

CS-522

**Principles of computer systems**

Argyraki Katerina, Candea George

Cursus	Sem.	Type
Computer and Communication Sciences		Opt.
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Opt.

Language of teaching	English
Credits	8
Session	Winter
Semester	Fall
Exam	During the semester
Workload	240h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	4 weekly
<b>Number of positions</b>	

**Summary**

This advanced graduate course teaches the key design principles underlying successful computer and communication systems, and shows how to solve real problems with ideas, techniques, and algorithms from operating systems, networks, databases, programming languages, and computer architecture.

**Content**

A modern computer system spans many layers: applications, libraries, operating systems, networks, and hardware devices. Building a good system entails making the right trade-offs (e.g., between performance, durability, and correctness) and understanding emergent behaviors. Great system designers make these trade-offs in a principled fashion, whereas average ones make them by trial-and-error. In this course we develop a principled framework for computer system design, covering the following topics:

- Modules and interfaces
- Names
- Layers
- Indirection and virtualization
- Redundancy and fault tolerance
- Client/server architectures
- Decentralized architectures
- Transactional building blocks

**Learning Prerequisites****Required courses**

The course is intellectually challenging and fast-paced, and it requires a solid background in operating systems, databases, networking, programming languages, and computer architecture. The basic courses on these topics teach how the elemental parts of modern systems work, and this course picks up where the basic courses leave off. To do well, a student must master the material taught in the following courses:

- CS-200 Computer architecture
- CS-214 Software construction
- CS-311 The Software enterprise - from ideas to product
- CS-300 Data-intensive systems

**Recommended courses**

The following EPFL courses cover material that significantly helps students taking this course, however they are not strictly required:

- CS-320: Computer language processing
- CS-470: Advanced computer architecture
- CS-422: Database systems
- COM-407: TCP/IP networking

### Learning Outcomes

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

- Design computer and communication systems that work well
- Make rational design trade-offs (e.g., performance vs. correctness, latency vs. availability)
- Anticipate emergent system behaviors (e.g., failure cascades, security vulnerabilities)
- Integrate multiple techniques, ideas, and algorithms from different fields of computing/communication into a working system

### Teaching methods

- A combination of online and in-class lectures
- Interactive design sessions
- Reading assignments
- Homework assignments

### Expected student activities

- Attend lectures and design sessions
- Complete the reading and writing assignments
- Participate actively in the course (physically and online)

### Assessment methods

- 50% OPs
- 50% final exam

### Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

### Resources

#### Bibliography

See course website for the latest information and an up-to-date bibliography.

#### Ressources en bibliothèque

- [Principles of computer system design : an introduction / Saltzer](#)

### **Websites**

- <https://pocs.epfl.ch>

### **Moodle Link**

- <https://go.epfl.ch/CS-522>