Basic computer principles

deeper view

AREEJ ALOUFI

Types of computers:

◆ supercomputer/mainframe.
◆ Minicomputer.
◆ Microcomputer.

Supercomputers/ Mainframes

A **mainframe** computer is a large computer, often used by large businesses, in government offices, or by universities.

They are typically:

- **Powerful** - they can process vast amounts of data, very quickly

- **Large** - they are often kept in special, air-conditioned rooms

- **Multi-user** - they allow several users (sometimes hundreds) to use the computer at the same time, connected via remote terminals (screens and keyboards)

- **Most expensive** - Several million dollars each

Personal Computers (PC)

- Also called Microcomputers.
- Available in desktop size, notebook size and handheld.

Minicomputers

- Size of filing cabinet

- Used by small and medium size companies and institutions

- Operated by computer specialist

- Terminals allow many people to use

Desktop Computer Components

+ System Unit
  + Houses the
    Central Processing Unit (CPU)

+ Peripherals
  + Hardware items
    outside the system unit box
    + Keyboard
    + Mouse
    + Monitor
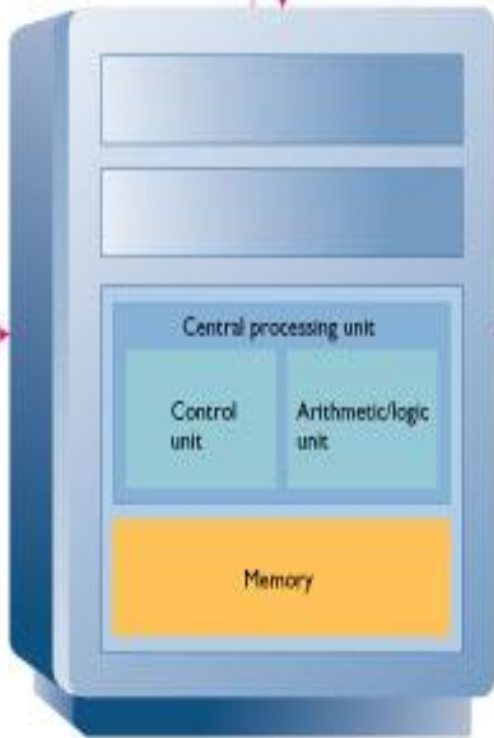   + Printer
    + Etc.

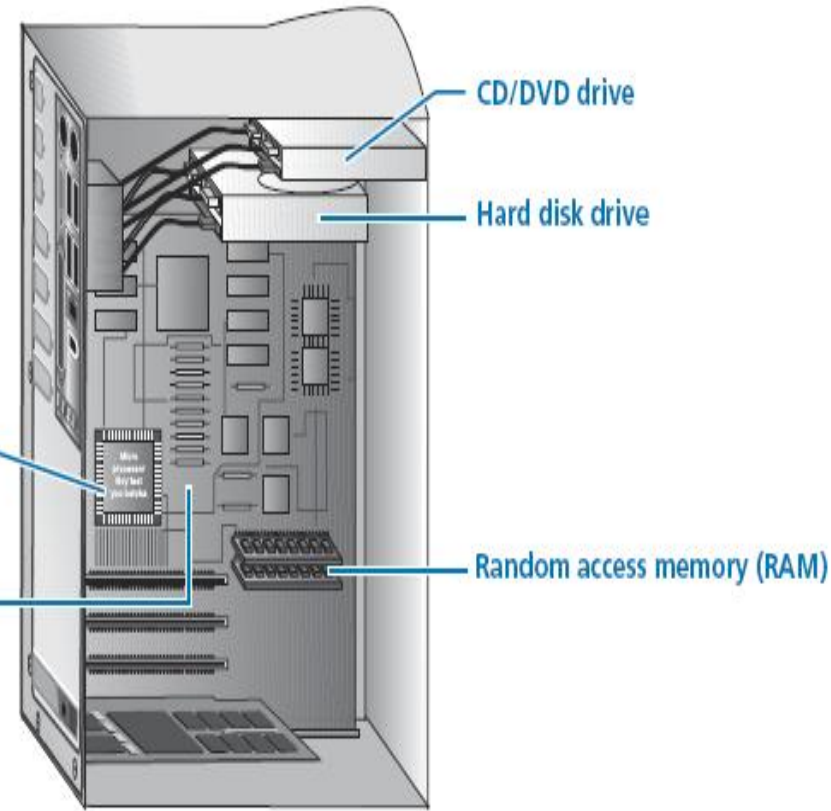# What Goes on Inside the Computer

The Central Processing Unit:

CD/DVD drive

Hard disk drive

Microprocessor

System board

Random access memory (RAM)

Stores data and programs

Secondary storage

Sends data to the central processing unit

Input

Central processing unit

Control unit

Arithmetic/logic unit

Memory

Makes processed information available

Output

**Processing**

The CPU (Central Processing Unit)

- Small chip found on the motherboard.

- The brains of the computer.

- The processor is a series of transistors that are arranged in an order to manipulate data received from the software.

- The basic task of CPU is to read data from storage, manipulate the data, and then move the data back to storage or send it to external devices, such as monitors or printers.

- Processor is named by its maker and the speed at which it manipulates data.
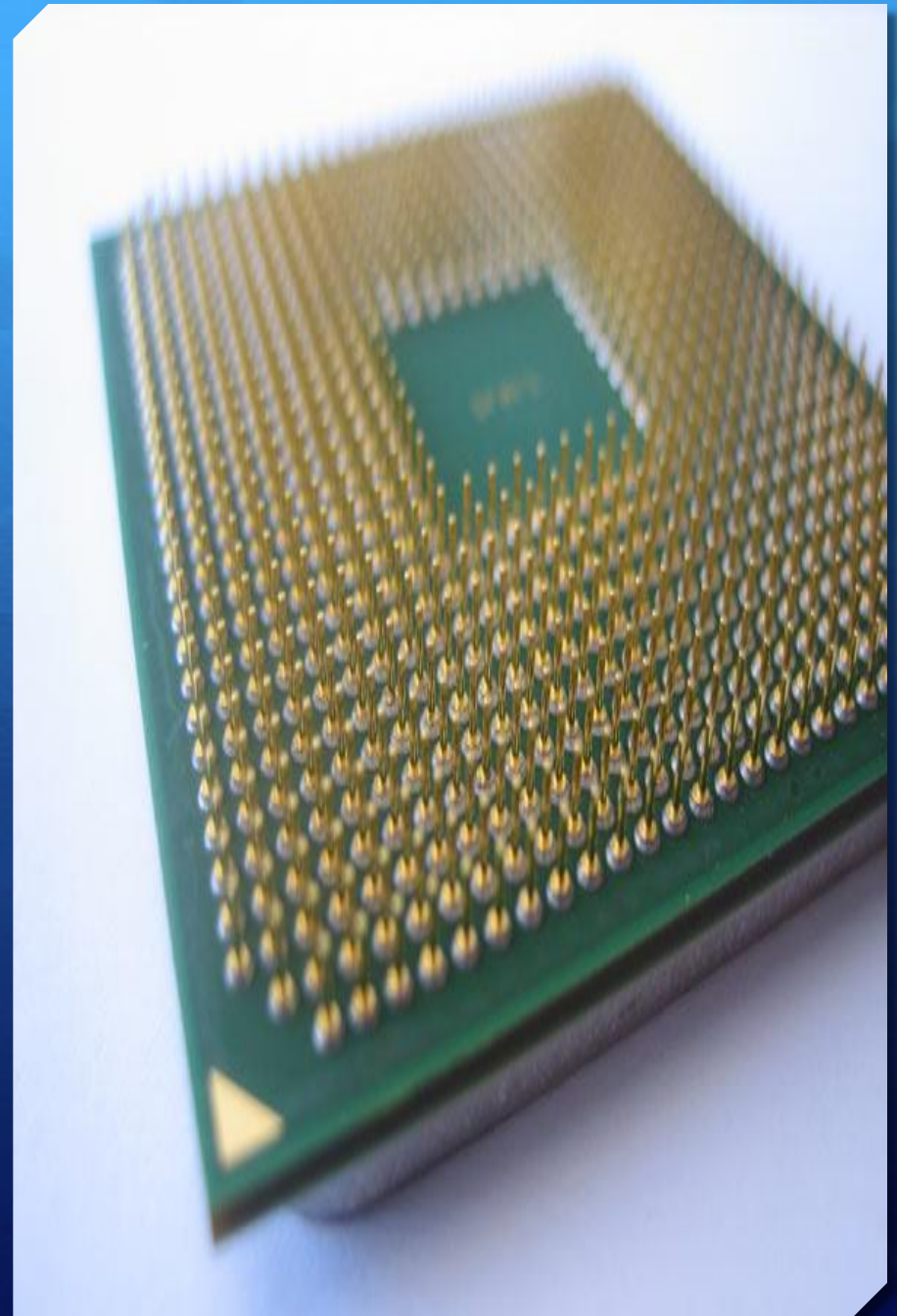
Control Unit- CU

+ Part of the hardware that is in-charge.

+ Directs the computer system to execute stored program instructions.

+ Communicates with other parts of the hardware.

Arithmetic / Logic Unit
ALU

- Executes arithmetic and logic operations including addition, subtraction, multiplication and comparisons such as "equal to"(=), "is less than"(<) or "is greater than"(>).

Registers

- Are temporary storage electronic devices.
- They hold the data for a short period then send it to internal memory, when it is stored temporarily.

Bus Line

+ The movement of data among other ALU components, it provides a path for the flow of electrical signals between units.

Bus width:

The amount of data transported at a single moment.

Three types:

1. Data bus (data signal)
2. Address bus sends data from internal memory
3. Control bus sends signals from the control unit.

+ A computer with a larger bus size will be faster because it can transfer more data at one time, will have larger memory, and can accommodate an increase in the number and variety of instructions.

Primary storage

+ Can be referred to as internal memory or simply memory.

+ They are available in the form of chip, semiconductor chips or integrated circuits.

Memory

+ The information entered to the computer.

+ The program that provides the instruction for processing the input information.

+ The results of the processing

Main Types of Memory

RAM
Random Access Memory

ROM
Read Only Memory

RAM chips

+ Provides for temporary storage of data and programs that would be lost if the computer loses power.
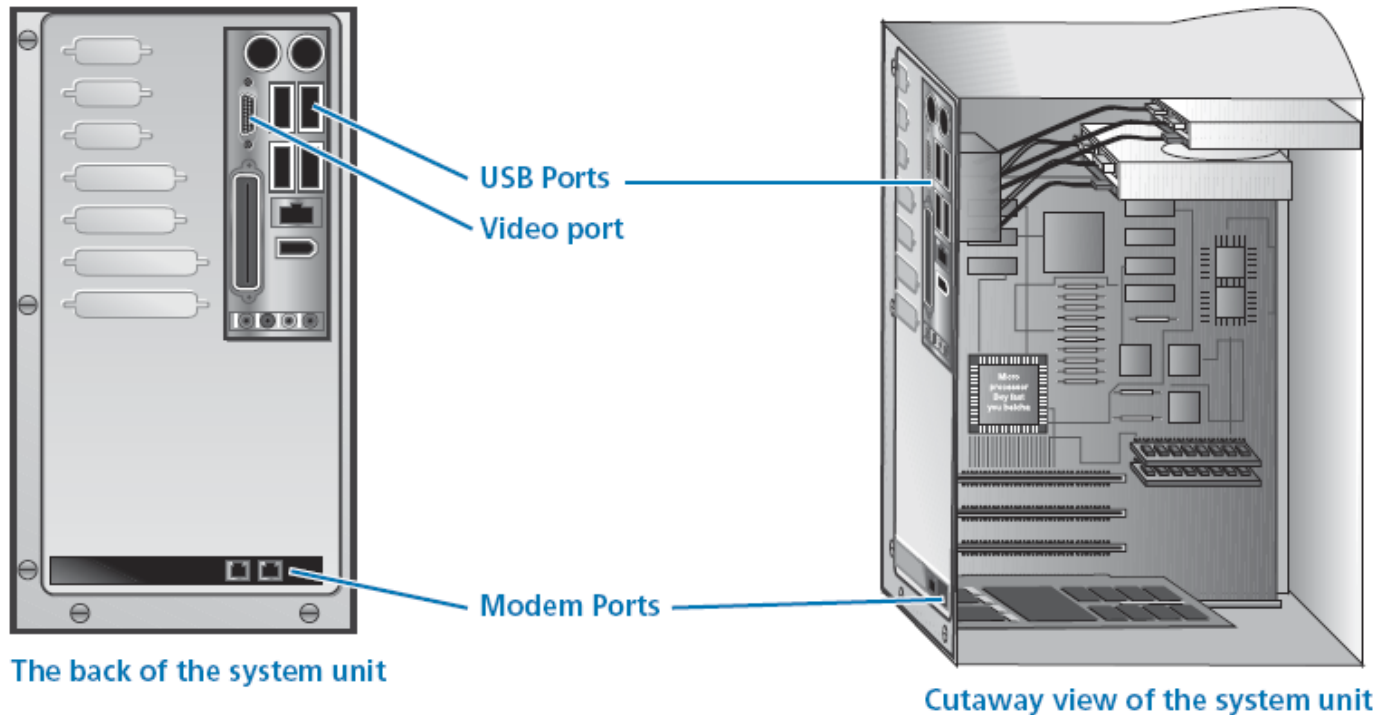
+ Storage capacity is expressed in megabytes (MB).

ROM chips

+ Contain data and programs to make the computer hardware work and cannot be changed, erased or lost when the computer is turned off.

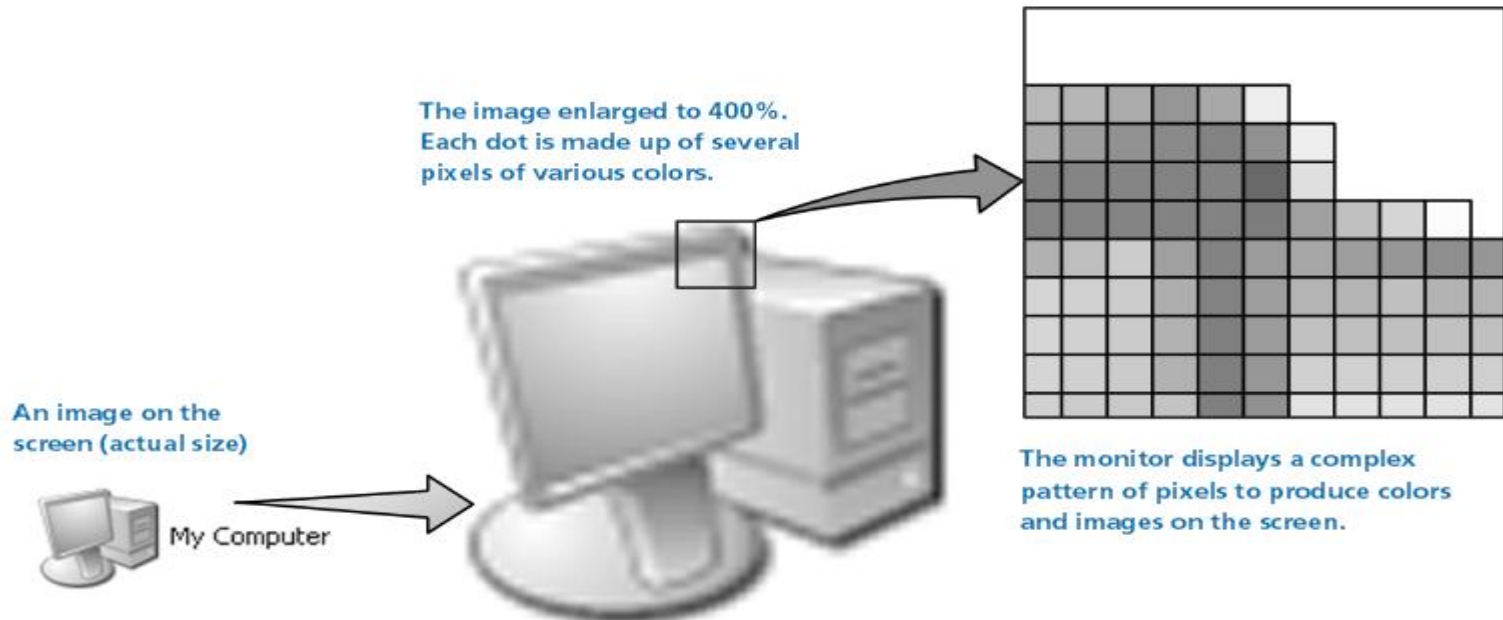# Further Looking Inside the System Unit

+ Video

+ Ports

USB Ports
Video port

Modem Ports

The back of the system unit

Cutaway view of the system unit

Computer Video

+ The image on the monitor is composed of tiny dots called *pixels*

+ The monitor displays a complex pattern of produce colors and images on the screen.

The image enlarged to 400%.
Each dot is made up of several
pixels of various colors.

An image on the
screen (actual size)

My Computer

The monitor displays a complex
pattern of pixels to produce colors
and images on the screen.

Resolution

+ The higher the resolution setting, the more you can display on the monitor
  + Images appear smaller at higher resolutions
  + You can view more on the screen at higher resolutions
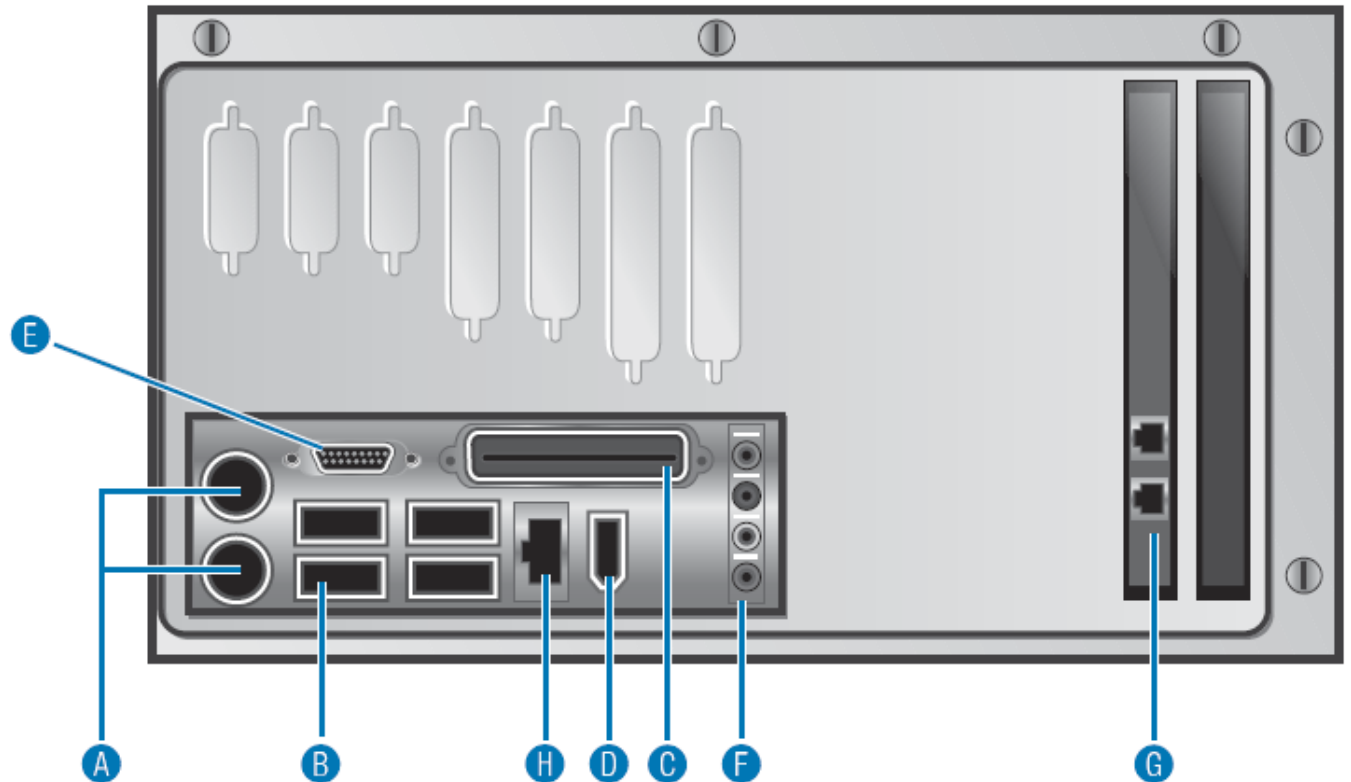

800 x 600

1024 x 768

1280 x 1024

1600 x 1200

Ports

+ Ports are connectors on the PC that link adapter cards, drives, printers, scanners, keyboards and mice, and other peripherals.

+ Different types of ports:
  + Parallel
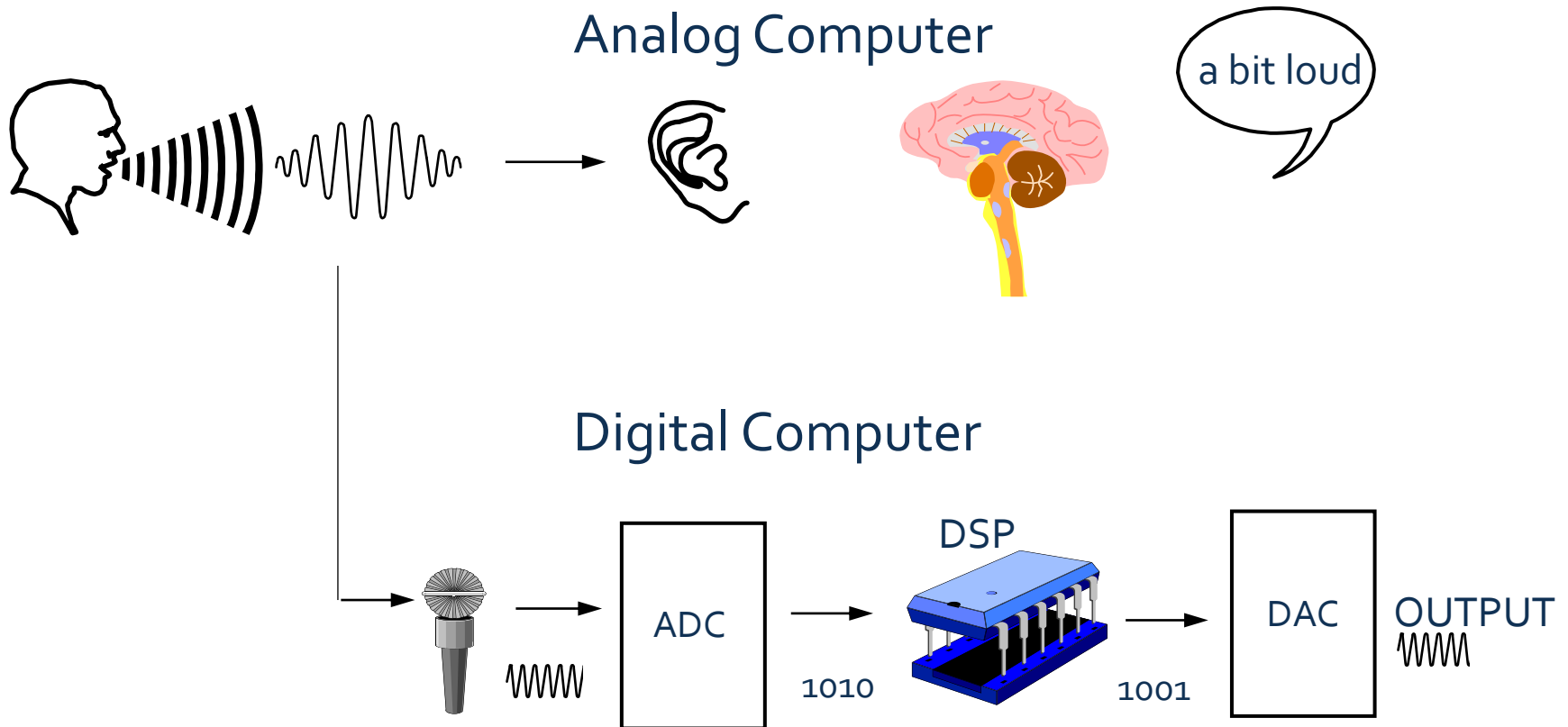 + Serial
  + USB
  + IDE
  + SCSI

Examples of Ports

A. PS/2

B. USB ports

C. Parallel

D. Firewire

E. Video

F. Miniplugs

G. Phone jack

H. Ethernet

Analog computers & Digital computers

What is DSP (digital signal processor)?

Analog Computer

a bit loud

Digital Computer

ADC → DSP → DAC → OUTPUT

1010   1001

A Typical DSP System

```
┌─────────┐         ┌─────────────┐
│         │ ◄─────► │   MEMORY    │
│         │         └─────────────┘
│         │
│         │         ┌─────────┐
│         │ ◄────── │  ADC    │ ◄─────
│  DSP    │         └─────────┘
│         │
│         │         ┌─────────┐
│         │ ──────► │  DAC    │ ─────►
│         │         └─────────┘
│         │
│         │         ┌─────────┐
│         │ ◄─────► │  PORTS  │ ◄────►
└─────────┘         └─────────┘
```
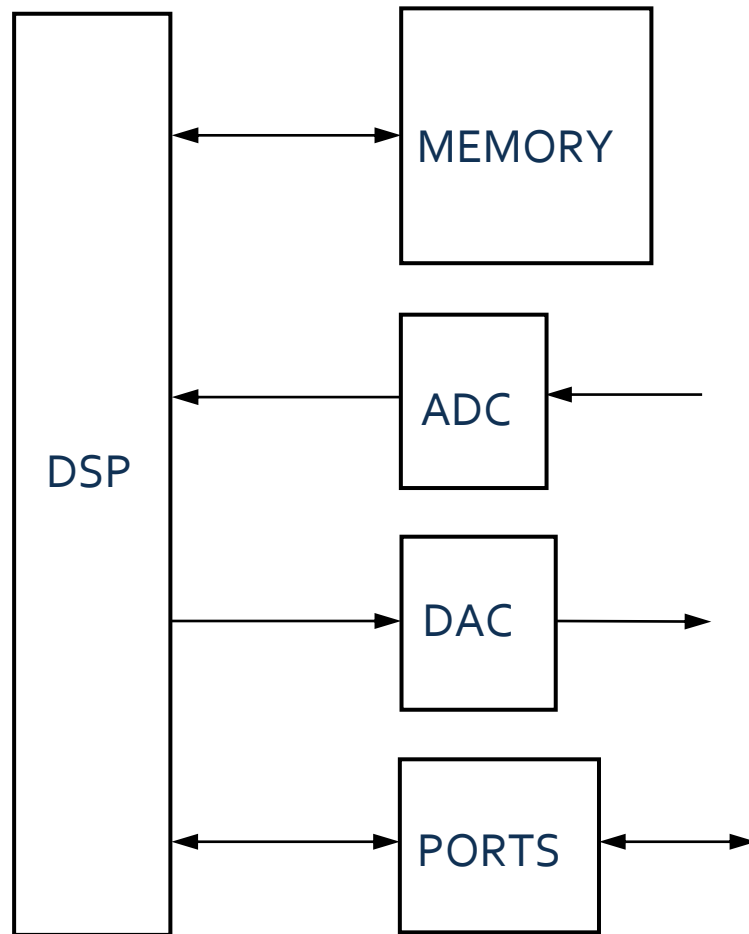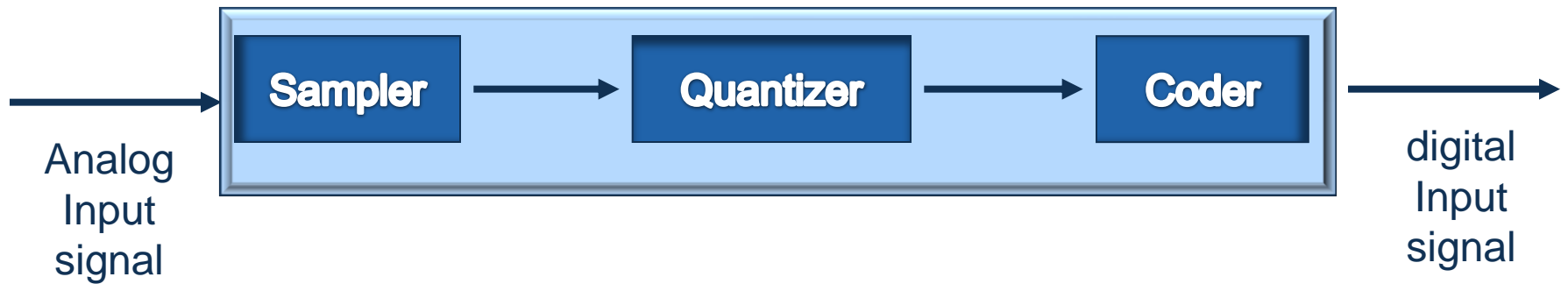
- **DSP Chip**

- **Memory**

- **Converters (Optional)**
  - **Analog to Digital**
  - **Digital to Analog**

- **Communication Ports**
  - **Serial**
  - **Parallel**

Analogue- to- digital conversion

Converts the analogue signal into a sequence of numbers having finite precession

ADC essential parts

Sampler

- The conversion of continuous time signal into a discrete signal obtained by taking "samples" of a continuous-time signal at a discrete time instants.

Quantizer

- The conversion of a discrete-time, discrete-valued (digital) signal.
- The value of each signal sample is represented by a value selected from a finite set of possible values.

Coding

- The assignment of a binary bit sequence to each discrete output from the quantizer

Digital-to-analog conversion

+ The digital signal processor outputs digital data that are subsequently converted into the analog signals needed to operate analog display devices such as television monitors.

DAC

+ Made of solid-state electronics that generates an output voltage to the input digital number

DAC characteristic

+ Most important is resolution.

+ It is how finely an analog voltage may be represented, which is determined by the number of digital bits.

DAC resolution

Example:

+ an 8-bit DAC outputs 256 (2 to the power of 8) analog voltage.

+ A 12-bit DAC outputs 5096 (2 to the power of 12) analog voltage

Which indicates significantly better resolution.

Digital Signal Processing (DSP) Advantages

- **Repeatability**
  - **Low sensitivity to component tolerances**
  - **Low sensitivity to temperature changes**
  - **Low sensitivity to aging effects**
    - **Nearly identical performance from unit to unit**
    - **Matched circuits cost less**
- **High noise immunity**
- **In many applications DSP offers higher performance and lower cost**
  - **CD players versus phonographic turntable**

Analog's Place in DSP

- **Most transducers are analog by nature**
  - Microphones, speakers, etc.

- **Analog circuits are required to pre-process low level signals before ADC**

- **Analog filters may be required to limit the bandwidth of signals**
  - Anti-alias (before ADC) and reconstruction filters (after DAC)

- **Analog circuits may be required to drive output transducers**
  - A power amplifier is required to enable a DAC to drive a speaker

Any Questions ?