Lab Introduction:

In this lab we'll be learning the basics of four physical topologies: Bus topology, Ring topology, Star topology and Mesh topology using a network simulation tool, Cisco Packet Tracer.

Objectives:

- To learn what Bus, Ring, Star and Mesh topologies are
- How these topologies work
- Where these topologies are used
- Advantages and disadvantages of these topologies

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Experiment No.: 1

Experiment Title: Simulating Bus Topology using Cisco Packet Tracer

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Objectives:

- To learn what a Bus topology is
- How a Bus topology works
- Where a Bus topology is used
- Advantages and disadvantages of Bus topology

Discussion:

Physical topology is the geometric representation of all the nodes and interconnections in a network.
A Bus topology is a physical topology where all the nodes are connected to a single backbone cable. When a signal moves along the backbone, only the receiver receives it, and the rest ignores it.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Connecting 5 Pcs to 5 switches, 1 per each, with straight through copper cable, as they are different typed devices and then connecting each switch to 1 other switch linearly with cross over copper cable, as they are same type of devices, all via Fast Ethernet ports.

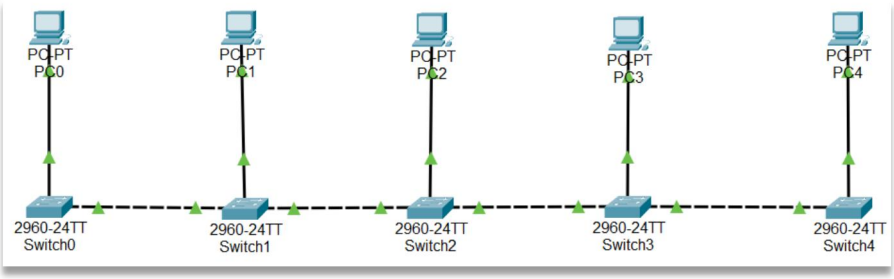

Fig 1.1: Simulating a bus topology in CPT

2. Configuring the PCs

2.1. Configure PC0, PC1, PC2, PC3, PC4 with the following IP addresses and Subnet Masks

Host	IP Address	Subnet Mask
PC0	10.10.10.1	255.0.0.0
PC1	10.10.10.2	255.0.0.0
PC2	10.10.10.3	255.0.0.0
PC3	10.10.10.4	255.0.0.0
PC4	10.10.10.5	255.0.0.0

3. Sending data across PCs

3.1. Connection tests across PCs
Ping PCs by there IP addresses from another PC in Command Prompt, one after another. If connection is there, four replies will come.
Command: ping<space>'IP address of some other PC'

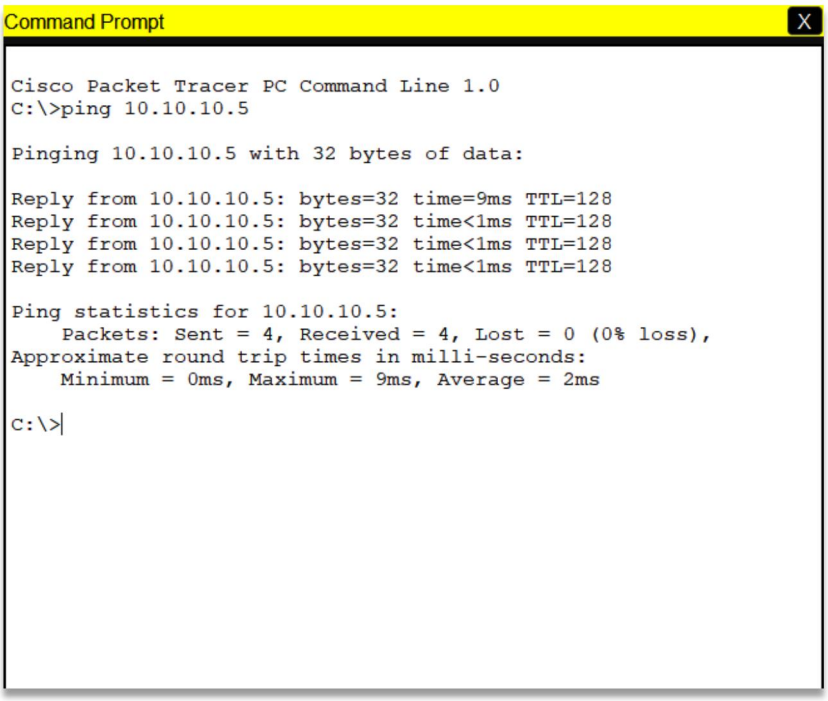

Fig 1.2: Pinging PC4 from PC0

4. Simulation:

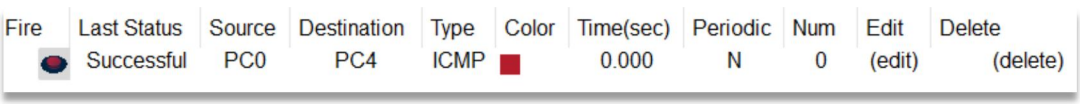

Fig 1.3: Successful packets travel across PCs

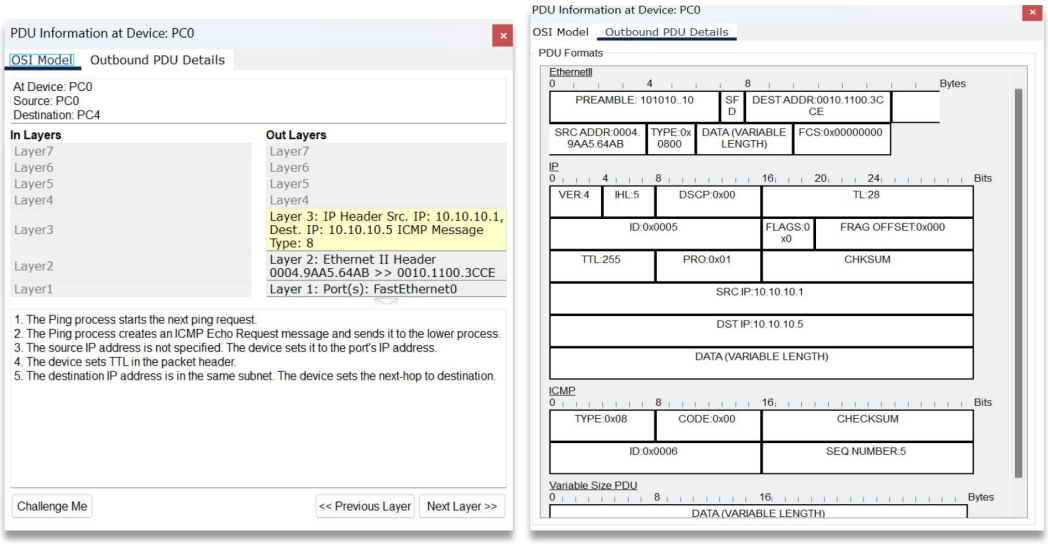

Fig 1.4: Protocol data unit at PC0

Conclusion:

- What a bus topology is:
  - It is also called a line topology.
  - Bus topology connects all station via a single cable called backbone
- How a bus topology works:
  - Data travels through the backbone, through each station, but only the destination accepts the data and others reject it.
- Where a Bus topology is used:
  - It is used in small networks.
- Pros and cons of using a bus topology:

Pros	Cons
1. Easy to manage in a small network, economical and trustworthy.	1. Not great for large networks.
2. Needed less cable.	2. Detecting faults in network is hard.
3. If need be, network I.e. backbone can be extended using repeaters.	3. Data transmission is slow.
4. If any station stops working, the system will still operate.	4. A single fault in the backbone can make the entire network to go down.
5. While adding or. Taking away stations, system stays on.	5. High packet loss.

Experiment No.: 2

Experiment Title: Simulating Ring Topology using Cisco Packet Tracer

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Objectives:

- To learn what a Ring topology is
- How a Ring topology works
- Where a Ring topology is used
- Advantages and disadvantages of Ring topology

Discussion:

Physical topology is the geometric representation of all the nodes and interconnections in a network.
A Ring topology is a physical topology where all the nodes are connected to 2 other nodes on both of its sides I.e neighboring nodes taking a ring form. Data travels across the network in a circular path until it reaches its destination. In this, data travels in unidirectional forms means in only one direction but it can also do bidirectional by having 2 connections between each Network Node, it is called Dual Ring Topology.
It is used in LANs and WANs.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Connecting 5 Pcs to 5 switches, 1 per each, with straight through copper cable, as they are different typed devices and then connecting each switch to 2 other neighboring switches with cross over copper cable, as they are same type of devices, all via Fast Ethernet ports.

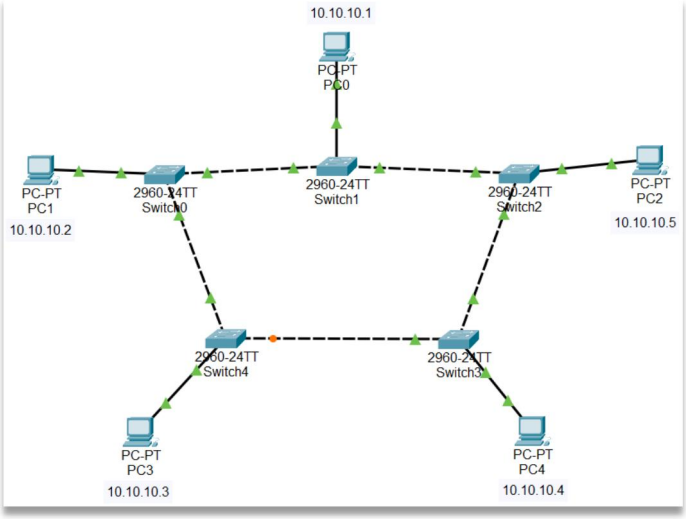

Fig 2.1: Simulating a ring topology in CPT

2. Configuring the PCs

2.1. Configure PC0, PC1, PC2, PC3, PC4 with the following IP addresses and Subnet Masks

Host	IP Address	Subnet Mask
PC0	10.10.10.1	255.0.0.0
PC1	10.10.10.2	255.0.0.0
PC2	10.10.10.5	255.0.0.0
PC3	10.10.10.3	255.0.0.0
PC4	10.10.10.4	255.0.0.0

3. Sending data across PCs

3.1. Connection tests across PCs
Ping PCs by there IP addresses from another PC in Command Prompt, one after another. If connection is there, four replies will come.
Command: ping<space>'IP address of some other PC'

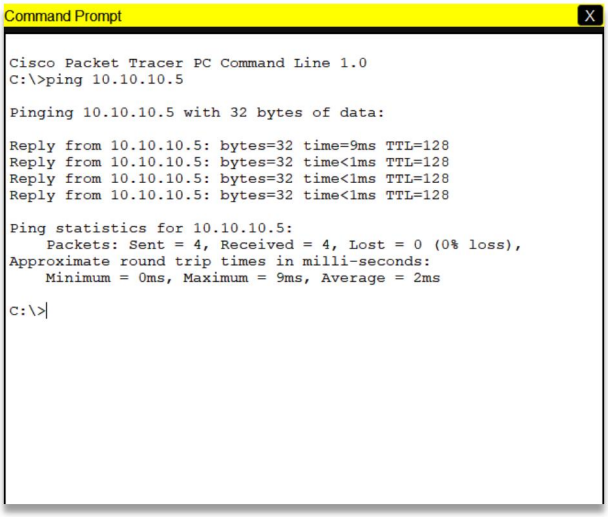

Fig 2.2: Pinging PC4 from PC0

4. Simulation:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC4	ICMP		0.000	N	0	(edit)	(delete)

Fig 2.3: Successful packets travel across PCs

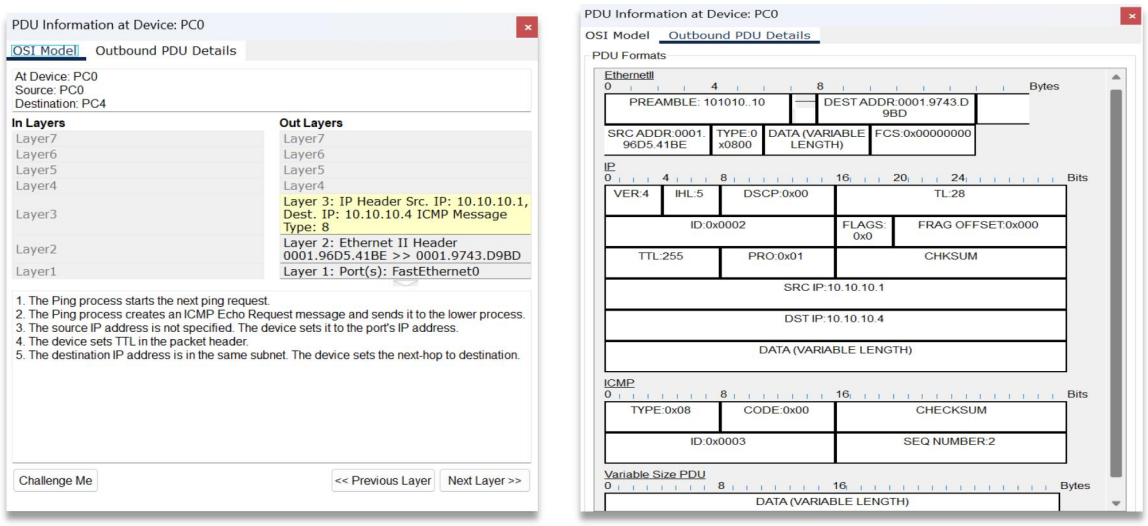

Fig 2.4: Protocol data unit at PC0

Conclusion:

- What a ring topology is:
  - The network is also mentioned as a hoop network.
  - A Ring topology is a physical topology where all the nodes are connected to 2 other nodes on both of its sides I.e neighboring nodes taking a ring form.
  - In this, data travels in unidirectional forms means in only one direction but it can also do bidirectional by having 2 connections between each Network Node, it is called Dual Ring Topology
- How a ring topology works:
  - Data travels across the network in a circular path until it reaches its destination.
- Where a ring topology is used:
  - It is used in LANs and WANs.
- Pros and cons of using a ring topology:

Pros	Cons
1. No need for a center station or server.	1. Network falls if any station falls, as every station is dependant on every other station.
2. Every connected station is equally important.	2. Detecting faults is quite complex.
3. Station increment does not affect its performance.	3. The whole system shuts down for station addition or subtraction.
4. Data flows in one direction which reduces the chance of packet collisions.	4. More expensive than bus topology.

Experiment No.: 3

Experiment Title: Simulating Star Topology using Cisco Packet Tracer

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Objectives:

- To learn what a Star topology is
- How a Star topology works
- Where a Star topology is used
- Advantages and disadvantages of Star topology

Discussion:

Physical topology is the geometric representation of all the nodes and interconnections in a network.
A Star topology is a physical topology where all the nodes are connected to a single network connecting device I.e. switch or hub. When data received by the network connecting device it forwards the data only to the destination, if it is a switch, or, it forwards the data to every other nodes except the sender where only the destination node, whose IP address matches, accepts it and others ignore it, if it's a hub.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Connecting 5 Pcs to a switch with straight through copper cable, as they are different typed devices via Fast Ethernet ports.

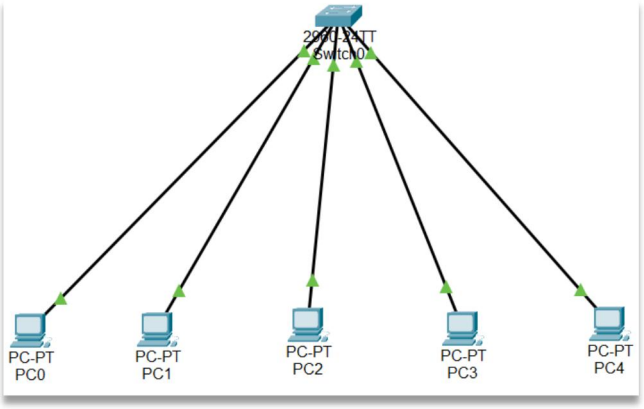

Fig 3.1: Simulating a bus topology in CPT

2. Configuring the PCs

2.1. Configure PC0, PC1, PC2, PC3, PC4 with the following IP addresses and Subnet Masks

Host	IP Address	Subnet Mask
PC0	10.10.10.1	255.0.0.0
PC1	10.10.10.2	255.0.0.0
PC2	10.10.10.3	255.0.0.0
PC3	10.10.10.4	255.0.0.0
PC4	10.10.10.5	255.0.0.0

3. Sending data across PCs

3.1. Connection tests across PCs
Ping PCs by there IP addresses from another PC in Command Prompt, one after another. If connection is there, four replies will come.
Command: ping<space>'IP address of some other PC'

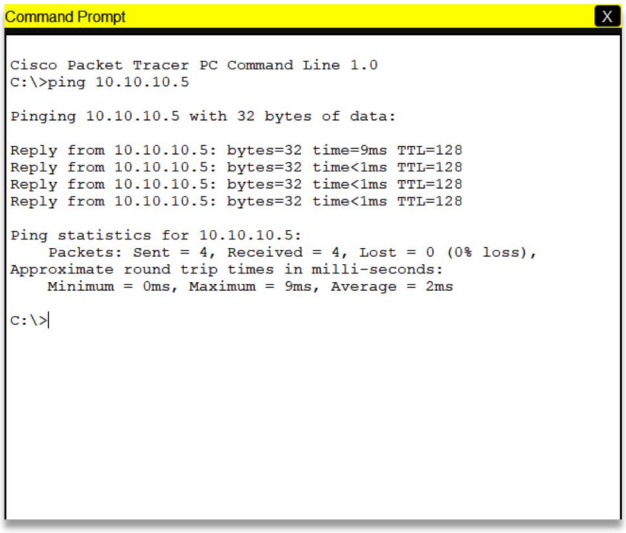

Fig 3.2: Pinging PC4 from PC0

4. Simulation:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC4	ICMP		0.000	N	0	(edit)	(delete)

Fig 3.3: Successful packets travel across PCs

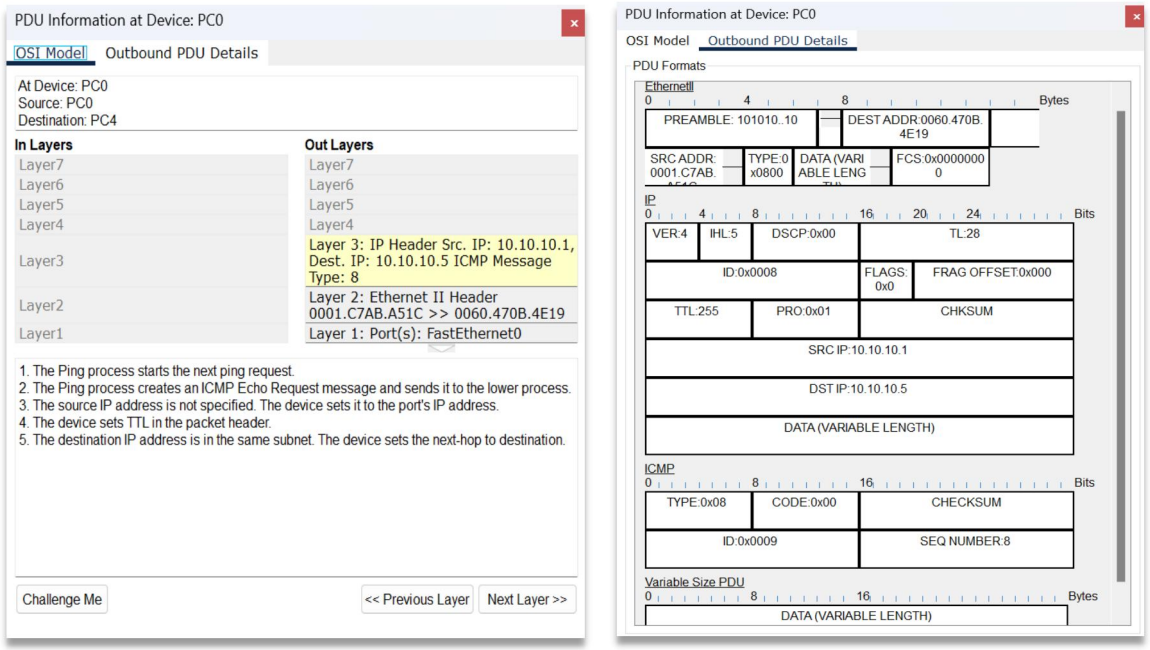

Fig 3.4: Protocol data unit at PC0

Conclusion:

- What a star topology is:
  - Star topology connects all station via a single central station.
- How a star topology works:
  - Data travels through the central station.
- Where a star topology is used:
  - It is used in LANs.
- Pros and cons of using a star topology:

Pros	Cons
1. New stations can be added or subtracted with the system keeping on. 2. Network fault detection is easeier. 3. Use of intelligent hub or switch helps in workload monitoring. 4. A single peripheral faulty station does not affect the network. 5. Multiple types of cables can be ued in a network.	1. Network falls if the center device falls. 2. More cables are needed. 3. Data transmission rate decreases if the number of station increases. 4. Performance depends on the central device.

Experiment No.: 4

Experiment Title: Simulating Mesh Topology using Cisco Packet Tracer

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Objectives:

- To learn what a Mesh topology is
- How a Mesh topology works
- Where a Mesh topology is used
- Advantages and disadvantages of Mesh topology

Discussion:

Physical topology is the geometric representation of all the nodes and interconnections in a network.
A Mesh topology is a physical topology where all the nodes are connected directly to every other nodes. Data can be directly sent to one node to the other.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Connecting 4 PCs to 4 switches, 1 per each, with straight through copper cable, as they are different typed devices and then connecting each switch to other 3 switches with cross over copper cable, as they are same type of devices.

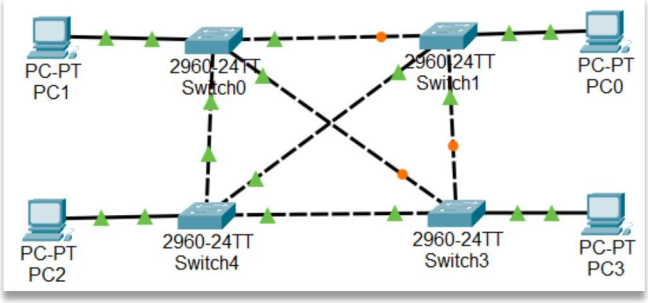

Fig 4.1: Simulating a mesh topology in CPT

2. Configuring the PCs

2.1. Configure PC0, PC1, PC2, PC3, PC4 with the following IP addresses and Subnet Masks

Host	IP Address	Subnet Mask
PC0	10.10.10.1	255.0.0.0
PC1	10.10.10.2	255.0.0.0
PC2	10.10.10.3	255.0.0.0
PC3	10.10.10.4	255.0.0.0

3. Sending data across PCs

3.1. Connection tests across PCs
Ping PCs by there IP addresses from another PC in Command Prompt, one after another. If connection is there, four replies will come.
Command: ping<space>'IP address of some other PC'

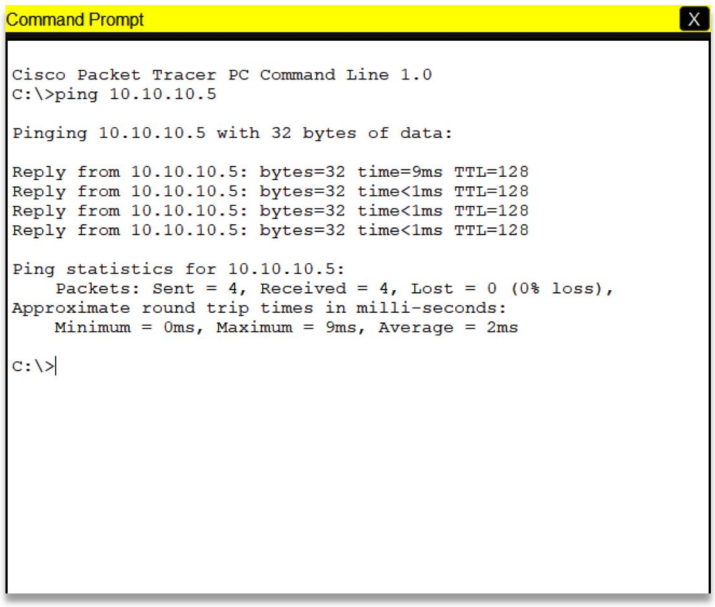

Fig 4.2: Pinging PC4 from PC0

4. Simulation:

Fig 4.3: Successful packets travel across PCs

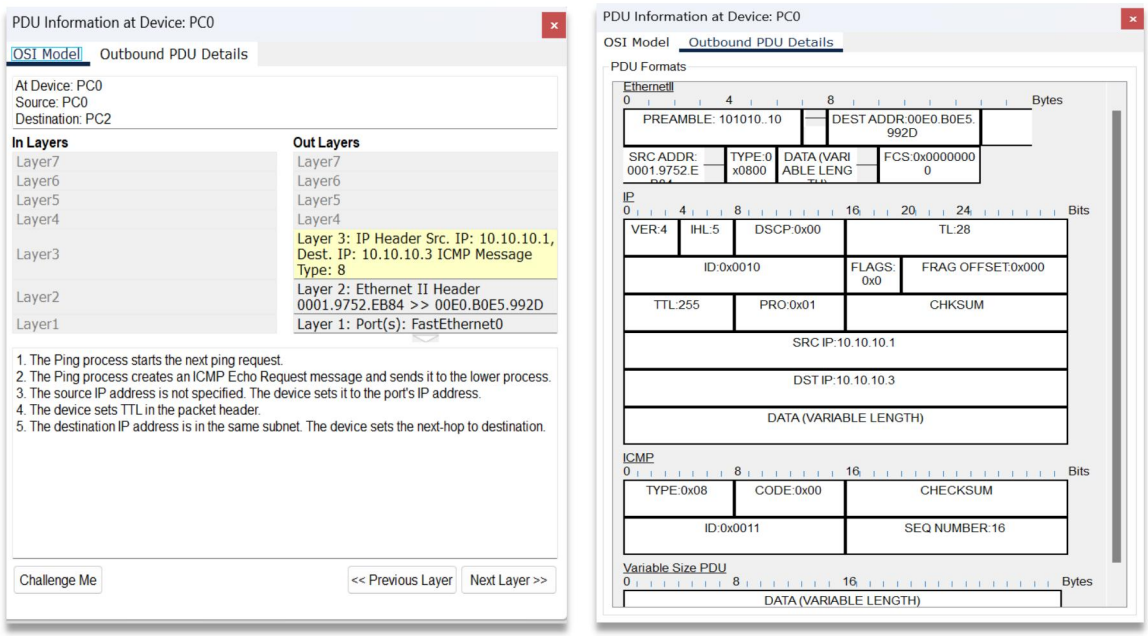

Fig 4.4: PDU(protocol data unit) details at PC0

Conclusion:

- What a mesh topology is:
  - A Mesh topology is a physical topology where all the nodes are connected directly to every other nodes.
  - More practical mesh topology is partial mesh topology.
- How a mesh topology works:
  - Data can be directly sent to one node to the other.
- Where a mesh topology is used:
  - Nearly in every network.
- Pros and cons of using a bus topology:

Pros	Cons
1. Data communication is much more reliable. 2. Any network problem can be easily solved. 3. Data transmission rate is hight. 4. There is no traffic problem as there is a dedicated point to point links in every station. 5. Provides high privacy and security. 6. Adding new devices won't disrupt data transmission.	1. Installation and configuration is quite complex. 2. Expensive. 3. Maintenance needs are challenging. 4. High risk of redundant connections.

Lab Conclusion:

From this lab we got to know about,

- Bus topology
  - An economical topology, good for small networks, where stations are connected by one single backbone.

- Ring topology
  - A centerless topology, used in LANs and WANs, where stations through interconnection creates a circular data-transmission path.

- Star topology
  - A topology, used in LANs, where all the stations are connected to a single center station.

- Mesh topology
  - An expensive and complex topology where each station has direct point-to-point connection to every other station.