INSTITUTE OF
TECHNOLOGY
DEVELOPMENT
OF CANADA

Introduction to Computers

ICR100

Fall Semester 2020

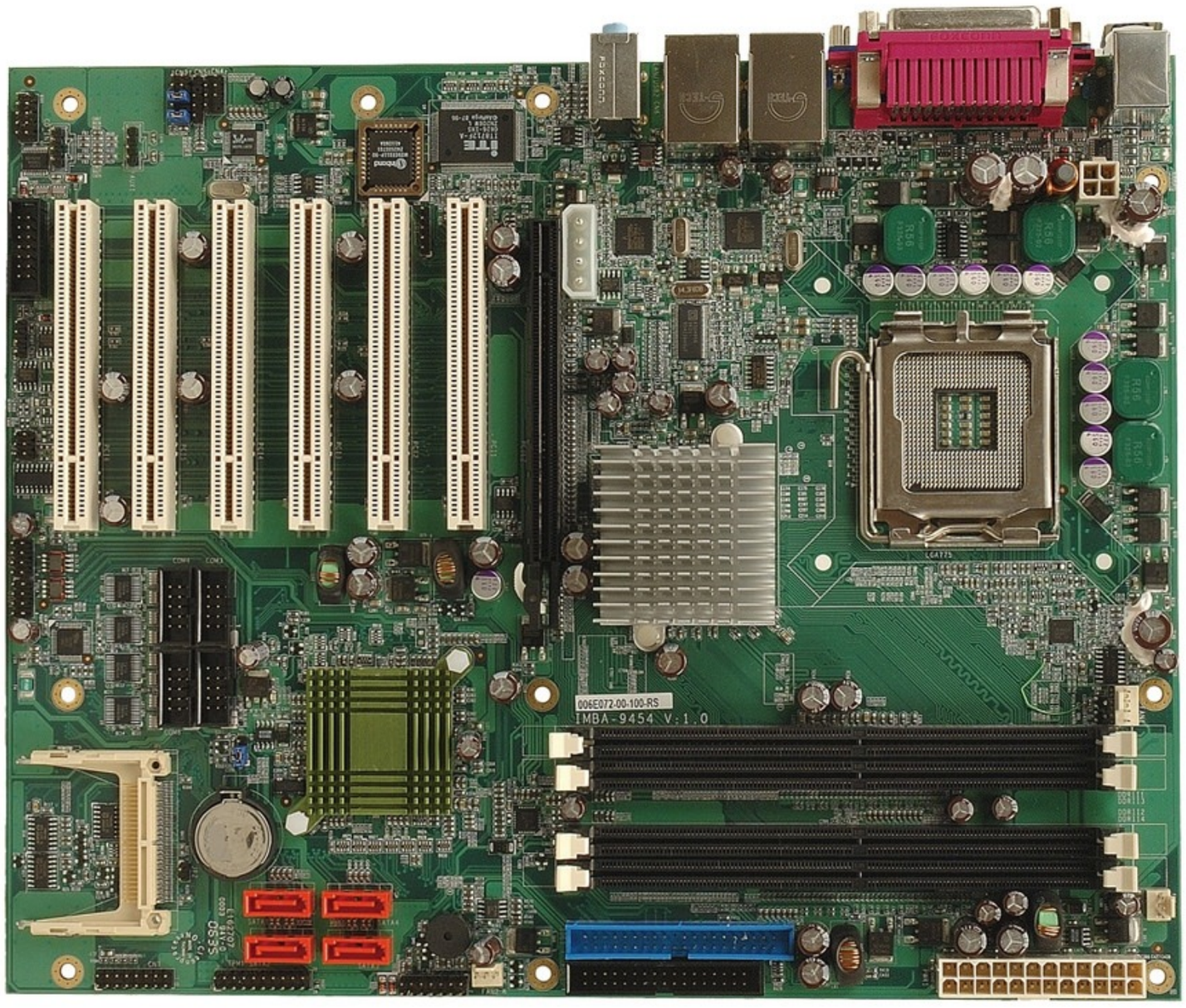
Hardware components

A computer is essentially made of:

- A **motherboard**
- A **power supply**
- A processor or **CPU** (**C**entral **P**rocessing **U**nit)
- **RAM** (**R**andom **A**ccess **M**emory)
- **ROM** (**R**ead **O**nly **M**emory)
- Storage, which can be **HDD** (**H**ard **D**isk **D**rive) or **SSD** (**S**olid **S**tate **D**rive)
- Cards: **sound card**, video card or **GPU** (**G**raphics **P**rocessing **U**nit), **network card**
- External peripherals: Mouse, keyboard, display and so on.

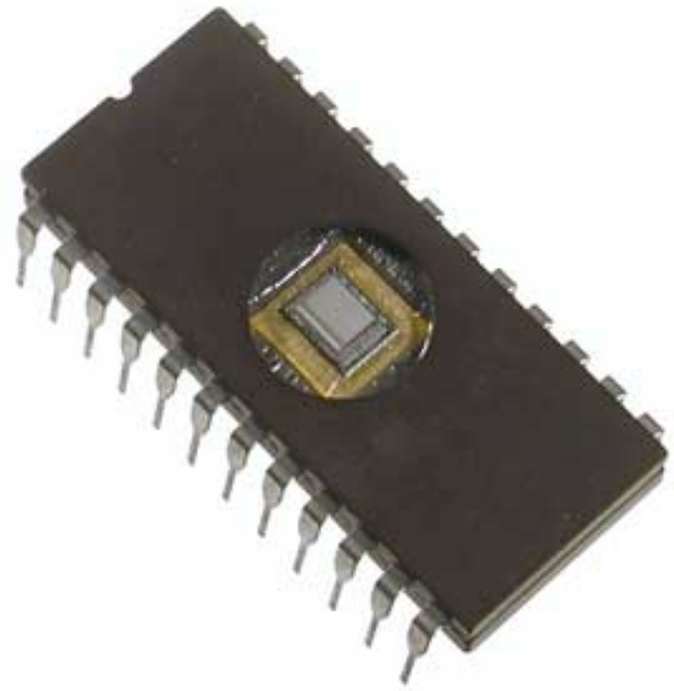
Motherboard

- Holds all the crucial computer components and allows the communication between them through a circuit.



ROM

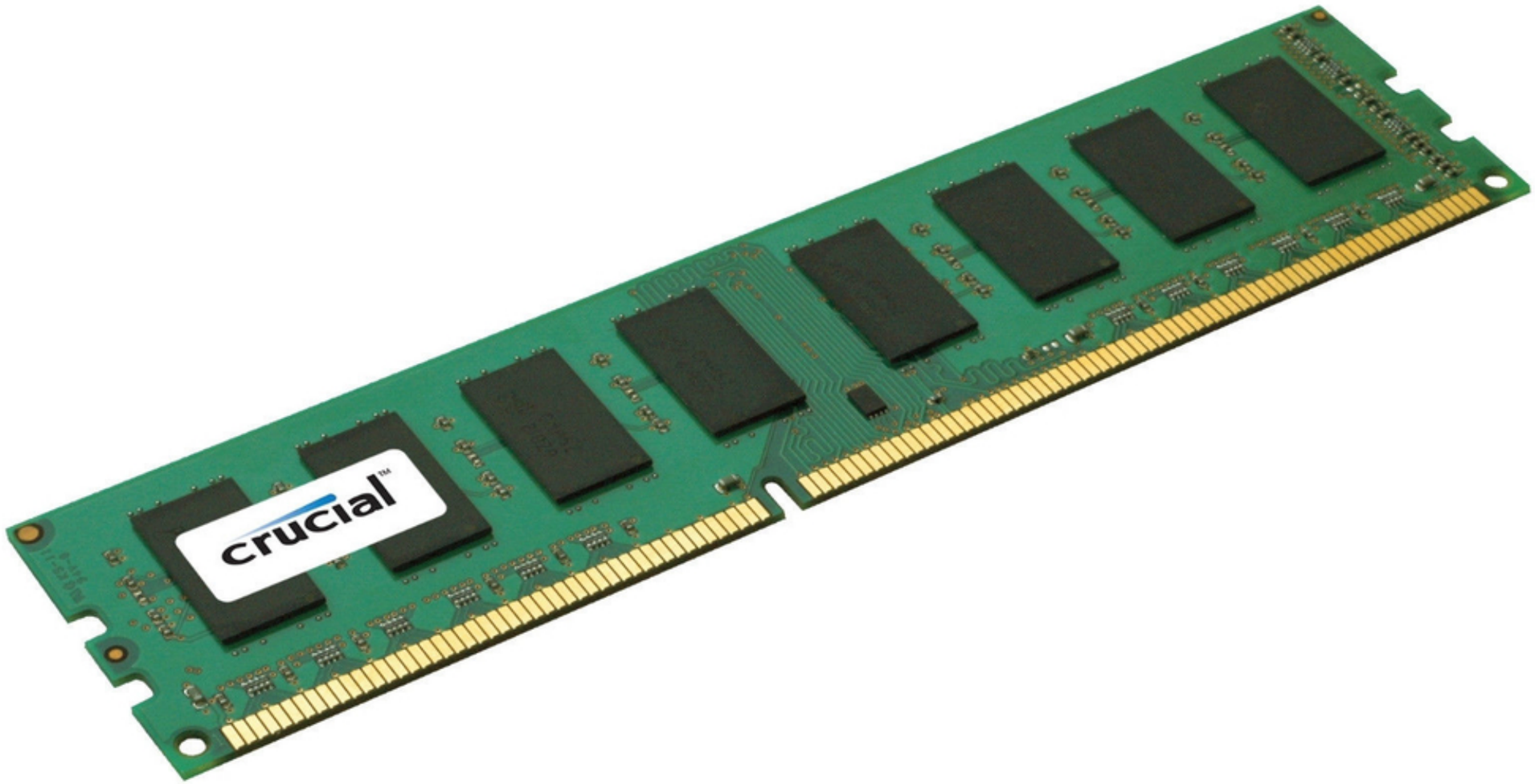
- The ROM is a permanent memory, the opposite of the RAM. It contains essential information, like the **BIOS** (**B**asic **I**nput **O**utput **S**ystem).



RAM

- The RAM is like the CPU's worktable. It's used to **temporarily** store all the things that CPU needs to work, such as running a program. Ram empties every time we shut down the computer.

- The RAM stays close to the CPU to make it work fast, but the fastest volatile memory is the **cache**: there are basically two types, **internal cache** (directly inside of the CPU) and **external cache** (right outside of the CPU), divided by layers (L1, L2, L3…)



CPU

- The core of the computer, its brain. It contains an **ALU** (**A**rithmetic and **L**ogic **U**nit) and a **CU** (**C**ontrol **U**nit): the first performs any operation, the second one controls the internal CPU components to make it work.

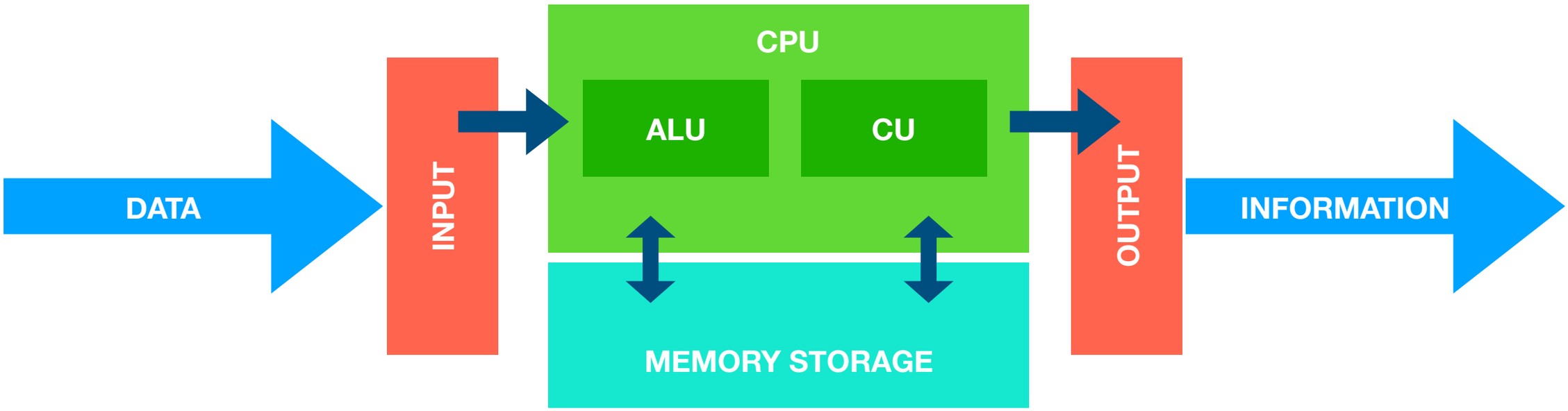
ALU vs. CU

- Outline the architecture of the central processing unit (**CPU**) and the functions of the arithmetic logic unit (**ALU**) and the **control unit** (**CU**) and the registers within the **CPU**. **Parts** of a **CPU**: **ALU.**
- The arithmetic logic unit executes all calculations within the **CPU**. **CU** - **control unit**, coordinates how data moves around.

Cache Memory

- **Cache memory** is a chip-based computer component that makes retrieving data from the computer's memory more efficient.
- **Cache memory** is an extremely fast **memory** type that acts as a buffer between **RAM** and the CPU.
- It holds frequently requested data and instructions so that they are immediately available to the CPU when needed.
- **Cache memory** is used to reduce the average time to access data from the Main **memory**.

Basic computer operation



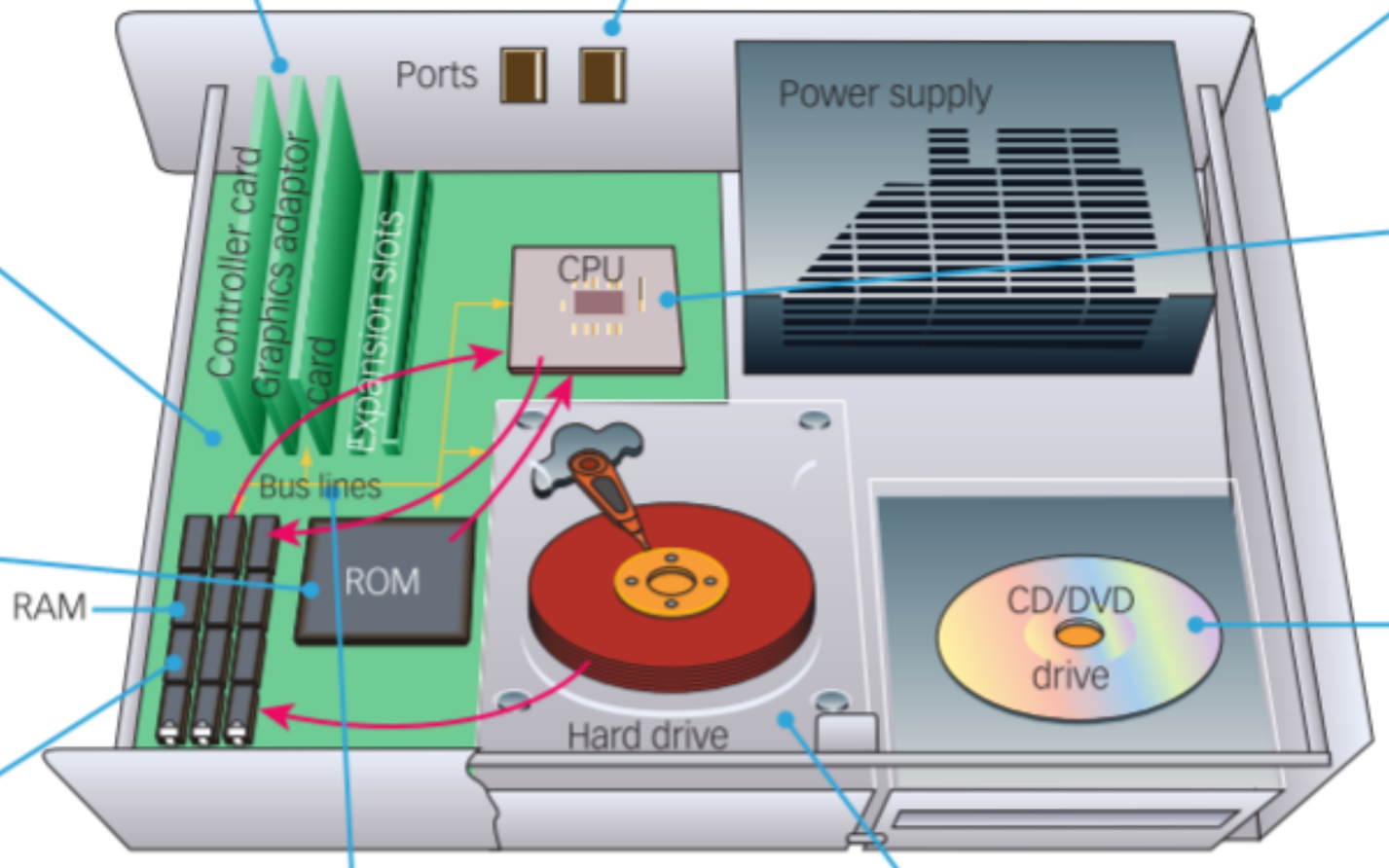
Hardware components

Cards inside the system box have their own particular task to do. Typically, a PC would have a graphics or video card, a sound card and a network or modem card. Empty expansion slots are available to insert extra cards as required.

A port is where external devices are attached to the system box. Connectors are different in size and shape for different types of devices.

All your computer's electrical needs are supplied from this shielded metal box. A transformer converts the mains current to make it suitable to pass to the motherboard and disk drives.

Most of the components in a PC are mounted on printed circuit boards. The motherboard is the largest and houses many types of chips.



The CPU is often called the brain of the computer. Most of the devices connected to the computer communicate with the CPU in order to carry out their tasks.

ROM is memory that cannot have new data written to it. It contains permanent instructions, such as how to start up the computer.

CDs and DVDs offer high-capacity permanent storage. The discs are written and read by laser light.

When you turn on the computer, the CPU starts reading instructions from ROM and the hard drive. These instructions are stored in RAM so that the CPU can access them quickly.

The bus lines transport data between the processors, memory and other components inside the system box. They are tiny electrical pathways printed on the top and bottom of the circuit boards.

The hard drive is a series of thin disks that store programs and documents while you are not working on them. It also stores the system files that the computer needs to make everything work. Data is stored magnetically on the hard disks.

Peripherals & data sizes

Peripherals:

- A **peripheral** is an external device used to put information into or get information out of a computer.

- An **input** device sends data or instructions to the computer.

- An **output** device provides output from the computer.

- Some devices are both *input*/*output* such as a data storage device (USB flash drive, disk drive, etc.).

The **mouse** is an input device.

The **display** is an output device.

GUESS GAME

The **printer** is…

GUESS GAME

The **scanner** is…

GUESS GAME

The **graphic tablet** is…

GUESS GAME

The **display tablet** is…

GUESS GAME

The **speakers** are…

Storage devices and measurements

- A storage device is an *input/output* device, because it both receives and gives back data.

- Files and spaces are measured in **bytes**.

- The size of one byte, historically hardware dependent, has been standardised to **8 bits**.

- 8 bits is a convenient power of two, it allows to represent enough characters without “dead space”.

From the smallest to the biggest

- The **bit** is the most basic unit of data of a computer, like dots and dashes in Morse code.
- 4 bits make a **nibble**, which is half of a byte.
- A **byte** is made of 8 bits.
- 16 bits make a **word** (2 bytes).
- **Word** has a double meaning in computers: it also indicates the number of bits that the CPU of a computer can handle at one time, going from a nibble to 128 bits.

- bit
- 4 bits = 1 **nibble**
- 8 bits = 1 **byte** (B)
- 16 bits = 1 **word**
- 1,024 bytes = 1 **kilobyte** (KB)
- 1,024 kilobytes = 1 **megabyte** (MB)
- 1,024 megabytes = 1 **gigabyte** (GB)
- 1,024 gigabytes = 1 **terabyte** (TB)
- 1,024 terabytes = 1 **petabyte** (PB)
- 1,024 petabytes = 1 **exabyte** (EB)
- 1,024 exabytes = 1 **zettabyte** (ZB)
- 1,024 zettabytes = 1 **yottabyte** (YB)

- **Facebook** generates more than **4 petabytes** of data on daily basis.

- **Google** handles hundreds of petabytes every day.

- Huge amounts of data are **challenging**: they are expensive, requires constant maintenance and elevated power and cooling costs.

- The entire web is about **5 exabytes**.
- All the digital information are made of bits, written in **binary code**, which physically exists because it’s based on electrons and transistors.
- Electrons have their own weight: an Amazon Kindle full of eBooks weighs 0,00000000000000001 grams more than an empty one.
- So, the web weighs about **50 grams**.

What about speed?

- Also the data transfer speed has improved enormously.
- It’s generally measured in kbps, Mbps or Gbps.
- Right now, the two main competitors are **USB** and **Thunderbolt**.

- **USB 1.1** – 12 Mbps, 1998
- **USB 2.0** - 480 Mbps, 2000
- **FireWire** - 800 Mbps, 2007
- **USB 3.0** - 5.0 Gbps, 2008
- **Thunderbolt v1** - 10 Gbps, 2011
- **USB 3.1** - 10 Gbps, 2013
- **Thunderbolt v2** - 20 Gbps, 2013
- **Thunderbolt v3** - 40 Gbps, 2015
- **USB 3.2** - 20 Gbps, 2017

Information System concepts

What is an IS?

- IS stands for **Information System**: a structure made to collect, process, store, and distribute information.

- Its purpose is to support business processes, and it’s used everywhere: schools, banks, libraries, and so on and so forth.

- Basically made of four components:

- **TECHNOLOGY**: hardware and software.

- **PROCESS**: set of procedures.

- **PEOPLE**: users and operators.

- **ORGANISATIONAL STRUCTURE**: the skeleton of an information system.

- In particular, a **computer-based information system** is an IS which uses the computer to complete tasks.

- A computer-based information system is made of:

- **HARDWARE**: physical devices.

- **SOFTWARE**: programs that allows hardware to process data.

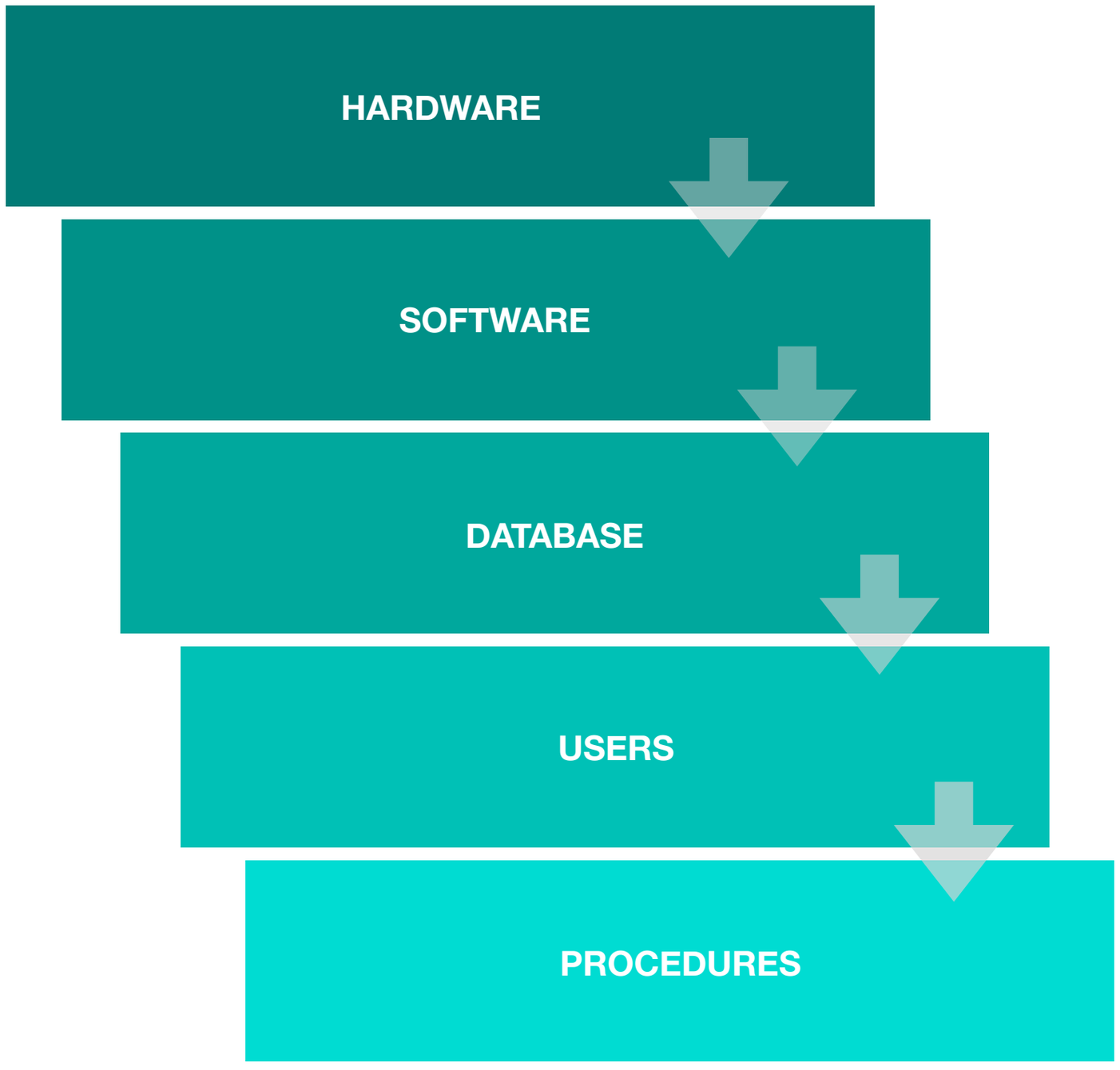
- **DATABASES**: collection of tables containing data.

- **NETWORKS**: what make possible for computers to communicate.

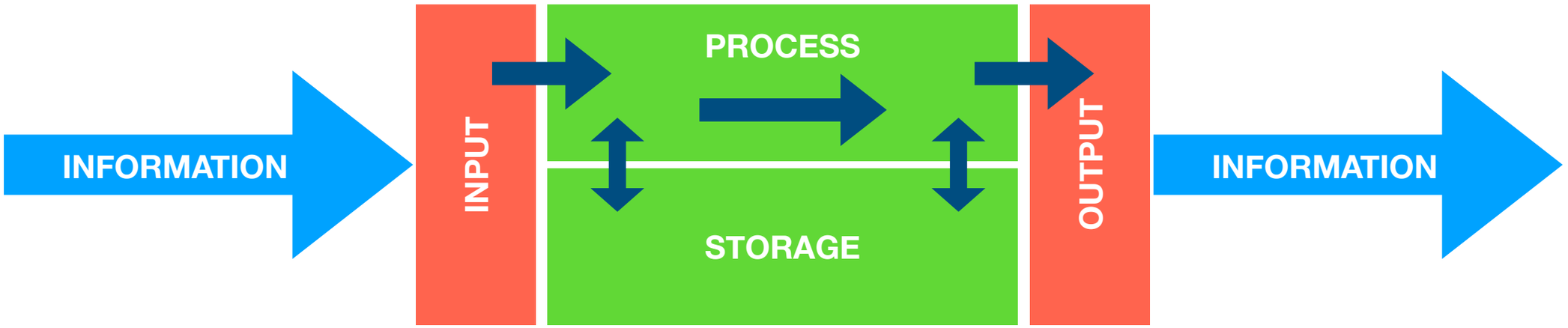
- **PROCEDURES**: the commands for combining and using the other components to manage and process information.

- **USERS**: people who run the procedures to manage information.

Information System concepts (IS)



Simple information system process



What is a database?

- A collection of organised information that can be easily **accessed**, **managed** and **updated**.

- A database is created and maintained through systems software of two types: **RDBMS** and **DBMS**.

- **RDBMS** (**R**elational **D**ata**B**ase **M**anagement **S**ystem) and **DBMS** (**D**ata**B**ase **M**anagement **S**ystem) perform the same function.

- The essential difference is that the first (RDBMS) stores data in **tabular form**, the second one (DBMS) as **files**.

Thank You,