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# Parallel and Distributed Computing

## Finalità

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. The course will also illustrate the peer-to-peer paradigm and the principles of autonomic computing, 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

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

### Distributed computing

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

### Peer-to-Peer Systems

- State Variables
- Dynamics of peer-to-peer networks
- Design issues
- Design strategies
- Most important overlay schemes (Napster, BitTorrent, eMule, JXTA, Skype, Chord)
- Sip2Peer middleware

### Autonomic Computing

- The four principles of autonomic computing
- Networked Autonomic Machine
- Adaptive Evolutionary Framework

### Simulations

- General concepts about simulations
- Event oriented simulations
- DEUS: a tool for complex simulations

## Attività d'esercitazione

Practice with the DEUS simulation tool.

## Modalità d'esame

Written examination and practical test (short project).

## Testi consigliati

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Official notes, slides and other training aid will be provided by the teacher.