IT Fundamentals

Unit - Hardware

Lesson 2.3.1 - Internal Computing Components

IT Fundamentals Objectives (FC0-U61)

Objective 2.3 - Explain the purpose of common internal computing components

- Motherboard/system board
- Firmware/BIOS
- RAM
- CPU
    - ARM
        - Mobile phone, Tablet
    - 32-bit
        - Laptop, Workstation, Server
    - 64-bit
        - Laptop, Workstation, Server
- Storage
    - Hard drive, SSD
- GPU
- Cooling
- NIC
- Wired vs. Wireless, On-board vs. add-on card

Grade Level(s)

8, 9

Cyber Connections

- **Hardware & Software**

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Internal Computing Components

Building a Computer 101

One of the (personal) joys of learning about computers is being able to build one. There are a variety of necessary internal components that personal computers need to be able to function. The *motherboard* is like the nervous system of the computer. All other internal components are connected to the motherboard. Electrical signals are conducted through it and without the motherboard, nothing else functions.

Every motherboard has a chip on it with a setup program embedded on it. This chip is the motherboard's *firmware.* Most modern systems come with Unified Extensible Firmware Interface (UEFI) firmware but older systems (and a small portion of current systems) use Basic Input Output System (BIOS) firmware.

Another critical part of a computer is *random access memory (RAM)*. RAM is like the conscious part of the brain, provided memory that can be accessed at random (hence what the name suggests). Individual motherboards are only capable of handling one type of RAM. Some of the most common types of RAM include DDR3 (very commonly used in today's laptops) and DDR4 (very commonly used in today's desktops).

The next necessary part of the computer is the *central processing unit (CPU).* The CPU is analogous to the spinal cord. This is a chip on the motherboard responsible for processing instruction. The two primary manufacturers of CPUs are Intel and AMD. Intel traditionally names their CPUs "Celeron, Pentium, and Core" whereas, AMD uses names such as "Sempron, Athlon, and Phenom".

The unconscious part of the brain, necessary for storing memories would be like that of the *hard drive/solid state drive.* These components are responsible for long-term storage of data. The difference between an HDD and SSD is that a hard drive uses solid disks of magnetic material turning at high speeds to store and retrieve programs (relatively similar to a phonograph record) while a solid state drive has no moving parts, instead it uses circuit boards and chips (similar to "playing around with electrons").

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Teacher Notes:

In order to display something on a monitor, a *graphics processing unit (GPU)* is needed. For basic computing, i.e. internet browsing, word documents, etc., an integrated GPU (part of the CPU) is sufficient, but for gaming, video editing, etc., a dedicated GPU is necessary. The two major manufacturers of GPUs are Nvidia and AMD. Nvidia tends to provide more powerful (and thus more expensive) units while AMD typically has less powerful (more affordable) units.

Just like how the human body needs to regulate heat (not too hot, not too cold), computers function the same. There are two options for cooling, air and liquid cooling. The CPU and GPUs generate a lot of heat. A heatsink will be placed directly on the unit and either a fan is placed on the heatsink to allow air to "pull" the heat away or a "loop" is built where liquid coolant is used to draw heat away from the component and then transferred to a radiator, much like that of a car radiator. Cases themselves will have fans to help push out any hot air trapped within the computer or pull in the cooler surrounding air.

Finally, (and this one is optional) if you want to connect to the Internet/some local area network, you will need a *network interface card (NIC).* An NIC can be either wired, allowing for a wired ethernet connection, or wireless, allowing for Wi-Fi (or both). Some motherboards already include this on-board, whereas others require an add-on card to be able to gain network access.

How It's Made: CPUs

The foundations for a processor or core come from what is commonly referred to as *ARM architecture.* Sometimes written Arm, it previously stood for Advanced RISC Machine, and originally for Acorn RISC Machine. The ARM architecture is used in the integration of System-on-Chip (SoC) devices such as smartphones, microcomputers, embedded devices, and even servers.

We have previously discussed the differences between 32-bit and 64-bit. This applies to CPUs. Most desktop computer CPUs today are 64-bit. As of MacOS Catalina, users have lost support for 32-bit applications. Windows with 64-bit CPUs are still able to run 32-bit programs by emulation (not in the sense of you opening a virtual machine, but as a background process). WOW64 is the x86 emulator that allows 32-bit Windows-based applications to run seamlessly on 64-bit Windows.

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