Distributed Systems
CSCI 4963/6963 – Fall 2015

General Information

Meeting time and place: TF 12:00pm-1:50pm, JEC 3207
Instructor: Stacy Patterson sep@cs.rpi.edu
Office hours: T 2:00pm – 3:00pm or by appointment, Lally 301

There is no textbook for this course. Conference and journal papers related to the course material will be posted on the course web site.

Course Description

This course explores the principles of distributed computing systems, emphasizing fundamental issues underlying the design of such systems: communication, coordination, synchronization, and fault-tolerance. We will study key algorithms and theoretical results and explore how these foundations play out in modern systems and applications like cloud computing, pervasive computing, and peer-to-peer systems.

Pre-requisites

• CSCI-2300: Intro to Algorithms
• CSCI-4210: Operating Systems

Learning Outcomes

Upon successful completion of this course a student is able to:
• Understand and apply different models and abstractions for distributed systems
• Describe and analyze key algorithms for distributed computing systems
• Identify fundamental limitations and impossibility results for distributed systems
• Implement distributed algorithms in real-world distributed computing platforms
• Understand and identify applications of distributed algorithms in real-world systems

Grading

Grading will be based on the following:
• Quizzes: 65%
• Programming Projects: 35%
Grades will be made available on LMS.

Quizzes

There will be approximately 8 in-class quizzes. Each quiz will be about 45 minutes. Quizzes will be announced in the lecture preceding the quiz date. Requests for quiz regrades must be made within 7 days of their return.

Programming Projects

There will be two programming projects in which students will implement applications that use the algorithms studied in class. The projects will be done in groups of two, unless the professor
approves otherwise. For each project, students must submit a short report and give a
demonstration of their code. Late reports and demonstrations will not be accepted.

**Students with Special Needs**

Federal law requires all colleges and universities to provide specified types of assistance to
students with disabilities. If you have such special assistance, please obtain an authorizing memo
from Disability Services for Students by contacting Mark Smith, Dean of Students, in the Dean of
Students Office (x6266). Information about a student's special needs will be treated as confidential.
Please submit a copy of your authorizing memo to me well in advance of any affected assignment.
Failure to do so may result in a lack of special accommodations

**Academic Integrity**

For programming assignments, discussion is allowed, but you must write your own code. Unless
otherwise specified by the instructor, quizzes will be closed book and will be done independently.

Violation of these policies will be considered a breach of academic integrity, and the student will be
subject to penalties outlined in The Rensselaer Handbook of Student Rights and Responsibilities,
including "an academic (grade) penalty administered by the professor and/or disciplinary action
through the Rensselaer judicial process described in this handbook."

**Preliminary Schedule**

Here is a list of the topics that will be covered in this course. The instructor may change the order
and the contents of the schedule depending on the background of students in the class as well as
other considerations.

**Lecture 1:** Introduction to Distributed Systems

**Lectures 2-3:** Clocks and the ordering of events in distributed systems

**Lectures 4-5:** Distributed Mutual Exclusion

**Lectures 6-7:** The Distributed Log Problem

**Lecture 8:** Global Snapshots

**Lectures 9-10:** Broadcast Algorithms

**Lectures 11-12:** Leader Election

**Lectures 13-16:** Distributed Agreement

**Lectures 17-19:** Transaction Management

**Lectures 20-21:** Distributed Commit Protocols

**Lectures 22-23:** Replication, the CAP Theorem

**Lectures 24-25:** Consistency Models, Cloud Databases

**Lectures 26-27:** P2P Systems, Distributed Hash Tables, Bit Torrent

**Lecture 28:** Bit Coin