Experiment No. 1

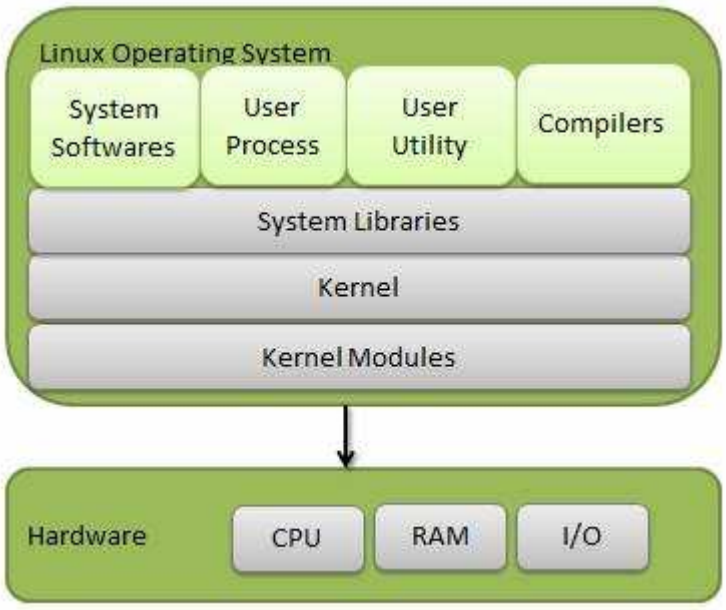
Aim: Introduction to Linux operating system and some commands.

Linux is one of popular version of UNIX operating System. It is open source as its source code is freely available. It is free to use. Linux was designed considering UNIX compatibility. Its functionality list is quite like that of UNIX [1].

1. ***Components of Linux System***

Linux Operating System has primarily three components [1, 3]:

- Kernel − Kernel is the core part of Linux. It is responsible for all major activities of this operating system. It consists of various modules and it interacts directly with the underlying hardware. Kernel provides the required abstraction to hide low level hardware details to system or application programs.
- System Library − System libraries are special functions or programs using which application programs or system utilities accesses Kernel's features. These libraries implement most of the functionalities of the operating system and do not requires kernel module's code access rights.
- System Utility − System Utility programs are responsible to do specialized, individual level tasks.



2. ***Kernel Mode vs User Mode***

Kernel component code executes in a special privileged mode called **kernel mode** with full access to all resources of the computer. This code represents a single process, executes in single address space and do not require any context switch and hence is very efficient and fast. Kernel runs each process and provides system services to processes, provides protected access of hardware to processes [1, 3].

Support code which is not required to run in kernel mode is in System Library. User programs and other system programs works in **user mode** which has no access to system hardware and kernel code. User programs/ utilities use System libraries to access Kernel functions to get system's low-level tasks [1, 3].

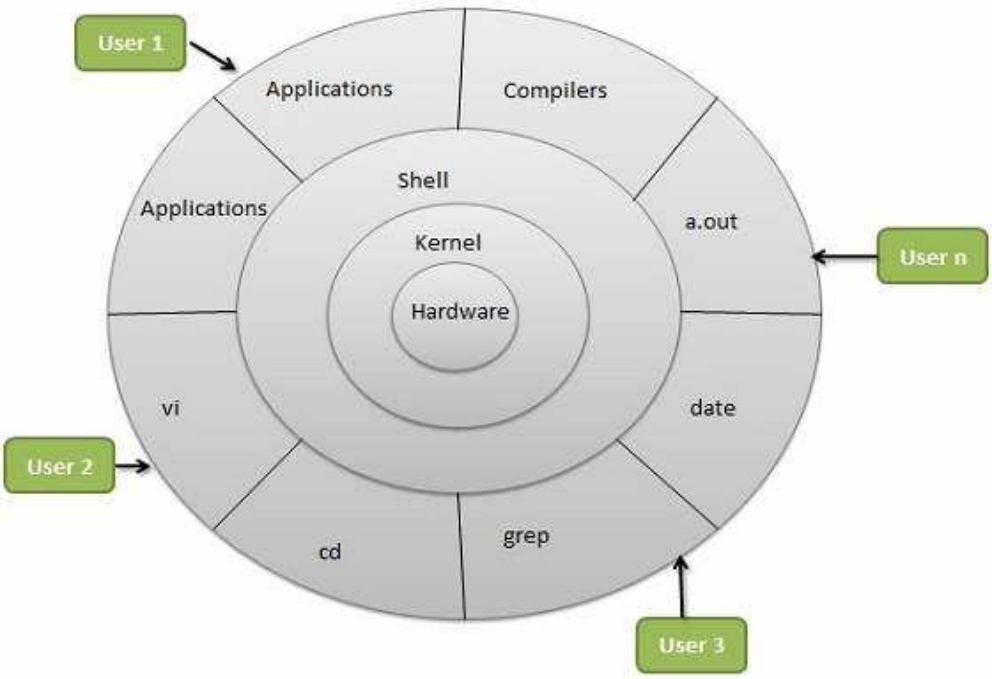
3. *Basic Features*

Following are some of the important features of Linux Operating System [1, 2]:

- Portable − Portability means software can works on different types of hardware in same way. Linux kernel and application programs supports their installation on any kind of hardware platform.
- Open Source − Linux source code is freely available and it is community based development project. Multiple teams work in collaboration to enhance the capability of Linux operating system and it is continuously evolving.
- Multi-User − Linux is a multiuser system means multiple users can access system resources like memory/ ram/ application programs at same time.
- Multiprogramming − Linux is a multiprogramming system means multiple applications can run at same time.
- Hierarchical File System − Linux provides a standard file structure in which system files/ user files are arranged.
- Shell − Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs. etc.
- Security − Linux provides user security using authentication features like password protection/ controlled access to specific files/ encryption of data.

4. *Architecture*

The following illustration shows the architecture of a Linux system [1, 2, 3]:



The architecture of a Linux System consists of the following layers:

- Hardware layer − Hardware consists of all peripheral devices (RAM/ HDD/ CPU etc).
- Kernel − It is the core component of Operating System, interacts directly with hardware, provides low level services to upper layer components.
- Shell − An interface to kernel, hiding complexity of kernel's functions from users. The shell takes commands from the user and executes kernel's functions.
- Utilities − Utility programs that provide the user most of the functionalities of an operating systems.

5. ***Commands***
    - **cat/etc/shells** : The command to know the list of shells available on our Linux.
    - **date** : This command is used to display the current data and time.
    - **cal** : This command is used to display the calendar of the current month and current year.
    - **echo "text"** : This command is used to print the arguments on the screen.
    - **tty** : It will display the terminal name.
    - **bc** : It will change the mode and in the new mode, arithmetic operations such as +, -, *, /, %, n, sqrt(), length(), = , etc can be performed.
    - **clear** : It is used to clear the screen.
    - **man <command name>** : It help us to know about the particular command and its options and working. It is like "help" command in windows.
    - **ls – options** : It is used to list all the contents in the current working directory.
        Options :
        a– used to list all the files including the hidden files.
        c– list all the files columnwise.
        d- list all the directories.
        m- list the files separated by commas.
        p- list files include „/" to all the directories.
        r- list the files in reverse alphabetical order.
        f- list the files based on the list modification date.
        x-list in column wise sorted order.
    - **pwd** : To print the complete path of the current working directory.
    - **mkdir <directory name>** : To create or make a new directory in a current directory.
    - **cd <directory name>** : To change or move the directory to the mentioned directory.
    - **rmdir <directory name>** : To remove a directory in the current directory and not the current directory itself.
    - **cat > filename.txt** : to create a new text file
    - **cat filename.txt** : to display text file on screen.
    - **cat filename1.txt filename2.txt > filename3.txt** : concatenate these two files and can save to another file.
    - **cat *.txt** : To display contents of all txt files.
    - **cat -n filename.txt** : To display the contents of a file with line number.
    - **cat filename1.txt >> filename2.txt** : To append the contents of filename1.txt to filename2.txt.
    - **sort <filename >** : To sort the contents in alphabetical order.
    - **sort –r <filename>** : To sort the contents in reverse alphabetical order.

- **cp <source filename> <destination filename>** : To copy the contents from source to destination file so that both contents are same.
- **mv <source filename> <destination filename>** : To completely move the contents from source file to destination file and to remove the source file.
- **rm <filename>** : To permanently remove the file we use this command.
- **wc<filename>** : To list the content count of no of lines , words, characters.
  Options :
  -c – to display no of characters.
  -l – to display only the lines.
  -w – to display the no of words.
- **pg <filename>** : This command is used to display the contents of the file page wise and the next page can be viewed by pressing the enter key.
- **head<filename>** : It is used to display the top ten lines of file.
- **tail<filename>** : This command is used to display the last ten lines of file.
- **grep "pattern" <filename>** : This command is used to search and print the specified patterns from the file.
- **Pipe (|)** : It is a mechanism by which the output of one command can be channelled into the input of another command.
- **ps** : This command is used to provide information about the currently running processes, including their process identification numbers (PIDs).

6. ***Exercise***

(a) Read about the following commands:

1. crontab
2. netstat
3. ifconfig
4. nslookup
5. ssh
6. find
7. ping
8. dig
9. host
10. scp
11. top / htop

(b) Read about the different types of kernel and shells.

References

[1] https://www.tutorialspoint.com/operating_system/os_linux.htm
[2] http://www.linux-india.org/characteristics-and-architecture-of-linux-oprating-system/
[3] https://cumulusnetworks.com/blog/linux-architecture/