CS 1550: Introduction

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Operating Systems
- Manage Resources
- Abstract Details

Manage Resources
- CPU Time
- Memory
- I/O Devices
  - Disks/Filesystems
- Security

Abstract Details
- Exclusive access to the CPU(s)
- Huge amounts of dedicated RAM
- Exclusive access to I/O devices
- Transparent security

In short, SHARING

Varieties of OS
- Mainframe OS
- Server OS
- Parallel Computer OS
- Personal Computer OS
- Real-Time OS
  - Hard real-time
  - Soft real-time
- Embedded OS
- Smart Card OS

Ye Olde Computer
Ye Olde Program

FORTRAN program

Data for program

$END

$RUN

$LOAD

FORTRAN

program

Data for program

Punchcard

Why Study History?

Ontogeny Recapitulates Phylogeny

Development of the species is mimicked by the gestation of an individual

Or:

What’s old will be new again

Multiprogramming

Memory partitions

Job 3

Job 2

Job 1

Operating system

Image Protection

Process’s Address Space

Address

User program

and data

Limit

Base

Operating system

Address

User data

User program

Operating system

0x1dfff

0x23000

0x27fff

0x2b000

0x2ffff

0x2d000

0x24fff

0x7fffffff

0x2b000

0x29000

0x2bfff

0x2ffff

0x2b000

0x23000

0x00000

Stack

Data (Heap)

Text (Code)
System Call

Context Switch
Switching from one running process to another

A Simple Computer System

Protect and Share
- CPU time
  - Preemption
- Memory
  - Address Spaces/Virtual Memory
- I/O
  - Spool
    - Simultaneous Peripheral Operation On Line
- Security

CPU Architecture

The Memory Hierarchy
Hard Drive Internals

- sector
- platter
- track
- cylinder
- surfaces
- spindle
- actuator
- read/write head

I/O Via Interrupts

Hardware View

- CPU
- Interrupt controller
- Disk controller
- Interrupt
- Controller
- CPU

Software View

- Return to caller
- Trap to kernel
- Call printf
- Push arguments

Hierarchical File System

Root directory
- bin
- cse
- faculty
- grads
- ls
- ps
- cp
- csh
- elm
- sbrandt
- kag
- amer4
- stuff
- classes
- research
- stuff

Monolithic OS

- Main procedure
- Service routines
- Utility routines

Microkernel

User mode
- Client process
- Client process
- Process server
- Terminal server
- File server
- Memory server
- Kernel mode

Virtual Machines

- System calls
- I/O instructions
- Calls to simulate I/O
- "Real" I/O instructions
- App1
- App2
- App3
- App4
- Linux
- Windows NT
- FreeBSD
- VMware
- VMware
- VMware
- Linux
- Bare hardware