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 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
- DEUS: a simple 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
Official notes, slides and other training aid will be provided by the teacher.