

# 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:** midterm + finalterm + project
- **Course references:**
  - link to the 18/19 Course on the Moodle through  
<https://elearning.di.unipi.it/course/view.php?id=155#section-0>

# 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
- Development of distributed online social networks (H2020 European Project HELIOS)