



LINUX

Kiran Gurbani

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LINUX

(As per the Syllabus 2016-17 of Mumbai University for F.Y.B.Sc. – CS, Semester II)

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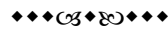
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Dedication



“Behind every young child who believe in herself is a Parent who believes first.” So, I would like to dedicate this book to my mother and father **Kavita S. Bajaj** and **Sahijram Bajaj**. I would like to thank my son **Chirag Gurbani** for being my stress buster and a motivating force for putting a better performance every time.

I am also thankful to all my friends and colleagues; with their support only, this book is possible.

My sincerest big thanks for a lifetime to **Mr. S.K. Srivastava** of Himalaya Publishing House Pvt. Ltd., for giving me best writing advice and motivation and whose belief in this book has kept me motivated and inspired and encouraged on even the darkest of days.

Kiran Gurbani



PREFACE

It is a great pleasure in presenting First Edition of this Book “*Linux*” to the students of F.Y.C.S (FYBSc. Computer Science). This book is written to cover all the topics of syllabus prescribed by the University of Mumbai for F.Y.B.Sc. C.S. This book is also useful for S.Y.Bs.c. Computer Science as well as T.Y.Bs.c. Computer Science.

Linux Operating System is open source software. It supports CUI and GUI interface. With major developments of technology, this operating system is considered more efficient than Window Operating System. Linux Operating System is secure because of its firewall protection feature. The Linux Operating System has its own K-Office and having powerful internet, network capabilities as well in Linux we have many inbuilt servers like NFS, Samba server, Web server– Apache, mailing server – sendmail, Proxy server-squid, DNS, System Administration for Users and Groups, DHCP Server, FTP, http, etc. Many distributors of Linux are available in the market REDHat, Ubuntu, Fedora, Suse, Mandrake, etc. In this book, I have considered RedHat Linux for reference.

In this book Linux Installation, History, Distribution, Linux Documentation Sources and different types of desktops and all Basic Linux commands, different types of methods for installing and updating packages are explained and Shell scripting is provided.

The concept and theory of each topic is followed by the theoretical explanation, some self assessment questions, all practical solutions of Linux commands, user administration, Linux documentation, Shell scripting with MCQ (Multiple Choice Questions) according to university pattern are provided at the end of this book, along with Practical’s Linux Installation stepwise with wizard is provided. Efforts have been made to make the text easy to read and understand. In this book, we have covered all types of programs expected by University of Mumbai in practical examination. At the end of this book, sample question paper is given for the student practice.

I have tried my level best to give everything in this book in proper manner. Still few points from book may be explained in better way than presently are there in the book.

Constructive suggestion and comments from the users will be sincerely appreciated. I would appreciate hearing from you about any textual errors or omissions which you identify. If you would like to suggest improvements or to contribute in any way, I would be glad to hear from you.

Please send correspondence to kiranrktcollege@gmail.com. and I want to dedicate this book to my mother Kavita S. Bajaj and father Sahijram Bajaj. Finally, I express my debt of gratitude to my parents and both sons who have provided me motivation and encouragement to write this book.

Last but not the least, I would like to give big lifetime thanks to Mr. S.K. Srivastava (Himalaya Publishing House) for providing an environment which stimulates new thinking and innovations and his support, motivation, guidance, cooperation and encouragement to write this book. I am very grateful for his support and thank him for his true blessings.

Kiran Gurbani

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SYLLABUS

Linux

Semester II – Theory
(Credits: 2 Lectures/Week: 3)
Course: USCS203

Objectives

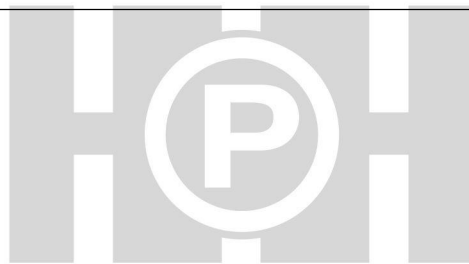
This course introduces various tools and techniques commonly used by Linux programmers, system administrators and end-users to achieve their day-to-day work in Linux environment. It is designed for computer students who have limited or no previous exposure to Linux.

Expected Learning Outcomes:

1. Upon completion of this course, students should have a good working knowledge of Linux, from both a graphical and command line perspective, allowing them to easily use any Linux distribution.
2. This course shall help student to learn advanced subjected in computer science practically.
3. Student shall be able to progress as a Developer or Linux System Administrator using the acquired skill set.

Unit I	Introduction History of Linux, philosophy, community, terminology, Distributions, Linux Kernel vs. distribution. Why learn Linux? Importance of Linux in software ecosystem: web servers, supercomputers, mobile, servers. Installation Installation methods, Hands– on installation using CD/ DVD or USB drive. Linux Structure Linux Architecture, Filesystems basic, The boot process, init scripts, run levels, shutdown process, very basic introductions to Linux processes, packaging methods: rpm/deb, Graphical vs. command line.	15L
Unit II	Graphical Desktop Session Management, Basic Desktop Operations, Network Management, installing and Updating Software, Text editors: gedit, vi, vim, emacs, Graphics editors, Multimedia applications. Command Line Command line mode options, Shells, Basic Commands, General Purpose Utilities, Installing Software, User management, Environment variables, Command aliases. Linux Documentation	15L

	<p>Man pages, GNU info, help command, More documentation sources</p> <p>File Operations</p> <p>File system, File system architecture, file types, File attributes, working with files, Backup, compression</p>	
Unit III	<p>Security</p> <p>Understanding Linux Security, Users of root, sudo command, working with passwords, Bypassing user authentication, Understanding ssh</p> <p>Networking</p> <p>Basic introduction to Networking, Network protocols: http, ftp etc., IP address, DNS Browsers, Transferring files.</p> <p>ssh, telnet, ping, traceroute, route, hostname, networking GUI.</p> <p>Basic Shell Scripting</p> <p>Features and Capabilities, Syntax, Constructs, Modifying files sed, awk command, File manipulation utilities, Dealing with large files and Text, String manipulation, Boolean expressions, File tests, Case, Debugging, Regular expressions.</p>	15L



PAPER PATTERN

Max. Marks: 75

Time: 2 $\frac{1}{2}$ Hrs.

All Questions are Compulsory.

Q. 1	Covering all the Units (I, II and III) Attempt All (Each of 5 Marks) (a) Multiple Choice Questions 5 Marks (b) Fill in the Blanks 5 Marks (c) Short Notes 5 Marks	15 Marks
Q. 2	From Unit I (With 100% option) Attempt any three of the following (a) 5 Marks (b) 5 Marks (c) 5 Marks (d) 5 Marks (e) 5 Marks (f) 5 Marks	15 Marks
Q. 3	From Unit II (With 100% option) Attempt any three of the following (a) 5 Marks (b) 5 Marks (c) 5 Marks (d) 5 Marks (e) 5 Marks (f) 5 Marks	15 Marks
Q. 4	From Unit III (With 100% option) Attempt any three of the following (a) 5 Marks (b) 5 Marks (c) 5 Marks (d) 5 Marks (e) 5 Marks (f) 5 Marks	15 Marks
Q. 5	Covering all the Units (I, II and III) with 75% option Attempt any three of the following (a) 5 Marks (b) 5 Marks (c) 5 Marks (d) 5 Marks (e) 5 Marks (f) 5 marks	15 Marks

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Chapter

1

Introduction to Linux

“Linux Strong point being open source free ware and inbuilt Firewall”

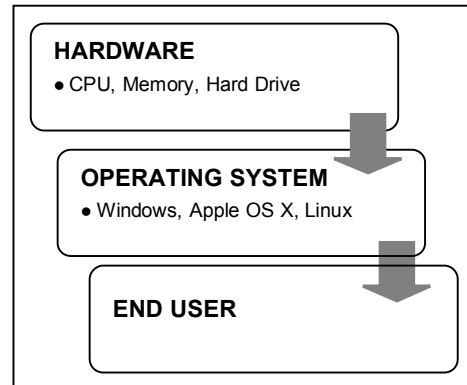
Structure:

- 1.1 Introduction to Different Operating System
- 1.2 Introduction to Linux
- 1.3 History of Linux
- 1.4 Philosophy
- 1.5 Community
- 1.6 Terminology
- 1.7 Distributions
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 - 1.10.1 Features of Linux
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1.1 Introduction to Different Operating System

Operating System

Operating System or kernel is a system software which acts as a user interface between computer hardware & user. A kernel is the program at the heart of any operating system that takes care of fundamental stuff, like letting hardware communicate with software.



Types of operating system

<p>1. Dos (Disk operating system)</p> <ul style="list-style-type: none"> ➤ Dos is a CUI (Character User Interface) OR CLI (Command Line Interface) ➤ Booting is done from any on disk (hard disk, floppy disk, compact disk) ➤ Single User Operating System ➤ Single tasking operating System ➤ Limited Networking 	<p>2. Windows Operating System</p> <ul style="list-style-type: none"> ➤ Windows is a GUI (Graphical User Interface) ➤ Multi User Operating System ➤ Multi tasking operating System ➤ Multi programming operating system ➤ Powerful Networking is available ➤ Different versions of Windows Launched into Market ➔ Windows 3.11, Windows 95, Windows 97, Windows 98, Windows 2000 (professional & server edition) , Windows Millennium, Windows xp, Windows vista, Windows 7, Win 8.
<p>3. Unix/Zenix Operating System</p> <ul style="list-style-type: none"> ➤ Unix is a CUI (Character User Interface) OR CLI (Command Line Interface) ➤ Multiuser Operating System ➤ Multitasking operating System ➤ Multiprogramming operating System ➤ Powerful Networking ➤ Remote sharing possible 	<p>4. Linux Operating System</p> <ul style="list-style-type: none"> ➤ Linux is a GUI (Graphical User Interface) with CLI (Command Line Interface) also available. ➤ Multiuser Operating System ➤ Multitasking operating System ➤ Multiprogramming operating System ➤ Powerful Networking ➤ Remote sharing possible ➤ Open Source operating System ➤ Inbuilt Firewall protection ➤ Inbuilt different servers

Booting & Types of Booting

Booting is Turn ON of Computer.

There are two types of Booting

1. Cold Booting
2. Warm Booting

<p>1. Cold Booting</p> <ul style="list-style-type: none"> (i) turn On of Computer (ii) switch on (iii) POST – Power on Self Test It checks all hardware devices are properly attached or not, if not throws respective Exception. (iv) It will check for 3 bootable files Autoexec.bat Command.com – written in fortran language in jcl(job control lang – \$job, \$run, \$send) Config.sys – It will store system configuration After checking for these Bootable Files in a respective disk, It will Boot from disk by giving respective prompt. c:\> d:\> e:\> 	<p>2. Warm Booting – (faster compared to cold booting)</p> <ul style="list-style-type: none"> (i) In this Booting, It will skip POST state, it will check for 3 bootable files Autoexec.bat Command.com – fortran – jcl – job control lang - \$job, \$run, \$send Config.sys – system configuration C:\> d:\> e:\> (ii) With the help of ctrl + alt + delete OR Restart button the machine can be booted with warm booting.
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1.2 Introduction to Linux



Linus Torvalds

for “GNU’s Not Unix”, chosen because GNU’s design is Unix-like, but differs from Unix by being free software and containing no Unix code.

Linux is a UNIX-base operating system. Its original creator was a Finnish student name **Linus Torvalds** he was Computer Science student, although being ‘**open source**’ it has change a great deal since its original conception.

It belongs to nobody, and is **free to download** and use. Any changes to it are open for all to adopt, and as a result it has developed into a very powerful OS that is rapidly gaining in popularity worldwide, particularly among those seeking an alternative to Window

Linux is called as **GNU Linux**. GNU (pronounced guh-noo) is a Unix-like computer operating system developed by the GNU project, Free Software Foundation. GNU operating system composed entirely of free software. GNU is a recursive acronym

Linux offers GPL License. GNU General Public License (GNU GPL or simply GPL) is the most widely used free software license.

The major advantage of Linux is its cost: the core OS is free, while many software applications also come with a **GNU General public License** written by Richard Stallman for the GNU Project.

It offers a **free operating system**. You do not have to shell hundreds of dollars to get the OS like Windows!

Linux is a Open Source Software, *Open Source* is a term that applies to software for which the source code (the inner workings of the program) is freely available for anyone to download, modify, and redistribute. Software covered under the GNU GPL(**General Public License**), described in the previous section, fits into the category of Open Source. Not surprisingly, though, so does a lot of other software that uses copyright licenses similar, but not identical, to the GPL. For example, software that can be freely modified but that does not have the same strict requirements for redistribution as the GPL is also considered Open Source. Being open-source, anyone with programming knowledge can modify it.

All the core UNIX system tools were designed so that they could operate together along with Linux. **The original text-based editors** (and even TeX and LaTeX) **use ASCII** (the American text encoding standard; an open standard) and you can use tools such as; *sed, awk, vi, grep, cat, more, tr* and various other text-based tools in conjunction with these editors.

The Linux operating systems now offer **millions of programs/applications to choose from**, most of them free!

Linux operating system has **inbuilt Firewall protection**. Once you have Linux installed you no longer need an antivirus! Linux is a highly secure system. More so , there is a global development community constantly looking at ways to enhance its security. With each upgrade, the OS becomes more secure and robust.

Linux is the OS of choice for **Server environments** due to its stability and reliability (Mega-companies like Amazon, Facebook ,and Google use Linux for their Servers). A Linux based server could run non-stop without a reboot for years on end. Linux has **many inbuilt servers** NFS, SAMBA, Apache, Dhcp, FTP, Http, DNS, SMTP with sendmail server, Proxy server (Postfix and squid)

The OS is comprised of a number of pieces:

1. **The Bootloader:** The software that manages the boot process of your computer. For most users, this will simply be a splash screen that pops up and eventually goes away to boot into the operating system.
2. **The kernel:** This is the one piece of the whole that is actually called “Linux”. The kernel is the core of the system and manages the CPU, memory, and peripheral devices. The kernel is the “lowest” level of the OS.
3. **Daemons:** These are background services (printing, sound, scheduling, etc) that either start up during boot, or after you log into the desktop.
4. **The Shell:** You’ve probably heard mention of the Linux command line. This is the shell – a command process that allows you to control the computer via commands typed into a text interface. This is what, at one time, scared people away from Linux the most (assuming they had to learn a seemingly archaic command line structure to make Linux work). This is no longer the case. With modern desktop Linux, there is no need to ever touch the command line.
5. **Graphical Server:** This is the sub-system that displays the graphics on your monitor. It is commonly referred to as the X server or just “X”.

6. **Desktop Environment:** This is the piece of the puzzle that the users actually interact with. There are many desktop environments to choose from (Unity, GNOME, Cinnamon, Enlightenment, KDE, XFCE, etc). Each desktop environment includes built-in applications (such as file managers, configuration tools, web browsers, games, etc).
7. **Applications:** Desktop environments do not offer the full array of apps. Just like Windows and Mac, Linux offers thousands upon thousands of high-quality software titles that can be easily found and installed. Most modern Linux distributions (more on this in a moment) include App Store-like tools that centralize and simplify application installation. For example: Ubuntu Linux has the Ubuntu Software Center (Figure 1) which allows you to quickly search among the thousands of apps and install them from one centralized location.

1.3 History of Linux

- ❑ **In 1969, ken Thompson & Dennis Ritchie** wrote a small, general purpose operating system called UNIX. This operating system was written in **assembly language**.
- ❑ **In 1973 Thompson & Ritchie rewrote the unix operating system** in c breaking away from the tradition of writing operating system in assembly language.
- ❑ **Around 1974 unix was licensed** to universities for educational purpose a few years later was made commercially available.
Many vendors such as SUN, IBM, Hewlett Packard & other purchased the source code of unix & developed their own versions of unix. Most of these versions were proprietary & maintained by their developers had to wait for a long time for bug fixes to get released.
- ❑ **In 1980, Microsoft developed a PC version of unix called xenix.**
- ❑ **In 1984, Richard Stallman's free software foundation (FSF)** began the GNU (**GNU stands for GNU's not unix**) project to create a free version of Unix O.S. The FSF successfully build a large number, of tools that could be freely used, read modified & redistributed.
- ❑ **Around 1990**, they had developed a number of tools but were having trouble creating a kernel.
- ❑ **In 1991, Linus Torvalds** developed a kernel & called it Linux. It has developed linux version 0.11.
- ❑ **Around 1992**, Linux kernel was combined with the not quite complete GNU system resulting in a complete free operating system. **This operating system is called GNU/LINUX as it is a combination of the GNU system & Linux as the Linux operating system.** Hence Linux was widely distributed over the internet and linux has all the internet utilities such as FTP (File Transfer Protocol) web browsers and remote connections with PPP (Point To Point Protocol). It also has a full set of program development utilities such as C++ compilers and debuggers hence linux has developed in the free and open environment of the internet. Linux is a open Source software the kernel coding is available on the net we can download the source code & do the changes in the coding and can create new version of Linux.

Linux also has filesystem standard (FSSTAND), which specifies the location of files and directories in linux file structure. Linux supports **ext3** partitions & **swap** partition for RAM, Linux supports all windows partitions Like VFAT, FAT32, NTFS, MSDOS Partition etc.

Distributor names of linux:

- | | | |
|-----------|------------|--------------|
| 1. RedHat | 2. Caldera | 3. Mandrake |
| 4. Debian | 5. Suse | 6. Stackware |
| 7. Fedora | 8. Ubuntu | |

1.4 Philosophy

All operating systems have a philosophy. And, the philosophy of an operating system matters.

Linux philosophy is quite naturally derived directly from the Unix philosophy.

Linux treats everyone equally and allows everyone the maximum amount of power.

Following are List of major tenets of Linux philosophy

- 1. Enlightenment:** From so many years number of peoples have attempted to enlighten and many of them codified various aspects of the Linux philosophy.
- 2. The terminal case:** The Linux philosophy is provided the ease with which one can open a terminal emulator to access the *CLI* and its concomitant power. Linux provided multiple *virtual terminals* that can be accessed using the *Ctrl-Alt-F [1-7] keys*. Linux has several fine *GUI desktop environments* from which to choose so that every user can choose the one he or she likes best.
- 3. Complete control:** Linux does not handhold. It assumes you know what you are doing when you type a command and it proceeds to execute that command without asking if you really want to. It gives you *complete control*.
- 4. Open Source software:** *Linux is a Open Source Software*, Open Source is a term that applies to software for which the source code (the inner workings of the program) is freely available for anyone to download, modify, and redistribute. Software covered under the *GNU GPL (General Public License)*, described in the previous section, fits into the category of Open Source. Not surprisingly, though, so does a lot of other software that uses copyright licenses similar, but not identical, to the GPL. For example, software that can be freely modified but that does not have the same strict requirements for redistribution as the GPL is also considered Open Source. Being open-source, anyone with programming knowledge can modify it.
- 5. Freeware with GNU GPL License:** Linux is called as *GNU Linux*. GNU (pronounced guh-noo) is a Unix-like computer operating system developed by the GNU project, Free Software Foundation. GNU operating system composed entirely of free software. GNU is a recursive acronym for “GNU’s Not Unix”, chosen because GNU’s design is Unix-like, but differs from Unix by being free software and containing no Unix code.

Linux offers GPL License. GNU General Public License (GNU GPL or simply GPL) is the most widely used free software license.

The major advantage of Linux is its cost: the core OS is free, while many software applications also come with a **GNU General public License** written by Richard Stallman for the GNU Project.

It offers a **free operating system**. You do not have to shell hundreds of dollars to get the OS like Windows!

This philosophy lives on today in GNU/Linux and various other UNIX system-based operating systems (FreeBSD, NetBSD, OpenBSD, etc.).

6. **Small is Beautiful:** This little command line program performs the very simple task of listing all users who are currently logged in while only listing each logged in user once. It also eliminates extraneous data provided by the who command.
7. **Each Program Does One Thing Well:** Each of the commands in this program is fairly small, and each performs a specific task.
8. **Store Data in Flat Text Files:**
 - ☞ “Flat text files” means that you store all *data as text*. Period. **Binary format files** are *verboten*. No special file-system formats are allowed. This rules out a host of interesting, but non portable, formats invented by vendors for propriety purposes.
 - ☞ Data files should consist of only a stream of bytes separated by line feed characters or “newlines”. Most Unix environments contain dozens of utilities for transmitting, modifying, and filtering text. Unix users employ these utilities in many combinations to do their daily work.
9. **Use Software Leverage**
 - ☞ Software Leverage means that by using four command line commands, Linux is leveraging the work of the programmers who created those commands with over 7,000 lines of C code. That is code that we do not have to create. Linux is leveraging the efforts of those other, under-appreciated programmers to accomplish the task we have set for ourselves.
 - ☞ Another aspect of software leverage is that good programmers write good code and great programmers borrow good code. Never rewrite code that has already been written.

Use Shell Scripts to Increase Leverage and Portability: The portability of shell scripts can be far more efficient in the long run than the perceived efficiency of writing a program in a compiled language not even considering the time required to compile and test such a program because they can run on many otherwise incompatible systems. Avoid Captive User Interfaces
10. **Make Every Program a Filter:** Each of the commands that make up this command line program is a **filter**. That is each command will take an input, usually from Standard Input, and “filters” the data stream by making some change to it, then sends the resulting data stream to Standard Output. Standard Input and Standard Output are known collectively as STDIO.
11. Treat all users with respect :Summation of the Linux philosophy is quite simple. ***Treat all users with respect.***

This amounts to allowing each user to do things her or his own way with a wide choice of powerful tools. It means making flexibility, simplicity, and freedom the foremost considerations when designing and building software systems.

1.5 Community

- ❑ Being a open source major changes, enhancement’s and new innovation are performed by **Linux Community**,
- ❑ It’s a community where people from all over the world meet and discuss GNU/Linux, free software and open source through various social mediums.
- ❑ **Linux Forums** is a **Linux Help community** where users share their knowledge, solve problems, learn and Join and find out more about **Linux**.
- ❑ **Linux.com:** Linux community portal sponsored by the Linux Foundation. Linux.com is the central resource for Linux users, developers, system administrators.

This is the place to learn about the latest in Linux and open source development, careers, best practices, and industry trends. Get news, information, and hands-on experience to help with your next project or career – or simply scratch an itch.

- ❑ **LinuxGizmos.com:** the canonical (no pun intended) place for news about embedded Linux (and the successor to the now-inactive LinuxDevices.com, which is now available as a static, searchable 15,000 page archive)
- ❑ **Linux.org:** an excellent starting place for all things linux
- ❑ **linuxmint.com:** The website for all **Linux** Mint users
- ❑ **Ubuntu Community** A help and support **forum** for Ubuntu **Linux**.
- ❑ **LinuxQuestions.org,** a friendly and active **Linux Community**

1.6 Terminology

Terminology is a terminal emulator for the X Window System that means GUI of Linux

1. **Distribution:** Distribution is a complete set of all the software you need TO MAKE UP a working operating system. There are many Linux distributions you can try out - some of the more popular are RedHat, Ubuntu, openSUSE and Fedora.
2. **Desktop environment:** A collection of graphical programs that work well together. It is a GUI provided at the top of your operating system. The most common desktop environments of Linux are GNOME(For Beginners) and KDE (For Professionals).
3. **Software repository:** A software repository is a set of software that is downloadable from the internet. Usually, you'll use a program called a package manager which allows you to download and install software from one or more repositories with just a few clicks.
4. **Package:** A package is a file which usually contains a software program. Packages can be downloaded from the internet (usually from a software repository).

The two most popular packaging formats are **RPM** – RedHat Package Manager (used by RedHat, Fedora, Mandriva, SUSE and others) and **Deb** (used by Ubuntu, Debian, Xandros and others), **YUM server** used by Redhat and Ubuntu for software installation.

5. **Terminal:** The terminal (also called the shell and command line) is a command line interface where you control the COMPUTER by typing text commands in and pressing Enter. If you've ever used DOS, it's similar to that, but much more powerful. It can be a bit tricky if you're not used to it, but often it can be the quickest, easiest and most universal way to perform a particular task.
6. **Root:** The **root** user (also known as the superuser) is a user on the computer who has access to everything and can perform all tasks (including administration tasks). You shouldn't log on as root unless you need to.

Graphical programs that need root access will usually prompt you for a password, or from the terminal use **su** or **sudo**.

7. **X:** X (also might be called X11 or the XWINDOW System) is a bit of software that provides the basic graphical functionality that all the desktop environments use.
8. **Kernel:** The kernel is the bit of software at the heart of the operating system. It deals with all the low-level tasks like managing your hardware, the processes running on the system and keeping everything running smoothly.

If you have any terms you want added to this post (whether or not you know the definition), why not share them in the comments?

9. **Shell:** Shell is a command interpreter which interprets commands for syntax checking on command prompt and passes to the kernel for execution and if syntax problem then it throws an exception.
10. **Service:** It is program which may run as a background process or foreground process. We can start and stop different services just Like To start network service we can write **service network start** Or to stop service **service network stop**.

We can start and stop the services of NFS, samba, ftpd, httpd servers.

Example : service nfs start





1.7 Distributions (Flavors of Linux)


Linux is actually just a kernel. You can obtain the sources for the kernel to compile and install it on a machine and then obtain and install many other freely distributed software programs to make a complete Linux installation.

These installations are usually referred to as Linux systems, because they consist of much more than just the kernel- Most of the utilities come from the GNU Project of the Free Software Foundation.

Many people have put together ready-to-install distributions (often called flavors), usually downloadable or on CD-ROMs or DVDs, that contain not just the kernel but also many other programming tools and utilities. These often include an implementation of the X Window System, a graphical environment common on many UNIX systems.

GNU Linux Distributors are

Linux Distribution	Description	Website/Logo
Fedora → Red Hat Linux: http://www.redhat.com	A commercial business distribution used mainly for Internet servers	 red hat®
SuSE Linux: http://www.suse.com	openSUSE is a community-created Linux distribution sponsored by Novell.	 SuSE
Mandrake Linux: http://www.mandrakesoft.com	A community Linux distribution initially forked from Mandriva Linux in response to the discontinuation of free versions of Mandriva Linux.	 MandrakeSoft™
Debian GNU/Linux: Ubuntu http://www.debian.org/	Debian is an older Linux distribution which comes with the GNOME desktop environment by	

	default, It is also FREEBSD with 37500 packages.	
Slackware Linux: http://www.slackware.com/	One of the original distribution sets popular with Linux geeks	

1. **Ubuntu:** Like most of you, Ubuntu is my #1 choice for desktop Linux. I use it both at home and work. Ubuntu is the #1 in the Linux desktop market and some use Ubuntu for the servers also. Ubuntu offers the following three editions.

- Ubuntu Desktop Edition
- Ubuntu Server Edition
- Ubuntu Notebook Remix

Website Details:

Home Page: <http://www.ubuntu.com>

2. **Debian:** Debian is also called as Debian GNU/Linux, as most of the basic OS tools comes from the GNU Project. Lot of other famous distributions are based on Debian, which includes our #1 distro Ubuntu and many others — such as Knoppix, Linspire, Damn Small Linux etc.,

Website Details:

Home Page: <http://www.debian.org/>

3. **Fedora:** Fedora is sponsored by Red Hat. If you are interested in experimenting with the the leading technologies, you should use fedora, as the release cycle is very short and fedora tends to include the latest technology software/packages in it's distribution.

Website Details:

Home Page: <http://www.fedoraproject.org/>

4. **CentOS:** If your organization does not want to spend money on purchasing Red Hat support, but still want all the benefits of the red-hat distribution, this is obviously the best choice, as this is totally based on the red-hat enterprise Linux.

CentOS is designed for people who need an enterprise class OS without the cost or support of the prominent North American Enterprise Linux vendor.

Website Details:

Home Page: <http://www.centos.org/>

5. **Red Hat:** This is my favorite server distribution. If an organization doesn't mind spending dollars on purchasing the red-hat support, this is always #1 recommendation to any organization who runs mission critical applications.

Red Hat Linux for mission critical production application is that Red Hat tends to take some of the new features from Fedora, which is well tested by the community.

Website Details:

Home Page: <http://www.redhat.org/>

1.8 Linux kernel vs distribution

Sr. No.	Linux Kernel	Distribution
1	Kernel is core of operating system bridges conventional software and hardware of your system.	Linux Distribution like Ubuntu, Redhat, Fedora, A typical Linux distribution comprises a Linux kernel, GNU tools and libraries, additional software, documentation.
2	The Linux kernel is a Unix-like computer operating system kernel. The Linux operating system is based on it and deployed on both traditional computer systems, usually in the form of linux distributions, and on embedded devices such as routers.	A Linux distribution (often abbreviated as distro) is an operating system made from a software collection, which is based upon the Linux kernel and, often, a package management system.
3	The Linux kernel was conceived and created in 1991 by Linus Torvalds. The Linux kernel, Its a free and open source software. The Linux kernel is released under the GNU General Public License released under various non-free licenses.	There are commercially backed distributions, such as Fedora (Red Hat), openSUSE(SUSE) and Ubuntu(Canonical Ltd.), and entirely community-driven distributions, Most distributions come ready to use and pre-compiled for a specific instruction set, while some distributions (such as Gentoo) are distributed mostly in source code form and compiled locally during installation.
4	Eg: Linux Kernel	Different distribution Like Redhat, Ubuntu, Suse, Mandrake, Debin etc....

1.9 Why Learn Linux?

Since Linux has many advantages and features to use it, Some of them are as follows :

- Licensee Free:** Linux is License Free software, No registration and Licensing fees is required.
- Security (Virus Free with inbuilt Firewall protection):**The security aspect of Linux is much stronger, Inbuilt Firewall protection is available hence Linux is not prone to viruses.
- OpenSource :** Linux is a opensource software hence source code is open & easily available on internet. It can be downloaded can be modified and customized.
- Customizable :** It is Customized with different types of hardware and software
- Flexibility :** Linux is a flexible freeware operating system.
- Cost:** The most obvious advantage of using Linux is the fact that it is free to obtain, Hence Cost is negligible.
- Linux is versatile :** you can use Linux on virtually anything you develop
- Linux is a community:** you can work with other Linux developers to share knowledge and learnings
- Linux is very stable :** Linux systems rarely crash, and when they do, the whole system normally does not go down. The “blue screen of death” familiar to windows users is not a worry for Linux users.

10. **Linux has different distributors and flavors:** Linux comes in all sizes and flavors, which offers a wide variety from which to choose the distro which will best suit your needs. Like Redhat, Ubuntu, Debin, Mandrake, Slackware, Suse etc...
11. **Linux has lots of support for all sorts of Programming languages:** Languages Like C/C++, Java, PHP, Ruby, Python, Perl, and so many more all work perfectly in Linux. If a specific language that you'd like to use isn't already installed by default, you can just get the necessary packages straight from your distribution's repositories.
12. **Bash Scripting:** Linux has capability of writing scripts and different blocks.
13. Different inbuilt servers available which requires restarting, re-configuring, upgrading, etc
14. Linux is also distributed under an open source license. Open source follows the following key Philosophies:
 - The freedom to run the program, for any purpose.
 - The freedom to study how the program works, and change it to make it do what you wish.
 - The freedom to redistribute copies so you can help your neighbor.
 - The freedom to distribute copies of your modified versions to others.

1.10 Importance of Linux in software ecosystem

1.10.1 Features of Linux

1. **GUI** (Graphical User Interface)
2. **Multitasking:** No of programs running at same time.
3. **Multuser:** Several users on the same machine at the same time
4. **Multiplatform:** Number of processors at a time. runs on many different CPUs, not just Intel.
5. **Multiprocessor:** Kernel supports multiple independently thread of a single process or multiple process.
6. **Multithreading:** Has native kernel support for multiple independent threads of control within a single process memory space.
7. **Linux runs in a protected mode on 386 machine.** It has memory protection between processes so that that one program can't bring whole system down.
8. It **supports virtual memory** using paging i.e. separate partition or file in file system created.
9. **Dynamically linked shared libraries** & static libraries.
10. It is an **open source software** hence all source code is available including the kernel and all drivers. Also all development tools and all user program all are freely distributed on the net.
11. **Multiple virtual consoles** i.e. it has several independent login sessions to console. You can switch by pressing hot key combination. These are dynamically allocated you can use upto 64.
12. **Linux has different filesystem** depending upon file system like FAT32, VFAT, NTFS or NFS, ext3, ext4, swap(RAM)
13. It **supports Network connectivity**
14. It **supports Network Servers** like It supports TCP/IP Networking including FTP, Telnet, NFS, etc.
15. It has **Hardware Support**
16. **Firewall Protection** inbuilt available so that no outsider intruder can attack on our System.
17. It has its **Own K-office**

18. **Linux supports network client and server** with static Routing & Dynamic Routing with the help of DHCP.
19. **Linux supports ‘Samba Server’** for connectivity of windows & linux file sharing.
20. **It Supports different Time Servers** with sendmail facility.
21. **It supports ftp & http services** with apache web server.

1.10.2 WebServers

1. **Economical:** Linux is an open source operating system, Its all versions are available with lower price other than web servers., hence Linux web servers are the best to choose for web hosting services.
2. **Flexibility:** Linux provides a flexible hosting environment with plenty of high performance applications. You can use both desktop and server applications, along with embedded systems. Disk space can easily be saved because you can install only the components you plan to use. For example, you can install just a few office programs instead of the entire suite.
3. **High Up time:** high up time decides how long a web server functions well. Linux servers have high up-time because of its robust performance and reliable.
4. **Stability and Performance:** If hosting package includes Linux based server then performance is good of web servers. This operating system is the most stable and doesn't slow down over time or freeze up. Linux web servers don't experience memory leaks and the up-times are often much better than other servers.
5. **Inexpensive Hosting:** Linux is an open source operating system, which means it's free to use. Most web hosting companies prefer Linux because it helps keep the cost down,
6. **Multitasking:** Linux server can run multiple programs simultaneously and its enables programs to run continuously in the background while user works with some other programs. Hence Linux web servers to have multitasking capabilities.

1.10.3 SuperComputers

1. **Customization:** Linux open source nature make source code available to modify code or make customization of code with supercomputer administration. Hence custom server implantation is possible.
2. **Less overhead, i.e way faster:** Linux does not require extra softwares to update or upgrade.
3. **No need for reboots**
4. **10,000 times more stable:** Linux with supercomputers are more stable.
5. **Easier to automate with scripts**
6. **Easier backup facility** available of linux servers with supercomputers

1.10.4 Mobile

1. Google's Android developers modified the Linux kernel and created Anriod operating system which is based on Linux kernel (core of operating system)
2. Android OS is owned by Google and powered by the Linux kernel, which can be found on a wide range of devices.

3. Android is an open source operating system which allows developers to access unlocked hardware and develop new programs as they wish.
4. Android manages processes and different Apps to keep minimum power consumption.
5. The Android Market, which is the Android equivalent of the Apple App Store is home to millions of apps, many of which are completely free.

1.10.5 Servers

Linux servers are very powerful of their outstanding characteristics like security, stability and flexibility. These Linux servers has inbuilt web servers and business applications which supports network administration and web and database management services.

Following are the Key features of Linux servers :

1. **High Level Security:** Since security is main concern hence Linux servers provides high level of security with the help of firewall protection and powerful system administration and file access system to provide authorization.
2. **Ease of administration:** Linux servers are easily administrated. They can be controlled and managed remotely. It reduces cost because no additional software setup for the administration is required.
3. **Supports multiple applications:** Linux servers supports many software applications because of its inbuilt technical strength.
4. **Flexibility in Customization:** Linux servers are easy to customize. TH users have great level of flexibility to modify source code of the server as per their requirement.
5. **Reliable:** These servers are very reliable as they offer consistent services without any failures.

Questions

1. Define what are different operating systems in market. Explain Linux operating System in detail.
2. Explain features of Linux in detail
3. Explain features of Linux in detail with different Linux distributions.
4. Explain Linux Architecture with neat diagram.
5. What is Linux? Define History of Linux
6. Explain about Philosophy of Linux
7. What is Linux Community and state the names of Linux communities.
8. Explain Linux Terminology
9. Explain Linux different Distributions in detail.
10. Explain Linux kernel vs different distribution
11. Define different reasons Why we learn Linux
12. Explain Importance of Linux in software ecosystem
13. Explain importance of Linux in web servers
14. Explain importance of Linux in Supercomputers
15. Explain importance of Linux in Mobile
16. Explain importance of Linux servers

