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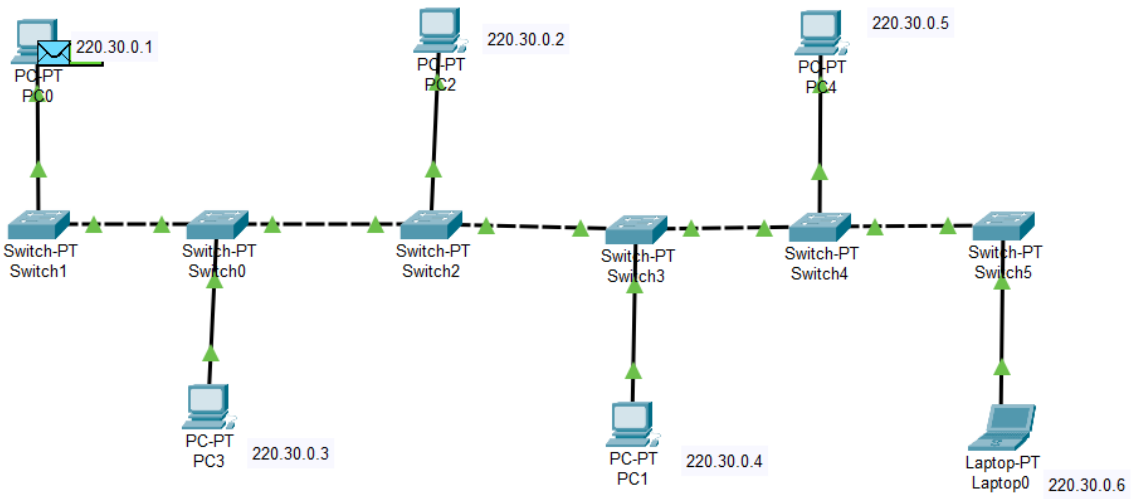
19ECE311-COMPUTER NETWORKS ASSIGNMENT-2

Qn1.Create all the topologies discussed in class in Cisco Packet Tracer (CPT)

1. Bus Topology:



Testing Ping:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 220.30.0.1

Pinging 220.30.0.1 with 32 bytes of data:

Reply from 220.30.0.1: bytes=32 time<1ms TTL=128
Reply from 220.30.0.1: bytes=32 time=4ms TTL=128
Reply from 220.30.0.1: bytes=32 time=3ms TTL=128
Reply from 220.30.0.1: bytes=32 time=5ms TTL=128

Ping statistics for 220.30.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 3ms

C:\>
```

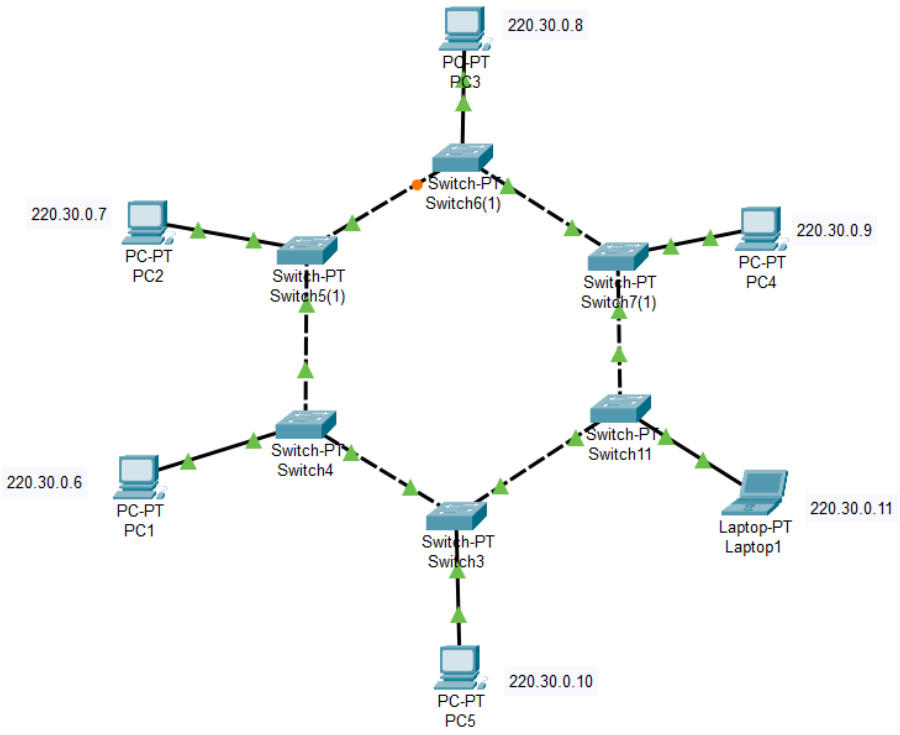
Result:

	Successful	PC0	PC3	ICMP		0.000	N	0	(edit)
	Successful	PC0	PC2	ICMP		0.000	N	1	(edit)
	Successful	PC0	PC4	ICMP		0.000	N	2	(edit)
	Successful	PC0	Laptop0	ICMP		0.000	N	3	(edit)
	Successful	PC0	PC1	ICMP		0.000	N	4	(edit)

Inference:

Each PC sends and receives data via the bus, with the data being broadcast to all devices, but only the intended recipient processes it. The bus requires terminators at both ends to prevent signal bounce. This setup is simple and easy to extend, but has limitations like performance degradation with more devices and a single point of failure if the bus cable breaks. It is suitable for small networks but not ideal for larger, more reliable systems.

2. Ring topology:



Ping Test:

```
C:\>ping 220.30.0.6

Pinging 220.30.0.6 with 32 bytes of data:

Reply from 220.30.0.6: bytes=32 time=5ms TTL=128
Reply from 220.30.0.6: bytes=32 time<1ms TTL=128
Reply from 220.30.0.6: bytes=32 time=4ms TTL=128
Reply from 220.30.0.6: bytes=32 time=4ms TTL=128

Ping statistics for 220.30.0.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 3ms
```

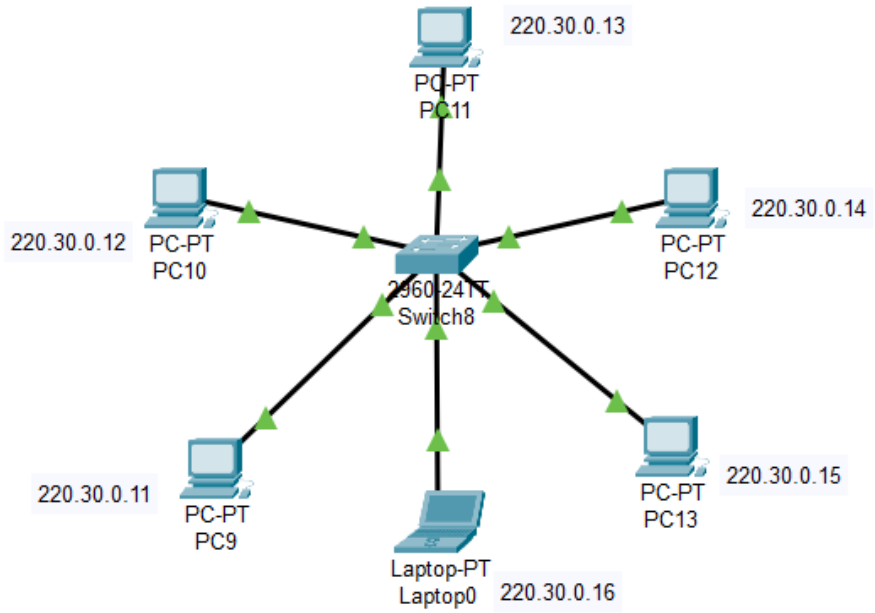
Result:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC1	PC2	ICMP		0.000	N	0	(edit)
	Successful	PC1	PC3	ICMP		0.000	N	1	(edit)
	Successful	PC1	PC4	ICMP		0.000	N	2	(edit)
	Successful	PC1	Laptop1	ICMP		0.000	N	3	(edit)
	Successful	PC1	PC5	ICMP		0.000	N	4	(edit)

Inference:

A ring topology is a network configuration where each device (node) is connected to exactly two other devices, forming a single continuous pathway for signals through each node. The successful ping to 220.30.0.6 (PC1) indicates a functional and relatively efficient network connection between the pinging device and PC1. All four sent packets were received with low latency (average of 6ms), suggesting a reliable path through the network infrastructure shown

3. Star Topology:



Ping Test:

```
C:\>ping 220.30.0.11

Pinging 220.30.0.11 with 32 bytes of data:

Reply from 220.30.0.11: bytes=32 time=4ms TTL=128
Reply from 220.30.0.11: bytes=32 time=3ms TTL=128
Reply from 220.30.0.11: bytes=32 time=15ms TTL=128
Reply from 220.30.0.11: bytes=32 time=5ms TTL=128

Ping statistics for 220.30.0.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 15ms, Average = 6ms
```

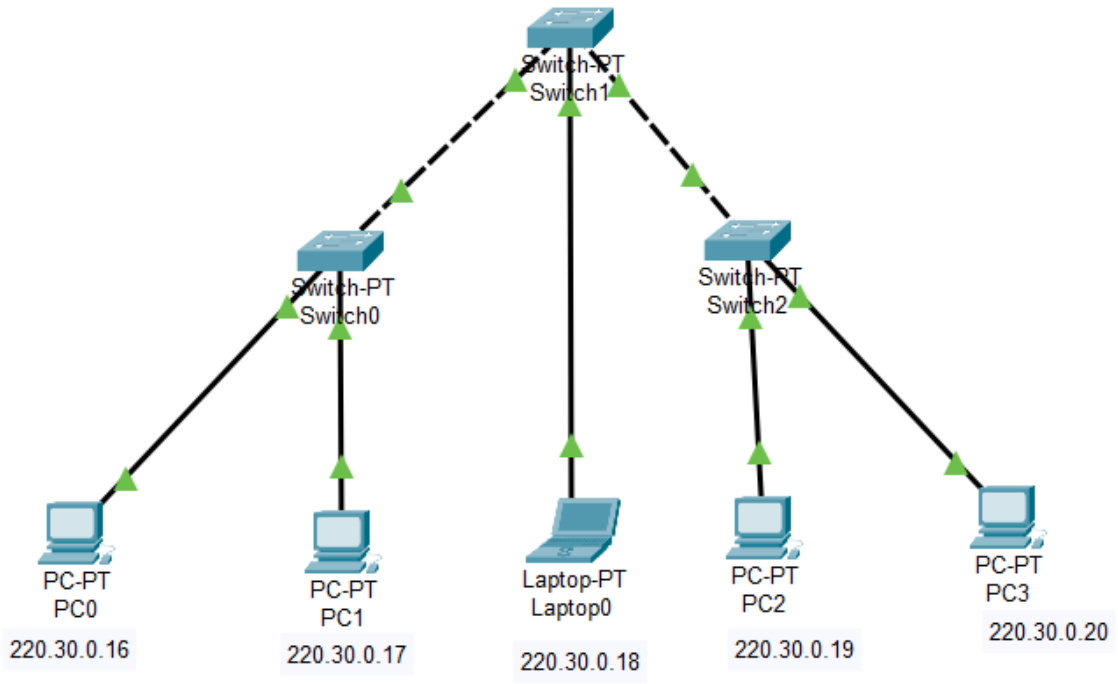
Result:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC9	PC10	ICMP		0.000	N	0	(edit)
	Successful	PC9	PC11	ICMP		0.000	N	1	(edit)
	Successful	PC9	PC12	ICMP		0.000	N	2	(edit)
	Successful	PC9	PC13	ICMP		0.000	N	3	(edit)
	Successful	PC9	Laptop0	ICMP		0.000	N	4	(edit)

Inference:

In a star network topology, all devices (the 5 PCs and the 1 laptop in this case) connect to a central hub or switch. The successful ping indicates a healthy and efficient network connection to the end devices via the switch in the star topology. All packets were delivered and returned with low and consistent latency, suggesting a reliable link and a functioning central Switch.

4. Tree Topology:



Ping Test:

```
Pinging 220.30.0.16 with 32 bytes of data:

Reply from 220.30.0.16: bytes=32 time<1ms TTL=128
Reply from 220.30.0.16: bytes=32 time=3ms TTL=128
Reply from 220.30.0.16: bytes=32 time<1ms TTL=128
Reply from 220.30.0.16: bytes=32 time=10ms TTL=128

Ping statistics for 220.30.0.16:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 3ms
```

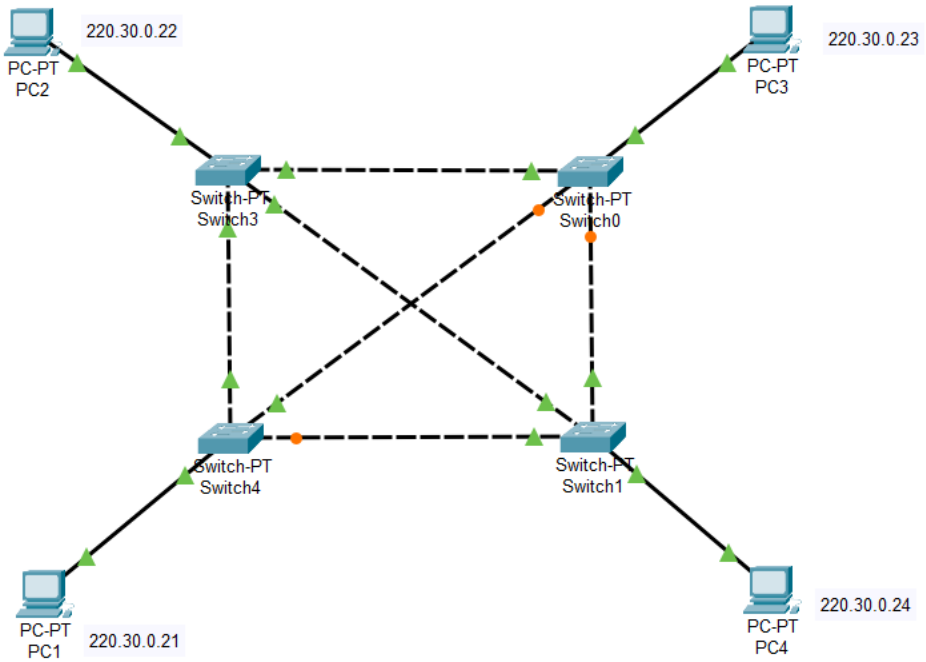
Result:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC0	Laptop0	ICMP		0.000	N	0	(edit)
	Successful	PC0	PC1	ICMP		0.000	N	1	(edit)
	Successful	PC0	PC2	ICMP		0.000	N	2	(edit)
	Successful	PC0	PC3	ICMP		0.000	N	3	(edit)

Inference:

The network exhibits a tree topology with a hierarchical structure centred around a root switch (Switch1) that connects to two lower-level switches (Switch0 and Switch2), each linking to multiple PCs. Laptop0 connects directly to the root switch, creating distinct network segments. All devices share the same IP range (220.30.0.x), indicating they are part of the same logical network.While the topology provides organized traffic management and moderate scalability (allowing new branches to be added), the root switch (Switch1) represents a potential single point of failure, as its failure would disrupt the entire network.

5. Mesh Topology



Ping Test:

```
C:\>ping 220.30.0.21

Pinging 220.30.0.21 with 32 bytes of data:

Reply from 220.30.0.21: bytes=32 time=3ms TTL=128
Reply from 220.30.0.21: bytes=32 time=10ms TTL=128
Reply from 220.30.0.21: bytes=32 time=12ms TTL=128
Reply from 220.30.0.21: bytes=32 time<1ms TTL=128

Ping statistics for 220.30.0.21:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 6ms
```

Result:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC1	PC2	ICMP		0.000	N	0	(edit)	
	Successful	PC1	PC3	ICMP		0.000	N	1	(edit)	
	Successful	PC1	PC4	ICMP		0.000	N	2	(edit)	

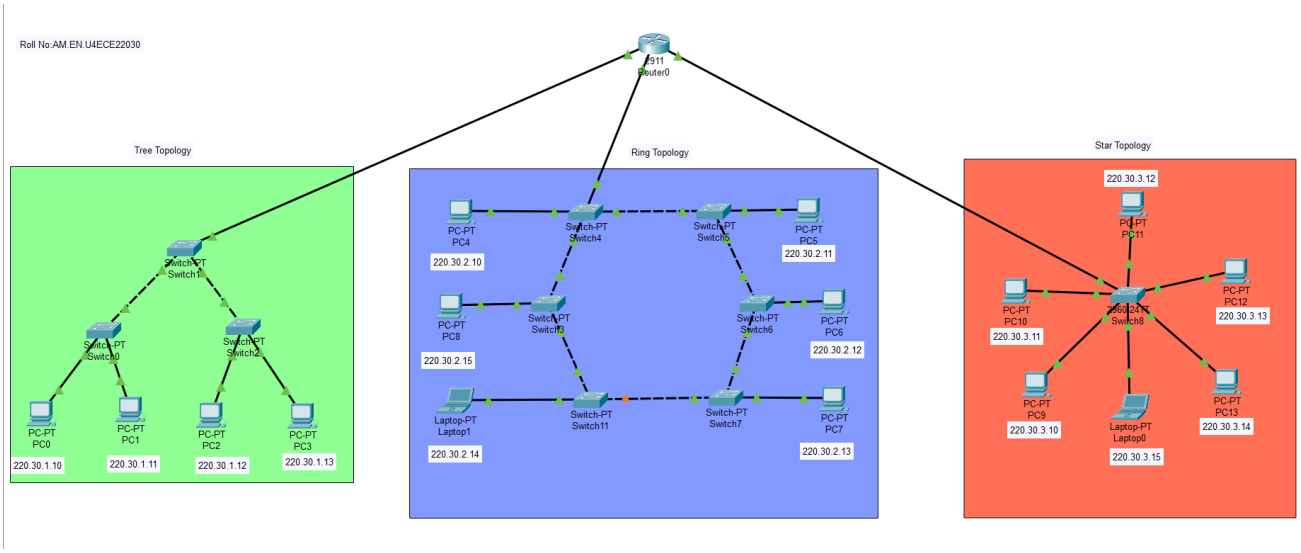
Inference:

In mesh topology the four switches are interconnected directly with each other, ensuring high redundancy and reliability. Each switch also connects to a PC with IP addresses in the 220.30.0.x range. This setup allows continuous communication even if one link fails

Conclusion:

- **Bus Topology** is simple and cost-effective for small networks but suffers from limited scalability and a single point of failure along the main cable.
- **Star Topology** provides easy management and fault isolation since each device connects independently to a central hub, but the hub becomes a critical single point of failure.
- **Ring Topology** ensures organized data flow and equal access to the network, but a break in any one connection can disrupt the entire network unless fault tolerance mechanisms are used.
- **Tree Topology** combines characteristics of star and bus topologies, offering scalability and structured segmentation, yet it inherits the vulnerability of a central root device failure.
- **Mesh Topology** (particularly full or partial mesh) delivers maximum redundancy and reliability through multiple pathways, but at the cost of higher complexity, setup, and maintenance expenses.

Qn2. 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. The IP addresses for the implementation of topologies should be chosen based on the 5 digits of your Roll No.



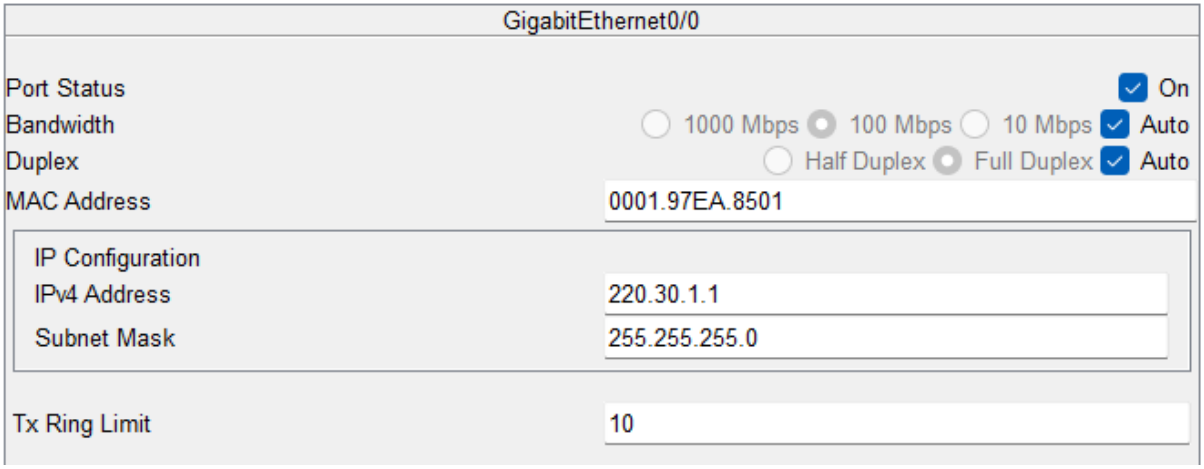
LAN1 (Tree topology) : IP Addresses – 221.30.1.10 - 221.30.1.13

LAN2 (Ring topology) : IP Addresses – 221.30.2.10 - 221.30.2.15

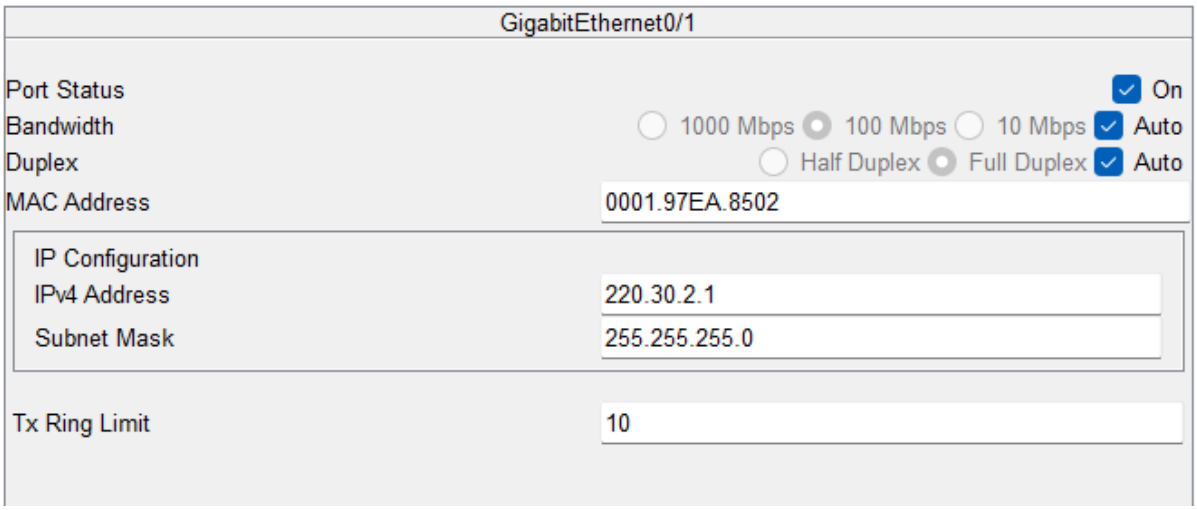
LAN3 (Star topology) : IP Addresses – 221.30.3.10 - 221.30.3.15

Router Configuration:

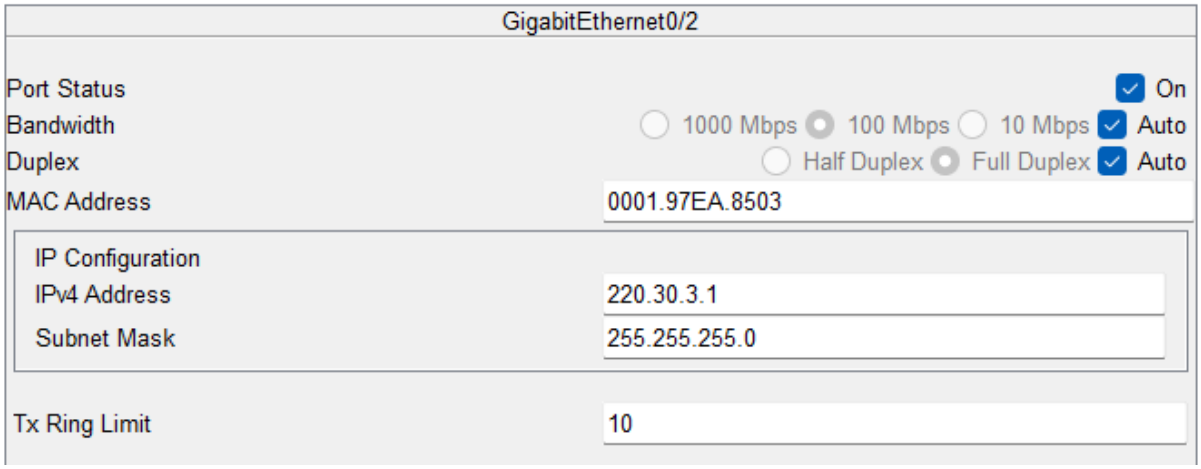
GigabitEthernet0/0 → Connected to LAN1 (Tree Topology)



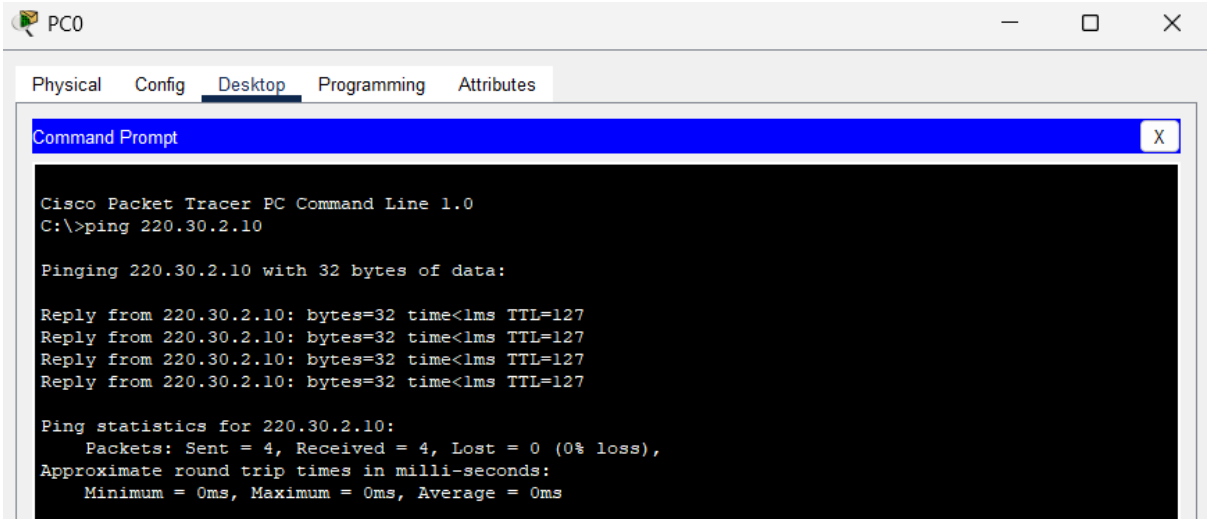
GigabitEthernet0/1 → Connected to LAN2 (Ring Topology)



GigabitEthernet0/2 → Connected to LAN3 (Star Topology)



Ping LAN2 from LAN1:



Ping LAN3 from LAN1:

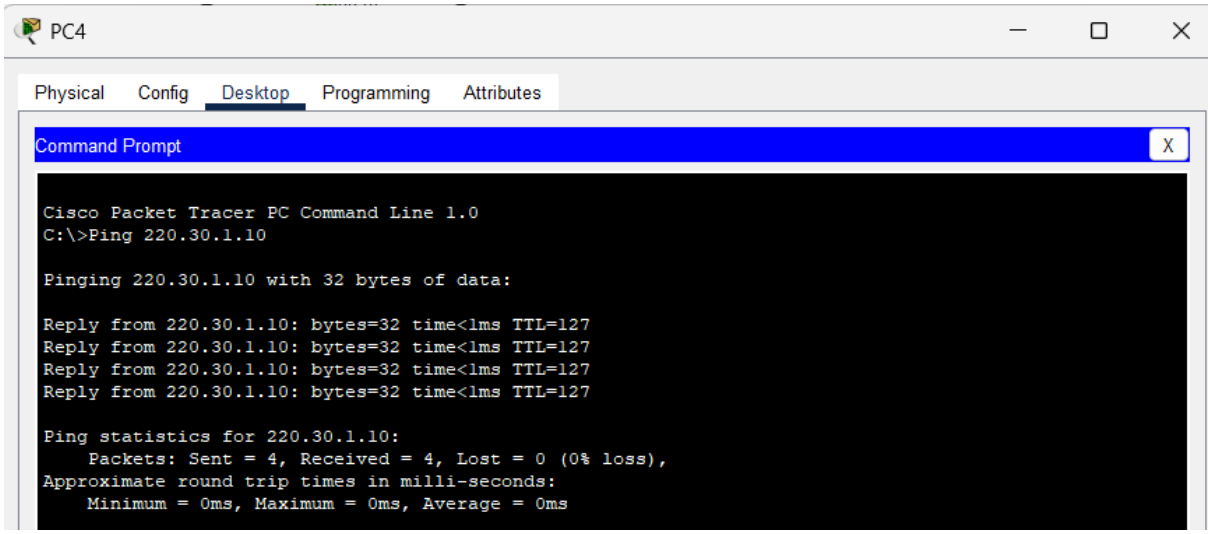
```
C:\>ping 220.30.3.10

Pinging 220.30.3.10 with 32 bytes of data:

Reply from 220.30.3.10: bytes=32 time<1ms TTL=127
Reply from 220.30.3.10: bytes=32 time<1ms TTL=127
Reply from 220.30.3.10: bytes=32 time<1ms TTL=127
Reply from 220.30.3.10: bytes=32 time<1ms TTL=127

Ping statistics for 220.30.3.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Ping LAN1 from LAN2:



Result:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC0	PC4	ICMP		0.000	N	0	(edit)
	Successful	PC1	PC10	ICMP		0.000	N	1	(edit)
	Successful	PC5	PC1	ICMP		0.000	N	2	(edit)
	Successful	PC4	Laptop0	ICMP		0.000	N	3	(edit)
	Successful	PC12	PC3	ICMP		0.000	N	4	(edit)
	Successful	PC13	Laptop1	ICMP		0.000	N	5	(edit)

Observation:

The network has three distinct logical topologies — Tree (green box), Ring (blue box), and Star (red box) — each with its own subnet:

- Tree Topology (220.30.1.x): A hierarchical structure with a root switch connecting to branch switches and multiple PCs.
- Ring Topology (220.30.2.x): Devices connected in a closed loop, allowing data to circulate sequentially.
- Star Topology (220.30.3.x): All devices are directly connected to a central switch.

A central router (Router0) interconnects these topologies, enabling communication between the different subnets. The diagram demonstrates the integration of Tree, Ring, and Star topologies, each operating on its own subnet, all interconnected by a central router for unified network communication.

ping is a network utility used to test if two devices, even from different networks, can communicate with each other. It sends ICMP Echo Request packets to a destination IP and waits for an Echo Reply. In this network, when a PC from LAN1 pings a PC from LAN2, the packet travels through its default gateway (the router), which forwards it to the correct network. If a reply is received, it confirms that the router is correctly routing packets between the LANs, meaning the networks are properly connected. A successful ping proves the connection works; a failure suggests a problem with IP settings, gateway, routing, or cabling.

Inference:

The network is designed to demonstrate the integration of three fundamental topologies- Tree, Ring, and Star — within a single infrastructure. Each topology operates independently using a distinct IP subnet, ensuring organized traffic management and easier network segmentation. A central router (Router0) connects all three topologies, enabling seamless inter-network communication. successful ping tests and packet transmissions between devices across different topologies confirm that routing between the subnets is correctly configured.