

CS-451

Distributed algorithms

Guerraoui Rachid

Cursus	Sem.	Type
Computer and Communication Sciences		Opt.
Computer science minor	H	Opt.
Computer science	MA1, MA3	Obl.
Cybersecurity	MA1, MA3	Obl.
Data Science	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Obl.

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Written
Workload	180h
Weeks	14
Hours	6 weekly
Courses	3 weekly
Exercises	2 weekly
TP	1 weekly
Number of positions	

Summary

Computing is often distributed over several machines, in a local IP-like network, a cloud or in a P2P network. Failures are common and computations need to proceed despite partial failures of machines or communication links. The foundations of reliable distributed computing will be studied.

Content

Reliable broadcast
 Causal Broadcast
 Total Order Broadcast
 Consensus
 Non-Blocking Atomic Commit
 Group Membership, View Synchrony
 Terminating Reliable Broadcast
 Shared Memory in Message Passing Systems
 Byzantine Fault Tolerance
 Self Stabilization
 Population protocols (models of mobile networks)
 Bitcoin, Blockchain
 Distributed Machine Learning
 Gossip

Keywords

Distributed algorithms, checkpointing, replication, consensus, atomic broadcast, distributed transactions, atomic commitment, 2PC, Machine Learning

Learning Prerequisites**Required courses**

Basics of Algorithms, networking and operating systems

Recommended courses

The lecture is orthogonal to the one on concurrent algorithms: it makes a lot of sense to take them in parallel.

Learning Outcomes

By the end of the course, the student must be able to:

- Choose an appropriate abstraction to model a distributed computing problem
- Specify the abstraction
- Present and implement it
- Analyze its complexity
- Prove a distributed algorithm
- Implement a distributed system

Teaching methods

Ex cathedra

Lectures, exercises and practical work

Assessment methods

Midterm and final exams

Project

Supervision

Office hours Yes

Assistants Yes

Forum Yes

Resources

Ressources en bibliothèque

- [Introduction to reliable and secure distributed programming / Cachin](#)

Notes/Handbook

Reliable and Secure Distributed Programming

Springer Verlag

C. Cachin, R. Guerraoui, L. Rodrigues

Websites

- <http://lpdwww.epfl.ch/education>