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Distributed Systems
Introduction

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2^{nd} semester - 2025′26

Introduction to SD

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Teachers

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  - Theory and Practice
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  - Practice

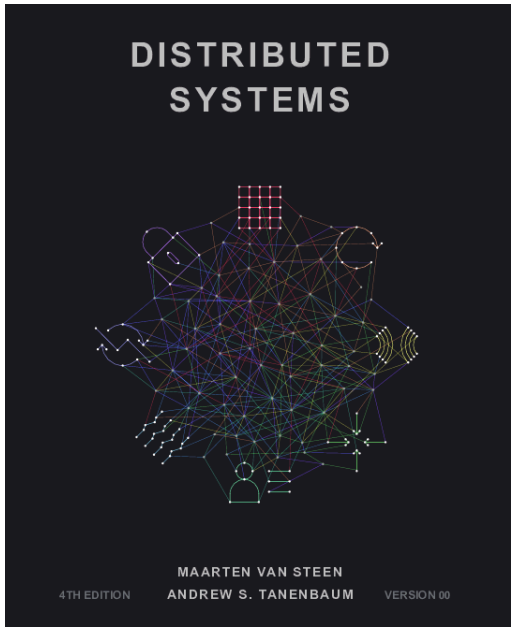
What You Will Learn in Distributed Systems

- **What distributed systems are** and why they are hard
- **Design goals**: transparency, scalability, dependability
- **Processes & virtualization**: threads, containers, VMs
- **System architectures**: client–server, P2P, cloud & edge
- **Communication models**: RPC, messaging, multicast
- **Coordination mechanisms**: clocks, mutual exclusion, elections
- **Consistency & replication**: trade-offs and models
- **Fault tolerance**: failures, replication, consensus
- **Naming & discovery**: DNS, DHTs, directory services

Bibliography

- Distributed Systems – Concepts and Design, Dollimore J., Kindberg T. e Coulouris G., Addison Wesley / Pearson Education Ltd, 2005
- Distributed Systems – Principles and Paradigms, Tanenbaum A.S. e Steen M.v., Pearson Education International / Prentice Hall, 2007
- Distributed Systems – An Algorithmic Approach, Ghosh S., Chapman & Hall CRC Computer and Information Science Series, 2007

Main Bibliography



- M. van Steen and A.S. Tanenbaum, Distributed Systems, 4th ed., distributed-systems.net, 2023.

Get your free copy at www.distributed-systems.net

Requirements

- **Knowledge** of **operating systems** and **multiprogramming**
  - Window, **Linux** and macOS can be used but only **Linux** is officially supported
- **Experience** in applying the **object-oriented paradigm** to design solutions
  - You will be using **Java 21**
- **Proficiency** with **concurrent programming principles**
  - Critical Regions, Race Conditions, Deadlock
  - Monitors, Mutexes, Semaphores, Condition Variables

Contact Hours

- Theory class (T)
  - 2h, Thursday 9-11h
  - Anf. IV
- Practice class (P)
  - 2h, Thursday 11-13h, 14-16h, 16-18h
  - 4.1.01

IMPORTANT: If you have any questions or doubts, send an email with the prefix *SD* in the subject line (e.g., "*SD* | *your subject here*") and include your name and student ID number in the body of the message. **Messages that do not follow this rule may be ignored**.

Lectures & Lab

- Lectures cover key topics from the syllabus
- Students are encouraged to **actively participate in discussions**
  - Foster critical reasoning and problem-solving skills
- Labs emphasize the principle **“learning by doing”**
  - Focus on discussing implementation strategies for solving specific problems.

Lab Assignments

Assignment 1

- *Concurrency* Project
  - Pure concurrent implementation
  - Intra-Process Communication (IPC)
  - Single platform
- Available at 19 February

Assignment 2

- *Message Passing* Project
  - Distributed implementation
  - RPC/REST/RMI, etc.
  - Multiple platforms
- Available at 26 March

- Students collaborate in groups of three (3).
- Lab class will be use to develop the assignments projects.

Evaluation

Theorical grade (50%)

- Written exame (época normal ou época de recurso)

Practical grade (50%)

- Comprised of 2 Assignments
  - 40% first assigment, 60% second assignment
- Last year grade: 10% cut and limited to a maximum of 14

Final grade

$$\text{course grade} = \frac{5 \times \text{theorical grade} + 5 \times \text{lab grade}}{10}$$

Rounding is always done half up to the nearest whole number.

- **Pass:** Both theoretical and lab grades must be **7.5 or higher**
  - Final grade must be **10 or higher**
- **Fail:** Any of the following:
  - Theoretical grade is below the minimum required.
  - Lab grade is below the minimum required.
  - Final grade is below 10.
- **Fail by Absence** (regular student)
  - More than two (2) lab classes are missed – $13 \times 20\% = 2.8$
    - Regulamento de Estudos da Universidade de Aveiro (REUA) - Regulamento 833/2021, publicado em Diário da República, 2ª Série de 3 de setembro de 2021, Artigo 18.º, n.º6.

Practical Assignment: Evaluation

- Group assignments
- A Github repo will be assigned to each group
  - Each student must provide his Github username
- Assignments are evaluated based on the **short** presentation + demo, repository, and code
- Read the assigment guide for more information
- Late submission penalties:
  - 10% – if submitted 1 day late
  - 25% – if submitted 2 days late
  - 100% – if submitted 3 or more days late

Practical Assignment: Auto-Evaluation

To account for asymmetries in the work carried out by the group members, a points system is applied.

- Each group has $N * 100$ points to distribute
  - N is the number of elements in the group
- Each group must report the self-assessment in the presentation
- The final grade f_i, rounded to one decimal place, is calculated based on the reference grade r and the individual grade p_i of each member:

$$f_i = f(r, p_i)$$

Final Remarks

- Important Dates
  - deadline for work assignment #1 → 25 March 2026
  - deadline for work assignment #2 → 31 May 2026
- All documentation about the course is available on the eLearning platform.
- For further questions, refer to the course operational document or contact me directly.

Questions?