CS 3013 Operating Systems
Craig E. Wills
Friday, January 15, 2010

WPI, C Term 2010
Syllabus

Instructor

Craig E. Wills, FL-236, cew@cs. Office hours: 1:00–3:00pm Mondays, 9:00–10:00am Thursdays, any time for short questions. Electronic mail is an effective method to contact me.

Assistants

- TAs: Thangam Seenivasan, thangam@cs. Office hours: TBA; Wei Zhang, weizhang@wpi. Office hours: TBA. SA: Thomas Liu, kangchao@wpi. Office hours: TBA.
- faculty + assistants: cs3013-staff@cs.

Course Web Page

Copies of all handouts, assignments, notes and old exams will be posted as appropriate on the course Web page. The address for it is `http://www.cs.wpi.edu/~cs3013/c10/`.

Laboratory

Projects involving the Linux kernel projects may be done in the Fossil Lab located in FL-B17. You will be creating virtual machines to use for these projects. Accounts on machines in the lab must be obtained from the course TAs.

Projects involving user-level programming can be done on your virtual machines (where they will be graded) or on the CCC Linux systems.

Purpose

This is an introductory course in the design of operating systems. It covers principles, design decisions, design techniques, policies, and mechanisms. The course focuses on the design of general-purpose multiprogramming systems and covers processes, resource allocation, concurrency, memory management, time management, device control, synchronization and mutual exclusion.

The course objectives are 1) to help students gain knowledge about the components of a structured operating system, 2) for students to learn the fundamental principles and abstractions underlying design choices, tradeoffs, and their consequences, 3) to give students opportunities to apply course material with "hands on" projects, and 4) for students to develop specific skills for working in the Unix/Linux environment.

Prerequisites

Working knowledge of common data structures such as stacks, queues, and linked lists. Knowledge of high-level programming language such as C/C++. An interest in learning about operating systems.

Recommended background: CS2303 or CS 2301, and CS2011.

Text Books

Required:

Modern Operating Systems. Andrew S. Tanenbaum, Prentice Hall, 3rd edition, 2008.

Reference:

Operating Systems Concepts with Java. A. Silberschatz, P.B. Galvin and G. Gagne, John Wiley & Sons, 8th edition, 2010. A good, general supplement to the text.

Linux Kernel Development. Robert Love, Novell Press, 2nd edition, 2005. A good book for help with Linux kernel development.

Understanding the Linux Kernel. Daniel P. Bovet and Marco Cesati, O'Reilly, 3rd edition, 2006. A more encyclopedic Linux kernel reference.

Grading Policy

Final grades will be computed as follows:
Midterm Exam: 30%;
Final Exam: 30%;
Homework, projects, quizzes, and class participation: 40%.

Grading policy for each project and homework will be provided at the time of the assignment. In general, each assignment will have a basic objective for the majority of the assignment points and an extended objective for demonstrating additional work and understanding.

Final grades will reflect the extent to which you have demonstrated understanding of the material, and completed the assigned projects. The base level grade will be a "B" which indicates that the basic objectives on assignments and exams have been met. A grade of "A" will indicate significant achievement beyond the basic objectives and a grade of "C" will indicate not all basic objectives were met, but work was satisfactory for credit. No incomplete grades will be assigned unless there exist exceptional, extenuating circumstances.

- **Programming Assignments**

  There will be 3-4 programming assignments. Assignments will involve programming in C/C++ primarily on the Fossil Lab Linux virtual machines. There will likely be a combination of individual and group projects.

  Students are assumed to be competent in a high-level programming language such as C or C++. System calls and other aspects of Unix/Linux will be introduced as the course progresses and programming projects are assigned.

- **Exams and Quizzes**

  There will be two in-class exams (including a final exam during the last week), plus the possibility of pop quizzes for which no advance notice will be provided. Exams will be closed book, closed notes. The majority of each exam will cover basic ideas and objectives of the class with a few questions testing additional understanding and insight.

- **Written Homeworks**

  There is a possibility of written homework assignments. Written assignments consist of problems from the book, made up problems, or readings from literature.

Late Policy

Each homework and programming assignment will be given a point value when it is handed out. The point value indicates the weight of the assignment relative to the other assignments. Late programs and homeworks will be be penalized 5% of total assignment value per day (with the weekend counting as one day) or partial day, and no assignments will be accepted after seven days beyond the due date. All programs and written homeworks are due at the *start* of class on the due date. Homeworks and programs turned in after the start of class will be counted late. Projects will be submitted as directed in class. Exceptions to these rules can be made only *a priori*. Finally, no assignments will be accepted after the last day of class to allow sufficient time for grading.

Academic Honesty

Unless explicitly noted, all work is to be done on an individual basis. You are encouraged to talk with others about ideas and material in the course, particularly in preparing for exams. However all work, in the form of code or answers to problems, you submit for grading must be your work. Misrepresentation of the work of another as one's own submitted work is a violation of academic honesty. Aiding someone else to commit an act of academic dishonesty is also a violation. Submitting individually-assigned work that was jointly done with another person is a violation of academic honesty.

Any violation of the WPI's guidelines for academic honesty will result in no credit for the course and referral to the Student Affairs Office. More information on definitions, responsibilities and procedures regarding the WPI academic honesty policy can be found at `http://www.wpi.edu/Pubs/Policies/Judicial/sect5.html`.

Student Disability

If you need course adaptations or accommodations because of a disability, or if you have medical information to share with the instructor, please let the instructor know. If you have not already done so, students with disabilities, who believe that they may need accommodations in this class, are encouraged to contact the Disability Services Office (DSO), as soon

as possible to ensure that such accommodations are implemented in a timely fashion. The DSO is located in Daniels Hall, (508) 831-5235.

Schedule

The following is a tentative outline of the material that will be covered in this course. All references to chapters are from Tanenbaum's book. Not all sections will be covered from each chapter and the lectures will be supplemented with material from other sources. Each week will entail two two-hour classes (on Tuesdays and Fridays) unless otherwise noted.

week 1: 1-15. Introduction, Chapter 1. Process Management 2.1.

week 2: 1-19–1-22. Interprocess Communication and Coordination 2.3. 2.4

week 3: 1-26–1-29, IPC (cont.). Process Scheduling 2.5.

week 4: 2-2-2-5. Threads 2.2. Unix IPC. Midterm Exam.

week 5: 2-9–2-12. Memory Management 4.1. Virtual Memory 4.3.

week 6: 2-16–2-19. Page Replacement 4.4, 4.5, 4.6, 4.7. Segmentation 4.8.

week 7: 2-23–2-26. I/O Devices, Chapter 5. Deadlock.

week 8: 3-2. One class. Final Exam.