SIES College of Arts, Science & Commerce

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**S.I.E.S College of Arts, Science and Commerce(Empowered Autonomous)**
**Sion(W), Mumbai – 400 022.**

## CERTIFICATE

This is to certify that Miss/Mr Shaikh Shakeeb Mohd Mukhtar Alam
Roll No._TCS 2526068__ has successfully completed the necessary course of experiments in the subject of **Computer Networks** during the academic year **2025 – 2026** complying with the requirements of **University of Mumbai**, for the course of **TYBSC Computer Science [Semester-V].**

8/9/25

Asst. Prof. In-Charge
Ms **Jessica D'Cruz**

Examination date:

Examiner's Signature & Date:

Signature of HOD
DR. MANOJ SINGH

College Seal

SIES COLLEGE OF ARTS SCIENCE AND COMMERCE ( EMPOWERED AUTONOMOUS)
SION - WEST , MUMBAI-22
Year: 2025-26

Name of the Student: Shaikh Shakeeb Subject: CN

Class : Ty.BSc.CS Semester: V Roll No: 068

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| Sr.No | DATE | TITLE OF PRACTICAL | SIGNATURE OF FACULTY |
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| 1 | 30/6/25 | Using window cmd execute the full networking commands : Ping , tracert , netstat , arp , ipconfig. | |
| | | getmac , hostname , nslookup, systeminfo , Pathping route. | 2/7/25 |
| 2 | 7/7/25 | 2A: Use CPT. Create Network of 2 computers. use static IP | |
| | | 2B: Use CPT/create-network of 1 server & comps . use dynamic IP | 7/7/25 |
| 3 | 14/7/25 | Using CPT Demonstrate the various physical network topologies. | 14/7/25 |
| 4 | 21/7/25 | Create a basic network of 1 server & 2 computers & 2 movable(mobile devices. | |
| 5 | 21/7/25 | using CPT, create Wireless network of multiple host using appropriate access point. | 21/7/25 |
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| 7 | 4/8/25 | Create a network & configure static routing | 4/8/25 |
| 8 | 11/8/25 | Create a network & implement RIP [Routing - Information - Protocol] | 11/8/25 |
| 9A | 18/8/25 | Create a network & implement OSPF (simple area) | |
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| 10 | 1/9/25 | Create a network & implement eBGP | |
| 11 | 1/9/25 | Create MAC protocol for wireless network. | 1/9/25 |
| 12 | 4/9/25 | Capture a ~~Packets~~ Packets through wire shark. | 4/9/25 |
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8/9/25
Name & Signature of Subject Incharge.

Name & Signature of Examiner

## Practical 1

**Aim:-** Perform the following networking commands in window-cmd and analyse the output.

**1]** **Hostname** - The hostname command is used to view or set the name of a computer on a network. This name (hostname) helps identify the device in a human-readable way instead of using an IP address. It's commonly used in networking, server management, and system configuration.

```
Microsoft Windows [Version 10.0.19045.5487]
(c) Microsoft Corporation. All rights reserved.

C:\Users\admin>hostname
DESKTOP-QOCTQUQ
```

**Explanation:-** Displays the computer's name (hostname). This is how your device is identified on a network.

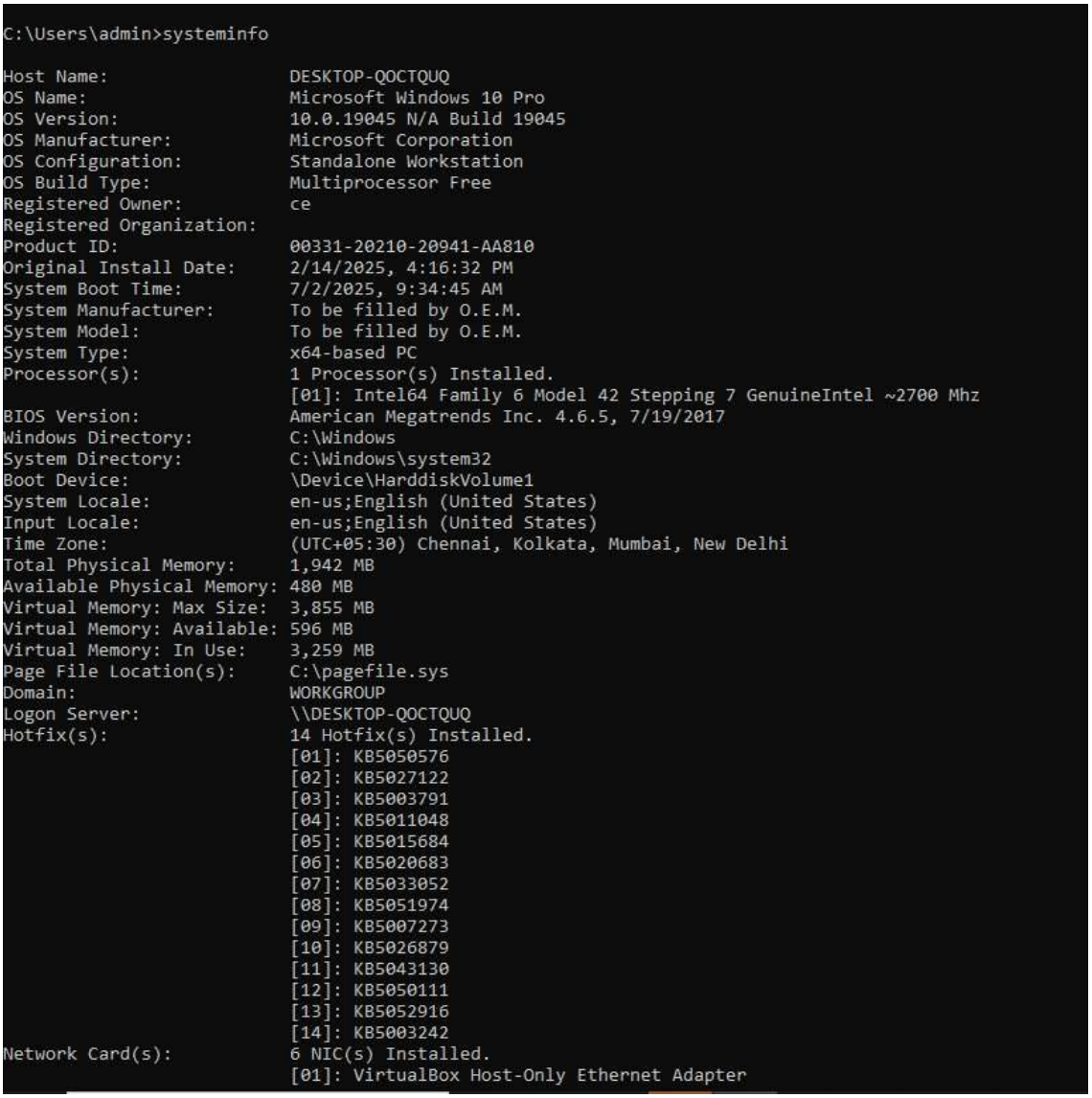
**2]** **getmac** - Displays the MAC (Media Access Control) addresses of the network adapters on the computer. Useful for identifying devices on a network and for security filtering.

```
C:\Users\admin>getmac

Physical Address    Transport Name
=================== ==========================================================
0A-00-27-00-00-15   \Device\Tcpip_{AEC7CF36-201D-4556-8BC6-E6C9202AD662}
00-50-56-C0-00-01   \Device\Tcpip_{8231FE41-7B99-4B41-A82C-7805183D93DC}
00-50-56-C0-00-08   \Device\Tcpip_{31542F2A-D070-4E69-A922-89AF9D3009B0}
0A-00-27-00-00-12   \Device\Tcpip_{911FC731-3F31-4570-B3AB-E60B637550A8}
00-E0-4C-43-2D-9C   \Device\Tcpip_{067BF367-F589-4B36-A9E8-01A5DFEAC3A6}
00-15-5D-87-9B-E5   \Device\Tcpip_{EBC24939-AA2C-40FD-9E2A-F5D4FB96F29A}
```

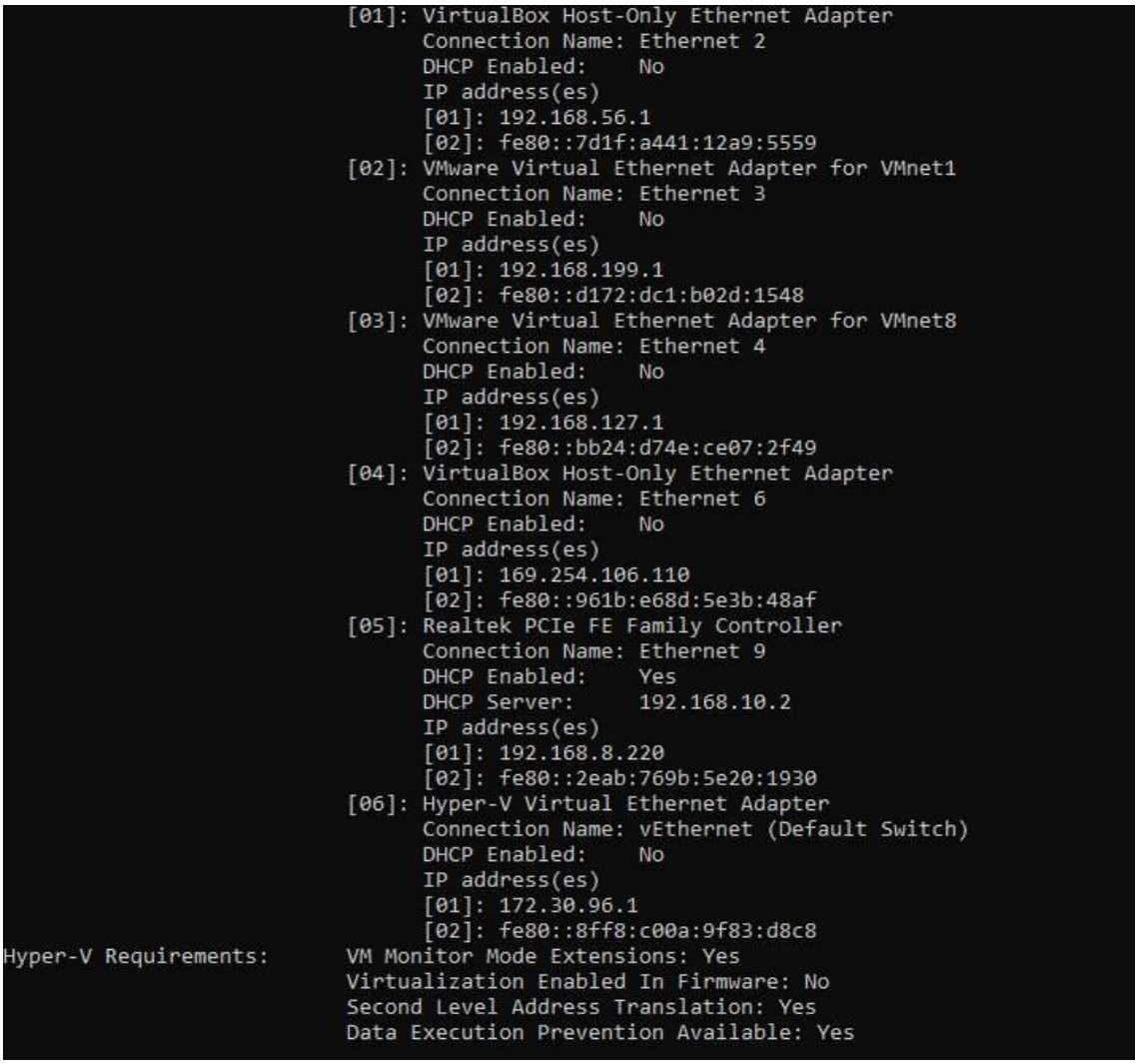
**Explanation:**

- **Physical Address:** Unique identifier for each network adapter.
- **Transport Name:** Internal identifier for the adapter.

3] **Systeminfo** - Shows detailed information about the computer's hardware and operating system. Includes data like OS version, BIOS info, memory, and network settings.



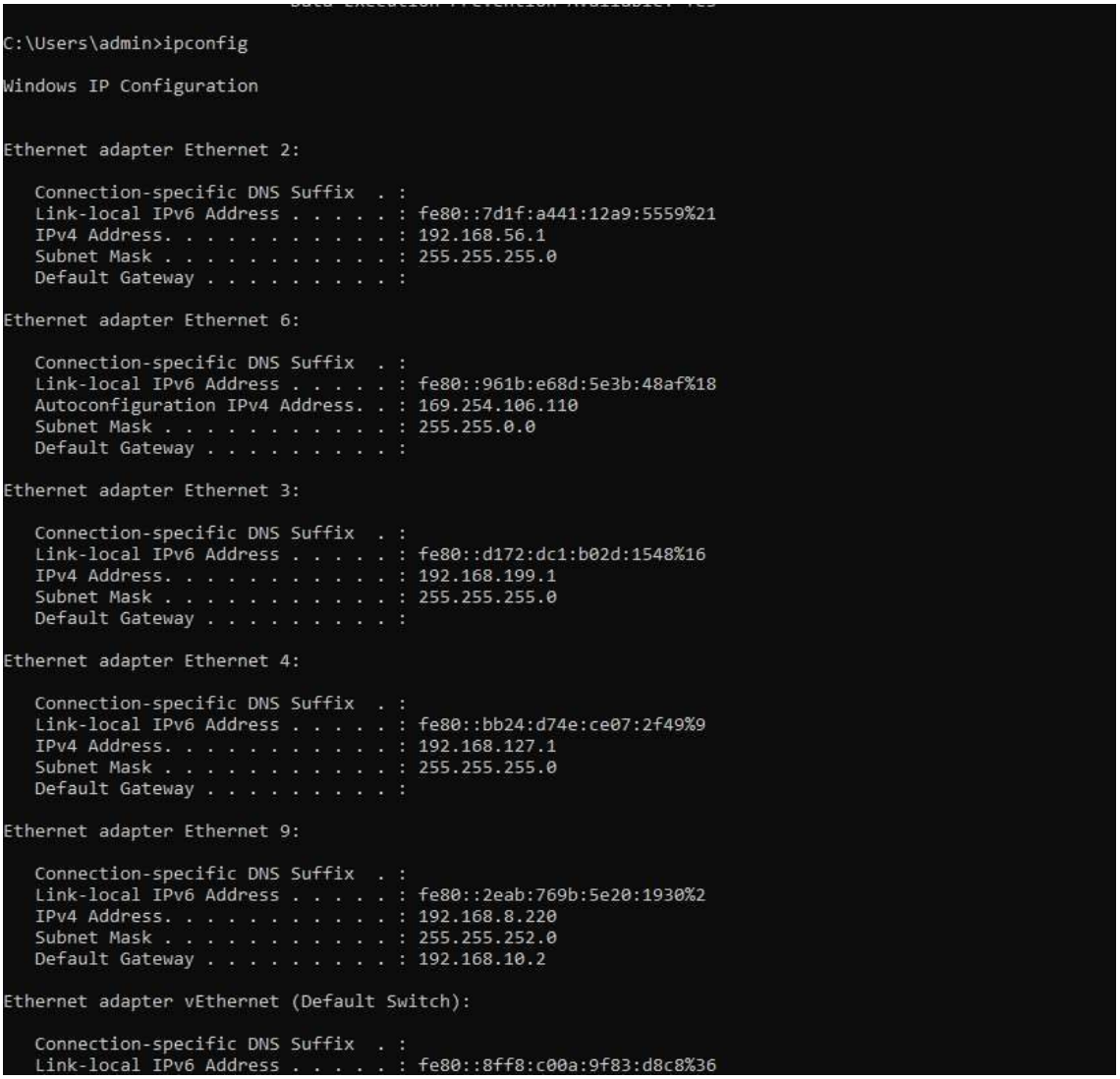
```
C:\Users\admin>systeminfo

Host Name:                 DESKTOP-QOCTQUQ
OS Name:                   Microsoft Windows 10 Pro
OS Version:                10.0.19045 N/A Build 19045
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:          ce
Registered Organization:
Product ID:                00331-20210-20941-AA810
Original Install Date:     2/14/2025, 4:16:32 PM
System Boot Time:          7/2/2025, 9:34:45 AM
System Manufacturer:       To be filled by O.E.M.
System Model:              To be filled by O.E.M.
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 42 Stepping 7 GenuineIntel ~2700 Mhz
BIOS Version:              American Megatrends Inc. 4.6.5, 7/19/2017
Windows Directory:         C:\Windows
System Directory:          C:\Windows\system32
Boot Device:               \Device\HarddiskVolume1
System Locale:             en-us;English (United States)
Input Locale:              en-us;English (United States)
Time Zone:                 (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Total Physical Memory:     1,942 MB
Available Physical Memory: 480 MB
Virtual Memory: Max Size:  3,855 MB
Virtual Memory: Available: 596 MB
Virtual Memory: In Use:    3,259 MB
Page File Location(s):     C:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:              \\DESKTOP-QOCTQUQ
Hotfix(s):                 14 Hotfix(s) Installed.
                           [01]: KB5050576
                           [02]: KB5027122
                           [03]: KB5003791
                           [04]: KB5011048
                           [05]: KB5015684
                           [06]: KB5020683
                           [07]: KB5033052
                           [08]: KB5051974
                           [09]: KB5007273
                           [10]: KB5026879
                           [11]: KB5043130
                           [12]: KB5050111
                           [13]: KB5052916
                           [14]: KB5003242
Network Card(s):           6 NIC(s) Installed.
                           [01]: VirtualBox Host-Only Ethernet Adapter
```




**Explanation:-**

- **OS Name/Version:** Windows 10 Pro, Build 19045.
- **Install Date:** 14 Feb 2025.
- **Boot Time:** 2 July 2025, 9:34 AM.
- **Processor:** Intel i7 (2.7 GHz, 1 core visible).
- **RAM:** 1,942 MB total, 480 MB available (very low → possible performance issue).
- **BIOS Date:** 2017 (may be outdated).
- **Hotfixes:** Lists installed Windows updates.

4] **ipconfig** - Displays the current IP address, subnet mask, and default gateway for all network adapters. Used to troubleshoot network connectivity issues.



```
C:\Users\admin>ipconfig

Windows IP Configuration


Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::7d1f:a441:12a9:5559%21
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet 6:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::961b:e68d:5e3b:48af%18
   Autoconfiguration IPv4 Address. . : 169.254.106.110
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::d172:dc1:b02d:1548%16
   IPv4 Address. . . . . . . . . . . : 192.168.199.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet 4:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::bb24:d74e:ce07:2f49%9
   IPv4 Address. . . . . . . . . . . : 192.168.127.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Ethernet 9:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::2eab:769b:5e20:1930%2
   IPv4 Address. . . . . . . . . . . : 192.168.8.220
   Subnet Mask . . . . . . . . . . . : 255.255.252.0
   Default Gateway . . . . . . . . . : 192.168.10.2

Ethernet adapter vEthernet (Default Switch):

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::8ff8:c00a:9f83:d8c8%36
```

## Explanation:

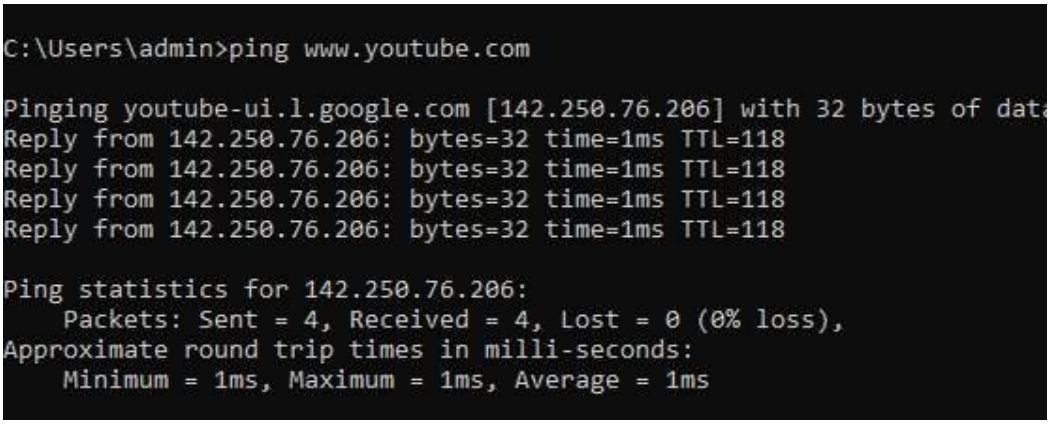
- Ethernet 9: **Real network card** with IP 192.168.8.220, connected to the network, with default gateway 192.168.10.2.
- Others (Ethernet 2, 3, 4, 6, vEthernet): Used for virtualization (VirtualBox, VMware, Hyper-V), mostly local-only.

**5]** **nslookup** - Queries DNS to find the IP address associated with a domain name or vice versa. Useful for diagnosing DNS resolution problems.


**Explanation:**

- DNS Server: 192.168.10.2 resolved www.google.com to:
  - IPv6: 2404:6800:4009:802::2004
  - IPv4: 142.250.70.36
- DNS resolution is working fine.

**6]** **ping** - Sends ICMP echo requests to a host to check if it's reachable and measures response time. Helps test basic network connectivity.

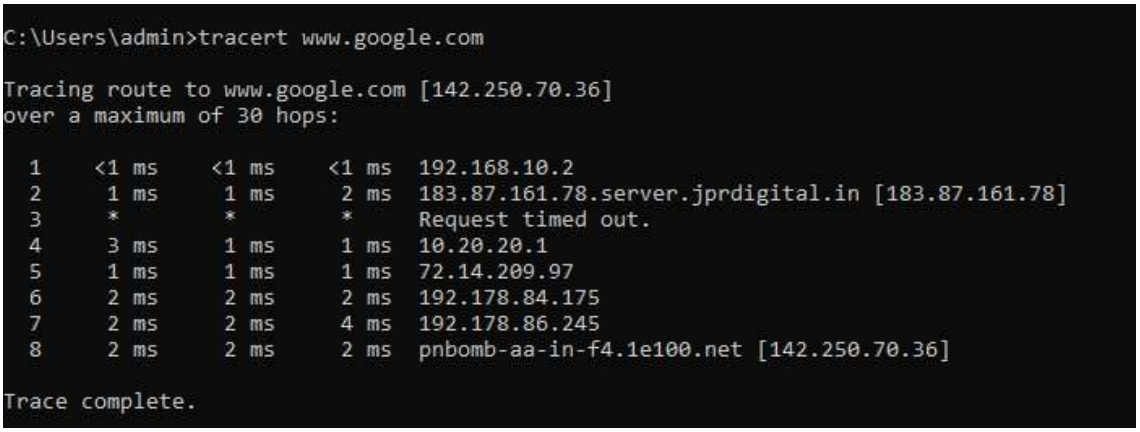



**Explanation:-**

- **Command Used:** tracert www.google.com

 **Purpose:** Shows the path (hops) your data takes to reach Google's server.

**7]** **tracert** - Traces the path that packets take to reach a destination across a network. Shows each hop and its delay, helping diagnose routing issues.




**Explanation:**

- Local IP: 192.168.8.220
- Multiple connections to web services (HTTPS).
- ESTABLISHED: Actively communicating.
- CLOSE_WAIT: Waiting for local app to close the connection.

**Example:** Connection to 4.213.25.240 is active on port 56534.

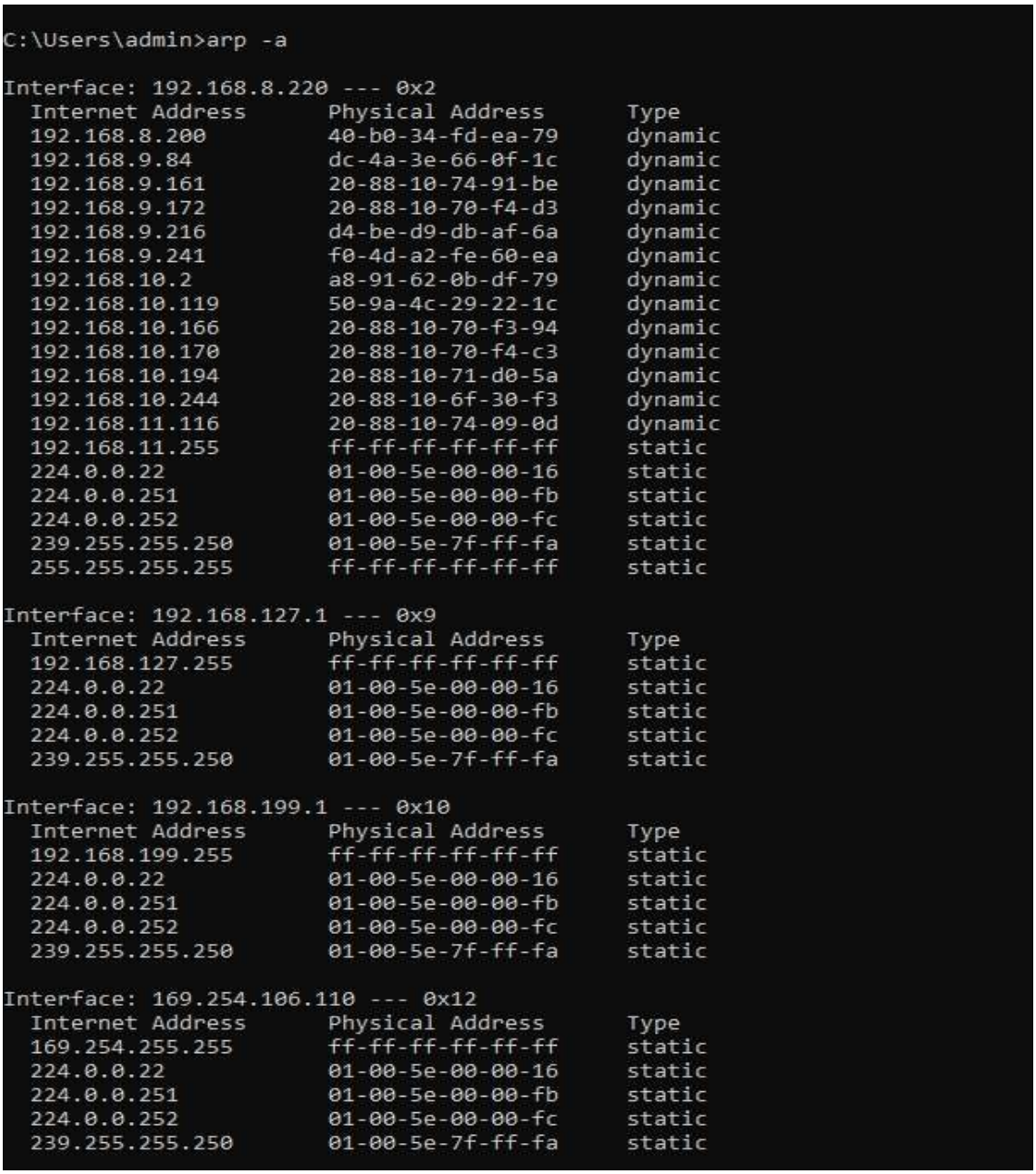
**8]** **netstat** - Displays current network connections, listening ports, and routing tables. Useful for monitoring active network traffic and diagnosing problems.

```
C:\Users\admin>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    192.168.8.220:56534    4.213.25.240:https     ESTABLISHED
  TCP    192.168.8.220:57759    a23-212-0-11:https     CLOSE_WAIT
  TCP    192.168.8.220:57762    20.189.173.17:https    CLOSE_WAIT
  TCP    192.168.8.220:57767    52.108.8.254:https     CLOSE_WAIT
  TCP    192.168.8.220:57769    13.107.6.254:https     CLOSE_WAIT
  TCP    192.168.8.220:57770    150.171.22.254:https   CLOSE_WAIT
  TCP    192.168.8.220:57771    204.79.197.222:https   CLOSE_WAIT
  TCP    192.168.8.220:57871    4.213.25.242:https     ESTABLISHED
```

**Explanation:-**

- **Shows:** ARP (Address Resolution Protocol) table — maps IP addresses to MAC addresses.
- **Example:** 192.168.10.2 has MAC a8-91-62-0b-df-79
- **Purpose:** Helps identify devices on your local network.

**9]** **arp** - Displays or modifies the ARP (Address Resolution Protocol) cache, which maps IP addresses to MAC addresses. Helpful for troubleshooting local network communication.



```
C:\Users\admin>arp -a

Interface: 192.168.8.220 --- 0x2
  Internet Address      Physical Address      Type
  192.168.8.200         40-b0-34-fd-ea-79     dynamic
  192.168.9.84          dc-4a-3e-66-0f-1c     dynamic
  192.168.9.161         20-88-10-74-91-be     dynamic
  192.168.9.172         20-88-10-70-f4-d3     dynamic
  192.168.9.216         d4-be-d9-db-af-6a     dynamic
  192.168.9.241         f0-4d-a2-fe-60-ea     dynamic
  192.168.10.2          a8-91-62-0b-df-79     dynamic
  192.168.10.119        50-9a-4c-29-22-1c     dynamic
  192.168.10.166        20-88-10-70-f3-94     dynamic
  192.168.10.170        20-88-10-70-f4-c3     dynamic
  192.168.10.194        20-88-10-71-d0-5a     dynamic
  192.168.10.244        20-88-10-6f-30-f3     dynamic
  192.168.11.116        20-88-10-74-09-0d     dynamic
  192.168.11.255        ff-ff-ff-ff-ff-ff     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
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.127.1 --- 0x9
  Internet Address      Physical Address      Type
  192.168.127.255       ff-ff-ff-ff-ff-ff     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
  239.255.255.250       01-00-5e-7f-ff-fa     static

Interface: 192.168.199.1 --- 0x10
  Internet Address      Physical Address      Type
  192.168.199.255       ff-ff-ff-ff-ff-ff     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
  239.255.255.250       01-00-5e-7f-ff-fa     static

Interface: 169.254.106.110 --- 0x12
  Internet Address      Physical Address      Type
  169.254.255.255       ff-ff-ff-ff-ff-ff     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
  239.255.255.250       01-00-5e-7f-ff-fa     static
```

**Explanation:-**

- **Combines:** ping + tracert, with loss & latency stats.

**Key Result:**

0% packet loss to 192.168.10.2 and ISP router 183.87.161.78

Good connectivity confirmed.

**10]** **pathping** - Combines ping and tracert by showing route details and packet loss statistics for each hop. Useful for identifying where network issues occur along the path.

```
C:\Users\admin>pathping www.google.com

Tracing route to www.google.com [142.250.70.36]
over a maximum of 30 hops:
  0  DESKTOP-QOCTQUQ [192.168.8.220]
  1  192.168.10.2
  2  183.87.161.78.server.jprdigital.in [183.87.161.78]
  3     *        *        *
Computing statistics for 50 seconds...
           Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           DESKTOP-QOCTQUQ [192.168.8.220]
                                0/ 100 =  0%   |
  1    0ms     0/ 100 =  0%     0/ 100 =  0%  192.168.10.2
                                0/ 100 =  0%   |
  2    1ms     0/ 100 =  0%     0/ 100 =  0%  183.87.161.78.server.jprdigital.in [183.87.161.78]

Trace complete.
```

**Explanation:-**

- **Destination:** Where traffic is going.
- **Netmask:** How much of the IP is matched.
- **Gateway:** Next-hop router.
- **Interface:** Which NIC is used.
- **Metric:** Lower = higher priority.

**Default Route:**

CopyEdit
0.0.0.0 0.0.0.0 192.168.10.2 192.168.8.220 35

Means all unknown traffic goes via 192.168.10.2 using your Realtek NIC.

**11]** **route** - Displays and modifies the IP routing table. Used to control how packets are forwarded in a network.

```
C:\Users\admin>route print
===========================================================================
Interface List
 21...0a 00 27 00 00 15 ......VirtualBox Host-Only Ethernet Adapter
 18...0a 00 27 00 00 12 ......VirtualBox Host-Only Ethernet Adapter
 16...00 50 56 c0 00 01 ......VMware Virtual Ethernet Adapter for VMnet1
  9...00 50 56 c0 00 08 ......VMware Virtual Ethernet Adapter for VMnet8
  2...00 e0 4c 43 2d 9c ......Realtek PCIe FE Family Controller
  1...........................Software Loopback Interface 1
 36...00 15 5d 87 9b e5 ......Hyper-V Virtual Ethernet Adapter
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0     192.168.10.2    192.168.8.220     35
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    331
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    331
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    331
      169.254.0.0      255.255.0.0         On-link   169.254.106.110    281
  169.254.106.110  255.255.255.255         On-link   169.254.106.110    281
  169.254.255.255  255.255.255.255         On-link   169.254.106.110    281
      172.30.96.0    255.255.240.0         On-link      172.30.96.1   5256
      172.30.96.1  255.255.255.255         On-link      172.30.96.1   5256
   172.30.111.255  255.255.255.255         On-link      172.30.96.1   5256
      192.168.8.0    255.255.252.0         On-link     192.168.8.220    291
    192.168.8.220  255.255.255.255         On-link     192.168.8.220    291
   192.168.11.255  255.255.255.255         On-link     192.168.8.220    291
     192.168.56.0    255.255.255.0         On-link      192.168.56.1    281
     192.168.56.1  255.255.255.255         On-link      192.168.56.1    281
   192.168.56.255  255.255.255.255         On-link      192.168.56.1    281
    192.168.127.0    255.255.255.0         On-link     192.168.127.1    291
    192.168.127.1  255.255.255.255         On-link     192.168.127.1    291
  192.168.127.255  255.255.255.255         On-link     192.168.127.1    291
    192.168.199.0    255.255.255.0         On-link     192.168.199.1    291
    192.168.199.1  255.255.255.255         On-link     192.168.199.1    291
  192.168.199.255  255.255.255.255         On-link     192.168.199.1    291
        224.0.0.0        240.0.0.0         On-link         127.0.0.1    331
        224.0.0.0        240.0.0.0         On-link      192.168.56.1    281
        224.0.0.0        240.0.0.0         On-link   169.254.106.110    281
        224.0.0.0        240.0.0.0         On-link     192.168.199.1    291
        224.0.0.0        240.0.0.0         On-link     192.168.127.1    291
        224.0.0.0        240.0.0.0         On-link     192.168.8.220    291
        224.0.0.0        240.0.0.0         On-link      172.30.96.1   5256
  255.255.255.255  255.255.255.255         On-link         127.0.0.1    331
  255.255.255.255  255.255.255.255         On-link      192.168.56.1    281
  255.255.255.255  255.255.255.255         On-link   169.254.106.110    281
  255.255.255.255  255.255.255.255         On-link     192.168.199.1    291
  255.255.255.255  255.255.255.255         On-link     192.168.127.1    291
  255.255.255.255  255.255.255.255         On-link     192.168.8.220    291
  255.255.255.255  255.255.255.255         On-link      172.30.96.1   5256
```

**Explanation:-**

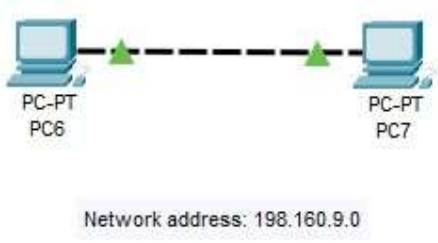
- **Internet:** Fully accessible.
- **DNS Resolution:** Working correctly.
- **NICs:** Multiple virtual and one real.
- **Memory:** Very limited — only 480MB free RAM → could slow things down.

- **Routing:** Correct default route set via physical adapter.
- **No Packet Loss:** Upstream path to Google is reliable.
- **Virtualization:** Hyper-V is available but disabled in firmware.

## Practical 2

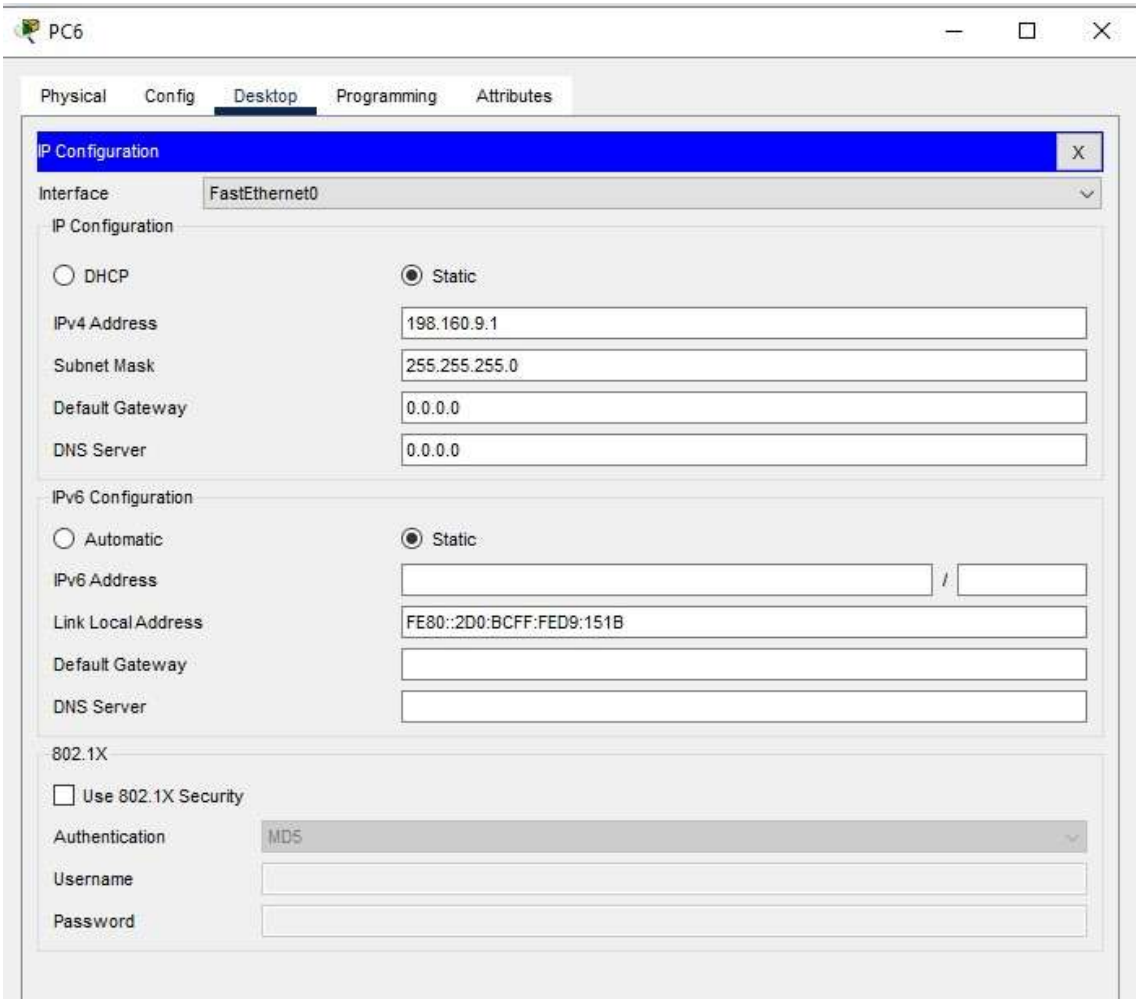
**Aim:-** 2A – Use CPT, Create network of 2 computers. Use static IP.

### Output:- Network Topology:-

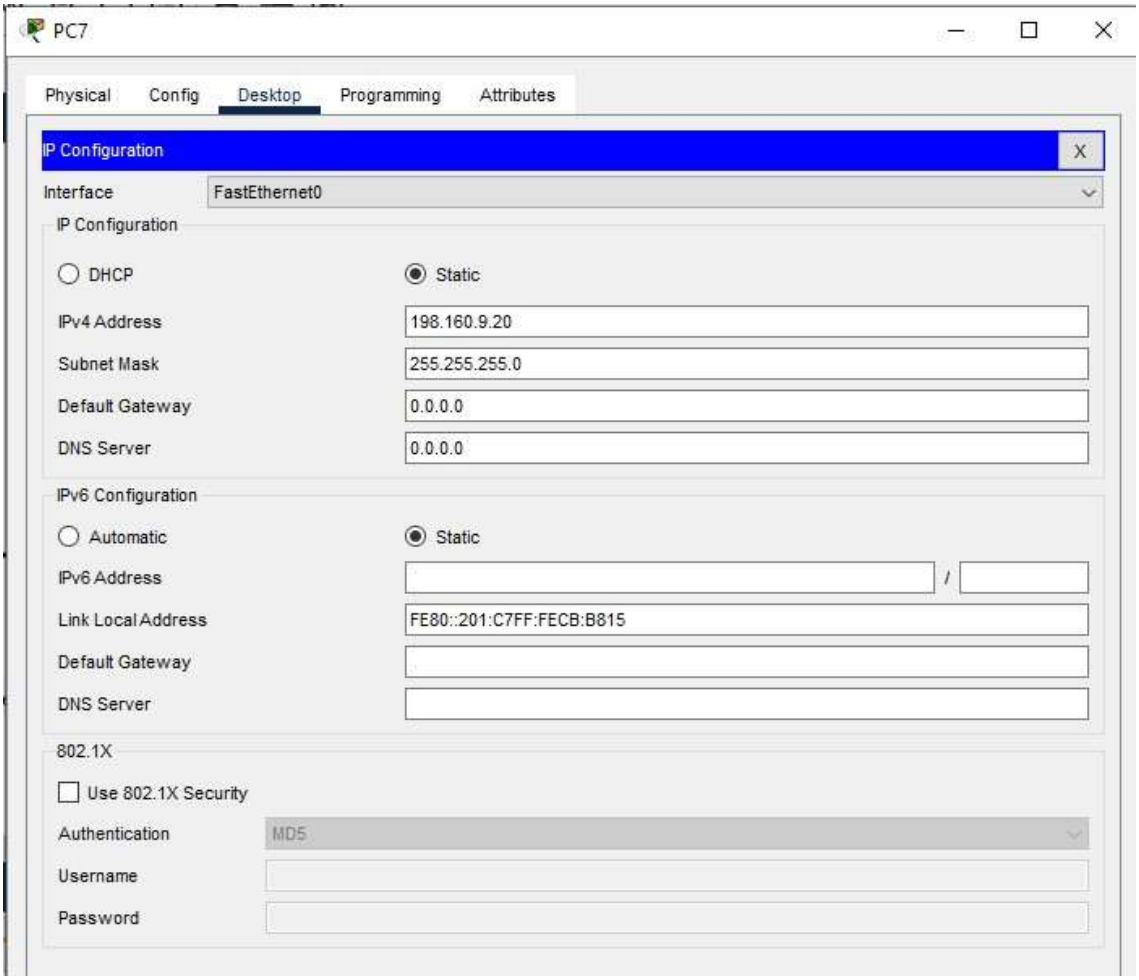



### Network Configuration:-

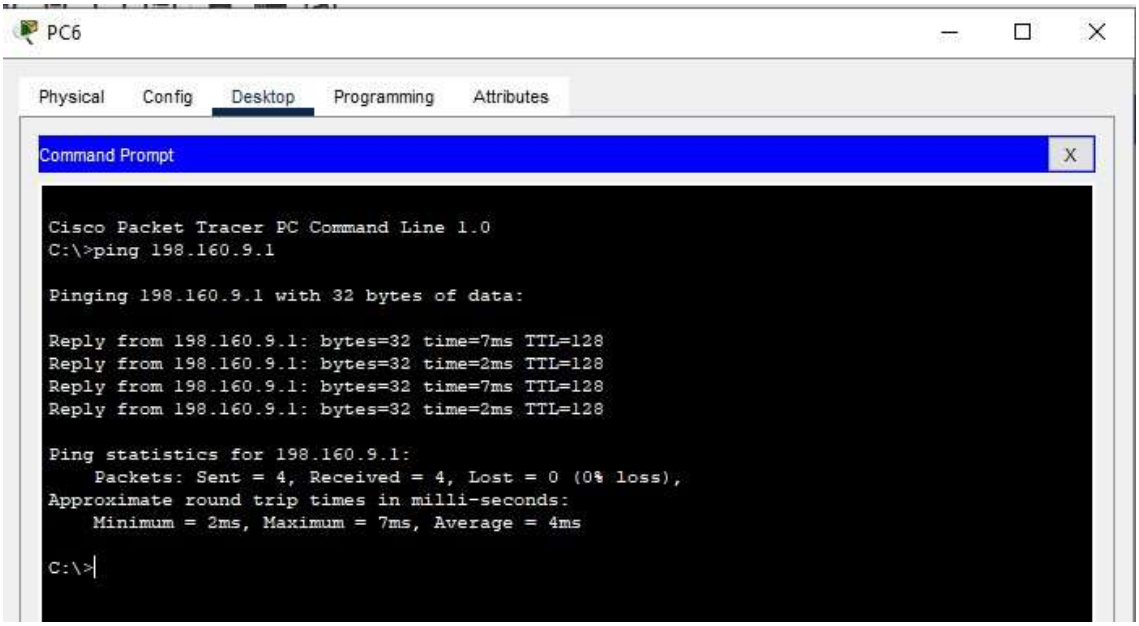
- Click on PC6. Go to desktop, Select IP config, Select Static Radio, Add IP Address.




- Click on PC7. Go to desktop, Select IP config, Select Static Radio, Add IP Address.




## Command Prompt of PC6

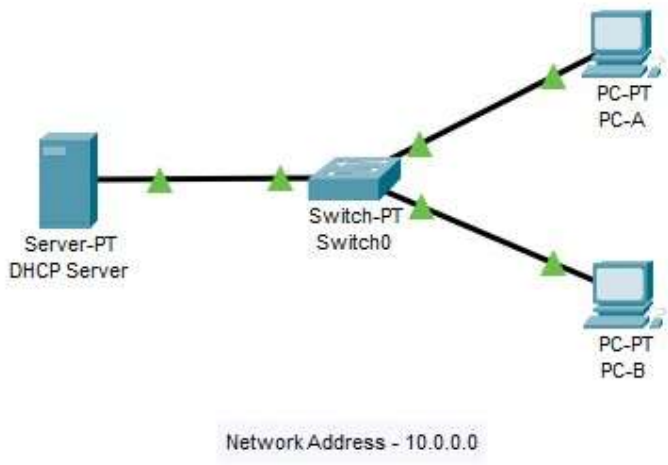


## Command Prompt of PC6

```
C:\>ping 198.160.9.20

Pinging 198.160.9.20 with 32 bytes of data:

Reply from 198.160.9.20: bytes=32 time<1ms TTL=128
Reply from 198.160.9.20: bytes=32 time<1ms TTL=128
Reply from 198.160.9.20: bytes=32 time<1ms TTL=128
Reply from 198.160.9.20: bytes=32 time<1ms TTL=128

Ping statistics for 198.160.9.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

**Aim:-** 2B – Use CPT, Create network of 1 server and 2 computers. Use dynamic IP.

## Output:- Network Topology:-

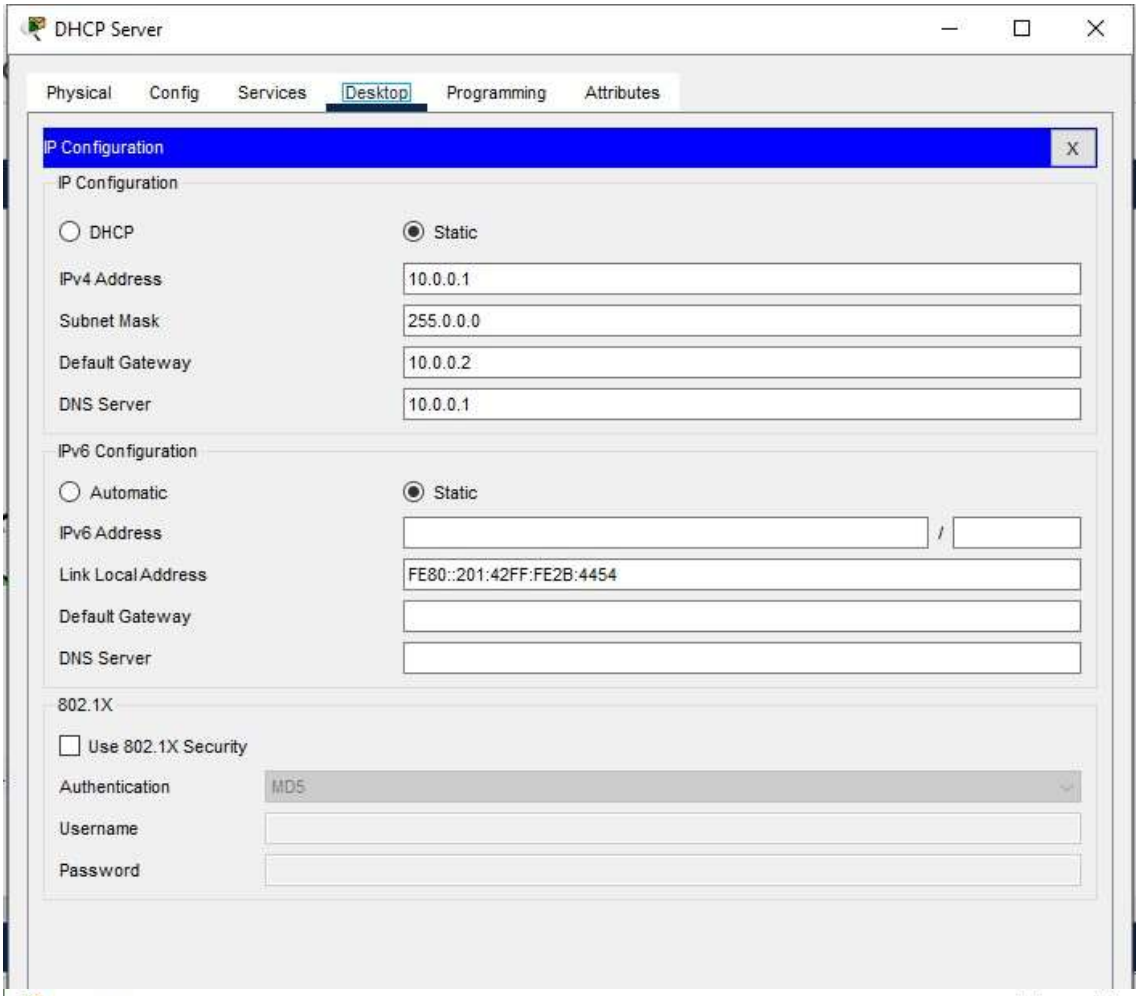


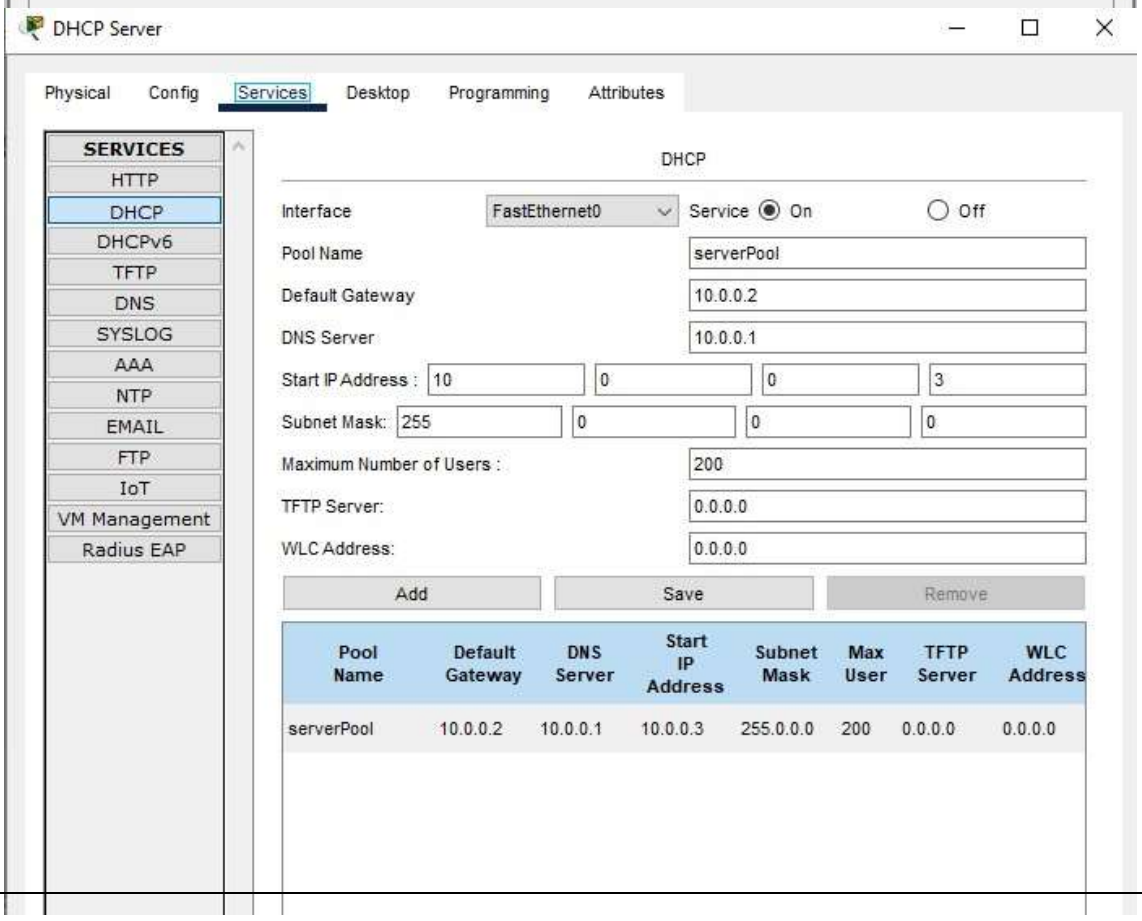

## Setting IP Address:-

IP Address – 10.0.0.1

Default Gateway – 10.0.0.2

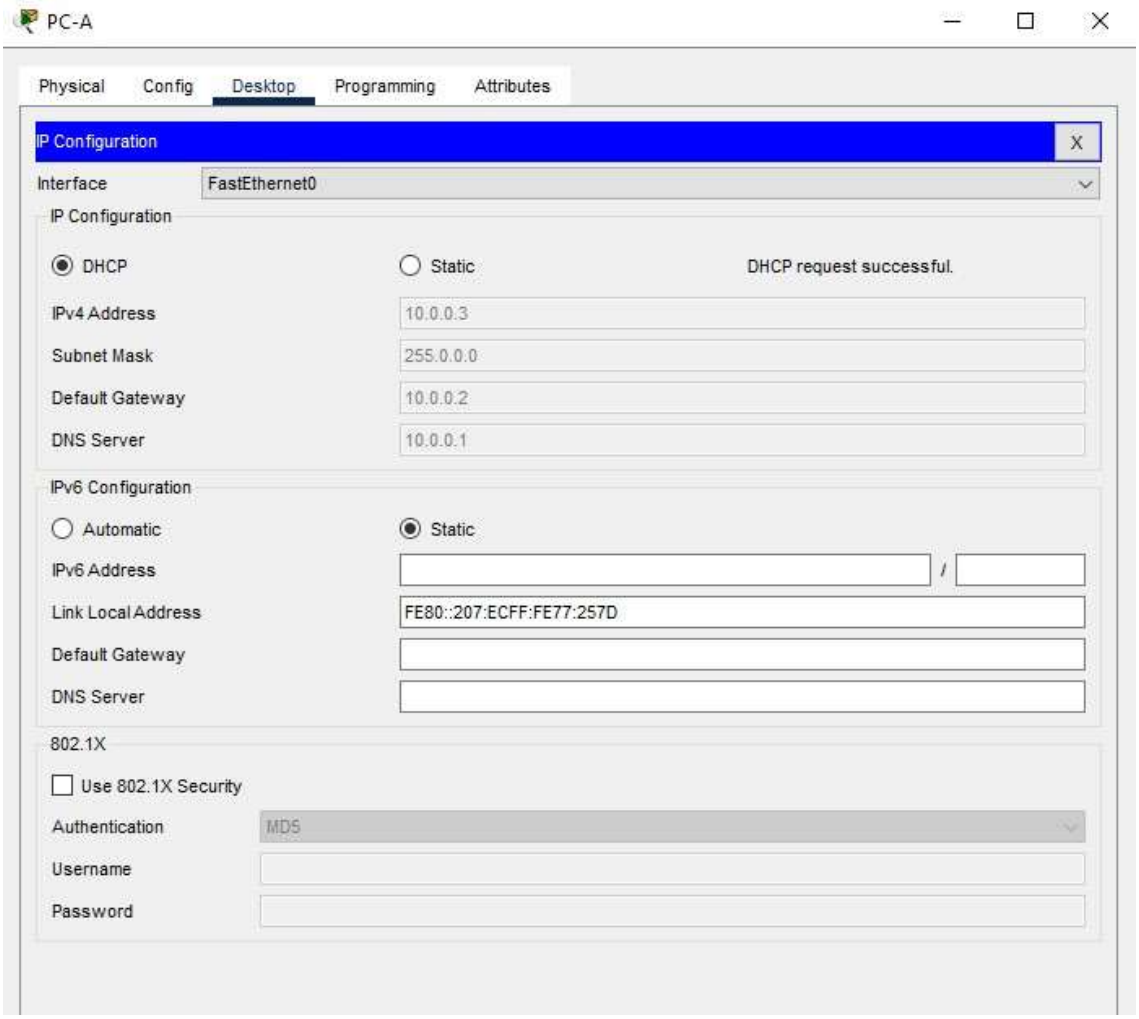
DNS Server – 10.0.0.1


DHCP Server
Physical
Config
Services
Desktop
Programming
Attributes
IP Configuration
X
IP Configuration
DHCP
Static
IPv4 Address
10.0.0.1
Subnet Mask
255.0.0.0
Default Gateway
10.0.0.2
DNS Server
10.0.0.1
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::201:42FF:FE2B:4454
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password


DHCP Server
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
DHCP
Interface
FastEthernet0
Service
On
Off
Pool Name
serverPool
Default Gateway
10.0.0.2
DNS Server
10.0.0.1
Start IP Address :
10
0
0
3
Subnet Mask:
255
0
0
0
Maximum Number of Users :
200
TFTP Server:
0.0.0.0
WLC Address:
0.0.0.0
Add
Save
Remove
Pool Name
Default Gateway
DNS Server
Start IP Address
Subnet Mask
Max User
TFTP Server
WLC Address
serverPool
10.0.0.2
10.0.0.1
10.0.0.3
255.0.0.0
200
0.0.0.0
0.0.0.0

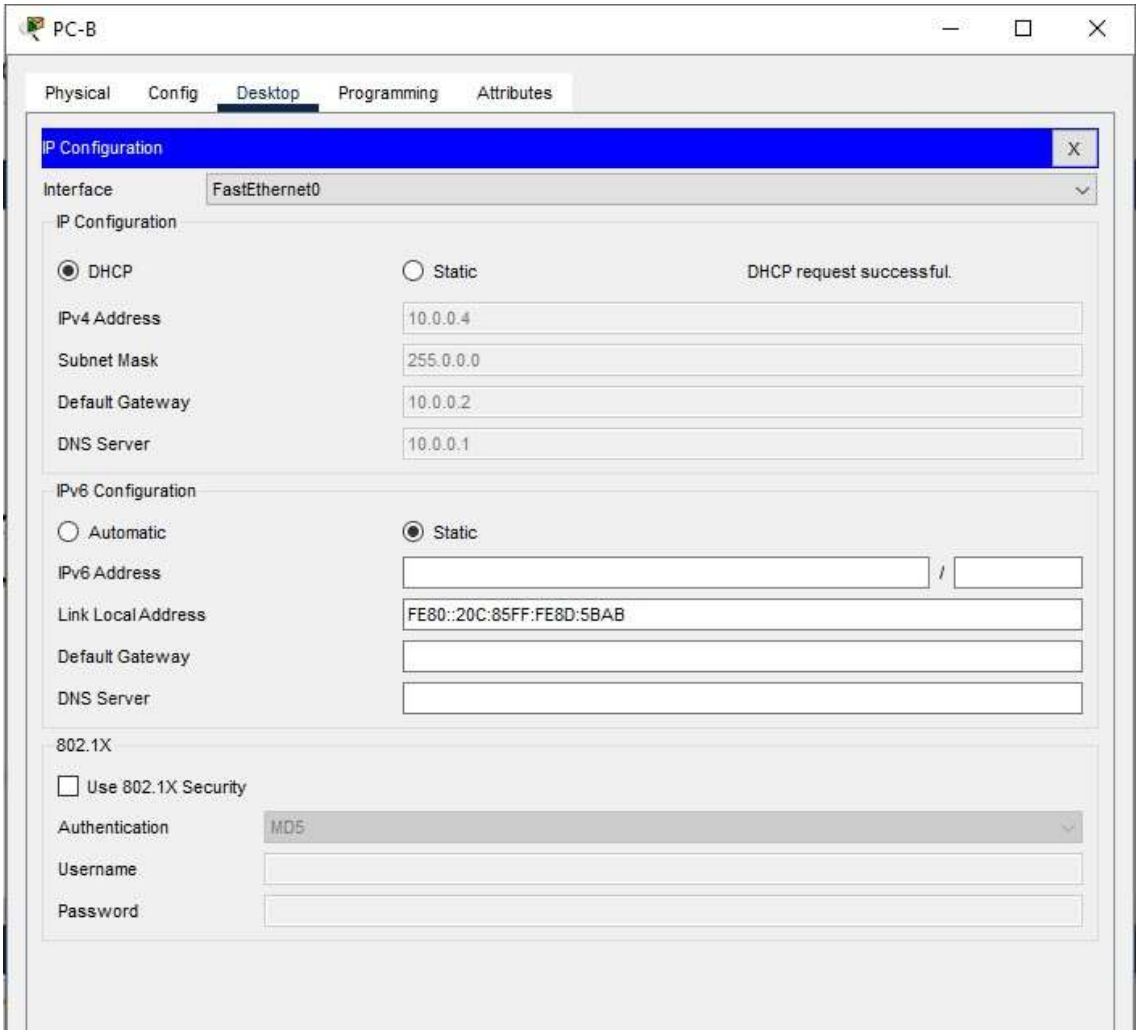
## Dynamic IP Address of PC-A

- Click on PC-A. Go to desktop, Select IP config, Select DHCP Radio.




## Dynamic IP Address of PC-B

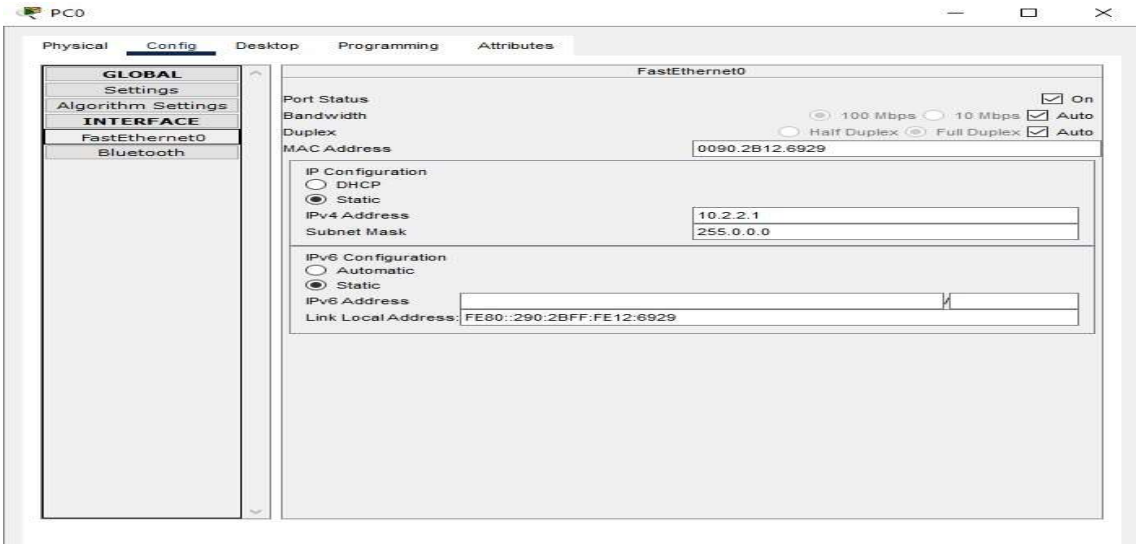
- Click on PC-B. Go to desktop, Select IP config, Select DHCP Radio.


PC-B
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
DHCP request successful.
IPv4 Address
10.0.0.4
Subnet Mask
255.0.0.0
Default Gateway
10.0.0.2
DNS Server
10.0.0.1
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::20C:85FF:FE8D:5BAB
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password

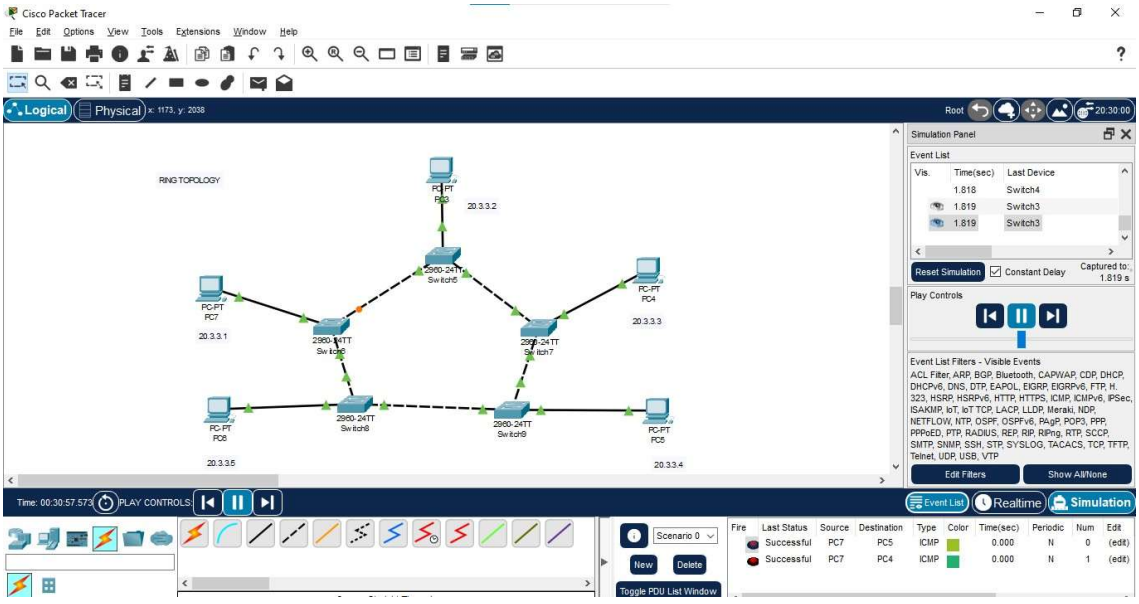
## Practical 3

**Aim:-** Using CPT demonstrate the various physical network topologies**.**

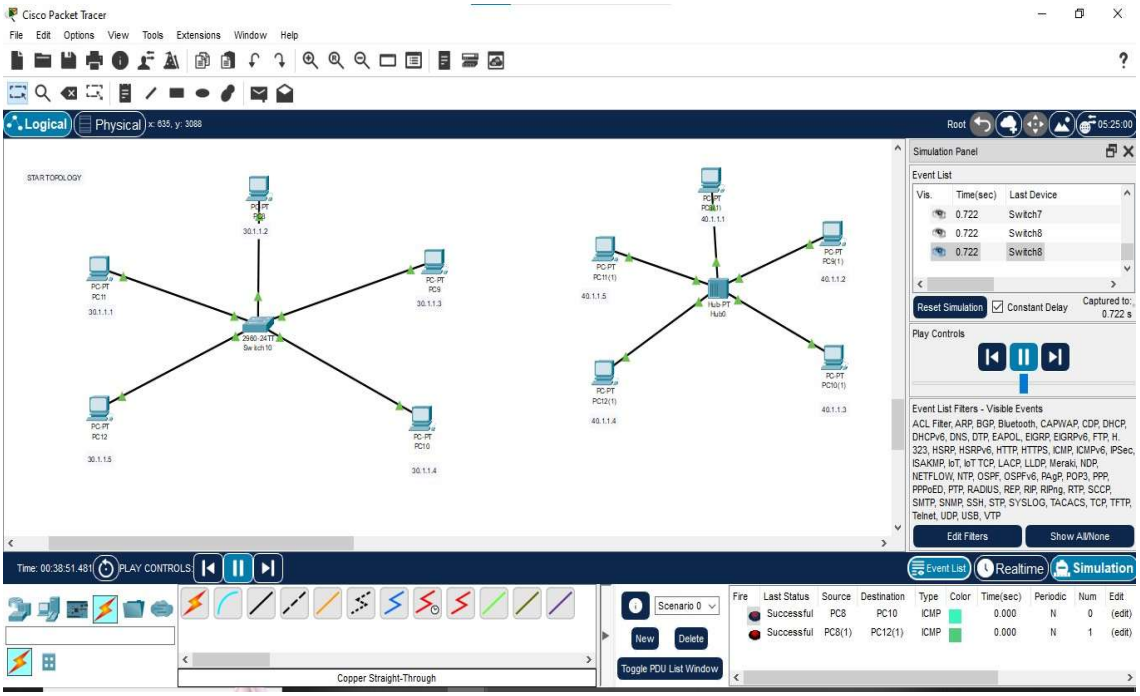
**NOTE:** For all PC,IP configurations are done as shown below.



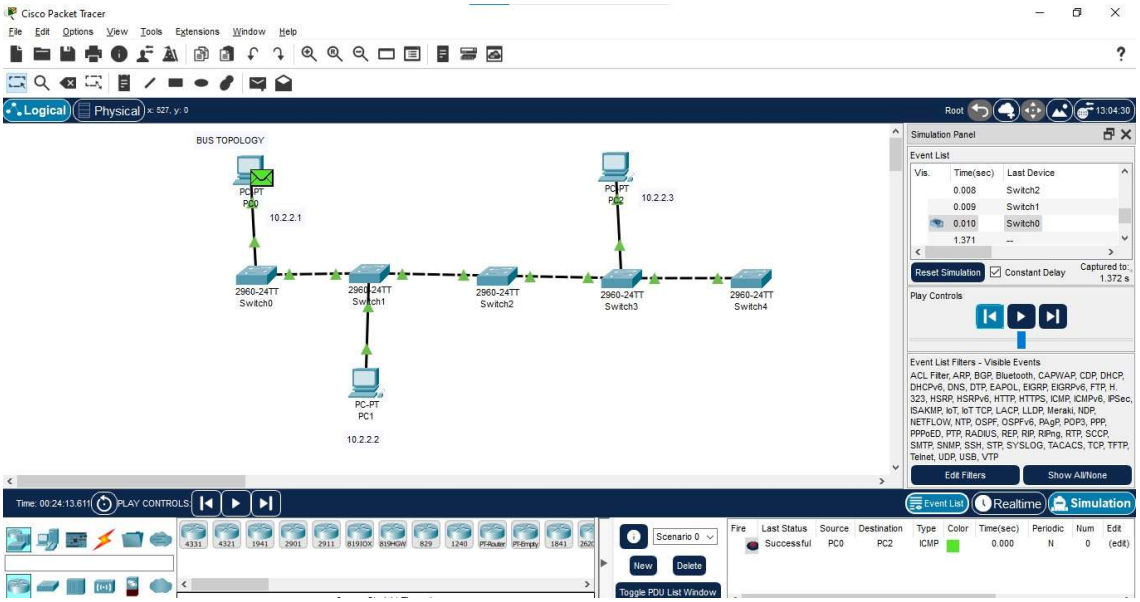

## Ring Topology:-



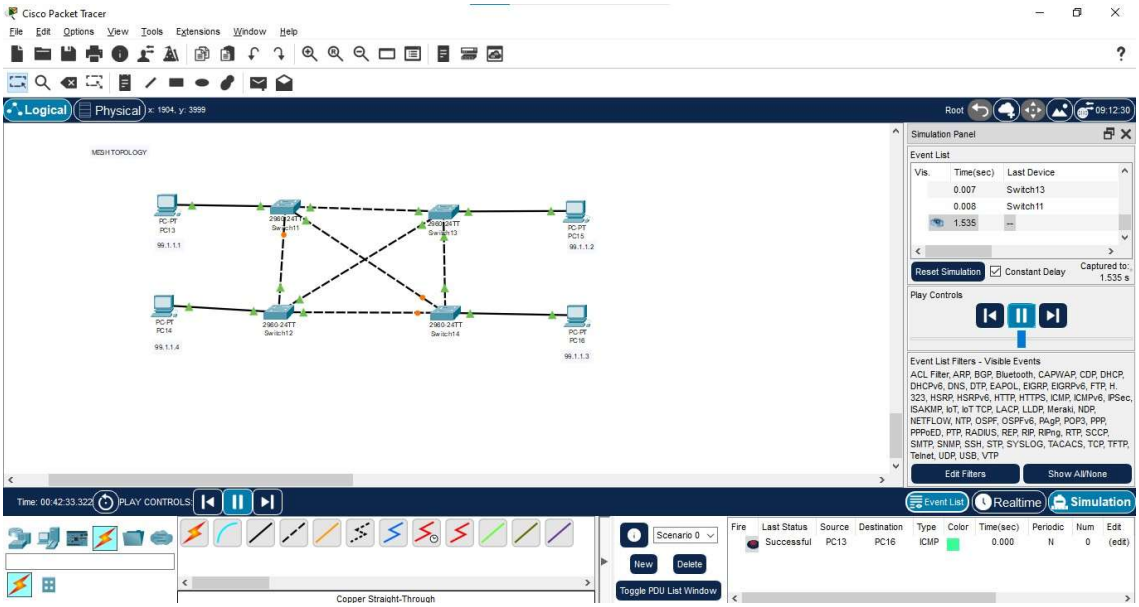
## Star Topology:-



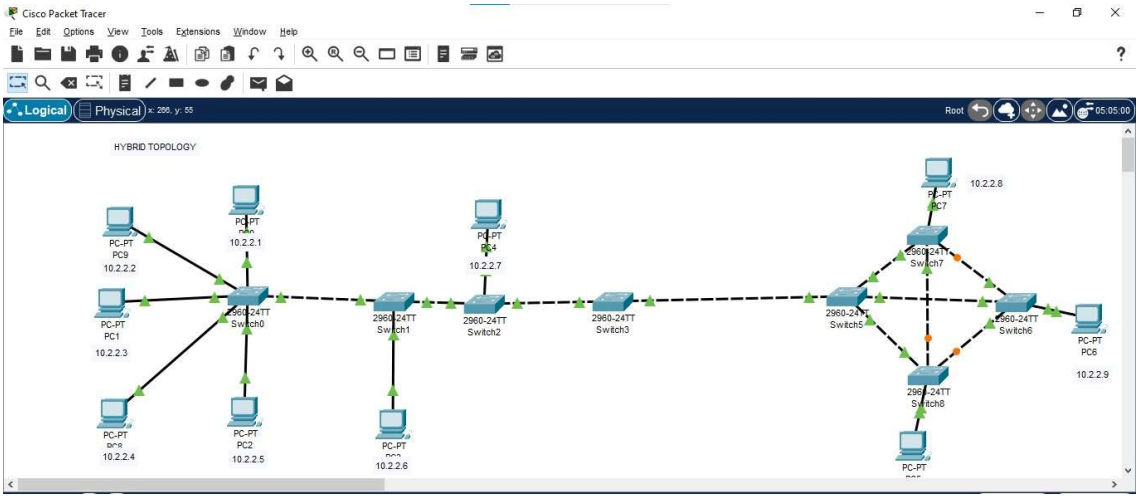

## Bus Topology:-



## Mesh Topology:-




## Hybrid Topology:-



## Practical 4

**AIM:-** Create a basic network of 1 sever and 2 movable/mobile devices.

### DESCRIPTION FOR HOME ROUTER:

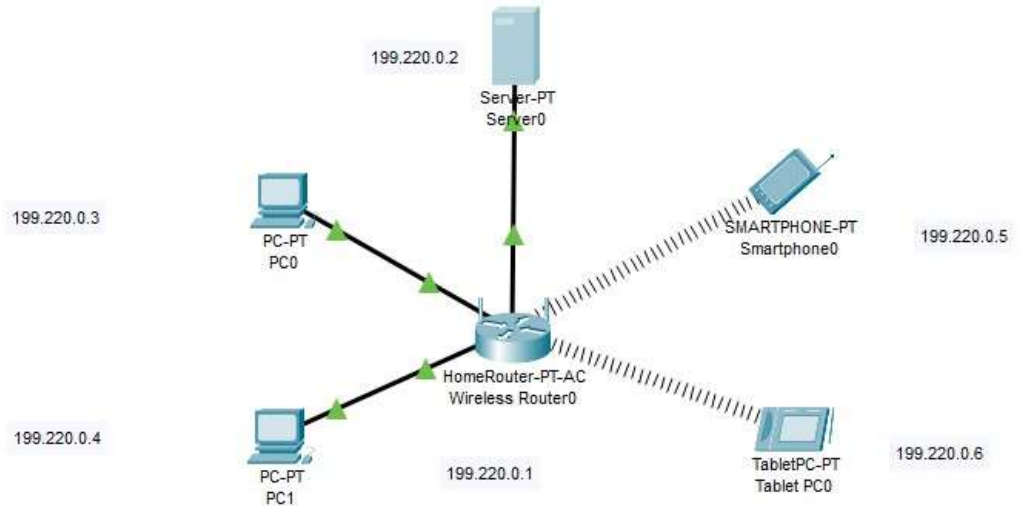
A home router is a device that serves as the gateway between your personal devices and the internet. It creates a local network, allowing smartphones, laptops, tablets, smart TVs, and other gadgets to connect and communicate wirelessly through Wi-Fi. At the same time, it manages the flow of data between your home and your internet service provider, assigning IP addresses to each device and directing traffic efficiently.

### FUNCTIONALITY:

A home router is a **smart all-in-one box** that does multiple jobs:

- Connects your home to the internet
- Creates a Wi-Fi network for wireless devices
- Assigns IP addresses to every device automatically (DHCP)
- Shares internet with all devices using NAT
- Protects your network with basic security (firewall, MAC filtering)
- Has ports for wired devices like TVs and PCs
- Let's you customize how certain devices get internet (port forwarding, DMZ)

**Output:-**




Server0

Physical | Config | Services | Desktop | Programming | Attributes

**IP Configuration**

IP Configuration

- DHCP
- Static

| | |
|---|---|
| IPv4 Address | 199.220.0.2 |
| Subnet Mask | 255.255.255.0 |
| Default Gateway | 199.220.0.1 |
| DNS Server | 0.0.0.0 |

IPv6 Configuration

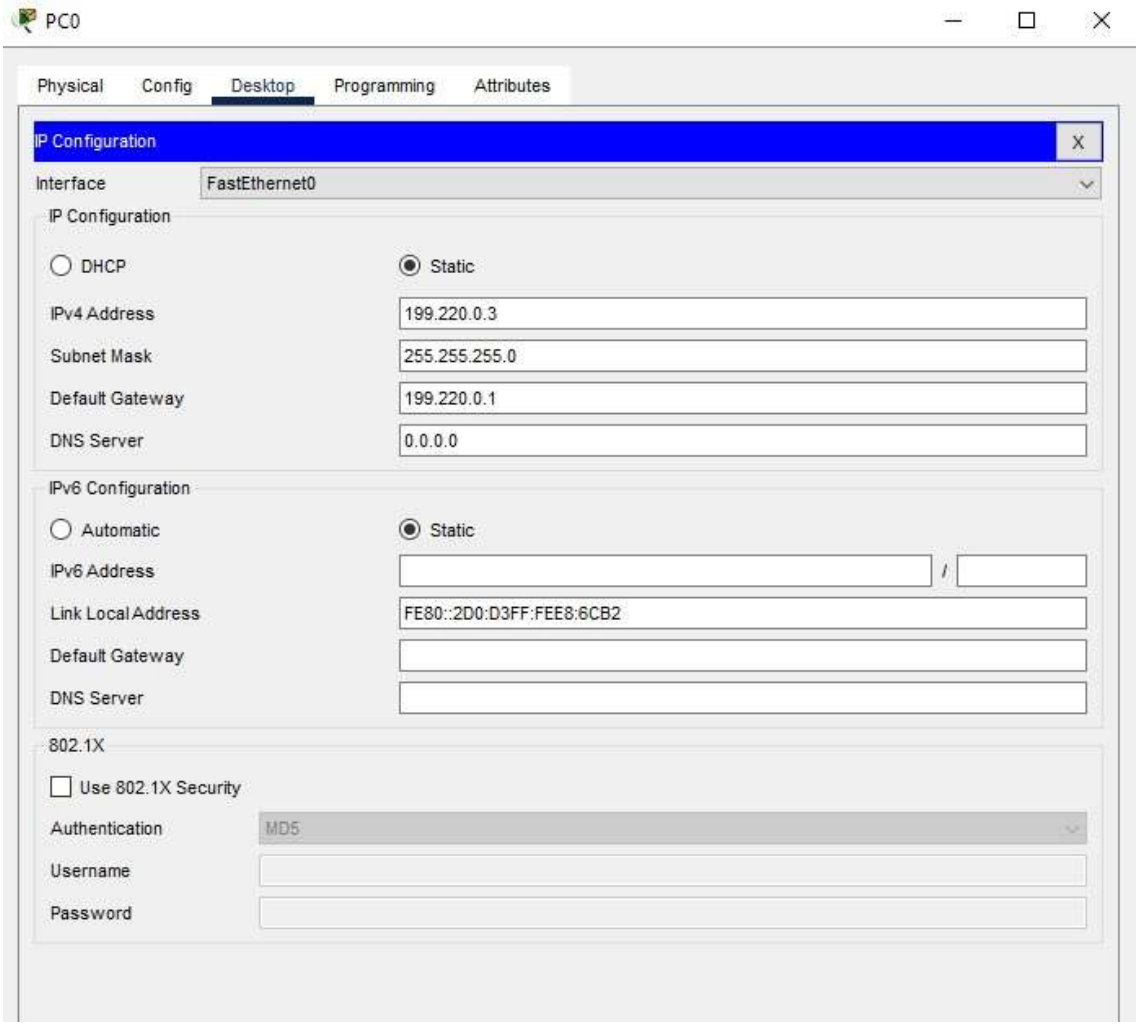
- Automatic
- Static

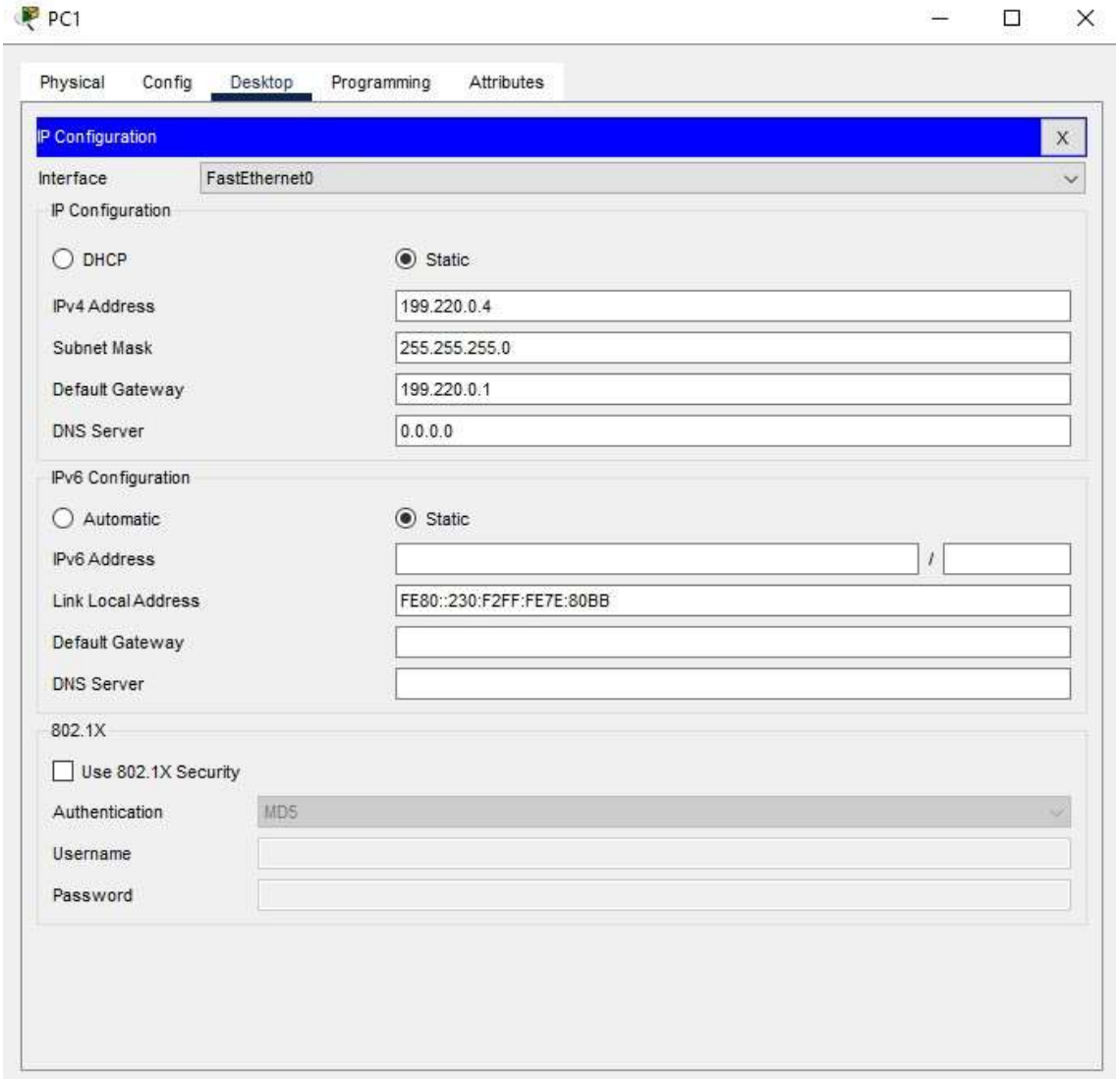
| | |
|---|---|
| IPv6 Address | / |
| Link Local Address | FE80::250:FFF:FEC1:85DC |
| Default Gateway | |
| DNS Server | |

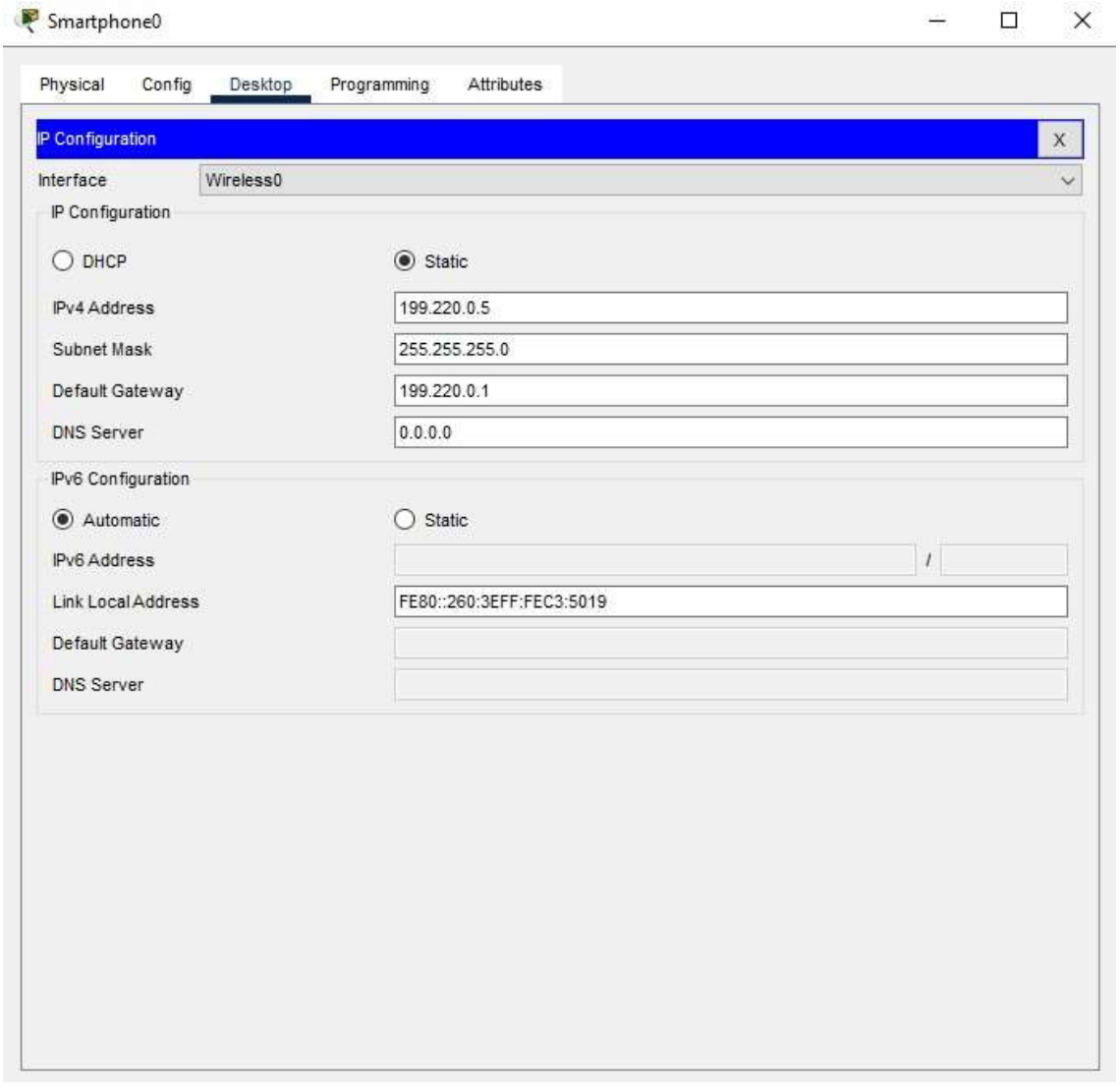
802.1X

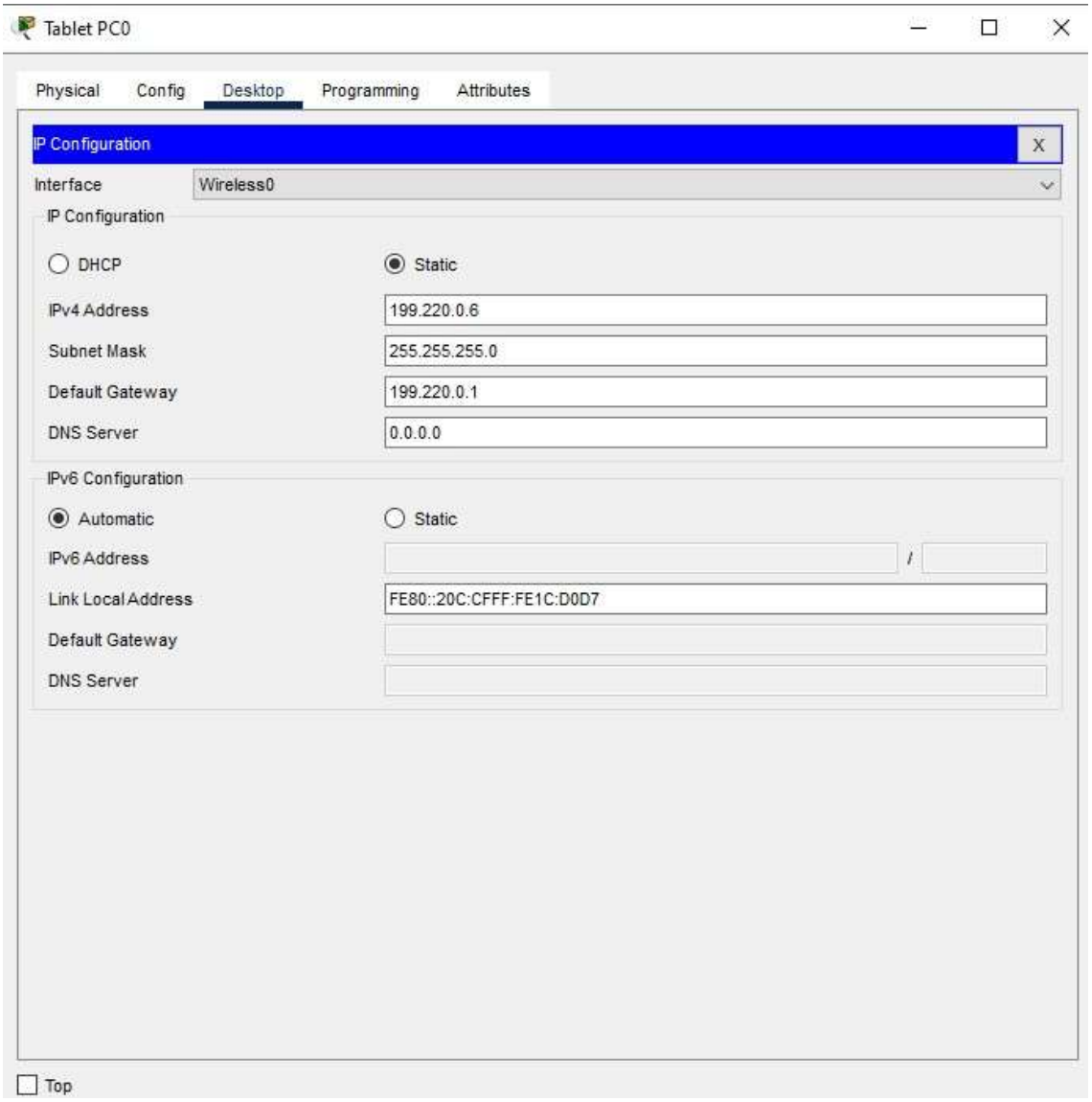
- Use 802.1X Security

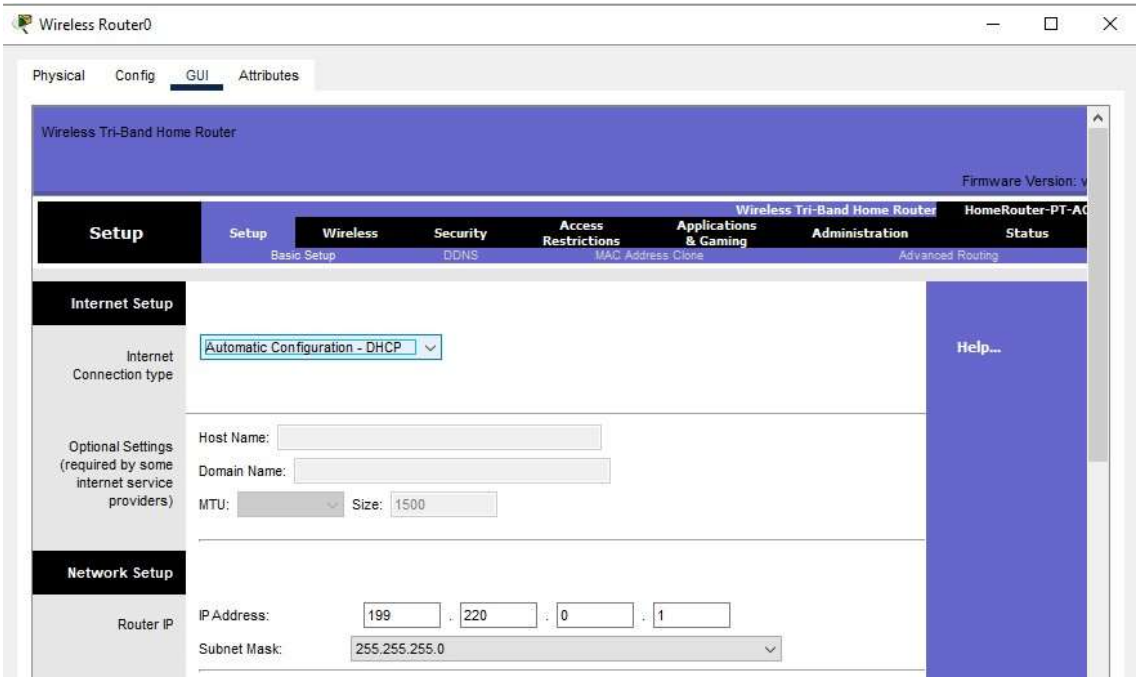
| | |
|---|---|
| Authentication | MD5 |
| Username | |
| Password | |


PC0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
199.220.0.3
Subnet Mask
255.255.255.0
Default Gateway
199.220.0.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::2D0:D3FF:FEE8:6CB2
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password


PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
199.220.0.4
Subnet Mask
255.255.255.0
Default Gateway
199.220.0.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::230:F2FF:FE7E:80BB
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password


Smartphone0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
Wireless0
IP Configuration
DHCP
Static
IPv4 Address
199.220.0.5
Subnet Mask
255.255.255.0
Default Gateway
199.220.0.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::260:3EFF:FEC3:5019
Default Gateway
DNS Server


Tablet PC0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
Wireless0
IP Configuration
DHCP
Static
IPv4 Address
199.220.0.6
Subnet Mask
255.255.255.0
Default Gateway
199.220.0.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::20C:CFFF:FE1C:D0D7
Default Gateway
DNS Server
Top


Wireless Router0
Physical
Config
GUI
Attributes
Wireless Tri-Band Home Router
Firmware Version:
Setup
Setup
Wireless
Security
Access Restrictions
Applications & Gaming
Administration
Status
Basic Setup
DDNS
MAC Address Clone
Advanced Routing
Internet Setup
Internet Connection type
Automatic Configuration - DHCP
Help...
Optional Settings (required by some internet service providers)
Host Name:
Domain Name:
MTU:
Size:
1500
Network Setup
Router IP
IP Address:
199
220
0
1
Subnet Mask:
255.255.255.0

## Practical 5

**AIM:-** Using cpt, create wireless network of multiple hosts using appropriate access point.

**DESCRIPTION**

**Access Point:**
An access point extends a wired network by creating a wireless one. It doesn't route traffic— it simply provides a place for wireless devices to connect.
**Functionality includes:**

Converts wired Ethernet signals into wireless signals

Allows multiple wireless devices to connect to a LAN

Supports roaming between APs in larger setups

Often used in enterprise networks for wide coverage

**Router**
A router is the brain of your network—it directs traffic between your local devices and the internet.
**Functionality includes:**

Assigns IP addresses to devices via DHCP

Routes data packets between networks

Provides firewall protection and NAT (Network Address Translation)

Often includes built-in Wi-Fi (acts as an Access point too)

Manages bandwidth and prioritizes traffic

**Repeater**
A repeater's job is simple: take a weak signal and make it strong again. It doesn't manage traffic or assign IPs—it just boosts range. **Functionality includes:**

Receives and retransmits Wi-Fi signals

Extends coverage into dead zones

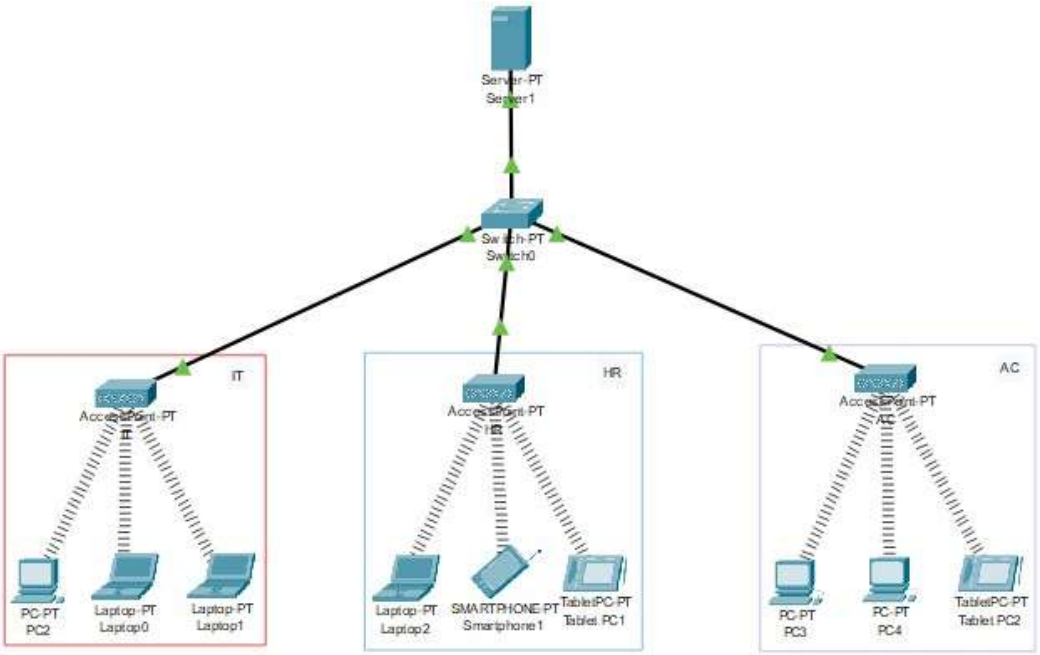
Doesn't create a new network—just repeats the existing one

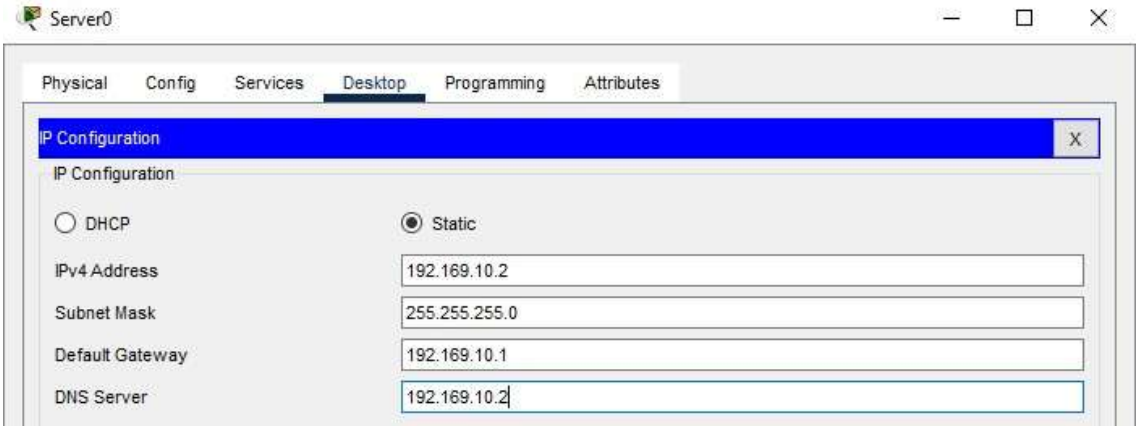
May reduce speed due to signal duplication.

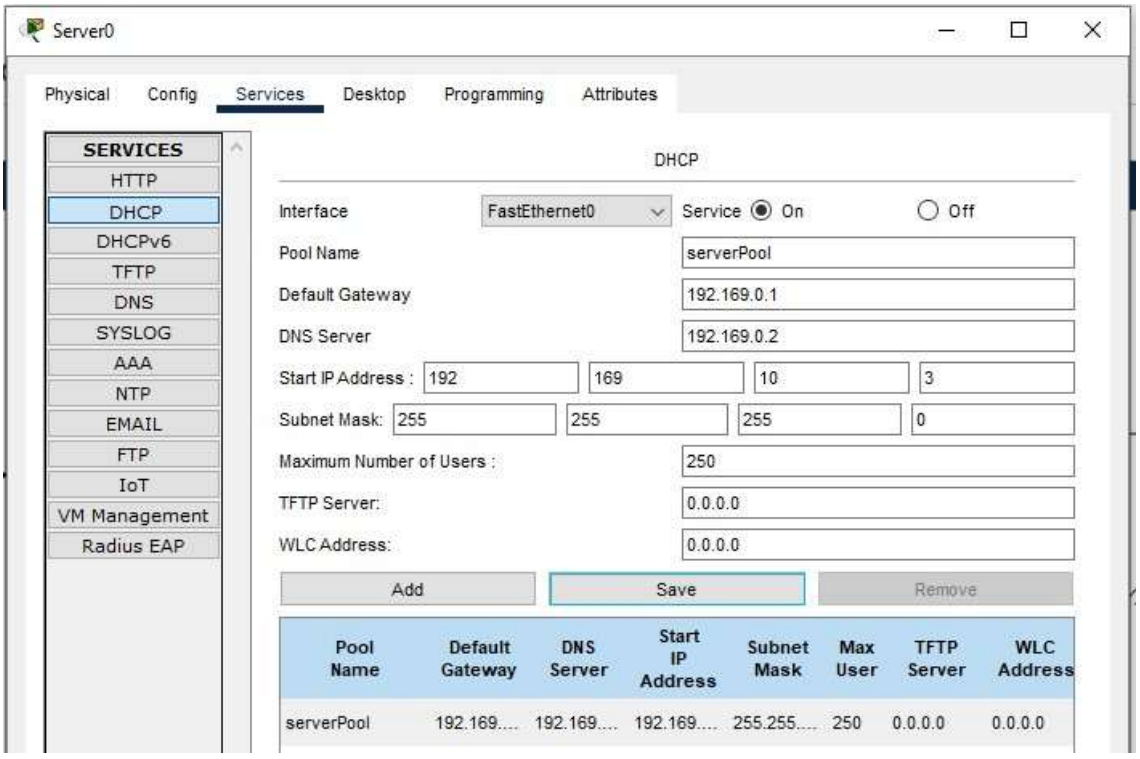
**DIFFERENCE BETWEEN:**

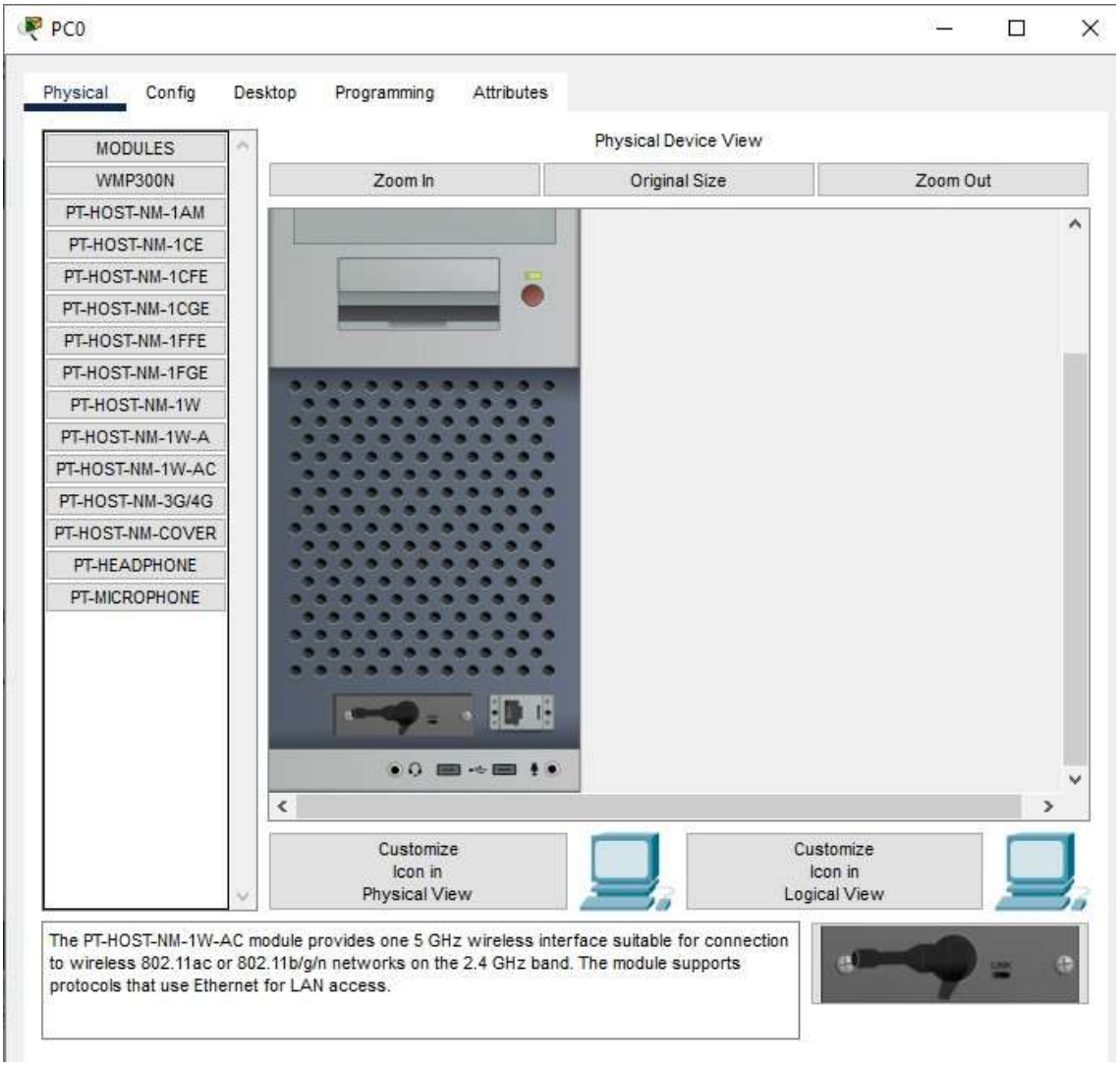
| Feature | Access Point | Router | Repeater |
|---|---|---|---|
| **Main Function** | Creates a wireless network from wired | Connects local network to internet | Extends existing Wi-Fi signal |
| **IP Address Assignment** | No (relies on router) | Yes (acts as DHCP server) | No |
| **Connection Type** | Wired to router/switch | Wired to modem/internet source | Wireless to router |
| **Wireless Coverage** | Expands coverage in large areas | Provides Wi-Fi and wired connections | Boosts signal in weak zones |
| **Speed Impact** | High performance | Depends on router quality | May reduce speed due to duplication |
| **Ideal Use Case** | Offices, large homes | Home or office internet gateway | Fixing Wi-Fi dead zones |

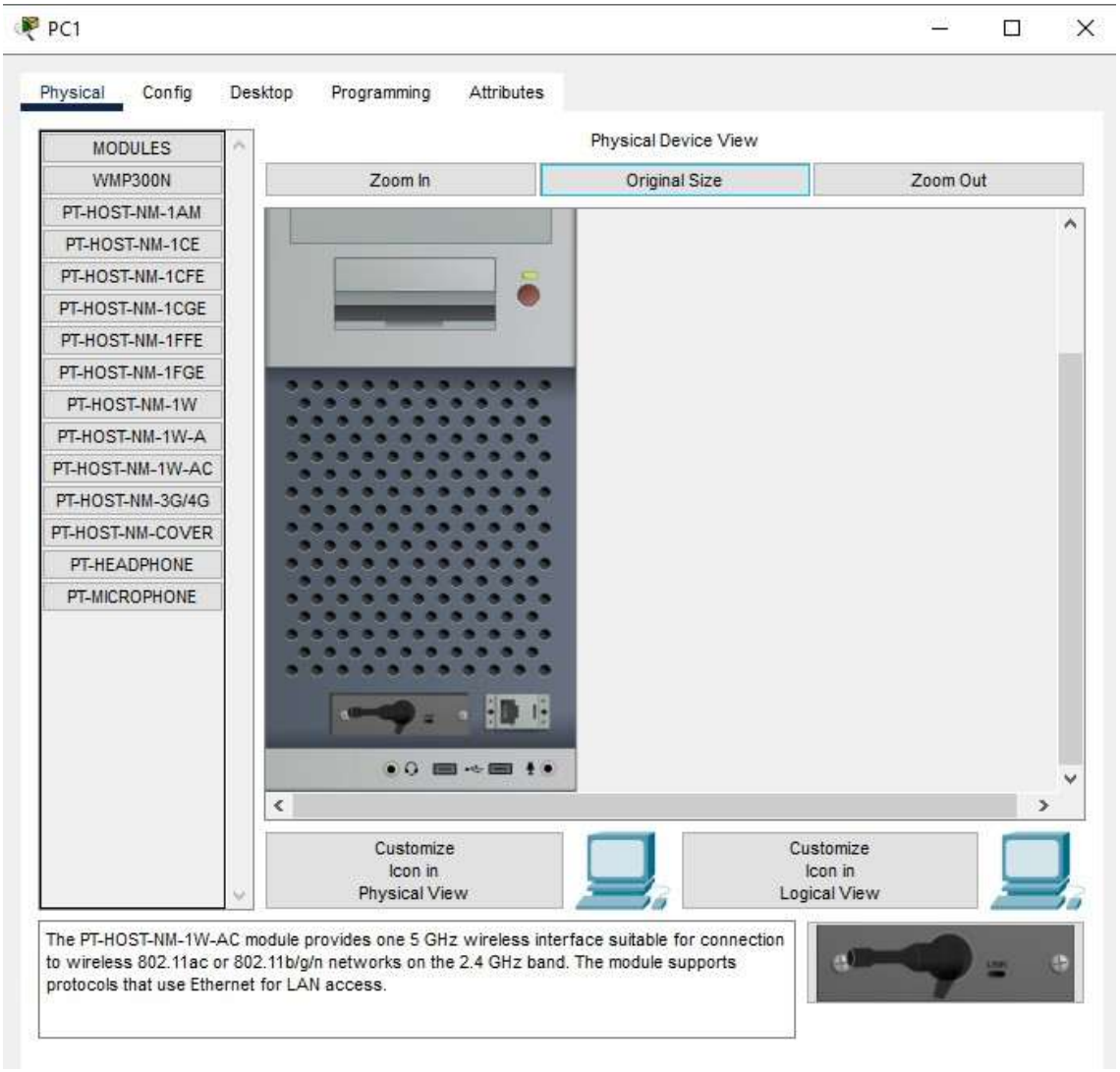
**OUTPUT:**


Server-PT
Server1
Switch-PT
Switch0
IT
Access Point-PT
PC-PT
PC2
Laptop-PT
Laptop0
Laptop-PT
Laptop1
HR
Access Point-PT
HR
Laptop-PT
Laptop2
SMARTPHONE-PT
Smartphone1
TabletPC-PT
Tablet PC1
AC
Access Point-PT
AC
PC-PT
PC3
PC-PT
PC4
TabletPC-PT
Tablet PC2


Server0
Physical
Config
Services
Desktop
Programming
Attributes
IP Configuration
X
IP Configuration
DHCP
Static
IPv4 Address
192.169.10.2
Subnet Mask
255.255.255.0
Default Gateway
192.169.10.1
DNS Server
192.169.10.2

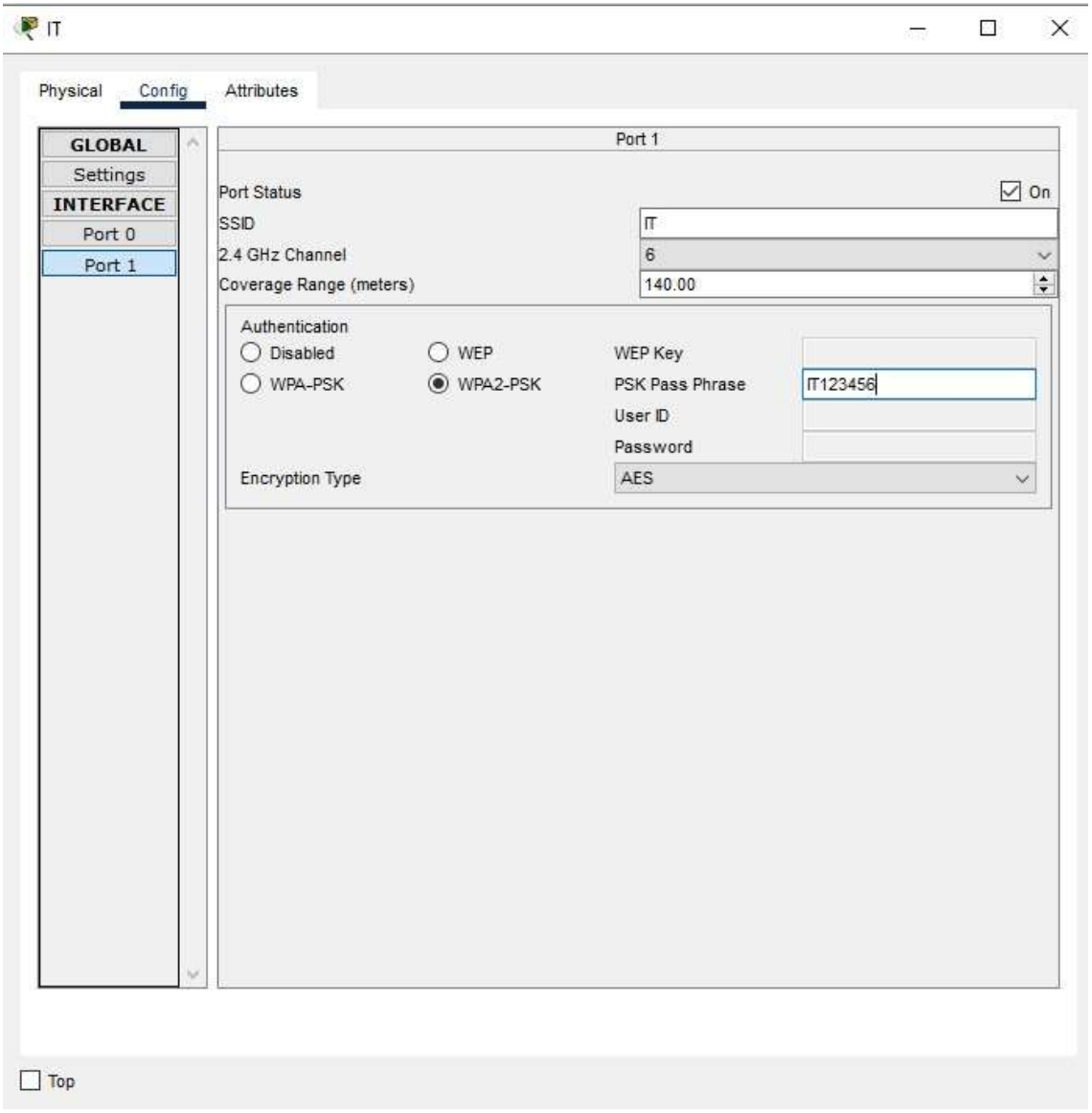

Server0
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
DHCP
Interface
FastEthernet0
Service
On
Off
Pool Name
serverPool
Default Gateway
192.169.0.1
DNS Server
192.169.0.2
Start IP Address :
192
169
10
3
Subnet Mask:
255
255
255
0
Maximum Number of Users :
250
TFTP Server:
0.0.0.0
WLC Address:
0.0.0.0
Add
Save
Remove
Pool Name
Default Gateway
DNS Server
Start IP Address
Subnet Mask
Max User
TFTP Server
WLC Address
serverPool
192.169....
192.169....
192.169....
255.255....
250
0.0.0.0
0.0.0.0

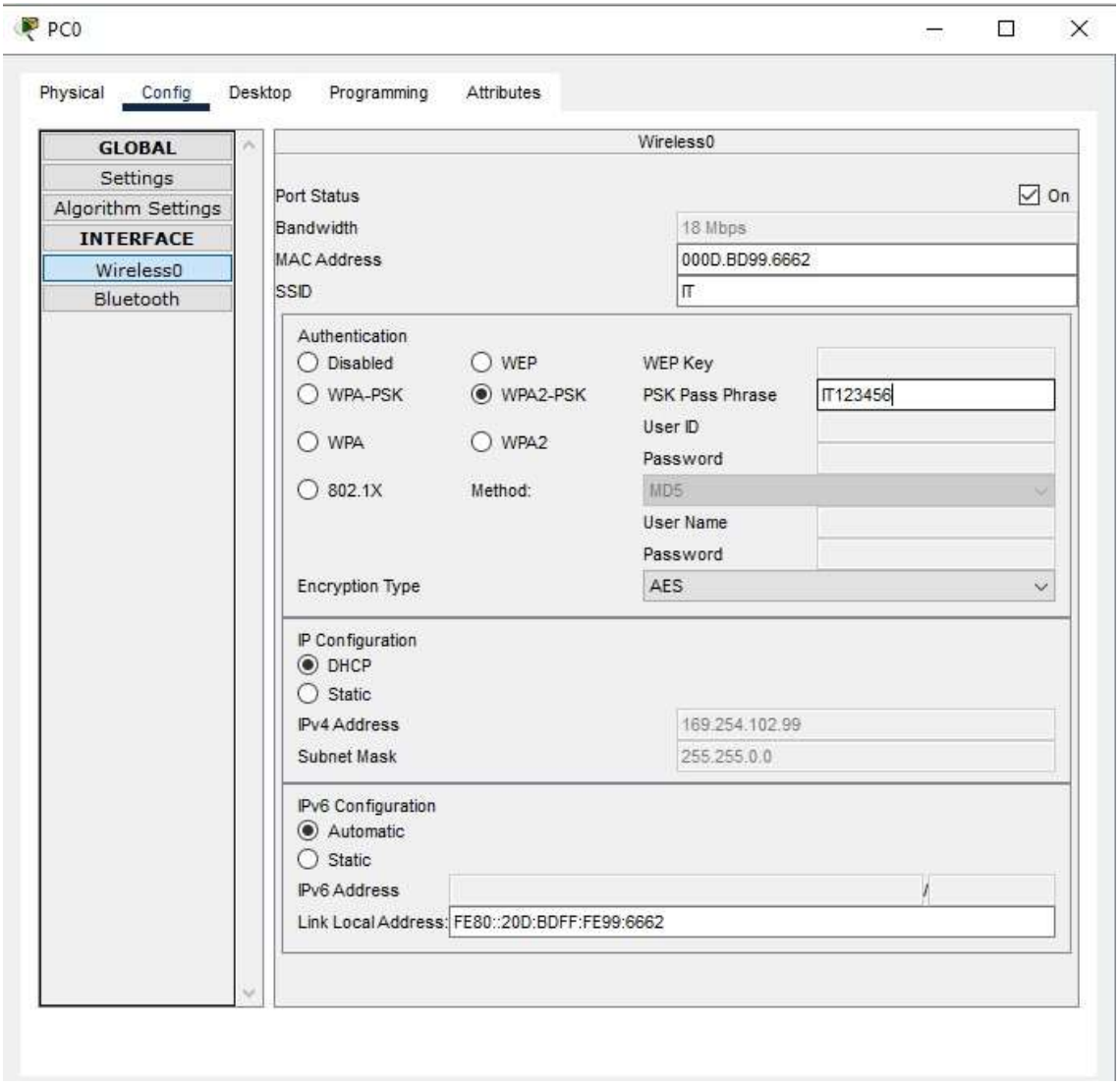

PC0
Physical
Config
Desktop
Programming
Attributes
MODULES
WMP300N
PT-HOST-NM-1AM
PT-HOST-NM-1CE
PT-HOST-NM-1CFE
PT-HOST-NM-1CGE
PT-HOST-NM-1FFE
PT-HOST-NM-1FGE
PT-HOST-NM-1W
PT-HOST-NM-1W-A
PT-HOST-NM-1W-AC
PT-HOST-NM-3G/4G
PT-HOST-NM-COVER
PT-HEADPHONE
PT-MICROPHONE
Physical Device View
Zoom In
Original Size
Zoom Out
Customize Icon in Physical View
Customize Icon in Logical View
The PT-HOST-NM-1W-AC module provides one 5 GHz wireless interface suitable for connection to wireless 802.11ac or 802.11b/g/n networks on the 2.4 GHz band. The module supports protocols that use Ethernet for LAN access.

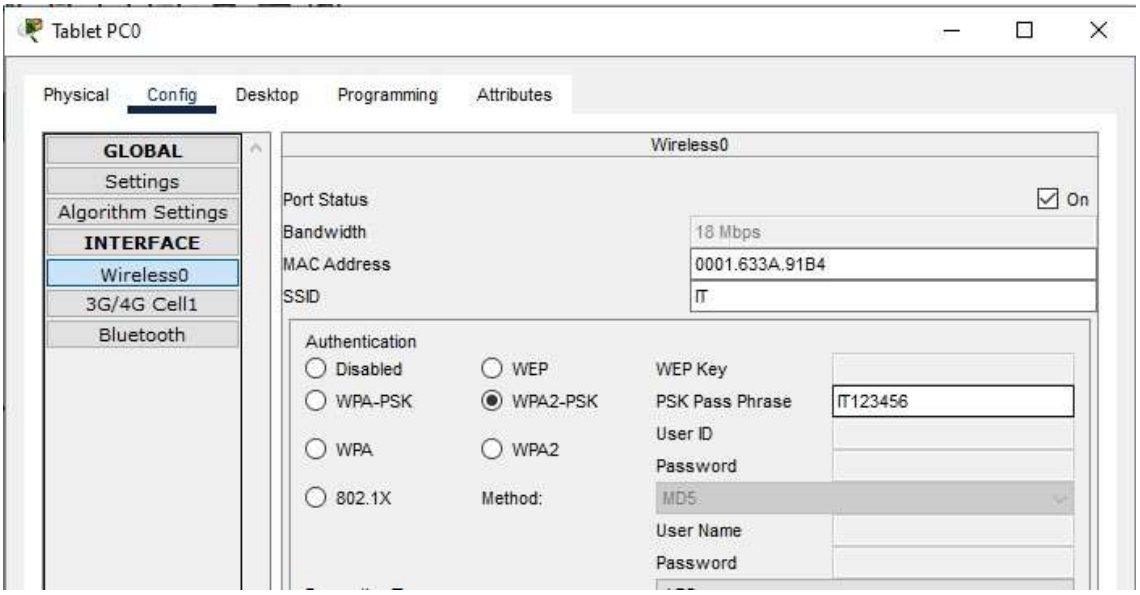

PC1
Physical
Config
Desktop
Programming
Attributes
MODULES
WMP300N
PT-HOST-NM-1AM
PT-HOST-NM-1CE
PT-HOST-NM-1CFE
PT-HOST-NM-1CGE
PT-HOST-NM-1FFE
PT-HOST-NM-1FGE
PT-HOST-NM-1W
PT-HOST-NM-1W-A
PT-HOST-NM-1W-AC
PT-HOST-NM-3G/4G
PT-HOST-NM-COVER
PT-HEADPHONE
PT-MICROPHONE
Physical Device View
Zoom In
Original Size
Zoom Out
Customize Icon in Physical View
Customize Icon in Logical View
The PT-HOST-NM-1W-AC module provides one 5 GHz wireless interface suitable for connection to wireless 802.11ac or 802.11b/g/n networks on the 2.4 GHz band. The module supports protocols that use Ethernet for LAN access.

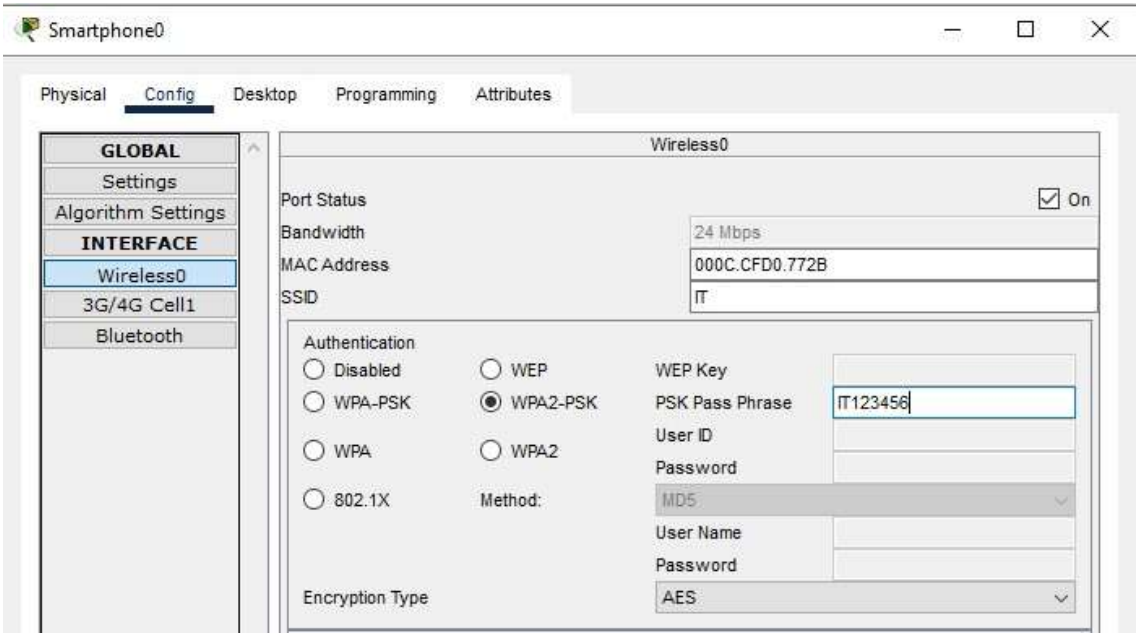

Laptop0
Physical
Config
Desktop
Programming
Attributes
MODULES
WPC300N
PT-LAPTOP-NM-1AM
PT-LAPTOP-NM-1CE
PT-LAPTOP-NM-1CFE
PT-LAPTOP-NM-1CGE
PT-LAPTOP-NM-1FFE
PT-LAPTOP-NM-1FGE
PT-LAPTOP-NM-1W
PT-LAPTOP-NM-1W-A
PT-LAPTOP-NM-1W-AC
PT-LAPTOP-NM-3G/4G
PT-HEADPHONE
PT-MICROPHONE
Physical Device View
Zoom In
Original Size
Zoom Out
Customize Icon in Physical View
Customize Icon in Logical View
The PT-LAPTOP-NM-1W-AC module provides one 5 GHz wireless interface suitable for connection to wireless 802.11ac or 802.11b/g/n networks on the 2.4 GHz band. The module supports protocols that use Ethernet for LAN access.

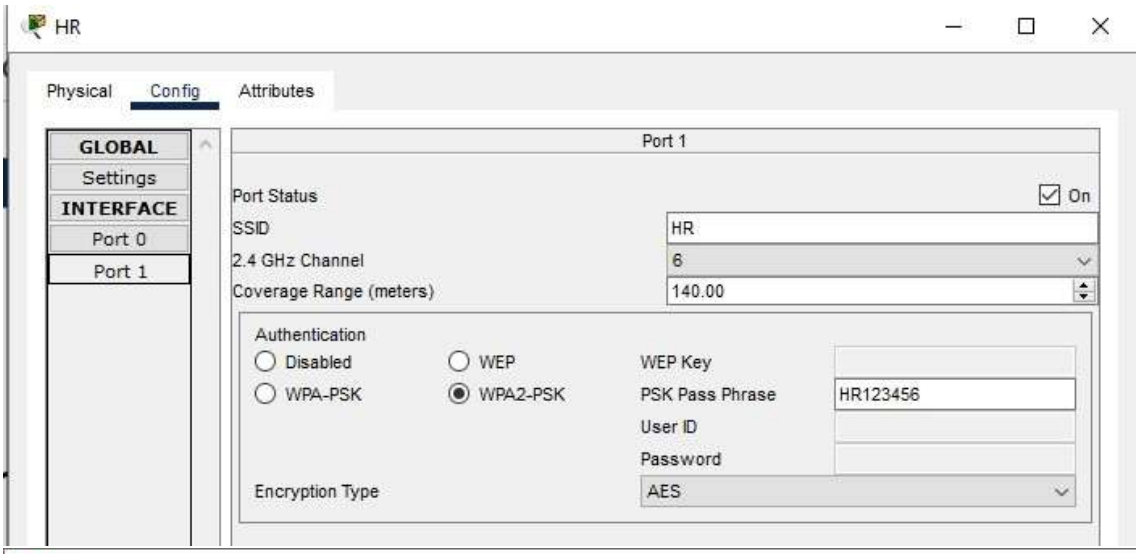

Laptop1
Physical
Config
Desktop
Programming
Attributes
MODULES
WPC300N
PT-LAPTOP-NM-1AM
PT-LAPTOP-NM-1CE
PT-LAPTOP-NM-1CFE
PT-LAPTOP-NM-1CGE
PT-LAPTOP-NM-1FFE
PT-LAPTOP-NM-1FGE
PT-LAPTOP-NM-1W
PT-LAPTOP-NM-1W-A
PT-LAPTOP-NM-1W-AC
PT-LAPTOP-NM-3G/4G
PT-HEADPHONE
PT-MICROPHONE
Physical Device View
Zoom In
Original Size
Zoom Out
Customize Icon in Physical View
Customize Icon in Logical View
The PT-LAPTOP-NM-1W-AC module provides one 5 GHz wireless interface suitable for connection to wireless 802.11ac or 802.11b/g/n networks on the 2.4 GHz band. The module supports protocols that use Ethernet for LAN access.

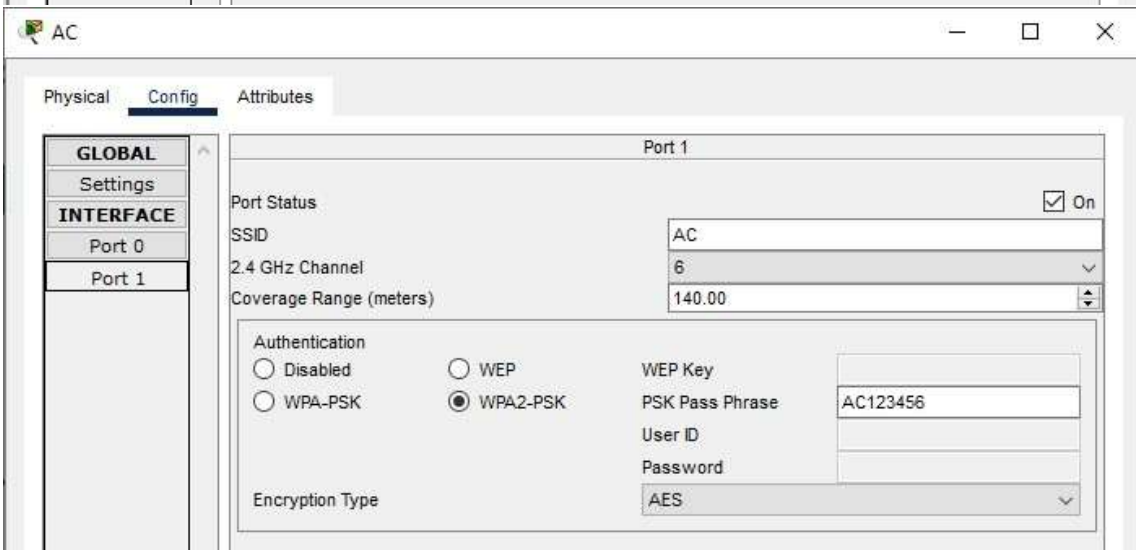

IT
Physical
Config
Attributes
GLOBAL
Settings
INTERFACE
Port 0
Port 1
Port 1
Port Status
On
SSID
IT
2.4 GHz Channel
6
Coverage Range (meters)
140.00
Authentication
Disabled
WEP
WPA-PSK
WPA2-PSK
WEP Key
PSK Pass Phrase
IT123456
User ID
Password
Encryption Type
AES
Top


PC0
Physical
Config
Desktop
Programming
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
Wireless0
Bluetooth
Wireless0
Port Status
On
Bandwidth
18 Mbps
MAC Address
000D.BD99.6662
SSID
IT
Authentication
Disabled
WEP
WPA-PSK
WPA2-PSK
WPA
WPA2
802.1X
Method:
MD5
WEP Key
PSK Pass Phrase
IT123456
User ID
Password
User Name
Password
Encryption Type
AES
IP Configuration
DHCP
Static
IPv4 Address
169.254.102.99
Subnet Mask
255.255.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address:
FE80::20D:BDFF:FE99:6662


Tablet PC0
Physical
Config
Desktop
Programming
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
Wireless0
3G/4G Cell1
Bluetooth
Wireless0
Port Status
On
Bandwidth
18 Mbps
MAC Address
0001.633A.91B4
SSID
IT
Authentication
Disabled
WEP
WPA-PSK
WPA2-PSK
WPA
WPA2
802.1X
Method:
MD5
WEP Key
PSK Pass Phrase
IT123456
User ID
Password
User Name
Password


Smartphone0
Physical
Config
Desktop
Programming
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
Wireless0
3G/4G Cell1
Bluetooth
Wireless0
Port Status
On
Bandwidth
24 Mbps
MAC Address
000C.CFD0.772B
SSID
IT
Authentication
Disabled
WEP
WPA-PSK
WPA2-PSK
WPA
WPA2
802.1X
Method:
MD5
WEP Key
PSK Pass Phrase
IT123456
User ID
Password
User Name
Password
Encryption Type
AES


HR
Physical
Config
Attributes
GLOBAL
Settings
INTERFACE
Port 0
Port 1
Port 1
Port Status
On
SSID
HR
2.4 GHz Channel
6
Coverage Range (meters)
140.00
Authentication
Disabled
WEP
WPA-PSK
WPA2-PSK
WEP Key
PSK Pass Phrase
HR123456
User ID
Password
Encryption Type
AES


AC
Physical
Config
Attributes
GLOBAL
Settings
INTERFACE
Port 0
Port 1
Port 1
Port Status
On
SSID
AC
2.4 GHz Channel
6
Coverage Range (meters)
140.00
Authentication
Disabled
WEP
WPA-PSK
WPA2-PSK
WEP Key
PSK Pass Phrase
AC123456
User ID
Password
Encryption Type
AES

## Practical 6

**Aim: -** Create a network with a router that connect 2 LANs.

**Description:-**

In this practical, we aim to create a computer network in which two separate Local Area Networks (LANs) are connected through a single router. The router acts as an intermediary device that allows communication between the two LANs while each LAN operates independently with its own set of devices and IP addresses.

The setup involves one router, two switches, and a total of six personal computers (PCs). Three PCs are placed on the left side, forming LAN 1, and the other three are placed on the right side, forming LAN 2. Each LAN is connected through its own switch. Switches are used to interconnect multiple PCs within the same network segment, allowing them to communicate with each other.

For LAN 1, the network address used is 193.162.10.0 with a subnet mask of 255.255.255.0. The router interface that connects to this LAN is assigned the IP address 193.162.10.1, which also serves as the default gateway for all the PCs in LAN 1. Each of the three PCs in LAN 1 is assigned a unique IP address within this range, such as 193.162.10.2, 193.162.10.3, and 193.162.10.4. These PCs are configured to use the router's interface IP (193.162.10.1) as their default gateway. This means that any traffic from these PCs destined for outside their network will be forwarded to the router.

On the other side, LAN 2 uses a different network address, which is 193.162.20.0 with the same subnet mask of 255.255.255.0. The router's second interface is connected to this LAN and is assigned the IP address 193.162.20.1, serving as the default gateway for LAN 2. The three PCs in this LAN are given the IP addresses 193.162.20.2, 193.162.20.3, and 193.162.20.4. Like LAN 1, each of these PCs uses the router's interface IP (193.162.20.1) as their default gateway.

The router is the key device in this setup because it has two interfaces—each one connected to a different LAN. This allows it to route data between the two networks. Since each interface of the router is assigned an IP address that falls within the respective network range, it can communicate with the devices in both LANs.

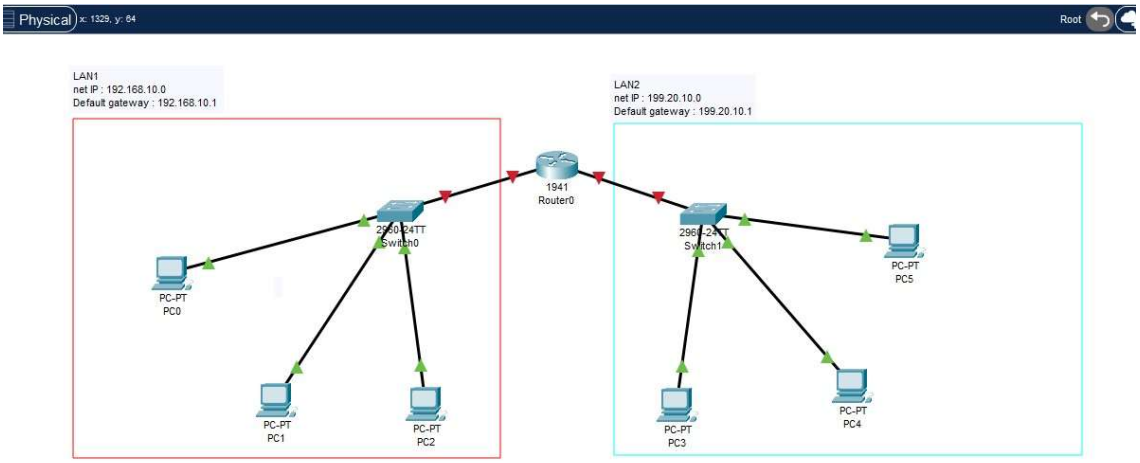
After connecting all devices and configuring the IP addresses and default gateways correctly, communication is tested. PCs within the same LAN should be able to communicate with each other without any issue. Furthermore,

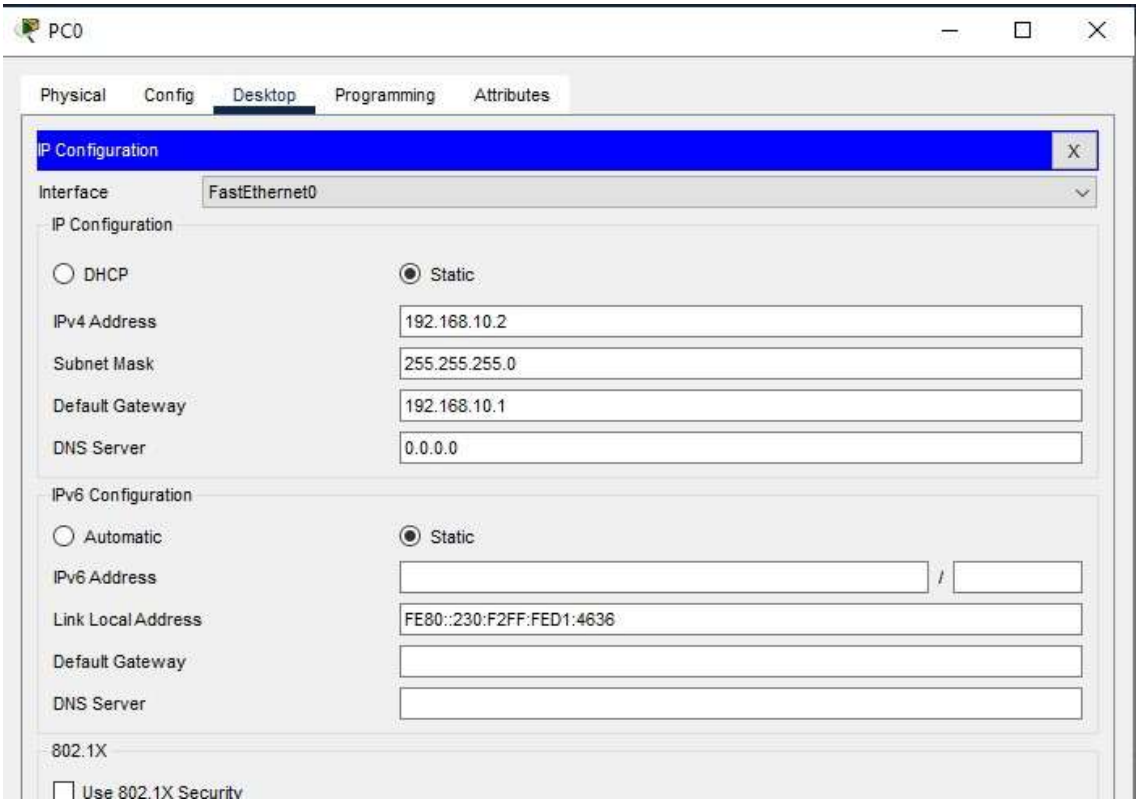
communication between devices in LAN 1 and LAN 2 should also be successful because the router is properly routing packets between the two networks.

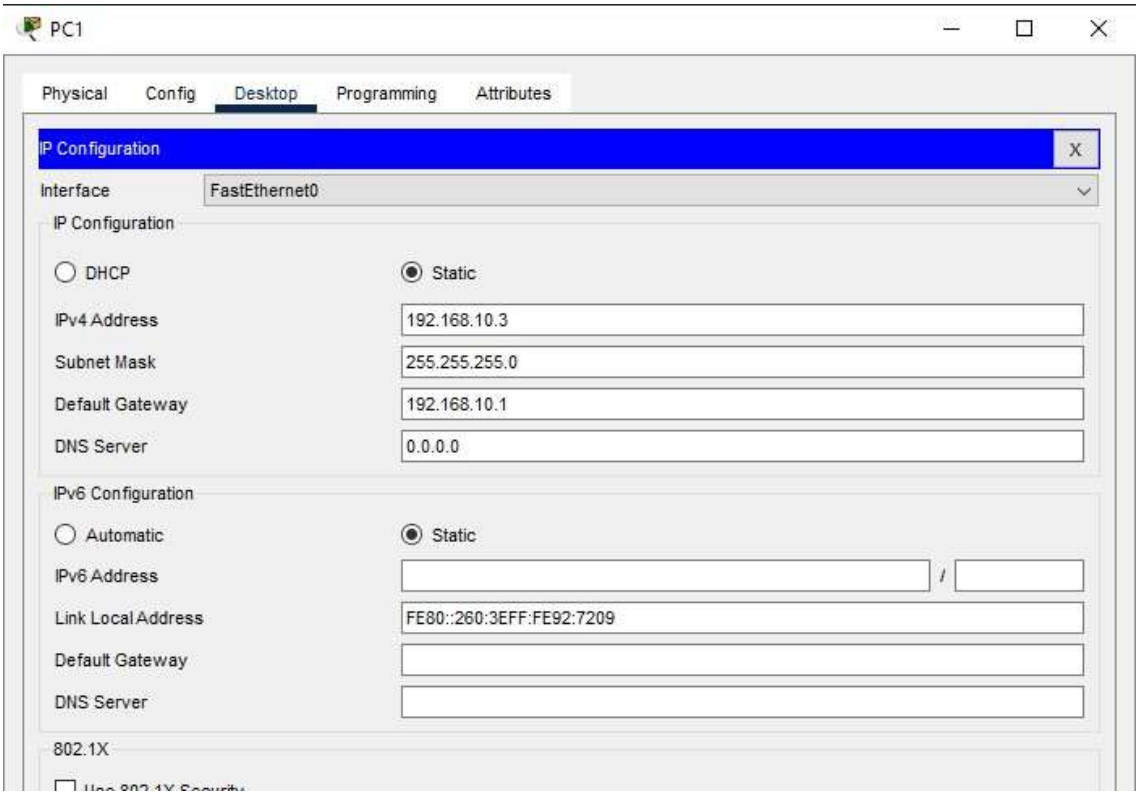
This kind of setup is commonly used in real-world scenarios where different departments or floors in an organization need to be kept on separate networks for security or organizational reasons, but still require the ability to communicate with each other when needed. The use of subnetting helps isolate and manage the traffic, and the router provides the necessary pathway for inter-network communication.

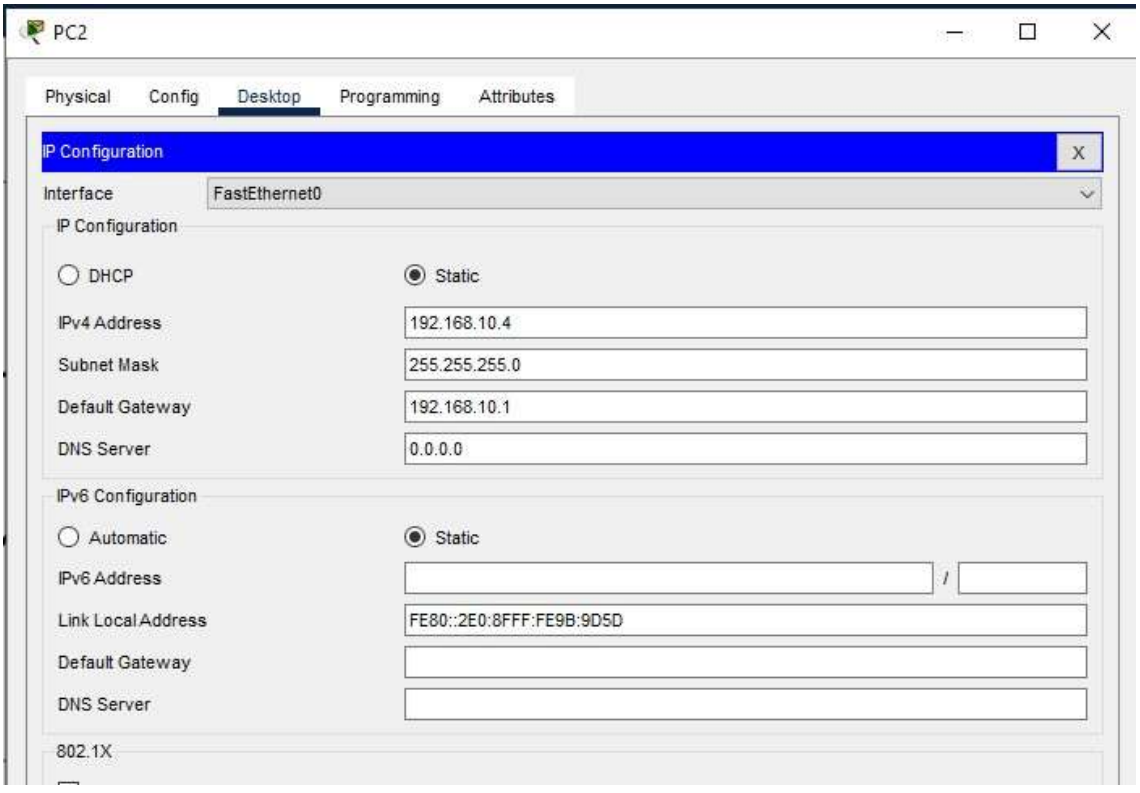
This practical helps in understanding how IP addressing, default gateways, switches, and routers work together to build a basic routed network between two different LANs.

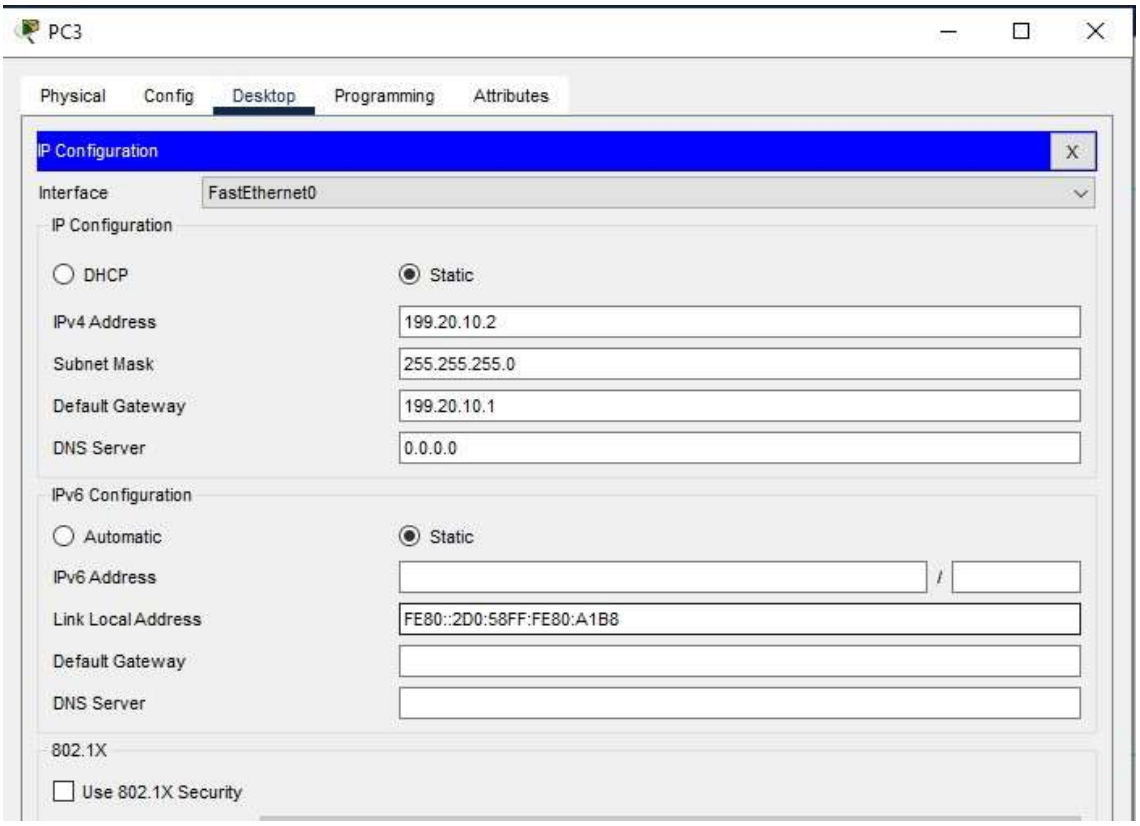
**Network Topology:-**

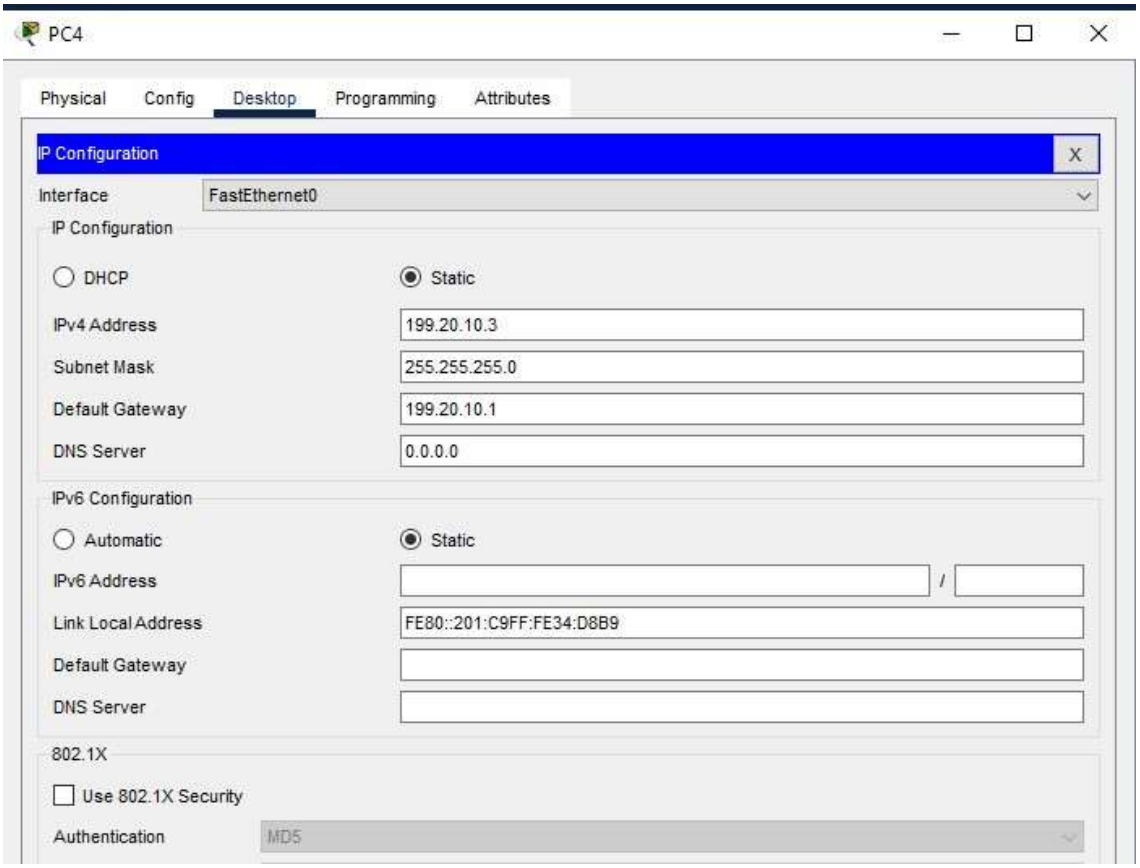

Physical
x: 1329, y: 64
Root
LAN1
net IP : 192.168.10.0
Default gateway : 192.168.10.1
LAN2
net IP : 199.20.10.0
Default gateway : 199.20.10.1
1941
Router0
2960-24TT
Switch0
2960-24TT
Switch1
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
PC-PT
PC3
PC-PT
PC4
PC-PT
PC5

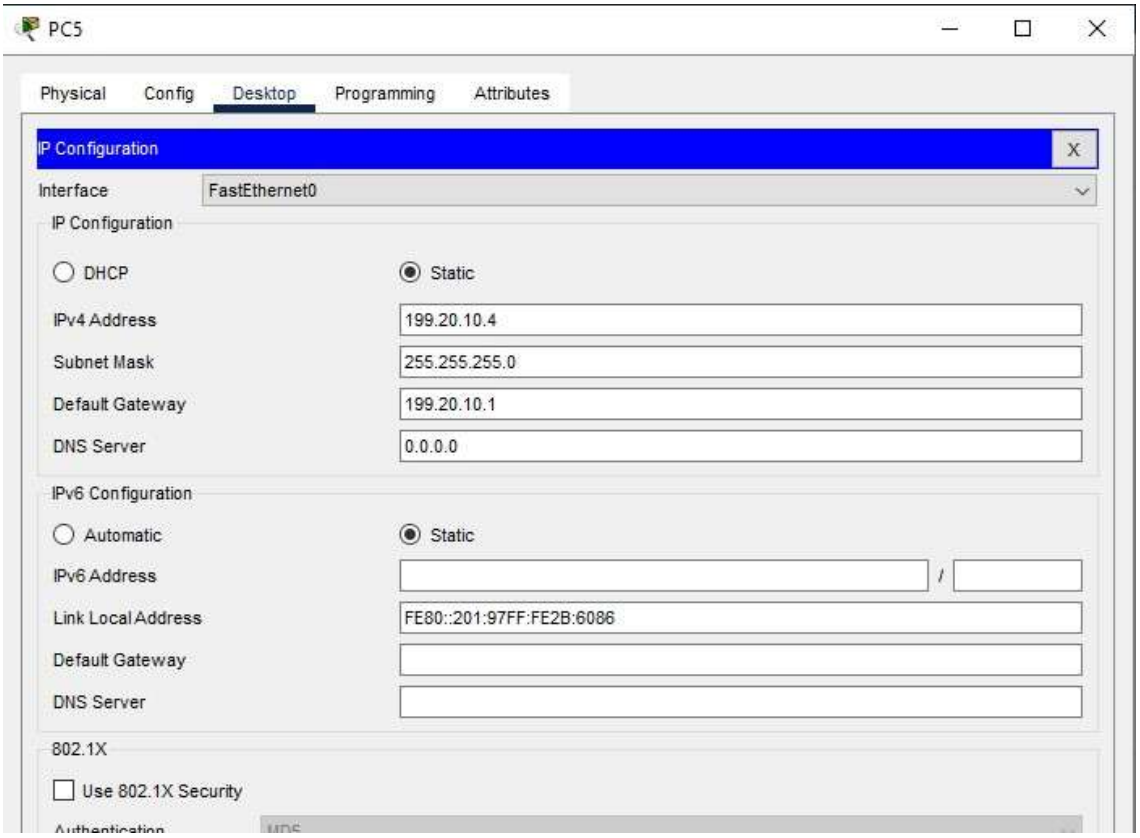

PC0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.10.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.10.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::230:F2FF:FED1:4636
Default Gateway
DNS Server
802.1X
Use 802.1X Security

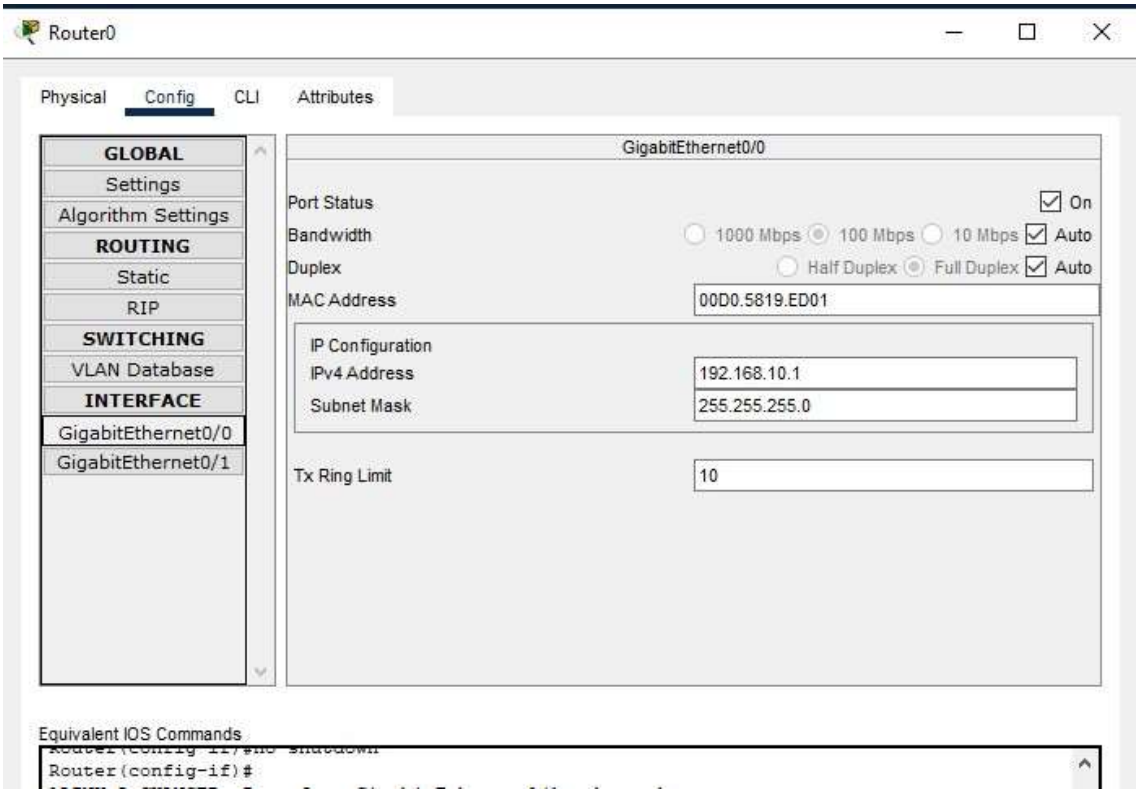

PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.10.3
Subnet Mask
255.255.255.0
Default Gateway
192.168.10.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::260:3EFF:FE92:7209
Default Gateway
DNS Server
802.1X

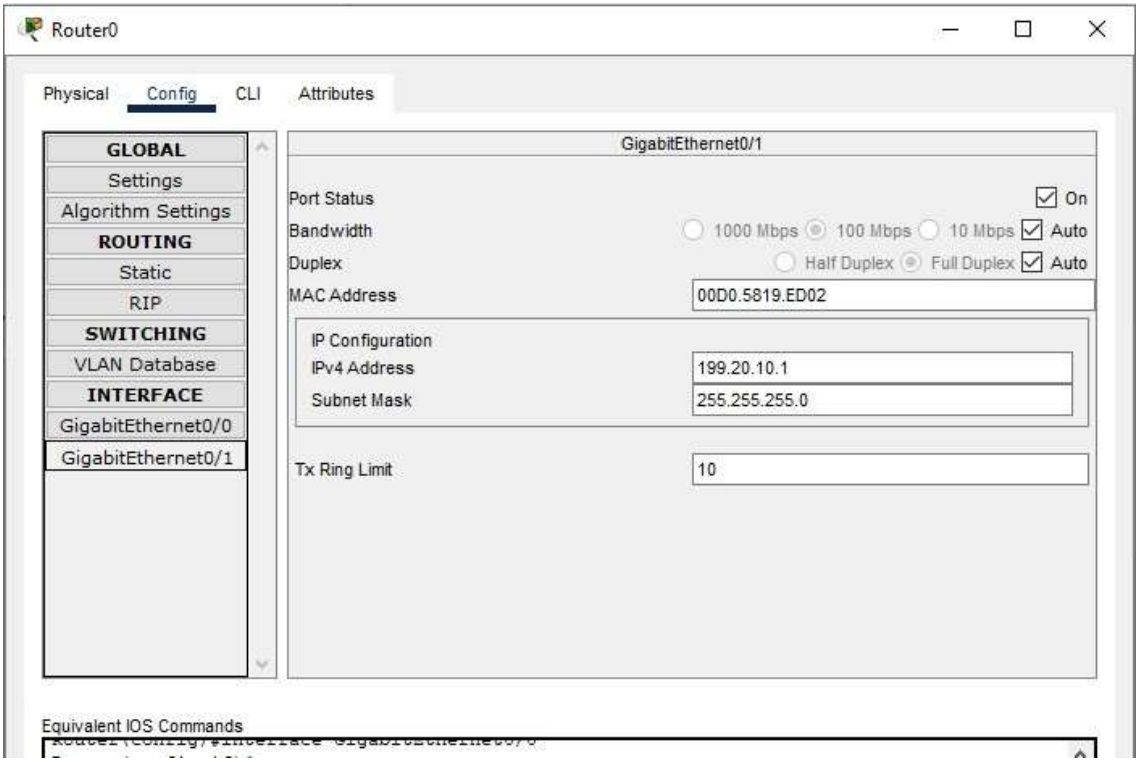

PC2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.10.4
Subnet Mask
255.255.255.0
Default Gateway
192.168.10.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::2E0:8FFF:FE9B:9D5D
Default Gateway
DNS Server
802.1X


PC3
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
199.20.10.2
Subnet Mask
255.255.255.0
Default Gateway
199.20.10.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::2D0:58FF:FE80:A1B8
Default Gateway
DNS Server
802.1X
Use 802.1X Security


PC4
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
199.20.10.3
Subnet Mask
255.255.255.0
Default Gateway
199.20.10.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::201:C9FF:FE34:D8B9
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5


PC5
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
199.20.10.4
Subnet Mask
255.255.255.0
Default Gateway
199.20.10.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::201:97FF:FE2B:6086
Default Gateway
DNS Server
802.1X
Use 802.1X Security


Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00D0.5819.ED01
IP Configuration
IPv4 Address
192.168.10.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands
Router(config-if)#


Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00D0.5819.ED02
IP Configuration
IPv4 Address
199.20.10.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands

## Practical 7

**Aim: -** Create a network and configure static routing.

**Description:-**

In this practical, a network was set up consisting of two separate LANs. Each LAN contained three PCs connected to a switch, and each switch was connected to a router. The two routers were connected to each other using a direct link.

Each device in the LAN was given an IP address manually (static IP). Initially, devices within the same LAN were able to communicate with one another, but communication between devices in different LANs was not possible. This is because each router only knows about the network directly connected to it.

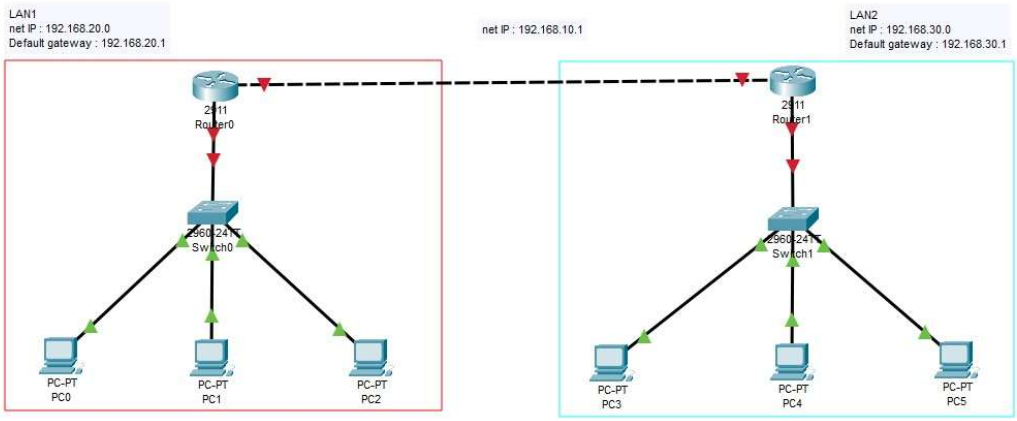
To solve this problem, static routing was configured on both routers. This means we manually informed each router about the existence of the other network and how to reach it. After configuring the routes, both LANs were able to communicate with each other.

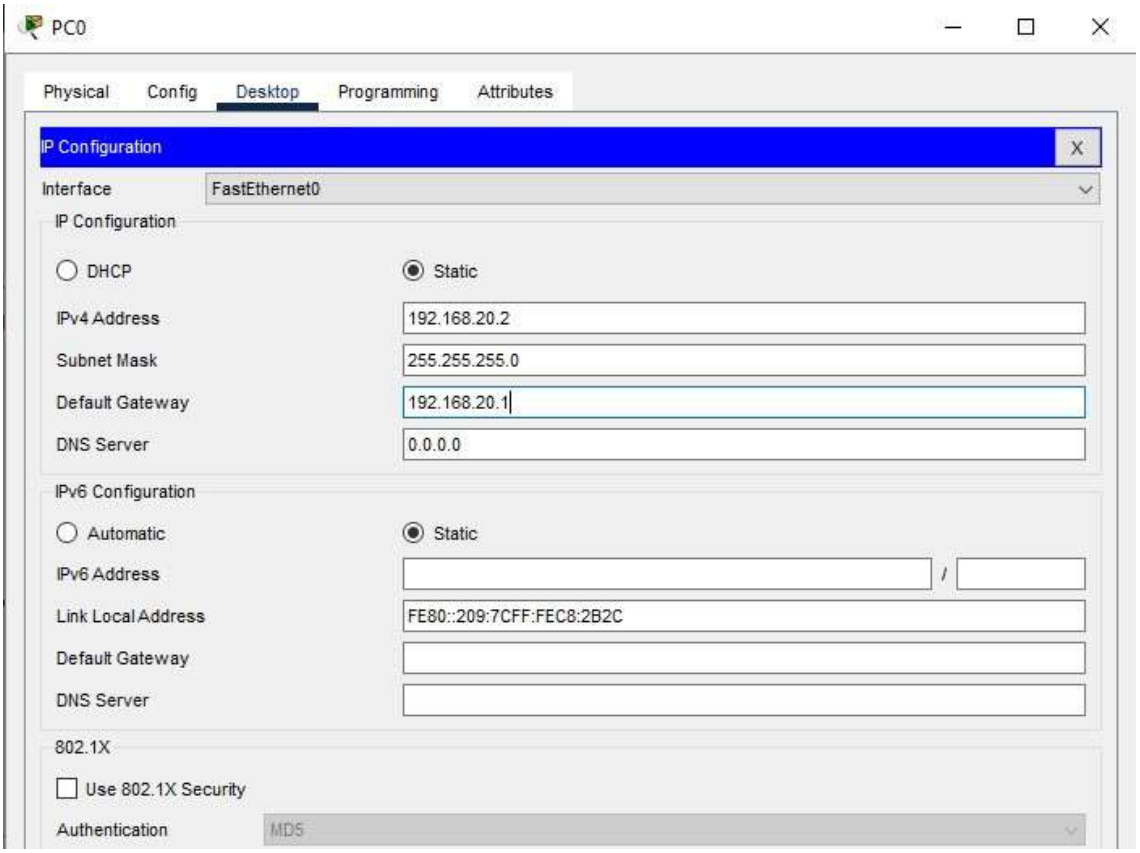
For example, a PC in the first LAN could now successfully send data to a PC in the second LAN and receive a reply. This confirmed that the routers were correctly forwarding packets using the static routes we defined.

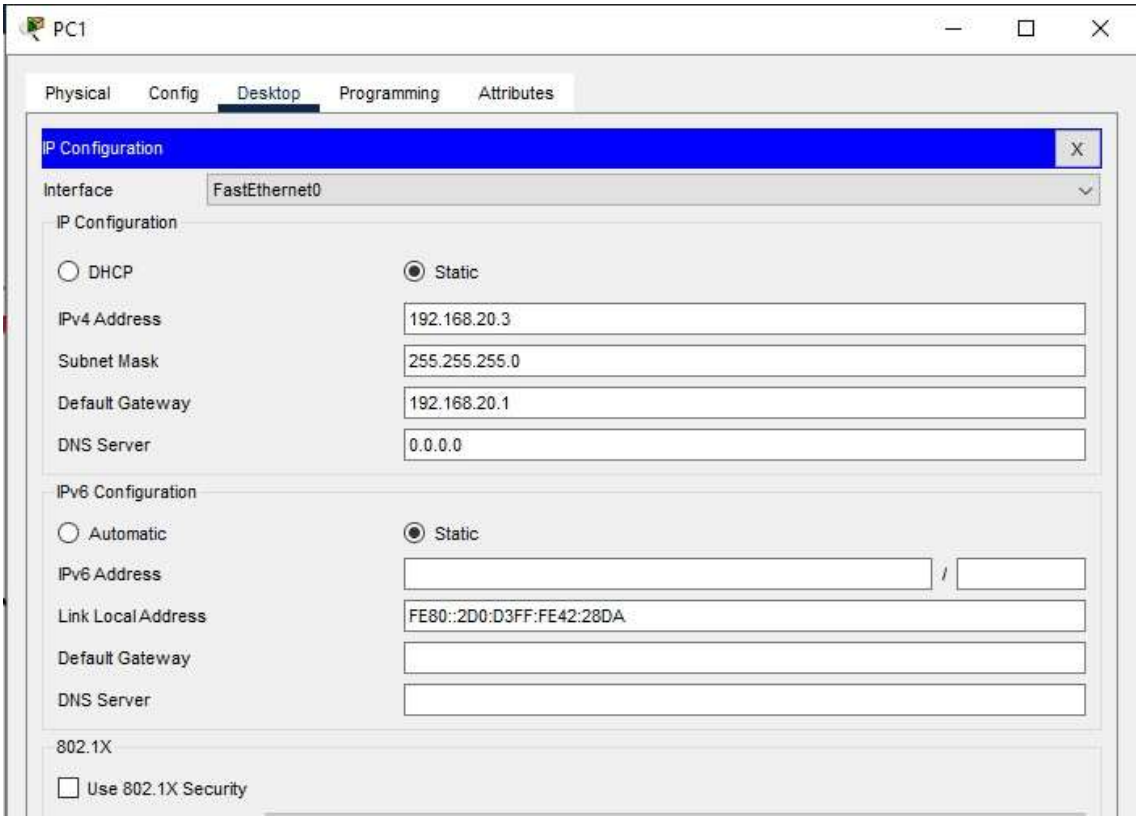
During the process, care was taken to enter commands in the correct mode of the router interface. Any mistakes in the configuration were corrected, and the settings were saved to ensure proper communication between networks.

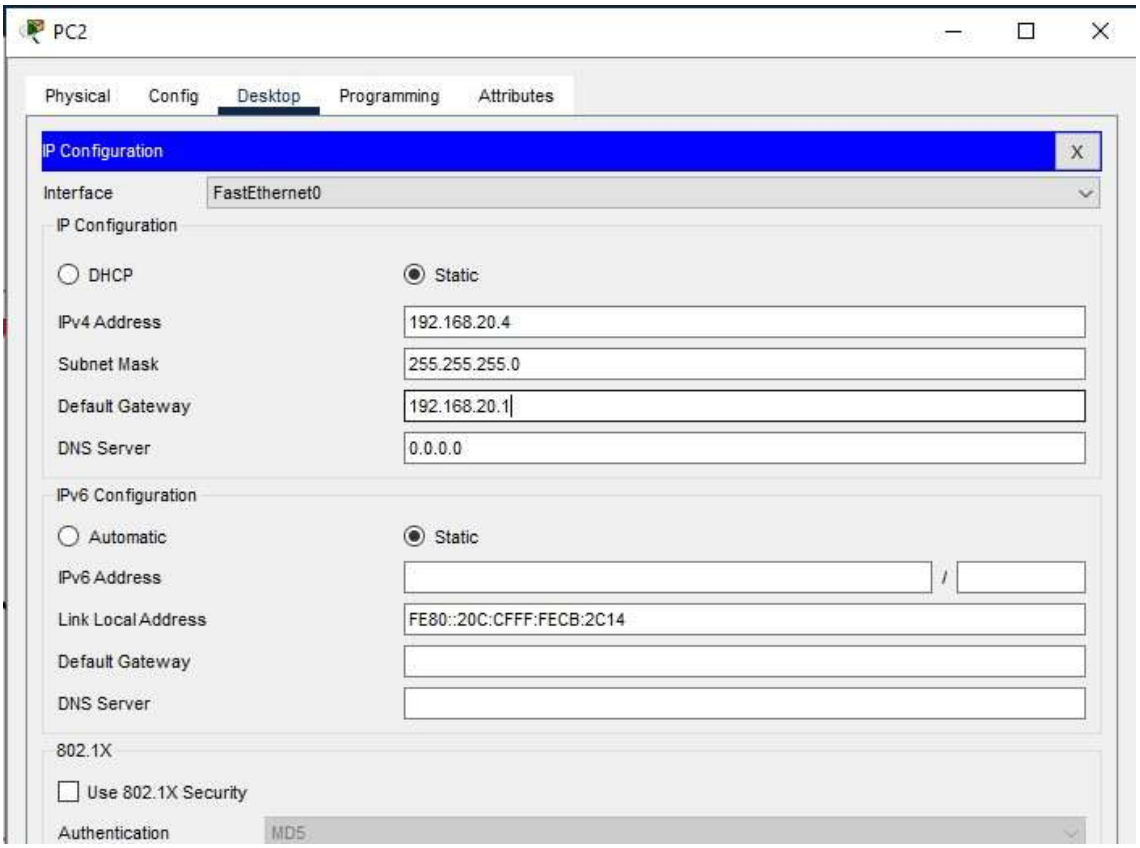
After successful configuration of static routing, devices from one LAN could ping and communicate with devices in the other LAN. This demonstrated that static routing was working correctly and the network was functioning as expected.

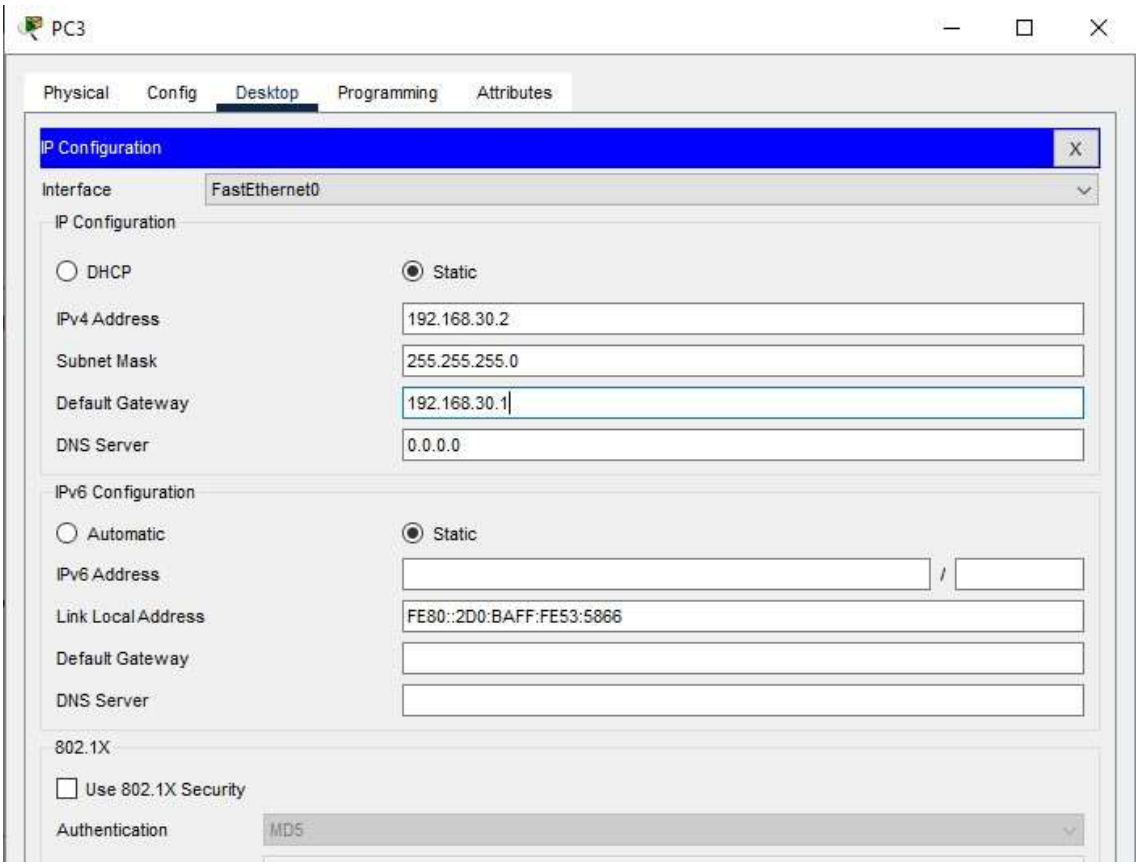
**Network Topology: -**

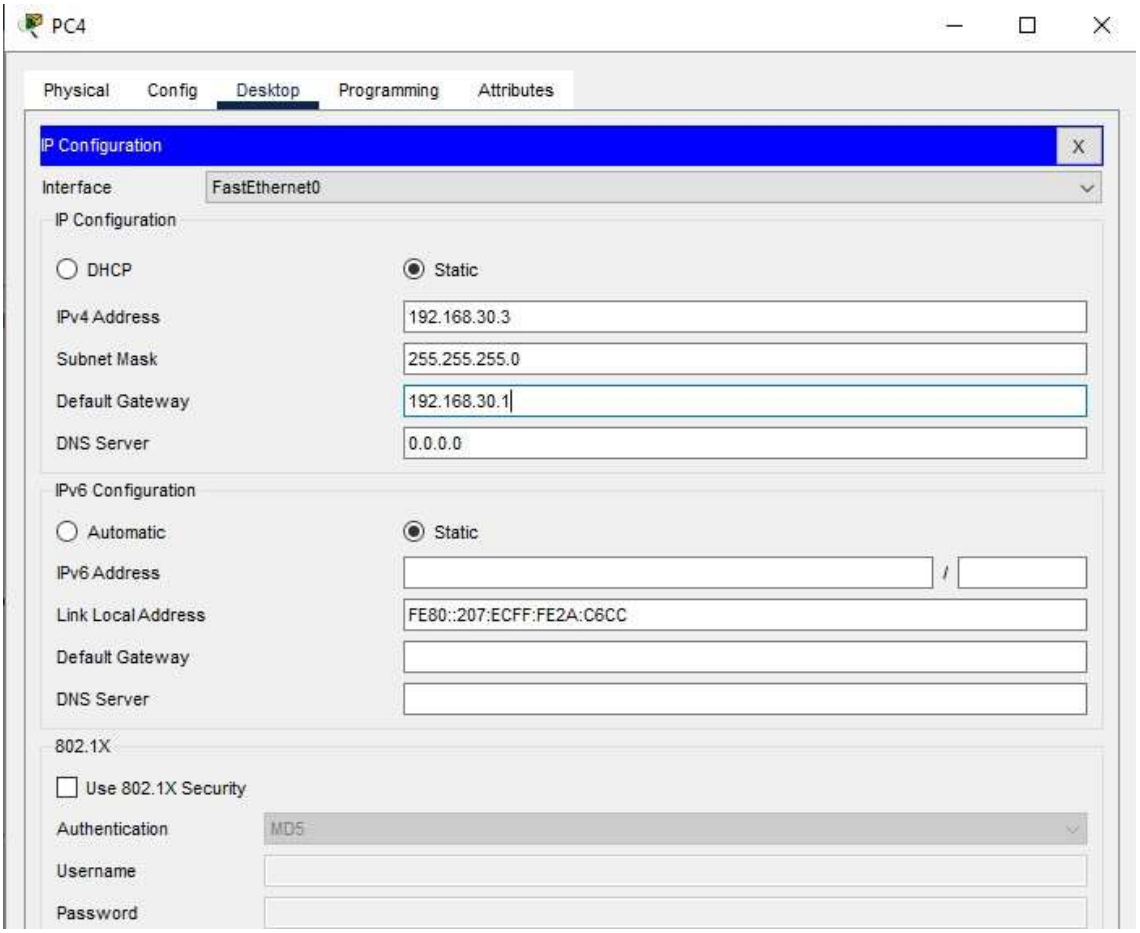

LAN1
net IP : 192.168.20.0
Default gateway : 192.168.20.1
net IP : 192.168.10.1
LAN2
net IP : 192.168.30.0
Default gateway : 192.168.30.1
2811
Router0
2811
Router1
2960-24TT
Switch0
2960-24TT
Switch1
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
PC-PT
PC3
PC-PT
PC4
PC-PT
PC5

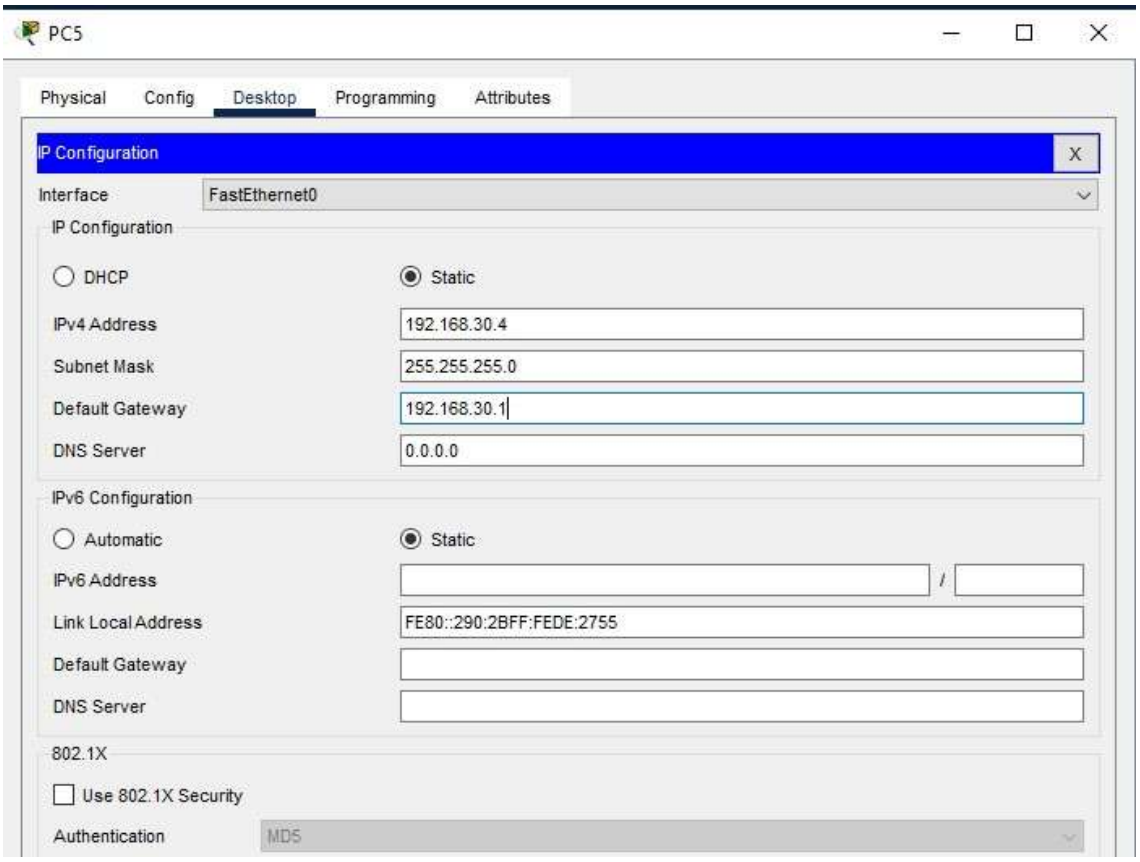

PC0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.20.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.20.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::209:7CFF:FEC8:2B2C
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5

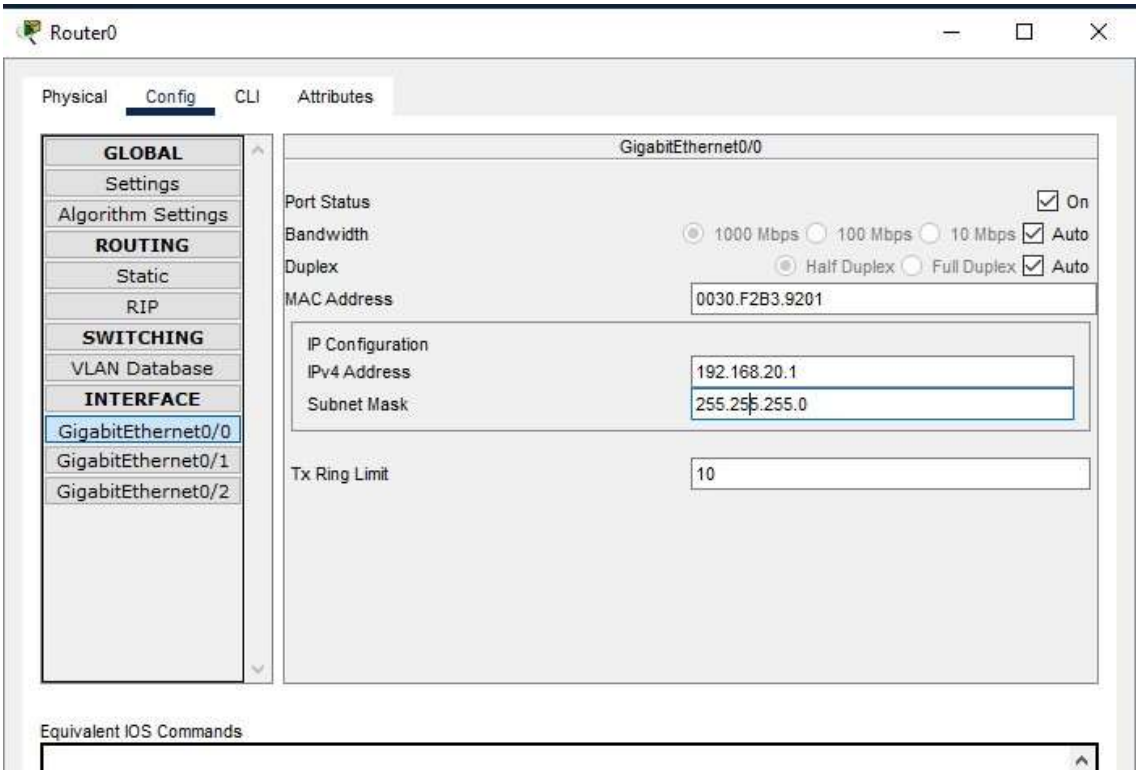

PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.20.3
Subnet Mask
255.255.255.0
Default Gateway
192.168.20.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::2D0:D3FF:FE42:28DA
Default Gateway
DNS Server
802.1X
Use 802.1X Security

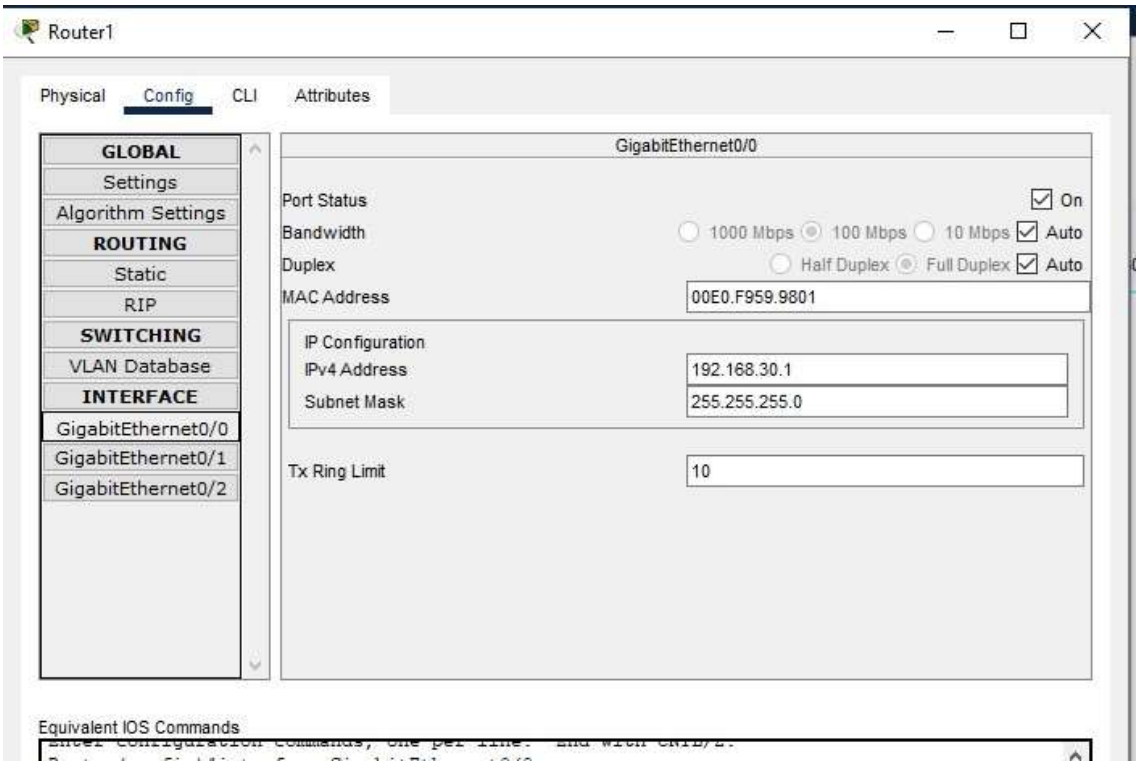

PC2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.20.4
Subnet Mask
255.255.255.0
Default Gateway
192.168.20.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::20C:CFFF:FECB:2C14
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5

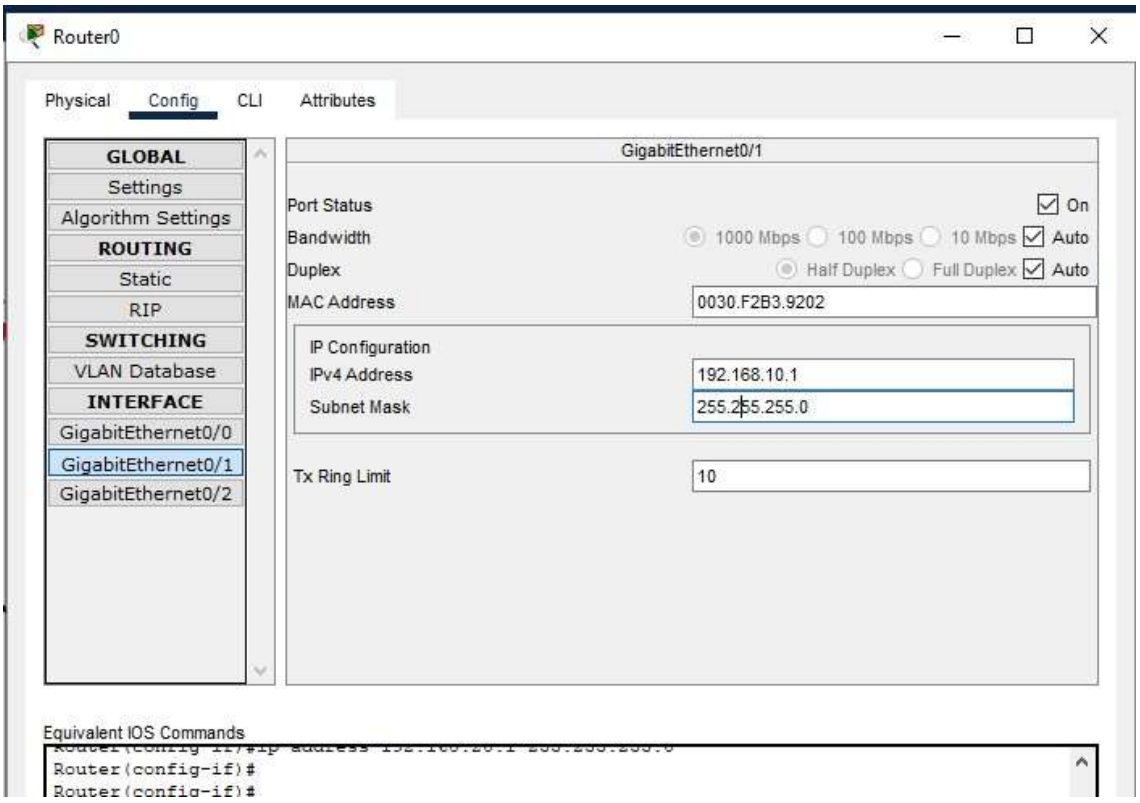

PC3
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.30.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.30.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::2D0:BAFF:FE53:5866
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5

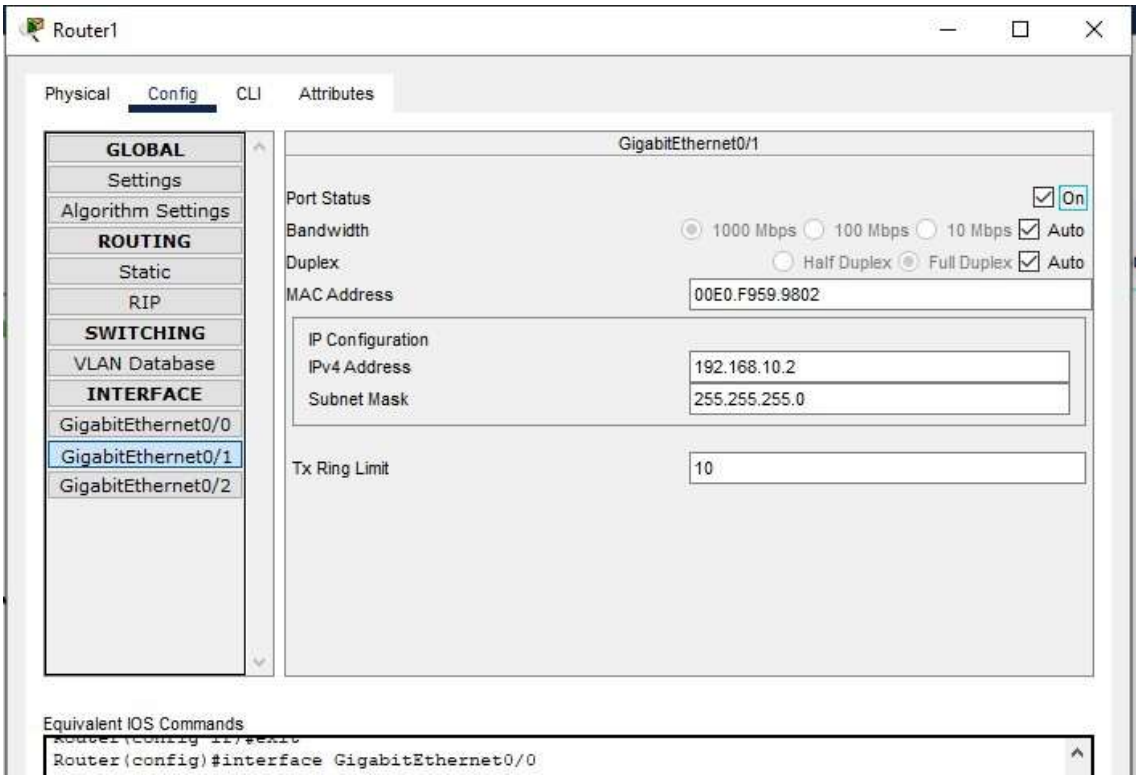

PC4
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.30.3
Subnet Mask
255.255.255.0
Default Gateway
192.168.30.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::207:ECFF:FE2A:C6CC
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password

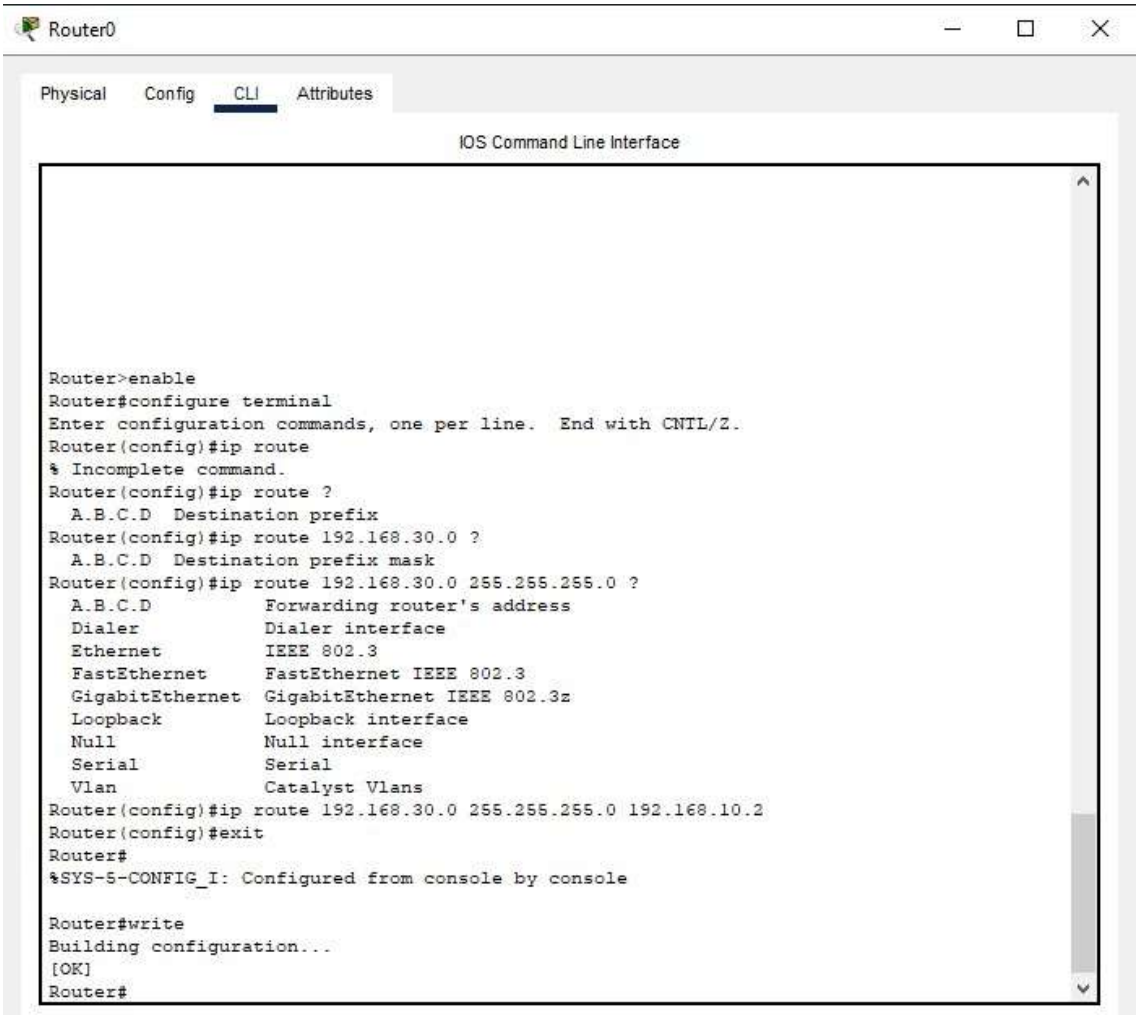

PC5
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.30.4
Subnet Mask
255.255.255.0
Default Gateway
192.168.30.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::290:2BFF:FEDE:2755
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5

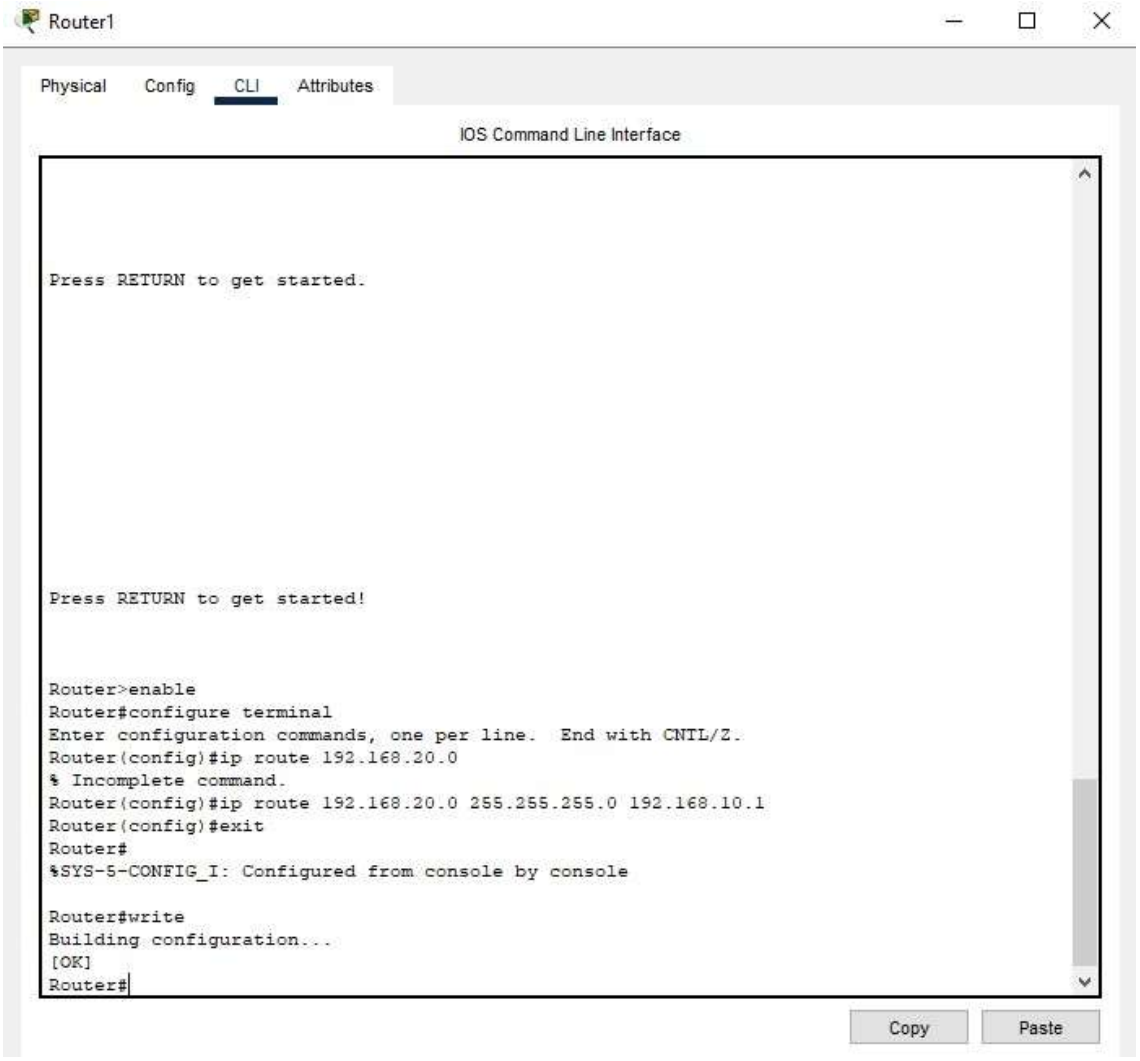

Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/2
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0030.F2B3.9201
IP Configuration
IPv4 Address
192.168.20.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands


Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/2
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00E0.F959.9801
IP Configuration
IPv4 Address
192.168.30.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands


Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/2
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0030.F2B3.9202
IP Configuration
IPv4 Address
192.168.10.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands
Router(config-if)#
Router(config-if)#


Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/2
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00E0.F959.9802
IP Configuration
IPv4 Address
192.168.10.2
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands
Router(config)#interface GigabitEthernet0/0


Router0
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)#ip route
% Incomplete command.
Router(config)#ip route ?
A.B.C.D Destination prefix
Router(config)#ip route 192.168.30.0 ?
A.B.C.D Destination prefix mask
Router(config)#ip route 192.168.30.0 255.255.255.0 ?
A.B.C.D Forwarding router's address
Dialer Dialer interface
Ethernet IEEE 802.3
FastEthernet FastEthernet IEEE 802.3
GigabitEthernet GigabitEthernet IEEE 802.3z
Loopback Loopback interface
Null Null interface
Serial Serial
Vlan Catalyst Vlans
Router(config)#ip route 192.168.30.0 255.255.255.0 192.168.10.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#write
Building configuration...
[OK]
Router#


Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
Press RETURN to get started.
Press RETURN to get started!
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 192.168.20.0
% Incomplete command.
Router(config)#ip route 192.168.20.0 255.255.255.0 192.168.10.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#write
Building configuration...
[OK]
Router#
Copy
Paste

## Practical 8

**Aim:-** Create a network and implement RIP.

**Description:-**

### Description about RIP Protocol □

RIP (Routing Information Protocol) is a distance-vector routing protocol used in local and wide area networks. It enables routers to exchange routing information and dynamically update their routing tables.

- RIP uses **hop count** as its metric to determine the best path.
- The maximum number of hops allowed is **15**, making it suitable for small to mediumsized networks.
- RIP updates are broadcast every **30 seconds**, which helps maintain up-to-date routing tables.
- It supports both **RIPv1 (classful)** and **RIPv2 (classless)** versions, with RIPv2 offering support for subnet masks and authentication.

### When to use Serial DTE and Serial DCE □

In serial communication between routers, two types of interfaces are used:

- **DTE (Data Terminal Equipment):** Typically the router that initiates the connection. It receives clocking from the DCE.
- **DCE (Data Communication Equipment):** Usually the modem or CSU/DSU that provides clocking to the DTE. In lab setups, one router is manually configured as DCE to simulate clocking.

**Use Case:**

- Use **DCE** when you need to provide clock rate (e.g., in lab simulations).
- Use **DTE** when connecting to a service provider or when the clock is externally provided.

### Description about Practical And Output □

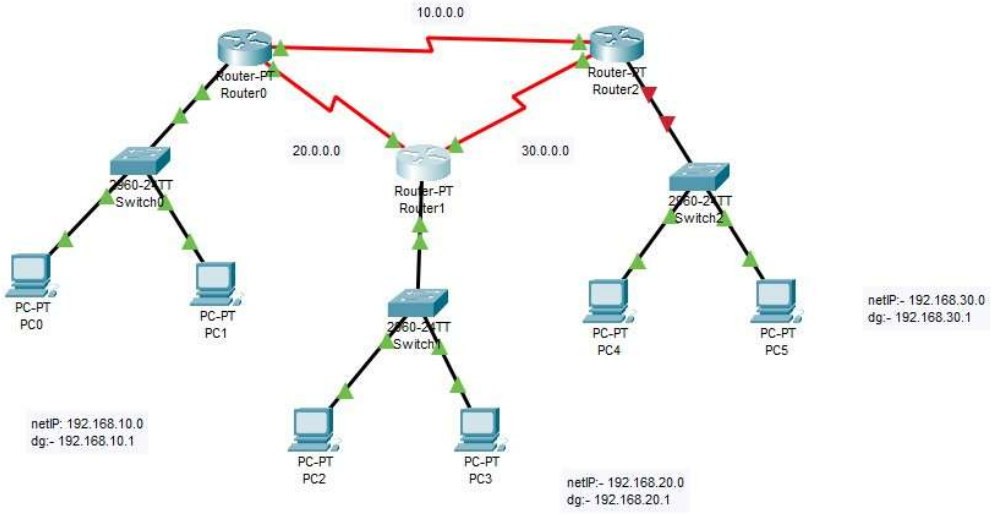
The following output displays a network topology created in Cisco Packet Tracer, showcasing the successful implementation of the Routing Information Protocol (RIP) across three interconnected routers.

- **Three distinct network segments** are visible, each with its own router, switch, and two PCs.

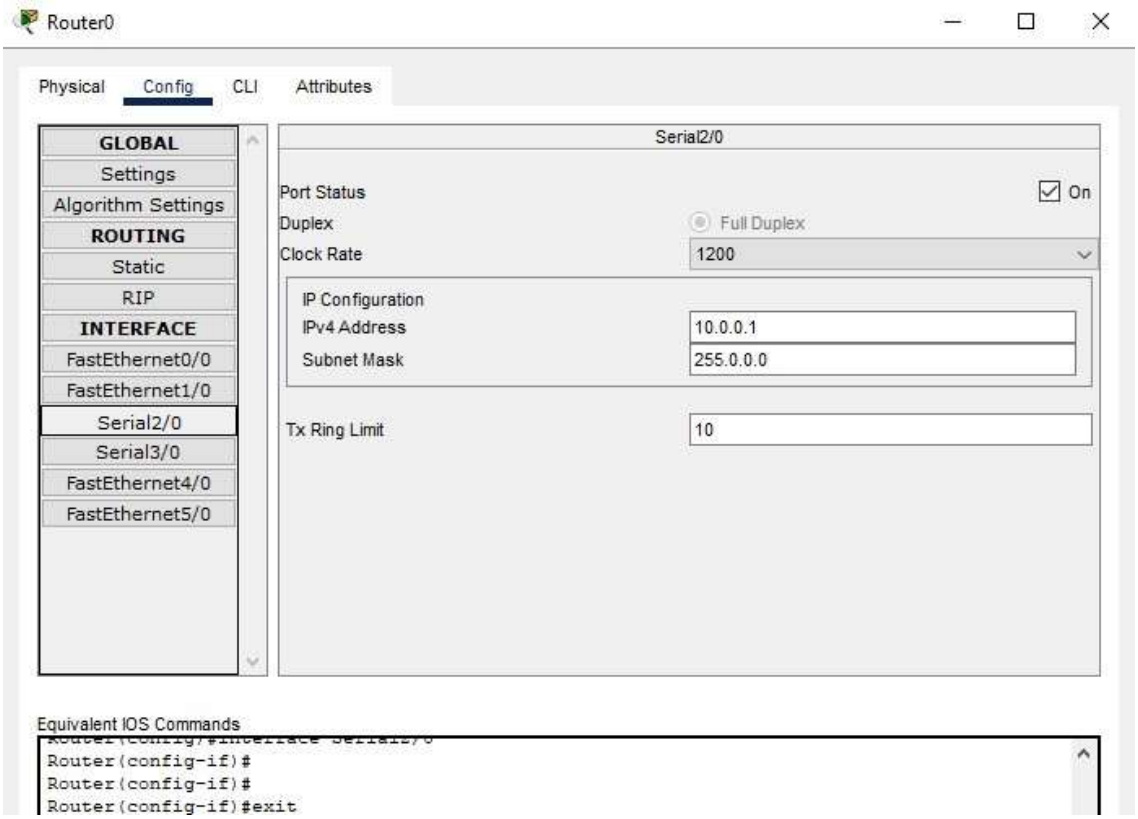
- **Routers are connected via serial links**, forming a triangular topology that allows RIP to propagate routes dynamically.
- **Each PC is assigned a unique IP address** within its subnet, and the default gateway is set to the router in its segment.
- **Red arrows indicate successful ICMP (ping) tests** between PCs across different networks, confirming that RIP has enabled inter-network communication.
- The simulation is running in **real-time mode**, and the routing tables have been updated with RIP-learned routes.
- The bottom-right corner shows **ping results**, verifying that devices in separate subnets can reach each other.

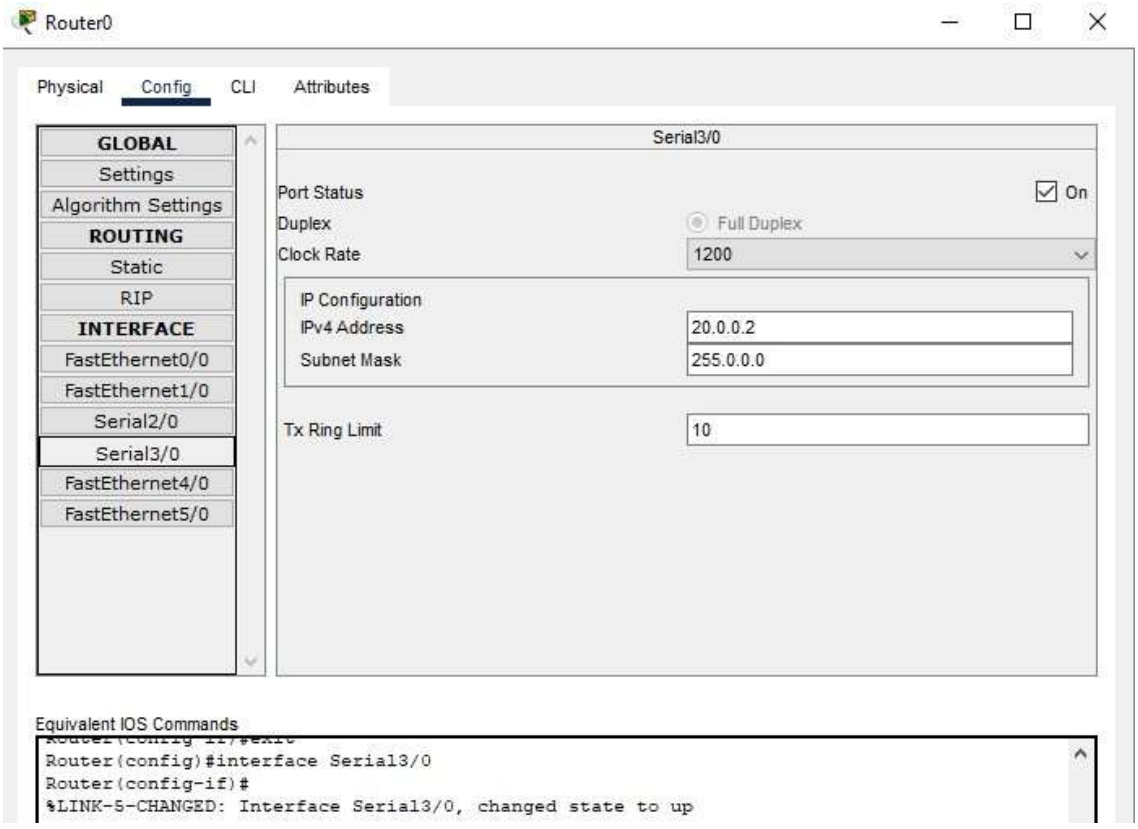
Also the output confirms that RIP is functioning correctly, dynamically sharing routing information and enabling seamless communication across the network.

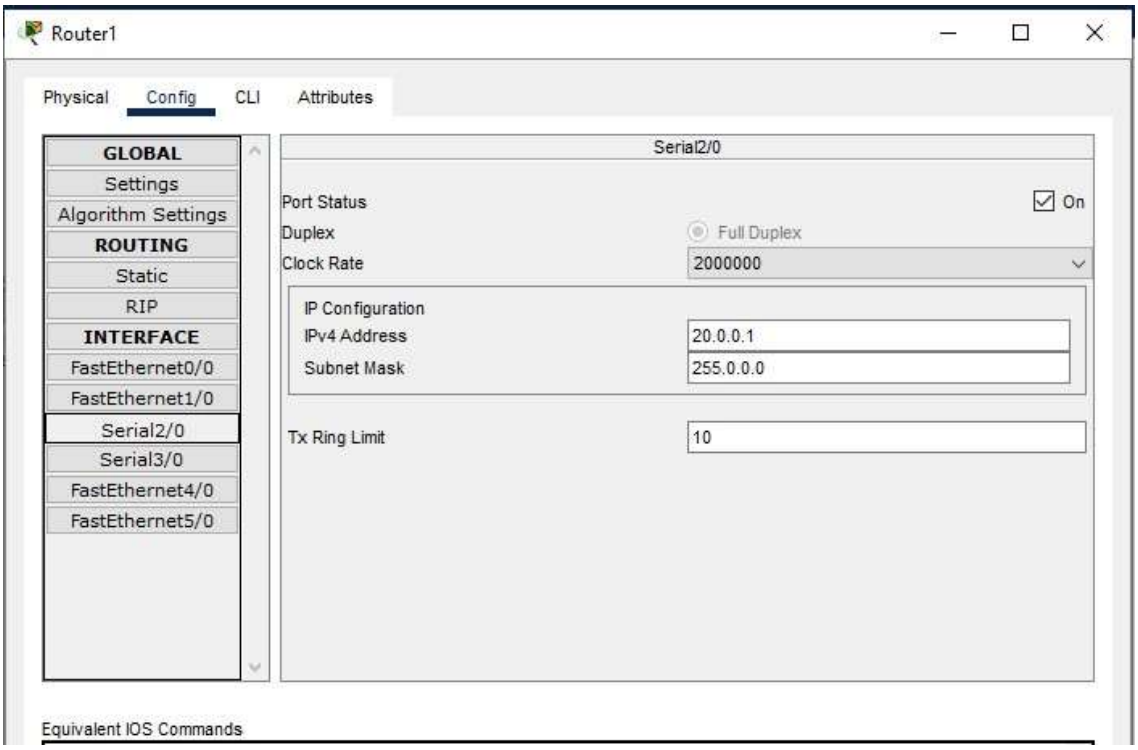
## Network Topology:-

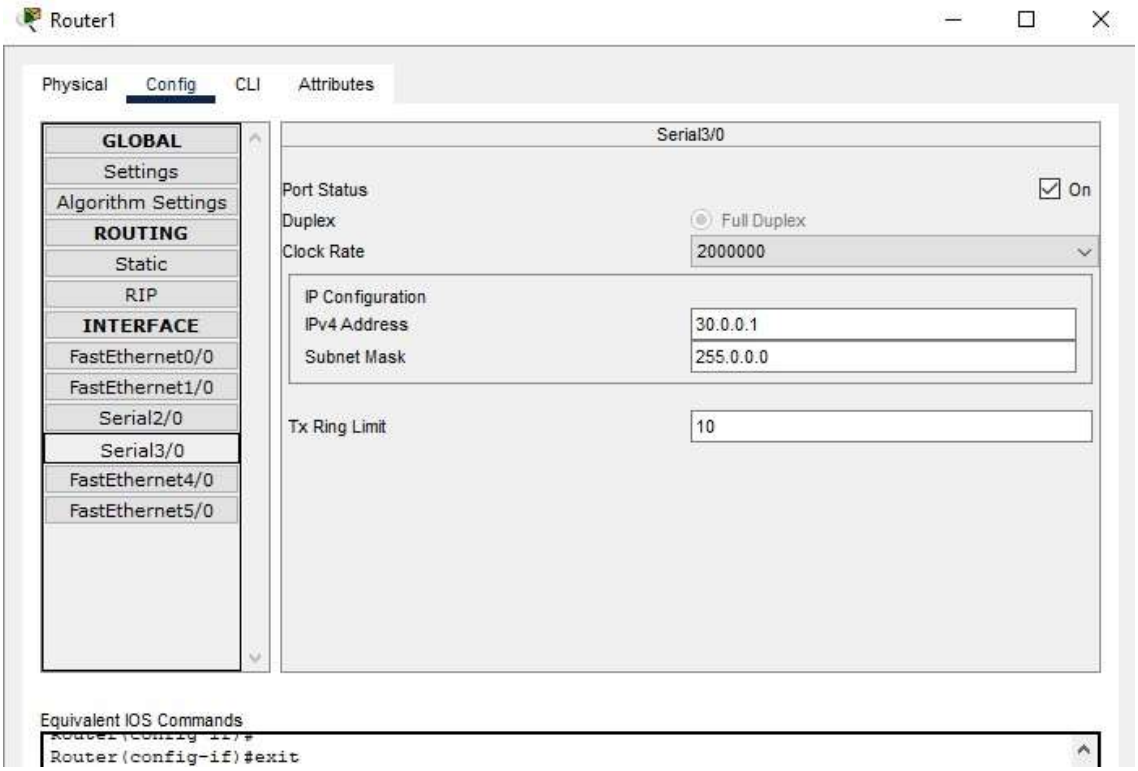


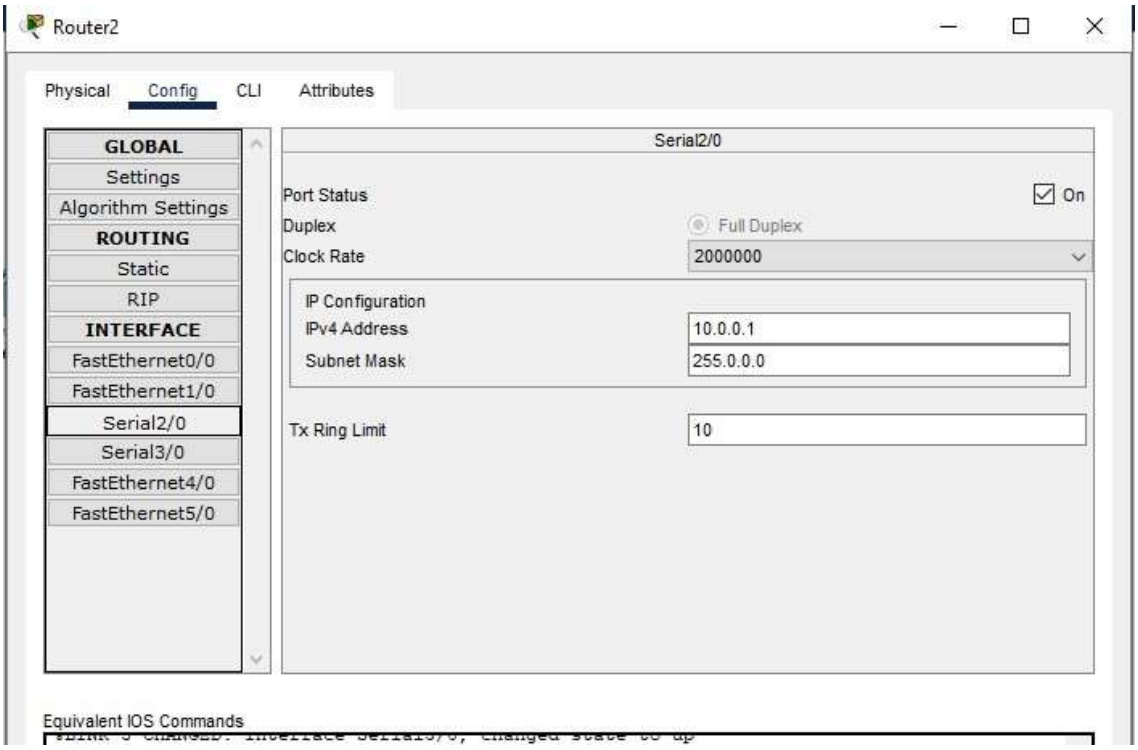
## Note:- Do the routing for PC also

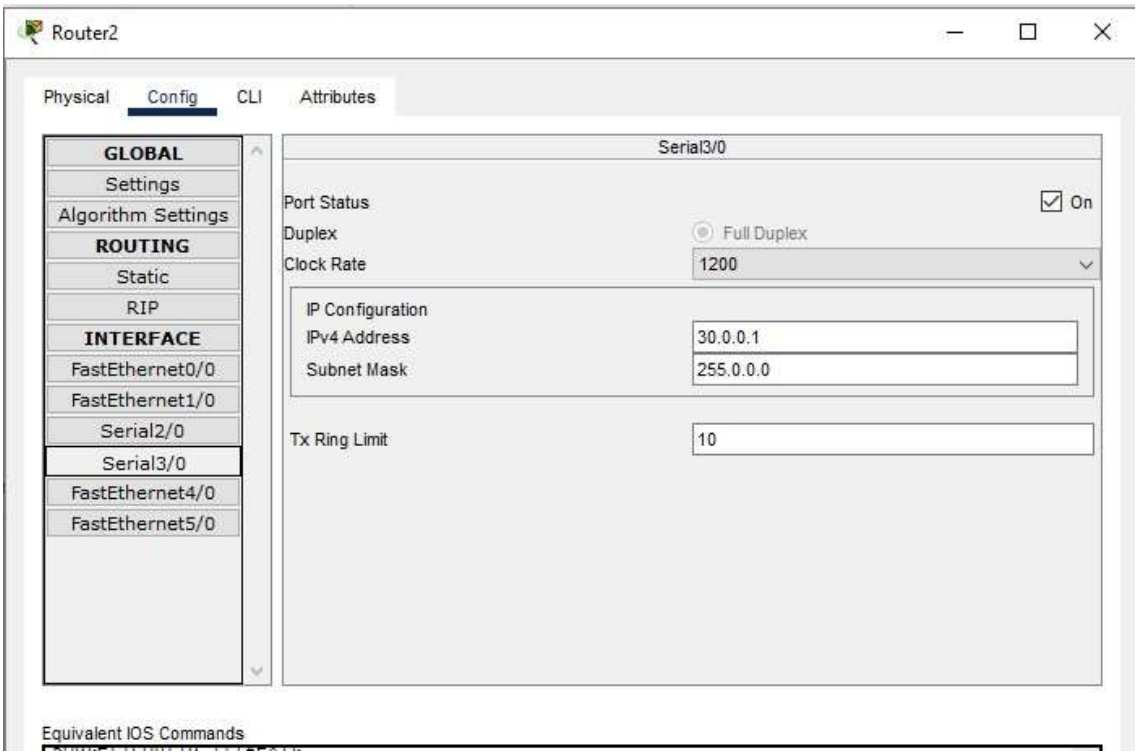


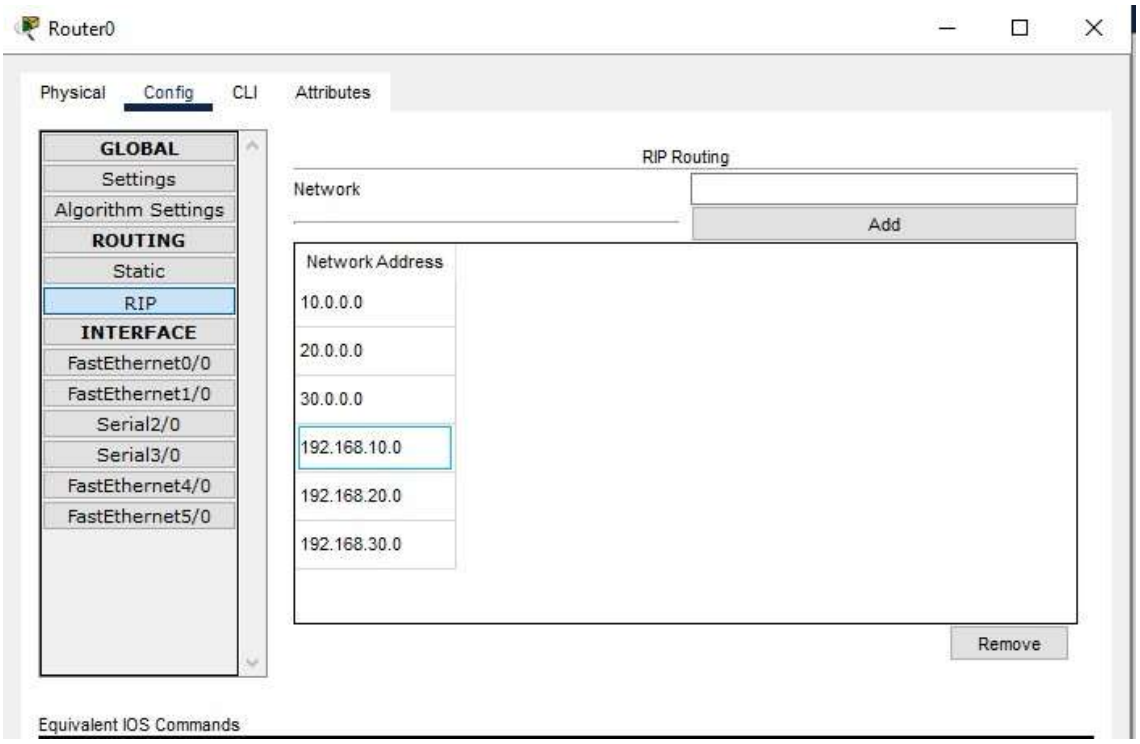




Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
20.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10
Equivalent IOS Commands


Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
30.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10
Equivalent IOS Commands
Router(config-if)#exit


Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
10.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10
Equivalent IOS Commands


Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
On
Duplex
Full Duplex
Clock Rate
1200
IP Configuration
IPv4 Address
30.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10
Equivalent IOS Commands




Note:- Same as for other 2 routers

## Practical 9

**Aim** □ Create a network and implement OSPF (single area).

**Description** □

### OSPF Algorithm □

OSPF, or Open Shortest Path First, is a dynamic routing protocol used to determine the most efficient path for data to travel across a network. It operates within an autonomous system and is based on the link-state routing principle.

Each router using OSPF builds a complete map of the network by exchanging information with its neighbours. This information includes the state and cost of its connections. Once all routers have shared their data, each one independently calculates the shortest path to every destination using Dijkstra's algorithm. This ensures that all routers have a consistent view of the network and make routing decisions based on the same information.

OSPF organizes networks into areas to reduce complexity and improve scalability. The backbone area, known as Area 0, connects all other areas and facilitates communication between them. Routers within an area share detailed information, but between areas, only summarized data is exchanged to keep things efficient.

The protocol reacts quickly to changes in the network, such as a link failure, by recalculating routes and updating its database. This fast convergence makes OSPF reliable and suitable for large, complex networks.

Key characteristics of OSPF include:

- It uses the Shortest Path First (SPF) algorithm, also known as Dijkstra's algorithm, to determine the most efficient route.
- OSPF maintains a complete map of the network topology by exchanging link-state advertisements (LSAs) between routers.
- Routing decisions are based on cost, which is typically calculated from bandwidth. Lower cost paths are preferred.
- OSPF supports hierarchical network design through the use of areas, which helps reduce routing overhead and improve scalability.
- It is a classless protocol, meaning it supports variable-length subnet masking (VLSM).
- OSPF does not send periodic updates; instead, it sends updates only when there is a change in the network topology.

- The administrative distance of OSPF is 110, which is lower than RIP but higher than EIGRP.

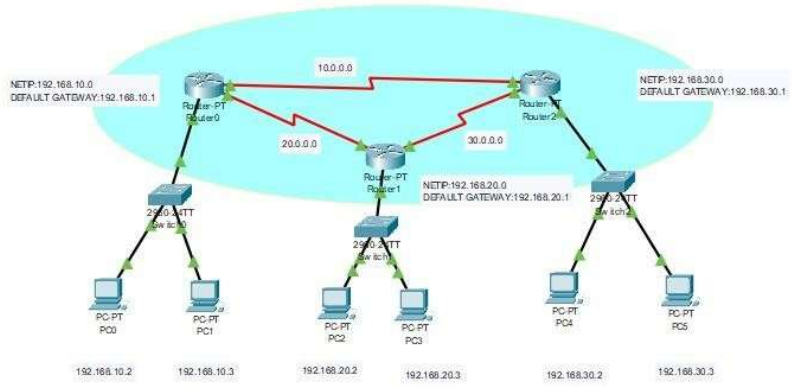
**OSPF (Single Area) Protocol:**

Single Area OSPF refers to a configuration where all routers are part of one area, typically Area 0, which is the backbone area. This setup is suitable for small to medium-sized networks where simplicity and ease of management are priorities.

Key points about Single Area OSPF:

- All routers share the same link-state database, which ensures consistent routing decisions across the network.
- The configuration is straightforward, as there is no need to define multiple areas or manage inter-area routing.
- It eliminates the need for Area Border Routers (ABRs), which are required in multiarea OSPF setups.
- Single Area OSPF reduces complexity and is easier to troubleshoot.
- It is ideal for networks that do not require segmentation for administrative or performance reasons.

Output 




| Fire | Last Status | Source | Destination | Type | Color | Time(sec) | Periodic | Num | Edi |
|---|---|---|---|---|---|---|---|---|---|
| | Successful | PC0 | PC5 | ICMP | | 0.000 | N | 15 | (ed |
| | Successful | PC0 | PC2 | ICMP | | 0.000 | N | 16 | (ed |
| | Successful | PC2 | PC5 | ICMP | | 0.000 | N | 17 | (ed |

## OUTPUT DESCRIPTION 

### Network Description in Single-Area OSPF Context

The topology consists of three routers, each connected to its own subnet. These routers are interconnected, forming a triangular structure that allows full communication between all nodes. Each router is also connected to a switch, which in turn connects to two end-user PCs.

- **Router0** manages the 192.168.10.0/24 subnet
- **Router1** manages the 192.168.20.0/24 subnet
- **Router2** manages the 192.168.30.0/24 subnet

Each router has a gateway IP address (.1) for its respective subnet and serves as the default gateway for the connected PCs.

### Characteristics of Single-Area OSPF in This Topology

- **Full visibility**: Every router knows the complete network topology.
- **Fast convergence**: Any change, such as a link failure, is quickly detected and recalculated.
- **No route summarization**: All routing information is detailed and shared without abstraction.  **Simplified configuration**: No need for Area Border Routers or multiple area definitions.

This design is ideal for small to medium-sized networks where simplicity and transparency are more important than scalability. If you're considering expanding this into a multi-area OSPF setup, I can help you plan how to segment the network and assign roles like ABRs.

# CN PRACTICAL 9.b

**Aim**  Create a network and implement OSPF (multi area).

## OSPF Algorithm 

OSPF, or Open Shortest Path First, is a dynamic routing protocol used to determine the most efficient path for data to travel across a network. It operates within an autonomous system and is based on the link-state routing principle.

Each router using OSPF builds a complete map of the network by exchanging information with its neighbours. This information includes the state and cost of

its connections. Once all routers have shared their data, each one independently calculates the shortest path to every destination using Dijkstra's algorithm. This ensures that all routers have a consistent view of the network and make routing decisions based on the same information.

OSPF organizes networks into areas to reduce complexity and improve scalability. The backbone area, known as Area 0, connects all other areas and facilitates communication between them. Routers within an area share detailed information, but between areas, only summarized data is exchanged to keep things efficient.

The protocol reacts quickly to changes in the network, such as a link failure, by recalculating routes and updating its database. This fast convergence makes OSPF reliable and suitable for large, complex networks.

Key characteristics of OSPF include:

- It uses the Shortest Path First (SPF) algorithm, also known as Dijkstra's algorithm, to determine the most efficient route.
- OSPF maintains a complete map of the network topology by exchanging link-state advertisements (LSAs) between routers.
- Routing decisions are based on cost, which is typically calculated from bandwidth. Lower cost paths are preferred.
- OSPF supports hierarchical network design through the use of areas, which helps reduce routing overhead and improve scalability.
- It is a classless protocol, meaning it supports variable-length subnet masking (VLSM).
- OSPF does not send periodic updates; instead, it sends updates only when there is a change in the network topology.
- The administrative distance of OSPF is 110, which is lower than RIP but higher than EIGRP.

**OSPF (Multi Area) Protocol:**

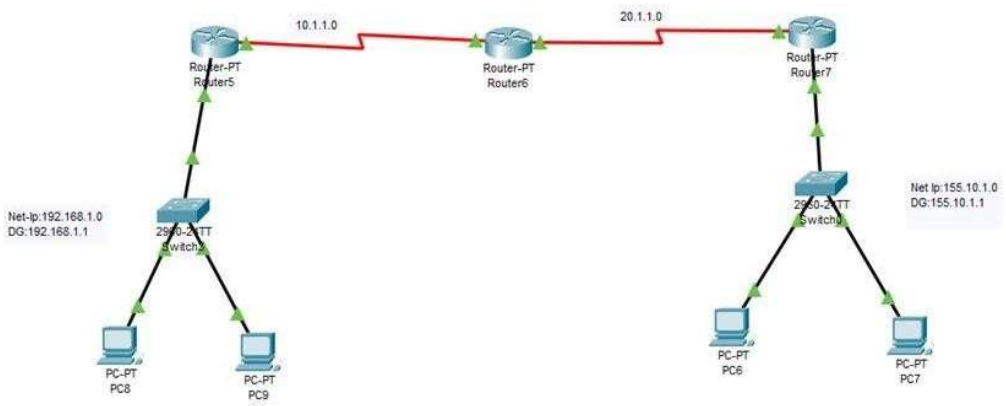
OSPF multi-area is a design approach used to scale large networks efficiently by dividing them into smaller, manageable sections called areas. Each area contains a group of routers that share detailed routing information only within that area, which helps reduce the size of routing tables and limits the scope of link-state updates.

At the heart of this design is **Area 0**, also known as the backbone area. All other areas must connect to Area 0 either directly or through a virtual link. This backbone acts as a central hub, allowing inter-area communication.

Routers that connect multiple areas are called **Area Border Routers (ABRs)**. These ABRs summarize and distribute routing information between areas, ensuring that internal details of one area don't overwhelm routers in another. This keeps the network efficient and responsive.

By using multiple areas, OSPF improves scalability, speeds up convergence, and reduces processing overhead. It's especially useful in large enterprise networks where thousands of routers might be deployed.

## Output 




| Fire | Last Status | Source | Destination | Type | Color | Time(sec) | Periodic | Num | Edit |
|---|---|---|---|---|---|---|---|---|---|
| | Successful | PC9 | PC6 | ICMP | | 0.000 | N | 33 | (ec |
| | Failed | PC9 | PC7 | ICMP | | 0.000 | N | 34 | (ec |
| | Successful | PC8 | PC7 | ICMP | | 0.000 | N | 35 | (ec |

## Output Description 

This output illustrates a multi-area OSPF (Open Shortest Path First) configuration involving three routers, two switches, and four end-user PCs. The network is segmented into three distinct OSPF areas to optimize routing efficiency and scalability.

### Area Breakdown

- **Area 0 (Backbone Area)**

- **Router6** serves as the backbone router and Area Border Router (ABR). o It connects to Router5 via the 10.1.1.0/30 network and to Router7 via the 20.1.1.0/30 network.
- Router6 maintains separate Link-State Databases (LSDBs) for each connected area.

- **Area 1**
  - **Router5** is part of Area 1. o It connects to a switch that serves PCs **PC8** and **PC9** on the 192.168.1.0/24 network.
  - Router5 advertises this network into Area 1.
- **Area 2**
  - **Router7** is part of Area 2. o It connects to a switch that serves PCs **PC6** and **PC7** on the 155.10.1.0/24 network. o Router7 advertises this network into Area 2.

## OSPF Behavior

- Routers exchange Hello packets to establish neighbor relationships.
- Each router generates Link-State Advertisements (LSAs) for its directly connected networks.  Router6, as an ABR, summarizes and redistributes routes between Area 1 and Area 2 via Area 0.
- All routers use Dijkstra's algorithm to compute the shortest path tree and populate their routing tables accordingly.

## Purpose and Benefits

- The multi-area design reduces routing table size and LSDB complexity.
- It improves convergence time and isolates instability within each area.
- This setup is ideal for medium to large enterprise networks requiring hierarchical routing.

## Practical 10

**AIM:-** Create a network and implement BGP

**DESCRIPTION:-**

**Network Overview:**

The topology consists of multiple routers, each representing a separate autonomous system (AS). These routers are interconnected to simulate WAN links, and each router connects to a local LAN with end devices such as PCs and switches.

**Key Components:**

- **Routers**: Each assigned a unique AS number.
- **Switches and PCs**: Connected to routers to simulate internal networks.
- **IP Addressing**: Each LAN and WAN link uses a distinct subnet.
- **Routing Protocol**: eBGP is used to exchange routing information between routers in different ASes.

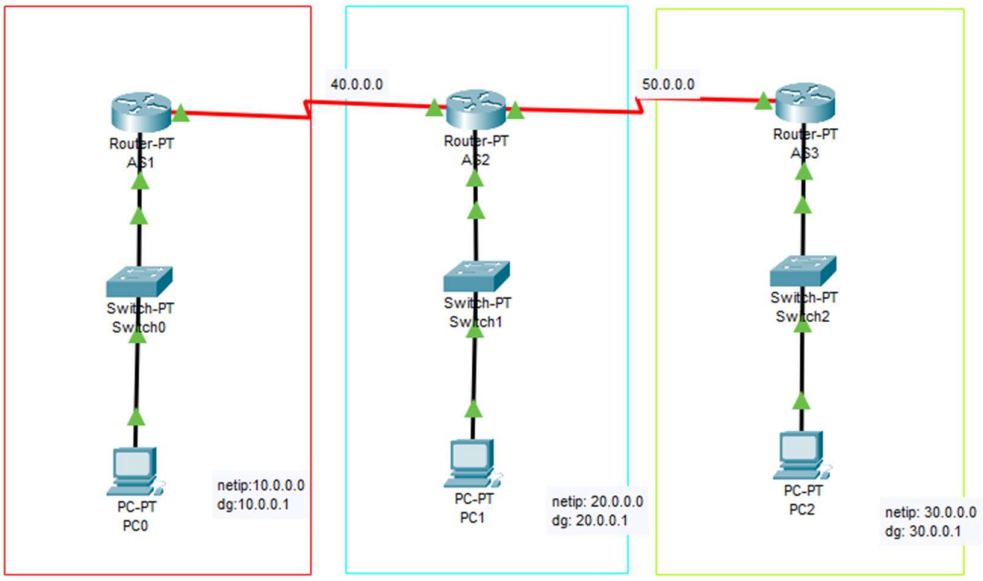
**Configuration Summary:**

- IP addresses are assigned to all interfaces.
- BGP processes are initiated on each router with their respective AS numbers.
- eBGP neighbor relationships are established using the IP addresses of adjacent routers.
- Local networks are advertised into BGP to ensure reachability across AS boundaries.

**Simulation Outcome:**

- All eBGP sessions are successfully established.
- Routing tables are populated with external routes.
- End-to-end connectivity between devices in different ASes is verified.
- The network demonstrates stable inter-AS communication using eBGP.

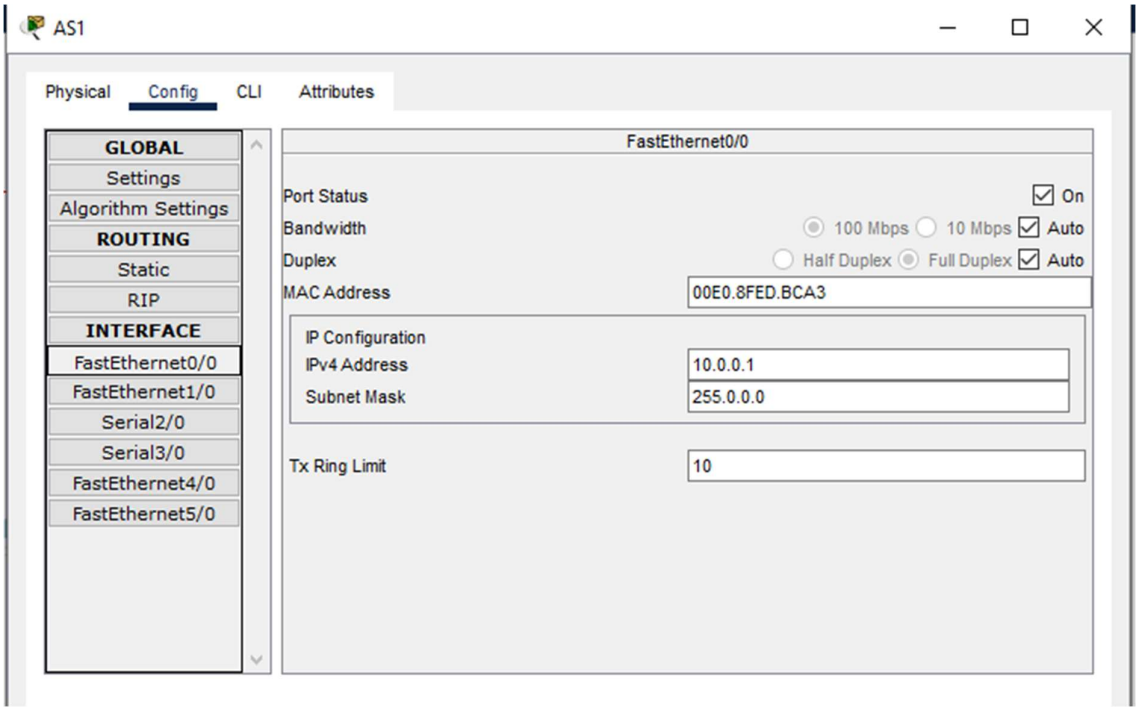
**NETWORK TOPOLOGY :-**

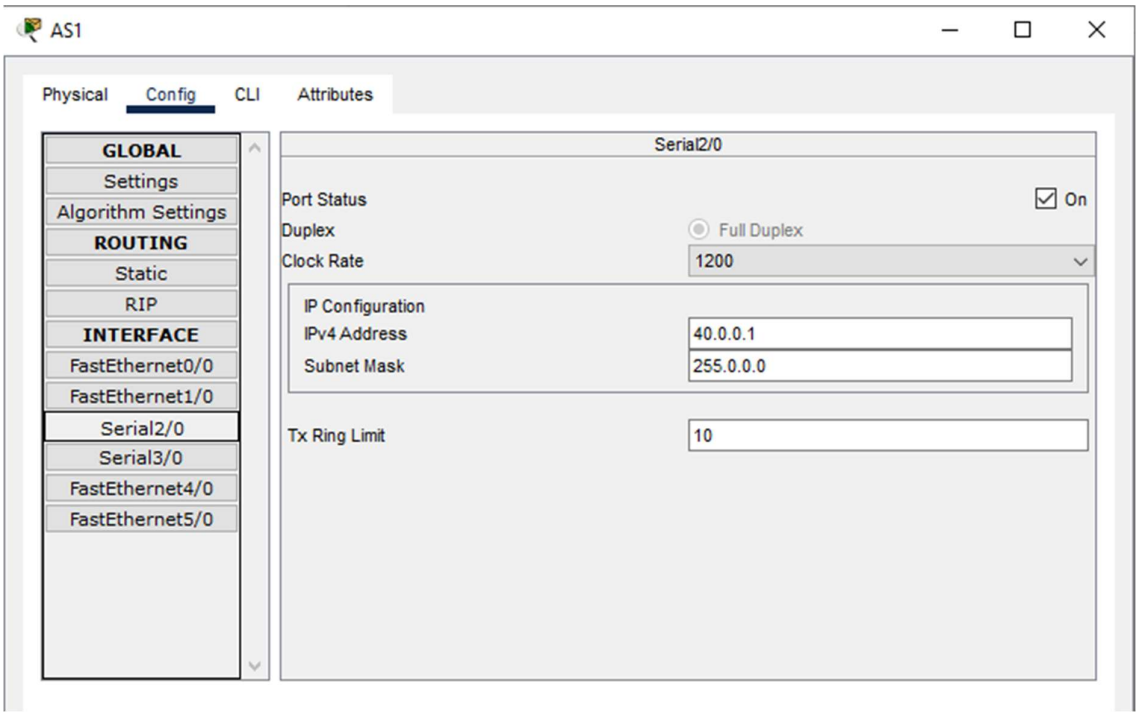


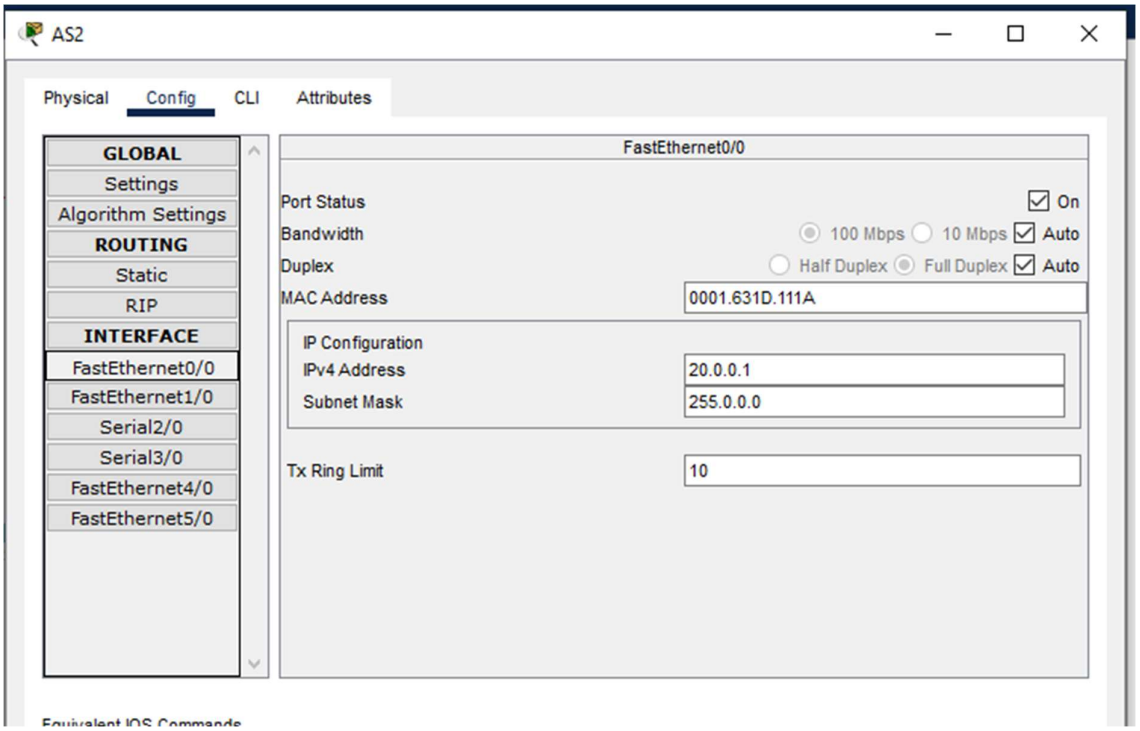

```
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#router bgp 1
Router(config-router)#network 10.0.0.0
Router(config-router)#network 40.0.0.0
Router(config-router)#neighbor 40.0.0.2 remote-as 2
Router(config-router)#exit
Router(config)#%BGP-5-ADJCHANGE: neighbor 40.0.0.2 Up
```

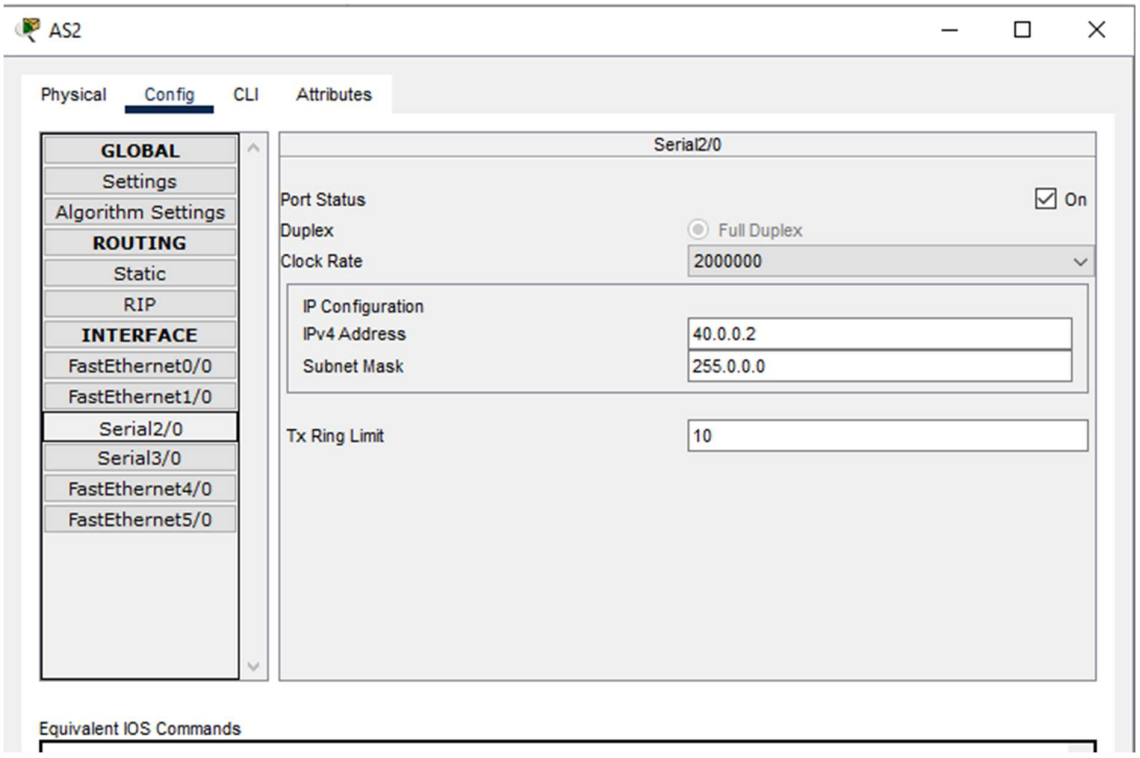
```
Press RETURN to get started!



Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router bgp 2
Router(config-router)#network 20.0.0.0
Router(config-router)#network 40.0.0.0
Router(config-router)#network 50.0.0.0
Router(config-router)#neighbor 40.0.0.1 remote-as 1
Router(config-router)#%BGP-5-ADJCHANGE: neighbor 40.0.0.1 Up

Router(config-router)#neighbor 50.0.0.2 remote-as 3
Router(config-router)#exit
Router(config)#%BGP-5-ADJCHANGE: neighbor 50.0.0.2 Up
```

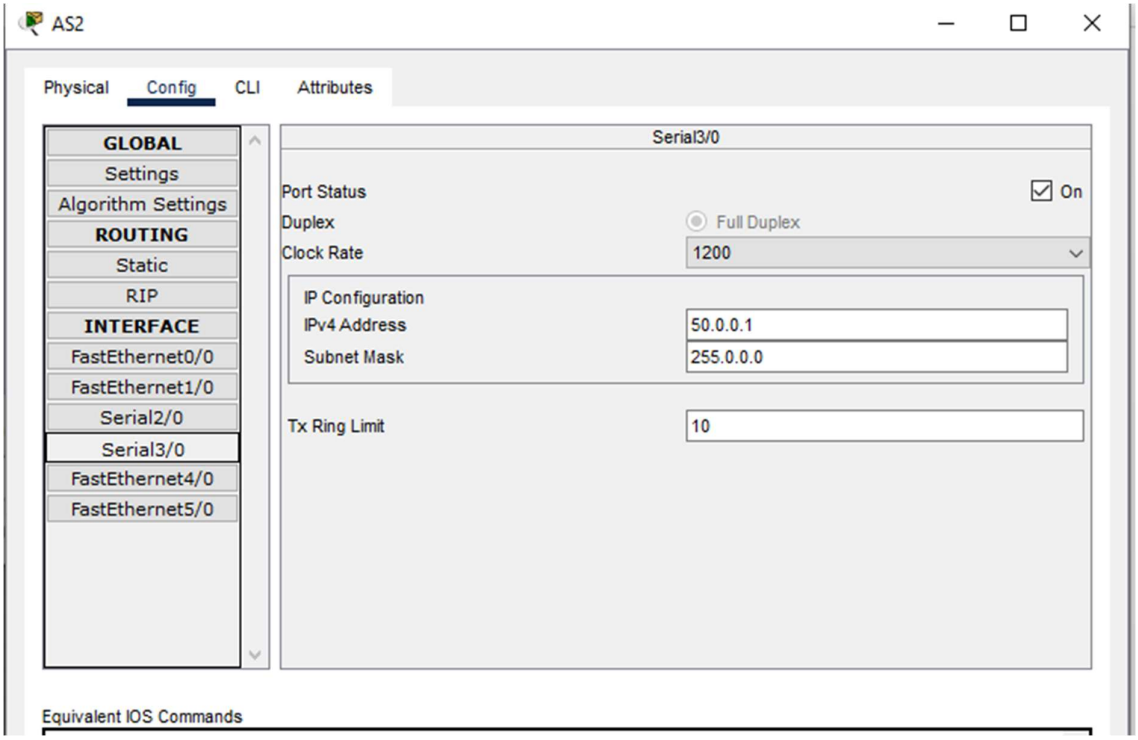
```
Press RETURN to get started!



Router>en
Router#cong t
             ^
% Invalid input detected at '^' marker.

Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router bgp 3
Router(config-router)#network 50.0.0.0
Router(config-router)#network 30.0.0.0
Router(config-router)#neighbor 50.0.0.1 remote-as 2
Router(config-router)#%BGP-5-ADJCHANGE: neighbor 50.0.0.1 Up

Router(config-router)#exit
Router(config)#
```

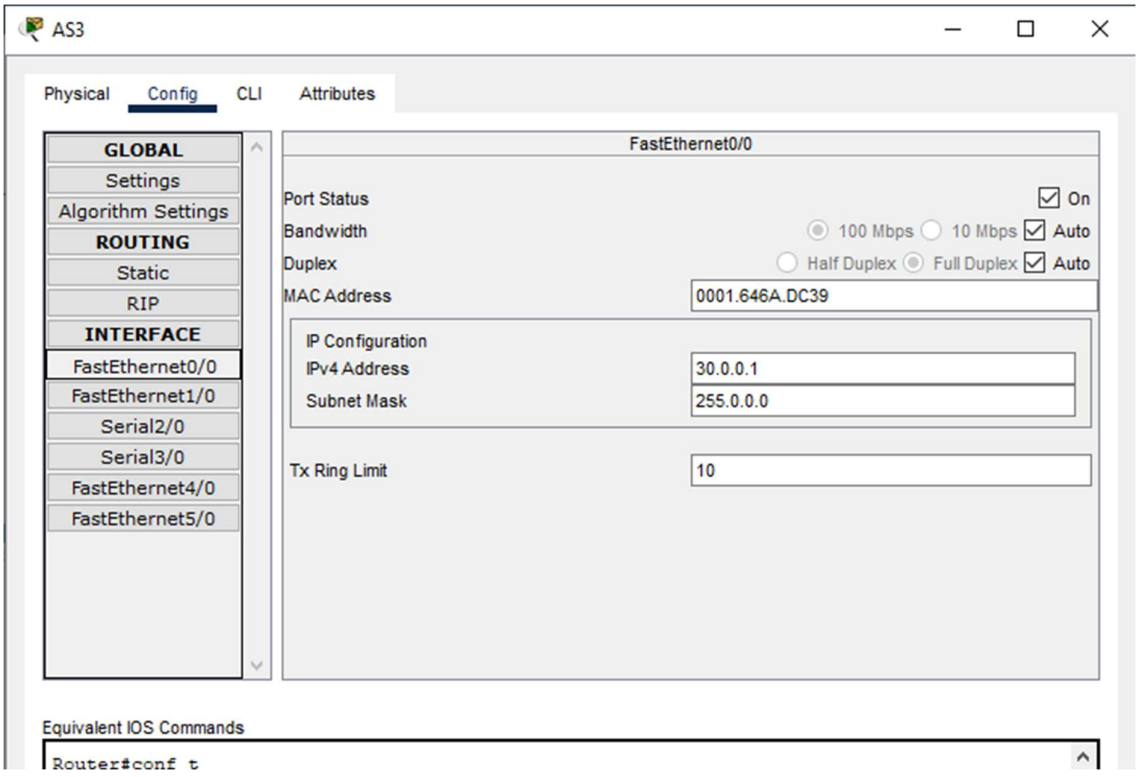

AS1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00E0.8FED.BCA3
IP Configuration
IPv4 Address
10.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10

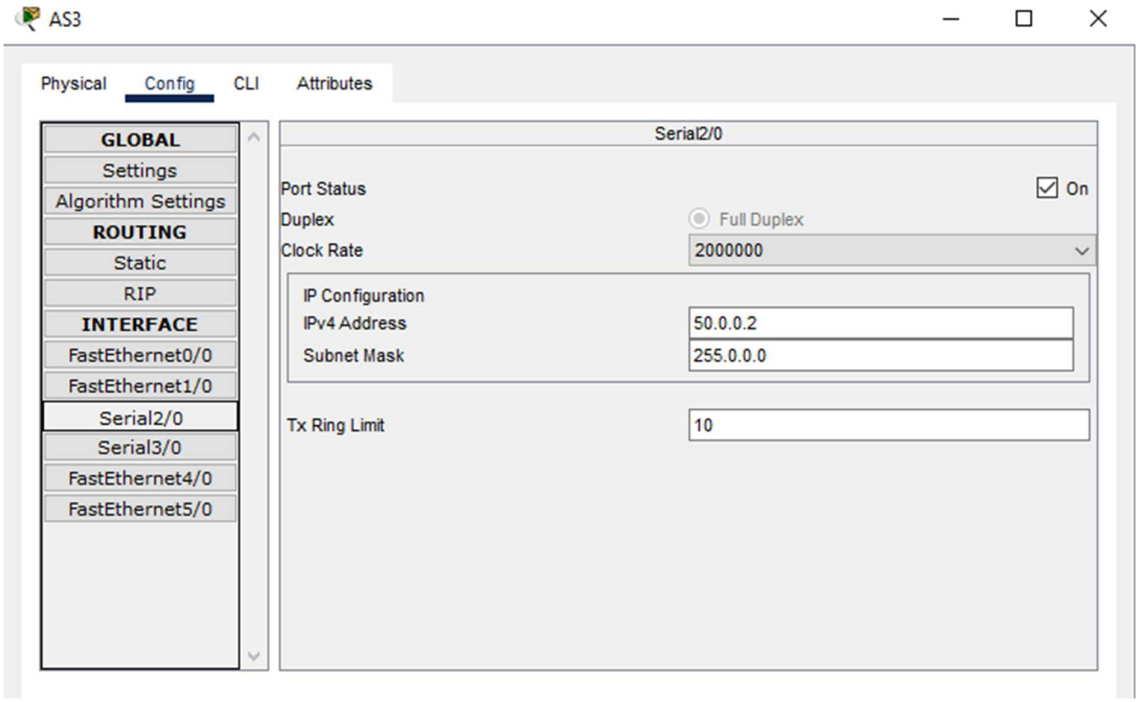

AS1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
1200
IP Configuration
IPv4 Address
40.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10


AS2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.631D.111A
IP Configuration
IPv4 Address
20.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10


AS2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
40.0.0.2
Subnet Mask
255.0.0.0
Tx Ring Limit
10
Equivalent IOS Commands


AS2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
On
Duplex
Full Duplex
Clock Rate
1200
IP Configuration
IPv4 Address
50.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10
Equivalent IOS Commands


AS3
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.646A.DC39
IP Configuration
IPv4 Address
30.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10
Equivalent IOS Commands
Router#conf t


AS3
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
50.0.0.2
Subnet Mask
255.0.0.0
Tx Ring Limit
10

## Practical 11

**AIM:-** Create a network and implement MAC protocol

**DESCRIPTION:-**

**What is a MAC ID?**

A MAC ID, also known as a MAC address, is a unique identifier assigned to the network interface card (NIC) of a device. It operates at the data link layer (Layer 2) of the OSI model and is used to identify devices within a local area network (LAN).

- Format: 12-digit hexadecimal (e.g., 00:1A:2B:3C:4D:5E)
- Purpose: Enables communication between devices on the same network and helps in routing data packets to the correct destination.

**What is Wireless MAC Filtering?**

Wireless MAC filtering is a security feature available in most wireless routers. It allows the network administrator to control which devices can connect to the wireless network based on their MAC addresses.

- **Allow List Mode**: Only devices with listed MAC addresses are permitted to connect. **Deny List Mode**: Devices with listed MAC addresses are blocked from connecting. This technique adds a layer of access control but is not foolproof, as MAC addresses can be spoofed.

**Description of the Practical**

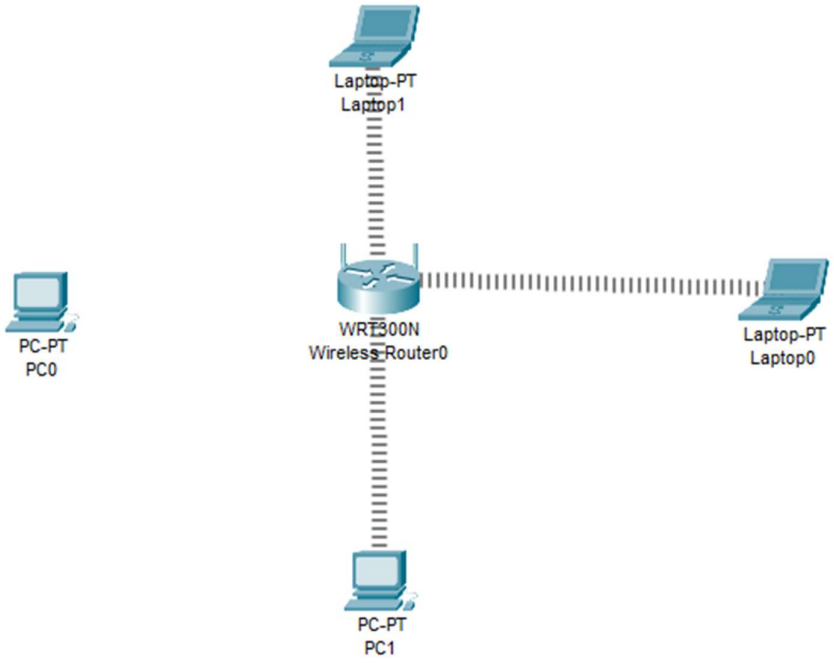
1. **Network Setup**:
    - Create a wireless network topology using a central wireless router and multiple client devices (e.g., laptops and desktop PCs).
    - Each device connects to the router wirelessly.
3. **MAC Address Identification**:
    - Access each device's network settings to retrieve its MAC address. o Document these addresses for use in filtering.
4. **Router Configuration**:
    - Log in to the router's admin interface.
    - Navigate to the Wireless > MAC Filter section.
    - Add MAC addresses to the filter list. o Choose the filtering mode (Allow or Deny).
    - Save and apply the settings.
5. **Testing**:

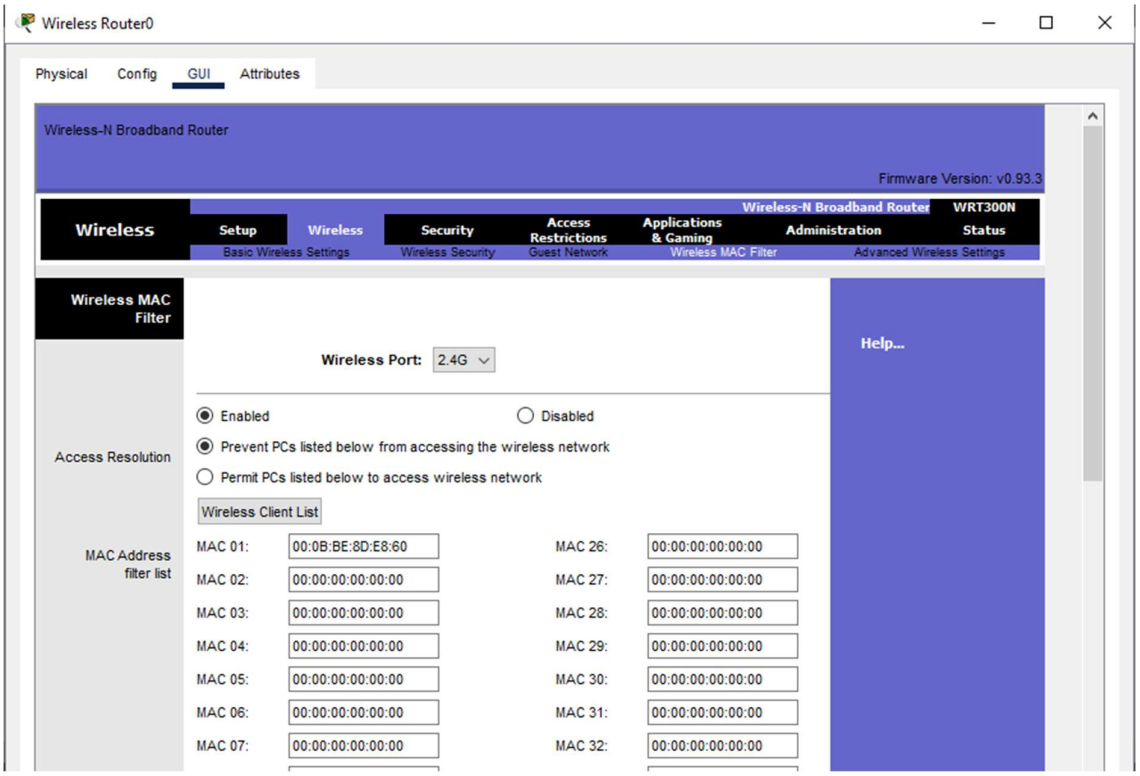
- Attempt to connect each device to the network. o Observe which devices are allowed or denied access based on the filter configuration.

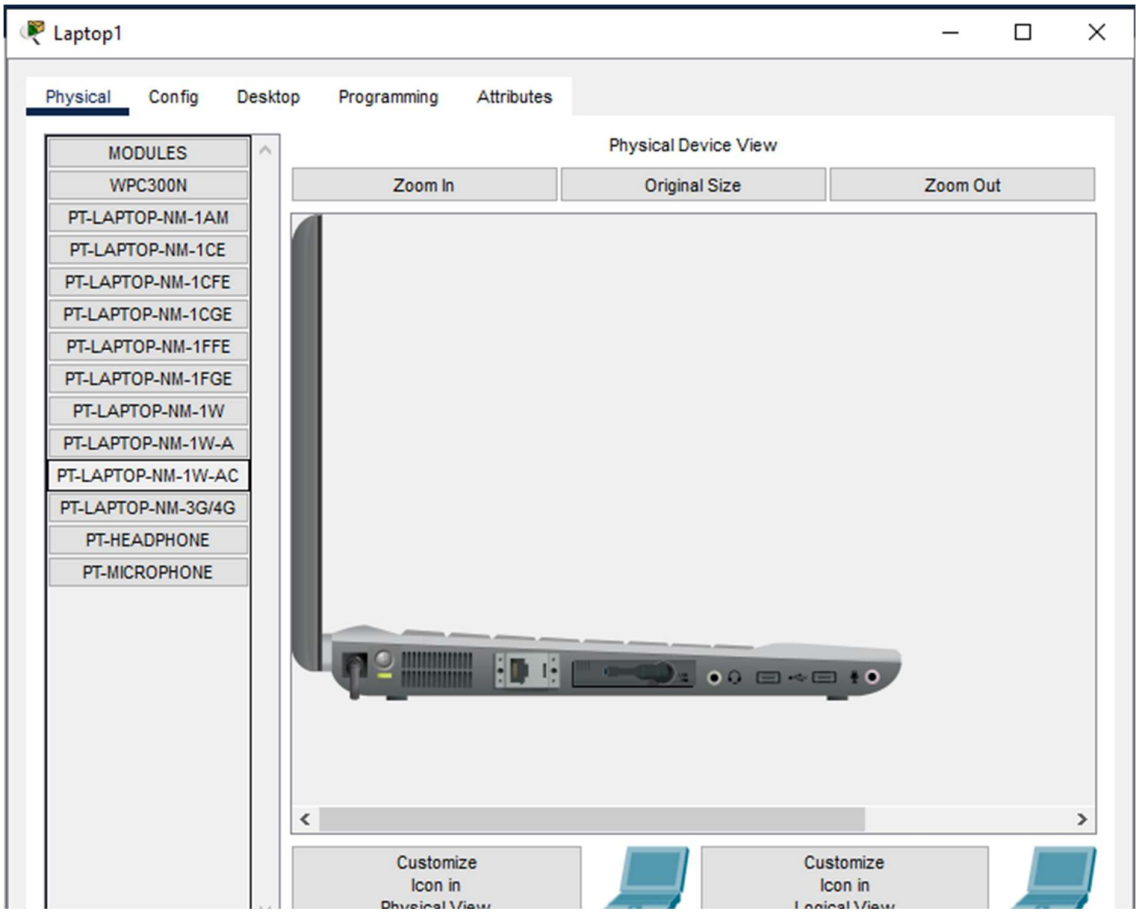
**Output**

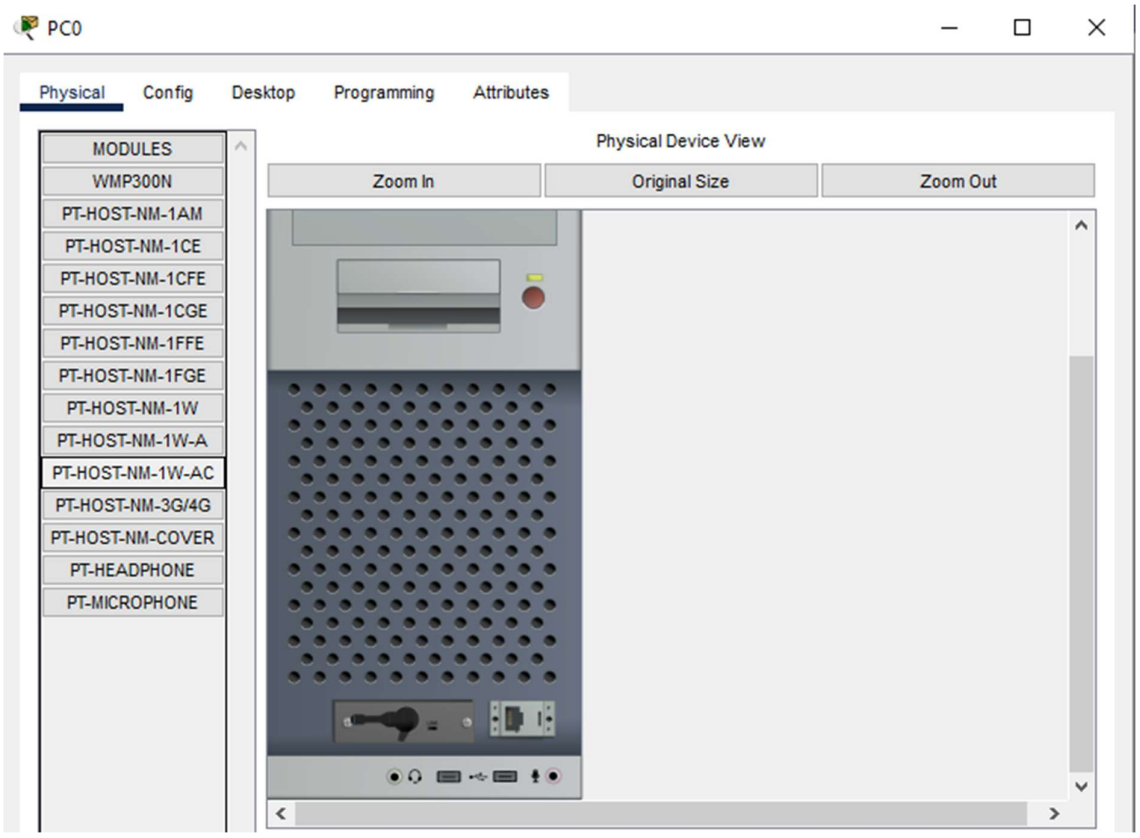
- Devices whose MAC addresses are allowed in the router settings will successfully connect to the wireless network.
- Devices whose MAC addresses are denied will be unable to access the network.
- The practical demonstrates how MAC filtering can be used to manage access in a wireless LAN environment.

**NETWORK TOPOLOGY:-**




Wireless Router0
Physical
Config
GUI
Attributes
Wireless-N Broadband Router
Firmware Version: v0.93.3
Wireless
Setup
Wireless
Security
Access Restrictions
Applications & Gaming
Administration
Status
Basic Wireless Settings
Wireless Security
Guest Network
Wireless MAC Filter
Advanced Wireless Settings
Wireless MAC Filter
Wireless Port: 2.4G
Help...
Enabled
Disabled
Access Resolution
Prevent PCs listed below from accessing the wireless network
Permit PCs listed below to access wireless network
Wireless Client List
MAC Address filter list
MAC 01: 00:0B:BE:8D:E8:60
MAC 02: 00:00:00:00:00:00
MAC 03: 00:00:00:00:00:00
MAC 04: 00:00:00:00:00:00
MAC 05: 00:00:00:00:00:00
MAC 06: 00:00:00:00:00:00
MAC 07: 00:00:00:00:00:00
MAC 26: 00:00:00:00:00:00
MAC 27: 00:00:00:00:00:00
MAC 28: 00:00:00:00:00:00
MAC 29: 00:00:00:00:00:00
MAC 30: 00:00:00:00:00:00
MAC 31: 00:00:00:00:00:00
MAC 32: 00:00:00:00:00:00


Laptop1
Physical
Config
Desktop
Programming
Attributes
MODULES
WPC300N
PT-LAPTOP-NM-1AM
PT-LAPTOP-NM-1CE
PT-LAPTOP-NM-1CFE
PT-LAPTOP-NM-1CGE
PT-LAPTOP-NM-1FFE
PT-LAPTOP-NM-1FGE
PT-LAPTOP-NM-1W
PT-LAPTOP-NM-1W-A
PT-LAPTOP-NM-1W-AC
PT-LAPTOP-NM-3G/4G
PT-HEADPHONE
PT-MICROPHONE
Physical Device View
Zoom In
Original Size
Zoom Out
Customize Icon in
Customize Icon in



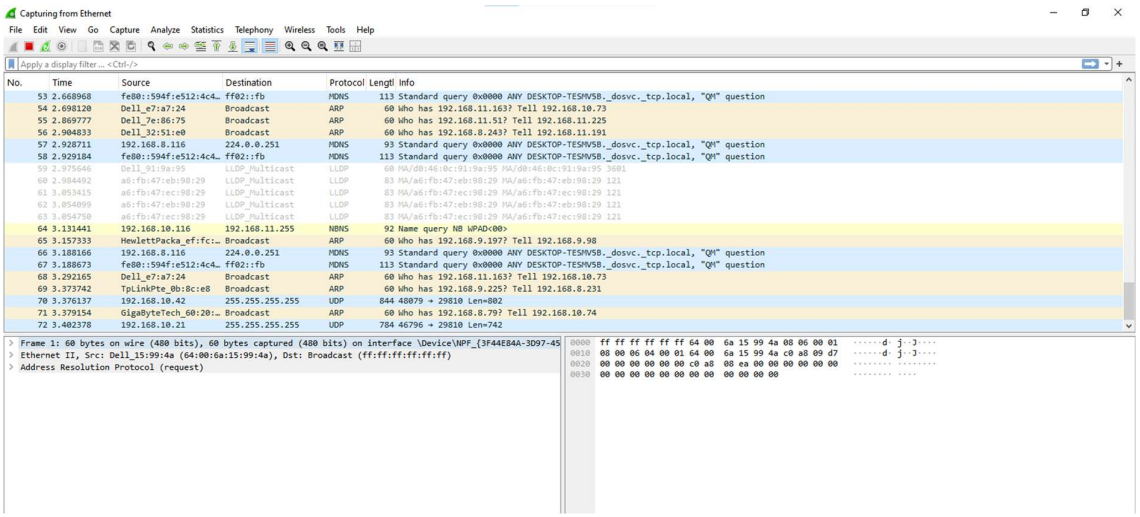

Same as for other two devices.

## Practical 12

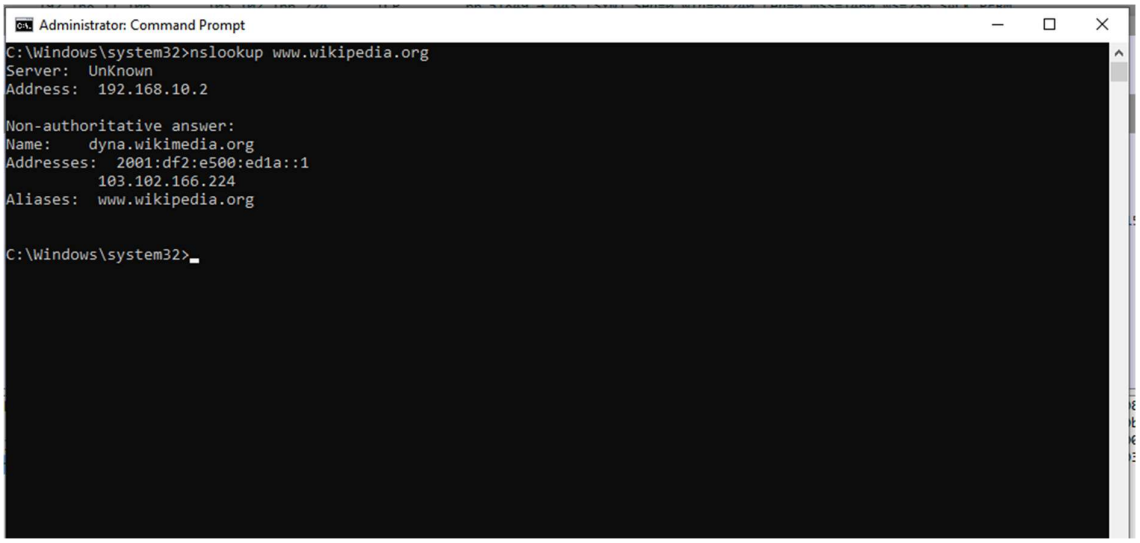
**Aim:**Capture packets using wireshark.

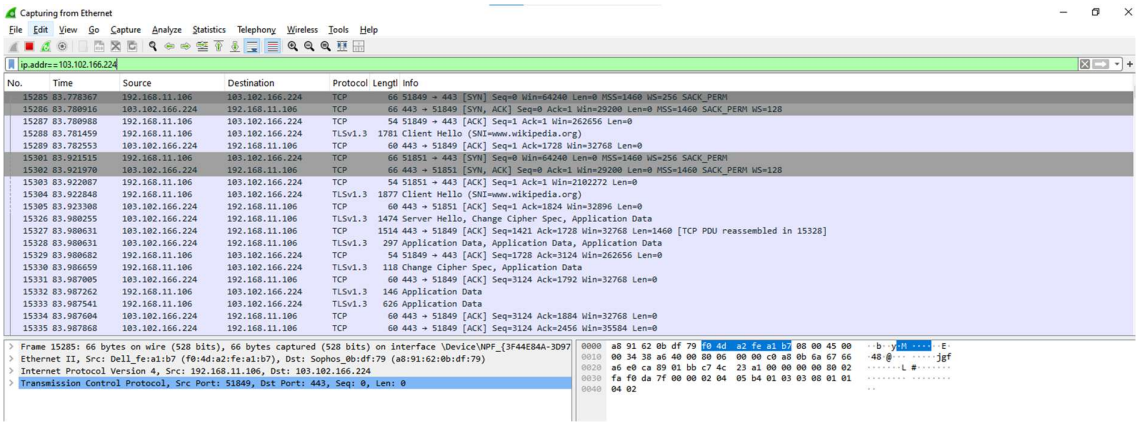
Q)What is purpose wireshark?

Wireshark is a powerful network protocol analyzer used to capture and inspect data packets in real time across a network. Its primary purpose is to help users understand what's happening at a microscopic level within their network—whether it's diagnosing connectivity issues, debugging applications, or investigating security breaches. By decoding hundreds of protocols, Wireshark allows network administrators, security professionals, and developers to visualize the flow of data, identify anomalies, and ensure systems are functioning as intended. It’s also widely used as an educational tool, offering students and enthusiasts a hands-on way to explore how network communication works. Essentially, Wireshark acts like a digital microscope, revealing the hidden conversations between devices that keep our connected world running.




To find Specific packet:


Administrator: Command Prompt
C:\Windows\system32>nslookup www.wikipedia.org
Server:  UnKnown
Address:  192.168.10.2
Non-authoritative answer:
Name:    dyna.wikimedia.org
Addresses:  2001:df2:e500:ed1a::1
          103.102.166.224
Aliases:  www.wikipedia.org
C:\Windows\system32>


Capturing from Ethernet
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
ip.addr==103.102.166.224
No. Time Source Destination Protocol Length Info
15285 83.778367 192.168.11.106 103.102.166.224 TCP 66 51849 → 443 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
15286 83.780916 103.102.166.224 192.168.11.106 TCP 66 443 → 51849 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM WS=128
15287 83.780988 192.168.11.106 103.102.166.224 TCP 54 51849 → 443 [ACK] Seq=1 Ack=1 Win=262656 Len=0
15288 83.781459 192.168.11.106 103.102.166.224 TLSv1.3 1781 Client Hello (SNI=www.wikipedia.org)
15289 83.782553 103.102.166.224 192.168.11.106 TCP 60 443 → 51849 [ACK] Seq=1 Ack=1728 Win=32768 Len=0
15301 83.921515 192.168.11.106 103.102.166.224 TCP 66 51851 → 443 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
15302 83.921970 103.102.166.224 192.168.11.106 TCP 66 443 → 51851 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM WS=128
15303 83.922087 192.168.11.106 103.102.166.224 TCP 54 51851 → 443 [ACK] Seq=1 Ack=1 Win=2102272 Len=0
15304 83.922848 192.168.11.106 103.102.166.224 TLSv1.3 1877 Client Hello (SNI=www.wikipedia.org)
15305 83.923308 103.102.166.224 192.168.11.106 TCP 60 443 → 51851 [ACK] Seq=1 Ack=1824 Win=32896 Len=0
15326 83.980255 103.102.166.224 192.168.11.106 TLSv1.3 1474 Server Hello, Change Cipher Spec, Application Data
15327 83.980631 103.102.166.224 192.168.11.106 TCP 1514 443 → 51849 [ACK] Seq=1421 Ack=1728 Win=32768 Len=1460 [TCP PDU reassembled in 15328]
15328 83.980631 103.102.166.224 192.168.11.106 TLSv1.3 297 Application Data, Application Data, Application Data
15329 83.980682 192.168.11.106 103.102.166.224 TCP 54 51849 → 443 [ACK] Seq=1728 Ack=3124 Win=262656 Len=0
15330 83.986659 192.168.11.106 103.102.166.224 TLSv1.3 118 Change Cipher Spec, Application Data
15331 83.987005 103.102.166.224 192.168.11.106 TCP 60 443 → 51849 [ACK] Seq=3124 Ack=1792 Win=32768 Len=0
15332 83.987262 192.168.11.106 103.102.166.224 TLSv1.3 146 Application Data
15333 83.987541 192.168.11.106 103.102.166.224 TLSv1.3 626 Application Data
15334 83.987604 103.102.166.224 192.168.11.106 TCP 60 443 → 51849 [ACK] Seq=3124 Ack=1884 Win=32768 Len=0
15335 83.987868 103.102.166.224 192.168.11.106 TCP 60 443 → 51849 [ACK] Seq=3124 Ack=2456 Win=35584 Len=0
Frame 15285: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface \Device\NPF_{3F44E84A-3D97
Ethernet II, Src: Dell_fe:a1:b7 (f0:4d:a2:fe:a1:b7), Dst: Sophos_0b:df:79 (a8:91:62:0b:df:79)
Internet Protocol Version 4, Src: 192.168.11.106, Dst: 103.102.166.224
Transmission Control Protocol, Src Port: 51849, Dst Port: 443, Seq: 0, Len: 0
0000 a8 91 62 0b df 79 f0 4d a2 fe a1 b7 08 00 45 00
0010 00 34 38 a6 40 00 80 06 00 00 c0 a8 0b 6a 67 66
0020 a6 e0 ca 89 01 bb c7 4c 23 a1 00 00 00 00 80 02
0030 fa f0 da 7f 00 00 02 04 05 b4 01 03 03 08 01 01
0040 04 02