CS 425 / ECE 428 / CSE 424: Distributed Systems

Spring 2009

Essentials

URL: http://courses.ece.uiuc.edu/ece428/index.shtml
All updates/announcements will be posted here; please check it periodically

Location: 1105 Siebel Center for Computer Science

Time: Tuesdays and Thursdays, 2PM-3:15PM

Instructor: Sayan Mitra, **Email:** mitras@illinois.edu
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TA: Jason Haas, **Email:** jjhaas2@illinois.edu

Newsgroup: TBA, **Email:** TBA

Office hours: See web page

The newsgroup is for questions/discussion on homeworks and programming assignments, however, if you post a solution (code or write-up) to the newsgroup, you will lose all points for that particular assignment. Use email only when you cannot use the newsgroup, e.g., for urget/personal questions.

Prerequisites: CS 241 (Systems Programming), or equivalent course on Operating Systems or Networking (approval of instructor required for latter).

Credits: 3 hours.

Main Text: Coulouris,G., Dollimore, J., and Kindberg, T., Distributed Systems: Concepts andDesign, Addison-Wesley, Fourth Edition, 2005, ISBN: 0201619180. [Recommended purchase copies available at Illini Book Store. On reserve at Grainger Library]. The third edition ought to suffice for most of our material, but we will refer to chapter, section, and problem numbers ONLY in the Fourth Edition. Correct inter- pretation/-translation of these numbers in the 3rd edition is solely the students responsibility.

Reference: S. Ghosh, Distributed Systems: An Algorithmic Approach (Computer and Information Sciences), 2007, ISBN: 1584885645.

Supplementary books are listed at the end of this handout. The latest editions available at the Grainger Library have been put on reserve. We may also read some research papers which will be made available at the course webpage.

Overview

The course focuses on basic concepts underlying design and implementation of distributed systems. It covers algorithms and lower-bounds for fundamental problems in distributed computation such as clock synchronization, mutual exclusion, routing, (graph) coloring, coordination, consensus, group communication,

transactions, and replicated data management. These topics are discussed in the context of real-world systems such as databases, peer to peer networks, distributed file systems, distributed robotics, and sensor networks. This course does not deal with computer networking (e.g., routing protocols in the Internet). Programming assignments do however require you to write multithreaded networking code.

Mechanics

Homeworks

Homework sets will be given out approximately every other week. Homeworks will be **due at the beginning of the class on the day of the deadline**. Homework solutions are required to be **typed**. We will not accept handwritten solutions. Figures and equations may be drawn by hand.

Homework sets, must be submitted at the beginning of class on the due date. No late homework will be accepted except under extremely rare non-academic circumstances (which usually require approval from the Deans office).

Programming Assignments (MPs)

Two programming assignments will be give out, each requiring roughly 4 weeks of effort. You may choose to **work in groups of 2 students** for each assignment.

MPs are to be submitted via email. Submissions are due on the due date. You may use a **single day of extension** for each project, though the use of these extensions will be tracked and may work against your grades in breaking ties. Submissions beyond the extension deadline **will be given 0 points**.

Code will be tested on **EWS machines**. Code will be partially tested such that we will make some effort to determine which part of the code is faulty, though **seg-faulting behavior will likely lead to a large loss** of points. We will provide some limited initial guidelines for how you should test your code.

All of the work you submit for grading, or in support of graded material must either be your own thought product or clearly and specifically credited to the proper source. Violations of this policy will be treated seriously.

Grading (tentative)

- class participation 10%
- homework 30%
- programming assignments 20%
- midterm 15%
- final 25%

Class participation is important. You are expected to have read reading material for the lecture (e.g., sections of the textbook, papers) before the lecture. Grading for **undergraduate and graduate** students will be separated. Grades will be assigned on a **curve** (relative grading). The fraction of students receiving As is not fixed a priori, but it has been generous in the past for classes that performed well as a whole.

Syllabus (tentative)

- Clock synchronization
- Mutual Exclusion
- Global Snapshot
- Distributed graph algorithms: Spanning tree, coloring
- Coordination (2 lectures): Leader election, Synchronizers
- Consensus (3 lectures): Synchronous, Asynchronous, Failure detectors
- Convergence: Pattern formation
- Transactions (3 lectures)
- Group communication
- Replication (3 lectures)
- Distributed shared memory
- Self-stabilizing systems
- Peer to Peer networks
- Sensor networks
- Distributed file system

See the webpage for the schedule.

Supplementary Textbooks

The following textbooks may be used for supplementary course material. They are on reserve at the Grainger Library (if available).

- Distributed Systems

    1. Distributed systems: principles and paradigms, A. Tanenbaum and M. Steen, Prentice Hall, 1ed, 2002, ISBN: 0130888931.
    2. Distributed algorithms: concepts and design, N. Lynch, Morgan-Kaufmann, 1ed, 1996, ISBN:1558603484.
    3. Distributed computing: fundamentals, simulations and advanced topics, H. Attiya and J.Welch, McGraw Hill, 1ed, 1998, ISBN: 0077093526.

- Computer Networks
    1. Unix network programming, W. R. Stevens, (Addison-Wesley, 3ed, 2002, Vols. 1 and 2 ISBN:0130810819 and ISBN: 0131411551 OR Prentice Hall, 1ed, 1990, ISBN: 0139498761). 2. An engineering approach to computer networking, S. Keshav, Addison-Wesley, 1ed, 1997, ISBN: 0201634422.
    2. Computer networks, A. Tanenbaum, Prentice-Hall, 4ed, 2002, ISBN: 0130661023.

Acknowledgments

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