ID2201 Distributed Systems, Basic Course (Distribuerade system, grundkurs) 2023/2024, period 2 (HT23)

The course covers fundamental models for distributed systems, inter-process communication, and how to handle synchronization, consistency, replication, fault tolerance, and security in a distributed system. The course consists of lectures and practical homework assignments to be presented and demonstrated in person at reporting sessions at KTH campus. The assignments will be programming tasks that exemplify problem statements examined in the course.

Intended learning outcomes

The students shall, after the course, be able to:

- Explain essential characteristics of distributed systems;
- Describe architectural and fundamental models of distributed systems;
- Explain and compare strategies for inter-process communication;
- Explain and compare middleware models;
- Explain and compare name services;
- Explain the concept of logical time;
- Use the logical time to implement distributed algorithms.

Examination

- LAB1 - Laboratory Work, 1.5, grade scale: P, F
- TEN1 - Examination, 6.0, grade scale: A, B, C, D, E, FX, F

The examination consists of a written examination (TEN1) and programming assignments (LAB1). Assignments should be done and presented in person at reporting sessions. The final grade is based on the performance of the written exam and the programming assignments.

- The ID2201 exam is a proctored on-campus computer-based closed-book exam in Canvas. The exam consists of questions of different types, e.g., Multiple Choice, Multiple Answer, True/False, and Numeric, to be answered in Canvas on a KTH computer in a computer room at the KTH campus.

- Each homework programming assignment is to be uploaded to Canvas by the due date and presented to a teaching assistant during the reporting session. If submitted on time and successfully presented, you will earn bonus points that will be added to your exam score.

- The exam passing grade (E) is 60 points out of 100 without a bonus (120 with a total bonus).
    - Grade A: > 92
    - Grade B: 85-92
    - Grade C: 77-84
    - Grade D: 69-76
    - Grade E: 60-68
    - Grade FX (Fail; eligible for completion): 55-59
    - Grade F (Fail): < 55

Course Book

Distributed Systems - Concepts and Design, by George Coulouris, Jean Dollimore, Tim Kindberg, Fifth Edition, Addison-Wesley, ISBN: 0-273-76059-9 (http://www.cdk5.net/wp/)

Tentative Lecture Layout

Fourteen lectures mainly follow the course book, as shown in the table below. Lectures are not compulsory but highly recommended.

1. Introduction [Chapters 1 and 2]
2. Erlang - concurrent and distributed programming in Erlang.
3. Networks and process [Chapters 3 and 4]
4. Remote invocation [Chapter 5]
5. Indirect Communication [Chapter 6]
6. File systems and Name services [Chapters 12 and 13]
7. Time [Chapter 14.1-4]
8. Global state [Chapter 14.5]
9. Coordination and agreement [Chapter 15]
10. Transactions [Chapter 16]
11. Distributed transactions [Chapter 17]
12. Replication [Chapter 18]
13. Distributed Hash Tables [Chapter 10]
14. Summary and Paxos Consensus Protocol

Supplementary reading

- *Distributed Systems - Principles and Paradigms*, by Maarten Van Steen and Andrew S. Tanenbaum, third or second edition, Pearson Education, ISBN: 0-13-239227-5
  - This book could have been the course book, as it covers nearly the same material.
- *Distributed Computing - Principles, Algorithms, and Systems*, by Ajay D. Kshemkalyani and Mukesh Singhal, Cambridge University Press, ISBN: 978-0-521-87634-6
  - This more theoretical book covers topics from the advanced course. If you're focused on theory and have a solid grasp of networks and programming systems, it may be ideal for you.
- Programming Erlang - Software for a Concurrent World, by Joe Armstrong, the Pragmatic Programmers, ISBN: 987- 1-934356-00-5
  - This is the book if you want to go further in Erlang programming.
- *Erlang Programming - A Concurrent Approach to Software Development*, by Francesco Cesarini, Simon Thompson, June 2009, O'Reilly, ISBN 10: 0-596-51818-8 | ISBN 13: 9780596518189