Chapter -8

UNIX/LINUX OPERATING SYSTEM

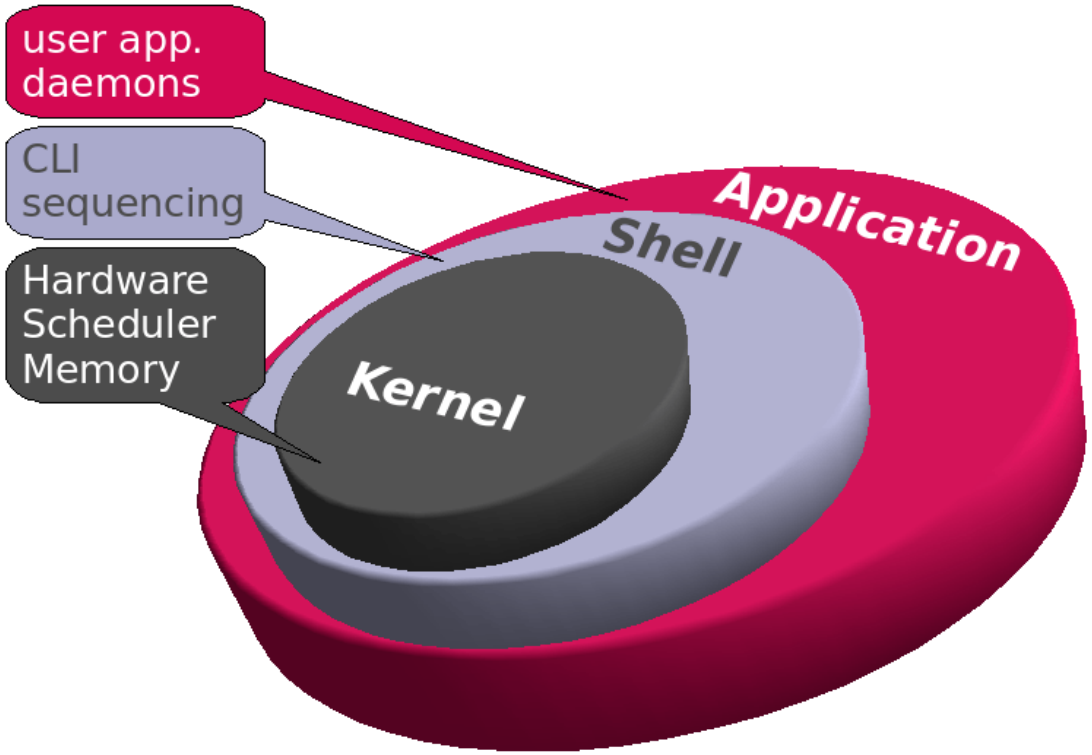
What is UNIX ?

- Unix is a portable, multitasking, multiuser, time-sharing operating system (OS) originally developed by AT&T Bell Labs.
- Several people can use a UNIX computer at the same time; hence *UNIX is called a multiuser system*.
- Any of these users can also run multiple programs at the same time; hence *UNIX is called multitasking*.
- There are many different versions of UNIX, although they share common similarities.
- The most popular varieties of UNIX are Sun Solaris, GNU/Linux, and MacOS X.

The UNIX Operating System

- The UNIX operating system is made up of three parts; ***the kernel***, ***the shell*** and ***the Application***.
- The **kernel** is that part of the system which manages the resources of whatever computer system it lives on.
- The **shell** is the command interpreter.
- The **shell** listens to your terminal and translates your requests into actions on the part of the kernel and the many utility programs.
- **Applications** which execute on the shell. It can be any utility program like a web browser, video player, etc.
- The file system is the organizing structure for data.

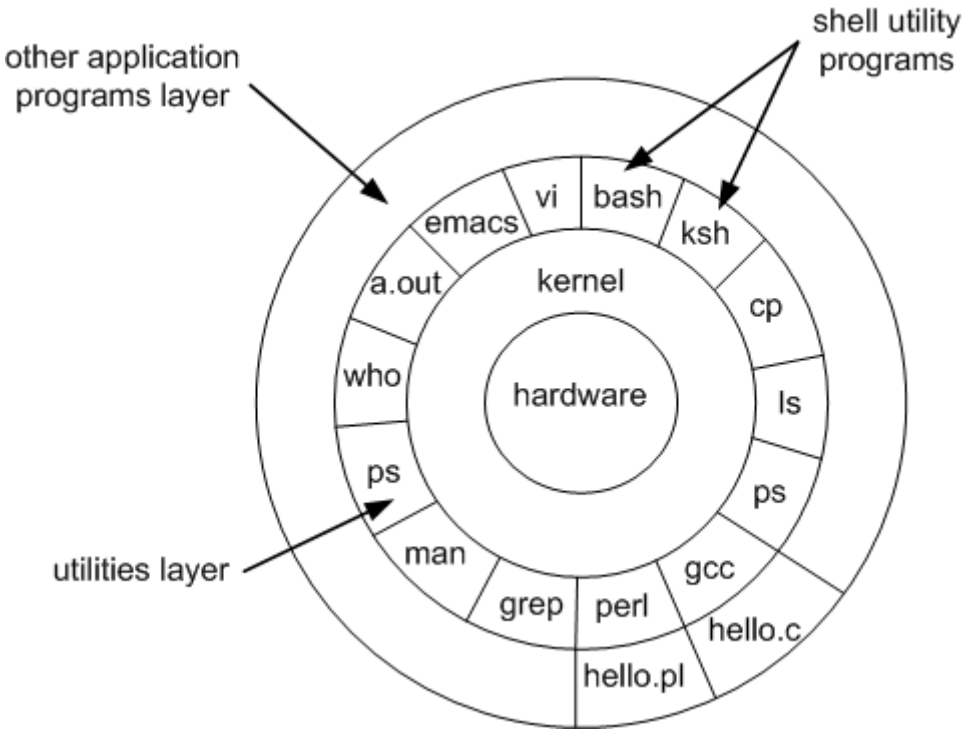
UNIX OS


user app.
daemons
CLI
sequencing
Hardware
Scheduler
Memory
Application
Shell
Kernel

What is a “shell”?

- The shell acts as an interface between the user and the kernel.
- The shell is a command line interpreter (CLI).
- User commands are often entered on a command line interface that is provided by a ‘**shell**’.
- The shell is a program that reads the user commands, evaluates it, and then prints the result.
- For evaluating the command, the shell may execute other commands, or pass them to the ‘kernel’.
- The most popular shells are: **bash**, tcsh, csh, and korn
- Shell commands are CASE SENSITIVE!

Operating System Organization



UNIX History

- The UNIX operating system was born in the late 1960s.
- It originally began as a one man project led by Ken Thompson of Bell Labs.
- In the time since UNIX was first developed, it has gone through many different generations.
- Some differ substantially from the original version, like Berkeley Software Distribution (BSD) or Linux.
- Others, still contain major portions that are based on the original source code.

Features of OS

- **Open Source**
- Linux source code is freely available and it is community based development project.

- **Multiuser capability**
- In a multi user system, the same computer resources hard disk, memory etc. are accessible to the many users.
- Users are given the different terminal to operate, a terminal in turn, is a keyboard and a monitor.
- All the terminals are connected to the main computer whose resources are available by all users.

Features of OS

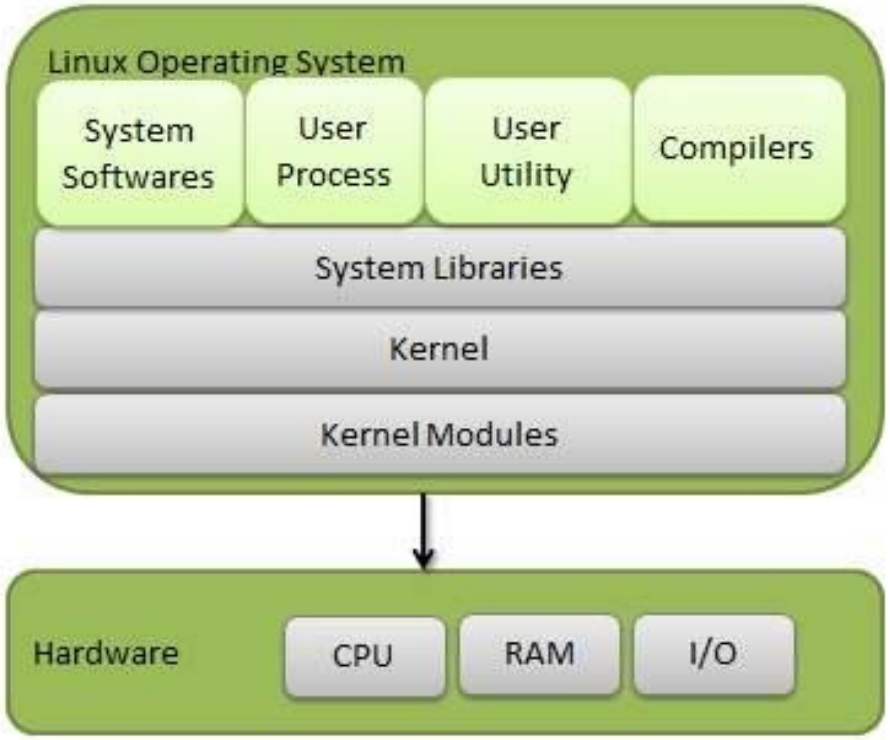
- **Multitasking capability**
- Unix is a powerful multi-tasking operating system.
- It means when a active task in in process, there can be a simultaneous background process working too

- **Communication**
- UNIX has the excellent communication with the users.
- The communication may be within the network of a single main computer or between two or more such computer network.

Features of OS

- **Security**
- Unix Has the three provisions for protecting the data.
  1. Re-assigning the passwords and login names
  2. Read, write and execute permissions
  3. File encryption
- **Portability**
- Portability means *software can works on different types of hardware* in same way.
- A portability credit of the UNIX is because of the C language, it *written in C language and C language is portable*.

Linux Architecture



Components of Linux Architecture

- **Hardware** : It contains physical devices of computer like CPU, Memory, Disk, printer etc.
- **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.
- **System Library** : System libraries are special functions or programs using which application programs or system utilities accesses Kernel's features.
- **System Utility :**System Utility programs are responsible to do specialized, individual level tasks.

Basic function of Kernel

- **Resource allocation**
- Manage the computer's resources and allow other programs to run and use these resources.
- Example: CPU, Memory and I/O devices.

- **Process Management**
- A process defines which memory portions the application can access.
- To allow the execution of applications and support them with features

Basic functions of Kernel

- **Memory Management**
- It allows processes to safely access this memory as they require it.
- Virtual addressing helps kernel to create virtual partitions of memory in two disjointed areas.
    1. kernel space(reserved for the kernel)
    2. User space(for the applications)
- **I/O Device Management**
- Processes need access to the peripherals connected to the computer, which are controlled by the kernel through **Device Drivers.**
- It is a computer program that enables the operating system to interact with a hardware device.
- A kernel maintains a list of available devices.

Basic functions of Kernel

- **Inter- Process Communication**
- It methods for Synchronization and Communication between processes called Inter- Process Communication (IPC).
- There are various approaches of IPC say, semaphore, shared memory, message queue, pipe (or named fifo), etc.
- **Scheduling**
- The kernel uses Scheduling Algorithms to determine which process is running next and how much time it will be given.
- **System Calls and Interrupt Handling**
- A system call is a mechanism that is used by the application program to request a service from the operating system.
- System calls include close, open, read, wait and write.
- To access the services provided by the kernel we need to invoke the related kernel functions

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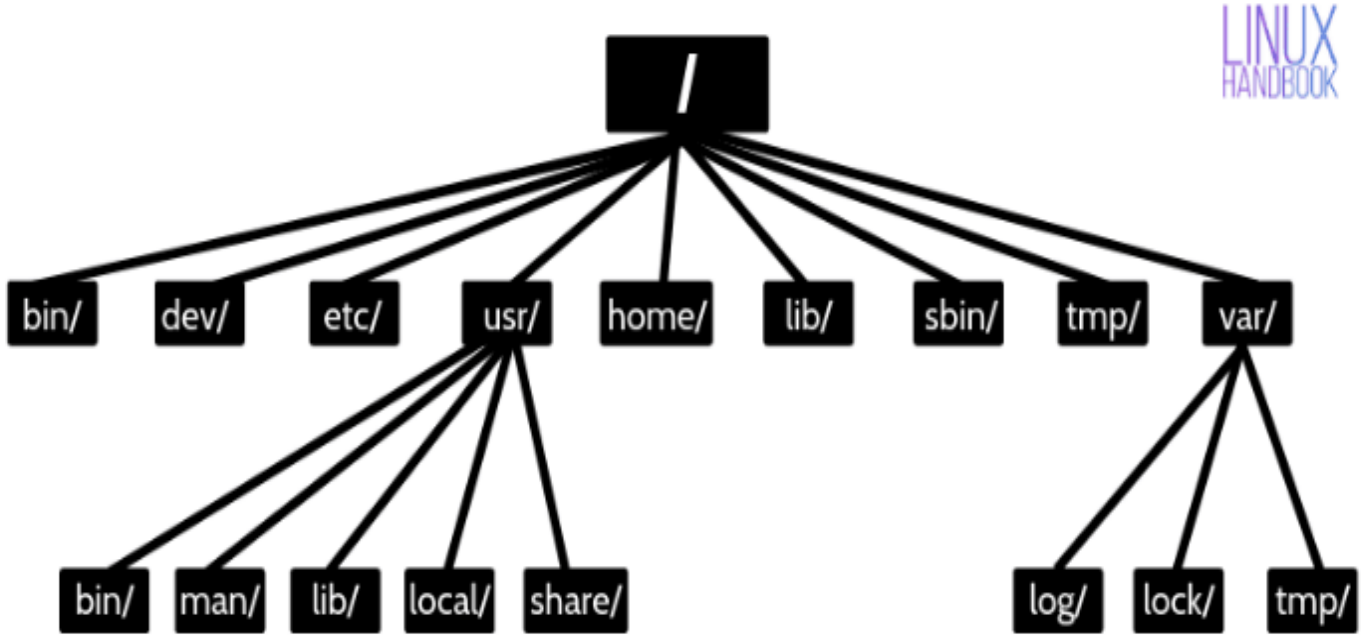
- **Security or Protection Management**
- Kernel also provides protection from faults (error control) and from malicious behaviours (Security).
- One approach toward this can be language based protection system.
- Here, the kernel will only allow code to execute which has been produced by a trusted language compiler.

Directory Structures

- A **directory** is a container that is used to contain folders and file. It organizes files and folders into a hierarchical manner.
- All the files are grouped together in the directory structure.
- The top of the hierarchy is traditionally called root(written as a slash/).

LINUX DIRECTORY STRUCTURE



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- 1. / – Root
- Every single file and directory starts from the root directory.
- Only root user has write privilege under this directory.
- Please note that /root is root user's home directory, which is not same as /.
- 2. /bin – User Binaries
- Contains binary executables.
- Common linux commands you need to use in single-user modes are located under this directory.
- Commands used by all the users of the system are located here.
- For example: ps, ls, ping, grep, cp.

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- 3. /sbin – System Binaries
- Just like /bin, /sbin also contains binary executables.
- But, the linux commands located under this directory are used typically by system aministrator, for system maintenance purpose.
- For example: iptables, reboot, fdisk, ifconfig, swapon
- 4. /etc – Configuration Files
- Contains configuration files required by all programs.
- This also contains startup and shutdown shell scripts used to start/stop individual programs.
- For example: /etc/resolv.conf, /etc/logrotate.conf

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- 5. /dev – Device Files
- Contains device files.
- These include terminal devices, usb, or any device attached to the system.
- For example: /dev/tty1, /dev/usbmono
- 6. /proc – Process Information
- Contains information about system process.
- This is a pseudo filesystem contains information about running process. For example: /proc/{pid} directory contains information about the process with that particular pid.
- This is a virtual filesystem with text information about system resources. For example: /proc/uptime

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- 7. /var – Variable Files
- var stands for variable files.
- Content of the files that are expected to grow can be found under this directory.
- This includes — system log files (/var/log); packages and database files (/var/lib); emails (/var/mail); print queues (/var/spool); lock files (/var/lock); temp files needed across reboots (/var/tmp);
- 8. /tmp – Temporary Files
- Directory that contains temporary files created by system and users.
- Files under this directory are deleted when system is rebooted.

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- 9. /usr – User Programs
- Contains binaries, libraries, documentation, and source-code for second level programs. /usr/bin contains binary files for user programs. If you can't find a user binary under /bin, look under /usr/bin. For example: at, awk, cc, less, scp
- /usr/sbin contains binary files for system administrators. If you can't find a system binary under /sbin, look under /usr/sbin. For example: atd, cron, sshd, useradd, userdel
- /usr/lib contains libraries for /usr/bin and /usr/sbin
- /usr/local contains users programs that you install from source. For example, when you install apache from source, it goes under /usr/local/apache2
- 10. /home – Home Directories
- Home directories for all users to store their personal files.
- For example: /home/john, /home/nikita

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- 11. /boot – Boot Loader Files
- Contains boot loader related files.
- Kernel initrd, vmlinux, grub files are located under /boot
- For example: initrd.img-2.6.32-24-generic, vmlinuz-2.6.32-24-generic
- 12. /lib – System Libraries
- Contains library files that supports the binaries located under /bin and /sbin
- Library filenames are either ld* or lib*.so.*
- For example: ld-2.11.1.so, libncurses.so.5.7

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- 13. /opt – Optional add-on Applications
- opt stands for optional.
- Contains add-on applications from individual vendors.
- add-on applications should be installed under either /opt/ or /opt/ sub-directory.
- 14. /mnt – Mount Directory
- Temporary mount directory where sysadmins can mount filesystems.

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- 15. /media – Removable Media Devices
- Temporary mount directory for removable devices.
- For examples, /media/cdrom for CD-ROM; /media/floppy for floppy drives; /media/cdrecorder for CD writer
- 16. /srv – Service Data
- srv stands for service.
- Contains server specific services related data.
- For example, /srv/cvs contains CVS related data.

S.NO	LINUX	WINDOWS
1.	Linux is a open source operating system.	While windows are the not the open source operating system.
2.	Linux is free of cost.	While it is costly.
3.	It's file name case-sensitive.	While it's file name is case-insensitive.
4.	In linux, monolithic kernel is used.	While in this, micro kernel is used.
5.	Linux is more efficient in comparison of windows.	While windows are less efficient.
6.	There is forward slash is used for Separating the directories.	While there is back slash is used for Separating the directories.
7.	Linux provides more security than windows.	While it provides less security than linux.

For Linux Commands and shell script program please refer the practical file.

Thank You