

Fumdamental Of Operating System

)?What is an Operating System (2

- An Operating System is a program that acts as an intermediary/interface between a user of a computer and the computer hardware.
- OS goals:
 - Control/execute user/application programs.
 - Make the computer system convenient to use.
 - Ease the solving of user problems.
 - Use the computer hardware in an efficient manner.

Components of an Operating System

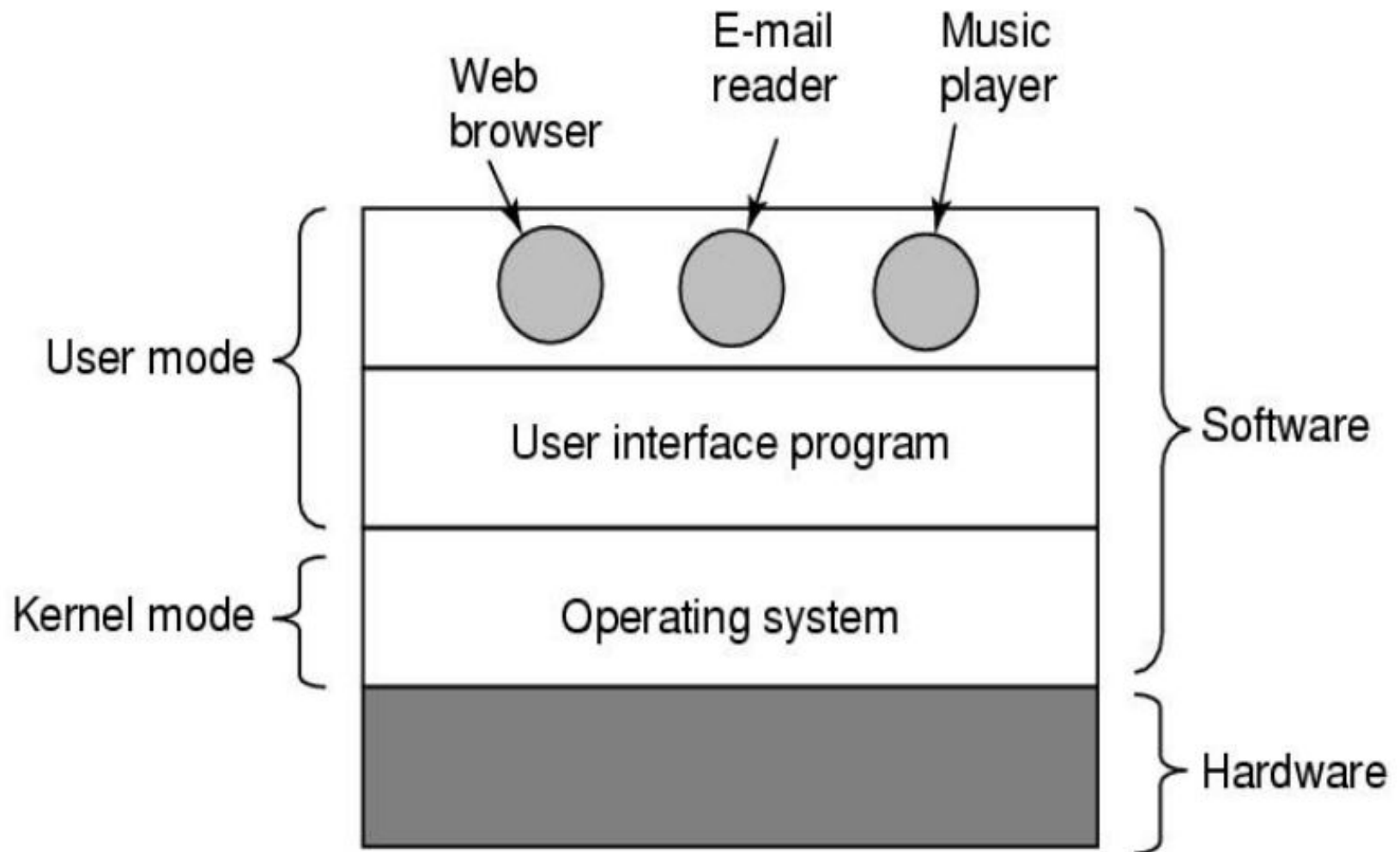


- Operating Systems (OS) are software programs that control thousands of operations, provide an interface between the user and the computer, and run applications.
- An OS is designed to control the operations of programs such as web browsers, word processors, and e-mail programs.

What is OS?

- *Operating System is a software, which makes a computer to actually work.*
- *It is the software the enables all the programs we use.*
- *The OS organizes and controls the hardware.*
- *OS acts as an interface between the application programs and the machine hardware.*
- *Examples: Windows, Linux, Unix and Mac OS, etc.,*

?Where does the OS fit in



1.1 General Definition

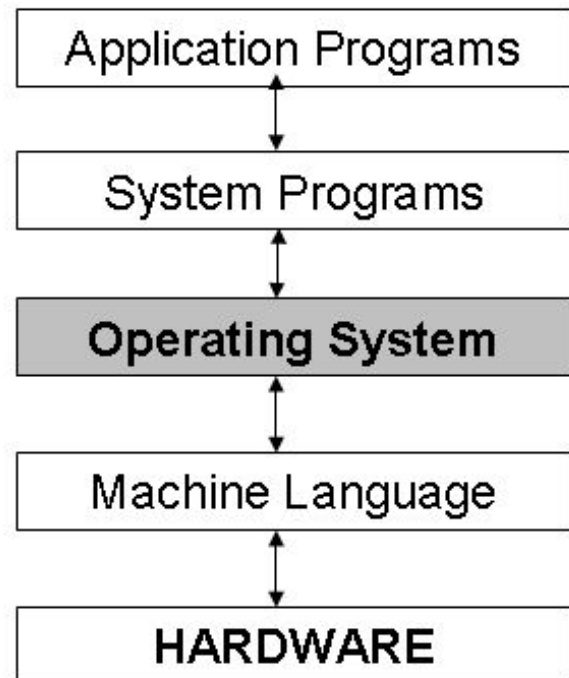
- An OS is a program which acts as an *interface* between computer system users and the computer hardware.
- It provides a user-friendly environment in which a user may easily develop and execute programs.
- Otherwise, hardware knowledge would be mandatory for computer programming.
- So, it can be said that an OS hides the complexity of hardware from uninterested users.

1.1 General Definition

- The OS manages these resources and allocates them to specific programs and users.
- With the management of the OS, a programmer is rid of difficult hardware considerations.
- An OS provides services for
 - Processor Management
 - Memory Management
 - File Management
 - Device Management
 - Concurrency Control

1.1 General Definition

- Another aspect for the usage of OS is that; it is used as a *predefined library* for hardware-software interaction.
- This is why, system programs apply to the installed OS since they cannot reach hardware directly.



Objectives of Operating System

- Convenience

- Efficiency

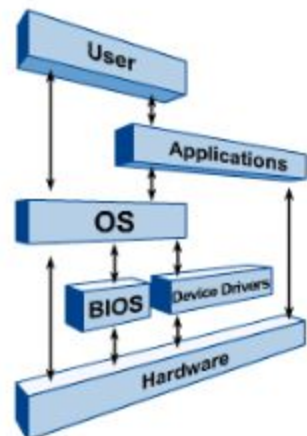
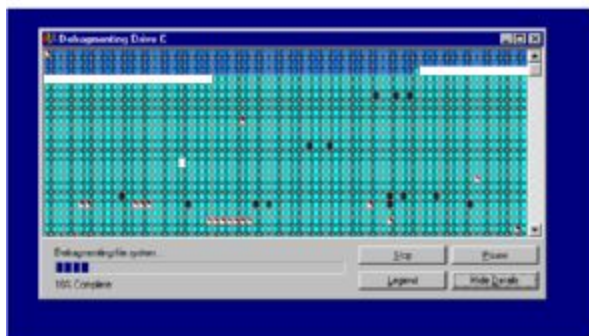
- Ability to evolve

What OS does?

An operating system performs basic tasks such as,

- controlling and allocating memory,
- prioritizing system requests,
- controlling input and output devices,
- facilitating networking and
- managing file systems.

Operating System Functions

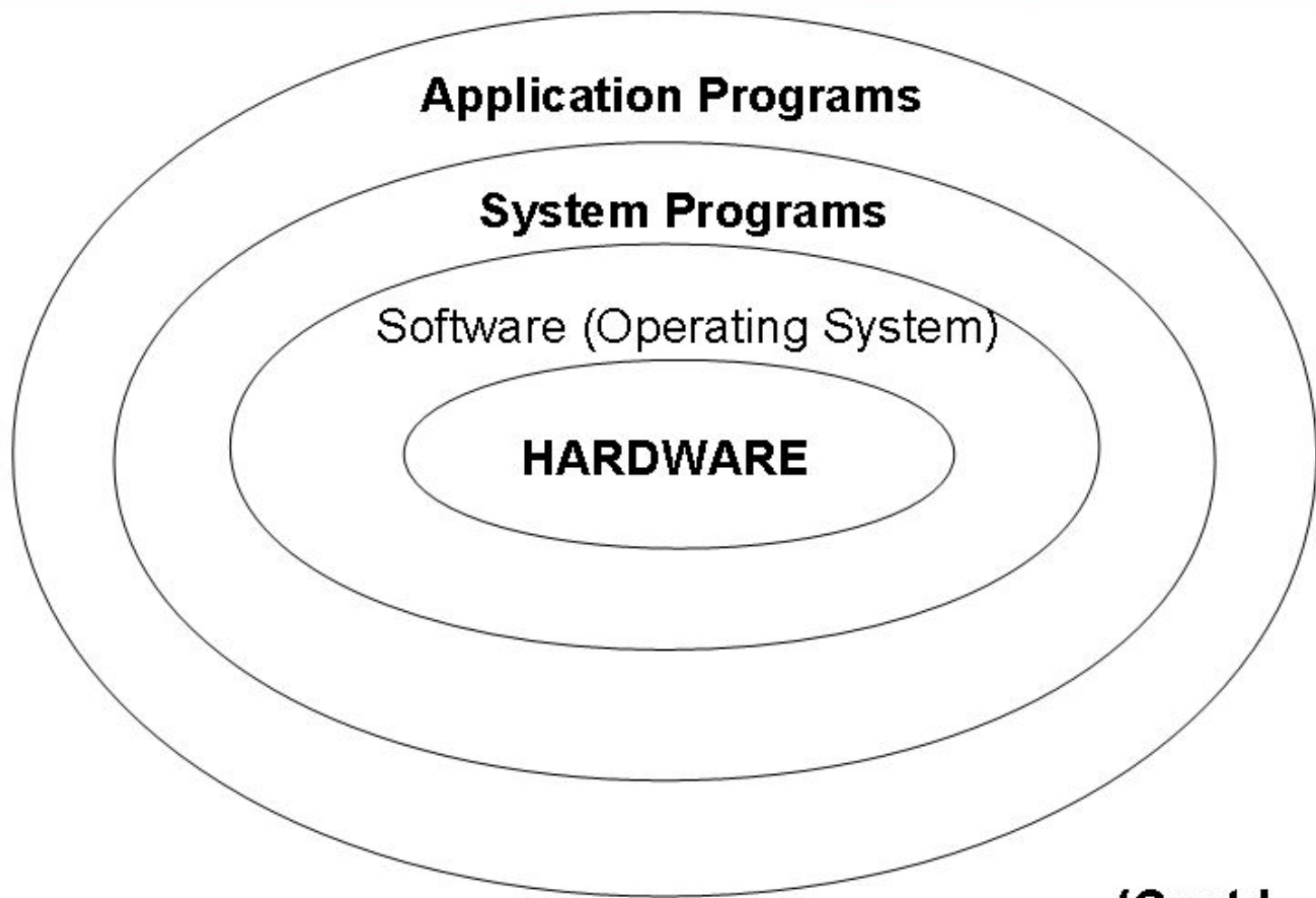


- All operating systems perform the same basic functions:
 - File and folder management
 - Management of applications
 - Support for built-in utility programs
 - Access control to computer hardware (The operating system can either access the hardware through the BIOS or through the device drivers Figure 2)
- Programs written for the UNIX operating system will not work on a Windows-based system, and vice versa.

Operating Systems functions:

- *The main functions of operating systems are:*
 1. Program creation
 2. Program execution
 3. Input/Output operations
 4. Error detection
 5. Resource allocation
 6. Accounting
 7. protection

Structure of Operating System:



(Contd...)

Structure of Operating System (Contd...):

- *The structure of OS consists of 4 layers:*
 1. **Hardware**

Hardware consists of CPU, Main memory, I/O Devices, etc,
 2. **Software (Operating System)**

Software includes process management routines, memory management routines, I/O control routines, file management routines.

(Contd...)

Structure of Operating System (Contd...):

3. System programs

This layer consists of compilers, Assemblers, linker etc.

4. Application programs

This is dependent on users need. Ex. Railway reservation system, Bank database management etc.,

Services provided by an OS

- Facilities for program creation
 - editors, compilers, linkers, debuggers, etc.
- Program execution
 - loading in memory, I/O and file initialization.
- Access to I/O and files
 - deals with the specifics of I/O and file formats.
- System access
 - resolves conflicts for resource contention.
 - protection in access to resources and data.

Evolution of OS:

- *The evolution of operating systems went through seven major phases.*
- *Six of them significantly changed the ways in which users accessed computers through the open shop, batch processing, multiprogramming, timesharing, personal computing, and distributed systems.*
- *In the seventh phase the foundations of concurrent programming were developed and demonstrated in model operating systems.*

(Contd...)

Evolution of OS (contd..):

Major Phases	Technical Innovations	Operating Systems
Open Shop	The idea of OS	IBM 701 open shop (1954)
Batch Processing	Tape batching, First-in, first-out scheduling.	BKS system (1961)
Multi-programming	Processor multiplexing, Indivisible operations, Demand paging, Input/output spooling, Priority scheduling, Remote job entry	Atlas supervisor (1961), Exec II system (1966)

(Contd...)

Evolution of OS (contd..):

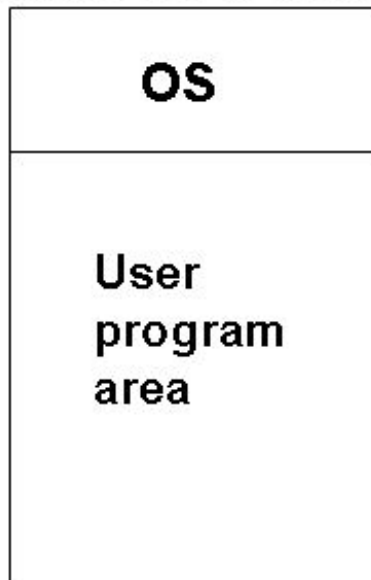
Timesharing	Simultaneous user interaction, On-line file systems	Multics file system (1965), Unix (1974)
Concurrent Programming	Hierarchical systems, Extensible kernels, Parallel programming concepts, Secure parallel languages	RC 4000 system (1969), 13 Venus system (1972), 14 Boss 2 system (1975).
Personal Computing	Graphic user interfaces	OS 6 (1972) Pilot system (1980)
Distributed Systems	Remote servers	WFS file server (1979) Unix United RPC (1982) 24 Amoeba system (1990)

Batch Processing:

- *In Batch processing same type of jobs batch (BATCH- a set of jobs with similar needs) together and execute at a time.*
- *The OS was simple, its major task was to transfer control from one job to the next.*
- *The job was submitted to the computer operator in form of punch cards. At some later time the output appeared.*
- *The OS was always resident in memory. (Ref. Fig. next slide)*
- *Common Input devices were card readers and tape drives.*

Batch Processing (Contd...):

- *Common output devices were line printers, tape drives, and card punches.*
- *Users did not interact directly with the computer systems, but he prepared a job (comprising of the program, the data, & some control information).*



Multiprogramming:

- *Multiprogramming is a technique to execute number of programs simultaneously by a single processor.*
- *In Multiprogramming, number of processes reside in main memory at a time.*
- *The OS picks and begins to executes one of the jobs in the main memory.*
- *If any I/O wait happened in a process, then CPU switches from that job to another job.*
- *Hence CPU in not idle at any time.*

Multiprogramming (Contd...):

OS
Job 1
Job 2
Job 3
Job 4
Job 5

- Figure depicts the layout of multiprogramming system.
- The main memory consists of 5 jobs at a time, the CPU executes one by one.

Advantages:

- Efficient memory utilization
- Throughput increases
- CPU is never idle, so performance increases.

Time Sharing Systems:

- *Time sharing, or multitasking, is a logical extension of multiprogramming.*
- *Multiple jobs are executed by switching the CPU between them.*
- *In this, the CPU time is shared by different processes, so it is called as “Time sharing Systems”.*
- *Time slice is defined by the OS, for sharing CPU time between processes.*
- *Examples: Multics, Unix, etc.,*

Types of OS:

Operating System can also be classified as,-

- ***Single User Systems***
- ***Multi User Systems***

Single User Systems:

- *Provides a platform for only one user at a time.*
- *They are popularly associated with Desk Top operating system which run on standalone systems where no user accounts are required.*
- *Example: DOS*

Multi-User Systems:

- *Provides regulated access for a number of users by maintaining a database of known users.*
- *Refers to computer systems that support two or more simultaneous users.*
- *Another term for multi-user is time sharing.*
- *Ex: All mainframes and are multi-user systems.*
- *Example: Unix*

Operating System Types - Basic Terminology



- The following terms are often used when comparing operating systems:
 - Multi-user
 - Multi-tasking
 - Multi-processing
 - Multi-threading
- A list of some of the most popular operating systems:
 - Microsoft Windows 95, 98, ME
 - Microsoft Windows NT/2000/XP
 - The Macintosh OS
 - UNIX

- Real-time operating system
 - Very fast small OS
 - Built into a device
 - Respond quickly to user input
 - MP3 players, Medical devices

- Single user/Single tasking OS
 - One user works on the system
 - Performs one task at a time
 - MS-DOS and Palm OS
 - Take up little space on disk
 - Run on inexpensive computers

- Single user/Multitasking OS
 - User performs many tasks at once
 - Most common form of OS
 - Windows XP and OS X
 - Require expensive computers
 - Tend to be complex

- Multi user/Multitasking OS
 - Many users connect to one computer
 - Each user has a unique session
 - UNIX, Linux, and VMS
 - Maintenance can be easy
 - Requires a powerful computer

Types Of OS

- Multiuser
- Multiprocessing
- Multitasking
- Multithreading
- Real Time

Different views of OS

- Application view
- Users view
- System view(resource manager)
- Implementation view

Operating system as Resource Manager

- Resources available in the system : CPU, memory(RAM), file storage space, I/O devices(disk), files, printers
- OS decides which program, for how much time to and after use it reclaims the resource.
- Each program gets time and space with the resource

Multiple users/applications share the resources

- Multiple users/applications share the resources bcoz devices are expensive
- How to allocate them to specific programs (process, jobs)?
- How to protect applications from one another?
- How to provide fair and efficient access to resources?
- How to operate and control the various I/O devices?