A

Training Report on

"linux"

Submitted

in partial fulfillment

for the award of the Degree of

Bachelor of Technology

In Department of Computer Science & Engineering

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Batch 2022-26

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Sept, 2022

JAIPUR ENGINEERING COLLEGE

(Approved by AICTE, New Delhi & Affiliated toRajasthan Technical University, Kota)

INTERNAL GUIDE CERTIFICATE

This is to certify that Syed Shoaib Akhtar student of B.Tech (Computer Science) academic year (2022-26) at **JAIPUR ENGINEERING COLLEGE** has completed Summer Training Report entitled. **"linux".** The training has been completed in II Semester course and for partially fulfilling the requirements of **Rajasthan Technical University, Kota.**

The Training Report has been completed under the guidance of **Mr. Sultan Singh Saini (HEAD OF CSE Deptt.)** of JEC and is as per norms and guidelines provided.

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CERTIFICATE

ACKNOWLEDGEMENT

I express my sincere thanks to my Training Co-coordinator Ms Sultan Singh Saini , Assistant Professor of the Department of Computer science & Engineering, for guiding me right from the inception till the successful completion of the training. I sincerely acknowledge him for extending their valuable guidance, support for literature, critical reviews of training and this report and above all for the moral support he provided me at all stages of training.

I would also like to thank the supporting staff for their help and cooperation throughout my training.

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ABSTRACT

Linux Server Administration is important to ensure the proper working of the servers to provide services to the client. There is a relationship between Server & Client. The purpose of the server is to fulfil the request made by the client. When there are a lot of clients to handle for a server, the server needs to be administered by qualified personnel or authorized operator. For example, suppose there are 30,000 hits per minutes to a server and those hits requests for different types of services to the server. Red hat is a commercial Linux distributor. These products are red hat enterprise Linux (RHEL) and Fedora which are freely available. RHEL is well tested before release and supported till seven years after the release, whereas, fedora provides faster update

Often clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system. A server host runs one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function.

Then a server has to determine the number of requests and fulfil their entire request in time without any error and breakdown. Another instance may be that, if due to increasing number of hits server gets down. Then there must be qualified personals to inquire the defects and bring back all the downed servers to online. So, Linux Server Administration is totally coined towards management and deployment of Linux Servers.

ACKNOWLEDGEMENT

The internship opportunity I had with **Grass Solution Pvt. Limited** was a great chance for learning and professional development. Therefore, I consider myself as a very lucky individual as I was provided with an opportunity to be a part of it. I am also grateful for having a chance to meet so many wonderful people and professionals who led me though this internship period.

Bearing in mind previous I am using this opportunity to express my deepest gratitude and special thanks to the MD of **Grass Solution Pvt. Limited** who in spite of being extraordinarily busy with her/his duties, took time out to hear, guide and keep me on the correct path and allowing me to carry out my project at their esteemed organization and extending during the training.

I express my deepest thanks for taking part in useful decision & giving necessary advices and guidance and arranged all facilities to make life easier. I choose this moment to acknowledge his/her contribution gratefully.

It is my radiant sentiment to place on record my best regards, deepest sense of gratitude to **Mr. Yadvendra**, for their careful and precious guidance, which were extremely valuable for my study both theoretically and practically.

I perceive as this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives. Hope to continue cooperation with all of you in the future,

Sincerely,

Alok Gupta

Global Institute of Technology, Jaipur

Date:

Users	Nowadays, Linux is in great demand. Anyone can use Linux whether a home user, developer or a student.	It was developed mainly for servers, workstations and mainframes.
Cost	Linux is freely distributed, downloaded, and distributed through magazines also. And priced distros of Linux are also cheaper than Windows.	Unix copyright vendors decide different costs for their respective Unix Operating systems.
Development	As it is open source, it is developed by sharing and collaboration of codes by world-wide developers.	Unix was developed by AT&T Labs, various commercial vendors and non-profit organizations.
Manufacturer	Linux kernel is developed by the community of developers from different parts of the world. Although the father of Linux, Linus Torvalds oversees things.	Unix has three distributions IBM AIX, HP-UX and Sun Solaris. Apple also uses Unix to make OSX operating system.
GUI	Linux is command based but some distros provide GUI based Linux. Gnome and KDE are mostly used GUI.	Initially it was command-based OS, but later Common Desktop Environment was created. Most Unix distributions use Gnome.
Interface	The default interface is BASH (Bourne Again Shell). But some distros have developed their own interfaces.	It originally used Bourne shell. But is also compatible with other GUIs.
File system support	Linux supports more file system than Unix.	It also supports file system but lesser than Linux.

1.3.8Open Source:

Linux code is freely available to all and is a community based development project.

1.4 Why we should use Linux

- It is an open source OS which gives a great advantage to the programmers as they can design their own custom operating systems.
- It gives you a lot of option of programs having some different features so you can choose according to your need.
- A global development community look at different ways to enhance its security, hence it is highly secured and robust so you don't need an anti-virus to scan it regularly. Companies like Google, Amazon and Facebook use Linux in order to protect their servers as it is highly reliable and stable.
- Above all you don't have to pay for software and server licensing to install Linux, it's absolutely free and you can install it on as many computers as you want.
- It's completely trouble-free operating system and don't have an issue with viruses, malware and slowing down your computer.

1.5 Linux vs Unix

Linux is the clone of Unix. It has several features similar to Unix, still have some key differences. Before Linux and Windows, computer world was dominated by Unix. Unix is a copyrighted name and IBM AIX; HP-UX and Sun Solaris are only Unix operating system remained till date.

Comparison	Linux	Unix
Definition	It is an open-source operating system which is *freely available to everyone*.	It is an operating system which *can be only used by its copyrighters*.
Examples	It has different distros like Ubuntu, Redhat, Fedora, etc	IBM AIX, HP-UX and Sun Solaris.

1.3 Features of Linux

1.3.1Multiuser capability:

Multiple users can access the same system resources like memory, hard disk, etc. But they have to use different terminals to operate.

1.3.2Multitasking:

More than one function can be performed simultaneously by dividing the CPU time intelligently.

1.3.3 Portability:

Portability doesn't mean it is smaller in file size or can be carried in pen drives or memory cards. It means that it support different types of hardware.

1.3.4Security:

It provides security in three ways namely authenticating (by assigning password and login ID), authorization (by assigning permission to read, write and execute) and encryption (converts file into an unreadable format).

1.3.5Graphical User Interface (X Window system):

Linux is command line-based OS but it can be converted to GUI based by installing packages.

1.3.6Application support:

It has its own software repository from where users can download and install many applications.

1.3.7 File System:

Provides hierarchical file system in which files and directories are arranged.

1.2.2 System Libraries

System libraries are special programs that helps in accessing the kernel's features. A kernel has to be triggered to perform a task and this triggering is done by the applications. But applications must know how to place a system call because each kernel has a different set of system calls. Programmers have developed standard library of procedures to communicate with kernel. Each operating system supports these standards and then these are transferred to system calls for that operating system.

Most well-known system library for Linux is glib (GNU C library).

1.2.3 System Tools

Linux OS has a set of utility tools which are usually simple commands. It is a software which GNU project has written and publish under their open source license so that software is freely available to everyone.

With the help of commands, you can access your files, edit and manipulate data in your directories or files, change location of files or anything.

1.2.4 Development Tools

With the above three components your OS is running and working. But to update your system you have additional tools and libraries. These additional tools and libraries are written by the programmers and are called tool chain. A tool chain is a vital development tool used by the developers to produce a working application.

1.2.5 End User Tools

These end tools make a system unique for a user. End tools are not required for the operating system but are necessary for a user.

Some examples of end tools are graphic design tools, office suites, browsers, multimedia players, etc.

Chapter 1

Introduction to Linux

1.1What is Linux

Linux is an operating system or a kernel, which germinated as an idea in the mind of young and bright **Linus Torvalds** when he was a computer science student. He used to work on the **UNIX OS** and thought that it needed improvements.

1.2 Structure of Linux OS

1.2.1 Kernel

Kernel is the core of the operating system. It establishes communication between devices and software. Moreover, it manages the system resources. Basically, it has four responsibilities:

- Device management: A system has many devices connected to it like CPU, memory device, sound cards, graphic cards, etc. A kernel stores all the data related to all the devices in device driver (without this kernel won't be able to control the devices). Thus, kernel knows what a device can do and how to manipulate it to bring out the best performance. It also manages communication between all the devices. Kernel has certain rules that has to be followed by all the devices.
- Memory management: Another function that kernel has to manage is the memory management. Kernel keeps a track of used and unused memory and make sure that processes shouldn't manipulate data of each other using virtual memory address.
- Process management: In process management kernel assign enough time and gives priorities to processes before handling CPU to other process. It also deals with security and ownership information.
- Handling system calls: Handling system calls means a programmer can write a query or ask the kernel to perform a task.

Chapter 2

Introduction to RHCSA

2.1 Introduction:

Red Hat Enterprise Linux (RHEL) is a Linux-based operating system from Red Hat designed for businesses. RHEL can work on desktops, on servers, in hypervisors or in the cloud. Red Hat and its community-supported counterpart, Fedora, are among the most widely used Linux distributions in the world.

Red Hat Enterprise Linux has multiple variants, with server versions for x86, x86-64, PowerPC, Itanium and IBM System z. It also includes desktop versions for x86 and x86-64. As of November, 2011, the latest variant of RHEL is RHEL 6.

Now Red Hat is owned by IBM.

Being a Linux distribution, Red Hat Enterprise Linux contains the Linux kernel as well as some applications for performing certain tasks. Like all Linux distributions, RHEL is open source. Thus, people can view its source code, download it and make their own customized versions. Some of the notable Linux distros that are actually derived from RHEL include CentOS, Oracle Enterprise Linux, Scientific Linux and Pie Box Enterprise Linux.

In the past, Red Hat gave this enterprise product for free and only charged for support. Later on, they decided to create two versions: RHEL, which would have less frequent version releases and consequently be more stable, and Fedora, which would undergo relatively more frequent version releases and consequently offer more bleeding edge technologies.

Fedora, which is given entirely for free, is sponsored by Red Hat (the company) but is actively developed by a community of developers. It is most suitable for Linux enthusiasts. RHEL, on the other hand, takes technologies developed via the Fedora Project and packages them into a more reliable and stable commercial product. Hence, RHEL is best suited for the enterprise.

People who subscribe to RHEL can download the installer for free but have to pay for support. Special editions of RHEL are available for academic institutions who are willing to pay a smaller fee to use the relatively more stable RHEL rather than a Fedora.

A typical RHEL distribution would include development tools, applications, services and utilities such as Compiz, CUPS, DHCP, Firefox, GIMP, MySQL, OpenOffice.org, Samba and Python, to name a few.

Software Requirement:

1.9.1 Regular User

A regular user account is created for you when you install Ubuntu on your system. All your files and folders are stored in /home/ which is your home directory. As a regular user, you do not have access to directories of other users.

1.9.2 Root User

Other than your regular account another user account called root is created at the time of installation. The root account is a **superuser** who can access restricted files, install software and has administrative privileges. Whenever you want to install software, make changes to system files or perform any administrative task on Linux; you need to log in as a root user. Otherwise, for general tasks like playing music and browsing the internet, you can use your regular account.

1.9.3 Service user

Linux is widely used as a Server Operating System. Services such as Apache, Squid, email, etc. have their own individual service accounts. Having service accounts increases the security of your computer. Linux can allow or deny access to various resources depending on the service.

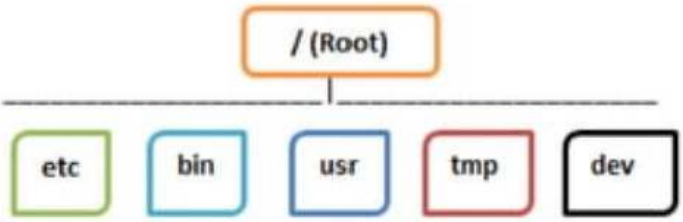


Figure 1.1 file system

1.8 Types of Files

In Linux and UNIX, everything is a file. Directories are files, files are files, and devices like Printer, mouse, keyboard etc. Are files.

Let's look into the File types in more detail.

1.8.1General Files

General Files also called as Ordinary files. They can contain image, video, program or simply text. They can be in ASCII or a Binary format. These are the most commonly used files by Linux Users.

1.8.2 Directory Files

These files are a warehouse for other file types. You can have a directory file within a directory (sub-directory).You can take them as 'Folders' found in Windows operating system.

1.8.3 Device Files:

In MS Windows, devices like Printers, CD-ROM, and hard drives are represented as drive letters like G: H: In Linux, there are represented as files. For example, if the first SATA hard drive had three primary partitions, they would be named and numbered as /dev/s*da1*, /dev/sda2 and /dev/sda3.

1.9 Users in Linux

There are 3 types of users in Linux.

- Regular
- Administrative(root)
- Service

Earlier it was an alternative of Ubuntu because media codecs and proprietary software are included in mint but was absent in Ubuntu. But now it has its own popularity and it uses cinnamon and mate desktop instead of Ubuntu's unity desktop environment.

1.6.3 Debian

Debian has its existence since 1993 and releases its versions much slowly then Ubuntu and mint.

This makes it one of the most stable Linux distributor.

Ubuntu is based on Debian and was founded to improve the core bits of Debian more quickly and make it more user friendly. Every release name of Debian is based on the name of the movie Toy Story.

1.6.4 Red Hat Enterprise

Red hat is a commercial Linux distributor. These products are red hat enterprise Linux (RHEL) and Fedora which are freely available. RHEL is well tested before release and supported till seven years after the release, whereas, fedora provides faster update and without any support.

Red hat uses trademark law to prevent their software from being redistributed. CentOS is a community project that uses red hat enterprise Linux code but removes all its trademark and make it freely available. In other words, it is a free version of RHEL and provide a stable platform for a long time.

1.6.5 Fedora

It is a project that mainly focuses on free software and provides latest version of software. It doesn't make its own desktop environment but used 'upstream' software. By default, it has GNOME3 desktop environment. It is less stable but provides the latest stuff.

1.7 Windows vs Linux File System

In Microsoft Windows, files are stored in folders on different data drives like C: D: E:

But, in **Linux, files are ordered in a tree structure starting with the root directory**.

This root directory can be considered as the start of the file system, and it further branches out various other subdirectories. The root is denoted with a forward slash '/'.

A general tree file system on your UNIX may look like this.

Coding	Linux is a Unix clone, behaves like Unix but doesn't contain its code.	Unix contain a completely different coding developed by AT&T Labs.
Operating system	Linux is just the kernel.	Unix is a complete package of Operating system.
Security	It provides higher security. Linux has about 60-100 viruses listed till date.	Unix is also highly secured. It has about 85-120 viruses listed till date

1.6 Linux Distributions

Other operating systems like Microsoft combine each bit of codes internally and release it as a single package. You have to choose from one of the version they offer.

But Linux is different from them. Different parts of Linux are developed by different organizations.

Different parts include kernel, shell utilities, X server, system environment, graphical programs, etc.

Some of the Linux Distributors are: -

1.6.1 Ubuntu

It came into existence in 2004 by Canonical and quickly became popular. Canonical wants Ubuntu to be used as easy graphical Linux desktop without the use of command line. It is the most well-known Linux distribution. Ubuntu is a next version of Debian and easy to use for newbies. It comes with a lot of pre-installed apps and easy to use repositories libraries.

Earlier, Ubuntu uses GNOME2 desktop environment but now it has developed its own unity desktop environment. It releases every six months and currently working to expand to run on tablets and smartphones.

1.6.2 Linux Mint

Mint is based on Ubuntu and uses its repository software so some packages are common in both.

2.5 Directory Structure

A standard Linux distribution follows the directory structure as provided below with Diagram and explanation.

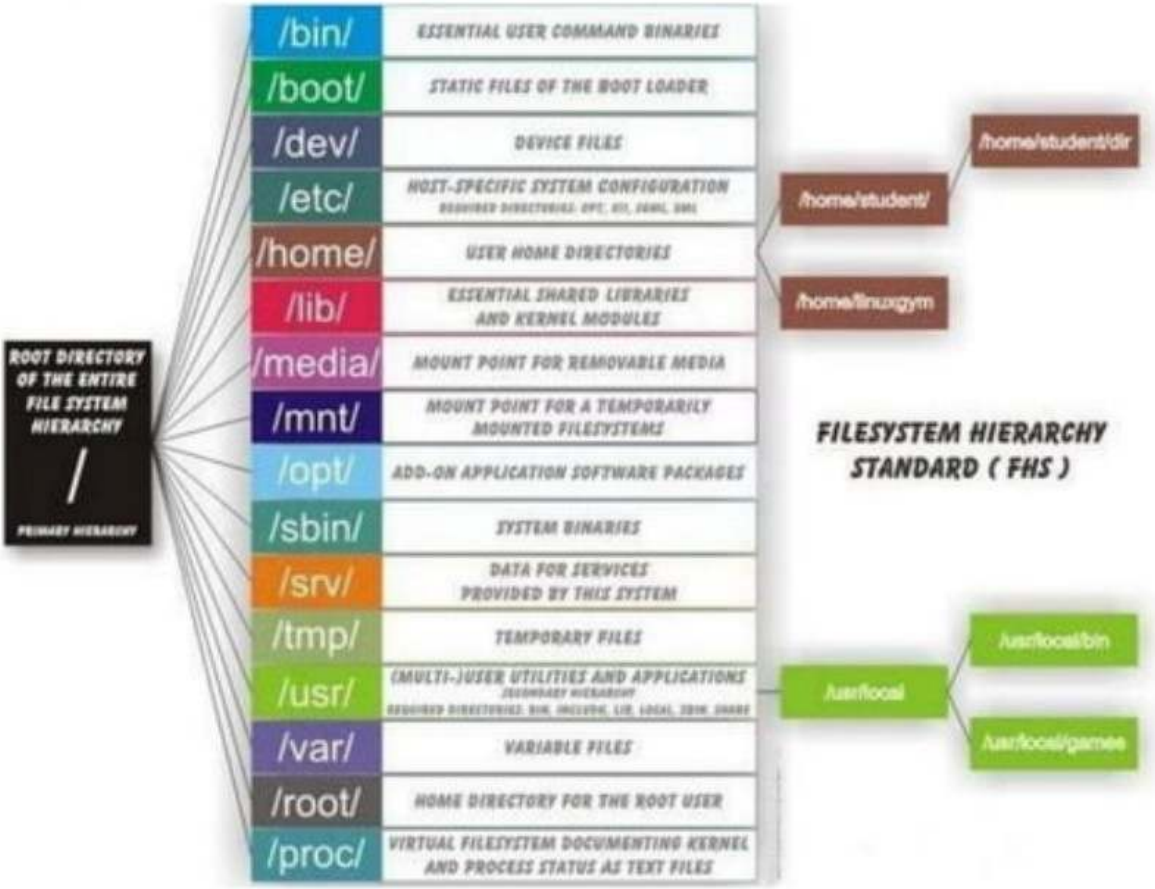


Figure 2.5 directory structure

2.6 Basic Commands

pwd	The pwd command stands for (print working directory). It displays the current working location or directory of the user. It displays the whole working path starting with /. It is a built-in command.
ls	The ls command is used to show the list of a folder. It will list out all the files in the directed folder.
cd	The cd command stands for (change directory). It is used to change to the directory you want to work from the present directory.
mkdir	With mkdircommand you can create your own directory.

Trivia 2

LILO needed to indicate **MBR** in order to locate operating systems on the hard drive. Any modifications done to **/etc/lilo.conf**, that must be updated in **MBR**, but in **GRUB**'s case no need to update, it reads directly from the file **/boot/grub/grub.conf**.

After making changes in **/etc/lilo.conf**, we'll have to update the **MBR** manually.

 # /sbin/lilo -v

Trivia 3

The **GRUB** second stage loader resides within the **MBR** and within **/boot** partition. Once **GRUB** is loaded into memory it becomes 2nd stage loader.

Trivia 4

The **/initrd** directory should not be removed it is a temporary place holder for kernel to have quick access to the modules that it needs to start the system modules include device drivers.

Kernel initialization highlights include:

1. initialize **CPU** components, e.g., **MMU**
2. initialize the scheduler (**PID** 0)
3. mount the root filesystem in rw mode
4. fork off the init process (**PID** 1)

In essence, kernel initialization does two things:

1. Start the core system of shared resource managers (**RAM**, processor and mass storage).
2. Starts a single process, **/sbin/init**.

Init process **(sbin/init)** is the very fistprocess which loads all the various daemons and mounts all the partitions which are listed under **/etc/fstab.**

About /etc/fstab

1. The **/sbin/init** reads **/etc/inittab** file
2. Set default runlevel (the **telinit** command allows administrators to tell the **init** process to change its current runlevel)
3. Calls **/etc/rc.d/rc.sysinit** and **/etc/rc.d/rc x** (where '**x**' is a runlevel)
4. In **/etc/rc.d/rc5.d** directory files starting with letter **K** –> kill scripts and files starting with letter **S** –>Startup scripts.
5. Start up the **tty** processes and **xdm** (**X** display manager)
6. Starts User's **login screen**

- Placed on the prime disk drive, in the prime sector of the first cylinder of track is 0 and head is 0 (this whole path is generally booked for boot programs)
- MBR involve a mini executable programs and a table specify the primary partitions.

  Boot Code (GRUB) 446 bytes

  partition 1: 16 bytes

  partition 2: 16 bytes

  partition 3: 16 bytes

  partition 4: 16 bytes

  magic Number: 2 bytes

1. MBR also document which primary partition is **ACTIVE.**
2. The **BIOS** surrender rights to the first stage boot loader, which then scans partition table and finds second stage boot loader on the partition configured as bootable.

Boot Loader

1. The boot loader termed from 1st stage loader and loads itself into **RAM**. All this go on in milliseconds.
2. The default stage 2 boot loader is a **GRUB (Grand Unified Boot Loader)** or **LILO** (Linux Loader)
3. Once **GRUB** is loaded into **RAM**, then it's search for the location of **Kernel**.
4. **GRUB** will scrutinize the map file to find the kernel image, that is located under **(/boot)** and load it.
5. GRUB loads the kernel **(vmlinuz-version)** from **/boot** partition.

Trivia 1

GRUB organize **RAMDISK** for initrd —> (**RAMDISK** is reserved space from **RAM**). In addition, it drives **initrd** into **RAM** to ready the kernel for loading itself into memory and depended modules so that it can leave the system to "**init**" process.

In, Linux most of the drivers are pre-built as modules, these would be initial ram drive (**initrd.img**) where it can keep all the information of additional modules. So, when the kernel boots, it creates **ramdrive**, loads the **initrd.img** and its depended modules.

GRUB reads **/boot/grub/grub.conf** & shows us a clean interface for selecting Operating System

Once Kernel loads its depended modules and then it hands over to "**init**" process. The kernel image has a small, unpacked program that un-compresses kernel and runs it.

AMD Sempron, AMD Turion, MD Opteron, AMD Phenom 1, and Celeron III are recommended.

Minimum of 512 MB RAM is required and the RAM above this size would be recommended.

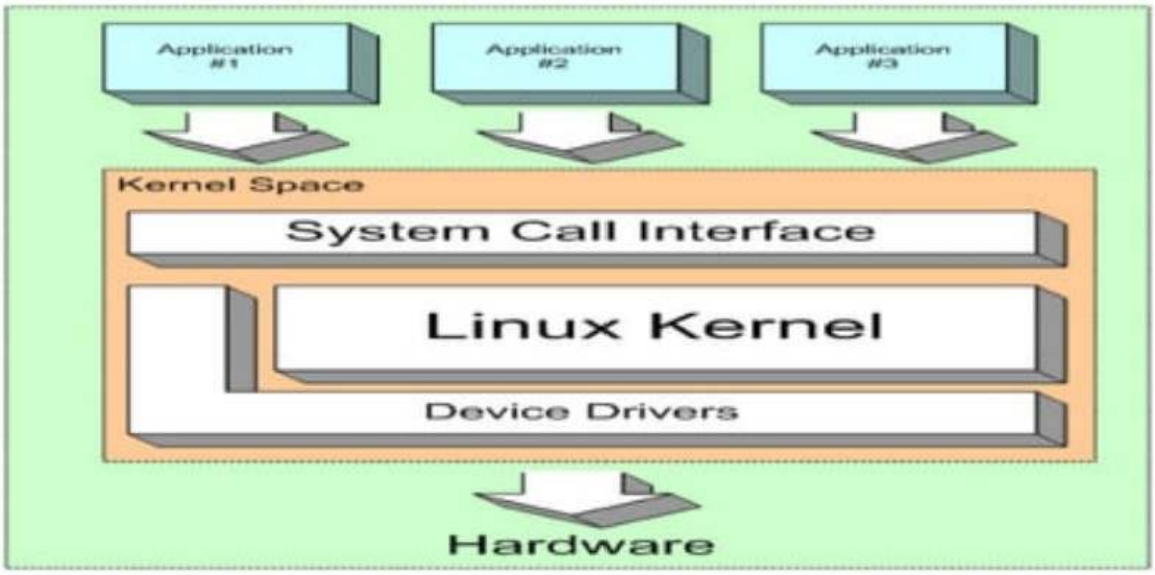


Figure 2.3 Software & Hardware Requirement

2.4 Boot Process

Power on

1. **BIOS (Basic Input Output System)** is a software program comes pre-built in a motherboard chipset.
2. **BIOS** loads and scans for devices such as **Hard Disk, CD-ROM, RAM**, etc.
3. **BIOS** searches for **MBR (Master Boot Record**: 1st sector) of the primary hard drive, it scans for 1st stage loader (In our case boot loader is (**GRUB LILO**) and hands over the responsibility to **MBR**.
4. Boot **PROM/FLASH/BIOS** is proficient of loading the **MBR** into **RAM** and executing it.
5. MBR (Master Boot Record)

- **512** bytes of space –> **MBR**
- **MBR** contains the information of loader of most operating system e.g. **UNIX, Linux** and **WINDOWS**
- **MBR** holds the small binary information of 1st stage of loader
- MBR consist physical sector of the first disk drive (i.e. **512 bytes**) and it's not part of any partition.

To use your local computer to develop your server, you must install a Linux system. Windows can also be used to create & deploy servers but carrying these tasks in windows becomes difficult. It's recommended to use Linux system. Red Hat Enterprise Linux 7.3 is one of the best Linux OS that can be used.

2.2 Installing the Red hat Enterprise Linux 7.3:

Installing a Linux system is easy and fast task. There is one more reason to use Linux system is because it's free.

Figure 2.2 Installing Redhat Enterprises Linux 7.3

2.3 Configuring the System:

As the Linux system is installed i.e. RHEL 7.3, log in as root. Now we've to configure it by installing some additional packages and upgrading the system packages

Open the Terminal and type following commands to install updates:

[root@localhost Desktop]# yum install updates

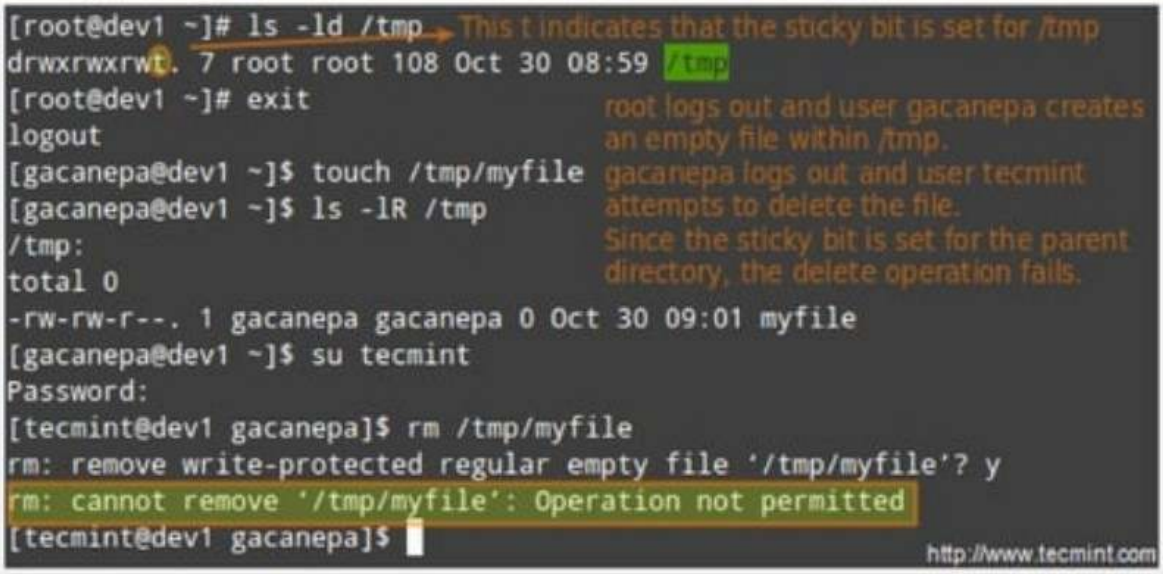
Hardware Requirement:

Minimum requirement is Pentium 4 or AMD or Celeron Processor. All the processors above this configuration would be very well working to go with Linux. So, the processors like Core 2 Duo Processor, Dual Core Processor, Dual core i3, Dual core i5, Dual core i7, AMD Duron,

UNDERSTANDING STICKY BIT

When the "sticky bit" is set on files, Linux just ignores it, whereas for directories it has the effect of preventing users from deleting or even renaming the files it contains unless the user owns the directory, the file, or is root.

```
# chmodo+t [directory]
```



```
[gacanepa@dev1 ~]$ passwd tecmint
passwd: Only root can specify a user name.
[gacanepa@dev1 ~]$ passwd
Changing password for user gacanepa.
Changing password for gacanepa.
(current) UNIX password:
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[gacanepa@dev1 ~]$
```

http://www.tecmint.com

UNDERSTANDING SETGID

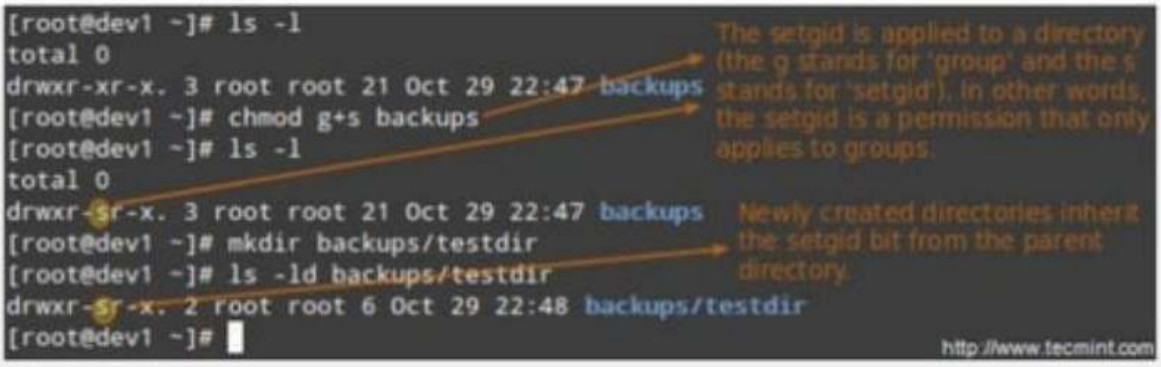
When the setgid bit is set, the effective GID of the real user becomes that of the group owner. Thus, any user can access a file under the privileges granted to the group owner of such file. In addition, when the setgid bit is set on a directory, newly created files inherit the same group as the directory, and newly created subdirectories will also inherit the setgid bit of the parent directory. You will most likely use this approach whenever members of a certain group need access to all the files in a directory, regardless of the file owner's primary group.

```
# chmodg+s [filename]
```

To set the setgid in octal form, prepend the number 2 to the current (or desired) basic permissions.

```
# chmod 2755 [directory]
```

SETTING THE SETGID IN A DIRECTORY



3.2 Linux File Permissions

All the three owners (user owner, group, others) in the Linux system have three types of permissions defined. Nine characters denotes the three types of permissions.

1. **Read (r):** The read permission allows you to open and read the content of a file. But you can't do any editing or modification in the file.
2. **Write (w):** The write permission allows you to edit, remove or rename a file. For instance, if a file is present in a directory, and write permission is set on the file but not on the directory, then you can edit the content of the file but can't remove, or rename it.
3. **Execute (x):** In Unix type system, you can't run or execute a program unless execute permission is set. But in Windows, there is no such permission available.
4. Octal permissions can also be set for the groups.
5. For example, to set **r** octal will be **4,** to set **w** octal will be **2,** to set **x** octal will be **1.**

UNDERSTANDING SETUID

When the setuid permission is applied to an executable file, an user running the program inherits the effective privileges of the program's owner. Since this approach can reasonably raise security concerns, the number of files with setuid permission must be kept to a minimum. You will likely find programs with this permission set when a system user needs to access a file owned by root.

Summing up, it isn't just that the user can execute the binary file, but also that he can do so with root's privileges. For example, let's check the permissions of /bin/passwd. This binary is used to change the password of an account, and modifies the /etc/shadow file. The superuser can change anyone's password, but all other users should only be able to change their own.

Figure 3.2 File Permission

Thus, any user should have permission to run /bin/passwd, but only root will be able to specify an account. Other users can only change their corresponding passwords.

UNDERSTANDING /ETC/PASSWD

The full account information is stored in the /etc/passwd file. This file contains a record per system user account and has the following format (fields are delimited by a colon).

```
[username]:[x]:[UID]:[GID]:[Comment]:[Home directory]:[Default shell]
```

UNDERSTANDING /ETC/GROUP

Group information is stored in the /etc/group file. Each record has the following format.

```
[Group name]:[Group password]:[GID]:[Group members]
```

Modifying User :-

After adding an account, you can edit the following information (to name a few fields) using the usermod command, whose basic syntax of usermod is as follows.

```
# usermod [options] [username]
```

Adding a New Group

```
# groupaddcommon_group # Add a new group
# chown :common_group common.txt # Change the group owner of common.txt to common_group
# usermod -aGcommon_group user1 # Add user1 to common_group
# usermod -aGcommon_group user2 # Add user2 to common_group
# usermod -aGcommon_group user3 # Add user3 to common_group
```

DELETING A GROUP

You can delete a group with the following command.

```
# groupdel [group_name]
```

rmdir	The rmdir command is used to remove a directory from your system.
touch	Used to create a file.
rm	To remove a file.
cp	To copy a file.
mv	To rename or to move a file.
man	Description of a command.
whereis	Used to determine location of a man page
head	It displays the beginning of a file.
tail	It displays the last part of a file.
cat	This command is versatile and multi worker.
grep	To search a pattern

Chapter 3

Managing Users and Groups and File Permissions

3.1 Adding User Accounts

To add a new user account, you can run either of the following two commands as root.

```
# adduser [new_account]
# useradd [new_account]
```

Chapter 6

INTRODUCTION TO RHCE

Introduction:

In a technical sense, a server is an instance of a computer program that accepts and responds to requests made by another program, known as a client. Less formally, any device that runs server software could be considered a server as well. Servers are used to manage network resources. For example, a user may setup a server to control access to a network, send/receive e-mail, manage print jobs, or host a website.

Some servers are committed to a specific task, often referred to as dedicated. As a result, there are a number of dedicated server categories, like print servers, file servers, network servers, and database servers. However, many servers today are shared servers which can take on the responsibility of e- mail, DNS, FTP, and even multiple websites in the case of a web server.

Because they are commonly used to deliver services that are required constantly, most servers are never turned off. Consequently, when servers fail, they can cause the network users and company many problems. To alleviate these issues, servers are commonly high-end computers setup to be fault tolerant.

6.1 Need of Servers:

As we know that internet is an ocean of data. Every nook & cranny of the world uses internet. There are millions of websites containing text, audio, video, images etc. the user of internet always access these contents from all over the world. As we know that each and every website is stored on someone's storage device and every one cannot keep their devices online for a long time. So we need a device that can be kept online for long times without any discontinuity. That's comes the need of servers. The server is a place where we can place our data (websites, images, video, audio etc.) at one place with 24x7 access to all our users. Following are the other advantages of server:

i. All time access to all users.
ii. The hardware & software is upgraded according to time. The owner of any website has not to worry about their technical front.
iii. All information is at one place.

This system is not registered to Red Hat Subscription Management. You can use subscription-manager to register.

repo id repo name

InstallMedia Red Hat Enterprise Linux 7.7

repolist: 5,229

- If no errors are returned, the following can be used to update:

  # yum update

5.3 Set up yum repository for locally-mounted DVD on Red Hat Enterprise Linux 7

- Once you have downloaded a **DVD version of your chosen Rhel Version** and copied it over to a location on your server.

  # mkdir -p /mnt/disc

  # mount /dev/sr0 /mnt/disc

- Copy the media.repo file from the root of the mounted directory to /etc/yum.repos.d/ and set the permissions to 0644 or another similar permissions set:

  1. # cp /mnt/disc/media.repo /etc/yum.repos.d/rhel7dvd.repo
  2. # chmod 644 /etc/yum.repos.d/rhel7dvd.repo
  3. vi /etc/yum.repos.d/rhel7dvd.repo
  4. enabled=1
  5. baseurl=file:///mnt/disc/
  6. gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
  7. [InstallMedia]
  8. name=DVD for Red Hat Enterprise Linux 7.1 Server
  9. mediaid=1359576196.686790
  10. metadata_expire=-1
  11. gpgcheck=1
  12. cost=500
  13. enabled=1
  14. baseurl=file:///mnt/disc/
  15. gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release

- Clear the cache and check whether you can get the packages list from the DVD repo

  # yum clean all

  # yumrepolist enabled

- It should look like the following if no other repository is enabled. To avoid any corruption its recommend to disable any non-redhat repositories.

  # yum repolist enabled

  Loaded plugins: product-id, search-disabled-repos, subscription-manager

Chapter 5

Package Management

5.1 What is YUM?

YUM (Yellowdog Updater Modified) is an open source command-line as well as graphical based package management tool for **RPM (RedHat Package Manager)** based Linux systems. It allows users and system administrator to easily install, update, remove or search software packages on a system. It was developed and released by **Seth Vidal** under **GPL (General Public License)** as an open source, means anyone can allowed to download and access the code to fix bugs and develop customized packages. **YUM** uses numerous third party repositories to install packages automatically by resolving their dependencies issues.

5.2 Commands

To install a Package

```
yum install package_name
```

To remove a Package

```
yum remove package_name
```

To update a Package

```
yum update package_name
```

To list all Packages

```
yumrepolist all
```

To clean yum cache

```
yum clean all
```

We can use any other file system type like: ext2, ext3, ext4, fat, vfat, ntfs etc.

- mkfs.ext4 /dev/sdc1

4.3. Mount/Unmount Partitions

Before mounting a disk, you are required to create a mount point. Then use the mount command to mound disk partition on a mount point.

- mkdir /newDisk1
- mount /dev/sdc1 /newDisk1

Now use one of following command to verify disk is mounted successfully.

- mount | grep "/dev/sdc1"
- df -h | grep "/dev/sdc1"

4.4. Mount Disk on Startup

Use **/etc/fstab** file which is used for mounting disk partitions during system boot up. Add the following entry in **/etc/fstab** file at the end of file.

```
/dev/sdc1       /newDisk1      ext3    defaults        0       2
```

Chapter 4

To create disk partition in Linux

4.1 How to Create Disk Partition in Linux

Create Disk Partitions

If you have added a new disk to your system, you can simply format entire disk and create it as a single disk. But it's a good idea to create smaller partitions on large size disks.

fdisk /dev/sdc

Use **n** to create new partition like below. After that select p or e for creating a primary or extended file system. As we are creating first partition, so we can use **p** (primary). Remember that you can't create more than 4 primary partitions.

- Command (m for help): n
- Command action
- e extended
- p primary partition (1-4)
- p
- Partition number (1-4): 1
- First sector (63-104857599, default 63): 2048
- Last sector, +sectors or +size{K,M,G} (2048-104857599, default 104857599): +10G

4.2 Save new partitioning table

Command (m for help): w

Format Disk Partitions

Use mkfs utility for creating the file system on disk partitions. You can define file system type with **mkfs** command which file system we need on disk.

- mkfs -t ext4 /dev/sdc1

NOTE: Installation of any web server package on RHEL 7.2 or any other Linux requires only 3-steps: -

Step 1: Install the required software.

Step 2: Configure the software.

Step 3: Start the service (daemon).

Step 1: Install the httpd package:

Open the terminal. Then write the following command to install the httpd package.

[root@localhost Desktop] # yum install httpd

Once the httpd package is installed properly then go to the next step.

Step 2: Configure the software:

Configuring the software means changing the internal settings of the software. Internal settings contain default port no.,default location to look up for webpages, default type of webpage to accept etc. if there is any need to configure these settings then type the following command:

[root@localhost Desktop] # vim /etc/httpd/conf/httpd.conf

Step 3: Starting the service:

Now start the service i.e. the daemon by typing following command:

[root@localhost Desktop] # systemctl start httpd

The service of Apache Web Server (httpd) is started.

NOTE: When there is communication over the network, there comes the concept of firewalls. Firewall prevents any unauthorized connection over any network. To prevent this intervention caused by the firewall in RHEL 7.2 we write following commands:

[root@localhost Desktop] # setenforce 0

[root@localhost Desktop] # iptables –F

This must be done on each and every server which is going to be created.

cache servers that deliver content on behalf of upstream servers to improve response time. Web browsers cache previously accessed web resources and reuse them when possible to reduce network traffic. HTTP proxy servers at private network boundaries can facilitate communication for clients without a globally routable address, by relaying messages with external servers.

HTTP is an application layer protocol designed within the framework of the Internet Protocol Suite. Its definition presumes an underlying and reliable transport layer protocol, and Transmission Control Protocol (TCP) is commonly used. However HTTP can be adapted to use unreliable protocols such as the User Datagram Protocol (UDP), for example in HTTPU and Simple Service Discovery Protocol (SSDP).

HTTP resources are identified and located on the network by uniform resource locators (URLs), using the uniform resource identifier (URI) schemes http and https. URIs and hyperlinks in Hypertext Markup Language (HTML) documents form inter-linked hypertext documents.

HTTP/1.1 is a revision of the original HTTP (HTTP/1.0). In HTTP/1.0 a separate connection to the same server is made for every resource request. HTTP/1.1 can reuse a connection multiple times to download images, scripts, stylesheets etc. after the page has been delivered. HTTP/1.1 communications therefore experience less latency as the establishment of TCP connections presents considerable overhead.

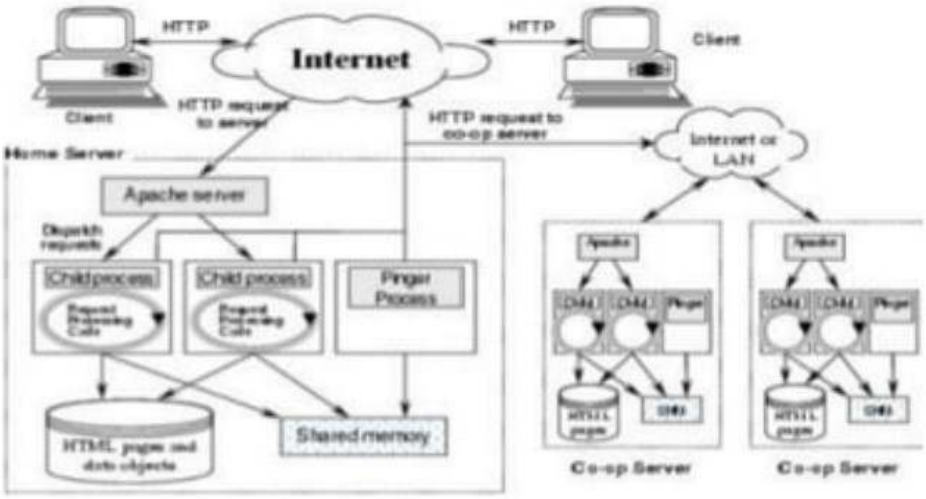


Figure 7.1 The Apache Web Server

Installation:

Chapter 7

Web Server Description

7.1. HTTP:

Introduction

The Hypertext Transfer Protocol (HTTP) is an application protocol for distributed, collaborative, hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web.

Hypertext is structured text that uses logical links (hyperlinks) between nodes containing text. HTTP is the protocol to exchange or transfer hypertext.

Development of HTTP was initiated by Tim Berners-Lee at CERN in 1989. Standards development of HTTP was coordinated by the Internet Engineering Task Force (IETF) and the World Wide Web Consortium (W3C), culminating in the publication of a series of Requests for Comments (RFCs). The first definition of HTTP/1.1, the version of HTTP in common use, occurred in RFC 2068 in 1997, although this was obsoleted by RFC 2616 in 1999.

A later version, the successor HTTP/2, was standardized in 2015, and is now supported by major web servers.

HTTP functions as a request–response protocol in the client–server computing model. A web browser, for example, may be the client and an application running on a computer hosting a web site may be the server. The client submits an HTTP request message to the server. The server, which provides resources such as HTML files and other content, or performs other functions on behalf of the client, returns a response message to the client. The response contains completion status information about the request and may also contain requested content in its message body.

A web browser is an example of a user agent (UA). Other types of user agent include the indexing software used by search providers (web crawlers), voice browsers, mobile apps, and other software that accesses, consumes, or displays web content.

HTTP is designed to permit intermediate network elements to improve or enable communications between clients and servers. High-traffic websites often benefit from web

built from higher-grade components than client computers. The following paragraphs describe the typical components of a server computer.

Memory

Don't scrimp on memory. People rarely complain about servers having too much memory. Many different types of memory are available, so you have to pick the right type of memory to match the memory supported by your motherboard. The total memory capacity of the server depends on the motherboard. Most new servers can support at least 12GB of memory, and some can handle up to 32GB.

Hard drives

Most desktop computers use inexpensive hard drives called IDE drives (sometimes also called ATA). These drives are adequate for individual users, but because performance is more important for servers, another type of drive known as SCSI is usually used instead. For the best performance, use the SCSI drives along with a high-performance SCSI controller card.

Recently, a new type of inexpensive drive called SATA has been appearing in desktop computers. SATA drives are also being used more and more in server computers as well due to their reliability and performance.

Network connection

The network connection is one of the most important parts of any server. Many servers have network adapters built into the motherboard. If your server isn't equipped as such, you'll need to add a separate network adapter card.

Figure 6.3A Look Of A Server

iv. No need of technical expatriation of any server related term because the entire tasks are done by server personnel.

v. Data processing is fast.

6.2 A Client-Server Relationship:

The **client–server model** is a distributed application structure that partitions tasks or workloads between the providers of a resource or service, called servers, and service requesters, called clients. Often clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system. A server host runs one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function. Clients therefore initiate communication sessions with servers which await incoming requests. Examples of computer applications that use the client– server model are Email, network printing, and the World Wide Web.

Servers are classified by the services they provide. For instance, a web server serves web pages and a file server serves computer files. A shared resource may be any of the server computer's software and electronic components, from programs and data to processors and storage devices. The sharing of resources of a server constitutes a service.

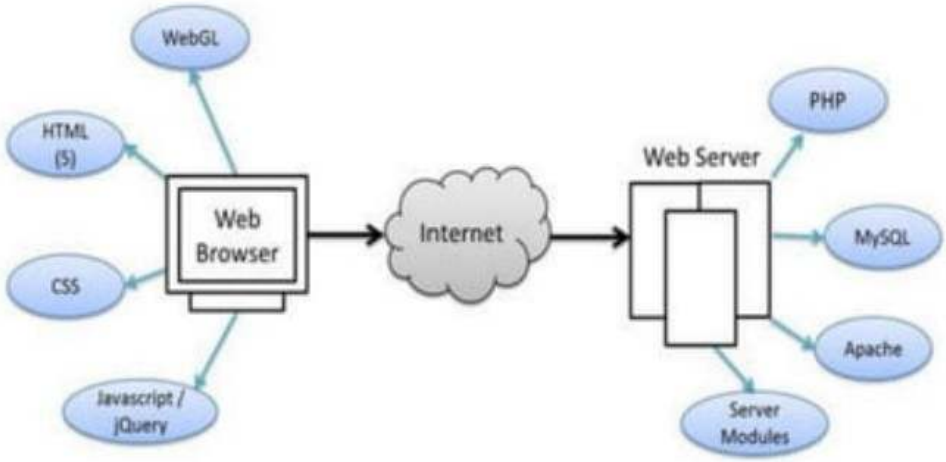


Figure 6.2A Client Server Relationship

6.3 Components of A Server:

The hardware components that a typical server computer comprises are similar to the components used in less expensive client computers. However, server computers are usually

administrative tools. NIS is often used with the Network File System (NFS). NIS is a UNIX-based program.

Although Sun and others offer proprietary versions, most NIS code has been released into the public domain and there are freeware versions available. NIS was originally called Yellow Pages but because someone already had a trademark by that name, it was changed to Network Information System. It is still sometimes referred to by the initials: "YP".

Sun offers NIS+ together with its NFS product as a solution for Windows PC networks as well as for its own workstation networks.

Installation:

Step 1: Install the ypserv package:

Open the terminal. Then write the following command to install the nfs-utils package. [root@localhost Desktop] # yum install ypserv

Once the ypserv package is installed properly then go to the next step.

Step 2: Configure the software:

Configuring the software means changing the internal settings of the software. Internal settings contain default port no. , default location to look up for webpages, default type of webpage to accept etc. if there is any need to configure these settings then type the following command:

[root@localhost Desktop] # vim /etc/yp.conf

Step 3: Starting the service:

Now start the service i.e. the daemon by typing following command:

[root@localhost Desktop] # systemctl start ypserv

The service of NIS Web Server is started.

7.5. NTP:

Introduction:

NTP (Network Time Protocol) is a network protocol that enables you to synchronize clocks on devices over a network. It works by using one or more NTP servers that maintain a highly accurate time, and allows clients to query for that time. These client devices query the server,

Installation:

Step 1: Install the nfs-utils package:

Open the terminal. Then write the following command to install the nfs-utils package.

[root@localhost Desktop] # yum install nfs-utils

Once the nfs-utils package is installed properly then go to the next step.

Step 2: Configure the software: Configuring the software means changing the internal settings of the software. Internal settings contain default port no. , default location to look up for webpages, default type of webpage to accept etc. if there is any need to configure these settings then type the following command:

[root@localhost Desktop] # vim /etc/exports

Step 3: Starting the service:

Now start the service i.e. the daemon by typing following command:

[root@localhost Desktop] # systemctl start nfs-server

The service of NFS Web Server is started.

7.4. NIS:

Introduction:

NIS (Network Information System) is a network naming and administration system for smaller networks that was developed by Sun Microsystems. NIS+ is a later version that provides additional security and other facilities. Using NIS, each host client or server computer in the system has knowledge about the entire system. A user at any host can get access to files or applications on any host in the network with a single user identification and password. NIS is similar to the Internet's domain name system (DNS) but somewhat simpler and designed for a smaller network. It's intended for use on local area networks.

NIS uses the client/server model and the Remote Procedure Call (RPC) interface for communication between hosts. NIS consists of a server, a library of client programs, and some