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BACS1024

INTRODUCTION TO

COMPUER SYSTEMS

Chapter 9: System Software Technology

0. Overview

1. Computer System Components
2. System Software Technology
3. Functions of an OS
4. Characteristics of an OS
5. Components of an OS
6. Types of OS

1. Computer System Components

1. Computer System Components

- **Hardware**

- ☐ Provides basic computing resources (CPU, memory, Input/Output (I/O) devices).

- **Operating System (OS)**

- ☐ Controls and coordinates the use of the hardware among the various application programs for the various users.

- **Applications Programs /Application Software**

- ☐ Define the ways in which the system resources are used to solve the computing problems of the users (compilers, database systems, video games, business programs).

- **Users**

- ☐ Include people, machines, and other computers.

2. System Software Technology

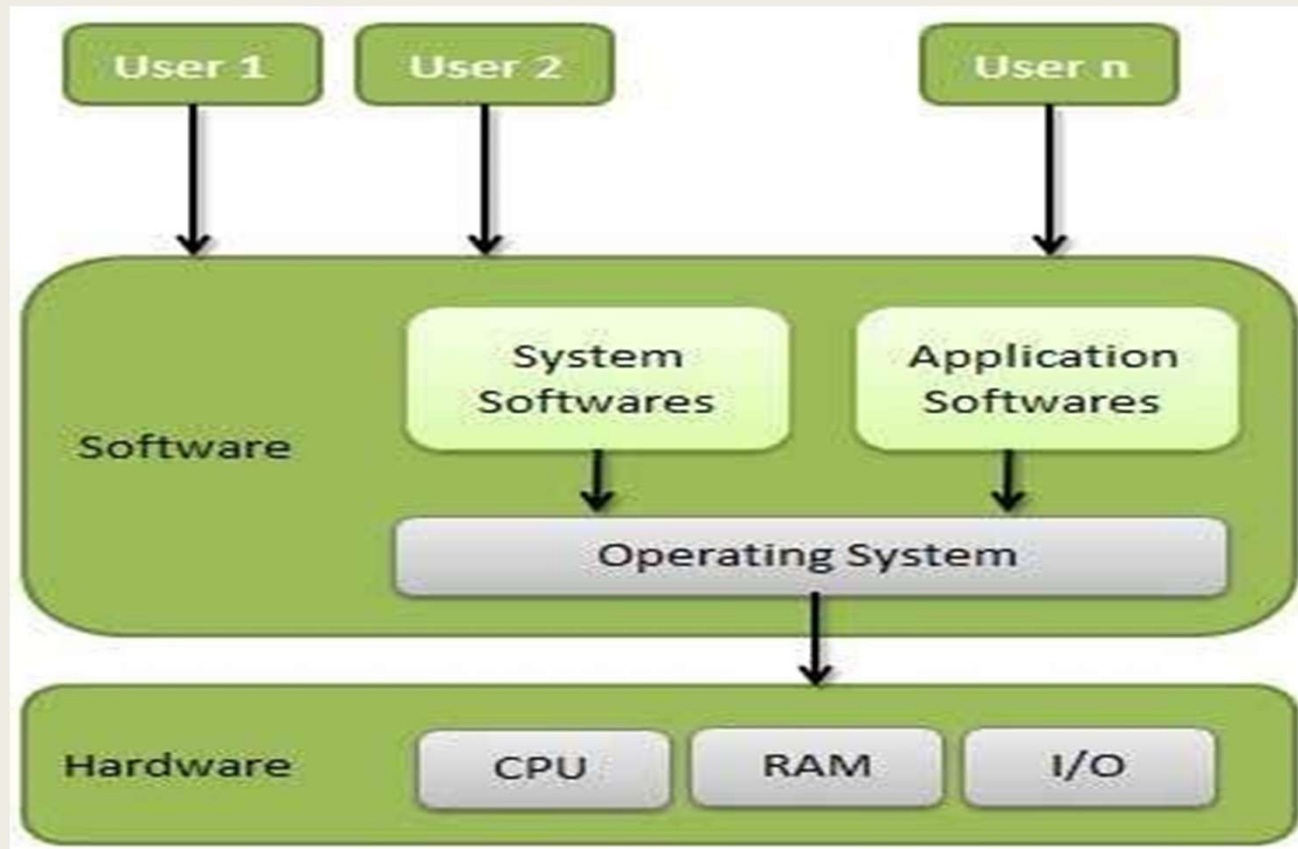
2. System Software Technology

■ Operating Systems

- ❑ It is a set of software routines that sits between the application program and the hardware
- ❑ It is a program that acts as intermediary between the computer user and the computer hardware.
- ❑ It manages all of the computer hardware and software which control every files, device, section of memory and every nanosecond of processing time.
- ❑ Purposes:
 - ❖ To control & operate the hardware in an efficient manner
 - ❖ To allow for concurrent processing of multiple programs and support for multiple users
 - ❖ To synergistic implementation of specialized hardware that is designed to improve system performance & capability

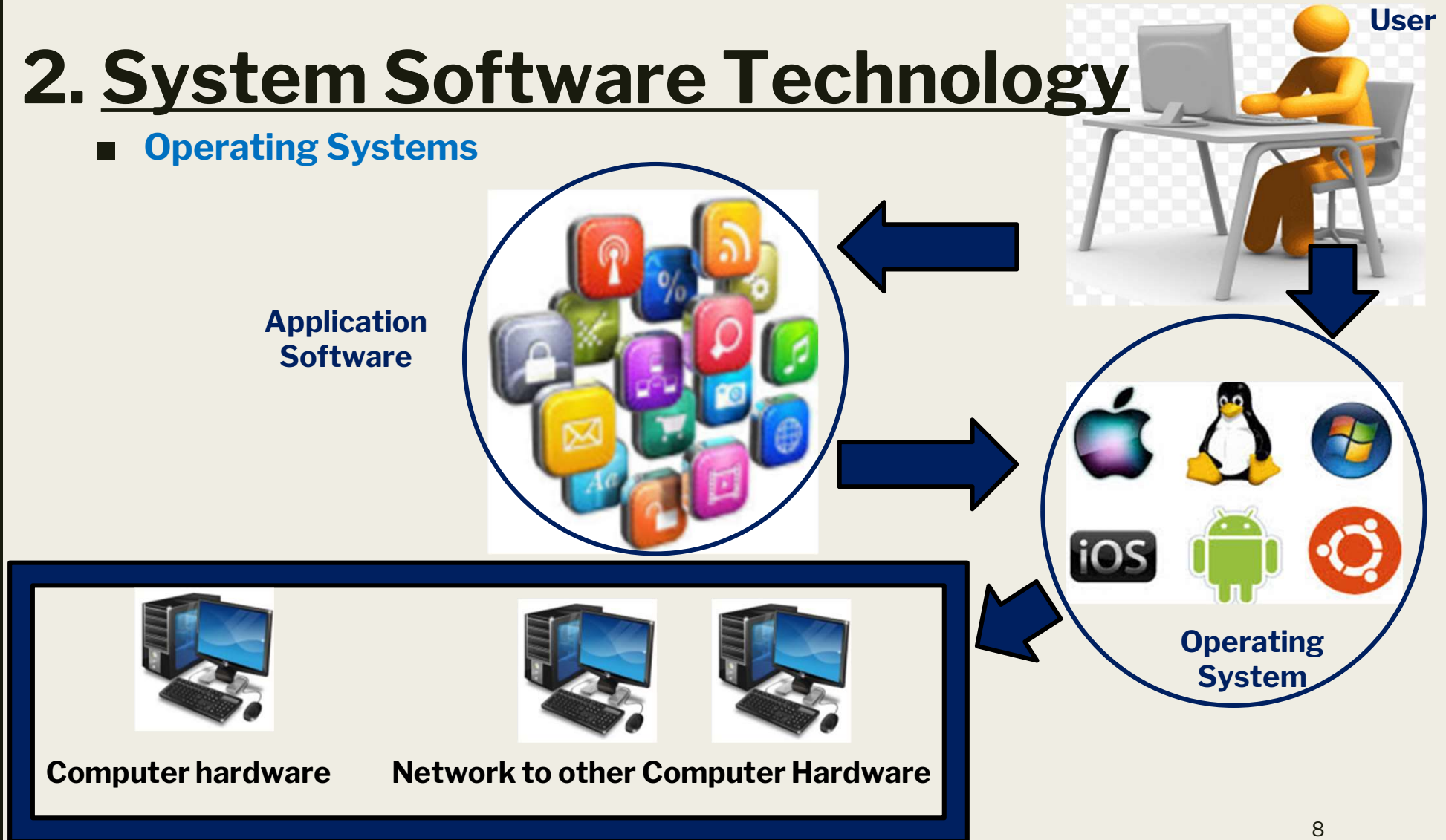
2. System Software Technology

- Operating Systems



2. System Software Technology

- Operating Systems



3. Function of OS

3. Function of an Operating System

■ **Functions of Operating Systems**

1. Make the computer system convenient to use
2. Use the computer hardware in an efficient manner
3. Allocate resources (e.g.: CPU time, memory space, file storage space, I/O devices) to specific programs - thus increasing efficiency of computer system
4. Control the execution of user programs and the operations of I/O devices

4. Characteristics of OS

4. Characteristics of an OS

■ Characteristics of an Operating Systems

☐ Concurrency

- ❖ Concurrency is the existence of several simultaneous or parallel activities such as overlapping of I/O operations with computation

☐ Sharing

- ❖ Concurrent activities may be required to share resources or information

☐ Long-term storage

- ❖ The need for sharing of programs and data implies the need for long term storage of information. Long term storage allows users the convenience of keeping their programs or data in the computer rather than on some external medium.

☐ Non-determinacy

- ❖ An operating system must be determinate in the sense that the same program that runs today or tomorrow with the same data, should produce the same results. On the other hand, it is indeterminate in that it must respond to events which will occur in an unpredictable manner.

5. Components of OS

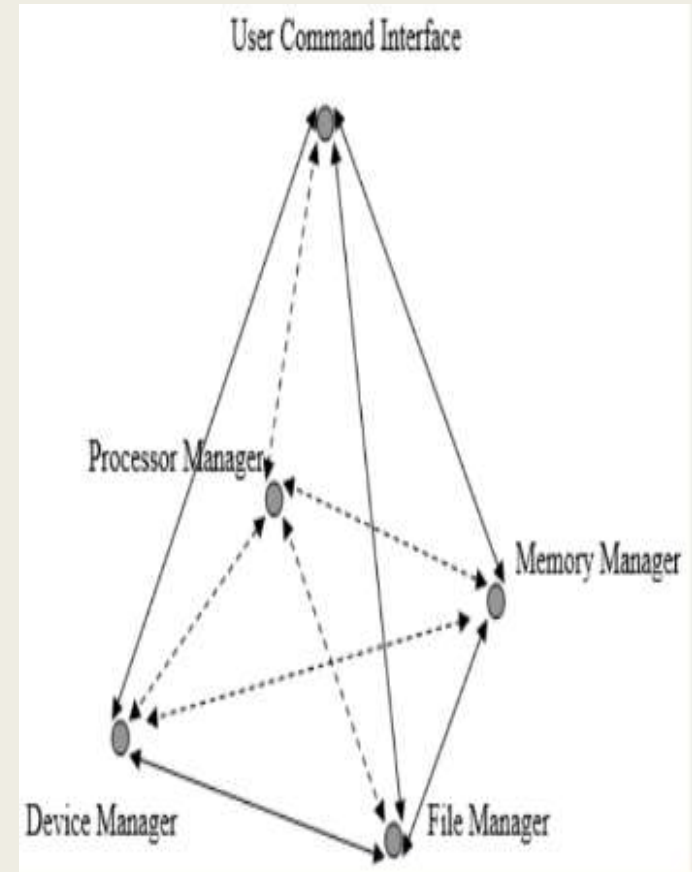
5. Components of an Operating System

■ Components of Operating Systems (OS)

1. Memory manager
2. Processor manager
3. Device manager
4. File manager

■ Tasks Performed by each components

1. Monitor its resources continuously
2. Enforce the policies that determine who gets what, when and how much
3. Allocate the resource when appropriate
4. Deallocate the resource (reclaim it) when appropriate



5. Components of an Operating System

■ **Components of an Operating Systems (OS)**

1. Command processor, application program interface & user interface
2. File management system
3. Core services management
4. I/O control system memory management
5. Network management

5. Components of an Operating System

■ **Components of an Operating Systems (OS)**

1. Processor Manager

- ❑ Allocates CPU time
- ❑ Keeps track of each process status - waiting, executing
- ❑ Sets up necessary registers and tables
- ❑ Reclaims processor when job is finished and/or time for job has expired
- ❑ Two levels of responsibility
 1. Accepts or rejects the incoming jobs (handled by Job Scheduler)
 2. Decides which process gets the CPU and for how long (Handled by the Process Scheduler)

5. Components of an Operating System

■ **Components of an Operating Systems (OS)**

2. Memory Manager

- ❑ Checks validity of each request for memory space and if it is a legal request, allocates a portion of memory that isn't already in use
- ❑ Sets up a table to keep track of who is using which section of memory.
- ❑ Deallocates memory blocks once program completes execution
- ❑ Protects OS memory space so that it cannot be altered by other programs

5. Components of an Operating System

■ **Components of an Operating Systems (OS)**

3. Device Manager

- ❑ Monitors every device, channel, and control unit.
- ❑ Allocate in the most efficient manner all of the system's devices (e.g. printers, devices, ports, disk drives) based on a scheduling policy chosen by the system's designers.
- ❑ Functions include:
 1. Allocation of devices
 2. Starting operation of devices
 3. Deallocation of devices once job completes

5. Components of an Operating System

■ **Components of an Operating Systems (OS)**

4. File Manager

- ❑ Keeps track of each file in the system (e.g. data files, program files, compilers, application programs)
- ❑ Allocate resources (e.g. opening files) and deallocate resources (e.g. closing files)
- ❑ Uses predetermined access policies to enforce restrictions on who has access to which files
- ❑ Example:
 - ❖ Restrictions on each file – system only, user only, group only, general access
 - ❖ User restriction – read only, read/write only, allowed to create file, allowed to delete file



6. Types of OS

6. Types of Operating System

- **Types of Operating Systems (OS)**

1. Batch OS
2. Interactive OS
3. Hybrid OS
4. Embedded OS
5. Real-time OS

6. Types of Operating System

■ Types of Operating Systems (OS)

1. Batch OS

- ☐ Jobs processed serially without user interaction
- ☐ Efficiency is measured in throughput ,i.e. the number of jobs completed in a given amount of time (e.g. 550 jobs per hour)
- ☐ E.g.: Preparation of a weekly payroll for an organization whereby time cards are
- ☐ collected, data entered and processed, paychecks and reports are then printed



6. Types of Operating System

■ **Types of Operating Systems (OS)**

2. Interactive OS

- ☐ User interacts directly with the operating system via commands entered from the keyboard
- ☐ Operating system provides immediate feedback to the user.
- ☐ Response time can be measured in fractions of a second
- ☐ E.g.: Banks' automatic teller machines (ATMs) which provides immediate cash and transaction details for its users.

6. Types of Operating System

■ Types of Operating Systems (OS)

3. Real-time OS

- ☐ Extremely fast systems which are used in time-critical environments where reliability is a major factor and data must be processed within a strict time limit.
- ☐ Usually a real-time system is a dedicated system which spends all or most of its time on a single job.
- ☐ Must be 100% responsive 100% of the time.
- ☐ E.g.: Air traffic control system used by the airport authority such as the radar system²²

6. Types of Operating System

■ Types of Operating Systems (OS)

4. Embedded OS

- ❑ Embedded systems are computers placed inside other products to add features and capabilities
- ❑ E.g.: In automobiles, embedded OS can help with engine performance, braking and navigation.



6. Types of Operating System

■ **Types of Operating Systems (OS)**

5. Hybrid S

- ☐ A combination of batch and interactive systems.
- ☐ Appear to be interactive for fast responses but actually accepts & runs batch programs in the background when the interactive load is light.
- ☐ Many large computer systems are hybrids.
- ☐ E.g.: Windows 8. This makes it possible to run the same application on both a low power tablet /kiosk & a high end desktop / laptop.

Chapter Review

Chapter Review

1. Computer System Components

- ☐ Hardware
- ☐ Software
- ☐ Users

2. System Software Technology

- ☐ Operating System

3. Functions of an OS

- ☐ Convenient
- ☐ Efficient
- ☐ Allocate / deallocate
- ☐ monitor

4. Characteristics of an OS

- ☐ Sharing
- ☐ Concurrency
- ☐ Long term storage
- ☐ No-determinacy

5. Components of an OS

- ☐ Processor manager
- ☐ Memory manager
- ☐ File manager
- ☐ Device manager
- ☐ Network manager

6. Types of OS

- ☐ Batch OS
- ☐ Interactive OS
- ☐ Real time OS
- ☐ Hybrid OS
- ☐ Embedded OS