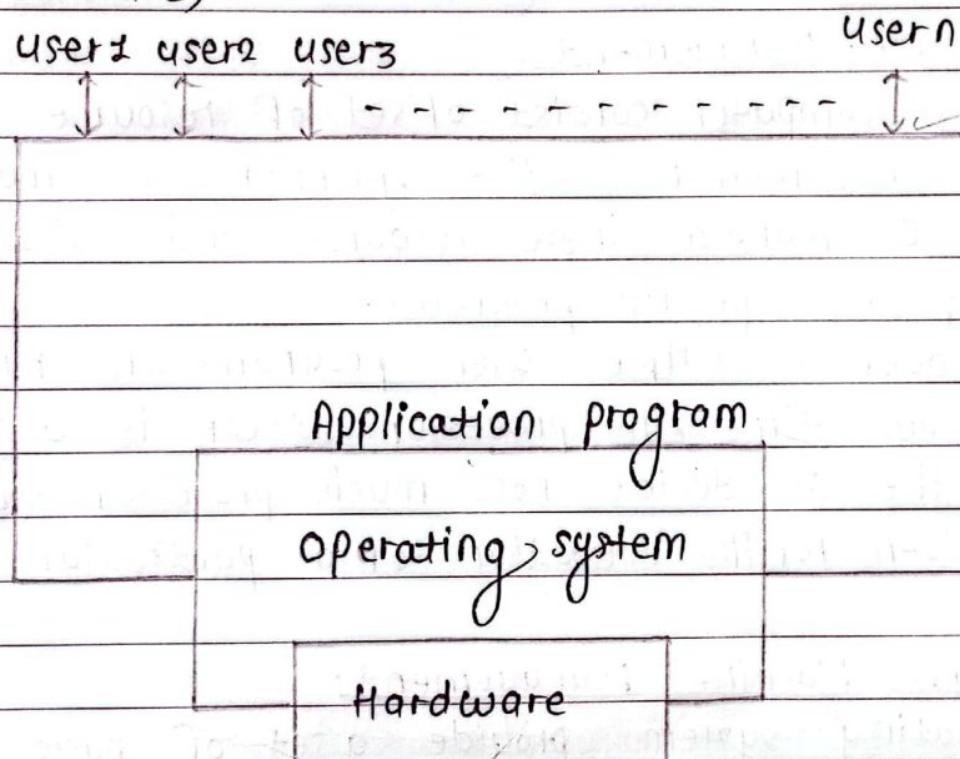


Introduction

- ① An operating system is a collection of software that manages computer hardwares resource and provide common service for computer program.
- ② Eg, windows, linux, unix and MAC OS
- ③ In simple terms, an operating system is an interface betn the computer user and the machine hardware



Fig, abstract view component of computer system.

- ④ From figure ,computer hardware contains a CPU , memory and I/O devices. and it provides the basic computing resource for the system.
- ⑤ The application program like spreadsheet , word processor, web browser etc are used to defined the way in which these resource are used to solve the computing problems of user and the system program mainly consist of compiler , editors , OS etc.

- ⑥ The OS is mainly used to control the hardware and coordinate its use among the various application programs for the different users.
- ⑦ An OS is a layer of software on a bare hardware machine that performs two basic functions:
 - ⑧ Resource Management.
 - ⑨ Virtual Machine Management.

① Resource Management:

- The computer consist of set of resource such as processors, memories, disk, printer and many others.
- The OS manage these resource and allocate them to specific programs.
- Moreover, multiple user programs are running at the same time, the processor itself is a resource and the OS decide how much processor time should be given for the execution of a particular user program.

② Virtual Machine Management:

- Operating system provide a set of basic command or instruction to perform various operation such as Read, Write, modify, save or close.
- Also dealing with hardware them is easier than directly dealing with hardware. Thus operating system hides the complexity of hardware and present a beautiful interface to user.
- Moreover, in this situation view, the fn of the OS is to present the user with the equivalent of an virtual machine that is easier to work with the underlying hardware.

Operating system perform the following function.

① Booting

Booting is a process of starting the computer OS start the computer to work. It checks the computer and make it ready to work.

② Memory Management

It is also an important function of an OS. The memory cannot be manage without OS. Different programs and data execute in memory at one time. If there is no OS, the program may fix with each other. The system will not work properly.

③ Loading and execution.

An program is loaded in the memory before it can be executed. operating system provides the facility to load program in memory easily and then execute it.

④ Data Security

Data is an important part of computer system. The operating system protect the data stored on the computer from illegal use, modification or deletion.

⑤ Disk Management

OS manage the disk space. It manage the stored files and folders in proper way.

⑥ Process Management

CPU can perform one task at one time. If there are many task, operating system decides which task should get the CPU.

⑦ Device controlling

OS also controls all devices attached to computer. The hardware device are controlled with help of small software called device driver.

⑧ Providing interface.

User interface control how you input data and instruction and how information is displayed on screen. The OS offers two types of the interface to the user.

(a) Graphical line interface.

(b) Command line interface.

⑨ Graphical line interface.

It interact with visual environment to communicate with computer. It uses windows, icons, menus and other graphical object to issue commands.

(b) Command line interface

It provides an interface to communicate with the computer by typing commands.

Evolution of OS

① Serial process (1st generation 1945-1955)

In earlier computer system from the date 1945 to mid 1955 program interacted directly with computer hardware because there was no OS.

The serial processing OS are those which perform all the instruction into a sequence manner.

or the executed by using the FIFO manner means first in first out. All the instruction that are entered first in the system will be executed first and the instruction that are entered later will be executed later.

In this program counter will determine which instruction is going to execute and the instruction will execute after this. This early system presented main problem is ~~sched~~ scheduled.

Scheduling: When a user required computer's time, they had to sign up sheet indicating the amount of time they needed. A user might sign up for an hour and finish in forty minutes. This would result in wasted computer processing time. On the other hand the user might run into problems, not finish in the allocated time and be forced to stop before resolving the problem.

② Batch processing (2nd generation 1955 - 1965)

To overcome the problem serial processing batch operating system was developed.

This batch processing is same as serial processing techniques but in the batch processing similar types of jobs are first preferred similar types of jobs are stored on the card and that card will be submitted to the system for processing. The system performs all operation on the instruction one by one and user cannot able to specify any input and operating system will increment program counter for executing the next instruction.

The main problem is that jobs those are prepared for execution must be same type and if the job requires for any types of input then this will not be possible for user. This problem is also that i/o devices are slow compared to processor.

③ Multiprogramming (3rd generation 1965-1980)

Multiprogramming allocates the processor to handle multiple batch job at a time.

Multiprogramming can be used to handle multiple interactive jobs. The multiprogramming operating system never uses any card because the process is entered on the spot by the user but the operating system also uses the process of allocation and deallocation of memory means, it will provide the memory space to all running and waiting process. There must be proper management of all running jobs.

④ Time-sharing system.

This system also uses for multiprogramming. In timesharing system, the processor time is shared among multiple user. Multiple user simultaneously access the system. Time sharing system offers the users an opportunity to interact directly with the computer using terminal and keyboard, each user submits the job required by pressing a transmit key and wait their turn for a response from processor. The intention of timesharing is to minimize response time back to the user, reduce ideal time and still

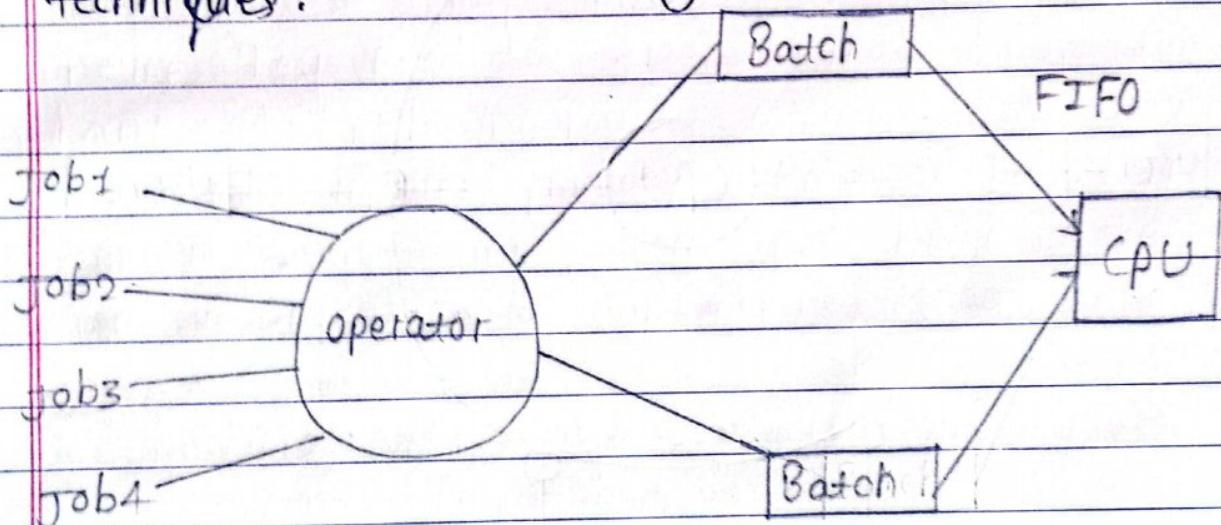
maximize processor uses.

Types of operating system.

(a) Batch operating system

This type of operating system does not interact with the computer directly. There is an operator which takes similar job having the same requirement and group them into batches. It is the responsibility of the operator to sort jobs with similar needs.

Since job are executed in the FIFO manner, the batch operating system requires very simple CPU scheduling techniques.



Advantage.

- ① Execution becomes fast and well manner managed.
- ② Multiple user can share the batch system.
- ③ The ideal time for a batch system is very less.

Disadvantage.

- ① Batch system are hard to debug.
- ② It is sometime costly.
- ③ The other jobs will have to wait for any unknown time if any job fails.

⑥ Timesharing Operating System.

In time sharing operating system, a computer provides computing service to several or many user concurrently online. The various users share the central processor, memory and other resource of the computer system facilitated controlled and monitored by the OS.

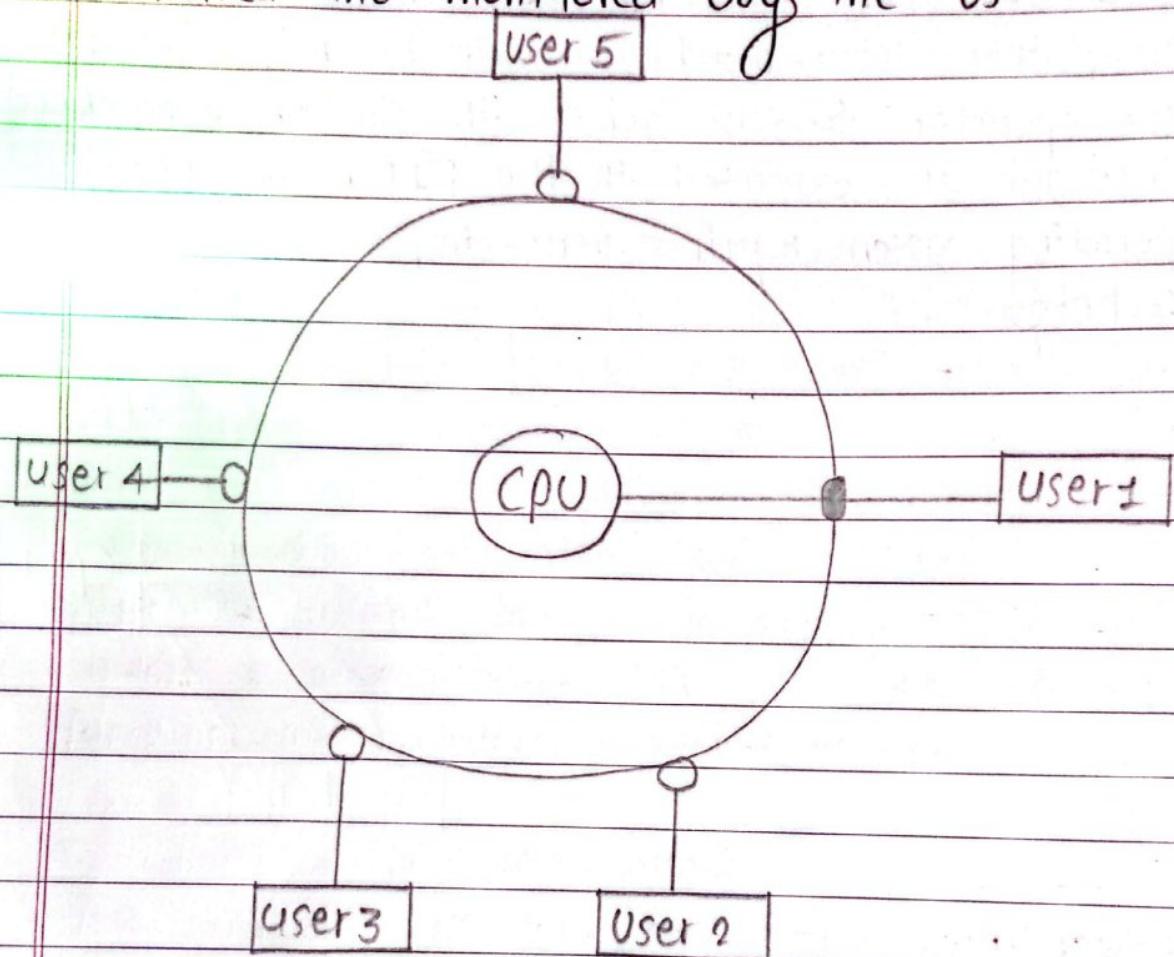


fig time sharing os.

Advantages

- Each task gets an equal opportunity.
- It provides quick response
- CPU ideal time can be reduced.

Disadvantages.

- Reliability problem.

→ Data communication problem.

c) Real time operating system (RTOS)

Real time OS are used in environments where a large no. of events, mostly external to the computer system must be accepted and proceed in a short time or within certain deadlines such application are industrial control, telephone switching equipment, flight control etc with an RTOS, the processing time is measured in 10^{-6} of second. This system is time bound and has fixed deadlines. There are two types of RTOS.

- (i) Hard RTOS.
- (ii) Soft RTOS.

(i) Hard RTOS

Hard RTOS have deadlines that must be met absolutely. for Eg Air traffic control system must be able to respond to an emergency within a few seconds.

(ii) Soft RTOS

soft RTOS have deadlines that can be missed, but the consequence missing a deadline may be undesirable for Eg a video game may not be as smooth if a frame is dropped, but the game will still be playable.

#(d) Multiprocessor operating system

Multiprocessor OS is one which consist of more than one independent processing unit because of multiple CPU's. This kind of OS perform parallel execution. we use this kind of operating system when

We have many jobs to perform and the single CPU switching takes much more time to execute all the processes. Many popular operating system such as windows, linux uses the multiprocessor OS.

(e) Personal Computer Operating system.

The operating system provides good support to a single user and are widely used for word processing, spread sheet, games, internet access etc.

(f) Handheld computer operating system.

These operating system are handheld computers (smart phones and tablets) Eg. android, IOS etc.

(g) Embedded operating system.

These operating system are designed for specific purpose and are found in embedded system. Embedded system is a computer system that has a dedicated function within a large mechanical or electronic system.

(h) Distributed operating system.

A distributed OS is an operating system that runs on multiple computer systems that are connected to a network. Its purpose is to provide a useful set of services. Generally to make the collection of machines behave like a single machine.

- Various interconnected computers communicate with each other using a shared communication network.
- Distributed OS typically run cooperatively on all machines whose resources they control. This machine might be capable of independent operation or they

might be usable merely as resource in the distributed systems e.g. salaries, OSF/1.

Advantage of Distributed OS.

- sharing of resource.
- Reliability.
- computation speed up.

Disadvantage of Distributed OS.

- Expensive
- failure of main network will stop the entire communication.

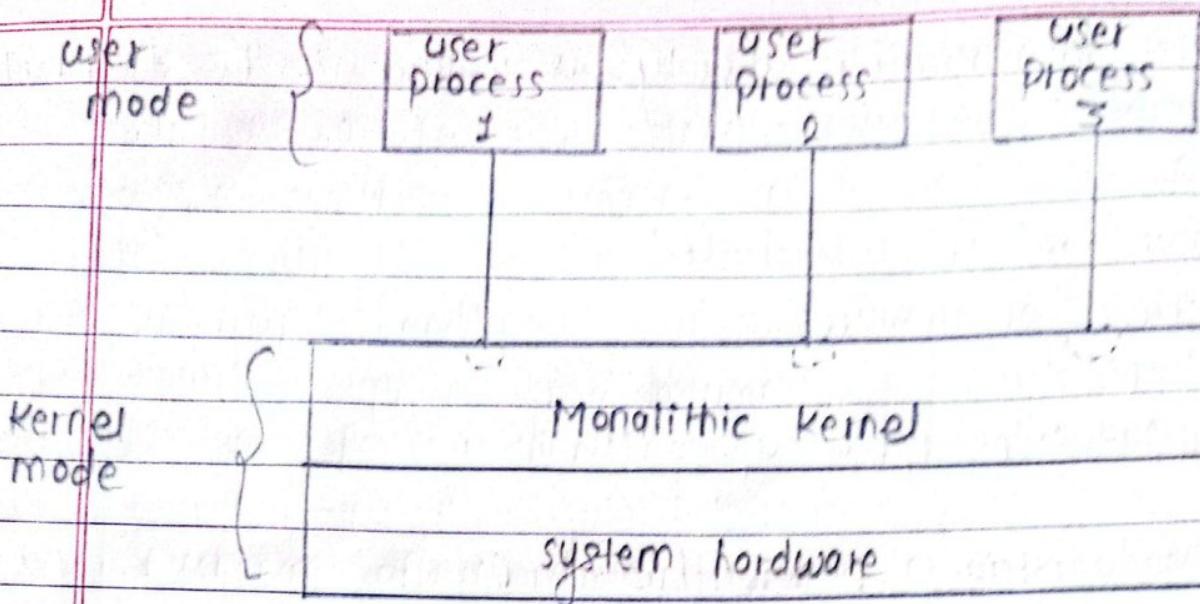
Operating System Structure

Interconnection of system components and their interface with kernel is the part of system structure.

① Monolithic structure.

Monolithic structure kernel is an OS architecture where the entire OS is working in kernel space. This increased the size of the kernel as well as the operating system.

- All basic service of operating system like process management, file management, memory management, scheduling, process communication etc. are all present inside kernel only.
- Examples OS/360, VMS, Linux etc.



Advantages.

- Monolithic kernel are quite fast.
- Highly efficient due to direct interconnection b/w components.

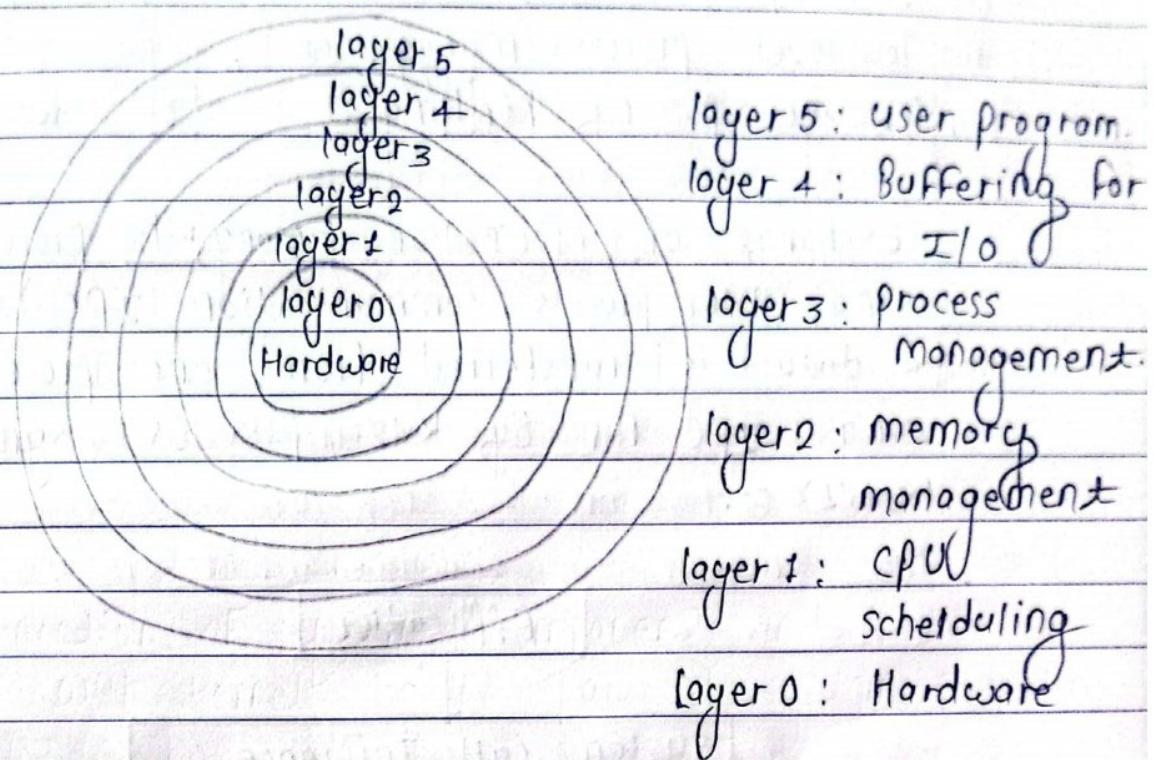
Disadvantages.

- It is difficult to isolate source of bug and other errors because monolithic kernel groups components together.
- If any service fails in the monolithic kernel it leads to the failure of the entire system.

② Layered structure.

- This is an important architecture of OS which is meant to overcome the disadvantage of early monolithic systems. In this approach OS is split into various layers such that all the layers performs different functionalities.
- Each layer can interact with the one just above it and the one just below it. lower most layer which directly deals with bare hardware is mainly

meant to perform the functionality of I/O communication and the uppermost layer which is directly connected with the application programs act as an interface betn user and os.



Advantages:

- ⇒ Each layer can be tested and debugged separately.
- ⇒ Designers can change each layers implementation without needing to modify the other layers.

Disadvantages:

- ⇒ It is not always possible to divide the functionalities, many a times they are interrelated and cannot be separated. Eg. microsoft windows NT OS.

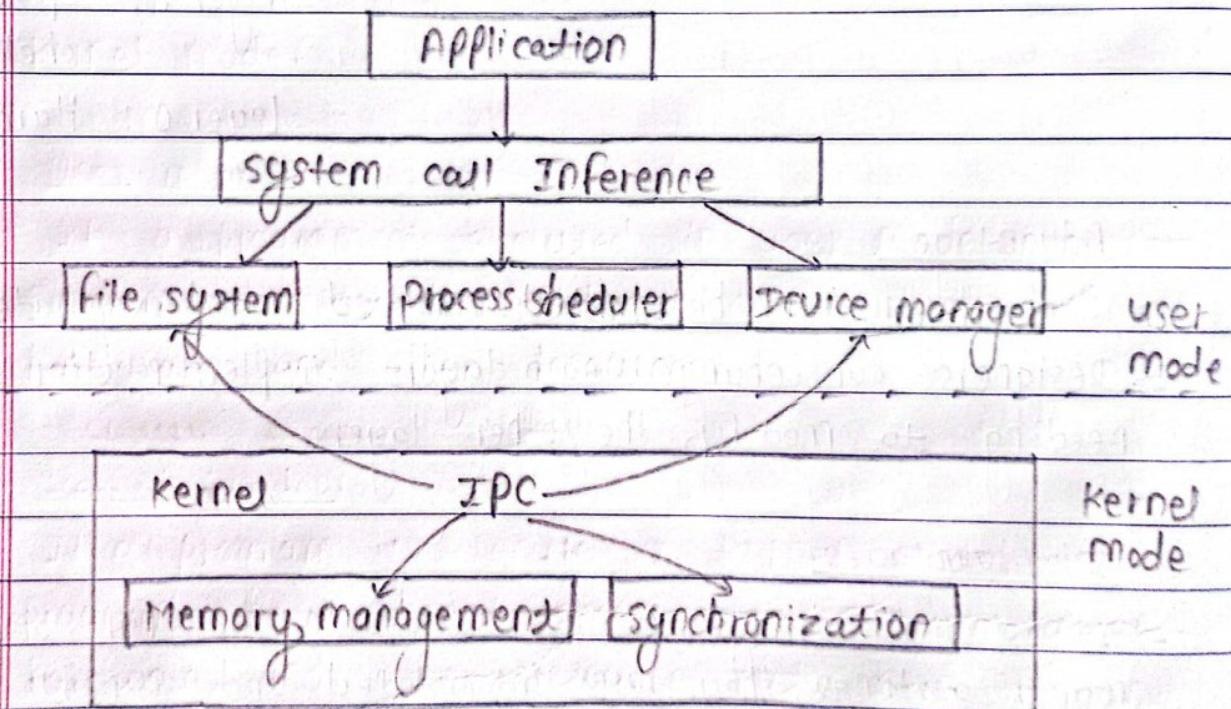
③ Microkernel

As compared to monolithic kernel, in microkernel almost all the functions and the service are removed from the Kernel mode and relocated into the user mode.

As a result, the kernel size is minimum. Since almost all functions and service operated in user mode, here the kernel mode does the following task only.

- (i) Interrupt handling.
- (ii) low level process management.
- (iii) Message passing handling.

Exchange of information among the process are done using inter process communication (IPC). A message (ie Data) is transferred from one process to another using IPC for Eg K42, pike OS, symbian and MINIX 3.



Advantages

- Kernel is small and isolated hence fn are better.
- Expansion of system is easier.

Disadvantages.

- It is expensive
- It performs degraded due to intermodule communication.

Virtual machine.

- A virtual machine does not own its hardware, it uses the resource of host computer.
- Fundamental idea behind the virtual machine is to abstract the hardware of a single component into several different execution environment, thereby creating the illusion that each separate execution environment is running its own private component.
- To get it easily, virtual machine allow you to run OS in an app window on your desktop that behaves like full separate computer.
- VM is a software that allow you to run many OS without risking your host OS.

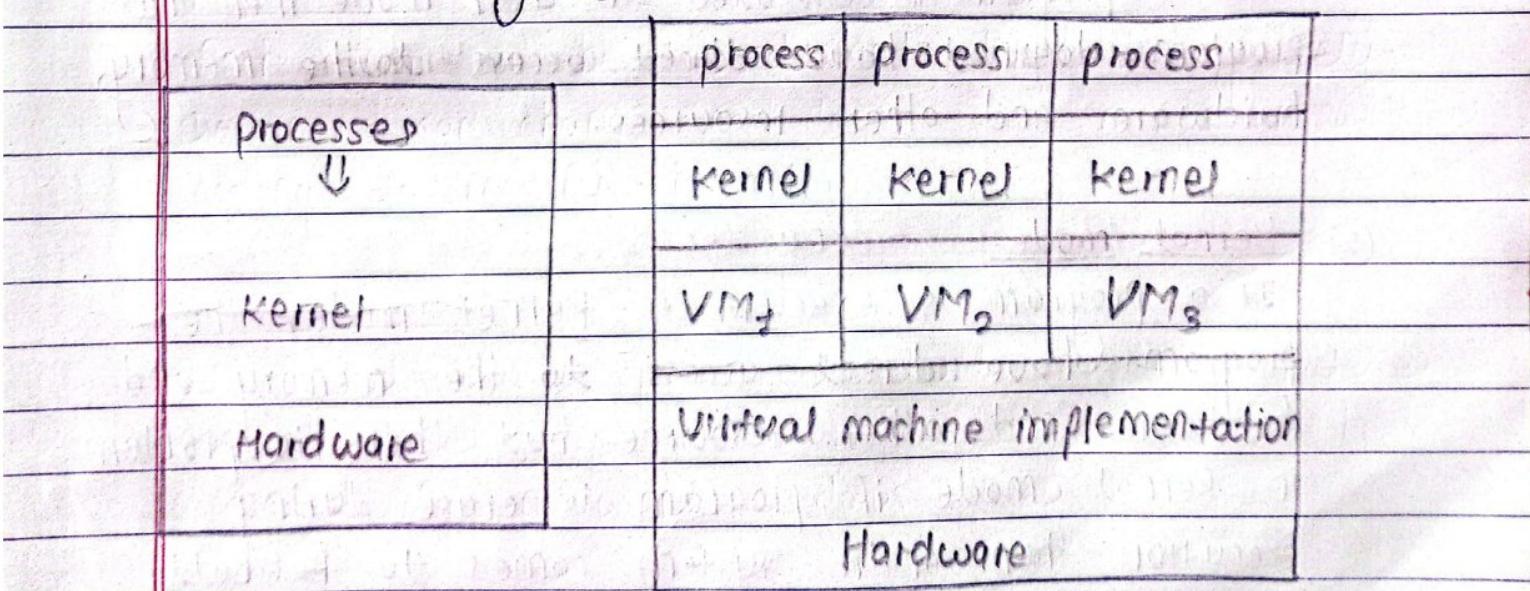


fig Non virtual
machine.

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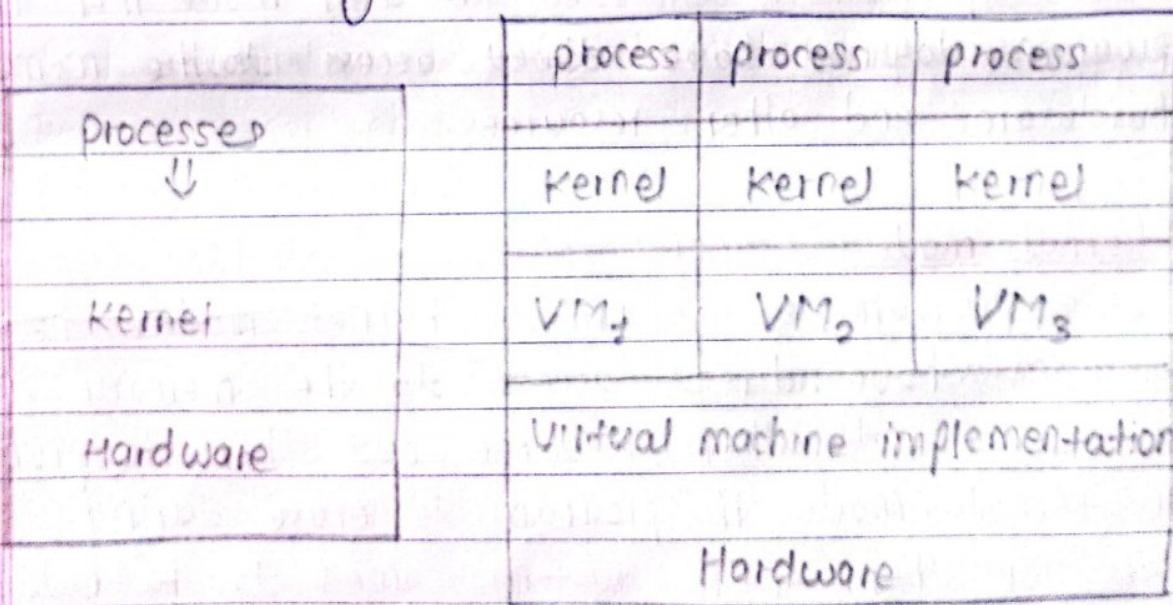


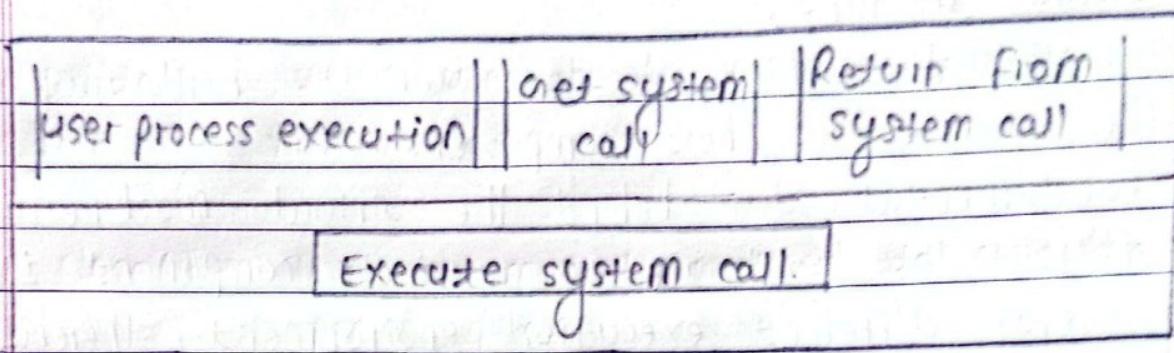
fig. Non virtual machine.

fig. Virtual machine.

~~IMP~~

System call.

System call is the programmatic way in which a computer program request a service from the kernel of the OS on which it is executed.



System call provides interface to the service mode available by an OS. There are two mode of operation that program can execute which are user mode and kernel mode.

① User mode

If a program is executed in user mode then that program does not have direct access to the memory hardware and other resources.

② Kernel mode.

If a program is execute in kernel mode, the program have direct access to the memory and hardware and other resource but there is problem in kernel mode if program is erased during execution then entire system comes to a halt.

If program is crashed in user mode then entire system does not halt. User mode operation is more safe.

So when program executed in user mode

need to switch in kernel mode to utilize required resource for particular time system call is needed.

System call can be roughly divided into five groups:

- (1) process control.
- (2) file manipulation.
- (3) Device management.
- (4) Information maintenance
- (5) communication.

① Process Control

This include creating process, exiting process etc
Some example of system call are:

- (i) fork() → To create a process we use a method called fork() function. It creates a child process identical to the parent in every way.
- (ii) exec() → To run a program, to execute a program exec() method is used.
- (iii) wait() → To make a process wait, wait() is used.
- (iv) exit() → It is used to terminate a process with an exit status.

② File manipulation.

This include create file, read file, delete file. There are some examples of system call for file manipulation are:

- (i) open() → This system call is used to open a file

for reading, writing or both.

- (iii) `Read()` → To read the content from a file into the buffer, we use a `Read()` system call.
- (iv) `Write()` → It is used to write content into the file from the buffer.
- (v) `close()` → This system call is used to close the opened file.

③ Device Management.

These include request of device, release of device and Read write operation and soon.

④ Information maintenance

- Get / set time or date.
- Get / set system data.
- Get / set process, file or device attributes.

⑤ Communication.

- Communication among the process in the system.
- Create, delete communication connection.
- Send, receive message.