



CS372
Introduction to Operating Systems

Professor Emmett Witchel

Department of Computer Sciences
The University of Texas at Austin
witchel@cs.utexas.edu

M, W 2-5pm PAI 3.14

<http://www.cs.utexas.edu/~witchel/372>

Operating Systems In The News

- ◆ FBI may scrap \$170 million project (01/13/05)
 - Bureau officials told a news briefing that they expect to find that after four years in development their much-touted Virtual Case File system does not work. But they said a suitable replacement is commercially available.
- ◆ New Technology Behind Wiretapping? (12/20/05)
 - So, are TIA [total information awareness] and the NSA wiretapping directive related?
- ◆ Robert Fripp records Windows Vista sounds (01/13/06)

Operating Systems In The News

- ◆ Google Earth to launch Sky for stargazers (08/23/07)
 - Popular mapping service Google Earth will launch a new feature called Sky, a "virtual telescope" that the search engine hopes will turn millions of Internet users into stargazers.
- ◆ EMI Music launches DRM-free downloads (04/02/07)
 - Apple's iTunes store to be the first online music store to sell EMI's new downloads
- ◆ KeeLog cipher broken (08/23/07)
 - KeeLoq is a cipher used by...Chrysler, Daewoo, Fiat, General Motors, Honda, Toyota, Volvo, Volkswagen, and Jaguar

Operating Systems In The News

- ◆ Google announces video expansion (01/06/06)
 - ...sell thousands of downloads, including recent television broadcasts of popular CBS shows and professional basketball games, as well as vintage episodes from series that went off the air decades ago

From : Google Video Team <video-support@google.com>

Hello, We recently emailed you to let you know that Google is ending the Google Video download to own/rent (DTO/DTR) program...

We've received feedback from people dissatisfied with our approach...

1. We will fully refund your credit card for the total amount of your Google Video purchases.
2. We're going to continue to support playing your videos through February, 2008. We won't be offering the ability to buy additional videos, but what you have already downloaded will remain playable.
3. The Google Checkout bonus you've already received is yours to keep. Your bonus expires on October 31, 2007...

Issues and Non-issues in the press

- ◆ Storage in crisis.
 - Will CD's be readable in 50 years?
 - Will VHS tapes be readable in 20? Will anyone care?
- ◆ Backup Media
 - 1 TB Disk \$250, available now.
 - DVD is 4.3 GB, dual layer 8 GB, Blu-ray 50 GB
 - Current backup tapes 100-200 GB
 - IBM is developing 100TB tape

Aren't Operating Systems Dead?

- ◆ The operating system (OS) I use has already been written, and I doubt it will be my job to write another one.
 - For example, Windows, Linux.
 - ... So, why should I study operating systems?
- ◆ Haven't OS developers figured everything out already? What more is there to do?
- ◆ Why should I study this as an undergraduate?
- ◆ Studying OS design IS studying design of large software systems.
- ◆ OS is needed to make hardware useful.

Why Study Operating Systems?

- ◆ Because OS hacking will make you a better programmer and a better thinker.
 - The OS is really large (Windows Vista is 50 million lines+).
 - The OS manages concurrency.
 - ❖ Concurrency leads to interesting programming challenges.
 - ❖ (Interesting programming challenges can lead to wisdom.)
 - OS code manages raw hardware.
 - ❖ Programming raw hardware is challenging: timing dependent behavior, undocumented behavior, HW bugs.
 - OS code must be efficient, low CPU, memory, disk use.
 - OS fails \Rightarrow machine fails. OS must fail less than user programs.
 - OS provides services that enable application programs
 - ... knowledge of OS will make you a better computer user
 - OS basis of system security.

Why Won't Operating Systems Go Away?

- ◆ Hardware needs an OS to be useful.
 - Multiplex resources for efficiency and security.
- ◆ OS is cornerstone of what makes computing fun.
- ◆ The design of an MP3 player involves many OS issues:
 - Its OS implements a file system which is specially designed to store music files.
 - The OS manages communication with your PC.
 - The OS reads music from the disc and buffers it in memory.
 - The OS controls the volume of the output device.
 - The OS controls the display.
 - The OS controls wireless network access.
- ◆ Cell phone, mp3 player, DVD player, TIVO, PDA, peer 2 peer file sharing

- ◆ Capstone course
 - Combines things from many different courses
 - ❖ Programming languages
 - ❖ Data structures
 - ❖ Algorithms
 - ❖ ...
- ◆ Projects
 - Build components of an operating system
 - ❖ Thread/process manager, memory management, file system, ...
 - Enhance software engineering skills
 - ❖ Thread programming, build large systems, group projects

I hear and I forget; I see and I remember;
I do and I *understand* !

Design and Implementation

- ◆ Design problems.
 - Understand the problem, and define it.
 - Understand the space of possible solutions, previous approaches
 - Formulate your own approach and justify why it might work.
- ◆ Implementation issues.
 - Real systems are more difficult to build than to explain.
 - The devil is often in the details.
 - Building a system gives you satisfaction, and feeling of accomplishment.
- ◆ Mix of specific and general
 - One way to do memory management (but a very interesting way).
 - Many scheduling algorithms.
 - Light on details of specific OSes, look at larger issues.

Administrivia

CPS

- ◆ We are getting a classroom participation system.
 - Remote controls for you, receiver for me.

Administrivia

Collaboration and Cheating

- ◆ Working in groups on homeworks is OK but...
 - You can only collaborate with other students in the course
 - Every student must craft their own final solution
 - Every student must fully write up their solution
 - All collaborators must be acknowledged in writing

- ◆ Collaboration
 - Discuss problem sets and programming assignments
 - Discuss possible interpretation of questions, technical details

- ◆ Cheating
 - Copying solutions code or programs from someone else, previous year's solutions, or public domain
 - Providing material for someone else to imitate IS still cheating.
 - Participate in discussion group where one person writes solution and everyone else copies it

Administrivia

Where to go for help?

- ◆ Attend class.
 - Unannounced in-class quizzes to encourage attendance.
- ◆ Ask questions in class.
 - Exercise your understanding of the course material on a daily basis
- ◆ Attend office hours
 - Emmett's office hours are M/W 5 - 6pm in ACES 6.240
 - Sit's office hrs: W 10:30 - 12:00 TH 11:00 - 12:30 Location TBA
 - Owen's office hours: TBA
 - If you can't come to office hours, set up an appointment
- ◆ Please limit e-mail to personal issues.
- ◆ Use the newsgroup.

Course Overview

- ◆ OS Structure, Processes and Process Management
- ◆ CPU scheduling
- ◆ Threads and concurrent programming
 - Thread coordination, mutual exclusion, monitors
 - Deadlocks
- ◆ Virtual memory & Memory management
- ◆ Disks & file systems
 - Distributed file systems
- ◆ Security
- ◆ Review of the movie, Primer.

Administrivia

Course Information and Handouts

- ◆ Slides are available online.
- ◆ A course packet is available.
- ◆ Updates will be made during the semester.

<http://www.cs.utexas.edu/~witchel/372>