all of the internal components connect to. A single socket/slot houses the CPU. Multiple slots allow for one or more memory modules to be attached. Other ports reside on the motherboard which allows the floppy drive, hard drive and optical drive to connect via ribbon cables. Small wires from the front of the computer case connect to the motherboard to allow the power, reset and LED lights to function. Power from the power supply is delivered to the motherboard by use of a specially designed port.

Also on the front of the motherboard are a number of peripheral card slots. These slots are where most video cards, sound cards and other expansion cards are connected to the motherboard.

On the left side of the motherboard (the side that faces the back end of the case) are a number of ports. These ports allow most of the computer's external peripherals to connect such as the monitor, printer, keyboard, mouse, speakers, phone line, network cable and more. Most motherboards also include USB and FireWire ports here that allow compatible devices to connect to your computer when you need them - devices like digital still and video cameras.
The motherboard and case are designed so that when peripheral cards are used, the sides of the cards fit just outside the back end, making their ports available for use.
**Ethernet Port**

*Ethernet port* is a network hardware interface used for data transfer and control between at least two devices that can support the IP protocol. It was introduced in 1980 and, at first, coaxial cable was used. In 1985 the *Ethernet port* was standardized and twisted pair cable replaced the coaxial cable. In our days twisted pair cable is used only on short distances, like the connection between a computer modem port or network port and an Ethernet switch or router. On long distances fiber optic links are used as Ethernet cable.

The *Ethernet port* speed can vary 10Mbps up to 10Gbps. High speeds are usually used in large data transfer networks like a CCTV IP network or cable company but in the last case high speed is only obtained between switches or routers in most cases the client receives only 10 or 100 Mbps.
The maximum Ethernet cable length between switches computers and routers is 100 meters or 328ft. After this the signal starts losing in amplitude and you could experience connection loss. If you want to use internet cables on longer distances it is better to use signal boosters for every 100 meters. A more efficient way is to use fiber optic cable who with special equipment can go up to 20 km without any signal booster.

USB Port

**USB port** (Universal Serial Bus) is the most used connection point for data transfer in the world. It was created in the mid-1990s with the intention of replacing all other PC ports like **serial port**, **parallel port**, PS/2 port. A standard usb connector is a simple socket with 4 pins: one for power, one for ground and two for data transfer.
ESATA Port

In computing, eSATAp (also known as Power over eSATA, Power eSATA, eSATA/USB Combo, eSATA USB Hybrid Port (EUHP)) is a combination connection for external storage devices. An eSATA or USB device can be plugged into an eSATAp port. The socket has keyed cutouts for both types of device to ensure that a connector can only be plugged in the right way. SATA is a computer bus interface for connecting host bus adapters to mass storage devices such as hard disk drives and optical drives. eSATA is a SATA connector accessible from outside the computer, to provide a signal (but not power) connection for external storage devices.

eSATAp combines the functionality of an eSATA and a USB port, and a source of power in a single connector. eSATAp can supply power at 5 V and 12 V.

On a desktop computer the port is simply a connector, usually mounted on a bracket at the back accessible from outside the machine, connected to motherboard sources of SATA, USB, and power at 5 V and 12 V. No change is required to drivers, registry or BIOS settings and the USB support is independent of the SATA connection.
DVI Port

DVI port is used to connect a monitor or other display device to a video transmitter. DVI stands for Digital Visual Interface and was created to transmit uncompressed digital video signal.

VGA PORT

The vga port is used for connecting a computer to a monitor. It was introduced in 1987 by IBM and was the replacement of MDA, CGA and EGA standards. The VGA connector has 15 pins displayed on three rows and for connecting a monitor to a computer you need a vga cable.
HDMI Port

HDMI port or High Definition Multimedia Interface is used for uncompressed digital video/audio transmission to a display device like a computer monitor or TV. HDMI 1.4 build for high HD resolutions supports a maximum of 4096×2160.

Firewire Port

Firewire port or IEEE 1394 was first developed in 1990 by Apple and worked as a serial bus interface for high speed data transfer. The standard was first introduced on computers in 2000 and became the main data connection port for apple.

IEEE 1394 (AKA Firewire, I-Link)

6-pin

4-pin
**PS2 Port**

The **PS2 port** is used for connecting keyboards and mice to a PC. This standard was introduced in 1987 by IBM with main purpose of replacing the serial keyboard and mouse.

PS2 connector color code
Purple – Keyboard
Green – Mouse

**Serial Port**

**Serial port** is an electronic communication gateway used for transferring data one bit at a time.

Together with **parallel port** the **serial port** was used almost for all type of information transfer between a computer and other peripheral devices. Today the **serial port** has been replaced with dedicated ports like **usb port** (used for data transfer and communication between a computer and other devices), **vga port** (video data communication), **Ethernet port** or internet port (used for network communication; any type of information).
Parallel Port

Parallel port is used for data transfer between a computer and a peripheral device through a 25 or 36 pin connector. If the serial port transferred data one bit at a time in parallel communication multiple bits are transferred at a time. By using the IEEE 1284 standard the parallel port becomes a bidirectional data gateway (can be used for transferring and receiving data packages).

Central Processing Unit (CPU)

What is a CPU?

The Central Processing Unit (CPU) is responsible for interpreting and executing most of the commands from the computer’s hardware and software.

The CPU could be considered the "brains" of the computer.

The CPU is Also Known As:

processor, computer processor, microprocessor, central processor, "the brains of the computer"

Important CPU Facts:

Not all central processing units have pins on their bottom sides, but in the ones that do, the pins are easily bent. Take great care when handling, especially when installing onto the motherboard. Each motherboard supports only a certain range of CPU types so always check with your motherboard manufacturer before making a purchase.
Popular CPU Manufacturers:

Intel, AMD

CPU Description:

A modern CPU is usually small and square with many short, rounded, metallic connectors on its underside. Some older CPUs have pins instead metallic connectors.

The CPU attaches directly to a CPU "socket" (or sometimes a "slot") on the motherboard. The CPU is inserted into the socket pin-side-down and a small lever helps to secure the processor.

After running even a short while, modern CPUs can get very hot. To help dissipate this heat, it is necessary to attach a heat sink and a fan directly on top of the CPU. Typically, these come bundled with a CPU purchase.

Other more advanced cooling options are also available including water cooling kits and phase change units.

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ROM (Read Only Memory)

It is a chipset on the motherboard called non-volatile memory that contains the BIOS program. It refers to special memory used to store programs that boot the computer and perform diagnostics. Most personal computers have a small amount of ROM (a few thousand bytes)

BIOS

Short for Basic Input/Output System, the BIOS, ROM BIOS, or System BIOS is a chip located on all motherboards that contain instructions and setup for how your system should boot and how it operates. In the below picture, is an example of what a BIOS chip may look like on your computer motherboard. In this example, this is a picture of an early AMIBIOS, a type of BIOS manufactured by the AMI. Another good example of a BIOS manufacturer is Phoenix.
The BIOS includes instructions on how to load basic computer hardware and includes a test referred to as a POST (Power On Self Test) that helps verify the computer meets requirements to boot up properly. If the computer does not pass the POST, you will receive a combination of beeps indicating what is malfunctioning within the computer.

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**RAM (Random Access Memory)**

RAM (pronounced ramm) is an acronym for random access memory, a type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes. RAM is the most common type of memory found in computers and other devices, such as printers.

**Types of RAM**

There are two different types of RAM:

- **DRAM (Dynamic Random Access Memory)**
- **SRAM (Static Random Access Memory)**

The two types of RAM differ in the technology they use to hold data, refreshed with DRAM being the more common type. In terms of speed, SRAM is faster. DRAM needs to be thousands of times per second while SRAM does not need to be refreshed, which is what makes it faster than DRAM.

DRAM supports access times of about 60 nanoseconds, SRAM can give access times as low as 10 nanoseconds. Despite SRAM being faster, it's not as commonly used as DRAM because it's so much more expensive. Both types of RAM are volatile, meaning that they lose their contents when the power is turned off.
Two types of DIMMs: a 168-pin SDRAM module (top) and a 184-pin DDR SDRAM module (bottom). Note that the SDRAM module has two notches on the bottom edge, while the DDR1 SDRAM module has only one. Also note that both modules have 8 RAM chips, but the lower one has an unoccupied space for a 9th.

A DIMM or dual in-line memory module comprises a series of dynamic random-access memory integrated circuits. These modules are mounted on a printed circuit board and designed for use in personal computers, workstations and servers. DIMMs began to replace SIMMs (single in-line memory modules) as the predominant type of memory module as Intel P5-based Pentium processors began to gain market share.

While the contacts on SIMMs on both sides are redundant, DIMMs have separate electrical contacts on each side of the module. Another difference is that standard SIMMs have a 32-bit data path, while standard DIMMs have a 64-bit data path. Since Intel's Pentium many processors have a 64-bit bus width, requiring SIMMs installed in matched pairs in order to
populate the data bus. The processor would then access the two SIMMs in parallel. DIMMs were introduced to eliminate this practice.

The most common types of DIMMs are:

- 72-pin SO-DIMM (not the same as a 72-pin SIMM), used for FPM DRAM and EDO DRAM
- 100-pin DIMM, used for printer SDRAM
- 144-pin SO-DIMM, used for SDR SDRAM
- 168-pin DIMM, used for SDR SDRAM (less frequently for FPM/EDO DRAM in workstations/servers, may be 3.3 or 5 V)
- 172-pin MicroDIMM, used for DDR SDRAM
- 184-pin DIMM, used for DDR SDRAM
- 200-pin SO-DIMM, used for DDR SDRAM and DDR2 SDRAM
- 204-pin SO-DIMM, used for DDR3 SDRAM
- 214-pin MicroDIMM, used for DDR2 SDRAM
- 240-pin DIMM, used for DDR2 SDRAM, DDR3 SDRAM and FB-DIMM DRAM
- 244-pin MiniDIMM, used for DDR2 SDRAM

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**Hard Drives**

Copy link and paste in a browser to watch video of inside of hard drive as it spins


What is a Hard Disk Drive?:

The hard disk drive is the main, and usually largest, data storage device in a computer. The operating system, software titles and most other files are stored in the hard disk drive.

**The Hard Disk Drive is Also Known As:**

HDD (abbreviation), hard drive, hard disk, fixed drive, fixed disk, fixed disk drive
Important Hard Disk Drive Facts:

The hard drive is sometimes referred to as the "C drive" due to the fact that Microsoft Windows designates the "C" drive letter to the primary partition on the primary hard drive in a computer by default.

While this is not a technically correct term to use, it is still common. For example, some computers have multiple drive letters (e.g. C, D, E) representing areas across one or more hard drives.

Popular Hard Disk Drive Manufacturers:

Seagate, Western Digital, Hitachi

Types of Hard Drives;

SCSI

(sku4ze) Short for small computer system interface, a parallel interface standard used by Apple Macintosh computers, PCs and many UNIX systems for attaching peripheral devices to computers. Nearly all Apple Macintosh computers, excluding only the earliest Macs and the recent iMac, come with a SCSI port for attaching devices such as disk drives and printers. SCSI interfaces provide for data transmission rates (up to 80 megabytes per second). In addition, you can attach multiple devices to a single SCSI port, so that SCSI is really an I/O bus rather than simply an interface.
ATA

(Also known as IDE) is a disk drive implementation that integrates the controller on the disk drive itself. ATA is used to connect hard disk drives, CD-ROM drives and similar peripherals and supports 8/16-bit interface that transfer up to 8.3MB/s for ATA-2 and up to 100MB/s (ATA-6).

So, what do parallel interfaces have to do with SAS (Serial Attached SCSI) and SATA (Serial ATA)? A lot, actually it is the architectural limitations of the parallel interfaces that serial technologies like SAS and SATA address. In contrast to multiple parallel data stream, data is transmitted serially, that is in a single steam, by wrapping multiple bits into packets and it is able to move that single stream faster than parallel technology.

Serial Attached SCSI (SAS)

Abbreviated as SAS, Serial Attached SCSI, an evolution of parallel SCSI into a point-to-point serial peripheral interface in which controllers are linked directly to disk drives. SAS is a performance improvement over traditional SCSI because SAS enables multiple devices (up to 128) of different sizes and types to be connected simultaneously.
with thinner and longer cables; its full-duplex signal transmission supports 3.0Gb/s. In addition, SAS drives can be hot-plugged.

Serial ATA (SATA)

Often abbreviated as SATA, Serial ATA is an evolution of the Parallel ATA physical storage interface. Serial ATA is a serial link — a single cable with a minimum of four wires creates a point-to-point connection between devices. Transfer rates for Serial ATA begin at 150MB/s. Starting with SATA, it extends the capabilities of ATA and offers transfer rates starting at 150MB/s and, after years of development, has moved to the mainstream of disk interfaces. The successor the SCSI interface is SAS at speeds of up to 3Gb/s. Additionally, it also addresses parallel interface issues such as drive addressability and limitations on the number of device per port connection. SAS devices can communicate with both SATA and SCSI devices (the backplanes of SAS devices are identical to SATA devices). A key difference between SCSI and SAS devices is the addition in SAS devices of two data ports, each of which resides in a different SAS domain. This enables complete failover redundancy. If one path fails, there is still communication along a separate and independent path.
How to differentiate between SATA and PATA

**2.5” Laptop drives**
- **SATA**
  - SATA Data
  - SATA Power
- **PATA**
  - 44 pin data + power

**IDE ribbon cable**

**SATA Data cable**

**Desktop 3.5” drives**
- **SATA Power**
- **Data**
- **PATA 40 pin Data**
  - 4 pin Molex power