

Computer Networking: Concepts

(CSE 3751)

Experiment 3

Aim:

Implementation of Network Topologies using Cisco Packet Tracer

Objectives:

1. An overview on network topologies (i.e. Star, Bus, Ring, and Mesh).
2. Constructing and simulating a network based on star topology to analyse the performance, scalability and fault tolerance.
3. Constructing and simulating a network based on bus topology to analyse the performance, scalability and fault tolerance.
4. Constructing and simulating a network based on ring topology to analyse the performance, scalability and fault tolerance.
5. Constructing and simulating a network based on mesh topology to analyse the performance, scalability and fault tolerance.

Exercises:

1. Differentiate physical and logical topology.
2. State the advantages and disadvantages of bus, ring, star and mesh technologies.
3. Briefly explain various factors for selecting a proper network topology.
4. For five devices in a network, what is the number of cable links required in a mesh, ring, bus, and star topology?
5. How does bus arbitration work in network topology?

Experiment-3

Aim:- Implementation of Network Topologies using Cisco Packet Tracer

Objectives:-

1) An overview on network topologies (i.e. Star, Bus, Ring & Mesh)

Star Topology:-

- The communication takes place by sending the message from the sender to the receiver through a network switch.
- If one host on the network is offline or unavailable, the entire network is not affected.
- If the central networking device (switch) becomes unavailable, the entire network will be affected & won't be able to communicate.
- It supports scalability.

Bus Topology:-

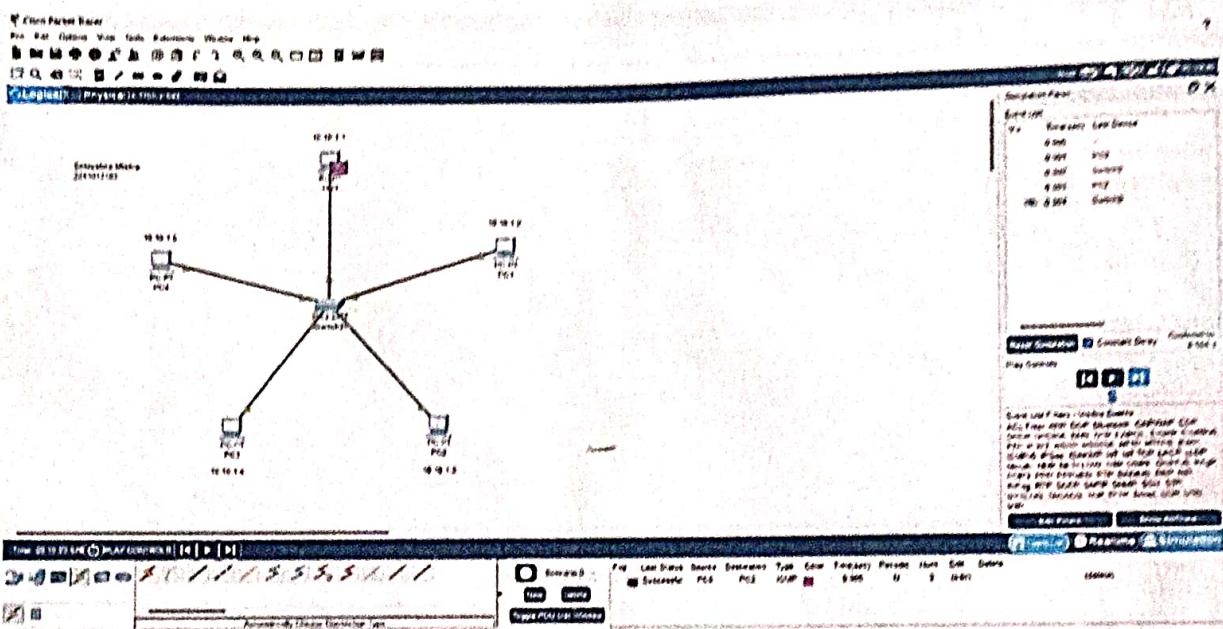
- It uses a single networking cable as the main backbone of the entire network. The single backbone allows nodes such as computers to connect to an excess any resource on the network.
- It takes a lot of overhead processing, for each host.
- Excessive traffic on the network.
- If multiple devices broadcast their devices, then network collision can occur & the packets become corrupted, which causes a device to retransmit the message over the network.
- So, it uses a single backbone cable. There is no redundancy if a network failure was to occur.
- It doesn't support scalability.

Ring Topology:-

- Communication occurs in single direction.
- In dual ring topology, it has 2 logical ring connections, on each node on the network.
- The communication occurs in opposite direction of each ring. One ring allows the traffic to flow clockwise & other anti-clockwise.
- If a node within the ring topology isn't available the entire network goes down & the device will not be able to communicate.

Mesh Topology:-

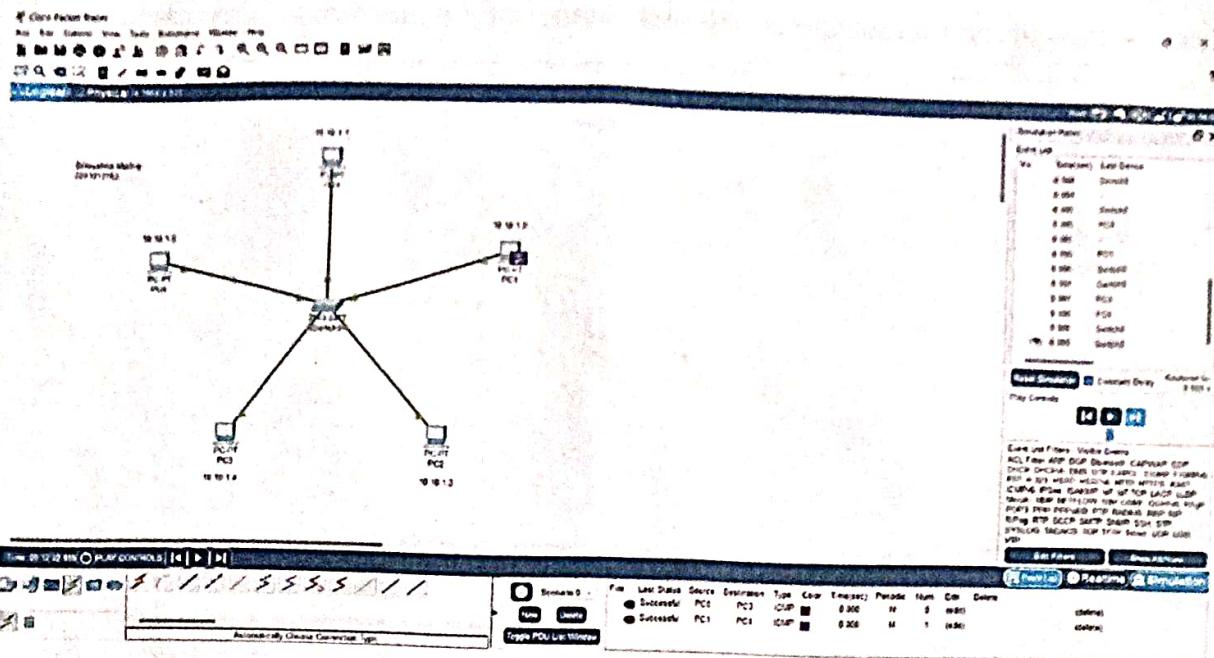
- In Mesh topology each device within the network connected to all other devices creating a physical and logical mesh design.
 - It provides full redundancy for traffic flow b/w any source & destination as all devices are interconnected.
- 2) Constructing and simulating a network based on star topology to analyse the performance, scalability & fault tolerance.



Single message transmission

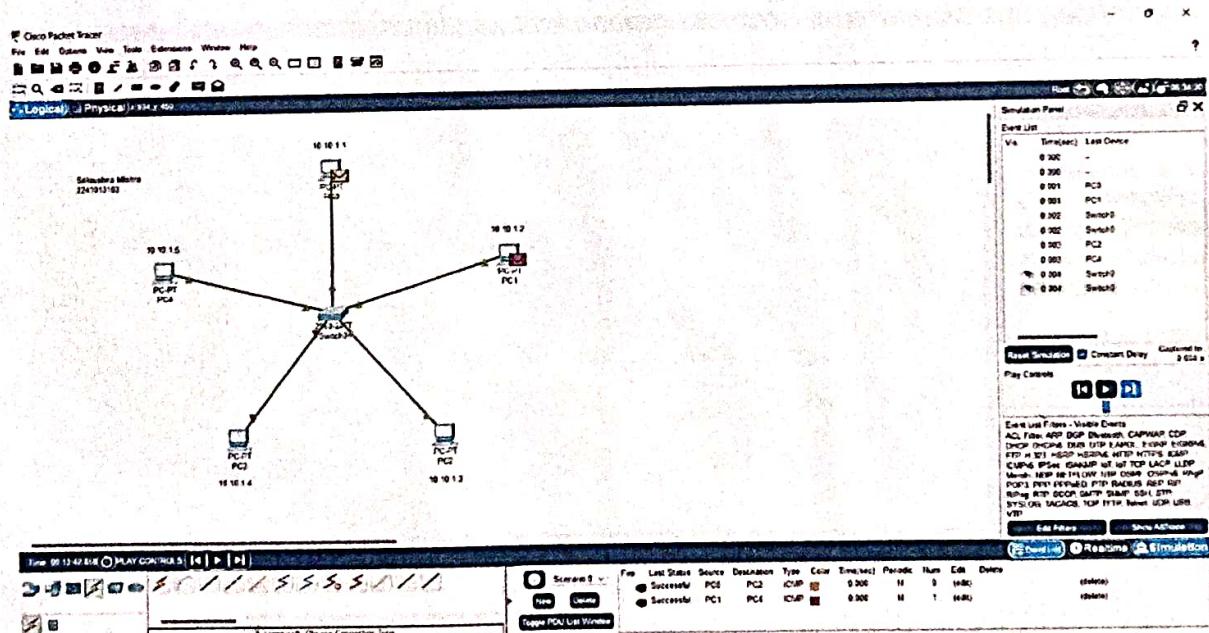
Analysis - I

Source is PC0 & Destination is PC2. The message is given to source & destination. The message is sent successfully.



Analysis-2 (Multiple message transformation)

Source is PC0 & destination is PC3. Another source is PC1 & destination is PC4. The message is given to both sources & destinations respectively. As a result both messages sent successfully.



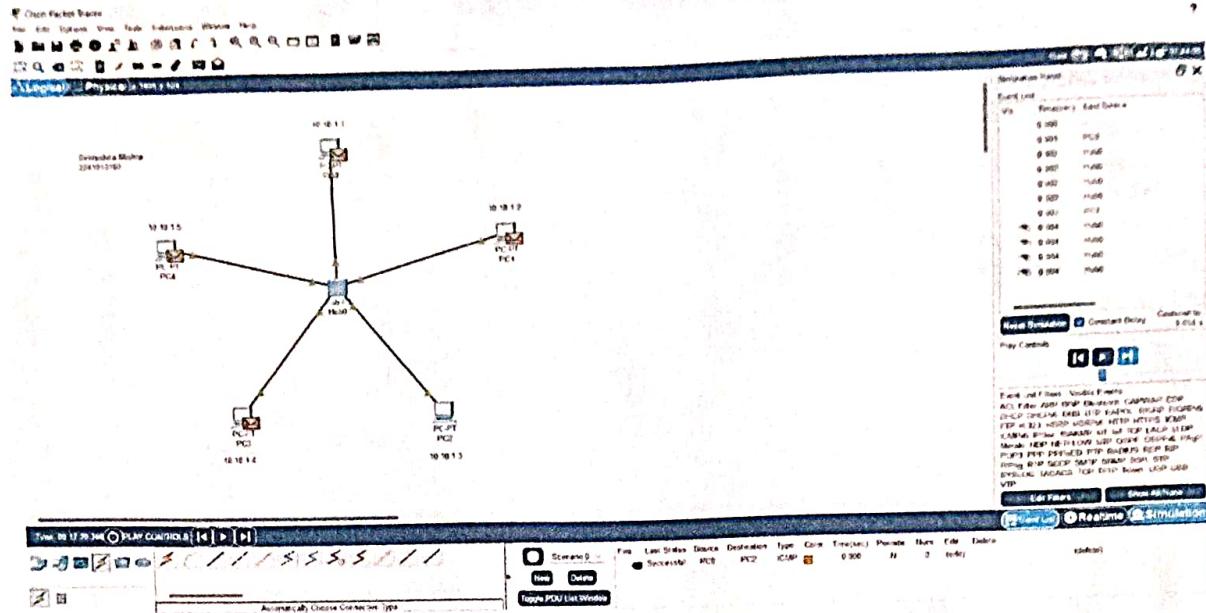
Analysis-3 (One PC disconnected)

Source is PC0 & destination is PC2. Another source is PC1 & destination is PC4. After disconnecting PC3, gt also sent messages from source to destination

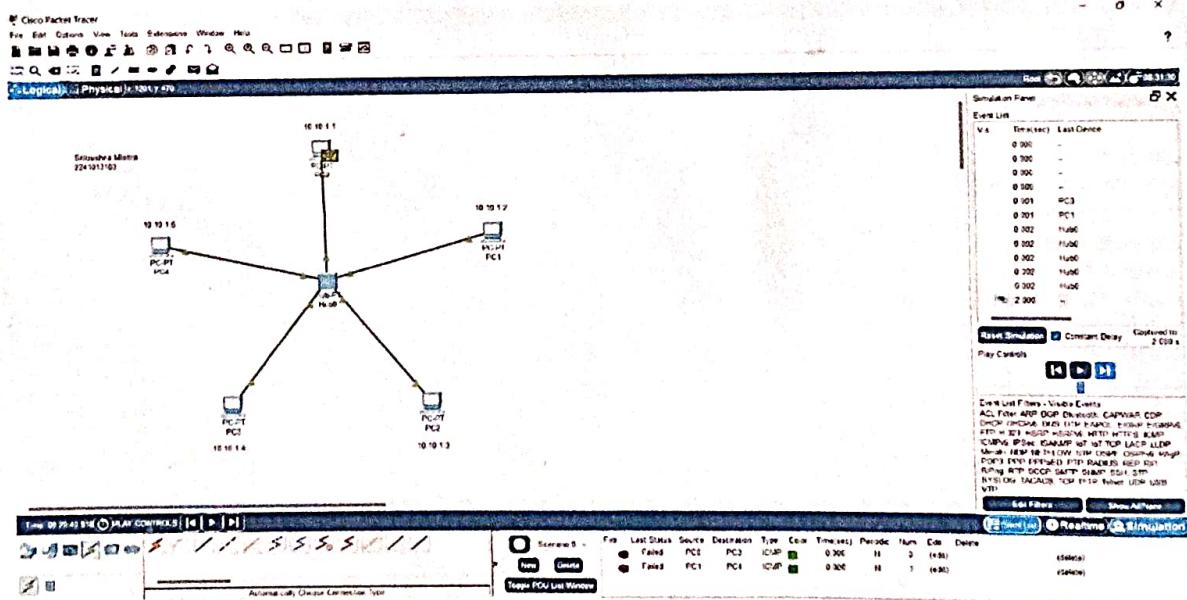
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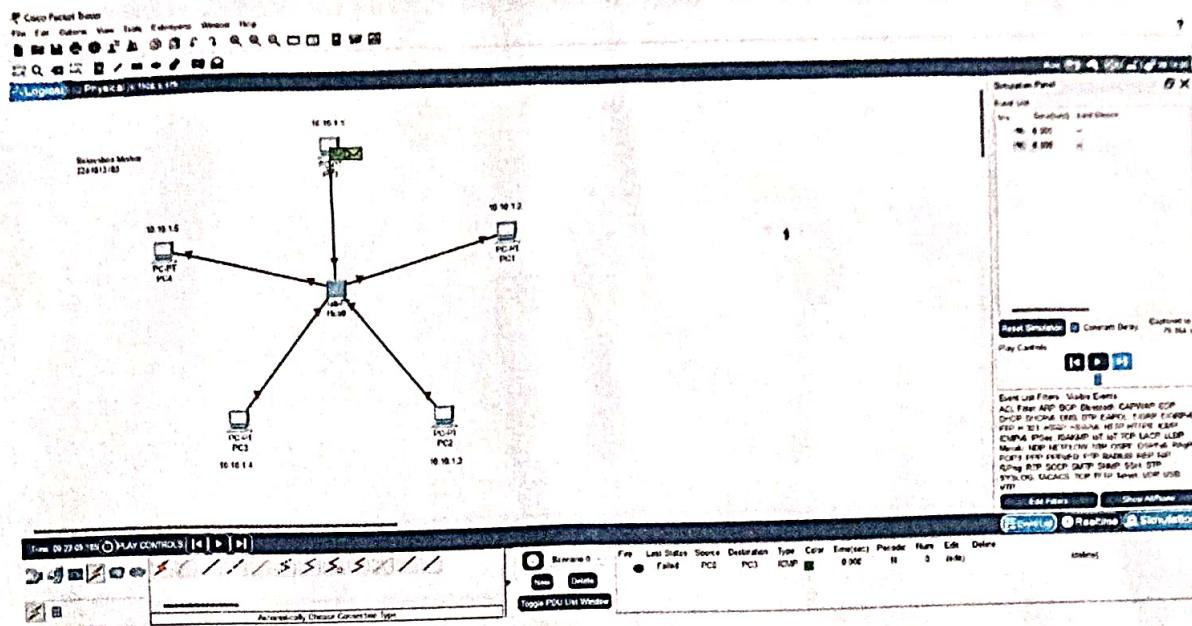
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Analysis - 4 (Single Message transmission using Hub)
Source is PC0 & dest is PC2. The message is given to source & dest.
The message is sent successfully



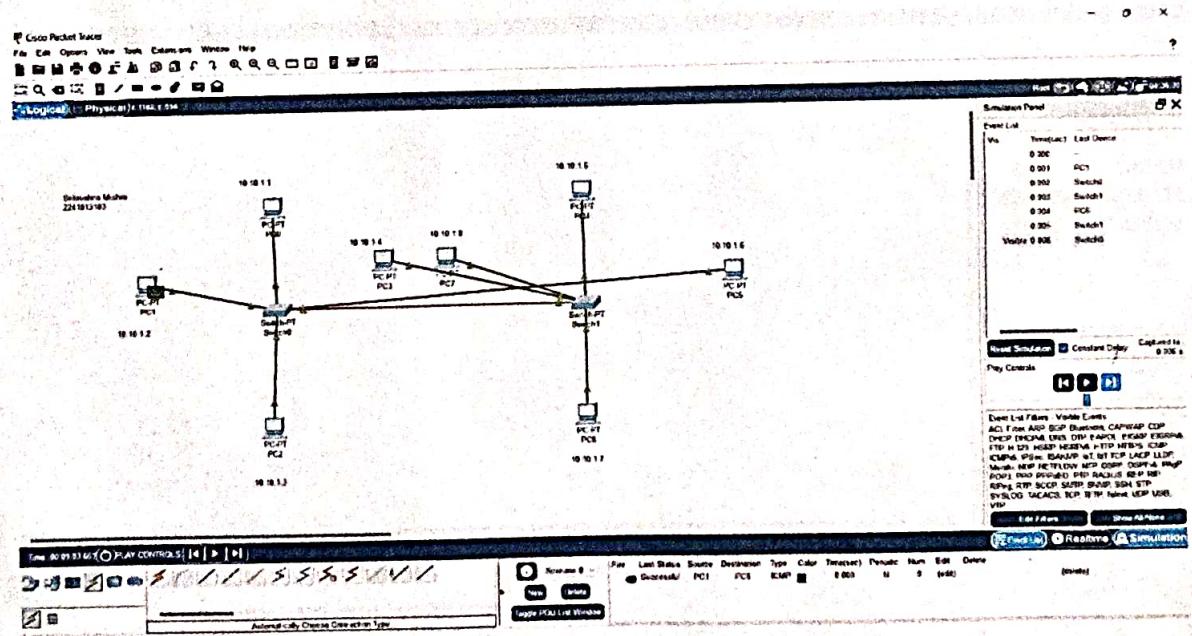
Analysis - 5 (Multiple Message transmission using Hub)
From source (PC0) to dest (PC3) & from source (PC1) to dest (PC4)
ICMP message fails to sent messages due to collision.



Analysis - 6 (Switch off Hub)

If the centralised device is disconnected then whole network communication disrupts.

Scalability

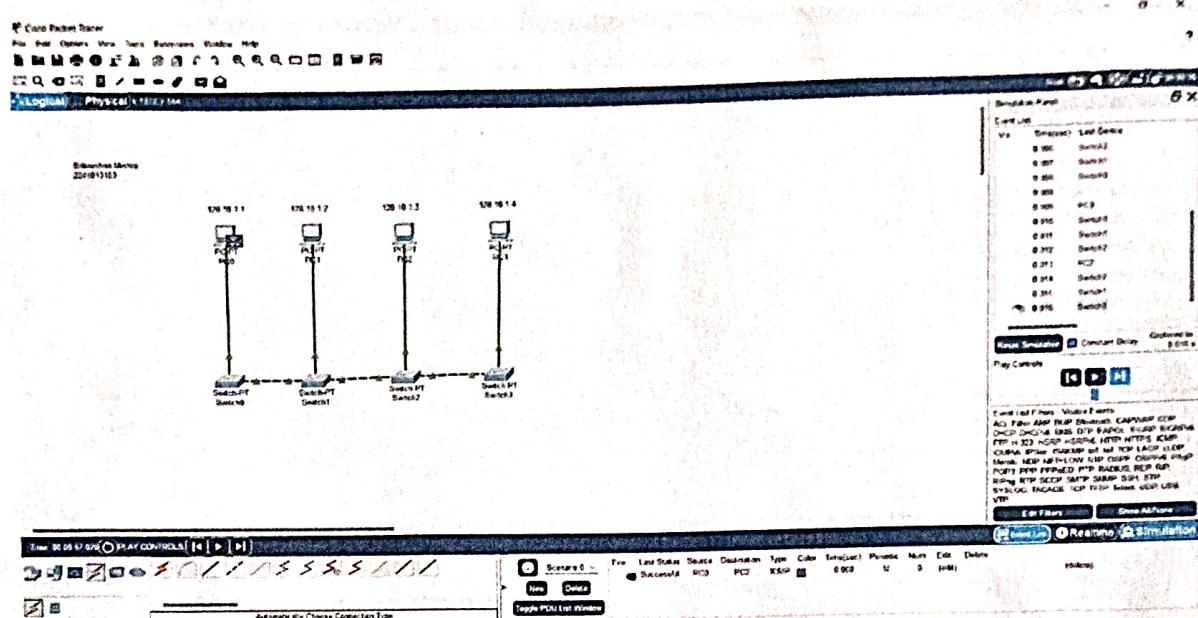


It supports scalability

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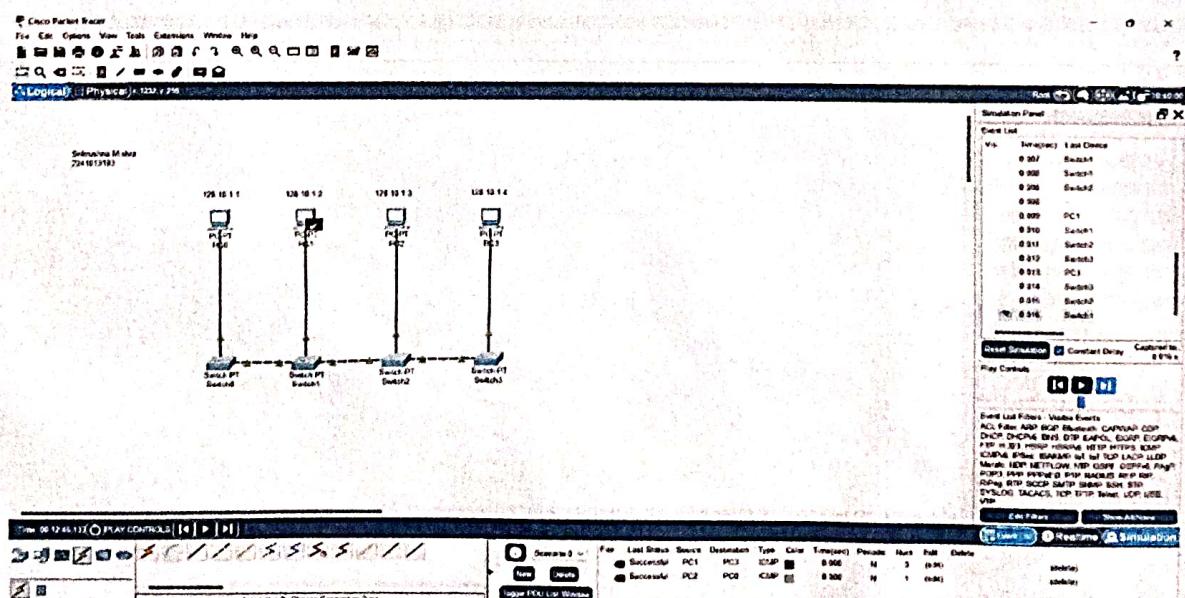
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3) Constructing and simulating a network based on bus topology to analyse the performance, scalability & fault tolerance.



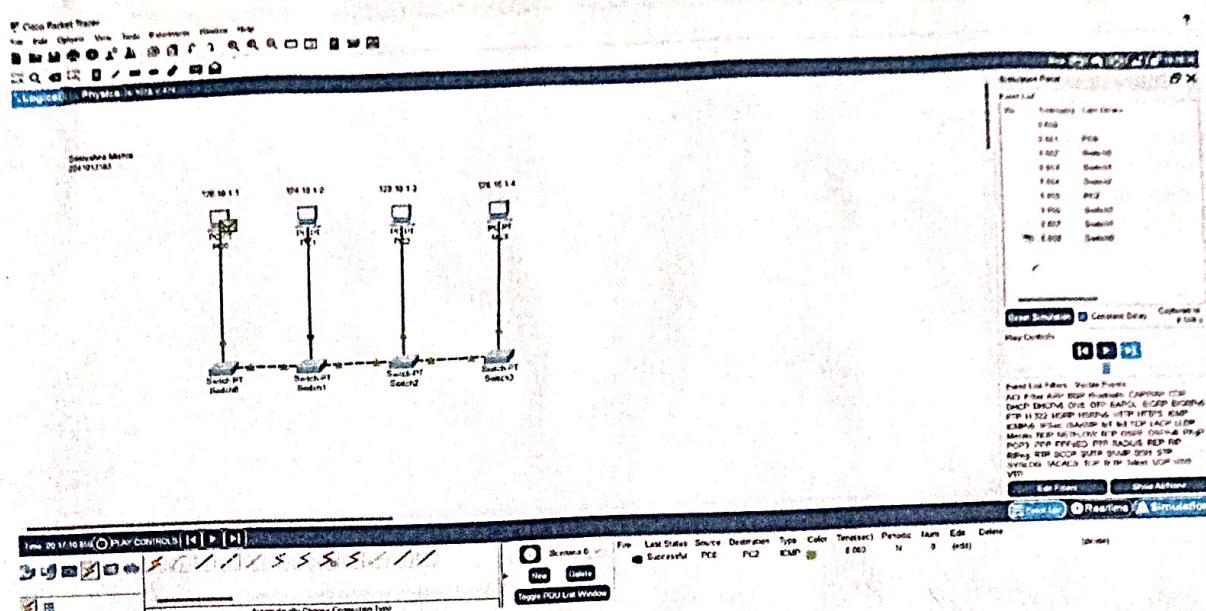
Analysis - 1 (Single Message Transmission)

The source is PC1 & the destination is PC2. The ICMP message sent successfully from source to destination.



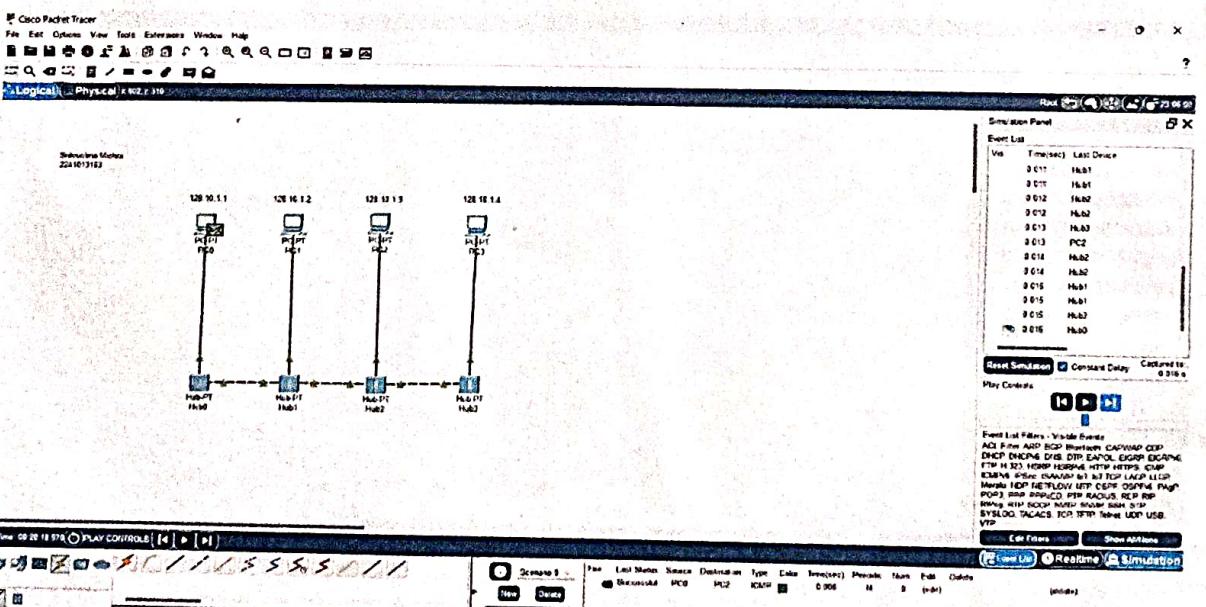
Analysis - 2

From Source (PC1) to dest (PC3) & From source (PC2) to dest (PC3) ICMP message successfully sent.



Analysis - 3 (Switch off one PC)

The source is PC0 & dest is PC2. After disconnection of PC1, it still sent ICMP messages b/w source to destinations



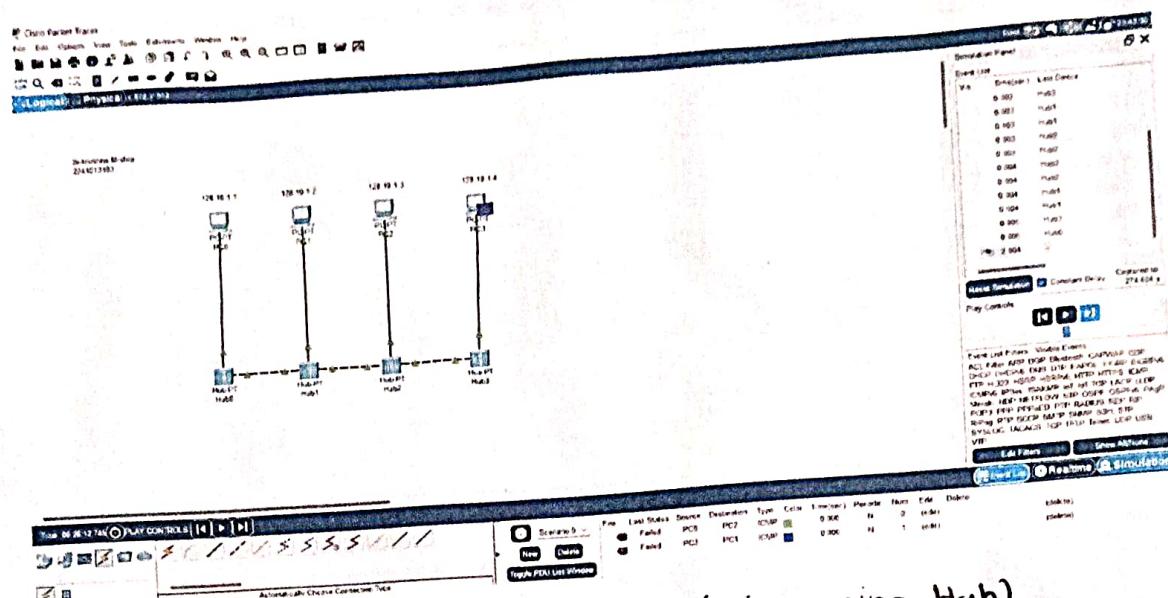
Analysis - 4 (Single Message Transmission)

From source (PC0) to dest (PC2) ICMP message shows sent successfully.

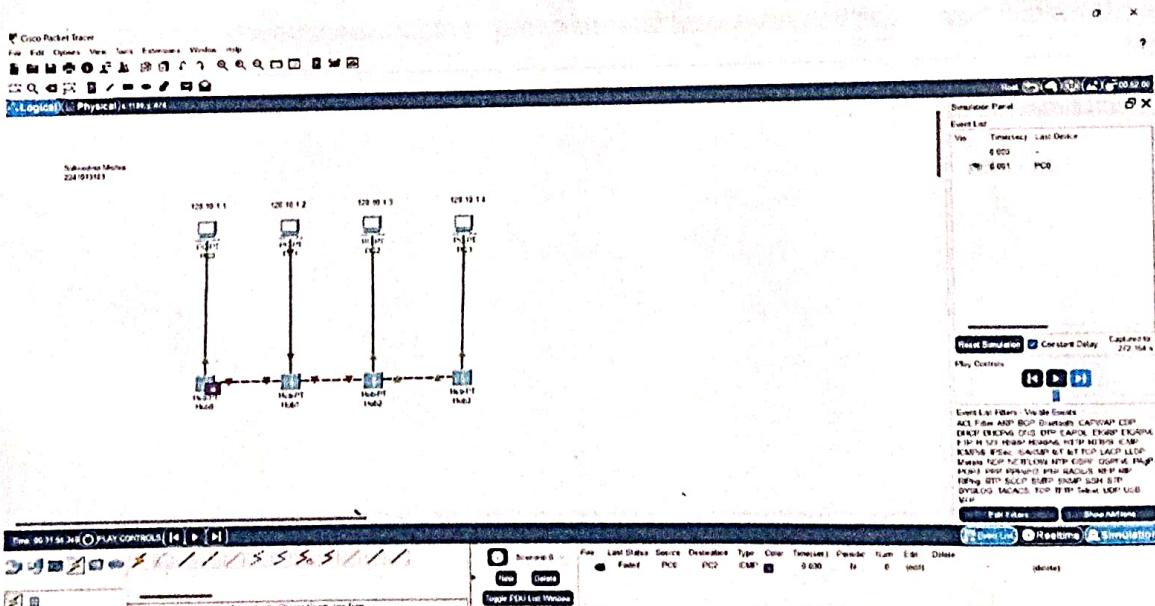
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Analysis - 5 (Multiple message transmission using Hub)
From source (PC0) to dest (PC2) & from source (PC3) to dest (PC1)
ICMP message shows failed status due to network collision



Analysis - 6 (Switch Hub off)
if the centralised device is disconnected then whole network communication disrupts.

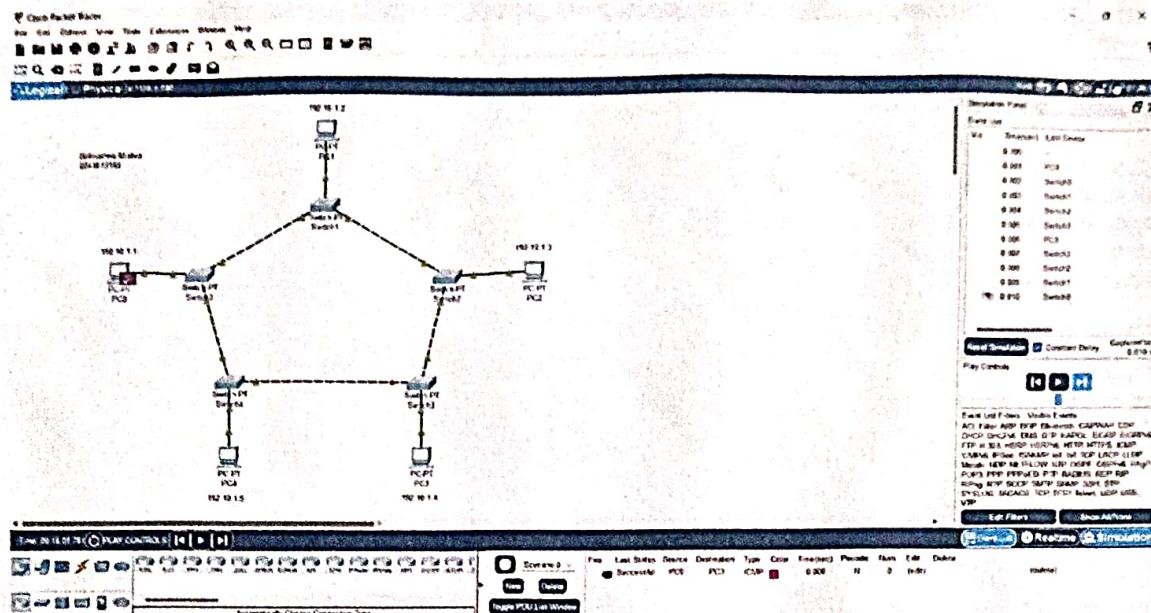
Scalability:-

It doesn't support scalability

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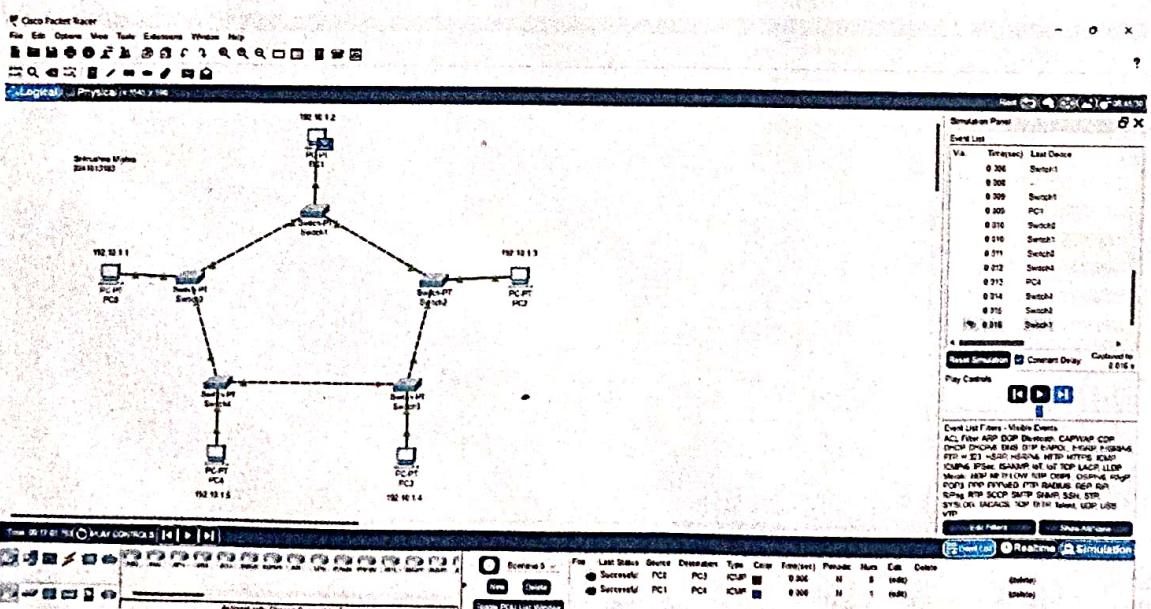
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4) Constructing & simulating a network based on ring topology to analyse the performance, scalability & fault tolerance.



Analysis - 1 (Single Message Transmission)

The source is PC0 & the dest is PC3. The ICMP message is given to source (PC0) & dest (PC3). The message sent successfully from source to destination

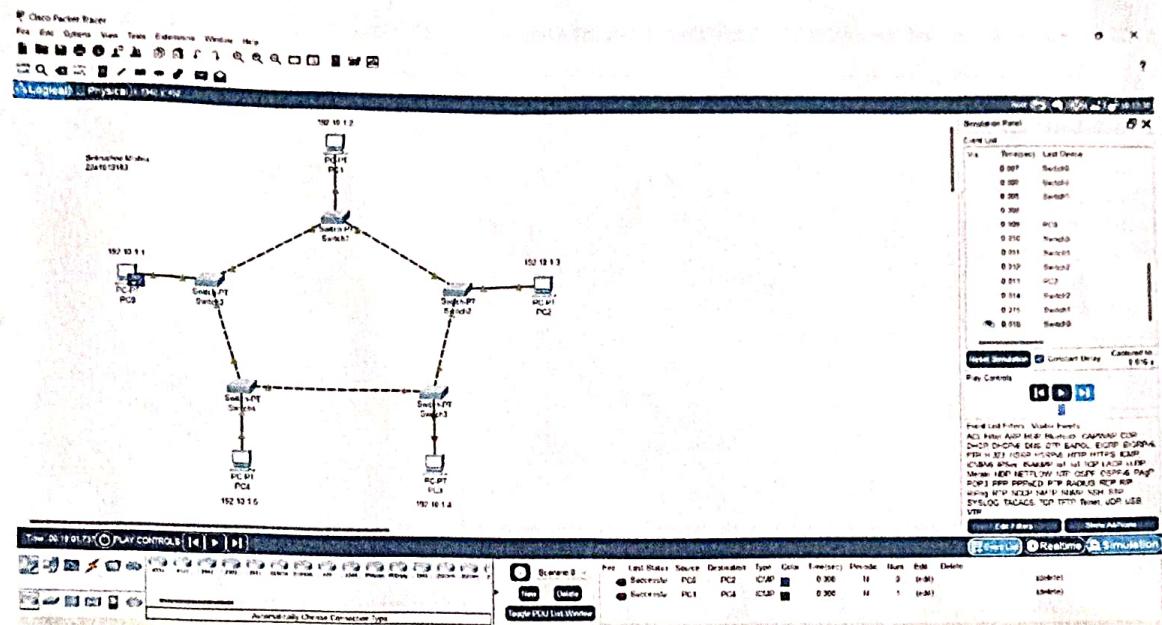


Analysis - 2 (Multiple Message Transmission)

The source is PC0 & destination is PC3. Another source is PC1 & dest is PC4. One ICMP message is sent from PC0 to PC3 & another is PC1 to PC4. In both cases message sent successfully

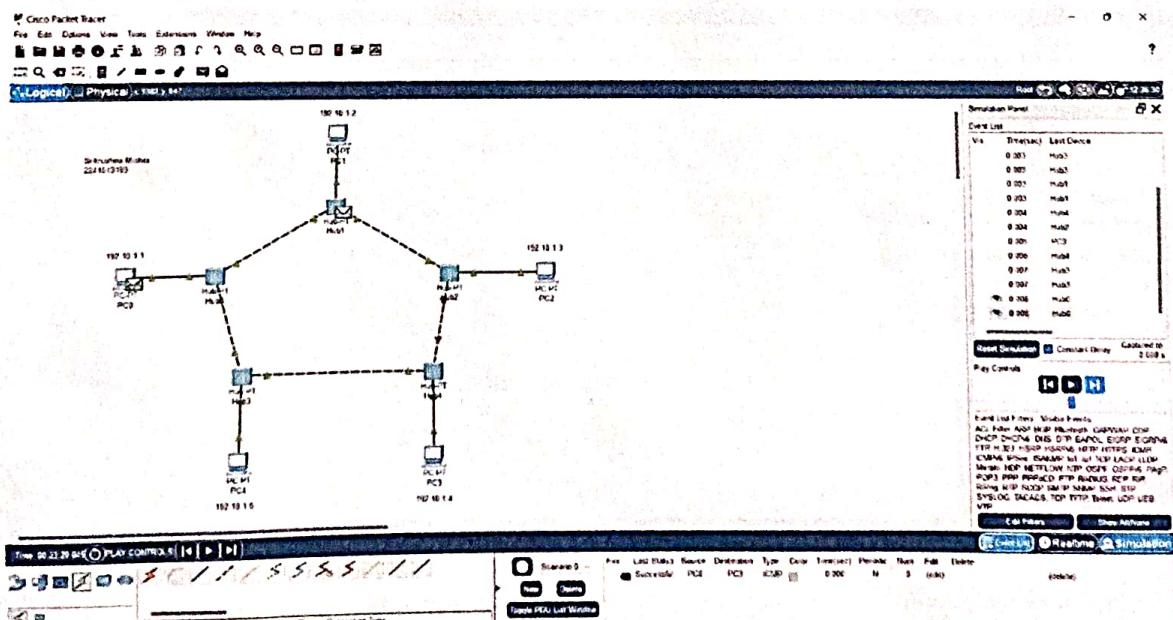
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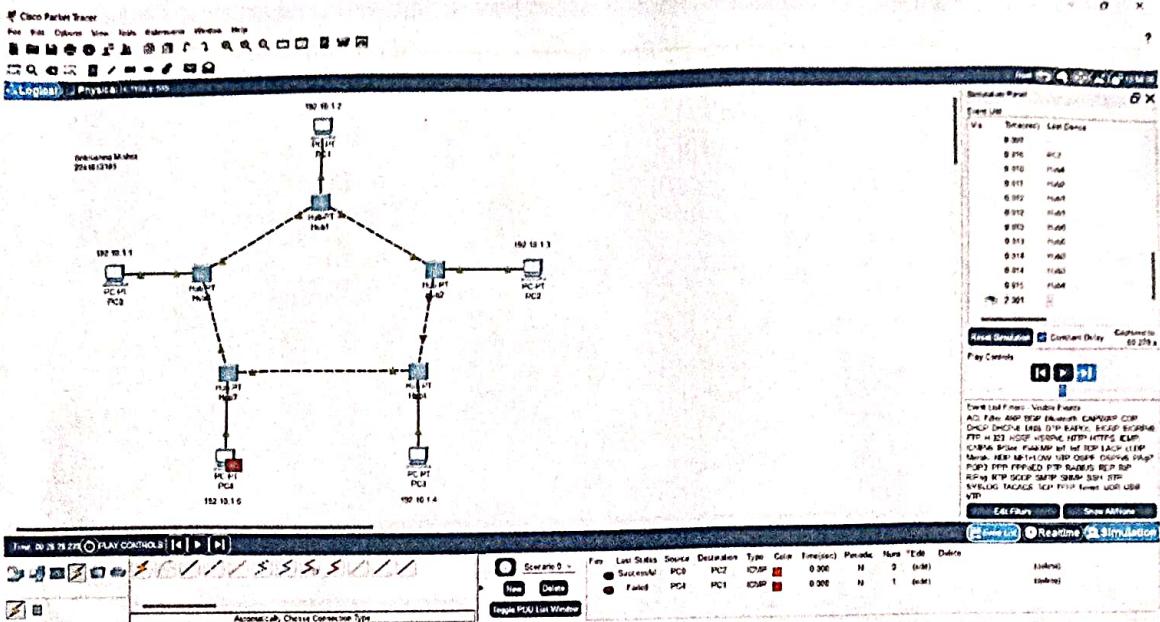
Analysis-3 (One PC disconnected)

The source is PC0 & destination is PC2. Another source is PC1 & destination is PC4. After disconnection of PC3, it also sent ICMP messages b/w sources & destinations successfully.

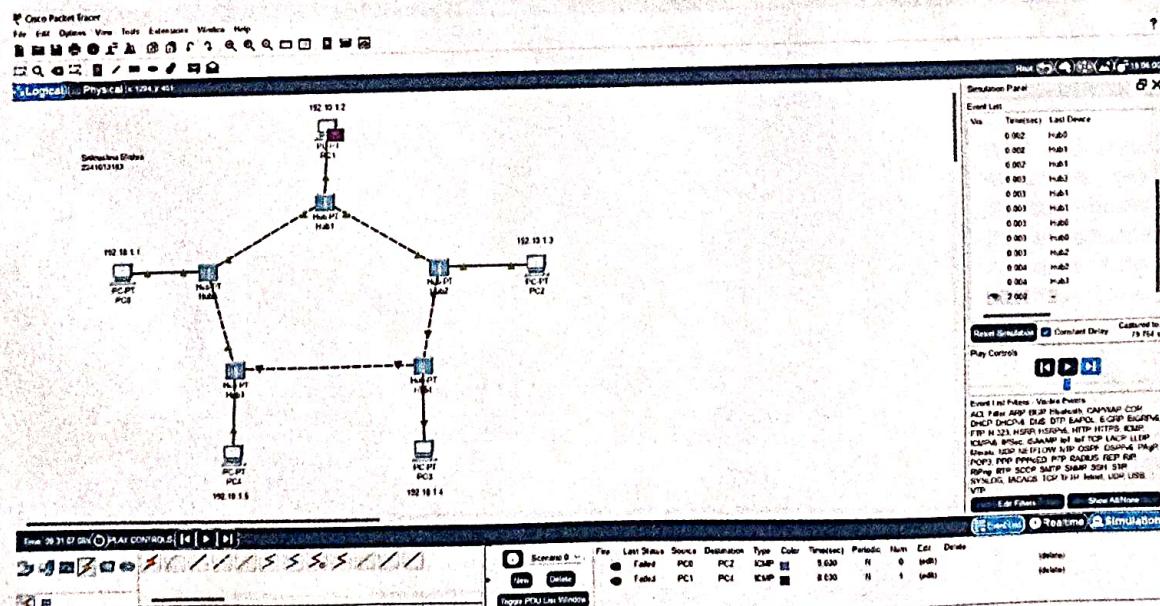


Analysis-4 (Single Message Transmission using Hub)

The source is PC0 & destination is PC3. The ICMP message sent successfully from source to destination.



Analysis - 5C Multiple Message Transmission using Hub)
From source (PC0) to dest (PC2) & from source (PC4) to dest (PC1) ICMP message shows failed status due to network collision



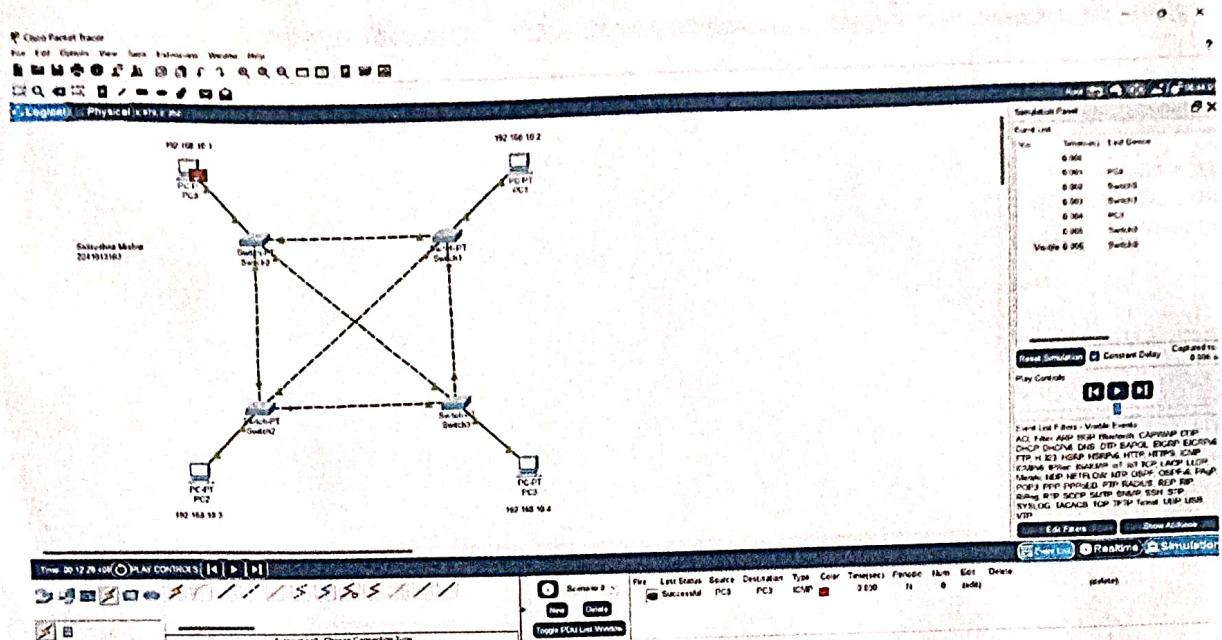
Analysis - 6 (Switch off Hub)
The source is PC0 & destination is PC2. Another source is PC1 & destination is PC4. In this case message can't be sent from source to destination due to switch off of hub.

Scalability - Ring topology is not scalable

Name: _____

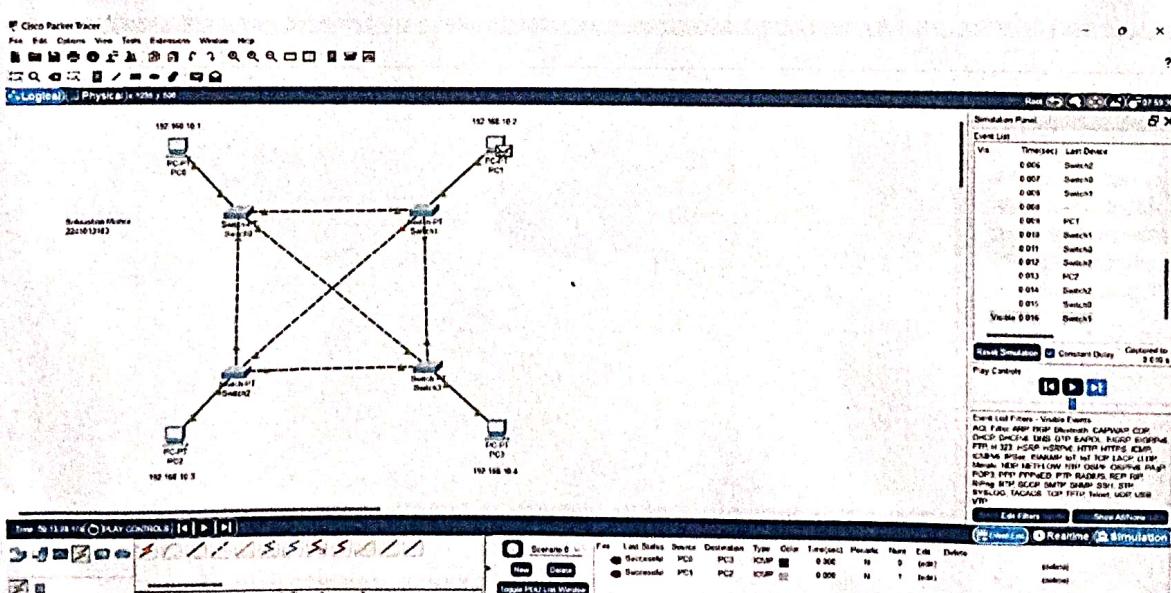
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5) Constructing & simulating a network based on mesh topology to analyze the performance, scalability & fault-tolerance



Analysis-1 (Single Message Transmission)

Source is PC0 & destination is PC3. The message is given to source & destination. The message is sent successfully.

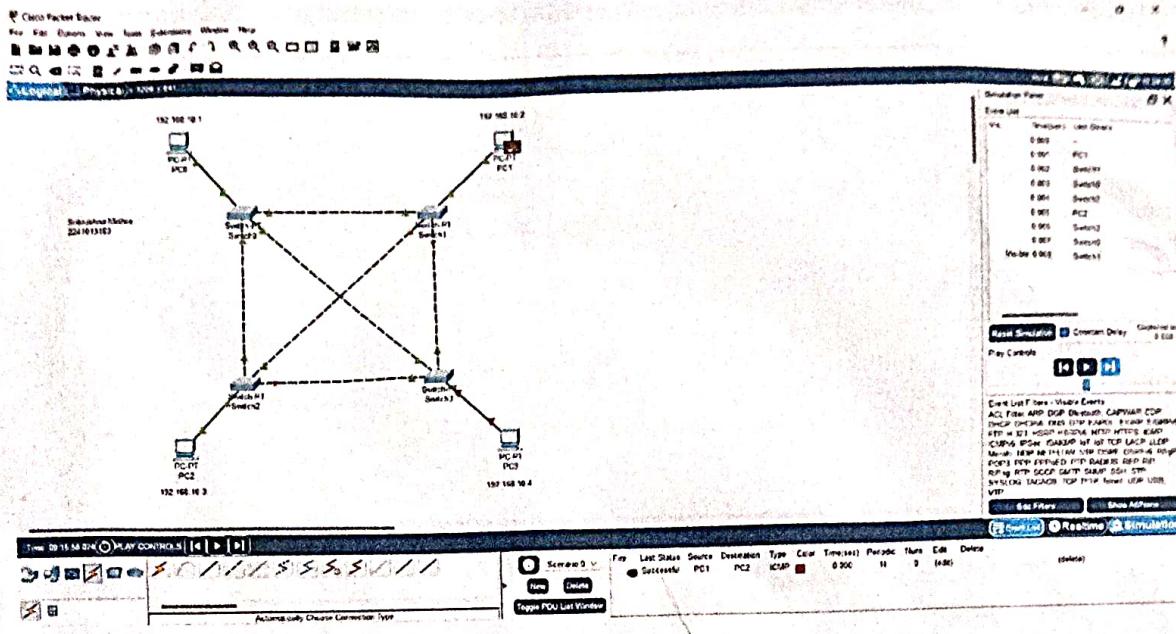


Analysis-2 (Multiple Message Transmission)

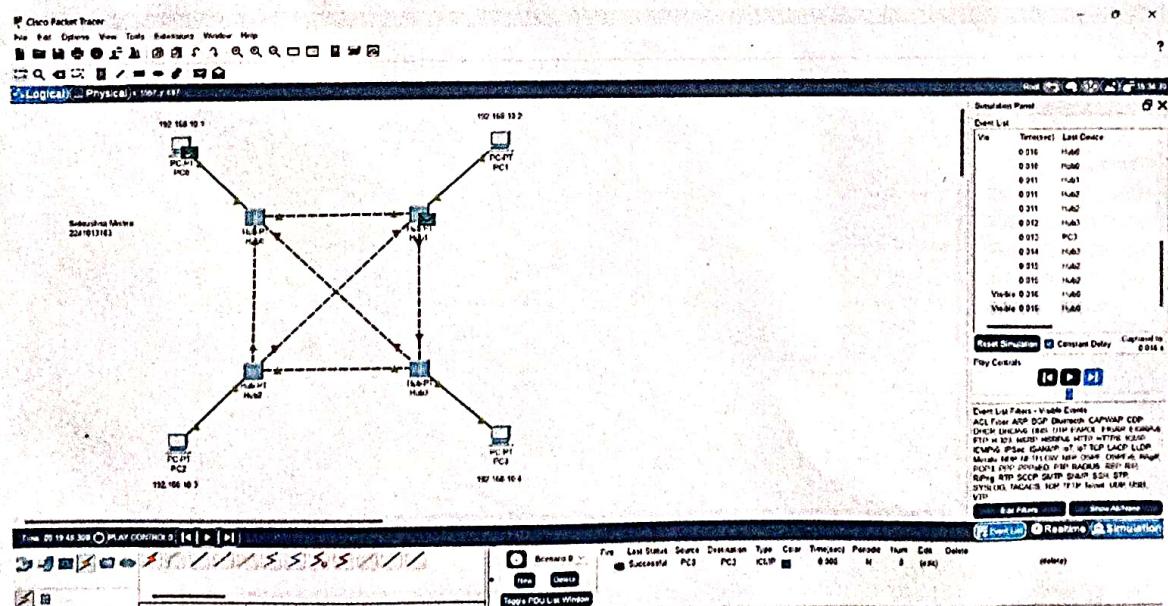
Source is PC0 & destination is PC3. Another source is PC1 & destination is PC2. ICMP message sent successfully from source to destination

Name: _____

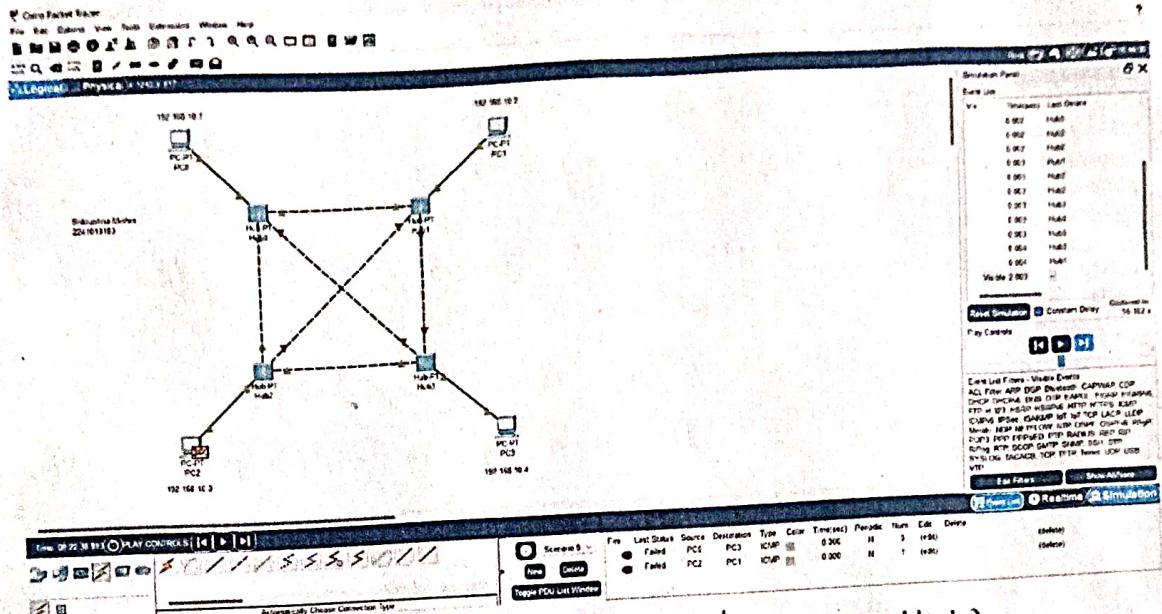
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Analysis - 3C (One PC disconnected)
Source is PC0 & destination is PC2. The message is sent successfully though one PC is disconnected.

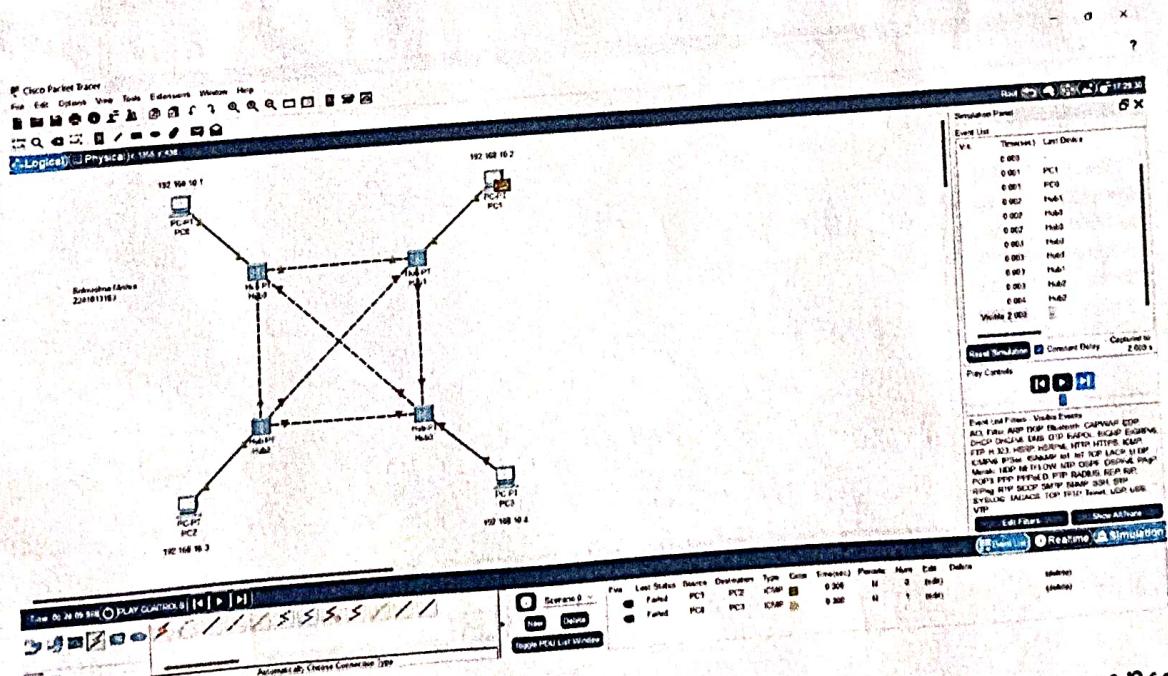


Analysis - 4 (Single message Transmission using Hub)
Source is PC0 & destination is PC2. The message is sent successfully through



Analysis - 5 (Multiple Message Transmission using Hub)

From source (PC0) to destination (PC3) & from source (PC2) to destination (PC1) ICMP message shows failed status due to network collision.



Analysis - 6 (Switch off Hub)
From source (PC1) to destination (PC2) & from another source (PC0) to destination (PC3), ICMP message shows failed status.
Scalability:- It is highly scalable

Name: _____

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Exercises:-

1) Differentiate physical & logical topology.

Physical Topology

- Depicts physical layout of network

- The layout can be modified based on needs

- It is actual route concerned with transmission

- Physical connection of the network

Logical Topology

- Depicts logistics of network

Concerned with transmission of data

- There is no interference & manipulation involved here.

- It is a high level representation of data flow

- Data path followed of the network

2) State the advantages & disadvantages of bus, ring, star & mesh topologies

Bus Topology

Advantage: Can connect a certain no. of nodes

Disadvantage: Bus failure results in network failure & security concerns increase as messages are broadcast to all nodes.

Ring Topology:

Advantage: Prevents data collisions and offers fair access to the network

Disadvantage: Scalability is limited, maintenance is complex & bandwidth efficiency is lower than star topologies.

Star Topology:

Advantage: New nodes can be added easily, performance is generally higher

Disadvantage: Installation is expensive & if a hub or switch fails, all connected devices lose network connection.

Mesh Topology:

Advantage: Provides extended coverage, seamless connectivity & is easy to set up & manage

Disadvantage: Can be expensive & there is potential for excess.

3) Briefly explain various factors for selecting a proper network topology.

Performance - How fast & efficient the network needs to be

Scalability - Whether the network can easily add new devices without disrupting the existing network.

Reliability - How reliable the network needs to be & whether it can reduce downtime

Cost - How much one can spend on setup & maintenance.

Management - How easy / difficult the network is to manage

Physical Space - How close together the systems are that need to be linked

4) For 5 devices in a network, what is the no. of cable links required in a mesh, ring, bus & star topology?

Given, no. of devices (n) = 5

Topology

Mesh

No. of cable links

$$\frac{n(n-1)}{2} = \frac{5(5-1)}{2} = 10$$

Ring

$n = 5$ (No. of links = No. of devices)

Bus

1 (bus itself, as it is required only one backbone)

Star

$n = 5$ (No. of links = No. of devices)

5) How does bus arbitration work in network topology?

Bus arbitration refers to the process by which the current bus master accesses and then leaves the control of the bus and passes it to another bus requesting processor unit.