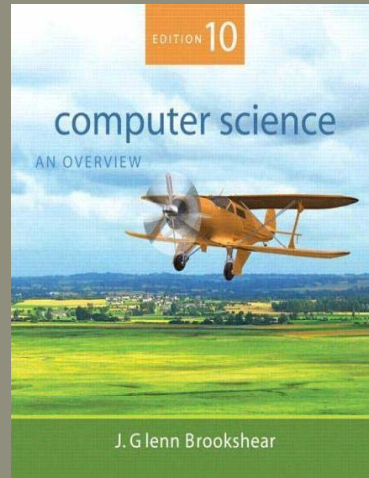


Chapter 3

Operating Systems



Functions of Operating Systems

- Oversee operation of computer
- Store and retrieve files
- Schedule programs for execution
- Coordinate the execution of programs

4.4



Chapter 3: Operating Systems

- 3.1 The History of Operating Systems
- 3.2 Operating System Architecture
- 3.3 Coordinating the Machine's Activities
- 3.4 Handling Competition Among Processes
- 3.5 Security

4.3



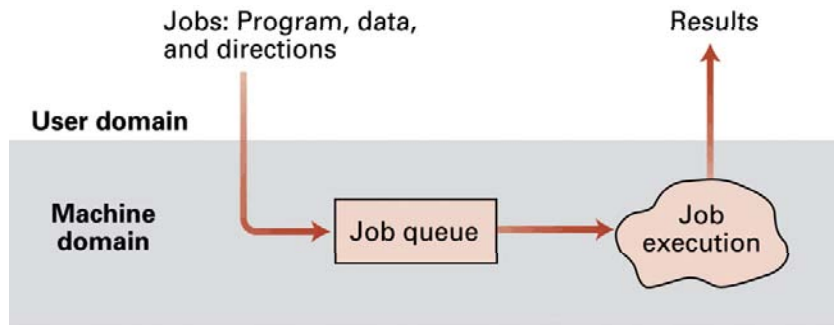
Evolution of Shared Computing

- Batch processing
- Interactive processing
 - Requires real-time processing
- Time-sharing/Multitasking
- Multiprocessor machines

4.5



Figure 3.1 Batch processing



4.6



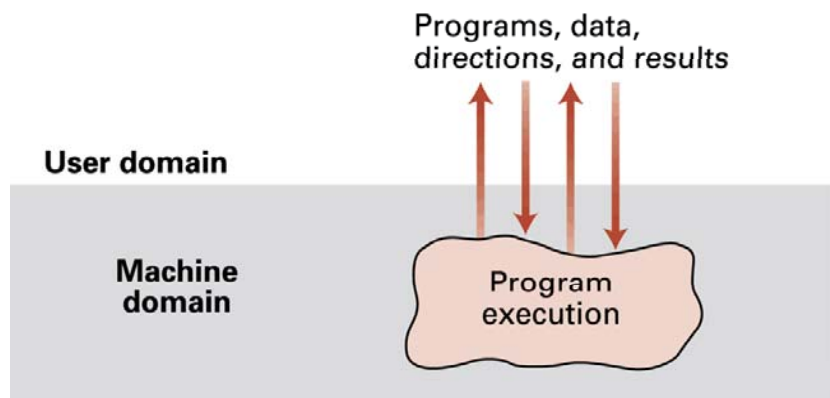
Types of Software

- Application software
 - Performs specific tasks for users
- System software
 - Provides infrastructure for application software
 - Consists of operating system and utility software

4.8



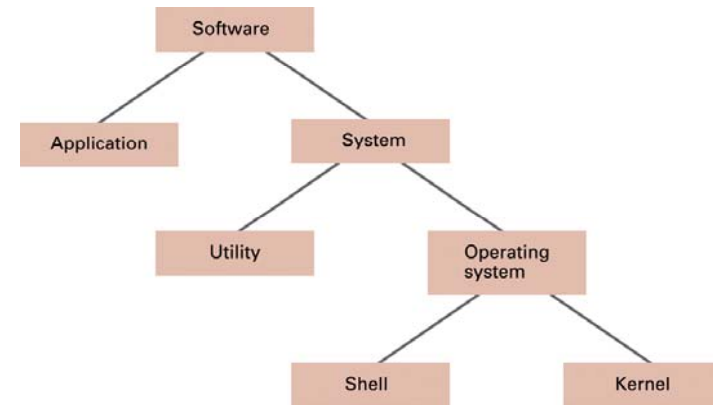
Figure 3.2 Interactive processing



4.7



Figure 3.3 Software classification



4.9



Operating System Components

- **Shell(外殼):** Communicates with users
 - Text based
 - Graphical user interface (GUI)
 - Window manager
- **Kernel(核心):** Performing basic required functions
 - File manager
 - Device drivers
 - Memory manager
 - Scheduler and dispatcher

4.21



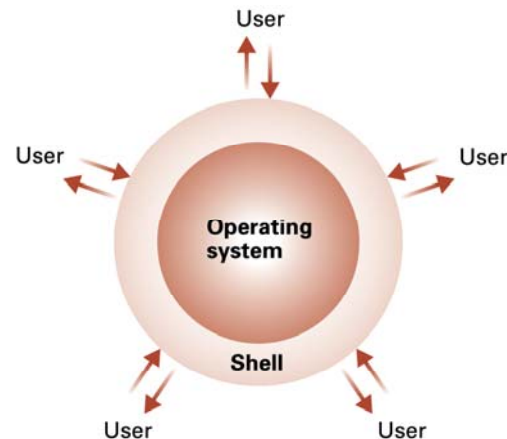
File Manager

- **Directory (or Folder):** A user-created bundle of files and other directories (subdirectories)
- **Directory Path:** A sequence of directories within directories

4.22



Figure 3.4 The shell as an interface between users and the operating system



4.21



Memory Manager

- Allocates space in main memory
- May create the illusion that the machine has more memory than it actually does (**virtual memory**) by playing a “shell game” in which blocks of data (**pages**) are shifted back and forth between main memory and mass storage

4.23



Getting it Started (Bootstrapping)

- **Bootstrap(啟動):** Program in ROM(唯讀記憶體)
 - Run by the CPU when power is turned on
 - Transfers operating system from mass storage to main memory
 - Executes jump to operating system

4.24



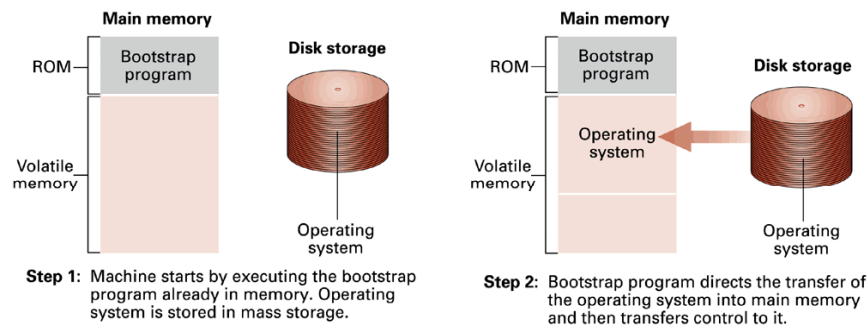
Processes(工作單元)

- **Process:** The activity of executing a program
- **Process State:** Current status of the activity
 - Program counter
 - General purpose registers
 - Related portion of main memory

4.26



Figure 3.5 The booting process



4.25



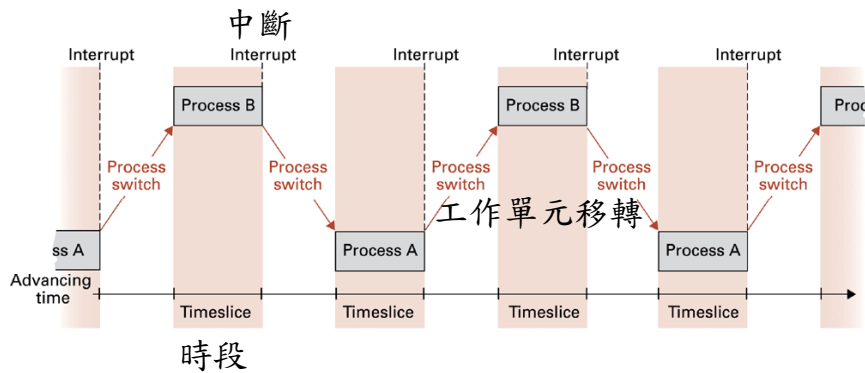
Process Administration

- **Scheduler(排程):** Adds new processes to the process table and removes completed processes from the process table (工作單元表)
- **Dispatcher(時段分配):** Controls the allocation of time slices to the processes in the process table
 - The end of a time slice is signaled by an interrupt.

4.27



Figure 3.6 Time-sharing between process A and process B



Deadlock(死結)

- Processes block each other from continuing
- Conditions required for deadlock
 1. Competition for non-sharable resources
 2. Resources requested on a partial basis
 3. An allocated resource can not be forcibly retrieved

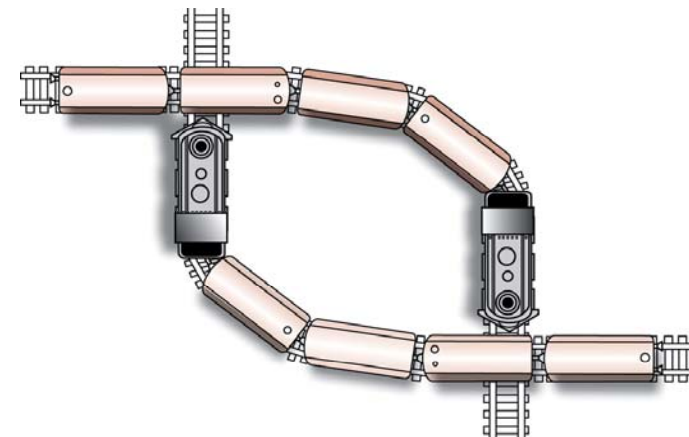


Handling Competition for Resources

- **Semaphore(信號):** A “control flag”
- **Critical Region(臨界區域):** A group of instructions that should be executed by only one process at a time
- **Mutual exclusion(互斥):** Requirement for proper implementation of a critical region



Figure 3.7 A deadlock resulting from competition for nonshareable railroad intersections





Security(安全性)

- Attacks from outside
 - Problems
 - Insecure passwords
 - Sniffing software (竊聽軟體)
 - Counter measures (反制措施)
 - Auditing software (監控軟體)

4.32



Security (continued)

- Attacks from within
 - Problem: Unruly processes
 - Counter measures: Control process activities via privileged modes and privileged instructions(特權指令)

4.33