Faculty of Engineering

COURSE OUTLINE

SENG 462: Distributed Systems and the Internet

Term – Spring 2016 (201601)

Instructor
Dr. Stephen W. Neville

Office Hours
Days: Wed.
Time: 2:30pm to 3:20 pm (or by appointment)

E-mail: sneville@ece.uvic.ca

Note: All course emails MUST have “SEng462:” in the subject line and MUST be sent from UVic email accounts. Emails without proper subject lines or sent from off-campus email accounts will likely be dropped by UVic’s email spam filters or be automatically redirected to junk email folders.

Course Objectives

The objectives of this course are to introduce basics of scalability problems that occur within distributed software systems, particularly as these apply to solutions involving Internet and middleware technologies. Students will gain an understanding of how to assess where and why system bottlenecks occur and how these can be resolved. Students will gain the ability to analyze web site user interaction data and how to transform such data in to knowledge about the computing resource requirements needed to meet desired system performance specification. Students will also be introduced to some of the mathematical models that are used to analyze system performance and scalability concerns, as well as some of the basic issues involved in securing software systems. Through the course project students will gain hands on experience with software scalability issues, as well as software instrumentation and analysis approaches.

Learning Outcomes

Students successfully completing this course will gain an understanding of:

• The problems that arise when software systems are scaled up to large numbers of users and/or systems events, i.e. into the many millions of daily transactions.
• How to perform the system testing required to identify where system bottlenecks are occurring and how to resolve them.
• Why middleware exists, its various forms, and how it is used to construct distributed software systems.
• What the ACID properties for transaction processing are and why they are important.
• The engineering principles that underlie the construction of larger-scale software systems that behave predictably, ensure security, etc., and why these are innately challenging engineering problems.
From the course project, students will gain practical experience in how to build and debug a larger-scale distributed software systems and why this is fundamentally different than building small-scale software systems intended to service only low numbers of users.

**Syllabus**

The exact pacing of the syllabus materials will vary in accordance with each class, as such the syllabus solely denotes a provisional pacing which may or may not change during the course delivery.

Course introduction
Discussion of course project details
Introduction to distributed systems
  - What and Why
  - Underlying issues
  - Transparency
  - Distributed Architectures
Distributed Software Design
  - Design Principals
  - Design Mechanisms
  - Design Methodology
Distribution and Performance Analysis
  - Workload Matrix
  - Performance Matrix
  - Rules for addressing bottlenecks
  - Soccer league example
Middleware
  - NOS, Stacks, OO-Middleware, Message-oriented Middleware
  - Middleware in multi-tiered distributed applications
Persistent State Architectures
  - Enterprise Jave Beans
Web services
  - Web service architectures
  - Implementing web services
Transaction Processing
  - Principals
  - Concurrency control
  - Distributed transactions
Capacity Planning
  - Performance measures & rules
  - Availability and Reliability
User Behavioural Modeling
  - Customer behaviour model graph (CBMG)
Client/Server interaction diagram (CSID)
Performance Modeling
  Single Queue Model
  Queuing Network Model
  Basic introduction to queuing theory
Security
  Network Security Approaches
  Cryptography
Timing issues in distributed systems (time permitting)
Statistical modeling issue in distributed systems (time permitting)

Lectures:

A-Section(s): A01, A02 / CRN 22804, 22805
Days: Tues., Wed., Fri.
Time: 1:30 pm - 2:20 pm
Location: Cornett Building A120

Tutorial:

T01  Tue  3:30pm - 4:20 pm  ELW B203

Required Text:
  No required text.

Optional Text:
  Title: Distributed Systems: Concepts and Design (3rd Ed.)
  Author: G. Coulouris, J.Dollimore, and T. Kindberg
  Publisher: Addison Wesley
  Year: 2001

Course Web Site: http://www.ece.uvic.ca/~sneville/Teaching/SEng462

Assessment:

Course Project: 40%  Due Dates: Project milestone due dates are provided on the project course web site http://www.ece.uvic.ca/~seng462.
Mid-term 20%  Date: Tuesday, Feb. 16th
Final Exam 40%

Note:
  Failure to complete and pass the course project will result in a grade of N being awarded for the course.
  Failure to pass the final exam will result in a failing grade for the course.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.

http://web.uvic.ca/calendar/FACS/UnIn/UARe/Grad.html
Note to Students:
Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Accommodation of Religious Observance
http://web.uvic.ca/calendar/GI/GUPo.html

Policy on Inclusivity and Diversity
http://web.uvic.ca/calendar/GI/GUPo.html

Standards of Professional Behaviour
You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities.
https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

Cheating, plagiarism and other forms of academic fraud are taken very seriously by the University, the Faculty, and the Department. You should consult the entry in the current Undergraduate Calendar for the UVic policy on academic integrity.
http://web.uvic.ca/calendar/FACS/UnIn/UARe/PoAcI.html

Course Lecture Notes
Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may constitute a breach of academic integrity as defined in the UVic Calendar as well as the Standards of Professional Behaviour required of all Faculty of Engineering students.