Tolerância a Faltas Distribuída

Introduction

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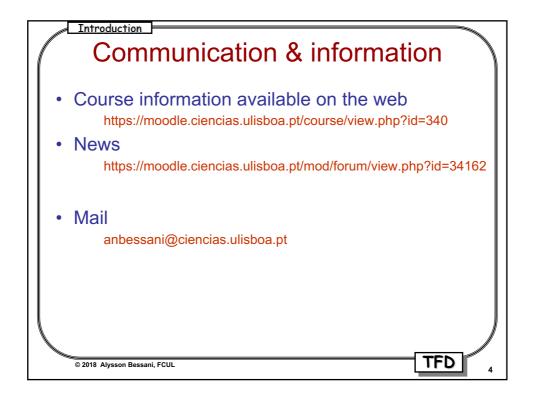1

About the course

- Prerequisites:
  - Notions on computing systems, networks, operating systems and distributed systems
  - Notions of discrete mathematics
  - Programming skills (e.g., network programming)

- Lectures:
  - Mondays, 16:30 to 20:00, room 8.2.6
    - We will have a 15 min. break between T and TP (~18:45hs)

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Teaching staff

- Instructor

  Alysson Bessani (anbessani@ciencias.ulisboa.pt)

  Office 6.3.23

  Office hours: Thursdays, 14h00-16h00hs

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Communication & information

- Course information available on the web

  https://moodle.ciencias.ulisboa.pt/course/view.php?id=340

- News

  https://moodle.ciencias.ulisboa.pt/mod/forum/view.php?id=34162

- Mail

  anbessani@ciencias.ulisboa.pt

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Objectives

- Learn advanced topics in distributed systems, paying special attention to:
  - Dependability and fault tolerance
  - High availability
  - How to manage critical state
  - Scalability and ability to deal with large volumes of data
  - Distributed algorithms
  - Security (with emphasis on availability)
- This is an exciting and trendy topic
  - Big data, Cloud computing, Internet of things relies on distributed systems, blockchains, all of them need fault tolerance

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Program

Date	T	TP
17-Sep	Introduction	Distributed Systems & Fault Tolerance
24-Sep	Distrisbuted Systems Models	Calculating Availiability & Reliability
01-Oct	Fault-tolerant Broadcasts and Rel. Problems I	A practical view of consensus
08-Oct	Fault-tolerant Broadcasts and Rel. Problems II	An overview of RAFT
15-Oct	Consensus and Failure Detectors	In-depth study of a consensus protocol
22-Oct	SBSeg	
29-Oct	Replication and Consistency	Optimistic Replication
05-Nov	Paxos and related protocols	Practical Paxos
12-Nov	Checkpointing and Rollback Recovery	Durability in State Machine Replication
19-Nov	DiSIEM meeting	
26-Nov	Fault-Tolerant Storage I	RAID
03-Dec	Fault-Tolerant Storage II	Cloud-of-clouds storage
10-Dec	Shared Memory Abstractions	Coordination Services
17-Dec	Wrap Up & Project Presentation	Project Presentation

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Bibliography

- References will be provided for each lecture

- Textbooks
  - C. Cachin, R. Guerraoui, L, Rodrigues, Reliable Distributed Programming, 2nd Edition. Springer, 2010. Selected parts
  - Sape Mullender (Editor). Distributed Systems, 2nd Ed., Addison-Wesley, 1993. Selected parts
  - B, Beyer, C. Jones, J. Petoff and N. R. Murphy. Site Reliability Engineering: How Google Runs Production Systems. O'Reilly. 2016. Selected parts

- Others (but very important!)
  - Research papers to be indicated (accessible through IEEE Explore, ACM Digital Library or B-On)

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Grading

- Paper assignments (15%)
  - Five paper reviews (3% each)
- Project with three phases (35%)
  - First phase: 10%
  - Second phase: 15%
  - Third phase: 10%
- Final exam (50%)

- Each component has minimum grade req. of 9 out-of 20

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Project

- Objective:
  - Implement a distributed fault tolerant service
  - Develop the underlying support for state machine replication
  - Optimize the implementation

- One project with three phases
  - Phase 1: Basic mechanisms for replica consensus
  - Phase 2: Fault tolerance and leader change
  - Phase 3: Optimizations, recovery and reconfiguration

- Groups of 3 students

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Important delivery dates

- Paper assignment I   24/09
- Paper assignment II   08/10
- **Project phase 1**   **22/10**
- Paper assignment III   05/11
- **Project phase 2**   **19/11**
- Paper assignment IV   03/11
- **Project phase 3**   **10/12**
- Paper assignment V   21/12

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Initial to-read list:

- Paper assignment 1 (Deadline: 24/09):
  – What good are models and what models are good? F. Schneider
  – The Network is Reliable. P. Balis and K. Kingsbury

- Paper assignement 2 (Deadline: 08/10)
  – In Search of an Understandable Consensus Algorithm, D. Ongaro and J. Ousterhout

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