CS270
Systems Software

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Typical Computer System

Hardware:
- CPU
- Bus
- RAM/ROM
- Disk(s)
- CD-ROM, DVD
- Monitor
- Graphics Card(s)
- Keyboard
- Mouse
- Printer
- Tape
- Modem
- Network int. NIC
Memory

"Front-Side" Bus
(132–2000MB/Sec)

CPU

AGP Bus

Graphics Adapter

I/O Bridge

PCI Bus

 ISA Bus

Serial Interface

Disk Controller

Disk
Operating System

- Exploits the hardware resources of one or more processors
- Provides a set of services to system users
- Manages secondary memory and I/O devices
Operating System

• Many different OSs
  – UNIX, Linux, OpenVMS, MacOS, Windows, DOS, ...

• Different OS environments, e.g.
  – general purpose
  – real time
  – distributed
Operating System

- Linux kernel
  - part of the OS that is running
  - provided core capabilities and interfaces

- Running separately from kernel code
  - commands, editors, programs, windowing system, etc.
Operating System Overview

System Processes
- Accounting/Logging
- RPC
- Login Manager
- Compilers
- Editors
- Command Line Interpreter/Shell

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

File System Driver
Character Device Driver
- TTY Driver
- Network Driver
- Ethernet Driver

Block Device Driver
- IDE Driver
- SCSI Driver

User Programs
Application Program Interface

IDE Disks
SCSI Disks
Ethernet Card

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Software

- Hardware provides framework for executing programs and storing files
  - files, directories
  - program
  - start a program -- process
  - owner of file and process
  - protection against unauthorized access
  - attributes
Directory Hierarchy
UNIX i-node

Directory Entry

```
filename
```

Pointer
Mode (file type)
owner/group
timestamps (3)
File size (blocks)
link count
direct blocks
...single indirect
double indirect
triple indirect

```
data
```

...
Resource Sharing

- CPU
  - time-slicing
- Memory
  - paging
- Secondary Memory (disk)
  - blocks of equal size
Communication

- Not practical to work in isolation: communicate!
  - displaying: process to graphics card
  - input: keyboard or mouse
  - network: email, ftp
  - interprocess communication
  - ...

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Communication

• Different mechanisms, e.g.,
  – pipe: from one process to another
  – socket: two-way high-speed data channel
X-server and X-clients
Standards

• Why do we need standards?
  – portability, portability & portability
  – POSIX 1003.1 is Unix and Unix-like OSs, maintained by IEEE and The Open Group
  – Linux implements POSIX standards
    – http://www.ieee.org
    – http://www.opengroup.org
    – http://www.unix.org