

CSE 120

Principles of Operating

Systems

Fall 2001

Lecture 1: Course Introduction

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Lecture 1 Overview

- Class overview
- What is an operating system?
- Operating system modules, interfaces, structure

CSE 120 Class Overview

- Course material taught through class lectures, textbook readings, and handouts
- Course assignments are
 - ◊ Homework questions from the book
 - ◊ Three large programming projects
- Discussion sections are a forum for asking questions
 - ◊ Primarily about lecture material and homework
 - ◊ But also “guest” discussions from the project TAs
 - ◊ Will have mailing list and online discussion forums, too

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Homeworks

- There will be approximately five homeworks throughout the quarter
 - ◊ Reinforce lecture material...no better practice
- Collaboration vs. cheating
 - ◊ I encourage you to discuss homework problems with others
 - » You can learn a lot from each other
 - ◊ But there is a distinction between collaboration and cheating
 - ◊ Rule of thumb: Discuss together in library, walk home, and write up answers independently
 - ◊ Cheating is copying from other student's homeworks or solution sets, searching for answers on the Web, etc.
 - ◊ Suspicious homeworks will be flagged for review by me

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Nachos

- Nachos is an instructional operating system
 - ♦ It is a user-level operating system and a machine simulator
 - » Not unlike the Java runtime environment
 - » Will become abundantly clear (or not so clear) very soon
 - ♦ Programming environment will be C++ on Unix (Linux/Solaris)
 - ♦ The projects will require serious time commitments
 - » This is not an understatement
- You will do three projects using Nachos (more later)
 - ♦ Concurrency and synchronization
 - ♦ Multiprogramming
 - ♦ Virtual memory
- You will work in groups of four on the projects
 - ♦ Start identifying partners now

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Labs

- We will have access to two labs in the AP&M basement
 - ♦ uAPE: sparc/Solaris
 - ♦ OSTL: x86/Linux (access is combo controlled)
- You can use either platform for your project
 - ♦ Or even your home machine
 - ♦ Helps if everyone in your group is using the same platform

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Exams

- Midterm
 - ♦ Thursday, October 25
 - ♦ Covers first half of class
- Final
 - ♦ Friday, December 7
 - ♦ Covers second half of class plus selected material from first half
 - » I will be explicit about the material covered
- Crib sheet
 - ♦ You can bring one double-sided 8.5x11" page of notes to each exam to assist you in answering the questions
 - ♦ Note: Not a substitute for thinking

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Grading

- Homeworks: 20%
 - ♦ Think of these collectively as a take-home midterm
- Midterm: 20%
- Final: 25%
- Projects: 35%

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How *Not* To Pass CSE 120

- Do not come to lecture
 - It's too early, the slides are online, and the material is in the book anyway
 - Lecture material is the basis for exams and directly relates to the projects
- Do not do the homework
 - It's only 20% of the grade
 - Excellent practice for the exams, and some homework problems are exercises for helping with the project
 - 20% is actually a significant fraction of your grade (difference between an A and a C)

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How *Not* To Pass (2)

- Do not ask questions in lecture, office hours, or email
 - It's scary, I don't want to embarrass myself
 - Asking questions is the best way to clarify lecture material at the time it is being presented
 - Office hours and email will help with homeworks, projects
- Wait until the last couple of days to start a project
 - We'll have to do the crunch anyways, why do it early?
 - The projects cannot be done in the last couple of days
 - Some groups last time learned that starting early meant finishing all of the project on time...and some didn't

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CSE 120 Course Material

- This course addresses classic OS concepts
 - The services provided by the OS
 - OS implementation on modern hardware
 - Co-evolution of hardware and software
 - Techniques for implementing software systems that are
 - » Large and complex
 - » Long-lived and evolving
 - » Concurrent
 - » Performance-critical
- System software tends to be mysterious
- Our goal is to reveal all mysteries

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Fundamental OS Issues

- The fundamental issues/questions in this course are:
 - Structure: how is an operating system organized?
 - Sharing: how are resources shared among users?
 - Naming: how are resources named (by users and programs)?
 - Protection: how are users/programs protected from each other?
 - Security: how can information access/flow be restricted?
 - Communication: how to exchange data?
 - Reliability and fault tolerance: how to mask failures?
 - Extensibility: how to add new features?

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Fundamental OS Issues (2)

- Concurrency: how to control parallel activities?
 - Performance: how to make efficient use of resources, reduce OS overhead?
 - Scale and growth: how to handle increased demand?
 - Compatibility: can we ever do anything new?
 - Distribution: how to coordinate remote operations?
 - Accountability: how to charge for/restrict use of resources?
- And the principles in this course are the design methods/approaches/solutions to these issues

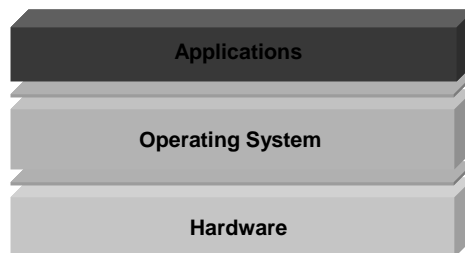
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What is an operating system?

- The operating system is the software layer between user applications and the hardware



- The OS is “all the code that you didn’t have to write” to implement your application

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The OS and Hardware

- The OS abstracts/controls/mediates access to hardware resources
 - Computation (CPUs)
 - Volatile storage (memory) and persistent storage (disk, etc.)
 - Communication (network, modem, etc.)
 - Input/output devices (keyboard, display, printer, camera, etc.)
- The OS defines a set of logical resources (objects) and a set of well-defined operations on those objects (interfaces)
 - Physical resources (CPU and memory)
 - Logical resources (files, programs, names)

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The OS and Hardware (2)

- Benefits to applications
 - Simpler (no tweaking device registers)
 - Device independent (all network cards look the same)
 - Portable (same program on Windows95/98/ME/NT/2000/...)
 - Transportable (same program across different OSes (Java))

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The OS and Applications

- The OS defines a logical, well-defined environment...
 - ♦ Virtual machine (each program thinks it owns the computer)
- For users and programs to safely coexist, cooperate, share resources
 - ♦ Concurrent execution of multiple programs (timeslicing)
 - ♦ Communication among multiple programs (pipes, cut & paste)
 - ♦ Shared implementations of common facilities
 - » No need to implement the file system more than once
 - ♦ Mechanisms and policies to manage/share/protect resources
 - » File permissions (mechanism) and groups (policies)

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OS Metaphors

- Service provider
 - ♦ The OS provides a standard set of facilities/services that enable programs to be simple and portable
- Executive/bureaucrat/big brother/juggler
 - ♦ The OS controls access to shared resources, and allocates resources for the greater good
- Caretaker
 - ♦ The OS monitors and recovers from exceptional conditions
- Cop/security guard
 - ♦ The OS mediates access to resources, granting or denying requests to use resources

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For next class...

- Browse the course web
 - ♦ <http://www-cse.ucsd.edu/classes/fa01/cse120/>
- Read Chapters 1 and 12
- Send your email address to me (voelker@cs.ucsd.edu) for mailing list
- Start thinking about partners for project groups
- No discussion section on Monday
 - ♦ Anirban is AWOL (stuck in India)
- I will bring account slips at the next lecture (not ready before class today)