

Operating Systems

Dickinson College
Computer Science 354
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slides courtesy of Professor Grant Braught

Operating Systems

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Operating Systems

- Syllabus:
 - ✓ Silberschatz, Galvin, Gagne (2006). **Operating Systems Concepts, Seventh Edition.**
 - ✓ Grading:
 - ❖ Homework: 10%
 - ❖ Projects (~5): 30%
 - ❖ Research Presentation 10%
 - ❖ Midterms (2): 30%
 - ❖ Cumulative Final: 20%
 - ✓ Cheating and Plagiarism
 - ✓ Late Work Policy

Operating Systems

- Course Outline:
 - ✓ Joke
 - ✓ What is an OS and why do we have them?
 - ✓ Programs and Processes
 - ✓ Process Scheduling
 - ✓ Threads and synchronization
 - ✓ Memory Management
 - ✓ File Systems
 - ✓ Protection and Security

If OS's Were Airlines

- Air DOS:
 - ✓ Everybody pushes the airplane until it glides, then they jump on and let the plane coast until it hits the ground again. Then they push again, jump on again, and so on ...
- Air Mac:
 - ✓ All the stewards, captains, baggage handlers, and ticket agents look and act exactly the same. Every time you ask questions about details, you are gently but firmly told that you don't need to know, don't want to know, and everything will be done for you without your ever having to know, so just shut up.
- Air Windows:
 - ✓ The terminal is pretty and colorful, with friendly stewards, easy baggage check and boarding, and a smooth take-off. After about 10 minutes in the air, the plane explodes with no warning whatsoever.

If OS's Were Airlines

- Air WindowsNT:
 - ✓ Just like Windows Air, but costs more, uses much bigger planes, and takes out all the other aircraft within a 40-mile radius when it explodes.
- Air Linux:
 - ✓ Disgruntled employees of all the other OS airlines decide to start their own airline. They build the planes, ticket counters, and pave the runways themselves. They charge a small fee to cover the cost of printing the ticket, but you can also download and print the ticket yourself. When you board the plane, you are given a seat, four bolts, a wrench and a copy of the seat-HOWTO.html. Once settled, the fully adjustable seat is very comfortable, the plane leaves and arrives on time without a single problem, the in-flight meal is wonderful. You try to tell customers of the other airlines about the great trip, but all they can say is, "You had to do what with the seat?"

Operating Systems

- What is an operating system?
- Why do we have operating systems?

OS Purposes

- An operating system serves two main purposes:
 - ✓ It makes the computer easier to use.
 - ✓ It allows for more efficient use of the computer hardware.

Ease of Use

- User Perspective:
 - ✓ OS make it easier for users to do things like:
 - ❖ Launch programs
 - ❖ Use multiple programs concurrently
 - ❖ Keep track of files
 - ❖ Add additional hardware devices
 - ❖ As operating systems improve so does the user experience.

Ease of Use

- Program / Programmer Perspective
 - ✓ The OS makes it easier for programs (and programmers) to use the computer by providing support for common tasks:
 - ❖ Accessing hardware devices
 - ❖ Sharing system resources with other programs
 - ❖ Coordinating activity with other programs

Efficient use of Hardware

- Operating system advances that allow more efficient use of computer hardware:
 - ✓ Multiprogramming
 - ✓ Timesharing
- The use of these advances necessitate that the operating system also manage:
 - ✓ Resource allocation and sharing
 - ✓ Protection
 - ✓ Security

Operating System Design

- An operating system will trade-off ease of use against efficient use of the hardware depending on the goals of the computer system for which it is designed.

OS Implementation

- Operating systems are generally divided into several different sub-systems:
 - ✓ Process Management
 - ❖ Process = Running program
 - ✓ Memory Management
 - ✓ Storage Management

Process Management

- Process management includes:
 - ✓ Starting new processes
 - ✓ Terminating processes
 - ✓ Scheduling processes
 - ✓ Interprocess communication mechanisms
 - ✓ Process/Thread synchronization mechanisms

Memory Management

- Memory management is responsible for:
 - ✓ Tracking free memory
 - ✓ Allocating memory to processes
 - ✓ Freeing memory from processes
 - ✓ Handling virtual memory

Storage Management

- Storage management is responsible for:
 - ✓ Creating and deleting files
 - ✓ Creating and deleting directories
 - ✓ Mechanisms for manipulating files and directories
 - ✓ Mapping files and directories onto disk
 - ✓ Tracking free disk space

Road Map

- Today:
 - ✓ What an OS is, why we have them, what they do.
- Next:
 - ✓ Base hardware and support for operating systems
- Later:
 - ✓ Process management
 - ❖ Concurrent programming
 - ✓ Memory management
 - ✓ Storage management
 - ✓ Protection and Security