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# Parallel and Distributed Computing

## Finalità

### Part 1

The aim of the course is to define and characterize computing systems, focusing on parallel and distributed computing systems. A sound theoretical foundation will be developed, related to performance evaluation and programming models of complex computing systems. From a practical point of view, some important tools for parallel and distributed programming will be illustrated.

### Part 2

The aim of the course is to illustrate the peer-to-peer paradigm and the most important distributed architectures based on it. Moreover, the principles of autonomic computing will be introduced, as well as a design solution for adaptive peer-to-peer systems. The last part of the course will be related to the simulation of complex systems, in particular peer-to-peer and autonomic systems.

## Programma

### Part 1

#### Systems e models

- State space
- Deterministic and stochastic models
- Complex systems
- Complex adaptive systems
- Population dynamics
- Network topologies
- DEVS models

#### Computing systems

- Information theory
- Taxonomy of computing systems
- Automata
- Von Neumann architecture

#### Parallel computing

- General concepts
- Multicore systems, Cell, General Purpose GPU Programming
- NUMA architecture; Onyx2
- Massive parallelism, CM2
- Programming models
- Parallel programming
- Message Passing Interface (MPI)

#### Distributed computing

- Cluster computing
- Grid computing
- Cloud computing
- Pervasive computing

### Part 2

#### Peer-to-Peer Systems

- State variables
- Dynamics of peer-to-peer networks
- Design issues
- Design strategies for overlay schemes
- Popular overlay schemes (Napster, BitTorrent, eMule, JXTA, Skype, Chord)

#### Autonomic Computing

- The four principles of autonomic computing
- Adaptive Evolutionary Framework

#### Simulation

- General concepts about simulation
- Event-driven simulation

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- DEUS: a simple tool for complex simulations

Modalità d'esame

Written examination and practical test (short essay).

Testi consigliati

Official notes, slides and other training aid will be made available on [my.unipr.it](http://my.unipr.it)