



# Full Stack Software Engineering for IoT

*<< More than the sum of its devices, the Internet of Things links technologies together to create new services and opportunities. >>*

Course (2 ECTS)

For Master II IFI, Master Ubinet and Polytech-SI5

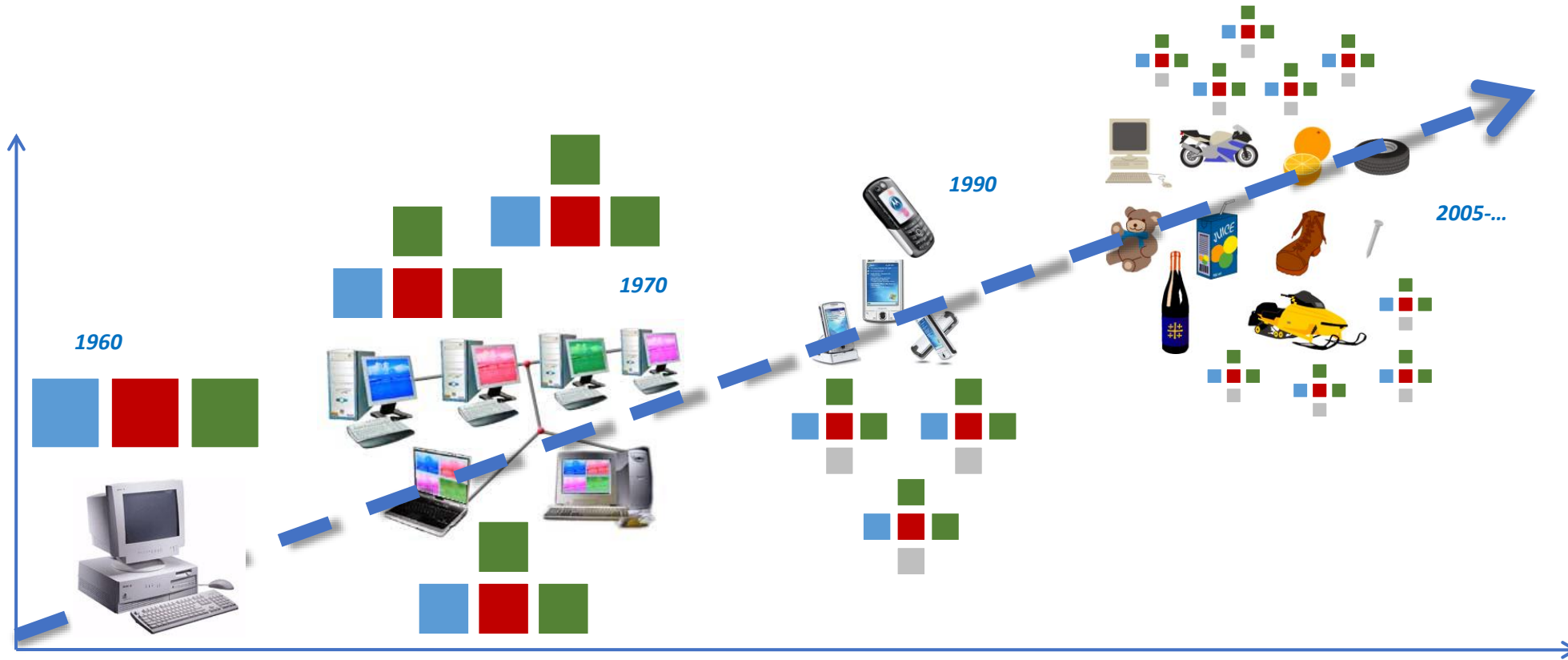
See <https://lms.univ-cotedazur.fr/course/view.php?id=14264>

# Internet of Things

Inputs / Outputs Connectivity

Interoperability & Security Challenge

# Things can be seen as the latest evolution of the computer ...



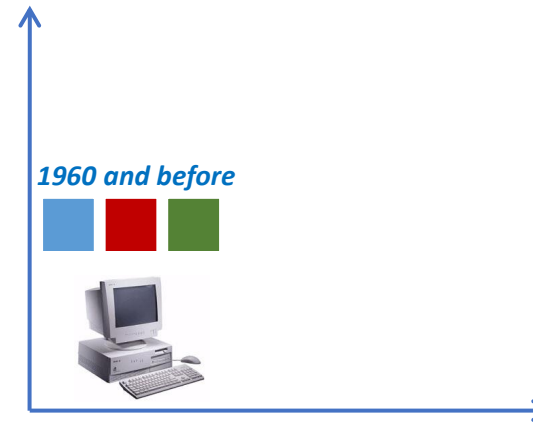
# Where Things come from?

## ► From Von Neumann Computer

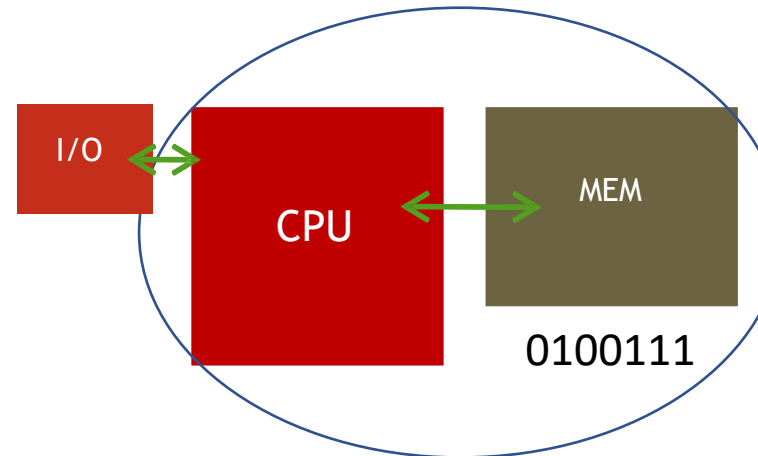
*EDVAC, one of the first electronic stored program computers*



How CPU/MEM work ?



Von Neumann  
1903 - 1957



DATA processing is key

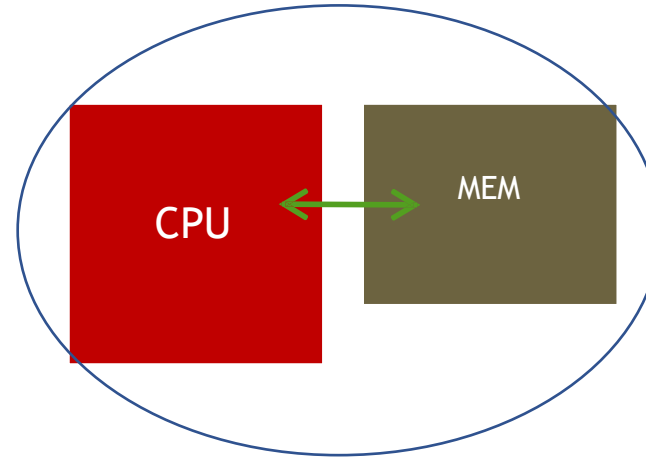
# CPU/MEM Von Neumann Architecture

- Memory

- Stores both program and data

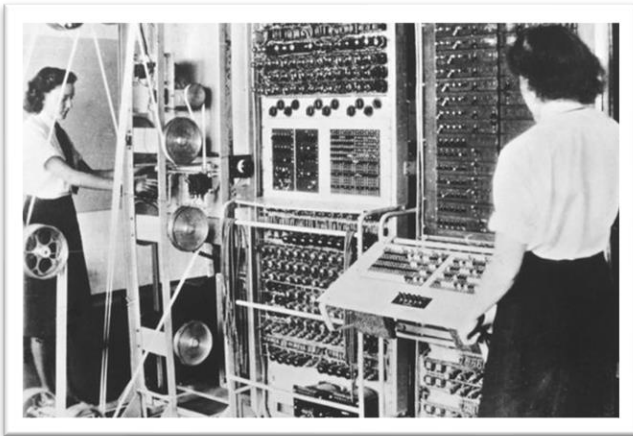
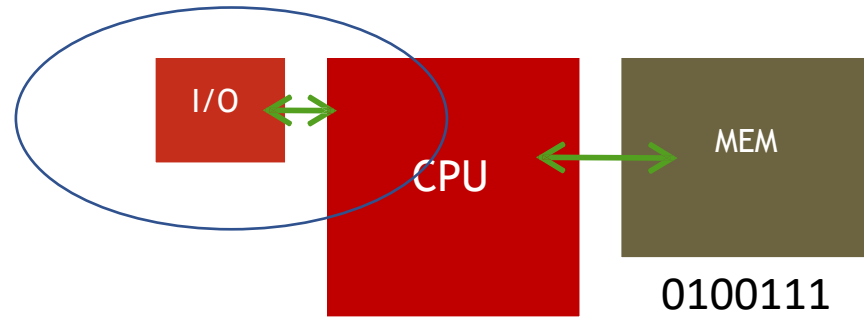
## CPU

- Directs the operations of the other units by providing timing and control signals.
- Performs arithmetic and logical operations such as addition, subtraction, multiplication and division.



# Where Things come from?

## ► From Von Neumann Computer



What are the inputs / outputs ?

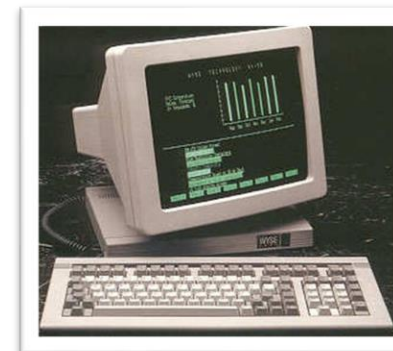
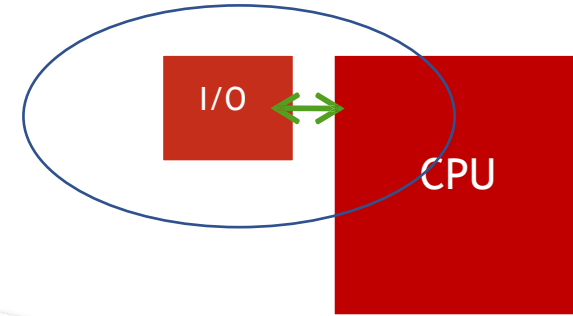
# I/O in Von Neumann Architecture

- Input

- An input device gets data from users
- Examples are keyboards, floppy disks ...

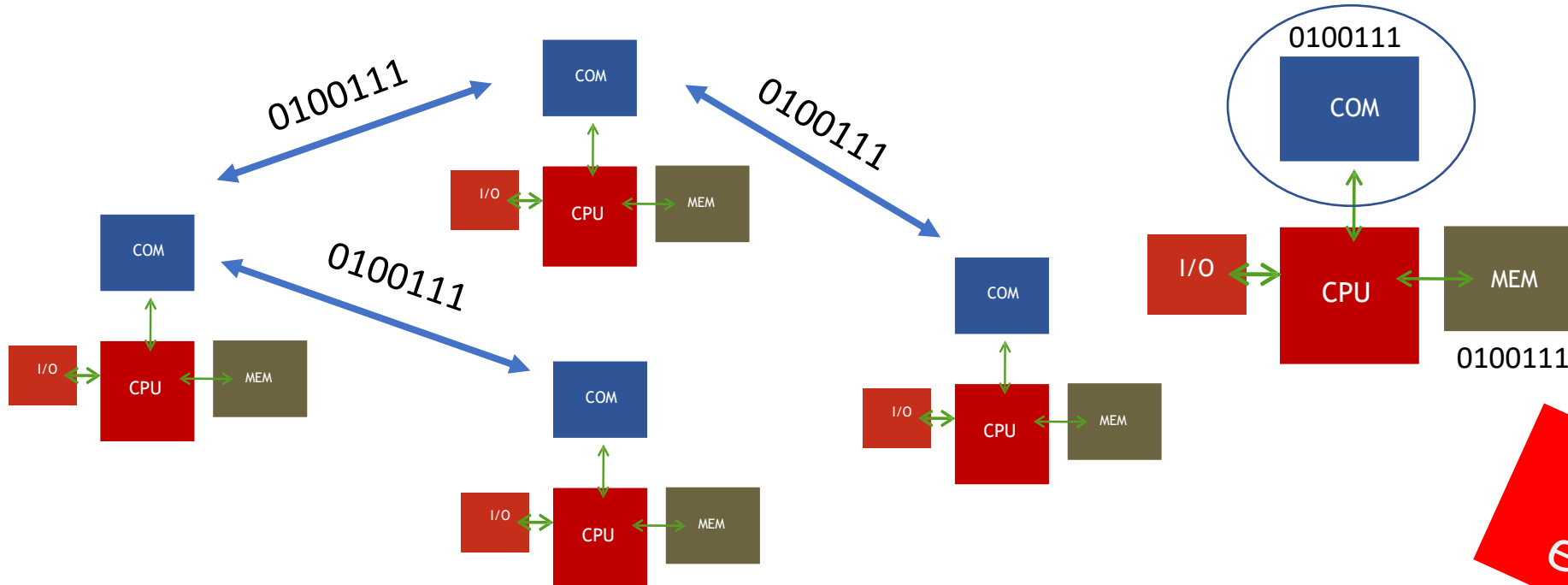
- Output

- An output device sends data to users.
- Typical output devices are monitors, printers and secondary storage devices.



# Distributed Computing

- Networks of communication
- Computers can exchange data

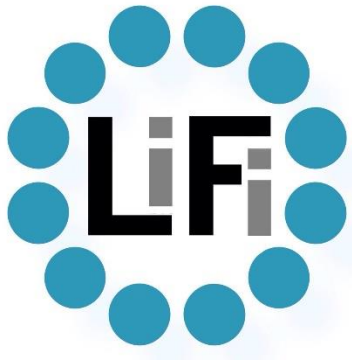


How does it works ?

DATA processing  
everytime is key

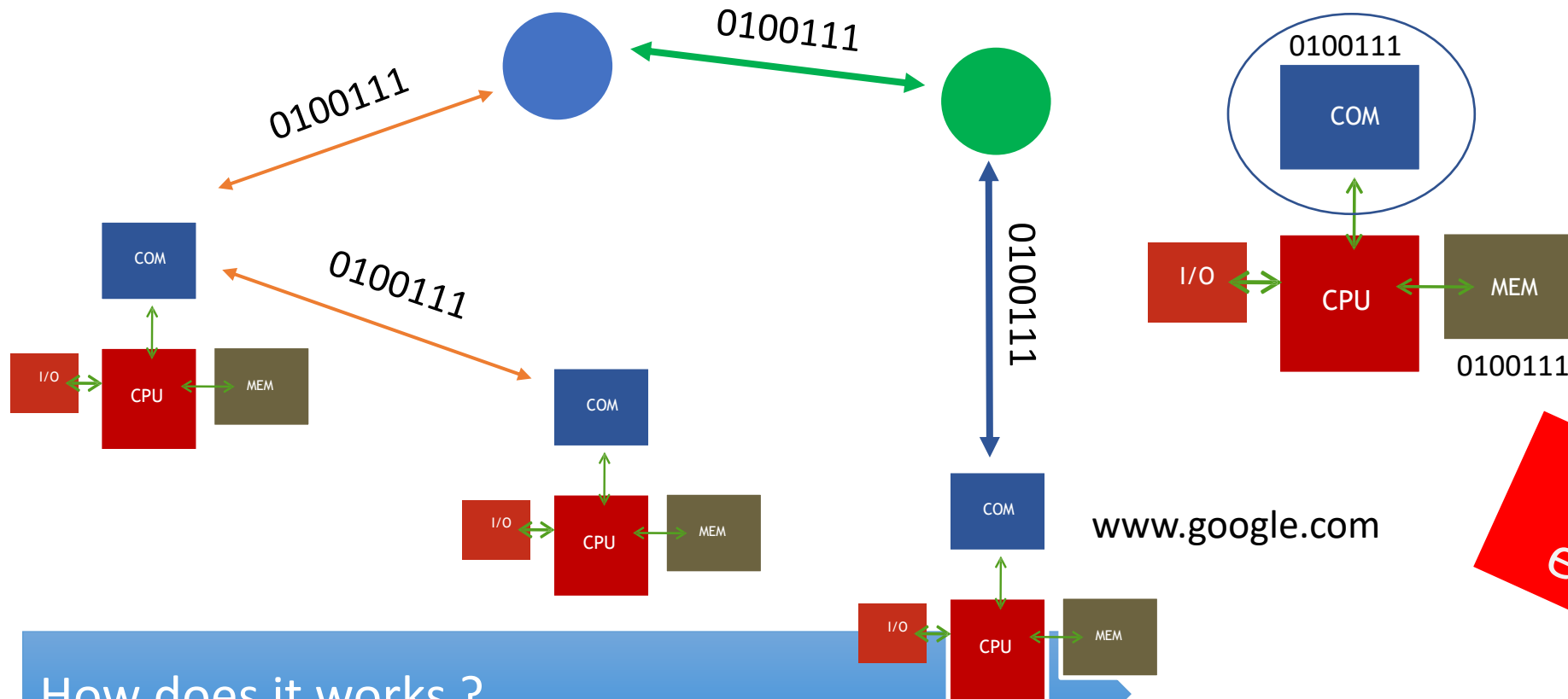


# Technologies for Local Communications (Connectivity)



# Network : Internet

- Networks of Networks
- Computers can exchange data all around the world



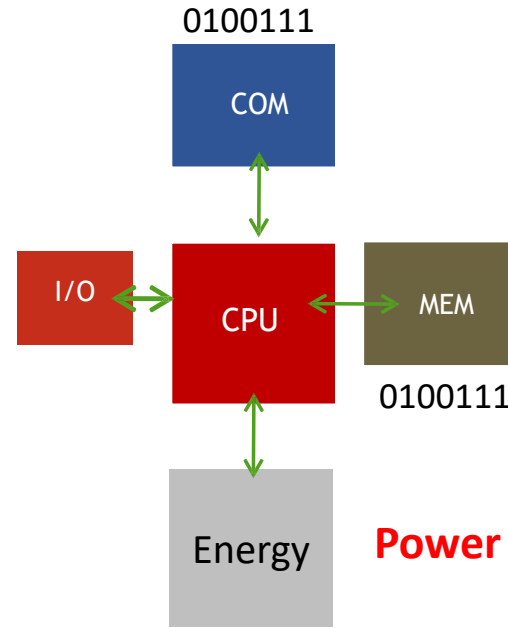
How does it works ?

DATA processing  
everytime is key

# Mobile Computing



?



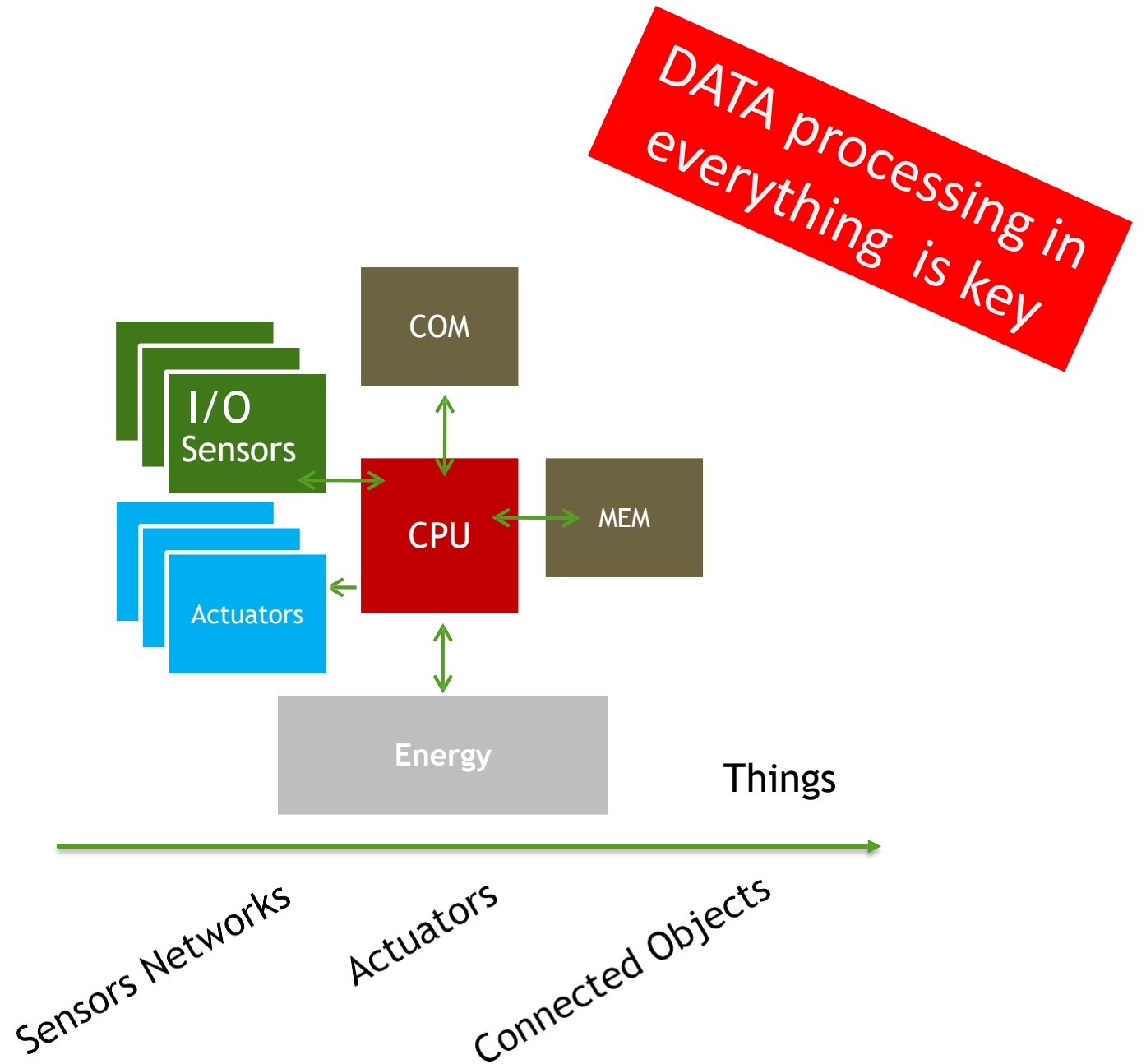
DATA processing  
everywhere is key

Power supply technologies

What are Things then ?

# What are Things ?

- ▶ Mainly based on Inputs / Outputs sophistication ...
- ▶ Things are connected Devices  
With new Network Technologies
- ▶ More or less sophisticated
  - ▶ Connected Sensors
  - ▶ Connected Actuators
  - ▶ Connected Objects (with sensors and actuators)



Is it new ?

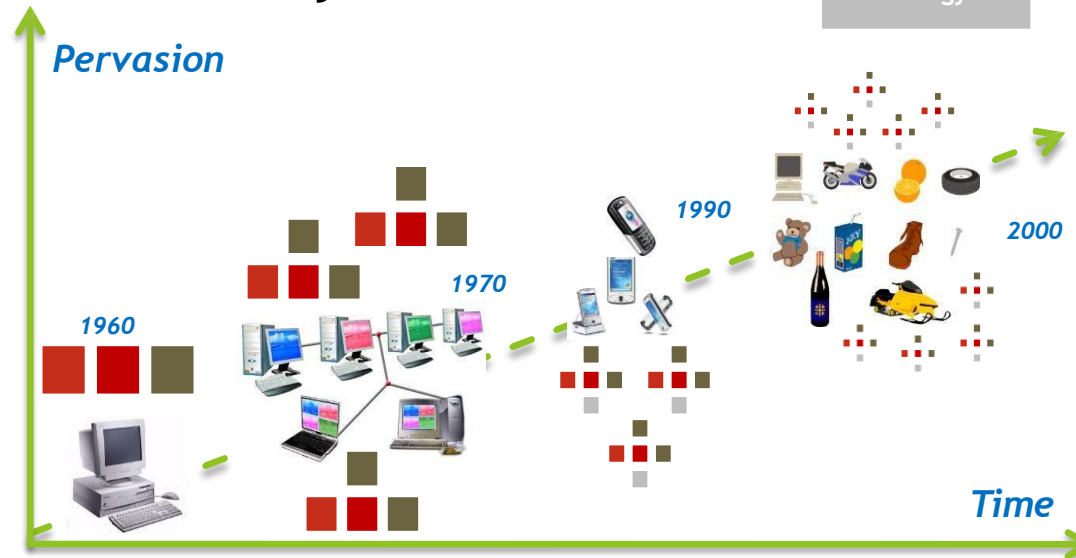
## Ubiquitous Computing (1991)

« Silicon-based information technology, is far from having become part of the environment »



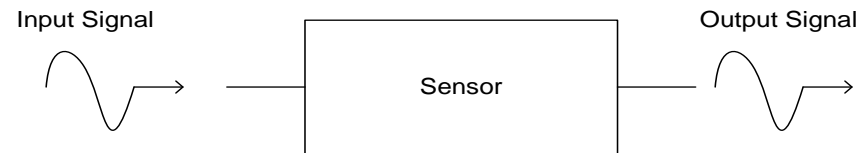
- ▶ Everytime, Everywhere, but in Everything
- ▶ Ubiquitous Computing is a Post distributed Distributed Computing
- ▶ After networks of distributed computers, mobiles computers, it's time for distributed « Things » and anything connected.

From Von Neumann Computer Model to connected Objects ....



# What are Sensors?

- American National Standards Institute (ANSI) Definition
  - A device which provides a usable output in response to a specified measurand



- A sensor acquires a physical parameter and converts it into a signal suitable for processing (e.g. optical, electrical, mechanical)
- A transducer
  - Microphone, Loud Speaker, Biological Senses (e.g. touch, sight,...)

# Detectable Phenomenon

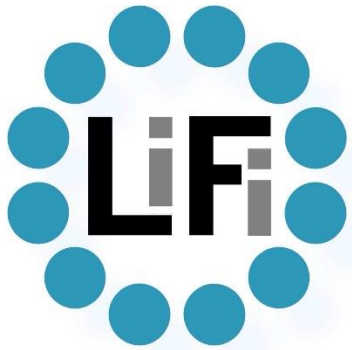
<b>Stimulus</b>	<b>Quantity</b>
<b>Acoustic</b>	<b>Wave (amplitude, phase, polarization), Spectrum, Wave Velocity</b>
<b>Biological &amp; Chemical</b>	<b>Fluid Concentrations (Gas or Liquid)</b>
<b>Electric</b>	<b>Charge, Voltage, Current, Electric Field (amplitude, phase, polarization), Conductivity, Permittivity</b>
<b>Magnetic</b>	<b>Magnetic Field (amplitude, phase, polarization), Flux, Permeability</b>
<b>Optical</b>	<b>Refractive Index, Reflectivity, Absorption</b>
<b>Thermal</b>	<b>Temperature, Flux, Specific Heat, Thermal Conductivity</b>
<b>Mechanical</b>	<b>Position, Velocity, Acceleration, Force, Strain, Stress, Pressure, Torque</b>



# What are actuators?

- A hardware device that converts a controller command signal into a change in a physical parameter such as mechanical (position or velocity change).
- It can be
  - Hydraulic
  - Pneumatic
  - Electric
    - Electromechanical Actuator
    - Electrohydraulic Actuator
  - Thermal or magnetic
  - Mechanical

# What about connectivity ?



# Your turn : SENSORS and ACTUATORS ?



Switch



Light



LED

# Your turn : SENSORS and ACTUATORS ?



Camera



Keyboard



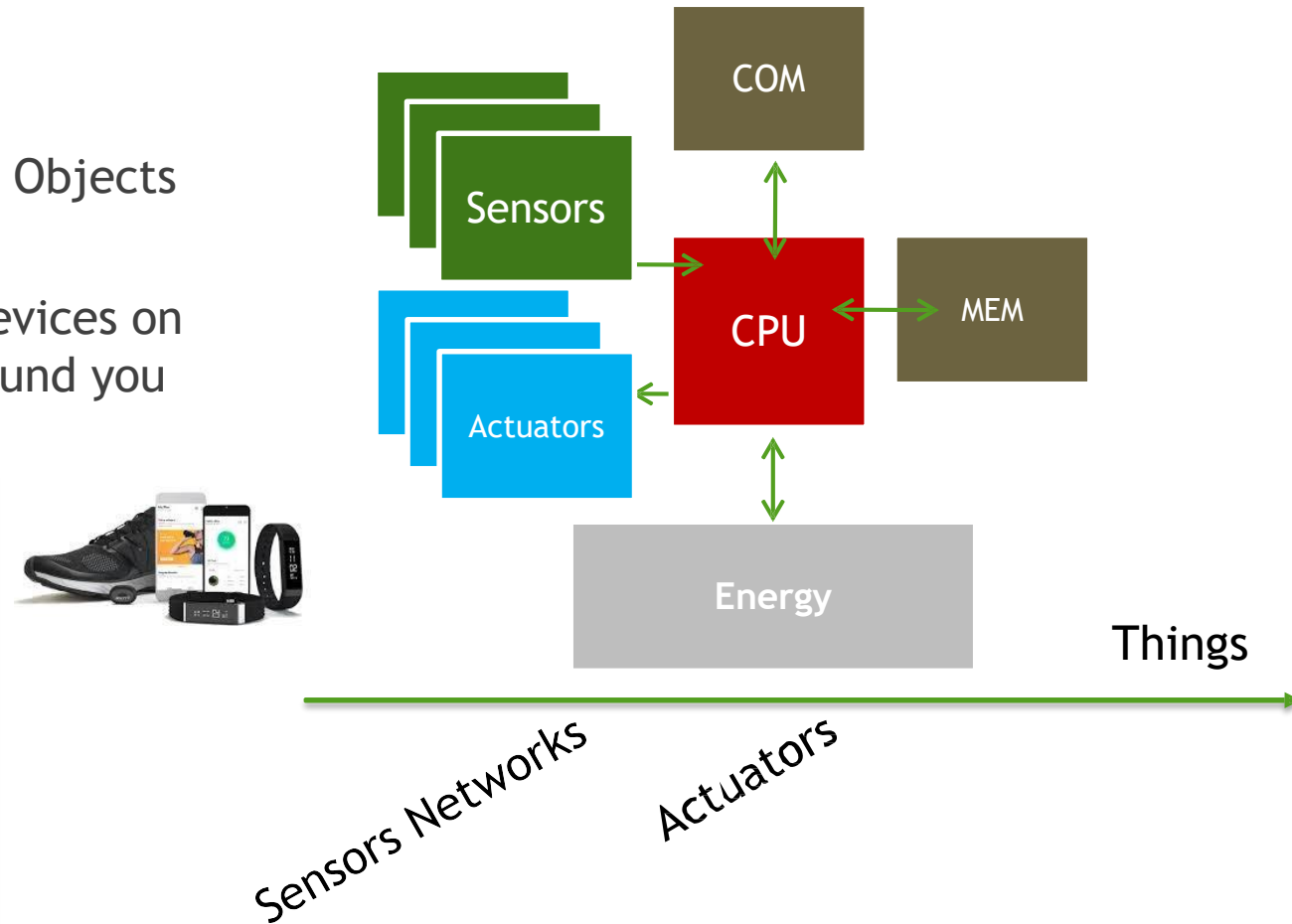
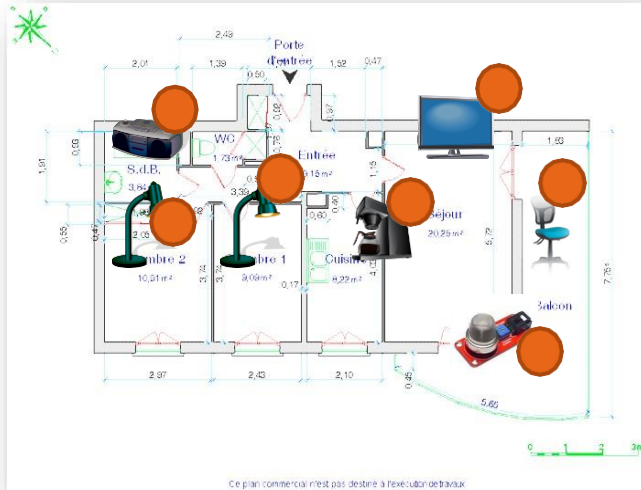
Mouse



SCREEN

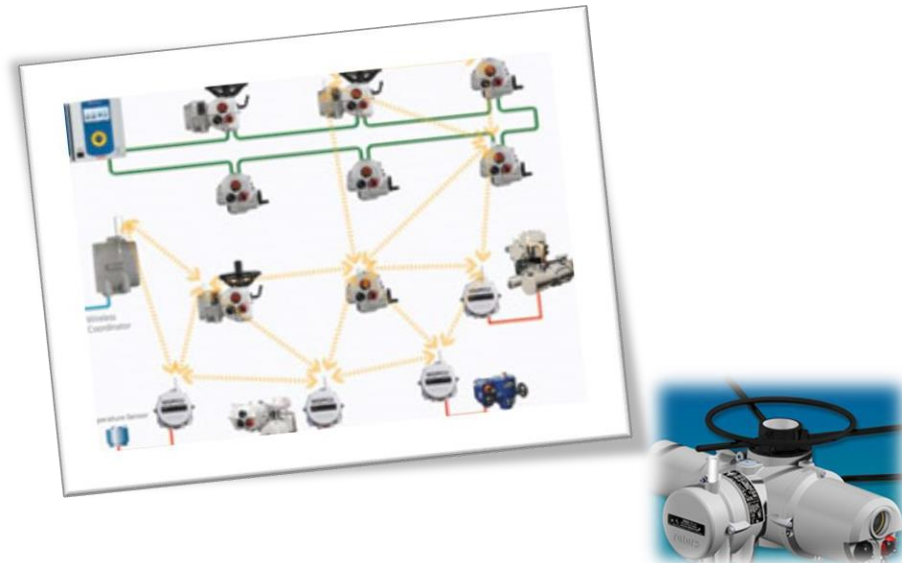
## Example of Things

- ▶ And they became Connected Objects ...
- ▶ To collect Data, to Control Devices on the field and much more around you

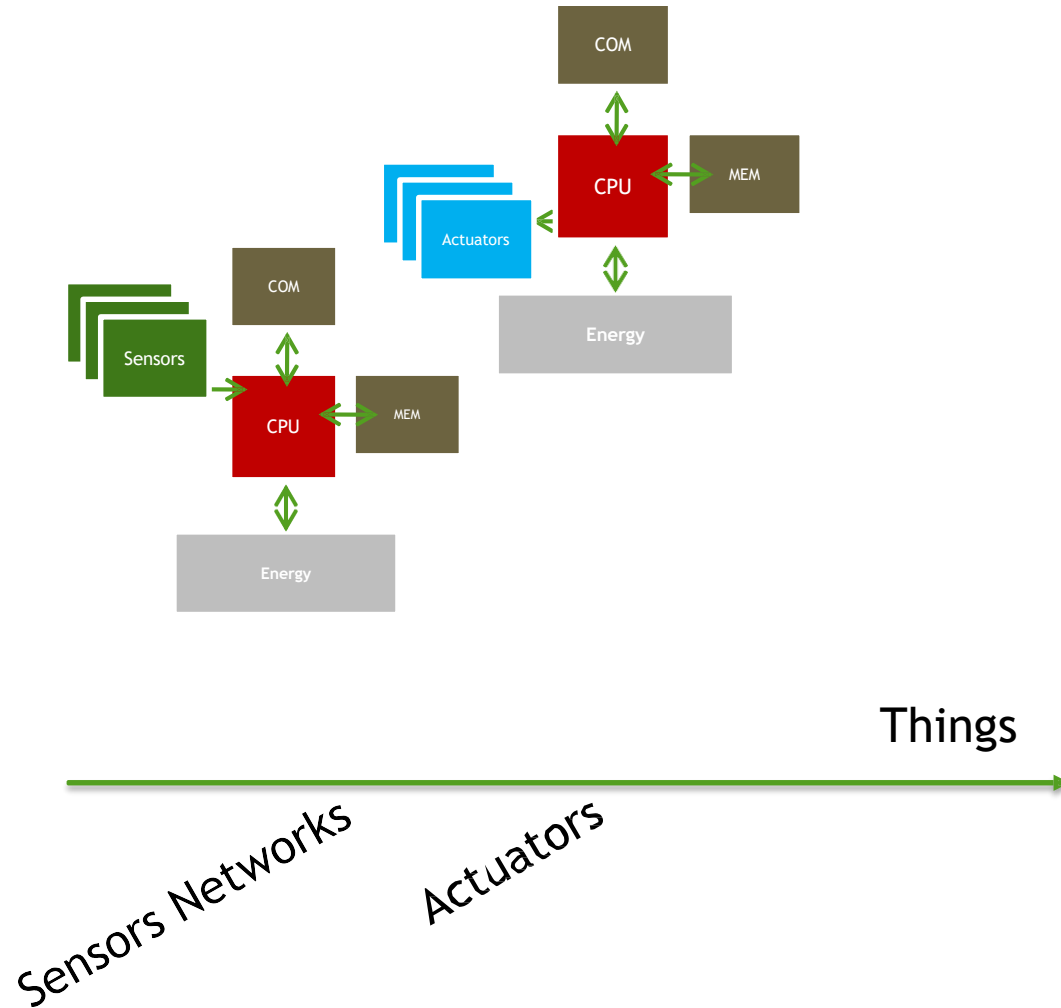


# Example of Things

- ▶ Actuators were added ...
- ▶ To collect Data and Control Devices on the field

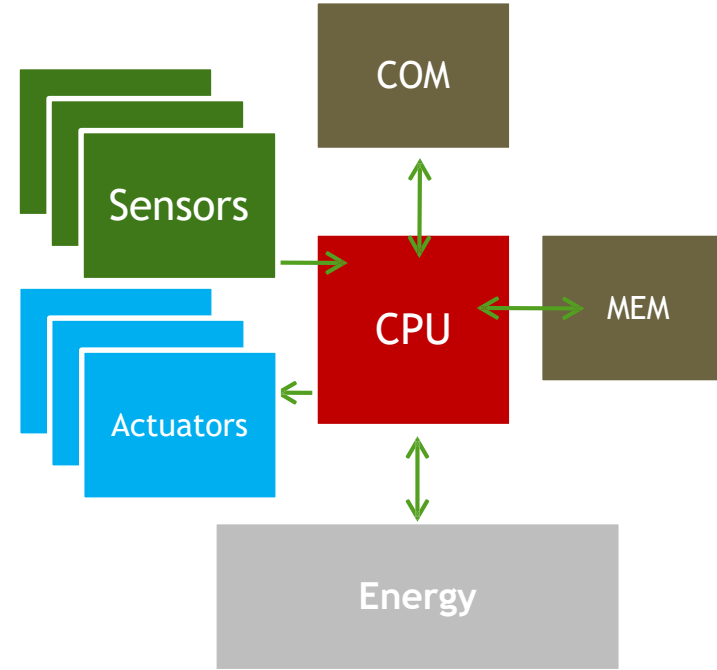


*Wireless Control for Valve Actuators*



# Your turn:

## Are you able to analyse Things ?



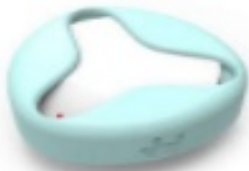
Parrot



Nabaztag



Crosscall Trecker X4



Beacons



nest



ZTE Watch Live



SmartPill