Operating System

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Learning Objectives

- **In this Lecture you will learn about:**

✓ Definition and need for operating system

✓ Main functions of an operating system

✓ Commonly used mechanisms for:
  - ✓ Process management
  - ✓ Memory management
  - ✓ File management
  - ✓ Security
  - ✓ Command interpretation module

✓ Some commonly used OS capability enhancement software

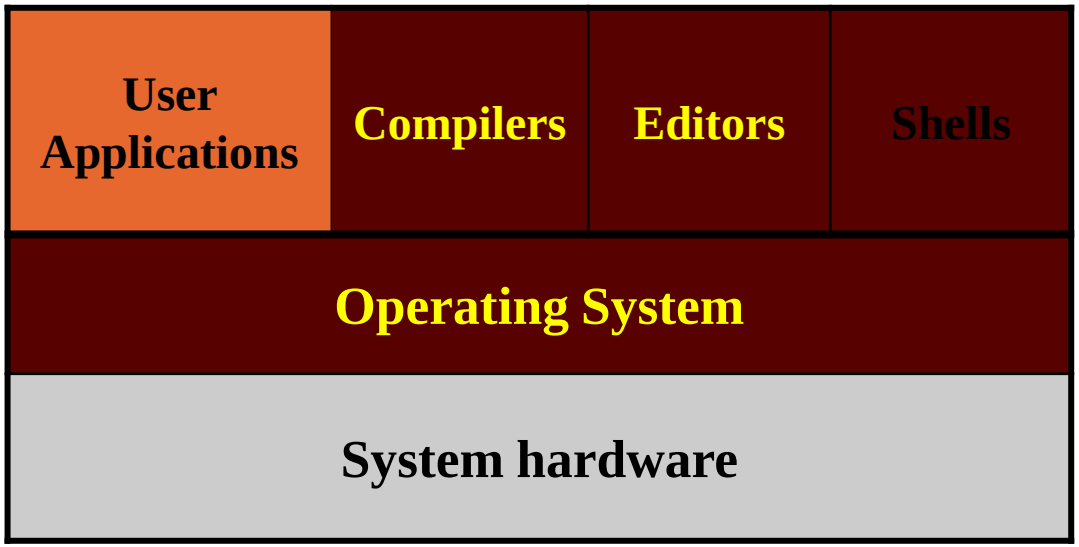
✓ Some popular operating systems

The Definition of an OS

Where comes the OS in?

A computer system consists of:

- User software
- System software
- Hardware



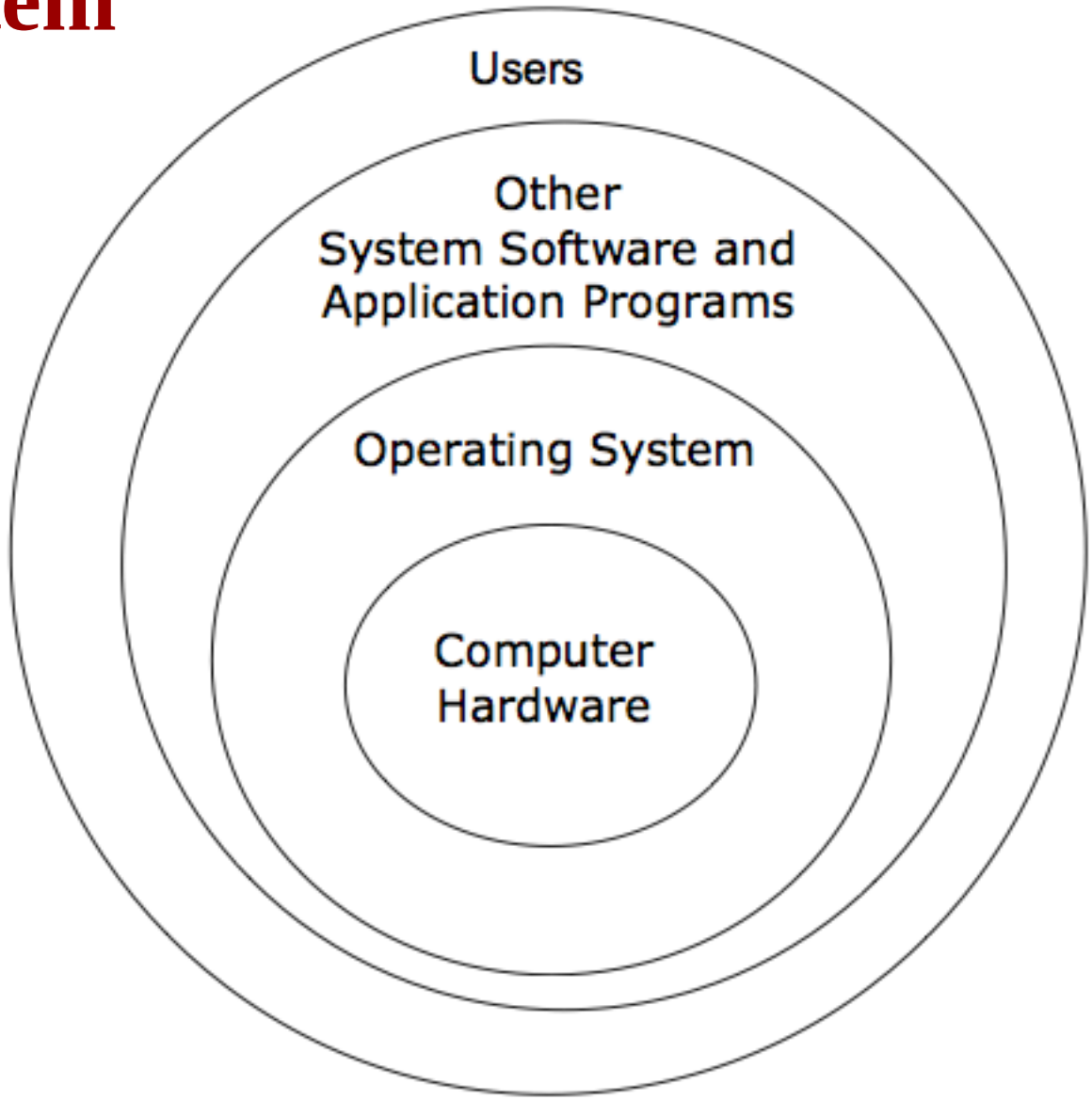
The Definition of an OS

What is an OS?

- A system software
- A collection of programs that:
  - manage all the system's hardware resources (the CPU, memory, I/O devices, etc.) of a computer system
  - provide the users the environment in which they can:
    - use the system resources
    - run their own applications
- Two primary objectives of an OS are:
  - Making a computer system convenient to use
  - Managing the resources of a computer system

Logical Architecture of a Computer System

The operating system Computer layer hides the details of the hardware from the programmer and provides the programmer with convenient interface for using the system

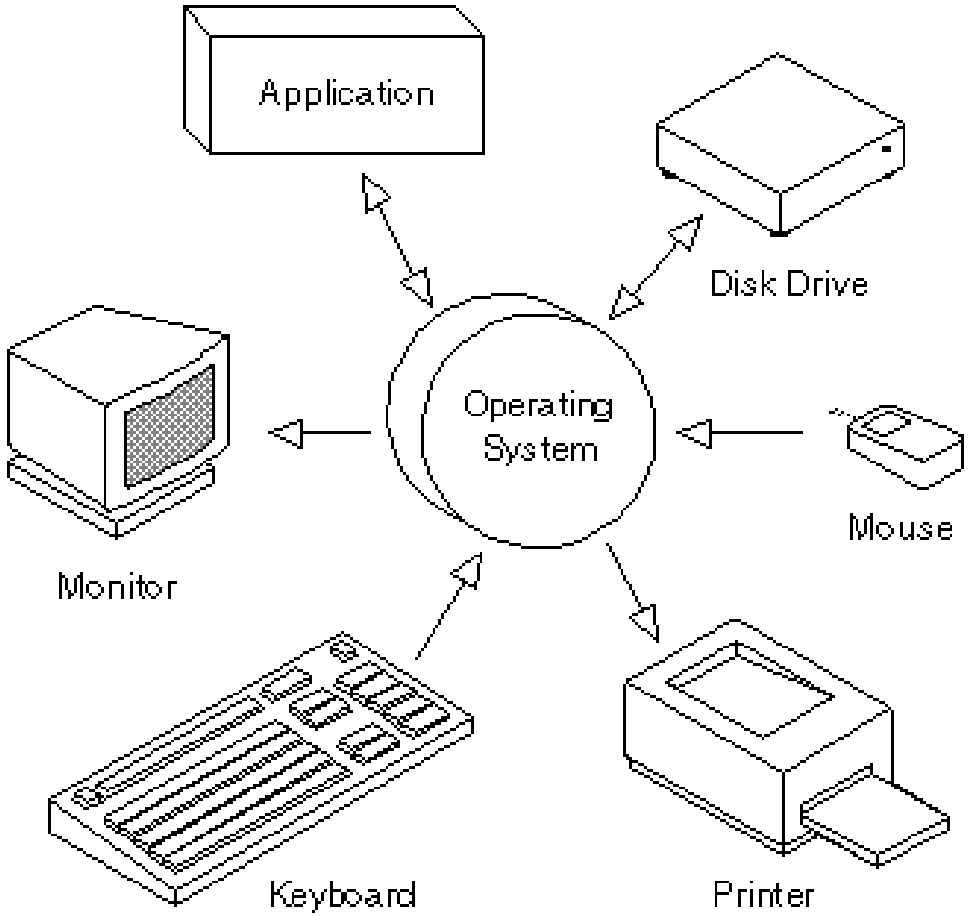


Specific Terms and Concepts

- Batch systems: no user interaction
- Multiprogramming: multiple programs loaded in memory
- Time-sharing: each process receives slices of CPU time
- Interactive systems: provides quick response to user's actions
- Multi-user: distinction between users
- Network OS: users aware of the existence of multiple computers
- Distributed OS: looks like a traditional single-processor system
- Processes, Files, System Calls

Basic task perform by OS

- An OS performs basi tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripherc devices such as printers



Main Functions of an OS

- **Process management** : creates, schedules and destroy processes
- **Memory management**: Allocates and releases memory
- **File management**: create, read, modify, remove etc. files
- **Security**
- **Command interpretation**
  - Text interface – command interpreter
  - Graphical interface

Process Management

- A **process** (also called **job**) is a program in execution
- **Process management** manages the processes submitted to a system in a manner to minimize *idle time* of processors (CPUs, I/O processors, etc.) of the system
- **Process Management Mechanisms in Early Systems**
  - **Manual loading mechanism:** Jobs were manually loaded one after another in a computer by the computer operator
  - **Batch processing mechanism:** Batch of jobs was submitted together to the computer and job-to-job transition was done automatically by the operating system
  - **Job Control Language (JCL):** Control statements were used to facilitate job loading and unloading

Memory management

- Memory is important resource of a computer system that must be properly managed for the overall system performance
- Memory management module:
  - Keeps track of parts of memory in use and parts not in use
  - Allocates memory to processes as needed and deallocates when no longer needed

File Management

- A **file** is a collection of related information
- Every file has a name, its data and attributes
- File's name uniquely identifies it in the system and is used by its users to access it
- File's data is its contents
- File's attributes contain information such as date & time of its creation, date & time of last access, date & time of last update, its current size, its protection features, etc.
- File management module of an operating system takes care of file-related activities such as structuring, accessing, naming, sharing, and protection of files

File Access Methods and Operations

- **File Access Methods:** Two commonly supported file access methods are:
  - **Sequential access:** Information stored in a file can be accessed sequentially (in the order in which they are stored, starting at the beginning)
  - **Random access:** Information stored in a file can be accessed randomly irrespective of the order in which the bytes or records are stored
- **File Operations**
  - Set of commands provided by an operating system to deal with files and their contents
  - Typical file operations include create, delete, open, close, read, write, seek, get attributes, set attributes, rename, and copy

Security

- Deals with protecting the various resources and information of a computer system against destruction and unauthorized access
- **External security:** Deals with securing computer against external factors such as fires, floods, earthquakes, stolen disks/tapes, etc. by maintaining adequate backup, using security guards, allowing access to sensitive information to only trusted employees/users, etc.
- **Internal security:** Deals with user authentication, access control, and cryptography mechanisms

Security

- **User authentication:** Deals with the problem of verifying the identity of a user (person or program) before permitting access to the requested resource
- **Access Control:** Once authenticated, access control mechanisms prohibit a user/process from accessing those resources/information that he/she/it is not authorized to access
- **Cryptography:** Means of encrypting private information so that unauthorized access cannot use information

Command interpretation

- Provides a set of commands using which the user can give instructions to the computer for getting some job done by it
- Commands supported by the command interpretation module are known as **system calls**
- Two types of user interfaces supported by various operating systems are:
  - **Command-line interface:** User gives instructions to the computer by typing the commands
  - **Graphical User Interface (GUI):** User gives commands to the system by selecting icon or menu item displayed on the screen with the use of a point-and-draw device

Key Words/Phrases

Application programmers
Application programs
Application software
Computer program
Customized software
Database
Education software
End-to-end solution
Entertainment software
Firmware
Graphics software
Hardware
Middleware
Open Source Software
Personal assistance software
Pre-written software
Public-domain software
Shareware
Software
Software package
Spreadsheet
System programmers
System programs
System software
Turnkey solution
User-supported software
Utilities
Word-processing