

B.C.A. (Sem – IV)

B.C.A. - 404

Operating System

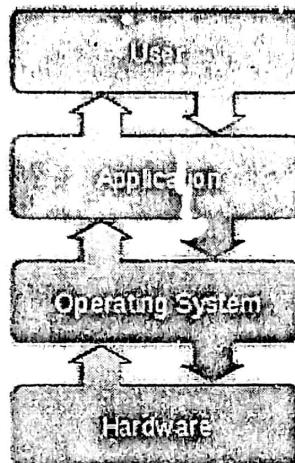
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Unit - 1

Unit-1Definition and meaning of operating system: -

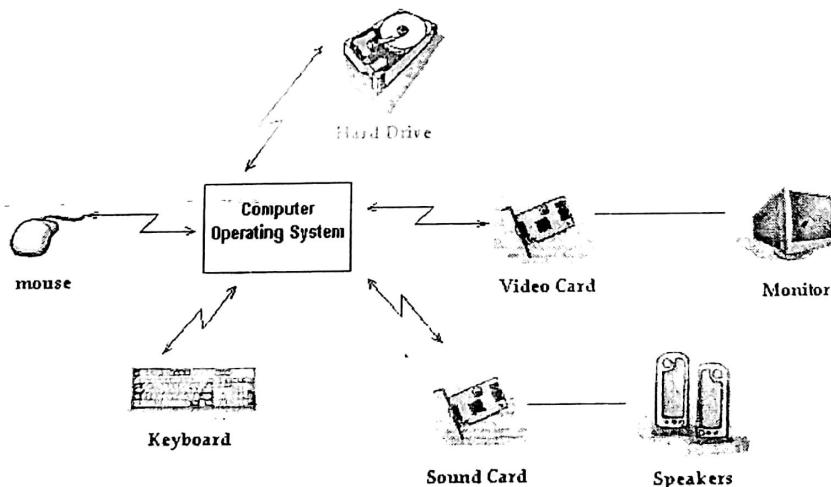
- **Definition:** "An Operating System is program that behaves like intermediary between the user of a computer and the computer hardware."
- The purpose of an operating system is to provide an environment in which a user can execute programs in suitable and efficient manner.
- An operating system is a program that manages the computer hardware.
- A computer system can be divided into four components.
 1. Hardware
 2. Operating system
 3. Application program
 4. User



- The hardware is central processing unit, memory, input / output devices etc...
- The application program is word, excel, database applications, compiler, browsers etc...
- The operating system is Linux, Windows 98, Windows XP, and Windows Vista etc...
- Operating system is the most important Command of system software in a computer system.
- Without an operating system, a user cannot run an application program on their computer.

Functions of operating system: -

- Users can interact directly with the operating system through a user interface such as a command language or a graphical user interface (GUI).
- It performs interface between your computer and the user.
- A computer is consisting of several parts including your monitor, keyboard, mouse, and other parts.
- The operating system provides an interface to these parts using "drivers".

Operating System Interfaces

- A driver is a specially written program which understands the operation of the device it interfaces to, such as a printer, video card, sound card or CD ROM drive.
- It translates commands from the operating system or user into commands understood by the component computer part it interfaces with.
- System tools (programs) used to monitor computer performance, debug problems, or maintain parts of the system.
- A set of functions which programs may use to perform specific tasks especially relating to interfacing with computer system components.

User interface (CUI): -

- The CUI stands for Character-Based User Interface.
- A CUI was most common interface types associated with old computers.
- CUI allows the user to interact with the machine, giving it commands and viewing text on screen.
- Early computers operated on CUI and they are most popular user interface.
- It typically used two colours black and white screens with only text.
- In CUI the users can use a keyboard as input device for navigation (using hotkeys) and enter the commands.
- There was no need for a mouse in CUI interface.
- As Character-Based User Interfaces do not support such advanced hardware.
- Most modern operating systems feature a modified version of a GUI called a command line interface.
- As experienced users can often work faster with character-oriented interface. Learning to use DOS or Linux is a good place to begin.

The screenshot shows a Windows Command Prompt window titled 'Administrator: C:\Windows\system32\cmd.exe'. The window displays a list of files and folders in the current directory. The list includes various application setup files, fonts, and utility programs. Some of the visible entries include:

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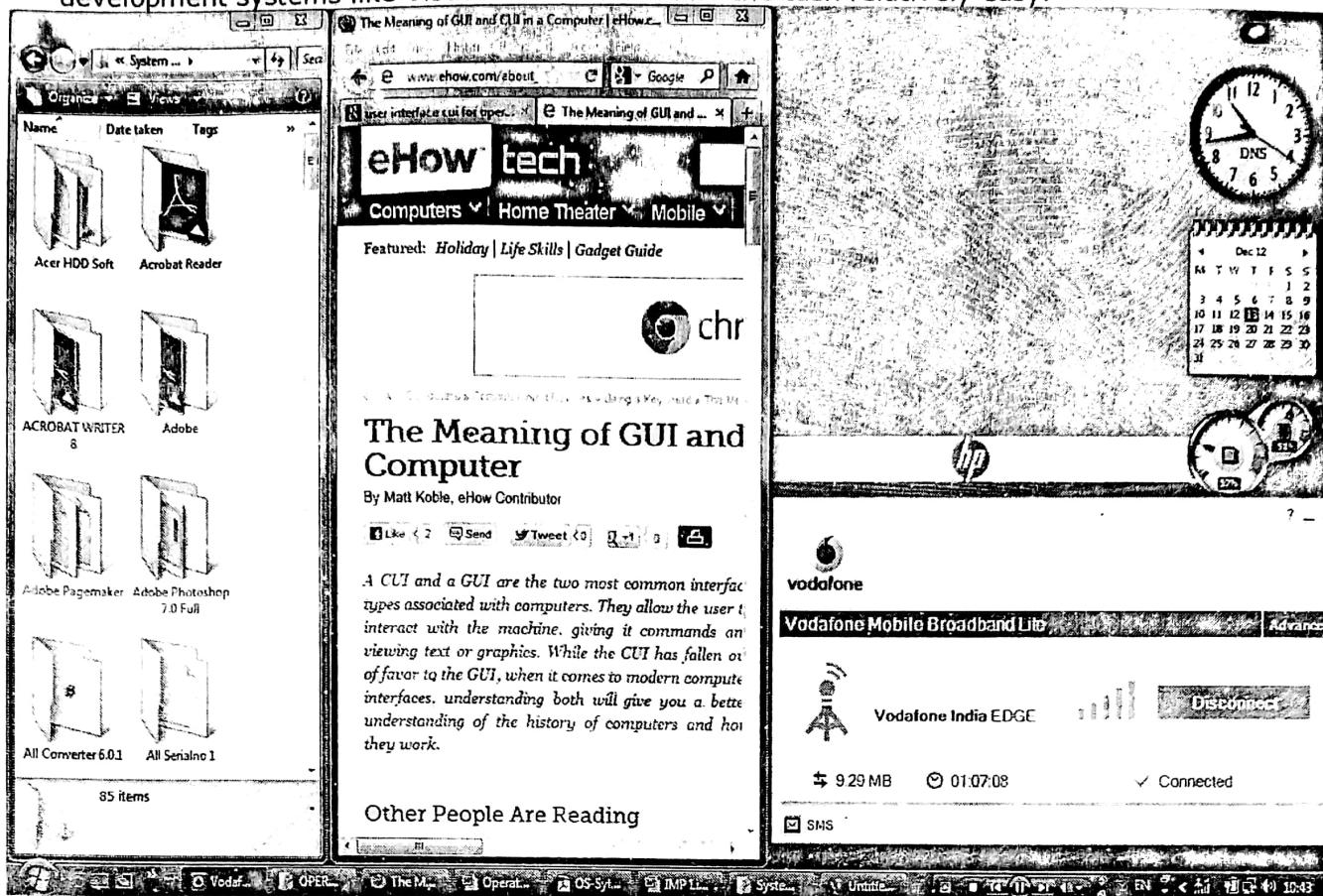
11-02-2011 08:40 <DIR> MS-Visio
10-02-2011 20:21 <DIR> MSN Messenger 6.2
11-02-2011 08:40 <DIR> My Screen Recorder
05-10-2007 10:39 63,115,889 MySQL.zip
01-11-2008 15:38 228,444,572 netbeans-6.1-m1-windows.exe
29-10-2011 19:54 <DIR> Nokia N-72
10-02-2011 20:40 <DIR> OFFICE 2003
11-02-2011 08:40 <DIR> OFFICE 2007
19-04-2007 15:19 4,917,216 Opera_9.20_Eng_Setup.exe
11-02-2011 08:40 <DIR> Oracle 10g
11-02-2011 08:40 <DIR> Oxford dictionary
10-02-2011 20:21 <DIR> Papa Fonts
11-02-2011 08:40 <DIR> PDF to Word
10-02-2011 20:21 <DIR> Pdf to Word File
17-09-2011 21:31 <DIR> PDF Tools 2007
11-02-2011 08:40 <DIR> PHP & MySQL
11-02-2011 08:40 <DIR> Power Archiver
11-02-2011 08:44 <DIR> Power-DVD
11-02-2011 08:40 <DIR> PPT Tempalets
11-02-2011 08:40 <DIR> Recovery software
09-08-2010 21:20 60,640 Rupee_Foradian.ttf
05-05-2007 22:03 20,942,920 SkypeSetup1.exe
29-10-2011 13:00 <DIR> Sound Forge
29-10-2007 20:17 37,757,602 Sound.Forge.zip
29-10-2011 12:59 37,757,730 Sound.Forge.zip.zip
10-02-2011 20:21 <DIR> Tally_v7.2_Rel1
21-09-2012 12:53 <DIR> TBIL Data Converter
10-02-2011 20:21 <DIR> Team Viewer Portable
06-04-2011 16:41 14,021,856 TeamViewer_Setup.exe
11-02-2011 08:40 <DIR> Total video convertor 3.11.01
20-03-2008 11:00 3,082,963 touchtyping.exe
11-02-2011 08:40 <DIR> Turbo G v3.0
14-02-2012 12:44 <DIR> TurboG++ for Windows 3.0.7.86a
14-02-2011 08:40 <DIR> UCDClient 14.04
14-02-2011 08:40 <DIR> UFSI PACK
14-02-2011 08:40 <DIR> Visual Studio-2008
11-02-2011 08:43 <DIR> VLC Player
17-09-2011 21:21 <DIR> Vodafone-Dongle-Crake
17-03-2007 10:09 19,290,894 wamp5_1.6.1.exe
23-08-2010 11:36 16,032,571 WampServer2.0i.exe
10-02-2011 20:21 <DIR> Winamp 5.08
11-02-2011 08:43 <DIR> Window Base Unix

```

User interface (GUI): -

- The GUI stands for Graphical User Interface.
- A GUI was most common interface types associated with modern computers.
- GUI allows the user to interact with the machine, giving it commands and viewing graphical output on screen.
- The CUI is replaced by GUI which is found in modern computer systems.
- This is the kind of interface modern computer users are used to and what all modern operating systems utilize.
- A GUI can display graphics, symbols and other visual outputs.
- This machine used both a mouse and icons for user navigations.

- Graphical User Interfaces it can support such advanced hardware like USB drives, video camera etc...
- GUI programs are more complex than character-oriented programs, but modern software development systems like Visual Studio.NET make the task relatively easy.



Types of operating system: -

- There are two types of operating systems.
 1. Single User operating system.
 2. Multi user operating system.
- **Single user operating system:** In this kind of operating system the processor or a computer perform only job at a time. That is at one point of time only one task can be performed.
For example: MS-DOS
- **Multi user operating system:** This type of operating system is used by more than one user. It allows the interaction of one user with other. It also helps in executing more than one task at a particular time.
For example: UNIX, Windows-NT, Windows-2003 server, Windows-2010 server.

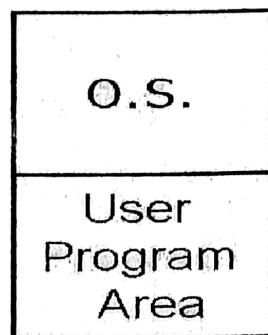
Classification of operating system: -

- An operating system can be classified as under.
 1. Early O.S. or Processing O.S.
 2. Batch O.S.
 3. Real time O.S.
 4. Multiprogramming O.S.
 5. Time sharing (Multitasking) O.S.
 6. Multiprocessing O.S.
 7. Distributed O.S.

Early O.S. or Processing O.S.: -

- In serial processing operating system only one job resides in computer memory and it remains there until it is executed.
- After completion of job, next job is entered in serial fashion.

- In this system, memory management is very simple because whole space is allocated to the job or program as shown in figure.



- Advantages:**

- o In early O.S. the resource management is very easy.
- o In early O.S. the resource allocation is very easy.

- Disadvantages:**

- o CPU remains ideal most of the time.
- o The processing O.S. is very slow.
- o In the processing O.S. the waiting time of jobs are more.

Batch O.S.: -

- Early computers were physically large machine which is run from console.
- In those computers common input devices are card reader and tape drive.
- And common output devices are line printer, tape drives and card punches.
- The user did not interact directly with the computer system.
- The user prepares a job which is consisted of program, the data, and some control information about the job.
- These jobs are submitted to the computer operator. After some time the output is generated.
- The major task was to transfer control automatically from one job to the next.
- For fast processing, same Command of jobs are batched together and run from computer as a group.

- Advantages:**

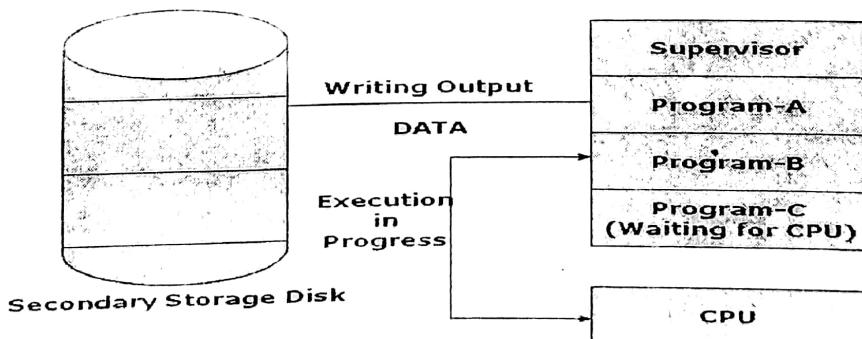
- o Resource management and allocation is very easy.
- o Faster than serial processing.

- Disadvantages:**

- o Lack of interaction between the user and the job while job is executing.
- o Utilization of CPU is very poor and the CPU is often ideal.
- o Difficult to provide the desired priority.

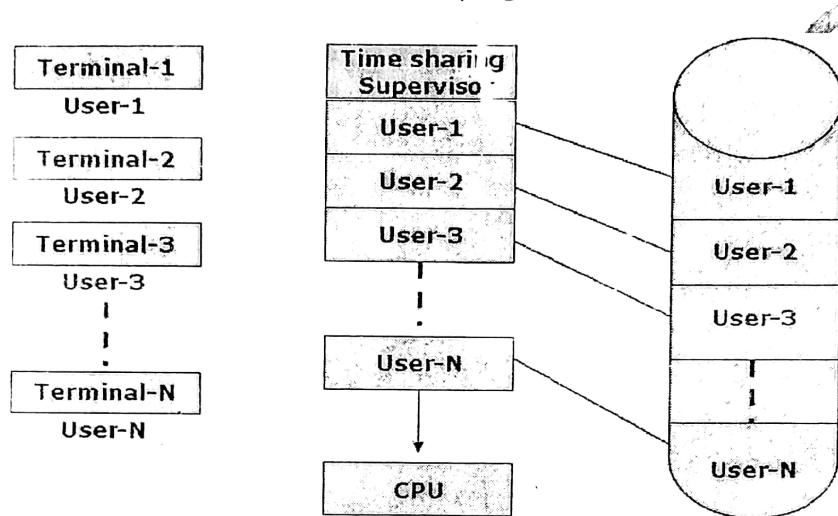
Multiprogramming O.S.: -

- Multiprogramming refers to keeping several programs in different parts of the main memory at a same time and executing them sequentially.
- Programs must be run sequentially, or on a first-come, first-serve basis.
- The operating system keeps several jobs in memory at a time.
- In multiprogramming system the CPU never remains idle.
- The CPU switches from one program to another in sequence.
- The operating speed of CPU is much faster than that of I/O operations.
- In multiprogramming system, when one program is waiting for I/O transfer, there is another program ready to use the CPU.

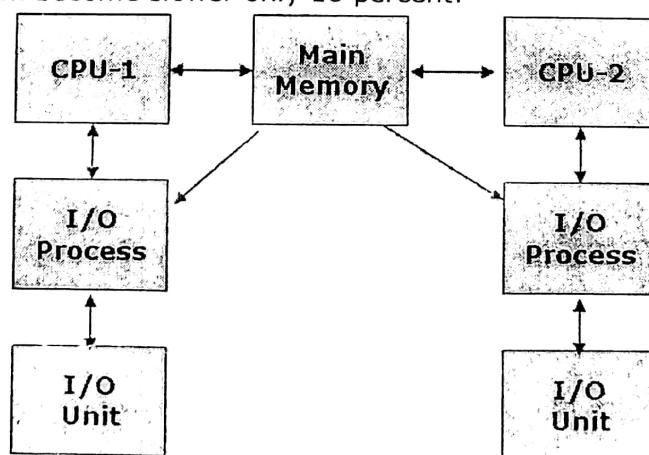


Time sharing O.S. (Multitasking O.S.): -

- Time-sharing or multitasking systems are logical extension of multiprogramming systems.
- Multiple jobs are executed by the CPU switching between them.
- A time-shared operating system uses the CPU scheduling to provide each user with a small portion of time.
- A programme is loaded into memory and it is executing which is referred as a process.
- A time shared operating system allows to user to share the computer's memory simultaneously.
- The short period of time during which a user process gets the attention of the CPU is known as a **Time Slice, Time Slot or Quantum.**
- Thus time sharing may be viewed as a multi-use multiprogramming technique.
- **Advantages:**
 - Reduce CPU idle time.
 - Provides advantages of quick response.
- **Disadvantages:**
 - Problem of data communication.
 - Question of security and integrity of user program and data.

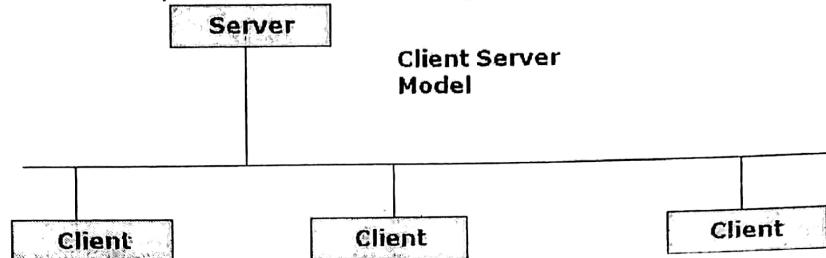
**Multiprocessing O.S. (Parallel processing O.S.): -**

- Most systems are single processor systems.
- They have only one main CPU.
- Depend upon the requirement multiprocessor systems are introduced.
- The multiprocessor systems have more than one processors.
- In multiprocessor systems the processors are in close communication, sharing the computers devices like local memory peripheral devices.
- These kinds of systems are also referred as **tightly coupled** systems.
- **Advantages:**
 1. One advantage of multiprocessor is that we can increase the number of process and hope that the work is done in shorter period of time.
 2. Another reason for multiprocessor system is that they increase the reliability.
 3. If we have 10 processors and one of them become fails, then the remaining nine processors must share the work of failure processor.
- Thus the entire system become slower only 10 percent.

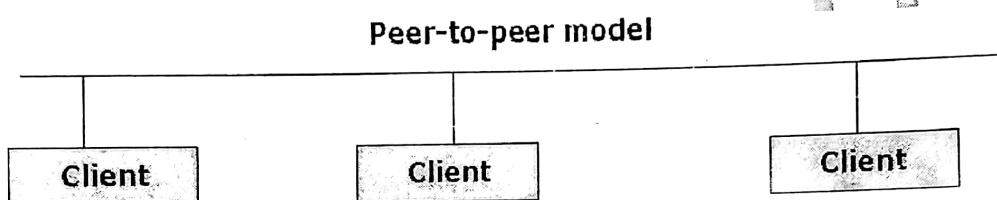


Distributed O.S.: -

- The processors communicate with one another through various communication lines, such as high speed buses or telephone lines.
- These systems are also known as **loosely coupled** systems.
- Distributed operating systems are based on two modes. [1] Client server model [2] Peer-to-peer model.
- Client Server model:** In this model, the client sends a request for a resource to the server and the server provides the requested resource as response back to the client.



- Peer-to-peer model:** In peer-to-peer model, all the computers behave as peers as well as clients. These peers communicate with each other for exchange of their resources.

**Advantages: -**

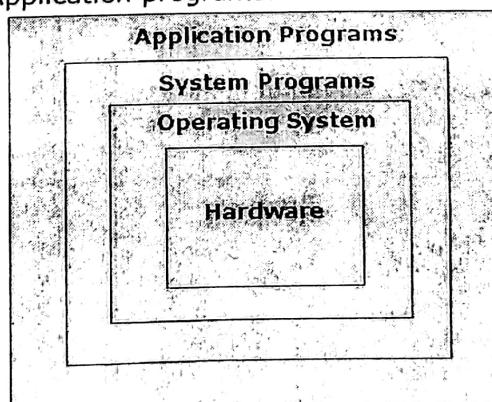
- Distributed systems provide the resource sharing.
- If a number of different computers are connected to one another, then a user at one node may be able to use the resource which is available on another node.
- These systems are used to computation speed up.
- Distributed systems are more reliable.

Real-Time system: -

- The real-time system is a special purpose operating system.
- A real-time system is used in air traffic control system, network multimedia systems, and command control systems.
- A real-time operating system has well defined, fixed time constraints.
- Processing must be completed before predefined time otherwise system will fail.
- There are two types of real-time systems. [1] Hard real-time system. [2] Soft real-time system.
- Hard real-time system:** The hard real-time system guarantees that the critical task is completed on time.
- Soft real-time system:** In a soft real-time system critical task gets priority over other tasks and retains the priority until it completes.

Structure of operating system: -

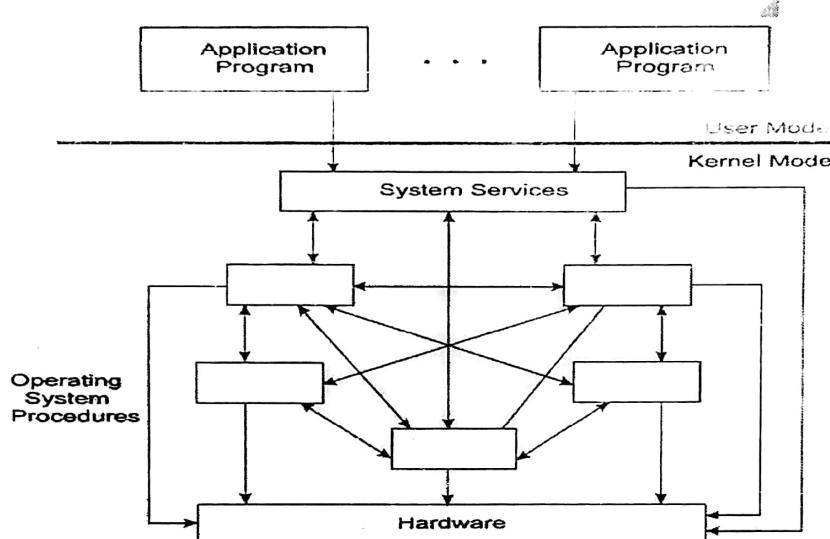
- The structure of operating system consists of four layers. [1] Hardware [2] Operating system [3] System programs [4] Application programs.



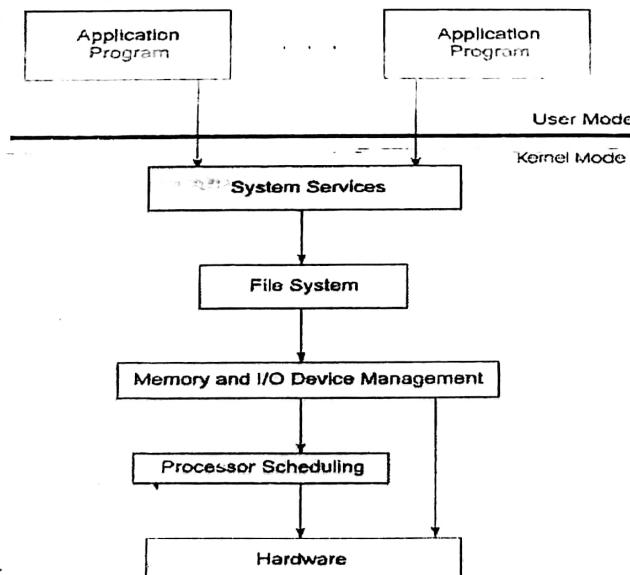
- Hardware:** The hardware consists of CPU, main memory, I/O devices, ALU, etc...
- Operating system:** Software includes process management routines, memory management routine, I/O controls routines, file management routines.
- System programs:** This layer consists of compilers, assemblers, linker, loader etc...
- Application programs:** This is dependent on user's requirement. For example railway reservation system, online banking system, bank database management system, online shopping system etc...

Monolithic Systems: -

- The components of monolithic operating system are organized randomly and any module can call any other module without any reservation.
- Similar to the other operating systems, applications in monolithic OS are separated from the operating system itself.
- When a user-mode program calls a system service, the processor traps the call and then switches the calling thread to kernel mode.
- Completion of system service switches the thread back to the user mode, by the operating system and allows the caller to continue.
- A monolithic kernel is an operating system architecture where the entire operating system is working in the kernel space.
- The best example of monolithic OS is **MS-DOS**.

**Layered Systems: -**

- The components of layered operating system are organized into modules and layers them one on top of each other.
- Each module provides a set of functions that other module can call.
- The main advantages of the layered approach are simplicity of construction and debugging.
- Interface functions at any particular level can invoke services provided by lower layers.
- The layered operating structure with hierarchical organization of modules is shown in following figure.



- Another advantage of a layered operating system structure is that each layer of code is access to only the lower layer interface.
- In this approach, the N^{th} layer can access services provided by the $(N-1)^{\text{th}}$ layer and provide service to the $(N+1)^{\text{th}}$ layer.
- This layered structure also allows the operating system to be debugged from starting layer until the whole system works correctly.
- The example of layered operating system is UNIX OS.

Kernel: -

- A kernel is a central component of an operating system.
- It acts as an interface between the user applications and the hardware.
- The sole aim of the kernel is to manage the communication between the software (user level applications) and the hardware (CPU, disk memory etc).
- The kernel is a program that constitutes the central core of a computer operating system. It has complete control over everything that occurs in the system.
- A kernel can be contrasted with a shell (such as bash, csh or ksh in Unix-like operating systems), which is the outermost part of an operating system and a program that interacts with user commands.
- The kernel itself does not interact directly with the user, but rather interacts with the shell and other programs as well as with the hardware devices on the system, including the processor (also called the central processing unit or CPU), memory and disk drives.
- **The main tasks of the kernel are :**

1. Process management
2. Device management
3. Memory management
4. Interrupt handling
5. I/O communication
6. File system...etc...

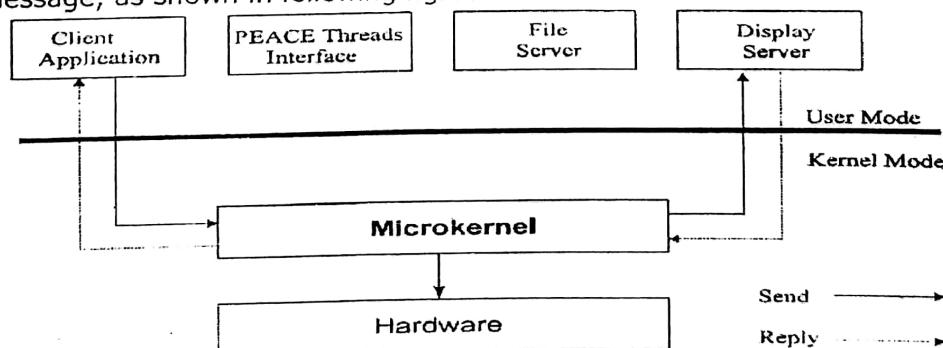
- **Kernels may be classified mainly in two categories.**

1. Monolithic
2. Microkernel

- **Monolithic Kernels:** - Monolithic kernels, which have traditionally been used by Unix-like operating systems, contain all the operating system core functions and the device drivers (small programs that allow the operating system to interact with hardware devices, such as disk drives, video cards and printers).
- **Microkernel:** - A microkernel usually provides only minimal services, such as defining memory address space; inter process communication (IPC) and process management. All other functions, such as hardware management, are implemented as processes running independently of the kernel.

Client-Server system (Microkernel system): -

- The beginning of new concepts in operating system design, microkernel, is aimed at migrating traditional service of an operating system out of the monolithic kernel into the user-level process.
- The idea is to divide operating system into several processes, each of which implements a single set of services. For example, I/O servers, memory servers, process servers, threads interface system.
- Each server runs in a user mode, provides services to the requested client.
- The client, which can be either another operating system component or application program, requests a service by sending a message to the server.
- An OS kernel (microkernel) running in kernel mode delivers the message to the appropriate server; the server performs the operation; and microkernel delivers the result to the client in another message, as shown in following figure.



Buffering: -

- A temporary storage area, usually in RAM. The purpose of most buffers is to act as a holding area, enabling the CPU to manipulate data before transferring it to a device.
- It is a process of storing data in memory area called Buffers while data is being transferred between two devices or between a device and an application.
- Buffering is done for 3 reasons.
 1. To manage the speed mismatch between sender and receiver of a data stream.
 2. To adapt between the devices having different data-transfer size.
 3. To support copy semantics for application I/O.
- Buffers are commonly used when burning data onto a compact disc, where the data is transferred to the buffer before being written to the disc.
- Another common use of buffers is for printing documents. When you enter a PRINT command, the operating system copies your document to a print buffer (a free area in memory or on a disk) from which the printer can draw characters at its own pace.

Spooling: -

- The full form of **spool** is **Simultaneous Peripheral Operation On-Line**.
- When the job is executed, the operating system **Satisfies** its request for card reader input by reading from the disk.
- Same way when the job is requested to the printer **to** output a line, that line is copied to system buffer and written to the disk.
- When the job is completed, the output is actually printed.
- This processing is known as spooling.

