"Creativity is subtraction"

Eigen Letters

Location: Mumbai, India

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Hey friends, this is the first edition of my newsletter. I am happy that this has finally come to reality. Its name comes from my love for the concept of eigenvalues and eigenvectors in Linear Algebra. In future, I will be sharing my version of these concepts.

Learning is something that always starts from scratch and we rarely talk about the initial process of learning. I believe that the world can become a much better place if people choose to share their learning processes and experiences. I firmly believe in the idea of knowledge sharing and my *website* is the first step towards that. I may not be perfect but will always try my best to put the best content forward.

Talking about the content of *Eigen Letters*, in every edition I shall try to deliver one core concept which has the potential to be new learning for many. These concepts will be centred around control theory, mathematics, machine learning and yeah sometimes be ready for surprises. In this edition, I will discuss the Linux Command Line and how to get started with it.

Linux Command Line

Linux is a community of open-source Unix like operating systems that are based on the Linux Kernel. It was initially released by Linus Torvalds on September 17, 1991. Fig. 1 shows the architecture of Linux.

Kernel: *A kernel is the core component of an operating system. It acts as a bridge between applications and the data processing performed at the hardware level.*
Shell: *Shell is an interface that allows users to communicate with the kernel.*

The command line also known as *shell*, provides a powerful, transparent interface between the user and the internals of a computer. In general, operating system shells use either a command-line interface (CLI) or graphical user interface (GUI), depending on a computer's role and particular operation. It is named a shell because it is the outermost layer around the operating system (*source: wiki*).

In Linux (we are using Ubuntu 20.04), the shell can be accessed by opening a terminal window. The shell provides an interface, called *command-line-interface*, that can be used to run commands and navigate through the filesystem. There exists different types of shells like Bourne shell (sh), Korn shell (ksh), C shell (csh) and Born Again Shell (bash). For Ubuntu distribution, the default shell is Bash. For a detailed shell comparison, you may visit *this article*.

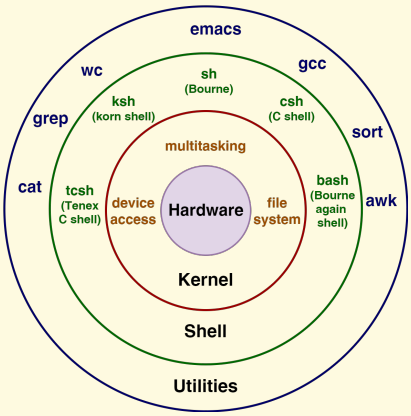

Fig. 1: Linux Architecture

Now, we shall discuss about various commands used in the shell language.

• Paths and pwd

The file space is made up of many nested directories and the location of each directory is given by a "*path*". These paths can be either *absolute* or *relative*.

As, the name suggests, the absolute path begins at the top of the filesystem directory tree. The very top of the filesystem directory tree is called the *root directory* and path to root directory is **/**. Therefore, absolute paths start with **/**. For example: the absolute paths to bin and lib directories are */bin* and */lib* respectively.

Paths can also be relative to the directory you are currently working on. The current working directory is denoted with one dot (**.**) and directory immediately above it represented with two dots (**..**). The shell starts your session from a special directory called *home directory*, which is represented by the character tilde (~) as shown in Fig. 2.

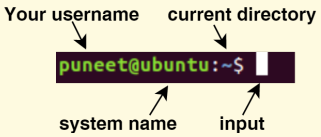

Fig. 2: Linux command line structure

The command **pwd** returns the full path of current working directory. I would encourage you to open the terminal window, type pwd command hit enter and see the path of your home directory. I got the following output.

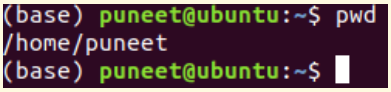

Fig. 3: pwd output

You can observe that ~, has entirely replaced the home directory path i.e. */home/puneet*.

• Listing the Contents (ls)

ls command prints a list of all the files and subdirectories in a directory.

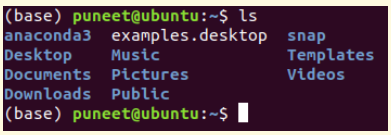

Fig. 4: ls output

• Changing Directories (cd)

The command **cd** is used to change the directories. The syntax for doing this is, **$ cd [target directory]**. If you are in some other directory and wants to return to your home directory, type cd and enter. This will change directories to the default location, the home directory.

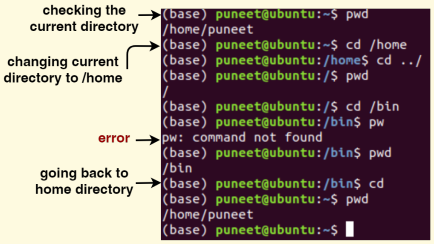

Fig. 5: cd output

• File Inspection (head and tail)

These commands are used to inspect the content of a file. The **head** command is used to print the first ten lines of a given file. Whereas, the **tail** command is complementary to the head command