

SIMON FRASER UNIVERSITY
Senate Committee for Undergraduate Studies
NEW COURSE PROPOSAL

Course Number: CMPT 431-3

Course Title: Distributed Systems

Short Course Title: Distributed Systems

Course vector: 3 lecture

Course Description (for Calendar). Attach a course outline to this proposal.

An introduction to distributed systems: systems consisting of multiple physical components connected over a network. Architectures of such systems, ranging from client-server (such as NFS) to peer-to-peer (such as Skype). Distributed systems are analyzed via case studies of real network file systems, replicated systems, sensor networks and peer-to-peer systems. Students will get hands-on experience designing and implementing a complex distributed system.

Prerequisite: CMPT 300, CMPT 371.

Corequisite: none

Course(s) to be dropped if this course is approved: none

Rationale for Introduction of this Course:

Over time, CMPT 401 (Operating Systems II) has focused more and more on the "distributed" aspects of systems, as opposed to operating systems in general. The instructors agree that the new course better reflects the material that is covered.

"Distributed systems" is a popular and active part of Computing Science. Having this material hidden under a generic (and arguably misleading) title makes it appear that the area is not addressed in our curriculum.

We have chosen to leave CMPT 401 in the calendar to allow a course that focuses purely on advanced aspects of operating systems to be offered in the future. This will be offered if there is interest in the near future, and removed if not.

Scheduling and Registration Information:

Indicate effective **semester/year** course would be first offered and planned **frequency** of offering thereafter.

One or two offerings annually in the Burnaby campus, one in Surrey. Offerings will begin under this number as soon as it is in the calendar.

Waiver required: no

Will this be a required or elective course in the curriculum?

Elective in both the Computing Science and Software Systems programs

What is the probable enrolment when offered?

30 students.

Which of your present CFL faculty have the expertise to offer this course?

Sasha Fedorova, Richard Vaughan, Dirk Beyer, Rob Cameron, Mohamed Hefeeda

Are there any proposed student fees associated with this course other than tuition fees? (if so, attach mandatory supplementary fee approval form)

no

Resource Implications:

Note: Senate has approved (S.93-11) that no new course should be approved by Senate until funding has been committed for necessary library materials. Each new course proposal must be accompanied by a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Campus where course will be taught:

Burnaby, Surrey.

Library report status

Provide details on how existing instructional resources will be redistributed to accommodate this new course. For instance, will another course be eliminated or will the frequency of offering of other courses be reduced; are there changes in pedagogical style or class sizes that allow for this additional course offering?

Resources currently used for CMPT 401 will be shifted to CMPT 431.

Any outstanding resource issues to be addressed prior to implementation: space, laboratory equipment, etc.

Resources currently used for CMPT 401 will be shifted to CMPT 431.

Approvals

1. **Departmental approval** indicates that the Department has approved the content of the course, and has consulted with other Departments and Faculties regarding proposed course content and overlap issues.

Chair, Dept./School

Date

Chair, Faculty Curriculum Committee

Date

2. **Faculty approval** indicates that all the necessary course content and overlap concerns have been resolved, and that the Faculty/Department commits to providing the required Library funds.

Dean or Designate

Date:

List which other Departments and Faculties have been consulted regarding the proposed course content including overlap issues. *Attach documentary evidence of responses.*

Other Faculties approval indicates that the Dean(s) or designate of other Faculties affected by the proposed new course support(s) the approval of the new course.

Date:

Date:

3. **SCUS approval** indicates that the course has been approved for implementation subject, where appropriate, to financial issues being addressed.

Course approved by SCUS (Chair of SCUS)

Date:

Approval is signified by date and appropriate signature.

Proposed CMPT 431 Course Outline

OBJECTIVE/DESCRIPTION:

Building on CMPT300, this course gives the student an in-depth understanding of important issues in modern distributed computer systems, including inter-process communication, caching, distributed file systems, clocks and synchronization, and security. This course covers the major ideas in distributed systems using original research papers in addition to the textbook. We look in detail at Google's file system and large-scale processing model. Assignment code is provided in C on UNIX/Linux, but projects can use any platform.

TOPICS:

- o 1.Introduction: Motivations for and characteristics of distributed systems, Architecture and design goals, multi-core and multi-CPU architectures, network OS, distributed OS, threads, mobile code.
- o 2.Interprocess Communications/Middleware: IPC primitives, Higher-level IPCs, Client-server paradigm, Remote Procedure Calls, Name service, Peer-to-peer systems.
- o 3.Topics from File Systems: Distributed file systems, Naming and transparency, Caching, Repeatable operations and stateless server, Case study: the Google File System
- o 4.Synchronization in Distributed Systems: Time, clocks and their synchronization, Mutual exclusion and other coordination problems, Deadlocks.
- o 5.Consistency in Distributed Systems: Transactions, 2-Phase commit protocols, Requirements for atomic commit protocols, Communication failures, Recovery.
- o 6.Protection and Security: Digital signature, authentication (Kerberos).
- o 7.Other Topics: Design principles, sensor networks, real-time distributed systems, distributed computation: Google's Map/Reduce model, distributed N-body simulation

GRADING:

Grading to be discussed during the first week of classes and will include Coding Assignments, Midterm, Project, Final exam.

Students must attain an overall passing grade on the weighted average of exams in the course in order to obtain a clear pass (C- or better).

TEXTBOOKS:

- o Distributed Systems Concepts and Design; 4th Edition , G. Coulouris, J. Dollimore, T. Kindberg, Addison-Wesley, 2005: 4th Edition