



**DEPARTMENT OF COMPUTER SCIENCE AND  
ENGINEERING  
SCHOOL OF TECHNOLOGY  
Pandit Deendayal Energy University  
SESSION 2025-26**

**Computer Network LAB(20CP301P)**



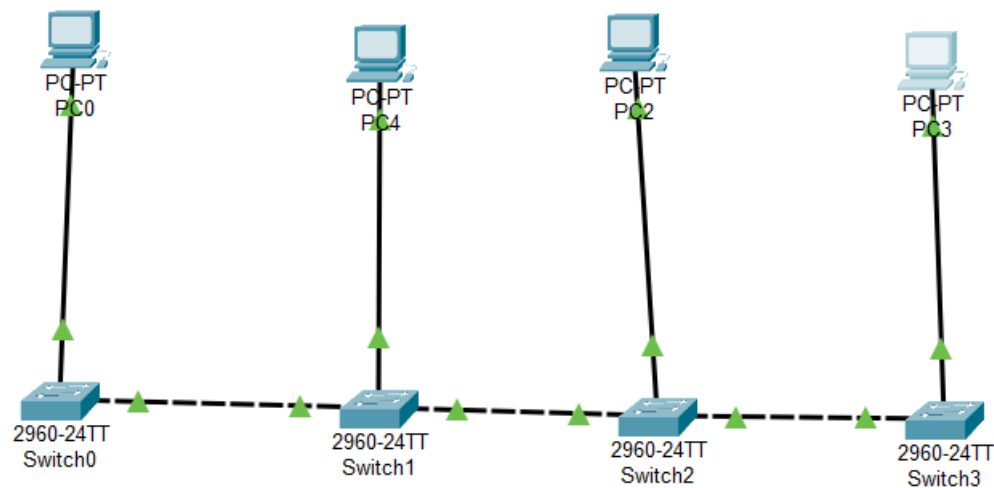
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Roll No: 23BCP002  
Division: 1 Group: 1x  
EXPERMINET NO 1**

**Aim:** To understand and implement different Topologies in Computer Network

**Tools:** Cisco Packet Tracer

### Setup and Theory:

- **Bus Topology**



```
C:\>ping 192.168.1.255

Pinging 192.168.1.255 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.1: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time=1ms TTL=128
Reply from 192.168.1.2: bytes=32 time=1ms TTL=128
Reply from 192.168.1.1: bytes=32 time=2ms TTL=128
Reply from 192.168.1.3: bytes=32 time=2ms TTL=128
Reply from 192.168.1.2: bytes=32 time=2ms TTL=128
Reply from 192.168.1.1: bytes=32 time=2ms TTL=128
Reply from 192.168.1.3: bytes=32 time=1ms TTL=128
Reply from 192.168.1.2: bytes=32 time=1ms TTL=128
Reply from 192.168.1.1: bytes=32 time=2ms TTL=128

Ping statistics for 192.168.1.255:
    Packets: Sent = 4, Received = 12, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 1ms
```

In a Bus topology, all devices are connected to a single central cable known as the backbone. Data sent by a device is broadcast to all devices on the network, but only the target device accepts and processes it. This topology operates on a single communication channel and requires that devices take turns to transmit to avoid data collisions.

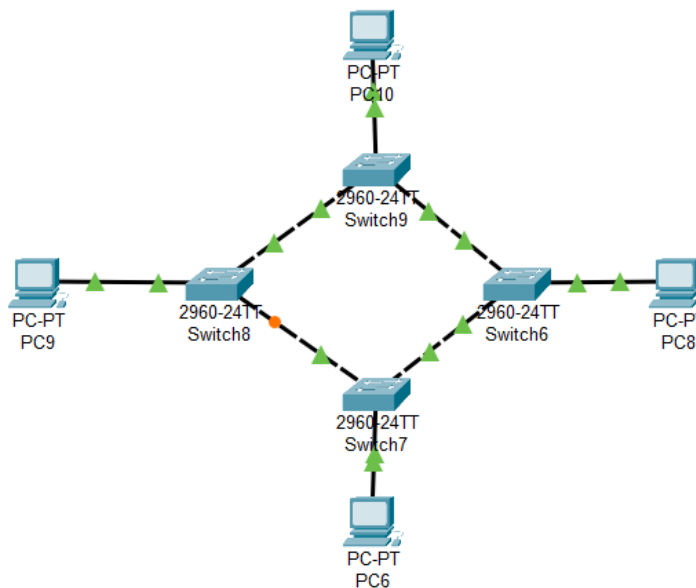
### Advantages

- Simple and cost-effective setup
- Requires minimal cabling

### Disadvantages

- Poor scalability
- Entire network fails if the backbone is damaged

### • Ring Topology



```
Pinging 192.168.1.255 with 32 bytes of data:

Reply from 192.168.1.5: bytes=32 time<1ms TTL=128
Reply from 192.168.1.7: bytes=32 time<1ms TTL=128
Reply from 192.168.1.8: bytes=32 time<1ms TTL=128
Reply from 192.168.1.5: bytes=32 time=1ms TTL=128
Reply from 192.168.1.8: bytes=32 time=1ms TTL=128
Reply from 192.168.1.7: bytes=32 time=2ms TTL=128
Reply from 192.168.1.5: bytes=32 time<1ms TTL=128
Reply from 192.168.1.7: bytes=32 time=1ms TTL=128
Reply from 192.168.1.8: bytes=32 time<1ms TTL=128
Reply from 192.168.1.7: bytes=32 time<1ms TTL=128
Reply from 192.168.1.5: bytes=32 time=1ms TTL=128
Reply from 192.168.1.8: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.255:
    Packets: Sent = 4, Received = 12, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 0ms
```

In a **Ring topology**, each device connects to exactly two other devices, forming a closed loop. Data travels in a specific direction and passes through each device until it reaches its destination. This structure ensures

orderly data transmission but lacks fault tolerance unless a dual-ring setup is used.

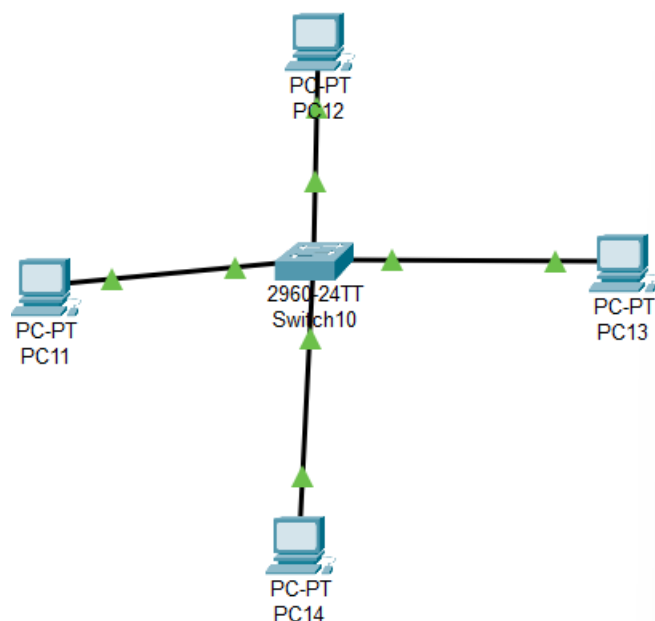
### Advantages

- Equal data access for all devices
- Predictable data flow reduces collisions

### Disadvantages

- A single failure can break the loop
- Troubleshooting and expansion are challenging

### • Star Topology



```

Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.255

Pinging 192.168.1.255 with 32 bytes of data:

Reply from 192.168.1.12: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.14: bytes=32 time<1ms TTL=128
Reply from 192.168.1.12: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.14: bytes=32 time<1ms TTL=128
Reply from 192.168.1.12: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.14: bytes=32 time<1ms TTL=128
Reply from 192.168.1.12: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.14: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.255:
    Packets: Sent = 4, Received = 12, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
  
```

In a **Star topology**, all devices are individually connected to a central hub or switch. The central device manages and directs data traffic. Each node communicates only with the hub, making fault isolation simple and minimizing the impact of individual device failures.

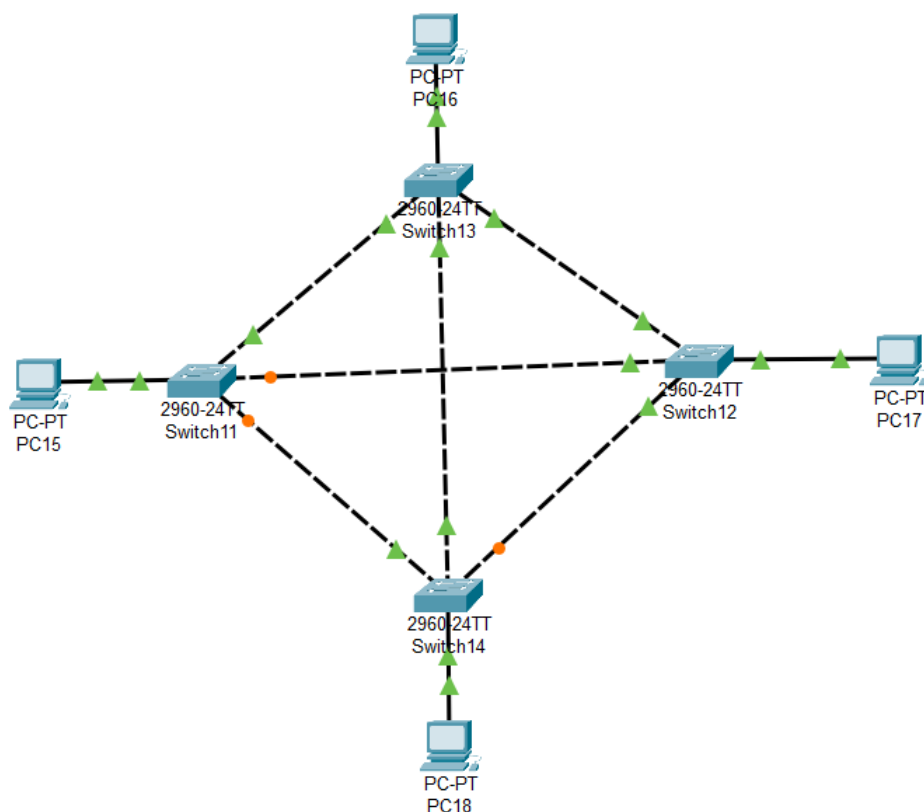
### Advantages

- Easy to install, manage, and troubleshoot
- Failure of one device or cable doesn't affect others

### Disadvantages

- Central device is a single point of failure
- Requires more cabling than bus or ring topologies

- **Mesh Topology**



```

C:\>ping 192.168.1.255

Pinging 192.168.1.255 with 32 bytes of data:

Reply from 192.168.1.16: bytes=32 time<1ms TTL=128
Reply from 192.168.1.15: bytes=32 time<1ms TTL=128
Reply from 192.168.1.17: bytes=32 time<1ms TTL=128
Reply from 192.168.1.16: bytes=32 time<1ms TTL=128
Reply from 192.168.1.15: bytes=32 time<1ms TTL=128
Reply from 192.168.1.17: bytes=32 time<1ms TTL=128
Reply from 192.168.1.16: bytes=32 time<1ms TTL=128
Reply from 192.168.1.15: bytes=32 time<1ms TTL=128
Reply from 192.168.1.17: bytes=32 time<1ms TTL=128
Reply from 192.168.1.16: bytes=32 time=1ms TTL=128
Reply from 192.168.1.15: bytes=32 time=1ms TTL=128
Reply from 192.168.1.17: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.1.255:
    Packets: Sent = 4, Received = 12, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

```

A **Mesh topology** features direct connections between every pair of devices. Each device can communicate with any other through multiple pathways, offering high redundancy and fault tolerance. Mesh topologies are best suited for critical applications where uptime is essential.

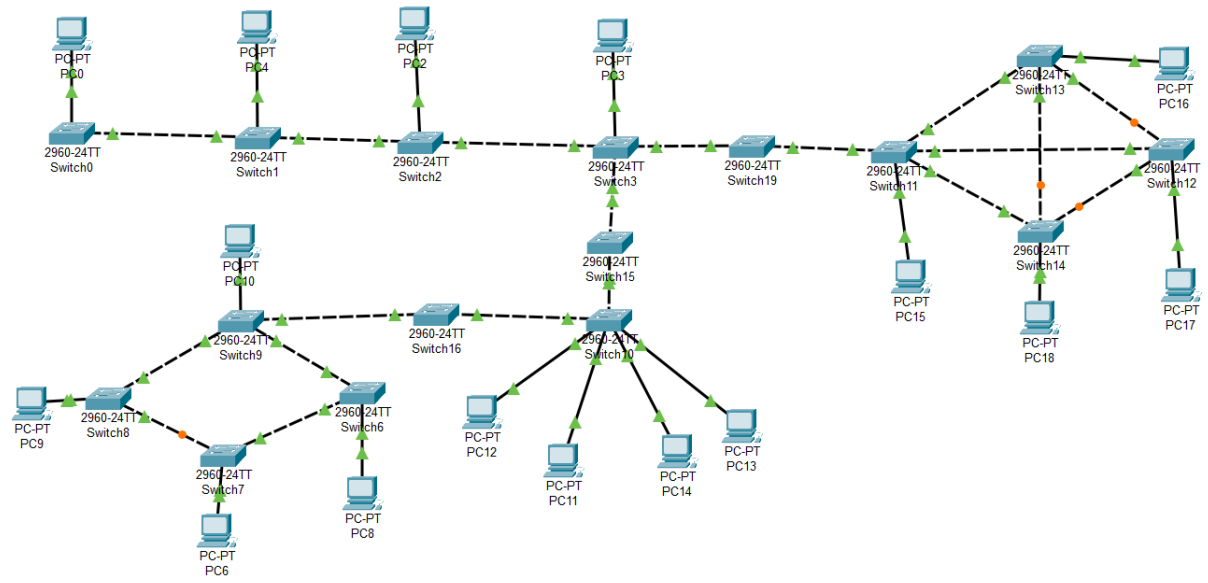
#### **Advantages**

- Extremely reliable and fault-tolerant
- Supports multiple simultaneous data paths

#### **Disadvantages**

- High cost due to excessive cabling
- Complex installation and management

- **Hybrid Topology**



```

C:\>ping 192.168.1.255

Pinging 192.168.1.255 with 32 bytes of data:

Reply from 192.168.1.4: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time=40ms TTL=128
Reply from 192.168.1.15: bytes=32 time<1ms TTL=128
Reply from 192.168.1.12: bytes=32 time<1ms TTL=128
Reply from 192.168.1.18: bytes=32 time=1ms TTL=128
Reply from 192.168.1.11: bytes=32 time=76ms TTL=128
Reply from 192.168.1.16: bytes=32 time=77ms TTL=128
Reply from 192.168.1.17: bytes=32 time=76ms TTL=128
Reply from 192.168.1.14: bytes=32 time=91ms TTL=128
Reply from 192.168.1.5: bytes=32 time=91ms TTL=128
Reply from 192.168.1.8: bytes=32 time=91ms TTL=128
Reply from 192.168.1.6: bytes=32 time=91ms TTL=128
Reply from 192.168.1.7: bytes=32 time=92ms TTL=128
Reply from 192.168.1.13: bytes=32 time=91ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time=1ms TTL=128
Reply from 192.168.1.15: bytes=32 time<1ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
Reply from 192.168.1.12: bytes=32 time<1ms TTL=128
Reply from 192.168.1.16: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.17: bytes=32 time<1ms TTL=128
Reply from 192.168.1.14: bytes=32 time<1ms TTL=128
Reply from 192.168.1.5: bytes=32 time=1ms TTL=128
Reply from 192.168.1.8: bytes=32 time=1ms TTL=128
Reply from 192.168.1.6: bytes=32 time=1ms TTL=128
Reply from 192.168.1.7: bytes=32 time=1ms TTL=128
Reply from 192.168.1.4: bytes=32 time=1ms TTL=128
Reply from 192.168.1.18: bytes=32 time=1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.4: bytes=32 time<1ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
Reply from 192.168.1.12: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.5: bytes=32 time<1ms TTL=128
Reply from 192.168.1.6: bytes=32 time<1ms TTL=128
Reply from 192.168.1.14: bytes=32 time=1ms TTL=128
Reply from 192.168.1.15: bytes=32 time=1ms TTL=128
Reply from 192.168.1.7: bytes=32 time=1ms TTL=128
Reply from 192.168.1.18: bytes=32 time=26ms TTL=128
Reply from 192.168.1.16: bytes=32 time=26ms TTL=128
Reply from 192.168.1.17: bytes=32 time=26ms TTL=128
Reply from 192.168.1.8: bytes=32 time=26ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.15: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.15: bytes=32 time<1ms TTL=128
Reply from 192.168.1.4: bytes=32 time=1ms TTL=128
Reply from 192.168.1.11: bytes=32 time=1ms TTL=128
Reply from 192.168.1.12: bytes=32 time=1ms TTL=128
Reply from 192.168.1.18: bytes=32 time=20ms TTL=128
Reply from 192.168.1.16: bytes=32 time=1ms TTL=128
Reply from 192.168.1.13: bytes=32 time=1ms TTL=128
Reply from 192.168.1.14: bytes=32 time=1ms TTL=128
Reply from 192.168.1.5: bytes=32 time=1ms TTL=128
Reply from 192.168.1.8: bytes=32 time=1ms TTL=128
Reply from 192.168.1.17: bytes=32 time=1ms TTL=128
Reply from 192.168.1.7: bytes=32 time=10ms TTL=128
Reply from 192.168.1.6: bytes=32 time=38ms TTL=128

Ping statistics for 192.168.1.255:
    Packets: Sent = 4, Received = 60, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 92ms, Average = 16ms

```

Tree topology is a hierarchical structure combining



multiple star topologies connected to a central backbone, similar to a bus. It is highly scalable and suitable for networks with layered administration, like universities or large enterprises.

**Advantages**

- Supports network expansion efficiently
- Combines advantages of star and bus topologies

**Disadvantages**

- Backbone failure can impact multiple branches
- Increased complexity in design and management

**Conclusion:**

Each network topology offers distinct advantages and trade-offs:

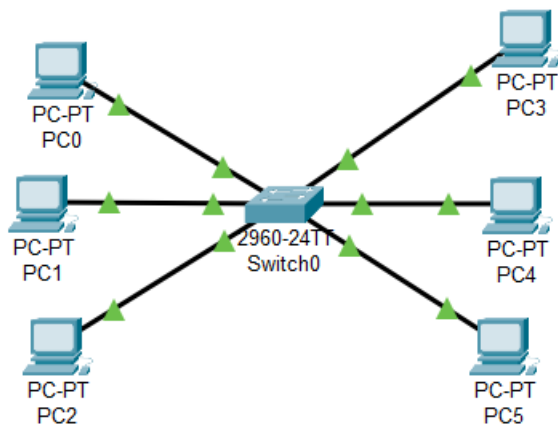
- Bus is economical for small setups but has limited scalability.
- Ring ensures structured data flow but is vulnerable to failures.
- Star is widely used for its simplicity and manageability.
- Mesh delivers maximum reliability at the cost of complexity and expense.
- Tree and Hybrid offer scalability and flexibility, making them ideal for large organizations.

## EXPERMINET NO 2

**Aim:** To study and configure VLAN (Virtual Local Area Network) in a network to understand how it segments network traffic, improves performance, and enhances security.

**Tools:** Cisco Packet Tracer

**Setup and Theory:**



Switch0

Physical
Config
CLI
Attributes

GLOBAL
Settings
Algorithm Settings
SWITCHING
VLAN Database
INTERFACE
FastEthernet0/1
FastEthernet0/2
FastEthernet0/3
FastEthernet0/4
FastEthernet0/5
FastEthernet0/6
FastEthernet0/7
FastEthernet0/8
FastEthernet0/9

VLAN Configuration
VLAN Number
VLAN Name
Add
Remove

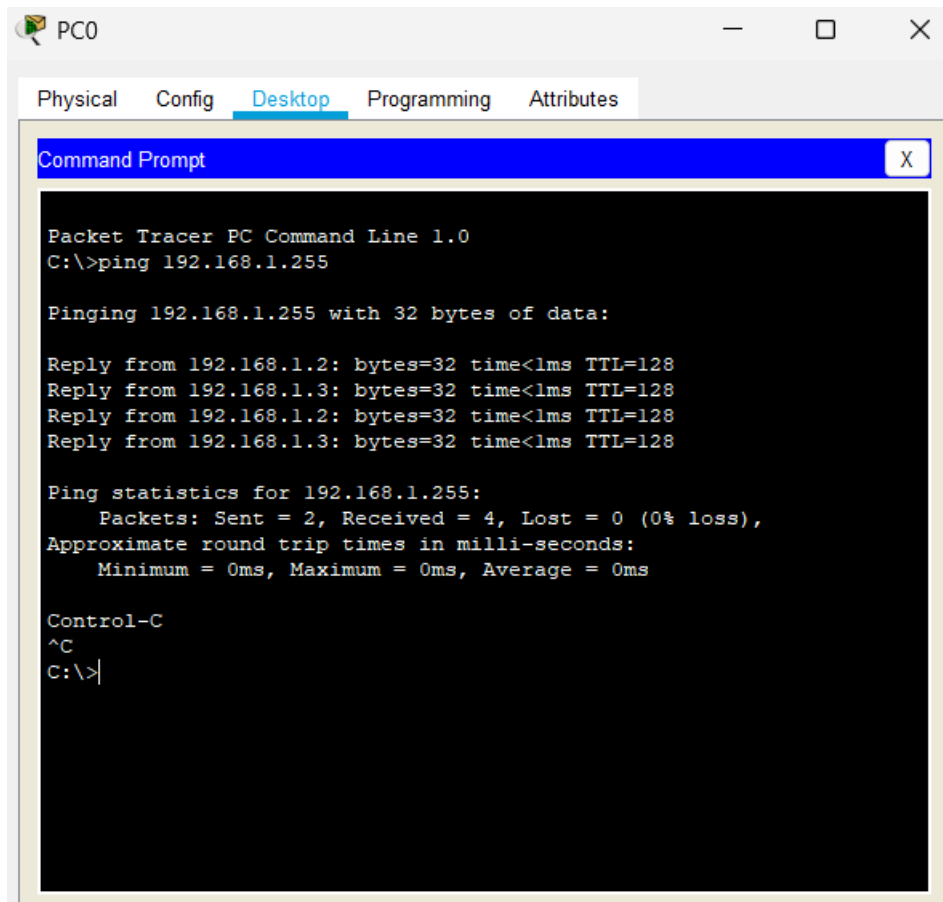
VLAN No	VLAN Name
1	default
100	Grouping
200	Grouping2
1002	fddi-default
1003	token-ring-default
1004	fddinet-default
1005	token-ring-fddi-default

Equivalent IOS Commands

```
% Warning: It is recommended to configure VLAN from config mode,
as VLAN database mode is being deprecated. Please consult user
documentation for configuring VTP/VLAN in config mode.

Switch(vlan)#
```

☐ Top



PC0

Physical Config Desktop Programming Attributes

Command Prompt

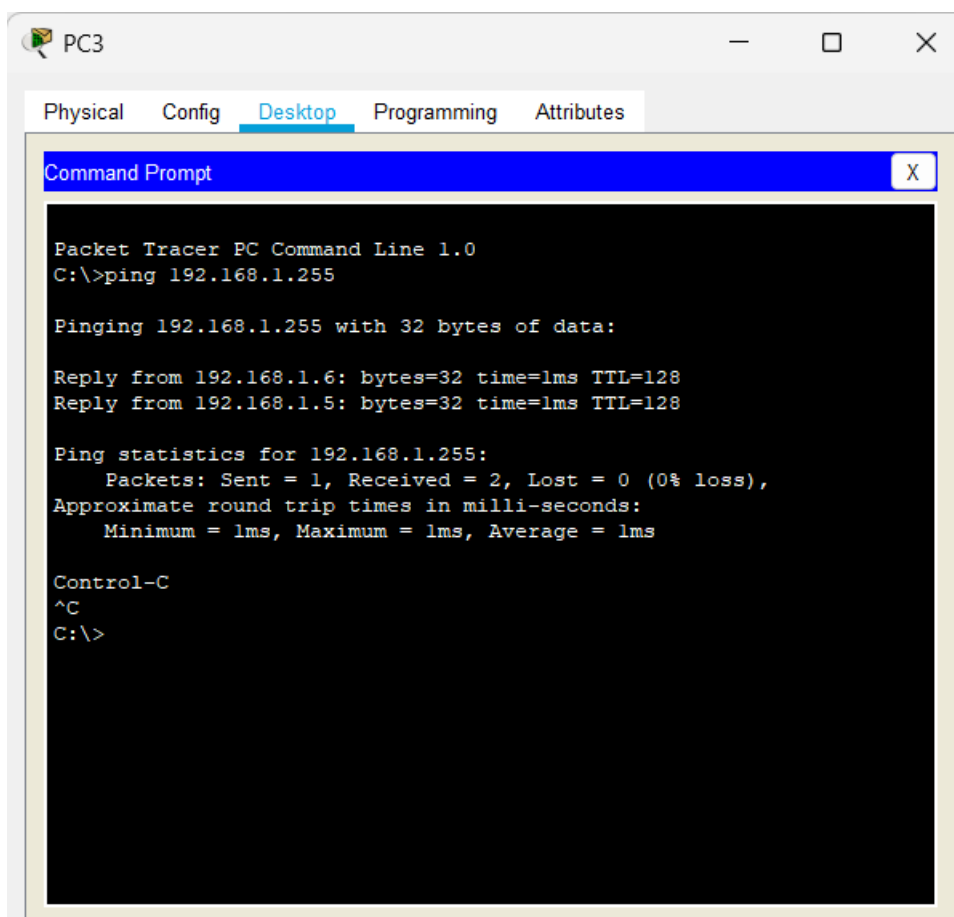
```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.255

Pinging 192.168.1.255 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.255:
    Packets: Sent = 2, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

Control-C
^C
C:\>
```



PC3

Physical Config Desktop Programming Attributes

Command Prompt

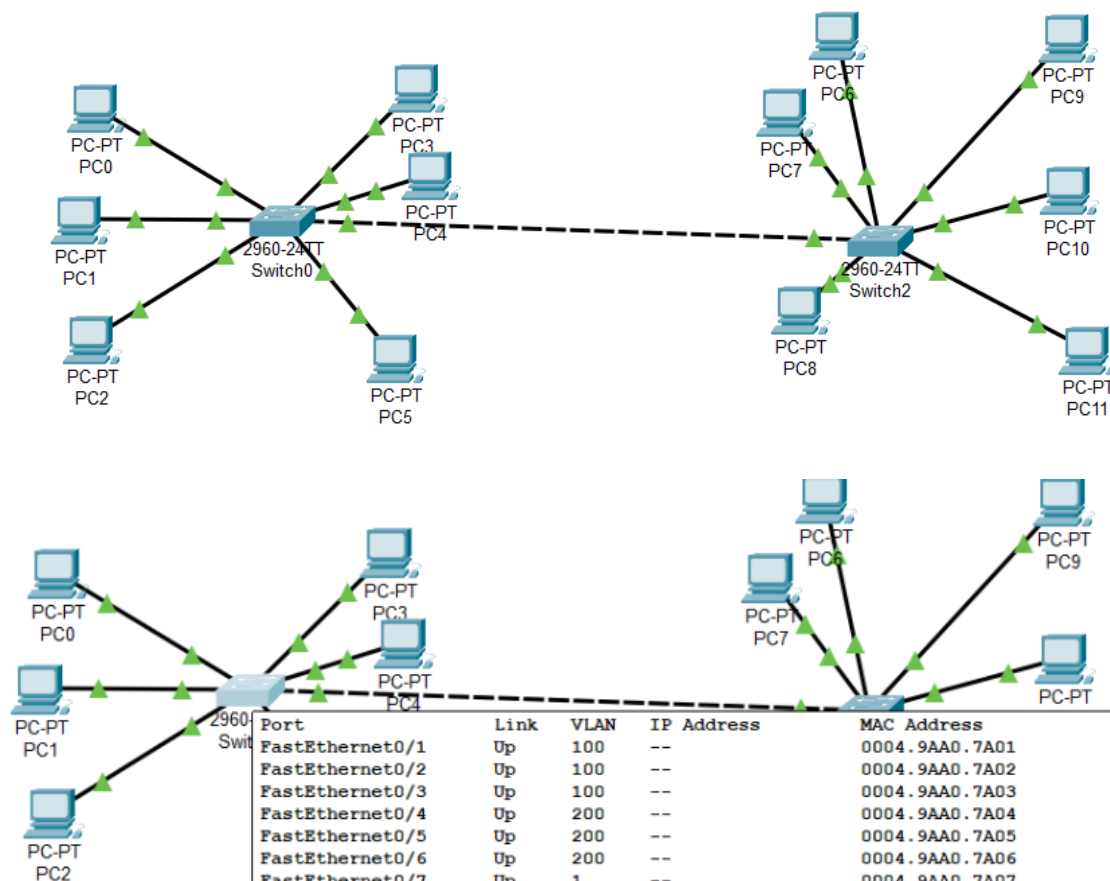
```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.255

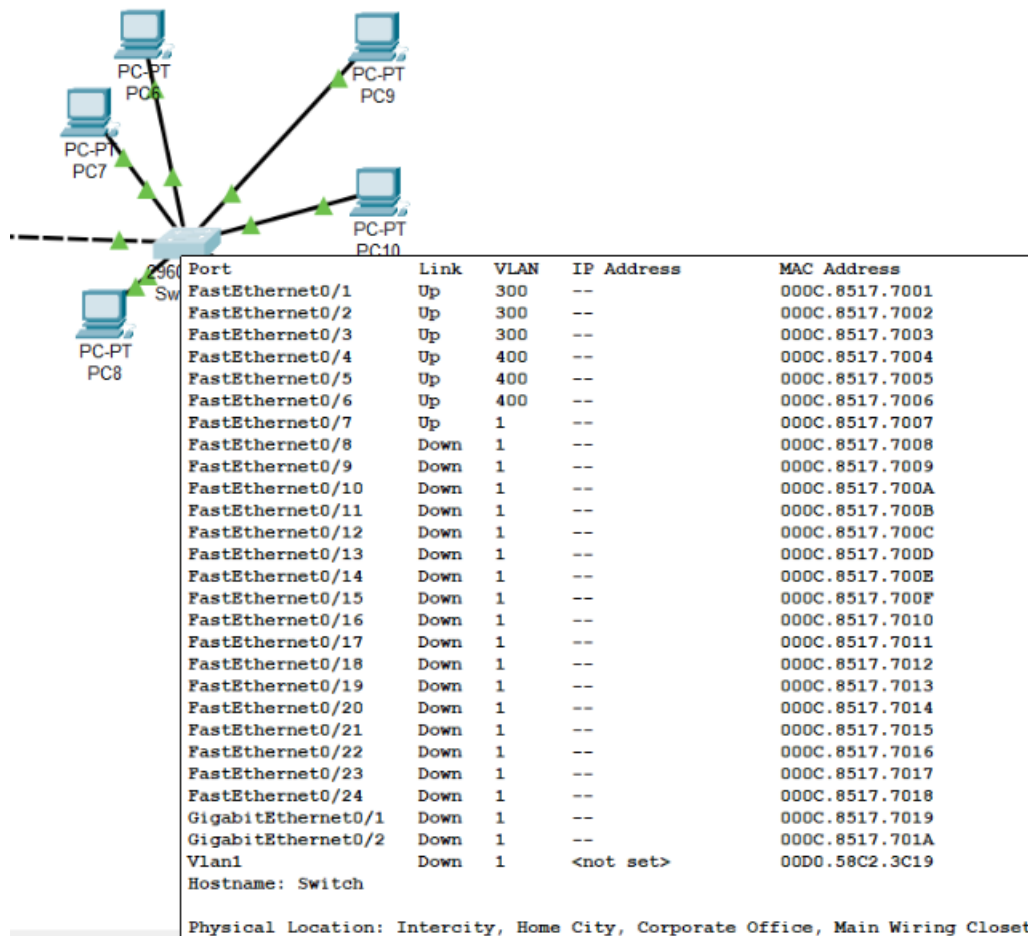
Pinging 192.168.1.255 with 32 bytes of data:

Reply from 192.168.1.6: bytes=32 time=1ms TTL=128
Reply from 192.168.1.5: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.1.255:
    Packets: Sent = 1, Received = 2, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

Control-C
^C
C:\>
```





A **VLAN (Virtual Local Area Network)** is a logical grouping of devices in a LAN, configured to communicate as if they are on the same physical network, regardless of their actual location. VLANs operate at **Layer 2 (Data Link Layer)** of the OSI model.

### Key Concepts:

- **Segmentation:** VLANs logically divide a single physical network into multiple isolated broadcast domains.
- **Broadcast Domain Isolation:** Devices in different VLANs cannot communicate directly without a Layer 3 device (router or Layer 3 switch).
- **Trunking:** Trunk ports carry traffic from multiple VLANs across a single physical link using tagging protocols like **IEEE 802.1Q**.

### Benefits of VLAN:

- **Improved Security:** Sensitive data can be isolated within specific VLANs.

- **Reduced Congestion:** Smaller broadcast domains mean less unnecessary traffic.
- **Improved Performance:** Network efficiency is increased through logical segmentation.
- **Flexibility and Scalability:** Devices can be moved across VLANs without changing physical connections.

## **Conclusion:**

**VLANs** are essential in modern networking for creating logical groupings of devices, improving network security, managing broadcast domains, and optimizing performance. By implementing VLANs, network administrators can reduce congestion, enhance data privacy, and scale networks efficiently. The practical configuration of VLANs reinforces the understanding of how Layer 2 segmentation is achieved in enterprise networks.

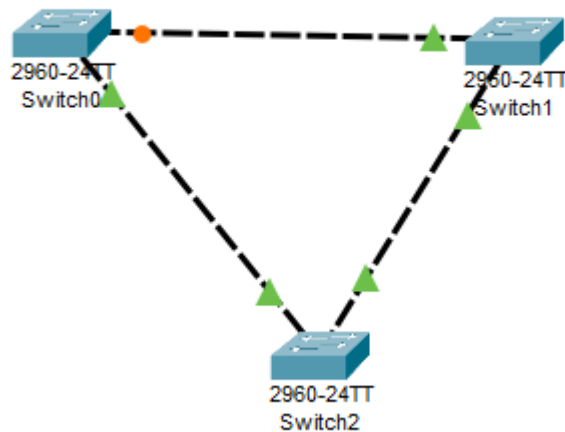
## EXPERIMENT NO 3

**Aim:** Check whether loop exist in network or not if yes identify it and block it anyway network do

**Tools:** Cisco Packet Tracer

### Setup and Theory:

- **Step 1:** Take three switches and connect all of them.
- **Step 2:** Check whether a loop exists or not.



- **Step 3:** “show spanning-tree” command for checking blocking and forwarding ports.



```

Switch>sh
Switch>show sp
Switch>show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    24577
             Address     0000.0CC8.21AE
             Cost        19
             Port        2(FastEthernet0/2)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     00D0.BA20.8175
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface          Role Sts Cost      Prio.Nbr Type
-----
Fa0/2              Root FWD 19        128.2   P2p
Fa0/3              Altn BLK 19        128.3   P2p

Switch>

```

- **Step 4:**

“

**enable**

**configure terminal**

**spanning-tree vlan 1 priority**

**24576**

**end**

” command to set manually priority. Default priority is 32768.

Physical Config **CLI** Attributes

## IOS Command Line Interface

```

Port 2 (FastEthernet0/2)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 00D0.BA20.8175
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20

Interface      Role Sts Cost      Prio.Nbr Type
-----
Fa0/2          Root FWD 19        128.2    P2p
Fa0/3          Altn BLK 19        128.3    P2p

Switch#Enable
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#sp
Switch(config)#spanning-tree vl
Switch(config)#spanning-tree vlan 1 pri
Switch(config)#spanning-tree vlan 1 priority 24576
Switch(config)#End
Switch#
%SYS-5-CONFIG_I: Configured from console by console

```

Ctrl+F6 to exit CLI focus

Copy

Paste

Switch1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Switch>sh
Switch>show
% Incomplete command.
Switch>
Switch>show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    24577
             Address     0000.0CC8.21AE
             Cost        19
             Port        3 (FastEthernet0/3)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

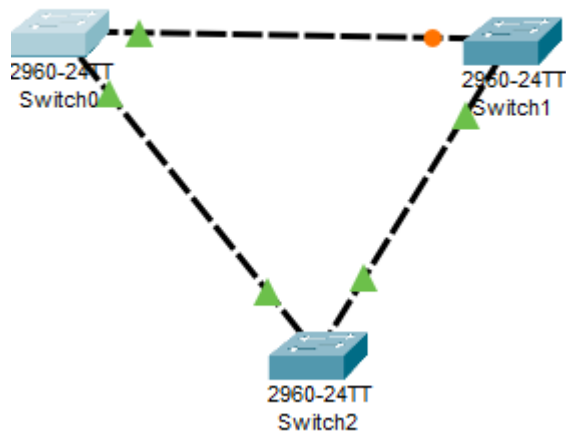
  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
             Address     0006.2AE5.6028
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface           Role Sts Cost      Prio.Nbr Type
-----
Fa0/1               Altn BLK 19      128.1   P2p
Fa0/3               Root FWD 19      128.3   P2p

Switch>
```

Ctrl+F6 to exit CLI focus

Copy Paste



**Conclusion:**