



Lab 01 – Introduction to Linux OS and Basic Commands in Linux

Objectives

- Learn about Linux OS and its Distributions
- Learn about Linux File Hierarchy and Basic Directory Commands
- Learn about Virtualization
- Learn about Linux Terminal and Shell
- Learn about basic commands and permissions in Linux

Guide on How to Set Up Your VM

1. Download Virtual Machine Application: <https://www.virtualbox.org/wiki/Downloads>
2. Download Ubuntu .iso file: <https://ubuntu.com/download/desktop>
3. Installation Procedure: <https://www.youtube.com/watch?v=IOwlnpWPuj0>
4. For Mac, check out this link:
<https://codingwithmanny.medium.com/installing-ubuntu-18-04-on-mac-os-with-virtualbox-ac3b39678602>

Operating System

An Operating System (OS) is an interface between a computer user and computer hardware. It is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is a vital component of the system software in a computer system.

Some popular OS include Linux OS, Windows OS, Android, iOS, etc.



Linux Operating System

Linux is an open source and free software operating system built around the Linux kernel and was first released by Linux Torvalds on September 17, 1991. There is a family of OS which uses the name 'Linux' to emphasize that many Linux distributions share Linux kernel.

Linux distributions include Fedora, Debian, Linux Mint, CentOS and so on. The most popular of all when it comes to desktop installation is Ubuntu.

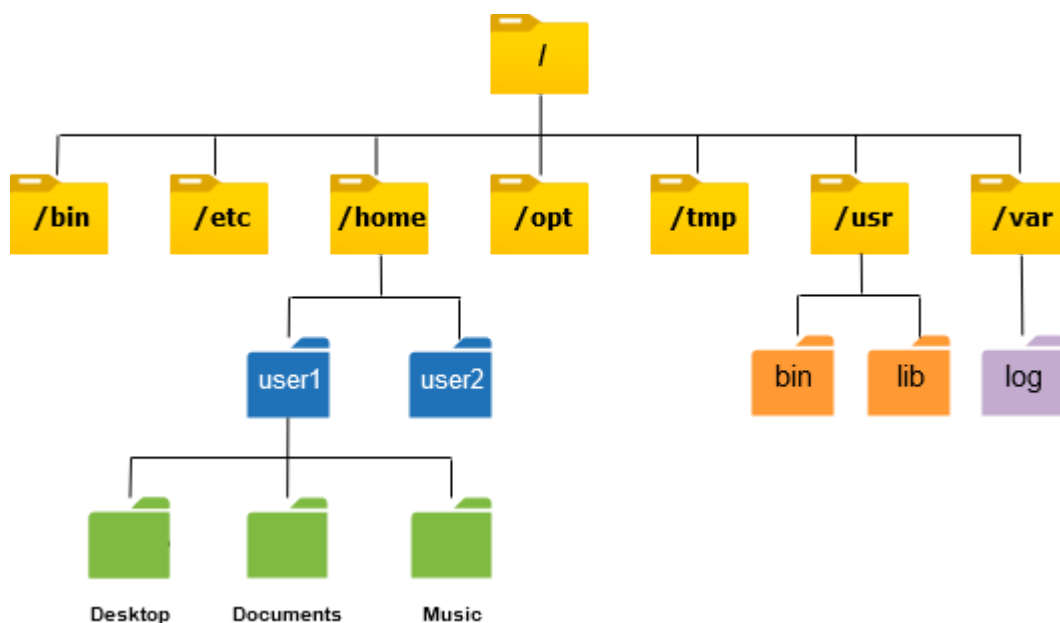
Features of Linux OS

Following are some of the important features of the Linux Operating System.

- **Portable:** Portability means software can work on different types of hardware in the same way. Linux kernel and application programs support their installation on any kind of hardware platform.
- **Open Source:** Linux source code is freely available and it is a community based development project. Multiple teams work in collaboration to enhance the capability of Linux OS and it is continuously evolving.
- **Multi-User:** Linux is a multiuser system which means multiple users can access system resources like memory/ RAM/ application programs at same time.
- **Multiprogramming:** Linux is a multiprogramming system which means multiple applications can run at same time.
- **Hierarchical File System:** Linux provides a standard file structure in which system files and user files are arranged.
- **Shell:** Linux provides a special interpreter program which can be used to execute commands of the OS. It can be used to do various types of operations, call application programs, etc.
- **Security:** Linux provides user security using authentication features like password protection, controlled access to specific files and encryption of data.

Linux File Hierarchy

The way the files of an operating system are organized on the disk. All the files are grouped together in the directory structure. The file-system is arranged in a hierarchical structure, like an inverted tree. The top of the hierarchy is traditionally called root (written as a slash /). Linux sorts directories descending from the root directory according to their importance to the boot process. The File system hierarchy standard (FHS) governs the unified file system for Linux by defining a standard set of directories, sub-directories and files. Linux is a case sensitive operating system.



The Root Directory

All the directories in the Linux system come under the root directory which is represented by a forward slash (/). Everything in your system can be found under this root directory even if they are stored in different virtual or physical devices.

Linux Directories

Following is the categorization of the directories according to the type of file. Directory type Types of files stored

Binary directories Contains binary or compiled source code files, e.g. /bin, /sbin.



Configuration directories	Contains configuration files of the system, e.g. /etc, /boot.
Data directories	Stores data files, e.g. /home, /root.
Memory directories	Stores device files which don't take up actual hard disk space, e.g. /dev, /proc, /sys.
USR (Unix System Resources)	Contains sharable, read only data, e.g. /usr/bin, /usr/lib.
var (variable directory)	Contains larger size data, e.g. /var/log, /var/cache.
Non-standard directories	Directories which do not come under standard FHS, e.g. lost+found, /run, etc.

Ubuntu

Ubuntu is an open source and freely available operating system, one of the Linux distributions i.e. it is based on Linux kernel. It was a project started by Mark Shuttleworth. There are several flavors of Ubuntu in markets like Ubuntu desktop for personal computing, Ubuntu server for servers and Ubuntu core for a network of physical devices popularly known as the Internet of things (IoT). Ubuntu is the most used type of Linux based OS in desktop installations. Linux is basically command based but some distros provide GUI based Linux. Gnome and KDE are the most used GUIs.

Virtualization

Virtualization refers to the use of software to allow system hardware to run multiple instances of different operating systems concurrently, allowing you to run different applications requiring different operating systems on one computer system.



Virtual Machine

A Virtual Machine (VM) is an OS or application environment that is installed on software, which imitates dedicated hardware .For e.g. VMware Workstation, VMware Fusion and VirtualBox etc.

VirtualBox

Oracle VM VirtualBox is a program for Windows, Linux, and Solaris etc. which enables you to install alternative operating systems within your current (host) operating system.

Linux Terminal and Shell

In a Linux system, the shell is a command-line interface that interprets a user's commands and script files, and tells the server's operating system what to do with them. It hides the details of the underlying operating system and manages the technical details of the operating system kernel interface, which is the innermost component of most operating systems.

On most Linux systems a program called bash (which stands for Bourne Again SHell, an enhanced version of the original Unix shell program, Sh) acts as the shell program. Besides bash, there are other shell programs that can be installed in a Linux system. These include: ksh, tcsh and zsh.

The Linux command line or Terminal is a text interface to your computer. It is a program that opens a window and lets you interact with the shell. It provides a way for the kernel and other processes to send text output to the user, and to receive text input from the user.



Linux Basic Commands

Keyboard Shortcuts

Commands	Description
Up Arrow	Used to show the previous command
Ctrl + C	Halts the current command or cancels the current operation and/or starts with a fresh new line
Ctrl + L	Clears the screen
Ctrl + A	Returns to the start of the command you're typing
Ctrl + E	Used to go to the end of the command you're typing
Ctrl + W	Deletes the word / argument left of the cursor in the current line
Ctrl + D	Used to log out of current session, similar to exit

System information Commands

date	Shows current system date and time
%m	Displays month of the year (in digits)
%d	Displays day of the month (in digits)



%D	Displays date (as mm/dd/yy)
%H	Displays hour (00 to 23)
%M	Displays minutes (00 to 59)
%S	Displays seconds (00 to 59)
%T	Displays time as HH:MM:SS
cal	Shows current month's calendar
uname	Shows kernel or system information
-a	Prints all the basic information currently available from the system.
-r	Prints the operating system release level
-s	Prints the operating system name
-m	Prints the machine hardware type
-p	Prints the machine's processor type
-v	Prints the operating system version



df	It is used to display the amount of space used and the amount of free
-h	Displays sizes in megabytes (M) and gigabytes (G)
-k	Displays the data in 1KB blocks
du	(Disk Usage) This command is used to estimate and display the disk space used by files. It shows the disk usage as per directory level.
-h	Used to print sizes in human readable format
-a	Used for printing all files including directories
-c	Used to print total size
-s	To get summary of file system
--time	Used to get the timestamp of last modified

File Handling Commands

ls	Used to list directory contents
-a	Lists all the files, including hidden files



-F	Displays the file type along with the name
-R	Displays the contents of the specified directory and sub directories
-r	Displays files and sub-directories in the reverse order
-S	Lists all files sorted by file size
-t	Lists all files sorted by last modified
-m	Shows comma separated output
-Q	Shows quoted output
-A	Displays the hidden files as well as the files beginning with '.'
-l	Displays a detailed list of files and directories
-laC	Displays a detailed list of files and directories in columns
cd	Used to change directory
pwd	Used to print name of current working directory
touch	Used to create a file



mv	Used to rename a file
rm	Used to remove files or directories
-i	Prompts for confirmation before deleting
find	Searches for files in a directory hierarchy
history	Prints recently used commands
dir	It works like the default ls command i.e. lists the files in a sorted manner.
locate	Used to find all instances of a file.
file	Tells you the type of file
man	Shows manual for command
file	Determine file types
less	View file contents

System Administration Commands

chmod	Used to change file access permissions
passwd	Changes your password



who	Used to display names of all the users currently logged on to the system, their display login name, terminal type and number, date and time of logging and the remote host name of the terminal of the users who have not logged in to the server.
-b	Indicates the most recent startup time and date
-l	Lists any login process
-H	Displays a header
-q	Prints only the login names and the number of users logged in
reboot	Used to reboot the system
poweroff	Used to power off the system

Text processing Commands

Cat	Used to display, create, read or modify files and for file concatenation
Echo	Used to display a line of text
Wc	(Word Count) Used to print number of lines, words and bytes/characters in files



Permissions

On Linux, there is a set of rules for each file which defines who can access that file. The command name `chmod` (Change Mode) is used to define the way a file can be accessed

Permissions define the permissions for the owner of the file (the "user"), members of the group who owns the file (the "group"), and anyone else ("others").

The first character: file type

The first character in each list is either a dash (-) or the letter d.

- A dash (-) indicates that the file is a regular file.
- The letter d indicates that the file is a directory, which is basically a special kind of file.

Permissions for files are represented by the following letters.

- r refers to the read permission.
- w refers to the write permission.
- x refers to the execute permission.

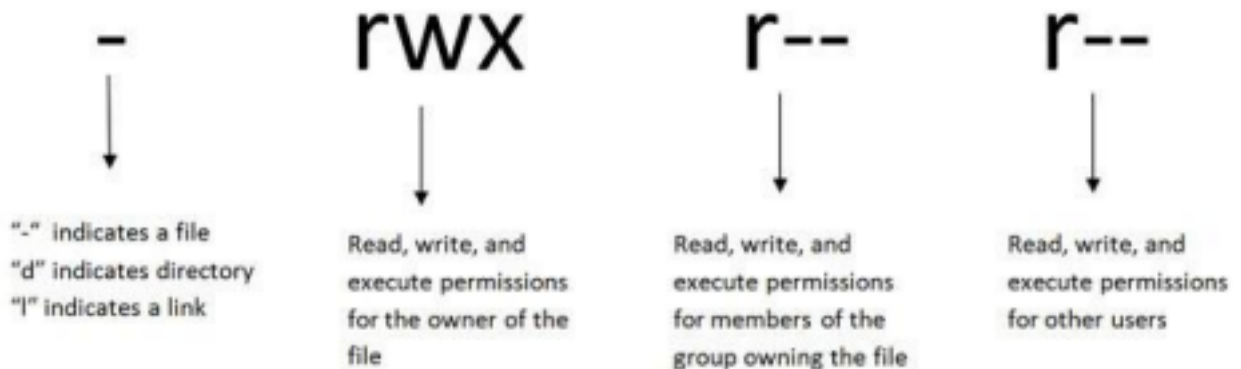
Number Octal Number representation Permission Symbol

0 000 No Permission ---

1	001	Execute	--x
2	010	Write	-w
3	011	Execute +write	-wx
4	100	Read	r--
5	101	Read +Execute	r-x



6	110	Read + write	rw
7	111	Read + write + execute	rwX



The command for changing directory permissions for group owners is similar, but add a “g” for group or “o” for users:

```
chmod g+w filename
```

```
chmod g-wx filename
```

```
chmod o+w filename
```

```
chmod o-rwx foldername
```

Assignment # 01

1. Write a command to display ALL information about your machine.
2. Write the ls command in such a way that it displays file permissions, owner of the file, group of the file, file size in bytes, file name and file modified time.
3. Create three text files namely file1, file2 and file3 and write some text in those files. Next, concatenate file1 and file2 with file3. Lastly, count the total number of words and lines in the file file3.
4. What is the command used for getting the time and date at which the System was last booted up?



5. The `rmdir` command is also used to delete the directory. However, it is different from the `rm` command. What is the difference? Elaborate by running the command and explaining its output.

Submission Guidelines

1. Rename your file as RollNumber_OSLab1.
2. Take a screenshot of each task (take ss of ALL tasks separately).
3. Copy paste all the screenshots in order on Google DOCS under the correct question. Don't just copy paste randomly.
4. Center align all the screenshots.
5. Copy/paste the Shared Link on LMS under Assignment Tab.
6. Make sure that the setting is set to "View only".