Information Technology Institute

Operating System Fundamentals

Table of Content

Self Study Topics

- Virtual Memory
  - Background.
  - Demand Paging.
  - Page Replacement.
  - Allocation of frames.
- File-System Interface
  - File Concept.
  - Access Methods.
  - Directory Structure.
  - Protection.

Self Study Topics (cont'd)

- File-System Implementation
  - File System Structure.
  - Allocation Methods.
  - Free-Space Management.
  - Directory Implementation.
  - Recovery.

Reference

- **Computer Operating System Concepts**
  - Author: Silberschatz
  - Publisher: Wiley
  - ISBN: 0471250600
- **Handbook of Cloud Computing**
  - Author: Borko Furht, Armando Escalante
  - Publisher: Springer
  - ISBN: 978-1-4419-6523-3

Chapter One

Introduction

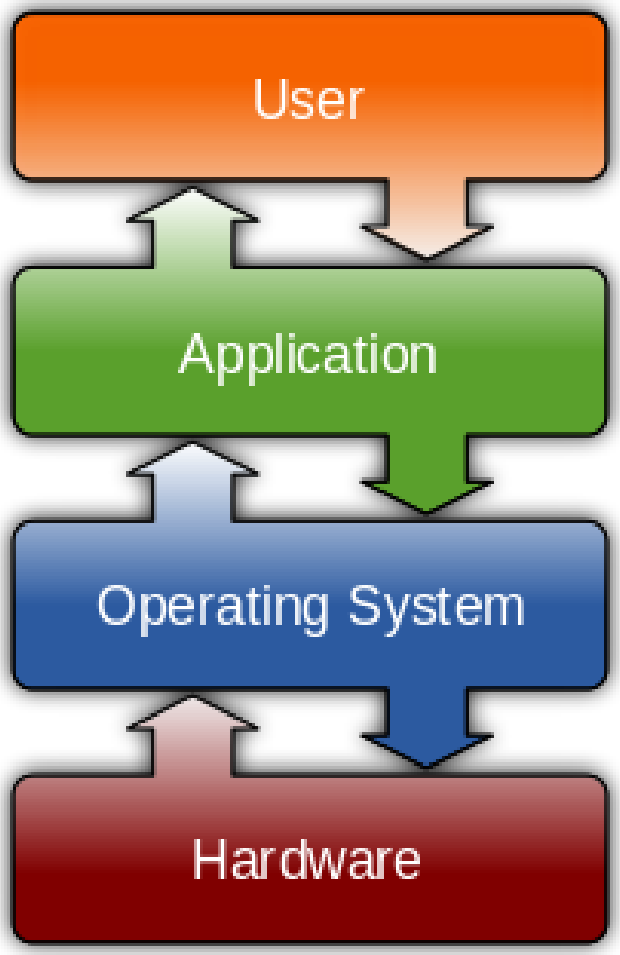
Table of Content

OPERATING SYSTEM

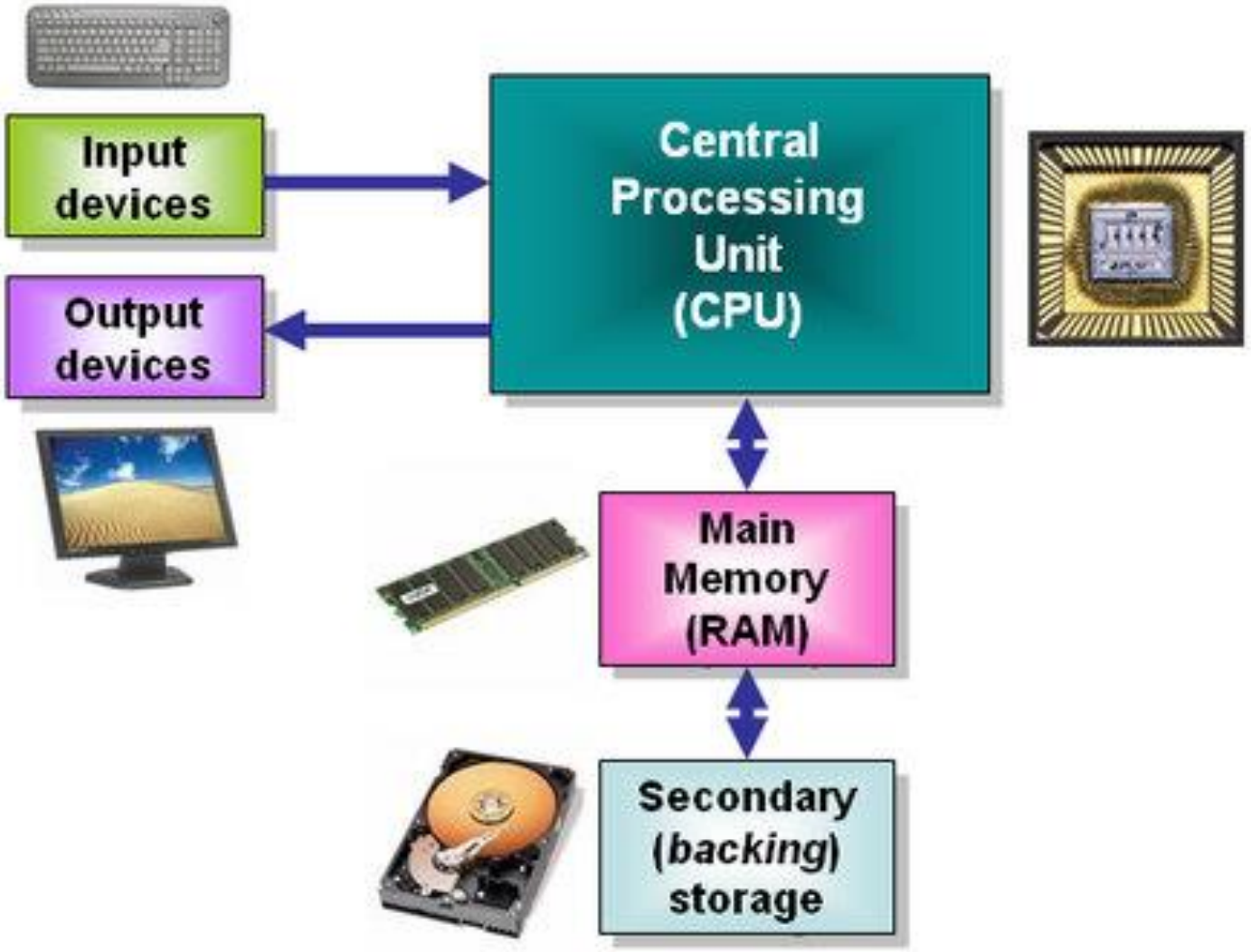
Operating System

- What is an Operating System?
  - It acts as an intermediary between a user and his hardware
- Operating system objective
  - Executes users programs
  - Solves its problems
  - Uses HW in an efficient manner
  - Makes user life easier ;)

Computer System Components



1. Computer Hardware



2. Operating System

- It controls and coordinates the use of the HW among the various application programs for the various users
  - It manages and allocates resources
  - It controls the execution of user programs and operations of I/O devices
- Kernel – the one program running at all times

3. Application Programs

- Compilers
- Web browsers
- Spread sheets
- Word processors
- …

4. Users

- People
- Machines
- Other Computers

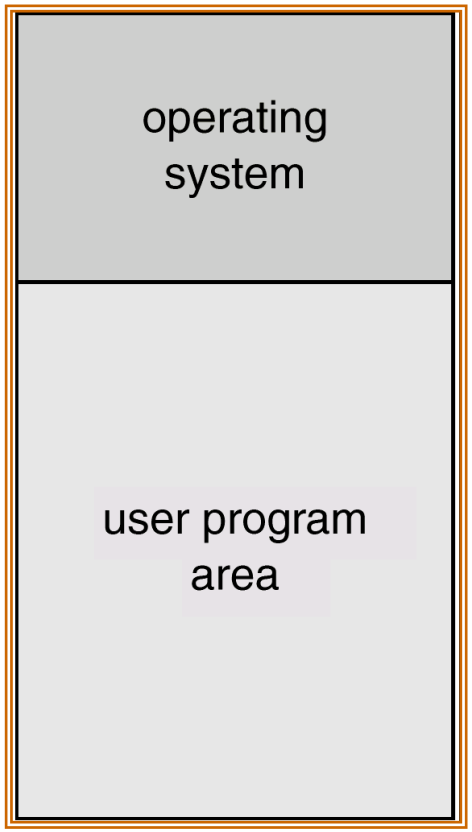
MAINFRAME SYSTEMS

Mainframe Systems

- Reduce setup time by batching similar jobs
- Automatic job sequencing
  - Automatically transfers control from one job to another.
  - First rudimentary operating system

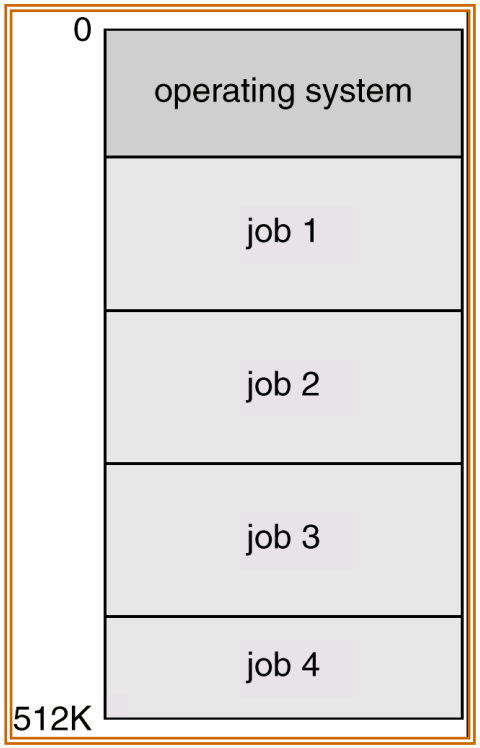
Mainframe Systems Cont'd

- Memory Layout for a Simple Batch System



Mainframe Systems Cont'd

- Multi-programmed Batch Systems
  - Several jobs are kept in main memory at the same time, and the CPU is multiplexed among them



Mainframe Systems Cont'd

- Time-Sharing Systems (Interactive Computing)
  - The CPU is multiplexed among several jobs that are kept in memory and on disk
  - The CPU is allocated to a job only if the job is in memory
  - A job swapped in and out of memory to the disk
  - On-line communication between the user and the system is provided
    - When the operating system finishes the execution of one command, it seeks the next "control statement" from the user's keyboard
  - On-line system must be available for users to access data and code

DESKTOP SYSTEMS

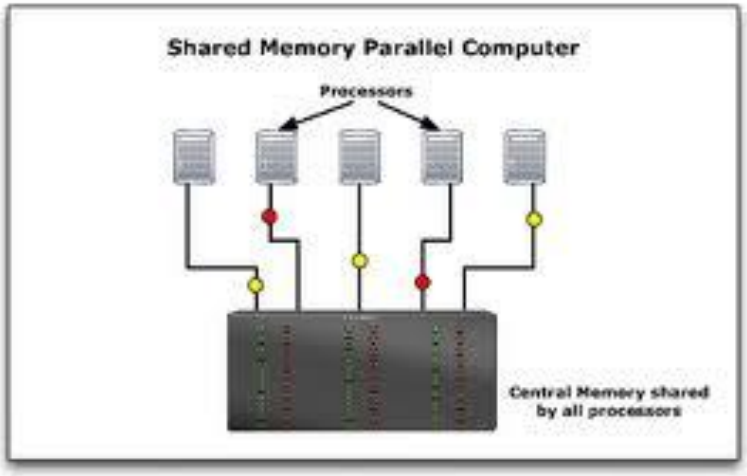
Desktop Systems

- *Personal computers*
  - Computer system dedicated to a single user
- I/O devices
  - Keyboards
  - Mice
  - Display screens
  - Small printers
- User convenience and responsiveness
- Can adopt technology developed for larger operating system
  - Often individuals have sole use of computer and do not need advanced CPU utilization of protection features
- May run several different types of operating systems (Windows, MacOS, UNIX, Linux)

MULTIPROCESSOR SYSTEMS

Parallel Systems

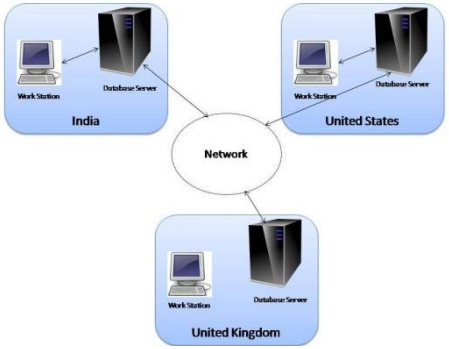
- Systems with more than one CPU in close communication
  - Also known as *multiprocessor systems*
- *Tightly coupled system*
  - processors share memory and a clock; communication usually takes place through the shared memory
- Advantages of parallel system:
  - Increased *throughput*
  - Economical
  - Increased reliability
    - graceful degradation
    - fail-soft systems



DISTRIBUTED SYSTEMS

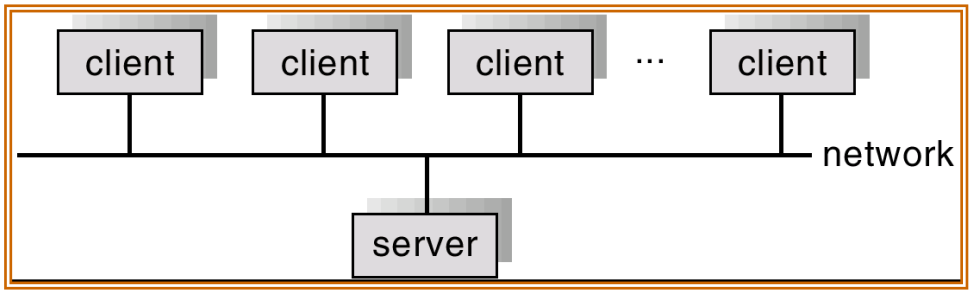
Distributed Systems

- Distribute the computation among several physical processors
- *Loosely coupled system*
  - Each processor has its own local memory
  - processors communicate with one another through various communications lines, such as high-speed buses or telephone lines
- Advantages of distributed systems
  - Resources Sharing
  - Computation speed up
    - load sharing
  - Reliability



Distributed Systems Cont'd

- Requires networking infrastructure
- Local area networks (*LAN*) or Wide area networks (*WAN*)
- May be either *client-server* or *peer-to-peer* systems



CLUSTERED SYSTEMS

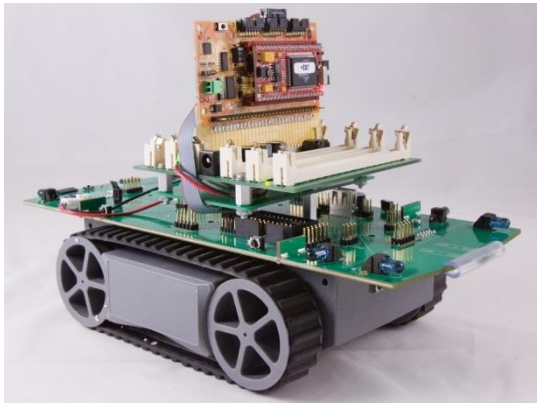
Clustered Systems

- Clustering allows two or more systems to share storage
- Provides high reliability
- *Asymmetric clustering*: one server runs the application or applications while other servers standby
- *Symmetric clustering*: all N hosts are running the application or applications

REAL-TIME SYSTEMS

Real-Time Systems

- Often used as a control device in a dedicated application such as controlling scientific experiments, medical imaging systems, industrial control systems, and some display systems
- Well-defined fixed-time constraints
- Real-Time systems may be either *hard* or *soft* real-time



Real-Time Systems Cont'd

- Hard real-time:
  - Secondary storage limited or absent, data stored in short term memory, or read-only memory (ROM)
  - Conflicts with time-sharing systems, not supported by general-purpose operating systems
- Soft real-time
  - Limited utility in industrial control of robotics
  - Integrate-able with time-share systems
  - Useful in applications (multimedia, virtual reality) requiring tight response times

HANDHELD SYSTEMS

Handheld Systems

- Personal Digital Assistants (PDAs)
- Cellular Phone & Smart Phone
- Issues:
  - Limited memory
  - Slow processors
  - Small display screens

Computing Environments

- Traditional computing
  - PCs, Servers, limited remote access
- Web-Based Computing
  - Client-server and web services, convenient remote access, location-less servers
- Embedded Computing
  - Very limited operating system features
  - Little or no user interface, remote access