

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)

(Affiliated to Osmania University; Accredited by NBA(AICTE) and NAAC(UGC), ISO Certified 9001:2015)
GANDIPET, HYDERABAD – 500 075

Department of Computer Science and Engineering



Course File

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

Course Code: (18CSC26)

B.E. VI Semester

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CSE - Vision, Mission, PEOs, POs, PSOs

Institute Vision, Mission (for R18, R20)

Vision	To be a Centre of Excellence in Technical Education and Research
Mission	To address the emerging needs through quality technical education and advanced research

Department Vision, Mission (R18)

Vision: To become a centre of excellence in the field of Computer Science and Engineering that produces innovative, skilful and, socially responsible professionals who can contribute significantly to industry and research

Mission:

Identifying emerging areas in the field of Computer Science & Engineering and incorporating in the curriculum

Providing professionals to the country with innovative ideas in certain areas of advanced computing through research and graduate studies

PEOs (R18)

PEO1	Practice their profession with confidence by applying new ideas and technologies for the sustainable growth of Industry & Society.
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PEO2	To pursue higher studies for professional growth with superior ethics and character.
PEO3	Engage in Research leading to innovations / products or become a successful entrepreneur.

B.E. Program Outcomes (PO's) – (R18, R20)

Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems

Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs(R18, R20)

PSO1: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PSO2: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

18CSC26

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Basics of Operating System, Linux Commands.

Course Objectives: The objectives of this course are

1. To familiarize students with the communication media, devices, and protocols.
2. To expose students to gain practical knowledge of computer networks configuration and monitoring.
3. To create network simple computer networks using simulation tools.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the different types of equipment like cables used in the networks Lab.
2. Recognize the various network devices like repeater, hub, switch.
3. Practice the basic network commands like ifconfig, ping, traceroute, nslookup, dig, arp, netstat, nmap.
4. Design and demonstrate network topologies using NS3 simulation tool.
5. Examine the packet transfer using NetAnim.
6. Analyze the network performance using Wire shark or any tool.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO	1	-	1	-	3	-	-	-	-	-	-	-	-	-	1	-
CO 1	1	-	1	-	3	-	-	-	-	-	-	-	-	-	1	-
CO 2	2	-	1	-	3	-	-	-	-	-	-	-	-	-	2	-
CO 3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	2	-
CO 4	2	2	3	1	2	-	-	-	-	-	-	-	-	2	2	2
CO 5	1	3	-	2	2	-	-	-	-	-	-	-	-	2	1	3
CO 6	1	3	-	2	2	-	-	-	-	-	-	-	-	2	1	3

LIST OF EXPERIMENTS:

1. Study of Network media, cables, and devices and Cable Construction
2. Demonstration of basic network commands/utilities (both in Windows and Linux)
3. PC Network Configuration
4. Building a switch-based network / Configuration of Cisco Catalyst Switch 3560
5. Configuration of Cisco Router 2900
6. Basic OSPF Configuration
7. Basic EIGRP Configuration
8. Analysis of network traces using tcpdump
9. Analysis of network traces using Wireshark

Textbooks:

1. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.

Online Resources:

1. <https://learningnetwork.cisco.com/s/question/0D53i00000Kt7EkCAJ/tools-for-ccnp-network-simulator-lab-tasks>
2. <https://www.packettracernetwork.com/>
3. <https://www.ghacks.net/2019/11/13/gns3-is-an-open-source-graphical-network-simulator-for-windows-linux-and-macos/>
4. <https://www.imedita.com/blog/top-10-list-of-network-simulation-tools/>

DOEN

2nd year
1st semester
1998-1999

Course: Environmental Science

DOEN (Theory) - 30001

DOEN (Lab) - 10001

Slip Tests / assignments

last 3 assignments

- ① slip Test 1 - March 10, 11, 12, 13, 14, 15
- ② slip Test 2 - May 21st week
- ③ Mid 1 - 25, 26, 27, 28 March
- ④ Mid 2 - 24, 25, 26 April
- ⑤ lab Internal 1 - March 10, 11, 12, 13, 14, 15
- ⑥ lab Internal 2 - before exam on 11th, 12th, 13th

~~Test~~

Family

- ① D. Naga Tyotthi - ~~Family~~
20/2/21
- ② A. Mohan ~~Family~~
- ③ E. Swathi - ~~Family~~
25/2/21

Students

- 1) SIRNAM SANJANA - C1 ~~Sanje~~
- 2) J. Yashwanth - C1 ~~Yashwanth~~
- 3) B. Sai Sanjana - C3 ~~Sanje~~
- 4) G. Pragapriya - C2 ~~Pragapriya~~
- 5) Khushi - C2 ~~Khushi~~
- 6) Varsha - C3 ~~Varsha~~
- 7) Kallamedu Richa - C2 ~~Richa~~
- 8) Tejaswini Jukka - C2 ~~Tejaswini~~

Sl.No.	Topics / Sub. Topics /Lab Activity	No. of Classes Estimated	Estimated date on which the lab activity need to be completed
1.	Study of Network media, cables, and devices and Cable Construction	3	B1&B2: 20/2/2021
2.	Demonstration of basic network commands/utilities (both in Windows and Linux)	3	B1&B2: 27/2/2021
3	PC Network Configuration	3	B1:18/3/2021 B2:10/3/2021
4	Building a switch-based network / Configuration of Cisco Catalyst Switch 3560	3	B1:25/3/2021 B2:17/3/2021/2021
	Lab internal-1	3	B1: 1/4/2021 B2: 24/3/2021
5	Configuration of Cisco Router 2900	3	B1:8/4/2021 B2:31/3/2021
6	Basic OSPF configuration	3	B1:15/4/2021 B2:7/4/2021
7	Basic EIGRP Configuration	3	B1:22/4/2021 B2:28/4/2021
8	Analysis of network traces using tcpdump	3	B1:29/4/2021 B2:5/5/2021
9	Analysis of network traces using Wireshark	3	B1:6/5/2021 B2:12/5/2021
	Lab internal-2	3	B1:13/5/2021 B2: 19/5/2021
	Total	27	

Holidays:

11/3/2021--- MahaShivratri
 14/4/2021--- Dr.B.R.Ambedkar Jayanti
 21/4/2021--- Sri Rama Navami

Lab internal -1—17/3/2021(B2), 18/3/2021(B1)
Lab internal -2— 19/3/2021(B2),20/3/2021(B1)

Xd
 Professor and Head Department
 Department of Computer Science & Engineering
 Chaitanya Bharathi Institute of Technology (A)
 Gandipet, Hyderabad-500 075.(T.S.)

Department of Computer Science and Engineering, CBIT, Hyderabad-75

BE VI Sem. (CSE1,CSE-2,CSE-3) (2020-21)

Subject:Data Communication and Computer Networks Lab Code: 18CSC23

CO	Internal CO Attainment (CIE)		External CO Attainment(SEE)		Direct Attainment
	CIE Attainment	@30% of CIE Attainment	SEE Attainment	@ 70% of SEE attainment	
CO1	2.88	0.860	2.96	2.070	2.930
CO2	2.88	0.860	2.96	2.070	2.930
CO3	2.88	0.860	2.96	2.070	2.930
CO4	2.88	0.860	2.96	2.070	2.930
CO5	1.59	0.480	1.61	1.130	1.610
CO6	2.88	0.860	2.96	2.070	2.930

#REF! #REF! #REF!
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SL. NO.	CO	Direct Attainment	80%	Indirect Attainment	20%	Total Attainment (100%)
1	CO1	2.9300	2.344	2.40	0.480	2.82
2	CO2	2.9300	2.344	2.87	0.574	2.92
3	CO3	2.9300	2.344	2.01	0.402	2.75
4	CO4	2.9300	2.344	2.17	0.434	2.78
5	CO5	1.6100	1.288	2.03	0.406	1.69
6	CO6	2.9300	2.344	2.34	0.468	2.81

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0.000 2.000 0.2
0.000 1.000 0.1
0.000 2.000 0.2

feedback

Course CO Attainment Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0.94133	-	0.94133	-	2.82400	-	-	-	-	-	-	-	-	-
CO2	1.94533	-	0.97267	-	2.91800	-	-	-	-	-	-	-	-	-
CO3	1.83067	-	-	1.83067	-	-	-	-	-	-	-	-	-	-
CO4	1.85200	1.85200	2.77800	0.92600	1.85200	-	-	-	-	-	-	-	-	1.85200
CO5	0.56467	1.69400	-	1.12933	1.12933	-	-	-	-	-	-	-	-	1.12933
CO6	0.93733	2.81200	-	1.87467	1.87467	-	-	-	-	-	-	-	-	1.87467
CNSP	1.34522	2.11933	1.56400	1.44017	2.11960	-	-	-	-	-	-	-	-	1.61867

3.1.3 Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	1	-	3	-	-	-	-	-	-	-	-	-
CO2	2	-	1	-	3	-	-	-	-	-	-	-	-	-
CO3	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO4	2	2	3	1	2	-	-	-	-	-	-	-	-	2
CO5	1	3	-	2	2	-	-	-	-	-	-	-	-	2
CO6	1	3	-	2	2	-	-	-	-	-	-	-	-	2
Avrg	1.500	2.667	1.667	1.750	2.400	-	-	-	-	-	-	-	-	2

Target Level for Course

75

PO attainment

(2020-21) DCCN Lab	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	1.13	2	1.25	1.31	1.8	-	-	-	-	-	-	-	-	1.5
Direct Attainment	1.35	2.12	1.56	1.44	2.12	-	-	-	-	-	-	-	-	1.62
Gap	-0.22	-0.12	-0.31	-0.13	-0.32	-	-	-	-	-	-	-	-	-0.12

PO Attainment	Level
x>=70	3
60<= x <70	2
50<= x <60	1
x <= 40	0

EXPERIMENT NO- 01

AIM: Study of Network media, cables, and devices and Cable Construction.

OBJECTIVE: To study about different types of network media, cables and devices and cable constructions.

DESCRIPTION:

NETWORK MEDIA (TRANSMISSIONMEDIA):

Network media refers to the communication channels used to interconnect nodes on a computer network. Typical examples of network media include copper coaxial cable, copper twisted pair cables and optical fiber cables used in wired networks, and radio waves used in wireless datacommunications networks.

Network medium is the actual physical path between the transmitter and the receiver i.e., It is the channel through which data is sent from one place to another.

It is classified into two types:

- i. Guided media(wired)
- ii. Unguided media(wireless)

GUIDED MEDIA:

Guided media is also called as wired media. It uses a system that guides the data signals along a specific path. Signals being transmitted are directed and confined in a narrow pathway by using physical links.

Features: High speed, secure, used for comparatively shorter distances

There are 3 types of guided media:

a) **Twisted pair cable:**

Twisted pair is a physical media made up of a pair of cables twisted with each other.

A twisted pair cable is cheap as compared to other transmission media. Installation of the twisted pair cable is easy, and it is a lightweight cable. The frequency range for twisted pair cable is from 0 to 3.5KHz. A twisted pair consists of two insulated copper wires arranged in a regular spiral pattern. The degree of reduction in noise interference is determined by the number of turns per foot. Increasing the number of turns per foot decreases noise interference.



Twisted pair cable is of two types:

Shielded twisted pair cable:

It consists of special jacket to block external interface. It is used in fast data rate Ethernet and in voice and data channels of telephone lines. It is bulky.

Characteristics of Shielded Twisted Pair:

- The cost of the shielded twisted pair cable is not very high and not very low.
- An installation of STP is easy.
- It has higher capacity as compared to unshielded twisted pair cable.
- It has a higher attenuation.
- It is shielded that provides the higher data transmission rate.

Disadvantages

- It is more expensive as compared to UTP and coaxial cable.
- It has a higher attenuation rate.

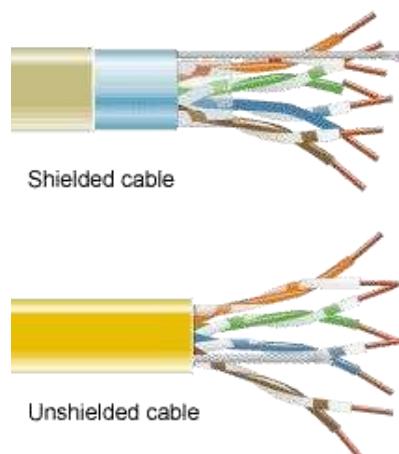
There are 3 types of guided media:

Unshielded Twisted Pair cable:

This type of cable has the ability to block interface and does not depend on a physical shield for this purpose.

Advantages:

- Least expensive.
- Easy to install.
- Short distance transmission due to attenuation.

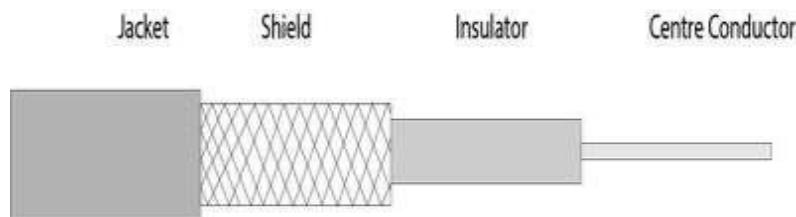


b) **Coaxial cable:**

It has an outer plastic covering containing 2 parallel conductors each having a separate insulated protection cover. The coaxial cable transmits information in 2 modes :

- 1) Baseband Mode - dedicated cable bandwidth
- 2) Broadband mode - bandwidth is split into separate ranges

Cable TV's and analog television networks use coaxial cables. They transmit signals over large distances at higher speed as compared to twisted cables.



Advantages:

1. High Bandwidth
2. Better noise immunity
3. Easy to install and expand
4. Inexpensive

c) **Optical Fiber:**

It uses the concept of reflection of light through a core made up of glass or plastic.

It is a transparent and flexible fiber made up of glass, which carries information in the form of light pulses from one end to another. Fiber optics is used for long distance and high performance network. Used in internet, telephone and television.

Core is surrounded by less dense glass or plastic covering called the cladding. Used to transfer large volumes of data. It can be uni-directional or bi-directional.



Basic elements of Fiber optic cable:

- **Core:** The optical fiber consists of a narrow strand of glass or plastic known as a core. A core is a light transmission area of the fiber. The more the area of the core, the more light will be transmitted into the fibre.
- **Cladding:** The concentric layer of glass is known as cladding. The main functionality of the cladding is to provide the lower refractive index at the core interface as to cause the reflection within the core so that the light waves are transmitted through the fibre.
- **Jacket:** The protective coating consisting of plastic is known as a jacket. The main purpose of a jacket is to preserve the fiber strength, absorb shock and extra fiber protection.

Advantages of Optical Fiber

Optical fiber is fast replacing copper wires because of these advantages that it offers:-

- High bandwidth
- Immune to electromagnetic interference
- Suitable for industrial and noisy areas
- Signals carrying data can travel long distances without weakening

Disadvantages of Optical Fibre

Despite long segment lengths and high bandwidth, using optical fibre may not be a viable option for everyone due to these disadvantages –

- Optical fibre cables are expensive
- Sophisticated technology required for manufacturing, installing and maintaining optical fibre cables
- Light waves are unidirectional, so two frequencies are required for full duplex transmission

ii) UNGUIDED MEDIA

An unguided transmission transmits the electromagnetic waves without using any physical medium. Therefore it is also known as **wireless transmission**. In unguided media, air is the media through which the electromagnetic energy can flow easily.

Unguided transmission is broadly classified into three categories:

i) Radiowaves:

Radio waves are electromagnetic waves and are omnidirectional. When an antenna transports radio waves they are propagated in all directions in free space which means the sending and receiving antennas do not have to be aligned that is any receiving antenna can receive that transmitted wave.

The frequency of radio waves about 30 hertz (Hz) to 300 gigahertz (GHz) and like all other electromagnetic waves radio waves travel at the speed of light in vacuum.

Applications of Radio waves

- These waves are omnidirectional so they are useful for multicasting in which one sender but manyreceivers.
- Examples of radio waves are television, AM and FM radio, cordless phones, andpaging.

Advantages anddisadvantages

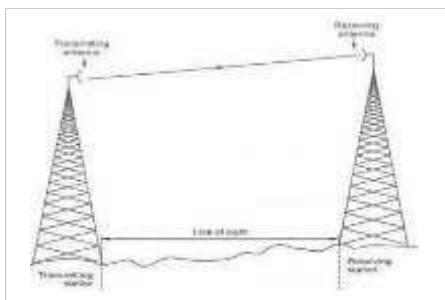
- Radio waves are easy to generate and penetrate buildings also can travel long distances.
- Radio waves cover a large area and can penetrate the buildings. By this, an AM radio can receive signals inside abuilding.
- This can also be disadvantageous because we cannot isolate a communication just inside or outside a building. Cause of this, governments strictly legislate theuse of radio transmitters.

ii) **Microwaves:**

Micro Waves includes a line of sight transmission that is the sending and receiving antennas that need to be properly aligned with each other. The distance is directly proportional to the height of the antenna which is covered by the signal. In mobile phone communication and television distribution, these are majorly used.

Applications of Micro Waves

Due to the unidirectional properties of Micro Waves, they are very useful when unicast (one-to-one) communication is needed between the sender and the receiver. Cellular phones, satellite networks, and wireless LANs are using Micro Waves.



Microwave Transmission

Two types of Microwave Transmission are as follows,

1. TerrestrialMicrowave
2. SatelliteMicrowave

iii) **Infrared waves:**

The frequency of Infrared waves is about 300 GHz to 430 THz, which can be used for short-range communication. Infrared waves of high frequencies cannot penetrate walls. This characteristic of Infrared waves prevents interference between one system and another. This means a short-range communication system in a room cannot be affected by another system in the adjacent room.

If we are using the infrared remote control, we do not interfere with the use of the remote by our neighbors. However, by this characteristic, infrared signals become useless for long-range communication. Also, we cannot use infrared waves outside a building because the sun's rays contain infrared waves that can interfere with communication.

Characteristics of infrared waves

- This type of wide bandwidth can be used to transmit digital data with a very high data rate.
- The Infrared Data Association (IrDA) has established standards for using these signals for communication between devices such as keyboards, mouse, PCs, and printers and it is also responsible for sponsoring the use of infrared waves.
- This type of communication provides better security with minimum interference.

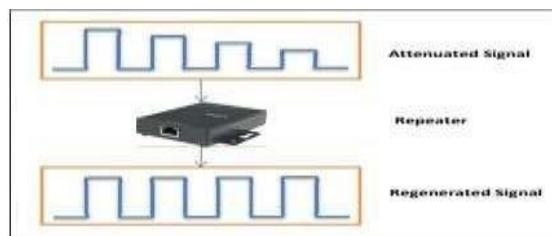
➤ **NETWORK DEVICES**

Hardware devices that are used to connect computers, printers, fax machines and other electronic devices to a network are called **network devices**. These devices transfer data in a fast, secure and correct way over same or different networks. Network devices may be inter-network or intra-network. Some devices are installed on the device, like NIC card or RJ45 connector, whereas some are part of the network, like router, switch, etc. Let us explore some of these devices in greater detail.

1. REPEATER

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

Repeaters are network devices operating at physical layer of the OSI model that amplify or regenerate an incoming signal before retransmitting it. They are incorporated in networks to expand its coverage area. They are also known as signal boosters.



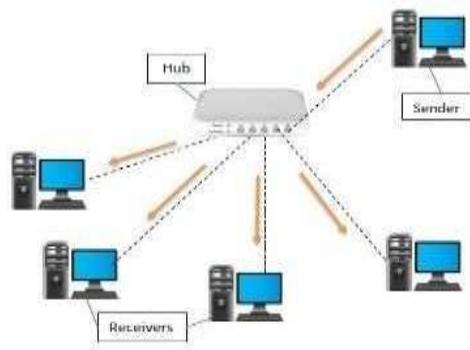
2. HUB

A hub is basically a multiport repeater. A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations.

Hubs cannot filter data, so data packets are sent to all connected devices. In other words, collision domain of all hosts connected through Hub remains one. Also, they do not have the intelligence to find out best path for data packets which leads to inefficiencies and wastage.

Types of Hub

- **Active Hub:** -These are the hubs which have their own power supply and can clean, boost, and relay the signal along with the network. It serves both as a repeater as well as wiring centre. These are used to extend the maximum distance between nodes.
- **Passive Hub:** -These are the hubs which collect wiring from nodes and power supply from active hub. These hubs relay signals onto the network without cleaning and boosting them and can't be used to extend the distance between nodes.
- **Intelligent Hub:** -It works like active hubs and include remote management capabilities. They also provide flexible data rates to network devices. It also enables an administrator to monitor the traffic passing through the hub and to configure each port in the hub.



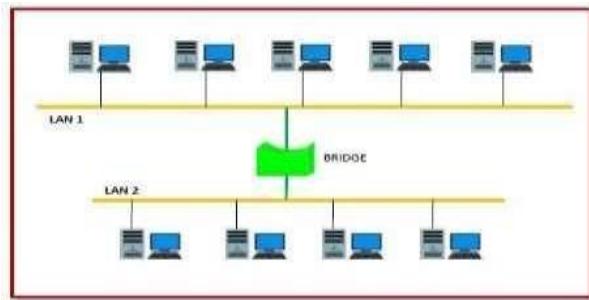
3. BRIDGE

A bridge operates at data link layer. A bridge is a repeater, with added on the functionality of filtering content by reading the MAC addresses of source and destination. It is also used for interconnecting two LANs working on the same protocol. It has a single input and single output port, thus making it a 2 port device.

Types of Bridges

- **Transparent Bridges:** -These are the bridges in which the stations are completely unaware of the bridge's existence i.e. whether or not a bridge is added or deleted from the network, reconfiguration of the stations is unnecessary. These bridges make use of two processes i.e. bridge forwarding and bridge learning.

- **Source Routing Bridges:** In these bridges, routing operation is performed by source station and the frame specifies which route to follow. The host can discover frame by sending a special frame called discovery frame, which spreads through the entire network using all possible paths to destination.



4. TWO LAYERSWITCH

A layer 2 switch is a type of network switch or device that works on the data link layer (OSI Layer 2) and utilizes MAC Address to determine the path through where the frames are to be forwarded. It uses hardware based switching techniques to connect and transmit data in a local area network (LAN). A layer 2 switch can also be referred to as a multiport bridge.

A layer 2 switch is primarily responsible for transporting data on a physical layer and in performing error checking on each transmitted and received frame. A layer 2 switch requires MAC address of NIC on each network node to transmit data. They learn MAC addresses automatically by copying MAC address of each frame received, or listening to devices on the network and maintaining their MAC address in a forwarding table. This also enables a layer 2 switch to send frames quickly to destination nodes. However, like other layer switches (3,4 onwards), a layer 2 switch cannot transmit packet on IP addresses and don't have any mechanism to prioritize packets based on sending/receiving application.

5. THREE LAYERSWITCH

A layer 3 switch combines the functionality of a switch and a router. It acts as a switch to connect devices that are on the same subnet or virtual LAN at lightning speeds and has IP routing intelligence built into it to double up as a router. It can support routing protocols, inspect incoming packets, and can even make routing decisions based on the source and destination addresses. This is how a layer 3 switch acts as both a switch and a router. Often referred to as a multilayer switch, a layer 3 switch adds a ton of flexibility to a network.

Features of a layer 3 switch

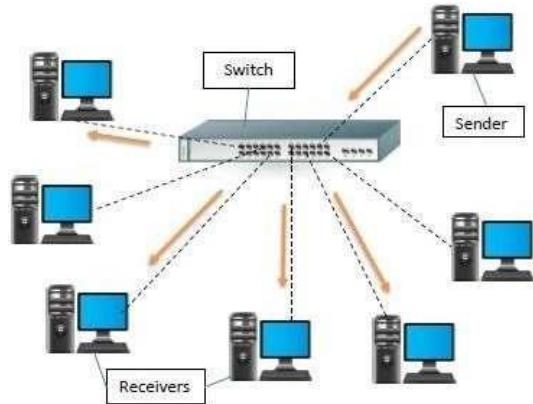
- Comes with 24 Ethernet ports, but no WAN interface.
- Acts as a switch to connect devices within the same subnet.
- Switching algorithm is simple and is the same for most routed protocols.

- Performs on two OSI layers — layer 2 and layer3.

Originally, layer 3 switches were conceived to improve routing performance on large networks, especially corporate intranets. To understand the purpose, let's step back a bit in time to see how these switches evolved.

Layer 2 switches work well when there is low to medium traffic in VLANs. But these switches would hang when traffic increased. So, it became necessary to augment layer 2's functionality.

One option was to use a router instead of a switch, but then routers are slower than switches, so this

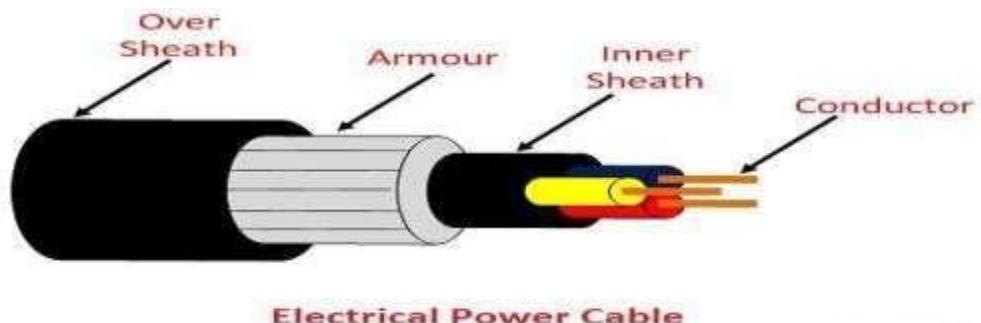


could lead to slower performance.

➤ CABLE CONSTRUCTION

A cable used for the transmission and distribution of electrical energy is called electrical power cable. Power cable consists two or more electrical conductors join with an over sheath. It is used for the transmission of extra high voltages in a place where overhead lines are impracticable to use like, the sea, airfield crossing, etc. But underground cable is more costly as compared to aerial cable for the same voltage which is one of the main draws back of electrical power cable.

The power cable mainly consists of three main components, namely, conductor, dielectric, and sheath. The conductor in the cable provides the conducting path for the current. The insulation or dielectric withstands the service voltage and isolates the conductor with other objects. The sheath does not allow the moisture to enter and protects the cables from all external influences like chemical or electrochemical attack, fire, etc. The main components of electrical power cables are explained below in details.



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CONDUCTOR

Coppers and aluminum wires are used as a conductor material in cables because of their high electrical conductivity. Solid or number of bare wires made of either copper or aluminum are used to make a power cable.

For a conductor having more than three wires, the wire is arranged around a center wire such that there are six in the first layer, twelve in the second, eighteen in the third, and so on. The number of wires in the conductors are 7, 19, 37, 61, 91, etc., The size of the conductor is represented by 7/A, 19/B, 37/C, etc., in which first figures represent the number of strands and the second figure A, B, C, etc., represents the diameters in cm or mm of the individual wire of the conductors.

INSULATION

The most commonly used dielectric in power cables is impregnated paper, butyl rubber, polyvinyl chloride cable, polyethylene, cross-linked polyethylene. Paper insulated cables are mostly preferred because their current carrying capacity is high, generally reliable and having a long life. The dielectric compound used for the cable should have following properties.

- The insulator must have high insulation resistance.
- It should have high dielectric strength so that it does not allow the leakage current to pass through it.
- The material must have good mechanical strength.
- The dielectric material should be capable of operating at high temperature.
- It should have low thermal resistance.
- It should have a low power factor.

The cables used for submarine and damp soil should use synthetic dielectrics like polyvinyl chloride, polyethylene, etc. These materials are comparatively lighter and have nonmigratory dielectric. Also, such type of dielectric material has good dielectric strength, low power loss, and low thermal resistance.

INNERSHEATH

It is used for protecting the cable from moistures which would affect the insulation. Cable sheath is made up of lead alloy, and these strengths withstand the internal pressures of the pressurized cables. The material used for inner sheath should be nonmagnetic material.

The aluminum sheath is also used in a power cable because it is cheaper, smaller in weight and high mechanical strength than the lead sheath. In oil-filled cables and telephone, cables corrugated seamless aluminum sheath is used because it has better-bending properties, reduced thickness, and lesser weight

PROTECTIVE COVERING

Lead sheath cables when directly laid down on the ground are damaged by corrosion and

electrolyte. For protecting the cables against corrosion layers of fibrous material like paper, hessian, etc., or polyvinyl chloride is used. Layers of fibrous material spread with the waterproof compound to the outside of the electrical cable are called serving.

ARMOURING

Armoring is the process in which layers of galvanized steel wires or two layers of metal tape are applied over sheath for protecting it from mechanical damage. The steel wires are normally used for armoring because it has high longitudinal strength. Armoring is also used for earthing the cable. When the fault occurs in the cable (due to insulation failure) the fault current flows through the armor and get earthed.

OVERSHEATH

It gives the mechanical strength to the cables. It protects the cable from overall damage like moisture, corrosion, dirt, dust, etc. The thermosetting or thermoplastic material is used for making over the sheath.

RESULT: Network media, cables, and devices and Cable Construction are discussed.

EXPERIMENT NO- 02

AIM:Demonstration of basic network commands/utilities in Windows.

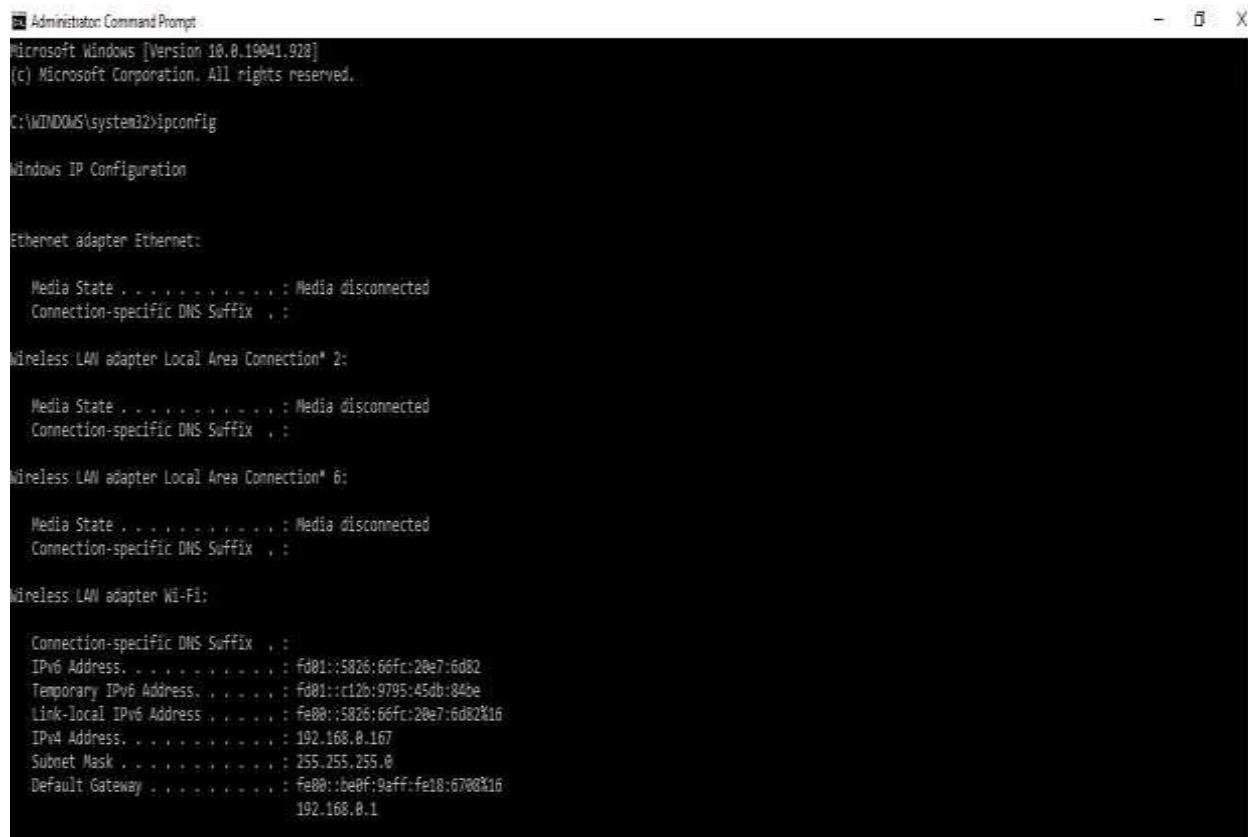
OBJECTIVE:To list commands and execute on the CLI to obtain results such as the IP address and ping among many other results.

DESCRIPTION AND EXECUTION:

1) Ipconfig

Ipconfig (Internet Protocol configuration) is among the most common networking tool that allows you to query and show current TCP/IP (Transmission Control Protocol/Internet Protocol) network configuration.

When you type ipconfig at the Command Prompt. You'll see a list of all the network connections your computer is using. Look under -Wireless LAN adapter if you're connected to Wi-Fi or -Ethernet adapter if you're connected to a wired network.



```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.19041.928]
(c) Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection 2:

  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Local Area Connection 6:

  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:

  Connection-specific DNS Suffix . :
  IPv6 Address . . . . . : fe01::5826:66fc:20e7:6d82
  Temporary IPv6 Address . . . . . : fe01::c12b:9795:45db:84be
  Link-local IPv6 Address . . . . . : fe00::5826:66fc:20e7:6d82%16
  IPv4 Address . . . . . : 192.168.0.167
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : fe80::be0f:9aff.fe18:6700%16
                           192.168.0.1
```

2) Ipconfig/all

all – Displays additional information for all network adapters

```
Windows IP Configuration

 Host Name . . . . . : Sasank-s-Omen
 Primary Dns Suffix . . . . . :
 Node Type . . . . . : Hybrid
 IP Routing Enabled. . . . . : No
 WINS Proxy Enabled. . . . . : No
 DNS Suffix Search List. . . . . : WirelessAP

Ethernet adapter Ethernet:

 Media State . . . . . : Media disconnected
 Connection-specific DNS Suffix . . . . . :
 Description . . . . . : Realtek Gaming GBE Family Controller
 Physical Address. . . . . : BC-E9-2F-8A-5C-9C
 DHCP Enabled. . . . . : Yes
 Autoconfiguration Enabled . . . . . : Yes

Wireless LAN adapter Local Area Connection 1:

 Media State . . . . . : Media disconnected
 Connection-specific DNS Suffix . . . . . :
 Description . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
 Physical Address. . . . . : CC-D9-AC-BS-BF-E5
 DHCP Enabled. . . . . : Yes
 Autoconfiguration Enabled . . . . . : Yes

Wireless LAN adapter Local Area Connection 2:

 Connection-specific DNS Suffix . . . . . :
 Description . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
 Physical Address. . . . . : CE-D9-AC-BS-BF-E4
 DHCP Enabled. . . . . : No
 Autoconfiguration Enabled . . . . . : Yes
 Link-local IPv6 Address . . . . . : fe80::c111:cb5e:a409:cd9e%16(Preferred)
 IPv4 Address . . . . . : 192.168.137.1(Preferred)
 Subnet Mask . . . . . : 255.255.255.0
 Default Gateway . . . . . :
 DHCPv6 IAID . . . . . : 248437164
 DHCPv6 Client DUID. . . . . : 00-01-00-01-26-89-14-91-BC-E9-2F-8A-5C-9C
 DNS Servers . . . . . :
 NetBIOS over Tcpip. . . . . : Enabled
```

```
Wireless LAN adapter Wi-Fi:  
  Connection-specific DNS Suffix  . : WirelessAP  
  Description . . . . . : Intel(R) Wi-Fi 6 AX201 160MHz  
  Physical Address . . . . . : CC-D9-AC-B5-BF-E4  
  DHCP Enabled. . . . . : Yes  
  Autoconfiguration Enabled . . . . . : Yes  
  Link-local IPv6 Address . . . . . : fe80::d507:5f03:ac24:52ca%12(PREFERRED)  
  IPv4 Address. . . . . : 192.168.1.100(PREFERRED)  
  Subnet Mask . . . . . : 255.255.255.0  
  Lease Obtained. . . . . : 26 April 2021 13:26:40  
  Lease Expires . . . . . : 27 April 2021 19:47:18  
  Default Gateway . . . . . : 192.168.1.1  
  DHCP Server . . . . . : 192.168.1.1  
  DHCPv6 IAID . . . . . : 147642796  
  DHCPv6 Client DUID. . . . . : 00-01-00-01-26-89-14-91-BC-E9-2F-8A-5C-9C  
  DNS Servers . . . . . : 49.205.171.194  
                           49.207.34.210  
  NetBIOS over Tcpip. . . . . : Enabled
```

3) Ping:

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 are displayed, along with round-trip times. Ping is the primary TCP/IP command used to troubleshoot connectivity, reachability, and name resolution.

It is one of the most basic yet useful network commands to utilize in the command prompt application. It tells you whether your computer can reach some destination IP address or domain name, and if it can, how long it takes data to travel there and back again.

```
C:\WINDOWS\system32>ping www.google.com

Pinging www.google.com [142.250.67.132] with 32 bytes of data:
Reply from 142.250.67.132: bytes=32 time=22ms TTL=117
Reply from 142.250.67.132: bytes=32 time=20ms TTL=117
Reply from 142.250.67.132: bytes=32 time=23ms TTL=117
Request timed out.

Ping statistics for 142.250.67.132:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 20ms, Maximum = 23ms, Average = 21ms
```

4) Tracert

tracert stands for traceroute like ping it sends out a data packet as a way to troubleshoot any network issues you might have, but instead tracks the route of the packet as it hops from server to server

```
C:\WINDOWS\system32>tracert www.google.com

Tracing route to www.google.com [142.250.67.132]
over a maximum of 30 hops:

 1      3 ms      2 ms      4 ms  dlinkrouter [192.168.0.1]
 2      2 ms      4 ms      2 ms  10.10.13.1
```

4.1 Tracert

```
C:\WINDOWS\system32>tracert -h 10 www.cbit.ac.in

Tracing route to cbit.ac.in [192.46.212.171]
over a maximum of 10 hops:

 1      2 ms      2 ms      4 ms  dlinkrouter [192.168.0.1]
 2      2 ms      4 ms      2 ms  10.10.13.1
 3      *      6 ms      *  28.69.103-217.in-addr.arpa [103.69.28.217]
 4      *      *      *  Request timed out.
 5      5 ms      5 ms      9 ms  137.59.200.16
 6      7 ms      7 ms      3 ms  14.142.71.253.static-hyderabad.vsnl.net.in [14.142.71.253]
 7     21 ms     19 ms     20 ms  172.25.81.134
 8     94 ms     99 ms    101 ms  172.28.132.237
 9     25 ms     24 ms     33 ms  100.76.112.62
10     96 ms    101 ms     24 ms  10.214.32.0

Trace complete.
```

5) nslookup:

The nslookup (Name Server Lookup) tool can show valuable details to troubleshoot and resolve DNS-related issues. You can use this command to display the default DNS name and address of the local device, determine the domain name of an IP address or the name servers for a specific node.

```
C:\WINDOWS\system32>nslookup www.hackerrank.com
Server: UnKnown
Address: fe80::be0f:9aff:fe18:6708

Non-authoritative answer:
Name: e8937.dscb.akamaiedge.net
Addresses: 2600:1417:75:cb6::22e9
           2600:1417:75:cab::22e9
           104.122.8.79
Aliases: www.hackerrank.com
          hackerrank.com.edgekey.net
```

7) netstat:

The netstat (Network Statistics) tool displays statistics for all network connections. It allows you to understand open and connected ports to monitor and troubleshoot networking problems for Windows 10 and apps. When using the netstat tool, you can list active network connections and listening ports. You can view network adapter and protocols statistics. You can even display the current routing table and much more.

```
C:\WINDOWS\system32>netstat
Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:49675        DESKTOP-8FEF7AJ:49676  ESTABLISHED
  TCP    127.0.0.1:49676        DESKTOP-8FEF7AJ:49675  ESTABLISHED
  TCP    192.168.0.167:52086    a23-50-254-60:https  CLOSE_WAIT
  TCP    192.168.0.167:52087    a23-50-254-60:https  CLOSE_WAIT
  TCP    192.168.0.167:52396    40.90.189.152:https  ESTABLISHED
  TCP    192.168.0.167:52988    a-0001:https          ESTABLISHED
  TCP    192.168.0.167:52990    52.113.196.254:https ESTABLISHED
  TCP    192.168.0.167:52991    13.107.42.254:https  ESTABLISHED
```

8) Arp:

Windows 10 maintains an arp (Address Resolution Protocol) table, which stores IP to Media Access Control (MAC) entries that the system has resolved. The arp tool lets you view the entire table, modify the entries, and use it to determine a remote computer's MAC address.

Type the following command to view the current arp table cache on Windows 10 and press Enter:
'arp -a'

```
C:\WINDOWS\system32>arp -a

Interface: 192.168.0.167 --- 0x10
  Internet Address      Physical Address      Type
  192.168.0.1            bc-0f-9a-18-67-08  dynamic
  192.168.0.147          1c-d6-be-77-6c-20  dynamic
  192.168.0.255          ff-ff-ff-ff-ff-ff  static
  224.0.0.2              01-00-5e-00-00-02  static
  224.0.0.22             01-00-5e-00-00-16  static
  224.0.0.251            01-00-5e-00-00-fb  static
  224.0.0.252            01-00-5e-00-00-fc  static
  228.8.8.8              01-00-5e-08-08-08  static
  239.255.3.22           01-00-5e-7f-03-16  static
  239.255.255.250        01-00-5e-7f-ff-fa  static
  239.255.255.251        01-00-5e-7f-ff-fb  static
  255.255.255.255        ff-ff-ff-ff-ff-ff  static
```

9) net

Used for: Displaying available Net switches Command to enter: net

The net command is definitely a versatile one, allowing you to manage many different aspects of a network and its settings such as network shares, users and print jobs, as just a few examples.

Running just net won't do much, but it will present you with a list of all the switches that are available.

These include accounts to set password and logon requirements, file to show a list of open files and sessions to list, or even disconnect, sessions on the network.

```
C:\WINDOWS\system32>net
The syntax of this command is:

NET
  [ ACCOUNTS | COMPUTER | CONFIG | CONTINUE | FILE | GROUP | HELP |
    HELPMMSG | LOCALGROUP | PAUSE | SESSION | SHARE | START |
    STATISTICS | STOP | TIME | USE | USER | VIEW ]
```

10) hostname

The hostname command provides you with an easy way of identifying the hostname that has been assigned to your Windows device.

```
C:\WINDOWS\system32>hostname
DESKTOP-8FEF7AJ
```

RESULTS:

Ipconfig, ping, tracert, nslookup, netstat, arp, net, hostname and some other commands have been executed and the results have been displayed.

EXPERIMENT NO- 03:

AIM:PC Network Configuration.

OBJECTIVE:To demonstrate PC Network Configuration.

ALGORITHM:

1. Start
2. Connect to the internet
3. Gather TCP/IP configuration information
4. Record IP address, Subnet Mask and Default gateway for the computer
5. Compare TCP/IP information with other computers
6. Check additional TCP/IP information
7. End

DESCRIPTION AND EXECUTION:

IP Address:

An Internet Protocol address (IP address) is a numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication. An IP address serves two main functions: host or network interface identification and location addressing.

Internet Protocol version 4 (IPv4) defines an IP address as a 32-bit number.

IPv4 Classes:

There are 5 classes of IPv4 addresses:

1) Class A:

The first bit of the first octet is always set to 0 (zero). Thus the first octet ranges from 1 – 127. Class A addresses only include IP starting from 1.x.x.x to 126.x.x.x only. The IP range 127.x.x.x is reserved for loopback IP addresses.

The default subnet mask for Class A IP address is 255.0.0.0 which implies that Class A addressing can have 126 networks (2^7-2) and 16777214 hosts ($2^{24}-2$).

2) Class B:

An IP address which belongs to class B has the first two bits in the first octet set to 10.

Class B IP Addresses range from 128.0.x.x to 191.255.x.x. The default subnet mask for Class B is

255.255.x.x.

Class B has 16384 (2^{14}) Network addresses and 65534 ($2^{16}-2$) Host addresses.

3) ClassC:

The first octet of Class C IP address has its first 3 bits set to 110.

Class C IP addresses range from 192.0.0.x to 223.255.255.x. The default subnet mask for Class C is 255.255.255.x.

Class C gives 2097152 (2^{21}) Network addresses and 254 (2^8-2) Host addresses.

ClassD:

Very first four bits of the first octet in Class D IP addresses are set to 1110.

Class D has IP address range from 224.0.0.0 to 239.255.255.255. Class D is reserved for Multicasting. In multicasting data is not destined for a particular host, that is why there is no need to extract host address from the IP address, and Class D does not have any subnet mask.

4) ClassE:

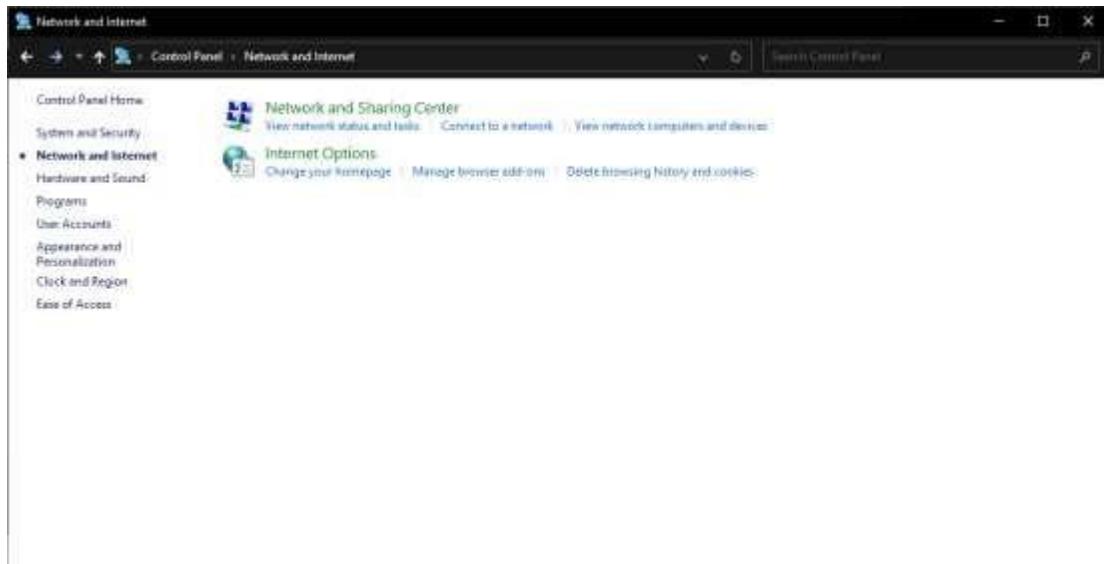
This IP Class is reserved for experimental purposes only for R&D or Study. IP addresses in this class ranges from 240.0.0.0 to 255.255.255.254. Like Class D, this class too is not equipped with any subnet mask.

DESCRIPTION AND EXECUTION:

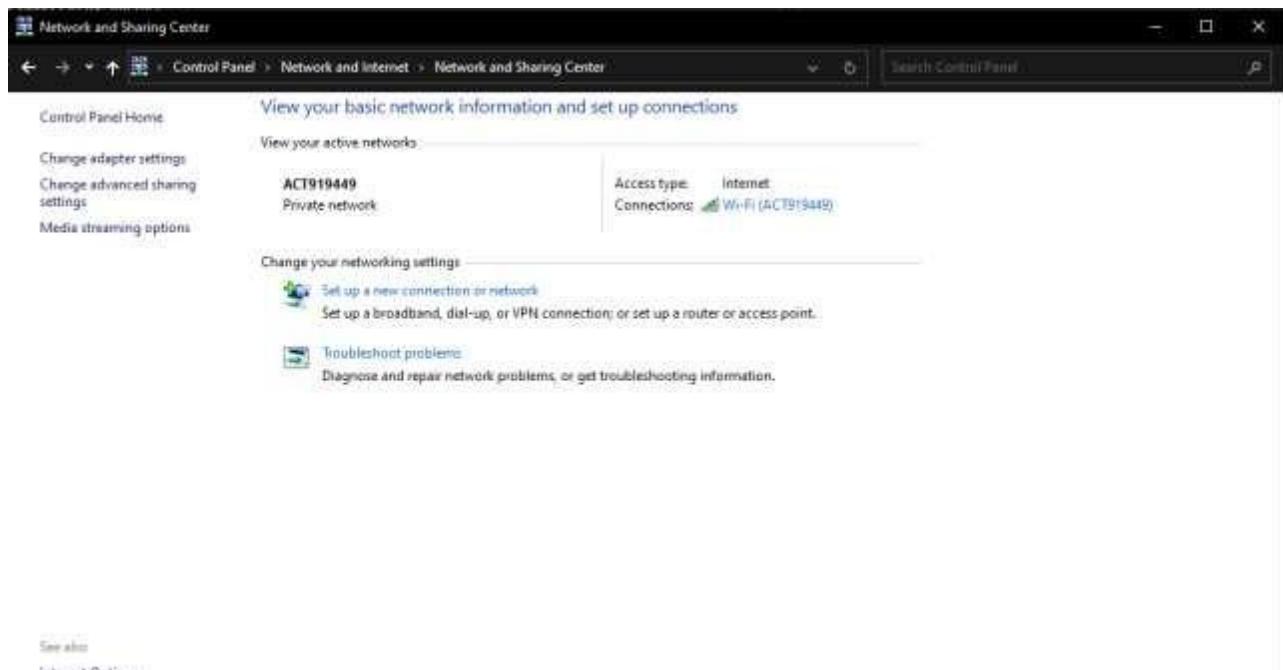
Network Configuration: Open Control Panel:

Open Network and Internet:

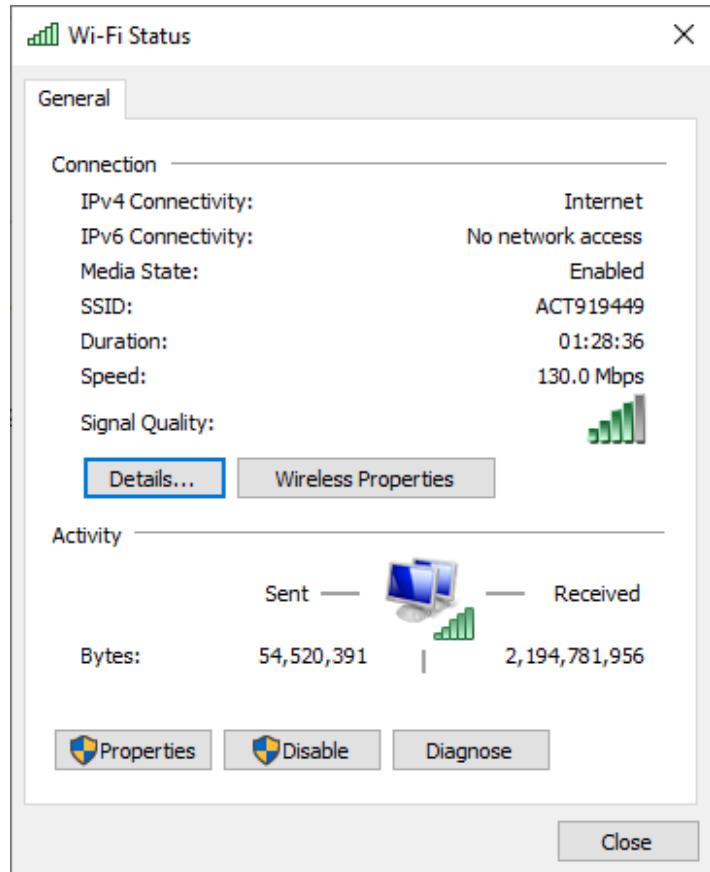




Open Network and Sharing Center:

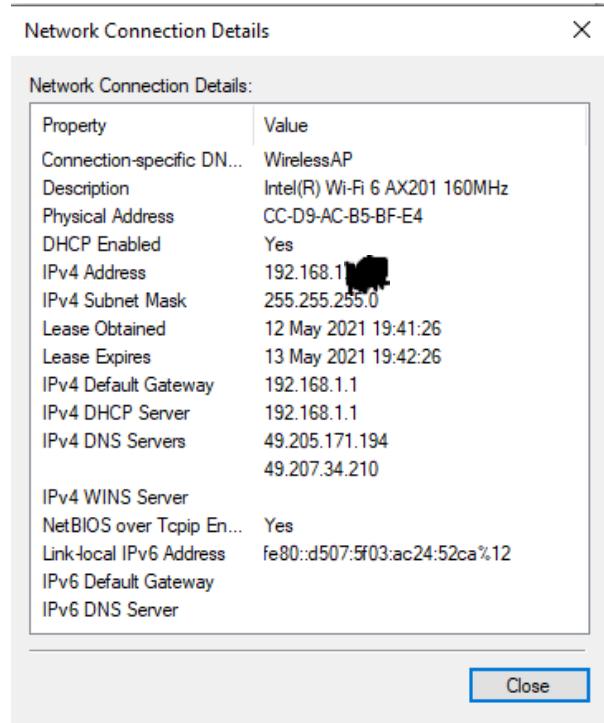


Go to Connection (Wi-Fi or LAN)

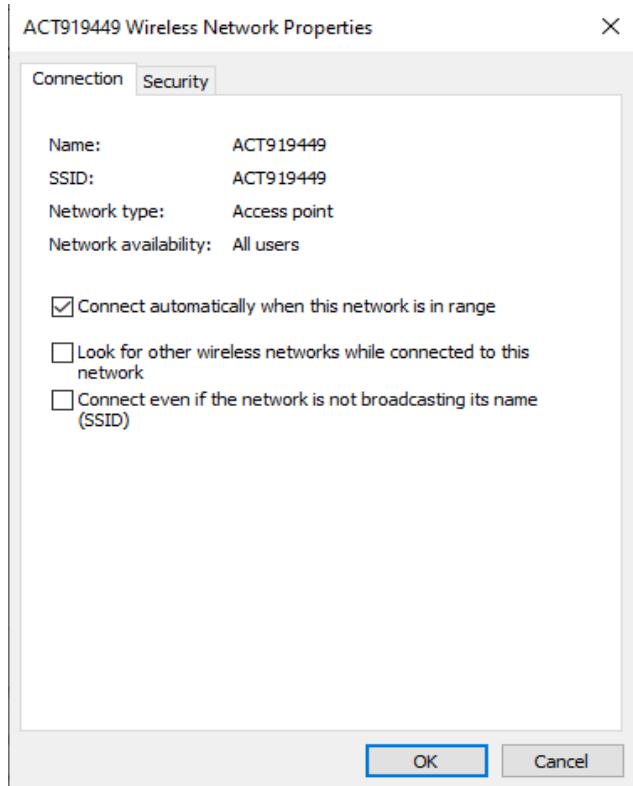


Details:

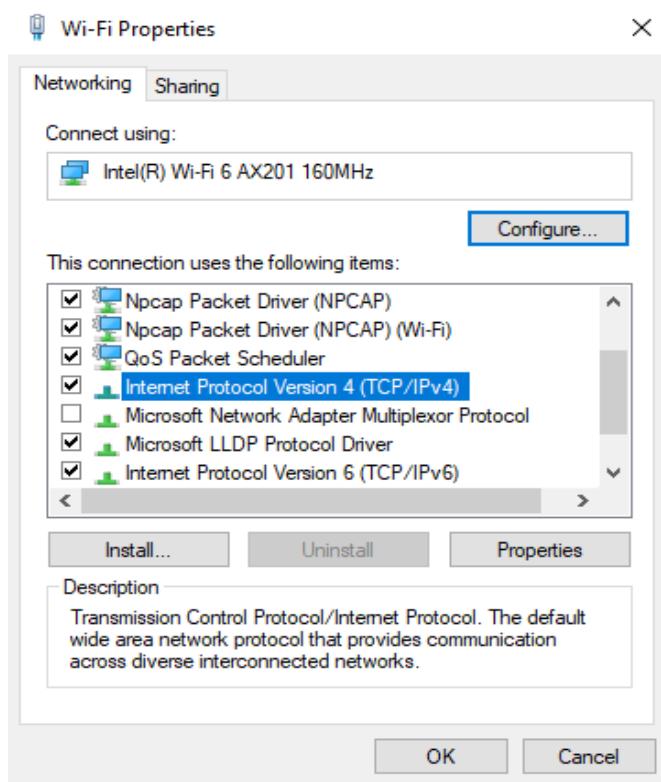
The IP address, Subnet mask and default gateways can be obtained here.



Wireless Properties:

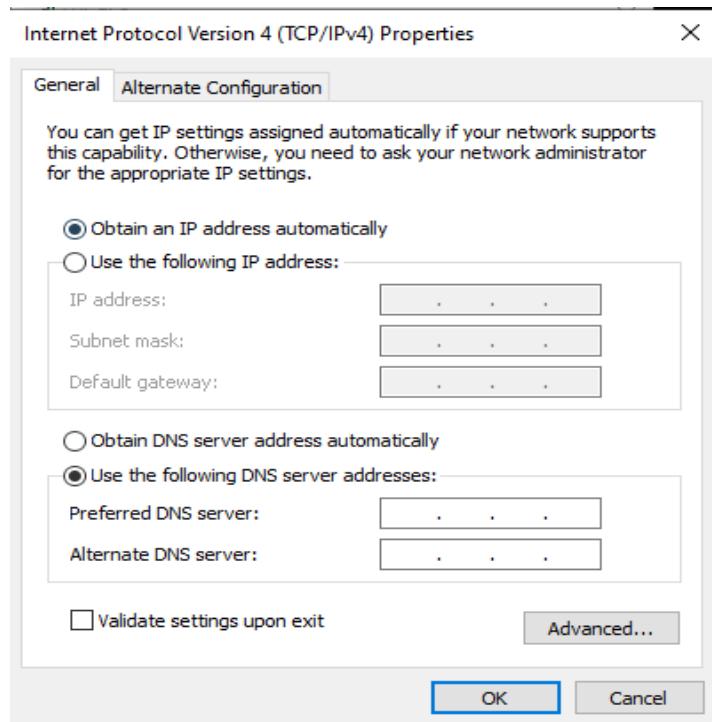


Wi-Fi Properties:



Internet Protocol Version 4 (TCP/IPv4):

The IP address and DNS server addresses can be set manually:



RESULTS:IP classes are studied and PC network configuration info is noted.

EXPERIMENT NO- 04

AIM:Building a switch – based network / Configuration of Cisco Catalyst Switch 3560

OBJECTIVE: To demonstrate building a switch – based network / Configuration Cisco Catalyst Switch3560.

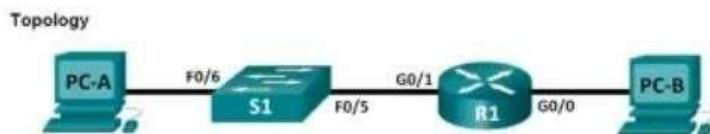
ALGORITHM:

1. Start
2. Setup the Topology and initializedevices
3. Configure Devices and verifyconnectivity
4. Display Deviceinformation
5. End

DESCRIPTION AND EXECUTION:

Resources: 1 Switch, 2 PCs, 1 Router.

The devices are connected in a star topology:



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	192.168.0.1	255.255.255.0	N/A
	G0/1	192.168.1.1	255.255.255.0	N/A
S1	VLAN 1	N/A	N/A	N/A
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1
PC-B	NIC	192.168.0.3	255.255.255.0	192.168.0.1

Laying out required devices:



PC-PT
PCA



2960-24TT
S1



1941
R1

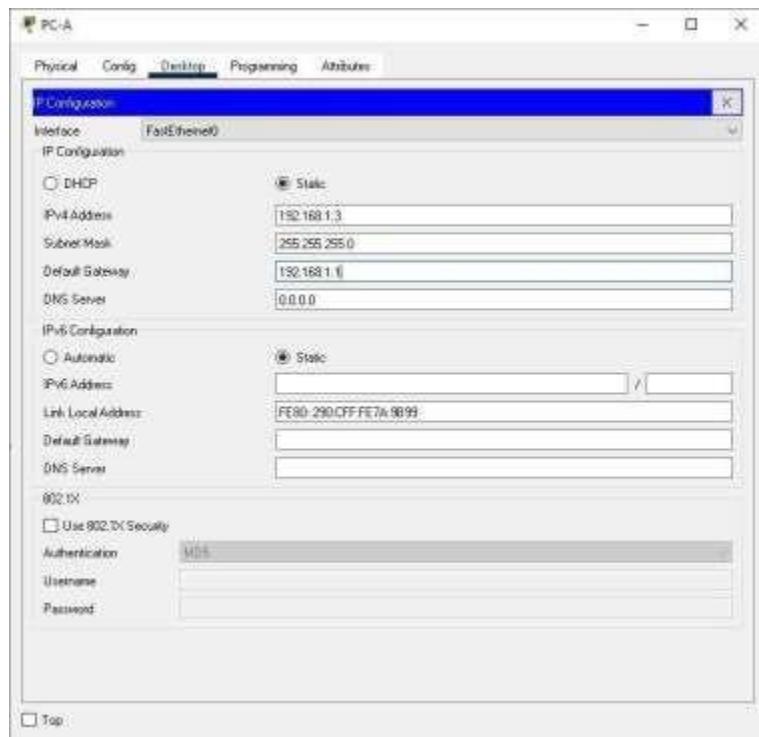


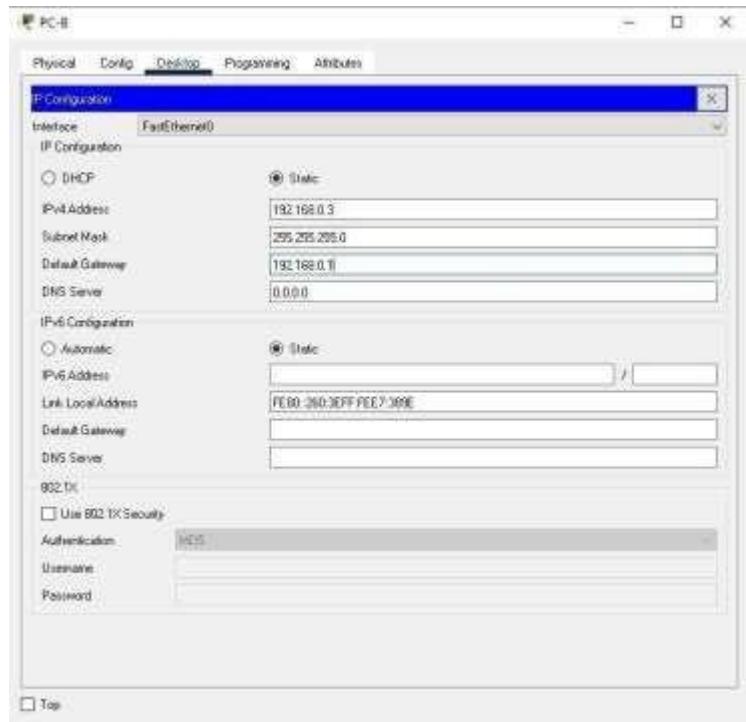
PC-PT
PC-B

Connecting the devices using cables:



Configuring PC-A and PC-B:





Configuring Switch S1:

Physical Config **CLI** Attributes

IOS CommandLine Interface

```
Switch>enable
Switch#
Switch#configure terminal
Enter configuration commands, one per line. End with CRTL/Z.
Switch(config)#interface FastEthernet0/6
Switch(config-if)#exit
Switch(config)#hostname SI
SI(config)ip domain-lookup
SI(config)int VLAN1
SI(config-if)#ip address 192.168.0.3 255.255.255.0
SI(config-if)#no shutdown

SI(config-if)#
*LINEPROTO-5-CHANGED: Interface Vlan1, changed state to up

*LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up

SI(config-if)exit
SI(config)#ip default-gateway 192.168.0.1
SI(config)#exit
SI#
*IFC-5-CONFIG_I: Configured from console by console

SI#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
(OK)
SI#ping 192.168.0.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/4/5 ms

SI#
```

Ctrl+F6 to end CLI focus

Copy **Page**

Checking ping from PCA to PCB:

```
PC-A

Physical Config Desktop Programming Attributes

Command Prompt

Packet Tracer PC Command Line 1.0
C:\ping 192.168.0.3

Pinging 192.168.0.3 with 32 bytes of data:
Reply from 192.168.0.3: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milliseconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\
```

RESULTS: After the configuration and connection of all devices, the ping is successful from PC-A to PC-B.

EXPERIMENT NO- 05

AIM: Configuration Of Cisco Router 2900

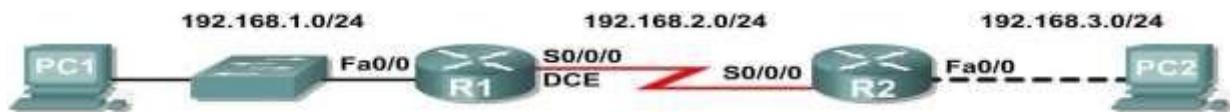
OBJECTIVE: To demonstrate Configuration Of Cisco Router 2900.

ALGORITHM:

1. Start
2. Setup the Topology and initialized devices
3. Configure Devices and router and verify connectivity
4. Display Device information
5. End

DESCRIPTION AND EXECUTION:

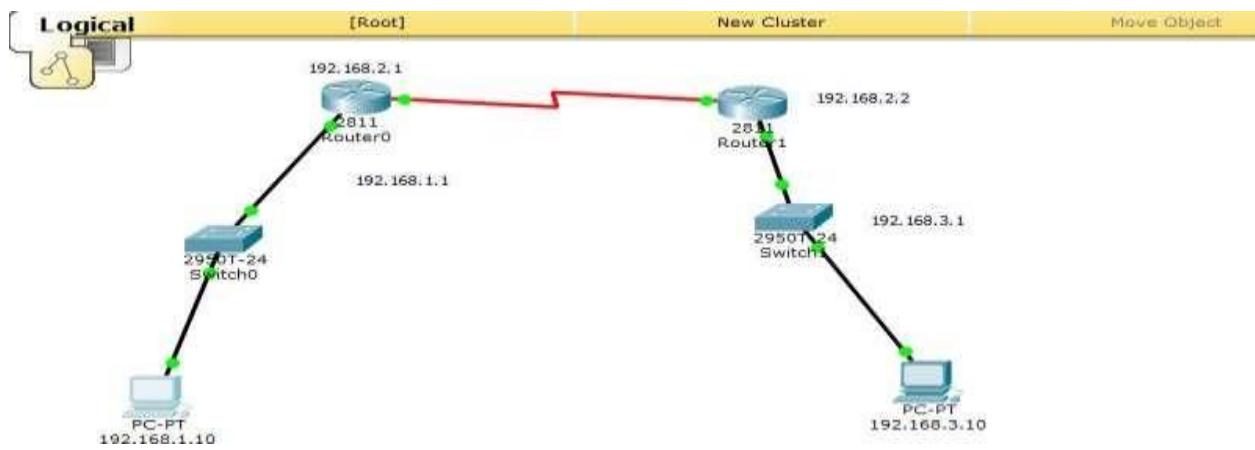
Resources: 2 Switch, 2 PCs, 2 Router.



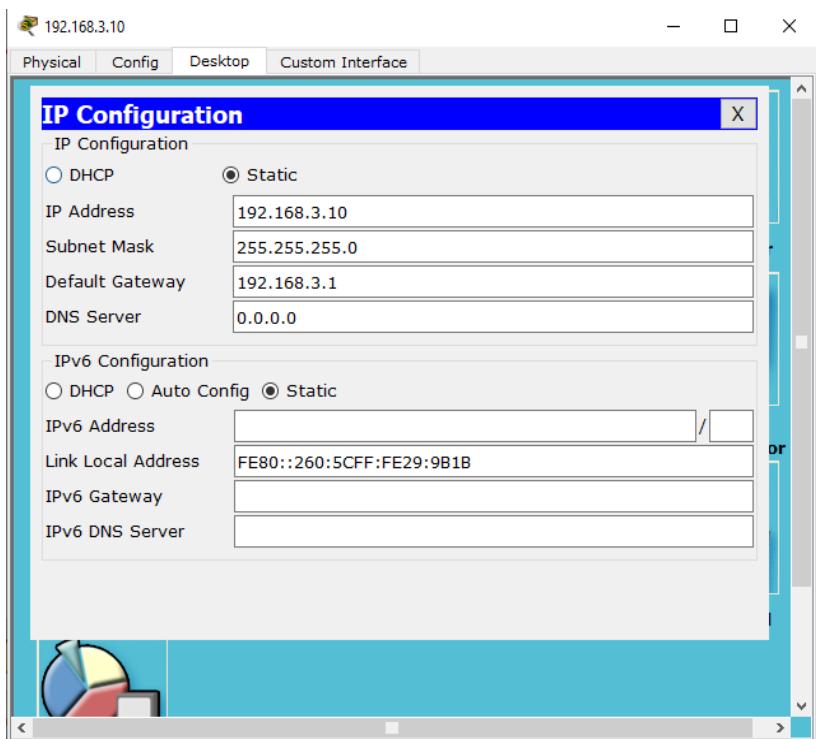
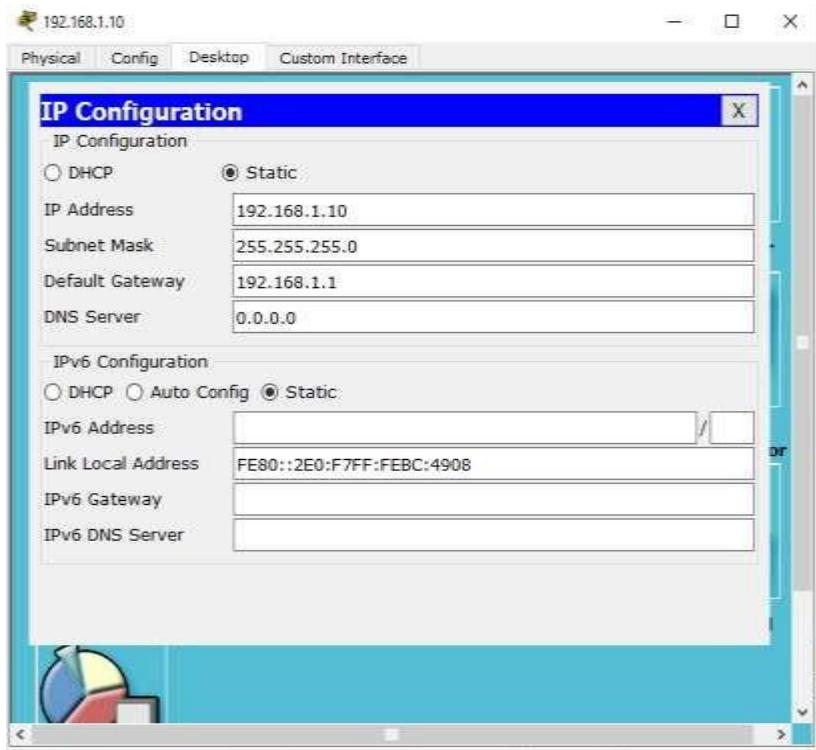
Device	Interface	IP Address	Subnet Mask	Def. Gateway
R1	Fa0/0	192.168.1.1	255.255.255.0	N/A
	S0/0/0	192.168.2.1	255.255.255.0	N/A
R2	Fa0/0	192.168.3.1	255.255.255.0	N/A
	S0/0/0	192.168.2.2	255.255.255.0	N/A
PC1	N/A	192.168.1.10	255.255.255.0	192.168.1.1

PC2	N/A	192.168.3.10	255.255.255.0	192.168.3.1
-----	-----	--------------	---------------	-------------

Connecting the devices using cables:



Configuring PC-A and PC-B:



Configuring router 1:

Router0 - FastEthernet0/0 Configuration:

- Port Status: On
- Bandwidth: 100 Mbps
- Duplex: Full Duplex
- MAC Address: 000D.8D18.1801
- IP Configuration:
 - IP Address: 192.168.1.1
 - Subnet Mask: 255.255.255.0
- Tx Ring Limit: 10

Router0 - Serial0/0/0 Configuration:

- Port Status: On
- Duplex: Full Duplex
- Clock Rate: 2000000
- IP Configuration:
 - IP Address: 192.168.2.1
 - Subnet Mask: 255.255.255.0
- Tx Ring Limit: 10



— □ ×

Physical

Config

CLI

IOS Command Line Interface

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

Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#no ip address
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no shutdown

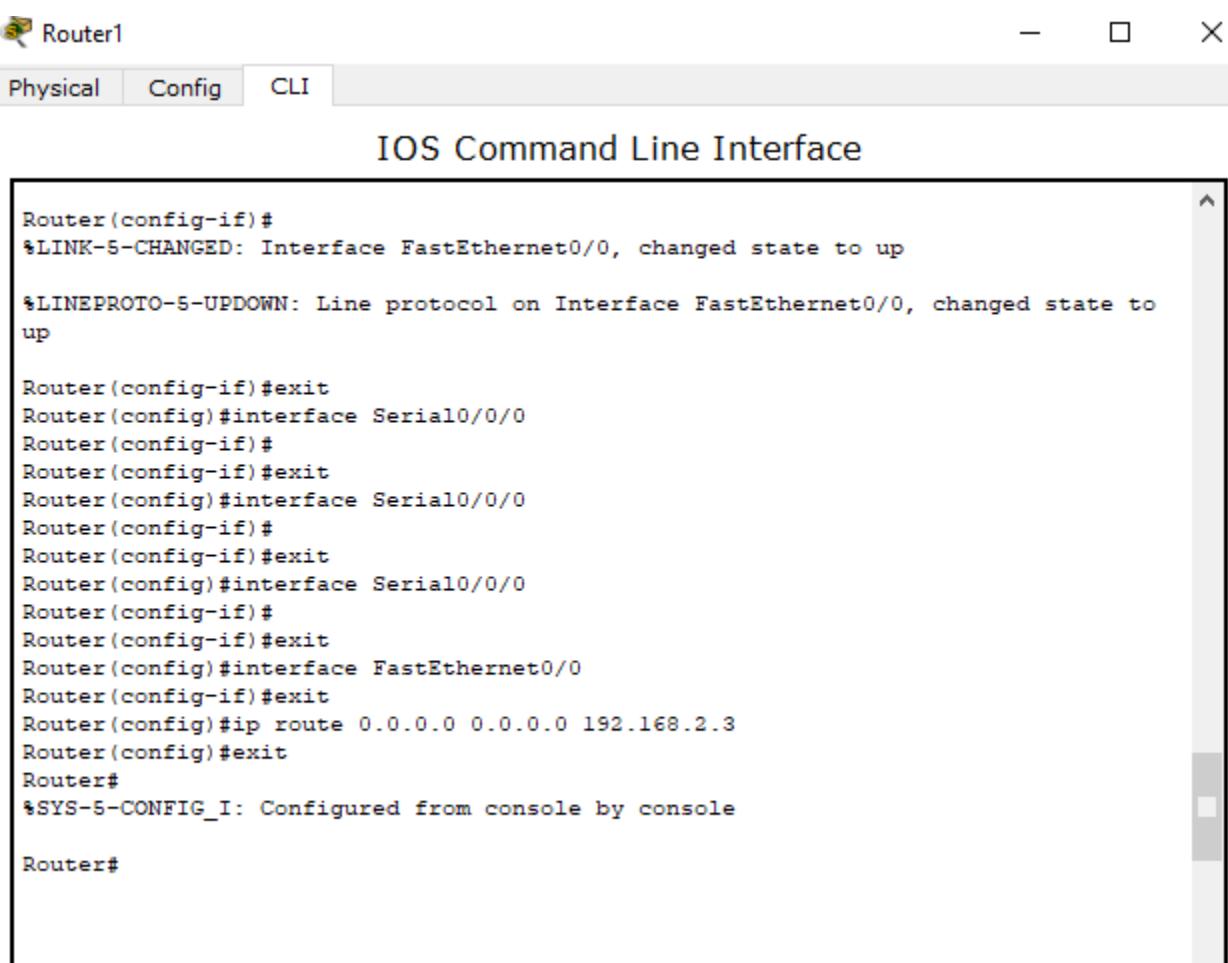
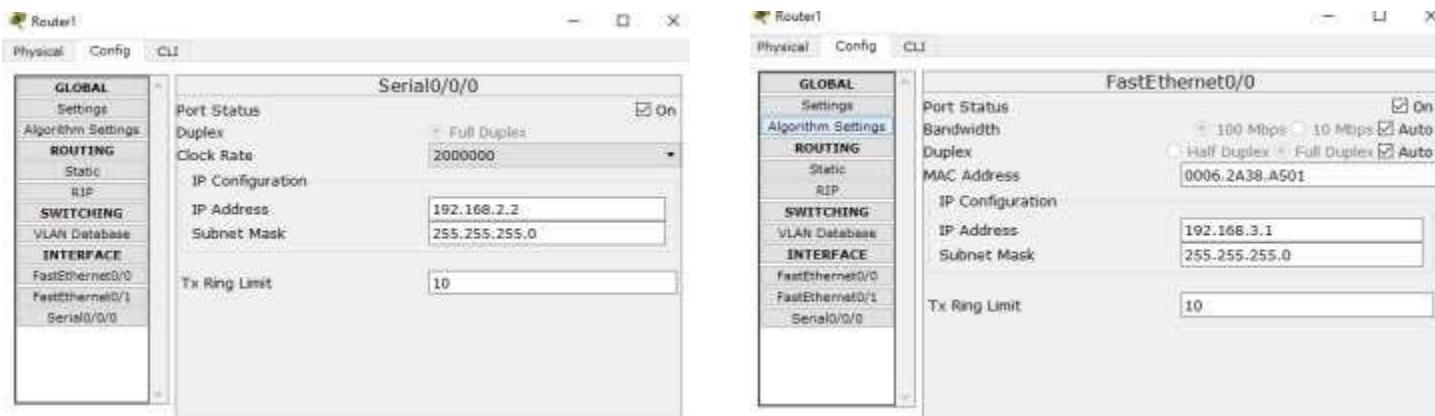
*LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
Router(config-if)#
*LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

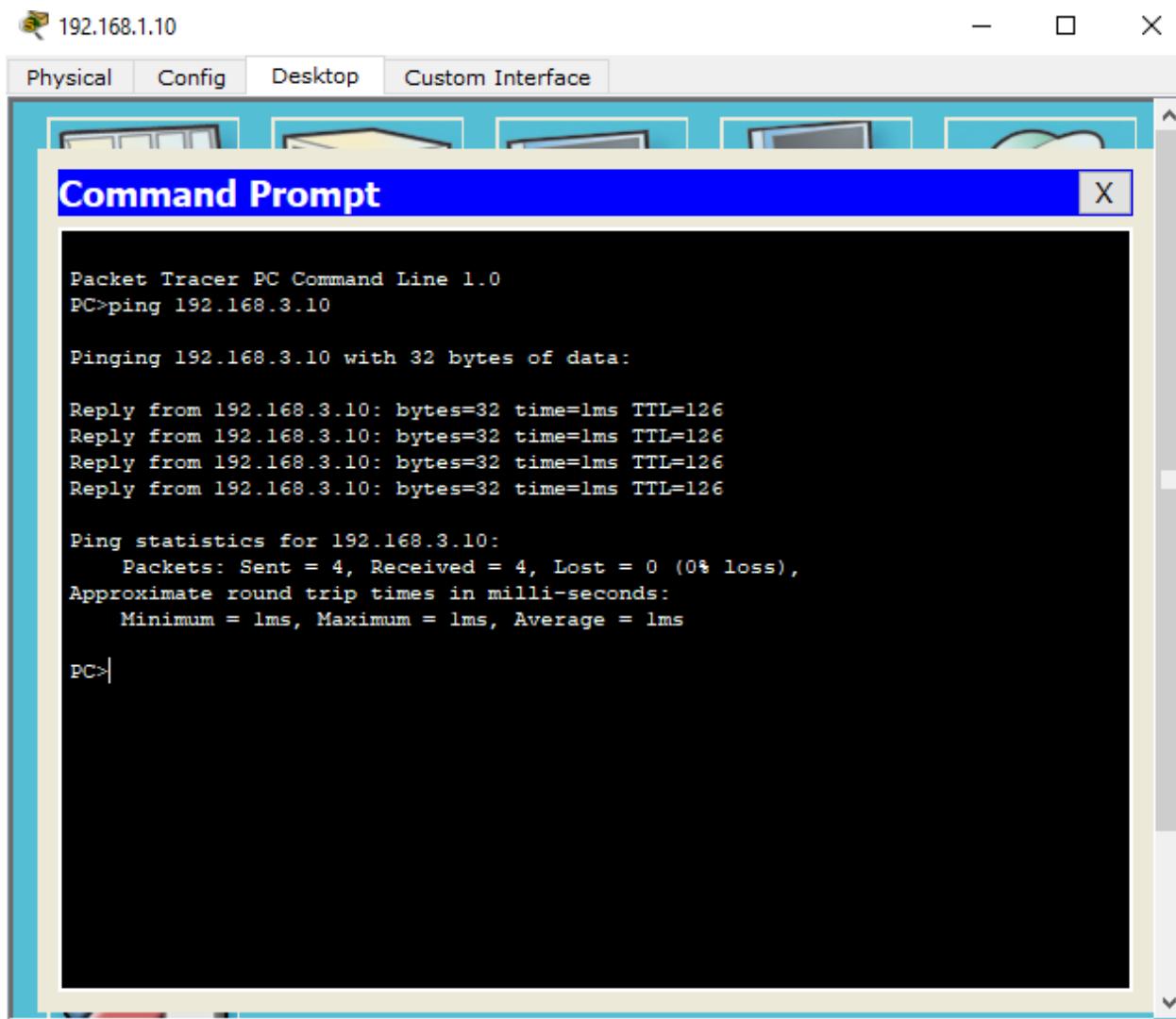
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#exit
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.2.3
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#
```

Configuring router 2:



Checking ping from PCA to PCB:



The screenshot shows a 'Command Prompt' window within the Packet Tracer software. The window title is 'Command Prompt'. The content of the window is as follows:

```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.3.10

Pinging 192.168.3.10 with 32 bytes of data:

Reply from 192.168.3.10: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.3.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

PC>
```

RESULTS: After the configuration and connection of all devices, the ping is successful from PC-A to PC-B.

EXPERIMENT NO- 06

AIM:Basic OPSF Configuration

OBJECTIVE:To demonstrate Basic OPSF Configuration.

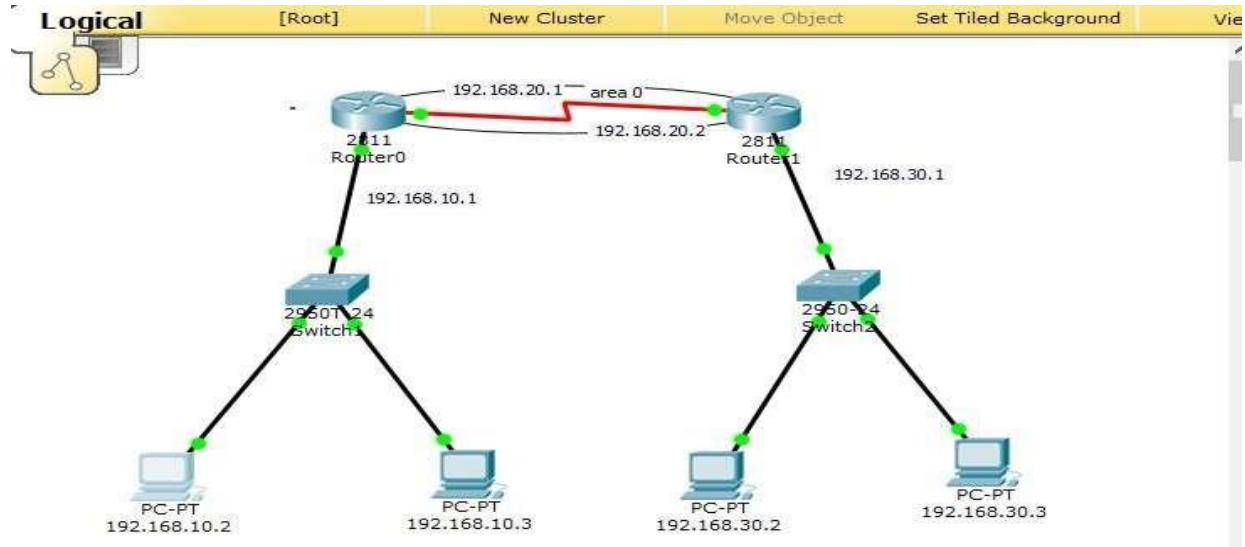
ALGORITHM:

1. Start
2. Setup the Topology and initializedevices
3. Configure Devices and verifyconnectivity
4. Display Deviceinformation
5. End

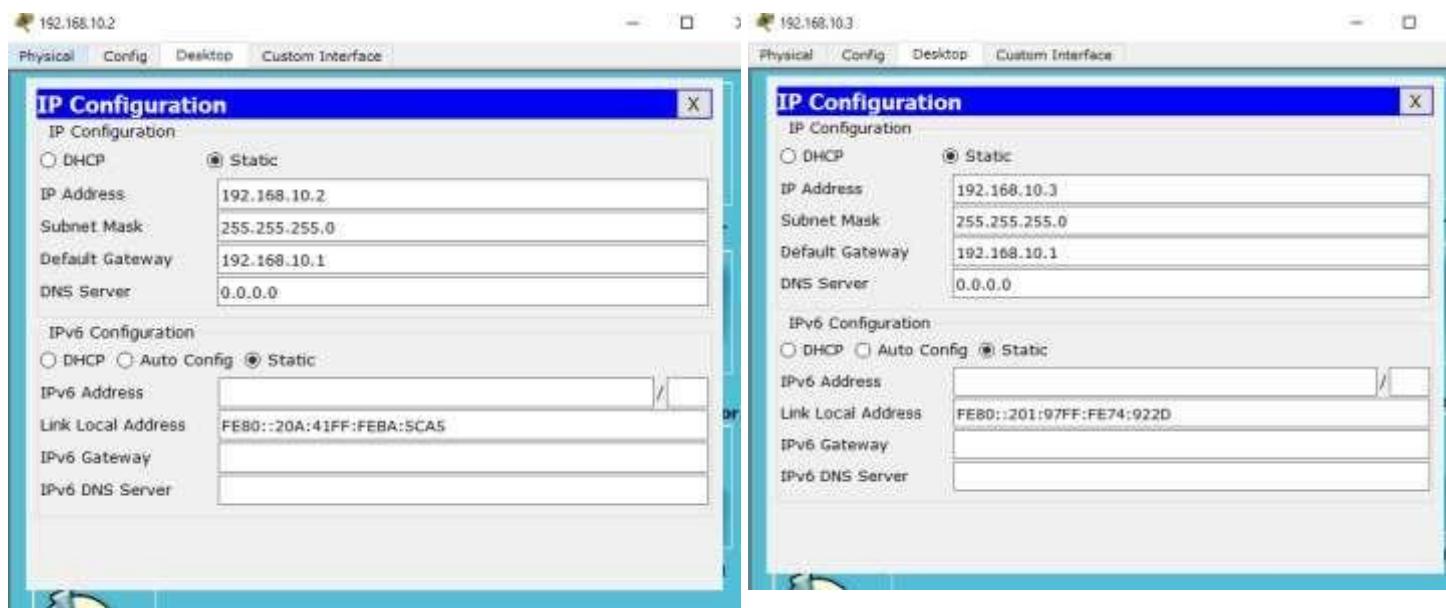
DESCRIPTION AND EXECUTION:

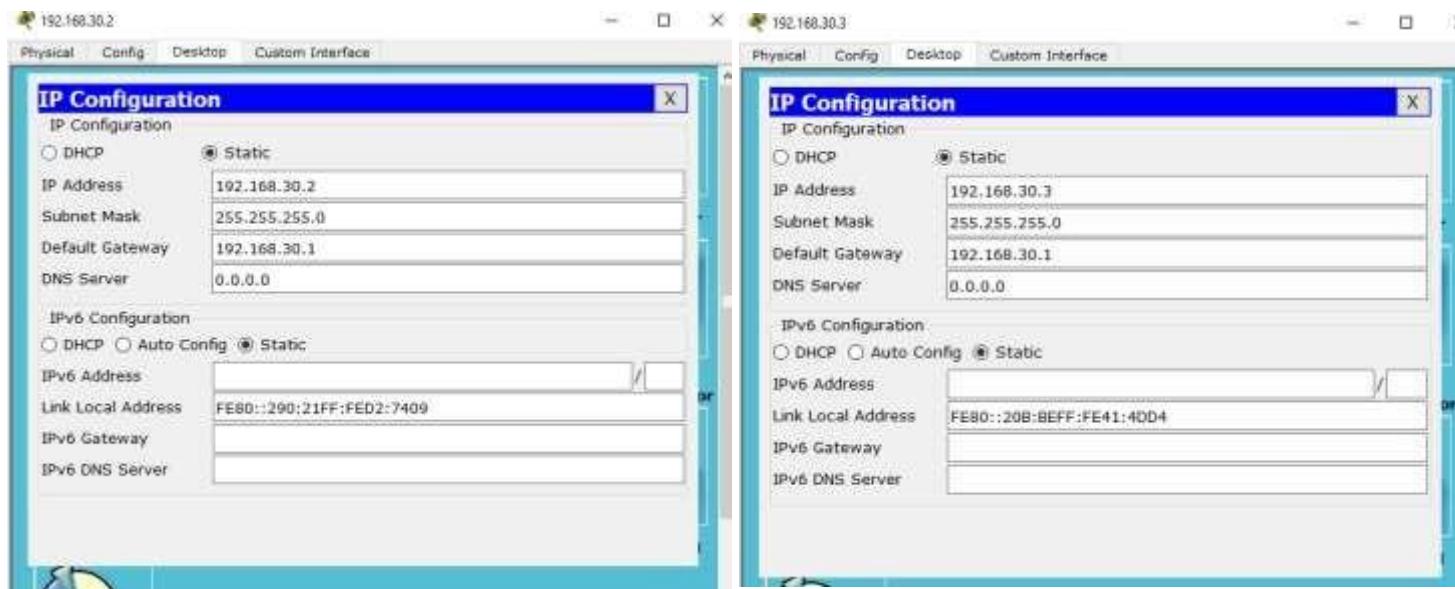
- OSPF is a link-state routing protocol. Link-state protocols use the shortest path first (SPF) algorithm to populate the routing table. OSPF shares information with everyrouter in thenetwork.
- OSPF is considered a difficult protocol to configure and requires a thorough understanding of terms that are commonlyused.

Connecting the devices using cables:



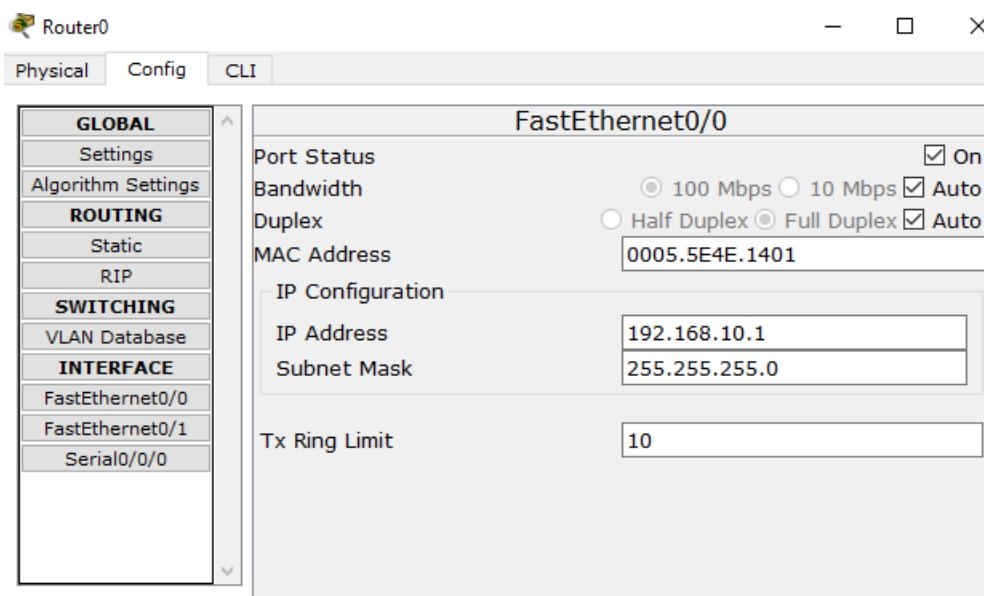
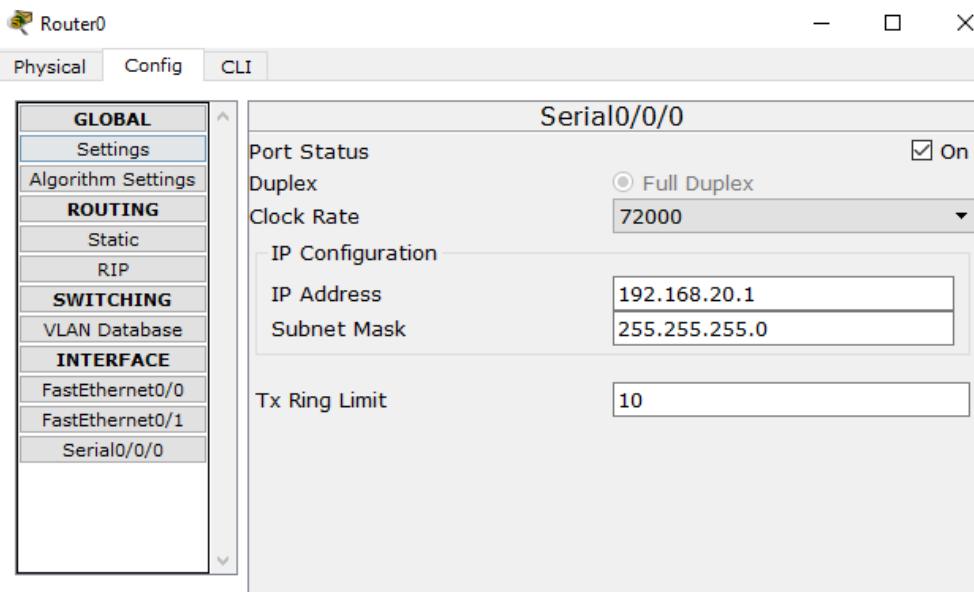
Configuring PC's:



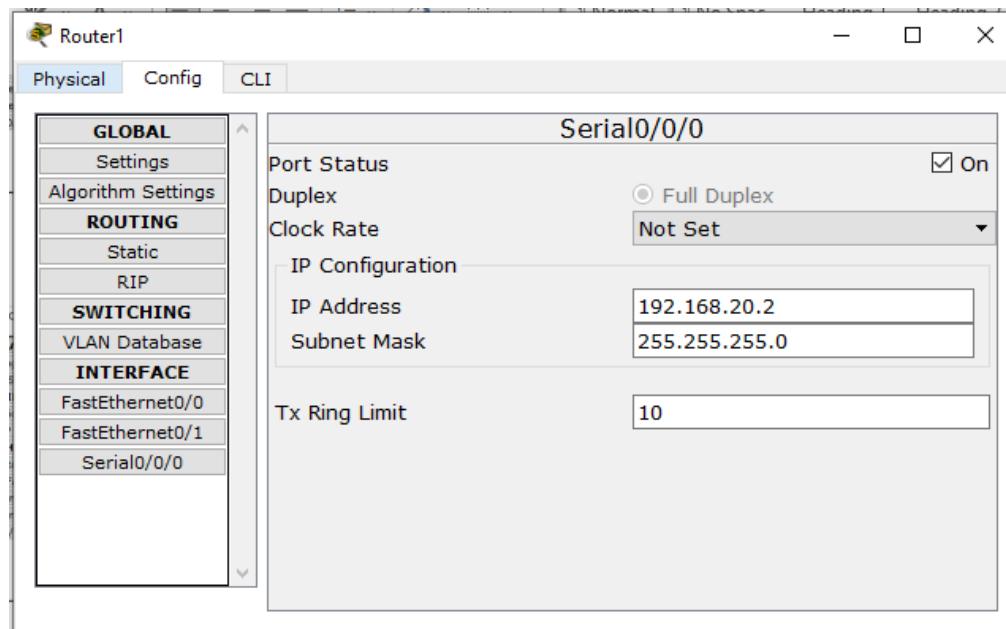
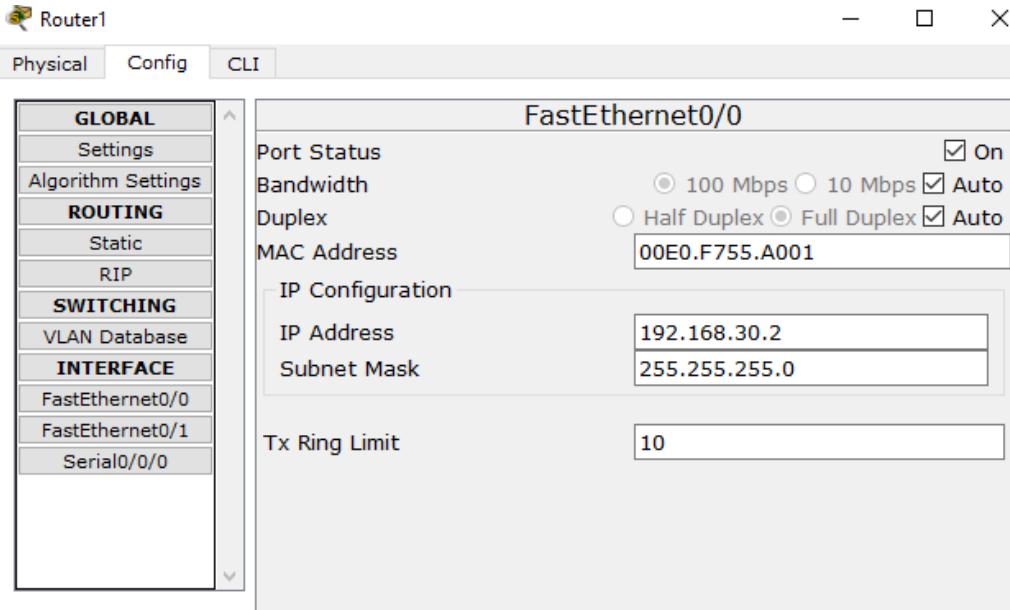


Configuring Routers:

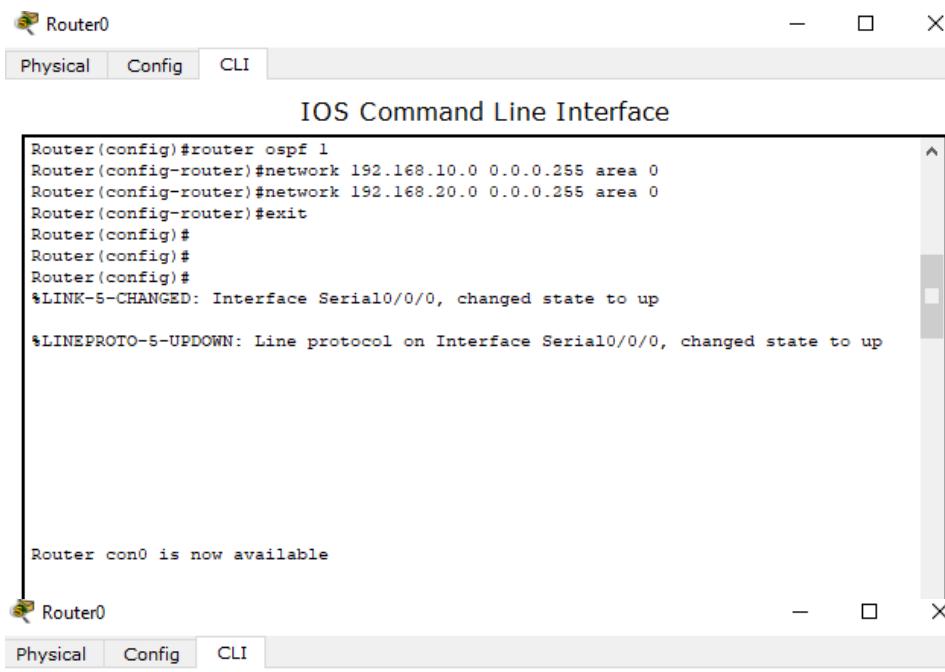
Router 0: Config



Router 1: config



Router 0: CLI



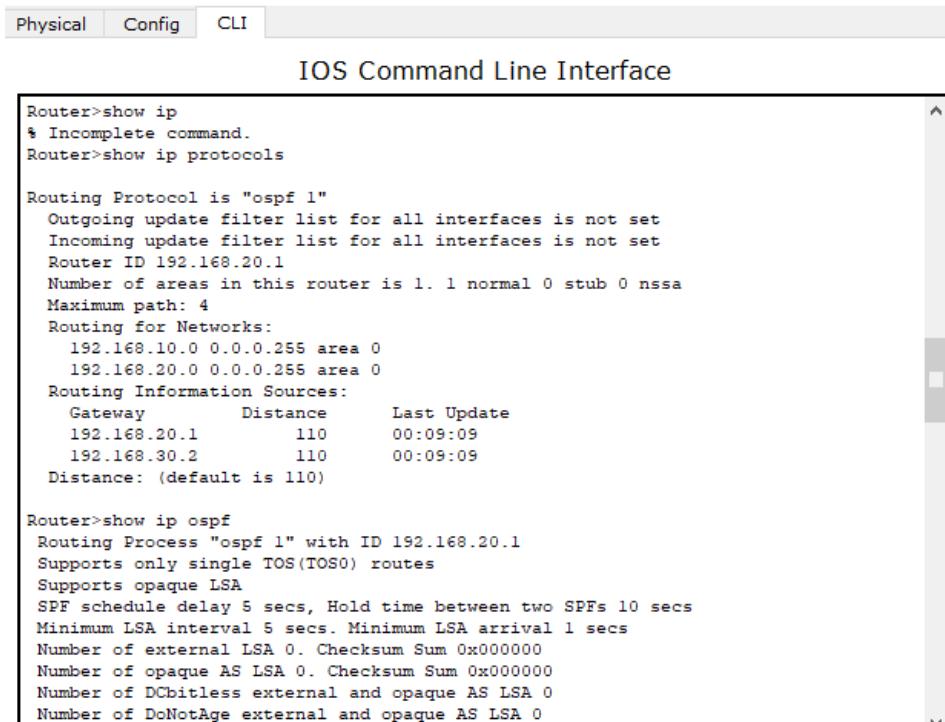
Router0

Physical Config CLI

IOS Command Line Interface

```
Router(config)#router ospf 1
Router(config-router)#network 192.168.10.0 0.0.0.255 area 0
Router(config-router)#network 192.168.20.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#
Router(config)#
Router(config)#
*LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router con0 is now available
```

Router0

Physical Config CLI

IOS Command Line Interface

```
Router>show ip
% Incomplete command.
Router>show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.20.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.10.0 0.0.0.255 area 0
    192.168.20.0 0.0.0.255 area 0
  Routing Information Sources:
    Gateway          Distance      Last Update
    192.168.20.1      110          00:09:09
    192.168.30.2      110          00:09:09
  Distance: (default is 110)

Router>show ip ospf
  Routing Process "ospf 1" with ID 192.168.20.1
  Supports only single TOS(TOS0) routes
  Supports opaque LSA
  SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
  Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
  Number of external LSA 0. Checksum Sum 0x00000000
  Number of opaque AS LSA 0. Checksum Sum 0x00000000
  Number of DCbitless external and opaque AS LSA 0
  Number of DoNotAge external and opaque AS LSA 0
```

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down
01:26:04: *OSPF-5-ADJCHG: Process 1, Nbr 192.168.20.1 on Serial0/0/0 from FULL to DOWN, Neighbor Down: Interface down or detached

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to down
03:05:46: *OSPF-5-ADJCHG: Process 1, Nbr 192.168.20.1 on Serial0/0/0 from INIT to DOWN, Neighbor Down: Interface down or detached
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
03:05:56: *OSPF-5-ADJCHG: Process 1, Nbr 192.168.20.1 on Serial0/0/0 from LOADING to FULL, Loading Done

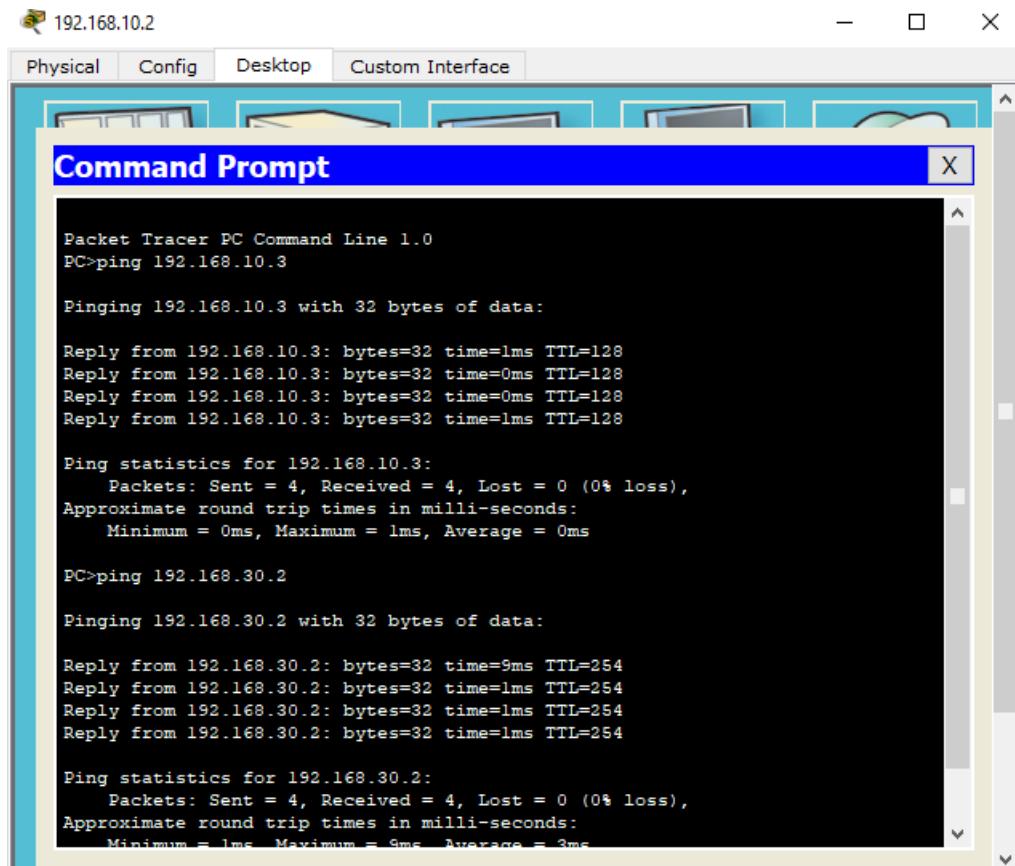
36 | P

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#

```

Roll No. :160118733093

Checking Ping:



```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.10.3

Pinging 192.168.10.3 with 32 bytes of data:

Reply from 192.168.10.3: bytes=32 time=1ms TTL=128
Reply from 192.168.10.3: bytes=32 time=0ms TTL=128
Reply from 192.168.10.3: bytes=32 time=0ms TTL=128
Reply from 192.168.10.3: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.10.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.30.2

Pinging 192.168.30.2 with 32 bytes of data:

Reply from 192.168.30.2: bytes=32 time=9ms TTL=254
Reply from 192.168.30.2: bytes=32 time=1ms TTL=254
Reply from 192.168.30.2: bytes=32 time=1ms TTL=254
Reply from 192.168.30.2: bytes=32 time=1ms TTL=254

Ping statistics for 192.168.30.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 9ms, Average = 3ms
```

RESULTS: After the configuration and connection of all devices, the ping is successful from PC-A to PC-B.

EXPERIMENT NO- 07

AIM:Basic EIGRP Configuration

OBJECTIVE:To demonstrate Basic EIGRP Configuration and To display EIGRP with a process ID of1.

ALGORITHM:

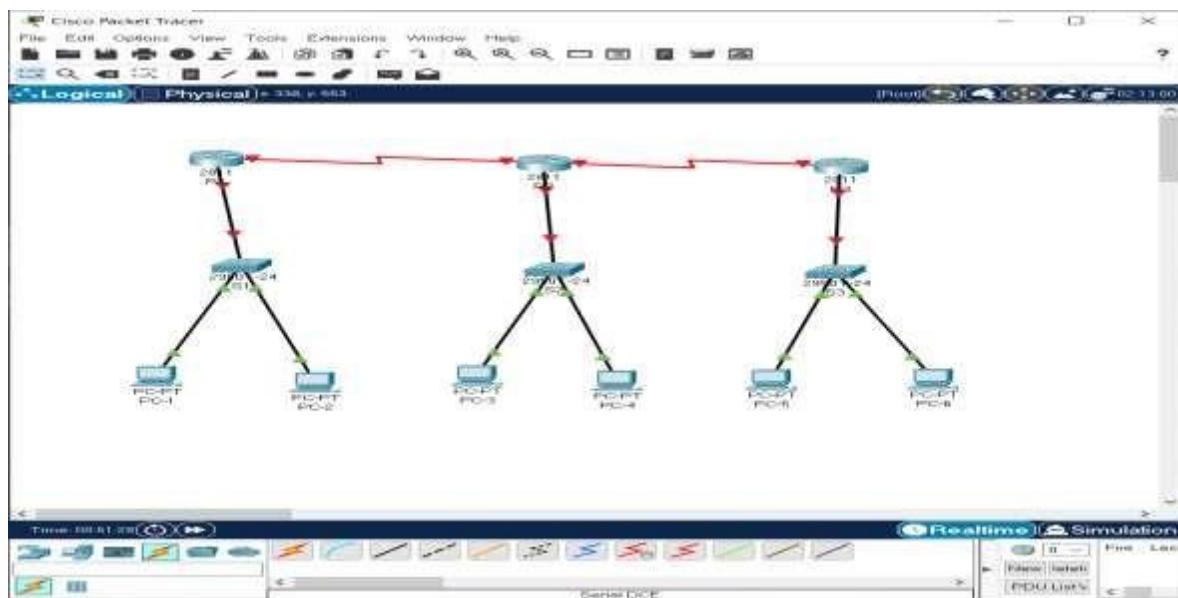
1. Start Cisco Packet Tracerapplication.
2. Setup devices and cable them according to the topologicaldiagram.
3. Configure fastethernet interface for router 1, 2 and3.
4. Configure serial 0/0/0 interface for router 1 and3.
5. Configure serial 0/1/0 interface for router2.
6. Configure eigrp network forrouters.
7. ConfigurePC's.
8. To verify connectivity, ping all PC's through commandprompt.
9. Exit.

DESCRIPTION AND EXECUTION:

Enhanced Interior Gateway Routing Protocol is an interior gateway protocol suited for many different topologies and media. In a well-designed network, EIGRP scales well and provides extremely quick convergence times with minimal network traffic. It has very low usage of network resources during normal operations; only hello packets are transmitted on a stable network.

When a change occurs, only routing table changes are propagated, not the entire routing table; this reduces the load on the routing protocol itself places on the network. It has rapid convergence times for changes in the network topology (in some situations convergence can be almost instantaneous). It is an enhanced distance vector protocol, relying on the Diffused Update Algorithm (DUAL) to calculate the shortest path to a destination within anetwork.

Setup topological network:



Router configuration:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fastethernet 0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown

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

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

Router(config-if)#interface serial 0/0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#clock rate 72000
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
Router(config-if)#exit
Router(config)#

```

```

R2
Physical Config CLI Attributes

2. ETHERNET0/0 (IP: 192.168.0.2)
3. Low-speed serial (ASYNC/ASYNC) network interface (S0/0)
  DRAM configuration is 64 bytes wide with parity disabled.
  256 bytes of non-volatile configuration memory.
  2499648 bytes of ATA System CompactFlash 0 (Read/Write)

  --- System Configuration Dialog ---
Would you like to enter the current configuration dialog? [yes/no]: no

Press RETURN to get started.

Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CTR-Z.
Router>config-term
Router>config-term address 192.168.0.1 255.255.255.0
Router>config-term shutdown

Router>config-term
SLINE-0-CHANGED: Interface FastEthernet0/0, changed state to up
SLINE-0-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router>config-term
SLINE-0-CHANGED: Line protocol on Interface FastEthernet0/0, changed state to up

Router>config-term
Router>config-term interface serial 0/0/0
Router>config-term ip address 10.0.0.2 255.0.0.0
Router>config-term baud rate 72000
This command applies only to DCE interfaces
Router>config-term shutdown

Router>config-term
SLINE-0-CHANGED: Interface serial0/0/0, changed state to up

Router>config-term
Router>config-term
SLINE-0-CHANGED: Line protocol on Interface Serial0/0/0, changed state to up

4. Serial0/0/0 (IP: 10.0.0.2)
  DRAM configuration is 64 bytes wide with parity disabled.
  256 bytes of non-volatile configuration memory.
  2499648 bytes of ATA System CompactFlash 0 (Read/Write)

  --- System Configuration Dialog ---
Would you like to enter the current configuration dialog? [yes/no]: no

Router>config-term

```

R3

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet 0/0
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#no shutdown

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

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

Router(config-if)#exit
Router(config)#interface serial 0/0/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

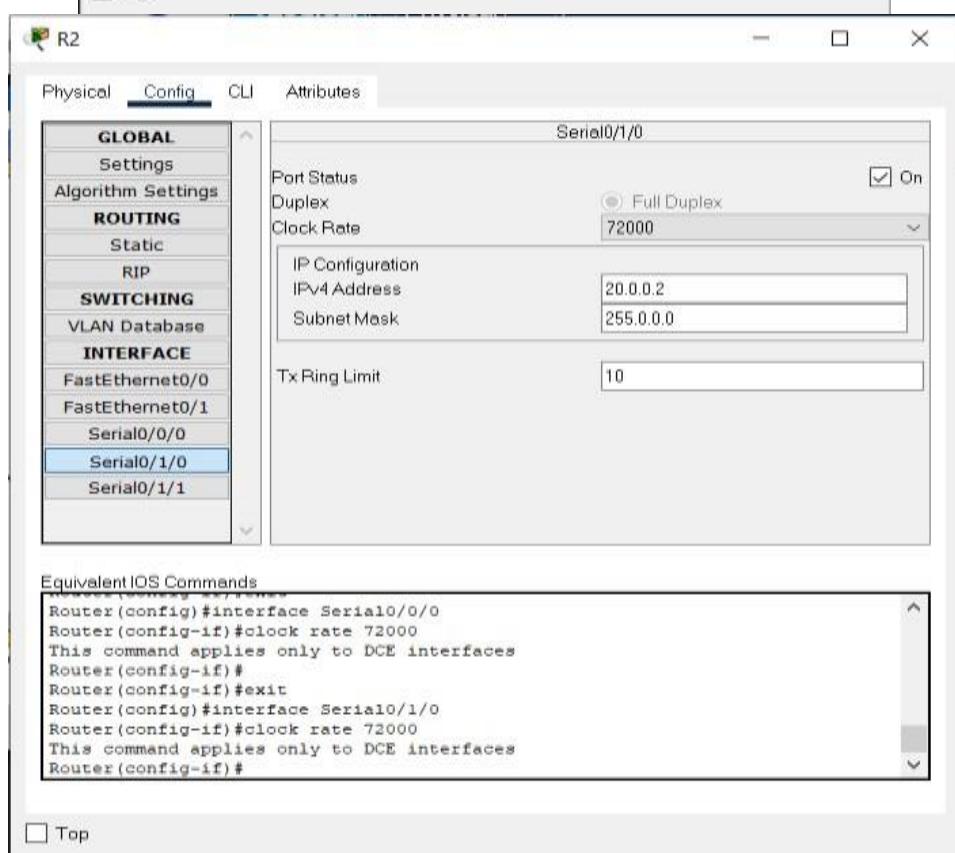
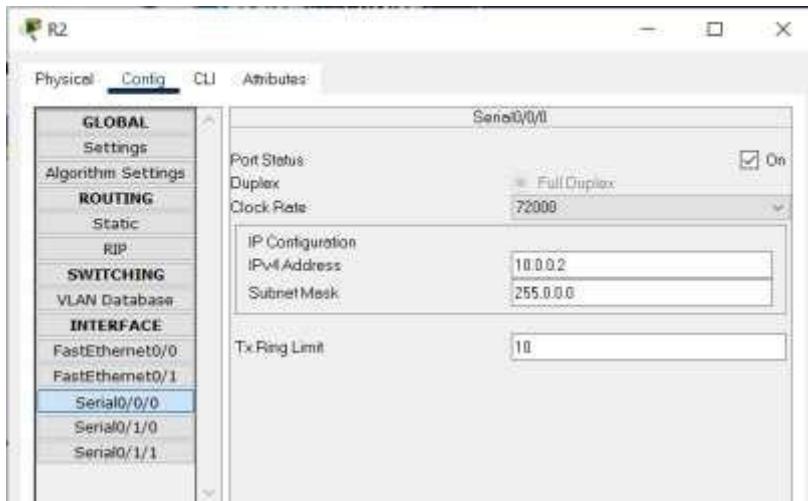
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

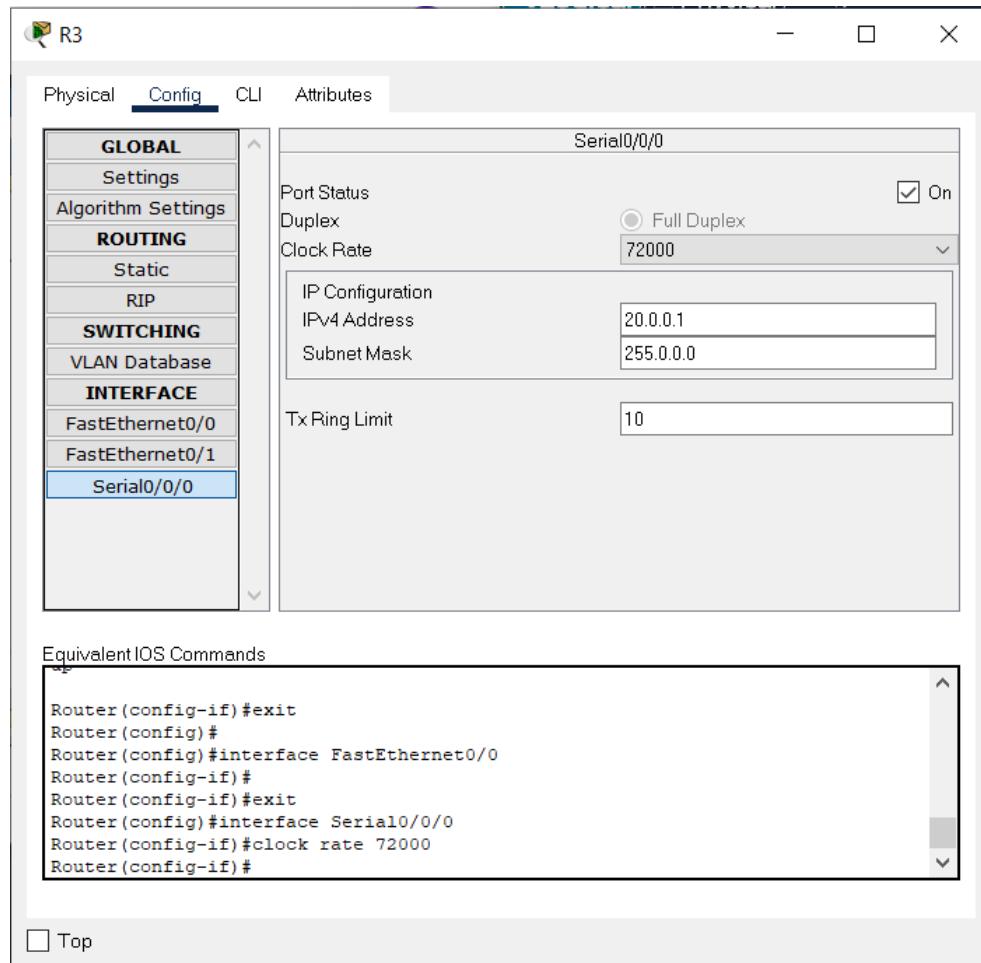
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to
up

Router(config-if)#exit
Router(config)#

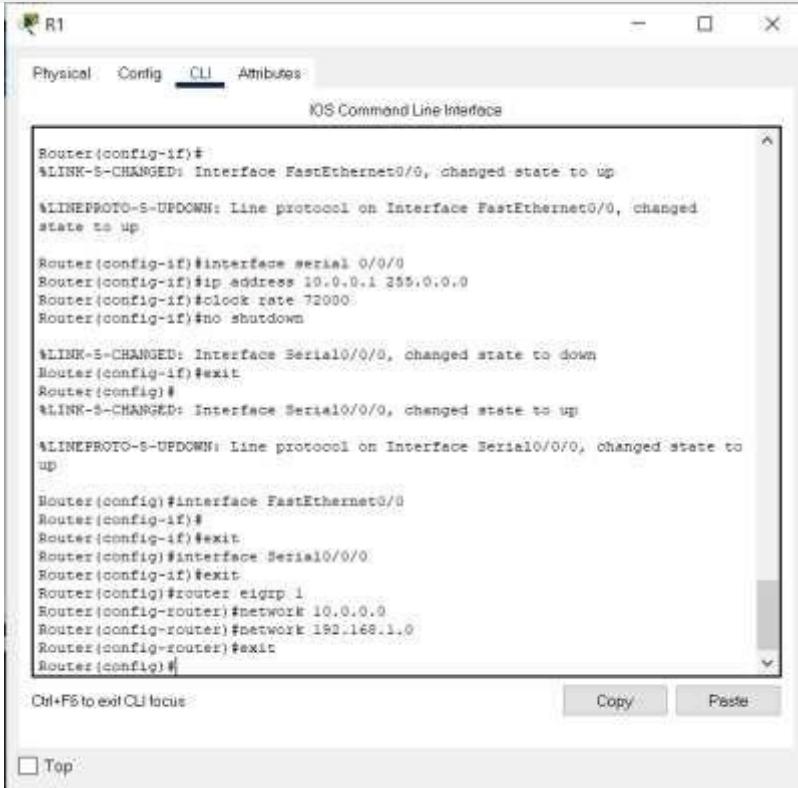
Ctrl+F6 to exit CLI focus
```

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Top



Top

R2

Physical Config **CLI** Attributes

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to down
Router(config-if)#exit
Router(config)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#
Router(config)#interface Serial0/0/0
Router(config-if)#clock rate 72000
This command applies only to DCE interfaces
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1/0
Router(config-if)#clock rate 72000
This command applies only to DCE interfaces
Router(config-if)#
Router(config)#router eigrp 1
Router(config-router)#network 10.0.0.0
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 10.0.0.1 (Serial0/0/0) is up: new
adjacency

Router(config-router)#network 192.168.3.0
Router(config-router)#network 20.0.0.0
Router(config-router)#exit
Router(config)#

Ctrl+F6 to exit CLI focus
```

Top

Copy **Paste**

R3

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Router(config-if)#exit
Router(config)#interface serial 0/0/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router(config-if)#exit
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/0/0
Router(config-if)#clock rate 72000
Router(config-if)#exit
Router(config)#router eigrp 1
Router(config-router)#network 20.0.0.0
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 20.0.0.2 (Serial0/0/0) is up: new
adjacency

Router(config-router)#network 192.168.3.0
Router(config-router)#exit
Router(config)#

Ctrl+F6 to exit CLI focus
```

Top

Copy **Paste**

PC configuration:

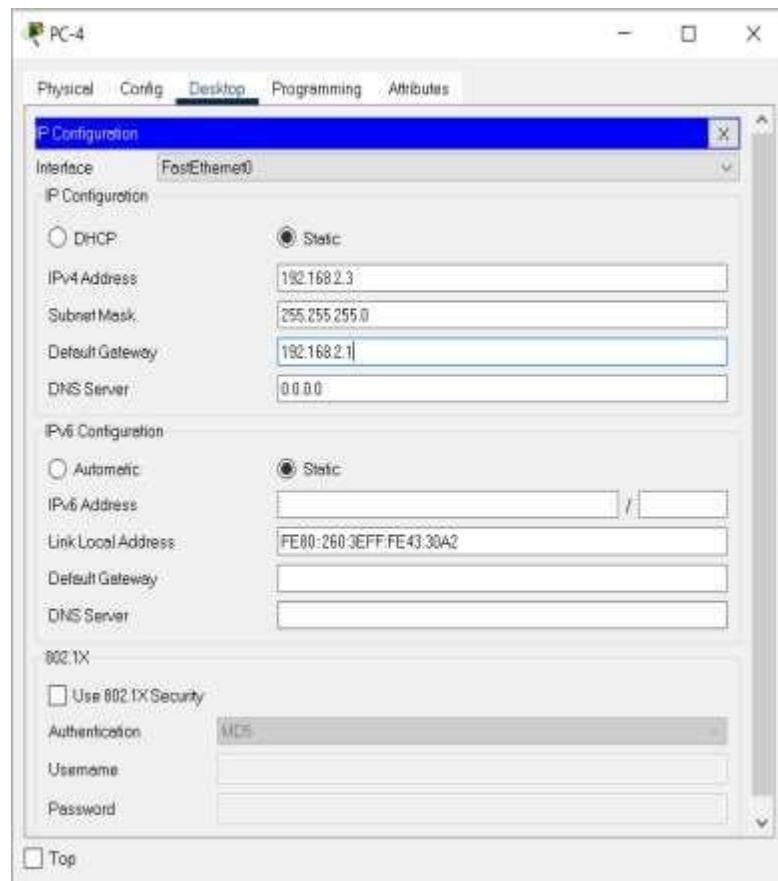
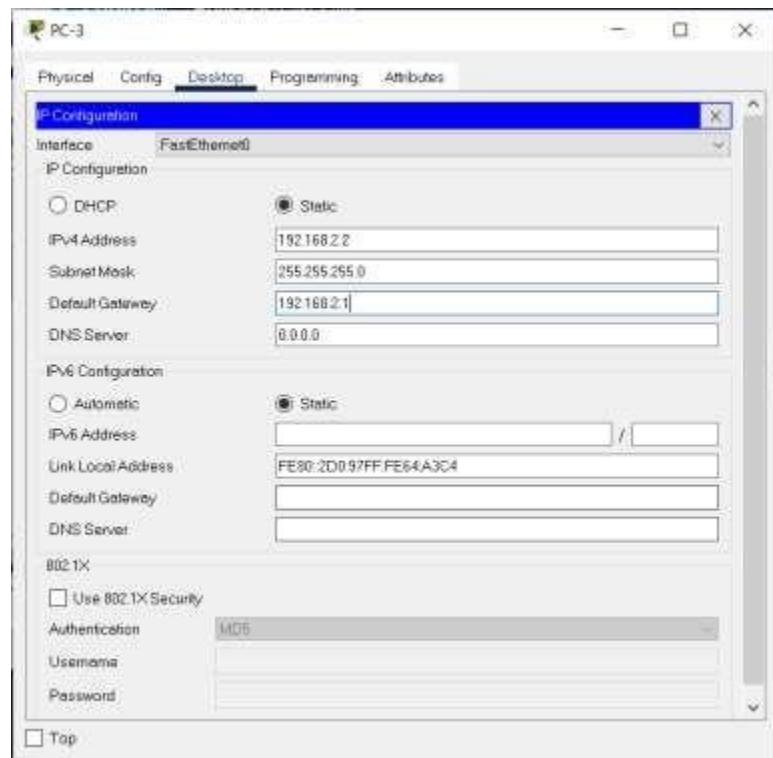
The image displays two windows from a network configuration application, labeled PC-1 and PC-2, showing the IP Configuration for their respective interfaces.

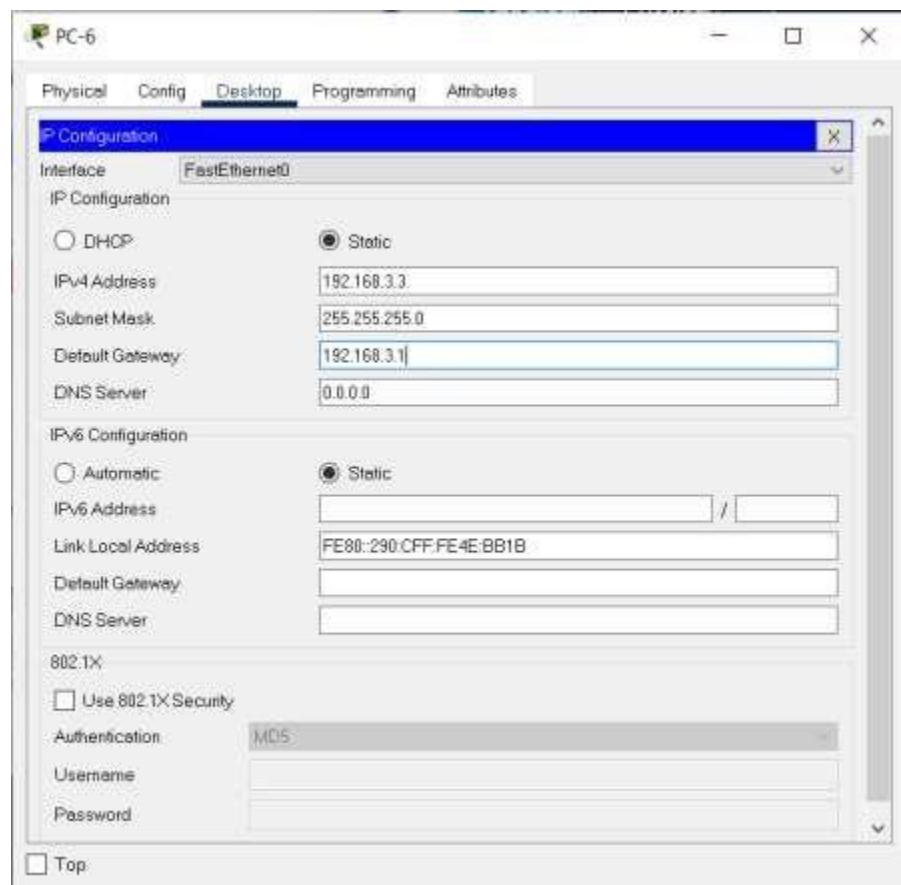
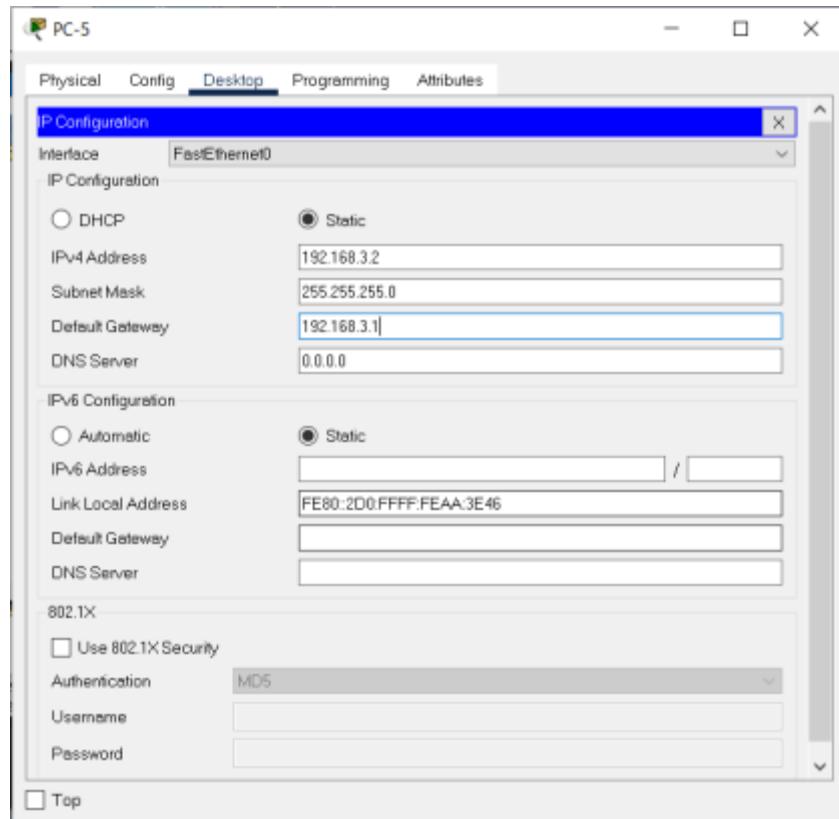
PC-1 Configuration (FastEthernet0):

- IP Configuration:** Interface is FastEthernet0. DHCP is off, and Static IP is set to 192.168.1.2 with a Subnet Mask of 255.255.255.0. Default Gateway is 192.168.1.1, and DNS Server is 0.0.0.0.
- IPv6 Configuration:** IPv6 Address is set to Static with a value of FE80::203:E4FF:FE27:62ED.
- 802.1X:** Use 802.1X Security is checked, and Authentication is set to MD5.
- Other:** Username and Password fields are empty, and the Top checkbox is unchecked.

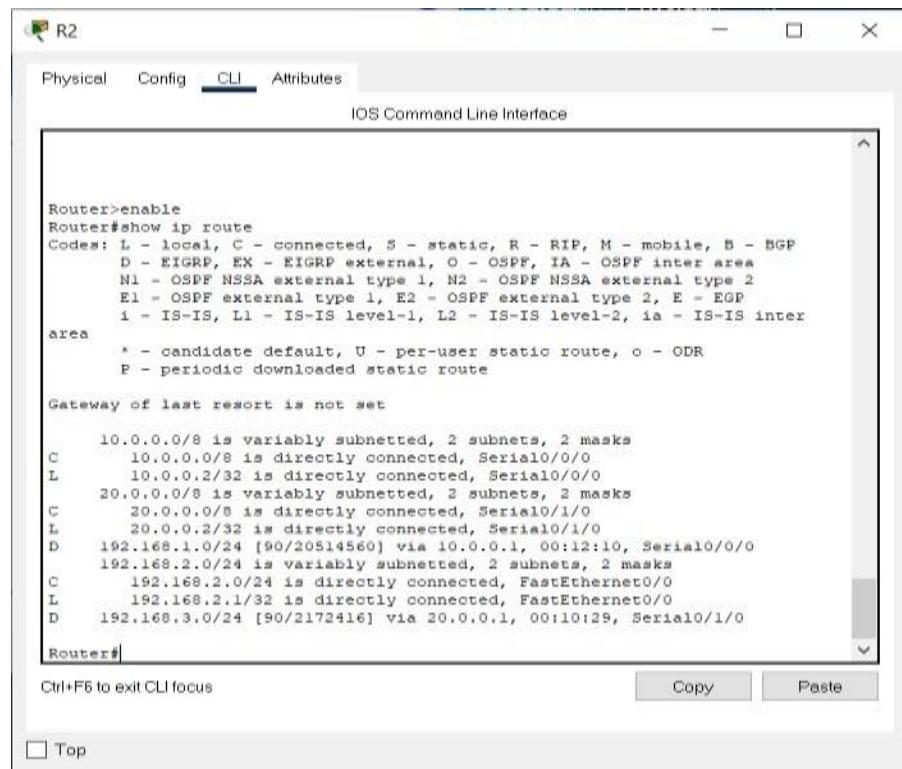
PC-2 Configuration (FastEthernet0):

- IP Configuration:** Interface is FastEthernet0. DHCP is off, and Static IP is set to 192.168.1.3 with a Subnet Mask of 255.255.255.0. Default Gateway is 192.168.1.1, and DNS Server is 0.0.0.0.
- IPv6 Configuration:** IPv6 Address is set to Static with a value of FE80::203:E4FF:FE96:4095.
- 802.1X:** Use 802.1X Security is checked, and Authentication is set to MD5.
- Other:** Username and Password fields are empty, and the Top checkbox is unchecked.





Verification:



```
Router>enable
Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    10.0.0.0/8 is directly connected, Serial0/0/0
L    10.0.0.2/32 is directly connected, Serial0/0/0
  20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    20.0.0.0/8 is directly connected, Serial0/1/0
L    20.0.0.2/32 is directly connected, Serial0/1/0
D    192.168.1.0/24 [90/20514560] via 10.0.0.1, 00:12:10, Serial0/0/0
      192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C      192.168.2.0/24 is directly connected, FastEthernet0/0
L      192.168.2.1/32 is directly connected, FastEthernet0/0
D      192.168.3.0/24 [90/2172416] via 20.0.0.1, 00:10:29, Serial0/1/0

Router#
```

Ctrl+F6 to exit CLI focus

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R2

Physical Config **CLI** Attributes

IOS Command Line Interface

```
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
area
* - candidate default, U - per-user static route, o - ODR
# - periodic downloaded static route
```

Gateway of last resort is not set

```
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 10.0.0.0/8 is directly connected, Serial0/0/0
L 10.0.0.7/30 is directly connected, Serial0/0/0
20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 20.0.0.0/8 is directly connected, Serial0/1/0
L 20.0.0.2/30 is directly connected, Serial0/1/0
D 192.168.1.0/24 [90/2051a5e6] via 10.0.0.1, 00:12:10, Serial0/0/0
192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.2.0/24 is directly connected, FastEthernet0/0
L 192.168.2.1/30 is directly connected, FastEthernet0/0
D 192.168.3.0/24 [90/2172416] via 10.0.0.1, 00:10:25, Serial0/1/0
```

Router#show ip eigrp neighbors

IP-EIGRP neighbors for process 1							
Address	Interface	Hold	Uptime	SRTT	RTO	Q	Seq
		(sec)		(ms)		Cnt	Num
10.0.0.1	Se0/0/0	14	00:15:14	40	1000	0	7
20.0.0.1	Se0/1/0	13	00:23:46	40	1000	0	8

Router#

Ctrl+F6 to exit CLI focus

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R2

Physical Config **CLI** Attributes

IOS Command Line Interface

```
IP-EIGRP neighbors for process 1
N  Address          Interface      Hold Uptime    RTT     RTO      Q      Seq
   (sec)          (sec)          (ms)          Cnt  Num
0  10.0.0.1          Se0/0/0      14  00:15:14  40    1000  0  7
1  20.0.0.1          Se0/1/0      13  00:13:46  40    1000  0  8

Router#show ip protocol

Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  Redistributing: eigrp 1
  EIGRP-IPv4 Protocol for AS(1)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
    RPF-aware route hold timer is 240
    Router-ID: 10.0.0.2
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1

  Automatic summarization: disabled
  Automatic address summarization:
  Maximum path: 4
  Routing for Networks:
  --More--
```

Ctrl+F6 to exit CLI focus

Top

PC-1

Physical Config **Desktop** Programming Attributes

Command Prompt

```
Packet Tracer PC Command Line 1.0
C:\ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:
Reply from 192.168.2.2: bytes=32 time=1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=13ms TTL=126
Reply from 192.168.2.2: bytes=32 time=23ms TTL=126
Reply from 192.168.2.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.2.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 23ms, Average = 6ms

C:\ping 192.168.3.2

Pinging 192.168.3.2 with 32 bytes of data:
Reply from 192.168.3.2: bytes=32 time=2ms TTL=125
Reply from 192.168.3.2: bytes=32 time=2ms TTL=125
Reply from 192.168.3.2: bytes=32 time=10ms TTL=125
Reply from 192.168.3.2: bytes=32 time=16ms TTL=125

Ping statistics for 192.168.3.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 16ms, Average = 7ms

C:\>
```

Top

RESULTS: Basic EIGRP Configuration is demonstrated.

EXPERIMENT NO- 08

AIM:Analysis of network traces using Tcpdump

OBJECTIVE:To demonstrate Analysis of network traces using Tcpdump.

ALGORITHM:

1. Start
2. Open Command Prompt and run with administrator rights
3. Run windump to locate your network adapter using the command windump -D
4. Run windump to collect packets and write to a file and also run all windump commands.
5. End

DESCRIPTION AND EXECUTION:

- Windump prints out a description of the contents of packets on a network interface that match the Boolean expression. It can also be run with the **-w** flag, which causes it to save the packet data to a file for later analysis, and/or with the **-r** flag, which causes it to read from a saved packet file rather than to read packets from a network interface. In all cases, only packets that match expression will be processed by windump.

Windump -D: displays the list of interfaces which are connected to the system. We can use any of the interfaces by specifying its number.

```
C:\WINDOWS\system32>windump
windump: listening on \Device\NPF_{993B4A02-97F5-4D95-8029-7BA9112024E9}
0 packets captured
0 packets received by filter
0 packets dropped by kernel

C:\WINDOWS\system32>windump -D
1. \Device\NPF_{3E35007A-B097-4B28-8790-F392C18814F2} (Realtek PCIe FE Family Controller)
2. \Device\NPF_{(ACI)4702-A064-4BDF-8CB6-190400A5D963} (Microsoft)
3. \Device\NPF_{993B4A02-97F5-4D95-8029-7BA9112024E9} (Microsoft)
```

Windump -i 2: By giving this command we will get the list of packets captured from the interface 2.

```
C:\WINDOWS\system32>windump -i 2
windump: listening on \Device\NPF_{4CCB47B2-A964-48DF-8CB6-19D4D0A5D963}
15:22:32.027064 IP 142.250.82.18.19305 > DESKTOP-LCUCLTS.58072: UDP, length 126
15:22:32.027769 IP 142.250.82.18.19305 > DESKTOP-LCUCLTS.58072: UDP, length 110
15:22:32.027937 IP DESKTOP-LCUCLTS.60642 > 74.125.24.189.443: UDP, length 33
15:22:32.039210 IP DESKTOP-LCUCLTS.58072 > 142.250.82.18.19305: UDP, length 38
15:22:32.040382 IP 142.250.82.18.19305 > DESKTOP-LCUCLTS.57926: UDP, length 62
```

Windump -i 2 -c5: By giving this command we will get the list of filters captured from the interface 2 but only limited to 5 filters since, we mentioned count as 5 (-c5).

```
C:\WINDOWS\system32>windump -i 2 -c5
windump: listening on \Device\NPF_{4CCB47B2-A964-48DF-8CB6-19D4D0A5D963}
22:29:46.139277 IP relay-e37a4922.net.anydesk.com.80 > DESKTOP-LCUCLTS.55623: . ack 3129932965 win 501
22:29:46.139364 IP DESKTOP-LCUCLTS.55623 > relay-e37a4922.net.anydesk.com.80: . ack 1 win 258
22:29:49.211407 IP ec2-15-206-34-128.ap-south-1.compute.amazonaws.com.443 > DESKTOP-LCUCLTS.55638: . ack 1627103327 win 10
22:29:49.211456 IP DESKTOP-LCUCLTS.55638 > ec2-15-206-34-128.ap-south-1.compute.amazonaws.com.443: . ack 1 win 255
22:29:49.388431 IP DESKTOP-LCUCLTS.55623 > relay-e37a4922.net.anydesk.com.80: . 0:1(1) ack 1 win 258
5 packets captured
6 packets received by filter
0 packets dropped by kernel
```

Windump -I 2 -c5 -w cap.pcap: this filter is used to write in to a file in which the file name is cap.pcap .but its limited to only 5 packets.

```
C:\WINDOWS\system32>windump -i 2 -c5 -w cap.pcap
windump: listening on \Device\NPF_{4CCB47B2-A964-48DF-8CB6-19D4D0A5D963}
5 packets captured
34 packets received by filter
0 packets dropped by kernel

C:\WINDOWS\system32>
```

```
C:\WINDOWS\system32>windump -i 2 -nn ip
windump: listening on \Device\NPF_{4CCB47B2-A964-48DF-8CB6-19D4D0A5D963}
22:33:35.517654 IP 192.168.1.3.32925 > 239.255.255.250.1900: UDP, length 125
22:33:35.722293 IP 192.168.1.3.32925 > 239.255.255.250.1900: UDP, length 125
22:33:36.131920 IP 192.168.1.3.32925 > 239.255.255.250.1900: UDP, length 125
22:33:36.557573 IP 192.168.1.6.55663 > 172.217.163.142.443: . 21623370:21623371(1) ack 127570534 win 257
22:33:36.588008 IP 172.217.163.142.443 > 192.168.1.6.55663: . ack 1 win 261 <nop,nop,sack 1 {0:1}>
22:33:36.837495 IP 192.168.1.6.55664 > 172.217.163.142.443: . 1523443714:1523443715(1) ack 3395170178 win
22:33:36.854268 IP 172.217.163.142.443 > 192.168.1.6.55664: . ack 1 win 261 <nop,nop,sack 1 {0:1}>
22:33:38.181928 IP 192.168.1.3.5353 > 224.0.0.251.5353: 10 [3q][domain]
22:33:39.820172 IP 52.109.8.21.443 > 192.168.1.6.55673: R 901927576:901927576(0) ack 3834849213 win 0
22:33:40.432270 IP 51.89.98.179.80 > 192.168.1.6.55623: . ack 3129932965 win 501
22:33:40.432324 IP 192.168.1.6.55623 > 51.89.98.179.80: . ack 1 win 258
```

Windump -l 2 -r cap.pcap: this filter is used to read from a file in which the file name is cap.pcap . but its limited to only 5 packets.

```
C:\WINDOWS\system32>windump -r cap.pcap
reading from file cap.pcap, link-type EN10MB (Ethernet)
22:30:43.599298 IP DESKTOP-LCUCLTS.55634 > 74.125.24.188.5228: . 725001177:725001178(1) ack 4225830922 win 256
22:30:43.650743 IP 74.125.24.188.5228 > DESKTOP-LCUCLTS.55634: . ack 1 win 282 <nop,nop,sack 1 {0:1}>
22:30:43.706492 IP relay-e37a4922.net.anydesk.com.80 > DESKTOP-LCUCLTS.55623: . ack 3129932965 win 501
22:30:43.706565 IP DESKTOP-LCUCLTS.55623 > relay-e37a4922.net.anydesk.com.80: . ack 1 win 258
22:30:44.301838 IP DESKTOP-LCUCLTS.55688 > 192.168.1.1.53: 54056+ A? android.clients.google.com. (44)

C:\WINDOWS\system32>
```

Windump -l -nnip: this filter captures the packets and DNS will be converted to IP address.

Windump -I -c5 -nnip:this filter captures only 5 packets and DNS will be converts in to IP address

```
C:\>windump -i 2 -c5 -m ip
windump: listening on \Device\WPF_{4CCB47B2-A964-480F-8CB6-19D4D0A5D963}
22:34:28.891906 IP 192.168.1.6.55634 > 74.125.24.188.5228: . 725001177:725001178(1) ack 4225830922 win 256
22:34:28.943042 IP 74.125.24.188.5228 > 192.168.1.6.55634: . ack 1 win 282 <nop,nop,sack 1 {0:1}>
22:34:29.729799 IP 192.168.1.6.55671 > 142.250.195.46.443: . 225356146:225356147(1) ack 4172478013 win 256
22:34:29.749949 IP 142.250.195.46.443 > 192.168.1.6.55671: . ack 1 win 265 <nop,nop,sack 1 {0:1}>
22:34:34.909478 IP 51.89.98.179.80 > 192.168.1.6.55623: . ack 3129932965 win 501
5 packets captured
7 packets received by filter
0 packets dropped by kernel
```

Windump -l port 80: this filter captures the packets whose port number is 80.

```
C:\WINDOWS\system32>windump -i 2 port 80
windump: listening on \Device\NPF_{4CCB47B2-A964-48DF-8CB6-19D400A5D963}
22:37:08.101883 IP relay-e37a4922.net.anydesk.com.80 > DESKTOP-LCUCLTS.55623: . ack 3129932965 win 501
22:37:08.101934 IP DESKTOP-LCUCLTS.55623 > relay-e37a4922.net.anydesk.com.80: . ack 1 win 258
22:37:10.949827 IP DESKTOP-LCUCLTS.55623 > relay-e37a4922.net.anydesk.com.80: . 0:1(t) ack 1 win 258
22:37:11.096546 IP relay-e37a4922.net.anydesk.com.80 > DESKTOP-LCUCLTS.55623: . ack 1 win 501 <nop,nop,sack 1 {0:1}
22:37:21.414054 IP relay-e37a4922.net.anydesk.com.80 > DESKTOP-LCUCLTS.55623: . ack 1 win 501
22:37:21.414115 IP DESKTOP-LCUCLTS.55623 > relay-e37a4922.net.anydesk.com.80: . ack 1 win 258
```

Windump -I 2 host 172.20.3.159: this filter is used to connect to the specified host and captures the packets from that host.

```
C:\WINDOWS\system32>windump -i 2 host 172.20.3.159
windump: listening on \Device\NPF_{4CCB47B2-4064-48D6-8C65-190D0A50963}
22:39:56.081825 IP DESKTOP-UCUCLTS > 172.20.3.159: ICMP echo request, id 1, seq 10, length 80
22:39:58.331375 IP DESKTOP-UCUCLTS.137 > 172.20.3.159.137: UDP, length 50
22:39:58.331375 IP DESKTOP-UCUCLTS.137 > 172.20.3.159.137: UDP, length 50
22:39:53.347654 IP DESKTOP-UCUCLTS.137 > 172.20.3.159.137: UDP, length 50
22:39:54.833158 IP DESKTOP-UCUCLTS > 172.20.3.159: ICMP echo request, id 1, seq 11, length 80
22:39:59.822892 IP DESKTOP-UCUCLTS > 172.20.3.159: ICMP echo request, id 1, seq 12, length 80
22:40:34.832565 IP DESKTOP-UCUCLTS > 172.20.3.159: ICMP echo request, id 1, seq 13, length 80

```

Administrator Command Prompt

```
Microsoft Windows [Version 10.0.19042.887]
(c) 2020 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>ping 172.20.3.159

Pinging 172.20.3.159 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 172.20.3.159:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Windump -I 2 tcp: this filter captures all tcp packets.

```
C:\Windows\system32>windump -i 2  tcp
windump: listening on \Device\PF_{ACCB47B2-A964-480F-8C86-1904D8A5D963}
12:43:14.697615 IP relay-e17a4922.net.anydesk.com.80 > DESKTOP-LCULTS.55623: . ack 3129932965 win 501
12:43:14.697667 IP DESKTOP-LCULTS.55623 > relay-e17a4922.net.anydesk.com.80: . ack 1 win 258
12:43:14.937735 IP relay-e17a4922.net.anydesk.com.80 > DESKTOP-LCULTS.55623: . ack 1 win 501
12:43:14.937809 IP DESKTOP-LCULTS.55623 > relay-e17a4922.net.anydesk.com.80: . ack 1 win 258
12:43:17.449576 IP DESKTOP-LCULTS.55634 > 74.125.24.188.5228: P 725801178:725801184(6) ack 4225830922 win 256
12:43:17.497319 IP 74.125.24.188.5228 > DESKTOP-LCULTS.55634: . ack 26 win 282
12:43:17.497389 IP 74.125.24.188.5228 > DESKTOP-LCULTS.55634: P 1:27(26) ack 26 win 282
12:43:17.549741 IP DESKTOP-LCULTS.55634 > 74.125.24.188.5228: . ack 27 win 256
12:43:28.956374 IP DESKTOP-LCULTS.55691 > eas03s31-in-F3.1e100.net.443: F 3485575741:3485575741(0) ack 2639045207 win 257
12:43:28.957413 IP DESKTOP-LCULTS.55691 > eas03s4-in-F14.1e100.net.443: S 2833361172:2833361172(0) win 64248 (mss 1460,nop,wscale 8,nop,nop,sackOK)
12:43:28.973023 IP eas03s31-in-F3.1e100.net.443 > DESKTOP-LCULTS.55691: F 1:1(0) ack 1 win 261
12:43:28.973082 IP DESKTOP-LCULTS.55691 > eas03s31-in-F3.1e100.net.443: . ack 2 win 257
```

RESULTS: The network packets received and sent are analyzed using the tcpdump utility.

EXPERIMENT NO- 09

AIM: Analysis of network traces using Wireshark

OBJECTIVE: To demonstrate Analysis of network traces using Wireshark.

ALGORITHM:

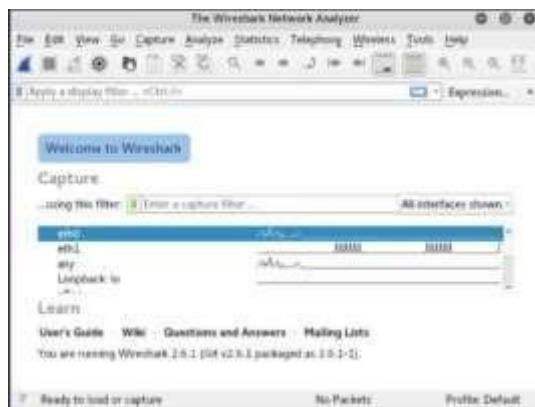
1. Start
2. ip.src == _address‘
3. ip.addr == _address‘
4. ip.dst == _address‘
5. tcp
6. http
7. tcp.port
8. tcp.analysis.flags
9. tcpcontains
10. udpcontains
11. http.response.code
12. end

DESCRIPTION AND EXECUTION:

- Several filters such as ip.src, ip.dst are applied to packets on wireshark and the packets are analysed.
- Wireshark is an open-source network protocol analysis software program started by Gerald Combs in 1998.
- A global organization of network specialists and software developers support Wireshark and continue to make updates for new network technologies and encryption methods.

- Wireshark is a packet sniffer and analysis tool. It captures network traffic on the local network and stores that data for offline analysis.
- Wireshark captures network traffic from Ethernet, Bluetooth, Wireless (IEEE.802.11), Token Ring, Frame Relay connections, and more.
- Wireshark allows you to filter the log either before the capture starts or during analysis, so you can narrow down and zero into what you are looking for in the network trace.
- For example, you can set a filter to see TCP traffic between two IP addresses.
- You can set it only to show you the packets sent from one computer. The filters in Wireshark are one of the primary reasons it became the standard tool for packet analysis.

- When you open Wireshark, you see a screen that shows you a list of all of the network connections you can monitor. You also have a capture filter field, so you only capture the network traffic you want to see



- You can select one or more of the network interfaces using —shift left-click. Once you have the network interface selected, you can start the capture, and there are several ways to do that. Click the first button on the toolbar, titled —Start Capturing Packets.||



- Analyzing Data Packets on Wireshark**

Wireshark shows you three different panes for inspecting packet data. The Packet List, the top pane, is a list of all the packets in the capture. When you click on a packet, the other two panes change to show you the details about the selected packet. You can also tell if the packet is part of a conversation. Here are some details about each column in the top pane:

- No.:** This is the number order of the packet that got captured. The bracket indicates that this packet is part of a conversation.
- Time:** This column shows you how long after you started the capture that this packet

got captured. You can change this value in the Settings menu if you need something different displayed.

- **Source:** This is the address of the system that sent the packet.
- **Destination:** This is the address of the destination of that packet.
- **Protocol:** This is the type of packet, for example, TCP, DNS, DHCPv6, or ARP.
- **Length:** This column shows you the length of the packet in bytes.
- **Info:** This column shows you more information about the packet contents, and will vary depending on what kind of packet it is.

- **Wireshark Capture Filters Commands**

- Capture filters limit the captured packets by the filter. Meaning if the packets don't match the filter, Wireshark won't save them. Here are some examples of capture filters:
 - host IP-*address*: this filter limits the capture to traffic to and from the IP address net 192.168.0.0/24: this filter captures all traffic on the subnet.
 - dst host IP-*address*: capture packets sent to the specified host. port 53: capture traffic on port 53 only.
 - port not 53 and not arp: capture all traffic except DNS and ARP traffic

Filters:

1. ip.src == address

No.	Time	Source	Destination	Protocol	Length	Info
416	25.424363	192.168.1.100	204.79.197.222	TLSv1.2	544	Client Hello
423	25.429384	192.168.1.100	204.79.197.222	TCP	66	64056 → 443 [ACK] Seq=491 Ack=1461 Win=262144 Len=0 SLE
424	25.429414	192.168.1.100	204.79.197.222	TCP	74	[TCP Dup ACK 423#1] 64056 → 443 [ACK] Seq=491 Ack=1461
425	25.429430	192.168.1.100	204.79.197.222	TCP	66	64056 → 443 [ACK] Seq=491 Ack=4381 Win=262144 Len=0 SLE
426	25.429444	192.168.1.100	204.79.197.222	TCP	54	64056 → 443 [ACK] Seq=491 Ack=6350 Win=262144 Len=0
427	25.431665	192.168.1.100	204.79.197.222	TLSv1.2	212	Client Key Exchange, Change Cipher Spec, Encrypted Hand
428	25.431810	192.168.1.100	204.79.197.222	TLSv1.2	141	Application Data
429	25.431897	192.168.1.100	204.79.197.222	TLSv1.2	132	Application Data
435	25.434993	192.168.1.100	204.79.197.222	TCP	54	64056 → 443 [ACK] Seq=814 Ack=6745 Win=261632 Len=0
436	25.435232	192.168.1.100	204.79.197.222	TLSv1.2	92	Application Data
438	25.436751	192.168.1.100	204.79.197.222	TCP	54	64056 → 443 [ACK] Seq=852 Ack=6783 Win=261632 Len=0
444	25.457176	192.168.1.100	204.79.197.222	TCP	66	[TCP Dup ACK 438#1] 64056 → 443 [ACK] Seq=852 Ack=6783
445	25.457214	192.168.1.100	204.79.197.222	TCP	66	[TCP Dup ACK 438#2] 64056 → 443 [ACK] Seq=852 Ack=6783
446	25.457254	192.168.1.100	204.79.197.222	TCP	54	64056 → 443 [ACK] Seq=852 Ack=9839 Win=262144 Len=0
447	25.457269	192.168.1.100	204.79.197.222	TCP	54	64056 → 443 [ACK] Seq=852 Ack=9877 Win=261888 Len=0
449	25.502568	192.168.1.100	204.79.197.200	TCP	54	64042 → 443 [ACK] Seq=130740 Ack=49553 Win=1020 Len=0

ip.addr == 192.168.1.100						
No.	Time	Source	Destination	Protocol	Length	Info
1327	278.277590	192.168.1.100	157.240.13.54	TCP	54	64055 → 443 [ACK] Seq=1752 Ack=673 Win=512 Len=0
1328	282.867332	192.168.1.100	52.111.252.2	TLSv1.2	89	Application Data
1329	282.888461	52.111.252.2	192.168.1.100	TCP	60	443 → 63931 [ACK] Seq=1 Ack=351 Win=1021 Len=0
1330	283.830667	52.114.14.237	192.168.1.100	TLSv1.2	686	Application Data
1331	283.837398	192.168.1.100	52.114.14.237	TLSv1.2	242	Application Data
1332	283.938264	52.114.14.237	192.168.1.100	TCP	60	443 → 60466 [ACK] Seq=3028 Ack=1517 Win=2047 Len=0
1333	289.001348	192.168.1.100	162.159.130.234	TLSv1.2	108	Application Data
1334	289.003401	162.159.130.234	192.168.1.100	TCP	60	443 → 63770 [ACK] Seq=2974 Ack=433 Win=68 Len=0
1335	289.280338	162.159.130.234	192.168.1.100	TLSv1.2	86	Application Data
1336	289.328397	192.168.1.100	162.159.130.234	TCP	54	63770 → 443 [ACK] Seq=433 Ack=3006 Win=512 Len=0
1337	291.997911	192.168.1.100	157.240.13.54	TLSv1.2	85	Application Data
1338	292.046742	157.240.13.54	192.168.1.100	TCP	60	443 → 64055 [ACK] Seq=673 Ack=1783 Win=437 Len=0
1339	292.225491	157.240.13.54	192.168.1.100	TLSv1.2	92	Application Data
1340	292.279939	192.168.1.100	157.240.13.54	TCP	54	64055 → 443 [ACK] Seq=1783 Ack=711 Win=512 Len=0
1341	298.250596	192.168.1.100	52.114.6.178	TCP	55	[TCP Keep-Alive] 64075 → 443 [ACK] Seq=2975 Ack=6257 Win=512 Len=0
1342	298.332125	52.114.6.178	192.168.1.100	TCP	66	[TCP Keep-Alive ACK] 443 → 64075 [ACK] Seq=6257 Ack=2975

2. ip.addr == _address

3.ip.dst == _address

ip.dst == 192.168.1.100						
No.	Time	Source	Destination	Protocol	Length	Info
1358	306.341430	20.44.232.74	192.168.1.100	TCP	1514	[TCP Previous segment not captured] 443 → 64076 [ACK] Seq=1461 Ack=220 Win=525312 Len=1460
1359	306.341430	20.44.232.74	192.168.1.100	TCP	1514	[TCP Out-Of-Order] 443 → 64076 [ACK] Seq=1461 Ack=220 Win=525312 Len=1460
1360	306.341430	20.44.232.74	192.168.1.100	TCP	1514	443 → 64076 [ACK] Seq=4381 Ack=220 Win=525312 Len=1460
1361	306.341430	20.44.232.74	192.168.1.100	TLSv1.2	136	Server Hello, Certificate, Certificate Status, Server Key Exchange, Early Data
1366	306.392168	20.44.232.74	192.168.1.100	TLSv1.2	105	Change Cipher Spec, Encrypted Handshake Message
1372	306.438962	20.44.232.74	192.168.1.100	TCP	60	443 → 64076 [ACK] Seq=5974 Ack=1958 Win=525568 Len=0
1373	306.439362	20.44.232.74	192.168.1.100	TCP	60	443 → 64076 [ACK] Seq=5974 Ack=4838 Win=525568 Len=0
1374	306.453967	20.44.232.74	192.168.1.100	TCP	1514	443 → 64076 [ACK] Seq=5974 Ack=5509 Win=524800 Len=1460
1375	306.453967	20.44.232.74	192.168.1.100	TCP	944	[TCP Previous segment not captured] 443 → 64076 [PSH, ACK] Seq=5974 Ack=5509 Win=524800 Len=1460
1376	306.453967	20.44.232.74	192.168.1.100	TCP	1514	[TCP Out-Of-Order] 443 → 64076 [ACK] Seq=7434 Ack=5509 Win=524800 Len=1460
1381	306.504062	20.44.232.74	192.168.1.100	TCP	60	443 → 64076 [ACK] Seq=9784 Ack=7069 Win=525568 Len=0
1382	306.519857	20.44.232.74	192.168.1.100	TLSv1.2	366	Application Data
1385	312.906113	52.111.252.2	192.168.1.100	TCP	60	443 → 63931 [ACK] Seq=1 Ack=386 Win=1021 Len=0
1387	314.307022	52.114.40.54	192.168.1.100	TLSv1.2	102	Application Data
1390	315.289284	162.159.128.233	192.168.1.100	TCP	66	[TCP Keep-Alive ACK] 443 → 64063 [ACK] Seq=1732 Ack=102 Win=512 Len=0
1392	315.314481	162.159.128.233	192.168.1.100	TCP	66	[TCP Keep-Alive ACK] 443 → 64064 [ACK] Seq=1637 Ack=112 Win=512 Len=0

4. tcp

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.100	162.159.130.234	TLSv1.2	108	Application Data
2	0.002612	162.159.130.234	192.168.1.100	TCP	60	443 → 63770 [ACK] Seq=1 Ack=55 Win=68 Len=0
3	0.278590	162.159.130.234	192.168.1.100	TLSv1.2	87	Application Data
4	0.328562	192.168.1.100	162.159.130.234	TCP	54	63770 → 443 [ACK] Seq=55 Ack=34 Win=510 Len=0
5	1.000994	192.168.1.100	104.120.170.193	TCP	54	64020 → 443 [FIN, ACK] Seq=1 Ack=1 Win=513 Len=0
6	1.001287	192.168.1.100	104.120.131.149	TCP	54	64032 → 443 [FIN, ACK] Seq=1 Ack=1 Win=510 Len=0
7	1.001495	192.168.1.100	40.100.136.130	TCP	54	64023 → 443 [FIN, ACK] Seq=1 Ack=1 Win=513 Len=0
8	1.001685	192.168.1.100	52.109.124.112	TCP	54	64021 → 443 [FIN, ACK] Seq=1 Ack=1 Win=513 Len=0
9	1.001868	192.168.1.100	52.109.124.112	TCP	54	64022 → 443 [FIN, ACK] Seq=1 Ack=1 Win=513 Len=0
10	1.002041	192.168.1.100	52.109.56.46	TCP	54	64024 → 443 [FIN, ACK] Seq=1 Ack=1 Win=512 Len=0
11	1.002140	192.168.1.100	52.109.124.32	TCP	54	64033 → 443 [FIN, ACK] Seq=1 Ack=1 Win=517 Len=0
12	1.002236	192.168.1.100	52.109.124.32	TCP	54	64034 → 443 [FIN, ACK] Seq=1 Ack=1 Win=517 Len=0
13	1.002292	192.168.1.100	52.109.124.129	TCP	54	64028 → 443 [FIN, ACK] Seq=1 Ack=1 Win=514 Len=0
14	1.002387	192.168.1.100	52.109.124.129	TCP	54	64031 → 443 [FIN, ACK] Seq=1 Ack=1 Win=515 Len=0
15	1.006927	104.120.170.193	192.168.1.100	TLSv1.2	85	Encrypted Alert
16	1.006968	192.168.1.100	104.120.170.193	TCP	54	64020 → 443 [RST, ACK] Seq=2 Ack=32 Win=0 Len=0
17	1.007448	104.120.170.193	192.168.1.100	TCP	54	443 → 64020 [FIN, ACK] Seq=32 Ack=2 Win=501 Len=0

5. http

http						
No.	Time	Source	Destination	Protocol	Length	Info
3185	366.531284	192.168.1.100	188.184.21.108	HTTP	604	GET / HTTP/1.1
3194	366.706610	192.168.1.100	188.184.21.108	HTTP	476	GET /favicon.ico HTTP/1.1
3198	366.836778	188.184.21.108	192.168.1.100	HTTP	248	HTTP/1.1 200 OK (image/vnd.microsoft.icon)

6. tcp.port

No.	Time	Source	Destination	Protocol	Length	Info
3181	366.405048	192.168.1.100	188.184.21.108	TCP	66	64105 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256
3182	366.405048	192.168.1.100	188.184.21.108	TCP	66	64106 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256
3183	366.531007	188.184.21.108	192.168.1.100	TCP	66	80 → 64106 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1
3184	366.531083	192.168.1.100	188.184.21.108	TCP	54	64106 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
3185	366.531284	192.168.1.100	188.184.21.108	HTTP	604	GET / HTTP/1.1
3186	366.534429	188.184.21.108	192.168.1.100	TCP	66	80 → 64105 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1
3187	366.534467	192.168.1.100	188.184.21.108	TCP	54	64105 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
3188	366.656961	188.184.21.108	192.168.1.100	TCP	60	80 → 64106 [ACK] Seq=1 Ack=551 Win=30336 Len=0
3189	366.658399	188.184.21.108	192.168.1.100	TCP	54	[TCP Previous segment not captured] 80 → 64106 [FIN, ACK]
3190	366.658445	192.168.1.100	188.184.21.108	TCP	54	[TCP Dup ACK 3184#1] 64106 → 80 [ACK] Seq=551 Ack=1 Win=
3191	366.658932	188.184.21.108	192.168.1.100	TCP	182	[TCP Out-Of-Order] 80 → 64106 [PSH, ACK] Seq=1 Ack=551
3192	366.658959	192.168.1.100	188.184.21.108	TCP	54	64106 → 80 [ACK] Seq=551 Ack=130 Win=131072 Len=0
3193	366.659128	192.168.1.100	188.184.21.108	TCP	54	64106 → 80 [FIN, ACK] Seq=551 Ack=130 Win=131072 Len=0
3194	366.706610	192.168.1.100	188.184.21.108	HTTP	476	GET /favicon.ico HTTP/1.1
3195	366.784480	188.184.21.108	192.168.1.100	TCP	54	80 → 64106 [ACK] Seq=130 Ack=552 Win=30336 Len=0
3196	366.835216	188.184.21.108	192.168.1.100	TCP	60	80 → 64105 [ACK] Seq=1 Ack=423 Win=30336 Len=0
3197	366.836778	188.184.21.108	192.168.1.100	TCP	1514	80 → 64105 [ACK] Seq=1 Ack=423 Win=30336 Len=1460 [TCP]

7. tcp.analysis.flags

No.	Time	Source	Destination	Protocol	Length	Info
2802	359.797773	34.236.109.12	192.168.1.100	TCP	1514	[TCP Previous segment not captured] 443 → 64101 [ACK] Seq=1461 Ack=518 Win=1461
2804	359.797773	34.236.109.12	192.168.1.100	TCP	1514	[TCP Out-Of-Order] 443 → 64101 [ACK] Seq=1461 Ack=518 Win=1461
2808	359.797871	192.168.1.100	34.236.109.12	TCP	66	[TCP Dup ACK 2807#1] 64101 → 443 [ACK] Seq=518 Ack=1461
2874	360.298145	192.168.1.100	162.159.128.233	TCP	55	[TCP Keep-Alive] 64063 → 443 [ACK] Seq=1021 Ack=1732 Win=1732
2875	360.300539	162.159.128.233	192.168.1.100	TCP	66	[TCP Keep-Alive ACK] 443 → 64063 [ACK] Seq=1732 Ack=1021
2878	360.313947	192.168.1.100	162.159.128.233	TCP	55	[TCP Keep-Alive] 64064 → 443 [ACK] Seq=1123 Ack=1637 Win=1637
2879	360.316556	162.159.128.233	192.168.1.100	TCP	66	[TCP Keep-Alive ACK] 443 → 64064 [ACK] Seq=1637 Ack=1123
2917	360.787282	142.250.182.110	192.168.1.100	TLSv1.3	93	[TCP Previous segment not captured] , Application Data
2918	360.787282	142.250.182.110	192.168.1.100	TCP	85	[TCP Out-Of-Order] 443 → 64080 [PSH, ACK] Seq=5093 Ack=5093
3069	362.866433	74.125.200.188	192.168.1.100	TLSv1.2	1484	[TCP Previous segment not captured] , Ignored Unknown R
3070	362.866433	74.125.200.188	192.168.1.100	TCP	1484	[TCP Out-Of-Order] 5228 → 64103 [ACK] Seq=1 Ack=518 Win=518
3072	362.866463	192.168.1.100	74.125.200.188	TCP	66	[TCP Dup ACK 3053#1] 64103 → 5228 [ACK] Seq=518 Ack=1 Win=
3121	363.034481	216.58.196.163	192.168.1.100	TCP	221	[TCP Previous segment not captured] 443 → 64104 [PSH, ACK] Seq=1431 Ack=518 Win=518
3122	363.034481	216.58.196.163	192.168.1.100	TCP	1484	[TCP Out-Of-Order] 443 → 64104 [ACK] Seq=1431 Ack=518 Win=518
3130	363.109502	52.7.235.26	192.168.1.100	TCP	66	[TCP Retransmission] 443 → 64092 [SYN, ACK] Seq=0 Ack=1 Win=510
3172	364.928680	192.168.1.100	8.36.80.215	TCP	55	[TCP Keep-Alive] 61467 → 443 [ACK] Seq=1 Ack=1 Win=510
3173	365.172497	8.36.80.215	192.168.1.100	TCP	60	[TCP Keep-Alive ACK] 443 → 61467 [ACK] Seq=1 Ack=2 Win=510

8. tcpcontains

No.	Time	Source	Destination	Protocol	Length	Info
1505	354.341813	192.168.1.100	142.250.67.67	TLSv1.3	571	Client Hello
1530	354.420966	192.168.1.100	216.58.196.173	TLSv1.3	571	Client Hello
1536	354.444008	192.168.1.100	142.250.182.110	TLSv1.3	571	Client Hello
1685	354.775316	192.168.1.100	142.250.76.36	TLSv1.3	571	Client Hello
2202	356.694994	192.168.1.100	142.250.76.78	TLSv1.3	571	Client Hello
2243	356.785330	192.168.1.100	172.217.31.193	TLSv1.2	571	Client Hello
2668	359.322017	192.168.1.100	142.250.196.78	TLSv1.3	571	Client Hello
2781	359.666879	192.168.1.100	142.250.77.142	TLSv1.3	571	Client Hello
3054	362.787917	192.168.1.100	74.125.200.188	TLSv1.2	571	Client Hello
3102	362.955028	192.168.1.100	216.58.196.163	TLSv1.3	571	Client Hello
3364	414.237410	192.168.1.100	142.250.76.78	TLSv1.2	571	Client Hello
3387	414.330100	192.168.1.100	216.58.196.163	TLSv1.3	571	Client Hello

9. udp contains

No.	Time	Source	Destination	Protocol	Length	Info
2599	359.107422	192.168.1.100	49.205.171.194	DNS	74	Standard query 0x0415 A ogs.google.com
2601	359.118710	49.205.171.194	192.168.1.100	DNS	111	Standard query response 0x0415 A ogs.google.com CNAME w
2696	359.377385	192.168.1.100	49.205.171.194	DNS	75	Standard query 0x4631 A apis.google.com
2703	359.380580	49.205.171.194	192.168.1.100	DNS	112	Standard query response 0x4631 A apis.google.com CNAME
2769	359.566222	192.168.1.100	49.205.171.194	DNS	75	Standard query 0x67b4 A play.google.com
2772	359.569258	49.205.171.194	192.168.1.100	DNS	91	Standard query response 0x67b4 A play.google.com A 142.
3035	362.703322	192.168.1.100	49.205.171.194	DNS	79	Standard query 0x3d22 A clients2.google.com
3036	362.706956	192.168.1.100	49.205.171.194	DNS	75	Standard query 0xbbce A docs.google.com
3037	362.712926	49.205.171.194	192.168.1.100	DNS	119	Standard query response 0x3d22 A clients2.google.com CN
3038	362.713183	49.205.171.194	192.168.1.100	DNS	91	Standard query response 0xbbce A docs.google.com A 142.
3041	362.736781	192.168.1.100	49.205.171.194	DNS	76	Standard query 0xc277 A mtalk.google.com
3042	362.739226	49.205.171.194	192.168.1.100	DNS	121	Standard query response 0xc277 A mtalk.google.com CNAME
3045	362.755539	192.168.1.100	224.0.0.251	MDNS	82	Standard query 0x0000 PTR _googlecast._tcp.local, "QM"
3046	362.755857	fe80::d507:5f03:ac2.. ff02::fb		MDNS	102	Standard query 0x0000 PTR _googlecast._tcp.local, "QM"
3047	362.758421	192.168.1.100	49.205.171.194	DNS	81	Standard query 0x6504 A update.googleapis.com
3055	362.792957	192.168.1.100	49.207.34.210	DNS	81	Standard query 0x6504 A update.googleapis.com
3066	362.821159	49.205.171.194	192.168.1.100	DNS	97	Standard query response 0x6504 A update.googleapis.com

10. http.request

No.	Time	Source	Destination	Protocol	Length	Info
1502	354.340488	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
1885	355.341376	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
2143	356.350681	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
2371	357.351327	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
3185	366.531284	192.168.1.100	188.184.21.108	HTTP	604	GET / HTTP/1.1
3194	366.706610	192.168.1.100	188.184.21.108	HTTP	476	GET /favicon.ico HTTP/1.1
3651	474.280406	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
3655	475.292987	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
3656	476.306958	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
3659	477.321952	192.168.1.100	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1

11. http.response.code

No.	Time	Source	Destination	Protocol	Length	Info
3198	366.836778	188.184.21.108	192.168.1.100	HTTP	248	HTTP/1.1 200 OK (image/vnd.microsoft.icon)

RESULTS: The packets received and sent are analyzed using filters in wireshark.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Department of Computer Science & Engineering

DCCN LAB INTERNAL-1

1. Describe how wired network media is constructed? **[CO1][BL2]**

2. Describe how wireless media works along with the required hardware components to spread and receive the signals? **[CO1,2][BL2]**

3. Demonstrate the commands
a. ifconfig/ipconfig b. netstat c. nslookup d. traceroute **[CO3][BL3]**

4. Demonstrate the commands
a. ping b. netstat c.arp d.dig **[CO3][BL3]**

5. Write about and simulate the following cases:
A) Assigning the IP address.
B) Checking the IP address and default gateway of your system.
C) Establishing a peer-to-peer network and check the systems in that network are reachable to each other. **[CO5][BL6]**

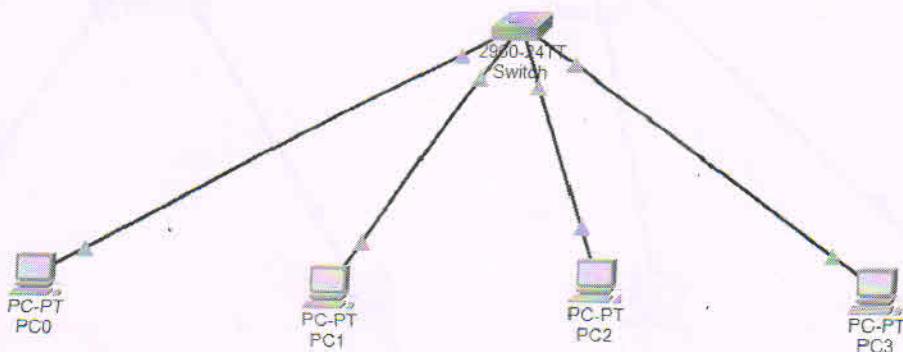
6. Build a switch based network with following topology. **[CO4][BL6]**

7. Write about and simulate the following cases:
A) Assigning the IP addresses to PCs. **[CO5][BL4]**
B) Check the systems in that network are reachable to other systems.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Department of Computer Science & Engineering

DCCN LAB INTERNAL-2

1. Write about and simulate the following cases: [CO4] [BL6]
A) Assigning the IP address.
B) Checking the IP address and default gateway of your system.
C) Establishing a peer-to-peer network and check the systems in that network are reachable to each other.
2. Build a switch based network with following topology. [CO4] [BL6]

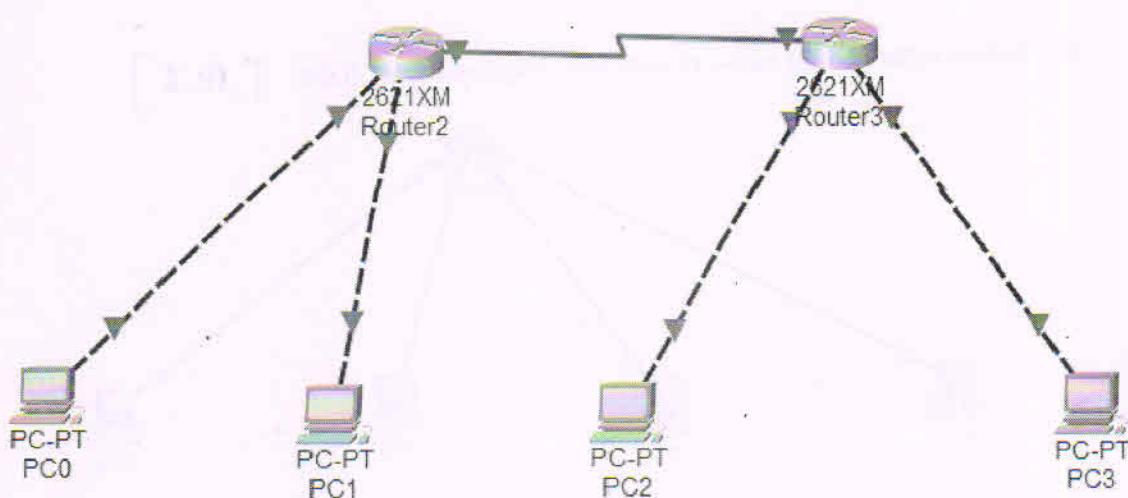


- Write about and simulate the following cases:
- A) Assigning the IP addresses to PCs.
B) Check the systems in that network are reachable to other systems.
 3. Write and simulate the following cases for a router:[CO4] [BL6]
 - i. Connecting a PC to the router
 - ii. assign the IP addresses to the interfaces to establish the connection between them using **CLI**.
 - B) Configure privilege mode password
 - C) Configure line console password
 - D) Configure vty line password
 - E) Configure router name and banner
 4. Write and simulate the following cases for a router:[CO4] [BL6]
 - i. Connecting two PCs to the router
 - ii. assign the IP addresses to the interfaces to establish the connections to router using **CLI**.

- B) Configure serial DCE connection between two routers and assign the IP addresses to the interfaces to establish the connection between them using **CLI**.
C) Configure static route on router

5. Build the following topology.

[CO4] [BL6]

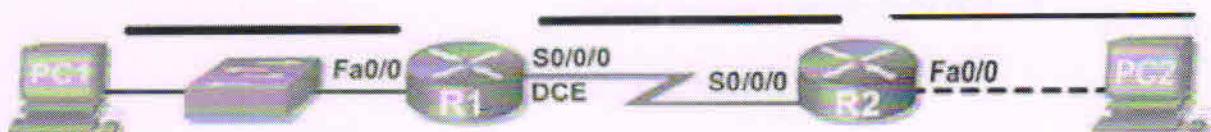


Write about and simulate the following cases:

- A) Configure router name and banner for each router
B) Assigning the IP addresses to PCs.
C) Check the systems in that network are reachable to other systems.
D) view the address tables of each router.

6. Build the following topology.

[CO4] [BL6]



Write about and simulate the following cases:

- A) Configure router name and banner for each router
B) Assigning the IP addresses to PCs.

- C) Configure OSPF.
 - D) Check the systems in that network are reachable to other systems and view their address tables.
7. Demonstrate the configuration of OSPF with appropriate topology. [CO4] [BL6]
8. Demonstrate the configuration of EIGRP with appropriate topology. [CO4] [BL6]

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Department of Computer Science & Engineering

DCCN LAB EXTERNAL QUESTION PAPER

1. Describe how wired network media is constructed? [CO1][BL2]
2. Describe how wireless media works along with the required hardware components to spread and receive the signals? [CO1,2][BL2]
3. Demonstrate the commands
 - a. ifconfig/ipconfig
 - b. netstat
 - c. nslookup
 - d. traceroute[CO3][BL3]
4. Write about packet tracing? Write the filters to do following analysis using wireshark
 - a. port-wise analysis
 - b. a particular ip packets analysis
 - c. Packet containing HTTP protocol
 - d. Packets count 20[CO6][BL4]
5. Write about packet tracing? Write the filters to do following analysis using tcpdump
 - a. port-wise analysis
 - b. a particular ip packets analysis
 - c. Packet containing HTTP protocol
 - d. Packets count 20[CO6][BL4]
6. Write about packet tracing? Write the filters to do following analysis using wireshark
 - a. port-wise analysis
 - b. Packets generated at a particular source
 - c. Packet containing TCP protocol
 - d. Write 20 Packets to file[CO6][BL4]
7. Write about packet tracing? Write the filters to do following analysis using tcpdump
 - a. port-wise analysis
 - b. Packets generated at a particular source
 - c. Packet containing TCP protocol
 - d. Write 20 Packets to file[CO6][BL4]
8. Demonstrate the commands
 - a. ping
 - b. netstat
 - c. arp
 - d. dig[CO3][BL3]
9. Write about and simulate the following cases:
 - A) Assigning the IP address.
 - B) Checking the IP address and default gateway of your system.

C) Establishing a peer-to-peer network and check the systems in that network are reachable to each other. [CO5][BL6]

10. Build a switch based network with following topology. [CO4][BL6]

11. Write about and simulate the following cases:

A) Assigning the IP addresses to PCs. [CO5][BL4]

B) Check the systems in that network are reachable to other systems.

12. Write and simulate the following cases for a router:

- A) i. Connecting a PC to the router
ii. assign the IP addresses to the interfaces to establish the connection between them using CLI.
- B) Configure privilege mode password
- C) Configure line console password
- D) Configure vty line password
- E) Configure router name and banner

[CO4][BL6]

13. Write and simulate the following cases for a router:

- A) i. Connecting two PCs to the router
ii. assign the IP addresses to the interfaces to establish the connections to router using CLI.
- B) Configure serial DCE connection between two routers and assign the IP addresses to the interfaces to establish the connection between them using CLI.
- C) Configure static route on router

[CO4][BL6]

14. Build the following topology. Write about and simulate the following cases:

- A) Configure router name and banner for each router
- B) Assigning the IP addresses to PCs.
- C) Check the systems in that network are reachable to other systems.
- D) View the address tables of each router.

[CO4][BL6]

15. Build the following topology. Write about and simulate the following cases:

- A) Configure router name and banner for each router
- B) Assigning the IP addresses to PCs.
- C) Configure OSPF.
- D) Check the systems in that network are reachable to other systems and view their address tables.

[CO4][BL6]

16. Demonstrate the configuration of OSPF with appropriate topology. [CO4][BL6]

17. Demonstrate the configuration of EIGRP with appropriate topology. [CO4][BL6]

C1E

Chaitanya Bharathi Institute of Technology(A)
Department of Computer Science and Engineering

Name of the Faculty: E. Swathi
Class: CSE Section: C3 Semester: VI
Name of the Course: DCCN LAB

Batch-1

SIN	HalticketNo	2/20/2021	2/27/2021	3/6/2021	3/20/2021	3/24/2021	3/31/2021	4/7/2021	5/3/2021	5/5/2021	5/12/2021	5/19/2021	Total
1	160118	8	8	10	10	9	9	9	9	9	8	9	9
2	160118733122	10	9	10	10	10	9	9	9	10	10	10	10
3	160118733123	4	6	8	9	10	9	9	9	9	2	7	8
4	160118733124	9	8	8	10	9	9	9	7	8	10	10	9
5	160118733125	8	8	10	9	10	10	9	9	10	10	10	10
6	160118733126	9	8	10	10	10	9	9	9	10	10	10	10
7	160118733127	6	6	8	7	7	9	9	10	9	10	10	8
8	160118733128	8	8	10	10	10	10	10	10	10	10	10	10
9	160118733129	5	6	8	7	5	9	9	9	9	10	10	10
10	160118733130	8	8	8	10	10	9	9	9	10	10	10	8
11	160118733131	9	8	10	10	10	10	10	9	10	10	10	10
12	160118733132	8	8	10	10	10	7	9	9	10	10	10	10
13	160118733133	7	8	10	7	7	9	8	10	8	9	10	9
14	160118733134	10	8	10	10	9	9	9	9	10	10	10	10
15	160118733135	6	8	10	8	10	9	9	9	10	10	10	10
16	160118733136	4	6	8	7	5	0	9	9	8	10	10	9
17	160118733137	4	8	10	10	9	9	9	9	10	10	10	9
18	160118733138	4	8	10	9	10	9	9	9	9	10	10	9
19	160118733139	8	8	10	10	10	9	9	7	7	10	10	8
20	160118733140	6	8	10	10	10	9	9	9	10	10	10	9
21	160118733141	8	8	10	10	9	9	9	9	10	10	10	10
22	160118733142	8	8	10	10	9	7	9	9	10	10	10	9
23	160118733143	8	8	10	10	10	10	10	10	10	10	10	10
24	160118733144	6	8	10	10	10	0	9	9	10	10	10	10
25	160118733145	8	8	10	8	10	0	9	9	10	10	10	9
26	160118733146	5	8	10	6	10	2	9	9	9	10	10	8
27	160118733147	4	9	9	4	6	9	9	9	9	10	10	8
28	160118733148	6	0	0	0	2	0	2	2	2	2	2	2
29	160118733149	0	8	10	10	9	9	9	10	10	10	10	9
30	160118733151	6	10	10	10	9	10	10	10	10	10	10	10
31	160118733152	2	2	0	0	0	2	2	0	0	0	2	2
32	160118733153	8	8	10	6	6	2	2	0	0	0	2	2
33	160118733154	4	9	9	10	8	8	9	9	10	10	8	7
34	160118733155	6	7	7	2	9	2	9	9	10	10	8	9
35	160118733157	8	6	8	7	5	9	9	9	10	10	8	9

Name of the Faculty: E. Swathi
 Class: CSE Section: C3 Semester: VI
 Name of the Course: DCCN LAB

Batch 2

SINO	HalfticketNo	2/20/2021	2/27/2021	3/6/2021	3/20/2021	3/25/2021	4/1/2021	4/8/2021	4/15/2021	4/29/2021	5/6/2021	5/13/2021	5/20/2021	Total
1	160118733158	10	0	0	0	2	2	2	2	2	2	2	0	2
3	160118733159	8	6	8	7	10	9	9	9	9	9	10	6	9
4	160118733160	8	8	10	6	10	9	9	7	9	9	10	10	9
	160118733161	9	8	8	4	9	7	7	7	9	9	10	10	9
5	160118733162	8	0	0	2	0	2	2	2	2	2	2	2	2
6	160118733163	6	8	10	10	10	10	9	9	9	10	10	10	10
7	160118733164	8	2	2	2	0	0	0	0	0	0	0	0	0
8	160118733165	8	8	8	10	8	10	9	9	9	9	10	10	9
9	160118733166	4	5	5	4	6	6	9	9	7	9	9	10	9
10	160118733167	6	8	8	6	8	6	9	9	7	9	9	8	9
11	160118733168	6	10	10	6	10	9	9	9	9	9	9	9	10
12	160118733169	4	5	5	6	6	6	9	9	9	9	10	10	0
13	160118733170	8	5	5	5	6	6	2	2	0	2	9	9	7
14	160118733171	8	8	10	10	9	9	9	9	9	9	10	10	6
15	160118733172	8	5	5	7	6	9	9	9	9	9	10	10	10
16	160118733173	8	8	10	10	10	9	9	9	9	9	10	10	9
17	160118733174	6	8	10	8	9	9	9	9	9	9	10	10	10
18	160118733175	6	8	10	10	9	9	9	9	9	9	10	6	9
19	160118733176	2	0	2	0	2	0	2	0	2	2	2	2	2
20	160118733177	6	0	0	2	10	2	2	2	2	2	2	2	2
21	160118733178	8	10	10	10	10	10	9	9	9	9	10	10	3
22	160118733179	8	9	7	9	9	7	9	7	10	10	10	10	10
23	160118733180	8	10	10	10	9	9	9	7	10	10	10	10	9
24	160118733185	4	8	8	10	10	9	9	9	9	9	10	2	9
25	160118733186	4	8	10	8	10	10	9	9	9	9	10	10	9
26	160118733313	10	8	8	10	10	10	10	10	10	10	10	10	9
27	160118733314	10	8	10	10	10	10	10	10	10	10	10	10	10
28	160118733315	10	10	10	8	10	8	9	9	9	9	9	10	10
29	160118733316	8	10	10	9	8	10	9	9	9	9	9	10	10
30	160118733317	8	7	9	9	9	2	2	2	0	0	0	0	4
31	160118733318	8	7	7	6	6	2	7	9	9	9	9	0	4
32	1601177333168	6	10	10	8	0	2	2	2	2	2	2	10	7
33	1601177333177	6	8	10	8	2	2	2	2	2	2	2	9	6
34	160117733335	7	8	10	8	9	0	2	2	0	2	2	2	6

Internal total marks

Chaitanya Bharathi Institute of Technology(A)
Department of Computer Science and Engineering

Name of the Faculty: E. Swathi
Class: CSE Section: C3 Semester: VI
Name of the Course: DCCN LAB

SlNo	HallTicketNo	CIE marks	Lab Internal-1		Lab Internal-2		Average of internals	Grand Total
			10M	15M	15M	15M		
1	160118733	9	12	11	11	12	11	21
2	160118733122	10	15	13	13	14	14	24
3	160118733123	8	11	9	9	10	10	18
4	160118733124	9	11	11	11	11	11	20
5	160118733125	10	11	12	12	12	12	22
6	160118733126	10	13	12	13	13	13	23
7	160118733127	8	10	10	10	10	10	18
8	160118733128	10	12	12	12	12	12	22
9	160118733129	8	11	13	13	12	12	20
10	160118733130	10	13	14	14	14	14	24
11	160118733131	10	14	13	13	14	14	24
12	160118733132	9	10	12	11	11	11	20
13	160118733133	9	14	11	11	13	13	22
14	160118733134	10	12	13	13	13	13	23
15	160118733135	9	13	14	14	14	14	23
16	160118733136	6	13	11	12	12	12	18
17	160118733137	9	12	14	14	13	13	22
18	160118733138	8	14	13	14	14	14	22
19	160118733139	9	13	12	13	13	13	22
20	160118733140	10	10	12	12	11	11	21
21	160118733141	10	11	7	9	9	9	19
22	160118733142	10	14	12	13	13	13	23
23	160118733143	10	11	14	13	13	13	23
24	160118733144	9	13	12	13	13	13	22
25	160118733145	8	13	13	13	13	13	21
26	160118733146	8	11	14	13	13	13	21
27	160118733147	8	13	12	13	13	13	21
28	160118733148	2	14	12	13	13	13	23
29	160118733149	9	11	10	11	11	11	20
30	160118733151	10	13	11	12	12	12	22
31	160118733152	2	9	11	10	10	10	12
32	160118733153	7	10	9	10	10	10	17
33	160118733154	9	9	7	8	8	8	17
34	160118733155	8	13	11	12	12	12	20
35	160118733157	9	12	11	12	12	12	21

Final total marks

Chaitanya Bharathi Institute of Technology(A)
Department of Computer Science and Engineering

Name of the Faculty: E. Swathi
Class: CSE Section: C3 Semester: VI
Name of the Course: DCCN LAB

SNo	HallTicketNo	CIE marks		Lab Internal-1		Lab Internal-2		Average of internats	Grand Total
		10M	15M	5	15M	12	11		
1	160118733158	2	9	12	6	12	11	12	9
3	160118733159	9	9	10	10	12	11	12	11
4	160118733160	9	8	10	10	12	11	12	11
5	160118733161	2	2	10	10	10	10	10	10
6	160118733163	10	13	13	13	13	13	13	12
7	160118733164	2	9	6	6	8	8	10	10
8	160118733165	9	13	12	13	12	13	12	12
9	160118733166	7	7	8	8	8	8	8	15
10	160118733167	9	10	11	11	11	11	11	20
11	160118733168	7	4	11	11	11	8	8	15
12	160118733169	7	12	12	13	13	13	13	20
13	160118733170	6	10	9	10	9	10	10	16
14	160118733171	10	10	13	13	12	12	12	22
15	160118733172	9	12	13	13	13	13	13	22
16	160118733173	10	12	11	11	11	12	12	22
17	160118733174	9	9	12	12	11	11	11	20
18	160118733175	9	9	12	12	11	11	11	20
19	160118733176	2	3	10	10	10	10	10	16
20	160118733177	3	9	10	10	10	10	10	9
21	160118733178	10	11	14	14	13	13	13	23
22	160118733179	9	11	11	11	11	11	11	20
23	160118733180	9	12	12	12	12	12	12	21
24	160118733185	9	10	10	10	10	10	10	19
25	160118733186	9	9	11	10	10	10	10	19
26	160118733187	10	10	13	13	12	12	12	22
27	160118733188	10	13	13	13	13	13	13	23
28	160118733189	10	10	9	9	10	10	10	20
29	160118733190	9	7	10	10	9	9	9	18
30	160118733191	4	10	10	10	10	10	10	14
31	160118733192	7	10	11	11	11	11	11	18
32	160118733193	6	11	11	11	11	11	11	17
33	160118733194	5	10	10	10	10	10	10	15
34	160118733195	6	6	11	11	11	11	11	15

CO	Internal CO Attainment (CE)	External CO Attainment(SEE)	@ 30% of SEE	@ 70% of SEE	Direct Attainment
CO1	2.88	0.860	2.96	2.070	2.330
CO2	2.88	0.860	2.96	2.070	2.330
CO3	2.88	0.860	2.96	2.070	2.330
CO4	2.88	0.860	2.96	2.070	2.330
CO5	1.59	0.480	1.61	1.130	1.510
CO6	2.88	0.860	2.96	2.070	2.330

SL. NO.	CO	Direct Attainment	80%	Indirect Attainment	20%	Total Attainment (100%)
1	CO1	2.9300	2.344	2.40	0.480	2.82
2	CO2	2.9300	2.344	2.87	0.574	2.92
3	CO3	2.9300	2.344	2.01	0.402	2.75
4	CO4	2.9300	2.344	2.17	0.434	2.78
5	CO5	1.6100	1.288	2.03	0.406	1.69
6	CO6	2.9300	2.344	2.34	0.488	2.81

feedback

Course CO Attainment Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	0.94133	+	0.94133	-	2.82400	-	-	-	-	-	-	-	-	-
C02	1.94533	-	0.97267	-	2.91800	-	-	-	-	-	-	-	-	-
C03	1.83067	-	-	1.83067	-	-	-	-	-	-	-	-	-	-
C04	1.85200	1.85200	2.77800	0.92600	1.85200	-	-	-	-	-	-	-	1.85200	-
C05	0.56467	1.69400	-	1.12933	1.12933	-	-	-	-	-	-	-	1.12933	-
C06	0.93733	2.81200	-	1.87467	1.87467	-	-	-	-	-	-	-	1.87467	-
ONS	1.34522	2.11933	1.56400	1.44017	2.11960	-	-	-	-	-	-	-	-	1.51657

3.1.3 Course Articulation Matrix

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	1	-	1	-	3	-	-	-	-	-	-	-	-
C02	2	-	1	-	3	-	-	-	-	-	-	-	-
C03	2	-	2	-	2	-	-	-	-	-	-	-	-
C04	2	-	3	-	2	-	-	-	-	-	-	2	-
C05	1	3	-	2	2	-	-	-	-	-	-	-	-
C06	1	3	-	2	2	-	-	-	-	-	-	2	-
Ave	1.500	2.667	1.667	1.750	2.400	-	-	-	-	-	-	-	2

Target Level for Course

75

PO attainment

PO Attainment	Level
x>=70	3
60<=x <70	2
50<=x <60	1
x<=40	0

(2020-21) DCCN Lab	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Direct Attainment	1.13	2	1.25	1.31	1.9	-	-	-	-	-	-	-	1.5	
Gap	-0.22	-0.12	-0.31	-0.13	-0.32	-	-	-	-	-	-	-	1.62	-0.12

Department Head and Head of Department
Professor and Head of Department
Chaitanya Bharathi Institute of Technology (T.S.)
Gondipet, Hyderabad-500 075. (A)

