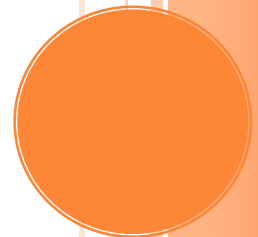# REDHAT LINUX CERTIFIED PROFESSIONAL

Step by Step guide for redhat Linux Professional

This document will guide you to know about Redhat enterprise Linux and its features. It will guide you to install and configure the Server.

Written by Ankam Ravi Kumar

4/29/2016

ABOUT AUTHOR

MY NAME IS ANKAM RAVI KUMAR HAVING MORE THAN 6YEARS OF SOLID INDUSTRY EXPERIENCE IN INFRASTRUCTURE MANAGEMENT / CUSTOMER SUPPORT / OPERATIONS AND TRAINING DOMAIN.

DEEP FUNCTIONAL AND MANAGEMENT KNOWLEDGE ACROSS THE FOLLOWING IT DOMAINS

- OPERATING SYSTEM MANAGEMENT SUCH HAS LINUX DIFFERENT FLAVORS, AIX, SOLARIS AND WINDOWS
- ENTERPRISE SERVER MANAGEMENT
- INSTALLING AND CONFIGURING BLADE SERVERS
- CORE STORAGE MANAGEMENT (OVERLAND STORAGE, EMC, IBM AND NETAPP)
- DATABASE MANAGEMENT (MS SQL, POSTGRESQL AND MYSQL)
- PROCESS MANAGEMENT (ITIL)
- VIRTUALIZATION MANAGEMENT (VSPHERE, VMWARE, KVM, HYPER-V AND XEN)
- BACKUP AND RECOVERY MANAGEMENT (NET VAULT, COMMVAULT AND SYMANTEC BACKUP EXEC)
- APPLICATION SERVER MANAGEMENT AND STORAGE CLUSTER MANAGEMENT
- DATA CENTER MANAGEMENT AND HOSTING SOLUTIONS
- SERVER MANAGEMENT
- PROGRAMMING LANGUAGES SUCH AS PHP AND HTML
- SCRIPTING LANGUAGES SHELL, PERL AND PYTHON
- ASSET MANAGEMENT AND PROCUREMENT. DESIGNED, PLANNED AND IMPLEMENTED THE DATA CENTER, SERVER MONITORING AND SAN ENVIRONMENTS.

I AM SPECIALIZED IN MANAGING AND BUILDING THE TEAMS FOR IT SERVICES DELIVERY AND SERVICE SUPPORT, TRAINING AND OPERATIONS IN BOTH SMALLER AND LARGER COMPANIES. RICH EXPERIENCE AND STRONG EXPOSURE IN IT INFRASTRUCTURE & DATA CENTER MANAGEMENT.

IMPLEMENTATION OF MONITORING SOLUTIONS FOR SMALL. MEDIUM AND ENTERPRISE COMPANIES, USING TOOLS NAGIOS, NAGIOSXI, CACTI, SOLARWINDS AND OP MANAGER.

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KEEP IN TOUCH FOR FURTHER QUESTIONS AND CLARIFICATIONS.

INDEX

ARK IT	**1. Introduction**	Document No.	:	RHEL Professional Guide
		Author	:	Ankam Ravi Kumar
		Web site	:	http://arkit.co.in
		Page No.	:	3

UNIX is the first Operating system in the world, developed by Kem Thompson and Dennis Ritchie in 1969 at Bell Lab by AT&T Company

> **IBM   :   AIX**
>
> **SGI   :   IRIX**
>
> **Sun   :   Solaris**

Free software foundation organization, they start a project by name GNU. The main aim of this project is to develop such an operating system that can run on any platform.

In 1991, a student Linuz Torvalds developed a kernel named Linux's kernel plus GNU application called Linux operating system.

Linux is an open source technology.

Different companies that provide Linux in Market are Redhat, SuSe, Scientific, Centos, and Knoppix etc.

Features:

- ➢ Linux is the fastest Operating system in the world. It runs 2 to 3 times fast than windows OS.
- ➢ Linux is the much secured OS because there is no any problem of virus.
- ➢ Linux file format is text format and windows file format is binary format.
- ➢ Linux is very reliable OS because kernel of Linux is very stable as compare to windows kernel not crashed easily.
- ➢ Kernel of Linux is very small in size it can be stored in floppy.
- ➢ Linux uses the x-Window system which is advanced network windowing system. Using this system we can display output of any workstation monitor attached in the network.

Advantages:

- ➢ Virus Proof
- ➢ Crash Proof
- ➢ Economical
- ➢ Multiuser, Multi-Tasking and Multi processing capacity

Login Modes:

**Two modes:** 1.Text mode (CLI)   2.Graphical Mode (GUI)

Login to Text mode we have use (Ctrl+Alt+F1…..F6, F8….F12) (Ctrl+Alt+F7) for Graphical Mode

ARK IT	2. Windows Vs Linux	Document No.	:	RHEL Professional Guide
		Author	:	Ankam Ravi Kumar
		Web site	:	http://arkit.co.in/
		Page No.	:	4

Windows	Linux
➢ It is a proprietary software everything need to buy	➢ It is an open source software everything is free
➢ Less Secure	➢ More Secure
➢ More costly	➢ Less Cost compare to windows
➢ Chance to get a carpal tunnel syndrome	➢ There is no chance to get carpal tunnel syndrome
➢ Developed by Microsoft corporation	➢ Developed by Linus Torvalds
➢ Options need to select	➢ You can develop anything as per your requirement
➢ Kernel is not editable	➢ Kernel is editable

		Document No.	:	RHEL Professional Guide
ARK IT	**3. Linux Architecture**	Author	:	Ankam Ravi Kumar
		Web site	:	*http://ark-library.blogspot.in*
		Page No.	:	5

Linux Architecture:
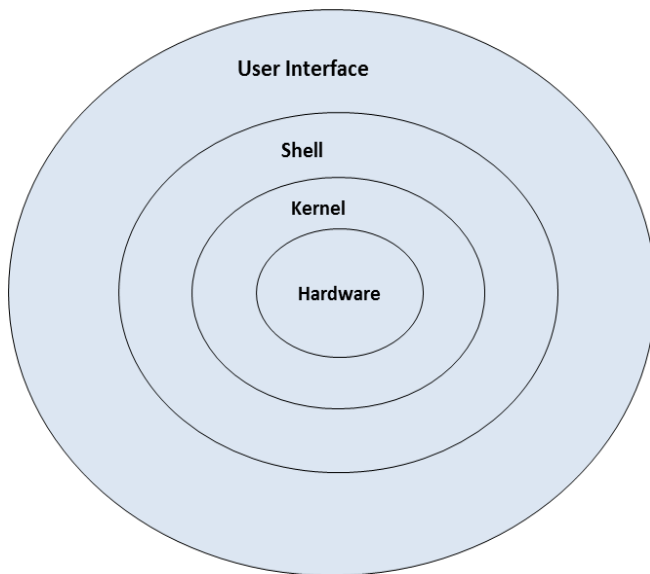
Kernel: It is a program. Kernel is a Core component of operating system, interacts directly with hardware and provides low level services to upper layer components.

Shell: An interface to kernel, hiding complexity of kernel's functions from users. Takes commands from user and executes kernel's functions.

User Interface: In information technology, the user interface (UI) is everything designed into an information device with which a human being may interact. Two types CLI (Command line interface) and GUI (Graphical User Interface).

System Library - System libraries are special functions or programs using which application programs or system utilities accesses Kernel's features. These libraries implements most of the functionalities of the operating system and do not requires kernel module's code access rights.

System Utility - System Utility programs are responsible to do specialized, individual level tasks.

ARK IT	4. Basic & Common Commands	Document No.	:	RHEL Professional Guide
		Author	:	Ankam Ravi Kumar
		Web site	:	http://ark-library.blogspot.in/
		Page No.	:	6

Before you turn over to the next chapter where you are going to meet a plethora of commands, remember a few things that apply to all UNIX commands.

➢ All UNIX commands must always be entered in small case letters
➢ Between the command name and the options that may be available with the command there must always be a space or a tab, for example, ls –l. Here is the command whereas –l is the option and the two have been separated by space. The option is usually preceded by a minus (-) sign. The option available with a command are often known as swithes.
➢ Two or more options available with command can usually be combined, for example, the command ls –l –a is same as ls –la.
➢ If you make a typing mistake, press backspace to erase characters Don't try back using arrow keys and then attempt deleting using the del key.
➢ To cancel the entire command before you press Enter, press ctrl+c Or del key.

Basic Commands:

$ date   #To see the date of the system.

$ date +%d-%Y-%H-%M #To see particular date format you always use date options

```
[ravi@ARK-IT-Solutions ~]$ date
Tue Jan  6 11:17:39 IST 2015
```

$ cal   #To see the current month calendar.

$ cal 11 2014   #To display the calendar, Month November (11) and year 2014

```
[ravi@ARK-IT-Solutions ~]$ cal
      January 2015
Su Mo Tu We Th Fr Sa
             1  2  3
 4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 31
```
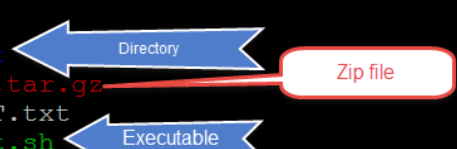
$ clear   #To clear the screen

$ ls –l   #List files, directories with their properties

$ ls   #To list files and directories

$ ls –a   #To list all hidden files and directories

$ ls –d   #To list only directories

```
[ravi@ARK-IT-Solutions ~]$ ls -l
total 12
drwxr-xr-x 2 ravi ravik 4096 Jan  6 11:27 ARK-It
-rw-r--r-- 1 ravi ravik  126 Jan  6 11:28 arkit.tar.gz
-rw-r--r-- 1 ravi ravik    0 Jan  6 11:27 ARK-IT.txt
-rw-r--r-- 1 ravi ravik   17 Jan  6 11:29 script.sh
```

$ pwd   #Print working directory

```
[ravi@ARK-IT-Solutions ~]$ pwd
/home/ravi
```

$ who am I #To see from which user you have logged in

```
[ravi@ARK-IT-Solutions ~]$ who am i
root     pts/2       2015-01-06 09:58 (192.168.234.1)
```

$ who   #To see all who is logged in yet this point of time from which IP

$ w   #More details about user related info

```
[ravi@ARK-IT-Solutions ~]$ who
ravi     pts/1       2015-01-06 11:43 (192.168.234.1)
root     pts/2       2015-01-06 09:58 (192.168.234.1)
```

$ uptime   #To see the server uptime, boot time, users and load.

```
[ravi@ARK-IT-Solutions ~]$ uptime
 11:45:34 up  1:58,  2 users,  load average: 0.06, 0.01, 0.00
```

$ uname –a #Verify Operating system version, kernel version and architecture

```
[ravi@ARK-IT-Solutions ~]$ uname -a
Linux ARK-IT-Solutions 2.6.18-8.el5 #1 SMP Fri Jan 26 14:15:21 EST 2007 i686 i686 i386 GNU/Linux
```

$ touch <File Name>   #Create an empty file / Multiple empty files yet a time

Options:

$ touch –am   #it will change a file time to current time

$ touch –r file1 –B 30 file2   #it will create two files with 30 seconds time difference

$ cat /dev/null > file   #To empty the data file

$ cat > <File Name>   #Create an single file with text

```
[ravi@ARK-IT-Solutions ARK-It]$ touch ravi kumar
[ravi@ARK-IT-Solutions ARK-It]$ ls
kumar   ravi
```

$ rm –rf <File / Directory Name> #Delete files and directories forcefully

$rmdir <directory>   #Delete directories only

```
[ravi@ARK-IT-Solutions ARK-It]$ ls
kumar   ravi
[ravi@ARK-IT-Solutions ARK-It]$
[ravi@ARK-IT-Solutions ARK-It]$
[ravi@ARK-IT-Solutions ARK-It]$ rm -rf ravi kumar
[ravi@ARK-IT-Solutions ARK-It]$ ls
```

$ mkdir <Directory Name> #Create an empty directory / directories

$ mkdir –p <directory/directory/directory> #to create parent directories

```
[ravi@ARK-IT-Solutions ARK-It]$ mkdir test
[ravi@ARK-IT-Solutions ARK-It]$ ls
test
```

$ cd <Path of the directory>   #Change directory

```
[ravi@ARK-IT-Solutions ~]$ pwd
/home/ravi
[ravi@ARK-IT-Solutions ~]$ cd ARK-It/test
[ravi@ARK-IT-Solutions test]$ pwd
/home/ravi/ARK-It/test
```

$ cat <File Name>   #View content of file

```
[ravi@ARK-IT-Solutions ARK-It]$ cat testfile
this book intention is to help others
```

$ time   #Calculate response time of the activity / command

```
[ravi@ARK-IT-Solutions test]$ time touch ravi

real      0m0.002s
user      0m0.000s
sys       0m0.002s
```

$ hwclock $to see detailed date and time with time zone

```
[root@ARK-IT-Solutions ~]# hwclock
Wed 07 Jan 2015 01:26:56 AM PST  -0.041534 seconds
```

$ cp <Source path> <Destination path> #Copy the files from one path to another path

$cp –Rv <source> <destination>   #copy directories from source to destination

Options:

-R, -r,   #copy directories recursively

-v   #verbose to see progress of copy job

-p   #preserve

-f   #forcefully

-I   #interactive: Ask before overwriting file

```
[ravi@ARK-IT-Solutions ~]$ cp -v ARK-IT.txt testingcopy/
`ARK-IT.txt' -> `testingcopy/ARK-IT.txt'
```

Copying directory must use –R to copy directories

```
[ravi@ARK-IT-Solutions ~]$ cp -v ARK-It/ testingcopy/
cp: omitting directory `ARK-It/'
[ravi@ARK-IT-Solutions ~]$ cp -Rv ARK-It/ testingcopy/
`ARK-It/' -> `testingcopy/ARK-It'
`ARK-It/test' -> `testingcopy/ARK-It/test'
`ARK-It/test/ravi' -> `testingcopy/ARK-It/test/ravi'
`ARK-It/testfile' -> `testingcopy/ARK-It/testfile'
```

$ mv <source> <destination>   #Move files/directories

$ mv <old name> <new name> #Rename the file and directory

```
[ravi@ARK-IT-Solutions ~]$ ls
ARK-It   arkit.tar.gz   ARK-IT.txt   kumar   ravi   script.sh   testingcopy
[ravi@ARK-IT-Solutions ~]$ mv ARK-It ARKIT  Renamed
[ravi@ARK-IT-Solutions ~]$ ls
ARKIT   arkit.tar.gz   ARK-IT.txt   kumar   ravi   script.sh   testingcopy
[ravi@ARK-IT-Solutions ~]$ mv ARKIT/ testingcopy/  Moved the Directory
[ravi@ARK-IT-Solutions ~]$ ls
arkit.tar.gz   ARK-IT.txt   kumar   ravi   script.sh   testingcopy
[ravi@ARK-IT-Solutions ~]$ ls testingcopy/
ARK-It   ARKIT   ARK-IT.txt
```

$ last   #Check who logged in and when logged in duration

```
[ravi@ARK-IT-Solutions ~]$ last
ravi      pts/1         192.168.234.1      Tue Jan  6 11:43    still logged in
root      pts/2         192.168.234.1      Tue Jan  6 09:58 - 11:49  (01:51)
root      pts/1         192.168.234.1      Tue Jan  6 09:56 - 09:58  (00:02)
reboot    system boot   2.6.18-8.el5       Tue Jan  6 09:47           (07:01)
```

$ arch   #to know architecture

```
[ravi@ARK-IT-Solutions ~]$ arch
i686
```

$ reboot / init 6   #Restart server

$poweroff / init 0   #To shut down the server

$ dmesg   #Check boot process logs

```
[ravi@ARK-IT-Solutions ~]$ dmesg
Linux version 2.6.18-8.el5 (brewbuilder@ls20-bc2-14.build.redhat.com)
SMP Fri Jan 26 14:15:21 EST 2007
BIOS-provided physical RAM map:
 BIOS-e820: 0000000000000000 - 000000000009f000 (usable)
 BIOS-e820: 000000000009f000 - 00000000000a0000 (reserved)
 BIOS-e820: 00000000000ca000 - 00000000000cc000 (reserved)
 BIOS-e820: 00000000000dc000 - 0000000000100000 (reserved)
 BIOS-e820: 0000000000100000 - 000000007fee0000 (usable)
 BIOS-e820: 000000007fee0000 - 000000007feff000 (ACPI data)
 BIOS-e820: 000000007feff000 - 000000007ff00000 (ACPI NVS)
 BIOS-e820: 000000007ff00000 - 0000000080000000 (usable)
 BIOS-e820: 00000000e0000000 - 00000000f0000000 (reserved)
 BIOS-e820: 00000000fec00000 - 00000000fec10000 (reserved)
 BIOS-e820: 00000000fee00000 - 00000000fee01000 (reserved)
 BIOS-e820: 00000000fffe0000 - 0000000100000000 (reserved)
1152MB HIGHMEM available.
896MB LOWMEM available.
```

$ nsloookup <Server Address> #check dns resolution

$ dig <server address> #check dns resolution to debug

$ tree <directory>   #it will show the tree of parent directory

$ stat <file name>   #detailed information about file

```
[root@ARK-IT-Solutions ~]# stat config.php
  File: `config.php'
  Size: 126            Blocks: 8          IO Block: 4096    regular file
Device: 802h/2050d      Inode: 1498498    Links: 1
Access: (0644/-rw-r--r--)  Uid: (    0/    root)  Gid: (    0/    root)
Access: 2014-11-09 08:50:51.000000000 -0800
Modify: 2014-11-09 08:03:48.000000000 -0800
Change: 2014-11-09 08:50:40.000000000 -0800
```

$ wc   #word count, character count and line count

Options:

-l   #Check line count

-c   #Character Count

-w   #Word Count

```
[root@localhost admin]# cat test.txt
ankam ravi kumar
this book is about Redhat enterprise linux step by step practice
[root@localhost admin]# wc test.txt
 2 14 82 test.txt
[root@localhost admin]# wc -l test.txt
2 test.txt
[root@localhost admin]# wc -w test.txt
14 test.txt
[root@localhost admin]# wc -c test.txt
82 test.txt
```

<u>Help relate commands:</u>

$ whatis <Command Name> #It will display single line description about command

```
[root@ARK-IT-Solutions ~]# whatis cal
cal                    (1)   - displays a calendar
cal                    (1p)  - print a calendar
```

$ whereis <Command Name> #It will provide you path of the command

```
[root@ARK-IT-Solutions ~]# whereis cal
cal: /usr/bin/Cal /usr/share/man/man1/cal.1.gz /usr/share/man/man1p/cal.1p.gz
```

$ man <command>   #manual page of the command

$ info <command>   #information about the command

$ <command> --help   #it will gives a command options and there usage

$ apropos <keyword>   #to know about the command use

```
[root@ARK-IT-Solutions ~]# apropos ypwhich
ypwhich                  (1)  - return name of NIS server or map master
```

		Document No.	:	RHEL Professional Guide
ARK IT	**5. OS Installation**	Author	:	Ankam Ravi Kumar
		Web site	:	http://ark-library.blogspot.in/
		Page No.	:	13

Installation methods of Linux operating system as follows

Boot from CD/DVD
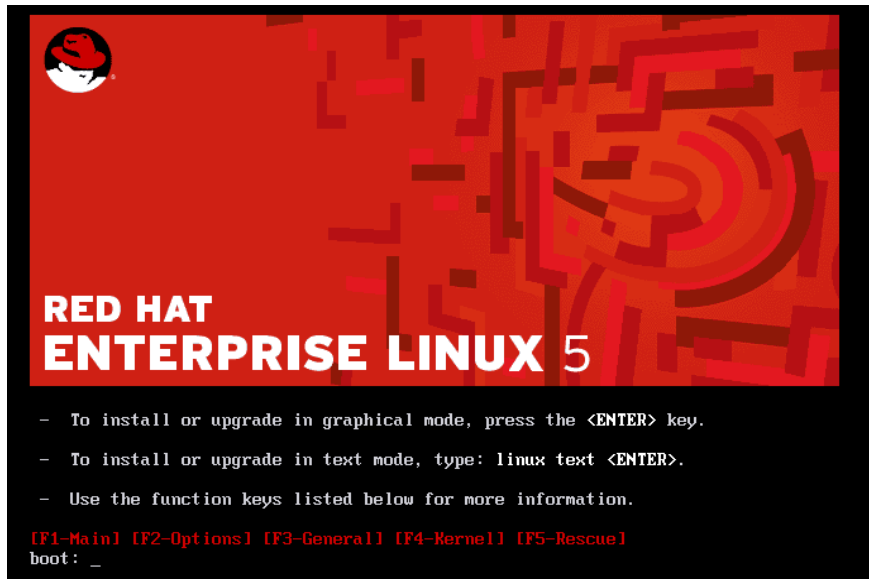
After booting from RHEL bootable CD/DVD, We will get above screen

  ➢ If you want to install OS using GUI then hit ENTER key
  ➢ If you want to install OS using TEXT mode (CLI) then type linux test hit ENTER key

   Currently we are installing Operating system using GUI mode.
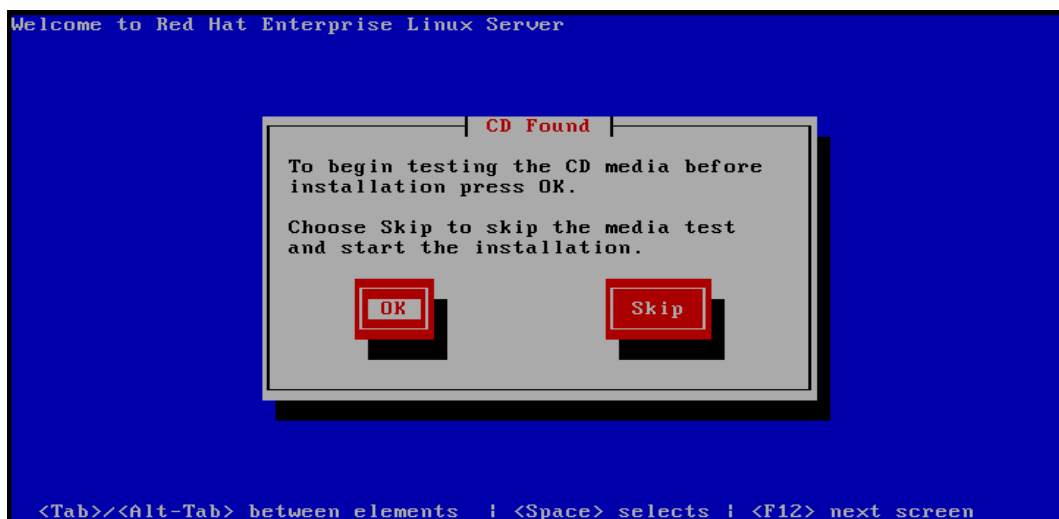
If you want to verify you installation media (OS CD/DVD) press **OK** (It will take long time to verify). Press **SKIP** to jump next screen.

Click **NEXT**
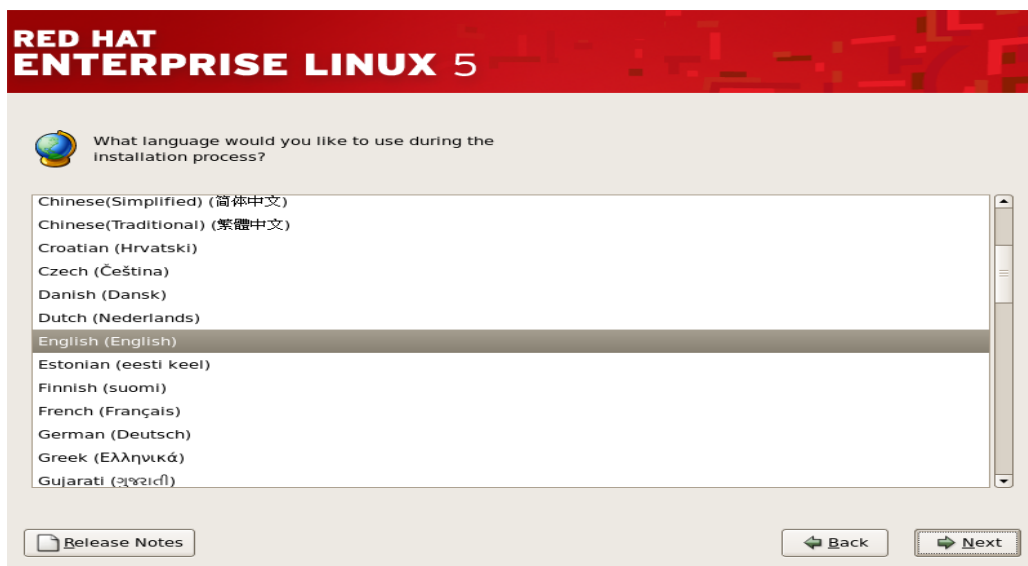
Select the Language then click **NEXT**
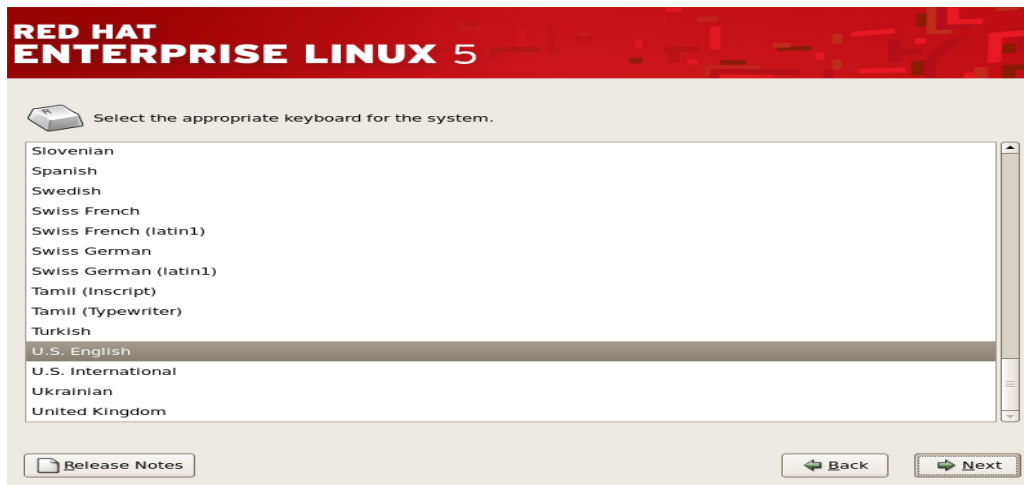
Select Keyboard Language then click **NEXT**

If you have License key enter or else select SKIP click on **OK**
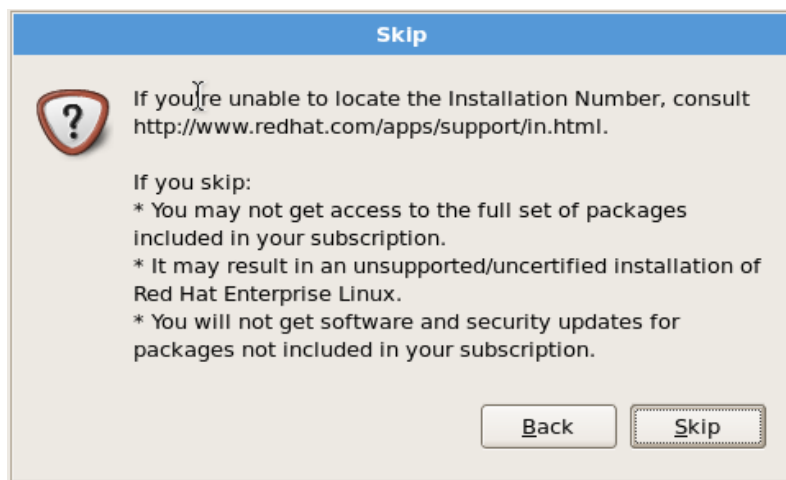
It will give you a WARNNING since you don't have a key click on **SKIP**
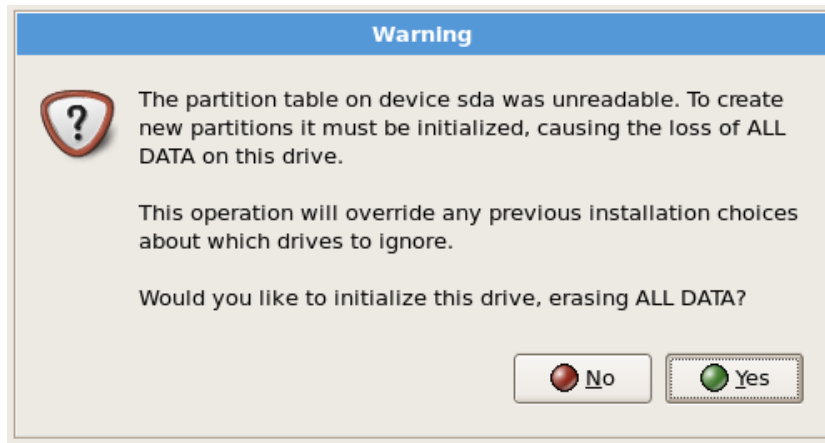
Click on **YES** to continue
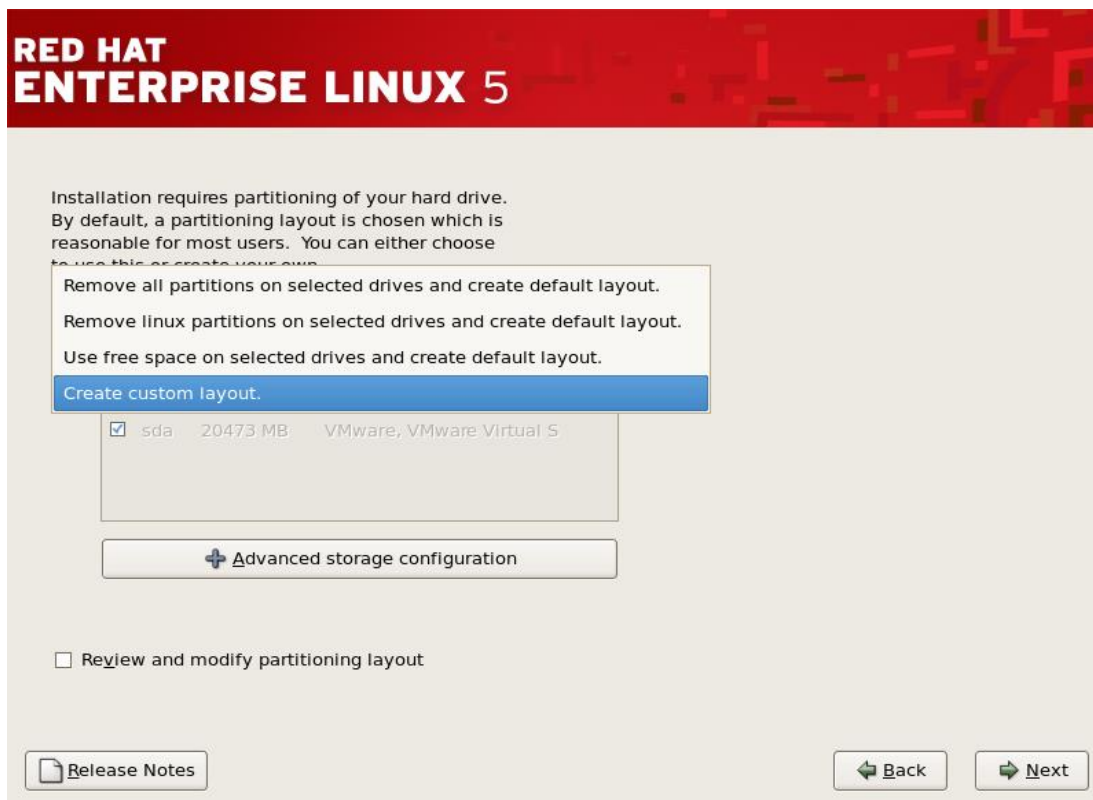
Options:

Remove all partitions on selected drives and create default layout this options will delete all the drive partitions and install OS

Remove all Linux Partitions this option will only remove Linux partitions and creates default layout, install OS

Use free space this option will install on free space of the drive creates default layout

Create Custom layout this option will not create any layout you have to create as per your requirement

This option will give more customization you to create your own layout (**Selected Customize Layout**)
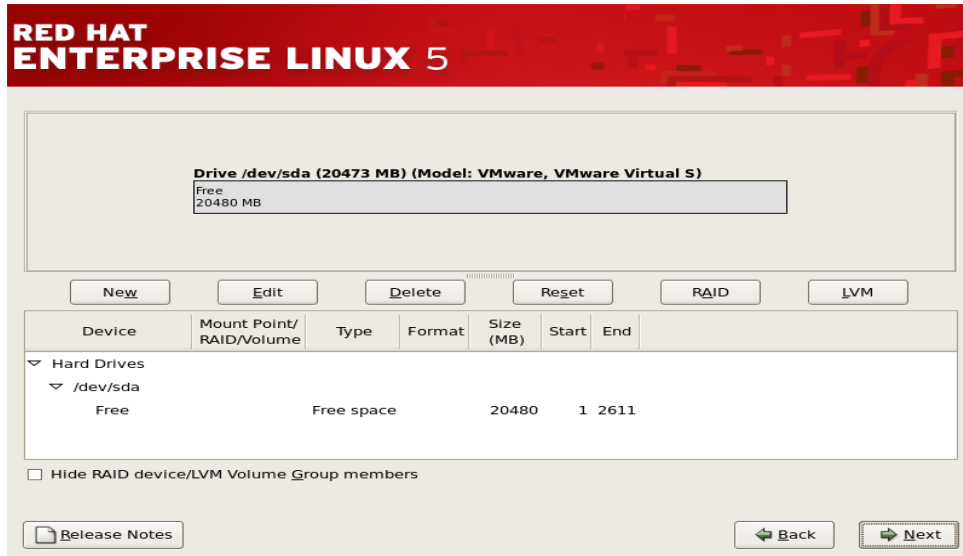
Now you can able to see HDD space to create partitions follow click on **NEW**
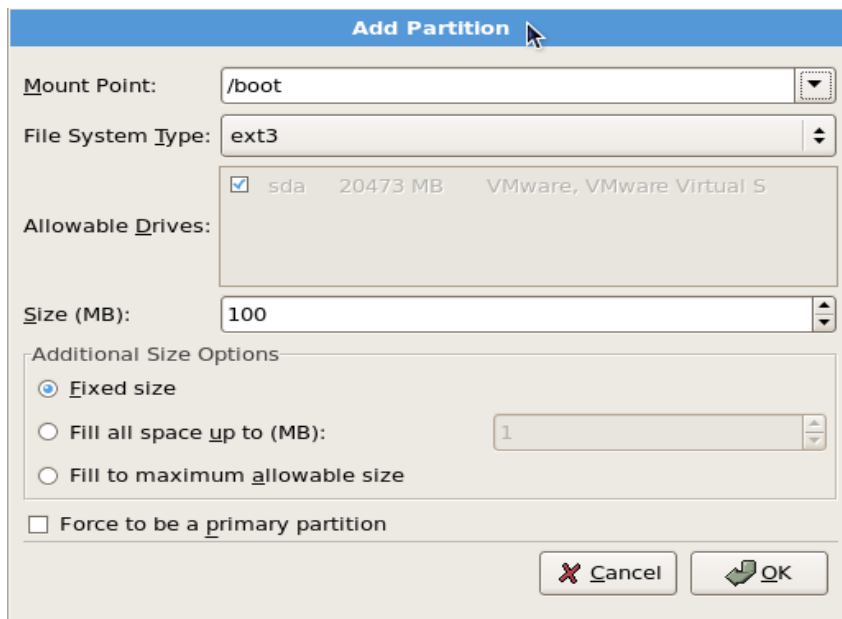
After clicking on NEW you will see above popup

First create /boot because it needs normal partition to store MBR (master boot record). 100MB is enough for /boot partition.

Mount point /boot

File system Type: ext3 OR ext4

Select fixed size Click **OK**
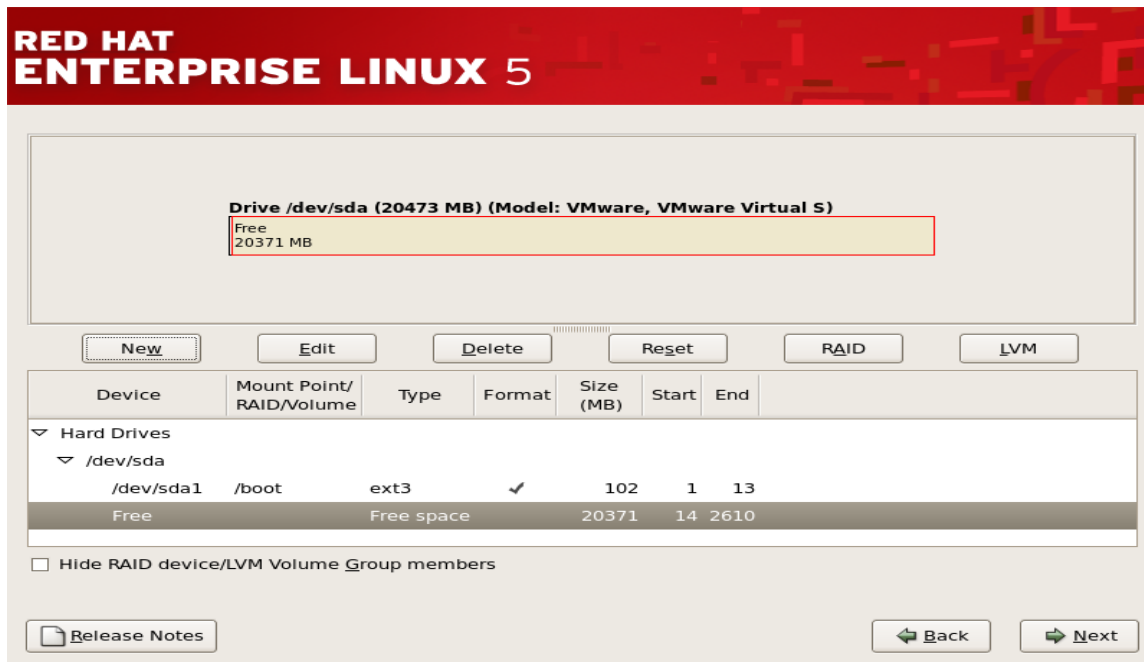
See above screen /boot partition is created.

Note: Always remember to create LVM partitions OR RAID partitions is recommended, because later on if you want extend the ROOT file system is possible and easy.

To create LVM partition click on **NEW** you can able to see popup as below
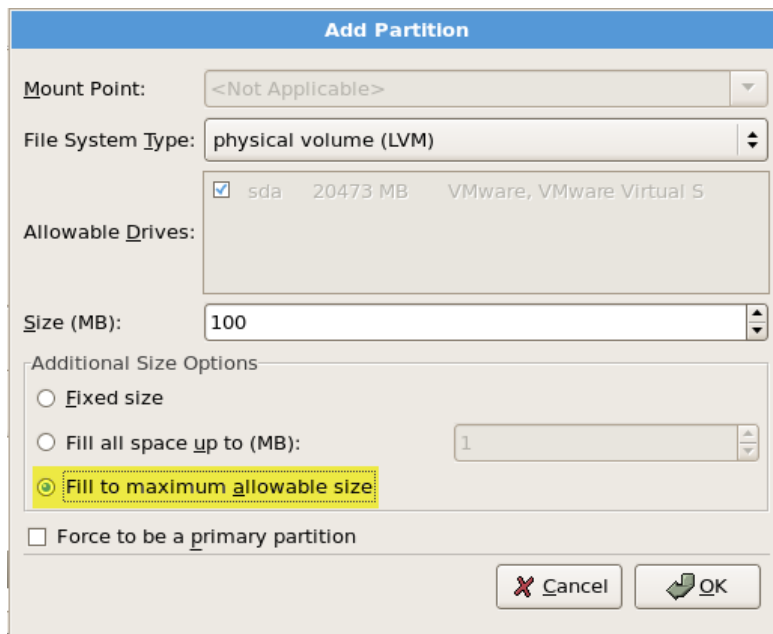
For creating a LVM partition we have to create **Physical Volume** select file system type as **physical volume (LVM)**

Select **Fill to maximum allowable size** then click on **OK**
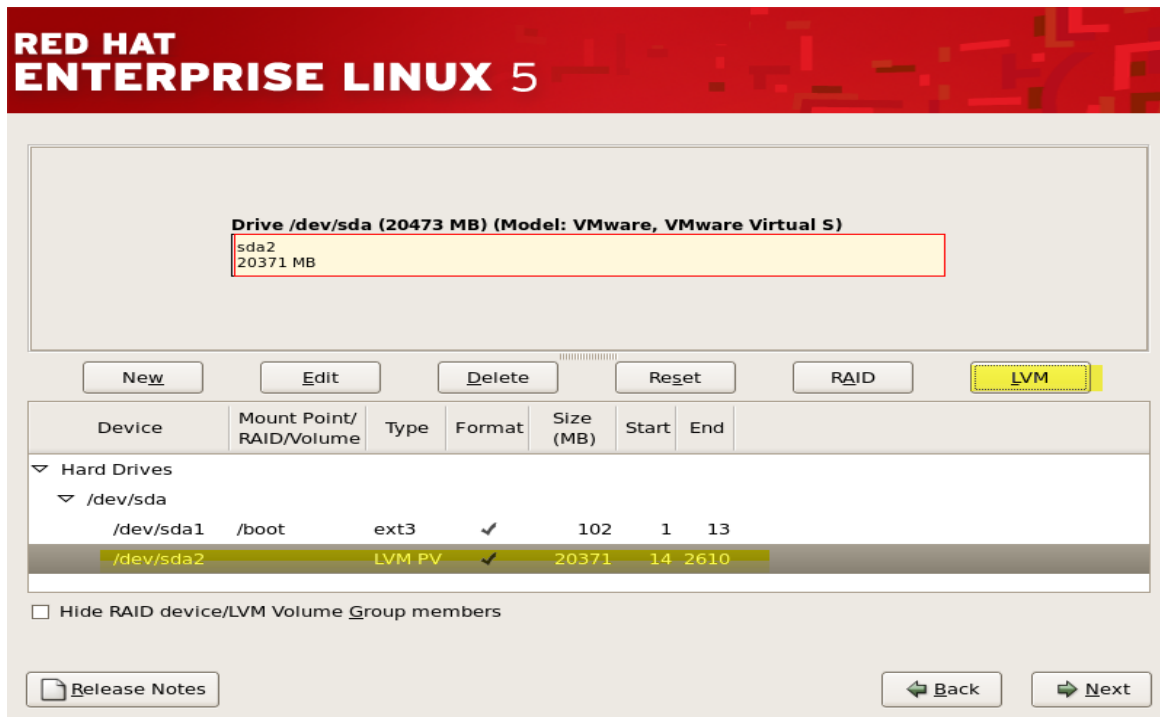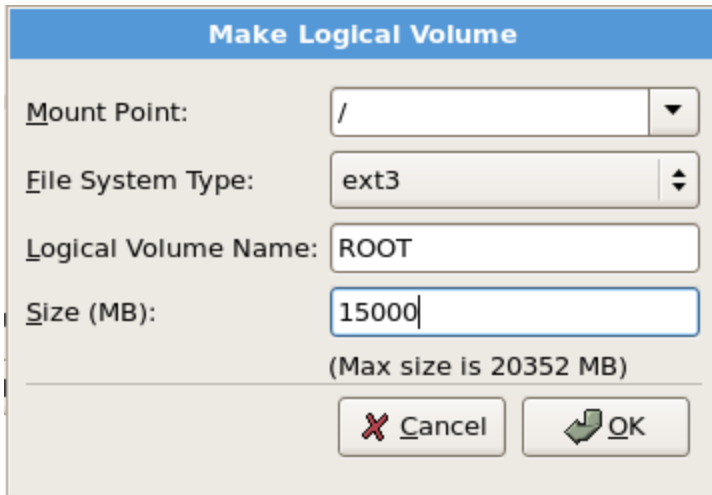
See above screen LVM PV is created now select PV and click on **LVM** popup will open as below screen
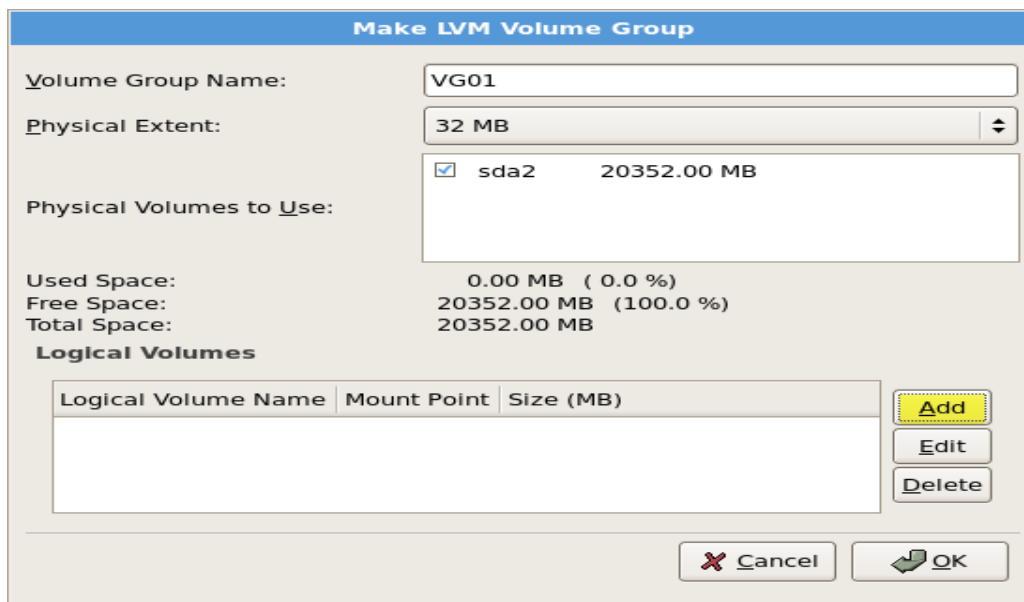
Change the Volume group name as required. Example: VG01

Click on **ADD**

As above screen select Mount point as "/" slash, provide Logical volume name "ROOT" for easy identification, provide the size as per your requirement (Minimum 10GB). Click on **OK**

Again click on **ADD**

Select File system type as SWAP, provide logical volume name as "SWAP" for easy identification. Provide the swap size is always (RAM SIZE * 2) in my case 2GB RAM. Click on **OK**

As you created above all the partitions are created. Click **NEXT**

Minimum Recommended Partitions

Slash "/"

/boot

SWAP

Select label and click **NEXT (if you want to change label you can change it using edit option)**
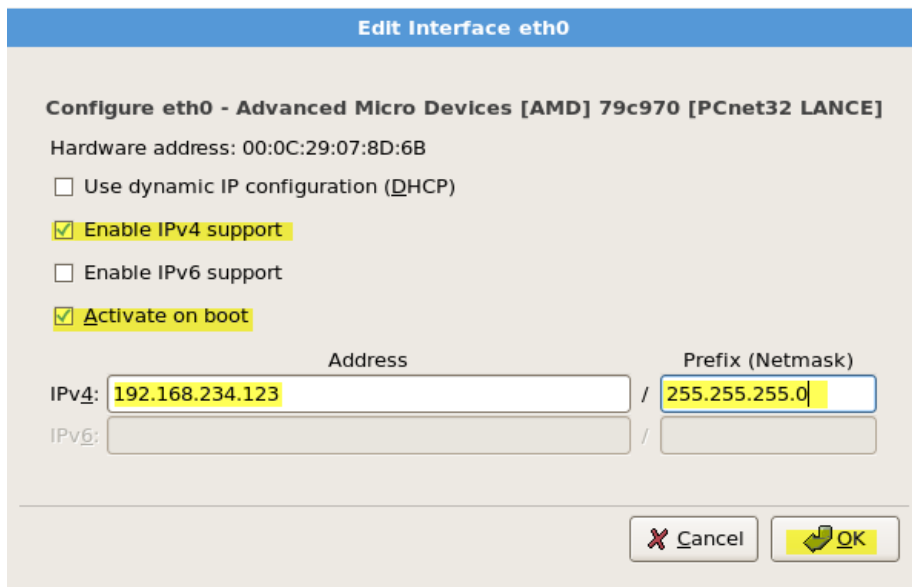
Here provide your system name (Example: ARK-IT-Solutions.localdomain)

Click on **EDIT**

If you are using DHCP in your network select **Use dynamic IP configuration**

If not using DHCP enable IP4 and provide IP address and Netmask Click on **OK**

Provide the gateway IP and DNS IP and Click on **NEXT**
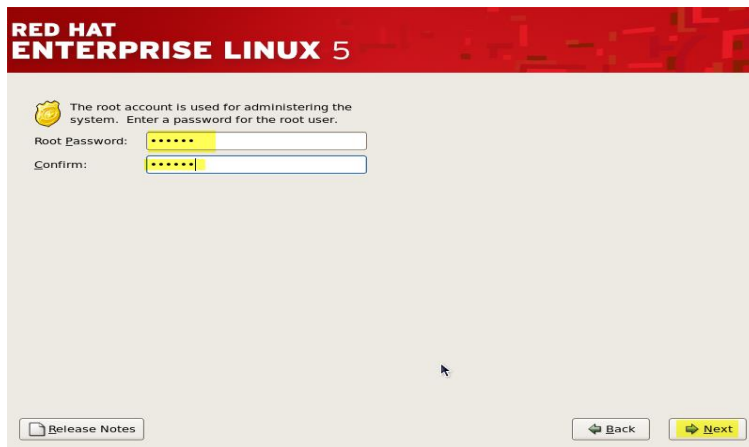
Select the time zone and click on **NEXT**

Provide your password and confirmation password then click on **NEXT**

Select to install the required software's while installing the operating system, select software development and web server and select Customize now.

Then click on **NEXT**

Select the required packages from all the fields click on optional packages and check all (as showed in below screen)
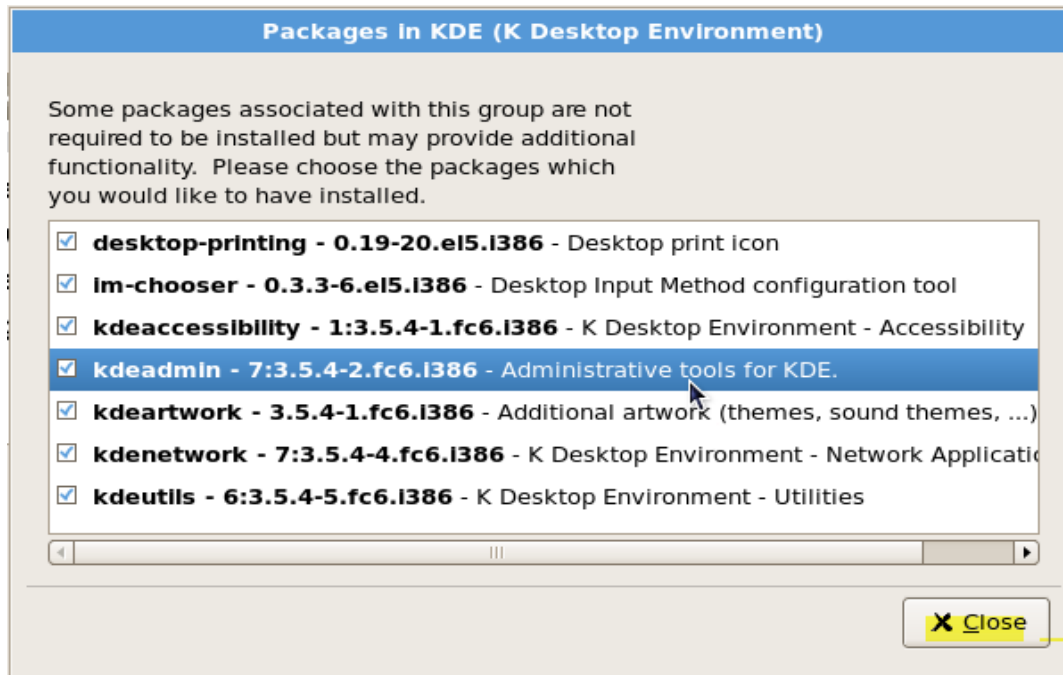
Selected all the optional packages as well click on **CLOSE**
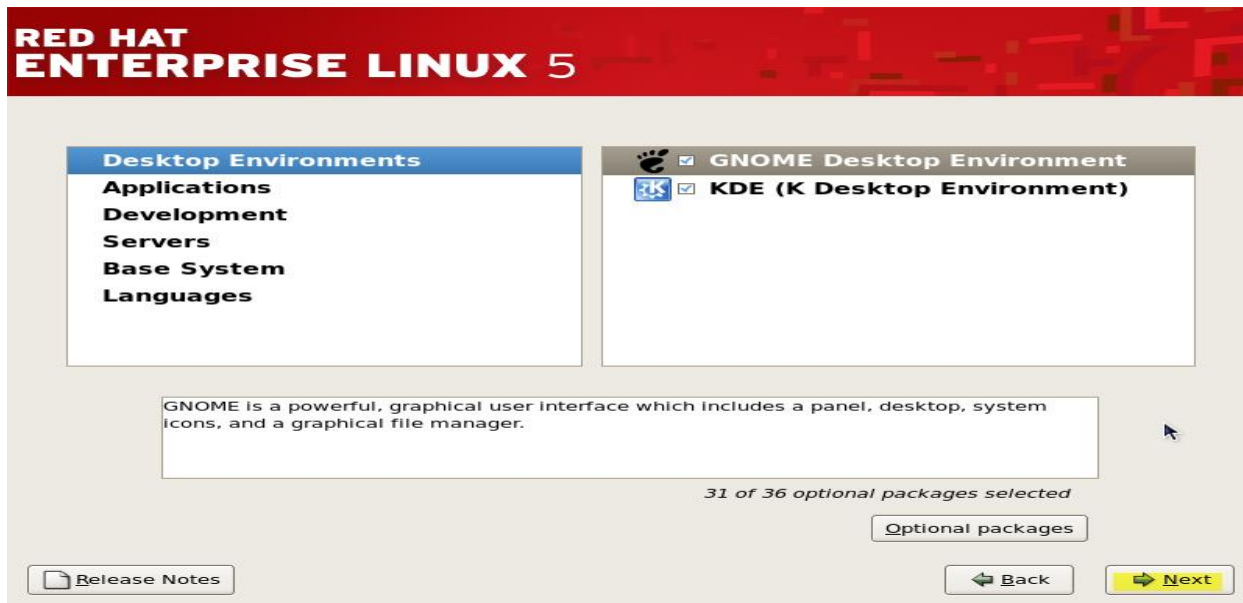
then click on **NEXT**
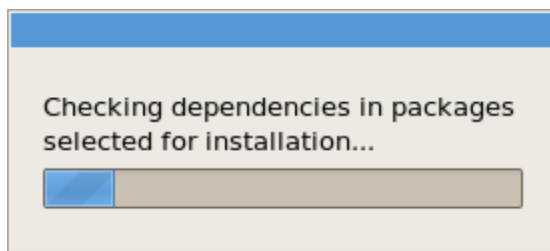
After next dependencies will be resolved and ready for installation
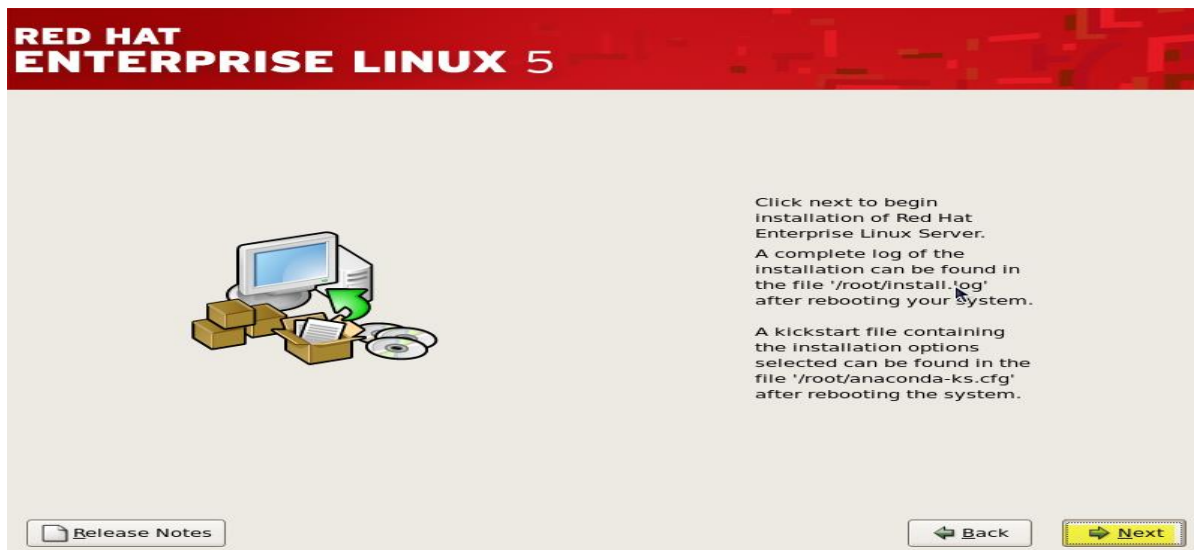
Click **NEXT** to install Operating system

Installation is in process (it will take few minutes depends on selected packages)

After completion creating partitions and installing packages it will ask you to reboot the server. Click on **Reboot**
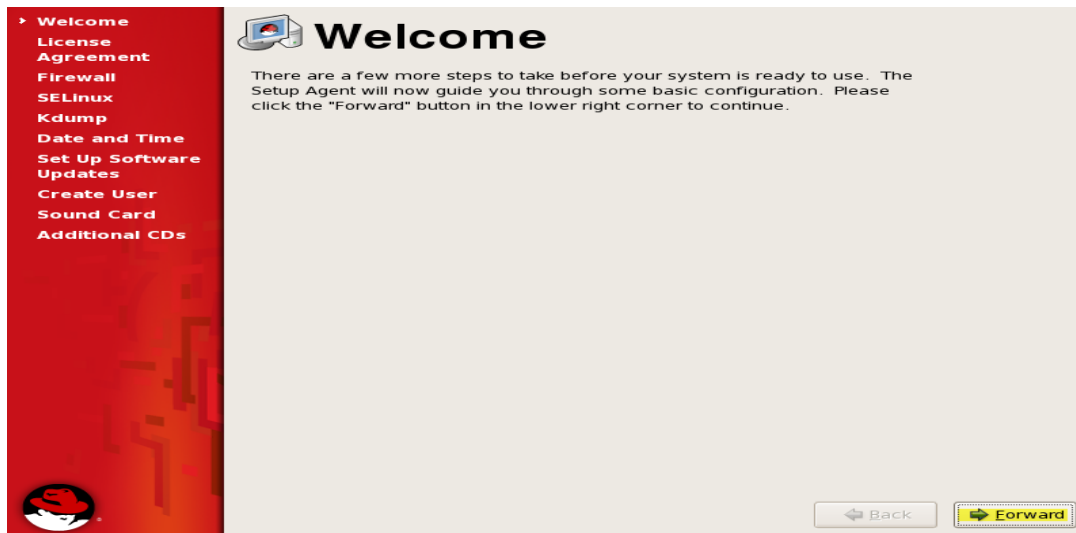
After reboot it will ask you to complete next options click on **FORWARD**

Select **Yes I agree to the license agreement** and click **FORWARD**

Firewall **enabled** and **disabled**

If you enable the firewall you have to allow the services and ports as you required

If you want to enable security click on Enable or else disable and click **FORWARD**
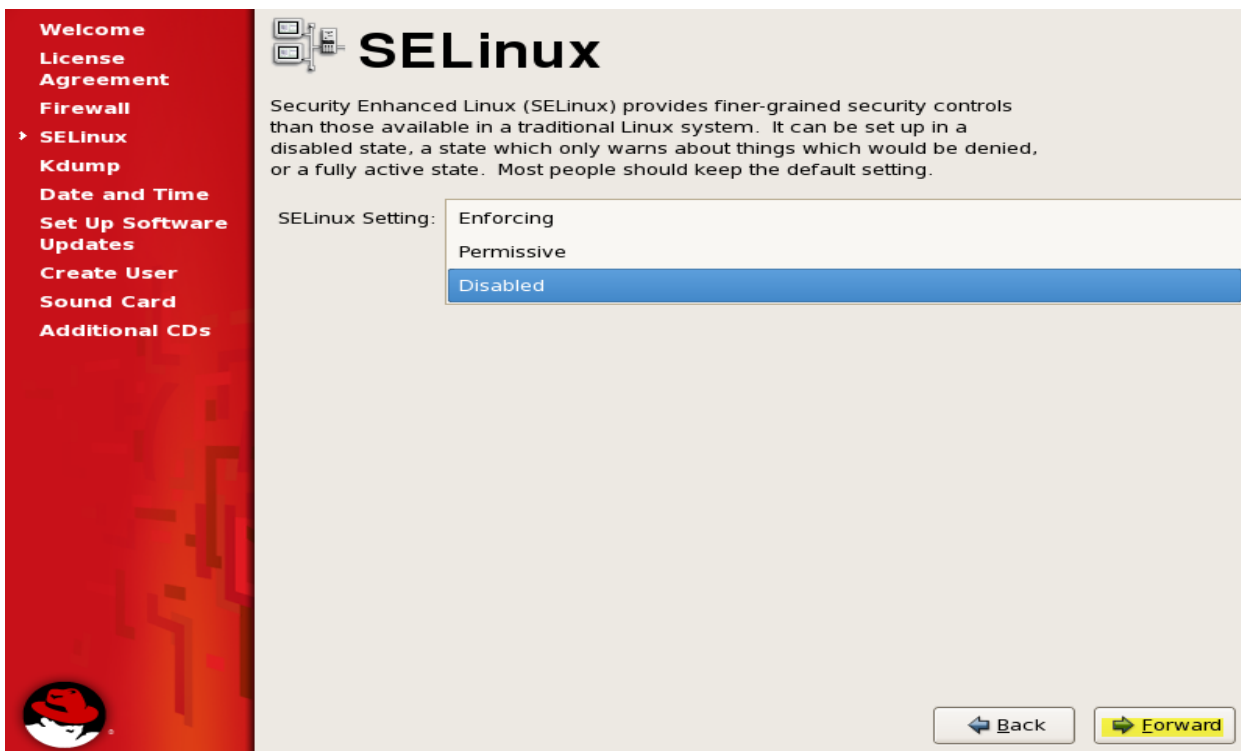
Disable the SELinux if you don't know the usage. Click on **FORWARD**
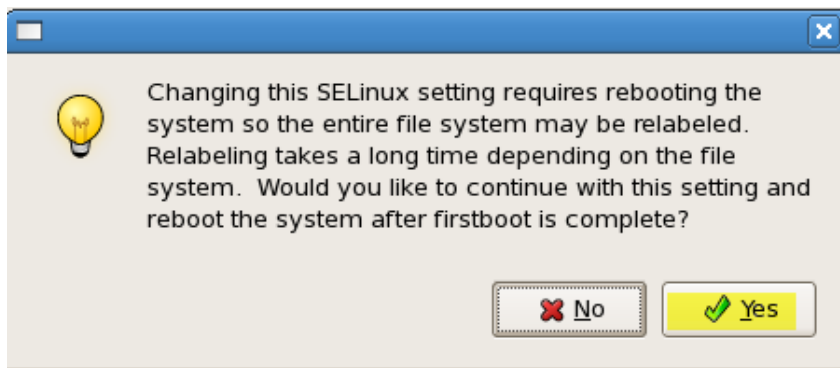
Click on **YES**

Click on **FORWARD**
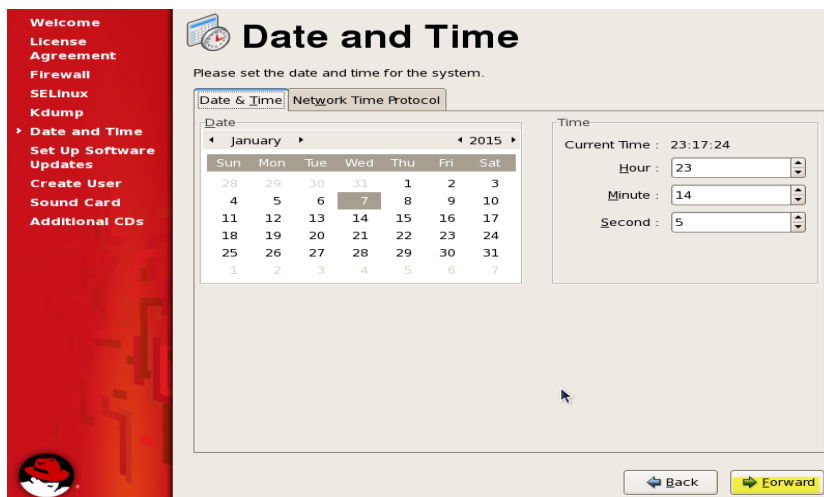
Select date and time then click on **FORWARD**
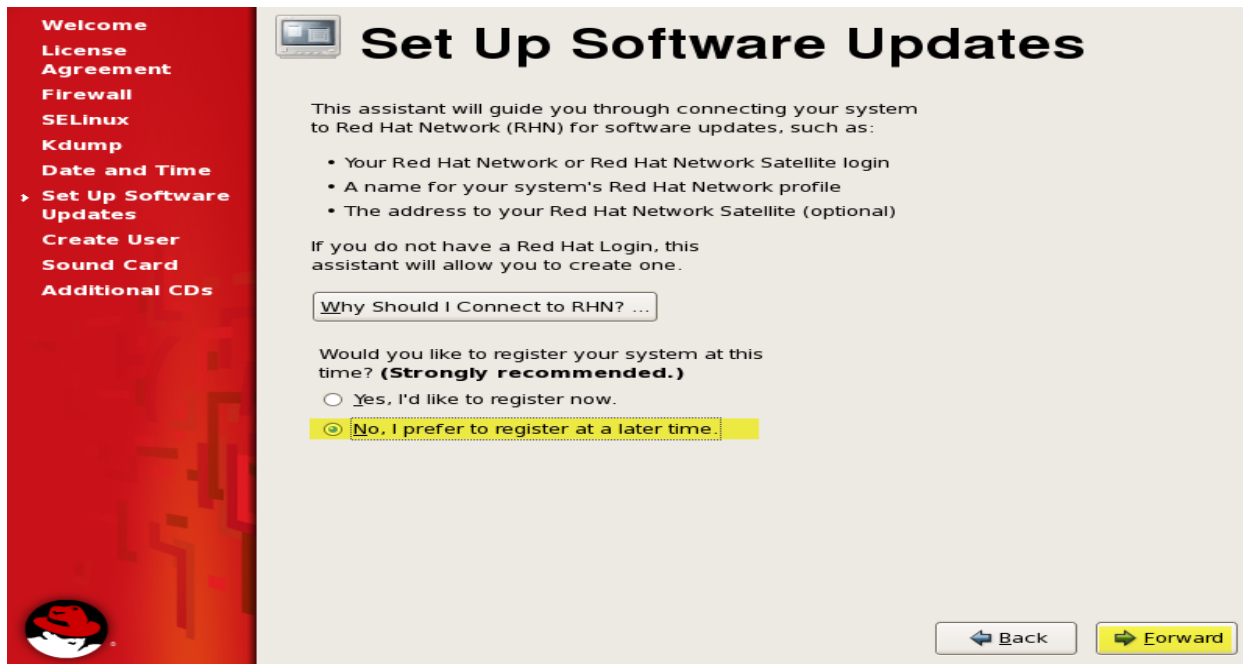
If you have redhat subscription then registers with site OR else not prefer click on **FORWARD**
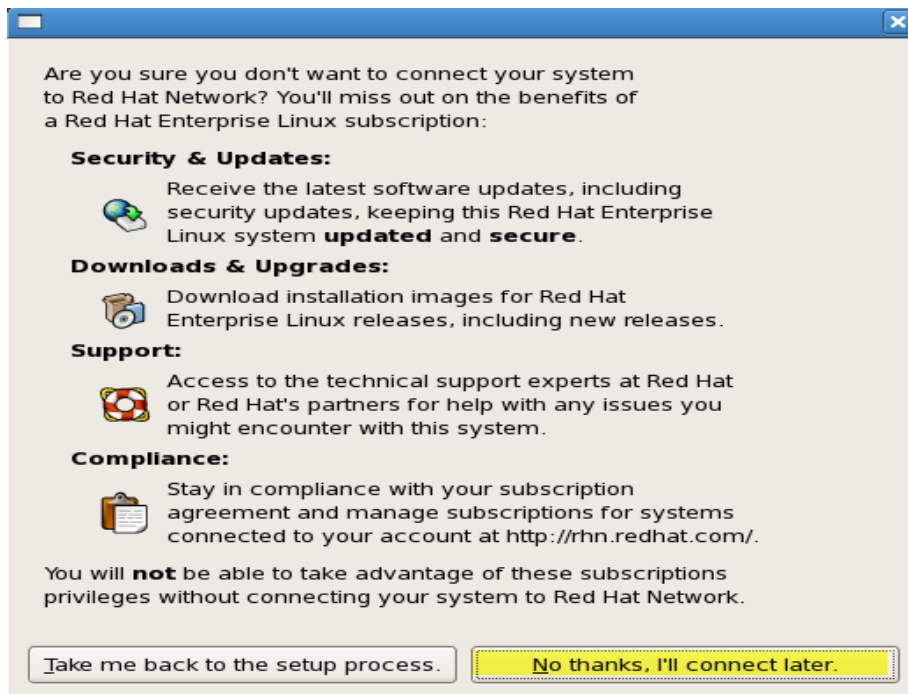
Click on No thanks

Click **FORWARD**
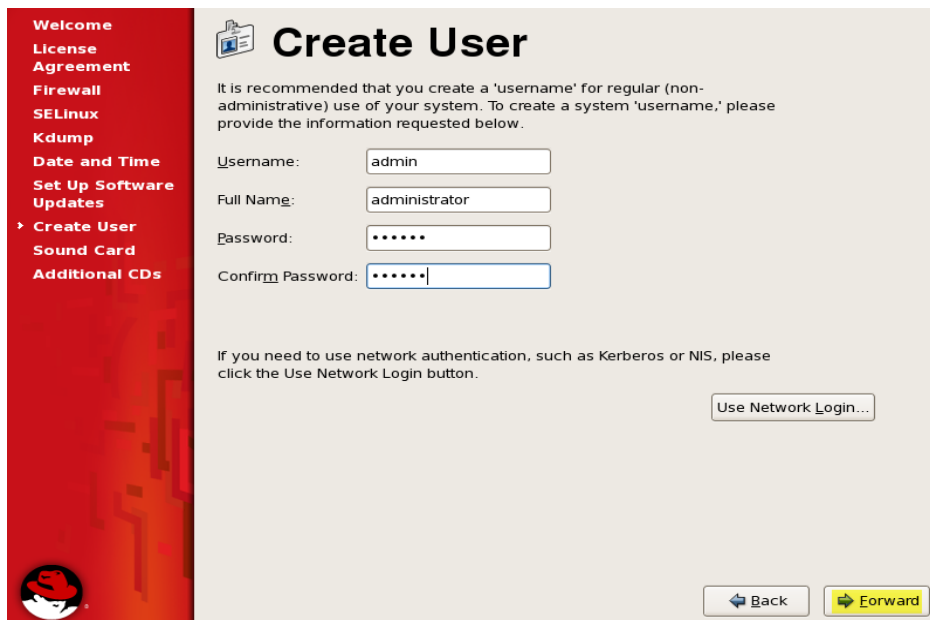
Provide additional username to create and provide password click on **FORWARD**
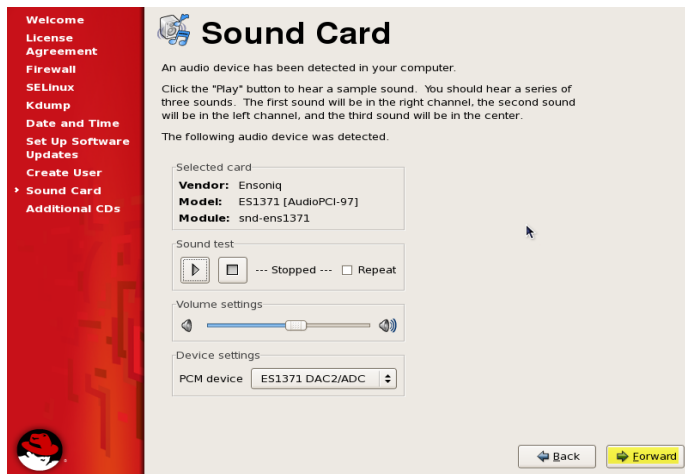
Test your sound then click on **FORWARD**
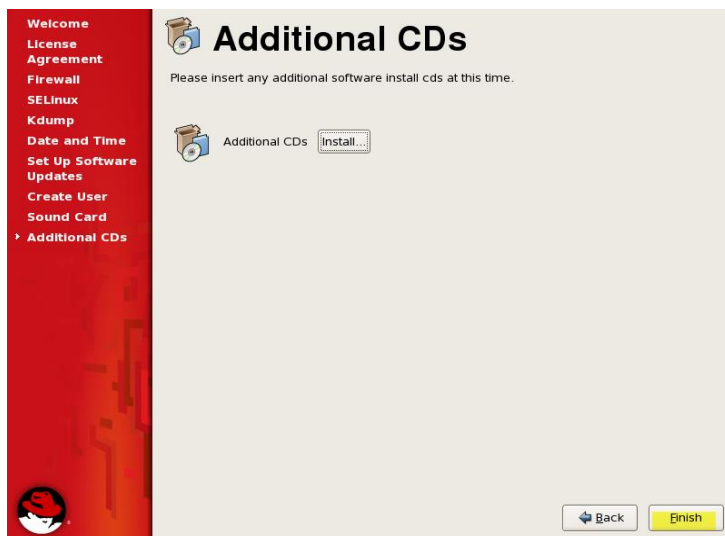
Click on **Finish**
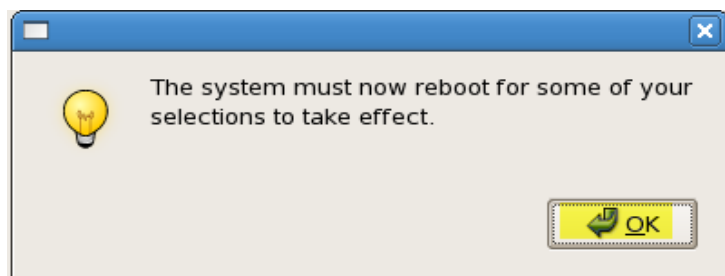
It will ask you to reboot click **OK**

Your server installation is successfully completed now you can use it.

POST: Power on self-test - Hardware will check it self

BIOS: Basic input and output system will load

MBR: Master boot record – which will have 446Bytes in size first sector of the HDD.

446 MBR	64 Partition Table	2 Active Sign

GRUB: it will boot in three steps

Stage 1: The duty of the stage 1 is to identify where the stage is located to

Stage 1.5: The duty of the stage 1.5 is to synchronize with the deferent file system. LBA – logical block addressing. Once executed, core.img will load its configuration file and any other modules needed, particularly file system drivers; at installation time, it is generated from diskboot.img and configured to load the stage 2 by its file path.

Stage 2: it will list out all the available operating systems and it will boot with the default operating system.

Kernel: Kernel version and its installed modules will load

Init: init is the root daemon process after this process all the process will start under init

Run levels:

Run levels are 7
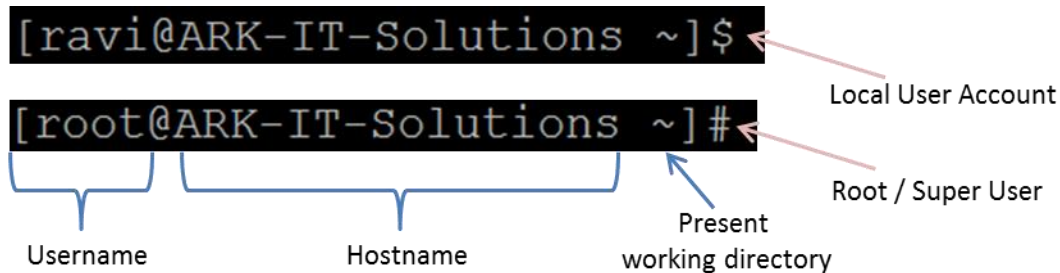
0   -   Shutdown/Halt/Power off

1   -   Single User Mode

2   -   Multiple user without Network

3   -   Multiple users with Network (CLI)

4   -   Unused

5   -   GUI mode

6   -   Reboot

After completion of run level it will enter into the User interface will ask you for the credential to login.

1 sylinder = 7.8 MB

BASH: Bourne again shell

Command Line Completion:

Single Tab – it will provide the best option

Double Tab – it will provide all the possible options (Autocompletes)

Command Line Editing:

Ctrl+a   -   It moves cursor to the Home line position

Ctrl+b   -   Moves the cursor back one character

Ctrl+c   -   Sends the signal SIGINT to the current task, which aborts and close it.

Ctrl+d   -   Close current shell prompt

Ctrl+e   -   It will move a cursor to end of the bash

Ctrl+f   -   Moves cursor forward one character

Ctrl+g	-	Abort the research and restore the original file
Ctrl+h	-	Deletes the previous character (Same as backspace)
Ctrl+k	-	It is used to delete the command from the courser to line home position
Ctrl+l	-	Clear the screen
Ctrl+u	-	Clears the line content before the cursor and copies it into the clipboard
Ctrl+y	-	Yank the content from the cursor position
Ctrl+z	-	Sends the signal SIGTSTP to the current task, which suspend it
Ctrl+Shift+c	-	Copy selected text
Ctrl+Shift+v	-	Paste the copied content
Ctrl+Shift+t	-	Tab
Ctrl+Shift+n	-	New Terminal
Ctrl+Shift+w	-	Close Tab
Ctrl+Shfift+q	-	Close a Terminal
Alt+b	-	Moves the cursor backward one word
Alt+c	-	Capitalizes the character under the cursor and moves to the end of word
Alt+d	-	Cut the word after the cursor
Alt+f	-	Moves the cursor forward one word
Alt+l	-	Lowers the case of every character from the cursor's position to the end
Alt+.	-	Insert the last argument to the previous command

Command Line History:

$ history	-	this command will display all the previous executed commands
$ history –c	-	Clear the command history
$!<number>	-	it executes mentioned number command

Note: Default history size is 1000 commands

```
[ravi@ARK-IT-Solutions ~]$ history
    1  clear
    2  cat /etc/shells
    3  history
[ravi@ARK-IT-Solutions ~]$
[ravi@ARK-IT-Solutions ~]$
[ravi@ARK-IT-Solutions ~]$ !2
cat /etc/shells
/bin/sh
/bin/bash
```

$!<charectar>   -   it will display/execute matching character command

$!!   -   it will execute last executed command

Sophisticated prompt control:

?   -   It will replace a single character

Example: rm –rf a?   -   it will delete the files with two characters

            Rm –rf a?? -   it will delete the three characters files after "a"

*   -   replace multiple number of characters

Example: rm –f a*   - it will remove all the files which are starting with "a"

Piping and Redirecting:

Redirecting input and output from standard stream to user defined place

    1. Input RD   -0   <
    2. Output RD -1   — Values   >   —Symbols
    3. Error RD   -2   >

Example: $ sort < <file name>

            $ wc < <file name>

            $ history > f2

            $mkdir d1 2> e1

```
[ravi@ARK-IT-Solutions ~]$ sort <testsort




example:
Example:
more than one file can be moved at a time if the destination is a directory
# mv : move /rename files and directory
# mv [option] file1 file2 file3 destination
# mv [option] file destination
# mv t.txt /home/raj/
Syntax:
[ravi@ARK-IT-Solutions ~]$ wc < testsort
 12  43 243
[ravi@ARK-IT-Solutions ~]$ cat > f1
klasdfhaskdfj h

[1]+  Stopped                 cat >f1
[ravi@ARK-IT-Solutions ~]$ mkdir d1 2> e1
[ravi@ARK-IT-Solutions ~]$ ls
d1  e1  f1  f2  testsort
```

Piping sending output or one command as a input to the another command

| Pipe ▯ symbol.

Page related command:

> **Less:** is used to see the command output page by page in up and down way

> **More:** we can't go upward downward, just see the output fit to the screen

```
[ravi@ARK-IT-Solutions ~]$ cat f2 |less
[ravi@ARK-IT-Solutions ~]$ cat f2 |more
```

	8. Linux Directory Structure	Document No.	:	RHEL Professional Guide
ARK IT		Author	:	Ankam Ravi Kumar
		Web site	:	http://ark-library.blogspot.in/
		Page No.	:	40

Overview

Everything in Linux can be reduced to a file. Partitions are associated with files such as /dev/hda1. Hardware components are associated with files such as /dev/modem. The Filesystem Hierarchy Standard (FHS) is the official way to organize files in Unix and Linux directories.

Linux file system and directory structure

Several major directories are associated with all modern Unix/Linux operating systems. These directories organize user files, drivers, kernels, logs, programs, utilities, and more into different categories. The standardization of the FHS makes it easier for users of other Unix-based operating systems to understand the basics of Linux. All of the other directories shown in Table are subdirectories of the root directory, unless they are mounted separately.

Directory	**Description**
/	The root directory, the top-level directory in the FHS. All other directories are subdirectories of root, which is always mounted on some partition. All directories that are not mounted on a separate partition are included in the root directory's partition.
/bin	Essential command line utilities. Should not be mounted separately; otherwise, it could be difficult to get to these utilities when using a rescue disk.
/boot	Includes Linux startup files, including the Linux kernel. Can be small; 16MB is usually adequate for a typical modular kernel. If you use multiple kernels, such as for testing a kernel upgrade, increase the size of this partition accordingly.
/etc	Most basic configuration files.
/dev	Hardware and software device drivers for everything from floppy drives to terminals. Do not mount this directory on a separate partition.
/home	Home directories for almost every user.
/lib	Program libraries for the kernel and various command line utilities. Do not mount this directory on a separate partition.
/mnt	The mount point for removable media, including floppy drives, CD-ROMs, and Zip disks.
/opt	Applications such as WordPerfect or Star Office.
/proc	Currently running kernel-related processes, including device assignments such as IRQ ports, I/O addresses, and DMA channels.
/root	The home directory of the root user.
/sbin	System administration commands. Don't mount this directory separately.
/tmp	Temporary files. By default, Red Hat Linux deletes all files in this directory periodically.
/usr	Small programs accessible to all users. Includes many system administration commands and utilities.
/var	Variable data, including log files and printer spools.

Console Based Text Editors:

1. Emacs
2. Nano
3. Vim/vi

Graphical (GUI) Editors:

1. Gedit
2. Gvim
3. Sublime (have to install separately)

Now we are going to discuss about vi/vim editor.

Vim is a highly configurable text editor built to enable efficient text editing. It is an improved version of the VI editor distributed with most UNIX systems. It is a tool, the use of which you must be learned. Program is written by Bram Moolenaar et al.

Usage of vi/vim, it has three modes

1. Command mode
2. Insert Mode
3. Ex-mode

Command mode: this mode is the default mode following things we can do

Yank/copy (yy)   -   copying the single line

(nyy) n number of lines at a time you can copy.

p   -   Paste a content bellow the cursor

P   -   Paste content above the cursor

dd   -   Delete a single line

ndd n number of line delete yet a time

x   -   Deleting a single character

dw   -   Deleting a single word

- - redo

u - Undo

J - Joining the line

r - Replace the character

Arrow Keys

h - Left

j - Down

k - Up

l - Right

Ctrl+d - Scroll Down

Ctrl+u - Scroll UP

Insert Mode: This mode is used to insert the text into the file

i - Inserting the content before the cursor position

I - it will insert the character starting of the line

a - it will insert the character of the cursor append

A - It will append the character from end of the line

O - It will insert a new line above the cursor

o - It will insert a new line below the cursor

s - Substitute the stream

EX-Mode: Esc is used to change the mode. Press Escape key to enter EX-Mode

:w - save the modifications

:q - quit

:wq - save & quit

:w! - save forcefully

:q!   -   Quit forcefully

:set nu   -   setting the line numbers

:set nonu   -   Remove line numbers

:<number> -   it will goes to particular line

:%s/find string name/replace string/g - to replace the string group of lines

:r   -   reading the another file from here

:!<command>   -   command will execute from here

:r !date   -   output will save in current file

option name	default value	description
autoindent	noai	Supply indentation automatically
autowrite	noaw	Automatically write to file while editing
ignorecase	noic	Ignore case when searching
lisp	nolisp	(, {,), and } commands deal with S-expressions
list	nolist	Tabs print as **^I**; end of lines marked with **$**
magic	nomagic	The characters **.**, **[**, and ***** are special ("magical") in scans
number	nonu	Lines are displayed prefixed with their line numbers
paragraphs	para=IPLPPPQPbpP	LI Macro names which start paragraphs
redraw	nore	Simulate a smart terminal on a dumb terminal
sections	sect=NHSHH	HU Macro names which start new sections
shiftwidth	sw=8	Shift distance for **<**, **>**, and other "shift" commands
showmatch	nosm	Show matching **(** or **{** locations as **)** or **}** is typed, for example
showmode	nosmd	Show input mode description
slowopen	slow	Postpone display updates during inserts
term	dumb	The kind of terminal you are using

Type of Users:

Root user - Default user highly privileged UID is 0. This will create while installing the operating system

System users - is nothing but services, at the time of installing particular package. UID starts from 1 to 499.

Local users - after installing of the operating system admin user will create these users. UID starts from 500 to 65534.

➢ After creating a user, user home directory will be created in default path /home.
➢ One group is will be created with same user name (primary group)
➢ Files from /etc/skel will be copied automatically to user home directory
➢ /etc/passwd file is updated with user information
➢ /etc/group file is update with primary group information

Important files

/etc/passwd   User Information
/etc/shadow   User Passwords
/etc/group   Group Information
/etc/gshadow   Group Passwords

User Administration Commands:

\# useradd <user name> -   To create specified local user

\# useradd –d <home directory> <user name>   - create a user with specified home path

```
[root@ARK-IT-Solutions ~]# useradd -d /users/ kumar
[root@ARK-IT-Solutions ~]# cat /etc/passwd |grep -E 'ravi|kumar'
ravi:x:501:501::/home/ravi:/bin/bash
kumar:x:502:502::/users/:/bin/bash
```

\# useradd –u <UID> <user name>   - create user with specific UID.

\# passwd <user name> -   change the user password

\# userdel <user name> -   delete user

userdel <user name>   -   delete user including home directory

finger <user name>   -   See user properties

chfn <user name>   -   Change user information

```
[root@ARK-IT-Solutions ~]# chfn ravi
Changing finger information for ravi.
Name []: Ankam Ravi Kumar
Office []: ARK-IT-Solutions
Office Phone []:
Home Phone []: +91

Finger information changed.
```


chage –l <user name> - to check user password expiry and account expiry information

```
[root@ARK-IT-Solutions ~]# chage -l ravi
Last password change                                  : Jan 08, 2015
Password expires                                      : never
Password inactive                                     : never
Account expires                                       : never
Minimum number of days between password change        : 0
Maximum number of days between password change        : 99999
Number of days of warning before password expires     : 7
```

su - <user name> -   Switch to other user account

id <user name> -   it will show the user id

```
[root@ARK-IT-Solutions ~]# id
uid=0(root) gid=0(root) groups=0(root),1(bin),2(daemon),3(sys),4(adm),6(disk),10(wheel)
```

system-config-users   -   create and manage user account in GUI

Usermod command options:

-c = We can add comment field for the user account.

-d = To modify the directory for any existing user account.

-e = Using this option we can make the account expiry in specific period.

-g = Change the primary group for a User.

-G = To add a supplementary groups.

-a = To add anyone of the group to a secondary group.

-l = To change the login name from arkit to arkit_admin.

-L = To lock the user account. This will lock the password so we can't use the account.

-m = moving the contents of the home directory from existing home dir to new dir.

-p = To Use un-encrypted password for the new password. (NOT Secured).

-s = Create a Specified shell for new accounts.

-u = Used to Assigned UID for the user account between 0 to 999.

-U = To unlock the user accounts. This will remove the password lock and allow us to use the user account.

Creating Groups:

Group information is located/stored on /etc/group file.

groupadd <group name>   - Create a group with specified name

usermod –G <group name> <user name> - Add user to group

gpasswd –a ravi Administrators – Adds the user ravi to the group Administrators

gpasswd –A ravi Administrators – give user ravi administrative rights to the group

gpasswd –d ravi Administrators – remove user ravi from the group Administrators

groupdel <group name> - Delete group name

groupmod –n <new group name> <old group name> - change group name

newgrp - <group name> - Login into the group if successful, re-initializes the user environment

A user profile is a visual display of personal data associated with a specific user, or a customized desktop environment. A profile refers therefore to the explicit digital representation of a person's identity. A user profile can also be considered as the computer representation of a user model.
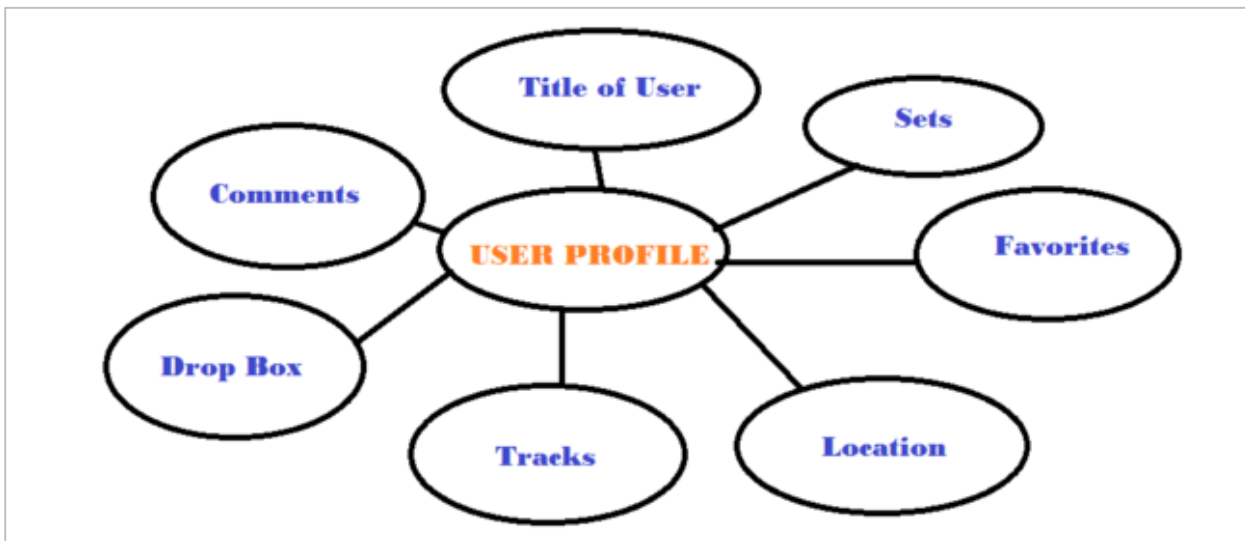
/etc/profile   -   it contains system void variables, if you do any modification in this file it will effect to the administrator and local user profiles.

~/.bash_profile   -   it contains user specific variables, if you do any modification in this file it will effect to that particular account only.

/etc/bashrc   -   it contains system void alias variables

~/.bashrc   -   it contains user specific alias variables

.bash_history   -   it contains all executed commands history

Commands:

alias   -   it will show the aliases

unalias <alias name>   -   it will remove mentioned alias

Note: you can always define an alias using /etc/bashrc OR .bashrc files

File Permissions:

Permission	Value	Number
Read	r	4
Write	w	2
Execute	x	1

Default permissions when you create a file or directory

File Permissions	
File	644
Directory	755

In above image explained about file permissions

Commands to Change file/directory permissions

Symbolic permissions

u   -   user/owner

g   -   Group

o   -   Others

w   -   Write

x   -   Execute

+   -   Allow

-           -   deny

chmod [options] <mode/permissions> <file/directory> - to change permissions file/folder

> Example: chmod 744 file1
> > # chmod u+rwx file or directory : in case of user only
> > # chmod ug+rwx file or directoty : in case of user and group
> > # chmod u+w,g+r,o+x directory/file
> > # chmod u+rw,g+rw directory/file
> > # chmod u-r, g-w,o-rw directory/file
> > # chmod ugo+rwx file/directory
> > # chmod ugo-rwx file/directory

chown [options] <new owner> <file/directory> - to change ownership of file/folder

> Example: chown user2 file1
> > chown user1:group1 file2

chgrp [options] <new group> <file/directory> - to change group of file/folder

> Example: chgrp gorup2 file2

String related commands will help you to print/search file text as required

HEAD

Head prints the first N number of data of the given input. By default, it prints first 10 lines of each given file.

Example: head file2

head –n 2 file3 #number of lines

```
[root@ARK-IT-Solutions ~]# head -n 2 install.log
Installing libgcc - 4.1.1-52.el5.i386
warning: libgcc-4.1.1-52.el5: Header V3 DSA signature: NOKEY, key ID 37017186
```

SORT

Sort is a simple and very useful command which will rearrange the lines in a text file so that they are sorted, numerically and alphabetically. By default, the rules for sorting are:

- ✓ Lines starting with a number will appear before lines starting with a letter.
- ✓ Lines starting with a letter that appears earlier in the alphabet will appear before lines starting with a letter that appears later in the alphabet.
- ✓ Lines starting with a lowercase letter will appear before lines starting with the same letter in uppercase.

Example: sort –r file2

```
[root@ARK-IT-Solutions ~]# sort -r install.log
warning: libgcc-4.1.1-52.el5: Header V3 DSA signature: NOKEY, key ID 37017186
Installing zsh - 4.2.6-1.i386
Installing zlib-devel - 1.2.3-3.i386
Installing zlib - 1.2.3-3.i386
```

Options

-b   ignores leading blanks
-d   considers only blanks and alphanumeric characters
-f   fold lower case to upper case characters
-g   compare according to general numerical value
-i   consider only printable characters
-M   compare (unknown) < `JAN' < ... < `DEC'
-n   compare according to string numerical value

-r   reverse the result of comparisons
-c   check whether input is sorted; does not sort
-k   start a key at POS1, end it at POS2 (origin 1)
-m   merges already sorted files; do not sort
-o   write result to FILE instead of standard output
-s   stabilize sort by disabling last-resort comparison
-S   use SIZE for main memory buffer
-t   use SEP instead of non-blank to blank transition
-T   use DIR for temporaries, not $TMPDIR or /tmp
-z   end lines with 0 byte, not newline

UNIQ

Uniq command is helpful to remove or detect duplicate entries in a file.

Example: uniq <file name> - it will print uniq values

```
[root@ARK-IT-Solutions uniq]# cat testuniq
aa
aa
aa
aa
bb
bb
bb
bb
bb
cc
cc
cc
cc
[root@ARK-IT-Solutions uniq]# uniq testuniq
aa
bb
cc
```

PASTE

It is very useful for merging a single file and also for merging set of files as well.

 ✓ paste command examples for single file handling
 ✓ paste command examples for multiple files handling
        Example: paste –s file1

---

paste –d, -s file1

```
[root@ARK-IT-Solutions paste]# cat testpaste
Linux
windows
Unix
Solaris
[root@ARK-IT-Solutions paste]# paste -s testpaste
Linux    windows Unix     Solaris
[root@ARK-IT-Solutions paste]# paste -d, -s testpaste
Linux,windows,Unix,Solaris
```

```
[root@ARK-IT-Solutions paste]# cat file1
Linux
windows
VMWare
[root@ARK-IT-Solutions paste]# cat file2
OpenSource
MoreCost
Virtualization
[root@ARK-IT-Solutions paste]# paste -d, file1 file2
Linux,OpenSource
windows,MoreCost
VMWare,Virtualization
```

CUT

Cut is used for text processing. You can use this command to extract portion of text from a file by selecting columns.

```
[root@ARK-IT-Solutions cut]# cat testcut
this is a file
ravi kumar
ankam ravi
kumar ravi
[root@ARK-IT-Solutions cut]# cut -c1-4 testcut
this
ravi
anka
kuma
```

TR

It will translate content of the file from one case to another case vice versa.

```
[root@ARK-IT-Solutions tr]# cat file1
abcdefghijklmnopqrstuvwxyz
[root@ARK-IT-Solutions tr]# tr 'a-z' 'A-Z' < file1
ABCDEFGHIJKLMNOPQRSTUVWXYZ
[root@ARK-IT-Solutions tr]# tr 'a-f' 'A-F' < file1
ABCDEFghijklmnopqrstuvwxyz
```

Note: if you want to change the file text to caps then redirect the output to another file

SED

Sed is a Stream Editor used for modifying the files in unix (or linux). Whenever you want to make changes to the file automatically, sed comes in handy to do this. Most people never learn its power; they just simply use sed to replace text. You can do many things apart from replacing text with sed.

```
[root@ARK-IT-Solutions sed]# cat testsed
unix is great os. unix is opensource. unix is free os.
learn operating system.
unix which one you choose.
[root@ARK-IT-Solutions sed]# sed 's/unix/linux/' testsed
linux is great os. unix is opensource. unix is free os.
learn operating system.
linux which one you choose.
```

DIFF

To compare the difference between two files text you can use this command

```
[root@ARK-IT-Solutions diff]# cat file1
I need to go to the store.
I need to buy some apples.
When I get home, I'll wash the dog.
[root@ARK-IT-Solutions diff]# cat file2
I need to go to the store.
I need to buy some apples.
Oh yeah, I also need to buy grated cheese.
When I get home, I'll wash the dog.
[root@ARK-IT-Solutions diff]# diff file1 file2
2a3
> Oh yeah, I also need to buy grated cheese.
```
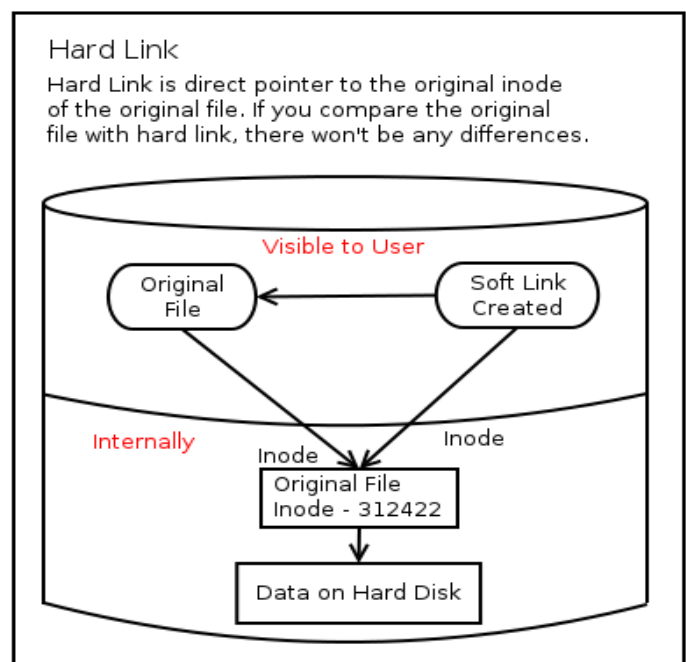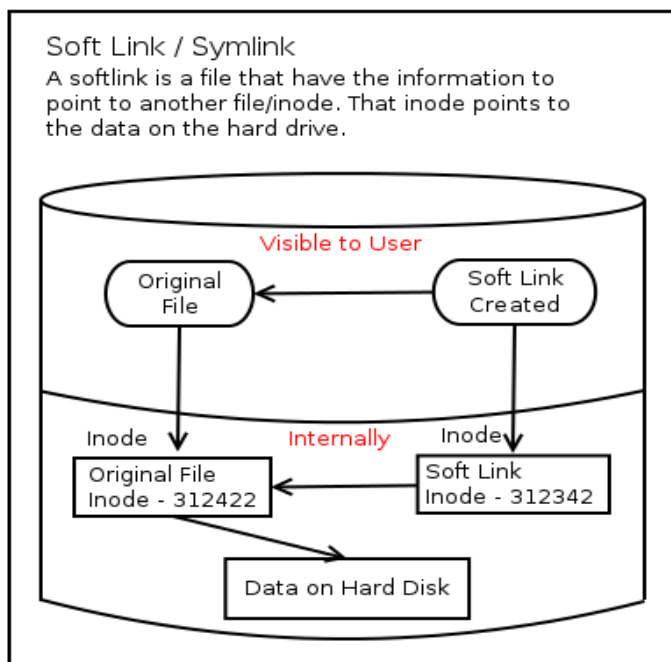
File Types

-b   -   block device file Example: HDD and pen drive
-d   -   directory file
-     -   common file
c   -   Character device file Example: terminal
l   -   Linked file

Linking means reflecting to the original file, In case of copy command updating is not possible after copying the file from the source to destination. In link updating is possible for both the files.

HARD Link	SOFT Link
1. The destination file is exact image of the source file.	1. The destination file size is length of the source file name
2. If source got deleted also even we can access the destination file	2. if source got deleted we can't access destination file
3. inode numbers of source and destination are same	3. inode numbers of source and destination are different
4. We can't put the hard link to different file system (partitions) because it will different.	4. we can put a link between different file systems
5. Ex: cp –l <source> <destination>	Ex: cp –s <source> <destination>

Soft Link / Symlink
A softlink is a file that have the information to point to another file/inode. That inode points to the data on the hard drive.

Hard Link
Hard Link is direct pointer to the original inode of the original file. If you compare the original file with hard link, there won't be any differences.

The program in running action
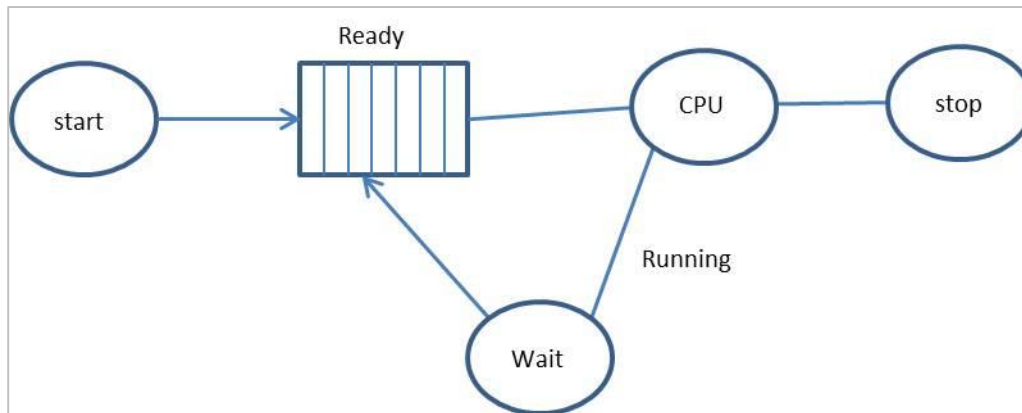
1. System Defined Process
2. User Defined Process

   System defined process is called as daemon, it is a program running for the service. It will start when booting the operating system, we can also start manually.

   User defined process is called executing commands.

Init is the parent process for all the processes. Process id is 0 always.
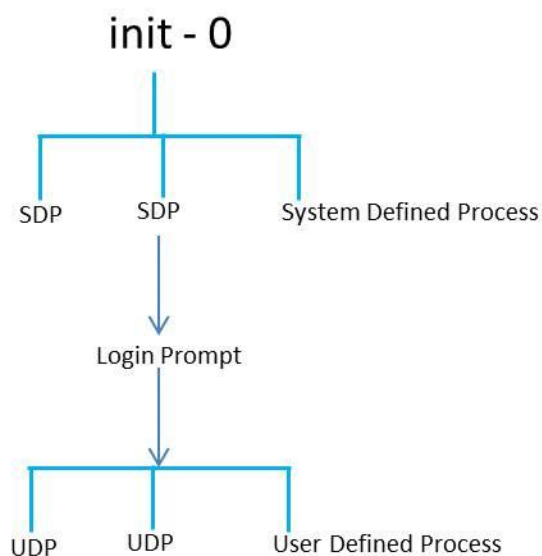
$ ps   -   it will display the process status correct terminal

```
[root@ARK-IT-Solutions ~]# ps
  PID TTY          TIME CMD
 3275 pts/1    00:00:00 bash
 4275 pts/1    00:00:00 ps
```

pts/0 -   sudo terminal

tty/1 -   virtual terminal

  Example: ps –a (a = all the processes)

      ps –f - full description of the process

      ps –af

      ps –u - for user processes

      ps –x - system processes

      ps –ax   - all terminals system processes

To see the background running processes

$ jobs -   to see background processes

$ fg

$ top -   it will display dynamic running processes correct time, system uptime and number of users logged in, CPU load memory and processes.

Killing the processes:

kill -9 <PID>   - kill the process using Process ID

kill –a <name>   - kill the process using process name

Search commands will help you to search files/directories and file content.

Command GREP

Grand regular expression, it is used to search the file name and content of the file

```
[root@ARK-IT-Solutions ~]# cat install.log |grep zlib
Installing zlib - 1.2.3-3.i386
Installing zlib-devel - 1.2.3-3.i386
```

Command FIND

It is command to find files with different options.

find / -iname <file name>　　　　- to search files with file name

find / -perm 770　　　　　　　　- to search files with their permissions

find / -user <user name>　　　　- to search files with user ownership

find / -size 10M　　　　　　　　- to search files with their size

```
[root@ARK-IT-Solutions ~]# find /root -iname ravi
/root/ravi
[root@ARK-IT-Solutions ~]# find /root -perm 644
/root/ravi1
/root/.gtkrc-1.2-gnome2
/root/.tcshrc
/root/.gnome2/share/cursor-fonts/fonts.dir
/root/.gnome2/share/fonts/fonts.dir
/root/.cshrc
```

Command LOCATE

Locate command can be used to searching for the file based on the string name from / onwards.

```
[root@ARK-IT-Solutions ~]# locate /root ravi
/root
/etc/selinux/targeted/contexts/users/root
```

Scheduling is very useful when you prefer do some automation jobs.

For scheduling the tasks in Linux we are using **at** and **crontab**

Command AT:

$ at – it is used to scheduled one are more jobs (commands) for a single execution.

Example: $ at 10:30

$ at now+5 minutes

$ at tomorrow

$ at 10:30 july 15 2015

The expression	Would translate to
noon	12:00 PM October 18 2014
midnight	12:00 AM October 19 2014
teatime	4:00 PM October 18 2014
tomorrow	10:00 AM October 19 2014
noon tomorrow	12:00 PM October 19 2014
next week	10:00 AM October 25 2014
next monday	10:00 AM October 24 2014
fri	10:00 AM October 21 2014
NOV	10:00 AM November 18 2014
9:00 AM	9:00 AM October 19 2014
2:30 PM	2:30 PM October 18 2014
1430	2:30 PM October 18 2014
2:30 PM tomorrow	2:30 PM October 19 2014
2:30 PM next month	2:30 PM November 18 2014
2:30 PM Fri	2:30 PM October 21 2014
2:30 PM 10/21	2:30 PM October 21 2014
2:30 PM Oct 21	2:30 PM October 21 2014
2:30 PM 10/21/2014	2:30 PM October 21 2014
2:30 PM 21.10.14	2:30 PM October 21 2014

now + 30 minutes	10:30 AM October 18 2014
now + 1 hour	11:00 AM October 18 2014
now + 2 days	10:00 AM October 20 2014
4 PM + 2 days	4:00 PM October 20 2014
now + 3 weeks	10:00 AM November 8 2014
now + 4 months	10:00 AM February 18 2015
now + 5 years	10:00 AM October 18 2019

$ atq - is a command to see scheduled jobs

$ atrm <job number> – is a command to remove the schedules jobs

CRONTAB:

The crontab is a list of commands that you want to run on a regular schedule, and also the name of the command used to manage that list.

Example: crontab –e   - to edit the jobs

crontab –l   - to list the scheduled jobs

crontab –c –u <user name> - to see particular user jobs

crontab –r   - to remove crontab file

crontab format

```
[root@ARK-IT-Solutions ~]# crontab -l
# * * * * *   command to execute
#
#
#
#                     day of week (0 – 6) (0 to 6 are Sunday to Saturday, or use names; 7 is Sunday, the same as 0)
#                   month (1 – 12)
#                 day of month (1 – 31)
#               hour (0 – 23)
#             min (0 – 59)
```

```
# * * * * *  command to execute
#  | | | | |
#  | | | | |
#  | | | | └──────── day of week (0 - 6) (0 to 6 are Sunday to Saturday, or use names; 7 is Sunday, the same as 0)
#  | | | └────────── month (1 - 12)
#  | | └──────────── day of month (1 - 31)
#  | └────────────── hour (0 - 23)
#  └──────────────── min (0 - 59)
```

Example: 5,10,15 * * * * mail –s "Mail from root" aravikumar48@gmail.com

This above example will send a mail yet every 5th 10th and 15th minute of hour

---

A file system is the underlying structure a computer uses to organize data on a hard disk. If you are installing a new hard disk, you need to partition and format it using a file system before you can begin storing data or programs.


```
                    File System
          ┌─────────────┴─────────────┐
   Local File System          Remote File System
 Minix, ext2, ext3,ext4           NFS and Samba
```
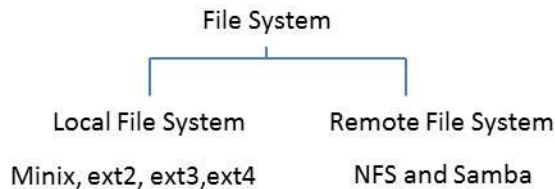
Minix -   14 characters, 64MB of storage

Ext   -   Extended file system, 255 characters, 2GB of storage

When you're going to format the Linux file system using extend file system it will create blocks.

1). Master Block/Boot Block

2). Super Block

3). Inode Block

4). Data Block

1. Master block entry is located at partition table, only boot partition contains master blocks data. Remaining partitions master blocks are empty.
2. Super block just like an index to the book and it will holds to the information as follows

   a. Utilized inode numbers
   b. Free inode numbers
   c. Utilized data blocks
   d. Free data blocks

Super block holds all this information.

3. Inode table (index table) which holds all the information about files/directories like permissions, owner, group name, size and time stamps.

4096 bytes default block size

15 data blocks = inode

If data size is more than 100MB block size is 4096bytes. If data size is less than 100MB block size is 1024bytes.

```
[root@ARK-IT-Solutions ~]# ls -ia
3670017 .              3670022 .bashrc      98312 .gconfd           3675670 .ICEauthority    3675673 ravi
      2 ..             3670023 .cshrc       98343 .gnome            3670018 install.log      3675674 ravi1
3675663 anaconda-ks.cfg    98335 Desktop     98314 .gnome2           3670019 install.log.syslog   98336 .redhat
3675671 .bash_history  3675668 .dmrc        98315 .gnome2_private   3675672 .lesshst         3670024 .tcshrc
3670020 .bash_logout      98342 .eggcups    98350 .gstreamer-0.10      98339 .metacity         98346 .Trash
3670021 .bash_profile     98311 .gconf    3675669 .gtkrc-1.2-gnome2     98334 .nautilus      3672047 .viminfo
```

Directory holds inode number of file and file name

4. Data block storage of files

Table

Now below is a very brief comparison of the most common file systems in use with the Linux world

File System	Max File Size	Max Partition Size	Journaling	Notes
Fat16	2 GB	2 GB	No	Legacy
Fat32	4 GB	8 TB	No	Legacy
NTFS	2 TB	256 TB	Yes	(For Windows Compatibility) NTFS-3g is installed by default in Ubuntu, allowing Read/Write support
ext2	2 TB	32 TB	No	Legacy
ext3	2 TB	32 TB	Yes	Standard linux filesystem for many years. Best choice for super-standard installation.
ext4	16 TB	1 EB	Yes	Modern iteration of ext3. Best choice for new installations where super-standard isn't necessary.
reiserFS	8 TB	16 TB	Yes	No longer well-maintained.
JFS	4PB	32PB	Yes (metadata)	Created by IBM - Not well maintained.
XFS	8 EB	8 EB	Yes (metadata)	Created by SGI. Best choice for a mix of stability and advanced journaling.
GB = Gigabyte (1024 MB) :: TB = Terabyte (1024 GB) :: PB = Petabyte (1024 TB) :: EB = Exabyte (1024 PB)				

Journaling:

A journaling file system is more reliable when it comes to data storage. Journaling file systems do not necessarily prevent corruption, but they do prevent inconsistency and are much faster at file system checks than non-journaled file systems. If a power failure happens while you are saving a file, the save will not complete and you end up with corrupted data and an inconsistent file system. Instead of actually writing directly to the part of the disk where the file is stored, a journaling file system first writes it to another part of the hard drive and notes the necessary changes to a log, then in the background it goes through each entry to the journal and begins to complete the task, and when the task is complete, it checks it off on the list. Thus the file system is always in a consistent state (the file got saved, the journal reports it as not completely saved, or the journal is inconsistent (but can be rebuilt from the file system)). Some journaling file systems can prevent corruption as well by writing data twice.

Journaling

```
   _____
   |                    |              |
Writable more      ordered more     journal
```
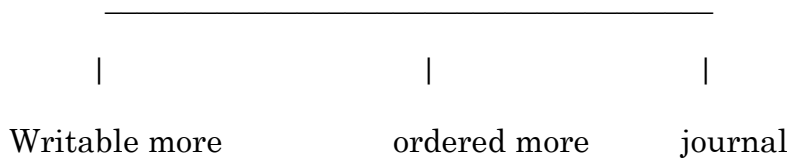
- i.   Write block – metadata is stored in HDD
- ii.   Ordered more – metadata and actual data
- iii.   Journal will maintain more space to do journaling

Network File System (NFS):

A Network File System (NFS) allows remote hosts to mount file systems over a network and interact with those file systems as though they are mounted locally. This enables system administrators to consolidate resources onto centralized servers on the network.

SAMBA (SMB):

Samba is a software it is used to share the file and printer between Linux to Windows vice versa

Creating Standard Partition:

Disk partitioning is the act of dividing a hard disk drive (HDD) into multiple logical storage units referred to as partitions, to treat one physical disk drive as if it were multiple disks, so that a different file system can be used on each partition.

All the device files are stored in /dev/ directory. If your Hard disk is connected

	SATA DRIVE	IDE DRIVE
Primary master	/dev/sda	/dev/hda
Primary slave	/dev/sdb	/dev/hdb
Secondary master	/dev/sdc	/dev/hdc
Secondary slave	/dev/sdd	/dev/hdd

fdisk   - it is a utility used for creating, deleting, listing and checking partitions

In this situation i am using vmware environment so just added one disk 5GB in size to server.

ls /sys/class/scsi_host/ | while read host ; do echo "- - -" > /sys/class/scsi_host/$host/scan ; done   -   To scan new hardware changes.

```
[root@ARK-IT-Solutions ~]# ls /sys/class/scsi_host/ | while read host ; do echo "- - -" > /sys/class/scsi_host/$host/scan
 ; done
[root@ARK-IT-Solutions ~]# fdisk -l

Disk /dev/sda: 21.4 GB, 21474836480 bytes
255 heads, 63 sectors/track, 2610 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          13      104391   83  Linux
/dev/sda2              14        2610    20860402+   8e  Linux LVM

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/sdb doesn't contain a valid partition table
```

In above image we can able to see new hard disk is found it does not have valid partitions

To create a partition we have to identify HDD name we can use fdisk utility to find.

fdisk –l – to identify HDD name

In this case our disk name is /dev/sdb

fdisk /dev/sdb

```
[root@ARK-IT-Solutions ~]# fdisk /dev/sdb
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel. Changes will remain in memory only,
until you decide to write them. After that, of course, the previous
content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

Command (m for help): m
Command action
   a   toggle a bootable flag
   b   edit bsd disklabel
   c   toggle the dos compatibility flag
   d   delete a partition
   l   list known partition types
   m   print this menu
   n   add a new partition
   o   create a new empty DOS partition table
   p   print the partition table
   q   quit without saving changes
   s   create a new empty Sun disklabel
   t   change a partition's system id
   u   change display/entry units
   v   verify the partition table
   w   write table to disk and exit
   x   extra functionality (experts only)
```

List the options using m option

```
Command (m for help): p

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System

Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-652, default 1):          1 cylinder = 7.8MB
Using default value 1                       mention the cylinders
Last cylinder or +size or +sizeM or +sizeK (1-652, default 652): +1G

Command (m for help): p

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1         123      987966   83  Linux
```

: p   - print the partition list in fdisk utility

n – to create a new partition

mention the partition type primary of extended.

Note: (one extended OR 3 Primary 1 Extended) if you create extended partition first you can't able to create a one more partition in same disk. We can create 3 primary and 1 extended partition.

p for primary

enter the partition number (there is no partitions in our scenario entered 1)

if want to enter the space in first step then calculate cylinders (7.8MB*number)

if you want to provide the space using MB, KB and GB then just hit enter

+1G

Now see partition is created or not using p

p

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

Calling ioctl() to re-read partition table.
Syncing disks.
```

To save the partition information :wq

```
[root@ARK-IT-Solutions ~]# partprobe /dev/sdb
[root@ARK-IT-Solutions ~]# fdisk -l /dev/sdb

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1         123      987966   83  Linux
```

To update partition information to kernel

partprobe /dev/sdb – to update partition information to partition table without reboot

Partition created now we have to create a file system in partition

mkfs.ext3 /dev/sdb1   - make file system in partition

```
[root@ARK-IT-Solutions ~]# mkfs.ext3 /dev/sdb1
mke2fs 1.39 (29-May-2006)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
123648 inodes, 246991 blocks
12349 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=255852544
8 block groups
32768 blocks per group, 32768 fragments per group
15456 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376

Writing inode tables: done
Creating journal (4096 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 23 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
```

After completion of creating a file system we have to mount the partition for use

Create a directory to mount # mkdir /arkit

mount /dev/sdb1 /arkit   - to mount the file system

```
[root@ARK-IT-Solutions ~]# mkdir /arkit
[root@ARK-IT-Solutions ~]# mount /dev/sdb1 /arkit/
[root@ARK-IT-Solutions ~]# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/mapper/VG01-ROOT
                       15G  3.3G   11G  25% /
/dev/sda1              99M   11M   83M  12% /boot
tmpfs                 506M     0  506M   0% /dev/shm
/dev/sdb1             950M   18M  885M   2% /arkit
```

To check filee system size # df –h   - check file system size

Note: SATA and SCSI we can create a 15 partitions and IDE 64 partitions only

To access partition of windows in linux

#mount –t vfat /dev/hdax /mnt

in order to check the label of any partition
#e2label /dev/hdax
where x is number

Mounting CD Rom
\# mount –t auto /dev/hdc /media/cdrom
-t : file type
auto : file type
in order to check where cdrom is attached we can open the file fstab
\#vi /etc/fstab

now in case of RHEl 3.0 we have to use command in order to unmount.
\# umount /media/cdrom

and then eject the cdrom in case of RHEL 4.0 we simply type
\# eject

Mounting Floppy
\#mount –t auto /dev/fd0 /media/floppy
in case of floppy we have to umount first then only we remove floppy otherwise all content of floppy may be lost or floppy may be physically damaged.
\# umount /media/floppy

Permanent mount file system we have to edit /etc/fstab/ file.

```
[root@ARK-IT-Solutions ~]# vi /etc/fstab
/dev/VG01/ROOT            /              ext3    defaults        1 1
LABEL=/boot               /boot          ext3    defaults        1 2
devpts                    /dev/pts       devpts  gid=5,mode=620  0 0
tmpfs                     /dev/shm       tmpfs   defaults        0 0
proc                      /proc          proc    defaults        0 0
sysfs                     /sys           sysfs   defaults        0 0
/dev/VG01/SWAP            swap           swap    defaults        0 0
/dev/sdb1                 /arkit         ext3    defaults        0 0
```

add the entry as mentioned in above screenshot

\# mount –a   - to verify mentioned entry is correct, if not it will give you error message

\# e2label /dev/sdb1 RAVI - to add label to partition

```
[root@ARK-IT-Solutions ~]# e2label /dev/sdb1 RAVI
[root@ARK-IT-Solutions ~]# e2label /dev/sdb1
RAVI
```

\# e2label /dev/sdb1 - to check disk label

DELETING PARTITION:

Deleting the partition will lead to lose the important data

Remove the entry from /etc/fstab if it is mounted as permanent

```
[root@ARK-IT-Solutions ~]# fdisk /dev/sdb

Command (m for help): p

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot        Start          End        Blocks   Id  System
/dev/sdb1                 1          123        987966   83  Linux

Command (m for help): d
Selected partition 1

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

Calling ioctl() to re-read partition table.

WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table.
The new table will be used at the next reboot.
Syncing disks.
[root@ARK-IT-Solutions ~]# partprobe /dev/sdb
[root@ARK-IT-Solutions ~]# fdisk -l /dev/sdb

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot        Start          End        Blocks   Id  System
```

fdisk /dev/sdb

:d

If you have more than one partition it will ask for the partition id

:wq

partprobe /dev/sdb

fdisk –l /dev/sdb

Extending the Swap:

Create a partition

Change the partition type ID to 82 using t option in fdisk utility

mkswap /dev/sdb2   - it will format in swap file system

free -   to check swap size

Options: -m in MB format

-G in GB format

```
[root@ARK-IT-Solutions ~]# fdisk /dev/sdb

Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 2
First cylinder (1-652, default 1):
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-652, default 652): +1G

Command (m for help): p

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb2               1         123      987966   83  Linux

Command (m for help):
Command (m for help): l

 0  Empty           1e  Hidden W95 FAT1 80  Old Minix       be  Solaris boot
 1  FAT12           24  NEC DOS         81  Minix / old Lin bf  Solaris
 2  XENIX root      39  Plan 9          82  Linux swap / So c1  DRDOS/sec (FAT-
 3  XENIX usr       3c  PartitionMagic  83  Linux           c4  DRDOS/sec (FAT-
 4  FAT16 <32M      40  Venix 80286     84  OS/2 hidden C:  c6  DRDOS/sec (FAT-
 5  Extended        41  PPC PReP Boot   85  Linux extended  c7  Syrinx
 6  FAT16           42  SFS             86  NTFS volume set da  Non-FS data
 7  HPFS/NTFS       4d  QNX4.x          87  NTFS volume set db  CP/M / CTOS / .
 8  AIX             4e  QNX4.x 2nd part 88  Linux plaintext de  Dell Utility
 9  AIX bootable    4f  QNX4.x 3rd part 8e  Linux LVM       df  BootIt
 a  OS/2 Boot Manag 50  OnTrack DM      93  Amoeba          e1  DOS access
 b  W95 FAT32       51  OnTrack DM6 Aux 94  Amoeba BBT      e3  DOS R/O
 c  W95 FAT32 (LBA) 52  CP/M            9f  BSD/OS          e4  SpeedStor
 e  W95 FAT16 (LBA) 53  OnTrack DM6 Aux a0  IBM Thinkpad hi eb  BeOS fs
 f  W95 Ext'd (LBA) 54  OnTrackDM6      a5  FreeBSD         ee  EFI GPT
10  OPUS            55  EZ-Drive        a6  OpenBSD         ef  EFI (FAT-12/16/
11  Hidden FAT12    56  Golden Bow      a7  NeXTSTEP        f0  Linux/PA-RISC b
12  Compaq diagnost 5c  Priam Edisk     a8  Darwin UFS      f1  SpeedStor
14  Hidden FAT16 <3 61  SpeedStor       a9  NetBSD          f4  SpeedStor
16  Hidden FAT16    63  GNU HURD or Sys ab  Darwin boot     f2  DOS secondary
17  Hidden HPFS/NTF 64  Novell Netware  b7  BSDI fs         fd  Linux raid auto
18  AST SmartSleep  65  Novell Netware  b8  BSDI swap       fe  LANstep
1b  Hidden W95 FAT3 70  DiskSecure Mult bb  Boot Wizard hid ff  BBT
1c  Hidden W95 FAT3 75  PC/IX

Command (m for help): t
Selected partition 2
Hex code (type L to list codes): 82
```

swapon /dev/sdb2 – in your case it may different.

To make permanent mount of swap file system edit the /etc/fstab file and add the entry

# mount –a   - to refresh the /etc/fstab mounts

LVM is a logical volume manager for the Linux kernel that manages disk drives and similar mass-storage devices. Using logical volume manager will give more flexibility to increase/reduce file system in more effective way and no loss of data.

Advantages

LVM gives you more flexibility than just using normal hard drive partitions:

- Use any number of disks as one big disk.
- Have logical volumes stretched over several disks.
- Create small logical volumes and resize them "dynamically" as they get filled up.
- Resize logical volumes regardless of their order on disk. It does not depend on the position of the LV within VG, there is no need to ensure surrounding available space.
- Resize/create/delete logical and physical volumes online. File systems on them still need to be resized, but some (such as ext4) support online resizing.
- Online/live migration of LV being used by services to different disks without having to restart services.
- Snapshots allow you to back up a frozen copy of the file system, while keeping service downtime to a minimum.
- Support for various device-mapper targets, including transparent file system encryption and caching of frequently used data.
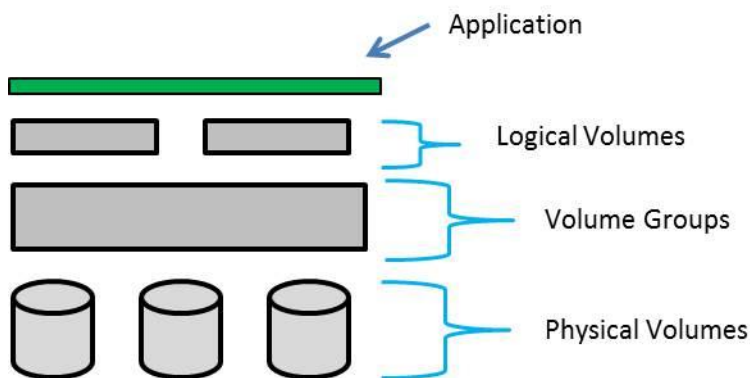
To make LVM's we will first create physical volumes, we will combine all the PV's into the volume group and top of the VG's we will create LVM's.

Let's create Partitions

```
[root@ARK-IT-Solutions ~]# fdisk /dev/sdb  ◄━━━

Command (m for help): n ◄━━━
Command action
    e    extended
    p    primary partition (1-4)
p ◄━━━
Partition number (1-4): 1
First cylinder (1-652, default 1):
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-652, default 652): +1G
                                                                      ▲
                                                                      ┃
Command (m for help): t ◄━━━
Selected partition 1
Hex code (type L to list codes): 8e ◄━━━
Changed system type of partition 1 to 8e (Linux LVM)

Command (m for help): wq ◄━━━
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
[root@ARK-IT-Solutions ~]# partprobe /dev/sdb ◄━━━
```

[root@ARK-IT-Solutions ~]# fdisk /dev/sdb

Command (m for help): **n**
Command action
  e   extended
  p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-652, default 1):
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-652, default 652): +1G

Command (m for help): **t**
Selected partition 1
Hex code (type L to list codes): **8e**
Changed system type of partition 1 to 8e (Linux LVM)

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

Calling ioctl() to re-read partition table.
Syncing disks.
[root@ARK-IT-Solutions ~]# **partprobe /dev/sdb**

Repeat the above step for remain partition creations.

```
   Device Boot      Start          End       Blocks   Id  System
/dev/sdb1               1          123       987966   8e  Linux LVM
/dev/sdb2             124          246       987997+  8e  Linux LVM
/dev/sdb3             247          369       987997+  8e  Linux LVM
```

Creating Physical volumes
```
[root@ARK-IT-Solutions ~]# pvcreate /dev/sdb1 /dev/sdb2 /dev/sdb3
  Physical volume "/dev/sdb1" successfully created
  Physical volume "/dev/sdb2" successfully created
  Physical volume "/dev/sdb3" successfully created
```

pvcreate /dev/sdb1 /dev/sdb2 /dev/sdb3 – to create PV's
pvscan   -   to see if any PV's are there
pvdisplay -   to see PV properties, attributes of a physical volume
pvs   -   to see the PV's information, produces formatted output about PV's

```
[root@ARK-IT-Solutions ~]# pvs
  PV          VG    Fmt  Attr PSize    PFree
  /dev/sda2   VG01  lvm2 a-     19.88G       0
  /dev/sdb1   data  lvm2 a-    964.00M 964.00M
  /dev/sdb2   data  lvm2 a-    964.00M 964.00M
  /dev/sdb3   data  lvm2 a-    964.00M 964.00M
```

vgcreate /dev/sdb1 /dev/sdb2 /dev/sdb3
```
[root@ARK-IT-Solutions ~]# vgcreate datavolume /dev/sdb1 /dev/sdb2 /dev/sdb3
  Volume group "datavolume" successfully created
```

vgdisplay -   It will display all VG properties
vgscan   -   It will scan for all existing volume groups and rebuild caches
```
[root@ARK-IT-Solutions ~]# vgscan
  Reading all physical volumes.  This may take a while...
  Found volume group "datavolume" using metadata type lvm2
  Found volume group "VG01" using metadata type lvm2
```

vgextend <pv name>   - allows you to add one or more initialized physical volumes to an existing volume group to extend it in size.
```
[root@ARK-IT-Solutions ~]# vgextend datavolume /dev/sdb3
  /dev/cdrom: open failed: Read-only file system
  /dev/cdrom: open failed: Read-only file system
  Attempt to close device '/dev/cdrom' which is not open.
  Volume group "datavolume" successfully extended
```

vgremove <vg name>   - to delete VG

```
[root@ARK-IT-Solutions ~]# vgremove datavolume /dev/sdb3
  /dev/cdrom: open failed: Read-only file system
  Volume group "datavolume" successfully removed
  /dev/cdrom: open failed: Read-only file system
  Attempt to close device '/dev/cdrom' which is not open.
  Volume group "sdb3" not found
```

vgreduce <vg name> <pv name>   - to remove PV from VG

```
[root@ARK-IT-Solutions ~]# vgreduce datavolume /dev/sdb3
  Removed "/dev/sdb3" from volume group "datavolume"
```

Note: Volume Group reducing will lead to data loss, we have to take a backup of complete VG then do above step. Do not practice above step in any production environment.

#vgrename   <old vg name> <new vg name> - to rename VG name

```
[root@ARK-IT-Solutions ~]# vgrename datavolume data
  /dev/cdrom: open failed: Read-only file system
  Attempt to close device '/dev/cdrom' which is not open.
  Volume group "datavolume" successfully renamed to "data"
```

#vgmerge <vg1> <vg2>   - To merge two VG's as one group

```
[root@ARK-IT-Solutions ~]# vgmerge data data1
  Volume group "data1" successfully merged into "data"
```

lvcreate –n <lv name> -L +<size> <vg name> - create a logical volume in an existing VG

```
[root@ARK-IT-Solutions ~]# lvcreate -n lv0 -L +1G data
  Logical volume "lv0" created
```

lvdisplay   - allows you to see the attributes of a logical volume like size, read/write status, snapshot information etc.

```
[root@ARK-IT-Solutions ~]# lvdisplay
  --- Logical volume ---
  LV Name                /dev/data/lv0
  VG Name                data
  LV UUID                p4EwcC-aS1i-MShb-z3nJ-O6eo-m7z7-4ysb3S
  LV Write Access        read/write
  LV Status              available
  # open                 0
  LV Size                1.00 GB
  Current LE             256
  Segments               1
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:2
```

lvextend –L +500M <lv path> - to extend the LV space

```
[root@ARK-IT-Solutions ~]# lvextend -L +500M /dev/data/lv0
  Extending logical volume lv0 to 1.49 GB
  Logical volume lv0 successfully resized
```

lvreduce –L -500M <lv path> - to reduce the LV space

```
[root@ARK-IT-Solutions ~]# lvreduce -L -500M /dev/data/lv0
  WARNING: Reducing active logical volume to 1.00 GB
  THIS MAY DESTROY YOUR DATA (filesystem etc.)
Do you really want to reduce lv0? [y/n]: y
  Reducing logical volume lv0 to 1.00 GB
  Logical volume lv0 successfully resized
```

Note: reducing the logical volume space will lead to data loss, before reducing the lv space we have to take lv snapshot to restore back to same state. Do not practice this command until unless it's required.

Command options:

lvchange   Change the attributes of logical volume(s)
lvconvert   Change logical volume layout
lvcreate   Create a logical volume
lvdisplay   Display information about a logical volume
lvextend   Add space to a logical volume
lvmchange   With the device mapper, this is obsolete and does nothing.
lvmdisks   can List devices that may be used as physical volumes
lvmsadc   Collect activity data
lvmsar   Create activity report
lvreduce   Reduce the size of a logical volume
lvremove   Remove logical volume(s) from the system
lvrename   Rename a logical volume
lvresize   Resize a logical volume
lvs   Display information about logical volumes
lvscan   List all logical volumes in all volume groups

lvm -   to enter into the logical volume mode

```
[root@ARK-IT-Solutions backup]# lvm
lvm>
```

lvrename -   to rename the lv name

```
[root@ARK-IT-Solutions ~]# lvrename /dev/data/lv0 /dev/data/lv1
  Renamed "lv0" to "lv1" in volume group "data"
```

lvremove -   to delete the LV

```
[root@ARK-IT-Solutions ~]# lvremove /dev/data/lv1
Do you really want to remove active logical volume "lv1"? [y/n]: y
  Logical volume "lv1" successfully removed
```

lvmdump - to collect all the information about LV's, VG's and PV's

```
[root@ARK-IT-Solutions ~]# lvmdump

Creating dump directory: /root/lvmdump-ARK-IT-Solutions.localdomain-20150115200500

Gathering LVM & device-mapper version info...
Gathering dmsetup info...
Gathering process info...
Gathering console messages...
Gathering /etc/lvm info...
Gathering /dev listing...
Creating report tarball in /root/lvmdump-ARK-IT-Solutions.localdomain-20150115200500.tgz...
[root@ARK-IT-Solutions ~]# ls
anaconda-ks.cfg  install.log        lvmdump-ARK-IT-Solutions.localdomain-20150115200500.tgz
```

lvmdiskscan   -   to see LV's, VG's and PV's info with size
lvs   -   to check logical volumes info

lvcreate –size 100m –snapshot –name snap /dev/data/lv0 - creates a snapshot logical volume named /dev/data/snap which has access to the contents of the original logical volume named /dev/data/lv0 at snapshot logical volume creation time. If the original logical volume contains a file system, you can mount the snapshot logical volume on an arbitrary directory in order to access the contents of the file system to run a backup while the original file system continues to get updated.

```
[root@ARK-IT-Solutions ~]# lvcreate --size 100m --snapshot --name snap /dev/data/lv0
  Logical volume "snap" created
```

mkfs.ext3 /dev/data/lv0 - to make file system in lv

```
[root@ARK-IT-Solutions ~]# mkfs.ext3 /dev/data/lv0
mke2fs 1.39 (29-May-2006)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
131072 inodes, 262144 blocks
13107 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=268435456
8 block groups
32768 blocks per group, 32768 fragments per group
16384 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376

Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 31 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[root@ARK-IT-Solutions ~]#
[root@ARK-IT-Solutions ~]# mkdir /lv0
[root@ARK-IT-Solutions ~]# mount /dev/data/lv0 /lv0/
```

mount <lv path> <mount point>   - to mount the lv

To example of snapshot

```
[root@ARK-IT-Solutions lv0]# lvcreate --size 100m --snapshot --name snap /dev/data/lv0
  Logical volume "snap" created
[root@ARK-IT-Solutions lv0]#
[root@ARK-IT-Solutions lv0]#
[root@ARK-IT-Solutions lv0]# ls
lost+found  snap  snaptest
[root@ARK-IT-Solutions lv0]# rm -rf snap
[root@ARK-IT-Solutions lv0]# mkdir /snap
[root@ARK-IT-Solutions lv0]# mount /dev/data/snap /snap/
[root@ARK-IT-Solutions lv0]# cd /snap/
[root@ARK-IT-Solutions snap]# ls
lost+found  snap  snaptest
[root@ARK-IT-Solutions snap]# cd /lv0/
[root@ARK-IT-Solutions lv0]# ls
lost+found  snaptest
```

To restore the snapshot data mount the snapshot to mount point and copy the files from snapshot to original path

In order to delete the logical volume
#umount /lv0
#lvremove /dev/data/lv0
#vgremove data
#pvremove /dev/sdb1
#pvremove /dev/sdb2

RAID (originally redundant array of inexpensive disks; now commonly redundant array of independent disks) is a data storage virtualization technology that combines multiple disk drive components into a logical unit for the purposes of data redundancy or performance improvement.

In RAID we have different RAID levels

1. Level 0   -   striped disk array without fault tolerance
2. Level 1   -   mirroring and duplexing
3. Level 2   -   error-correcting coding
4. Level 3   -   bit-interleaved parity
5. Level 4   -   dedicated parity drive
6. Level 5   -   block interleaved distributed parity
7. Level 6   -   independent data disks with double parity
8. Level 10   -   a stripe of mirrors

RAID Level 0: It's just stripping. RAID Level 0 requires a minimum of 2 drives to implement.
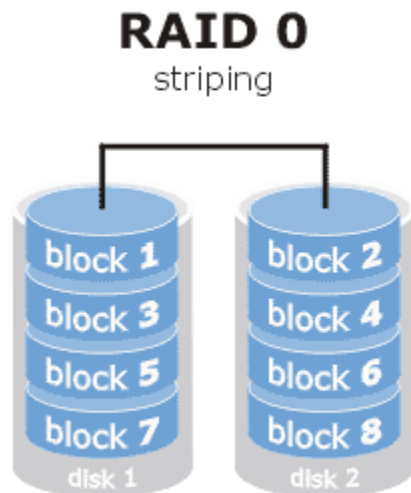

- RAID 0 implements a striped disk array, the data is broken down into blocks and each block is written to a separate disk drive
- I/O performance is greatly improved by spreading the I/O load across many channels and drives
- Best performance is achieved when data is striped across multiple controllers with only one drive per controller
- No parity calculation overhead is involved

- Very simple design
- Easy to implement

RAID Level 1: For Highest performance, the controller must be able to perform two concurrent separate Reads per mirrored pair or two duplicate Writes per mirrored pair. Raid level 1 requires a minimum of 2 drives to implement.
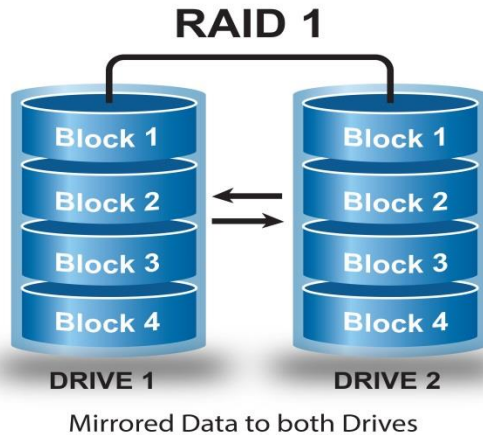
- One Write or two Reads possible per mirrored pair
- Twice the Read transaction rate of single disks, same Write transaction rate as single disks
- 100% redundancy of data means no rebuild is necessary in case of a disk failure, just a copy to the replacement disk
- Transfer rate per block is equal to that of a single disk
- Under certain circumstances, RAID 1 can sustain multiple simultaneous drive failures
- Simplest RAID storage subsystem design

RAID Level 2: Each bit of data word is written to a data disk drive each data word has its Hamming Code ECC word recorded on the ECC disks. On Read, the ECC code verifies correct data or corrects single disk errors.


Diagram of RAID level 2
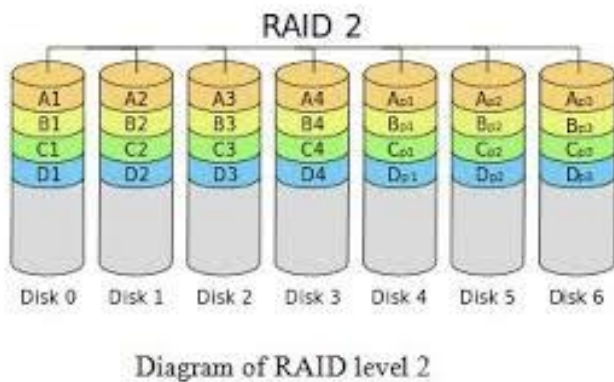
- "On the fly" data error correction
- Extremely high data transfer rates possible

---

- The higher the data transfer rate required, the better the ratio of data disks to ECC disks
- Relatively simple controller design compared to RAID levels 3,4 & 5

RAID Level 3: Byte-level striping with dedicated parity, data block is subdivided ("striped") and written on the data disks. Stripe parity is generated on Writes, recorded on the parity disk and checked on Reads. Requires minimum 3 disks to implement
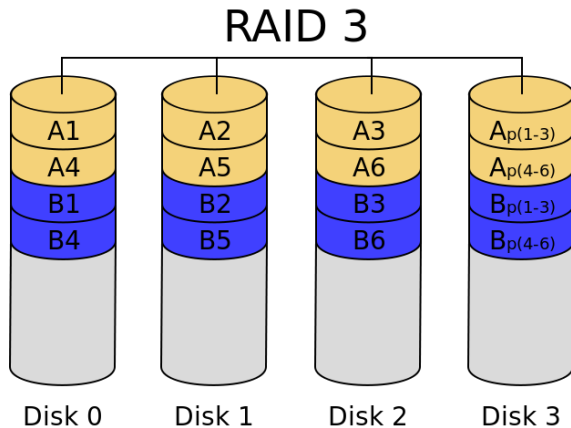
- Very high Read data transfer rate
- Very high Write data transfer rate
- Disk failure has an insignificant impact on throughput
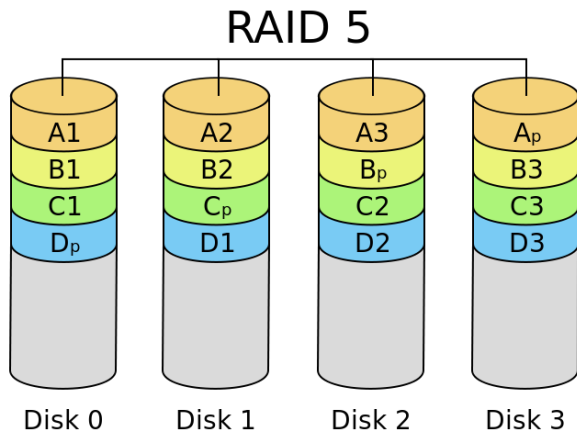- Low ratio of ECC (Parity) disks to data disks means high efficiency

RAID Level 4: Block-level striping with dedicated parity. Each entire block is written onto a data disk. Parity for same rank blocks is generated on Writes, recorded on the parity disk and checked on Reads. Requires minimum 3 disks
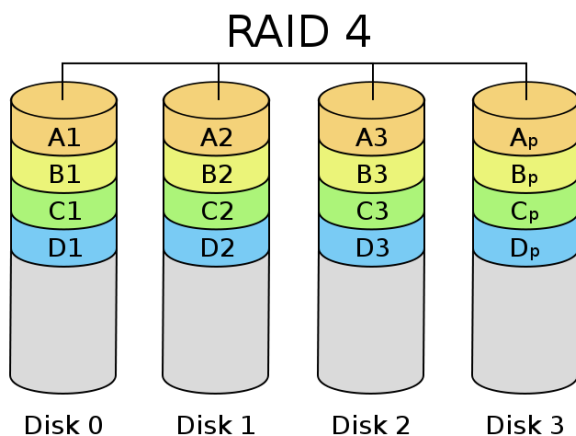
- Very high Read data transaction rate
- Low ratio of ECC (Parity) disks to data disks means high efficiency

- High aggregate Read transfer rate

RAID Level 5: Block-level striping with distributed parity. Each entire data block is written on a data disk; parity for blocks in the same rank is generated on Writes, recorded in a distributed location and checked on Reads. Requires minimum 3 disks to implement

- Highest Read data transaction rate
- Medium Write data transaction rate
- Low ratio of ECC (Parity) disks to data disks means high efficiency
- Good aggregate transfer rate

RAID Level 6: Block-level striping with double distributed parity. Two independent parity computations must be used in order to provide protection against double disk failure. Two different algorithms are employed to achieve this purpose. Requires minimum 4 disks implement
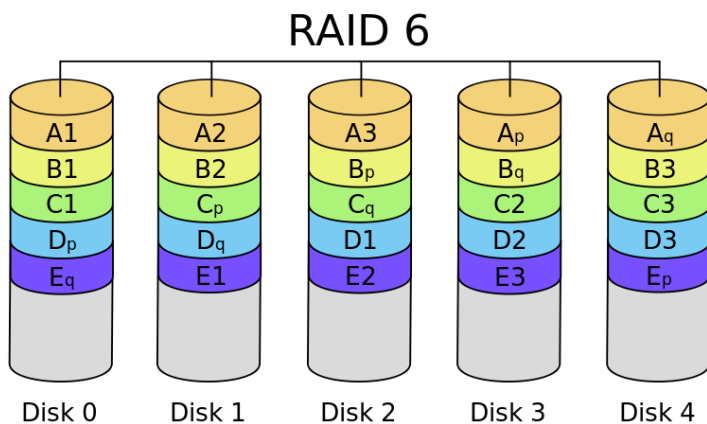
- RAID 6 is essentially an extension of RAID level 5 which allows for additional fault tolerance by using a second independent distributed parity scheme (dual parity)
- Data is striped on a block level across a set of drives, just like in RAID 5, and a second set of parity is calculated and written across all the drives; RAID 6 provides for an extremely high data fault tolerance and can sustain multiple simultaneous drive failures
- RAID 6 protects against multiple bad block failures while non-degraded
- RAID 6 protects against a single bad block failure while operating in a degraded mode
- Perfect solution for mission critical applications

RAID Level 10: Disks within the group are mirrored and groups are stripped, required minimum 4 disks to implement

RAID 10 – Blocks Mirrored. (and Blocks Striped)
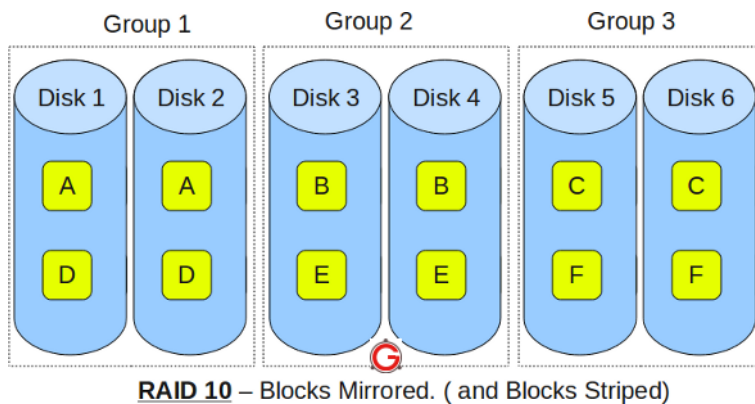
- RAID 10 is implemented as a striped array whose segments are RAID 1 arrays
- RAID 10 has the same fault tolerance as RAID level 1
- RAID 10 has the same overhead for fault-tolerance as mirroring alone
- High I/O rates are achieved by striping RAID 1 segments
- Under certain circumstances, RAID 10 array can sustain multiple simultaneous drive failures
- Excellent solution for sites that would have otherwise gone with RAID 1 but need some additional performance boost

Implementing the RAID will be two types 1.Software RAID and 2.Hardware RAID
Let's see the difference between those

SOFTWARE RAID	HARDWARE RAID
1. It will use computer system CPU	1. It will use its own CPU
2. Low cost compare to H/W RAID	2. More cost compare to S/W RAID
3. It has data integrity issues due to system crashes	3. No data integrity issues
4. No write-back cache	4. It is capable of write-back cache
5. Limited operating system migrations	5. Can be migrated to any OS type
6. Unprotected at boot (cannot manage or protect data at boot):Drive failure or corrupted data during boot and before the RAID software become active leads to an inoperable system	6. Protected at boot: No negative impact on data availability when boot drive has medium errors or fails completely
7. Performance issues will be there	7. No performance issues compare to S/W RAID

Add new disks for RAID Creation

```
[root@ARK-IT-Solutions ~]# fdisk /dev/sdb

Command (m for help): t
Partition number (1-4): 4
Hex code (type L to list codes): fd
Changed system type of partition 4 to fd (Linux raid autodetect)

Command (m for help): t
Partition number (1-4): 3
Hex code (type L to list codes): fd
Changed system type of partition 3 to fd (Linux raid autodetect)

Command (m for help): t
Partition number (1-4): 2
Hex code (type L to list codes): fd
Changed system type of partition 2 to fd (Linux raid autodetect)

Command (m for help): t
Partition number (1-4): 1
Hex code (type L to list codes): fd
Changed system type of partition 1 to fd (Linux raid autodetect)

Command (m for help): p

Disk /dev/sdb: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1         123      987966   fd  Linux raid autodetect
/dev/sdb2             124         246      987997+  fd  Linux raid autodetect
/dev/sdb3             247         369      987997+  fd  Linux raid autodetect
/dev/sdb4             370         652     2273197+  fd  Linux raid autodetect
```

Create partitions using disks, partition type should be Linux raid AutoDetect (fd)

Creating RAID Device
mdadm --create /dev/md0 --level=5 --raid-disk=3 /dev/sdb1 /dev/sdb2 /dev/sdb3

```
[root@ARK-IT-Solutions ~]# mdadm --create /dev/md0 --level=5 --raid-disk=3 /dev/sdb1 /dev/sdb2 /dev/sdb3
mdadm: array /dev/md0 started.
```

mkfs.ext3 /dev/md0   - to make file system in RAID device

```
[root@ARK-IT-Solutions ~]# mkfs.ext3 /dev/md0
mke2fs 1.39 (29-May-2006)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
247296 inodes, 493920 blocks
24696 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=507510784
16 block groups
32768 blocks per group, 32768 fragments per group
15456 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912

Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 20 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
```

Mounting and using raid device

```
[root@ARK-IT-Solutions ~]# mkdir /raid
[root@ARK-IT-Solutions ~]# mount /dev/md0 /raid/
[root@ARK-IT-Solutions ~]# df -h /raid/
Filesystem            Size   Used Avail Use% Mounted on
/dev/md0              1.9G    35M  1.8G   2% /raid
```

mdadm –detail   /dev/md0   - to see the raid device details

```
[root@ARK-IT-Solutions ~]# mdadm --detail /dev/md0
/dev/md0:
        Version : 00.90.03
  Creation Time : Fri Jan 16 20:48:23 2015
     Raid Level : raid5
     Array Size : 1975680 (1929.70 MiB 2023.10 MB)
    Device Size : 987840 (964.85 MiB 1011.55 MB)
   Raid Devices : 3
  Total Devices : 3
Preferred Minor : 0
    Persistence : Superblock is persistent

    Update Time : Fri Jan 16 20:50:56 2015
          State : clean
 Active Devices : 3
Working Devices : 3
 Failed Devices : 0
  Spare Devices : 0

         Layout : left-symmetric
     Chunk Size : 64K

           UUID : f80e5790:5f75bd45:ef144696:16e8e48b
         Events : 0.2

    Number   Major   Minor   RaidDevice State
       0       8       17        0       active sync   /dev/sdb1
       1       8       18        1       active sync   /dev/sdb2
       2       8       19        2       active sync   /dev/sdb3
```

mdadm /dev/md0 --fail /dev/sdb3   - to do manual failure of disk

```
[root@ARK-IT-Solutions ~]# mdadm /dev/md0 --fail /dev/sdb3
mdadm: set /dev/sdb3 faulty in /dev/md0
```

To see the detail of raid device and any failed disks

```
[root@ARK-IT-Solutions ~]# mdadm --detail /dev/md0
    Number   Major   Minor   RaidDevice State
       0       8       17        0       active sync   /dev/sdb1
       1       8       18        1       active sync   /dev/sdb2
       2       0       0         2       removed

       3       8       19        -       faulty spare  /dev/sdb3
```

mdadm /dev/md0 --remove /dev/sdb3   - Removing failed drive from RAID

```
[root@ARK-IT-Solutions ~]# mdadm /dev/md0 --remove /dev/sdb3
mdadm: hot removed /dev/sdb3
```

mdadm /dev/md0 --add /dev/sdb4   - Adding New disk to RAID Device

```
[root@ARK-IT-Solutions ~]# mdadm /dev/md0 --add /dev/sdb4
mdadm: added /dev/sdb4
```

To Destroy RAID Device and its related disk completely wipe
umount /raid   - to un mount the file system
mdadm –stop /dev/md0 - Stopping RAID Device
mdadm –remove /dev/md0   - to remove RAID Device
fdisk /dev/sdb   use d to delete all the disks from OS

```
[root@ARK-IT-Solutions ~]# umount /raid/
[root@ARK-IT-Solutions ~]# mdadm --stop /dev/md0
mdadm: stopped /dev/md0
[root@ARK-IT-Solutions ~]# mdadm --remove /dev/md0
[root@ARK-IT-Solutions ~]#
[root@ARK-IT-Solutions ~]# fdisk /dev/sdb

Command (m for help): d
Partition number (1-4): 1

Command (m for help): d
Partition number (1-4): 2

Command (m for help): d
Partition number (1-4): 3

Command (m for help): d
Selected partition 4
```
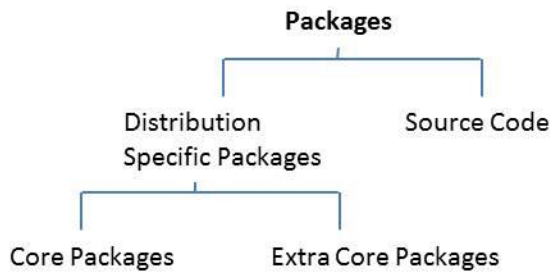
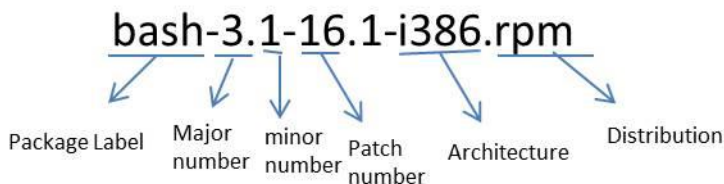RPM is a powerful software manager. It can install, remove, query, and verify the software on your system. Setup of applications is called as package.

Core Packages: These packages are available with you installation media

Extra Core Packages: These extra core packages mean after OS installation, upgrade of package OR release is called as extra core packages.

Above is the explanation about rpm structure

rpm <options> <package name>   - to install, remove, query and upgrade RPM

Options:
-I	-	install
-v	-	verbose
-q	-	query
-e	-	deleting/erasing
-U	-	upgrade
-a	-	all
-h	-	hashes '#' s

rpm –import <key file name> -   to import the rpm license key

Drawbacks of RPM:
1. Distribution packages
2. Architecture specific
3. Dependency

rpm -ivh <package name>   -   to install package

```
[root@ARK-IT-Solutions Server]# rpm -ivh telnet-server-0.17-38.el5.i386.rpm
warning: telnet-server-0.17-38.el5.i386.rpm: Header V3 DSA signature: NOKEY, key ID 37017186
Preparing...                ########################################### [100%]
   1:telnet-server          ########################################### [100%]
```

rpm –import <key file path>   - to import license key

```
[root@ARK-IT-Solutions Server]# rpm --import /mnt/RPM-GPG-KEY-redhat-release
```

rpm –ev <package name>   -   to delete/erase rpm

```
[root@ARK-IT-Solutions Server]# rpm -ev telnet-server
```

rpm –qa |grep telnet   -   to query the rpm

```
[root@ARK-IT-Solutions Server]# rpm -qa |grep telnet
telnet-0.17-38.el5
```

rpmbuild <file name>   - to RPM from source code

Source Code: source code is the external packages which we are writing some scripts OR software packages.

Note: when we are installing some of the packages using package manager it will ask you to install dependency packages, installing all the packages manually will eat most of your time. To resolve these types of dependencies we have to configure YUM server.

YUM: yellowdog updater modified

Some of the advantages of YUM include

• Automatic resolution of software dependencies.

• Command-line and graphical versions. YUM can install or upgrade software by using either the command-line version (yum command) or one of two graphical programs:

• Adding and removing software.

• Package updater that only shows software updates available from RHN.

• Multiple software locations at one time. YUM can be configured to look for software packages in more than one location at a time.

• Ability to specify particular software versions or architectures.

YUM downloads software from repositories located over the network, either on the local network or over the Internet. The files, including the RPM package files, in these repositories are organized in a specific way so that they can be found by the YUM client.

Configure YUM server we have to install createrepo RPM in server
rpm -ivh createrepo-0.4.4-2.fc6.noarch.rpm

```
[root@ARK-IT-Solutions Server]# rpm -ivh createrepo-0.4.4-2.fc6.noarch.rpm
Preparing...                ########################################### [100%]
   1:createrepo             ########################################### [100%]
```

Copy all the RPM packages to one location local path (in this case I have copied to /yum location)

Edit the file
vi /etc/yum.repos.d/rhel-debuginfo.repo

```
[rhel-debuginfo]
name=ARK-IT
baseurl=file:///yum/
enabled=1
gpgcheck=1
gpgkey=file:///yum/rpm-gpg/RPM-GPG-KEY-redhat-release
```

Save the file and exit

Create a repository

createrepo –v /yum/   - to create a repository database

```
[root@ARK-IT-Solutions ~]# createrepo -v /yum/
2112/2113 - cups-lpd-1.2.4-11.5.el5.i386.rpm
2113/2113 - iputils-20020927-43.el5.i386.rpm

Saving Primary metadata
Saving file lists metadata
Saving other metadata
```

Repo data path (repository files)

```
[root@ARK-IT-Solutions repodata]# pwd
/yum/repodata
[root@ARK-IT-Solutions repodata]# ls -l
total 8444
-rw-r--r-- 1 root root 2283273 Jan 17 00:00 filelists.xml.gz
-rw-r--r-- 1 root root 5583857 Jan 17 00:00 other.xml.gz
-rw-r--r-- 1 root root  746041 Jan 17 00:00 primary.xml.gz
-rw-r--r-- 1 root root     951 Jan 17 00:00 repomd.xml
```

yum list all   - to check packages are fetching from YUM server

yum install <package name>   - to install packages

```
[root@ARK-IT-Solutions repodata]# yum install telnet-server
Loading "rhnplugin" plugin
Loading "installonlyn" plugin
This system is not registered with RHN.
RHN support will be disabled.
Setting up Install Process
Setting up repositories
Reading repository metadata in from local files
Parsing package install arguments
Resolving Dependencies
--> Populating transaction set with selected packages. Please wait.
---> Downloading header for telnet-server to pack into transaction set.
telnet-server-0.17-38.el5 100% |=========================| 8.4 kB    00:00
---> Package telnet-server.i386 1:0.17-38.el5 set to be updated
--> Running transaction check

Dependencies Resolved

================================================================================
 Package                 Arch        Version         Repository         Size
================================================================================
Installing:
 telnet-server           i386        1:0.17-38.el5   rhel-debuginfo     35 k

Transaction Summary
================================================================================
Install       1 Package(s)
Update        0 Package(s)
Remove        0 Package(s)

Total download size: 35 k
Is this ok [y/N]: y
Downloading Packages:
Running Transaction Test
Finished Transaction Test
Transaction Test Succeeded
Running Transaction
  Installing: telnet-server                      ######################### [1/1]

Installed: telnet-server.i386 1:0.17-38.el5
Complete!
```

Like above all the packages and there dependencies will be installed.

yum remove <package name> - to remove package its dependencies

```
[root@ARK-IT-Solutions repodata]# yum remove telnet-server
Loading "rhnplugin" plugin
Loading "installonlyn" plugin
This system is not registered with RHN.
RHN support will be disabled.
Setting up Remove Process
Resolving Dependencies
--> Populating transaction set with selected packages. Please wait.
---> Package telnet-server.i386 1:0.17-38.el5 set to be erased
--> Running transaction check

Dependencies Resolved

================================================================================
 Package                 Arch        Version          Repository        Size
================================================================================
Removing:
 telnet-server           i386        1:0.17-38.el5    installed         49 k

Transaction Summary
================================================================================
Install       0 Package(s)
Update        0 Package(s)
Remove        1 Package(s)

Is this ok [y/N]: y
Downloading Packages:
Running Transaction Test
Finished Transaction Test
Transaction Test Succeeded
Running Transaction
  Removing   : telnet-server                        ####################### [1/1]

Removed: telnet-server.i386 1:0.17-38.el5
Complete!
```

yum clean all   -   it will clean all the cache data of yum server

yum update <package name>   - to update/upgrade mentioned package

If you want make this YUM as centralized server for all the local domain servers. We have to share this using FTP and HTTP protocol.

SERVER SIDE
[rhel-debuginfo]
name=ARK-IT
baseurl=ftp://yum/
enabled=1
gpgcheck=1
gpgkey=ftp://yum/rpm-gpg/RPM-GPG-KEY-redhat-release

CLIENT SIDE
[rhel-debugino]
Name=ARK-IT
Baseurl=ftp://SERVERIP/PATH
Enabled=1
Gpgcheck=0

A computer network or data network is a telecommunications network that allows computers to exchange data. In computer networks, networked computing devices pass data to each other along data connections. Data is transferred in the form of packets.

Configuration Files

File	Description
/etc/resolve.conf	List DNS servers for internet domain name resolution.
/etc/hosts	Lists hosts to be resolved locally (not by DNS).
/etc/nsswitch.conf	List order of host name search. Typically look at local files, then NIS server, then DNS server.
/etc/sysconfig/network-scripts/ifcfg-device	Specify TCP network information.

mii-tool   - Media in dependent interface tool it will check for the connectivity, speed of device.

system-config-network -   to configure the IP Address in CLI and GUI
setup   -   to configure the IP and DNS, it will work in CLI and GUI
ifconfig   -   to see the IP details
ifdown <ethernet>   -   it will bring down the interface
ifup <Ethernet>   -   it will bring UP the interface

To Assign Temporary IP Adress
ifconfig <device name> <IP Address> <Netmask> <Gateway> - this will assign a IP temporarily after reboot it will not be there.
vi /etc/sysconfig/network-scripts/ifcfg-eth0 – to assign permanent IP Address

```
[root@ARK-IT-Solutions ~]# vi /etc/sysconfig/network-scripts/ifcfg-eth0
# Advanced Micro Devices [AMD] 79c970 [PCnet32 LANCE]
DEVICE=eth0
BROADCAST=192.168.234.255
HWADDR=00:0c:29:07:8d:6b
IPADDR=192.168.234.123
NETMASK=255.255.255.0
NETWORK=192.168.234.0
ONBOOT=yes
GATEWAY=192.168.234.1
DNS=4.4.4.4
TYPE=Ethernet
```

vi /etc/hosts   -   to add entry in this file follow as below

```
[root@ARK-IT-Solutions ~]# vi /etc/hosts
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1        ARK-IT-Solutions.localdomain    ARK-IT-Solutions        localhost.localdomain   localhost
```
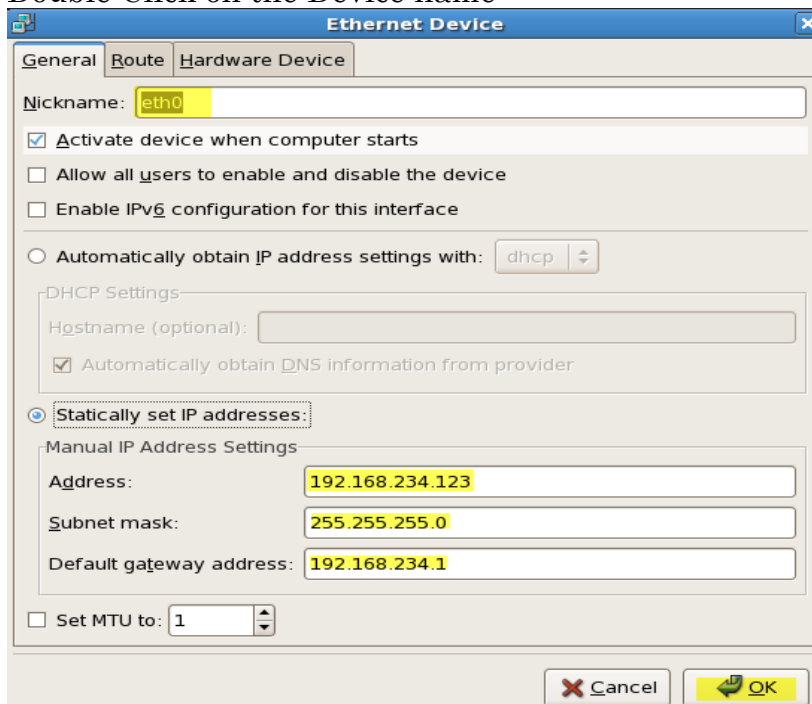
hostname   -   to add temporary Hostname and see the hostname

Using NEAT Command

neat   -   it is used to assign the IP Address in GUI mode. (It will not work in CLI)
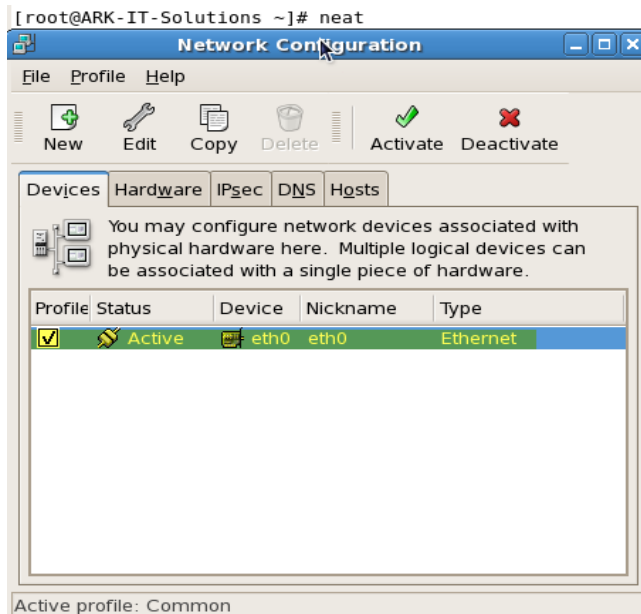
Double Click on the Device name

Nickname: Provide the device name
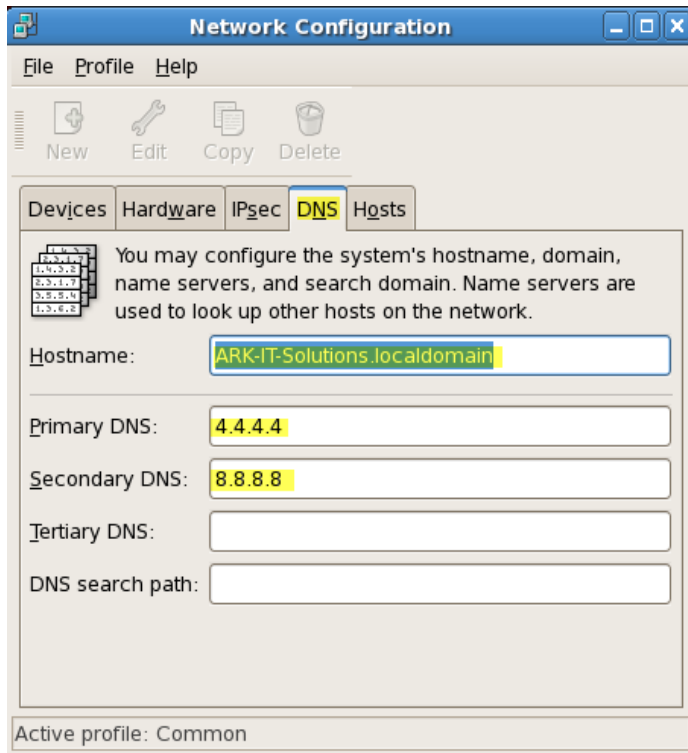Address: <Enter IP Address>
Subnet mask: <Enter Netmask>
Gateway: <Enter Gateway>

Click on OK

Using DNS tab you can provide

Hostname: <Enter FQDN>
Primary DNS: <Enter Primary DNS Address>
Secondary DNS: <Enter Primary DNS Address>

Using neat we can also create virtual network devices

service network restart - to restart the network service
service network reload - to reload the network configuration settings
service network start/stop – to start and stop the service

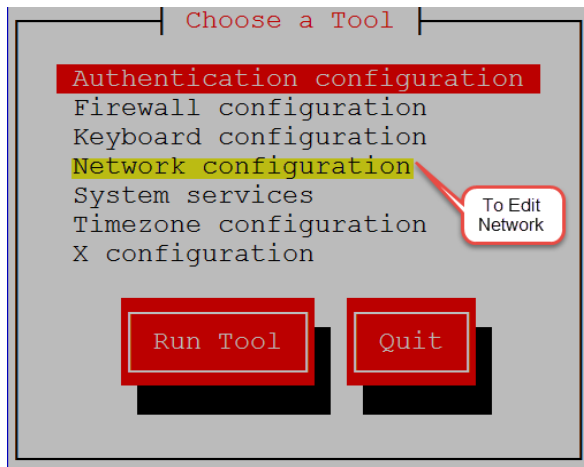
__Using Setup Tool__

Using Setup command you can configure
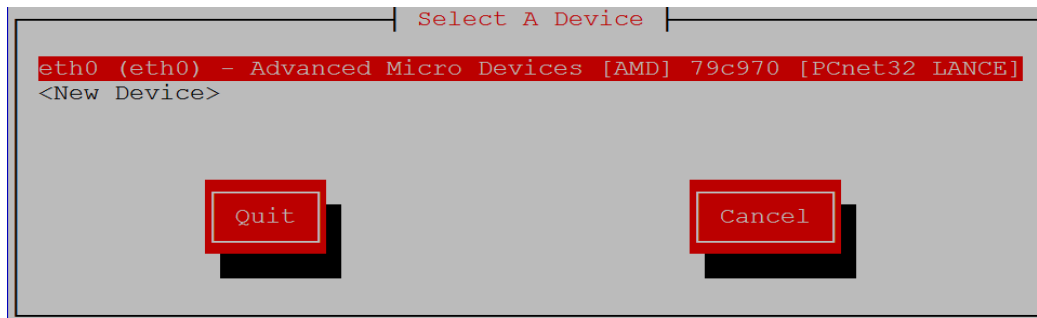   1. Authentication Configuration

2. Firewall Configuration
3. Keyboard configuration
4. Network configuration
5. System services
6. Time zone configuration
7. X configuration

In this topic we are going to talk about Network configuration

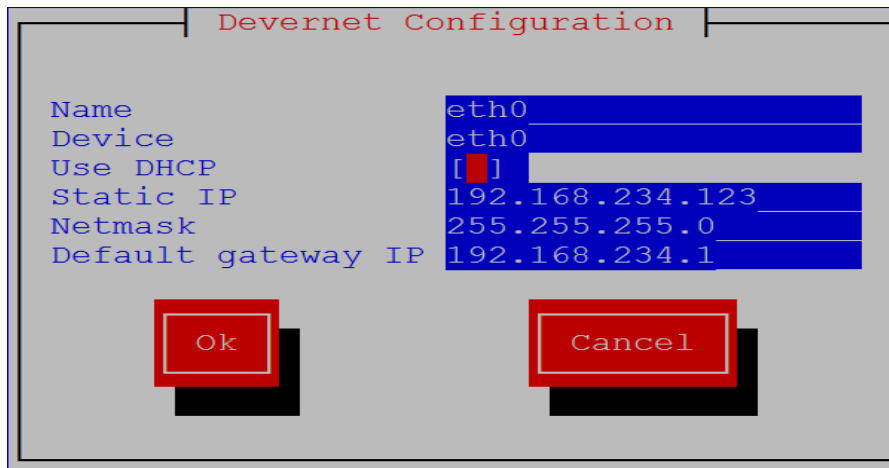# setup   -   to enter into the setup tool

Select Network Configuration and hit Enter (click on Run Tool)

After entering into the Network configuration all the Network devices (Ethernet cards) you can able to see. Select the card which you want to modify the settings and hit Enter.

```
┌──────┤ Devernet Configuration ├──────┐
│                                        │
│   Name              eth0               │
│   Device            eth0               │
│   Use DHCP          [ ]                │
│   Static IP         192.168.234.123    │
│   Netmask           255.255.255.0      │
│   Default gateway IP 192.168.234.1     │
│                                        │
│        Ok              Cancel          │
│                                        │
└────────────────────────────────────────┘
```

Provide all the required information such as IP Address, Netmask and Gateway Address. Click on OK

Then restart/reload your network service so that it will affect the new configuration changes

What is Kickstart?

Installing Red Hat based systems from physical or virtual media is easy enough when there are only one or two hosts to install. Beyond this, when an administrator needs to setup several Linux systems, Kickstart can provide a relatively easy way to accomplish mass deployment and can be totally automated. It is easy to have several different Kickstart configurations ready to go, each having a different deployment configuration.

Most large companies use this technique to deploy a Red Hat base server image that can then be customized as required. What makes Kickstart even easier is that an administrator can configure Kickstart with nothing more complex than a web server, installation media and at least one Kickstart configuration file. The only other requirement is an active DHCP server so that new clients waiting to be kick started can reach the Kickstart server, having obtained a valid DHCP address. Kickstart can also use other installation mediums, such as NFS and even local media if desired.

Just we can say un-attended installation process, this can be configured using

1. NFS
2. FTP
3. HTTP

Prerequisites: -

- Required installation media
- Configure FTP site to share packages
- Configure DHCP server

To copy all the packages from installation media mount the DVD to mount point
mount /dev/dvd /media

Install FTP packages
rpm -ivh vsftpd-2.0.5-10.el5.i386.rpm

Copy the data from /media to /var/ftp/pub/
cp –Rv /media/* /var/ftp/pub

Start the ftp service
service vsftpd restart; chkconfig vsftpd on

```
[root@localhost RHEL_5 i386 DVD]# service vsftpd restart
Shutting down vsftpd:                                    [FAILED]
Starting vsftpd for vsftpd:                              [  OK  ]
```

Stop firewall and SELinux security for now.
service iptables stop
vi /etc/selinux/config
In 6th line change from enforcing to disabled.
SELINUX=disabled

Save & exit

Install and start the DHCP service
rpm -ivh dhcp-3.0.5-3.el5.i386.rpm

```
[root@localhost Server]# rpm -ivh dhcp-3.0.5-3.el5.i386.rpm
Preparing...                ########################################### [100%]
   1:dhcp                   ########################################### [100%]
```

After installing the dhcp package DHCP sample configuration file will be available in /usr/share/doc/dhcp*/dhcpd.conf

Copy above sample file to /etc/dhcpd.conf then modify as per your requirement.

cat dhcpd.conf.sample > /etc/dhcpd.conf

Edit the main config file now
vi /etc/dhcpd.conf
cat /etc/dhcpd.conf

#------------------------Configuration File Starting---------------#
ddns-update-style interim;
ignore client-updates;

subnet 192.168.234.0 netmask 255.255.255.0 {

--- default gateway
        option routers   192.168.0.1;
        option subnet-mask   255.255.255.0;

        option nis-domain   "domain.org";
        option domain-name   "domain.org";
        option domain-name-servers 192.168.1.1;

        option time-offset   -18000; # Eastern Standard Time

```
#       option ntp-servers            192.168.1.1;
#       option netbios-name-servers    192.168.1.1;
# --- Selects point-to-point node (default is hybrid). Don't change this unless
# -- you understand Netbios very well
#       option netbios-node-type 2;

        range dynamic-bootp 192.168.234.28 192.168.234.50;
        default-lease-time 21600;
        max-lease-time 43200;

        # we want the nameserver to appear at a fixed address
        host ns {
              next-server localhost.localdomain;
              hardware ethernet 00:0C:29:07:8D:6B;
              fixed-address 192.168.234.123;
        }
}
# -------------------- Config file END -------------#
```

service dhcpd restart

```
[root@ARK-IT-Solutions ~]# service dhcpd restart
Shutting down dhcpd:                            [FAILED]
Starting dhcpd:                                 [  OK  ]
```

Copy the below sample configuration file
In this case i have created a file in /var/ftp/pub/rhel5.cfg

```
#sample KickStart File Start
install
text
url --url=ftp://192.168.234.132/pub/
key --skip
lang en_US.UTF-8
keyboard us

network --onboot yes --device eth0 --bootproto dhcp

reboot
rootpw redhat

firewall --disabled
authconfig --enableshadow --enablemd5
selinux --disabled
timezone America/New_York

bootloader --location=mbr --append="rhgb quiet"
```

clearpart --all
part / --fstype ext3 --size=4000
part /boot --fstype ext3 --size=100
part swap --size=2000

%packages --nobase
@core
%post
#END

Then boot the station1 with installation media (RHEL5/6)

When it will boot with CD/DVD enter

Boot: linux ks=ftp://192.168.234.132/pub/rhel5.cfg

Installation will continue and it will complete automatically.

Disk quotas are commonly used by ISPs, by Web hosting companies, on FTP sites, and on corporate file servers to ensure continued availability of their systems.

Quotas are used to limit a user's or a group of user's ability to consume disk space. This prevents a small group of users from monopolizing disk capacity and potentially interfering with other users or the entire system.

- **Soft limit**
  this is the maximum amount of space a user can have on that partition. If you have set a grace period, this will act as an alarm. The user will then be notified she is in quota violation. If you have set a grace period, you will also need to set a hard limit. A grace period is the number of days a user is allowed to be above the given quota. After the grace period is over, the user must get under the soft limit to continue. By default grace period have seven days limits.
- **Hard limit**
  hard limits are necessary only when you are using grace periods. If grace periods are enabled, this will be the absolute limit a user can use. Any attempt to consume resources beyond this limit will be denied. If you are not using grace periods, the soft limit is the maximum amount of available space for each user.
- **Grace Periods**
  Linux has provided the default of seven days for both inode and block usage. That is, a user may exceed the soft limit on either resource for up to seven days. After that, further requests by that user to use files will be denied.

To do quota we will use edquota, repquota and quotacheck tools to create modify and report quota management.

Quota can be applied to users and groups, block size and inode number.

We have to install/verify quota packages is installed.
rpm –qa |grep quota   - to verify quota rpm is installed or not

```
[root@localhost ~]# rpm -qa |grep quota
quota-3.13-1.2.3.2.el5
```

Now open /etc/fstab to open quota
/dev/sdb1   /qcheck   ext3   defaults,usrquota,grpquota 1 2
```
[root@localhost ~]# cat /etc/fstab |grep /dev/sdb1
/dev/sdb1              /qcheck                  ext3      defaults,usrquota,grpquota 1 2
```

Either reboot or remount the file system to enable quota
mount –o remount,usrquota,grpquota,rw /qcheck

```
[root@localhost ~]# mount -o remount,usrquota,grpquota,rw /qcheck
[root@localhost ~]# mount |grep /qcheck
/dev/sdb1 on /qcheck type ext3 (rw,usrquota,grpquota)
```

In this case /qcheck is the mount point.

To enable or create a quota file we have to run
quotacheck –cugm /qcheck

                    quotacheck command options
                              -v scans and prints verbose
                              -c performs a new scan
                              -g scan quota for groups
                              -m remount the scanned file system
                              -u scan quota for users
                              -a Check all quota-enabled, locally-mounted FS

Switch on the quota using below command
quotaon –avug

```
[root@localhost ~]# quotaon -avug
/dev/sdb1 [/qcheck]: group quotas turned on
/dev/sdb1 [/qcheck]: user quotas turned on
```

Now quota is on. Add quota soft and hard limits to any user

```
[root@localhost ~]# edquota ravi
Disk quotas for user ravi (uid 501):
  Filesystem              blocks      soft      hard    inodes      soft      hard
  /dev/sdb1                    0        10        20         0         0         0
```

Now verify writing some dump data (dd command).

Login as a ravi user then
$ dd if=/dev/zero of=/qcheck/test bs=1024 count=10
$ dd if=/dev/zero of=/qcheck/test bs=1024 count=21

```
[ravi@localhost ~]$ dd if=/dev/zero of=/qcheck/test bs=1024 count=10
sdb1: warning, user block quota exceeded.
10+0 records in
10+0 records out
10240 bytes (10 kB) copied, 0.000216823 seconds, 47.2 MB/s
[ravi@localhost ~]$ dd if=/dev/zero of=/qcheck/test bs=1024 count=21
sdb1: warning, user block quota exceeded.
sdb1: write failed, user block limit reached.
dd: writing `/qcheck/test': Disk quota exceeded
21+0 records in
20+0 records out
20480 bytes (20 kB) copied, 0.00203529 seconds, 10.1 MB/s
```

In above screenshot it is showing that warning and exceeded limits for user ravi.
To verify the quota settings
quota –u <user name>

```
[root@localhost ~]# quota ravi
Disk quotas for user ravi (uid 501):
     Filesystem  blocks    quota    limit    grace    files    quota    limit    grace
       /dev/sdb1     20*      10       20                  1        0        0
```

To increase a grace period for a user
edquota –T <user name>

```
[root@localhost ~]# edquota -T ravi
Times to enforce softlimit for user ravi (uid 501):
Time units may be: days, hours, minutes, or seconds
  Filesystem                          block grace                 inode grace
  /dev/sdb1                           10days                      unset
```

Enable the quota for a group.
edquota –g <group name>

```
[root@localhost ~]# edquota -g quota
Disk quotas for group quota (gid 502):
  Filesystem                 blocks      soft      hard     inodes      soft      hard
  /dev/sdb1                       0        10        20          0         0         0
```

In this case quota is group name

Removing quota
Switchoff the quota
quotaoff –avug

```
[root@localhost ~]# quotaoff -avug
/dev/sdb1 [/qcheck]: group quotas turned off
/dev/sdb1 [/qcheck]: user quotas turned off
```

Then clear the entry in /etc/fstab

```
[root@localhost ~]# cat /etc/fstab |grep qcheck
/dev/sdb1                  /qcheck                 ext3      defaults        0 0
```

Remount the partition using
mount –o remount,rw <mountpoint>

```
[root@localhost ~]# mount -o remount,rw /qcheck
[root@localhost ~]# mount |grep /qcheck
/dev/sdb1 on /qcheck type ext3 (rw)
```

It will clear the quota

Remote management tools we will use to install/configure the linux/Unix servers from remote location.

Remote management can be done using CLI and GUI modes, just we will discuss here about most common tools.

GUI
1. VNC (real/tight)
2. Webmin
3. Rdesktop
4. Xming

CLI
1. Putty

VNC (Virtual Network Computing) Servers enables remote desktop access for Linux systems similar to **MSTSC** in windows. Generally Linux administrators doesn't prefer to use windows access, But sometimes we required to have access remote desktop of Linux. In that case we need to install vnc server on our Linux system.

Step 1: Install Required Packages

Most of Linux servers doesn't have desktop installed on their system. So make sure you have installed else use following command to install it.

```
For CentOS/RHEL 6:
# yum groupinstall "Desktop"

For CentOS/RHEL 5:
# yum groupinstall "GNOME Desktop Environment"
```

Now install few required packages for **vnc-server**

```
# yum install pixman pixman-devel libXfont
```

Step 2: Install VNC Server

After installing required packages, lets install **vnc-server** in your system. **vnc-server** is available under default yum repositories.

```
# yum install vnc-server
```

On **CentOS/RHEL 6**, you will see that **tigervnc-server** package will be installed.
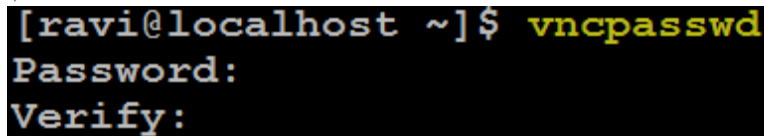
Step 3: Create User for VNC

Lets' create few users for connecting through vnc. You can also use existing system users by connecting through vnc, In that case we only need to set **vncpasswd** for that account.

```
# useradd ravi
# passwd ravi

# useradd ravi1
# passwd ravi2
```

Now set the vnc password for all accounts need to connect through vnc.

```
# su - ravi
$ vncpasswd
$ exit
```

```
[ravi@localhost ~]$ vncpasswd
Password:
Verify:
```

```
# su - ravi1
$ vncpasswd
$ exit
```

Step 4: Configure VNC Server for Users

Now edit **/etc/sysconfig/vncservers** configuration file and add the following to the end of the file.

```
VNCSERVERS="1:user1 2:user2"
VNCSERVERARGS[1]="-geometry 800x600"
VNCSERVERARGS[2]="-geometry 1024x768"
```

```
[root@localhost ~]# cat /etc/sysconfig/vncservers
# The VNCSERVERS variable is a list of display:user pairs.
#
# Uncomment the lines below to start a VNC server on display :2
# as my 'myusername' (adjust this to your own).  You will also
# need to set a VNC password; run 'man vncpasswd' to see how
# to do that.
#
# DO NOT RUN THIS SERVICE if your local area network is
# untrusted!  For a secure way of using VNC, see
# <URL:http://www.uk.research.att.com/archive/vnc/sshvnc.html>.

# Use "-nolisten tcp" to prevent X connections to your VNC server via TCP.

# Use "-nohttpd" to prevent web-based VNC clients connecting.

# Use "-localhost" to prevent remote VNC clients connecting except when
# doing so through a secure tunnel.  See the "-via" option in the
#  `man vncviewer' manual page.

# VNCSERVERS="2:myusername"
# VNCSERVERARGS[2]="-geometry 800x600 -nolisten tcp -nohttpd -localhost"
 VNCSERVERS="2:ravi"
 VNCSERVERARGS[2]="-geometry 800x600"
```

Where **VNCSERVERS** is the list of users need to connect, **VNCSERVERARGS** defined the screen size. Like user ravi have a **800×600** screen size on his client.

Now start vnc-server service using following command and check the output

```
# service vncserver start
```

```
[root@localhost ~]# service vncserver restart
Shutting down VNC server: 1:ravi 2:ravi1                        [FAILED]
Starting VNC server: 1:ravi
New 'localhost.localdomain:1 (ravi)' desktop is localhost.localdomain:1

Starting applications specified in /home/ravi/.vnc/xstartup
Log file is /home/ravi/.vnc/localhost.localdomain:1.log

2:ravi1 xauth:  creating new authority file /home/ravi1/.Xauthority

New 'localhost.localdomain:2 (ravi1)' desktop is localhost.localdomain:2

Creating default startup script /home/ravi1/.vnc/xstartup
Starting applications specified in /home/ravi1/.vnc/xstartup
Log file is /home/ravi1/.vnc/localhost.localdomain:2.log

                                                               [  OK  ]
```
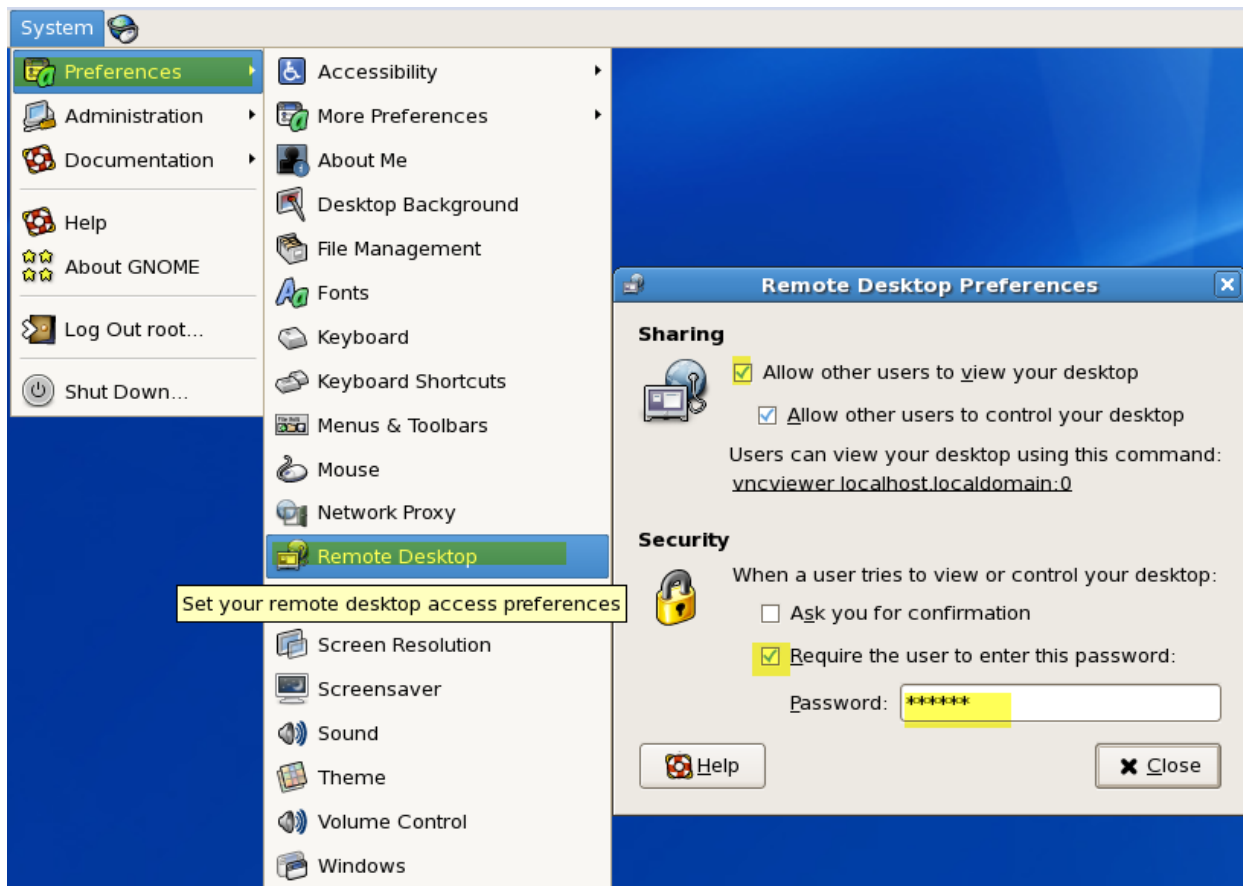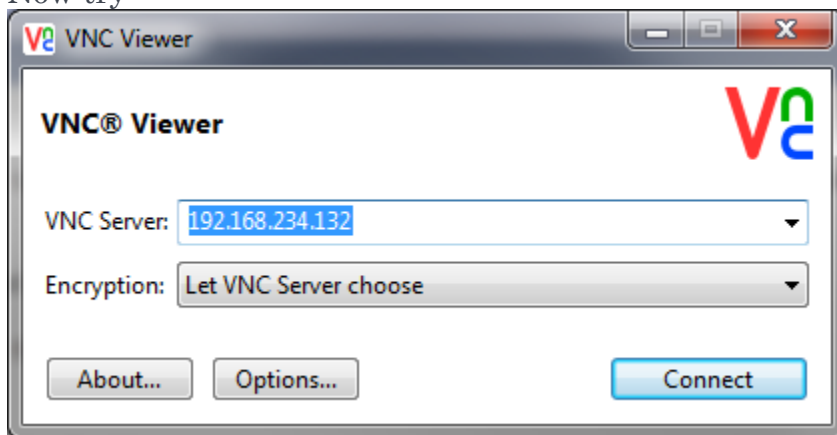
Step 5: Connect VNC Server using VNC Viewer

If your not able to connect to your VNC server then just enable the remote desktop allow from GUI
Login into the server GUI mode then go to System→ Preferences → Remote Desktop →Sharing Allow
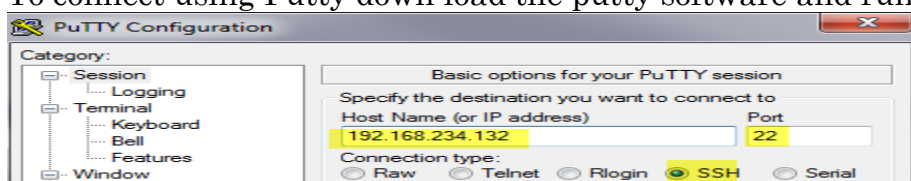

Provide the sharing and keep password for the session.

Now try

You will get the VNC Session connected
To connect using Putty down load the putty software and run

Network File System (NFS) is a distributed file system protocol originally developed by Sun Microsystems in 1984, allowing a user on a client computer to access files over a network much like local storage is accessed.
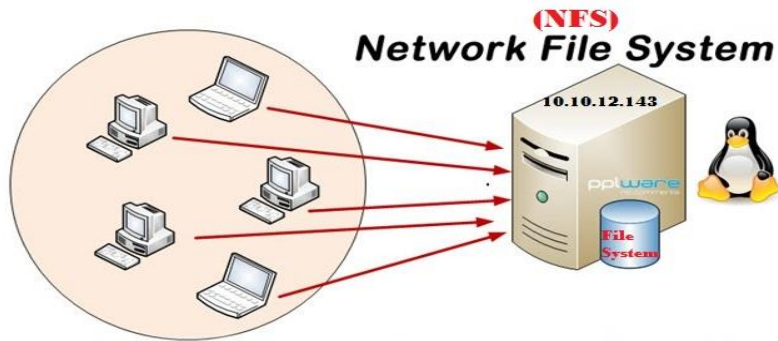
Service Profile: nfs and portmap
Configuration File: /etc/exports
Port Number: 2049 portmap: 111
Log File: /var/log/messages
Versions available: Version 2, 3 & 4

To configure NFS share we have to install below packages

```
[root@localhost ~]# rpm -qa |grep nfs
nfs-utils-1.0.9-16.el5
nfs-utils-lib-1.0.8-7.2
```

Nfs-utils are installed in my system, if there is no nfs-utils in your server please install
yum install nfs*
yum install xinet*

Start NFS, Portmap and Xinetd services
service portmap restart
service xinetd restart

```
[root@localhost Server]# service portmap restart
Stopping portmap:                                          [  OK  ]
Starting portmap:                                          [  OK  ]
[root@localhost Server]# service xinetd restart
Stopping xinetd:                                           [FAILED]
Starting xinetd:                                           [  OK  ]
```
service nfs restart

```
[root@localhost Server]# service nfs restart
Shutting down NFS mountd:                                  [  OK  ]
Shutting down NFS daemon:                                  [  OK  ]
Shutting down NFS quotas:                                  [  OK  ]
Shutting down NFS services:                                [  OK  ]
Starting NFS services:                                     [  OK  ]
Starting NFS quotas:                                       [  OK  ]
Starting NFS daemon:                                       [  OK  ]
Starting NFS mountd:                                       [  OK  ]
```

Verify the port nfs is working

rpcinfo -p | grep nfs

```
[root@localhost Server]# rpcinfo -p |grep nfs
    100003    2    udp    2049   nfs
    100003    3    udp    2049   nfs
    100003    4    udp    2049   nfs
    100003    2    tcp    2049   nfs
    100003    3    tcp    2049   nfs
    100003    4    tcp    2049   nfs
```

Share the directory or disk using NFS

To sharing the Directory/Disk we have edit the /etc/exports and add the entries

```
[root@localhost Server]# vi /etc/exports
/qcheck 192.168.234.123(rw,sync)
```

CLIENT SIDE

Go to Client machine and check it out share is accessible

showmount -e 192.168.234.132

```
[root@ARK-IT-Solutions client]# showmount -e 192.168.234.132
Export list for 192.168.234.132:
/qcheck 192.168.234.123
```

Now mount the share to your local mount point

mount -t nfs 192.168.234.132:/qcheck /mnt

```
[root@ARK-IT-Solutions client]# mount -t nfs 192.168.234.132:/qcheck /mnt
[root@ARK-IT-Solutions client]#
[root@ARK-IT-Solutions client]#
[root@ARK-IT-Solutions client]# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/mapper/VG01-ROOT
                       15G  3.4G   11G  25% /
/dev/sda1              99M   11M   83M  12% /boot
tmpfs                 506M     0  506M   0% /dev/shm
/dev/sdb1             5.0G  2.6G  2.2G  55% /yum
192.168.234.132:/qcheck
                      5.0G  139M  4.6G   3% /mnt
```

Likewise you can provide the permissions to NFS share

Here are the most common NFS export techniques and options:

/home/nfs/ 192.168.234.123(rw,sync)	export /home/nfs directory for host with an IP address 192.168.234.123 with read, write permissions, and synchronized mode
/home/nfs/ 192.168.234.0(ro,sync)	export /home/nfs directory for network 192.168.234.0 with netmask 255.255.255.0 with read only permissions and synchronized mode
/home/nfs/ 192.168.234.123(rw,sync) 192.168.234.124 (ro,sync)	export /home/nfs directory for host with IP 192.168.234.123with read, write permissions, synchronized mode, and also export /home/nfs directory for another host with an IP address 192.168.234.124 with read only permissions and synchronized mode
/home/nfs/ 192.168.234.123 (rw,sync,no_root_squash)	export /home/nfs directory for host with an IP address 192.168.234.123with read, write permissions, synchronized mode and the remote root user will be treated as a root and will be able to change any file and directory.
/home/nfs/ *(ro,sync)	export /home/nfs directory for any host with read only permissions and synchronized mode
/home/nfs/ *.linuxcareer.com(ro,sync)	export /home/nfs directory for any host within linuxconfig.org domain with a read only permission and synchronized mode
/home/nfs/ foobar(rw,sync)	export /home/nfs directory for hostname foobar with read, write permissions and synchronized mode

Mounting NFS share as permanent, we have to edit /etc/fstab, if you want restart and verify the mount point

```
[root@ARK-IT-Solutions mnt]# cat /etc/fstab |grep /mnt
192.168.234.132:/qcheck /mnt                     nfs      defaults      0 0
```

mount –a   - To refresh the mount points
 To remove nfs share we have to un-mount the share from client machine
umount /mnt

```
[root@ARK-IT-Solutions ~]# umount /mnt/
```

Remove entry from /etc/fstab file

Thanks for Reading this Book. Compliments / Feedback you can send it to
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