FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY

(FISAT)™

HORMIS NAGAR, MOOKKANNOOR

ANGAMALY-683577

'FOCUS ON EXCELLENCE'

……..

LABORATORY RECORD

Name : LIYA V JOHN

Branch : MCA **Semester : SECOND**

Batch : B **Roll No : 14**

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Name : LIYA V JOHN

Branch : COMPUTER APPLICATION

Semester : SECOND

Roll No : 14

University Exam.Reg. No : ..…FIT20MCA2072……..

CERTIFICATE

Certified that this is the Bonafide record of the Practical work done by Mr/Ms …… …LIYA …V…JOHN……in the ……..… Laboratory of the Federal Institute of Science and Technology during the academic year ……2020-2021…….

Signature of Staff in Charge

Name :

Date :

Signature of H.O.D

Name:

Date of University practical examination ……

Signature of Internal Examiner

Signature of External Examiner

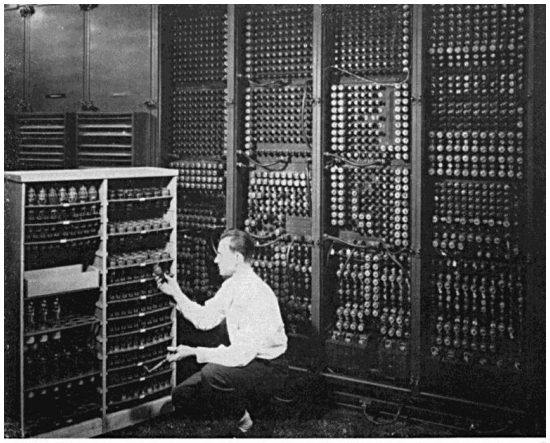
EXPERIMENT -1

1. BASIC INTRODUCTORY CONCEPT OF COMPUTER HARDWARE

1.1 What is Computer?

A computer is a programmable electronic device that accepts raw data as input and processes it with a set of instructions (a program) to produce the result as output. It renders output just after performing mathematical and logical operations and can save the output for future use. It can process numerical as well as non-numerical calculations.

1.2 History of Computers



Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

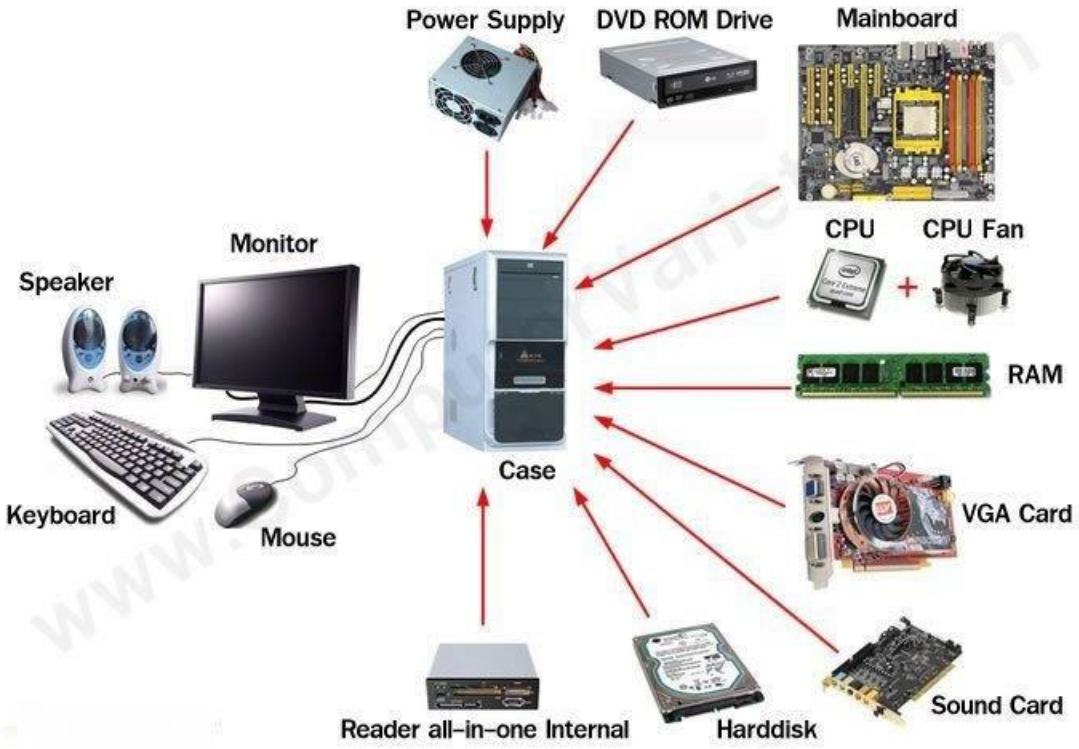
Since the evolution of humans, devices have been used for calculations for thousands of years. One of the earliest and well-known devices was an abacus. Then in 1822, the father of computers, **Charles Babbage** began developing the first mechanical computer.

1.3 Computer Hardware

Computer hardware includes the physical parts of a computer, such as the case, central processing unit (CPU), monitor, mouse, keyboard, computer data storage, graphics card, sound card, speakers and motherboard. Hardware is typically directed by the software to execute any command or instruction. A combination of

hardware and software forms a usable computing system, although other systems exist with only hardware.

1.4 The following are the basic components that will be detailed :-



1.4.1 Motherboard

1.4.2. RAM Modules

1.4.3. Daughter cards

1.4.4 Bus slots

1.4.5. SMPS

1.4.6. Internal Storage Devices

1.4.7. Interfacing Ports

1.4.1 Mother board:

The motherboard serves as a single platform to connect all of the parts of a computer together. It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via

cables. It can be considered as the backbone of a computer. A motherboard comes with following features − • Motherboard varies greatly in supporting various types of components. • Motherboard supports a single type of CPU and few types of memories. • Video cards, hard disks, sound cards have to be compatible with the motherboard to function properly. • Motherboards, cases, and power supplies must be compatible to work properly together. The popular manufacturers of the motherboard are: Intel, ASUS, AOpen, ABIT, Biostar, Gigabyte, MSI. The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes. Motherboard contains ports to connect all of the internal components. It provides a single socket for CPU, whereas for memory, normally one or more slots are available. Motherboards provide ports to attach the floppy drive, hard drive, and optical drives via ribbon cables. Motherboard carries fans and a special port designed for power supply. There is a peripheral card slot in front of the motherboard using which video cards, sound cards, and other expansion cards can be connected to the motherboard. On the left side, motherboards carry a number of ports to connect the monitor, printer, mouse, keyboard, speaker, and network cables. Motherboards also provide USB ports, which allow compatible devices to be connected in plug-in/plug-out fashion. For example, pen drive, digital cameras, etc

1.4.1.1 FEATURES OF MOTHERBOARD

- Motherboard varies greatly in supporting various types of components.
- Motherboard supports a single type of CPU and few types of memories.
- Video cards, hard disks, sound cards have to be compatible with the motherboard to function properly.
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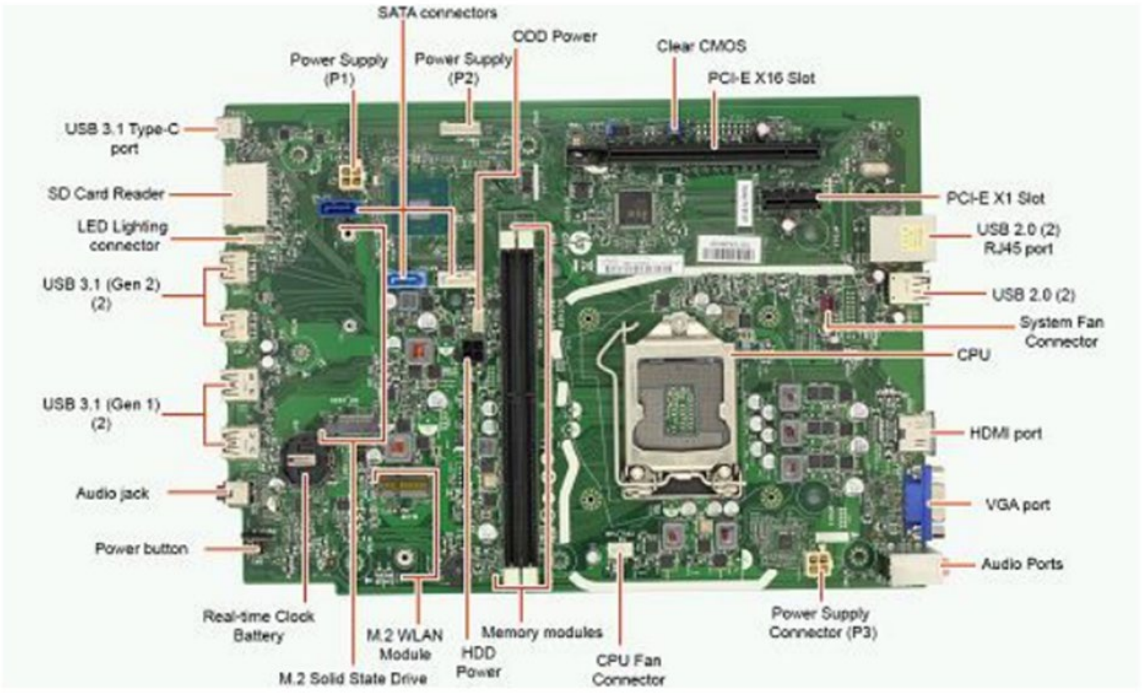
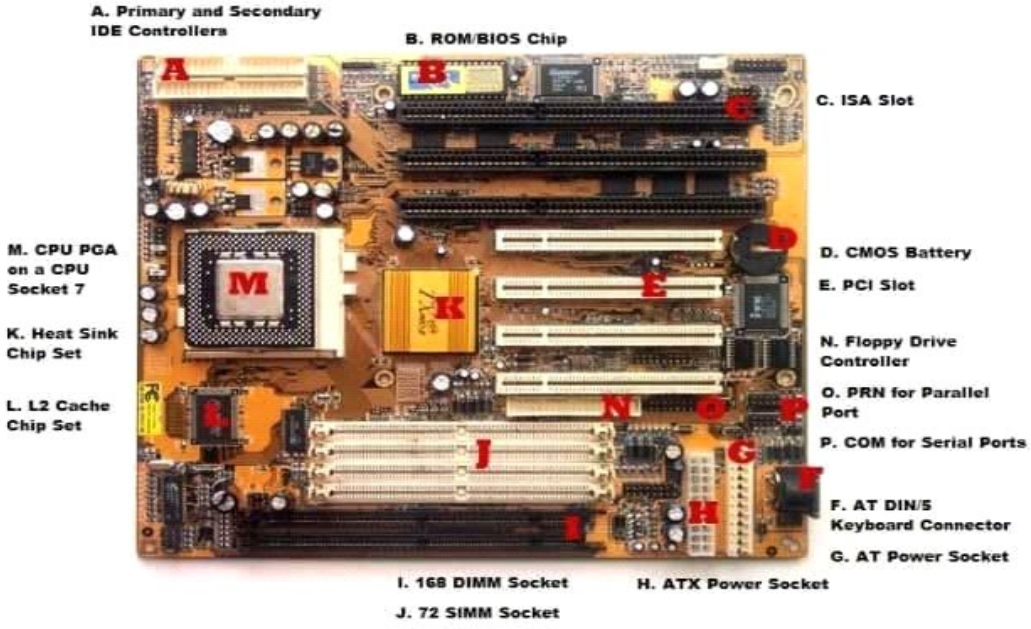


1.4.1.2 TYPES OF MOTHERBOARD

1.4.1.2.1 AT Motherboard

These motherboards have bigger physical dimensions of hundreds of millimetres and hence they are not the right fit for the mini desktop category of computers.



1.4.1.2.2 ATX Motherboards

ATX denotes Advanced technology extended, It was developed by Intel during the 1990s and it was an improved version over an earlier version of AT motherboard. It is smaller in size when compared to AT and it provides interchangeability of the connected components.

1.4.1.2.3 BTX Motherboard

BTX denotes Balanced Technology Extended, intended to manage demands of new technologies in terms of more power requirements hence generation of more heat.

1.4.1.2.4 Pico BTX Motherboard

These boards are smaller in size and hence the word Pico. Two expansion slots are supported in spite of being sharing the top half of BTX. Half-height or riser cards are its unique features and it supports the demands of digital applications.

1.4.1.2.5 Mini ITX Motherboard

It's a miniature version of motherboard. Designed in the early 2000s and its dimension is 17 x 17 cm. Mainly used in small form factor (SFF) computer due to its lower power consumption and faster cooling ability.

1.4.1.3 MAIN COMPONENTS OF MOTHERBOARD

1.4.1.3.1 FLOPPY DISC CONTROLLER

A floppy disk controller (FDC) is an electronic chip controller used as an interface between a computer and a floppy disk drive. Modern computers have this chip embedded in the motherboard, whereas they were a separate component when they were originally introduced.

A floppy disk controller (FDC) is a specially designed chip that controls the reading and writing functionality of a floppy drive. An FDC can support up to four floppy disk drives at a time. The controller is connected to the system bus of the CPU and appears as a set of I/O ports to the computer. It is usually

also linked to a serial bus of the direct memory access (DMA) controller. In an x86 computer, the floppy disk controller uses IRQ6, whereas interrupt schemes are used on other systems. Data transmission is often done by FDC while in DMA mode.

Floppy disk controller functions (FDC)

- Translate data bits into FM, MFM, M²FM, or GCR format to be able to record them
- Interpret and execute commands such as seek, read, write, format, etc.
- Error detection with check sums generation and verification, like CRC
- Synchronize data with phase-locked loop(PLL)

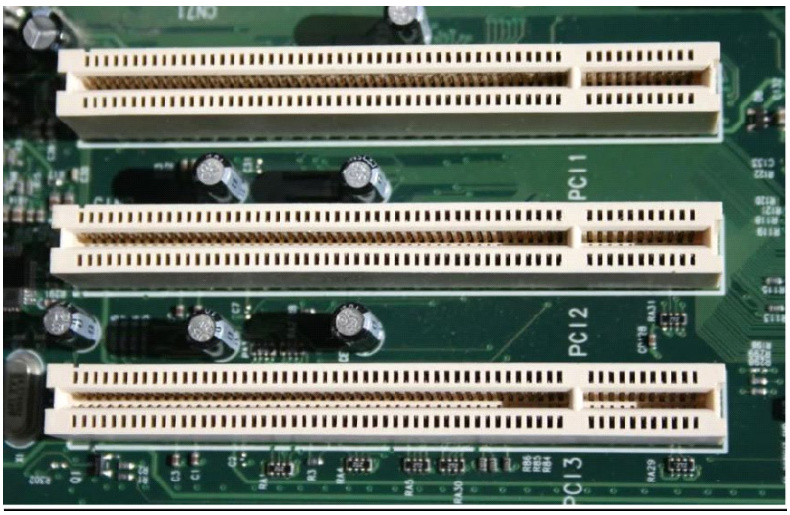
1.4.1.3.2 Serial Ports

Serial Ports provide an interface to connect serial lines to prepare a serial communication. Serial ports are typically used in modem, mouse, security cameras etc. A Serial port uses DB-9 connector, a 9 pin D-Shaped Connector which connects to the transmission line. A serial port provides a serial communication using one line and thus have no dependency on other wire's speed and its length can be extended as per the need.

1.4.1.3.3 Parallel Ports

Parallel ports provide an interface to connect multiple lines to prepare a parallel communication to send large data at a time. Parallel ports are used in connecting printers, hard-drives, CD-drives etc. All lines speed should be same to avoid error and cross-talk issues. To avoid such issues, the wires are kept small in length. A parallel port uses D-25 connector, a 25 pin D- Shaped connector which connects to the transmission wires.

1.4.1.3.4 The Expansion Buses



An expansion bus is an input/output pathway from the CPU to peripheral devices and it is typically made up of a series of slots on the motherboard. Expansion boards(cards) plug into the bus. PCI is the most common expansion bus in a PC and other hardware platforms. PCI stands for Peripheral Component Interface; PCI slot allows you to insert expansion cards into your computer. Buses carry signals such as data, memory addresses, power, and control signals from component to component. Other types of buses include ISA and EISA. Expansion buses enhance the PCs capabilities by allowing users to add missing features in their computers by slotting adapter cards into expansion slots.

1.4.1.3.5 The Computer Chip-sets

A chipset is a group of small circuits that coordinate the flow of data to and from a PC's key components. These key components include the CPU itself, the main memory, the secondary cache, and any devices situated on the buses. A chip set also controls data flow to and from hard disks and other devices connected to the IDE channels.

A computer has got two main chipsets:

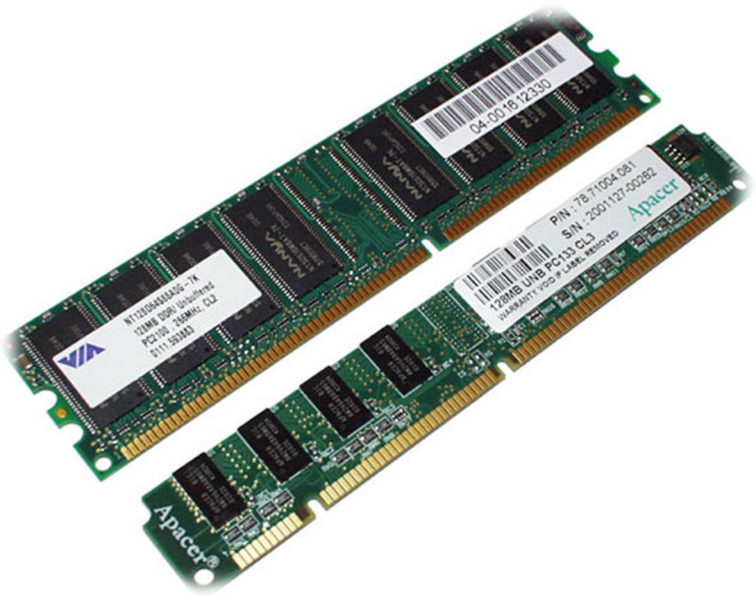
- The North Bridge (also called the memory controller) is in charge of controlling transfers between the processor and the RAM, which is why it is located physically near the processor. It is sometimes called the GMCH, for Graphic and Memory Controller Hub.
- The South Bridge (also called the input/output controller or expansion controller) handles communications between slower peripheral devices. It is also called the ICH (I/O Controller Hub). The term "bridge" is generally used to designate a component which connects two buses.

Chipset manufacturers include SIS, VIA, ALI, and OPTI.

1.4.2. RANDOM ACCESS MEMORY

1.4.2.1. Introduction

RAM, which stands for Random Access Memory, is a hardware device generally located on the motherboard of a computer and acts as an internal memory of the CPU. It allows CPU store data, program, and program results when you switch on the computer. It is the read and write memory of a computer, which means the information can be written to it as well as read from it.



RAM comes in the form of a chip that is individually mounted on the motherboard or in the form of several chips on a small board connected to the motherboard. It is the main memory of a computer. It is faster to write to and read from as compared to other memories such as a hard disk drive (HDD), solid-state drive (SSD), optical drive, etc.

A computer's performance mainly depends on the size or storage capacity of the RAM. If it does not have sufficient RAM (random access memory) to run the OS and software programs, it will result in slower performance. So, the more RAM a computer has, the faster it will work. Information stored in RAM is accessed randomly, not in a sequence as on a CD or hard drive. So, its access time is much faster.

1.4.2.2. CHARACTERISTICS OF RAM

1.4.2.2.1. SDRAM AND DDR

Memory modules are labelled with either SDRAM (Synchronous Dynamic Random-Access Memory) or DDR (Double Data Rate). DDR RAM, as the "double data rate" name suggests, offers much faster speeds than SDRAM. Each generation of DDR, such as DDR2 and DDR3, offers performance improvements over the one preceding it.

1.4.2.2.2. SPEED

The two numbers often quoted first on memory module specifications -- for example, "DDRxxx/PCxxxx" -- indicate the maximum clock speed and maximum transfer rate the device can operate at -- and the higher the better. The stated clock speed is actually double the real figure, so a stick of RAM labelled DDR3-1333 PC3200 offers a clock speed of 666 MHz and a transfer rate of 3,200 MB/s.

1.4.2.2.3 PINS

Essentially, the number of pins a memory module has indicates the number of connections it has to the motherboard -- and thus which motherboards it's compatible with. More pins mean more data can be transferred at once, for faster operation overall, though performance is based on a variety of different factors, including CPU speed and the motherboard configuration.

1.4.2.2.4 VOLTS

The voltage rating associated with a memory module -- for example, 2.5 V -- indicates how much power it draws from the motherboard in order to operate properly. RAM sticks that can work at lower voltages use up less power and give off less heat, and are therefore more suitable for smaller systems such as laptops.

1.4.2.2.5 CAS LATENCY

CAS (Column Address Strobe) Latency, sometimes abbreviated to just "CL," indicates the time it takes for a memory module to return data to the CPU. A lower CAS Latency indicates RAM that performs faster.

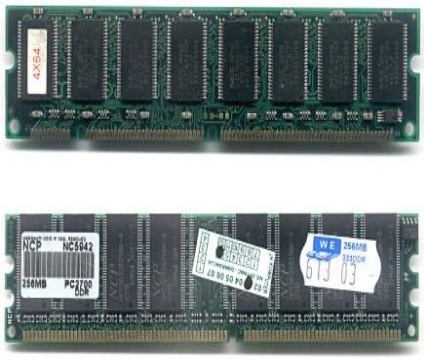
1.4.2.2.6 TIMING

Memory modules feature other timings besides CAS Latency, usually listed as a series of numbers after the other specifications. In order after CAS Latency, they are RAS (Row Address Strobe) to CAS delay, RAS Precharge, Active to Precharge delay and, optionally, command rate. These

timings are only really of interest to advanced technical users, as the impact they have on performance is very small.

1.4.2.2.7 REDUNDANCY

The redundancy built into a memory module indicates its ability to recover from errors and to alert the operating system to a problem, rather than just allowing it to crash and lose your data. More expensive and critical server memory uses Error Checking and Correcting Redundancy, or ECC, in order to detect and correct errors wherever possible.



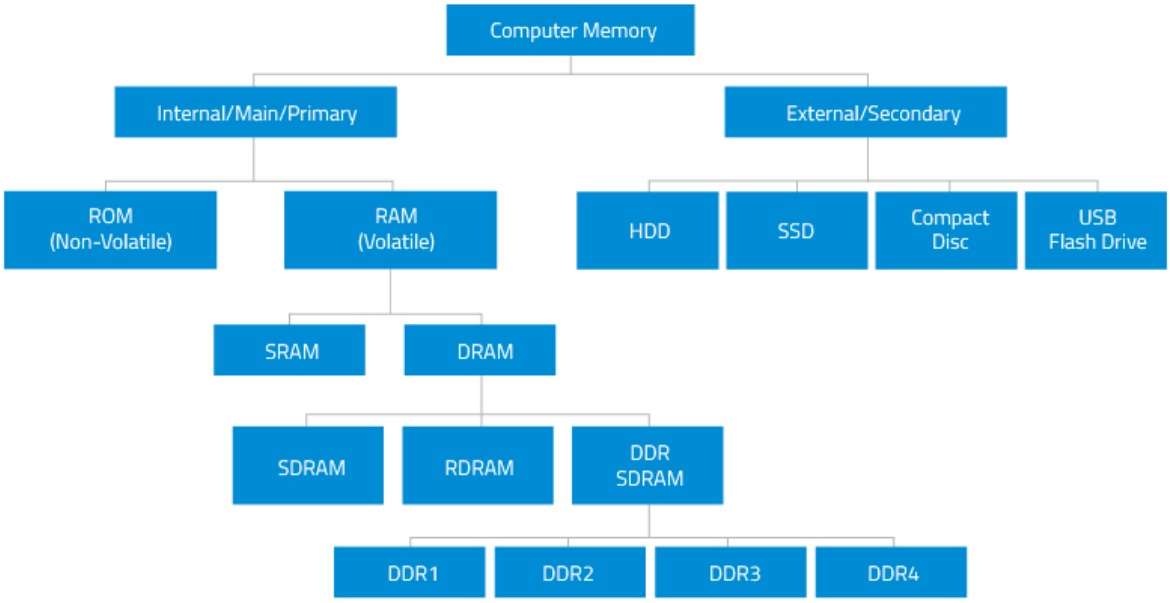
1.4.2.3. Different Types of RAM

RAM(Random Access Memory) is a part of computer's Main Memory which is directly accessible by CPU. RAM is used to Read and Write data into it which is accessed by CPU randomly. RAM is volatile in nature, it means if the power goes off, the stored information is lost. RAM is used to store the data that is currently processed by the CPU. Most of the programs and data that are modifiable are stored in RAM.

Integrated RAM chips are available in two form:

1. SRAM(Static RAM)
2. DRAM(Dynamic RAM)
3. **1.4.2.3.1 SRAM**

4. The SRAM memories consist of circuits capable of retaining the stored information as long as the power is applied. That means this type of memory requires constant power. SRAM memories are used to build Cache Memory.
5. **1.4.2.3.2 DRAM**
6. DRAM stores the binary information in the form of electric charges that applied to capacitors. The stored information on the capacitors tend to lose over a period of time and thus the capacitors must be periodically recharged to retain their usage. The main memory is generally made up of DRAM chips.



1.4.2.4. Functions

1.4.2.4.1. Reading Files

Hard drives can store vast numbers of files, but compared to other computer components, drives run very slowly. Accessing hard drive files -- especially when those files are scattered across the drive due to fragmentation -- requires the drive to move its mechanical read/write head back and forth and to wait for the spinning platters to spin into the correct position. Even though

drives spin at thousands of rotations per minute, this process causes a noticeable delay when reading files. To lessen the slowdown, computers store files in RAM after the files are first read from the drive. RAM has no moving parts, so the files can load very quickly during subsequent uses.

1.4.2.4.2 Temporary Storage

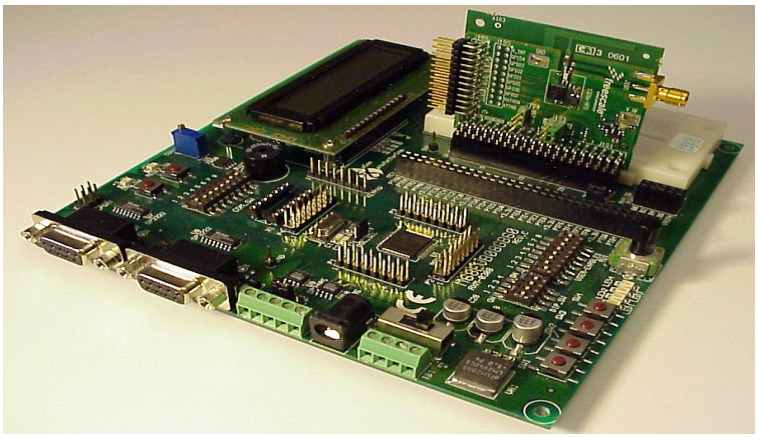
In addition to storing files read from the hard drive, RAM also stores data that programs are actively using but that doesn't need to be saved permanently. By keeping this data in RAM, programs can work with it quickly, improving speed and responsiveness.

1.4.2.4.3 RAM Size

If RAM works so much faster than the hard drive, why not load all of the computer's data into RAM? One major reason: computers have far less RAM than drive space. As of publication, hard drive sizes range from a few hundred gigabytes in laptops to 10TB in high-end enterprise systems. Most home computers have between 1 and 4TB of drive space.

1.4.3 DAUGHTER CARD

Referred to as a piggyback board and **daughter card**, a daughterboard is an expansion board that connects directly to the motherboard and gives added functionality.



Motherboard with daughter card

To disable a daughter board, the user must physically remove it from the motherboard Daughter boards do not provide new functions to the circuit like an expansion but they extend the circuitry of the circuit in which they are plugged into

1.4.3.1 Functionalities of daughter board:

- It is known as the piggyback board, riser card, daughtercard etcetera.
- A daughter board is smaller than a motherboard and may have some slots like the motherboard.
- A daughter board is a printed circuit board which is connected to the motherboard or expansion card.
- Unlike expansion card, daughter boards are directly connected to the motherboard by soldering.
- Daughter boards do not provide new functions to the circuit like an expansion but they extend the circuitry of the circuit in which they are plugged into.
- Daughter boards are released by the vendors as an update of motherboard or expansion card.

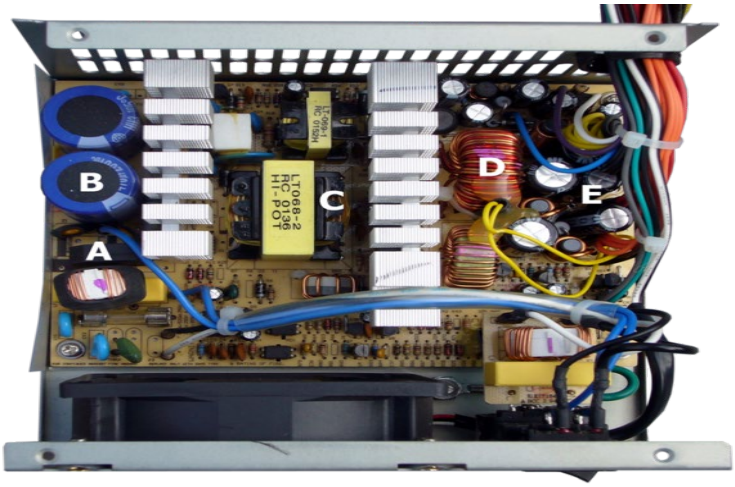
1.4.3.2 List of daughter cards

- Video Card: This is also referred to as the graphics adapter, display adapter or video adapter.
- Sound Card: To handle sound, to insert a microphone or connect a speaker this sound card is used.
- Network Interface Card: This is also referred as NIC. The computer can be connected to a network only with the use of this network interface card.

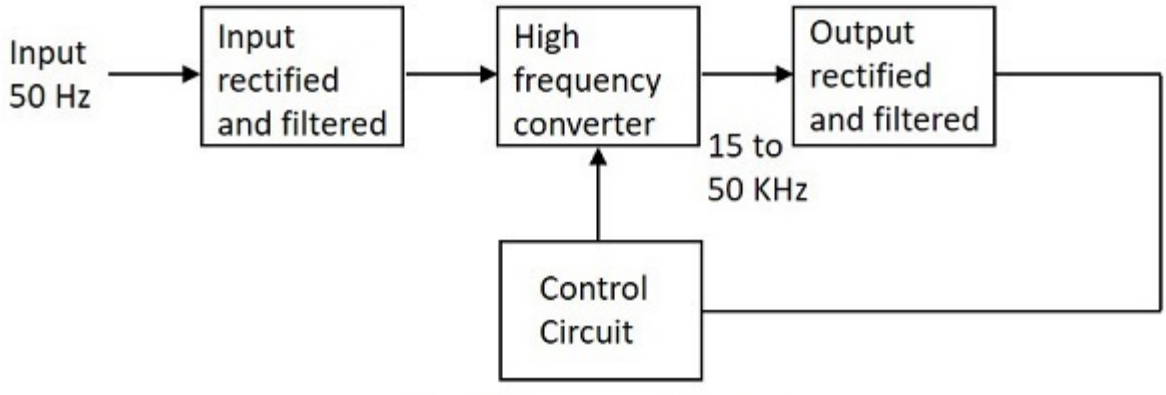
- Ethernet Card: Ethernet card is used to connect computers to computers. A cable is used to connect the Ethernet cards in each computer to make a network.

1.4.4. SWITCHED- MODE POWER SUPPLY

Switched-mode power supply Introduction A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Its function is to convert a level of voltage to the voltage or current required by the client through different forms of architecture.



WORKING



The working of SMPS is simply understood by knowing that the transistor used in LPS is used to control the voltage drop while the transistor in SMPS

is used as a controlled switch. The AC input supply signal 50 Hz is given directly to the rectifier and filter circuit combination without using any transformer. A fast switching device such as a Power transistor is employed in this section, which switches ON and OFF according to the variations and this output is given to the primary of the transformer. This is a regulated output voltage which is then given to the control circuit, which is a feedback circuit**.**

1.4.5. INTERNAL STORAGE DEVICES

A storage device is any type of computing hardware that is used for storing, porting or extracting data files and objects. Storage devices can hold and store information both temporarily and permanently. They may be internal or external to a computer.

Some storage devices are classed as 'internal' which means they are inside the computer case. At the most basic level, internal storage is needed to hold the operating system so that the computer is able to access the input and output devices. It will also be used to store the applications software that you use and more than likely, the original copies of your data files.

Internal storage allows the data and applications to be loaded very rapidly into memory, ready for use. The data can be accessed much faster than data which is stored on an external storage device. This is because internal storage devices are connected directly to the motherboard and its data bus whereas external devices are connected through a hardware interface such as USB, which means they are considerably slower to access.

The main disadvantage of internal storage is that when the hard disk fails (and it will), all the data and applications may be lost. This can be avoided to some extent by using more than one hard disk within the machine. Each hard disk has a copy of all the data, so if one fails the other can carry on. This is called a RAID array. An alternative is to use external drives for backup

1.4.5.1. Examples of Internal storage devices

- Hard Disk
- SSD
- RAM

1.4.5.1.1. HARD DISK

A **hard disk drive** (sometimes abbreviated as a **hard drive**, **HD**, or **HDD**) is a non-volatile data storage device. It is usually installed internally in a computer, attached directly to the disk controller of the computer's motherboard. It contains one or more platters, housed inside of an air-sealed casing. Data is written to the platters using a magnetic head, which moves rapidly over them as they spin.

Internal hard disks reside in a drive bay, connected to the motherboard using an ATA, SCSI, or SATA cable. They are powered by a connection to the computer's PSU (power supply unit).

Hard disk, Magnetic storage medium for a microcomputer. Hard disks are flat, circular plates made of aluminum or glass and coated with a magnetic material. Hard disks for personal computers can store up to several gigabytes (billions of bytes) of information. Data are stored on their surfaces in concentric tracks. A small electromagnet, called a magnetic head, writes a binary digit (1 or 0) by magnetizing tiny spots on the spinning disk in different directions and reads digits by detecting the magnetization direction of the spots. A computer’s hard drive is a device consisting of several hard disks, read/write heads, a drive motor to spin the disks, and a small amount of circuitry, all sealed in a metal case to protect the disks from dust. In addition to referring to the disks themselves, the term hard disk is also used to refer to the whole hard drive.

Computers rely on hard disk drives (HDDs) to store data permanently. They are storage devices used to save and retrieve digital information that will be required for future reference.

Hard drives are non-volatile, meaning that they retain data even when they do not have power. The information stored remains safe and intact unless the hard drive is destroyed or interfered with. The information is stored or retrieved in a random-access manner as opposed to sequential access. This implies that blocks of data can be accessed at any time they are required without going through other data blocks.

1.4.5.1.2. SOLID STATE DRIVE

A solid-state drive (SSD) is a solid-state storage device that uses integrated circuit assemblies to store data persistently , typically using flash memory, and functioning as secondary storage in the hierarchy of computer storage. It is also sometimes called a **solid-state device** or a **solid-state disk**, even though SSDs lack the physical spinning disks and movable read–write heads used in hard disk drives (HDDs) and floppy disks.

Compared with electromechanical drives, SSDs are typically more resistant to physical shock, run silently, and have quicker access time and lower latency. SSDs store data in semiconductor cells. SSDs have a limited number of writes, and slow as they reach storage capacity.

1.4.5.1.3. RAM

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types −

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

1.4.5.2. Static RAM (SRAM)

The word **static** indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not be refreshed on a regular basis.

1.4.5.3. Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually **refreshed** in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory as it is cheap and small

1.4.5.4 SOME OTHER STORAGE DEVICES

- Magnetic Storage Device
- Optical Storage Device
- Flash Memory Device
- Online and Cloud
- Paper Storage

1.4.6 COMPUTER PORTS

1.4.6.1 WHAT IS MEANT BY A PORT?

A port in a computer network is a communication endpoint whereas, in an operating system, it is a logical construct, recognizes precise method otherwise a network service type. These endpoints recognize the combination of every protocol and its address through 16-bit unsigned numbers, called the port number. The protocols that use port numbers are the TCP (Transmission Control Protocol) and UDP (User Datagram Protocol). The port number in every computer networking uses an IP address of the type of protocol & the host

1.4.6.2 What is Port in Computer/Computer Port?

A computer port or a communication port is a connection point used as an interface between the computer & the peripherals like keyboard, mouse, printer, display unit, monitor, flash drive and speaker. The computer port transmits the data from any peripheral to the computer. In general, the communication ports are available in two type like Serial Ports as well as Parallel Ports.

1.4.6.3 Characteristics of Computer Ports

The characteristics of the computer port include the following.

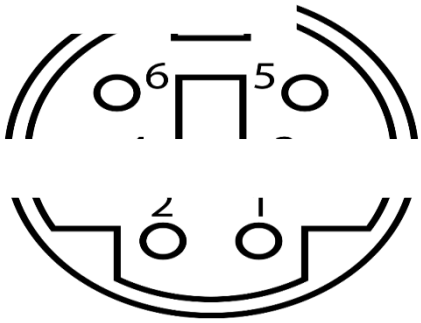
- It is an interface between external devices as well as a computer.
- Ports on the motherboard can be connected using an external device cable by plugging in.
- The external devices which are c rts are the keyboard, mouse, microphone, monitor, speakers, etc.

1.4.6.4 Types of Computer Ports

There are different types of ports available in a computer network. Some of them are:

- PS/02
- Serial Port
- Parallel Port
- Ethernet
- VGA Port
- USB Port
- DVI Port
- HDMI Port
- Display Port

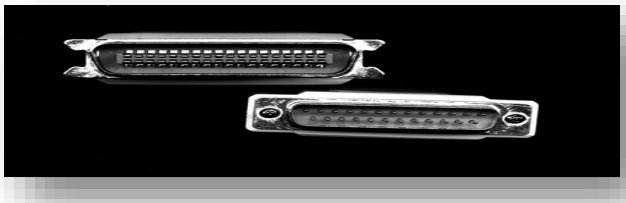
1.4.6.4.1 PS/2 PORTS: PS/2 is a type of port used by older computers for connecting input devices such as keyboards and mice. The port was introduced with IBM's Personal System/2 computer in 1987 (which was abbreviated"PS/2").The PS/2 port has six pins and is roughly circular in shape



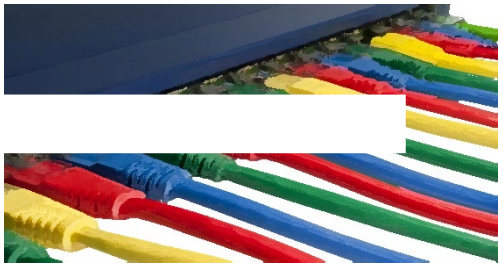
1.4.6.4.2 SERIAL PORT: A serial port is an interface that allows a PC to transmit or receive data one bit at a time. It is one of the oldest types of interfaces commonly used to connect printers and external modems to a PC. Compared to a parallel port, the data transfer rate of a serial port is slower. Normally, a serial port is a male port, while a parallel port is a female port. The serial port standard is RS-232. This standard is used for transmitting serial communication between devices

1.4.6.4.3 PARALLEL PORT: Parallel port is a type of interface found on computers (personal and otherwise) for connecting peripherals. Parallel ports send multiple bits of data at once (parallel communication), as opposed

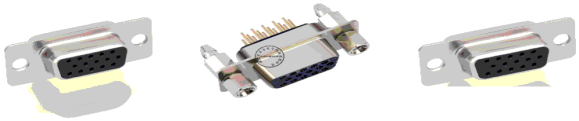
to serial communication, in which bits are sent one at a time. Parallel port is an interface between computer and peripheral devices like printers with parallel communication



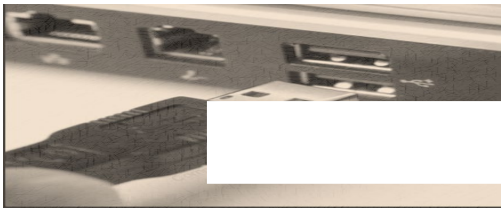
1.4.6.4.4 ETHERNET: A Ethernet port is a jack or socket on a computer that allows the use of an Ethernet connector. These ports are essential in allowing the creation of local area networks (LANs). An Ethernet port is usually found on networking devices, including computers, routers, video game consoles, modems, and televisions. Ethernet is a communication system that allows multiple local devices to share information and work together.



1.4.6.4.5 VGA PORT: Abbreviated VGA, Video Graphics Array is a standard type of connection for video devices such as monitors and projectors. Generally, VGA refers to the types of cables, ports, and connectors used to connect monitors to video cards.



1.4.6.4.6 USB PORT: A **USB port** is a standard cable connection interface for personal computers and consumer electronics devices. USB stands for Universal Serial Bus, USB ports allow USB devices to be connected to each other with and transfer digital data over USB cables



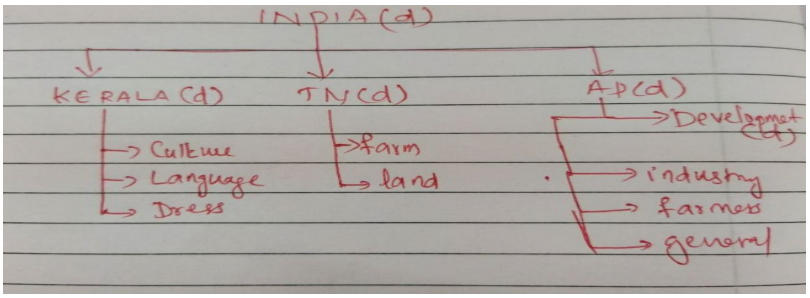
1.4.6.4.7 HDMI PORT: Full form of HDMI is **High-Definition Multimedia Interface.**

HDMI is a proprietary audio/video interface for transmitting uncompressed video data and compressed or uncompressed digital audio data from an HDMI-compliant source device, such as a display controller, to a compatible computer monitor, video projector, digital television, or digital audio device..

1.4.6.4.8 DISPLAY PORT: DisplayPort is a digital display interface developed by a consortium of PC and chip manufacturers and standardized by the Video Electronics Standards Association. Display Port is a digital display interface with optional multiple channel audio and other forms of data. Display Port is developed with an aim of replacing VGA and DVI ports as the main interface between a computer and monitor.

EXPERIMENT -2

LINUX COMMANDS



1. Create the directories and files as given in the above directory structure. Directories are mentioned as (d). Files should be filled with necessary text data.

```
liya@liya-VirtualBox: ~/INDIA
liya@liya-VirtualBox:~$ mkdir INDIA
liya@liya-VirtualBox:~$ cd INDIA
liya@liya-VirtualBox:~/INDIA$ mkdir KERALA
liya@liya-VirtualBox:~/INDIA$ mkdir TN
liya@liya-VirtualBox:~/INDIA$ mkdir AP
```

```
liya@liya-VirtualBox:~/INDIA$ cd KERALA
liya@liya-VirtualBox:~/INDIA/KERALA$ vim culture
liya@liya-VirtualBox:~/INDIA/KERALA$ cat culture
culture of kerala is a combination of both Indian and Dravidian culture.
this culture is being influenced by the neighbouring states.
performing arts arts are:
Kathakali
Mohaniyattom

liya@liya-VirtualBox:~/INDIA/KERALA$ vim Language
liya@liya-VirtualBox:~/INDIA/KERALA$ cat Language
Many languages spoken in kerala
official language: Malayalam
other common languages are:
tamil
english
liya@liya-VirtualBox:~/INDIA/KERALA$ vim Dress
liya@liya-VirtualBox:~/INDIA/KERALA$ cat Dress
TRaditional wear of kerala is Mundu
it is white and worn by men and women
liya@liya-VirtualBox:~/INDIA/KERALA$
```

```
liya@liya-VirtualBox:~/INDIA$ cd TN
liya@liya-VirtualBox:~/INDIA/TN$ vim farm
liya@liya-VirtualBox:~/INDIA/TN$ cat farm
The major crops sown in Tamil Nadu are rice, jowar, ragi, bajra, maize, and pulses.
Few other crops that are highly cultivated in the regions of Tamil Nadu are cotton, sugarcane, tea, coffee, and coconut.
Tamil Nadu has also gained a commendable status is the horticultural sector in its agricultural department.
liya@liya-VirtualBox:~/INDIA/TN$ vim land
liya@liya-VirtualBox:~/INDIA/TN$ cat land
Tamil Nadu covers an area of 130,058 km2 (50,216 sq mi), and is the tenth-largest state in India.
Lands are classified with reference to their soil composition
and are further sub- divided into sorts of grades with reference to their chemical and physical properties
and other circumstances affecting their fertility.
```

```
liya@liya-VirtualBox:~/INDIA$ cd AP
liya@liya-VirtualBox:~/INDIA/AP$ mkdir Development
liya@liya-VirtualBox:~/INDIA/AP$ vim farmers
liya@liya-VirtualBox:~/INDIA/AP$ cat farmers
FARMER" will refer to a person actively engaged in the economic and/or livelihood activity of growing crops and
producing other primary agricultural commodities and will include
all agricultural operational holders, cultivators, agricultural labourers, sharecroppers, tenants, poultry
and livestock rearers, fishers, beekeepers, gardeners, pastoralists, non-corporate planters and planting labourers,
as well as persons engaged in various farmingrelated occupations such as sericulture, vermiculture, and agro-forestry.
The term will also include tribal families / persons engaged in shifting cultivation and in the collection,
use and sale of timber and non-timber forest produce.
liya@liya-VirtualBox:~/INDIA/AP$ vim general
liya@liya-VirtualBox:~/INDIA/AP$ cat general
Andhra Pradesh, state of India, located in the southeastern part of the subcontinent.
It is bounded by the Indian states of Tamil Nadu to the south, Karnataka to the southwest and west,
Telangana to the northwest and north, and Odisha to the northeast.
The eastern boundary is a 600-mile (970-km) coastline along the Bay of Bengal.
Telangana was a region within Andhra Pradesh for almost six decades,
but in 2014 it was carved off to form a separate state.
The capital of both Andhra Pradesh and Telangana is Hyderabad, in west-central Telangana.
liya@liya-VirtualBox:~/INDIA/AP$ vim industries
liya@liya-VirtualBox:~/INDIA/AP$ cat industries
Automobiles and Auto components Industry, spices, mines and minerals,
Textiles and apparels, IT industry, Bulk drugs and pharmaceuticals,
horticulture, poultry farming are the main industries in Andhra Pradesh.
```

2. List your present working directory.

```
liya@liya-VirtualBox:~/INDIA$ ls
AP  KERALA  TN
liya@liya-VirtualBox:~/INDIA$ ls -al
total 20
drwxrwxr-x  5 liya liya 4096 Aug 30 01:28 .
drwxr-xr-x 22 liya liya 4096 Aug 30 02:31 ..
drwxrwxr-x  2 liya liya 4096 Aug 30 02:31 AP
drwxrwxr-x  2 liya liya 4096 Aug 30 02:19 KERALA
drwxrwxr-x  2 liya liya 4096 Aug 30 02:26 TN
```

3. Move to the root directory.

```
liya@liya-VirtualBox:~/INDIA$ cd /
liya@liya-VirtualBox:/$
```

4. Copy the file 'Culture' to the folder AP.

Before Copying:

```
liya@liya-VirtualBox:~/INDIA/AP$ ls
Development  farmers  general  industries
liya@liya-VirtualBox:~/INDIA/AP$
```

After copying:

```
liya@liya-VirtualBox:/$ cp /home/liya/INDIA/KERALA/culture /home/liya/INDIA/AP
liya@liya-VirtualBox:/$ ls /home/liya/INDIA/AP
culture  Development  farmers  general  industries
```

5. Display the content of the file ‘general’.

```
liya@liya-VirtualBox:~/INDIA/AP$ cat general
Andhra Pradesh, state of India, located in the southeastern part of the subcontinent.
It is bounded by the Indian states of Tamil Nadu to the south, Karnataka to the southwest and west,
Telangana to the northwest and north, and Odisha to the northeast.
The eastern boundary is a 600-mile (970-km) coastline along the Bay of Bengal.
Telangana was a region within Andhra Pradesh for almost six decades,
but in 2014 it was carved off to form a separate state.
The capital of both Andhra Pradesh and Telangana is Hyderabad, in west-central Telangana.
liya@liya-VirtualBox:~/INDIA/AP$
```

6. Move the file ‘language’ to the directory AP/Development.

Before moving:

```
liya@liya-VirtualBox:~/INDIA/KERALA$ ls
culture  Dress  Language
```

After moving:

```
liya@liya-VirtualBox:~/INDIA/KERALA$ mv Language /home/liya/INDIA/AP/Development
liya@liya-VirtualBox:~/INDIA/KERALA$ ls /home/liya/INDIA/AP/Development
Language
liya@liya-VirtualBox:~/INDIA/KERALA$
```

```
liya@liya-VirtualBox:~/INDIA/KERALA$ ls
culture  Dress
liya@liya-VirtualBox:~/INDIA/KERALA$
```

7. List all the files in the folder AP.

```
liya@liya-VirtualBox:~/INDIA/AP$ ls -R
.:
culture  Development  farmers  general  industries

./Development:
Language
liya@liya-VirtualBox:~/INDIA/AP$
```

8. List first 10 lines of the file ‘Dress’.

```
liya@liya-VirtualBox:~/INDIA/KERALA$ vim Dress
liya@liya-VirtualBox:~/INDIA/KERALA$ cat Dress
TRaditional wear of kerala is Mundu
it is white and worn by men and women
t resembles a long skirt or a dhoti.
The upper garment varies with gender and age.
When you visit Kerala, you'll see men and women wearing completely white attires.
It depicts purity and elegance and
Their warm nature, amicable behaviour and simplicity in living welcomes all from around the world.
The lower garment Mundu is a white cloth wrapped around the waist.
It has a border called Kara which can be of any colour, mostly golden.
Kara renders a style to the Mundu by displaying it on the left or right side of the person.
Kara can be embroidered or decorated with ornaments for special occasions.
Mundu can be turned into a half skirt kind of a thing by tucking the lower end into the waist.
Men prefer to do this while doing any physical activities.
The upper garment is called 'Melmundu' which is worn like a towel on the shoulders.
The white shirt is also worn by many men these days.
liya@liya-VirtualBox:~/INDIA/KERALA$ head Dress
TRaditional wear of kerala is Mundu
it is white and worn by men and women
t resembles a long skirt or a dhoti.
The upper garment varies with gender and age.
When you visit Kerala, you'll see men and women wearing completely white attires.
It depicts purity and elegance and
Their warm nature, amicable behaviour and simplicity in living welcomes all from around the world.
The lower garment Mundu is a white cloth wrapped around the waist.
It has a border called Kara which can be of any colour, mostly golden.
Kara renders a style to the Mundu by displaying it on the left or right side of the person.
liya@liya-VirtualBox:~/INDIA/KERALA$
```

9. List the last 10 lines of the file ‘Dress’.

```
liya@liya-VirtualBox:~/INDIA/KERALA$ tail Dress
It depicts purity and elegance and
Their warm nature, amicable behaviour and simplicity in living welcomes all from around the world.
The lower garment Mundu is a white cloth wrapped around the waist.
It has a border called Kara which can be of any colour, mostly golden.
Kara renders a style to the Mundu by displaying it on the left or right side of the person.
Kara can be embroidered or decorated with ornaments for special occasions.
Mundu can be turned into a half skirt kind of a thing by tucking the lower end into the waist.
Men prefer to do this while doing any physical activities.
The upper garment is called 'Melmundu' which is worn like a towel on the shoulders.
The white shirt is also worn by many men these days.
```

10. List all the files in AP in long listing format.

```
liya@liya-VirtualBox:~/INDIA$ cd AP
liya@liya-VirtualBox:~/INDIA/AP$ ls -al
total 28
drwxrwxr-x 3 liya liya 4096 Aug 30 03:12 .
drwxrwxr-x 5 liya liya 4096 Aug 30 01:28 ..
-rw-rw-r-- 1 liya liya  184 Aug 30 03:04 culture
drwxrwxr-x 2 liya liya 4096 Aug 30 03:13 Development
-rw-rw-r-- 1 liya liya  690 Aug 30 03:00 farmers
-rw-rw-r-- 1 liya liya  553 Aug 30 03:00 general
-rw-rw-r-- 1 liya liya  213 Aug 30 03:01 industries
liya@liya-VirtualBox:~/INDIA/AP$
```

11. List the files in AP which begin with the character ‘f’.

```
liya@liya-VirtualBox:~/INDIA/AP$ ls f*
farmers
liya@liya-VirtualBox:~/INDIA/AP$
```

12. List the files page by page.

```
liya@liya-VirtualBox:~/INDIA$ ls -al -R|more -c -15
```

```
liya@liya-VirtualBox: ~/INDIA   liya@liya-VirtualBox: ~/INDIA
.:
.:
total 20
drwxrwxr-x  5 liya liya 4096 Aug 30 01:28 .
drwxr-xr-x 22 liya liya 4096 Aug 30 03:27 ..
drwxrwxr-x  3 liya liya 4096 Aug 30 03:12 AP
drwxrwxr-x  2 liya liya 4096 Aug 30 03:27 KERALA
drwxrwxr-x  2 liya liya 4096 Aug 30 02:26 TN

./AP:
total 28
drwxrwxr-x 3 liya liya 4096 Aug 30 03:12 .
drwxrwxr-x 5 liya liya 4096 Aug 30 01:28 ..
-rw-rw-r-- 1 liya liya  184 Aug 30 03:04 culture
drwxrwxr-x 2 liya liya 4096 Aug 30 03:13 Development
-rw-rw-r-- 1 liya liya  690 Aug 30 03:00 farmers
--More--
```

```
liya@liya-VirtualBox: ~/INDIA   liya@liya-VirtualBox: ~/INDIA
.:
-rw-rw-r-- 1 liya liya  553 Aug 30 03:00 general
-rw-rw-r-- 1 liya liya  213 Aug 30 03:01 industries

./AP/Development:
total 12
drwxrwxr-x 2 liya liya 4096 Aug 30 03:13 .
drwxrwxr-x 3 liya liya 4096 Aug 30 03:12 ..
-rw-rw-r-- 1 liya liya  103 Aug 30 02:19 Language

./KERALA:
total 16
drwxrwxr-x 2 liya liya 4096 Aug 30 03:27 .
drwxrwxr-x 5 liya liya 4096 Aug 30 01:28 ..
-rw-rw-r-- 1 liya liya  184 Aug 30 02:18 culture
-rw-rw-r-- 1 liya liya  982 Aug 30 03:27 Dress
--More--
```

```
liya@liya-VirtualBox: ~/INDIA    liya@liya-VirtualBox: ~/INDIA
.:

./TN:
total 16
drwxrwxr-x 2 liya liya 4096 Aug 30 02:26 .
drwxrwxr-x 5 liya liya 4096 Aug 30 01:28 ..
-rw-rw-r-- 1 liya liya  314 Aug 30 02:24 farm
-rw-rw-r-- 1 liya liya    0 Aug 30 02:23 farms
-rw-rw-r-- 1 liya liya  319 Aug 30 02:26 land
liya@liya-VirtualBox:~/INDIA$
```

13. Remove the file ‘general.

```
liya@liya-VirtualBox:~/INDIA$ cd AP
liya@liya-VirtualBox:~/INDIA/AP$ ls
culture  Development  farmers  general  industries
```

```
liya@liya-VirtualBox:~/INDIA/AP$ rm general
liya@liya-VirtualBox:~/INDIA/AP$ ls
culture  Development  farmers  industries
liya@liya-VirtualBox:~/INDIA/AP$
```

14. Change the permission of the file ‘Culture’ as only read permission to all.

```
liya@liya-VirtualBox:~$ cd INDIA
liya@liya-VirtualBox:~/INDIA$ cd AP
liya@liya-VirtualBox:~/INDIA/AP$ chmod -w culture
liya@liya-VirtualBox:~/INDIA/AP$ chmod -x culture
liya@liya-VirtualBox:~/INDIA/AP$ ls -al
total 24
drwxrwxr-x 3 liya liya 4096 Aug 30 04:01 .
drwxrwxr-x 5 liya liya 4096 Aug 30 01:28 ..
-r--r--r-- 1 liya liya  184 Aug 30 03:04 culture
drwxrwxr-x 2 liya liya 4096 Aug 30 03:13 Development
-rw-rw-r-- 1 liya liya  690 Aug 30 03:00 farmers
-rw-rw-r-- 1 liya liya  213 Aug 30 03:01 industries
liya@liya-VirtualBox:~/INDIA/AP$
```

15. List the lines of the file which contains a string ‘Saree’.

```
liya@liya-VirtualBox:/$ grep -inr "Saree" /home/liya/INDIA
Binary file /home/liya/INDIA/KERALA/.Dress.swp matches
/home/liya/INDIA/KERALA/Dress:16:women may wear a Mundu or a Saree depending on the occasion and custom.
/home/liya/INDIA/KERALA/Dress:17:Saree is called mundum neriyath,
/home/liya/INDIA/KERALA/Dress:19:Set Saree is worn by women in special occasions
liya@liya-VirtualBox:/$
```

The -inr option has three parts:

- i to ignore case sensitivity,
- n to display the line numbers in for each matched result, and
- r to recursively read all files under each directory.

16. Use man command to get the syntax of wc command.

```
WC(1)                                                                   User Commands

NAME
       wc - print newline, word, and byte counts for each file

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

DESCRIPTION
       Print newline, word, and byte counts for each FILE, and a total line if more than one FILE is specified.  A word is a non-zero-length sequence of characters delimited by white space.

       With no FILE, or when FILE is -, read standard input.

       The options below may be used to select which counts are printed, always in the following order: newline, word, character, byte, maximum line length.

       -c, --bytes
              print the byte counts

       -m, --chars
              print the character counts

       -l, --lines
              print the newline counts

       --files0-from=F
              read input from the files specified by NUL-terminated names in file F; If F is - then read names from standard input

       -L, --max-line-length
              print the maximum display width

       -w, --words
              print the word counts

       --help display this help and exit

       --version
              output version information and exit

AUTHOR
       Written by Paul Rubin and David MacKenzie.

REPORTING BUGS
       GNU coreutils online help: <https://www.gnu.org/software/coreutils/>
       Report wc translation bugs to <https://translationproject.org/team/>

COPYRIGHT
 Manual page wc(1) line 1 (press h for help or q to quit)
```

17. Count the number of characters, words, lines in the directory listing.

```
liya@liya-VirtualBox:/$ wc -mlw `find /home/liya/INDIA/ -type f`
  21  211 1165 /home/liya/INDIA/KERALA/Dress
   6   27  184 /home/liya/INDIA/KERALA/culture
   3   51  314 /home/liya/INDIA/TN/farm
   4   50  319 /home/liya/INDIA/TN/land
   7   89  688 /home/liya/INDIA/AP/farmers
   3   28  213 /home/liya/INDIA/AP/industries
   5   14  103 /home/liya/INDIA/AP/Development/Language
   6   27  184 /home/liya/INDIA/AP/culture
  55  497 3170 total
```

Q18. Put a listing of the files in your directory into a file called filelist.

```
liya@liya-VirtualBox:~$ ls -a -R /home/liya/INDIA/ > filelist
liya@liya-VirtualBox:~$ cat filelist
/home/liya/INDIA/:
.
..
AP
KERALA
TN

/home/liya/INDIA/AP:
.
..
culture
Development
farmers
industries

/home/liya/INDIA/AP/Development:
.
..
Language

/home/liya/INDIA/KERALA:
.
..
culture
Dress

/home/liya/INDIA/TN:
.
..
farm
land
liya@liya-VirtualBox:~$
```

Q19. List the status of all process running in your system.

```
liya@liya-VirtualBox:~$ ps
    PID TTY          TIME CMD
   2727 pts/1    00:00:00 bash
   3338 pts/1    00:00:00 ps
liya@liya-VirtualBox:~$
```

Q20. List the disk partitions in your harddisk.

```
liya@liya-VirtualBox:~$ df
Filesystem     1K-blocks    Used Available Use% Mounted on
udev             1984432       0   1984432   0% /dev
tmpfs             402812    1384    401428   1% /run
/dev/sda5        9994532 7757844   1709280  82% /
tmpfs            2014044       0   2014044   0% /dev/shm
tmpfs               5120       4      5116   1% /run/lock
tmpfs            2014044       0   2014044   0% /sys/fs/cgroup
/dev/loop1         56832   56832         0 100% /snap/core18/2074
/dev/loop2        224256  224256         0 100% /snap/gnome-3-34-1804/66
/dev/loop3         33152   33152         0 100% /snap/snapd/12704
/dev/loop0         56832   56832         0 100% /snap/core18/2128
/dev/loop5         52224   52224         0 100% /snap/snap-store/547
/dev/loop4         66688   66688         0 100% /snap/gtk-common-themes/1515
/dev/loop6        224256  224256         0 100% /snap/gnome-3-34-1804/72
/dev/loop7         52224   52224         0 100% /snap/snap-store/542
/dev/loop8         66432   66432         0 100% /snap/gtk-common-themes/1514
/dev/loop9         33152   33152         0 100% /snap/snapd/12883
/dev/sda1         523248       4    523244   1% /boot/efi
tmpfs             402808      12    402796   1% /run/user/125
tmpfs             402808      48    402760   1% /run/user/1000
/dev/sr0           59590   59590         0 100% /media/liya/VBox_GAs_6.1.22
liya@liya-VirtualBox:~$
```

Q21. Redirect the output of the top program to a file called ‘errors’.

```
liya@liya-VirtualBox:~$ top >> errors
liya@liya-VirtualBox:~$ cat errors | more -c -15

top - 16:12:54 up  1:25,  1 user,  load average: 0.00, 0.08, 0.09
Tasks: 212 total,   1 running, 211 sleeping,   0 stopped,   0 zombie
m
%Cpu(s):  9.7 us,  3.2 sy,  0.0 ni, 87.1 id,  0.0 wa,  0.0
39;49mhi,  0.0 si,  0.0 st
MiB Mem :   3933.7 total,   1603.8 free,   1110.1 used,   1219.8 buff/cache
MiB Swap:    460.5 total,    460.5 free,      0.0 used.   2551.5 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND

   1582 liya      20   0 4246984 382696 136696 S  13.3   9.5   1:53.10 gnome-shell

   1923 liya      20   0  830072  53460  39756 S   6.7   1.3   0:11.80 gnome-terminal-

   3426 liya      20   0   20656   3856   3180 R   6.7   0.1   0:00.01 top
--More--
```

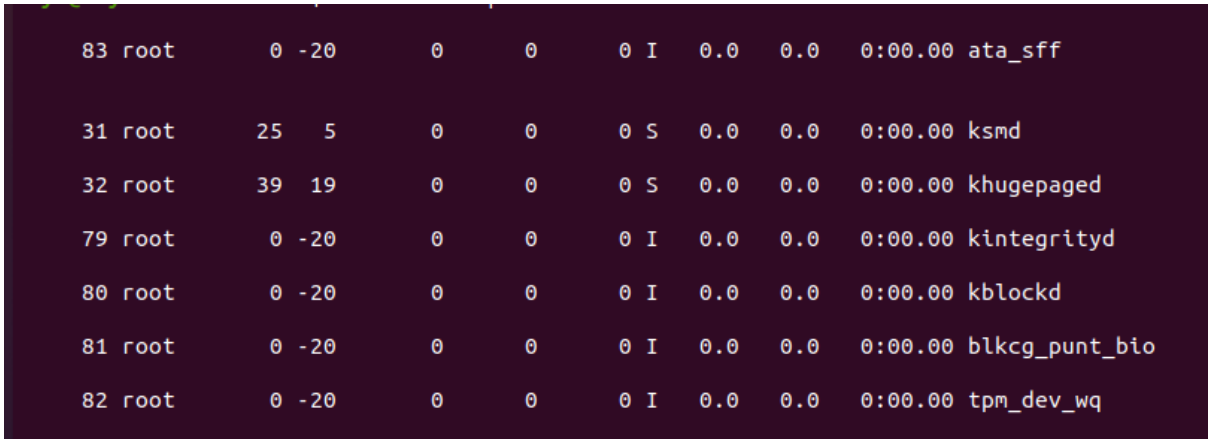
```
      1 root      20   0  167736  11808   8504 S   0.0   0.3   0:01.31 systemd

      2 root      20   0       0      0      0 S   0.0   0.0   0:00.00 kthreadd

      3 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_gp

      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp

      6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-events_highpri

      9 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 mm_percpu_wq

     10 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_rude_

--More--
```

```
    11 root      20   0       0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_trace
    12 root      20   0       0      0      0 S   0.0   0.0   0:00.10 ksoftirqd/0
    13 root      20   0       0      0      0 I   0.0   0.0   0:00.61 rcu_sched
    14 root      rt   0       0      0      0 S   0.0   0.0   0:00.05 migration/0
    15 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/0
    16 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
    17 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
    18 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/1
--More--
```

```
    19 root      rt   0       0      0      0 S   0.0   0.0   0:00.42 migration/1
    20 root      20   0       0      0      0 S   0.0   0.0   0:00.07 ksoftirqd/1
    22 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
    23 root      20   0       0      0      0 S   0.0   0.0   0:00.00 kdevtmpfs
    24 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 netns
    25 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 inet_frag_wq
    26 root      20   0       0      0      0 S   0.0   0.0   0:00.00 kauditd
--More--
```

```
    27 root      20   0       0      0      0 S   0.0   0.0   0:00.00 khungtaskd
    28 root      20   0       0      0      0 S   0.0   0.0   0:00.00 oom_reaper
    29 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 writeback
    30 root      20   0       0      0      0 S   0.0   0.0   0:00.27 kcompactd0
    31 root      25   5       0      0      0 S   0.0   0.0   0:00.00 ksmd
    32 root      39  19       0      0      0 S   0.0   0.0   0:00.00 khugepaged
    79 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kintegrityd
    80 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kblockd
--More--
```

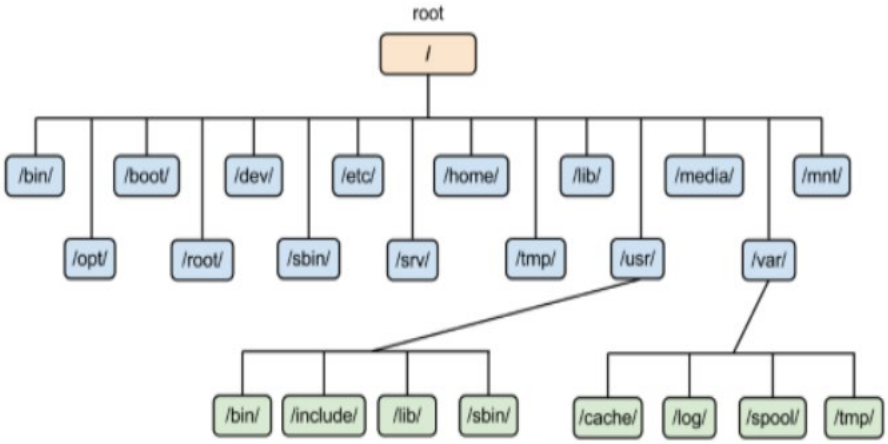
```
top - 16:12:58 up  1:25,  1 user,  load average: 0.00, 0.08, 0.09
Tasks: 211 total,   1 running, 210 sleeping,   0 stopped,   0 zombie
m
%Cpu(s):  0.3 us,  0.2 sy,  0.0 ni, 99.4 id,  0.0 wa,  0.0
39;49mhi,  0.2 si,  0.0 st



   1493 liya      20   0  163996   2836   2464 S   0.6   0.1   0:13.46 VBoxClient
   1582 liya      20   0 4246984 382660 136696 S   0.6   9.5   1:53.12 gnome-shell
    170 root      20   0       0      0      0 I   0.3   0.0   0:01.20 kworker/0:2-events
--More--
```


83 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 ata_sff
31 root 25 5 0 0 0 S 0.0 0.0 0:00.00 ksmd
32 root 39 19 0 0 0 S 0.0 0.0 0:00.00 khugepaged
79 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kintegrityd
80 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kblockd
81 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 blkcg_punt_bio
82 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 tpm_dev_wq

EXPERIMENT -3

3.1 Linux File System Hierarchy Structure

1. Explain File system hierarchy in a common Linux distribution.
   AND
2. Explain each directories and its use in Linux. Filesystem hierarchy standard describes directory structure and its contents.



File system hierarchy of Linux

Linux uses the Filesystem Hierarchy Standard (FHS) file system structure, which defines the names, locations, and permissions for many file types and directories.

• 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** is the main directory which contains all other subdirectories. The root directory is the one from which all other directories branch off from. When you run tree and tell it to start with /, you will see the whole directory tree, all directories and all the subdirectories in the whole system, with all their files, fly by.

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

   The /bin directory contains the essential user binaries (programs) that must be present when the system is mounted in single-user mode. Applications such as Firefox are stored in /usr/bin, while important system programs and utilities such as the bash shell are located in /bin. The /usr directory may be stored on another partition – placing these files in the /bin directory ensures the system will have these important utilities even if no other file systems are mounted.

3. /**sbin**: directory is similar – it contains essential system administration binaries.

4. /**boot:** The /boot directory contains files required for starting your system. If you mess up one of the files in here, you may not be able to run your Linux and it is a pain to repair. On the other hand, don't worry too much about destroying your system by accident: you have to have superuser privileges to do that.

5. /**dev** : /dev contains device files. Many of these are generated at boot time or even on the fly. For example, if you plug in a new webcam or a USB pendrive into your machine, a new device entry will automatically pop up here.

6. **/etc** : is the directory where names start to get confusing. /etc gets its name from the earliest Unixes and it was literally "et cetera" because it was the dumping ground for system files administrators were not sure where else to put.

7. **/home**: is where you will find your users' personal directories. In my case, under /home there are two directories: /home/paul, which contains all my stuff; and /home/guest, in case anybody needs to borrow my computer.

8. **/lib**: is where libraries live. Libraries are files containing code that your applications can use. They contain snippets of code that applications use to draw windows on your desktop, control peripherals, or send files to your hard disk. There are more lib directories scattered around the file system, but this one, the one hanging directly off of / is special in that, among other things, it contains the all-important kernel modules. The kernel modules are drivers that make things like your video card, sound card, WiFi, printer, and so on, work.

9. **/media**: directory is where external storage will be automatically mounted when you plug it in and try to access it. As opposed to most of the other items on this list, /media does not hail back to 1970s, mainly because inserting and detecting storage (pendrives, USB hard disks, SD cards, external SSDs, etc) on the fly, while a computer is running, is a relatively new thing.

10. **/mnt**: directory, however, is a bit of remnant from days gone by. This is where you would manually mount storage devices or partitions. It is not used very often nowadays.

11. **/opt**: directory is often where software you compile (that is, you build yourself from source code and do not install from your distribution repositories) sometimes lands. Applications will end up in the /opt/bin directory and libraries in the /opt/lib directory. A slight digression: another place where applications and libraries end up in is /usr/local, When software gets installed here, there will also be /usr/local/bin and /usr/local/lib directories. What determines which software goes where is how the developers have configured the files that control the compilation and installation process.

12. **/proc**: like /dev is a virtual directory. It contains information about your computer, such as information about your CPU and the kernel your Linux system is running. As with /dev, the files and directories are generated when your computer starts, or on the fly, as your system is running and things change.

13. **/run:** is another new directory. System processes use it to store temporary data for their own nefarious reasons.

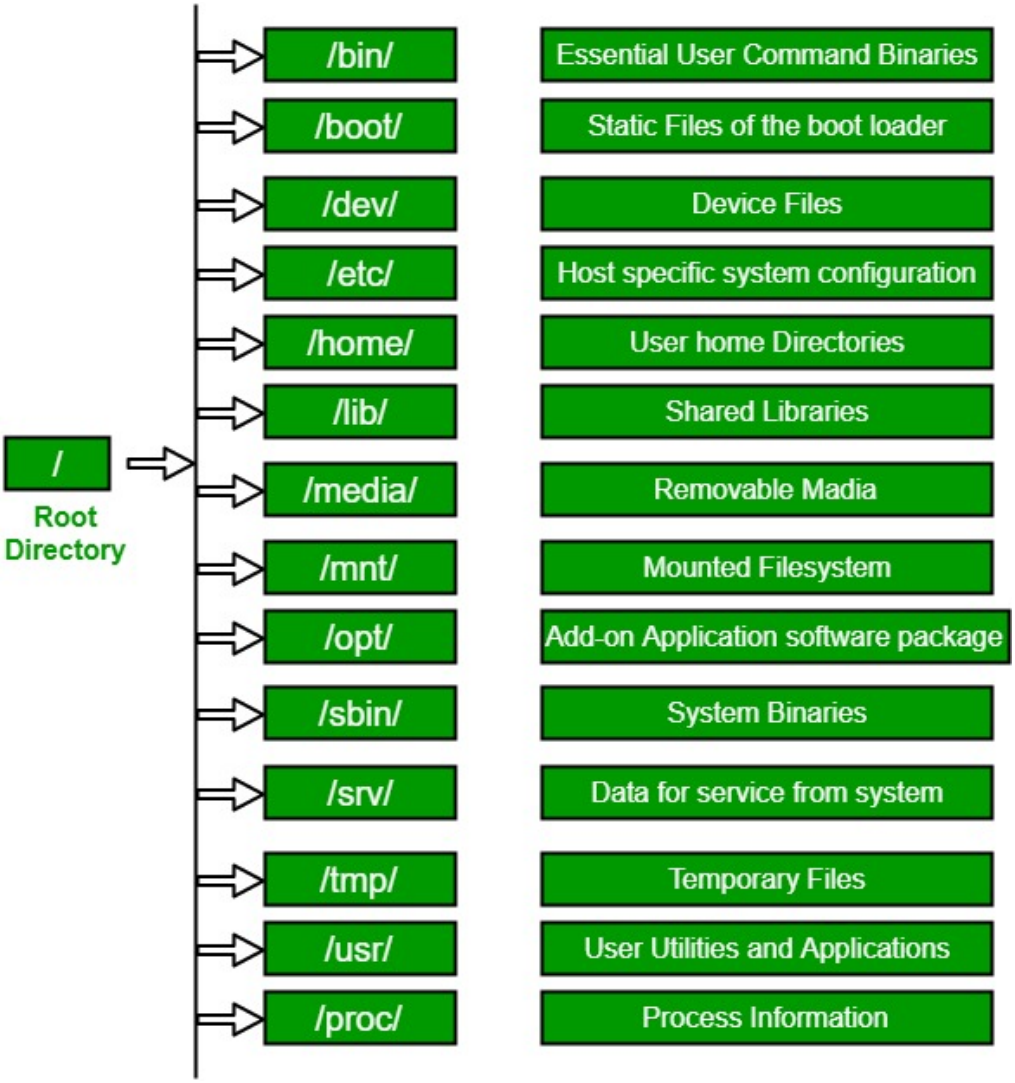
14./**usr**: directory was where users' home directories were originally kept back in the early days of UNIX. However, now /home is where users kept their stuff as we saw above. These days, /usr contains a mish-mash of directories which in turn contain applications, libraries, documentation, wallpapers, icons and a long list of other stuff that need to be shared by applications and services.

15./**srv**: directory contains data for servers. If you are running a web server from your Linux box, your HTML files for your sites would go into /srv/http (or /srv/www). If you were running an FTP server, your files would go into /srv/ftp.

16./**sys**: is another virtual directory like /proc and /dev and also contains information from devices connected to your computer. In some cases you can also manipulate those devices. I can, for example, change the brightness of the screen of my laptop by modifying the value stored (on your machine you will probably have a different file). But to do that you have to become superuser. The reason for that is, as with so many other virtual directories, messing with the contents and files in /sys can be dangerous and you can trash your system. DO NOT TOUCH until you are sure you know what you are doing.

17./**tmp**: contains temporary files, usually placed there by applications that you are running. The files and directories often (not always) contain data that an application doesn't need right now, but may need later on. You can also use /tmp to store your own temporary files — /tmp is one of the few directories hanging off / that you can actually interact with without becoming superuser.

18./**var**: was originally given its name because its contents was deemed variable, in that it changed frequently. Today it is a bit of a misnomer because there are many other directories that also contain data that changes frequently, especially the virtual directories we saw above. Be that as it may, /var contains things like logs in the /var/log subdirectories. Logs are files that register events that happen on the system. If something fails in the kernel, it will be logged in a file in /var/log; if someone tries to break into your computer from outside, your firewall will also log the attempt here. It also contains spools for tasks. These "tasks" can be the jobs you send to a shared printer when you have to wait because another user is printing a long document, or mail that is waiting to be delivered to users on the system.


/
Root Directory
/bin/
Essential User Command Binaries
/boot/
Static Files of the boot loader
/dev/
Device Files
/etc/
Host specific system configuration
/home/
User home Directories
/lib/
Shared Libraries
/media/
Removable Madia
/mnt/
Mounted Filesystem
/opt/
Add-on Application software package
/sbin/
System Binaries
/srv/
Data for service from system
/tmp/
Temporary Files
/usr/
User Utilities and Applications
/proc/
Process Information

3.2. The tree installation process:

```
liya@liya-VirtualBox:~$ sudo apt install tree
[sudo] password for liya:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi libgstreamer-plugins-bad1.0-0 libva-wayland2
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  tree
0 upgraded, 1 newly installed, 0 to remove and 198 not upgraded.
Need to get 43.0 kB of archives.
After this operation, 115 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 tree amd64 1.8.0-1 [43.0 kB]
Fetched 43.0 kB in 0s (164 kB/s)
Selecting previously unselected package tree.
(Reading database ... 191229 files and directories currently installed.)
Preparing to unpack .../tree_1.8.0-1_amd64.deb ...
Unpacking tree (1.8.0-1) ...
Setting up tree (1.8.0-1) ...
Processing triggers for man-db (2.9.1-1) ...
liya@liya-VirtualBox:~$
```

```
liya@liya-VirtualBox:~$ tree -L 1 /
/
├── bin -> usr/bin
├── boot
├── cdrom
├── dev
├── etc
├── home
├── lib -> usr/lib
├── lib32 -> usr/lib32
├── lib64 -> usr/lib64
├── libx32 -> usr/libx32
├── lost+found
├── media
├── mnt
├── opt
├── proc
├── root
├── run
├── sbin -> usr/sbin
├── snap
├── srv
├── swapfile
├── sys
├── tmp
├── usr
└── var
```

```
liya@liya-VirtualBox:~$ tree
.
├── 14liya
├── 14liya.txt
├── a
├── add
├── anju
│   ├── redirect.txt
│   ├── second.txt
│   └── third.txt
├── b
├── c
├── check.txt
├── Desktop
│   └── anju
├── dev
│   └── xyz
│       ├── myfile
│       └── newfile.txt
```

```
├── Documents
├── Downloads
├── errors
├── ffe
├── filelist
├── INDIA
│   ├── AP
│   │   ├── culture
│   │   ├── Development
│   │   │   └── Language
│   │   ├── farmers
│   │   └── industries
│   ├── KERALA
│   │   ├── culture
│   │   └── Dress
│   └── TN
│       ├── farm
│       └── land
```

```
├── lee
│   └── aju
├── library
│   ├── fiction
│   │   ├── xx
│   │   └── yy
│   └── nonfiction
│       ├── pp
│       └── qq
```

```
├── liya
├── liya1
├── liya1.txt
├── liya2.txt
├── liya.txt
├── Music
├── myapp
├── numbers
├── Pictures
├── Public
├── read
├── redirect.txt
├── second.txt
├── Templates
├── test
│   └── test
│       └── test
└── Videos

25 directories, 37 files
```

1. Explore various directories and files using the command cd, ls etc in linux and provide its screenshots.

```
liya@liya-VirtualBox:~$ ls
14liya      b           Documents  INDIA    liya1.txt  numbers     second.txt
14liya.txt  c           Downloads  lee      liya2.txt  Pictures    Templates
a           check.txt   errors     library  liya.txt   Public      test
add         Desktop     ffe        liya     Music      read        Videos
anju        dev         filelist   liya1    myapp      redirect.txt
```

```
liya@liya-VirtualBox:~$ cd Desktop
liya@liya-VirtualBox:~/Desktop$ ls
anju
liya@liya-VirtualBox:~/Desktop$ cd Documents
bash: cd: Documents: No such file or directory
liya@liya-VirtualBox:~/Desktop$ cd Desktop
bash: cd: Desktop: No such file or directory
liya@liya-VirtualBox:~/Desktop$ cd ..
liya@liya-VirtualBox:~$ cd Desktop
liya@liya-VirtualBox:~/Desktop$ ls
anju
liya@liya-VirtualBox:~/Desktop$ cd ..
liya@liya-VirtualBox:~$ cd Documents
liya@liya-VirtualBox:~/Documents$ ls
liya@liya-VirtualBox:~/Documents$ cd ..
liya@liya-VirtualBox:~$ cd dev
liya@liya-VirtualBox:~/dev$ ls
xyz
```

```
liya@liya-VirtualBox:~/dev$ cd ..
liya@liya-VirtualBox:~$ cd library
liya@liya-VirtualBox:~/library$ ls
fiction  nonfiction
liya@liya-VirtualBox:~/library$ cd ..
liya@liya-VirtualBox:~$ cd lee
liya@liya-VirtualBox:~/lee$ ls
aju
liya@liya-VirtualBox:~/lee$ cd ..
liya@liya-VirtualBox:~$ cd Downloads
liya@liya-VirtualBox:~/Downloads$ ls
liya@liya-VirtualBox:~/Downloads$ cd INDIA
bash: cd: INDIA: No such file or directory
liya@liya-VirtualBox:~/Downloads$ cd ..
liya@liya-VirtualBox:~$ cd INDIA
liya@liya-VirtualBox:~/INDIA$ ls
AP  KERALA  TN
liya@liya-VirtualBox:~/INDIA$ cd ..
liya@liya-VirtualBox:~$ cd anju
liya@liya-VirtualBox:~/anju$ ls
redirect.txt  second.txt  third.txt
liya@liya-VirtualBox:~/anju$ cd ..
liya@liya-VirtualBox:~$ cd test
liya@liya-VirtualBox:~/test$ ls
test
```

EXPERIMENT -4

4.1 Shell Script

1. Write a Shell program to display a given message.

```
liya@liya-VirtualBox:~$ vim sh1
liya@liya-VirtualBox:~$ chmod +x sh1
liya@liya-VirtualBox:~$ ./sh1
HELLO WORLD
liya@liya-VirtualBox:~$
```

Output:

```
echo "HELLO WORLD"

~
~
```

Result:

The program executed successfully

2. Write a shell script to evaluate arithmetic operations.

```
echo "enter two integer number"
read x
read y
c=`expr $x + $y`
echo "sum=$c"
c=`expr $x - $y`
echo "sub=$c"
c=`expr $x / $y`
echo "div=$c"
c=`expr $x \* $y`
echo "product=$c"
c=`expr $x % $y`
echo "remainder=$c"
```

Output:

```
liya@liya-VirtualBox:~$ vim sh2
liya@liya-VirtualBox:~$ ./sh2
enter two integer number
8
4
sum=12
sub=4
div=2
product=32
remainder=0
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

3. Write a shell Script to determine largest among three integer number.

```
echo "Enter three integer numbers:"
read a
read b
read c
if [ $a -ge $b ]
then
if [ $a -ge $c ]
then
echo "$a is greatest"
else
echo "$c is greatest"
fi
elif [ $b -ge $c ]
then
echo "$b is greatest"
else
echo "$c is greatest"
fi
~
```

Output:

```
liya@liya-VirtualBox:~$ vim sh3
liya@liya-VirtualBox:~$ chmod +x sh3
liya@liya-VirtualBox:~$ ./sh3
Enter three integer numbers:
6
8
3
8 is greatest
```

Result:

The program executed successfully

4. Write a shell script to compare two string.

```
echo “enter two string”
read a
read b
if [ -z $a ]
then
echo “ First String is empty: Null String”
fi
if [ -z $b ]
then
echo “ First String is empty: Null String”fi
if [ $a = $b ]
then
echo “Strings are equal: strings Matched”
else
echo “Strings are not equal: Strings not match”
fi
```

Output:

```
liya@liya-VirtualBox:~$ vim sh4
liya@liya-VirtualBox:~$ ./sh4
“enter two string”
light
eight
“Strings are not equal: Strings not match”
liya@liya-VirtualBox:~$ ./sh4
“enter two string”
show
show
“Strings are equal: strings Matched”
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

5. Write a shell script to read and check the directory exists or not, if not make directory.

```
echo “enter name of directory”
read dir
if [ -d $dir ]
then
echo “Directory $dir Exists!”
else
mkdir $dir
fi
~
```

Output:

```
liya@liya-VirtualBox:~$ vim sh6
liya@liya-VirtualBox:~$ ./sh6
“enter name of directory”
z
“Directory z Exists!”
liya@liya-VirtualBox:~$ ./sh6
“enter name of directory”
yy
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

6. Write a shell script to read and check the file exists or not, if not make file.

```
echo “enter name of file”
read filename
if [ -f $filename ]
then
echo “File $filename Exits!”
else
touch $filename
fi
~
~
```

Output:

```
liya@liya-VirtualBox:~$ vim sh7
liya@liya-VirtualBox:~$ chmod +x sh7
liya@liya-VirtualBox:~$ ./sh7
“enter name of file”
z
liya@liya-VirtualBox:~$ ./sh7
“enter name of file”
sh7
“File sh7 Exits!”
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

7. Write a shell script to implement menu driven program to perform all arithmetic operation using case statement.

```
echo “enter two integer values”
read a
read b
echo -e “Menu \n 1 for Addition \n 2 for Substraction \n 3 for Multiplication \n 4 for Division \n 5 for Remainder”
echo “enter choice”
read ch
case $ch in
1) echo “Sum=$(expr $a + $b)”;;
2) echo “Substraction=$(expr $a - $b)”;;
3) echo “Multiplication=$(expr $a \* $b)”;;
4) echo “Division=$(expr $a / $b)”;;
5) echo “Remainder=$(expr $a % $b)”;;
6) echo “invalid Choice:Try Again!”
esac
```

Output:

```
liya@liya-VirtualBox:~$ vim sh5
liya@liya-VirtualBox:~$ ./sh5
“enter two integer values”
5
9
-e “Menu n 1 for Addition n 2 for Substraction n 3 for Multiplication n 4 for Division n 5 for Remainder”
“enter choice”
5
“Remainder=5”
liya@liya-VirtualBox:~$ ./sh5
“enter two integer values”
8
6
-e “Menu n 1 for Addition n 2 for Substraction n 3 for Multiplication n 4 for Division n 5 for Remainder”
“enter choice”
4
“Division=1”
liya@liya-VirtualBox:~$ ./sh5
“enter two integer values”
7
3
-e “Menu n 1 for Addition n 2 for Substraction n 3 for Multiplication n 4 for Division n 5 for Remainder”
“enter choice”
3
“Multiplication=21”
```

Result:

The program executed successfully

8. Write a shell script to do:

a. display list of directory contents

b. Name of current directory

c. Who is logged on

d. Long listing of directory contents according to choose of user.

```
echo -e "Menu \n 1 for listing directory content \n 2 for print name of current directory \n 3
for Show who is logged on \n 4 Show directory content using long listing format "
echo "enter your choice "
read ch
case $ch in
1) ls;;
2) pwd;;
3) who;;
4) ls -l;;
*) echo "Invalid Choice: Try Again!!"
esac
~
```

Output:

```
liya@liya-VirtualBox:~$ vim sh8
liya@liya-VirtualBox:~$ chmod +x sh8
liya@liya-VirtualBox:~$ ./sh8
-e "Menu n 1 for listing directory content n 2 for print name of current directory n 3 for Show
who is logged on n 4 Show directory content using long listing format "
"enter your choice "
1
14liya      check.txt  ffe       liya1          num           second.txt  sh7        yy
14liya.txt  d          filelist  liya1.txt      numbers       sh1         sh78       z
a           Desktop    g         liya2.txt      Pictures      sh2         sh8
add         dev        INDIA     liya.txt       Public        sh22        Templates
anju        dig        lar       Music          q             sh3         test
b           Documents  lee       myapp          qqq           sh4         ttt
c           Downloads  library   n              read          sh5         v
calculator  errors     liya      naturalnumsum  redirect.txt  sh6         Videos
liya@liya-VirtualBox:~$ ./sh8
-e "Menu n 1 for listing directory content n 2 for print name of current directory n 3 for Show
who is logged on n 4 Show directory content using long listing format "
"enter your choice "
2
/home/liya
```

```
liya@liya-VirtualBox:~$ ./sh8
-e “Menu n 1 for listing directory content n 2 for print name of current directory n 3 for Show
who is logged on n 4 Show directory content using long listing format “
“enter your choice “
3
liya     :0           2021-09-23 20:40 (:0)
```

Result:

The program executed successfully

9. Write a shell script to getting input details like name, roll number and marks and print them using command line arguments.

```
liya@liya-VirtualBox:~$ cat > Studentdetails
echo "Name of the student: $1"
echo "Roll Number of the student: $2"
echo "Marks of the student: $3"
liya@liya-VirtualBox:~$ chmod +x Studentdetails
liya@liya-VirtualBox:~$ ./Studentdetails Liya 14 83
Name of the student: Liya
Roll Number of the student: 14
Marks of the student: 83
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

10. Understand the differences between Echo statement using single quote, double quote and without quotes.

```
liya@liya-VirtualBox:~$ cat > file1.sh

a=12
echo $a
echo "$a"
echo '$a'
liya@liya-VirtualBox:~$ chmod +x file1.sh
liya@liya-VirtualBox:~$ ./file1.sh
12
12
$a
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

11. To check whether there is any entry in the month of May in the system log.

```
if [[ -e /var/log/syslog ]];
then
cat /var/log/syslog | grep "^May"
else
echo "File not found"
fi
~
```

Output:

```
hp@hp-HP-Laptop-15s-du0xxx:~/Desktop/ansar$ chmod +x sh11.sh
hp@hp-HP-Laptop-15s-du0xxx:~/Desktop/ansar$ ./sh11.sh
Binary file (standard input) matches
hp@hp-HP-Laptop-15s-du0xxx:~/Desktop/ansar$ dir
```

Result:

The program executed successfully

12. Implement arithmetic calculator using Functions.

```
add()
{
i=$1
j=$2
((k=i+j))
echo Sum is $k
}
sub()
{
i=$1
j=$2
((k=i-j))
echo difference is $k
}
mul()
{
i=$1
j=$2
((k=i*j))
echo product is $k
}
echo "Enter your option: 1: Add, 2:Subtract, 3: Multiply"
read i
case $i in
1) add 1 2;;
2) sub 1 2;;
3) mul 1 2;;
esac
```

Output:

```
liya@liya-VirtualBox:~$ gedit sh13.sh
liya@liya-VirtualBox:~$ chmod +x sh13.sh
liya@liya-VirtualBox:~$ ./sh13.sh
Enter your option: 1: Add, 2:Subtract, 3: Multiply
2
difference is -1
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

13. To find the sum of n natural numbers.

a. Using for loop

```
echo "Using for loop"
sum=0
for ((i=0;i<10;i++))
do
((sum=sum+i))
done
echo $sum
~
```

```
liya@liya-VirtualBox:~$ vim sh14
liya@liya-VirtualBox:~$ chmod +x sh14
liya@liya-VirtualBox:~$ ./sh14
Using for loop
45
```

b.Using While loop

```
echo "Using While loop"
i=0
sum=0
while ((i<10));do
((sum=sum+i))
((i=i+1))
done
echo $sum
~
~
~
~
```

```
liya@liya-VirtualBox:~$ vim sh14b
liya@liya-VirtualBox:~$ chmod +x sh14b
liya@liya-VirtualBox:~$ ./sh14b
Using While loop
45
liya@liya-VirtualBox:~$
```

Result:

The program executed successfully

EXPERIMENT -5

5.1 Installing LAMP on Ubuntu

Step 1: Update Package Repository Cache

Before you begin:

1. Open the terminal either by using the **CTRL+ALT+T** keyboard shortcut or by searching for the word *terminal* in **Ubuntu**

2. Make sure to update the package repository cache to ensure it installs the latest versions of the software. To do so, type in the following command:

```
sudo apt-get update
```

```
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo apt-get update
Get:1 http://in.archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Hit:2 https://screenrec.com/download/ubuntu stable InRelease
Get:3 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security/main amd64 DEP-11 Metadata [27
.6 kB]
Get:5 http://security.ubuntu.com/ubuntu focal-security/universe amd64 DEP-11 Metadata
 [61.0 kB]
Get:6 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 DEP-11 Metada
ta [2,464 B]
Get:1 http://in.archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Get:1 http://in.archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Get:1 http://in.archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Hit:7 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:8 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease
Fetched 463 kB in 2min 36s (2,977 B/s)
Reading package lists... Done
hp@hp-HP-Laptop-15s-du0xxx:~$
```

Step 2: Install Apache

1. To install Apache, run the following command in the terminal:

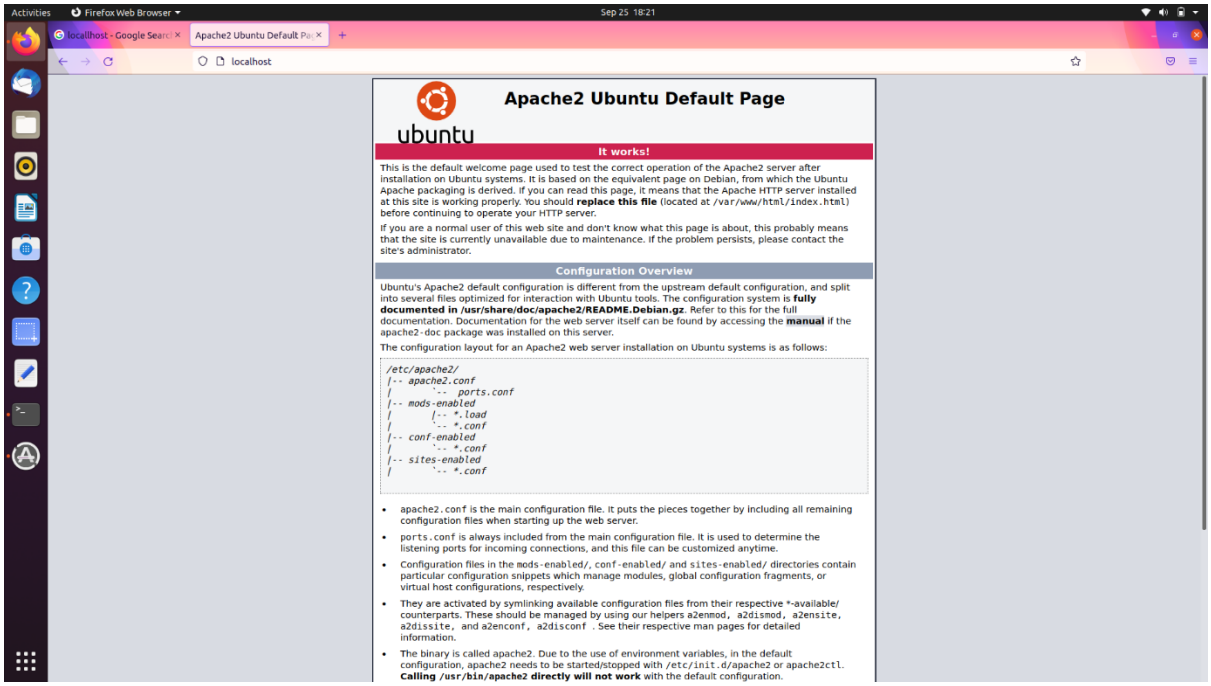
sudo apt-get install apache2

```
Reading package lists... Done
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo apt-get install apache2
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  enchant geoip-database libbind9-161 libboost-filesystem1.67.0
  libboost-iostreams1.67.0 libdns-export1107 libdns1107 libdns1109 libenchant1c2a
  libexiv2-14 libfprint0 libgeoip1 libgspell-1-1 libgutenprint-common
  libgutenprint9 libiptc0 libirs161 libisc-export1104 libisc1104 libisc1105
  libisccc161 libisccfg163 libllvm9 liblwres161 libnfs12 liboauth0
  printer-driver-gutenprint python3-asn1crypto shim ubuntu-software
  ubuntu-system-service
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.2-0
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.2-0
0 upgraded, 9 newly installed, 0 to remove and 66 not upgraded.
Need to get 1,819 kB of archives.
After this operation, 7,938 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

Press **y** (yes) and hit **ENTER** to permit the installation.

2. To ensure Apache is running, enter the Localhost of your server in the address bar and press **ENTER**.

The test Apache web server page should display as below.



Step 3: Install PHP

1. To install PHP, run the following command:

$ sudo apt-get install php7.4

```
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo apt-get install php7.4
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  enchant geoip-database libbind9-161 libboost-filesystem1.67.0 libboost-iostreams1.67.0 libdns-export1107 libdns1107 libdns1109 libenchant1c2a libexiv2-14 libfprint0 libgeoip1 libgspell-1-1
  libgutenprint-common libgutenprint9 libiptc0 libirs161 libisc-export1104 libisc1104 libisc1105 libisccc161 libisccfg163 libllvm9 liblwres161 libnfs12 liboauth0 printer-driver-gutenprint
  python3-asn1crypto shim ubuntu-software ubuntu-system-service
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  libapache2-mod-php7.4 php-common php7.4-cli php7.4-common php7.4-json php7.4-opcache php7.4-readline
Suggested packages:
  php-pear
The following NEW packages will be installed:
  libapache2-mod-php7.4 php-common php7.4 php7.4-cli php7.4-common php7.4-json php7.4-opcache php7.4-readline
0 upgraded, 8 newly installed, 0 to remove and 66 not upgraded.
Need to get 4,015 kB of archives.
After this operation, 18.0 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

Press **y** and **ENTER** to allow the installation.

Step 4: Restart Apache

After the php installation you must restart the Apache service.

Enter the command:

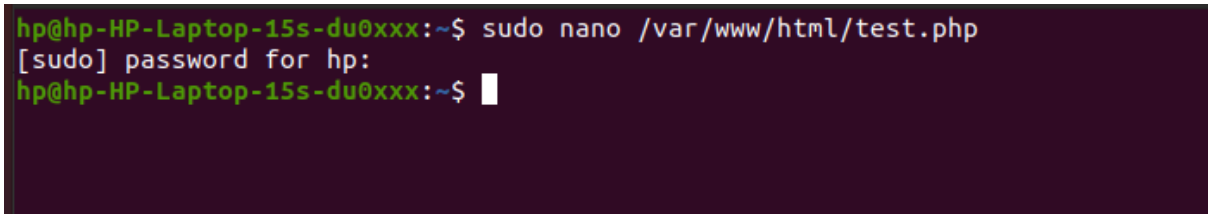
$ sudo /etc/init.d/apache2 restart

Step 5: Test PHP Processing on Web Server

1. Create a basic **PHP script** and save it to the "web root" directory. This is necessary for Apache to find and serve the file correctly. This directory is located at **/var/www/html/**.

To create a file in that directory, type in the following command:

sudo nano /var/www/html/test.php



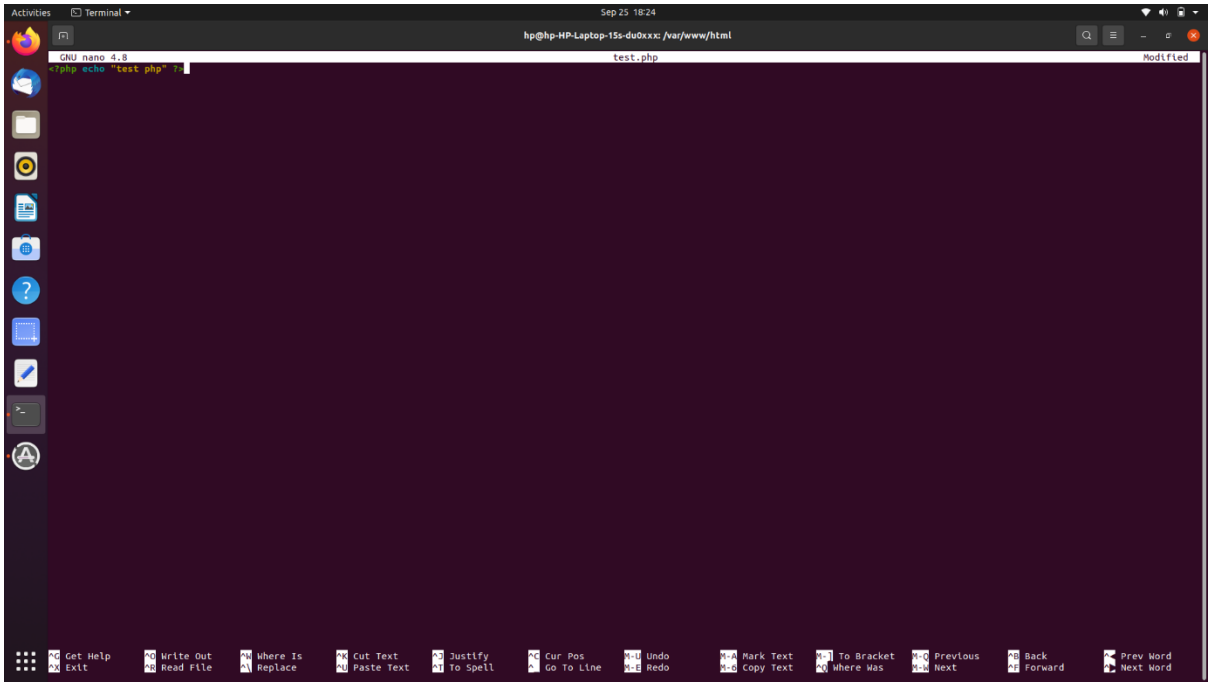
This command opens the **bank file**.

2. Inside the file, type in the valid PHP code:

<?php

Echo " test php ";

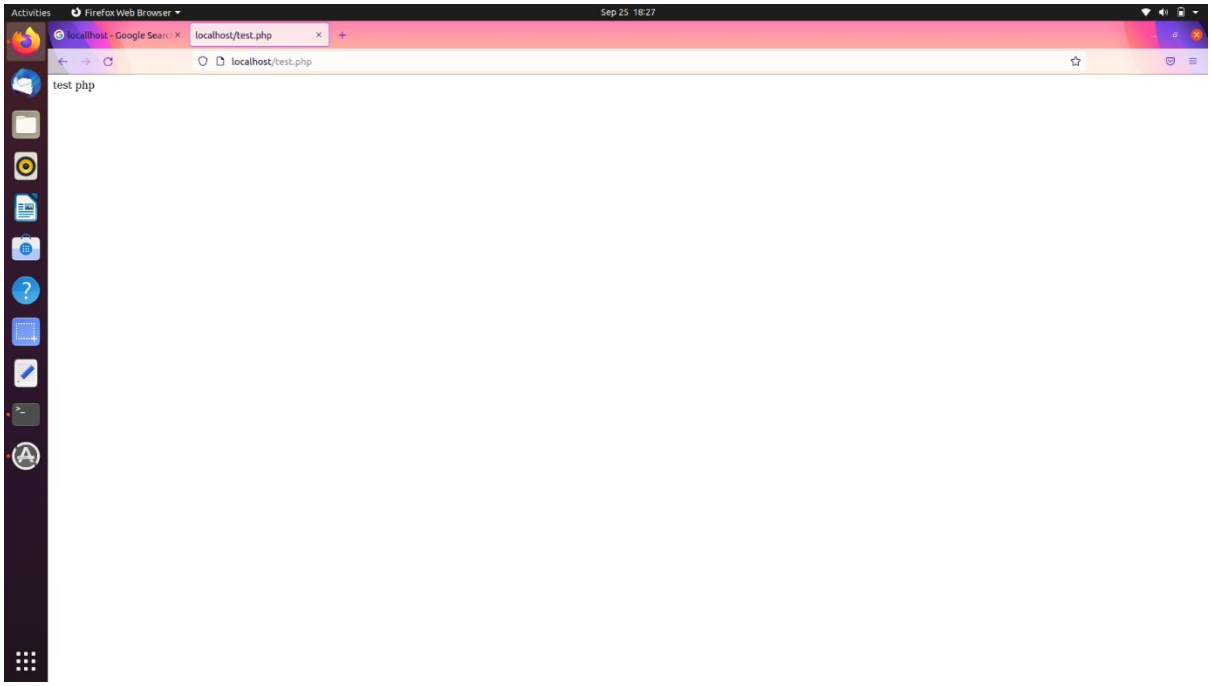
?>



3. Press **CTRL + X** to save and close the file. Press **y** and **ENTER** to confirm.

4. Then check the code are run currectly in php.open the browser enter the Ip address (localhost/test.php).

It show the below image



Step 6: Install Mysql server

1. To install Mysql server, run the following command:

$ sudo apt-get install mysql-server

```
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo apt-get install mysql-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  enchant geoip-database libbind9-161 libboost-filesystem1.67.0
  libboost-iostreams1.67.0 libdns-export1107 libdns1107 libdns1109
  libenchant1c2a libexiv2-14 libfprint0 libgeoip1 libgspell-1-1
  libgutenprint-common libgutenprint9 libiptc0 libirs161 libisc-export1104
  libisc1104 libisc1105 libisccc161 libisccfg163 libllvm9 liblwres161 libnfs12
  liboauth0 printer-driver-gutenprint python3-asn1crypto shim ubuntu-software
  ubuntu-system-service
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  libaio1 libcgi-fast-perl libcgi-pm-perl libevent-core-2.1-7
  libevent-pthreads-2.1-7 libfcgi-perl libhtml-template-perl libmecab2
  mecab-ipadic mecab-ipadic-utf8 mecab-utils mysql-client-8.0
  mysql-client-core-8.0 mysql-server-8.0 mysql-server-core-8.0
Suggested packages:
```

2.Then it's asking us for a root password . enter the password . Again we get to repeat it

Step 7: Check the Mysql server

1. To check Mysql server, run the following command

$ mysql -u root -p

- Enter the root password and press enter

```
hp@hp-HP-Laptop-15s-du0xxx:~$ mysql -u root -p
Enter password:
ERROR 1045 (28000): Access denied for user 'root'@'localhost' (using password: YES)
hp@hp-HP-Laptop-15s-du0xxx:~$ mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 19
Server version: 8.0.26-0ubuntu0.20.04.2 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> create database testdb;
Query OK, 1 row affected (0.01 sec)

mysql> show databases;
+--------------------+
| Database           |
+--------------------+
| information_schema |
| mysql              |
| performance_schema |
| sys                |
| testdb             |
+--------------------+
5 rows in set (0.00 sec)

mysql>
```

2 . Create a database testdb and show it

- Enter the command

Create database testdb;

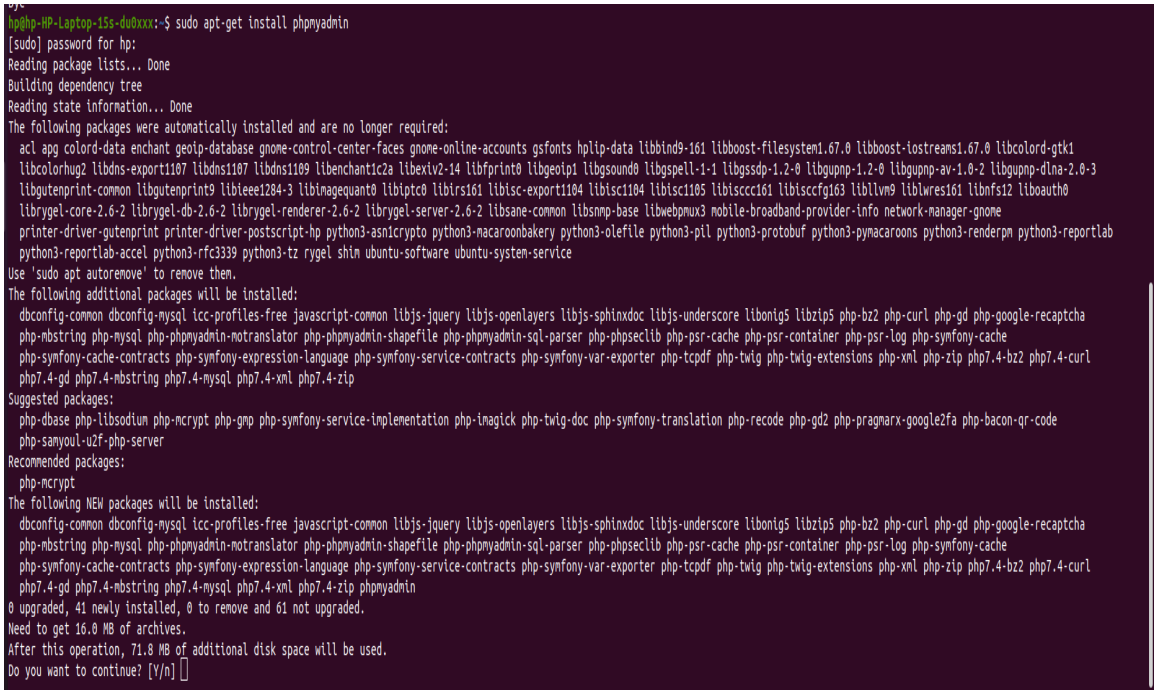
Show databases;

- So mysql is working then exit the mysql prompt just enter **exit;**

Step 8: Install PHP Myadmin

1. To install PHP Myadmin, run the following command:

$ sudo apt-get install phpmyadmin



Press **y** and **ENTER** to allow the installation

2. Then its ask what type of server, we have Apache2 is set by default that's what we want then press ok
3. Then a configuration prompt are open . here we're going to just choose yes and then it ask the input password for phpmyadmin
4. Then check it currect . go to the localhost/phpmyadmin. Here we can not found it so

We have to actually edit the file php is located in Apache2 folder.

5. Enter the following command to edit the file

$ sudo nano/etc/php7.4/apache2.php.ini

6. Then we need to uncomment an **extension=mysql.so.** find it the file just remove the

Semicolon.

7. Then enter ctl+x to save

Step 9: Restart Apache

After the php installation you must restart the Apache service.

Enter the command:

$ sudo /etc/init.d/apache2 restart

Step 9.1:Include phpmyadmin in apache configuration

1. Enter the command:

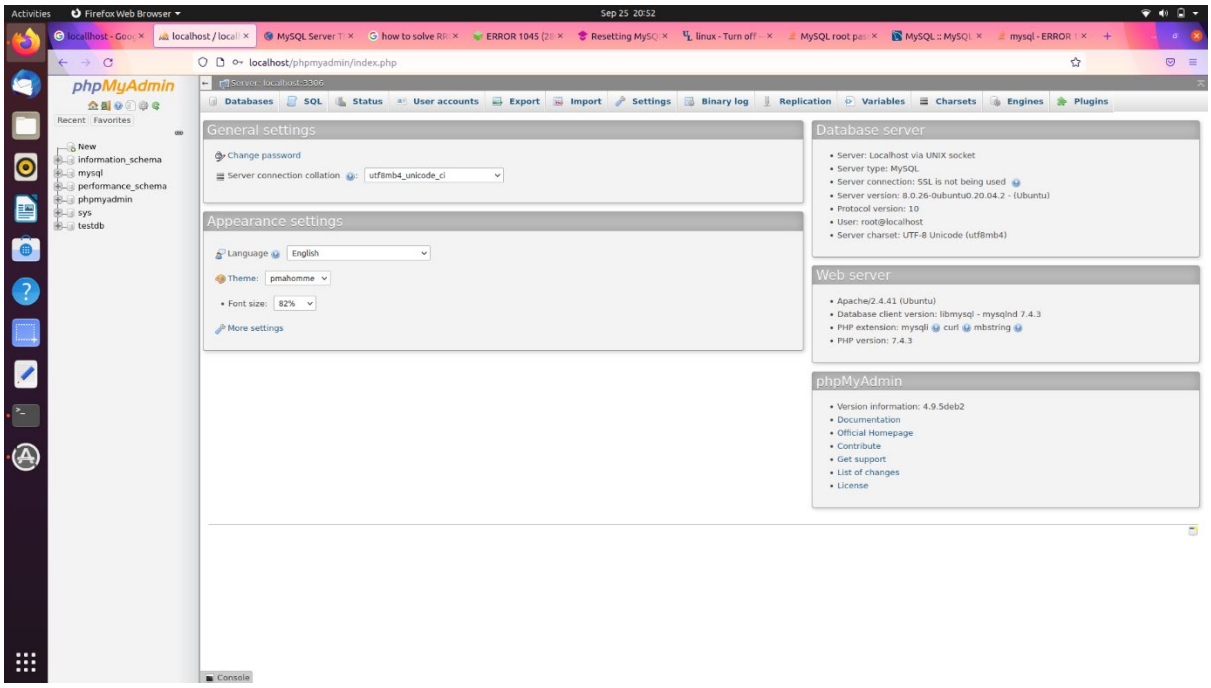
$ sudo nano/etc/apache2/apache2.conf

2. Type the following command to the nano editor

Include /etc/phpmyadmin/apache.conf

3.Then enter ctl+x to save

4.Then again restart the apache



EXPERIMENT -6

6.1.Laravel installation On Ubuntu with Apache

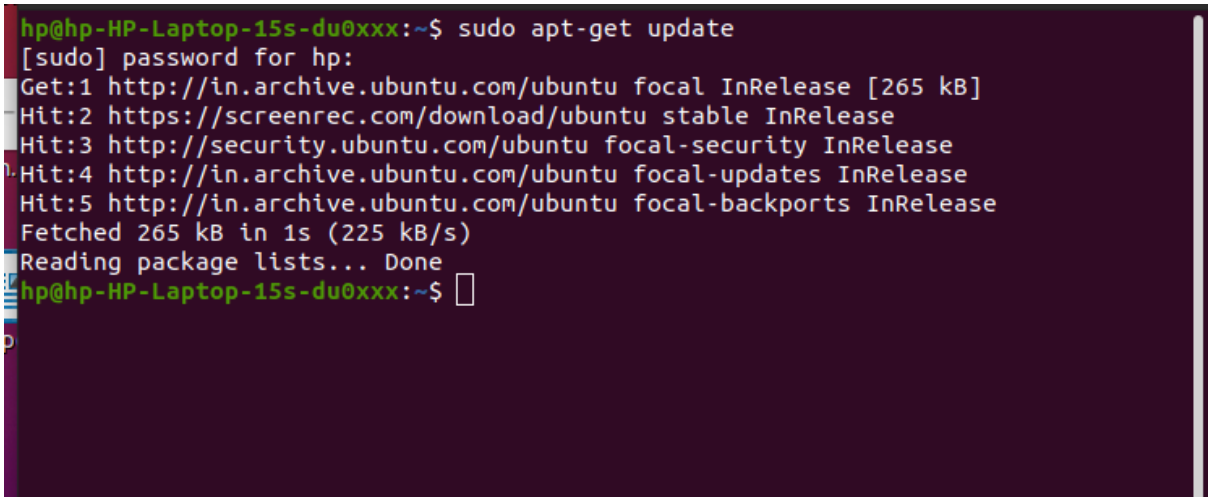
Step 1: Update Package Repository Cache

Before you begin:

1. Open the terminal either by using the **CTRL+ALT+T** keyboard shortcut or by searching for the word *terminal* in **Ubuntu**

2. Make sure to update the package repository cache to ensure it installs the latest versions of the software. To do so, type in the following command:

```
sudo apt-get update
```



Step 2: Install Apache

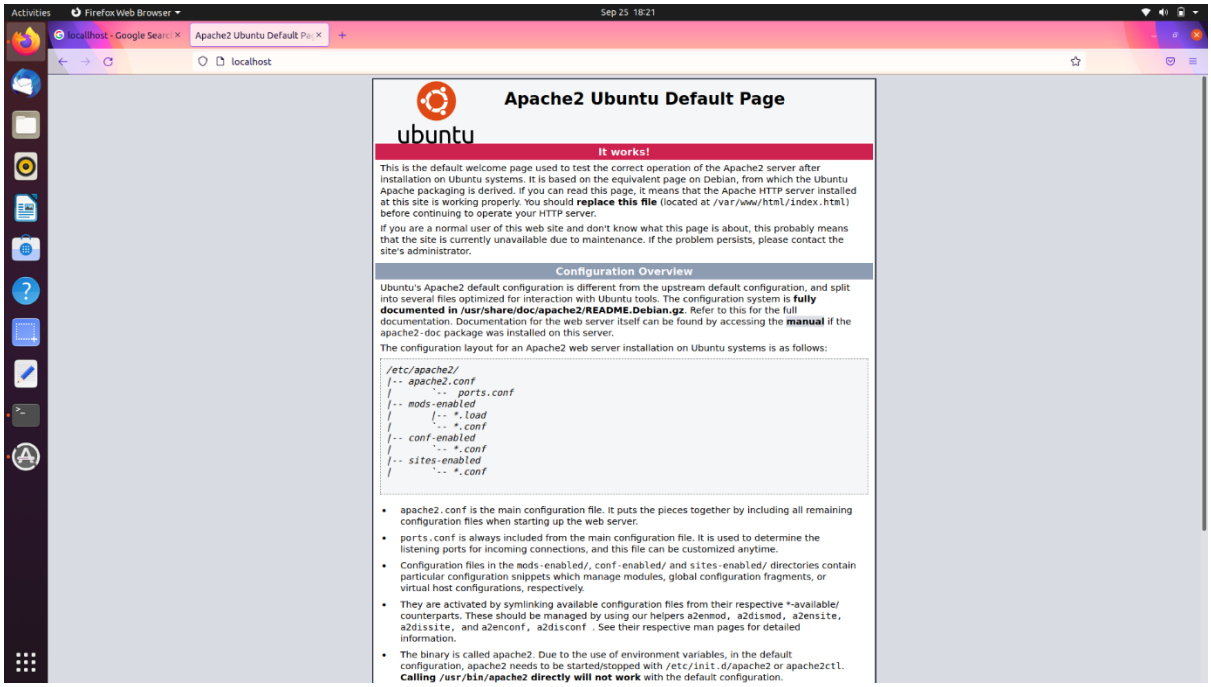
1. To install Apache, run the following command in the terminal:

```
sudo apt-get install apache2
```

```
Reading package lists... Done
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo apt-get install apache2
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  enchant geoip-database libbind9-161 libboost-filesystem1.67.0
  libboost-iostreams1.67.0 libdns-export1107 libdns1107 libdns1109 libenchant1c2a
  libexiv2-14 libfprint0 libgeoip1 libgspell-1-1 libgutenprint-common
  libgutenprint9 libiptc0 libirs161 libisc-export1104 libisc1104 libisc1105
  libisccc161 libisccfg163 libllvm9 liblwres161 libnfs12 liboauth0
  printer-driver-gutenprint python3-asn1crypto shim ubuntu-software
  ubuntu-system-service
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.2-0
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.2-0
0 upgraded, 9 newly installed, 0 to remove and 66 not upgraded.
Need to get 1,819 kB of archives.
After this operation, 7,938 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

2. To ensure Apache is running, enter the Localhost of your server in the address bar and press **ENTER**.

The test Apache web server page should display as below.



Step 3: Install PHP

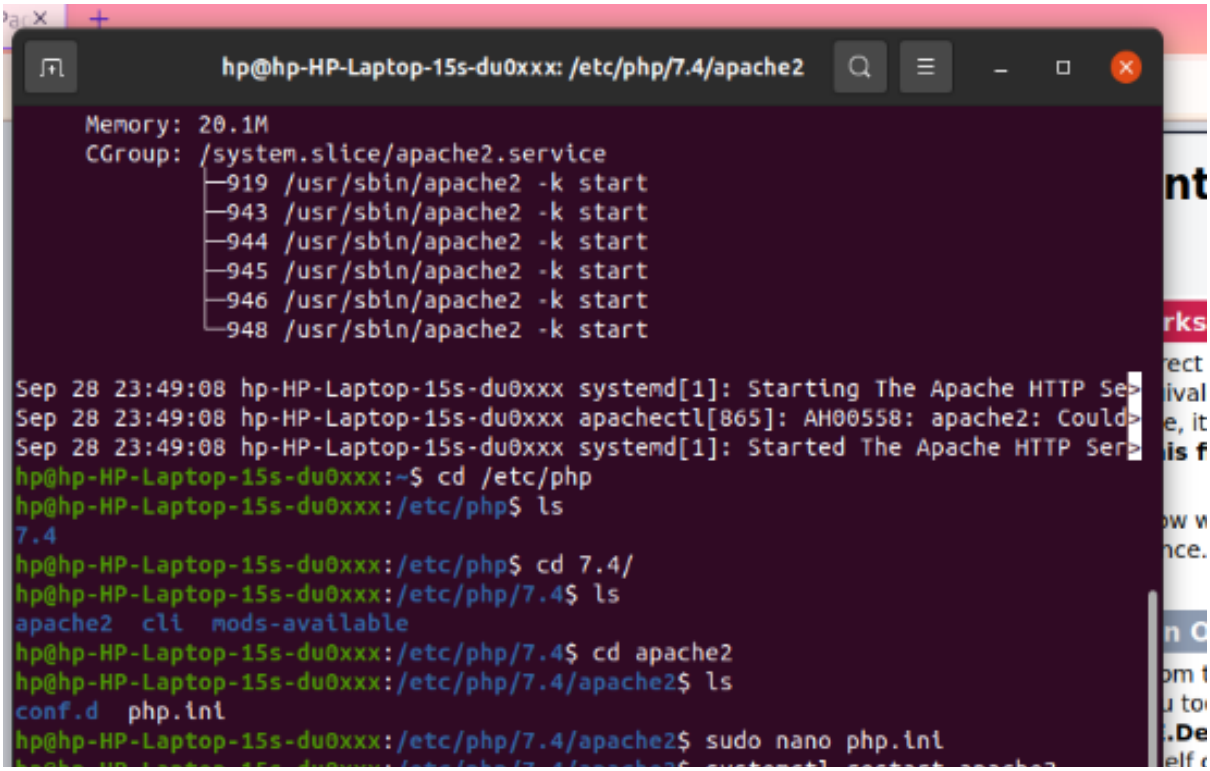
2. To install PHP, run the following command:

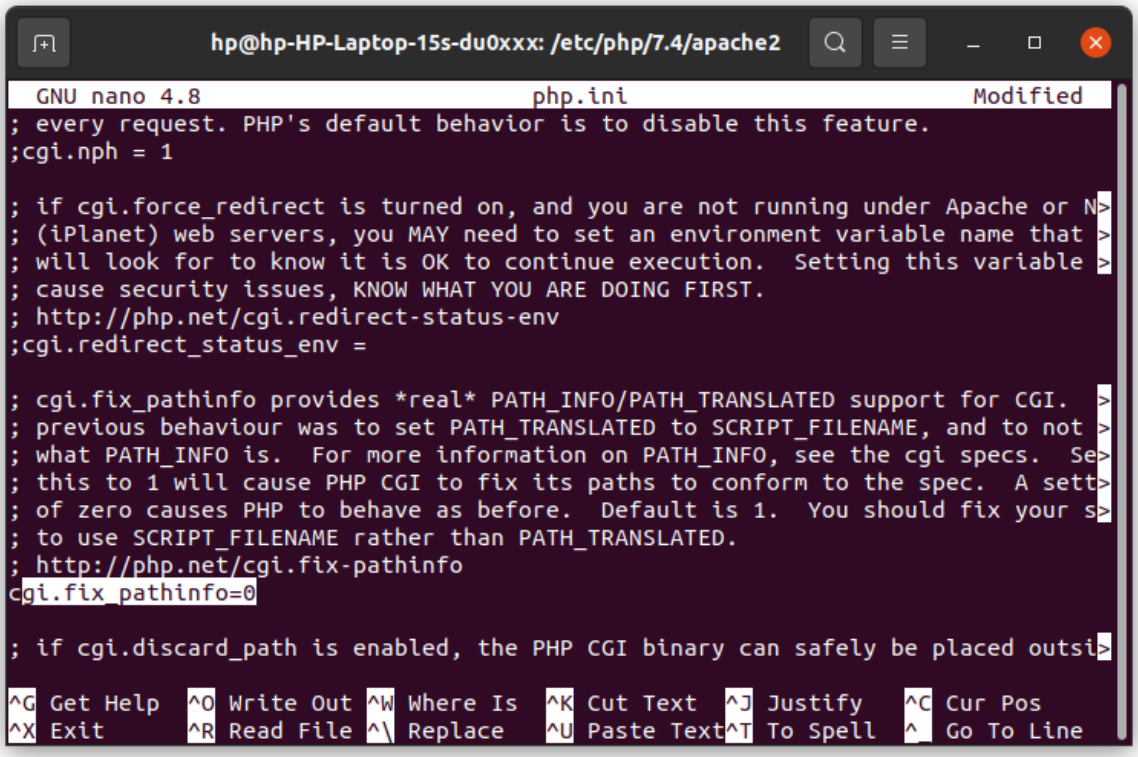
$ sudo apt-get install php7.4

```
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo apt-get install php7.4
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  enchant geoip-database libbind9-161 libboost-filesystem1.67.0 libboost-iostreams1.67.0 libdns-export1107 libdns1107 libdns1109 libenchant1c2a libexiv2-14 libfprint0 libgeoip1 libgspell-1-1
  libgutenprint-common libgutenprint9 libiptc0 libirs161 libisc-export1104 libisc1104 libisc1105 libisccc161 libisccfg163 libllvm9 liblwres161 libnfs12 liboauth0 printer-driver-gutenprint
  python3-asn1crypto shim ubuntu-software ubuntu-system-service
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  libapache2-mod-php7.4 php-common php7.4-cli php7.4-common php7.4-json php7.4-opcache php7.4-readline
Suggested packages:
  php-pear
The following NEW packages will be installed:
  libapache2-mod-php7.4 php-common php7.4 php7.4-cli php7.4-common php7.4-json php7.4-opcache php7.4-readline
0 upgraded, 8 newly installed, 0 to remove and 66 not upgraded.
Need to get 4,015 kB of archives.
After this operation, 18.0 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

Press **y** and **ENTER** to allow the installation

3. Then make a change in php init file . set cgi.fix_pathinfo set to be 0.Do it using the following commands.
   - Cd /etc/php/ 7.4/apache2/
   - Sudo nano php.ini
   - It open the php.ini file ,then uncomment the line and it set to be 0





- Then restart the apache server using the following command

  $ systemctl restart apache

4. Install Composer

Composer is a PHP dependency manager that facilitates the download of PHP libraries in our projects. Composer both works great with and makes it much easier to install Laravel.

1. Install composor using the following command

   $ **Curl -sS https://getcomposer.org/installer | php**

2. In this time your system not insdtaaled the curl file .then install it using the following command

   $ Sudo apt install curl

```
hp@hp-HP-Laptop-15s-du0xxx:/etc/php/7.4/apache2$ sudo nano php.ini
hp@hp-HP-Laptop-15s-du0xxx:/etc/php/7.4/apache2$ systemctl restart apache2
hp@hp-HP-Laptop-15s-du0xxx:/etc/php/7.4/apache2$ curl -sS http://getcomposer.org/installer | php

Command 'curl' not found, but can be installed with:

sudo snap install curl  # version 7.78.0, or
sudo apt  install curl  # version 7.68.0-1ubuntu2.7

See 'snap info curl' for additional versions.

hp@hp-HP-Laptop-15s-du0xxx:/etc/php/7.4/apache2$ sudo apt install curl
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  acl apg colord-data enchant geoip-database gnome-control-center-faces
  gnome-online-accounts gsfonts hplip-data libbind9-161
  libboost-filesystem1.67.0 libboost-iostreams1.67.0 libcolord-gtk1
  libcolorhug2 libdns-export1107 libdns1107 libdns1109 libenchant1c2a
  libexiv2-14 libfprint0 libgeoip1 libgsound0 libgspell-1-1 libgssdp-1.2-0
  libgupnp-1.2-0 libgupnp-av-1.0-2 libgupnp-dlna-2.0-3 libgutenprint-common
  libgutenprint9 libieee1284-3 libimagequant0 libiptc0 libirs161
  libisc-export1104 libisc1104 libisc1105 libisccc161 libisccfg163 libllvm9
  liblwres161 libnfs12 liboauth0 librygel-core-2.6-2 librygel-db-2.6-2
  librygel-renderer-2.6-2 librygel-server-2.6-2 libsane-common libsnmp-base
  libwebpmux3 mobile-broadband-provider-info network-manager-gnome
  printer-driver-gutenprint printer-driver-postscript-hp python3-asn1crypto
  python3-macaroonbakery python3-olefile python3-pil python3-protobuf
  python3-pymacaroons python3-renderpm python3-reportlab
  python3-reportlab-accel python3-rfc3339 python3-tz rygel shim
  ubuntu-software ubuntu-system-service
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  curl
0 upgraded, 1 newly installed, 0 to remove and 91 not upgraded.
Need to get 161 kB of archives.
After this operation, 412 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 curl amd64 7.68.0-1ubuntu2.7 [161 kB]
Fetched 161 kB in 11s (14.8 kB/s)
Selecting previously unselected package curl.
(Reading database ... 192305 files and directories currently installed.)
Preparing to unpack .../curl_7.68.0-1ubuntu2.7_amd64.deb ...
Unpacking curl (7.68.0-1ubuntu2.7) ...
Setting up curl (7.68.0-1ubuntu2.7) ...
Processing triggers for man-db (2.9.1-1) ...
hp@hp-HP-Laptop-15s-du0xxx:/etc/php/7.4/apache2$
```

3. Move the file using the following command

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

Step 5 – Install Laravel 8.x on Ubuntu 20.04

Now install Laravel Framework using composer, just type composer global require Laravel/installer It will take a while to complete download its dependencies

1. Lavaral install with following command

$ composer global require laravel/installer

```
hp@hp-HP-Laptop-15s-du0xxx:~$ composer global require laravel/installer
Changed current directory to /home/hp/.config/composer
https://repo.packagist.org could not be fully loaded (curl error 28 while downloading https://repo.packagist.org/pa
d from the local cache and may be out of date
Using version ^4.2 for laravel/installer
./composer.json has been updated
Running composer update laravel/installer
Loading composer repositories with package information
Updating dependencies
Lock file operations: 13 installs, 0 updates, 0 removals
  - Locking laravel/installer (v4.2.8)
  - Locking psr/container (1.1.1)
  - Locking symfony/console (v5.3.7)
  - Locking symfony/deprecation-contracts (v2.4.0)
  - Locking symfony/polyfill-ctype (v1.23.0)
  - Locking symfony/polyfill-intl-grapheme (v1.23.1)
  - Locking symfony/polyfill-intl-normalizer (v1.23.0)
  - Locking symfony/polyfill-mbstring (v1.23.1)
  - Locking symfony/polyfill-php73 (v1.23.0)
  - Locking symfony/polyfill-php80 (v1.23.1)
  - Locking symfony/process (v5.3.7)
  - Locking symfony/service-contracts (v2.4.0)
  - Locking symfony/string (v5.3.7)
```

Next add bin directory to path environment through the ~/.bashrc configuration .so edit the ~/.bashrc configuration using nano command. The command are follow

```
$ nano ~/.bashrc
```

2.It open the file and add the following line at the end of the file.

```
export PATH="$HOME/.config/composer/vendor/bin:$PATH"
```

```
# Add an "alert" alias for long running commands.  Use like so:
#   sleep 10; alert
alias alert='notify-send --urgency=low -i "$([ $? = 0 ] && echo terminal ||

# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
    . ~/.bash_aliases
fi

# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
    . /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
    . /etc/bash_completion
  fi
fi
export PATH="$HOME/.config/composer/vendor/bin:$PATH"

^G Get Help  ^O Write Out  ^W Where Is  ^K Cut Text  ^J Justify
^X Exit      ^R Read File  ^\ Replace   ^U Paste Text ^T To Spell
```

3.Then reload your bashrc configuration using the source command.

```
$ source ~/.bashrc
```

4.Then echo $PATH. It will return your “Bin” directory path for the Composer package.

$ echo $PATH

```
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo nano ~/.bashrc
[sudo] password for hp:
hp@hp-HP-Laptop-15s-du0xxx:~$ source ~/.bashrc
hp@hp-HP-Laptop-15s-du0xxx:~$ echo $PATH
/home/hp/.config/composer/vendor/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/
usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
hp@hp-HP-Laptop-15s-du0xxx:~$
```

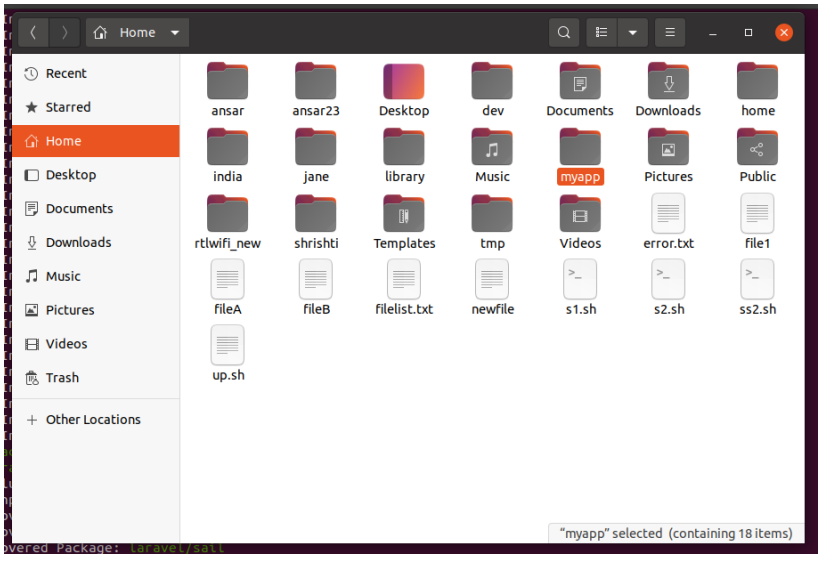
5.then create a new project in lavaral with the following command

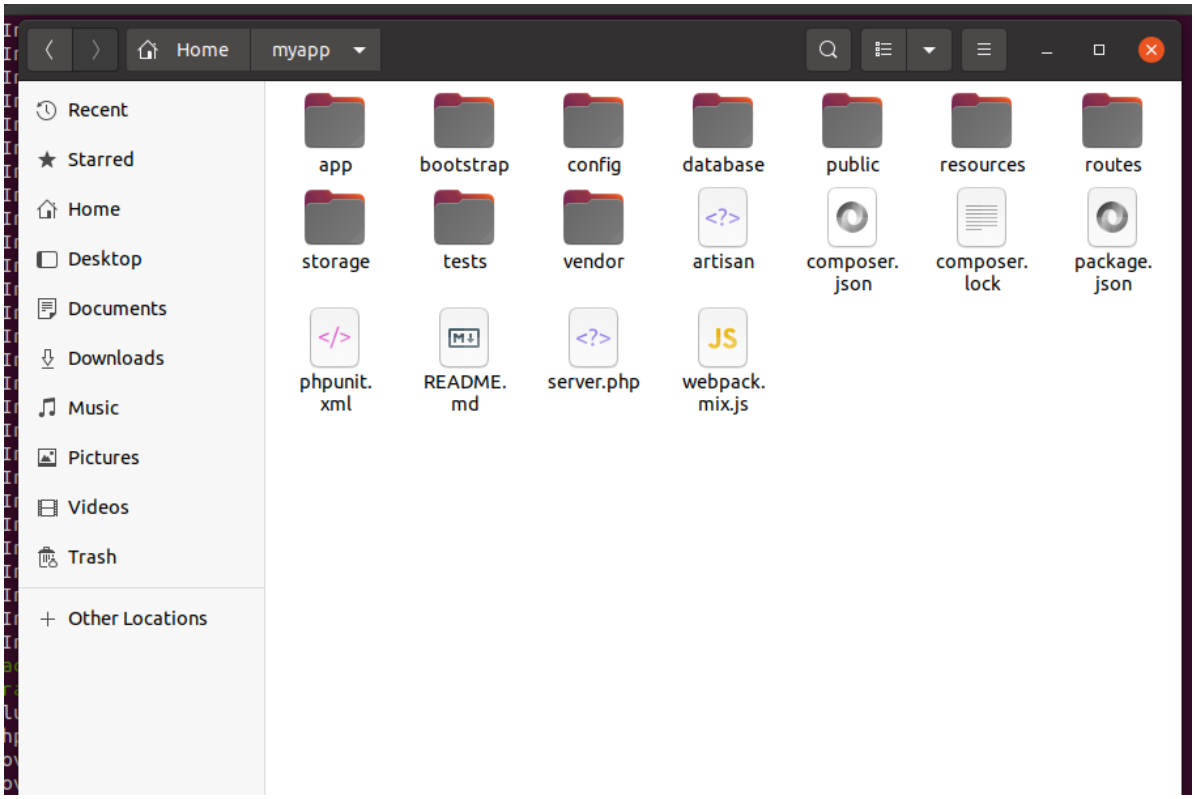
$ laravel new myapp1

```
hp@hp-HP-Laptop-15s-du0xxx:~$ laravel new myapp

Creating a "laravel/laravel" project at "./myapp"
Installing laravel/laravel (v8.6.2)
  - Downloading laravel/laravel (v8.6.2)
  - Installing laravel/laravel (v8.6.2): Extracting archive
Created project in /home/hp/myapp
> @php -r "file_exists('.env') || copy('.env.example', '.env');"
Loading composer repositories with package information
Updating dependencies
Lock file operations: 111 installs, 0 updates, 0 removals
  - Locking asm89/stack-cors (v2.0.3)
  - Locking brick/math (0.9.3)
  - Locking dflydev/dot-access-data (v3.0.1)
  - Locking doctrine/inflector (2.0.3)
  - Locking doctrine/instantiator (1.4.0)
  - Locking doctrine/lexer (1.2.1)
  - Locking dragonmantank/cron-expression (v3.1.0)
  - Locking egulias/email-validator (2.1.25)
  - Locking facade/flare-client-php (1.9.1)
  - Locking facade/ignition (2.13.1)
  - Locking facade/ignition-contracts (1.0.2)
```

Here you can see the installation of my new project myapp1 finished. You can also see inside my home directory a new directory has been created with my project name.





Step 6– Finally Configure Apache for Laravel and test it

1. First, add your project directory to www-data group use the following command

```
$ sudo chgrp -R www-data /home/hp/myapp
```

- Then you need to change access permission 775 of the storage directory under your project. use the following command.

```
$ sudo chmod -R 775 /home/hp/myapp/storage
```

```
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo chgrp -R www-data /home/hp/myapp
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo chmod -R 775 /home/hp/myapp/storage
hp@hp-HP-Laptop-15s-du0xxx:~$ cd /etc/apache2/sites-available/
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$ ls
000-default.conf  default-ssl.conf
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$
```

6.Then create an apache vhost configuration go to the following directory and create a vhost config file using nano file editor.

```
$ cd /etc/apache2/sites-available/
$ sudo nano myapp1.com.conf
```

And paste the following line inside the file.

```
<VirtualHost *:80>
    ServerName myapp.com
```

```
    ServerAdmin admin@myapp.com
    DocumentRoot /home/hp/myapp/public

    <Directory /home/hp/myapp>
        Options Indexes MultiViews
        AllowOverride None
        Require all granted
    </Directory>

    ErrorLog ${APACHE_LOG_DIR}/error.log
    CustomLog ${APACHE_LOG_DIR}/access.log combined
</VirtualHost>
```

```
chgrp: cannot access '/home/myapp': No such file or directory
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo chgrp -R www-data /home/hp/myapp
hp@hp-HP-Laptop-15s-du0xxx:~$ sudo chmod -R 775 /home/hp/myapp/storage
hp@hp-HP-Laptop-15s-du0xxx:~$ cd /etc/apache2/sites-available/
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$ ls
000-default.conf  default-ssl.conf
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$ sudo nano myapp.com.conf
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$ sudo nano myapp.com.conf
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$ sudo a2enmod rewrite
Enabling module rewrite.
To activate the new configuration, you need to run:
  systemctl restart apache2
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$ sudo a2ensitemyapp.com.conf
sudo: a2ensitemyapp.com.conf: command not found
hp@hp-HP-Laptop-15s-du0xxx:/etc/apache2/sites-available$ sudo a2ensite myapp.com.conf
Enabling site myapp.com.
To activate the new configuration, you need to run:
  systemctl reload apache2
```

7. Now enable mod rewrite for apache2 just type

```
$ sudo a2enmod rewrite
```

Then enable your site, just type

```
$ sudo a2ensite myapp1.com.conf
```

Finally, Restart the apache service, type

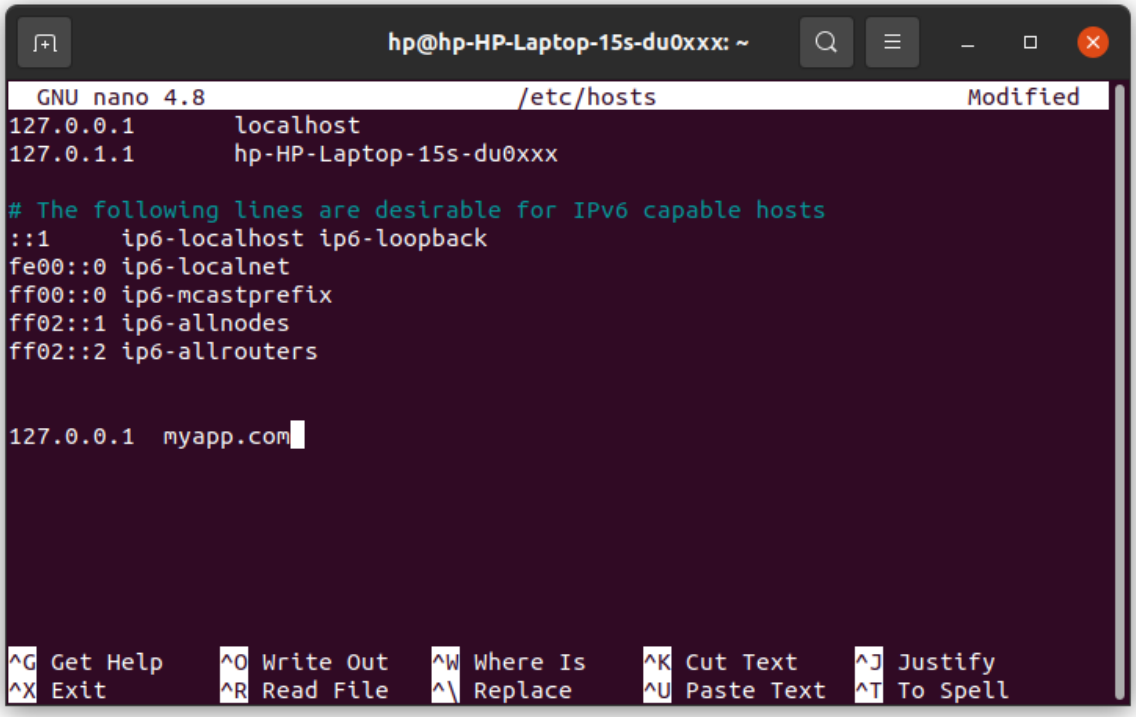
```
$ systemctl restart apache2
```

8. As you are in a local environment you need a local dns resolver for your site. Go ahead and edit /etc/hosts file, add a dns record for your site then save the file.

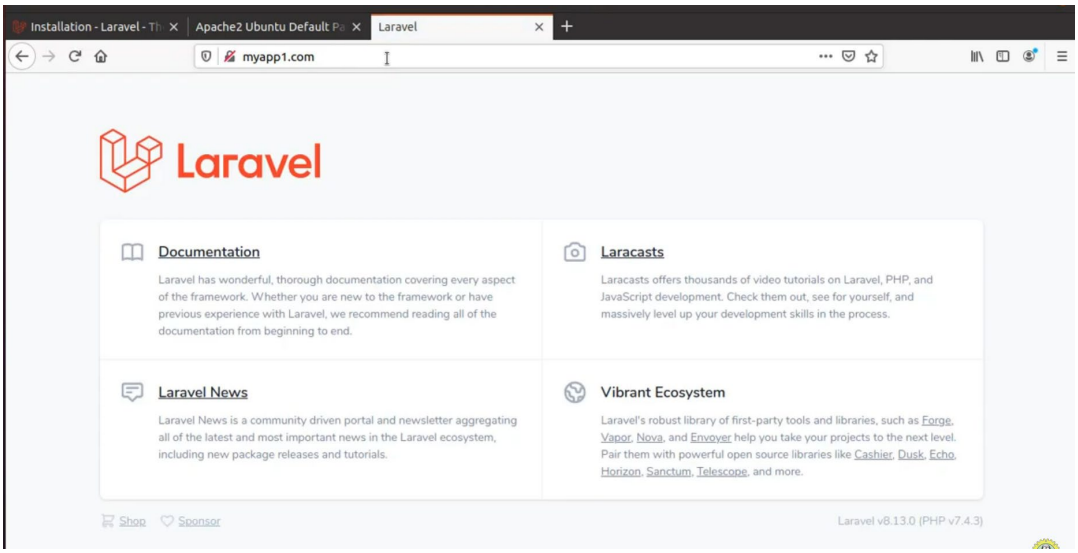
```
$ sudo nano /etc/hosts
```

Inside the file add the below line

```
127.0.0.1   myapp.com
```



Now get back to the web browser and open a tab then type your project hostname.



And here it is it's working. Here you can see the Laravel version and PHP version.

EXPERIMENT -7

7.1.Networking commands

7.1.1.PING COMMAND

PING (Packet Internet Groper) command is used to check the network connectivity between host and server/host. This command takes as input the IP address or the URL and sends a data packet to the specified address with the message "PING" and get a response from the server/host this time is recorded which is called latency. Fast ping low latency means faster connection. Ping uses **ICMP(Internet Control Message Protocol)** to send an **ICMP echo message** to the specified host if that host is available then it sends **ICMP reply message**. Ping is generally measured in millisecond every modern operating system has this ping pre-installed.

Syntax: ping [OPTIONS] DESTINATION

```
liya@liya-VirtualBox:~$ ping google.com
PING google.com (142.250.182.46) 56(84) bytes of data.
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=1 ttl=118 tim
e=20.8 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=2 ttl=118 tim
e=61.2 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=3 ttl=118 tim
e=24.8 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=4 ttl=118 tim
e=24.2 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=5 ttl=118 tim
e=21.3 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=6 ttl=118 tim
e=22.2 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=7 ttl=118 tim
e=20.1 ms
```

7.1.2.TRACEROUTE COMMAND

Traceroute command in Linux prints the route that a packet takes to reach the host. This command is useful when you want to know about the route and about all the hops that a packet takes. Below image depicts how traceroute command is used to reach the Google (172.217.26.206) host from the local machine and it also prints detail about all the hops that it visits in between.

Syntax: traceroute [options] host_Address [pathlength]

```
liya@liya-VirtualBox:~$ traceroute google.com
traceroute to google.com (142.250.77.142), 30 hops max, 60 byte packets
 1  _gateway (10.0.2.2)  3.675 ms  3.646 ms  3.499 ms
 2  * * *
 3  * * *
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
liya@liya-VirtualBox:~$
```

7.1.3 ROUTE COMMAND

route command in Linux is used when you want to work with the IP/kernel routing table. It is mainly used to set up static routes to specific hosts or networks via an interface. It is used for showing or update the IP/kernel routing table.

Syntax: route

```
liya@liya-VirtualBox:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    100    0        0 enp0s3
10.0.2.0        0.0.0.0         255.255.255.0   U     100    0        0 enp0s3
link-local      0.0.0.0         255.255.0.0     U     1000   0        0 enp0s3
liya@liya-VirtualBox:~$
```

7.1.4 NSLOOKUP COMMAND

nslookup (stands for "Name Server Lookup") is a useful command for getting information from DNS server. It is a network administration tool for querying the Domain Name System (DNS) to obtain domain name or IP address mapping or any other specific DNS record. It is also used to troubleshoot DNS related problems.

Syntax: nslookup [option]

```
liya@liya-VirtualBox:~$ nslookup google.com
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
Name:   google.com
Address: 142.250.77.142
Name:   google.com
Address: 2404:6800:4007:817::200e

liya@liya-VirtualBox:~$
```

7.1.5 IFCONFIG COMMAND

ifconfig(interface configuration) command is used to configure the kernel-resident network interfaces. It is used at the boot time to set up the interfaces as necessary. After that, it is usually used when needed during debugging or when you need system tuning. Also, this command is used to assign the IP address and netmask to an interface or to enable or disable a given interface.

Syntax: ifconfig [...OPTIONS] [INTERFACE]

```
liya@liya-VirtualBox:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
        inet6 fe80::539d:86af:3064:4b44  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:76:e4:b8  txqueuelen 1000  (Ethernet)
        RX packets 342  bytes 292553 (292.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 414  bytes 40404 (40.4 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 192  bytes 16146 (16.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 192  bytes 16146 (16.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

liya@liya-VirtualBox:~$
```

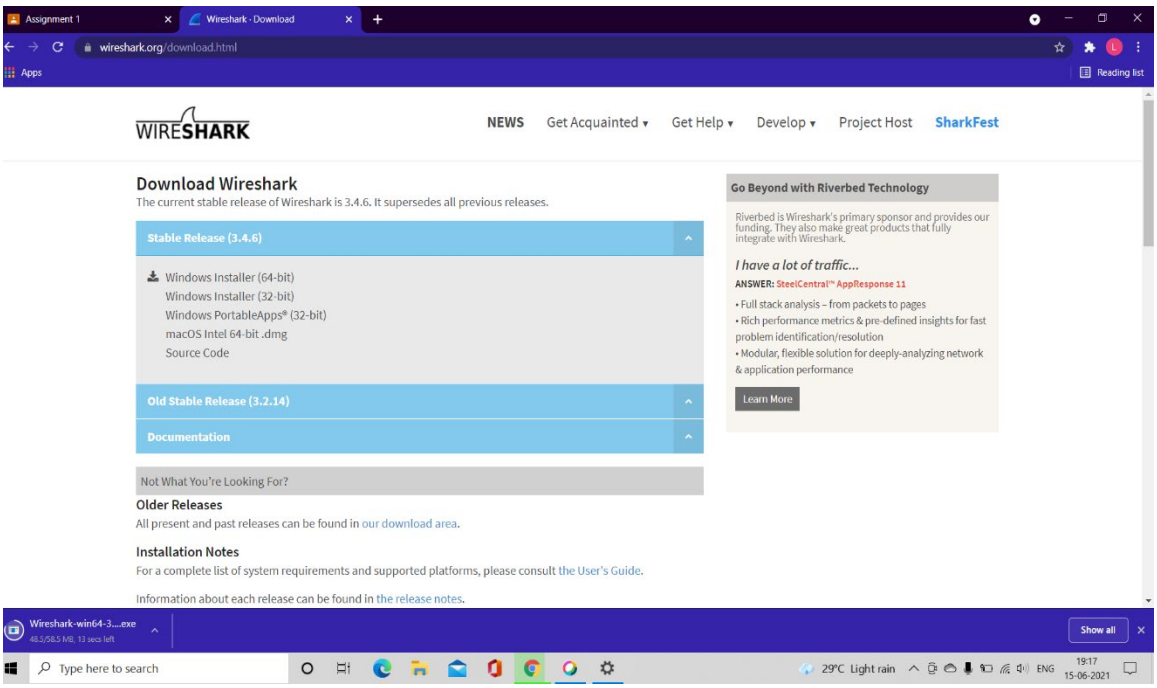
EXPERIMENT -8

8.1 WIRESHARK Installation

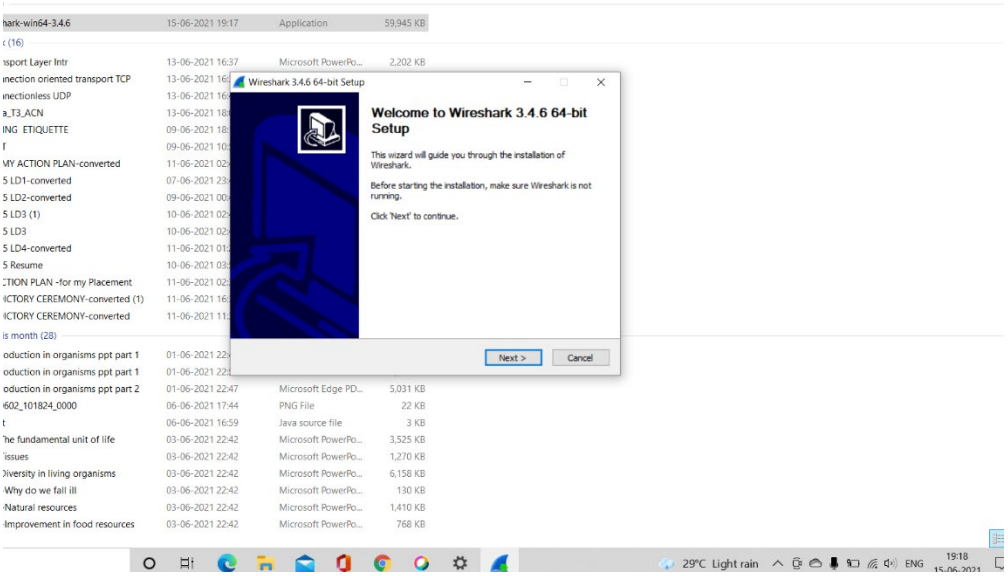
Wireshark is a free and open source packet analyser used for network troubleshooting and analysis.

To install Wireshark:

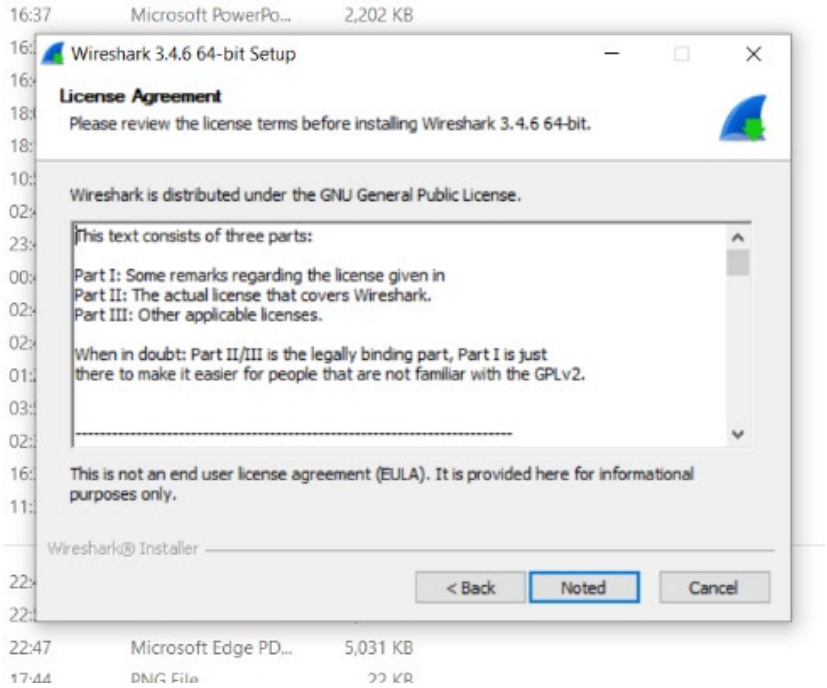
1. Open a web browser.
2. Select Download Wireshark.



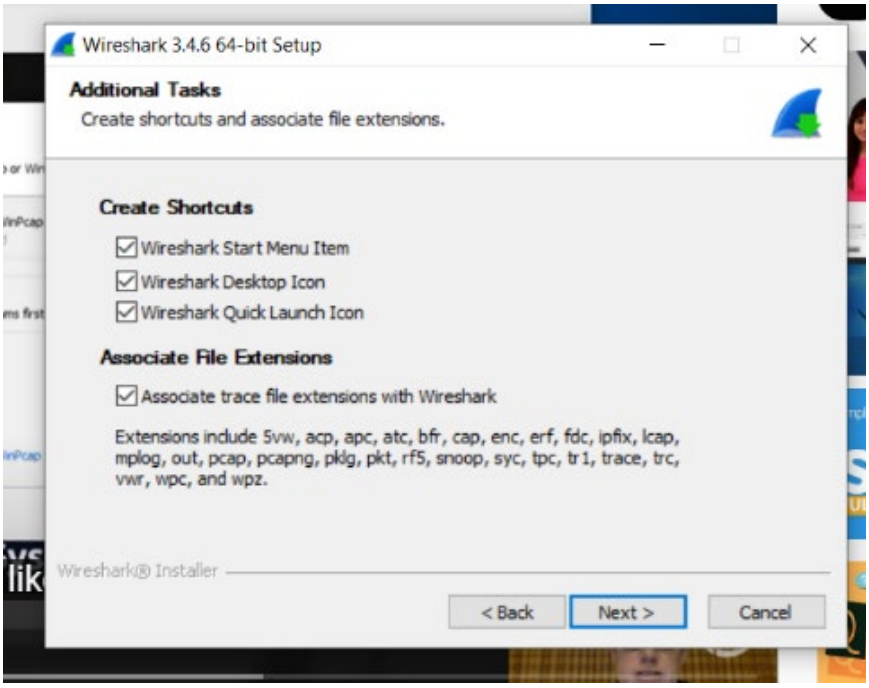
3. Select the Wireshark Windows Installer matching your system type, either 32-bit or 64-bit. Save the program in the Downloads folder.
4. Close the web browser.
5. Locate the version of Wireshark you downloaded
6. If you see a User Account Control dialog box, select Yes to allow the program to make changes to this computer.
7. Select Next > to start the Setup Wizard.



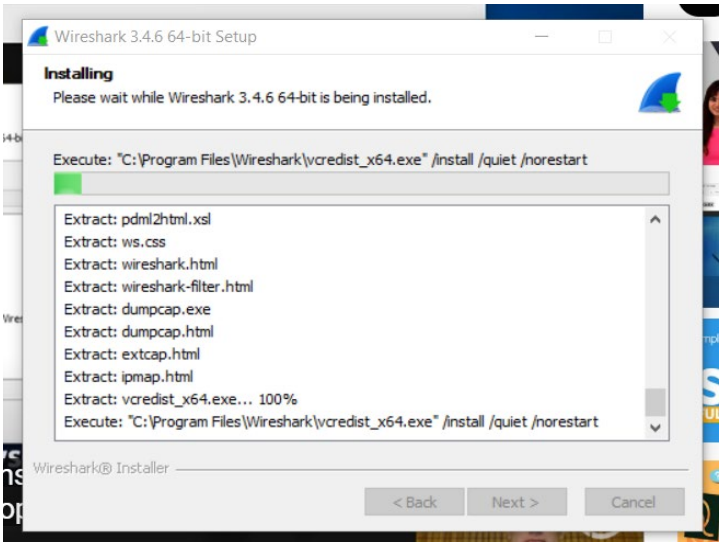
8. Review the license agreement. If you agree, select Noted to continue.



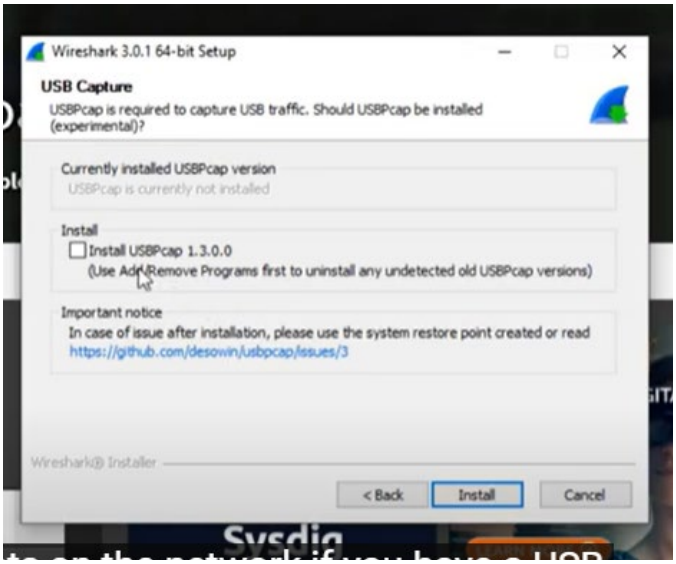
9. Select Next > to accept the default components.

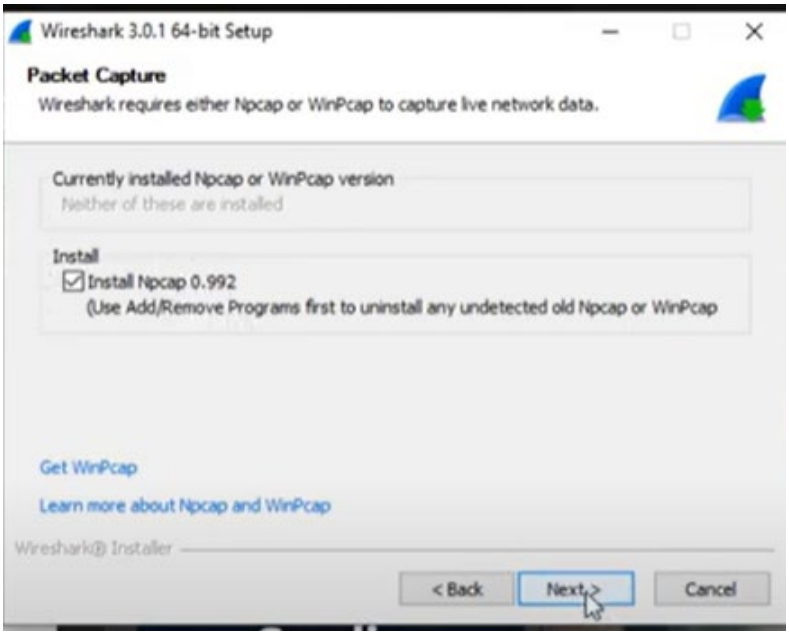


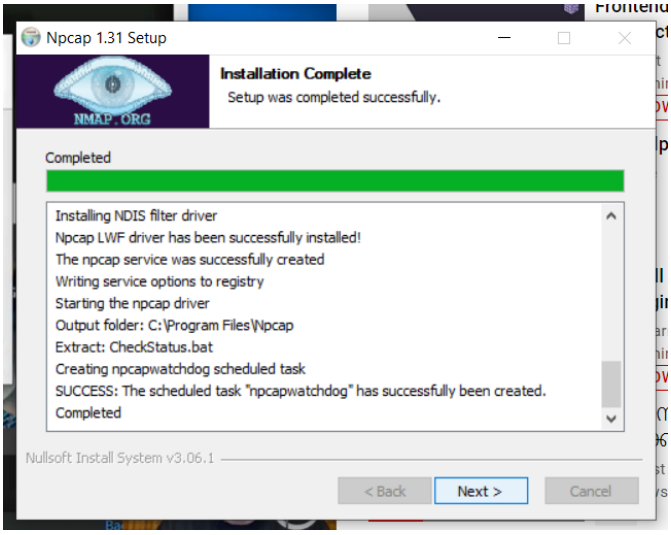
10. Select the shortcuts you would like to have created. Leave the file extensions selected. Select Next > to continue.
11. Select Next > to accept the default install location.
12. Select Install to begin installation.



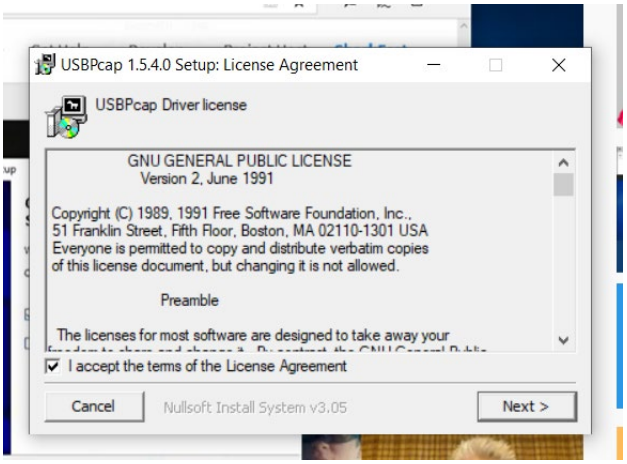
13. Select Next > to install WinPcap.
14. Select Next > to start the Setup Wizard.



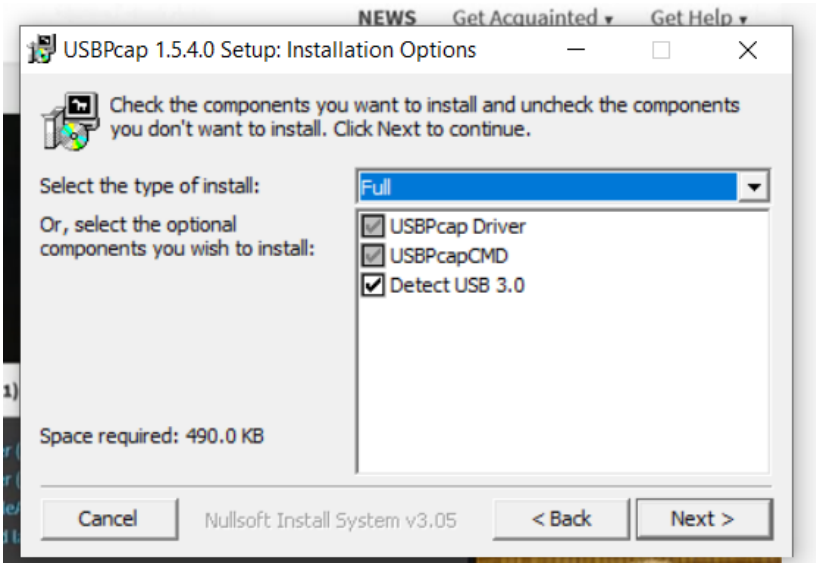


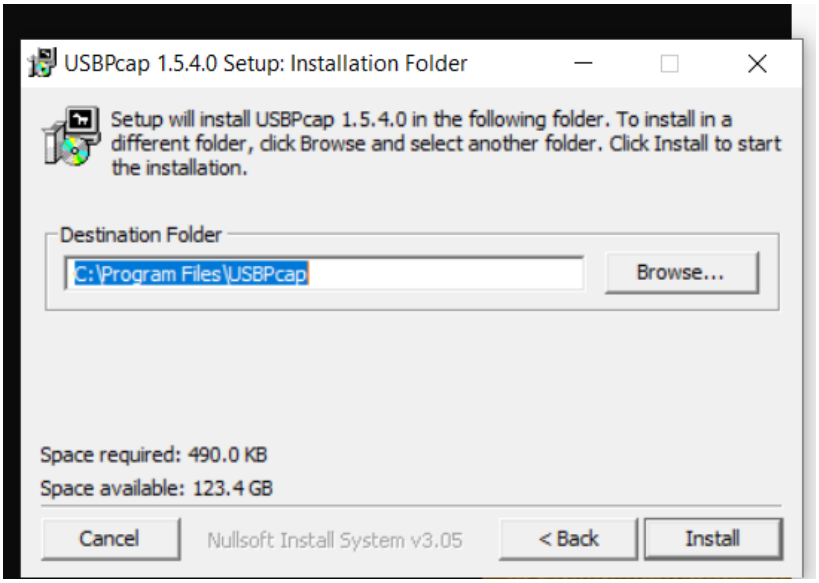


15. Review the license agreement. If you agree, select Next to continue.

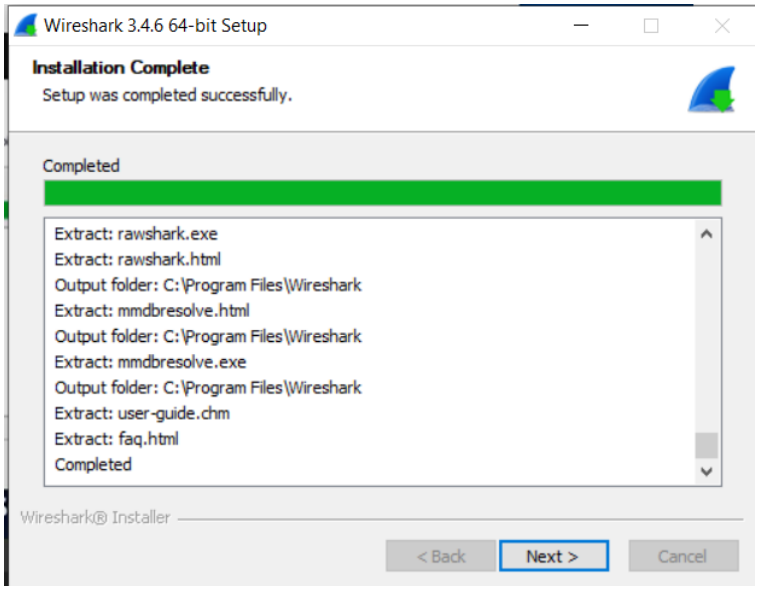


16. Select Install to begin installation.

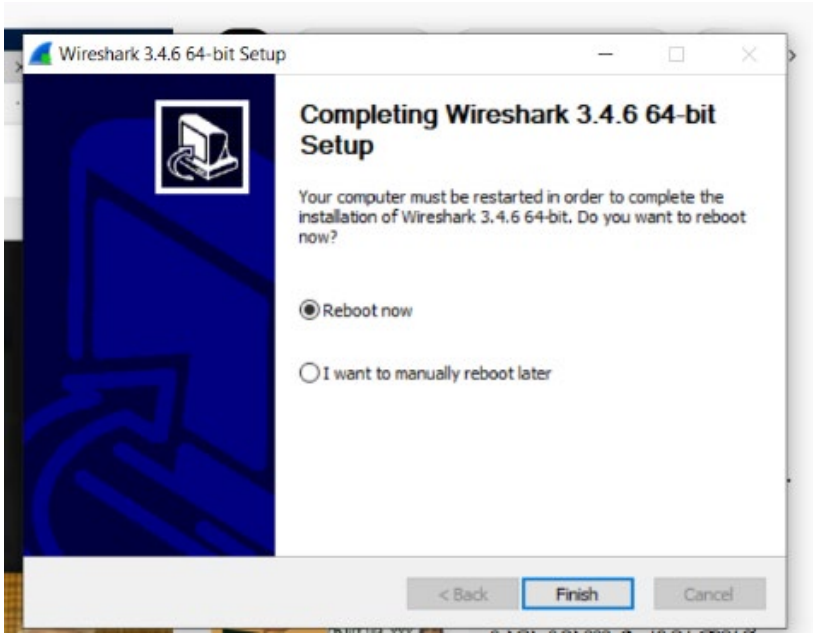




17. Select Finish to complete the installation of WinPcap.
18. Select Next > to continue with the installation of Wireshark.



19. Select Finish to complete the installation of Wireshark.

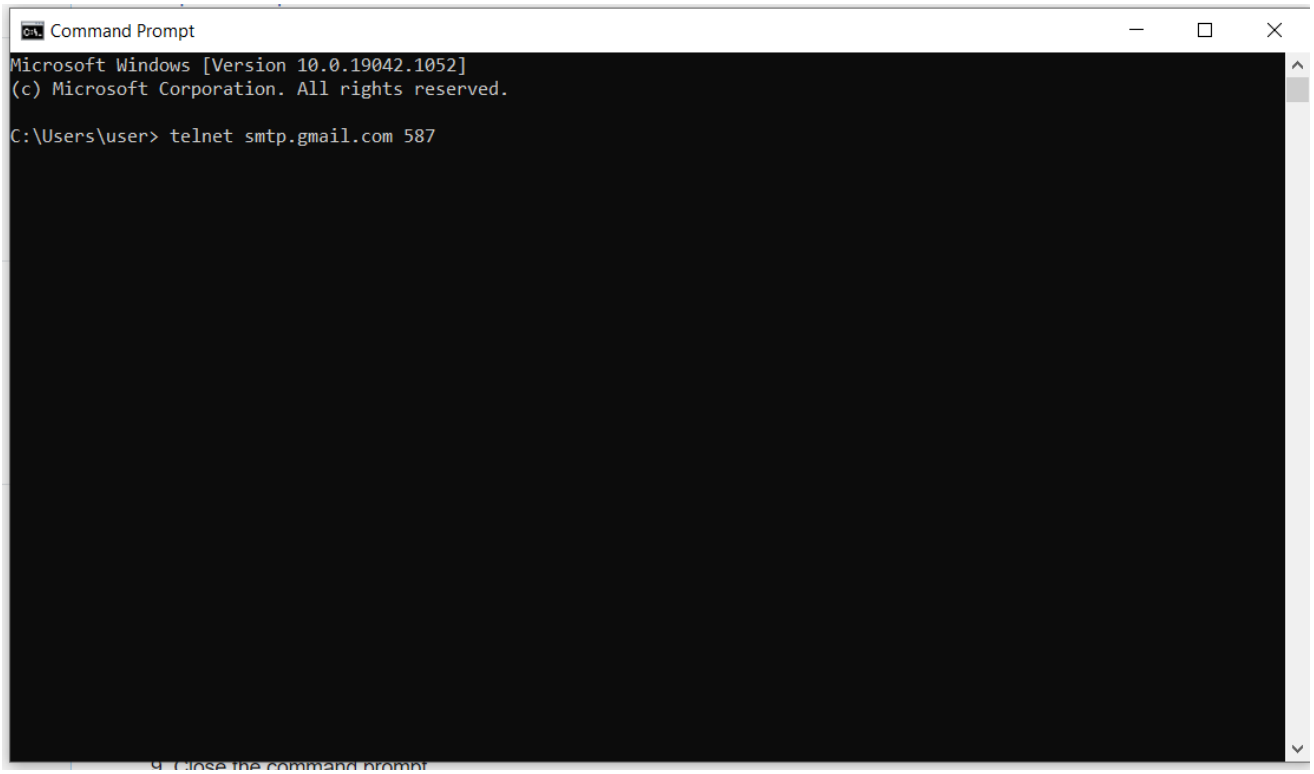


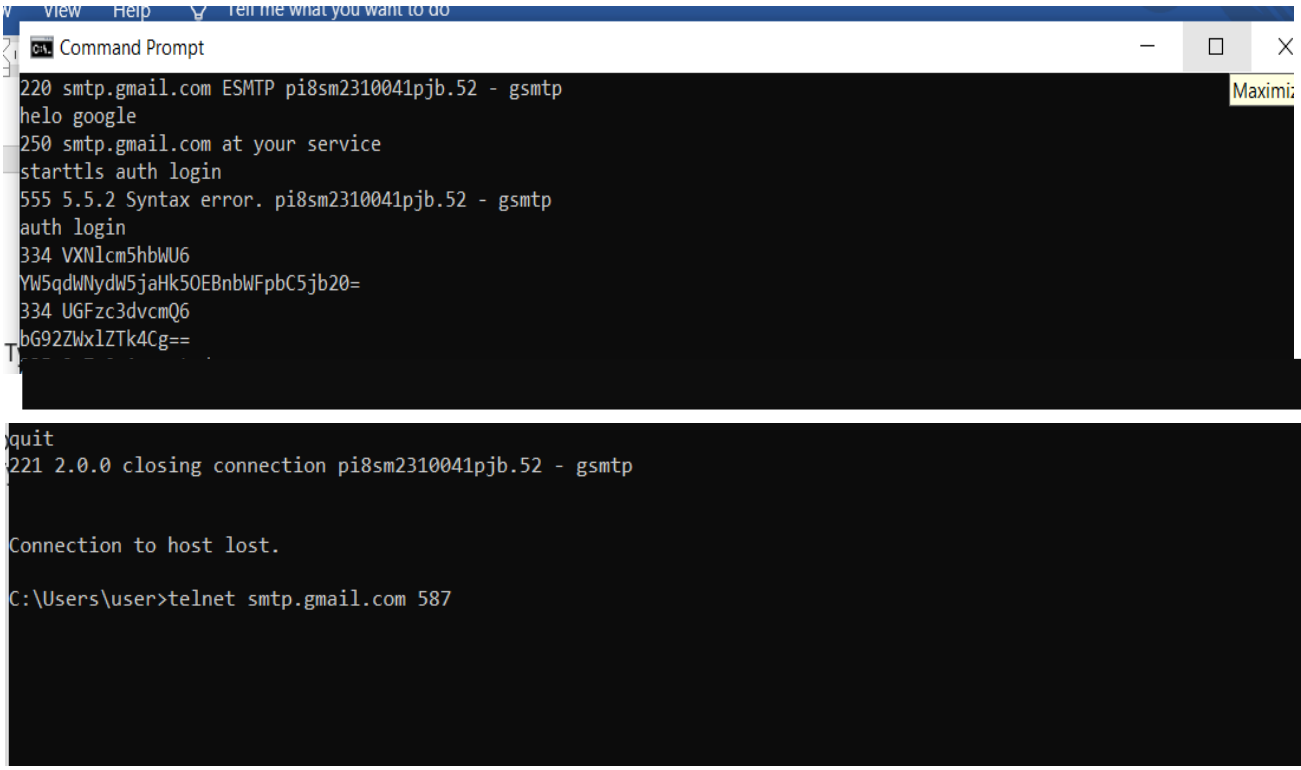
8 .2 Demonstrate the process to filtering SMTP packets

To capture SMTP traffic:

1. Start a Wireshark capture.
2. Open a command prompt.
3. Type **telnet smtp.gmail.com 587**
4. This will display the message “connecting to server….”
5. 220 is shown
6. Observe the server response.
7. Type **helo** domainname and press **Enter**.
8. Observe the server response.
9. Type starttls auth login.

10. Type auth login.
11. It will ask for username and password in encrypted form
12. Enter username and password in encrypted form
13. Observe response.
14. Type quit t close connection

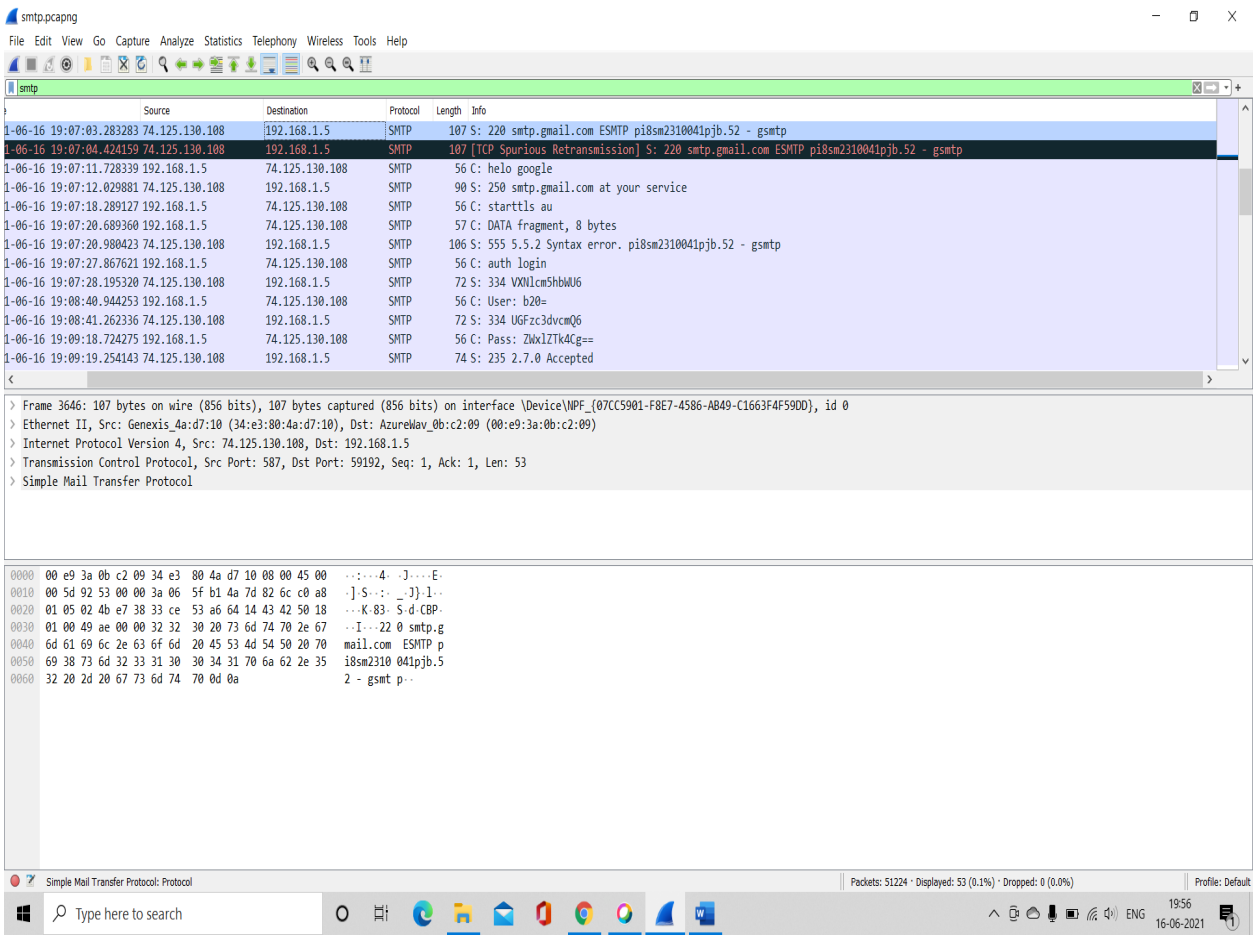




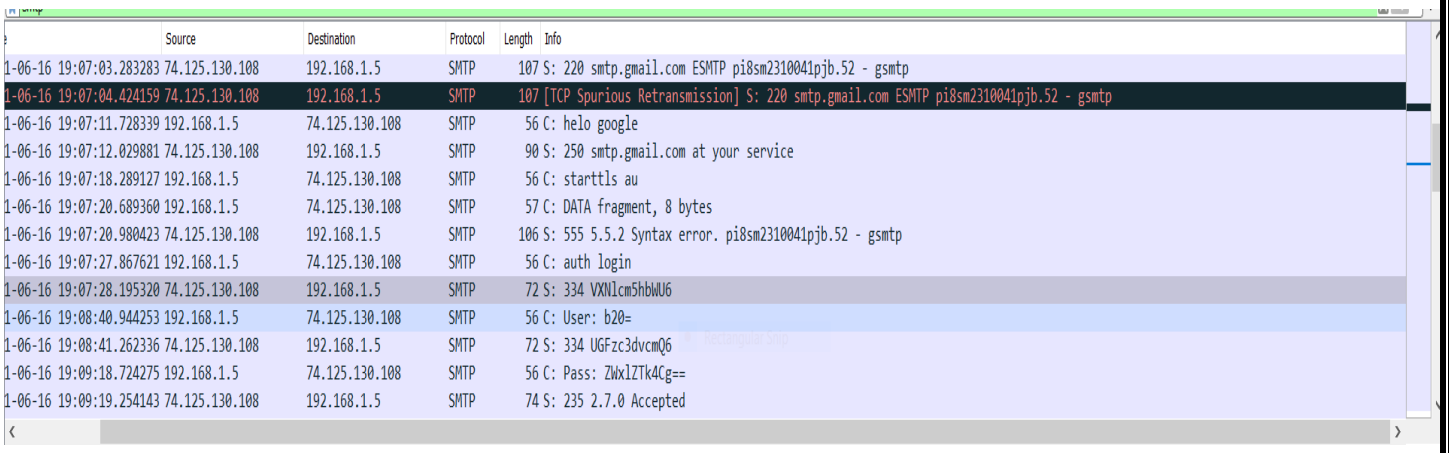
8.3 Analyze TCP Connection Traffic

To analyze TCP connection traffic:

1. Observe the traffic captured in the top Wireshark packet list pane. The first three packets (TCP SYN, TCP SYN/ACK, TCP ACK) are the TCP three way handshake. Select the first packet.
2. Observe the packet details in the middle Wireshark packet details pane. Notice that it is an Ethernet II / Internet Protocol Version 4 / Transmission Control Protocol frame.
3. Expand Ethernet II to view Ethernet details.
4. Observe the Destination and Source fields. The destination should be your default gateway's MAC address and the source should be your MAC address. You can use ipconfig /all and arp -a to confirm.
5. Expand Internet Protocol Version 4 to view IP details.
6. Observe the Source address. Notice that the source address is your IP address.
7. Observe the Destination address. Notice that the destination address is the IP address of the SMTP server.
8. Expand Transmission Control Protocol to view TCP details.
9. Observe the Source port. Notice that it is a dynamic port selected for this HTTP connection.
10. Observe the Destination port. Notice that it is smtp (25). Note that all of the packets for this connection will have matching MAC addresses, IP addresses, and port numbers.

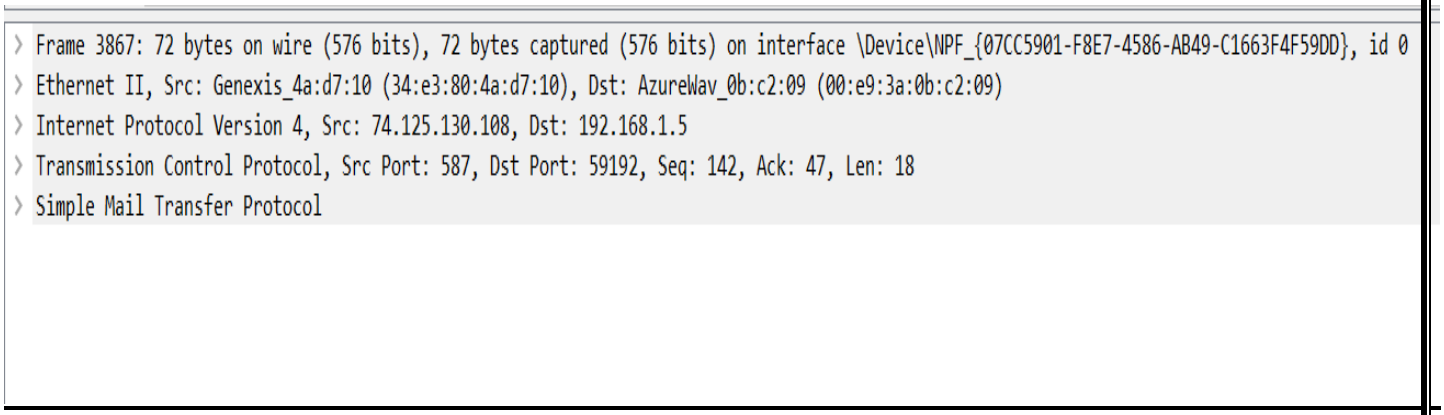


Traffic captured:



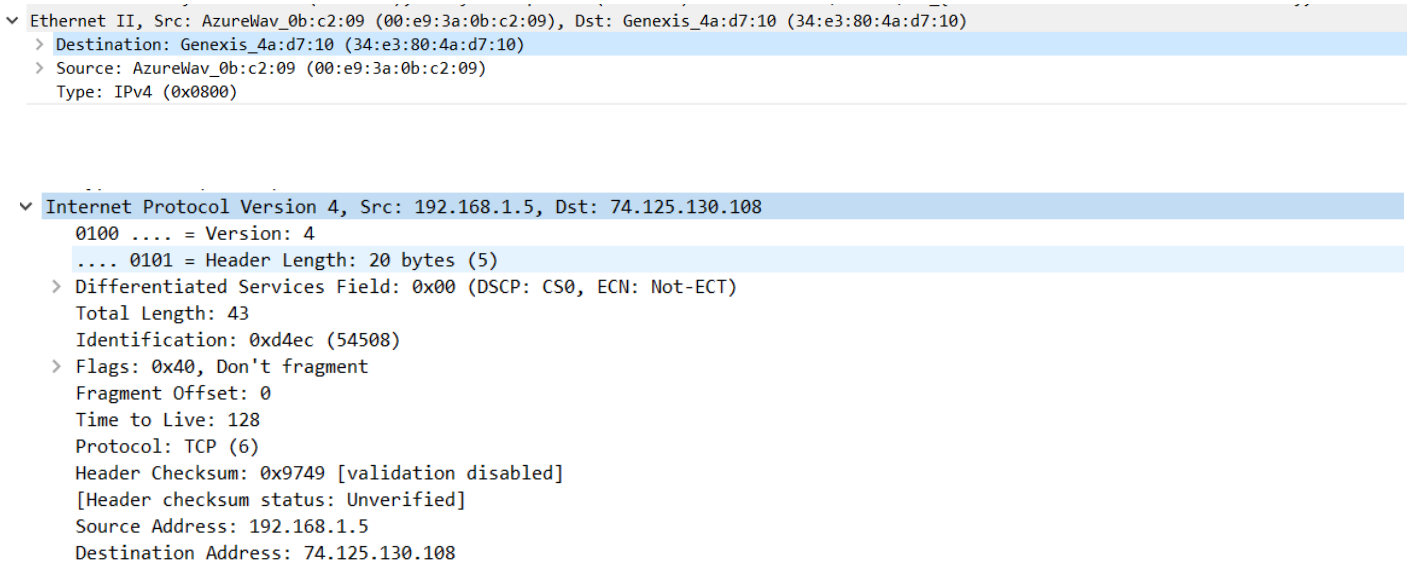
	Source	Destination	Protocol	Length	Info
1-06-16 19:07:03.283283	74.125.130.108	192.168.1.5	SMTP	107	S: 220 smtp.gmail.com ESMTP pi8sm2310041pjb.52 - gsmtp
1-06-16 19:07:04.424159	74.125.130.108	192.168.1.5	SMTP	107	[TCP Spurious Retransmission] S: 220 smtp.gmail.com ESMTP pi8sm2310041pjb.52 - gsmtp
1-06-16 19:07:11.728339	192.168.1.5	74.125.130.108	SMTP	56	C: helo google
1-06-16 19:07:12.029881	74.125.130.108	192.168.1.5	SMTP	90	S: 250 smtp.gmail.com at your service
1-06-16 19:07:18.289127	192.168.1.5	74.125.130.108	SMTP	56	C: starttls au
1-06-16 19:07:20.689360	192.168.1.5	74.125.130.108	SMTP	57	C: DATA fragment, 8 bytes
1-06-16 19:07:20.980423	74.125.130.108	192.168.1.5	SMTP	106	S: 555 5.5.2 Syntax error. pi8sm2310041pjb.52 - gsmtp
1-06-16 19:07:27.867621	192.168.1.5	74.125.130.108	SMTP	56	C: auth login
1-06-16 19:07:28.195320	74.125.130.108	192.168.1.5	SMTP	72	S: 334 VXNlcm5hbWU6
1-06-16 19:08:40.944253	192.168.1.5	74.125.130.108	SMTP	56	C: User: b20=
1-06-16 19:08:41.262336	74.125.130.108	192.168.1.5	SMTP	72	S: 334 UGFzc3dvcmQ6
1-06-16 19:09:18.724275	192.168.1.5	74.125.130.108	SMTP	56	C: Pass: ZWxlZTk4Cg==
1-06-16 19:09:19.254143	74.125.130.108	192.168.1.5	SMTP	74	S: 235 2.7.0 Accepted

Packet Details:



```
> Frame 3867: 72 bytes on wire (576 bits), 72 bytes captured (576 bits) on interface \Device\NPF_{07CC5901-F8E7-4586-AB49-C1663F4F59DD}, id 0
> Ethernet II, Src: Genexis_4a:d7:10 (34:e3:80:4a:d7:10), Dst: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09)
> Internet Protocol Version 4, Src: 74.125.130.108, Dst: 192.168.1.5
> Transmission Control Protocol, Src Port: 587, Dst Port: 59192, Seq: 142, Ack: 47, Len: 18
> Simple Mail Transfer Protocol
```

Ethernet details:



```
Ethernet II, Src: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09), Dst: Genexis_4a:d7:10 (34:e3:80:4a:d7:10)
  > Destination: Genexis_4a:d7:10 (34:e3:80:4a:d7:10)
  > Source: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09)
    Type: IPv4 (0x0800)
```



```
Internet Protocol Version 4, Src: 192.168.1.5, Dst: 74.125.130.108
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 43
    Identification: 0xd4ec (54508)
  > Flags: 0x40, Don't fragment
    Fragment Offset: 0
    Time to Live: 128
    Protocol: TCP (6)
    Header Checksum: 0x9749 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.1.5
    Destination Address: 74.125.130.108
```

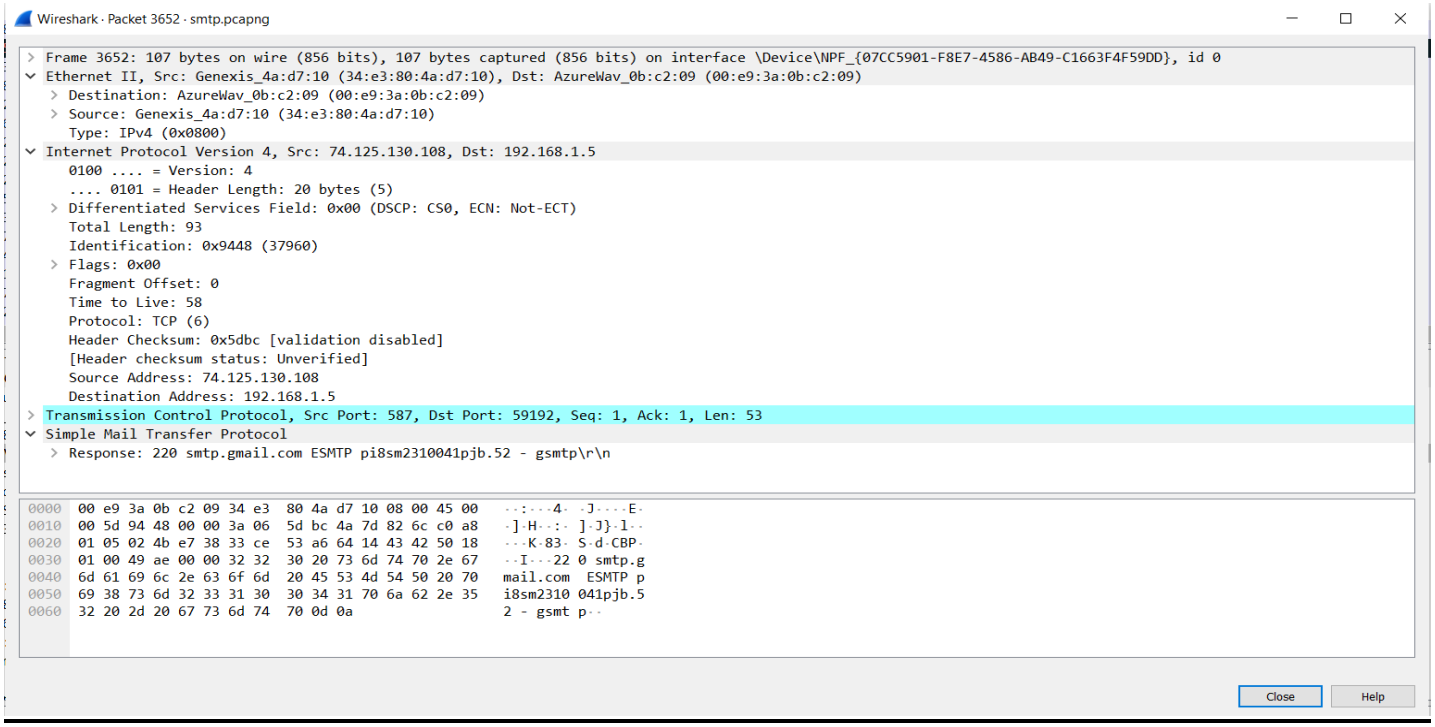
```
Transmission Control Protocol, Src Port: 59192, Dst Port: 587, Seq: 32, Ack: 90, Len: 3
    Source Port: 59192
    Destination Port: 587
    [Stream index: 62]
    [TCP Segment Len: 3]
    Sequence Number: 32    (relative sequence number)
    Sequence Number (raw): 1679049569
    [Next Sequence Number: 35    (relative sequence number)]
    Acknowledgment Number: 90    (relative ack number)
    Acknowledgment number (raw): 869159935
    0101 .... = Header Length: 20 bytes (5)
  > Flags: 0x018 (PSH, ACK)
    Window: 513
    [Calculated window size: 131328]
    [Window size scaling factor: 256]
    Checksum: 0x8e5d [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
  > [SEQ/ACK analysis]
  > [Timestamps]
    TCP payload (3 bytes)
    TCP segment data (3 bytes)
> [7 Reassembled TCP Segments (8 bytes): #3772(1), #3785(1), #3793(1), #3796(1), #3799(1), #3801(1), #3802(3)]
```

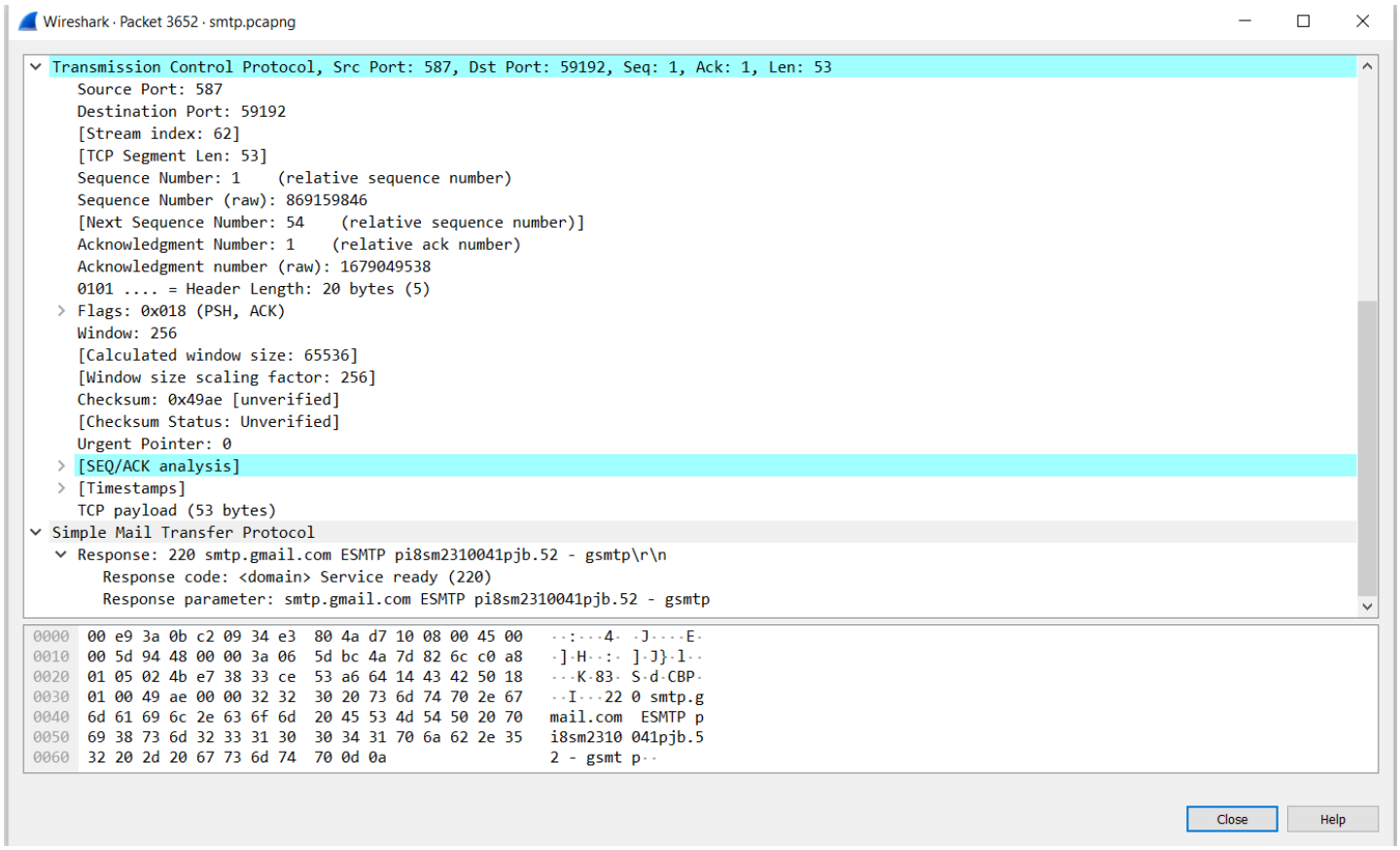
8.4 Analyze SMTP Service Ready Traffic

To analyze SMTP Service Ready traffic:

1. Observe the traffic captured in the top Wireshark packet list pane.
2. Select the fourth packet, which is the first SMTP packet and labeled **220 ...**.
3. Observe the packet details in the middle Wireshark packet details pane. Notice that it is an Ethernet II / Internet Protocol Version 4 / Transmission Control Protocol / Hypertext Transfer Protocol frame. Also notice that the Ethernet II, Internet Protocol Version 4, and Transmission Control Protocol values are consistent with the TCP connection analyzed.
4. Expand Simple Mail Transfer Protocol and Response to view SMTP details.
5. Observe the Response code and Response parameter.
6. Observe the traffic captured in the top Wireshark packet list pane.
7. Select the fifth packet, labeled **TCP ACK**. This is the client TCP acknowledgement of receiving the Service Ready message.

220 message:


Wireshark · Packet 3652 · smtp.pcapng
Frame 3652: 107 bytes on wire (856 bits), 107 bytes captured (856 bits) on interface \Device\NPF_{07CC5901-F8E7-4586-AB49-C1663F4F59DD}, id 0
Ethernet II, Src: Genexis_4a:d7:10 (34:e3:80:4a:d7:10), Dst: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09)
Destination: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09)
Source: Genexis_4a:d7:10 (34:e3:80:4a:d7:10)
Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 74.125.130.108, Dst: 192.168.1.5
0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
Total Length: 93
Identification: 0x9448 (37960)
Flags: 0x00
Fragment Offset: 0
Time to Live: 58
Protocol: TCP (6)
Header Checksum: 0x5dbc [validation disabled]
[Header checksum status: Unverified]
Source Address: 74.125.130.108
Destination Address: 192.168.1.5
Transmission Control Protocol, Src Port: 587, Dst Port: 59192, Seq: 1, Ack: 1, Len: 53
Simple Mail Transfer Protocol
Response: 220 smtp.gmail.com ESMTP pi8sm2310041pjb.52 - gsmtp\r\n
0000 00 e9 3a 0b c2 09 34 e3 80 4a d7 10 08 00 45 00
0010 00 5d 94 48 00 00 3a 06 5d bc 4a 7d 82 6c c0 a8
0020 01 05 02 4b e7 38 33 ce 53 a6 64 14 43 42 50 18
0030 01 00 49 ae 00 00 32 32 30 20 73 6d 74 70 2e 67
0040 6d 61 69 6c 2e 63 6f 6d 20 45 53 4d 54 50 20 70
0050 69 38 73 6d 32 33 31 30 30 34 31 70 6a 62 2e 35
0060 32 20 2d 20 67 73 6d 74 70 0d 0a
Close
Help


Wireshark · Packet 3652 · smtp.pcapng
Transmission Control Protocol, Src Port: 587, Dst Port: 59192, Seq: 1, Ack: 1, Len: 53
Source Port: 587
Destination Port: 59192
[Stream index: 62]
[TCP Segment Len: 53]
Sequence Number: 1 (relative sequence number)
Sequence Number (raw): 869159846
[Next Sequence Number: 54 (relative sequence number)]
Acknowledgment Number: 1 (relative ack number)
Acknowledgment number (raw): 1679049538
0101 .... = Header Length: 20 bytes (5)
Flags: 0x018 (PSH, ACK)
Window: 256
[Calculated window size: 65536]
[Window size scaling factor: 256]
Checksum: 0x49ae [unverified]
[Checksum Status: Unverified]
Urgent Pointer: 0
[SEQ/ACK analysis]
[Timestamps]
TCP payload (53 bytes)
Simple Mail Transfer Protocol
Response: 220 smtp.gmail.com ESMTP pi8sm2310041pjb.52 - gsmtp\r\n
Response code: <domain> Service ready (220)
Response parameter: smtp.gmail.com ESMTP pi8sm2310041pjb.52 - gsmtp
0000 00 e9 3a 0b c2 09 34 e3 80 4a d7 10 08 00 45 00
0010 00 5d 94 48 00 00 3a 06 5d bc 4a 7d 82 6c c0 a8
0020 01 05 02 4b e7 38 33 ce 53 a6 64 14 43 42 50 18
0030 01 00 49 ae 00 00 32 32 30 20 73 6d 74 70 2e 67
0040 6d 61 69 6c 2e 63 6f 6d 20 45 53 4d 54 50 20 70
0050 69 38 73 6d 32 33 31 30 30 34 31 70 6a 62 2e 35
0060 32 20 2d 20 67 73 6d 74 70 0d 0a
Close
Help

TCP ACK:

	Time	Source	Destination	Protocol	Length	Info
3650	2021-06-16 19:07:04.306638	192.168.1.5	20.197.71.89	TLSv1.2	98	Application Data
3651	2021-06-16 19:07:04.391988	20.197.71.89	192.168.1.5	TLSv1.2	229	Application Data
3652	2021-06-16 19:07:04.424159	74.125.130.108	192.168.1.5	SMTP	107	[TCP Spurious Retransmission] S: 220 smtp.gmail.com ESMTP pi8sm2310041pjb.52 - gsmtp
3653	2021-06-16 19:07:04.424205	192.168.1.5	74.125.130.108	TCP	66	[TCP Dup ACK 3647#1] 59192 → 587 [ACK] Seq=1 Ack=54 Win=131328 Len=0 SLE=1 SRE=54
3654	2021-06-16 19:07:04.428285	54.189.17.76	192.168.1.5	TCP	54	443 → 57139 [ACK] Seq=342 Ack=386 Win=3 Len=0
3655	2021-06-16 19:07:04.445667	192.168.1.5	20.197.71.89	TCP	54	64116 → 443 [ACK] Seq=176 Ack=700 Win=513 Len=0
3656	2021-06-16 19:07:06.877545	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=1 Ack=54 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3657	2021-06-16 19:07:07.331571	192.168.1.5	74.125.130.108	TCP	57	59192 → 587 [PSH, ACK] Seq=1 Ack=54 Win=131328 Len=3
3658	2021-06-16 19:07:07.461861	74.125.130.108	192.168.1.5	TCP	66	[TCP ACKed unseen segment] 587 → 59192 [ACK] Seq=54 Ack=4 Win=65536 Len=0 SLE=1 SRE=2
3659	2021-06-16 19:07:07.579297	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=4 Ack=54 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3660	2021-06-16 19:07:07.669845	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=54 Ack=5 Win=65536 Len=0
3661	2021-06-16 19:07:07.878399	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=5 Ack=54 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3662	2021-06-16 19:07:07.976726	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=54 Ack=6 Win=65536 Len=0
3663	2021-06-16 19:07:08.966506	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=6 Ack=54 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3664	2021-06-16 19:07:09.101922	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=54 Ack=7 Win=65536 Len=0
3665	2021-06-16 19:07:09.164389	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=7 Ack=54 Win=131328 Len=1 [TCP segment of a reassembled PDU]

8.4 Analyze SMTP HELO Traffic

To analyze SMTP HELO traffic:

1. Observe the traffic captured in the top Wireshark packet list pane.
2. Select the following TCP segments and acknowledgements. If you observe the packet details in the bottom Wireshark packet bytes pane carefully, you will see that the segments spell out the helo message. The sequence ends with a Wireshark-combined SMTP client helo message, followed by a server TCP acknowledgement.

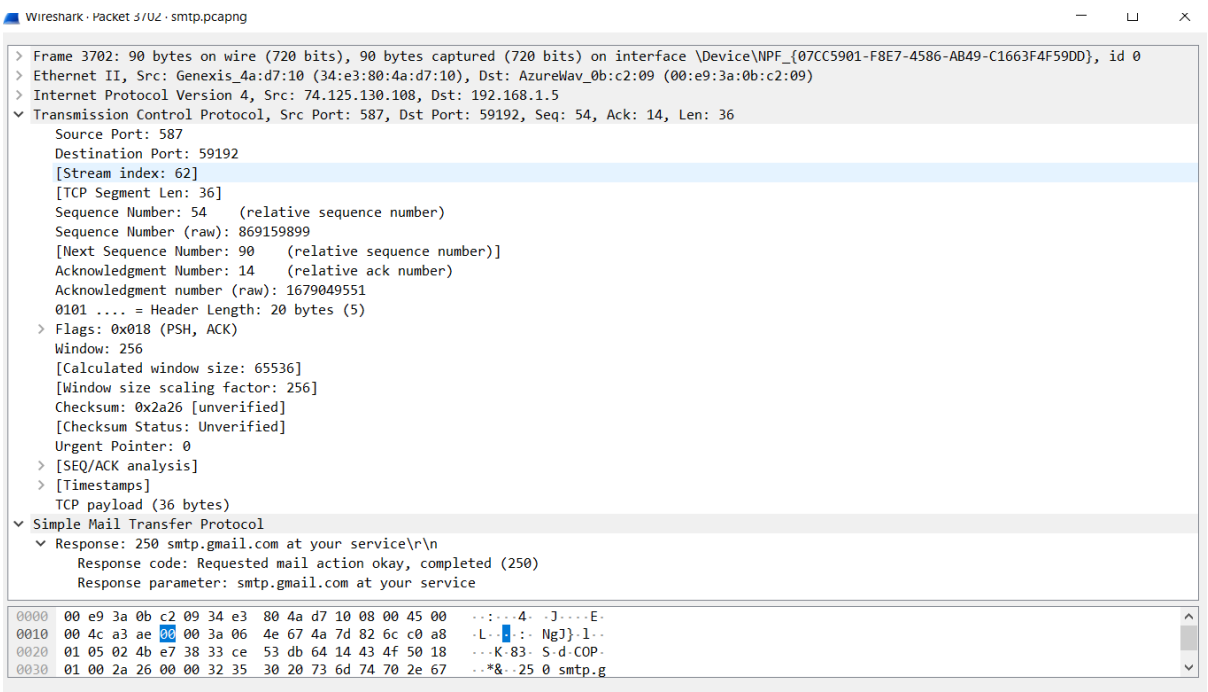
3698	2021-06-16 19:07:11.728339	192.168.1.5	74.125.130.108	SMTP	56	C: helo google
3699	2021-06-16 19:07:11.769155	192.168.1.5	172.217.194.189	UDP	75	61868 → 443 Len=33
3700	2021-06-16 19:07:11.782847	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=54 Ack=14 Win=65536 Len=0
3701	2021-06-16 19:07:12.017164	192.168.1.5	172.217.194.189	UDP	75	61868 → 443 Len=33
3702	2021-06-16 19:07:12.029881	74.125.130.108	192.168.1.5	SMTP	90	S: 250 smtp.gmail.com at your service
3703	2021-06-16 19:07:12.079466	192.168.1.5	74.125.130.108	TCP	54	59192 → 587 [ACK] Seq=14 Ack=90 Win=131328 Len=0
3704	2021-06-16 19:07:12.172544	172.217.194.189	192.168.1.5	UDP	74	443 → 61868 Len=32
3705	2021-06-16 19:07:12.578708	192.168.1.5	172.217.194.189	UDP	75	61868 → 443 Len=33
3706	2021-06-16 19:07:12.685101	172.217.194.189	192.168.1.5	UDP	74	443 → 61868 Len=32
3707	2021-06-16 19:07:13.494094	192.168.1.5	172.217.194.189	UDP	75	61868 → 443 Len=33
3708	2021-06-16 19:07:13.609571	172.217.194.189	192.168.1.5	UDP	74	443 → 61868 Len=32
3709	2021-06-16 19:07:13.898271	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=14 Ack=90 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3710	2021-06-16 19:07:14.018207	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=90 Ack=15 Win=65536 Len=0
3711	2021-06-16 19:07:14.182974	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=15 Ack=90 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3712	2021-06-16 19:07:14.324491	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=90 Ack=16 Win=65536 Len=0
3713	2021-06-16 19:07:14.416346	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=16 Ack=90 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3714	2021-06-16 19:07:14.529263	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=90 Ack=17 Win=65536 Len=0
3715	2021-06-16 19:07:14.588157	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=17 Ack=90 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3716	2021-06-16 19:07:14.732621	74.125.130.108	192.168.1.5	TCP	54	587 → 59192 [ACK] Seq=90 Ack=18 Win=65536 Len=0
3717	2021-06-16 19:07:14.872842	192.168.1.5	74.125.130.108	TCP	55	59192 → 587 [PSH, ACK] Seq=18 Ack=90 Win=131328 Len=1 [TCP segment of a reassembled PDU]
3718	2021-06-16 19:07:15.185813	192.168.1.5	74.125.130.108	TCP	56	59192 → 587 [PSH, ACK] Seq=18 Ack=90 Win=131328 Len=2 [TCP segment of a reassembled PDU]
3719	2021-06-16 19:07:15.216796	192.168.1.5	172.217.194.189	UDP	75	61868 → 443 Len=33

8.5 Analyze SMTP Completed Traffic

To analyze SMTP Completed traffic:

1. Observe the traffic captured in the top Wireshark packet list pane.
2. Select the following SMTP packet, labeled **250 ...**
3. Observe the packet details in the middle Wireshark packet details pane.
4. Expand Simple Mail Transfer Protocol and Response to view SMTP details.
5. Observe the Response code and Response parameter.

3698	2021-06-16 19:07:11.728339	192.168.1.5	74.125.130.108	SMTP	56 C: helo google
3702	2021-06-16 19:07:12.029881	74.125.130.108	192.168.1.5	SMTP	90 S: 250 smtp.gmail.com at your service

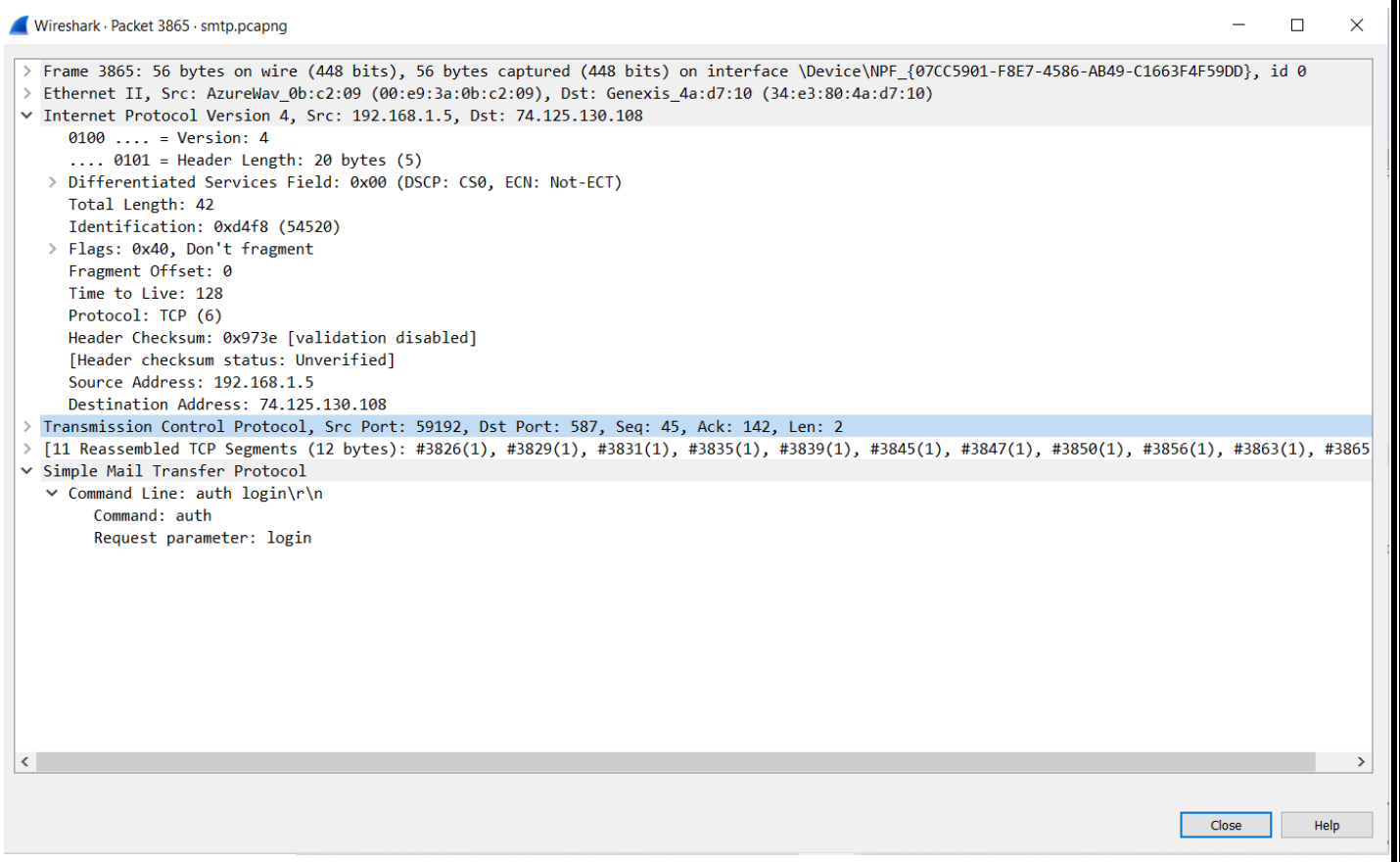


8.6 Analyze SMTP AUTH LOGIN Traffic

To analyze SMTP AUTH LOGIN traffic:

1. Observe the traffic captured in the top Wireshark packet list pane.
2. Select the following TCP segments and acknowledgements. If you observe the packet details in the bottom Wireshark packet bytes pane carefully. The sequence ends with a server TCP acknowledgement.

No.	Time	Source	Destination	Protocol	Length	Info
3865	2021-06-16 19:07:27.867621	192.168.1.5	74.125.130.108	SMTP	56	C: auth login
3867	2021-06-16 19:07:28.195320	74.125.130.108	192.168.1.5	SMTP	72	S: 334 VXNlcm5hbWU6
4462	2021-06-16 19:08:40.944253	192.168.1.5	74.125.130.108	SMTP	56	C: User: b20=
4464	2021-06-16 19:08:41.262336	74.125.130.108	192.168.1.5	SMTP	72	S: 334 UGFzc3dvcmQ6
4742	2021-06-16 19:09:18.724275	192.168.1.5	74.125.130.108	SMTP	56	C: Pass: ZWxlZTk4Cg==
4744	2021-06-16 19:09:19.254143	74.125.130.108	192.168.1.5	SMTP	74	S: 235 2.7.0 Accepted



USERNAME:

```
Frame 4464: 72 bytes on wire (576 bits), 72 bytes captured (576 bits) on interface \Device\NPF_{07CC5901-F8E7-4586-AB49-C1663F4F59DD}, id 0
Ethernet II, Src: Genexis_4a:d7:10 (34:e3:80:4a:d7:10), Dst: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09)
Internet Protocol Version 4, Src: 74.125.130.108, Dst: 192.168.1.5
Transmission Control Protocol, Src Port: 587, Dst Port: 59192, Seq: 160, Ack: 81, Len: 18
    Source Port: 587
    Destination Port: 59192
    [Stream index: 62]
    [TCP Segment Len: 18]
    Sequence Number: 160    (relative sequence number)
    Sequence Number (raw): 869160005
    [Next Sequence Number: 178    (relative sequence number)]
    Acknowledgment Number: 81    (relative ack number)
    Acknowledgment number (raw): 1679049618
    0101 .... = Header Length: 20 bytes (5)
    Flags: 0x018 (PSH, ACK)
    Window: 256
    [Calculated window size: 65536]
    [Window size scaling factor: 256]
    Checksum: 0x7a79 [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
    [SEQ/ACK analysis]
    [Timestamps]
    TCP payload (18 bytes)
Simple Mail Transfer Protocol
    Response: 334 UGFzc3dvcmQ6\r\n
        Response code: AUTH input (334)
        Response parameter: UGFzc3dvcmQ6
```

```
0010  00 3a 5d b6 00 00 3a 06  94 71 4a 7d 82 6c c0 a8   ·:]···:· ·qJ}·l··
0020  01 05 02 4b e7 38 33 ce  54 45 64 14 43 92 50 18   ···K·83· TEd·C·P·
0030  01 00 7a 79 00 00 33 33  34 20 55 47 46 7a 63 33   ··zy··33 4 UGFzc3
```

PASSWORD:

```
> Frame 4742: 56 bytes on wire (448 bits), 56 bytes captured (448 bits) on interface \Device\NPF_{07CC5901-F8E7-4586-AB49-C1663F4F59DD}, id 0
> Ethernet II, Src: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09), Dst: Genexis_4a:d7:10 (34:e3:80:4a:d7:10)
v Internet Protocol Version 4, Src: 192.168.1.5, Dst: 74.125.130.108
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 42
    Identification: 0xd53a (54586)
  > Flags: 0x40, Don't fragment
    Fragment Offset: 0
    Time to Live: 128
    Protocol: TCP (6)
    Header Checksum: 0x96fc [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.1.5
    Destination Address: 74.125.130.108
> Transmission Control Protocol, Src Port: 59192, Dst Port: 587, Seq: 97, Ack: 178, Len: 2
> [13 Reassembled TCP Segments (14 bytes): #4619(1), #4627(1), #4640(1), #4657(1), #4664(1), #4668(1), #4680(1), #4698(1), #4712(1), #4722(1), #4726
v Simple Mail Transfer Protocol
    Password: ZWxlZTk4Cg==
```

ANALYZE 275 ACCEPTED MESSAGE:

```
> Frame 4744: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface \Device\NPF_{07CC5901-F8E7-4586-AB49-C1663F4F59DD}, id 0
> Ethernet II, Src: Genexis_4a:d7:10 (34:e3:80:4a:d7:10), Dst: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09)
v Internet Protocol Version 4, Src: 74.125.130.108, Dst: 192.168.1.5
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 60
    Identification: 0xad7b (44411)
  > Flags: 0x00
    Fragment Offset: 0
    Time to Live: 58
    Protocol: TCP (6)
    Header Checksum: 0x44aa [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 74.125.130.108
    Destination Address: 192.168.1.5
```

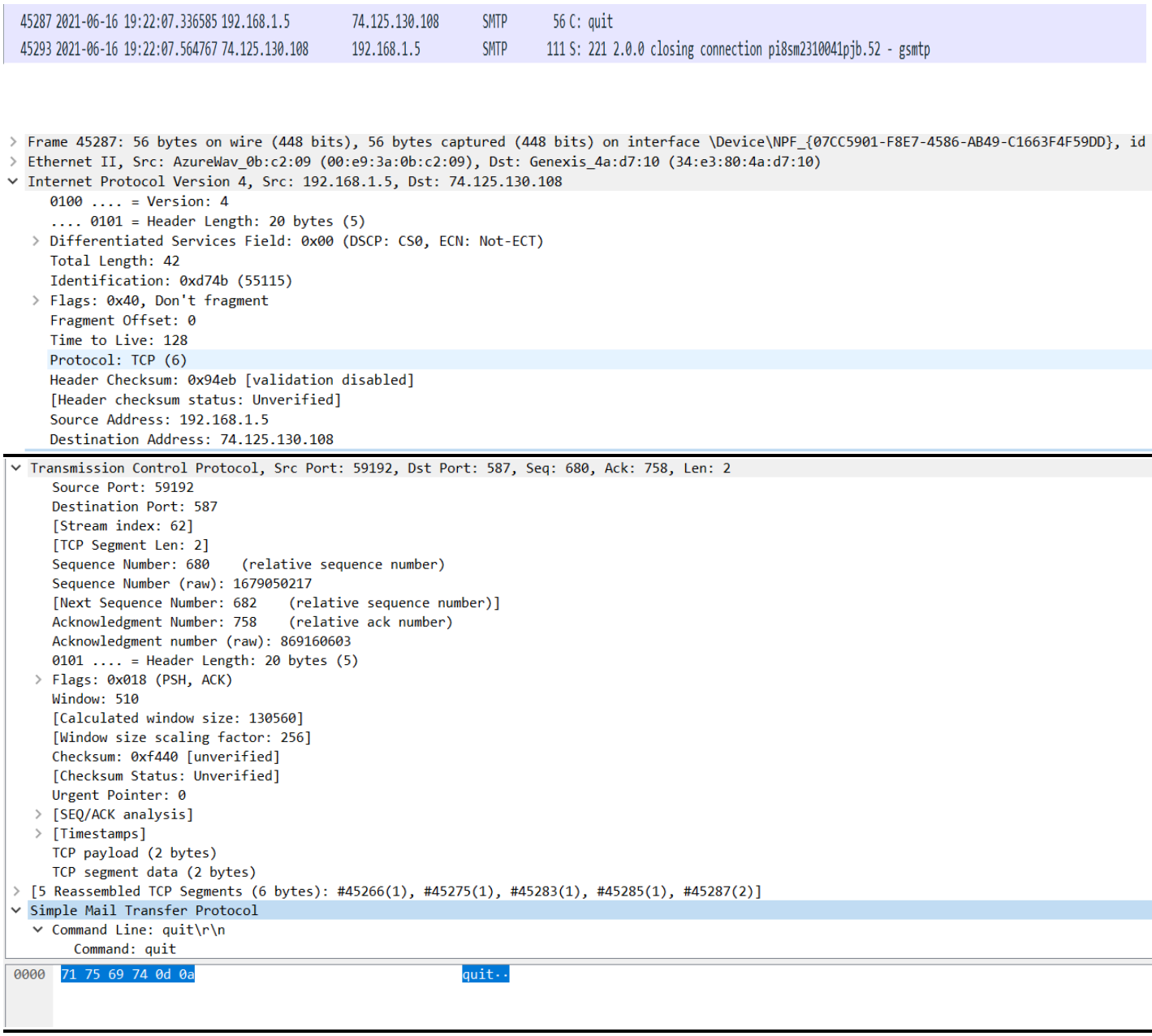
```
v Transmission Control Protocol, Src Port: 587, Dst Port: 59192, Seq: 178, Ack: 99, Len: 20
    Source Port: 587
    Destination Port: 59192
    [Stream index: 62]
    [TCP Segment Len: 20]
    Sequence Number: 178    (relative sequence number)
    Sequence Number (raw): 869160023
    [Next Sequence Number: 198    (relative sequence number)]
    Acknowledgment Number: 99    (relative ack number)
    Acknowledgment number (raw): 1679049636
    0101 .... = Header Length: 20 bytes (5)
  > Flags: 0x018 (PSH, ACK)
    Window: 256
    [Calculated window size: 65536]
    [Window size scaling factor: 256]
    Checksum: 0x7e44 [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
  > [SEQ/ACK analysis]
  > [Timestamps]
    TCP payload (20 bytes)
v Simple Mail Transfer Protocol
  v Response: 235 2.7.0 Accepted\r\n
      Response code: Authentication successful (235)
      Response parameter: 2.7.0 Accepted
```

```
0000  00 e9 3a 0b c2 09 34 e3  80 4a d7 10 08 00 45 00   ··:···4· ·J····E·
0010  00 3c ad 7b 00 00 3a 06  44 aa 4a 7d 82 6c c0 a8   ·<·{··:· D·J}·l··
0020  01 05 02 4b e7 38 33 ce  54 57 64 14 43 a4 50 18   ···K·83· TWd·C·P·
0030  01 00 7e 44 00 00 32 33  35 20 32 2e 37 2e 30 20   ··~D··23 5 2.7.0
```

8.7 Analyze SMTP QUIT Traffic

To analyze SMTP QUIT traffic:

1. Observe the traffic captured in the top Wireshark packet list pane.
2. Select the following TCP segments and acknowledgements. If you observe the packet details in the bottom Wireshark packet bytes pane carefully, you will see that the segments spell out the quit message. The sequence ends with a Wireshark-combined SMTP client quit message, followed by a server TCP acknowledgement.



8.8 Analyze SMTP Closing Traffic

To analyze SMTP Closing traffic:

1. Observe the traffic captured in the top Wireshark packet list pane.
2. Select the following SMTP packet, labeled **221 ...**
3. Observe the packet details in the middle Wireshark packet details pane.
4. Expand Simple Mail Transfer Protocol and Response to view SMTP details.
5. Observe the Response code and Response parameter.
6. Close Wireshark to complete this activity. **Quit without Saving** to discard the captured traffic.

```
> Frame 45293: 111 bytes on wire (888 bits), 111 bytes captured (888 bits) on interface \Device\NPF_{07CC5901-F8E7-4586-AB49-C1663F4F59DD}, id 0
> Ethernet II, Src: Genexis_4a:d7:10 (34:e3:80:4a:d7:10), Dst: AzureWav_0b:c2:09 (00:e9:3a:0b:c2:09)
v Internet Protocol Version 4, Src: 74.125.130.108, Dst: 192.168.1.5
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 97
    Identification: 0xd54e (54606)
  > Flags: 0x00
    Fragment Offset: 0
    Time to Live: 58
    Protocol: TCP (6)
    Header Checksum: 0x1cb2 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 74.125.130.108
    Destination Address: 192.168.1.5
v Transmission Control Protocol, Src Port: 587, Dst Port: 59192, Seq: 758, Ack: 682, Len: 57
    Source Port: 587
    Destination Port: 59192
    [Stream index: 62]
    [TCP Segment Len: 57]
    Sequence Number: 758    (relative sequence number)
    Sequence Number (raw): 869160603
    [Next Sequence Number: 815    (relative sequence number)]
    Acknowledgment Number: 682    (relative ack number)
    Acknowledgment number (raw): 1679050219
    0101 .... = Header Length: 20 bytes (5)
  > Flags: 0x018 (PSH, ACK)
    Window: 256
    [Calculated window size: 65536]
    [Window size scaling factor: 256]
    Checksum: 0x44ce [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
  > [SEQ/ACK analysis]
  > [Timestamps]
    TCP payload (57 bytes)
v Simple Mail Transfer Protocol
  v Response: 221 2.0.0 closing connection pi8sm2310041pjb.52 - gsmtp\r\n
      Response code: <domain> Service closing transmission channel (221)
      Response parameter: 2.0.0 closing connection pi8sm2310041pjb.52 - gsmtp
```

```
0000  00 e9 3a 0b c2 09 34 e3  80 4a d7 10 08 00 45 00   ··:···4· ·J····E·
0010  00 61 d5 4e 00 00 3a 06  1c b2 4a 7d 82 6c c0 a8   ·a·N··:· ··J}·l··
0020  01 05 02 4b e7 38 33 ce  56 9b 64 14 45 eb 50 18   ···K·83· V·d·E·P·
0030  01 00 44 ce 00 00 32 32  31 20 32 2e 30 2e 30 20   ··D···22 1 2.0.0
0040  63 6c 6f 73 69 6e 67 20  63 6f 6e 6e 65 63 74 69   closing  connecti
```

EXPERIMENT -9

9.1. Introduction to Virtual Machine and installation

9.1.2. Creating a Virtual Machine

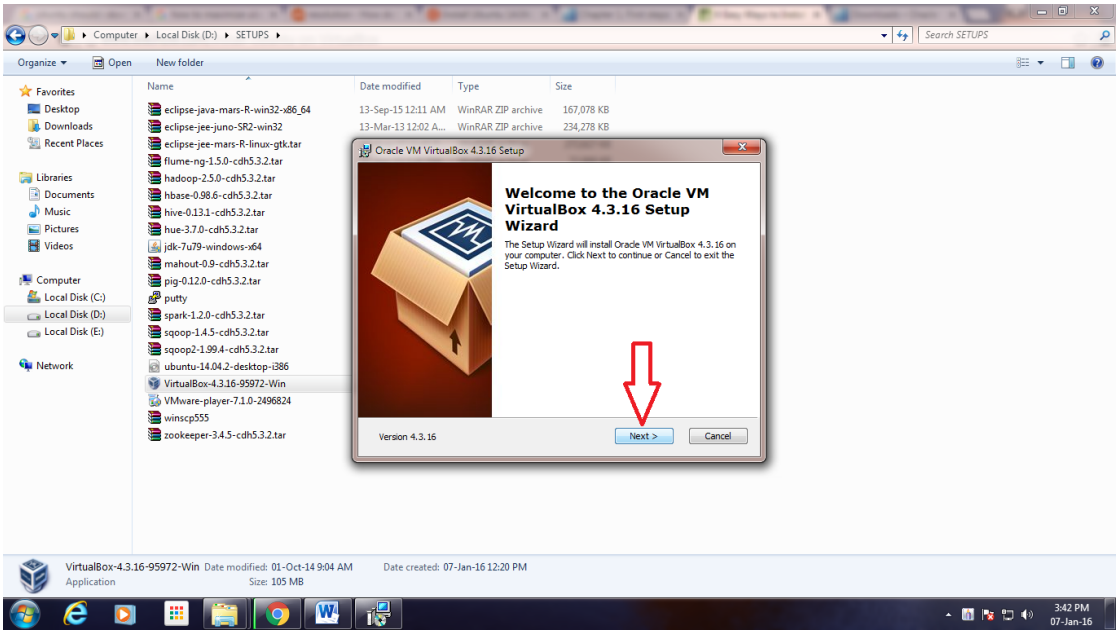
9.1.2.1 Install VirtualBox .

If you don't already have VirtualBox installed on your Windows or Mac computer, you'll need to install it before proceeding.

Following are the steps required to install VirtualBox(Oracle VM VirtualBox):

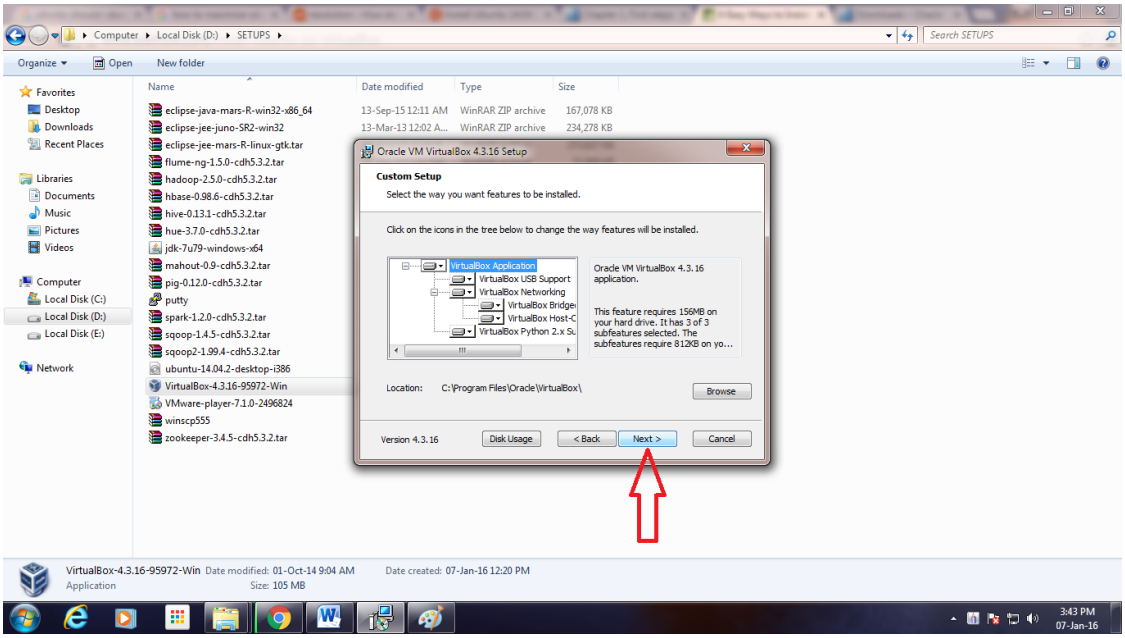
You can download the latest version of VirtualBox from the Virtual Box website: **https://www.virtualbox.org/wiki/Downloads** according to the version of your operating system Windows, Mac or Linux.

- Click Next



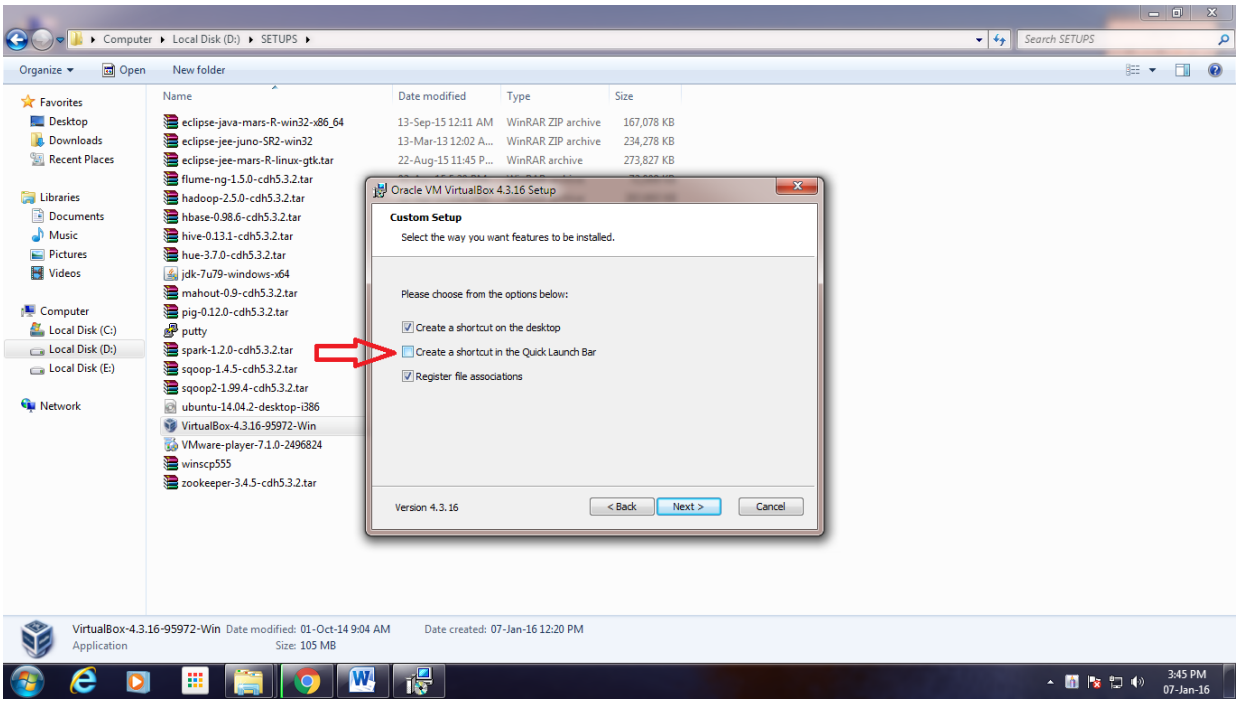
To Install VirtualBox – Setup Wizard

- Click Next



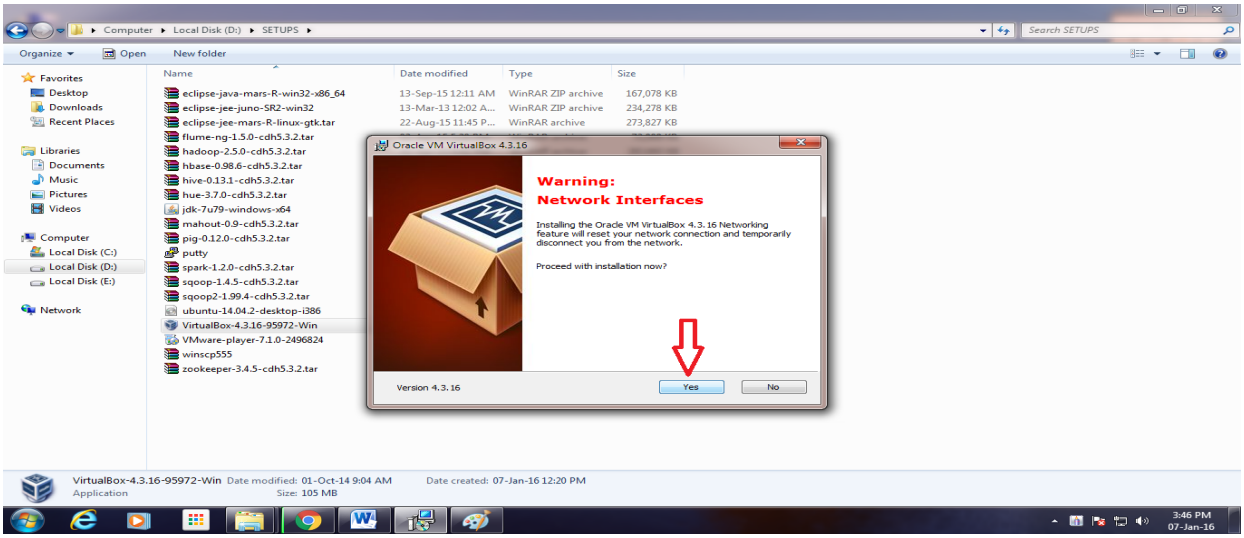
To Install VirtualBox – Custom Setup

- Uncheck "Create a shortcut in the Quick Launch Bar" and click "Next"



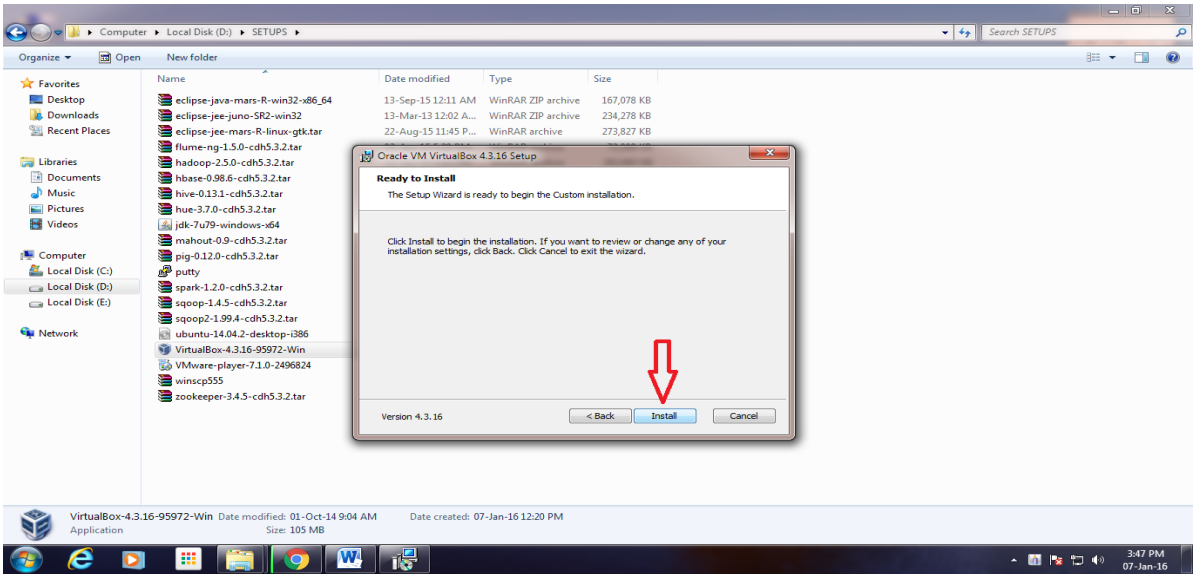
To Install VirtualBox – Features Selection

- Click “Yes”



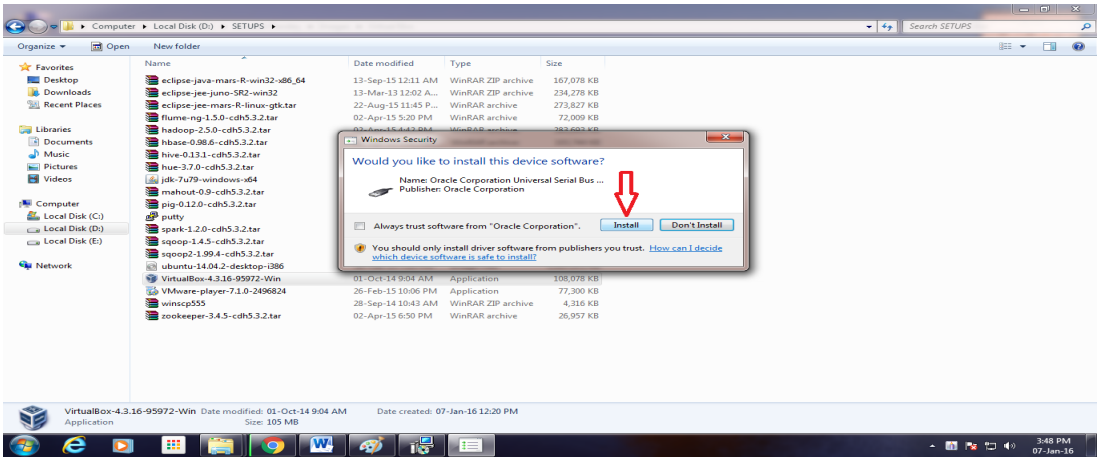
To Install VirtualBox – Network Interfaces Warning

- Click “Install”



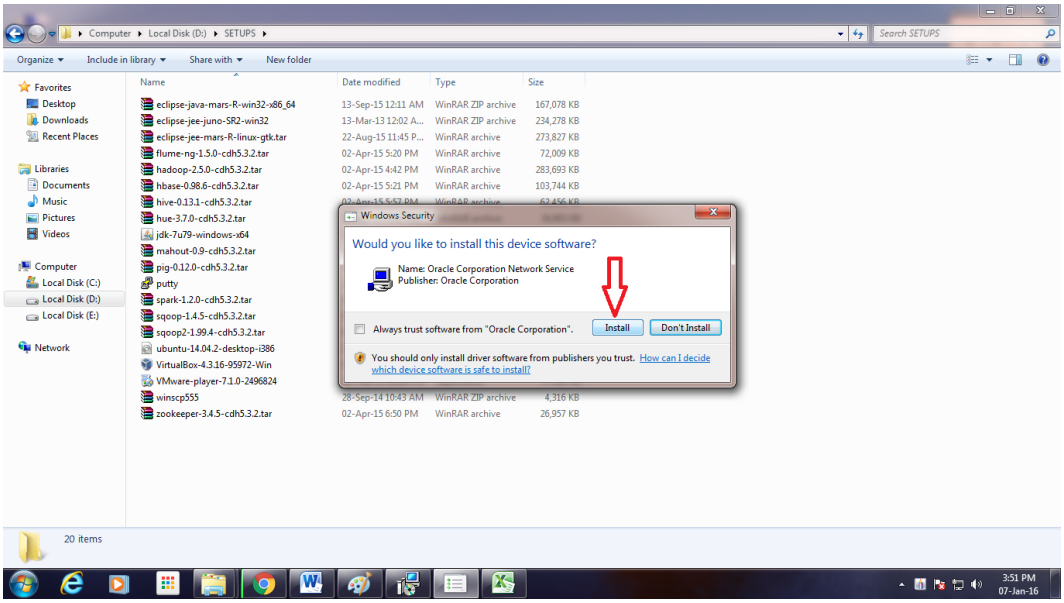
Installation of Oracle VM VirtualBox – Ready to Install

- Click “Install”



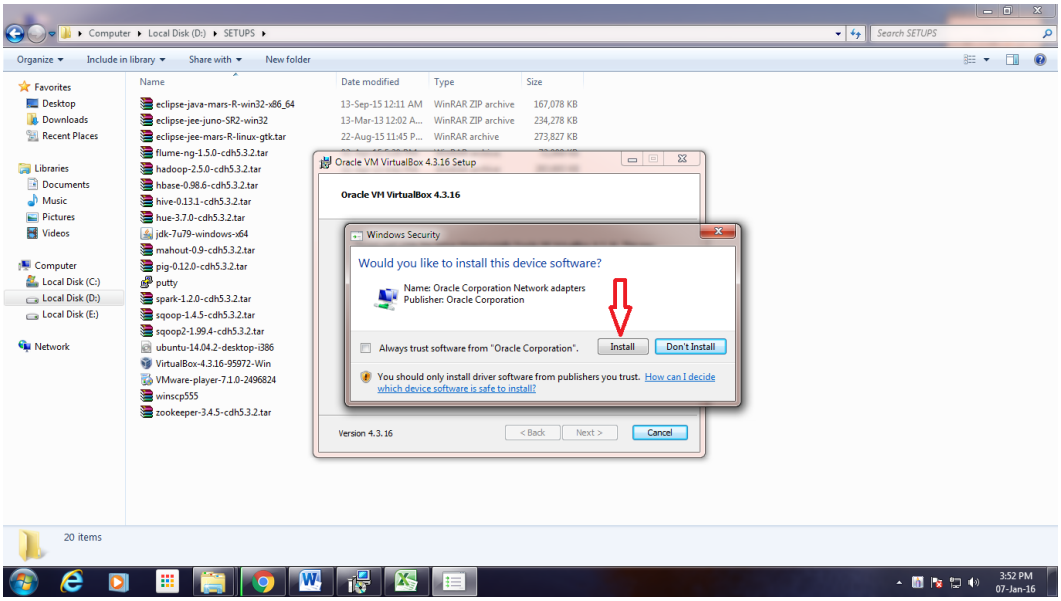
Installation of Oracle VM VirtualBox- Serial Bus Software Installation

- . Click “Install”



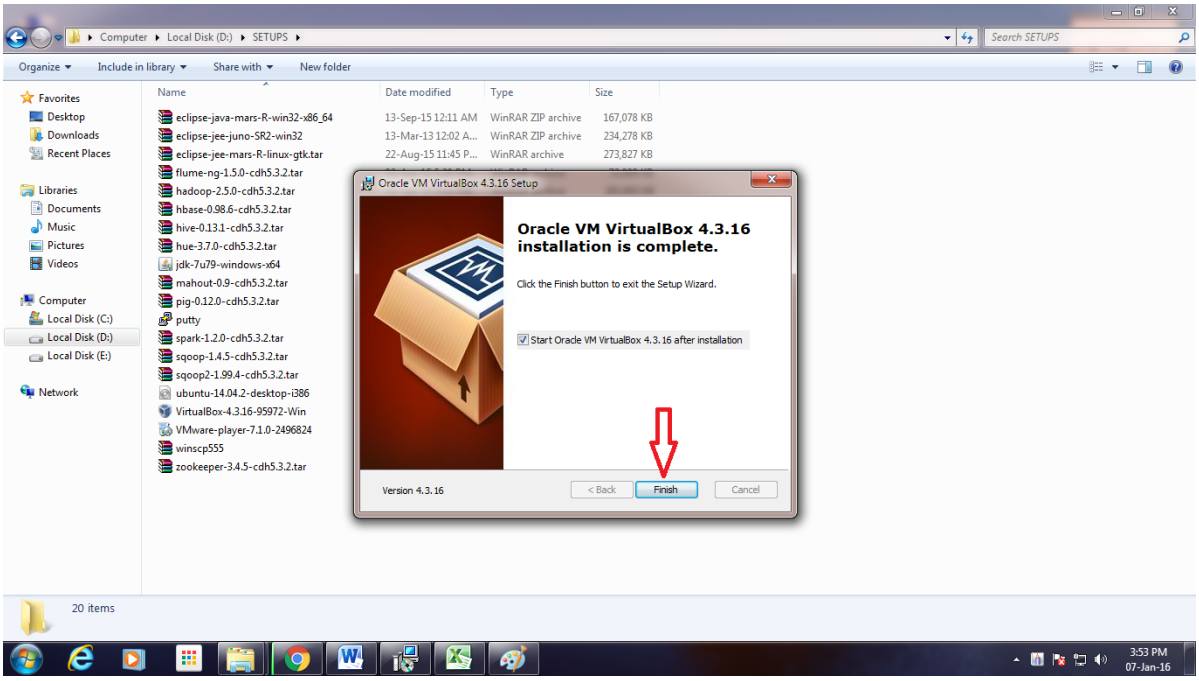
Installation of Oracle VM VirtualBox – Network Service Installation

- Click “Install”

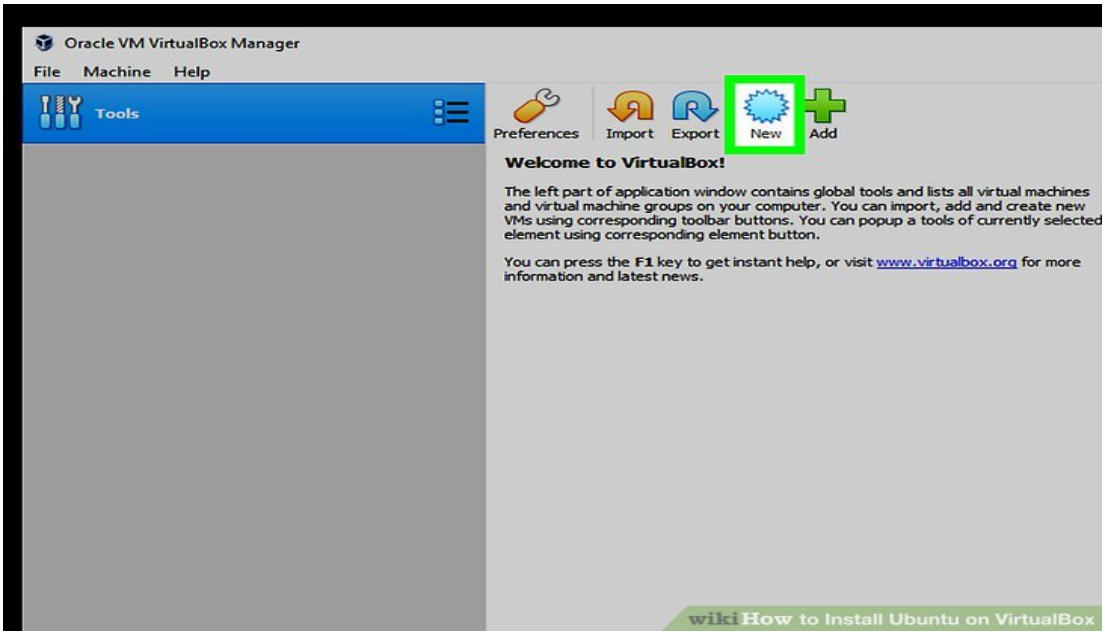


Installation of Oracle VM VirtualBox – Network Adapters Installation

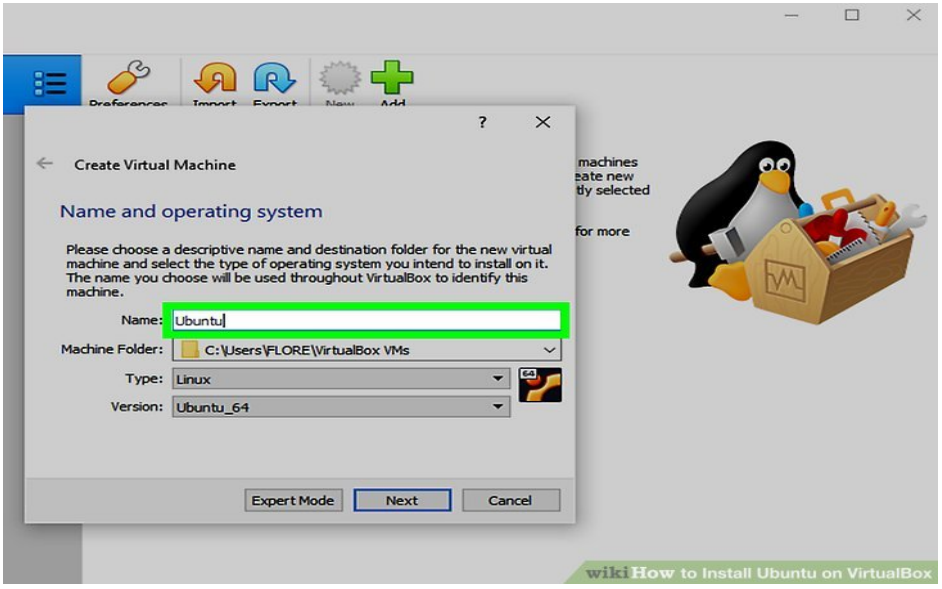
- Click “Finish”



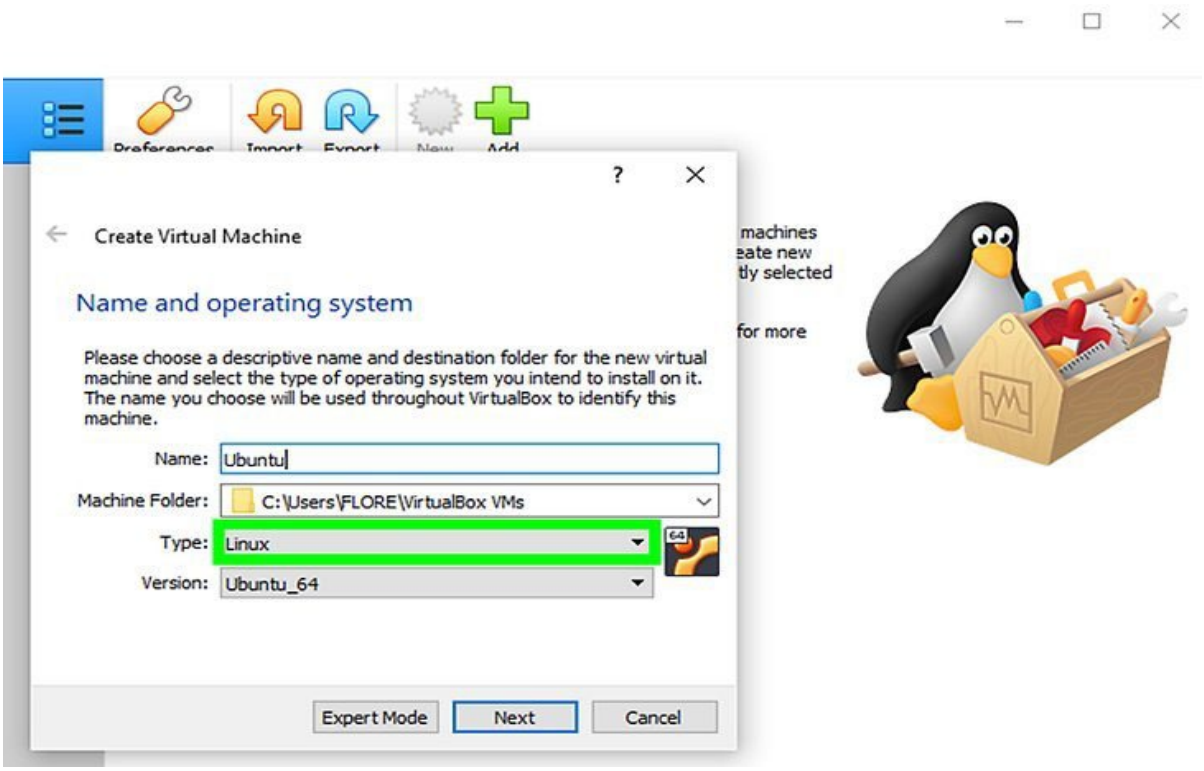
9.1.2.2. **Open VirtualBox.** Double-click (or click once on a Mac) the VirtualBox app icon.



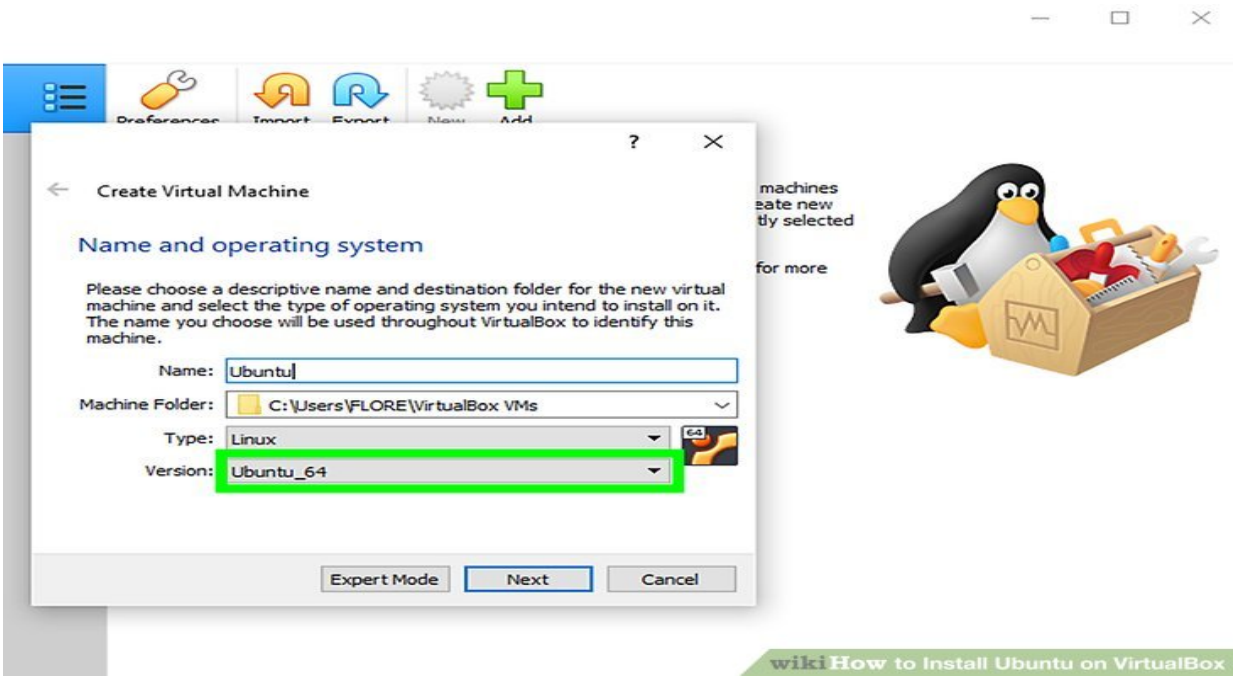
Click New. It's a blue badge in the upper-left corner of the VirtualBox window. Doing so opens a pop-up menu.



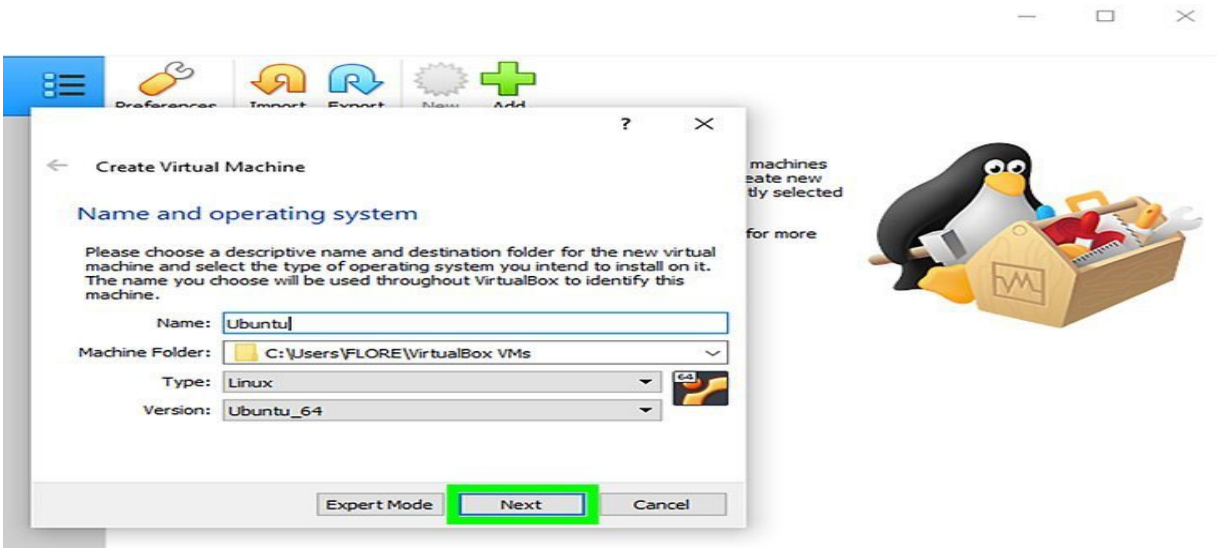
Enter a name for your virtual machine. Type whatever you want to name your virtual machine (e.g., `Ubuntu`) into the "Name" text field that's near the top of the pop-up menu.



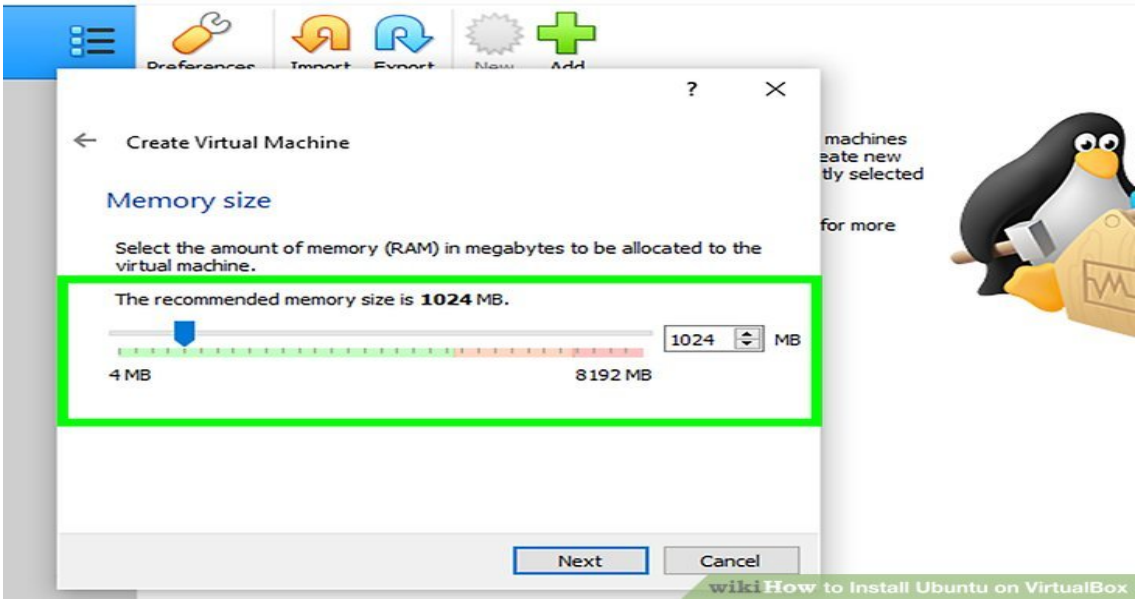
For **Operating System Type**, select the OS that you want to install.



Select the **version** of the operating system.



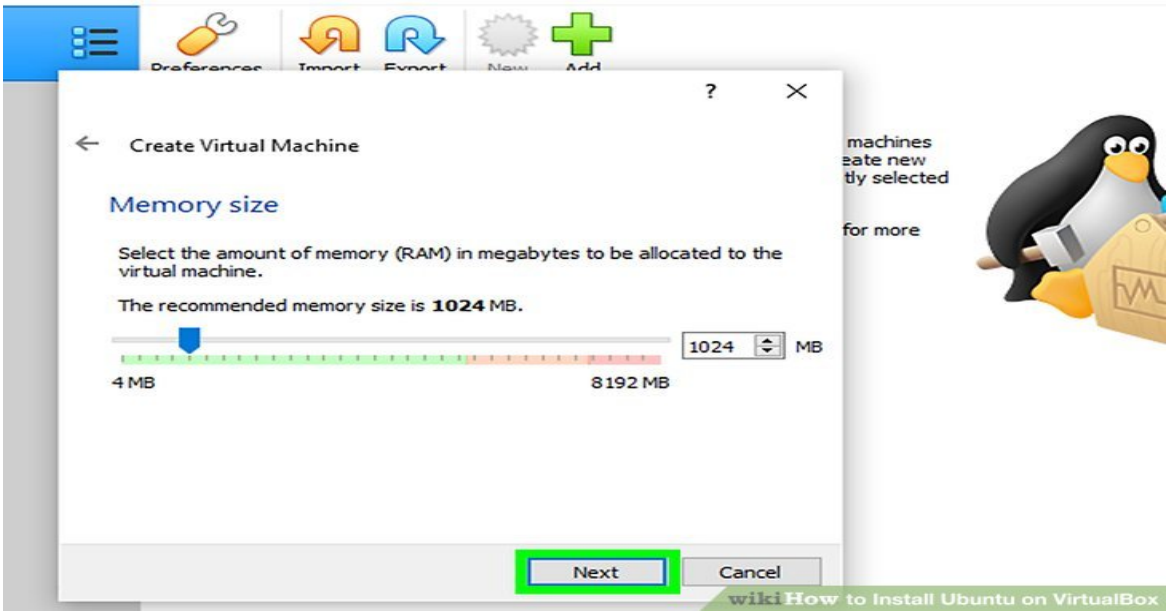
Click Next. It's at the bottom of the menu.



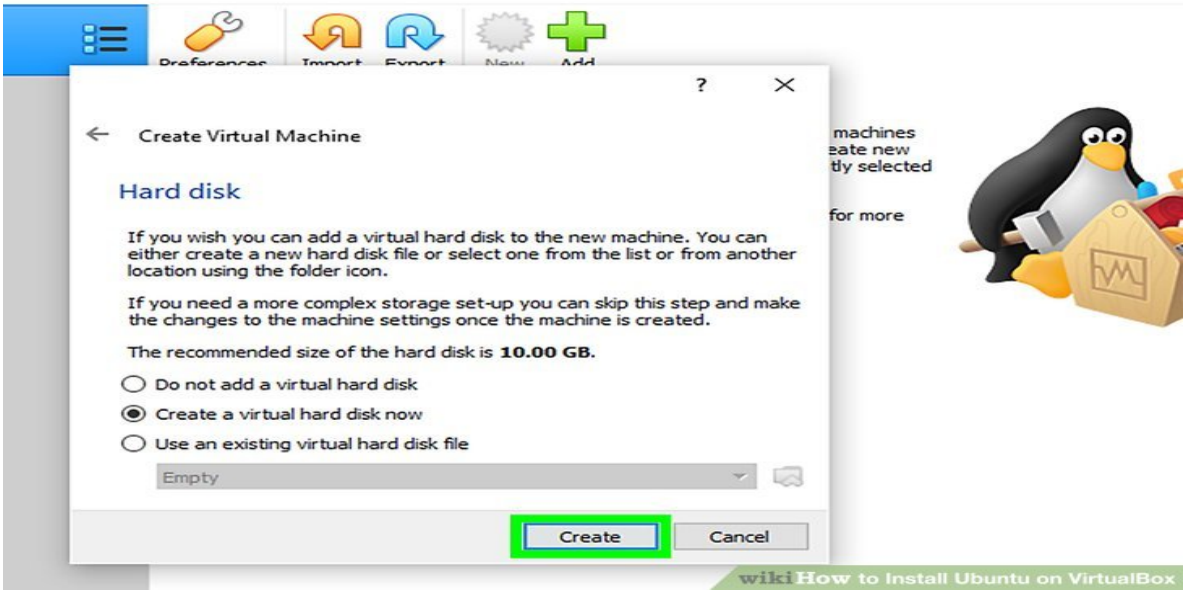
Select an amount of RAM to use. Click and drag the slider left or right to decrease or increase the amount of RAM that VirtualBox will have available for your virtual machine.

The ideal amount of RAM will automatically be selected when you get to this page.

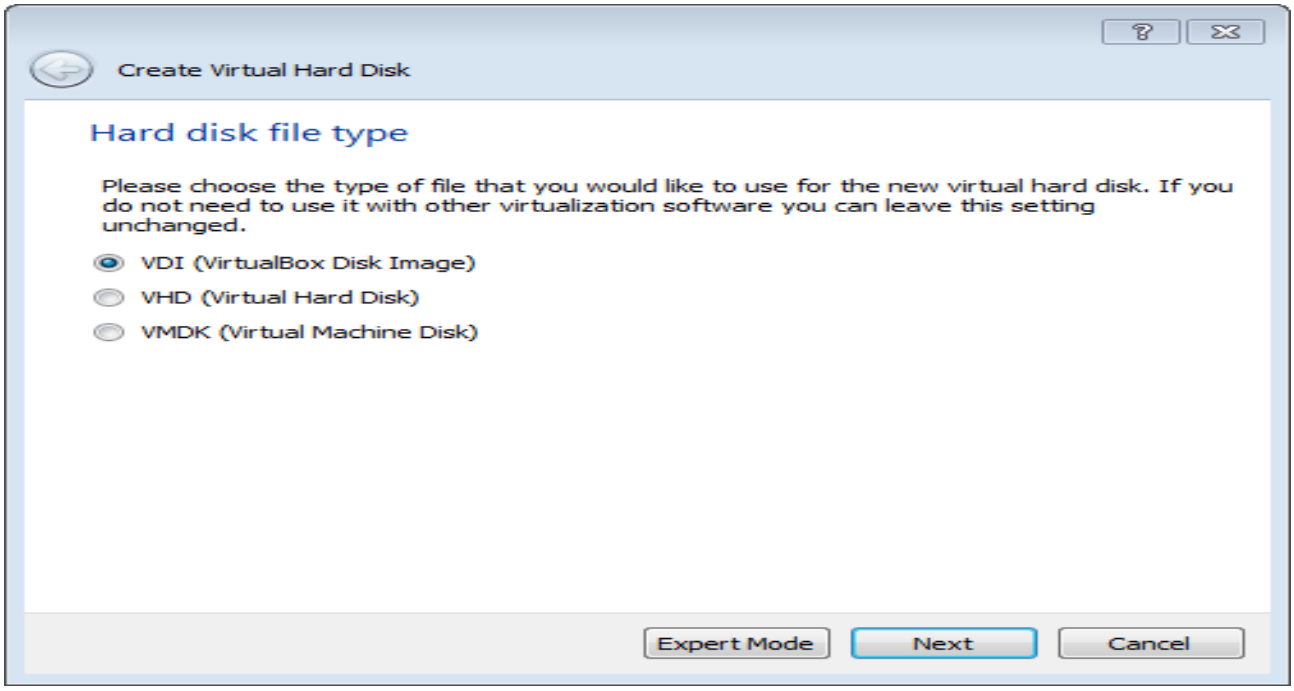
Make sure not to increase the RAM into the red section of the slider; try to keep the slider in the green.



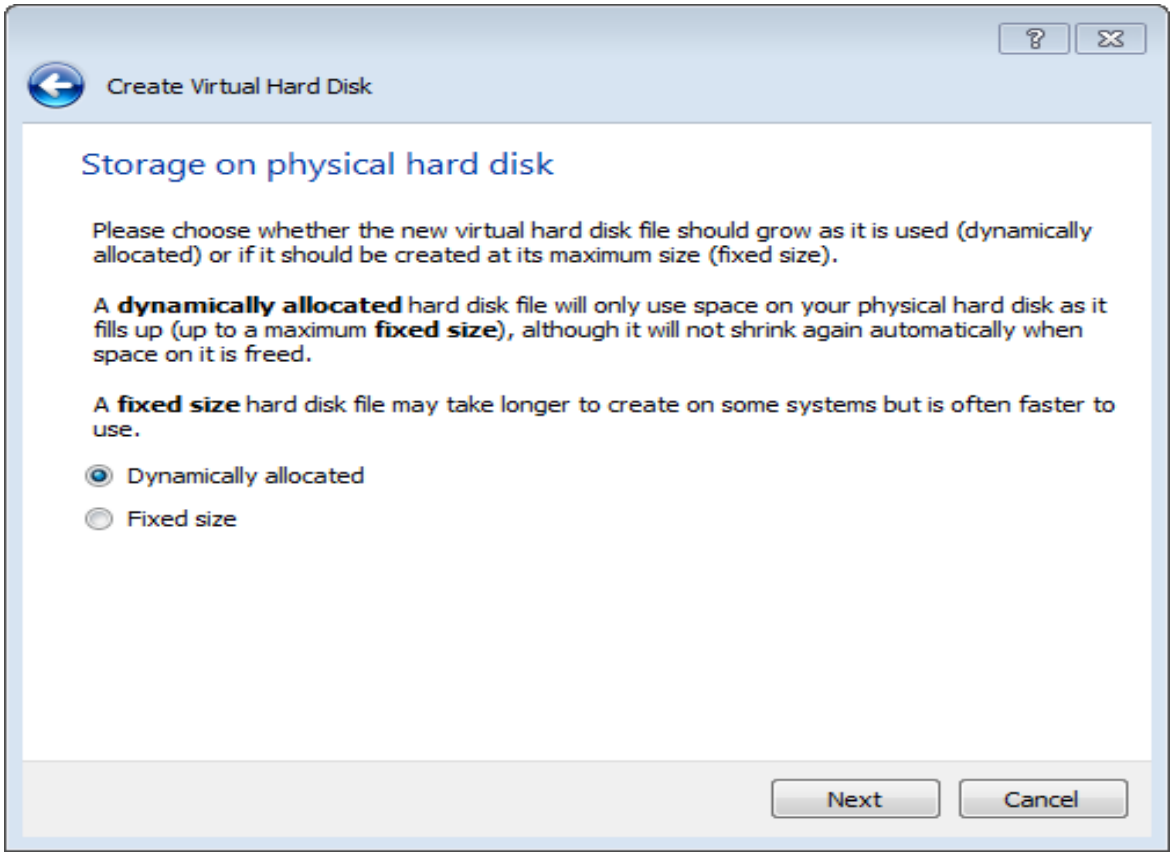
Click Next. It's at the bottom of the menu.



Create your virtual machine's virtual hard drive. The virtual hard drive is a section of your computer's hard drive space which will be used to store your virtual machine's files and programs:

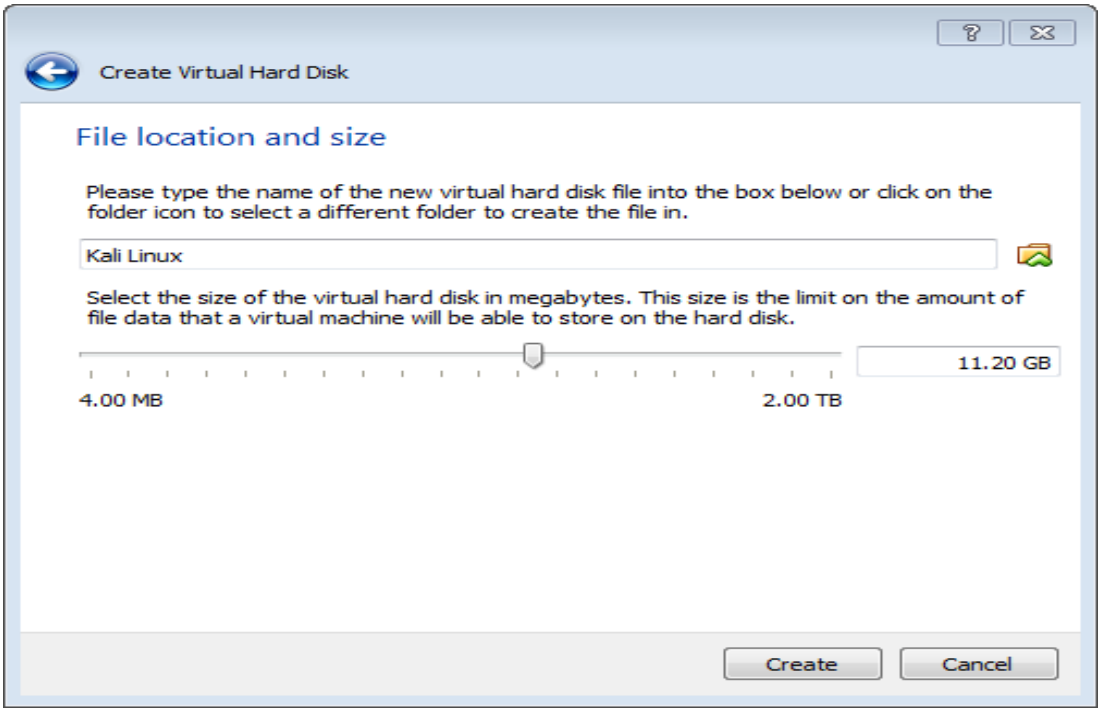


Use “VDI” to create a virtual hard disk



Choose “Dynamically allocated”

Allocate at Minimum 8 GB (recommended 10 or more).



Click **Create**, to create your new virtual machine. The virtual machine is displayed in the list on the left side of the VirtualBox Manager window, with the name that you entered initially.

VMs can run multiple operating system environments on a single physical computer, saving physical space, time and management costs.