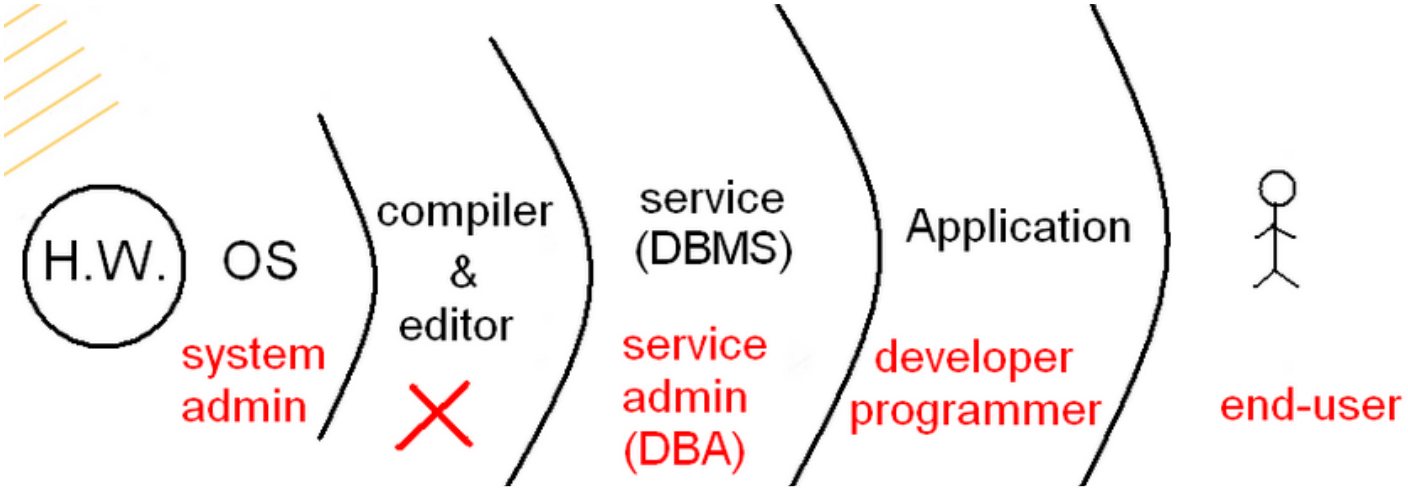
#linux #os #scheduling

LPIC 1 class

Session 1

GNU/Linux → OS
Linux → Core or Kernel

40 years ago architecture → Multiuser Single server



OS = Kernel + tools
GNU/Linux = Linux + GNU

File system: store and recovery of files in system

- Format
- Block size

Multiuser Single server Architecture

Users with Terminal (IU and OU)

CPU		**ALU**		
Input Unit		CU		OU
		MU		

Client server Architecture

Every OS needs to work with special Filesystems

Linux native file system: EXT4, btrfs
Non-native: NTFS, XFS, APFS, ZFS, SWAP
Cross-platform FS: FAT8, 16, 32, CDFS, ISO

```shell
mk
```

GCC = GNU C Compiler

Enterprise Environments

- Big scale, scalable, multilocation, multiservice, complex
- high con-current users, 24/7
- zero down time = high availability
- separability of internal / external parts
- Income,

My ubuntu details:

- share folder : `D:\Hesam\Linux_shared`

Anisa ftp
http://ftp.anisa.co.ir/OVA/RockyLinux_9_Minimal.ova
http://ftp.anisa.co.ir/ISO/Rocky-9.0-x86_64-dvd.iso
Alireza's at share folder

Client / Server old
→ 2-layer → 3-layer → N-tier

middle-tier

IPC - ICP (**Internal Communication Protocol**)

Administration	DevOps	Developer
LPICs		
LPIC-3		
300 Mix Env. (SMB, LDAP)		
303 Security		
305 Virtualization		

Linux

1. Debian based
2. Redhat based

- LPIC 3
  - SMB protocol - CIFS protocol for connecting Windows - Samba (Windows mask on Linux)
  - LDAP protocol - LDAP servers implementation by providers
    - (Active directory Windows, Oracle Internet directory, Linux: several like OPEN LDAP)
    -
- Security Enhanced Linux: for Application limitation (like firewall)

Anisa FTP with files for download

→
→

Session 2

? to review
part 2

1. `root` : as super user
2. `root` : `filesystem root` highest position in hierarchy - `/`
3. `root` : `root` a root's home directory - `/root/` دارکتوری هم نام یوزر
4. `root` : `root` a group - `/root/`
5. `root` : `root` as a access level

tilde ~ current user home directory

when login → go to home of user

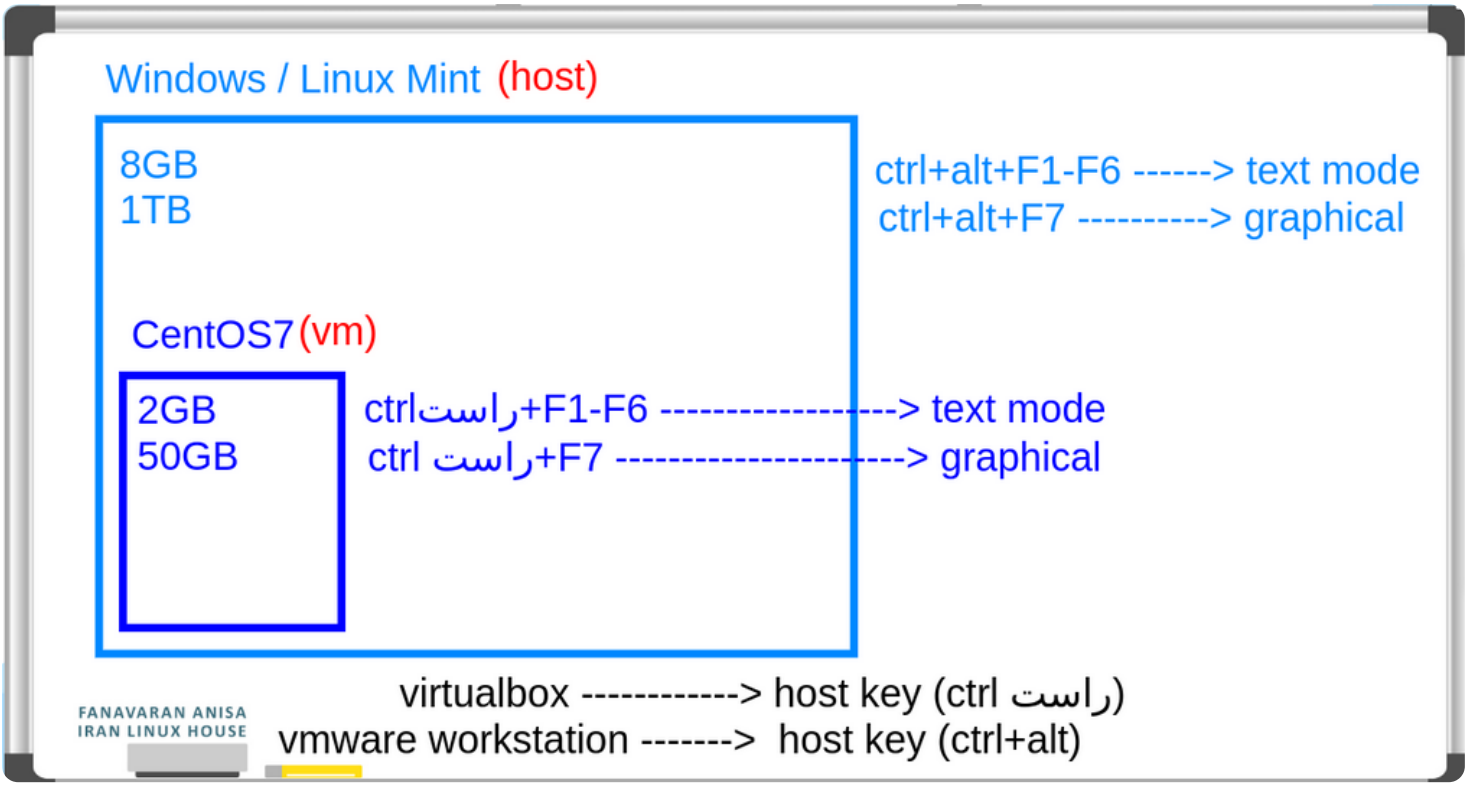
- `whoami`
- `pwd` - `cd`
- root account identifier at shell: `#`
- rest of user: `$`
- switch to `root` user
  1. Run `sudo <command>` and type in your login password, if prompted, to run only that instance of the command as root. Next time you run another or the same command without the `sudo` prefix, you will not have root access.
  2. Run `sudo -i`. This will give you an interactive root shell. Note that the `$` at the end of your prompt has changed to a `#`, indicating that you have root access. But you fall in the root home directory (`/root/`). From here you can run any sequence of commands as root, or run the command `exit` to leave the root shell.
  3. Use the `su` (substitute user) command to get a root shell. This is effectively the same as using `sudo -i`. Note that when you use this command it will ask for the root password and

not your login password. These are not the same. You may have to set or change the root password by running `sudo passwd root` first.

4. Run `sudo -s`. This gives you root access, but maintains your current SHELL. Shell specific settings, including your current directory, are preserved. For instance if you use `bash` (Ubuntu's default shell), aliases (and any other settings from `~/.bashrc`) are kept when you switch to the root user. To leave the root access, type `exit` as in the cases above.

Session 3

have 6 text mode and one graphical mode



right Ctrl +
Ctrl+alt+ F + $\{1, \ldots, 7\}$

- there exist `system` and `service/application` related users
  - like `ftp service`, `mail server service`, etct
  - We can check them in `config` file [later](in cource)
  check whole users $\rightarrow$ check config file
  shutdown $\rightarrow$ `init 0`

< i see till min 41:03> exercises at <-48:00>

shutdown	`init 0`
reboot	`init 6`

`whoami`
`pwd`

`dir` or `ls` `ls <address>` `ls /Var>`
useradd with privilages of `root`

control + F2
`useradd` → `passwd` to set password

`hostname` `<computername>.<domain name>`

```shell
echo "server1.lpic.org" > /etc/hostname
init 6
```

- reboot to be possible to see the file

`ps` ?

- Zoom in or out in `Ctrl+Shift` `Ctrl`
- clear screen `clear`
- `R Ctrl+l` hostkey
- `L Ctrl+ C`
- `ls -l` long list with details
- `cat`

```shell
ls /boot

boot loader# grub2
initrd #
# kernel linux file which contains version
```

- `-l` (long listing), `-a` (show hidden dot files), and `-t` options (list by time)
- Sometimes, an `argument` is associated with an `option`.
- argument must immediately follow the option.
  - single-letter options, the argument typically follows after a space.
  - full-word options, the argument often follows an equal sign (=).

```shell
ls ?
ls --hide=Desktop
```

1. دسترسی‌ها permission access
2. hard link
3. مالک
4. گروه مالک group owner
5. size (Byte)
6. modify time (mtime)
7. filename

- `ls -l -h` `<switch> <option` > option does not work stand alone
- `ls -a` all provide all which add things start with `.`
- `.` and `..`
  - absolute address vs relative addressing
  - `ls .` folder im am in
  - `ls./..` = `ls ..`
- 1993 - 1994 FHS Filesystem Hierarchy Standard → LSB (Linux Standard Base)
- Long Term Support LTS
- check distro differences
- Linux features LSB, LTS
- `\` : ریشه فایل سیستم و شروع آدرس دهی از این دایرکتوری
- `/boot` : برخی فایل های اصلی در این قرار دارند از جمله
- `/` :
- `/` :
- `/bin` : فایل اجرایی دستورات عمومی سیستم که توسط همه کاربران قابل اجرا هستند در این مسیر قرار می گیرد. اصطلابه این دستورات user commands یا general commands می گویند
- `/sbin` : فایل اجرایی دستورات عمومی سیستم که توسط همه کاربران قابل اجرا هستند در این مسیر قرار می گیرد. اصطلابه این دستورات system commands یا administration commands می گویند
- `/lib` : فایل اجرایی دستورات عمومی سیستم که توسط همه کاربران قابل اجرا هستند در این مسیر قرار می گیرد. اصطلابه این دستورات user commands یا general commands می گویند
- `/opt` : `<optinal>` third-party applications

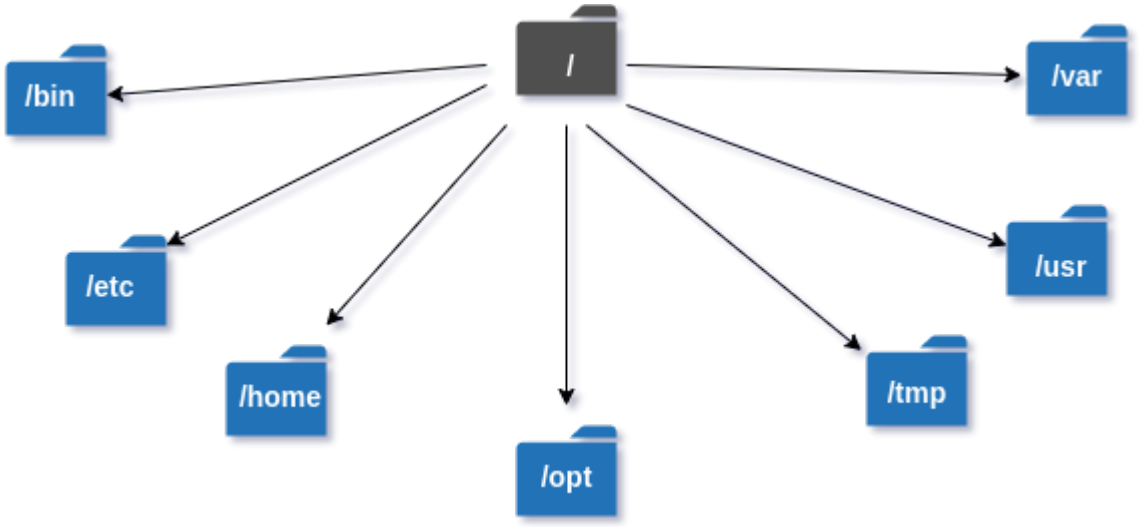
تکالیف

- Window
  - client
  - server
- Linux
  - client: N/A
  - server:
    1. Server (core) → ubuntu server, RHEL, OEL,
    2. desktop → ubuntu server, RHEL, OEL,
- `ls /bin/ | more` : only go done, `q` for quit
- `ls /bin/ | less` : ↑ ↓ work
  - less or more pagination
- `|` : pipe operator : to side of operator should be command
- `cat` :
- `cat <filename> | ws -l` or `ws -l <filename>` :
- `less <filename>`
- `nl
- `cat file | nl | more`
- `4700 PB` = $4700 \times 1000^5 Byte$ = $4700 \times 1000^4 \times 1000 Byte$ = 4.7e+15 KB
- `4700 PB` = $4700 \times 1000^5 Byte$ = $4700 \times 1000^7 \times \frac{1}{1000^2} ZB$ = 0.0047 ZB

- `4700 TB` = $4700 \times 1000^4 Byte$ = $4700 \times 1000^3 \times 1000 Byte$ = 4.7e+12 KB
- `4700 TB` = $4700 \times 1000^4 Byte$ = $4700 \times 1000^7 \times \frac{1}{1000^3} ZB$ = 4.7e-6 ZB

linux-directory-structure

These are the common top-level directories associated with the root directory:



Directories	Description
/bin	binary or executable programs.
/etc	system configuration files.
/home	home directory. It is the default current directory.
/opt	optional or third-party software.
/tmp	temporary space, typically cleared on reboot.
/usr	User related programs.
/var	log files.

Some other directories in the Linux system:

Directories	Description
/	
/boot	It contains all the boot-related information files and folders such as conf, grub, etc.
/dev	It is the location of the device files such as dev/sda1, dev/sda2, etc.
/lib	It contains kernel modules and a shared library.
/lost+found	It is used to find recovered bits of corrupted files.

Directories	Description
/media	It contains subdirectories where removal media devices are inserted.
/mnt	It contains temporary mount directories for mounting the file system.
/proc	It is a virtual and pseudo-file system to contains info about the running processes with a specific process ID or PID.
/run	It stores volatile runtime data.
/sbin	binary executable programs for an administrator.
/srv	It contains server-specific and server-related files.
/sys	It is a virtual file system for modern Linux distributions to store and allows modification of the devices connected to the system.

Log Files:

Log Files	Descriptions
/var/log/lastlog	It stores user's last login info.
/var/log/messages	It has all the global system messages
/var/log/wtmp	It keeps a history of login and logout information.

System Configuration Files:

Configuration Files	Description
/etc/bashrc	It is used by bash shell that contains system defaults and aliases.
/etc/crontab	A shell script to run specified commands on a predefined time interval.
/etc/exports	It contains information on the file system available on the network.
/etc/fstab	Information of the Disk Drive and their mount point.
/etc/group	It is a text file to define Information of Security Group.
/etc/grub.conf	It is the grub bootloader configuration file.
/etc/init.d	Service startup Script.
/etc/lilo.conf	It contains lilo bootloader configuration file.
/etc/hosts	Information of IP and corresponding hostnames
/etc/hosts.allow	It contains a list of hosts allowed accessing services on the local machine.
/etc/host.deny	List of hosts denied accessing services on the local machine.
/etc/inittab	INIT process and their interaction at the various run levels.
/etc/issue	Allows editing the pre-login message.
/etc/modules.conf	It contains the configuration files for the system modules.

Configuration Files	Description
/etc/motd	It contains the message of the day.
/etc/mtab	Currently mounted blocks information.
/etc/passwd	It contains username, password of the system, users in a shadow file.
/etc/printcap	It contains printer Information.
/etc/profile	Bash shell defaults.
/etc/profile.d	It contains other scripts like application scripts, executed after login.
/etc/rc.d	It avoids script duplication.
/etc/rc.d/init.d	Run Level Initialisation Script.
/etc/resolv.conf	DNS being used by System.
/etc/security	It contains the name of terminals where root login is possible.
/etc/skel	Script that initiates new user home directory.
/etc/termcap	An ASCII file that defines the behavior of different types of the terminal.
/etc/X11	Directory tree contains all the conf files for the X-window System.

Virtual and Pseudo Process Related Files:

Virtual and Pseudo Process Related Files	Descriptions
/proc/cpuinfo	CPU Information
/proc/filesystems	It keeps useful info about the processes that are currently running.
/proc/interrupts	it keeps the information about the number of interrupts per IRQ.
/proc/ioports	Contains all the Input and Output addresses used by devices on the server
/proc/meminfo	It reports the memory usage information.
/proc/modules	Currently using kernel module.
/proc/mount	Mounted File-system Information.
/proc/stat	It displays the detailed statistics of the current system.
/proc/swaps	It contains swap file information.

Session 4

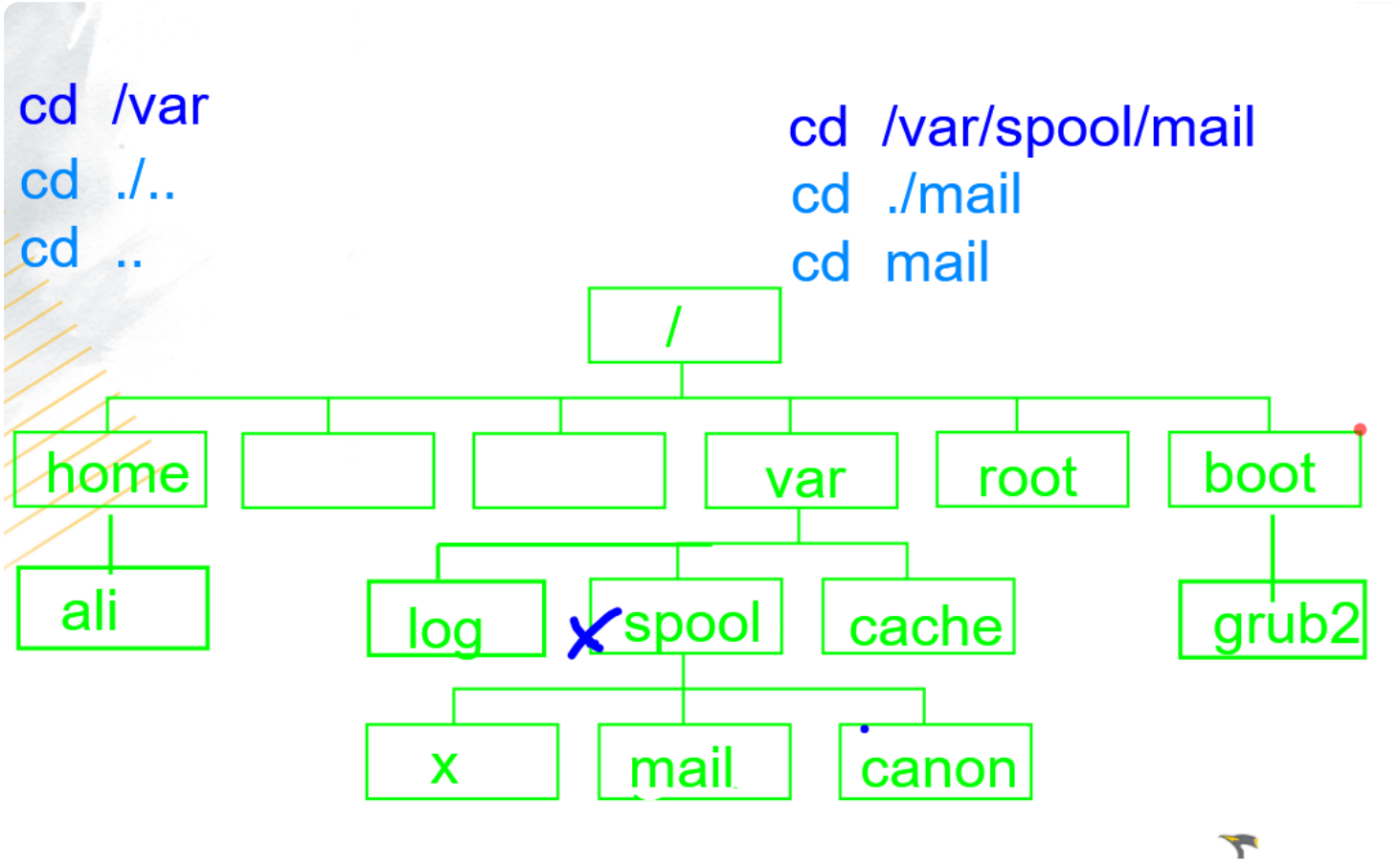
- Programs
  - complier - binary file

        - system related `/sbin`
        - person related `/bin`
    - interpereter
        - python, shell, perl - text file (script) - `~` ?
- executable file
    - windows
    - Linux
        - executable file
        - use permission to use `rwx`
            - whatever get `x` permission
- `wc -l` line count
- `cat localrepo | nl`
- `ls /boo -a -l -h` arguments
    - 0 referencing
    - `ls -l -h -a /boot` more Linux
    - similar arguments can be mixed `ls -alh /boot`
    - switches without values can be merged
        - `command -a <value> -b <value>`
    - `ls -lhtr` ? ?????
- unix style: `ls -a` , `rpm -i ...` , `ps -a -u -x` or `ps -aux`
- GNU style `ls --all` , `rpm --install ...`
- BSD style `ps aux` , `rpm --install ...`
- `user manual` or `manual`
    - `man ls` : `man <name>`
    1. user command - default user - `/bin`
    2. system command - `/sbin`

```
LS(1)                                User Commands                                LS(1)

NAME
       ls - list directory contents

SYNOPSIS
       ls [OPTION]... [FILE]...

DESCRIPTION
       List  information  about  the  FILEs  (the  current  directory by default).  Sort
       entries alphabetically if none of -cftuvSUX nor --sort is specified.

       Mandatory arguments to long options are mandatory for short options too.

       -a, --all
              do not ignore entries starting with .

       -A, --almost-all
              do not list implied . and ..

       --author
              with -l, print the author of each file

       -b, --escape
              print C-style escapes for nongraphic characters

       --block-size=SIZE
              scale sizes by SIZE before printing them;  e.g.,  '--block-size=M'  prints
              sizes in units of 1,048,576 bytes; see SIZE format below
Manual page ls(1) line 1 (press h for help or q to quit)
```

- search `/`
    - `n` : next match

    - `N` : previous match
    - `q` : quit
- `echo $?`
- `touch`
    - `touch .f4` `touch ./.f5` `touch ....f4`
    - `~` home directory of root user
    - `rm -i <filename>` : i = `interactive`
        - in `redhat` and `centos` and??? : as these are for servers to prevent deleting files
            - `rm -f` - `force`
    - `cd -` : last address
    - `history`
        - `!number`
- `cd ~` or `cd ../../../root` or `cd ./../../../root` `cd $HOME` `cd/root` or simply `cd`
- absolute vs relative address
    - absolute: not important where we are: only address `destination` start with `/`
        - `.` currnet directory
        - `..` currnet directory
    - relative



- `mkdir /root/1403/mehr/11/linux/class/`
    - `mkdir/root/1403` `cd ~
    - `mkdir/root/1403/mehr` `mkdir ./1403 cd ~
    - ...
    - missed for few minutes
    - `rm f?`

    - `mkdir - p`
- `auto completion` : to character
- `echo`
    1. print argument:
        - `echo salam baxs`
        - `echo "salam baxs"`
    2. see `variable` value
        - V1=500 : in RAM -= memory
        - `echo V1` `echo $V1`
        - `echo $?` : `?` exit code = 0 correct else not correct
- `echo $PATH`
- `which mkdir` the one is nearest
- `which -a mkdir`
- `whereis mkdir`

File Types

- `-` regular files (data → txt, jpg, pdf, mp3)
- `d` directory
- `l` symbolic link (shortcut)
- `c` special device, character
- `b` special device, block
- `p` pipe: interfacing 2 file
- `s` socket: 2 applications
- `file <filename>`
- `ls -l zero`
- `ls -l cdrom` → `ls - sr0`
- `ls -l sd*`
- `touch f4.mp4`
- `reset`
- `cd /dev` and `cd /etc` and check file types
- `pwd > f1`
- command `>` file: to write to file (making file method 2)
- command `>>` file : to append (making file method 3)

exercise 1

```shell
cd
echo Hesam > myinfo.mp3
echo MH >> myinfo.mp3
echo 09350000 >> myinfo.mp3

cd /root/1043/mehr/11/Linux/calss
```

```
echo "Hesam
MH
09350000" > myinfo.mp3

echo Hesam > myinfo.mp3
echo MH >> myinfo.mp3
echo 09350000 >> myinfo.mp3
```

Find file python - check version

- python - check version

```shell
ls /usr/bin/python*
which systemctl

python3 --version
```

Session 5

exercises of session 4: i missed

- copy file: `cp <source file> <destination>`
    1. make new copy in same place with new name: `cp myinfo m1`
    2. make new copy in other place with same name: `cp ./myinfo ./root/hes/`
    3. make new copy in other place with new name: `cp ./myinfo ./root/moz.txt
        1. `cp ./myinfo ../../hes_info.txt
- move file: `mv <source file> <destination>`
    1. rename file in same place : `mv myinfo m1`
    2. move = cut and past : `mv ./myinfo ./root/hes/`
    3. move + rename: `mv ./myinfo ./root/moz.txt
        1. `mv ./myinfo ../../moz.txt
-

```shell
echo "1403/07/18" >>moz.txt

date >> moz.txt
```

Exercise:

1. make following path `/root/1403/mehr/18/linux/class/mydir
    - since does not have `/` at end, it is file and should be made by touch

```shell
mkdir /root/1403/mehr/18/linux/class/mydir

mkdir /root/1403
cd ./1403/
mkdir /root/1403
cd ./1403/

## or
mkdir -p /root/1403/mehr/18/linux/class
cd /root/1403/mehr/18/linux/class
touch mydir

# or
touch /root/1403/mehr/18/linux/class/mydir
```

2. remove file `mydir`
3. move file `myinfor` `11/class` to `18/class`

```shell
mv ./root/1403/mehr/11/myinfo ./root/1403/mehr/18/myinfo
```

4. `myinfo.mp3`

```shell
date >> myinfo.mp3
cp ./myinfo.mp3 ./opt/myinfo.mp3
```

5. `myinfo.mp3`

```shell
cd ./opt
cp ./myinfo.mp3 hajiz.pdf
```

6. `myinfo.txt`

```shell
cp ./root/hes/myinfo.txt  ./root/hes/1403/
mv ./root/hes/myinfo.txt ./root/hes/test47
```

Exercise:

```shell
dmesg >
```

- `dmesg` : command for getting ????
- copy directory: ?
  - read `man cp` `-r` `--recursively` = with all details within
  - `cp -r 1403 1404`
- `tree` command
- `rmdir 1404` # not empty folders

- `rm 1404`
- `rm -r 1404`
  - `rm -rf 1404` : `force` so that not to ask for each cleaning
- `;` : `: pwd; date; ls/boooot; hostname`
  - `mkdir anisa; cd anisa`
- define `alias` : `alias pk='cp /var/log/messages /root/1403/mehr/18/m1.txt
  - `alias`
  - `unalias` : `unalias ll
  - alias are session based unless we write it in related file to be permeant `
  - `alias hmh='pwd; ls'`

`ll` = `ls -l`

- alias has priority over `$PATH`
- `/bin/rm f1`
- `timedatectl`
- `ping`
- `ifconfig`
- `systemctl restart network`
- `yum install -y <package name>`
- `sudo` ???????

session 5 - part 2

- `ls -l <names>`
- `ls -l <wildcard on names>`
  - `ls -l m*` : `*` nothing or something with any length

wildcards

- on file names
- meta characters:
  - `*`

```shell
cd /dev
ls -l sd*
ls -l sd?             # 3 chars
ls -l sd??            # 4 chars
ls -l sd[abcdek]            #
ls -l sd[a-ek]            #
ls -l sd[!aekrt]            #
ls -l sd{a,b,c,d,e,k}            #
ls -l sd{a,b1,cdefg123}            #
```

Exercise: on `anisa sample`

```
cd /anisa
ls -l
ls -l man*
ls -l man?
ls -l ????
ls -l man??


ls -l *i
ls -l [s-S]*
rm -f {s,S}*; rm -f [sS]* ; rm -f s* S*
touch majid, karim; touch /root/anisa/majid /root/anisa/karim;
ls -l *i*
ls -l ??i*
clear; pwd; cd ./var/log/
mkdir /opt/test
mv /root/anisa/??[0-9]* ./opt/test/
```

- 4th way to make file: use text editor
  - nano, emacs
  - gedit, kedit, nedit, xed,
  - vi, vitiny

vi

- mode of operations
  - command mode $\longleftrightarrow$ unten i for Insertoben Esc - insert (edit) mode
- `vi /opt/f1` , `/opt/f1`
- `vi f1 f2, f3`

```
cd ~
ls
vi batman.rrr
h j k l
i
Hesam
Esc.
:w    \n = Enter
:q    \n = Enter

:wq

vi batman.rrr
Mohammad Hosseini
099352002331
```

```
:wq
```

- command
- `i h j k l`
- `:`

```shell
cd ~
dmesg > f1
vi f1

:set nu # set number
:185    # go to line 185
:       # movment in
# <--h j k^ l-->
:       # movment in  <--h 4j 2k^ 8l-->
#w word forward   6w
#b word backward  2b

#H  head line screan
#L  Last line screan

#gg = :1 last line of file

#G last line of file
ctrl+f 1 page forward (down)
ctrl+b 1 page backward (up)
:55
i 8 space
Esc.
---> ^ caret start of line
     0 start of line
     $ end of line

:       # movment in  <--h j k^ l-->
::
```

```shell
ls - lhtr #?
```

regular expression

- More capable for working on contents file

Session 6

- on using `vi`

```
demsg >f1
vi f1

:99
----> go to middle of line
### deletion from text
x 8x # delete from right of cursur
X 9X # delete from left of cursur


s Xi # delete 1 character from right and go to Insert mode
6s =
S  3S + insert mode # delete line and go to insert mode
### cut from text
d6w   # d + number + dirction
d9l
d7w
d5j
d$ --> D
dG
...
dd # cut one line
5dd
...
cd6w   # c + number + dirction + go to Insert mode
c9l
c7w
c5j
c$ --> C
cG
....
cc  # cut one line + go to Insert mode
5cc # cut one 5 line + go to Insert mode
### copy from text
Yank = copy
y6w   # y + number + dirction
y9l
y7w
y5j
y$ --> Y
yG
....
yy # copy one line
5yy


p # paste right of  - 6p
P # paste left of

u # (undo)
ctrl+r # (redo)
. # redo the last command
```

```
#### searcing in manual
/word + enter # go from location downward
?word + enter # go from location upward and from start to location
n # next match in direction
N # next match in anti direction

i # switch to Insert mode +  start add from location to the right
a # switch to Insert mode + start add from location to the left
I # switch to Insert mode + cursur go to start of line
A # switch to Insert mode + cursur go to end of line
o # switch to Insert mode + **open** (add) new line after cursur
O # switch to Insert mode + **open** (add) new line before cursur
r # switch to Insert mode + replace 1 character + switch to command mode
R # switch to Insert mode + replace Mode
Insert or Ins. # Switch between Insert mode and replace mode
#### : File / host command mode
:w + Enter  # save file if name is given
:w + name and address file  # save file
vi f1 f2 f3 f4
:n # go to next file
:e + name and address file # open new file
:r + name and address file # copy other file inside what you are in
:q # quit vi if you saved
:wq # to save and exit
:q! # to force ignoring changes

:n! #
:e!
:w! # save for file you are not owner

:wq! # not correct # not needed to force
:wq = :x = ZZ # save and exit
:w!q #  correct

#### work on sample @ 39:00
:set nu # line number
:180
y3l
6p



/pci # serach downward
     # n next, N the one before

?PCI # search in last driection we worked
     # n , N switch drection

vi numbers myinfo

:w # save file
# save as continue in old file in Linux # unlike Windows
```

if we close `vi` and open new `vi` , what we copy or cut will not be accessible any more.
- old process of `vi`
- new process of `vi`
- open 2 files if we know in advance
- `:e` to open other files and do what we need like past
- decide on action on newly opened like paste and move on
- `:r`

- `ubuntu` and `Mint` - copied in `common RAM` part
- open temporary `subshell`

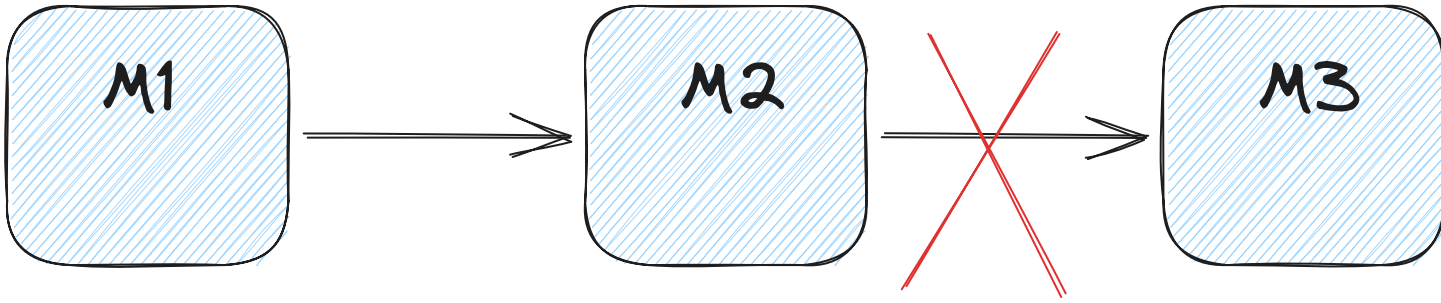
```
:! command # to do bash command  in vi

           # Enter to go back
```

processes and Subshell

Working with few machines in a queue

`SSH` or `TELNET` connecting to next Machines

- what happens if we exit from last?
- what happens if network connection somewhere disconnect? Machine before that




```
bash
    --- ls YES
         --- cp ? NO
              # while copy in progress: no place to do this
              # wait until task done and shell allow us
               --- pwd ?

ps # show processes
```

- is it possible to run `bash` inside `bash` ? Yes

```
bash
   |___ bash # subshell of above
            --- pwd
            --- zsh
                   --- csh
                          --- ksh
                                 --- pwd
                                 --- bash
                                 # if exit, go 1 step back
                                 # if KILLED, to patternt of where it was
```

```
ps # show
```

- `process ID` = `PID` of `ps` changes every time as `ps` task is 2 print exiting processes and terminate
- `PID` of `bash` is same. Interactive processes are like this = endless life time processes.

- `exit` or `Ctrl+D` (left Ctrl)

```
bash
   |___ vi
            --- :! pwd # temporary subshell is opended
            --- :! --- bash # if more than 1 line bash command is needed
                           # line of commands
```

7 notes

LPIC 1 concepts

1. `Linux` assign a number to each `file`, called `inode#`

2. `Linux` assign a number to each `user` , called `UID` = `User Identity`
3. `Linux` assign a number to each `Group` , called `GID` = `Group Identity`
4. `Linux` assign a number to each `Process` , called `PID` = `Process Identity`

LPIC 2 concepts

1. `mail server` by default at any `Linux` . For internal email between users of this `Linux`
2. `router` by default (software) . routing table . Off by default
   - command to start
3. `firewall` : Kernel itself handle this functionality.
   - Interfaces for configuring firewall = to write rules : `firewalld` , `ufw` , `ipchains` , `iptables` , etc

LPIC 1 concepts details

---

1. `inode#`

```
ls -i # to watch inode,
      # random number allocation to same file
ls -li
```

- `inode table` when disk/partition is formatted
  - contains more columns more on inode

inode#	filename
1	
2	write related file name
200_000_000	

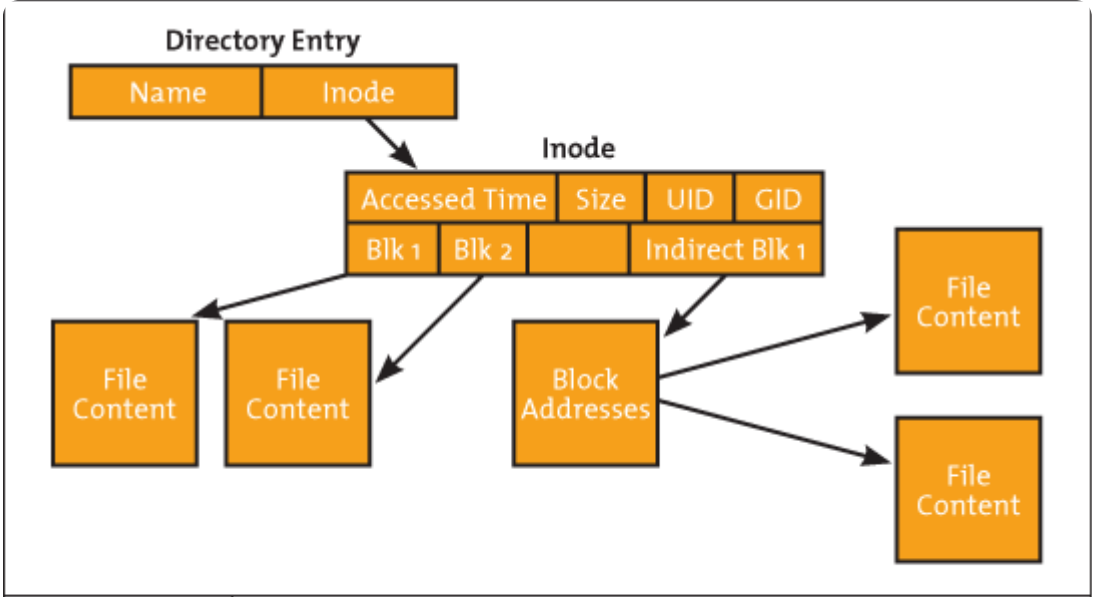
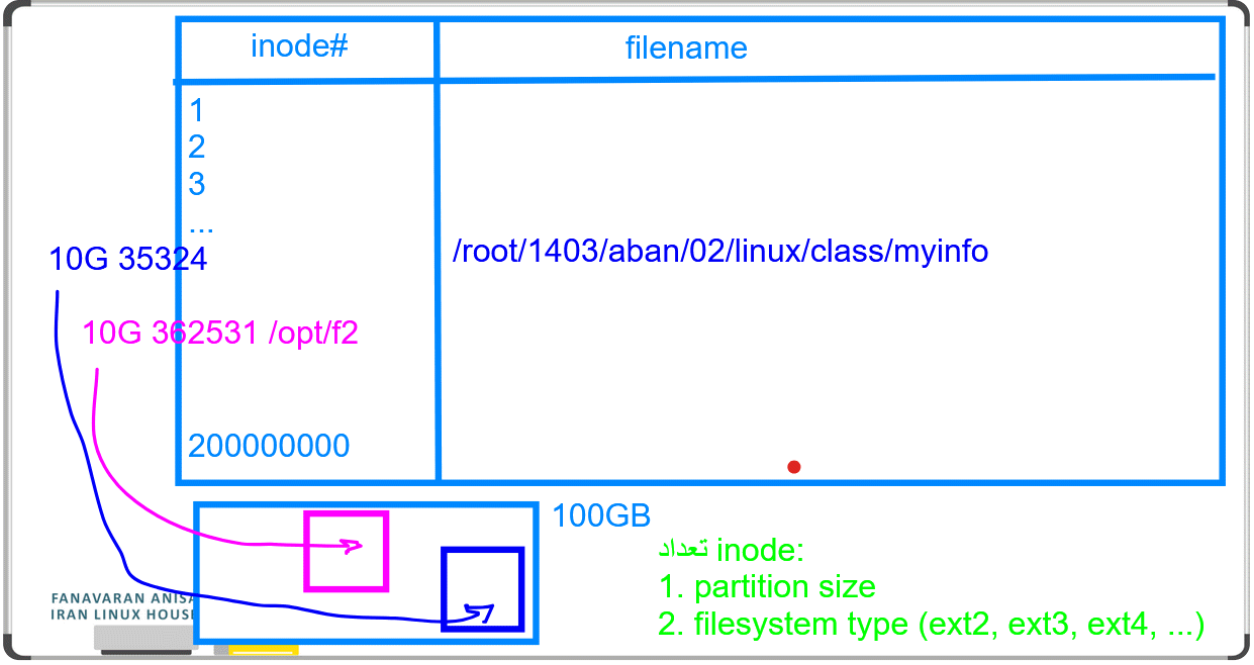


FIGURE 1 RELATIONSHIP BETWEEN THE DIRECTORY ENTRY, AN INODE, AND BLOCKS OF AN ALLOCATED FILE

- number of `inode` is function of
  1. `partition size`
  2. type of `file system`
- What is the maximum number of files? = number of `inode`s
  - if small size files and `inode` finished, no other file can be made even if half of hard is empty. Like Car plate `پلاک`
  - block size is something else
  - delete file → make `inode` free

```
inode       size      address
35324       10G      /root/1403/aba/02/linux/class/myinfo
53297547    2K      /opt/f1
```

- how commands work in backend
  - `cp` - make a new file at same folder or other folder
    - 2 different file at the end of copy process
  - `rm` remove file -
    - in graphical interface - only pointer to file is deleted
      - pointer to file deleted
      - finename in table will be deleted
      - summary of changes write in temp [recyclebin??]
      - Hard is not cleaned and space is not freed - `restore` in `trash`



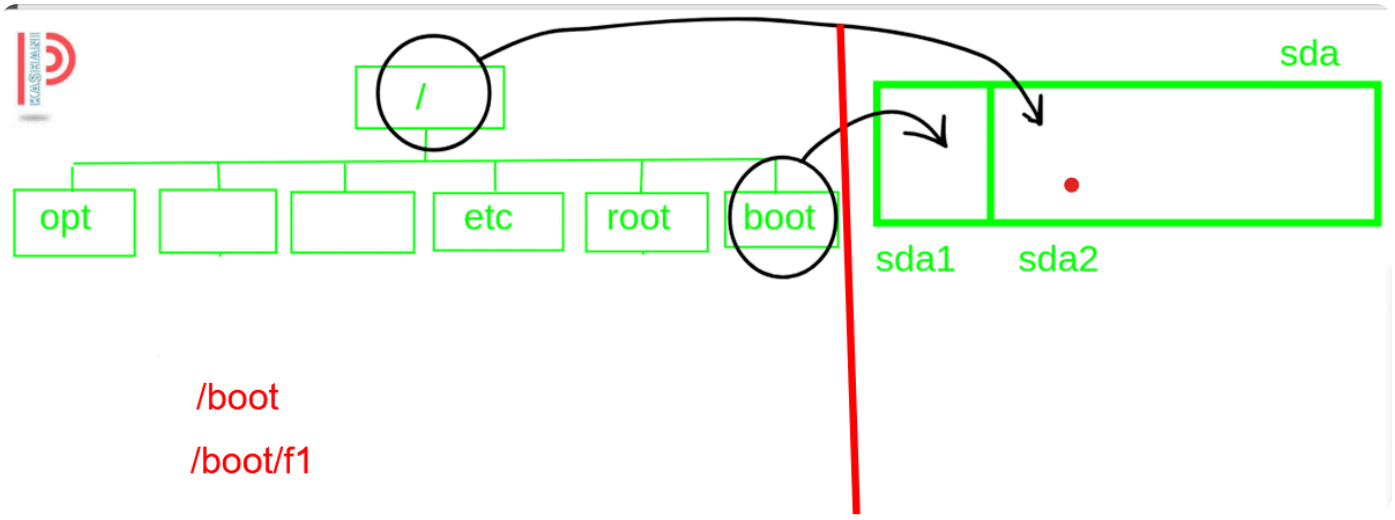
- `rm` in `command mode`
  - pointer to file deleted
  - finename in table related row will be deleted
  - no information be stored
  - invalid marker on file in Harddisk → space free up
    - recovery from backup - depends on your actions on partition
    - recovery tool capabilities: `testdick`
- `mv`
  - filename in table be updated
  - no physically change on file
  - `mv` to `/boot` → `inode` will be changed, why?
    - since partition is changed: *each partition has its own inode table*

```
cd /dev
ls -l sd* # try to understand

ls -l sda*

df -h
```

- disk partition

```
root@kashani3:/dev
File  Edit  View  Search  Terminal  Help
[root@kashani3 dev]# ls -l sda*
brw-rw---- 1 root disk 8,  0 Oct 21 16:52 sda
brw-rw---- 1 root disk 8,  1 Oct 21 16:52 sda1
brw-rw---- 1 root disk 8,  2 Oct 21 16:52 sda2
[root@kashani3 dev]#
[root@kashani3 dev]# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/centos-root    18G  6.2G   12G  36% /
devtmpfs                  992M     0  992M   0% /dev
tmpfs                     1001M  140K 1001M   1% /dev/shm
tmpfs                     1001M  8.7M  992M   1% /run
tmpfs                     1001M     0 1001M   0% /sys/fs/cgroup
/dev/sda1                  497M  106M  391M  22% /boot
[root@kashani3 dev]#
```

- logical vs physical partition understanding



- `mount point` - 2:20:00
  - a directory in logical domain (addressing domain) which is connected to partition in physical domain is called a `mount point`.
  - connecting is called mounting. disconnecting = unmounting
  - hard with `n` partition needs `n` `mount point`
    - `mount` command - make connection
    - `umount` first and then do action like
  - only these could be moved `/boot, /root, /home, /opt, /temp, /var`
  - `/bin, /etc, /sbin, /lib` should not be
    - if `/var` moved, services might be affected

On Hard-disk and partitioning

- magnetic disk → track → sector → bit (magnetic bipolar stuff which can store 1 bit of data)
- how to use a new hard? stranded partitioning = fixed size
  1. cable connection (data) + power
  2. partitioning → `fdisk`
  3. choose filesystem
  4. format → `mkfs`

    - (example: ext4 → Block size (4KB))
    - at the end of format we have `inode table`
5. mount: make a directory and point it to partition → `mount != umount`
6. to view → `df -hT`

- hard devices type
  - IDE (PATA =Parallel ATA) - 2 cable each with 2 free port = 4 port.
    IDE cables - connectors (primary, secondary) -
    power cable
    jumpers to mention which hard to be - or based on sequence of connecting to slots
    - `/dev/hda`
      `hdb`
      `hdc`
      `hdd`
  - SCSI → card on motherboard - port # 8-1=7 or 16 -1= 15
    - `/dev/sda`
      `sdb` , `sdc` , `sdd` , ...
  - SATA = Serial ATA
    - `/dev/sda`
    `sdb` , `sdc` , `sdd` , ...
  -
  - cool disk = cool memory = pen memory = memory stick = flash memory
    USB connected, plug&play
    - `/dev/sda`
    `sdb` , `sdc` , `sdd` , ...
- If system has SCSI, SATA and cool disk, first SCSI labeled and then SATA and finally cool disk.
  - SSD hard
  1. SATA - technologically is SATA
     - `/dev/sda`
       `sdb`
  2. NVMe
     - `/dev/nvme0n1`
       `nvme1n1`
       `nvme2n1`
  - SD cards: mini/micro SD
    - `/dev/mmcblk0`
      `mmcblk1` , `...`

Why we partition?

- segregate `system data` from `user/services/projects data`
  - encrypt on partition
  - make read-only for backup
- speed in recovery

- access management - DB admin to only access his related partition (part)
- differentiation between services
- different file system on partition per service needs
- back up
  - data
  - block → whole partition blocks to be copied
- Low-level backup = `image`
- LVM = Logical volume ????????????? 3:27:00
- dual-boot capability

Session 7

```
root@hes:~# df -h
Filesystem                         Size  Used Avail Use% Mounted on
tmpfs                              197M  1.2M  196M   1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv  8.1G  7.2G  448M  95% /
tmpfs                              985M     0  985M   0% /dev/shm
tmpfs                              5.0M     0  5.0M   0% /run/lock
/dev/sda2                          1.7G   94M  1.5G   6% /boot
tmpfs                              197M   12K  197M   1% /run/user/0
Linux_shared                       327G  312G   15G  96% /media/sf_Linux_shared
root@hes:~# ls -l sd
ls: cannot access 'sd': No such file or directory
root@hes:~# ls -l
total 8
-rw------- 1 root root  391 Oct 28 15:24 50-cloud-initbackup.yaml
drwx------ 3 root root 4096 Oct 30 06:48 snap
root@hes:~# find /  -name "sd*"



root@hes:~# cd /dev
root@hes:/dev# ls -l s*
brw-rw---- 1 root disk   8,   0 Oct 30 06:48 sda
brw-rw---- 1 root disk   8,   1 Oct 30 06:48 sda1
brw-rw---- 1 root disk   8,   2 Oct 30 06:48 sda2
brw-rw---- 1 root disk   8,   3 Oct 30 06:48 sda3
crw-rw---- 1 root cdrom 21,   0 Oct 30 06:48 sg0
crw-rw---- 1 root disk  21,   1 Oct 30 06:48 sg1
crw------- 1 root root  10, 231 Oct 30 06:48 snapshot
brw-rw---- 1 root cdrom 11,   0 Oct 30 06:48 sr0
lrwxrwxrwx 1 root root       15 Oct 30 06:04 stderr -> /proc/self/fd/2
lrwxrwxrwx 1 root root       15 Oct 30 06:04 stdin -> /proc/self/fd/0
lrwxrwxrwx 1 root root       15 Oct 30 06:04 stdout -> /proc/self/fd/1

shm:
total 0
```

```
snd:
total 0
drwxr-xr-x 2 root root       60 Oct 30 06:05 by-path
crw-rw---- 1 root audio 116,  5 Oct 30 06:48 controlC0
crw-rw---- 1 root audio 116,  3 Oct 30 06:48 pcmC0D0c
crw-rw---- 1 root audio 116,  2 Oct 30 06:48 pcmC0D0p
crw-rw---- 1 root audio 116,  4 Oct 30 06:48 pcmC0D1c
crw-rw---- 1 root audio 116,  1 Oct 30 06:05 seq
crw-rw---- 1 root audio 116, 33 Oct 30 06:48 timer
```

Methods of partitioning

- `MBR scheme` : master boot record = first 512 byte of Disk, (other names `MSDOS style, MSDOS, DOS`)
  - only 4 primary is possible
    - extended to 16 then 64
  - size limited for each to 2 TB
- `GPT scheme` : GUID partition Table
  - 128 partition
  - larger size till 9.5 ZB

Both limited, but differences:

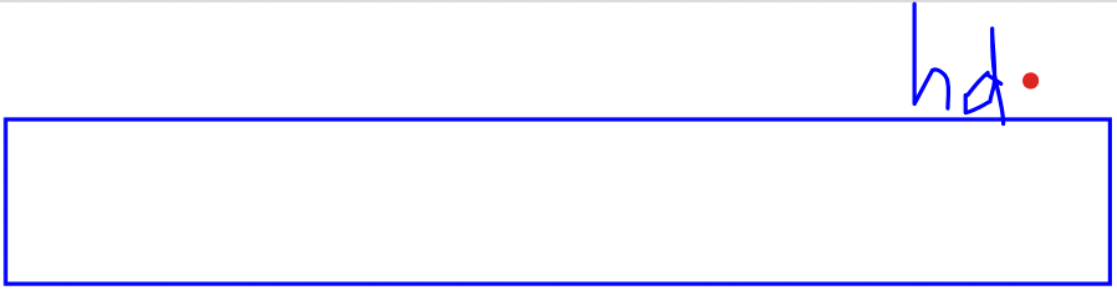
1. 4 partition vs 128 primary partition
   change 1 extended to logical min12:00
2. ????

`MBR scheme`

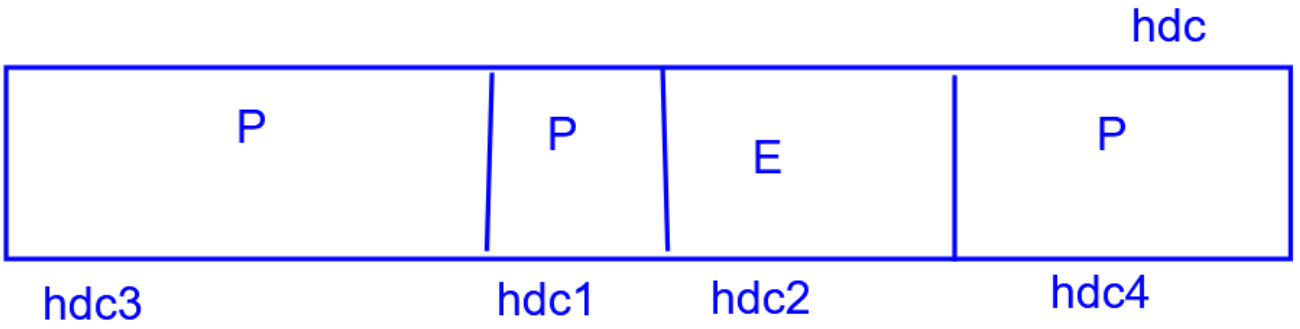
- Extended Partition will be used to make Logical partitions

Primary Partition	Extended Partition	Logical Partition
Max 4	n/a	n/a
Max 3	Max 1	Max 60

- example: What is partition name connected to Secondary Master → IDE
  - `hdc`

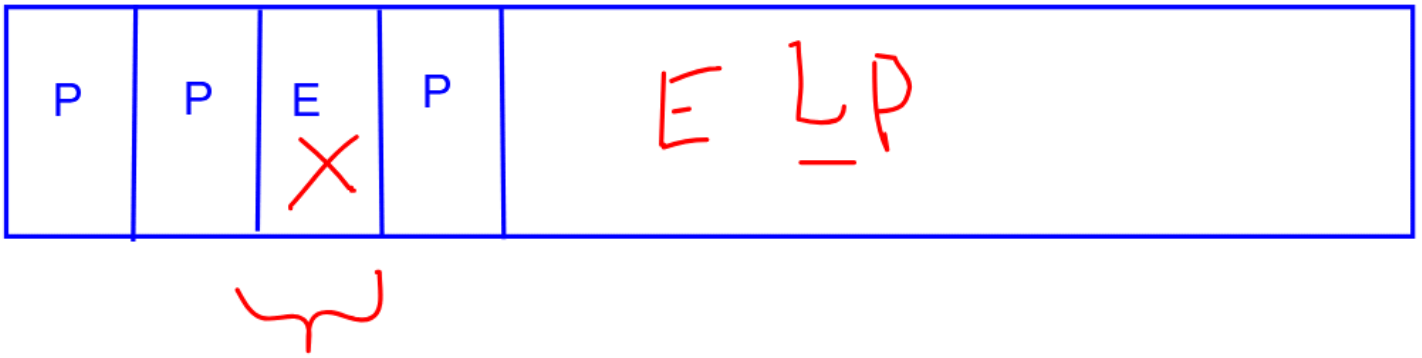


- partition name on this hard
  - add number to partition name - `hdc1` , `hdc2` , ...

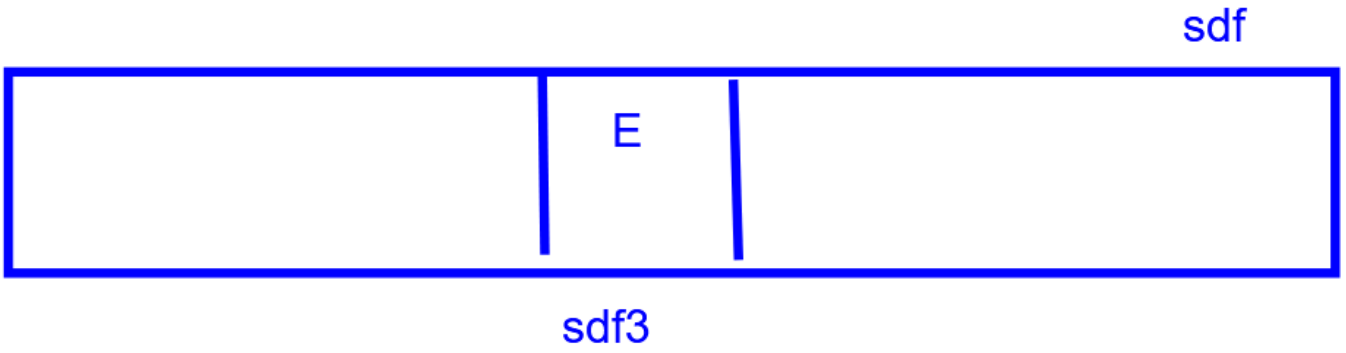


- example: we have 3 IDE, 2 SCSI, 1 SATA and 1 flash. What is flash name?
  SCSI, SATA and flash: `sd#`
  - we have 4 then name is `sdd`
- 1 P → `sdd1`
- can we make Disk as 1 primary partition? Yes
- can we make Disk as 1 extended partition? Yes. One primary was needed to be possible to be booted from 30 years ago. if it was 2nd hard.
- partition identified by sector or cylinder number. start or end is not important
- SAS hard on enterprise servers.
  - SATA with 10000 rpm ??
- is this possible? Yes
  - what happened to end of Disk? wasted - unallocated = free space
  - maximum count limit reached (one dimension of limitation) - max Disk space not met

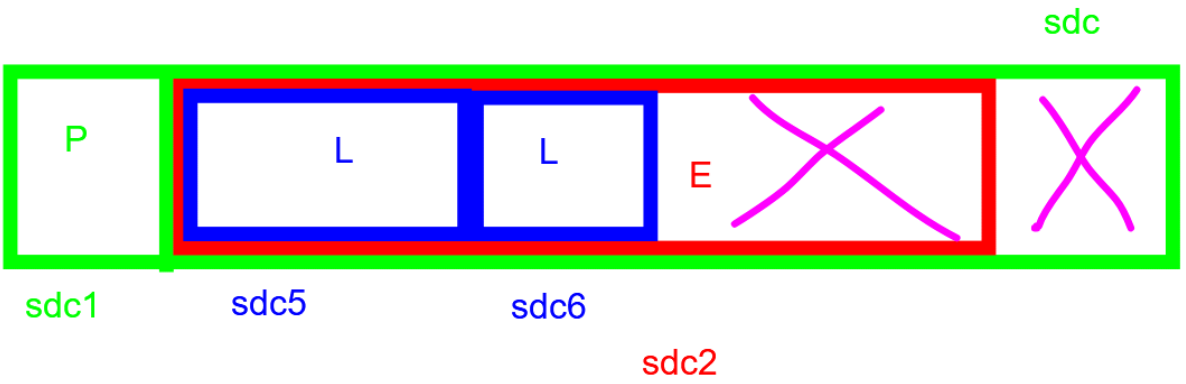
→
whole data will be lost ????



- example: 6th SCSI hard. what is name? `sdf`
  - can label not starting from 1.
  - Normal admin will not do such.
  - start from start of Disk
  - name starting from 1 as partition number

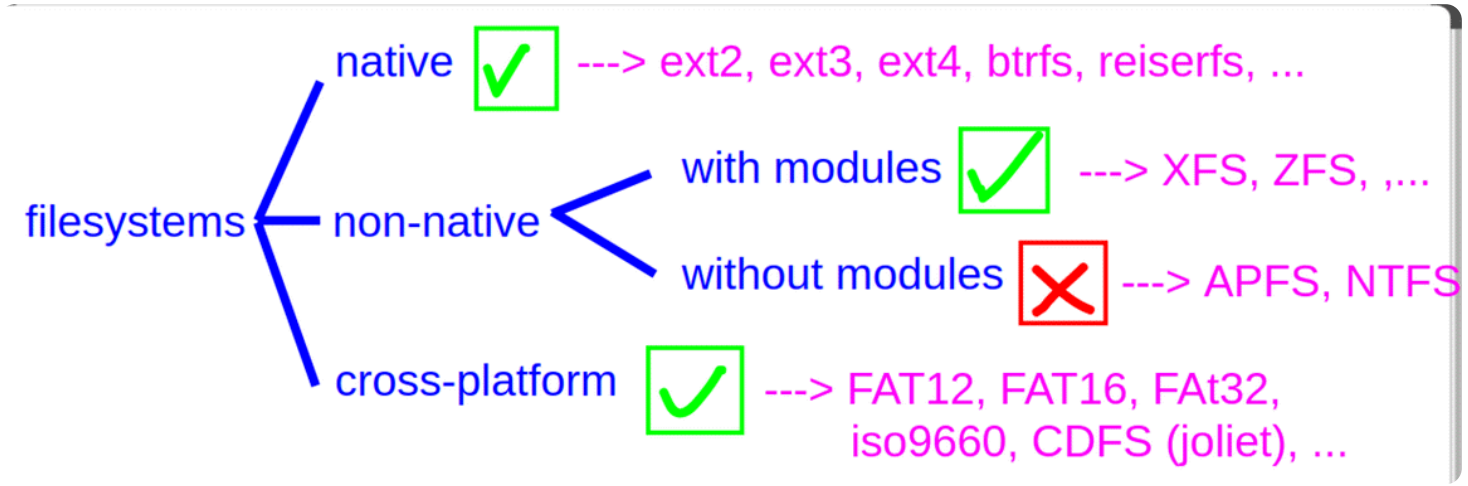


- example:
  - logical inside `extended`
  - the first logical should be `5` and should be name in order
  - last logical number = 64
  - first `Logical` on `Extended` labeled 5
    - then we can have till 64 - on `sdc` hard for example `sdc64`




```
root@hes:/dev# ls -l /dev/sd*
brw-rw---- 1 root disk 8, 0 Oct 30 06:48 /dev/sda
brw-rw---- 1 root disk 8, 1 Oct 30 06:48 /dev/sda1
brw-rw---- 1 root disk 8, 2 Oct 30 06:48 /dev/sda2
brw-rw---- 1 root disk 8, 3 Oct 30 06:48 /dev/sda3
root@hes:/dev# ^C
root@hes:/dev# ls -l cdrom
lrwxrwxrwx 1 root root 3 Oct 30 06:05 cdrom -> sr0
```

filesystems



- small partition $\leq 2TB <$ large partition

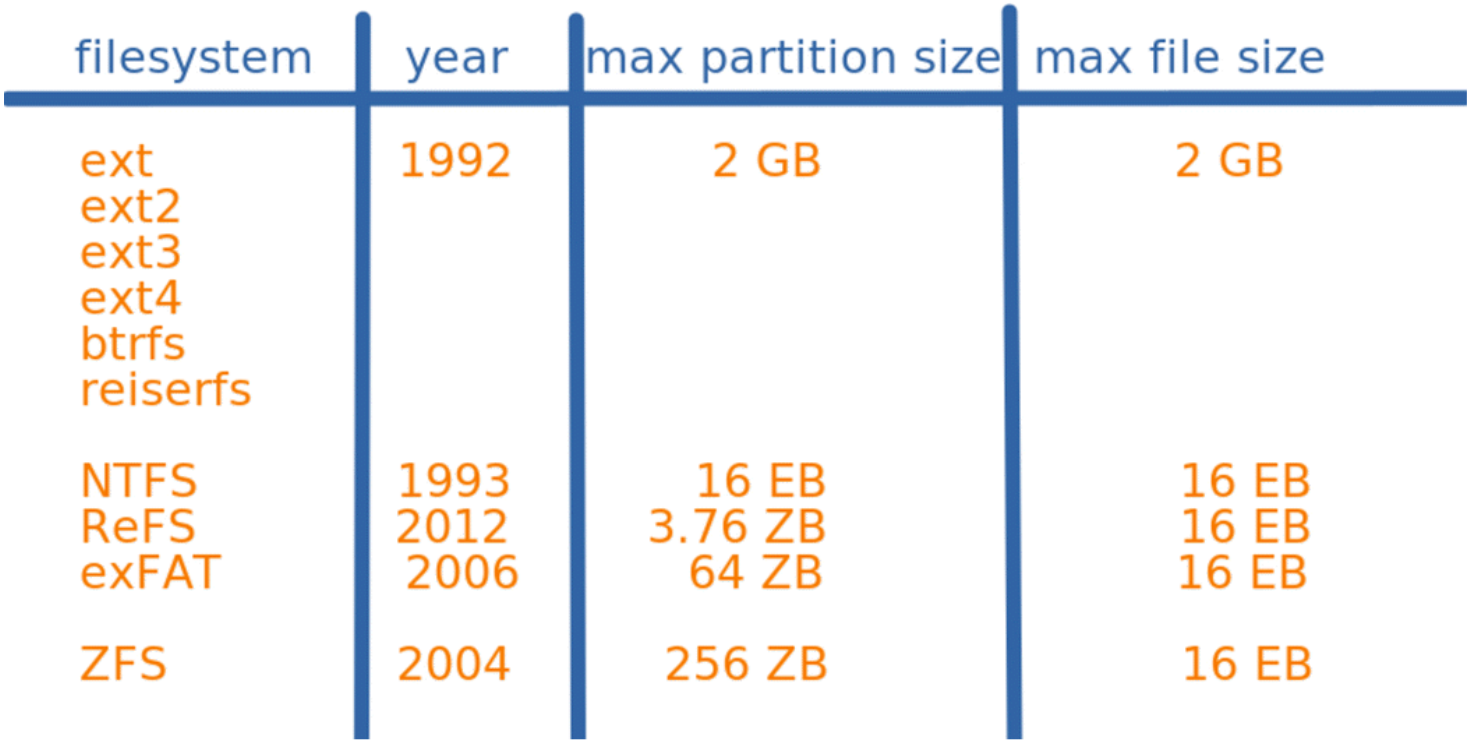
the extended filesystem → `extfs` → `ext`

- `ext` - linux native - 1992
  - with coming of `ext2` in few months, in early 1993, deprecated.

    - max partition size: 2GB - max single file size : 2GB
- `ext2
    - linux native - 1993. similar to first generation with main distinction.
    - not have `journal` functionality. hence, if `crashed`, `recovery` is slow and mostly not successful.
    - max partition size: 32TB - max single file size : 2TB
- `ext3`
    - linux native - 1999. similar to `ext2` with only adding `journal` functionality.
    - hence, if `crashed`, `recovery` is slow and mostly not successful.
        - max partition size: 32TB - max single file size : 2TB
- what is `journal`?
    - metadata gathered from not closed and files in use are called.
    - application of `journal`: is for `recovery` after `crash`. This metadata is store with different method in different filesystems.
    - save and decide / store unsaved things
    - `crash`: edited, open changed not saved, ... like electricity : clean vs dirty. consistent vs not consistent.
    - if `crashed`, `recovery` is slow and mostly is successful.
- `ext4`
    - Linux native - 2006. similar to older generation, but have diverse changes with enhancement. enhanced for huge size.
    - max partition size: 1 EB = 1,000,000 TB - max single file size : 16 TB
-
- Use `ext4` for personal and enterprise
- `butterfs`
    - advanced Linux native by Oracle- 2007. similar to XFS and ext4, good for huge size partitions on very huge Disk.
    - `time shifting` functionality
    - max partition size: 16 EB = 16,000 PB - max single file size : 16 EB
        - Oracle concept: `table space`: logical -> 1 or some file
        - big table space
- `reiserfs`
    - Linux native by German guy called Reiser- 2001. similar to XFS and ext4, good for huge size. journal functionality.
    - million small files of like 1 KB
    - max partition size: 16 TB - max single file size : 8 TB
    - versions
- `vFAT` virtual File Allocation Table (FAT)
    - Linux knows them as Virtual FAT, including FAT12, FAT16, FAT32, etc.
    - FAT12: max partition size: 32 MB- max single file size : 32 MB
    - FAT16: max partition size: 4 GB - max single file size : 2 GB
    - FAT32: max partition size: 8 TB - max single file size : 4 GB
- rest of cross-platform like `iso9660, CDFS (joliet)`

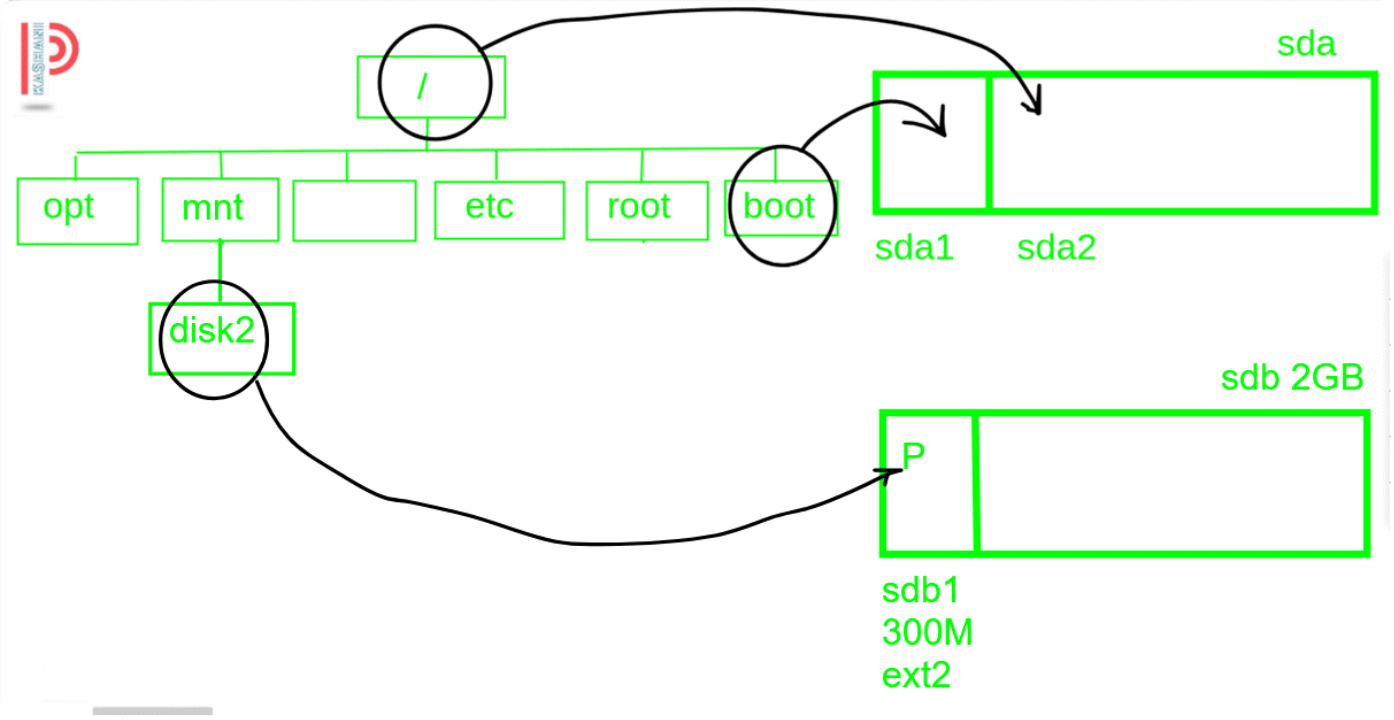
    - All are fine for using in CD, DVD, etc. Almost similar and have minor differentiation.
- `swap`
    - part of Linux hard file system, considered as different partition with `swap` file system. useful in systems where RAM might become limited.
    - whole programs stays on RAM for working.
        - IF RAM become limited, `swap` become temporary location
- `NFS` network file system
    - sometime in our system `mountpoint` which seems to be local but data are store on other Linux hard in network stored.
    - NFS refer to 3 things:
        - name of service network file sharing
        - file system of NFS
        - NFS protocol
        - NFS service on other location and make mount point for it in local Disk.
- How Windows do this?
    - file sharing protocol `CIFS` old $\rightarrow$ `SMB`
    - `SIMBA` to connect Windows to Linux
- `proc`
    - semi filesystem with storing footprints of kernel in filesystem
    - where to see them?
        - `/proc` and `/sys`
- What is definition of `FILE SYSTEM` ?
    - A `file system` is a `system`, parts which are working together, which `manage`
        - `storing` and `recovery` of files in disk.

Comparison_of_file_systems



- practical numbers may differ

    - per need and use case we have to investigate and decide
- Mounting logic explanation - start session 2 - continue example



    - under `/mnt/disk2`
    - add `SATA`
        - `VMDK` (Virtual Machine Disk) and `dynamically allocated` - `sdb`

```shell
ls -l /dev/sd* # to get list sd? on /dev/
fdisk /dev/sdb # provide fdisk possibilities
               # n new
                      # Partition type: p primary, e extended
                      # Partiotion number (1-4, defaulat 1)
                      # First sector (2048 - 4194303 , default 2048):
                      # Last sector , +sectors or +size{K, M, G} (2048 - 4194303 ,
                      # MiBi Byte - hardware 1000, software 1024
                      # Id 83 =  native Linux file system
               # p print
               # d delete
               # w write table to disk and exit
        # if it can not write in filesystem MBR, ask for reboot
init 6 # reboot is needed
mkfs -t ext2 /dev/sdb1 # -t type selection
                       # -t ext2
```

- review what reported at the end

```
[root@kashani3 ~]# mkfs -t ext2 /dev/sdb1
mke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=1024 (log=0)
Fragment size=1024 (log=0)
Stride=0 blocks, Stripe width=0 blocks
76912 inodes, 307200 blocks
15360 blocks (5.00%) reserved for the super user
First data block=1
Maximum filesystem blocks=67633152
38 block groups
8192 blocks per group, 8192 fragments per group
2024 inodes per group
Superblock backups stored on blocks:
        8193, 24577, 40961, 57345, 73729, 204801, 221185

Allocating group tables: done
Writing inode tables: done
Writing superblocks and filesystem accounting information: done
```

- notes
  - software vs hardware size difference
  - 5% of storage reserved for supper user
  - `df` only show `mounted` items
  - Till now, it is made but not mounted to address so that to be accessible
  - unmount `umount` physical or logical address
    - we need to be out of place to unmount!

```
cd /mnt #
ls
mkdir /mnt/disk2 # empty forlder
cd disk2/
cd ..  # during mount and umount time, we should not be in folder
mount /dev/sdb1 -t ext2  /mnt/disk2/
echo $? # check what returned? 0 = done
df -h # or check
pwd
cd dick2/
ls # not empty any more
   # lost+found dirctory
vi primary.txt # -> 1403/08/09\nThis is my PRIMARY partition.
cat primary.txt
# history command
```

- do same in my machine as sample
  - note the order of steps and switches
- unmounting

```
umount  <> # Physical address or Logical address (Mounted on)
           # if in location: target is busy
```

- get Type of file system in `df` - `T` = `Type` column added

```
root@hes:~# df -hT
Filesystem                         Type    Size  Used Avail Use% Mounted on
tmpfs                              tmpfs   197M  1.1M  196M   1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv ext4    8.1G  7.6G   33M 100% /
tmpfs                              tmpfs   985M     0  985M   0% /dev/shm
tmpfs                              tmpfs   5.0M     0  5.0M   0% /run/lock
/dev/sda2                          ext4    1.7G   94M  1.5G   6% /boot
Linux_shared                       vboxsf  327G  299G   28G  92% /media/sf_Linux_shared
tmpfs                              tmpfs   197M   12K  197M   1% /run/user/0
```

Linux books

Folder address : `D:\Hesam\Data Science\Linux`

- Wiley Linux.Bible.9th.Edition.pdf
- Wiley Linux Command Line and Shell.Scripting.Bible.3rd.Edition.pdf

What is `$?` in Bash?

- `$?` is a special parameter in Bash that holds the `exit status of the most recently executed foreground pipeline`.
- It expands to the decimal exit status of the last executed command.
- An exit status of `0` indicates success, while non-zero values indicate various types of errors or failures.

Key Points

- $? is typically used immediately after running a command to check its exit status.
- It can be used in conditional statements like if() { } to check if a command succeeded or failed.
- The exit status is usually a small integer value, often 0 for success and 1-255 for various error conditions.
- $? is reset to 0 after each successful command execution.

- **Exercise for next time:**
  we know that with `df -hT` for mounted. How we get similar information for unmounted items?

```
root@hes:~# df -hT
Filesystem                         Type    Size  Used Avail Use% Mounted on
```
SHELL

```
tmpfs                                tmpfs   197M  1.1M  196M   1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv ext4    8.1G  7.2G  444M  95% /
tmpfs                                tmpfs   985M     0  985M   0% /dev/shm
tmpfs                                tmpfs   5.0M     0  5.0M   0% /run/lock
/dev/sda2                            ext4    1.7G   94M  1.5G   6% /boot
Linux_shared                         vboxsf  327G  313G   14G  96% /media/sf_Linux_shared
tmpfs                                tmpfs   197M   12K  197M   1% /run/user/0
```

- solution reference:
  The drives on any system can either be mounted or unmounted. The mounted drives are the ones that are ready to be accessed at any time whereas the data residing on the unmounted drives can only be accessed after these drives are mounted.
  1. `sudo fdisk -l`

```
root@hes:~# fdisk -l
Disk /dev/loop0: 4 KiB, 4096 bytes, 8 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/loop1: 73.88 MiB, 77463552 bytes, 151296 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/loop2: 272.11 MiB, 285323264 bytes, 557272 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/loop3: 505.09 MiB, 529625088 bytes, 1034424 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/loop4: 91.69 MiB, 96141312 bytes, 187776 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/loop5: 38.83 MiB, 40714240 bytes, 79520 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/sda: 10 GiB, 10737418240 bytes, 20971520 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 8BDAD3B2-0B2C-4563-9AAB-442A602539CC

Device       Start      End  Sectors  Size Type
/dev/sda1     2048     4095     2048    1M BIOS boot
/dev/sda2     4096  3674111  3670016  1.8G Linux filesystem
/dev/sda3  3674112 20969471 17295360  8.2G Linux filesystem


Disk /dev/sdb: 1 GiB, 1073741824 bytes, 2097152 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/mapper/ubuntu--vg-ubuntu--lv: 8.25 GiB, 8854175744 bytes, 17293312 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

2. `sudo blkid`

SHELL

```
root@hes:~# sudo blkid
/dev/sr0: BLOCK_SIZE="2048" UUID="2024-01-11-12-47-49-66" LABEL="VBox_GAs_6.1.50" TYPE="iso
/dev/mapper/ubuntu--vg-ubuntu--lv: UUID="bbe08565-5d30-42a8-bb84-2aecebbee7eb" BLOCK_SIZE="
/dev/sda2: UUID="ecb84121-5aa7-4b01-8a6d-b4433dc5e7c4" BLOCK_SIZE="4096" TYPE="ext4" PARTUU
/dev/sda3: UUID="VEA5dH-S9Ou-ndm8-tBsu-f3bx-NefO-jA2z2Z" TYPE="LVM2_member" PARTUUID="467a3
/dev/loop1: BLOCK_SIZE="131072" TYPE="squashfs"
/dev/loop6: BLOCK_SIZE="131072" TYPE="squashfs"
/dev/loop4: BLOCK_SIZE="131072" TYPE="squashfs"
/dev/loop2: BLOCK_SIZE="131072" TYPE="squashfs"
/dev/loop0: BLOCK_SIZE="131072" TYPE="squashfs"
/dev/sda1: PARTUUID="ca0a7439-c349-4cee-9dbf-7598c4b48a4f"
/dev/loop5: BLOCK_SIZE="131072" TYPE="squashfs"
/dev/loop3: BLOCK_SIZE="131072" TYPE="squashfs"
```

3. `lsblk`

SHELL

```
root@hes:~# lsblk
NAME                      MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
loop0                       7:0    0     4K  1 loop /snap/bare/5
loop1                       7:1    0  73.9M  1 loop /snap/core22/1663
loop2                       7:2    0 272.1M  1 loop /snap/firefox/5134
```

```
loop3                         7:3    0 505.1M  1 loop /snap/gnome-42-2204/176
loop4                         7:4    0  91.7M  1 loop /snap/gtk-common-themes/1535
loop5                         7:5    0  38.8M  1 loop /snap/snapd/21759
loop6                         7:6    0 273.6M  1 loop /snap/firefox/5187
sda                           8:0    0    10G  0 disk
├─sda1                        8:1    0     1M  0 part
├─sda2                        8:2    0   1.8G  0 part /boot
└─sda3                        8:3    0   8.2G  0 part
  └─ubuntu--vg-ubuntu--lv 252:0    0   8.2G  0 lvm  /
sdb                           8:16   0     1G  0 disk
sr0                          11:0    1  61.1M  0 rom
```

4. `sudo parted -l`

```
(base) [root@ ~]# parted -l
Model: VMware Virtual disk (scsi)
Disk /dev/sda: 85.9GB
Sector size (logical/physical): 512B/512B
Partition Table: msdos
Disk Flags:

Number  Start   End     Size    Type     File system  Flags
 1      1049kB  1075MB  1074MB  primary  xfs          boot
 2      1075MB  85.9GB  84.8GB  primary               lvm


Error: /dev/sdb: unrecognised disk label
Model: VMware Virtual disk (scsi)
Disk /dev/sdb: 429GB
Sector size (logical/physical): 512B/512B
Partition Table: unknown
Disk Flags:

Error: /dev/sdc: unrecognised disk label
Model: VMware Virtual disk (scsi)
Disk /dev/sdc: 268GB
Sector size (logical/physical): 512B/512B
Partition Table: unknown
Disk Flags:

Model: Linux device-mapper (linear) (dm)
Disk /dev/mapper/centos-home: 26.8GB
Sector size (logical/physical): 512B/512B
Partition Table: loop
Disk Flags:

Number  Start  End     Size    File system  Flags
 1      0.00B  26.8GB  26.8GB  xfs


Model: Linux device-mapper (linear) (dm)
```

```
:Disk /dev/mapper/centos-swap: 4295MB
Sector size (logical/physical): 512B/512B
Partition Table: loop
Disk Flags:

Number  Start  End     Size    File system     Flags
 1      0.00B  4295MB  4295MB  linux-swap(v1)


Model: Linux device-mapper (linear) (dm)
Disk /dev/mapper/centos-root: 478GB
Sector size (logical/physical): 512B/512B
Partition Table: loop
Disk Flags:

Number  Start  End    Size   File system  Flags
 1      0.00B  478GB  478GB  xfs
```

- تمرین : روی هارد دوم خود یک پارتیشن logical به سایز 200M بسازید که ext3 فرمت شود و از مسیر `/root/alaki/` در دسترس باشد.

2:59:50

Mounting Steps for reference:

- [x] cable connection (data) + power: not needed as it already exited disk
2. partitioning → `fdisk`
   need to make an `extended` first as `Logical` could be added there
   make 1 `extended` larger than `200 MB`
   not work with `extended` - only to make it possible to `Logical`
   `boot, format` not possible on `extended`
3. choose filesystem
4. format → `mkfs`
   - (example: ext4 → Block size (4KB))
   - at the end of format we have `inode table`
5. mount: make a directory and point it to partition → `mount != umount`
6. to view → `df -hT`

```
fdisk Command (m for help): m

Help:

  DOS (MBR)
   a   toggle a bootable flag
   b   edit nested BSD disklabel
```

```
   c   toggle the dos compatibility flag

  Generic
   d   delete a partition
   F   list free unpartitioned space
   l   list known partition types
   n   add a new partition
   p   print the partition table
   t   change a partition type
   v   verify the partition table
   i   print information about a partition

  Misc
   m   print this menu
   u   change display/entry units
   x   extra functionality (experts only)

  Script
   I   load disk layout from sfdisk script file
   O   dump disk layout to sfdisk script file

  Save & Exit
   w   write table to disk and exit
   q   quit without saving changes

  Create a new label
   g   create a new empty GPT partition table
   G   create a new empty SGI (IRIX) partition table
   o   create a new empty MBR (DOS) partition table
   s   create a new empty Sun partition table


Command (m for help): p
Disk /dev/sdb: 1 GiB, 1073741824 bytes, 2097152 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0xbbe4b1b0

Device     Boot   Start     End Sectors  Size Id Type
/dev/sdb1          2048 1048576 1046529  511M 83 Linux
/dev/sdb2       1050624 1071103   20480   10M  5 Extended
```

```
ls -l /dev/sd*
fdisk /dev/sdb
      p   # p   print the partition table
      n   # n new
      e
      2 # default = Enter for defualt
      Last Sector +1G
```

```
Command (m for help): n
Partition type
   p   primary (1 primary, 1 extended, 2 free) #
   l   logical (numbered from 5)

Select (default p): l

Adding logical partition 5
First sector (1052672-1071103, default 1052672):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (1052672-1071103, default 1071103): +2M

Created a new partition 5 of type 'Linux' and of size 2 MiB.

Device     Boot   Start     End Sectors  Size Id Type
/dev/sdb1          2048 1048576 1046529  511M 83 Linux
/dev/sdb2       1050624 1071103   20480   10M  5 Extended
/dev/sdb5       1052672 1056767    4096    2M 83 Linux


Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.


root@hes:~# df -hT
Filesystem                         Type    Size  Used Avail Use% Mounted on
tmpfs                              tmpfs   197M  1.1M  196M   1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv ext4    8.1G  7.6G   33M 100% /
tmpfs                              tmpfs   985M     0  985M   0% /dev/shm
tmpfs                              tmpfs   5.0M     0  5.0M   0% /run/lock
/dev/sda2                          ext4    1.7G   94M  1.5G   6% /boot
Linux_shared                       vboxsf  327G  299G   28G  92% /media/sf_Linux_shared
tmpfs                              tmpfs   197M   12K  197M   1% /run/user/0

# reboot message
init 6
ls -l /dev/sd* # root@hes:~# ls -l /dev/sd*
brw-rw---- 1 root disk 8,  0 Dec 30 15:59 /dev/sda
brw-rw---- 1 root disk 8,  1 Dec 30 15:59 /dev/sda1
brw-rw---- 1 root disk 8,  2 Dec 30 15:59 /dev/sda2
brw-rw---- 1 root disk 8,  3 Dec 30 15:59 /dev/sda3
brw-rw---- 1 root disk 8, 16 Dec 30 15:59 /dev/sdb
brw-rw---- 1 root disk 8, 17 Dec 30 15:59 /dev/sdb1
brw-rw---- 1 root disk 8, 18 Dec 30 15:59 /dev/sdb2
brw-rw---- 1 root disk 8, 21 Dec 30 15:59 /dev/sdb5

mkfs -t ext3 /dev/sdb5 # equivalent
mkfs.ext3 /dev/sdb5
### why???
root@hes:~# mksf -t ext3 /dev/sdb5
```

```
-bash: mksf: command not found

pwd # ensure to be on /root
mkdir /root/alaki
df -h
mount /dev/sdb5 -t ext3  /root/alaki/
mount /dev/sdb5 /root/alaki/ # format not needed. it infer itself
df -h
cd /alaki
echo "1403/08/09
This is my LOGICAL partition." > logical.txt
cat logical.txt
```

```
root@hes:~# mkfs.
mkfs.bfs     mkfs.btrfs   mkfs.cramfs  mkfs.ext2    mkfs.ext3    mkfs.ext4    mkfs.minix

# not working in my Linux
```

- With `reboot`, partitions are not there any more
  - system does not know to were connect what
  - stored in RAM → we need to `persist`
  - `config` file store this located at `/etc`
    - `fstab` = file system table
    - need a row per partition

```
vi /etx/fstab
root@hes:~# vi /etc/fstab
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point>   <type>  <options>       <dump>  <pass>
# / was on /dev/ubuntu-vg/ubuntu-lv during curtin installation
/dev/disk/by-id/dm-uuid-LVM-cm7KMhr6LDVL7GVxYSJRkfXEtZfykJkwD4OUp0fwK0bRwpPPRjvoTor5GkNQatM
# /boot was on /dev/sda2 during curtin installation
/dev/disk/by-uuid/ecb84121-5aa7-4b01-8a6d-b4433dc5e7c4 /boot ext4 defaults 0 1
/swap.img       none    swap    sw      0       0
~
```

```
        - 6 item with 1 space between
```

```
#
# /etc/fstab
# Created by anaconda on Sun Dec  3 03:45:10 2017
#
# Accessible filesystems, by reference, are maintained under '/dev/disk'
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info
#
/dev/mapper/centos-root                   /               xfs     defaults 0 0
UUID=78062850-3fda-4190-817b-91b219ff0374  /boot           xfs     defaults 0 0
/dev/mapper/centos-swap                   swap            swap    defaults 0 0
/dev/sdb1                                 /mnt/disk2      ext2    defaults 0 0
~
```

col1	col2	col3	col4	col5	col6
Physical address or	mount pount	filesystem tipe	option	dump backup	file system check
UUID or			example:ro	0 no	0 no, 1 earliest (only for `/`, 2 then rest
label				1 yes	

filesystem check types

1. `automatic` → `/etc/fstab`
   will be read at after reboot - if 1 or 2 → check first and then mount
2. `manual` → manual by admin
   `unmount ...` unmount to not corrupt data
   `fsck ....` file system check
   `mount ....` mount again

- file we write at `/etc/fstab` will be considered at next `reboot`
- how to do without reboot?
  - `mount -a` = All

- **Exercise**: how to find `Universal UniqID` of partitions in Linux?
  Universally Unique Identifier (**UUID**) is a 128-bit
  Here are the key methods to find the UUID of partitions in Linux:

1. `tune2fs -l <partition>`
   `tune2fs -l /dev/sdb1 | grep UUID`
   `tune2fs -l /dev/sdb1 | grep UUID >> /etc/fstab
2. `blkid`
3. `lsblk -f` # shows UUIDs along with other partition information.
4. `ls -l /dev/disk/by-uuid`
5. `findmnt -n -o UUID /`

// Key Points:

- These methods work for both local and remote systems
- No need for root access in most cases
- UUIDs remain consistent even if device names change
- Useful for scripting and automating system configurations

// Best Practices:

- Use UUIDs instead of device names (/dev/sdX) in fstab for reliability
- Combine with other commands like `df` or `mount` for more context
- Be aware of potential caching issues with `blkid`

By using these methods, you can reliably retrieve UUIDs for partitions in Linux, which is essential for many system administration and scripting tasks.

Session 8

- get details on partition - `tune2fs -l /mnt/disk2/`

```
ls -l /dev/sd*
root@hes:~# tune2fs -l /dev/sdb1
tune2fs 1.47.0 (5-Feb-2023)
Filesystem volume name:   <none>
Last mounted on:          <not available>
Filesystem UUID:          a09ebe4a-f52d-47ed-b1c9-cf52175f5fe8
Filesystem magic number:  0xEF53
Filesystem revision #:    1 (dynamic)
Filesystem features:      ext_attr resize_inode dir_index filetype sparse_super large_file
Filesystem flags:         signed_directory_hash
Default mount options:    user_xattr acl
Filesystem state:         clean
Errors behavior:          Continue
Filesystem OS type:       Linux
Inode count:              130816
Block count:              130816
Reserved block count:     6540
Overhead clusters:        8283
Free blocks:              122527
Free inodes:              130805
```

```
First block:              0
Block size:               4096
Fragment size:            4096
Reserved GDT blocks:      31
Blocks per group:         32768
Fragments per group:      32768
Inodes per group:         32704
Inode blocks per group:   2044
Filesystem created:       Mon Dec 30 12:25:34 2024
Last mount time:          Mon Dec 30 12:25:43 2024
Last write time:          Mon Dec 30 12:58:18 2024
Mount count:              1
Maximum mount count:      -1
Last checked:             Mon Dec 30 12:25:34 2024
Check interval:           0 (<none>)
Lifetime writes:          12 kB
Reserved blocks uid:      0 (user root) # root
Reserved blocks gid:      0 (group root) # Group root
First inode:              11
Inode size:               256
Required extra isize:     32
Desired extra isize:      32
Default directory hash:   half_md4
Directory Hash Seed:      b9e8bb37-7c99-43dc-bc33-b9fd067ced3a
```

- Label partition : `mkfs3 -L "name" /dev/sdb5`
  - name - 1 word, unique and not a reserved Linux keywords

```
mkfs3 -L "backup" /dev/sdb5`
mount /dev/sdb5  /root/alaki
mount -Lbackup /root/alaki
```

- How to revise `/etc/fstab` file?
  - `UUID=`
  - `LABEL=`
- Disk usage = ` du -csh /var/ # c cummulative, h human readable, s summarize

```
 du -csh /var/ /bin /usr/
1.9G    /var/
0       /bin
2.0G    /usr/
3.9G    total
```

readable

- `df -hT # h human readable, T type of file system

Exercise: We can get details for mounted partitions with `df -hT`. How we can get similar details for unmounted partitions?
???

- `df -i` details per `inode`

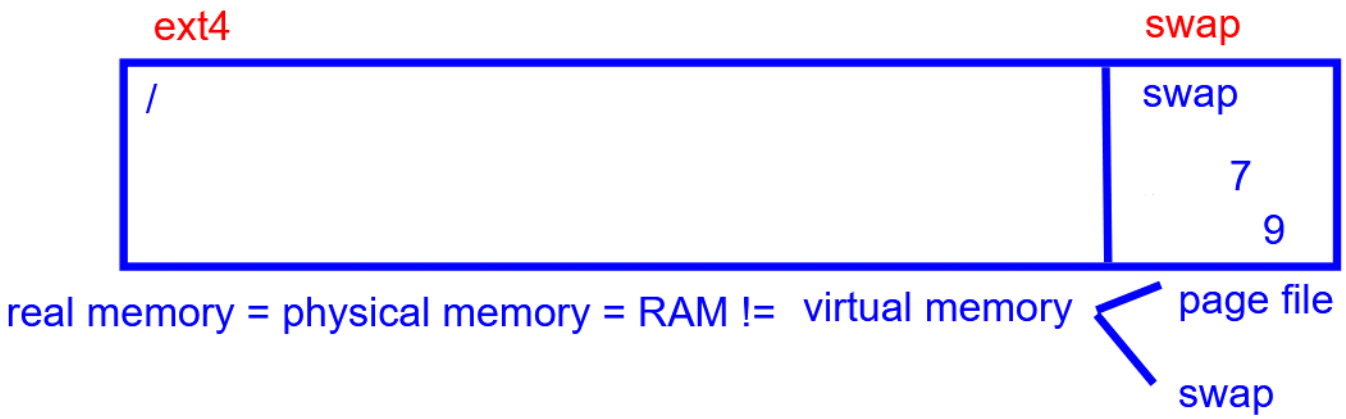
```
root@hes:~# df -i
Filesystem                         Inodes   IUsed   IFree IUse% Mounted on
tmpfs                              251932     960  250972    1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv 540672  138928  401744   26% /
tmpfs                              251932       1  251931    1% /dev/shm
tmpfs                              251932       3  251929    1% /run/lock
/dev/sda2                          114688     317  114371    1% /boot
tmpfs                               50386      33   50353    1% /run/user/0
Linux_shared                         1000 -999000 1000000     - /media/sf_Linux_shared
```

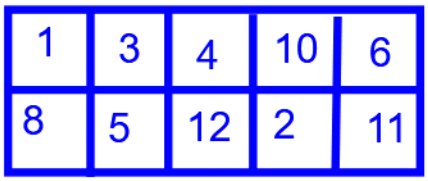
- count `inode` depends on
  - `partition size`
  - `format` type
- `device` does not have number - `partitions` on device got numbers
- How to identify `logical` partitions on devices?
  - start from 5 in partition numbers
- how to understand count `extended` partitions?
  - maximum possible extended is 1. It is either 0 or 1.
  - when we have `logical`, we have to have `extended` → therefore: 1 `extended`
  - at most 4 `primary` is possible
  - numbers `1, 2, 3, 4` are for `primary` or 3 `p` and 1 `e`
  - which one is `extended`?
  - each one could be
  - `fdisk -l` # provide details for all disks
  - `fdisk -l /dev/sdb`

```
root@laptop2:~# ls -l /dev/sd*
brw-rw---- 1 root disk 8, 0 Nov  3 16:37 /dev/sda
brw-rw---- 1 root disk 8, 1 Nov  3 16:37 /dev/sda1
brw-rw---- 1 root disk 8, 2 Nov  3 16:37 /dev/sda2
brw-rw---- 1 root disk 8, 3 Nov  3 16:37 /dev/sda3
brw-rw---- 1 root disk 8, 5 Nov  3 16:37 /dev/sda5
brw-rw---- 1 root disk 8, 6 Nov  3 16:37 /dev/sda6
```

- `#block` * `block_size` = Size
- How to check count logical?

    - `fdisk -l < >`
- Check `Disk label style` ,
    - `MBR = dos`
    - `GPT` till 128 primary partition is possible
        - we do not have `logical`
- we can change format `fdisk <>` then `g`
  `g create a new empty GPT partition table`
- last possible logical is 64. If there exists number > 64 then we can ensure it is `GPT`
- change format to `dos - MBR` again
  `o create a new empty MBR (DOS) partition table`
  partitions will be deleted and information will be lost.
- after we have done configuration, only steps are
    - 0. cable connection
    - 4. mount
        - not needed in graphical case
- new flash disk
    - under `/media/` # portable devices
    - `/mnt` on old devices
    - some system has both of above
    - `umount` or eject flash
- other tools for partitioning
    - `parted` # partition editor
        - `parted -l`
        - `gparted` - Gnome
- what `unmount` do
    - synch data
    - power off
- Minimum partition required for a Linux? 1
    - mount point of this = `/`
- minimum practical = 2
    - mount points : `/` and `swap` with `swap` file system + if RAM become limited
- real memory = physical memory = RAM != virtual memory
- virtual memory
    1. page file (Windows)
    2. swap
- Least Recently Use (LRU) algorithm





LRU (Least Recetly Used)

- who use swap? Kernel
- what is `mount point` of swap? Kernel does not required as it knows where it writes.
- what is reasonable / logical size of `swap` ?
  - not logical to have huge as addressing of it have overhead for Kernel
  - 1.5 RAM $\leq$ swap $\leq$ 3.5 RAM
  -
- RAM : 2TB, swap size? 5TB ? no ~~5TB~~
  - per use case: 8 GB at most
  - how to understand `swap` allocated volume is low or high?

My location on 2:27:32 ???

Session 9

missed

My location on 2:27:32 ???

Session 10

My location on 2:27:32 ???

Session 11

14:07 joined

exercise
2. write a line of command to - part 2 -
Part on `processes` finished

User and group management

```shell
useradd peter
```

1. check user is not already taken
2. assign the first existing `UID`
3. make a `GID`
4. add him to this group
    1. `opensuse` : group `users`
5. make directry of
6. ownership and access of this dirctory to be assigned to user
7. `/etc` ?????
8. `/var/spool/mail/peter` file which stores emails related to this user
9. etcetera
10. in `/etc/passwd` = `Linux password file` make one record for this user
    1. take a look at this file: 7 columns
11. `passwd peter`
    1. `shadowing feature` is active to make passwords invisible
    2. passwords stored at `/etc/shadow` - `SHA512`

```
guseradd edari
```

1. check user is not already taken
2. assign the first existing `UID`
3. make a `GID`
4. etc
5. a record for this group added to `/etc/group`
6. `gpasswd edari`
7. `/etc/gpasswd`

```shell
useradd peter
```

difference between `ubuntu` and `centos`

exercise at class

```
groupadd it
groupadd IT
```

```
groupadd research
groupadd developers
groupadd managers
yum install - yz zsh
which zsh
which -a zsh
useradd -d /my_HHH_dir ?????????????


cat /etc/


# dar group asli esm fard are naanvested

groups smith
groups

id peter
id  # currnet ligind user information
```

- add smith to research group
  - `vi /etc/group`
  - `usermod -G research peter`
- `groups smith`
- `usermod -Ga managers smith` # wrong
- `usermod -aG managers smith`
- Lock/Unlock the user
  - `usermod -L smith`
  - `usermod -U smith`
  - `passwd -l smith`
  - `passwd -u smith`
- `cat /etc/passwd | grep smith`
- `usermod -s /bin/bash smith`
- `chsh` # change shell
- what are differences of `/sbin/nologin` and `/bin/false` ?
  `UID` and `GID` user root: 0

in 2:55
`redhat` based: 500 `UID` and `GID`, (from 0 to 499)
`debian` based: 1000 `UID` and GID, from 0 to 999)
are reserved for services.
This and other defualts are stored at `logins.def` at ???
and can be modified

```shell
su - peter
- whoami
- ls
- ls -a
- cd /etc/skel/
```

15:02 - 15:07 missed - min 1118
non-login mode ~/ .bashrc environment

```shell
su  # means switch to root
su - zahra
```

- when files at `~/.bash_profile` runs?
  - when login
  129 min
- when files at `~/.bashrs` runs?
  - when kernel ?

```shell
.bash_logout
.bach_profile  ~./ bash_login  ???
```

```shell
ll filename # ll f1


newgrp
```

@ min 157

user management

administrative like acivity in Linux: 4 person to do admin tasks

- change their `UID-GID` to `0` : not proper way
- `sudoers` - listen carefully
  - make group : myadmin
    - add persons to this group
    - limit on set of commands
-

```shell
history
$HISTSIZE
$HISTFILE
echo $HISTTIMEFORMAT # ???
```

- We can assign `uid` to user home directory
- `userdel`
  - `-r`
- `groupdel`

I need `Windows` `bash` script to - monitor battery level continuously and make beep when power is less than 6%. - monitor battery level continuously and make beep when power is above than 96%.

Shadowing feature

`pwconf`

table

what happens between starting up till ?

runlevels

- BIOS (Basic Input/Output System) → Firmware
- hardware clock → CMOS battery
- software clock
-
- CHS (cylinder/head/sector)
- LBA(Logical Block Addressing)
- EFI (Extensible Firmware Interface)
- UEFI (Universal Extensible Firmware Interface) → 2005
  - 35 to 100 MB - EFI boot partition
- MBR (Master Boot Record)
  512 first Byte
- 446 B (boot loader information)
- 64 B (boot l?
- 2 B - parity check of file

Bootloaders:

Name	abb name	address	
LILO	lilo	`/etc/lilo.conf`	
Grand unified Bootloader (GRUB legacy)	grub	`/boot/grub/menu.lst`	/boott/grub/grub.conf
GRUB2		`/boot/grub/grub.cfg`	`/boot/grub2/grub.cfg`

- Sample Grub file
  - General section
  - Private section(s)

Kernel ring bugger

- `dmesg` @ `/var/log/dmesg`
-

Session 12

Missed 10 min of start

```shell
runlevel # show current and preivous runlevels
> N 5 # 5  Full multi user + graphical

# change runlevel
init
telinit
```

- `rc` directories

```shell
init 2 # change to run level2



startx # add graphical service
```

service (server)	application	daemon (service)
WEB	apache	httpd
SSH	openssh-server	sshd
DNS	bind	named
database	Mysql	mysqld
cache/proxy	squid	squid
		network-manager

- `cd /etc/init.d`

```shell
fuser 22/tcp # if provide responce
/etc/init.d/ sshd status
netstats -ntulp  | grep :22
netstats -ntulp  | grep ssh
/etc/init.d/ sshd stop
```

```
/etc/init.d/ sshd start # new process with new pid
/etc/init.d/ sshd restart
/etc/init.d/ sshd reload # send reload signal = 1 = SIGHUP to ?
kill 1
kill -s SIGHUP 4053
```

Symbolic Link (SL)

```shell
/etc/init.d/sshd     status|stop|reload|start|restart|
            httpd
            mysqld


each service has one SL on each rc
```

SL Snnsshd → start
SL Knnsshd → kill

```shell
/etc/rc0.d/Knnssd
/etc/rc1.d/Knnssd
/etc/rc2.d/Knnssd
/etc/rc3.d/Knnssd
/etc/rc4.d/Knnssd
/etc/rc5.d/Knnssd
/etc/rc6.d/Knnssd
```

```shell
K\d{1,2}name  # priority with highest = 00
# sample Network is more important than SSH
```

commands to manage ?

---

difference between `redhat` vs `debian` - base

- Redhat base

```shell
1. LSB  /etc/init.d/sshd staus
2. service sshd status
3. chkconfig # command to manage things
     1. chkconfig --list crond
     2. chkconfig crond off
     3. chkconfig crond on
     4. chkconfig --level 135 crond on
----
4. systemctl
```

- Debian

```shell
1. LSB  /etc/init.d/sshd staus
2. service sshd status|... # recently added
3. update-rc.d # command to manage things
     1. update-rc.d crond defaults
     2. update-rc.d -f dovcot remove # mailserver
     3. update-rc.d -f dovcot stop 24 2 3 4 5 # /etc/rc[2-5].d/K24dovcot
     4. ?
----
4. systemctl
```

Service managment methods

- `system V (Sysvinit)` → init (CentOS 5, older) (Ubuntu 6.06, older)
  `service sshd stop`
- `upstart` → init (CentOS 6) (Ubuntu 6.10 to 14.10)

```shell
initctl stop sshd
chkconfig or  update-rc.d
init 0
```

- `systemd` → init (CentOS 7 onward) (Ubuntu 15.04, newer)

```shell
   systemctl stop sshd.service   # در لحظه
   systemctl stop sshd   # در لحظه
   systemctl start sshd  #  در لحظه
   systemctl enable sshd # in next boot and always
   systemctl disable sshd  # in next boot and always
   systemctl poweroff    # = init 0
```

```shell
BIOS                                BIOS
MBR                                 MBR
B.L.                                B.L.
Kernel                              Kernel
init                                systemd
runlevel --> service                target unit --> service unit
```

```shell

CentOS 5:  cat  /etc/inittab |grep initdefault
min 97?

```

write [unit] to make service up

systemd

types of units

1. service sshd.service = sshd
2. socket
3. target multi-user.target = multi-user
4. timer
5. mount
6. path
7. slice

`/etc/systemd/system`
`/lib/systemd/system`

```shell
systemctl status sshd
journalctl -xe # to check those which have issues
systemctl --failed

systemctl -list-uinit  --type=service
```

```shell
shutdown
-h (halt, shutdown)
-r (reboot)
-c (cancel)
-f (fast boot -> NO file system check)
-F (force filesystem check -> YES file system check )
```

package management

- default

1. Redhat Base `rpm` *.rpm* redhat package management
2. Debian Base `dpkg` *.deb debian package management

a-b.c.d-e.f.rpm
a = package name
b = version
c = major release (major revision)
d = minor release (minor revision)
e = build number
f = arch

```shell
rpm
-i install
-u (update)
-U (install/update)
   -v (verbose)
```

```
   -h (hash)
-e  (erase)
-q  (query)
   -a  (list all package names installed on this system)
   -f (file)
   -l (list of all package files)
   -c (list of all package config  files)




uname -r
rpm -qa | grep ssh #
which ssh
rpm -qf /usr/bin/ssh

rpm -qa | grep chmod
rpm -qa | grep -i chmod
which chmod
rpm -qf ???


rpm -qc openssh-clients
rpm -ql openssh-server

rpm -qlzsh | wc -l
```

exercise image

```shell
rpm -i zsh
rpm -ivh zsh
rpm -Uvh zsh


wget <address to download>


cd /media/
mkdir DVD_DRIVE
```

exercise image

- issue with `rpm`
  - `not installing dependencies`
- Wrapper based installation to cover above shortcomings

wrapper:

```shell
1.  yum/dnf       (Redhat Base) # Yellowdog Updater Modified
/etc/yum.conf
yum update | install | remove
2. apt           (Debian Base) # Advanced Package Tools
   apt-get update
   apt-get update
   apt-get update
   apt-get update
   apt-get update
   apt-get update
```

- Graphical
- sandbox
    - snap - flatpack

How to install from local

min 205

```shell
cd /etc/yum.repos.d/
# make local



[LocalRepo]
name=
```

Session 13

joined at 6:50

- use `alias` for few line repetitive commands

Scripting

- shell scripting
- bash scripting

```
bash myscript
!rm # last use of rm will be repeated
chown root:it myscript
chmod +x myscrpit  = chmod a+x myscrpit

myscript # will not run, why?
```

```
        # command not found, currnet dircty is not part of Linux PATH
echo $PATH
```

1. put file in one of addresses in PATH list
2. `PATH=$PATH+`
3. `PATH=; .` # do not use
4. provide path `./root/class/myclass or ./myscript

```
#! /bin/bash      # shebang
ls /boot > /root/class/list1
cp /root/class/list1  /root/class/list2
#cp /root/class/list1  /root/class/list2 #
```

Good script should have

1. `x` permission
2. `.sh` extension
3. `shebang` line `#!`

How to write a new C or `?` program

1. `apt-get update / yum update
2. `apt` gcc, g++, ...
3. `gcc <filename> -o myapp`

```
#include<studio.h>

int main():
{
    printf("Hi there!");
    return 0
}
```

```
which python
```

`bash` scripting

```
expr 7+8 # 7+8
expr 7 + 8 # 15
date
sleep 4 # second
echo salam # print
```

```
echo $HOME
seq 1 10 # with steps
v1=3
v2=5
expr $v1 + $v2
v3 = `expr $v1 + $v2` # ` = $()

read age

ls - l /bin/top
which top
ls -l `which top`
ls -l $(which top)
```

```
#  /bin/bash
echo "Start time is: `date`"
sleep 8
echo "End time is: `date`"
```

- read `date` command details

```
date +%R
date
```

```
#  /bin/bash
echo "Start time is: `date   ???? `"
sleep 8
echo "End time is: $(date ?? )"
```

```
#  /bin/bash
echo "your 1st number is: $1"
echo "your 2st number is: $2"
total=`expr $1 + $2`
echo "your total is: $total"
```

`./myscript.sh 7 + 8`

```
#  /bin/bash
echo -n "please enter your age: "
read age
total=`expr $age \* 365` # \ is scape character
echo "your age in days is : $total"
```

exercise
get 2 numbers from user and print sum of them

```
#  /bin/bash
echo -n "please enter number 1: "
read number1
echo -n "please enter number 2: "
read number2
total=`expr $number1 \+ $number1 ` # \ is scape character
echo "sum of ? and ? is : $total"
```

```
#  /bin/bash
if [ $USER = root]
    then echo "You are allowed :)"
    else echo "You are not allowed :("
fi
```

67:40

```
#  /bin/bash
for i in 1 2 3 4 5
   do
      echo "your room number is: #$i "
  done


for i in `seq 1 500`
   do
      echo "your room number is: #$i "
      touch test$i.txt # make file
  done
```

```
man touch

find / -mtime -2  # 2 days
```

exercise 2 min 75:00
rewrite exercise 5000 karbar with `bash`
get 2 numbers from user and print sum of them

```



paste -d "@" users domain > mailing.list
 | split -200
```

min 80:00

```
#!  /bin/bash
`date +%F_%T`.bck
```

`cron`

```
- crond^
crontab -l --> list
crontab -r --> remove
crontab -e --> edit
```

MIN HRS DOM MOY DOW COM
15 8 * * */rrot/class/myscript*
15 * * * /rrot/class/myscript # every hour at 15'

- `*  *  *  *  /rrot/class/myscript # every minutes`

  15 17-20 * * */rrot/class/myscript # 17 till 20*
  15 17,20 * * /rrot/class/myscript # 17 and 20
  0 sun
  1 mon
  2 tue
  3 wed
  4 thu
  5 fri
  6 sat
  7 sun

read from end to start to understand

anacron anacron for desktops

- every 7 minutes or every 7 hours?
  exercise 3
  how to run script with `cron` every 30second
  how to run script with `cron` every 15 min ?
  how to run script with `cron` every 5 min ?
  how to run script with `cron` every 7 min ?
  how to run script with `cron` every 3 hour ?
  how to run script with `cron` every 9 min ?

exercise 4
memorize dictation of month and days

Networking

what is computer network?
2 device connect in a medium with same protocol

OSAI layers
All people seem ti need data processing
Please do not Throw sausages Pizza Away

client Server
Application A
Presentation P
Session S
Transport T
Network N
Data Link D
Physical P

```
---------------
```

Network Interface Card (NIC) کارت شبکه

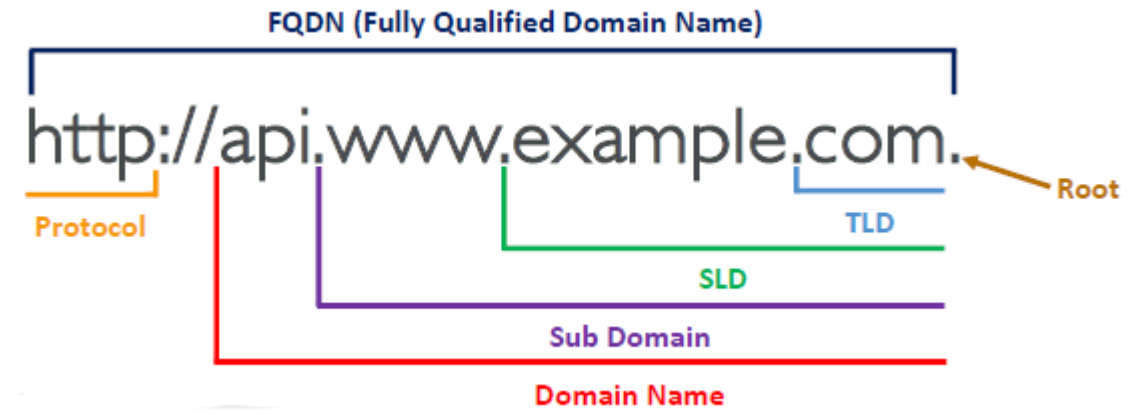
1. Ethernet -> eth0 `# has priority`
2. Wireless -> wlan0

`eht0, eth1, ...` and `wh0, ....`

naming approaches

1. Hostname
   - Hostname = computer_name.domain_name
     www.google.com
     mail.yahoo.com
     kashani.lpir.org
     TLD (top level domain)
     - General TLD
     com, net, org, gov, edu
     - CC TLD
     .ir, fr, ca, ...
     SLD (Second level domain)
     Sub-Domain Name

2. Physical address - MAC address Burned, Hardware addr
3. IP Address




```
hostname
hostname test.lpir.org # changed temporary

# CentOS /etc/sysconfig/network
HOSTNAME=
# CentOS7 /etc/hostname
```

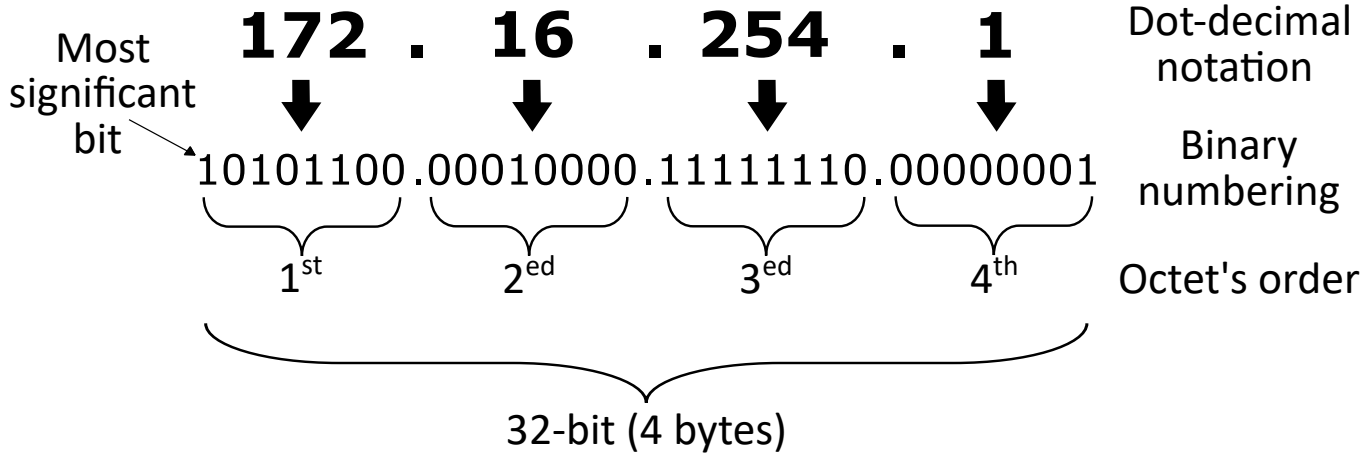
######## Physical address - MAC address Burned, Hardware addr
Hexadecimal
manufacturer number part number

```
yum install net-tools  --> ifconfig, rout, ...
          iproute      --> ip

ifconfig # check
         # not possible to change MAC address phusically
```

loopback IP address 147:51

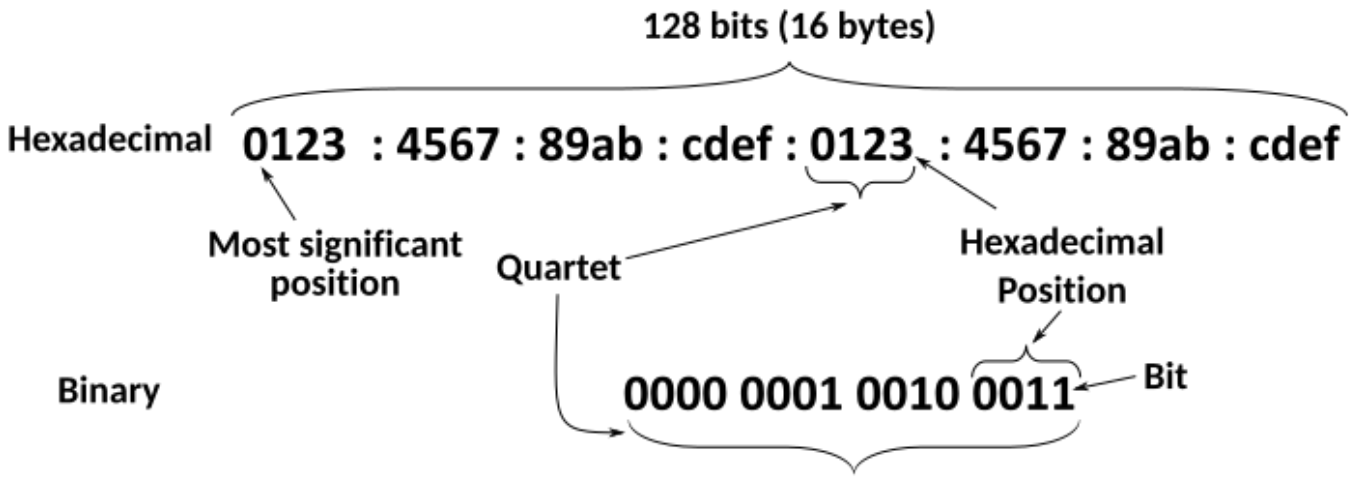
######## IP address

1. IPv4 : 32 bit -> $2^{32} = 4,294,967,296$



`0.0.0.0` to `255.255.255.255`

2. IPv6 : 128 bit -> 2^{128} = huge numbers



- switch vs router (gateway)

NAT server = router with change IP functionality
default gateway = internet

image

IP

- static
  - servers
  - clients if less than 11
- dynamic (DHCP)
  - `Windows` `ipconfig/release ipconfig/renew`
  - `linux` dhclient (IP, gateway, dns)
-

```
ifconfig eth0 192.168.10.11
ifconfig eth0 192.168.10.11 netmask 255.255.255.0 # (Classfull model) neteer to write netma
ifconfig eth0 192.168.10.11/24  (CIDR Model)

                        # /24 prefix
```

- netmask
  - differentiate `netid(network)` from `hostid(host)` # min 178
  - IP (host id) = 2^8 = 256

    192.168.10.0 -> network interface
    192.168.10.255 -> broadcast
  - host count = 256 - 2

```
ifconfig eth0 192.168.10.11/28 # 16 subnets each with 16 hostids
                               # we need to make rout to connect these
```

$min\x194$

- Debian based
  `/etc/network/interfaces`

```
auto enp0s3
iface enp03 inet dhcp

auto enp0s3
   iface enp03 inet static
   address 192.168.10.11
   netmask 2555.255.255.0
   gateway   192.168.10.1
   dns-nameservers   192.168.10.2
```

- Redhat based
  `/etc/network/interfaces` ??????????????

```
auto enp0s3
iface enp03 inet dhcp

auto enp0s3
   iface enp03 inet static
   address 192.168.10.11
   netmask 2555.255.255.0
   gateway   192.168.10.1
   dns-nameservers   192.168.10.2
```

```
route -n # numeric
route add defualt ????
```

####### DNS

`/etc/hosts`

`192.168.10.11 oradb.lpir.org oradb`

`192.168.10.12 appsrv.lpir.org appsrv`

```
/etc/resolve.conf
nameserver 192.168.10.1
nameserver 192.168.10.2 # go to this if upper is not proving answer
                        #
nameserver 8.8.8.8
nameserver 4.2.2.4
```

SHELL

port

- port count 2^{16} = 65536
- 0 to 1023 = privileged - well-known ports
    - page 425 426 book
- ping protocol = Internet_Control_Message_Protocol - ICMP

```
wget http://www.google.com
```

summarizer - hash

- hash algorithm

```
cksum myfile1
md5sum myfile1
sha1sum myfile1
sha224sum myfile1
sha256sum myfile1
sha384sum myfile1
sha512sum myfile1
sha1024sum myfile1
sha32048sum myfile1
```

```
service network stop
systemctl stop network
ifconfig eth0 down = ifdown eth0
ifconfig eth0 up = ifup eth0


ifconfig

ip
ip address show
ip a show
ip a s
ip a

route -n # roting table
ip rout show
ip r s
ip s

# link means network card


/etc/sysconfig/network-scripts/
# in Rocky Linux 9
nmcli connection migrate

/etc/NetworkManager/sysyem-connections/
```

```
change file
systemctl restart
```

To change network setting

- GUI : via menu
- TUI (Text based User Interface) : `nmtui` , `ntsysv` , `nt` , `nc` , `mc` = like `nc` in Window
- CLI : `nmcli`

make up and down

picture

####### SSH

- port 22
- `opensssh-client` `openssh-server` server_A
  `opensssh-client` `openssh-server` server_B

1. remote console

```
ssh
```

2. secure copy

```
scp username_A@IP_A:/path  username_B@IP_B:/path
# similar to cp
```

- Exam next week = @ 13:00