**Week 03 Journal - Class Handouts + Chapter 6 from A+ textbook** Seraphim Gerber

At the heart of every computer is a special motherboard chip called the processor, also known as a CPU or microprocessor, which mainly determines the power of the computer. The processor executes instructions, performs calculations, and coordinates input/output operations that work with electronic chips for exact specifications.

Processors come in a variety of speeds, measured in gigahertz (GHz). One gigahertz is 1 billion cycles per second, or 1GHz. Today’s processors run at speeds near 5GHz. The number of bits processed at one time is the processor’s register size or word size. Today’s CPUs have register sizes of 64 or 128 bits.

Processors operate on binary code, 1s and 0s. The 1s and 0s travel from one place to another inside the processor and outside to other chips with electric lines called buses. Inside the CPU, these buses are called the internal data bus or system bus. Every line carries one 1 or one 0, meaning 16 lines carries 16-bits. Today’s processors have 64 or 128 internal data bus lines.

For a CPU to communicate with external devices such as a printer, the 1s and 0s travel on an external data bus, or external data path. This external data bus connects processors to adapters, such as the keyboard, mouse, hard drive, and other devices. External data lines are seen by looking at expansion slots on the motherboard.

A processor has a special component called the arithmetic logic unit (ALU), which does all the calculations and comparison logic that the computer needs. It connects to the registers, control unit, and internal bus. The control unit coordinates activities in the processor. The I/O unit manages the data entering and leaving the processor. The registers in the CPU make up a high-speed storage area for 1s and 0s before the bits are processed.

In relation to processor speed, registers are an important concept. Registers can temporarily hold calculations, data, or instructions. The data or instructions needed by the CPU to operate on is usually found in cache memory, the motherboard memory, or the hard drive. Cache memory is a very fast type of memory designed to increase the speed of processor operations. When data continuously flows into the CPU, CPU efficiency is increased. Cache provides the fastest access. If the information isn’t cached, the processor searches for the data in the motherboard RAM.

To control the transfer of 1s and 0s to and from the processor, the motherboard generates a clock signal. Data is sent four times during a single clock cycle, displayed by a sine wave.

Computer users interested in improved video performance can buy a separate video adapter containing a GPU. GPUs contain hundreds of small core processors.

Keeping the CPU cool is critical. Many technologies reduce processor energy consumption by turning off unused parts of the processor or slowing the processor down when it begins to overheat. Unfortunately, these measures alone aren’t enough. Today’s systems use several methods to cool down such as heat sinks, fans, thermal pastes, liquid cooling, or passive cooling.

The principal chips on the motherboard that work in conjunction with the processor are known as a chipset. A chipset allows certain features on the computer, such as controlling the maximum amount of motherboard memory, the type of RAM chips, the motherboard’s capacity for two or more CPUs, and whether the motherboard supports the latest version of PCIe.

The chipset is a square integrated circuit that looks similar to a processor. Normally, chipsets are soldered to the motherboard and often covered with a heat sink. Chipsets usually go with a particular processor and determine the memory chips a motherboard can have.

**The chapter portrays pipelines as an unquestioned benefit, but can you think of any downsides to pipelining, or any scenarios where pipelining may not be effective?**

Designing the pipelined processor can be complex and the throughput is difficult to predict. The longer the pipeline is, the worse the problem of a hazard is for branch instructions.

**Consider the tasks you typically use your personal computer for. Would you benefit more from increasing the amount of cache/RAM (faster access, but more expensive) or disk storage (slower, but cheaper)?**

I would benefit more from disk storage as I have no necessity for speed since I use my PC mainly for video editing and social games.