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Experiment No: 01

Name of the Experiment: Design and Implementation of Bus Topology

Objective:

The objective of this experiment is to analyze the performance characteristics of a bus topology network by measuring network latency and throughput under varying traffic loads.

Materials:

1. Computers (at least three) with network interface cards (NICs)
2. Ethernet cables
3. Network switch (optional, for monitoring)
4. Network traffic generator software (e.g., iPerf)
5. Network monitoring tools (e.g., Wireshark)
6. Stopwatch or timing software
7. Data collection sheets or software

Procedure:

Setup:

Connect the computers using Ethernet cables to create a bus topology. One computer will act as the main station (center) and the others as peripheral stations (nodes).

Install the network traffic generator software (e.g., iPerf) on each computer.

Optionally, set up a network switch to monitor traffic between the main station and peripheral stations using network monitoring tools (e.g., Wireshark).

Baseline Measurement:

Start with an idle network to establish baseline measurements.

Use a stopwatch or timing software to record the time it takes for a small data packet to travel from the main station to a peripheral station and back.

Repeat the measurement multiple times and calculate the average round-trip latency.

Latency Analysis:

Gradually increase the traffic load by configuring the network traffic generator software to send increasing amounts of data between the main station and a peripheral station.

Measure the round-trip latency at each traffic load level, repeating each measurement multiple times and calculating the average.

Plot a graph of traffic load (in Mbps or packets per second) against round-trip latency.

Throughput Analysis: Configure the network traffic generator software to simulate different levels of traffic load.

Measure the throughput (data transfer rate) between the main station and a peripheral station for each traffic load level.

Plot a graph of traffic load against throughput.

Collision Detection and Handling: Introduce a scenario where two peripheral stations attempt to transmit data simultaneously, leading to a collision.

Use Wireshark or similar tools to analyze the collision behavior and observe how the collision is detected and resolved within the bus topology.

Steps to Configure and Setup Bus Topology in Cisco Packet Tracer :

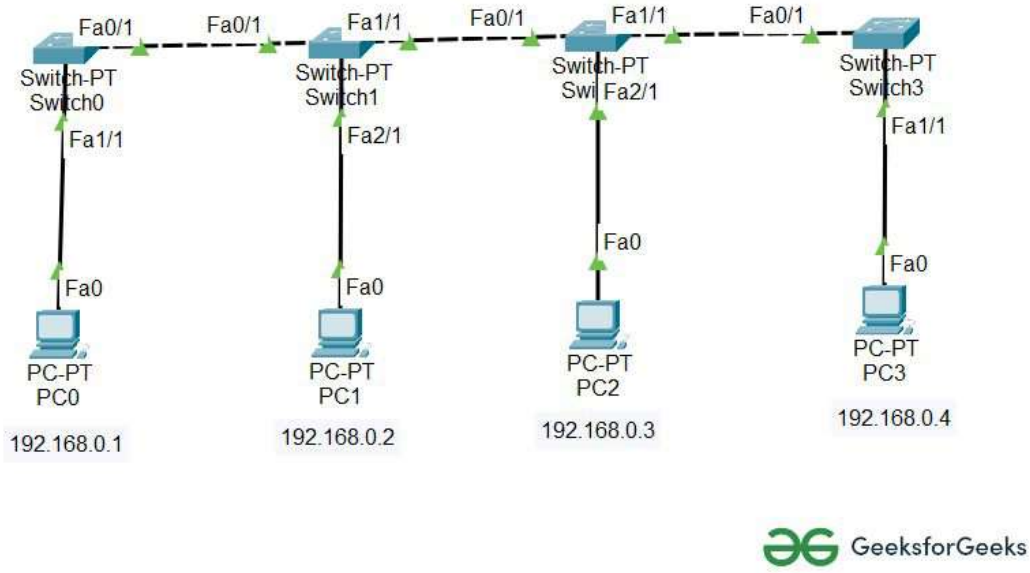
Step 1: First, open the cisco packet tracer desktop and select the devices given below:

S.NO	Device	Model-Name
1.	PC	PC
2.	Switch	PT-Switch

IP Addressing Table

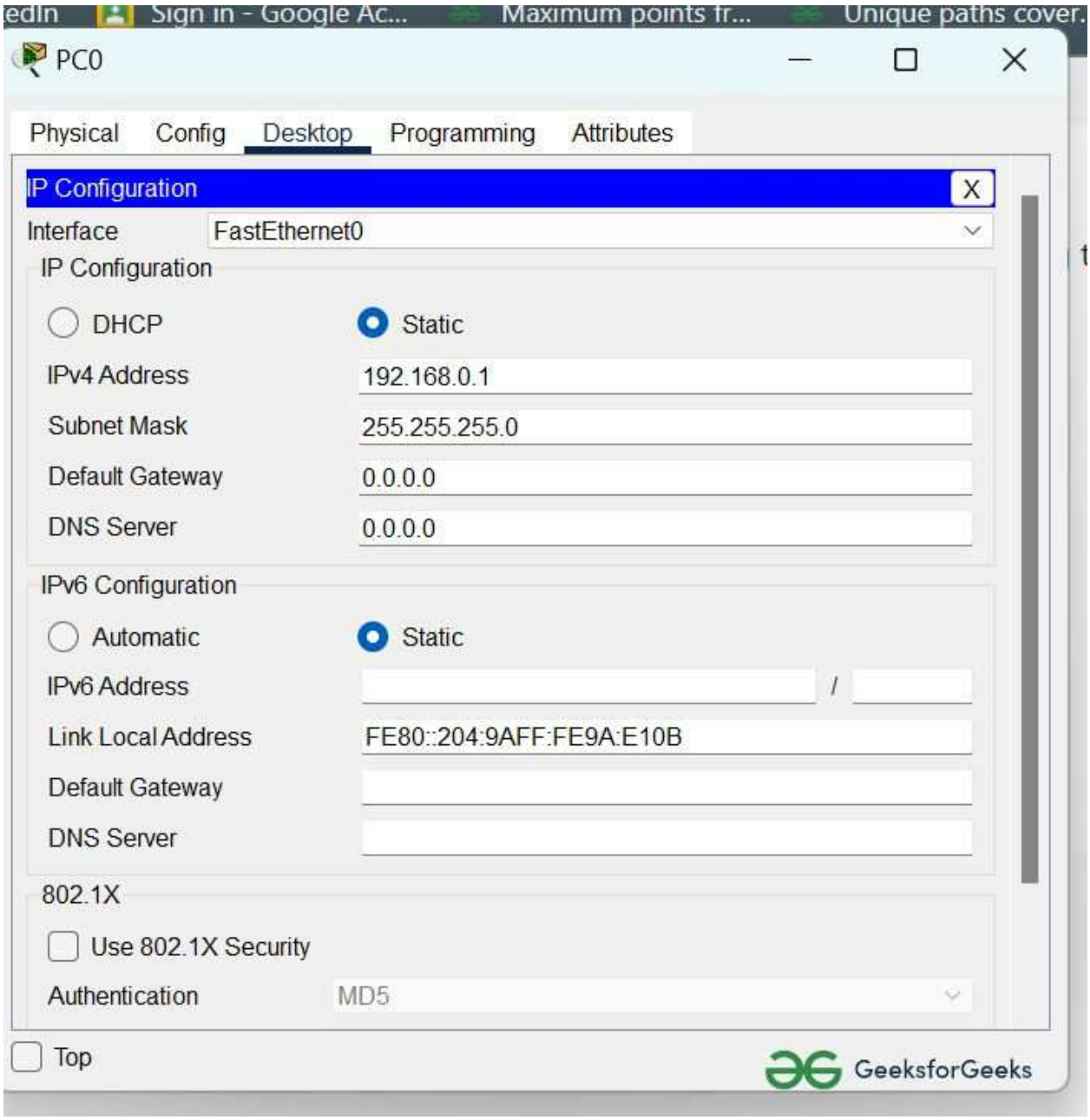
S.NO	Device	IPv4 Address	Subnet Mask
	pc0	192.168.0.1	255.255.255.0
	pc1	192.168.0.2	255.255.255.0
	pc2	192.168.0.3	255.255.255.0
	pc3	192.168.0.4	255.255.255.0

- Then, create a network topology as shown below image:
- Use an Automatic connecting cable to connect the devices with others.



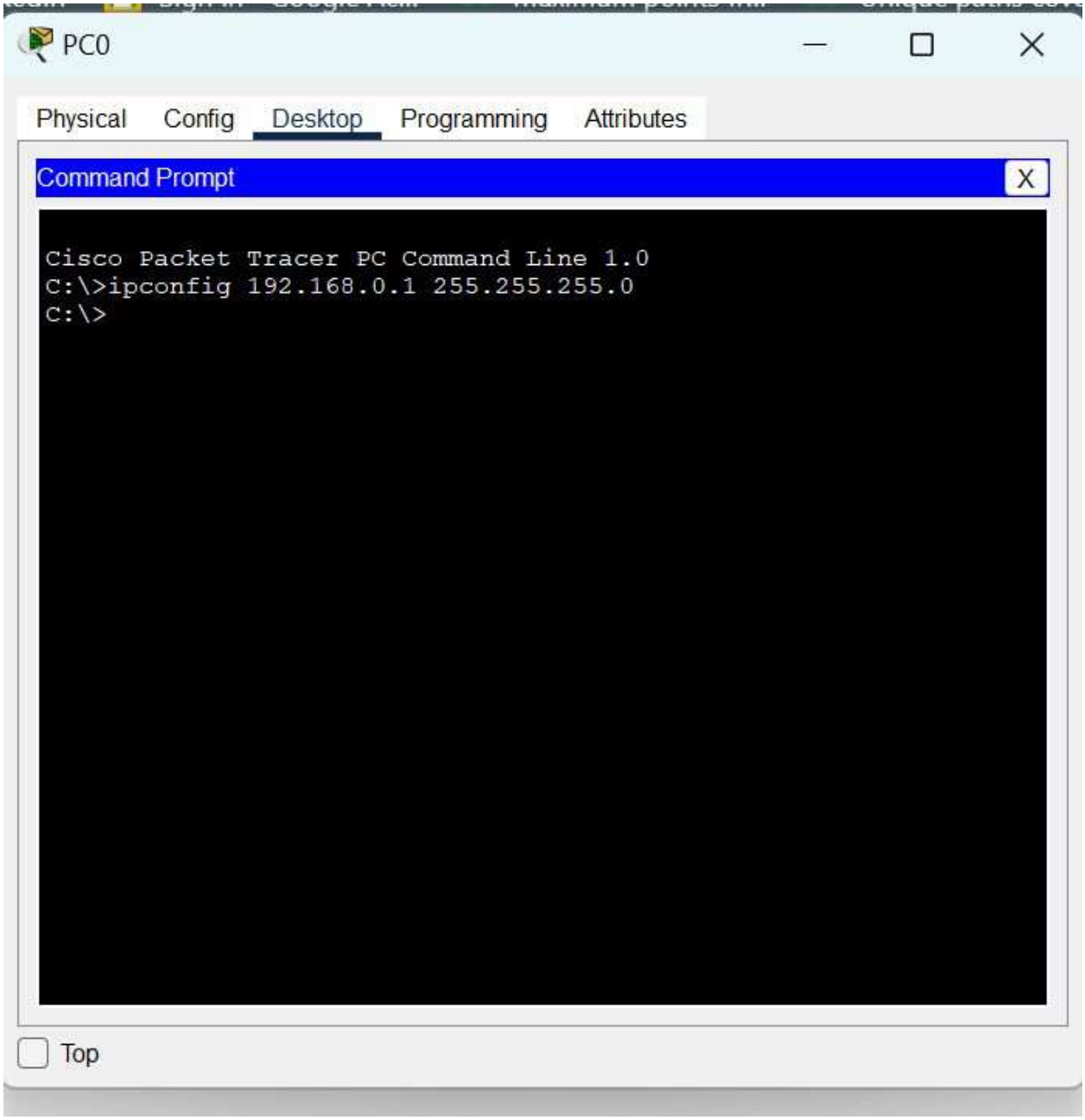
Step 2: Configure the PCs (hosts) with IPv4 address and Subnet Mask according to the IP addressing table given above.

- To assign an IP address in PC0, click on PC0.
- Then, go to desktop and then IP configuration and there you will IPv4 configuration.
- Fill IPv4 address and subnet mask.



- Assigning an IP address using the ipconfig command, or we can also assign an IP address with the help of a command.
- Go to the command terminal of the PC.
- Then, type ipconfig <IPv4 address><subnet mask><default gateway>(if needed)

  Example: ipconfig 192.168.0.1 255.255.255.0

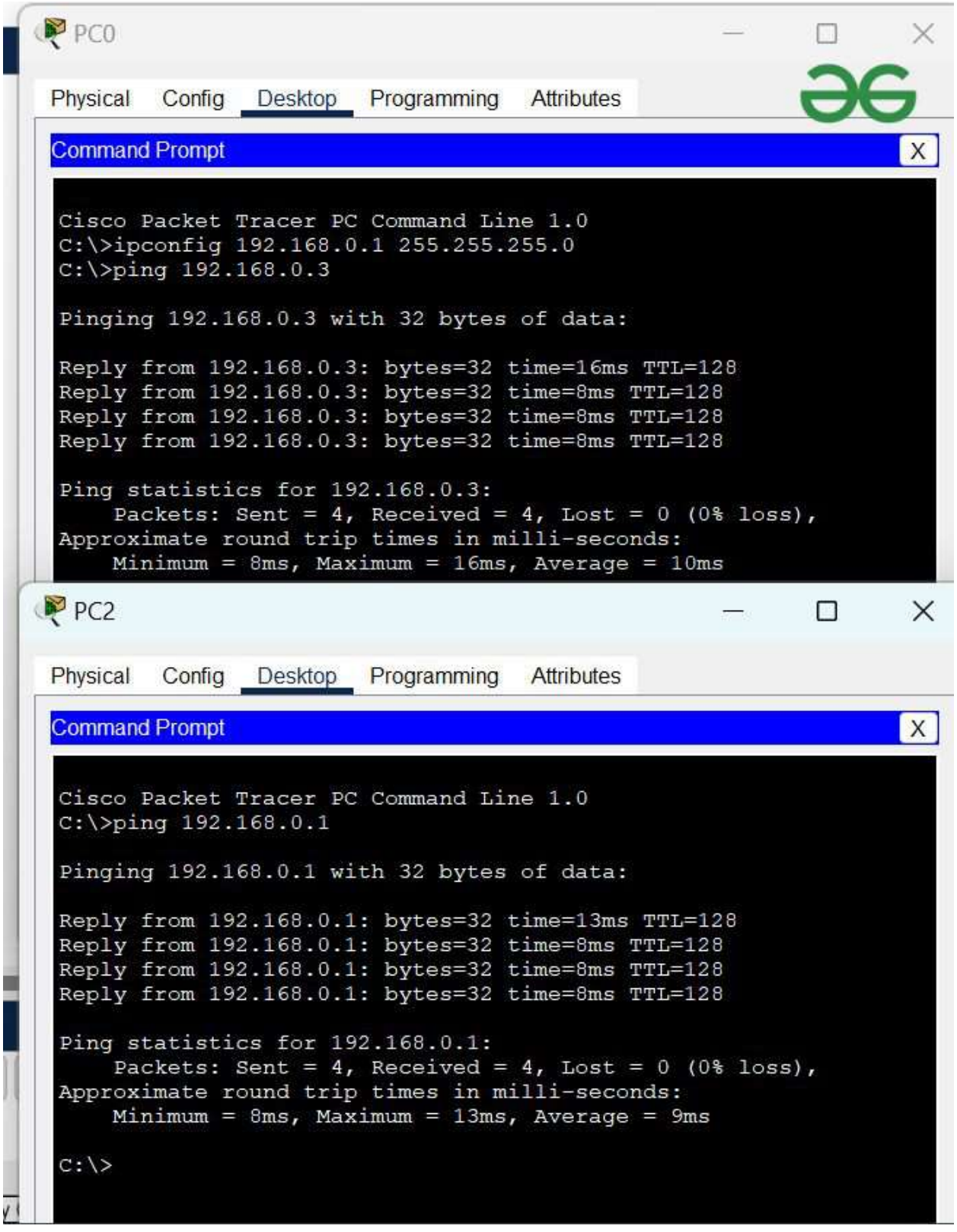


- Repeat the same procedure with other PCs to configure them thoroughly.

Step 3:

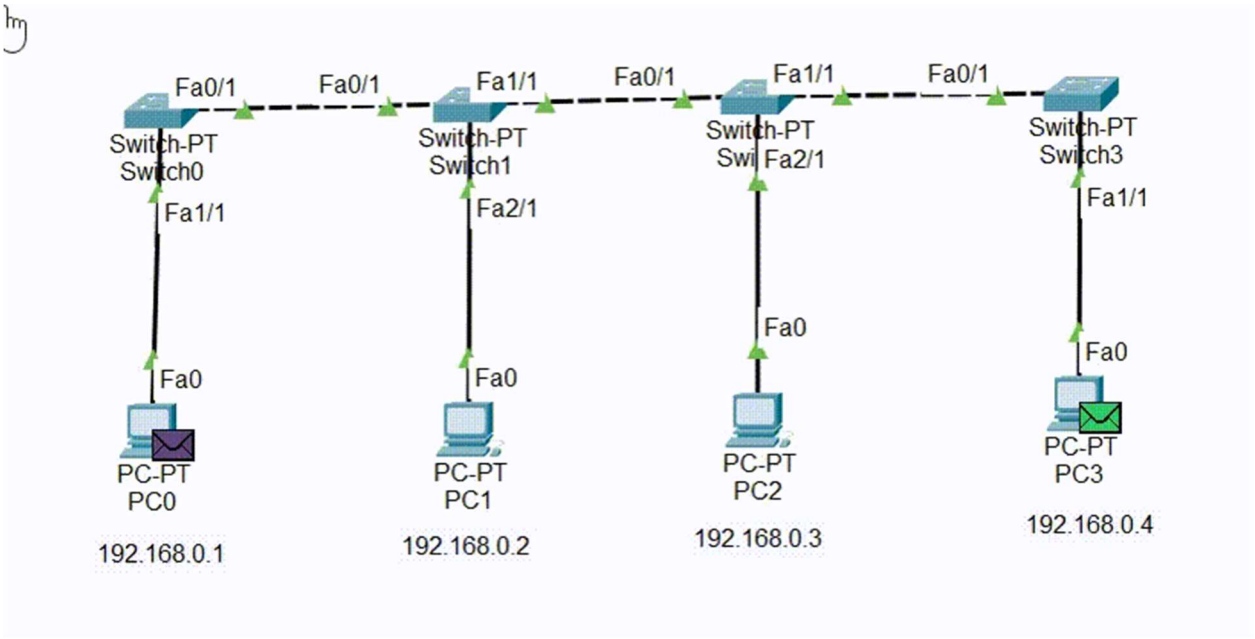
Verify the connection by pinging the IP address of any host in PC0.

- Use the ping command to verify the connection.
- As we can see we are getting replies from a targeted node on both PCs.
- Hence the connection is verified.


PC0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig 192.168.0.1 255.255.255.0
C:\>ping 192.168.0.3
Pinging 192.168.0.3 with 32 bytes of data:
Reply from 192.168.0.3: bytes=32 time=16ms TTL=128
Reply from 192.168.0.3: bytes=32 time=8ms TTL=128
Reply from 192.168.0.3: bytes=32 time=8ms TTL=128
Reply from 192.168.0.3: bytes=32 time=8ms TTL=128
Ping statistics for 192.168.0.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 8ms, Maximum = 16ms, Average = 10ms
PC2
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.1
Pinging 192.168.0.1 with 32 bytes of data:
Reply from 192.168.0.1: bytes=32 time=13ms TTL=128
Reply from 192.168.0.1: bytes=32 time=8ms TTL=128
Reply from 192.168.0.1: bytes=32 time=8ms TTL=128
Reply from 192.168.0.1: bytes=32 time=8ms TTL=128
Ping statistics for 192.168.0.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 8ms, Maximum = 13ms, Average = 9ms
C:\>

Simulation Result:

A simulation of the experiment is given below we have sent two PDU packets one targeted from PC0 to PC2 and another targeted from PC3 to PC1.



Experiment No: 02

Name of the experiment:

Design & Implementation of Ring Topology

Objective:

The objective of this experiment is to investigate the network latency and resilience of a ring topology by measuring data transmission times and assessing its ability to recover from node failures.

Materials:

1. Computers (at least four) with network interface cards (NICs)
2. Ethernet cables
3. Network switch (optional, for monitoring)
4. Network traffic generator software (e.g., iPerf)
5. Network monitoring tools (e.g., Wireshark)
6. Stopwatch or timing software
7. Data collection sheets or software

Procedure:

Setup: Connect the computers using Ethernet cables to form a ring topology. Ensure each computer is connected to two adjacent computers, creating a closed loop.

Install the network traffic generator software (e.g., iPerf) on each computer.

Optionally, set up a network switch to monitor traffic between nodes using network monitoring tools (e.g., Wireshark).

Baseline Measurement:

Start with an idle network to establish baseline measurements.

Select any two nodes that are not adjacent to each other in the ring. Measure the time it takes for a small data packet to travel from one node to the other and back.

Repeat the measurement multiple times and calculate the average round-trip latency.

Latency Analysis:

Gradually increase the traffic load by configuring the network traffic generator software to send increasing amounts of data around the ring.

Measure the round-trip latency at each traffic load level, repeating each measurement multiple times and calculating the average.

Plot a graph of traffic load (in Mbps or packets per second) against round-trip latency.

Node Failure and Recovery:

Introduce a node failure by disconnecting one of the cables between two adjacent nodes.

Monitor the network behavior during and after the node failure.

Measure the time it takes for the network to detect the failure, isolate the faulty segment, and recover to a stable state.

Network Resilience and Fault Tolerance:

Introduce multiple node failures, one at a time, in different locations within the ring.

Observe the network's behavior and recovery process for each node failure.

Measure the network's resilience by analyzing its ability to maintain communication and restore connectivity.

Steps to Configure and Setup Ring Topology in Cisco Packet Tracer:

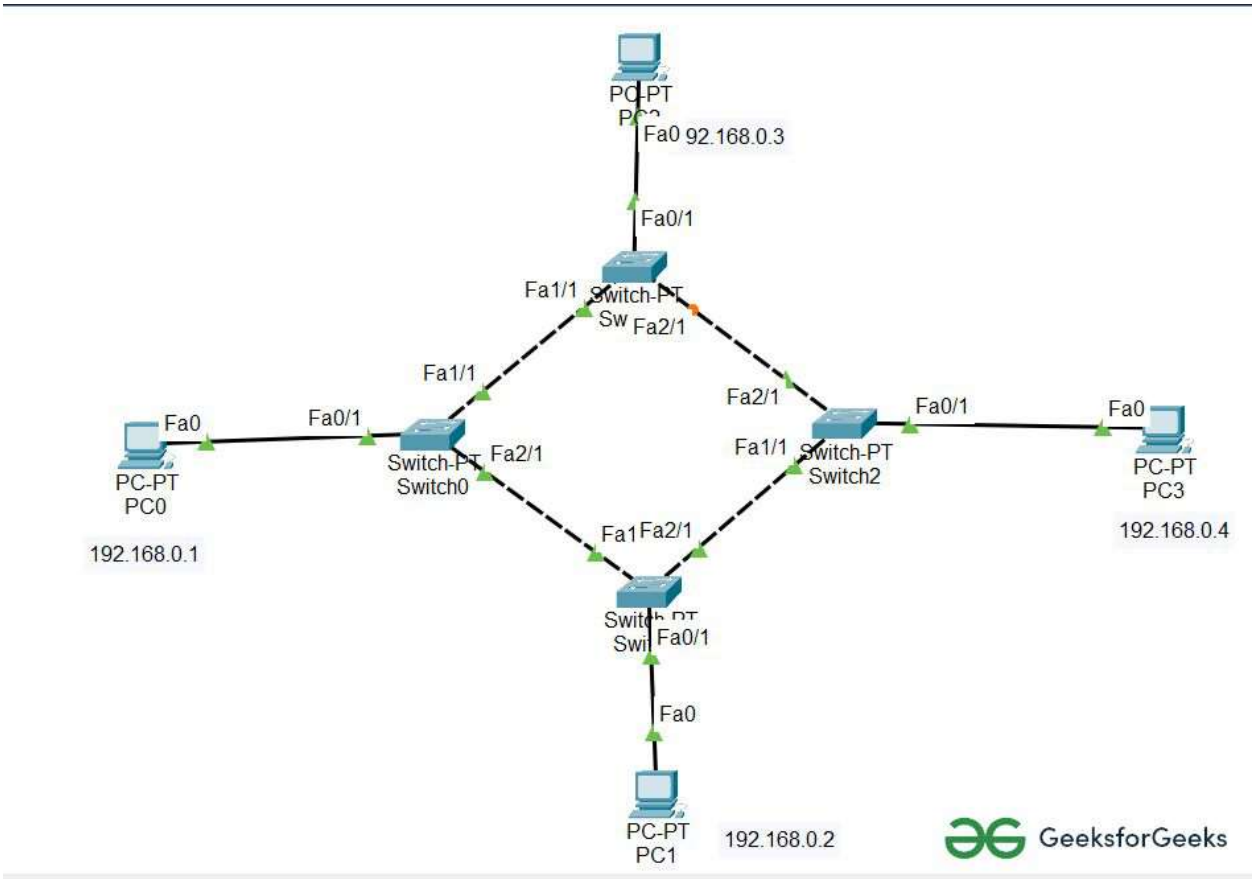
Step 1: First, open the cisco packet tracer desktop and select the devices given below:

S.NO	Device	Model Name
1.	PC	PC
2.	Switch	PT-Switch

IP Addressing Table

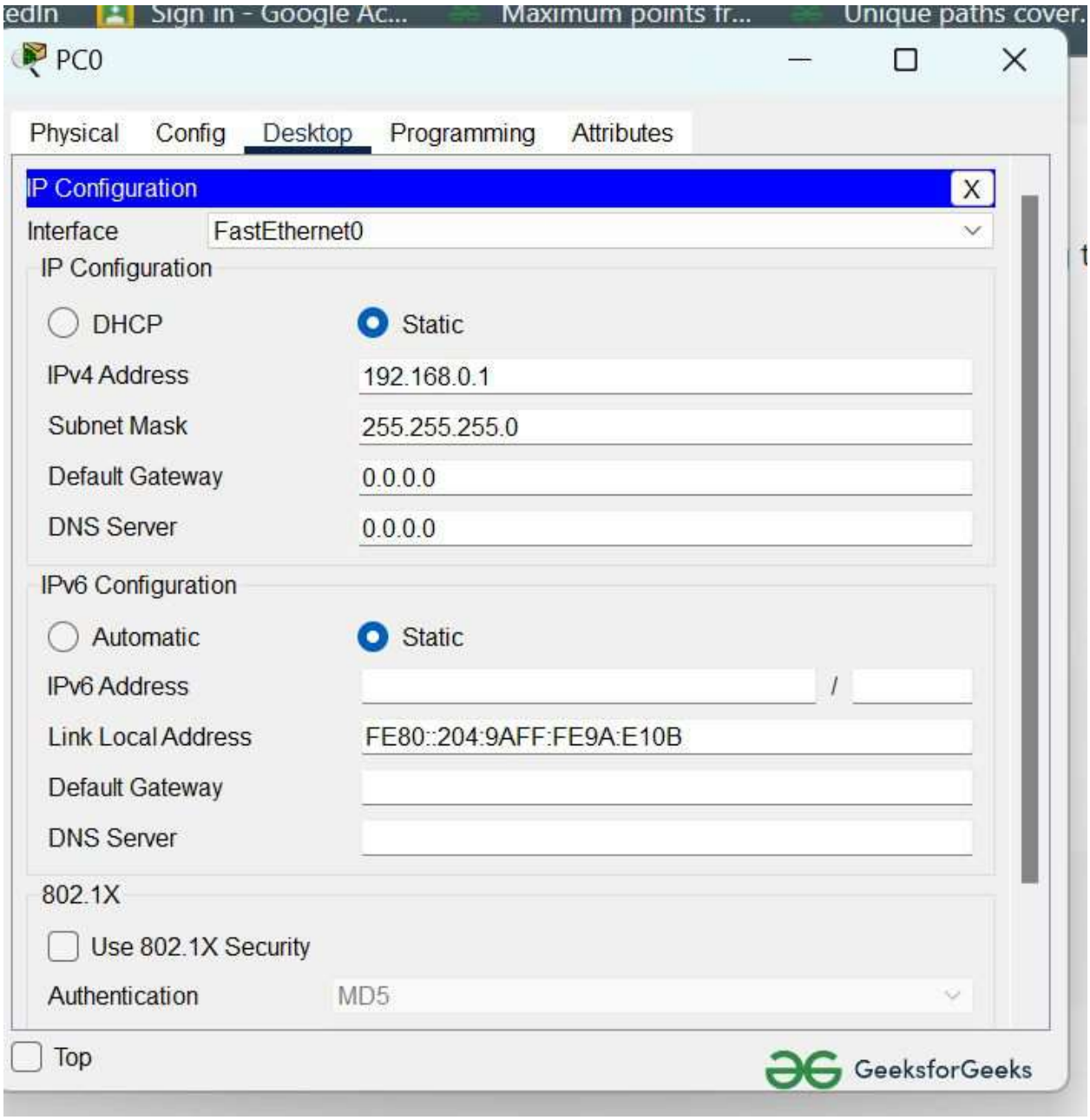
S.NO	Device	IPv4 Address	Subnet Mask
1.	**pc0**	192.168.0.1	255.255.255.0
2.	**pc1**	192.168.0.2	255.255.255.0
3.	**pc2**	192.168.0.3	255.255.255.0
4.	**pc3**	192.168.0.4	255.255.255.0

- Then, create a network topology as shown below the image.
- Use an Automatic connecting cable to connect the devices with others.



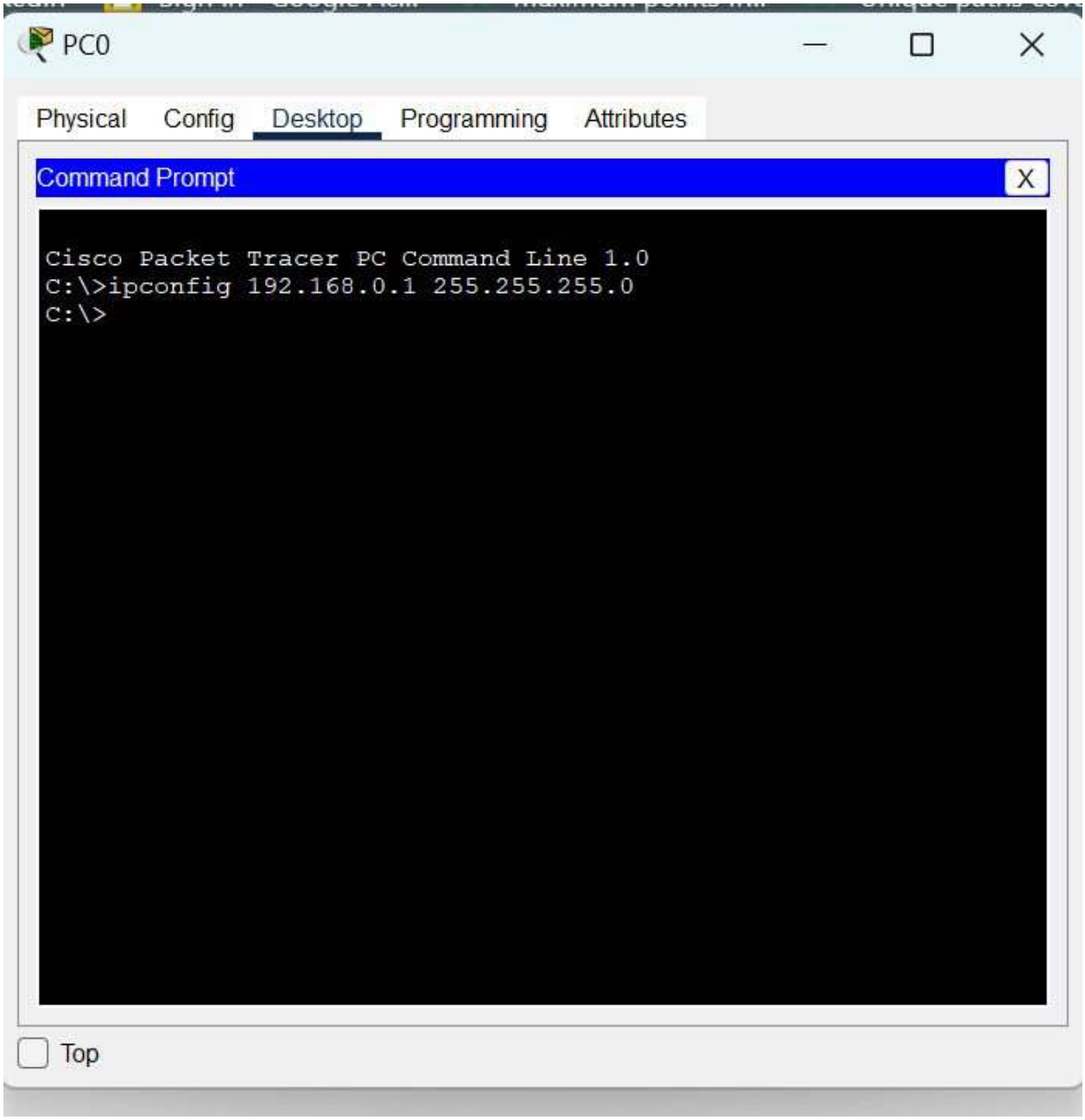
Step 2: Configure the PCs (hosts) with IPv4 address and Subnet Mask according to the IP addressing table given above.

- To assign an IP address in PC0, click on PC0.
- Then, go to desktop and then IP configuration and there you will IPv4 configuration.
- Fill IPv4 address and subnet mask.



- Assigning IP address using the ipconfig command, or we can also assign an IP address with the help of a command.
- Go to the command terminal of the PC.
- Then, type ipconfig <IPv4 address><subnet mask><default gateway>(if needed)

  Example: ipconfig 192.168.0.1 255.255.255.0

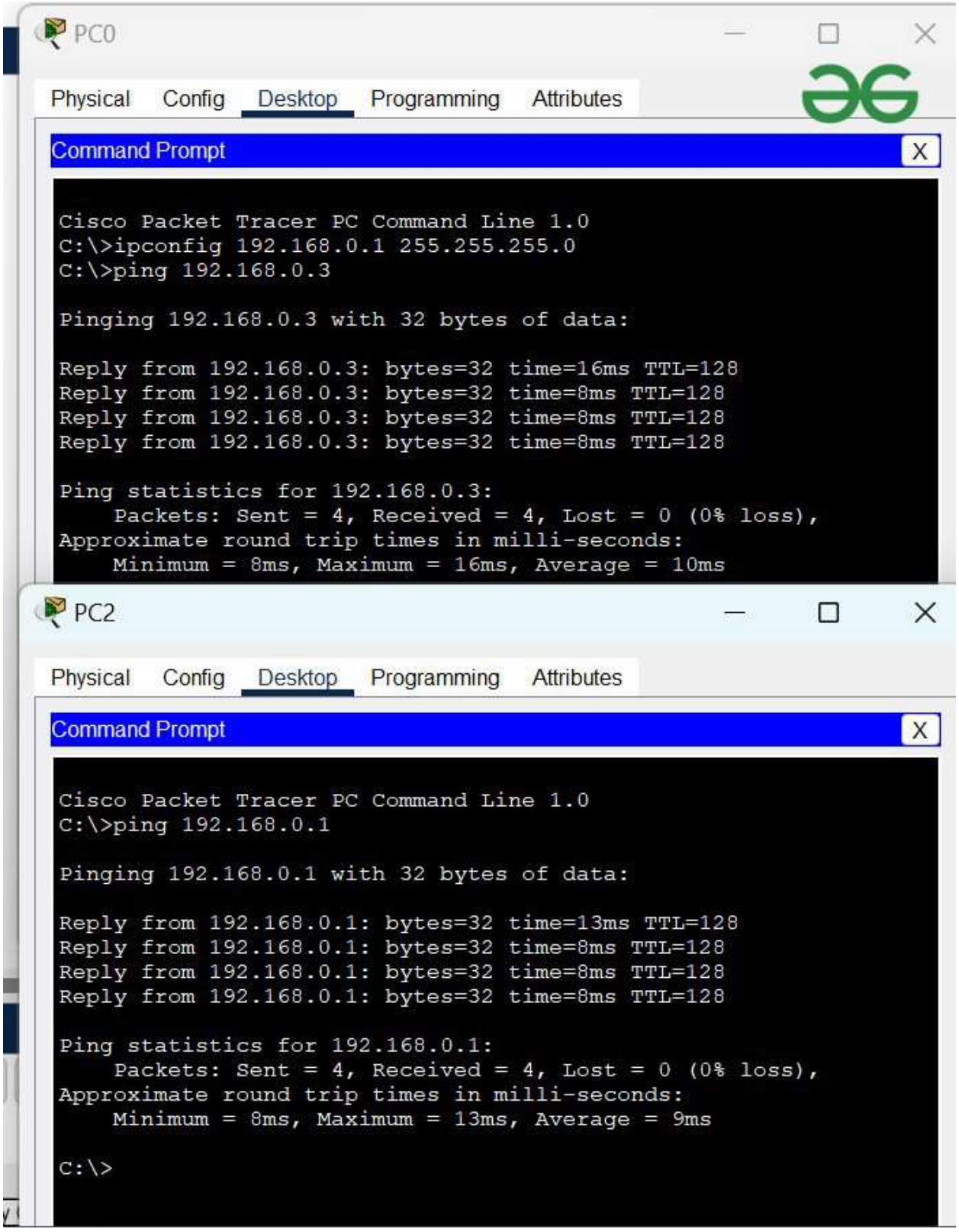


- Repeat the same procedure with other PCs to configure them thoroughly.

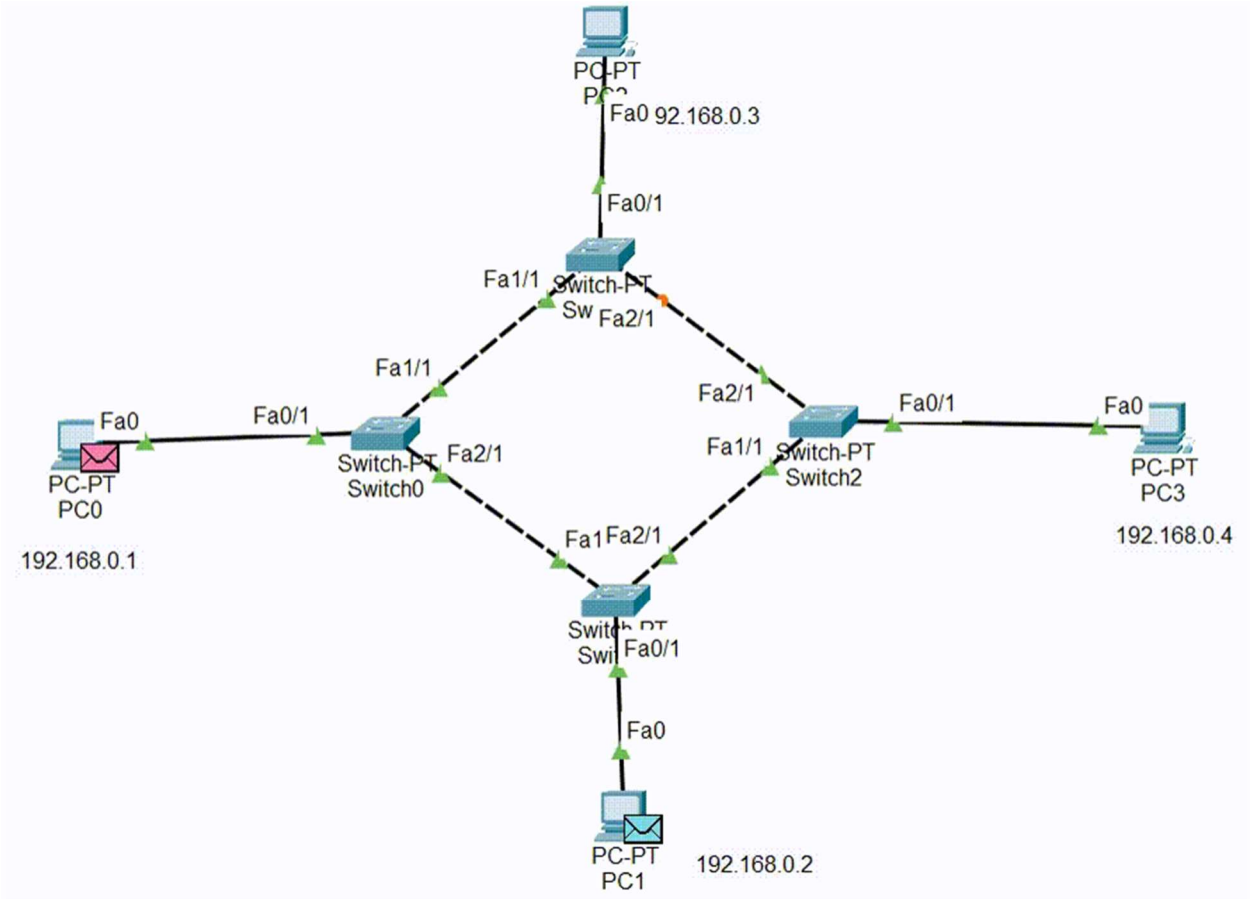
Step 3:

Verify the connection by pinging the IP address of any host in PC0.

- Use the ping command to verify the connection.
- As we can see we are getting replies from a targeted node on both PCs.
- Hence the connection is verified.



- A simulation of the experiment is given below we have sent two PDU packets one targeted from PC0 to PC2 and another targeted from PC1 to PC3.


PC-PT
Fa0
92.168.0.3
Fa0/1
Fa1/1
Switch-PT
Sw
Fa2/1
Fa1/1
Fa2/1
Fa0
Fa0/1
Switch-PT
Switch0
Fa2/1
Fa1/1
Switch-PT
Switch2
Fa0/1
Fa0
PC-PT
PC0
192.168.0.1
PC-PT
PC3
192.168.0.4
Fa1
Fa2/1
Fa0/1
Fa0
PC-PT
PC1
192.168.0.2

Experiment No: 03

Name of the experiment: Design and Implementation of Star Topology

Objective:

The objective of this experiment is to investigate the performance characteristics and scalability of a star topology network by measuring latency, throughput, and assessing its ability to handle increased network traffic.

Materials:

Computers (at least four) with network interface cards (NICs)

Ethernet cables

Network switch (hub can also be used for a basic setup)

Network traffic generator software (e.g., iPerf)

Network monitoring tools (e.g., Wireshark)

Stopwatch or timing software

Data collection sheets or software

Procedure:

Setup:

- Connect the computers using Ethernet cables to a central network switch in a star topology. Each computer should be directly connected to the central switch.
- Install the network traffic generator software (e.g., iPerf) on each computer.
- Set up a network monitoring tool (e.g., Wireshark) to capture and analyze network traffic.

Baseline Measurement:

- Start with an idle network to establish baseline measurements.
- Select two computers connected to the central switch and measure the time it takes for a small data packet to travel between them.
- Repeat the measurement multiple times and calculate the average latency.

Latency Analysis:

- Gradually increase the traffic load by configuring the network traffic generator software to send increasing amounts of data between different computers.
- Measure the latency for data transmission at each traffic load level, repeating each measurement multiple times and calculating the average.

Throughput Measurement:

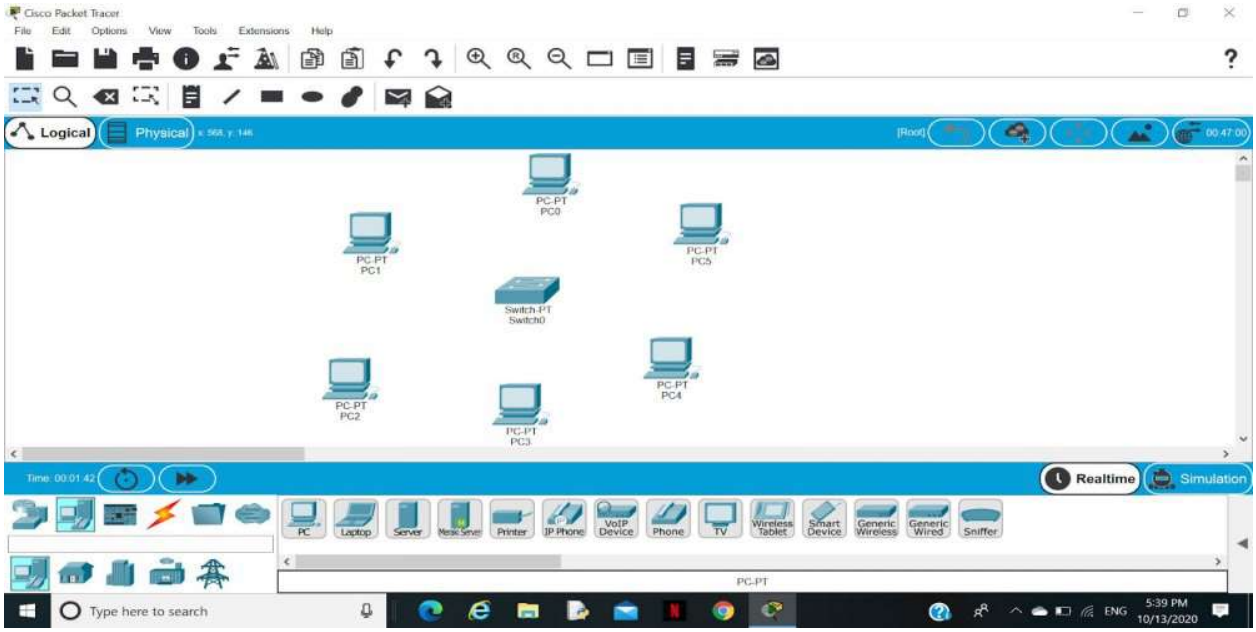
Configure the network traffic generator software to simulate different levels of traffic load.

Measure the throughput (data transfer rate) between a source computer and a destination computer for each traffic load level.

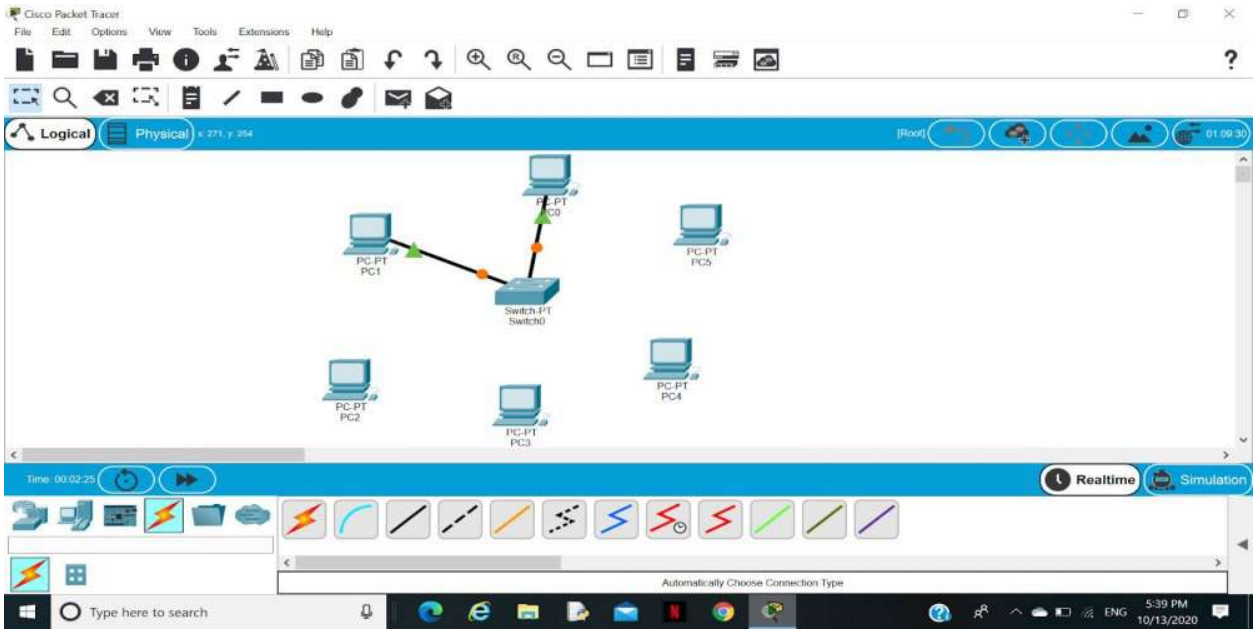
Plot a graph of traffic load against throughput.

Steps Implementing Star Topology using Cisco Packet Tracer:

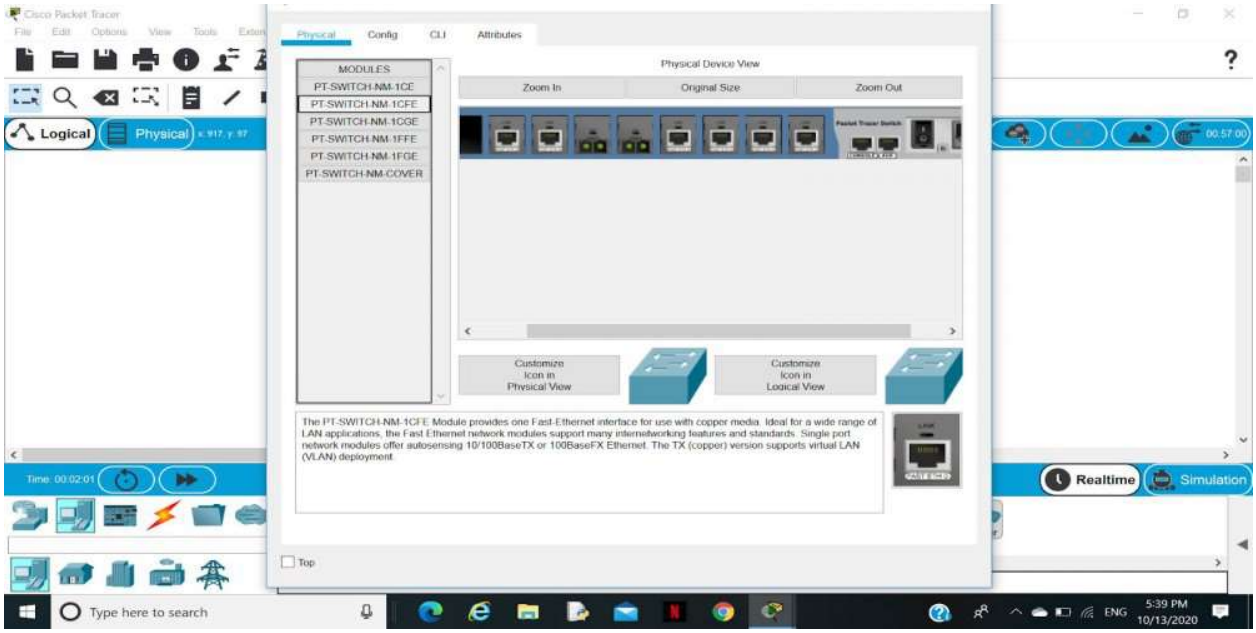
Step 1: We have taken a switch and linked it to six end devices.



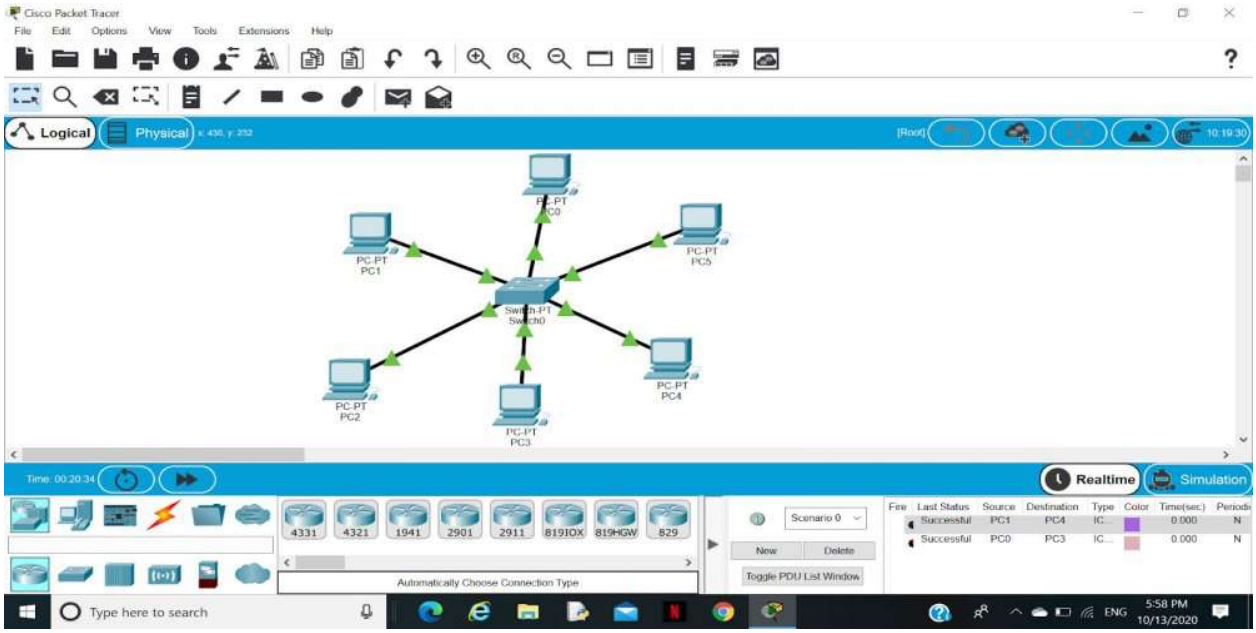
Step 2: Link every device with the switch.



Step 3: Provide the IP address to each device.



Step 4: Transfer message from one device to another and check the Table for Validation.



Now to check whether the connections are correct or not try to ping any device and the image below is doing the same.

To do ping one terminal of one device and run the following command:

Command:

"ping ip_address_of _any_device"

Example:

ping 192.168.1.4

Note: If the connections are correct

then you will receive the response.