Practical : 1

Aim : Experiment on simulation tools Cisco Packet Tracer.

➢ Topology :

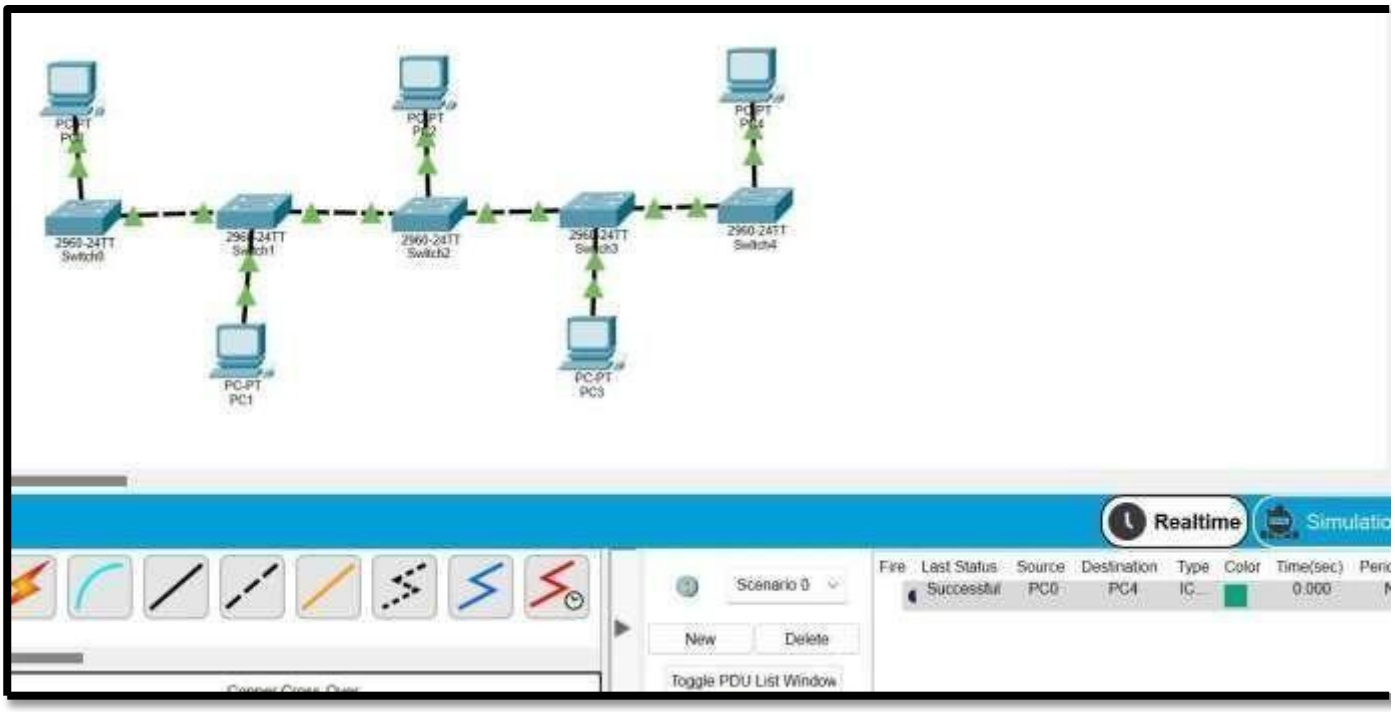
- Topology defines the structure of the network of how all the components are interconnected to each other.
- There are six type of topology :
  - » Bus Topology
  - » Ring Topology
  - » Tree Topology
  - » Star Topology
  - » Mesh Topology
  - » Hybrid Topology
  - »

➢ Bus Topology :

- **Tool :**
  Laptop, Copper Straight-through & copper cross-over wires, switch 2950-24.

- **Description :**
  Bus topology is a network type in which every computer and network device is connected to a single cable.

- **Steps :**
  1. Open Cisco Packet Tracer.
  2. Select Laptop & Switch [2950-24].
  3. Put 5 Switches in Straight horizontal line form.
  4. Select copper straight-through wire to connect each laptop to switches.
  5. Select copper cross-over wire to connect switches to each other.
  6. Give IP address to each PC.
  7. Select message and forward that message that begin from Laptop-0 and ends at Laptop-3.
  8. Open Simulation and analyses network.

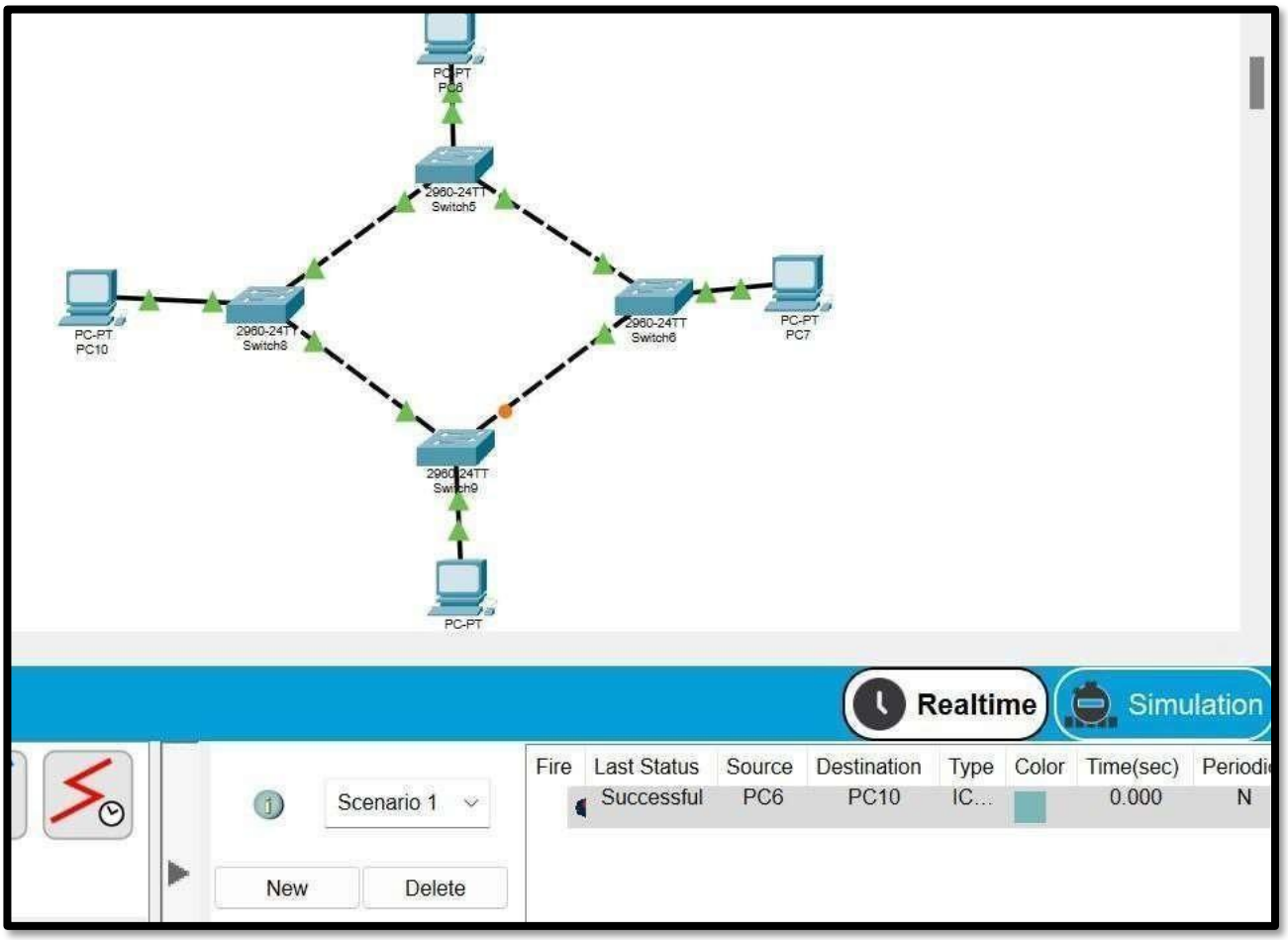

PC-PT PC0
PC-PT PC2
PC-PT PC4
2960-24TT Switch0
2960-24TT Switch1
2960-24TT Switch2
2960-24TT Switch3
2960-24TT Switch4
PC-PT PC1
PC-PT PC3
Realtime
Simulatio
Scenario 0
New
Delete
Toggle PDU List Window
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Successful
PC0
PC4
IC...
0.000

➢ Ring Topology :

- **Tool :**
  Laptop, Copper Straight-through & copper cross-over wires, switch 2950-24.

- **Description :**
  In this topology, it forms a ring connecting devices with exactly two neighboring devices.

- **Steps :**
  1. Open Cisco Packet Tracer.
  2. Select Laptop & Switch [2950-24].
  3. Put Switches in ring form.
  4. Select copper straight-through wire to connect every Laptop to equivalence Switches.
  5. Select copper cross-over wire to connect Switches to each other and make a ring structure.
  6. Give IP address to each Laptop.
  7. Select message and forward that message that begin from Laptop2 and ends at Laptop1.
  8. Open Simulation and analyses network.

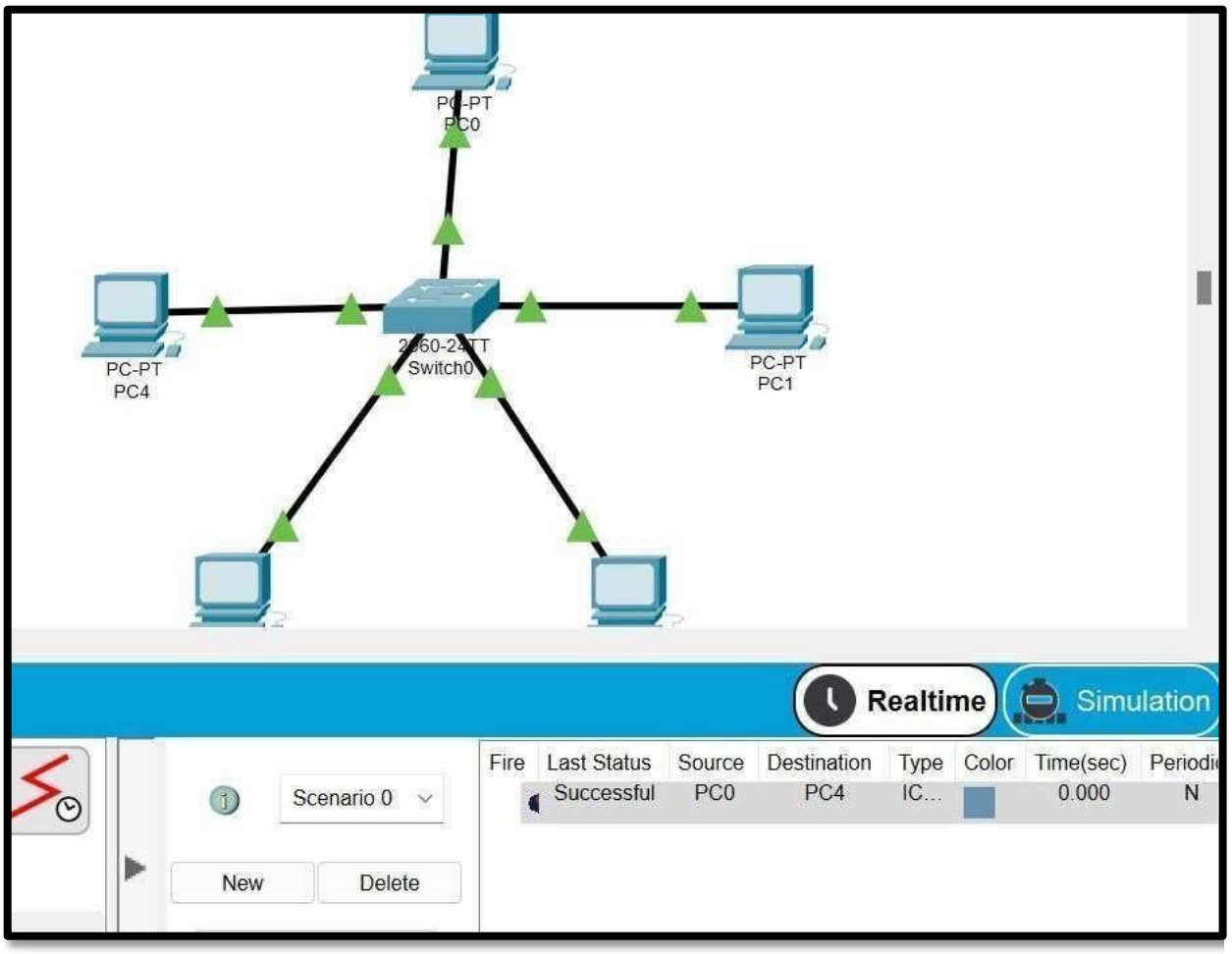


➢ Star Topology :

- **Tool :**
  Laptop, Copper Straight-through wires, Hub PT .

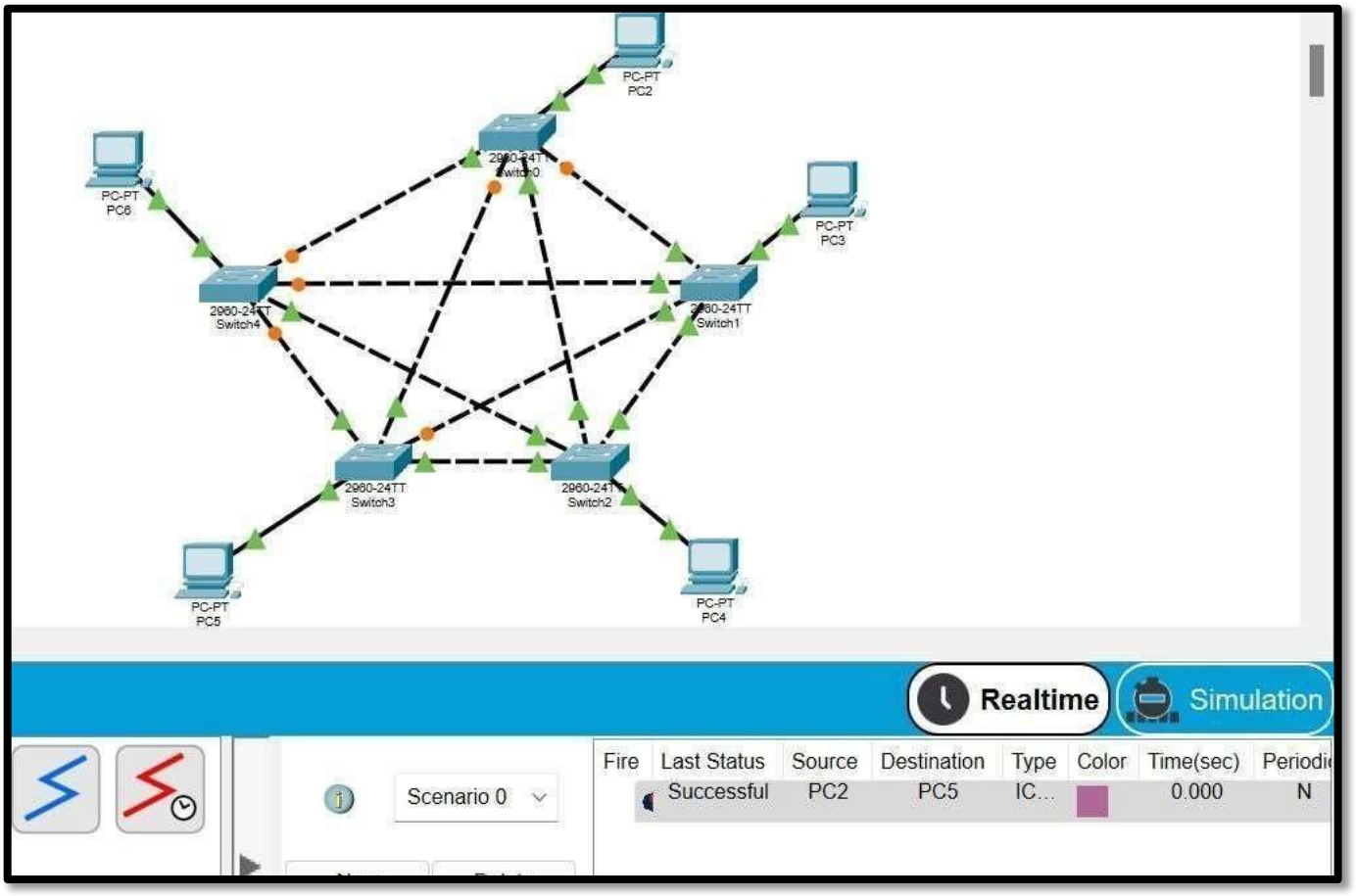
- **Description :**
  In star topology, all the devices are connected to a single hub through a cable. This hub is central node and all the other PC are connected to this central node / hub.

- **Steps :**
  1. Open Cisco Packet Tracer.
  2. Select Laptop & Hub PT.
  3. Put Hub in the center and connect Laptop in the star form.
  4. Select copper straight-through wire to connect every laptop to Hub.
  5. Give IP address to each PC.
  6. Select message and forward that message that begin from PC17 and ends at PC20.
  7. Open Simulation and analyses network.



- **Mesh Topology :**
  - **Tool :**
    Laptop, Copper Straight-through & copper cross-over wires, switch 2950-24.
  - **Description :**
    In mesh topology , every device is connect to each another device. Every device has a same number of connection with other device. No single device has different number of connection.
  - **Steps :**
    1. Open Cisco Packet Tracer.
    2. Select Laptop & Switch 2950-24.
    3. Put switches in ring form and one switch in center and connect it with each other.

4. Select copper straight-through wire to connect every Laptop to equivalence Switches.
5. Select copper cross-over wire to connect Switches to each other and make a ring structure.
6. Give IP address to each PC.
7. Select message and forward that message that begin from Laptop0 and ends at Laptop3.
8. Open Simulation and analyses network.

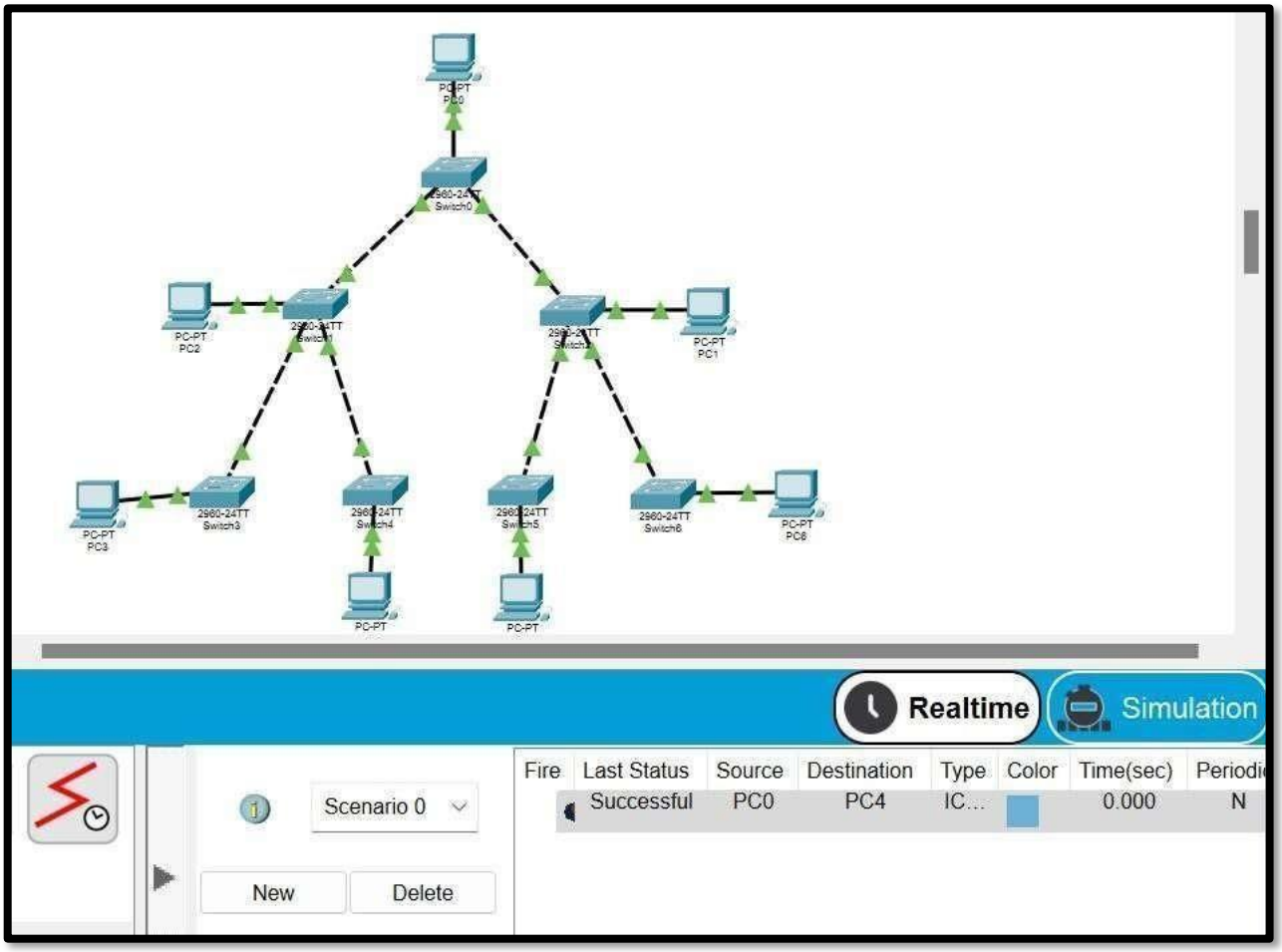


➢ Tree Topology :

- **Tool :**
  Laptop, Copper Straight-through & copper cross-over wires, switch 2950-24.

- **Description :**
  This topology is the variation of star topology. This topology has a hierarchical flow of data.

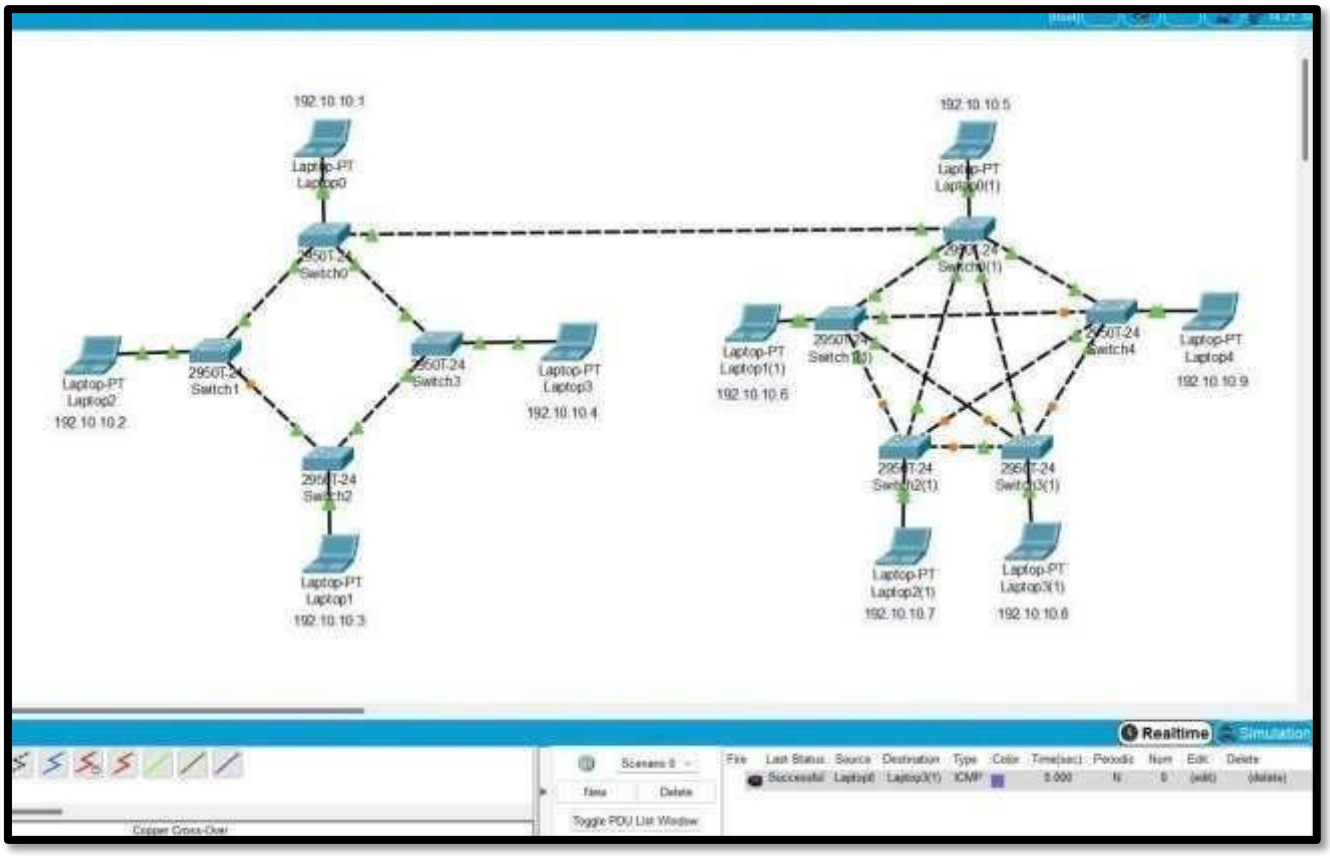
- **Steps :**
  1. Open Cisco Packet Tracer.
  2. Select Laptop & Switch 2950-24.
  3. Put switch in tree structure form.
  4. Select copper straight-through wire to connect every Laptop to equivalence Switches.
  5. Select copper cross-over wire to connect Switches to each other and make a ring structure.
  6. Select message and forward that message that begin from Laptop0 and ends at Laptop5.
  7. Open runtime and see that the task is successful or not.



- **Hybrid Topology :**

- **Tool :**
  Laptop, Copper Straight-through & copper cross-over wires, switch 2950-24.
- **Description :**
  It is combination of two or more topology.

- **Steps :**
  1. Open Cisco Packet Tracer.
  2. Select Laptop & Switch 2950-24.
  3. Take any two or more topology and combine it by putting a switch and make new topology it's called Hybrid topology.
  4. Give IP address to each PC.
  5. Select message and forward that message that begin from Laptop0 and ends at Laptop3(1).
  6. Open runtime and see that the task is successful or not.



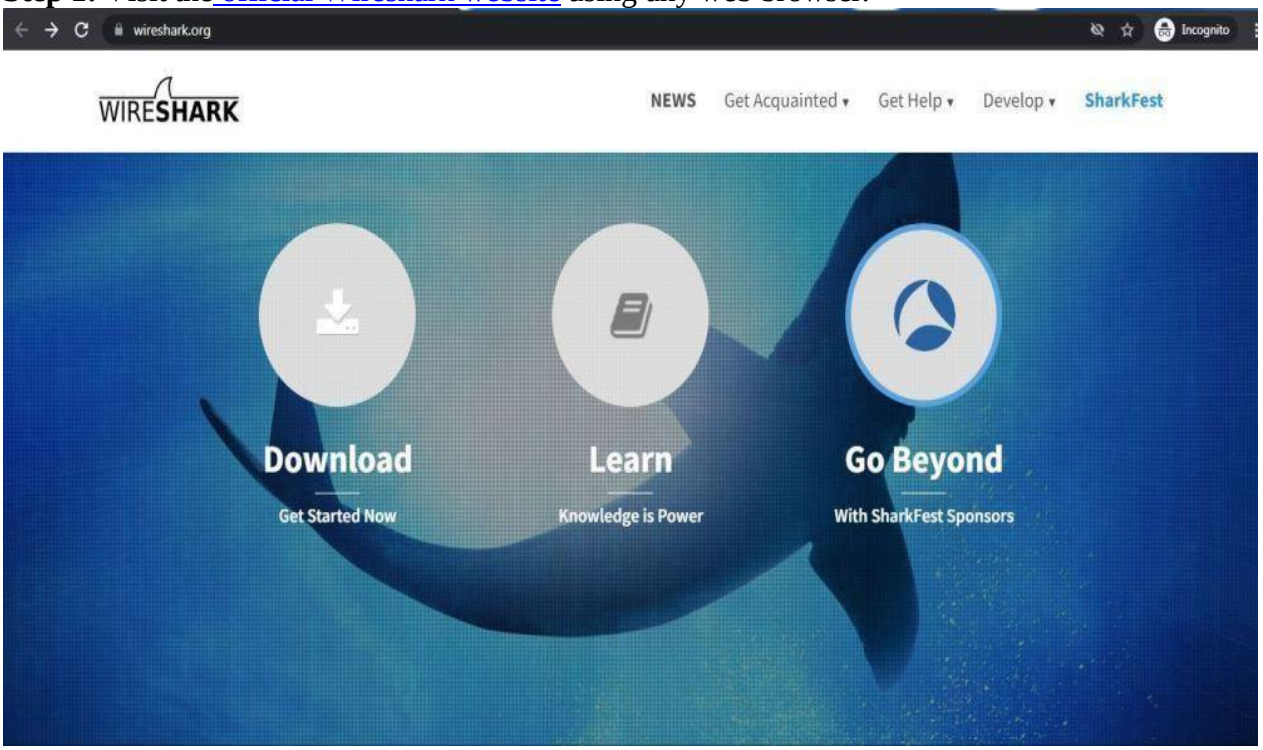
Practical : 2

Aim : To understand the features of WireShark as a packet capture tool and understand encapsulation of information.

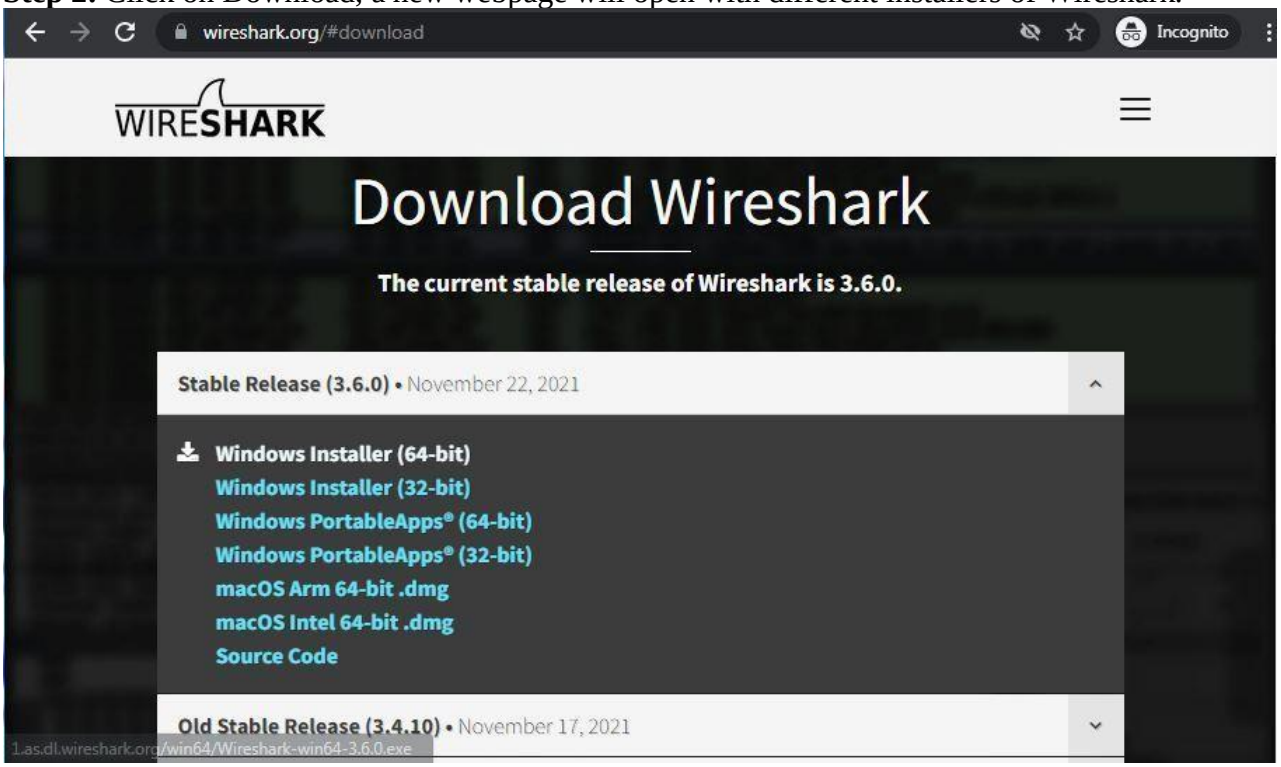
Purpose:
What is Wireshark?
Wireshark is software that is widely used in the analysis of data packets in a network. Wireshark is completely free and open source. Wireshark tool is used to monitor transmission packets being send in Wi-Fi and LAN environments.
This packet analyzer is used for a variety of purposes like troubleshooting networks, understanding communication between two systems, developing new protocols, etc. Wireshark is a cross-platform software, it can be run on Linux, windows, mac, and any other operating system. This software is written in C and C++, and its initial release was in the year 1998. Its latest release is 3.6.0 which got released on 22 November 2021.

Installing Wireshark on Windows:
Follow the below steps to install Wireshark on Windows:

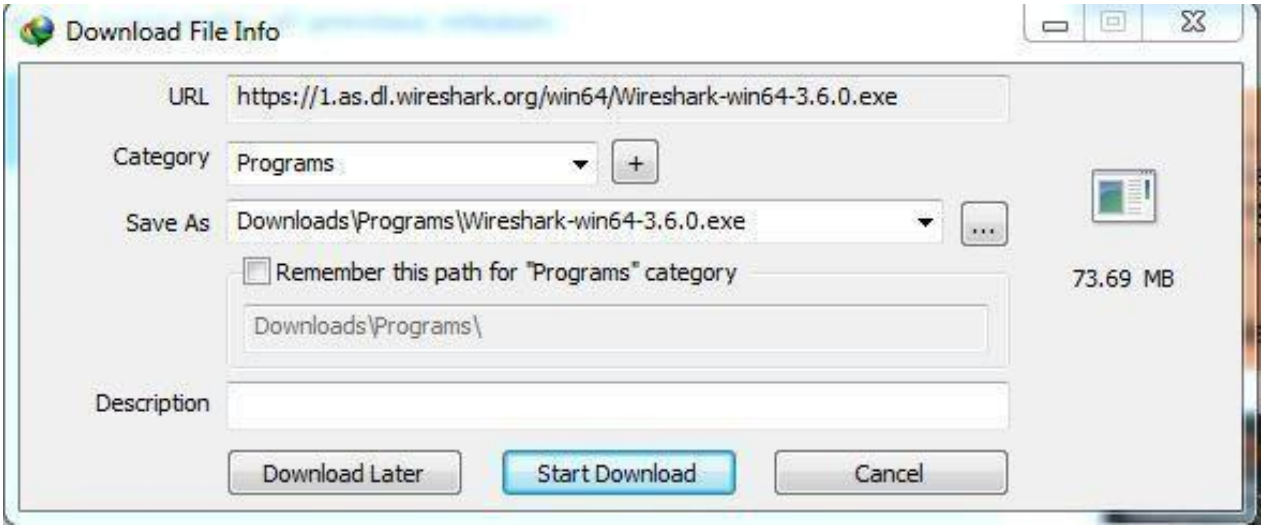
Step 1: Visit the official Wireshark website using any web browser.



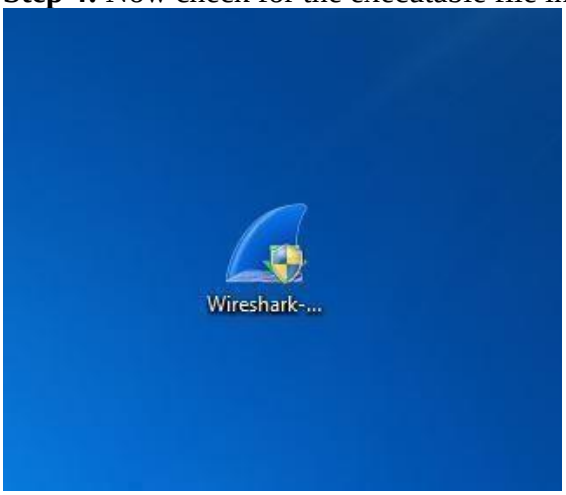
Step 2: Click on Download, a new webpage will open with different installers of Wireshark.



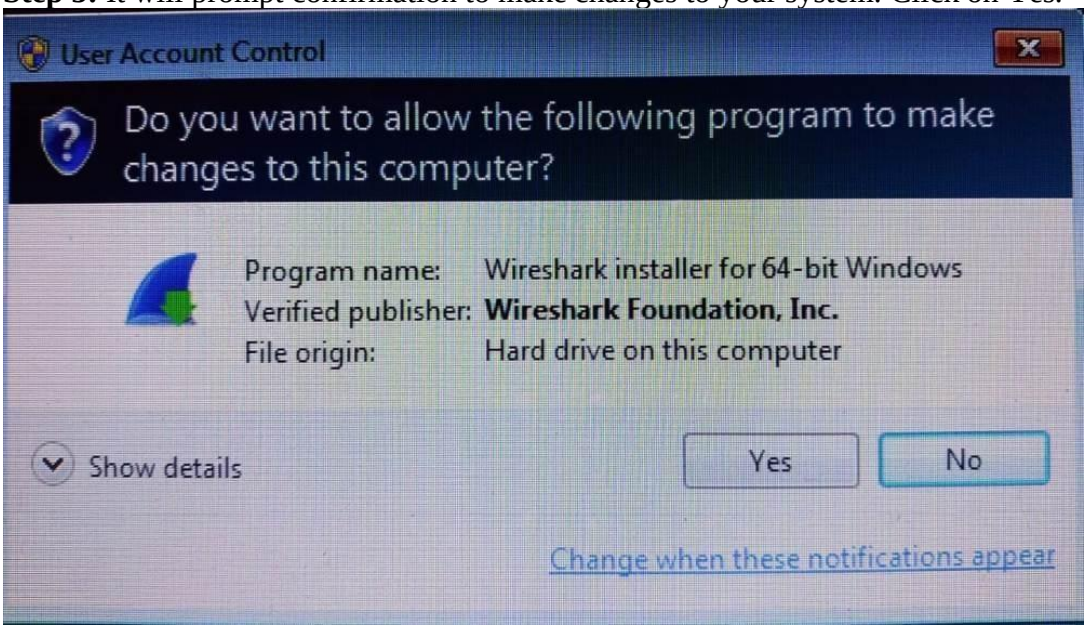
Step 3: Downloading of the executable file will start shortly. It is a small 73.69 MB file that will take some time.



Step 4: Now check for the executable file in downloads in your system and run it.

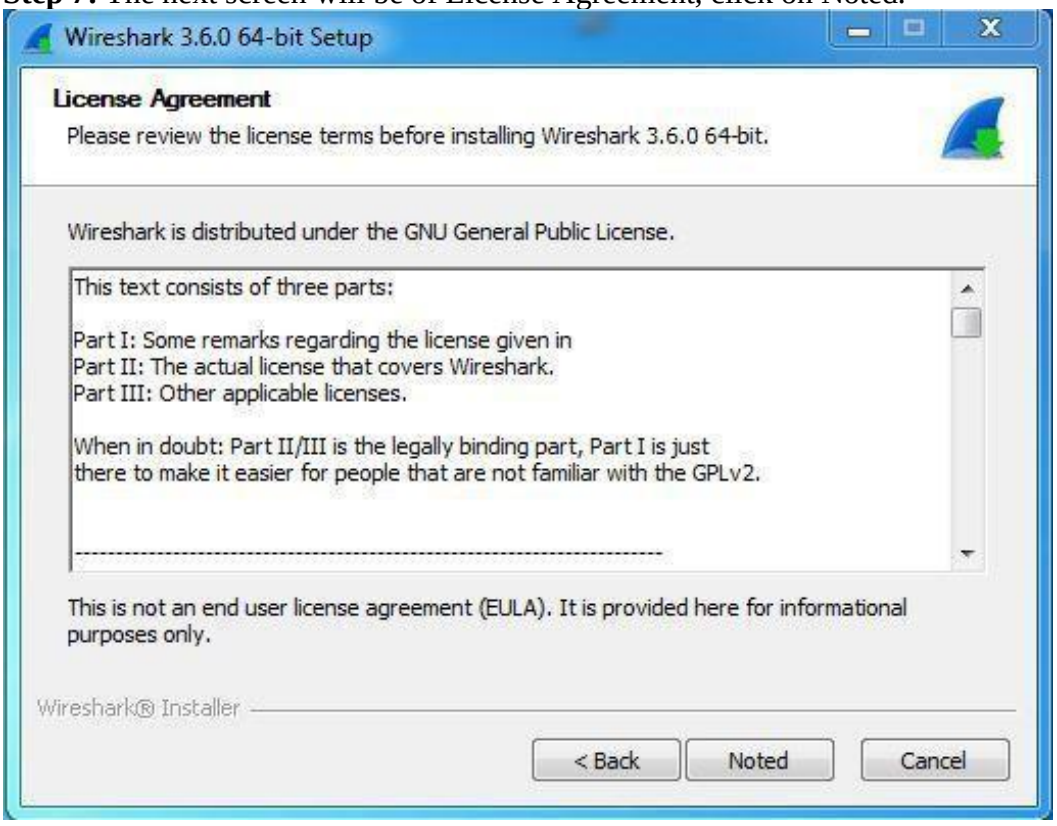


Step 5: It will prompt confirmation to make changes to your system. Click on Yes.

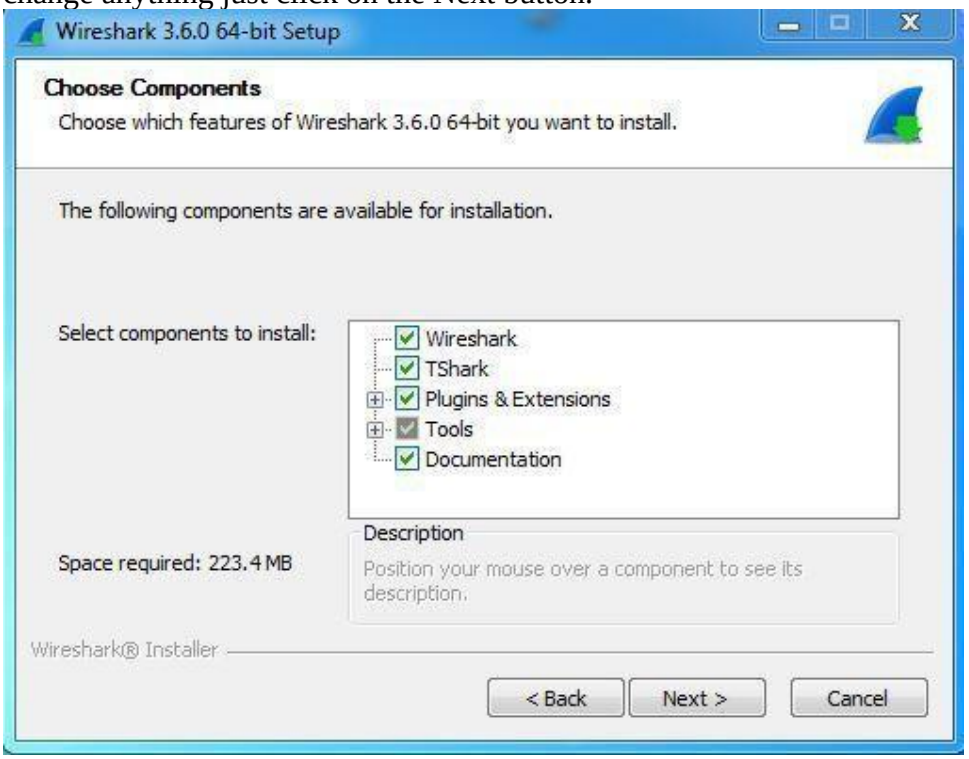


Step 6: Setup screen will appear, click on Next.

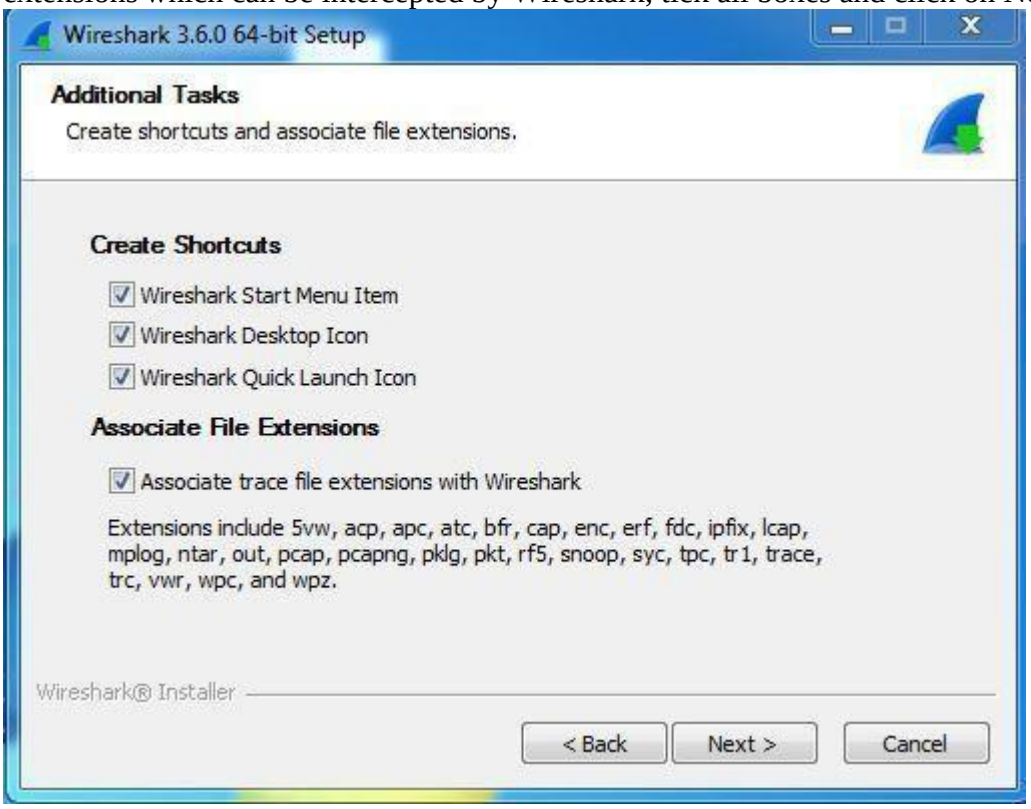
Step 7: The next screen will be of License Agreement, click on Noted.



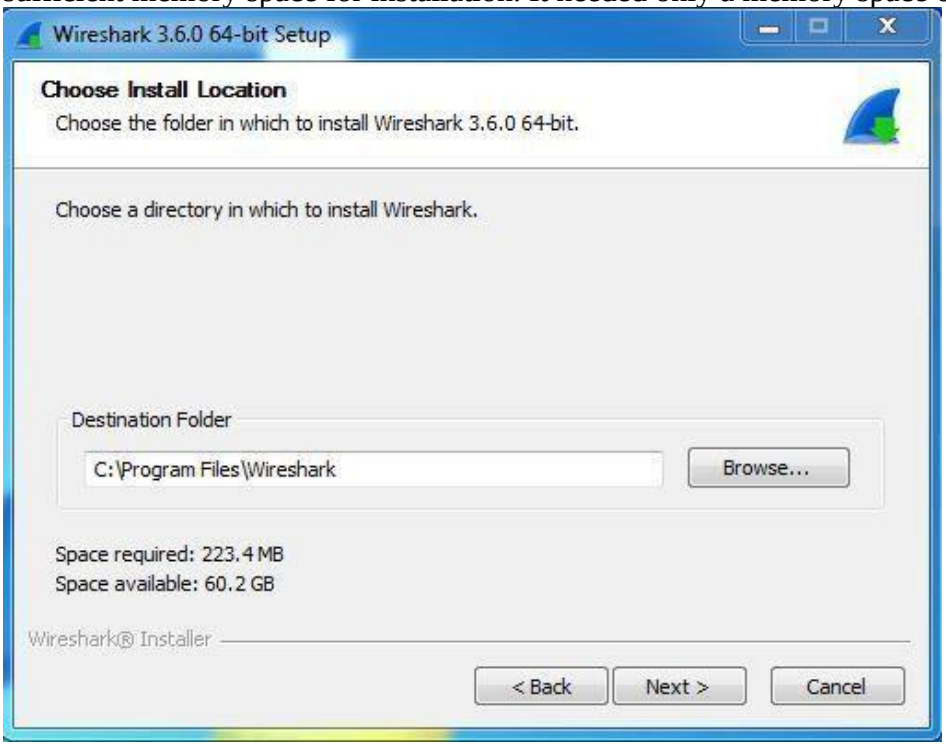
Step 8: This screen is for choosing components, all components are already marked so don't change anything just click on the Next button.



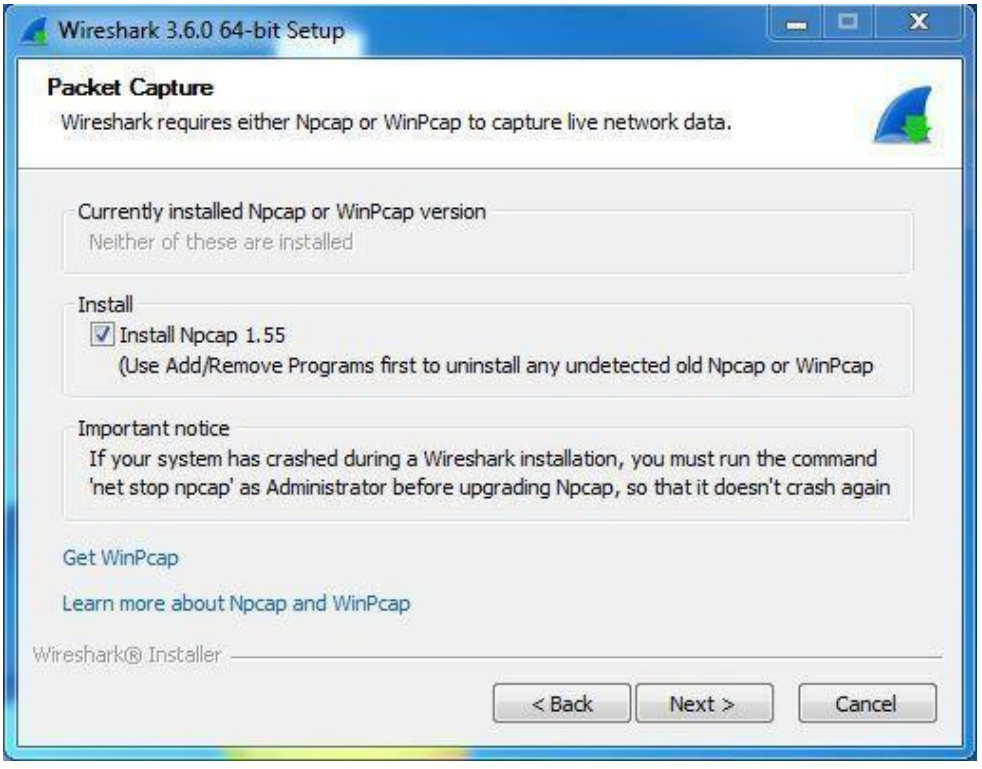
Step 9: This screen is of choosing shortcuts like start menu or desktop icon along with file extensions which can be intercepted by Wireshark, tick all boxes and click on Next button.



Step 10: The next screen will be of installing location so choose the drive which will have sufficient memory space for installation. It needed only a memory space of 223.4 MB.

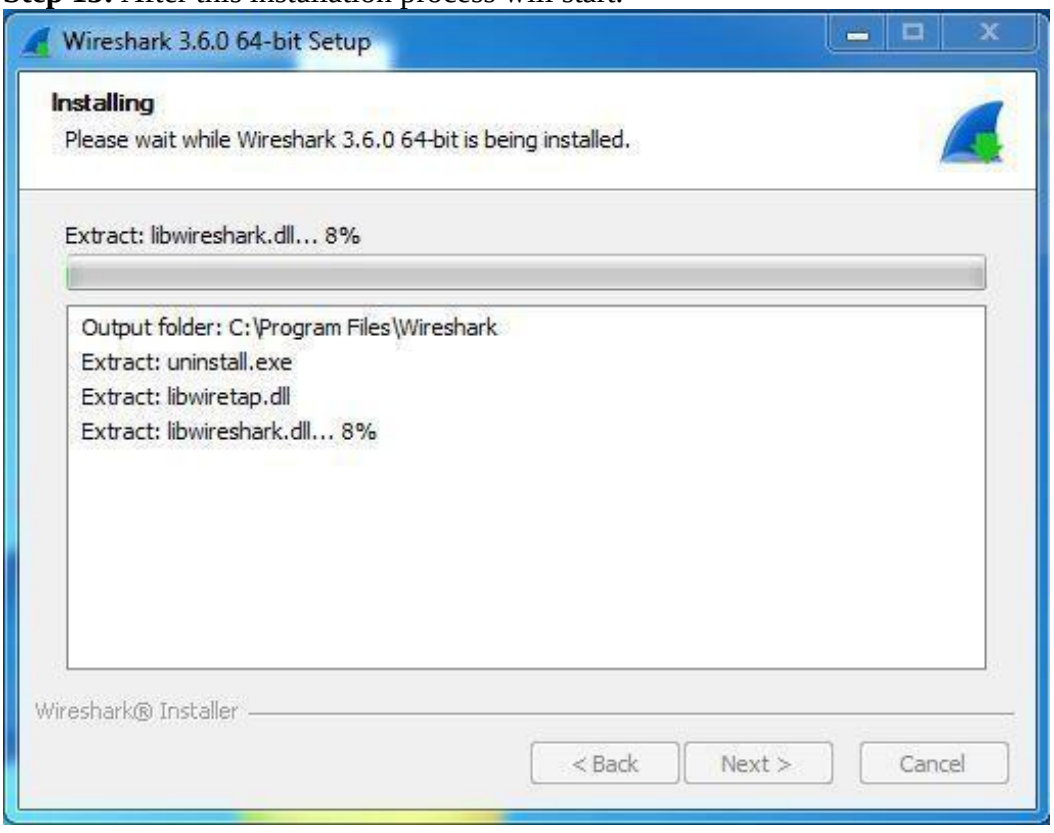


Step 11: Next screen has an option to install Npcap which is used with Wireshark to capture packets *pcap* means packet capture so the install option is already checked don't change anything and click the next button.

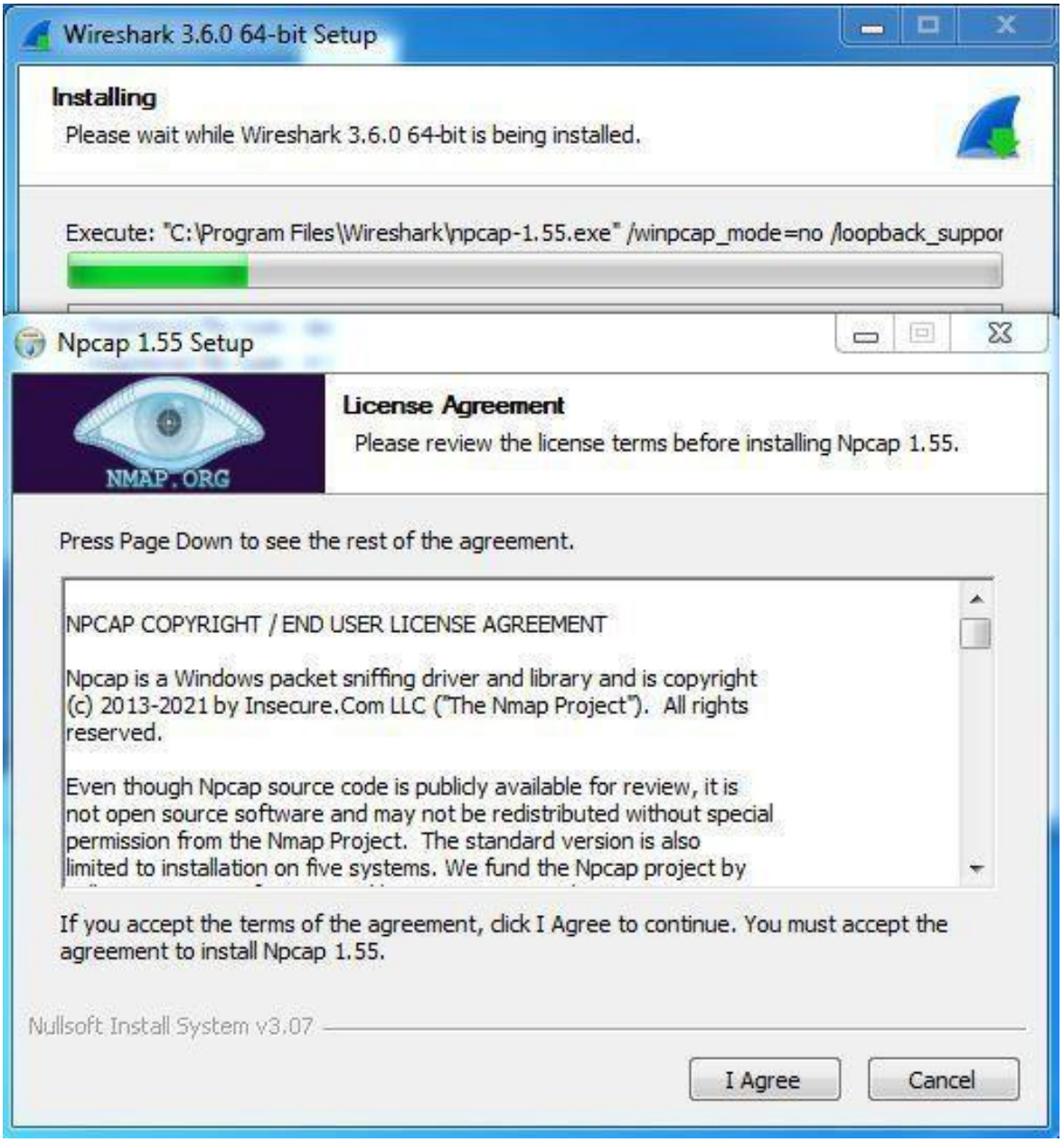


Step 12: Next screen is about USB network capturing so it is one's choice to use it or not, click on Install.

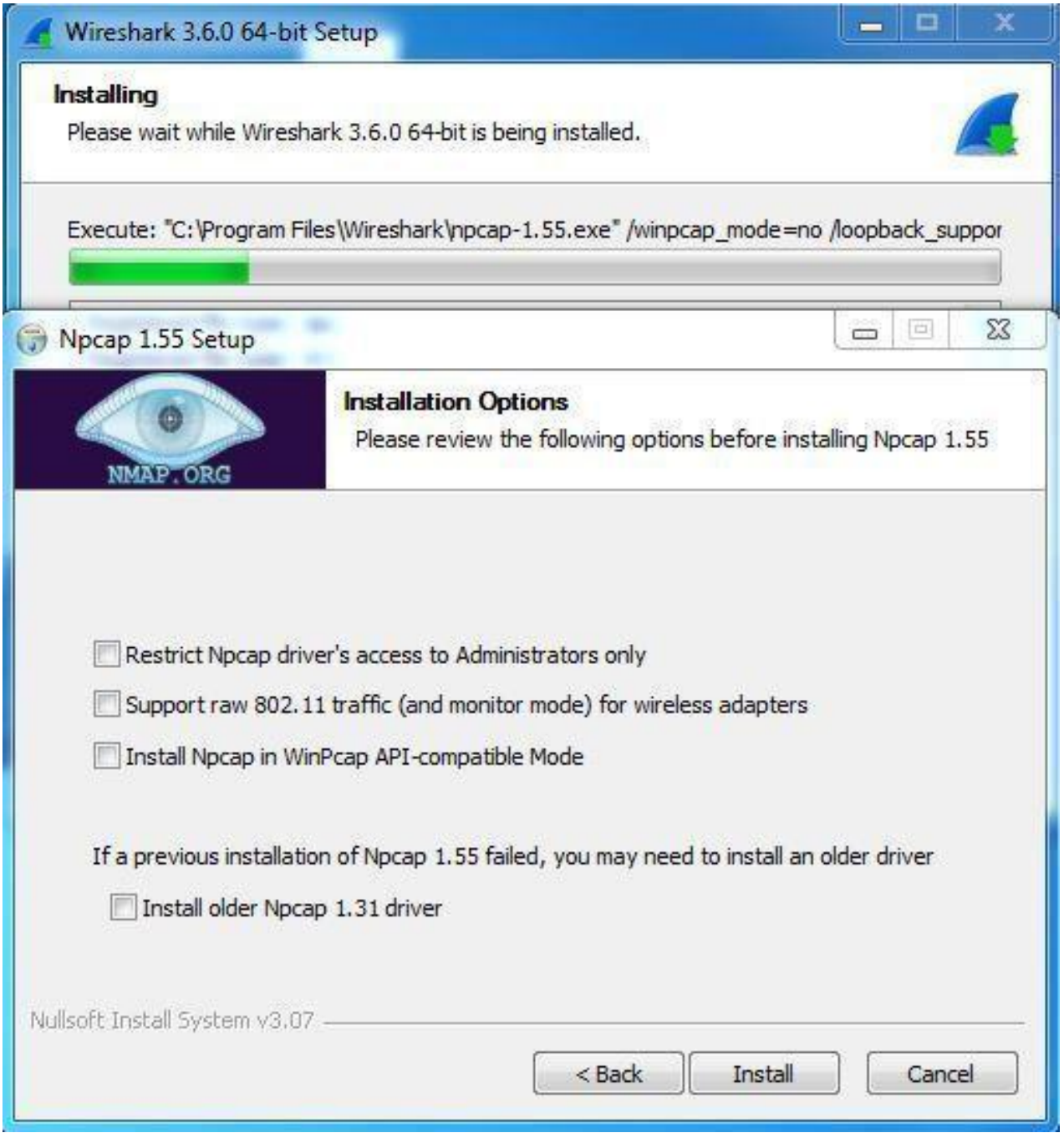
Step 13: After this installation process will start.



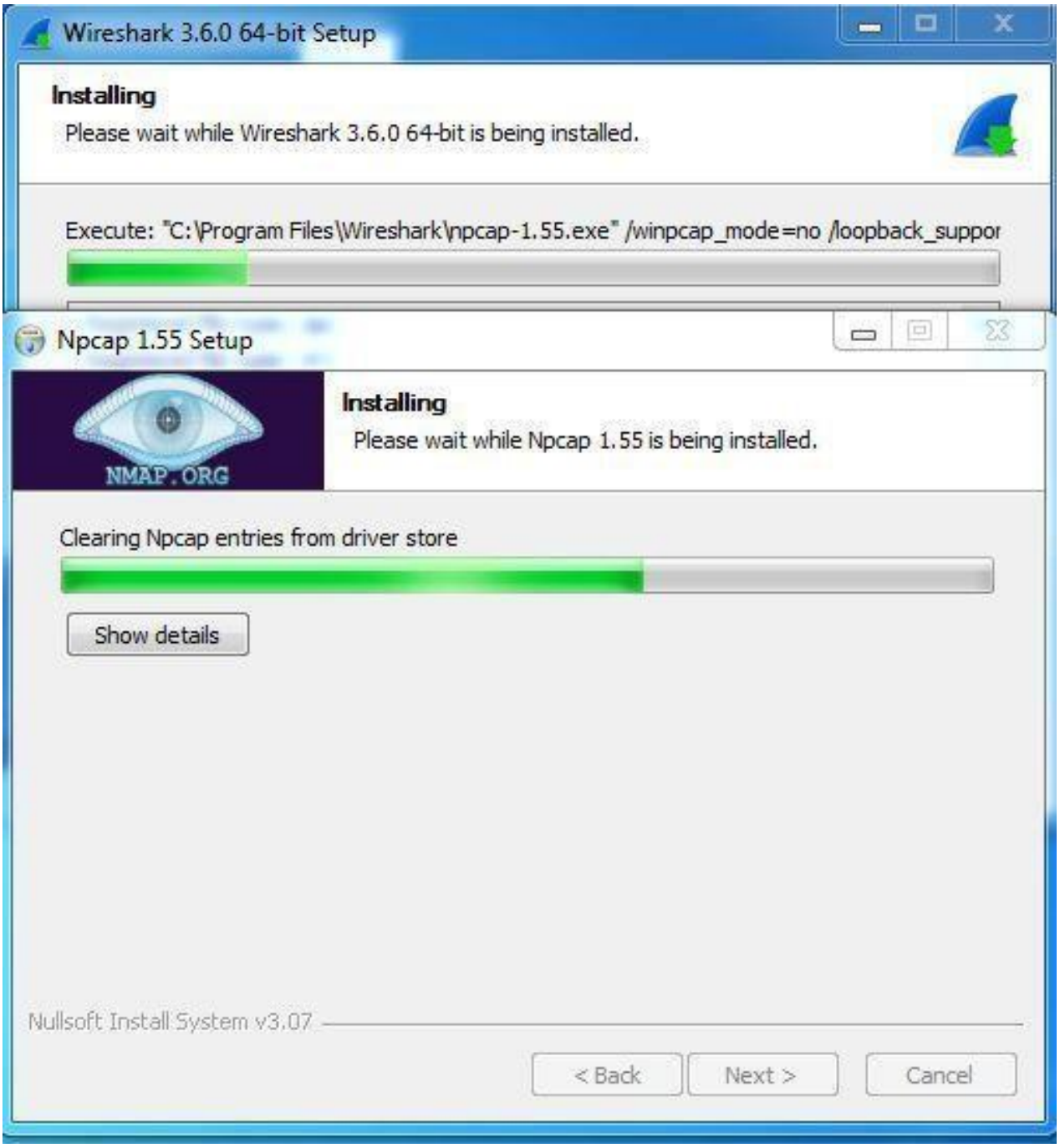
Step 14: This installation will prompt for Npcap installation as already checked so the license agreement of Npcap will appear to click on the *I Agree* button.



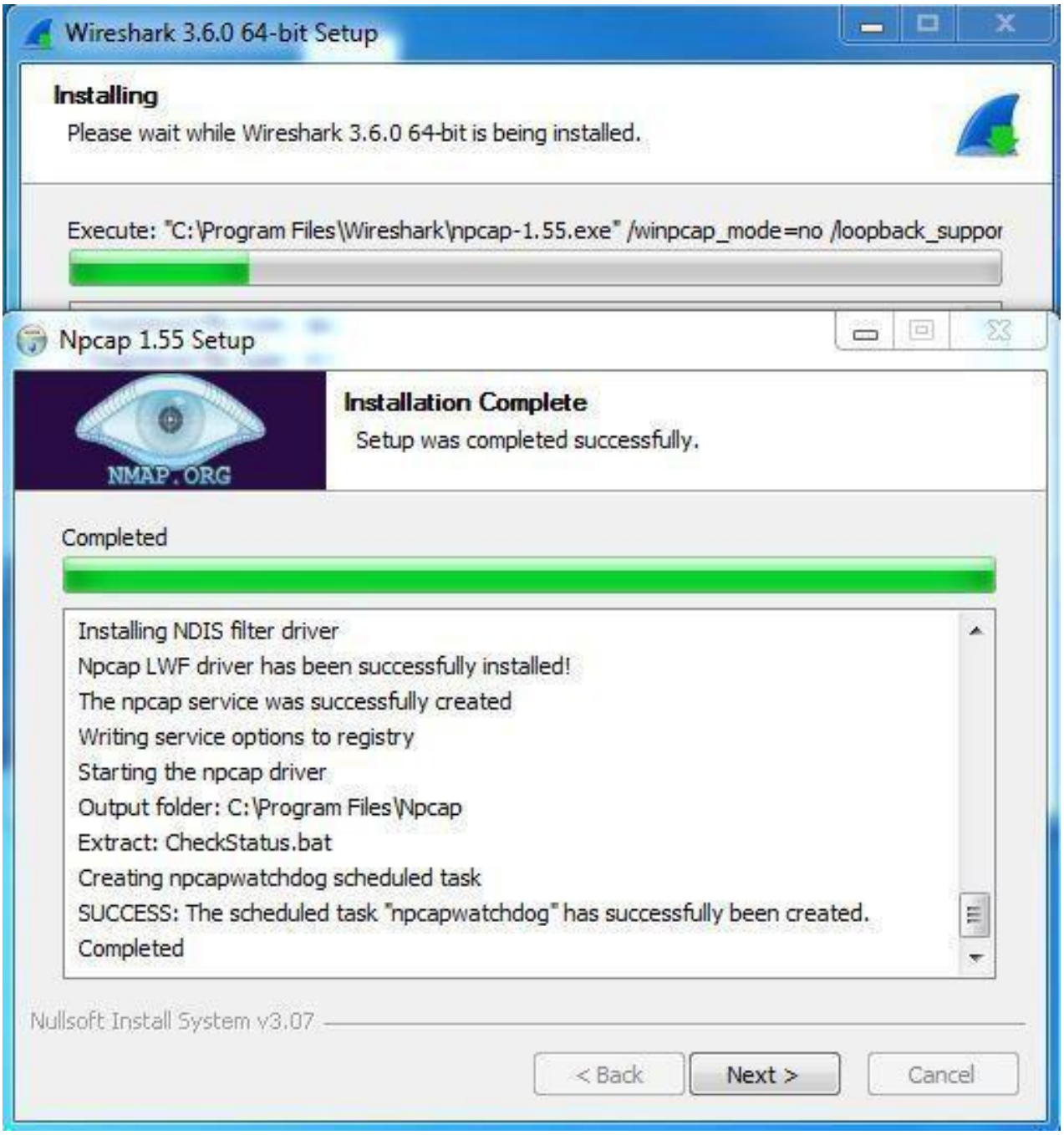
Step 15: Next screen is about different installing options of *npcap*, don't do anything click on Install.



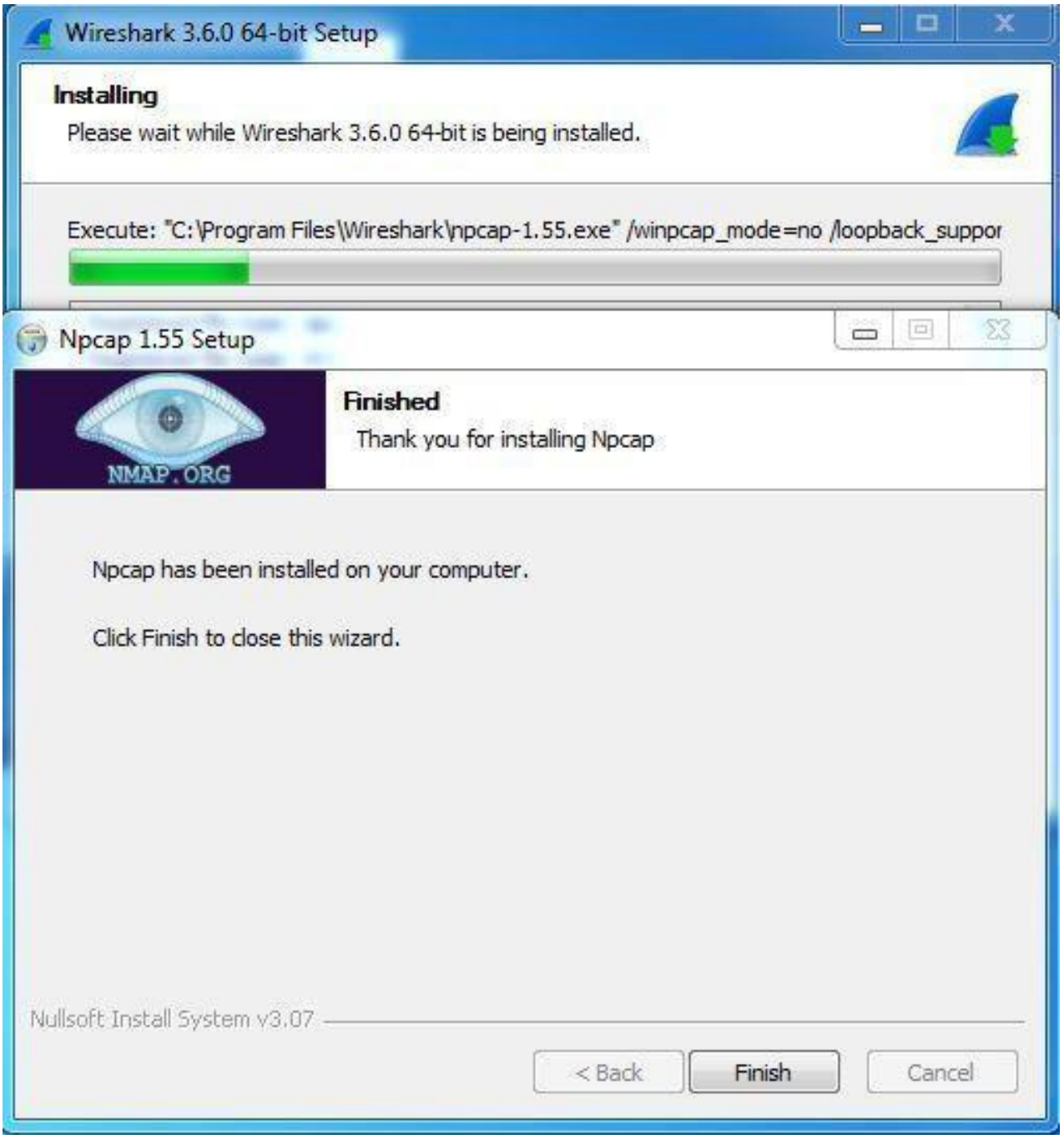
Step 16: After this installation process will start which will take only a minute.



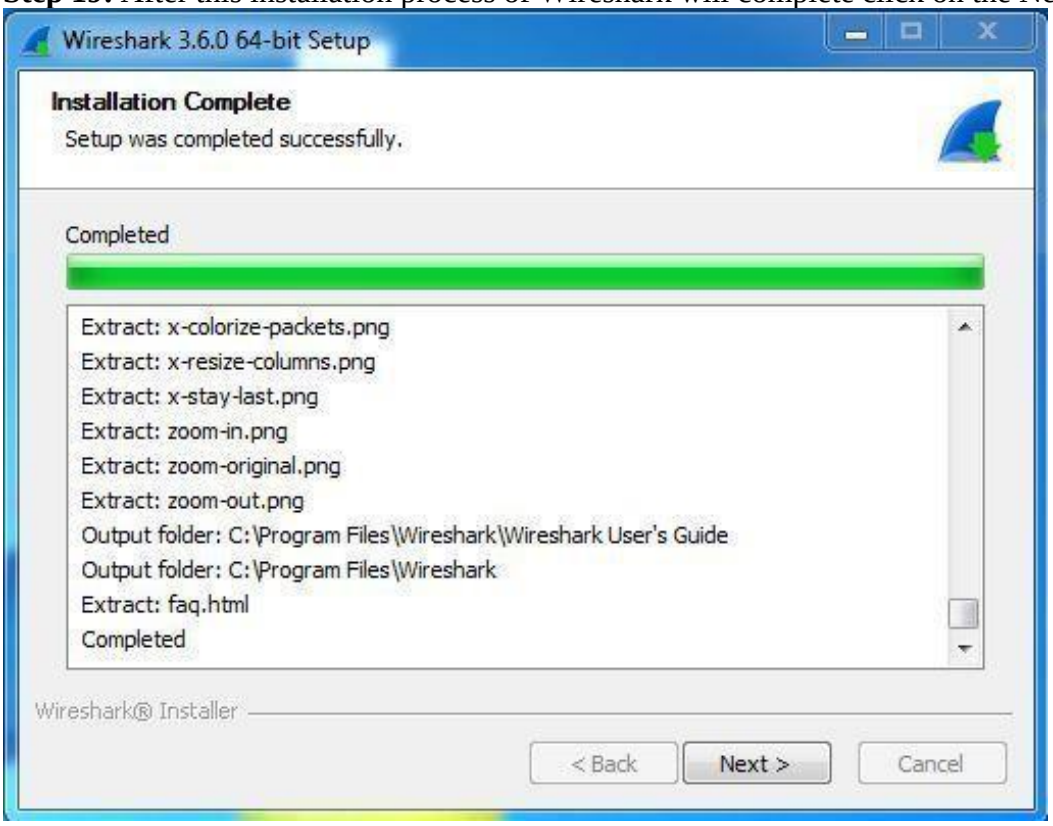
Step 17: After this installation process will complete click on the Next button.



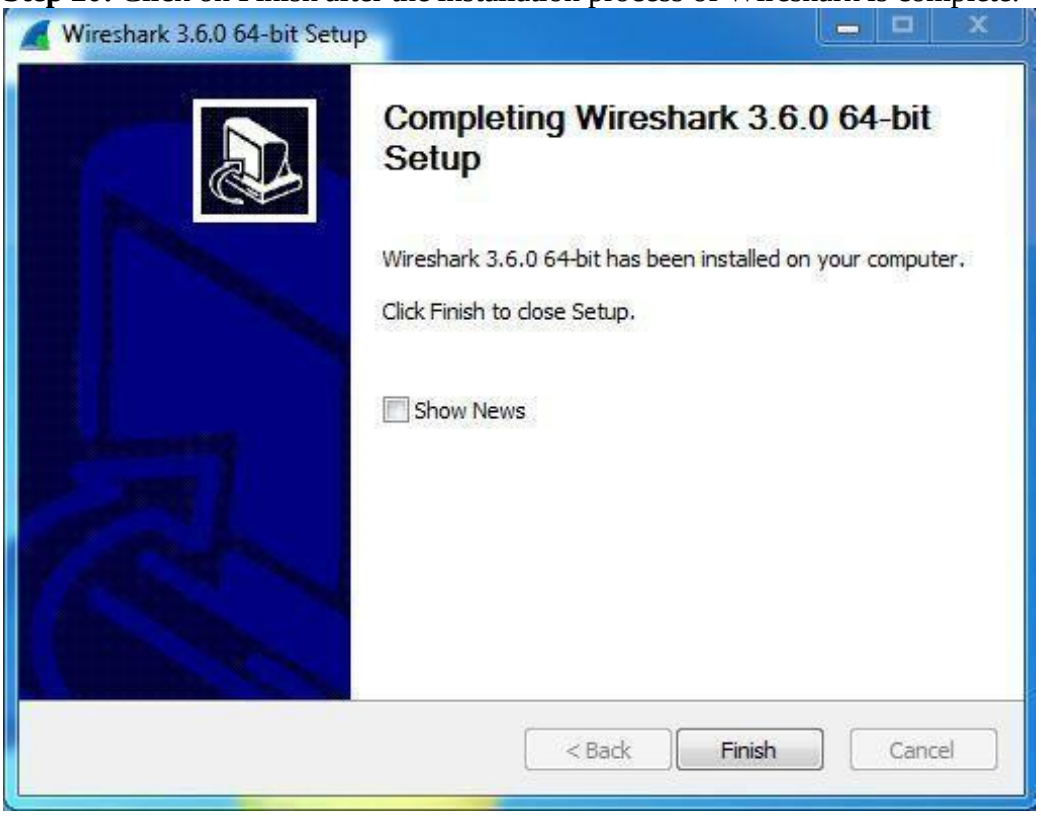
Step 18: Click on Finish after the installation process is complete.



Step 19: After this installation process of Wireshark will complete click on the Next button.

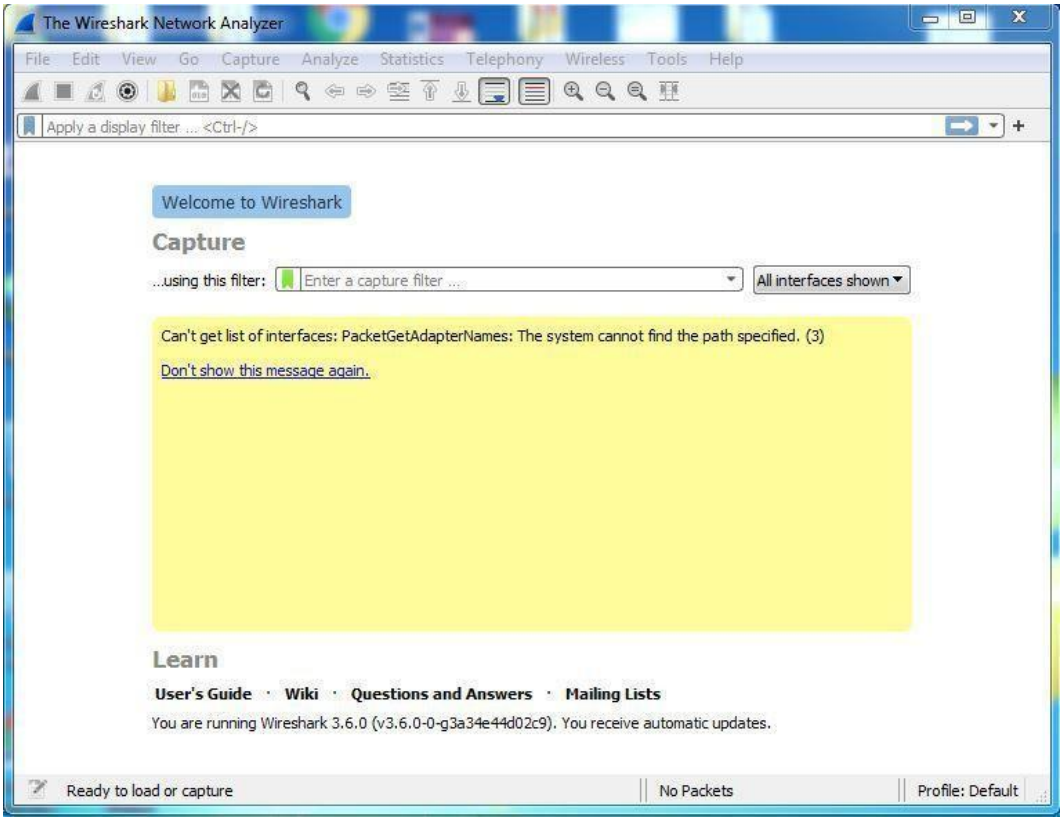


Step 20: Click on Finish after the installation process of Wireshark is complete.



Wireshark is successfully installed on the system and an icon is created on the desktop as shown below:

Now run the software and see the interface.



At this point, you have successfully installed Wireshark on your windows system.

Practical – 3

Aim: To study behavior of generic devices used for networking: (CISCO PACKET TRACER)

Network Devices

1. **Routers**

   a) Router-PT Router

   Router is a network hardware device that allows to make communication in between the internet and all devices which are linked to the internet in your house and office. Router has responsible to receives, analyze, and forward the all data packets from the modem and transfer it to the destination point. After reaching the data packets, the router monitors the destination address; get to make consultation its routing table that take the decision which is the best route for transferring the data packets.

2. **Switches**

   a) Switch-PT Switch

   In a network, a switch is a hardware device that filters and forwards network packets from one networking device (switch, router, computer, server, etc.) to another. It is widely used in local area networks (LANs) to send each incoming message frame by looking at the physical device address, known as the Media Access Control address (MAC address).

b) IS-2000 Switch

Cisco Industrial Ethernet 2000 Series switches are fixed platforms that deliver Layer 2 switching with proven Cisco IOS Software. With their extensive certifications and wide range of power supply voltage input and operation temperatures, these switches are suitable for almost all industrial applications. They support IEEE 1588, Common Industrial Protocol (CIP), and PROFINET v.2, among other industry protocols.

c) Bridge-PT Bridge

Bridge in networking divides a LAN into multiple segments. Bridge basically works in a bus topology. As mentioned in below example, In bus topology the time PC 1 wants to send data to PC 8, it broadcast the data to all the connected devices in a network and like this, it creates lots of traffic. So, from overcoming this problem we are using a networking device bridge. At the end of this post, I have also explained the functions of bridge in networking, its characteristics and how bridge it works.

d) 3560-24PS Multilayer Switch

A multilayer switch is a network device that has the ability to operate at higher layers of the OSI reference model, unlike the Data Link Layer (DLL) traditionally used by switches. A multilayer switch can perform the functions of a switch as well as that of a router at incredibly fast speeds. A switch traditionally inspects

frames, while a multilayer switch inspects deeper into the protocol description unit (at packet or even at segment level).

3. Hubs

a) Hub-PT Hub

Hubs are networking devices operating at a physical layer of the OSI model that are used to connect multiple devices in a network. They are generally used to connect computers in a LAN.
A hub has many ports in it. A computer which intends to be connected to the network is plugged in to one of these ports. When a data frame arrives at a port, it is broadcast to every other port, without considering whether it is destined for a particular destination device or not.

b) Repeater-PT Hub

A repeater operates at the physical layer. Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted to extend the length to which the signal can be transmitted over the same network. An important point to be noted about repeaters is that they do not amplify the signal. When the signal becomes weak, they copy it bit by bit and regenerate it at its star topology connectors connecting if original strength. It is a 2-port device.

c) CoAxialSplitter-PT Coaxial Splitter

Coax splitters are used in video transmissions systems to take a single video feed and branch it off to multiple places. Coaxial cable splitters typically come in 2, 3, 4 and 6 way configurations. Ideally, a coaxial cable splitter maintains the proper impedance environment on both the input and output ports. For video coax systems, this impedance is typically 75 ohms. As the name implies, a coax signal splitter takes the power on the input port and splits it equally among the output ports.

4. Wireless Devices

a) LAP-Pt Light Weight Access Point

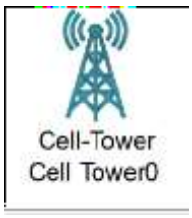
In this Cisco Unified Wireless Network architecture, access points are "lightweight," meaning that they cannot act independently of a controller. The wireless LAN controller manages the access point configurations and firmware. The access points are zero-touch and no individual configuration of access points is required.

b) HomeRouter-PT-AC Wireless Router

Wireless routers are commonly found in homes -- they're the hardware devices that Internet service providers use to connect you to their cable or xDSL Internet network. A wireless router, also called a Wi-Fi router, combines the networking functions of a wireless access point and a router.
A router connects local networks to other local networks or to the Internet.

c) Cell-Tower Cell Tower

Cell towers, also known as cell sites, are where electric communications equipment and antennae are mounted, allowing the surrounding area to use wireless communication devices like telephones and radios.
Cell towers are usually built by a tower company or a wireless carrier when they expand their network coverage or capacity, providing a better reception signal in that area.



5. Security

a) 5506-X ASA

Stop more threats with the threat-focused 5500-X NGFW
Beat sophisticated cyber-attacks with a superior security appliance. We offer the industry's first threat-focused next-generation firewall (NGFW), the ASA 5500-X Series.

End Devices

1) End Devices

a. PC-PT PC

Clients are computer devices which access and uses the network as well as shares network resources. They are also users of the network, as they can send and receive requests from the server. Computers are becoming increasingly important in practically every profession, making our daily work more doable. Previously, computers were solely employed to execute difficult numerical computations, but they have progressed too far and now serve a variety of functions.

b. Laptop-PT Laptop

A laptop computer is a portable computer, which is small in size and light in weight, which you can carry very easily from one place to another.
The advantage of using a laptop computer is that you can work from anywhere, any time. There are various types of laptop computer.

c. Server-PT Server

The server is the software that handles a specific task. However, the powerful hardware that supports this software is also called a server. This is because the server software that coordinates a network of hundreds or thousands of clients requires hardware that's more robust than computers for consumer use.

d. TV-PT TV

Television (TV), the electronic delivery of moving images and sound from a source to a receiver. By extending the senses of vision and hearing beyond the limits of physical distance, television has had a considerable influence on society. Conceived in the early 20th century as a possible medium for education and interpersonal communication, it became by mid-century a vibrant broadcast medium, using the model of broadcast radio to bring news and entertainment to people all over the world.

e. SMARTPHONE-PT Smartphone

A smartphone is a handheld electronic device that provides a connection to a cellular network and the internet. The world's first smartphone was created by IBM in 1994, nicknamed Simon.
The introduction of smartphones dramatically altered the telecommunications sector. Smartphones were considered the death knell of the prototypical cell phone. The popularity of smartphones has also created business opportunities outside of the development of operating systems and the construction of device hardware.

f. TabletPC-PT Tablet

A tablet, tablet computer, or tablet PC is a mobile computing device designed to be held in one or two hands. It is approximately the size of a hardcover book (seven inches or bigger), and resembles a large smartphone.
Tablets let you do many of the same things as a traditional computer. They can browse the Internet, connect to social network apps, and display HD videos. They excel at applications that do not require a large amount of precise user input.

g. Analog-Phone-PT

The original telephone technology, which converts air vibrations into an analogous electrical frequency. Unless a key telephone system, digital PBX or voice over IP (VoIP) is used, most homes and small offices still use analog phones, and the local loop is mostly analog. Likewise, the first cellular phone systems were analog and are still widely used as a backup system. All new cellular systems that are deployed are digital. See local loop, AMPS, TDMA, CDMA and cellular generations.

2) Home

a. Air Conditioner IoT

An air conditioner is a system that is used to cool down a space by removing heat from the space and moving it to some outside area. The cool air can then be moved throughout a building through ventilation. Air conditioners require some input of work to operatre, otherwise entropy would decrease naturally which is forbidden by the Second law of thermodynamics.

b. Bluetooth Speaker IoT

Bluetooth speakers are the application of Bluetooth technology to traditional digital and multimedia speakers, allowing users to avoid annoying wires and listen to music in various ways. Since the advent of Bluetooth speakers, with the development of smart terminals, they have attracted widespread attention from users such as mobile phones and tablets; Bluetooth

c. Light IoT

An electric light, lamp, or light bulb is an electrical component that produces light. It is the most common form of artificial lighting. Lamps usually have a base made of ceramic, metal, glass, or plastic, which secures the lamp in the socket of a light fixture, which is often called a "lamp" as well. The electrical connection to the socket may be made with a screw-thread base, two metal pins, two metal caps or a bayonet cap.

d. Portable Music Player IoT

A portable media player (PMP) (also including the related digital audio player (DAP)) is a portable consumer electronics device capable of storing and playing digital media such as audio, images, and video files. The data is typically stored on a compact disc (CD), Digital Video Disc (DVD), Blu-ray Disc (BD), flash memory, microdrive, or hard drive; most earlier PMPs used physical media, but modern players mostly use flash memory. In contrast, analogue portable audio players play music from non-digital media that use analogue media, such as cassette tapes or vinyl records.

Connections

A. Copper Straight-Through

A straight through cable is a type of twisted pair cable that is used in local area networks to connect a computer to a network hub such as a router. This type of cable is also sometimes called a patch cable and is an alternative to wireless connections where one or more computers access a router through a wireless signal. On a straight through cable, the wired pins match. Straight through cable use one wiring standard: both ends use T568A wiring standard or both ends use T568B wiring standard.

B. Copper Cross-Over

A crossover Ethernet cable is a type of Ethernet cable used to connect computing devices together directly. Unlike straight through cable, the RJ45 crossover cable uses two different wiring standards: one end uses the T568A wiring standard, and the other end uses the T568B wiring standard. The internal wiring of Ethernet crossover cables reverses the transmit and receive signals. It is most often used to connect two devices of the same type: e.g., two computers

Practical-4

Aim : Data Link Layer (Error Detection) using checksum.

Check Sum :

Checksum is used for error detection.
On the sender's side, this method uses a checksum generator to generate a Checksum. On receiving end, a checksum checker is used to validate whether the correct data is received.

Code:

```
#include<stdio.h>
#include<math.h>

int sender(int arr[10],int n)
{
   int checksum,sum=0,i;
   printf("\n****SENDER SIDE****\n");
   for(i=0;i<n;i++)
   sum+=arr[i];
   printf("SUM IS: %d",sum);
   checksum=~sum;     //1's complement of sum
   printf("\nCHECKSUM IS:%d",checksum);
   return checksum;
}
void receiver(int arr[10],int n,int sch)
{
   int checksum,sum=0,i;
```

```
    printf("\n\n****RECEIVER SIDE****\n");
    for(i=0;i<n;i++)
        sum+=arr[i];
    printf("SUM IS:%d",sum);
    sum=sum+sch;
    checksum=~sum;     //1's complement of sum
    printf("\nCHECKSUM IS:%d",checksum);
}
void main()
{
    int n,sch,rch;
    printf("\nENTER SIZE OF THE STRING:");
    scanf("%d",&n);
    int arr[n];
    printf("ENTER THE ELEMENTS OF THE ARRAY TO CALCULATE
CHECKSUM:\n");
    for(int i=0;i<n;i++)
    {
        scanf("%d",&arr[i]);
    }
    sch=sender(arr,n);
    receiver(arr,n,sch);
}
```

Output :

```
Enter String a
101011
Enter String b
101011

Sum=1010110
Checksum=0101001
PS C:\Users\hp\OneDrive\Documents\College Work\college Notes\CN\CN Checksum>
```

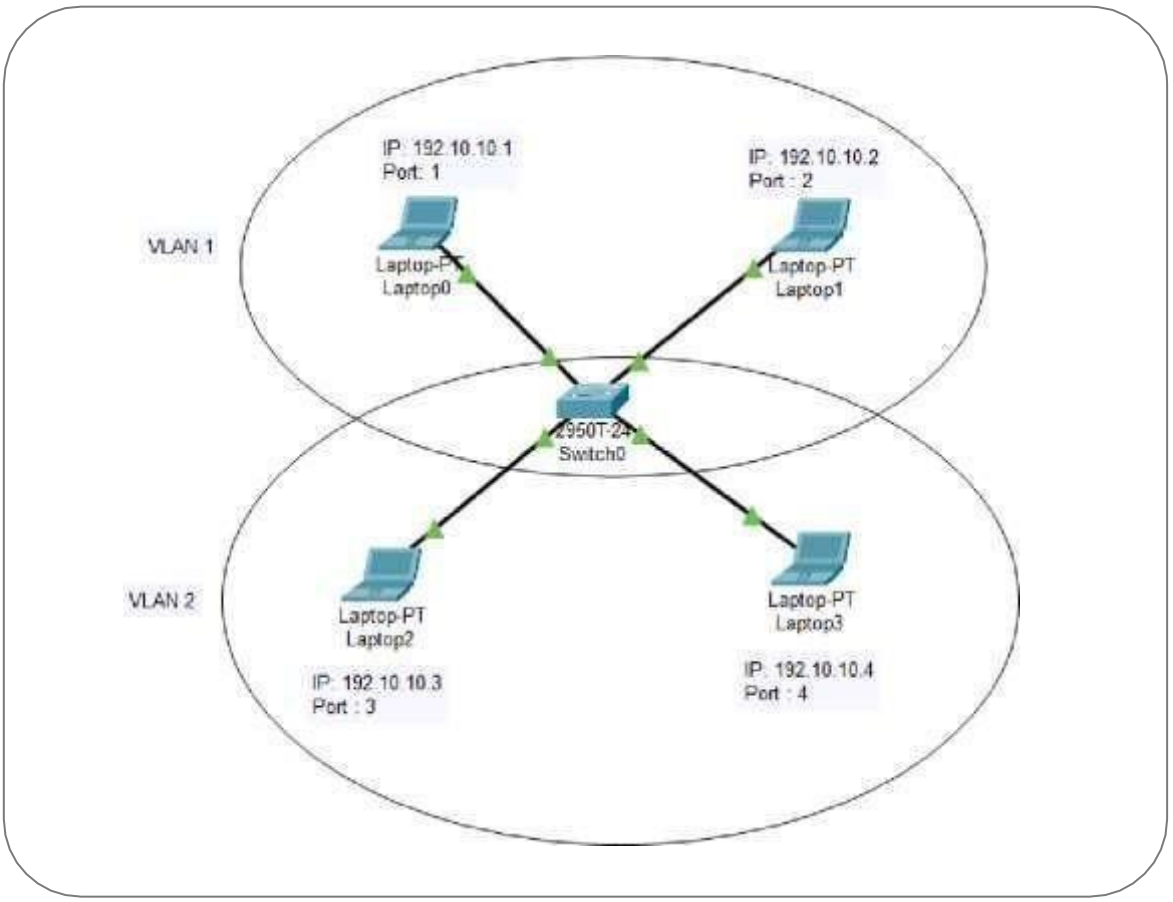
Practical-5

AIM: Create virtual LAN network and pass the packet in cisco packet tracker Application.

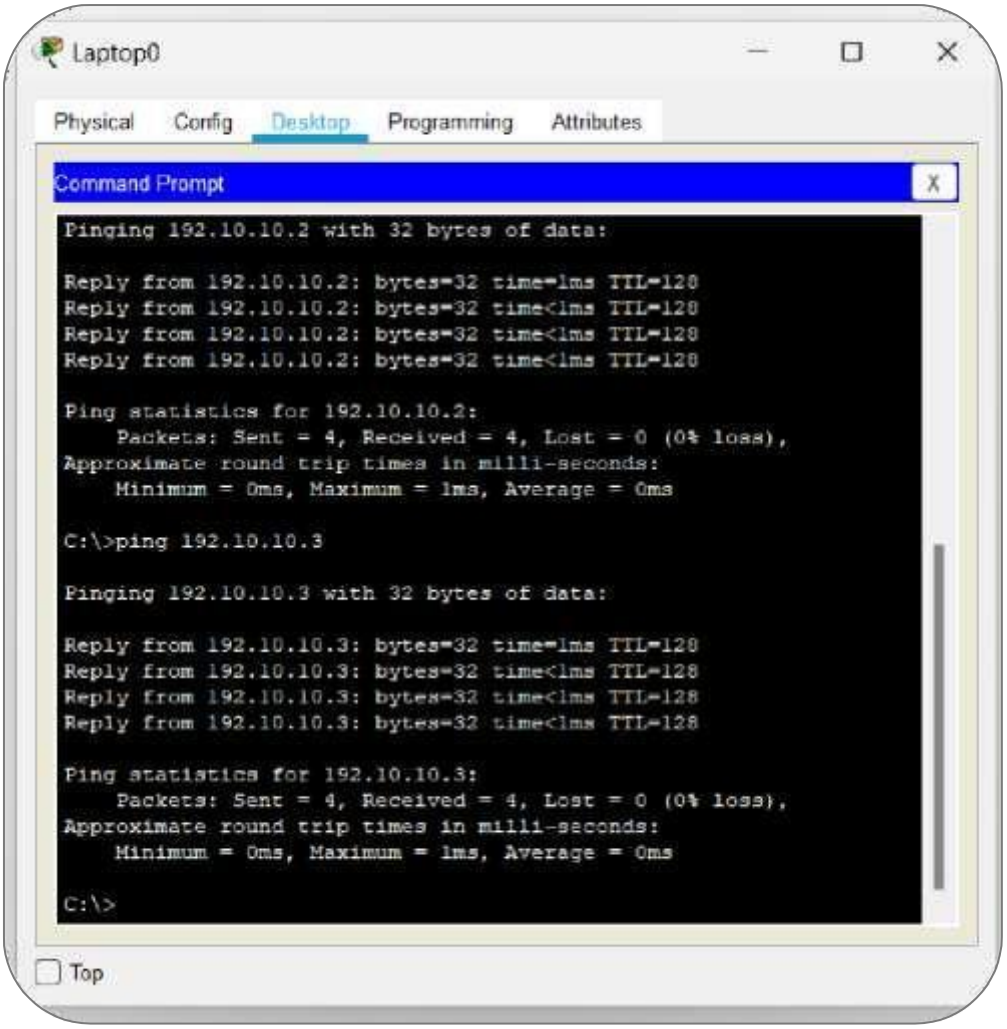
In this practical, we learn about how to create virtual LAN? and how to communicate device when they connect with VLAN.

Steps :

1. Open cisco packet tracker software.
2. Connect Laptop(1 to 4) with 2950T-24 switch using straight through cable.
3. Give IP address to all pc.



4. After that click on any pc and select desktop and click on command prompt.
5. Then write a command in CMD, “ping <IP_ADDRESS>”
   This process shows that all four devices are connected with each other.



6. Then exit from CMD and BACK to the cisco home page.
7. Click on the switch and select on CLI.
8. Now we make two VLAN:
    1. VLAN 1
    2. VLAN 2

   Using CLI.

9. In CLI:

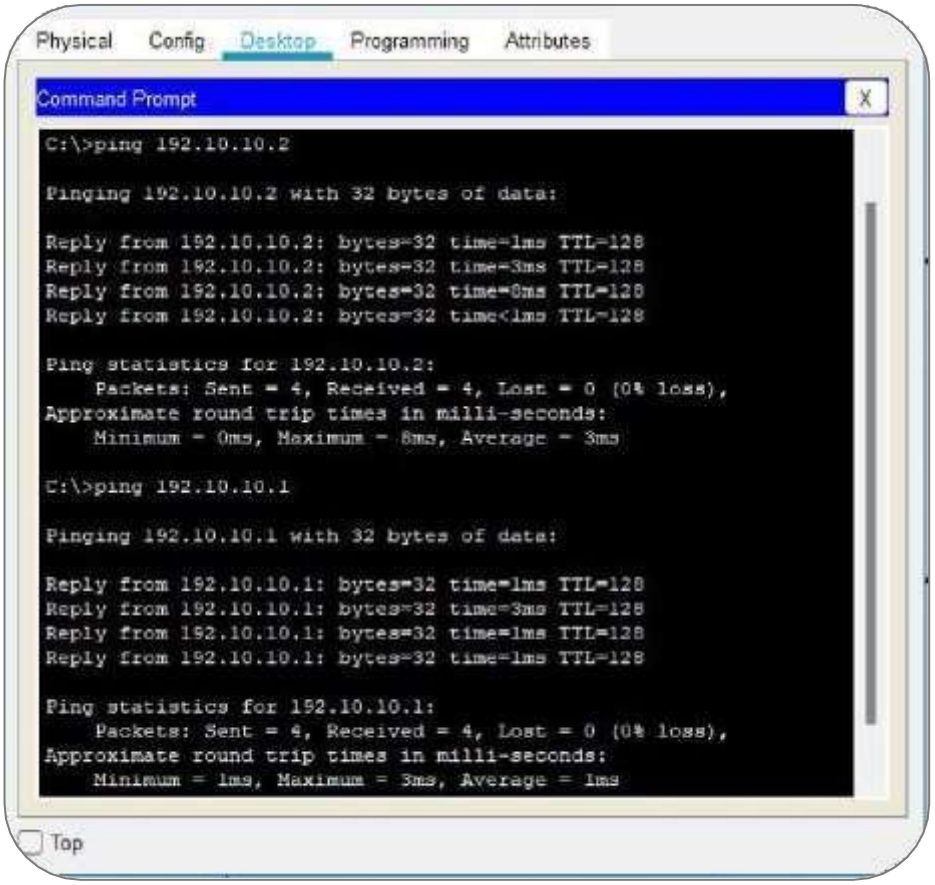
- Enable
- Conf t
- VLAN 1 <FIRST NAME>
- name1
- VLAN 2 <SECOND NAME>
- name 2

- interface fa 0/1
- switchport access VLAN 1
- interface fa 0/2
- switchport access VLAN 1
- interface fa 0/3
- switchport access VLAN 2
- interface fa 0/4
- switchport access VLAN 2

10. then exit from CLI and again repeat the process open command prompt and enter:

- Ping 192.4.5.1 <PC 1 IP ADDRESS>
- Ping 192.4.5.2 <PC 2 IP ADDRESS>
- Ping 192.4.5.3 <PC 3 IP ADDRESS>
- Ping 192.4.5.4 <PC 4 IP ADDRESS>

*In this process we get the error with PC 3 and PC 4 because, they are not connected with VLAN 1.



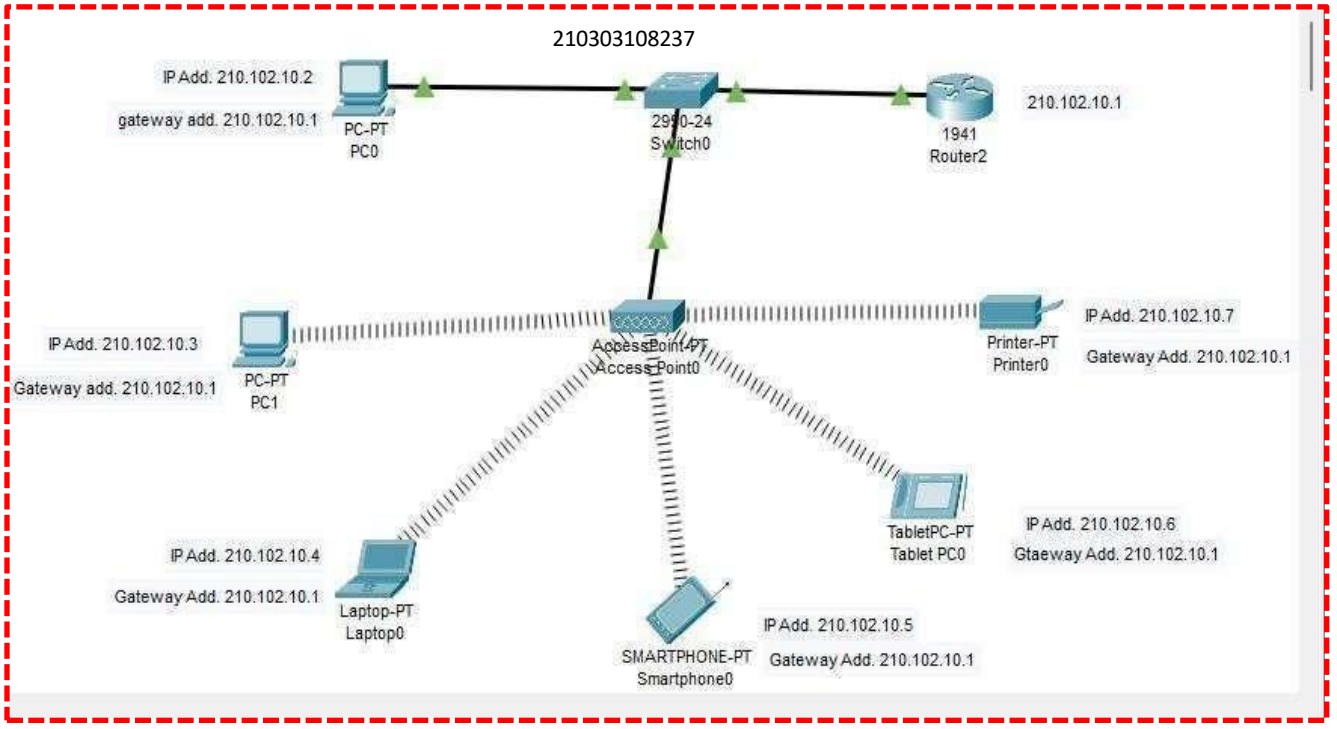
Observation:

We understand about that when we are not creating the VLAN that time device sends the message to all device are receiving the message but when we apply VLAN then only that device are only receive the message which is connected with same VLAN

Practical:-6

Aim: Wireless LAN

A wireless LAN (WLAN) is a wireless computer network that links two or more devices using wireless communication to form a local area network (LAN) within a limited area such as a home, school, computer laboratory, campus, or office building.

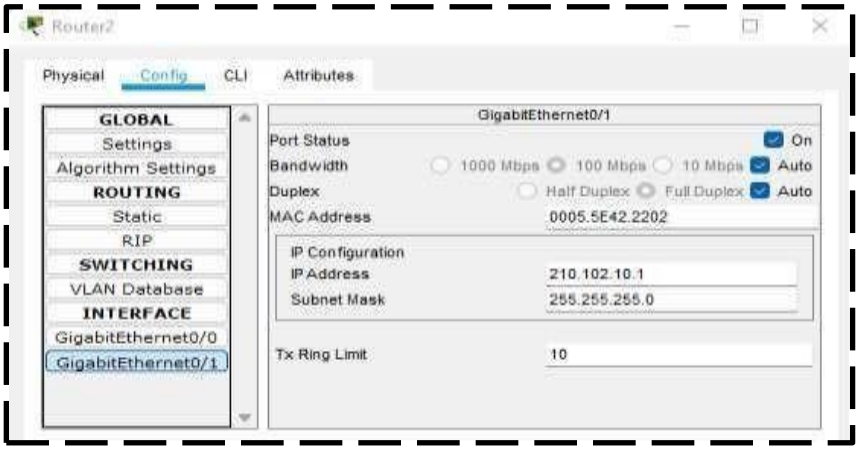


STEP-1: Take devices like [pc,laptop, printer, switch, router,tablet,smartphone].

STEP-2: Connect PCO with switch (FastEthernet fa0 - FastEthernet fao/1).

STEP-3: Switch with router (FastEthernet fao/2 - GigabitEthernet 0/1) and switch withAccess point (FastEthernet fa0/3 - port 0).

STEP-4: Open router, go to config and select GigabitEthernet 0/1. In that click on "ON"checkbox button. And give the IP address of the router.



STEP-5: Now select one by one all the devices and give their IP address and set default gateway is the same as router IP address.

STEP-6: Now select one by one all the devices and remove the Ethernetport and set WPN300N At the Ethernet place. See the following image and do the same for all devices.

STEP-7: Open Access point, selectport 1 "ON" the port status and giveSSID name, select WPA2-PSK and create password.

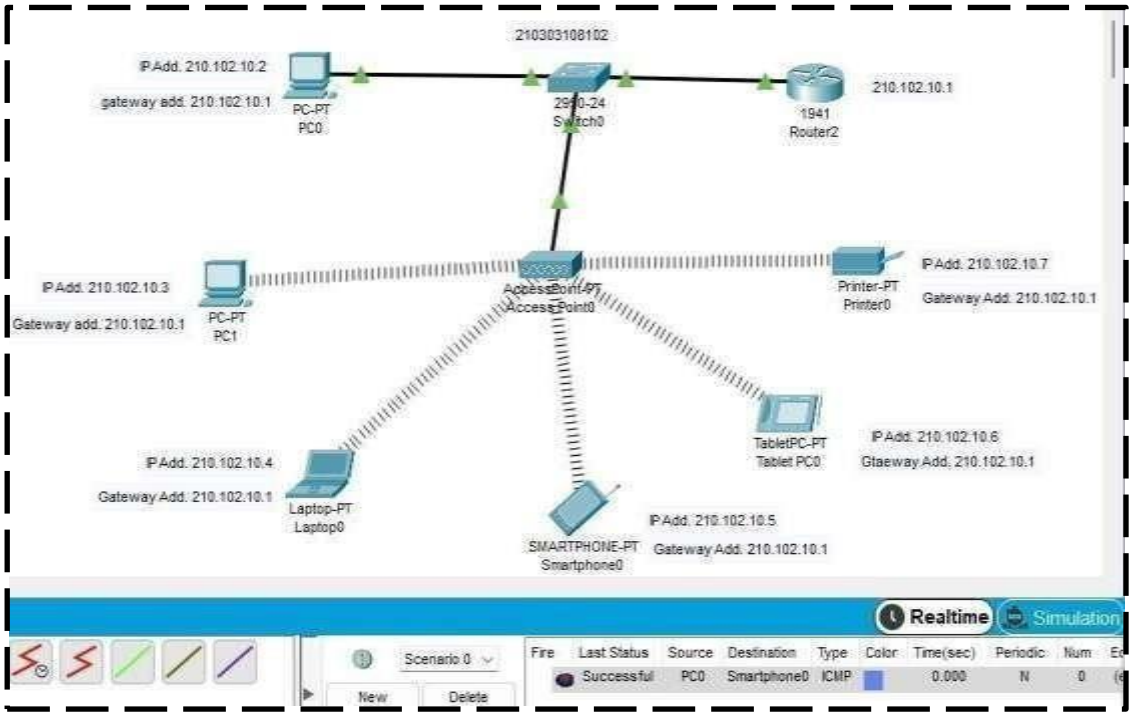
STEP-8: Select one by one PC, laptop and smartphone.

STEP-9: Then go to Desktop and select PC wireless and put the password and SSID in that to Connect the PC to the access point.

STEP-10: Open one by one laptop, PC, smartphone, tablet, printer.

STEP-11: Then select port 1 "ON" the port status and give SSID name then select WPA2-PSK And create password.

STEP-12: Now perform the practical by passing packet from PC0 to smartphone.


210303108102
IP Add. 210.102.10.2
gateway add. 210.102.10.1
PC-PT
PC0
2960-24
Switch0
1941
Router2
210.102.10.1
IP Add. 210.102.10.3
Gateway add. 210.102.10.1
PC-PT
PC1
Access Point-PT
Access Point0
Printer-PT
Printer0
IP Add. 210.102.10.7
Gateway Add. 210.102.10.1
TabletPC-PT
Tablet PC0
IP Add. 210.102.10.6
Gtaeway Add. 210.102.10.1
IP Add. 210.102.10.4
Gateway Add. 210.102.10.1
Laptop-PT
Laptop0
SMARTPHONE-PT
Smartphone0
IP Add. 210.102.10.5
Gateway Add. 210.102.10.1
Realtime
Simulation
Scenario 0
New
Delete
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Periodic
Num
Successful
PC0
Smartphone0
ICMP
0.000
N
0

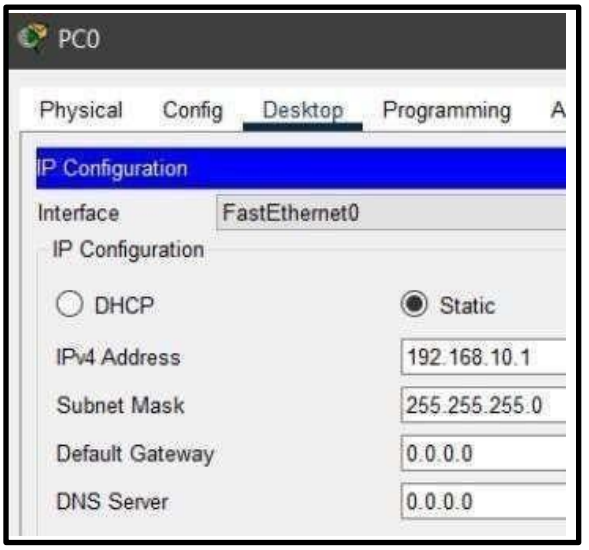
Practical-7

Aim: Internetworking with routers: Design three or four simple networks (with 3 to 4 hosts)and connect via Router. Perform simulation and trace how routing is done in packet transmission.

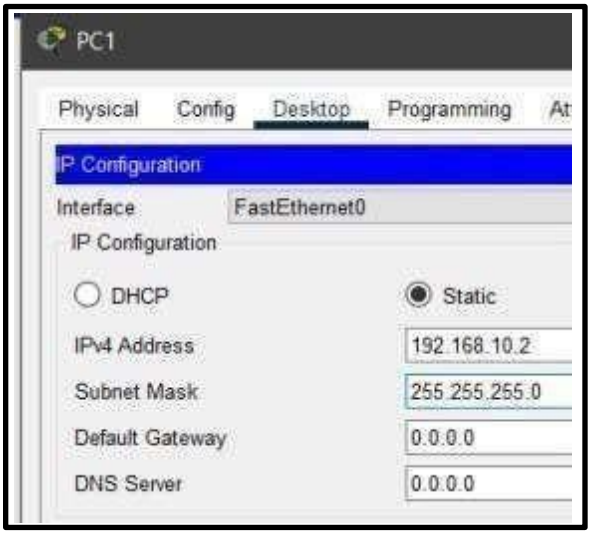
- Experiment on the same subset
- Perform experiment across the subnet and observe functioning of Router via selecting asuitable pair of source and destination.

1: Setup the router and hosts in CISCO Packet Tracer and assign the IP address to all the hosts respectively,

- We will give IP addresses to the hosts and we will only change the subnet ID of all the IP addresses because we want all the hosts to remain in the same network. Subnet Masks of all the end devices are given as follows: Take3 PCs, a switch and a router. The IP Addresses and the Subnets for the computers are as follows, First we have to give the same subnet for all three.

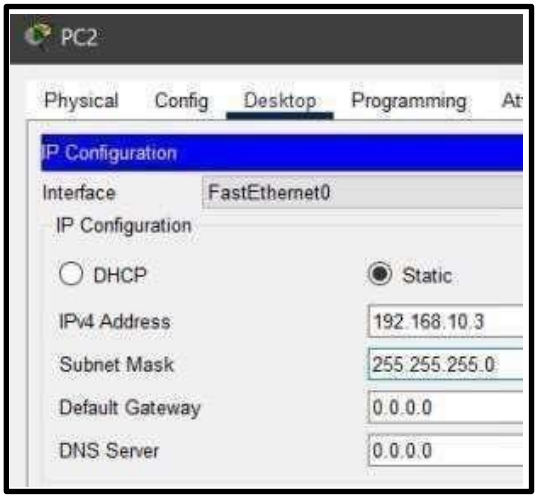


PC0 is 192.168.10.1 with subnet 255.255.255.0

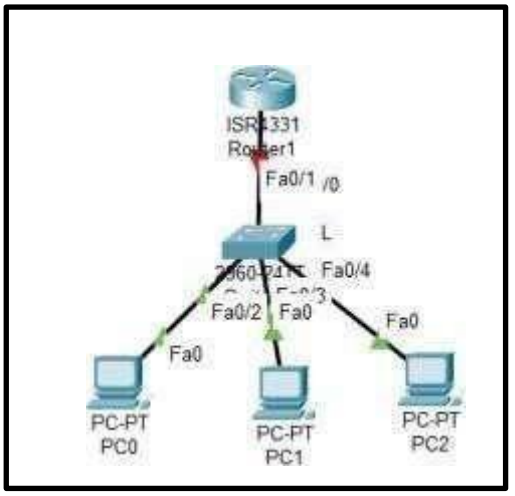


PC1 is 192.168.10.2 with subnet 255.255.255.0

PC2 is 192.168.10.3 with subnet 255.255.255.0



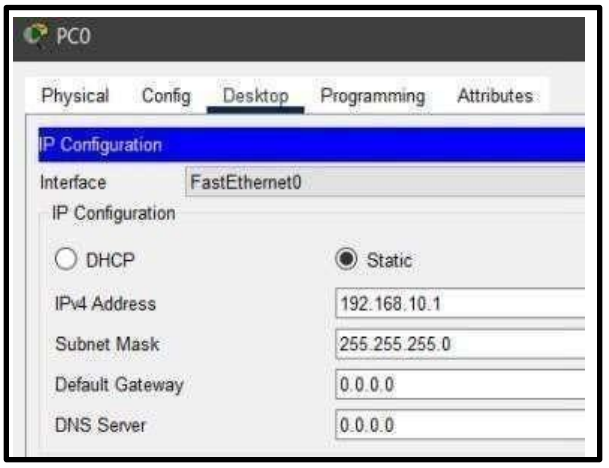
Now the subnets are the same across all three computers.



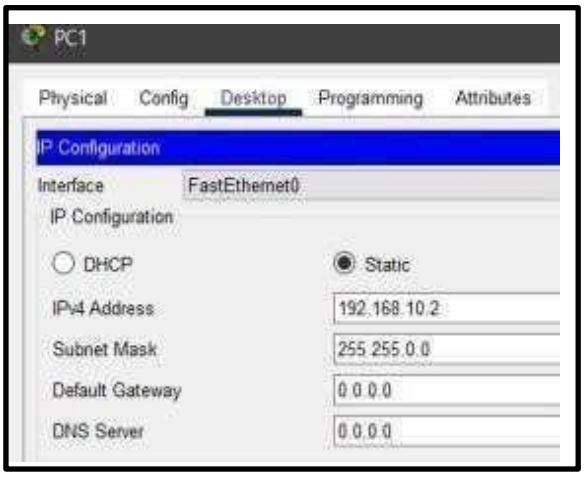
Perform simulation and trace how routing is done by sending a PDU (packet datagram Unit) from PC0-PC2, PC1-PC0, PC2-PC0 vice-versa.

The transmission of all the Packets from all the sources are successfully transmitted to all the destinations.

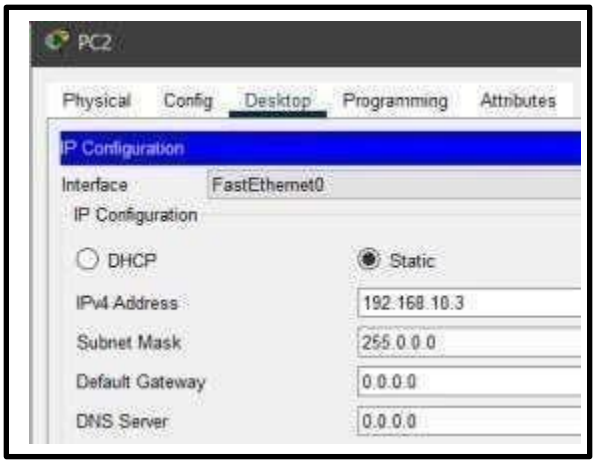
2. Performing experiments across subnets by usingvarious subnet masks.



PC0 has the same address 192.168.10.1 but with the subnet 255.255.255.0



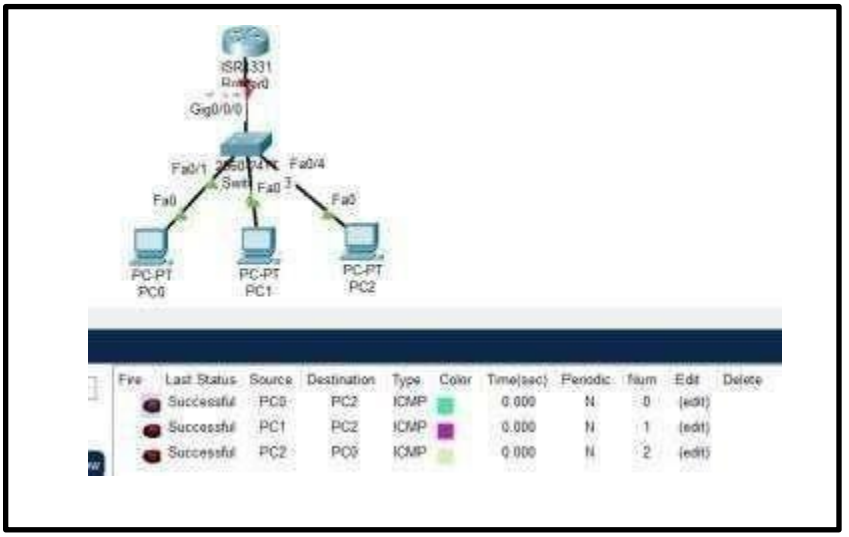
PC1 has IP address 192.168.10.2 but with subnet 255.255.0.0



PC2 has IP Address 192.168.10.3 but with subnet

255.0.0.0

By transferring PDU, All the transmissions are successful.



Therefore, there is no difference in the functioning of router between having same subnet and different subnet.

Practical-8

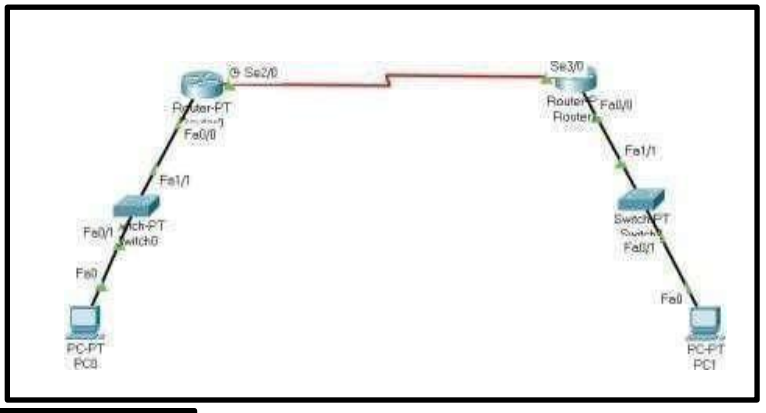
Aim: Implementation of SUBNETTING

Theory

Subnetting is the practice of dividing up a network into two or more networks. Common advantages of subnetting include enhancing routing efficiency, network management control, and improving network security. While these are just a few of the benefits that subnetting provides, they are the most noticeable after immediately implementing a subnet system.

This results in the logical division of an IP address into two fields: the network number or routing prefix and the rest field or host identifier. Addresses help to identify the pieces of hardware connected to your network. To locate a particular device, you would need to organize the IP addresses in a logical way. This is where subnetting excels as a tool to help you maintain efficiency across your network.

The subnet connection of networks:



Configuring routers in two ways as shown above for the individual networks. As we connected all the devices in the terminal now, Configure the router

Click on the router0 then CLI,

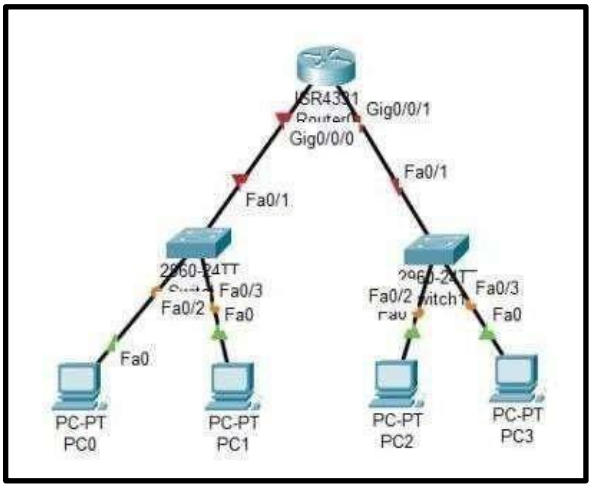
```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 192.168.1.34 255.255.255.224
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```

Practical-9

Aim: Routing at Network Layer

Static routing is a form of routing that occurs when a router uses a manually-configured routing entry, rather than information from dynamic routing traffic. In many cases, static routes are manually configured by a network administrator by adding entries into a routing table, though this may not always be the case. Unlike dynamic routing, static routes are fixed and do not change if the network is changed or reconfigured.

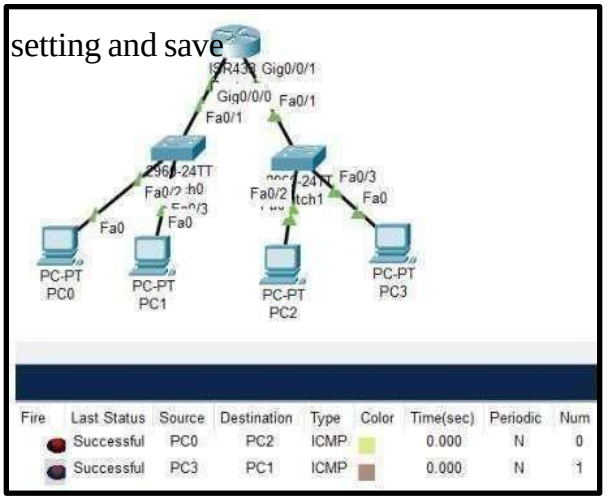
Step to implement static routing, In this example we are using a router, two switches and four PCs.



STEP-1: Take a router, two switches and four pc and connect them with the suitable wire.

STEP-2: Then we will click on pc0 and pc1 then go to desktop then go to ip configuration and give pc0 and pc1 IP address and default gateway.

STEP-3: Now we will assign IP Address and subnet mask by clicking on the router and configuring it, going to config in Gig0/0/0, clicking on the Port status and then go to the same setting and save



Now assign the IP Addresses to the PCs accordingly, PC0-10.0.0.1 PC1-10.0.0.2 The default gateway Address is 10.0.0.3 The address of Gig0/0/0 (Gigabit Ethernet 0/0) will be 10.0.0.3

After updating the IP in the router do not forget to turn on the router. In a similar way allocate the IP Addresses to the computers under Switch-1(2)

PC2- 20.0.0.1

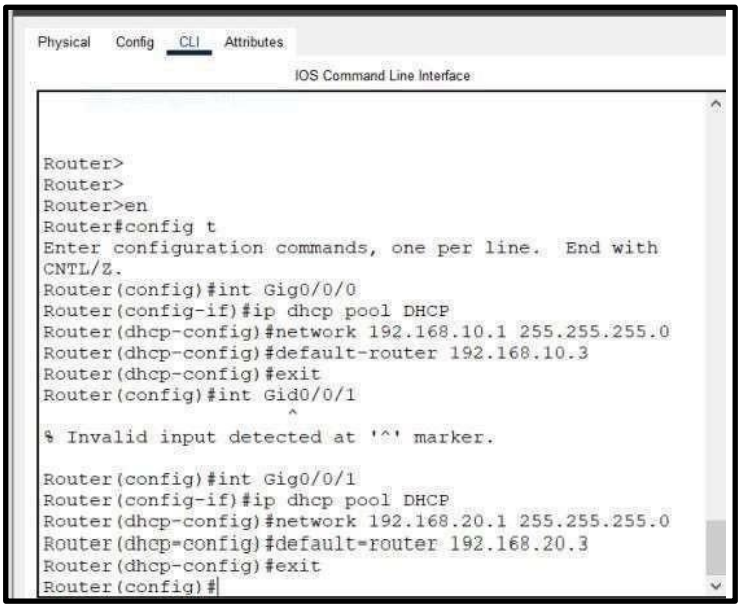
PC3-20.0.0.2

Default gateway is 20.0.0.3 Go to the router setting and update the address of Gig0/0/120.0.0.3 Turnon the router. The PDU is transmitting successfully.

Dynamic routing, also called adaptive routing, is a process where a router can forward data via a different route for a given destination based on the current conditions of the communication circuits within a system. The term is most commonly associated with data networking to describe the capability of a network to 'route around' damage, such as loss of a node or a connection between nodes, so long as other path choices are available. Dynamic routing allowsas many routes as possible to remain valid in response to the change.

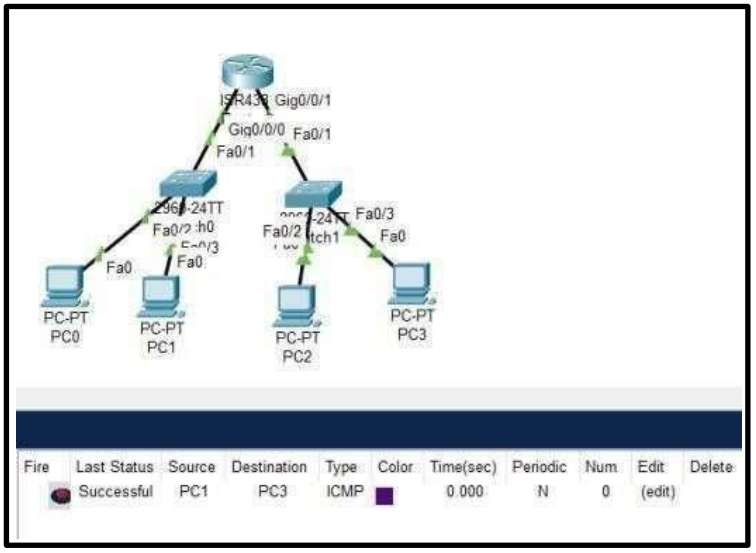
Go to the CLI of the router and execute thefollowing commands,

-* Note, int Gig0/0/0/ or Gig0/0/1 might changedepending on the type of router used.



Use Router 4331 for ease. The usage of IP Addresses in the DHCP Pool can be left thesame or can be changed. In this case, it is changed to checkthe commands are working, if they are executed the IP Addressin the PCs will also change.

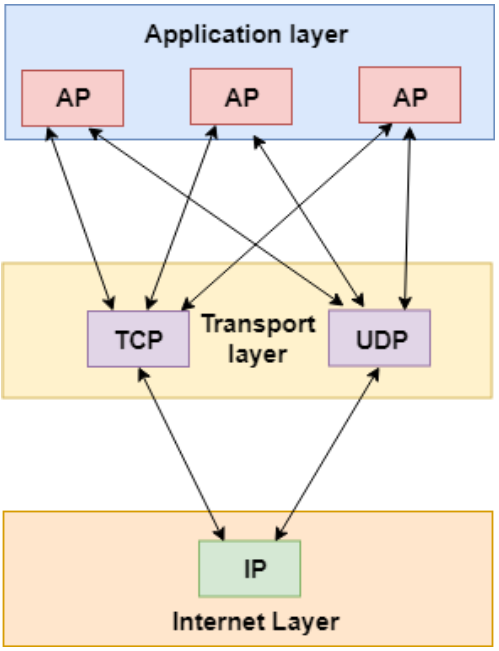
PDU is transmitted successfully



Practical- 10

Aim: Experiment on Transport Layer.

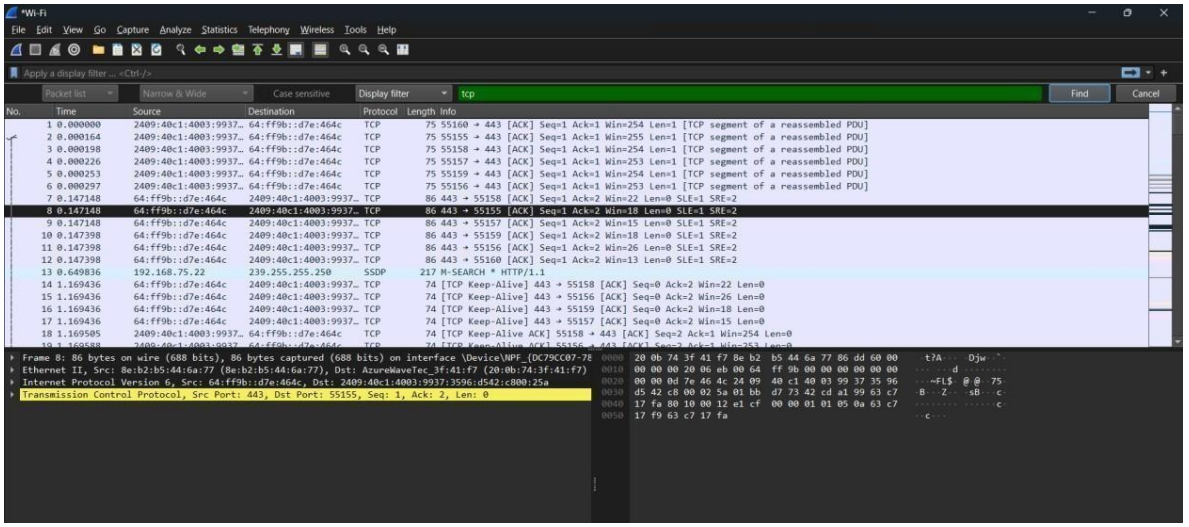
- The transport layer is a 4th layer from the top.
- The main role of the transport layer is to provide the communication services directly to the application processes running on different hosts.
- Although the application processes on different hosts are not physically connected, application processes use the logical communication provided by the transport layer to send the messages to each other.
- The transport layer protocols are implemented in the end systems but not in the network routers.
- A computer network provides more than one protocol to the network applications. For example, TCP and UDP are two transport layer protocols that provide a different set of services to the network layer.
- All transport layer protocols provide multiplexing/demultiplexing service. It also provides other services such as reliable data transfer, bandwidth guarantees, and delay guarantees.
- Each of the applications in the application layer has the ability to send a message by using TCP or UDP. The application communicates by using either of these two protocols. Both TCP and UDP will then communicate with the internet protocol in the internet layer. The applications can read and write to the transport layer. Therefore, we can say that communication is a two-way process.

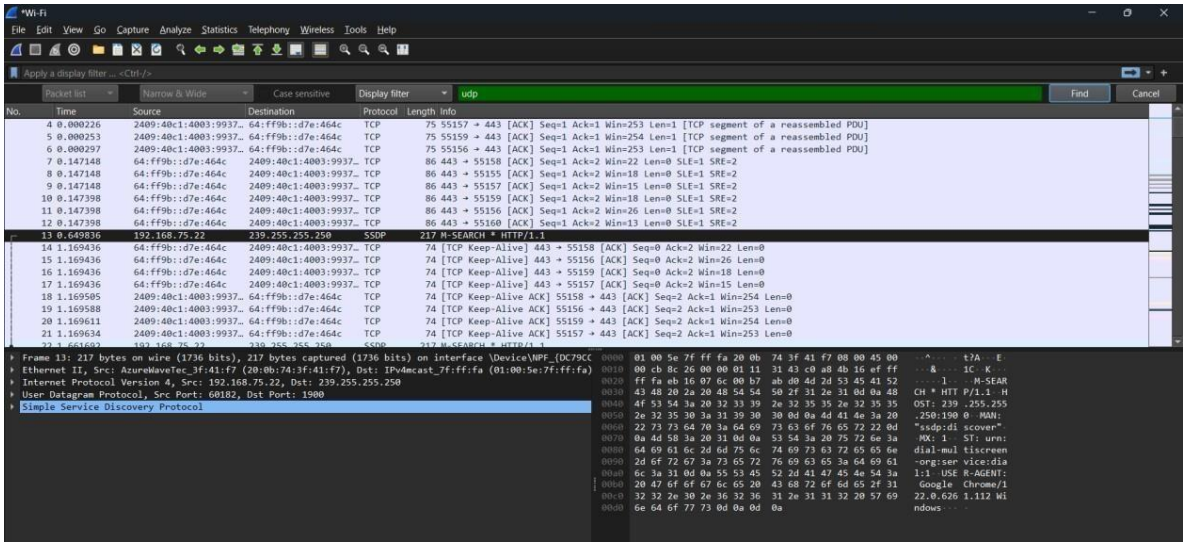


- Transmission Control Protocol (TCP)
  - Transmission Control Protocol is a connection-oriented protocol for communications that helps in the exchange of messages between different devices over a network.
  - The Internet Protocol (IP), which establishes the technique for sending data packets between computers, works with TCP.
  - The position of TCP is at the transport layer of the OSI model. TCP also helps in ensuring that information is transmitted accurately by establishing a virtual connection between the sender and receiver.

- User Datagram Protocol (UDP)
  - User Datagram Protocol (UDP) is a Transport Layer protocol. UDP is a part of the Internet Protocol suite, referred to as the UDP/IP suite.
  - Unlike TCP, it is an unreliable and connectionless protocol.
  - So, there is no need to establish a connection before data transfer.
  - The UDP helps to establish low-latency and loss-tolerating connections establish over the network. The UDP enables process-to-process communication.

TCP	UDP
Keeps track of lost packets. Makes sure that lost packets are re-sent	Doesn't keep track of lost packets
Adds sequence numbers to packets and reorders any packets that arrive in the wrong order	Doesn't care about packet arrival order
Slower, because of all added additional functionality	Faster, because it lacks any extra features
Requires more computer resources, because the OS needs to keep track of ongoing communication sessions and manage them on a much deeper level	Requires less computer resources
Examples of programs and services that use TCP: - HTTP - HTTPS - FTP - Many computer games	Examples of programs and services that use UDP: - DNS - IP telephony - DHCP - Many computer games




*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
udp
No. Time Source Destination Protocol Length Info
Frame 13: 217 bytes on wire (1736 bits), 217 bytes captured (1736 bits) on interface \Device\NPF_{DC79CC
Ethernet II, Src: AzureWaveTec_3f:41:f7 (20:0b:74:3f:41:f7), Dst: IPv4mcast_7f:ff:fa (01:00:5e:7f:ff:fa)
Internet Protocol Version 4, Src: 192.168.75.22, Dst: 239.255.255.250
User Datagram Protocol, Src Port: 60182, Dst Port: 1900
Simple Service Discovery Protocol