Introduction to Distributed Algorithms

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`https://www.lrde.epita.fr/~renault/teaching/algorep/`

Forewords

A distributed system is a collection of independent computers that appears to its users as a single coherent system

Andrew S. Tanenbaum

A distributed system is one in which the failure of a computer you didn't even know can rend you own computer unusable.

Leslie Lamport

What is a distributed system?

A distributed system is:

- a collection of autonomous computers
- connected through a network
- which enables computers to coordinate their activities
- so that users perceive the system as a single one

Example of Distributed Systems

- Grid/Cluster Computing

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- World Wide Web

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- Network File Server

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- Sensors Network

Parallel versus Distributed?

- Parallel architecture

- Distributed architecture

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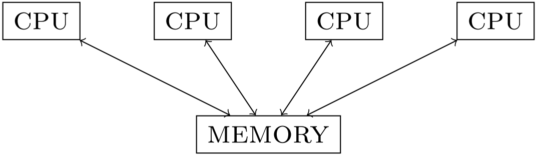

- Distributed architecture

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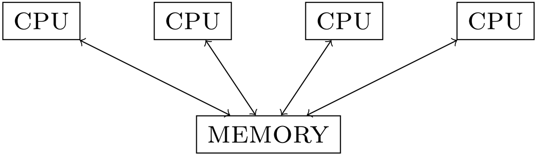

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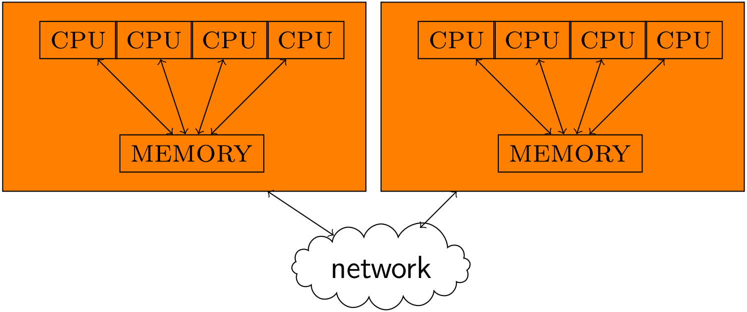

Remark

From a distributed system point of view no real difference between parallelism and distributed system (more details later in this lecture).

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8. The is one administrator

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- Topology
  - Hierarchical, Decentralized, Ring, Centralized

This class

1. Theoretical, mathematical viewpoint
2. Show some classical solutions and compute complexity
   - Define distributed computing environments
   - Define abstract problems
   - Describe algorithms that solve the problems
   - Analyze complexity
   - Present Impossibility results
3. Practical through a **project** (team of 3)

Objectives

Making you familiar with distributed algorithms since you will use them regardless the compagny you target!

Model Assumptions

- IPC methods: shared memory or message-passing
- Timing
  - Synchronous: rounds
  - Asynchronous: arbitrary speed
  - Partially synchronous models: with timing assumptions with bounds on messages delays, processors speeds and clock rates
- Failures
  - Processors: stoping, byzantine
  - Communication: loss, duplication, failure, recovery

Topic Overview

1. Synchronous model
   - Basic,easy to program
   - Not realistic, but sometimes emulate worse-behaved networks
   - Impossibility for synchronous network carry over worse networks
2. Asynchronous model
   - Realistics but hard to cope with
3. Partially synchronous model
   - Somewhere in between