# Linux OS

## Basics

ASCII

a

b

2

\_

alphanumeric

a-z A-Z 0-9 \_

## Unix/Linux

### Shell

sh shell

csh c-shell

zsh zeeshell

tsh

tcsh

bash born-again

### Linux flavors

ubuntu

debian

kali

raspbian

redhat

centOS

Fedora

### misc

directory == folder

command options operand

mkdir captain

ls -l

cd captain

### redirection operators

> output redirection

>> output redirection (append)

### basic commands

clear clear the screen

date

cal

who

alias

unalias

### more commands

#### echo

followed by a string

#### read

read from the input

#### ulimit

-a limits related to the OS

### command paths

/bin

/usr/bin

### dir & file commands

pwd

cd change

cd captain

cd ..

cd .

cd ~ (home)

mkdir create directory

ls list

cat

head

-n

tail

-n

less

more

uniq

cp copying

mv move

renaming

rm remove

rmdir remove an empty directory

rm -r remove a full directory

## file system

### various file systems

fat

file allocation table

fat32

fat64

ntfs

new tech file system

apfs

apple file system

ext3/4

journaling

linux uses

procfs

### inode

unique number given to every file

inode data struct

all info file

### types of files

- regular

d directory

p pipe/fifo

b block device driver

c char device diver

s socket

/dev

/dev/tty0

/dev/tty1

/dev/tty2

/dev/pts/1

/dev/pts/2

### path

relative path

step by step

/amazon/hyd15/floor2/room7/chair5

cd ..

/amazon/hyd15/floor2/room7/

cd ..

/amazon/hyd15/floor2

cd ..

/amazon/hyd15

cd floor3

/amazon/hyd15/floor3/

cd room6

/amazon/hyd15/floor3/room6

cd chair2

/amazon/hyd15/floor3/room6/chair2

absolute path

/amazon/hyd15/floor2/room7/chair5

cd /amazon/hyd15/floor3/room6/chair2

/amazon/hyd15/floor2/room7/chair5

### permissions

participants.xlsx

user group others

r w x r w - r - -

1 1 1 1 1 0 1 0 0

7 6 4

### users & groups

every user belongs to a group

u g o r w x

o+r read for others

+r read for all

g-w remove write permissions for group

#### directory permissions

writing into folder → creating new files

reading a folder → viewing list of files & folders

executing folder → can’t even cd

#### root

super user

### file descriptors

temporary number given to each open file

smallest available number is assigned

#### open file descriptors

stdin 0

stdout 1

stderr 2

hello.txt 3

## editors

### general

sublimetext

atom

vscode

notepad++

command based CLI

### linux editors

vi (vim)

gedit

atom

sublimetext

vscode

emacs

notepad++

nano

## vi

visual editor

vim

### two modes

#### insertion

i

a

#### command

esc

:w save

:wq save & quit

:q! quit without saving

:w! save as

yy copy

p paste

dd cut

delete

u undo

ctrl+r redo

4yy copies four lines

## specials (w.r.t strings)

### wild cards

\*

?

### escape characters

\” “

\\ \

\$ $

## grep

-i ignore-case

-v invert the condition

-n line number

-c total counts

-w match the entire word

-m max counts

-A2 also displays 2 lines after the match

-B3 also displays 3 lines before the match

-C5 also displays 5 lines before & after match

-E extended grep (includes regex)

### regular expressions

#### meta characters

^ line starts with

$ ends with

[ ] pick from within that range

[a-z] all lower

[A-Z] all upper

[a-zA-Z] all alphabets

[a-egtkl] [abcdegtkl]

[0-9] any digit

[0-39] [01239]

. place holder for one character (except newline)

\* zero or more occurrences

? zero or one occurrence

+ one or more

{x, y} min x number of times

max y number of times

{1,} one or more (same as +)

{1,4} min 1 max 4

{1} only 1

#### specail sequences

\d digits

[0-9]

\D any non digit

\s whitespace

(space tab newline )

\S invert of \s

\w alphanumeric

[a-zA-Z\_]

\W

\| or

"akash\|akshat" looks for akash or akshat anywhere in the file

\b word boundary

\\ \

\\* \*

\[ [

## more file commands

### find

find where option operand more options

find /home/nigam -type d -exec

-empty empty files

-name name of the file

-type type of the file

f file

d directory

p pipe/fifo

-exec execute something over find

-size

c bytes

k Kilobytes

b block(512bytes)

M mega

G giga

-delete

### wc

-l line

-c character

-w word

### sort

-r reverse

-n numeric

-k column

-c

-u unique

-o store it in an output file

### uniq

-c count

-d only repeated lines

-f skip some words

-s skip some characters

-i ignore case

## links

hard links

symbolic link

### ln

create a hard link

-s create symbolic link (soft)

## shell scripts

### variables

local

shell

env

### local variables

can start with a-z A-Z \_

can have a-z A-Z \_ 0-9

hello23

max\_temp

hi\_34\_XX

invalid:

23hello

hi-we

hy,iu

### environment variables

SHELL

LOGNAME  
HOME  
PWD

PATH

IFS

internal field separator

### special variables

$0 filename

$n command line arguments

$1

$2

$# total number of arguments

$\* all the arguments

$@

$? exit status of the last command

$$ current pid

$! pid of last process executed

### arithmetic

let

to ensure its a mathematical expressions

+

-

\* mul

/ div

% modulus (remainder)

= assignment

expr ` `

(( ))

### conditional

#### if

if [ conditional expression ]

then

set of commands

else

other commands

fi

the square brackets are called as test

can also use the keyword test

#### case

case $data in

)

;;

)

;;

\*) default

### loops

while

for

until

#### while

while [ condition ]

do

commands

done

### operators

#### arth

+

-

\* mul

/ div

% modulus (remainder)

#### = assignment

== equality

!=

#### relational

-eq equality

-ne not equal to

-lt lesser than

-le less than or equal to

-gt greater than

-ge greater than or equal to

#### strings

= equal to

!= not equal to

-z size is zero

-n size is non-zero

#### logical

&& and

|| or

-o or

-a and

! not

#### file

-f file exists & is a regular file

-d file exists & is a directory

-e file exists

-x file is executable

-w file is writable

-r file is readable

-p file is pipe

-S file is socket

-s file exists & is non zero in size

#### key words

if

elif

else

then

test

while

do

done

## process

everything in linux → file

if it’s running its a process

### pid

## man

1 commands

2 system calls

3 functions

4

5

6

7 misc , signals

# system programming

1. application programming
2. system programming
3. kernel programming

### system calls

codes inside the kernel

## file based system calls

### open

opens a file

O\_RDONLY read only

O\_WRONLY write only

previous content is deleted

O\_RDWR read & write

O\_APPEND append mode

### read

(from where -fd, read into where - buffer, how many bytes/chars)

return → number of bytes/characters read

### write

(where to write -fd, what to write - buffer, how many bytes/chars)

return → number of bytes/characters write

### lseek

lseek(fd, OFFSET, from where)

fd file desc

from where

SEEK\_CUR (current)

SEEK\_END (end)

SEEK\_SET (start)

### create()

### unlink()

### chmod()

### close()

### dup()

create a duplicate fd

### dup2()

create a duplicate fd, with number specified by user

| p |
| --- |
| \n |
| k |
| a |
| a |
| a |

printf is nothing but

write(1, …, …)

0 stdin

1 stdout

2 stderr

### modes of operation

user mode

kernel mode

## process

ps

### information about process

pid pid

ppid ppid

mem

virtual mem

actual ram

shared mem

start time stime

elapsed time etime

running time

cpu/kernel time

uid

gid

name/command cmd

cpu usage

priority pri

state stat

tty tty

num of threads nlwp

### init

pid 1

first process to run

### fork()

creates a new process

returns 0 to child

child’s pid to the parent

shared with child:

code written after fork

open file descriptors

### wait(NULL)

wait for a child process to exit

### waitpid()

wait for a particular pid to exit

### state

R Run

using CPU resources

S Sleep

wait, delay

T Stop

pause

--------------------------------------

Z zombie

D uninterruptible

-------------------------------------

I kernel threads

+ needs a stdout

s session leader

## signals

### kill

### kill()

### 

|  | action | keyboard | handled? |
| --- | --- | --- | --- |
| SIGTERM | end | no | yes |
| SIGINT | end | ctrl + c | yes |
| SIGKILL | end | no | no |
| SIGSTOP | stop | ctrl + z | no |
| SIGQUIT | end | ctrl + \ | yes |
| SIGALARM | end self | no | yes |
|  |  |  |  |

#### from keyboard:

SIGINT SIGSTOP SIGQUIT

two signals can not be handled:

SIGKILL SIGSTOP