OPERATING SYSTEM CONCEPTS

BY:

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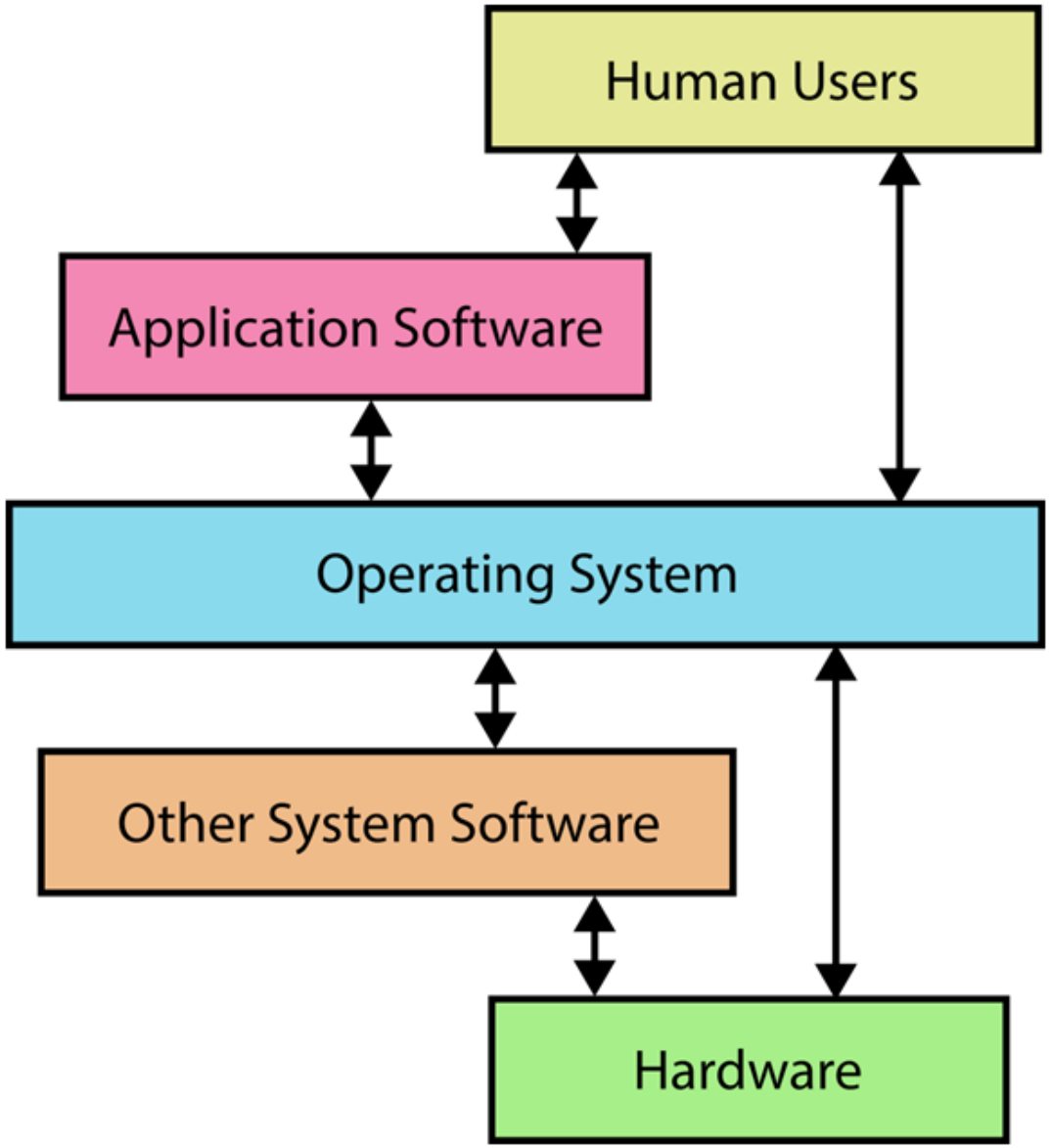
Why do we Need an Operating System???



Need of Operating System

- Easy interaction between the human & computer.
- Starting computer operation automatically when power in turned on.
- Controlling input & output.
- Controlling program execution.
- Managing use of main memory.

Operating system goals

Convenience for user.

Efficient operation of the computer system.

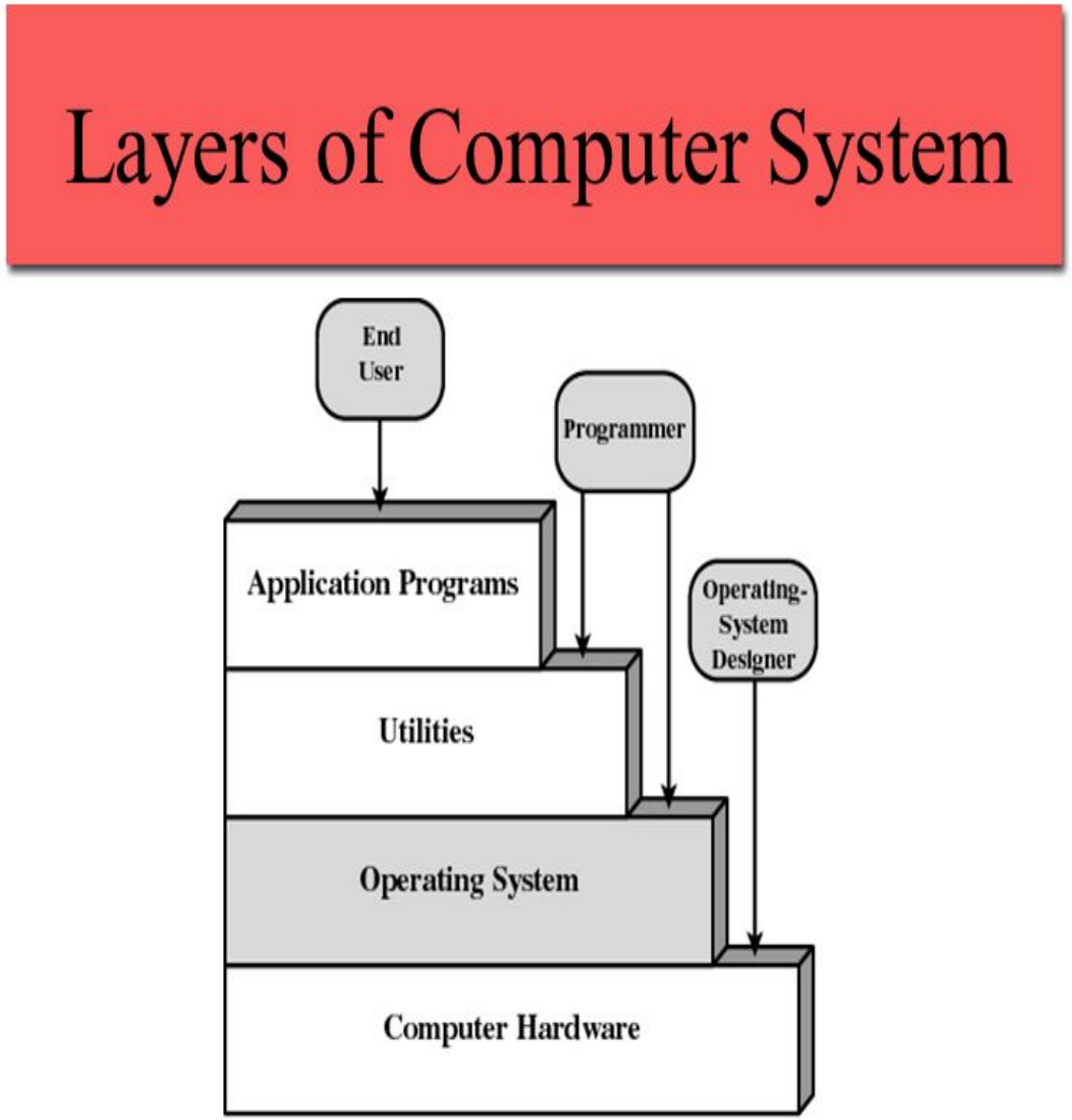
What is an operating system ?

- An operating system is system software that manages computer hardware, software resources, and provides common services for computer programs.

OS: An Essential Component of Computer System

The computer system can be divided into 4 main components:

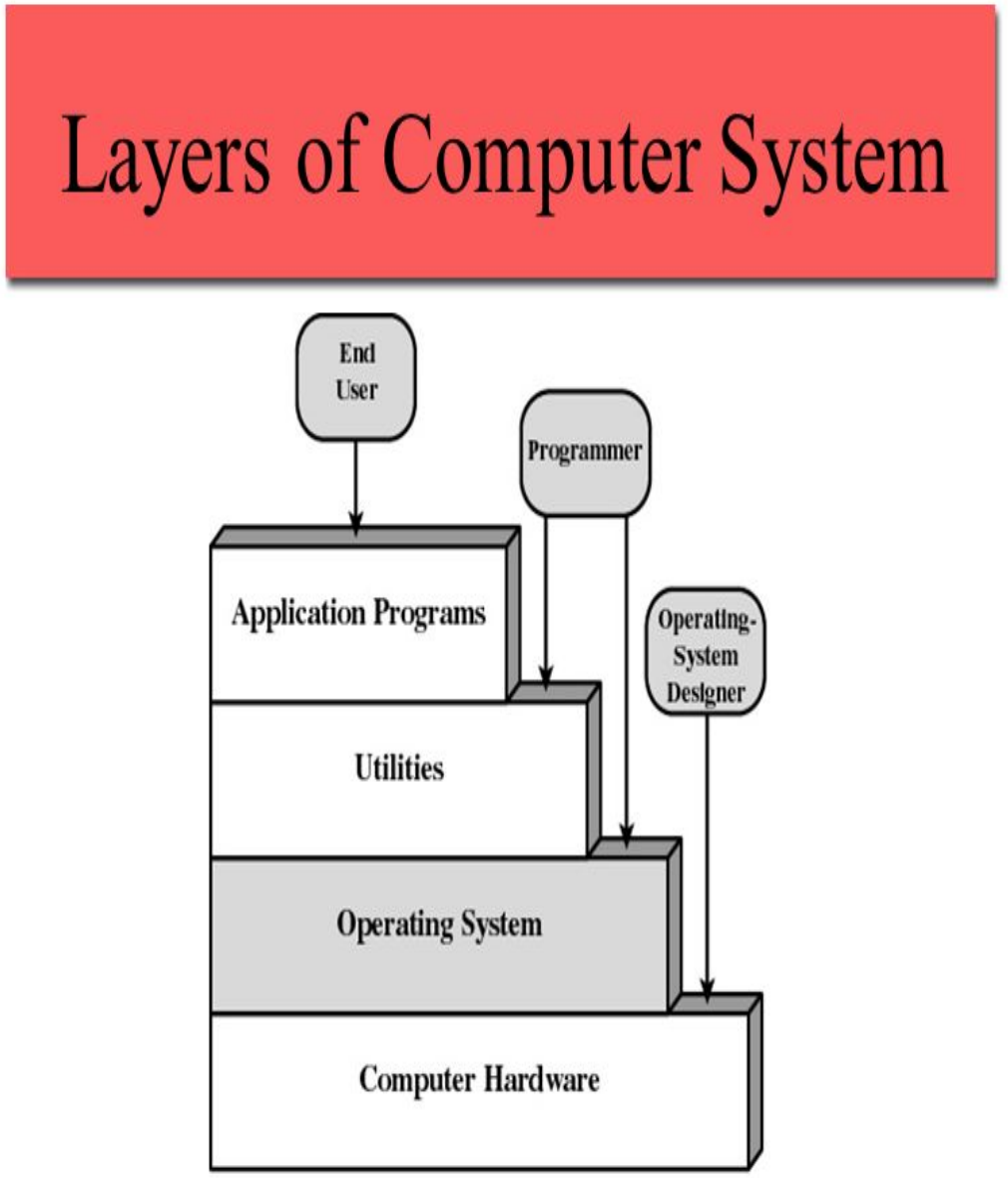
- Hardware
- Operating System
- Application Programs
- Users



OS: An Essential Component of Computer System

Hardware

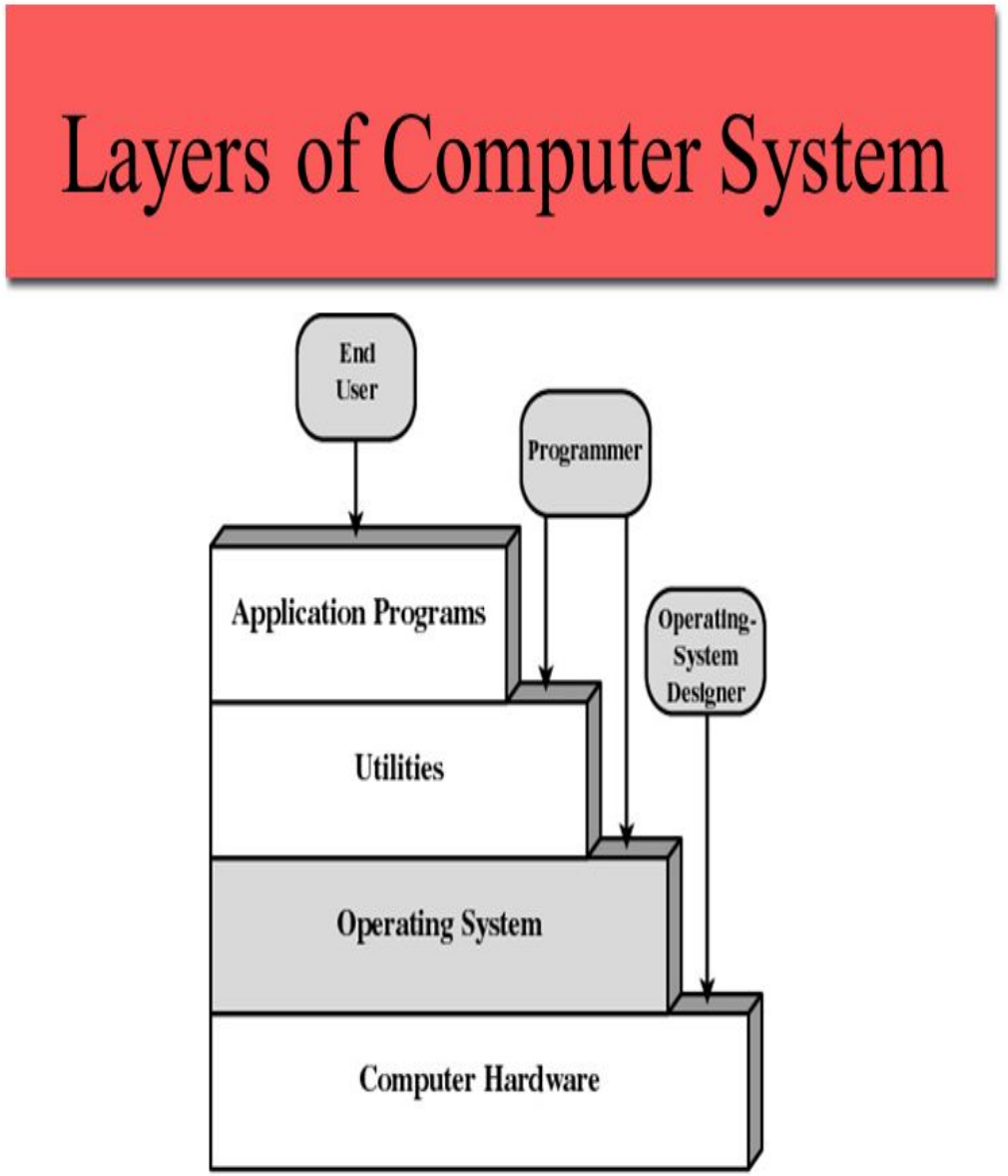
- The hardware comes at the lowest level.
- It contains various kinds of physical devices such as processor, memory, keyboard, mouse, monitor, etc.



OS: An Essential Component of Computer System

Operating System

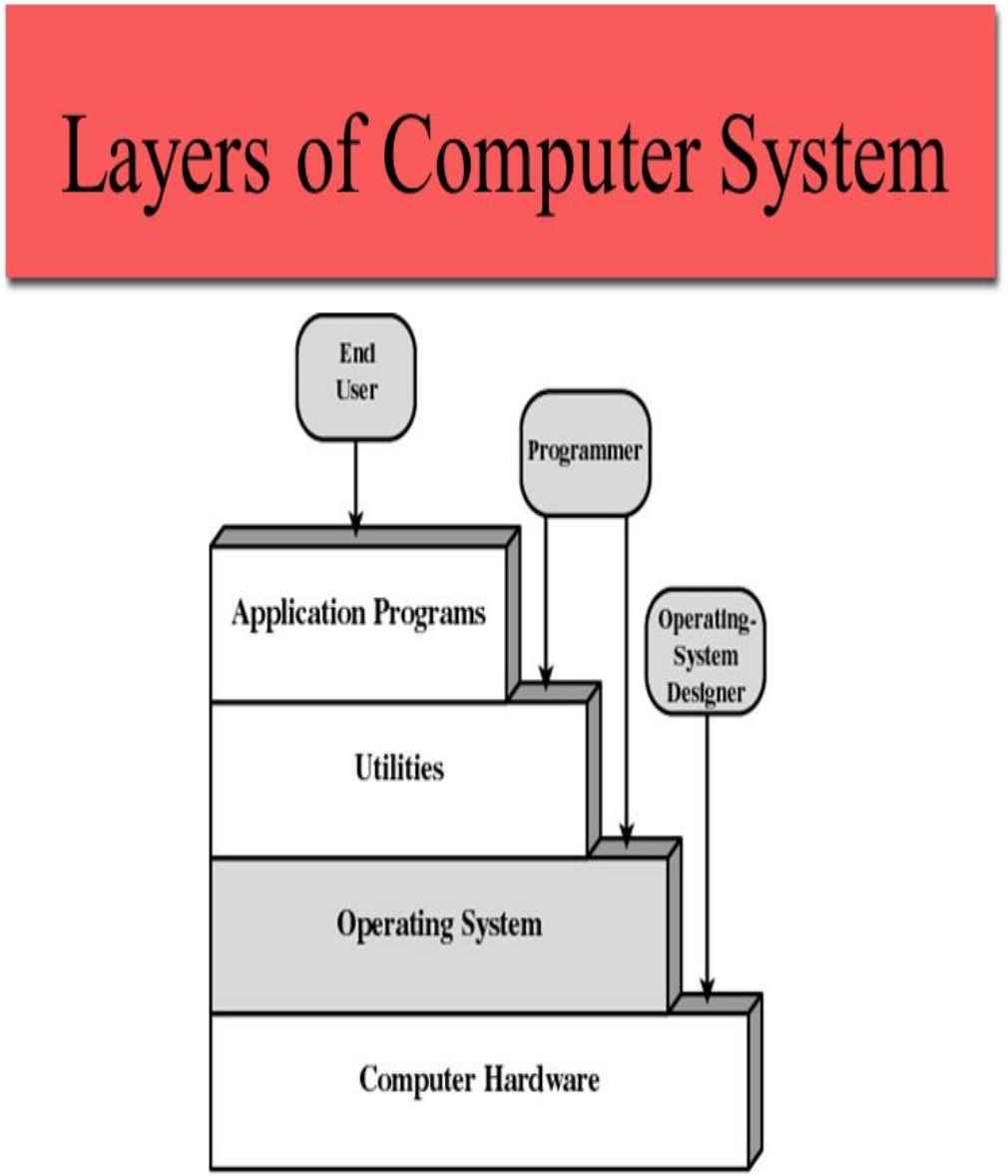
- It manages all the underlying hardware.
- It also masks the complex details of hardware from the user and provides simple interface between application programs & hardware.



OS: An Essential Component of Computer System

Application Programs

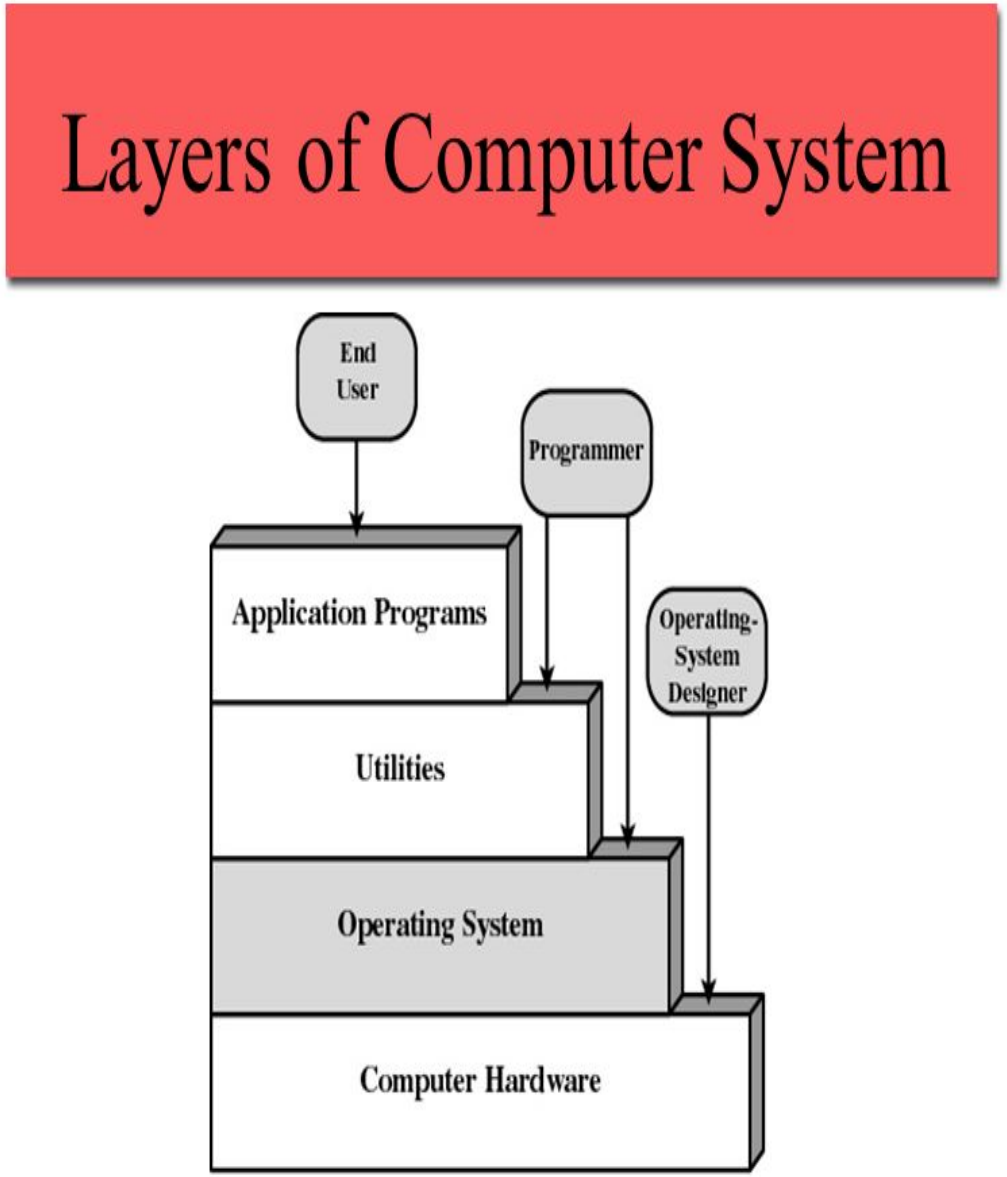
- They perform tasks using different kinds of functionalities provided by OS to perform their tasks.
- For example, airline reservation system, web-browser, Microsoft office, etc..



OS: An Essential Component of Computer System

Users

- Users interact with the system by using application programs to perform particular tasks.



OS: From User View

- Top-down View
- It can be considered as an Extended machine
- OS represents the computer system as a machine which is easier to program rather than underlying hardware.
- It hides all the details and complexities of underlying hardware and provide a simple interface to the user.
- The primary goal of OS is the *user convenience*.

OS: From System View

- Bottom-up View
- It can be considered as a Resource manager
- OS manages all the resources such as CPU, memory, I/O devices.
- Resources are in one of the two ways:
- **Time multiplexing:** Here, each user takes turn to use the resource.
- **Space multiplexing:** Here, each user gets part of the resource.
- The primary goal of OS is the *efficiency*.

ANY
QUESTIONS?

Evolution of Operating System

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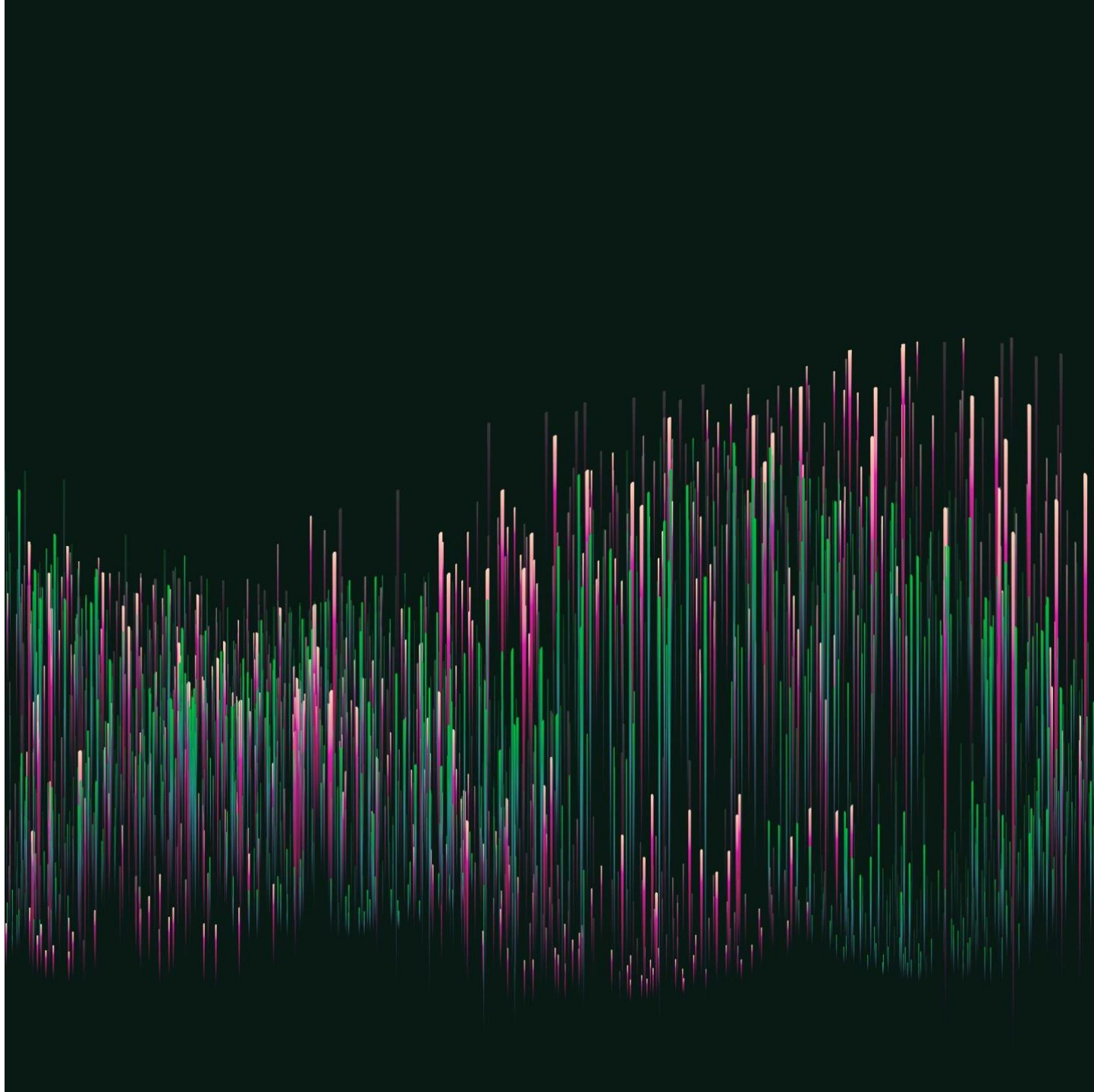
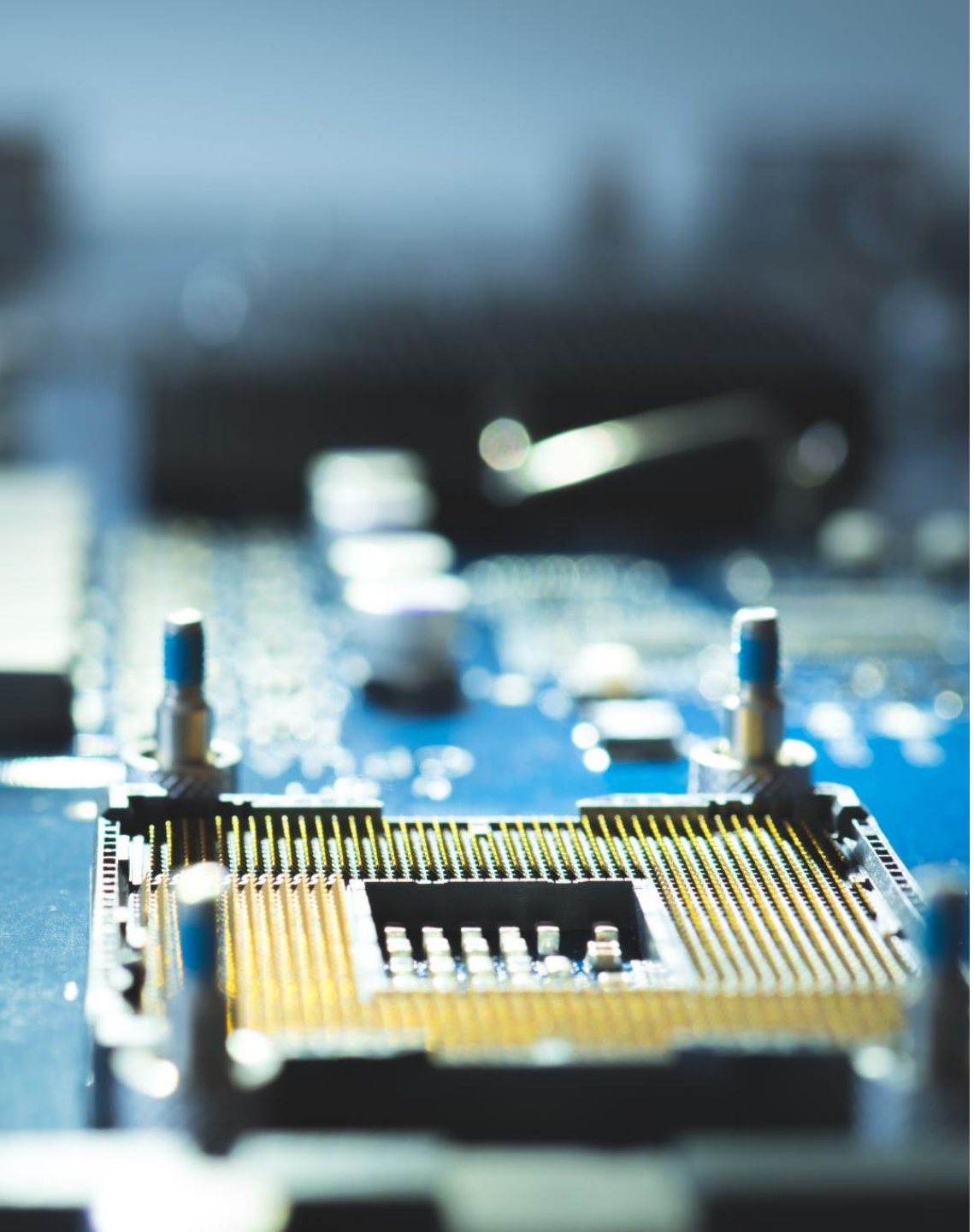


The First Generation (1945 – 1955)

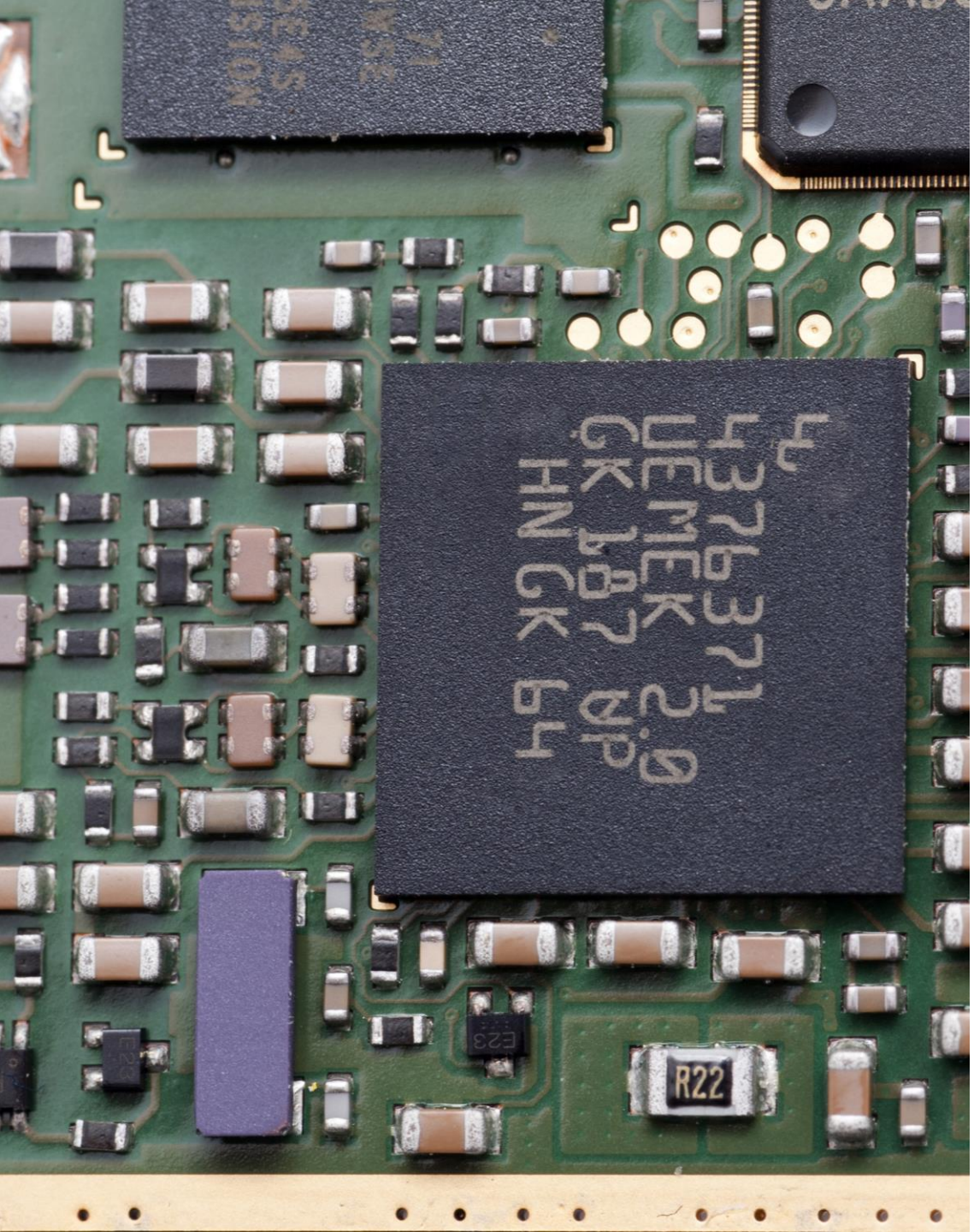
- Hardware: Vacuum tubes & plug boards.
- Neumann and others succeeded in building calculating engine
- No operating systems, no programming languages
- Introduction of Punch cards made it possible to write and read programs instead of using plug boards



The Second Generation

(1955 – 1965)

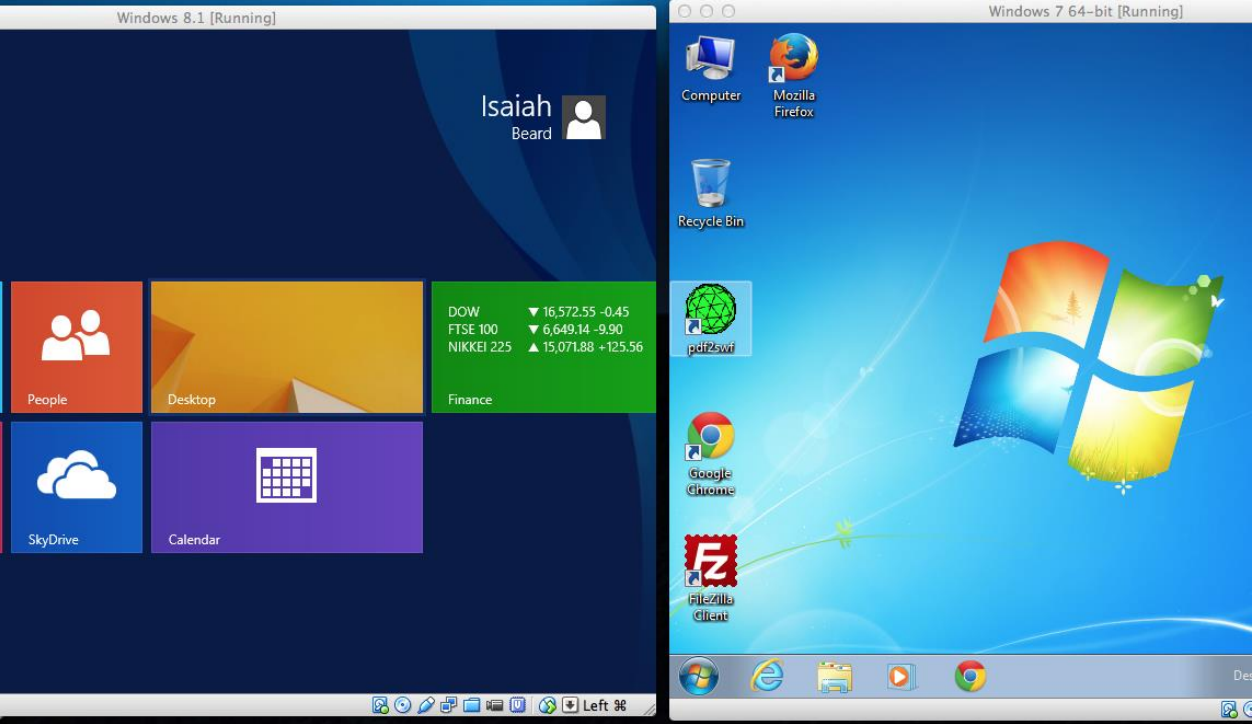
+ Hardware: Transistors
+ Clear separation between designers, builders, operators, programmers and maintenance personnel.
+ Machines were called Mainframes.
+ Batch OS took birth.



The Third Generation

(1965 – 1980)

+ Hardware: Integrated Circuits (ICs)
+ Multiprogramming OS and its variations such as Time sharing, Interactive, Multitasking OS came in picture
+ SPOOLing began during this time duration
+ UNIX became popular OS

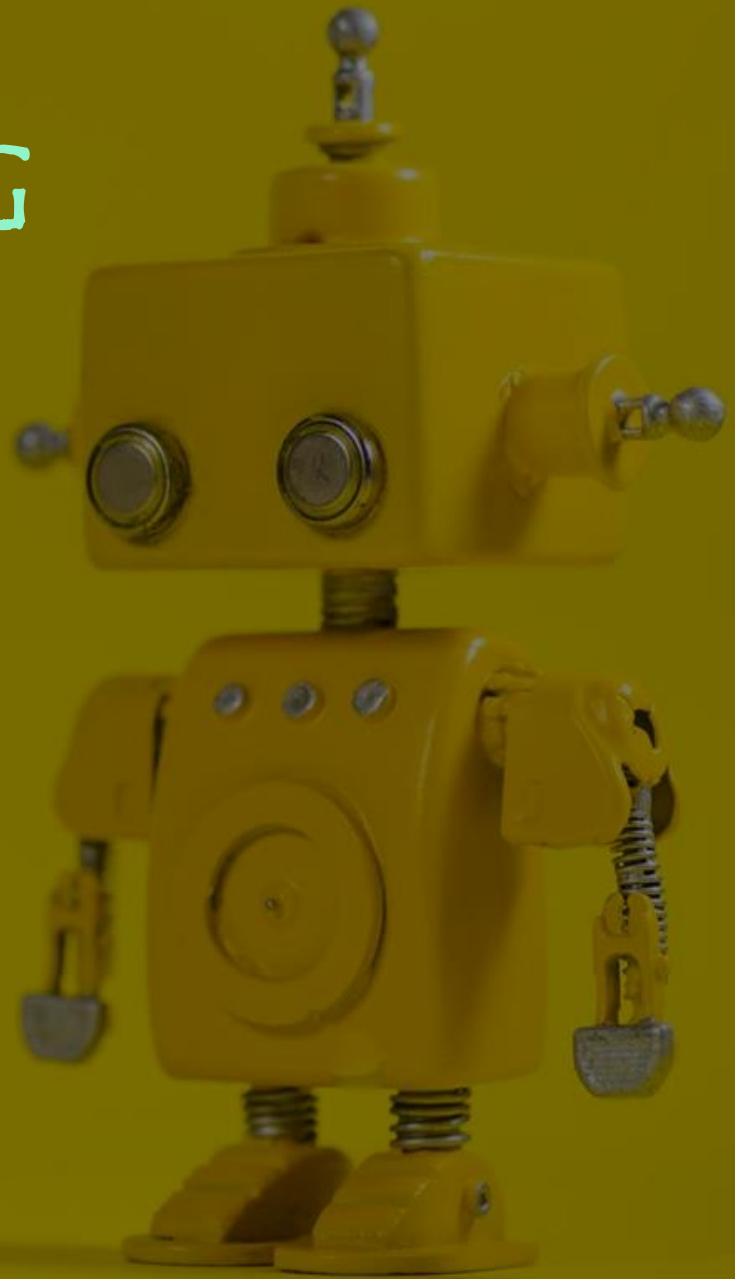


The Fourth Generation (1980 – Present)

- Hardware: LSI Circuits
- Personal Computers evolved
- MS-DOS was used by IBM which became dominant in the markets.
- Later, Apple came with system which provided user friendly GUI.
- Microsoft also has a chain of OS which support GUI, such as Windows 95, 98, NT, ME, XP, Windows Vista, Windows 7 , 8 , 10, etc.
- In parallel to this, UNIX and LINUX also got a good evolution.

Any
Questions

TYPES OF OPERATING SYSTEM



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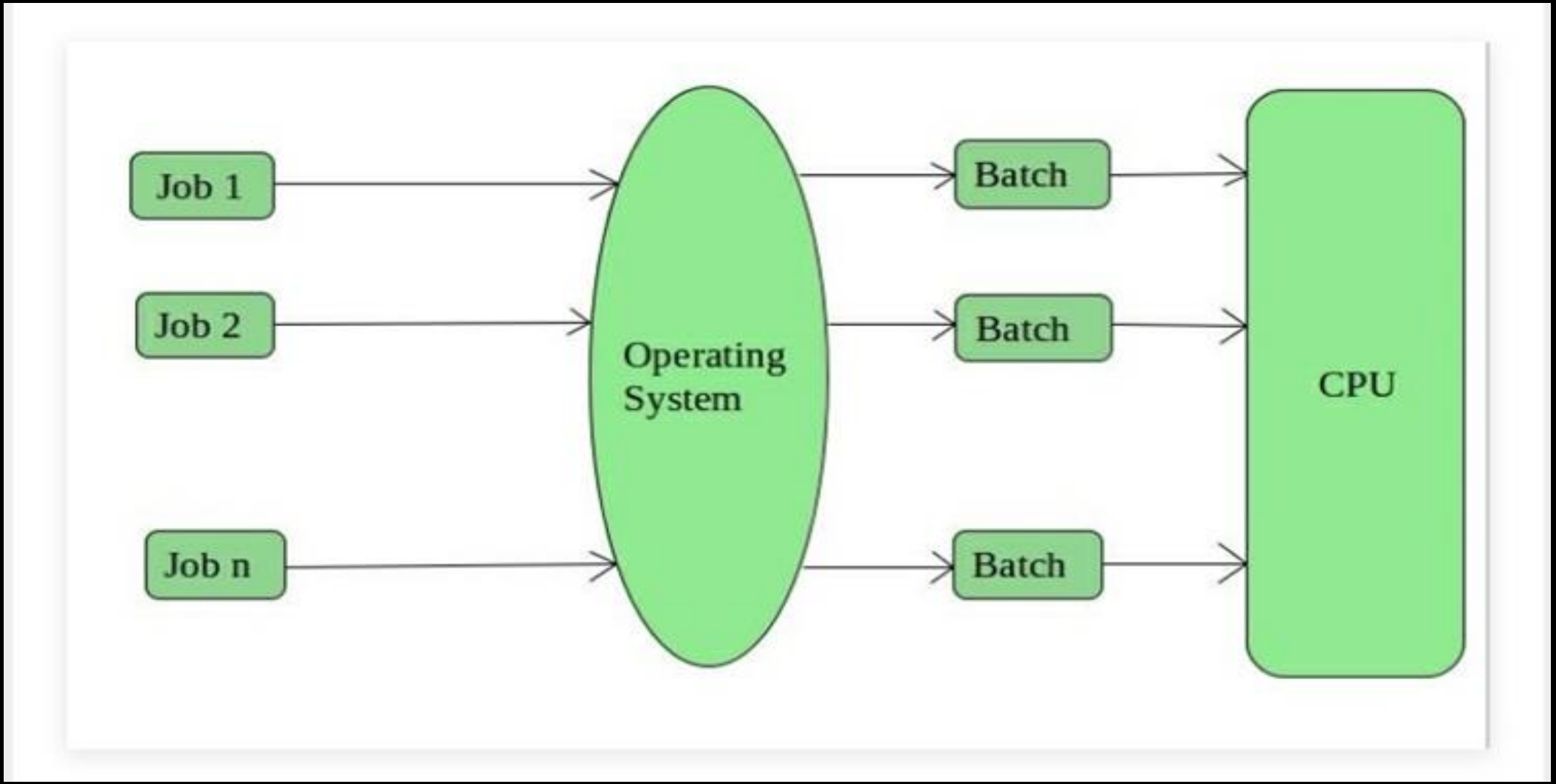
BATCH OPERATING SYSTEM

This type of operating system does not interact with the computer directly.

There is an operator which takes similar jobs having same requirement and group them into batches.

It is the responsibility of operator to sort the jobs with similar needs.

EXAMPLE OF BATCH OPERATING SYSTEM

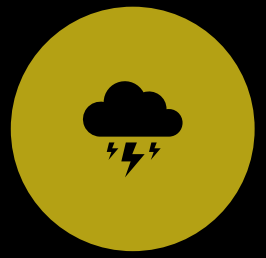


ADVANTAGES OF BATCH OPERATING SYSTEM

Multiple users can share the batch system.

The idle time for batch system is very less.

DISADVANTAGES OF BATCH OPERATING SYSTEM



Low throughput

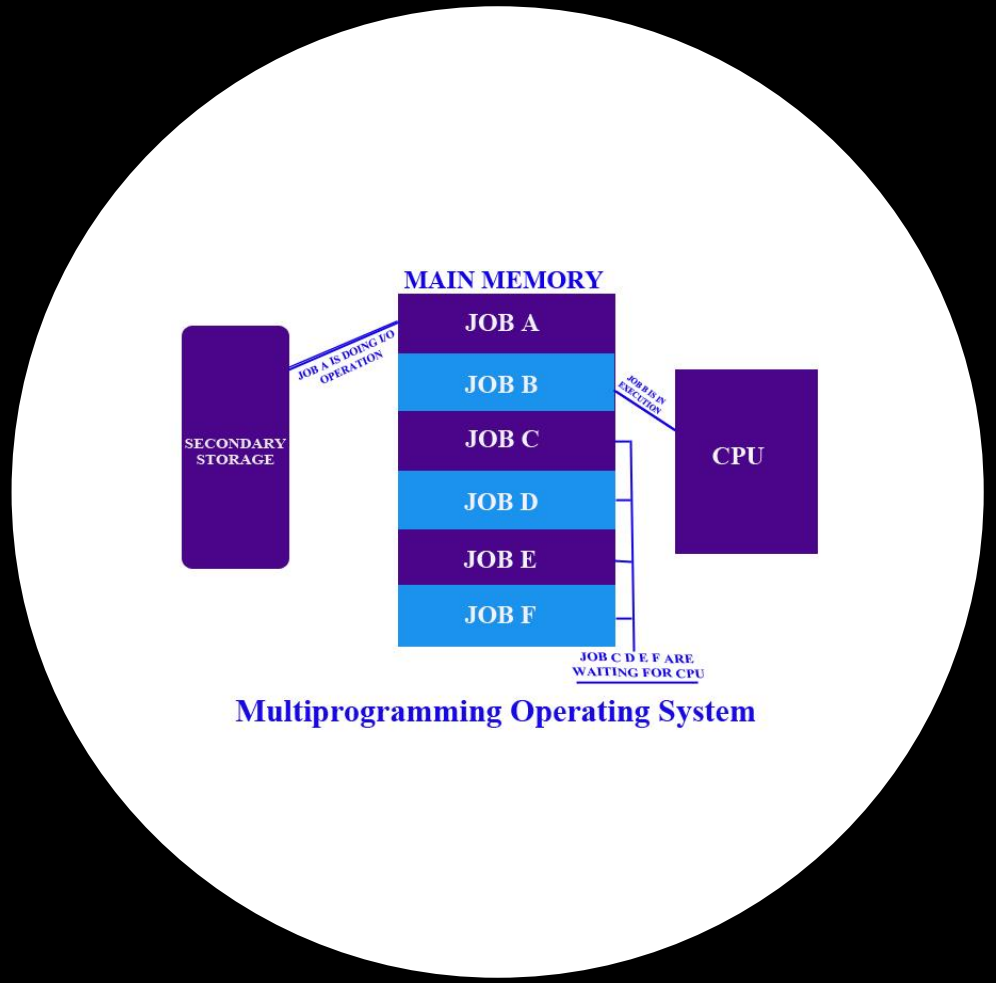
Batch system are hard to debug.

Programmers do not have direct interaction with job.

Operations were too much time consuming.

MULTIPROGRAMMING OPERATING SYSTEM

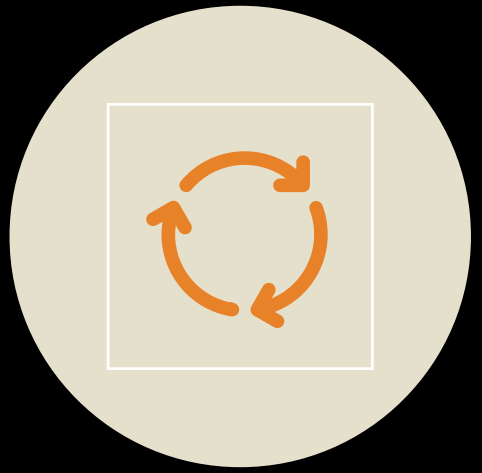
- Multiprogramming is also the ability of an OS to execute more than one program on a single processor machine.
- More than one task/ program/ job/ process can reside into the main memory at one point of time.



Multiprogramming Operating System

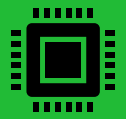
ADVANTAGES OF MULTIPROGRAMMING OPERATING SYSTEM

IMPROVED RESOURCE UTILIZATION.



PROVIDES BETTER SYSTEM THROUGHPUT.

DISADVANTAGES OF MULTIPROGRAMMING OPERATING SYSTEM



Sometimes tasks/process is difficult to handle.

Due to high load of tasks , long time jobs have to wait longer.

REAL TIME OPERATING SYSTEM

- These type of Operating System serves the real time systems.
- The time interval is called response time.
- In real time system time is very critical factor as input immediately affects the output.
- Types of Real Time OS:

1.Soft real-time system

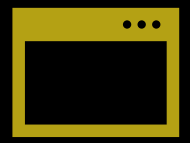
2.Hard real -time system

SOFT REAL-TIME SYSTEM

These OS are for applications where for time is less strict, missing an occasional deadline is acceptable.

Ex: audio manager

HARD REAL -TIME SYSTEM



These OS are used for systems where time is very strict even the shortest possible delay is not acceptable.

Ex : oil refinery

ADVANTAGES OF REAL TIME OPERATING SYSTEM

These type of systems are error free.

Time is very less for task shifting.

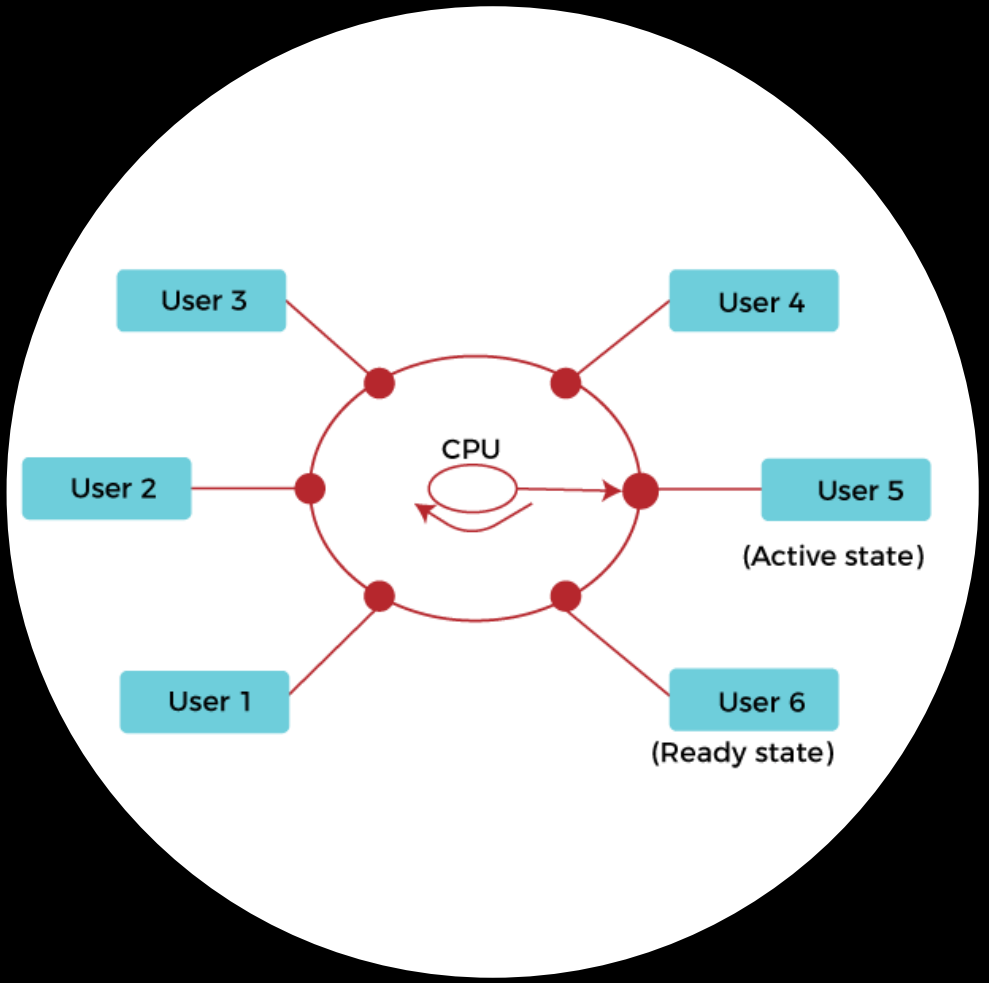
DISADVANTAGES OF REAL TIME OPERATING SYSTEM

Very few tasks run at a time.

The algorithm is very complex.

TIME SHARING OPERATING SYSTEM

- Each task is given some time to execute , so that all the tasks work smoothly.
- Each user gets time of CPU as they use single system.
- These system are also known as multitasking system.
- The time that each task gets to execute is called quantum.



ADVANTAGES OF TIME SHARING OPERATING SYSTEM

Provides advantage of quick response.

Reduced CPU idle time.

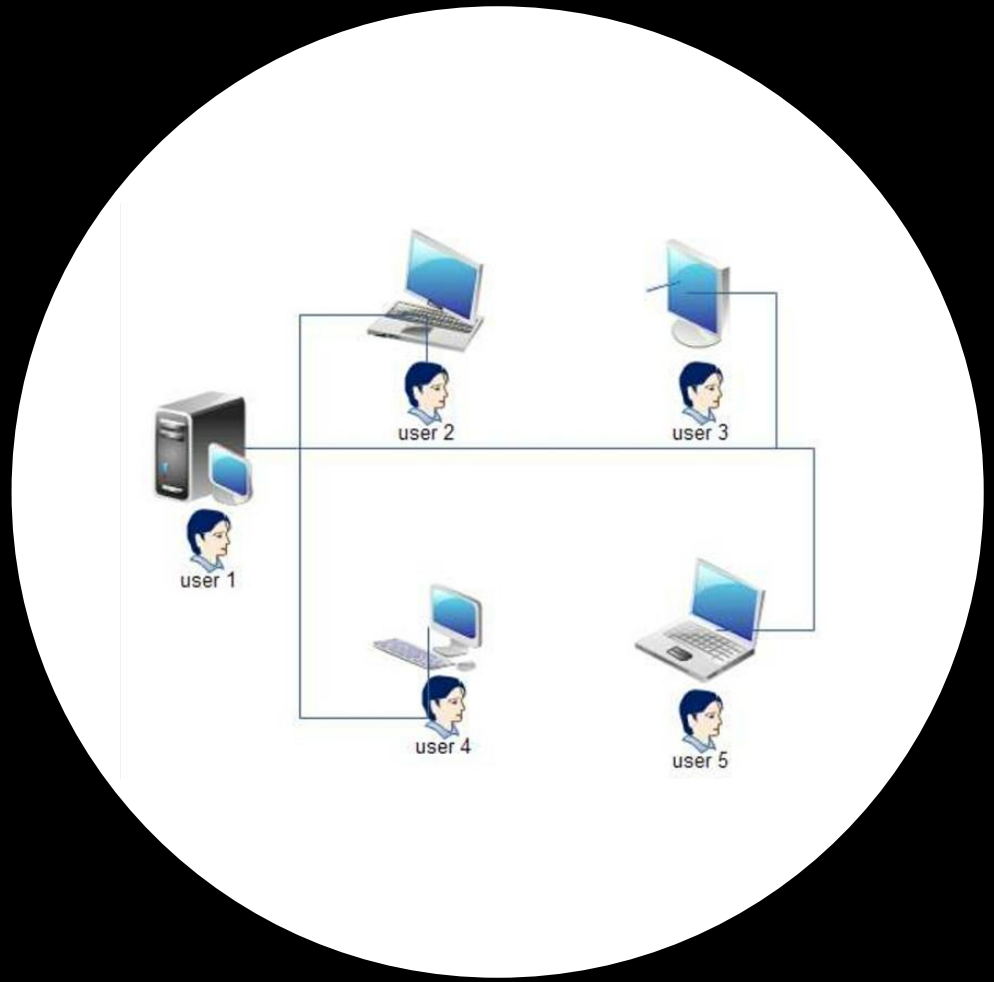
DISADVANTAGES OF TIME SHARING OPERATING SYSTEM

Problem of data communication between processes.

Problem of reliability.

MULTI-USER OPERATING SYSTEM

- A multi-user OS is a computer operating system which allows multiple user to access the single system with one operating system on it.
- It is generally used on large mainframe computers.
- Example : Ubuntu , Windows 2000



ADVANTAGES OF MULTI USER OPERATING SYSTEM

- Different users can access the same document on their computer.
- System can be handled efficiently.

NETWORK OPERATING SYSTEM

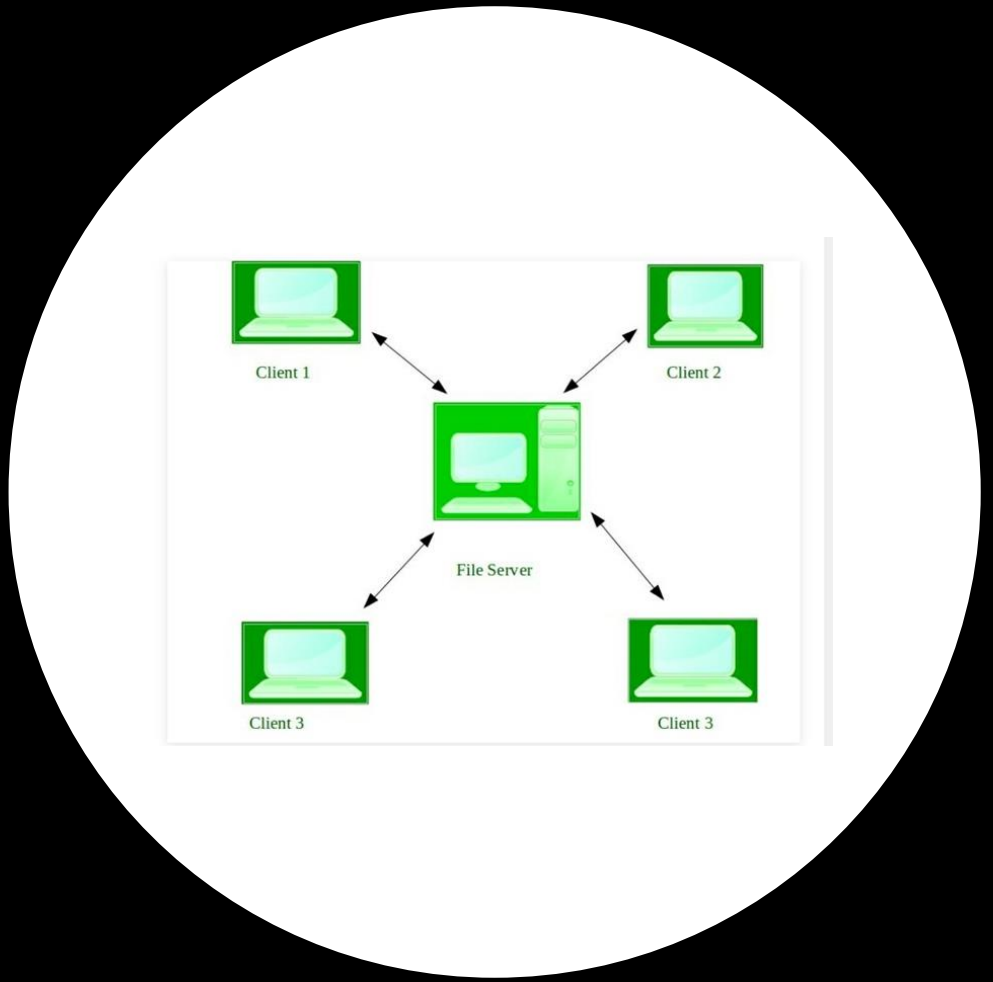
These system run on a server and provide the capability to manage data , users , groups , security , and other networking functions.

These type of OS allows shared files , printers , security , application over a small private network.

Example : Microsoft windows server 2003 , Linux

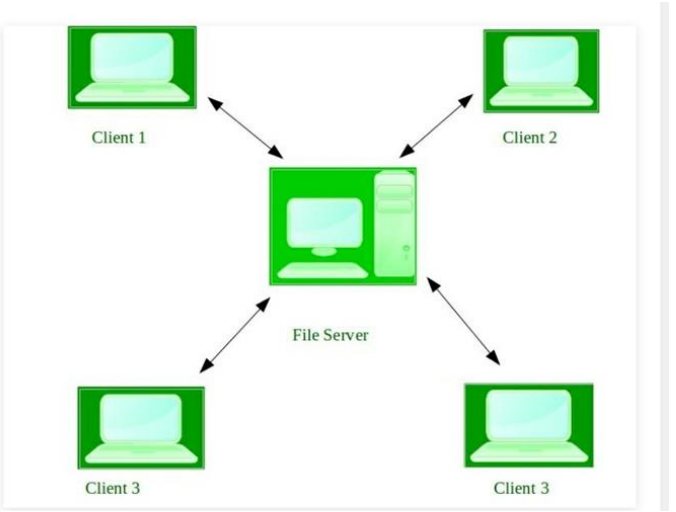
ADVANTAGES OF NETWORK OPERATING SYSTEM

- Server access are possible from different locations and types of systems.

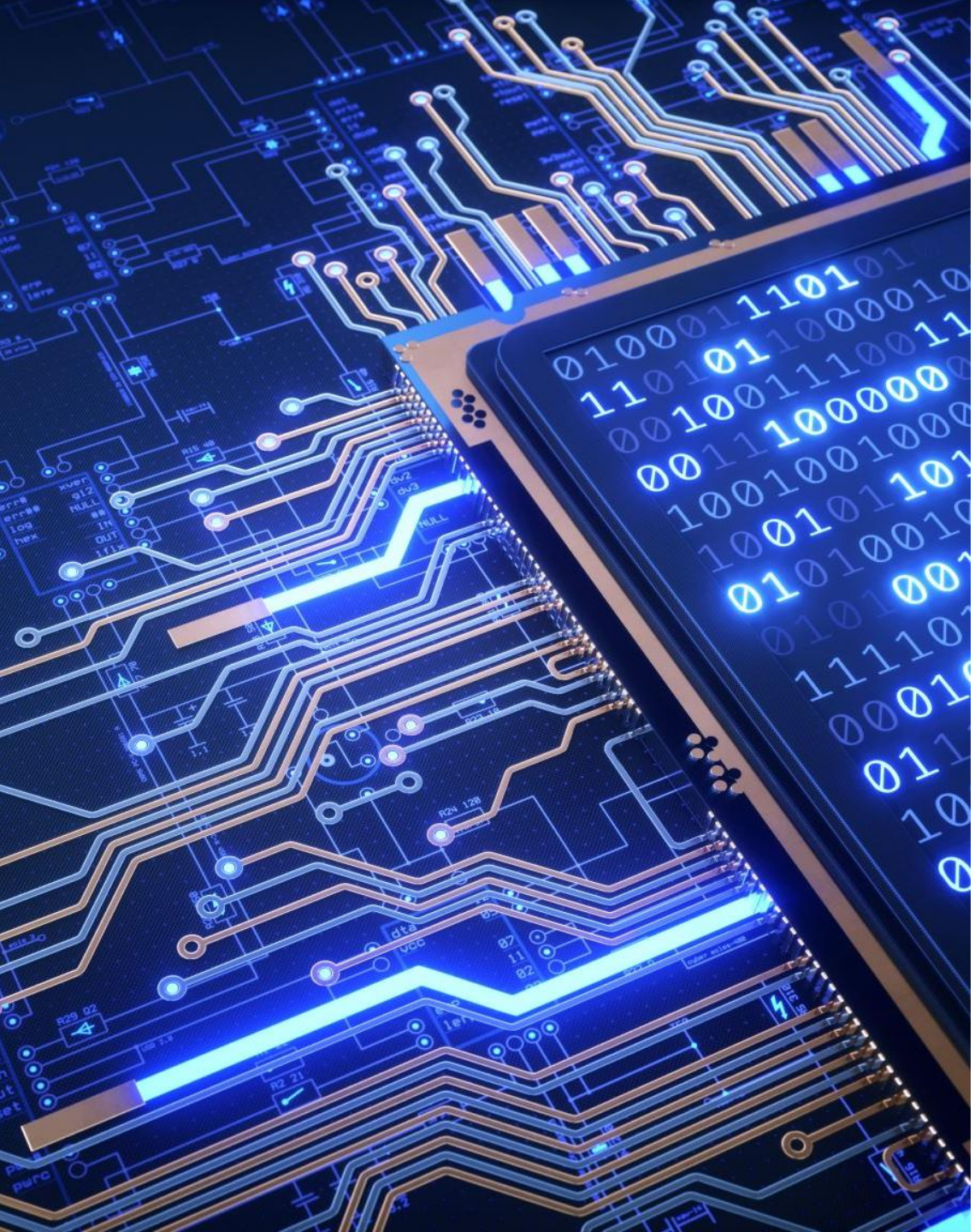


DISADVANTAGES OF NETWORK OPERATING SYSTEM

- Servers are costly
- Maintenance and updates are required regularly



Any questions?



Operating System Services

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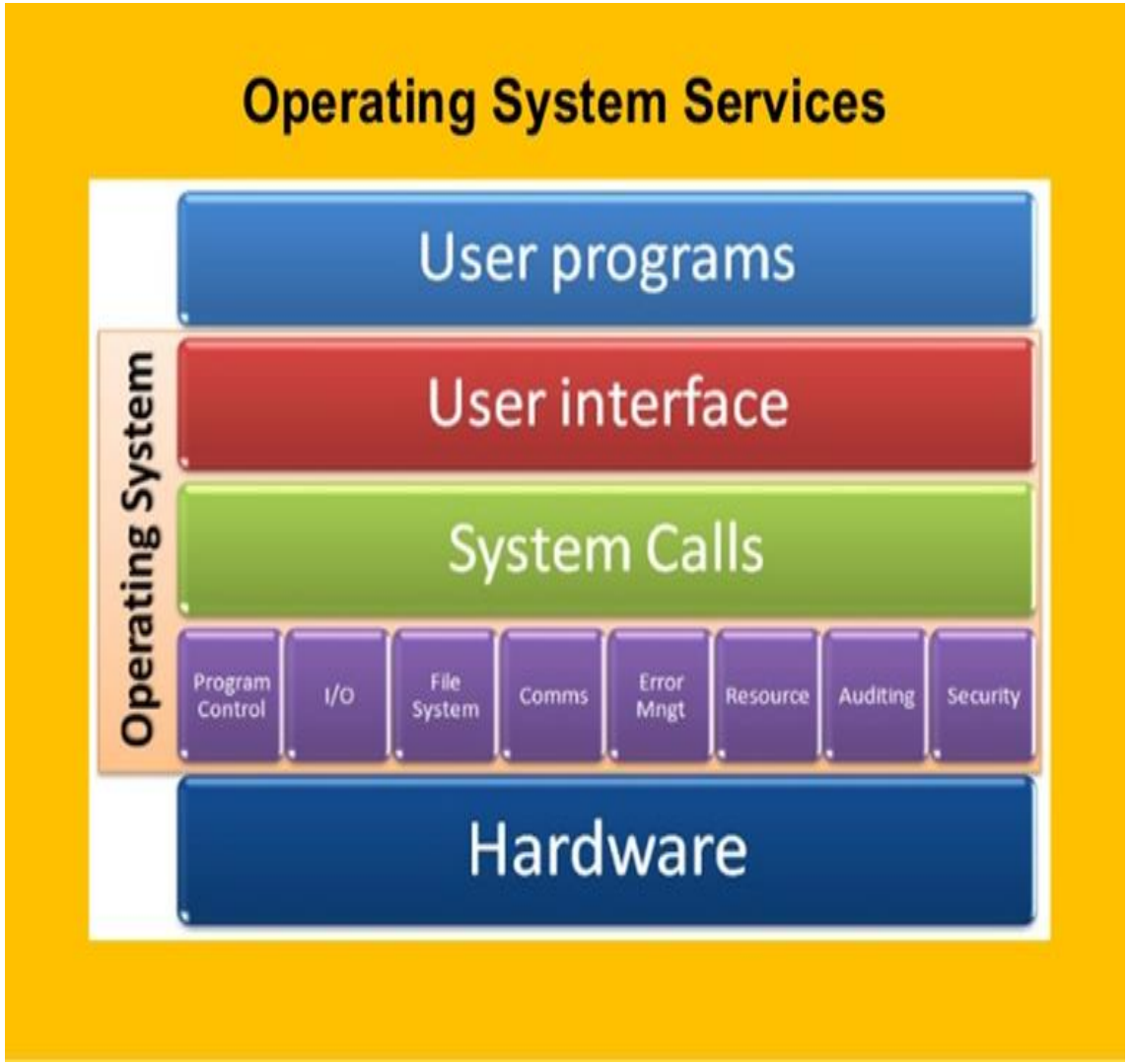
OPERATING SYSTEM SERVICES

+ Operating system services can be described from 2 different point of view
+ **User point of view:** Primary goal is convenience.
+ **System point of view:** Primary goal is efficiency.



SERVICES FROM USER POINT OF VIEW

Program execution

- Loading program into memory
- Execution
- Run program
- Handle errors

SERVICES FROM USER POINT OF VIEW

I/O operation

- Controls FILE & I/O DEVICES.

SERVICES FROM USER POINT OF VIEW

File System manipulation

- **Reading , Writing , Rename , Delete , Permission change of file or directory.**

SERVICES FROM USER POINT OF VIEW

Communication

- Exchange of Information among processes
- Data transfer via shared memory or message passing.

SERVICES FROM USER POINT OF VIEW

Error detection

- *May occur in CPU , User program , I/O devices.*
- *OS detects such errors & makes user aware from them.*
- *Provides error recovery mechanism*

SERVICES FROM SYSTEM POINT OF VIEW

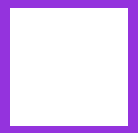
RESOURCE ALLOCATION

When multiple users share the same machine or when multiple jobs are running simultaneously, fair allocation of resources should be done among them.

SERVICES FROM SYSTEM POINT OF VIEW

ACCOUNTING

Keeping track of resource utilization by different users for billing in multi-user environment



Collect usage statistics for future planning

SERVICES FROM SYSTEM POINT OF VIEW

PROTECTION

ENSURE THAT ALL ACCESS TO SYSTEM RESOURCES IS CONTROLLED

ENSURE THAT ALL INFORMATION STORED ON SYSTEM IS SECURED

QUESTIONS

Linux Operating System

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Linux Overview

Linux was first developed by Linus Torvalds, a student in Finland, in 1991.

Linux is the most famous free and open-source Operating system.

You can make changes to the source code of Linux as per your requirements.

You can also distribute this modified OS.

Many flavors are available of Linux such as Red Hat Enterprise Linux and its derivatives like Fedora & CentOS, Debian and its derivatives like Ubuntu and Linux Mint, Linspire, PCLinux.

Features of Linux

Free and open-source software:

Open source means Linux is available with its source code

Free means users have the freedom to make changes in source code according to their requirements and redistribute the modified OS.

Most of the Linux flavors are either totally free or costs very less compared to other OS.

Features of Linux

Flexibility in Usage

Linux can be used for high performance server applications, desktop applications and embedded systems.

Multi-User System

Linux is a multi-user operating system as it allows multiple users to work simultaneously on the same system.

Different users can login from different machines into same machine by using programs like 'TELNET'.

Features of Linux

Multi-tasking System

Linux is a multi-tasking operating system which allows multiple programs to run simultaneously.

High Performance and Reliability

Linux provides high performance with minimum requirements of hardware compared to other operating systems.

System crashes, hangs, virus attacks are almost absent from the Linux world.

Features of Linux

The Building-block Approach

Linux uses the building-block approach to perform complex tasks.

It provides a few hundred commands each of which can perform one simple job.

To perform complex tasks, such simple commands can be combined using pipes and filters.

Features of Linux

Flexible Interface

Linux supports both GUI (Graphical User Interface) and CLI (Command Line Interface)

User can choose any interface according to their convenience and expertise.

File System Support

Linux supports a wide range of file systems such as ext, ext2, ext3, ext4, XFS, JFS, etc.

It also supports file systems supported by other OS such as NTFS, so that linux users can access files managed by those operating systems.

Features of Linux

Programming facility

The Linux shell is also a programming language which supports all the programming features such as variables, control structures, loops and so on.

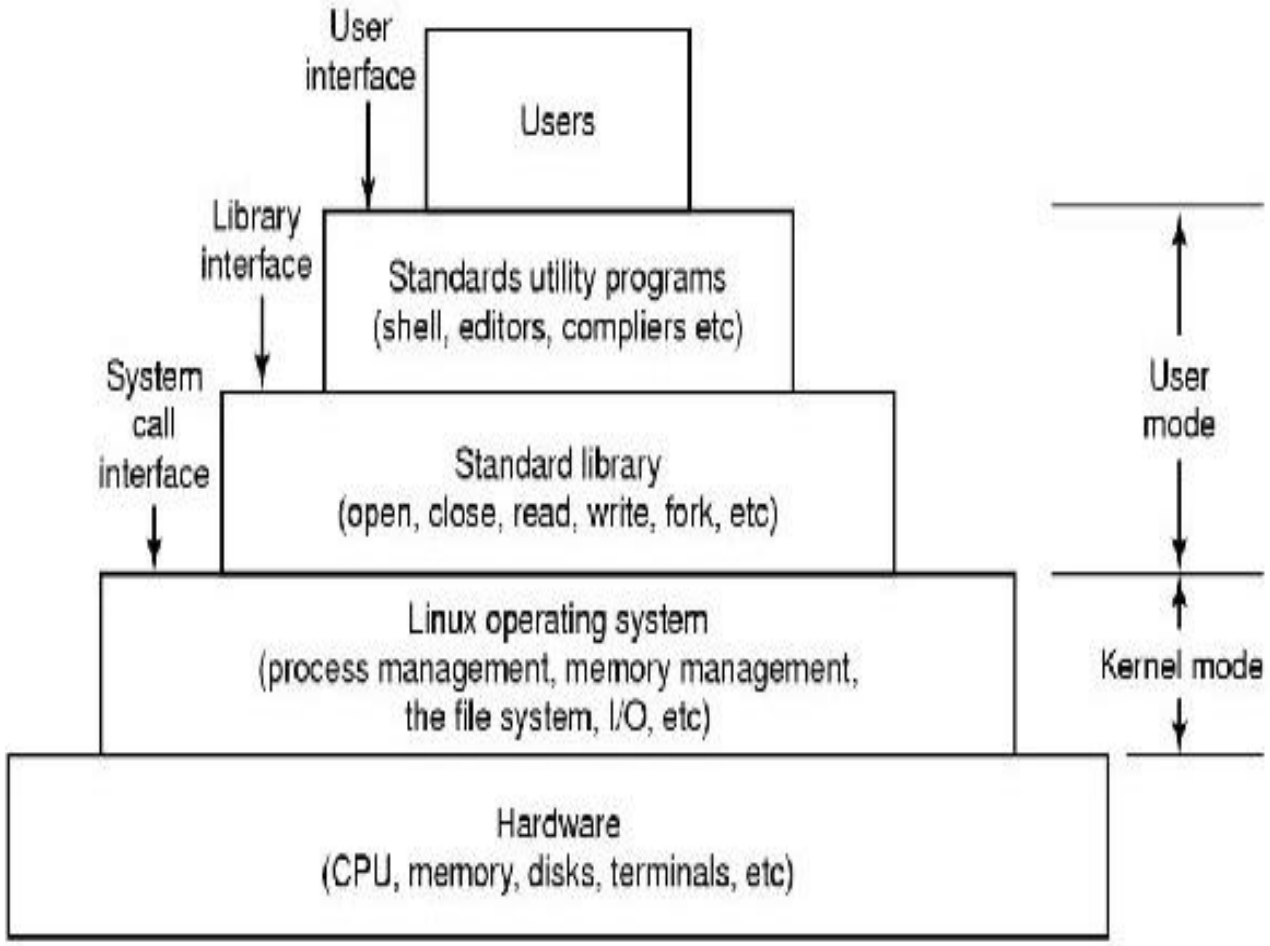
Online help

Linux provides an online help facility for all the commands using a command 'man'.

As Linux is a community driven OS, many developers and distributors work on it and there is a vast support available on internet.

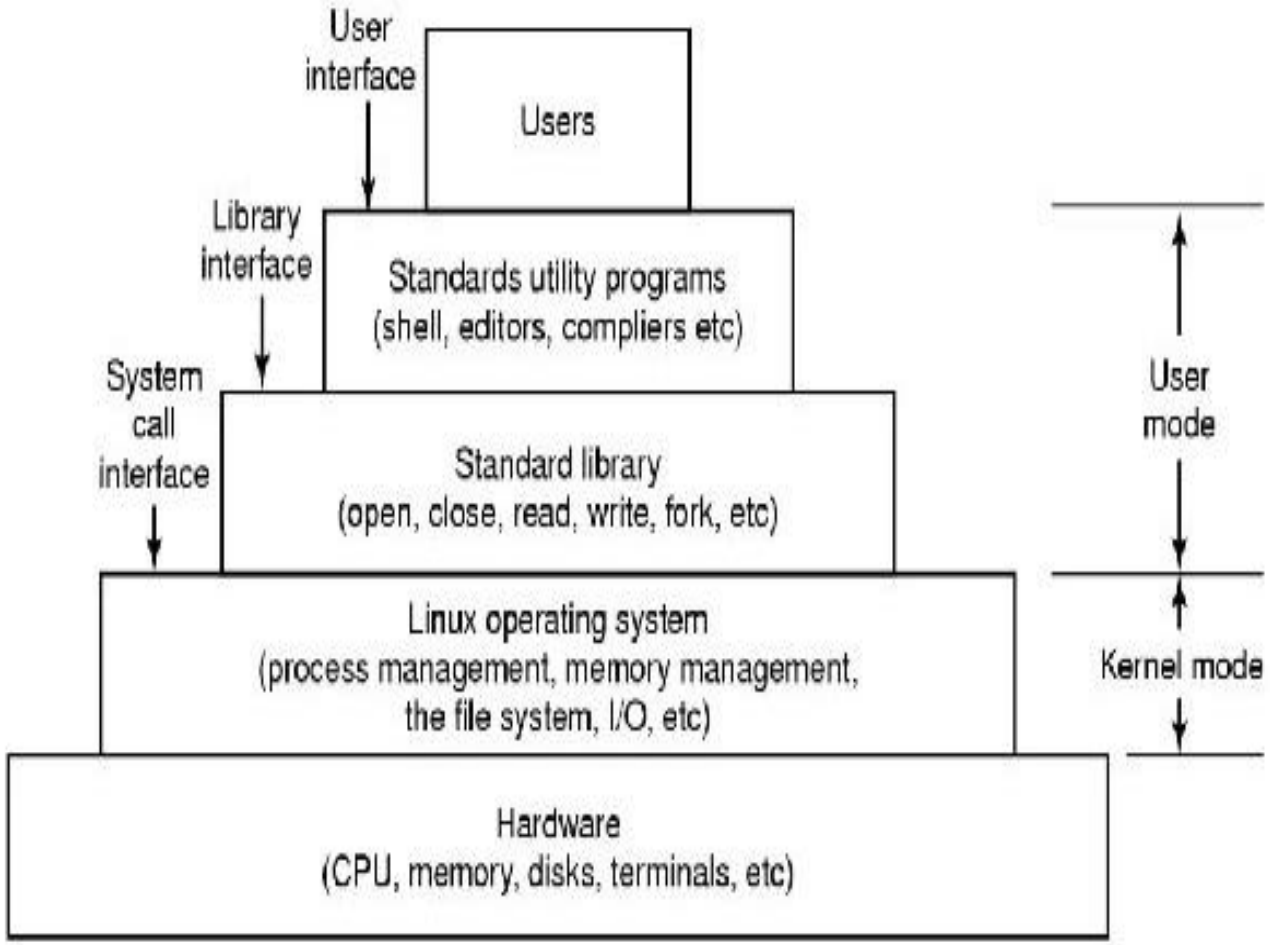
The Linux Architecture

- Linux architecture is also known as the layered structure of the Linux.
- As Linux is a UNIX like OS, its architecture resembles to that of UNIX.
- The various layers depicted in Linux architecture are as shown in the figure.



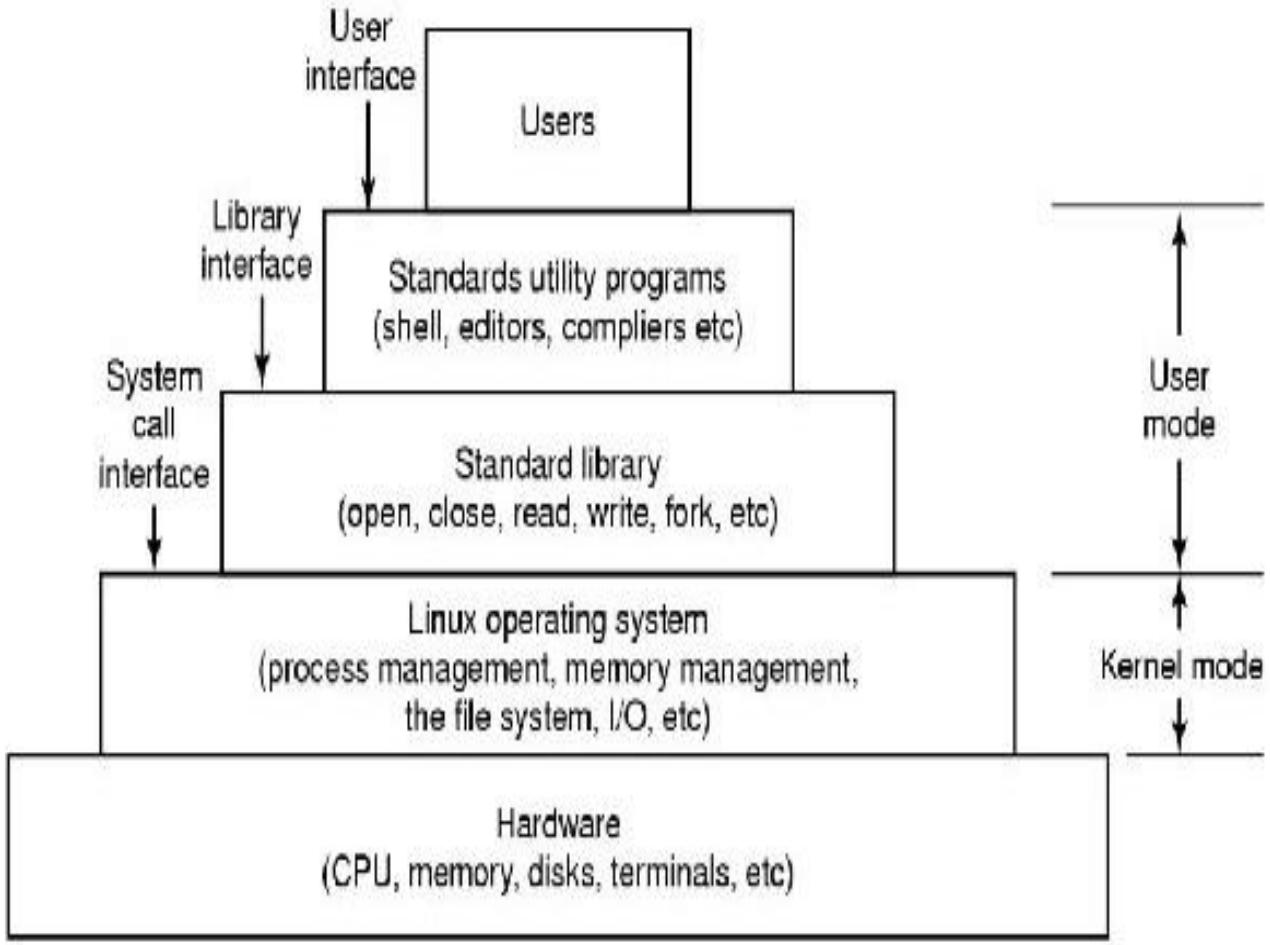
The Linux Architecture

- **Hardware**
- The bottom layer is hardware which consists of various physical devices such as CPU, memory, disks, monitors, printers, etc.



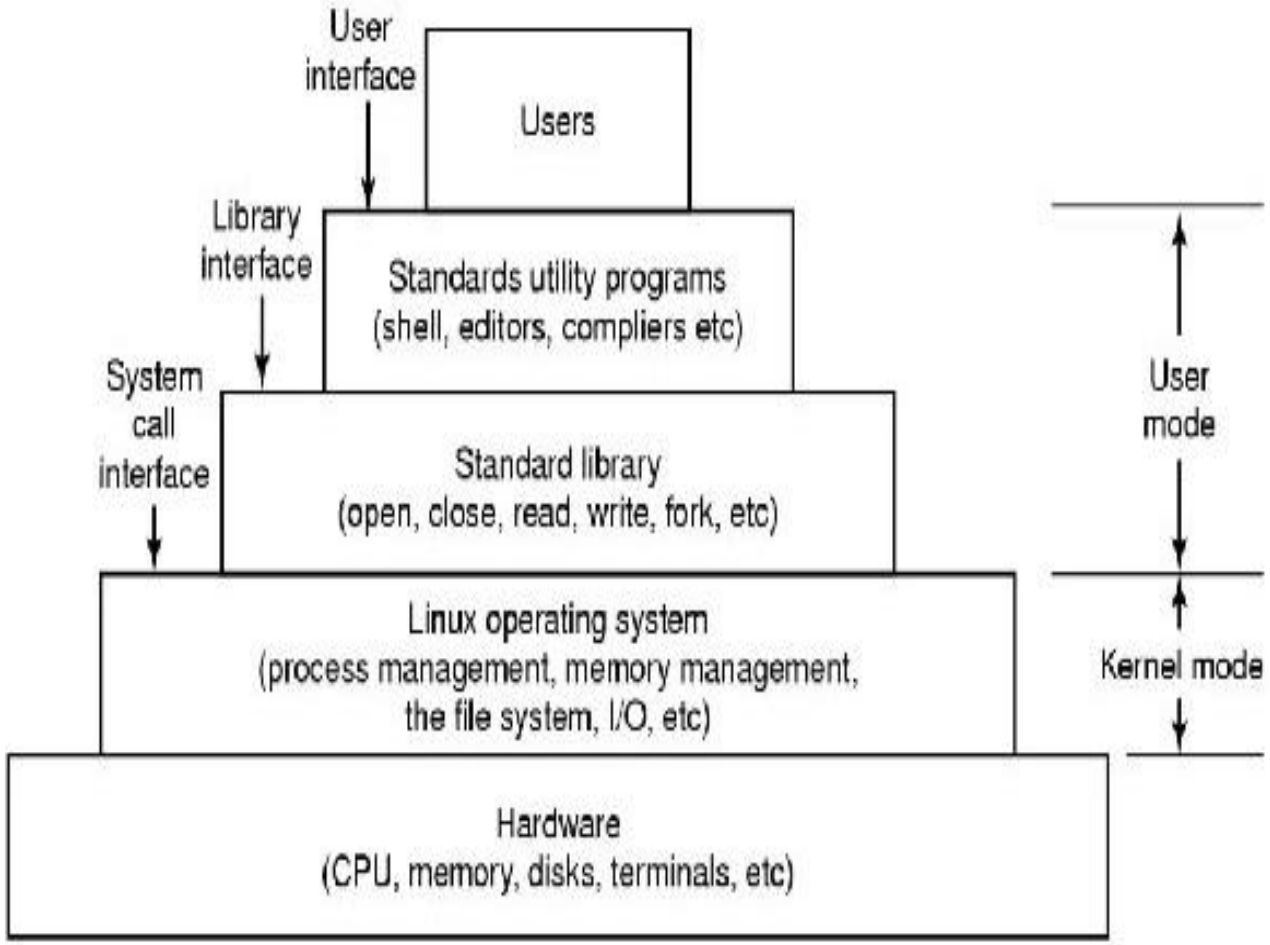
The Linux Architecture

- **Linux Kernel**
- The next higher layer is Linux Kernel which represents the core of the OS.
- It manages all the underlying hardware.
- It directly interacts with the hardware and provides user programs required services, hiding all the complex details of the hardware.



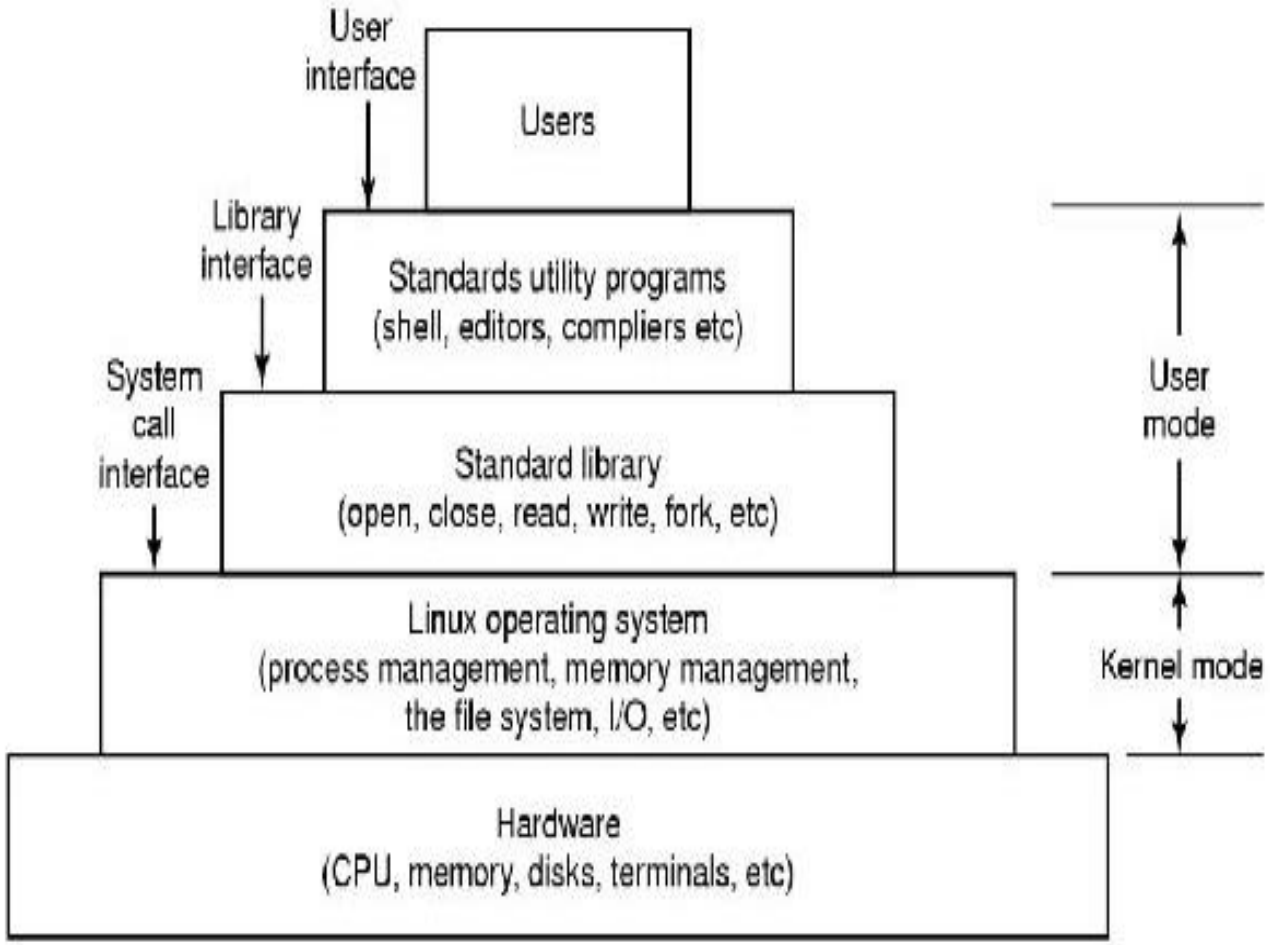
The Linux Architecture

- **Standard Library**
- Above OS, next layer is for standard library which contains a set of procedures, one procedure per system call.
- These procedures are written in assembly language and used to involve various system calls from user programs.



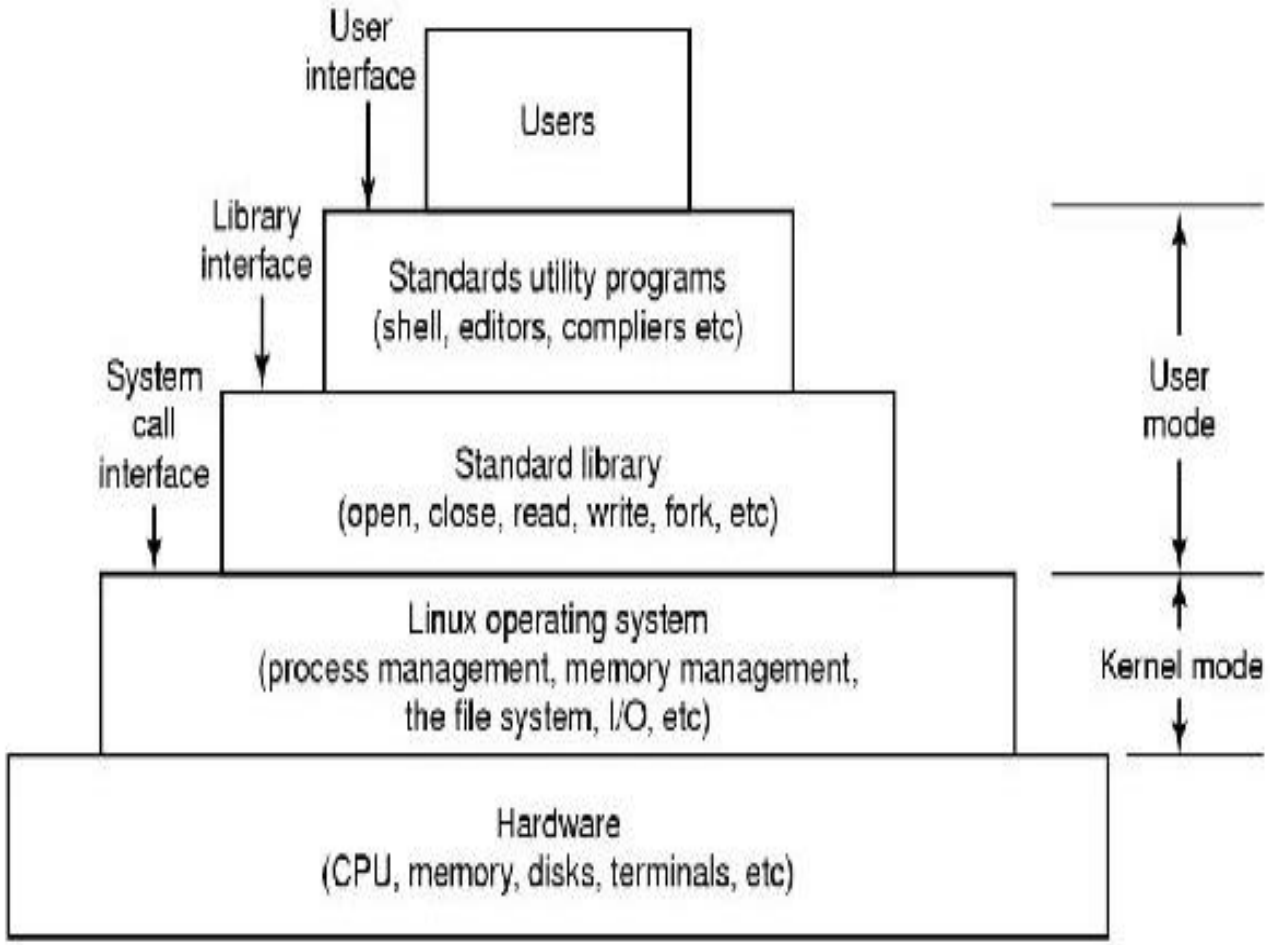
The Linux Architecture

- **Standard Utility Programs**
- Standard utility programs include command processor (shell), compilers, editors, text processing programs, file manipulation utilities, a variety of commands, graphical user interfaces and so on.



The Linux Architecture

- **Users**
- The topmost layer is of Users.
- User programs come in this layer which interact with the system either by using library procedures to invoke system calls, or by using utility programs such as shell.



Linux Distributions (Distros)

- A Linux distribution is an OS made through a software collection that contains the Linux kernel and a package management system.
- Usually, Linux users obtain their OS by downloading a Linux distribution, available for a range of systems from embedded devices (e.g., ***OpenWrt***) to robust supercomputers (e.g., Rocks Cluster Distribution).

Linux Distributions (Distros)

- A Linux distribution is composed of a Linux kernel, GNU libraries and tools, other software, a window system, documentation, a desktop environment, and a window manager.
- Almost every added software is open-source and free and becomes available both as in source code and compiled binary form, permitting changes to the actual software.

Linux Distributions (Distros)

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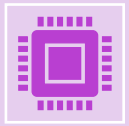
History of Linux Distributions



Linus Torvalds integrated the Linux kernel and shared its first version, 0.01, in 1991.

Initially, Linux was distributed as only source code, and after that, as a combination of downloadable floppy disk images.

Distributions started simplifying the installation procedure as it was complicated, specifically during the growing numbers of available software.

History of Linux Distributions

Users admired Linux distributions as replacements to the Microsoft Windows and DOS OSes on proprietary Unix versions, Apple Macintosh Mac OS, and IBM PC compatible systems.

They accepted Linux distributions for low cost and the source code availability for all or most of their software.

Linux has become more famous in embedded and server device markets as compared to the desktop market as of 2017.

It is utilized on over 50% of web servers.

Any
Questions