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Description of a Motherboard

General Description

A motherboard is a printed circuit board that connects a computer's central processing unit (CPU), graphics processing unit (GPU), memory (also known as random access memory (RAM), hard disks, networking cards, sound, and any other expansion cards together. It can come in any size from small form factor information technology extended (ITX) all the way up to full tower extended advanced technology extended (E-ATX) motherboard. A motherboard one would buy would depend on what CPU and features a person may need.

Description of Major Parts

As Figure 1 shows, the major parts of a motherboard are the CPU socket, expansion slots, memory slots, chipset, back input/output (I/O), front I/O, and other various ports that are connection points for different items like hard drives, power, and various other ports. All these parts are essential to the computer and are described below.

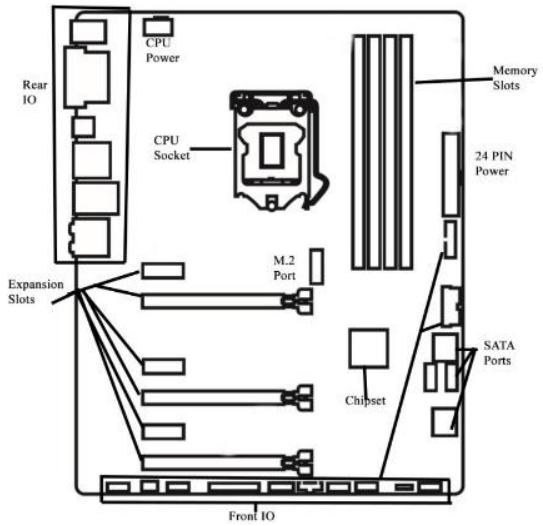

Figure 1: ATX Motherboard

Source: Micro-Star International. C236a Support Manual. Taipei: Que. 2015, p.1.

CPU Socket

The central processing unit (CPU) socket is where the "brain" of the computer is located. It is known as the CPU socket (which securely holds the CPU down), for which there are two distinct types: pin grid array (PGA) (where the pins are on the CPU and the contact points are in the socket) and land grid array (LGA) (where the pins are on the socket and then the CPU has contact points. CPU Sockets can also come in sizes from 168 pins from the original Intel 8086 CPU all the way up to 4094 pins with the AMD Ryzen Threadripper and AMD Epyc families of CPUs in 2018

Expansion Slots

The expansion slots (also known as peripheral component interconnect-express (PCI-E) Slots) enable a user to add components internally to a computer. Components like networking card, video cards, redundant array of independent disks (RAID) cards, universal serial bus (USB) cards, and many more types of cards connect to these slots. The largest slot is the PCI-E 16x, slot

and the smallest is a PCI-E 4x slot. It is important to that there are enough PCI “lanes” on the CPU to support all the expansion; most consumer ones have 22 PCI lanes, while professional and server CPUs may now have 68 or more lanes.

Memory Slots

These slots are responsible for holding the memory known as random access memory (RAM). Memory temporarily stores data for short-term usage. The more RAM a computer has, the faster it will run depending on the application because it has adequate space to store data. The standard of RAM in 2018 is DDR4.

Back I/O

The purpose of the back input/output (I/O) ports is to allow the user to connect external peripherals to the back of the computer. Devices like keyboards, mice, thumb drives, printers, and much more can be connected.

Front I/O Headers

These are used to connect the ports and buttons from the front of the PC to the motherboard, so these ports become operational. There are headers for front audio and USB ports, activity light emitting diodes (LEDs), and Power/Reset buttons.

Other Ports

Other ports may be located around at other points around the motherboard. Ports like the ATX 24 pin connector which is used for power to the motherboard. There is also serial advanced technology attachment (SATA) ports for connecting a user’s hard disk to the PC. The CPU receives power from a 4 or 8 pin power connector measuring 12 volts typically. Finally, a newer

slot called an m.2 slot that is used for solid state drives (SSDs) which has a much higher bandwidth compared to the SATA ports may be present on newer motherboards.

Chipset

A chipset manages the data flow on the traces (the thin wires on the motherboard) to the various components on the motherboard. There are usually extra features on the chipset like having the instructions for the motherboard for functions such as disk control, audio, and networking so these features can work without having an extra PCI-E card in the system.

Operation of a Motherboard

When an operator inputs a command, it travels from the input device (keyboard, mouse, and or touchscreen) it flows from the device to the USB ports. Then the command goes to the USB controller which sends it to the chipset. The chipset will take the command and then push it to the CPU. The CPU will do its processing of the command producing a result. The result is then sent to the chipset. The chipset then will send the result to an output device (display, printer, and or speakers). This all happens using thin wires called traces on the motherboard at speeds that are instantaneous to the user.