Programação em Sistemas Distribuídos

MEI-MI-MSI

2018/19

Course Presentation

Prof. António Casimiro

Instructors

- Lectures and Practice
  - Prof. António Casimiro (casim@ciencias.ulisboa.pt)
- Class times
  - Friday, 16h30-20h00, room 6.2.52
- Student contact hours
  - Thursday, 11h00-12h00, office 6.3.45

Classes
Classrooms and Laboratories

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- Classes are organized in the following manner:
  - Lecture and lecture/practice classes – one weekly session of each, 2+1,5 hours respectively.
  - Laboratory – open lab work.
- Forecast of number of sessions or course duration:
  - 11 lectures plus 11 lecture/practice sessions.
- Lectures & practice classes will take place in room 6.2.52
- Project and tool evaluation work will take place in laboratory, in free schedule:
  - Laboratories are open 24/7 for students to carry on their projects
  - Students are also encouraged to pursue experiments on their own, taking advantage of all the facilities available.

Programação em Sistemas distribuídos

1º Semestre 2018-19

Course Schedule and Plan

T	Date	TPs	Assignments
No Lecture	21/set		
Subjects			
Topics			
Bibliography			
Lecture 1	28/set		
Subjects	Course Presentation and Introduction to Distributed Systems Programming		
Topics	Introduction to course contents. Course plan, organization, grading. Review of Distributed Systems Foundations. Non-functional properties of distributed systems. Frameworks and strategies for distributed systems (DS) programming.	Project description	Ass1- CAP given Project release
Bibliography	DSSA Chapter 1, Chapter intros. 6, 11, 16, Chapters 3.1 and 3.2; Lecture slides		
No Lecture	05/out		
Subjects			
Topics	Holiday - No lecture		
Bibliography			
Lecture 2	12/out		
Subjects	Complements of DS Paradigms		
Topics	Review of basic paradigms, Time and Clocks, Synchronism, Ordering	Project support	
Bibliography	DSSA Chapters 2.5 and 2.6; Lecture slides		
Lecture 3	19/out		
Subjects	Complements of DS Paradigms		
Topics	Ordering protocols. Coordination and Consistency.	JavaRMI	Ass1- CAP delivery Ass2- Cassandra given
Bibliography	DSSA Chapters 2.7 and 2.8; Lecture slides		
Lecture 4	26/out		
Subjects	Complements of DS Paradigms		
Topics	Concurrency and Atomicity. Consistency in Large-scale and/or Partitionable Systems.	CORBA	Phase1 Delivery 29/oct
Bibliography	DSSA Chapters 2.9, 2.10 and 2.11; Lecture slides Readings: Linearizability-Wikipedia, Linearizability-Coulouris-5ed-776-778, CAP-Vogels, CAP-Browne, Objects-CORBA-Coulouris-5ed-337-353		
Lecture 5	02/nov		
Subjects	Models of Distributed Computing		
Topics	Classes of distributed activities. Remote Operations (RPC, RMI, WWW). Distributed Objects.	Project phase 1 - demonstrations	Ass2- Cassandra delivery Ass3- Zookeeper given
Bibliography	DSSA Chapter 3.2; Lecture slides Readings: RMI-Coulouris-5ed-204-212		
Lecture 6	09/nov		
Subjects	Models of Distributed Computing		
Topics	Distributed Shared Memory (DSM, Tuples).	Zookeeper	
Bibliography	DSSA Chapter 3.8 Readings: DSM-Coulouris-5ed-262-270; DSM-Coulouris-4ed-749-781 ZooKeeper Overview, ZooKeeper Programmers Guide		
Lecture 7	16/nov		
Subjects	Models of Distributed Computing		
Topics	Distributed Atomic Transactions. Message-oriented (Message Queue, Publish/Subscribe).	Project support	Phase2 Delivery 19/nov
Bibliography	DSSA Chapter 8.6 and 3.7; Lecture slides Readings: PubSub-Coulouris-5ed-242-253, MsgQueues-Coulouris-5ed-254-262		
Lecture 8	23/nov		
Subjects	Models of Distributed Computing		
Topics	Stream. Group-Oriented. Peer-to-peer.	Project phase 2 - demonstrations	Ass3- Zookeeper delivery Ass4- GFS given
Bibliography	Lecture slides Readings: P2P-Coulouris-5ed-423-459		
Lecture 9	30/nov		
Subjects	Advanced DS Services		
Topics	Distributed File Services (NFS,AFS,CODA,GFS)	Map Reduce&Hadoop	
Bibliography	DSSA Chapter 4.2; Lecture slides Readings: NFS-Coulouris-5ed-536-547, AFS-Coulouris-5ed-548-562, CODA-Coulouris-5ed-795-801, GFS-Ghemawat, GFS-Wikipedia, Hadoop-Wikipedia		
Lecture 10	07/dez		
Subjects	Advanced DS Services		
Topics	Name and Directory Services (X.500) Time Services (NTP)	Cloud Computing	
Bibliography	DSSA Chapters 4.1, 4.5 and 14.3; Lecture slides		
Lecture 11	14/dez		
Subjects			
Topics	Review of main course topics. Preparation for exam.	Project phase 3 - demonstrations (week after)	Ass4- GFS delivery Phase3 Delivery 17/dec
Bibliography			

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Communication

- Web Page:
  - https://moodle.ciencias.ulisboa.pt/course/view.php?id=1188
  - official and current information of the course
- Electronic mail (e-mail):
  - docentes-psd@listas.di.ciencias.ulisboa.pt
  - direct communication with the instructors
- News Forum (Moodle):
  - PSD Announcements
  - to be used by instructors for posting information
- Discussion Forum (Moodle):
  - PSD Discussion
  - to be used by students and instructors for posting and discussing all aspects of general interest
- Individual instructors email address:
  - use only when none of the above applies
- Student contact hours

Program - Lectures

- Introduction to distributed systems programming
- Complements to distributed systems paradigms
- Advanced distributed system services
- Models of Distributed Computing
  - Remote Operations (RPC, RMI, WWW)
  - Distributed Objects
  - Distributed Shared Memory (DSM, Tuples)
  - Distributed Atomic Transactions
  - Message-oriented (Message queues, Publish/Subscribe, Stream)
  - Group-oriented
  - Peer-to-peer

Program - Practice/Guided Lab

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- Focus on selected systems and platforms
- Practical insight on selected material from lectures
- Further insight on some paradigms
- Some algorithms in detail
- Introduction to project assignments

Program - Practice/Guided Lab

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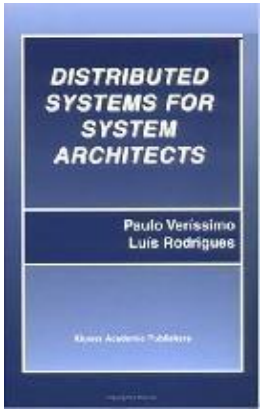
- Selected systems and platforms
  - **JavaRMI**
  - CORBA
  - Cloud Computing
  - Map Reduce
  - **Zookeeper**
  - NTP
  - NFS, AFS and Google File System
  - Web Services

Bibliography

- **Main Textbook:**
  - P. Veríssimo and L. Rodrigues, Distributed Systems for System Architects, Kluwer Academic Publishers, 2001, 650pp., Part I - Distribution
  - *Establishes the main logical thread of the notions provided in the course, complemented with additional material, as per below*



- **Complementary (other books):**
  - G. Coulouris, J. Dollimore, T. Kindberg, *Distributed Systems - Concepts and Design*, Addison-Wesley, 5th ed, 2012
  - A. Tanenbaum, M. Steen, *Distributed Systems Principles and Paradigms*, Prentice Hall, 2nd ed, 2007 (3rd also edition available, both online)
  - *Selected chapters of the above books will be made available in the course web page*

Grading

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- Composition
  - Assignments (20%)
  - Project (40%)
  - Final Exam (40%)
  - Eliminating: Project & Final Exam
- Class participation and regularity
  - No formal attendance is required, but active participation and contribution to discussions are expected

Grading

- Assignments
  - 4 pen-and-paper studies (5% each)
  - About one each three weeks
  - Individual
  - Read a paper and related material to write a summary
- Project
  - One, split in three stages, interim feedback is given
  - Groups of 3 students
  - Project grade counts 40% towards the final grade
  - Failing the project (<9,5) implies failing the course
- Final Exam
  - Final 2 hours exam: comprehensive, without consultation, format is multiple-choice and development questions
  - A mark lower than 8 points implies failing the course

NOTES on pen&paper assignments

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- Understand the situation/environment which concerns the material given
- Follow the objectives or plans, policies, mechanisms or systems proposed, and start by describing them in your own words, in a way that shows you understood the problem and discussion, and the intended rationale and impact of any solutions proposed
- Then, analyse critically whether the objective is achieved, whether or not you agree with what is described/proposed. Isolate and describe main strengths and/or weaknesses of the approach. If that applies, explain how you would conclude/do otherwise
- Do not refrain from consulting related works if that helps building your reasoning

NOTES on project

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- Understand the situation/environment which concerns the material given
- Imagine yourself as member of a real system development and engineering team. Think and plan before starting coding or putting tools to work.
- Write down the steps you perform and your findings as they happen. You will forget them later, and we'll be very disappointed when evaluating your report
- Be skeptical and objective when **interpreting** the results, be it to report them or to plan the next move. A pessimist is an advised optimist
- When writing the report, be concise, clear, objective