

USEET4 - Peer-to-Peer Systems and Blockchain

Présentation

Prérequis

- Computer Networks.
- At least one programming language.
- Algorithmics.

Objectifs pédagogiques

The student will acquire knowledge relative to the development of distributed systems, in particular of blockchain-based systems.

At the end of the course, the student

- will be able to develop a distributed application.
- will be able to develop a smart contract.
- will be able to understand consensus mechanisms.

Programme

Contenu

The course covers the following topics:

- Peer-to-peer Systems: general concepts, unstructured overlays: Flooding, Random Walks, Epidemic Diffusion, structured overlays: Distributed Hash Tables (DHT), Routing on a DHT, IPFS.
- Blockchains: basic concepts, basic cryptographic tools (digital signatures, cryptographic hash, Zero-Knowledge,...), data structures: Merkle trees, Merkle Patricia tries.
- Bitcoin: transaction and block structure. Mining : Proof of Work, rewards. Bitcoin: attacks, 51%, double spending. Bitcoin: tracciabilità e mixing. Structure of the P2P network.
- Byzantine Fault-Tolerance (BFT) Consensus and BFT-based blockchains.
- Ethereum: smart contract, gas. Consensus: from PoW to PoS. Ethereum: Solidity, smart contracts programming. Smart contract security and attacks.
- Distributed Ledgers Applications: tokens (fungible and non-fungible), Self Sovereign Identity, Supply-chains.
- Scalability enhancement: Zero Knowledge rollup e optimistic roll-up, side chain, inter-chain protocols, channel networks (Lightning network).

complementary content:

- Peer to peer system: applications BitTorrent, a Content Distribution Network, implementation of the Kademlia DHT.

Modalités de validation

- Contrôle continu
- Projet(s)
- Examen final

Description des modalités de validation

At the end of the course, the student must submit the final project to be evaluated.

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Code : USEET4

Unité spécifique de type cours

5 crédits

Responsabilité nationale :
EPN05 - Informatique / Stefano
SECCI