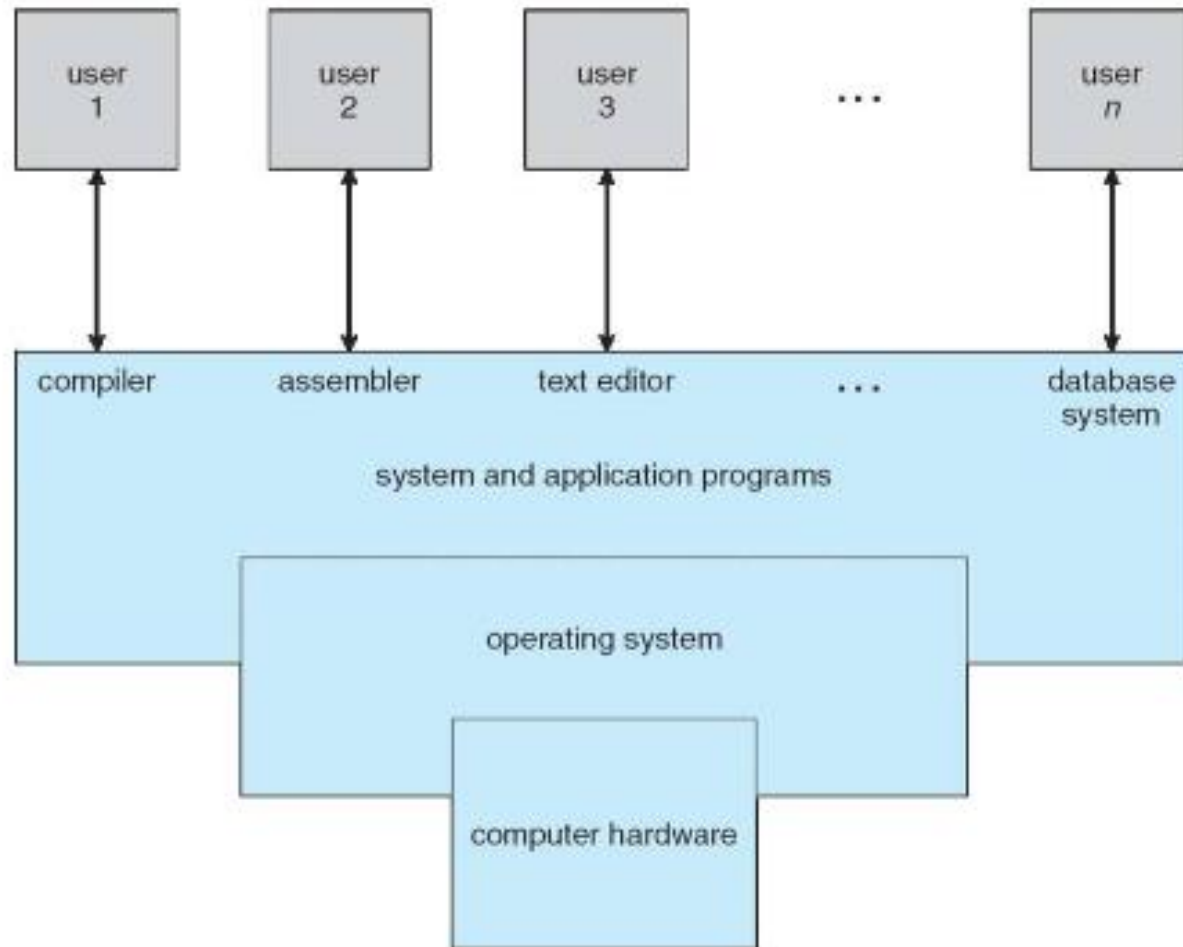# What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware

- Operating system goals:
  - Execute user programs and make solving user problems easier
  - Make the computer system convenient to use
  - Use the computer hardware in an efficient manner

# Four Components of a Computer System

Computer System Structure

- Computer system can be divided into four components:
  - Hardware – provides basic computing resources
    - CPU, memory, I/O devices
  - Operating system
    - Controls and coordinates use of hardware among various applications and users
  - Application programs – define the ways in which the system resources are used to solve the computing problems of the users
    - Word processors, compilers, web browsers, database systems, video games
  - Users
    - People, machines, other computers

Computer System Organization

- Computer-system operation

  - One or more CPUs, device controllers connect through common bus providing access to shared memory

  - Concurrent execution of CPUs and devices competing for memory cycles

| magnetic disk | A | main memory | A | cache | A | hardware register |
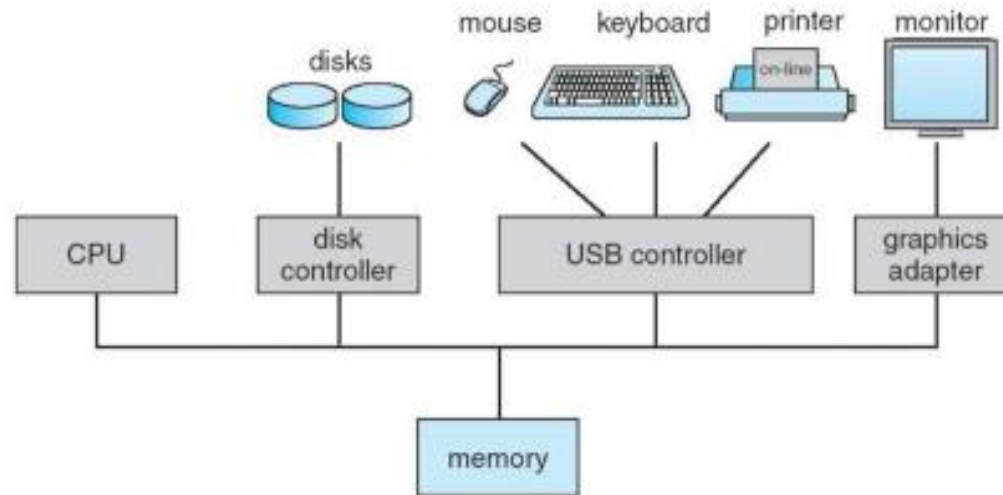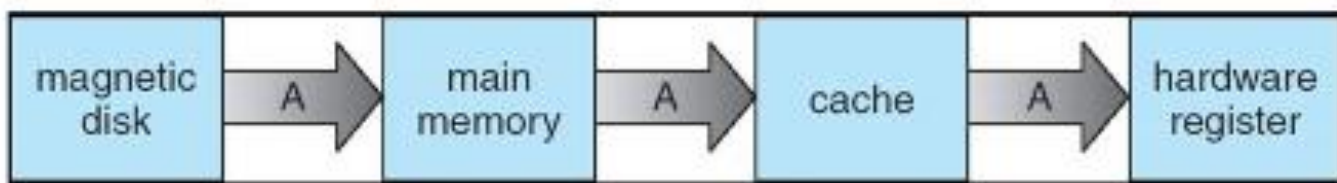
Computer-System Operation

- I/O devices and the CPU can execute concurrently

- Each device controller is in charge of a particular device type

- Each device controller has a local buffer

- CPU moves data from/to main memory to/from local buffers

- I/O is from the device to local buffer of controller

- Device controller informs CPU that it has finished its operation by causing an interrupt

Process Management Activities

The operating system is responsible for the following activities in connection with process management:

- Creating and deleting both user and system processes
- Suspending and resuming processes
- Providing mechanisms for process synchronization
- Providing mechanisms for process communication
- Providing mechanisms for deadlock handling

Memory Management

- All data in memory before and after processing

- All instructions in memory in order to execute

- Memory management determines what is in memory when
  - Optimizing CPU utilization and computer response to users

- Memory management activities
  - Keeping track of which parts of memory are currently being used and by whom
  - Deciding which processes (or parts thereof) and data to move into and out of memory
  - Allocating and deallocating memory space as needed

Storage Management

- OS provides uniform, logical view of information storage
  - Abstracts physical properties to logical storage unit - file
  - Each medium is controlled by device (i.e., disk drive, tape drive)
    - Varying properties include access speed, capacity, data-transfer rate, access method (sequential or random)

- File-System management
  - Files usually organized into directories
  - Access control on most systems to determine who can access what
  - OS activities include
    - Creating and deleting files and directories
    - Primitives to manipulate files and dirs
    - Mapping files onto secondary storage
    - Backup files onto stable (non-volatile) storage media

What is Linux?

- Linux is Free and Open Source.

- It is a UNIX like multi-user,multitasking operating system with the X Windows GUI,which can work on multiple hardware platform.

- Since Linux is free and Open Source, there are many flavours to linux.

Linux is a Free and Open Source O.S. (FOSS)

What it gives you?
        Freedom to use
        Freedom to examine
        Freedom to redistribute
        Freedom to modify

Advantages of Linux

- Low Cost
- Stability
- Performance
- Network Friendliness
- Flexibility

- Compatibility
- Fast and Easy Installation
- Full use of Hard Disk
- Multitasking
- Security

Linux flavours

Why so many Linux flavours??

- All Linux flavours are called Distros which are a fancy term for distributions.

- Since its Free and Open Source people are free to modify and release their own version and copies.

- If you dont like you one distro you can freely move to any other one which you like for e.g-Open Suse, Mandriva, Slackware etc.

- Some popular linux distros are Ubuntu,Kubuntu,Fedora,Mint,OpenSuse, ArchLinux,RedHat.

Where Linux is used?

- Servers
- Super computers
- Desktop
- Laptops
- Televisions Samsung most models, LG some models
- Digital Video Recorder
- Set-top boxes
- MP3 / Ogg portable players
- Mobile phones
- Handheld and portable
- Internet Tablets
- Gaming consoles
- Toys

Applications for Linux

- **Office: Open office, Koffice .**
- **Database: Oracle, MySQL.**
- **_Email:_ Evolution / Mozilla Thunderbird.**
- **Audio/Video: MPlayer / VLC.**
- **CD Burning: K3b.**
- **Graphics: The Gimp / Photogenics.**
- **Instant Messaging: Gaim.**
- **Web Browsing: Mozilla Firefox**

- **Antivirus: ClamAV**

Partial list of Big and Famous Organizations using Linux

- U.S. Postal Service.
- U.S. Federal Courts.
- U.S. Army.
- U.S. Department of Defense.
- U.S. Navy.
- Federal Aviation Administration
- French Parliament.
- Commercial Bank of China .
- Government of Mexico City.
- New York Stock Exchange.

- Google
- Wikipedia
- Yahoo
- Amazon.com
- Cisco
- Novell
- IBM
- BMW
- Audi
- Tommy Hilfiger
- Toyota Motor Sales, U.S.A.
- Panasonic

All these organizations have admitted that they got not only economical advantage by using Linux but also got greater stability and security.

LINUX Architecture
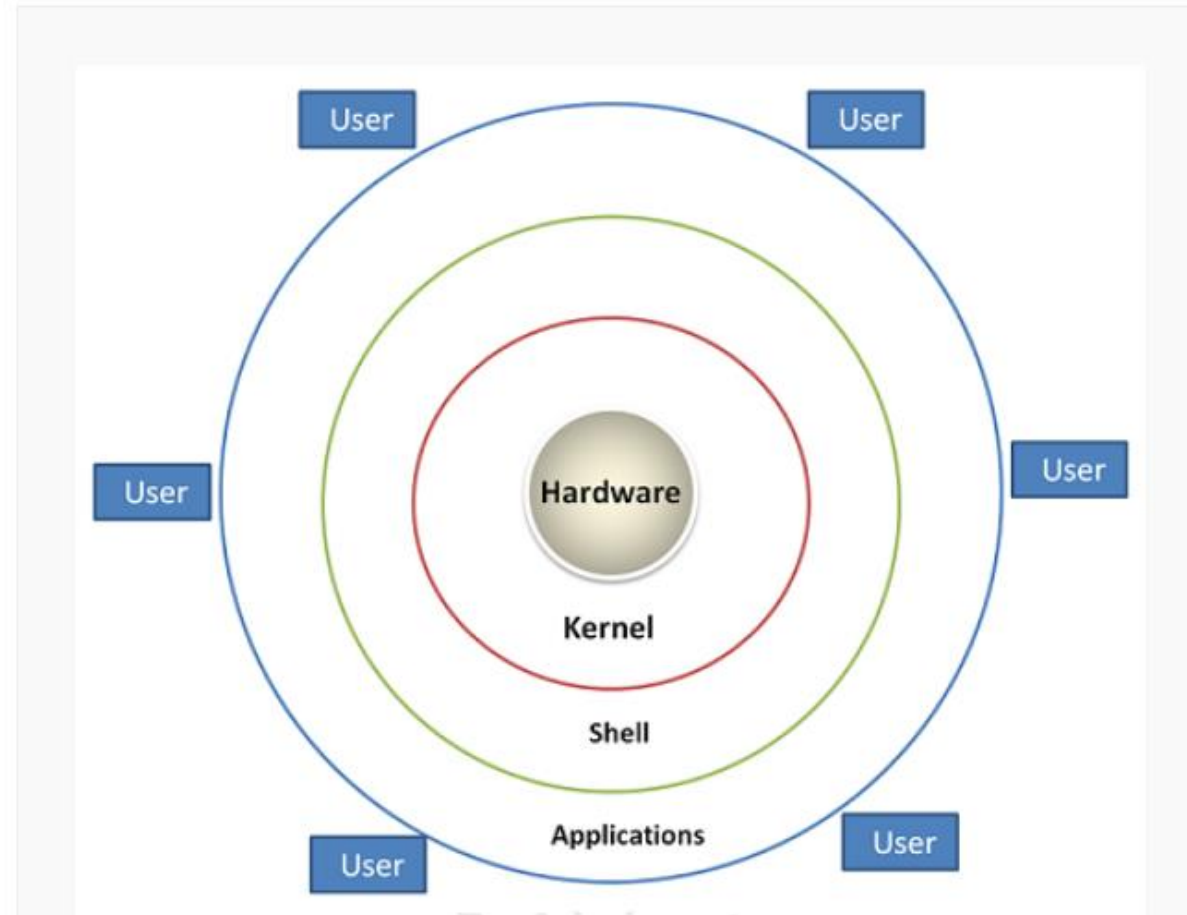
- **Hardware** – Hardware consists of all physical devices attached to the System. For example: Hard disk drive, RAM, Motherboard, CPU etc.

- **Kernel** – Kernel is the core component for any (Linux) operating system which directly interacts with the hardware.

- **Shell** – Shell is the interface which takes input from Users and sends instructions to the Kernel, Also takes the output from Kernel and send the result back to output shell.

- **Applications** – These are the utility programms which runs on Shell. This can be any application like Your web browser, media player, text editor etc.

Kernel and Shell

- ## What is a Kernel?

  The kernel is a computer program that is the core of a computer's operating system, with complete control over everything in the system.

  It manages following resources of the Linux system –
  File management
  Process management
  I/O management
  Memory management
  Device management etc.

Kernel and Shell

- ## What is a Shell?

  A shell is special user program which provide an interface to user to use operating system services.

Shell

Shell is broadly classified into two categories –
- Command Line Shell
- Graphical shell

Shell

There are several shells are available for Linux systems like –

- BASH (Bourne Again SHell)
- CSH (C SHell)
- KSH (Korn SHell)

Each shell does the same job but understand different commands and provide different built in functions.

System Calls

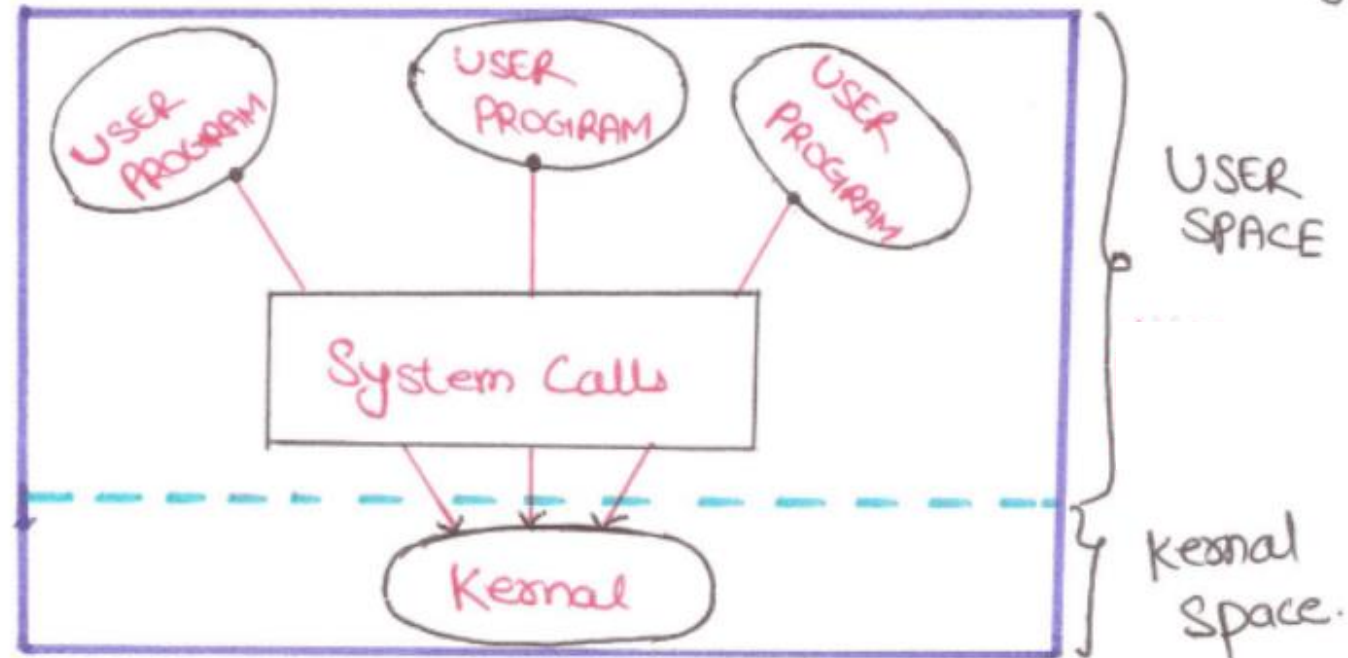For performing any operation an user must have to request for a service call

There are two modes in the operation of system which is user mode or system mode

In user mode -> All user processes are executed.

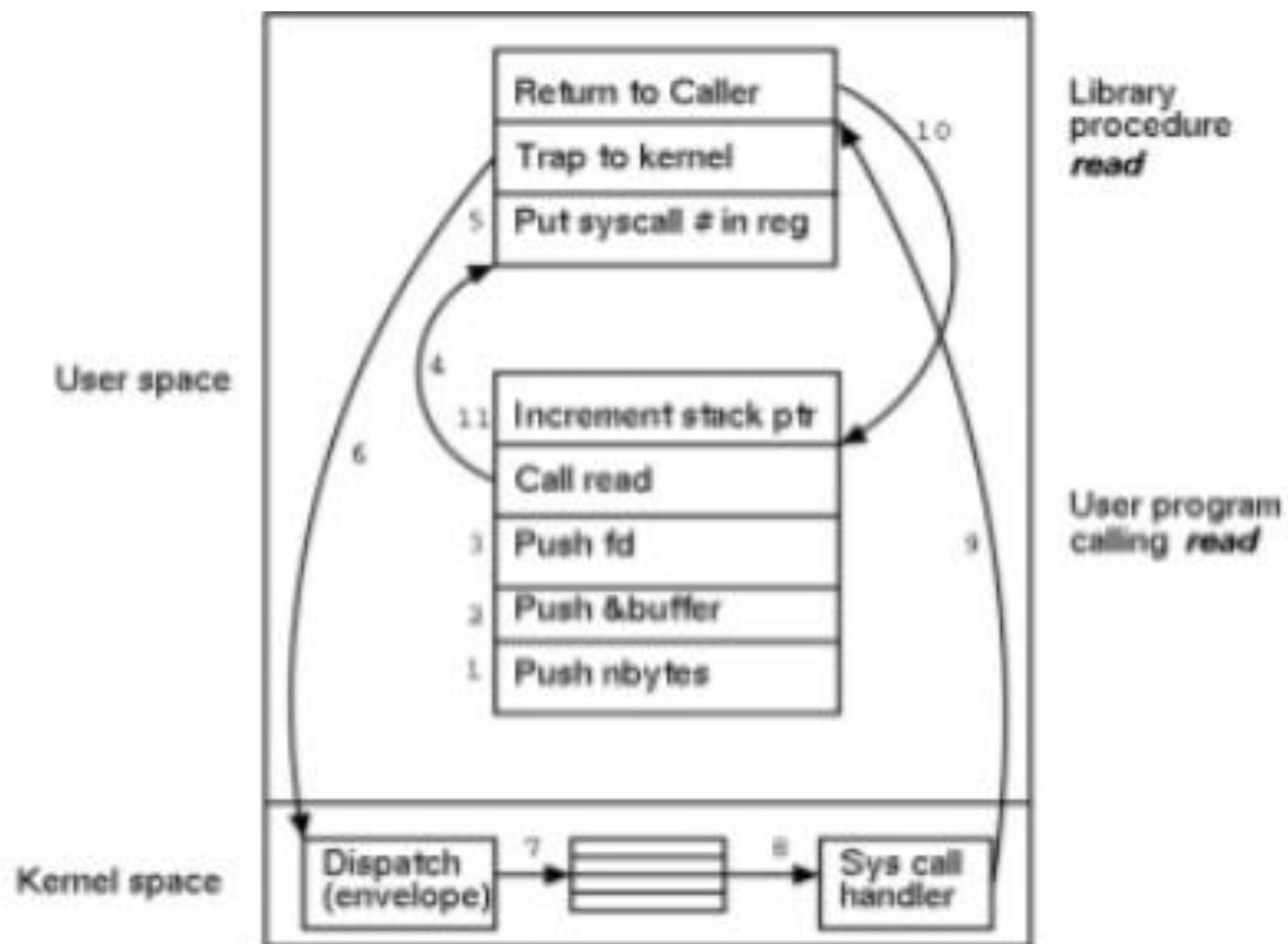**In system mode ->** All privileged operations are executed.

Basically the system call is an instruction that request the operating system to perform desired operation that needs hardware access or other privileged operations.
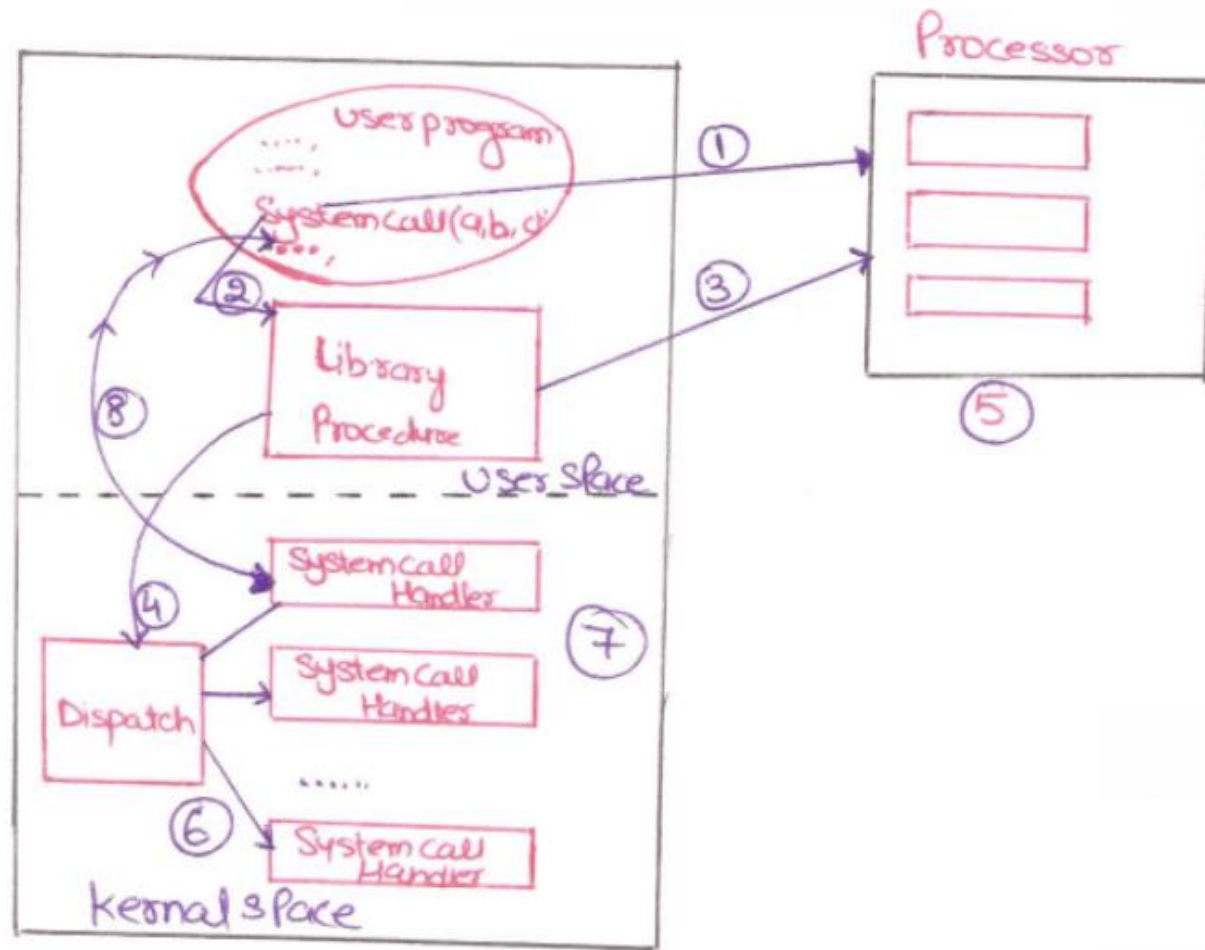
System call are inherently used for security reason

Kernal Space & User Space in Main Memory

Return to Caller

Trap to kernel

5 | Put syscall # in reg

4

11 | Increment stack ptr

Call read

3 | Push fd

2 | Push &buffer

1 | Push nbytes

6

10

9

Library procedure *read*

User program calling *read*

User space

Kernel space

Dispatch (envelope)

7

8

Sys call handler

Working of System Call

There are some examples

- fork()- create a process

- Exit()- terminate a process

- Kill()- terminate a process abnormally

- Create()- to create a new file

- Open ()- to open a file

- Close ()- to close a file

- read()- to read a file

Linux command structure

command [options] [parameters]

Commands are case sensitive.

Options are generally preceded by a hyphen (-), and for most commands, more than one option can be strung together, in the form:

command -[option][option][option]

e.g.:

ls -alR

will perform a long list on all files in the current directory and recursively perform the list through all sub-directories.