



Information Technology Institute

The background of the slide is composed of several elements: a dark red vertical bar on the left, a light gray horizontal bar across the middle, and a dark red horizontal bar at the bottom. The light gray bar contains a faint, stylized floral pattern on the right side. On the left side of the light gray bar, there is a circular image of a planet or moon with a reddish-orange glow.

Operating System Fundamentals

Table of Content

1. Overview

1. Introduction
2. Computer System Structure
3. Operating System Structure

2. Process Management

1. Processes
2. CPU Scheduling
3. Deadlocks

3. Storage Management

1. Memory Management
2. Virtual Memory
3. File Management

4. Introduction to Cloud Computing

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

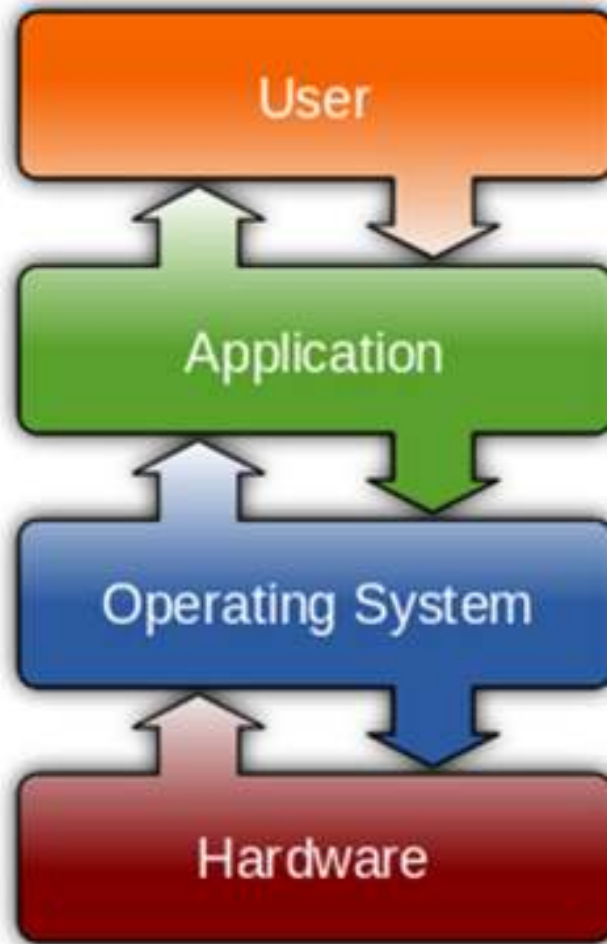
- Operating System
- Mainframe Systems
- Desktop Systems
- Multiprocessor Systems
- Distributed Systems
- Clustered System
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- Handheld Systems
- Computing Environments

OPERATING SYSTEM

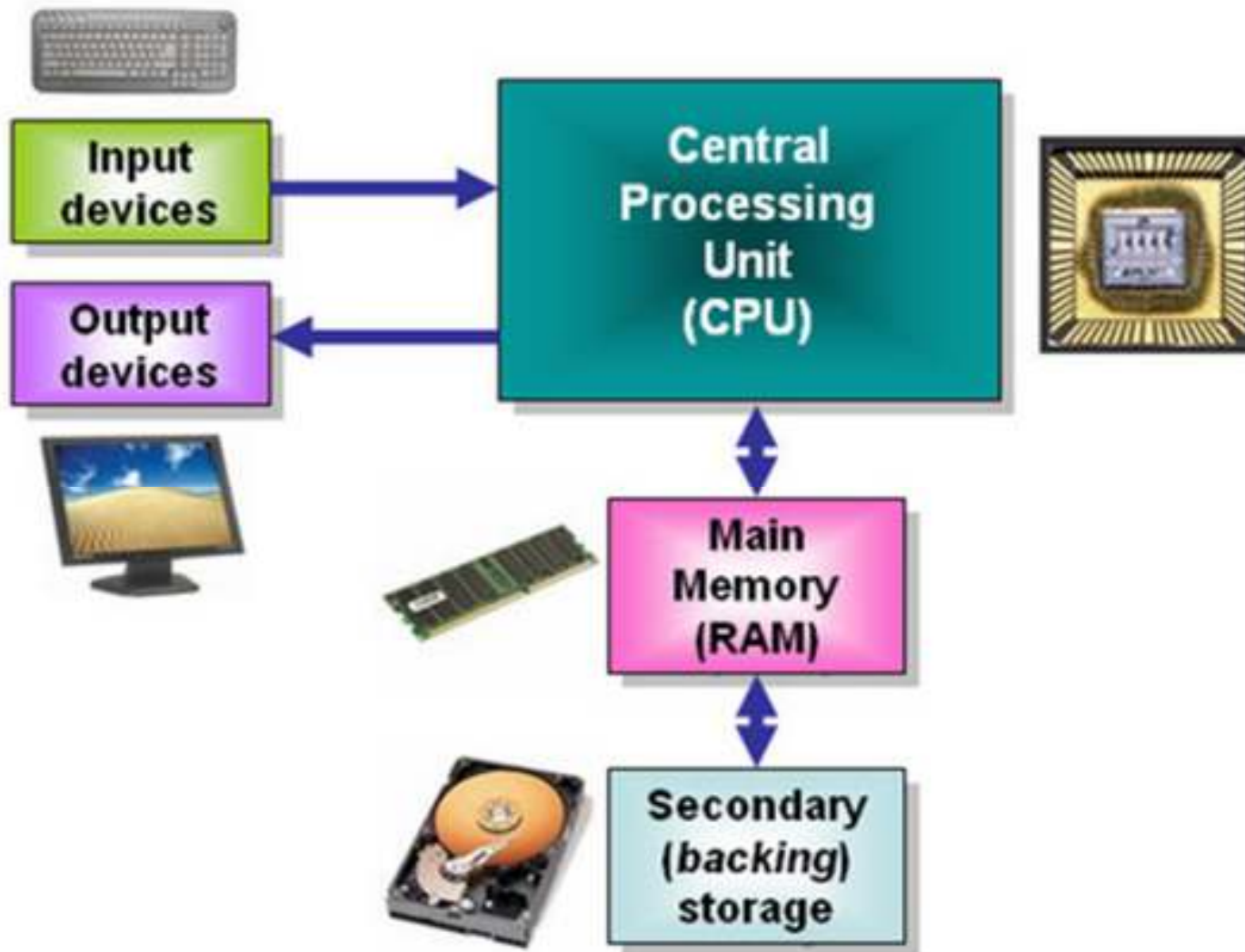
Operating System

- 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

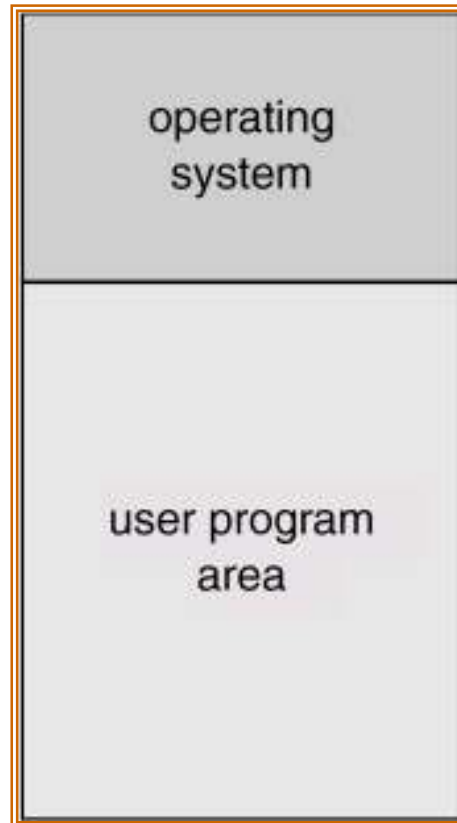
Mainframe Systems

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



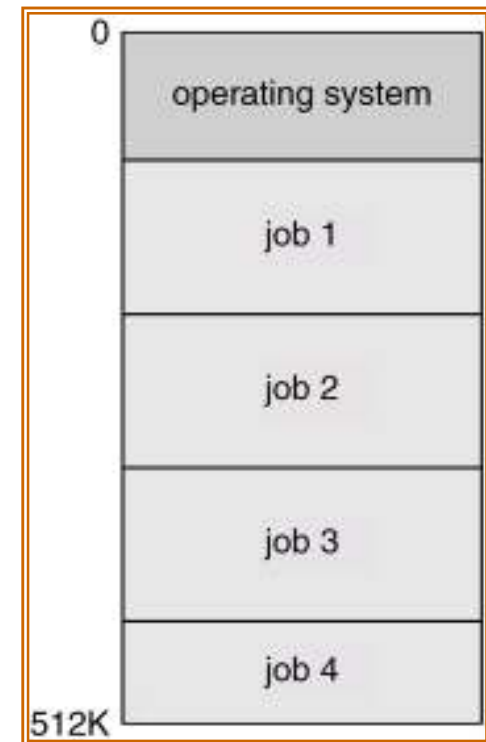
Mainframe Systems Cont'd

- 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

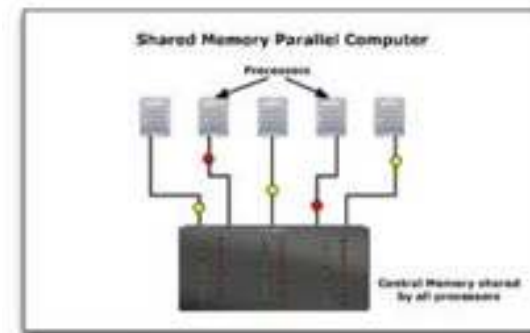
- *Personal computers*
 - Computer system dedicated to a single user
- *I/O devices*
 - Keyboards
 - Mice
 - Display screens
 - Small printers
- *User convenience and responsiveness*
- *Can adopt technology developed for larger operating system*
 - Often individuals have sole use of computer and do not need advanced CPU utilization or 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

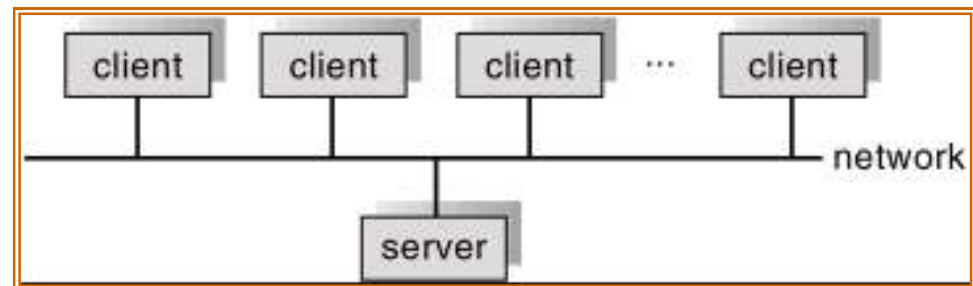
Distributed Systems

- 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

