

PEER TO PEER SYSTEMS AND BLOCKCHAINS



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- **Course** details:
 - 6 CFU: 48 hours
 - **Pre-requisites:** a basic course in networking
 - **Semester:** second
 - **Exam mode:** (project or written test) + oral test
- **Course references:**
 - link to the 16/17 Course on the Moodle through
<https://elearning.di.unipi.it/course/view.php?id=89>

Some reasons to take this exam



- Applications distributed on thousands of machines on the Internet, are becoming commonplace:
 - an unprecedented shift in scale and complexity
- new challenges are now arising: classic methodologies for the development of distributed systems are no more valid.
- new “tools” are required:
 - probabilistic algorithms
 - computation based on a local view
 - distributed consensus algorithms
 - secure distributed structures
 - statistical analysis of complex topologies
 - game theory for defining peer cooperation

Syllabus



- P2P Overlays: Structured and Unstructured
- Distributed Hash Tables.
 - Theory: *routing on structured networks*. Applications: *the KAD network of Bittorrent*
- Content Distribution Networks (CDN)
 - Theory: *Game theory*. Applications: *Bittorrent, Video streaming: Netflix*
- Probabilistic epidemic protocols.
 - Theory: *Gossip protocols*. Applications: *Cassandra*
- BlockChains
 - Theory: *Distributed secure structures, Consensus algorithms*
 - Applications: *Bitcoin cryptocurrency, Ethereum smart contracts*
- Analysis of P2P topologies:
 - Theory: *small worlds, scale free networks*. Applications: *Freenet, Analysis of the Bitcoin transaction graph*



Available Thesis

- analysis of the Bitcoin Transaction Graphs
 - discovering economic phenomena through graph analysis
- implementing distributed access control policies through blockchains methodologies
 - exploiting the Ethereum blockchain
- vertex centric algorithms for the analysis of complex graphs:
 - current flow betweenness: graphs as electric circuits