National University of Computer and Emerging Sciences

Operating System Lab - 01

Lab Manual

Objective

The purpose of this lab manual is to introduce Operating System and Linux along with its basic commands.

Operating System

Operating System(OS) is a set programs that manages the activities of the computer system and lets the user use the system resources effectively.

An OS creates ability to:

- serve a variety of purposes
- interact with users in more complicated ways
- keep up with needs that change overtime
- management of the processor, RAM, I/O
- file and information Management
- management of execution of applications

Examples of OS are: Microsoft Windows, MAC OS, Ubuntu etc.

UNIX and LINUX

In 1969 - 1970, kenneth Thompson, Dennies Ritchie and others at AT&T Bell Labs began developing a small operating system. The operating system was soon recognized as UNIX. Later this system was rewritten in C Programming language, due to this UNIX was the first widely used operating system. In 1991, Linus Torvalds began developing an operating system kernel, which he named "Linux". The kernel could combine with the FSF (Free Software Foundation) materials and other components to produce a freely modifiable and very useful operating system.

Linux is not derived from UNIX source code but its interface is intentionally like UNIX. Linux is considered to be the friendliest UNIX like operating system. Linux is free. It can be downloaded from the internet or redistributed under GNU License. Most UNIX like operating systems are not free. However, some LINUX distributed like RedHat provide additional support, bug fixing and consultancy for an additional fee.

For this lab and upcoming labs, we will be using Ubuntu (Linux Distribution). All Linux distribution has two modes of operation,

- terminal (also called BASH (Bourne Again Shell)),
- graphical user interface (GUI).

Once we see how it works, we will jump onto command line or BASH; for the purpose that we are interested not in using Linux but in programming in Linux, command prompt just lets you do this, since GUI is less customizable.

Software Requirements

For this course, we will use

- VMWare Workstation PRO 12.X
- Ubuntu 16.04 LTS

to demonstrate and practice lab exercises.
If you would like to install Ubuntu 16.04 LTS or any other version on a host you can follow this LINK.

Linux File System Architecture

Generalized file system provides a simple and unified way to access resources on a hard drive. The basic unit is a file. A file consists of essential data, metadata (data about the data), nonessential metadata and some information. Essential data can only be edited by the file system driver and other privilege programs because improper editing may cause the file to become un-usable. Nonessential metadata contain information useful for indexing systems. A directory/folder is a file that may contain other directories or files.

The file system on Linux is managed a little differently from the conventional setting you see in windows. In Linux, the main directory (my Computer in windows) is root (represented as /, not an alphabetical name, so /home means home directory in root folder). Just like windows it has got directories for specific purpose, like devices, documents, downloads etc. The physical hard drive partitions are shown in figure 1.1, where hda is commonly used for hard drive, sda for flash drive. The common directory structure of Linux is as follows:

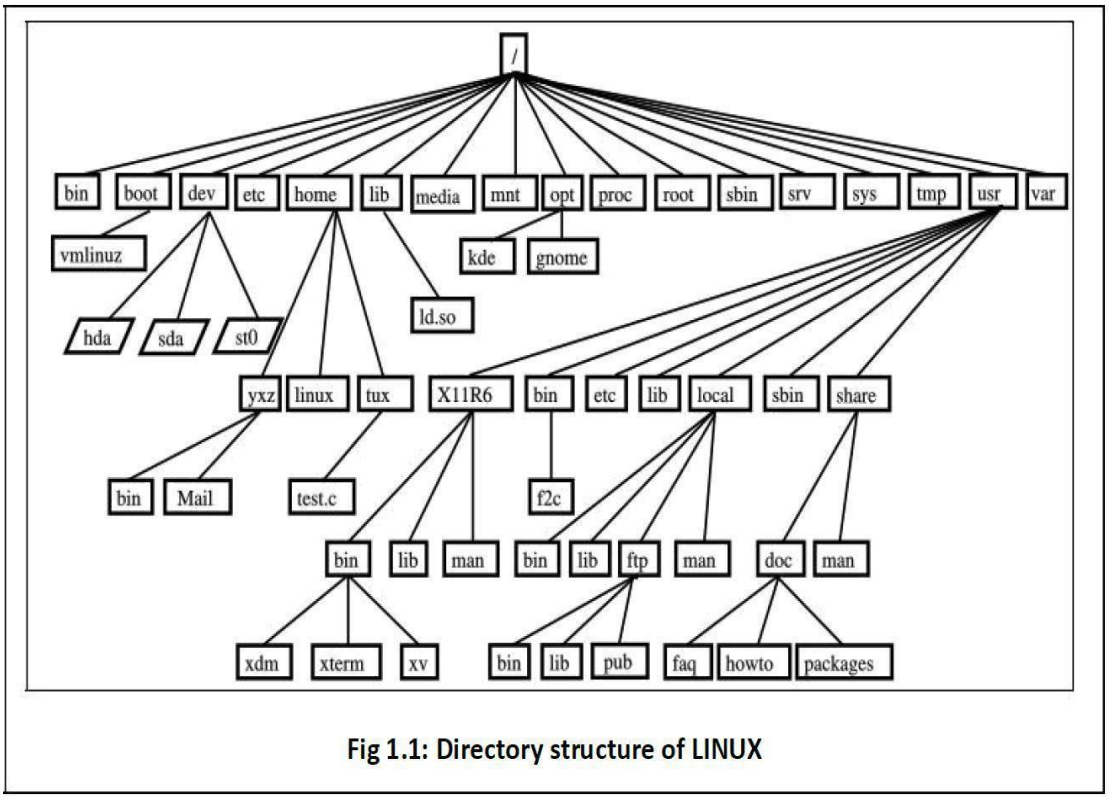


Fig 1.1: Directory structure of LINUX

Directories of Linux

Directory	Description
/	Root directory, this directory contains all other directory
/bin	This contains programs needed for the early boot process, also contains commands binaries
/boot	static files of the boot loader
/dev	This directory contains list of all devices installed on the system to be mounted
/etc	The folder contains system configuration file
/etc/init.d	Contain boot scripts, the file necessary to boot a system
/home	The folder contains private directories of a user, it includes the functionality like My Documents (of MS Windows)
/lib	Shared libraries (dynamic link programs)
/lost+found	The directory is installed during operating system installation and it contain files that are broken and recovered from un-expected system crash.
/mount	Mount for removable media
/mnt	Mount for temporary file system
/opt	Optional software, add-ons, plug-ins etc. (e.g. GNOME)
/proc	Contains process files, contains running process data
/run	The directory is for applications to save their transient data, till the application finishes execution
/sbin	Contains the programs reserved for the system administrator and needed for booting
/srv	Data file for services provided by the system
/sys	Contains systems files, where all device information for the kernel is gathered
/tmp	Folder for temporary files
/usr	Contains all user's application data, cookies browsing history etc.

/usr/bin	generally accessible programs, programs installed for all users on the system
/usr/include	header files for the C compiler
/usr/g++	header files for the C++ compiler
/usr/sbin	contains programs reserved for system administrator
/usr/share/doc	contains various documentation files
/usr/share/man	this folder has system manual pages
/usr/src/Linux	kernel source code
/var	configuration files (such as those linked from /usr)
/var/adm	System administration data
/var/log	Contains log files
/var/tmp	Contains temporary files

For detailed explanation please visit

- http://www.howtogeek.com/117435/htg-explains-the-linux-directory-structure-explained/
- http://www.tecmint.com/linux-directory-structure-and-important-files-paths-explained/

Editors in Linux

The following are the top five widely used editors for Linux:

Editor's Name	Features
NANO	It is a simple text editor, and it is capable of editing a file within the terminal
VIM	The most used text editor for operating system running via SSH protocol for editing or creating a file
VI	VI can be found on embedded devices
EMACS	A text editor contains features for programming. EMACS is content aware, fully documented, plugin supported and much more.
GEDIT	Also, content aware, easy to use and read. Widely used by beginners

How to use VIM

VIM text editor has four modes:

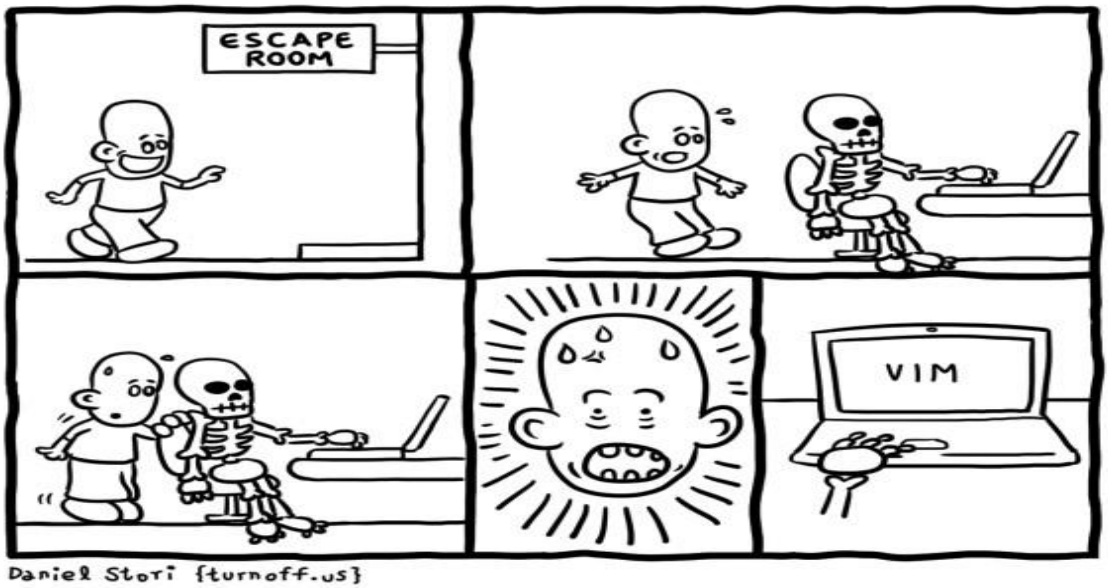
- Insert: to type text
- Command: also known as normal mode
- Ex: to issue colon commands
- Visual: to select text visually

The Insert mode is not default; you must press ‘i’ to move into insert mode. Type some text in the screen. Press the <Esc> button to get out of insert mode into Command mode. The command mode is used to move about, and to manipulate text, sometimes in interesting ways. The Visual mode is used to select text, press v to enter it and select some text, then you can issue commands that will apply only to the selected area, type <Esc> again to return to Command mode. The Ex mode is used to issue colon commands, which is used for operations like saving, search & replace and configuring vim. Save the text you just typed in by going to the Ex mode by pressing ‘:’ from the normal mode and typing :w filename<Enter> .Quit vim by executing the colon command ‘:q’. To summarize,

- vim (to start vim)
- i (to insert text)
- <type text> <Esc> (to come to command mode)
- :w filename (to save the text to the file 'filename')
- :q (to quit the file)
- :q! (to quit without saving)
- vim filename (to open the file you just saved directly in vim)

However, it is best to learn vim by using it. You can quickly learn the basics of vim by using the inbuilt vim tutorial, by typing vim-tutor in the terminal. Using the Ex: command ‘:help’ from inside Vim is often very useful.

For more help regarding VIM, visit: https://help.ubuntu.com/community/VimHowto



Introduction to Terminal

"Under Linux there are GUIs (graphical user interfaces), where you can point and click and drag, and hopefully get work done without first reading lots of documentation. But the traditional environment is a CLI (command line interface), where you type commands to tell the computer what to do. That is faster and more powerful, but requires finding out what the commands are."

To start the terminal press ‘ctrl + alt + t’ or type ‘terminal’ in search.

We will go through commands in terminal with great details in the next lab but you can go to this link to increase your knowledge about using the terminal.