UNIT-6: Computer Software

Contents:

❑ Introduction, Types of Software, System Software, Application Software,

❑Operating System (Introduction, Objectives of Operating System,

❑Types of OS, Functions of OS, Process Management, Memory Management, File Management, Device Management, Protection and Security, User Interface,

❑Examples of Operating Systems)

❑Software Acquisition

Hardware

Computer Hardware:

- Hardware refers to the physical components of a computer.

- Computer Hardware is any part of the computer that we can touch these parts.

- These are the primary electronic devices used to build up the computer. Examples of hardware in a computer are the Processor, Memory Devices, Monitor, Printer, Keyboard, Mouse, and the Central Processing Unit.
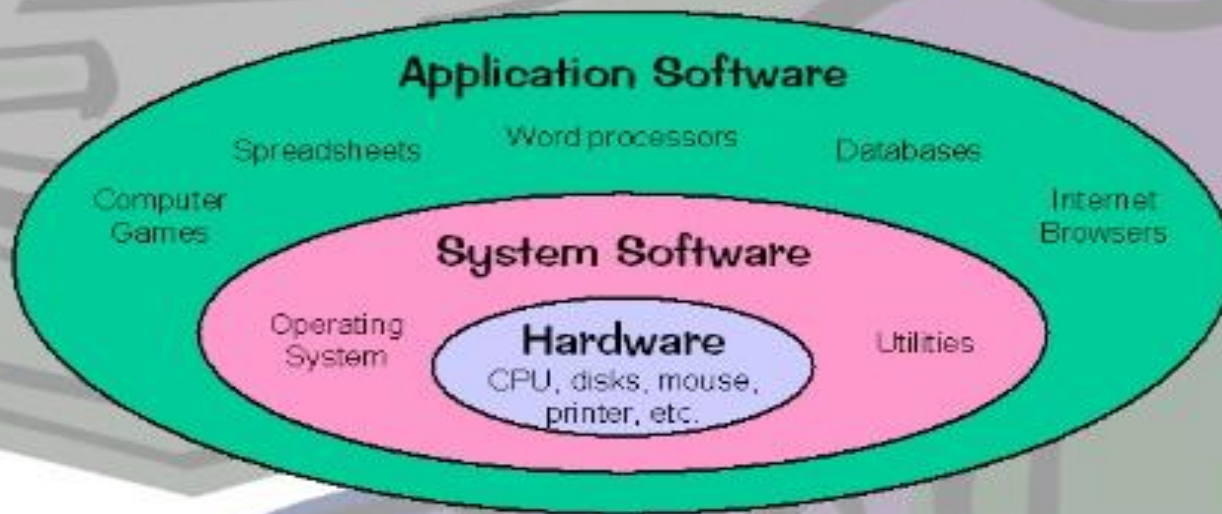
Software

Computer Software:

- Software is a collection of instructions, procedures, documentation that performs different tasks on a computer system.

- we can say also Computer Software is a programming code executed on a computer processor.

- The code can be machine-level code or the code written for an operating system. Examples of software are Ms Word, Excel, Power Point, Google Chrome, Photoshop, MySQL etc.

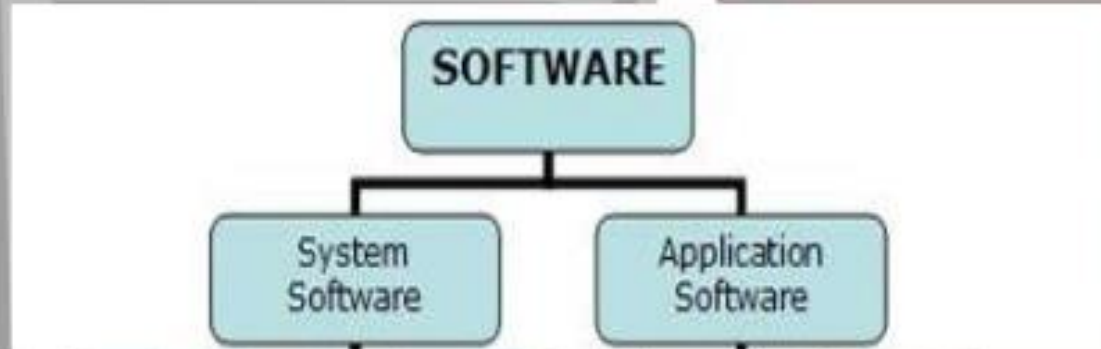| Hardware	Software
Hardware is a physical parts computer that cause processing of data.	Software is a set of instruction that tells a computer exactly what to do.
It is manufactured.	It is developed and engineered.
Hardware can not perform any task without software.	software can not be executed without hardware.
As Hardware are physical electronic devices, we can see and touch hardware.	We can see and also use the software but can't actually touch them.
It has four main categories: input device, output devices, storage, and internal components.	It is mainly divided into System software, Programming software and Application software.

Hardware	Software
Hardware is not affected by computer viruses.	Software is affected by computer viruses.
It can not be transferred from one place to another electrically through network.	But, it can be transferred.
If hardware is damaged, it is replaced with new one.	If software is damaged, its backup copy can be reinstalled.
Ex: Keyboard, Mouse, Monitor, Printer, CPU, Hard disk, RAM, ROM etc.	Ex: Ms Word, Excel, Power Point, Photoshop, MySQL etc.

What is Software?

*The term Software refers to a set of Computer programms, procedures and associated documents describing the programs, and how they are to be used.

Application Software
- Spreadsheets
- Word processors
- Databases
- Computer Games
- Internet Browsers

System Software
- Operating System
- Utilities

Hardware
CPU, disks, mouse, printer, etc.

TYPES OF SOFTWARE

SOFTWARE

- System Software
- Application Software

- Although, the range of software available today is vast and varied, we classify most software into two categories:-
1. System Software
2. Application Software

System Software

* System Software includes the Operating System and all the utilities that enable the computer to function.

* **System software** is a term referring to any computer software which manages and controls the hardware so that application software can perform a task.

*Example:

Operating Systems, Compiler, Loader, Linker, Interpreter.

Application Software

*Application Software is a set of one or more programs, which solves a specific Task.

*Application Software includes programs that do real work for a user.

*Example:
   Payroll systems, Inventory Control, Manage student database, Word Processor, Spreadsheet and Database Management System etc.,

Types of system software

*Operating Software

*Language Translators

*Communication Software

*Utility Software

System Software

Operating Software — Language Translators — Communication Software — Utility Software

Operating System

*Operating System is a software, which makes a computer to actually work.

*It is the software that 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.

*<u>Examples:</u> Windows, Linux, Unix and Mac OS, etc.,

Examples of Operating Software

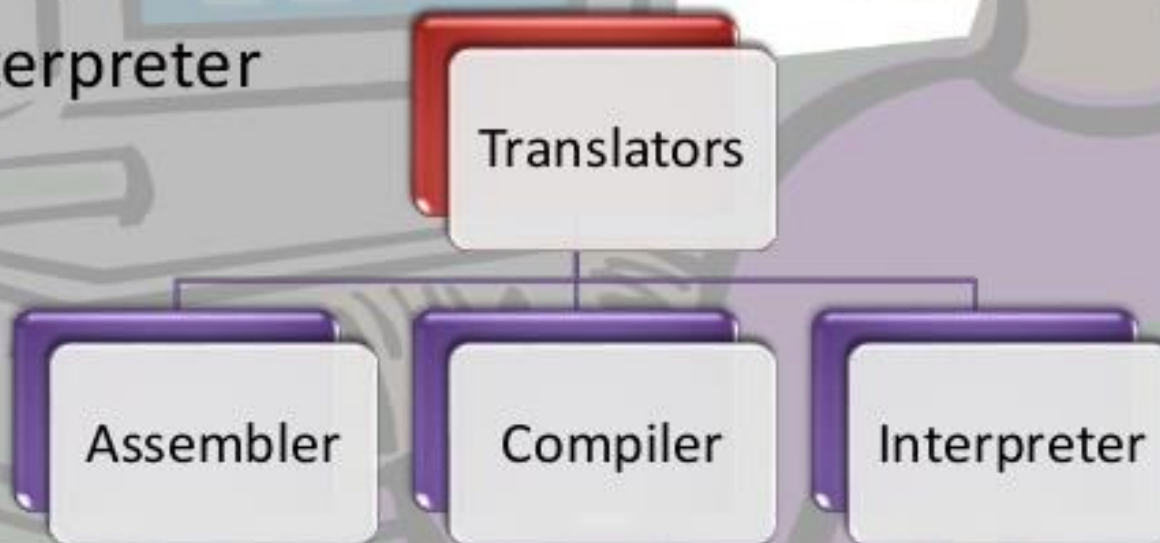UNIT- 6 Computer Software

Language translators

* Language translators is a program that translates a set of instruction code to machine level language.

| High Level Language | → | Translator | → | Machine code |

*For a Machine, it is not possible to understand the natural language, so translators convert it into machine code.

Examples of Language Translators

- There are 3 types of Language translators:-
1. Assembler
2. Compiler
3. Interpreter

Translators

Assembler   Compiler   Interpreter
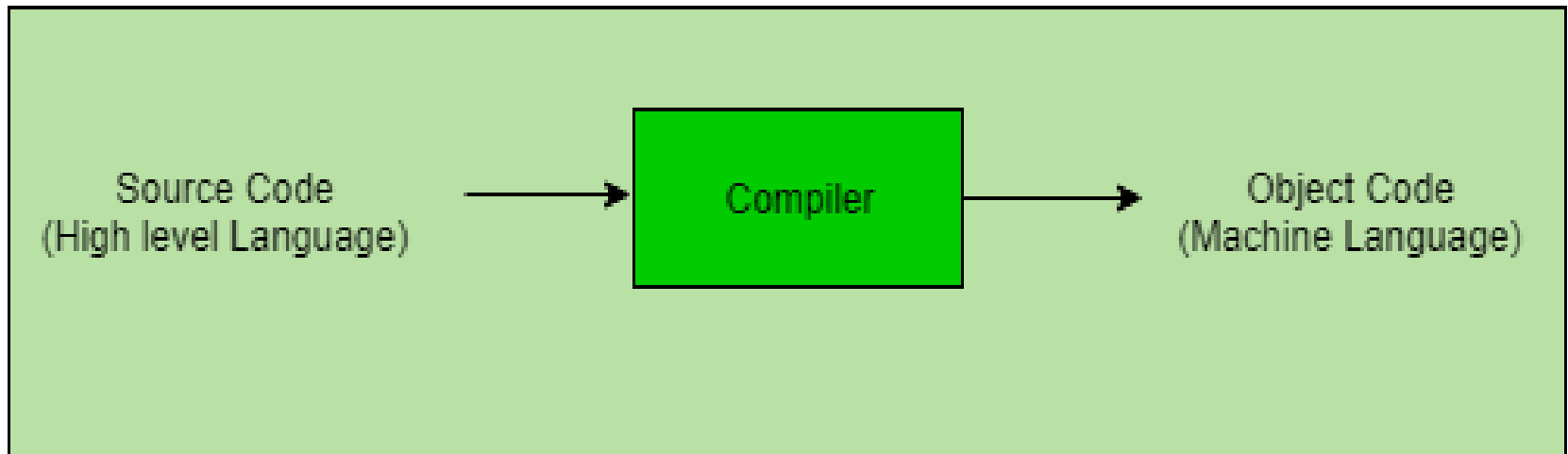
Language Translator

- A **translator** is a programming language processor that converts a **computer** program from one language to another.

- It takes a program written in source code and converts it into machine code.

- The hardware understands a language, which humans cannot understand. So we write programs in high-level language, which is easier for us to understand and remember.

- These programs are then fed into a series of tools and OS components to get the desired code that can be used by the machine.

- This is known as Language Processing System.

Language Translator Cont..

Compiler —
The language processor that reads the complete source program written in high level language as a whole in one go and translates it into an equivalent program in machine language is called aCompiler. **Example:** C, C++, C#, Java

- In a compiler, the source code is translated to object code successfully if it is free of errors. The compiler specifies the errors at the end of compilation with line numbers when there are any errors in the source code. The errors must be removed before the compiler can successfully recompile the source code again.>

Language Translator Cont..

- **Interpreter** –
  The translation of single statement of source program into machine code is done by language processor and executes it immediately before moving on to the next line is called an interpreter.

- If there is an error in the statement, the interpreter terminates its translating process at that statement and displays an error message.

- The interpreter moves on to the next line for execution only after removal of the error.

- An Interpreter directly executes instructions written in a programming or scripting language without previously converting them to an object code or machine code.
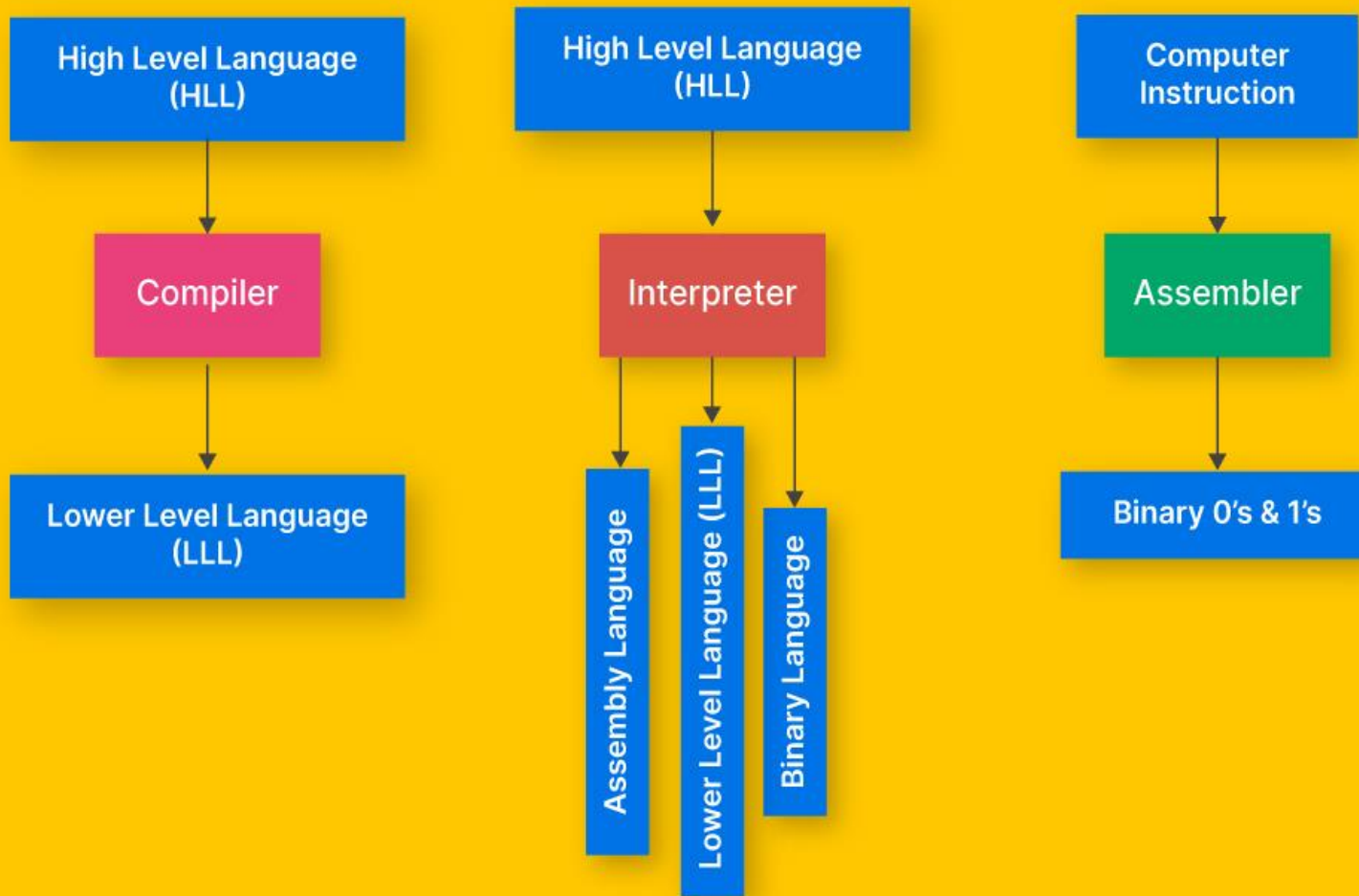 **Example:** Perl, Python and Mat lab.

Language Translator Cont..

- Compilers and interpreters are used to convert High-Level Language into machine language.

- **Assemblers** are used to convert Low-level Language or Assembly Language Code into Machine Language (Binary code)

- **Compiler**, Computer software that translates (compiles) source code written in a high-level language (e.g., C++) into a set of machine-language instructions that can be understood by a digital computer's CPU. ...

- **Compiler** transforms code written in a high-level programming language into the machine code, at once, before program runs, whereas an **Interpreter** coverts each high-level program statement, one by one, into the machine code, during program run

Difference between Compiler and Interpreter –

Compiler	Interpreter
A compiler is a program which coverts the entire source code of a programming language into executable machine code for a CPU.	Interpreter takes a source program and runs it line by line, translating each line as it comes to it.
Compiler takes large amount of time to analyze the entire source code but the overall execution time of the program is comparatively faster.	Interpreter takes less amount of time to analyze the source code but the overall execution time of the program is slower.
Compiler generates the error message only after scanning the whole program, so debugging is comparatively hard as the error can be present any where in the program.	Its Debugging is easier as it continues translating the program until the error is met
Generates intermediate object code.	No intermediate object code is generated.
Examples: C, C++, Java	Examples: Python, Perl

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Programming Software

- It includes tools in form of programs or applications that software developers take in use to create, debug, maintain and support other programs and applications.

- Compiler, debugger, interpreter, linker and text editor are the parts programming software.

Programming Software Cont…

1. Compiler

- They convert high level language program into low level language program.

2. Assembler

- They convert assembly language program into low level language programs.

3. Interpreter

- It processes high level language line by line and simultaneously produce low level programs.

4. Linker

- Most low-level language allow the developer to develop large program containing multiple modules.

- Linker arranges the object code of all the modules that have been generated by the language translator into single program.

Programming Software Cont…

5. Debugger

- It is a software that is used to detect the errors and bugs in programs.
- It locates the position of errors in the program codes.

6. Text editor

- It is a program that allows user to work with texts in a computer system.
- It is used for documentation purpose and enables us to edit information present in existing document or file.
- Exemple: C, C++, C#, BASIC, Java, Python, etc.

Communication Software

- Communication Software is used to provide remote access to systems and exchange files and messages in text , audio or video formats b/w different computers.

Utility Software Example

Utility Software

- **Utility software** is software designed to help to analyze, configure, optimize or maintain a computer.

- Utility software usually focuses on how the computer infrastructure operates.

- It is used to support the computer infrastructure - in contrast to application software, which is aimed at directly performing tasks that benefit ordinary users.

Types of Application software

1. General Purpose Application Software
2. Specific Purpose Application Software

Application Software

General Purpose

Specific Purpose

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General purpose Application Software

- General Purpose software is intended to perform a broader class of functions.

- You can use these softwares for more purposes but limited capabilities for each purpose

- Ex:-Word processing,spreadsheet,Desktop publising(DTP),Graphics packages etc.

Examples of General Purpose

Word Processers

- Word processers can handle every form of writing, aside from calligraphy.

Spreadsheet Programs

- Spreadsheet Programs like Excel handle a significant portion of data processing problems.

Specific Purpose Application Software

- Software which is designed to carry out a specific set of tasks, usually in line with the requirements of a paying customer.

- You can use these softwares for less purposes but with greater capabilities for each purpose.

- Ex:-Web Browser, Media players, calender Programs etc.

Examples of specific Purpose

Web Browser

- A web browser is a specific purpose application software for retrieving, presenting, an traversing informatio resources on the world wide web.

Media Player

- A media player is a specific Purpose application software for playing multimedia files like video movies and music.

What are types of utility software?

- File Viewer.
- File Compressor.
- Diagnostic Utilities.
- Disk Scanner.
- Antivirus.
- **Disk Defragmenter**.
- Backup Utility.
- Data Recovery Utility.

Program Vs Software

- The **software** is a broad term which is designed to perform some specific set of operations.

- A **program** is set of instructions which perform only a specific type of task.

- A **software** consists of bundles of **programs** and data files.

- **Programs in a** specific **software** use these data files to perform a dedicated type of tasks.

- A **program** is an executable code, which serves some computational purpose.

- **Software** is considered to be collection of executable programming code, associated libraries and documentations.

- **Software**, when made for a specific requirement is called **software** product.

Computer Virus

- A computer virus is a set of malicious code or program written to alter the way a computer operates.

- It is usually designed to spread from computer to computer.

- A virus operates by inserting or attaching itself to a legitimate program or document support macros in order to execute the codes.

- Virus has the potential to cause unexpected or damaging effects such as harming system software by corrupting or damaging data.

- Once a virus successfully attach itself to a program, file or document, the virus will remain dormant until circumstances cause computer to execute its code.

- In order for a virus to infect any computer the infected program has to be run in order for the code to be executed.

Computer Virus Cont..

Signs of Computer Virus

- 1. Frequent pop-up windows

- 2. Changes your homepage

- 3. Mass email being sent from your email account

- 4. Frequent crashes

- 5. Slow computer performance
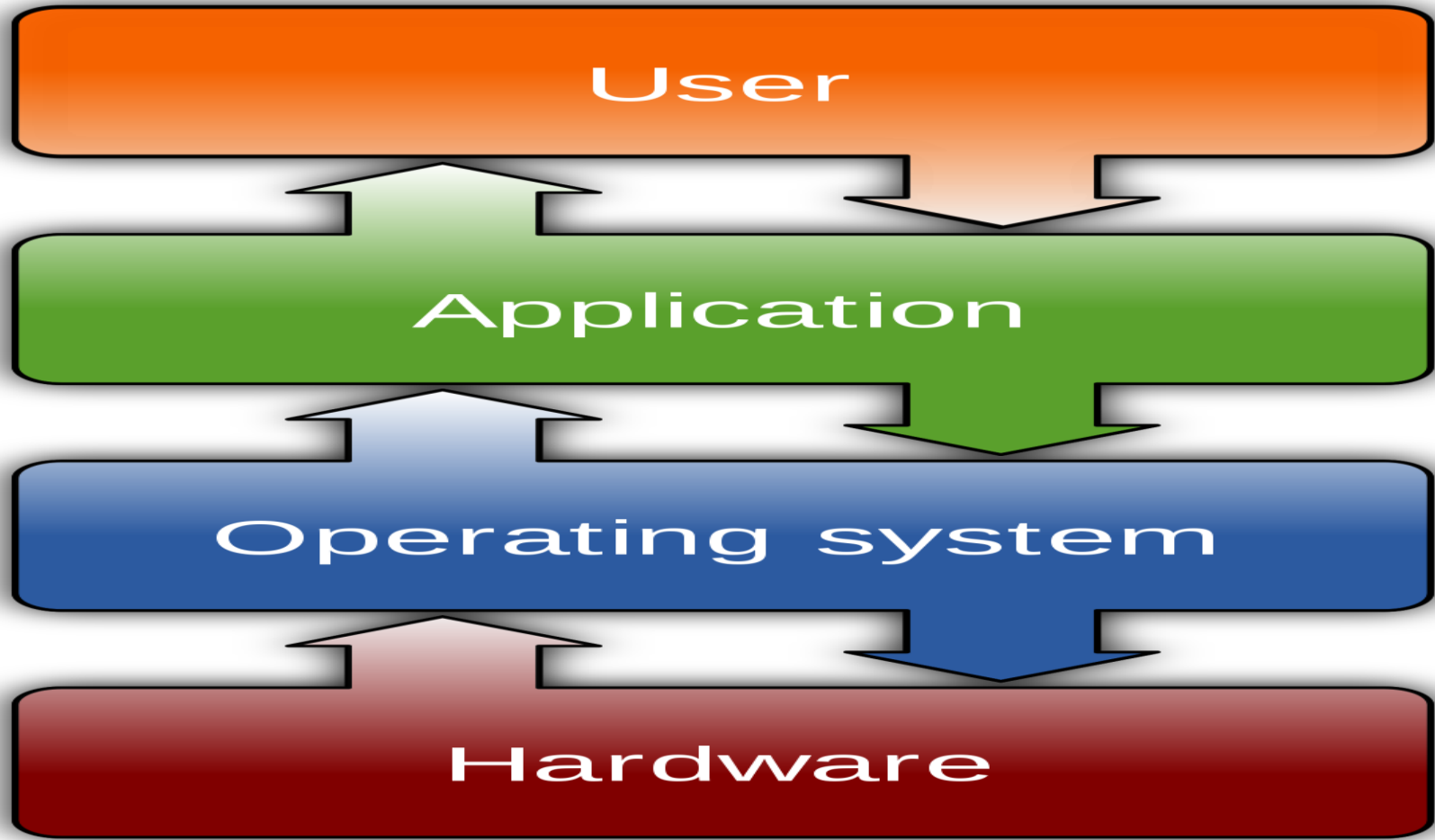
Introduction to Operating System

- An operating system (OS) is a collection of software that manages computer hardware resources and provides common services for computer programs.

- The operating system is a vital component of the system software in a computer system.

- An operating system is a software that makes the computer hardware to work while the computer hardware provides 'raw computer power', the operating system is responsible for making computer more useful for users.

- The operating system provides an interface for users to communicate with computer.

- It also manages the use of hardware, resources and enables proper implementation of application programs.

- In short, the operating system is the master of control program of a computer.

Why to Learn Operating System?

- An Operating System (OS) is an interface between a computer user and computer hardware.

- An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

- Some popular Operating Systems include Linux Operating System, Windows Operating System, VMS, OS/400, AIX, z/OS, etc.

Operating System Cont..
How IS IT?

Objectives of Operating System

- To make the computer system convenient to use in an efficient manner.
- To hide the details of the hardware resources from the users.
- To provide users a convenient interface to use the computer system.
- To act as an intermediary between the hardware and its users, making it easier for the users to access and use other resources.
- To manage the resources of a computer system.
- To keep track of who is using which resource, granting resource requests, and mediating conflicting requests from different programs and users.
- To provide efficient and fair sharing of resources among users and programs.
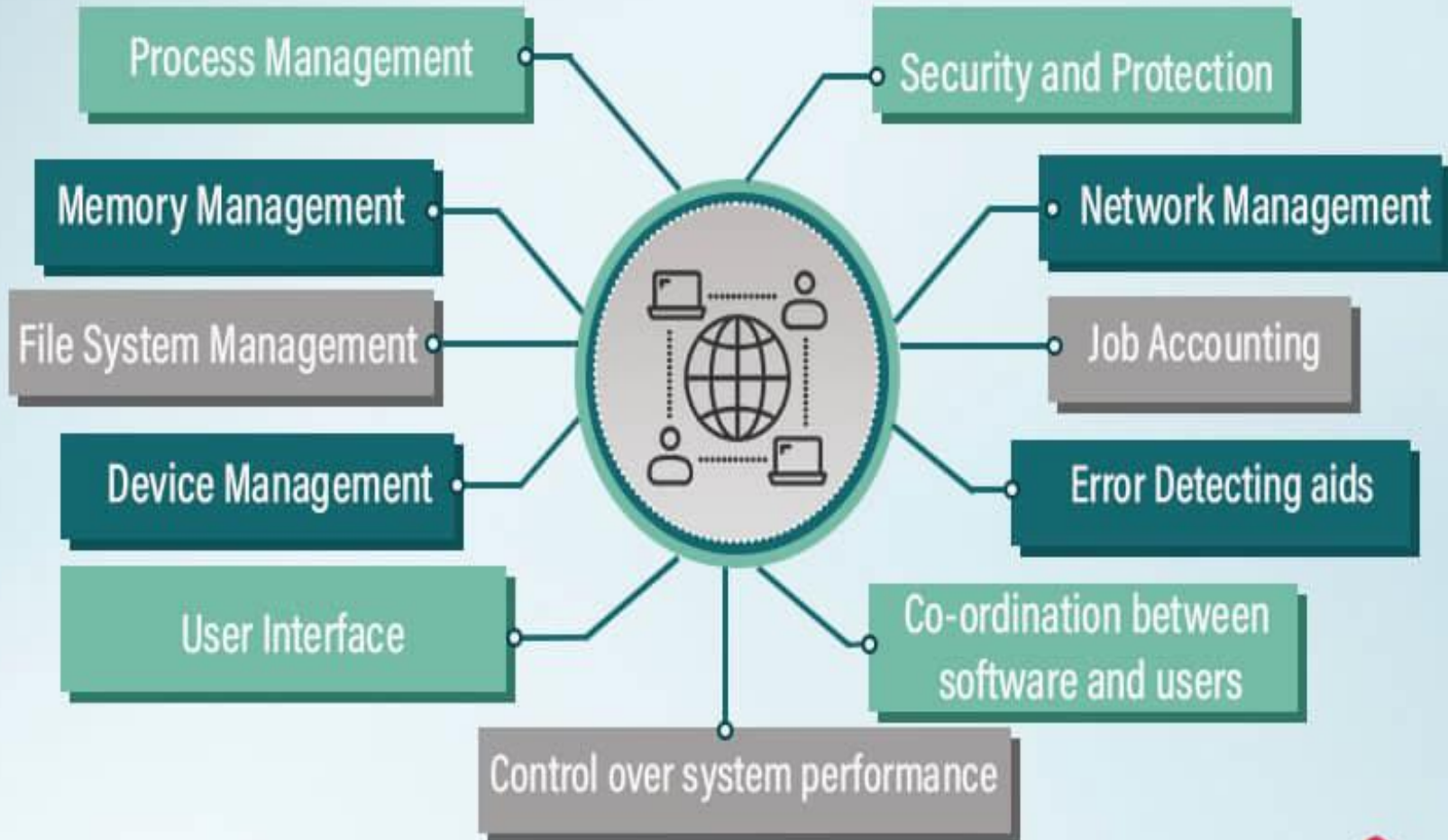
Characteristics of Operating System

- **Memory Management** − Keeps track of the primary memory, i.e. what part of it is in use by whom, what part is not in use, etc. and allocates the memory when a process or program requests it.

- **Processor Management** − Allocates the processor (CPU) to a process and deallocates the processor when it is no longer required.

- **Device Management** − Keeps track of all the devices. This is also called I/O controller that decides which process gets the device, when, and for how much time.

- **File Management** − Allocates and de-allocates the resources and decides who gets the resources.

- **Security** − Prevents unauthorized access to programs and data by means of passwords and other similar techniques.

- **Job Accounting** − Keeps track of time and resources used by various jobs and/or users.

- **Control Over System Performance** − Records delays between the request for a service and from the system.

- **Interaction with the Operators** − Interaction may take place via the console of the computer in the form of instructions. The Operating System acknowledges the same, does the corresponding action, and informs the operation by a display screen.

- **Error-detecting Aids** − Production of dumps, traces, error messages, and other debugging and error-detecting methods.

- **Coordination Between Other Software and Users** − Coordination and assignment of compilers, interpreters, assemblers, and other software to the various users of the computer systems.

Functions of Operating System

- The main function of operating system is to manage the resources such as memory and files of the computer system.

- The operating system also resolved the conflicts that arises when two users or programs request the same resources at the same time.

- Therefore it is also called resource manager of computer.

- Some of the important functions of operating system are:

Functions of Operating System

Functions of Operating System Cont..

- 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

- Memory management refers to management of Primary Memory or Main Memory.

- Main memory is a large array of words or bytes where each word or byte has its own address.

- Main memory provides a fast storage that can be accessed directly by the CPU. For a program to be executed, it must in the main memory.

- *An Operating System does the following activities for memory management −*

- Keeps tracks of primary memory, i.e., what part of it are in use by whom, what part are not in use.

- In multiprogramming, the OS decides which process will get memory when and how much.

- Allocates the memory when a process requests it to do so.

- De-allocates the memory when a process no longer needs it or has been terminated.

Processor Management

- In multiprogramming environment, the OS decides which process gets the processor when and for how much time.
- This function is called **process scheduling**.
- *An Operating System does the following activities for processor management* −
- Keeps tracks of processor and status of process.
- The program responsible for this task is known as **traffic controller**.
- Allocates the processor (CPU) to a process.
- De-allocates processor when a process is no longer required.

Device Management

- An Operating System manages device communication via their respective drivers.

- **It does the following activities for device management −**

- 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.

- **An Operating System does the following activities for file management −**

- 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.

Other Functions of OS cont…

- **Security** − By means of password and similar other techniques, it prevents unauthorized access to programs and data.

- **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.

- **Error detecting aids** − Production of dumps, traces, error messages, and other debugging and error detecting aids.

- **Coordination between other software's and users** − Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

Other Functions of OS cont…

- **Job Management:**
  - OS manages the jobs waiting to be processed.
- **Batch Processing:**
  - Data are accumulated and processed in groups.
  - Most of the tasks of OS are grouped and performed one by one.
- **On-line Processing:**
  - Data are processed instantaneously.
  - Most on-line operating systems have multi-user and multitasking capabilities.
- **Data Management:**
  - OS manages the storage and retrieval of data.

Other Functions of an OS Cont…

- **Virtual Storage:**
  - Using this method the capacity of main memory increases without actually increasing its size.
  - This is done by breaking a job into sequences of instructions, called pages or segments, and keeping only a few of these in main memory at a time; the remaining are kept on secondary storage devices

- **Input/ Output Management:**
  - OS manages the input to and output from a computer system. This applies to the flow of data among computers, terminals, and other devices such as printers.
  - Application programs used the operating system extensively to handle input and output devices as needed.

Operating Systems

- Most important programs that run on a computer.

- It perform basic tasks,
  - such as recognizing input from the keyboard,
  - sending output to the display screen,
  - keeping tracks of files and directories on the disk
  - controlling peripheral devices such as disk drives and printers.

- Most commonly used operating systems :
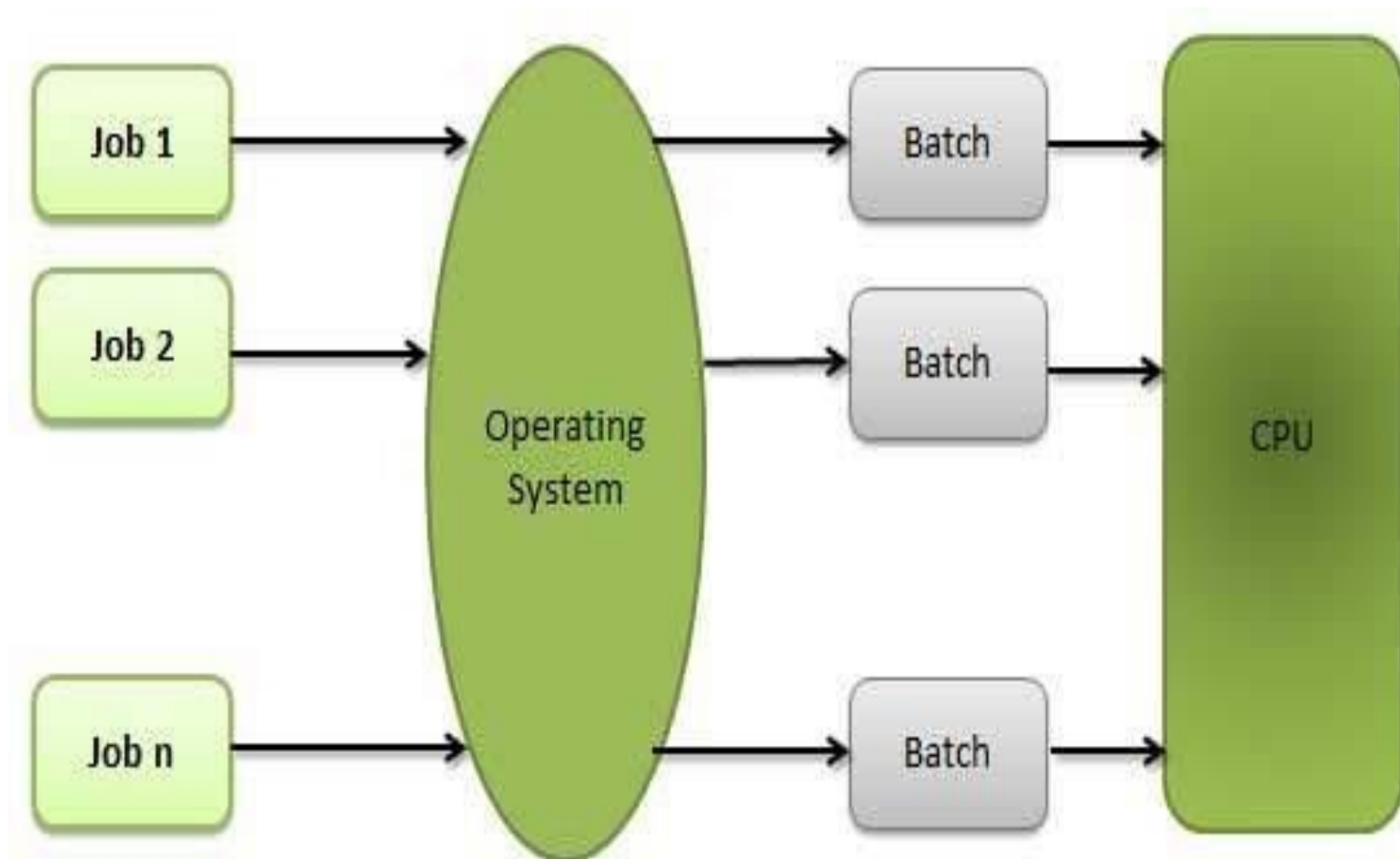 - Microsoft Windows, DOS, Xenix, Mac OS, OS/2, UNIX, MVS, etc

Types of Operating System

- There are several types of Operating Systems which are mentioned below.
- Batch Operating System
- Multi-Programming System
- Multi-Processing System
- Multi-Tasking Operating System
- Time-Sharing Operating System
- Distributed Operating System
- Network Operating System
- Real-Time Operating System

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1. Batch Operating System

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

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

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

- **Examples:** Payroll **System**, Bank Statements, etc. Each task is given some time to execute so that all the tasks work smoothly. Each user gets the time of CPU as they use a single **system**.

1. Batch Processing Operating System Cont..

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1. Batch Processing Operating System Cont..

- **Advantages of Batch Operating System**
- It is very difficult to guess or know the time required for any job to complete. Processors of the batch systems know how long the job would be when it is in the queue.
- Multiple users can share the batch systems.
- The idle time for the batch system is very less.
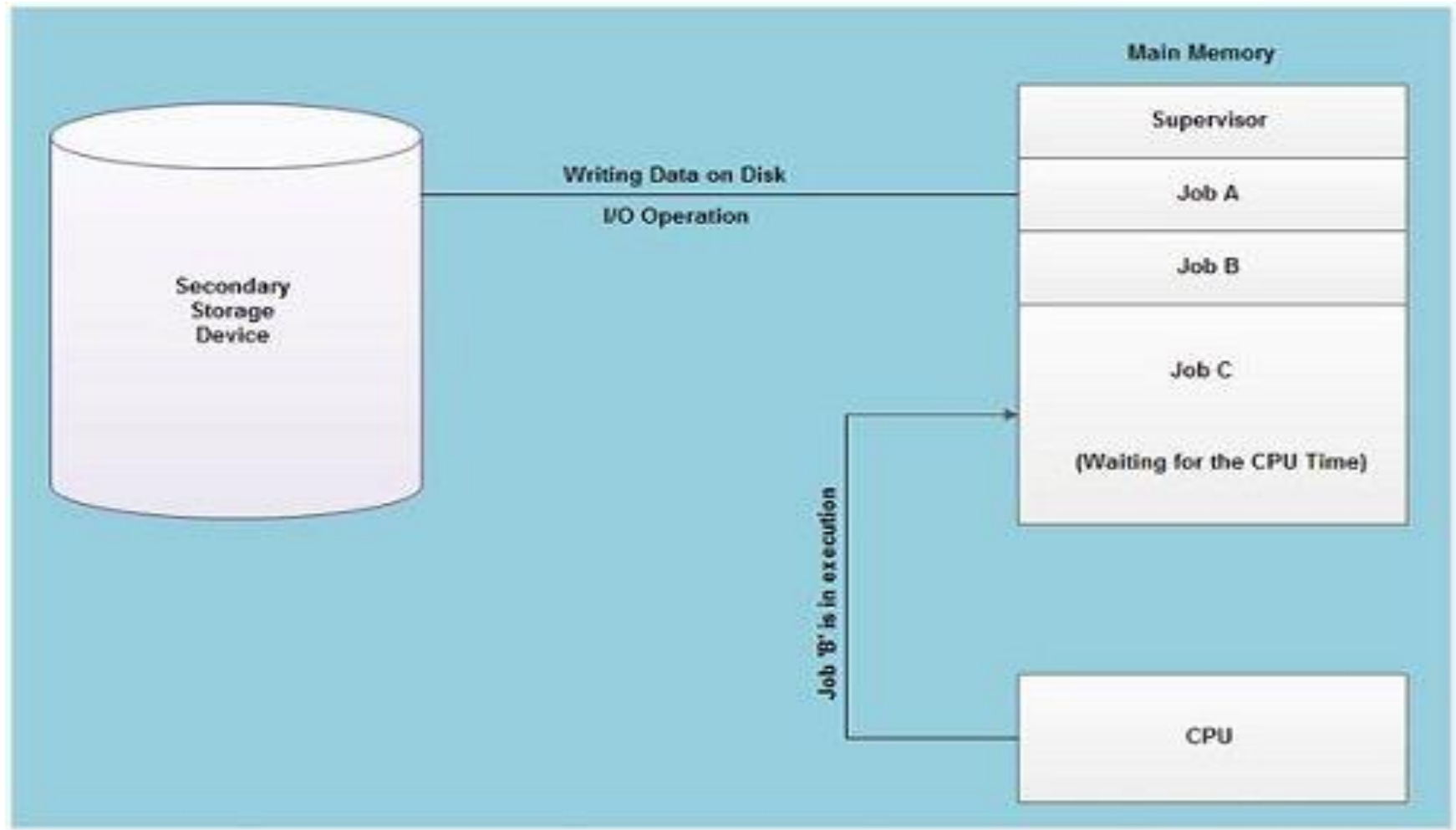- It is easy to manage large work repeatedly in batch systems.
- **Disadvantages of Batch Operating System**
- The computer operators should be well known with batch systems.
- Batch systems are hard to debug.
- It is sometimes costly.
- The other jobs will have to wait for an unknown time if any job fails.

2. Multi-Programming Operating System

- Multiprogramming Operating Systems can be simply illustrated as more than one program is present in the main memory and any one of them can be kept in execution.
- This is basically used for better execution of resources.
- **Advantages of Multi-Programming Operating System**
- Multi Programming increases the Throughput of the System.
- It helps in reducing the response time.
- **Disadvantages of Multi-Programming Operating System**
- There is not any facility for user interaction of system resources with the system.

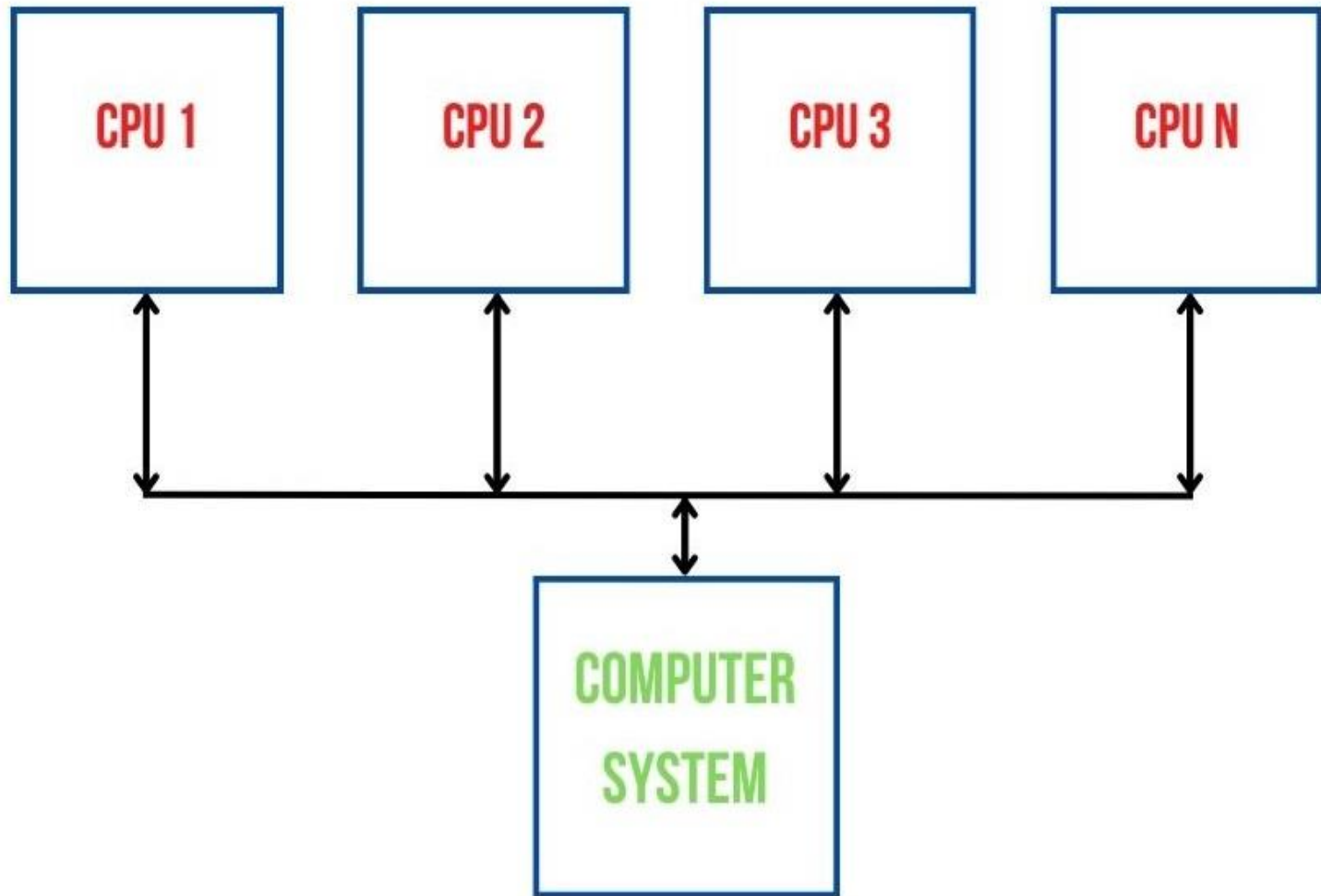# 2. Multi-Programming Operating System

2. Multi-Programming Operating System

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- **Disadvantages of Multi-Programming Operating System**

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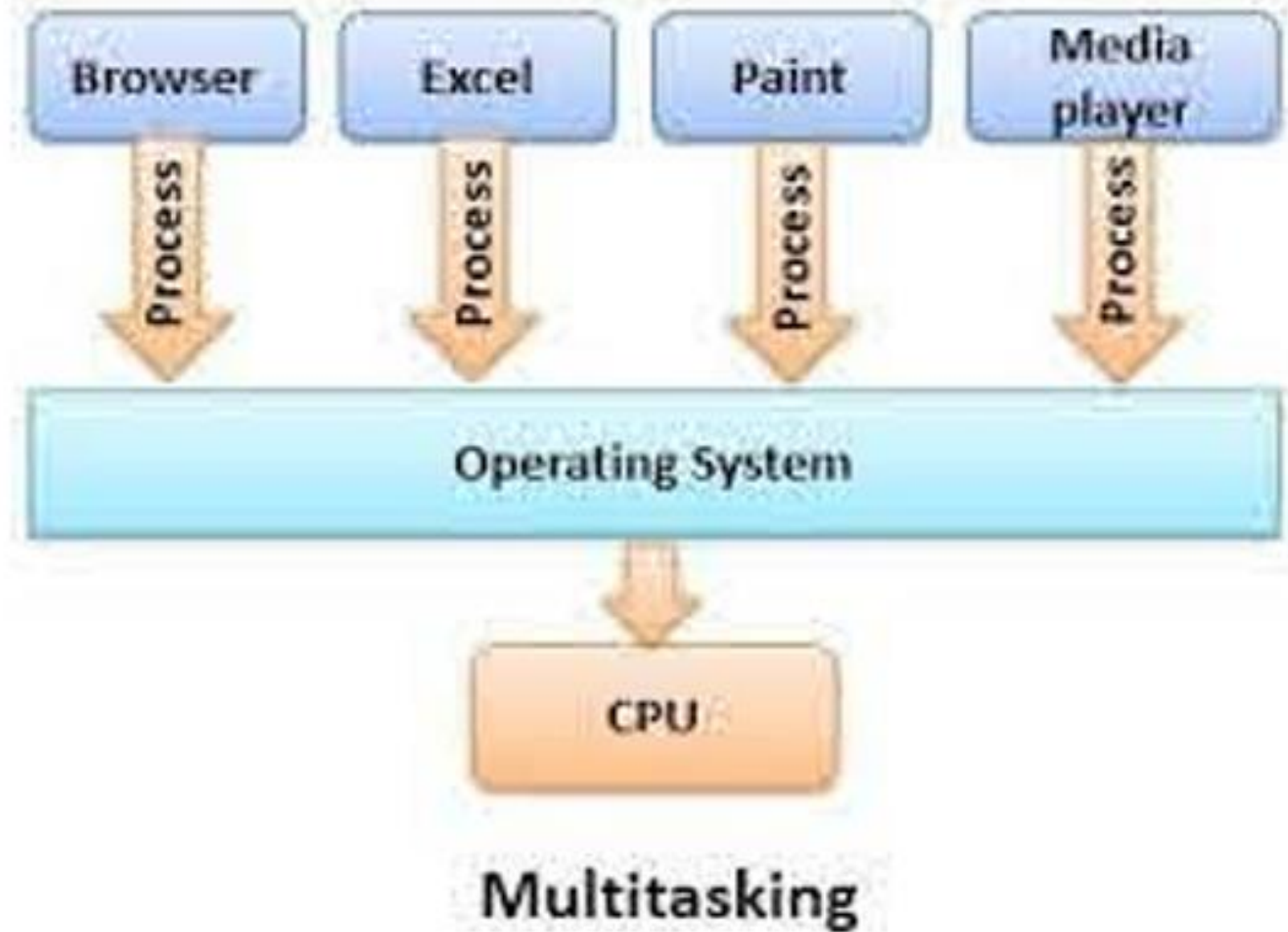
3. Multi-Processing Operating System

- Multi-Processing Operating System is a type of Operating System in which more than one CPU is used for the execution of resources. It betters the throughput of the System.

- **Advantages of Multi-Processing Operating System**

- It increases the throughput of the system.

- As it has several processors, so, if one processor fails, we can proceed with another processor.

- **Disadvantages of Multi-Processing Operating System**

- Due to the multiple CPU, it can be more complex and somehow difficult to understand.

MULTIPROCESSING
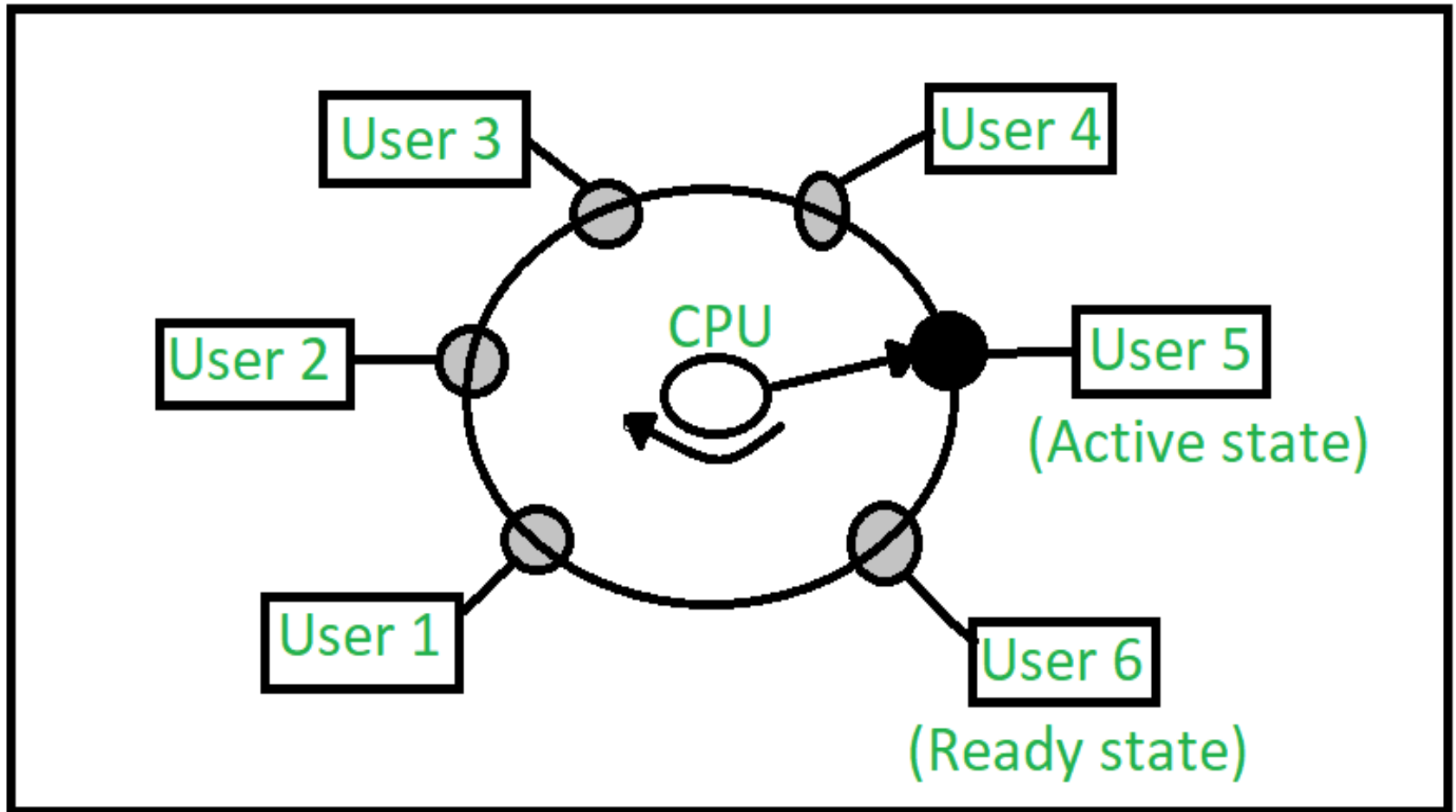
4. Multi-Tasking Operating System

- Multitasking Operating System is simply a multiprogramming Operating System with having facility of a Round-Robin Scheduling Algorithm.

- It can run multiple programs simultaneously.

- There are two types of Multi-Tasking Systems which are listed below.

- Preemptive Multi-Tasking

- Cooperative Multi-Tasking

- **Advantages of Multi-Tasking Operating System**

- Multiple Programs can be executed simultaneously in Multi-Tasking Operating System.

- It comes with proper memory management.

- **Disadvantages of Multi-Tasking Operating System**

- The system gets heated in case of heavy programs multiple times.

Multitasking

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5. Time-Sharing Operating Systems

- Each task is given some time to execute so that all the tasks work smoothly.

- Each user gets the time of the CPU as they use a single system. These systems are also known as Multitasking Systems.

- The task can be from a single user or different users also. The time that each task gets to execute is called quantum. After this time interval is over OS switches over to the next task.

5. Time-Sharing Operating Systems Cont..

Examples of Time-Sharing OS with explanation

- **IBM VM/CMS**: IBM VM/CMS is a time-sharing operating system that was first introduced in 1972. It is still in use today, providing a virtual machine environment that allows multiple users to run their own instances of operating systems and applications.

- **TSO (Time Sharing Option)**: TSO is a time-sharing operating system that was first introduced in the 1960s by IBM for the IBM System/360 mainframe computer. It allowed multiple users to access the same computer simultaneously, running their own applications.

- **Windows Terminal Services**: Windows Terminal Services is a time-sharing operating system that allows multiple users to access a Windows server remotely. Users can run their own applications and access shared resources, such as printers and network storage, in real-time.

5. Time-Sharing Operating Systems Cont..

- **Advantages of Time-Sharing OS**
- Each task gets an equal opportunity.
- Fewer chances of duplication of software.
- CPU idle time can be reduced.
- Resource Sharing: Time-sharing systems allow multiple users to share hardware resources such as the CPU, memory, and peripherals, reducing the cost of hardware and increasing efficiency.
- Improved Productivity: Time-sharing allows users to work concurrently, thereby reducing the waiting time for their turn to use the computer. This increased productivity translates to more work getting done in less time.
- Improved User Experience: Time-sharing provides an interactive environment that allows users to communicate with the computer in real time, providing a better user experience than batch processing.
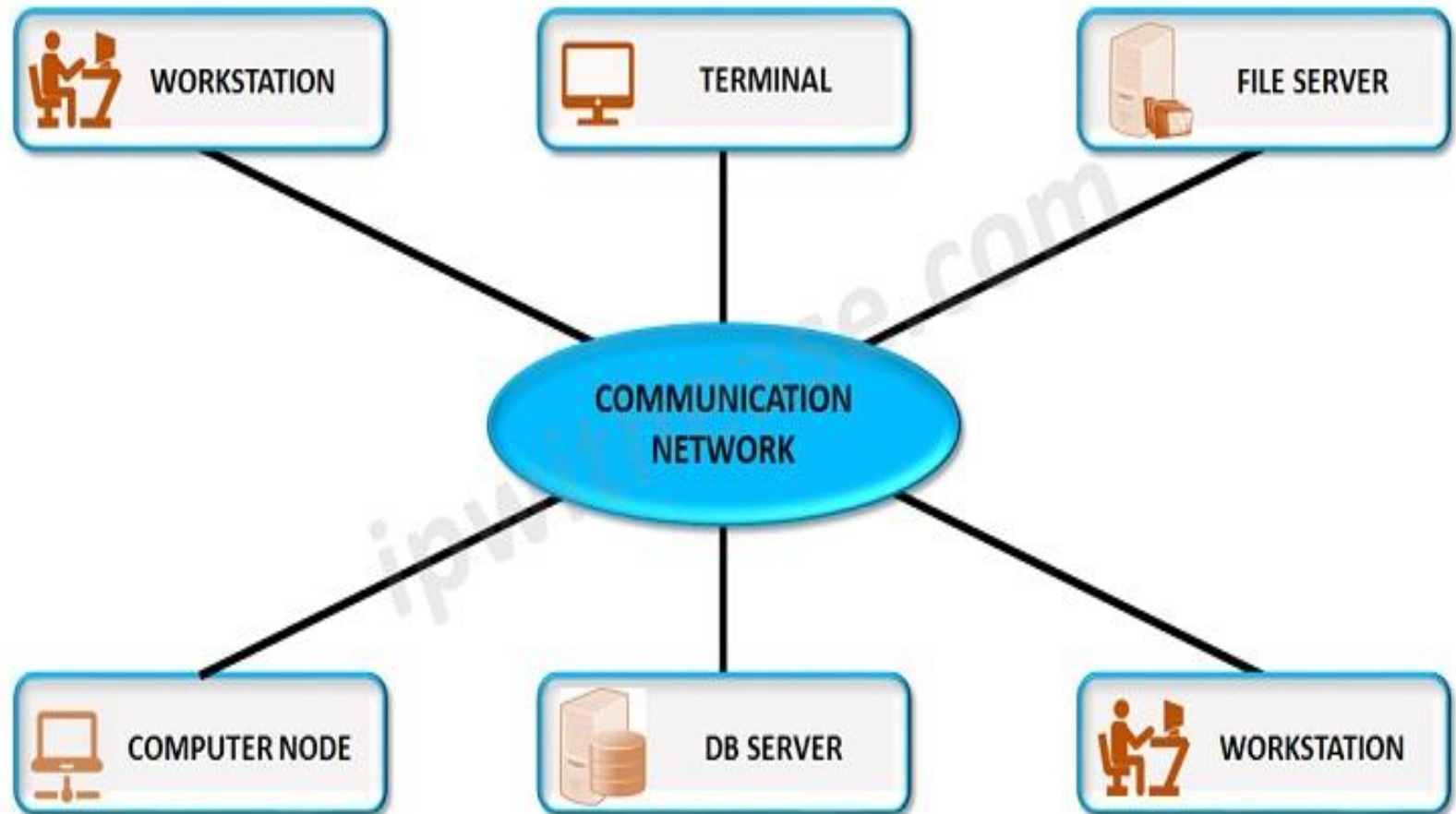- **Disadvantages of Time-Sharing OS**
- Reliability problem.
- One must have to take care of the security and integrity of user programs and data.
- Data communication problem.
- High Overhead: Time-sharing systems have a higher overhead than other operating systems due to the need for scheduling, context switching, and other overheads that come with supporting multiple users.
- Complexity: Time-sharing systems are complex and require advanced software to manage multiple users simultaneously. This complexity increases the chance of bugs and errors.
- Security Risks: With multiple users sharing resources, the risk of security breaches increases. Time-sharing systems require careful management of user access, authentication, and authorization to ensure the security of data and software.

6. Distributed Operating System

- These types of operating system is a recent advancement in the world of computer technology and are being widely accepted all over the world and, that too, at a great pace.

- Various autonomous interconnected computers communicate with each other using a shared communication network.

- Independent systems possess their own memory unit and CPU. These are referred to as loosely coupled systems or distributed systems.

- These systems' processors differ in size and function.

- The major benefit of working with these types of the operating system is that it is always possible that one user can access the files or software which are not actually present on his system but some other system connected within this network i.e., remote access is enabled within the devices connected in that network.

- **Examples of Distributed Operating Systems are** LOCUS, etc.

DISTRIBUTED OPERATING SYSTEM

WORKSTATION

TERMINAL

FILE SERVER

COMMUNICATION NETWORK

COMPUTER NODE

DB SERVER
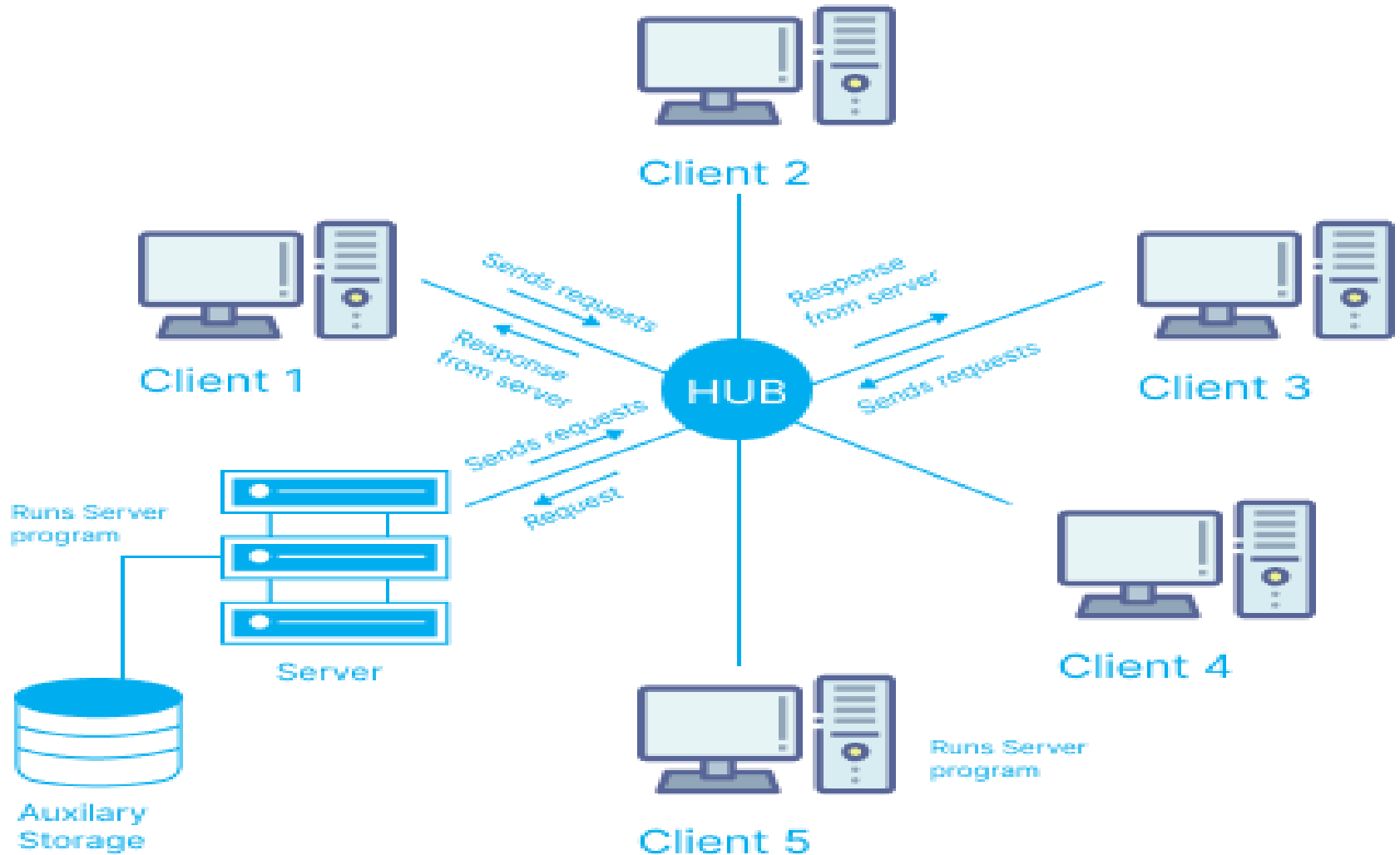
WORKSTATION

https://ipwithease.com

6. Distributed Operating System Cont..

- **Advantages of Distributed Operating System**
- Failure of one will not affect the other network communication, as all systems are independent of each other.
- Electronic mail increases the data exchange speed.
- Since resources are being shared, computation is highly fast and durable.
- Load on host computer reduces.
- These systems are easily scalable as many systems can be easily added to the network.
- Delay in data processing reduces.
- **Disadvantages of Distributed Operating System**
- Failure of the main network will stop the entire communication.
- To establish distributed systems the language is used not well-defined yet.
- These types of systems are not readily available as they are very expensive. Not only that the underlying software is highly complex and not understood well yet.

7. Network Operating System

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

- These types of operating systems allow shared access to files, printers, security, applications, and other networking functions over a small private network.

- One more important aspect of Network Operating Systems is that all the users are well aware of the underlying configuration, of all other users within the network, their individual connections, etc. and that's why these computers are popularly known as tightly coupled systems.

- **Examples of Network Operating Systems are** Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare, BSD, etc.

7. Network Operating System Cont..

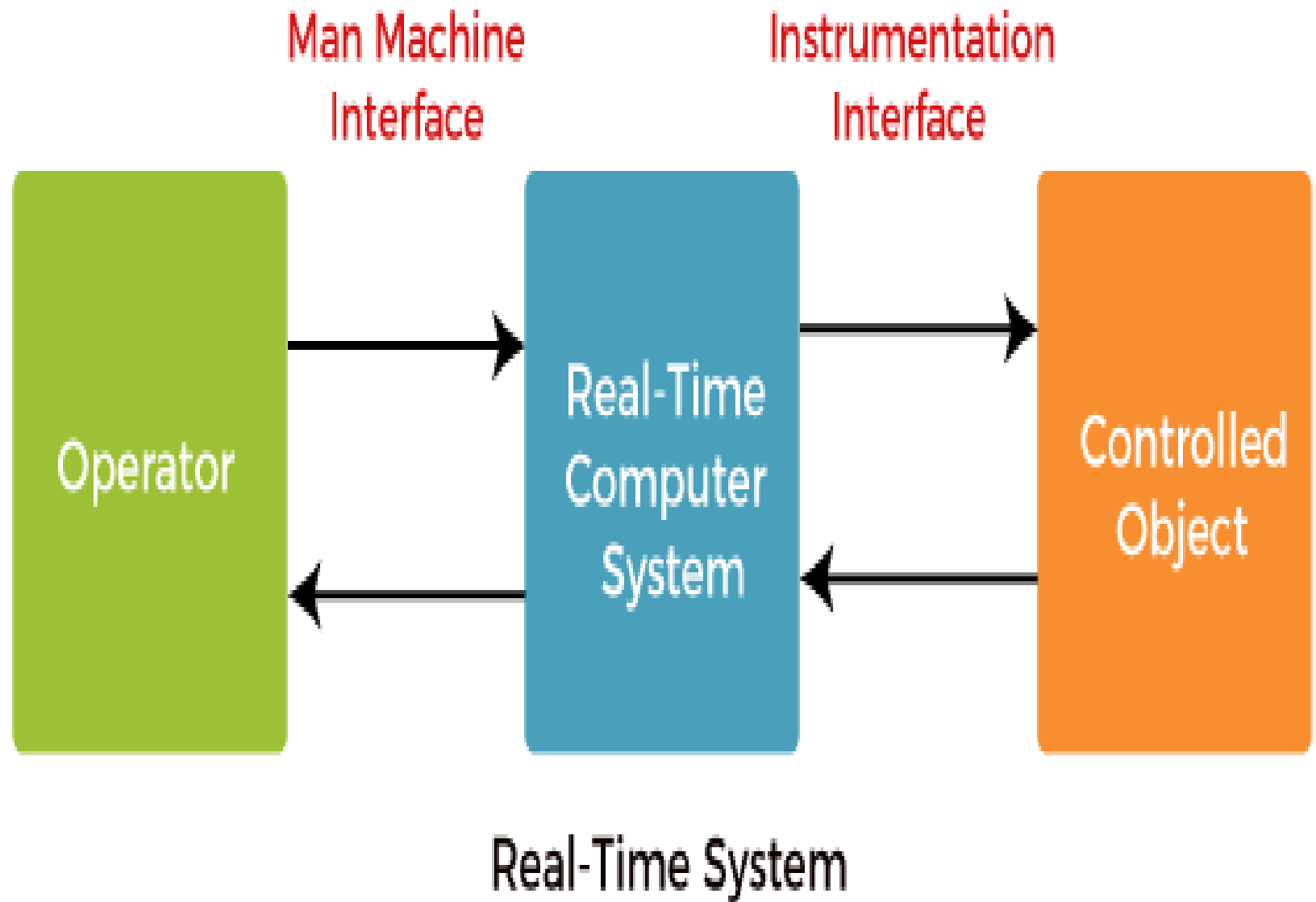UNIT- 6 Computer Software   1/16/2024

7. Network Operating System Cont..

- **Advantages of Network Operating System**
- Highly stable centralized servers.
- Security concerns are handled through servers.
- New technologies and hardware up-gradation are easily integrated into the system.
- Server access is possible remotely from different locations and types of systems.
- **Disadvantages of Network Operating System**
- Servers are costly.
- User has to depend on a central location for most operations.
- Maintenance and updates are required regularly.

8. Real-Time Operating System

- These types of OSs serve real-time systems. The time interval required to process and respond to inputs is very small. This time interval is called **response time**.
Real-time systems are used when there are time requirements that are very strict like missile systems, air traffic control systems, robots, etc.

- **Types of Real-Time Operating Systems**

- **Hard Real-Time Systems:**
Hard Real-Time OSs are meant for applications where time constraints are very strict and even the shortest possible delay is not acceptable. These systems are built for saving life like automatic parachutes or airbags which are required to be readily available in case of an accident. Virtual memory is rarely found in these systems.

- **Soft Real-Time Systems:**
These OSs are for applications where time-constraint is less strict.

- **Examples of Real-Time Operating Systems are** Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems, etc.

Real-Time System

8. Real-Time Operating System Cont..

- ## Advantages of RTOS
- **Maximum Consumption:** Maximum utilization of devices and systems, thus more output from all the resources.
- **Task Shifting:** The time assigned for shifting tasks in these systems is very less. For example, in older systems, it takes about 10 microseconds in shifting from one task to another, and in the latest systems, it takes 3 microseconds.
- **Focus on Application:** Focus on running applications and less importance on applications that are in the queue.
- Real-time **operating system in** the **embedded system:** Since the size of programs is small, RTOS can also be used in embedded systems like in transport and others.
- **Error Free:** These types of systems are error-free.
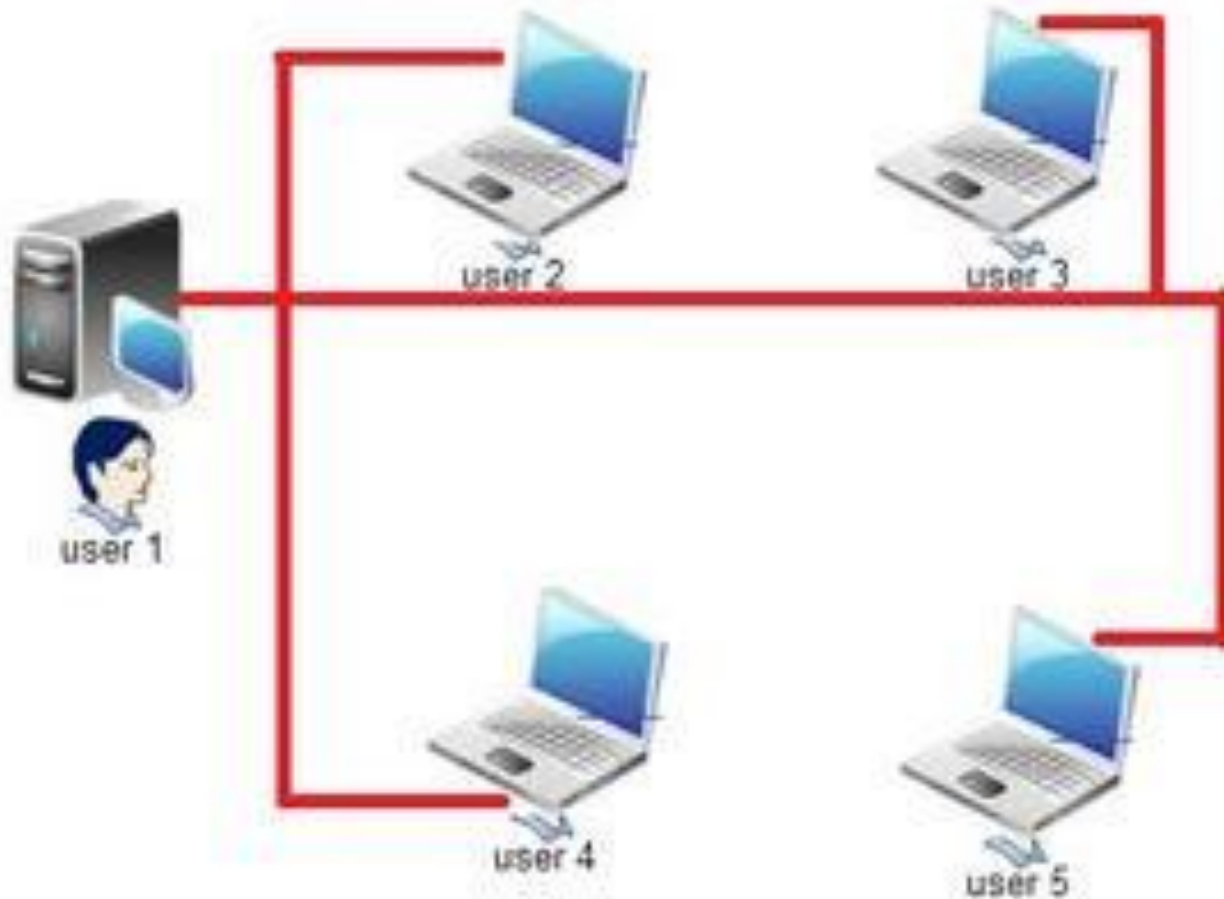- **Memory Allocation:** Memory allocation is best managed in these types of systems.

- ## Disadvantages of RTOS
- **Limited Tasks:** Very few tasks run at the same time and their concentration is very less on a few applications to avoid errors.
- **Use heavy system resources:** Sometimes the system resources are not so good and they are expensive as well.
- **Complex Algorithms:** The algorithms are very complex and difficult for the designer to write on.
- **Device driver and interrupt signals:** It needs specific device drivers and interrupts signal to respond earliest to interrupts.
- **Thread Priority:** It is not good to set thread priority as these systems are very less prone to switching tasks.

9. Multi user Operating System

- The multi user operating system enables multiple users to use the resource of a computer system at the same time.

- It allows number of users to work simultaneously on the same computer.

- It is an **operating system** that permits several **users** to utilize the programs that are concurrently running on a single network server.

- The single network server is termed as "Terminal server". "Terminal client" is a software that supports **user** sessions.

- *Examples include UNIX, MVS, etc. It is usually implemented by following multiterminal configuration*.

- In the configuration, a single powerful computer is connected to multiple terminals through serial ports.

- The computer system is responsible for processing different requests generated by various terminals at a time.

- Control computer is equipped with fast processor and a memory of large capacity for catering to multiple requests of end-users.

- **Example** : Linux, Unix, VM-386, etc.

UNIT- 6 Computer Software

9. Multi user Operating System Cont..

Advantages

a) Allows resources of computer to be utilized in efficient manner.

b) It enhances the overall productivity of various users by providing simultaneous access to various computer resources.

Disadvantages

a) It is complex and hence difficult to handle and maintain.

b) It may result in inconsistent data if activities of a user aren't protected from other users.

c) It is required to have robust security mechanism.
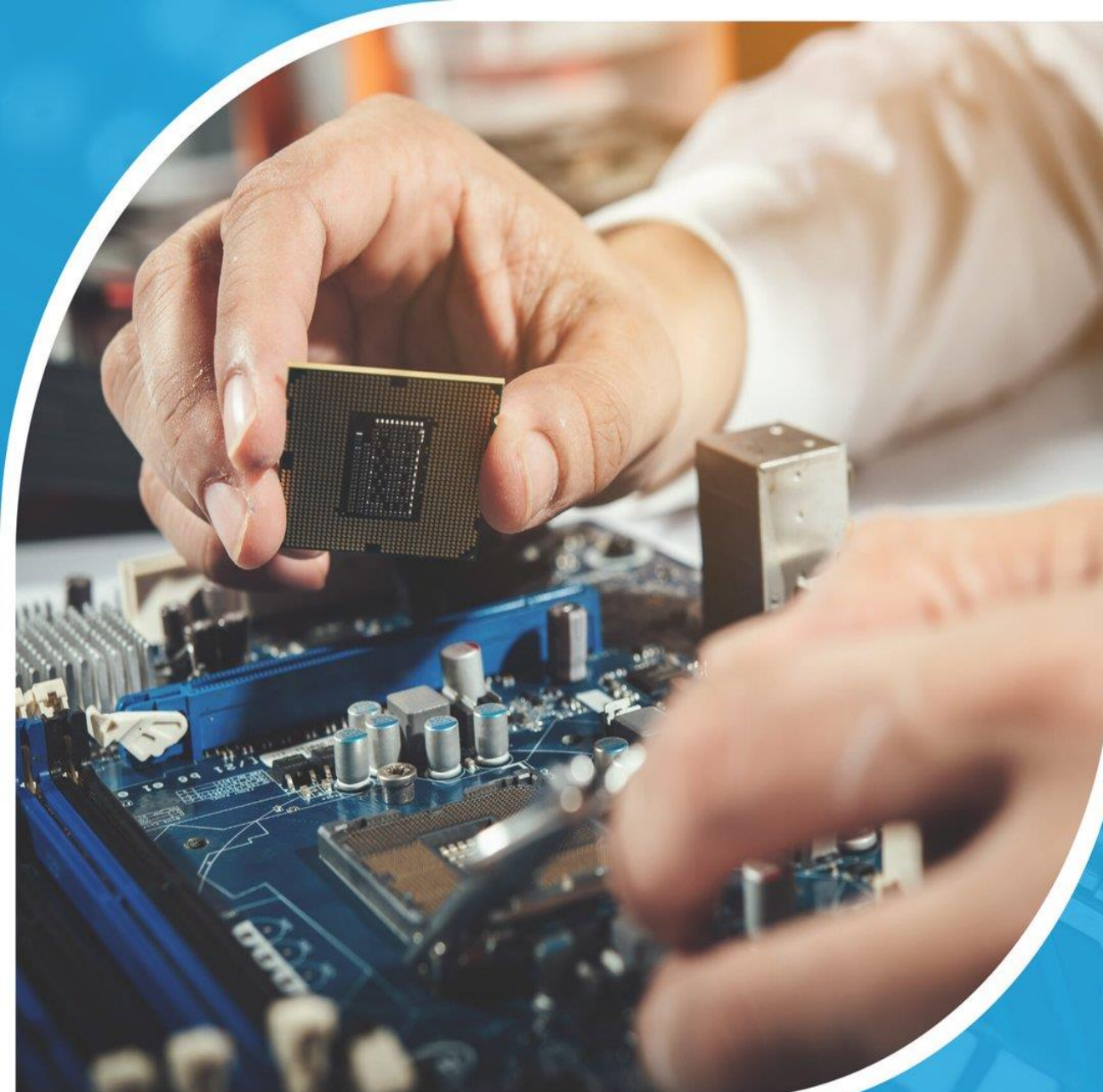
10. Embedded Operating System

- It is somewhat similar to real-time OS.
- The embedded OS is installed on an embedded computer system which is used for performing computational task in electronic devices.
- This OS provides limited functionality that is required for corresponding embedded computer system.
- Example: Palm OS, Window CE.

Advantages:

a) It allows implementation of embedded system in efficient manner.

b) System with embedded OS is easy to use and maintain.

Disadvantages:

a) It is possible to perform some specific operation with those OS.

b) This OS cannot be used in frequently changing environment.

Embedded System

10. Embedded Operating System

- **Features.**

- In contrast to being an all-purpose computer that can be used for various tasks, the embedded systems are designed to perform a specific task.

- Additionally, some of them have real-time performance limitations due to reasons related to safety and usability.

Characteristics of Embedded System :

- Requires continuous execution.
- It ought to have high accessibility and dependability.
- Created around an ongoing working framework.
- For the most part, have simple and a diskless activity, ROM boot.
- Intended for one explicit assignment.
- It should be associated with peripherals to interface info and yield gadgets.
- Offers high unwavering quality and strength.
- Required negligible UI
- Restricted memory, ease, less force utilization.
- It needn't bother with any optional memory in PC.

10. Embedded Operating System

- **Advantages of Embedded System :**
- Simple to deliver higher creation.
- Less costs for per bit of resultant.
- It has not many interconnections.
- It has Better steady and Higher speed.
- It has Higher dependable
- To use for one errand.
- Versatile because of little in size.
- It has Low force utilization and Better exactness in outcome.
- To upgrade assets, for example, memory and chip.
- It assists with developing item quality.
- It can bear a wide assortment of climate.
- Less inclined to reprise mistakes.
- To deliver constant reaction.
- It has no UI and Lesser repetition.
- No much information stockpiling.
- To run pre arranged program for client application.
- As an installed framework ordinarily plays out a basic job that doesn't change, the necessities for the working framework are less difficult.

10. Embedded Operating System

- **Disadvantages of Embedded System :**
  There are a few restrictions of installed framework, as follows.
- Subsequent to creating installed framework, you can't make any alteration, improvement or up degree.
- Hard to keep up.
- Hard to take a back-up of implanted documents.
- You need to reset all setting, due to happen any issue in the framework.
- Investigating is Harder.
- Harder to move information from one framework to other framework.
- Constraints for equipment, because of make it for explicit undertaking.
- Less force supply sturdiness.
- Restricted assets for memory.
- To require higher improvement endeavors for planning an installed framework.
- Need to long an ideal opportunity to advertise

Open Source Operating System

- An Open Source Operating System is an operating system whose copyright holders or owners enable the third parties or the user to use, see, and edit the operating system's source code.

- We can create an operating system according to our requirements by altering the source code of an open-source operating system.

What is an Open-Source Operating System?

- An **Operating System** whose source code is open to all and anyone can use, view, or edit is called an open source operating system.

- Similarly, an operating system whose source code is not accessible by the public is known as a closed source operating system.

- Popular examples of closed operating systems are **Microsoft Windows**, **Mac OS**, and **Apple iOS**.

How does an Open-Source Operating System Work?

- The Open-Source Operating System works similarly to that any other closed operating system.

- The difference between the open-source operating system and the closed-source operating system is that in the open-source operating system, you can alter an open system according to your needs provided that you have enough technical knowledge.

How does an Open-Source Operating System Work? Cont..

- **GitHub** is a platform where you can find the source code of open-source projects uploaded by the developer.

- To alter an open-source operating system, first, you need to fork the repository (repository can be thought of as a folder in the cloud where all the files related to a project are stored) containing the source code of the open-source operating system. Forking a project will create a copy of the project, now you can edit or make changes to the file.

- Making the changes in the forked version will not affect the original source code.

- On the other hand, you can not alter a closed-source operating system. As the source code of an open-source operating system is publicly available, you can read the source and alter the operating system according to your needs.

Types of Open Source Operating Systems

- **Linux-based open source operating system** - The open source operating system which is based on the Linux kernel is known as Linux based open source operating system. (Kernel is responsible for the interface between the computer's hardware and its processes).
Examples: Ubuntu, Kali Linux, Linux mint, etc

- **Non-Linux based operating system** - An open source operating system that is not based on a Linux kernel operating system is known as a non-Linux based operating system. Example: FreeDOS, ReactOS, Haiku, etc.

Advantages of Open-Source Operating System

- **Cost efficient:** Open source operating systems are usually free or sometimes less than the closed source operating system.
- **Reliable and efficient:** As the source code of the operating system is open for all, Anyone around the globe can make changes to the source code and resolve any bugs or make some improvements to the source code. Open-source operating systems are more efficient and reliable because developers are also the users of the operating system and the bugs or issues are resolved.
- **Flexibility:** The source code of the open-source operating system is available for everyone. The operating system can be modified or customized according to the requirements of the user.
- **Developer Community** Open source operating systems usually have their own community, where developers around the globe gather in a place to work with the source code, improve, and help other developers in the community.

Disadvantages of Open-Source Operating System

- **Security risk:** The source code is available for everyone and anyone can analyze the source code and search for vulnerabilities and break into the operating system easily.

- **Complicated:** Using an open-source operating system requires a little technical knowledge as compared to using a closed-source operating system such as Windows and Mac OS.

- **No support:** As Open source operating systems are open-sourced and no company or organization is responsible for the maintenance of the operating system, there will be no help desk to address the problems encountered while using an open-source operating system. Even though open source operating systems have a developer community, unlike the community of closed source operating systems, There might be chances of not getting a proper diagnosis of the problem.

Examples of open source programs

- Linux operating system.
- Android by Google.
- Open office.
- **Firefox** browser.
- VCL media player.
- Moodle.
- ClamWinantivirus.
- WordPress content management system.

Free Open Source Software (FOSS)

- Free and open-source software is a term used to refer to groups of software consisting of both free software and open-source software, where anyone is freely licensed to use, copy, study, and change.

- Free Open Source Software (FOSS), sometimes also called just Open Source or Free Software, is software that is licensed to be free to use, modify, and distribute.

- Most FOSS licenses also include a kind of legal **Golden Rule** that requires any changes, such as fixes and enhancements, to be released under the same license.

- This creates the all important trust in developers and users that generates large, sustainable communities that continue to grow the software capability over time

- *Because open source software features open code, more programmers are able to view the code, create new functionality, and fix bugs. This follows the same natural way that science has developed over time."*

Open Source Software

- Open Source Software is something that you can modify as per your needs, and share with others without any licensing violation burden.

- When we say Open Source, the source code of the software is available publicly with Open Source licenses like GNU (GPL) which allows you to edit the source code and distribute it. Read these licenses and you will realize that these licenses are created to help us.

- Coined by the development environments around software produced by open collaboration of software developers on the internet.

- Later specified by the Open Source Initiative (OSI).

- It does not explicitly state ethical values, besides those directly associated with software development.

Open Source Software Cont..

Advantages:

- **Cost:** Open source software is typically free to use, modify and distribute.

- **Customization**: The source code of open source software is available to everyone, allowing users to modify and customize it to suit their needs.

- **Community support**: Open source software often has a large community of developers and users who contribute to its development and provide support.

- **Transparency**: The source code of open source software is open for everyone to see, making it easier to identify and fix bugs and vulnerabilities.

- **Flexibility:** Open source software can be used on a wide range of platforms and devices.

Open Source Software Cont..

Disadvantages:

- **Support**: While open source software does have a large community of developers and users, it may not always have the same level of professional support as commercial software.

- **Compatibility:** Open source software may not always be compatible with other software applications and hardware devices.

- **Security:** Because the source code of open source software is available to everyone, it may be easier for malicious actors to identify and exploit vulnerabilities.

- **Complexity**: Open source software can be more complex and difficult to use than commercial software, especially for non-technical users.

- **Documentation:** Open source software may not always have the same level of documentation and user guides as commercial software.

Free Software

- "Free software" means software that respects users' freedom and community. Roughly, it means that the users have the freedom to run, copy, distribute, study, change and improve the software. The term "free software" is sometimes misunderstood—it has nothing to do with price. It is about freedom.

- **Advantages:**

- **Cost:** Free software is typically free to use, modify and distribute.

- **Freedom:** Free software is often accompanied by a set of ethical principles that promote users' freedom to use, study, modify, and share the software.

- **Collaboration**: Free software often encourages collaboration among developers and users, leading to faster development and better quality software.

- **Transparency**: Free software is often developed in a transparent way, with the source code and development process available for public scrutiny.

- **Flexibility**: Free software can be used on a wide range of platforms and devices.

Free Software Cont..

Disadvantages:

- **Support**: While free software does have a community of developers and users, it may not always have the same level of professional support as commercial software.

- **Compatibility**: Free software may not always be compatible with other software applications and hardware devices.

- **Security:** Because free software is available for everyone to use and modify, it may be easier for malicious actors to identify and exploit vulnerabilities.

- **Complexity:** Free software can be more complex and difficult to use than commercial software, especially for non-technical users.

- **Documentation:** Free software may not always have the same level of documentation and user guides as commercial software.

Differences between Open source software and Free Open Source Software

- Open-Source Software: What's the Difference? While freeware is free software, it nevertheless maintains its copyright.

- Alternatively, open-source software is both free and publicly available to use, modify, repackage and redistribute with no limitations.

- Free software licenses are also open source, but not all open source licenses require developers to share their code.

- Some permit developers to use open source code to create closed source applications, such as the MIT License. These non-copyleft licenses are known as permissive licenses

What is the difference between open source and free source software?

- Freeware software is an entirely different category of software which are distributed free of cost.

- On the other hand, free and open-source software is somewhat similar with a few small differences.

- **Free software has no restrictions while open-source software does apply a few restrictions to the users sometimes**

Free vs.Open Source Software

FREE SOFTWARES	OPEN SOURCE SOFTWARES
• Freedom to run program for any purpose • Freedom to study about program • Freedom to distribute copes of software. • Freedom to modify/improve program and release improvements to public	• It has distribution of License. • Availability of Source Code. • Free Distribution • Integrity of Authors Source Code.

Software Acquisition

- **Software acquisition** is generally a multi-organization endeavor concerned with the funding, management, engineering, system integration, deployment and long-term support of
  large **software** systems.

- Different kinds of software are made available for use to users in different ways.

- The user may have to purchase the software, can download for free from the Internet, or can get it bundled along with the hardware which is called system acquisition.

- Nowadays with the advent(development) of Cloud computing, many application software are also available on the cloud for use through the Internet, e.g. Google Docs.

Software Acquisition Cont..

The different ways in which the software are made available to users are:

- **Retail Software** is an off-the-shelf software sold in retail stores. It comes with printed manuals and installation instructions. For example, Microsoft Windows operating system.
- **OEM Software** stands for "Original Equipment Manufacturer" software.
- It refers to software that is sold, and bundled with hardware. Microsoft sells its operating system as OEM software to hardware dealers.
- OEM software is sold at a reduced price, without the manuals, packaging, and installation instructions. For example, Dell computers are sold with the "Windows 10" OS pre-loaded on them.
- **Demo-Software** is designed to demonstrate what a purchased version of the software is capable of doing and provides a restricted set of features.To use the software, the user must buy a fully- functional version.
- EG. Typing master, USB Flash Data Recovery Software, etc.
- **Shareware** is a program that the user is allowed to try for free, for a specified period of time, as defined in the license. It is downloadable from the Internet.
- When the trial period ends, the software must be purchased or uninstalled.
- Eg. Different Antivirus Software, IDM etc

Software Acquisition Cont..

- **Freeware** is software that is free for personal use. It is downloadable from the Internet.

- The commercial use of this software may require a paid license. The author of the freeware software is the owner of the software, though others may use it for free. The users abide by the license terms, where the user cannot make changes to it, or sell it to someone else.

- E.g. Linux, Debian, Apache, PostgreSQL, different Videogames, etc.

- **Public Domain Software** is free software.   Unlike freeware, public domain software does not have a copyright owner or license restrictions.

- The source code is publicly available for anyone to use.   Public domain software can be modified by the user.

- Eg.SHA3, Diamond Trust of London(video game),7-Zip, etc.

- **Open-Source Software** is software whose source code is available and can be customized and altered within the specified guidelines laid down by the creator.

- Unlike public domain software, open-source software has restrictions on their use and modification, redistribution limitations, and copyrights.

- Eg. Linux, Apache, Firefox, OpenOffice.

Software Acquisition and Reuse Cont..

- Software **reuse** is the process of implementing or updating software **systems** using existing software assets.

- The systematic development of **reusable** components.

- The systematic **reuse** of these components as building blocks to create new **system**.

- **Software reuse** is the **process** of implementing or updating **software systems** using existing **software** components.

- A good **software reuse process** facilitates the increase of productivity, quality, and reliability, and the decrease of costs and implementation time.