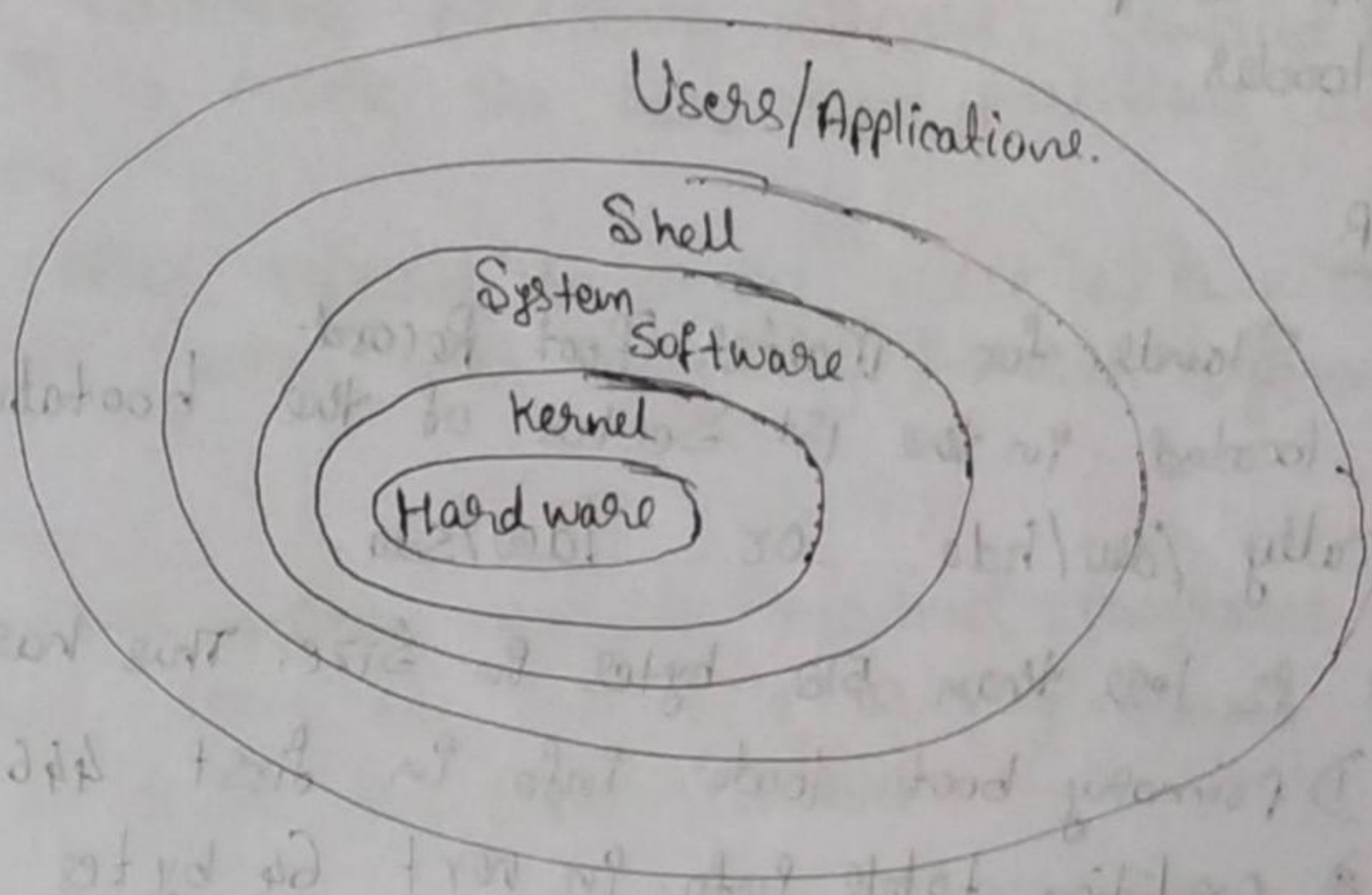
19/10/21

Introduction to Linux.

Structure of a Linux Based Operating System.



→ An Operating System (O.S) is the low-level Software that manages resources, Controls, peripherals, and Provides basic services to other Software.

→ In linux, there are 6 distinct Stages in the booting Process

BIOS	Basic Input/output System executes MBR
MBR	Master Boot Record executes GRUB.
GRUB	Grand Unified Bootloader executes Kernel.
Kernel	Kernel executes /sbin/init
Init	Init executes runlevel programs.
Runlevel	Runlevel programs are executed. from /etc/rc.d/rc*.d/.

1) BIOS

- BIOS Stands for Basic Input/output System.
- Performs Some System integrity checks
- Searches, loads and executes the bootloader program.
- It looks for boot loader in floppy, Cd-rom or hard drive. You Can press a key (typically F12 or F2, but it depends on the System) during the BIOS Startup to Change the Boot Sequence.

- Once the boot loader Program is detected and loaded into the memory. BIOS gives the Control to it.

⇒ So, in simple terms Bios loads and executes the MBR Bootloader.

2) MBR

- MBR Stands for Master Boot Record.
- It is located in the 1st Sector of the bootable disk. Typically /dev/hda. or /dev/sda.
- MBR is less than 512 bytes in Size. This has 3 Components
  1) primary boot loader info. in first 446 bytes
  2) partition table info. in next 64 bytes
  3) mbr validation Check in last 2 bytes
- It Contains information about GRUB (or LILO in old Systems)
- So, in Simple terms MBR loads and executes the GRUB bootloader.

3) GRUB

- GRUB Stands for. Grand Unified Boot loader.
- If you (we) have multiple kernel images installed on our System we Can Choose which one to be executed.
- GRUB displays a Splash Screen, waits for a few Seconds, if we don't enter anything, it loads the default kernel image as Specified in the grub Configuration file.
- GRUB has the knowledge of the System (the Older Linux loader LILO didn't understand file System).
- GRUB Configuation file is /boot/grub/grub.conf, it Contains both kernel and initrd image.
- So, in Simple terms GRUB just loads and executes kernel and initrd images

4) Kernel

- Mounts the root file System as Specified in the "root=" in grub.Conf
- Kernel executes the /sbin/init program, which is always the first program to be executed

- the kernel then establishes a temporary root file System using Initial RAM Disk (Initrd) Until the real file System is mounted.
- "Initrd" also Contains necessary drivers Compiled inside, which helps it to access the hard drive partitions and other hardware.

→ The Kernel is often referred to as the Core of any O.S. It has Complete Control over everything in our System.

5) Init

→ At this point, our System executes run level programs. At one point it would look for init file, usually found at /etc/inittab to decide the Linux runlevel.

→ Modern Linux Systems use Systemd to Choose a runlevel instead.

- Run level 0 is matched by poweroff.target [runlevel0.target is a Symbolic link to poweroff.target]
- Run level 1 is matched by rescue.target, Single User Mode.
- Run level 2 → multi User mode, without NFS.
- Run level 3 → Full multiUser mode.
- Run level 4 → UnUsed, NotUsed / user-definable [For Special purposes]
- Run level 5 → Full mode [Same as Run level 3 + display Manger]
- Run level 6 → Reboot [Reboot the device].

6) Run level Programs:

- When the Linux System is booting up, we See Various Services getting Started. Ex: "Starting Sendmail..... OK". These are Runlevel programs, executed from the runlevel directory as defined by our runlevel.
- each of run level has its own directory.

→ Runlevel 0 → /etc/rc.d/rc0.d/
→ Run level 1 → /etc/rc.d/rc1.d/
→ Run level 2 → /etc/rc.d/rc2.d/
→ Run level 3 → /etc/rc.d/rc3.d/
→ Run level 4 → /etc/rc.d/rc4.d/
→ Run level 5 → /etc/rc.d/rc5.d/
→ Run level 6 → /etc/rc.d/rc6.d/

• (• Note that the exact location of these directories may vary from distribution to distribution.

→ → Under the /etc/rc.d/rc*.d/ directories, we could see programs that start with S and K for startup and kill respectively.

(2) → Startup programs are executed during System Startup
• → Kill programs executed during Shutdown.

2] Functions of operating System.

→ An O.S is a program that acts as an interface between the User and the Computer hardware and controls the execution of all kinds of programs.

② Memory Management:-

→ Memory Management refers to management of Primary 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.

(3) → An Operating System does the following tasks for Memory Management

• Keeps track of Primary Memory.
• In multi programming, the O.S decides which process will get memory when and how much.
• Allocates memory when a process requests.
• De allocates memory when a process no longer needs it or it has been terminated.

b) Processor Management:-

In multiprogramming environment, the O.S decides which process gets the processor. when and for how much time

→ An O.S does the following activities for Processor management

• Keeps track of processor and Status of process
• Allocation and de-allocation of Processor to a process.

c) Device Management :-

An O.S manages device communication via their respective drivers.

→ Activities of Device Mangged by O.S are.

- Keeps tracks of all devices. I/O controller, etc.
- Decides which process gets the device when and for how much time.
- Allocates the device in efficient way.
- De-allocates devices.

d) File Management.

→ A file System is normally organized into directories for easy Navigation and Usage.

→ following activities for file Management.

- Keeps track of information, location, Uses, Status etc.
- Decides who gets the resources.
- Allocates and de-allocates the resources.

Some other Important Activities/Functions of O.S.

e) Security :- By means of password and similar other techniques, it prevents Unauthorized access to data.

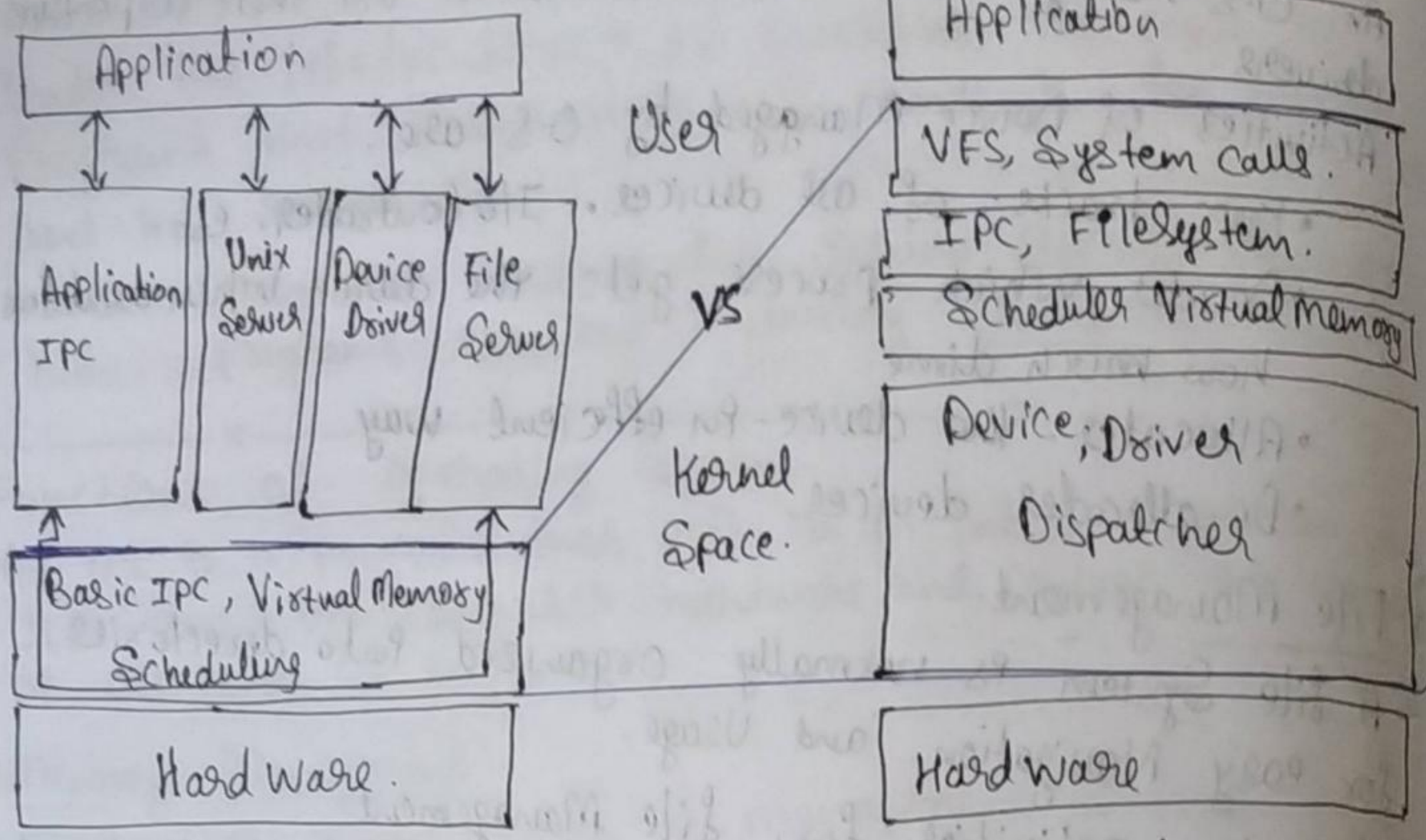
f) Control over System performance :- Recording delays between request for a service and response from the System.

g) Job accounting :- Keeping track of time and resources Used by various jobs and Users.

h) Error detecting aids :- Production of dumps, traces, error messages and other debugging and error detecting aids.

i) Coordination between other Softwares and Users :- O.S also Coordinate, and assign Interpreters, Compilers, assemblers, and other Software to the various Users of the Computer Systems.

3) Difference between Micro kernel and Monolithic Kernel?

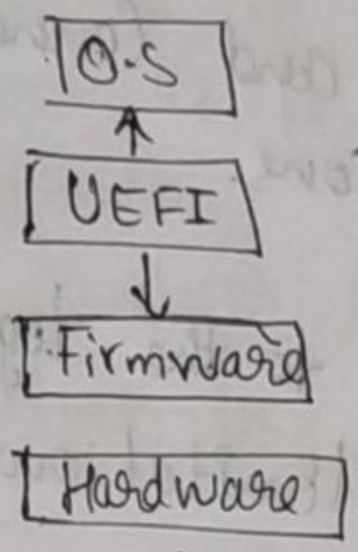


Basis	Micro kernel	Monolithic Kernel
Basic	→ In Kernel (micro) user Services and Kernel Services are kept in Seperate address Space.	→ In monolithic Kernel both User Services and Kernel Service are Kept in Same address Space
Size	→ Smaller in Size.	→ Larger than microKernel.
Execution	→ Slow execution.	→ Fast execution.
Extendible	→ The microkernel easily extendible	→ monolithic kernel hard to extend.
Code	→ to write a microkernel, more Code is required	→ To write a monolithic kernel, less Code is required.
Security	→ If a Service Crashes. it does effect on working of Kernel.	→ If a Service Crashes, the whole System Crashes in monolithic Kernel.
Ex:-	QNx, Symbian, L4Linux. K42, Mac OSX Minix etc.	Linux, BSDs (Free BSD, OpenBSD, Net BSD). Microsoft Windows, Solaris etc.

4). Discuss on UEFI, Legacy, Bios.

① UEFI :- Unified Extensible Firmware Interface (UEFI) is a specification for a Software Program that Connects a Computer's firmware to its O.S.

→ UEFI is expected to eventually replace Bios but it is Compatible with it.



⇒ EFI (extensible Firmware Interface)

→ Intel developed the original EFI

→ UEFI functions via the firmware installed on a Computer's motherboard. Like Bios, UEFI is installed at the time of manufacturing and is first Program that runs when booting a Computer.

→ It Checks to See which hardware Components are attached, wakes up the Components and hands them over to the O.S.

→ the new Specifications addresses the Several limitations of Bios; including restrictions on hard disk partition Size and the amount of time Bios takes to perform its tasks.

⇒ Most of Modern Computer Systems are equipped to Support both traditional Bios and UEFI, although Intel Corp. has Stated its intention to phase out Bios Support in newer Personal Computers PC's.

② Legacy :-

A Legacy Systems is an old or out-dated System, technology or Software application that Continues to be used by organization because it still Performs the functions it was initially intended to do.

→ Generally legacy Systems no longer have Support and maintenance and they are limited in terms of growth However they Cannot be easily replaced.

→Legacy Systems are often essential within an organizat

- **BIOS :-**

The Basic Input Output System is a very small piece of Code Contained on a chip on our System board. When we Start our Computer, BIOS is the first S/w that runs, It identifies our Computer's hard ware, Configures it, tests it, and Connects it to O.S. for further Instructions.

⇒UEFI is a Successor to the legacy PC BIOS, aiming to address its technical limitations.

5) Discuss On Linux, Windows, Mac OS.

#1 Basic Diffrence and History.

Windows	MAC	Linux
→Windows was first released in 1985. It was Supposed to be graphical user interface on top of MS-DOS. →All features of MS-DOS were later Integrated in windows 95. release. It was huge Success for and led to Windows. transition.	→This O.S from Apple Stands older than Windows. →It was 1st released in 1984. →It began as a GUI right from its inception. →In 2005 the design and Structure of MAC OS was Changed to Intel X86 based architecture.	→It was initially developed. by Finnish University, released in 1991. and designed for GNU developers. GNU developers later Integrated it into Linux →It is Open to Consumers and everyone. Can use as per the. Specifications.

File Structure

→Windows follows a directory Structure to Store the diffrent kinds of files of the User. →It has logical drives and Cabinet drawers. It also has folders.	→the file Structure of MAC OS is Commonly known as MAC OS X. →If you dig into MAC's hard disk. through finder you will See many	→Linux has Completely diffrent file Structure form. windows and MAC.

→Some Common folders. like documents, music video etc. All these files can be Stored in these folders and also new folders. can be created. It also has a files which can be Spread Sheet or any application Program.

→ It Can have extension .txt, .jpg etc.

→ Windows also Provides Recycle bin. where all deleted files. Can be Stored. it Can be Configured to increase its size.

directories.

→ The root directory of MAC may encounter when they visit their own MAC book.

→ we can explore the file System and directory structure. by going to directories like.

/Application, /developer, /sbin, /tmp. etc.

→ It was developed. with a. diffrent. code base. It Stores data in the form of tree: there is a Single file. tree and all your drives are mounted. over. this tree.

Registry.

→ Windows Registry. is a master database. that is Used to. Store all Settings on your. Computer.

→ It is responsible for Storing. all User Information. with its Passwords, and device relate Information.

→ the registry also has an editor which allows. you to view. all keys. and Values or even. drivers if necessary.

→ MAC. Stores. all application Settings in a. Series of .plist files, which have the Various. Preferences folder in MAC.

→ The .plist files Contains all properties in. either plain. text or binary format.

→ Linux also doesnot have. a Specific registry of its own

→ All application Setting is Stored. on a Program basis. Under the diffrent. Users in the. Same hierarchy. format of the files being Stored.

There is no Centralized database for. Storing these. details. and So Periodic. cleaning is also not required.

Interchangable Interfaces

Windows	MAC	Linux
→ Windows Interface was not interchangable Until 2008. → Windows xp had Some improvements but not par. Start Menu, taskbar System tray and Windows Explorer.	→ MAC has facility to ~~build~~ bridge Virtual network interfaced. This can done by going to System. preferences and Managing the interfaces.	→ Linux is Easy to Switch interfaces You can Switch the environment. without having to carry all installations. There are Utilities like GNOME and KDE which help in catering to these needs. They help in focusing on diffrent aspects.

Command terminal.

Windows	MAC	Linux
→ A terminal or Command Prompt is a blackbox ideally Used to execute Commands. → It is also Called the Windows Command Processor. It is Used to execute Commands and diffrent batch files. → It can also be Used for administrative functions. and troable Shoot and Solve all Windows issues.	→ MAC Provides a Console as terminal Application. • It has a Console command-line, Prompt and terminal. → Command line Used to type Commands. Prompt will provide us with Some information and also enable Us to run Commands → A terminal is an actual interface that will provide. the modern GUI as well.	→ Linux also provides a terminal we can find it at Applications → System or Application → Utilities. → In addition to this there is also Shell Prompt. the most Common Shell Used is bash It defines how the terminal will behave and look when it is run.

6. List the Steps to check disk partitions in windows.

① open File Explorer.
② Right Click On 'This PC'
③ Choose 'Manage' from the pop-up Menu
④ Navigate to Storage ⇒ Disk Management in Navigation Panel.

7. List the Steps to Start or Stop Services in Windows.

① Hit the Windows Key + R to open the "Run" Window.
②. Type Services.msc in the open box.
③. Services dialog box/window will open.
④ Select the Service to Start/Stop.
⑤ Choose the relevant option to operate on those Services.

8. Commands to Check disk partitions.

① open a Command prompt:
Start > Run > Cmd.
② Startup the DISKPART Utility:
C:\Users\Administrators > diskpart.
③ Select the disk, we wish to View. (any valid disk Number)
DISKPART > Select disk 1
④ View the details of Selected disk.
DISKPART > detail disk.

Difference b/w FAT 32 and NTFS.

→ A file System provides the way of organizing file.

- FAT :- File Allocation Table.
- NTFS :- New Technology File System.

Characteristics.	FAT 32	NTFS.
• Structure.	→ Simple.	→ Complex
• Maximum Number of Characters Supported in a fileName.	→ 83.	→ 255
• Maximum file Size	→ 4GB	→ 16TB
• Encryption	→ Not encrypted.	→ Encrypted with encrypting File Sys
• Security.	→ Network type only.	→ Both local and Network type.
• Fault Tolerance.	→ No provision for fault tolerance.	→ Automatic trouble-Shoot is present.
• Compatibility with O.S	→ Windows 95/98 /2000/2003/xp	→ Windows NT/2k/xp macOS x, Linux
• Compression.	→ Not allowed	→ Supports file Compression.
• Accessing Speed.	→ Low	→ Relatively higher than other File Systems.
• User level disk Space	→ Not present.	→ Present.
• Conversion	→ Allowed.	→ Not Allowed.

→ A Process is the instance of Program that is being executed by one or many threads.

Unit - II Process Scheduling IPC.

Process: A process is program (Under) in execution.

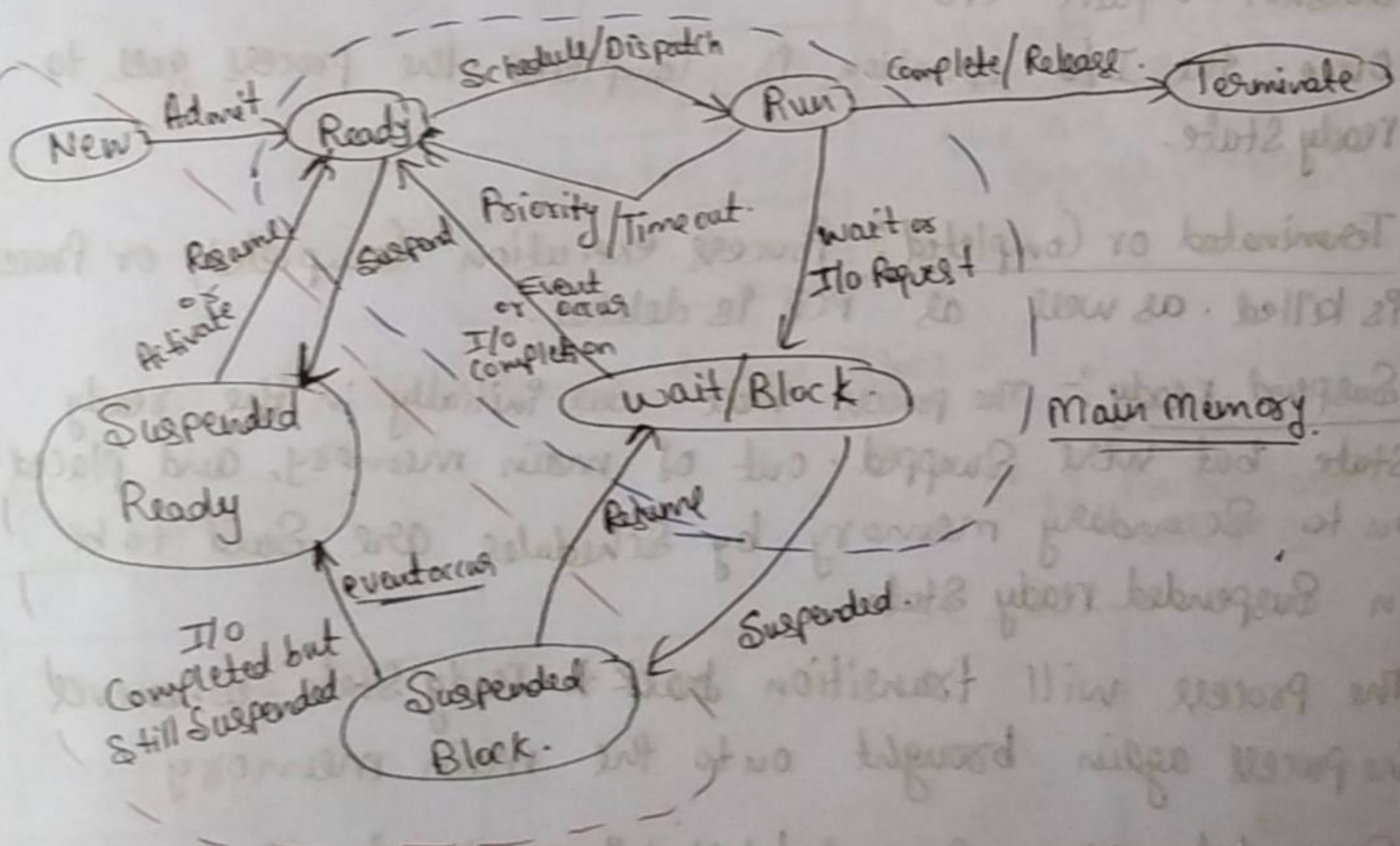
⇒ When we write a C program, the Compiler creates a binary code, the original program and binary code both are programs. When we actually run the binary code it becomes a process

+ A process is a active entity, program is a passive entity.

Attributes or Characteristics of a Process.

1. Process-Id.
2. Process_State
3. CPU registers.
4. I/O status Information.
5. CPU Scheduling Info etc....

Process State Diagram.



Process States.

- **New (create):** the process is about to created, but not yet created, it is the program which is present in Secondary memory that will be picked by O.S to create the process.

② Ready :- New → Ready.
Ready to run. After the Creation of Process, the process enters the ready State i.e the process is loaded in to the main memory.
→ The process is ready to run and is waiting to get the CPU time for its execution.
→ These process are waiting in a queue called Ready Queue.

③ Run :- The process is choosen by CPU for execution and the instructions within the process are executed by any one of the available CPU Cores.

④ Blocked or Wait :- Whenever the process requests access to I/O or needs input from the user or needs access to a critical region (the lock for which is already acquired) it enters the blocked or wait State.
→ The process continues to wait in the main memory and doesnot require CPU.
→ Once the I/O operation is Completed the process goes to ready State.

⑤ Terminated or Completed :- Process execution Completed; or Process is killed as well as PCB is deleted.

⑥ Suspend ready :- The process that was initially in the ready State but were swapped out of main memory, and placed on to Secondary memory by Scheduler are Said to be in Suspended ready State.
→ The process will transition back to ready State whenever the process again brought on to the main memory

⑦ Suspended wait or Suspend blocked :- Similar to Suspend ready but uses the process which was performing I/O operations and lack of main memory Caused them to move to Secondary memory.
⇒ When work is finished they may go to Suspend ready

CPU and IO Bound Process.

⇒ If the process is intensive in terms of CPU operations then it is called. CPU Bound Process.

⇒ If the Process is intensive interms of IO operations then it is called IO Bound Process.

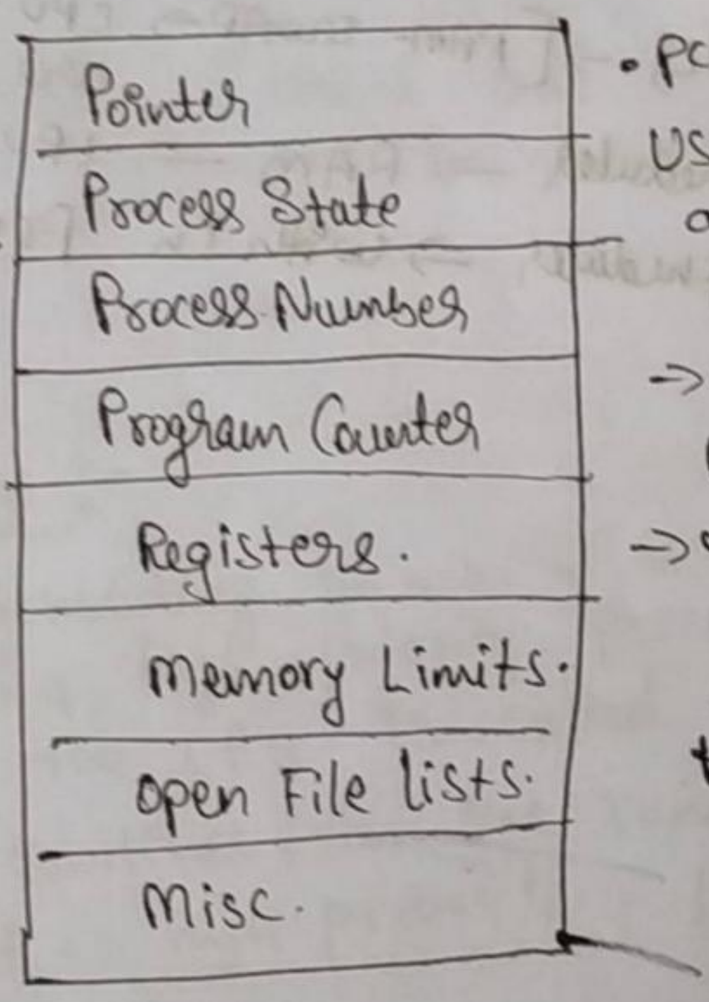
Process Table and Process Control Block.

A Process Control Block (PCB) contains information about the process, i.e registers, time quantum, priority etc.

⇒ The Process table is an array of PCB's, that means logically Contains a PCB for all of the current processes in the System.

⇒ P.T is used for Context Switching and Scheduling and other activities.

⇒



• PCB is a datastructure used by O.S to Store all info related to. process.

⇒ also known as. process descriptor.

⇒ when a process is created (initialized. or installed) the O.S creates corresponding PCB.

fig1. Process Control Block.

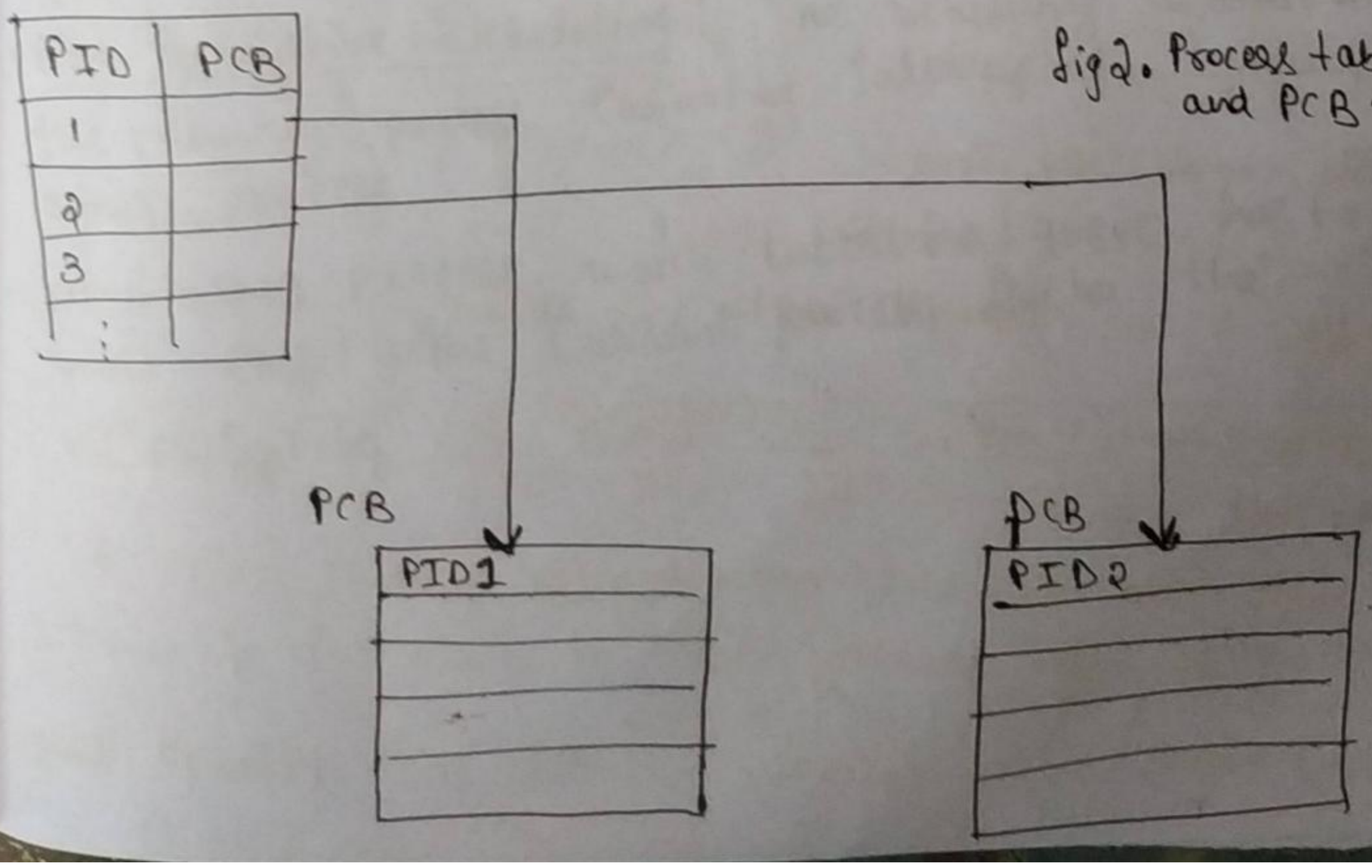


fig2. Process table and PCB.