

Sistema centralizzato di iscrizione agli esami Programma

# UNIVERSITÀ DI PISA PEER TO PEER SYSTEMS AND BLOCKCHAINS

## LAURA EMILIA MARIA RICCI

Anno accad CdS Codice CFU	emico		2016/17 INFORMATICA 261AA 6
Moduli	Settore/i	Tipo	Ore

LEZIONI

Docente/i EMANUELE CARLINI LAURA EMILIA MARIA RICCI

### Obiettivi di apprendimento

SISTEMI PEER TO PEER INF/01

### Conoscenze

The course aims at providing a mix of foundations and advanced knowledge in the field of distributed computing specifically targeting peer to peer applications. The course provides both theoretical knowledge and applications to real scenarios.

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The main three topics of the course regard Distributed Hash Table, Complex Network Analysis and Blockchain technologies

### Modalità di verifica delle conoscenze

Delivery: face to face, with the support of computer based tools (software blackboard, audio/video of lessons available through web)

- attending lectures
- individual study
- Laboratory work
- Practical

Attendance: Not mandatory Teaching methods:

- Lectures
- laboratory (bring you own device model)
- project work

#### Capacità

The student will eventually be able to design, develop and tune distributed applications using peer-to-peer simulator or practical programming frameworks.

### Modalità di verifica delle capacità

Mid and final term exercises are assigned during the course and part of the exam consist in the preparation of a small project, to be designed, developed and tested through the tools presented in the cours

Prerequisiti (conoscenze iniziali) JAVA programming Network programming frameworks Basic mathematica skills

Corequisiti



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No corequisite.

# Programma (contenuti dell'insegnamento)

### P2P Topologies

- Peer to Peer (P2P) systems: general concepts
- Unstructured Overlays: Flooding, Random Walks, Epidemic Di usion
- Structured Overlays: Distributed Hash Tables (DHT), Routing on a DHT -Case Studies:
- Bittorrent as a Content Distribution Network: KAD implementation of

the Kademlia DHT, game-based cooperation

Complex Network for the analysis of P2P systems

- Network models
- Random Graphs and Small Worlds
- Small World navigability: Watts Strogatz and Kleinberg.
- Complex networks navigability

#### Cryptocurrencies and Blockchains

### Basic concepts:

- review of basic cryptographic tools (digital signatures, cryptographic hash,

- Merkle trees.,..)
- blockchains: de nitions
- distributed consensus: de nitions
- the Bitcoin blockchains
- Nakamoto consensus
- Bitcoin mining mechanism
- pseudoanonymity: traceability and mixing
- the Bitcoin P2P Network
- The Bitcoin ecosystem
- scalability issues
- Bitcoin Extensions/alternatives: altcoins, sidechains, the StellarConsensus Protocol

#### - Applications of blockchains

- Ethereum: programming smart contracts
- Blockchain 1.0: cryptocurrencies
- Blockchain 2.0: nancial instruments built on cryptocurrencies
- Blockchain 3.0: applications beyond cryptocurrencies (DNS, lotteries, voting, IoT...)

### Bibliografia e materiale didattico

Slides of the course

Tutorials and papers available on the web.

Indicazioni per non frequentanti All the taching material is published on the age of the course

### Modalità d'esame

(wrtten exam OR project) + oral test if the student pass both mid and final term the oral proof, he/she is exempted from the oral examination

#### Stage e tirocini

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

Pagina web del corso https://elearning.di.unipi.it/course/view.php?id=89



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