

# Motherboard

## Part 1

# Definition

- The motherboard (mainboard, mobo) is a set of multilayer printed circuits covered by several tracks and containing connection ports.
- The motherboard is a master card representing the heart of any type of computer.

# Role

- Connect the different components that make up the computer (processor, central memory as well as peripherals such as hard drives and the optical drive).
- Ensures connection of all essential components.
- Computer performance strongly depends on its characteristics.

# Bus

# Definition

- Computers use binary information.
- This information is used to represent data transferred in specific time intervals in the form of voltages.
- In computing, the word bus means a set of physical connections (cables, printed circuit tracks, etc.) that can be used jointly by several hardware elements in order to communicate.

# Bus

# Definition

- The use of buses is a revolutionary idea which made it possible to reduce the number of channels necessary for the communication of the different components.
- In the case where the line is used solely for the communication of two hardware components, the word bus is replaced by the word hardware port (serial port, parallel port, etc.).

# bus

## Features

- A data bus is characterized by the amount of information transmitted simultaneously.
- This quantity corresponds to the number of physical lines.
- A layer of 64 wires thus makes it possible to transmit 64 bits in parallel.
- We use the word Bus width or Bus volume to express the number of bits that a bus can transmit simultaneously.

# bus

## Features

- The greater the number of wires, the greater the number of bytes transferred.
- The transfer speed expresses the quantity transmitted in a time interval.
- The speed of the bus is defined by its frequency (expressed in Hertz), that is to say the number of data packets sent or received per second.

# bus

## Features

- We speak of a cycle to designate each sending or reception of data.
- Using both characteristics, we can easily calculate the amount of data it can transport per unit of time called:
  - Bandwidth,
  - Transfer rate
  - Data rateby multiplying its width by its frequency.



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Features

Example :

**Consider a motherboard with a 32-bit bus width, clocked at a frequency of 500 MHz**

**Calculate the bandwidth of this motherboard**

# bus

## Composition

In practice, a bus is generally made up of 50 to 100 lines classified into three functional subsets:

- Address bus
- Data bus
- Control Bus

# bus

# Composition

## The address bus (memory bus)

- Transports addressing information used to describe the area of memory that the processor wishes to access to read or write data.
- It is a one-way bus.
- The address bus size indicates the maximum amount of memory.

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Composition

**Example :**

Consider a motherboard with a bus width of 8 bits.

Calculate the maximum memory (RAM) size

# bus

# Composition

## The data bus

- Allows instructions and data to be transported to or from the processor.
- It is a two-way bus.

# bus

# Composition

## The control bus (command bus)

- Transports commands and synchronization signals from the control unit to all hardware components.
- This is a two-way bus

# bus

## Composition

- The data bus and the address bus are completely independent; CPU designers can use whatever size they want for each.
- In practice, processors equipped with a wide data bus also have a wide address bus.
- Bus sizes can provide valuable information about the power of a processor.

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# Main buses

There are generally two main buses on a computer:

## The system bus

- Also called internal bus, or front-side bus (FSB).
- The system bus allows the processor to communicate with the system's central memory (random access memory or RAM).



# bus

# Main buses

## The expansion (extension) bus

- Sometimes called input/output bus
- Allows the various components of the motherboard (USB, serial, parallel, hard drives, CD-ROM, etc.) to communicate with each other.
- Above all, it allows the addition of new peripherals thanks to the expansion connectors (slots) connected to the I/O bus.