

# Labs Manual

## LPIC-1: System Administrator

Version: 5.0



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## Lab 1

### Installation Linux

#### Objectives

- ❖ Installation Linux from local device
- ❖ Installation Linux from internet

#### Task 1: Introduction this labs

- Introduction Lab topology
- Login this lab

#### Task 2: Installation Linux Distro CentOS 7.x

- Login this labs by remote desktop.
- Open VMware wordstation.
- Power ON the virtual machine Server-02.
- The VM auto boot CD-ROM include CentOS 7 Operation System.
- Encrypt your data store in the server
- Layout disk such as below:
  - /swap: 1GB
  - /boot: 1GB
  - /home: 5 GB
  - /: all space capacity
- Set root password such as 'student'.
- Now, wait the Linux installation and click “**Reboot**” after finish.

#### Task 3: Installation Debian from internet

- Power ON the virtual machine Server-03 and process such as lecture module 1.

## Lab 2

# System Architecture

## Task 1: Shutdown Linux

Perform this task on Server-01

- Shutdown the system after 1 minutes

```
# shutdown +1 "Test shutdown"
```

- Try command lines:

```
# init 0

# telinit 0

# shutdown now
```

## Task 2: Restart Linux

- Shutdown the system after 1 minutes

```
# shutdown -r +1 "Test shutdown"
```

- Try command lines:

```
# init 6

# telinit 6

# reboot
```

## Task 3: Check hardware on Linux

- List all hardware on CentOS:

```
# lshw
```

- List all pci on CentOS:

```
# lspci
```

- List all usb on CentOS:

```
# lsusb
```

- Check CPU info on linux:

```
# cat /proc/cpuinfo
```

- Check Memory info on linux:

```
# cat /proc/meminfo
```

#### **Task 4: Working with systemd init**

Perform this task on Server-01

- Check the current runlevel:

```
# runlevel
```

- Check the default target:

```
# systemctl get-default
```

- To list all currently loaded target units, type the following command at a shell prompt:

```
# systemctl list-units --type target
```

What is current target? .....

- Change default target to poweroff.target

```
# systemctl .....
```

- Reboot this server, waiting the server booting. What's happened?
- Interrupt the boot loader when the menu appears by pressing any key.
- Move the selection to the default entry (the first one) using the cursor keys.
- Press **e** to edit the current entry.
- Move the cursor to the line that starts with **linux16**.
- Move the cursor to the end of the line (using the **End** key), and append the following text:

```
systemd.unit=rescue.target
```

- Press **Ctrl+x** to boot using the modified configuration.
- When prompted for the root password, enter "**student**".
- Set the default systemd target back to the multi user target.
- Press **Ctrl+d** to continue booting into the (new) default target.
- Login and reboot for verify.

## Lab 3

### Working on Command Line

#### Task 1: Basic command line

Perform this task on Server-01

- What is current linux kernel in your system?
- Show content in file below, what is CentOS version?

```
# ...../etc/centos-release
```

- Check current time, date, timezone in your server.
- Set correct time, date, timezone.
- Set static hostname on server such as “server-01.robusta.local”
- Show first 20 line on /var/log/dmereg
- Show command history on this server
- Clear command history on this server
- Change current working directory to /tmp
- Run command:

```
# which mv
```

- Run command:

```
# ls
```

- Run command:

```
# alias 'ls=ls -l'
```

- Run again command:

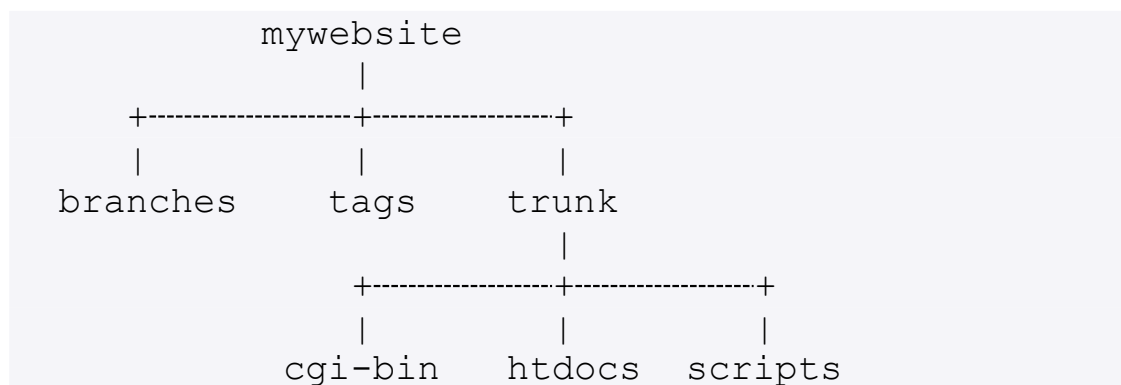
```
# ls
```

- What's happened?

#### Task 2: Working with directory and files

Perform this task on Server-01

- Create new directory **/LPI1**
- In the **/LPI1** directory, create 03 sub-directory **lecture**, **lab**, **exam** by **single mkdir command**
- With single command, create the empty files with the file name **system\_changes-machineY-month\_Z.txt** in the **/LPI1** directory. Replace Y with the machine number (form 1 to 10) and replace Z with the months **jan, feb, and mar**. (Total create 30 empty file).
- With single command, Create the **/LPI1/syschanges** directory with the subdirectories **jan, feb, and mar**.
- Sort all newly created files by month into the corresponding subdirectory
- Compress **/LPI1** to **/tmp/lpi1.tar.gz**
- Remove all newly created files related to machine 9 and 10
- Rename subdirectory **jan** to **Thang\_1**
- Rename all file in **Thang\_1** directory correct month is **Thang\_1**
- Remove directory **/LPI1/syschanges**
- With single command, create the directory tree below:



### Task 3: Forgot root password CentOS 7.x

Perform this task on Server-02

- Booting Server-02, press any key to access boot menu.
- In the boot menu, choose first row and press 'e'



```
CentOS Linux (3.10.0-327.el7.x86_64) 7 (Core)
CentOS Linux (0-rescue-4b0ea84d57b249dca8665624e579170a) 7 (Core)
```

Use the ↑ and ↓ keys to change the selection.  
Press 'e' to edit the selected item, or 'c' for a command prompt.

- The default such as:

```
insmod xfs
set root='hd0,msdos1'
if [ x$feature_platform_search_hint = xy ]; then
    search --no-floppy --fs-uuid --set=root --hint-bios=hd0,msdos1 --hin\
t-efi=hd0,msdos1 --hint-baremetal=ahci0,msdos1 --hint='hd0,msdos1' d40e2af5-c\
463-4e94-ba7f-464ad2055ef1
else
    search --no-floppy --fs-uuid --set=root d40e2af5-c463-4e94-ba7f-464a\
d2055ef1
fi
linux16 /vmlinuz-3.10.0-123.6.3.el7.x86_64 root=/dev/mapper/centos-roo\
t rd.lvm.lv=centos/swap vconsole.font=latarcyrheb-sun16 rd.lvm.lv=centos/ro\
ot crashkernel=auto vconsole.keymap=us rhgb quiet LANG=en_US.UTF-8
initrd16 /initramfs-3.10.0-123.6.3.el7.x86_64.img

Press Ctrl-x to start, Ctrl-c for a command prompt or Escape to
discard edits and return to the menu. Pressing Tab lists
possible completions.
```

- Change ro to rw `init=/sysroot/bin/sh` such as:

```
insmod xfs
set root='hd0,msdos1'
if [ x$feature_platform_search_hint = xy ]; then
    search --no-floppy --fs-uuid --set=root --hint-bios=hd0,msdos1 --hin\
t-efi=hd0,msdos1 --hint-baremetal=ahci0,msdos1 --hint='hd0,msdos1' d40e2af5-c\
463-4e94-ba7f-464ad2055ef1
else
    search --no-floppy --fs-uuid --set=root d40e2af5-c463-4e94-ba7f-464a\
d2055ef1
fi
linux16 /vmlinuz-3.10.0-123.6.3.el7.x86_64 root=/dev/mapper/centos-roo\
t rw init=/sysroot/bin/sh rd.lvm.lv=centos/swap vconsole.font=latarcyrheb-sun\
16 rd.lvm.lv=centos/roo crashkernel=auto vconsole.keymap=us rhgb quiet LANG=en\
_US.UTF-8
initrd16 /initramfs-3.10.0-123.6.3.el7.x86_64.img

Press Ctrl-x to start, Ctrl-c for a command prompt or Escape to
discard edits and return to the menu. Pressing Tab lists
possible completions.
```

- Now press **Control+x** to start on single user mode

```
[ OK ] Started Show Plymouth Boot Screen.
[ OK ] Reached target Paths.
[ OK ] Reached target Basic System.
      Starting File System Check on /dev/mapper/centos-root...
[ 1.062057] sd 0:0:0:0: [sdal] Assuming drive cache: write through
[ 1.063004] sd 0:0:0:0: [sdal] Assuming drive cache: write through
[ 1.063978] sd 0:0:0:0: [sdal] Assuming drive cache: write through
systemd-fsck[394]: fsck: error 2 (No such file or directory) while executing fsck.ext2 for /dev/mapper/centos-root
[ OK ] Started File System Check on /dev/mapper/centos-root.
[ OK ] Started dracut initqueue hook.
      Mounting /sysroot...
[ OK ] Mounted /sysroot.
[ OK ] Reached target Initrd Root File System.
      Starting Reload Configuration from the Real Root...
[ OK ] Started Reload Configuration from the Real Root.
[ OK ] Reached target Initrd File Systems.
[ OK ] Reached target Initrd Default Target.

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.

:/# _
```

- Type command such as below:

```
# chroot /sysroot

# passwd root

# touch /.autorelabel
```

- Reboot VM and verify with new password

### Task 4: Set password for Grub Boot Loader 2 on CentOS 7.x

Perform this task on Server-02

- Set password for user root of Grub Boot Loader 2

```
# grub2-setpassword
```

- Reboot OS
- Booting VM02-CentOS-7.x, press any key to access boot menu.
- In the boot menu, choose first row and press 'e'

```
CentOS Linux (3.10.0-327.el7.x86_64) 7 (Core)
CentOS Linux (0-rescue-4b0ea84d57b249dca8665624e579178a) 7 (Core)

Use the ↑ and ↓ keys to change the selection.
Press 'e' to edit the selected item, or 'c' for a command prompt.
```

- The console require enter username and password:

```
Enter username:
root
Enter password:
_
```

## Lab 4

# Manage Share Libraries, Streaming edit and redirect

### Task 1: Manage shared libraries

Perform this task on Server-01

- Display current locations for modules for a particular user and program:

```
# ldconfig -p
```

- To find the shared libraries that a calendar program (/usr/bin/cal):

```
#...../usr/bin/cal
```

- To set the environment variable for developers, first make a directory in your home directory

```
# mkdir $HOME/libs
```

- Set the variable

```
# LD_LIBRARY_PATH=$HOME/libs
```

- Export the variable

```
# export LD_LIBRARY_PATH
```

- Check that it is exported

```
# env
```

- To set this permanently edit /etc/profile or ~/.bash\_profile. Now unset the variable

```
# unset LD_LIBRARY_PATH
```

## Task 2: Streaming edit and redirect

Perform this task on Server-01

- Run this command:

```
# echo redhat | passwd --stdin root
```

- Logout and login again verify
- Change password to 'student'
- Copy first 10 lines in `/etc/passwd` to `/tmp/task2_lab4.txt`
- Export column 1 of file `/tmp/task2_lab4.txt` to `/tmp/1.txt`
- Export column 2 of file `/tmp/task2_lab4.txt` to `/tmp/2.txt`
- Export column 6 of file `/tmp/task2_lab4.txt` to `/tmp/6.txt`
- Print to console and store in to `/tmp/cut.txt` with column 1,2,6 of file `/tmp/task2_lab4.txt`, column separate by ':'
- Using paste command, merge 3 file `/tmp/1.txt`, `/tmp/2.txt` and `/tmp/6.txt` to `/tmp/paste.txt`
- Compare 02 file with command:

```
# diff -q /tmp/paste.txt /tmp/cut.txt
```

```
# diff -s /tmp/paste.txt /tmp/cut.txt
```

- Using paste comand, create new file `paste2.txt` with `paste2.txt` and `cut.txt` are identical
- Create new empty file `~/demo.txt`.
- Add context such as below to `~/demo.txt` file:

```
Linux is Unix
Unix not linux
liNux like uNix
```

- Add 3 black line after every line and save overwrite name `~/demo.txt`
- With sed command, replace all like to "linux" – not match case in `~/demo.txt` to LINUX (ex: LiNUx, linuX -> LINUX)
- With sed command, replace all like to "unix" – not match case in `~/demo.txt` to [UNI]x
- Delete all black line.
- Convert all character on file `~/demo.txt` to UPPER CASE.
- Process all example command in Module 3 - Lesson 3

## Lab 5

### Working with file in linux

#### Task 1: Edit file with vi command

Perform this task on Server-01

- Edit file `~/.vimrc` and adding:

```
set number
```

- Use **vi** command, create new file `/tmp/truyenkieu.txt` with contents below:

```
Dau long hai a to nga  
  
Thuy Kieu la chi em la Thuy Van  
  
Mai cot cach, tuyet tinh than  
  
Moi nguoi mot ve muoi phan ven muoi
```

- Use vi command, delete line 3.
- Use vi command, replace all **Thuy** to **Thu'y**

#### Task 2: grep and egrep

Perform this task on Server-01

- Copy file `/etc/ssh/sshd_config` to `/tmp/`
- Add to end of line `/tmp/sshd_config`:

```
Dong nao bat dau bang dau # co nghia la ghi chu
```

- Show all lines on `/tmp/sshd_config` without notes line.
- Use **egrep** command, print to console total CPU support virtualization on linux. If you see **vmx** or **svm** in the core information on `/proc/cpuinfo`, then your hardware (CPU) supports the virtualization.

### Task 3: Managing links between files/directory

Perform this task on Server-01

- With single command, create new file `~/newfile.txt` has content:
- Create soft link `~/newfile.txt` to `/tmp/softlinknewfile.abc`
- Using `ls` command verify softlink.
- Create new hardlink `~/newfile.txt` to `/hardlink.doc`
- Using `vi` command, add everything to `~/newfile.txt`
- Using `cat` and `diff` command verify/compare contents on softlink and hardlink.
- Using `vi` command, add everything to `/tmp/softlinknewfile.abc`
- Using `cat` and `diff` command verify/compare contents on original file and hardlink.
- Using `vi` command, add everything to `/hardlink.doc`
- Using `cat` and `diff` command verify/compare contents on original file and softlink.
- Remove `/tmp/softlinknewfile.abc`, verify `~/newfile.txt` and `/hardlink.doc`
- Create again softlink
- Delete file `~/newfile.txt`, verify softlink and hardlink file, content on file.
- Create `/tmp/test` directory and 10 file `{1..10}.txt` into this.
- Create `/source` directory and copy random 5 files `.txt` form `/tmp/test/` with command below:

```
# cd /tmp/test
```

```
# shuf -zn5 -e *.txt | xargs -0 cp -vt /source/
```

- Create symbolic link of `/source`.
- Create hard link of `/source` -> result?

## Lab 6

# Package management

### Task 1: Mount CD-ROM ISO CentOS

*Perform this task on Server-02*

- Insert CentOS CD to Server from VMware Workstation.
- Create folder `/mnt/cdrom`
- Mount CD-ROM to mount point:

```
# mount .....<path/to/cdrom> ..... /mnt/cdrom
```

- Change directory to Package folder:

```
# cd /mnt/cdrom/Packages/
```

### Task 2: Using RPM command

- List all rpm package install on system:

```
# rpm -qa
```

- Install package tcpdump on system:

```
# rpm -ivh tcpdump-.....rpm
```

- If have requirement package, install the requirement package before install tcpdump package.
- 

### Task 3: Install Repository Local

*Perform this task on Server-02*

#### Step 1: Install package create Repository

- Package called “**createrepo**” to create our local repository.

```
Using rpm command line install package createrepo-xxx.rpm (need install another package requirement)
```



## Step 2: Create source repository

- Create folder for repository:

```
[root@localhost ~]# mkdir /localrepo
```

- Copy all packages of CentOS to **/localrepo** directory:

## Step 3: Create file config repo

Create and edit file localrepo.repo:

```
vi /etc/yum.repos.d/localrepo.repo
```

Add contents:

```
[localrepo]
name=.....
baseurl=.....
gpgcheck=0
enabled=1
```

## Step 4: Active repository

```
# createrepo -v /localrepo/
```

## Task 4: Using yum command

### On Server-02:

- Clean all cache:

```
# yum clean all
```

- Install service:

```
# yum -disablerepo="*" -enablerepo="localrepo" install httpd*
```

### On Server-01:

- Type command:

```
# tree
```

- Install epel repository:

```
# wget http://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
```

```
# rpm -ivh epel-release-latest-7.noarch.rpm
```

- Use yum command verify epel repo id.
- Install package tree:

```
# yum install -y tree
```

## Lab 7

# Process management

### Task 1: Manage processes

*Perform this task on Server-02*

- Check the system uptime with uptime command.
- Check the usage memory and swap on your system
- Run command below:

```
# find / -ctime -1 > /tmp/changed-file-list.txt
```

- Press Ctrl-Z to suspend foreground command

```
# [CTRL-Z]  
  
[2]+  Stopped    find / -ctime -1 > /tmp/changed-file-list.txt
```

- Run all command such as below:

```
# NCORES=4
```

- Create more background processes:

```
# for I in $( seq $((NCORES*2)) )  
  
> do  
  
> sha1sum /dev/zero &  
  
> done
```

- Inspect the CPU usage (as a percentage) of all your sha1sum processes, using the **ps** and **pgrep** commands. What do you notice?

```
# ps -o pid,pcpu,nice,comm $(pgrep sha1sum)
```

- Use the killall command to terminate all your sha1sum processes.

### Task 2: Use the screen tool

*Perform this task on Server-02*

- Install screen package.
- Create new screen with session name LPI1
- After connect to screen session, using command:

```
# vi /tmp/testscreen.txt
```

- Type any contents.
- Dettach this screen (not terminate)
- Create second screen
- Connect to second screen, and show all contents into file /etc/hosts
- Dettach second screen
- List all screen on your system.
- Re-attach first screen and save this open file.
- Terminate all screen.
- Set password for screen with password like '123456'

**Task 3: Manage priority of the processes**

- Run all command such as below:

```
# NCORES=2
```

- Create more background processes:

```
# for I in $( seq $((NCORES*2-1)) )  
  
> do  
  
> sha1sum /dev/zero &  
  
> done
```

- Start new **sha1sum /dev/zero** with nice level 10.
- Using the ps command, inspect the CPU usage of your sha1sum commands.
- Use the renice command to set the nice level of the sha1sum with a nice level of 10 down to -10.
- Identify the sha1sum process using the most CPU. It will be near the top.
- In top command, press 'r', then enter the PID of sha1sum command with nice level of -10 and enter 0, then press Enter.

## Lab 8

# Disk management

### Task 1: Working with fdisk command

*Perform this task on Server-01*

- On first SCSI hard disk, create 03 new partitions with capacity 2GB (new partition 1<sup>st</sup>), 2GB (new partition 2<sup>nd</sup>) with fdisk command and 2GB (new partition 3<sup>rd</sup>).
- Format new partition 2<sup>nd</sup> to ext2 file system and mount to **/ext2**
- Format new partition 3<sup>rd</sup> to ext4 file system and mount to **/ext4**
- Edit /etc/fstab and configure auto mount new partition 2 to /ext2 and new partition 3 to /ext4 when system startup. After that, reboot system for verify.

### Task 2: Swap

*Perform this task on Server-01*

- Create swap from new partition 1 (created task above).
- Turn on new swap and verify.
- Set auto mount swap partition when system startup and verify.
- Create new directory /swap
- Change directory to /swap
- Create a file /swap/swapfile has file size=1GB (using dd command)
- Type command:

```
# chmod 600 /swap/swapfile
```

- Create swap from /swap/swapfile.
- Turn on new swap and verify.
- Set auto mount swap partition when system startup and verify.

### Task 3: Working with parted command

*Perform this task on Server-02*

- Add new disk from VMware Workstation with 10GB capacity to Server-02.
- Use **partprobe** command re-load new hard disk.
- Set partition table for new hard disk such as GPT.
- Create new partition with 5GB.
- Format new partition such as xfs and mount to **/xfs**

## Lab 9

# Maintain the integrity of filesystems

- On Server-01, convert partition /dev/sda6 with ext4 file systems.
- On Server-01, Copy 3 files (random) on /var/log to /ext4
- On Server-01, Extend /dev/sda7 to 8GB and verify current data.
- On Server-01, reduce /dev/sda7 to 6GB and verify current data.
- On Server-01, Delete 3 partition /dev/sda5, /dev/sda6
- On Server-02, Copy 3 files (random) on /var/log to /xfs
- On Server-02, Extend /dev/sdb1 to 10GB and verify current data.
- On Server-02, how to reduce /dev/sdb1 to 6GB???

## Lab 10

### User and Group

#### Task 1: Manage Local User and Group

*Perform this task on Server-01*

- Adding 2 directories backup and document into /etc/skel. After that, directory Adding file welcome.txt in /etc/skel/document such as below:

```
# cat welcome.txt
Chao mung ban den voi LPI
Moi chi tiet lien he voi administrator
```

- Create new 3 user: **tom**, **jessica**, **steven** have default group is **quota**.
- Verify file/directory in home directory of **tom**, **jessica**, **steven** user's.
- Set password 'redhat' for 3 users: **tom**, **jessica**, **steven**
- Create user **putin** without logon to your system and verify.
- Change home directory of **steven** to **/ftp/data/steven**
- Edit file /etc/motd such as:

```
# cat /etc/motd
Chao mung ban den voi may chu cua toi
```

- Using **vi**, change uid in **/etc/passwd** file of **tom** user to 0. Reboot server and login with **tom** user and password is **redhat**.
- Configure **jessica** user require change password next logon.
- Modify user **putin** can logon to your system.
- General password hv03 such as:

```
# matkhau=$(openssl rand -base64 12)
# echo $matkhau
# usermod -p $matkhau putin
```

- What is password of user **putin**?
- Logout current user and login with **putin** user.
- Check current time on your system.
- Change **mindays** of tom user is 3 days.
- Try change password of **tom** user? What happened?
- Set current date such as 4 days after and try change password **tom** user again. What happened?

## Task 2: Configure sudoers

*Perform this task on Server-01*

- Configure user **tom** has full privileges such as **root**, without password when use sudo command.
- Configure user **putin** can shutdown your system.

## Task 3: Configure quota

*Perform this task on Server-01*

- Check /dev/sda7 mounted to /ext4 directory.
- Check package create quota (quota-xxx.rpm). If it didn't install, you can install such as (mount cdrom and install):

```
# rpm -ivh tcp_warppers-7.xxx.rpm
# rpm -ivh quota-xxx.rpm
```

- Configure quotas: user tom: 10MB, putin: 100MB on /dev/sda7
- Verify with dd command

## Lab 11

### File Permission

#### Task 1: Basic permission on Linux

*Perform this task on Server-01*

- Create user **hv01**, **hv02** member of **hocvien** group.
- Create user **hv03** member of **lpi** group
- Change password **hv01**, **hv02**, **hv03**
- Switch to user **hv01** and create file **/home/hv01/test.txt** with whatever contents.
- Switch to user **hv02**, and check such as:

```
$ cat /home/hv01/test.txt
$ cd /home/hv01
$ ls -l /home/hv01
$ mkdir /home/hv01/hv02
$ mkdir /home/hv02/lpi
```

- Switch to user **root**
- Create folder **/public**, sub-folder **/public/limit**
- Create 3 files **read.txt**, **write.txt**, **nonpermission.txt** in **/public** folder with whatever contents.
- Create 2 files **hv01.txt** and **hv02.txt** in **/pub/limit**.
- What is permission, owner of new file/folder?
- Switch user to **hv01** and check with command:

```
$ ls -l /public
$ ls -l /public/limit
$ cat /public/read.txt
$ vi /public/write.txt
    Add another line and save
$ vi /public/limit/hv02.txt
    Add another line and save
$ cat /public/limit/hv01.txt
```

- Exit and back to root user
- Set permission of folder **/public/limit** is **740** and check with **ls** command
- Set owner of folder **/public/limit** is **root** and group is **hocvien**.



- Set permission of file **/public/read.txt** is 764
- Set permission of file **/public/write.txt** is 762
- Set permission of file **/public/nonpermission.txt** is 700
- Switch user to **hv01** and check:
  - o List all file/directory in **/public**
  - o List all file/directory in **/public/limit**
  - o View contents of file **/public/limit/hv02.txt**
  - o Add new line in **/public/limit/hv01.txt**
  - o View contents of file **/public/read.txt**, **/public/write.txt**, **/public/nonpermission.txt**
  - o Add new line in **/public/read.txt**, **/public/write.txt**, **/public/nonpermission.txt**
  - o Exit and back to root and check command:
    - **cat /public/write.txt**
- Switch user to **hv03** and check:
  - o List all file/directory in **/public**
  - o List all file/directory in **/public/limit**
  - o View contents of file **/public/limit/hv02.txt**
  - o View contents of file **/public/read.txt**, **/public/write.txt**, **/public/nonpermission.txt**
  - o Add new line in **/public/read.txt**, **/public/write.txt**, **/public/nonpermission.txt**
  - o Exit and back to root and check command:
    - **cat /public/write.txt**
- Set all folder and files in directory **/public** with permission of owner is read and write, group is read-only and others is non-permission.
- 
- Change owner and group of **/public** directory is **hv01:hocvien**
- Set sticky bit for **/public** directory.
  - Switch user to **hv03**

- Create file **test.txt** with whatever contents.
  - Create folder **test.d**
- Delete file **test.txt** and **read.txt**

## Task 2: Special permission on Linux

*Perform this task on Server-01*

- Create and adding user **tom**, **jessica**, **steven** to group **accountant**
- In the **/test\_permission**, create new directory **Finances**
- Configure all new file, directory create into **/test\_permission/Finances** all users is member of accountant group have read and write, other user cannot access into this. Only owner create this file should be delete this.
- Login tom, jessica, steven and putin user for verify.

## Task 3: Umask

*Perform this task on Server-01*

- By **root** user, set umask for user **putin** and **jessica** such as 0007
- Login to **putin** user and **jessica** verify by umask command and create and check permission to new file and new directory.
- Login to user tom and check umask, create new fil/directory and check this permission.

## Lab 12

### Shell Scripts

- Create file `/bin/sysadmin` such as bash script, when run, main console show such as below:

```
[root@lpi1 ~]# sysadmin
1) Tao tai khoan  3) Shutdown      5) Quit
2) Health check  4) Reboot
Vui long chon chuc nang - Nhan Enter de xem lai bang chuc nang:
```

- When press 1:

```
Nhap username=
```

- If not type username or type incorrect username, require retype user.
- If type correct username, check the existed username. If not existed, create new username.
- Change password username such as:

```
Nhap username= abc123
*****
Tao tai khoan abc123 thanh cong!!!
*****
Ban muon dat mat khau cho user abc123? y
Dat mat khau manual hay random?
1) manual
2) random
Vui long chon chuc nang - Nhan Enter de xem lai bang chuc nang:
```

```
Vui long chon chuc nang - Nhan Enter de xem lai bang chuc nang: 2
Mat khau ngau nhien la: w0kKuXp0gsM=
Changing password for user abc123.
passwd: all authentication tokens updated successfully.
Dat mat khau thanh cong
*****
Set tai khoan abc123 muon quyen root: y
Set tai khoan abc123 co quyen root thanh cong. Su dung sudo truoc
command de muon quyen

Press any key to continue
```

- When press 2:

```
***** HEATH CHECK SYSTEM *****
May chu: lpi1.trungnguyenkbuor.com

He dieu hanh: CentOS Linux release 7.2.1511 (Core)

Thong tin kernel: 3.10.0-327.el7.x86_64

Thong tin uptime: 21:48:09 up 2:08, 2 users, load average: 0.00, 0.01, 0.05

CPU: Intel(R) Core(TM) i5-4300U CPU @ 1.90GHz

So Core CPU: 2

Thong tin Memory:
                total        used        free      shared  buff/cache   available
Mem:            1824         141        1376          8         306        1513
Swap:           2047           0        2047

Press any key to continue
```

- When press 3:

```
*****
Ban muon shutdown he thong? Go 'Yes' de shutdown:
```

- When press 4:

```
*****
Ban muon khoi dong lai he thong? Go 'Yes' de khoi dong lai:
```

- When press 5:

```
Vui long chon chuc nang - Nhan Enter de xem lai bang chuc nang: 5
Ban co muon thoat chuong trinh? y
*****
                HAVE A NICE DAY
*****
[root@lpi1 ~]#
```

- For Press any key to continue, use such as below:

```
read -n 1 -s -r -p "Press any key to continue"
```

## Lab 13

# Scheduling jobs

### Task 1: Working with crontab

- Create crontab every 2 minutes write current time to file **/etc/timestamp.log**
- Using **tail -f** for verify.
- Check current time on system.
- Create crontab reboot your system at 01:15am every Saturday.
- Set time to **20/4/2019 01:14** and verify.

### Task 2: Working with nohup

- Create 02 directories **/tmp/source** and **/tmp/backup**
- Create script auto cp all data into **/tmp/source** to **/tmp/backup** every 30 seconds.
- Touch 3 files (random) in **/tmp/source** and verify.

# Lab 14

## Networking Fundamentals

### Task 1: Configure IP on server-01

- On Server-01, configure IP by edit file in /etc/sysconfigs/network-scripts with IP address is 172.20.10.11/24 and gateway is 172.20.10.2
- Configure Server can access internet with DNS is 8.8.8.8.

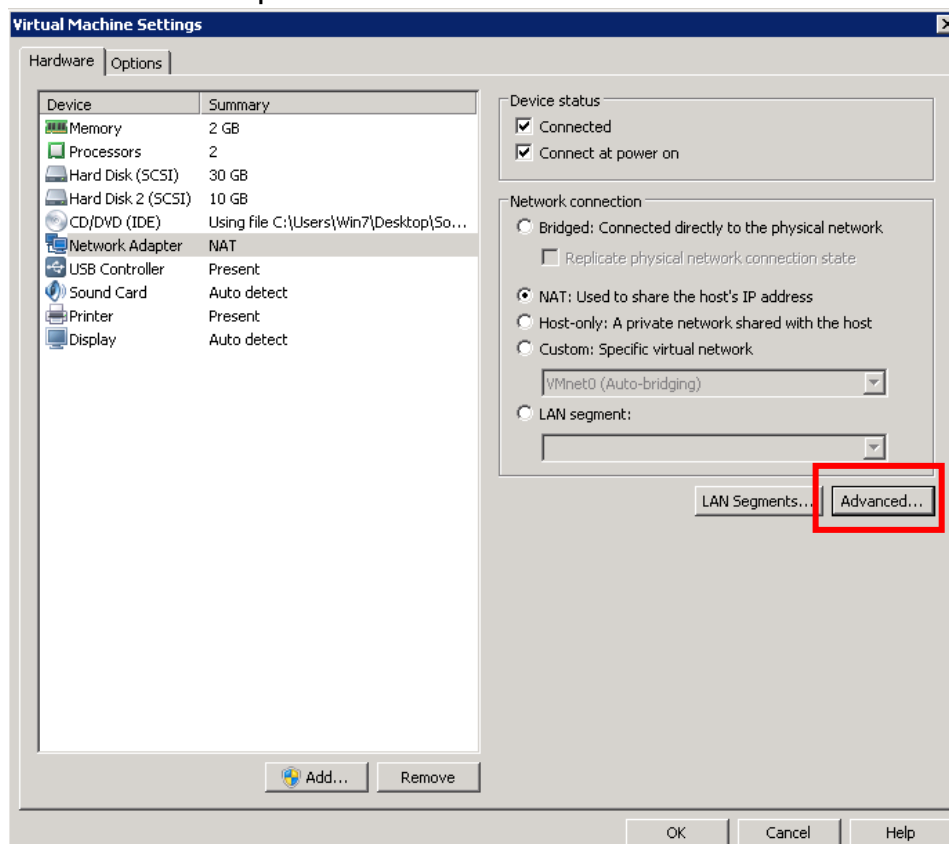
### Task 2: Configure IP on server-02

- On Server-02, configure IP by edit file in /etc/sysconfigs/network-scripts with IP address is 172.20.10.12/24 and gateway is 172.16.0.2
- Configure Server can access internet with DNS is 8.8.8.8

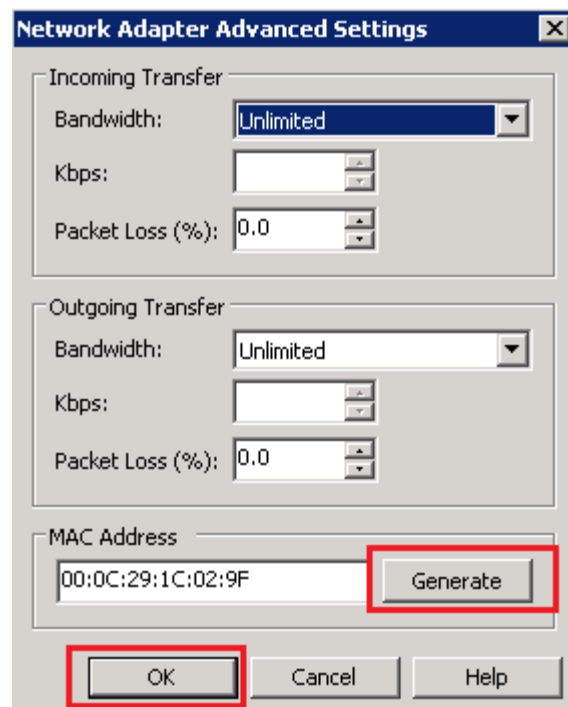
### Task 3: Basic troubleshooting

#### Change MAC address of network on Server-02

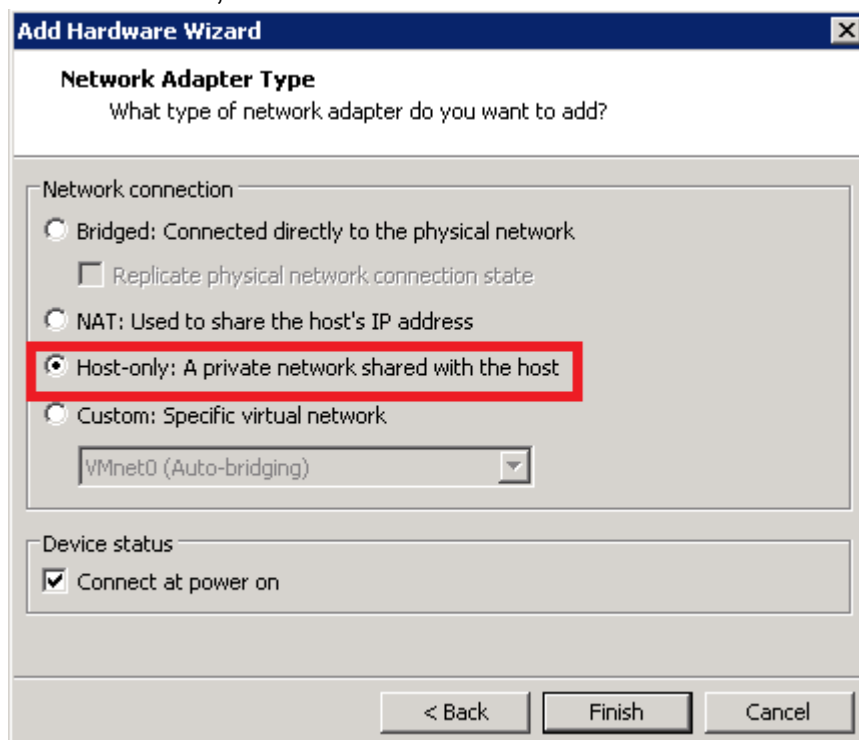
- Right click in the Virtual Machine and select "Settings..."
- Choose Network Adapter and select "Advanced..."



- Click General:



- Final, Click OK.  
Return cosole of VM and check network.
- On Server-01, add new network interface such as:



Config IP of new interface:

IP: 192.168.100.10

NETMASK: 255.255.255.0

GATEWAY: 192.168.100.2

Restart network service.

Check network:

```
# ip a
# ping robusta.vn
```

Check route:

```
# ip route
```

#### **Task 4: Configure NFS Client**

Connect to //192.168.1.51 and copy file storage.rar to you PC.

Extract this file.

Add Virtual machine to vmware workstation, power on (I moved it).

#### ***Mount NFS***

Install package nfs client (On both server-01 and Server-02):

```
# yum install nfs-utils -y
```

Set domain of server, edit file /etc/idmapd.conf:

```
Domain = robusta.local
```

Start service and add service startup when boot:

```
# systemctl start rpcbind
# systemctl enable rpcbind
```

Mount NFS:

Create new folder:

On server-01:

```
# mkdir /nfs
# mount -t nfs 172.20.10.100:/mnt/lpi/share/server-01/ /nfs
```

On server-02:

```
# mkdir /nfs
# mount -t nfs 172.20.10.100:/mnt/lpi/share/server-02/ /nfs
```



***Config fstab, open and edit file /etc/fstab:***

```
# add like follows
172.20.10.100:/mnt/lpi/share/server-01/ nfs defaults
0 0
```

***Reset and virify***

```
# reboot
# df -HT
```

**Task 5: Configure iSCSI Client**

Install package:

```
# yum -y install iscsi-initiator-utils
```

Discovery target and LUN mapping:

```
# iscsiadm --mode discovery -t sendtargets --portal
172.20.10.100
```

Retart service and login to target:

```
# systemctl restart iscsid.service
# systemctl enable iscsid.service
# iscsiadm -m node --login
```

Check new disk:

```
# fdisk -l
```

# Lab 15

## SSH

### Task 1: Configure SSH Server

- On Server-01, disable user root login from ssh:

```
# vi /etc/ssh/sshd_config
PermitRootLogin no
PermitEmptyPasswords no
PasswordAuthentication yes
```

Restart ssh service and verify.

After that, change **PermitRootLogin yes** and process all tasks below.

### Task 2: SSH Client on Linux

- Install package ssh client on 02 server:

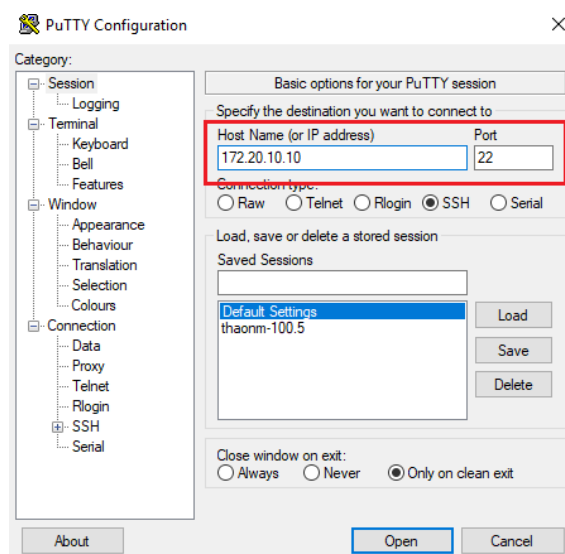
```
# yum -y install openssh-clients
```

On Server-02:

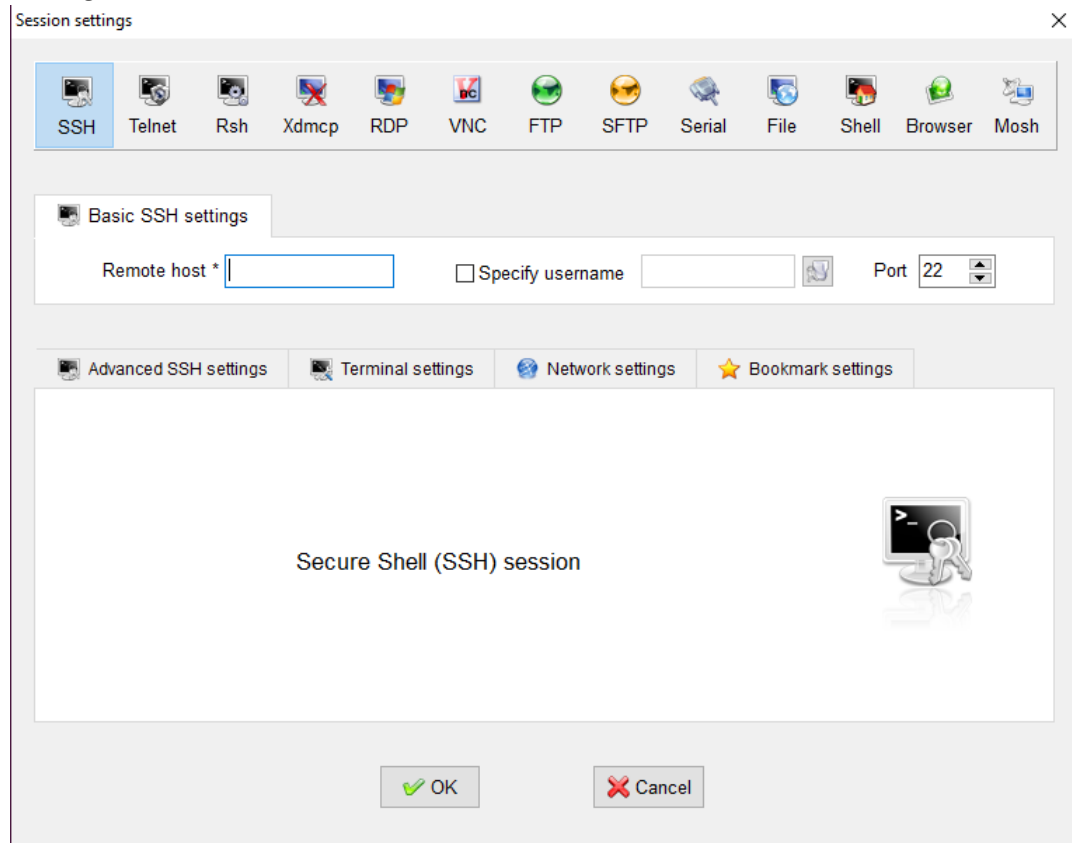
```
# ssh root@172.20.10.10
```

### Task 3: SSH Client on Windows

Using putty:



### Using MobaXterm Personal:



### Task 5: Copy using SSH

- On Server-01, create file test.txt:

```
# vi /root/test.txt
Day 1a file test
```

- On Server-01, transfer file test.txt to Server-02 using scp command:

```
# scp ..... 
```

### Task 7: SFTP

- On Server-02:  
Create folder /demo and file demoupload.txt:

```
# mkdir /demo
# vi /demo/demoupload.txt
Day 1a file demo upload sftp
```

Using SFTP client on Linux:

```
# sftp root@172.20.10.10
```

```
# show current directory on remote server
sftp> pwd
Remote working directory: <path>

# show current directory on local server
sftp> !pwd

# show files in current directory on FTP server
sftp> ls -l

# show files in current directory on local server
sftp> !ls -l

# upload a file to remote server
sftp> put /demo/demoupload.txt uploadfile.txt

download some files from remote server
sftp> get uploadfile.txt

#exit sftp
sftp> exit
```

### Task 6: SSH Keys Authentication

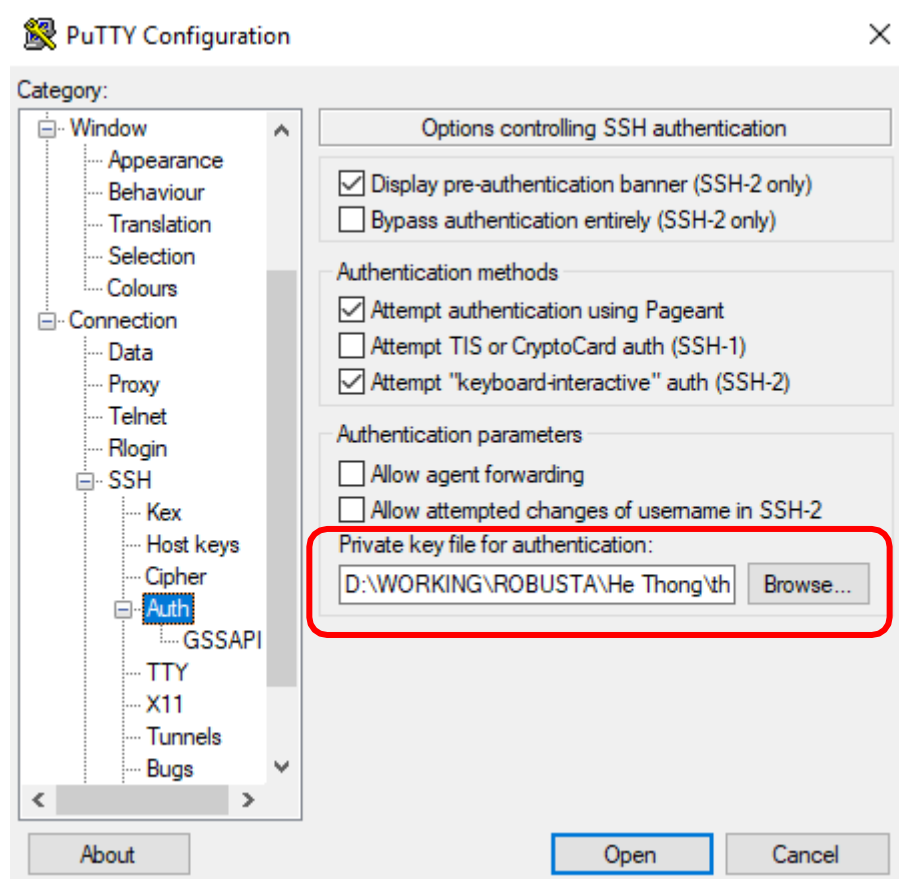
- Working this task with Server-01 such as SSH Server and Server-02 such as SSH Client.
- Create SSH key on SSH Client:

```
# ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/root/.ssh/id_rsa): # Enter
Created directory '/root/.ssh'.
Enter passphrase (empty for no passphrase): # set passphrase
(set no passphrase to Enter with empty)
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:
38:f1:b4:6d:d3:0e:59:c8:fa:1d:1d:48:86:f0:fe:74
root@trungnguyenkbuor.local
The key's randomart image is:
```

- Move private key correct file into home directory of user root and set permission for security.

- Transfer public key to SSH Server.
- Configure SSH using key authentication
- Reset SSH service and verify.

Using RSA key on Windows with putty:



## Lab 16

# User Interfaces and Desktops

### Task 1: Use X11 on Linux

- Perform this task on Server-01
- Install X11 such as below:

```
# yum install xorg-x11-server-Xorg xorg-x11-xauth xorg-x11-apps xterm -y
```

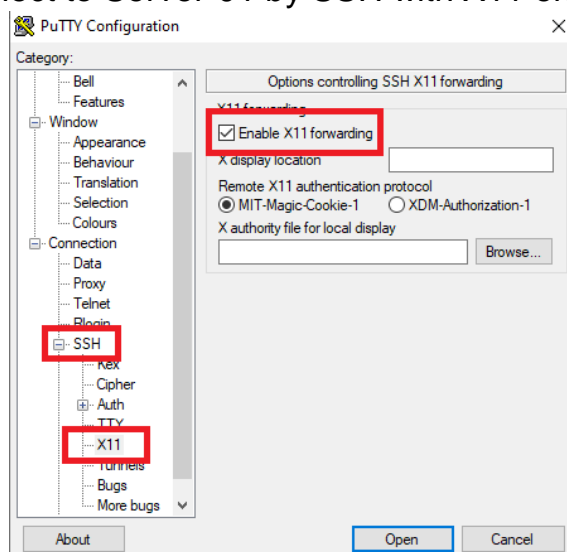
- Using putty, connect to Server-01 by SSH.
- Use command:

```
# xclock &  
  
# xeyes &  
  
# xterm &
```

- Enable SSH allow X11 (restart ssh service after edited):

```
X11Forwarding yes  
X11DisplayOffset 10  
X11UseLocalhost no
```

- On windows 7, download and install Xming:  
<https://sourceforge.net/projects/xming/>
- Using putty, connect to Server-01 by SSH with X11 enable:



- Use command:

```
# xclock &  
  
# xeyes &  
  
# xterm &
```

### Task 2: GNOME desktop

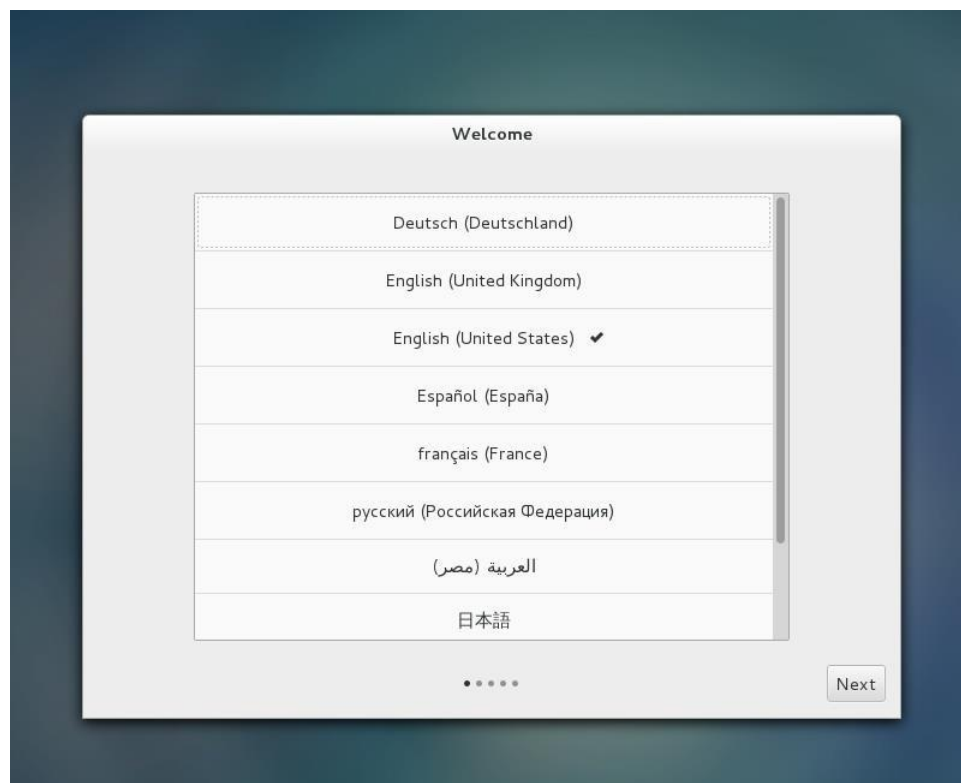
- Install GNOME with yum, you can login with console:

```
# yum -y groups install "GNOME Desktop"
```

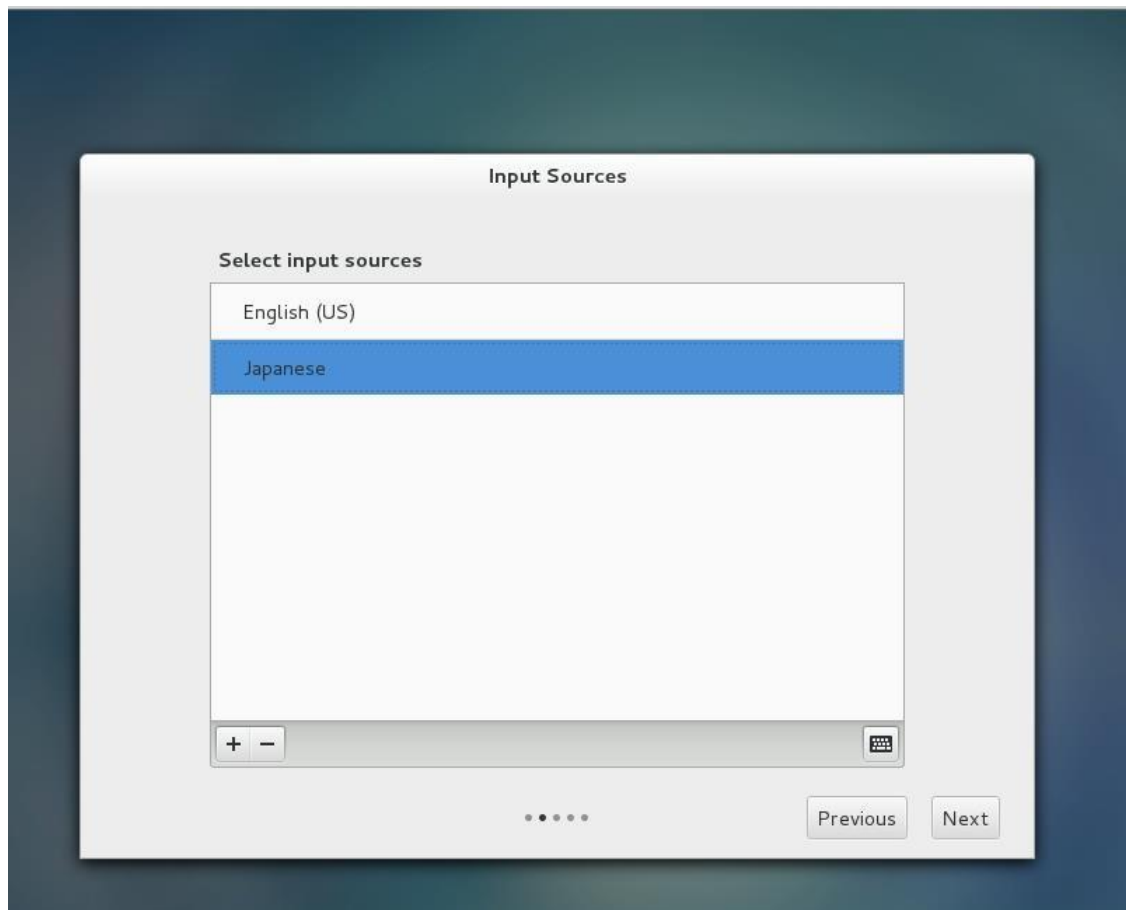
- Start GNOME Desktop:

```
# startx
```

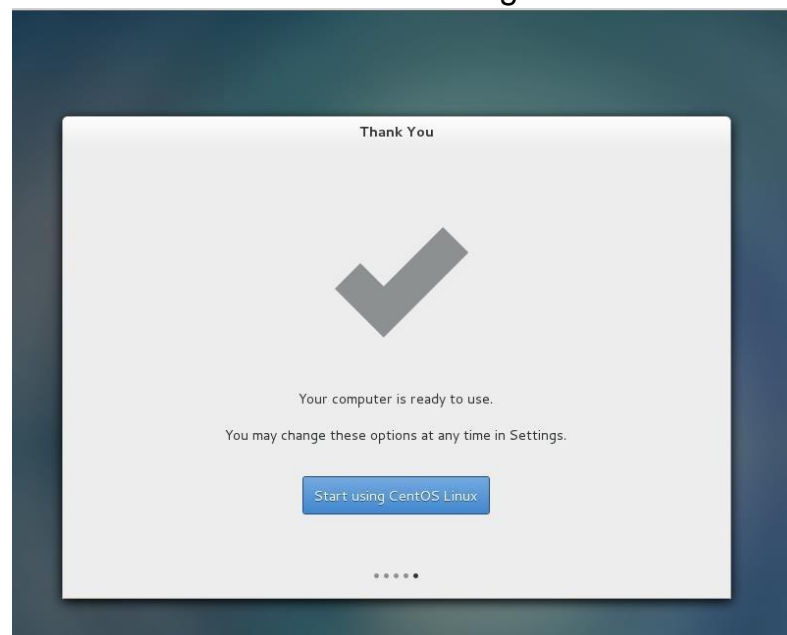
- GNOME Desktop Environment starts. For first booting, initial setup runs like follows. Select System language first.



- Select your keyboard type.



- Add online accounts if you'd like to. You can skip this step.
- Configuration finished and click "Start using CentOS Linux".



- Reboot system. What the target using after boot?
- Set default target is GUI. Reboot server and verify.



### Task 3: KDE desktop

- Perform this task on Server-02
- Installation of KDE desktop environment:

```
# yum groupinstall "KDE Plasma Workspaces" "X Window System"
```

- Update default target

```
# systemctl set-default graphical.target
```

- All done. Reboot your system, accept license, verify and compare with GNOME

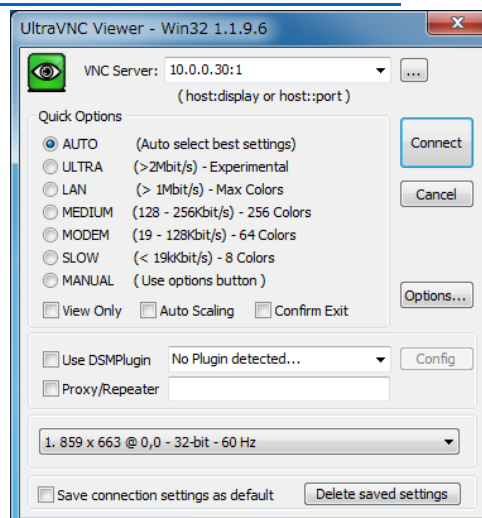
### Task 4: Remote desktop with VNC

- Perform this task on Server-01
- Install VNC server with tigervnc.
- Create new user remote01 grant all root privileges.
- Create VNC remote for root and remote01 user.
- Disable firewall such as below:

```
# systemctl stop firewalld  
  
# systemctl disable firewalld
```

- Install VNC viewer on Windows 7 Remote desktop to Lab. Download from the site below to install UltraVNC.

<http://www.uvnc.com/downloads/ultravnc.html>



### Task 5: Remote desktop with xrdp

- Perform this task on Server-01, require tigervnc install on server.
- Install epel repository:

```
# rpm -Uvh https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
```

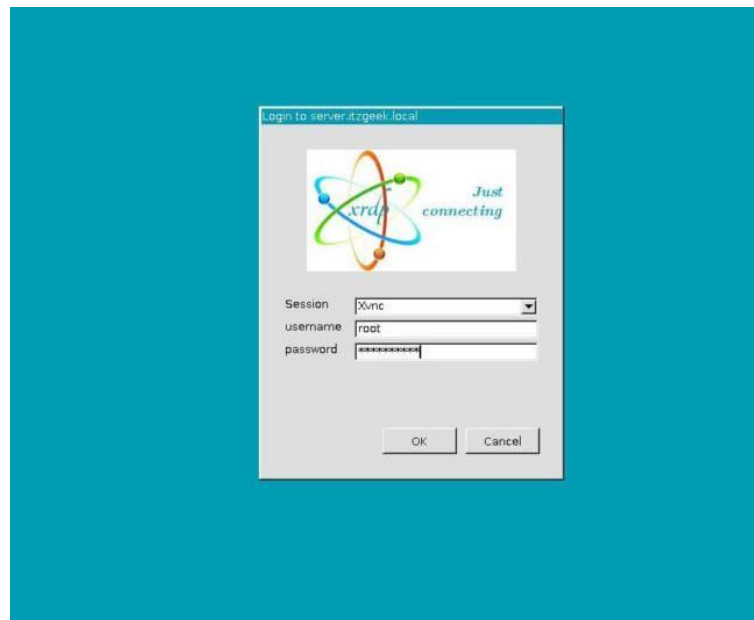
- Install xrdp with yum:

```
# yum -y install xrdp
```

- Start xrdp service:

```
# systemctl start xrdp.service  
# systemctl enable xrdp.service
```

- From Windows 7 of Remote desktop, using remote desktop client (mstsc) connect to CentOS Server.



## Lab 17

# Essential System Services

### Task 1: Maintenance system time

- Check current hardware clock and content on /etc/adjtime.
- Change hardware clock:

```
# hwclock set date="10/14/2010 16:55:05"  
# hwclock show
```

- Check agent current hardware clock and content on /etc/adjtime.
- Install chrony package on both 02 server.
- Configure Server-01 such as Network Time Server.
- Configure Server-02 such as NTP client.
- Change time/date on both 02 server and verify NTP working.

### Task 2: System logging

- Overview:



- Install rsyslog:

```
# yum -y install rsyslog
```

- Configure Log Managed Server to receive logs from client servers. On Server-01, edit file **/etc/rsyslog.conf**:

```
# uncomment such as below:  
# Provides UDP syslog reception  
$ModLoad imudp  
$UDPServerRun 514  
  
# Provides TCP syslog reception  
$ModLoad imtcp  
$InputTCPListener 514
```

- Start rsyslog service:

```
# systemctl start rsyslog.service
```

- Verify the syslog server listening.

```
# netstat -antup | grep 514
tcp        0      0 0.0.0.0:514          0.0.0.0:*           LISTEN     759/rsyslogd
tcp6       0      0 :::514              :::*                 LISTEN     759/rsyslogd
udp        0      0 0.0.0.0:514          0.0.0.0:*           759/rsyslogd
udp6       0      0 :::514              :::*                 759/rsyslogd
```

- Install rsyslog on Server-01:

```
# yum -y install rsyslog
```

- At the end of file place the following line to point the client message log to the server, on Server-02, edit file **/etc/rsyslog.conf**:

```
# uncomment such as below:

$ActionQueueFileName fwdRule1 # unique name prefix for spool files
$ActionQueueMaxDiskSpace 1g    # 1gb space limit (use as much as
possible)
$ActionQueueSaveOnShutdown on  # save messages to disk on shutdown
$ActionQueueType LinkedList    # run asynchronously
$ActionResumeRetryCount -1     # infinite retries if host is down

#add to end of file
*.info;mail.none;authpriv.*;cron.*    @172.20.10.12:514
```

- Start rsyslog service:

```
# systemctl start rsyslog.service
```

- On Log Server (Server-01):

```
# tail -10 /var/log/secure
```

- If you'd like to separate logs for each Host, for each date, Configure like follows on Log Server:

```
# vi /etc/rsyslog.conf

# add: define logfiles

$template
Secure_log, "/var/log/secure.d/%fromhost%_%$year%%$month%%$day%.secure"
```

```
# add: specify logfiles defined above
authpriv.* -?Secure_log
```

- On Log Server (Server-01):

```
# systemctl restart rsyslog
# ll /var/log/secure.d
```

### Task 3: Mail Transfer Agent (MTA) basics

#### Configure alias

- Edit file /etc/aliases, At the end of the list is a commented out line, uncomment it and change the name such as yourname:

```
root: trungnguyenkbuor
```

- Re read the aliases file:

```
# sendmail -bi
or
# newaliases
```

#### Installation mail command on CentOS

- Installation mail command with mailx package:

```
# yum install -y mailx
```

- Create user with username such as your-name:

```
# useradd trungnguyenkbuor
# passwd trungnguyenkbuor
```

- Switch to user hv01:

```
# su hv01
```

- Create new email send to root and auto forward to your-name user (ex: trungnguyenkbuor):

```
$ mail root
Subject: Testing Email
day la mail gui cho root nhung forward cho tui
```

- Press CTRL+D to submit message
- Exit user hv01 and switch to your-name user (ie: trungnguyenkbuor) with run scriptlogon:

```
$ exit  
  
# su - trungnguyenkbuor
```

- Log on to your username:
- Check mail with mail command:

```
$ mail  
  
Heirloom Mail version 12.5 7/5/10.  Type ? for help.  
"/var/spool/mail/trungnguyenkbuor": 1 message 1 new  
>N 1 hv01@localhost.local  Fri Dec  8 17:44  22/862  
"Testing Email"  
&
```

- Type 1 after "&" sign for see new email 1:

```
& 1
```

- If you want exit, press q and enter.

### Task 4: Printer

- Perform this task on Server-01
- Install cups and cups-pdf package
- Edit file /etc/cupsd.conf such as:

```
Listen *:631  
  
<Location />  
.....  
Allow All  
</Location>  
  
<Location /admin>  
.....  
Allow All  
</Location>  
  
<Location /admin/conf>  
.....  
Allow All  
</Location>
```

- Start service cups.
- Using Web browser on Windows 7, connect to <http://ip:631> and verify.

# Lab 18

## Security

Perform this lab on Server-01

### Task 1: Working with Selinux

- Check current Selinux on system with `getenforce` and `sestatus` command.
- Disabled Selinux
- Reboot your system and verify.

### Task 2: Working with TCPwappers

- Edit file `/etc/hosts`, configure nodename such as:
  - o `mail.classroom.com`      `172.20.10.1`
  - o `server-02.classroom.com`      `172.20.10.12`
- Configure deny all ssh client from domain `classroom.com` but allow only `mail.classroom.com` should be connection.

### Task 3: Working with Firewall

- Start `firewalld` services.
- Open port for printer server, `webmin` on `server-01`.
- Enabled SELinux
- Change Listen port 22 of SSH to 2222.
- Allow port 2222 from `firewalld`.
- Using SSH client, connect to `Server-01` with port 2222.
- Using command:

```
# semanage port -a -t ssh_port_t -p tcp 2222
```

- Re-connect ssh and verify.

## Lab 19

# Configure IPv6

Configure ensxx with a static ipv6 addresses as follows (keep current IPv4):

- Configure a Static IPv6 address in Server-01 as fddb:fe2a:ab1e::c0a8:64/64.
- Configure a Static IPv6 address in Server-02 as fddb:fe2a:ab1e::c0a8:02/64.
- The changes should be permanent even after the reboot.