

LAB 4: DHCP SERVER and CLIENTS

OBJECTIVES

This lab is design to demonstrate how to setup a DHCP server for an internal subnet. You will also create a virtual machine (VM) and install CentOS 7 workstation for DHCP Client. You will test DHCP server from CentOS 7 workstation.

OVERVIEW

Two different network interface cards will be used. The first network interface card (NIC) ens32 will be connected to external network with dynamic IP addressing method (DHCP). External DHCP server will assign the IP address for ens32. The network interface card ens33 will be connected to an internal subnet with a static IP address. The IP address 172.16.1.1 will be assigned to ens33 with 255.255.255.0 subnet mask. These static IP address 172.16.1.1 will be the gateway address of the subnet. The static IP address 172.16.1.1 will be the gateway address of the subnet.

The server will provide DHCP service to the internal network (ens33). Even though, the server is the DHCP client itself (ens32) from the external DHCP Server. All the servers will be used static IP addresses, but all other workstations will be the DHCP clients that configure network settings by this DHCP server.

All the workstations will get the IP configuration information automatically. It will reduce tremendous amount work when systems administrators have to configure network settings lot of workstations. It also makes easy to deploy a workstation image to multiple computers through network.

PROCEDURE I

[1] DHCP Server setup

```
[sysadmin@hadrian ~]# sudo yum -y install dhcp
```

```
[sysadmin@hadrian ~]# sudo cp /usr/share/doc/dhcp-4.2.5/dhcpd.conf.example  
/etc/dhcp/dhcpd.conf
```

```
[sysadmin@hadrian ~]# sudo vi /etc/dhcpd.conf
```

```
#
```

```
# DHCP Server Configuration file.
```

```
#
```

```
ddns-update-style interim;
```

```
ignore client-updates;
```

```
subnet 172.16.1.0 netmask 255.255.255.0 {  
    option routers 172.16.1.1;  
    option subnet-mask 255.255.255.0;  
    option domain-name "csusbcoyote.net";  
    option domain-name-servers 139.182.2.1, 139.182.2.6;  
    option time-offset -28800; # Pacific Standard Time  
  
    range dynamic-bootp      172.16.1.101      172.16.1.254;  
    default-lease-time 21600;  
    max-lease-time 43200;  
}
```

```
[root@hadrian /root]# systemctl start dhcpd
```

```
[root@hadrian /root]# systemctl enable dhcpd
```

Question: What does "ddns-update-style interim;" mean?

Question: What does "ignore client-updates;" mean?

Question: How to find out how many IP addresses are leased on DHCP server?

Question: How to add your own DNS on the DHCP so that your DHCP clients get new DNS settings?

Question: How to reserve an IP address to the particular machine so that the machine get same IP address every time the network started?

Question: Why subnetting is important?

*Question: What following command do? **systemctl restart dhcpd***

*Question: What following command do? **systemctl enable dhcpd***

Troubleshoot hint:

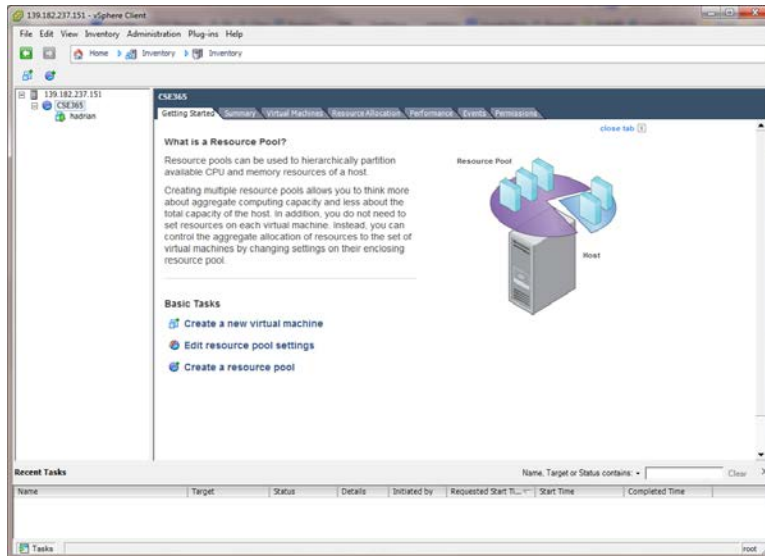
You have to restrict and specify which network interface should listen on the dhcp request.

(Check /etc/sysconfig/dhcpd file for hint)

PROCEDURE II

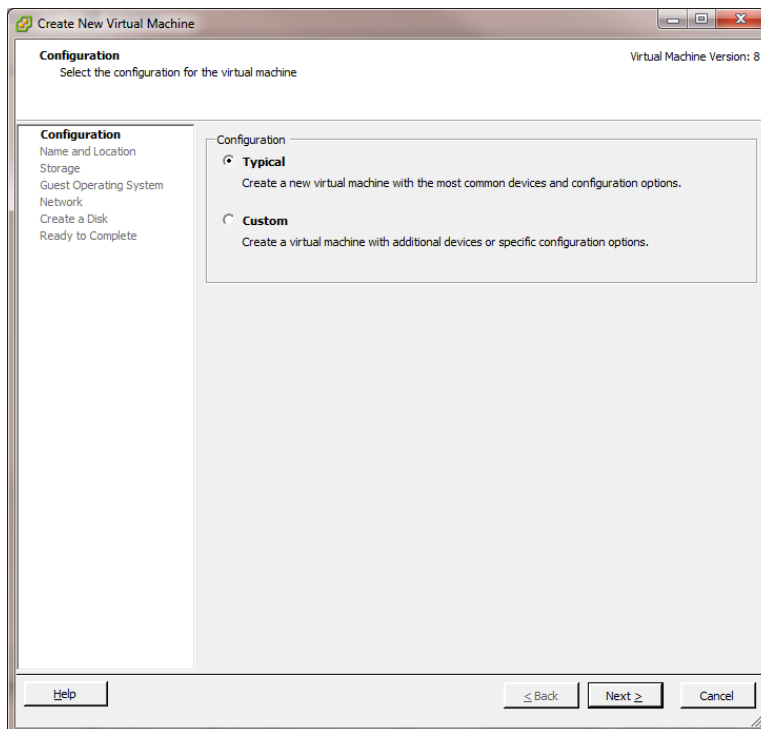
[1] Creating a virtual machine: lin

1. Click on “Sysadmin#” Resource Pool and Click on “Create a new virtual machine” on Basic Tasks



Please make sure that you create VM under your resource pool.

2. Select “Typical” and Click “Next”



3. Type “lin-sysadminID” in “Name:” field

The screenshot shows the 'Create New Virtual Machine' wizard at the 'Name and Location' step. The left sidebar lists the configuration steps: Configuration, Name and Location (selected), Storage, Guest Operating System, Network, Create a Disk, and Ready to Complete. The main area has a 'Name:' label and a text input field containing 'lin-29'. Below the input field, there is explanatory text: 'Virtual machine (VM) names may contain up to 80 characters and they must be unique within each vCenter Server VM folder. VM folders are not viewable when connected directly to a host. To view VM folders and specify a location for this VM, connect to the vCenter Server.' At the bottom, there are buttons for 'Help', '< Back', 'Next >', and 'Cancel'.

Create New Virtual Machine Virtual Machine Version: 8

Name and Location
Specify a name and location for this virtual machine

Configuration
Name and Location
Storage
Guest Operating System
Network
Create a Disk
Ready to Complete

Name:
lin-29

Virtual machine (VM) names may contain up to 80 characters and they must be unique within each vCenter Server VM folder.
VM folders are not viewable when connected directly to a host. To view VM folders and specify a location for this VM, connect to the vCenter Server.

Help < Back Next > Cancel

4. Select “datastore1” and Click “Next”

The screenshot shows the 'Create New Virtual Machine' wizard at the 'Storage' step. The left sidebar lists the configuration steps: Configuration, Name and Location, Storage (selected), Guest Operating System, Network, Create a Disk, and Ready to Complete. The main area is titled 'Select a destination storage for the virtual machine files:'. It contains a table with storage options. The first row, 'datastore1', is selected. Below the table is a checkbox for 'Disable Storage DRS for this virtual machine' which is unchecked. Another section titled 'Select a datastore:' contains an empty table. At the bottom, there are buttons for 'Help', '< Back', 'Next >', and 'Cancel'.

Create New Virtual Machine Virtual Machine Version: 8

Storage
Select a destination storage for the virtual machine files

Configuration
Name and Location
Storage
Guest Operating System
Network
Create a Disk
Ready to Complete

Select a destination storage for the virtual machine files:

Name	Drive Type	Capacity	Provisioned	Free	Type	Thin Pro
datastore1	Non-SSD	227.75 GB	4.37 GB	226.19 GB	VMFS5	Supporte

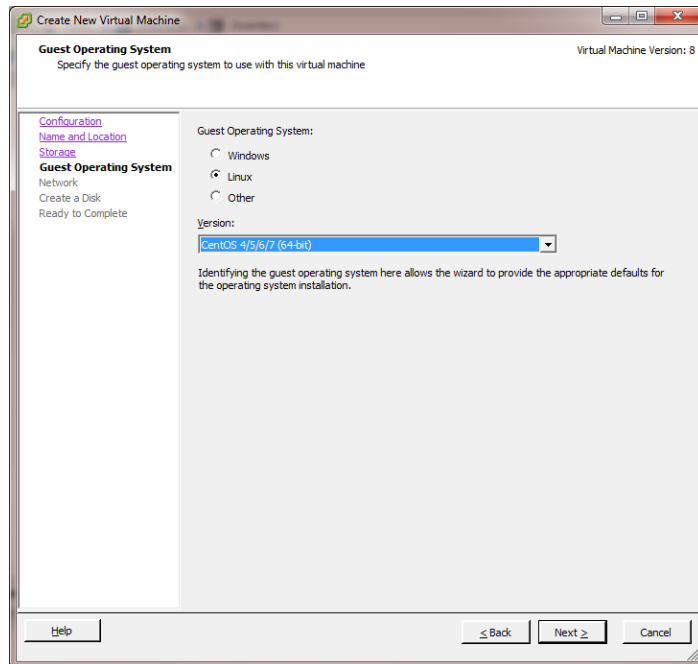
☐ Disable Storage DRS for this virtual machine

Select a datastore:

Name	Drive Type	Capacity	Provisioned	Free	Type	Thin Provi
------	------------	----------	-------------	------	------	------------

Help < Back Next > Cancel

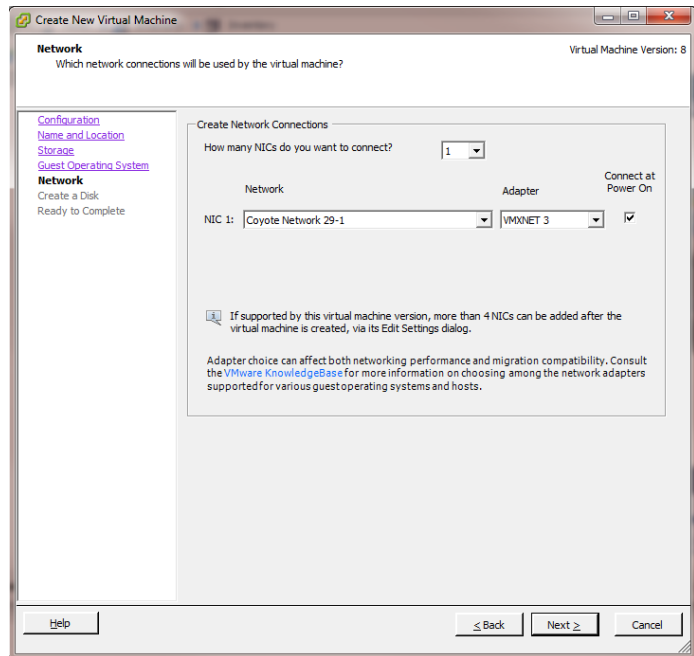
5. Select “Linux” on Guest Operating System: and select “CentOS (64bit) and click “Next”



What is the limitation of 32bit OS?

What are the differences between 32 bit OS and 64 bit OS?

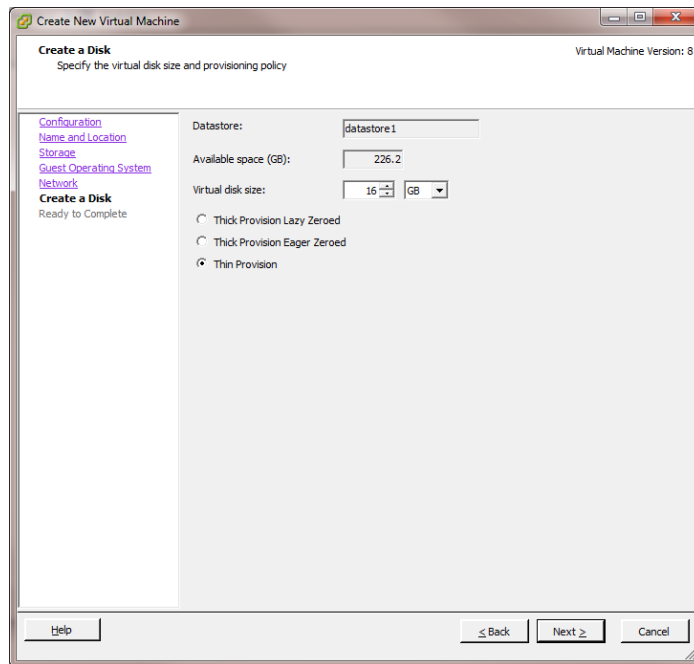
6. Select “Coyote Network #” for NIC1 and Click “Next” Select the NIC as VMXNET3



Why we need only one NIC instead of two not like hadrian?

What are the differences between E100, VMXNET 2 (Enhanced), and VMXNET3?

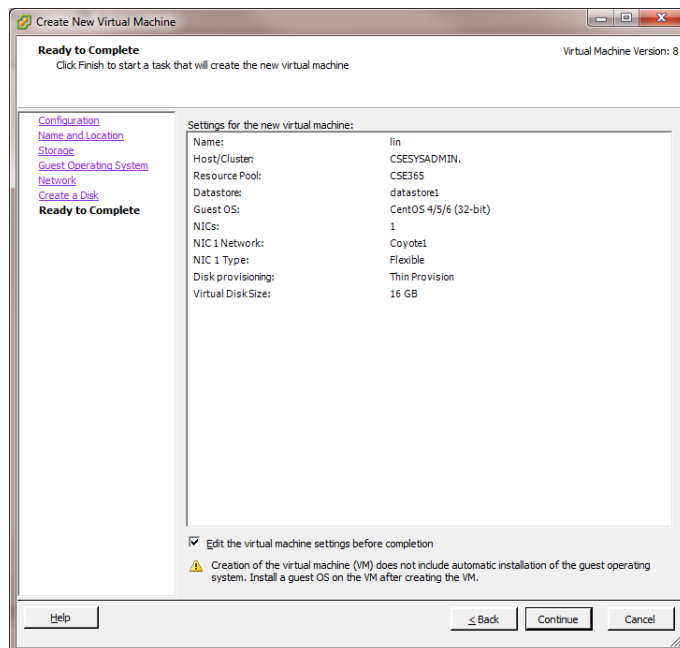
7. Set virtual disk size as 16GB and select “Thin Provision” and Click “Next”



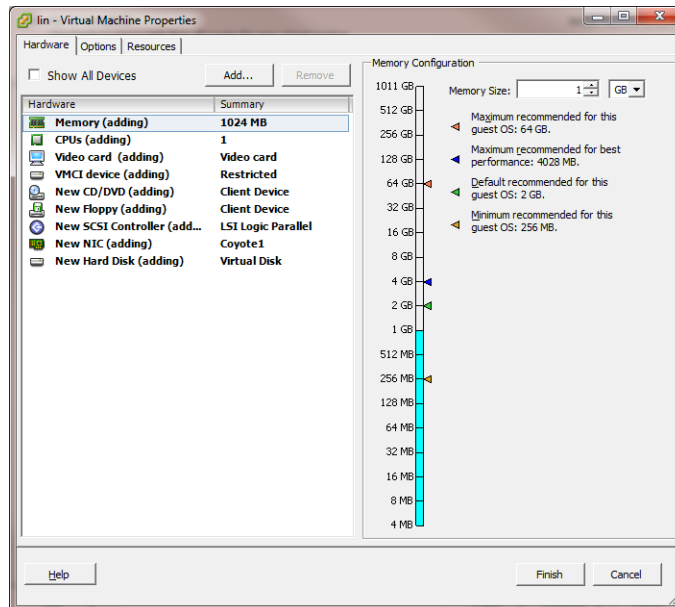
What are the differences between Thick Provisioning Lazy Zeroed and Thick Provisioning Eager Zeroed?

What is Thin Provision and why we use Thin Provision?

8. Check “Edit the virtual machine settings before completion” and Click on “Continue”



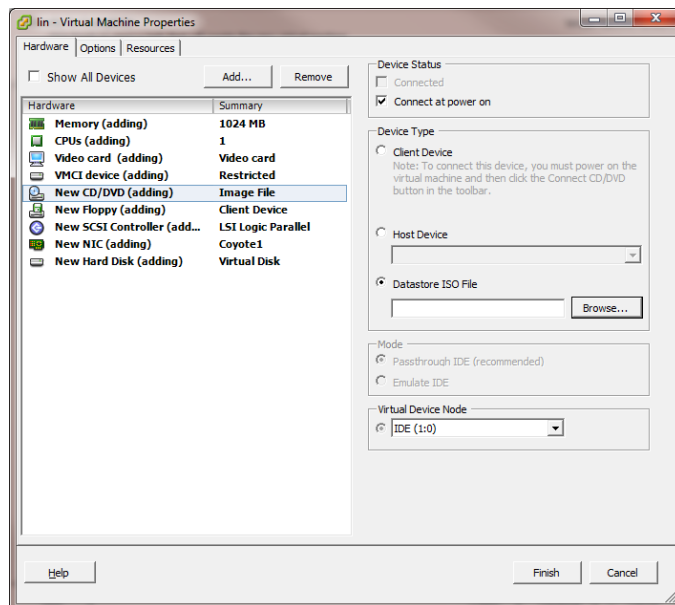
9. Click on triangle near 1GB and Click on “New CD/DVD (adding)”



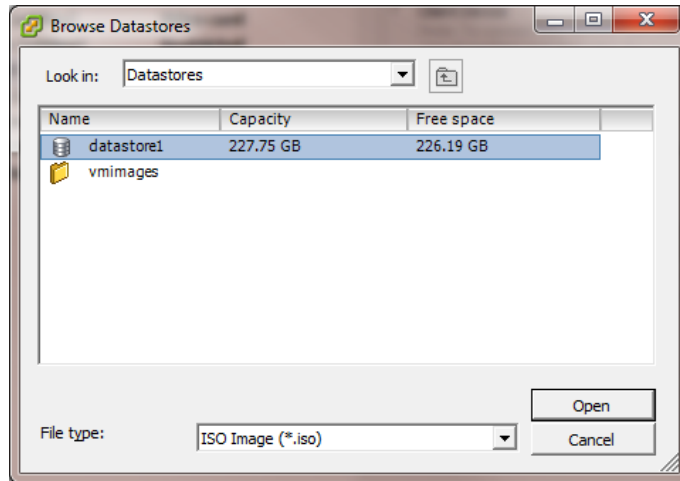
In production environment, you might use much more than we use here.

This is just an experimental lab environment settings.

10. Click on “Datastore ISO File” and Check “Connect on power on” and Click on “Browse...”

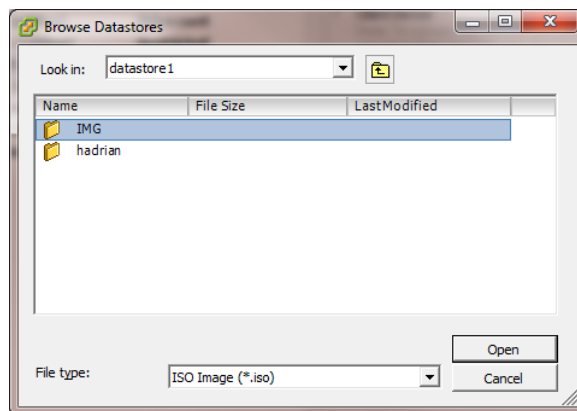


11. Click on “datastore1” and Click on “Open”

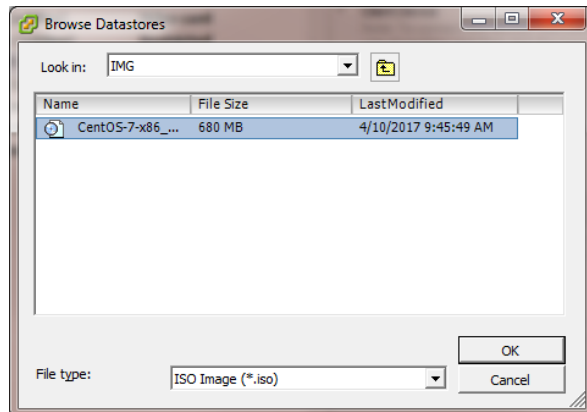


How can we add an external storage on the data stores?

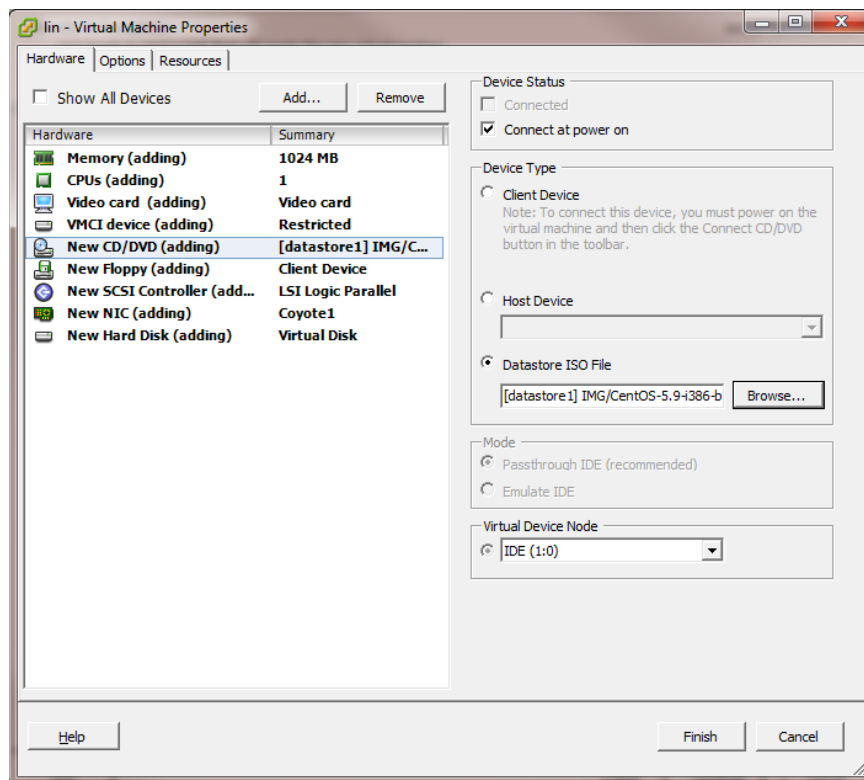
12. Click on “IMG” and Click on “Open”



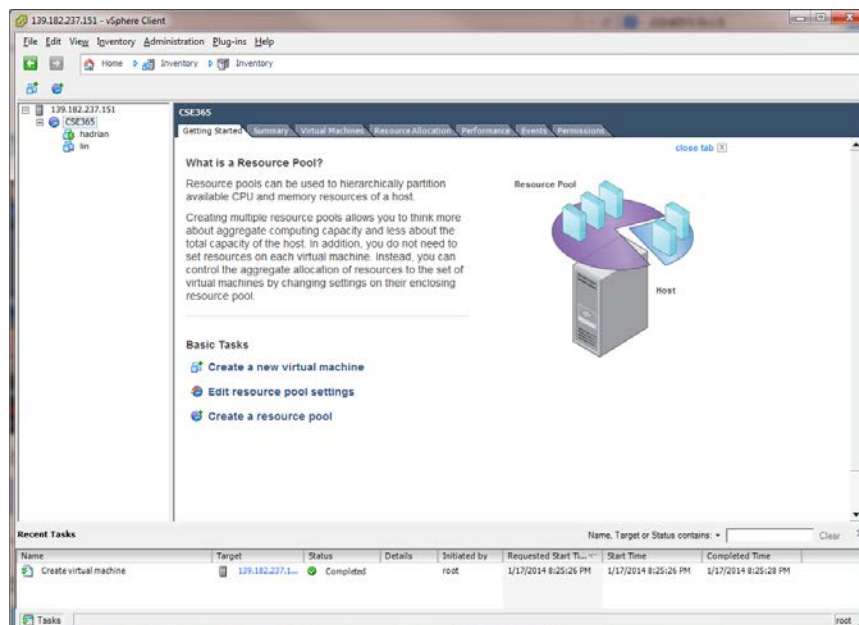
Select “CentOS-7-x86...” and Click “OK”



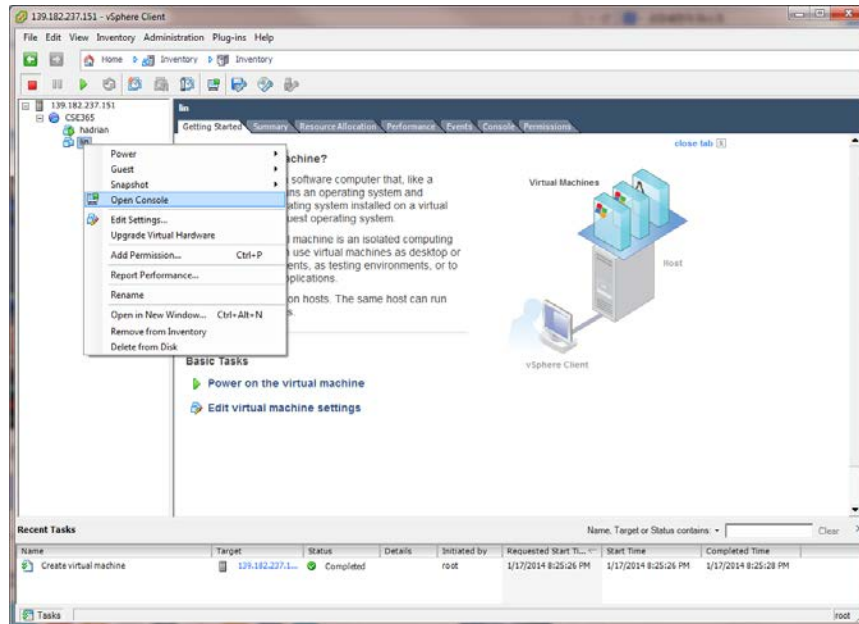
13. Click “Finish”



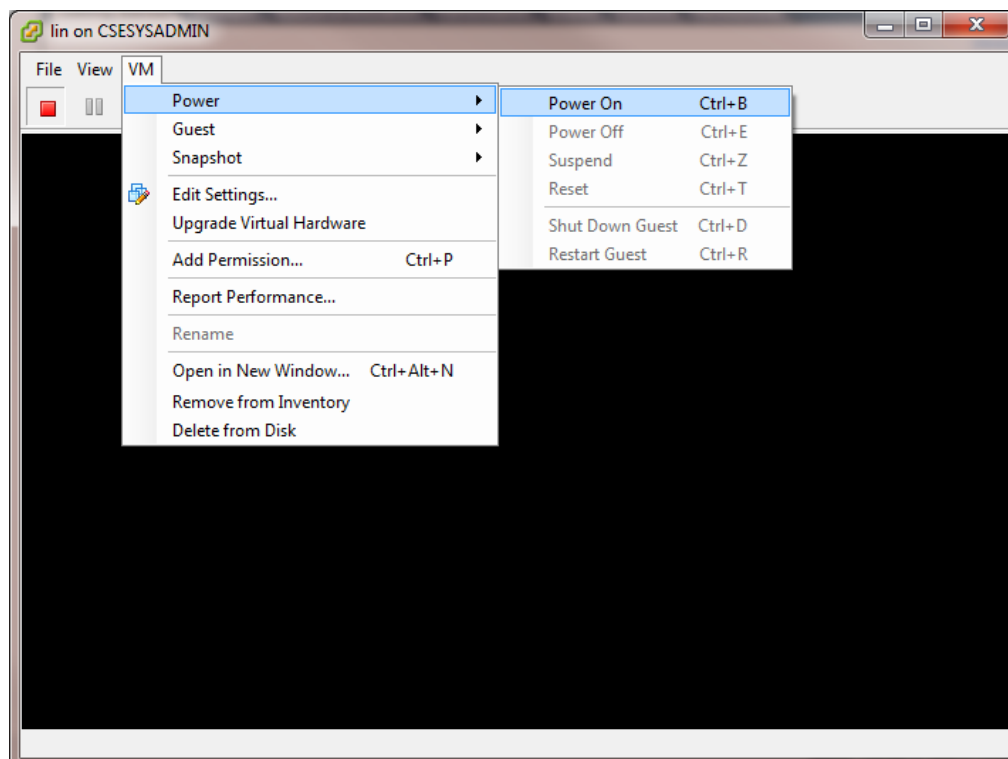
14. The virtual machine “lin” has been created.



15. Right click on “lin” and Click on “Open Console”



16. Click on “VM” and Click on “Power” and Click on “Power On” or click on the green triangle to turn on the ‘lin”

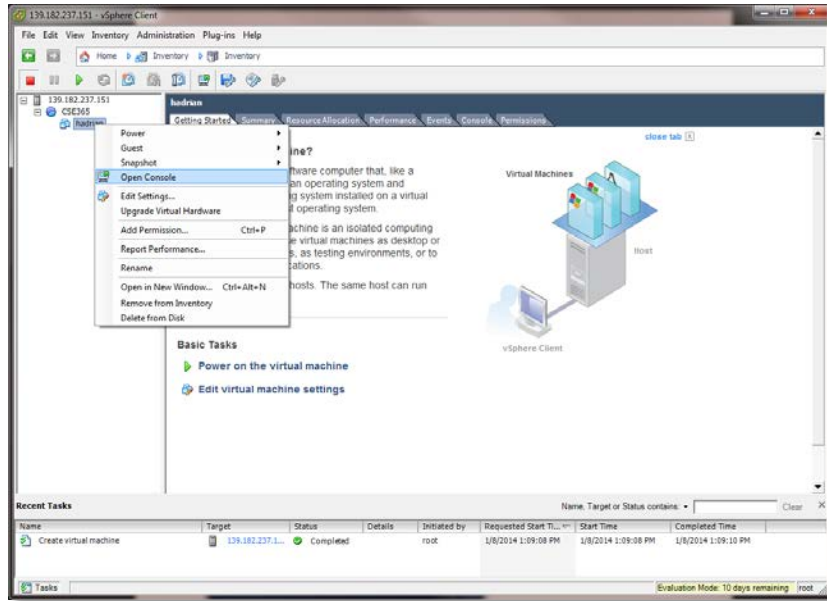


PROCEDURE III

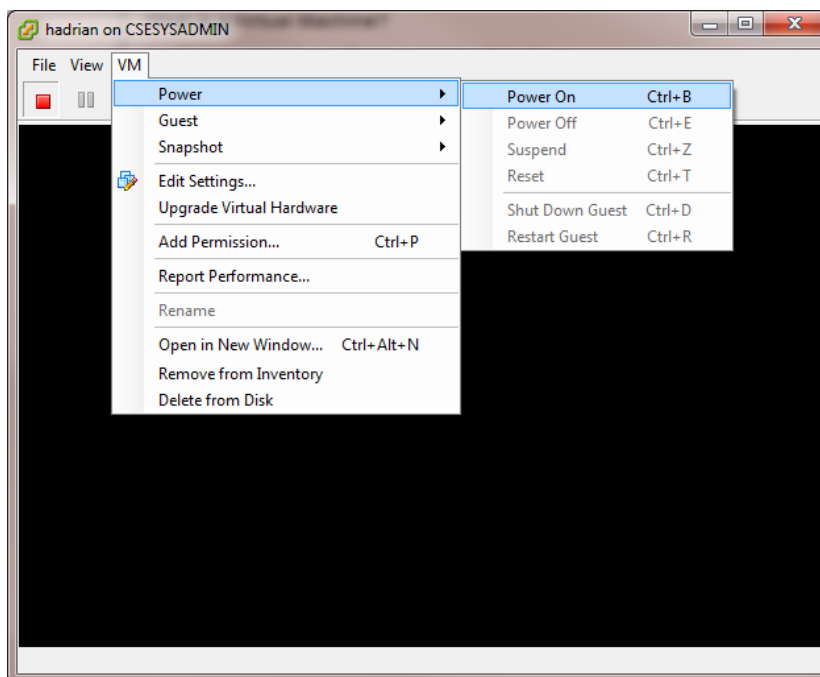
CentOS Linux Installation

To install CentOS Linux on the virtual machine **hadrian**, you have to click on the vSphere client:

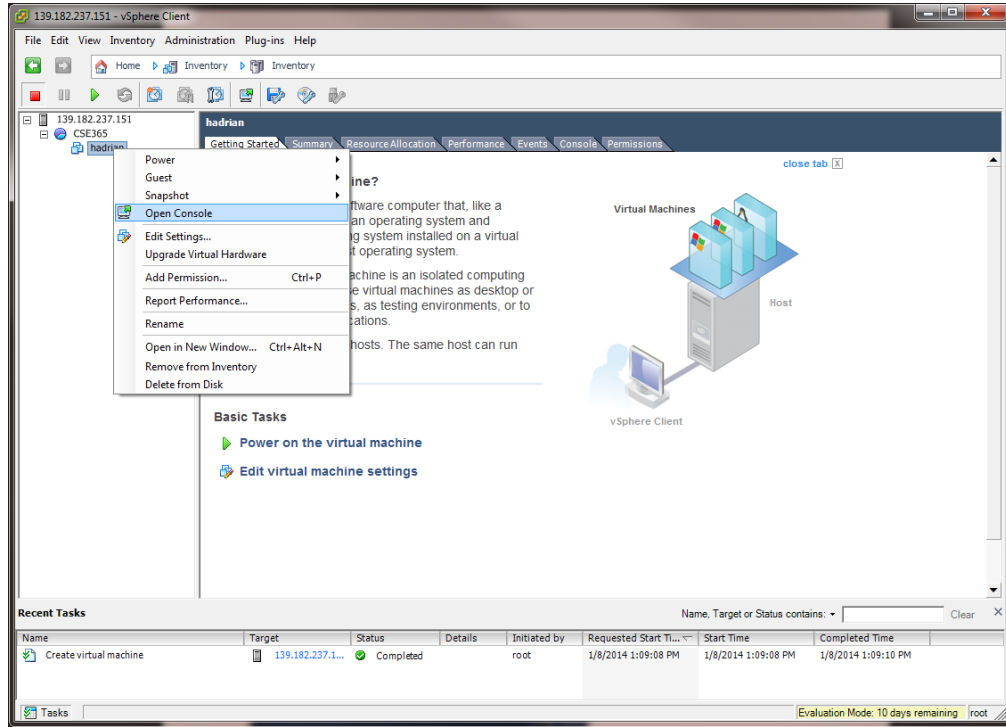
1. Right click on **hadrian** and Click **Open Console**.



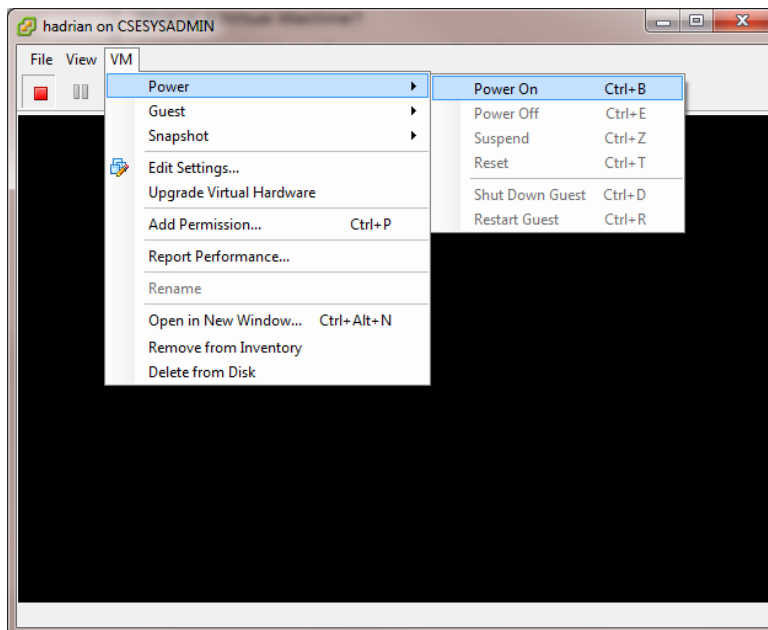
2. Click **VM** and Click **Power** and Click **Power On** or Click on the green triangle to turn on the **hadrian**.



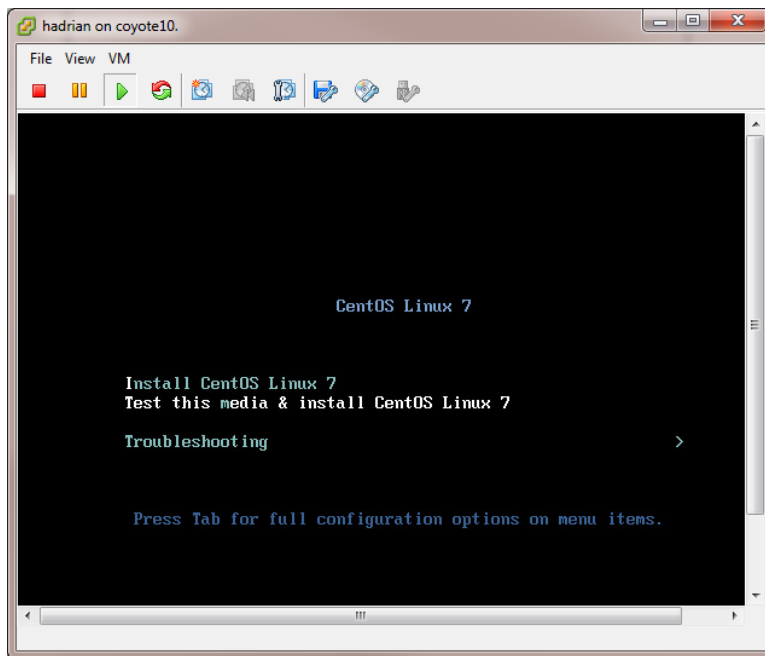
3. Right click on **hadrian** and Click **Open Console**.



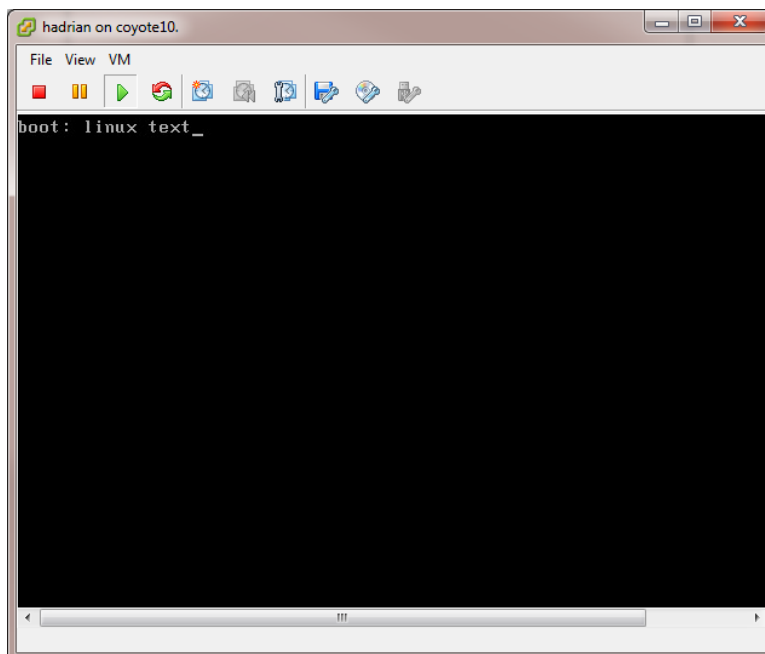
4. Click **VM** and Click **Power** and Click **Power On** or Click on the green triangle to turn on the **hadrian**.



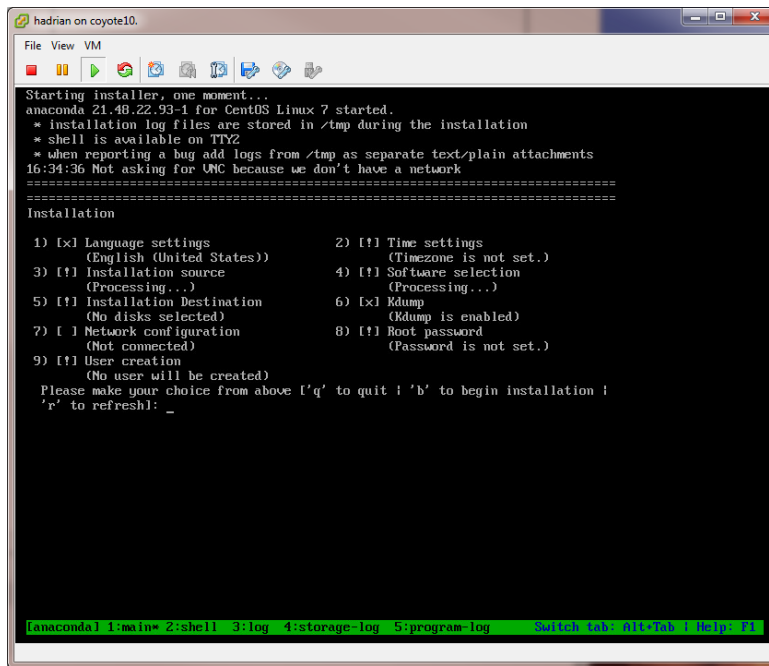
5. Press Esc key.



6. Type "linux text"



7. Press C for continue.



The screenshot shows the Anaconda installer window titled "hadrian on coyote10". The window has a menu bar with "File", "View", and "VM". Below the menu bar is a toolbar with various icons. The main content area displays the following text:

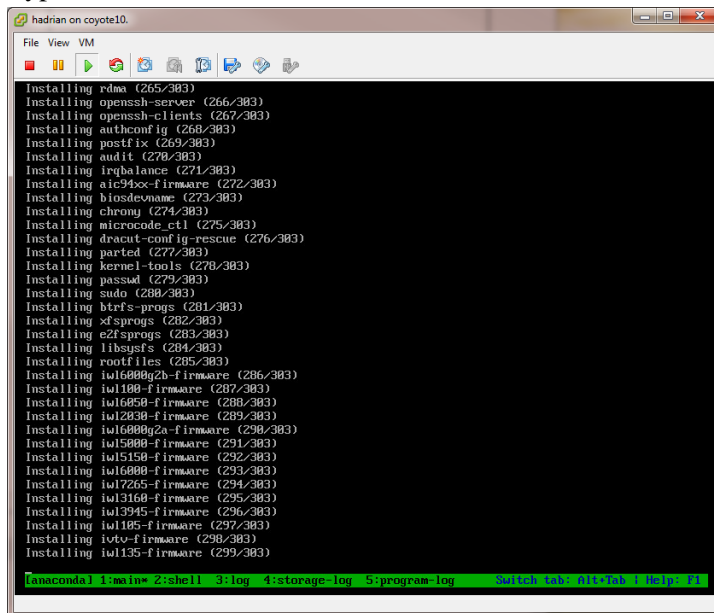
```
Starting installer, one moment...
anaconda 21.48.22.93-1 for CentOS Linux 7 started.
* installation log files are stored in /tmp during the installation
* shell is available on TTY2
* when reporting a bug add logs from /tmp as separate text/plain attachments
16:34:36 Not asking for UNC because we don't have a network
=====
Installation

1) [x] Language settings          2) [!] Time settings
    (English (United States))      (Timezone is not set.)
3) [!] Installation source        4) [!] Software selection
    (Processing...)                (Processing...)
5) [!] Installation Destination    6) [x] Kdump
    (No disks selected)            (Kdump is enabled)
7) [ ] Network configuration      8) [!] Root password
    (Not connected)                (Password is not set.)
9) [!] User creation
    (No user will be created)

Please make your choice from above ! 'q' to quit ! 'b' to begin installation !
'r' to refresh! : _
```

At the bottom of the window, there is a status bar with the text: `[anaconda] 1:main* 2:shell 3:log 4:storage-log 5:program-log` and a button labeled "Switch tab: Alt+Tab | Help: F1".

8. Type b for boot



The screenshot shows the Anaconda installer window titled "hadrian on coyote10". The window has a menu bar with "File", "View", and "VM". Below the menu bar is a toolbar with various icons. The main content area displays the following text:

```
Installing rdma (265/383)
Installing openssh-server (266/383)
Installing openssh-clients (267/383)
Installing authconfig (268/383)
Installing postfix (269/383)
Installing audit (270/383)
Installing irqbalance (271/383)
Installing aic94xx-firmware (272/383)
Installing biosdevname (273/383)
Installing chrony (274/383)
Installing microcode_ctl (275/383)
Installing dracut-config-rescue (276/383)
Installing parted (277/383)
Installing kernel-tools (278/383)
Installing passwd (279/383)
Installing sudo (280/383)
Installing btrfs-progs (281/383)
Installing xfsprogs (282/383)
Installing e2fsprogs (283/383)
Installing libysfs (284/383)
Installing rootfiles (285/383)
Installing iwl6000g2b-firmware (286/383)
Installing iwl100-firmware (287/383)
Installing iwl6050-firmware (288/383)
Installing iwl2830-firmware (289/383)
Installing iwl6000g2a-firmware (290/383)
Installing iwl5800-firmware (291/383)
Installing iwl5150-firmware (292/383)
Installing iwl6000-firmware (293/383)
Installing iwl7265-firmware (294/383)
Installing iwl3160-firmware (295/383)
Installing iwl3945-firmware (296/383)
Installing iwl195-firmware (297/383)
Installing vtv-firmware (298/383)
Installing iwl135-firmware (299/383)
```

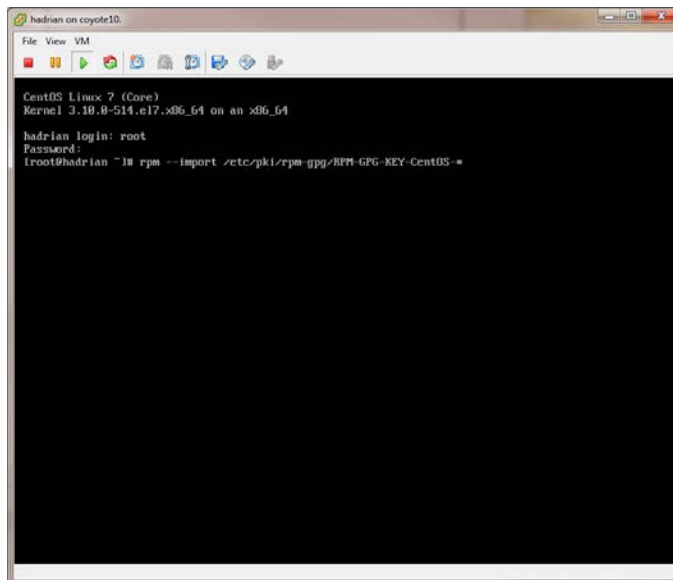
At the bottom of the window, there is a status bar with the text: `[anaconda] 1:main* 2:shell 3:log 4:storage-log 5:program-log` and a button labeled "Switch tab: Alt+Tab | Help: F1".

PROCEDURE II

Update CentOS Linux

Updating the system is one of the important roles of systems administrator tasks. It will prevent potential attack or system malfunctioning.

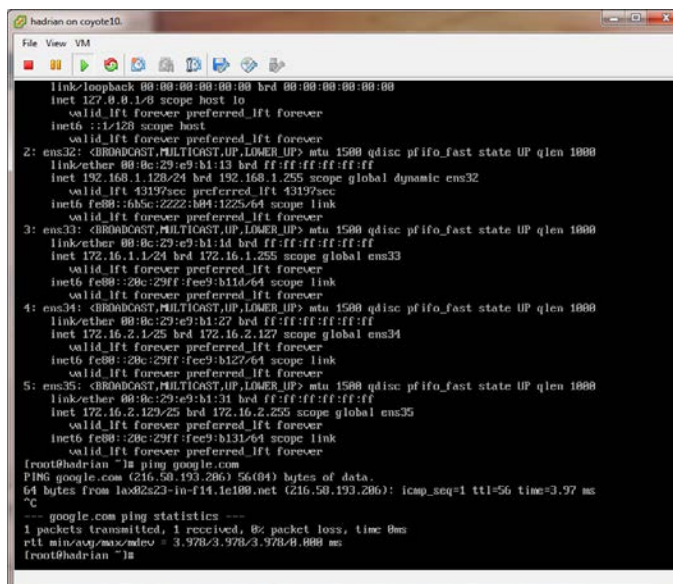
1. Login as **root**.
2. Import RPM GPG KEYS: Type **rpm --import /etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-***



```
CentOS Linux 7 (Core)
Kernel 3.10.0-514.el7.x86_64 on an x86_64

hadrian login: root
Password:
[root@hadrian ~]# rpm --import /etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-*
```

3. Check the IP configuration on NIC1 (eth0): Type **ip a**

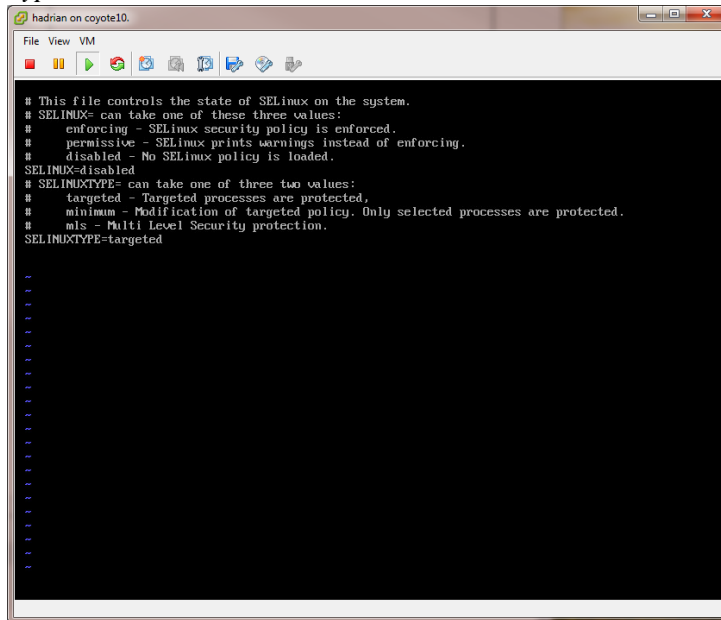


```
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
    valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
    valid_lft forever preferred_lft forever
2: ens32: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP qlen 1000
    link/ether 08:0e:29:e9:b1:13 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.128/24 brd 192.168.1.255 scope global dynamic ens32
        valid_lft 43197sec preferred_lft 43197sec
    inet6 fe80::5b5c:2222:b04:1225/64 scope link
        valid_lft forever preferred_lft forever
3: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP qlen 1000
    link/ether 08:0e:29:e9:b1:1d brd ff:ff:ff:ff:ff:ff
    inet 172.16.1.1/24 brd 172.16.1.255 scope global ens33
        valid_lft forever preferred_lft forever
    inet6 fe80::28c:29ff:fe9:b11d/64 scope link
        valid_lft forever preferred_lft forever
4: ens34: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP qlen 1000
    link/ether 08:0e:29:e9:b1:27 brd ff:ff:ff:ff:ff:ff
    inet 172.16.2.1/25 brd 172.16.2.127 scope global ens34
        valid_lft forever preferred_lft forever
    inet6 fe80::28c:29ff:fe9:b127/64 scope link
        valid_lft forever preferred_lft forever
5: ens35: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP qlen 1000
    link/ether 08:0e:29:e9:b1:31 brd ff:ff:ff:ff:ff:ff
    inet 172.16.2.129/25 brd 172.16.2.255 scope global ens35
        valid_lft forever preferred_lft forever
    inet6 fe80::28c:29ff:fe9:b131/64 scope link
        valid_lft forever preferred_lft forever
[root@hadrian ~]# ping google.com
PING google.com (216.58.193.286) 56(84) bytes of data:
64 bytes from lax2s23-in-f14.1e100.net (216.58.193.286): icmp_seq=1 ttl=56 time=3.97 ms
^C
--- google.com ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 8ms
rtt min/avg/max/mdev = 3.978/3.978/3.978/0.888 ms
[root@hadrian ~]#
```

4. *Disable selinux*

#vi /etc/selinux/config

*Type **SELINUX=disabled***

A screenshot of a terminal window titled 'hadrian on coyote10'. The window shows the content of the /etc/selinux/config file. The text is as follows:

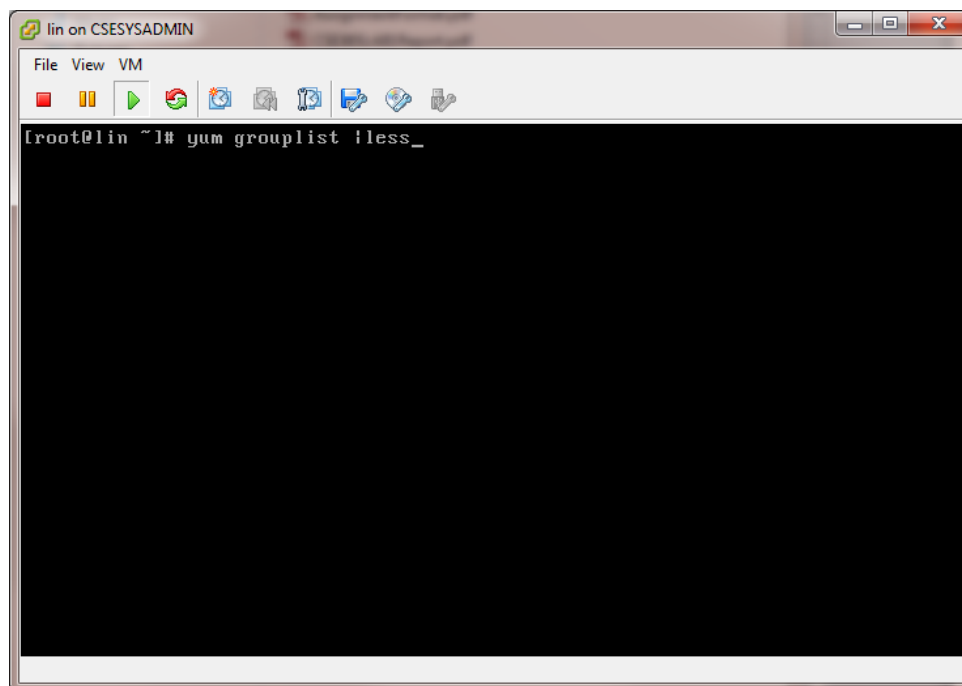
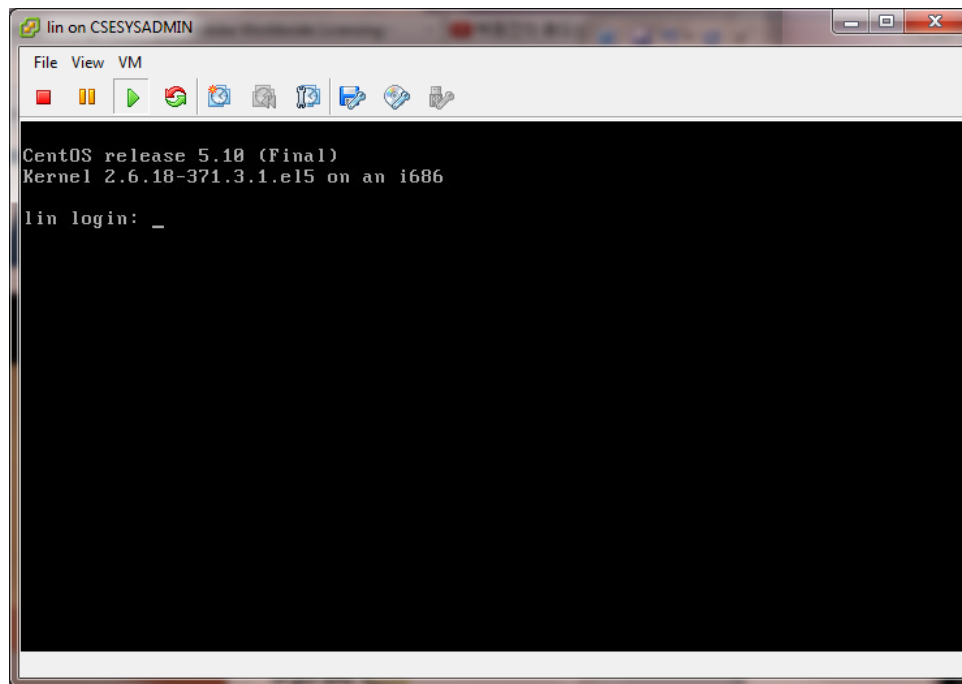
```
## This file controls the state of SELinux on the system.
## SELINUX= can take one of these three values:
##   enforcing - SELinux security policy is enforced.
##   permissive - SELinux prints warnings instead of enforcing.
##   disabled - No SELinux policy is loaded.
SELINUX=disabled
## SELINUXTYPE= can take one of three two values:
##   targeted - Targeted processes are protected,
##   minimum - Modification of targeted policy. Only selected processes are protected.
##   mls - Multi Level Security protection.
SELINUXTYPE=targeted
```

The terminal window has a standard Linux desktop environment with a menu bar (File, View, VM) and a toolbar with various icons. The background is black, and the text is white.

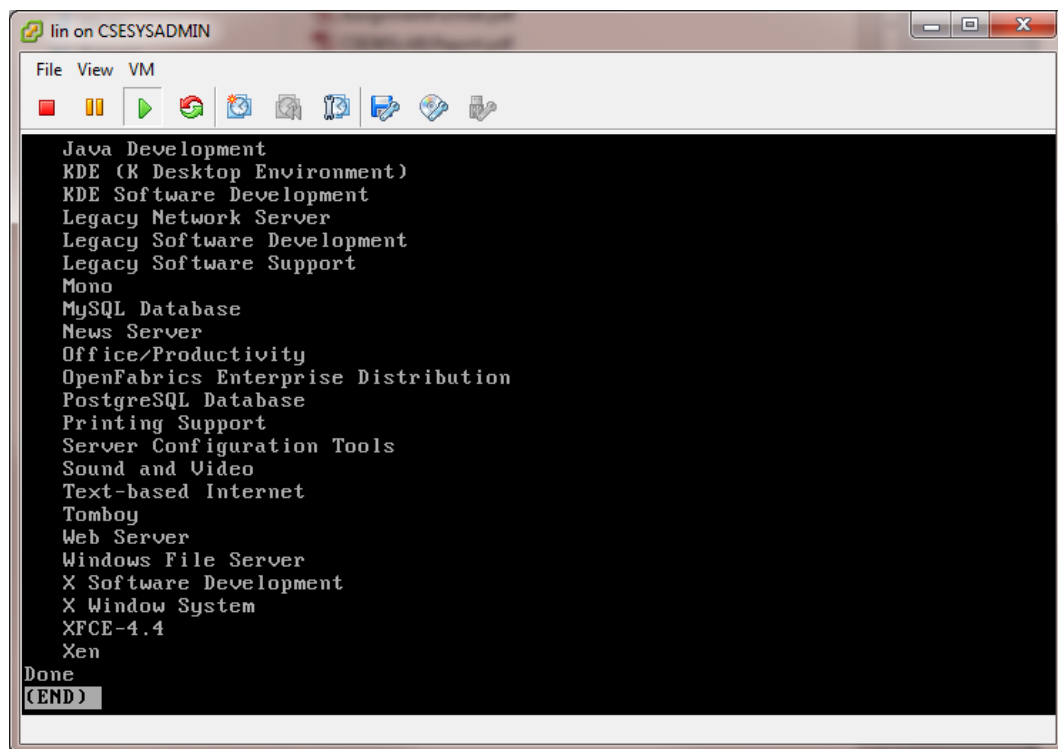
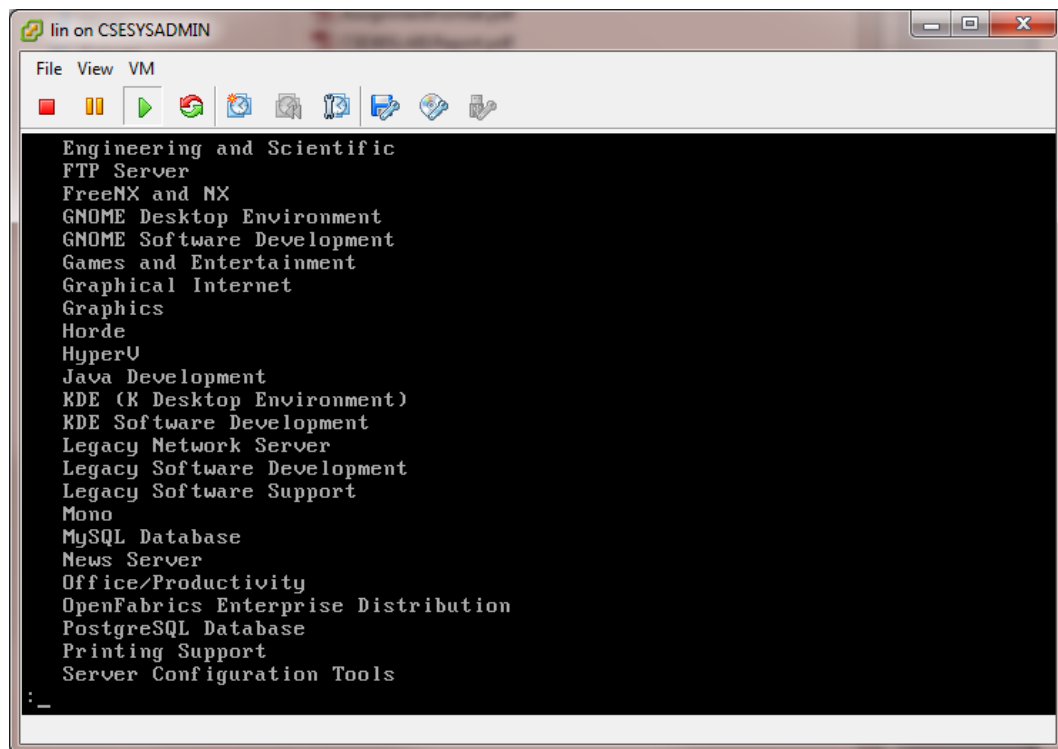
PROCEDURE IV

[1] Installing X Window System and GNOME Desktop Environment

1. Login as “root” and check the list: “yum grouplist | less”



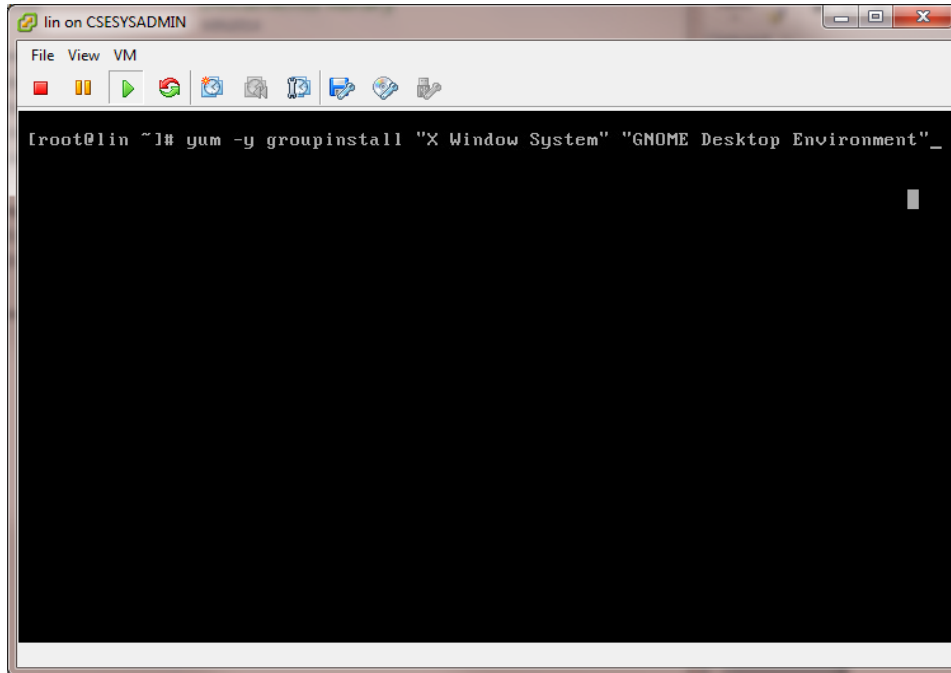
Note: Check the list of Group Packages.



2. Install group packages using yum groupinstall option.

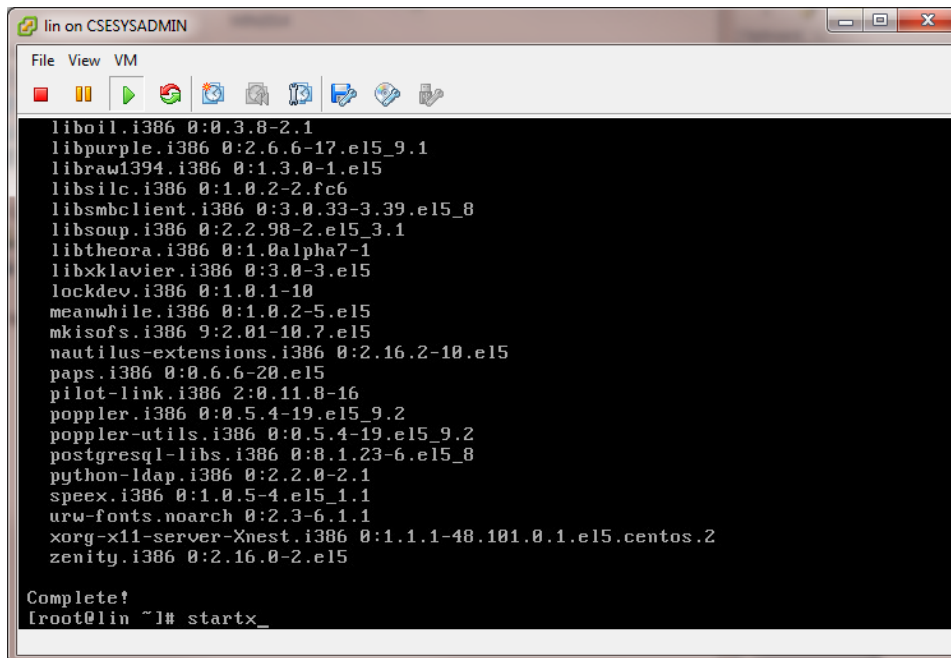
Note: Do not make any typos here.

yum -y groupinstall "X Window System" "GNOME Desktop Environment"



A terminal window titled "lin on CSESYSADMIN" with a menu bar (File, View, VM) and a toolbar. The command `yum -y groupinstall "X Window System" "GNOME Desktop Environment"` has been entered at the prompt `[root@lin ~]#`. The terminal output is currently blank, indicating the command is waiting to complete.

3. Type "startx" to start X Window

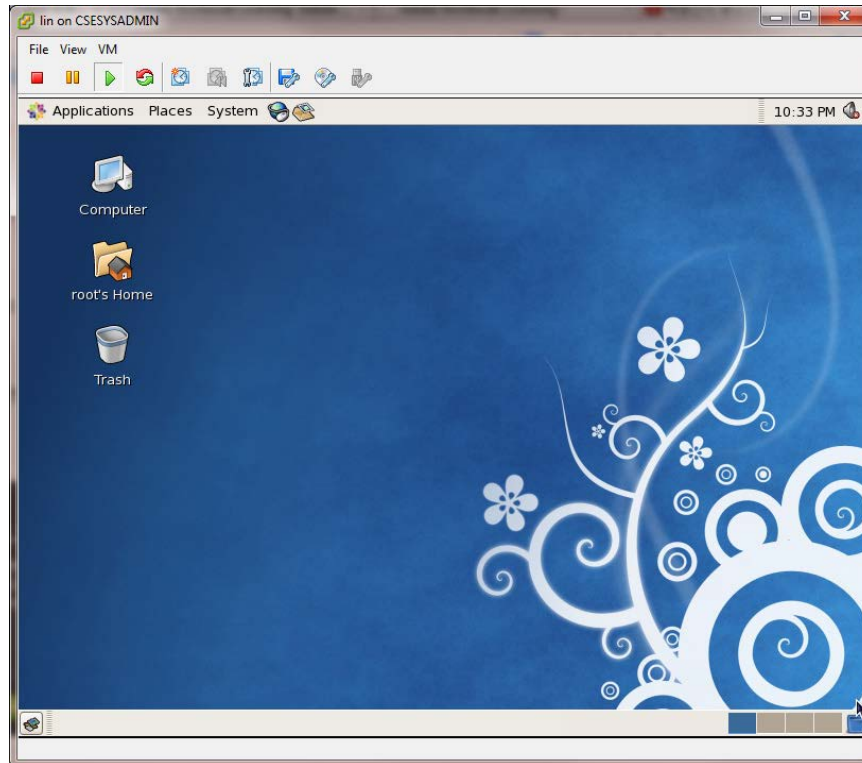


A terminal window titled "lin on CSESYSADMIN" with a menu bar (File, View, VM) and a toolbar. The output of the previous command is displayed, listing various installed packages and their versions. The command `startx` has been entered at the prompt `[root@lin ~]#`, and the terminal shows "Complete!" followed by the prompt `[root@lin ~]#`.

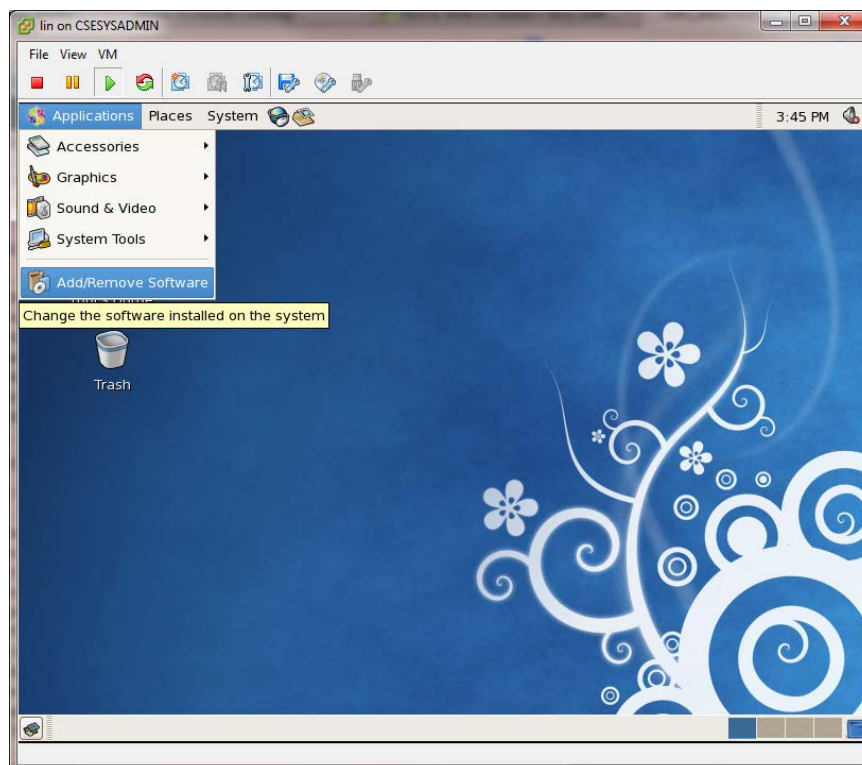
```
liboil.i386 0:0.3.8-2.1
libpurple.i386 0:2.6.6-17.e15_9.1
libraw1394.i386 0:1.3.0-1.e15
libsilk.i386 0:1.0.2-2.fc6
libsmclient.i386 0:3.0.33-3.39.e15_8
libsoup.i386 0:2.2.98-2.e15_3.1
libtheora.i386 0:1.0alpha7-1
libxklavier.i386 0:3.0-3.e15
lockdev.i386 0:1.0.1-10
meanwhile.i386 0:1.0.2-5.e15
mkisofs.i386 9:2.01-10.7.e15
nautilus-extensions.i386 0:2.16.2-10.e15
paps.i386 0:0.6.6-20.e15
pilot-link.i386 2:0.11.8-16
poppler.i386 0:0.5.4-19.e15_9.2
poppler-utils.i386 0:0.5.4-19.e15_9.2
postgresql-libs.i386 0:8.1.23-6.e15_8
python-ldap.i386 0:2.2.0-2.1
speex.i386 0:1.0.5-4.e15_1.1
urw-fonts.noarch 0:2.3-6.1.1
xorg-x11-server-Xnest.i386 0:1.1.1-48.101.0.1.e15.centos.2
zenity.i386 0:2.16.0-2.e15

Complete!
[root@lin ~]# startx_
```

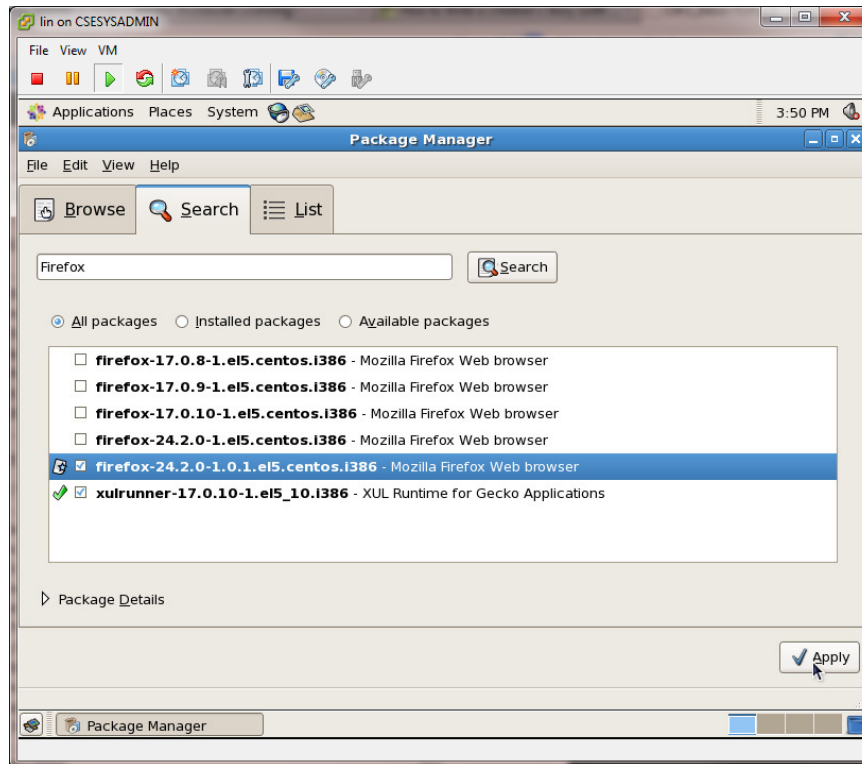
4. Type **startx**



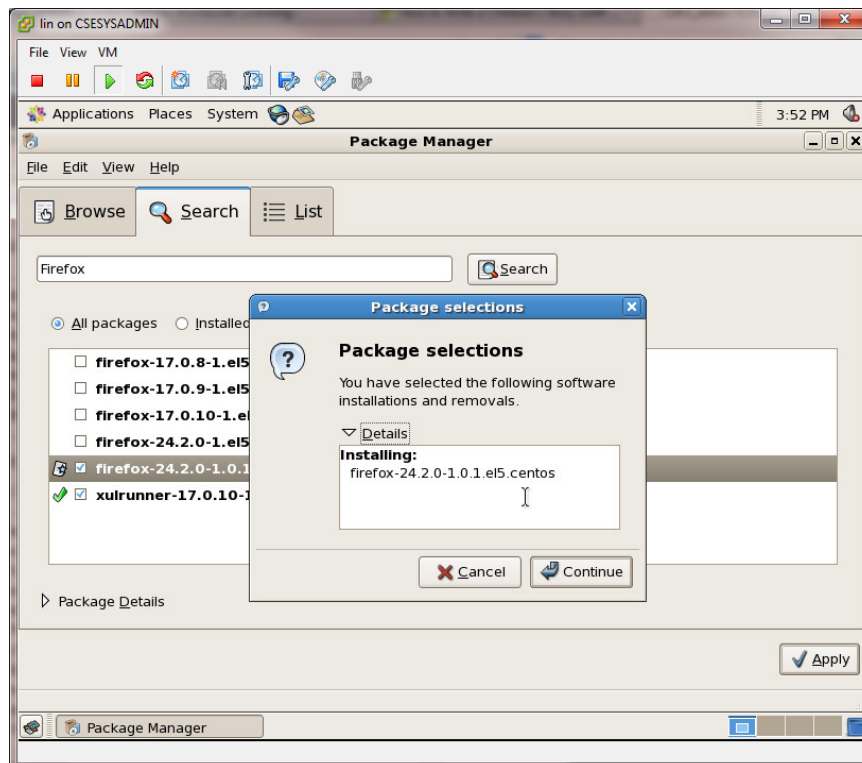
5. Click on “Applications” and Click on “Add/Remove Software”



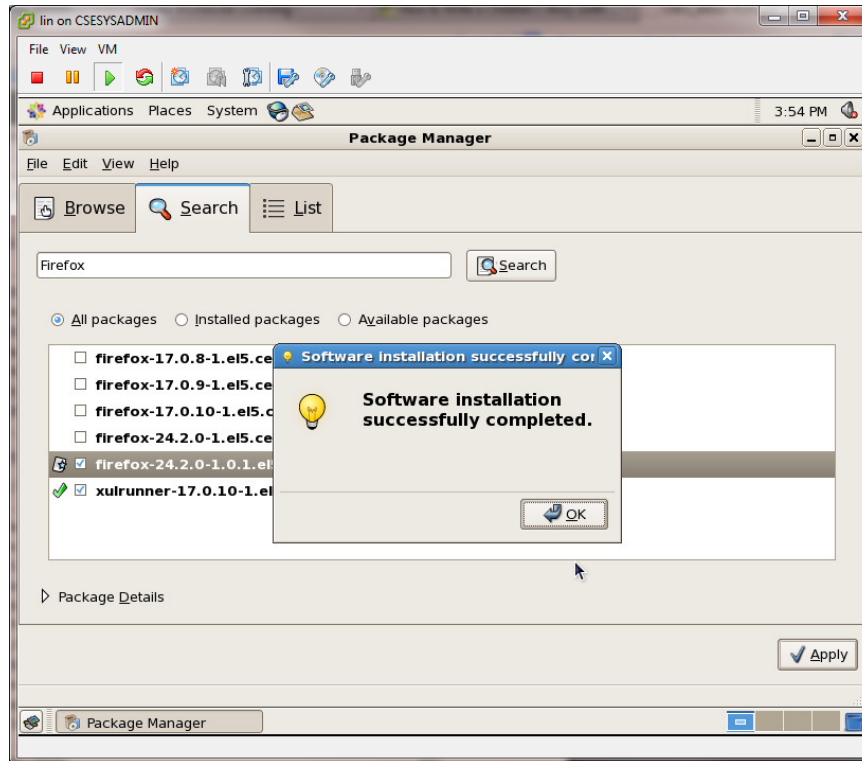
6. Click on “Search” tab and type “Firefox” and press “Search” button and check latest Firefox from the list and click on “Apply” button.



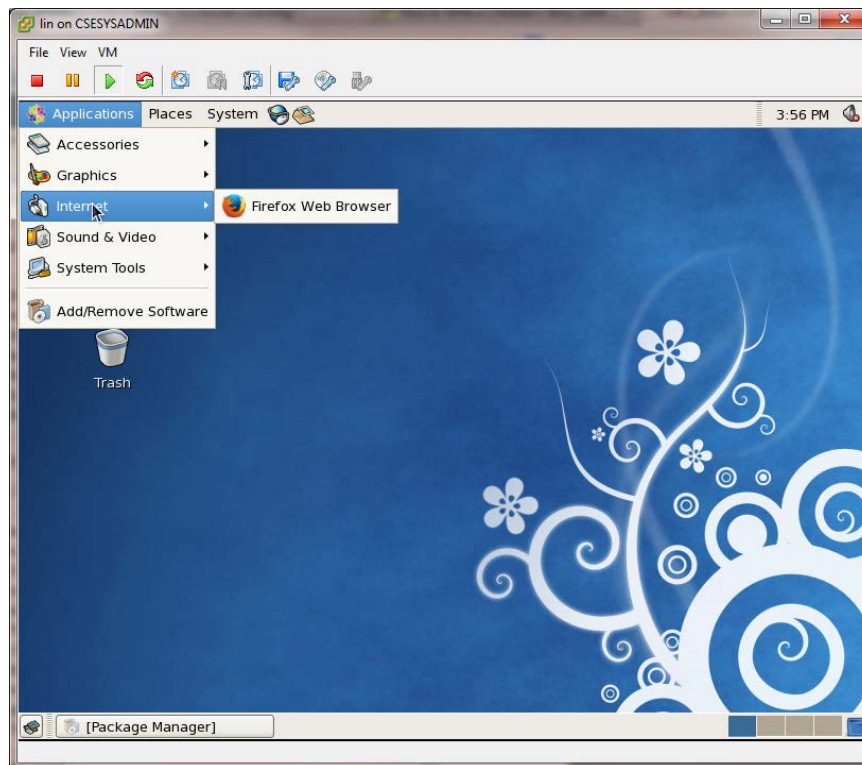
7. Click on “Continue”



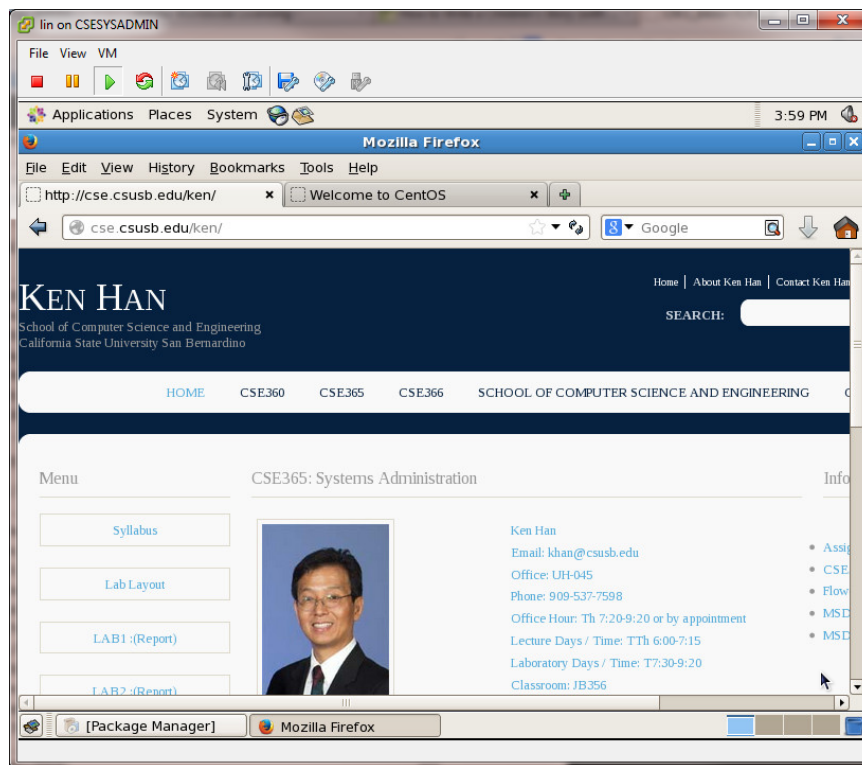
8. Click “OK”



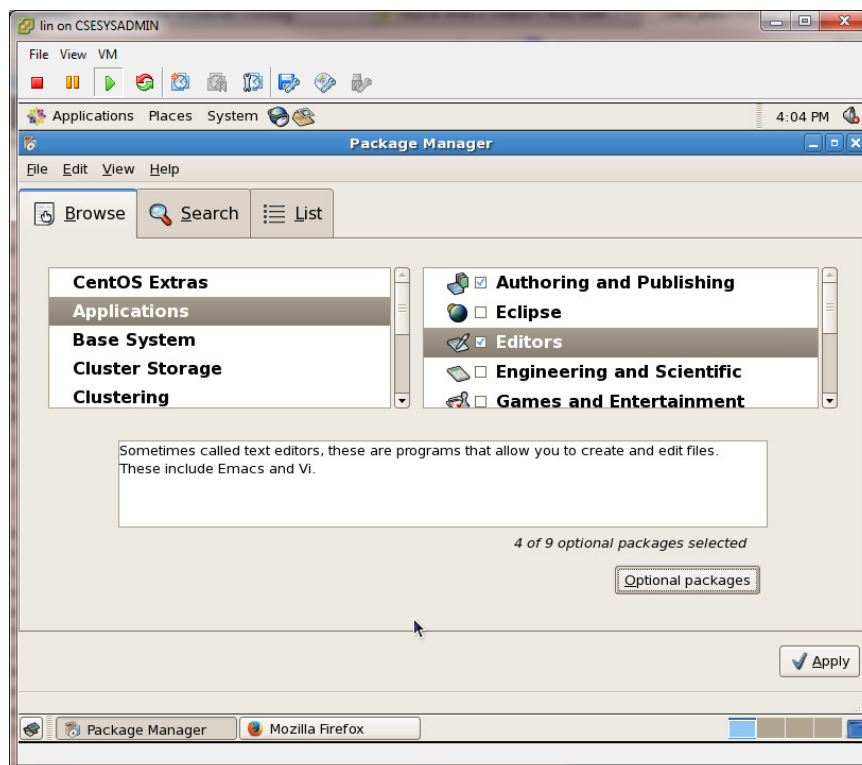
9. Close the “Package Manager” and click on “Application” > “Internet” > “Firefox”



10. Please browse to “http://cse.csusb.edu/ken/”



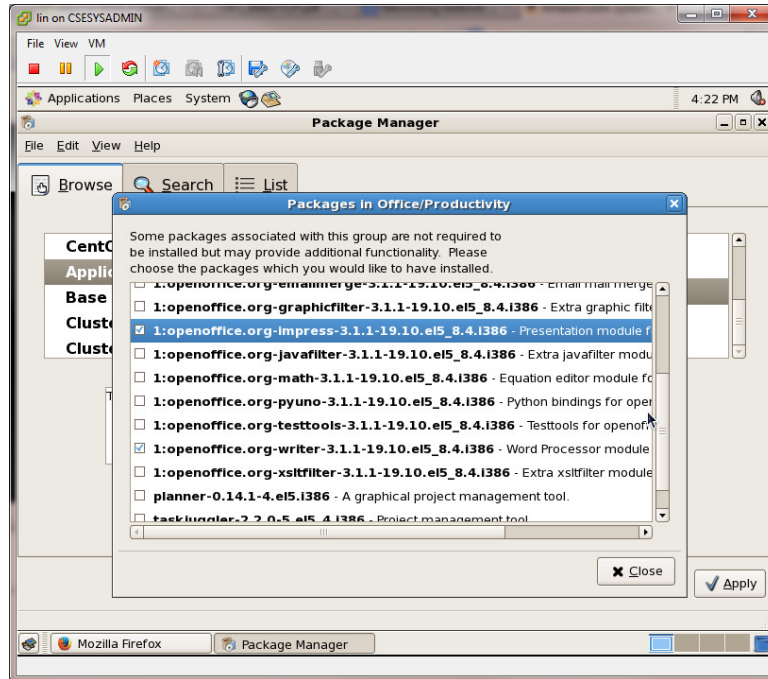
11. Please install “Authoring and Publishing” packages and “Editors” packages.



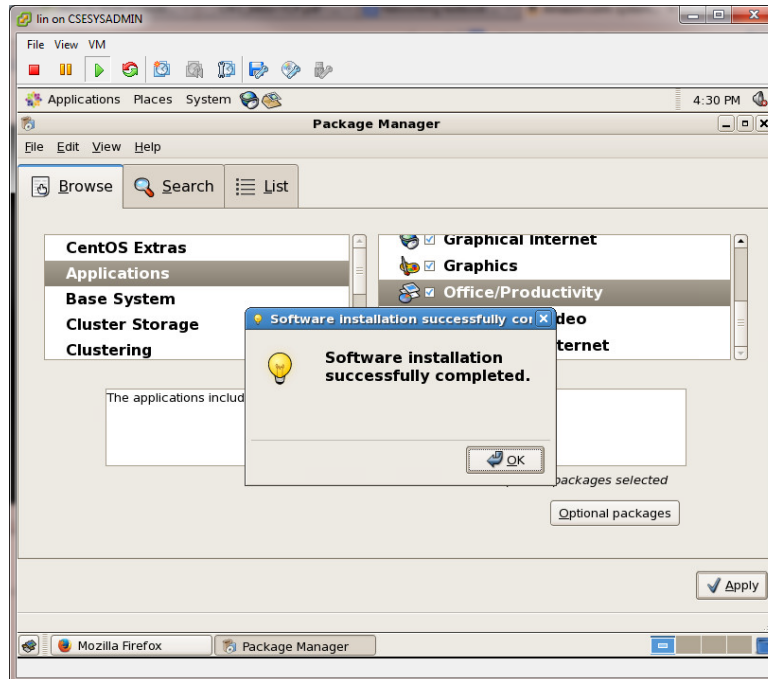
12. Applications > Add/Remove Software

From the Package Manager, Applications > Office/Productivity

Install “openoffice impress” and “openoffice writer”



13. Complete the installation.



14. Use *ifconfig* command on *lin* to test whether your DHCP server (*hadrian*) is giving out IP to *lin* and find out your network settings on *lin*.

EXERCISE I

Write a bash script that creates a DHCP Server configuration file (*dhcpcd.conf*)

OUTPUT:

```
#
# DHCP Server Configuration file.
#
ddns-update-style interim;
ignore client-updates;

subnet 172.16.1.0 netmask 255.255.255.0 {
    option routers 172.16.1.1;
    option subnet-mask 255.255.255.0;
    option domain-name "csusbcoyote.net";
    option domain-name-servers 139.182.2.1, 139.182.2.6;
    option time-offset -28800; # Pacific Standard Time

    range dynamic-bootp      172.16.1.101      172.16.1.254;
    default-lease-time 21600;
    max-lease-time 43200;
}
```

LAB REPORT

NAME: _____

QUESTIONS (40%)

Answer all the questions above lab manual.

Explain following lines line by line?

```
ddns-update-style interim;
ignore client-updates;

subnet 172.16.1.0 netmask 255.255.255.0 {
option routers 172.16.1.1;
option subnet-mask 255.255.255.0;
option domain-name "csusbcoyote.net";
option domain-name-servers 139.182.2.1, 139.182.2.6;      option
time-offset -28800; # Pacific Standard Time

range dynamic-bootp      172.16.1.101      172.16.1.254;
default-lease-time 21600;
max-lease-time 43200;
}
```

TROUBLESHOOTING (50%)

From this lab what troubles did you have?

(Describe all the troubleshooting skills you have learn from this lab.)

Identify the problem:

Problem 1:

Problem 2:

How did you solve the problem?

Solution 1:

Solution 2:

LINUX COMMANDS (10%)

1. List all the UNIX Commands that you used in this lab:

2. Explain systemctl command:

1. How to enabling service?
2. How to disabling service?
3. How to check the status of the service?
4. How to list all services?
5. How to display dependencies?
6. How to check the properties of service?