CSE 660

Operating System Concepts & Theory

May 10, 2011

Lab 1 & 2

Install the Lustre File System

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Purpose:

The Lab assignment is to install Centos and install the Lustre File System. Some direction was given as part of the lab.

What is the Lustre File System?

Overview

Lustre is a massively parallel distributed system, which is used for large cluster computing. In addition, Lustre provides a high performance file system for clusters of thousands nodes with petabytes of storage capacity.

Lustre installation on a Linux, Lustre file system driver module is loaded into the kernel and the file system is mounted like any other local or network file system. According the Lustre Operations Manual, "It is best known for powering seven of the ten largest high-performance computing (HPC) clusters worldwide, with tens of thousands of client systems, petabytes (PB) of storage and hundreds of gigabytes per second (GB/sec) of I/O throughput."

How does it work?

Lustre has a number of components.

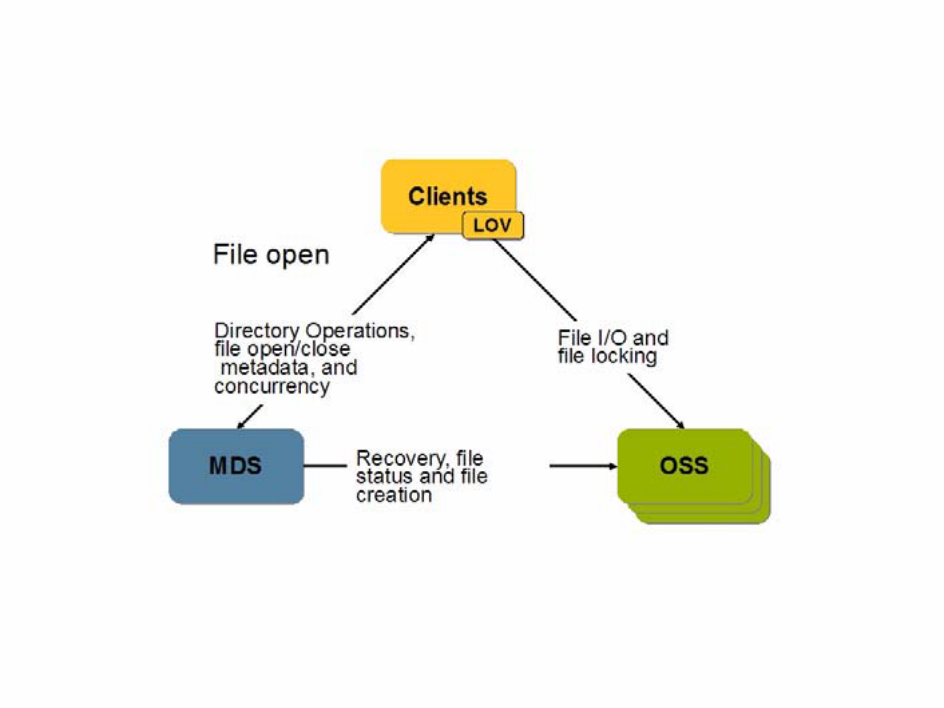
The Metadata server (MDS) manages the names and directories that Lustre is designed to track.

The Metadata Target (MDT) stores the information on files, directories, and permissions. There is only one per Lustre file system and works with the MDT.

The Object Storage Target (OST) stores the data on the file system. The data could be spread among multiple OSS's.

Object Storage Servers (OSS) are in charge of managing the I/O of the file system. It works with the network to request handling of the data working with multiple OST's if needed.

The clients work with the MDS and the OSS to manage and synchronize the data. See Figure below.



Application or usage.

The Lustre File System can be used to provide performance where I/O is needed. It is also very scalable. Additional OSS can be added to increase the size of storage but still keep performance especially for high performance computing clusters.

Installation of the Centos?

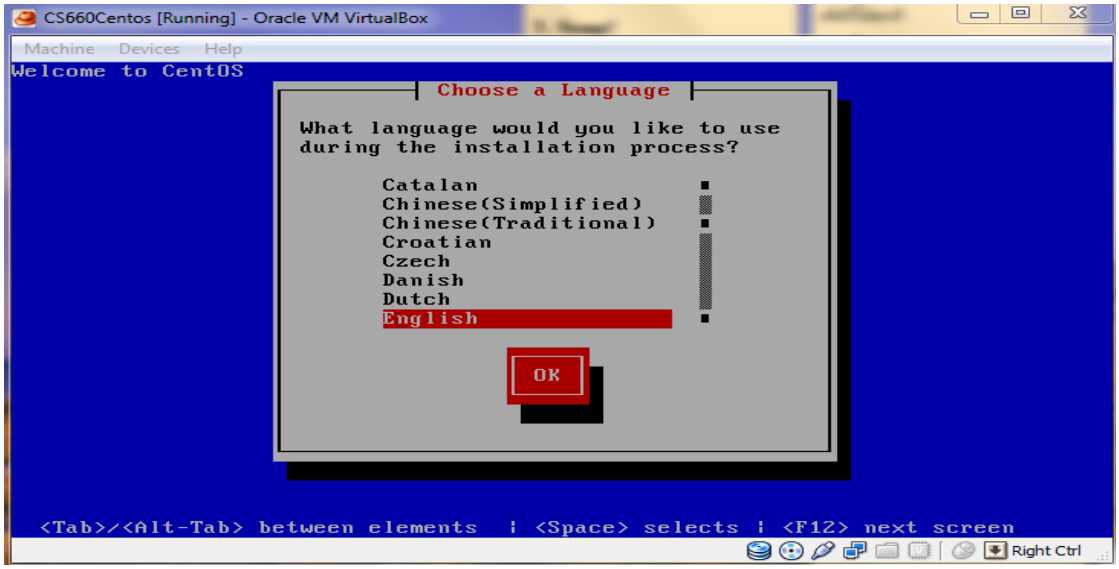
Preparation

The assignment of lab1&2 is to use Centos (a Linux distribution). We decided to use the net install version of Centos for the installation. This allows us to select what we want to install and then the installation program will download from the internet the files we need to complete the installation. We used the latest version of VBox from Sun to create our Virtual system for this project.

Installation tutorial

In VBox we mount the Net Install ISO so that we could boot the Centos installation program. In the following figure, you need to choose the preferring language that you would like to use

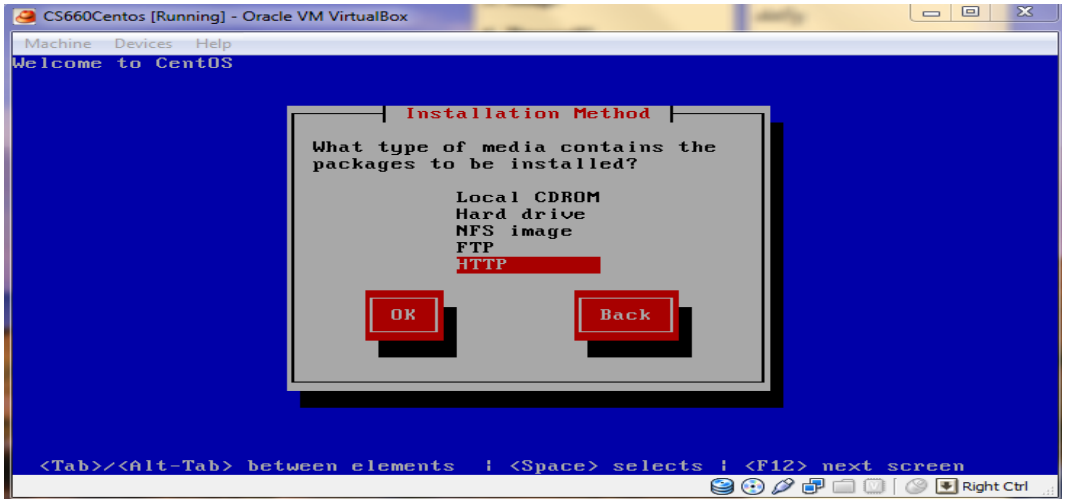
during the installation process by using the arrows “up and down”, then by clicking on the tap key to click the OK button.



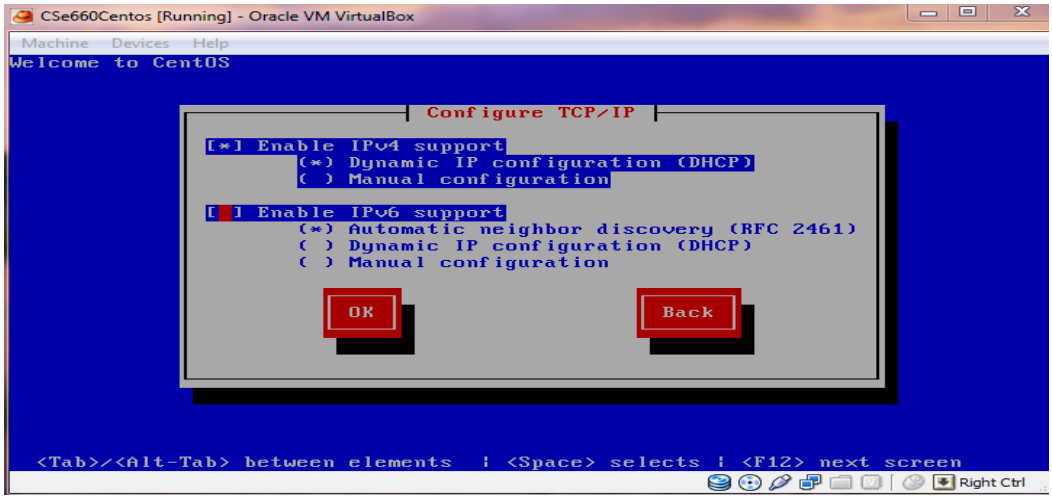
We have chosen “English”, as it appears in the above figure, clicked tap key, and clicked “OK” by clicking Enter key.

The following figure, allows us to choose the type of keyboard that we are using. We have chosen “us” and clicked “OK”.

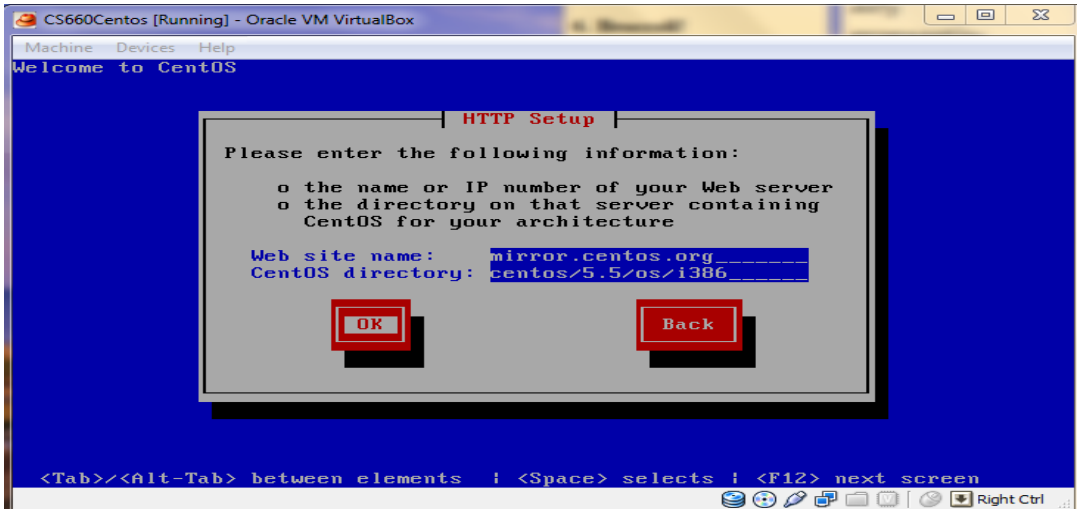
In the following figure, you have to choose the media type that contains the packages to be installed, which is “HTTP” as it shown.



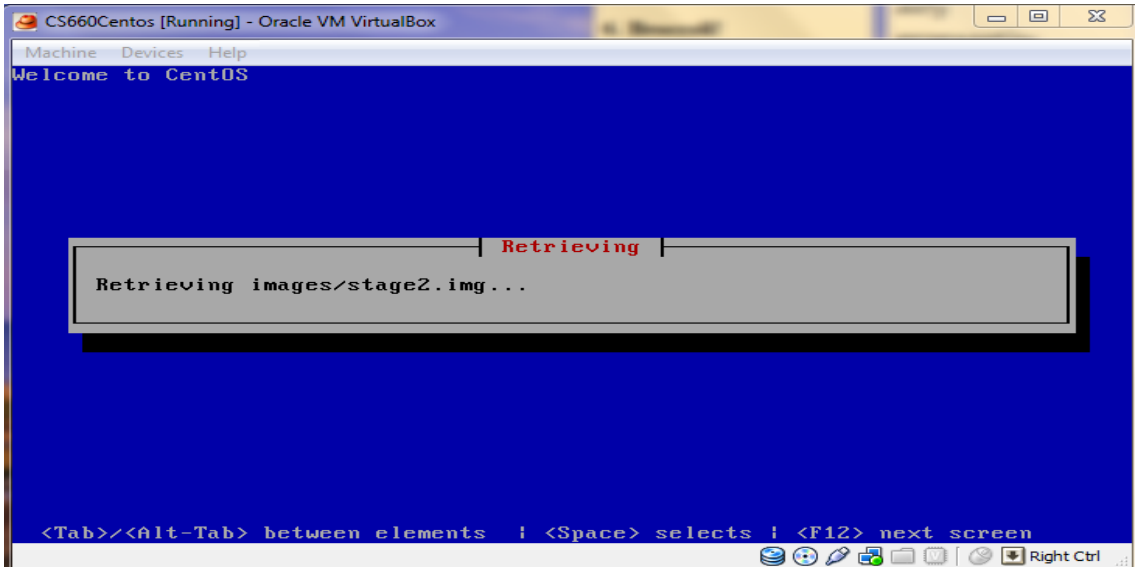
In order to configure TCP/IP, we have marked the following as it shown.



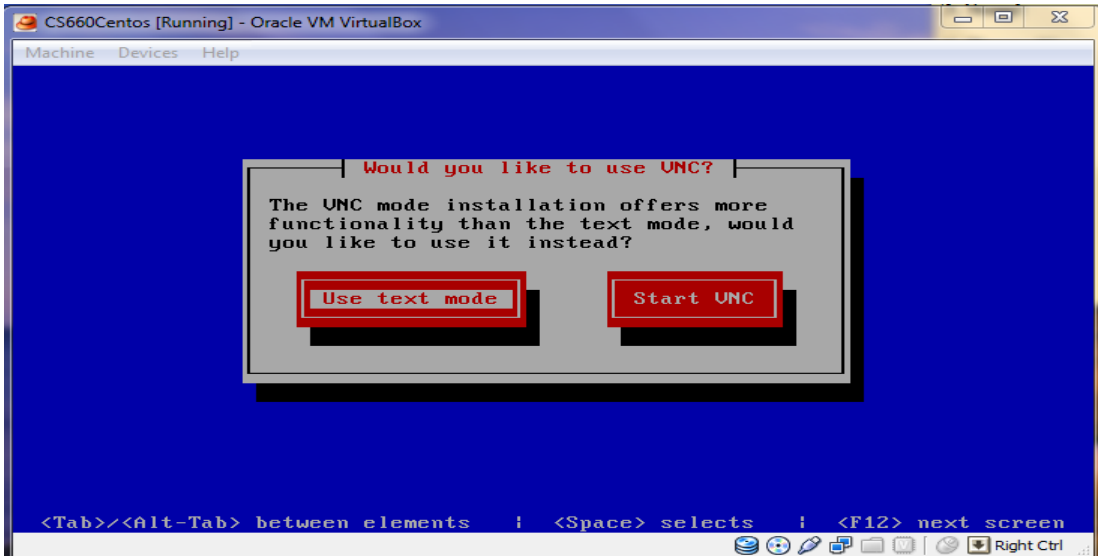
To setup the HTTP, we have the name of the Web server “site name”, and the directory on that server containing Centos.

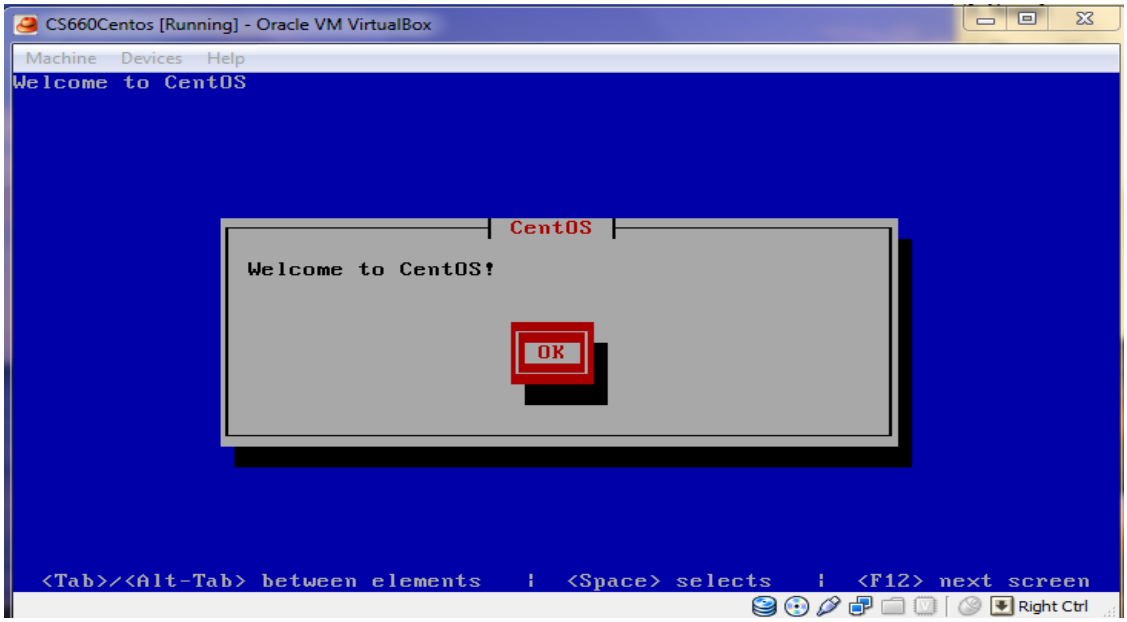


Retrieving …..

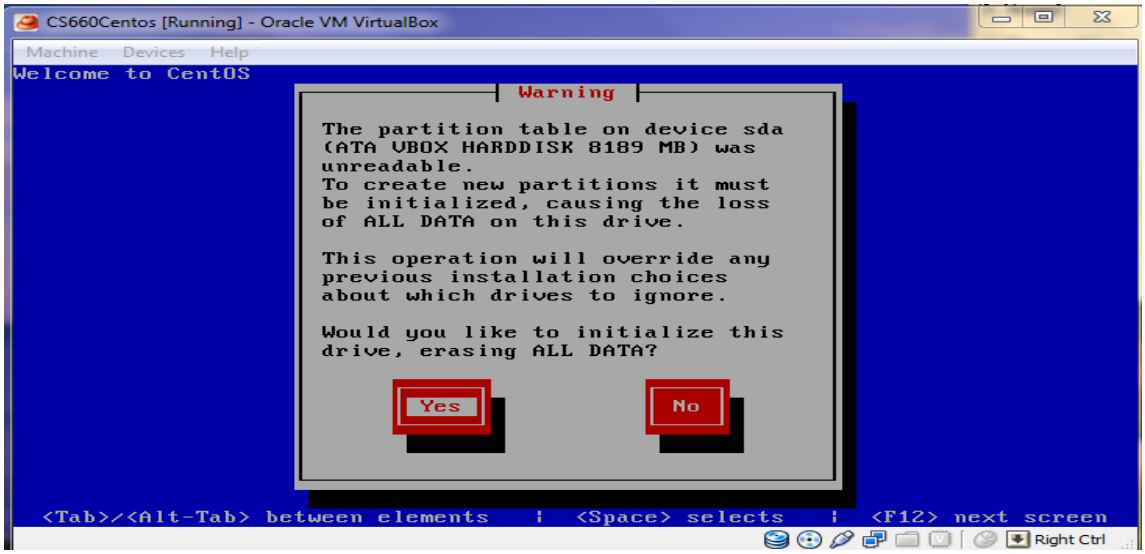


Installation mode, which we have chosen “Text Mode”.

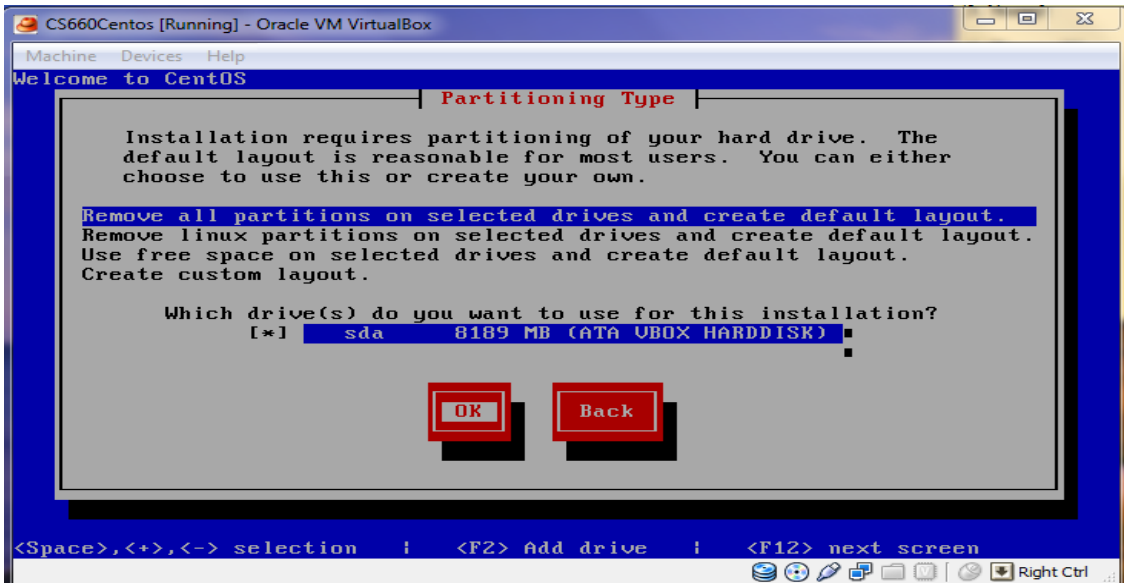




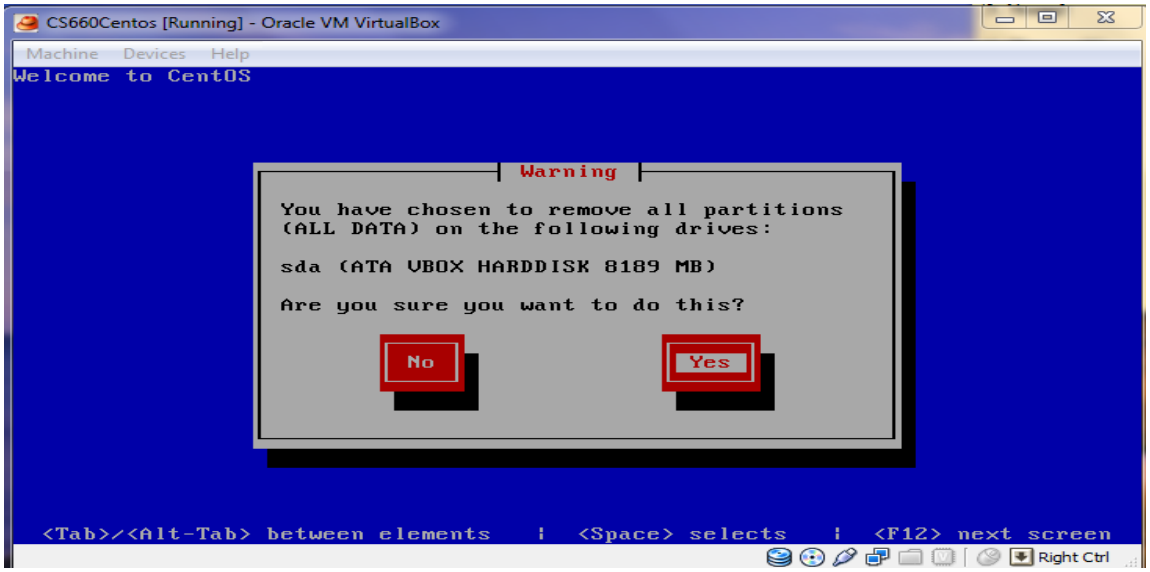
Because the device unreachable, we have to create new partition, which is going to override all previous installation, and erase all data. Choose “Yes”.



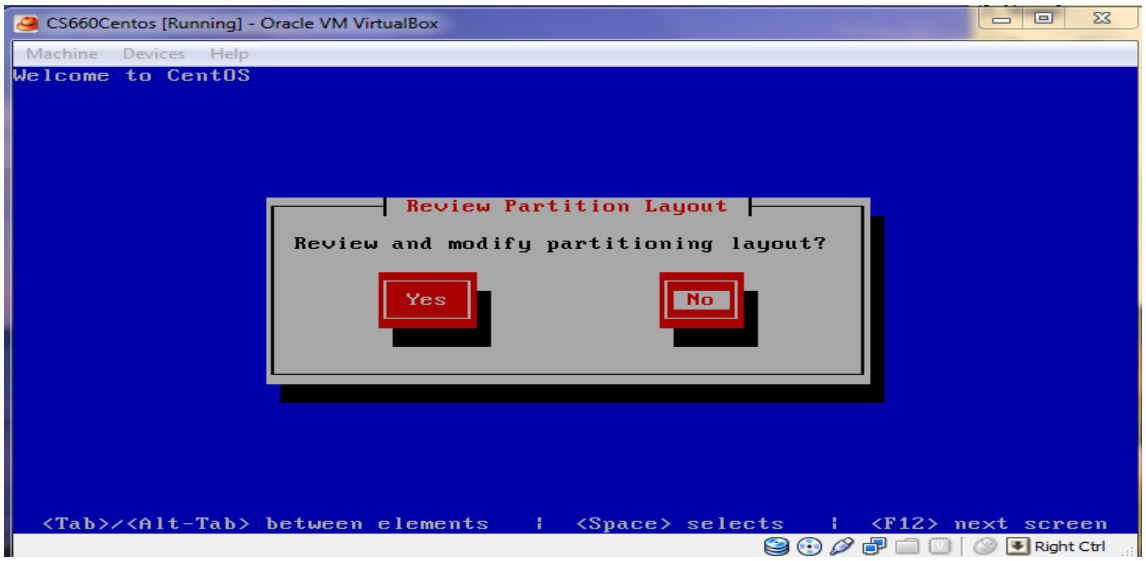
In partitioning type, we have removed all partitions on drivers, created a default layout, and chose the driver that we want to use in our installation.



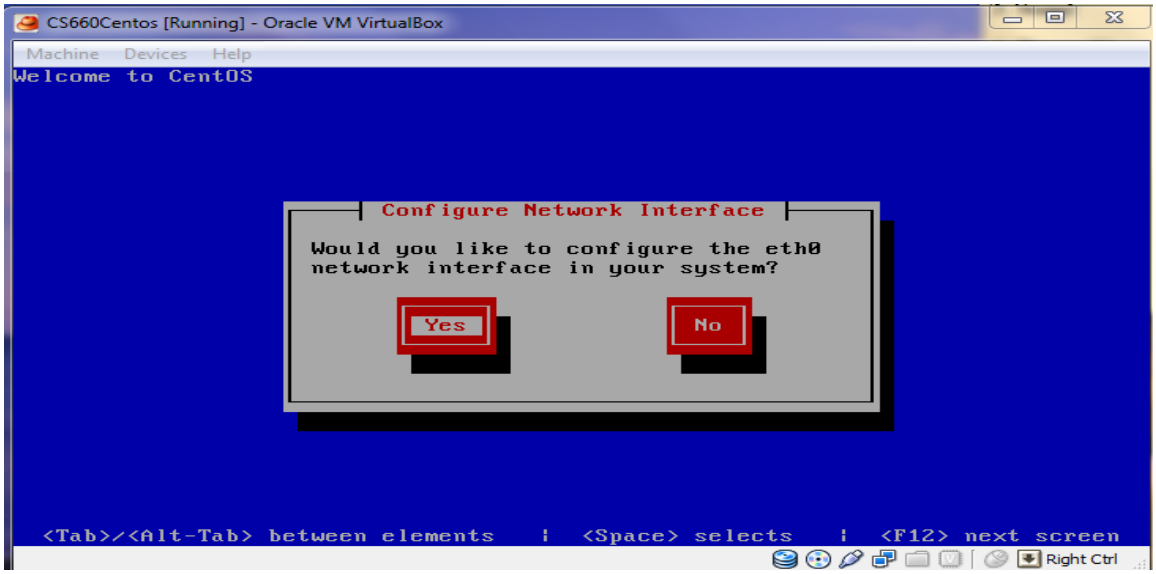
Warning about the previous figure.



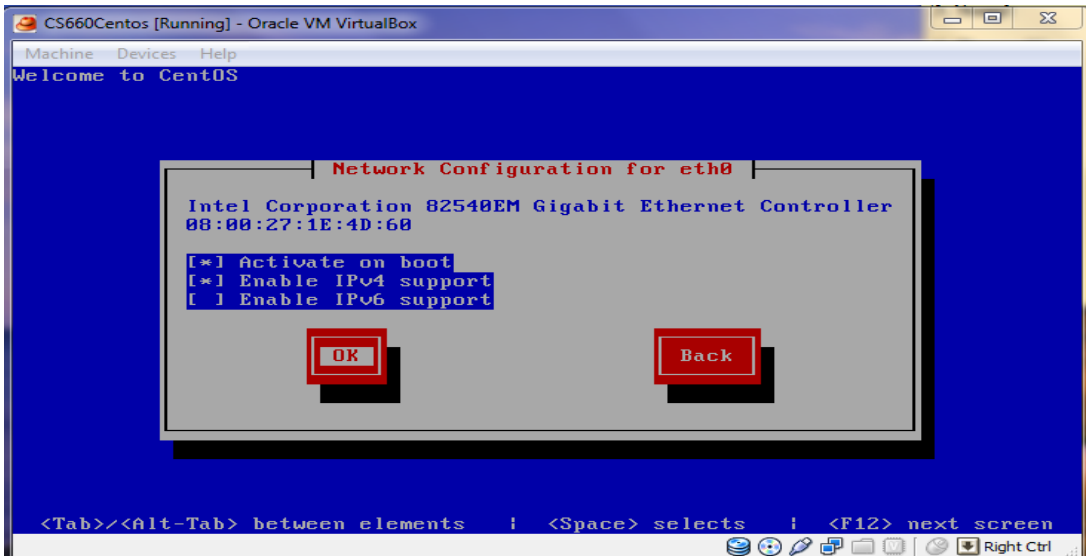
A chance to review the partition layout.

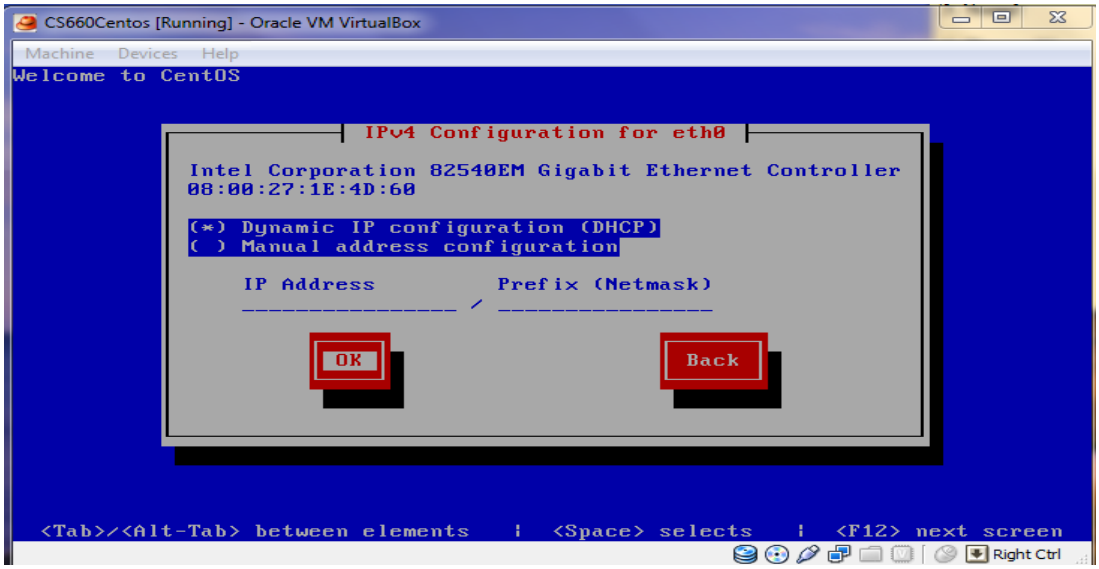


Click “Yes” to configure network interface.

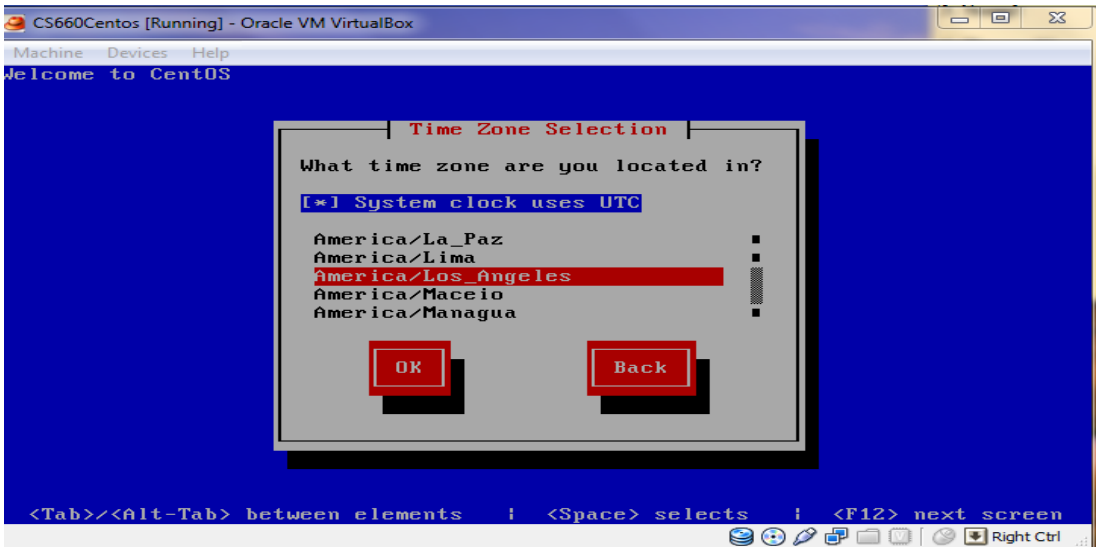


Configuration for “eth0” Ethernet network as an interface to the system.

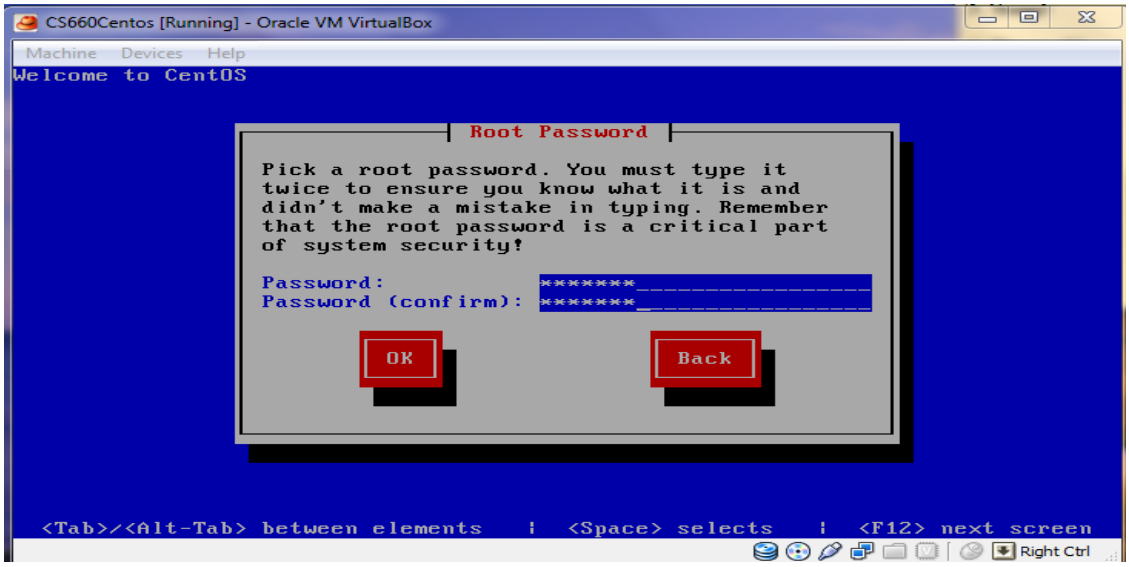




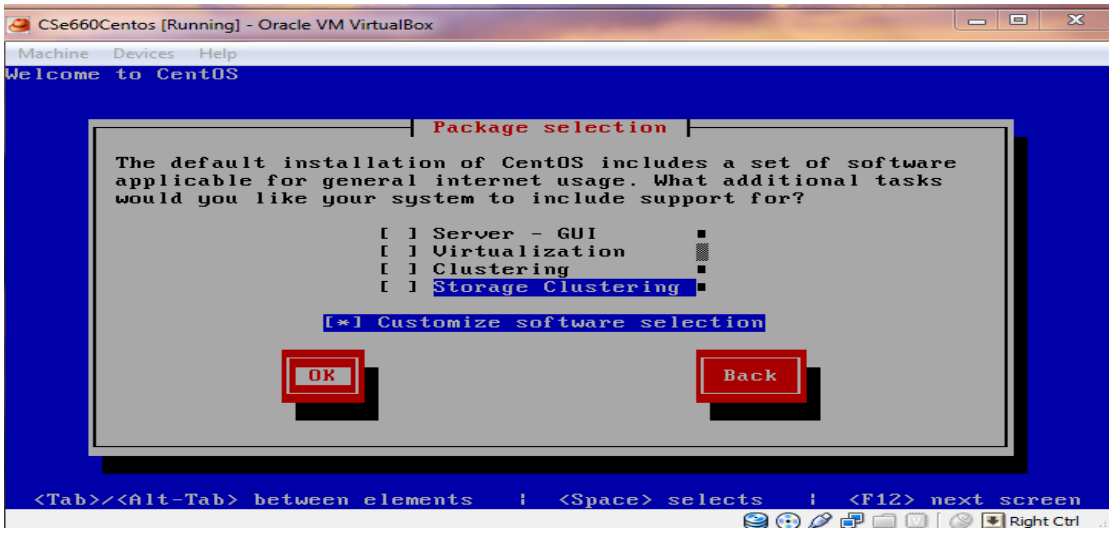
Time Zone Selection options.



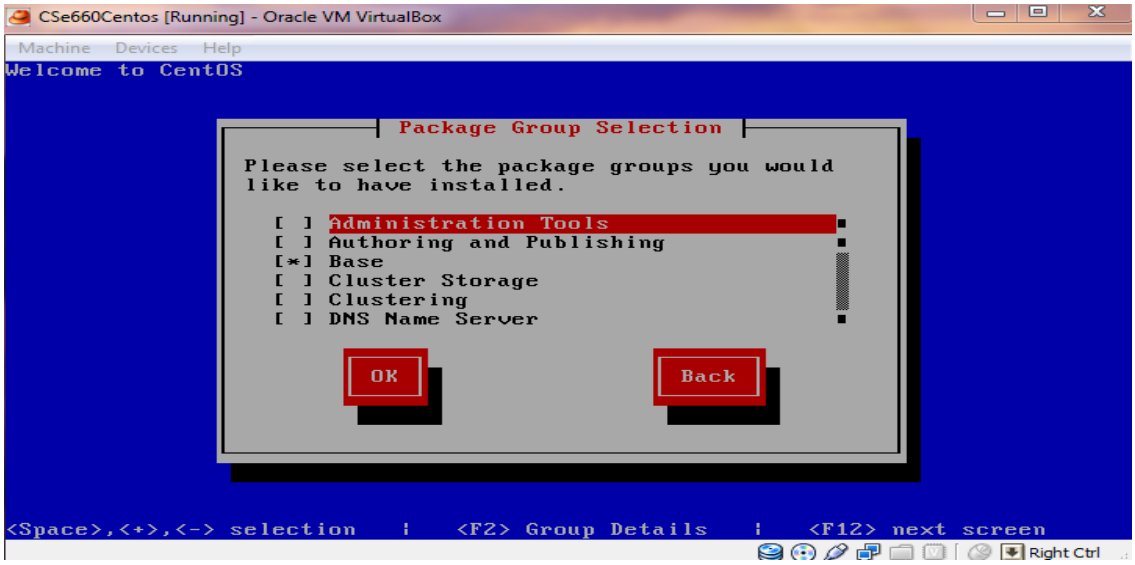
Creating a new password from the root.



In package selection, since we don't need any additional software application, we have chosen "Customize software selection".

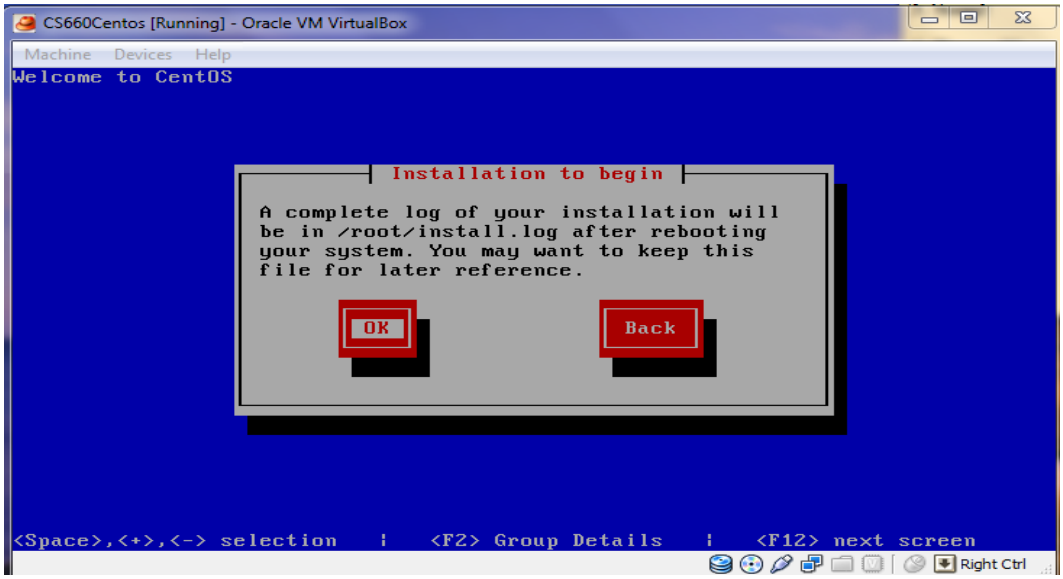


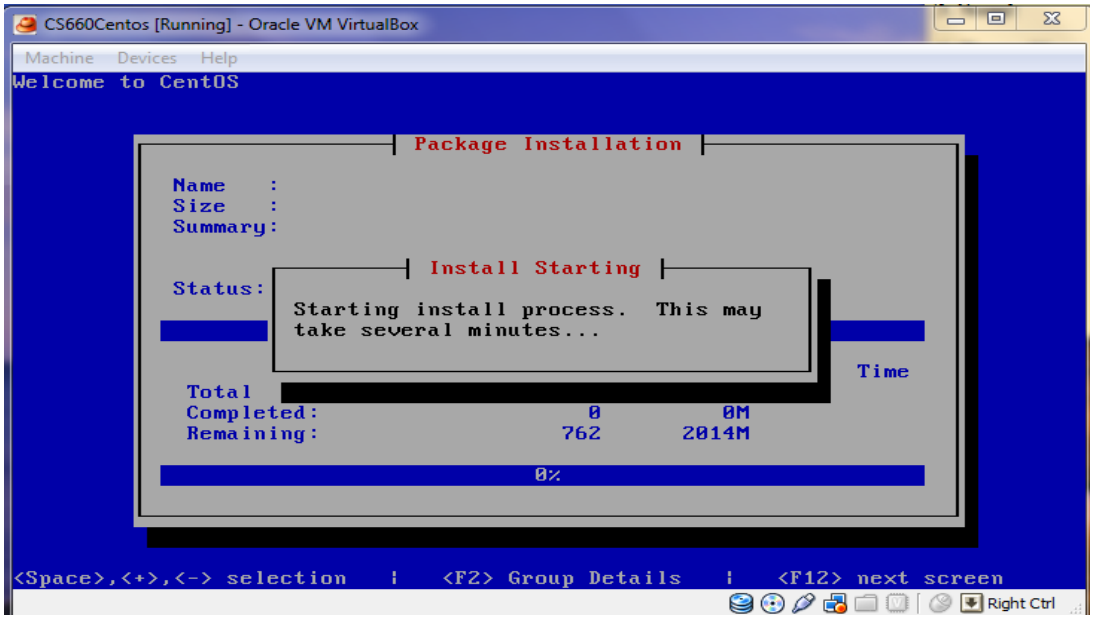
In Package Group Selection, we only need the “base” package group.

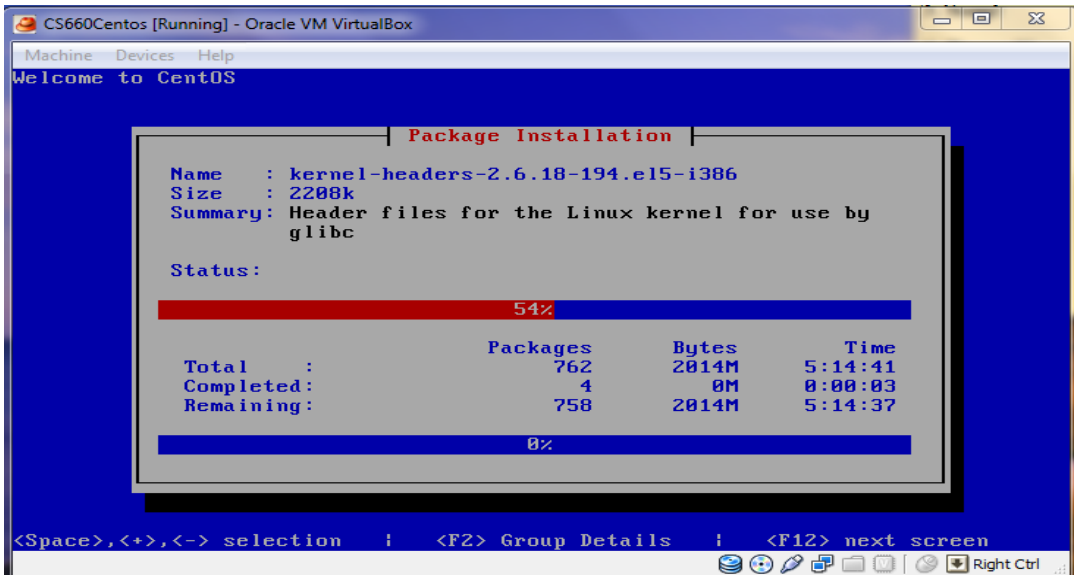


The reference of our installation, which is /root/install.log.

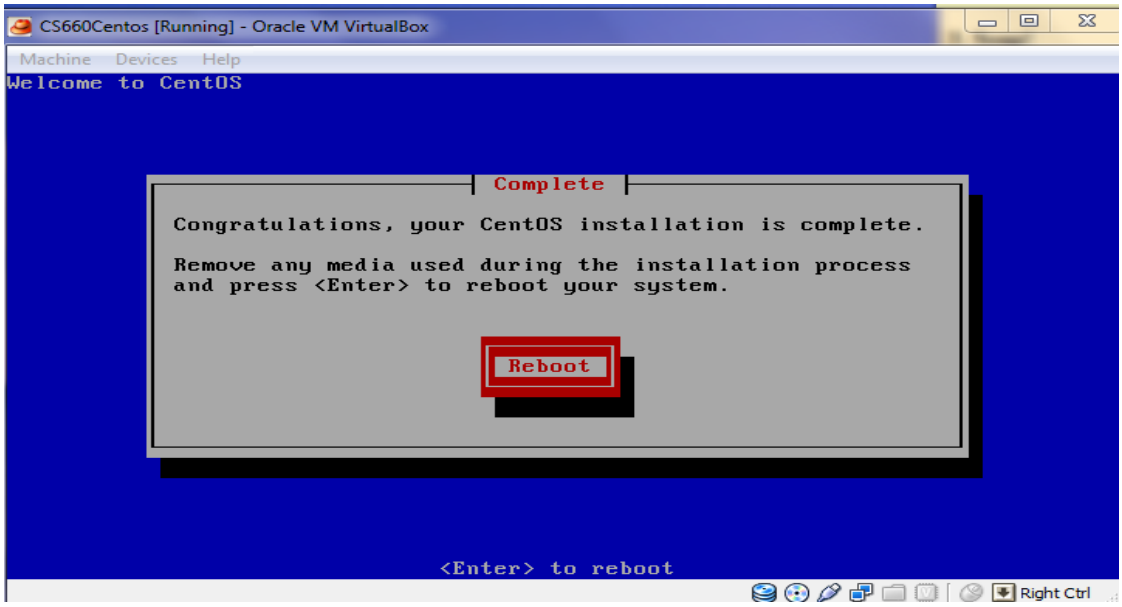
Click “OK” to begin installation.



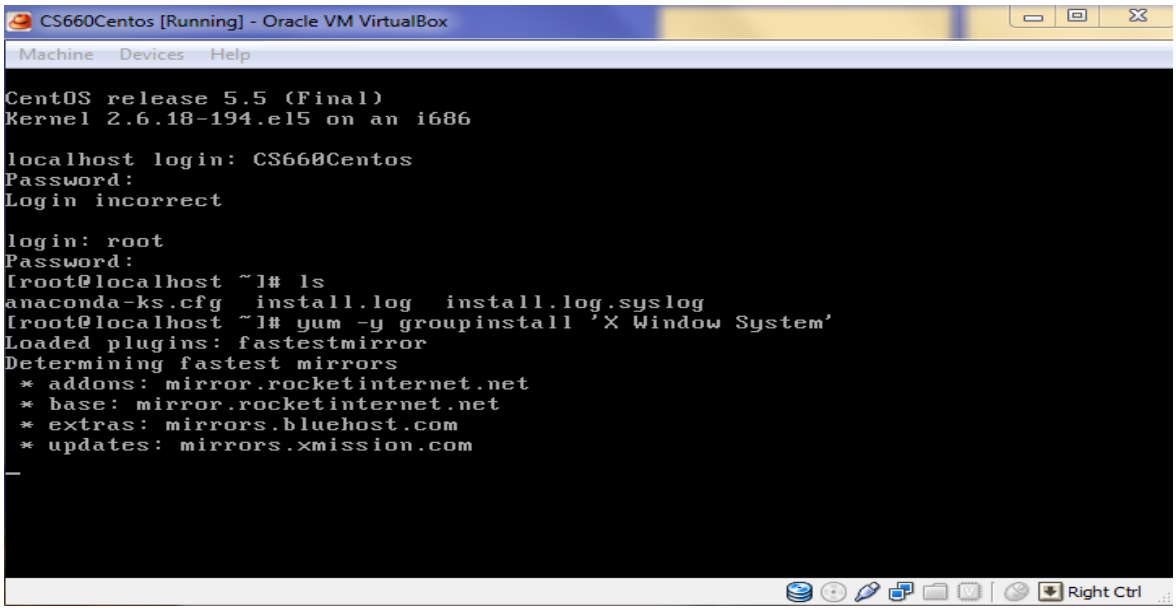

CS660Centos [Running] - Oracle VM VirtualBox
Machine Devices Help
Welcome to CentOS
Package Installation
Name :
Size :
Summary:
Status:
Install Starting
Starting install process. This may take several minutes...
Time
Total
Completed: 0 0M
Remaining: 762 2014M
0%
<Space>,<+>,<-> selection | <F2> Group Details | <F12> next screen
Right Ctrl


CS660Centos [Running] - Oracle VM VirtualBox
Machine Devices Help
Welcome to CentOS
Package Installation
Name : kernel-headers-2.6.18-194.el5-i386
Size : 2208k
Summary: Header files for the Linux kernel for use by glibc
Status:
54%
Packages Bytes Time
Total : 762 2014M 5:14:41
Completed: 4 0M 0:00:03
Remaining: 758 2014M 5:14:37
0%
<Space>,<+>,<-> selection | <F2> Group Details | <F12> next screen
Right Ctrl

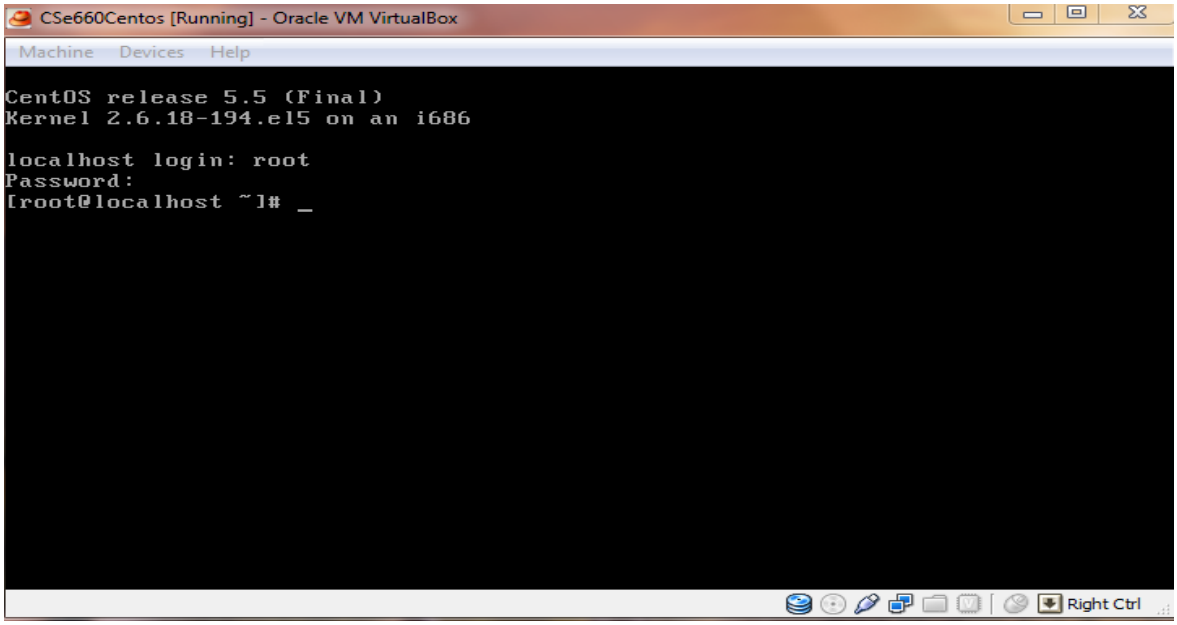
Installation has been completed. Click “Reboot”.



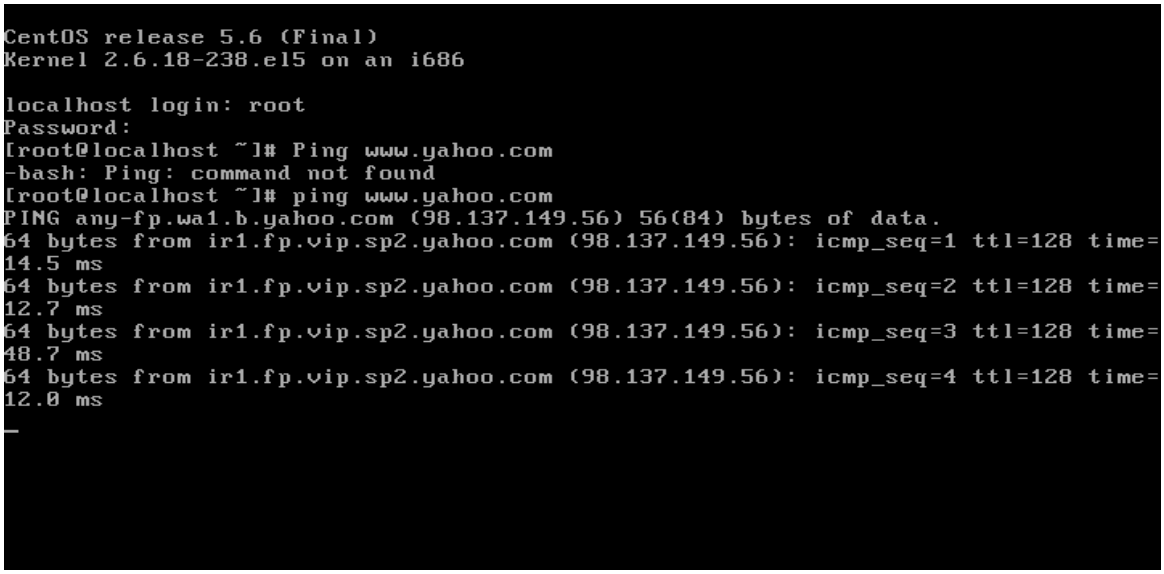
Rebooting…..



Logged in as the root, enter the your password.



Now, we are going to ping “www.yahoo.com” as it shown, to test the internet connection.



Now, we are going to install variety of group install using the following commands:

yum -y groupinstall 'X Window System'

execute startx to start the X-Window system.

yum -y groupinstall 'KDE (K Desktop Environment)'

Then execute system-config-display.

Wait and after some time a gui configuration will pop up. Select the resolution of "1024X768" and click “OK”.

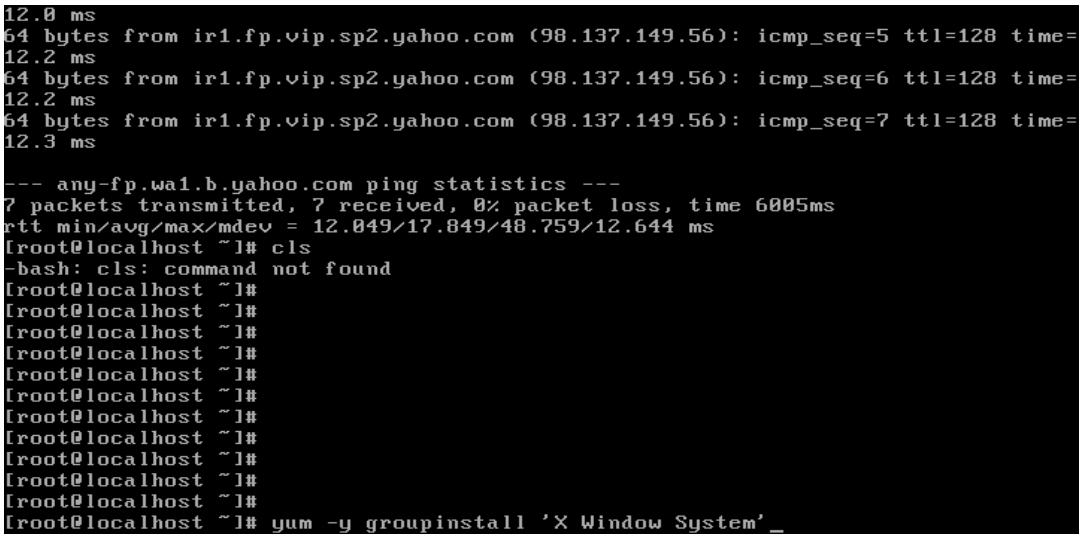
You may install firefox and development tools by:

yum install firefox

yum groupinstall "Development Tools"

Group installing “X Window System” using:

#yum –y groupinstall ‘X Window System’



```
rtt min/avg/max/mdev = 12.049/17.849/48.759/12.644 ms
[root@localhost ~]# cls
-bash: cls: command not found
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# yum -y groupinstall 'X Window System'
Loaded plugins: fastestmirror
Determining fastest mirrors
 * base: mirrors.easynews.com
 * extras: mirror.hmc.edu
 * updates: centos.mirror.facebook.net
base                                                     | 1.1 kB     00:00
base/primary                                             | 954 kB     00:00
base                                                                  2683/2683
extras                                                   | 2.1 kB     00:00
_
```

```
  Installing     : libgnomecanvas                                         5/192
  Installing     : libXmu                                                 6/192
  Installing     : libfontenc                                             7/192
  Installing     : gnome-keyring                                          8/192
  Installing     : alsa-lib                                               9/192
  Installing     : libXfont                                              10/192
  Installing     : xorg-x11-font-utils                                   11/192
  Installing     : libxslt                                               12/192
  Installing     : libXxf86vm                                            13/192
  Installing     : libdrm                                                14/192
  Installing     : mesa-libGL                                            15/192
  Installing     : pyxf86config                                          16/192
  Updating       : openssh                                               17/192
  Installing     : xorg-x11-xauth                                        18/192
  Installing     : usermode-gtk                                          19/192
  Installing     : libogg                                                20/192
  Installing     : avahi                                                 21/192
  Installing     : libXtst                                               22/192
  Installing     : libXxf86misc                                          23/192
  Installing     : libxkbfile                                            24/192
  Installing     : libdmx                                                25/192
  Installing     : pycairo                                               26/192
  Installing     : ttmkfdir                                              27/192
  Installing     : audiofile                                             28/192
_
```

```
  xorg-x11-drv-ur98.i386 0:1.1.0-1.1
  xorg-x11-drv-v4l.i386 0:0.1.1-4
  xorg-x11-drv-vesa.i386 0:1.3.0-8.2.el5
  xorg-x11-drv-vga.i386 0:4.1.0-2.1
  xorg-x11-drv-via.i386 0:0.2.1-9
  xorg-x11-drv-vmmouse.i386 0:12.4.0-2.1
  xorg-x11-drv-vmware.i386 0:10.13.0-2.1
  xorg-x11-drv-void.i386 0:1.1.0-3.1
  xorg-x11-drv-voodoo.i386 0:1.1.0-3.1
  xorg-x11-font-utils.i386 1:7.1-2
  xorg-x11-fonts-base.noarch 0:7.1-2.1.el5
  xorg-x11-server-utils.i386 0:7.1-5.el5_6.2
  xorg-x11-utils.i386 0:7.1-2.fc6
  xorg-x11-xkb-utils.i386 0:1.0.2-2.1
  xsri.i386 1:2.1.0-10.fc6
  xulrunner.i386 0:1.9.2.15-2.el5_6
  yelp.i386 0:2.16.0-26.el5

Dependency Updated:
  openssh.i386 0:4.3p2-72.el5_6.3
  openssh-clients.i386 0:4.3p2-72.el5_6.3
  openssh-server.i386 0:4.3p2-72.el5_6.3

Complete!
[root@localhost ~]# _
```

Complete!

yum –y groupinstall ‘KDE (K Desktop Environment)’

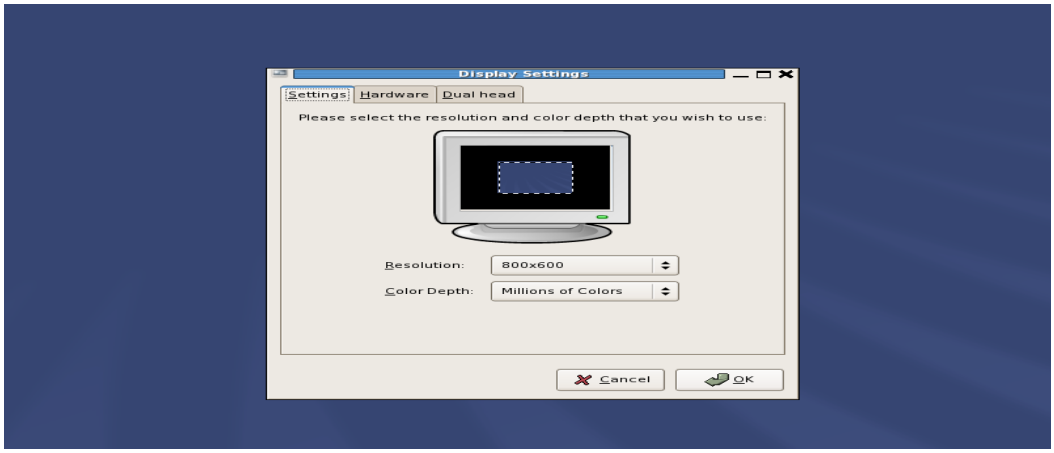
```
  xorg-x11-drv-ur98.i386 0:1.1.0-1.1
  xorg-x11-drv-v4l.i386 0:0.1.1-4
  xorg-x11-drv-vesa.i386 0:1.3.0-8.2.el5
  xorg-x11-drv-vga.i386 0:4.1.0-2.1
  xorg-x11-drv-via.i386 0:0.2.1-9
  xorg-x11-drv-vmmouse.i386 0:12.4.0-2.1
  xorg-x11-drv-vmware.i386 0:10.13.0-2.1
  xorg-x11-drv-void.i386 0:1.1.0-3.1
  xorg-x11-drv-voodoo.i386 0:1.1.0-3.1
  xorg-x11-font-utils.i386 1:7.1-2
  xorg-x11-fonts-base.noarch 0:7.1-2.1.el5
  xorg-x11-server-utils.i386 0:7.1-5.el5_6.2
  xorg-x11-utils.i386 0:7.1-2.fc6
  xorg-x11-xkb-utils.i386 0:1.0.2-2.1
  xsri.i386 1:2.1.0-10.fc6
  xulrunner.i386 0:1.9.2.15-2.el5_6
  yelp.i386 0:2.16.0-26.el5

Dependency Updated:
  openssh.i386 0:4.3p2-72.el5_6.3
  openssh-clients.i386 0:4.3p2-72.el5_6.3
  openssh-server.i386 0:4.3p2-72.el5_6.3

Complete!
[root@localhost ~]# yum -y groupinstall 'KDE (K Desktop Environment)'_
```

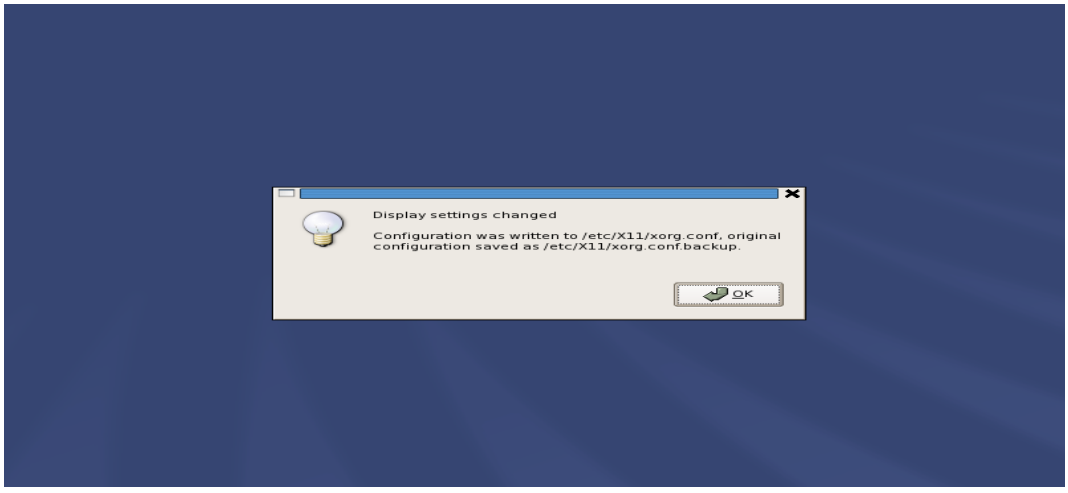
```
 lockdev                     i386  1.0.1-10                    base      14 k
 net-snmp-libs               i386  1:5.3.2.2-9.el5_5.1          base     1.3 M
 paps                        i386  0.6.6-19.el5                base      33 k
 pilot-link                  i386  2:0.11.8-16                 base     407 k
 poppler                     i386  0.5.4-4.4.el5_5.14          base     3.0 M
 poppler-utils               i386  0.5.4-4.4.el5_5.14          base      73 k
 qt                          i386  1:3.3.6-23.el5              base     3.6 M
 sane-backends               i386  1.0.18-5.el5                base     1.0 M
 sane-backends-libs          i386  1.0.18-5.el5                base     2.3 M
 sip                         i386  4.4.5-3                     base     216 k
 system-config-printer-libs  i386  0.7.32.10-1.el5             base     218 k
Updating for dependencies:
 cups-libs                   i386  1:1.3.7-26.el5_6.1          updates  199 k
 dbus                        i386  1.1.2-15.el5_6              updates  235 k
 dbus-libs                   i386  1.1.2-15.el5_6              updates  124 k

Transaction Summary
================================================================================
Install      55 Package(s)
Upgrade       3 Package(s)

Total download size: 159 M
Downloading Packages:
(1/58): libXdamage-1.0.3-2.1.i386.rpm                    |  11 kB     00:00
_
```

```
(29/58): dbus-1.1.2-15.el5_6.i386.rpm                    | 235 kB     00:00
(30/58): flac-1.1.2-28.el5_0.1.i386.rpm                  | 305 kB     00:02
(31/58): pilot-link-0.11.8-16.i386.rpm                   | 407 kB     00:02
(32/58): lm_sensors-2.10.7-9.el5.i386.rpm                | 511 kB     00:01
(33/58): gmp-4.1.4-10.el5.i386.rpm                       | 664 kB     00:02
(34/58): libtheora-1.0alpha7-1.i386.rpm                  | 708 kB     00:04
(35/58): libsmbclient-3.0.33-3.29.el5_6.2.i386.rpm       | 908 kB     00:00
(36/58): htdig-3.2.0b6-11.el5.i386.rpm                   | 997 kB     00:04
(37/58): sane-backends-1.0.18-5.el5.i386.rpm             | 1.0 MB     00:05
(38/58): PyXML-0.8.4-4.el5_4.2.i386.rpm                  | 1.0 MB     00:04
(39/58): arts-1.5.4-1.i386.rpm                           | 1.1 MB     00:04
(40/58): net-snmp-libs-5.3.2.2-9.el5_5.1.i386.rpm        | 1.3 MB     00:04
(41/58): gphoto2-2.2.0-3.el5.i386.rpm                    | 1.4 MB     00:05
(42/58): PyQt-3.16-4.i386.rpm                            | 2.0 MB     00:08
(43/58): sane-backends-libs-1.0.18-5.el5.i386.rpm        | 2.3 MB     00:06
(44/58): kdeaddons-3.5.4-1.fc6.i386.rpm                  | 2.5 MB     00:09
(45/58): poppler-0.5.4-4.4.el5_5.14.i386.rpm             | 3.0 MB     00:13
(46/58): cups-1.3.7-26.el5_6.1.i386.rpm                  | 3.1 MB     00:00
(47/58): qt-3.3.6-23.el5.i386.rpm                        | 3.6 MB     00:16
(48/58): kdeutils-3.5.4-5.fc6.i386.rpm                   | 3.8 MB     00:14
(49/58): kdeartwork-3.5.4-1.fc6.i386.rpm                 | 5.8 MB     00:24
(50/58): kdemultimedia-3.5.4-2.fc6.i386.rpm              | 7.4 MB     00:34
(51/58): kdegraphics-3.5.4-17.el5_5.1.i386.rpm           | 7.8 MB     00:27
(52/58): hplip-1.6.7-6.el5_6.1.i386.rpm                  | 7.8 MB     00:02
(53/58): kdeaccessibil (39%) 20% [==          ] 236 kB/s | 1.7 MB     00:30 ETA
```

system-config-display

```
  libmng.i386 0:1.0.9-5.1
  libraw1394.i386 0:1.3.0-1.el5
  libsane-hpaio.i386 0:1.6.7-6.el5_6.1
  libsmbclient.i386 0:3.0.33-3.29.el5_6.2
  libtheora.i386 0:1.0alpha7-1
  lm_sensors.i386 0:2.10.7-9.el5
  lockdev.i386 0:1.0.1-10
  net-snmp-libs.i386 1:5.3.2.2-9.el5_5.1
  paps.i386 0:0.6.6-19.el5
  pilot-link.i386 2:0.11.8-16
  poppler.i386 0:0.5.4-4.4.el5_5.14
  poppler-utils.i386 0:0.5.4-4.4.el5_5.14
  qt.i386 1:3.3.6-23.el5
  sane-backends.i386 0:1.0.18-5.el5
  sane-backends-libs.i386 0:1.0.18-5.el5
  sip.i386 0:4.4.5-3
  system-config-printer-libs.i386 0:0.7.32.10-1.el5

Dependency Updated:
  cups-libs.i386 1:1.3.7-26.el5_6.1          dbus.i386 0:1.1.2-15.el5_6
  dbus-libs.i386 0:1.1.2-15.el5_6

Complete!
[root@localhost ~]#
[root@localhost ~]# system-config-display_
```





Installing FireFox. #yum install firefox.

```
  poppler.i386 0:0.5.4-4.4.el5_5.14
  poppler-utils.i386 0:0.5.4-4.4.el5_5.14
  qt.i386 1:3.3.6-23.el5
  sane-backends.i386 0:1.0.18-5.el5
  sane-backends-libs.i386 0:1.0.18-5.el5
  sip.i386 0:4.4.5-3
  system-config-printer-libs.i386 0:0.7.32.10-1.el5

Dependency Updated:
  cups-libs.i386 1:1.3.7-26.el5_6.1          dbus.i386 0:1.1.2-15.el5_6
  dbus-libs.i386 0:1.1.2-15.el5_6

Complete!
[root@localhost ~]#
[root@localhost ~]# system-config-display
Window manager warning: Failed to read theme from file /usr/share/themes/Clearlo
oks/metacity-1/metacity-theme-1.xml: Failed to open file '/usr/share/themes/Clea
rlooks/metacity-1/metacity-theme-1.xml': No such file or directory
Window manager warning: Failed to load theme "Clearlooks": Failed to open file '
/usr/share/themes/Clearlooks/metacity-1/metacity-theme-1.xml': No such file or d
irectory
Window manager warning: Lost connection to the display ':17.0';
most likely the X server was shut down or you killed/destroyed
the window manager.
[root@localhost ~]# yum install firefox_
```

Enter “y” for Yes.

```
Loading mirror speeds from cached hostfile
 * base: mirrors.easynews.com
 * extras: mirror.hmc.edu
 * updates: centos.mirror.facebook.net
Setting up Install Process
Resolving Dependencies
--> Running transaction check
---> Package firefox.i386 0:3.6.15-1.el5.centos set to be updated
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package         Arch         Version                     Repository       Size
================================================================================
Installing:
 firefox         i386         3.6.15-1.el5.centos         updates          14 M

Transaction Summary
================================================================================
Install       1 Package(s)
Upgrade       0 Package(s)

Total download size: 14 M
Is this ok [y/N]: y_
```

```
================================================================================
Installing:
 firefox         i386         3.6.15-1.el5.centos         updates          14 M

Transaction Summary
================================================================================
Install       1 Package(s)
Upgrade       0 Package(s)

Total download size: 14 M
Is this ok [y/N]: y
Downloading Packages:
firefox-3.6.15-1.el5.centos.i386.rpm                     |  14 MB     00:03
Running rpm_check_debug
Running Transaction Test
Finished Transaction Test
Transaction Test Succeeded
Running Transaction
  Installing     : firefox                                                 1/1

Installed:
  firefox.i386 0:3.6.15-1.el5.centos

Complete!
[root@localhost ~]# _
```

Install “Development Tools”

yum groupinstall “Development Tools”

```
================================================================================
Installing:
 firefox         i386         3.6.15-1.el5.centos         updates          14 M

Transaction Summary
================================================================================
Install       1 Package(s)
Upgrade       0 Package(s)

Total download size: 14 M
Is this ok [y/N]: y
Downloading Packages:
firefox-3.6.15-1.el5.centos.i386.rpm                     |  14 MB     00:03
Running rpm_check_debug
Running Transaction Test
Finished Transaction Test
Transaction Test Succeeded
Running Transaction
  Installing     : firefox                                                 1/1

Installed:
  firefox.i386 0:3.6.15-1.el5.centos

Complete!
[root@localhost ~]# yum groupinstall "Development Tools"_
```

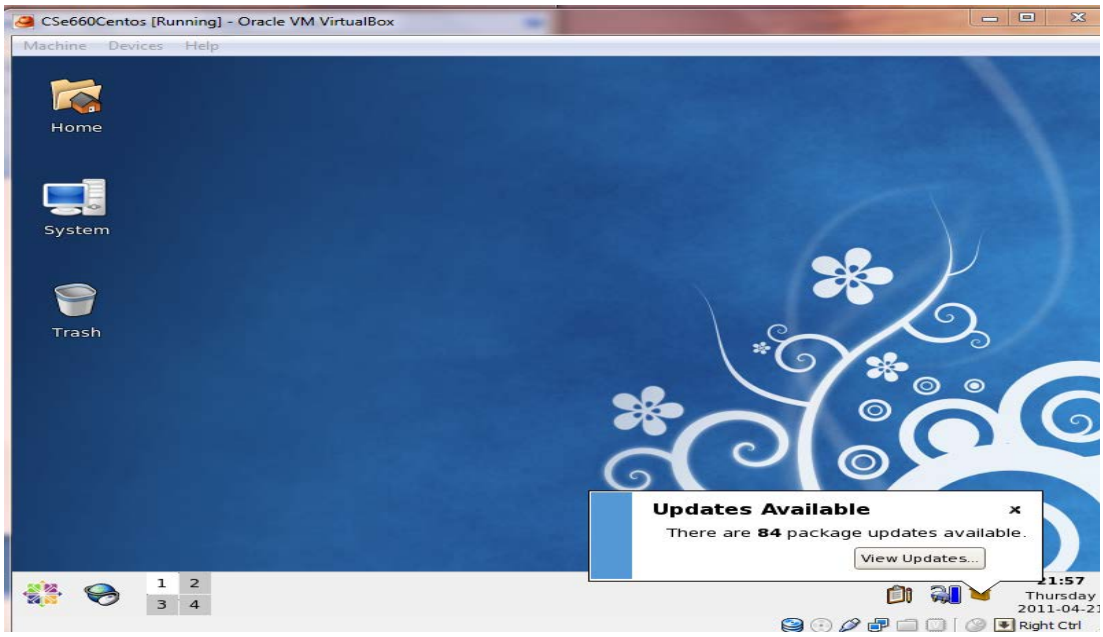
Enter “y” for Yes.

```
 glibc-devel               i386       2.5-58.el5_6.3          updates      2.0 M
 glibc-headers             i386       2.5-58.el5_6.3          updates      603 k
 imake                     i386       1.0.2-3                 base         319 k
 kernel-devel              i686       2.6.18-238.9.1.el5      updates      5.5 M
 kernel-headers            i386       2.6.18-238.9.1.el5      updates      1.1 M
 libXevie                  i386       1.0.1-3.1               base          14 k
 libgfortran               i386       4.1.2-50.el5            base         232 k
 libstdc++-devel           i386       4.1.2-50.el5            base         2.8 M
 perl-URI                  noarch     1.35-3                  base         116 k
 postgresql-libs           i386       8.1.23-1.el5_6.1        updates      196 k
 pyspi                     i386       0.6.1-1.el5             base          79 k
 systemtap-runtime         i386       1.3-4.el5               base          92 k
 xorg-x11-server-Xvfb      i386       1.1.1-48.76.el5_6.4     updates      1.6 M
Updating for dependencies:
 glibc                     i686       2.5-58.el5_6.3          updates      5.3 M
 glibc-common              i386       2.5-58.el5_6.3          updates       16 M
 nscd                      i386       2.5-58.el5_6.3          updates      167 k

Transaction Summary
================================================================================
Install      56 Package(s)
Upgrade       3 Package(s)

Total download size: 93 M
Is this ok [y/N]: y_
```

```
Transaction Summary
================================================================================
Install      56 Package(s)
Upgrade       3 Package(s)

Total download size: 93 M
Is this ok [y/N]: y
Downloading Packages:
(1/59): pstack-1.2-7.2.2.i386.rpm                        | 4.5 kB     00:00
(2/59): libXevie-1.0.1-3.1.i386.rpm                      |  14 kB     00:01
(3/59): diffstat-1.41-1.2.3.el5.i386.rpm                 |  18 kB     00:00
(4/59): byacc-1.9-29.2.2.i386.rpm                        |  37 kB     00:00
(5/59): redhat-rpm-config-8.0.45-32.el5.centos.noarch.rp |  54 kB     00:00
(6/59): ltrace-0.5-13.45svn.el5.i386.rpm                 |  61 kB     00:00
(7/59): pyspi-0.6.1-1.el5.i386.rpm                       |  79 kB     00:01
(8/59): apr-util-1.2.7-11.el5_5.2.i386.rpm               |  80 kB     00:00
(9/59): systemtap-runtime-1.3-4.el5.i386.rpm             |  92 kB     00:00
(10/59): indent-2.2.9-14.fc6.i386.rpm                    |  93 kB     00:00
(11/59): patchutils-0.2.31-2.2.2.i386.rpm                | 109 kB     00:00
(12/59): perl-URI-1.35-3.noarch.rpm                      | 116 kB     00:00
(13/59): python-ldap-2.2.0-2.1.i386.rpm                  | 122 kB     00:00
(14/59): apr-1.2.7-11.el5_5.3.i386.rpm                   | 123 kB     00:00
(15/59): flex-2.5.4a-41.fc6.i386.rpm                     | 124 kB     00:00
_
```

Typing “startx” to open the centos window as following.

```
  apr.i386 0:1.2.7-11.el5_5.3
  apr-util.i386 0:1.2.7-11.el5_5.2
  at-spi.i386 0:1.7.11-3.el5
  elfutils-libs.i386 0:0.137-3.el5
  gail.i386 0:1.9.2-3.el5_4
  glibc-devel.i386 0:2.5-58.el5_6.3
  glibc-headers.i386 0:2.5-58.el5_6.3
  imake.i386 0:1.0.2-3
  kernel-devel.i686 0:2.6.18-238.9.1.el5
  kernel-headers.i386 0:2.6.18-238.9.1.el5
  libXevie.i386 0:1.0.1-3.1
  libgfortran.i386 0:4.1.2-50.el5
  libstdc++-devel.i386 0:4.1.2-50.el5
  perl-URI.noarch 0:1.35-3
  postgresql-libs.i386 0:8.1.23-1.el5_6.1
  pyspi.i386 0:0.6.1-1.el5
  systemtap-runtime.i386 0:1.3-4.el5
  xorg-x11-server-Xvfb.i386 0:1.1.1-48.76.el5_6.4

Dependency Updated:
  glibc.i686 0:2.5-58.el5_6.3          glibc-common.i386 0:2.5-58.el5_6.3
  nscd.i386 0:2.5-58.el5_6.3

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



Installing Centos is done.

Installation of Lustre

Preparation of Centos for Lustre

Visiting the website http://www.lustre.org is the first requirement. There are a number of areas that should read through, especially the Lustre manual.

Packages for Lustre

Lustre is designed, developed and maintained by Oracle Corporation.

We had to install the following package, in the following order:

1- Lustre-patched kernel (MDS/MGS/OSS Only)
kernel-2.6.18-194.3.1.el5_lustre.1.8.4.i686.rpm.

***Note:** in case if you weren't able to install the kernel you have to use the following command: "rpm –ivh – force kernel-2.6.18-194.3.1.el5_lustre.1.8.4.i686.rpm", to force it.

2- Lustre modules (Client and Server for Lustre patched kernel)
lustre-modules-1.8.4-2.6.18_194.3.1.el5_lustre.1.8.4.i686.rpm.

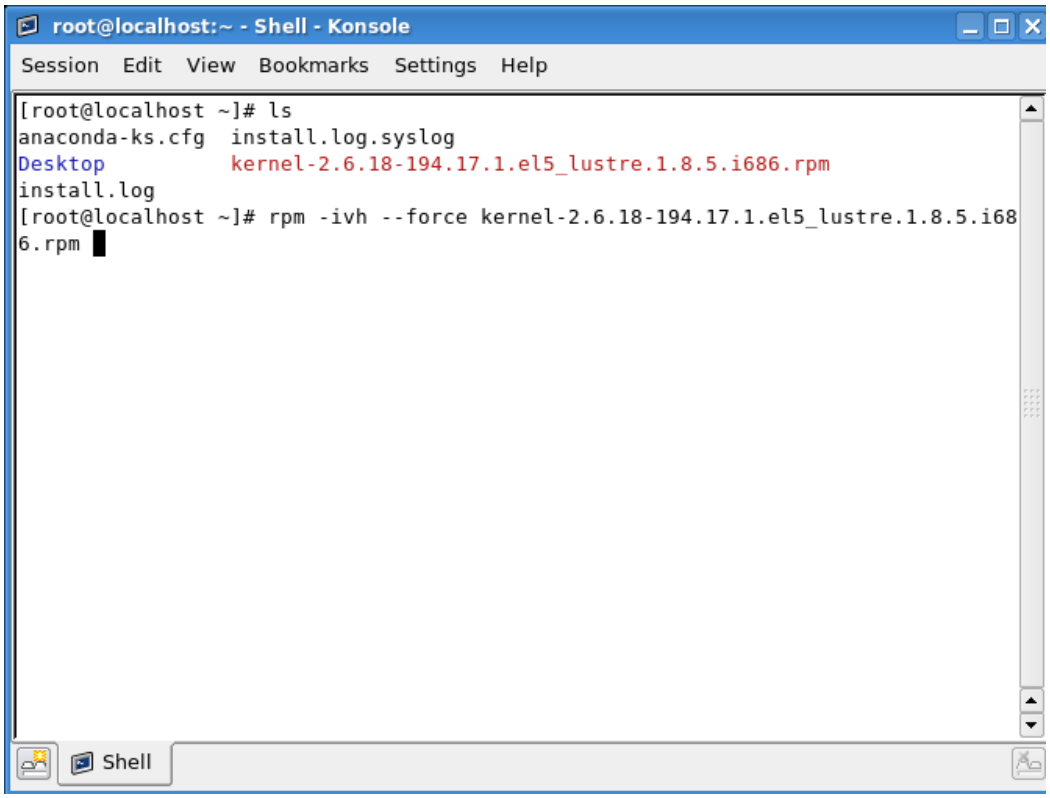
3- Backing filesystem kernel module (MDS/MGS/OSS Only)
lustre-ldiskfs-3.1.3-2.6.18_194.3.1.el5_lustre.1.8.4.i686.rpm.

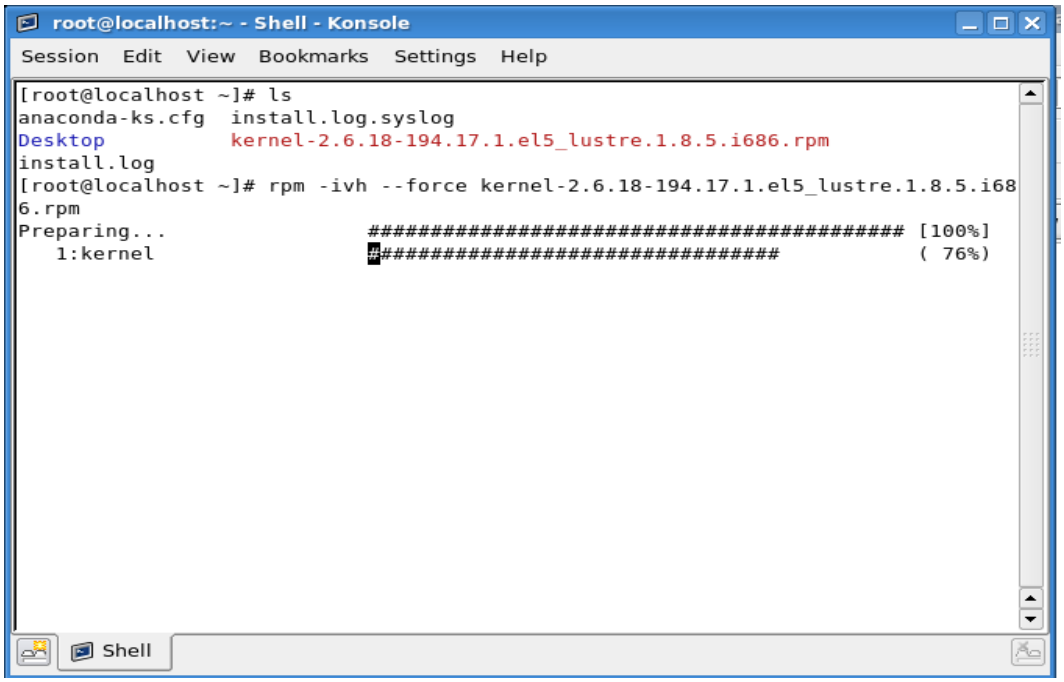
4- Lustre userland tools (Client and server for patched Lustre kernel)
lustre-1.8.4-2.6.18_194.3.1.el5_lustre.1.8.4.i686.rpm.

5- Backing filesystem creation and repair tools (MDS/MGS/OSS Only)
e2fsprogs-1.41.10.sun2-0redhat.rhel5.i386.rpm.

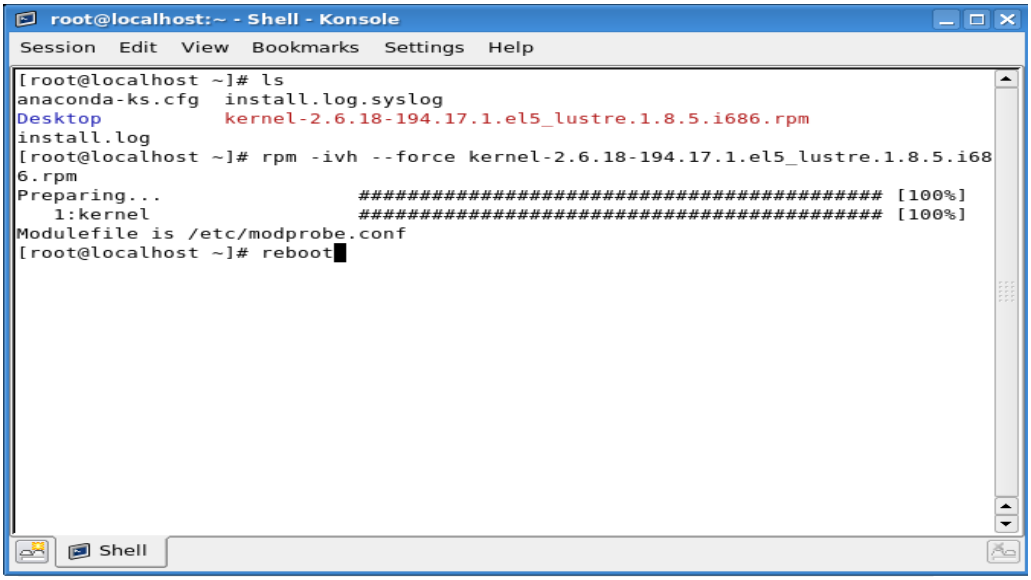
Installation of server files of Lustre for Centos

After downloading the Lustre kernel we had to install it using the force command to overwrite the newer Centos kernel that existed.

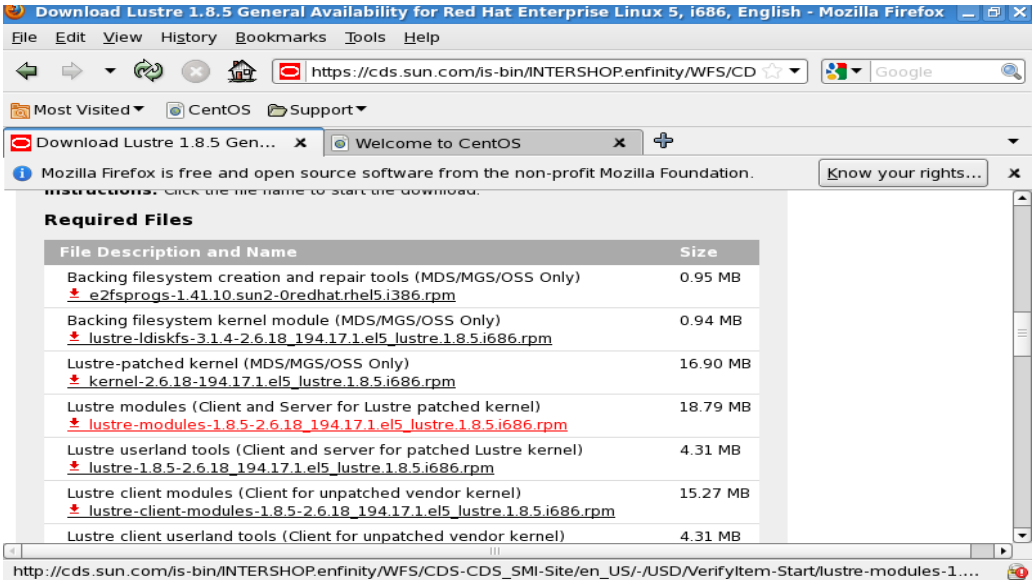

root@localhost:~ - Shell - Konsole
Session Edit View Bookmarks Settings Help
[root@localhost ~]# ls
anaconda-ks.cfg install.log.syslog
Desktop kernel-2.6.18-194.17.1.el5_lustre.1.8.5.i686.rpm
install.log
[root@localhost ~]# rpm -ivh --force kernel-2.6.18-194.17.1.el5_lustre.1.8.5.i68
6.rpm
Shell

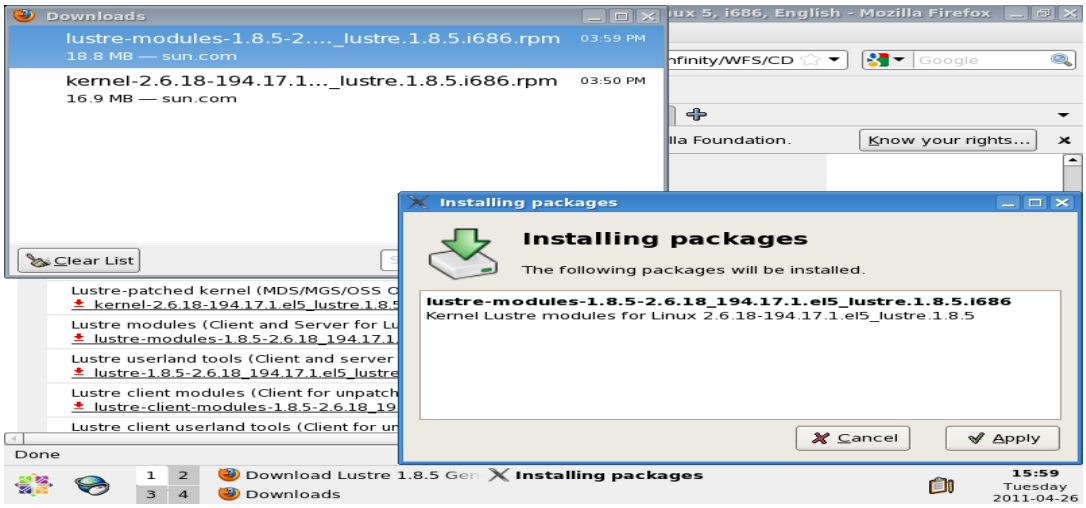

root@localhost:~ - Shell - Konsole
Session Edit View Bookmarks Settings Help
[root@localhost ~]# ls
anaconda-ks.cfg install.log.syslog
Desktop kernel-2.6.18-194.17.1.el5_lustre.1.8.5.i686.rpm
install.log
[root@localhost ~]# rpm -ivh --force kernel-2.6.18-194.17.1.el5_lustre.1.8.5.i68
6.rpm
Preparing... ### [100%]
1:kernel ################################# (76%)
Shell

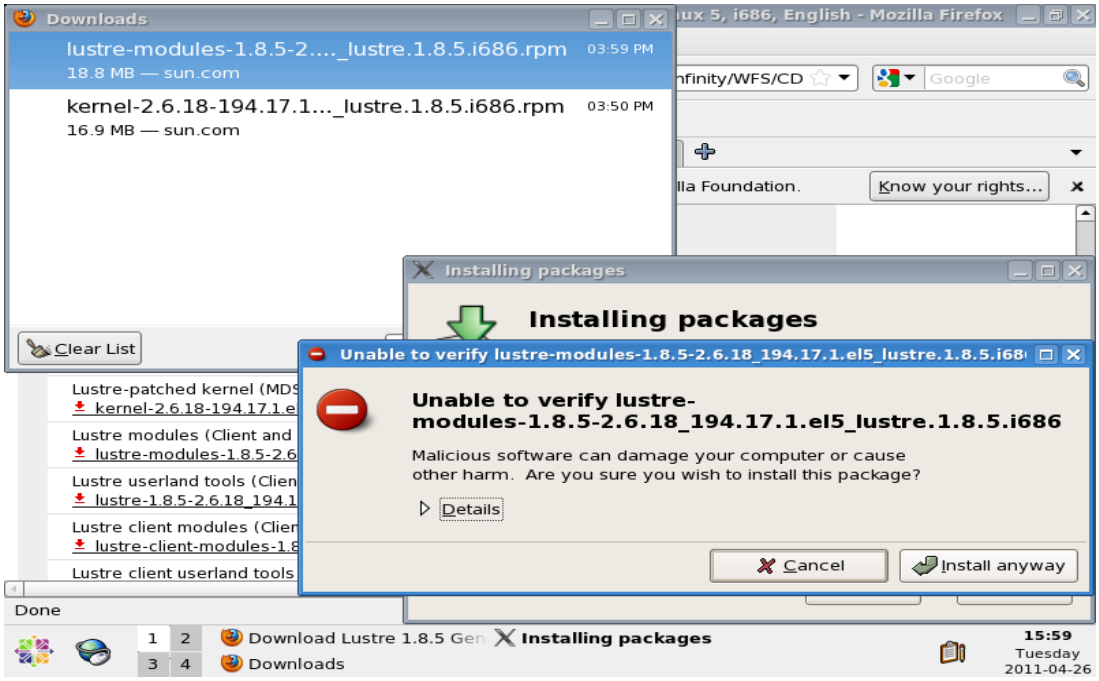
After it finishes installing the kernel, reboot

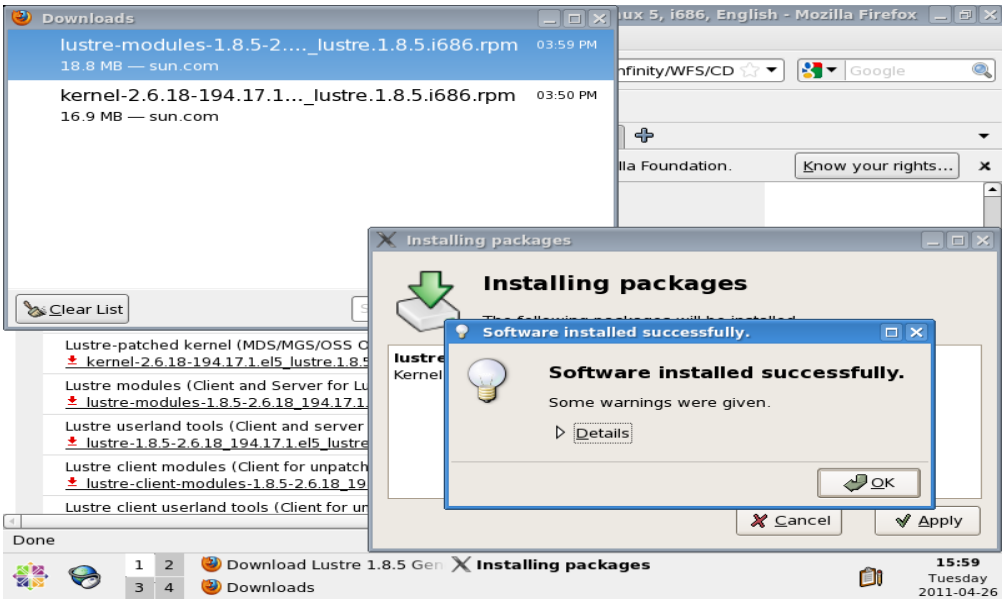


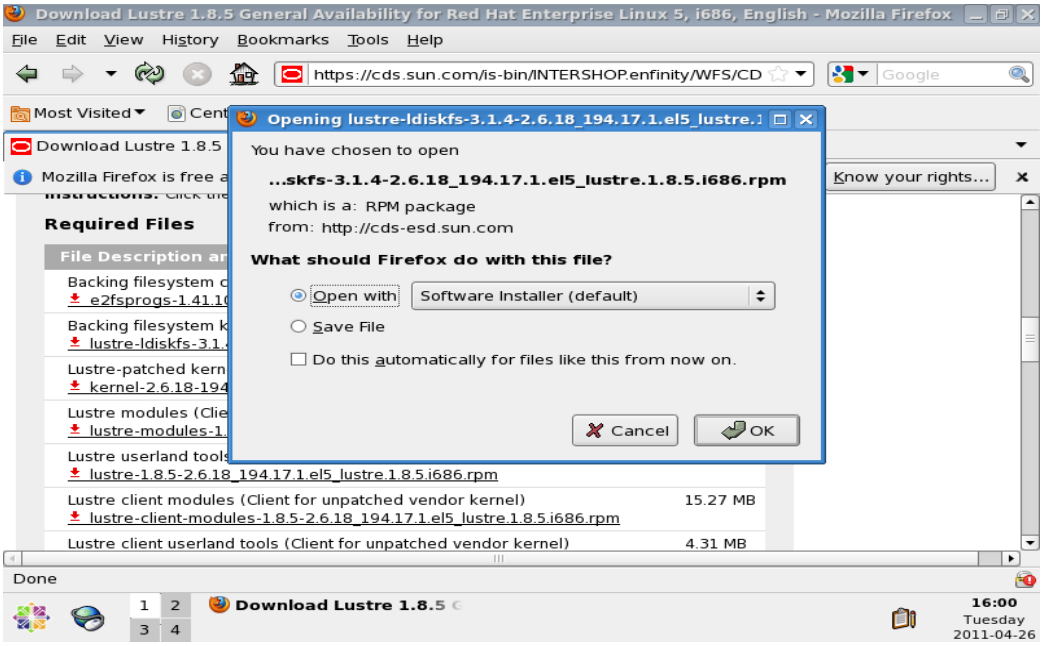
Now, after we have rebooted to the Lustre kernel, we are going to install the rest of the commands in the order that we have mentioned above. We decided to use Firefox to download and use the install feature that is compatible with Centos. After the kernel, the modules are installed. Each of the installs gave a warning about not being able to verify Lustre. We will show this the first time, but it is implied on the other installs of Lustre.

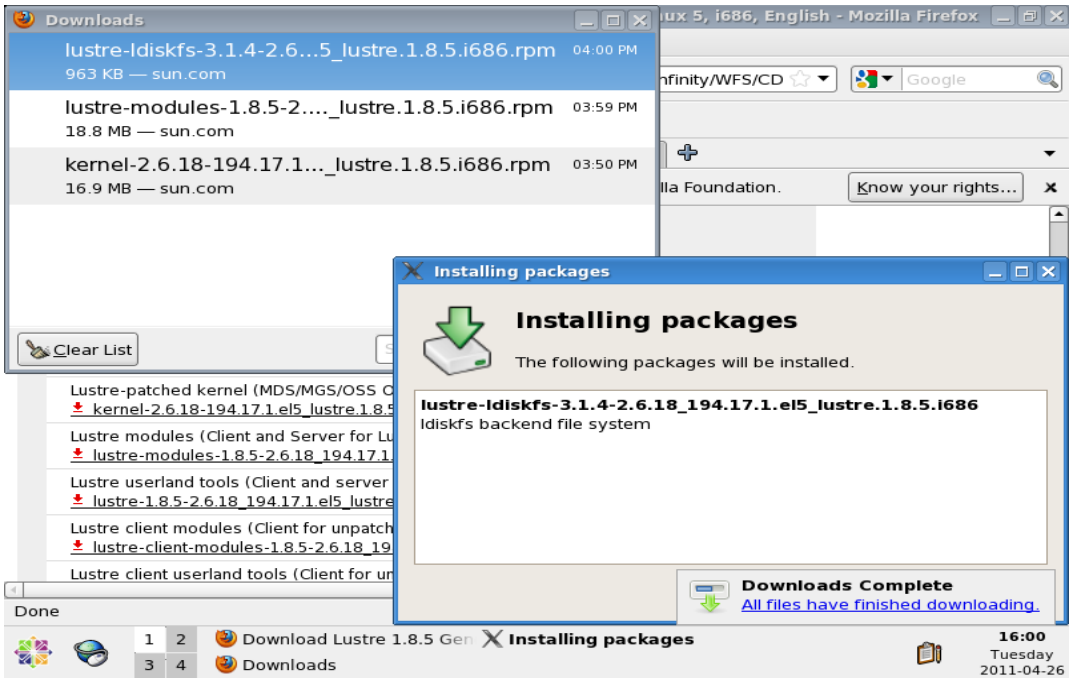


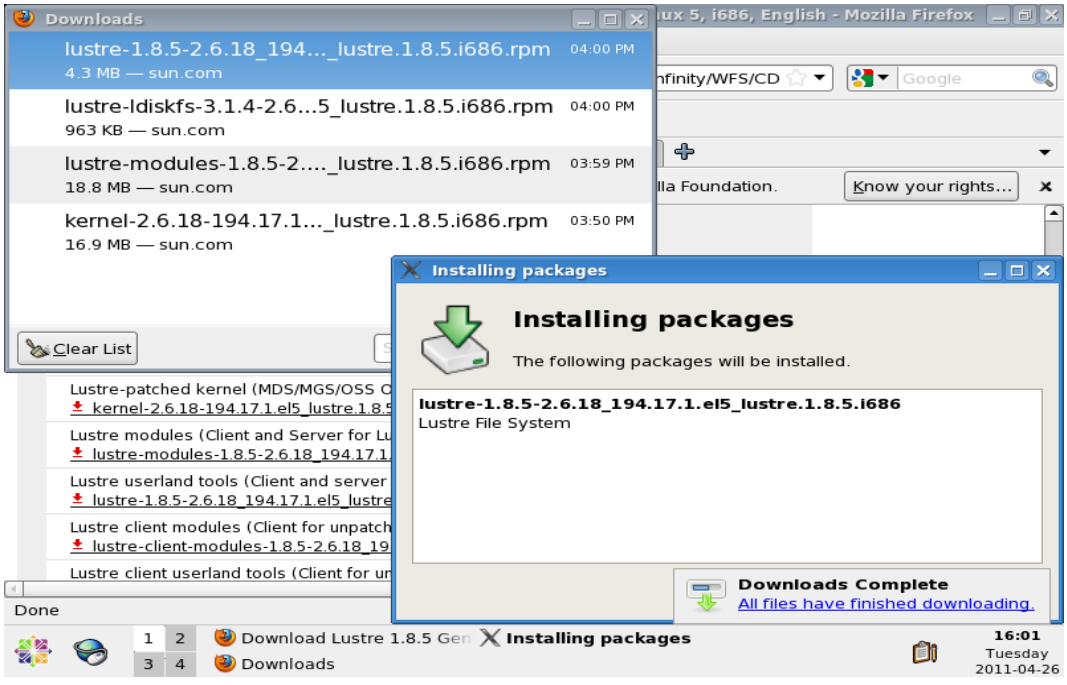

Downloads
lustre-modules-1.8.5-2...._lustre.1.8.5.i686.rpm 03:59 PM
18.8 MB — sun.com
kernel-2.6.18-194.17.1..._lustre.1.8.5.i686.rpm 03:50 PM
16.9 MB — sun.com
Clear List
Installing packages
Installing packages
The following packages will be installed.
lustre-modules-1.8.5-2.6.18_194.17.1.el5_lustre.1.8.5.i686
Kernel Lustre modules for Linux 2.6.18-194.17.1.el5_lustre.1.8.5
Cancel
Apply
Know your rights...
Done
Installing packages
Downloads
15:59
Tuesday
2011-04-26

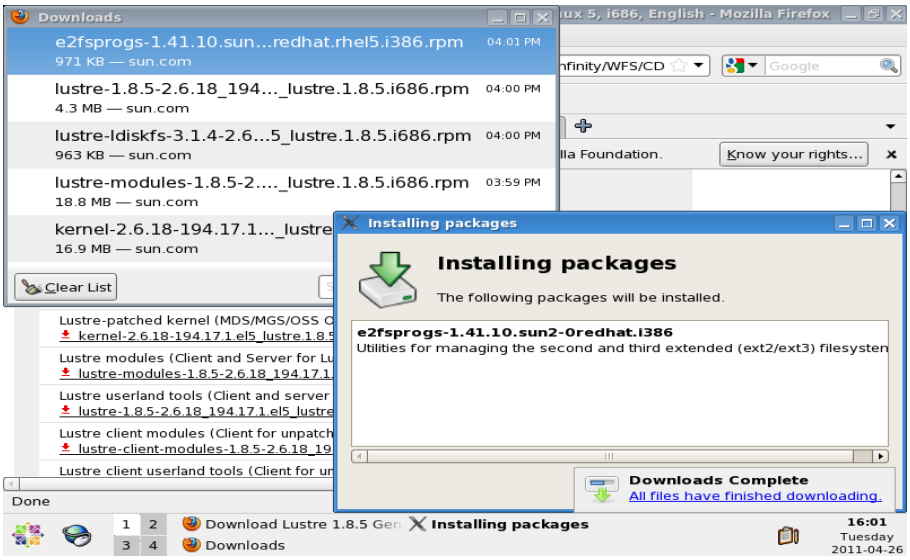

Downloads
lustre-modules-1.8.5-2...._lustre.1.8.5.i686.rpm 03:59 PM
18.8 MB — sun.com
kernel-2.6.18-194.17.1..._lustre.1.8.5.i686.rpm 03:50 PM
16.9 MB — sun.com
Clear List
Installing packages
Installing packages
Unable to verify lustre-modules-1.8.5-2.6.18_194.17.1.el5_lustre.1.8.5.i68
Unable to verify lustre-modules-1.8.5-2.6.18_194.17.1.el5_lustre.1.8.5.i686
Malicious software can damage your computer or cause other harm. Are you sure you wish to install this package?
Details
Cancel
Install anyway
Know your rights...
Done
Installing packages
Downloads
15:59
Tuesday
2011-04-26

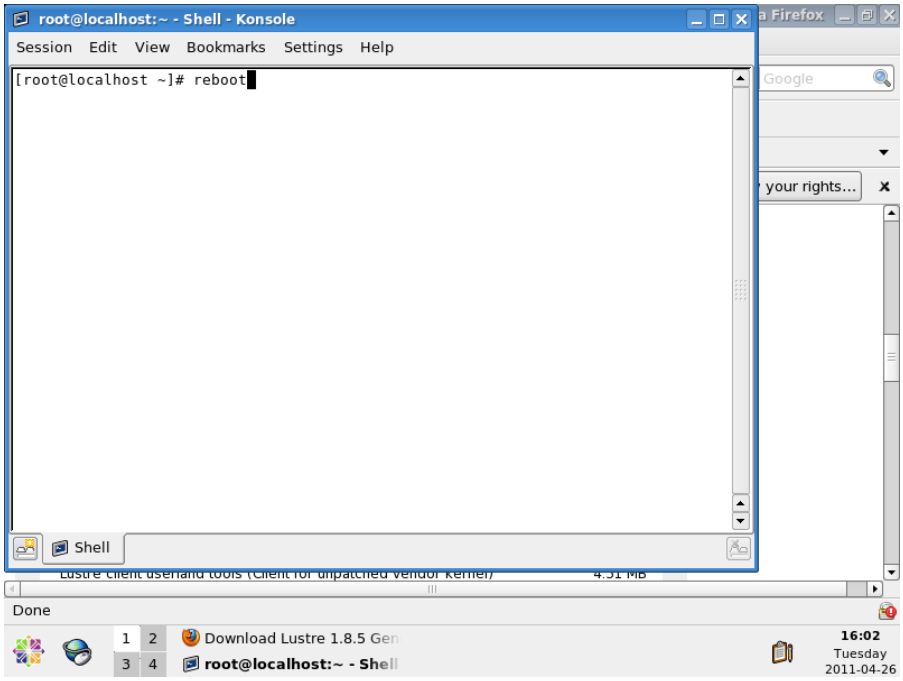

Downloads
lustre-modules-1.8.5-2..._lustre.1.8.5.i686.rpm 03:59 PM
18.8 MB — sun.com
kernel-2.6.18-194.17.1..._lustre.1.8.5.i686.rpm 03:50 PM
16.9 MB — sun.com
Clear List
Installing packages
Installing packages
Software installed successfully.
Software installed successfully.
Some warnings were given.
Details
OK
Cancel
Apply
Know your rights...
Done
Download Lustre 1.8.5 Gen
Installing packages
Downloads
15:59
Tuesday
2011-04-26


Download Lustre 1.8.5 General Availability for Red Hat Enterprise Linux 5, i686, English - Mozilla Firefox
File Edit View History Bookmarks Tools Help
https://cds.sun.com/is-bin/INTERSHOP.enfinity/WFS/CD
Opening lustre-ldiskfs-3.1.4-2.6.18_194.17.1.el5_lustre.1.8.5.i686.rpm
You have chosen to open
...skfs-3.1.4-2.6.18_194.17.1.el5_lustre.1.8.5.i686.rpm
which is a: RPM package
from: http://cds-esd.sun.com
What should Firefox do with this file?
Open with
Software Installer (default)
Save File
Do this automatically for files like this from now on.
Cancel
OK
Know your rights...
Required Files
Lustre userland tools
lustre-1.8.5-2.6.18_194.17.1.el5_lustre.1.8.5.i686.rpm
Lustre client modules (Client for unpatched vendor kernel)
15.27 MB
lustre-client-modules-1.8.5-2.6.18_194.17.1.el5_lustre.1.8.5.i686.rpm
Lustre client userland tools (Client for unpatched vendor kernel)
4.31 MB
Done
Download Lustre 1.8.5
16:00
Tuesday
2011-04-26

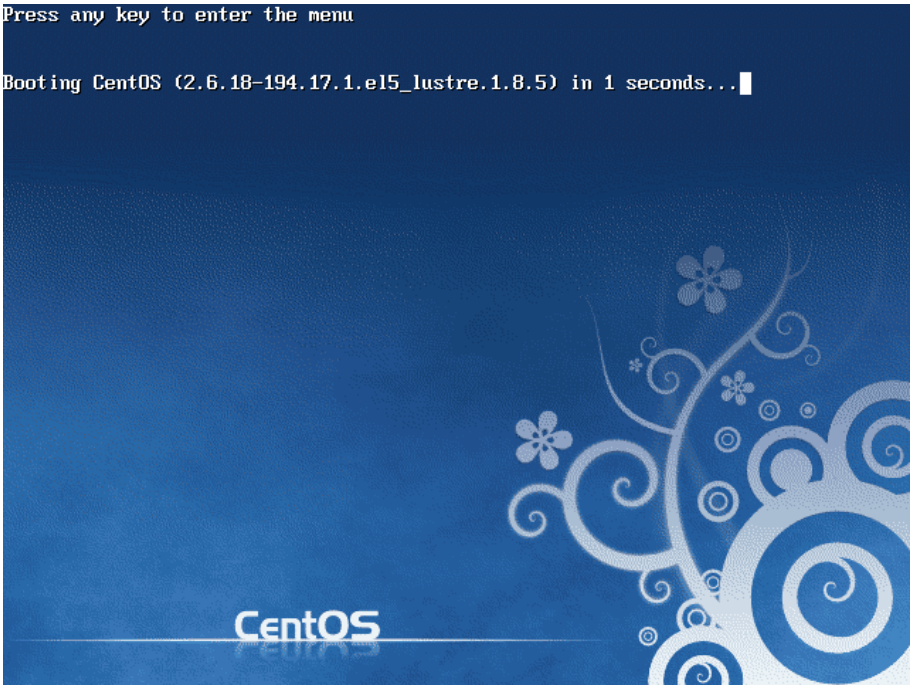

Downloads
lustre-ldiskfs-3.1.4-2.6...5_lustre.1.8.5.i686.rpm 04:00 PM
963 KB — sun.com
lustre-modules-1.8.5-2...._lustre.1.8.5.i686.rpm 03:59 PM
18.8 MB — sun.com
kernel-2.6.18-194.17.1..._lustre.1.8.5.i686.rpm 03:50 PM
16.9 MB — sun.com
Clear List
Installing packages
Installing packages
The following packages will be installed.
lustre-ldiskfs-3.1.4-2.6.18_194.17.1.el5_lustre.1.8.5.i686
ldiskfs backend file system
Downloads Complete
All files have finished downloading.
Know your rights...
Done
Download Lustre 1.8.5 Gen
Installing packages
Downloads
16:00
Tuesday
2011-04-26


Downloads
lustre-1.8.5-2.6.18_194..._lustre.1.8.5.i686.rpm 04:00 PM
4.3 MB — sun.com
lustre-ldiskfs-3.1.4-2.6...5_lustre.1.8.5.i686.rpm 04:00 PM
963 KB — sun.com
lustre-modules-1.8.5-2...._lustre.1.8.5.i686.rpm 03:59 PM
18.8 MB — sun.com
kernel-2.6.18-194.17.1..._lustre.1.8.5.i686.rpm 03:50 PM
16.9 MB — sun.com
Clear List
Installing packages
Installing packages
The following packages will be installed.
lustre-1.8.5-2.6.18_194.17.1.el5_lustre.1.8.5.i686
Lustre File System
Downloads Complete
All files have finished downloading.
Know your rights...
Done
Download Lustre 1.8.5 Gen
Installing packages
Downloads
16:01
Tuesday
2011-04-26

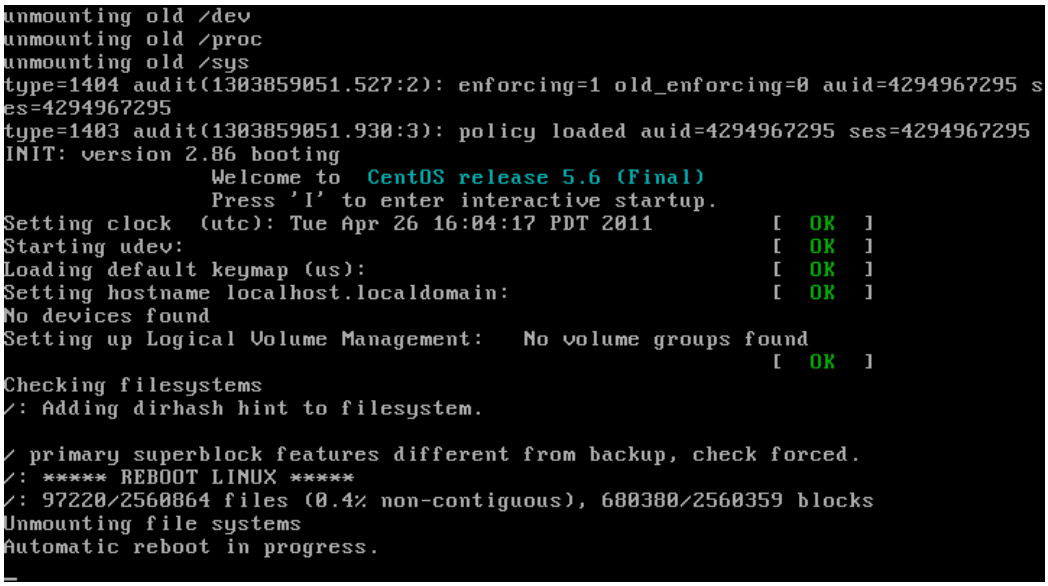

Downloads
e2fsprogs-1.41.10.sun...redhat.rhel5.i386.rpm 04:01 PM
971 KB — sun.com
lustre-1.8.5-2.6.18_194..._lustre.1.8.5.i686.rpm 04:00 PM
4.3 MB — sun.com
lustre-ldiskfs-3.1.4-2.6...5_lustre.1.8.5.i686.rpm 04:00 PM
963 KB — sun.com
lustre-modules-1.8.5-2...._lustre.1.8.5.i686.rpm 03:59 PM
18.8 MB — sun.com
kernel-2.6.18-194.17.1..._lustre
16.9 MB — sun.com
Clear List
Installing packages
Installing packages
The following packages will be installed.
e2fsprogs-1.41.10.sun2-0redhat.i386
Utilities for managing the second and third extended (ext2/ext3) filesysten
Downloads Complete
All files have finished downloading.
Done
Download Lustre 1.8.5 Gen
Installing packages
Downloads
16:01
Tuesday
2011-04-26

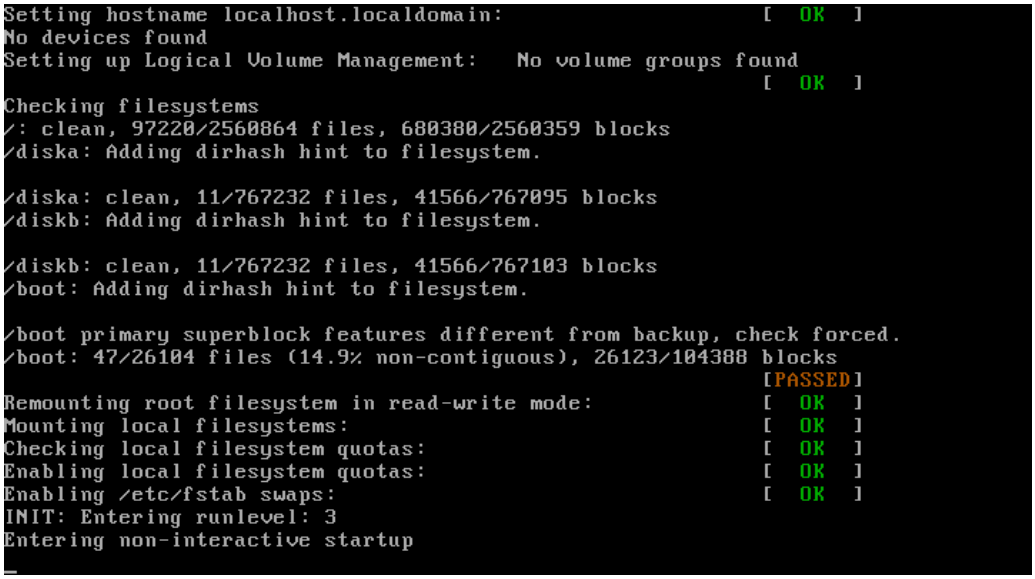

root@localhost:~ - Shell - Konsole
Session Edit View Bookmarks Settings Help
[root@localhost ~]# reboot
Shell
Done
Download Lustre 1.8.5 Gen
root@localhost:~ - Shell
16:02
Tuesday
2011-04-26

After reboot, the splash screen indicates that the Lustre Kernel is running.




```
Setting up other filesystems.
Setting up new root fs
no fstab.sys, mounting internal defaults
Switching to new root and running init.
unmounting old /dev
unmounting old /proc
unmounting old /sys
type=1404 audit(1303859051.527:2): enforcing=1 old_enforcing=0 auid=4294967295 s
es=4294967295
type=1403 audit(1303859051.930:3): policy loaded auid=4294967295 ses=4294967295
INIT: version 2.86 booting
               Welcome to  CentOS release 5.6 (Final)
               Press 'I' to enter interactive startup.
Setting clock  (utc): Tue Apr 26 16:04:17 PDT 2011         [  OK  ]
Starting udev:                                             [  OK  ]
Loading default keymap (us):                               [  OK  ]
Setting hostname localhost.localdomain:                    [  OK  ]
No devices found
Setting up Logical Volume Management:   No volume groups found
                                                           [  OK  ]
Checking filesystems
/: Adding dirhash hint to filesystem.

/ primary superblock features different from backup, check forced.
/: |=============================================                  / 70.0%
```





Now that the Lustre File System is installed the configuration of the Lustre can now be set.

The first thing to do is check your IP address. This address will potentially change after each reboot. We initially set the network to DHCP.

```
CentOS release 5.6 (Final)
Kernel 2.6.18-194.17.1.el5_lustre.1.8.5 on an i686

localhost login: root
Password:
Last login: Tue Apr 26 16:06:51 on tty1
[root@localhost ~]# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0C:29:B9:72:04
          inet addr:192.168.63.136  Bcast:192.168.63.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:34 errors:0 dropped:0 overruns:0 frame:0
          TX packets:21 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4643 (4.5 KiB)  TX bytes:3334 (3.2 KiB)
          Interrupt:67 Base address:0x2000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:8 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:560 (560.0 b)  TX bytes:560 (560.0 b)

[root@localhost ~]# _
```

Modify the Modeprobe.conf file to add Lustre Network info.

```
[root@localhost ~]# vi /etc/modprobe.conf_
```

We need to add the line that is highlighted. This is used by the Luster Network (lnet).

```
alias eth0 pcnet32
alias scsi_hostadapter mptbase
alias scsi_hostadapter1 mptspi
alias scsi_hostadapter2 ata_piix
alias net-pf-10 off
alias ipv6 off
options ipv6 disable=1
alias snd-card-0 snd-ens1371
options snd-card-0 index=0
options snd-ens1371 index=0
options lnet networks=tcp0_
remove snd-ens1371 { /usr/sbin/alsactl store 0 >/dev/null 2>&1 || : ; }; /sbin/m
odprobe -r --ignore-remove snd-ens1371
~
~
~
~
~
~
~
~
~
~
~
-- INSERT --
```

Directories need to be created.

```
[root@localhost /]# ls
bin   dev    diskb  home  lost+found  misc  net  proc  sbin     srv  tmp  var
boot  diska  etc    lib   media       mnt   opt  root  selinux  sys  usr
[root@localhost /]# mkdir mnt_
```

```
[root@localhost /]# cd mnt
[root@localhost mnt]# mkdir mdt
[root@localhost mnt]# mkdir ost
[root@localhost mnt]# _
```

We dismount the two partitions that were created earlier. They are to be used for Lustre. Then we create the MDT part of Lustre.

```
[root@localhost /]# df
Filesystem           1K-blocks      Used Available Use% Mounted on
/dev/sda2              9920624   2399388   7009168  26% /
/dev/sda5              2972236     70120   2748700   3% /diska
/dev/sda3              2972268     70120   2748728   3% /diskb
/dev/sda1               101086     22821     73046  24% /boot
tmpfs                   517632         0    517632   0% /dev/shm
[root@localhost /]# ls
bin   dev    diskb  home  lost+found  misc  net  proc  sbin     srv  tmp  var
boot  diska  etc    lib   media       mnt   opt  root  selinux  sys  usr
[root@localhost /]# umount /dev/sda5
[root@localhost /]# umount /dev/sda3
[root@localhost /]# _
```

Create the MGS and MDT Lustre File System

```
[root@localhost /]# mkfs.lustre --fsname=lustre --mgs --mdt /dev/sda5

   Permanent disk data:
Target:     lustre-MDTffff
Index:      unassigned
Lustre FS:  lustre
Mount type: ldiskfs
Flags:      0x75
              (MDT MGS needs_index first_time update )
Persistent mount opts: iopen_nopriv,user_xattr,errors=remount-ro
Parameters: mdt.group_upcall=/usr/sbin/l_getgroups

checking for existing Lustre data: not found
device size = 2996MB
2 6 18
formatting backing filesystem ldiskfs on /dev/sda5
        target name  lustre-MDTffff
        4k blocks     767095
        options        -J size=116 -i 4096 -I 512 -q -O dir_index,uninit_groups
-F
mkfs_cmd = mke2fs -j -b 4096 -L lustre-MDTffff  -J size=116 -i 4096 -I 512 -q -O
 dir_index,uninit_groups -F /dev/sda5 767095
Writing CONFIGS/mountdata
```

Create the OST Lustre File System.

```
[root@localhost mnt]# mkfs.lustre --fsname=lustre --ost --mgsnode=192.168.63.136
@tcp0 /dev/sda3

   Permanent disk data:
Target:     lustre-OSTffff
Index:      unassigned
Lustre FS:  lustre
Mount type: ldiskfs
Flags:      0x72
              (OST needs_index first_time update )
Persistent mount opts: errors=remount-ro,extents,mballoc
Parameters: mgsnode=192.168.63.136@tcp

checking for existing Lustre data: not found
device size = 2996MB
2 6 18
formatting backing filesystem ldiskfs on /dev/sda3
        target name  lustre-OSTffff
        4k blocks     767103
        options        -J size=116 -i 16384 -I 256 -q -O dir_index,extents,unini
t_groups -F
mkfs_cmd = mke2fs -j -b 4096 -L lustre-OSTffff  -J size=116 -i 16384 -I 256 -q -
O dir_index,extents,uninit_groups -F /dev/sda3 767103
_
```

Now we mount both file systems.

```
[root@localhost mnt]# mount -t lustre /dev/sda5 /mnt/mdt
Lustre: MGC192.168.63.136@tcp: Reactivating import
Lustre: MGS: Logs for fs lustre were removed by user request.  All servers must
be restarted in order to regenerate the logs.
Lustre: lustre-MDT0000: new disk, initializing
Lustre: 4169:0:(lproc_mds.c:271:lprocfs_wr_group_upcall()) lustre-MDT0000: group
 upcall set to /usr/sbin/l_getgroups
[root@localhost mnt]# _
```

```
[root@localhost mnt]# mount -t lustre /dev/sda3 /mnt/ost
LDISKFS-fs: file extents enabled
LDISKFS-fs: mballoc enabled
Lustre: MGS: Regenerating lustre-OSTffff log by user request.
Lustre: lustre-OST0000: new disk, initializing
[root@localhost mnt]# _
```

This completes Lustre File system. It is installed and running. The client is normally installed on a different system for testing.

Test for server installation.

For our test we will not be installing a client on a separate computer. We will connect to another computer who is also a Luster File Server. Each will connect as a client to the other. For testing we can connect to our own file server to test for functionality.

Installation of Client files for Lustre on Centos

If we were truly using a client, we would install the client packages for Lustre. But we all ready have the services installed on the server to attach to a different server to act as a client. Mount the client link to a previously created folder. This can under the /mnt folder.

```
[root@LustreIJB lustre]# mount -t lustre 192.168.1.23@tcp0:/lustre /mnt/l2_
```

So now we create a file under one connection.

```
[root@LustreIJ mnt]# cd l2
[root@LustreIJ l2]# ls
[root@LustreIJ l2]# touch foo
[root@LustreIJ l2]# ls
foo
[root@LustreIJ l2]# _
```

Then we change to the other directory on the other system

```
[root@LustreIJB mnt]# cd lustre
[root@LustreIJB lustre]# ls
foo
```

The file is automatically replicated.

Installation Issues

Installation issues of Centos

The installation went well. There was a learning curve on what to install what not to install on the initial installation.

Installation issues of Lustre Server

The installation had some issue initially, because once we rebooted the system and after we installed the Lustre system, the Centos file system would crash. We just had to install the partions of Centos in a different order and remove any references of any unwanted partitions in the fstab file.

Installation issues of Lustre Client

The difficulty here was understanding how Lustre worked and how to test it. Once we did it the first time, it was easy to repeat with other students who needed to connect to us for testing purposes.

Conclusions

The Lustre File system is interesting. The ability to have a file replicated or synchronized quickly was great. We were also able to remove the network connection, create a file and re-connect the network and have the file synchronized. In a large scale implementation, it could be difficult to manage.