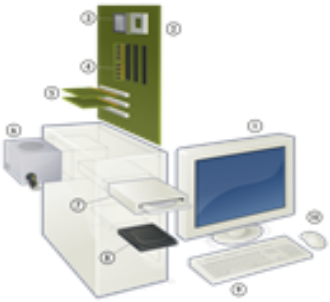
1. **Introduction to Computer hardware: Physical identification of major components of a computer system such as mother board, RAM modules, daughter cards, bus slots, SMPS, internal storage devices, interfacing ports. Specifications of desktop and server class computers. Installation of common operating systems for desktop and server use.**

INTRODUCTION TO COMPUTER HARDWARE

Computer hardware refers to the physical parts or components of a computer such as the monitor, mouse, keyboard, computer data storage, hard drive disk (HDD), system unit (graphic cards, sound cards, memory, motherboard and chips), etc. all of which are physical objects that can be touched.



MOTHERBOARD

The official motherboard definition is that it's the main printed circuit board within a computer, which means it's the primary piece of circuitry that all of the other pieces plug into to create a cohesive whole.

The motherboard is the backbone that ties the computer's components together at one spot and allows them to talk to each other. Without it, none of the computer pieces, such as the CPU, GPU, or hard drive, could interact. Total motherboard functionality is necessary for a computer to work well. If your motherboard is on the fritz, expect some big problems.

Some computer hardwares are:

1. Mouse & keyboard
2. USB
3. Parallel port
4. CPU Chip
5. RAM slots
6. Floppy controller
7. IDE controller
8. PCI slot
9. ISA slot
10. CMOS Battery
11. AGP slot
12. CPU slot
13. Power supply plug in

PROCESSOR

A processor (CPU) is the logic circuitry that responds to and processes the basic instructions that drive a computer. The CPU is seen as the main and most crucial integrated circuitry (IC) chip in a computer, as it is responsible for interpreting most of computers commands. CPUs will perform most basic arithmetic, logic and I/O operations, as well as allocate commands for other chips and components running in a computer.

DAUGHTER CARDS

Daughterboard (or daughter board, daughter card, or daughtercard) is a circuit board that plugs into and extends the circuitry of another circuit board. The other circuit board may be the computer's main board (its motherboard) or it may be

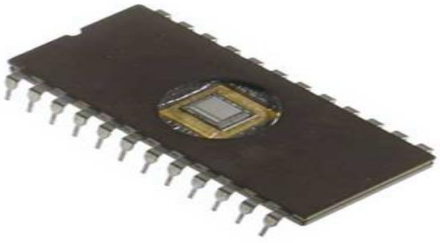
another board or card that is already in the computer, often a sound card. The term is commonly used by manufacturers of wavetable daughterboards that attach to existing sound cards. A mezzanine card is a kind of daughterboard that is installed in the same plane as but on a second level above the motherboard.

RAM

Random Access Memory (RAM) is a high-speed component in devices that temporarily stores all information a device needs for the present and future. It's a type of computer memory, that can be randomly accessed, meaning any byte of memory can be accessed without touching the preceding bytes. RAM is found in servers, PCs, tablets, smartphones, backup drives and other devices. In today's technology, RAM takes the form of integrated circuit chips with metal-oxide-semiconductor (MOS) memory cells. The speed and performance of a system is directly correlated with the amount of RAM installed. RAM stores the information a computer is actively using so that it can be accessed quickly. It allows computers to perform everyday tasks such as loading applications, browsing the internet, editing a spreadsheet, and switching quickly among all these tasks.

ROM

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap.



BUS SLOTS (Expansion slot)

Alternatively known as a bus slot or expansion port, an expansion slot is a connection or port inside a computer on the motherboard or riser card. It provides an installation point for a hardware expansion card to be connected. For example, if you wanted to install a new video card in the computer, you'd purchase a video expansion card and install that card into the compatible expansion slot.

The address bus, a one-way pathway that allows information to pass in one direction only, carries information about where data is stored in memory.

The data bus is a two-way pathway carrying the actual data (information) to and from the main memory.

The control bus holds the control and timing signals needed to coordinate all of the computer’s activities.

HDD/SSD

An HDD is a data storage device that lives inside the computer. It has spinning disks inside where data is stored magnetically. The HDD has an arm with several "heads" (transducers) that read and write data on the disk. It is similar to how a turntable record player works, with an LP record (hard disk) and a needle on an arm (transducers). The arm moves the heads across the surface of the disk to access different data.

SSDs got their name—solid state—because they have no moving parts. In an SSD, all data is stored in integrated circuits. This difference from HDDs has a lot of implications, especially in size and performance. Without the need for a spinning disk, SSDs can go down to the shape and size of a stick of gum or even as small as a postage stamp. Their capacity—or how much data they can hold—varies, making them flexible for smaller devices, such as slim laptops,

convertibles, or 2 in 1s. And SSDs dramatically reduce access time since users don’t have to wait for platter rotation to start up.

SMPS

The full form of SMPS is Switched Mode Power Supply also known as Switching Mode Power Supply. SMPS is an electronic power supply system that makes use of a switching regulator to transfer electrical power effectively. It is a PSU (power supply unit) and is usually used in computers to change the voltage to the appropriate range for the computer. An SMPS adjusts output voltage and current between different electrical configurations by switching the basics of typically lossless storage such as capacitors and inductors. Ideal switching concepts determined by transistors controlled outside of their active state that have no resistance when ‘on’ and carry no current when ‘off.’ It is the idea why switches with an ideal function will operate with 100 per cent output, that is, all input energy is provided to the load; no power is wasted as dissipated heating. In fact, such ideal systems do not exist, which is why a switching power source cannot be 100 per cent proficient, but it is still a vital improvement in effectiveness over a linear regulator.

INSTALLATION OF OPERATING SYSTEM IN OUR DESKTOP OR LAPTOP

An operating system, or "OS," is software that communicates with the hardware and allows other programs to run. They also allow you to install and run programs written for the operating system. Windows and Linux can be installed on standard PC hardware, while OS X is designed to run on Apple systems.

INSTALLATION PROCEDURE OF OPERATING SYSTEM

The following is an overview of the procedures that are needed to install a new operating system (OS).

1. Set up the display environment.

If you are not using the local DVD drive and monitor for the Tools and Drivers CD or OS installation CD, you have two options for your display environment.

View system output serially, through the Embedded Lights Out Manager (LOM) service processor (SP) SSH or through the physical port.

Use the remote KVMS Over IP feature of the Embedded LOM

2. Erase the primary boot disk.

If you have an operating system preinstalled on the server, you will need to remove it before installing a new operating system.

3. Set up the BIOS.

You need to make sure that the BIOS is set up for the operating system that you plan to install.

4. Install the operating system.

5. Configure your server for RAID.

If you plan to configure your server for RAID operation, you will need to perform some setup tasks before installing the operating system

6. Install the operating system, update the drivers, and run operating system updates, as necessary.

Choosing an Operating System Installation Method

The following is an overview of the possible methods of installation for the operating system that you plan to install.

- CD-ROM or DVD
- Network Installation (PXE/Jumpstart/RIS)
- Remote KVMS Over IP With Virtual CD-ROM
- Serial Redirection

- CD-ROM or DVD

  This method includes installing the operating system directly onto the server, using the server's onboard DVD, a USB connected drive, and a VGA monitor attached the the system. For more details on CD/DVD installation for your specific operating system, refer to the instructions included in your installation software or the online documentation referenced in the specific operating system

- Network Installation (PXE/Jumpstart/RIS)

  This method includes setting up an installation on a host server, and then installing the operating system over the network. Network installation methods include AutoYast for SUS, Kickstart for RedHat, Jumpstart for Solaris, and Remote Installation Services (RIS) for Windows. Due to missing network interface card (NIC) drivers in some operating systems, the following is recommended for network installations:

  Solaris - Use the Broadcom NICs connectors labelled 0 and 1

  Red Hat Enterprise Linux - Use the Broadcom NIC connectors labelled 0 and 1

  SUSE Linux Enterprise Server-Use either NVIDIA NIC connector labelled2&3

  Windows - Any of the Broadcom or NVIDIA NIC connectors.

- Remote KVMS Over IP With Virtual CD-ROM

  This method includes using a remote networked system to install the operating system onto the Sun Fire X2100 M2 server. The CD or DVD drive of the remote system (virtual cdrom) is used to access the operating system media.

HOW TO SELECT APPROPRIATE OPERATING SYSTEM FOR YOUR SYSTEM

Step 1: Check the system requirements:

If you have decided to install a new OS firstly you need to figure out which OS you want to use. Operating systems have different system requirements, so if you own an older computer, make sure that your computer can handle a newer version of operating system.

Step 2: Deciding whether to download or purchase:

If you want to install Windows on to your computer you need to purchase license. Each windows license comes up with an activation key which is good for one installation.

Step 3: Research about your software compatibility:

Make sure that the OS which you want to install on your computer supports all the programs that you want to use. If you want to use Microsoft Office, then you won't be able to install that application on a Linux machine.

Step 4: Get your new operating system:

If you have purchased a copy of Windows from any store, you should be given an installation disc along with your windows activation code. If you don't have the installation disc, but have a valid code, then you can download a copy of the installation disc online.

Step 5: Backup your data:

When you are installing a new OS, you are most likely going to wipe the hard drive in this process. This mean that you are going to lose all your files, until and unless you backup them

INSTALLATION OF SERVER SYSTEM

SERVER SYSTEM

A Server Core installation provides a minimal environment for running specific server roles, which reduces the maintenance and management requirements and the attack surface for those server roles. A server running a Server Core installation supports the following server roles:

Active Directory Domain Services (AD DS)

Active Directory Lightweight Directory Services (AD LDS)

DHCP Server

DNS Server

File Services

Print Services

Streaming Media Services

Web Server (IIS)

STEPS TAKE PART IN INSTALLATION

Phase 1: Collecting Information

In the first installation phase, the setup program asks for the preliminary information that it needs to begin the installation. A setup wizard prompts you for the following information:

Language: Select your language, time-zone, and keyboard type.

Product Key: Enter the 25-character product key that came with the installation media. If setup says you entered an invalid product key, double-check it carefully. You probably just typed the key incorrectly.

Operating System Type: The setup program lets you select Windows Server 2008 Standard Edition or Core. Choose Standard Edition to install the full server operating system; choose Core if you want to install the new text-only version.

License Agreement: The official license agreement is displayed. You have to agree to its terms in order to proceed.

Install Type: Choose an Upgrade or Clean Install type.

Disk Location: Choose the partition in which you want to install Windows.

Upgrade to NTFS: If you want to upgrade a FAT32 system to NTFS, you'll need to say so now.

Phase 2: Installing Windows

In this phase, Windows setup begins the actual process of installing Windows. The following steps are performed in sequence:

Copying Files: Compressed versions of the installation files are copied to the server computer.

Expanding Files: The compressed installation files are expanded.

Installing Features: Windows server features are installed.

Installing Updates: The setup program checks Microsoft's website and downloads any critical updates to the operating system.

Completing Installation: When the updates are installed, the setup program reboots so it can complete the installation.

Configuring Your Server

After you've installed Windows Server 2008, the computer automatically reboots, and you're presented with the Initial Configuration Tasks Wizard. This wizard guides you through the most important initial tasks for configuring your new server. The following list describes the server configuration settings available from this wizard:

Set the Administrator Password: The very first thing you should do after installing Windows is set a secure administrator password.

Set the Time Zone: This is necessary only if the indicated time zone is incorrect.

Configure Networking: The default network settings are usually appropriate, but you can use this option to change the defaults if you wish.

Provide Computer Name and Domain: This option lets you change the server's computer name and join a domain.

Enable Automatic Updating: Use this option if you want to let the server automatically check for operating system updates.

Download and Install Updates: Use this option to check for critical operating system updates.

Add Roles: This option launches the Add Roles Wizard, which lets you configure important roles for your server.

Add Features: This option lets you add more operating system features.

Enable Remote Desktop: Use this option to enable the Remote Desktop feature, which lets you administer this server from another computer.

Configure Windows Firewall: If you want to use the built-in Windows firewall

VIRTUALBOX INSTALLATION IN UBUNTU

VirtualBox is a general-purpose virtualization tool for x86 and x86-64 hardware, targeted at server, desktop, and embedded use, that allows users and administrators to easily run multiple guest operating systems on a single host.

Step 1: Open a terminal, and enter the following to update the repository:

sudo apt-get update

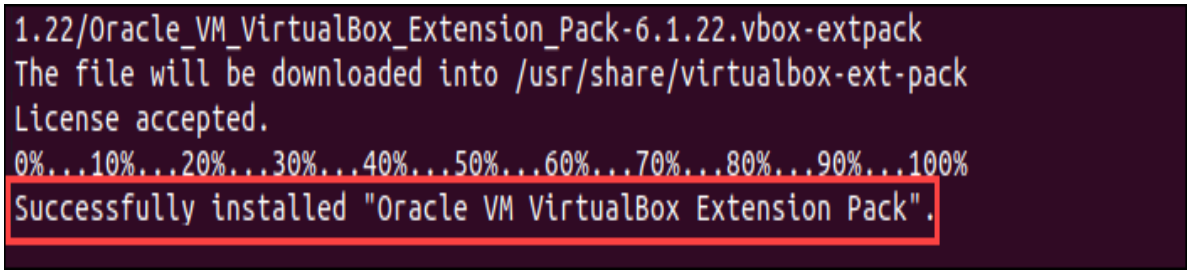
Step 2: Download and install VirtualBox by running:

sudo apt-get install virtualbox

Step 3: Next, install the VirtualBox Extension Pack:

sudo apt-get install virtualbox-ext–pack

OUTPUT:



2. Study of the terminal-based text editor such as Vim or Emacs. Basic Linux commands, familiarity with following commands/operations expected.

Here discussing some basic Linux commands.

1. man

The man stands for manual. The man command displays the user manual of any command that we run on the terminal. It displays the command details such as NAME, SYNOPSIS, OPTIONS, DESCRIPTION, EXIT STATUS, RETURN VALUES, FIL, ERRORS VERSIONS, AUTHORS, EXAMPLES.

Eg: man ls

Display the manual page for the item (program) ls.

2. ls, echo, read

ls

The ls command is used to view the contents of a directory. By default, this command will display the contents of your current working directory. If you want to see the content of other directories, type ls and then the directory's path. For example, enter ls /home/username/Documents to view the content of Documents.

echo

This command is used to move some data into a file.

Eg: If you want to add the text, "Hello, my name is John" into a file called name.txt, you would type echo Hello, my name is John >> name.txt

read

read command in Linux system is used to read from a file descriptor. Basically, this command read up the total number of bytes from the specified file descriptor into the buffer. If the number or count is zero then this command may detect the errors. But on success, it returns the number of bytes read. Zero indicates the end of the file. If some errors found then it returns -1.

Syntax: read

3. more, less, cat

more

As 'cat' command displays the file content. Same way 'more' command also displays the content of a file. Only difference is that, in case of larger files, 'cat'

command output will scroll off your screen while 'more' command displays output one screenful at a time.

Syntax: more <filename>

less

The 'less' command is same as 'more' command but include some more features.

It automatically adjusts with the width and height of the terminal window, while 'more' command cuts the content as the width of the terminal window get shorter.

Syntax: less <filename>

cat

cat (short for concatenate) is one of the most frequently used commands in Linux. It is used to list the contents of a file on the standard output stdout.

To run this command, type cat followed by the file's name and its extension.

Eg: cat file.txt.

cat -> filename creates a new file.

4. cd, mkdir, pwd, find

cd

To navigate through the Linux files and directories, use the cd. It requires either the full path or the name of the directory, depending on the current working directory that you're in.

cd .. (With two dots) to move one directory up

mkdir

Use mkdir command to make a new directory

Eg: If you type mkdir Music it will create a directory called Music.

pwd

Use the pwd command to find out the path of the current working directory (folder) you're in. The command will return an absolute (full) path, which is basically a path of all the directories that starts with a forward slash (/). An example of an absolute path is /home/username.

find

Find searches for files and directories. The difference is, you use the find command to locate files within a given directory.

Eg: find /home/ -name notes.txt command will search for a file called notes.txt within the home directory and its subdirectories.

5. mv, cp, rm, tar

mv

The primary use of the mv command is to move files, although it can also be used to rename files. The arguments in mv are similar to the cp command. You need to type mv, the file's name, and the destination's directory.

Eg: mv file.txt /home/username/Documents.

To rename files, the Linux is mv oldname.ext newname.ext

cp

Use the cp command to copy files from the current directory to a different directory. For instance, the command cp scenery.jpg /home/username/Pictures would create a copy of scenery.jpg (from your current directory) into the Pictures directory.

cp –i : will ask for user's consent in case of a potential file overwrite.

rm

The rm command is used to delete directories and the contents within them.

Eg: rm Music, will deletes the directory named Music.

tar

The tar command is the most used command to archive multiple files into a tarball a common Linux file format that is similar to zip format, with compression being optional.

6. wc, cut, paste

wc

wc command helps in counting the lines, words, and characters in a file. It displays the number of lines, number of characters, and the number of words in a file. Mostly, it is used with pipes for counting operation.

Syntax: wc [OPTION]... [FILE]...

wc [OPTION]... --files0-from=F

cut

cut command is useful for selecting a specific column of a file. It is used to cut a specific sections by byte position, character, and field and writes them to

standard output. It cuts a line and extracts the text data. It is necessary to pass an argument with it; otherwise, it will throw an error message.

Syntax: cut OPTION... [FILE]..

paste

Paste command is one of the useful commands in Unix or Linux operating system. It is used to join files horizontally (parallel merging) by outputting lines consisting of lines from each file specified, separated by **tab** as delimiter, to the standard output. When no file is specified, or put dash ("- ") instead of file name, paste reads from standard input and gives output as it is until an interrupt command **[Ctrl-c]** is given.

Syntax: paste [OPTION]... [FILES]...

7. head, tail, grep, expr

head

The head command is used to view the first lines of any text file. By default, it will show the first ten lines, but you can change this number to your liking.

For example, if you only want to show the first five lines, type head -n 5 filename.ext.

tail

This one has a similar function to the head command, but instead of showing the first lines, the tail command will display the last ten lines of a text file.

For example, tail -n filename.ext.

grep

Another basic Linux command that is undoubtedly helpful for everyday use is grep. It lets you search through all the text in a given file.

Eg: grep blue notepad.txt will search for the word blue in the notepad file. Lines that contain the searched word will be displayed fully. Usually output of a previous command is piped into the grep command.

For example: ls -l | grep "kernel"

expr

The expr command is used to evaluate a given expression and display its standard output. Each separated expression is considered as an argument. These expressions could be integer and string expressions, including regular expressions. If expressions are not passed properly, it will prevent the execution of the command. Syntax: expr expression

8. chmod, chown

chmod

Linux chmod command is used to change the access permissions of files and directories. It stands for change mode. It cannot change the permission of symbolic links. Even, it ignores the symbolic links come across recursive directory traversal.

Syntax: chmod <options> <permissions> <file name>

chown

Linux chown command is used to change a file's ownership, directory, or symbolic link for a user or group. The chown stands for change owner. In Linux, each file is associated with a corresponding owner or group. The Linux system may have multiple users. Every user has a unique name and user ID. If only a user is available in the system, the user will be the owner of each file.

Syntax: chown [OPTION]... [OWNER] [: [GROUP]] FILE...

9. Redirections & Piping

Redirection is a technique that essentially allows commands to either read data from a text file, or save the output to text files. In other words, it lets you redirect a command’s standard output to a file rather than displaying it on the screen.

Eg:

file1

$ cat file1

apple

102

cakes

drinks

bananas

500

301

After sorting:

file2

$ sort file2

102

301

500

apple

bananas

cakes

drinks

Piping is a technique that lets you use Linux commands as building blocks to build your own custom commands.

Eg:

$ ls -l

total 0

-rw-r--r--. 1 root root 0 Oct 20 19:22 file1

-rw-r--r--. 1 root root 0 Oct 20 19:22 file2

-rw-r--r--. 1 root root 0 Oct 20 19:22 file3

drwxr-xr-x. 2 root root 6 Oct 20 19:22 folder1

drwxr-xr-x. 2 root root 6 Oct 20 19:22 folder2

drwxr-xr-x. 2 root root 6 Oct 20 19:22 folder3

After piping:

$ ls -l | grep "^-"

-rw-r--r--. 1 root root 0 Oct 20 19:22 file1

-rw-r--r--. 1 root root 0 Oct 20 19:22 file2

-rw-r--r--. 1 root root 0 Oct 20 19:22 file3

10. useradd, usermod, userdel, passwd

useradd

useradd is used to create a new user, while passwd is adding a password to that user's account. To add a new person named John type, useradd John and then to add his password type, passwd 12345678

usermod

usermod command or modify user is a command in Linux that is used to change the properties of a user in Linux through the command line. After creating a user, we have to sometimes change their attributes like password or login directory etc. so in order to do that we use the Usermod command.

Eg: sudo usermod -c "This is test user" test_user

userdel

userdel is to remove a user is very similar to adding a new user. To delete the users account type,

Syntax: userdel UserName

passwd

passwd command in Linux is used to change the user account passwords. The root user reserves the privilege to change the password for any user on the system, while a normal user can only change the account password for his or her own account.

Syntax: passwd [options] [username]

Eg: Command: passwd

11. df,top, ps

df

Use df command to get a report on the system's disk space usage, shown in percentage and KBs. If you want to see the report in megabytes, type df -m.

top

As a terminal equivalent to Task Manager in Windows, the top command will display a list of running processes and how much CPU each process uses. It's very useful to monitor system resource usage, especially knowing which process needs to be terminated because it consumes too many resources.

ps

Ps command will display all current processes along with their process ids (PID). Read manuals for various options.

12. ssh, scp, ssh-keygen, ssh-copy-id

ssh

In Linux, ssh is a protocol, which stands for Secure Shell or Secure Socket Shell. The secure shell is useful for security while connecting to a remote server. The

ssh command uses a ssh protocol, which is a secure protocol, as the data transfer between the client and the host takes place in encrypted form. It transfers the input through the client to the host and returns the output transferred by the host. It executes through TCP/IP port 22. The encrypted connection is also used to run the commands on a Linux server, port forwarding, tunnelling, and more.

Syntax: ssh user_name@host(IP/Domain_name)

scp

scp (secure copy) command in Linux system is used to copy file(s) between servers in a secure way. The SCP command or secure copy allows secure transferring of files in between the local host and the remote host or between two remote hosts. It uses the same authentication and security as it is used in the Secure Shell (SSH) protocol. SCP is known for its simplicity, security and pre-installed availability.

Syntax:

scp [-346BCpqrTv] [-c cipher] [-F ssh_config] [-i identity_file] [-l limit] [-o ssh_option] [-P port] [-S program] [[user@]host1:]file1 … [[user@]host2:]file2

ssh-keygen

SSH or Secure Shell is a useful encrypted protocol to secure connections between the client and the server for different administrative tasks. It supports various types of authentication systems. Public key-based authentication and password-based authentication are mostly used. Key-based authentication is more secure than password-based based authentication. Authentication key pairs for the SSH are generated by the ssh-keygen tool that can be used for different purposes such as authenticating the host, automating login, etc.

```
fahmida@fahmida-VirtualBox:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/fahmida/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/fahmida/.ssh/id_rsa
Your public key has been saved in /home/fahmida/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:t6fQ9kVRmyF0en/TWldkVsNHeWjLrudX41H4dXkPrWI fahmida@fahmida-VirtualBox
The key's randomart image is:
+---[RSA 3072]----+
|             .o.*X|
|               *BB|
|              +.B=|
|               *oX|
|        S .   ..=%|
|         o .E.o=B|
|        . +..o+ +|
|         o +.....|
|          . .o.. |
+----[SHA256]-----+
fahmida@fahmida-VirtualBox:~$
```

ssh-copy-id

The ssh-copy-id command is a simple tool that allows you to install an SSH key on a remote server's authorized keys. This command facilitates SSH key login, which removes the need for a password for each login, thus ensuring a password-less, automatic login process. The ssh-copy-id command is part of OpenSSH, a tool for performing remote system administrations using encrypted SSH connections.

Eg: sudo apt-get update && sudo apt-get install openssh-client

OUTPUT

$ssh-copy-id
Usage: /usr/bin/ssh-copy-id [-h|-?|-f|-n] [-i [identity_file]] [-p port] [[-o <ssh -o options>] ...] [user@]hostname -f: force mode -- copy keys without trying to check if they are already installed -n: dry run -- no keys are actually copied -h|-?: print this help

3. File system hierarchy in a common Linux distribution, file and device permissions, study of system configuration files in /etc, familiarizing log files for system events, user activity, network events.

File System Hierarchy

The Linux File Hierarchy Structure or the Filesystem Hierarchy Standard (FHS) defines the directory structure and directory contents in Unix-like operating systems. It is maintained by the Linux Foundation.

- In the FHS, all files and directories appear under the root directory /even if they are stored on different physical or virtual devices.
- Some of these directories only exist on a particular system if certain subsystems, such as the X Window System, are installed.
- Most of these directories exist in all UNIX operating systems and are generally used in much the same way; however, the descriptions here are those used specifically for the FHS and are not considered authoritative for platforms other than Linux.

1. / (Root): Primary hierarchy root and root directory of the entire file system hierarchy.

- Every single file and directory start from the root directory
- The only root user has the right to write under this directory
- /root is the root user's home directory, which is not the same as /

2. /bin: Essential command binaries that need to be available in single-user mode; for all users, e.g., cat, ls, cp.

- Contains binary executables
- Common Linux commands you need to use in single-user modes are located under this directory.
- Commands used by all the users of the system are located here e.g., ps, ls, ping, grep, cp

3. /boot : Boot loader files, e.g., kernels, initrd.

- Kernel initrd, vmlinux, grub files are located under /boot
- Example: initrd.img-2.6.32-24-generic, vmlinuz-2.6.32-24-generic

4. /dev : Essential device files, e.g., /dev/null.
These include terminal devices, usb, or any device attached to the system.

- Example: /dev/tty1, /dev/usbmon0

5. /etc : Host-specific system-wide configuration files.

- Contains configuration files required by all programs.

- This also contains startup and shutdown shell scripts used to start/stop individual programs.
- Example: /etc/resolv.conf, /etc/logrotate.conf.

6. /home : Users' home directories, containing saved files, personal settings, etc.

- Home directories for all users to store their personal files.
- example: /home/kishlay, /home/kv

7. /lib : Libraries essential for the binaries in /bin/ and /sbin/.

- Library filenames are either ld* or lib*.so.*
- Example: ld-2.11.1.so, libncurses.so.5.7

8. /media : Mount points for removable media such as CD-ROMs (appeared in FHS-2.3).

- Temporary mount directory for removable devices.
- Examples, /media/cdrom for CD-ROM; /media/floppy for floppy drives; /media/cdrecorder for CD writer

9. /mnt : Temporarily mounted filesystems.

- Temporary mount directory where sysadmins can mount filesystems.

10. /opt : Optional application software packages.

- Contains add-on applications from individual vendors.
- Add-on applications should be installed under either /opt/ or /opt/ sub-directory.

11. /sbin : Essential system binaries, e.g., fsck, init, route.

- Just like /bin, /sbin also contains binary executables.
- The Linux commands located under this directory are used typically by system administrator, for system maintenance purpose.
- Example: iptables, reboot, fdisk, ifconfig, swapon

12. /srv : Site-specific data served by this system, such as data and scripts for web servers, data offered by FTP servers, and repositories for version control systems.

- srv stands for service.
- Contains server specific services related data.
- Example, /srv/cvs contains CVS related data.

13. /tmp : Temporary files. Often not preserved between system reboots, and may be severely size restricted.

- Directory that contains temporary files created by system and users.
- Files under this directory are deleted when system is rebooted.

14. /usr : Secondary hierarchy for read-only user data; contains the majority of (multi-)user utilities and applications.

- Contains binaries, libraries, documentation, and source-code for second level programs.
- /usr/bin contains binary files for user programs. If you can't find a user binary under /bin, look under /usr/bin. For example: at, awk, cc, less, scp

15. /proc : Virtual filesystem providing process and kernel information as files. In Linux, corresponds to a procfs mount. Generally, automatically generated and populated by the system, on the fly.

- Contains information about system process.
- This is a pseudo filesystem contains information about running process. For example: /proc/{pid} directory contains information about the process with that particular pid.
- This is a virtual filesystem with text information about system resources. For example: /proc/uptime

File permissions in Linux

Every file and directory in Linux have the following three permissions for all the three kinds of owners:

Permissions for files

- Read – Can view or copy file contents
- Write – Can modify file content
- Execute – Can run the file (if its executable)

Permissions for directories

- Read – Can list all files and copy the files from directory
- Write – Can add or delete files into directory (needs execute permission as well)
- Execute – Can enter the directory.

Each letter denotes a particular permission:

- r: Read permission
- w: Write permission
- x: Execute permission
- –: No permission set

Device Permissions on Linux

When using ykman on Linux, you may find that the tool is sometimes unable to access your YubiKey for some of the commands. This is often due to USB device permissions, and can be tested by running the same ykman command as root.

The YubiKey is accessed in several different ways, depending on which command is invoked.

Smart Card Access

For smart card-based applications, or when accessing a YubiKey over NFC, the access is done via pcscd, the PC/SC Smart Card Daemon. It's usually enough to have pcscd installed and running for this to work. Smart card access is required for the piv, oath, and openpgp commands, as well as for any command issued over NFC.

Keyboard Access

The Yubico OTP application is accessed via the USB keyboard interface. Permission is typically granted using udev, via a rules file. You can find an example udev rules file which grants access to the keyboard interface here. Keyboard access is required for the otp command.

FIDO Access

The FIDO protocols are accessed via a USB HID interface. As with keyboard access, permission is granted through udev. You can find an example udev rules file which grants access to a large number (not just YubiKeys) of FIDO devices here. FIDO access is required for the fido command.

4. Shell scripting: bash syntax, environment variables, variables, control constructs such as if, for and while, aliases and functions, accessing command line arguments passed to shell scripts. Startup scripts, login and logout scripts, familiarity with system and system 5 init scripts is expected.

1. Creating a shell script

Create a new directory bash_scripts where you will run the shell scripting exercises.

mkdir bash_scripts

cd bash_scripts

Note: It is recommended to create a new script file for every exercise; make them executable; give them names with extension .sh – it is just a convention rather than a must. The first line of a bash script starts with

#!/bin/bash

All non-executable comments in a script are prepended with #,
For example, we list all the files in the current director ls -la ls -l /etc
Comment. Here, we list files in /etc directory.
Script scr1.sh is like a calculator:

```
#!/bin/bash echo "I will work out X*Y"
echo "Enter X"
read X
echo "Enter Y"
 read Y
echo "X*Y = $X*$Y = $[X*Y]"
```

Make the script executable and run
chmod 755 scr1.sh
./scr1.sh

2. if and case statements

1)

```
#!/bin/bash
X=10
Y=5
if [ "$X" -gt "$Y" ]; then
echo "$X is greater than $Y"
elif [ "$X" -lt "$Y"]; then
echo "$X is less than $Y"
else
echo "$X is equal to $Y"
fi
```

2) #!/bin/bash

```
case $1 in
--test|-t)
echo "you used the --test option"
 exit 0
;;
--help|-h)
echo "Usage:"
echo " myprog.sh
[--test|--help|--version]"
exit 0
;;
 --version|-v)
echo "myprog.sh version 0.0.1"
 exit 0
;;
*)
echo "No such option $1"
 echo "Usage:"
echo " myprog.sh
[--test|--help|--version]"
 exit 1
;;
esac
echo "You typed \"$1\" on the command-line"
```

Note:always watch for correct syntax of case statement.

3) case string

```
in
regex1)
commands1
;;
regex2)
commands2
;;
.....
esac
```

Where regex is a regular expression to match the string. To catch all remaining strings, use *) at the end.

3. Looping with while and until statements

1) Script scr2.sh:

```
 #!/bin/bash
 N=1
while [ "$N" -le "10" ]
do
echo "Number $N"
 N=$[N+1]
done
```

2)Script scr3.sh

```
#!/bin/bash
N=1
until [ "$N" -gt "10" ]
do
echo "Number $N"; N=$[N+1]
done
```

Note: common mistakes in shell scripting are usually due to incorrect syntax. For example, there should be no spaces before and after operator "=" .

```
N=1 # correct
N =1 # error
N= 1 # error
N=$[N+1] # correct
N =$[N+1] # error
N= $[N+1] # error
```

4. Looping with for statement

1)Script scr4.sh

```
   #!/bin/bash
   for i in red white blue
    do
   echo "$i is a color"
   done
```

2)Script backup-lots.sh

```
   #!/bin/bash
   for i in 0 1 2 3 4 5 6 7 8 9 ;do
   cp $1 $1.BAK-$i
   done
```

Now create a file important_data with some numbers in it and then run
./backup-lots.sh important_data
which will copy the file 10 times with 10 different extensions. As you can see, the variable $1 has a special meaning – it is the first argument on the command-line.

Note: watch for correct syntax:

for i in 0 1 2 3 4 5 6 7 8 9 do .... done

The continue statement is useful for terminating the current iteration of the loop.

3) #!/bin/bash

```
for i in 0 1 2 3 4 5 6 7 8 9 ; do
 NEW_FILE=$1.BAK-$i
if [ -e $NEW_FILE ] ; then
echo "backup-lots.sh: **warning** $NEW_FILE"
echo " already exists - skipping"
continue
fi
cp $1 $NEW_FILE
done
```

5. Functions

Function definitions provide a way to group statement blocks into one.

1)

```
#!/bin/bash
function usage ()
 {
echo "Usage:"
echo " myprog.sh [--test|--help|--version]"
}
case $1 in
--test|-t)
echo "you used the --test option"
exit 0
;;
--help|-h)
usage
;;
--version|-v)
echo "myprog.sh version 0.0.2"
exit 0
;;
-*)
 echo "Error: no such option $1"
usage
exit 1
;;
 esac
echo "You typed \"$1\" on the command-line"
```

Note: watch for syntax:

2)

```
function usage ()
{
command1
command2; command3
......
}
```

The word function in a function is optional.
That is, the following will work as well:

3)

```
 usage ()
{
command1
command2; command3
.....
}
```

6. Using quotes

Single forward quotes ' protect the enclosed text from the shell.

1)

```
echo 'error $?'
echo 'shell name $0'
```

Double quotes " allow all shell interpretations to take place inside them.

2)

```
echo "error $?" #gives the error code of the last command
echo "shell name $0" #gives the current shell name
```

Command substitution

3)

```
X=`expr 100 + 50 '*' 3`
echo $X
```

Assigning command output to a variable:

4)

```
FSIZE=`wc -l /etc/profile`
```

same as

5)

```
FSIZE=$(wc -l /etc/profile)
```

7. Introduction to awk

The basic function of awk is to search files for lines or other text units containing one or more patterns. When a line matches one of the patterns, special actions are performed on that line. Display user names from /etc/passwd (field 1):

1)

awk -F: '{ print $1 }' /etc/passwd

Where F is the field separator in the passwd file. The fields are separated by : Default field separator is a blank space. Awk scans the input file and splits each input line into fields.

2)

cat /etc/passwd | awk -F: '{ print $1 }'

Display user names home directories and login shell (fields 1 and 7), and store them in a separate file, users.txt

3)

awk -F: '{ print $1, $6, $7 }' /etc/passwd > users.txt

or

cat /etc/passwd | awk -F: '{ print $1, $6, $7 }' > users.txt `

Default field separator is empty space. To print users (field 1) from just created file users.txt: awk '{ print $1 }' users.txt

8.Introduction to sed

String editor, sed, is used for editing lines in a file or a stream; output is going to the standard output and can be re-directed to a new file.

Syntax:

sed [options] 'command1' [files]

sed [options] -e 'command1' [-e command2 ...] [files]

sed [options] -f script [files]

Delete lines from 3 through 5 in file list.txt:

sed '3,5d' list.txt

Delete lines that contain “O” at the beginning of the line:

sed '/^O/d' list.txt

Translate capital C,R,O into small c,r,o:

sed 'y/CRO/cro/' list.txt

Delete empty lines:

sed '/^$/d' list.txt

Replace string Oop with Wee for the first occurence on a line

sed 's/Oop/Wee/' lsst.txt

Remove ss string (replace with empty entry)for the first occurence on a line:

sed 's/ss//' list.txt

Remove ss string for all occurrences on a line:

sed 's/ss//g' list.txt

Substitute a single space for any number of spaces wherever they occur on the line:

sed 's/ *\/ /g' list.txt

Substitute underscore for any number of spaces wherever they occur on the line:

sed 's/ *\/_/g' list.tx

5. **Installation and configuration of LAMP stack. Deploy an open-source application such as phpmyadmin and Wordpress.**

INSTALLING LAMP

Procedure:

Step 1: Update your system

sudo apt update

sudo apt upgrade

Step 2: Install Apache

sudo apt install apache2 -y

To check whether installed or not:

Open web browser and search localhost in address bar

then apache2 default page is displayed .Successfully installed.

Step 3: Firewall setting

sudo ufw status

if inactive the sudo ufw enable

sudo ufw app list

sudo ufw allow in “Apache Full”

clear

Step 4: Installing MySQL

sudo apt install mysql-server -y

or

sudo apt install mariadb-server mariadb-client

Check installation:

sudo systemctl status mysql

sudo mysql_secure_installation

sudo mysql

show databases;

create database name;

Step 5:Installing php

sudo apt install php -y

php version : php -v

cd /var/www/html

sudo gedit filename.php

Open web browser and search localhost/filename.php in address bar

Step 6:Install phpMyAdmin

sudo apt install php-mbstring php-zip php-gd php-curl php-json

sudo apt install phpmyadmin -y

Press space and enter

Set password

sudo systemctl restart apache2

Open browser and type localhost/phpmyadmin

Type username phpadmin and password

Step 7: Host WORDPRESS

1)Open browser and go to **https://wordpress.org/latest.zip**

2)Copy the link address and open terminal

3)Install wget (if not installed) -> sudo apt install wget

wget (paste the copied link address)

4)Install unzip (if not installed) -> sudo apt install unzip

5)Go to wordpress directory

cd wordpress/

6)Copy all the files in wordpress recursively

sudo cp –r * /var/www/html

cd /var/www/html

7)Remove one file name “index.html”

sudo rm –rf index.html

8)Change permission(ownership) of the files

sudo chmod –R www-data:www-data /var/www/

9)Open browser and type localhost

10)WordPress window will be opened -> successful installation

11)Select English Language and continue

12)Set database Connection details :

13)Open terminal

sudo mysql –u root –p

(Enter password of database)

- create database [databasename];
- create user “[username]” identified by “[password]”;
- grant all privileges on [databasename].* to “[username]”;
- exit

Database Name : [databasename]

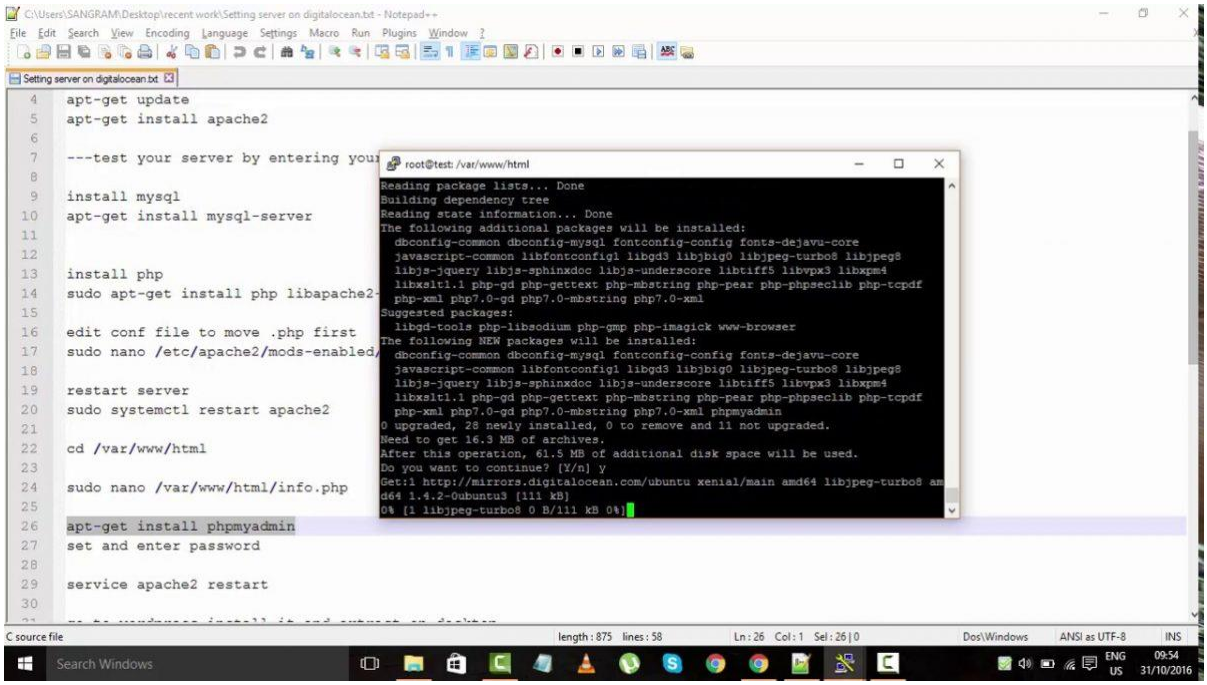
Username : [username]

Password : [password]

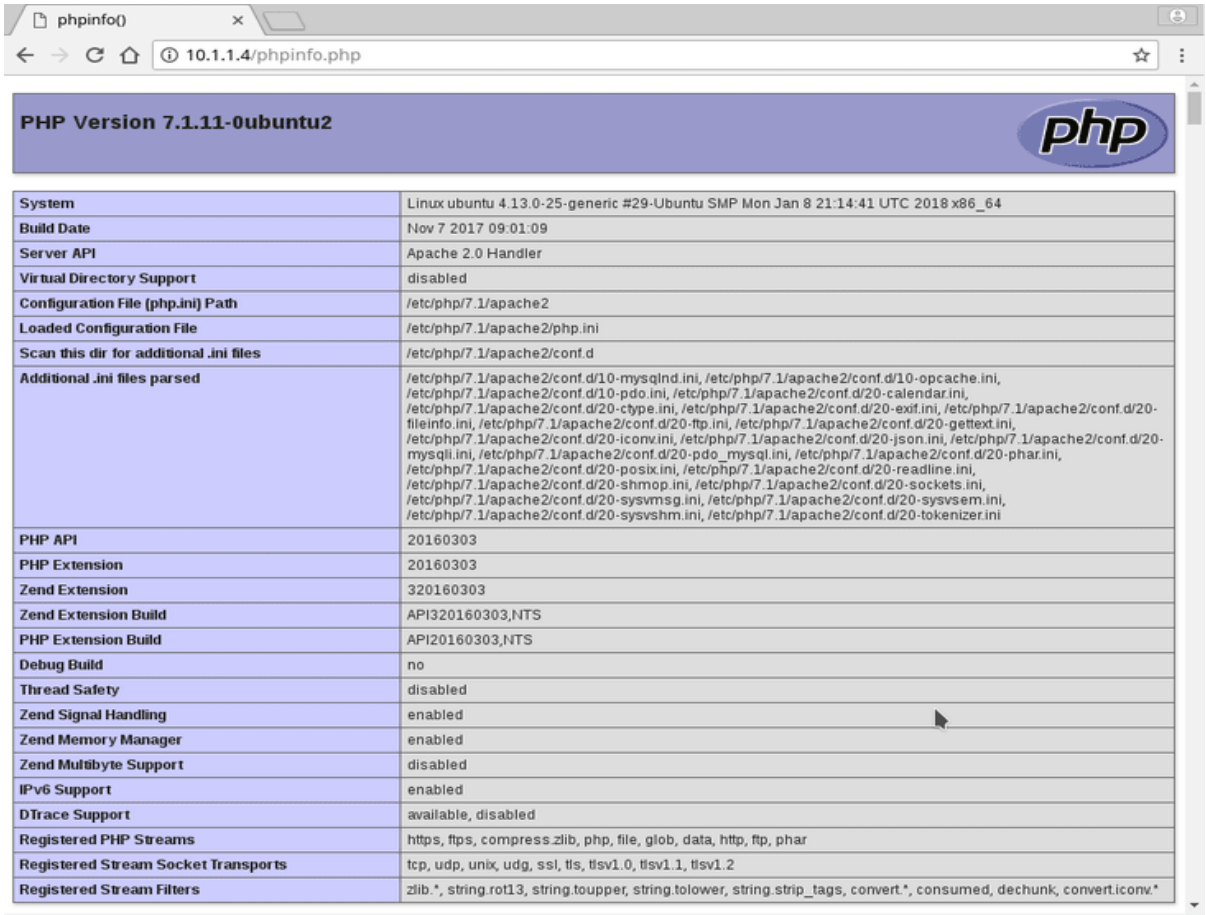
Database Host : localhost

Table Prefix : wp_

OUTPUT



PHPMYADMIN



System	Linux ubuntu 4.13.0-25-generic #29-Ubuntu SMP Mon Jan 8 21:14:41 UTC 2018 x86_64
Build Date	Nov 7 2017 09:01:09
Server API	Apache 2.0 Handler
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php/7.1/apache2
Loaded Configuration File	/etc/php/7.1/apache2/php.ini
Scan this dir for additional .ini files	/etc/php/7.1/apache2/conf.d
Additional .ini files parsed	/etc/php/7.1/apache2/conf.d/10-mysqlnd.ini, /etc/php/7.1/apache2/conf.d/10-opcache.ini, /etc/php/7.1/apache2/conf.d/10-pdo.ini, /etc/php/7.1/apache2/conf.d/20-calendar.ini, /etc/php/7.1/apache2/conf.d/20-ctype.ini, /etc/php/7.1/apache2/conf.d/20-exif.ini, /etc/php/7.1/apache2/conf.d/20-fileinfo.ini, /etc/php/7.1/apache2/conf.d/20-ftp.ini, /etc/php/7.1/apache2/conf.d/20-gettext.ini, /etc/php/7.1/apache2/conf.d/20-iconv.ini, /etc/php/7.1/apache2/conf.d/20-json.ini, /etc/php/7.1/apache2/conf.d/20-mysqli.ini, /etc/php/7.1/apache2/conf.d/20-pdo_mysql.ini, /etc/php/7.1/apache2/conf.d/20-phar.ini, /etc/php/7.1/apache2/conf.d/20-posix.ini, /etc/php/7.1/apache2/conf.d/20-readline.ini, /etc/php/7.1/apache2/conf.d/20-shmop.ini, /etc/php/7.1/apache2/conf.d/20-sockets.ini, /etc/php/7.1/apache2/conf.d/20-sysvmsg.ini, /etc/php/7.1/apache2/conf.d/20-sysvsem.ini, /etc/php/7.1/apache2/conf.d/20-sysvshm.ini, /etc/php/7.1/apache2/conf.d/20-tokenizer.ini
PHP API	20160303
PHP Extension	20160303
Zend Extension	320160303
Zend Extension Build	API320160303,NTS
PHP Extension Build	API20160303,NTS
Debug Build	no
Thread Safety	disabled
Zend Signal Handling	enabled
Zend Memory Manager	enabled
Zend Multibyte Support	disabled
IPv6 Support	enabled
DTrace Support	available, disabled
Registered PHP Streams	https, ftps, compress.zlib, php, file, glob, data, http, ftp, phar
Registered Stream Socket Transports	tcp, udp, unix, udg, ssl, tls, tlsv1.0, tlsv1.1, tlsv1.2
Registered Stream Filters	zlib.*, string.rot13, string.toupper, string.tolower, string.strip_tags, convert.*, consumed, dechunk, convert.iconv.*

6. Installation and configuration of common software frame works such as Laravel.

Installing Laravel

Procedure:

Step 1: Install Apache web server

To install apache2, type:

sudo apt install apache2

Once installed, Apache should be running. If it's not, for whatever reason, start it:

sudo systemctl start apache2

Then enable it to start on boot time.

sudo systemctl enable apache2

To verify the status of Apache, execute:

sudo systemctl status apache2

Step 2: Install PHP and additional PHP extensions

Laravel 8 requires PHP 7.3 or above.

PHP 7.4 is available in Ubuntu repositories. So, install PHP and the following PHP extensions.

sudo apt install php libapache2-mod-php php-mbstring php-cli php-bcmath php-json php-xml php-

When the installation is complete, verify the PHP version.

php –v

Step 3: Create Database for Laravel Application

Next up, we will create a database for the Laravel application. But first, we need to install a database server. Laravel supported database systems are MariaDB, MySQL, SQLite, Postgres, or SQL Server.

We will go with the MariaDB database engine.

sudo apt install mariadb-server

Once the database server is installed, log into the MariaDB prompt:

sudo mysql -u root -p

Once logged in create the database, database user, and grant all privileges to the database user.

CREATE DATABASE laravel_db;CREATE USER 'laravel_user'@'localhost' IDENTIFIED BY 'secretpassword';GRANT ALL ON laravel_db.* TO 'laravel_user'@'localhost';FLUSH PRIVILEGES;QUIT;

Step 4: Install Composer

Composer is a dependency package manager for PHP. It provides a framework for managing libraries and dependencies and required dependencies. To use Laravel, first install composer.

To download Composer, invoke the command shown.

curl -sS https://getcomposer.org/installer | php

Next, move the composer file to the /usr/local/bin path.

sudo mv composer.phar /usr/local/bin/composer

Assign execute permission:

sudo chmod +x /usr/local/bin/composer

Verify the Composer version installed:

composer -–version

Composer version 2.1.3 is installed.

Step 5: Install Laravel 8 on Ubuntu

With Composer installed, the next course of action is to install Laravel.

Navigate to the webroot directory, type:

cd /var/www/html

Now, install Laravel using the composer command, type:

sudo composer create-project laravel/laravel laravelapp

The command creates a new directory called laravelapp and installs all the files and directories for Laravel.

Step 6: Configure Apache to serve Laravel site

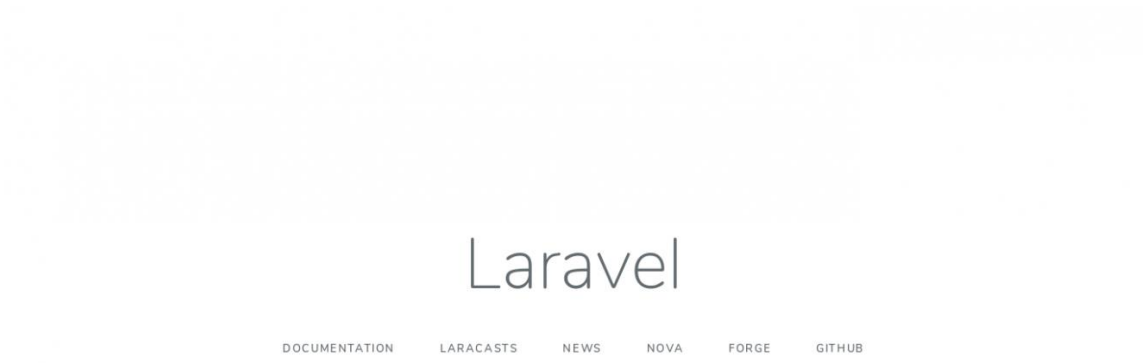
Lastly, we need to set up the Apache webserver to host the Laravel site. For that to happen, we need to create a virtual host file.

sudo vim /etc/apache2/sites-available/laravel.conf

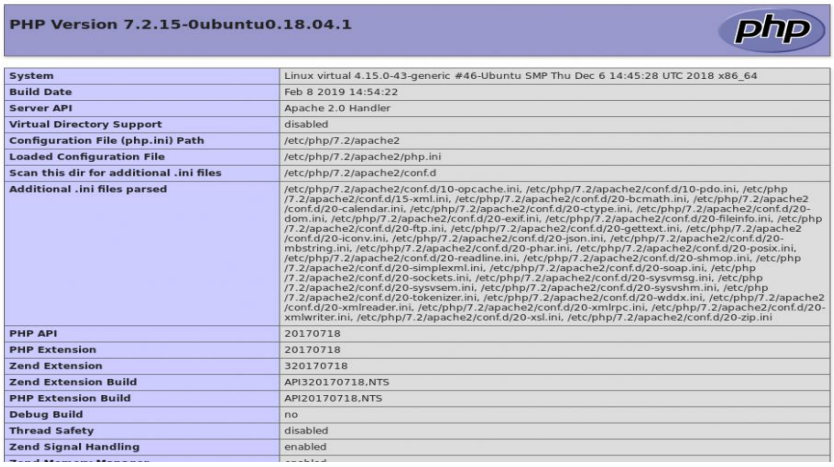
Step 7: Access Laravel from a browser

sudo apt Laravel

OUTPUT



PHPMYADMIN



PHP Version 7.2.15-0ubuntu0.18.04.1

System	Linux virtual 4.15.0-43-generic #46-Ubuntu SMP Thu Dec 6 14:45:28 UTC 2018 x86_64
Build Date	Feb 8 2019 14:54:22
Server API	Apache 2.0 Handler
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php/7.2/apache2
Loaded Configuration File	/etc/php/7.2/apache2/php.ini
Scan this dir for additional .ini files	/etc/php/7.2/apache2/conf.d
Additional .ini files parsed	/etc/php/7.2/apache2/conf.d/10-opcache.ini, /etc/php/7.2/apache2/conf.d/10-pdo.ini, /etc/php/7.2/apache2/conf.d/15-xml.ini, /etc/php/7.2/apache2/conf.d/20-bcmath.ini, /etc/php/7.2/apache2/conf.d/20-calendar.ini, /etc/php/7.2/apache2/conf.d/20-ctype.ini, /etc/php/7.2/apache2/conf.d/20-dom.ini, /etc/php/7.2/apache2/conf.d/20-exif.ini, /etc/php/7.2/apache2/conf.d/20-fileinfo.ini, /etc/php/7.2/apache2/conf.d/20-ftp.ini, /etc/php/7.2/apache2/conf.d/20-gettext.ini, /etc/php/7.2/apache2/conf.d/20-iconv.ini, /etc/php/7.2/apache2/conf.d/20-json.ini, /etc/php/7.2/apache2/conf.d/20-mbstring.ini, /etc/php/7.2/apache2/conf.d/20-phar.ini, /etc/php/7.2/apache2/conf.d/20-posix.ini, /etc/php/7.2/apache2/conf.d/20-readline.ini, /etc/php/7.2/apache2/conf.d/20-shmop.ini, /etc/php/7.2/apache2/conf.d/20-simplexml.ini, /etc/php/7.2/apache2/conf.d/20-soap.ini, /etc/php/7.2/apache2/conf.d/20-sockets.ini, /etc/php/7.2/apache2/conf.d/20-sysvmsg.ini, /etc/php/7.2/apache2/conf.d/20-sysvsem.ini, /etc/php/7.2/apache2/conf.d/20-sysvshm.ini, /etc/php/7.2/apache2/conf.d/20-tokenizer.ini, /etc/php/7.2/apache2/conf.d/20-wddx.ini, /etc/php/7.2/apache2/conf.d/20-xmlreader.ini, /etc/php/7.2/apache2/conf.d/20-xmlrpc.ini, /etc/php/7.2/apache2/conf.d/20-xmlwriter.ini, /etc/php/7.2/apache2/conf.d/20-xsl.ini, /etc/php/7.2/apache2/conf.d/20-zip.ini
PHP API	20170718
PHP Extension	20170718
Zend Extension	320170718
Zend Extension Build	API320170718,NTS
PHP Extension Build	API20170718,NTS
Debug Build	no
Thread Safety	disabled
Zend Signal Handling	enabled

7. **Build and install software from source code, familiarity with make and cmake utilities expected.**

Procedure:

Step 1: Set Up the Repository

sudo apt install cmake

Step 2: Install following packages

sudo apt install \

clang-tools lld llvm-dev libclang-dev liblld-10-dev \

libpng-dev libjpeg-dev libgl-dev \

python3-dev python3-numpy python3-scipy python3-imageio python3-pybind11 \libopenblas-dev libeigen3-dev libatlas-base-dev \

doxygen ninja-build

Step 3: Building halide with cmake

Halide$ cmake -G Ninja -DCMAKE_BUILD_TYPE=Release -S . -B build

dev@host:~/Halide$ cmake --build ./build

Step 4: CMake Presets

If you are using CMake 3.19+, we provide several presets to make the above commands more convenient. The following CMake preset commands correspond to the longer ones above.

> cmake --preset=msvc-release # Ninja generator, MSVC compiler, Release build

> cmake --preset=win64 # VS 2019 generator, 64-bit build

> cmake --preset=win32 # VS 2019 generator, 32-bit build

$ cmake --preset=gcc-release # Ninja generator, GCC compiler, Release build

$ cmake --list-presets # Get full list of presets.

Step 5: Installing

Once built, Halide will need to be installed somewhere before using it in a separate project. On any platform, this means running the cmake --install command in one of two ways. For a single-configuration generator (like Ninja), run either:

dev@host:~/Halide$ cmake --install ./build --prefix /path/to/Halide-install

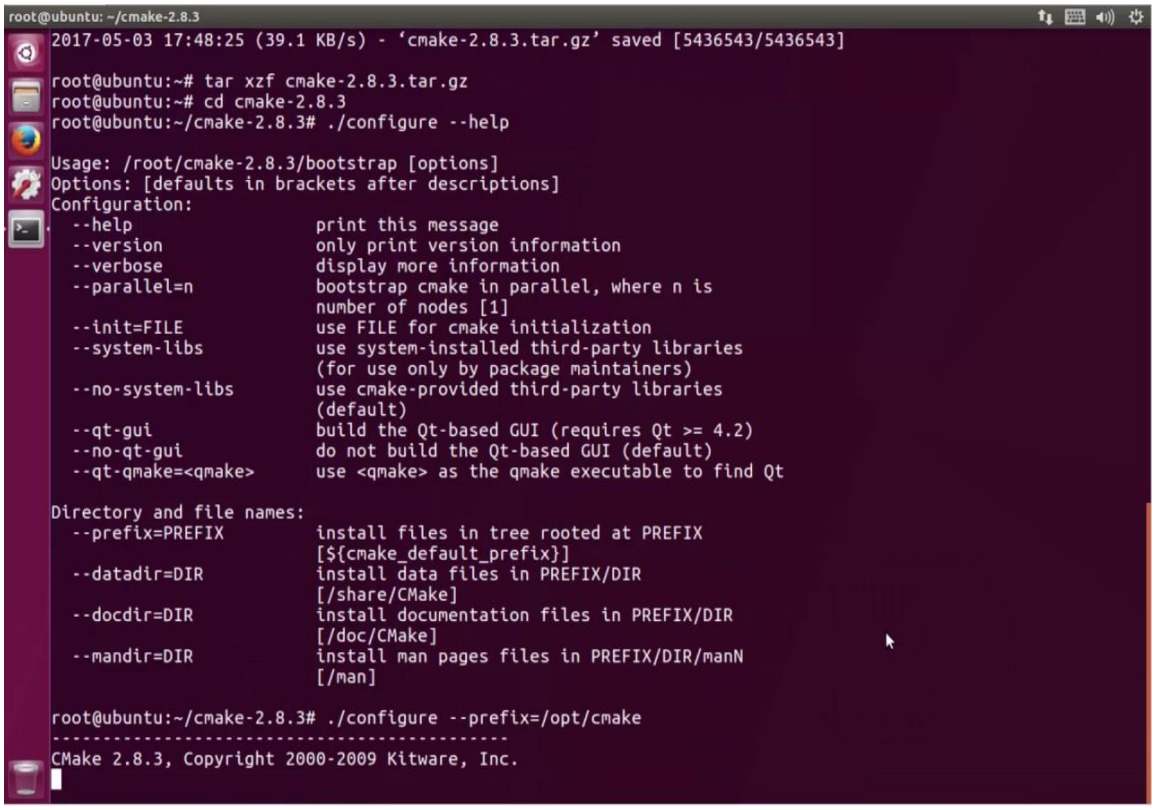
> cmake --install .\build --prefix X:\path\to\Halide-install

For a multi-configuration generator (like Visual Studio) run:

dev@host:~/Halide$ cmake --install ./build --prefix /path/to/Halide-install --config Release

> cmake --install .\build --prefix X:\path\to\Halide-install --config Release

OUTPUT



8. **Introduction to command line tools for networking IPv4 networking, network commands: ping route traceroute, nslookup, ip. Setting up static and dynamic IP addresses. Concept of Subnets, CIDR address schemes, Subnet masks, iptables, setting up a firewall for LAN, Application layer (L7) proxies.**

Set up repository

1.Ping IP address

Eg: ping 8.8.8.8

2.nslookup

nslookup facebook.com

or

nslookup 157.240.23.35

3.To install traceroute

sudo apt install traceroute

4. To find how many hopes

traceroute 172.16.13.163

or

traceroute 8.8.8 -m 30

5.To identify ip version

ip -v

6. To get ip address

ip addr

IPv4 networking for Setting up static and dynamic IP addresses.

- **For setting up ip address as static:**

Step 1: Update the terminal

sudo apt-get update

Step 2: To show ip address

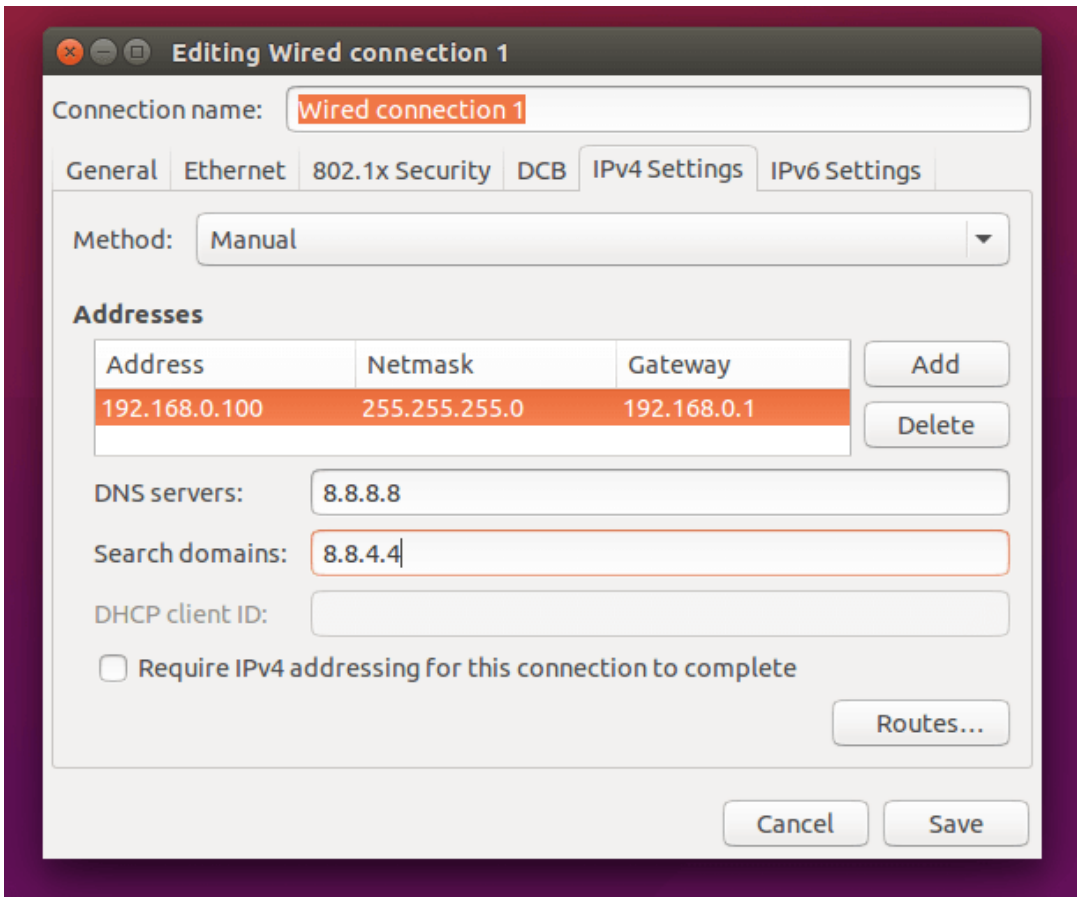
ip address

Step 3: To add new ip address

Go to settings-> network->add ip address manually->save

Open terminal and type,

ifconfig



Step 4: To see new ip address, refresh network connection and again give command:

ip address

- **For setting up ip address as dynamic:**

Step 1: To show device name

nmcli connection add con -name “dyn”

Step 2: To show ip address

ip address

Step 3: To connect

nmcli connection add con-name “dyn” ifname emp4s0 autoconnect yes type ethernet

Step 4: To show the connection

nmcli connection show

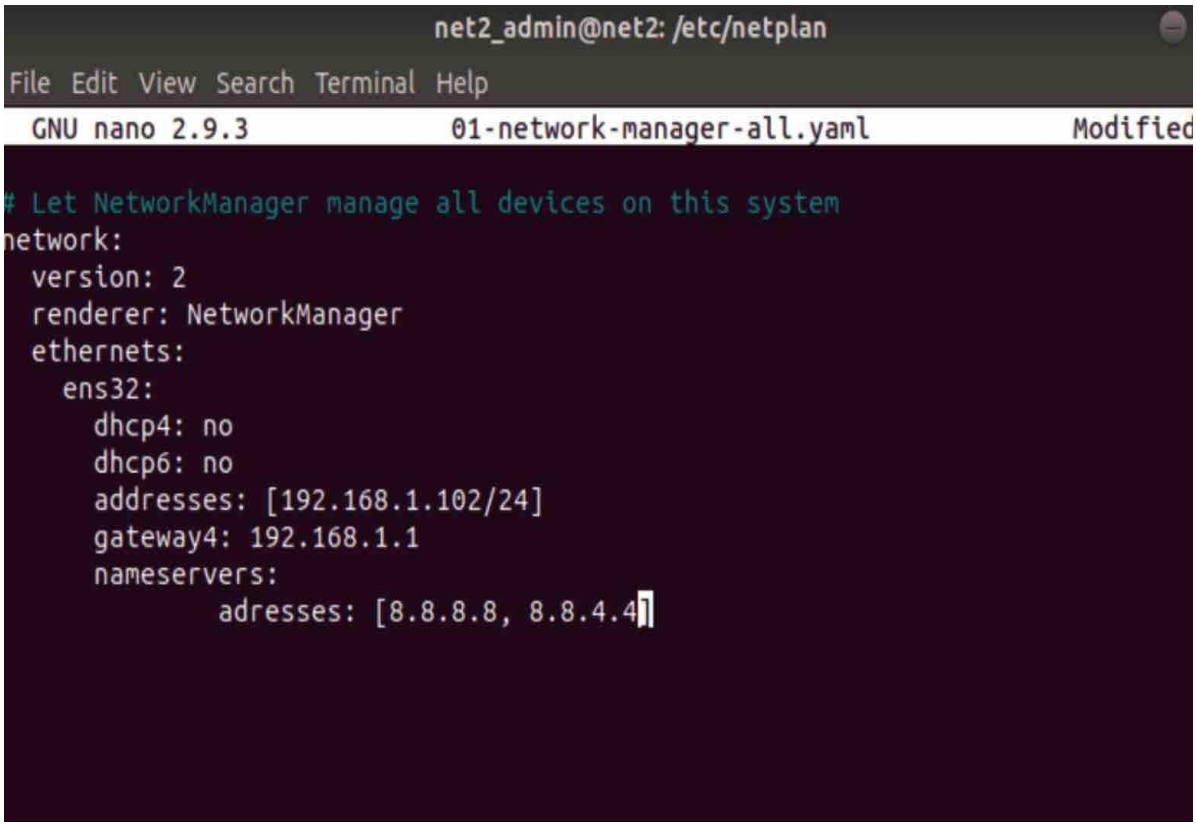
Step 5: To down the connection

nmcli connection down docker 0

Step 6: To establish the connection

nmcli connection up dyn

OUTPUT



9. Analysing network packet stream using tcpdump and wireshark. Perform basic network service tests using nc.

Installing tcpdump and analysing network packet stream

Procedure:

Step 1: Update the system

sudo apt-get update

Step 2: Install tcpdump on the system

sudo apt-get install tcpdump

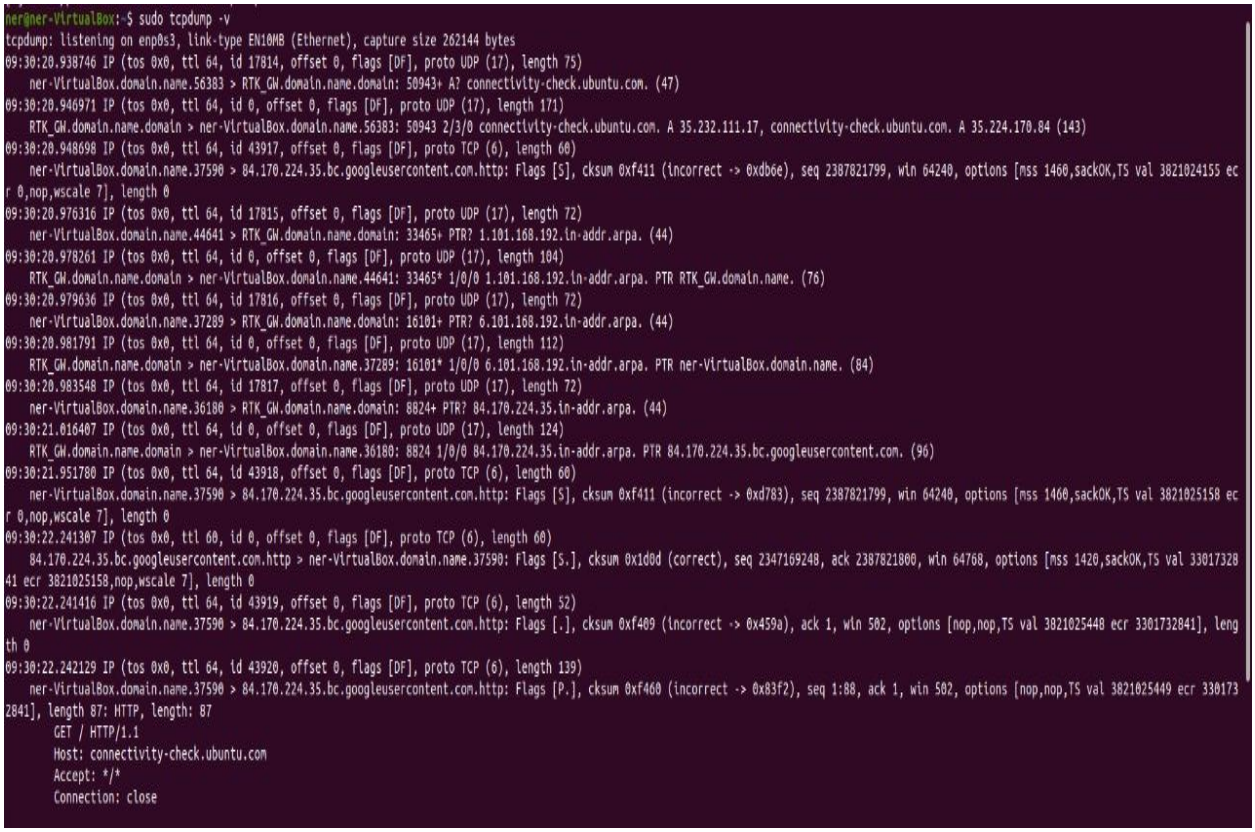
Step 3: Check the version

tcpdump --version

To capture packets from a source ip.

tcpdump –n src host ip-address

OUTPUT



Installing wireshark and analysing network packet stream

Wireshark is a free and open-source network protocol analyser widely used around the globe. With Wireshark, you can capture incoming and outgoing packets of a network in real-time and use it for network troubleshooting, packet analysis, software and communication protocol development, and many more.

Procedure:

Step 1: Update the system

sudo apt-get update

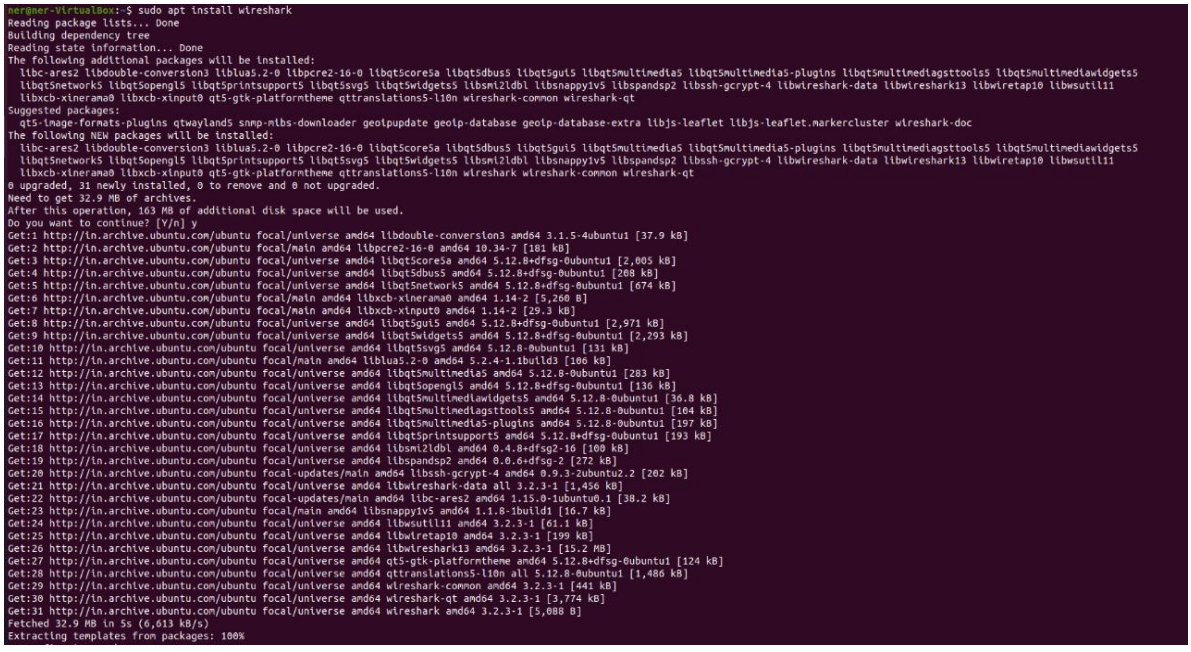
Step 2: Install wireshark on the system

sudo apt-get install wireshark

Step 3: Check the version

wireshark –version

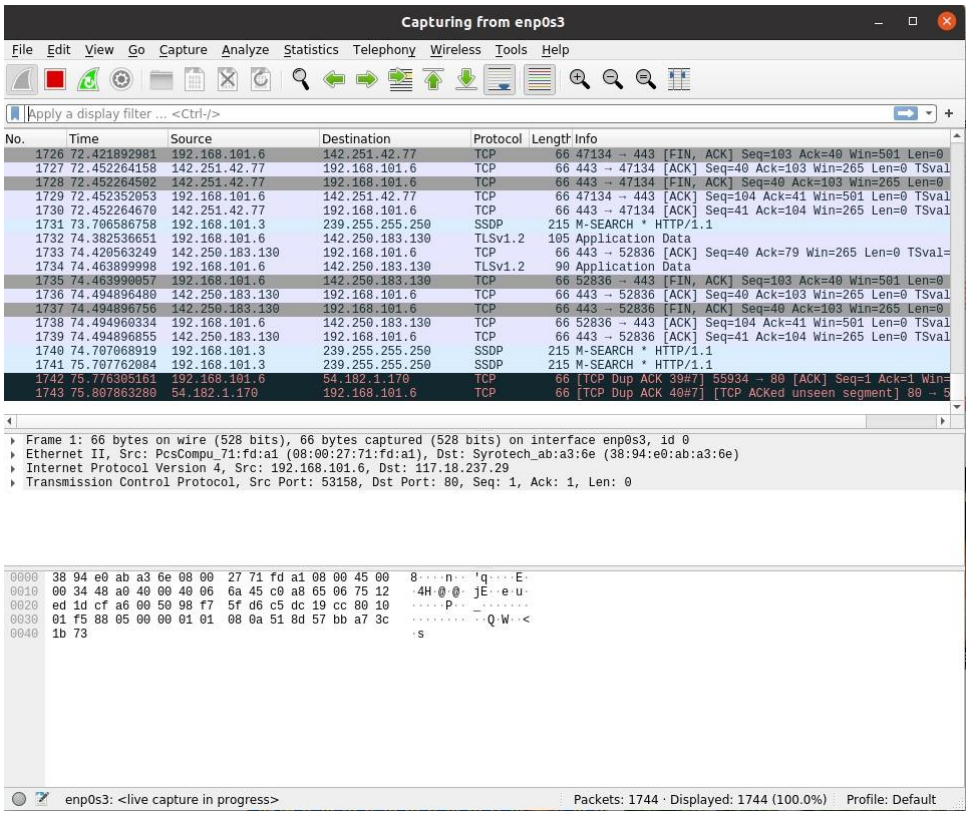
OUTPUT



To capture network packet streams type,

wireshark

then copy the ip address



10. Introduction to Hypervisors and VMs, Xen or KVM, Introduction to Containers: Docker, installation and deployment.

Installation and Deployment of Hypervisor (Type 2)

A type 2 hypervisor enables users to run isolated instances of other operating systems inside a host system. As a Linux based OS, Ubuntu supports a wide range of virtualization solutions.

Aside from popular third-party apps, such as VirtualBox and VMWare, the Linux kernel has its own virtualization module called KVM (Kernel-based Virtual Machine).

Procedure:

Step 1: Install KVM Packages

1. First, update the repositories:

   sudo apt update

2. Then, install essential KVM packages with the following command:

   sudo apt install qemu-kvm libvirt-daemon-system libvirt-clients bridge-utils

Step 2: Authorize Users

1. Only members of the **libvirt** and **kvm** user groups can run virtual machines. Add a user to the libvirt group by typing:

   sudo adduser ‘username’ libvirt

Replace username with the actual username.

Step 3: Install Virtual Manager

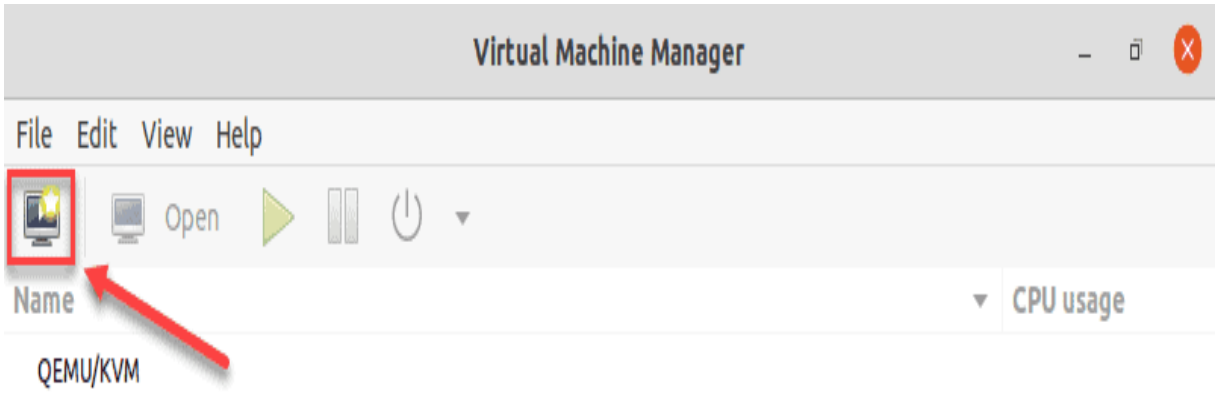
1.Type the command in the terminal
   sudo apt install virt-manager

2. Type Y and press ENTER. Wait for the installation to finish

```
marko@test-machine:~$ sudo apt install virt-manager
[sudo] password for marko:
Reading package lists... Done
Building dependency tree
Reading state information... Done
0 upgraded, 33 newly installed, 0 to remove and 74 not upgraded.
Need to get 7,987 kB of archives.
After this operation, 62.5 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

Step 4: Check if it is working....

sudo virt-manager



Installation and Deployment of Docker

Procedure:

1)Set up the repository

Step 1: Update the apt package index and install packages to allow apt to use a repository over HTTPS:

sudo apt upgrade

sudo apt-get install \

apt-transport-https \

ca-certificates \

curl \

gnupg \

lsb-release

Step 2: Add Docker's official GPG key:

curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add

Step 3: Use the following command to set up the stable repository

echo \

> "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] https://download.docker.com/linux/ubuntu \

> $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null

2)Install Docker Engine

Step 1:Update the apt package index, and install the *latest version* of Docker Engine and container, or go to the next step to install a specific version:

sudo apt-get update

Step 2: Install docker

sudo apt-get install docker-ce docker-ce-cli containerd.io

Step 3: Check that whether it is running

sudo systemctl status docker

Step 4: To view different docker commands

docker

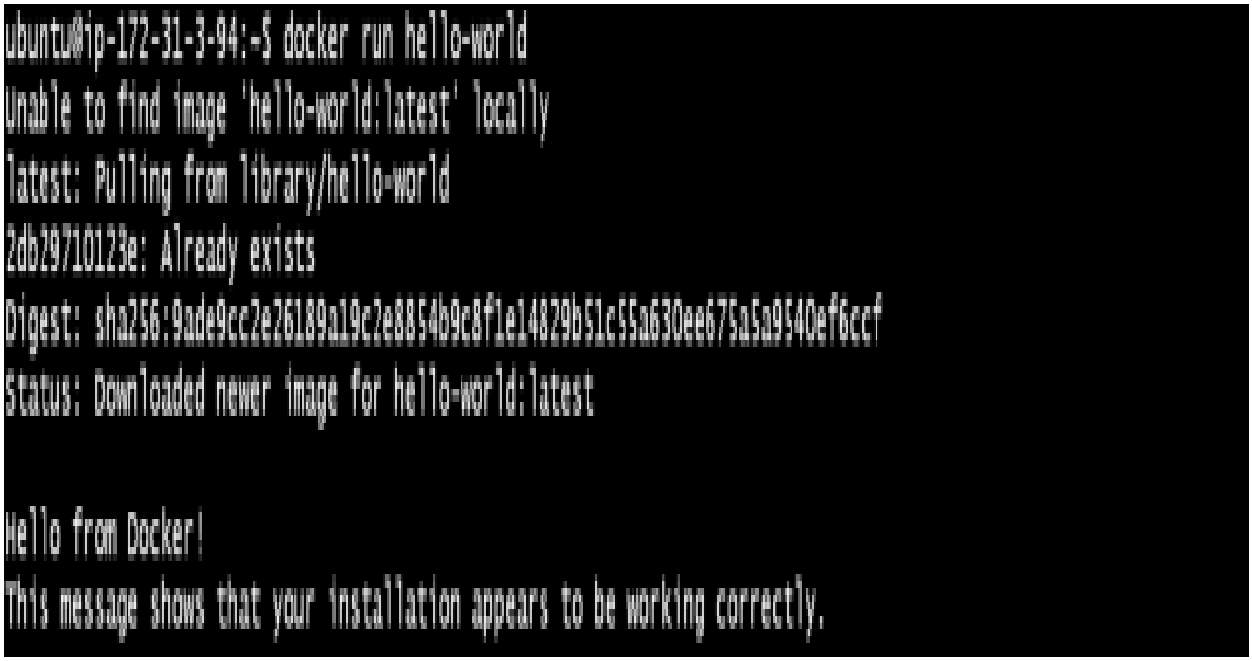
Step 5: Docker information

sudo docker info

Step 6: Verify that Docker Engine is installed correctly by running the hello-world image.

sudo docker run hello-world

OUTPUT



11. Automation using Ansible: Spin up a new Linux VM using Ansible playbook.

Ansible is an open-source automation tool for provisioning, application deployment (WordPress deployment in this case), and configuration management. Gone are the days of SSH'ing into your server to run a command or hacking together bash scripts to semi-automate laborious tasks. Whether you're managing a single server or an entire fleet, Ansible can not only simplify the process but save you time. So, what makes Ansible so great?

Ansible is completely agent-less, meaning you don't have to install any software on your managed hosts. All commands are run through Ansible via SSH and if Ansible needs updating you only need to update your single control machine and not any remote machines. The only prerequisite to running Ansible commands is to have Python installed on your control machine.

Procedure:

Installation

Step 1: First, ensure that pip is installed.

sudo easy_install pip

Step 2: Then install Ansible.

sudo pip install ansible

Step 3: Once the installation has completed you can verify that everything installed correctly by issuing:

ansible --version

Step 4: If you were installing Ansible on Ubuntu the commands would be:

sudo apt update

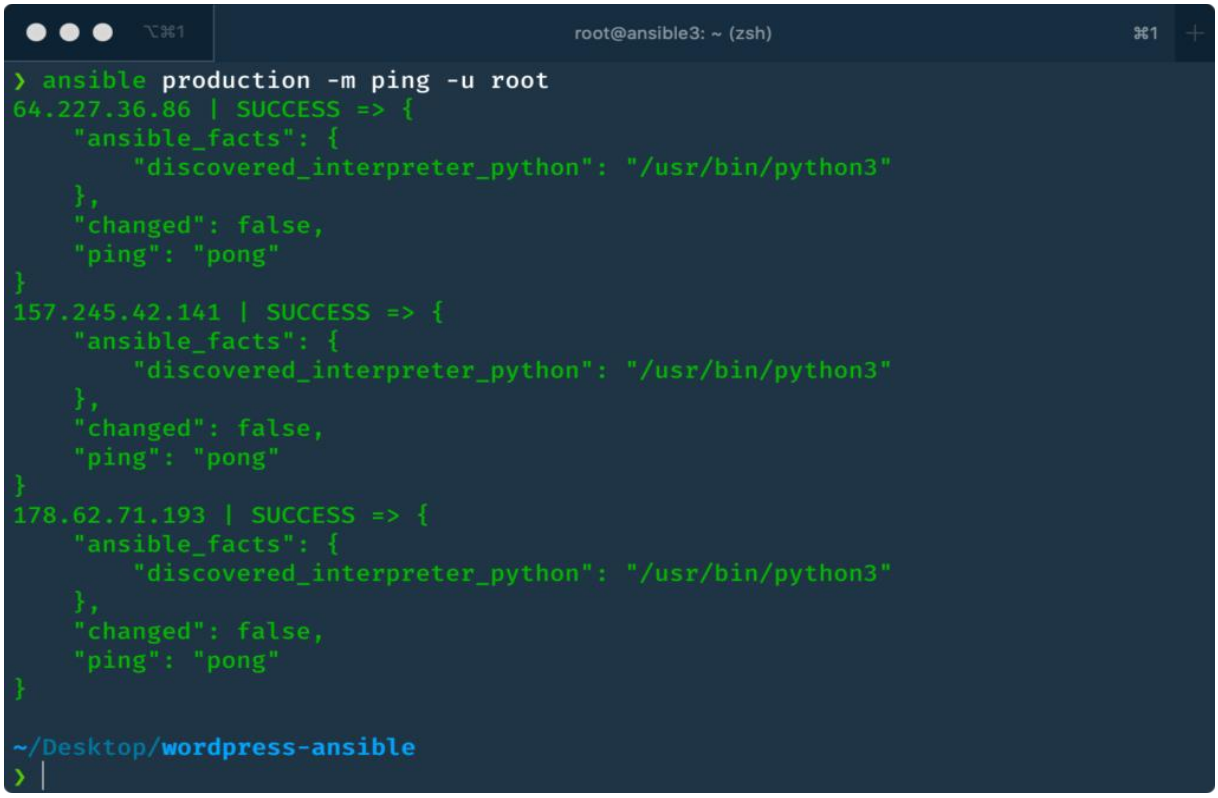
sudo apt install software-properties-common

sudo apt-add-repository --yes --update ppa:ansible/ansible

sudo apt install ansible

Running Commands

ansible production -m ping -u root



Playbooks

Playbooks allow you to chain commands together, essentially creating a blueprint or set of procedural instructions. Ansible will execute the playbook in sequence and ensure the state of each command is as desired before moving onto the next. This is what makes Ansible idempotent. If you cancel the playbook execution partway through and restart it later, only the commands that haven't completed previously will execute. The rest will be skipped.

Playbooks allow you to create truly complex instructions, but if you're not careful they can quickly become unwieldy (think of god classes in OOP), which brings us onto roles.

Roles add organization to playbooks. They allow you to split your complex build instructions into smaller reusable chunks, very much like a function in programming terms. This makes it possible to share your roles across different playbooks, without duplicating code. For example, you may have a role for installing Nginx and configuring sensible defaults, which can be used across multiple hosting environments.

Organization of Playbook

ansible.cfg

hosts

provision.yml

roles

nginx

handlers

main.yml

tasks

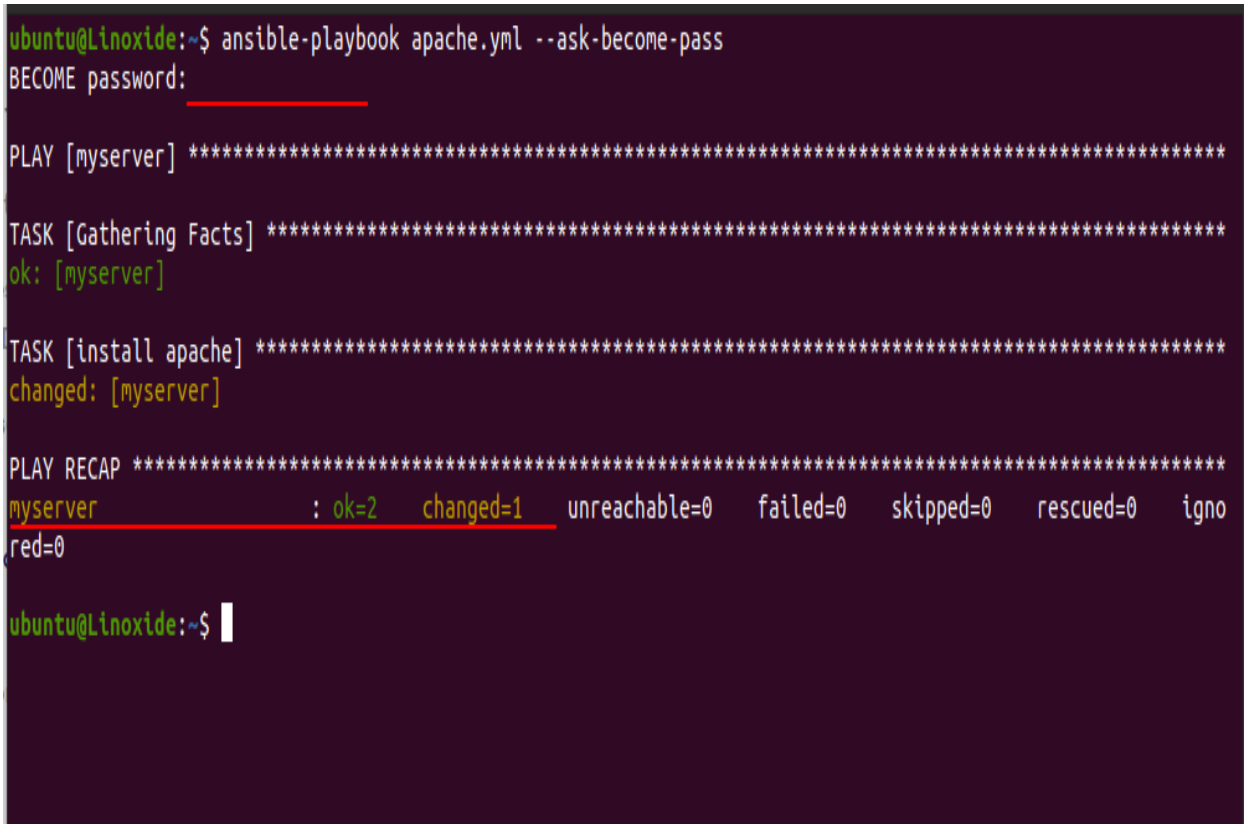
main.yml

--- - hosts: production

user: root

vars:
username: ashley
password:
6rlLdG6wd1CT8v7i$7psP8l26lmaPhT3cigoYYXhjG28CtD1ifILq9KzvA0W0
TH2Hj4.iO43RkPWgJGIi60Mz0CsxWbRVBSQkAY95W0
public_key: ~/.ssh/id_rsa.pub
roles:
common
- ufw
- user
- nginx
- php
- mariadb
- wp
-cli
- ssh

OUTPUT


ubuntu@Linoxide:~$ ansible-playbook apache.yml --ask-become-pass
BECOME password:
PLAY [myserver] **
TASK [Gathering Facts] ***
ok: [myserver]
TASK [install apache] **
changed: [myserver]
PLAY RECAP ***
myserver : ok=2 changed=1 unreachable=0 failed=0 skipped=0 rescued=0 igno
red=0
ubuntu@Linoxide:~$