Introduction to Operating Systems

CS 447, Lecture 1

Monday, Aug 4, 2003

What does a system consist of?

- Components
- Coordination
- Behavior
  - Static Structure
  - Dynamic behavior
- External Interface – high level abstraction separated from system's implementation

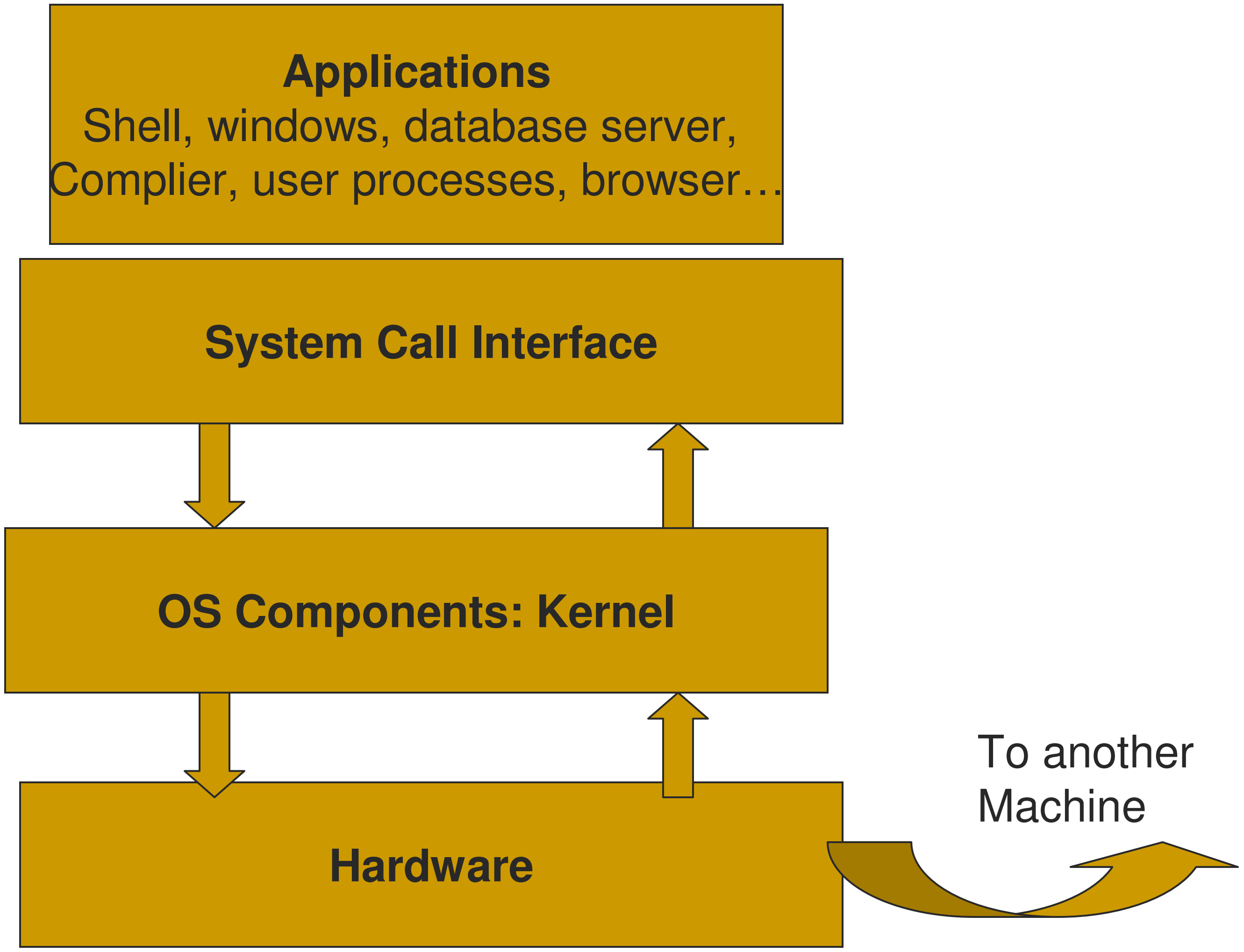
Example Systems

- Database Systems
- Operating Systems
- File Systems
- Multiprocessor Systems
- Distributed Systems
- A Document Processing System
- An Academic System

Why study operating systems

- Commonly used (everyday) system
- OS – An Important system in itself for CS curriculum
- As an example large system
  - What goes in making of such systems
    - Many algorithms, data structures, policies
    - New and interesting problems and their solutions
  - Architecture of such a system

Overall Architecture - Layering



Trace the sequence of events: keystroke → display of a char

- Key hit → interrupt generated → stroke read in input buffer → waiting process signaled → waiting process wakes up → it completes its blocked read call → takes action after reading (e.g. display the character)

What are the functions of an OS?

- Manage Resources for users
  - CPU
  - Memory
  - Disk
  - Peripheral devices: keyboard, display, mouse, printer, ..
  - Networking
- Provide abstractions to use the system
  - Users, processes, files, synchronizers, messaging

CPU requirements

- Multiprogramming
- Fairness
- Fast response
- High utilization

Memory Requirements

- Efficient and fair Allocation
- Protection
- Memory hierarchies and consistency
- Kernel vs. User space
- Virtual memory

Requirements for Disk Management

- Allocation and Deallocation
- Fragmentation
- Structuring
- Protection
- Navigation
- Ability to work in coordination with memory

Peripherals

- Installation and deinstallation
- Interrupts and events/messaging
- Priorities
- Communication
- Uniform interface – device drivers
- Special requirements
  - Keyboard and display buffers

OS Abstractions

- Users
- Processes
- Files and Directories
- Memory Pages
- Synchronizers
- Messaging Primitives
- I/O

System Calls

- For all of the above abstractions
- The only way to interact with an OS
- All applications developed on top of system call layer
- Calls are made in user space, in user mode
- OS executes in kernel space and may also in user space but in kernel mode

Users

- Identity
- Owenerships
- Abilities
- Accounting

Processes

- Space allocation
- Allocation of Computational power
- Protection
- Kernel vs. user tasks
- Execution cycle and Multiprogramming
- Interconnectibility – devices and other processes
- Acounting

Files

- Create, Destroy, Read, Write, change modes,..
- Block sizes
- Protection
- Modes
- Uniform interface for multiple types of file systems

Memory

- Pages
- Allocation and deallocation
- accounting

Synchronizers and messaging

- Create
- Connect
- Send/receive/operate
- Close/destroy
- accounting

Course Book: Get hold of any of the below books

- Silberschatz, Galvin
- Dhamdhere
- Stallings