CGS 3269 - COMPUTER SYSTEMS ARCHITECTURE

SPRING 2002

Basic Components of the PC Architecture

There are five key parts to a computer. These include:

- The Processor (also called the Central Processing Unit or CPU)
- The Memory (of which there are several types)
- The Input / Output circuitry
- Disk storage
- Programs

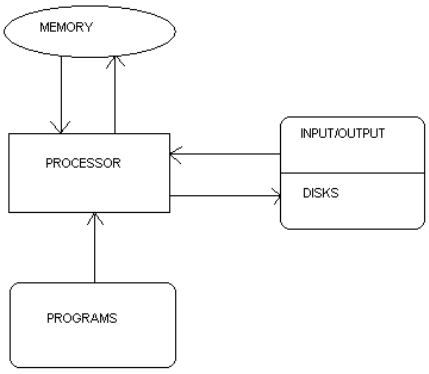

Figure 1: The major components of a PC

There also are other components that form part of the packaging and support for these basics, such as the power supply, the motherboard, and the peripheral cards.

The Processor

The purpose of the processor is to carry out a series of steps called a program. To carry out this job, the processor has certain capabilities. The first capability is the ability to read and write information in the computer's memory. This is critical because both the program instructions that the processor carries out, and the data on which the processor works are stored in the computer memory. The next capability is to recognize and execute a series of commands or instructions provided by the programs. The last is the capability to tell the other parts of the computer what to do so that the processor can orchestrate the operation of the computer.

Memory

Memory is where the computer's processor finds programs and data when it is doing its assigned task. The computer's memory is just a temporary space (like a scratch pad or a chalkboard) where the computer scribbles while work is being done. Unlike our memories, the computer's memory is not a permanent repository. Instead, the computer's memory simply provides a place where computing can happen.

While the computer's processor makes a vital distinction between programs and data, the computer's main memory does not. To the computer's memory (and to many other parts of the computer) there is no difference between programs and data – both are information to be recorded temporarily.

Note: ***Most of today's systems come with dedicated processor cache memory which, for reasons of speed optimization, does distinguish between data that is program code and data that is the user's content. However, your computer's main RAM, which is what*** **memory** ***refers to in general, makes no such distinction.***

Input/Output Devices

The processor and the memory by themselves make up a closed world. I/O devices open that world and enable it to communicate with us. An I/O device is anything, other than memory, with which the computer communicates. These devices include the keyboard, the display screen, the mouse, the printer, a telephone line connected to the computer, and any other channel of communication into or out of the computer. It also includes the circuitry that manages the video images on your monitor, or plays sounds on your computer speakers; even if that circuitry is built onto the motherboard. Taken together, I/O is the computer's window on the world – the thing that keeps the processor and memory from being a closed and useless circle.

Disk Storage

Disk storage refers to the *non-volatile memory* that does not change or disappear when the power goes off. The processor can write to it and read from it at will, but nonvolatile memory will keep whatever data is stored in it for months, or even longer, without any external power whatsoever.

Note: ***Memory, in general, can be classified into two categories:***

- **Volatile *memory and,***
- **Non-volatile *memory***

In volatile memory, the computer system must use power, and dedicated circuitry to constantly rewrite (or refresh) every piece of data that is stored in memory. If this refreshing did not occur, the data in memory would simply fade away. This susceptibility to lose data (in a power loss, or even a power drop, such as a brownout) is called* volatility*. An example of volatile memory would be your system's RAM.

In non-volatile memory the data stored does not change or disappear when the power goes off. The non-volatile memory will keep whatever data is stored in it for months, or even longer, without any external power whatsoever. An example of non-volatile memory would be your computer's hard drive.

Programs

Programs tell the computer what to do. There are two categories of programs:

- Systems Programs
- Application Programs

All programs accomplish some kind of work. Systems programs help operate the computer itself; in fact, the inner systems of a computer are so complex that you can’t get them to work without the help of systems programs. An application program carries out a task, which you, the user, wants done, whether it’s composing a document, or surfing the Internet.

A few of the systems programs that the PC needs to manage its operations are permanently built into it. These can be called the ROM programs or firmware because they are permanently stored in read-only memory (unlike re-writeable memories, like RAMs or hard drives). These kinds of system programs do the most fundamental kind of supervisory and support work, such as providing essential services that all the application programs use. These service programs are called the Basic Input/Output System, also referred to as the BIOS.

Other systems programs build on the foundation created by the BIOS program and provide a higher level of support services. Operating systems such as Linux and Microsoft Windows are examples of these higher-level systems programs that are not built into the computer.