Computer Network

1. To study different networking commands for checking network connections.

Aim: The aim of this experiment is to understand and learn the various networking commands that can be used to check network connections.

Requirements:

- Computer running a network operating system such as Windows or Linux
- Access to the command prompt or terminal
- Basic knowledge of networking concepts and terminology

Procedure:

1. Open the command prompt or terminal on the computer.
2.The IPCONFIG network command provides a comprehensive view of information regarding the IP address configuration of the device we are currently working on.

```
Trace complete.
PS C:\Users\stargaly galaxie> ipconfig

Windows IP Configuration


Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::4b7f:1dc:4ed6:8579%41
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Local Area Connection* 3:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 4:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::49c5:7b01:143a:1deb%10
   IPv4 Address. . . . . . . . . . . : 192.168.137.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::d371:b874:dd37:8494%20
   IPv4 Address. . . . . . . . . . . : 100.110.70.112
   Subnet Mask . . . . . . . . . . . : 255.255.128.0
   Default Gateway . . . . . . . . . : 100.110.0.1

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter vEthernet (WSLCore):

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::32ef:7637:c2e5:387a%50
   IPv4 Address. . . . . . . . . . . : 172.21.112.1
   Subnet Mask . . . . . . . . . . . : 255.255.240.0
   Default Gateway . . . . . . . . . :
```

3.The NSLOOKUP command is used to troubleshoot network connectivity issues in the system. Using the nslookup command, we can access the information related to our system's DNS server, i.e., domain name and IP address

```
PS C:\Users\stargaly galaxie> nslookup
Default Server:  jio-cachedns.jio.com
Address:  49.45.0.5
```

4.The HOSTNAME command displays the hostname of the system. The hostname command is much easier to use than going into the system settings to search for it

```
PS C:\Users\stargaly galaxie> hostname
stargaly
```

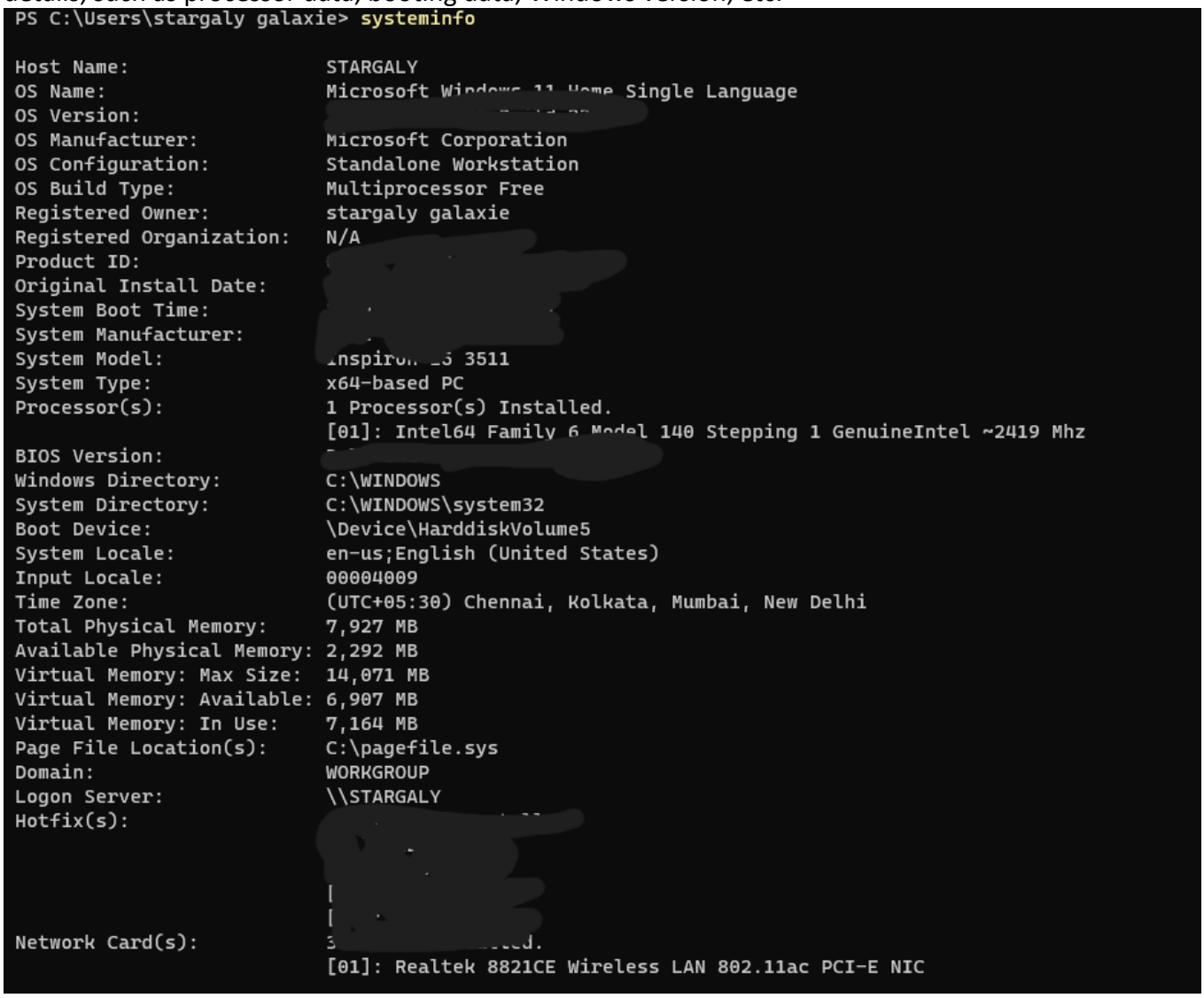
5.The Ping command is one of the most widely used commands in the prompt tool, as it allows the user to check the connectivity of our system to another host.

```
PS C:\Users\stargaly galaxie> ping www.bing.com

Pinging dual-a-0001.dc-msedge.net [131.253.33.200] with 32 bytes of data:
Reply from 131.253.33.200: bytes=32 time=125ms TTL=107
Reply from 131.253.33.200: bytes=32 time=129ms TTL=107
Reply from 131.253.33.200: bytes=32 time=118ms TTL=107
Reply from 131.253.33.200: bytes=32 time=118ms TTL=107

Ping statistics for 131.253.33.200:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 118ms, Maximum = 129ms, Average = 122ms
```

6.The TRACERT command is used to trace the route during the transmission of the data packet over to the destination host and also provides us with the “hop” count during transmission.

```
PS C:\Users\stargaly galaxie> tracert www.google.com

Tracing route to www.google.com [142.250.192.68]
over a maximum of 30 hops:

  1     2 ms     1 ms     1 ms  192.168.1.1 [192.168.1.1]
  2    16 ms    16 ms    16 ms  abts-north-dynamic-255.31.235.223.airtelbroadband.in [223.235.31.255]
  3    16 ms    29 ms    16 ms  nsg-corporate-85.239.185.122.airtel.in [122.185.239.85]
  4    51 ms    56 ms    55 ms  182.79.134.4
  5    54 ms    54 ms    55 ms  72.14.213.254
  6   121 ms    51 ms    51 ms  216.239.57.17
  7    51 ms    51 ms    51 ms  142.250.61.203
  8    57 ms    55 ms    55 ms  bom12s16-in-f4.1e100.net [142.250.192.68]

Trace complete.
```

7.Using the SYSTEMINFO command, we can access the system's hardware and software details, such as processor data, booting data, Windows version, etc.



```
PS C:\Users\stargaly galaxie> systeminfo

Host Name:                 STARGALY
OS Name:                   Microsoft Windows 11 Home Single Language
OS Version:
OS Manufacturer:           Microsoft Corporation
OS Configuration:          Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:          stargaly galaxie
Registered Organization:   N/A
Product ID:
Original Install Date:
System Boot Time:
System Manufacturer:
System Model:              Inspiron 15 3511
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 140 Stepping 1 GenuineIntel ~2419 Mhz
BIOS Version:
Windows Directory:         C:\WINDOWS
System Directory:          C:\WINDOWS\system32
Boot Device:               \Device\HarddiskVolume5
System Locale:             en-us;English (United States)
Input Locale:              00004009
Time Zone:                 (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Total Physical Memory:     7,927 MB
Available Physical Memory: 2,292 MB
Virtual Memory: Max Size:  14,071 MB
Virtual Memory: Available: 6,907 MB
Virtual Memory: In Use:    7,164 MB
Page File Location(s):     C:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:              \\STARGALY
Hotfix(s):
                           [
                           [
Network Card(s):           [01]: Realtek 8821CE Wireless LAN 802.11ac PCI-E NIC
```

Theory:

The ping command sends a packet to a specified IP address and waits for a response. If the response is received, it indicates that there is connectivity between the two devices. The tracert command is used to determine the path that a packet takes from the local computer to a remote destination. It sends packets with increasing Time-to-Live (TTL) values, and each router along the path decrements the TTL value by one. The ipconfig command is used to view information about the computer's IP configuration, including IP address, subnet mask, and default gateway. The ns lookup command is used to query DNS servers for information about domain names and IP addresses. The netstat command is used to view information about active network connections and their status, including local and remote addresses, protocols, and state.

Result:

After performing the above commands, the user should have a better understanding of network connectivity and troubleshooting. The output of each command provides useful information that can be used to diagnose and resolve network issues

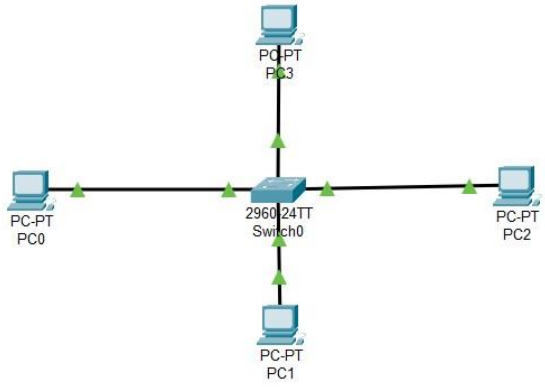
2. Performing a Switch Based Network Establishment in Packet Tracer.

Aim: The aim of this experiment is to understand how to establish a network using switches in Packet Tracer

Requirements: - Cisco Packet Tracer software -
4 PCs
1 switch
LAN cable

Procedure:

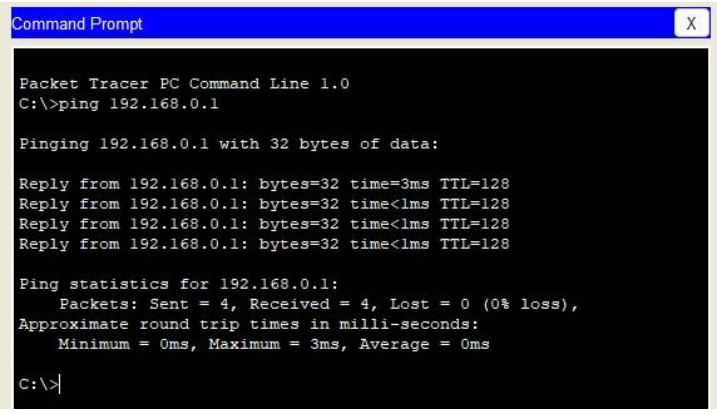
1. Open Cisco Packet Tracer software
2. Drag and drop 4 PCs from the End Devices list to the workspace
3. Drag and drop a switch from the Switches list to the workspace 4. Connect the switch to each PC using the Cat-5 LAN cable 5. Power on all the devices.



6. Configure IP addresses for each PC using the following details:

PC	IPv4 Address	Subnet Mask
PC0	192.168.0.1	255.255.255.0
PC1	192.168.0.2	255.255.255.0
PC2	192.168.0.3	255.255.255.0
PC3	192.168.0.4	255.255.255.0

7. Test the network by pinging each PC from every other PC using the following command:
ping 192.168.0.1
8. Verify that all pings are successful and there are no network connectivity issues.



Theory: A switch is a networking device that connects devices together on a Local Area Network (LAN). It receives incoming data packets and forwards them to their intended destination device based on the device's MAC address. Switches are used to create multiple broadcast domains in a network, thus reducing network congestion and improving overall network performance. In a switch-based network, each device is connected to a switch port, and the switch is responsible for forwarding data packets between the devices. Switches use MAC address tables to keep track of which device is connected to which port. When a packet arrives at a switch, the switch looks up the destination MAC address in its table and forwards the packet to the appropriate port.

Result: In this experiment, we successfully established a switch-based network using Packet Tracer. We connected four PCs to a switch, configured their IP addresses, and tested the network connectivity by pinging each PC from every other PC. All pings were successful, and there were no network connectivity issues. This experiment helped us to understand the basic concepts of switch-based networking and how to establish a network using switches in Packet Tracer.

3.To construct a bus topology in cisco packet tracer.

Aim: The aim of this experiment was to construct a bus topology using Packet Tracer. The bus topology is an essential and straightforward topology used in computer networking, which provides a central cable where all devices or nodes are connected.

Apparatus(Components) : 1. Laptop/PC
2. Cisco Packet Tracer

Procedure:

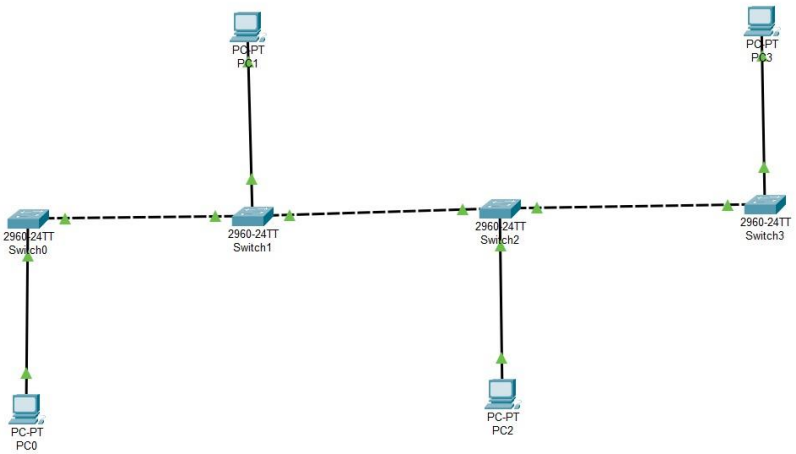
STEP 1: Open the Cisco Packet Tracer.
STEP 2: Select devices PCs, Switch(2960-24TT).

STEP 3: Assign the IPv4 Address and Subnet Mask on the PCs devices

PC	IPv4 Address	Subnet Mask
PC0	192.168.0.1	255.255.255.0
PC1	192.168.0.2	255.255.255.0
PC2	192.168.0.3	255.255.255.0
PC3	192.168.0.4	255.255.255.0

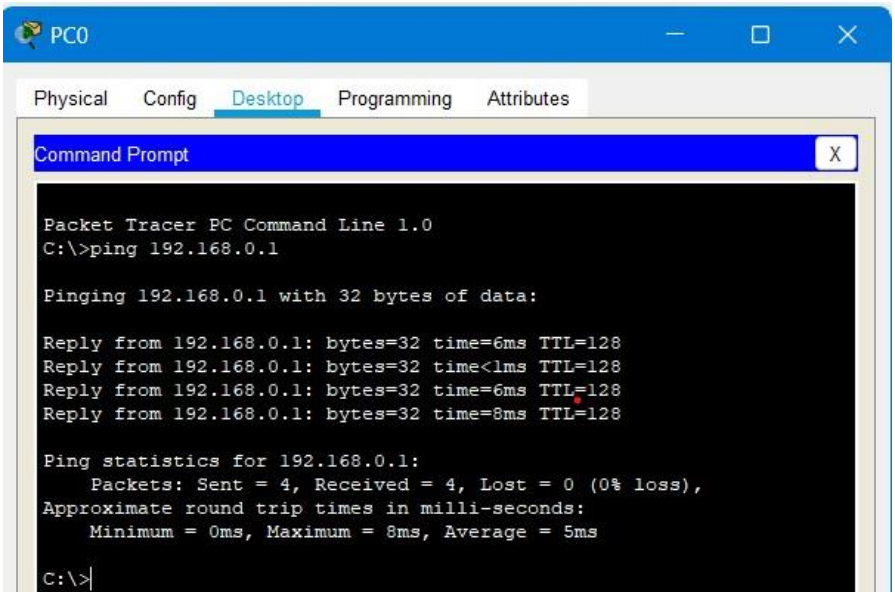
SETP 4: Then, Use copper cross - over cable to connect switch0 to switch1, switch1 to switch2 and vice versa.

And use copper straight - through cable to connect switch0 to PC0, switch1 to PC1 and vice versa.

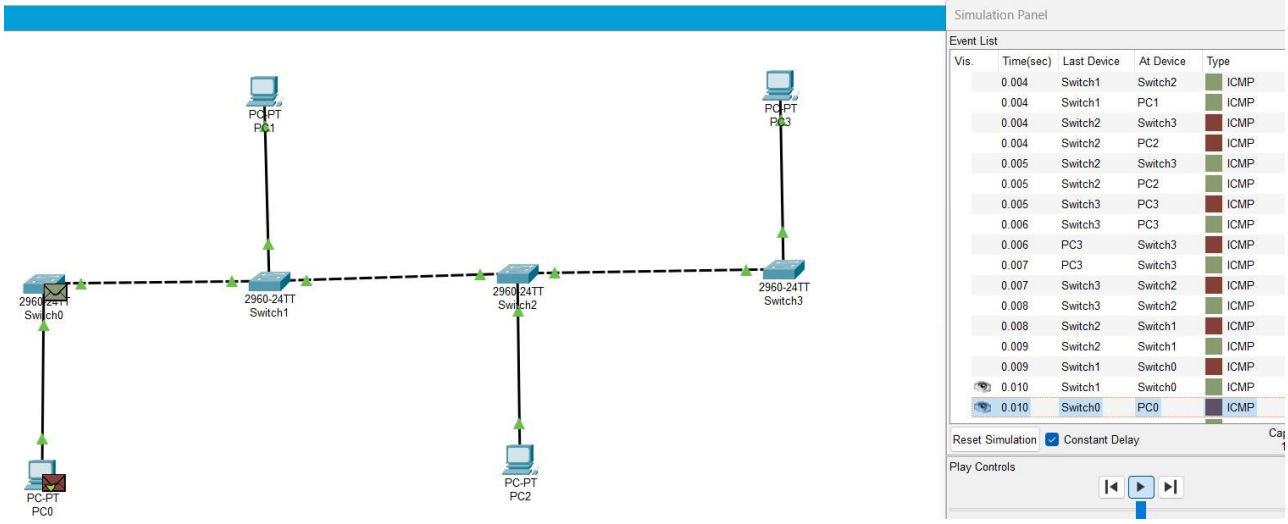


SETP 5: Verify the connection by pinging the IO address of any host

- Use the ping command to verify the connection.
- We getting replies(Lost =0).
- Hence the connection is verified.



Simulation : Select ADD SIMPLE PDU (P), Then Choose source To Destination Point.



4. Constructing a Ring Topology in Packet Tracer

Aim: The aim of this experiment is to construct a ring topology in Packet Tracer. The primary objective is to understand the different techniques associated with the creation of a ring topology and the networking features required to implement it.

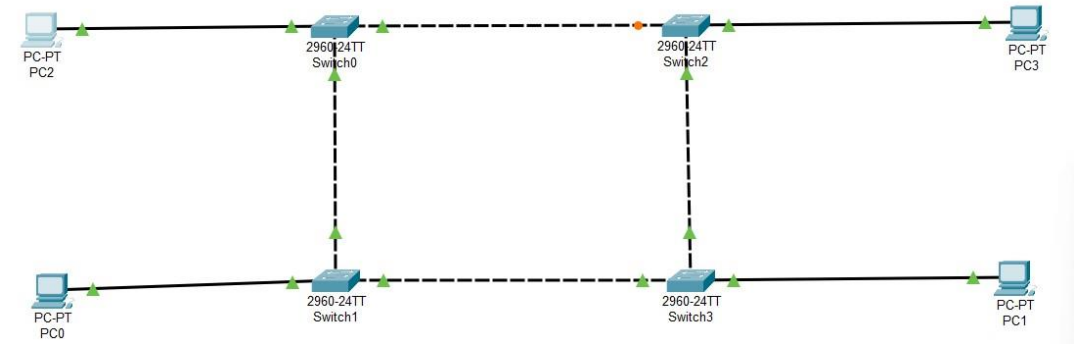
Requirements: To conduct this experiment, we require the following items:

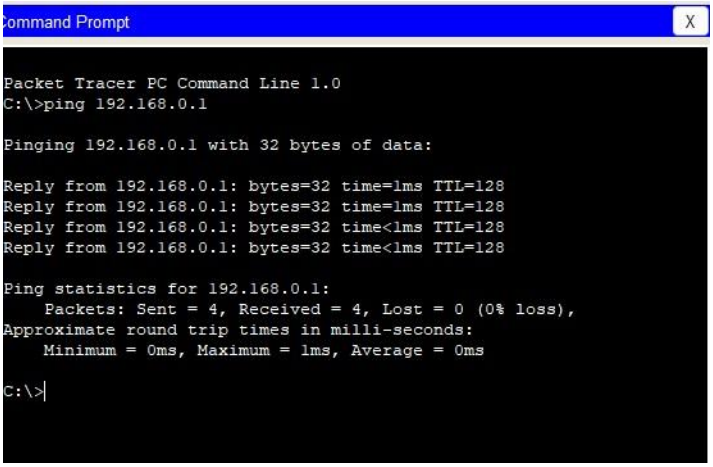
1. Cisco Packet Tracer software
2. Six computers or devices
3. Six Ethernet cables
4. One switch

Procedure: To create a ring topology, follow the below steps:

1. Open Packet Tracer software and drag and drop six computers/devices, one switch, and Ethernet cables to the workspace.
2. Connect one Ethernet cable to each device/computer and connect the other end of each cable to the switch. Ensure that each system has an active connection with the switch.
3. After connecting all the devices and switches, select the connection tool from the toolbar and connect the first device to the second device.
4. After connecting the second device to the third one, continue to create a circle-like topology by connecting each device (in sequence) to the next one until the last device is connected to the first one, which will form the ring.

PC	IPv4 Address	Subnet Mask
PC0	192.168.0.1	255.255.255.0
PC1	192.168.0.2	255.255.255.0
PC2	192.168.0.3	255.255.255.0
PC3	192.168.0.4	255.255.255.0



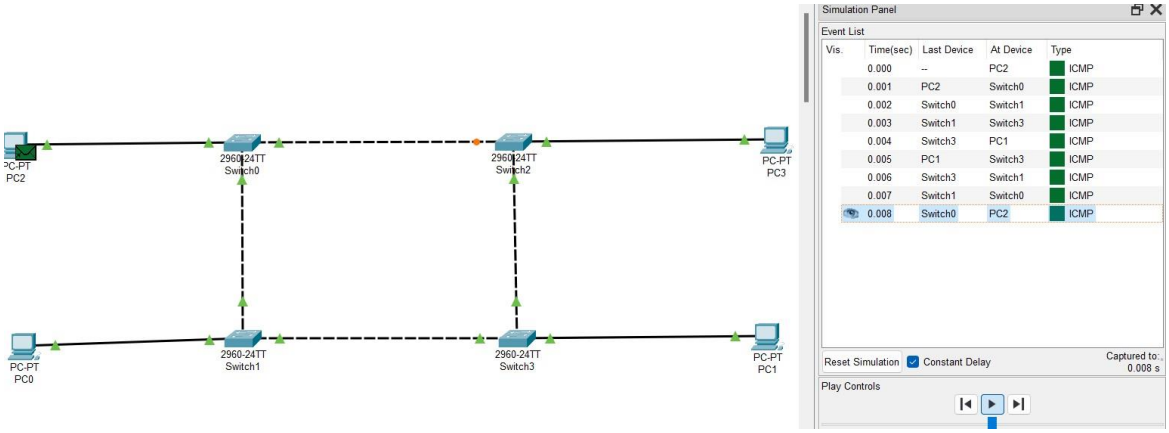


Theory: The ring topology is a networking configuration where each device in the network is connected to its neighbouring devices. The topology configuration allows data to travel in

a circular path around the ring passing through every device until it reaches the targeted device, and each device deactivates the message once it receives it.

In a ring topology, if a device receives a message not intended for it, the message circulates around the ring network until it reaches the intended device. As a result, each device acts as a repeater and regenerates the signal as necessary to ensure reliable data transfer.

Simulation :



Result: Upon completing the above steps, we have successfully created the ring topology by connecting each device in a circular fashion. Each device now acts as a repeater, and data can be transferred from one device to another in a circular fashion until it reaches the destination device. If any device within the ring topology fails, the data packet automatically reroutes to other available paths, enabling uninterrupted data transfer.

5. Constructing a Star Topology in Packet Tracer.

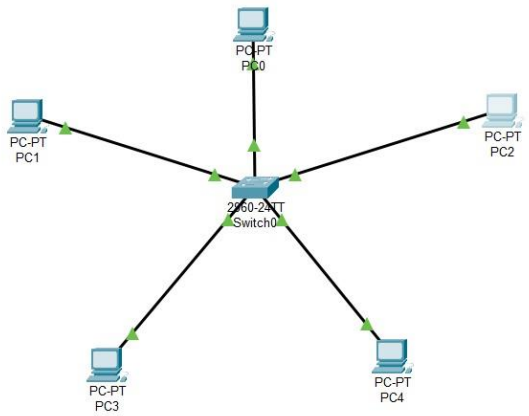
Aim:

A Star topology is a type of network topology in which all devices are connected to a central hub or switch. In this experiment, we will be using Packet Tracer to construct a Star topology using five PCs and an 8-port switch.

Requirements: - Windows PC - CISCO Packet Tracer Software (Student Version) - 5 PCs - 8-port switch - Cat-5 LAN cable

Procedure: 1. Open CISCO Packet Tracer software on your Windows PC.
2. Click on the "End Devices" icon located on the left corner of the Packet Tracer window.

3. Drag and drop five PCs from the "End Devices" icon list onto the Packet Tracer workspace.
4. Click on the "Switches" icon located on the bottom left corner of the Packet Tracer window.
5. Drag and drop an 8-port switch from the "Switches" icon list onto the Packet Tracer workspace.
6. Connect all five PCs to the switch using Straight-through Ethernet cables. To do this, click on the "Straight-through copper" cable icon located on the left side of the Packet Tracer window, and then click on the first PC and the switch port to which it will be connected. Repeat this process for the remaining four PCs.



7. Verify that all devices are connected to the switch by selecting each device and checking its "Physical" tab. 8. Assign IP addresses to the five PCs. To do this, click on each PC, then click on the "Config" tab, and then click on the "FastEthernet" interface. In the "IP Configuration" section, select "Static" and enter the following IP addresses:

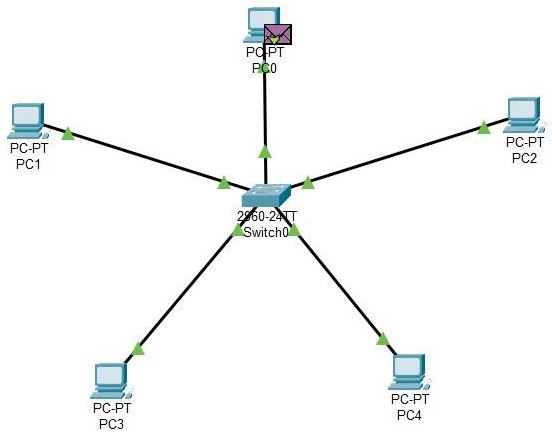
PC	IPv4 Address	Subnet Mask
PC0	192.168.0.1	255.255.255.0
PC1	192.168.0.2	255.255.255.0
PC2	192.168.0.3	255.255.255.0
PC3	192.168.0.4	255.255.255.0
PC4	198.168.0.5	255.255.255.0

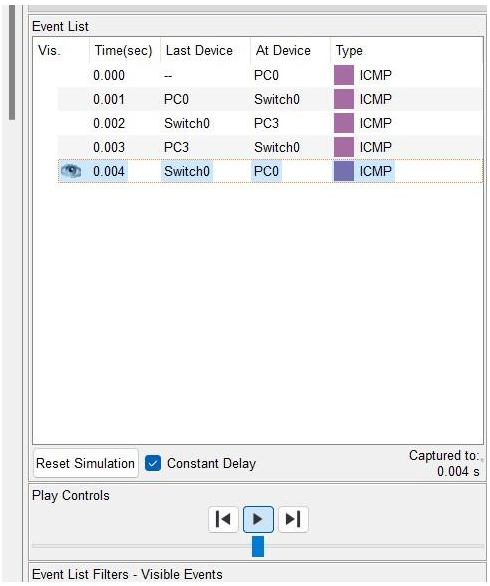
1. Test the network by pinging between the PCs. To do this, open the Command Prompt on any PC, and enter the following command: ping [IP address of the target PC] For

example, to ping PC2 from PC1, enter "ping 192.168.1.2". Repeat this process to test connectivity between all PCs.

```
C:\>ping 192.168.0.5

Pinging 192.168.0.5 with 32 bytes of data:

Reply from 192.168.0.5: bytes=32 time=1ms TTL=128
Reply from 192.168.0.5: bytes=32 time=3ms TTL=128
Reply from 192.168.0.5: bytes=32 time<1ms TTL=128
Reply from 192.168.0.5: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 3ms, Average = 1ms

C:\>ipconfig

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Link-local IPv6 Address.....: FE80::201:42FF:FE16:AD63
   IPv6 Address.....: ::
   IPv4 Address.....: 192.168.0.1
   Subnet Mask.....: 255.255.255.0
   Default Gateway.....: ::
                                 0.0.0.0

Bluetooth Connection:

   Connection-specific DNS Suffix..:
   Link-local IPv6 Address.....: ::
   IPv6 Address.....: ::
   IPv4 Address.....: 0.0.0.0
   Subnet Mask.....: 0.0.0.0
   Default Gateway.....: ::
                                 0.0.0.0

C:\>
```

Simulation :





Result:

In this experiment, we successfully constructed a Star Topology using Cisco Packet Tracer software. We were able to connect 5 PCs to an 8-port switch using the star topology. We assigned IP addresses to each PC and tested the connectivity by pinging between them. The

ping results showed that all devices were able to communicate with each other, thus verifying the successful establishment of a star topology network.

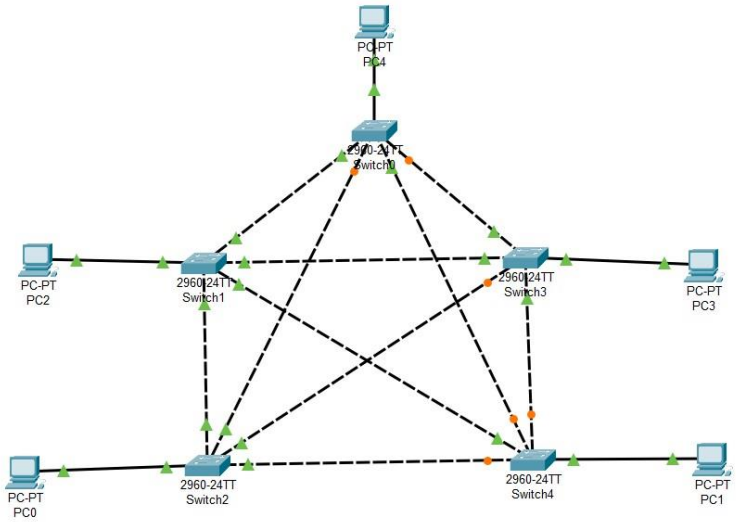
6. Constructing a Mesh Topology in Packet Tracer

Aim: The aim of this experiment is to construct a mesh topology using Packet Tracer software and to observe how the network devices communicate with each other in this topology.

Requirements: - Windows PC - Cisco Packet Tracer software (student version) - 5 PCs - 5 switches - Cat-5 LAN cable

Procedure:

1. Open the Packet Tracer software and select the empty topology option.
2. Drag and drop 5 PCs from the End Devices section and 5 switches from the Switches section.
3. Connect each PC to every switch using a straight-through Ethernet cable.
4. Repeat the process for all the remaining PCs.
5. Now we have a mesh topology, where each PC is connected to every other PC via a switch.

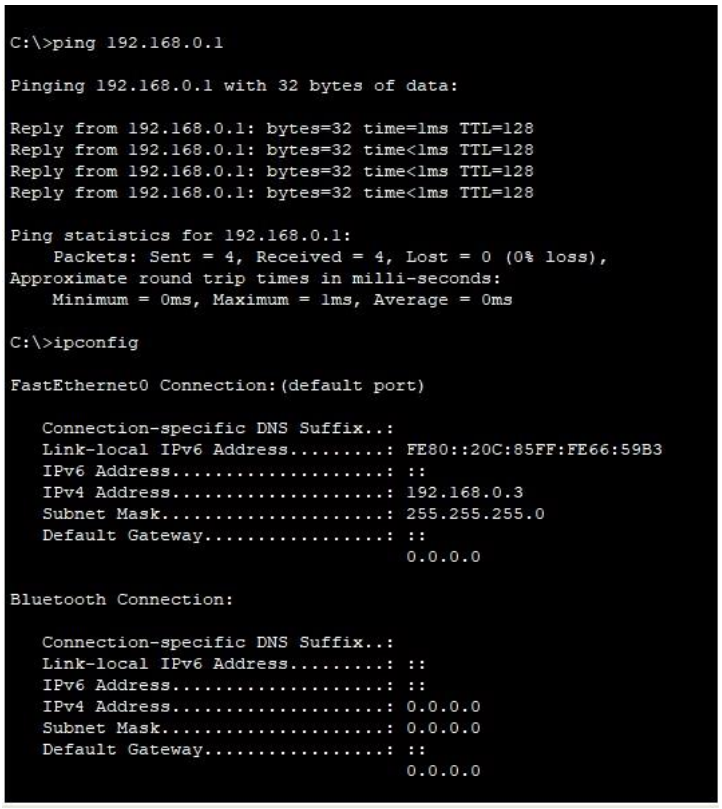


6. Assign IP addresses to each PC. For example, assign the IP addresses 192.168.1.1, 192.168.1.2, 192.168.1.3, 192.168.1.4 and 192.168.1.5 to the respective PCs.

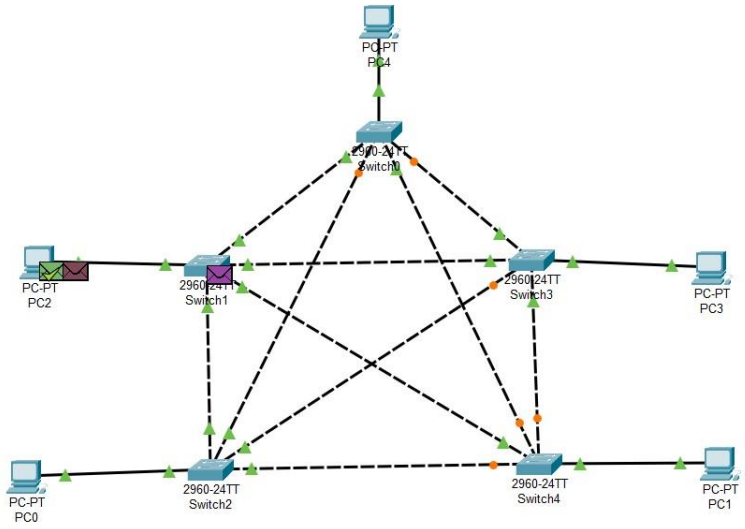
PC	IPv4 Address	Subnet Mask
PC0	192.168.0.1	255.255.255.0

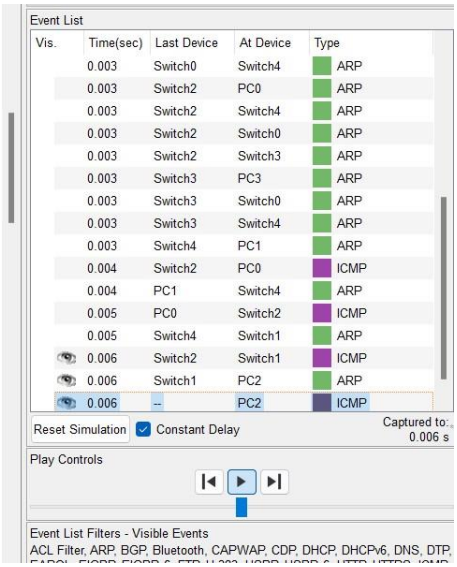
PC1	**192.168.0.2**	**255.255.255.0**
PC2	**192.168.0.3**	**255.255.255.0**
PC3	**192.168.0.4**	**255.255.255.0**
PC4	**198.168.0.5**	**255.255.255.0**

7. Check the connectivity between the PCs using the ping command.



Simulation :





Result:

After following the above procedure, we were able to successfully create a mesh topology using Packet Tracer. We confirmed the connectivity between the PCs by using the ping command. The mesh topology provided a high level of redundancy and fault tolerance, as each device was connected to every other device via a switch. This type of topology is useful in situations where network downtime is unacceptable, such as in mission-critical applications like hospitals or data center.

7. Constructing a Hybrid Topology in Packet Tracer.

Aim: The aim of this experiment is to construct a Hybrid topology in Packet Tracer, which is a combination of two or more different types of topologies, such as Bus, Ring, Star, or Mesh, to form a single network.

Apparatus(Components) : 1.Laptop/PC, 2. Cisco Packet Tracer

Procedure:

Step 1: First, open the cisco packet tracer desktop and select the devices given below:

S.NO	Device	Model name	Qty.
1.	PC0	PC0	8
2.	Switch	PT-Switch, 2960-24TT	8
3.	Router	2911	1

IP Addressing Table for PCs of LAN1 and LAN2: LAN1:

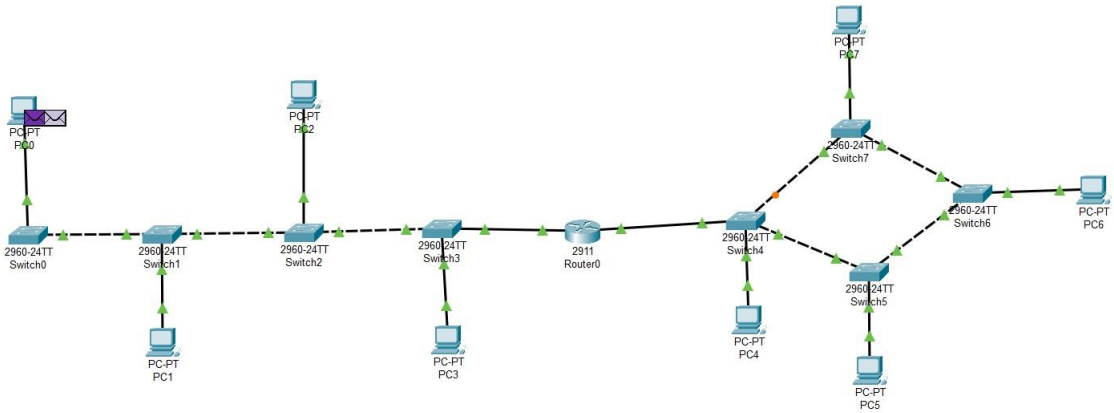
S.NO	Device	IPv4 Address	Subnet Mask	Default Gateway

1.	pc0	13.12.11.1	255.0.0.0	13.12.11.5
2.	pc1	13.12.11.2	255.0.0.0	13.12.11.5
3.	pc2	13.12.11.3	255.0.0.0	13.12.11.5
4.	pc3	13.12.11.4	255.0.0.0	13.12.11.5

LAN2:

S.NO	Device	IPv4 Address	Subnet Mask	Default Gateway
1.	pc4	192.168.1.1	255.255.255.0	192.168.1.5
2.	pc5	192.168.1.2	255.255.255.0	192.168.1.5
3.	pc6	192.168.1.3	255.255.255.0	192.168.1.5
4.	pc7	192.168.1.4	255.255.255.0	192.168.1.5

- Then, create two network topologies (Ring and Bus)as shown below the image.
- Use an Automatic connecting cable to connect the devices with others.



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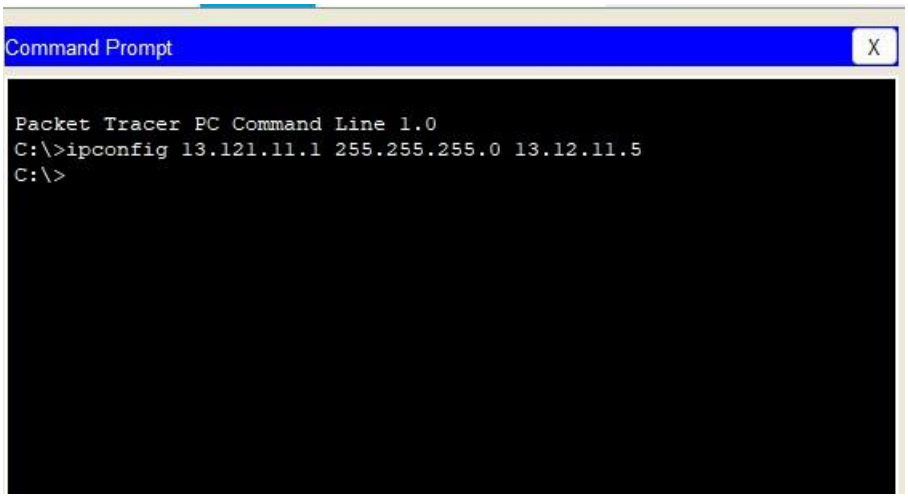
Step 2: Configure the PCs (hosts) with IPv4 address, Subnet Mask, and Default gateway according to the IP addressing table above.

- To assign an IP address in PC0, click on PC0.
- Then, go to desktop and IP configuration and there you will find IPv4 configuration.
- Fill IPv4 address, subnet mask, and default gateway to the particular input box.
- Repeat the same procedure with PCs of LAN2 to configure them.

Step 3. Assigning IP address using the ipconfig command.

- We can also assign an IP address with the help of a command.
- Go to the command terminal of the PC0.
- Then, type ipconfig <IPv4 address><subnet mask><default gateway>(if needed)

- 

Step 4: Configure router with IP address and subnet mask.
IP Addressing Table Router:

Device	Interface	IPv4 Address	Subnet Mask
Router0	FastEthernet0/0	13.12.11.5	255.0.0.0
	FastEthernet0/1	192.168.1.5	255.255.255.0

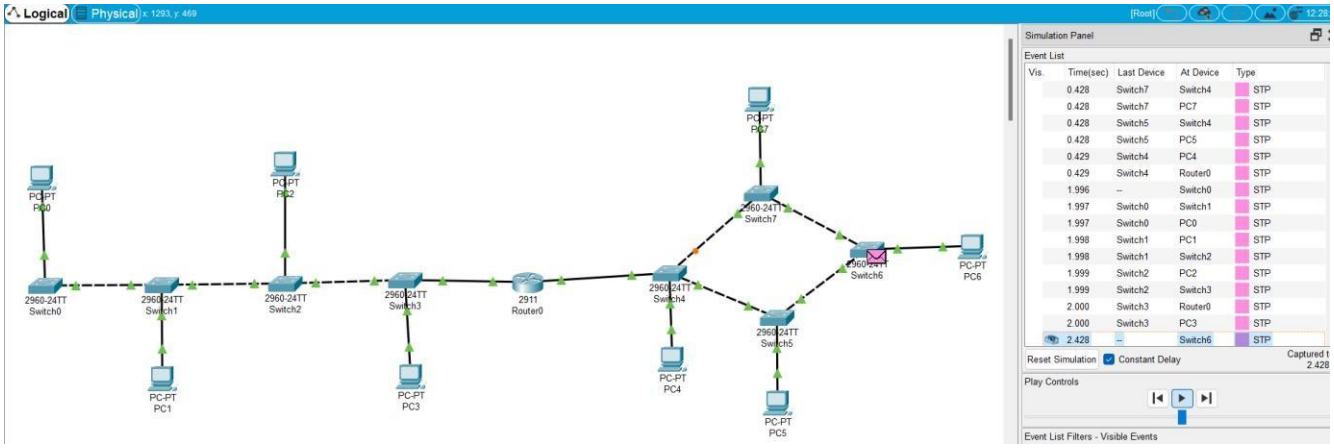
- To assign an IP address in router0, click on router0.
- Then, go to config and then Interfaces.
- Then, configure the IP address in Fast Ethernet and serial ports according to IP addressing Table.
- Fill IPv4 address and subnet mask.

Step 5: Verifying the network by pinging the IP address of any PC. We will use the ping command to do so.

- First, click on PC0 then Go to the command prompt
- Then type ping <IP address of targeted node>
- As we can see in the below image we are getting replies which means the connection is working properly.

Simulation :

A simulation of the experiment is given below we are sending PDU from PC0 to PC5.


Logical
Physical
Simulation Panel
Event List
Vis.
Time(sec)
Last Device
At Device
Type
0.428 Switch7 Switch4 STP
0.428 Switch7 PC7 STP
0.428 Switch5 Switch4 STP
0.428 Switch5 PC5 STP
0.429 Switch4 PC4 STP
0.429 Switch4 Router0 STP
1.996 -- Switch0 STP
1.997 Switch0 Switch1 STP
1.997 Switch0 PC0 STP
1.998 Switch1 PC1 STP
1.998 Switch1 Switch2 STP
1.999 Switch2 PC2 STP
1.999 Switch2 Switch3 STP
2.000 Switch3 Router0 STP
2.000 Switch3 PC3 STP
2.428 -- Switch6 STP
Reset Simulation
Constant Delay
Play Controls
Event List Filters - Visible Events
PC-PT PC0
PC-PT PC2
PC-PT PC7
PC-PT PC6
2960-24TT Switch0
2960-24TT Switch1
2960-24TT Switch2
2960-24TT Switch3
2911 Router0
2960-24TT Switch4
2960-24TT Switch7
2960-24TT Switch6
2960-24TT Switch5
PC-PT PC1
PC-PT PC3
PC-PT PC4
PC-PT PC5