

Data and Program Representation

- ✚ In order to be understood by a computer, data and programs need to be represented appropriately
 - Coding systems: Used to represent numeric, text-based, and multimedia data, as well as to represent programs
- ✚ Digital computers: Can only understand two states, off and on (0 and 1)
 - Digital data representation: The process of representing data in digital form so it can be used by a computer.

Digital Data Representation

- ✚ Bit: The smallest unit of data that a binary computer can recognize (a single 1 or 0)
- ✚ Byte = (8 bits) and used to express the size of documents and other files, programs, etc. as: kilobyte (KB), megabyte (MB), gigabyte (GB), etc.

The Binary Numbering System

- ✚ Numbering system: A way of representing numbers
 - Decimal numbering system: Uses 10 symbols (0-9)
 - Binary numbering system: Uses only two symbols (1 and 0)
 - the position of the digits determines the power to which the base number (such as 10 or 2) is raised

Coding Systems for Text-Based Data

- ✚ ASCII and EBCDIC (8 bit):
 - ASCII (American Standard Code for Information Interchange): coding system traditionally used with PCs
 - EBCDIC (Extended Binary-Coded Decimal Interchange Code): developed by IBM, primarily for mainframe use
- ✚ Unicode: newer code (32 bits per character is common); universal coding standard designed to represent text-based data written in any language
 - Graphics (still images such as photos or drawings)
 - Bitmapped images: A variety of bit depths are possible (4, 8, 24 bits)

Representing Programs (Machine Language):

- ✚ Machine language: Binary-based language for representing computer programs the computer can execute directly
 - Early programs were written in machine language.
 - Today's programs still need to be translated into machine language in order to be understood by the computer
- ✚ Most program are written in other programming languages
 - Language translators are used to translate the programs into machine language

The System Unit

- ✚ System unit: The main case of a computer
 - Houses the processing hardware for a computer
 - Also contains memory, the power supply, cooling fans, and interfaces to connect peripheral devices
 - Houses the drive bays in which storage devices (hard drives, DVD drives, etc.) are located
 - With a desktop PC, usually looks like a rectangular box

1)The Motherboard

- ✚ Computer chip: A very small pieces of silicon or other semi-conducting material onto which integrated circuits are embedded
- ✚ Circuit board: A thin board containing computer chips and other electronic components
- ✚ Motherboard or system board: The main circuit board inside the system unit
 - All computer components must connect to the motherboard
 - External devices (monitors, keyboards, mice, printers) typically connect by plugging into a port exposed through the exterior of the system unit

2)The CPU

- ✚ Central processing unit (CPU): circuitry and components packaged together and attached to the motherboard
 - It does the vast majority of processing for a computer.
 - Also called a processor; called a microprocessor when talking about PCs
 - Typically designed for desktop PCs, portable PCs, or servers
- ✚ Often made by Intel or AMD:
 - Dual-core CPU (AMD): Contain the processing components (cores) of two separate processors on a single CPU
 - Quad-core CPU (Intel): Contains 4 cores

Processing Speed

- ✚ CPU clock speed: One measurement of processing speed
 - Measured in megahertz (MHz) or gigahertz (GHz)
 - Higher CPU clock speed = more instructions processed per second
- ✚ Alternate measure of processing speed is the number of instructions a CPU can process per second. As Megaflops, gigaflops, teraflops
- ✚ Other factors (CPU architecture, memory, bus speed, etc.) also affect the overall processing speed of a computer
- ✚ Benchmark tests: Can be used to evaluate overall processing speed.

Word Size and Cache Memory

- ✚ Word size: The amount of data that a CPU can manipulate at one time
 - Typically, 32 or 64 bits
- ✚ Cache memory: Special group of very fast memory chips located on or close to the CPU
 - Level 1 is fastest, then Level 2, then Level 3
 - More cache memory typically means faster processing
 - Usually internal cache today

Bus Width and Speed

- ✚ Bus: An electronic path over which data can travel
- ✚ Bus width: The number of wires in the bus over which data can travel
 - Bus width and speed determine the throughput (or bandwidth) of the bus

3)Memory

- ✚ RAM (random access memory): Temporary memory that the computer uses
 - Consists of chips connected to a memory module which is connected to the motherboard
 - Holds data and program instructions while they are needed.
 - Adequate RAM is needed to run programs
 - Volatile: Contents of RAM is lost when the computer is shut off
 - Some forms of nonvolatile RAM are under development
- ✚ ROM (read-only memory): Read-only chips located on the motherboard into which data or programs have been permanently stored
 - Retrieved by the computer when needed
- ✚ Flash memory: Type of nonvolatile memory that can be erased and reprogrammed
 - Some flash memory chips are used by the PC
 - Flash memory chips are also used in flash memory storage media (sticks, cards, and drives)

4)Fans, Heat Sinks and Other Cooling Components

- ✚ Heat: A continuing problem for CPU and computer manufacturers
- ✚ Fans: Used on most PCs
- ✚ Heat sinks: Small components typically made out of aluminum with fins that help to dissipate heat
- ✚ Water cooling systems: Cool the PC with liquid-filled tubes
 - Other cooling methods (such as ion pump cooling systems) are under development

5)Expansion Slots, Expansion Cards and Express Cards

- ✚ Expansion card: A circuit board used to add additional functionality or to attach a peripheral device
- ✚ Expansion slot: A location on the motherboard into which expansion cards are inserted
- ✚ Express Card Modules: Designed for notebook computer expansion

6)Ports and Connectors

- ✚ Port: A connector on the exterior of a PC's system unit to which a device may be attached
 - Serial, Parallel, Network, Keyboard, Mouse, Monitor (VGA, DVI, HDMI) and Modem, Phone
- ✚ Many desktop PCs come with a variety of ports on the front of the system unit for easy access
 - A wired or wireless hub can connect many devices to a single USB or FireWire port
- ✚ Notebook computers have ports similar to desktop PCs, but often not as many
- ✚ Handheld computers and mobile devices typically have less ports
 - An SD slot is common for both memory cards and to connect peripheral devices.