

Linux OS

- **Opensource** - free to download, free share & change the code.
 - Linux OS
 - URL: <https://www.kernel.org/>
- **Freeware** - free to download, free share
 - UNIX
 - URL: <https://www.oracle.com/solaris/solaris11/downloads/solaris-downloads.html>

UNIX:

- Full form: **Uniplexed Information and Computing Service (UNICS)**
- 1969 by Dennis Ritchie & Kemp Thomson

Linux

- By Linus B. Torvalds. Released on 17th sept 1991.
- Derived from UNIX.

Multi-users:

- Virtual terminal / virtual consoles / pseudo terminal.
- Ctrl + atl + <f1, f2...f7> OR chvt <>
- 7 VC

Linux: - top 500 super computers

Secure:

- Permissions
- SELinux - security enhanced linux
- Firewall (netfilters, iptables/ip6tables, firewalld)

MBR

- Master Boot Record.
- 4 primary partitions
- HDD: 2TB
- 512 bytes
- 3 sub-divisions
 - 446 bytes → boot related info
 - 64 bytes → (16x4)
 - 2 bytes → magical bytes

GPT

- GUID partition table
- GUID = globally unique identifier
- 128 primary partitions
- HDD: 18 exabyte (approx. 18x10¹⁸ GB)

GRUB

- Grand unified boot loader
- RHEL 6 → GRUB 0.97
- RHEL 7 → GRUB 2.0

1st process

- RHEL 6 → init process (PID 0)
- RHEL 7 → systemd (PID 0)

Runlevel

- Init 0 → runlevel0.target
- Init 1 → runlevel1.target
- Init 2 → runlevel2.target/multi-user.target
- Init 3 → runlevel3.target/multi-user.target
- Init 4 → runlevel4.target/unused till date
- Init 5 → runlevel5.target/graphical.target
- Init 6 → reboot.target

FHS

14 directories (standard), / → nameless root/root directory

- /bin → cmd binary for normal users
- /sbin → cmd binary for super/root users
 - #which useradd
 - /usr/sbin/useradd
 - #which ping
 - /usr/bin/ping
- /etc → configuration file
- /boot → boot related info/file
- /kernel → kernel related file.
- /mnt → temporary mounts
 - /mnt/abc
 - /mnt/dvd-rom
- /run → /mnt
- /dev → device related
 - /dev/sr0 → CD/DVD
 - /dev/sda or /dev/had → hard disk
- /tmp → temporary files
- /var → logs
- /lib or /libx64 → library
- /home → home directory for normal users
 - /home/Jeetu (~)
 - /home/hulk (~)
- /root → home directory for root user (~)
- /proc → running process related info.
 - CPU → /proc/cpuinfo
 - Memory → /proc/meminfo
- /usr → user installed packages/application

File systems in linux:

- Ext, Ext2
- Ext3, Ext4 → RHEL 6
- XFS → RHEL 7 (back compatible)

Kernel version: “**uname -a**”

User IDs:

- RHEL 6
 - Root → 0
 - System users → 1-499
 - Normal → 500+
 - RHEL 7 (root → 0-999)
 - Root → 0
 - System users → 1-999
 - Normal → 1000+
-

Installation of RHEL:

1. CD-DVD or ISO.
 - a. GUI
 - b. Text-based (CLI)
2. Network boot
3. Kickstart

[Task-1: install a new RHEL VM in text mode (CLI).]

Installation destination mount point from 50 GB:

1. / = 35GB
2. /boot = 500mb
3. Swap (1.5xRAM) = 2xRAM = 4GB = virtual memory

File management:

- Create a file / Modify a file
 - Touch
 - Create blank file (1,2,3...n)
 - Update the time stamp of a file.
 - Ex:
 - #touch <file-name>
 - Cat
 - Create
 - #cat > cat1.txt
 - View
 - #cat cat1.txt
 - Append
 - cat >> cat1.txt
 - Overwriting
 - cat > cat1.txt
 - Vi / Vim
 - #vi <file-name>
 - Press ‘i’, to enter into insert mode.
 - ...
 - Press “:wq!” To save & quit.
 - W = write / save
 - Q = quit / come out of vi editor
 - ! = forcefully perform the action.
 - #vim <file-name>
 - Press ‘i’, to enter into insert mode.
 - ...
 - Press “:wq!” To save & quit.
 - W = write / save
 - Q = quit / come out of vi editor
 - ! = forcefully perform the action
 - Gedit
 - Like notepad in windows
 - #gedit <file-name>
 - Nano
 - #nano <file-name>
- Delete a file
 - #rm <file-name>
 - #rm -f <file-name> //w/o asking Y/N
 - #rm -f *.txt //everything that start with anything & ends with.txt
 - #rm -f f?.txt //delete files with 1 character after ‘f’ &ends with anything.
 - #rm -f f???.txt //delete files with 2 characters after ‘f’ &ends with anything.
- Copy a file
 - #cp <source> <destination>

Path in linux

- Relative path
 - Revolves around the pwd
 - Ex: #cp t1 d1/
- Absolute path
 - Work with from the beginning of the path till the end.
 - Ex: #cp /root/Desktop/t3 /root/Desktop/d1/

File mgmt - conti...

- Move a file
 - #mv <source> <destination>
- Rename
 - #mv <old-name> <new-name>
- Hide
 - #mv <old-name> .<old-name>
- Unhide
 - #mv .<old-name> <old-name>
- Single ‘.’
 - Current directory
- Double “..”
 - Parent directory or 1 step above.

Directories

- Create
 - #mkdir <dir-name>
- Change the location
 - #cd
- delete
 - #rmdir <dir-name> //works with empty directories.
 - #rm -rf <dir-name> //works with empty & non-empty directories.
 - r= recursive
 - f= forcefully (without prompt)

Permissions

For file/directory

- read (r) → 4
- write (w) → 2
- execute (x) → 1
- all perms → 7

to view the permissions

#ls -l or #ll

```
[root@svr Desktop]# ll
total 0
drwxr-xr-x . 1 2 root 4 root 15 Apr 14 12:13 lti
-rw-r--r-- . 1 1 root 4 root 0 Apr 14 11:58 t2
-rw-r--r-- . 1 1 root 4 root 0 Apr 14 11:58 t3
[root@svr Desktop]#
```

Column1:

- type of file
- and permission allocation to that file/directory

(d/-) → d= directory, - → file

(rwxr-xr-x) → permission to owner, group and others

Owner = rwx, means =>u

- owner can read the f/d
- owner can write into f/d
- owner can execute the f/d

group = r-x, means =>g

- group can read the content of f/d
- group can execute the contents of f/d
- but group cannot write anything in the f/d

other = r-x, means =>o

- other can read the content of f/d
- other can execute the contents of f/d
- but other cannot write anything in the f/d

- Column2: number of links occupied in the memory block.
- Column3: owner of the file/directory → to change the owner: chown
- Column4: group owner of the file/directory → chown, chgrp
- Column5: file/directory size in bytes.
- Column6: time stamp of file/directory.
- Column7: name of the file/directory.

To change the file/directory owner & group owner:

The screenshot shows a terminal window titled "RHEL7-LTI-main" running as root. The terminal displays the following commands and their outputs:

```
[root@svr Desktop]# chgrp wheel t2
[root@svr Desktop]# ll
total 0
drwxr-xr-x. 2 root root 15 Apr 14 12:13 lti
-rw-r--r--. 1 jeetu wheel 0 Apr 14 11:58 t2
-rw-r--r--. 1 root root 0 Apr 14 11:58 t3
[root@svr Desktop]# chown :wheel t3
[root@svr Desktop]# ll
total 0
drwxr-xr-x. 2 root root 15 Apr 14 12:13 lti
-rw-r--r--. 1 jeetu wheel 0 Apr 14 11:58 t2
-rw-r--r--. 1 root wheel 0 Apr 14 11:58 t3
[root@svr Desktop]# chown jeetu:wheel lti
[root@svr Desktop]# ll
total 0
drwxr-xr-x. 2 jeetu wheel 15 Apr 14 12:13 lti
-rw-r--r--. 1 jeetu wheel 0 Apr 14 11:58 t2
-rw-r--r--. 1 root wheel 0 Apr 14 11:58 t3
[root@svr Desktop]#
```

Changing the permissions of a f/d:

1. Changing via numerical method.
 - a. #chmod <number> <file-name>
 - b. 000
 - c. 111
 - d. 222
 - e. ...
 - f. 777
2. Changing via symbolic/alphabetical method.
 - a. #chmod <user><op><perms> <file-name>
 - b. #chmod ugo=x <file-name>
 - i. = means assigning new perms
 - ii. + means save existing perms + add new perms
 - iii. - means save existing perms + subs new perms
 - c. Ex: #chmod u=rwx,g=rx,o=x t2

User management:

Important files in user mgmt:

- /etc/passwd → holds user related information
- /etc/shadow → holds users passwd detailed information.

Tasks:

1. create a user
2. modify a user
3. delete a user
4. sudo user → EDITOR=vim visudo

/etc/passwd: (7 columns)

1. login name
2. x → referenced password → /etc/shadow
3. user id.
4. Group id of the user.
5. Description/full name /GECOS → “chfn”
6. Default home directory of a user.
7. Default SHELL.

/etc/shadow: (9 columns)

1. Login name
2. True encrypted password (MD5 or SHA512)
 - a. \$6 = SHA512 algo
 - b. \$1 = MD5 algo
3. Last password change (since 1st Jan 1970 in number of days)
4. Minimum passwd age (0)
5. Maximum passwd age (99999 in days) ~273yrs → 30 days
6. Warning days → 7 days
7. Empty → inactive
8. Empty → account expiry
9. Empty → not used till date / for future purpose.

To check the passwd algo:

```
# authconfig --test | grep hashing
```

Creating a user:

- a. #useradd <option> <username>
- b. Ex: #useradd -u 1024 -s /bin/csh rocky
- c. Areas where new user's entry is gonna create:
 - a. /etc/passwd
 - b. /etc/shadow
 - c. /home/<user-name-dir>
 - d. /var/mail/

Modify an existing user:

- a. #usermod
- b. Ex: #usermod -c "Italian Stallion" rocky

Delete a user:

- a. Partial deletion (used for deleting users' credentials)
 - a. #userdel <username>
 - i. /etc/passwd
 - ii. /etc/shadow
- b. Full deletion (used for deleting user completely from the Linux system)
 - a. #userdel -r <username>
 - i. /etc/passwd
 - ii. /etc/shadow
 - iii. /home/<user-name-dir>
 - iv. /var/mail/

To search a specific keyword in a file:

- `#grep rocky /etc/passwd` OR
- `#cat /etc/passwd | grep rocky`

To search a file or directory in linux:

- `find / -name content.txt` // searching a file
- `find / -type d -name lti` // searching a directory

Groups in Linux:

- File: `/etc/group`
- Consists of 4 columns
 - Group name
 - X → referenced passed → `/etc/gshadow`
 - Group ID
 - Group members

Sudo users:

- User with limited admin rights.

Sudo user = normal user + limited admin permissions.

- Root user => #
- Normal user => \$
- Sudo user => \$

File → `/etc/sudoers`

Commands → `#visudo` or `EDITOR=vim visudo`

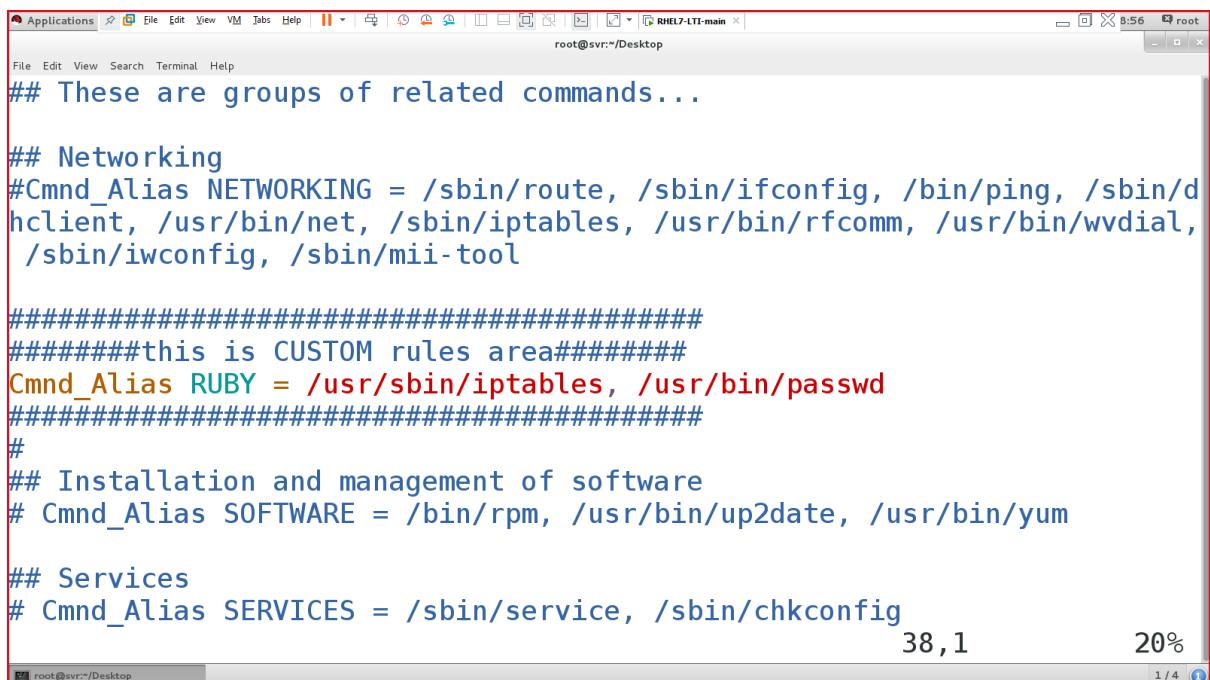
root ALL=(ALL) ALL

- col1: user name
- col2: machine=terminal
- col3: commands given to the user

sudo tasks:

- a. create a new sudo user with ALL permission/cmd.
- b. create a new sudo user with PREDIFINED cmd.
- c. Create a new sudo user with CUSTOM cmd.

Defining the commands:



```
## These are groups of related commands...

## Networking
#Cmnd_Alias NETWORKING = /sbin/route, /sbin/ifconfig, /bin/ping, /sbin/dhcclient, /usr/bin/net, /sbin/iptables, /usr/bin/rfccomm, /usr/bin/wvdial, /sbin/iwconfig, /sbin/mii-tool

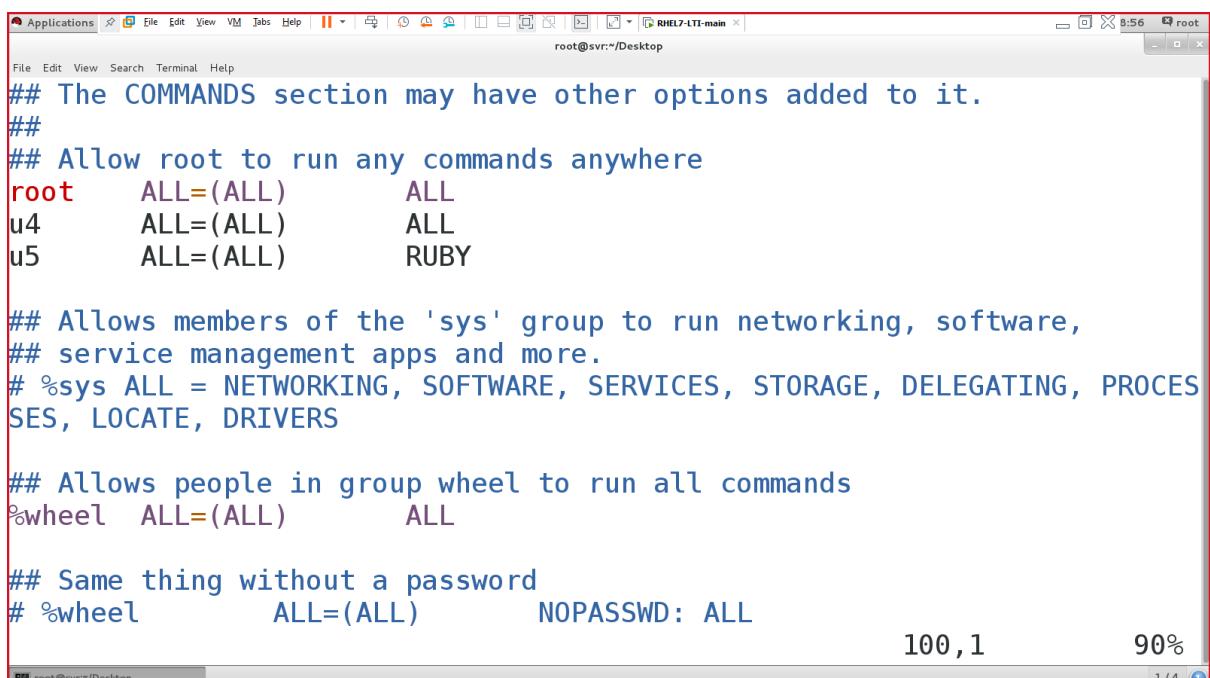
#####
#####this is CUSTOM rules area#####
Cmnd_Alias RUBY = /usr/sbin/iptables, /usr/bin/passwd
#####

##
## Installation and management of software
# Cmnd_Alias SOFTWARE = /bin/rpm, /usr/bin/up2date, /usr/bin/yum

## Services
# Cmnd_Alias SERVICES = /sbin/service, /sbin/chkconfig
```

38,1 20%
1 / 4

Allocating the commands to the users.



```
## The COMMANDS section may have other options added to it.
##

## Allow root to run any commands anywhere
root    ALL=(ALL)      ALL
u4      ALL=(ALL)      ALL
u5      ALL=(ALL)      RUBY

## Allows members of the 'sys' group to run networking, software,
## service management apps and more.
# %sys ALL = NETWORKING, SOFTWARE, SERVICES, STORAGE, DELEGATING, PROCESSES, LOCATE, DRIVERS

## Allows people in group wheel to run all commands
%wheel  ALL=(ALL)      ALL

## Same thing without a password
# %wheel          ALL=(ALL)      NOPASSWD: ALL
```

100,1 90%
1 / 4

Packages management:

- Installing packages/software on linux machine.
- Local repository (repository = location where all packages are present).
- Internet based repository.

Repo:

- RedHat repo = local (DVD), RedHat satellite server (paid).
- Centos repo = local (DVD), Centos mirror server (free).

Packages managers - responsible for package mgmt (install, remove, update...)

- RPM
 - Redhat package manager
 - Default method to manage a package in RHEL/Centos/Fedora...
 - Extension is .rpm
- YUM
 - Yellowdog update manager OR Yellowdog update modifier.
 - A server that WE need to install.
 - To install YUM server, there are 2 methods.
 - Full - 8/9 steps, independent of DVD, permanent.
 - Shortcut - 1 step, temporary (dependent on DVD)
 - Extension is .rpm
- APT
 - Advanced packaging tool
 - Ubuntu server.
 - Free of cost, no charges to download or install any packages.
 - Extension is .rpm, .deb, .dpkg
- DPKG
 - Debian-based package manager.
 - Extension as .deb, .dpkg
 - Kali, backtrack.
 - Free of cost

Naming convention of a package in Linux: Name-major-version-architecture.rpm

Win → XShell_5.0-Build-1019.exe

- XShell = name of the software
- _5.0 = versions
- Build-1019 = release/built
- .exe = extension

Linux → zip-3.0-10.el7.x86_64.rpm

- Zip = name of the package
- '3.0' = major release/version
- 10.el7 = minor release
- X86_64 = architecture of the package
- .rpm = extension.

Architecture of any linux package:

- a. 32bit = i686
- b. 64bit = x86_64
- c. No architecture = noarch = 32bit and 64bit

RPM - Redhat package manager.

- Install
 - #rpm -ivh <package-full-name>.rpm
 - I = install
 - V = verbose
 - H = hashing (#####)
 - Ex: #rpm -ivh /run/media/root/RHEL-7.0\ Server.x86_64/Packages/dhcp-4.2.5-27.el7.x86_64.rpm OR
 - #rpm -ivh dhcp-4.2.5-27.el7.x86_64.rpm
- Query
 - rpm -q <package-name> → list single installed package.
 - rpm -qa → list all installed packages.
- Uninstall/remove
 - #rpm -e <package-name>
- Update
 - #rpm -Uvh <package-name>
 - U = means, update

Problems of RPM:

- *Full name* → dhcp-4.2.5-27.el7.x86_64.rpm
- *Location* → /run/media/root/RHEL-7.0\ Server.x86_64/Packages/dhcp-4.2.5-27.el7.x86_64.rpm (absolute path or relative path)
- *Dependency*
 - #rpm -ivh system-config-kickstart-2.9.2-4.el7.noarch.rpm → dependency error while installing
 - #rpm -ivh --nodeps system-config-kickstart-2.9.2-4.el7.noarch.rpm → installation done w/o dependency.

YUM - yellowdog update manager

- Install a YUM server
- It consists of 8/9 steps.

Steps to install YUM server:

Step 1: check the firewall & SELinux

- #systemctl status firewalld → check FW status
- #systemctl stop firewalld → stop FW

SELinux:

- setenforce 0 → will make SELinux permissive
- getenforce → output will permissive.

Step 2: check the list of packages.

- rpm -q createrepo deltarpm python-deltarpm vsftpd

Step 3: create a local repo directory

- mkdir /var/ftp/pub/yumserver

Step 4: copy all the packages from DVD to the local repo (created in step 3)

- cp -var /run/media/root/RHEL-7.0\ Server.x86_64/Packages/* /var/ftp/pub/yumserver/
- v= verbose
- a= all (hidden & visible)
- r= recursively

Step 5: create yum/client answer file.

- To go to /etc/yum.repos.d directory
- List the contents of the directory, if any file named package... or Redhat.... Then delete those files.
- Create a new file 'yum.repo' And write below lines:
 - [yumserver]
 - name="Joker SVR"
 - baseurl=ftp://192.168.10.10/pub/yumserver
 - gpgcheck=0
 - enabled=1

Step 6: create index for the packages.

- #createrepo -v /var/ftp/pub/yumserver/

```
[root@svr ~]# createrepo -v /var/ftp/pub/yumserver/
Spawning worker 0 with 1077 pkgs
Spawning worker 1 with 1076 pkgs
Spawning worker 2 with 1076 pkgs
Spawning worker 3 with 1076 pkgs
Worker 0: reading 389-ds-base-1.3.1.6-25.el7.x86_64.rpm
Worker 1: reading 389-ds-base-libs-1.3.1.6-25.el7.x86_64.rpm
Worker 2: reading ElectricFence-2.2.2-39.el7.i686.rpm
Worker 3: reading ElectricFence-2.2.2-39.el7.x86_64.rpm
Worker 0: reading GConf2-3.2.6-8.el7.i686.rpm
Worker 1: reading GConf2-3.2.6-8.el7.x86_64.rpm
Worker 2: reading GeoIP-1.5.0-9.el7.i686.rpm
Worker 3: reading GeoIP-1.5.0-9.el7.x86_64.rpm
Worker 0: reading ImageMagick-6.7.8.9-10.el7.i686.rpm
Worker 1: reading ImageMagick-6.7.8.9-10.el7.x86_64.rpm
Worker 2: reading ImageMagick-c++-6.7.8.9-10.el7.i686.rpm
```

Step 7: enable, start & check the status of vsftpd service.

- #systemctl enable vsftpd → ensure to start vsftpd service at next boot time.
- #systemctl start vsftpd → start the vsftpd service for NOW.
- #systemctl status vsftpd → running status of vsftpd

Step 8: clean, update & verify.

- #yum clean all
- #yum update all
- #yum repolist

```
[root@svr ~]# yum repolist
Loaded plugins: langpacks, product-id, subscription-manager
This system is not registered to Red Hat Subscription Management. You can use subscription-manager to register.
repo id          repo name          status
yumserver        "Joker SVR"      4,305
repolist: 4,305
[root@svr ~]#
```

END OF FULL YUM SERVER

- Install
 - #yum install -y <package-name>
 - #yum install -y dhcp system-config-kickstart...
- Query
 - #yum info <package-name>
 - #yum info finger
- Uninstall/remove
 - #yum remove <package-name>
- Upgrade/update
 - #yum update <package-name>

For shortcut YUM method

Step 1: DVD must be present. Go to /etc/yum.repo.d

Step 2: remove/move all the file.

Step 3: create a new client answer file as yum.repo & write/paste below code:

- [rubyRockss]
- name="Ruby repo"
- baseurl=file:///run/media/root/CentOS\ 7\ x86_64/
- gpgcheck=0
- enabled=1
 - :wq!

The screenshot shows a terminal window titled 'root@svr:/etc/yum.repos.d'. The window contains the following configuration for a repository named 'rubyRockss':

```
[rubyRockss]
name="Ruby repo"
baseurl=file:///run/media/root/CentOS\ 7\ x86_64/
gpgcheck=0
enabled=1
```

Save & quit

Step 4: run cmd → #yum repolist

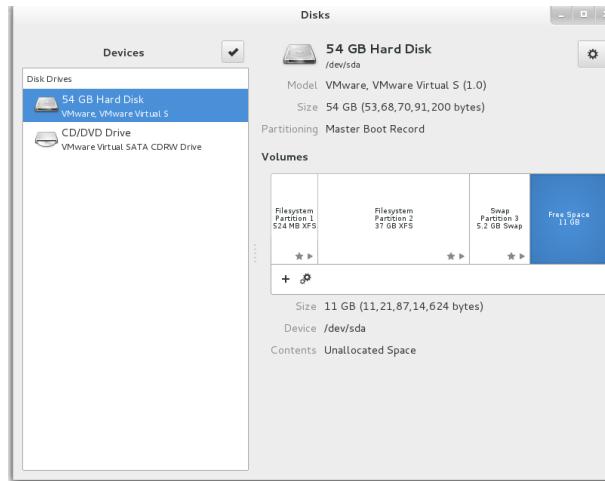
```
[root@svr yum.repos.d]# yum repolist
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
repo id                                repo name                               status
rubyRockss                               "Ruby repo"                            3,831
repolist: 3,831
[root@svr yum.repos.d]#
```

Partitioning:

- Simple partitioning → 1 blank storage disk
- Advanced partitioning → logical volume manager (LVM) → 3 blank storage disks.

Simple partitioning

Before:



- Create a partition for the disk → fdisk
- Create a file system for the partition (created in step 1) → mkfs
- Create a mount point to access the disk. → mkdir
- Edit /etc/fstab file → critical.
- Mount & verify

Step1: Create a partition for the disk

“fdisk” works on hard disk → /dev/sda

```
[root@svr ~]# fdisk /dev/sda
Welcome to fdisk (util-linux 2.23.2).

Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Command (m for help): m
```

Listing help commands:

```
Command (m for help): m
Command action
  a  toggle a bootable flag
  b  edit bsd disklabel
  c  toggle the dos compatibility flag
  d  delete a partition
  g  create a new empty GPT partition table
  G  create an IRIX (SGI) partition table
  l  list known partition types
  m  print this menu
  n  add a new partition
  o  create a new empty DOS partition table
  p  print the partition table
  q  quit without saving changes
  s  create a new empty Sun disklabel
```

Create primary partition:

```
Command (m for help): n
Partition type:
  p  primary (3 primary, 0 extended, 1 free)
  e  extended
Select (default e): p
Selected partition 4
First sector (82946048-104857599, default 82946048):
Using default value 82946048
Last sector, +sectors or +size{K,M,G} (82946048-104857599, default 104857599): +10G
Partition 4 of type Linux and of size 10 GiB is set
Command (m for help):
```

Again press ‘m’ for help & select ‘w’.

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

WARNING: Re-reading the partition table failed with error 16: Device or
resource busy.
The kernel still uses the old table. The new table will be used at
the next reboot or after you run partprobe(8) or kpartx(8)
Syncing disks.
[root@svr ~]#
```

Either reboot your system or execute the command:

- #partprobe /dev/sda

Step2: Create a file system for the partition

“mkfs” works on partition, you created in step 1.

```
[root@svr ~]# mkfs.
mkfs.btrfs  mkfs.ext3    mkfs.gfs2    mkfs.vfat
mkfs.cramfs mkfs.ext4    mkfs.minix   mkfs.xfs
mkfs.ext2   mkfs.fat     mkfs.msdos
[root@svr ~]# mkfs.xfs /dev/sda4
meta-data=/dev/sda4          isize=256    agcount=4, agsize=655360 b
  lks
    =                      sectsz=512    attr=2, projid32bit=1
    =
    =
data      =                      crc=0
    =
    =
naming    =version 2           bsize=4096   blocks=2621440, imaxpct=25
log       =internal log        bsize=4096   ascii-ci=0 ftype=0
    =
realtime  =none              sectsz=512    sunit=0 blks, lazy-count=1
                           extsz=4096   blocks=0, rtextents=0
[root@svr ~]#
```

Step 3: Create a mount point to access the disk

- #mkdir /warmachine

Step 4: edit /etc/fstab

```
# 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
#
UUID=8d0e66cc-bca0-4f93-b3f7-24293f7acb58 /          xfs    defaults    1 1
UUID=81cde27d-893c-4600-add6-b5a737969567 /boot      xfs    defaults    1 2
UUID=a321d2c8-c116-4385-8e65-b2e42fe52c84 swap        swap   defaults    0 0
```

1

2

xfs
xfs
swap

defaults
defaults
defaults

1 1
1 2
0 0

3

4

5

- Col1: what to mount? → /dev/sda4
- Col2: where to mount → /warmachine
- Col3: file system of the hard disk → xfs
- Col4: how to mount/permission → defaults
- Col5: priority at boot time → 2 2

```
#          xfs    defaults    1 1
UUID=8d0e66cc-bca0-4f93-b3f7-24293f7acb58 /          xfs    defaults    1 2
UUID=81cde27d-893c-4600-add6-b5a737969567 /boot      xfs    defaults    0 0
UUID=a321d2c8-c116-4385-8e65-b2e42fe52c84 swap        swap   defaults    2 2
```

Save & quit

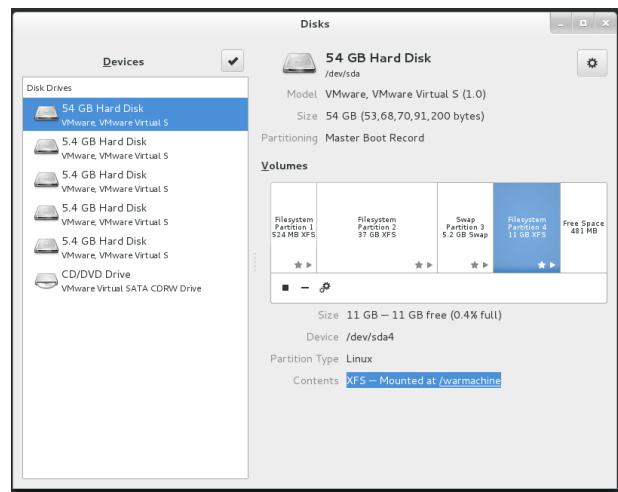
Step 5: Mount & verify

```
[root@svr ~]# mount -a
[root@svr ~]# mount | grep /warmachine
/dev/sda4 on /warmachine type xfs (rw,relatime,seclabel,attr2,inode64,noquota)
[root@svr ~]#
```

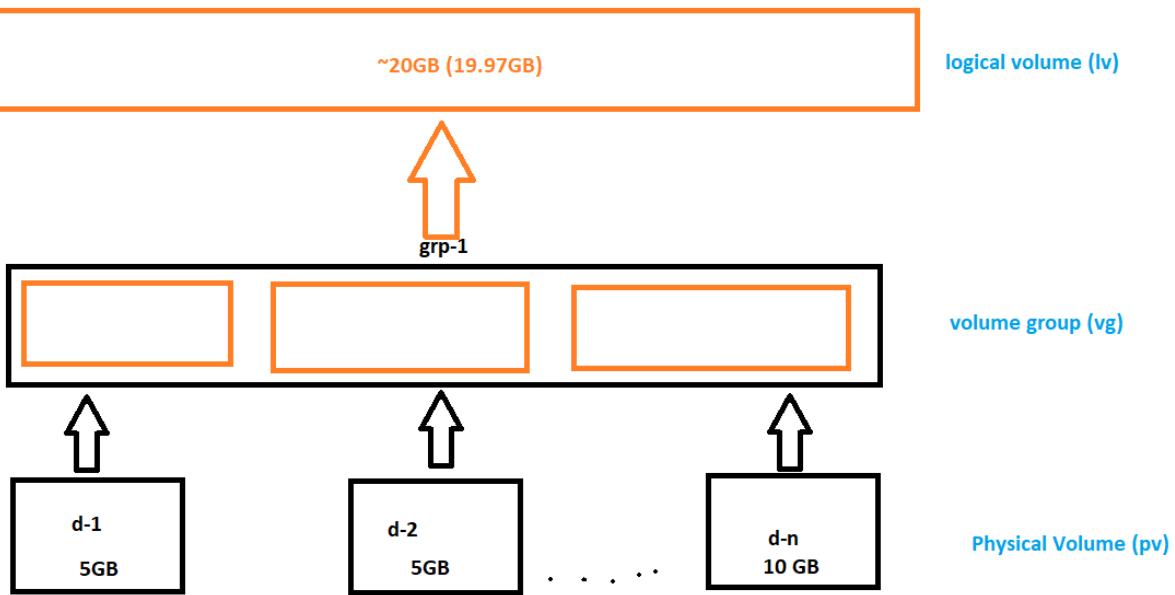
Verify:

```
[root@svr ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2       35G  7.7G  27G  23% /
devtmpfs        1.9G    0  1.9G   0% /dev
tmpfs           1.9G 140K  1.9G   1% /dev/shm
tmpfs           1.9G  8.9M  1.9G   1% /run
tmpfs           1.9G    0  1.9G   0% /sys/fs/cgroup
/dev/sda1       497M 119M  379M  24% /boot
/dev/sda4       10G   33M   10G   1% /warmachine
[root@svr ~]#
```

After the partitioning:



Logical Volume Manager (LVM)



Steps to perform LVM.

- Create a partition for the disk → fdisk
- pv → pvcreate, pvdisplay/pvs, pvremove
- vg → vgcreate, vgdisplay/vgs, vgremove
- lv → lvcreate, lvdisplay/lvs, lvremove
- Create a file system for the partition (created in step 1) → mkfs
- Create a mount point to access the disk. → mkdir
- Edit /etc/fstab file → critical.
- Mount & verify

Disks for LVM → **/dev/sdb** & **/dev/sdc**

Step 1: Create a partition for the disk (use FDISK utility)

#fdisk /dev/sdb

```
root@svr:~# fdisk /dev/sdb
root@svr:~# 
Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p):
Using default response p
Partition number (1-4, default 1):
First sector (2048-10485759, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-10485759, default 10485759):

Using default value 10485759
Partition 1 of type Linux and of size 5 GiB is set

Command (m for help): p
Disk /dev/sdb: 5368 MB, 5368709120 bytes, 10485760 sectors
Disk /dev/sdb: 5368 MB, 5368709120 bytes, 10485760 sectors
  
```

```
Partition 1 of type Linux and of size 5 GiB is set
Command (m for help): p
Disk /dev/sdb: 5368 MB, 5368709120 bytes, 10485760 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 label type: dos
Disk identifier: 0xb418f722

Device Boot Start End Blocks Id System
/dev/sdb1 2048 10485759 5241856 83 Linux
```

Then select 'w' to save & quit the utility

```
Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
[root@svr ~]#
```

#fdisk /dev/sdc

```
[root@svr ~]# fdisk /dev/sdc
Welcome to fdisk (util-linux 2.23.2).

Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table
Building a new DOS disklabel with disk identifier 0x28f4af7d.

Command (m for help): n
Partition type:
 p primary (0 primary, 0 extended, 4 free)
 e extended
Select (default p):
Using default response p
Partition number (1-4, default 1):
First sector (2048-10485759, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-10485759, default 10485759):

Using default value 10485759
Partition 1 of type Linux and of size 5 GiB is set

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
[root@svr ~]#
```

Step 2: create a physical volume (PV)

```
#pvcreate <disk-1> <disk-2>...
```

```
[root@svr ~]# pvcreate /dev/sdb1 /dev/sdc1
  Physical volume "/dev/sdb1" successfully created
  Physical volume "/dev/sdc1" successfully created
[root@svr ~]#
```

Display the pv:

```
[root@svr ~]# pvs
  PV          VG  Fmt Attr PSize PFree
  /dev/sdb1    lvm2 a--  5.00g 5.00g
  /dev/sdc1    lvm2 a--  5.00g 5.00g
[root@svr ~]#
```

Step 3: create a volume group (vg)

```
#vgcreate <name-of-the-vg> <pv1> <pv2>...<pvn>
```

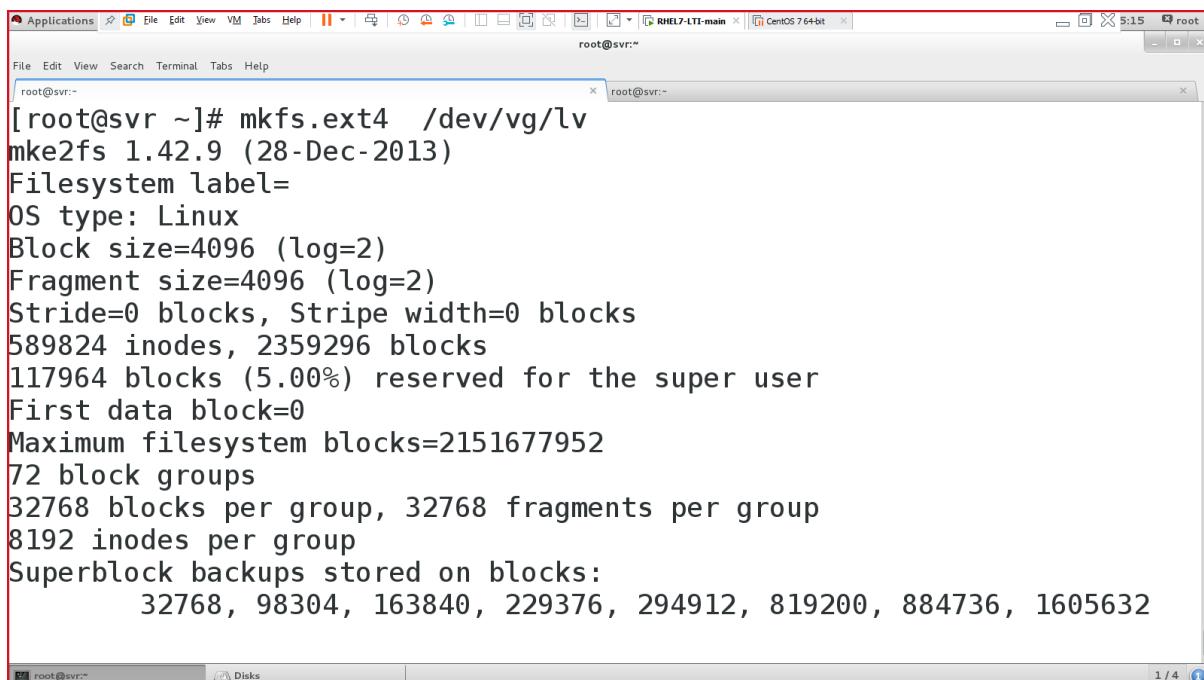
```
#vgcreate vg /dev/sdb1 /dev/sdc1
```

```
[root@svr ~]# vgcreate vg /dev/sdb1 /dev/sdc1
  Volume group "vg" successfully created
[root@svr ~]# vgs
  VG #PV #LV #SN Attr   VSize VFree
  vg     2   0   0 wz--n-  9.99g 9.99g
[root@svr ~]#
```

Step 4: create a logical volume (lv)

```
[root@svr ~]# lvcreate -n lv -L 9G vg
  Logical volume "lv" created
[root@svr ~]# lvs
  LV   VG   Attr       LSize Pool Origin Data%  Move Log Cpy%Sync Convert
  lv    vg   -wi-a---- 9.00g
```

Step 5: create a file system (.ext4)



```
[root@svr ~]# mkfs.ext4 /dev/vg/lv
mke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
589824 inodes, 2359296 blocks
117964 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=2151677952
72 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
      32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632
```

Step 6: create a mount point



```
[root@svr ~]# mkdir /tonystark
[root@svr ~]#
```

Step 7: mount the hard drive

a. Permanent

a. Edit /etc/fstab

defaults	0 0			
/dev/sda4	/warmachine	xfs	defaults	2 2
/dev/vg/lv	/tonystark	ext4	defaults	2 2

Save & quit

NOTE: EITHER PERFORM PERMANENT MOUNT OR TEMPORARY MOUNT (1 at a time)

b. Temporary

a. Use mount command.

```
[root@svr ~]# mkdir /joker
[root@svr ~]# mount /dev/vg/lv /joker
[root@svr ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2        35G  7.7G  27G  23% /
devtmpfs        1.9G     0  1.9G   0% /dev
tmpfs           1.9G  472K  1.9G   1% /dev/shm
tmpfs           1.9G  8.9M  1.9G   1% /run
tmpfs           1.9G     0  1.9G   0% /sys/fs/cgroup
/dev/sda1       497M 119M  379M  24% /boot
/dev/sda4        10G   33M   10G   1% /warmachine
/dev/mapper/vg-lv 8.8G   37M  8.3G   1% /joker
[root@svr ~]#
```

Step 8: mount & verify

```
[root@svr ~]# mount -a
[root@svr ~]#
```

And verify:

```
[root@svr ~]# mount | grep /tony
/dev/mapper/vg-lv on /tonystark type ext4 (rw,relatime,seclabel,data=ordered)
[root@svr ~]#
```

Verify by saving the file in the mounted drive

```
[root@svr ~]# touch /tonystark/mach42
[root@svr ~]# ls /tonystark/
lost+found  mach42
[root@svr ~]#
```

Verify using "df -h".

The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "root@svr:~". The command entered is "lsblk", which lists the system's block devices. The output shows the following disk configuration:

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
sda	8:0	0	50G	0	disk	
└─sda1	8:1	0	500M	0	part	/boot
└─sda2	8:2	0	34.2G	0	part	/
└─sda3	8:3	0	4.9G	0	part	[SWAP]
└─sda4	8:4	0	10G	0	part	/warmachine
sdb	8:16	0	5G	0	disk	
└─sdb1	8:17	0	5G	0	part	
└─vg-lv	253:0	0	9G	0	lvm	/joker
sdc	8:32	0	5G	0	disk	
└─sdc1	8:33	0	5G	0	part	
└─vg-lv	253:0	0	9G	0	lvm	/joker
sdd	8:48	0	5G	0	disk	
sde	8:64	0	5G	0	disk	
sr0	11:0	1	1024M	0	rom	

[root@svr ~]#

RAID

- redundant array of independent disks or
- redundant array of inexpensive disks.

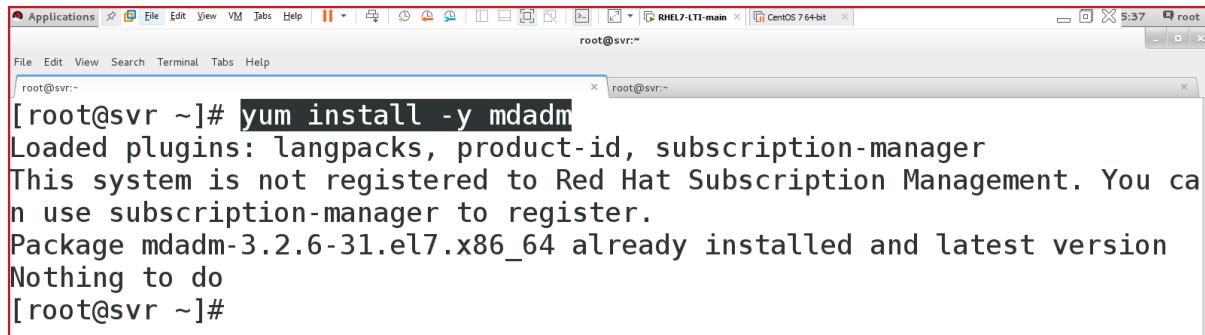
Types of RAID:

- Raid 0 - striping
- Raid 1 - mirroring
- Raid 5 - striping with parity
- Raid 6 - striping with dual/double parity
- Raid 10 - combining striping with mirroring.

Disks to be in the RAID 0 - /dev/sdd & /dev/sde

Package required for RAID

```
#yum install -y mdadm
```

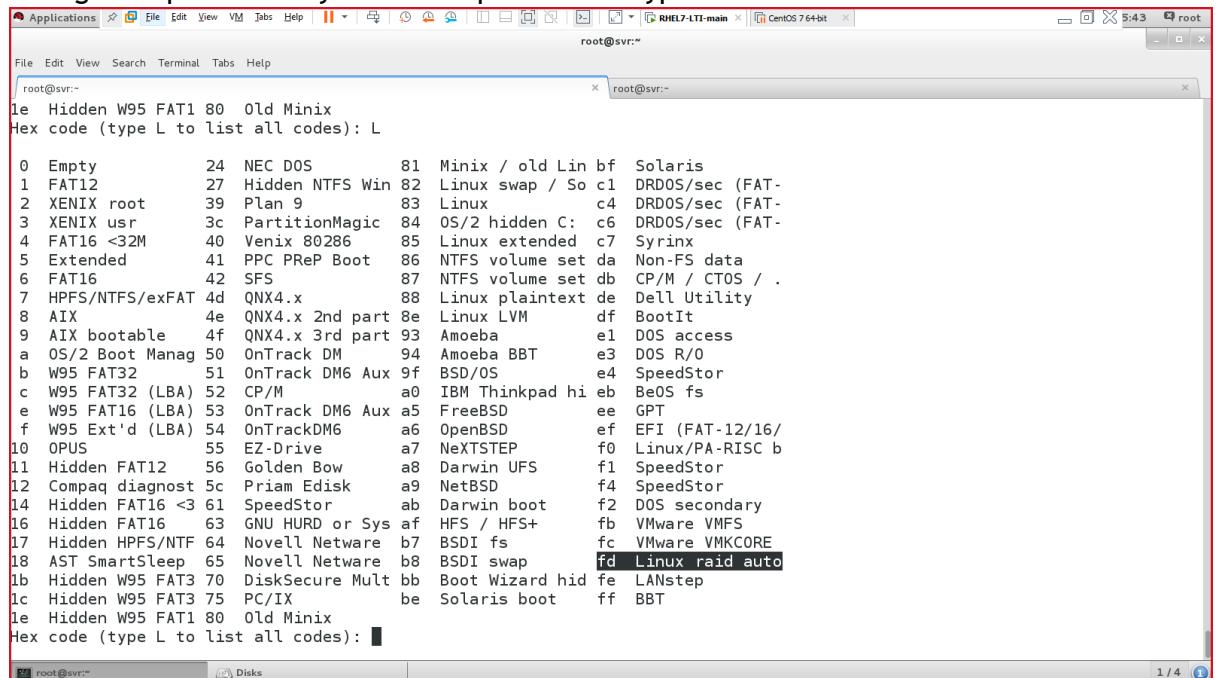


```
[root@svr ~]# yum install -y mdadm
Loaded plugins: langpacks, product-id, subscription-manager
This system is not registered to Red Hat Subscription Management. You can use subscription-manager to register.
Package mdadm-3.2.6-31.el7.x86_64 already installed and latest version
Nothing to do
[root@svr ~]#
```

Format the disk in the required raid format.

```
#fdisk /dev/sdd
```

- Format the disk in the default setting (done earlier in standard partitioning)
- N = new, p = primary, 1, select 1st sector & last sector.
- Change the partition's system id → press 't' → type 'L' → select 'fd'



```
[root@svr ~]# fdisk /dev/sdd
File Edit View Search Terminal Tabs Help
root@svr:~ [root@svr:~]
1e Hidden W95 FAT1 80 Old Minix
Hex code (type L to list all codes): L

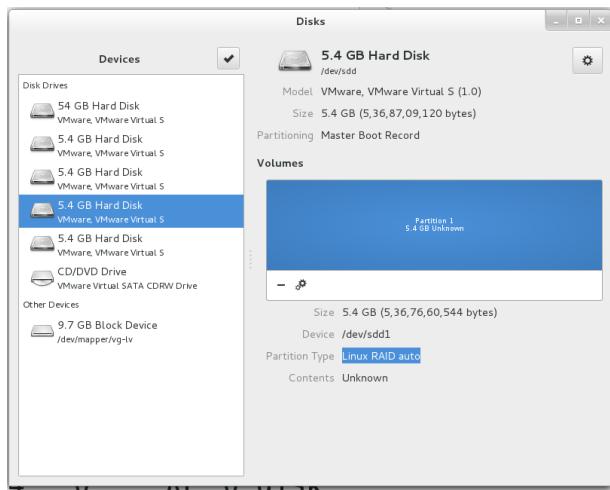
      0  Empty          24  NEC DOS          81  Minix / old Lin bf  Solaris
      1  FAT12          27  Hidden NTFS Win  82  Linux swap / So c1  DRDOS/sec (FAT-
      2  XENIX root     39  Plan 9          83  Linux           c4  DRDOS/sec (FAT-
      3  XENIX usr      3c  PartitionMagic  84  OS/2 hidden C: c6  DRDOS/sec (FAT-
      4  FAT16 <32M    40  Venix 80286    85  Linux extended  c7  Syrix
      5  Extended        41  PPC PReP Boot   86  NTFS volume set da  Non-FS data
      6  FAT16          42  SFS            87  NTFS volume set db  CP/M / CTOS /
      7  HPFS/NTFS/exFAT 4d  QNX4.x       88  Linux plaintext de  Dell Utility
      8  AIX            4e  QNX4.x 2nd part 8e  Linux LVM         df  BootIt
      9  AIX bootable   4f  QNX4.x 3rd part 93  Amoeba          e1  DOS access
     a  OS/2 Boot Manag 50  OnTrack DM    94  Amoeba BBT       e3  DOS R/O
     b  W95 FAT32      51  OnTrack DM6 Aux 9f  BSD/OS         e4  SpeedStor
     c  W95 FAT32 (LBA) 52  CP/M          a0  IBM Thinkpad hi eb  BeOS fs
     e  W95 FAT16 (LBA) 53  OnTrack DM6 Aux af  FreeBSD         ee  GPT
     f  W95 Ext'd (LBA) 54  OnTrackDM6   a6  OpenBSD         ef  EFI (FAT-12/16/
    10  OPUS           55  EZ-Drive       a7  NeXTSTEP       f0  Linux/PA-RISC b
    11  Hidden FAT12    56  Golden Bow    a8  Darwin UFS      f1  SpeedStor
    12  Compaq diagnost 5c  Priam Edisk   a9  NetBSD         f4  SpeedStor
    14  Hidden FAT16 <3 61  SpeedStor    ab  Darwin boot     f2  DOS secondary
    16  Hidden FAT16    63  GNU HURD or Sys af  HFS / HFS+    fb  VMware VMFS
    17  Hidden HPFS/NTF 64  Novell Netware b7  BSDI fs       fc  VMware VMKCORE
    18  AST SmartSleep 65  Novell Netware b8  BSDI swap      fd  Linux raid auto
    1b  Hidden W95 FAT3 70  DiskSecure Mult bb  Boot Wizard hid fe  LANstep
    1c  Hidden W95 FAT3 75  PC/IX          be  Solaris boot    ff  BBT
    1e  Hidden W95 FAT1 80  Old Minix
```

```
[root@svr ~]# fdisk /dev/sdd
Hex code (type L to list all codes): fd
Changed type of partition 'Linux' to 'Linux raid autodetect'
```

Command (m for help):

1 / 4

Verify:



Perform the same for the 2nd disk in RAID:

#fdisk /dev/sde

Execute the below cmd to examine (-E) the disks:

```
[root@svr ~]# mdadm -E /dev/sdd1 /dev/sde1
mdadm: No md superblock detected on /dev/sdd1.
mdadm: No md superblock detected on /dev/sde1.
[root@svr ~]#
```

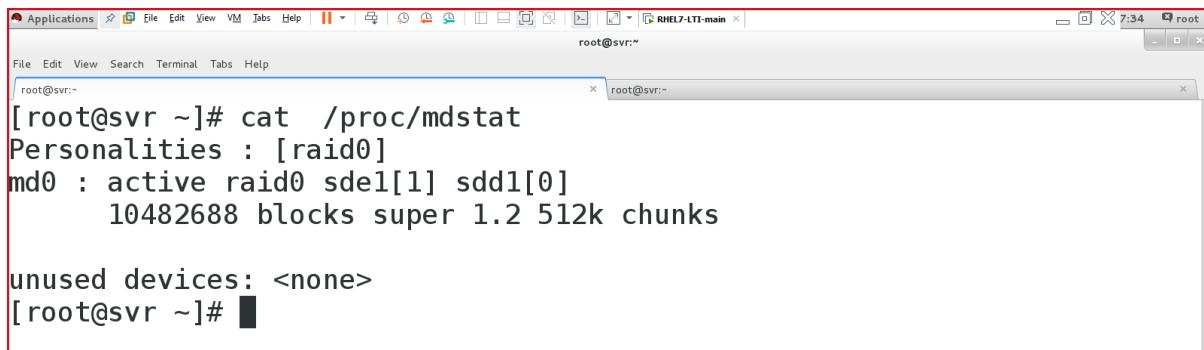
Create raid 0 on /dev/md0

```
[root@svr ~]# mdadm --create /dev/md0 --level=stripe --raid-device=2 /dev/sdd1 /dev/sde1
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.
[root@svr ~]# mdadm -E /dev/sdd1 /dev/sde1
/dev/sdd1:
      Magic : a92b4efc
      Version : 1.2
      Feature Map : 0x0
      Array UUID : 8c818db8:1cc3508b:aa22769e:2303fabf
                  Name : svr.alpha.corp:0 (local to host svr.alpha.corp)
      Creation Time : Thu Apr 16 07:30:57 2020
      Raid Level : raid0
      Raid Devices : 2

      Avail Dev Size : 10483696 (5.00 GiB 5.37 GB)
      Data Offset : 16 sectors
      Super Offset : 8 sectors
                  State : clean
      Device UUID : ac721758:17d43c04:c3808029:3aafdf972

      Update Time : Thu Apr 16 07:30:57 2020
      Checksum : 3879271b - correct
      Events : 0
```

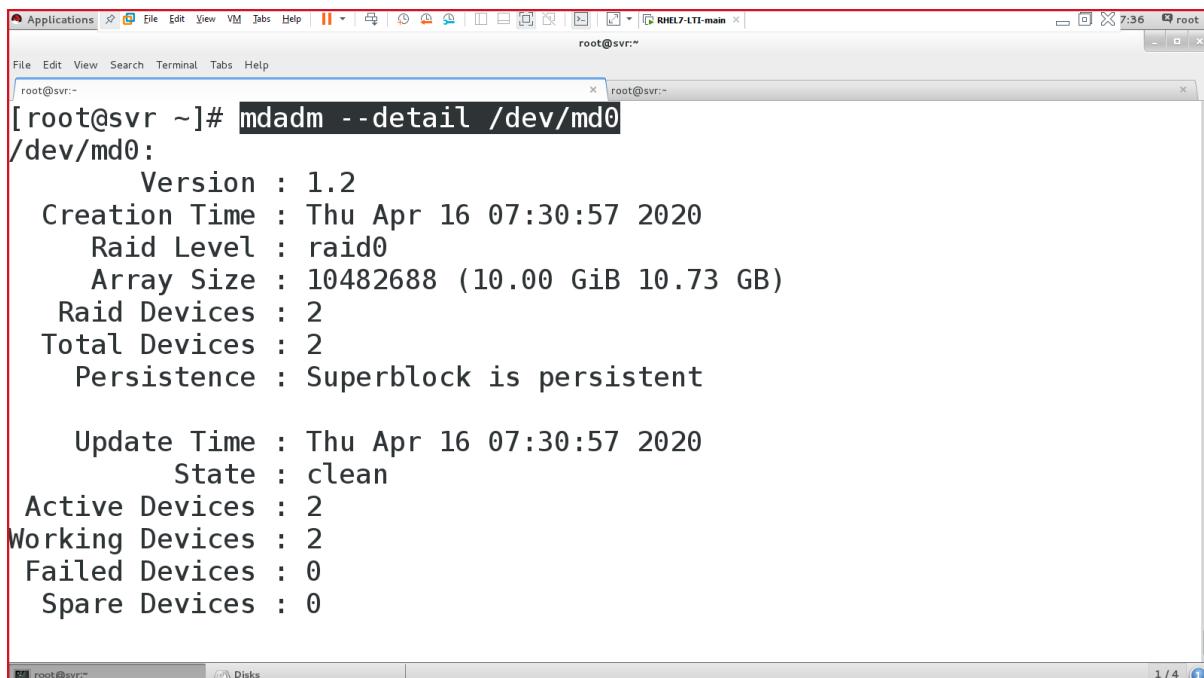
Check the raid status using below command:



```
[root@svr ~]# cat /proc/mdstat
Personalities : [raid0]
md0 : active raid0 sde1[1] sdd1[0]
      10482688 blocks super 1.2 512k chunks

unused devices: <none>
[root@svr ~]#
```

Verify raid status:

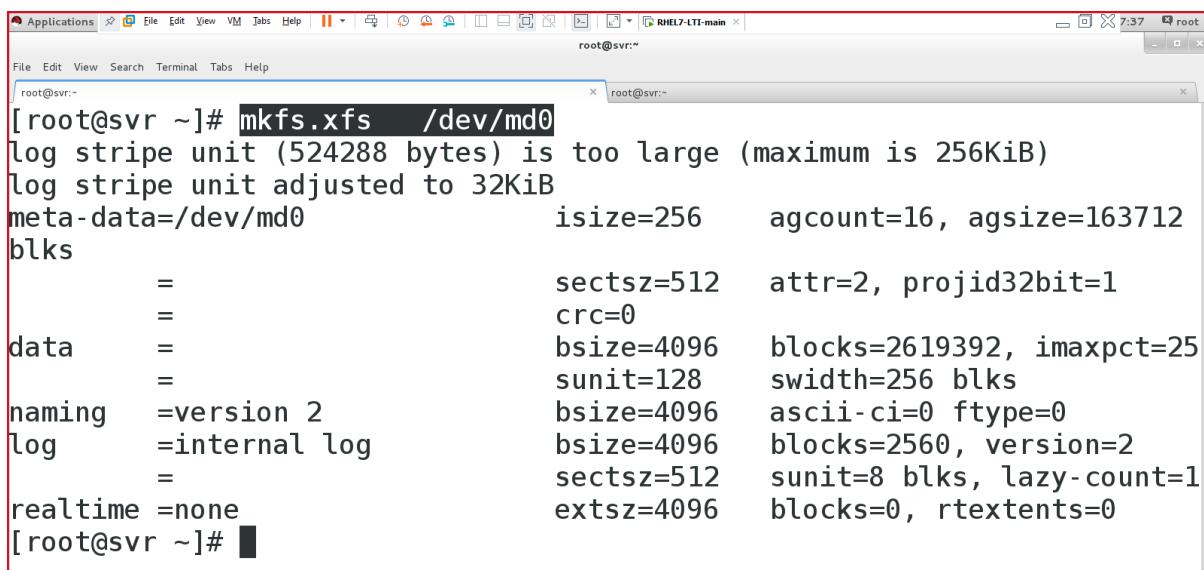


```
[root@svr ~]# mdadm --detail /dev/md0
/dev/md0:
      Version : 1.2
      Creation Time : Thu Apr 16 07:30:57 2020
      Raid Level : raid0
      Array Size : 10482688 (10.00 GiB 10.73 GB)
      Raid Devices : 2
      Total Devices : 2
      Persistence : Superblock is persistent

      Update Time : Thu Apr 16 07:30:57 2020
      State : clean
      Active Devices : 2
      Working Devices : 2
      Failed Devices : 0
      Spare Devices : 0

[root@svr ~]#
```

Create a filesystem for RAID (you can use any FS, i.e, xfs, ext3, ext4):



```
[root@svr ~]# mkfs.xfs /dev/md0
log stripe unit (524288 bytes) is too large (maximum is 256KiB)
log stripe unit adjusted to 32KiB
meta-data=/dev/md0              isize=256    agcount=16, agsize=163712
blks
      =                      sectsz=512   attr=2, projid32bit=1
      =                      crc=0
data      =                      bsize=4096   blocks=2619392, imaxpct=25
      =                      sunit=128    swidth=256 blks
naming    =version 2            bsize=4096   ascii-ci=0 ftype=0
log       =internal log        bsize=4096   blocks=2560, version=2
      =                      sectsz=512   sunit=8 blks, lazy-count=1
realtime  =none                extsz=4096   blocks=0, rtextents=0
[root@svr ~]#
```

Steps for RAID 0:

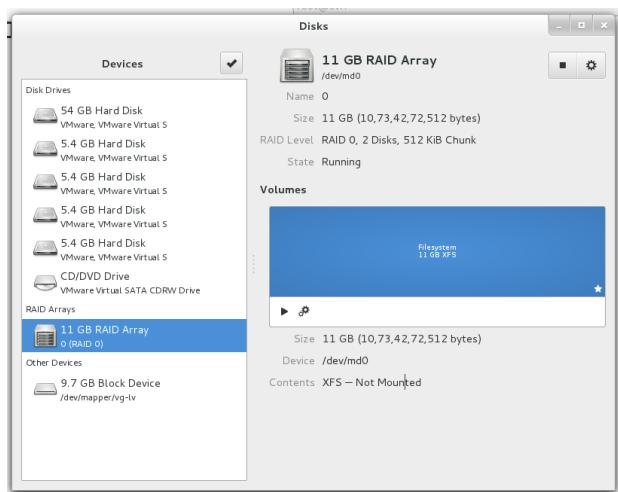
- Attach at least 2 disks, and reboot.
- Use FDISK utility to create a new partition & then convert it into the raid format (fd).
- Examine the disk → #mdadm -E /dev/sdd1 /dev/sde1
- Create a raid 0:
#mdadm --create=/dev/md0 --level=stripe --raid-device=2 /dev/sdd1 /dev/sde1
- Examine the disk again → #mdadm -E /dev/sdd1 /dev/sde1
- Check the details:
 - #cat /proc/mdstat
 - #mdadm --detail /dev/md0
- Create a file system:
 - #mkfs.xfs /dev/md0
- Edit fstab file:
 - Either you can use /dev/md0
`/dev/md0 /raid0 xfs defaults 1 1`
 - Or use UUID (extracted from [blkid /dev/md0])
`UUID=70acac47-840d-434a-ac6d-baa1a6738f60 /raid0 xfs defaults
1 1`

```
#  
# /etc/fstab  
# Created by anaconda on Tue Apr 14 10:32:47 2020  
#  
# 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  
#  
UUID=8d0e66cc-bca0-4f93-b3f7-24293f7acb58 /          xfs    defaults    1 1  
UUID=81cde27d-893c-4600-add6-b5a737969567 /boot      xfs    defaults    1 2  
UUID=a321d2c8-c116-4385-8e65-b2e42fe52c84 swap      swap    defaults    0 0  
/dev/sda4      /warmachine  xfs    defaults    2 2  
#/dev/vg/lv   /tonystark  ext4   defaults    2 2  
#/dev/md0     /raid0     xfs    defaults    1 1  
UUID=70acac47-840d-434a-ac6d-baa1a6738f60      /raid0 xfs    defaults    1 1
```

- Mount & verify
 - #mount -a
 - #mount
- Verify: → df -h

```
[root@svr ~]# df -h  
Filesystem      Size  Used Avail Use% Mounted on  
/dev/sda2        35G  7.7G  27G  23% /  
devtmpfs       1.9G    0  1.9G  0% /dev  
tmpfs          1.9G  524K  1.9G  1% /dev/shm  
tmpfs          1.9G   8.9M  1.9G  1% /run  
tmpfs          1.9G    0  1.9G  0% /sys/fs/cgroup  
/dev/sda1       497M 119M  379M  24% /boot  
/dev/sda4        10G   33M   10G  1% /warmachine  
/dev/mapper/vg-lv 8.8G  37M  8.3G  1% /joker  
/dev/md0         10G   33M   10G  1% /raid0  
[root@svr ~]#
```

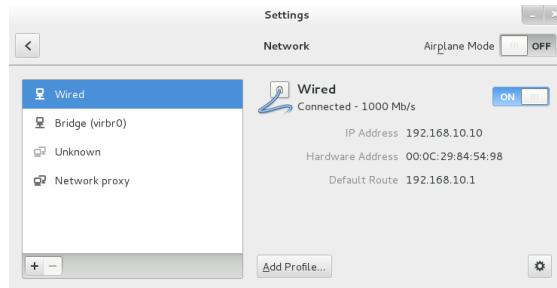
Verify using GUI.



RAID CONFIGURATION OVER

Networking:

- #ifconfig
- #ifconfig | grep inet
- **NMCLI** - Network Manager Command Line Interface (RHEL 5, 6, 7, 8)
 - nmcli connection show
 - nmcli device status
 - nmcli device show
 - nmcli device show eno16777736
- **NMTUI** - Network Manager Text User Interface (RHEL 7, RHEL 6 = setup)
 - #nmtui
 - Then change the required settings (IP address)
 - Then restart the network service
 - #systemctl restart network
- **File**
 - /etc/sysconfig/network-scripts/ifcfg-eno16777736
 - Search using → #find /etc -name ifcfg*
 - Edit the file (change the IP address & gateway)
 - Then restart the network service again.
- **GUI**



Working with services:

RHEL 6

- `#service <service-name> <action>`
- Ex:
 - `#service network restart`
 - `#service network start`
 - `#service network stop`

RHEL 7

- `#systemctl <action> <service-name>`
- Ex:
 - `#systemctl restart network` → restart the service
 - `#systemctl start network` → start the service
 - `#systemctl stop network` → stop the service
 - `#systemctl disable network` → disable the service, after the reboot
 - `#systemctl enable network` → enable the service, after the reboot
- Service
 - Network
 - Dhcp
 - Dns
 - Vsftpd
 - ...

Firewall:

RHEL 6

- Netfilter / iptables (IPv4 traffic) / ip6tables (IPv6 traffic)

To list firewall rules (RHEL 6 method)

- `#iptables -L` //L = list the rules
- `#iptables -F` //F = flush/remove the rules.
- `iptables -I INPUT -s 10.10.10.10 -j ACCEPT` //accepting any traffic from specific IP address.
 - I = insert
 - 's' = source
 - 'j' = jump
 - ACCEPT = allow, REJECT = deny, DROP = discard.

Blocking complete IP address range for SMTP protocol.

- `iptables -I INPUT -s 192.168.11.0/24 -p tcp --destination-port 25 -j DROP`
- `iptables-save > /etc/iptables/rules.v4` → save iptables rules in RHEL 6.

RHEL 7

- `firewall-cmd`
- To list all the zones in RHEL 7 system:
 - `#firewall-cmd --get-zones`
- To list default zone:
 - `#firewall-cmd --list-all`
- Change the default 'public' zone to 'external'
 - `#firewall-cmd --set-default-zone=external`
 - To verify:
 - `#firewall-cmd --list-all`
- To add http/https service
 - `#firewall-cmd --add-service=http -permanent`
 - `#firewall-cmd --add-service=https -permanent`
 - `#firewall-cmd --add-service=ftp -permanent`
 - `#firewall-cmd --reload`
- To add port numbers in the firewall
 - `#firewall-cmd --add-port=21/tcp --permanent`
 - `#firewall-cmd --add-port=53/tcp --permanent`
 - `#firewall-cmd --add-port=53/udp --permanent`
 - `#firewall-cmd --reload`
- To list all services and ports allowed in firewall
 - `#firewall-cmd --list-all`
- To add specific IP address or address range in firewall
 - `#firewall-cmd --add-source=10.10.10.10/8 --permanent` → IP addr
 - `#firewall-cmd --add-source=192.168.10.0/24 --permanent` → range
 - `#firewall-cmd --reload` → reload
 - `#firewall-cmd --list-all` → verify/listing.

NTP:

- NTP = Network Time Protocol
- Time syncing between systems in the network.
- Port number = 123/udp

Lab setup:

- 1 NTP server
 - Centos OS 7
 - Internet is allowed.
- 1 NTP client
 - Windows based machine
 - Internet is allowed.
- Packages required: ntp
- Service for NTP server: ntpd
- Config file for NTP: /etc/ntp.conf

Steps:

- Install the NTP package.
 - #yum install ntp -y
- Edit the configuration file of NTP
 - #vim /etc/ntp.conf

Add below entries from line 25:

```
server 0.in.pool.ntp.org
server 1.in.pool.ntp.org
server 2.in.pool.ntp.org
server 3.in.pool.ntp.org
```



```
17 restrict 192.168.1.0 mask 255.255.255.0 nomodify notrap
18
19 # Use public servers from the pool.ntp.org project.
20 # Please consider joining the pool (http://www.pool.ntp.org/join.html).
21 #server 0.centos.pool.ntp.org iburst
22 #server 1.centos.pool.ntp.org iburst
23 #server 2.centos.pool.ntp.org iburst
24 #server 3.centos.pool.ntp.org iburst
25 #server 0.pool.ntp.org
26 #server 1.pool.ntp.org
27 #server 2.pool.ntp.org
28 #server 3.pool.ntp.org
29 Server 0.in.pool.ntp.org
30 server 1.in.pool.ntp.org
31 server 2.in.pool.ntp.org
32 server 3.in.pool.ntp.org
33
34
35 #broadcast 192.168.1.255 autokey      # broadcast server
-- INSERT --
```

On line 17, allow your IP address range:



```
13 restrict 127.0.0.1
14 restrict ::1
15
16 # Hosts on local network are less restricted.
17 restrict 192.168.6.0 mask 255.255.255.0 nomodify notrap
18
```

At the last line, add file to capture NTP logs:

```
#logfile /var/log/ntp.log
```

```
67 disable monitor  
68  
69 logfile /var/log/ntp.log  
-- INSERT --
```

69,25

Bot

Save & quit.

Add the service in the firewall

- #firewall-cmd --add-service=ntp --permanent
- #firewall-cmd --add-port=123/udp --permanent
- #firewall-cmd --reload

Enable, start & status for NTP

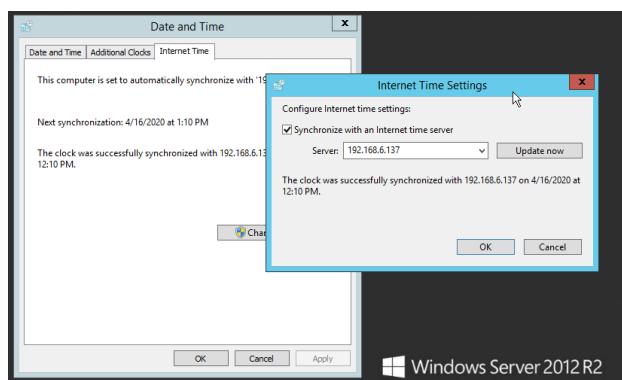
- #systemctl enable ntpd
- #systemctl start ntpd
- #systemctl status ntpd

#####NTP SERVER CONFIG OVER#####

On NTP-Client machine,

- Go to the date & time settings.
- And add the NTP server IP address.

In windows system



On linux system,

```
root@svr:~/Desktop
[root@svr Desktop]# ntpdate -u 192.168.6.137
16 Apr 12:26:04 ntpdate[39728]: step time server 192.168.6.137 offset 413.427744 sec
[root@svr Desktop]# date
Thu Apr 16 12:26:13 IST 2020
[root@svr Desktop]#
```

"-u" = update from NTP server.

#####NTP SERVER CONFIG DONE#####

DHCP server:

- Systems required: 2
- System 1: DHCP server, 192.168.10.10/24 (static IP), no internet required.
- System 2: DHCP client, (have to provide IP dynamically), no internet required.
- Packages: dhcp
- Port number: 67, 68
- Config file for DHCP: /etc/dhcp/dhcpd.conf

On DHCP server:

Install DHCP package:

- #yum install -y dhcp
- Copy the sample DHCP file to the DHCP config directory.



```
Applications Places Terminal
root@svr:~/Desktop
File Edit View Search Terminal Help
[root@svr Desktop]# cp /usr/share/doc/dhcp-4.2.5/dhcpd.conf.example /etc/dhcp/dhcpd.conf
cp: overwrite '/etc/dhcp/dhcpd.conf'? y
[root@svr Desktop]# vim /etc/dhcp/dhcpd.conf
[root@svr Desktop]#
```

A screenshot of a terminal window titled "Terminal". The window shows a root shell session. The user has run the command "cp /usr/share/doc/dhcp-4.2.5/dhcpd.conf.example /etc/dhcp/dhcpd.conf" and confirmed the overwrite. Then, they have opened the file in vim with the command "vim /etc/dhcp/dhcpd.conf". The window title bar includes "Applications", "Places", "Terminal", and "root". The status bar at the bottom right shows "Thu 12:45 PM".

Perform the changes in the “dhcpcd.conf” file:

On line 7, change the domain name to your working domain:
→ option domain-name "alpha.corp";

On line 27, make the below changes:

```
subnet 192.168.10.0 netmask 255.255.255.0 {
    option routers 192.168.10.254;
    option subnet-mask 255.255.255.0;
    option domain-name-servers 192.168.10.10;
    option time-offset -18000;
    range 192.168.10.100 192.168.10.200;
}
:wq!
Save & quit:
#systemctl enable dhcpcd
#systemctl start dhcpcd
#systemctl status dhcpcd → Active: (running)
```

On DHCP server - config file

```

# option definitions common to all supported networks...
option domain-name "alpha.corp";
option domain-name-servers svr.alpha.corp;
default-lease-time 600;
max-lease-time 7200;

# Use this to enable / disable dynamic dns updates globally.
#ddns-update-style none;

# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
#authoritative;

# Use this to send dhcp log messages to a different log file (you also
# have to hack syslog.conf to complete the redirection).
log-facility local7;

# No service will be given on this subnet, but declaring it helps the
# DHCP server to understand the network topology.

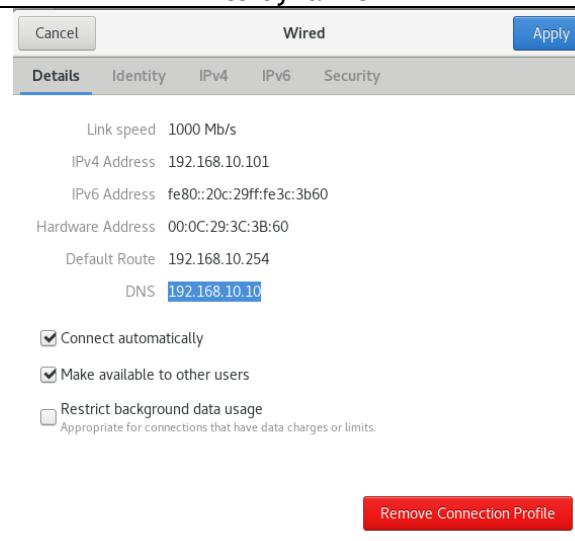
subnet 192.168.10.0 netmask 255.255.255.0 {
    option routers 192.168.10.254;
    option subnet-mask 255.255.255.0;
    option domain-name-servers 192.168.10.10;
    option time-offset -18000;
    range 192.168.10.100 192.168.10.200;
}

# This is a very basic subnet declaration.

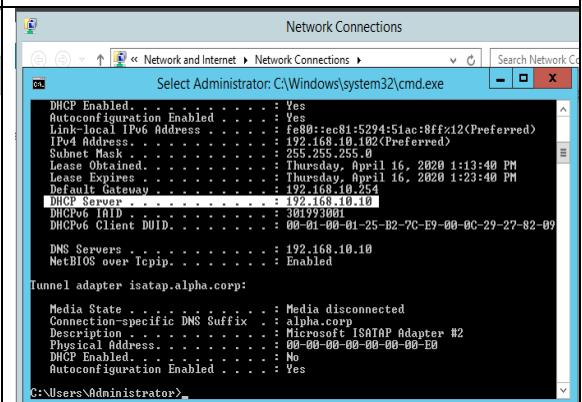
```

root@svr:~

On linux machine, change the IP settings to dynamic



On windows machine:



#####DHCP CONFIG OVER#####

FTP:

- File transfer protocol.
- Port no: 21
- Packages: ftp

[scenario 1]: install & access simple FTP server

Install FTP packages:

- #yum install -y ftp vsftpd

The screenshot shows a terminal window titled 'Terminal' with a red border. The title bar says 'root@svr:~/Desktop'. The window content displays the transaction summary for installing the vsftpd package. It shows the total download size (61 kB), installed size (96 kB), and the progress of the download. The package being installed is 'ftp-0.17-66.el7.x86_64.rpm'. The transaction summary includes steps like 'Running transaction check', 'Running transaction test', and 'Transaction test succeeded'. The final output shows the package is installed and the transaction is complete. The status bar at the bottom right indicates '1 / 1'.

```
Total download size: 61 k
Installed size: 96 k
Downloading packages:
No Presto metadata available for yumserver
ftp-0.17-66.el7.x86_64.rpm
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : ftp-0.17-66.el7.x86_64
  Verifying  : ftp-0.17-66.el7.x86_64
Installed:
  ftp.x86_64 0:0.17-66.el7
Complete!
[root@svr Desktop]#
```

- Installing vsftpd:

The screenshot shows a terminal window titled 'Terminal' with a red border. The title bar says 'root@svr:~/Desktop'. The window content shows the output of the 'yum install -y ftp vsftpd' command. It lists loaded plugins and states that the system is not registered with Red Hat Subscription Management. It then shows that the package 'ftp-0.17-66.el7.x86_64' is already installed and up-to-date, along with the 'vsftpd-3.0.2-9.el7.x86_64' package. The message 'Nothing to do' is displayed, indicating no further action is needed.

```
[root@svr Desktop]# yum install -y ftp vsftpd
Loaded plugins: langpacks, product-id, subscription-manager
This system is not registered to Red Hat Subscription Management. You can use subscription-manager to register.
Package ftp-0.17-66.el7.x86_64 already installed and latest version
Package vsftpd-3.0.2-9.el7.x86_64 already installed and latest version
Nothing to do
[root@svr Desktop]#
```

- Enable, start & status of vsftpd:

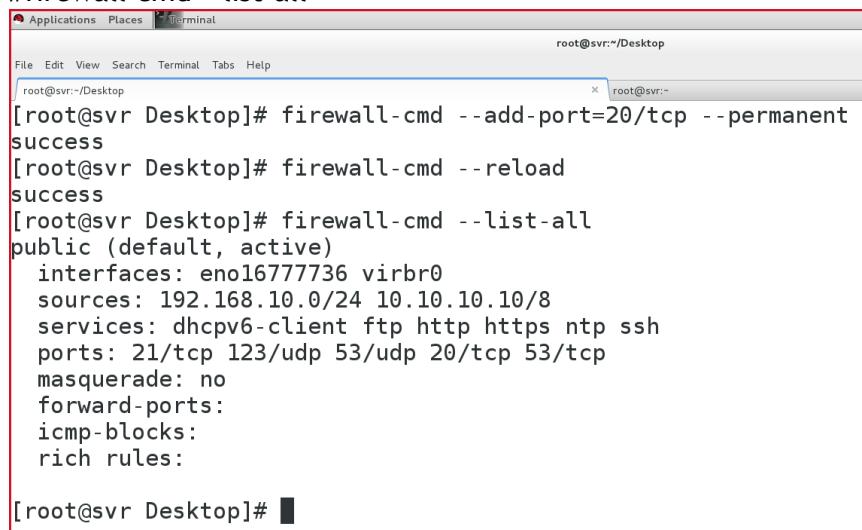
The screenshot shows a terminal window titled 'Terminal' with a red border. The title bar says 'root@svr:~/Desktop'. The window content shows the output of several systemctl commands related to vsftpd. It includes enabling the service, starting it, and checking its status. The status output shows the service is active (running) since the previous day. Log messages at the bottom indicate the service was started at 12:54:27 on April 15 and 14:46:39 on April 16.

```
[root@svr Desktop]# systemctl enable vsftpd
[root@svr Desktop]# systemctl start vsftpd
[root@svr Desktop]# systemctl status vsftpd
vsftpd.service - Vsftpd ftp daemon
   Loaded: loaded (/usr/lib/systemd/system/vsftpd.service; enabled)
     Active: active (running) since Wed 2020-04-15 12:54:27 IST; 1 day 1h ago
       Main PID: 1600 (vsftpd)
          CGroup: /system.slice/vsftpd.service
                  └─1600 /usr/sbin/vsftpd /etc/vsftpd/vsftpd.conf

Apr 15 12:54:27 svr.alpha.corp systemd[1]: Starting Vsftpd ftp daemon...
Apr 15 12:54:27 svr.alpha.corp systemd[1]: Started Vsftpd ftp daemon.
Apr 16 14:46:39 svr.alpha.corp systemd[1]: Started Vsftpd ftp daemon.
[root@svr Desktop]#
```

- Make the FTP entry in the firewall.

```
#firewall-cmd --list-all
```

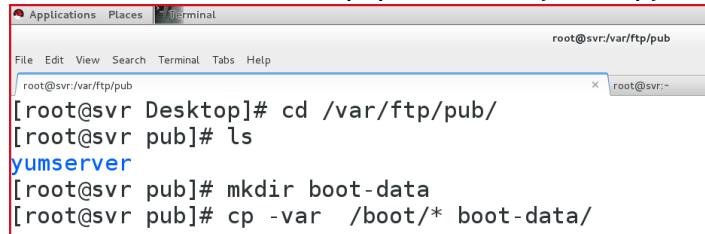


A terminal window titled 'Terminal' with a red border. The title bar says 'root@svr:~/Desktop'. The command history shows:

```
[root@svr Desktop]# firewall-cmd --add-port=20/tcp --permanent
success
[root@svr Desktop]# firewall-cmd --reload
success
[root@svr Desktop]# firewall-cmd --list-all
public (default, active)
  interfaces: eno1677736 virbr0
  sources: 192.168.10.0/24 10.10.10.10/8
  services: dhcpcv6-client ftp http https ntp ssh
  ports: 21/tcp 123/udp 53/udp 20/tcp 53/tcp
  masquerade: no
  forward-ports:
  icmp-blocks:
  rich rules:

[root@svr Desktop]#
```

- Create a folder in /var/ftp/pub directory, & copy some random data in it.

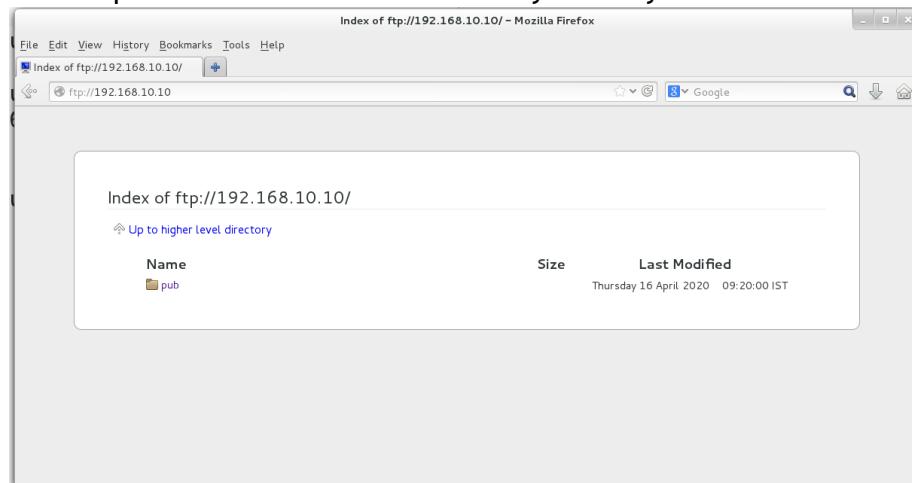


A terminal window titled 'Terminal' with a red border. The title bar says 'root@svr:/var/ftp/pub'. The command history shows:

```
[root@svr Desktop]# cd /var/ftp/pub/
[root@svr pub]# ls
yumserver
[root@svr pub]# mkdir boot-data
[root@svr pub]# cp -var /boot/* boot-data/
```

- Open firefox & visit <ftp://<ip-address-of-ftp-server>>

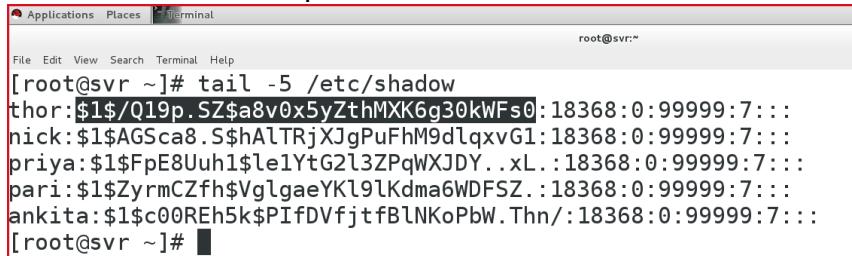
- Either open it on same FTP server or any other system within the network.



[scenario 2]: secure the FTP server using username & password

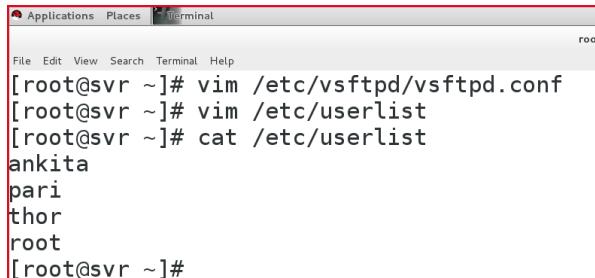
- Install vsftpd package.
- Enable, start & status of VSFTPD service.
- Configure the FTP config file → /etc/vsftpd/vsftpd.conf
- Before you proceed, take the backup of the config file.
cp /etc/vsftpd/vsftpd.conf /etc/vsftpd/vsftpd.conf-backup
- #vim /et/vsftpd/vsftpd.conf
 - Edit line 12, from YES to NO
anonymous_enable=NO
 - Append (in the bottom of the file), new lines:
userlist_file=/etc/userlist → allow list of users to access FTP
userlist_deny=NO → perms to not to block the list.
 - Save & quit.

- Create few users with passwords.



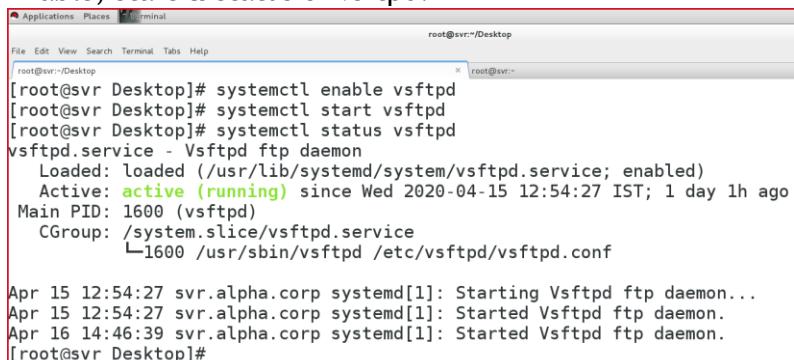
```
File Edit View Search Terminal Help
root@svr:~#
[root@svr ~]# tail -5 /etc/shadow
thor:$1$/Q19p.SZ$a8v0x5yZthMXK6g30kWFs0:18368:0:99999:7:::
nick:$1$AGSc8.S$hALTjXJgPuFhM9dlqxvG1:18368:0:99999:7:::
priya:$1$FpE8Uuh1$le1YtG2l3ZPqWXJDY..xL.:18368:0:99999:7:::
pari:$1$ZymCZfh$VglgaeYKl9lKdma6WDFSZ.:18368:0:99999:7:::
ankita:$1$c0REh5k$PIfDVfjtBlnKoPbW.Thn/:18368:0:99999:7:::
[root@svr ~]#
```

- Create /etc/userlist file & add abv user names in it.



```
File Edit View Search Terminal Help
root@svr:~#
[root@svr ~]# vim /etc/vsftpd/vsftpd.conf
[root@svr ~]# vim /etc/userlist
[root@svr ~]# cat /etc/userlist
ankita
pari
thor
root
[root@svr ~]#
```

- Enable, start & status of vsftpd:

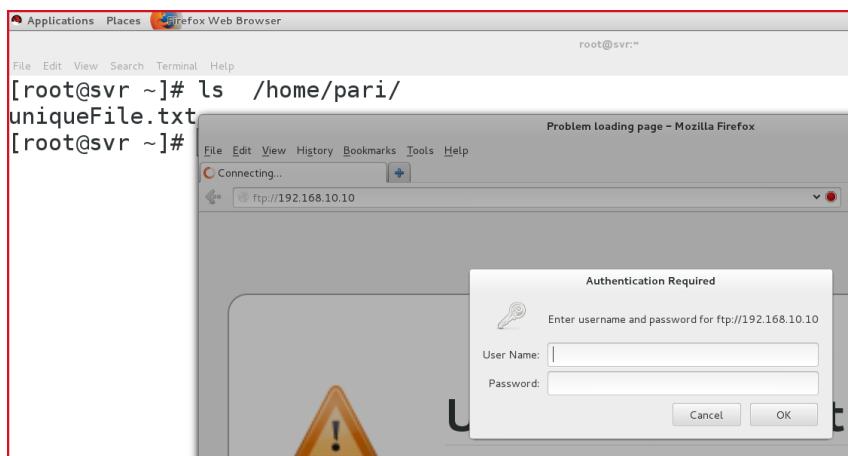


```
File Edit View Search Terminal Tabs Help
root@svr:~/Desktop
[root@svr Desktop]# systemctl enable vsftpd
[root@svr Desktop]# systemctl start vsftpd
[root@svr Desktop]# systemctl status vsftpd
vsftpd.service - Vsftpd ftp daemon
   Loaded: loaded (/usr/lib/systemd/system/vsftpd.service; enabled)
     Active: active (running) since Wed 2020-04-15 12:54:27 IST; 1 day 1h ago
       Main PID: 1600 (vsftpd)
          CGroup: /system.slice/vsftpd.service
                  └─1600 /usr/sbin/vsftpd /etc/vsftpd/vsftpd.conf

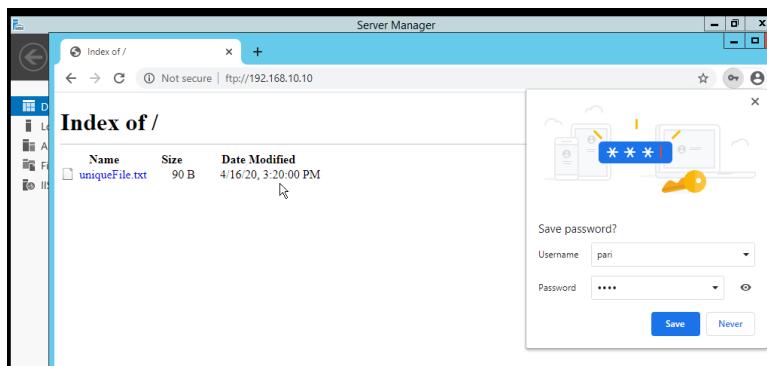
Apr 15 12:54:27 svr.alpha.corp systemd[1]: Starting Vsftpd ftp daemon...
Apr 15 12:54:27 svr.alpha.corp systemd[1]: Started Vsftpd ftp daemon.
Apr 16 14:46:39 svr.alpha.corp systemd[1]: Started Vsftpd ftp daemon.
[root@svr Desktop]#
```

- #systemctl restart vsftpd

On client's web browser:

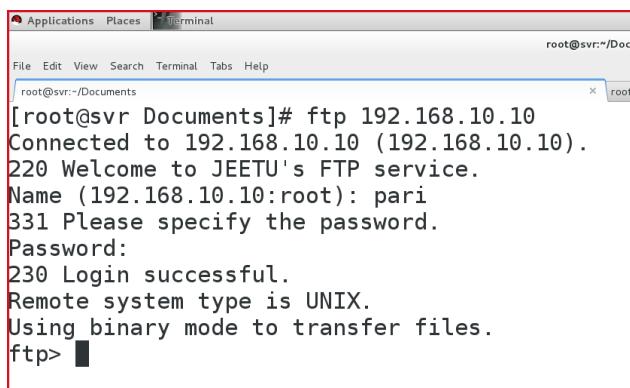


OR

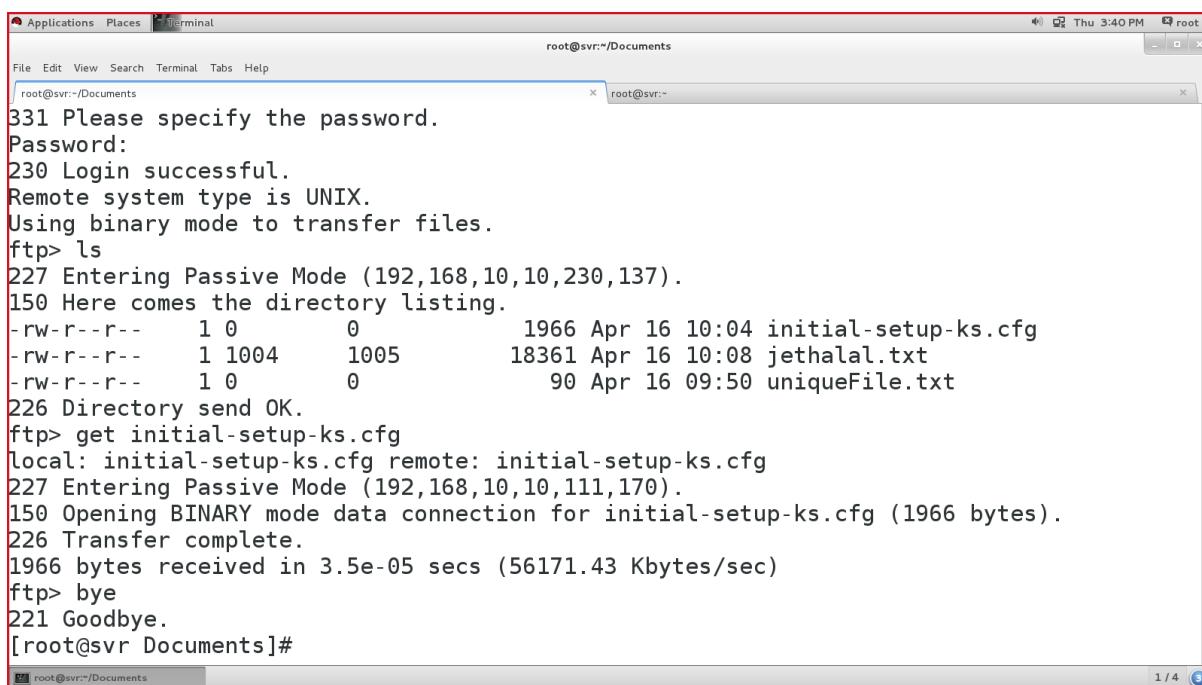


Login to user using linux terminal:

```
#ftp <ftp-server-ip>  
type password of pari user
```



List & download a file and then quit the ftp console:



The screenshot shows a terminal window titled "Terminal" with a red border. The title bar includes "Applications Places Terminal" and "root@svr:~/Documents". The status bar at the top right shows "Thu 3:40 PM root". The main area of the terminal displays an FTP session:

```
root@svr:~/Documents
File Edit View Search Terminal Tabs Help
root@svr:~/Documents x root@svr:-
331 Please specify the password.
Password:
230 Login successful.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> ls
227 Entering Passive Mode (192,168,10,10,230,137).
150 Here comes the directory listing.
-rw-r--r-- 1 0 0 1966 Apr 16 10:04 initial-setup-ks.cfg
-rw-r--r-- 1 1004 1005 18361 Apr 16 10:08 jethalal.txt
-rw-r--r-- 1 0 0 90 Apr 16 09:50 uniqueFile.txt
226 Directory send OK.
ftp> get initial-setup-ks.cfg
local: initial-setup-ks.cfg remote: initial-setup-ks.cfg
227 Entering Passive Mode (192,168,10,10,111,170).
150 Opening BINARY mode data connection for initial-setup-ks.cfg (1966 bytes).
226 Transfer complete.
1966 bytes received in 3.5e-05 secs (56171.43 Kbytes/sec)
ftp> bye
221 Goodbye.
[root@svr Documents]#
```

The terminal window has a scroll bar on the right side.

SSH

- Secure Shell
- Secure Remote access to the remote systems.
- Port number: 22
- Service name for SSH: sshd

Steps to configure SSH on server & client :

- Install SSH packages:
#yum install -y openssh*
- Enable, start & status of SSH
#systemctl enable sshd
#systemctl start sshd
#systemctl status sshd

Connect to SSH server from SSH client:

Syntax: #ssh <username>@<ip-address>

```
[root@cli .ssh]# ssh root@svr.alpha.corp
The authenticity of host 'svr.alpha.corp (192.168.10.10)' can't be established.
ECDSA key fingerprint is SHA256:YNdfQ0bNFKe6lJgQ8Gs2Uq3zj9IopUKiQAND2ly6DeI.
ECDSA key fingerprint is MD5:6f:97:17:4e:ec:50:96:cf:63:4d:ba:84:28:8d:fa:e9.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'svr.alpha.corp,192.168.10.10' (ECDSA) to the list of known hosts.
root@svr.alpha.corp's password:
Last login: Wed Apr 15 12:54:54 2020
[root@svr ~]# ls
```

Password-less SSH:

- Ping the two servers (either name or IP)
- Ssh-keygen

```
[root@cli ~]# ssh-keygen -t rsa -b 4096
Generating public/private rsa key pair.
Enter file in which to save the key (/root/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /root/.ssh/id_rsa.
Your public key has been saved in /root/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:1KDTBzVX8J+Hjdm7/f086Uq5HZWPSCiwKr4rHIUZ8Bc root@cli.alpha.corp
The key's randomart image is:
+---[RSA 4096]---+
|o E o.o oo. |
| o . o + o . |
| = . + o o . |
| o o = B o |
```

Verify:

```
[root@cli .ssh]# ls
id_rsa id_rsa.pub known_hosts
[root@cli .ssh]#
```

➤ Copy the generated keys to the remote computer.

```
[root@cli .ssh]# ssh-copy-id u5@svr
The authenticity of host 'svr (192.168.10.10)' can't be established.
ECDSA key fingerprint is SHA256:YNdfQObNFKe6lJgQ8Gs2Uq3zj9IopUKiQAND2ly6DeI.
ECDSA key fingerprint is MD5:6f:97:17:4e:ec:50:96:cf:63:4d:ba:84:28:8d:fa:e9.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already
installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install t
he new keys
u5@svr's password:

Number of key(s) added: 1

Now try logging into the machine, with: "ssh 'u5@svr'"
and check to make sure that only the key(s) you wanted were added.

[root@cli .ssh]#
```

➤ Login:

```
[root@cli .ssh]# ssh u5@svr
Last login: Fri Apr 17 08:58:09 2020 from cli
[u5@svr ~]$ ls
not-one-can-hack-me.txt
[u5@svr ~]$ mv not-one-can-hack-me.txt  u-r-hacked.txt
[u5@svr ~]$ ls
u-r-hacked.txt
[u5@svr ~]$ exit
logout
Connection to svr closed.
[root@cli .ssh]# cd
[root@cli ~]#
[root@cli ~]#
```

SCP:

- In windows, we have WinSCP.
- Secure copy.

Copy syntax:

- #cp <source> <destination>

Secure copy syntax:

- #scp <source> <destination>

Source: either on local machine or remote machine

Destination: either on remote machine or local machine.

Use SCP to copy a remote file on local system:

- #scp root@cli.alpha.corp:/root/pwsh.rpm /root/
 - *Source* = root@cli.alpha.corp:/root/pwsh.rpm
 - *Destination* = /root/

Use SCP to copy a local file on to remote system:

- #scp <local-file> <user>@<ip>:<absolute-path>
- scp /root/corona.tar root@cli:/root/tar-file

rsync:

- remote sync
- copy & paste file/directories to & from local m/c & remote m/c.
- It is faster than SCP.
- Uses less bandwidth.
- Incremental backup.

Syntax: #rsync -<option> <source> <destination>

Package for rsync: rync

Cmd:

```
#rsync -zvh /root/remote/* root@cli:/root/rsync-dir
```

- ‘z’ = compress
- ‘v’ = verbose
- ‘h’= human readable

Using rsync with ssh:

```
➤ # rsync -avzhe ssh root@cli:/root/rsync-dir/file.tar .
```

NFS:

- Network file system
- File sharing, L-L or W-W
- Packages: rpcbind, nfs-utils
- File: /etc/exports
- Port number: 2049/tcp

Installing NFS on server:

- # yum install -y nfs-utils rpcbind

Create a directory to be shared on the network.

- #mkdir /nfs
- Create some random files in it.

Edit NFS config file.

- #vim /etc/exports
 - Col1. What to share.
 - Col2. Where(how to share.)
 - * = share to all in the network
 - no_root_squash,rw,sync
 - no_root_squash = all user will have permission as root
 - rw = read/write
 - sync = synchronization
- /nfs *(no_root_squash,rw,sync)
- :wq!

Make the entry in the SVR firewall:

- # firewall-cmd --add-port=2049/tcp --permanent
- #firewall-cmd --add-service=nfs --permanent
- #firewall-cmd --permanent --add-service=rpc-bind
- #firewall-cmd --permanent --add-service=mountd
- #firewall-cmd --permanent --add-port=2049/udp
- #firewall-cmd --reload
- #firewall-cmd --list-all

Export the NFS file system:

- #exportfs

Enable, start & status of the NFS services.

- #systemctl enable rpcbind
- #systemctl start rpcbind
- #systemctl status rpcbind
- #systemctl enable nfs-server.service
- #systemctl start nfs-server.service
- #systemctl status nfs-server.service

#####NFS SERVER CONFIG OVER#####

Now switch to NFS client:

Install nfs packages

➤ #yum install -y nfs-utils rpcbind

Create a mount point to access the NFS server directory

➤ Mkdir /Lakshman

Enable, start & status nfs-server, rpcbind services:

➤ #systemctl status rpcbind nfs-server
➤ #systemctl enable rpcbind nfs-server
➤ #systemctl start rpcbind nfs-server
➤ #systemctl status rpcbind nfs-server

Show the NFS shared directories for SVR (192.168.10.10)

➤ #showmount -e 192.168.10.10

```
File Edit View Search Terminal Help
[root@cli ~]# showmount -e 192.168.10.10
Export list for 192.168.10.10:
/nfs *
[root@cli ~]#
```

Mount the NFS shared directory in your system directory (step2)

➤ # mount 192.168.10.10:/nfs /Lakshman

```
[root@cli ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
devtmpfs        894M    0  894M  0% /dev
tmpfs          910M    0  910M  0% /dev/shm
tmpfs          910M   11M  900M  2% /run
tmpfs          910M    0  910M  0% /sys/fs/cgroup
/dev/mapper/cl-root  47G  8.7G  39G  19% /
/dev/sda1       1014M 233M  782M  23% /boot
tmpfs          182M  4.0K  182M  1% /run/user/42
tmpfs          182M   28K  182M  1% /run/user/0
192.168.10.10:/nfs  35G  7.9G  27G  23% /lakshman
[root@cli ~]#
```

Samba server

- It is used for sharing the data between cross-platforms, windows to linux & vice-versa.

Lab setup:

- ✓ linux machine (192.168.10.10)
- ✓ windows machine (192.168.10.102)
- ✓ ensure both are pinging.

Packages required:

- # yum install samba-client samba cifs-utils

Add service in firewall:

- # firewall-cmd --permanent --add-service=samba
- #firewall-cmd --reload

Create a group with users & password in it.

- #groupadd grp1
- #useradd -G grp1 user1
- #useradd -G grp1 user2
- #useradd -G grp1 user3
- #grep grp1 /etc/group
- #passwd user1
- #passwd user2
- #passwd user3

Create a directory to be shared using SAMBA

- #mkdir /samba

Link the group (grp1) to the directory

- # chown -R root:grp1 /samba

Configure samba server config file:

- #vim /etc/samba/smb.conf

Edit from the line number: 275.

```
[mysamba]
comment=this is samba shared directory for WIN users
browseable=yes
path=/samba
valid user=@grp1
writable=yes
```

Save & quit

Verify the configuration for “/etc/samba/smb.conf”

#testparm

```
[root@svr Desktop]# testparm
Load smb config files from /etc/samba/smb.conf
Processing section "[homes]"
Processing section "[printers]"
Processing section "[mysamba]"
Unknown parameter encountered: "valid user"
Ignoring unknown parameter "valid user"
Loaded services file OK.
Server role: ROLE_STANDALONE
Press enter to see a dump of your service definitions
```

Hit enter again:

```
[mysamba]
comment = this is samba shared directory for WIN users
path = /samba
read only = No
[root@svr Desktop]#
```

Now add the users in samba access by providing password:

```
[root@svr Desktop]# smbpasswd -a user1
New SMB password:
Retype new SMB password:
Added user user1.
[root@svr Desktop]# smbpasswd -a user2
New SMB password:
Retype new SMB password:
Added user user2.
[root@svr Desktop]# smbpasswd -a user3
New SMB password:
Retype new SMB password:
Added user user3.
[root@svr Desktop]#
```

Enable, start & status samba service (smb)

- #systemctl enable smb
- #systemctl start smb
- #systemctl status smb

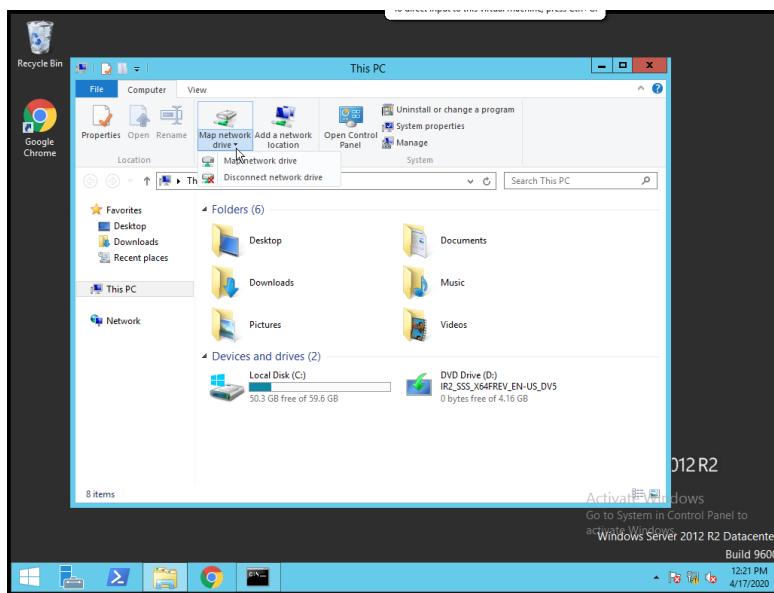
Verify for user1 from linux system:

```
file edit view search terminal Help
[root@svr Desktop]# smbclient -L localhost -U user1
Enter user1's password:
Domain=[MYGROUP] OS=[Unix] Server=[Samba 4.1.1]

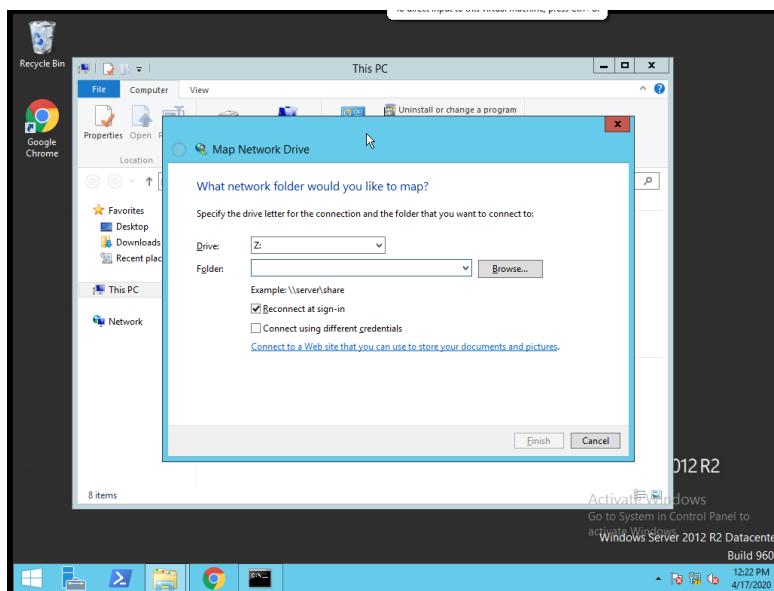
      Sharename      Type      Comment
      -----      ----      -----
      mysamba       Disk      this is samba shared directory for WIN users
      IPC$          IPC       IPC Service (Samba Server Version 4.1.1)
      user1         Disk      Home Directories
Domain=[MYGROUP] OS=[Unix] Server=[Samba 4.1.1]

      Server           Comment
      -----
      Workgroup        Master
      -----
[root@svr Desktop]#
```

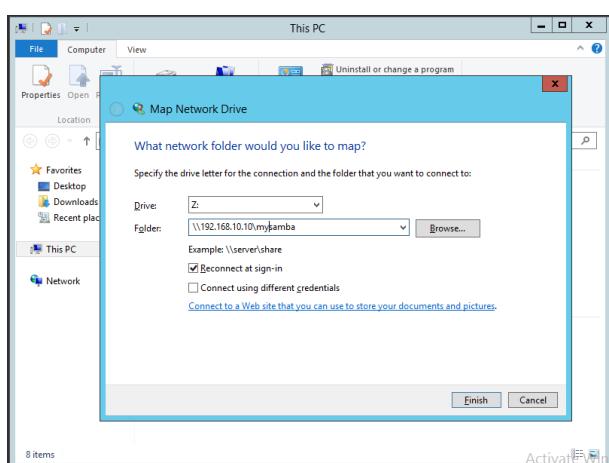
On windows system, open THIS PC, click on computer → Map network drive



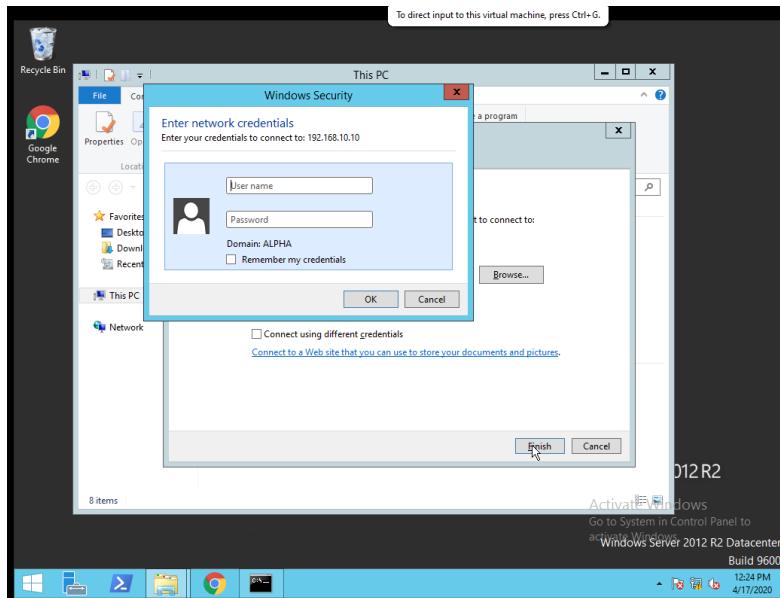
You will get something like:



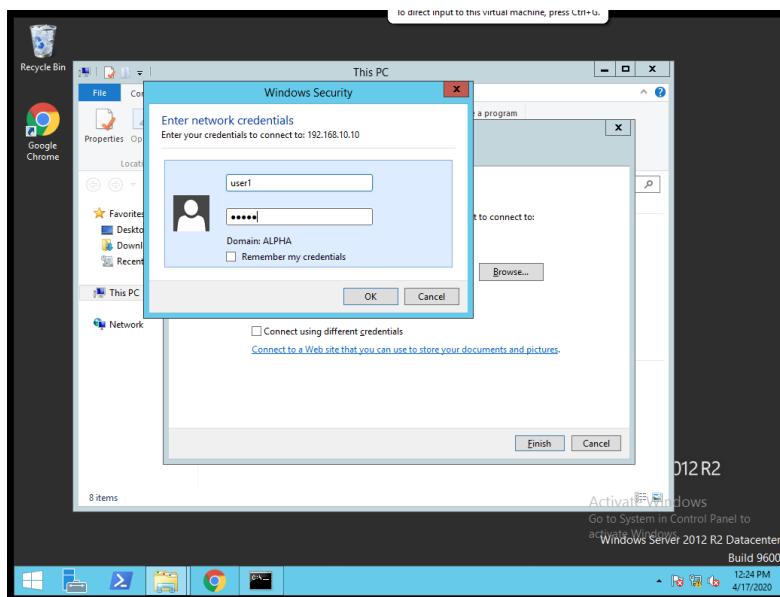
Provide the samba server address with shared folder information:



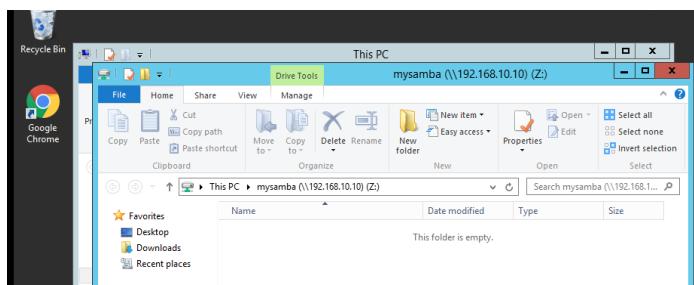
It will prompt the users credentials:



Enter user creds created on Linux server:

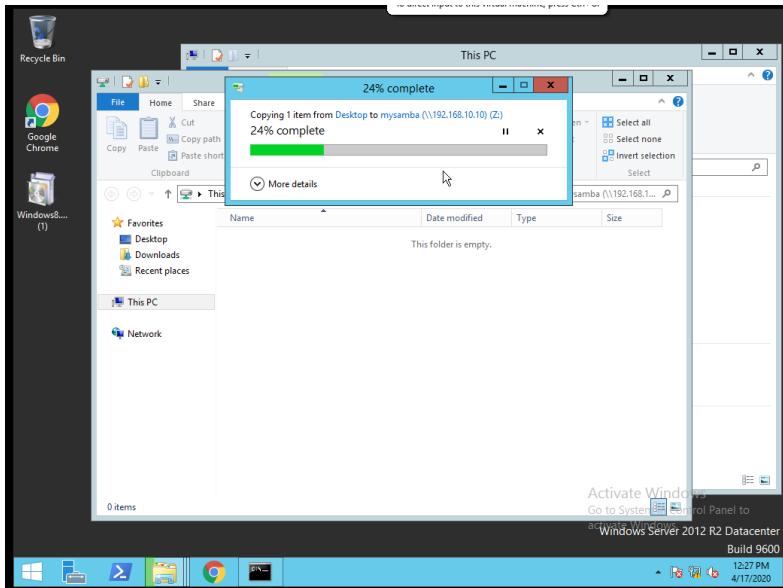


After entering correct creds:



Copy & paste some random files & folders:

If it doesn't allow to copy & paste, change the permission of /samba directory to 777



Switch to Linux VM & verify if the copied data is present:

A screenshot of a terminal window titled 'Applications' on a Linux VM. The window title is 'RHEL7-LTI-main'. The terminal session shows the user navigating to the '/samba' directory and listing its contents. The output of the 'ls' command shows a single file named 'Windows8.1-KB2919355-x64 (1).msu'.

```
[root@svr Desktop]# cd /samba/
[root@svr samba]# ls
Windows8.1-KB2919355-x64 (1).msu
[root@svr samba]#
```

#####SAMBA CONFIG OVER#####

Apache web server:

- Web server in linux
- Similar to IIS web server in windows.
- Used for hosting your website on *intranet* or *internet*.
 - Package required: **httpd**
 - Service required: **httpd**
 - Port number: **80**
 - Config file: **/etc/httpd/conf/httpd.conf**

Install packages:

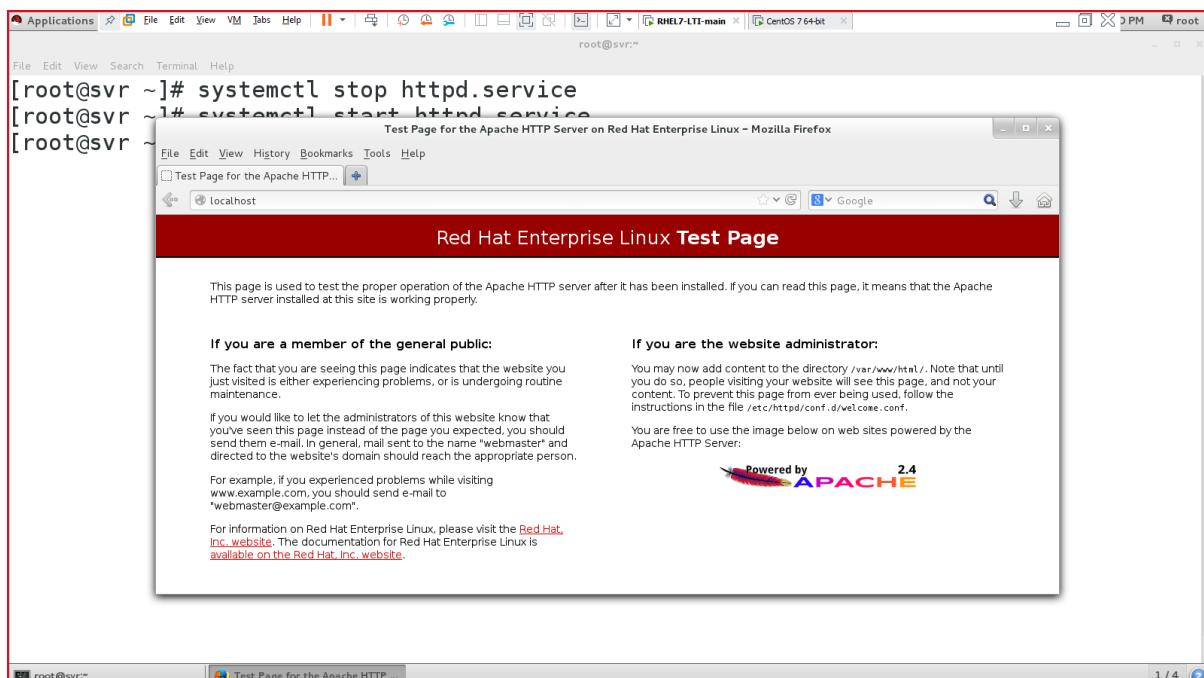
- `#yum install -y httpd`
In /etc/passwd → apache (service account)

[scenario -1]: create default web site & access it

Enable, start & status of httpd:

- `#systemctl enable httpd.service`
- `#systemctl start httpd.service`
- `#systemctl status httpd.service`

Open firefox and type <http://localhost> & verify if the ‘test page’ is present or not.



To create your own web page:

`#vim /var/www/html/index.html`

```
Applications File Edit View Search Terminal Help root@  
  
<html>  
<head>  
<title>LTI SESSION</title>  
</head>  
<body>  
<h1 align='center'>Hello Mr. Jeetu</h1>  
</body>  
</html>  
~
```

save & quit

Go to web browser & refresh the web page.



[scenario -2]: create & access multiple site

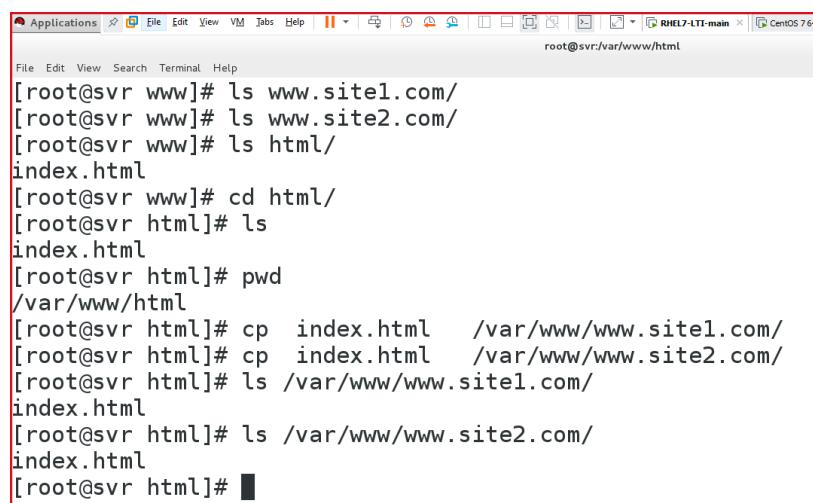
www.site1.com → 192.168.10.10

www.site2.com → 192.168.10.10

Create 2 folders (in /var/www):

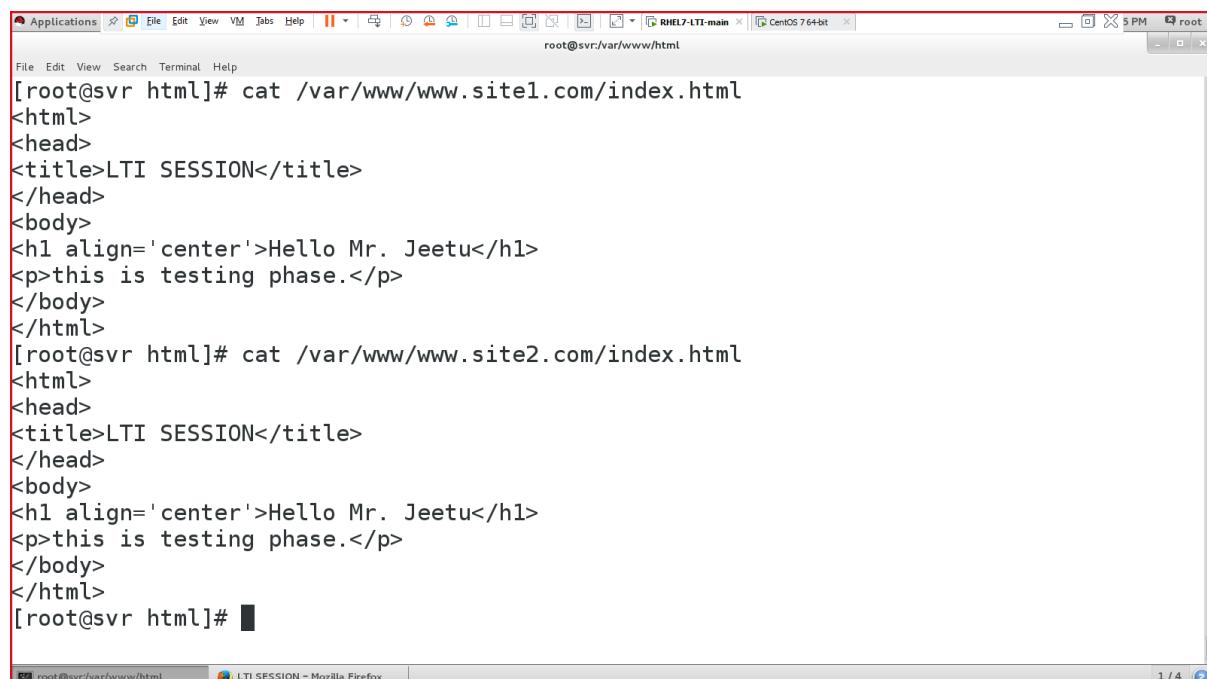
```
[root@svr ~]# cd /var/www/
[root@svr www]# ls
cgi-bin  html
[root@svr www]# mkdir www.site{1,2}.com
[root@svr www]# ls
cgi-bin  html  www.site1.com  www.site2.com
[root@svr www]#
```

Either create 2 files in the above directories or copy & paste the /var/www/html/index.html file to the above directories



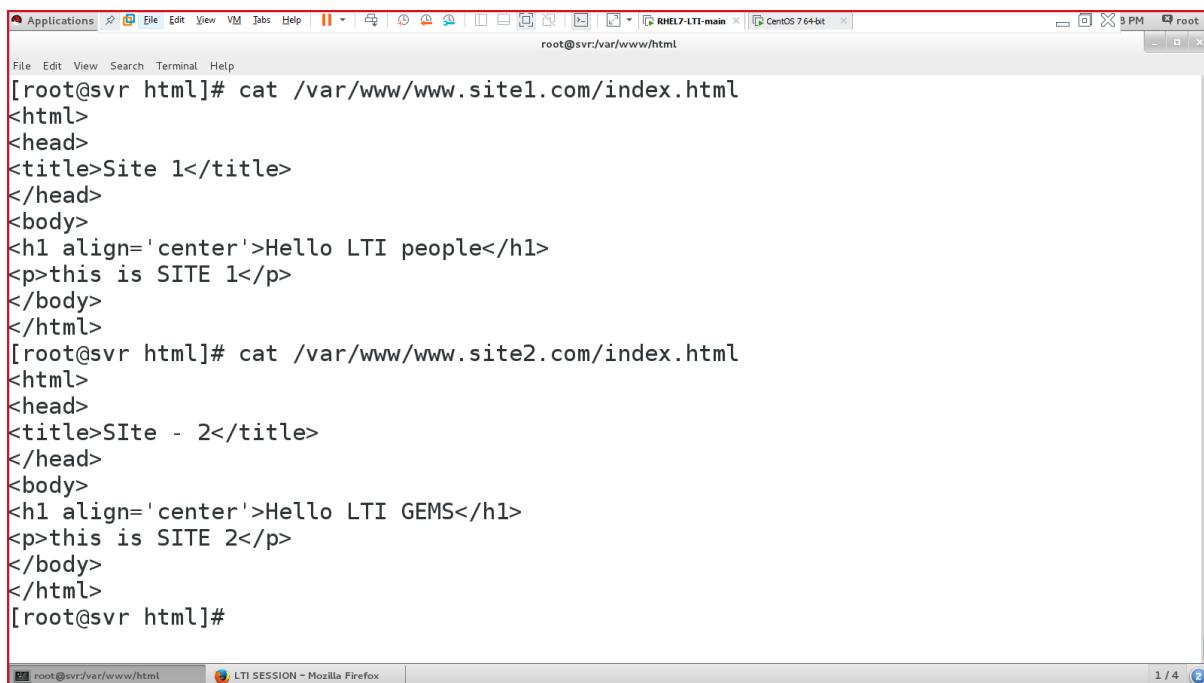
```
Applications  File Edit View VM Tabs Help ||| RHEL7-LTI-main | CentOS 7 64-bit
File Edit View Search Terminal Help
root@svr:~#
[root@svr www]# ls www.site1.com/
[root@svr www]# ls www.site2.com/
[root@svr www]# ls html/
index.html
[root@svr www]# cd html/
[root@svr html]# ls
index.html
[root@svr html]# pwd
/var/www/html
[root@svr html]# cp index.html    /var/www/www.site1.com/
[root@svr html]# cp index.html    /var/www/www.site2.com/
[root@svr html]# ls /var/www/www.site1.com/
index.html
[root@svr html]# ls /var/www/www.site2.com/
index.html
[root@svr html]#
```

Verify:



```
Applications  File Edit View VM Tabs Help ||| RHEL7-LTI-main | CentOS 7 64-bit
File Edit View Search Terminal Help
root@svr:~#
[root@svr html]# cat /var/www/www.site1.com/index.html
<html>
<head>
<title>LTI SESSION</title>
</head>
<body>
<h1 align='center'>Hello Mr. Jeetu</h1>
<p>this is testing phase.</p>
</body>
</html>
[root@svr html]# cat /var/www/www.site2.com/index.html
<html>
<head>
<title>LTI SESSION</title>
</head>
<body>
<h1 align='center'>Hello Mr. Jeetu</h1>
<p>this is testing phase.</p>
</body>
</html>
[root@svr html]#
```

Edit the site contents:



```
[root@svr html]# cat /var/www/www.site1.com/index.html
<html>
<head>
<title>Site 1</title>
</head>
<body>
<h1 align='center'>Hello LTI people</h1>
<p>this is SITE 1</p>
</body>
</html>
[root@svr html]# cat /var/www/www.site2.com/index.html
<html>
<head>
<title>SItE - 2</title>
</head>
<body>
<h1 align='center'>Hello LTI GEMS</h1>
<p>this is SITE 2</p>
</body>
</html>
[root@svr html]#
```

Configure the apache config file:

```
#vim /etc/httpd/conf/httpd.conf
```

Create a new line below line 42 & add below content

```
#Listen 12.34.56.78:80
Listen 80

<VirtualHost 192.168.10.10:80>
    DocumentRoot /var/www/www.site1.com
    Servername www.site1.com
</VirtualHost>
<VirtualHost 192.168.10.10:80>
    DocumentRoot /var/www/www.site2.com
    Servername www.site2.com
</VirtualHost>
```

save & quit

Make the entries in the /etc/hosts file, to access the site(s) - for name resolution :

```
192.168.10.10    www.site1.com
192.168.10.10    www.site2.com
:wq!
```

Enable, start & status httpd service:

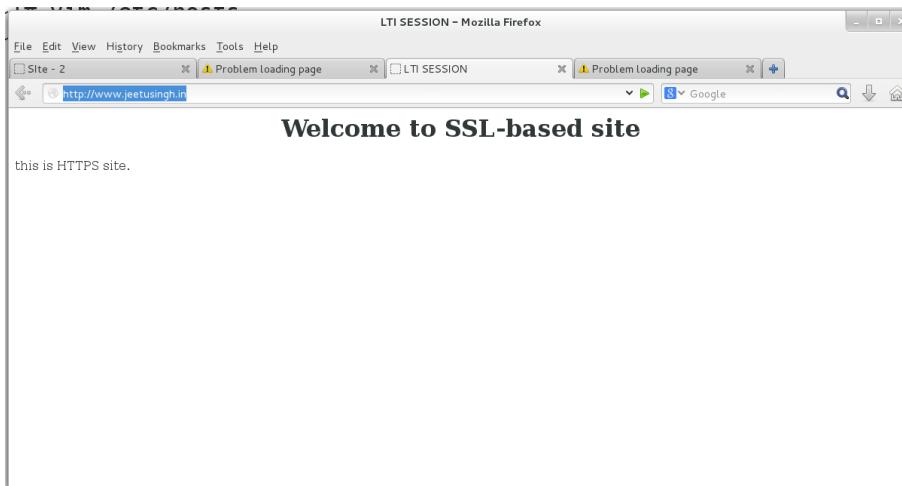
- #systemctl enable httpd
- #systemctl start httpd
- #systemctl status httpd

[scenario -3]: creating HTTPS (using SSL) website

Steps:

- Create a directory in “/var/www/www.jeetusingh.in/”
- Create a web page “/var/www/www.jeetusingh.in/index.html”
- Config httpd file
- Restart the httpd service
- Edit /etc/hosts file

& verify using browser <http://www.jeetusingh.in>



Configure HTTPS/SSL certificate & attach it to the site (www.jeetusingh.in)

- ✓ Install ssl packages:
 - #yum install -y mod_ssl openssh* openssl*
- ✓ Create SSL certificate:
 - go to certificate location “/etc/pki/tls/certs/”
- ✓ create a key certificate:
 - #make jeetusingh.key & enter the pass phrase
 - #ls

```
[root@svr certs]# ls
ca-bundle.crt      jeetusingh.key  make-dummy-cert  renew-dummy-cert
ca-bundle.trust.crt localhost.crt  Makefile
```
- ✓ Create a CSR file
 - #openssl rsa -in jeetusingh.key -out jeetusingh.key
- ✓ Create a CRT file
 - #cp localhost.crt jeetusingh.crt
 - #ls → look for jeetusingh.crt file in the directory.

```
[root@svr certs]# ls
ca-bundle.crt      jeetusingh.crt  localhost.crt  Makefile
ca-bundle.trust.crt jeetusingh.key  make-dummy-cert  renew-dummy-cert
[root@svr certs]#
```

- ✓ Create a new “jeetusingh.csr” file

```
[root@svr certs]# make jeetusingh.csr
umask 77 ; \
/usr/bin/openssl req -utf8 -new -key jeetusingh.key -out jeetusingh.csr
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [XX]:IN
State or Province Name (full name) []:KA
Locality Name (eg, city) [Default City]:BLR
Organization Name (eg, company) [Default Company Ltd]:IIHT
Organizational Unit Name (eg, section) []:Trainer
Common Name (eg, your name or your server's hostname) []:jeetusingh.in
Email Address []:jitendra.singh@iiht.com

Please enter the following 'extra' attributes
to be sent with your certificate request
```

root@svr:/etc/pki/tls/certs LTI SESSION - Mozilla Firefox 1 / 4

- ✓ Validate & bind the certificate:

```
#openssl x509 -in jeetusingh.csr -out jeetusingh.crt -req -signkey jeetusingh.key
-days 365
```

```
Applications File Edit View VM Tabs Help | RHEL7-LTI-main | CentOS 7.6+bit | root@svr:/etc/pki/tls/certs | 5 PM
File Edit View Search Terminal Help
[root@svr certs]# openssl x509 -in jeetusingh.csr -out jeetusingh.crt -req -signkey jeetusingh.key -days 365
Signature ok
subject=/C=IN/ST=KA/L=BLR/O=IIHT/OU=Trainer/CN=jeetusingh.in/emailAddress=jitendra.singh@iiht.com
Getting Private key
[root@svr certs]#
```

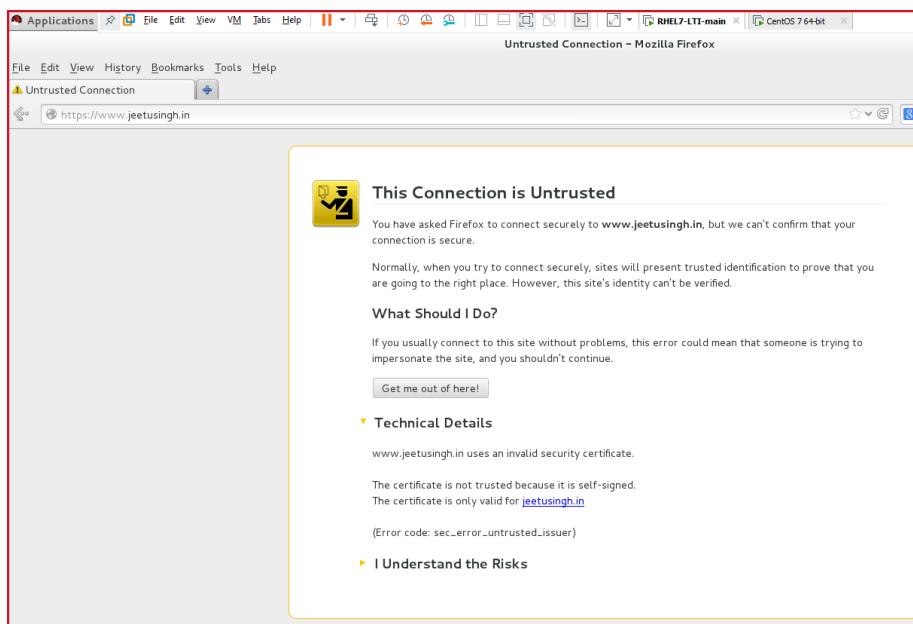
- ✓ Configure the SSL config file:

- #vim /etc/httpd/conf.d/ssl.conf
- Uncomment line 59 & 60 & edit accordingly
- On line 100,
 SSLCertificateFile /etc/pki/tls/certs/jeetusingh.crt
- On line 107,
 SSLCertificateKeyFile /etc/pki/tls/certs/jeetusingh.key
 :wq!

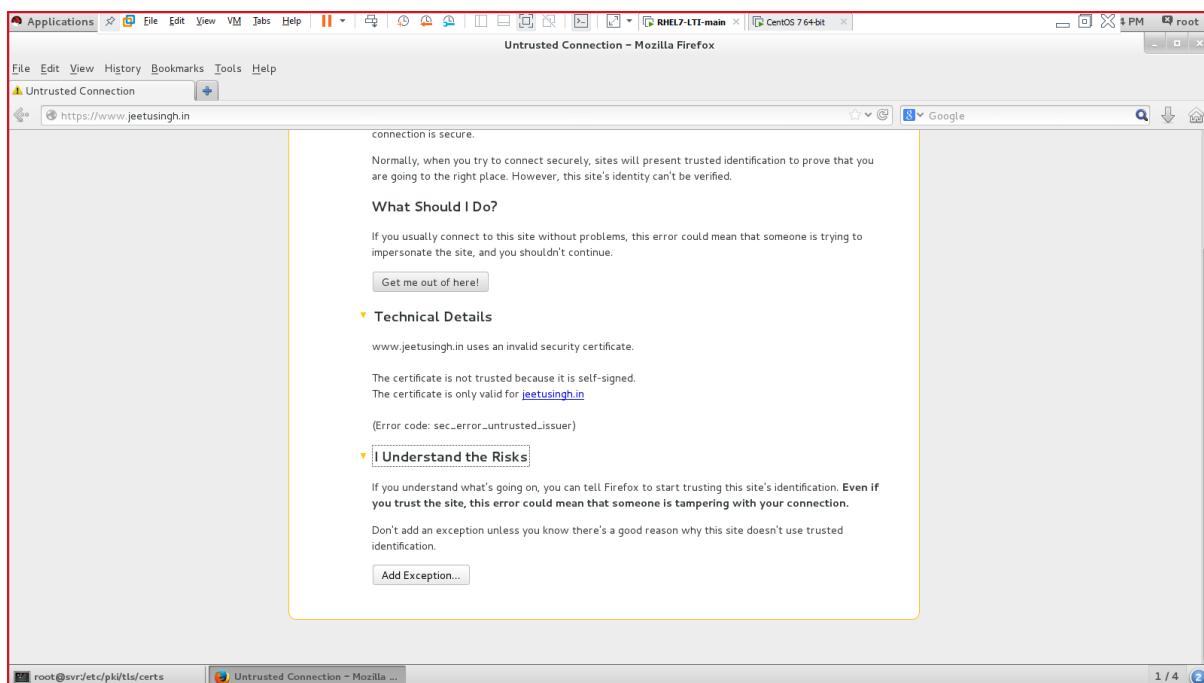
- ✓ Restart & status httpd service:

```
#systemctl restart httpd
#systemctl status httpd
```

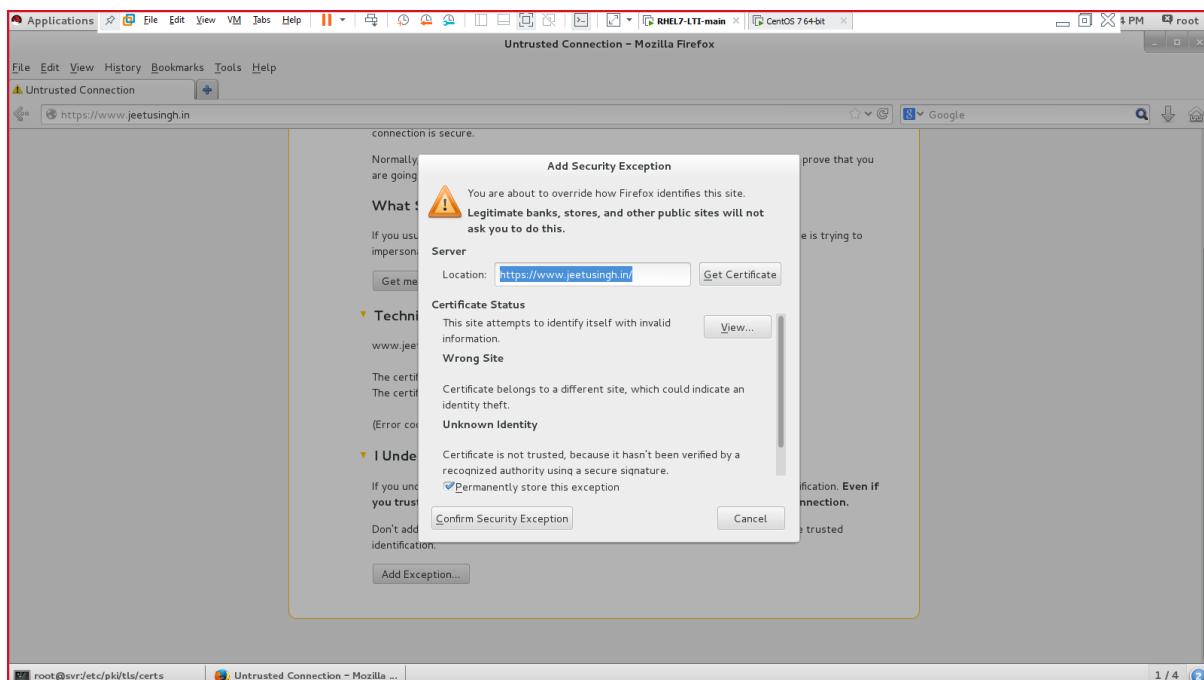
- ✓ Go to web browser & type <https://www.jeetusingh.in>



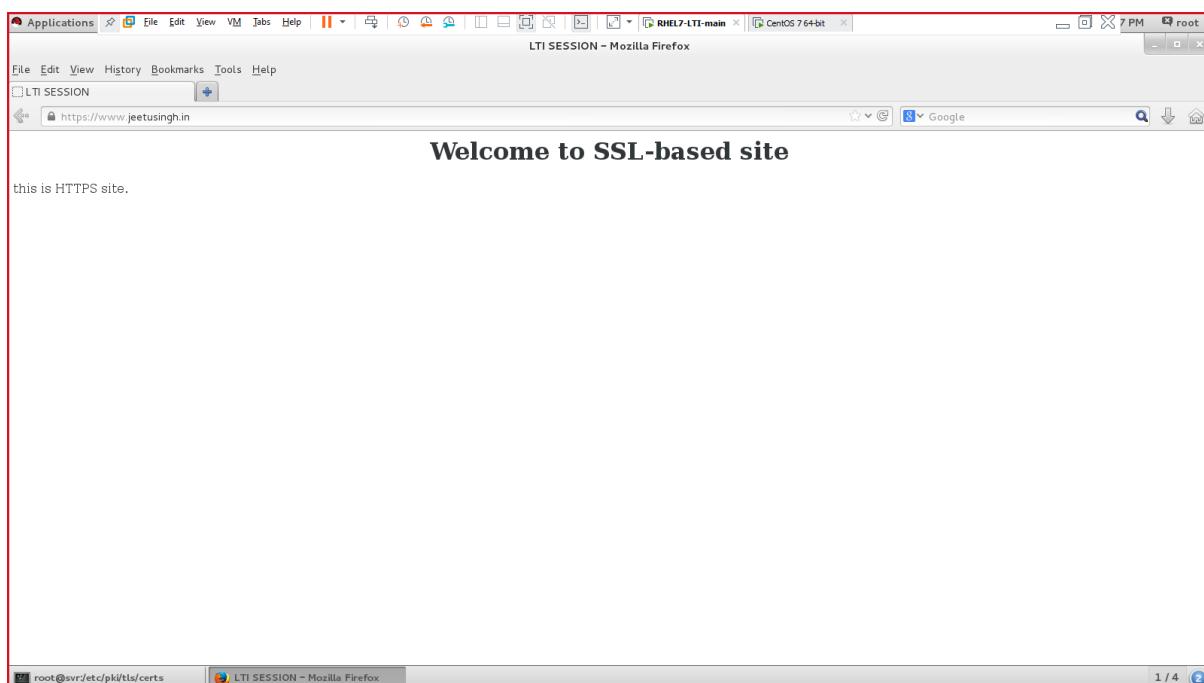
Click on “I Understand the Risks” & click on “Add exception”

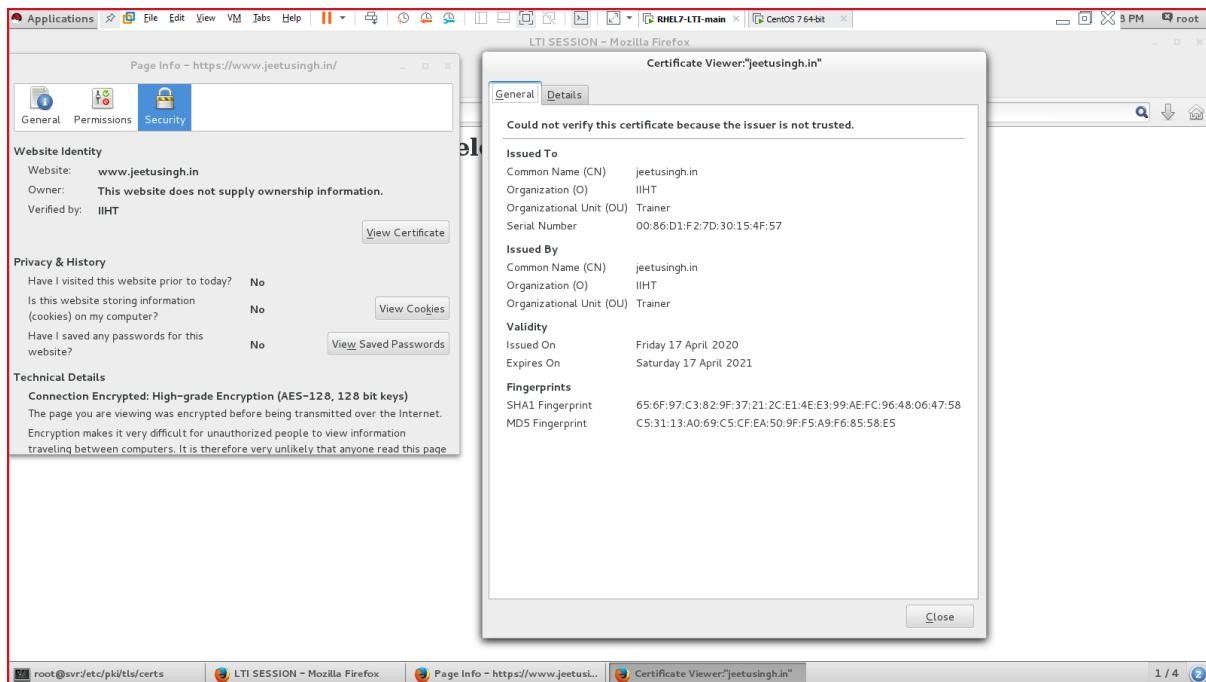


Click on “Confirm security exception”



Access the site on HTTPS network:





Telnet:

- ✓ Remote connection
- ✓ Similar to SSH
- ✓ BUT: it is not SECURE

Lab setup:

- System 1: telnet server → 192.168.10.10
- System 2: telnet client → 192.168.10.11

Install telnet packages:

- #yum install -y telnet telnet-server xinetd

On telnet server:

```
#vim /etc/xinetd.conf
```

- :set nu
- Go to line 14, and uncomment it.
- Then, write
- disabled = no

```
:wq!
```

Enable, start & status of xinetd & telnet services

- #systemctl enable xinetd telnet.socket
- #systemctl start xinetd telnet.socket
- #systemctl status xinetd telnet.socket

```
#####telnet server config over#####
```

On telnet client machine,

- Install telnet services
#yum install -y telnet*
- Enable, start & status telnet services
#systemctl enable telnet.socket
#systemctl start telnet.socket
#systemctl status telnet.socket
- Connect to telnet server via client machine:

```
[root@cli ~]# telnet 192.168.10.10
Trying 192.168.10.10...
Connected to 192.168.10.10.
Escape character is '^]'.

Kernel 3.10.0-123.el7.x86_64 on an x86_64
svr login: rocky
Password:
[rocky@svr ~]$ hostname
svr.alpha.corp
[rocky@svr ~]$ whoami
rocky
[rocky@svr ~]$ exit
logout
Connection closed by foreign host.
[root@cli ~]#
[root@cli ~]# █
```

Connecting to telnet using telnet server:

```
File Edit View Search Terminal Help
[root@svr ~]# telnet 192.168.10.10
Trying 192.168.10.10...
Connected to 192.168.10.10.
Escape character is '^]'.

Kernel 3.10.0-123.el7.x86_64 on an x86_64
svr login: rocky
Password:
Last login: Sat Apr 18 08:18:23 from ::ffff:192.168.10.11
[rocky@svr ~]$ exit
logout
Connection closed by foreign host.
[root@svr ~]#
```

Connect to a service to check if the service is working.

```
[root@svr ~]# telnet localhost smtp
Trying ::1...
Connected to localhost.
Escape character is '^]'.

220 svr.alpha.corp ESMTP Postfix
```

SQUID server:

- It is a proxy server
- Filtering the traffic on the network
- Blocking the unwanted sites within the network
- Squid server uses port 3128
- Config file: /etc/squid/squid.conf
- Service: squid

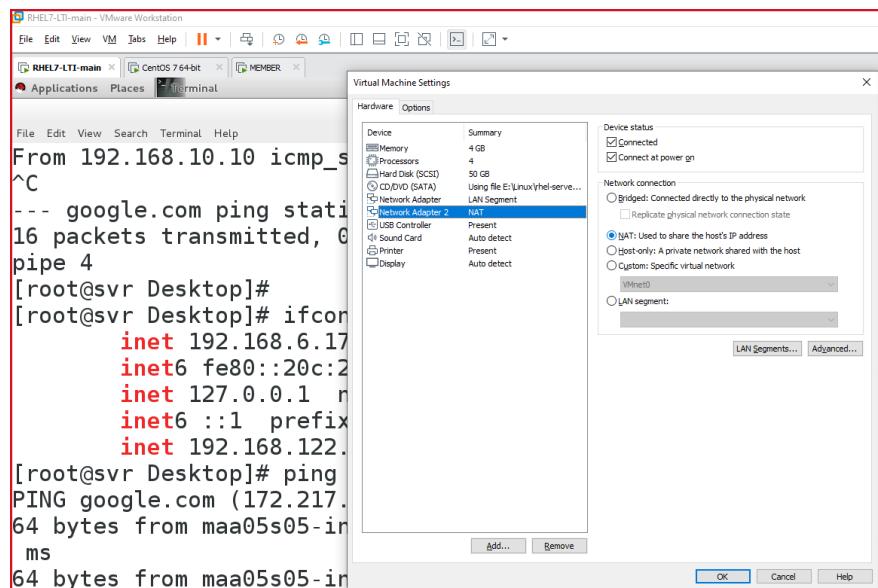
Lab setup:

- One linux based server (squid server) (svr -- internet is present)
- One linux / windows-based client. (cli -- internet is present)

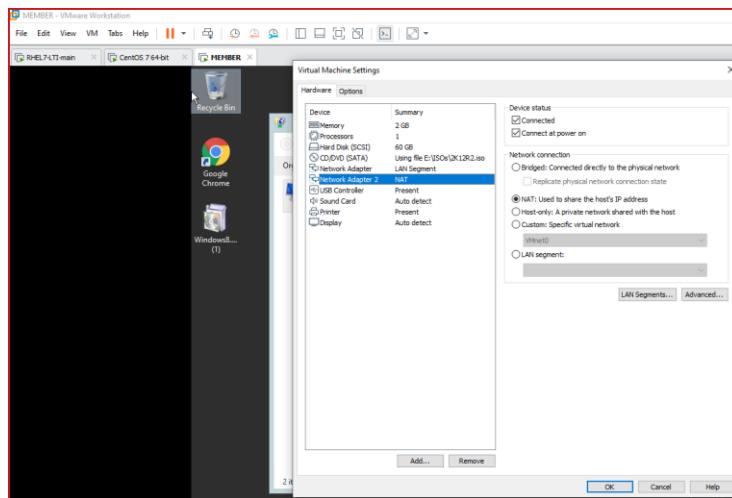
Steps

- Install squid server using yum.
#yum install -y squid OR
#rpm -ivh /run/media/root/RHEL.../Packages/squid<hit-tab>.rpm (enter)
- Add additional NIC card in the server VM & client VM with NAT service.

Server machine:



Client machine:



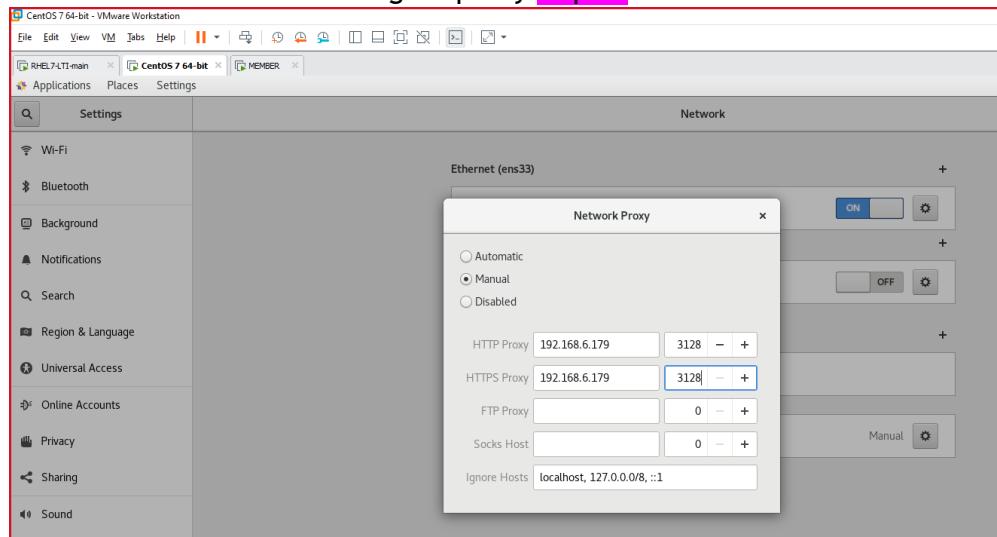
- Disable internal network with the VMs

Install SQUID on the server machine.

- #yum install -y squid

Steps:

- On client, open any webpage (link facebook.com)
- Start the monitoring of the client.
- Go to client machine & configure proxy IP:port on the client.



Enable, start & status of squid service:

- #systemctl enable squid
- #systemctl start squid
- #systemctl status squid

Log file of squid: /var/log/squid/access.log

- #vim /etc/squid/squid.conf
- Set the line numbers (:set nu)
- Add a new entry in the line number 11
acl localnet src 192.168.6.0/24 → copy the content from line 10 & add ur IP.
- Go to line 38, and append localnet in the line (ex 😊)
http_access allow localhost manager localnet
- Save & quit the file (:wq!)

Run command: tail -f /var/log/squid/access.log

Go to client & open <https://ziyad-bhombal.web.app>

Switch back to squid server & verify the logs contain keyword “ziyad-bhombal.web.app”.



```
root@svr ~]# grep ziyad /var/log/squid/access.log
1587186645.776 35645 192.168.6.137 TCP_MISS/200 2069852 CONNECT ziyad-bhombal.web.app:
443 - HIER_DIRECT/151.101.1.195 -
1587186822.900 173821 192.168.6.137 TCP_MISS/200 2067664 CONNECT ziyad-bhombal.web.app:
443 - HIER_DIRECT/151.101.1.195 -
[root@svr ~]#
```

NOW: To block the unwanted websites using SQUID

- Go to squid config file
- Undo the changes, and add the below content on the top of the file:
acl badsites url_regex "/etc/squid/badsites"
http_access deny badsites
acl pgnetwork src 192.168.6.0/24
http_access allow pgnetwork
- :wq!

Create the file to block the websites without '-' sign:

#cat > /etc/squid/badsites

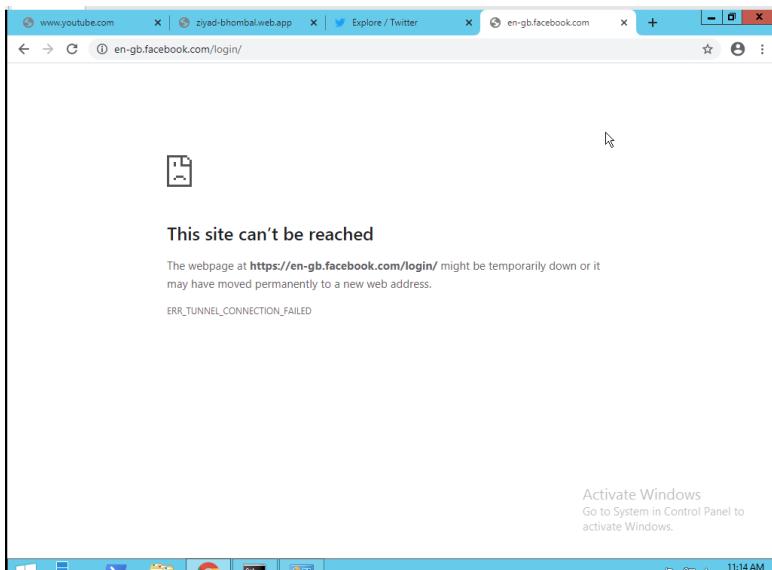
- Facebook.com
- Youtube.com
- ziyad-bhombal.web.app

press ctrl+d

Restart the SQUID service:

- #systemctl restart squid
- #systemctl status squid

Go to client machine to verify the sites are working.



#####END OF SQUID SERVER #####

DNS server:

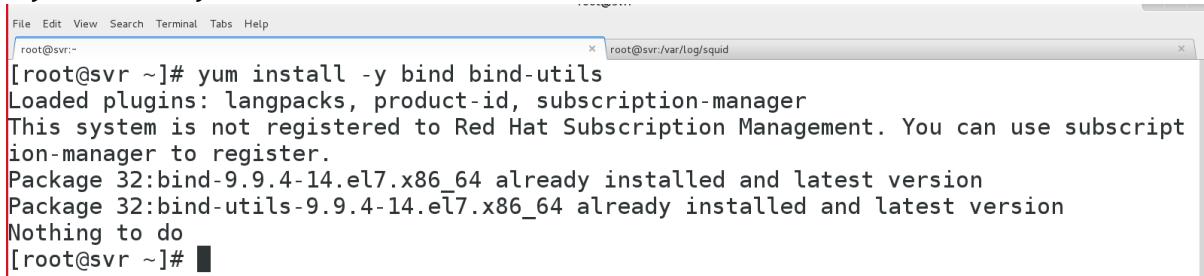
- Resolves IP into name & vice-versa.
- Local system
 - Linux → /etc/hosts
 - Windows → C:\Windows\System32\drivers\etc\hosts
- Port number: 53
- Service: named
- Files:
 - /etc/named.conf (main config file)
 - /var/named/forward.alpha.corp (create a new file)
 - /var/named/reverse.alpha.corp (create a new file)

Lab setup:

- One server
 - DNS server
 - Static IP
 - Add DNS port in firewall or turn off
 - Internet is not required.
 - Hostname must a domain-based name (svr.alpha.corp)
- One/multiple client (windows or linux)
 - DNS client
 - Static/dynamic IP
 - Add DNS port in firewall or turn off
 - Internet is not required.
 - Hostname must a domain-based name (cli.alpha.corp)
 - PING SERVER & CLIENT SYSTEM BY IP ADDRESS
- Disable SQUID server on client & server machine

Install BIND/DNS

- # yum install -y bind bind-utils



```
File Edit View Search Terminal Tabs Help
root@svr:~# yum install -y bind bind-utils
[root@svr ~]# yum install -y bind bind-utils
Loaded plugins: langpacks, product-id, subscription-manager
This system is not registered to Red Hat Subscription Management. You can use subscription-manager to register.
Package 32:bind-9.9.4-14.el7.x86_64 already installed and latest version
Package 32:bind-utils-9.9.4-14.el7.x86_64 already installed and latest version
Nothing to do
[root@svr ~]#
```

- Edit /etc/named.conf file:

On line 11, add your DNS ip address at the end. Followed by ‘;’

```
listen-on port 53 { 127.0.0.1; 192.168.10.10; }
```

on line 17, add ‘any;’ to the end:

```
allow-query { localhost; any; };
```

```

10 options {
11     listen-on port 53 { 127.0.0.1; 192.168.10.10; };
12     listen-on-v6 port 53 { ::1; };
13     directory      "/var/named";
14     dump-file      "/var/named/data/cache_dump.db";
15     statistics-file "/var/named/data/named_stats.txt";
16     memstatistics-file "/var/named/data/named_mem_stats.txt";
17     allow-query    { localhost; any; };
18
19     /* */
-- INSERT --

```

:wq!

Enable, start & status ‘named’ service:

- #systemctl enable named
- #systemctl start named
- #systemctl status named → active (Running)

Open & modify /etc/named.conf file again:

Go to line 55, & add below data in it.

```

zone "alpha.corp" IN {
type master;
file "forward.alpha.corp";
allow-update {none;};
};

zone "10.168.192.in-addr-arpa" IN {
type master;
file "reverse.alpha.corp";
allow-update {none;};
};

include "/etc/named.rfc1912.zones";
include "/etc/named.root.key";
-- INSERT --

```

```

zone "alpha.corp" IN {
type master;
file "forward.alpha.corp";
allow-update {none;};
};

zone "10.168.192.in-addr-arpa" IN {
type master;
file "reverse.alpha.corp";
allow-update {none;};
};

```

#cd /var/named; ls → look for the named.localhost file

#cp named.localhost forward.alpha.corp

```
#vim forward.alpha.corp
```

```
root@svr:/var/named          root@svr:/var/log/squid
$TTL 1D
@ IN SOA @ svr.alpha.corp. (
    0      ; serial
    1D     ; refresh
    1H     ; retry
    1W     ; expire
    3H )   ; minimum
@ IN NS svr.alpha.corp.
@ IN A 192.168.10.10
svr IN A 192.168.10.10
cli IN A 192.168.10.11
member IN A 192.168.10.12
~
~
~
-- INSERT --
root@svr:/var/named           :wq!
```

```
$TTL 1D
@ IN SOA @ svr.alpha.corp. (
    0      ; serial
    1D     ; refresh
    1H     ; retry
    1W     ; expire
    3H )   ; minimum
@ IN NS svr.alpha.corp.
@ IN A 192.168.10.10
svr IN A 192.168.10.10
cli IN A 192.168.10.11
member IN A 192.168.10.12
```

```
save & quit
```

```
#cp forward.alpha.corp reverse.alpha.corp
```

```
#vim reverse.alpha.corp
```

```
root@svr:/var/named          root@svr:/var/log/squid
@ IN SOA @ svr.alpha.corp. (
    0      ; serial
    1D     ; refresh
    1H     ; retry
    1W     ; expire
    3H )   ; minimum
@ IN NS svr.alpha.corp.
@ IN PTR alpha.corp.
@ IN A 192.168.10.10
svr IN A 192.168.10.10
cli IN A 192.168.10.11
member IN A 192.168.10.12
12 IN PTR member.alpha.corp.
11 IN PTR cli.alpha.corp.
10 IN PTR svr.alpha.corp.
-- INSERT --
```

```
@ IN SOA @ svr.alpha.corp. (
```

```

          0      ; serial
          1D    ; refresh
          1H    ; retry
          1W    ; expire
          3H )  ; minimum
@     IN   NS    svr.alpha.corp.
@     IN   PTR   alpha.corp.
@     IN   A    192.168.10.10
svr   IN   A    192.168.10.10
cli   IN   A    192.168.10.11
member IN   A    192.168.10.12
12    IN   PTR   member.alpha.corp.
11    IN   PTR   cli.alpha.corp.
10    IN   PTR   svr.alpha.corp.

```

Save & quit

[IMP: Change the ownership of the forward.alpha.corp & reverse.alpha.corp file]

```

root@svr:/var/named          root@svr:/var/log/squid
[root@svr named]# chown root:named forward.alpha.corp
[root@svr named]# chown root:named reverse.alpha.corp
[root@svr named]# ll
total 24
drwxr-x--- 7 root  named   56 Apr 14 16:11 chroot
drwxrwx--- 2 named  named   22 Apr 18 11:58 data
drwxrwx--- 2 named  named   58 Apr 18 11:58 dynamic
-rw-r----- 1 root  named  241 Apr 18 12:22 forward.alpha.corp
-rw-r----- 1 root  named 2076 Jan 28  2013 named.ca
-rw-r----- 1 root  named  152 Dec 15  2009 named.empty
-rw-r----- 1 root  named  152 Jun 21  2007 named.localhost
-rw-r----- 1 root  named  168 Dec 15  2009 named.loopback
-rw-r----- 1 root  named  343 Apr 18 12:27 reverse.alpha.corp
drwxrwx--- 2 named  named    6 Jan 29  2014 slaves
[root@svr named]#

```

Verify the named.conf

#named-checkconf -z /etc/named.conf

```

[root@svr named]# named-checkconf -z /etc/named.conf
zone alpha.corp/IN: loaded serial 0
zone 10.168.192.in-addr.arpa/IN: loaded serial 0
zone localhost.localdomain/IN: loaded serial 0
zone localhost/IN: loaded serial 0
zone 1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.ip6.arpa/IN: loaded serial 0
zone 1.0.0.127.in-addr.arpa/IN: loaded serial 0
zone 0.in-addr.arpa/IN: loaded serial 0
[root@svr named]#

```

Output of the command must give → “...loaded serial 0”

Verify forward.alpha.corp

named-checkzone forward forward.alpha.corp

```
[root@svr:var/named]# named-checkzone forward forward.alpha.corp
zone forward/IN: loaded serial 0
OK
[root@svr named]#
```

Output → “loaded serial 0”

Verify reverse.alpha.corp

```
# named-checkzone reverse reverse.alpha.corp
```

```
[root@svr:var/named]# named-checkzone reverse reverse.alpha.corp
zone reverse/IN: loaded serial 0
OK
[root@svr named]#
```

Output → “loaded serial 0”

Enable, start, restart & status of named

- #systemctl enable named
- #systemctl restart named
- #systemctl status named

```
[root@svr named]# systemctl enable named
[root@svr named]# systemctl restart named
[root@svr named]# systemctl status named
named.service - Berkeley Internet Name Domain (DNS)
   Loaded: loaded (/usr/lib/systemd/system/named.service; enabled)
   Active: active (running) since Sat 2020-04-18 12:37:27 IST; 5s ago
     Process: 23190 ExecStop=/bin/sh -c /usr/sbin/rndc stop > /dev/null 2>&1 || /bin/kill
-TERM $MAINPID (code=exited, status=0/SUCCESS)
     Process: 23202 ExecStart=/usr/sbin/named -u named $OPTIONS (code=exited, status=0/SUCCESS)
     Process: 23200 ExecStartPre=/usr/sbin/named-checkconf -z /etc/named.conf (code=exited
, status=0/SUCCESS)
   Main PID: 23204 (named)
      CGroup: /system.slice/named.service
              └─23204 /usr/sbin/named -u named
```

From server machine:

- #ping svr.alpha.corp → pinging
- #ping cli.alpha.corp → pinging

Switch to client machine:

```
# vim /etc/resolv.conf
```

```
# Generated by NetworkManager
search alpha.corp
nameserver 192.168.10.10 :wq!
```

Restart & status the network & NetworkManager services

```
#systemctl restart network
```

```
#systemctl restart NetworkManager
```

```
#systemctl status network  
#systemctl status networkmanager
```

```
[root@cli ~]# ping svr.alpha.corp  
PING svr.alpha.corp (192.168.10.10) 56(84) bytes of data.  
64 bytes from 192.168.10.10 (192.168.10.10): icmp_seq=1 ttl=64 time=0.210 ms  
64 bytes from 192.168.10.10 (192.168.10.10): icmp_seq=2 ttl=64 time=0.451 ms  
64 bytes from 192.168.10.10 (192.168.10.10): icmp_seq=3 ttl=64 time=0.629 ms
```

To verify the DNS name:

```
#dig <domain-name>      or #dig alpha.corp
```

```
[root@cli ~]# dig alpha.corp  
;  
;; global options: +cmd  
;; Got answer:  
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 54206  
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 2  
  
;; OPT PSEUDOSECTION:  
; EDNS: version: 0, flags:; udp: 4096  
;; QUESTION SECTION:  
;alpha.corp.          IN      A  
  
;; ANSWER SECTION:  
alpha.corp.      86400   IN      A      192.168.10.10
```

```
:: AUTHORITY SECTION:
```

```
1 / 4  
To direct input to this VM, click inside or press Ctrl-G.  
Windows Start File Explorer Task View Taskbar System Icons Date/Time
```

#####END OF DNS/BIND server configuration #####

Mail server:

- Linux: for sending (Postfix), for receiving (dovecot), GUI-web (squirrel mail or thunderbird)

Components of a mail server:

- MTA
 - a. Mail transfer agent
 - b. Send/receive email to & from other systems using SMTP
- MUA
 - a. Mail user agent
 - b. Email client
 - c. Outlook, thunderbird, lotus, Squirrel mail
- MDA
 - a. Mail delivery agent
 - b. Delivery of the mail

For configuring mail server:

- Postfix
 - For sending an email
 - SMTP protocol
 - Already in DVD
- Dovecot
 - For receiving emails
 - POP3/IMAP protocol
 - Already in DVD
- Squirrel mail / ThunderBird
 - MUA
 - Download it from internet (URL: <https://squirrelmail.org/download.php>)

Lab setup:

- Mail server: svr.alpha.corp
- Domain name: alpha.corp
- IP address: 192.168.10.10/24
- DNS is required

On server (svr.alpha.corp)

- In the DNS forward lookup zone file (MX), add below command at line 8
#svr IN MX 10 svr.alpha.corp.

```
$TTL 1D
@ IN SOA @ svr.alpha.corp. (
    0 ; serial
    1D ; refresh
    1H ; retry
    1W ; expire
    3H ) ; minimum
svr IN MX 10 svr.alpha.corp.
@ IN NS svr.alpha.corp.
@ IN A 192.168.10.10
svr IN A 192.168.10.10
cli IN A 192.168.10.11
member IN A 192.168.10.12
:wq!
```

Restart & status of ‘named’ service:

- #systemctl restart named
- #systemctl status named → active running, proceed further

Above setup will only if DNS is present. Else edit /etc/hosts file to proceed further.

POSTFIX server config starts

- Install required packages (in DVD)
#yum install -y postfix
- Configure postfix configuration file:
#vim /etc/postfix/main.cf
 - line75 (uncomment & write this)→ myhostname = svr.alpha.corp
 - line83 (uncomment & write this)→ mydomain = alpha.corp
 - line99 *uncomment*
 - line113 *uncomment*
 - line116 *comment it.*
 - line164 (appendat last) mydestination = \$myhostname,
localhost.\$mydomain, localhost, \$mydomain
 - line264 mynetworks = 192.168.10.0/24, 127.0.0.0/8
 - line419 (uncomment) home_mailbox = Maildir/
:wq!
- Enable, start & status postfix:
#systemctl enable postfix
#systemctl start postfix
systemctl status postfix

Verify the postfix configuration:

```
#systemctl enable telnet.socket  
#systemctl start telnet.socket  
#systemctl status telnet.socket                          → active (listening)
```

Communicate using telnet service:

```
[root@svr ~]# telnet localhost smtp
Trying ::1...
Connected to localhost.
Escape character is '^]'.
220 svr.alpha.corp ESMTP Postfix
ehlo localhost
250-svr.alpha.corp
250-PIPELINING
250-SIZE 10240000
250-VRFY
250-ETRN
250-ENHANCEDSTATUSCODES
250-8BITMIME
250 DSN
```

Sending email from THOR to LOKI:

```
250-ENHANCEDSTATUSCODES
250-8BITMIME
250 DSN
mail from:<thor>
250 2.1.0 Ok
rcpt to:<loki>
250 2.1.5 Ok
data
354 End data with <CR><LF>.<CR><LF>
Hello Loki,
How's Asguard?
Hulk sends his LOVE.
TR
THOR, Odin's Son
.
250 2.0.0 Ok: queued as 8265822FE076
quit
221 2.0.0 Bye
Connection closed by foreign host.
[root@svr ~]#
[loki@centos7 ~]
To direct input to this VM, click inside or press Ctrl+G.
```

Switch to user's home directory:

```
[root@svr ~]# su - loki
[loki@svr ~]$ ls
Maildir
[loki@svr ~]$ ls Maildir/
cur new tmp
[loki@svr ~]$ ls Maildir/new/
1587203344.Vfd00120063e3M497879.svr.alpha.corp
[loki@svr ~]$ cat Maildir/new/1587203344.Vfd00120063e3M497879.svr.alpha.corp
Return-Path: <thor@alpha.corp>
X-Originating-To: loki@alpha.corp
Delivered-To: loki@alpha.corp
Received: from localhost (localhost [IPv6:::1])
        by svr.alpha.corp (Postfix) with ESMTP id 8265822FE076
        for <loki>; Sat, 18 Apr 2020 15:16:44 +0530 (IST)
Message-ID: <>20200418094721.8265822FE076@svr.alpha.corp>
Date: Sat, 18 Apr 2020 15:16:44 +0530 (IST)
From: thor@alpha.corp

Hello Loki,
How's Asguard?
Hulk sends his LOVE.
TR
THOR, Odin's Son
[loki@svr ~]$
```

POSTFIX CONFIGURATION IS OVER

CONFIGURING DOVECOT

- Install dovecot server
 #yum install -y dovecot
- To verify
 #rpm -q dovecot

Edit the config file for dovecot server.

- Edit main file:
 # vim /etc/dovecot/dovecot.conf
 Uncomment line 24,
 protocols = imap pop3 lmtp
 :wq!
- Edit supportive files in dovecot:
 - a. # vim /etc/dovecot/conf.d/10-mail.conf
 Uncomment line 24, to download the mails
 mail_location = maildir:~/Maildir
 - b. #vim /etc/dovecot/conf.d/10-auth.conf
 Uncomment line 10
 disable_plaintext_auth = yes
 on line 100, append ‘login’
 auth_mechanisms = plain login
 :wq!
 - c. #vim /etc/dovecot/conf.d/10-master.conf
 Line 91 & 92, uncomment & add “postfix” to user and group:
 user = postfix
 group = postfix
 :wq!

Enable, start & status of dovecot service:

- #systemctl enable dovecot
- #systemctl start dovecot
- #systemctl status dovecot → active (running)

Verify dovecot configuration:

```
# telnet localhost pop3
[root@centos7 ~]# telnet localhost pop3
Trying ::1...
Connected to localhost.
Escape character is '^>'.
+OK Dovecot ready.
user loki      → login to user "loki"
+OK
pass loki     → password for user loki
+OK Logged in.
list          → list the mail present
+OK 1 messages:
1 389
.
retr 1        → retrieve <mail-number>
```

```
+OK 389 octets
Return-Path: thor@alpha.corp
X-Original-To: loki
Delivered-To: loki@alpha.corp
Received: from localhost (localhost [IPv6:::1])
    by svr.alpha.corp (Postfix) with ESMTP id 021A322FE076
    for <loki>; Mon, 20 Apr 2020 00:48:39 +0530 (IST)
Message-Id: <20200419191847.021A322FE076@svr.alpha.corp>
Date: Mon, 20 Apr 2020 00:48:39 +0530 (IST)
From: thor@alpha.corp

Hahaha      → mail body
Hahahahah   → mail body
.
quit        → quit the console
+OK Logging out.
Connection closed by foreign host.
[root@centos7 ~]#
```

Example:

```
[root@centos7 ~]#
[root@centos7 ~]# telnet localhost pop3
Trying ::1...
Connected to localhost.
Escape character is '^]'.
+OK Dovecot ready.
user loki
+OK
pass loki
+OK Logged in.
list
+OK 1 messages:
1 389
.
1
-ERR Unknown command: 1
retr 1
+OK 389 octets
Return-Path: <thor@alpha.corp>
```

```
retr 1
+OK 389 octets
Return-Path: <thor@alpha.corp>
X-Original-To: loki
Delivered-To: loki@alpha.corp
Received: from localhost (localhost [IPv6:::1])
    by svr.alpha.corp (Postfix) with ESMTP id 021A322FE076
    for <loki>; Mon, 20 Apr 2020 00:48:39 +0530 (IST)
Message-Id: <20200419191847.021A322FE076@svr.alpha.corp>
Date: Mon, 20 Apr 2020 00:48:39 +0530 (IST)
From: thor@alpha.corp

hahaha
hahahahah
.
quit
+OK Logging out.
Connection closed by foreign host.
[root@centos7 ~]#
```

Squirrel mail to send, receive and read mail in linux system:

- Install squirrelmail, apache (httpd) & PHP packages.
`#yum install -y httpd`
`#yum install -y php`

- Install epel in centos to download & install squirrel mail:
#yum -y install epel-release
- Install squirrel mail:
#yum install -y squirrelmail
- Switch to squirrelmail config directory
#cd /usr/share/squirrelmail/config

```
#ls → conf.pl
[root@centos7 ~]# cd /usr/share/squirrelmail/config/
[root@centos7 config]# ls
config_default.php config_local.php config.php conf.pl index.php
[root@centos7 config]#
```

To execute the conf.pl file,

```
./conf.pl
```

In the main menu, change below settings:

- 1. Organization Preferences
- 2. Server Settings
- 7. Message of the Day (MOTD)

Save & quit the console.

Edit httpd file for squirrel mail:

- # vim /etc/httpd/conf/httpd.conf
Go to the bottom of the file & append below content:

```
Alias /webmail /usr/share/squirrelmail
<Directory /usr/share/squirrelmail>
    Options indexes FollowSymLinks
    RewriteEngine On
    AllowOverride All
    DirectoryIndex index.php
    Order allow,deny
    Allow from all
</Directory>
```

```
#EnableMMAP off
EnableSendfile on

Alias /webmail /usr/share/squirrelmail
<Directory /usr/share/squirrelmail>
    Options indexes FollowSymLinks
    RewriteEngine On
    AllowOverride All
    DirectoryIndex index.php
    Order allow,deny
    Allow from all
</Directory>
```

:wq!

Restart “**httpd**” & “**dovecot**” service & view the status

Launch firefox web browser & type below path

- <http://<IP-Address>/webmail>

we installed THUNDERBIRD for sending and receiving emails:

steps:

- thunderbird-68.7.0.tar.bz2
- uncompress it:
 - #bzip2 thunderbird-68.7.0.tar.bz2
- output -> thunderbird-68.7.0.tar
- extract the abv:
 - #tar -xvf thunderbird-68.7.0.tar
- output -> thunderbird--> directory

Single system env:

name: svr.lti.com
domain: lti.com
DNS is running
install
- postfix
- dovecot
- squirrelmail or thunderbird
users on same system
- user1
- user2

=====MAIL SERVER CONFIG OVER=====

Recommendation for LAB setup:

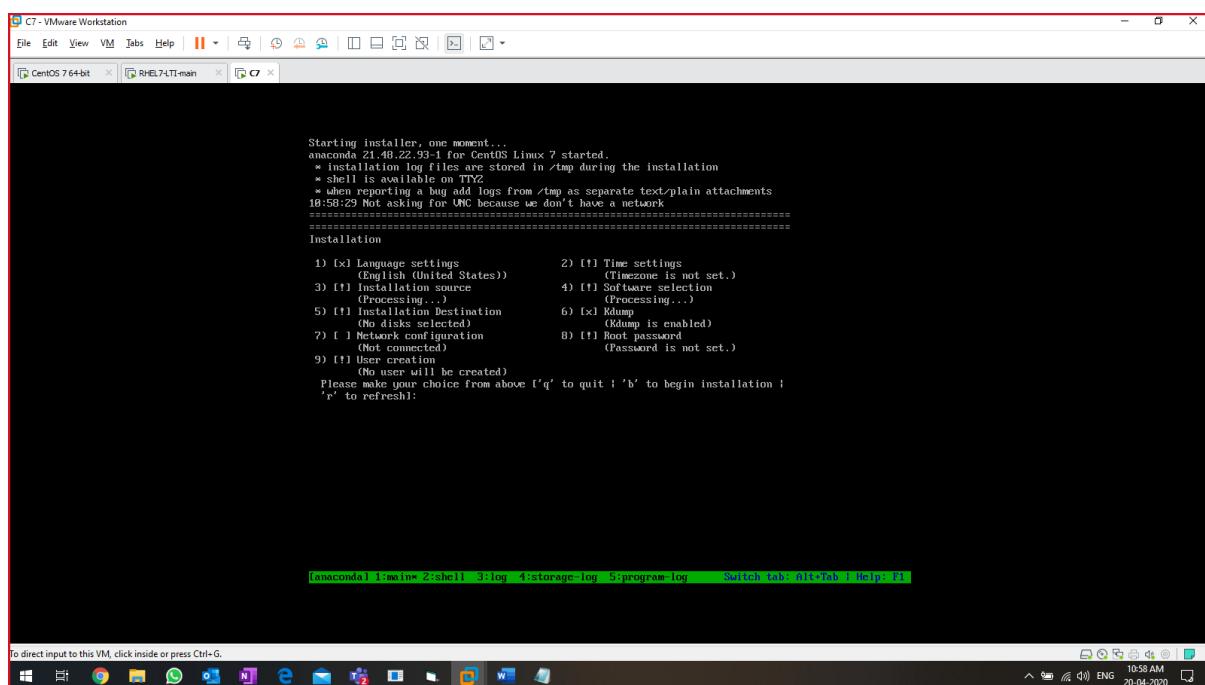
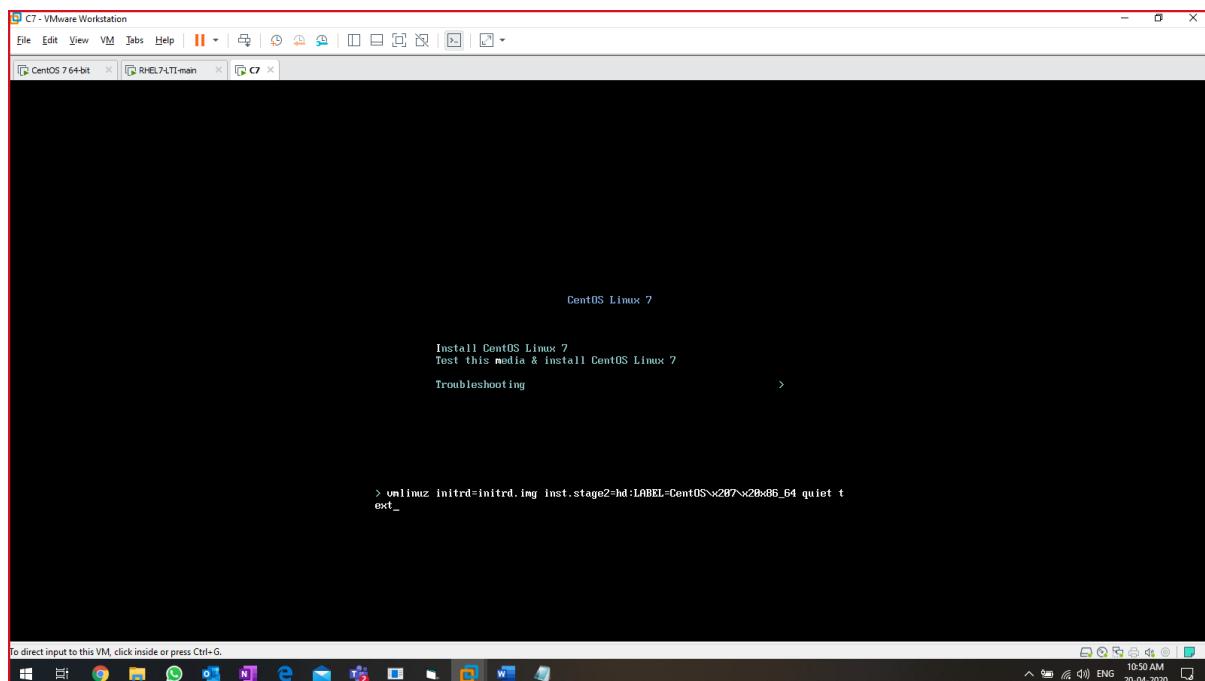
sys-1 (2 LAN cards- 1 LAN segment, 1 NAT)

- GUI/text installation
- file, user, service mgmt
- RPM / YUM (full and shortcut)
- partitioning (attach 3GB disks)
 - o Simple
 - o LVM
 - o RAID
- Networking
- Firewall
- NTP + internet
- FTP
- SSH
- telnet
- SCP
- rsync
- apache web server
- DNS
- MAIL server (postfix, dovecot, (thunderbird or squirrel mail))

sys-2 (2 LAN cards- 1 LAN segment, 1 NAT)

- DHCP
- SCP (win to linux with NAT)
- rsync
- NFS (l-l)
- SAMBA (linux-windows)
- Squid proxy

Text based installation:



URL: http://www.geekpills.com/linux_tutorial/rhel7centos7-text-installation

Convert GUI to CLI permanently

➤ # systemctl set-default multi-user.target & reboot

Convert CLI to GUI permanently

➤ # systemctl set-default graphical.target & reboot

FSCK:

- File system consistency check
- Use cases
 - System failure at boot time
 - File System is corrupted.
 - External devices

Scan HDD without reboot:

- List all available device:
 - `#ls -l /sys/class/scsi_host/`
- search for the device having keyword “mpt” in it & check the “host<value>”
 - `#grep mpt /sys/class/scsi_host/host?/proc_name`
- reset the values for the host<value> file
 - `#echo “- - -” > /sys/class/scsi_host/host32/scan`
- Check using the commands
 - “disks” GUI
 - `#lsblk`

FSCK = RHEL 6,

Xfs_repair = RHEL 7

At boot time, file check:

- 0 = dont scan at boot time
- 1 = scan at boot time -> /
- 2 = scan at boot time -> /boot, /usr, /home

Redirection:

- Redirecting the output in a certain file/location
- 3 std
 - Standard input → ‘0’ → keyboard, file...
 - `# cat < lti-history.txt`
 - Standard output → ‘1’
 - `#cat >> lti-history.txt`
 - Standard error → ‘2’
 - `#ld 2> error.txt`
- To send success messages/outputs in one file & errors in another file:
 - `# ls -l f1 f2 lti-history.txt pkgs.txt d1 d2 1>success.txt 2>error.txt`
- Send the output to null zone
 - `#ld 1> success.txt 2>/dev/null`

Reset root password in RHEL 7:

- Reboot the linux system
- Stop the booting process at GRUB screen.
- Select the linux kernel line & press “e”.
- Search for the line that starts with “Linux 16” and on the same line append “rd.break”
- Press CTRL+X

```
Generating "/run/initramfs/rdsosreport.txt"

Entering emergency mode. Exit the shell to continue.
Type "journalctl" to view system logs.
You might want to save "/run/initramfs/rdsosreport.txt" to a USB stick or /boot
after mounting them and attach it to a bug report.

switch_root:/# mount -o remount,rw /sysroot
switch_root:/# chroot /sysroot
sh-4.2# passwd root
Changing password for user root.
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: all authentication tokens updated successfully.
sh-4.2# touch /.autorelabel
sh-4.2# exit
exit
switch_root:/# exit
logout
[ 207.512523] piix4_smbus 0000:00:07.3: Host SMBus controller not enabled!
```

Get system information:

- #cat /proc/meminfo → list memory information
- #free → list memory & swap
- #free -k → list memory info in KBs
- #free -m → list memory info in MBs
- #free -g → list memory info in GBs
- #cat /proc/cpuinfo → list CPU info (file)
- #lscpu → list CPU info (command)

[Task: increase the SWAP space to twice the current SWAP space size]

```
[root@cli Desktop]# free -m
      total        used        free      shared  buffers   cached
Mem:       1826       1040        786         10          0       407
-/+ buffers/cache:       631       1194
Swap:      4999          0       4999
[root@cli Desktop]#
```

Powershell

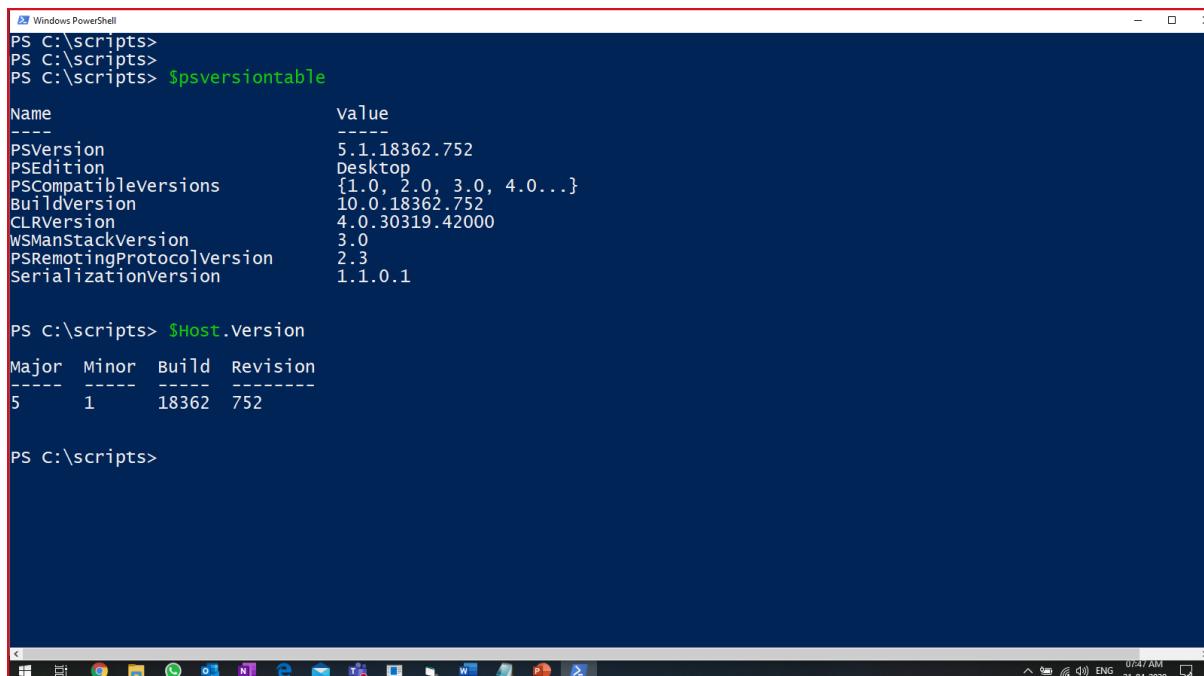
Lab setup:

- One domain controller - **DC**
- Two members - **svr, member**

Powershell:

- Command-line utility
- **Administrative tasks**
 - Manage local system
 - Manage remote system
 - Domain-joined systems
 - Non-domain joined systems
 - Report of users, drives, spaces...
- Microsoft product, which does not have any GLOBAL EXAMINATION.
 - 10961 - basics of powershell
 - 10962 - advanced powershell
- CMD prompt commands can be executed on powershell.

Powershell version:



```
Windows PowerShell
PS C:\scripts>
PS C:\scripts> $psversiontable
Name           Value
----           -----
PSVersion      5.1.18362.752
PSEdition      Desktop
PSCompatibleVersions {1.0, 2.0, 3.0, 4.0...}
BuildVersion   10.0.18362.752
CLRVersion     4.0.30319.42000
WSManStackVersion 3.0
PSRemotingProtocolVersion 2.3
SerializationVersion 1.1.0.1

PS C:\scripts> $Host.Version
Major  Minor  Build  Revision
-----  -----  -----  -----
5      1       18362  752

PS C:\scripts>
```

Powershell commands:

- Cmdlets
- Verb-noun

To update PS:

➤ Update-help -force

To check date:

➤ Get-date or
➤ date

to check the list of cmdlets, present in PS:

- get-command or
- gcm

to count the number of cmdlets:

- get-command | measure
- gcm | measure

to create a new alias

- new-alias -name <new-name-u-want> -value <original-cmd>
- Ex: new-alias -name d -value get-date

To create a directory in PS:

- mkdir <directory-name-with-path> or
- new-item -type directory -path <path-with-name-of-directory>
- Ex: New-Item -Type Directory -Path C:\lti-ps\testDir

To change the directory:

- cd <full-path-to-the-location> //Linux or CMS
- Set-Location C:\lti-ps\ //powershell

To list cmdlets with a specific keyword ('item')

- get-help *item* → search for key in start, middle or end of the cmdlet
- Get-Command -Noun item → search for the key END's with the 'item'

List top 10 processes which are consuming higher CPU:

Listing service:

- Get-Service -Name "T*" | Where-Object Status -eq "running"
- Get-Service | Where-Object {(\$_.Status -eq 'running') -and (\$_.Name -like 'T*')}

```
#list running processes & send it to a text file
Get-Service
| Where-Object Status -EQ "running"
| Select-Object DisplayName
| Out-File running-servvvv.txt

#display the file
notepad.exe running-servvvv.txt

#[Method-1:] to list services starting with "T" & status is running
Get-Service -Name "T*" | where-Object Status -eq "running"

#[Method-2:] to list services starting with "T" & status is running
Get-Service | where-Object {($_.Status -eq 'running') -and ($_.Name -like 'T*')}
| select Name

#to convert it into different outputs
Get-Process | Out-File pro1.txt
.\pro1.txt

#to convert it into CSV format
Get-Process | ConvertTo-Csv | Out-File pro1.csv
.\pro1.csv
```

```

#to convert it into csv + list 10 lines
Get-Process | select -First 10
| Select-Object processname, cpu
| ConvertTo-Csv -NoTypeInformation
| Out-File pro1.csv
.\pro1.csv

#to convert it into HTML append the data using "-append" parameter
Get-Process
| select -First 10
| Select-Object processname, cpu
| ConvertTo-HTML | Out-File pro1.html -Append
.\pro1.html

```

Execution policy:

- Run a script in powershell
- Do u have permissions to run a script.
- Locally, remotely
- Policy:
 - o **Restricted**
 - Locally, remotely NO script is allowed to get executed.
 - o **Unrestricted**
 - Locally, remotely ALL script is allowed to get executed.
 - o **All-signed**
 - Locally, remotely ALL script must be digitally signed.
 - o **Remote-signed**
 - Locally no digital signature but remote script must be digitally signed.
- Cmdlets:
 - o Get-executionpolicy
 - o Set-executionpolicy <Policy-name> → admin mode only

To create a self-sign certificate:

- a. Create certificate using below cmdlet:

```

New-SelfSignedCertificate -CertStoreLocation cert:\currentUser\my
-Subject "CN=wakanda-forever"
-KeyAlgorithm RSA
-KeyLength 2048
-Provider "Microsoft Enhanced RSA and AES Cryptographic Provider"
-KeyExportPolicy Exportable
-KeyUsage DigitalSignature
-Type CodeSigningCert

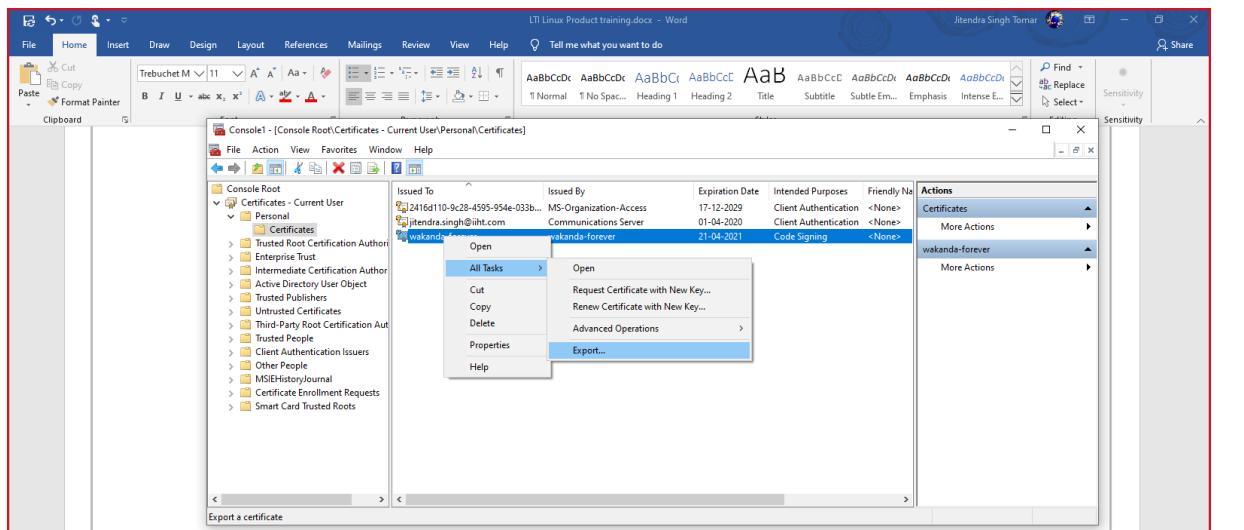
```

To verify, either of these can be executed.

- ls Cert:\CurrentUser\My\
- Get-ChildItem Cert:\CurrentUser\My\

- b. Export the certificate.

- o Open MMC using run prompt
- o Add certificate snap-in
- o Export the certificate:



- c. Install/Importing the exported certificate.
 - o Double click on the certificate
 - o Install it in TRUSTED ROOT CERTIFICATE AUTHORITY.
- d. Digitally sign the script.

```

PS C:\lti-ps> $cert = Get-ChildItem
Cert:\CurrentUser\My\D3757C6C9AC98C9BBD805B51037783FCC7B70288

PS C:\lti-ps> $cert
PSParentPath: Microsoft.PowerShell.Security\Certificate::CurrentUser\My

Thumbprint          Subject
-----
D3757C6C9AC98C9BBD805B51037783FCC7B70288 CN=wakanda-forever
  
```

- e. Bind the certificate

```

PS C:\lti-ps> set-AuthenticodeSignature -FilePath ".\first.ps1" -Certificate $cert

Directory: c:\lti-ps

SignerCertificate          Status          Path
-----                    -----          -----
D3757C6C9AC98C9BBD805B51037783FCC7B70288  Valid        first.ps1

PS C:\lti-ps>
  
```

To read 10 newest application event logs in local system:

```
PS C:\lti-ps> Get-EventLog -LogName Application -Newest 10 | Select-Object EntryType, Message | Format-Table -AutoSize -Wrap
```

```
|> Windows PowerShell
| PS C:\lti-ps> Get-EventLog -LogName Application -Newest 10 | select-object EntryType, Message | Format-Table -AutoSize -Wrap
|   EntryType Message
| -----
|   Error svchost (7388,R,98) TILEREPOSITORYS-1-5-18: Error -1023 (0xfffffc01) occurred while opening logfile
|   C:\WINDOWS\system32\config\systemprofile\AppData\Local\TileDataLayer\Database\EDB.log.
| Information Successfully scheduled Software Protection service for re-start at 2120-03-28T07:45:54Z. Reason:
|   RulesEngine.
| Information Updated windows defender status successfully to SECURITY_PRODUCT_STATE_ON.
| Information Offline downlevel migration succeeded.
|   Error svchost (560,R,98) TILEREPOSITORYS-1-5-18: Error -1023 (0xfffffc01) occurred while opening logfile
|   C:\WINDOWS\system32\config\systemprofile\AppData\Local\TileDataLayer\Database\EDB.log.
|   Error svchost (11276,R,98) TILEREPOSITORYS-1-5-18: Error -1023 (0xfffffc01) occurred while opening logfile
|   C:\WINDOWS\system32\config\systemprofile\AppData\Local\TileDataLayer\Database\EDB.log.
| Information The description for Event ID '0' in source 'gupdate' cannot be found. The local computer may not have
|   necessary registry information or message DLL files to display the message, or you may not have permission
|   to access them. The following information is part of the event: 'Service stopped'.
| Information The Exchange web service request GetAppManifests succeeded.
| Information Ending session 6 started 2020-04-21T05:18:45.439528400Z.
| Information Starting session 6 - 2020-04-21T05:18:45.439528400Z.

PS C:\lti-ps>
```

Basic commands:

```
pwd  
Set-Location C:\lti-ps  
Get-ChildItem  
Move-Item -Path .\1st-get-date.ps1 -Destination .\testDir  
Copy-Item -Path C:\lti-ps\*.ps1 -Destination C:\lti-ps\testDir
```

Task:

- a. Create a script, which when clicked opens Outlook, notepad, Google Chrome.
- b. List the logical disks information in GBs

WMI objects

- CIM
 - Common information model.
 - A standard given by distributed mgmt task force (DMTF)
 - Provides a common definition of managing network, systems, application, service etc...
- WMI
 - Windows management instrumentation
 - WMI is Microsoft implementation of CIM.
 - CIM + hardware + software
 - Everything is based on CLASSES
 - Cmdlet: get-wmiobject

Cmdlets:

- Get-WmiObject -Class win32_operatingsystem
- Get-WmiObject -Class win32_bios
- Get-WmiObject -Class win32_battery
- Get-WmiObject -Class win32_logicaldisk → task (b)

To get top 10 highest CPU utilization services:

```
Get-Process
| select -Unique
| Select-Object Processname, CPU
| Sort-Object CPU -Descending
| select -First 10
```

Mathematical operations:

```
[math]:::Sqrt(25)
[math]:::PI
[math]:::Round(18.26)
[math]:::Floor()
[math]:::Ceiling()
```

Hash table:

```
@{key=value; key1=value1;key2=value2...}
@{label= "CPU(in2digits)" ; exp= ""} OR @{l= "CPU(in2digits)" ; e= ""}
```

To get top 10 processes in round off format:

```
Get-Process
| select -Unique
| Select-Object Processname,@{l="CPU";e={[math]:::round( ($_.CPU),2) }} 
| Sort-Object CPU -Descending
| select -First 10
```

Microsoft documentation: <https://docs.microsoft.com/en-us/powershell/scripting/getting-started/getting-started-with-windows-powershell?view=powershell-5.1>

Task: display below values:

```
Name      : "OS-name"
IP address : <IP>
C Drive size : <val> Total in GBs
C Drive size : <val> free in GBs
domain name : <domain-name>
```

Operators:

```
>   =      → '-eq'
>   !=     → '-ne'
>   '>'    → '-gt'
>   '<'    → '-lt'
>   '>='   → '-ge'
>   '<='   → '-le'
```

Task: to fetch the name of a service from user, display the status (running or stopped) & then ask user to start the service if it is stopped:

```
# to list the status of a service,
# and ask user to start the service
cls

#fetch the service name from user
$name = Read-Host "Enter service name"

#store the service info in a variable
$svc = Get-Service -Name $name

#store service NAME in a variable
$n = $svc.name

#store service status in a variable
$s = $svc.Status

#display all together
write-host "Service name $n is $s"

if($s -eq "stopped"){
    $ans = read-host "Do u want to start the service (Y | N)"
    if(($ans -eq "y") -or ($ans -eq "yes")){
        Get-Service -Name $name | start-service
    }else{
        write-host "Fine, if u dont want to start the service"
    }
}else{
    write-host "service already running"
}
```

Interactive script to start a service & display its final result:

```
# to list the status of a service,
# and ask user to start the service
cls

#fetch the service name from user
$name = Read-Host "Enter service name"

#store the service info in a variable
$svc = Get-Service -Name $name

#store service NAME in a variable
$n = $svc.name

#store service status in a variable
$s = $svc.Status

#display all together
write-host "Service name $n is $s"

if($s -eq "stopped"){
    $ans = read-host "Do u want to start the service (Y | N)"
    if(($ans -eq "y") -or ($ans -eq "yes")){
        Get-Service -Name $name | start-service
        $cs = Get-Service -Name $name
        if($cs.Status -eq "running"){
            write-Host "Service is running"
        }else{
            write-Host "still not running"
        }
    }else{
        write-Host "Fine, if u dont want to start the service"
    }
}
else{
    write-Host "service already running"
}
```

Create a “Microsoft.PowerShell_profile.ps1” file, which gets loaded every time you start the terminal.

New-Item -ItemType File \$PROFILE -Force → PS console

- “New-item” = create something (file or directory)
- “-itemtype file” = creating a text file
- “\$PROFILE” = below value is stored in this variable
[C:\Users\Jeetu\Documents\WindowsPowerShell\Microsoft.PowerShell_profile.ps1]
- “-Force” = create FORCEFULLY.

For PS ISE

```
➤ $profile
➤ C:\Users\Jeetu\Documents\WindowsPowerShell\Microsoft.PowerShellISE_profile.ps1
```

If the above file does not exist, then create it:

```
➤ New-Item -ItemType File $profile -Force
```

Powershell Functions

Syntax:

```
Function <function-name>
{
...
...
}
<function-name>
```

To get the service info using functions:

```
#declare the function
function get-svcstatus{
cls
$n = Read-Host "enter service name"
Get-Service -Name $n
}

#call the function
get-svcstatus
```

To display the status of a service using function & passing service name as parameter:

```
function get-svcstatus{
param($svc)
$ans = Get-Service -Name $svc
Write-Host "Service $svc is: "$ans.status
}

get-svcstatus -svc mpssvc
```

Create function and load it in the memory, when PS console is triggered/opened:

Create a script & store it in any place [C:\lti-ps\testDir\function-1.ps1]

```
function get-svcstatus{
param($svc)
$ans = Get-Service -Name $svc
Write-Host "Service $svc is: "$ans.status
}
```

Call the function from the prompt by passing the parameter:

```
get-svcstatus -svc bits
```

if you want, the same script must be called every time you start the PS console:

- Notepad.exe \$PROFILE
- Import-Module C:\lti-ps\testDir\function-1.ps1

To get logical disk information:

```
function get-diskinfo{
cls
Get-wmiobject -Class win32_logicaldisk |
Select-Object DeviceID, DriveType,
FreeSpace,
Size
}
get-diskinfo
```

Converting & displaying the disk info in GBs format:

```
function get-diskinfo{
cls
Get-wmiobject -Class win32_logicaldisk |
Select-Object DeviceID, DriveType,
@{@l="Size";e={[math]::Round($_.size/1GB,2)}},
@{@l="FreeSpace";e={[math]::Round($_.size/1GB,2)}}
}
get-diskinfo
```

Get the info of other devices in the network:

[method-1]

```
function get-diskinfo{
cls
Get-wmiobject -Class win32_logicaldisk -ComputerName cli |
Select-Object DeviceID, DriveType,
@{@l="Size";e={[math]::Round($_.size/1GB,2)}},
@{@l="FreeSpace";e={[math]::Round($_.size/1GB,2)}}
}
get-diskinfo
```

[method-2]

```
function get-diskinfo{
cls
Get-wmiobject -Class win32_logicaldisk -ComputerName $newcomp |
Select-Object DeviceID, DriveType,
@{@l="Size";e={[math]::Round($_.size/1GB,2)}},
@{@l="FreeSpace";e={[math]::Round($_.size/1GB,2)}}
}

#create a text file & write computernames in it
#notepad.exe comp.txt

#fetch the values in a variable
$newcomp = Get-Content .\comp.txt

#call the function
get-diskinfo
```

To get the logs for remote system:

```
Get-EventLog -LogName Application -Newest 5 -ComputerName dc  
| Select-Object EntryType, Message | ft -AutoSize -Wrap
```

To get the output in the colour mode:

```
$name = Get-Service -Name winrm  
cls  
if($name.Status -eq "Running"){  
    Write-Host $name.name" is running" -ForegroundColor Black -BackgroundColor Green  
}else{  
    Write-Host $name.name" is stopped" -ForegroundColor white -BackgroundColor Red  
}
```

TASK: display ALL SERVICES (running in green & stopped in red)

Sending variable values using pipeline in advance functions:

```
function get-eventdata{  
[cmdletbinding()  
param(  
    [Parameter(Mandatory=$true,  
    valueFromPipeline=$true  
)]  
    [string]$com  
)  
cls  
#write-Host "$com function executed"  
Get-EventLog -LogName Application -ComputerName $com -Newest 5  
}  
$com | get-eventdata
```

Active directory mgmt using PowerShell: