

OPERATING SYSTEM

BY:

DR. AHMED ELSAWY

Introduction

- Modern computers have an operating system:
 - to run other programs, such as application software.
- Examples of operating systems
 - Microsoft Windows,
 - Mac OS,
 - Unix, and
 - Linux.

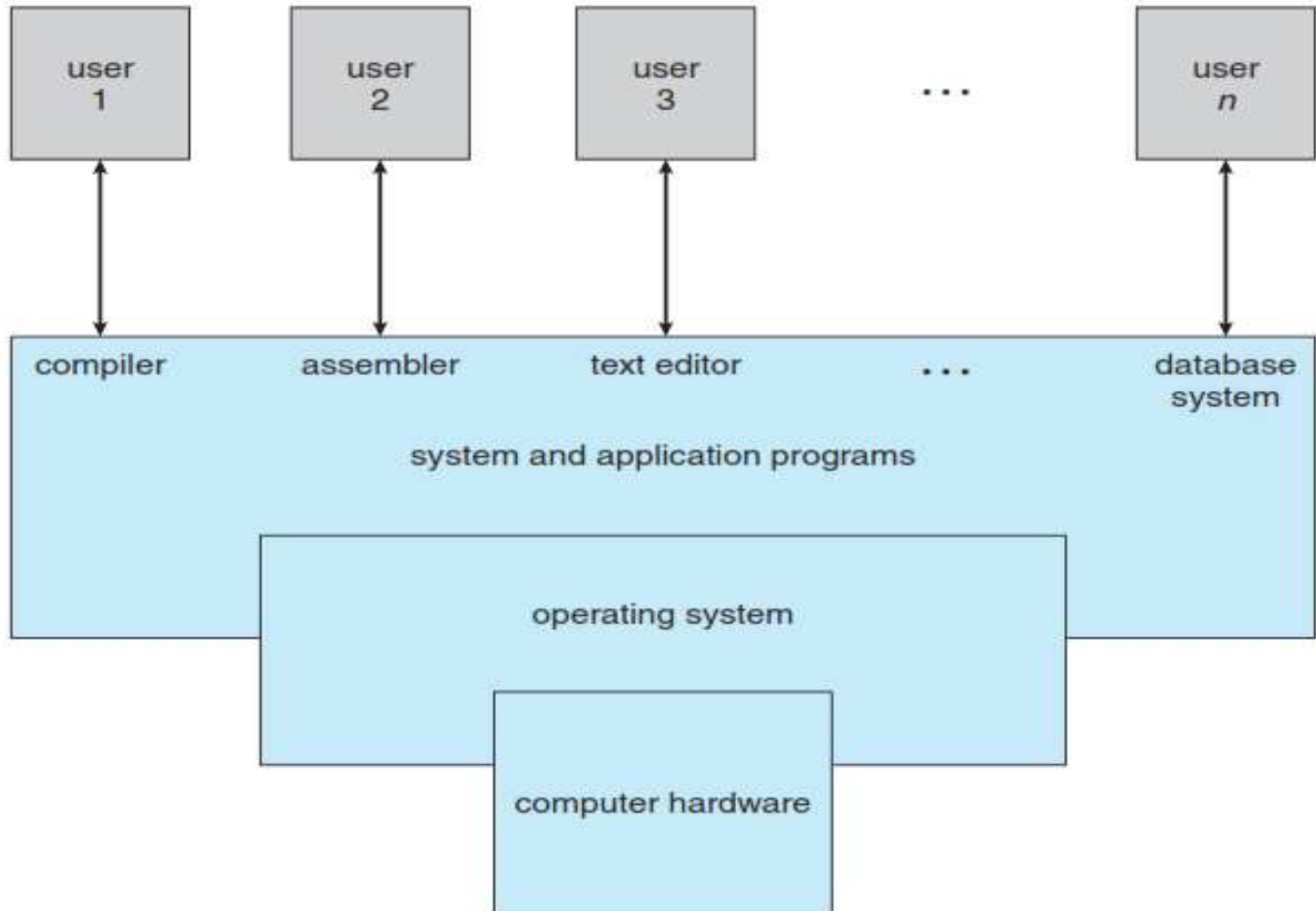
Operating System (OS)

- an intermediary between users and computer hardware.
- an environment can execute programs conveniently and efficiently.
- software which manages hardware.
- controls the allocation of resources and services such as memory, processors, devices and information.

Operating System

could be defined as a program that manages the hardware and software resources of a computer and acts as an intermediary between the user and the computer hardware.

Operating System



Operating System

- the central core of a computer's operating system is a computer program called **Kernel**
 - It has complete control over everything that occurs in the system.
 - it is the first program loaded on startup.
 - loaded into a protected area of memory.

The Kernel Operations

- manages the remainder of the startup (like input/output).
- responsible for managing memory.
- managing and communicating with computing peripherals (like printers, speakers)
- connects the application software to the hardware of a computer.

OS History

- the early 1960s, computers did not have operating systems
 - execution of jobs on batch processing systems
- Through the 1960s, the development of operating systems.
 - IBM System/360 produced a family of mainframe computers with operating system OS/360

OS History

- In the 1970s, commercially-popular minicomputer
 - first microcomputers did not have the capacity operating systems.
 - minimalistic operating systems were developed.
 - early operating system was CP/M
 - MS-DOS, which became wildly popular as the operating system chosen for the IBM PC

OS History

- By the 1990s, the microcomputer had GUI facilities
 - robustness and flexibility of operating systems .
 - Microsoft's response to this change was the development of Windows NT.
 - Apple rebuilt their operating system on top of a Unix core as Mac OS X.

OS History

- Today, Modern OS's use a mouse for input with GUI
 - OS may depend on the hardware architecture.
 - only Linux and BSD running on almost any CPU.

OS based computer type

- Personal computers
 - IBM PC compatible - Microsoft Windows and smaller Unix-variants (like Linux and BSD)
 - Apple Macintosh - Mac OS X, Windows, Linux and BSD
- Mainframes - A number of unique OS's, sometimes Linux and other Unix variants.
- Embedded systems - a variety of dedicated OS's, and limited versions of Linux or other OS's

Operating System Functions

- Memory Management
- Processor Management
- Device Management
- File Management
- Security
- Control over system performance
- Job accounting
- Error detecting aids
- Coordination between other software and users

Memory Management

- management of Primary Memory or Main Memory.
 - is a large array of words or bytes where each word or byte has its own address.
 - fast storage that can be access directly by the CPU.
 - a program to be executed in it.

Memory Management

- activities of OS does for memory management.
 - Keeps tracks of primary memory
 - which process will get memory when and how much.
 - Allocates the memory when the process requests.
 - De-allocates the memory when the process has been terminated.

Processor Management

- OS decides which process gets the processor when and how much time (called process scheduling).
- activities of OS does for processor management:
 - Keeps tracks of processor and status of process.
 - Allocates the processor (CPU) to a process.
 - De-allocates processor when processor is no longer required.

Device Management

- OS manages device communication via their respective drivers.
 - Keeps tracks of all devices. Program responsible for this task is known as the I/O controller.
 - Decides which process gets the device when and for how much time.
 - Allocates the device in the efficient way.
 - De-allocates devices.

File Management

- A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions.
 - Keeps track of information, location, uses, status etc. The collective facilities are often known as file system.
 - Decides who gets the resources.
 - Allocates the resources.
 - De-allocates the resources.

Security

- Defense of the system against internal and external attacks
- System must determine:
 - User identities (**user IDs**, security IDs) include name and associated number, one per user
 - User ID then associated with all files, processes of that user to determine access control
 - Group identifier (**group ID**) allows set of users to be defined and controls managed.
 - **Privilege escalation** allows user to change to effective ID with more rights

Error detection

- OS needs to be constantly aware of possible errors
 - May occur in the CPU and memory hardware, in I/O devices, in user program
 - For each type of error, OS should take the appropriate action to ensure correct and consistent computing
 - Debugging facilities can greatly enhance the user's and programmer's abilities to efficiently use the system

Another function for OS

- **Control over system performance**
 - Recording delays between request for a service and response from the system.
- **Job accounting**
 - Keeping track of time and resources used by various jobs and users.
- **Coordination between other software and users**
 - Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

Operating-System Services

- provides an environment for the execution of programs.
- services to programs and to the users of those programs.
- make the programming task easier.
- services provided differ from one operating system to another

Operating-System Services

- **1- User interface**

- **command-line** interface (CLI), (uses text commands)
- **batch** interface (commands are entered into files, and those files are executed).
- **graphical** user interface (GUI) (pointing device to direct I/O, choose from menus)

Operating-System Services

- **2- Program execution**
 - the major activities of an OS with respect to program management:
 - Loads a program into memory.
 - Executes the program.
 - Handles program's execution.
 - Provides a mechanism for process synchronization.
 - Provides a mechanism for process communication.
 - Provides a mechanism for deadlock handling.

Operating-System Services

- **3- I/O Operation**

- I/O subsystem comprised of I/O devices and their corresponding driver software.
- the major activities of an OS with respect to I/O Operation.
 - I/O operation means read or write operation with any file or any specific I/O device.
 - Program may require any I/O device while running.
 - Operating system provides the access to the required I/O device when required.

Operating-System Services

- **4- File system manipulation**
 - A file represents a collection of related information.
 - Computer can store files on the disk for long term storage purpose.
 - Each of these media has its own properties like speed, capacity, data transfer rate and data access methods.
 - A file system is normally organized into directories for easy navigation and usage.

Operating-System Services

- **4- File system manipulation**

- the major activities of an OS with respect to file management.
 - Program needs to read a file or write a file.
 - The operating system gives the permission to the program for operation on file.
 - Permission varies from read-only, read-write, denied and so on.
 - Operating System provides an interface to the user to create/delete files.
 - Operating System provides an interface to the user to create/delete directories.
 - Operating System provides an interface to create the backup of file system.

Operating-System Services

- **5- Communication**

- distributed systems which are a collection of processors operating system manages communications between processes.
- OS handles routing and connection strategies, and the problems of contention and security.
- the major activities of an OS with respect to communication.
 - Two processes often require data to be transferred between them.
 - The both processes can be on the one computer or on different computer but are connected through computer network.
 - Communication may be implemented by two methods either by Shared Memory or by Message Passing.

Operating-System Services

- **6- Resource Management**

- In case of multi-user environment, resources such as main memory, CPU cycles and files storage are to be allocated to each user and managed by OS.
- Following are the major activities of an operating system with respect to resource management.
 - OS manages all kind of resources using schedulers.
 - CPU scheduling algorithms are used for better utilization of CPU.

Operating-System Services

- **7- Protection**

- Protection refers to mechanism or a way to control the access of programs, processes, or users to the resources
- the major activities of an operating system with respect to protection.
 - OS ensures that all access to system resources is controlled.
 - OS ensures that external I/O devices are protected from invalid access attempts.
 - OS provides authentication feature for each user by means of a password.

Operating-System Services

- **8- Error detection**

- Error can occur anytime and anywhere. Error may occur in CPU, in I/O devices or in the memory hardware.
- the major activities of an operating system with respect to error handling.
 - OS constantly remains aware of possible errors.
 - OS takes the appropriate action to ensure correct and consistent computing.

Operating-System Services

- **9- Accounting:**
 - keep track of which users use how much and what kinds of computer resources.
 - simply for accumulating usage statistics.
 - statistics may be a valuable tool for researchers who wish to reconfigure the system to improve computing services.

Operating-System Services

