Linuxs Basics

Introduction

Linux operating systems are based on the Linux kernel. A Linux based operating system will consist of Linux kernel, GUI/CLI, system libraries and system utilities. The Linux kernel was independently developed and released by Linus Torvalds.

Linux is a **kernel** and and not a complete operating system. Linux kernel is combined with GNU system to make a complete operating system. Therefore, linux based operating systems are also called as GNU/Linux systems. GNU is an extensive collection of free softwares like compiler, debugger, C library etc.

A **Linux distribution(distro)** is an operating system based on the Linux kernel and a package management system. A package management system consists of tools that help in installing, upgrading, configuring and removing softwares on the operating system.

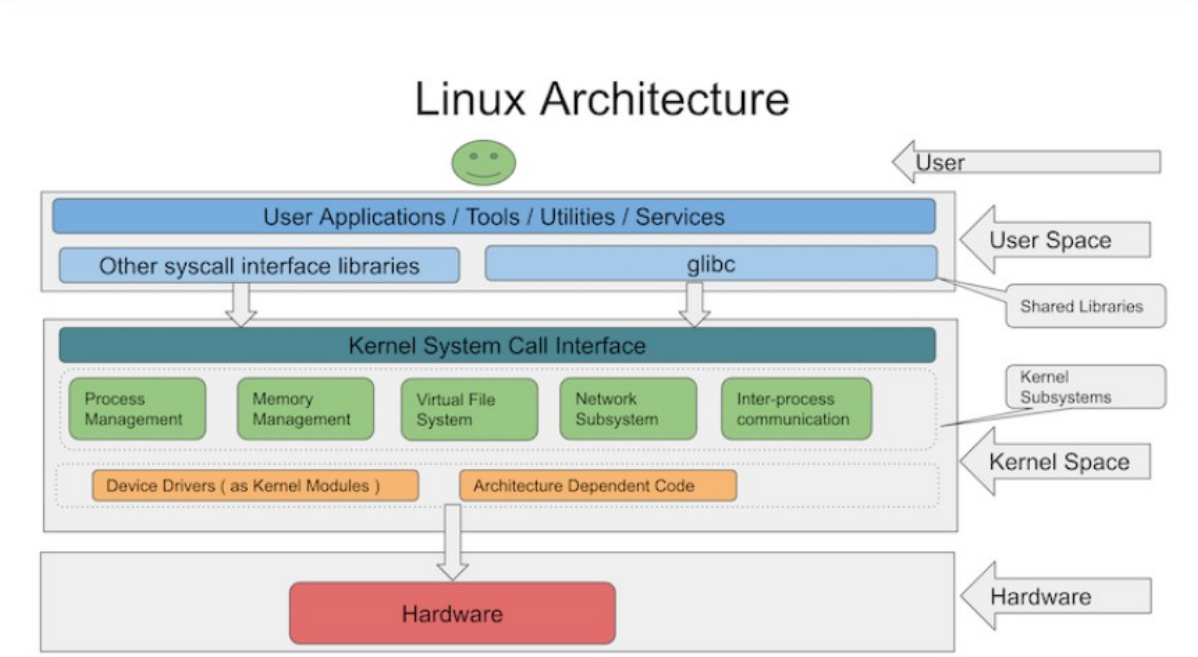
Software are usually adopted to a distribution and are packaged in a distro specific format. These packages are available through a distro specific repository. Packages are installed and managed in the operating system by a package manager.

List of popular Linux distributions:

- Fedora
- Ubuntu
- Debian
- Centos
- Red Hat Enterprise Linux
- Suse
- Arch Linux

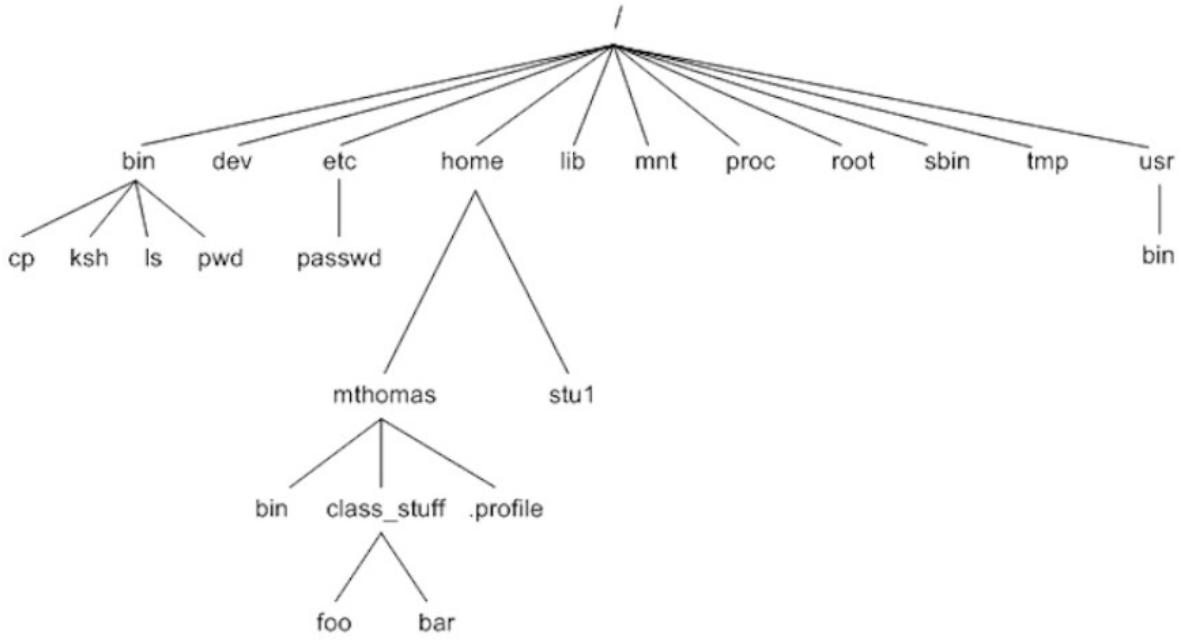
Packaging systems	Distributions	Package manager
Debian style (.deb)	Debian, Ubuntu	APT
Red Hat style (.rpm)	Fedora, CentOS, Red Hat Enterprise Linux	YUM

Linux Architecture



File System Organization

The linux file system has a hierarchical (or tree-like) structure with its highest level directory called root (denoted by /). Directories present inside the root directory stores file related to the system. These directories in turn can either store system files or application files or user related files.



bin | The executable program of most commonly used commands reside in bin directory

sbin | This directory contains programs used for system administration.

home | This directory contains user related files and directories.

lib | This directory contains all the library files.

etc | This directory contains all the system configuration files.

proc | This directory contains files related to the running processes on the system.

dev | This directory contains files related to devices on the system.

mnt | This directory contains files related to mounted devices on the system.

tmp | This directory is used to store temporary files on the system.

usr | This directory is used to store application programs on the system.

Commands for Navigating the File Systems

pwd : to get name or path of the current directory.

cd <folder> : change directory

ls : list files and directories

Commands for Manipulating Files

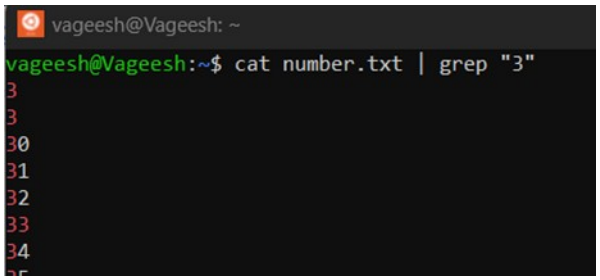
- touch <file name>– Create new file.
- mkdir < Folder name>– Create new Directory
- cp <src> <dst>– copy fil and Directory
- mv <src> <dst>– move files and Directories
- rm < File name>– Delete file and directory

Commands for Viewing Files

- cat – to view the content of the file.
- head <file name> - Displays Top ten lines
  - head -n 5 <file name > - Displays top 5 lines
- tail <file name> - Displays last ten lines
  - tail -n 5 <file name> - Displays last 5 lines
- more <file name> - list according to the screen size and cannot navigate the more lines.
- less < file name > - list according to the screen size and cannot navigate the more lines

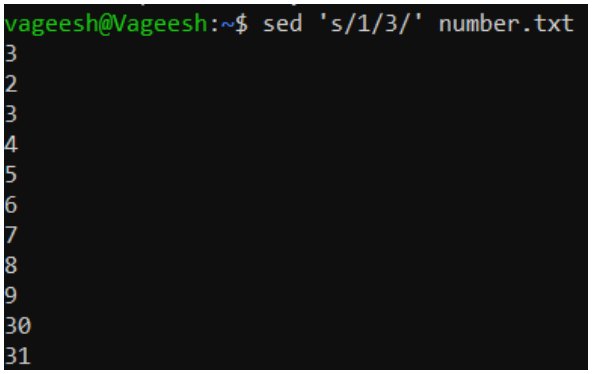
Text Processing Commands

- grep <word_to_search> <file_name> – print only the lines which contain a particular word(s)

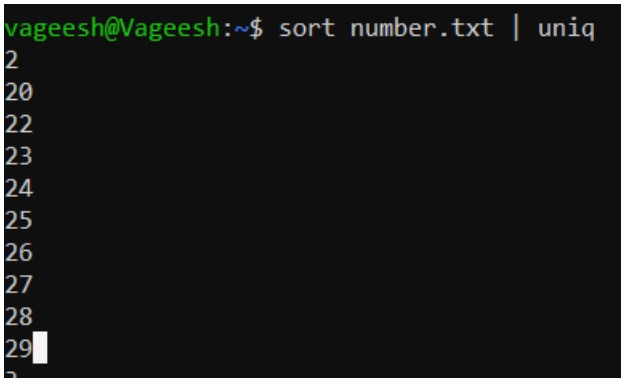


- sed 's/<text_to_replace>/<replacement_text>/' <file_name> - can be used to replace a text in a file.

- Use ‘-i ’ to so that the changes are reflected back in the file.



- Sort – sorting the numbers in asceinging order.



which <docker> : shows the path of docker.

whoami : shows the current username.

apt or yum list : gives the package list.

echo “hello” or echo hello : prints the statement.

echo `date` : to print the date.

echo “hello” >file1 Creates a file and inserts hello text in that.

sort : in alphabetical order.

Group

useradd Vageesh : creates a new user, and creates the group by default.

cat /etc/passwd/ : shows the new user created.

groupadd Wow : creates the new Group in the name of Wow

cat /etc/group/ you can find the new group that is created.

gpasswd -a Vageesh Wow : adding user Vageesh to the Wow group.

gpasswd -M a,b Wow : adding multiple users to the the Wow group.

ln -s a softa : create a softlink for folder ‘a’ and you can create a softlink for file also.

ln AB BackupAB : create a Hardlink for file.

tar -cvf a.tar a : archives the folder a into a.tar file.

(c- create, v-verbrose, f-forcefully.)

gzip a.tar : compresses the a.tar file and create a.tar.gz file.

gunzip a.tar.gz : unzips the compressed file.

tar -xvf a.tar : extracts the a.tar file.

Access modes/Permissions

Access Mode		**File**	**Directory**
r	**4**	To display content.	To list the content.
w	**2**	To modify.	To create or remove file.
x	**1**	To execute the file.	To enter into the Directory.

d	**rwx**	**r_x**	**r_ _**	**1**
File or Directory	owner	group	others	Symbolic link
	4+2+1	4 + 2	4	
	7	5	4	

chmod 777 file1 or folder : giving read, write and execution permission to owner, group and others.

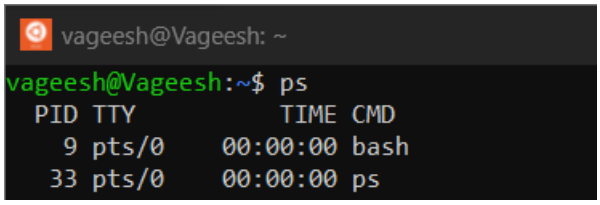
chown Vageesh file: access to particular user.

chgrp wow folder: give access to group.

Linux Process Management Commands

ps (Process status)

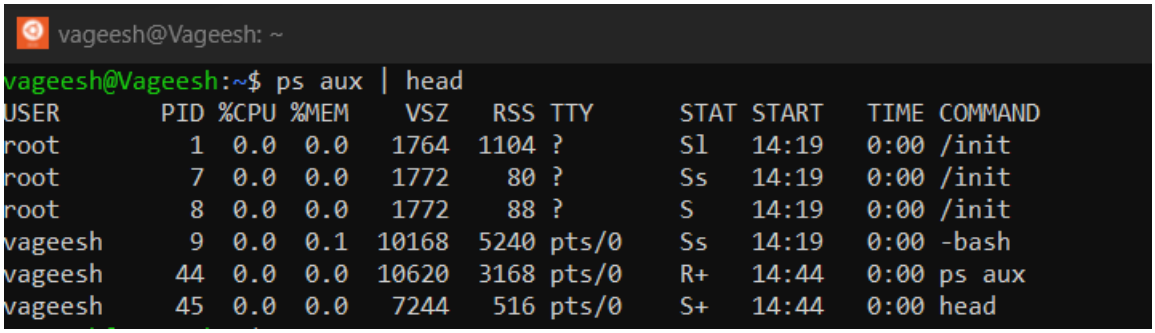
The ps command is used to know the information of a process or list of processes.



If you get an error "ps command not found" while running ps command, do install **procps** package.

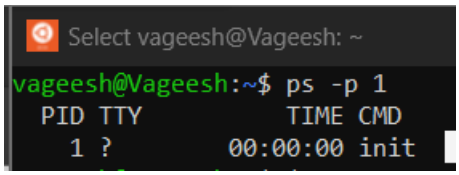
ps without any arguments is not very useful.to list all the processes on the system by using the below command.

a = show processes for all users
u = display the process's user/owner
x = also show processes not attached to a terminal

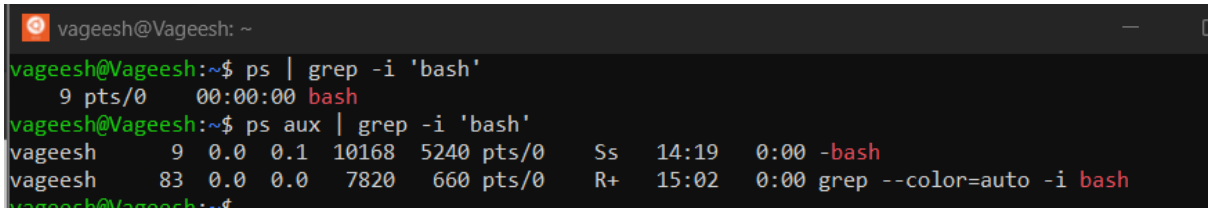


to list the information about the process with a specific process ID.

$ ps -p 1



We can use grep in combination with ps command to list only specific processes.



Top -The top command is used to show information about Linux processes running on the system in real time. It also shows a summary of the system information.

```
vageesh@Vageesh: ~

vageesh@Vageesh:~$
vageesh@Vageesh:~$ top
top - 15:05:32 up  1:00,  0 users,  load average: 0.00, 0.00, 0.00
Tasks:   5 total,   1 running,   4 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.0 us,  0.0 sy,  0.0 ni,100.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :   3844.5 total,   3692.7 free,     81.2 used,     70.6 buff/cache
MiB Swap:   1024.0 total,   1024.0 free,      0.0 used.   3614.7 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
    1 root      20   0    1764   1104   1028 S   0.0   0.0   0:00.02 init
    7 root      20   0    1772     80      0 S   0.0   0.0   0:00.00 init
    8 root      20   0    1772     88      0 S   0.0   0.0   0:00.32 init
    9 vageesh   20   0   10168   5240   3364 S   0.0   0.1   0:00.39 bash
   85 vageesh   20   0   10876   3748   3196 R   0.0   0.1   0:00.00 top
```

For each process, top lists down the process ID, owner, priority, state, cpu utilization, memory utilization and much more information. It also lists down the memory utilization and cpu utilization of the system as a whole along with system uptime and cpu load average.

Memory Management

Free : The free command is used to display the memory usage of the system. The command displays the total free and used space available in the RAM along with space occupied by the caches/buffers.

Using ‘-h’ for human readable format

```
vageesh@Vageesh: ~
vageesh@Vageesh:~$
vageesh@Vageesh:~$ free
               total        used        free      shared  buff/cache   available
Mem:         3936764       82928     3781532          68       72304     3701660
Swap:        1048576           0     1048576
vageesh@Vageesh:~$ free -h
               total        used        free      shared  buff/cache   available
Mem:           3.8Gi        81Mi       3.6Gi       0.0Ki        70Mi       3.5Gi
Swap:          1.0Gi          0B       1.0Gi
```

Vmstat : The vmstat command can be used to display the memory usage along with additional information about io and cpu usage.

```
vageesh@Vageesh:~$ vmstat
procs -----------memory---------- ---swap-- -----io---- -system-- ------cpu-----
 r  b   swpd   free   buff  cache   si   so    bi    bo   in   cs us sy id wa st
 2  0      0 3781336   6524  65816    0    0     2   130    1    3  0  0 100  0  0
```

Checking Disk Space

df (disk free)- command is used to display the free and available space for each mounted file system.

```
vageesh@Vageesh:~$ df
Filesystem     1K-blocks      Used Available Use% Mounted on
/dev/sdb       263174212   1969696 247766360   1% /
none             1968380         4   1968376   1% /mnt/wsl
tools          248882172 207678184  41203988  84% /init
none             1966296         0   1966296   0% /dev
none             1968380         0   1968380   0% /run
none             1968380         0   1968380   0% /run/lock
none             1968380         0   1968380   0% /run/shm
none             1968380         0   1968380   0% /run/user
tmpfs            1968380         0   1968380   0% /sys/fs/cgroup
drivers        248882172 207678184  41203988  84% /usr/lib/wsl/drivers
lib            248882172 207678184  41203988  84% /usr/lib/wsl/lib
drvfs          248882172 207678184  41203988  84% /mnt/c
drvfs          976759804 625422128 351337676  65% /mnt/d
```

du (disk usage) - command is used to display disk usage of files and directories on the system.

```
55M     .
vageesh@Vageesh:~$ du -h | head
4.0K    ./data
4.0K    ./.landscape
4.0K    ./.kube/cache/http/.diskv-temp
2.8M    ./.kube/cache/http
8.0K    ./.kube/cache/discovery/kubernetes.docker.internal_6443/coordination.k8s.io/v1
12K     ./.kube/cache/discovery/kubernetes.docker.internal_6443/coordination.k8s.io
12K     ./.kube/cache/discovery/kubernetes.docker.internal_6443/v1
8.0K    ./.kube/cache/discovery/kubernetes.docker.internal_6443/autoscaling/v1
8.0K    ./.kube/cache/discovery/kubernetes.docker.internal_6443/autoscaling/v2beta2
8.0K    ./.kube/cache/discovery/kubernetes.docker.internal_6443/autoscaling/v2beta1
vageesh@Vageesh:~$
```

top 5 largest files and directories using the command

```
vageesh@Vageesh:~$ du -h | sort -rh | head -5
55M     .
8.1M    ./.minikube
8.0M    ./.minikube/cache/preloaded-tarball
8.0M    ./.minikube/cache
3.1M    ./.kube/cache
```

Network Management commands

Dig is a userspace DNS system which creates and sends request to DNS resolvers and prints the response it receives to the console.

dig +trace linkedin.com

```
vageesh@Vageesh:~$ dig +trace linkedin.com

; <<>> DiG 9.16.1-Ubuntu <<>> +trace linkedin.com
;; global options: +cmd
.                       0       IN      NS      k.root-servers.net.
.                       0       IN      NS      a.root-servers.net.
.                       0       IN      NS      l.root-servers.net.
.                       0       IN      NS      b.root-servers.net.
.                       0       IN      NS      c.root-servers.net.
.                       0       IN      NS      m.root-servers.net.
.                       0       IN      NS      d.root-servers.net.
.                       0       IN      NS      i.root-servers.net.
.                       0       IN      NS      g.root-servers.net.
.                       0       IN      NS      j.root-servers.net.
.                       0       IN      NS      e.root-servers.net.
.                       0       IN      NS      f.root-servers.net.
.                       0       IN      NS      h.root-servers.net.
;; Received 432 bytes from 172.22.64.1#53(172.22.64.1) in 20 ms
```

Some of the various DNS query types are A, AAAA, NS, TXT, PTR, MX and CNAME.

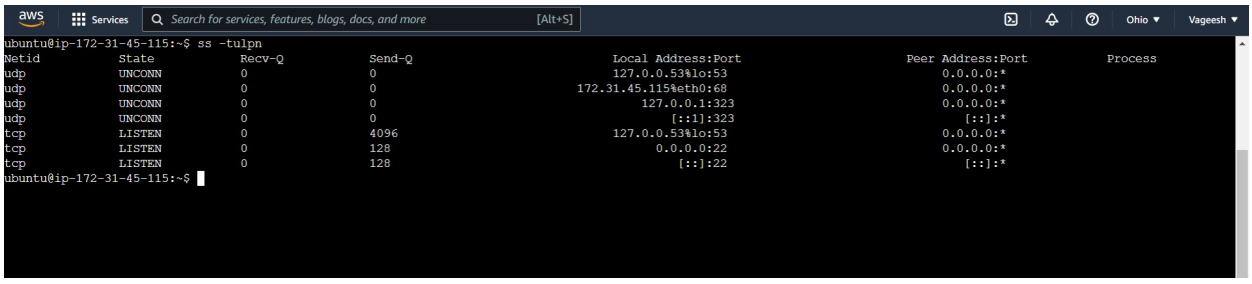
```
vageesh@Vageesh: ~
vageesh@Vageesh:~$ dig A linkedin.com +short
13.107.42.14
vageesh@Vageesh:~$ dig AAAA linkedin.com +short
2620:1ec:21::14
vageesh@Vageesh:~$
vageesh@Vageesh:~$ dig NS linkedin.com +short
dns4.p09.nsone.net.
ns1.p43.dynect.net.
dns3.p09.nsone.net.
dns1.p09.nsone.net.
ns4.p43.dynect.net.
ns2.p43.dynect.net.
ns3.p43.dynect.net.
dns2.p09.nsone.net.
vageesh@Vageesh:~$ dig www.linkedin.com CNAME +short
www-linkedin-com.l-0005.l-msedge.net.
vageesh@Vageesh:~$
```

ss -- The socket statistics command (ss) displays information about network sockets on the system. This tool is the successor of netstat, which is deprecated. Following are some command-line options supported by the ss command:

-t -- Displays the TCP socket. Similarly, -u displays UDP sockets, -x is for UNIX domain sockets, and so on.

-l -- Displays only listening sockets.

-n -- Instructs the command to not resolve service names. Instead displays the port numbers.



curl https://linkedin.com -v to check the details of the certificate attatched to the domain name.