RAJALAKSHMI ENGINEERING COLLEGE

An Autonomous Institution
Affiliated to Anna University, Chennai,
Rajalakshmi Nagar, Thandalam – 602 105

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

CS19541 - COMPUTER NETWORKS
Laboratory Record Note Book

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Register No. : 2116221501159

Year / Branch / Section : III AI&ML - C

Semester : V

AcademicYear: 2024-2025

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BONAFIDE CERTIFICATE

Name: TARUN SAI N S

Academic Year: 2024-25 Semester: V Branch: AI&ML

Reg. No: 2116221501159

Certified that this is the bonafide record of work done by the above student in

the CS19541 – COMPUTER NETWORKS Laboratory during the academic year 2024- 2025

Signature of Faculty in-charge

Submitted for the Practical Examination held on.....

Internal Examiner External Examiner

EX: 1	BASIC NETWORK COMMANDS

AIM:

To study the various Network commands used in Linux and Windows

BASIC NETWORK COMMANDS:

- arp -a:
    - Address Resolution Protocol (ARP) shows IP address of Computer along with ip and Mac address of router

```
C:\Users\vijay\221501172>arp -a

Interface: 192.168.31.48 --- 0x7
  Internet Address      Physical Address      Type
  192.168.31.1          4c-82-a9-d6-49-79     dynamic
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

- hostname:
    - Displays the name of the computer

```
C:\Users\vijay\221501172>hostname
Vijay
```

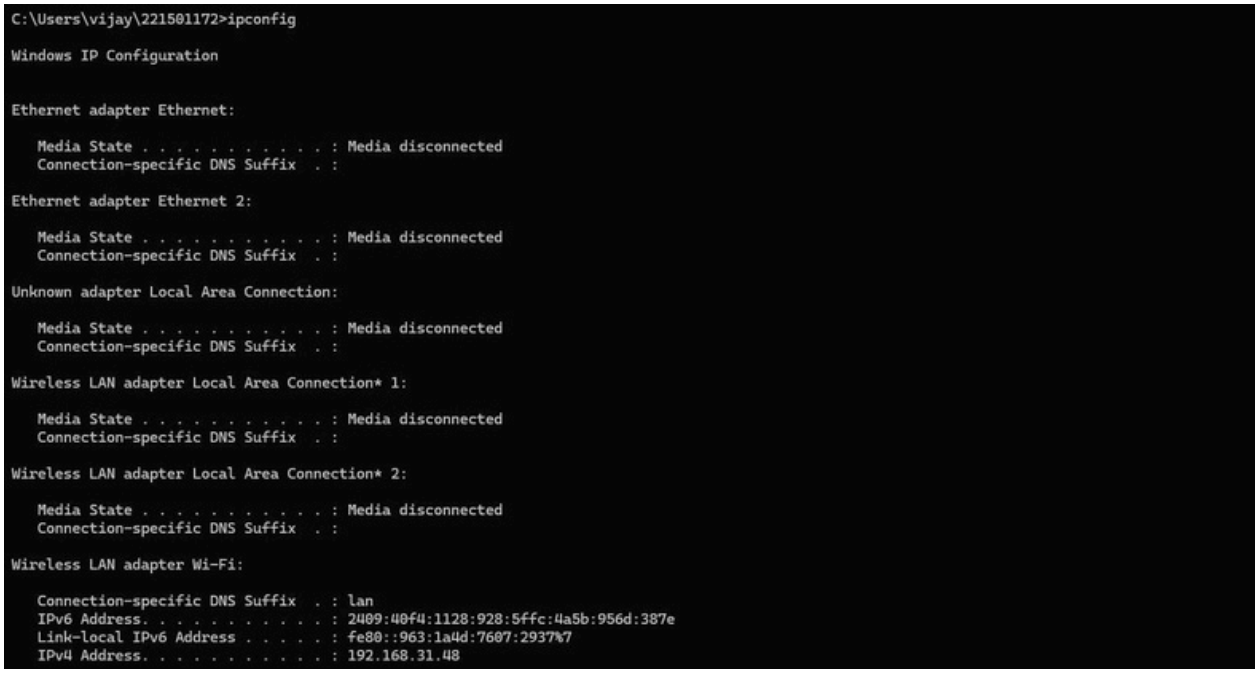
- ping
    - Packet Internet Groping testing connectivity

```
C:\Users\vijay\221501172>ping www.google.com

Pinging www.google.com [2404:6800:4007:819::2004] with 32 bytes of data:
Reply from 2404:6800:4007:819::2004: time=32ms
Reply from 2404:6800:4007:819::2004: time=33ms
Reply from 2404:6800:4007:819::2004: time=31ms
Reply from 2404:6800:4007:819::2004: time=33ms

Ping statistics for 2404:6800:4007:819::2004:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 31ms, Maximum = 33ms, Average = 32ms
```

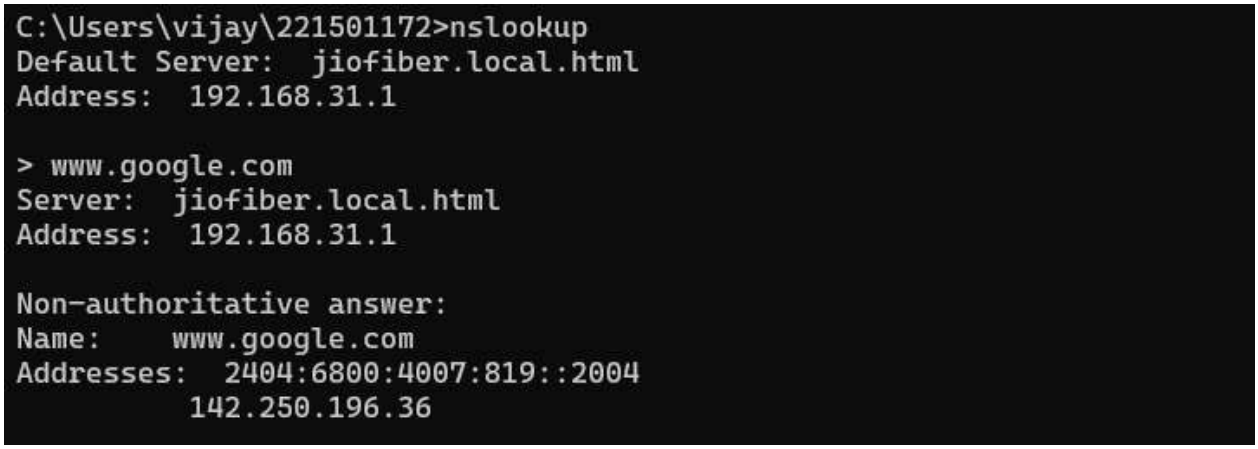
- netstat
    - Network statistics monitors all the connections

```
C:\Users\vijay\221501172>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:49670        Vijay:49671            ESTABLISHED
  TCP    127.0.0.1:49671        Vijay:49670            ESTABLISHED
  TCP    127.0.0.1:49672        Vijay:49673            ESTABLISHED
  TCP    127.0.0.1:49673        Vijay:49672            ESTABLISHED
  TCP    127.0.0.1:52310        Vijay:52313            ESTABLISHED
  TCP    127.0.0.1:52313        Vijay:52310            ESTABLISHED
  TCP    192.168.31.48:49414    20.198.119.143:https   ESTABLISHED
  TCP    192.168.31.48:54868    4.195.14.14:https      ESTABLISHED
  TCP    192.168.31.48:55487    20.212.88.117:https    ESTABLISHED
  TCP    [2409:40f4:1128:928:5ffc:4a5b:956d:387e]:55461  [2603:1040:a06:6::1]:https  ESTABLISHED
  TCP    [2409:40f4:1128:928:5ffc:4a5b:956d:387e]:55469  [64:ff9b::22e1:a5be]:https  ESTABLISHED
  TCP    [2409:40f4:1128:928:5ffc:4a5b:956d:387e]:55486  dns:https              ESTABLISHED
  TCP    [2409:40f4:1128:928:5ffc:4a5b:956d:387e]:55495  [64:ff9b::142a:4919]:https  TIME_WAIT
```

- ipconfig
    - Displays the detailed configuration of about all the connections in a system



- nslookup
    - Name server lookup to perform DNS lookups



- route
    - Shows / Manipulates the IP routing table

```
C:\Users\vijay\221501172>route print
===========================================================================
Interface List
 16...5c 60 ba 3b 43 15 ......Realtek PCIe GbE Family Controller
 14...00 ff c4 74 de 3c ......ExpressVPN TAP Adapter
 13...........................ExpressVPN TUN Driver
 15...32 03 c8 42 72 2f ......Microsoft Wi-Fi Direct Virtual Adapter
 20...b2 03 c8 42 72 2f ......Microsoft Wi-Fi Direct Virtual Adapter #2
  7...30 03 c8 42 72 2f ......Realtek RTL8822CE 802.11ac PCIe Adapter
  1...........................Software Loopback Interface 1
===========================================================================
```

Result:

Thus the basic network commands have been executed successfully.

EX: 2	DIFFERENT TYPES OF NETWORK CABLES

AIM:

To study the different types of network cable and their specializations

TYPES OF NETWORK CABLES:

➔ **Coaxial Cable**

- It contains a conductor, insulator, braiding, and sheath which covers each other from the center respectively.
- There are two types based on the number of cores present. They are

  Single Core Coaxial Cable

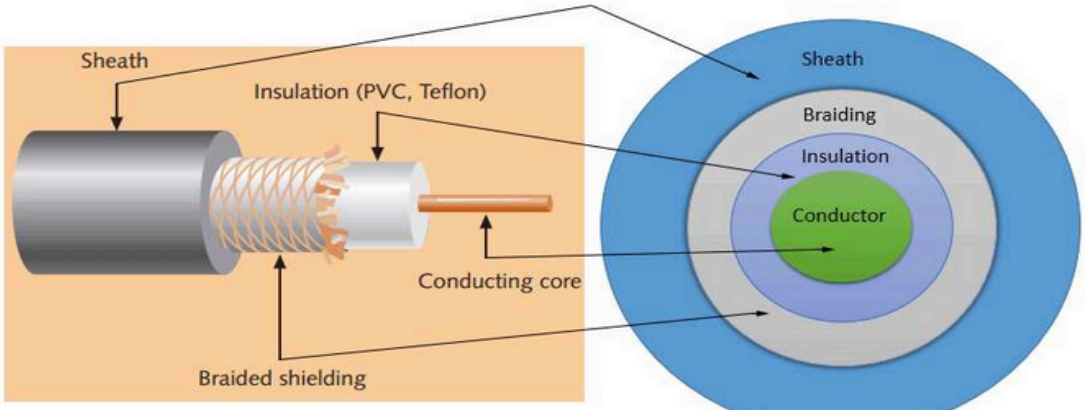
  Multi Core Coaxial Cable
- Some of the few Coaxial Cable used in Computer Networks are,

  RG-6 - Used in cable networks to provide cable Internet service and cable TV over long distances.

  RG-8 - Used in the earliest computer networks. This cable was used as the backbone cable in the bus topology. In Ethernet standards, this cable is documented as the 10base5 Thicknet cable.

  RG-58 - This cable is thinner, easier to handle and install than the RG-8 cable. This cable was used to connect a system with the backbone cable. In Ethernet standards, this cable is documented as the 10base2 Thinnet cable.

RG-59 - Used in cable networks to provide short-distance service.



➔ **Twisted pair cable**

- ◆ It has been primarily developed for computer networks commonly known as Ethernet Cable. It is commonly used for most of the Local Area Network (LAN)
- ◆ This cable consists of color-coded pairs of insulated copper wires. Every two wires are twisted around each other to form a pair. Usually, there are four pairs. Each pair has one solid color and one striped color wire. Solid colors are blue, brown, green,

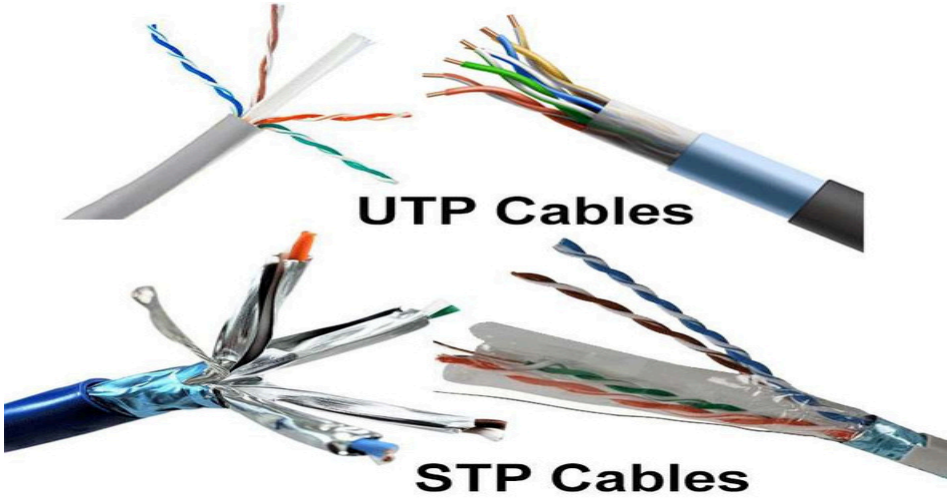
and orange. In striped color, the solid color is mixed with the white color.

- Based on how pairs striped in the sheath , there are two types they are,

  UTP (Unshielded Twisted Pair)

  STP (Shielded Twisted Pair)

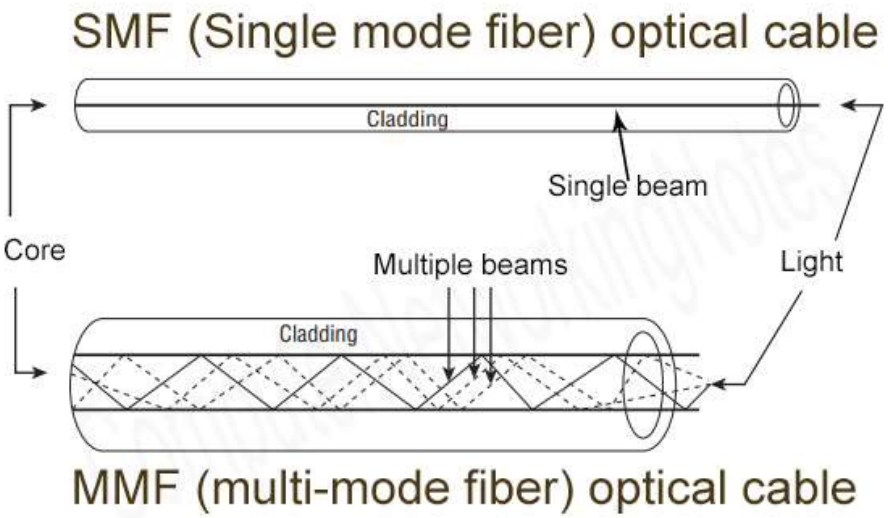
- Some of the Twisted Pair Cables are cat1, cat2, cat3, cat4, cat5, cat5e, cat6, cat6a, cat7 among them cat5e, cat6, cat6a are commonly used.



➔ **Fiber cable**

- It consists of core, cladding, buffer and jacket.
  - Core carries the data signals in the form of light.
  - Cladding reflects light back to the core.
  - Buffer protects the light from leaking.
  - The jacket protects the cable from physical damage.

- Fiber optic cable is completely immune to EMI (Electromagnetic Inference)and RFI (Radio Frequency Inference)
- Based on how many beams of light transmit there are two types they are,
  - **SMF (** Single mode Fiber**)** Optical Cable
  - **MMF (**Multi mode Fiber**)** Optical Cable



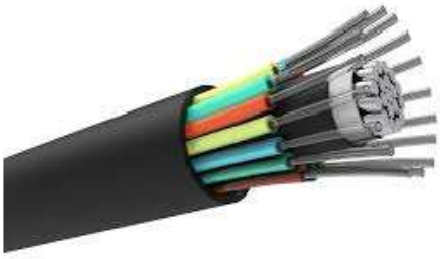
- **SMF (Single-mode fiber) optical cable**

This cable carries only a single beam of light. This is more reliable and supports much higher bandwidth and longer distances than the MMF cable. This cable uses a laser as the light source and transmits 1300 or 1550 nano-meter wavelengths of light.

- **MMF (multi-mode fiber) optical cable**

This cable carries multiple beams of light. Because of multiple beams, this cable carries much more data than the SMF cable.

This cable is used for shorter distances. This cable uses an LED as the light source and transmits 850 or 1300 nano-meter wavelengths of light.



Result:

Thus the different types of cables has been studied.

EX: 3	SOCKET PROGRAMMING USING TCP

a. Implementation of Echo Message

Aim:

To implement a TCP echo server-client communication where the client sends a message, and the server echoes it back.

Procedure:

- **Server**:
  - Create a socket and bind it to a port.
  - Listen for incoming connections.
  - Accept a connection, receive a message, and send it back.
  - Stop the server when "end" is received.
- **Client**:
  - Connect to the server.
  - Send a message and receive the echoed response.
  - Close the connection.

Program Code:

Server:

```
from socket import *
s = socket(AF_INET, SOCK_STREAM)
s.bind(("", 8000))
s.listen(5)
while True:
    c, a = s.accept()
    print("Received connection from", a)
    data = c.recv(100).decode()
    print(data)
    c.send(data.encode('utf-8'))
    if data.lower() == 'end':
        break
c.close()
```

Client:

```
from socket import *

s = socket(AF_INET, SOCK_STREAM)
s.connect(("127.0.0.1", 8000))
op = input("Enter a message: ")
s.send(op.encode('utf-8'))
data = s.recv(100).decode()
print(data)
s.close()
```

Output:

Server Output:

```
Received connection from ('127.0.0.1', 56321)

Hello Server

Received connection from ('127.0.0.1', 56322)

Python Sockets are fun!

Received connection from ('127.0.0.1', 56323)

end
```

Client Outputs:

Client 1:

```
Enter a message: Hello Server

Hello Server
```

Client 2:

```
Enter a message: Python Sockets are fun!

Python Sockets are fun!
```

Client 3 (terminates server):

```
Enter a message: end

end
```

Result:

Successfully implemented TCP echo communication.

b.Implementation of Chat Communication

Aim:

To implement a TCP chat application for server-client communication.

Procedure/Algorithm:

- **Server**:
  - Create a socket, bind it, and listen for incoming connections.
  - Accept a connection, and communicate by sending and receiving messages in a loop.
  - Stop communication if "end" is received.
- **Client**:
  - Connect to the server.
  - Continuously send and receive messages.

Program Code:
Server:

```
from socket import *
s = socket(AF_INET, SOCK_STREAM)
s.bind(("", 8000))
s.listen(5)
cont = 'yes'
while cont == 'yes':
    c, a = s.accept()
    print("Received connection from", a)
    while True:
        data = c.recv(100).decode()
        print(data)
        res = input("Enter Reply: ")
        c.send(res.encode('utf-8'))
        if data.lower() == 'end' or res.lower() == 'end':
            break
    cont = input("Receive Connection (yes or no): ")
c.close()
```

Client:

```
from socket import *

s = socket(AF_INET, SOCK_STREAM)
s.connect(("127.0.0.1", 8000))

while True:
    message = input("Enter a message: ")
    s.send(message.encode('utf-8'))
    if message.lower() == 'end':
        break
    reply = s.recv(100).decode()
    print(reply)

s.close()
```

Output:

Server Output

```
Received connection from ('127.0.0.1', 56321)
Hello Server
Enter Reply: Hi Client!
Python Sockets are fun!
Enter Reply: Yes, they are! What are you learning?
end
Enter Reply: Goodbye!

Receive Connection (yes or no): yes
Received connection from ('127.0.0.1', 56322)
Hello Again!
Enter Reply: Welcome back! Ready for more socket programming?
end
Enter Reply: Bye!

Receive Connection (yes or no): no
```

Client Output (Client 1)

```
Enter a message: Hello Server

Hi Client!

Enter a message: Python Sockets are fun!

Yes, they are! What are you learning?

Enter a message: end

Goodbye!
```

Client Output (Client 2)

```
Enter a message: Hello Again!

Welcome back! Ready for more socket programming?

Enter a message: end

Bye!
```

Result:

Successfully implemented TCP chat communication.

EX: 4	SOCKET PROGRAMMING USING UDP

a. Implementation of Echo Message

Aim:

To implement a UDP echo server-client communication where the client sends a message, and the server echoes it back.

Procedure/Algorithm:

Server:

Create a socket and bind it to a port.

Receive a message, and send it back to the client.

Stop the server when "end" is received.

Client:

Send a message to the server and receive the echoed response.

Close the connection when "end" is sent.

Program Code:
Server:

```
import socket
server_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
server_socket.bind(('', 12500))
while True:
    message, address = server_socket.recvfrom(1024)
    message = message.decode()
    print(message)
    server_socket.sendto(message.encode('utf-8'), address)
    if message == 'end':
        break
server_socket.close()
```

Client:

```
import socket
client_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
addr = ("127.0.0.1", 12500)
message = input("Enter Message: ")
client_socket.sendto(message.encode('utf-8'), addr)
data, server = client_socket.recvfrom(1024)
print(data.decode())
if message.lower() == 'end':
    print("Connection Closed....")
```

Output:

Server Output

```
Hello Server

Python Sockets over UDP!

end
```

Client Outputs

Client 1:

```
Enter Message: Hello Server

Hello Server
```

Client 2:

```
Enter Message: Python Sockets over UDP!

Python Sockets over UDP!
```

Client 3 (terminates communication):

```
Enter Message: end

end

Connection Closed....
```

Result:

Successfully implemented UDP echo communication.

b. Implementation of Chat communication

Aim:

To implement a UDP chat application for server-client communication.

Procedure/Algorithm:

Server:

Create a socket and bind it to a port.

Continuously send and receive messages.

Stop the communication if "end" is received.

Client:

Send messages to the server and receive replies in a loop.

Program Code:

Server:

```
import socket
server_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
server_socket.bind(('', 12500))
cont = 'no'
while cont == 'no':
    while True:
        message, address = server_socket.recvfrom(1024)
        print("Received Message from ", address)
        message = message.decode()
        print(message)
        res = input("Enter Response: ")
        server_socket.sendto(res.encode('utf-8'), address)
        if message == 'end' or res == 'end':
            break
    cont = input("Break Connection: ")
server_socket.close()
```

Client:

```
import socket
client_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
addr = ("127.0.0.1", 12500)
while True:
    message = input("Enter Message: ")
    client_socket.sendto(message.encode('utf-8'), addr)
    if message.lower() == 'end':
        print("Connection Closed....")
        break
    data, server = client_socket.recvfrom(1024)
    print(data.decode())
```

Output:

Server Output

```
Received Message from  ('127.0.0.1', 56321)

Hello Server

Enter Response: Hi Client!

Received Message from  ('127.0.0.1', 56321)

How are you?

Enter Response: I'm good. How about you?

Received Message from  ('127.0.0.1', 56321)

end

Enter Response: Goodbye!

Break Connection: yes
```

Client Output

```
Enter Message: Hello Server

Hi Client!

Enter Message: How are you?

I'm good. How about you?

Enter Message: end

Goodbye!

Connection Closed....
```

Result:

Successfully implemented UDP chat communication.

PACKET TRACKING USING WIRESHARK

AIM:

To study and understand the working and usage of Packet Capturing Tool: Wireshark and perform different tasks with the help of it.

WIRESHARK:

Wireshark is a popular open-source network protocol analyzer. It allows users to capture and examine data packets traveling across a network. This can be incredibly useful for troubleshooting network issues, analyzing network performance, and ensuring security.

With Wireshark, you can:

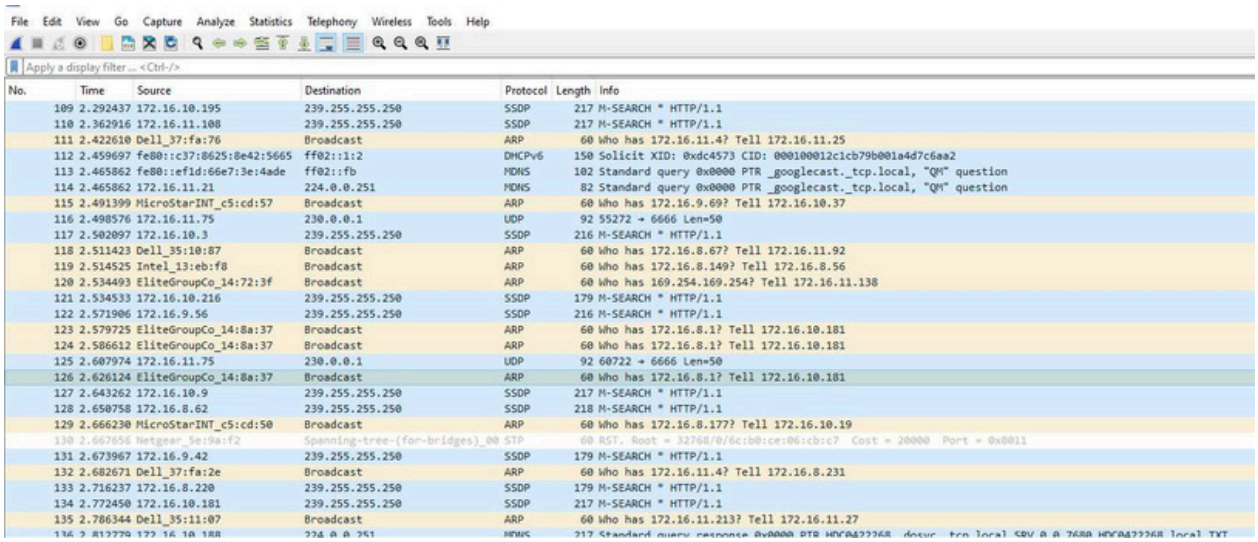
- **Capture Live Network Traffic**: Monitor data packets in real-time from various network interfaces.
- **Analyze Protocols**: Decode and inspect packets from numerous network protocols and services.
- **Filter and Search:** Use advanced filtering options to focus on specific types of traffic or data.
- **Visualize Data**: Generate statistics and visualizations to understand network behavior better.

I. CAPTURE LIVE NETWORK TRAFFIC:

After downloading the Wireshark application, By launching it and selecting the network that you want to track the packets, you can stop the tracking by pressing the stop icon in the top left corner or by pressing the ctrl + E button. In th homepage you can view the following,

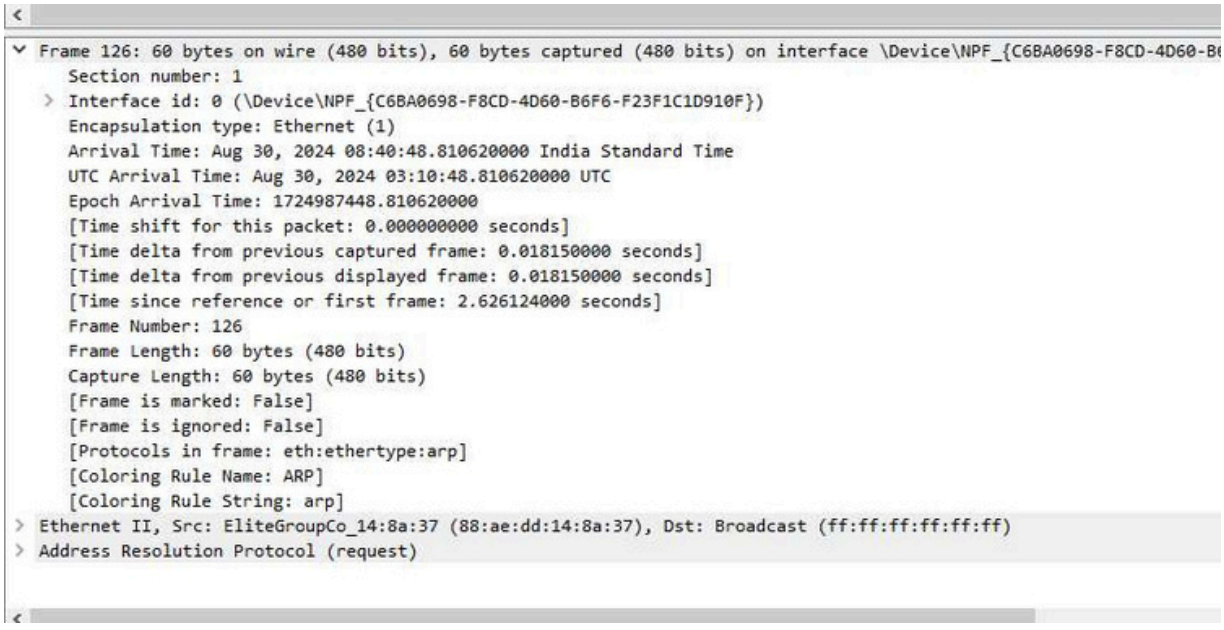
PACKET LISTS:

It shows the list of packets that are captured from the interval of start and end of the tracking. It shows the serial number, time, its source, destination , protocol, length and its information.



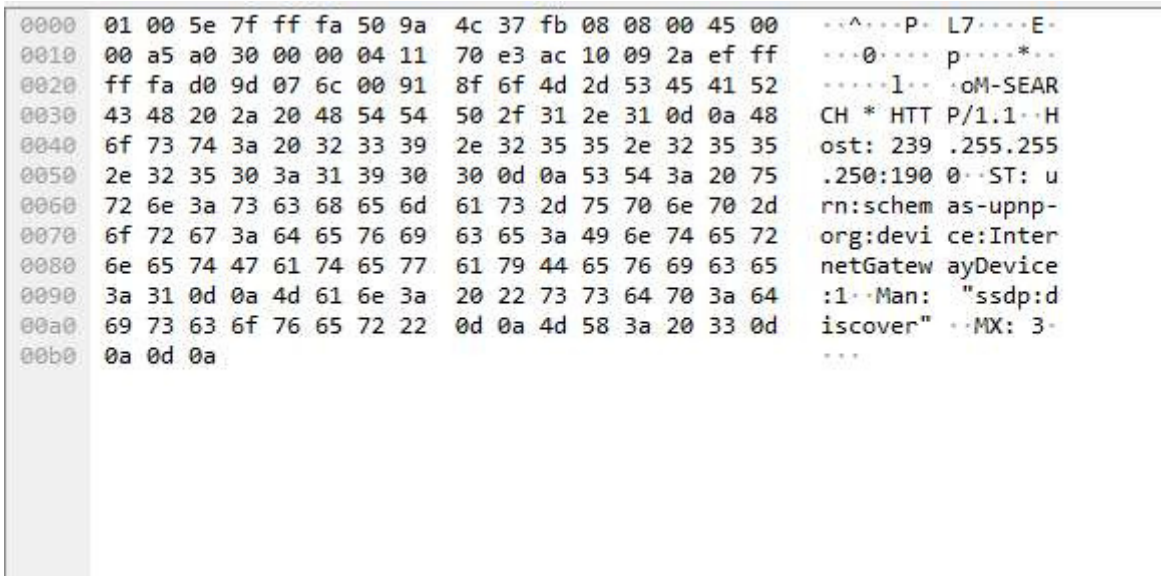
PACKET DETAILS:

It shows the information of the packet it contains arrival time, section number, frame number, length, protocol etc.,



PACKET BYTES:

It shows the byte representation of the packet in hexadecimal format which can also be changed to binary, decimal or octal.

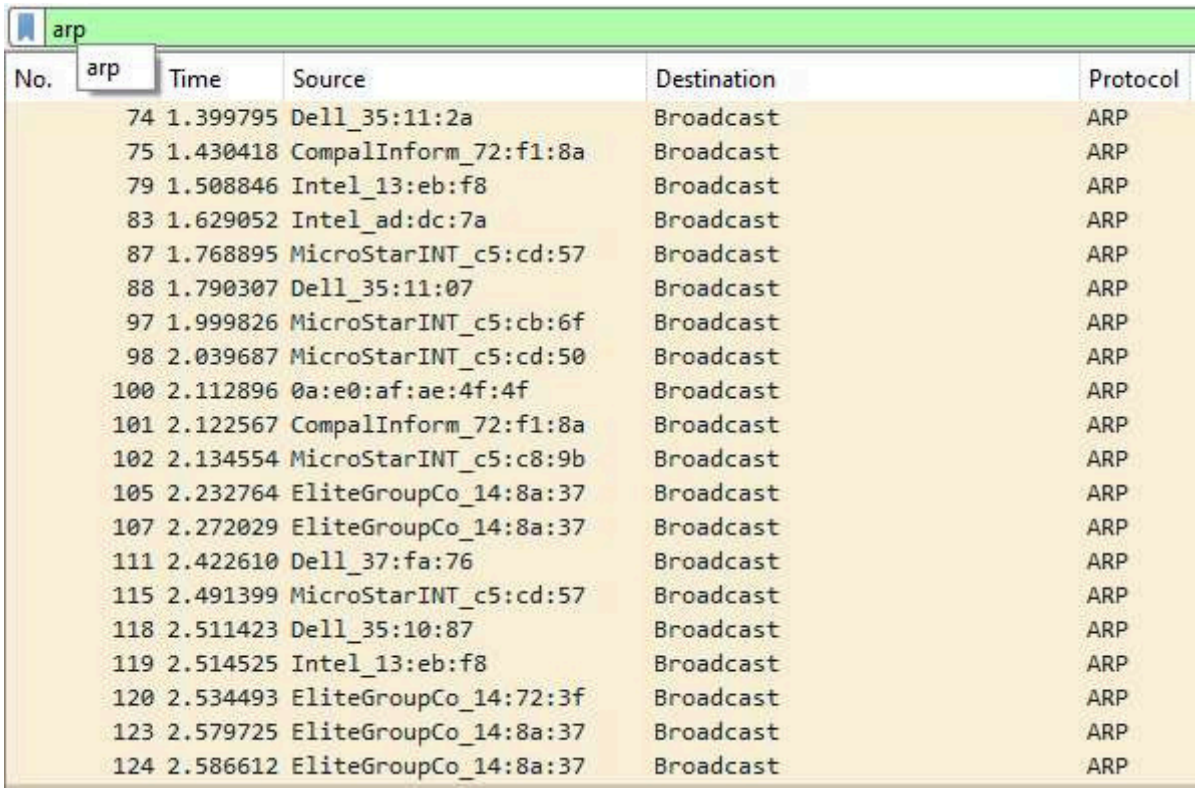


II. ANALYZE PROTOCOLS

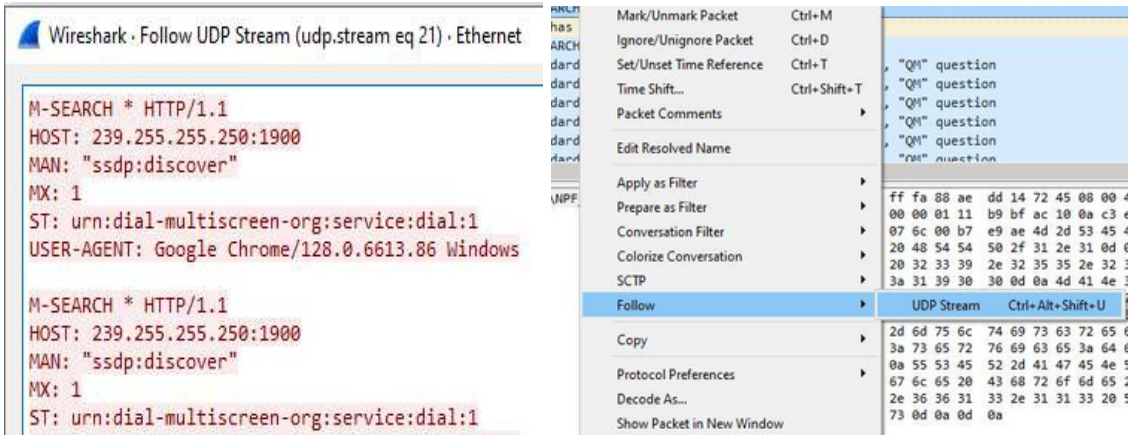
We can inspect the packets by double clicking on the packet from the packet list pane and there is a colorization mechanism is present which show different colors to different protocols which can be customizable over the networks through right clicking the packet and chose colourization to view the current colourization we can view it by customize colourization option.

III. FILTER AND SEARCH

If it needs to search for a specific protocol or any packet we can search from the search column present above the packet list pane and we can use already defined filters also that are shown when typing through the search box by using it.

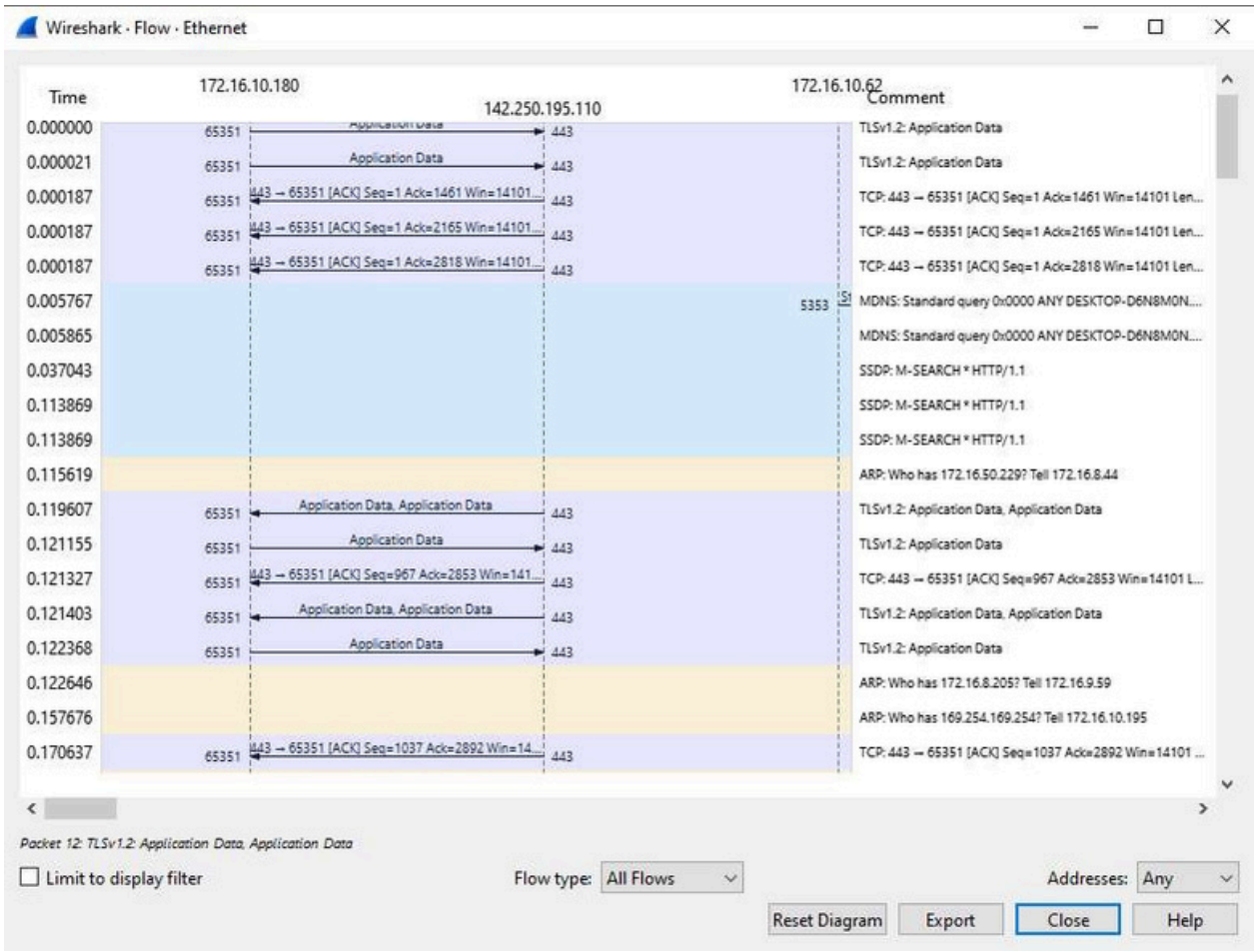


We can also find a packet and track the flow of the packet by right clicking the packet from the list and clicking on follow -> TCP/UDP stream to view the conversation.



IV. VISUALIZE THE DATA

We can visualize the data through flow graphs and other methods by clicking on the statistics from the top bar.



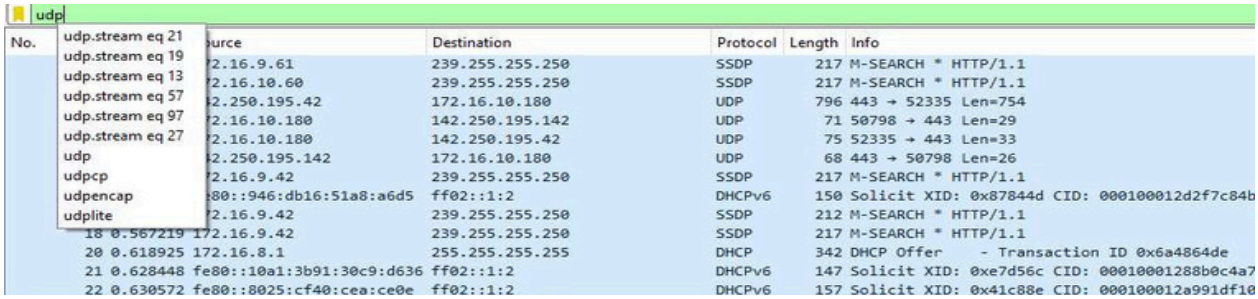
CAPTURING AND ANALYZING PACKETS USING WIRESHARK

1. **Create a Filter to display only TCP/UDP packets, inspect the packets and provide the flow graph**

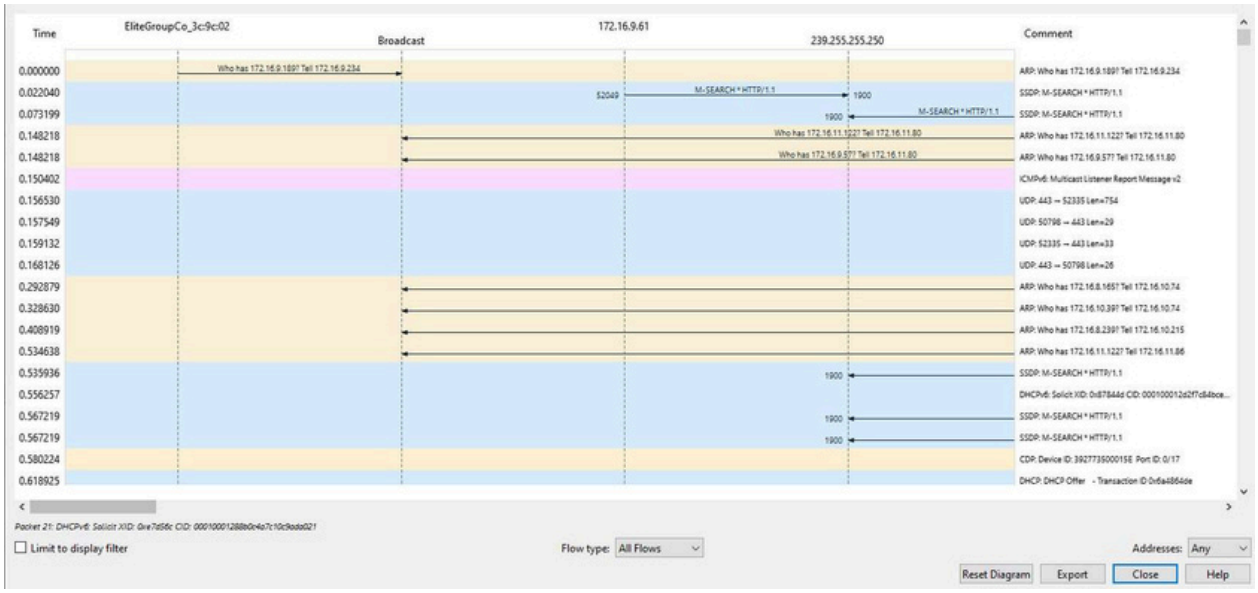
   PROCEDURE:

   - Select Start capture in a network
   - Stop the capture and save the packets
   - Search for TCP in the search bar to view TCP packets
   - Search for UDP to view UDP packets
   - To view flow graph click statistics and select flow graph

   PACKETS:



   FLOW GRAPH:

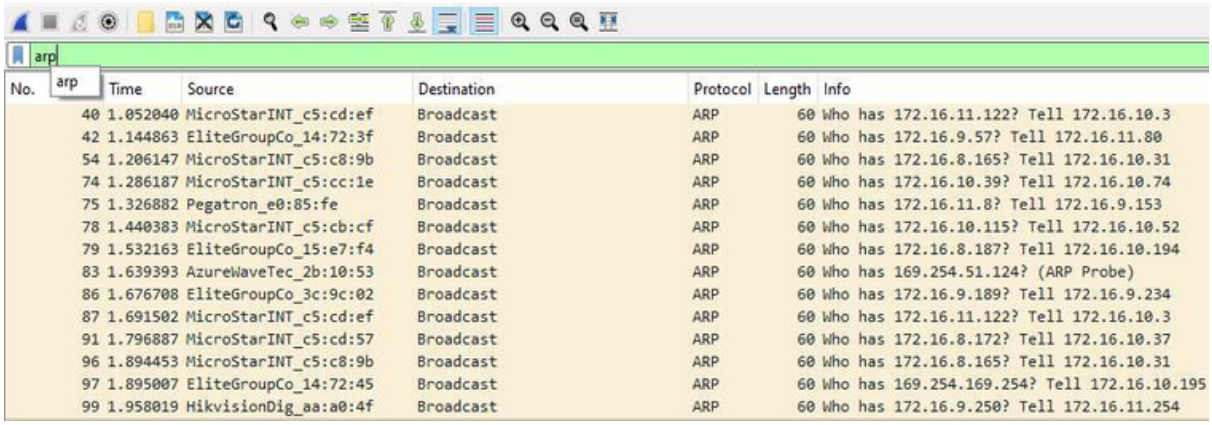


2. **Create a Filter to display only ARP packets and inspect the packets.**

PROCEDURE:

- Select Start capture in a network
- Stop the capture
- Search for arp in the search bar
- Save the packets

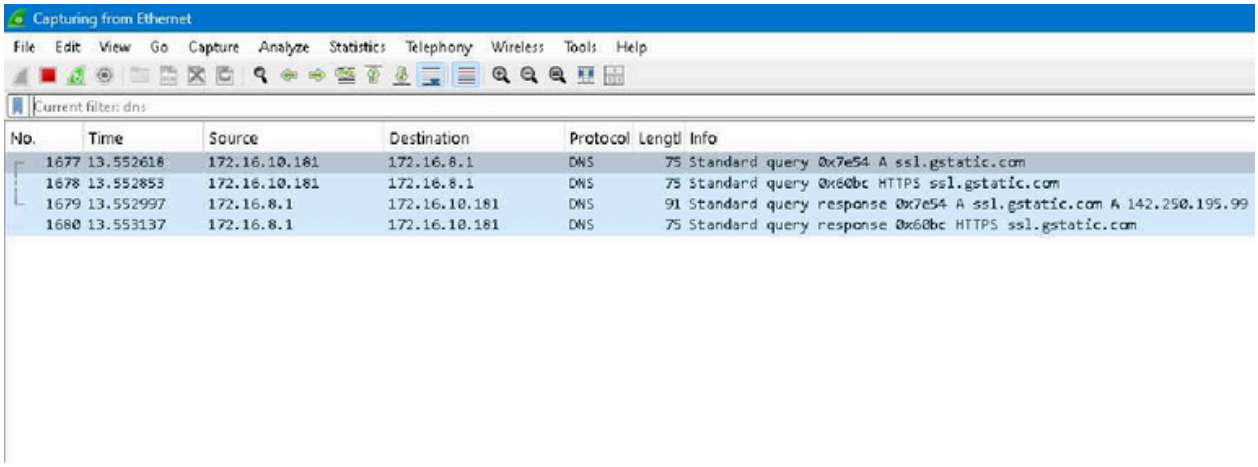
PACKETS:

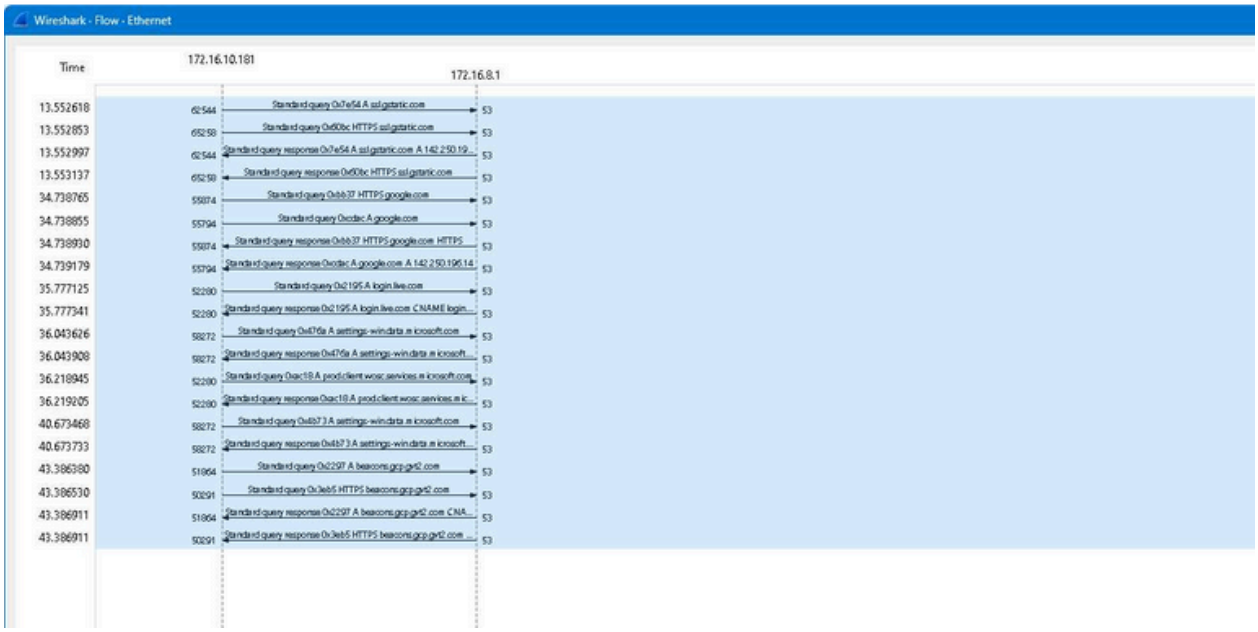


3. **Create a Filter to display only DNS packets and provide the flow graph.**

PROCEDURE:

- Select Start capture in a network
- Stop the capture
- Search for DNS in the search bar
- Select the flowgraph from the statistics
- Save the packets





4. **Create a Filter to display only HTTP packets and inspect the packets**

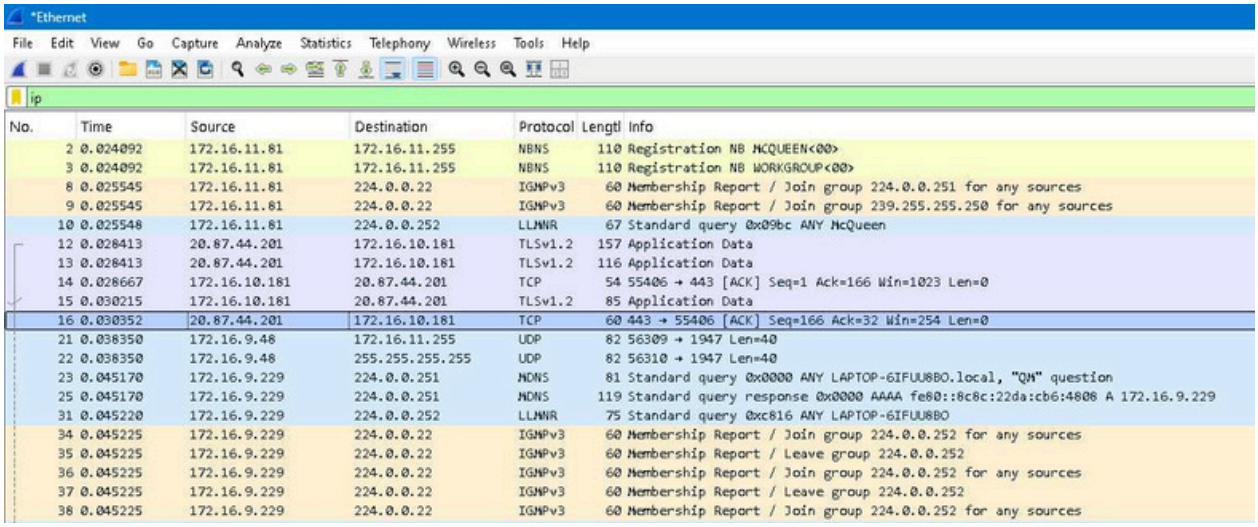
   PROCEDURE:

   - Select Start capture in a network
   - Stop the capture
   - Search for HTTP in the search bar
   - Save the packets

5. **Create a Filter to display only IP/ICMP packets and inspect the packets.**

   PROCEDURE:

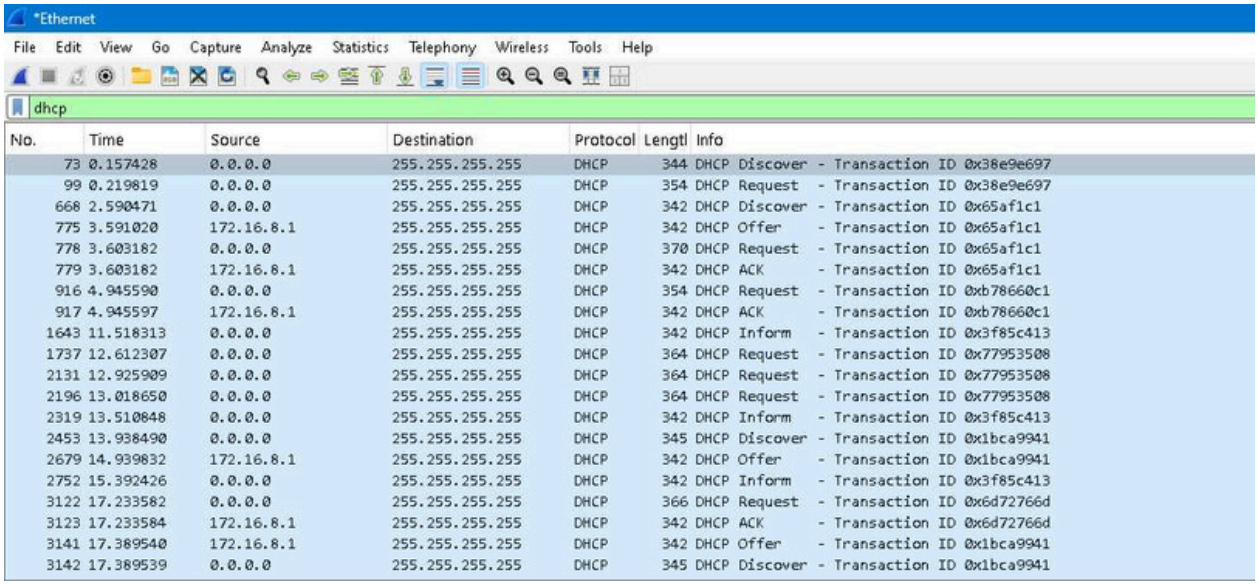
   - Select Start capture in a network
   - Stop the capture
   - Search for IP in the search bar
   - Double click on the packet to inspect the packet.
   - Save the packets

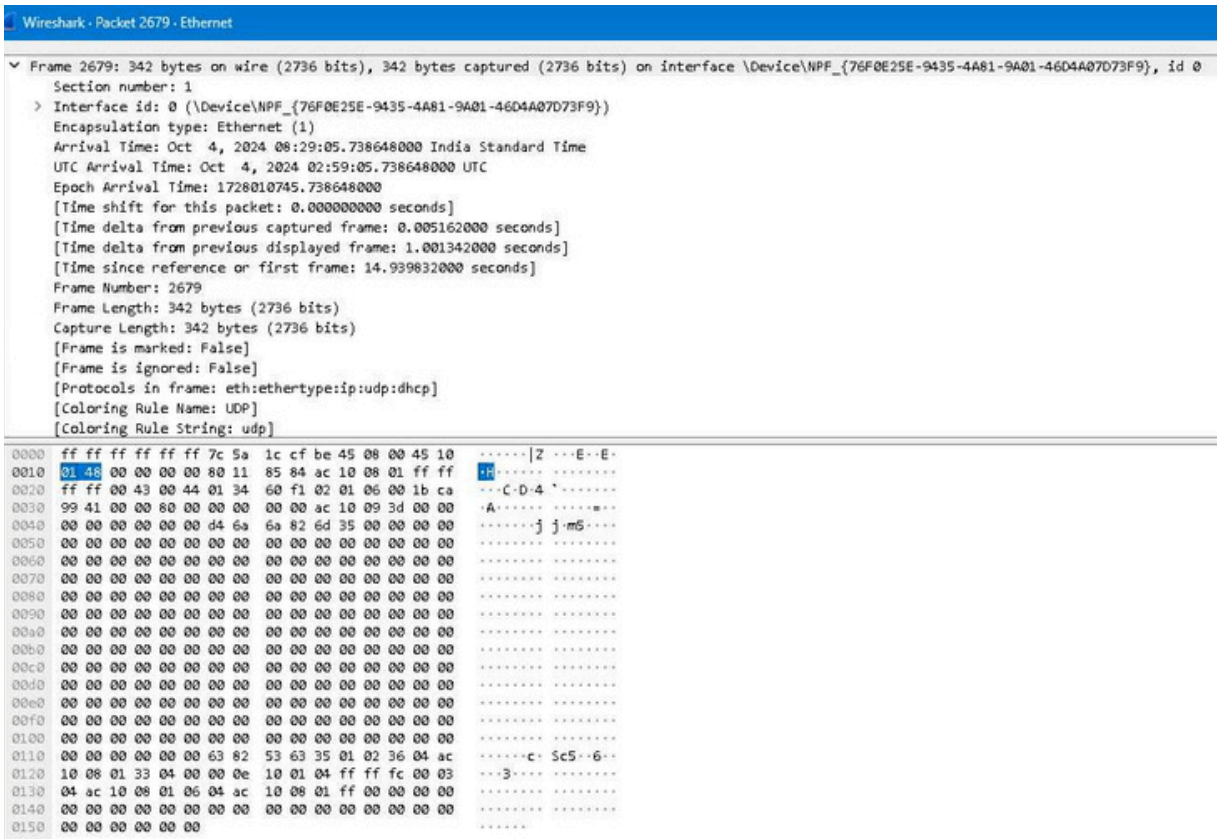


6. **Create a Filter to display only DHCP packets and inspect the packets.**

   PROCEDURE:

   - Select Start capture in a network
   - Stop the capture
   - Search for DHCP in the search bar
   - Double click on the packet to inspect the packet.
   - Save the packets





Result:

Thus the uses of the Wireshark Tool has been studied and understood.

Practical -3

AIM: To study the Packet tracer tool Installation and User Interface Overview

c) To understand environment of CISCO PACKET TRACER to design simple network.

INTRODUCTION:

A simulator, as the name suggests, simulates network devices and its environment. Packet Tracer is an exciting network design, simulation and modelling tool.

1. It allows you to model complex systems without the need for dedicated equipment.
2. It helps you to practice your network configuration and troubleshooting skills via computer or an Android or iOS based mobile device.
3. It is available for both the Linux and Windows desktop environments.
4. Protocols in Packet Tracer are coded to work and behave in the same way as they would on real hardware.

INSTALLING PACKET TRACER:

To download Packet Tracer, go to **https://www.netacad.com** and log in with your Cisco Networking Academy credentials; then, click on the Packet Tracer graphic and download the package appropriate for your operating system. (Can be used to download in your laptop).

Windows

Installation in Windows is pretty simple and straightforward; the setup comes in a single file named Packettracer_Setup6.0.1.exe. Open this file to begin the setup wizard, accept the license agreement, choose a location, and start the installation.

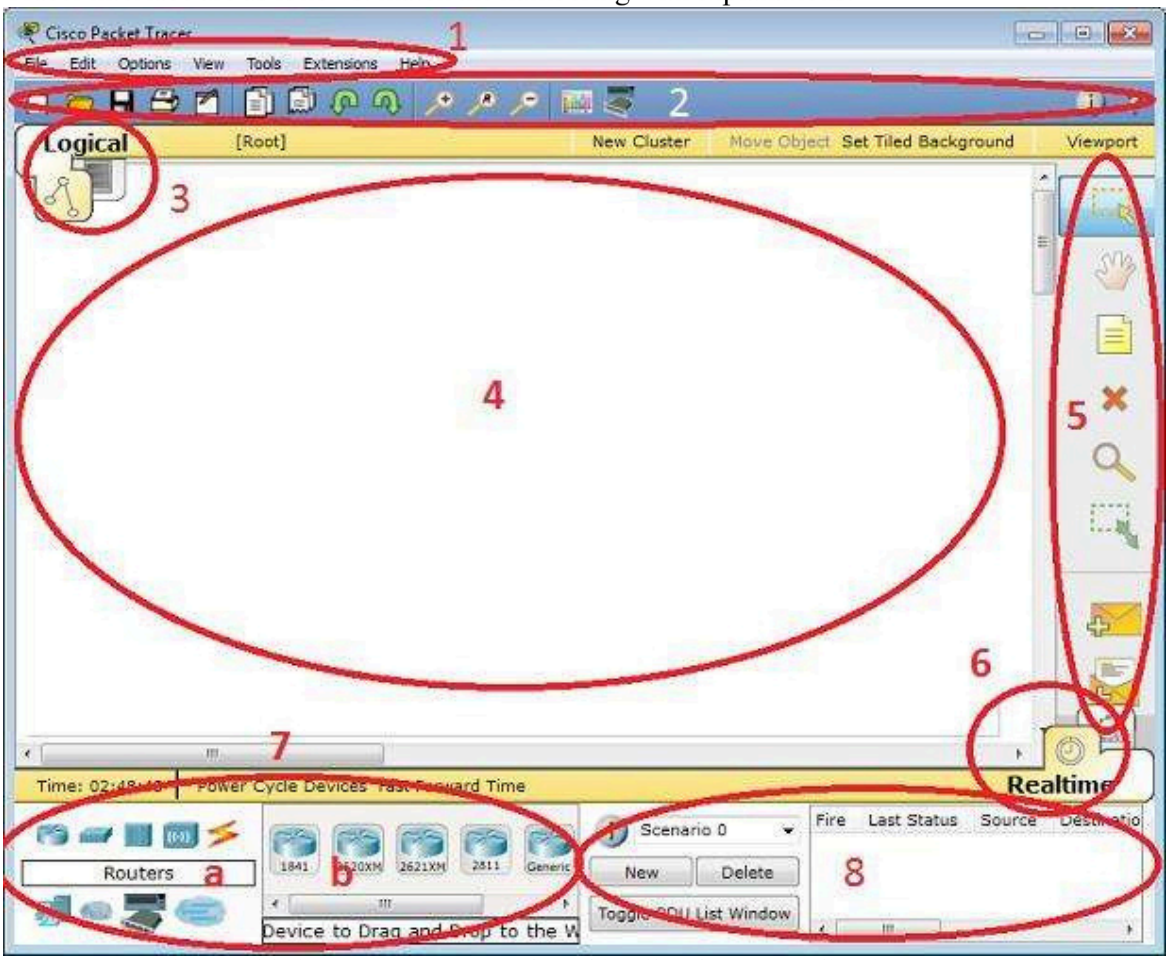
Linux

Linux users with an Ubuntu/Debian distribution should download the file for Ubuntu, and those using Fedora/Redhat/CentOS must download the file for Fedora. Grant executable permission to this file by using chmod, and execute it to begin the installation.

```
chmod +x PacketTracer601_i386_installer-rpm.bin
        ./PacketTracer601_i386_installer-rpm.bin
```

USER INTERFACE OVERVIEW:

The layout of Packet Tracer is divided into several components. The components of the Packet Tracer interface are as follows: match the numbering with explanations.



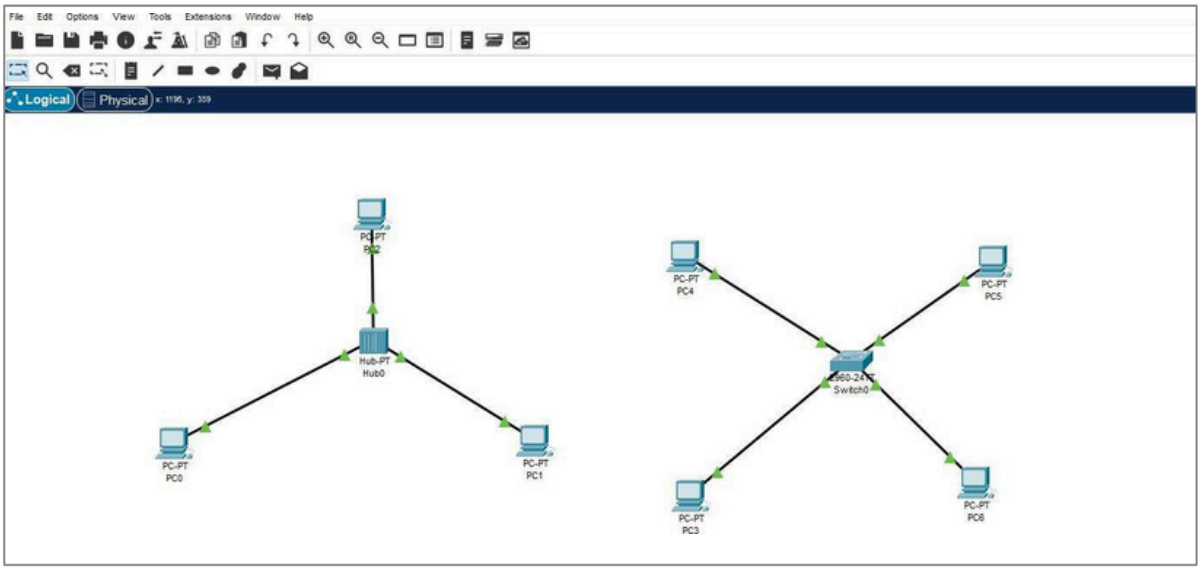
1. Menu bar – This is a common menu found in all software applications; it is used to open, save, print, change preferences, and so on.
2. Main toolbar – This bar provides shortcut icons to menu options that are commonly accessed, such as open, save, zoom, undo, and redo, and on the right-hand side is an icon for entering network information for the current network.
3. Logical/Physical workspace tabs – These tabs allow you to toggle between the Logical and Physical work areas.
4. Workspace – This is the area where topologies are created and simulations are displayed.
5. Common tools bar – This toolbar provides controls for manipulating topologies, such as select, move layout, place note, delete, inspect, resize shape, and add simple/complex PDU.
6. Real-time/Simulation tabs – These tabs are used to toggle between the real and simulation modes. Buttons are also provided to control the time, and to capture the packets.
7. Network component box – This component contains all of the network and end devices available with Packet Tracer, and is further divided into two areas: Area 7a: Device-type selection box – This area contains device categories Area 7b: Device-specific selection box – When a device category is selected, this selection box displays the different device models within that category

8. User-created packet box – Users can create highly-customized packets to test their topology from this area, and the results are displayed as a list.

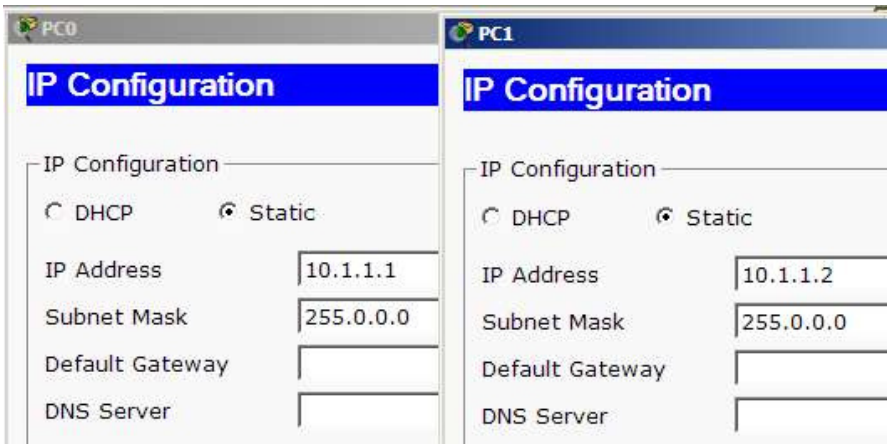
d) Analyse the behaviour of network devices using CISCO PACKET TRACER simulator.

1. From the network component box, click and drag-and-drop the below components:
    a. 4 Generic PCs and One HUB
    b. 4 Generic PCs and One switch

2. Click on Connections:
    a. Click on Copper Straight-Through cable,
    b. Select one of the PC and connect it to HUB using the cable. The link LED should glow in green, indicating that the link is up. Similarly connect remaining 3 PCs to the HUB.
    c. Similarly connect 4 PCs to the switch using copper straight-through cable.



3. Click on the PCs connected to hub, go to the Desktop tab, click on IP Configuration, and enter an IP address and subnet mask. Here, the default gateway and DNS server information is not needed as there are only two end devices in the network.



Click on the PDU (message icon) from the common tool bar,

a. Drag and drop it on one of PC (source machine) and then drop it on another PC (destination machine) connected to the HUB.

4. Observe the flow of PDU from source PC to destination PC by selecting the Realtime mode of simulation.

5. Repeat step #3 to step #5 for the PCs connected to the switch.

6. Observe how HUB and switch are forwarding the PDU and write your observation and conclusion about the behaviors of Switch and HUB.

Student observation:

a. From your observation write down the behavior of Switch and HUB in terms of forwarding the packets received by them.

b. Find out the network topology implemented in your college and draw and label that topology in your observation book.

Practical-6

AIM: Write a program to implement error detection and correction using HAMMING code concept. Make a test run to input data stream and verify error correction feature.

Error Correction at Data Link Layer:
Hamming code is a set of error-correction codes that can be used to detect and correct the errors that can occur when the data is transmitted from the sender to the receiver. It is a technique developed by R.W. Hamming for error correction.

Create sender program with below features.

1. Input to sender file should be a text of any length. Program should convert the text to binary.
2. Apply hamming code concept on the binary data and add redundant bits to it.
3. Save this output in a file called channel.

Create a receiver program with below features

1. Receiver program should read the input from Channel file.
2. Apply hamming code on the binary data to check for errors.
3. If there is an error, display the position of the error.
4. Else remove the redundant bits and convert the binary data to ascii and display the output.

Student observation:-

Write the code here:

```
import numpy as np

# Function to convert text to binary
def text_to_binary(text):
return ''.join(format(ord(char), '08b') for char in text)

# Function to convert binary to text
def binary_to_text(binary_data):
chars = [chr(int(binary_data[i:i+8], 2)) for i in range(0, len(binary_data), 8)]
return ''.join(chars)

# Function to calculate redundant bits needed for Hamming Code
def calculate_redundant_bits(m):
r = 0
while (2 ** r) < (m + r + 1):
r += 1
return r

# Function to apply Hamming Code to add redundant bits to binary data
def apply_hamming_code(data):
m = len(data)
r = calculate_redundant_bits(m)
```

Practical-6

```
hamming_code = ['0'] * (m + r)
j = 0
k = 1
for i in range(1, m + r + 1):
if i == 2 ** j:
j += 1
else:
hamming_code[i - 1] = data[-k]
k += 1

for i in range(r):
x = 2 ** i
one_count = 0
for j in range(1, m + r + 1):
if j & x and hamming_code[j - 1] == '1':
one_count += 1
hamming_code[x - 1] = '1' if one_count % 2 != 0 else '0'

return ''.join(hamming_code[::-1])

# Function to detect and correct errors in Hamming Code
def detect_and_correct_hamming_code(data):
n = len(data)
r = calculate_redundant_bits(n)
error_position = 0
for i in range(r):
x = 2 ** i
one_count = 0
for j in range(1, n + 1):
if j & x and data[-j] == '1':
one_count += 1
if one_count % 2 != 0:
error_position += x

if error_position > 0:
print(f"Error detected at position: {error_position}")
data = list(data)
data[-error_position] = '1' if data[-error_position] == '0' else '0'
data = ''.join(data)
else:
print("No error detected.")

# Removing redundant bits
corrected_data = []
j = 0
for i in range(1, n + 1):
if i != 2 ** j:
corrected_data.append(data[-i])
else:
```

Practical-6

```
j += 1

return ''.join(corrected_data[::-1])

# Sender Program
def sender(text):
binary_data = text_to_binary(text)
encoded_data = apply_hamming_code(binary_data)
with open("channel.txt", "w") as f:
f.write(encoded_data)
print("Data has been sent to channel.txt.")

# Receiver Program
def receiver():
with open("channel.txt", "r") as f:
encoded_data = f.read()
print(f"Received encoded data: {encoded_data}")
corrected_data = detect_and_correct_hamming_code(encoded_data)
decoded_text = binary_to_text(corrected_data)
print(f"Decoded text after error correction: {decoded_text}")

# Example Usage
# Enter text to send
text_to_send = "Hello"  # Modify the text to test
sender(text_to_send)
receiver()
```

Input:-
Text to send: "Hello"

Output:

Received encoded data: 0100100001100110101101100011010100011001110100
No error detected.
Decoded text after error correction: Hello

Practical-7

AIM: Write a program to implement flow control at data link layer using SLIDING WINDOW PROTOCOL. Simulate the flow of frames from one node to another.

Program should achieve at least below given requirements. You can make it a bidirectional program wherein receiver is sending its data frames with acknowledgement (Piggybacking).

Create a sender program with following features:-

1. Input Window size from the user.
2. Input a Text message from the user.
3. Consider 1 character per frame.
4. Create a frame with following fields [Frame no., DATA].
5. Send the frames. [Print the output on screen and save it in a file called Sender_Buffer.]
6. Wait for the acknowledgement from the Receiver. [Induce delay in the program]
7. Reader a file called Receiver_Buffer.
8. Check ACK field for the Acknowledgement number.
9. If the Acknowledgement number is as expected, send new set of frames accordingly, [overwrite the Sender_Buffer file with new frames] Else if NACK is received, resend the frames accordingly. [Overwrite the Sender_Buffer with old frame].

Create a receiver file with following features

1. Reader a file called Sender_Buffer.
2. Check the Frame no.
3. If the Fame no. are as expected, write the appropriate ACK no. in the Receiver_ Buffer file. Else write NACK no. in the Receiver_Buffer file.

NOTE: Induce error and verify the behaviour of the program. Manually Change the Frame no and Ack no in the files].

Student observation:

Write the code here:

```
import random

# Constants for ACK and NACK
ACK = "ACK"
NACK = "NACK"

# Sliding window protocol implementation
def sliding_window_protocol(window_size, message):
# Split the message into frames (1 character per frame)
frames = [(i, message[i]) for i in range(len(message))]
current_window_start = 0
current_window_end = min(window_size, len(frames))
expected_ack = current_window_start

while current_window_start < len(frames):
print("\n--- SENDING WINDOW ---")
```

Practical-7

```
# Send frames in the current window
for i in range(current_window_start, current_window_end):
frame_no, data = frames[i]
print(f"Sent frame {frame_no} with data '{data}'.")

# Simulate Receiver side: Acknowledge frames
print("\n--- RECEIVER WINDOW ---")
for i in range(current_window_start, current_window_end):
frame_no, data = frames[i]

# Randomly decide to send ACK or NACK (to simulate error)
ack_type = ACK if random.random() > 0.2 else NACK  # 20% chance of NACK
if ack_type == ACK:
print(f"Frame {frame_no} received correctly. Sending {ACK}.")
else:
print(f"Error in frame {frame_no}. Sending {NACK}.")
expected_ack = frame_no  # Reset to the frame needing retransmission
break
else:
# If no errors in the window, move to the next set of frames
expected_ack = current_window_end

# Update window based on the acknowledgments received
if expected_ack == current_window_end:
print("All frames in the window acknowledged correctly. Moving window forward.")
current_window_start += window_size
current_window_end = min(current_window_start + window_size, len(frames))
else:
print(f"Resending frames from frame {expected_ack} due to error.")
current_window_start = expected_ack
current_window_end = min(current_window_start + window_size, len(frames))

print("\nAll frames sent and acknowledged successfully.")

# User input for window size and message
window_size = int(input("Enter window size: "))
message = input("Enter the message to send: ")

# Run the sliding window protocol
sliding_window_protocol(window_size, message)
```

Practical-7

Input:

Enter window size: 3
Enter the message to send: HELLO

Output:

--- SENDING WINDOW ---
Sent frame 0 with data 'H'.
Sent frame 1 with data 'E'.
Sent frame 2 with data 'L'.
--- RECEIVER WINDOW ---
Error in frame 0.
Sending NACK.
Resending frames from frame 0 due to error.
--- SENDING WINDOW ---
Sent frame 0 with data 'H'.
Sent frame 1 with data 'E'.
Sent frame 2 with data 'L'.
--- RECEIVER WINDOW ---
Frame 0 received correctly.
Sending ACK.
Frame 1 received correctly.
Sending ACK.
Frame 2 received correctly.
Sending ACK.
All frames in the window acknowledged correctly.
Moving window forward.
--- SENDING WINDOW ---
Sent frame 3 with data 'L'.
Sent frame 4 with data 'O'.
--- RECEIVER WINDOW ---
Error in frame 3.
Sending NACK.
Resending frames from frame 3 due to error.
--- SENDING WINDOW ---
Sent frame 3 with data 'L'.
Sent frame 4 with data 'O'.
--- RECEIVER WINDOW ---
Frame 3 received correctly.
Sending ACK. Error in frame 4.
Sending NACK.
Resending frames from frame 4 due to error.

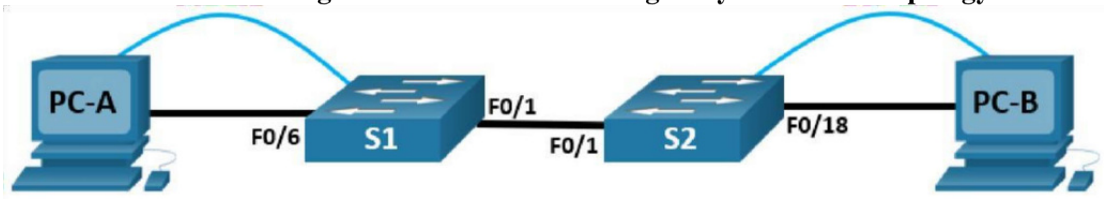
Practical-7

```
--- SENDING WINDOW ---
Sent frame 4 with data 'O'.
--- RECEIVER WINDOW ---
Frame 4 received correctly.
Sending ACK.
All frames in the window acknowledged correctly.
Moving window forward.
All frames sent and acknowledged successfully.
```

Practical-8

AIM: - a) Simulate Virtual LAN configuration using CISCO Packet Tracer Simulation.

Packet Tracer - Configure VLANs and Trunking - Physical Mode Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
S1	VLAN 1	192.168.1.11	255.255.255.0	N/A
S2	VLAN 1	192.168.1.12	255.255.255.0	N/A
PC-A	NIC	192.168.10.3	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.10.4	255.255.255.0	192.168.10.1

Blank Line - no additional information

Objectives

Part 1: Build the Network and Configure Basic Device Settings
Part 2: Create VLANs and Assign Switch Ports
Part 3: Maintain VLAN Port Assignments and the VLAN Database Part 4: Configure an 802.1Q Trunk between the Switches

Background / Scenario

Modern switches use virtual local-area networks (VLANs) to improve network performance by separating large Layer 2 broadcast domains into smaller ones. VLANs can also be used as a security measure by controlling which hosts can communicate. In general, VLANs make it easier to design a network to support the goals of an organization.
VLAN trunks are used to span VLANs across multiple devices. Trunks allow the traffic from multiple VLANS to travel over a single link, while keeping the VLAN identification and segmentation intact.
In this Packet Tracer Physical Mode (PTPM) activity, you will create VLANs on both switches in the topology, assign VLANs to switch access ports, and verify that VLANs are working as expected. You will then create a VLAN trunk between the two switches to allow hosts in the same VLAN to communicate through the trunk, regardless of which switch to which the host is attached.

Instructions

Part 1: Build the Network and Configure Basic Device Settings

Step 1: Build the network as shown in the topology.

Attach the devices as shown in the topology diagram, and cable as necessary. a. Click and drag both switch **S1** and **S2** to the **Rack**.

b. Click and drag both **PC-A** and **PC-B** to the **Table** and use the power button to turn them on.

c. Provide network connectivity by connecting **Copper Straight-through** cables, as shown in the topology.
d. Connect **Console Cable** from device **PC-A** to **S1** and from device **PC-B** to **S2**.

Step 2: Configure basic settings for each switch.

a. From the **Desktop Tab** on each PC, use the **Terminal** to console into each switch and enable privileged EXEC mode.
Open configuration window
b. Enter configuration mode.
c. Assign a device name to each switch.
d. Assign **class** as the privileged EXEC encrypted password.
e. Assign **cisco** as the console password and enable login.
f. Assign **cisco** as the vty password and enable login.
g. Encrypt the plaintext passwords.
h. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.
i. Configure the IP address listed in the Addressing Table for VLAN 1 on the switch.
Note: The VLAN 1 address is not grade because you will remove it later in the activity. However, you will need VLAN 1 to test connectivity later in this Part.
j. Shut down all interfaces that will not be used.
k. Set the clock on each switch.
Note: The clock setting cannot be graded in Packet Tracer.
l. Save the running configuration to the startup configuration file.
Close configuration window

Step 3: Configure PC hosts.

From the **Desktop** tab on each **PC**, click IP Configuration and enter the addressing information as displayed in the Addressing Table.

Step 4: Test connectivity.

Test network connectivity by attempting to ping between each of the cabled devices.

Questions:

Can PC-A ping PC-B?
Can PC-A ping S1?
Can PC-B ping S2?
Can S1 ping S2?

Close configuration window

Part 2: Create VLANs and Assign Switch Ports

In Part 2, you will create Management, Operations, Parking Lot, and Native VLANs on both switches. You will then assign the VLANs to the appropriate interface. The **show vlan** command is used to verify your configuration settings.

Step 1: Create VLANs on the switches.

From the **Desktop Tab** on each **PC**, use Terminal to continue configuring both network switches.

Open configuration window

a. Create the VLANs on **S1**.

```
S1(config)# vlan 10
S1(config-vlan)# name Operations
S1(config-vlan)# vlan 20
S1(config-vlan)# name Parking_Lot
S1(config-vlan)# vlan 99
S1(config-vlan)# name Management
S1(config-vlan)# vlan 1000
S1(config-vlan)# name Native
S1(config-vlan)# end
```

b. Create the same VLANs on S2.

c. Issue the **show vlan brief** command to view the list of VLANs on **S1**.

```
S1# show vlan brief
```

```
VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                 Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                 Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                 Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                 Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                 Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                 Gi0/1, Gi0/2
                                                 active
                                                 active
                                                 active
                                                 active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

Questions:

What is the default VLAN?

What ports are assigned to the default VLAN?

Step 2: Assign VLANs to the correct switch interfaces.

a. Assign VLANs to the interfaces on **S1**.
   1) Assign PC-A to the Operation VLAN.
      S1(config)# **interface f0/6**
      S1(config-if)# **switchport mode access**
      S1(config-if)# **switchport access vlan 10**
   2) From VLAN 1, remove the management IP address and configure it on VLAN 99.
      S1(config)# **interface vlan 1**
      S1(config-if)# **no ip address**
      S1(config-if)# **interface vlan 99**
      S1(config-if)# **ip address 192.168.1.11 255.255.255.0**
      S1(config-if)# **end**

b. Issue the **show vlan brief** command and verify that the VLANs are assigned to the correct interfaces. c. Issue the **show ip interface brief** command.
   Question:
   What is the status of VLAN 99? Explain.

d. Assign **PC-B** to the Operations VLAN on **S2**.
e. From VLAN 1, remove the management IP address and configure it on VLAN 99 according to the Addressing Table.
f. Use the **show vlan brief** command to verify that the VLANs are assigned to the correct interfaces.
   Questions:
   Is S1 able to ping S2? Explain.
   Is PC-A able to ping PC-B? Explain.

Part 3: Maintain VLAN Port Assignments and the VLAN Database

In Part 3, you will change port VLAN assignments and remove VLANs from the VLAN database.

Step 1: Assign a VLAN to multiple interfaces.

From the **Desktop Tab** on each **PC**, use **Terminal** to continue configuring both network switches.

Open configuration window

a. On S1, assign interfaces F0/11 – 24 to VLAN99.
   S1(config)# **interface range f0/11-24**
   S1(config-if-range)# **switchport mode access**
   S1(config-if-range)# **switchport access vlan 99**
   S1(config-if-range)# **end**
b. Issue the **show vlan brief** command to verify VLAN assignments.
c. Reassign F0/11 and F0/21 to VLAN 10.
d. Verify that VLAN assignments are correct.

Step 2: Remove a VLAN assignment from an interface.

a. Use the **no switchport access vlan** command to remove the VLAN 99 assignment to F0/24.
   S1(config)# **interface f0/24**
   S1(config-if)# **no switchport access vlan**
   S1(config-if)# **end**
b. Verify that the VLAN change was made.
   Question:

Which VLAN is F0/24 now associated with?

Step 3: Remove a VLAN ID from the VLAN database.

a. Add VLAN 30 to interface F0/24 without issuing the global VLAN command.
S1(config)# **interface f0/24**
S1(config-if)# **switchport access vlan 30**
% Access VLAN does not exist. Creating vlan 30
Note: Current switch technology no longer requires that the **vlan** command be issued to add a VLAN to the database. By assigning an unknown VLAN to a port, the VLAN will be created and added to the VLAN database.

b. Verify that the new VLAN is displayed in the VLAN table.
Question:
What is the default name of VLAN 30?

c. Use the **no vlan 30** command to remove VLAN 30 from the VLAN database.
S1(config)# **no vlan 30**
S1(config)# **end**

d. Issue the **show vlan brief** command. F0/24 was assigned to VLAN 30.
Question:
After deleting VLAN 30 from the VLAN database, why is F0/24 no longer displayed in the output of the **show vlan brief** command? What VLAN is port F0/24 now assigned to? What happens to the traffic destined to the host that is attached to F0/24?

e. On interface F0/24, issue the **no switchport access vlan** command.

f. Issue the **show vlan brief** command to determine the VLAN assignment for F0/24.
Questions:
To which VLAN is F0/24 assigned?

Note: Before removing a VLAN from the database, it is recommended that you reassign all the ports assigned to that VLAN.

Why should you reassign a port to another VLAN before removing the VLAN from the VLAN database?

Close configuration window.

Part 4: Configure an 802.1Q Trunk Between the Switches

In Part 4, you will configure interface F0/1 to use the Dynamic Trunking Protocol (DTP) to allow it to negotiate the trunk mode. After this has been accomplished and verified, you will disable DTP on interface F0/1 and manually configure it as a trunk.

Step 1: Use DTP to initiate trunking on F0/1.

The default DTP mode of a 2960 switch port is dynamic auto. This allows the interface to convert the link to a trunk if the neighboring interface is set to trunk or dynamic desirable mode.

Open configuration window

a. On **S1**, set F0/1 to negotiate trunk mode.

S1(config)# **interface f0/1**
S1(config-if)# **switchport mode dynamic desirable**

Sep 19 02:51:47.257: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
Sep 19 02:51:47.291: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to up
You should also receive link status messages on S2.
S2#
Sep 19 02:42:19.424: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
Sep 19 02:42:21.454: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to up
Sep 19 02:42:22.419: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

b. On **S1** and **S2**, issue the **show vlan brief** command. Interface F0/1 is no longer assigned to VLAN 1. Trunked interfaces are not listed in the VLAN table.
c. Issue the **show interfaces trunk** command to view trunked interfaces. Notice that the mode on **S1** is set to desirable, and the mode on **S2** is set to auto.
S1# **show interfaces trunk**

S2# **show interfaces trunk**
Note: By default, all VLANs are allowed on a trunk. The **switchport trunk** command allows you to control what VLANs have access to the trunk. For this activity, keep the default settings. This allows all VLANs to traverse F0/1.

Close configuration window

d. Verify that VLAN traffic is traveling over trunk interface F0/1.
Questions:
Can S1 ping S2?
Can PC-A ping PC-B?
Can PC-A ping S1?
Can PC-B ping S2?

Step 2: Manually configure trunk interface F0/1.

The **switchport mode trunk** command is used to manually configure a port as a trunk. This command should be issued on both ends of the link.

a. On interface F0/1, change the switchport mode to force trunking. Make sure to do this on both switches.

Open configuration window

S1(config)# **interface f0/1**
S1(config-if)# **switchport mode trunk**

b. Issue the **show interfaces trunk** command to view the trunk mode. Notice that the mode changed from **desirable** to **on**.
S1# **show interfaces trunk**
c. Modify the trunk configuration on both switches by changing the native VLAN from VLAN 1 to VLAN 1000.
S1(config)# **interface f0/1**
S1(config-if)# **switchport trunk native vlan 1000**
d. Issue the **show interfaces trunk** command to view the trunk. Notice the Native VLAN information is updated.
S2# **show interfaces trunk**
Questions:
Why might you want to manually configure an interface to trunk mode instead of using DTP?
Why might you want to change the native VLAN on a trunk?

Close configuration window

Reflection Questions

1. What is needed to allow hosts on VLAN 10 to communicate to hosts on VLAN 99?
2. What are some primary benefits that an organization can receive through effective use of VLANs?

b) Design and configure a VLAN for the below given scenario.

There are 10 faculty in Robotics department, sitting in 3 different blocks. Design and configure a Virtual LAN for Robotics department (using switch and Ethernet cables) so that all the faculty are logically in the same LAN.

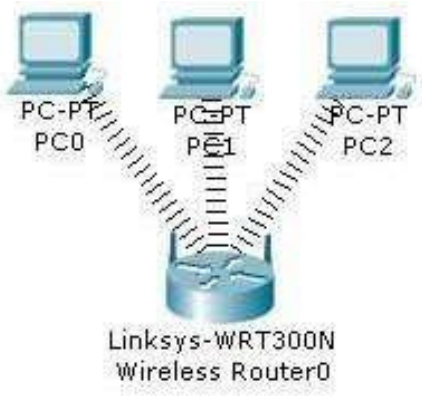
Student observation:-

a) Draw and Label the VLAN for Qb).
b) Show the ip configuration for each device.
c) Write the commands used for VLAN configuration in switch.

Practical-8

AIM:-b) Configuration of Wireless LAN using CISCO Packet Tracer.

Design a topology with three PCs connected from Linksys Wireless routers.



Perform following configuration:-

- Configure Static IP on PC and Wireless Router
- Set SSID to MotherNetwork
- Set IP address of router to 192.168.0.1, PC0 to 192.168.0.2, PC1 to 192.168.0.3 and PC2 to 192.168.0.4.
- Secure your network by configuring WAP key on Router
- Connect PC by using WAP key

To complete these tasks follow these step by step instructions:-

Step1:- Click on wireless router,

- Select Administration tab from top Menu, set username and password to admin and click on Save Setting.

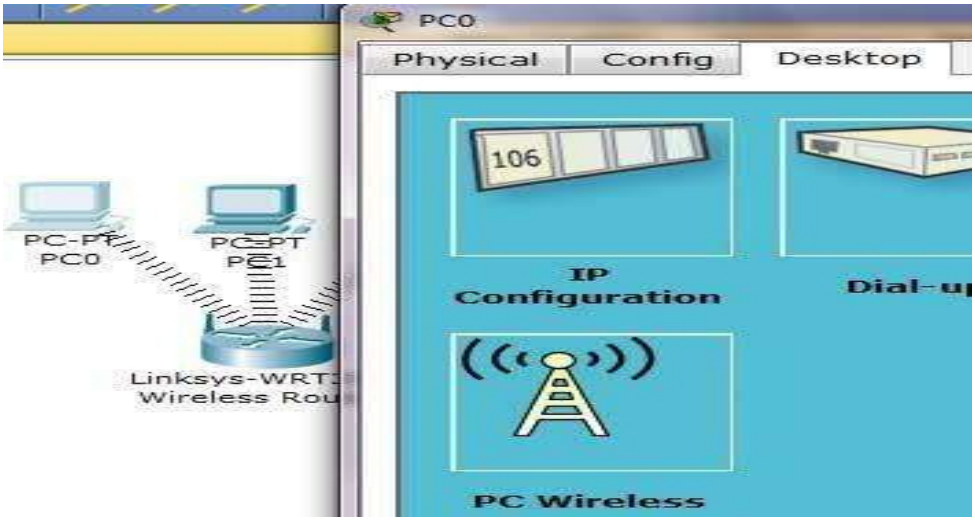
- Next click on wireless tab and set default SSID to MotherNetwork.
- Now Select wireless security and change Security Mode to WEP

- Set Key1 to 0123456789

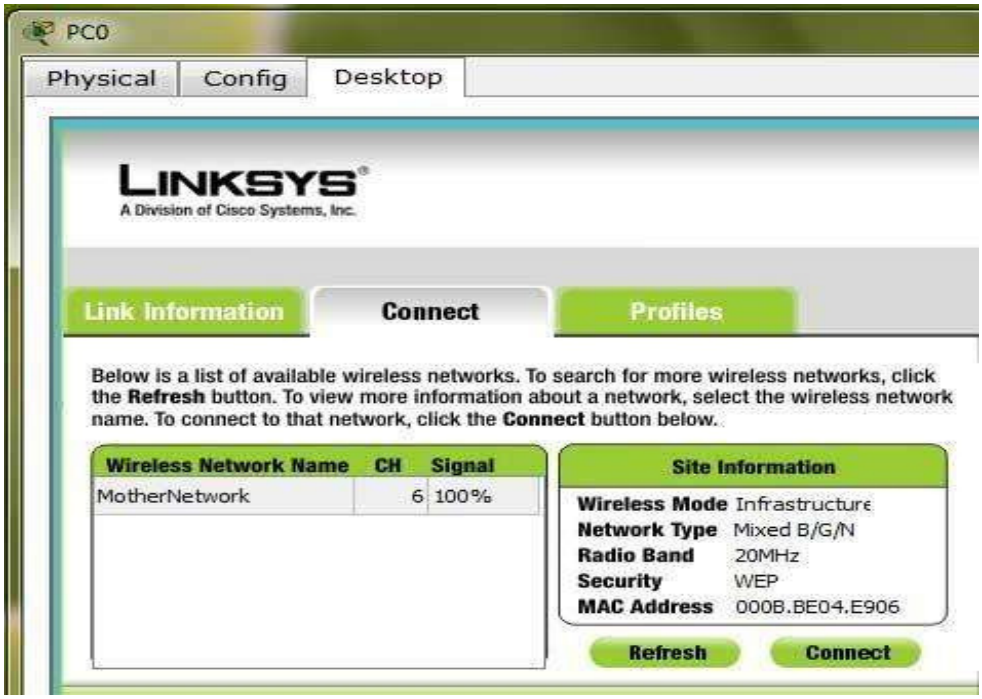
- Again go in the end of page and Click on Save Setting
- Now we have completed all given task on Wireless router. Now configure the static IP on all three PC's
- Double click on pc select Desktop tab click on IP configuration select Static IP and set IP as given below

PC	IP	Subnet Mask	Default Gateway
PC0	192.168.0.2	255.255.255.0	192.168.0.1
PC1	192.168.0.3	255.255.255.0	192.168.0.1
PC2	192.168.0.4	255.255.255.0	192.168.0.1

- Now it's time to connect PC's from Wireless router. To do so click PC select Desktop click on PC Wireless

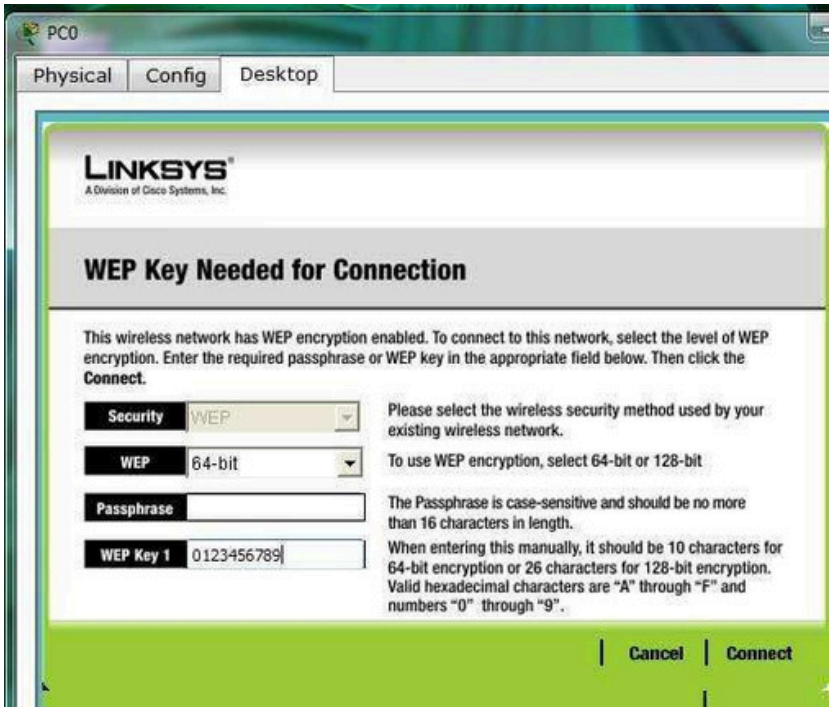


- Click on connect tab and click on Refresh button



As you can see in image that Wireless device is accessing MotherNetwork on CH 6 and signal strength is 100%. In left side you can see that WEP security is configured in network. Click on connect button to connect MotherNetwork

- It will ask for WAP key insert 0123456789 and click connect



It will connect you with wireless router.

As you can see in image below that system is connected. And PCI card is active.

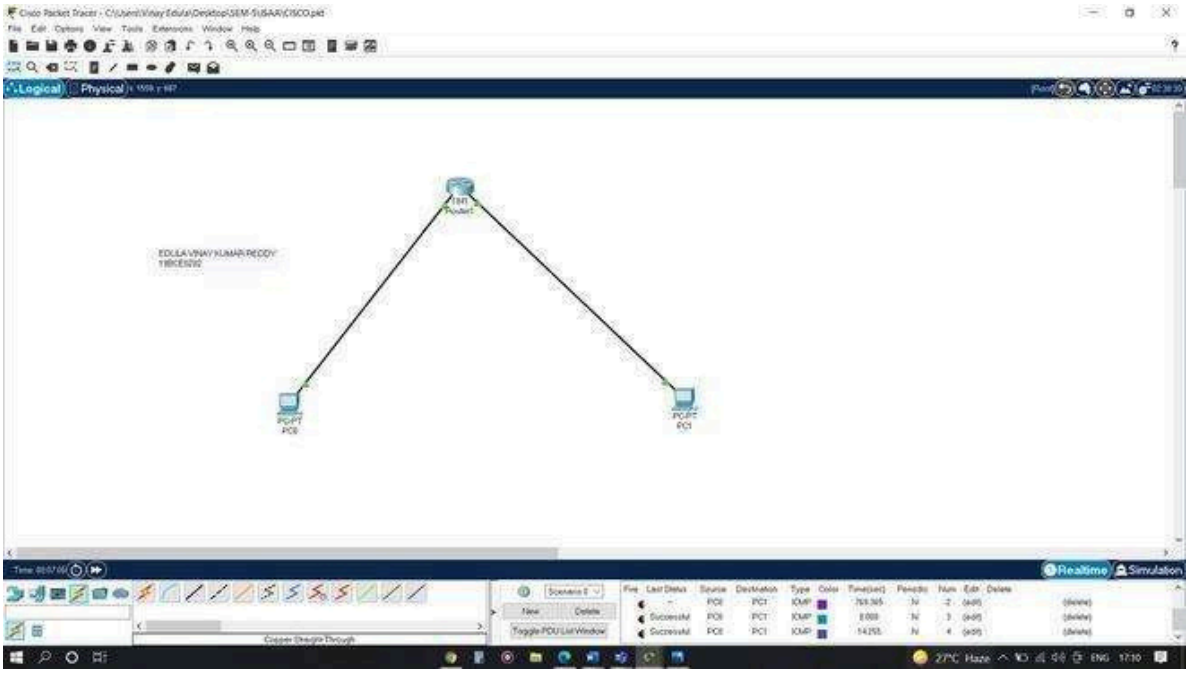
- Repeat same process on PC1 and PC2.

Practical-10

AIM:-a) Internetworking with routers in CISCO PACKET TRACER simulator.

d) Design and configure a simple internetwork using a router.

In this network, a router and 2 PCs are used. Computers are connected with routers using a copper straight-through cable. After forming the network, to check network connectivity a simple PDU is transferred from PC0 to PC1.



Procedure:

Step-1(Configuring Router1):

1. Select the router and Open CLI.
2. Press ENTER to start configuring Router1.
3. Type enable to activate the privileged mode.

Router1 Command Line Interface:

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 192.168.10.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
Router(config-if)#interface FastEthernet0/1
Router(config-if)#ip address 192.168.20.1 255.255.255.0
Router(config-if)#no shutdown

Step-2(Configuring PCs):

1. Assign IP Addresses to every PC in the network.
2. Select the PC, Go to the desktop and select IP Configuration and assign an IP address, Default gateway, Subnet Mask
3. Assign the default gateway of PC0 as 192.168.10.1.
4. Assign the default gateway of PC1 as 192.168.20.1.

Step-3(Connecting PCs with Router):

1. Connect FastEthernet0 port of PC0 with FastEthernet0/0 port of Router1 using a copper straight-through cable.
2. Connect FastEthernet0 port of PC1 with FastEthernet0/1 port of Router1 using a copper straight-through cable.

Router Configuration Table:

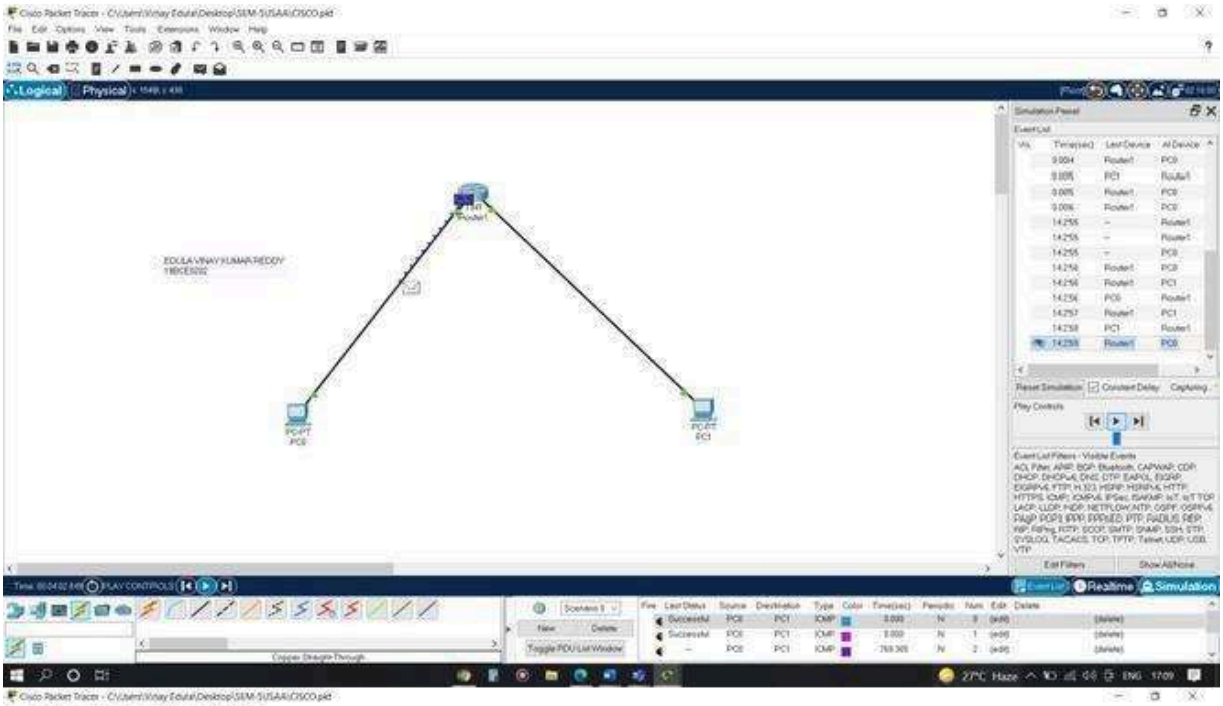
Device Name	IP address FastEthernet0 /0	Subnet Mask	IP Address FastEthernet0/1	Subnet Mask
Router1	192.168.10.1	255.255.255.0	192.168.20.1	255.255.255.0

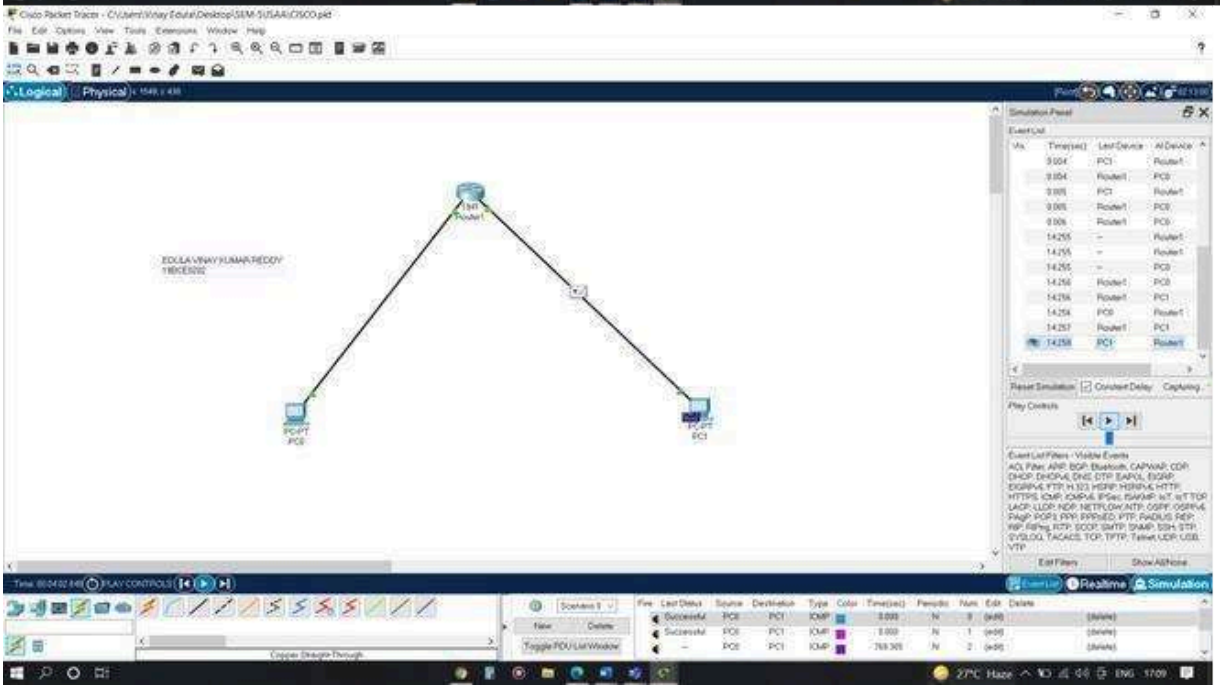
PC Configuration Table:

Device Name	IP address	Subnet Mask	Gateway
PC 0	192.168.10.2	255.255.255.0	192.168.10.1
PC 1	192.168.20.2	255.255.255.0	192.168.20.1

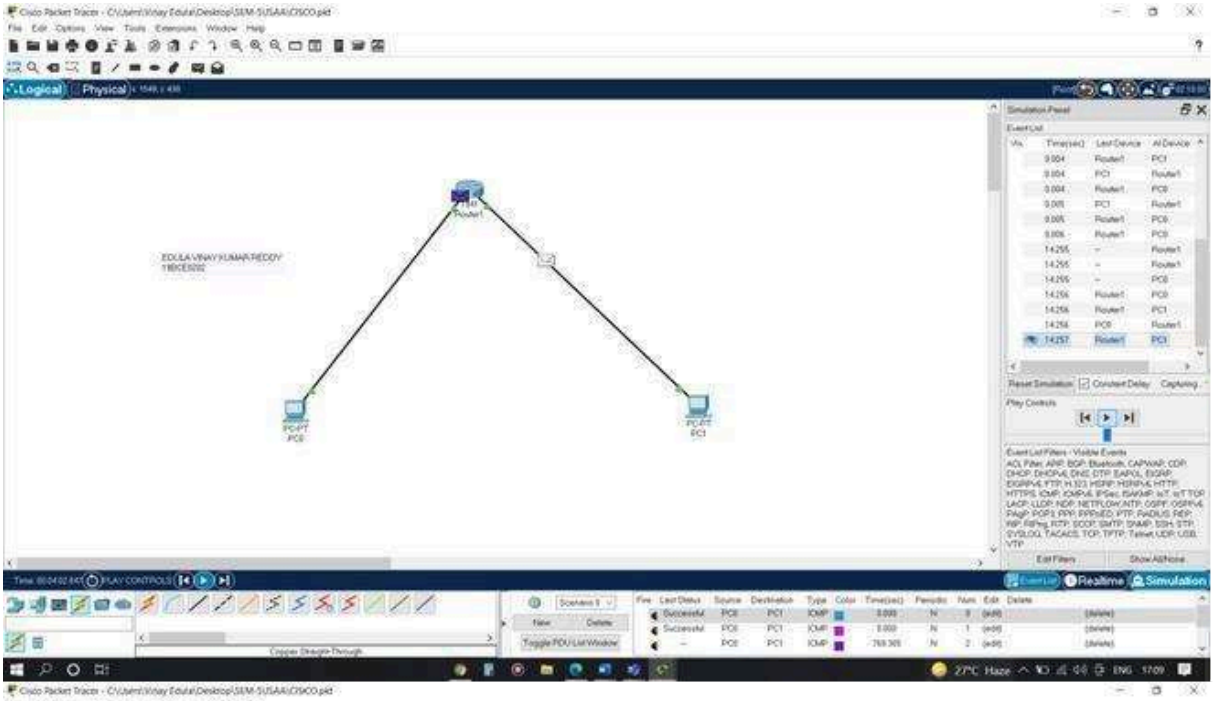
Designed Network topology:
Simulation of Designed Network Topology:

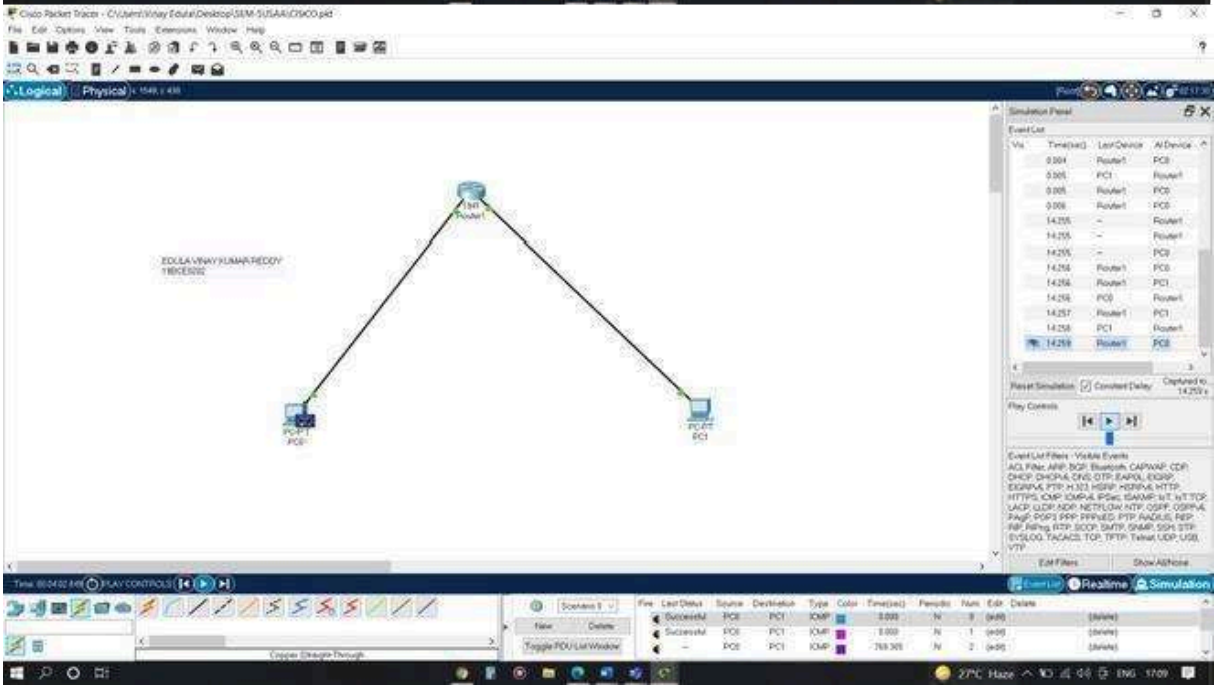
Sending a PDU From PC0 to PC1:





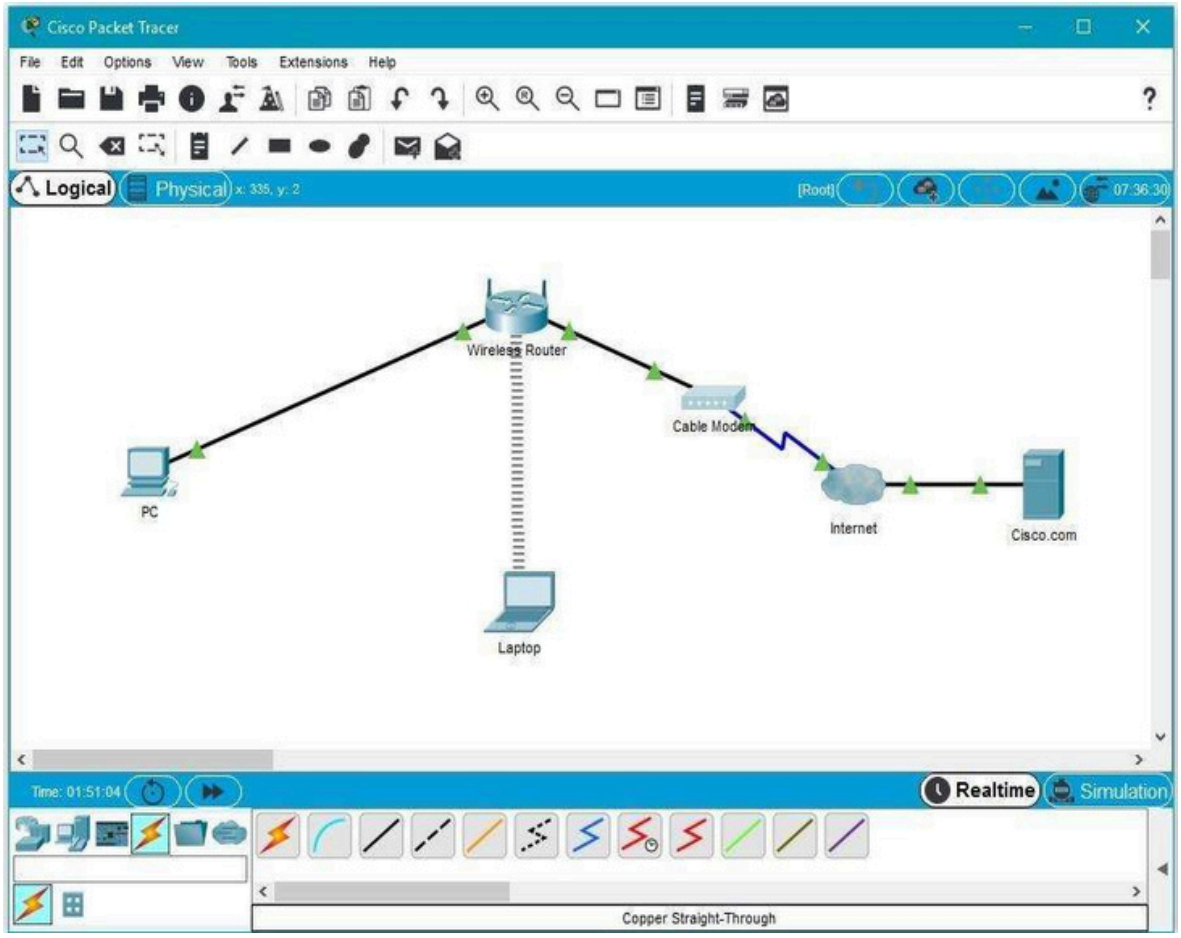
Acknowledgment From PC1 to PC0:





Practical 10

AIM:- b) Design and configure an internetwork using wireless router, DHCP server and internet cloud.



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
PC	Ethernet0	DHCP		192.168.0.1
Wireless Router	LAN	192.168.0.1	255.255.255.0	
Wireless Router	Internet	DHCP		
Cisco.com Server	Ethernet0	208.67.220.220	255.255.255.0	
Laptop	Wireless0	DHCP		

Objectives

Part 1: Build a Simple Network in the Logical Topology Workspace

Part 2: Configure the Network Devices
Part 3: Test Connectivity between Network Devices Part 4: Save the File and Close Packet Tracer

Part 1: Build a Simple Network in the Logical Topology Workspace

Step 1: Launch Packet Tracer.

Step 2: Build the topology

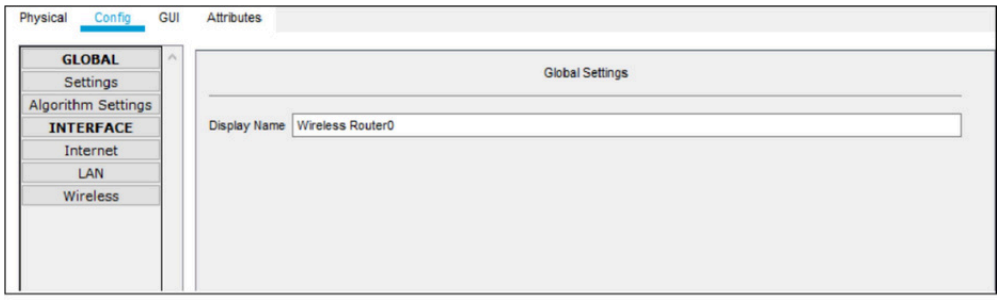
a. Add network devices to the workspace.

Using the device selection box, add the network devices to the workspace as shown in the topology diagram.

To place a device onto the workspace, first choose a device type from the **Device-Type Selection** box. Then, click on the desired device model from the **Device-Specific Selection** box. Finally, click on a location in the workspace to put your device in that location. If you want to cancel your selection, click the **Cancel** icon for that device. Alternatively, you can click and drag a device from the **Device-Specific Selection** box onto the workspace.

b. Change display names of the network devices.

To change the display names of the network devices click on the device icon on the Packet Tracer **Logical** workspace, then click on the **Config** tab in the device configuration window. Type the new name of the device into the **Display Name** box as show in the figure below.



c. Add the physical cabling between devices on the workspace

Using the device selection box, add the physical cabling between devices on the workspace as shown in the topology diagram.

The PC will need a copper straight-through cable to connect to the wireless router. Select the copper straight-through cable in the device selection box and attach it to the FastEthernet0 interface of the PC and the Ethernet 1 interface of the wireless router.

The wireless router will need a copper straight-through cable to connect to the cable modem. Select the copper straight-through cable in the device-selection box and attach it to the Internet interface of the wireless router and the Port 1 interface of the cable modem.

The cable modem will need a coaxial cable to connect to the Internet cloud. Select the coaxial cable in the device-selection box and attach it to the Port 0 interface of the cable modem and the coaxial interface of the Internet cloud.

The Interne cloud will need copper straight-through cable to connect to the Cisco.com server. Select the copper straight-through cable in the device-selection box and attach it to the Ethernet interface of the Internet cloud and the FastEthernet0 interface of the Cisco.com server.

Part 2: Configure the Network Devices

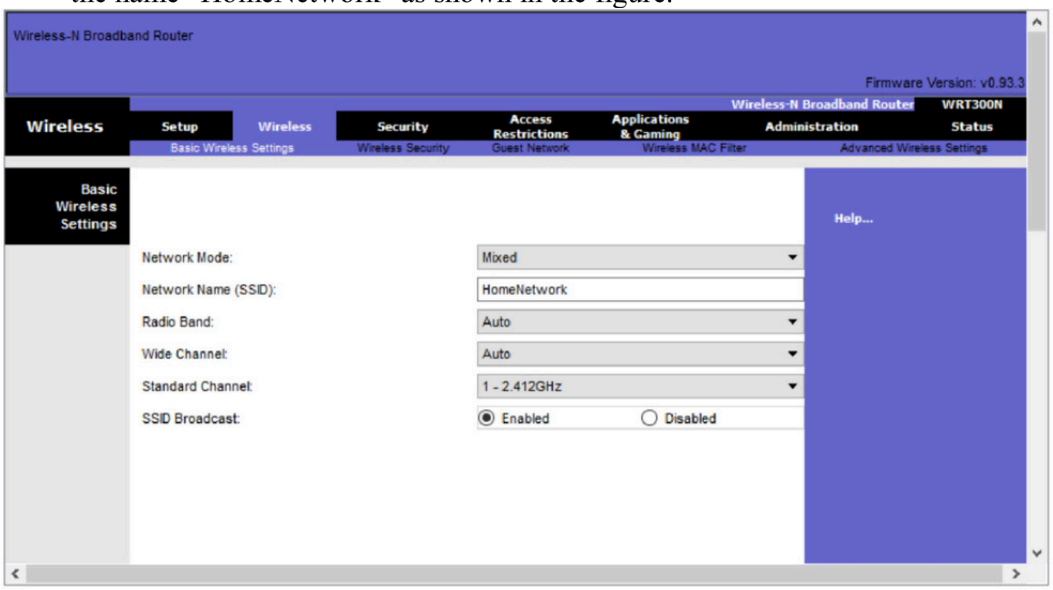
Step 1: Configure the wireless router

a. Create the wireless network on the wireless router

Click on the **Wireless Router** icon on the Packet Tracer **Logical** workspace to open the device configuration window.

In the wireless router configuration window, click on the **GUI** tab to view configuration options for the wireless router.

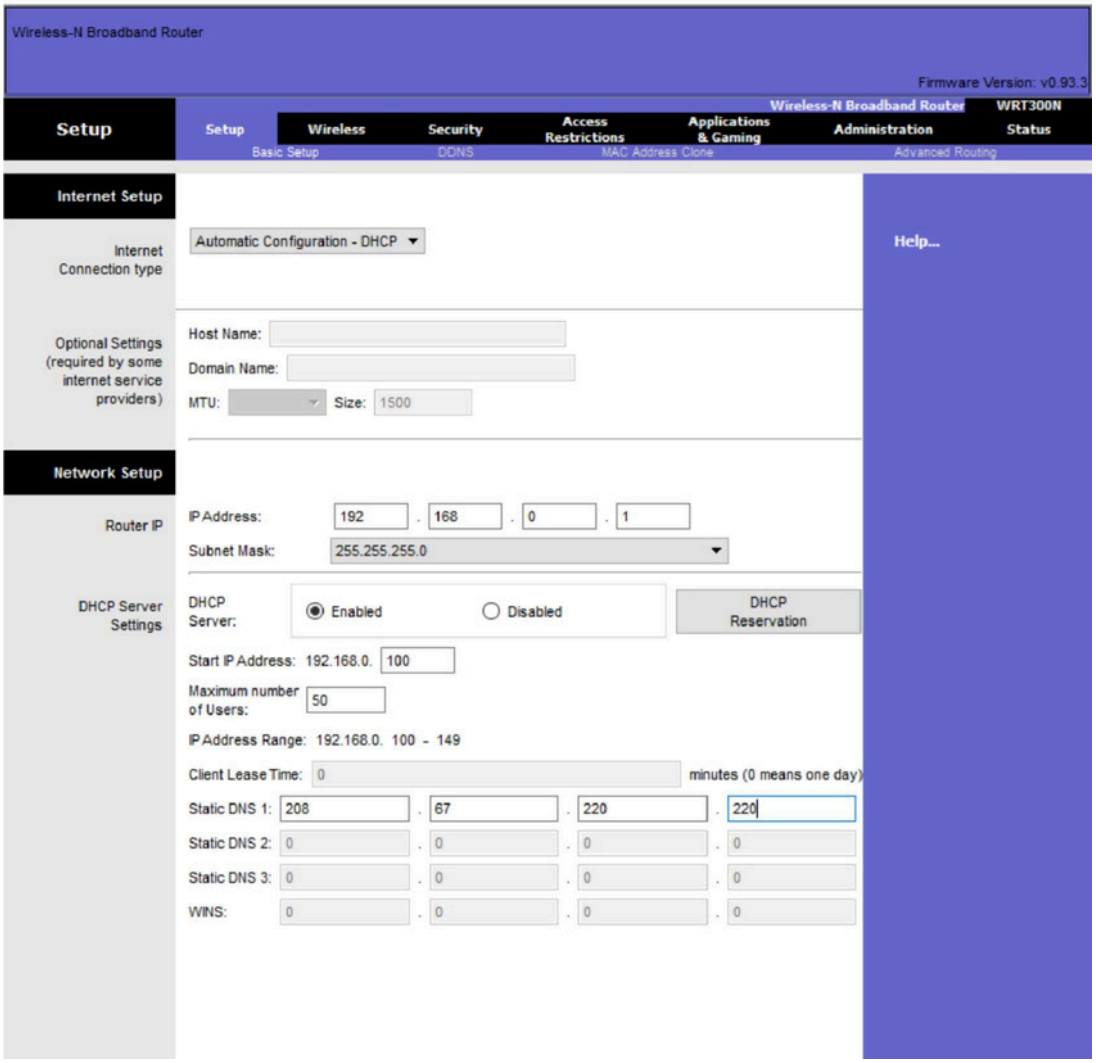
Next, click on the **Wireless** tab in the GUI to view the wireless settings. The only setting that needs to be changed from the defaults is the **Network Name (SSID)**. Here, type the name "HomeNetwork" as shown in the figure.



Configure the Internet connection on the wireless router
Click on the **Setup** tab in the wireless router GUI.

In the **DHCP Server** settings verify that the **Enabled** button is selected and configure the static IP address of the DNS server as 208.67.220.220 as shown in the figure.

b. Click on the **Save Settings** tab.



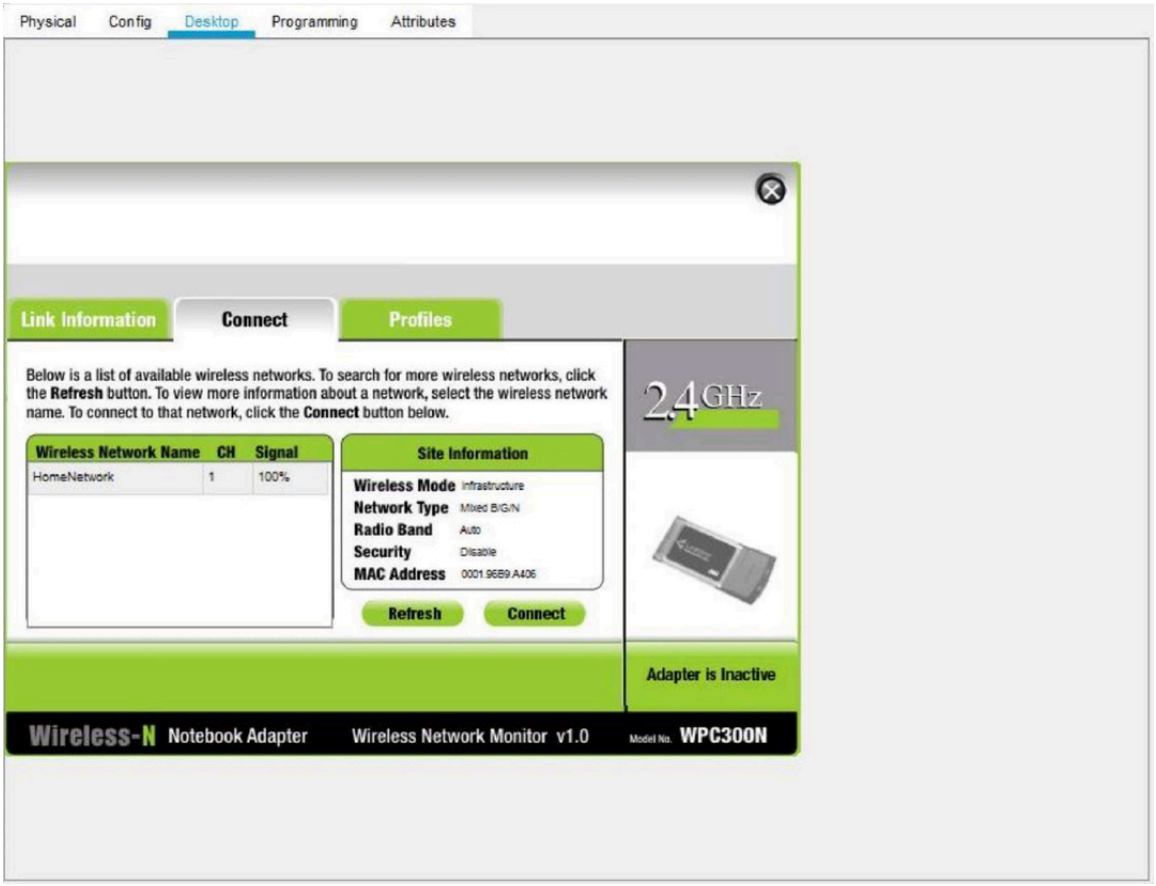
Step 2: Configure the laptop

a. Configure the Laptop to access the wireless network
Click on the Laptop icon on the Packet Tracer **Logical** workspace and in the laptop configuration windows select the **Physical** tab.
In the **Physical** tab you will need to remove the Ethernet copper module and replace it with the Wireless WPC300N module.
To do this, you first power the Laptop off by clicking the power button on the side of the laptop. Then remove the currently installed Ethernet copper module by clicking on the module on the side of the laptop and dragging it to the **MODULES** pane on the left of the laptop window. Then install the Wireless WPC300N module by clicking on it in the **MODULES** pane and dragging it to the empty module port on the side of the laptop. Power the laptop back on by clicking on the Laptop power button again.

With the wireless module installed, the next task is to connect the laptop to the wireless network.

Click on the **Desktop** tab at the top of the Laptop configuration window and select the **PC Wireless** icon.

Once the Wireless-N Notebook Adapter settings are visible, select the **Connect** tab. The wireless network "HomeNetwork" should be visible in the list of wireless networks as shown in the figure.
Select the network, and click on the **Connect** tab found below the **Site Information pane.**

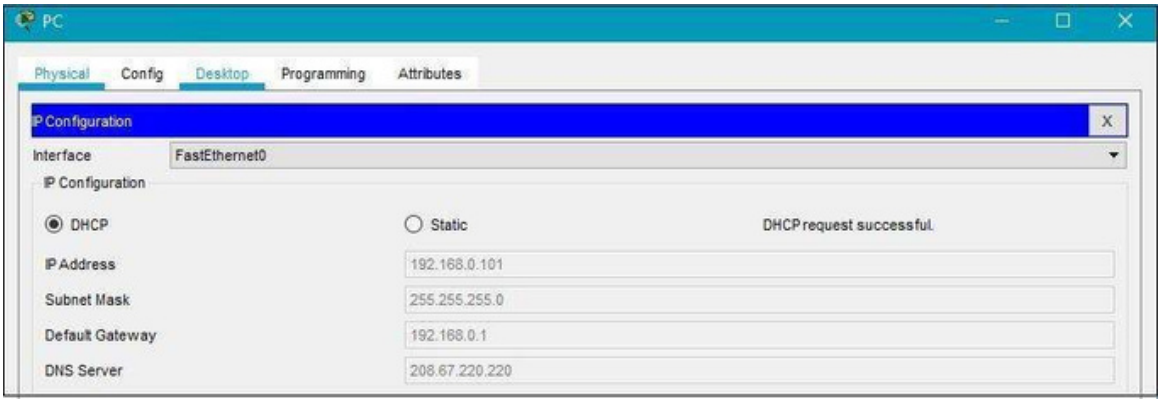


Step 3: Configure the PC

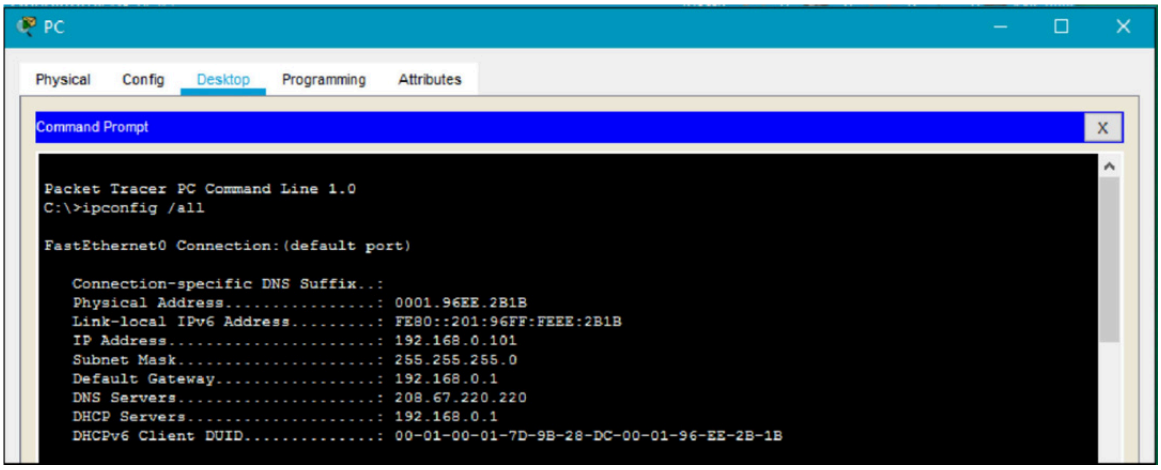
a. Configure the PC for the wired network

Click on the **PC** icon on the Packet Tracer **Logical** workspace and select the **Desktop** tab and then the **IP Configuration** icon.

In the IP Configuration window, select the **DCHP** radio button as shown in the figure so that the PC will use DCHP to receive an IPv4 address from the wireless router. Close the IP Configuration window.



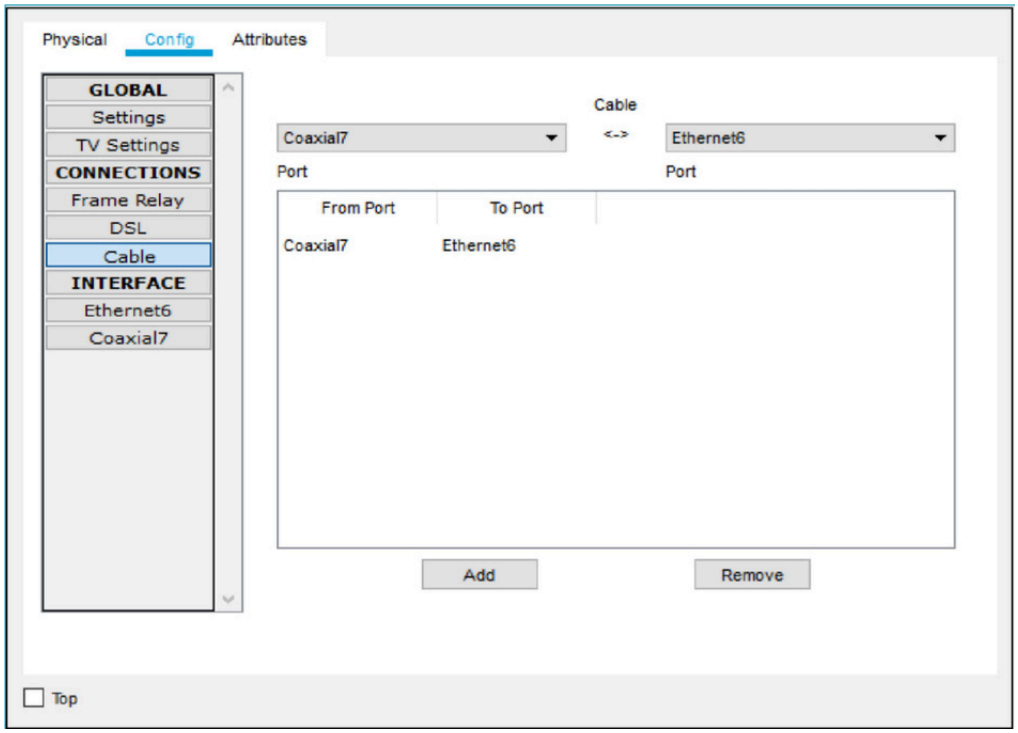
Click on the Command Prompt icon. Verify that the PC has received an IPv4 address by issuing the **ipconfig /all** command from the command prompt as shown in the figure. The PC should receive an IPv4 address in the 192.168.0.x range.



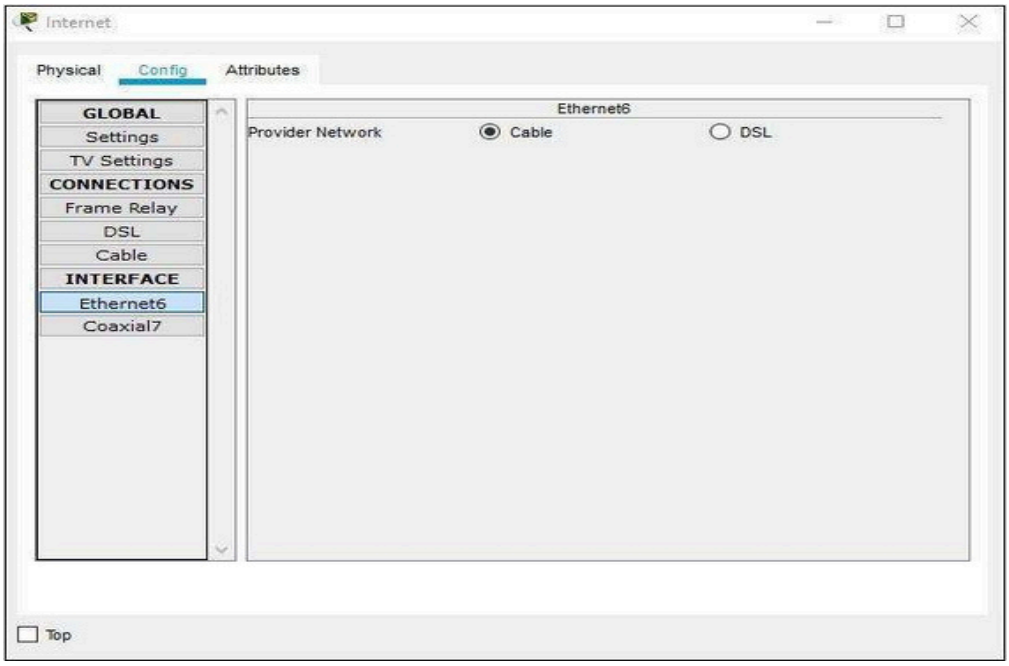
Step 4: Configure the Internet cloud

a. Install network modules if necessary
Click on the **Internet Cloud** icon on the Packet Tracer **Logical** workspace and then click on the **Physical** tab. The cloud device will need two modules if they are not already installed. The PT-CLOUD-NM-1CX which is for the cable modem service connection and the PT-CLOUD-NM-1CFE which is for a copper Ethernet cable connection. If these modules are missing, power off the physical cloud devices by clicking on the power button and drag each module to an empty module port on the device and then power the device back on.

b. Identify the From and To Ports
Click on the **Config** tab in the Cloud device window. In the left pane click on **Cable** under **CONNECTIONS**. In the first drop down box choose Coaxial and in the second drop down box choose
Ethernet then click the **Add** button to add these as the **From Port** and **To Port** as shown in the figure.



c. Identify the type of provider
While still in the **Config** tab click Ethernet under **INTERFACE** in the left pane. In the Ethernet configuration window select **Cable** as the Provider Network as shown in the figure.



Step 5: Configure the Cisco.com server

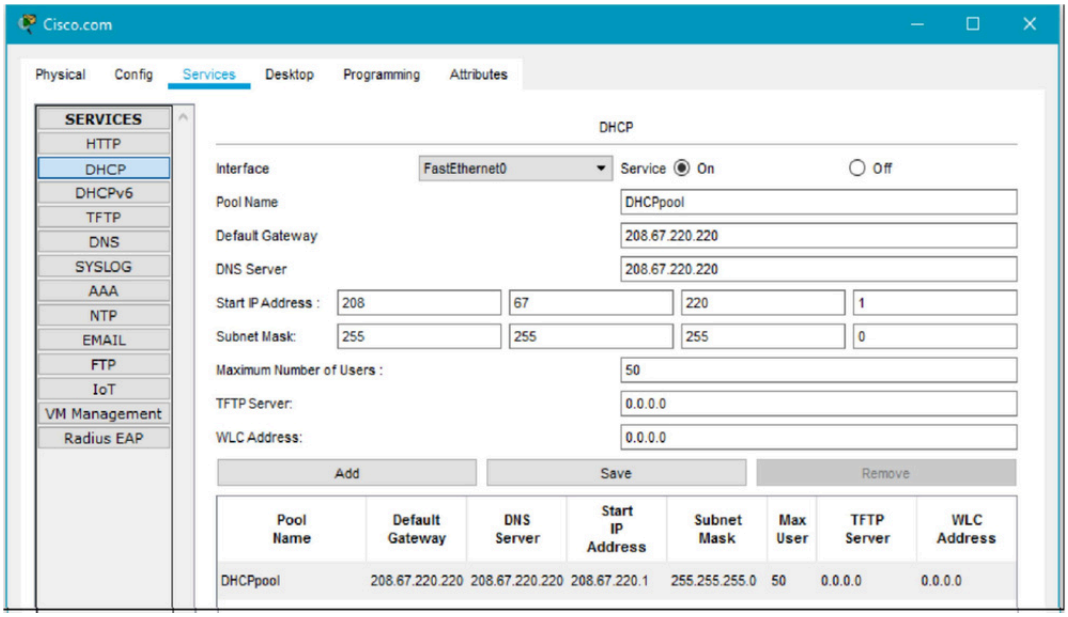
a. Configure the Cisco.com server as a DHCP server

Click on the Cisco.com server icon on the Packet Tracer **Logical** workspace and select the **Services** tab. Select **DHCP** from the **SERVICES** list in the left pane.

In the DHCP configuration window, configure a DHCP as shown in the figure with the following settings.

- Click **On** to turn the DCHP service on
- Pool name: DHCPpool
- Default Gateway: 208.67.220.220
- DNS Server: 208.67.220.220
- Starting IP Address: 208.67.220.1
- Subnet Mask 255.255.255.0
- Maximum number of Users: 50

Click **Add** to add the pool



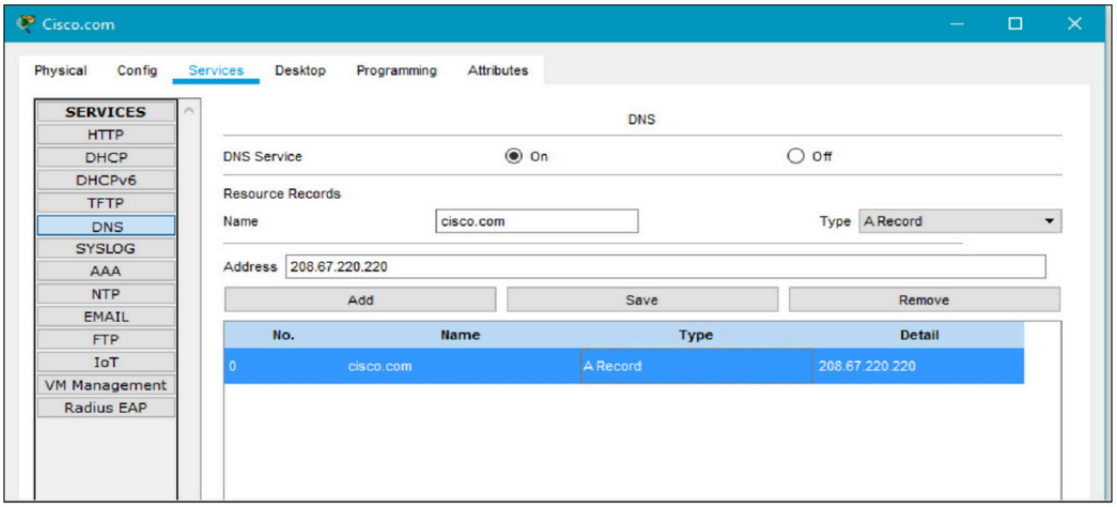
b. Configure the Cisco.com server as a DNS server to provide domain name to IPv4 address resolution.

While still in the **Services** tab, select **DNS** from the **SERVICES** listed in the left pane.

Configure the DNS service using the following settings as shown in the figure.

- Click **On** to turn the DNS service on
- Name: Cisco.com
- Type: A Record
- Address: 208.67.220.220

Click **Add** to add the DNS service settings



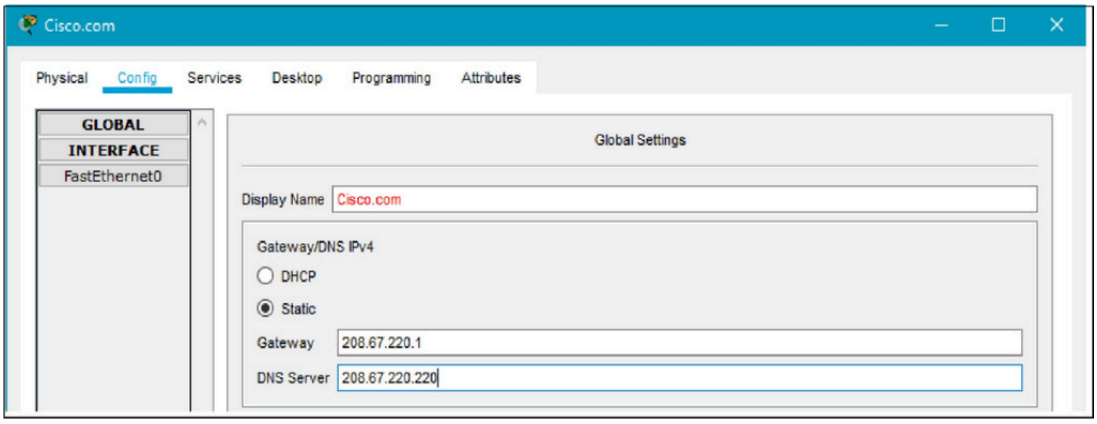
c. Configure the Cisco.com server Global settings.

Select the **Config** tab.

Click on **Settings** in left pane.

Configure the Global settings of the server as follows:

- Select **Static**
- Gateway: 208.67.220.1
- DNS Server: 208.67.220.220

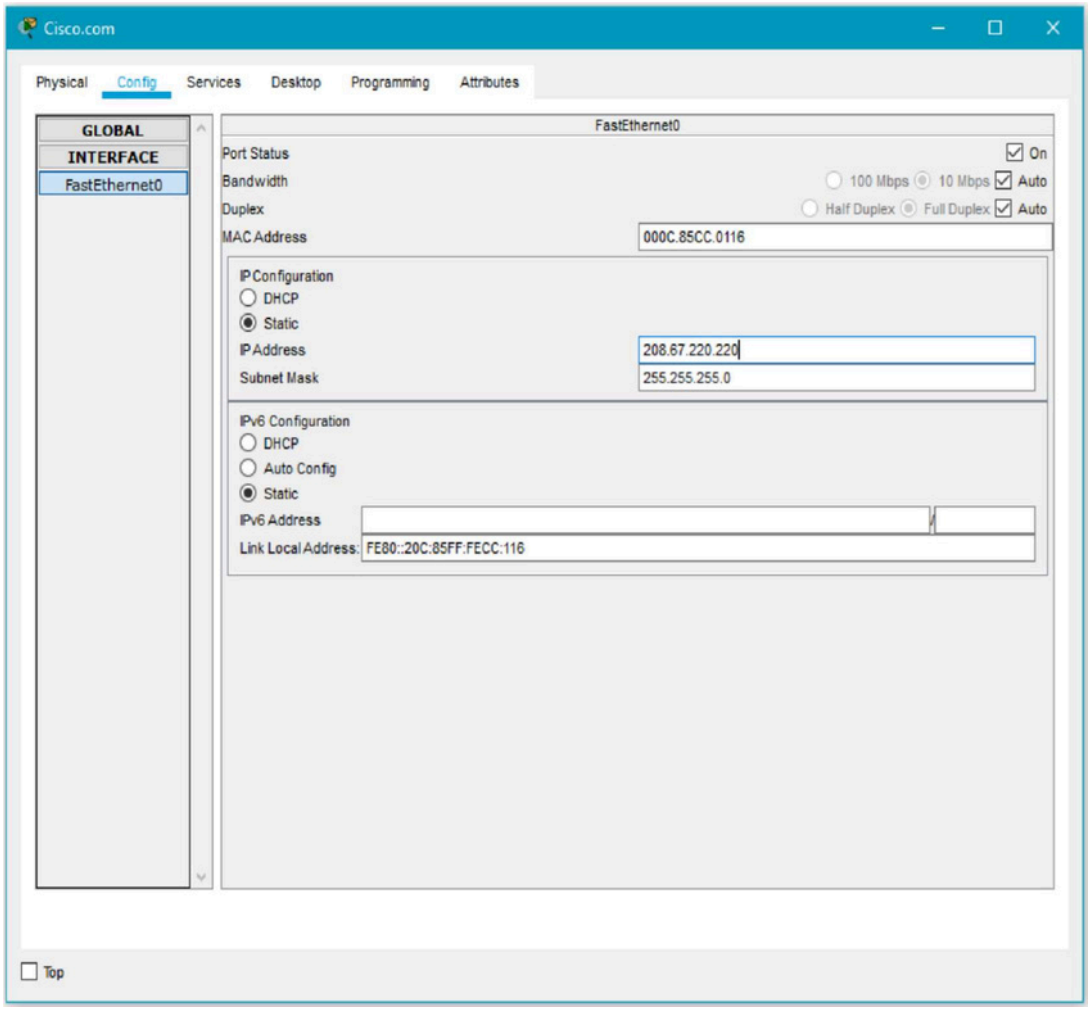


d. Configure the Cisco.com server FastEthernet0 Interface settings.

Click on **Fast Ethernet** in left pane of the **Config** tab

Configure the Fast Ethernet Interface settings of the server as follows:

- Select **Static** under IP Configuration
- IP Address: 208.67.220.220
- Subnet Mask: 255.255.255.0



Part 3: Verify Connectivity

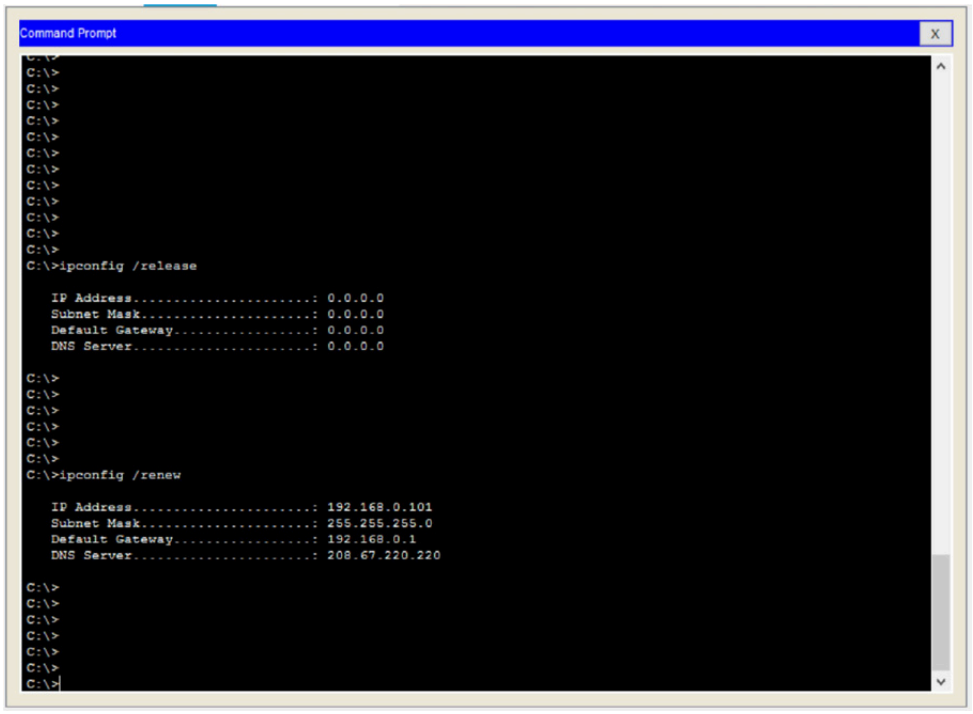
Step 1: Refresh the IPv4 settings on the PC

a) Verify that the PC is receiving IPv4 configuration information from DHCP.

Click on the **PC** on the Packet Tracer **Logical** workspace and then the select the **Desktop** tab of the PC configuration window.

Click on the **Command Prompt** icon

In the command prompt refresh the IP settings by issuing the commands **ipconfig /release** and then **ipconfig /renew.** The output should show that the PC has an IP address in the 192.168.0.x range, a subnet mask, a default gateway, and DNS server address as shown in the figure.



b) Test connectivity to the Cisco.com server from the PC

From the command prompt, issue the command **ping Cisco.com.** It may take a few seconds for the ping to return. Four replies should be received as shown in the figure.