Welcome to Operating Systems!

Operating system: the single-most complex and essential software running on your machine

In this class, we will explore how an OS works
• Basic concepts
• Structure, design, implementation
• Principles that apply to all OS’s

Resources

Web page
• http://www-cse.ucsd.edu/classes/sp06/cse120/

Lecture notes
• Available via web page evening before lecture

Book
• Operating System Concepts, 7th ed., Wiley 2005

Webboard
• http://webboard.ucsd.edu/WB/?boardid=cs120s

Computer system (for programming assignments)
• ieng9.ucsd.edu

Lectures vs. Book

Lectures are very important: Don’t miss them!

Designed to highlight what is most important to know

Exam questions will come directly from lectures
• Lecture notes + what is said in class

Use the book as a reference, to fill in details and gaps
Grading

30% Midterm exam
40% Final exam
30% Programming projects

Collaboration Policy

Can collaborate, but must submit your own work
Exams will include questions on programming
Collaborate: discuss approaches, not solutions
Test: Can you reproduce and explain it, all by yourself?

What is an Operating System?

Basically, software the enhances the hardware
• Provides interface so that system is easier to use
• Provides resources to allow programs to run
• Protects resources and running programs
• Keeps the system running smoothly
So why not just do everything in hardware?

Some Key Terms

Hardware
• All the physical working parts

Resources
• What are needed to allow work to get done

Operating System
• Software that enhances the hardware

Kernel
• The essential part (“core”) of the operating system

“The System”
• Generally all of the above, viewed in a unified way
In this Class, We Focus on the Kernel

All programs depend on it
  • Loads and runs them
  • Accessed via system calls
Works closely with hardware
  • Access device registers
  • Responds to interrupts
Allocates basic resources
  • CPU time, memory space
Controls I/O devices: display, keyboard, disk, network

Two Purposes of Operating System

Provides abstract machine
  • Functions and resources
Manages resources
  • Allocates space and time
Goals
  • As abstract machine
    - Simplicity, Convenience
  • As resource manager
    - Efficiency, Reliability, Protection, Security

Resources and Abstractions

Hardware Abstraction
  CPU process, thread
  Memory segment, page
  Disk file, directory
  Network connection, socket
  Display window
  Keyboard stream

Resource: something that allows work to get done
Abstraction: a simplified representation or model

What If There Is No Kernel?

All we have is bare hardware
You want to run a program
  • How do you load it?
  • How do you run it?
  • What happens when it exits?
Need at least a minimal kernel to do these functions
Minimal Kernel: Allow Program To Run

Minimal kernel
- Resident code
- Runs by default
- Loads program into memory
- Allows it to run
- When it exits, go to kernel

Questions
- What if program fails or has a bug?
- How is kernel protected?

Provide Common Functions

Some funcs useful to many progs
- I/O device control
- Memory allocation

Place these functions in kernel
- Called by programs
- Or accessed implicitly

What should functions be?
- How many programs should benefit?
- Might kernel get too big?

Allow Multiple Programs to Run

When I/O issued, CPU not needed
- Allow another program to run: multiprogramming
- Requires yielding (giving up CPU) and sharing memory

What if one running program
- monopolizes CPU, memory?
- reads/writes another’s memory?
- uses I/O device being used by another?

Virtualize, Idealize (Abstract)

Multiple virtual processors
- by rapidly switching CPU use

Multiple virtual memories
- by memory partitioning and re-addressing

Idealized devices
- by simplifying interfaces, and using other resources to enhance function

Bottom line: make the system easy to use and work well
Outline of Course

Processes
Virtual Memory
File System
I/O
Protection and Security
Distributed Systems and Networks

Reading and Programming Assignment

Read Chapters 1 and 2
• Review hardware material
  - You are expected to already know this
  - If not, you may need to do further research
• Get familiar with operating system concepts
  - Just get to know terms, ideas
  - Later, this material will be good to refer to

Programming Assignment 1
• Will be available tomorrow or Thurs (see web page)
• Will be due on Wed April 12