RAJALAKSHMI ENGINEERING COLLEGE

An AUTONOMOUS Institution

Affiliated to ANNA UNIVERSITY, Chennai

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CS19541- COMPUTER NETWORKS LABORATORY

LAB MANUAL

THIRD YEAR

FIFTH SEMESTER

2024- 2025

ODD SEMESTER

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Register No. : 221701053

Semester : V

Academic Year : 2024 - 2025

List of Experiments

List of Experiments		
1.	**Study of various Network commands used in Linux and Windows:** Hands-on practice of various network commands.	[4]
2.	**Study of Network cables.** 1. Understand different types of Network cables. 2. Make a cross-wired cable and straight through cable using clamping/crimping tool.	[4]
3.	**Experiments on CISCO PACKET TRACER (Simulation Tool):** **a)** To understand environment of CISCO PACKET TRACER to design simple network. **b)** Analyse the behaviour of network devices using CISCO PACKET TRACER simulator. Design a simple network with multiple nodes and connect via networking devices available in library. Perform simulation and trace communication behaviour of specified network devices. 1: Use only HUB to design a small network having 4 to 6 hosts 2: Use only a Switch to design a small network with 4 to 6 hosts. 3: Use both the device (HUB and SWITCH) for a network and find out functioning difference between switch and hub. **Find out the network topology implemented in your college and draw and label that topology in your observation book.**	[2] [2]

4.	**a) Setup and configure a LAN (Local area network) using a Switch and Ethernet cables in your lab.** 1. Connect 3-4 host machines to a switch. 2. Assign ip addresses to each host machine. 3. Check the connectivity between the machines by using ping command. 4. Share and access files and folder across the machines of the LAN.	[2]

5.	**Experiments on Packet capture tool: Wireshark** To understand the features of wireshark as a packet capture tool and understand **encapsulation of information at various layers of a Protocol stack**.	[4]
6.	**Error Correction at Data Link Layer:** 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.	[4]
7.	**Flow control at Data Link Layer:** 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.	[4]
8.	a) **Virtual LAN**: Simulate Virtual LAN configuration using CISCO Packet Tracer Simulation. b) 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. c) **Wireless LAN:** Configuration of Wireless LAN using CISCO Packet Tracer.	[4] [2]

9.	**Implementation of SUBNETTING in CISCO PACKET TRACER simulator.** a) Design multiple subnet with suitable number of hosts. b) Assign static IP address across all subnet and connect the subnets via Router. c) Simulate packet transmission across the subnets and observe the results:- a. When subnets are connected via a router. b. When subnets are not connected without a router.	[4]

10.	**Internetworking with routers in CISCO PACKET TRACER simulator.** **a) Design and configure a simple internetwork using a router.** 1. Design different networks (with 3 to 4 hosts) and connect via Router. 2. Allot static ip address to machines and router interfaces. 3. Perform simulation and trace how routing is done in packet transmission. **b) Design and configure an internetwork using wireless router DHCP server and internet cloud.** **c) Design and configure an inter-network in your lab using switch, router and Ethernet cables.**	[4] [2]
11.	**Routing at Network Layer:** a) Simulate Static Routing Protocol Configuration using CISCO Packet Tracer. b) Simulate RIP using CISCO Packet Tracer.	[4]
12.	**End –End Communication at Transport Layer** a) Implement echo client server using TCP/UDP sockets. b) Implement a chat program using socket programming.	[4]
13.	Implement your own ping program.	[2]
14.	Write a code using RAW sockets to implement packet sniffing.	[4]
15.	Analyse various types of servers using Webalizer tool.	[4]
	Total	**60 hours**

	Additional programs for practice	
1.	**Data Link Layer (Frame Generation):** Write a program to read a stream of data from data file (Having Characters) to create BSC frames by implementing character stuffing concept and inserting control characters. The receiving program must execute on other computer and decode received bytes and write to a file.	
2.	Demonstrate Configuration of Network Address Translation (NAT) and Port Address Translation (PAT) using CISCO Packet Tracer simulation.	
3.	Implement a static routing protocol which also displays the routing table details after every update.	
4.	Implement a dynamic routing protocol which also displays the routing table after every updates.	
5.	Implement FTP server using socket programming.	

Practical -1

AIM: -

Study of various Network commands used in Linux and Windows:

BASIC NETWORKING COMMANDS:

arp –a:- ARP is short form of address resolution protocol, It will show the IP address of your computer along with the IP address and MAC address of your router.
hostname: This is the simplest of all TCP/IP commands. It simply displays the name of your computer.
ipconfig /all: This command displays detailed configuration information about your TCP/IP connection including Router, Gateway, DNS, DHCP, and type of Ethernet adapter in your system
nbtstat –a: This command helps solve problems with NetBIOS name resolution. (Nbt stands for NetBIOS over TCP/IP)
netstat: (network statistics) netstat displays a variety of statistics about a computers active TCP/IP connections. It is a command line tool for monitoring network connections both incoming and outgoing as well as viewing routing tables, interface statistics etc. e.g.:- netstat -r
nslookup: (name server lookup) is a tool used to perform DNS lookups in Linux. It is used to display DNS details, such as the IP address of a particular computer, the MX records for a domain or the NS servers of a domain. nslookup can operate in two modes: interactive and non-interactive. e.g.:- nslookup www.google.com
pathping: Pathping is unique to Window's, and is basically a combination of the Ping and Tracert commands. Pathping traces the route to the destination address then launches a 25 second test of each router along the way, gathering statistics on the rate of data loss along each hop.
ping: (Packet INternet Groper) command is the best way to test connectivity between two nodes. Ping use ICMP (Internet Control Message Protocol) to communicate to other devices. 1. #ping hostname(ping localhost) 2. #ping ip address (ping 4.2.2.2) 3. #ping fully qualified domain name(ping www.facebook.com

Route: route command is used to show/manipulate the IP routing table. It is primarily used to setup static routes to specific host or networks via an interface.

Some important Linux networking commands

1. **ip**

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The ip command is one of the basic commands every administrator will need in daily work, from setting up new systems and assigning IPs to troubleshooting existing systems. The ip command can show address information, manipulate routing, plus display network various devices, interfaces, and tunnels.

ip <OPTIONS> <OBJECT> <COMMAND>

Here are some common use cases for the ip command.

a. To show the IP addresses assigned to an interface on your server:
    a. [root@server ~]# *ip address show*

b. To assign an IP to an interface, for example, **enps03**:
    a. [root@server ~]# ip address add 192.168.1.254/24 dev enps03

c. To delete an IP on an interface:
    a. [root@server ~]# ip address del 192.168.1.254/24 dev enps03

d. Alter the status of the interface by bringing the interface **eth0** online:
[root@server ~]# ip link set eth0 up

e. Alter the status of the interface by bringing the interface **eth0** offline:
[root@server ~]# ip link set eth0 down

f. Alter the status of the interface by enabling promiscuous mode for **eth0**:
[root@server ~]# ip link set eth0 promisc on

g. Add a default route (for all addresses) via the local gateway 192.168.1.254 that can be reached on device **eth0**:
[root@server ~]# ip route add default via 192.168.1.254 dev eth0

h. Add a route to 192.168.1.0/24 via the gateway at 192.168.1.254:
[root@server ~]# ip route add 192.168.1.0/24 via 192.168.1.254

i. Add a route to 192.168.1.0/24 that can be reached on device **eth0**: [root@server ~]# ip route add 192.168.1.0/24 dev eth0

j. Delete the route for 192.168.1.0/24 via the gateway at 192.168.1.254:
[root@server ~]# ip route delete 192.168.1.0/24 via 192.168.1.254

k. Display the route taken for IP 10.10.1.4:
[root@server ~]# ip route get 10.10.1.4

2. ifconfig

The ifconfig command was/is a staple in many sysadmin's tool belt for configuring and troubleshooting networks. It has since been replaced by the ip command discussed above.

3. mtr

MTR (Matt's traceroute) is a program with a command-line interface that serves as a network diagnostic and troubleshooting tool. This command combines the functionality of the ping and traceroute commands. Just like a traceroute, the mtr command will show the route from a computer to a specified host. mtr provides a lot of statistics about each hop, such as response time and percentage. With the mtr command, you will get more information about the route and be able to see problematic devices along the way. If you see a sudden increase in response time or packet loss, then obviously, there is a bad link somewhere.
The syntax of the command is as follows: **mtr <options> hostname/IP**
Let's look at some common use cases.

a. The basic mtr command shows you the statistics, including each hop (hostnames) with time and loss%:
[root@server ~]# *mtr google.com*

b. Show numeric IP addresses (if you use -g, you will get IP addresses (numbers) instead of hostnames):
[root@server ~]# mtr -g google.com

c. Show the numeric IP addresses and hostnames, too:
[root@server ~]# mtr -b google.com

d. Set the number of pings that you want to send:
[root@server ~]# mtr -c 10 google.com

4. tcpdump

The tcpdump command is designed for capturing and displaying packets.

You can install tcpdump with the command below: [root@server ~]
dnf install -y tcpdump

Before starting any capture, you need to know which interfaces tcpdump can use. You will need to use sudo or have root access in this case.
[root@server ~]*# tcpdump -D*

If you want to capture traffic on **eth0**, you can initiate that with tcpdump -i eth0 sample output:

```
[root@server ~]# tcpdump -i eth0
```

[root@server ~]# *tcpdump -i eth0 -c 10*

om a specific host. For example, to find traffic coming

0 host 8.8.8.8

using the command below:

t 10.1.0.0 mask 255.255.255.0

t 10.1.0.0/24

d from port numbers

st 8.8.8.8 and port 53

0 host www.google.com and port 443

rt not 53 and not 25

Capture traffic to host

from and going to 8.8.8.8, use th command:
[root@server ~]# *tcpdump -i eth0 -*

For traffic coming from 8.8.8.8, use:
[root@server ~]# *tcpdump -i eth0 host 8.8.8.8*

For outbound traffic going to 8.8. use:
[root@server ~]# *tcpdump -i eth0 host 8.8.8.8*

Capture traffic t network

You can also capture traffic to an network
[root@server ~]# *tcpdump*
or:
[root@server ~]# *tcpdump -*

Capture traffic

Capture only DNS port 53 traffic:
[root@server ~]# *tcpdump -i eth0 port 53*

For a specific host,
[root@server ~]# *tcpdump -*

To capture only HTTPS traffic,
[root@server ~]# *tcpdump -i eth0 -*

To capture all port except port 80 and 25,
[root@server ~]# *tcpdump -*

5. ping

Ping is a tool that verifies IP-level connectivity to another TCP/IP computer by sending Internet Control Message Protocol (ICMP) Echo Request messages.
The receipt of corresponding Echo Reply messages is displayed, along with round-trip times. Ping is the primary TCP/IP command used to troubleshoot connectivity reachability, and name resolution.

```
[root@server ~]# ping google.com
PING google.com (216.58.206.174) 56(84) bytes of data.
64 bytes from sof02s27-in-f14.1e100.net (216.58.206.174): icmp_seq=1
ttl=56 time=10.7 ms
64 bytes from sof02s27-in-f14.1e100.net (216.58.206.174): icmp_seq=2
ttl=56 time=10.2 ms
64 bytes from sof02s27-in-f14.1e100.net (216.58.206.174): icmp_seq=3
 ttl=56 time=10.4 ms ^C
```

You need to stop the ping command by pressing **CTRL+C**.
Otherwise, it will ping until you stop it.

If you want to ping a host ten times, use the following command:
[root@server ~]# *ping -c 10 google.com*

While pinging a host, you'll find different output from the ping results, including the following three examples.

Destination Host Unreachable
The possible best reason is there is no route from the local host system and to the destination desired destination host, or a remote router reports that it has no route to the destination host.

Request timed out
This result means that no Echo Reply messages were received within the default time of one second or the time that you set while you are pinging that host. This can be due to many different causes; the most common include network congestion, failure of the ARP request, packet filtering/firewall, etc.

Unknown host/Ping Request Could Not Find Host
Maybe you misspelled the hostname or the host does not exist at all in the network.

You must have 0% packet loss for every ping result with a good latency or lower response time. Depending on which transmission medium (UTP, fibre optics cable, WiFi) you're using, your latency will differ.

Configuring an Ethernet connection by using nmcli

If you connect a host to the network over Ethernet, you can manage the connection's settings on the command line by using the **nmcli** utility.

Procedure

1. List the NetworkManager connection profiles:

   # nmcli connection show
   NAME UUID TYPE DEVICE
   Wired connection 1 a5eb6490-cc20-3668-81f8-0314a27f3f75 ethernet enp1s0

2. **# nmcli connection add con-name <connection-name> ifname <device-name> type ethernet**
   Skip this step to modify an existing profile.

3. Optional: Rename the connection profile:

   # nmcli connection modify "Wired connection 1"
   Here, "Wired connection 1" is the name of the connection

4. Display the current settings of the connection profile: **# nmcli connection show**

   connection.interface-name: enp1s0
   connection.autoconnect: yes
   ipv4.method: auto
   ipv6.method: auto
   ...

5. Configure the IPv4 settings:
   - To use DHCP, enter:

     # nmcli connection modify "Wired connection 1" ipv4.method auto Skip this step if ipv4.method is already set to auto (default).

   - To set a static IPv4 address, network mask, default gateway, DNS servers, and search domain, enter:

     # nmcli connection modify "Wired connection 1" ipv4.method manual ipv4.addresses 192.0.2.1/24 ipv4.gateway 192.0.2.254 ipv4.dns 192.0.2.200 ipv4.dns-search example.com

6. Configure the IPv6 settings:
   - To use stateless address autoconfiguration (SLAAC), enter:

nmcli connection modify "Wired connection 1" ipv6.method auto Skip this step if ipv6.method is already set to auto (default).

- To set a static IPv6 address, network mask, default gateway, DNS servers, and search domain, enter:

nmcli connection modify "Wired connection 1" ipv6.method manual ipv6.addresses 2001:db8:1::fffe/64 ipv6.gateway 2001:db8:1::fffe ipv6.dns 2001:db8:1::ffbb ipv6.dns-search example.com

7. Activate the profile:

nmcli connection up Internal-LAN

Verification

1. Display the IP settings of the NIC:

ip address show enp1s0 enp1s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000 link/ether 52:54:00:17:b8:b6 brd ff:ff:ff:ff:ff:ff
inet 192.0.2.1/24 brd 192.0.2.255 scope global noprefixroute enp1s0 valid_lft forever preferred_lft forever
inet6 2001:db8:1::fffe/64 scope global noprefixroute valid_lft forever preferred_lft forever

2. Display the IPv4 default gateway:

ip route show default

default via 192.0.2.254 dev enp1s0 proto static metric 102

3. Display the IPv6 default gateway:

ip -6 route show default default via 2001:db8:1::ffee dev enp1s0 proto static metric 102 pref medium

4. Display the DNS settings:

cat /etc/resolv.conf
search example.com
nameserver 192.0.2.200
nameserver 2001:db8:1::ffbb

If multiple connection profiles are active at the same time, the order of nameserver entries depend on the DNS priority values in these profile and the connection types.

5. Use the ping utility to verify that this host can send packets to other hosts:

   # ping <host-name-or-IP-address>

   Troubleshooting

- Verify that the network cable is plugged-in to the host and a switch.
- Check whether the link failure exists only on this host or also on other hosts connected to the same switch.
- Verify that the network cable and the network interface are working as expected.

  Perform hardware diagnosis steps and replace defect cables and network interface cards.
- If the configuration on the disk does not match the configuration on the device, starting or restarting NetworkManager creates an in-memory connection that reflects the configuration of the device. **Student Observation:**

1. **Which command is used to find the reachability of a host machine from your device?**
2. **Which command will be give the details of hops taken by a packet to reach its destination?**
3. **Which commands displays the ip configuration of your machine.**
4. **Which command displays the TCP port status in your machine?**
5. **Write the modify the ip configuration in a Linux machine.**

Answer:

1. ping
2. traceroute (or tracert on Windows)
3. ifconfig (or ip a on modern Linux systems), ipconfig (on Windows)
4. netstat -t
5. ip addr add (to modify IP configuration)

Result:

The experiment was studied and experimented successfully.

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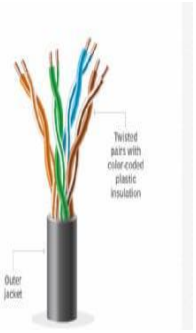
Practical-2

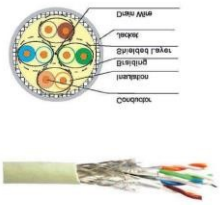
Aim: Study of different types of Network cables.

a) Understand different types of network cable.

Different type of cables used in networking are:

1. Unshielded Twisted Pair (UTP) Cable
2. Shielded Twisted Pair (STP) Cable
3. Coaxial Cable
4. Fibre Optic Cable

Cable type	Category	Maximum Data Transmission	Advantages/ Disadvantages	Application/Use	Image
UTP	Category 3	10 bps	**Advantages** • Cheaper in cost • Easy to install as they have a smaller overall diameter. **~~Disadvantages~~** • More prone to (EMI) Electromagnetic interference and noise	10Base-T Ethernet	
	Category 5	Up to 100 Mbps		Fast Ethernet, Gigabit Ethernet	
	Category 5e	1Gbps		Fast Ethernet, Gigabit Ethernet	
STP	Category6,6a	10Gbps	**~~Advantages~~** Shielded. • Faster than UTP. • Less susceptible to noise and interference **~~Disadvantages~~** • Expensive	Gigabit Ethernet, 10G Ethernet (55m) Widely used in data centres	
SSTP	Category 7	10Gbps			

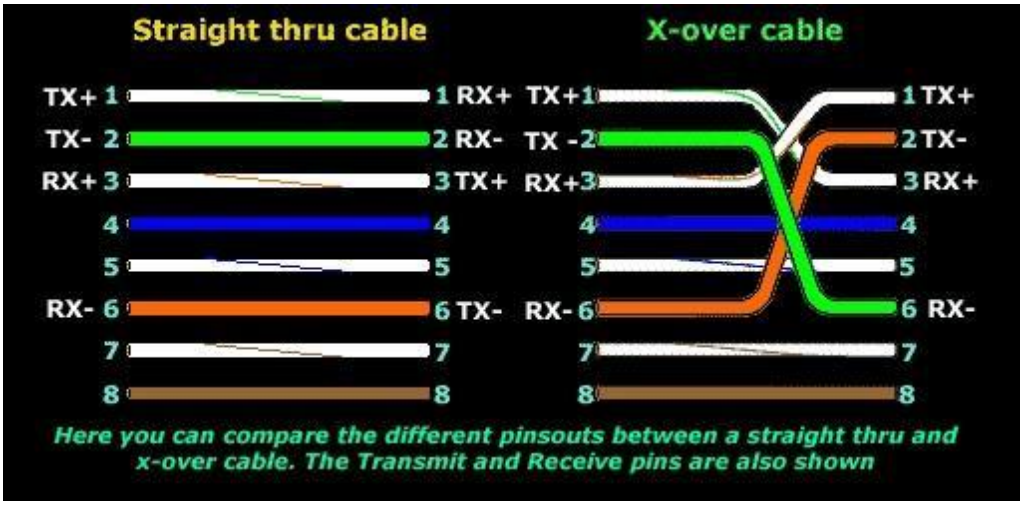
			• Greater installation effort	Gigabit Ethernet, 10G Ethernet (100m)	

Coaxial cable	RG-6 RG-59 RG-11	10-100Mbps	• High bandwidth • Immune to interference • Low loss bandwidth • Versatile • **Disadvantages** • Limited distance • Cost • Size is bulky	Speed of signal is 500m Television network High speed internet connections	
fibre optics cable	Single mode Multi mode	100Gbps	**Advantages** • High speed • High bandwidth • High security • Long distance **Disadvantages** • Expensive • Requires skilled installers	Maximum distance of fibre optics cable is around 100meters	

b) Make Your Own Ethernet Cross-Over Cable/ Straight cable

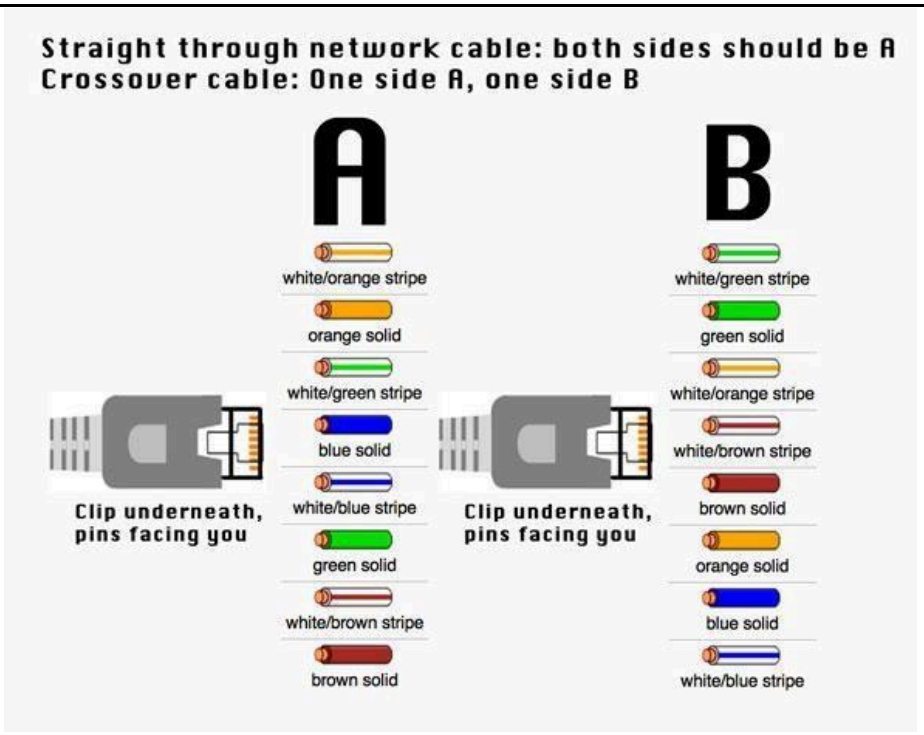
Tools and parts needed:

- Ethernet cabling. CAT5e is certified for gigabit support, but CAT5 cabling works as well, just over shorter distances.
- A crimping tool. This is an all-in-one networking tool shaped to push down the pins in the plug and strip and cut the shielding off the cables.
- Two RJ45 plugs.
- Optional two plug shields.

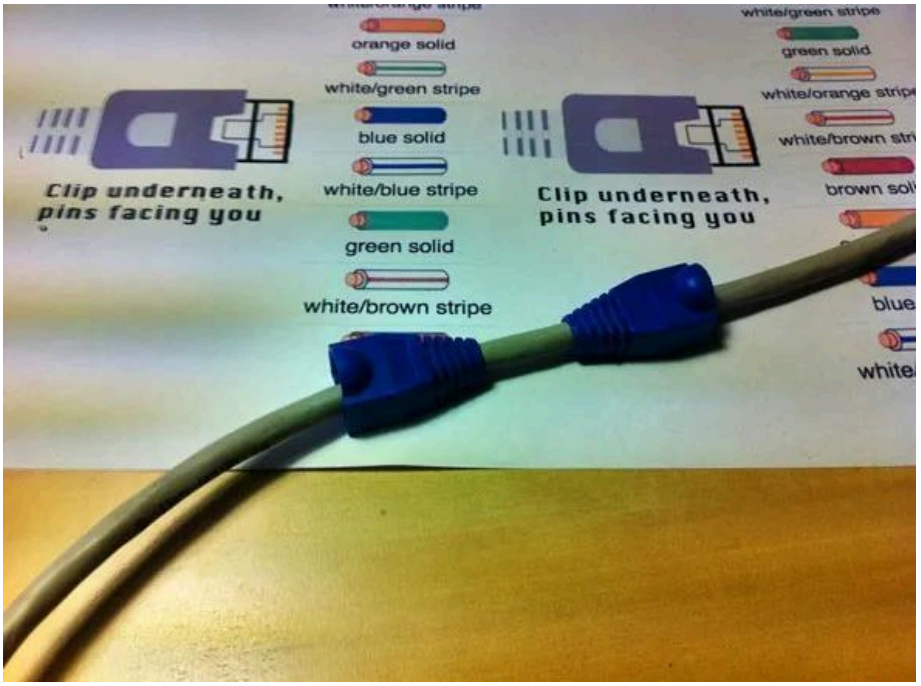


Difference between crossover cable and straight cable

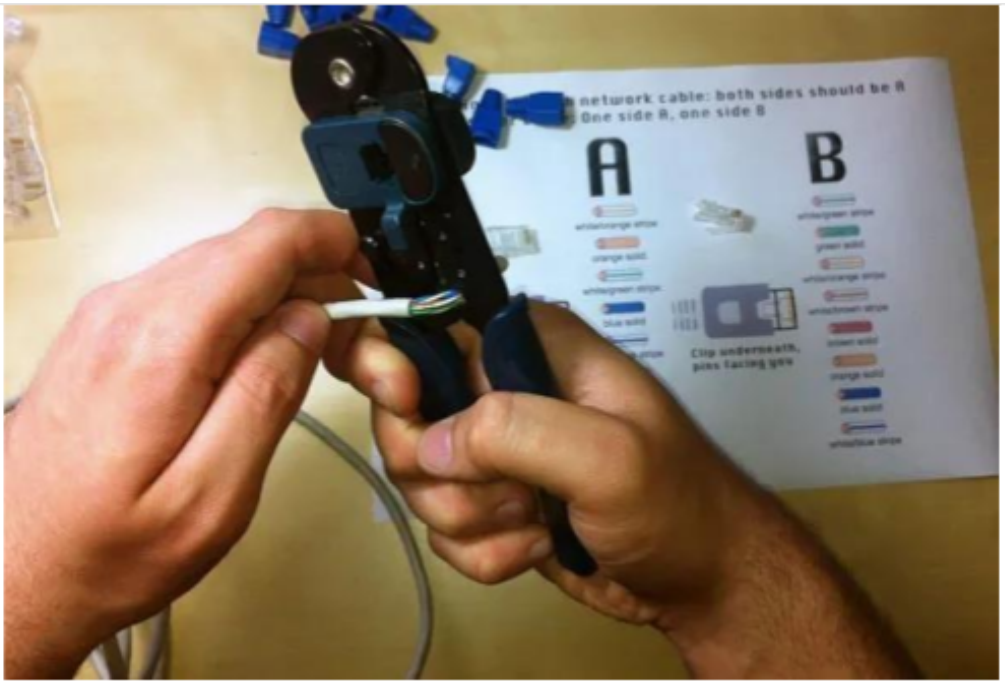
Take a print out the diagram below or have it handy as a reference


Straight through network cable: both sides should be A
Crossover cable: One side A, one side B
A
white/orange stripe
orange solid
white/green stripe
blue solid
white/blue stripe
green solid
white/brown stripe
brown solid
Clip underneath, pins facing you
B
white/green stripe
green solid
white/orange stripe
white/brown stripe
brown solid
orange solid
blue solid
white/blue stripe
Clip underneath, pins facing you

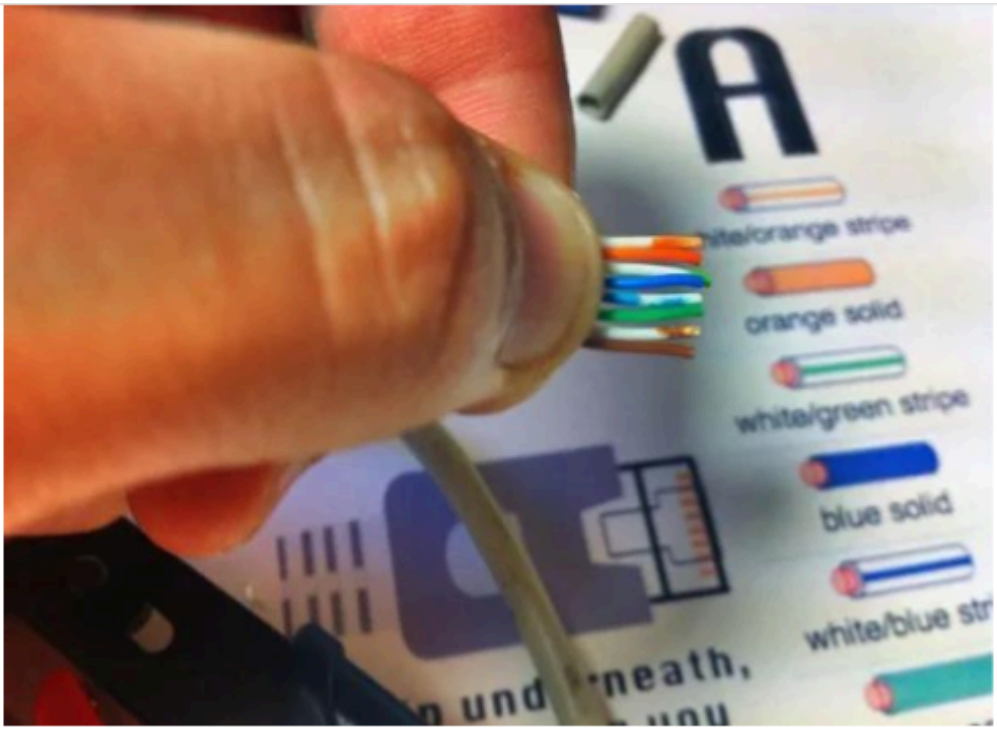
Step 1: To start construction of the device, begin by threading shields onto the cable.



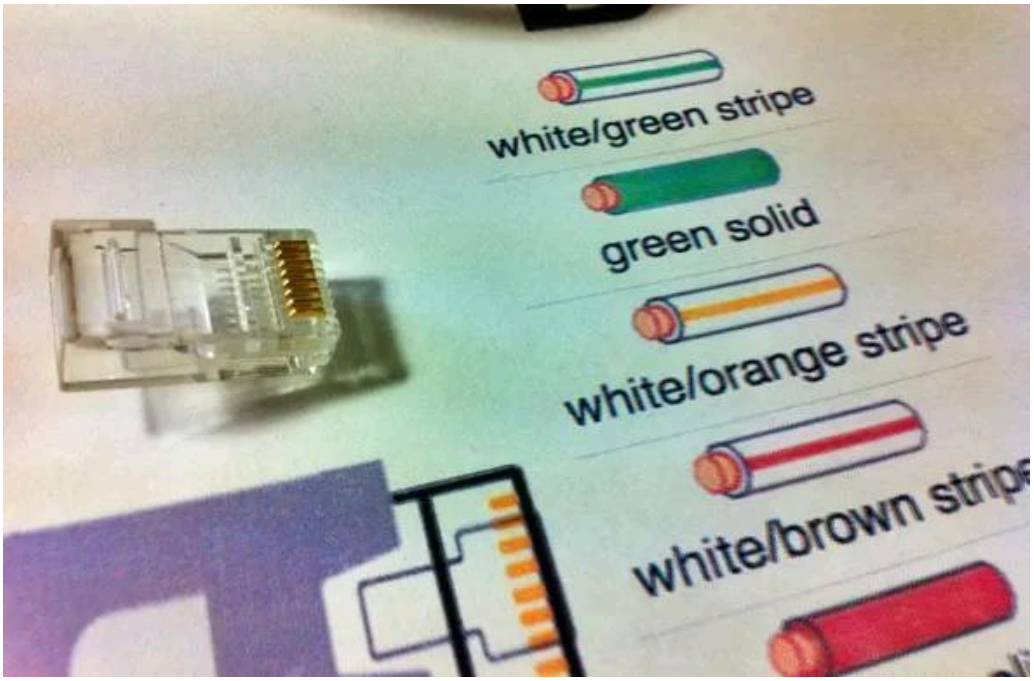
Step 2: Next, strip approximately 1.5 cm of cable shielding from both ends. The crimping tool has a round area to complete this task.



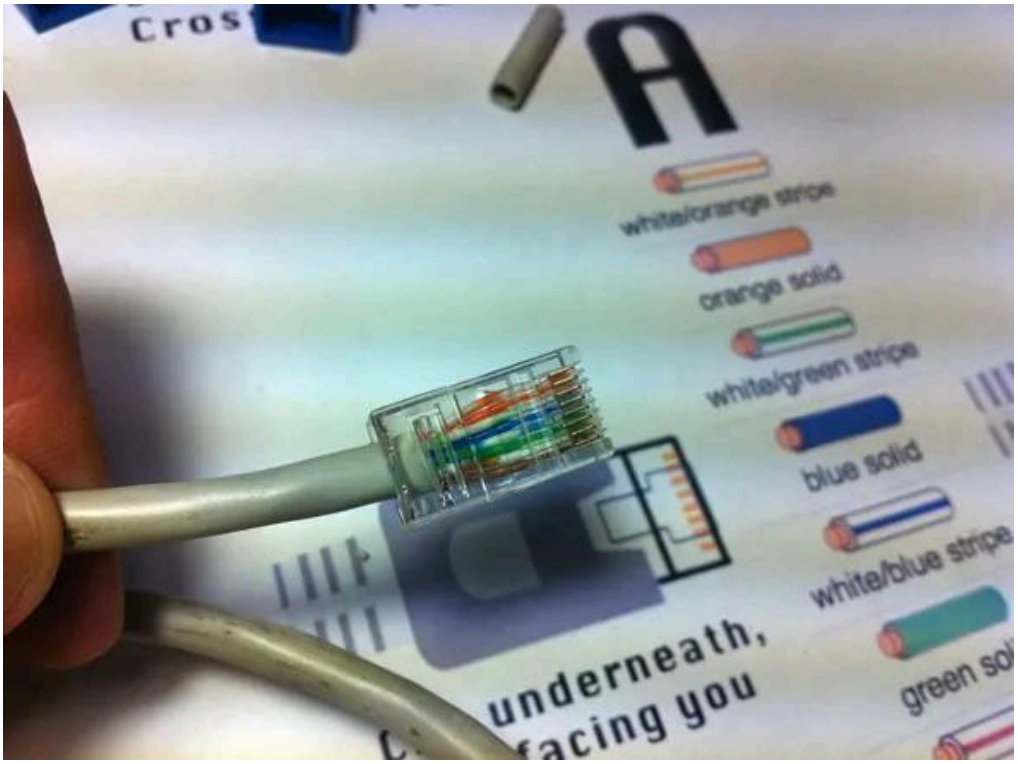
Step 3: After, you will need to untangle the wires; there should be four "twisted pairs." Referencing back to the sheet, arrange them from top to bottom. One end should be in arrangement A and the other in B.



Step 4: Once the order is correct, bunch them together in a line, and if there are any that stick out farther than others, snip them back to create an even level. The difficult aspect is placing these into the RJ45 plug without messing up the order. To do so, hold the plug with the clip side facing away from you and have the gold pins facing toward you, as shown.



Step 5: Next, push the cable right in. The notch at the end of the plug needs to be just over the cable shielding, and if it isn't, that means that you stripped off too much shielding. Simply snip the cables back a little more.



Step 6: After the wires are securely sitting inside the plug, insert it into the crimping tool and push down.

It should be shaped correctly, but pushing too hard can crack the fragile plastic plug.

Step 7: Lastly, repeat for the other end using diagram B (to make a crossover cables)/ using diagram A (to make a straight through cable)

To test it, plug it in and attempt to connect two devices directly.

Student observation:-

1. **What is the difference between cross cable and straight cable?**
2. **Which type of cable is used to connect two PC?(straight/Cross cable) 3. Which type cable is used to connect a router/switch to your PC? (straight/Cross cable)**
4. **Find out the category of twisted pair cable used in your la to connect the PC to the network socket.**

5. **Write down your understanding, challenges faced and output received while making a twisted pair cross/straight cable.**

Answer:

1. Straight cable: Same pinout on both ends; Cross cable: Different pinout on each end.

2. Cross cable

3. Straight cable

4. Cat 5e or Cat 6

5. Understanding: Correctly wiring the cable and ensuring proper crimping; Challenges: Correct pairing of wires, crimping precision, cable length limitations; Output Successful communication between connected devices.

Result:

The different types of Network cables were studied.

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

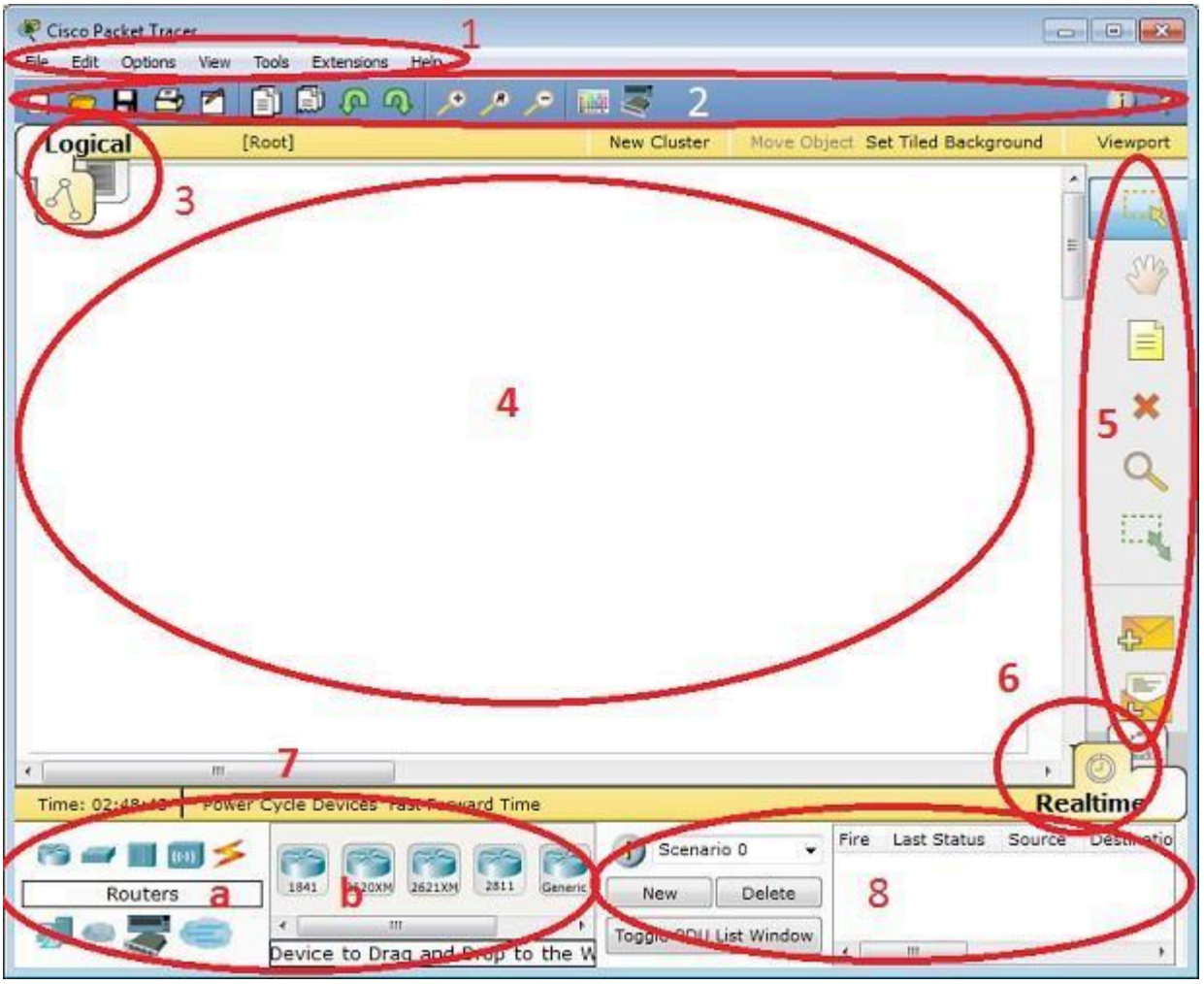
Linux users with an Ubuntu/Debian distribution should download the file for Ubuntu, and those using Fedora/Redhat/CentOS must download the file for Fedora. Grant executable permission to this file by using chmod, and execute it to begin the installation.

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

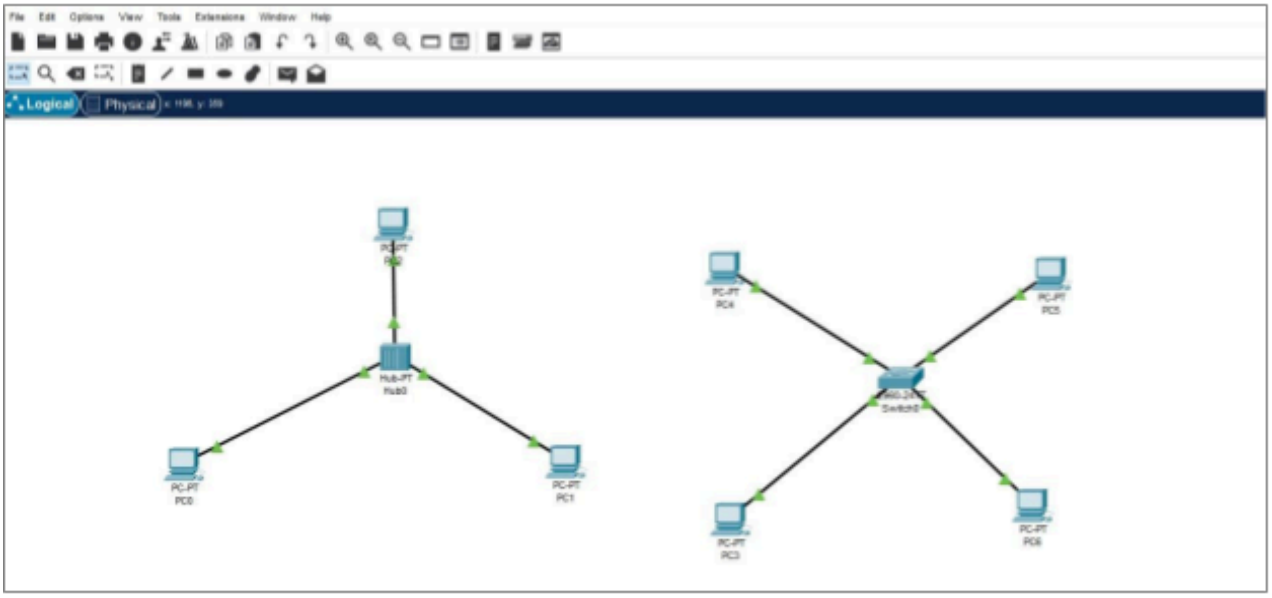
selected, this selection box displays the different device models within that category

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.

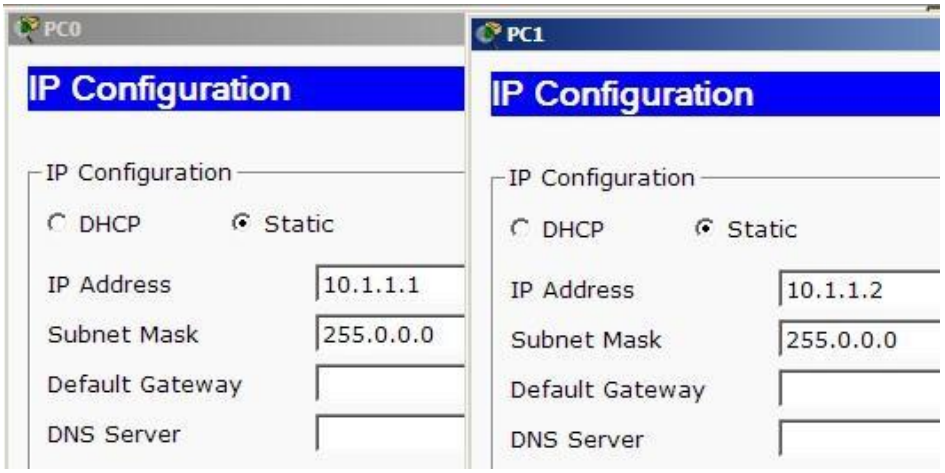
d) Analyse the behaviour of network devices using CISCO PACKET TRACER simulator.

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.

Result:

Thus the Packet tracer tool Installation and User Interface Overview was studied.

Practical -4

AIM: Setup and configure a LAN (Local area network) using a Switch and Ethernet cables in your lab.

What is a LAN?

A Local Area Network (LAN) refers to a network that connects devices within a limited area, such as an office building, school, or home. It enables users to share resources, including data, printers, and internet access. LAN connects devices to promote collaboration and transfer information between users, such as computers, printers, servers, and switches. A local area network (LAN) switch serves as the primary connecting device, managing and directing communications within the local network. Each connected device on a LAN switch can communicate directly with each other, allowing for fast and secure data transfer.

How to set up a LAN

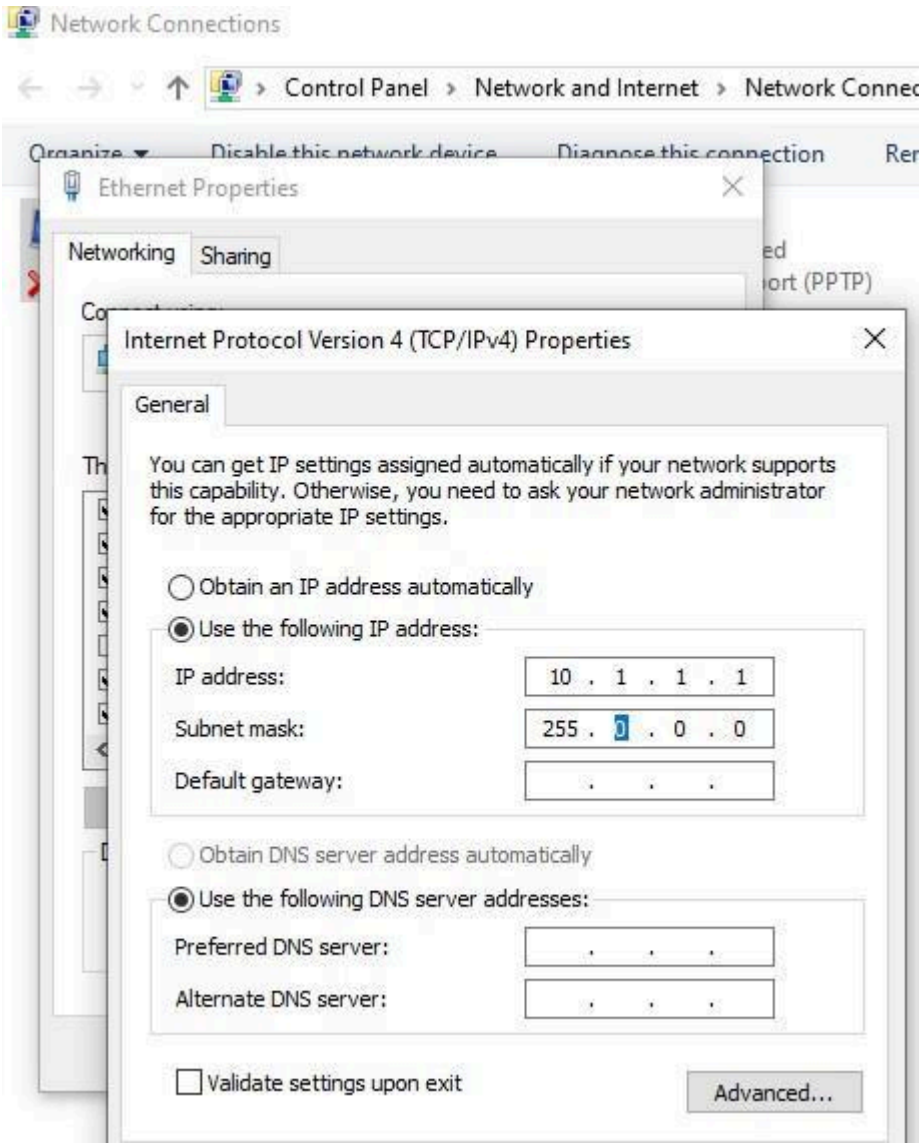
Step 1. Plan and Design an appropriate network topology taking into account network requirements and equipment location.

Step 2. You can take 4 Computers, a Switch with 8, 16, or 24 ports which is sufficient for networks of these sizes, and 4 Ethernet cables.

Step3: Connect your computers to network switch via an Ethernet cable, which is as simple as plugging one end of the Ethernet cable into your computer and the other end into your network switch.

Step4: Assign IP address to your PCs

1. Log on to the client computer as Administrator or as Owner.
2. Click Network and Internet Connections.
3. Right Click Local Area Connection/Ethernet->Go to Properties->Select Internet Protocol (TCP/IPv4)->Click on Properties->Select use the following ip address option and assign ipaddress.



Similarly assign IP address to all the PCS connected to switch.
PC1-IP address: 10.1.1.1, subnet mask 255.0.0.0
PC2-IP address-10.1.1.2, subnet mask 255.0.0.0
PC3-IP address 10.1.1.3, subnet mask 255.0.0.0.
PC4-IP address 10.1.1.4, subnet mask 255.0.0.0.

Step 5:- Configure a network switch:

1. Connect your computer to the switch: To access the switch's web interface, you will need to connect your computer to the switch using an Ethernet cable.
2. Log in to the web interface: Open a web browser and enter the IP address of the switch in the address bar. This should bring up the login page for the switch's web interface. Enter the username and password to log in.
3. Configure basic settings: Once you're logged in, you will be able to configure basic settings for the switch,
4. Assign IP address as: 10.1.1.5, subnet mask 255.0.0.0.

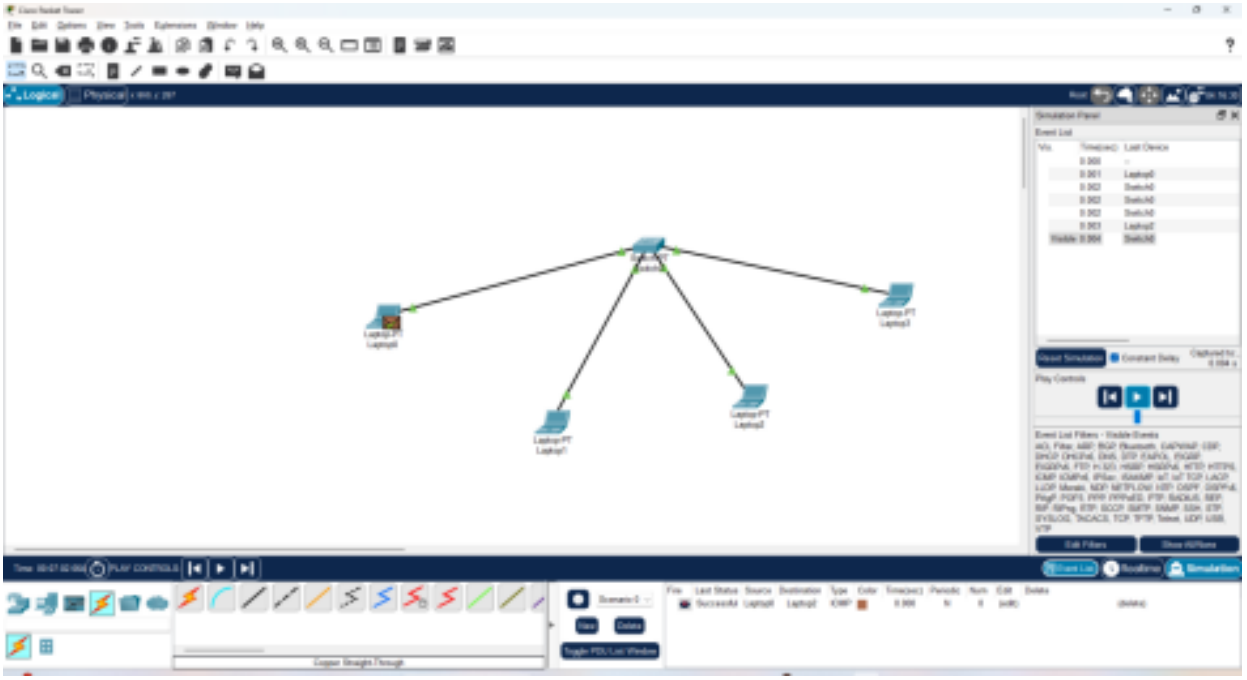
Step 6:- Check the connectivity between switch and other machine by using ping command in the command prompt of the device.

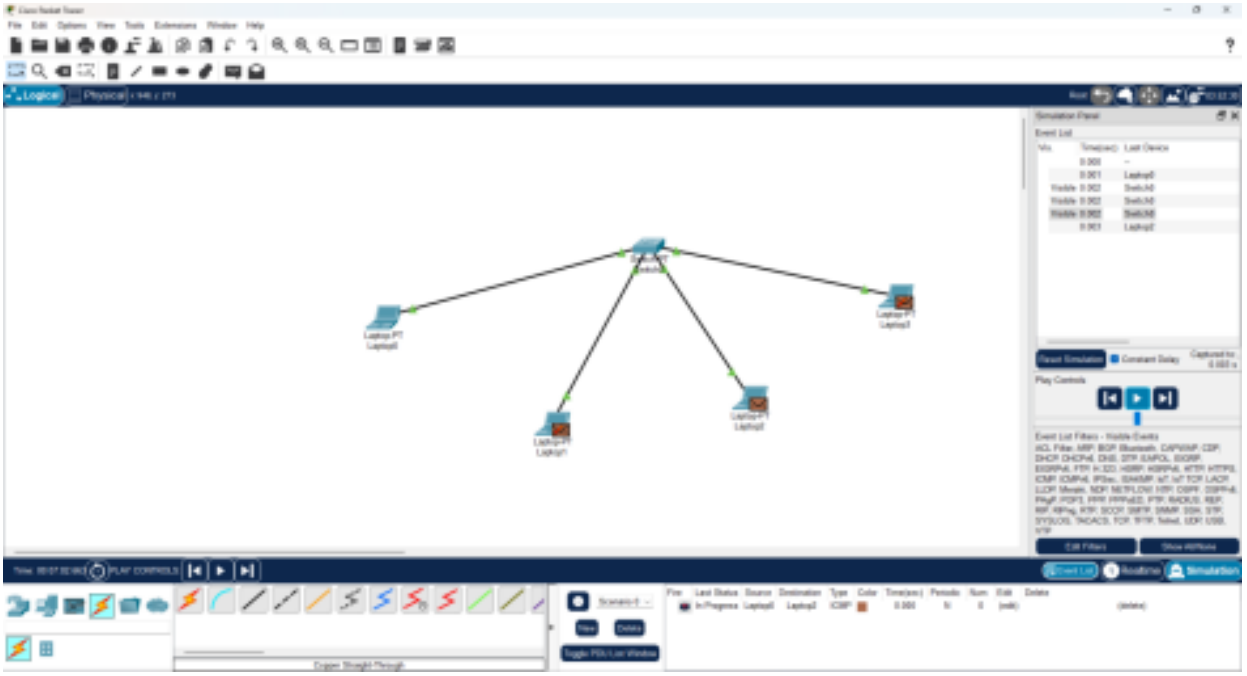
Step 7: Select a folder, ->go to properties-> click Sharing tab->share it with everyone on the same LAN.

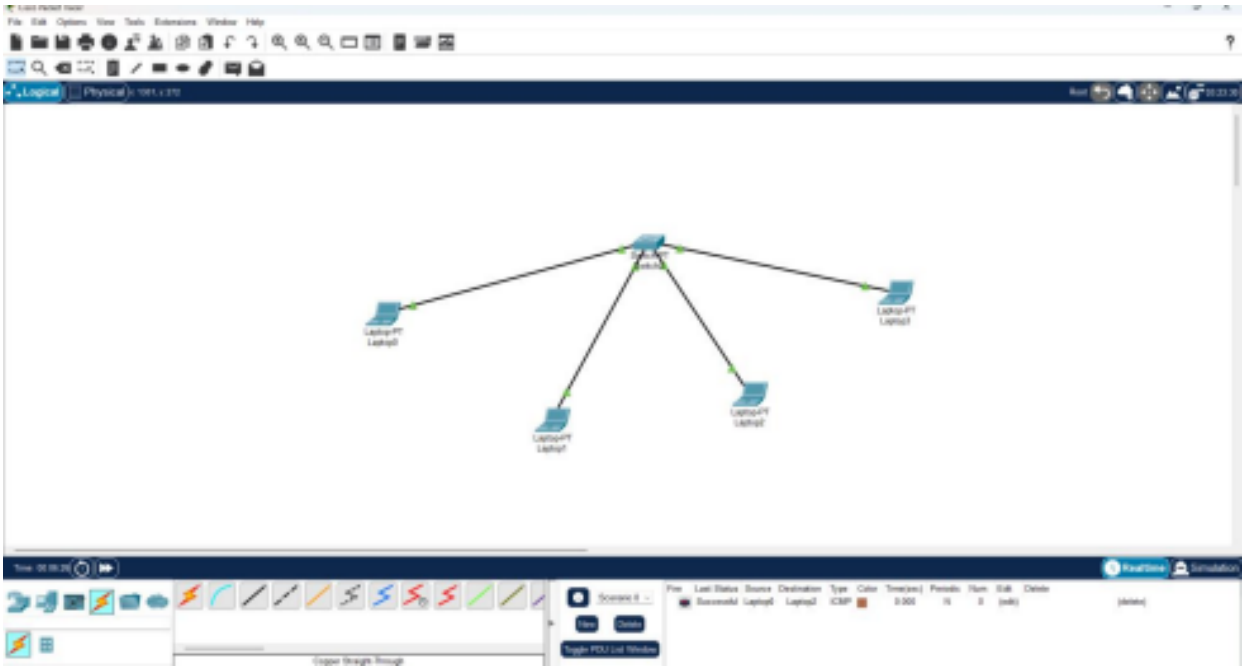
Step 8. Try to access the shared folder from others Computers of the network.

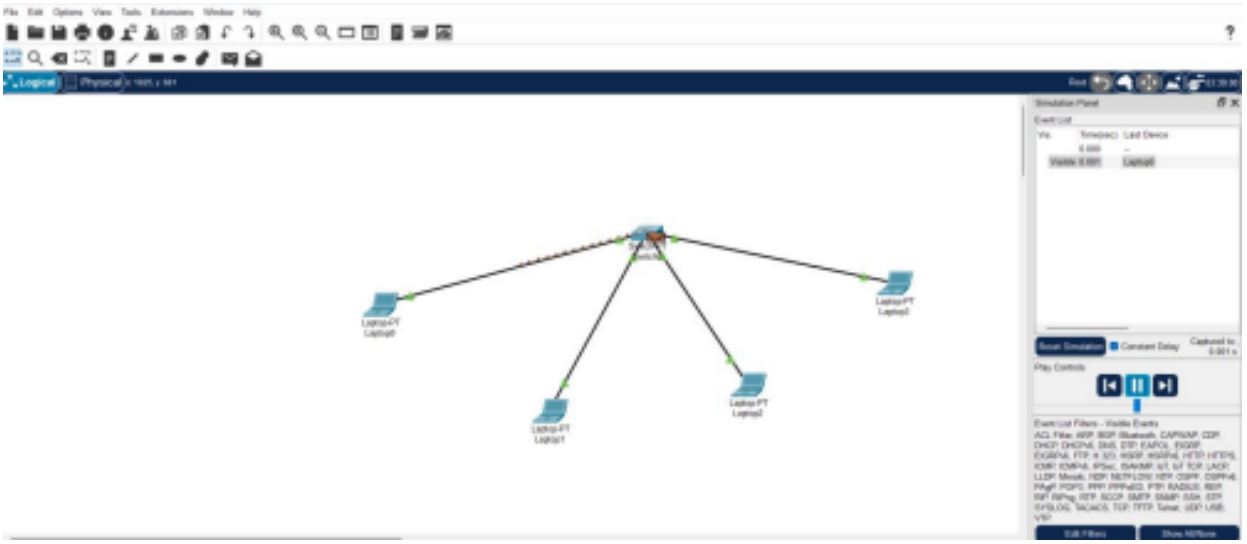
Student observation:

Draw a neat diagram of the LAN in the configuration observation book. that you have implemented in your lab. Write the ip configuration of each and every device. Write the outcome and challenges faced while configuring the LAN.









Result:

Thus the setup and configure a LAN (Local area network) using a Switch and Ethernet cables were studied.

Practical-5

AIM Experiments on Packet capture tool: Wireshark

Packet Sniffer

- Sniffs messages being sent/received from/by your computer
- Store and display the contents of the various protocol fields in the messages
- Passive program
  - never sends packets itself
  - no packets addressed to it
  - receives a copy of all packets (sent/received)

Packet Sniffer Structure Diagnostic Tools

- Tcpdump
  - E.g. tcpdump -enx host 10.129.41.2 -w exe3.out
- Wireshark
  - wireshark -r exe3.out

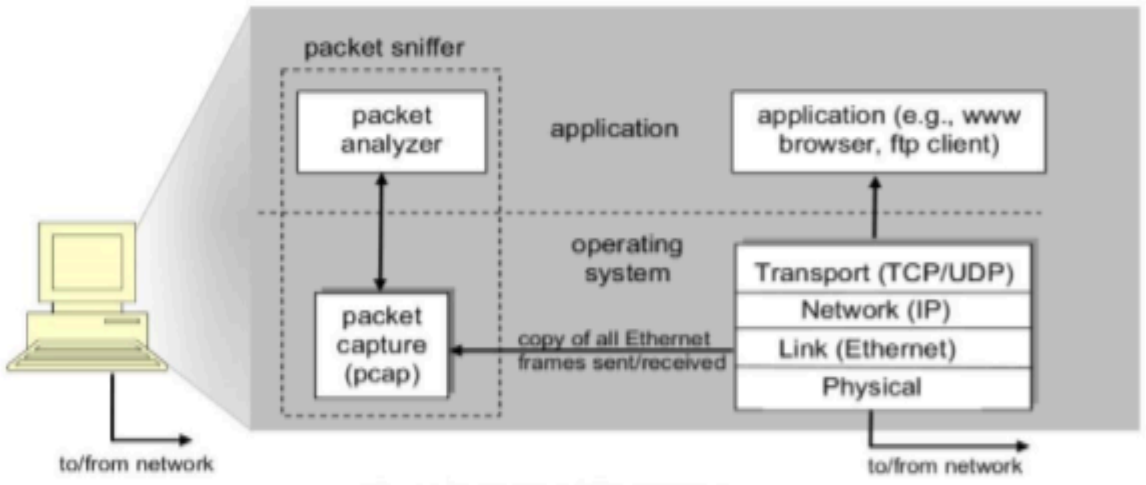


Figure 1: Packet sniffer structure

DESCRIPTION:

WIRESHARK

Wireshark, a network analysis tool formerly known as Ethereal, captures packets in real time and display them in human-readable format. Wireshark includes filters, color coding, and other features that let you dig deep into network traffic and inspect individual packets. You can use Wireshark to inspect a suspicious program's network traffic, analyze the traffic flow on your network, or troubleshoot network problems.

What we can do with Wireshark:

- Capture network traffic
- Decode packet protocols using dissectors
- Define filters – capture and display
- Watch smart statistics
- Analyze problems
- Interactively browse that traffic

Wireshark used for:

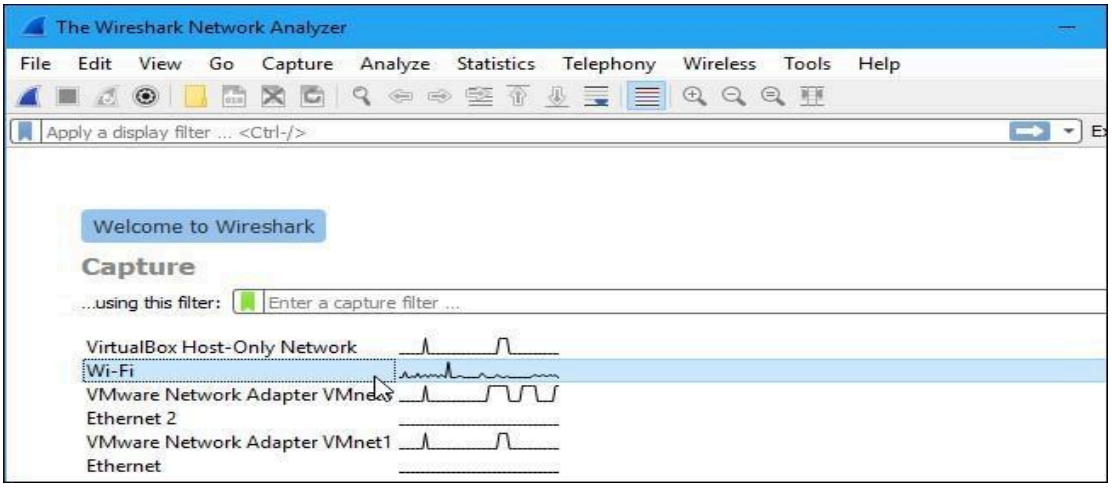
- Network administrators: troubleshoot network problems
- Network security engineers: examine security problems
- Developers: debug protocol implementations
- People: learn **network protocol internals**

Getting Wireshark

Wireshark can be downloaded for Windows or macOS from its official website. For Linux or another UNIX-like system, Wireshark will be found in its package repositories. For Ubuntu, Wireshark will be found in the Ubuntu Software Center.

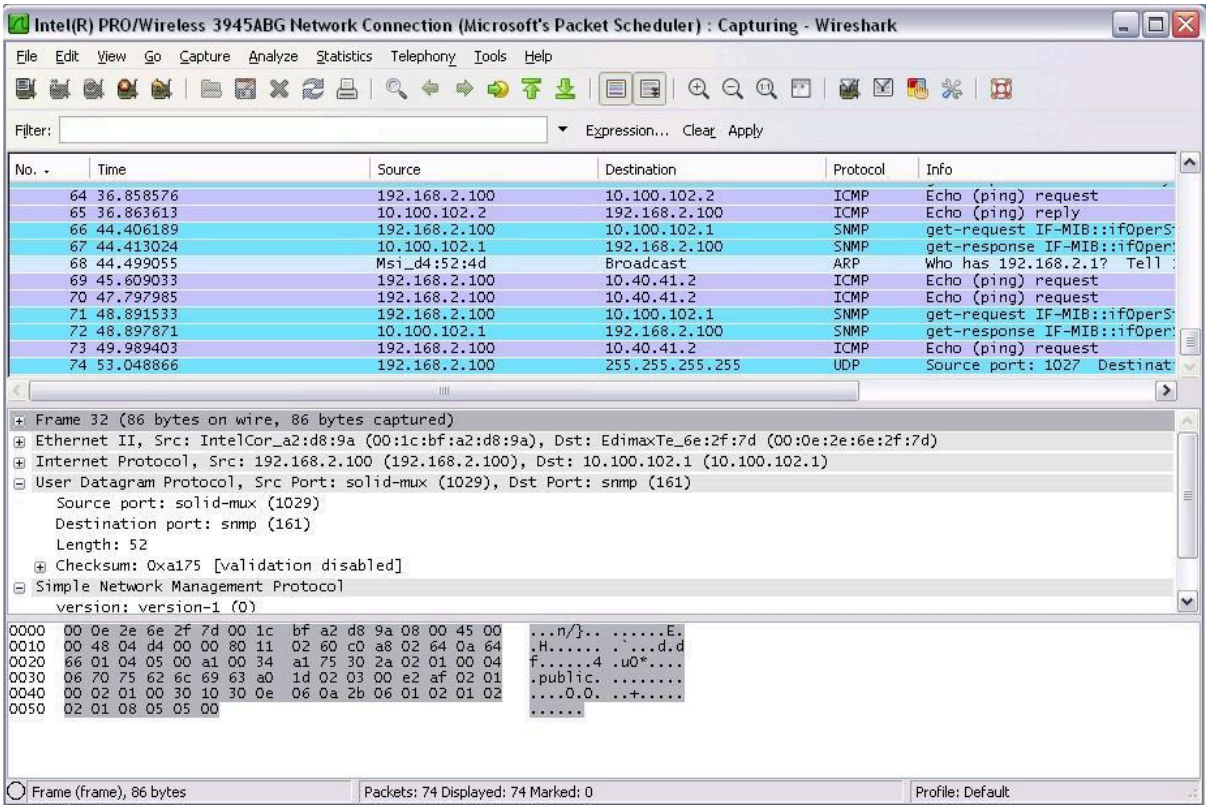
Capturing Packets

After downloading and installing Wireshark, launch it and double-click the name of a network interface under Capture to start capturing packets on that interface



As soon as you click the interface's name, you'll see the packets start to appear in real time. Wireshark captures each packet sent to or from your system.

If you have promiscuous mode enabled—it's enabled by default—you'll also see all the other packets on the network instead of only packets addressed to your network adapter. To check if promiscuous mode is enabled, click Capture > Options and verify the "Enable promiscuous mode on all interfaces" checkbox is activated at the bottom of this window.



Click the red "Stop" button near the top left corner of the window when you want to stop capturing traffic.

The "Packet List" Pane

The packet list pane displays all the packets in the current capture file. The "Packet List" pane Each line in the packet list corresponds to one packet in the capture file. If you select a line in this pane, more details will be displayed in the "Packet Details" and "Packet Bytes" panes.

The "Packet Details" Pane

The packet details pane shows the current packet (selected in the "Packet List" pane) in a more detailed form. This pane shows the protocols and protocol fields of the packet selected in the "Packet List" pane. The protocols and fields of the packet shown in a tree which can be expanded and collapsed.

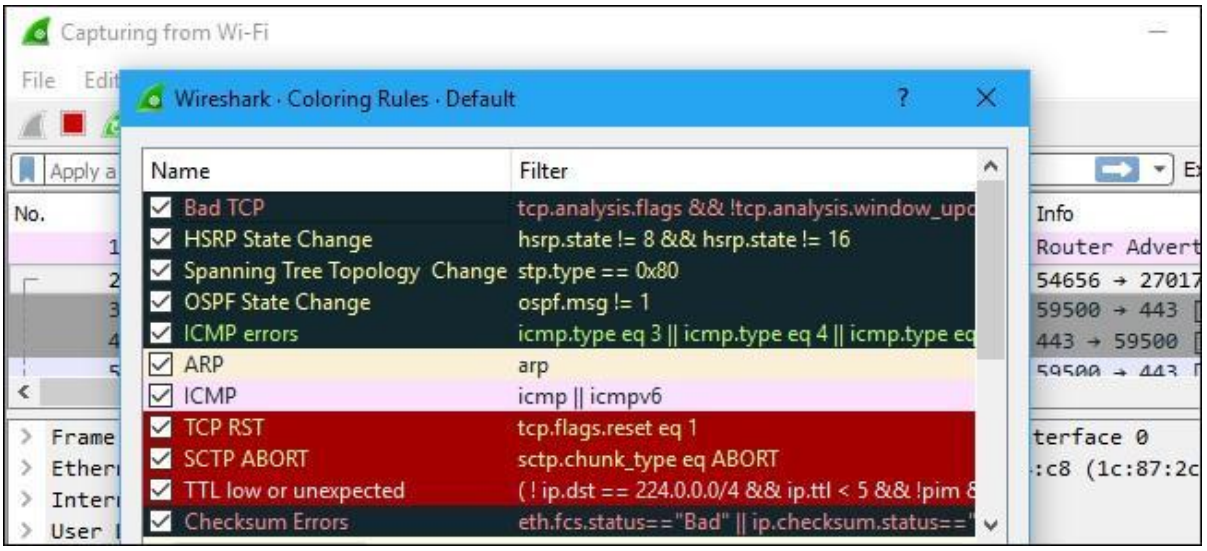
The "Packet Bytes" Pane

The packet bytes pane shows the data of the current packet (selected in the "Packet List" pane) in a hexdump style.

Color Coding

You'll probably see packets highlighted in a variety of different colors. Wireshark uses colors to help you identify the types of traffic at a glance. By default, light purple is TCP traffic, light blue is UDP traffic, and black identifies packets with errors—for example, they could have been delivered out of order.

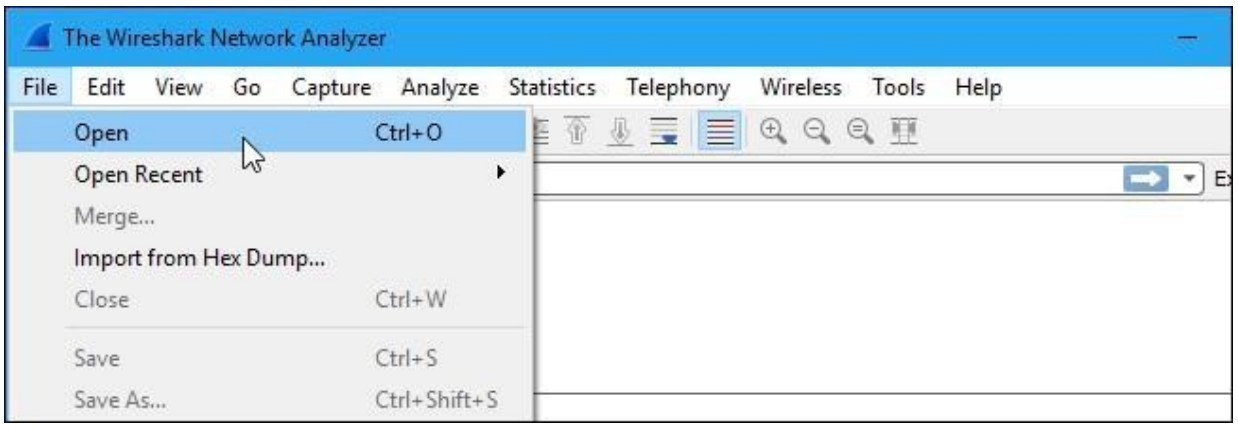
To view exactly what the color codes mean, click View > Coloring Rules. You can also customize and modify the coloring rules from here, if you like.



Sample Captures

If there's nothing interesting on your own network to inspect, Wireshark's wiki has you covered. The wiki contains a page of sample capture files that you can load and inspect. Click File > Open in Wireshark and browse for your downloaded file to open one.

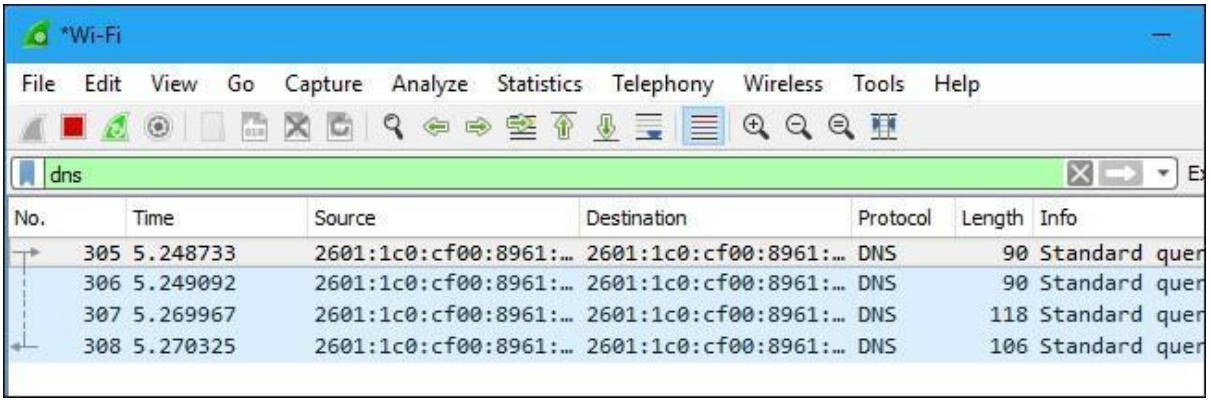
You can also save your own captures in Wireshark and open them later. Click File > Save to save your captured packets.



Filtering Packets

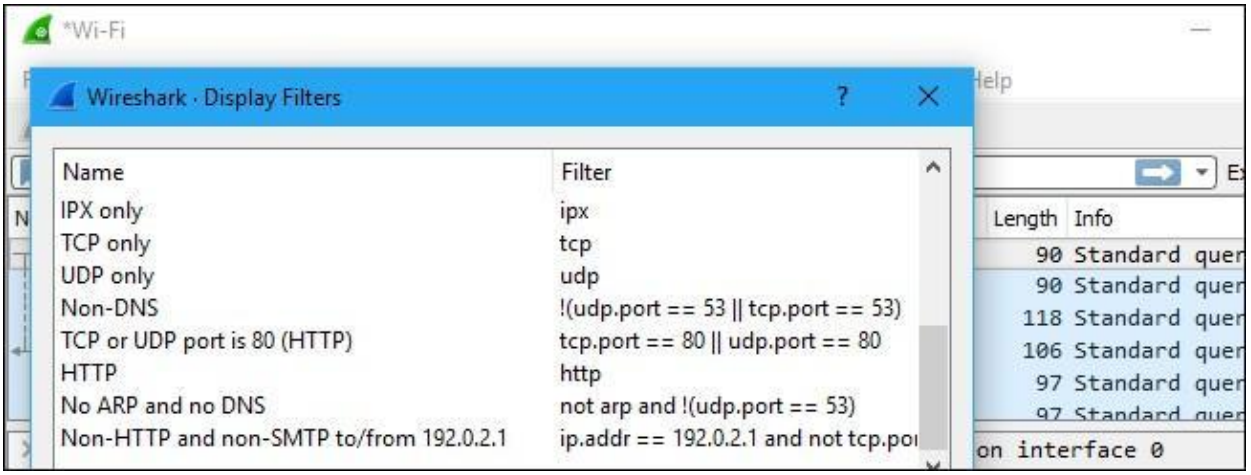
If you're trying to inspect something specific, such as the traffic a program sends when phoning home, it helps to close down all other applications using the network so you can narrow down the traffic. Still, you'll likely have a large amount of packets to sift through. That's where Wireshark's filters come in.

The most basic way to apply a filter is by typing it into the filter box at the top of the window and clicking Apply (or pressing Enter). For example, type "dns" and you'll see only DNS packets. When you start typing, Wireshark will help you autocomplete your filter.

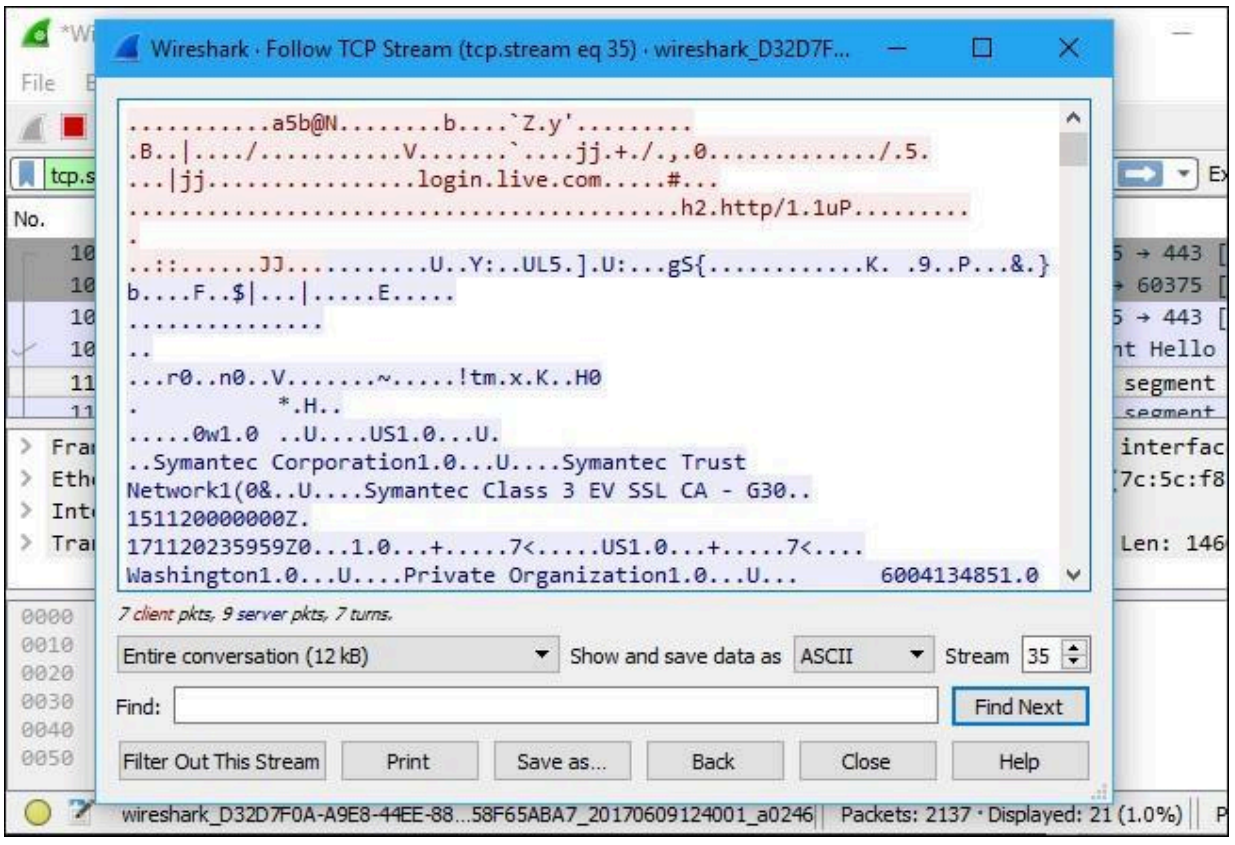


You can also click Analyze > Display Filters to choose a filter from among the default filters included in Wireshark. From here, you can add your own custom filters and save them to easily access them in the future.

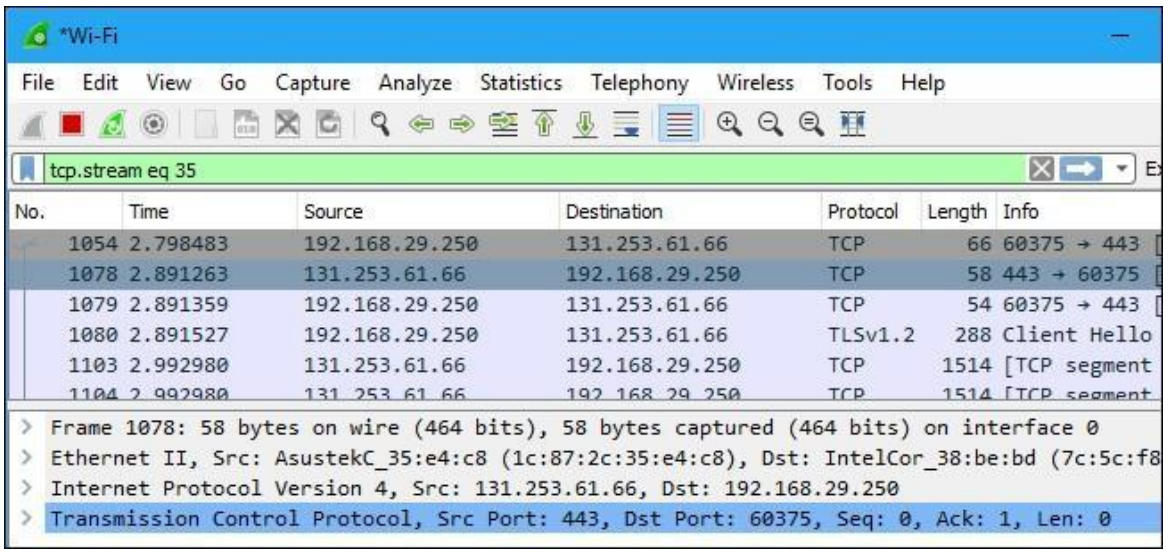
For more information on Wireshark's display filtering language, read the Building display filter expressions page in the official Wireshark documentation.



Another interesting thing you can do is right-click a packet and select Follow > TCP Stream. You'll see the full TCP conversation between the client and the server. You can also click other protocols in the Follow menu to see the full conversations for other protocols, if applicable.

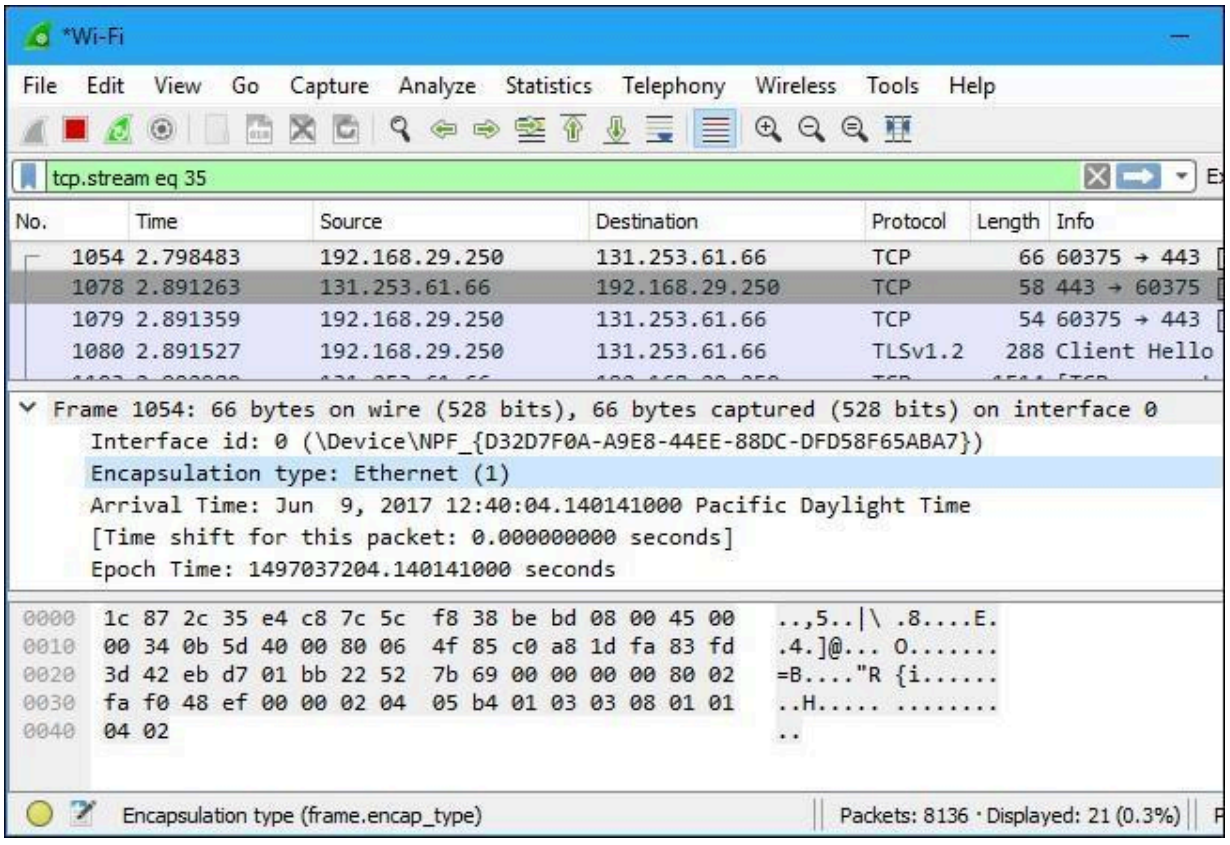


Close the window and you'll find a filter has been applied automatically. Wireshark is showing you the packets that make up the conversation.

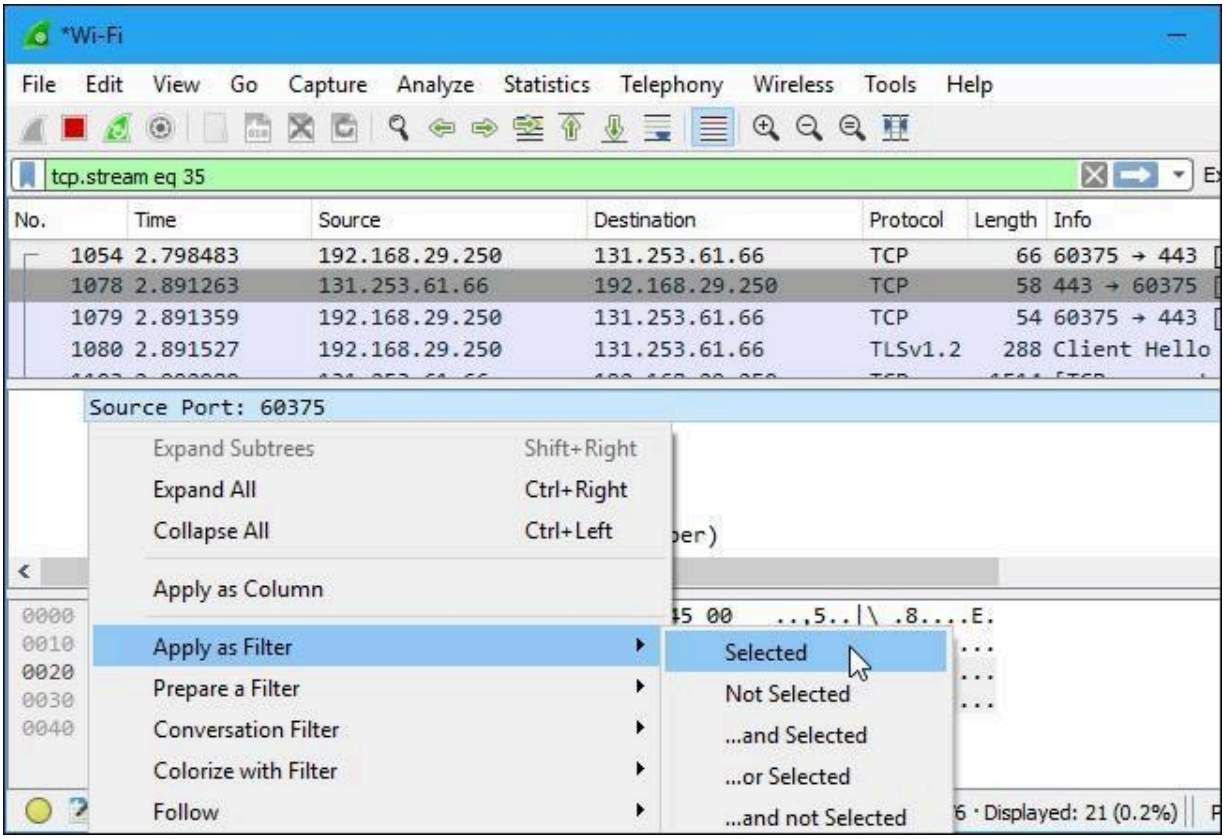


Inspecting Packets

Click a packet to select it and you can dig down to view its details.

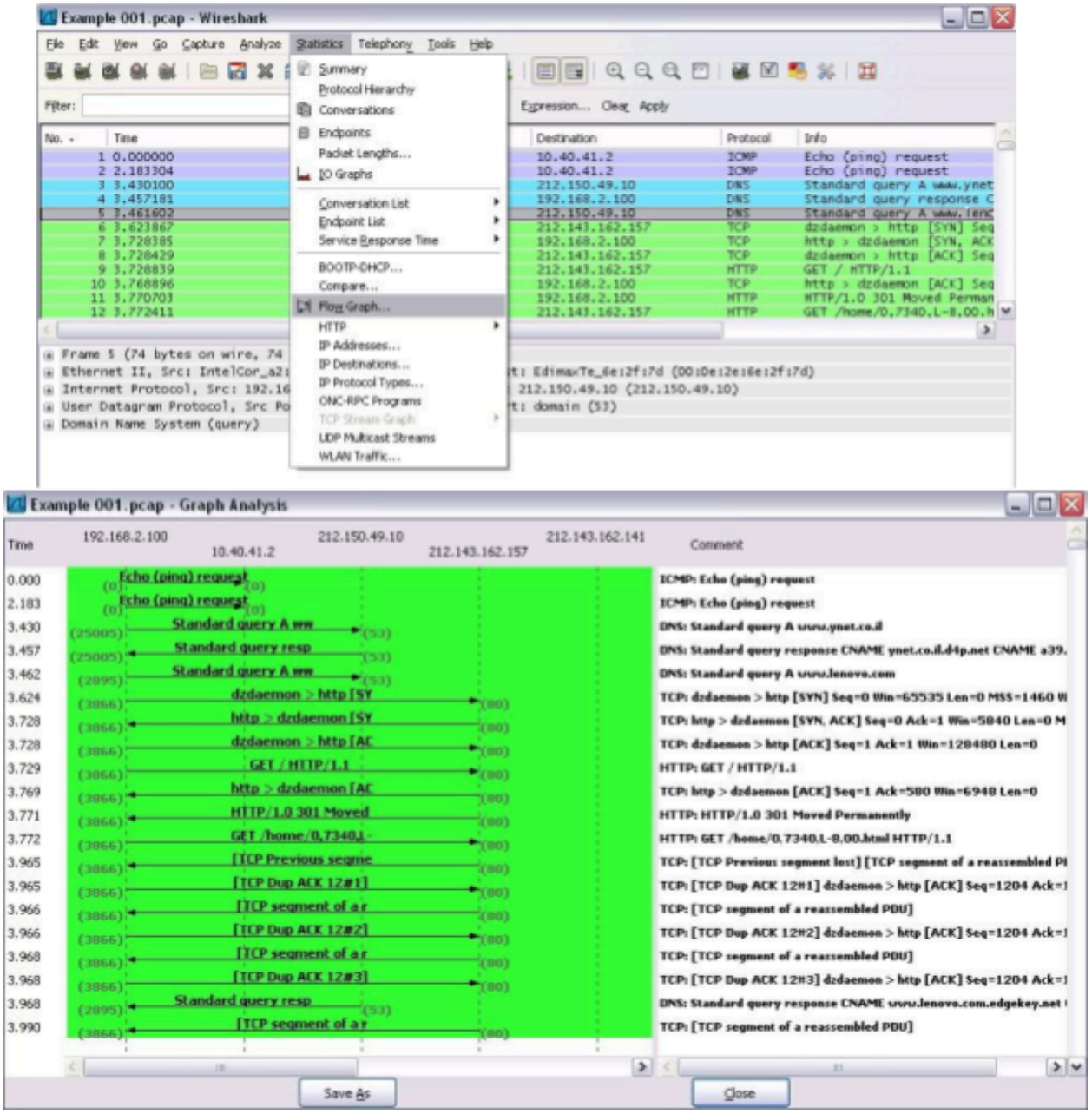


You can also create filters from here — just right-click one of the details and use the Apply as Filter submenu to create a filter based on it.



Wireshark is an extremely powerful tool, and this tutorial is just scratching the surface of what you can do with it. Professionals use it to debug network protocol implementations, examine security problems and inspect network protocol internals.

Flow Graph: Gives a better understanding of what we see.



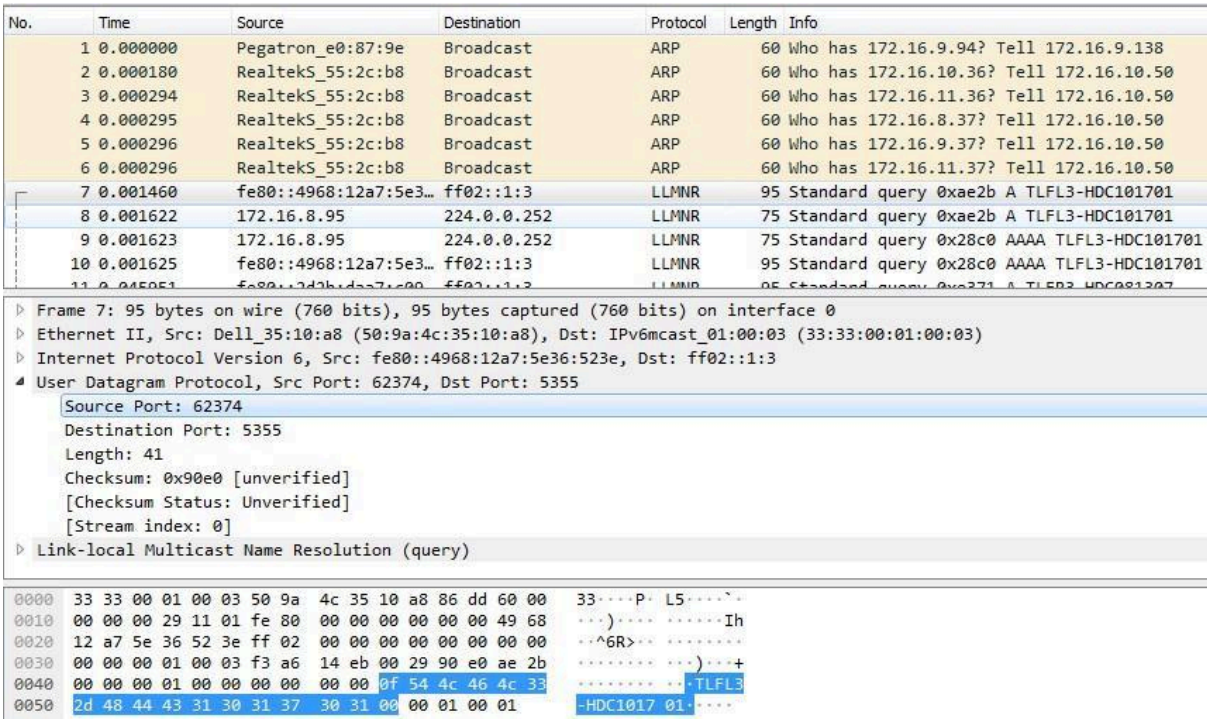
CAPTURING AND ANALYSING PACKETS USING WIRESHARK TOOL

To filter, capture, view, packets in Wireshark Tool.
Capture 100 packets from the Ethernet: IEEE 802.3 LAN Interface and save it.

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture ☾ option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Save the packets.

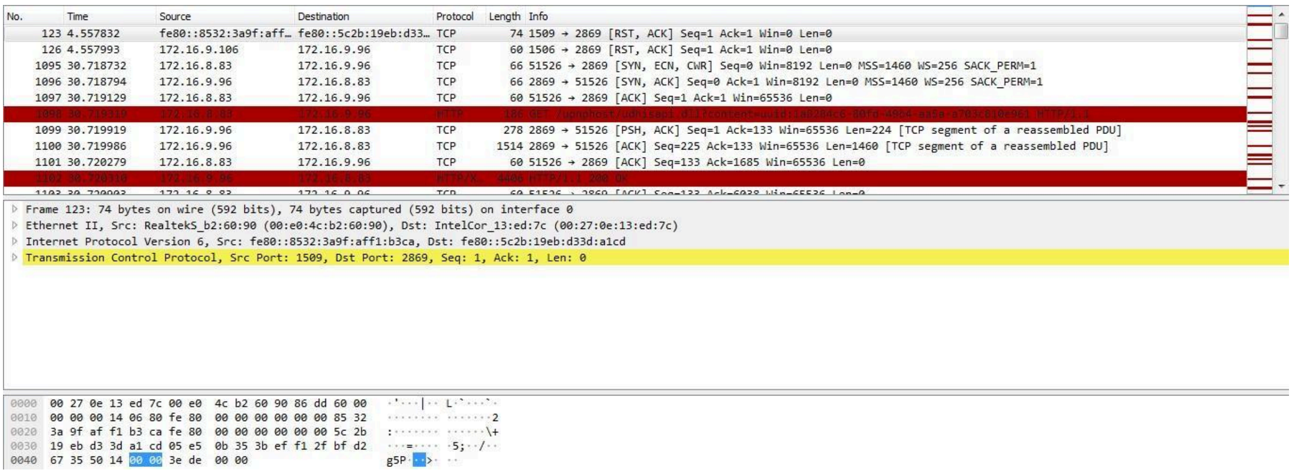
Output



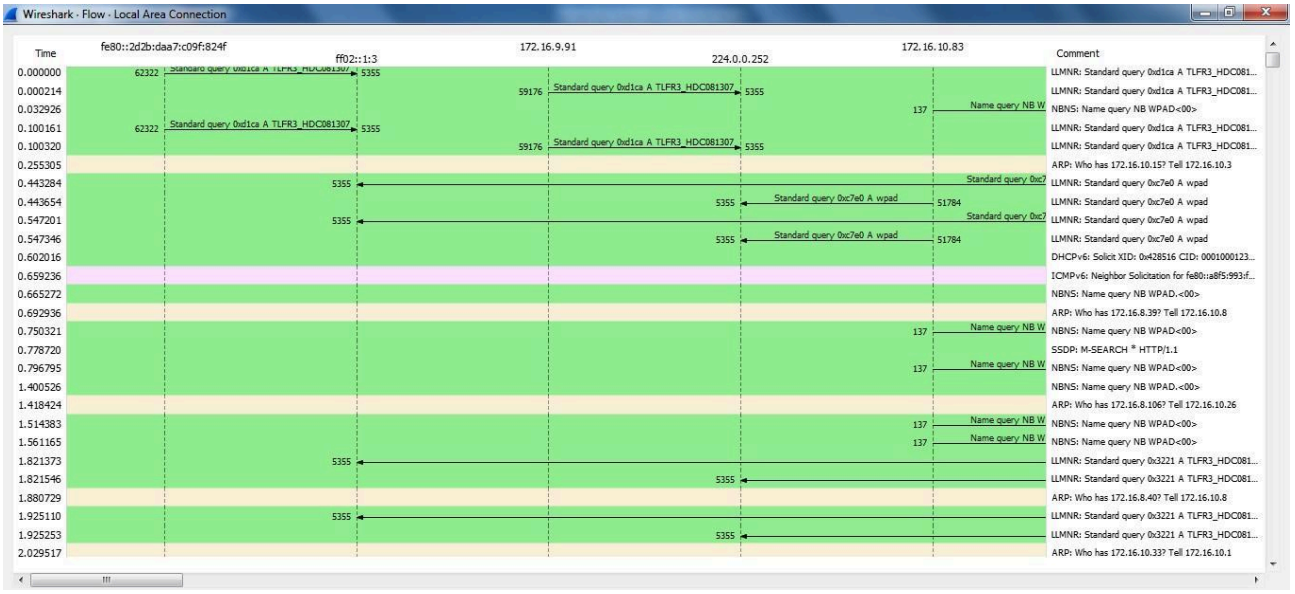
1. **Create a Filter to display only TCP/UDP packets, inspect the packets and provide the flow graph**

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture ☾ option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search TCP packets in search bar.
- To see flow graph click Statistics ☾ Flow graph.
- Save the packets.



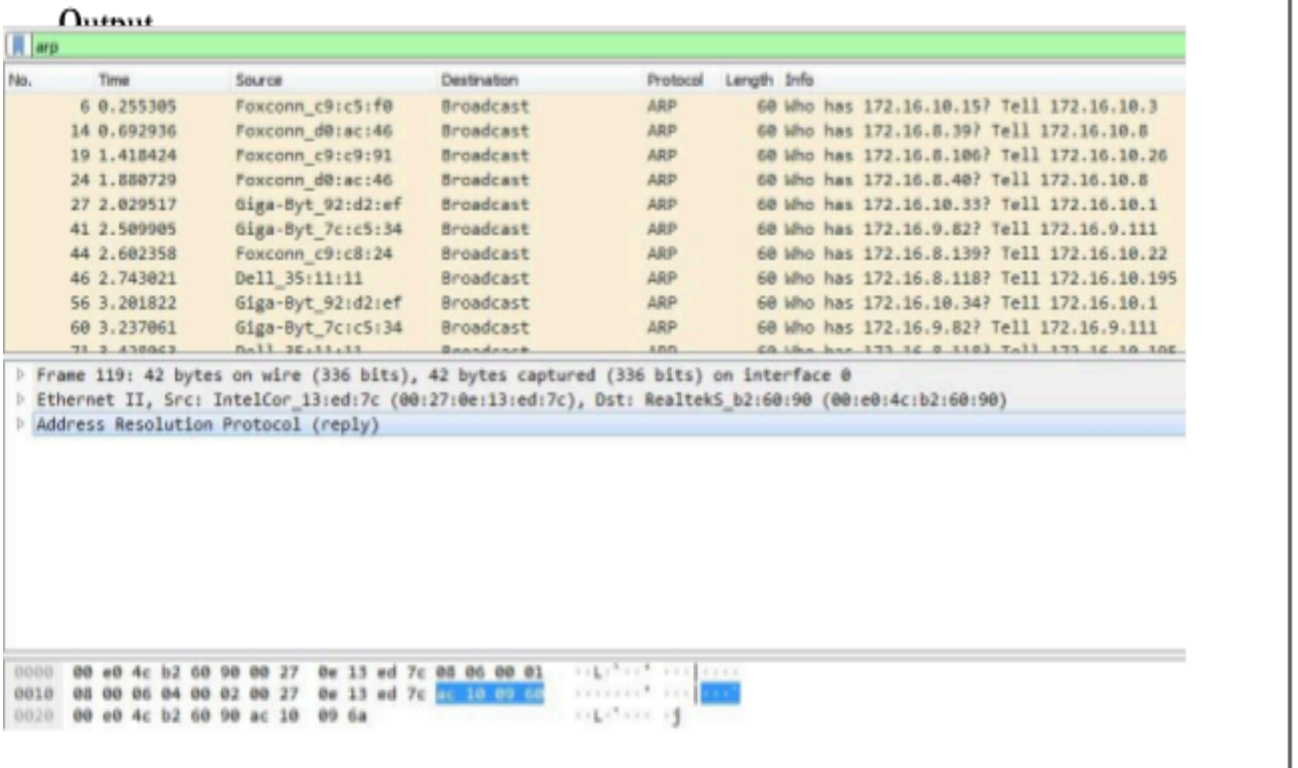
Flow Graph

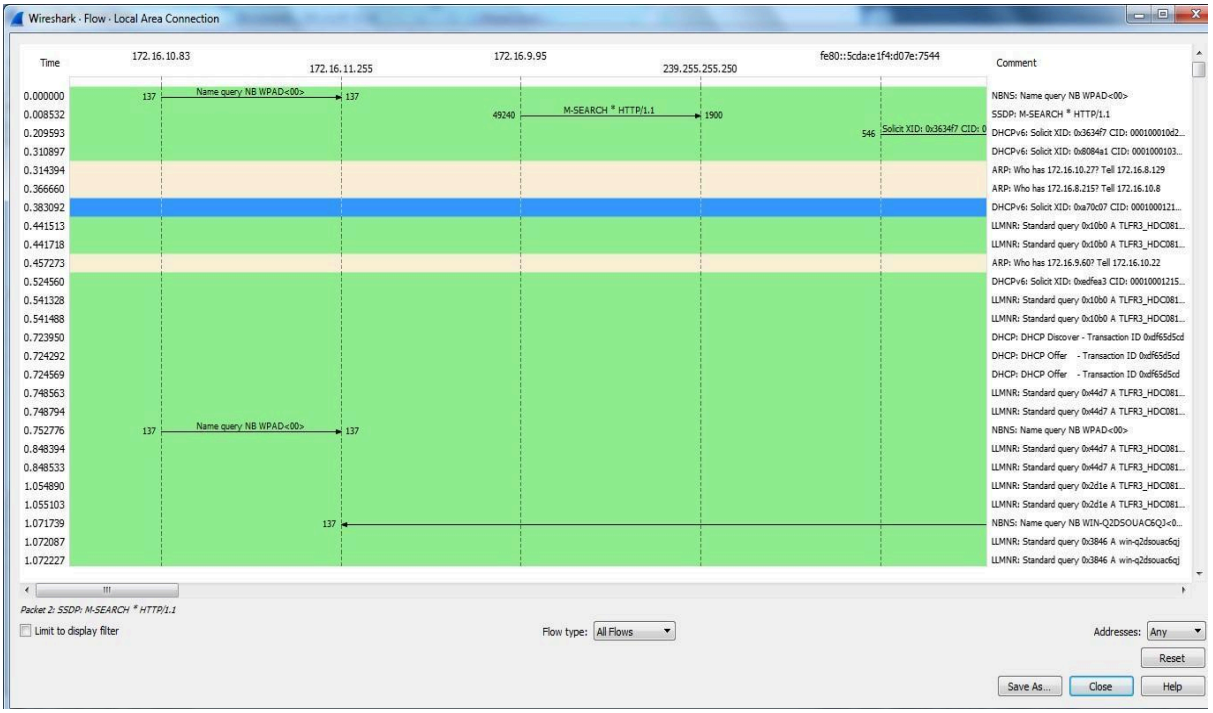


2. Create a Filter to display only ARP packets and inspect the packets.

Procedure

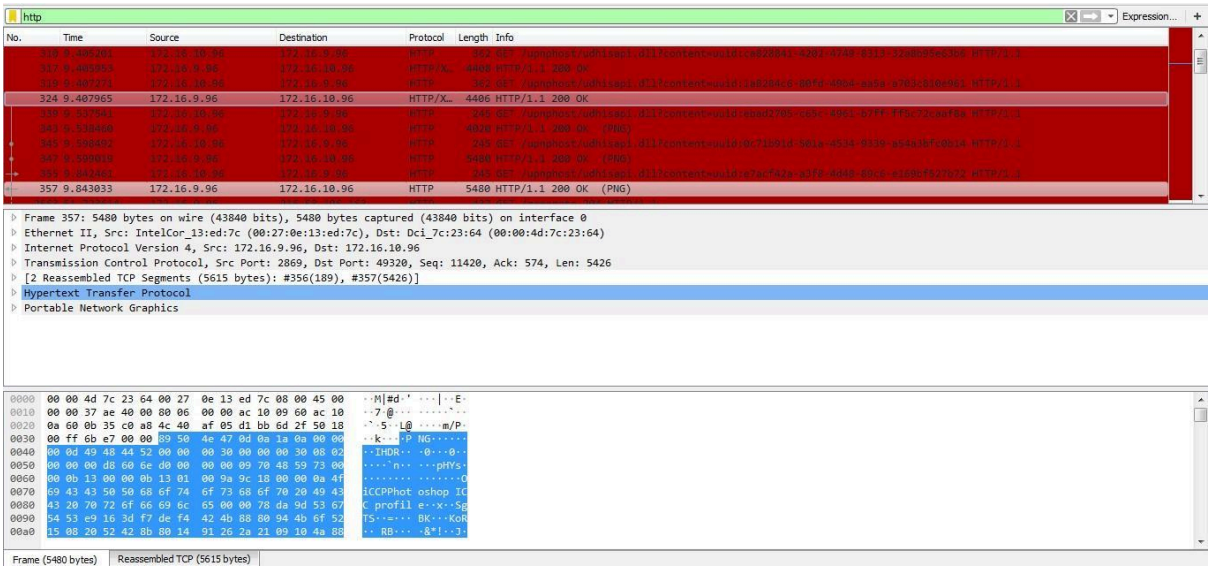
- Go to capture ☾ option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search ARP packets in search bar.
- Save the packets.





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

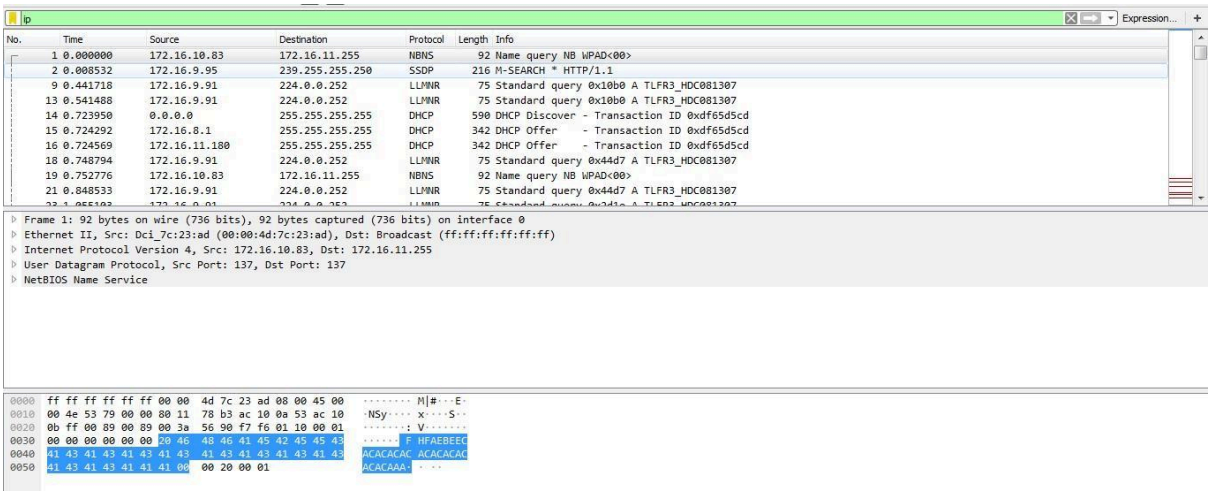
- Select Local Area Connection in Wireshark.
- Go to capture ☾ option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search HTTP packets in search bar.
- Save the packets.



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

- Select Local Area Connection in Wireshark.

- Go to capture option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search ICMP/IP packets in search bar.
- Save the packets

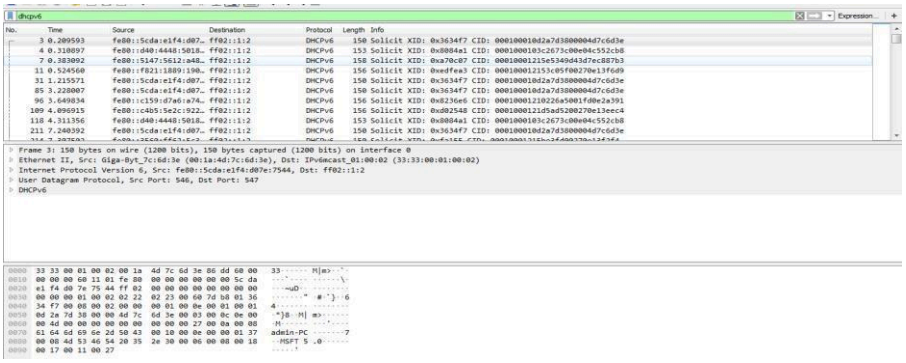


6. Create a Filter to display only DHCP packets and inspect the packets.

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search DHCP packets in search bar.
- Save the packets

Output



Student observation:

1. **What is promiscuous mode?**
2. **Does ARP packets has transport layer header? Explain.**
3. **Which transport layer protocol is used by DNS?**
4. **What is the port number used by http protocol?**

5. What is a broadcast ip address?

Answers:

1. Promiscuous Mode: NIC receives all network packets, not just those addressed to it.

2. ARP Packets and Transport Layer Header: No, ARP operates at Layer 2 and doesn't use a transport layer header.

3.Transport Layer Protocol for DNS: DNS typically uses UDP (and TCP when needed).

4. HTTP Port Number: Port 80(HTTPS uses port 443).

5. Broadcast IP Address: The address used to send packets to all devices in a network (e.g., 192.168.1.255 in a /24 subnet).

Result:

Thus the experiment on wireshark was studied and completed successfully.

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:

```
def calcRedundantBits(m):

    for i in range(m):
        if(2**i >= m + i + 1):
            return i


def posRedundantBits(data, r):
    j = 0
    k = 1
    m = len(data)
    res = ''

    for i in range(1, m+r+1):
        if(i == 2**j):
```

```
            res = res + '0'
            j += 1
        else:
            res = res + data[-1 * k]
            k += 1
    return res[::-1]

def calcParityBits(arr, r):
    n = len(arr)
     for i in range(r):
       val = 0
       for j in range(1, n + 1):

                if(j & (2**i) == (2**i)):
            val = val ^ int(arr[-1 * j])



            arr = arr[:n-(2**i)] + str(val) + arr[n-(2**i)+1:]
    return arr

def detectError(arr, nr):
    n = len(arr)
    res = 0

     for i in range(nr):
       val = 0
       for j in range(1, n + 1):
            if(j & (2**i) == (2**i)):
                val = val ^ int(arr[-1 * j])

       res = res + val*(10**i)
```

```
        return int(str(res), 2)


    data = '1011001’
    m = len(data)
    r = calcRedundantBits(m)
    arr = posRedundantBits(data, r)
    arr = calcParityBits(arr, r)
    print("Data transferred is " + arr)
    arr = '11101001110'
    print("Error Data is " + arr)
    correction = detectError(arr, r)
    if(correction==0):
       print("There is no error in the received message.")
    else:
       print("The position of error is ",len(arr)-correction+1,"from the left")
```

Input:-
data = '1011001'

Output:
Data transferred is 10101100101

Result:
Thus error detection and error correction using hamming code has been implemented successfully**.**

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:

```
#include<stdio.h>
int main()
{
   int w,i,f,frames[50];

   printf("Enter window size: ");
   scanf("%d",&w);
   printf("\nEnter number of frames to transmit: ");
   scanf("%d",&f);
   printf("\nEnter %d frames: ",f);

   for(i=1;i<=f;i++)
      scanf("%d",&frames[i]);
```

```
        printf("\nWith sliding window protocol the frames will be sent in the following manner (assuming no corruption of frames)\n\n");
        printf("After sending %d frames at each stage sender waits for acknowledgement sent by the receiver\n\n",w);

        for(i=1;i<=f;i++)
        {
            if(i%w==0)
            {
                printf("%d\n",frames[i]);
            printf("Acknowledgement of above frames sent is received by sender\n\n");
            }
            else
                printf("%d ",frames[i]);
        }

        if(f%w!=0)
            printf("\nAcknowledgement of above frames sent is received by sender\n");

        return 0;
    }
```

Input:

```
Enter window size: 4
Enter number of frames to transmit: 7
Enter 7 frames: 10 20 30 40 50 60 70
```

Output:

With sliding window protocol the frames will be sent in the following manner (assuming no corruption of frames)

After sending 4 frames at each stage sender waits for acknowledgement sent by the receiver

10 20 30 40
Acknowledgement of above frames sent is received by sender

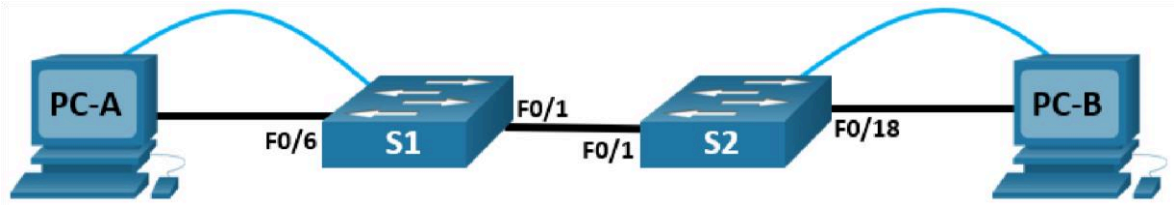
50 60 70
Acknowledgement of above frames sent is received by sender.

Result:
Thus the flow control at data link layer using sliding window has been successfully implemented.

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
10   Operations                        active
20   Parking_Lot                       active
99   Management                        active
1000 Native                            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-5UPDOWN: state to up Line protocol on Interface Vlan99, changed

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?

_____

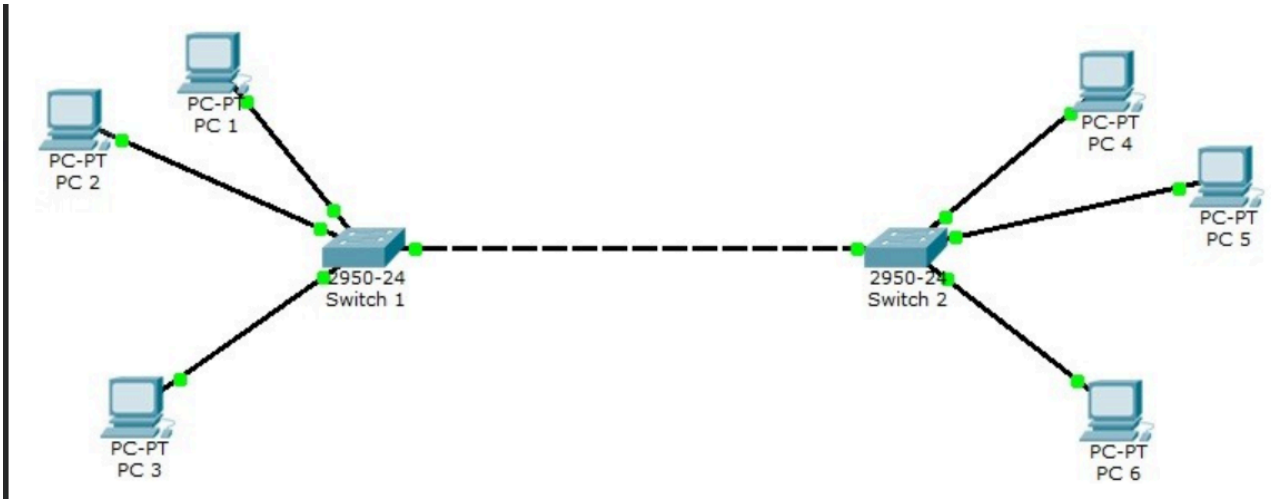
_____ ___

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.



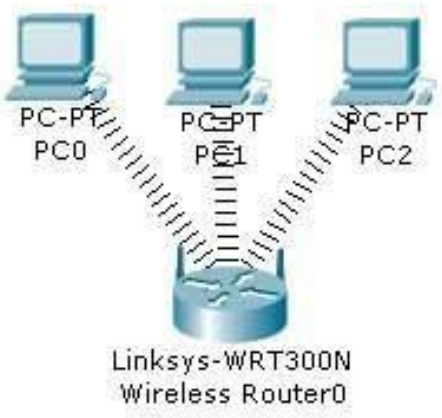
Result:

Thus, the virtual LAN configuration was designed and executed using CISCO packet tracer.

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.

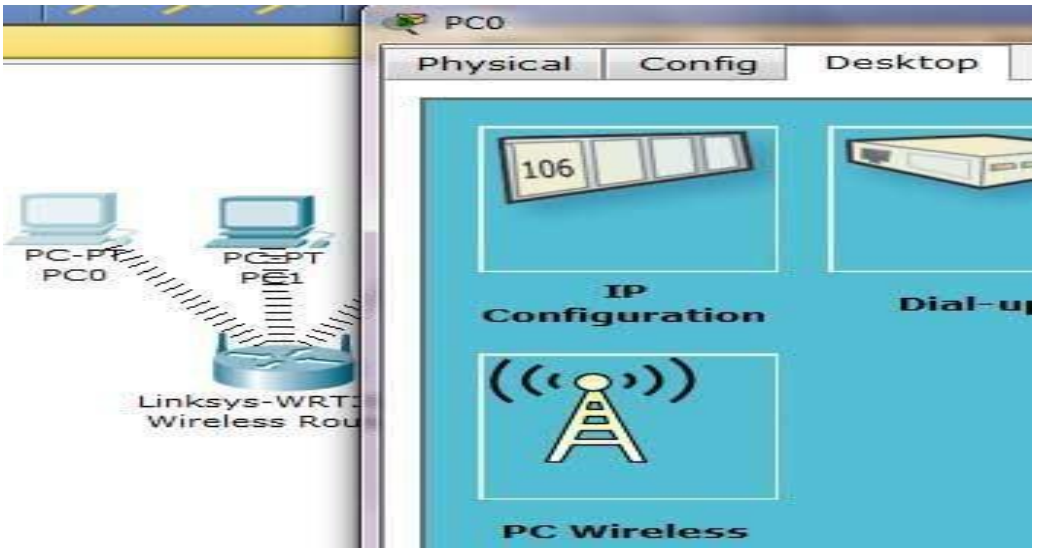
- Next click on wireless tab and set default SSID to MotherNetwork.
- Now Select wireless security and change Security Mode to WEP

- Set Key1 to 0123456789

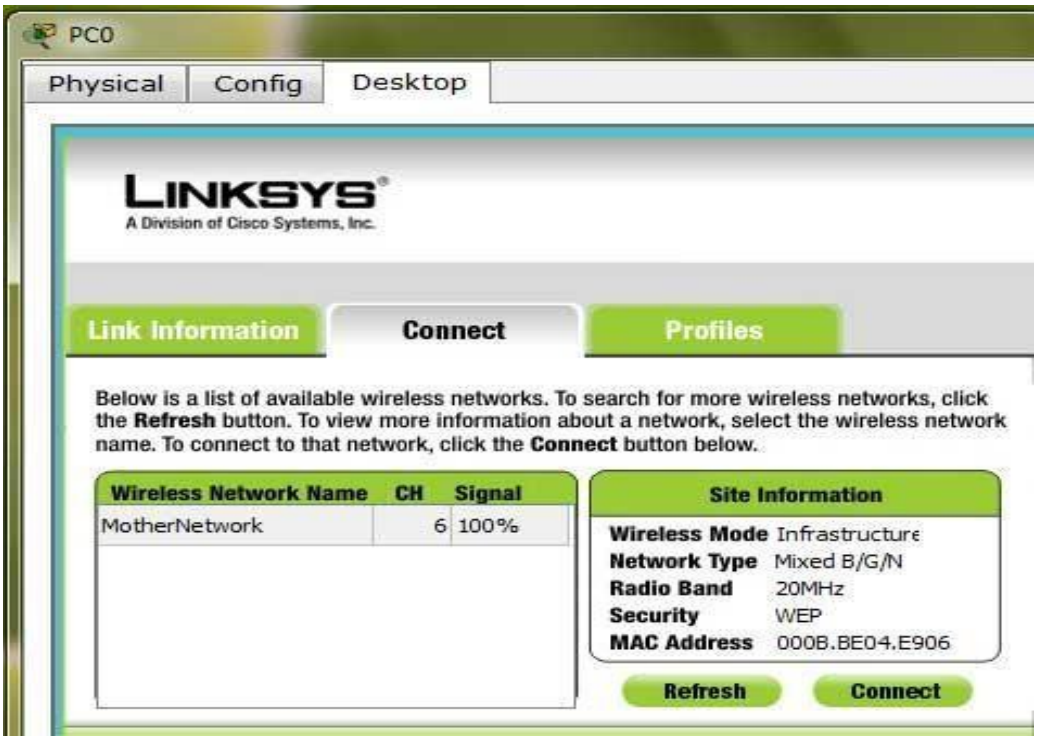
- Again go in the end of page and Click on Save Setting
- Now we have completed all given task on Wireless router. Now configure the static IP on all three PC's
- Double click on pc select Desktop tab click on IP configuration select Static IP and set IP as given below

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

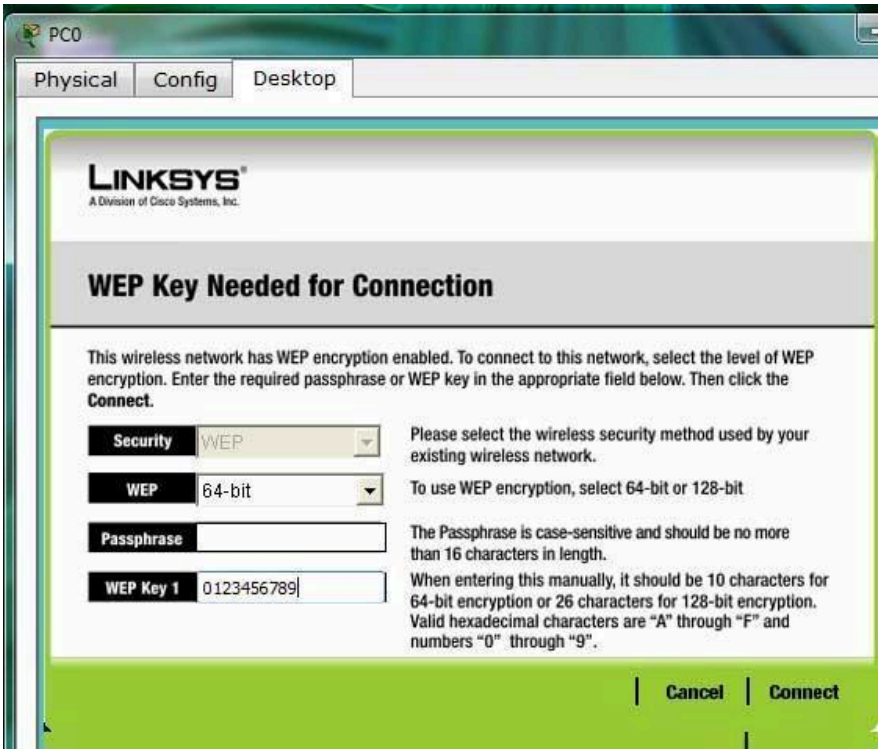


- Click on connect tab and click on Refresh button



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.

Student observation:

c) **What is SSID of a wireless router?**

d) **What is a security key in wireless router?**

e) **Configure a simple Wireless LAN in your lab using a real access point and write down the configurations in your notebook.**

Answer:

c) **SSID** is the unique name of a wireless network that helps devices identify and connect to it.

d) A **security key** is a password required to connect to a wireless network, ensuring only authorized access.

e) Configuration Detials:

SSID: "Lab_WLAN"

Security Protocol: WPA2

Security Key: 1234

Router IP: 192.168.1.1

Result:

Thus, the virtual LAN was studied and verified successfully.

Practical-9

AIM:-Implementation of SUBNETTING in CISCO PACKET TRACER simulator.

Classless IP subnetting is a technique that allows for more efficient use of IP addresses by allowing for subnet masks that are not just the default masks for each IP class. This means that we can divide our IP address space into smaller subnets, which can be useful when we have a limited number of IP addresses but need to create multiple networks.

CREATING A NETWORK TOPOLOGY:

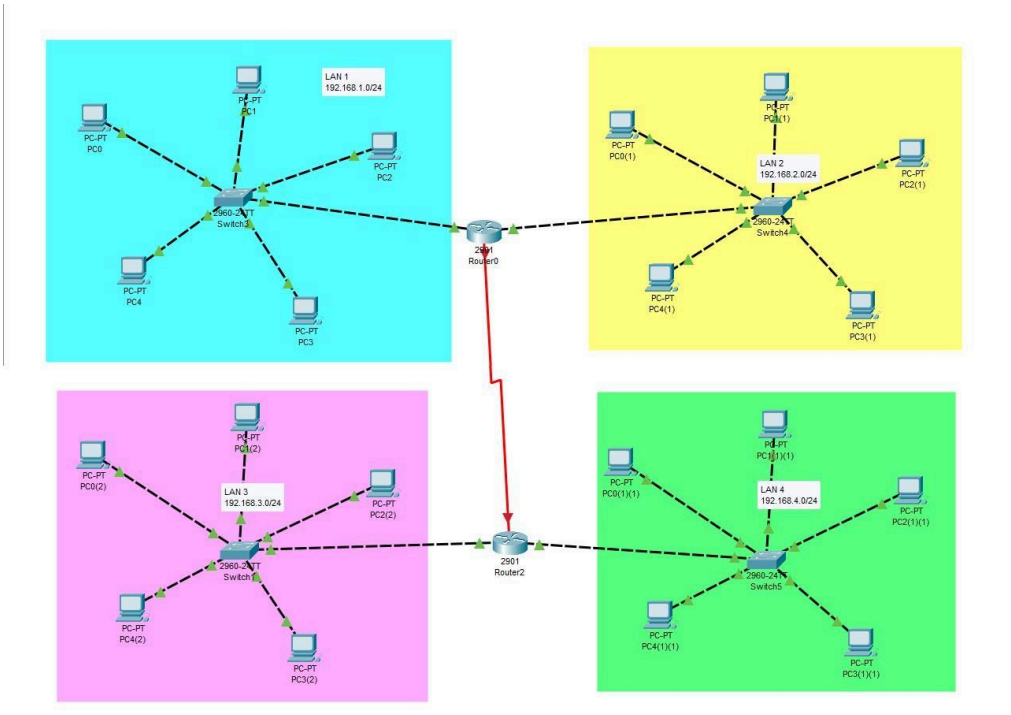
The first step in implementing classless IP subnetting is to create a network topology in Packet Tracer. To create a network topology in Packet Tracer, select the "New" button in the top left corner, then select "Network" and "Generic". This will create a blank network topology that we can use to add devices.

ADDING THE DEVICES:

Once we have created our network topology, we can add devices to it. Here, we will be adding routers, witches, and PCs. To add a device, select the device from the bottom left corner and drag it onto the network topology. Then, connect the devices by dragging a cable from one device's port to another device's port.

SUBNETTING:

To subnet the network address of 192.168.1.0/24 to provide enough space for at least 5 addresses for end devices, the switch, and the router, we can use a /27 subnet mask. This will give us 8 subnets with 30 host addresses each.



The IP addressing for the network shown in the topology can be as follows:

- Router R1:
- GigabitEthernet0/0: 192.168.1.1
- GigabitEthernet0/1: 192.168.2.1 Switch S1:
- FastEthernet0/1: 192.168.1.0/27
- PC1: 192.168.1.11
- PC2: 192.168.1.12
- PC3: 192.168.1.13
- PC4: 192.168.1.14
- PC5: 192.168.1.15
- FastEthernet0/2: 192.168.2.0/27
- PC1: 192.168.2.11
- PC2: 192.168.2.12
- PC3: 192.168.2.13
- PC4: 192.168.2.14
- PC5: 192.168.2.15 Router R2:
- FastEthernet0/0: 192.168.3.1
- FastEthernet0/1: 192.168.4.1 Switch S2:
- FastEthernet0/1: 192.168.3.0/27
- PC1: 192.168.3.11
- PC2: 192.168.3.12
- PC3: 192.168.3.13
- PC4: 192.168.3.14
- PC5: 192.168.3.15
- FastEthernet0/2: 192.168.4.0/27
- PC1: 192.168.4.11
- PC2: 192.168.4.12
- PC3: 192.168.4.13
- PC4: 192.168.4.14
- PC5: 192.168.4.15

CONFIGURING THE DEVICES:

Now that we have added our devices and connected them, we can start configuring them. We will start by configuring the router. Right-click on the router and select "CLI". This will open the command-line interface (CLI) for the router. In the CLI, enter the following commands:

```
#enable
#configure terminal
#interface FastEthernet0/0
#ip address {IP address} {subnet mask}
#no shutdown
#exit

interface FastEthernet0/1
ip address {IP address} {subnet mask}
```

no shutdown
exit

Replace "{IP address}" and "{subnet mask}" with your desired IP address and subnet mask.

The first interface, FastEthernet0/0, will be connected to the switch, while the second interface, FastEthernet0/1, will be connected to one of the PCs. These commands configure the router's interfaces with IP addresses and subnet masks.

Next, we will configure the switch. Right-click on the switch and select "CLI". In the CLI, enter the following commands:

enable
configure terminal
interface
FastEthernet0/1
switchport mode
access exit

interface FastEthernet0/2
switchport mode
access exit

These commands configure the switch to operate in access mode on its two ports, which are connected to the two PCs.

Finally, we will configure the PCs. Right-click on each PC and select "Config". In the configuration window, enter the IP address, subnet mask, default gateway, and DNS server information. The IP address and subnet mask should be within the same subnet as the router's FastEthernet0/1 interface.

To configure the GigabitEthernet interface on the router, you can follow these steps:

1. Right-click on the router and select "CLI".
2. Enter the following commands:

enable configure terminal
interface GigabitEthernet0/0 ip
address {IP address} {subnet
mask}
no shutdown
exit

Replace "{IP address}" and "{subnet mask}" with your desired IP address and subnet mask. These commands configure the GigabitEthernet interface with an IP address and subnet mask, and enable the interface.

TESTING THE NETWORK:

Now that our network topology is configured, we can test the network. Open a command prompt on each PC and try to ping the other PC. If the ping is successful, then the network is functioning properly. We can also use the "ping" command to test connectivity between the router and the PCs.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	Successful	PC4(2)	Router2	ICMP		0.000	N	12
	Successful	PC4(2)	PC2(1)(1)	ICMP		0.000	N	13
	Successful	PC0	Router0	ICMP		0.000	N	14

Student observation:

a) Write down your understanding of subnetting.

b) What is the advantage of implementing subnetting within a Network?

c) Find out whether subnetting is implemented in your college. If yes, draw and list down the subnets used with ip addresses.

a) **Subnetting** divides a larger network into smaller, manageable sub-networks (subnets) to enhance network organization and control.

b) **Advantage**: Subnetting improves security, reduces network congestion, and allows efficient IP address management within a network.

c) Admin: 192.168.10.0/24

Classrooms: 192.168.20.0/24

Labs: 192.168.30.0/24

Result:

Thus the experiment was completed successfully.

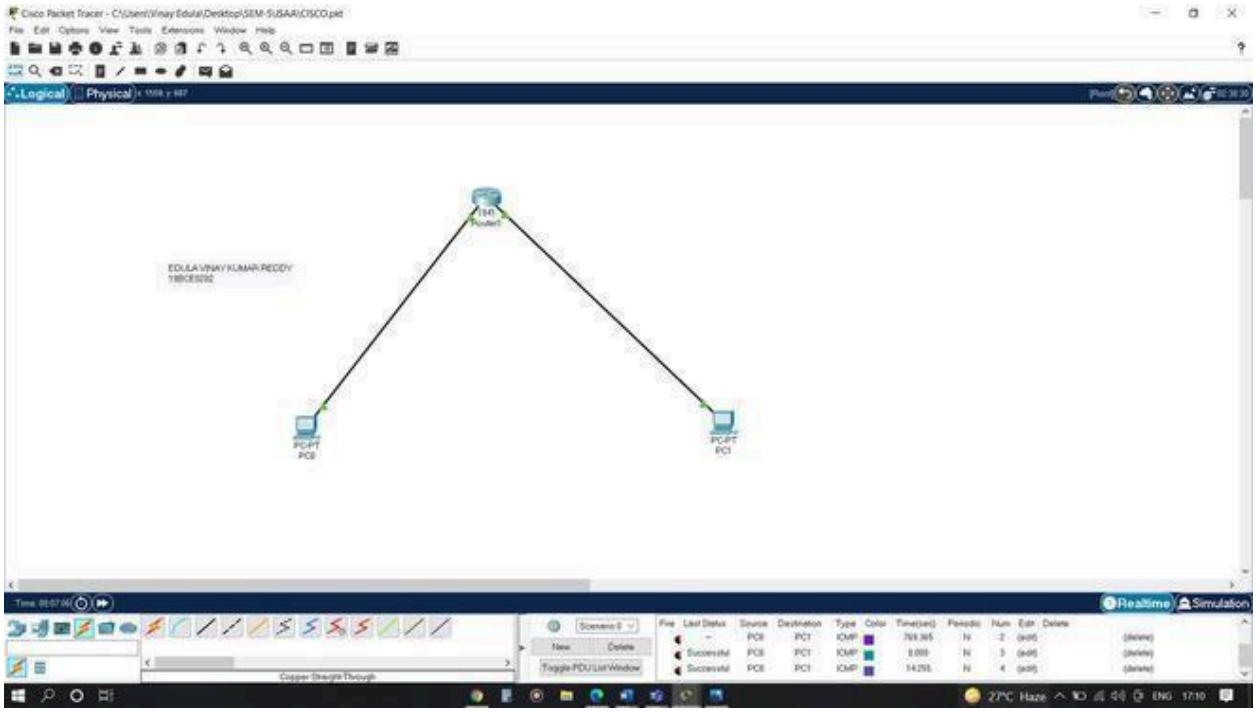
Practical-10

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

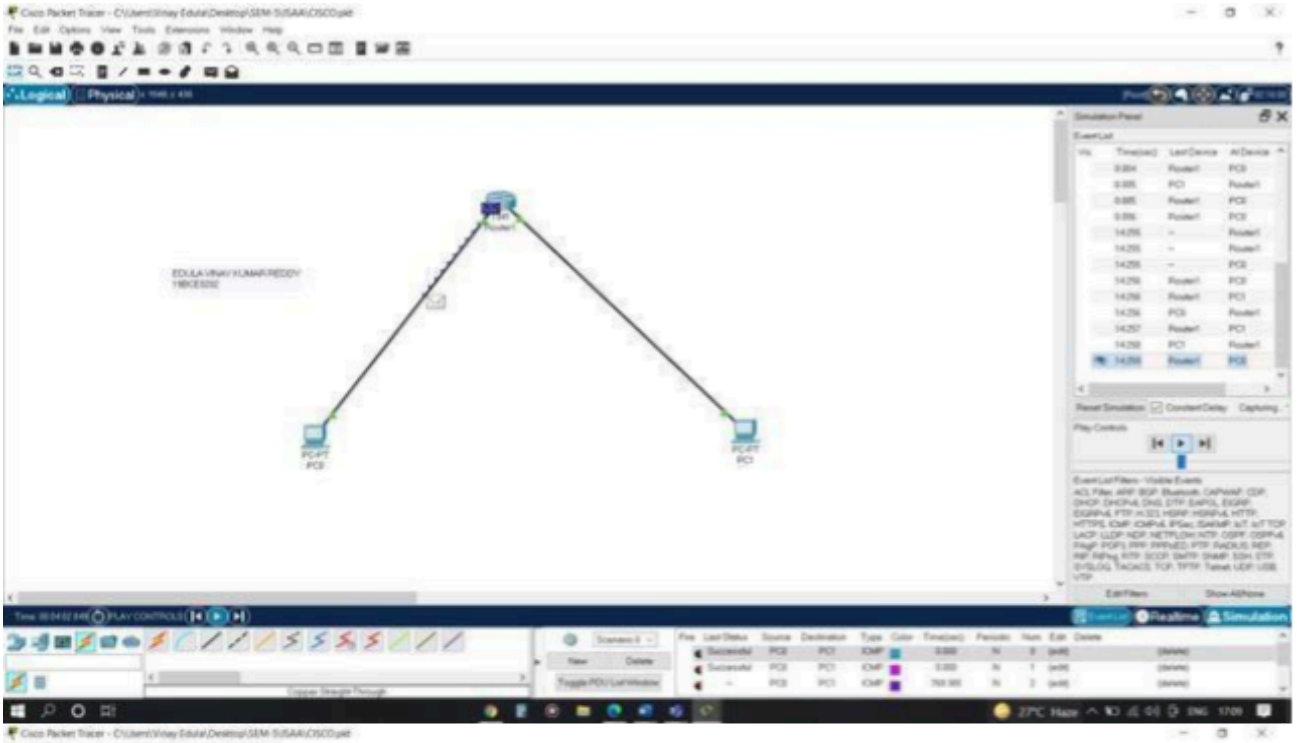
PC Configuration Table:

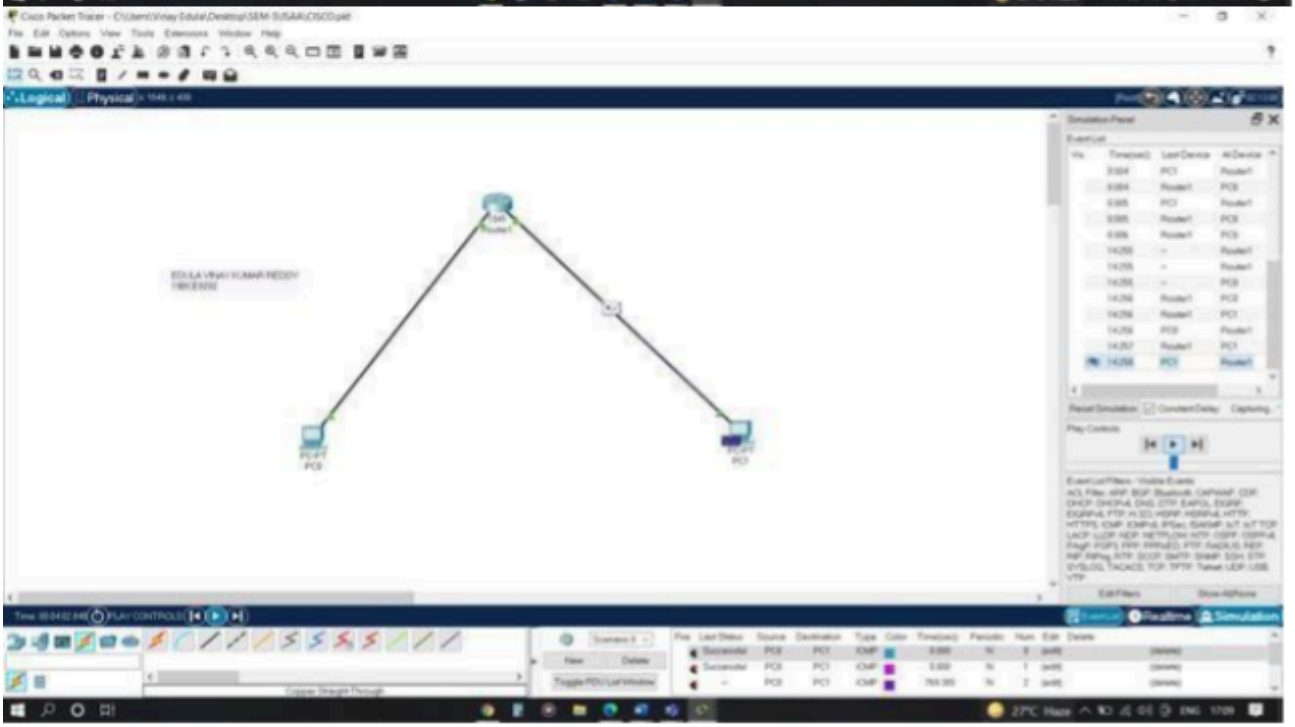
Device Name	IP address	Subnet Mask	Gateway
PC 0	192.168.10.2	255.255.255.0	192.168.10.1
PC 1	192.168.20.2	255.255.255.0	192.168.20.1

Designed Network topology:

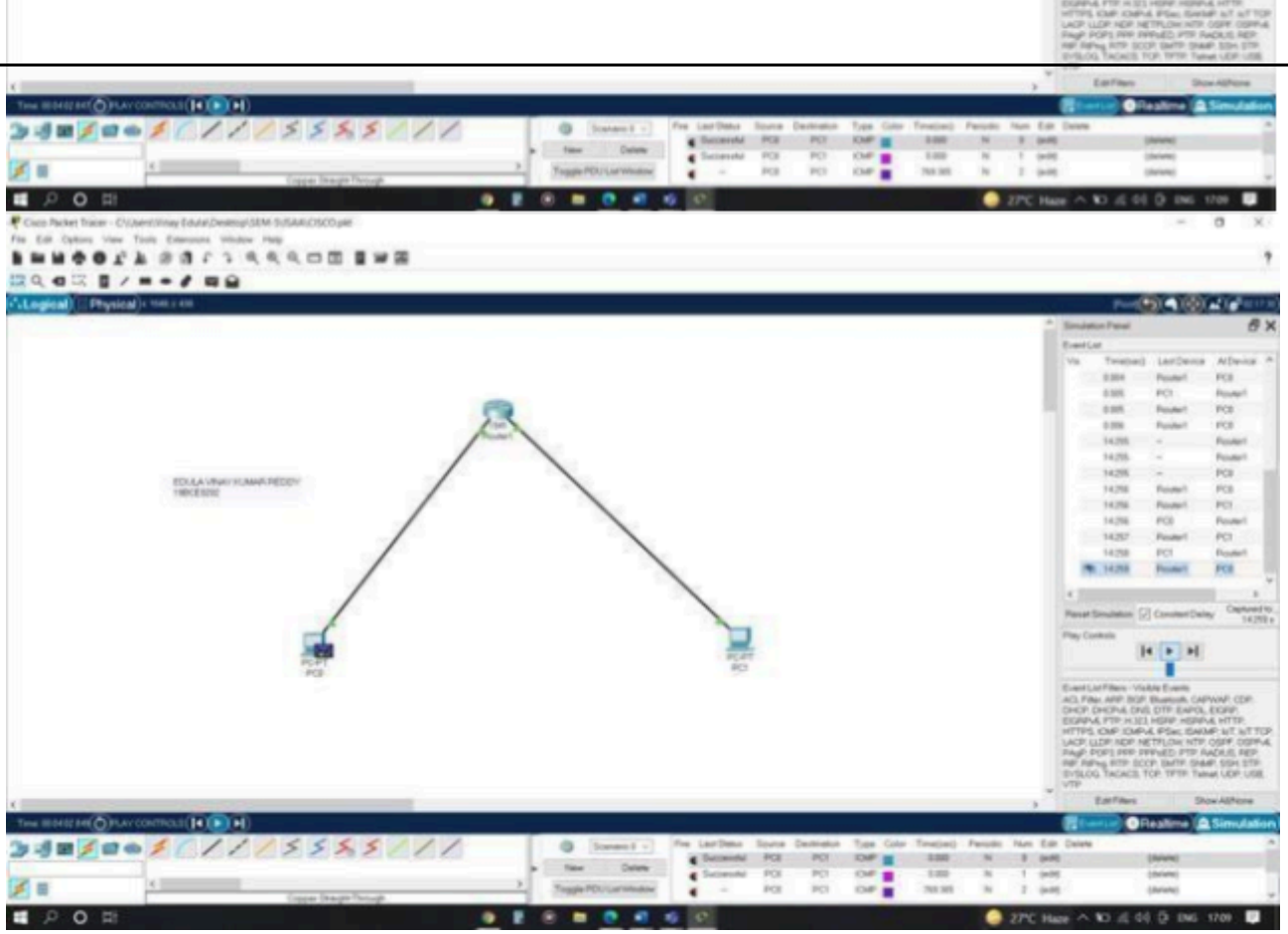
Simulation of Designed Network Topology:

Sending a PDU From PC0 to PC1:



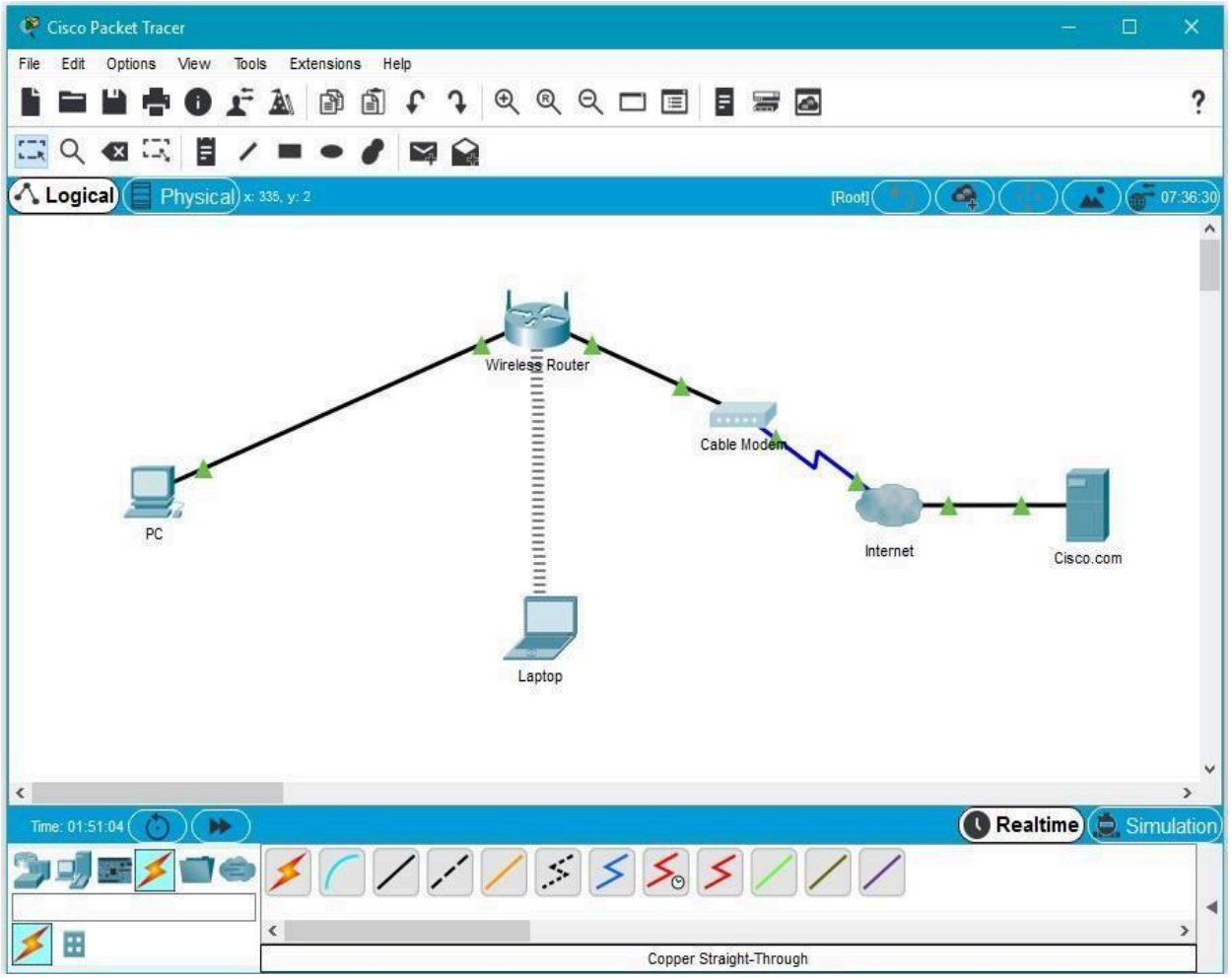


Acknowledgment From PC1 to PC0:



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	Wireless 0	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

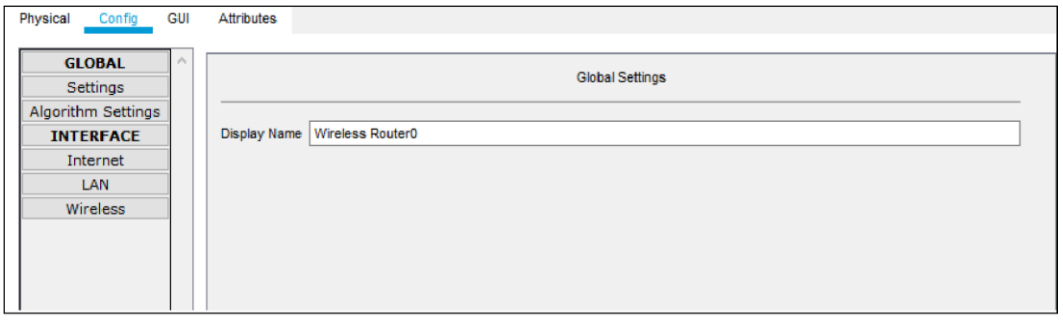
a. Add network devices to the workspace.

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

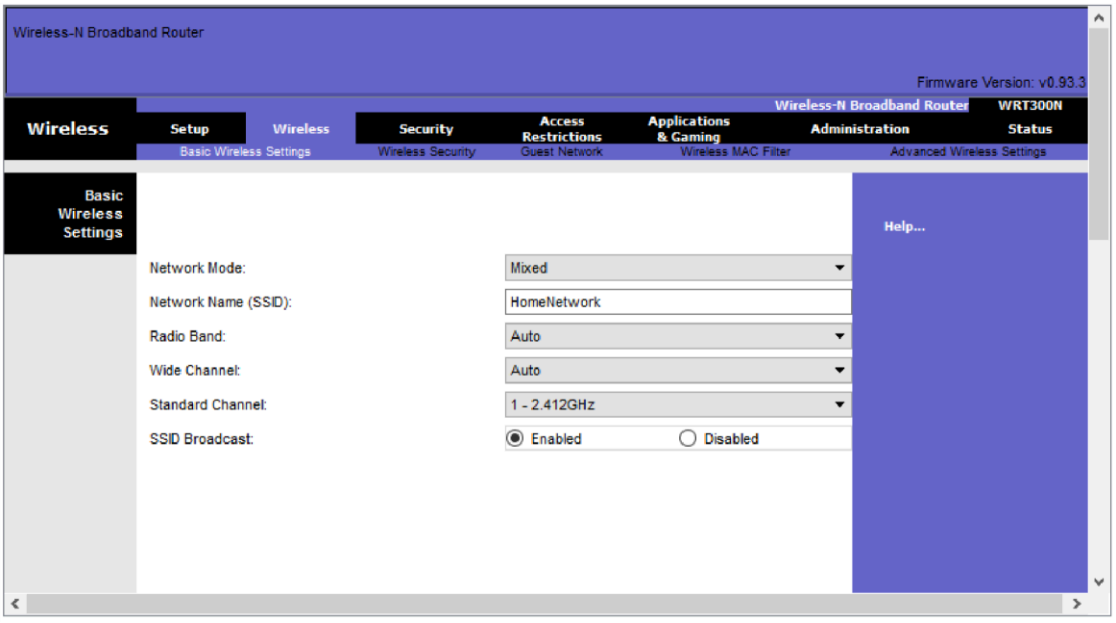
Step 1: Configure the wireless router

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.

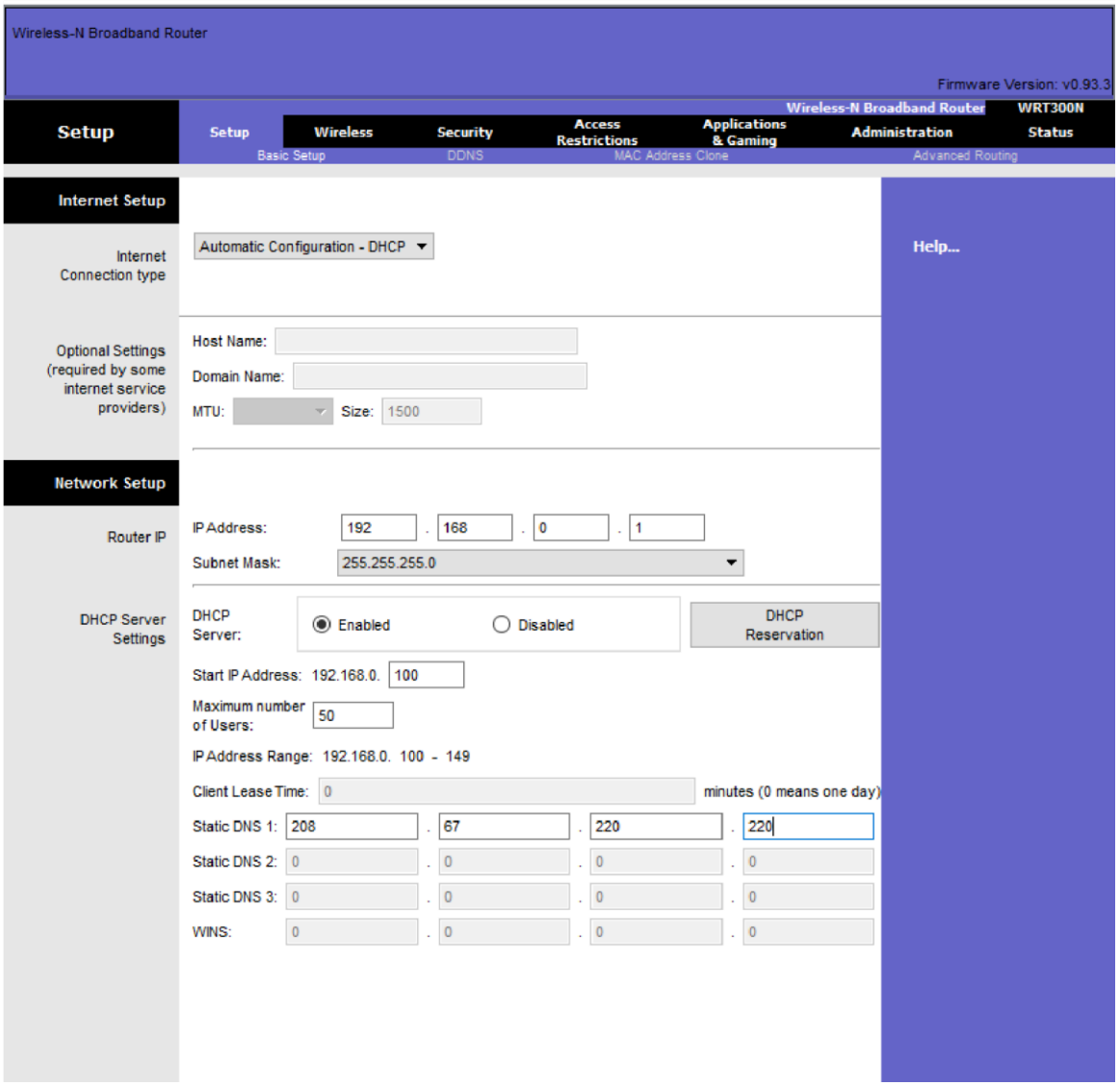
Next, click on the **Wireless** tab in the GUI to view the wireless settings. The only setting that needs to be changed from the defaults is the **Network Name (SSID)**. Here, type the name “HomeNetwork” as shown in the figure.



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

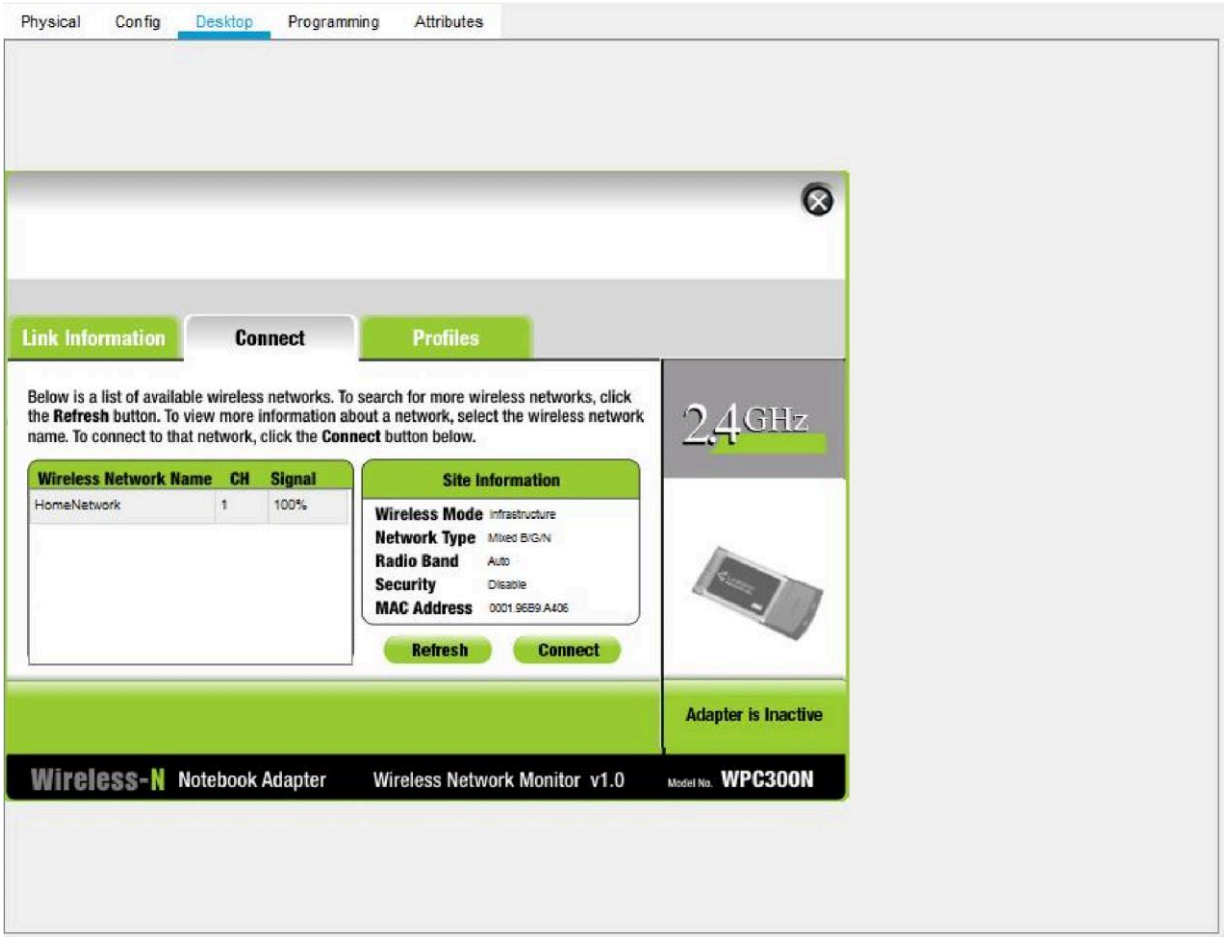
on the side of the laptop. Power the laptop back on by clicking on the Laptop power button again.

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.**

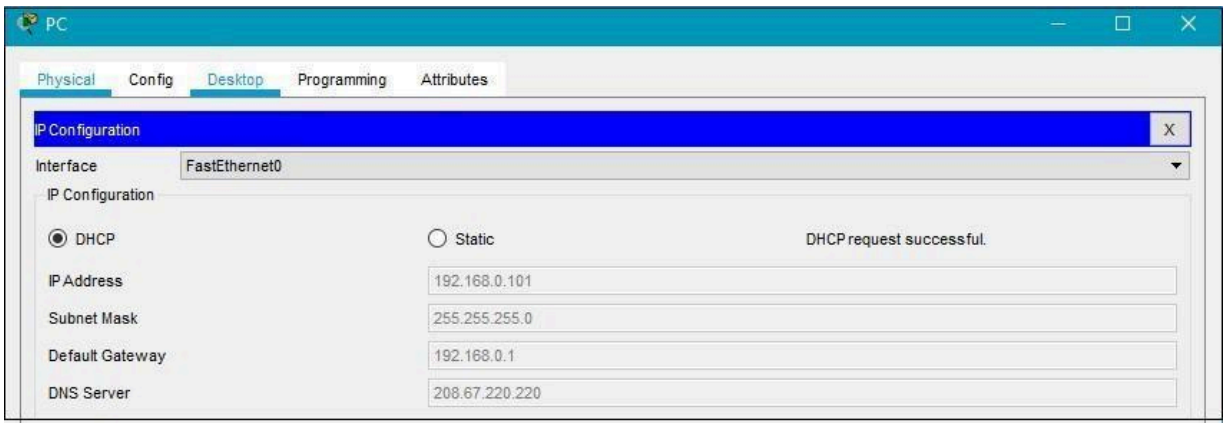


Step 3: Configure the PC

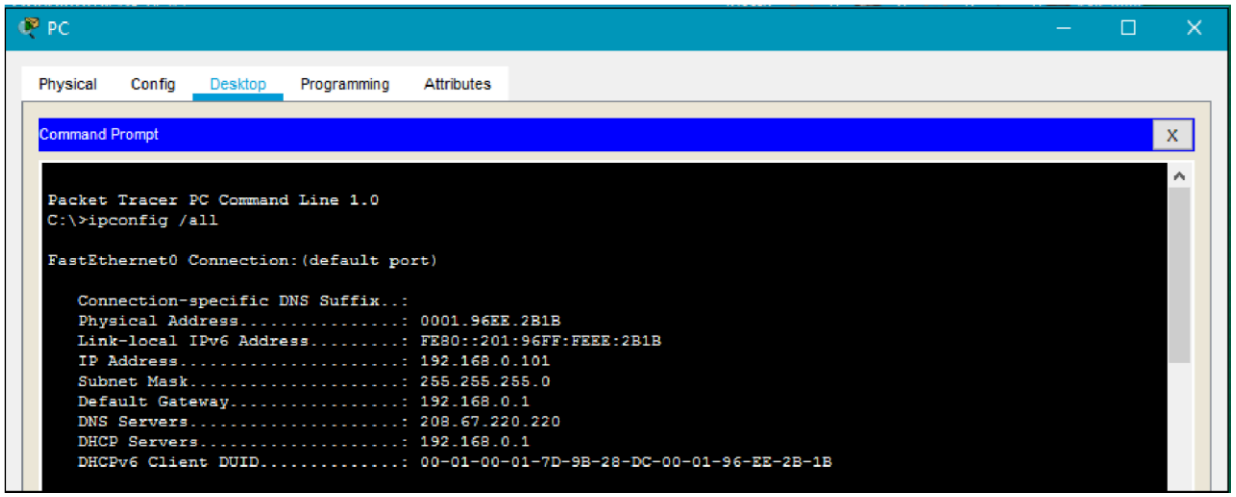
a. Configure the PC for the wired network

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

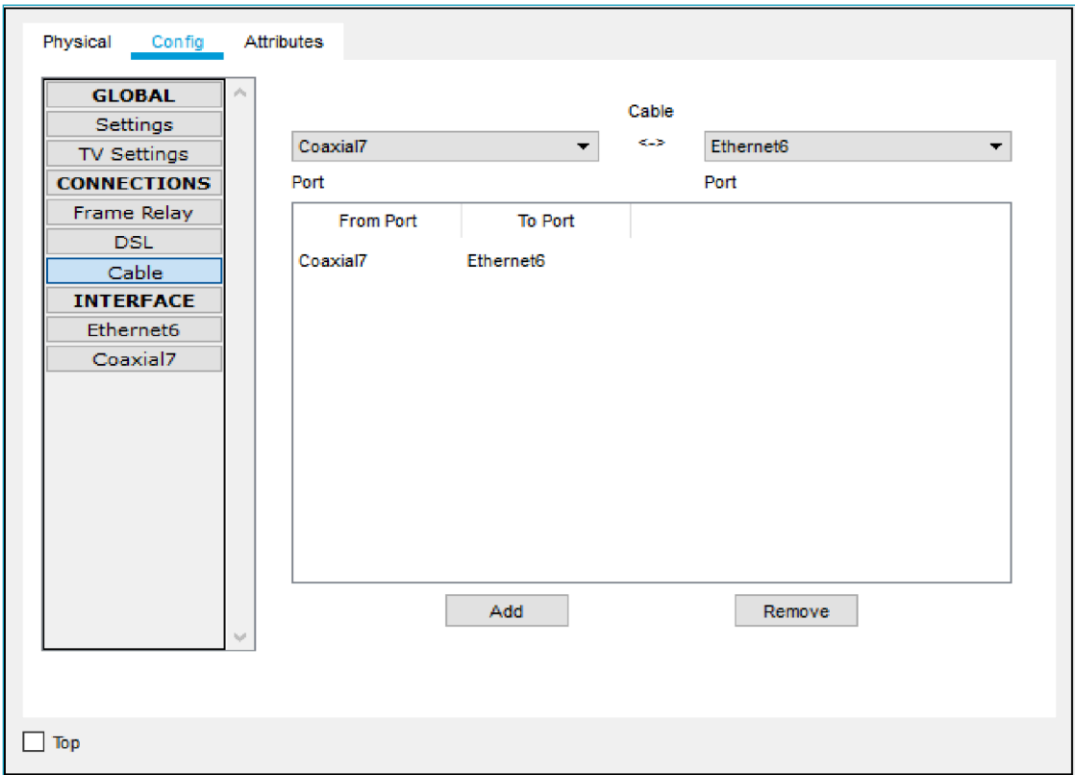
a. Install network modules if necessary

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

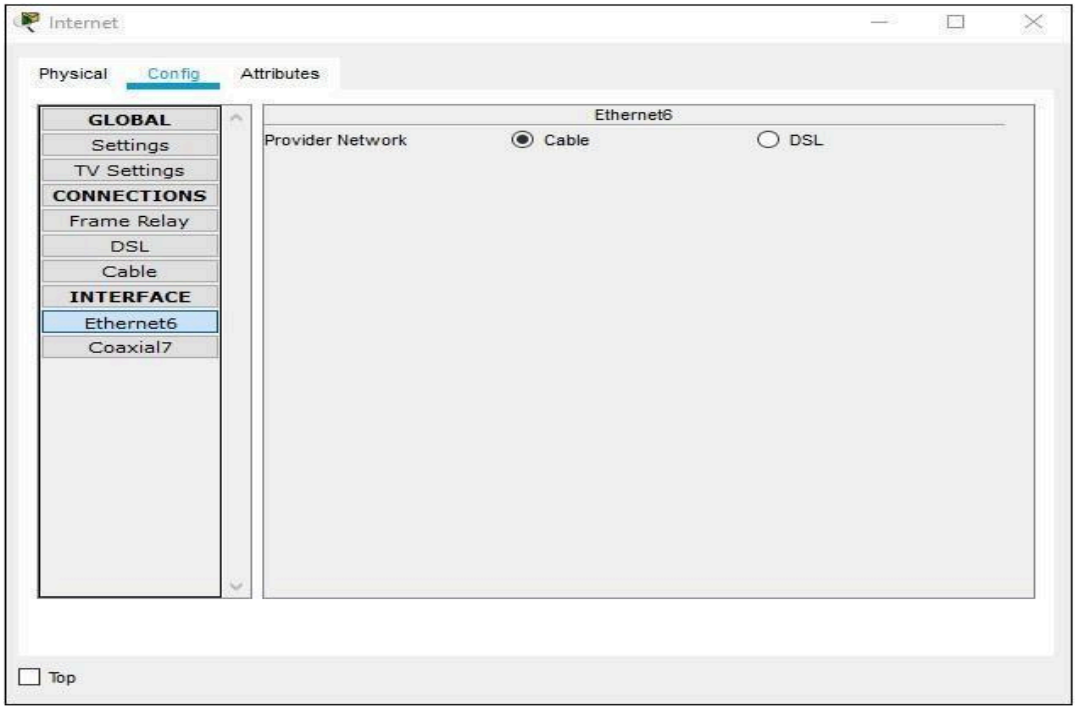
Click on the **Config** tab in the Cloud device window. In the left pane click on **Cable** under **CONNECTIONS**. In the first drop down box choose Coaxial and in the second drop down box choose

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

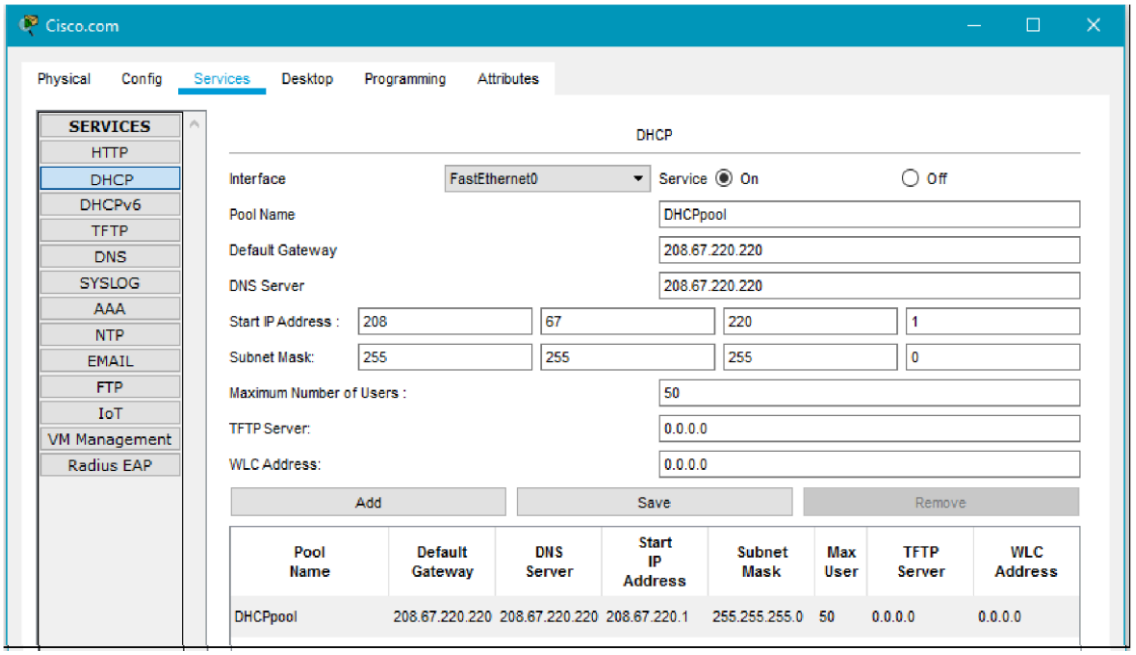
a. Configure the Cisco.com server as a DHCP server

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



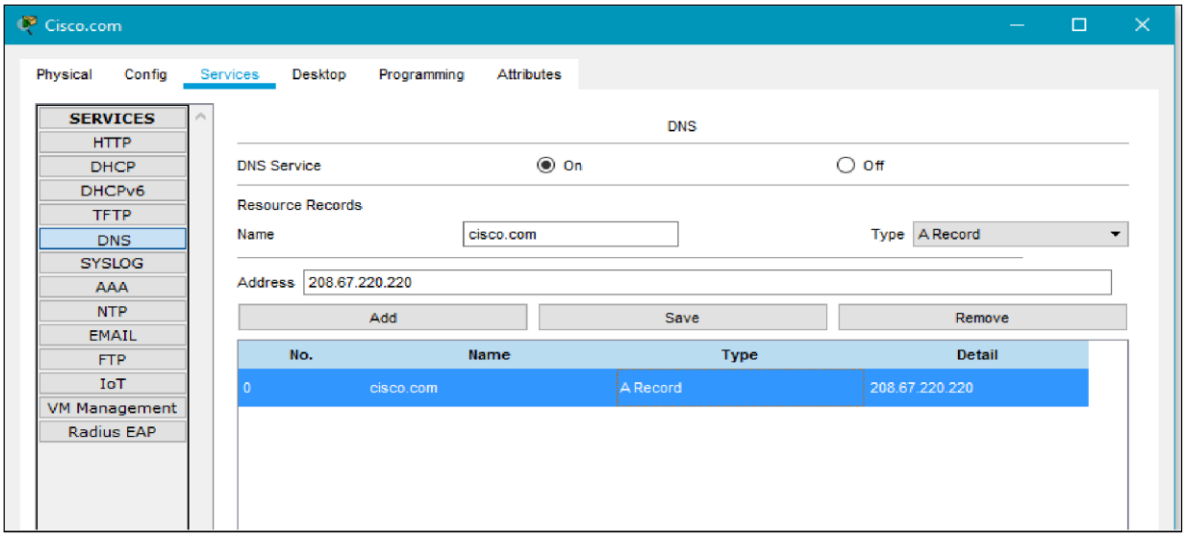
b. Configure the Cisco.com server as a DNS server to provide domain name to IPv4 address resolution.

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.

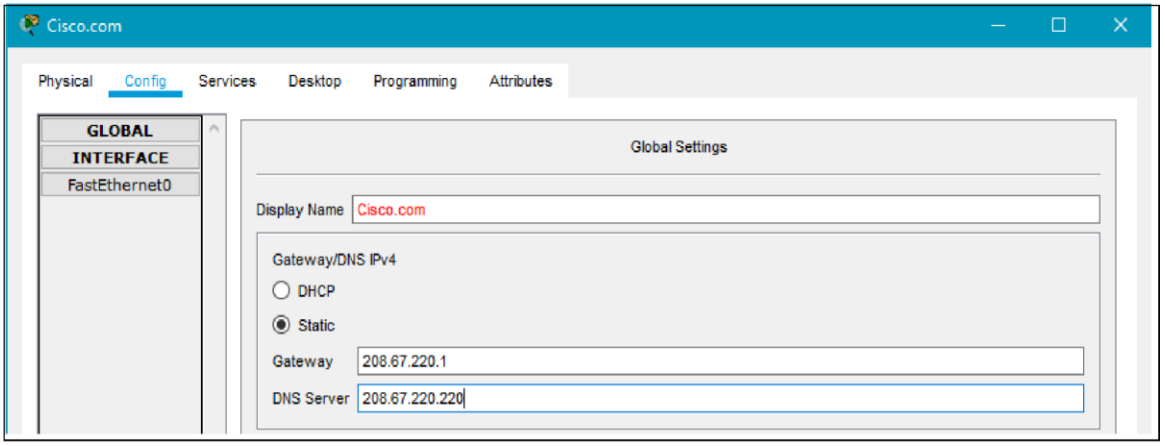
- Click **On** to turn the DNS service on
- Name: Cisco.com
- Type: A Record
- Address: 208.67.220.220

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



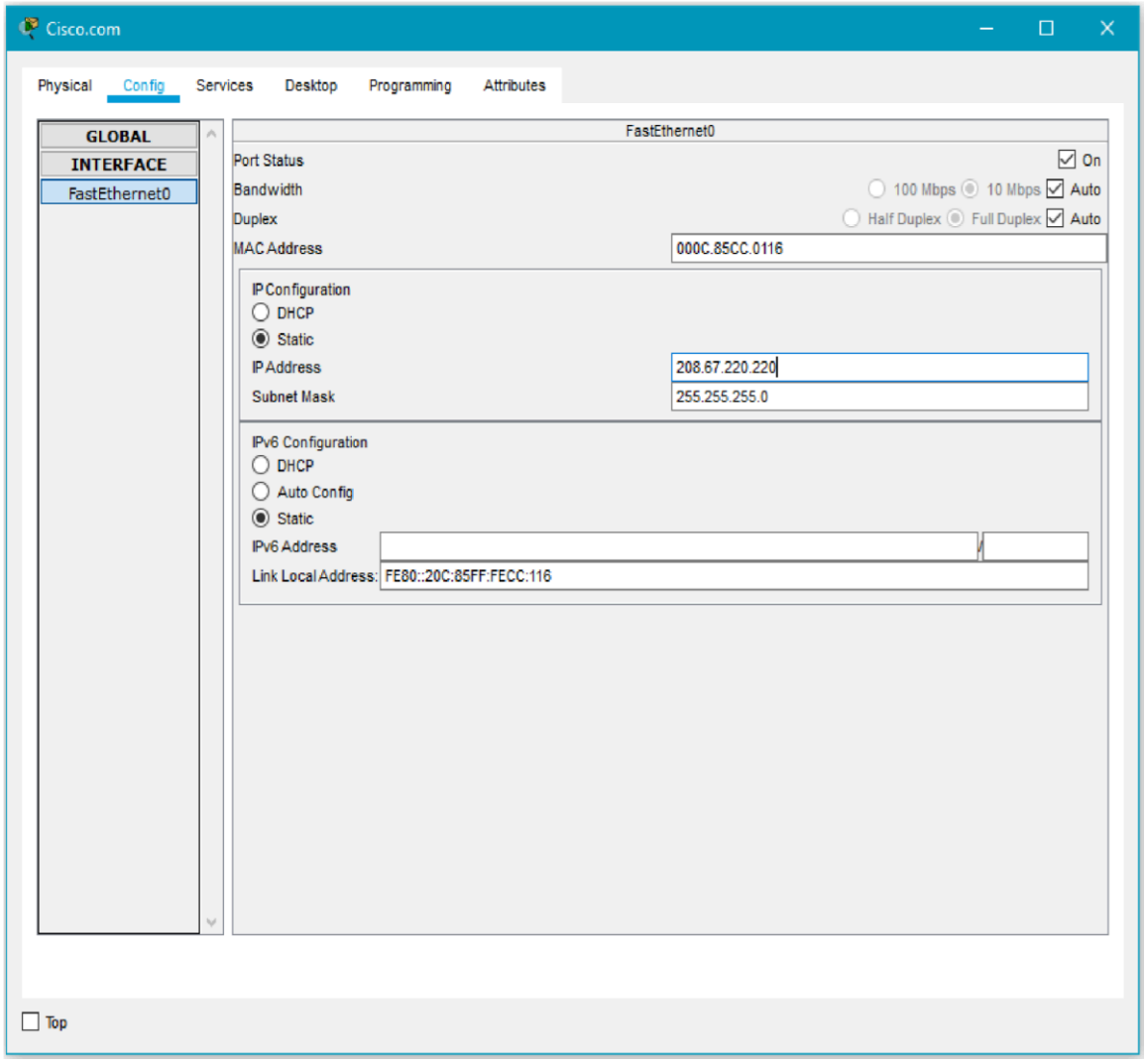
c. Configure the Cisco.com server Global settings. Select the **Config** tab.
Click on **Settings** in left pane.
Configure the Global settings of the server as follows:

- 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

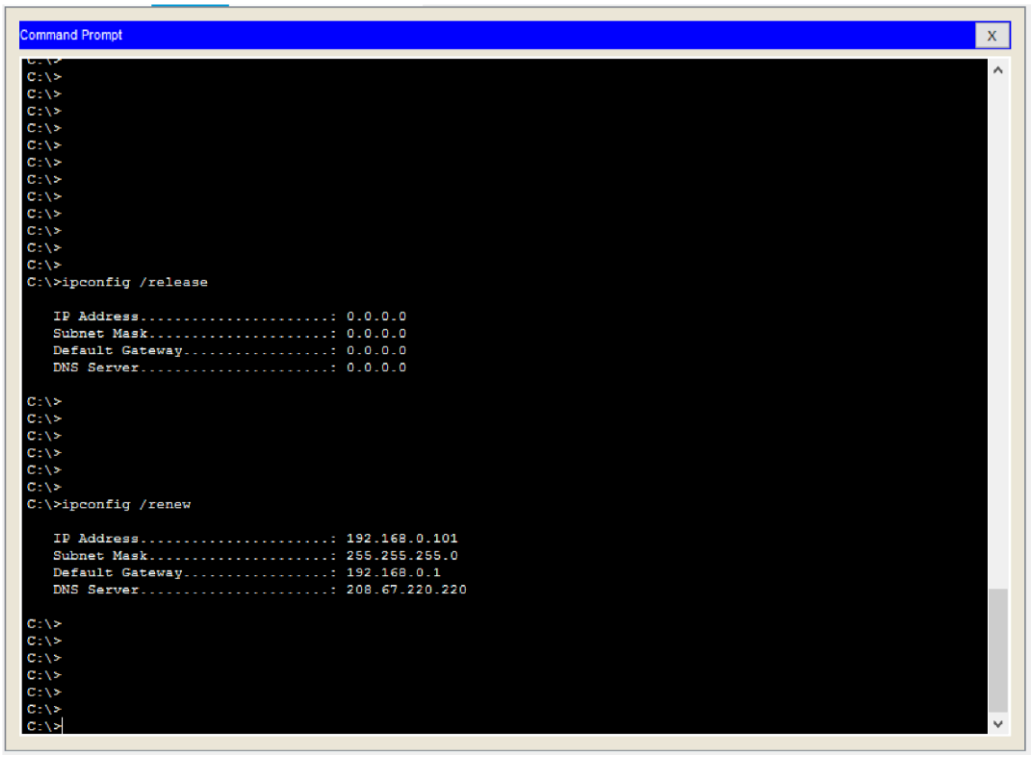
Step 1: Refresh the IPv4 settings on the PC

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.

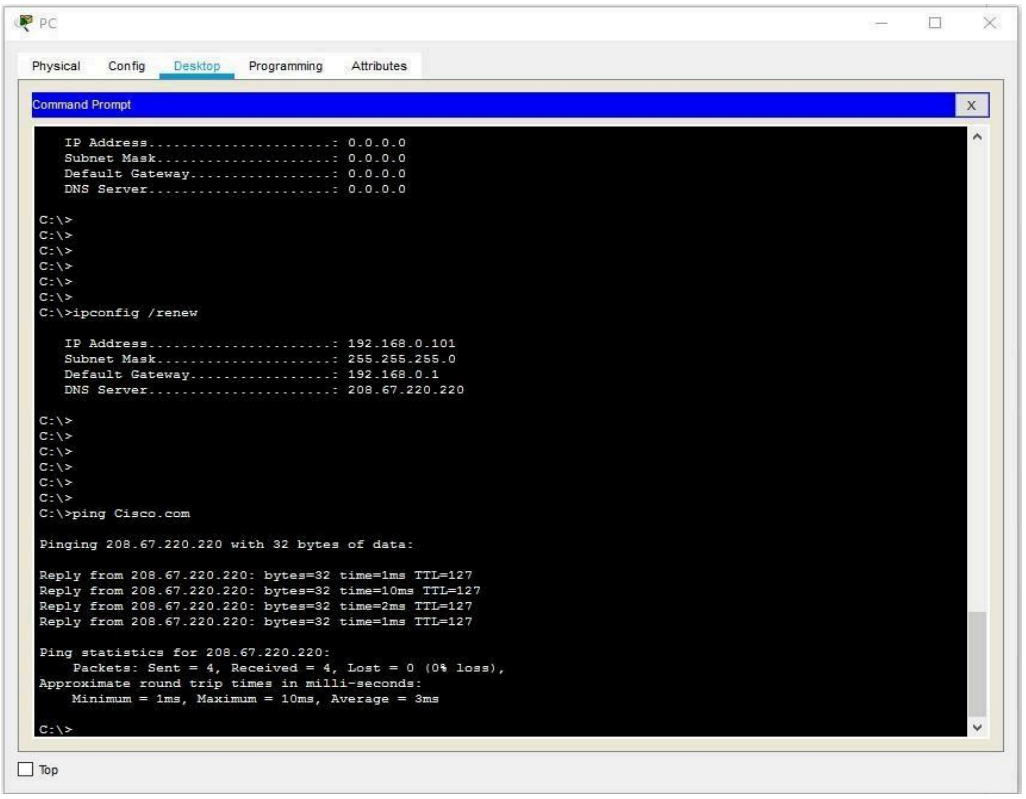
Click on the **Command Prompt** icon

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.



Student observation:

1. **Write down the key features of configuring Wireless router and DHCP server.**
2. **What is the significance of DHCP sever in internetworking.**
3. **Design and configure an inter-network in your lab using switch, router and Ethernet cables. Draw and label the design in your notebook. Also, show the ip address configuration of each and every device.**

Answer:

1. Key Features

- Wireless Router: Set SSID, choose security (WPA2-PSK), and select a channel and configure IP address (e.g., 192.168.1.1).
- DHCP Server: Assign automatic IPs within a range (e.g., 192.168.1.100 - 192.168.1.200). Set lease time.

2. Significance of DHCP

- Automates IP address assignment.
- Reduces configuration errors and IP conflicts.
- Makes network management easier.

Devices: Router, Switch, PCs

Design:

PC1 (192.168.1.2) <--> Switch <--> Router (192.168.1.1) <--> Internet

PC2 (192.168.1.3) <--> Switch

IP Configuration:

- Router: 192.168.1.1
- PCs: 192.168.1.2, 192.168.1.3
- Subnet Mask: 255.255.255.0

Result:

Thus the experiment was completed successfully.