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
  - Theory: *routing on structured networks*. Applications: *the KAD network of Bittorrent*

- Distributed Hash Tables.
  - Theory: *Game theory*. Applications: *Bittorrent, Video streaming: Netflix*

- Content Distribution Networks (CDN)
  - Theory: *Probabilistic epidemic 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