19ECE311 – COMPUTER NETWORKS

ASSIGNMENT-1

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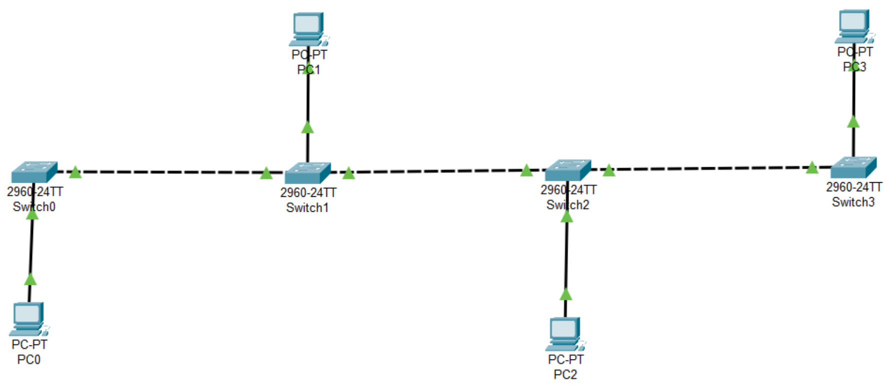
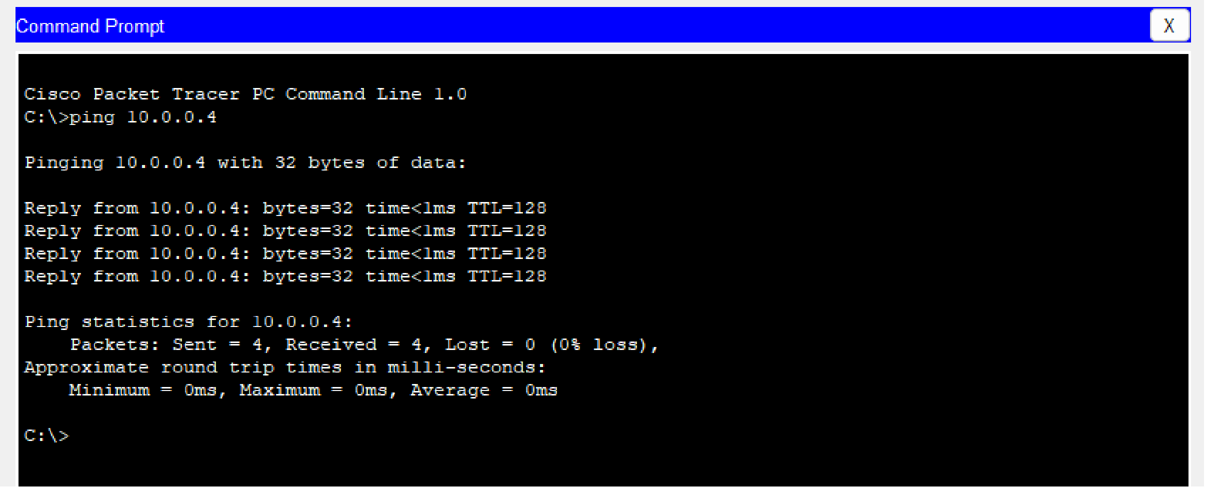
Roll No: AM.EN.U4ECE22012 Date: 28/04/2025

BUS TOPOLOGY

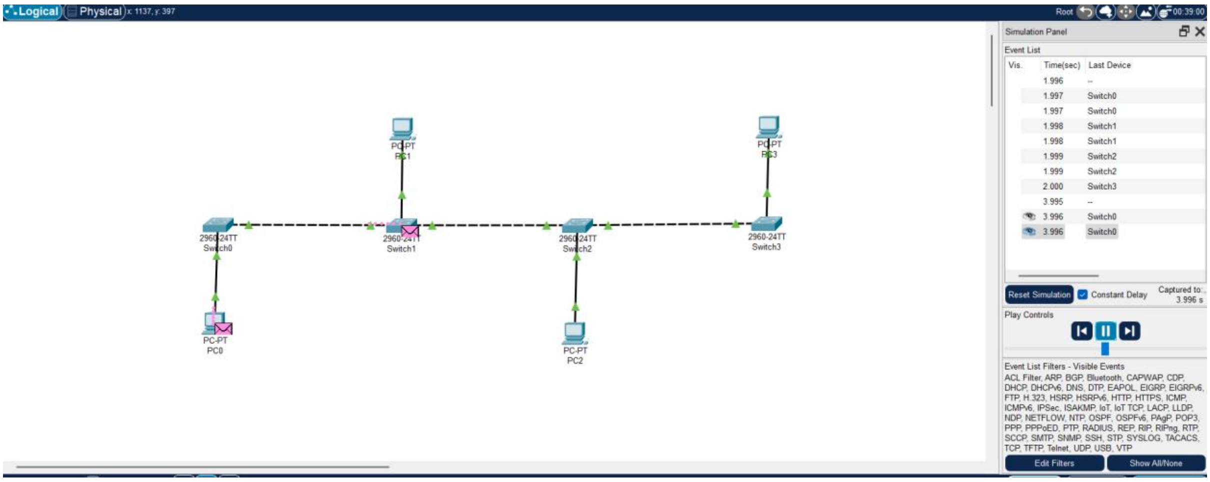


COMMAND PROMPT

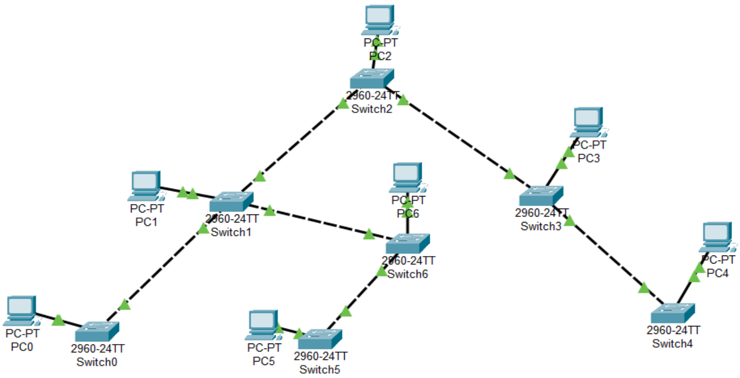


Command Prompt X

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time<1ms TTL=128
Reply from 10.0.0.4: bytes=32 time<1ms TTL=128
Reply from 10.0.0.4: bytes=32 time<1ms TTL=128
Reply from 10.0.0.4: bytes=32 time<1ms TTL=128

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```



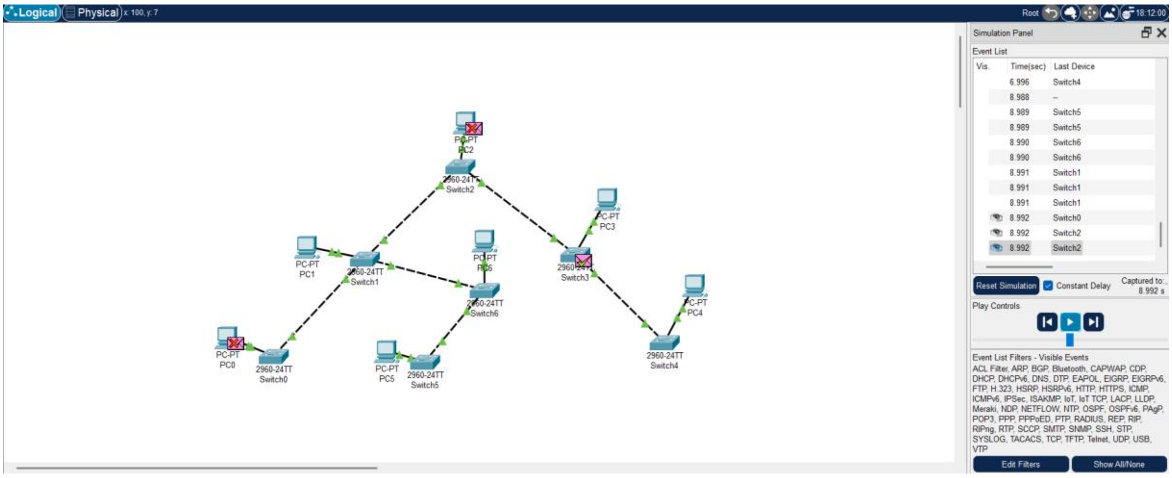
TREE TOPOLOGY



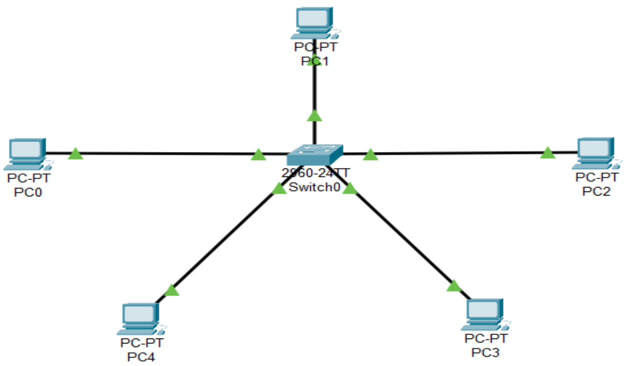
COMMAND PROMPT

Command Prompt X

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time<1ms TTL=128
Reply from 10.0.0.5: bytes=32 time<1ms TTL=128
Reply from 10.0.0.5: bytes=32 time<1ms TTL=128
Reply from 10.0.0.5: bytes=32 time<1ms TTL=128

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 10.0.0.7

Pinging 10.0.0.7 with 32 bytes of data:

Reply from 10.0.0.7: bytes=32 time<1ms TTL=128
Reply from 10.0.0.7: bytes=32 time<1ms TTL=128
Reply from 10.0.0.7: bytes=32 time<1ms TTL=128
Reply from 10.0.0.7: bytes=32 time<1ms TTL=128

Ping statistics for 10.0.0.7:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```



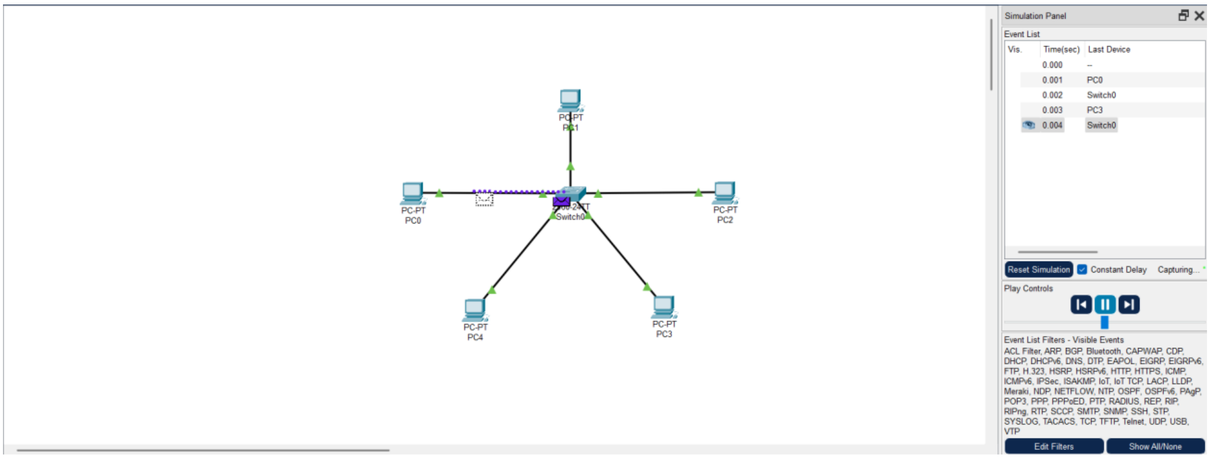
STAR TOPOLOGY



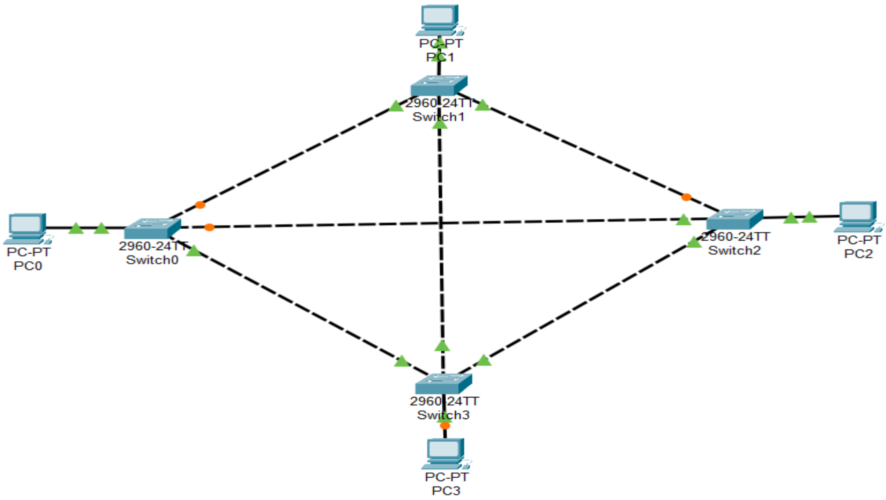
COMMAND PROMPT

Command Prompt X

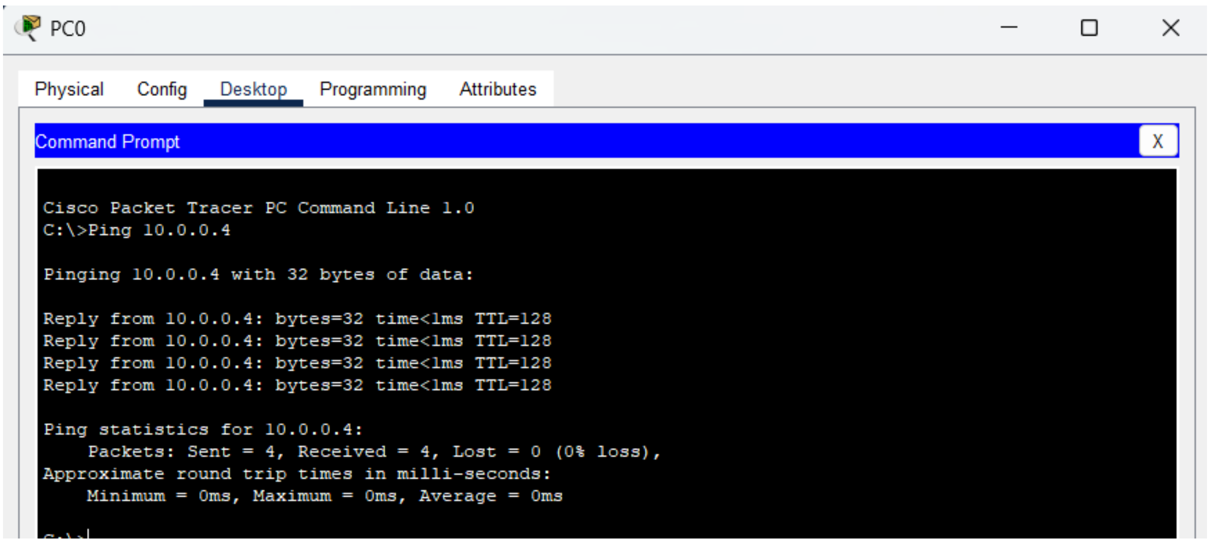
```
Cisco Packet Tracer PC Command Line 1.0
C:\>Ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time<1ms TTL=128
Reply from 10.0.0.4: bytes=32 time<1ms TTL=128
Reply from 10.0.0.4: bytes=32 time<1ms TTL=128
Reply from 10.0.0.4: bytes=32 time=11ms TTL=128

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 11ms, Average = 2ms
```

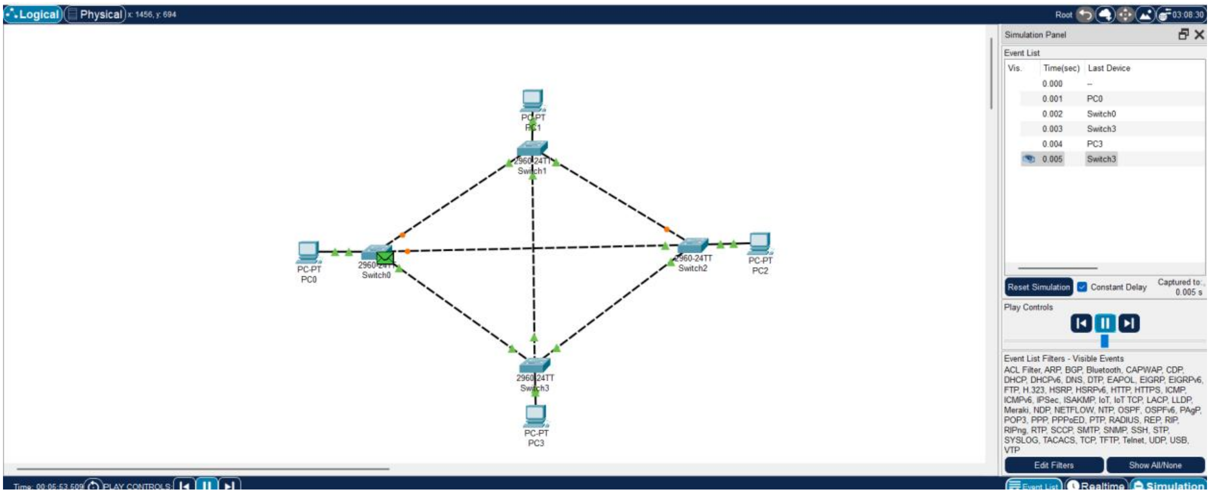


MESH TOPOLOGY

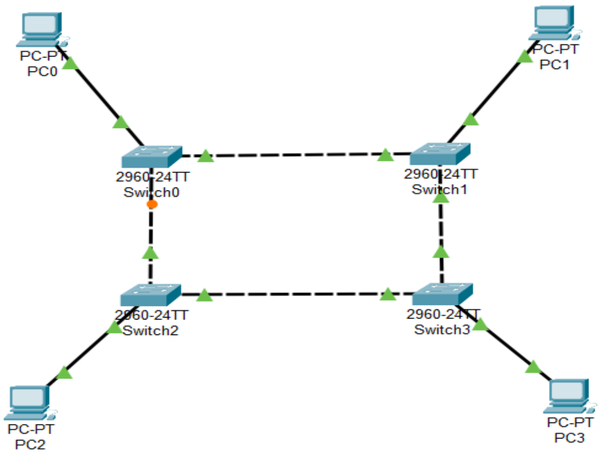


COMMAND PROMPT

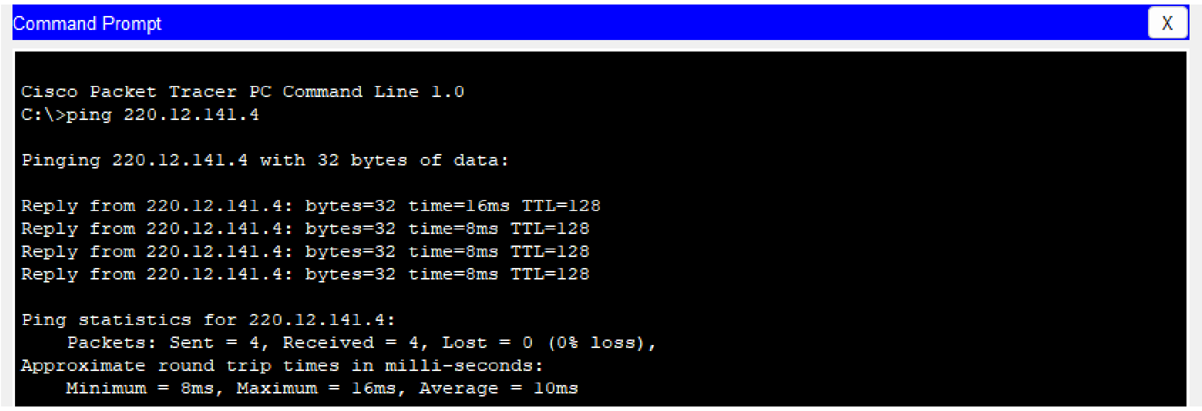




RING TOPOLOGY

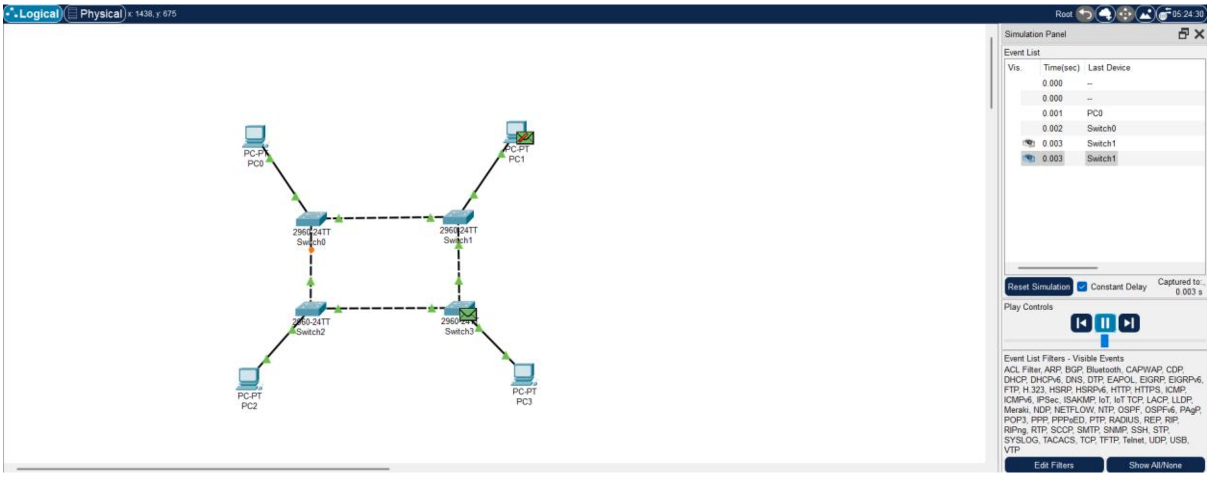


COMMAND PROMPT



Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 220.12.141.4

Pinging 220.12.141.4 with 32 bytes of data:

Reply from 220.12.141.4: bytes=32 time=16ms TTL=128
Reply from 220.12.141.4: bytes=32 time=8ms TTL=128
Reply from 220.12.141.4: bytes=32 time=8ms TTL=128
Reply from 220.12.141.4: bytes=32 time=8ms TTL=128

Ping statistics for 220.12.141.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 8ms, Maximum = 16ms, Average = 10ms
```



INFERENCE

The simulation of Bus, Star, Tree, Ring, and Mesh topologies provides a comprehensive understanding of how different network architectures operate under various conditions. Each topology demonstrates unique structural characteristics and operational behaviors, making them suitable for specific networking needs. The simulation also reinforces the importance of topology selection in designing efficient, reliable, and scalable networks. It reveals how centralized vs. decentralized structures influence data flow, fault tolerance, and network management. By observing real-time communication between nodes, the simulation offers a practical view of how each topology performs, including routing efficiency, ease of expansion, and impact of failures.

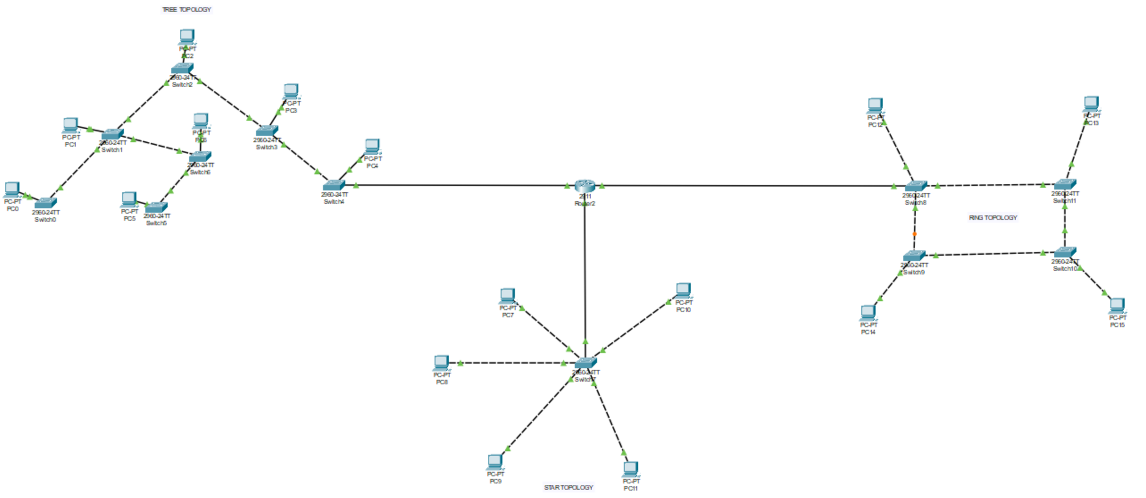
OBSERVATION

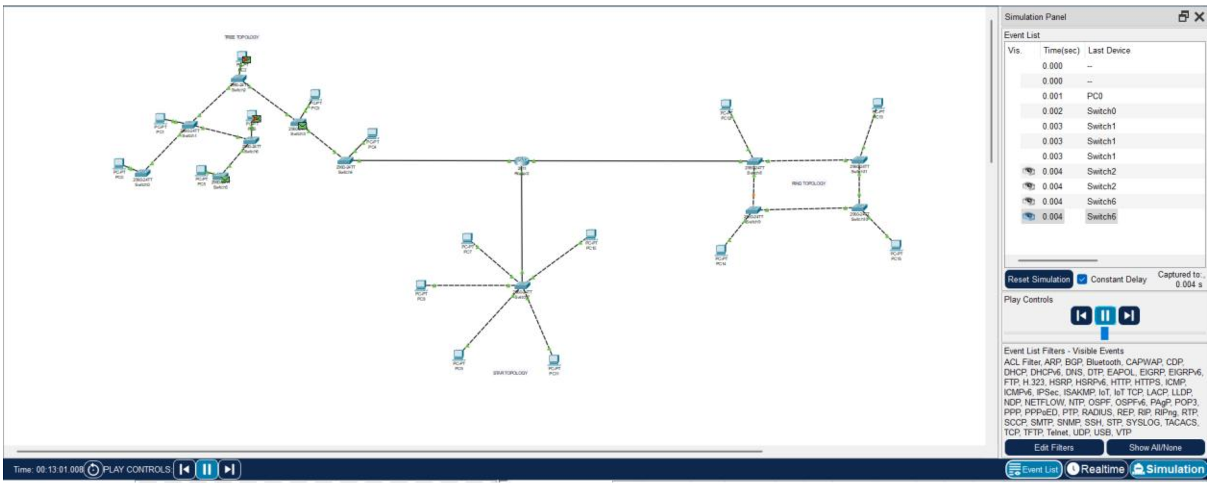
In the Bus topology, all devices share a common communication line, making it simple and cost-effective for small networks, but difficult to troubleshoot and prone to complete failure if the main cable is disrupted. The Star topology showed centralized communication through a single switch or hub, allowing easy device management and fault isolation, though the entire network depends on the central device's health. The Tree topology combined characteristics of both bus and star, proving useful for hierarchical structuring in large networks but revealed vulnerabilities at branch points. The Ring topology maintained orderly data flow with equal access but showed sensitivity to a single node or link failure, potentially halting the entire loop. Finally, the Mesh topology provided the highest reliability and redundancy, as each node connects to multiple others; however, it is the most complex and expensive to implement. Overall, the simulation demonstrates how each topology impacts network performance, scalability, fault tolerance, and maintenance requirements.

ASSIGNMENT-2

Create 3 LAN networks connected via a single Router (CPT). Choose appropriate router, connection and configure it. Each LAN network is configured via Tree, Star and Ring topologies respectively.

3 LAN NETWORK





IP Addresses :

- 220.12.214.1 - 220.12.214.5 (Star topology)
- 220.12.204.1-220.12.204.4 (Ring topology)
- 220.12.141.1-220.12.141.8(Tree topology)

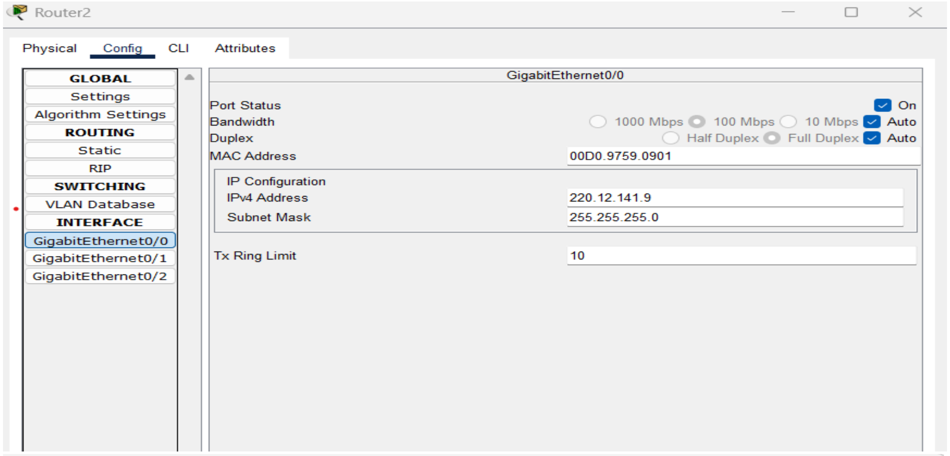
COMMAND PROMPT

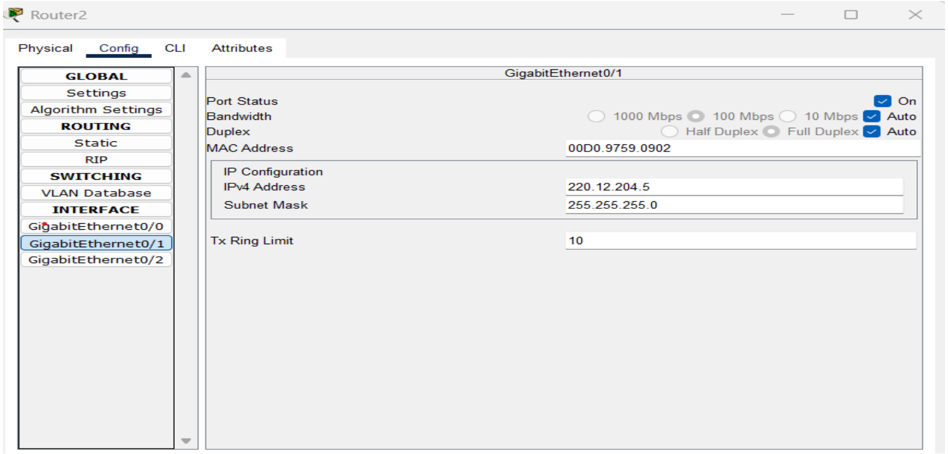
Command Prompt

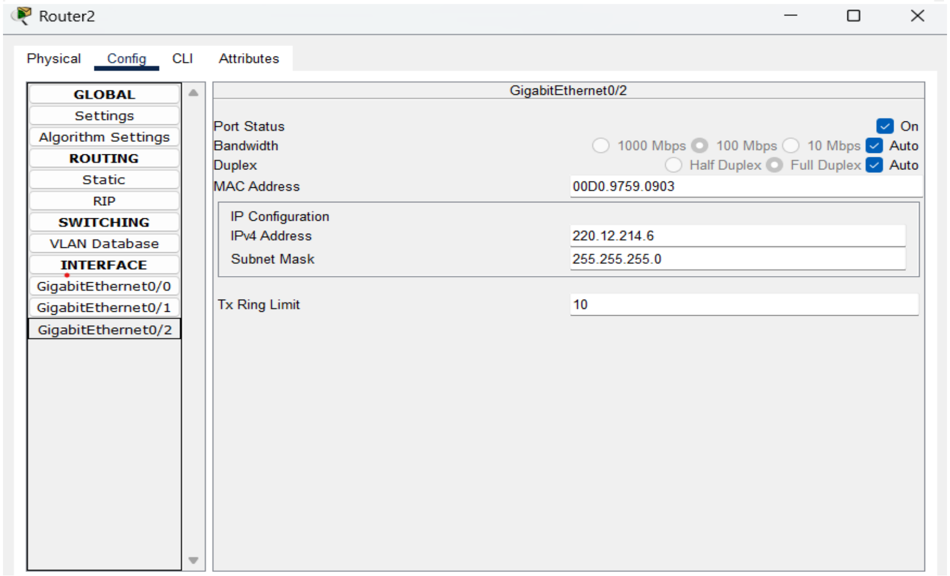
```
C:\>ping 220.12.214.5

Pinging 220.12.214.5 with 32 bytes of data:

Reply from 220.12.214.5: bytes=32 time=2ms TTL=127
Reply from 220.12.214.5: bytes=32 time<1ms TTL=127
Reply from 220.12.214.5: bytes=32 time<1ms TTL=127
Reply from 220.12.214.5: bytes=32 time=8ms TTL=127

Ping statistics for 220.12.214.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 8ms, Average = 2ms

C:\>ping 220.12.204.5

Pinging 220.12.204.5 with 32 bytes of data:

Reply from 220.12.204.5: bytes=32 time=12ms TTL=255
Reply from 220.12.204.5: bytes=32 time=2ms TTL=255
Reply from 220.12.204.5: bytes=32 time=16ms TTL=255
Reply from 220.12.204.5: bytes=32 time<1ms TTL=255

Ping statistics for 220.12.204.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 16ms, Average = 7ms

C:\>ping 220.12.204.3

Pinging 220.12.204.3 with 32 bytes of data:

Reply from 220.12.204.3: bytes=32 time<1ms TTL=127
Reply from 220.12.204.3: bytes=32 time=3ms TTL=127
Reply from 220.12.204.3: bytes=32 time<1ms TTL=127
Reply from 220.12.204.3: bytes=32 time<1ms TTL=127

Ping statistics for 220.12.204.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 3ms, Average = 0ms

C:\>
```

ROUTER CONFIGURATION

```
3 Gigabit Ethernet interfaces
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up


Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/2
Router(config-if)#
Router(config-if)#exit
```







GigabitEthernet0/0 → Connected to LAN1 (Tree Topology)

GigabitEthernet0/1 → Connected to LAN2 (Star Topology)

GigabitEthernet0/2 → Connected to LAN3 (Ring Topology)

INFERENCE

This simulation effectively demonstrates the integration of three distinct LAN topologies—**Tree**, **Star**, and **Ring**—within a unified network infrastructure using a centralized router (CPT). Each LAN is independently structured to reflect its respective topology and is logically segregated using unique IP addressing schemes under the subnet series **220.12.X.X**, promoting clarity in routing and efficient traffic management.

- **LAN1 (Tree Topology)** utilizes IP range **220.12.141.1–8**, showcasing a hierarchical layout that is scalable and ideal for large networks where expansion is frequent.
- **LAN2 (Star Topology)**, with IPs **220.12.214.1–5**, highlights centralized communication where all nodes connect directly to a central switch, ensuring easy fault detection and simplified management.
- **LAN3 (Ring Topology)**, assigned **220.12.204.1–4**, demonstrates a circular communication flow that can be effective in scenarios requiring equal access time for nodes and predictable performance.

The router's configuration, with interfaces **GigabitEthernet0/0 to 0/2** assigned to each LAN, provides clear segmentation and inter-LAN communication through routing. This setup is valuable in understanding the operational dynamics, benefits, and limitations of different network topologies within a cohesive environment. It also mirrors real-world network designs where multiple departments or branches (with different setups) communicate through a central gateway.

OBSERVATION

In this simulation, the integration of three distinct LAN topologies—Tree, Star, and Ring—through a centralized router highlights several key observations. The router successfully enables communication across all networks using clearly segmented IP ranges, demonstrating efficient routing and logical separation. The **Tree topology** shows a scalable and structured hierarchy ideal for larger networks, but its dependency on upper-level switches poses a risk, as a single failure can isolate entire sections. The **Star topology** performs reliably, offering direct and fast communication between nodes and the central switch, with easy fault detection; however, failure of the central switch can bring down the entire LAN. The **Ring topology** ensures equal access and predictable traffic flow, but it is sensitive to link failures unless redundancy is built in. The simulation confirms that with proper interface mapping and subnetting, inter-topology communication is achievable. It also emphasizes how different topologies behave in terms of scalability, fault tolerance, and network performance, offering valuable insights into real-world network design and management.