

# DevOps Certification Training

Study Material – Linux Fundamentals



## What is Linux ?

**LINUX** is an operating system, or a kernel distributed under an open-source license. Its functionality list is quite like UNIX. The kernel is a program at the heart of the Linux operating system that takes care of fundamental stuff, like letting hardware communicate with software.

## Why do we need an Operating System ?

Every time you switch on your computer, you see a screen where you can perform different activities like write, browse the internet or watch a video. What is it that makes the computer hardware work like that? How does the processor on your computer know that you are asking it to run a mp3 file?

Well, it is the operating system or the kernel which does this work. So, to work on your computer, you need an Operating System (OS). In fact, you are using one as you read this on your computer. Now, you may have used popular OS's like Windows, Apple OS X, but here we will learn introduction to Linux operating system, Linux overview and what benefits it offers over other OS choices.



## Who originally created Linux?

### Linus Torvalds

Linux® is an open-source operating system (OS). It was originally conceived of and created as a hobby by **Linus Torvalds** in 1991. Linus, while at university, sought to create an alternative, free, open-source version of the MINIX operating system, which was itself based on the principles and design of Unix. Currently Linux is licensed under the GPLv2 license.

## Evolution of Linux

So **Linus devised a Kernel** named Linux in 1991. Though he would need programs like File Manager, Document Editors, Audio -Video programs to run on it. Something as you have a cone but no ice-cream on top.

As time passed by, he collaborated with other **programmers in places like MIT** and applications for Linux started to appear. So around 1991, a working Linux operating

system with some applications was officially launched, and this was the start of one of the **most loved and open-source OS options available today**.

The earlier versions of Linux OS were not so user-friendly as they were in use by computer programmers and **Linus Torvalds never had it in mind to commercialize** his product.

This definitely curbed the Linux's popularity as other commercially oriented Operating System Windows got famous. Nonetheless, the open-source aspect of the Linux operating system made it more robust.

### **What are various features of Linux ?**

#### **1. Open Source**

As it is open source, its source code is easily available. Anyone having programming knowledge can customize the operating system. One can contribute, modify, distribute, and enhance the code for any purpose.

#### **2. Security**

The Linux security feature is the main reason that it is the most favorable option for developers. It is not completely safe, but it is less vulnerable than others. Each application needs to authorize by the admin user. The virus is not executed until the administrator provides the access password. Linux systems do not require any antivirus program.

#### **3. Free**

Certainly, the biggest advantage of the Linux system is that it is free to use. We can easily download it, and there is no need to buy the license for it. It is distributed under GNU GPL (General Public License). Comparatively, we have to pay a huge amount for the license of the other operating systems.

#### **4. Lightweight**

Linux is lightweight. The requirements for running Linux are much less than other operating systems. In Linux, the memory footprint and disk space are also lower. Generally, most of the Linux distributions required as little as 128MB of RAM around the same amount for disk space.

## 5. Stability

Linux is more stable than other operating systems. Linux does not require to reboot the system to maintain performance levels. It rarely hangs up or slow down. It has big up-times.

## 6. Performance

Linux system provides high performance over different networks. It is capable of handling a large number of users simultaneously.

## 7. Flexibility

Linux operating system is very flexible. It can be used for desktop applications, embedded systems, and server applications too. It also provides various restriction options for specific computers. We can install only necessary components for a system.

## 8. Software Updates

In Linux, the software updates are in user control. We can select the required updates. There a large number of system updates are available. These updates are much faster than other operating systems. So, the system updates can be installed easily without facing any issue.

## 9. Distributions/ Distros

There are many Linux distributions available in the market. It provides various options and flavors of Linux to the users. We can choose any distros according to our needs. Some popular distros are Ubuntu, Fedora, Debian, Linux Mint, Arch Linux, and many more.

For the beginners, Ubuntu and Linux Mint would be useful and, Debian and Fedora would be good choices for proficient programmers.

## 10. Live CD/USB

Almost all Linux distributions have a Live CD/USB option. It allows us to try or run the Linux operating system without installing it.

## 11. Graphical User Interface

Linux is a command-line based OS but, it provides an interactive user interface like Windows.

## 12. Suitable for programmers

It supports almost all of the most used programming languages such as C/C++, Java, Python, Ruby, and more. Further, it offers a vast range of useful applications for development.

The programmers prefer the Linux terminal over the Windows command line. The package manager on Linux system helps programmers to understand how things are done. Bash scripting is also a functional feature for the programmers. It also provides support for SSH, which helps in managing the servers quickly.

## 13. Community Support

Linux provides large community support. We can find support from various sources. There are many forums available on the web to assist users. Further, developers from the various opensource communities are ready to help us.

## 14. Privacy

Linux always takes care of user privacy as it never takes much private data from the user. Comparatively, other operating systems ask for the user's private data.

## 15. Networking

Linux facilitates with powerful support for networking. The client-server systems can be easily set to a Linux system. It provides various command-line tools such as ssh, ip, mail, telnet, and more for connectivity with the other systems and servers. Tasks such as network backup are much faster than others.

## 16. Compatibility

Linux is compatible with a large number of file formats as it supports almost all file formats.

## 17. Installation

Linux installation process takes less time than other operating systems such as Windows. Further, its installation process is much easy as it requires less user input. It does not require much more system configuration even it can be easily installed on old machines having less configuration.

## 18. Multiple Desktop Support

Linux system provides multiple desktop environment support for its enhanced use. The desktop environment option can be selected during installation. We can select any

desktop environment such as GNOME (GNU Network Object Model Environment) or KDE (K Desktop Environment) as both have their specific environment.

## 19. Multitasking

It is a multitasking operating system as it can run multiple tasks simultaneously without affecting the system speed.

## What is Linux Shell ?

The shell can be defined as a command interpreter within an operating system like Linux/GNU or Unix. It is a program that runs other programs. The shell facilitates every user of the computer as an interface to the Unix/GNU Linux system. Hence, the user can execute different tools/utilities or commands with a few input data.

The shell sends the result to the user over the screen when it has completed running a program which is the common output device. That's why it is known as "**command interpreter**".

The shell is not just a command interpreter. Also, the shell is a programming language with complete constructs of a programming language such as **functions, variables, loops, conditional execution**, and many others.

For this reason, GNU/Unix Linux Shell is stronger than the Windows shell.

## What are various types of Shell ?

There are various types of shell, which are as follows:

1. Bash Shell
2. Csh/Tcsh Shell
3. Ksh Shell
4. Zsh Shell
5. Fish Shell

### 1. Bash Shell :

In the bash shell, bash means Bourne Again Shell. It is a default shell over several distributions of Linux today. It is a sh-compatible shell. It could be installed over Windows OS. It facilitates practical improvements on sh for interactive and programming use which contains:

- Job Control

- Command-line editing
- Shell Aliases and Functions
- Unlimited size command history

## 2. Csh/Tcsh Shell :

Tcsh is an upgraded C shell. This shell can be used as a shell script command processor and interactive login shell.

Tcsh shell includes the following characteristics:

- C like syntax
- Filename completion and programmable word
- Command-line editor
- Job control
- Spelling correction

## 3. Ksh Shell :

Ksh means for **Korn shell**. It was developed and designed by **David G. Korn**. Ksh shell is a high-level, powerful, and complete programming language and it is a reciprocal command language as well just like various other GNU/Unix Linux shells. The usage and syntax of the C shell are very same as the C programming language.

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## 5. Fish Shell :

Fish stands for "**friendly interactive shell**". It was produced in 2005. Fish shell was developed to be fully user-friendly and interactive just like other shells. It contains some good features which are mentioned below:

- Web-based configuration
- Man page completions
- Auto-suggestions
- Support for term256 terminal automation
- Completely scripted with clean scripts

## What is Shell Scripting ?

The common concept of the shell script is the command list. A good shell script will contain comments which are preceded via # simbol.

Shell functions and scripts are interpreted. It means they aren't compiled.

There are also conditional tests like value Y is greater than value Z, loops permitting us to proceed by massive data amounts, files to store and read data, and variables to store and read data, and these scripts may contain functions.

The shells are usually interactive which means they receive commands as input through the users and run them. Although sometimes we routinely wish to run a set of commands, hence, we have to type within the commands all-time inside the terminal.

A shell script includes syntax similarly to other programming languages. When we have prior experience along with a programming language such as C/C++, Python, etc. It will be very easy to begin with it. The shell script combines the below components:

### Functions

- **Control flow:** if, else, then, shell loops, case, etc.
- **Shell commands:** touch, pwd, echo, ls, cd, etc.
- **Shell keywords:** break, if, else, etc.

### Shell Scripts Need

There are several causes to write these shell scripts:

- For automating manual task
- For avoiding repetitive work
- Shell scripting is used by system admins for many routine backups



- Including new functionalities to the shell
- System monitoring etc.

### **Shell Script Advantages**

- The syntax and command are exactly similar to those entered directly in a command line. Thus, the programmers don't have to switch to completely different syntax
- Interactive debugging
- Quick start
- It is much quicker to write the shell scripts etc.

### **Shell Script Disadvantages**

- A single error can modify the command which could be harmful, so prone to very costly errors.
- Design flaws in the language implementation and syntax.
- Slower execution speed.
- Offer minimal data structure dissimilar other scripting languages.
- Not well suited for complex and large tasks etc.

### **What is Linux Distributions and its types ?**

A typical Linux distribution comprises a Linux kernel, GNU tools and libraries, additional software, documentation, a window system (the most common being the X Window System, or, more recently, Wayland), a window manager, and a desktop environment.

Most of the included software is free and open-source software made available both as compiled binaries and in source code form, allowing modifications to the original software.

Few of the types are :

1. Ubuntu
2. Fedora
3. RedHat
4. CentOS

## Explain file permissions in Linux ?

There can be three types of users in Linux (File Owner, Group and Others) All the three owners in the Linux system have three types of permissions defined. Nine characters denotes the three types of permissions.

Permissions denoted as : - **RWX RWX RWX**

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.

File Permission Representation : - **RWX RWX RWX**

These 10 bits represents the file permissions for a file or a directory in linux.

- **1<sup>st</sup> bit** : It denotes whether the permissions are related to a file or a directory. 'd' represents permissions belong to a directory and '-' represents a file.
- **2<sup>nd</sup> – 4<sup>th</sup> bit** : It denotes permissions for owner.
- **5<sup>th</sup> – 7<sup>th</sup> bit** : It denotes permissions for a group.
- **8<sup>th</sup> – 10<sup>th</sup> bit** : It denotes permissions are set for others.