Operating System

• Different concepts
  – single user
  – multiprogramming
  – multi-user
Operating System Evolution

Basic Input Output

Application

I/O Routines

Memory
Operating System Evolution

Single User

Application
Command line Interpreter
Monitor/Kernel
I/O Routines

Memory
Operating System Evolution

Multiprogramming

- Application 3
- Application 2
- Application 1
- Monitor/Kernel
- I/O Routines

Memory
Operating System Evolution

Multi-User

User 1

User 2

User 3

Monitor/Kernel

I/O Routines

Memory
Operating System Functions

- Process Management
- Main Memory Management
- File Management
- I/O System Management
- Secondary Storage Management
- Networking
- Protection
- Accounting/Logging
- Command Interpreter/GUI
Operating System Overview

Kernel
- Memory Mgmt
- Process Mgmt
- Interprocess Communication
- Buffer/Cache Mgmt
- Error Handling
- Protection/Security

File System Driver
- Character Device Driver
- Block Device Driver
  - Network Driver
    - TTY Driver
    - Ethernet Driver
  - IDE Driver
  - SCSI Driver
  - Ethernet Card
  - IDE Disks
  - SCSI Disks

System Processes
- Accounting/Logging
- RPC
- Login Manager
- Compilers
- Editors
- Command Line Interpreter/shell
- User Programs

Application Program Interface
Linux

- a free Unix-type OS
- adheres to the POSIX standard: Portable Operating System Interface [for Unix]
- what came before?
MULTICS

• Multics (Multiplexed Information and Computing Service)
• mainframe area
• early OS (late 60s)
• last Multics system shut down in 2000, Canadian Dept. National Defense
UNICS

- Ken Thompson wanted “fast” response OS for “Space Wars” game
  - implemented UNICS (“UNI” versus “MULTI” from Multics)
  - implemented in assembly language for PDP-7
UNIX

- Dennis Ritchie suggested to rewrite the OS using C
  - which he had developed from B
  - initial concern that C would not be fast enough
  - still some assembly code
  - Bell Labs started using this UNIX and utilities like nroff and troff were developed
BSD UNIX

- Improvements made to Unix by UC Berkeley grad students
- first good memory management system
- first real networking capability
- 1970 BSD UNIX was distributed to general public
System III and V

• Breakup of Bell Systems allowed AT&T to start selling UNIX licenses
  • System III and System V (mid 80s)
  • later System V Release 4
Evolution

- No clear winner between System V and BSD Unix. Following are System V based, but incorporate BSD features:
  - Solaris (Sun Microsystems)
  - HP-UX (HP)
  - AIX (IBM)
  - IRIS (Silicon Graphics)
Open Source Software

• Free software?
  - freedom to use, view, and modify

• Early days: Richard Stallman wrote version of Emacs and made available to public
  - he started GNU Project “GNU’s not Unix”
  - GNU C Compiler

• Free Software Foundation http://www.fsf.org
Linux

- Linus Torvalds posts message in newsgroup
  - who wants to participate? 1991
  - playing with MINIX he wanted to write “performance code”
  - release of Linux 1.0 (Linux = Linus’ Minix) under GNU GPL (General Public License) in 1994
  - first a few friends - now thousands of volunteer developers
  - 1996 Linux 2.0 became major competitor to other OSs, including commercial Unix
Linux vs Unix

• They are not the same!
  • no shared code
  • but: same POSIX standard
  • look and feel almost the same
  • BUT under the hood they are different!