

Programming Languages

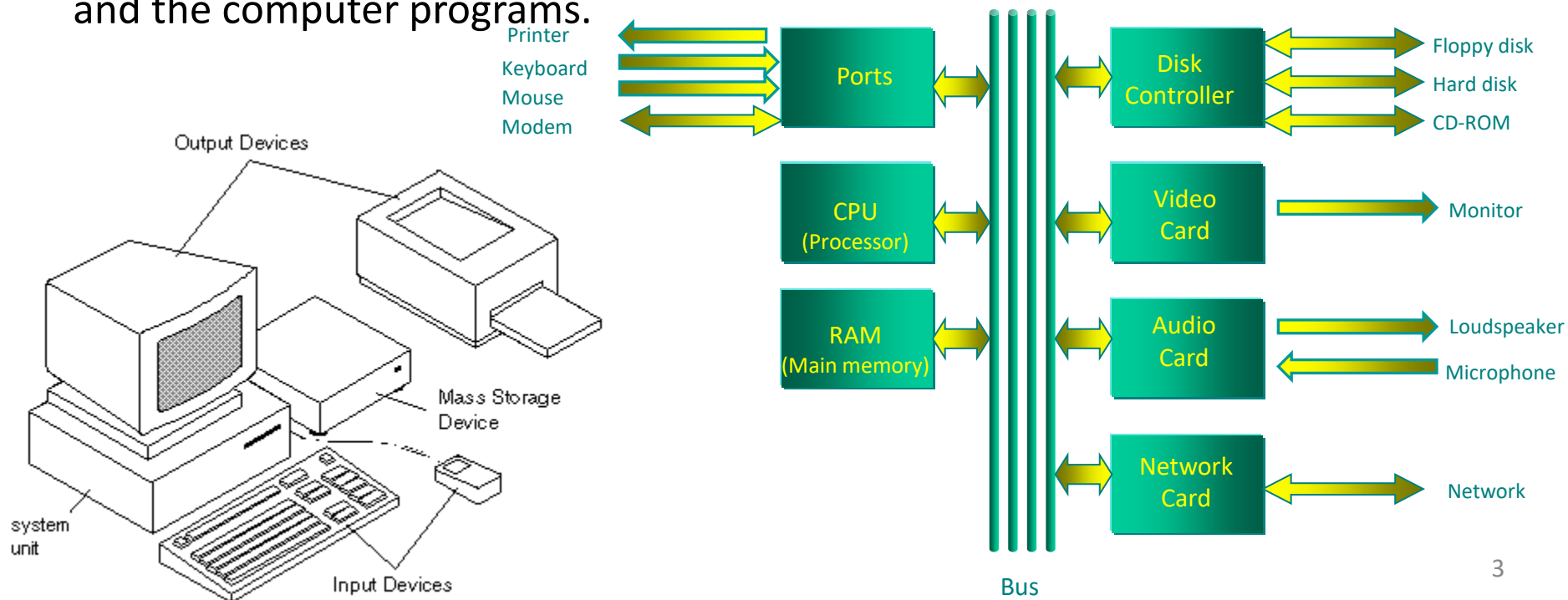
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FILS - 2009

PART 1. COMPUTERS AND THEIR PROGRAMMING

Hardware and Software

- A **computer** is a programmable electronic device that can store, retrieve, and process data.
Programmable means the computer can execute a programmed list of instructions and respond to new instructions that it is given.
Data means information suitable represented (coded).
- The **hardware** components of a computer system are the electronic and mechanical parts.
- The **software** components of a computer system are the intangible parts: the data and the computer programs.



Software

Programs are lists of instructions for the processor.

Data can be any information that a program needs: character data, numerical data, image data, audio data, and countless other types. The distinction between programs and data is not as clear-cut : the electronics of computer memory (both main memory and secondary memory) make no distinction between programs and data.

Fundamental Idea (Von Neumann's Architecture):

Both programs and data are saved in computer memory in the same way.

Types of programs

- **Application** programs are programs that people use to get their work done. Computers exist because people want to run these programs.
 - Word processors
 - Game programs
 - Spreadsheets
 - Data base systems
 - Graphics programs
 - Web browsers
- **Systems** programs keep all the hardware and software running together smoothly.
 - Operating system.
 - Networking system.
 - Database system.
 - Programming Language compilers and interpreters.
 - Web site server.
 - Data backup.

Operating Systems

- The **operating system** is a complex collection of many programs concerned with keeping the hardware and software components of a computer system coordinated and functioning.
- The operating system is software; the same hardware can be used with many different operating systems (although only one at a time): until the operating system is up and running, other programs will not be available.

Starting a program

1. The user asks to run an application. This could be done by clicking on an icon, making a menu choice, etc.
2. The OS determines the name of the application.
3. The OS finds the section of the hard disk where the application program and its data are stored.
4. The OS finds an unused section of main memory that is large enough for the application.
5. The OS makes a copy of the application and its data in that section of main memory.
6. The OS sets up resources for the application.
7. Finally, the OS starts the application running.

As the application runs, the OS is there in the background managing resources, doing input and output for the application, and keeping everything else running

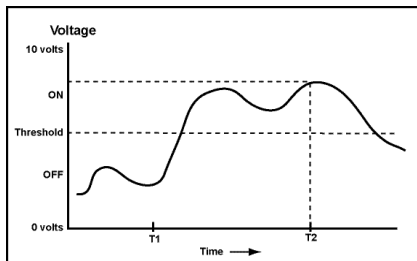
Computer Networks

- A computer **network** consists of two or more computers connected so that they can exchange data and programs.
- The operating system that runs on a networked computer must manage its share of the network (along with managing all its other responsibilities.) The operating system is able to find programs and data that are stored on other network computers, and copy them into its own main memory.
- In a **local-area network** only a few dozen computers are connected together, usually all located within the same building. Each computer has a **network address** that the other computers use to access it. There may be an especially powerful computer called a **server** whose hard disk holds all the application programs and data that the other computers are expected to need. Each computer in a network has a **network interface card** . This is an input/output device that sends and receives data over cables. The network interface cards of computers on a network are connected together with cables.
- A **wide-area network** can connect thousands of computers together over great distances. The long distance connections are made by using fiber optic lines, telephone lines, microwave communications, and satellite communications. Each computer in the network has a network address (as with local-area networks) to uniquely identify it. An agreement about how to represent and transmit data over a network is called a **protocol**. Usually large networks use a protocol called TCP/IP .
- The **Internet** consists of many wide-area networks that have been connected together to form one huge worldwide network. Even on this huge network, each computer must have a unique network address.

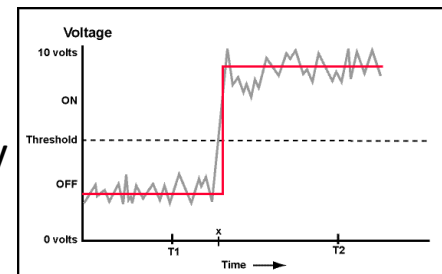
Analog and Binary Signals

- **Binary** means "two states": "1" and "0", "true" and "false", or "on" and "off".
- A single binary device or a light switch can be in just one of two possible states. A **bit** is a single "on/off" value. A light switch holds one bit of information.
- The ignition switch of an automobile is **discrete**—it has definite states—but there are usually more than two states (off, running, start, acc...)

An **analog signal** may continuously change in value. Its values can be anything within a range of values, and its exact value at any time is important.



Analog vs. Binary



Reasons for using binary:

- Simple; easy to build.
- Unambiguous signals (hence noise immunity). They are called **discrete** or **digital** because they have a fixed number of definite states.
- Flawless copies can be made.
- Anything that can be represented with some sort of sets of symbols can be represented with patterns of bits: the set of characters for instance.