CS 571 Operating Systems

Dr. Songqing Chen

About this Class

- **Focus:**
  - Fundamental concepts underlying Operating Systems
  - Implementation of OS components
- **Prerequisite:**
  - Grade of C or better in CS310, CS 367 and CS 465 (or equivalent).
  - Programming in C.
- **Desirable but not required**
  - CS 555 (Computer Networks)

What you will learn

- **Main focus:** basic concepts underlying the design, implementation, and management of operating systems
  - processes, memory management, I/O, interprocess communication, files, directories, shells, distributed systems, performance,
- **Programming assignments provide an opportunity to become familiar with OS**
  - OS/161
  - a MIPS r2000/r3000 simulator designed to allow students to develop real Operating System Kernel code

Tentative Course Topics

- Introduction
- Processes and Threads
- Concurrent Processes
- CPU Scheduling & Deadlocks
- Memory Management & Virtual Memory
- File Systems & I/O
- Distributed Systems
- Communication in Distributed Systems
- Distributed File Systems
- Security & Protection
- Virtual Machines

Course Objectives

- **Why bother studying operating systems?**
- Understanding the principles behind the design of centralized and distributed operating systems
- Observing how these principles are put into practice in real operating systems
- Discussing both “solved” and “open” problems and issues in OS design, recent trends
- Gaining hands-on experience in actual kernel level programming
  - This is the best and only way to understand how an OS works
  - And it is fun

Pre-requisites

- **Prerequisites (undergraduate)**
  - Computer Architecture (CS 367, CS 465)
  - Data Structures (CS 310)
  - **Proficient in programming in C**
Class Information

- Instructor: Songqing Chen
- Office: Engineering Building, Room 5319
- Email: sqchen@cs.gmu.edu
- Office hours: Wednesday 2:00 p.m. – 3:00 p.m. or by appointment
- Course home page: www.cs.gmu.edu/~sqchen/courses/CS571S16/
- We will use emails for communications; you must have a GMU account and check the account for messages periodically, if not daily.

Teaching Assistant

- TA: Pooja Sunkapur
- Email: psunkapu@masonlive.gmu.edu
- Office: Engineering Building, Room 5321 (tentative, may change)
- Office Hours (Tentative)
  - Tuesday 5:00 – 7:00 PM
  - Friday 12:00 PM – 2:00 PM
- Contact TA using your GMU account.

Textbooks

  - Free online
- Recommended: Modern Operating Systems (3rd edition, 2008), by A. S. Tanenbaum

Important Dates

- First class: Jan. 19
- Drop without tuition liability: Jan. 26
- Add deadline: Jan. 26
- Last day to drop: Feb. 19
- Spring break: Mar. 7-13
- Midterm exam: Mar. 16 (Tentative)
- Last class: May 2
- Final exam: May 4th

Grading

- Projects – 40%
  - NO credit if your project does not compile.
  - Unless under prearranged conditions, late projects lose 10% per day after the respective deadlines and will not be accepted 3 days after due.
- Midterm – 25%
- Final 35%
- Grading is proficiency-based. Cutoffs will be in the vicinity of, but not higher than:
  - A > 95%, A- > 90%, B+ > 85%, B > 80%,
  - B- > 75%, C > 60%, F

Programming Assignments

- We will be using OS 161 for all assignments
  - Developed at Harvard and used at a number of Universities
- It is a MIPS r2000/r3000 simulator designed to allow students to develop real Operating System Kernel code
- You will “need” to develop your code on zeus.ite.gmu.edu
- Log into your account before next class
- You will write C code and use UNIX and GNU tools
  - We will start right away
- It will be a challenging and informative project!
- Project information (including due date) is available on the course homepage. Check frequently for updates.
**Important Notes**

- Missed exams must be arranged with the instructor **BEFORE** the exam date.
- Follow links in the syllabus on the course homepage for
  - Disability
  - School Calendar
  - Honor Code – homework assignments and projects are all **INDIVIDUAL** efforts.

**OS 161 programming projects**

You hear and you forget.
You see and you remember.
You do and you understand.

**OS 161**

- The first assignment is posted
- **OS 161** is a MIPS r2000/r3000 simulator designed to allow students to develop real Operating System Kernel code
- You will “need” to develop your code on zeus.ite.gmu.edu
  - Log into your account as soon as possible
- You will write C code and use UNIX and GNU tools
  - We will start this week
- It will challenging, informative, and fun!

**Usage**

- You will also be using several tools
- **CVS/SVN/git**
  - No particular recommendation
  - It is your choice
- **GDB (Gnu Debugger)**
  - GDB allows you to examine what is happening inside a program while it is running.

**Assignments**

- **Project 1**: Environment setup
  - Individual, due 11:59 PM, Jan. 31.
- **Project 2**: Code review
  - No submission
- **Project 3**: Synchronization
  - Due 11:59 PM, Mar. 6.
- **Project 4**: Process management/System call, part 1
  - Due 11:59 PM, March 20.
- **Project 5**: Process management/System call, part 2
  - Due 11:59 PM, April 10.
- **Project 6**: Memory management
  - Due 11:59 PM, May 1.

**Team approach**

- Except for Project 1, you can work in teams of 2
- Pick your teammate wisely
- Rules of “divorce”
  - You may divorce by giving Prof and TA one week’s notice
  - This applies to both team members
  - All divorces will be friendly
  - Both teammates get all work produced to date
  - Once you are divorced you cannot remarry (e.g. pick someone else to team with).
- Email you TA your team info. before or when you submit you project 3.