

Computer Systems and Networks

a course for the Master SNE
Innopolis University – 2022

0. Presentation of this course

Teaching staff

Instructor: prof. Paolo Ciancarini, PhD

TA: Saif Mohammed Sabri,
Iseoluwa Oyeniyi

Who am I

Professor of Computer Science

Researcher on sw technologies for
distributed systems

... and who are you?

Structure

Lectures

Monday (till sept 12, then Tuesday)

Wednesday

Labs

13 Lectures + 6 Labs

1 day midterm + 1 day project presentation

Main questions

This course

Which are the basis for designing applications on networked systems?

How is their design described and developed?

How do you understand such systems?

How do you make them secure?

Course syllabus

1. Introduction
2. Documenting
3. System architecture patterns
4. Pipe and filter
5. Inter process communication
6. Inter system communication
7. OSI model and middleware
8. Daemons and Distributed objects
9. Midterm
10. Client server
11. Concurrency
12. Distribution
13. Distributed consensus
14. Security of web based systems
15. Final Exam

Labs

Team and individual assignments

Some with presentations or demos

Partly live-graded

Labs details

1. Introduction to system architecture
2. Architecture patterns
3. Technological Communication
4. Networking recon and analysis
5. Linux daemon configuration (web server as a daemon)
6. Static code analysis and race-condition detection

The midterm

- Choose a topic: a distributed system
- Look for 2-3 references to scientific works
- Ask me for approval by email
- Prepare 12-15 slides (overleaf preferred)
- Send me links to the slides
- Present the slides (max 10 minutes)

structure for the midterm report

1. Description of a system
2. Context (Main use cases, context diagram)
 1. Describe a possible scenario for using the system
3. Main architectural drivers (eg. Non-functional requirements)
4. Structure (which patterns? components/connectors?)
5. Behavior (how does the system work?)
6. Rationale (why the system has this form?)
7. Similar or competing systems
8. References (at least 3, sites do not count)

Alternative: present a *class* of systems (eg.: torrents) or a theory problem in distributed systems

Timeline for midterm presentations

Choose topic before sept 17

Send me message with references

I can help with additional material

Send slides: sept 19, 2022

Presentations: sept 21, 2022

Grading

Labs 50%

Midterm presentation: 20%

Final project 20%

Bonus: 10% I will grade class participation will by in-class engagement, including asking questions (you can ask, I can ask). The lack of attendance will count against your bonus grade

Prerequisites

- This course presents some fundamental ideas on **computer systems and networks** and their principles of construction exploiting middleware and distributed programming
- Prerequisites:
 - Be able to program (object oriented: Java or Python)
 - Basic notions of networking
 - Basic notions of operating systems
 - Basic notions of concurrent programming

Goals of this course

- Understand principles and concepts underlying applications running on multiple, networked **computer systems**: communication, concurrency, coordination and related algorithms
- Learn how to **design** and describe simple **distributed applications** using (open source)
- Gain **practical** experience on concurrent and distributed programming (Python or Java)
- Improve your understanding of computer systems and networks

Learning objectives

- Describe the characteristics of different applications which run on networked computer systems, like distributed file systems, microservices, blockchains, IoT
- Compare different types of systems and their software.
- Understand how to design, implement, and deploy computer systems using the models of: web applications, web services, remote objects, and indirect asynchronous messaging.
- Understand the challenge of managing time in a distributed system, and implement a means of assessing a distributed system's state.
- Understand transactions and implement a two phase commit protocol.
- Understand the problem of distributed consensus and design solutions

This course: Scheduling

I. 29.8 9.30-11.30

II. 31.8 9.30-11.30

III. 5.9

IV. 7.9

V. 12.9

VI. 14.9

VII. 20.9

VIII. 21.9

IX. 27.9 Midterm

X. 28.9

XI. 4.10

XII. 5.10

XIII. 11.10

XIV. 12.10

XV. 19.10 Exam 10-12

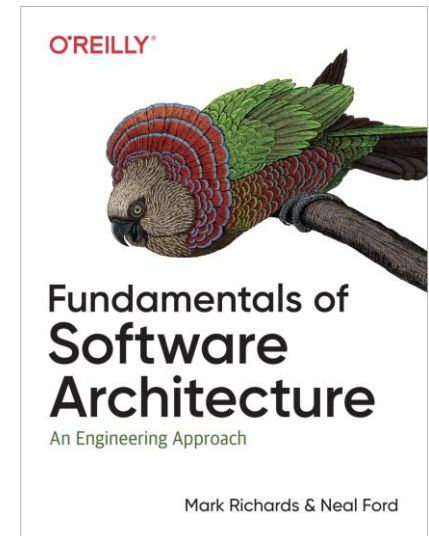
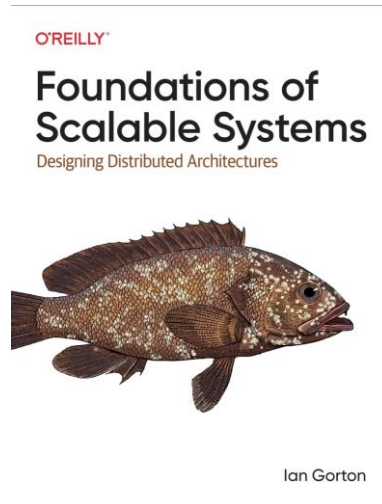
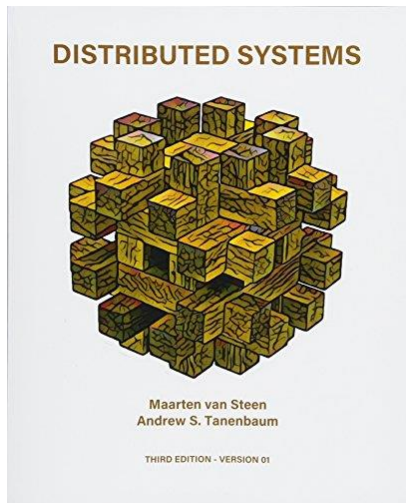
midterm presentation (choose topic by sept 15)

final exam (demo project, deliver report in advance)

Channels

- **Telegram** (course): InnoCSN
- **Telegram** (personal) @PaLoCaPa
- **Email:** `paolo.ciancarini@unibo.it`
- **skype:** `paolociancarini`
- **Twitter:** `@paolociancarini`
- **Linkedin:** search me and ask for contact!
- **Moodle**

Textbooks



vanSteen and Tanenbaum, *Distributed Systems*, 3ed, 2017

Gorton, *Foundations of scalable systems*, O'Reilly, 2022

Richard and Ford, *Foundations of software architecture*, 2020

Additional material (slides, papers, books) distributed during the course

Questions?