

Practical No 1

Aim: Using, linux-terminal or Windows-cmd, execute following networking commands and note the output: ping, traceroute, netstat, arp, ipconfig, Getmac, hostname, NSLookUp, pathping, SystemInfo

Theory:

- 1) **ping:** ping is a computer network administration software utility used to test the reachability of a host on an Internet Protocol network. It is available for virtually all operating systems that have networking capability, including most embedded network administration software
- 2) **traceroute:** The traceroute command (tracert) is a utility designed for displaying the time it takes for a packet of information to travel between a host system and the final destination system. This command returns a list of the hops that the data packets take along their path along their way to the destination
- 3) **netstat:** The netstat provides statistics about all active connections so you that we can find out which computers or networks a PC is connected to
Some of the netstat commands commonly used are
 - i) **netstat -in** command
This netstat function shows the state of all configured interfaces.
 - ii) **netstat -a** command
The netstat -a command shows the state of all sockets.
 - iii) **netstat -s**
The netstat -s command shows statistics for each protocol (while the netstat -p command shows the statistics for the specified protocol).
 - iv) **netstat -r**
Another option relevant to performance is the display of the discovered Path Maximum Transmission Unit (PMTU).
- 4) **arp:** The ARP (Address Resolution Protocol) commands are used to view, display, or modify the details/information in an ARP table/cache.
Some of the common arp commands are as follows
 - i) **arp -a:** This command is used to display the ARP table for a particular IP address. It also shows all the entries of the ARP cache or table.
 - ii) **arp -g:** Same as the arp -a command.

- iii) `arp -d`: This command is used to delete an entry from the ARP table for a particular interface. To delete an entry, write `arp -d` command along with the IP address in a command prompt to be deleted.
 - iv) `arp -s`: This command is used to add the static entry in the ARP table, which resolves the InetAddr (IP address) to the EtherAddr (physical address). To add a static entry in an ARP table, we write `arp -s` command along with the IP address and MAC address of the device in a command prompt.
- 5) `ipconfig`: `ipconfig` (Internet Protocol CONFIGuration) is used to display and manage the IP address assigned to the machine. In Windows, typing `ipconfig` without any parameters displays the computer's currently assigned IP, subnet mask and default gateway addresses.
 - 6) `getmac`: `Getmac` is a Windows command used to display the Media Access Control (MAC) addresses for each network adapter in the computer.
 - 7) `hostname`: A hostname is a label that is assigned to a device connected to a computer network and it is used to identify the device.
 - 8) `NSlookup`: Using this command we can find the corresponding IP address or domain name system record. The user can also enter a command for it to do a reverse DNS lookup and find the host name for an IP address that is specified.
 - 9) `Pathping`: This command sends multiple echo Request messages to each router between a source and destination, over a period of time, and then computes results based on the packets returned from each router. It can be used to find the routers or links having network problems.
 - 10) `SystemInfo`: This command is use ot display detailed configuration information about a computer and its operating system, including operating system configuration, security information, product ID, and hardware properties

Link for the video demonstration of the practical:

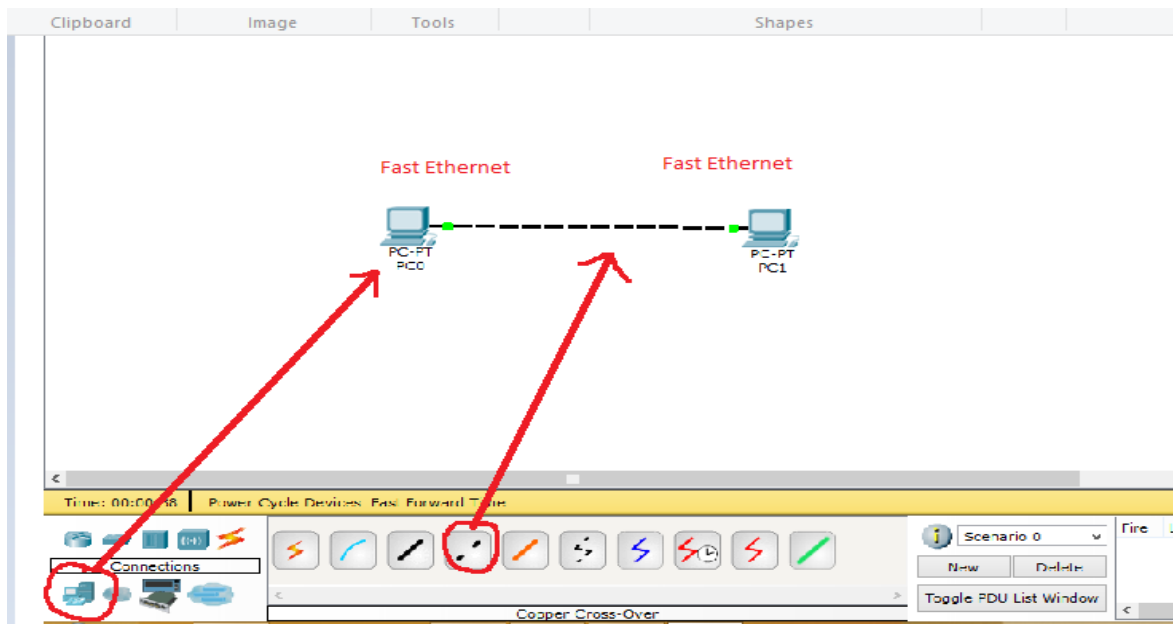
<https://youtu.be/CeMNBxW5LsM>

Practical No 2

Aim: Using Packet Tracer, create a basic network of two computers using appropriate network wire through Static IP address allocation and verify connectivity

Theory:

We use the following network to verify the connectivity using Cisco packet tracer



Now we set the ip address of the devices as follows

Host name	ip Address	Default Gateway
PC0	192.168.1.2	192.168.1.1
PC1	192.168.1.3	192.168.1.1

PC0

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.2

Subnet Mask 255.255.255.0

Default Gateway 192.168.1.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::202:16FF:FEA6:BA6D

Default Gateway

DNS Server

PC1

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.3

Subnet Mask 255.255.255.0

Default Gateway 192.168.1.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

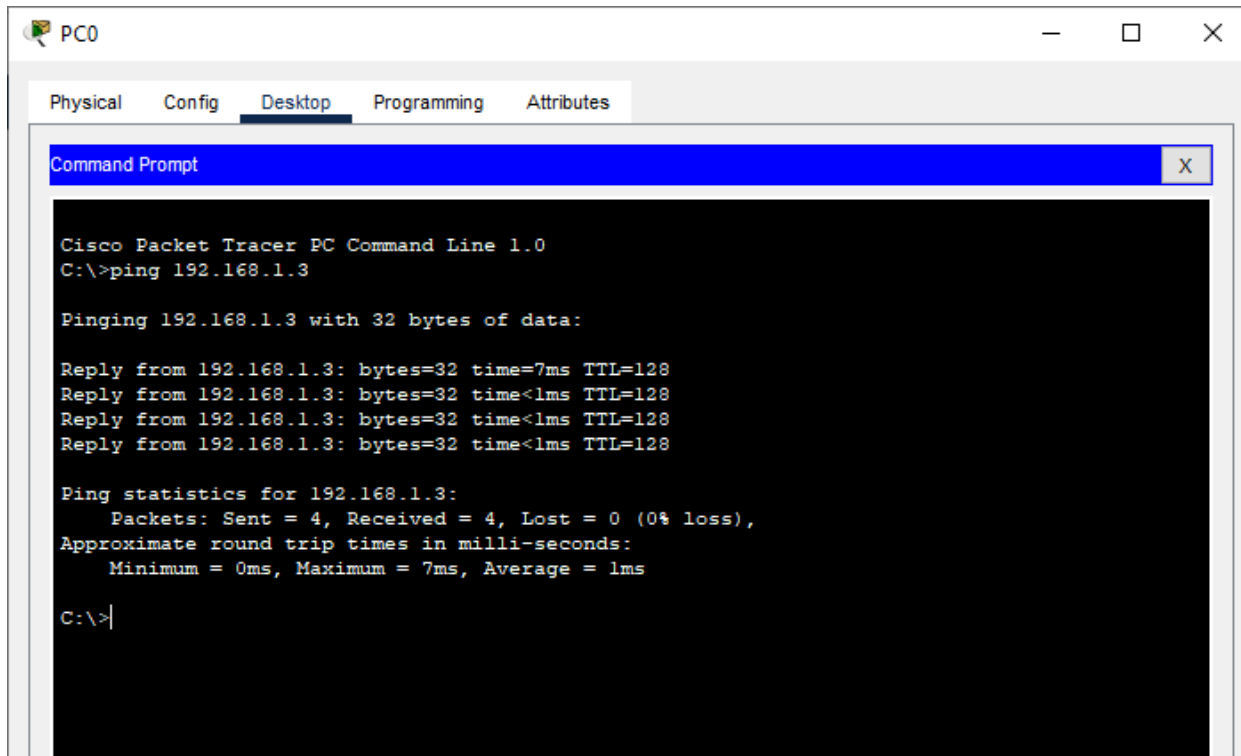
Link Local Address FE80::206:2AFF:FE01:EEDE

Default Gateway

DNS Server

802.1X

In order to check the connectivity we send a ping command from PC0 to PC1 as follows



The screenshot shows a Cisco Packet Tracer interface for PC0. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The command prompt shows the execution of the 'ping 192.168.1.3' command. The output indicates that four packets were sent and received successfully with 0% loss. The round trip times are: Minimum = 0ms, Maximum = 7ms, Average = 1ms.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=7ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 7ms, Average = 1ms

C:\>|
```

Result:

Hence the Connectivity between the PCs has been verified.

Link for the video demonstration of the practical:

<https://youtu.be/yYYqDgM1XqQ>

Practical No 3

Aim: Using Packet Tracer, create a basic network of one server and two computers using appropriate network wire. Use Dynamic IP address allocation and show connectivity

Theory:

For assigning ip addresses dynamically we use the DHCP protocol

Dynamic Host Configuration Protocol (DHCP) is a client/server protocol that automatically provides an Internet Protocol (IP) host with its IP address and other related configuration information such as the subnet mask and default gateway.

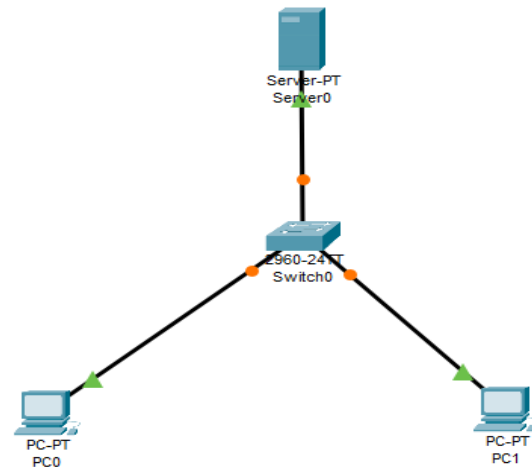
The DHCP server maintains a pool of IP addresses and leases an address to any DHCP-enabled client when it starts up on the network. Because the IP addresses are dynamic (leased) rather than static (permanently assigned), addresses no longer in use are automatically returned to the pool for reallocation.

DHCP provides the following benefits.

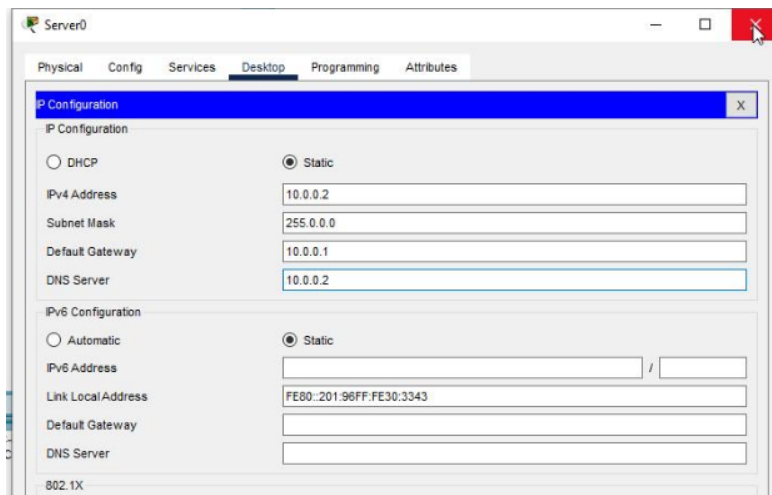
- 1) Reliable IP address configuration. DHCP minimizes configuration errors caused by manual IP address configuration, such as typographical errors, or address conflicts caused by the assignment of an IP address to more than one computer at the same time.
- 2) Reduced network administration. DHCP includes the following features to reduce network administration

DHCP runs at the application layer of the Transmission Control Protocol/IP (TCP/IP) stack to dynamically assign IP addresses to DHCP clients and to allocate TCP/IP configuration information to DHCP clients. This includes subnet mask information, default gateway IP addresses and domain name system (DNS) addresses.

We use the following topology for the present case



Configuring the Server:



Enabling and setting the DHCP Service on the Server:

The screenshot shows the 'Server0' configuration window with the 'Services' tab selected. The 'DHCP' service is enabled (Service: On). The configuration details are as follows:

Interface	Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Maximum Number of Users	TFTP Server	WLC Address
FastEthernet0	serverPool	10.0.0.1	10.0.0.2	10.0.0.3	255.0.0.0	512	0.0.0.0	0.0.0.0

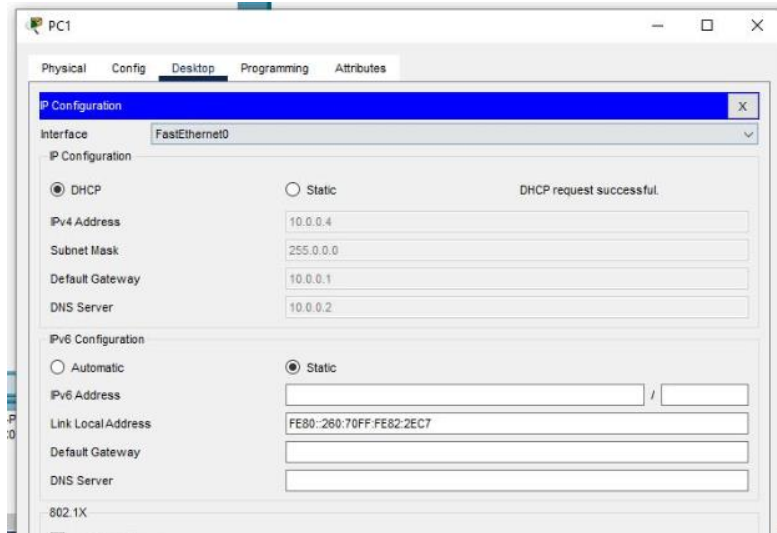
Buttons: Add, Save, Remove

Verifying the Dynamic Addressing on both the PCs:

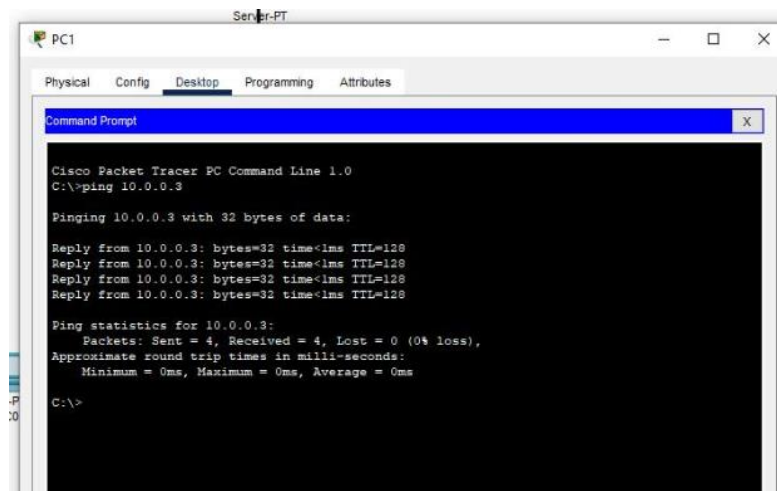
The screenshot shows the 'PC0' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing the following settings:

Interface	IP Configuration	IPv4 Address	Subnet Mask	Default Gateway	DNS Server
FastEthernet0	DHCP	10.0.0.3	255.0.0.0	10.0.0.1	10.0.0.2

IPv6 Configuration: Automatic (selected), Static (unselected). IPv6 Address: FE80::260:5CFF:FE65:CD24. Link Local Address: FE80::260:5CFF:FE65:CD24. Default Gateway: . DNS Server: .



Checking the connectivity:



Result:

Hence the Connectivity between the PCs has been verified.

Link for the video demonstration of the practical:

https://youtu.be/Jnj8c_15AiE

Practical No 4

Aim: Using Packet Tracer, create a basic network of one server and two computers and two mobile / movable devices using appropriate network wire. And verify the connectivity

Theory:

A Wireless Access Point (WAP) is a networking device that allows wireless-capable devices to connect to a wired network. Instead of using wires and cables to connect every computer or device in the network, installing WAPs is a more convenient, more secure, and cost-efficient alternative.

Setting up a wireless network provides a lot of advantages and benefits for you and your small business.

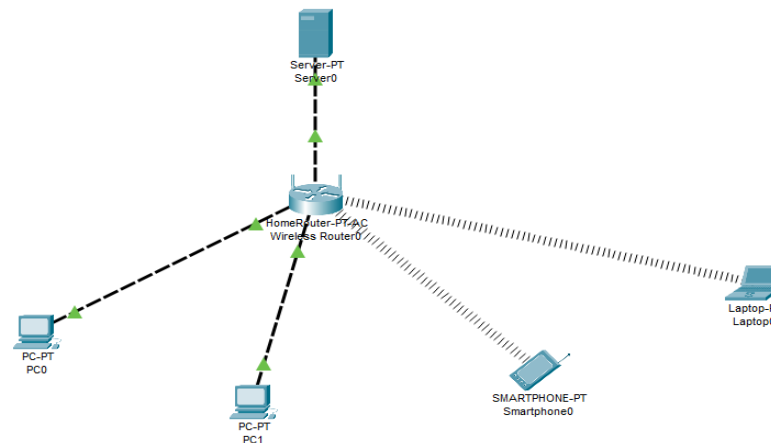
- 1) It is easier to set up compared to setting up a wired network.
- 2) It is more convenient to access.
- 3) It is less complicated to add new users in the network.
- 4) It gives users more flexibility to stay online even when moving from one area in the office to another.
- 5) Guest users can have Internet access by just using a password.
- 6) Wireless network protection can be set up even if the network is visible to the public by configuring maximum wireless security.
- 7) Segmentation of users, such as guests and employees, is possible by creating Virtual Local Area Networks (VLANs) to protect your network resources and assets.

There are different purposes of setting up a wireless network using a WAP.

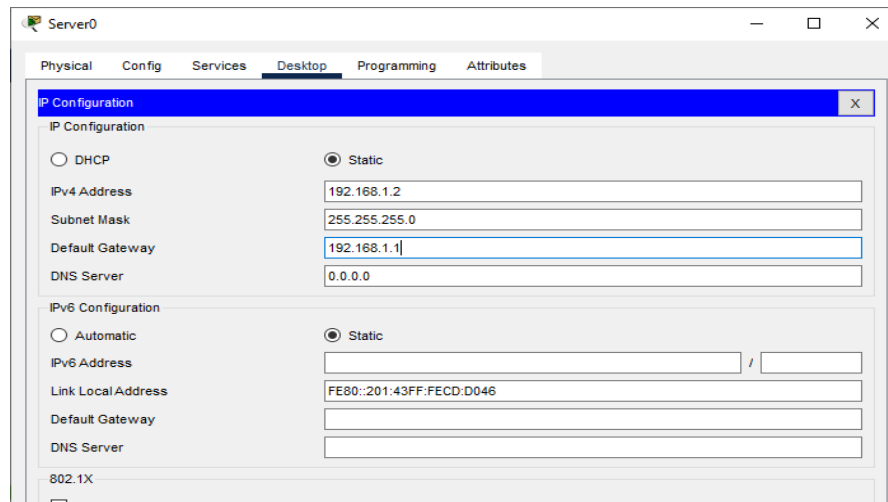
With a WAP, the following can be done:

- 1) Create a wireless network within your existing wired network.
- 2) Extend the signal range and strength of your wireless network to provide complete wireless coverage and get rid of dead spots especially in larger office spaces or buildings.
- 3) Accommodate wireless devices within a wired network.
- 4) Configure the settings of your wireless access points in one device.

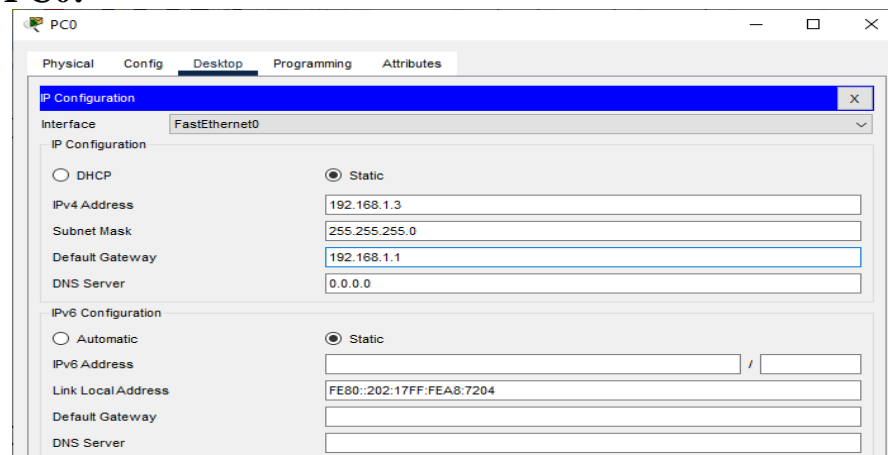
For the present case we use the following topology



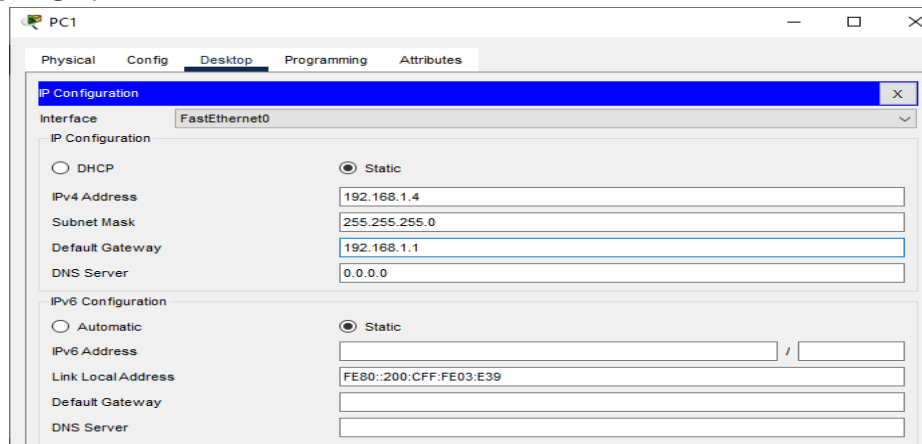
Configure the Server:



Configure PC0:



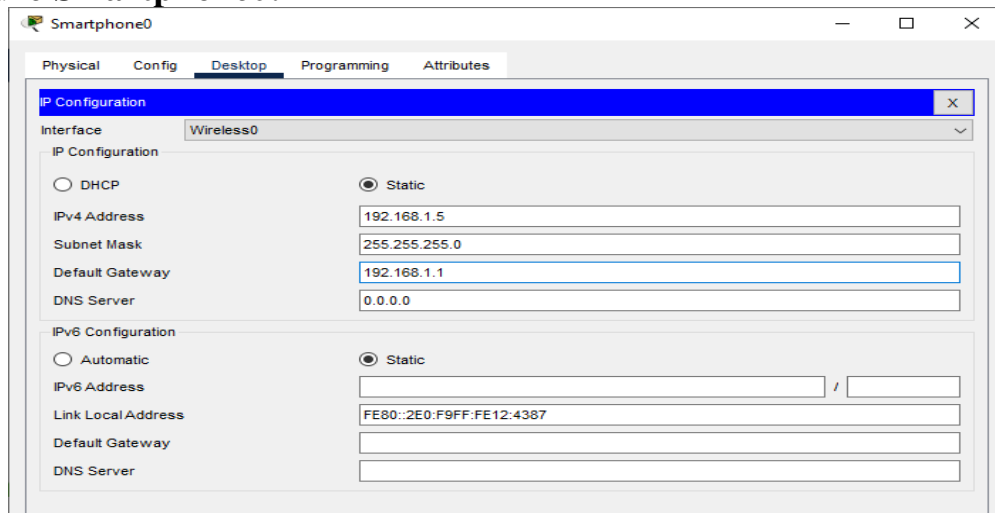
Configure PC1:



The screenshot shows the 'PC1' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'FastEthernet0' interface. The 'Static' radio button is selected under 'IP Configuration'. The fields are filled with the following values:

Field	Value
IPv4 Address	192.168.1.4
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::200:CFF:FE03:E39
Default Gateway	
DNS Server	

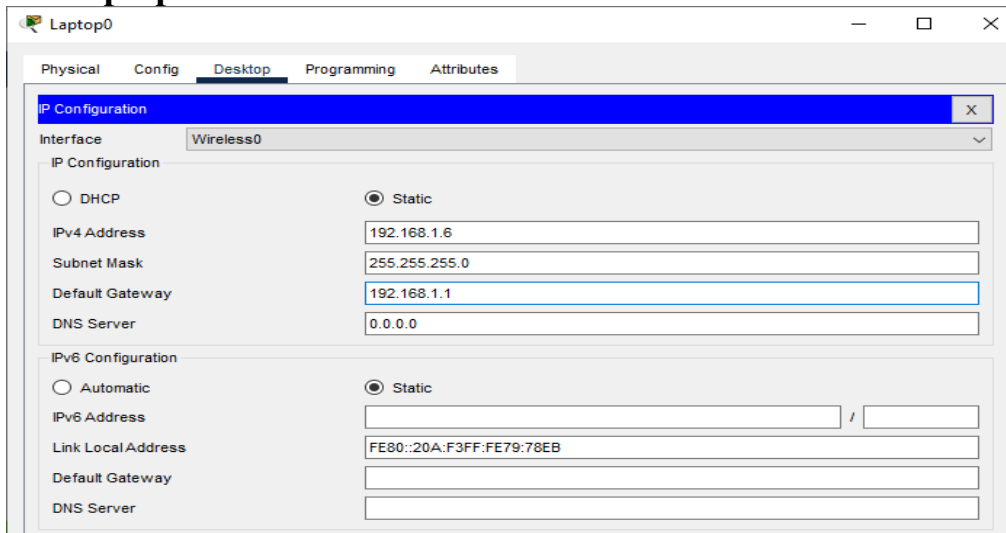
Configure Smartphone0:



The screenshot shows the 'Smartphone0' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'Wireless0' interface. The 'Static' radio button is selected under 'IP Configuration'. The fields are filled with the following values:

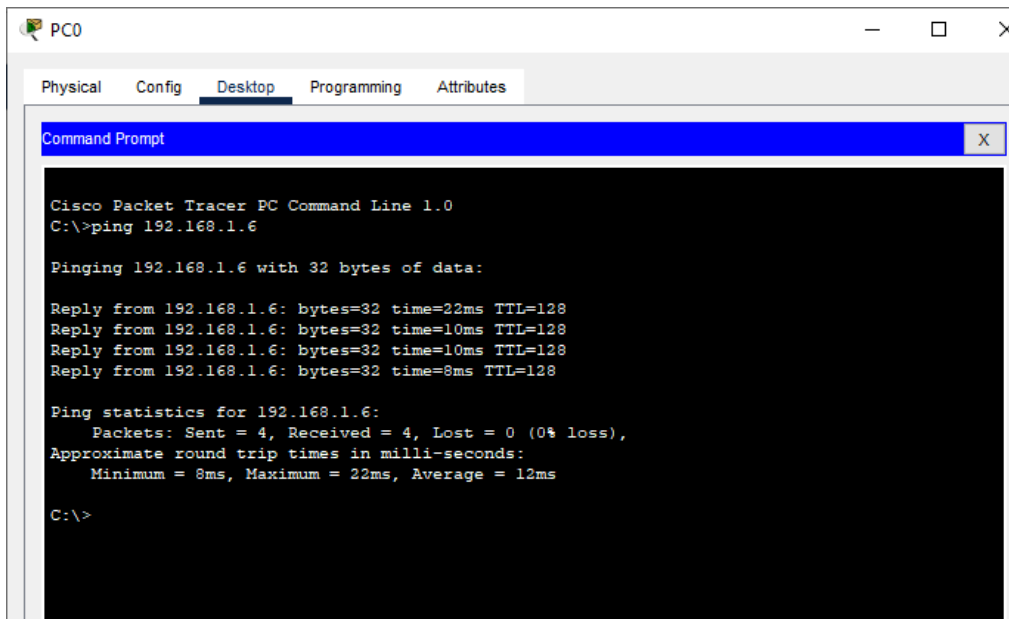
Field	Value
IPv4 Address	192.168.1.5
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::2E0:F9FF:FE12:4387
Default Gateway	
DNS Server	

Configure Laptop0:



The screenshot shows the 'Laptop0' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'Wireless0' interface. The 'Static' radio button is selected under 'IP Configuration'. The fields are filled with the following values:

Field	Value
IPv4 Address	192.168.1.6
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::20A:F3FF:FE79:78EB
Default Gateway	
DNS Server	

Checking the connectivity (pinging laptop0 from PC0):

The screenshot shows a Cisco Packet Tracer PC Command Line window for PC0. The window has tabs for Physical, Config, Desktop, Programming, and Attributes. The Desktop tab is active, displaying a Command Prompt. The Command Prompt shows the command 'ping 192.168.1.6' being executed. The output indicates that the ping was successful, with 4 packets sent, 4 received, and 0% loss. The round trip times are listed as Minimum = 8ms, Maximum = 22ms, and Average = 12ms.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.6

Pinging 192.168.1.6 with 32 bytes of data:

Reply from 192.168.1.6: bytes=32 time=22ms TTL=128
Reply from 192.168.1.6: bytes=32 time=10ms TTL=128
Reply from 192.168.1.6: bytes=32 time=10ms TTL=128
Reply from 192.168.1.6: bytes=32 time=8ms TTL=128

Ping statistics for 192.168.1.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 8ms, Maximum = 22ms, Average = 12ms

C:\>
```

Similarly the ping message can be checked for all the devices

Result:

Hence the Connectivity of the network has been verified.

Link for the video demonstration of the practical:

<https://youtu.be/zvBKvkY8-nA>

Practical No 5

Aim: Using Packet Tracer to create a network with three routers with RIPv1 and each router associated network will have minimum three PC and show the connectivity

Theory:

RIP is one of the dynamic routing protocols and the first distance-vector routing protocol that uses the hop count as a routing metric. A lower hop count is preferred.

Each router between the source and destination network is counted as one hop. RIP prevents routing loops by imposing a maximum number of hops on the path between source and destination.

In RIP, Every 30 seconds, each router broadcasts its entire routing table to its nearest neighbors.

Pros and Cons of RIP Protocol

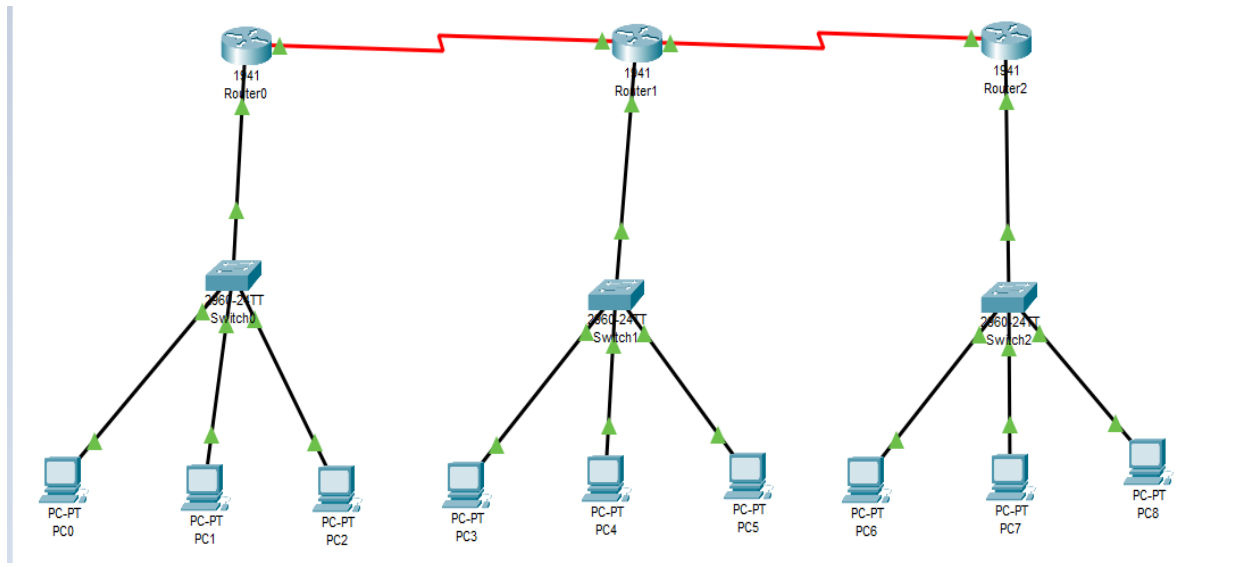
Pros:

1. The RIP protocol is ideal for small networks since it is simple to learn and configure.
2. RIP routing is guaranteed to work with nearly all routers.
3. When the network topology changes, RIP does not require an update.

Cons:

1. RIP does not support variable length subnet masks
2. RIP transmits updates every 30 seconds, which cause traffic and consumes bandwidth.
3. RIP hop counts are restricted to 15, hence any router beyond that distance is deemed infinity and becomes unreachable.
4. The rate of convergence is slow in RIP compared to other routing protocols. When a link fails, finding alternate network paths takes a long time.
5. RIP does not support multiple paths on the same route, which may result in extra routing loops.

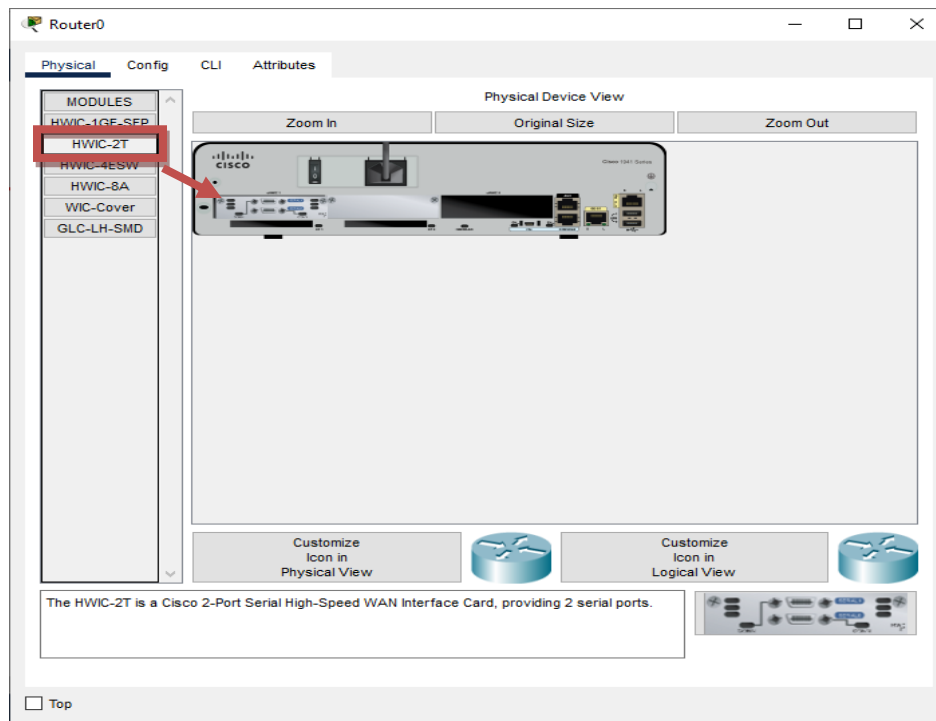
We use the following topology for the present case



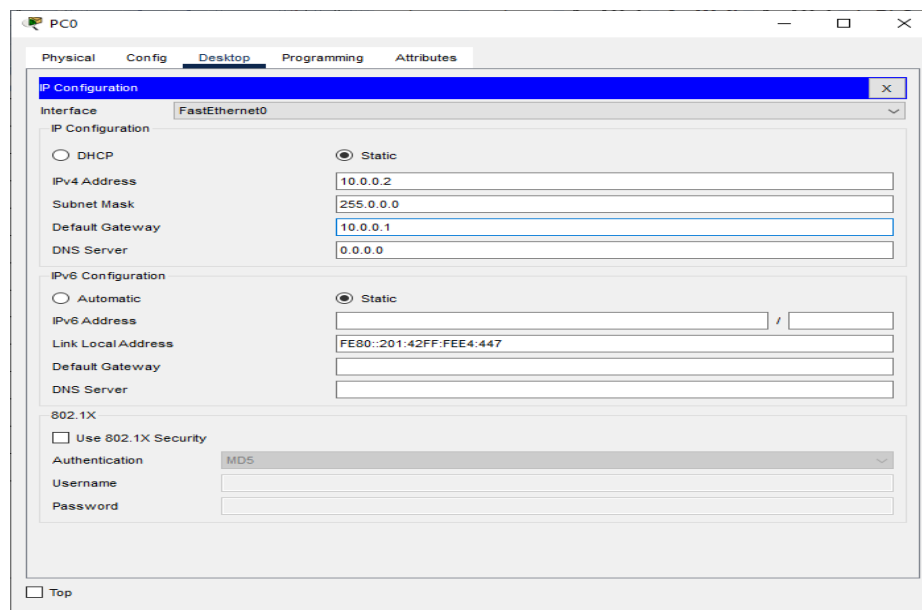
We configure the above network using the following IP addresses

Host	Interface	IP address	Network Address	Default Gateway
Router 0	G0/0	10.0.0.1	10.0.0.0	
	S0/1/0	192.168.0.1	192.168.0.0	
Router 1	G0/0	20.0.0.1	20.0.0.0	
	S0/1/0	192.168.0.2	192.168.0.0	
	S0/1/1	192.168.1.1	192.168.1.0	
Router 2	G0/0	30.0.0.1	30.0.0.0	
	S0/1/1	192.168.1.2	192.168.1.0	
PC0	FastEthernet0	10.0.0.2	10.0.0.0	10.0.0.1
PC1	FastEthernet0	10.0.0.3	10.0.0.0	10.0.0.1
PC2	FastEthernet0	10.0.0.4	10.0.0.0	10.0.0.1
PC3	FastEthernet0	20.0.0.2	20.0.0.0	20.0.0.1
PC4	FastEthernet0	20.0.0.3	20.0.0.0	20.0.0.1
PC5	FastEthernet0	20.0.0.4	20.0.0.0	20.0.0.1
PC6	FastEthernet0	30.0.0.2	30.0.0.0	30.0.0.1
PC7	FastEthernet0	30.0.0.3	30.0.0.0	30.0.0.1
PC8	FastEthernet0	30.0.0.4	30.0.0.0	30.0.0.1

Adding Serial Interface in each Router



Configuring PC0:



Configuring PC1:

The screenshot shows the 'PC1' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'FastEthernet0' interface. The 'Static' radio button is selected for both IPv4 and IPv6 configurations. The IPv4 configuration includes an IP Address of 10.0.0.3, Subnet Mask of 255.0.0.0, Default Gateway of 10.0.0.1, and DNS Server of 0.0.0.0. The IPv6 configuration includes a Static IPv6 Address, Link Local Address of FE80::205:5EFF:FE88:E00C, and a Default Gateway. The 802.1X section is also visible, with 'Use 802.1X Security' unchecked, Authentication set to MDS, and empty fields for Username and Password.

PC1

Physical Config Desktop Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 10.0.0.3

Subnet Mask: 255.0.0.0

Default Gateway: 10.0.0.1

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::205:5EFF:FE88:E00C

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MDS

Username:

Password:

☐ Top

Configuring PC2:

The screenshot shows the 'PC2' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'FastEthernet0' interface. The 'Static' radio button is selected for both IPv4 and IPv6 configurations. The IPv4 configuration includes an IP Address of 10.0.0.4, Subnet Mask of 255.0.0.0, Default Gateway of 10.0.0.1, and DNS Server of 0.0.0.0. The IPv6 configuration includes a Static IPv6 Address, Link Local Address of FE80::2D0:BAFF:FE8E:684C, and a Default Gateway. The 802.1X section is also visible, with 'Use 802.1X Security' unchecked, Authentication set to MDS, and empty fields for Username and Password. A warning message 'This address is already used in the network.' is displayed next to the IPv4 configuration.

PC2

Physical Config Desktop Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☐ DHCP ☒ Static This address is already used in the network.

IPv4 Address: 10.0.0.4

Subnet Mask: 255.0.0.0

Default Gateway: 10.0.0.1

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::2D0:BAFF:FE8E:684C

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MDS

Username:

Password:

☐ Top

Configuring PC3:

The screenshot shows the configuration window for PC3. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is 20.0.0.2, Subnet Mask is 255.0.0.0, Default Gateway is 20.0.0.1, and DNS Server is 0.0.0.0. Under 'IPv6 Configuration', the 'Static' radio button is chosen. The IPv6 Address is empty, Link Local Address is FE80::202:17FF:FE81:A06, Default Gateway is empty, and DNS Server is empty. Under '802.1X', 'Use 802.1X Security' is unchecked, Authentication is MD5, Username is empty, and Password is empty. A 'Top' button is at the bottom left.

IP Configuration	
Interface: FastEthernet0	
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	20.0.0.2
Subnet Mask	255.0.0.0
Default Gateway	20.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::202:17FF:FE81:A06
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

☐ Top

Configuring PC4:

The screenshot shows the configuration window for PC4. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is 20.0.0.3, Subnet Mask is 255.0.0.0, Default Gateway is 20.0.0.1, and DNS Server is 0.0.0.0. Under 'IPv6 Configuration', the 'Static' radio button is chosen. The IPv6 Address is empty, Link Local Address is FE80::20A:41FF:FE13:AB7E, Default Gateway is empty, and DNS Server is empty. Under '802.1X', 'Use 802.1X Security' is unchecked, Authentication is MD5, Username is empty, and Password is empty. A 'Top' button is at the bottom left.

IP Configuration	
Interface: FastEthernet0	
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	20.0.0.3
Subnet Mask	255.0.0.0
Default Gateway	20.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::20A:41FF:FE13:AB7E
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

☐ Top

Configuring PC5:

The screenshot shows the configuration window for PC5. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 20.0.0.4, Subnet Mask to 255.0.0.0, Default Gateway to 20.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has 'Static' selected, with a Link Local Address of FE80::2E0:F9FF:FE0D:3AA. The 802.1X section has 'Use 802.1X Security' unchecked, and Authentication set to MD5. A 'Top' button is at the bottom left.

Interface	FastEthernet0
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	20.0.0.4
Subnet Mask	255.0.0.0
Default Gateway	20.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::2E0:F9FF:FE0D:3AA
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

☐ Top

Configuring PC6:

The screenshot shows the configuration window for PC6. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 30.0.0.2, Subnet Mask to 255.0.0.0, Default Gateway to 30.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has 'Static' selected, with a Link Local Address of FE80::2E0:F9FF:FE9A:D3AA. The 802.1X section has 'Use 802.1X Security' unchecked, and Authentication set to MD5. A 'Top' button is at the bottom left.

Interface	FastEthernet0
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	30.0.0.2
Subnet Mask	255.0.0.0
Default Gateway	30.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::2E0:F9FF:FE9A:D3AA
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

☐ Top

Configuring PC7:

The screenshot shows the configuration window for PC7. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 30.0.0.3, Subnet Mask to 255.0.0.0, Default Gateway to 30.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has the 'Static' radio button selected, with the Link Local Address set to FE80::201:C9FF:FEDC:D846. The 802.1X section is collapsed.

Field	Value
Interface	FastEthernet0
IP Configuration	Static
IPv4 Address	30.0.0.3
Subnet Mask	255.0.0.0
Default Gateway	30.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::201:C9FF:FEDC:D846
Default Gateway	
DNS Server	
802.1X	Use 802.1X Security: <input type="checkbox"/>
Authentication	MDS
Username	
Password	

Configuring PC8:

The screenshot shows the configuration window for PC8. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 30.0.0.4, Subnet Mask to 255.0.0.0, Default Gateway to 30.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has the 'Static' radio button selected, with the Link Local Address set to FE80::260:3EFF:FE25:E1BE. The 802.1X section is collapsed.

Field	Value
Interface	FastEthernet0
IP Configuration	Static
IPv4 Address	30.0.0.4
Subnet Mask	255.0.0.0
Default Gateway	30.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::260:3EFF:FE25:E1BE
Default Gateway	
DNS Server	
802.1X	Use 802.1X Security: <input type="checkbox"/>
Authentication	MDS
Username	
Password	

Configuring Router 0 (using the CLI mode)

```
Router>en
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface serial 0/1/0
Router(config-if)#ip address 192.168.0.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
Router#
```

Configuring Router 1 (using the CLI mode)

```
Router>enable
Router#configure terminal
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit

Router(config)#interface serial 0/1/0
Router(config-if)#ip address 192.168.0.2 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit

Router(config)#interface serial 0/1/1
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown
```

Configuring Router 2 (using the CLI mode)

```
Router>enable
Router#configure terminal
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit

Router(config)#interface serial 0/1/1
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#no shutdown
```

Setting the RIPv1 on Router 0

```
Router>enable
Router#configure terminal
Router(config)#router rip
Router(config-router)#network 10.0.0.0
Router(config-router)#network 192.168.0.0
Router(config-router)#exit
```

Setting the RIPv1 on Router 1

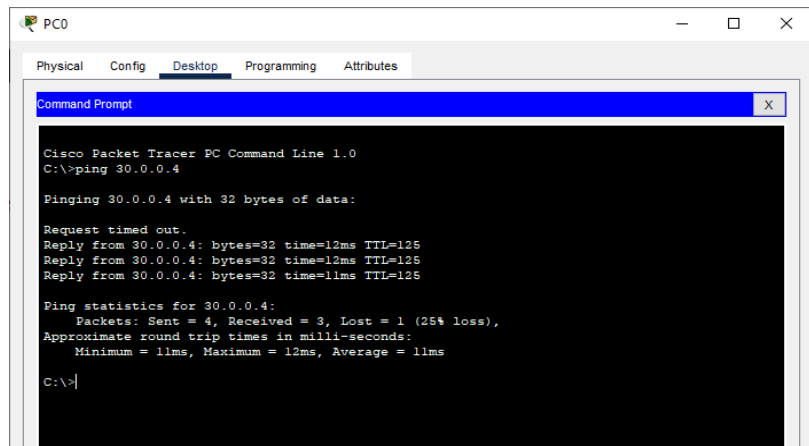
```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 192.168.0.0
Router(config-router)#network 20.0.0.0
Router(config-router)#network 192.168.1.0
Router(config-router)#exit
Router(config)#
Router#
```

Setting the RIPv1 on Router 2

```
Router>enable
Router#configure terminal
Router(config)#router rip
Router(config-router)#network 192.168.1.0
Router(config-router)#network 30.0.0.0
Router(config-router)#exit
Router(config)#
```

Checking the connectivity by using the ping command

Pinging PC8 (ip address 30.0.0.4) from PC0



```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 30.0.0.4

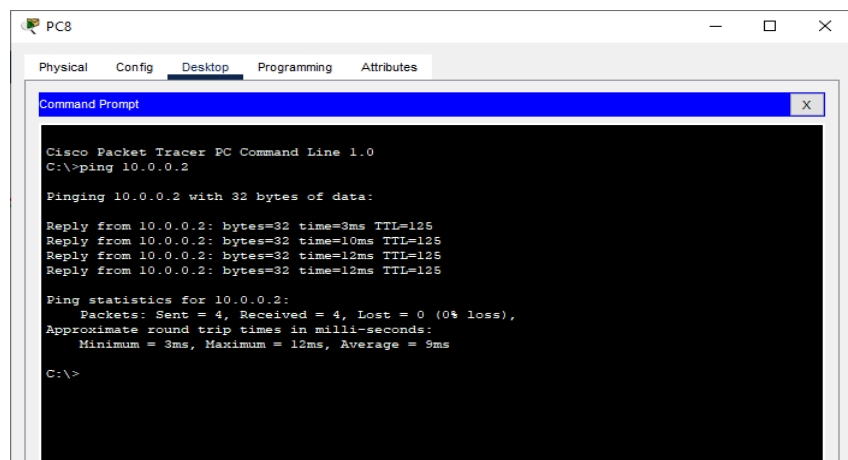
Pinging 30.0.0.4 with 32 bytes of data:

Request timed out.
Reply from 30.0.0.4: bytes=32 time=12ms TTL=125
Reply from 30.0.0.4: bytes=32 time=12ms TTL=125
Reply from 30.0.0.4: bytes=32 time=11ms TTL=125

Ping statistics for 30.0.0.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 12ms, Average = 11ms

C:\>
```

Pinging PC0 (ip address 10.0.0.2) from PC8



```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time=3ms TTL=125
Reply from 10.0.0.2: bytes=32 time=10ms TTL=125
Reply from 10.0.0.2: bytes=32 time=12ms TTL=125
Reply from 10.0.0.2: bytes=32 time=12ms TTL=125

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 12ms, Average = 9ms

C:\>
```

Result:

Hence the RIPv1 has been studied and verified through the given network

Link for the video demonstration of the practical:

<https://youtu.be/DLMpobkrDGw>

Practical No 6

Aim: Using Packet Tracer to create a network with three routers with RIPv2 and each router associated network will have minimum three PC and show the connectivity

Theory:

RIPv2 is an enhancement to the original RIP protocol developed in 1994. RIPv2 is also a distance vector routing protocol but has a few enhancements to make it more efficient than RIPv1.

RIPv2 is more efficient than RIPv1, but is not suitable for larger, more complex networks. It simply provides more flexibility on smaller networks.

RIPv2 uses the same routing metric as RIPv1, the hop count. Updates with RIPv2 are sent via multicasts and not broadcasts. RIPv2 can also be configured to do classless routing. When configured for classless routing, RIPv2 will transmit subnet masks when it sends routing updates. This allows for the use of subnetting and discontinuous networks.

RIPv2 allows for authentication to be required for updates. When authentication is enabled, each router is configured with the RIP update password. The password sent with the RIP update must match the password configured on the destination router. If the passwords do not match, then the receiving router will not process the update.

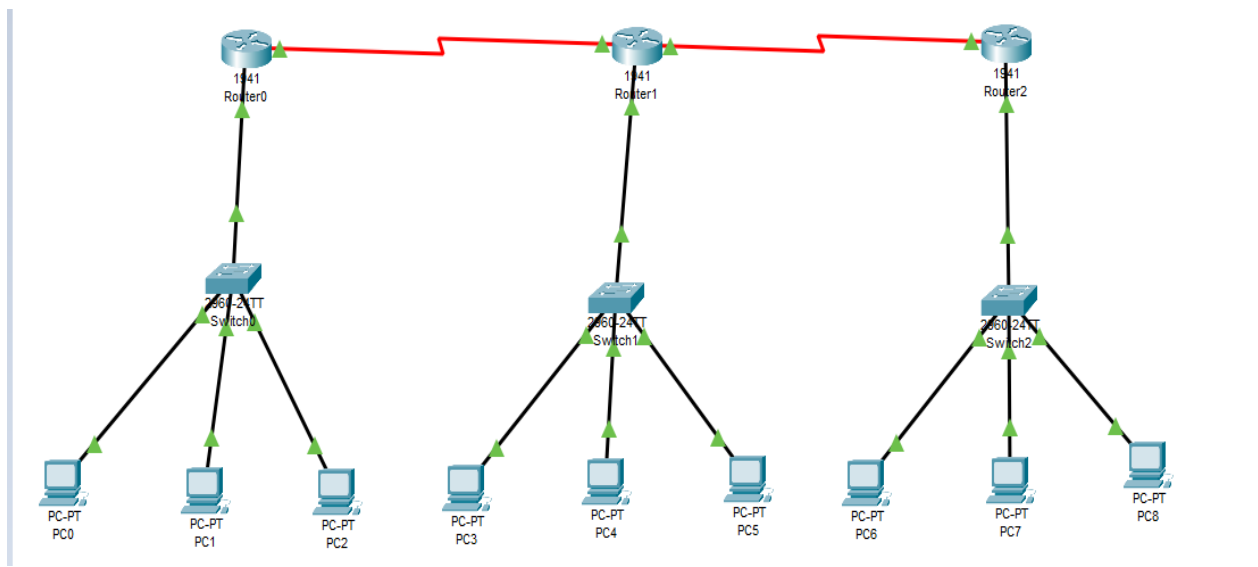
Advantages of RIPv2

- 1) It's a standardized protocol.
- 2) It's VLSM compliant.
- 3) Provides fast convergence.
- 4) It sends triggered updates when the network changes.
- 5) Works with snapshot routing – making it ideal for dial networks.

Disadvantage of RIPv2

- 1) Max hop count of 15, due to the 'count-to-infinity' vulnerability.
- 2) No concept of neighbors.
- 3) Exchanges entire table with all neighbors every 30 seconds (except in the case of a triggered update).

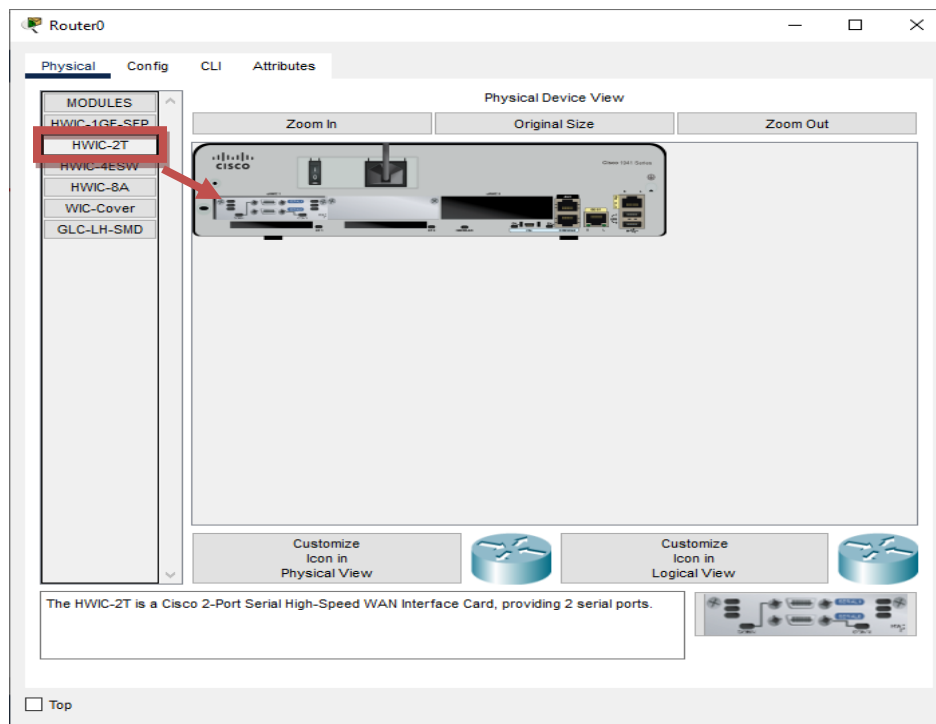
We use the following topology for the present case



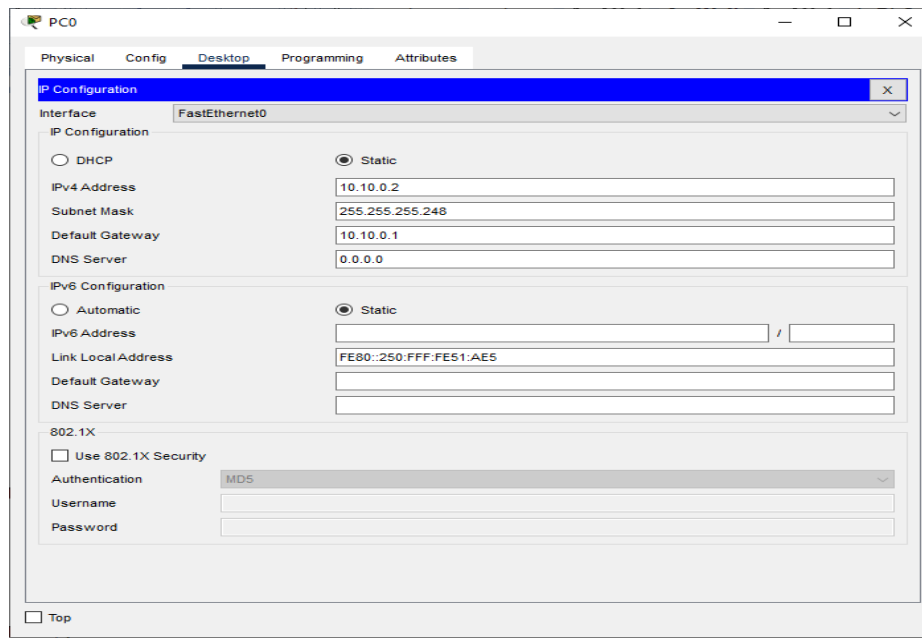
We configure the above network using the following IP addresses

Host	Interface	IP address	Subnet Mask	Network Address	Default Gateway
Router 0	G0/0	10.10.0.1	255.255.255.248	10.10.0.0	
	S0/1/0	192.168.0.1	255.255.255.252	192.168.0.0	
Router 1	G0/0	10.20.0.1	255.255.255.248	10.20.0.0	
	S0/1/0	192.168.0.2	255.255.255.252	192.168.0.0	
	S0/1/1	192.168.1.1	255.255.255.252	192.168.1.0	
Router 2	G0/0	10.30.0.1	255.255.255.248	10.30.0.0	
	S0/1/1	192.168.1.2	255.255.255.252	192.168.1.0	
PC0	FastEthernet0	10.10.0.2	255.255.255.248	10.10.0.0	10.10.0.1
PC1	FastEthernet0	10.10.0.3	255.255.255.248	10.10.0.0	10.10.0.1
PC2	FastEthernet0	10.10.0.4	255.255.255.248	10.10.0.0	10.10.0.1
PC3	FastEthernet0	10.20.0.2	255.255.255.248	10.20.0.0	10.20.0.1
PC4	FastEthernet0	10.20.0.3	255.255.255.248	10.20.0.0	10.20.0.1
PC5	FastEthernet0	10.20.0.4	255.255.255.248	10.20.0.0	10.20.0.1
PC6	FastEthernet0	10.30.0.2	255.255.255.248	10.30.0.0	10.30.0.1
PC7	FastEthernet0	10.30.0.3	255.255.255.248	10.30.0.0	10.30.0.1
PC8	FastEthernet0	10.30.0.4	255.255.255.248	10.30.0.0	10.30.0.1

Adding Serial Interface in each Router



Configuring PC0:



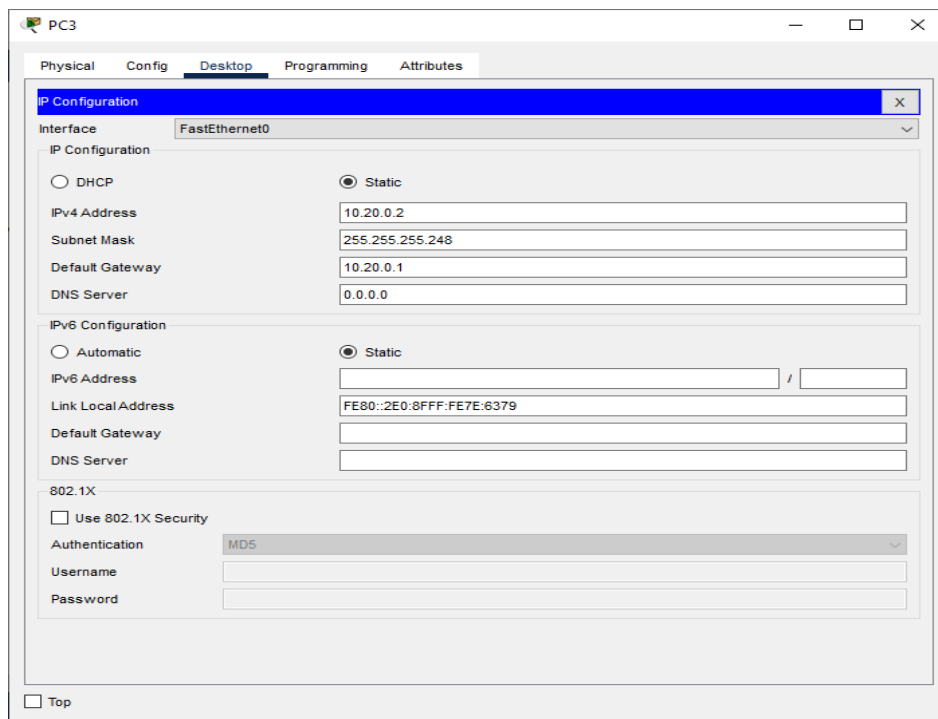
Configuring PC1:

The screenshot shows the 'PC1' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing the 'FastEthernet0' interface. The 'IP Configuration' group has 'Static' selected. The 'IPv4 Address' is set to '10.10.0.3', 'Subnet Mask' to '255.255.255.248', 'Default Gateway' to '10.10.0.1', and 'DNS Server' to '0.0.0.0'. The 'IPv6 Configuration' group has 'Static' selected. The 'IPv6 Address' is empty, 'Link Local Address' is 'FE80::2D0:BAFF:FEA4:5B72', 'Default Gateway' is empty, and 'DNS Server' is empty. The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to 'MD5', and 'Username' and 'Password' fields empty. A 'Top' button is at the bottom left.

Configuring PC2:

The screenshot shows the 'PC2' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing the 'FastEthernet0' interface. The 'IP Configuration' group has 'Static' selected. The 'IPv4 Address' is set to '10.10.0.4', 'Subnet Mask' to '255.255.255.248', 'Default Gateway' to '10.10.0.1', and 'DNS Server' to '0.0.0.0'. The 'IPv6 Configuration' group has 'Static' selected. The 'IPv6 Address' is empty, 'Link Local Address' is 'FE80::2D0:BCFF:FE33:A758', 'Default Gateway' is empty, and 'DNS Server' is empty. The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to 'MD5', and 'Username' and 'Password' fields empty. A 'Top' button is at the bottom left.

Configuring PC3:



The screenshot shows the configuration window for PC3. The 'Desktop' tab is selected. The 'IP Configuration' section is expanded, showing the 'FastEthernet0' interface. The 'Static' radio button is selected for both IPv4 and IPv6 configurations. The IPv4 address is 10.20.0.2, subnet mask is 255.255.255.248, default gateway is 10.20.0.1, and DNS server is 0.0.0.0. The IPv6 address is empty, link local address is FE80::2E0:8FFF:FE7E:6379, and default gateway and DNS server are empty. The '802.1X' section is also visible, with 'Use 802.1X Security' unchecked, authentication set to MD5, and empty fields for username and password.

PC3

Physical Config Desktop Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 10.20.0.2

Subnet Mask 255.255.255.248

Default Gateway 10.20.0.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::2E0:8FFF:FE7E:6379

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

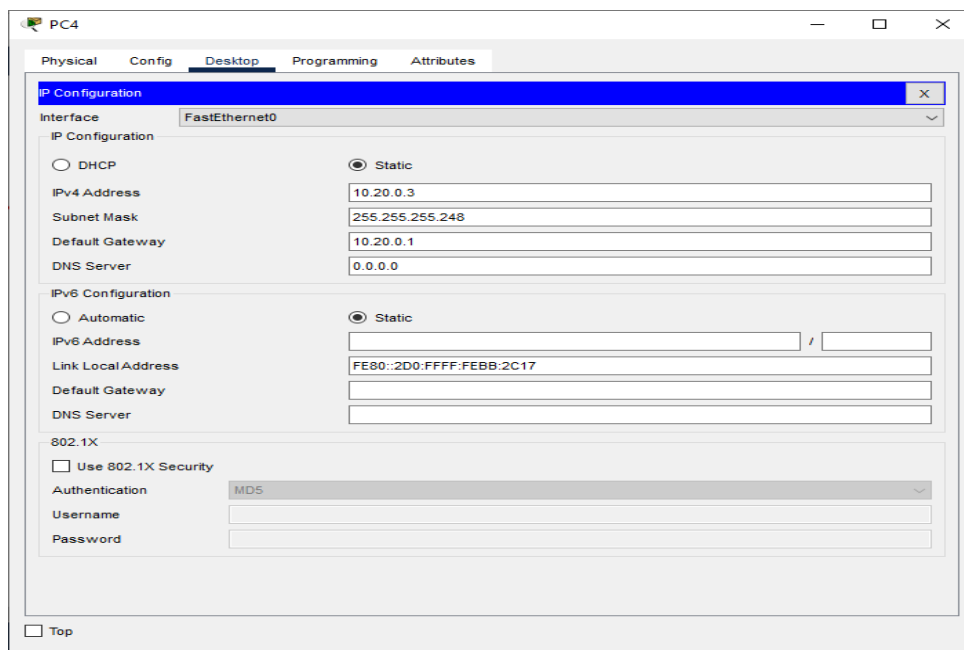
Authentication MD5

Username

Password

☐ Top

Configuring PC4:



The screenshot shows the configuration window for PC4. The 'Desktop' tab is selected. The 'IP Configuration' section is expanded, showing the 'FastEthernet0' interface. The 'Static' radio button is selected for both IPv4 and IPv6 configurations. The IPv4 address is 10.20.0.3, subnet mask is 255.255.255.248, default gateway is 10.20.0.1, and DNS server is 0.0.0.0. The IPv6 address is empty, link local address is FE80::2D0:FFFF:FE8B:2C17, and default gateway and DNS server are empty. The '802.1X' section is also visible, with 'Use 802.1X Security' unchecked, authentication set to MD5, and empty fields for username and password.

PC4

Physical Config Desktop Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 10.20.0.3

Subnet Mask 255.255.255.248

Default Gateway 10.20.0.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::2D0:FFFF:FE8B:2C17

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

Password

☐ Top

Configuring PC5:

The screenshot shows the configuration window for PC5. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 10.20.0.4, Subnet Mask to 255.0.0.0, Default Gateway to 10.20.0.1, and DNS Server to 0.0.0.0. Under 'IPv6 Configuration', the 'Static' radio button is also chosen. The IPv6 Address field is empty, and the Link Local Address is set to FE80::230:F2FF:FE77:CBE7. The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to MD5, and empty fields for Username and Password. A 'Top' button is at the bottom left.

Field	Value
Interface	FastEthernet0
IP Configuration	Static
IPv4 Address	10.20.0.4
Subnet Mask	255.0.0.0
Default Gateway	10.20.0.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::230:F2FF:FE77:CBE7
Default Gateway	
DNS Server	
802.1X	
Use 802.1X Security	<input type="checkbox"/>
Authentication	MD5
Username	
Password	

Configuring PC6:

The screenshot shows the configuration window for PC6. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 10.30.0.2, Subnet Mask to 255.255.255.248, Default Gateway to 10.30.0.1, and DNS Server to 0.0.0.0. Under 'IPv6 Configuration', the 'Static' radio button is also chosen. The IPv6 Address field is empty, and the Link Local Address is set to FE80::200:CFE:FE40:DCD0. The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to MD5, and empty fields for Username and Password. A 'Top' button is at the bottom left.

Field	Value
Interface	FastEthernet0
IP Configuration	Static
IPv4 Address	10.30.0.2
Subnet Mask	255.255.255.248
Default Gateway	10.30.0.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::200:CFE:FE40:DCD0
Default Gateway	
DNS Server	
802.1X	
Use 802.1X Security	<input type="checkbox"/>
Authentication	MD5
Username	
Password	

Configuring PC7:

The screenshot shows the configuration window for PC7. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Interface' is 'FastEthernet0'. The 'IP Configuration' section has 'Static' selected. The fields are: IPv4 Address: 10.30.0.3, Subnet Mask: 255.0.0.0, Default Gateway: 10.30.0.1, and DNS Server: 0.0.0.0. The 'IPv6 Configuration' section has 'Static' selected. The fields are: IPv6 Address: (empty), Link Local Address: FE80::202:4AFF:FE4A:9D36, Default Gateway: (empty), and DNS Server: (empty). The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to 'MD5', and 'Username' and 'Password' fields empty. A 'Top' button is at the bottom left.

Configuring PC8:

The screenshot shows the configuration window for PC8. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Interface' is 'FastEthernet0'. The 'IP Configuration' section has 'Static' selected. The fields are: IPv4 Address: 10.30.0.4, Subnet Mask: 255.0.0.0, Default Gateway: 10.30.0.1, and DNS Server: 0.0.0.0. The 'IPv6 Configuration' section has 'Static' selected. The fields are: IPv6 Address: (empty), Link Local Address: FE80::240:BFF:FE65:D944, Default Gateway: (empty), and DNS Server: (empty). The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to 'MD5', and 'Username' and 'Password' fields empty. A 'Top' button is at the bottom left.

Configuring IP addresses on Router 0

i) Interface G0/0

The screenshot shows the configuration window for Router0, specifically the 'Config' tab for the GigabitEthernet0/0 interface. The left sidebar lists various configuration categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, GigabitEthernet0/0 is selected. The main configuration area for GigabitEthernet0/0 includes the following settings:

- Port Status: ☒ On
- Bandwidth: ☐ 1000 Mbps ☒ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 0090.0C15.A101
- IP Configuration:
 - IPv4 Address: 10.10.0.1
 - Subnet Mask: 255.255.255.248
- Tx Ring Limit: 10

ii) Interface S0/1/0

The screenshot shows the configuration window for Router0, specifically the 'Config' tab for the Serial0/1/0 interface. The left sidebar lists various configuration categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, Serial0/1/0 is selected. The main configuration area for Serial0/1/0 includes the following settings:

- Port Status: ☒ On
- Duplex: ☒ Full Duplex
- Clock Rate: 1200
- IP Configuration:
 - IPv4 Address: 192.168.0.1
 - Subnet Mask: 255.255.255.252
- Tx Ring Limit: 10

Configuring IP addresses on Router 1

i) Interface G0/0

The screenshot shows the configuration window for Router1, specifically for the GigabitEthernet0/0 interface. The left sidebar lists various configuration categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, GigabitEthernet0/0 is selected. The main panel displays the configuration for GigabitEthernet0/0. The Port Status is set to On. The Bandwidth is set to 100 Mbps. The Duplex is set to Full Duplex. The MAC Address is 0001.9670.9B01. The IP Configuration section shows the IPv4 Address as 10.20.0.1 and the Subnet Mask as 255.255.255.248. The Tx Ring Limit is set to 10.

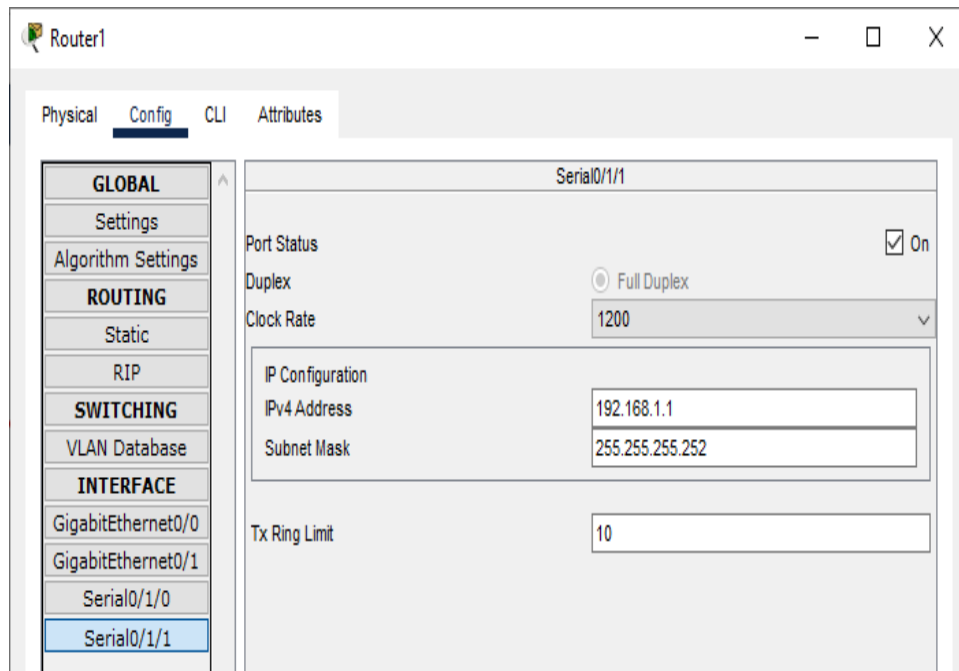
Parameter	Value
Port Status	On
Bandwidth	100 Mbps
Duplex	Full Duplex
MAC Address	0001.9670.9B01
IPv4 Address	10.20.0.1
Subnet Mask	255.255.255.248
Tx Ring Limit	10

ii) Interface S0/1/0

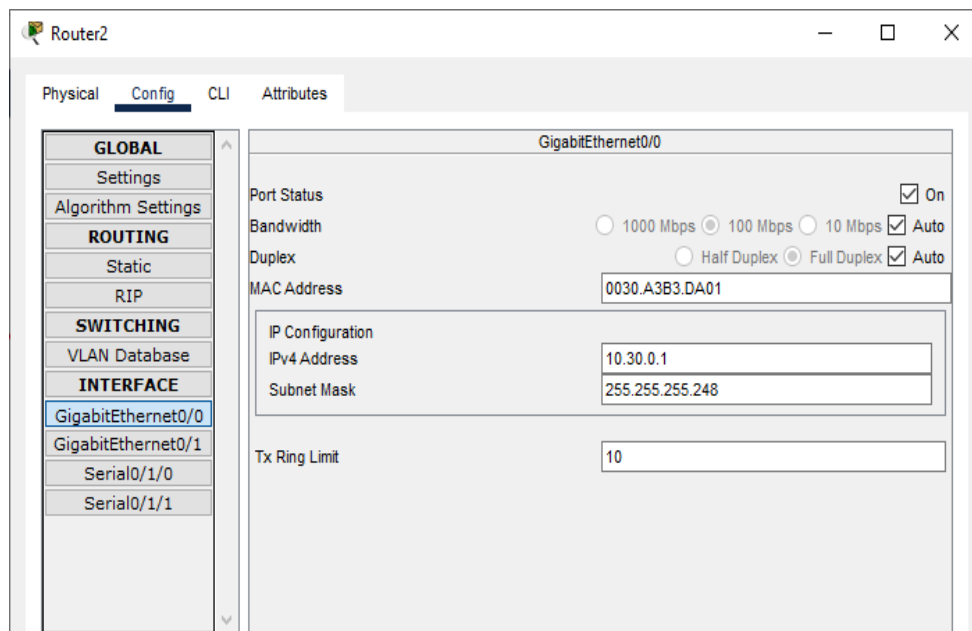
The screenshot shows the configuration window for Router1, specifically for the Serial0/1/0 interface. The left sidebar lists various configuration categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, Serial0/1/0 is selected. The main panel displays the configuration for Serial0/1/0. The Port Status is set to On. The Duplex is set to Full Duplex. The Clock Rate is set to 2000000. The IP Configuration section shows the IPv4 Address as 192.168.0.2 and the Subnet Mask as 255.255.255.252. The Tx Ring Limit is set to 10.

Parameter	Value
Port Status	On
Duplex	Full Duplex
Clock Rate	2000000
IPv4 Address	192.168.0.2
Subnet Mask	255.255.255.252
Tx Ring Limit	10

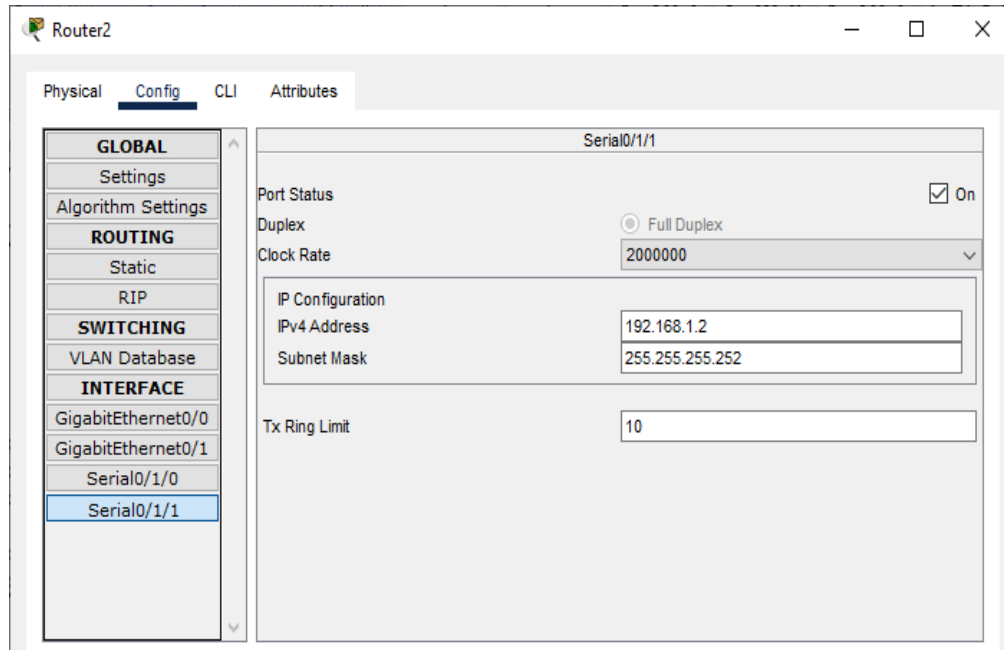
iii) Interface S0/1/1

**Configuring IP addresses on Router 2**

i) Interface G0/0



ii) Interface S0/1/1

**Configuring Router 0 for RIPv2 (using the CLI mode)**

```
Router>enable
Router#configure terminal
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 10.10.0.0
Router(config-router)#network 192.168.0.0
Router(config-router)#exit
Router(config)#
```

Configuring Router 1 for RIPv2 (using the CLI mode)

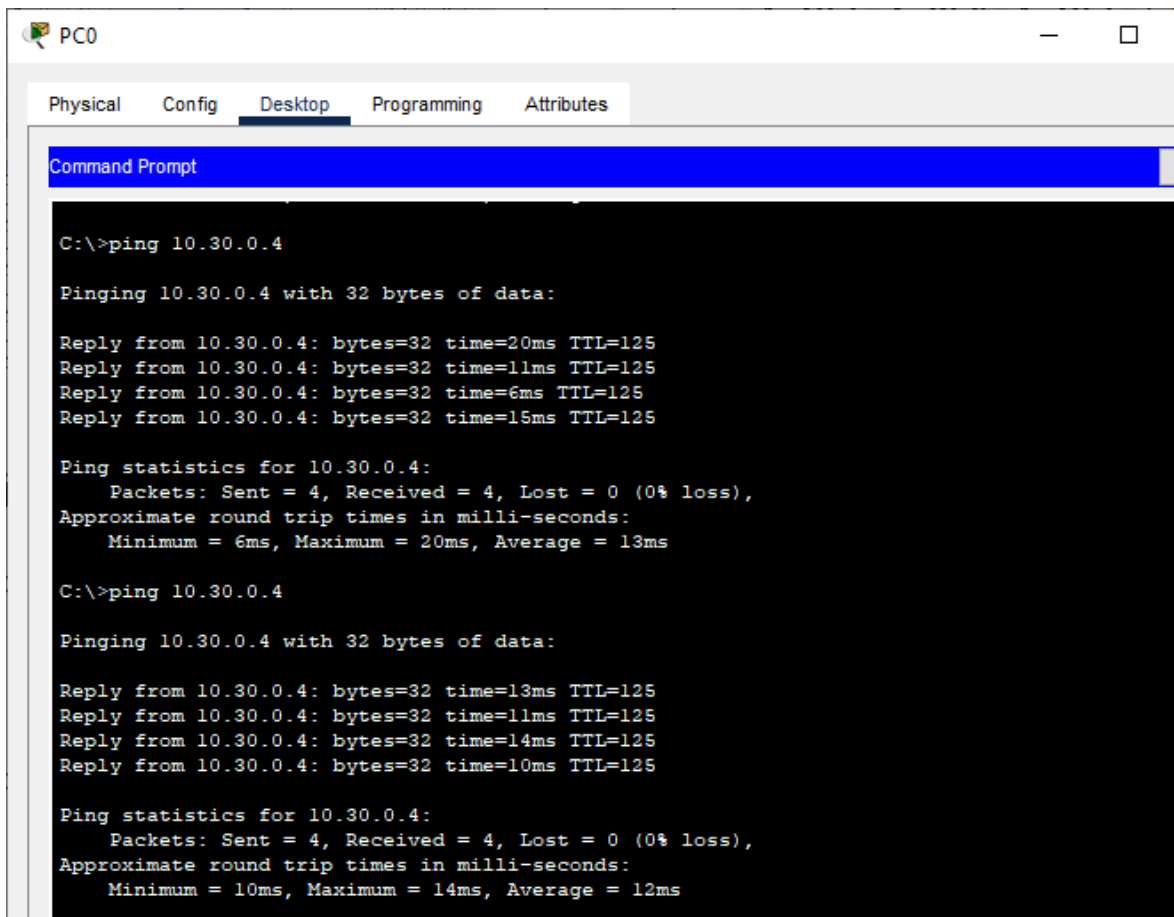
```
Router>enable
Router#configure terminal
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 10.20.0.0
Router(config-router)#network 192.168.0.0
Router(config-router)#network 192.168.1.0
Router(config-router)#exit
Router(config)#
```

Configuring Router 2 for RIPv2 (using the CLI mode)

```
Router>enable
Router#configure terminal
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 10.30.0.0
Router(config-router)#network 192.168.1.0
Router(config-router)#exit
Router(config)#
```

Checking the connectivity by using the ping command

- i) Pinging PC8 (ip address 10.30.0.4) from PC0



The screenshot shows a PC0 desktop environment with a window titled 'PC0'. The 'Desktop' tab is selected, displaying a 'Command Prompt' window. The command prompt shows two successful ping operations to the IP address 10.30.0.4. Each operation consists of four replies and a summary of ping statistics.

```
C:\>ping 10.30.0.4

Pinging 10.30.0.4 with 32 bytes of data:

Reply from 10.30.0.4: bytes=32 time=20ms TTL=125
Reply from 10.30.0.4: bytes=32 time=11ms TTL=125
Reply from 10.30.0.4: bytes=32 time=6ms TTL=125
Reply from 10.30.0.4: bytes=32 time=15ms TTL=125

Ping statistics for 10.30.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 6ms, Maximum = 20ms, Average = 13ms

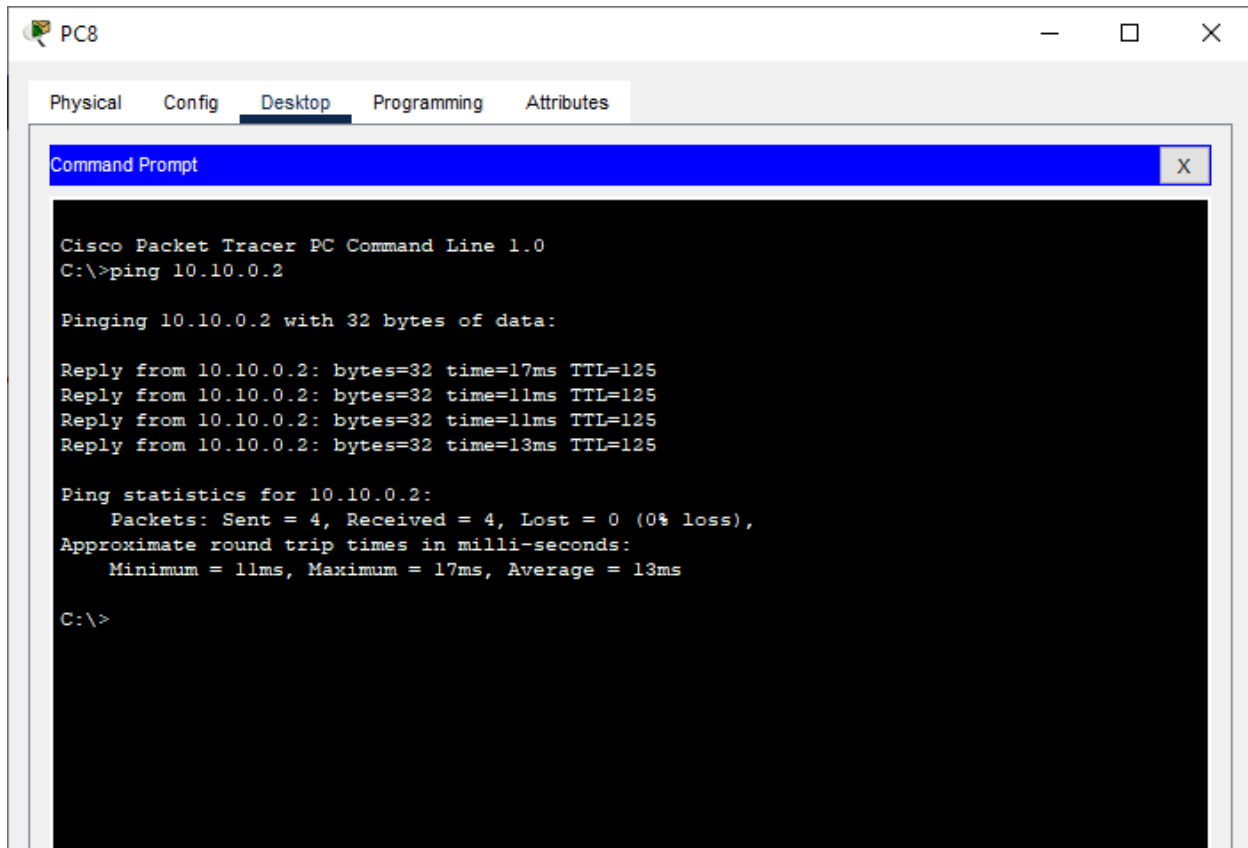
C:\>ping 10.30.0.4

Pinging 10.30.0.4 with 32 bytes of data:

Reply from 10.30.0.4: bytes=32 time=13ms TTL=125
Reply from 10.30.0.4: bytes=32 time=11ms TTL=125
Reply from 10.30.0.4: bytes=32 time=14ms TTL=125
Reply from 10.30.0.4: bytes=32 time=10ms TTL=125

Ping statistics for 10.30.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 14ms, Average = 12ms
```

ii) Pinging PC0 (ip address 10.10.0.2) from PC8



```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.10.0.2

Pinging 10.10.0.2 with 32 bytes of data:

Reply from 10.10.0.2: bytes=32 time=17ms TTL=125
Reply from 10.10.0.2: bytes=32 time=11ms TTL=125
Reply from 10.10.0.2: bytes=32 time=11ms TTL=125
Reply from 10.10.0.2: bytes=32 time=13ms TTL=125

Ping statistics for 10.10.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 17ms, Average = 13ms

C:\>
```

Result:

Hence the RIPv2 has been studied and verified through the given network

Link for the video demonstration of the practical:

<https://youtu.be/qrBpjsxSkZY8>

Practical No 7

Aim: Using Packet Tracer, create a network with three routers with OSPF and each router associated network will have minimum three PC and show Connectivity

Theory:

Open shortest path first (OSPF) is a link-state routing protocol that is used to find the best path between the source and the destination router using its own shortest path first (SPF) algorithm. A link-state routing protocol is a protocol that uses the concept of triggered updates, i.e., if there is a change observed in the learned routing table then the updates are triggered only, not like the distance-vector routing protocol where the routing table is exchanged at a period of time.

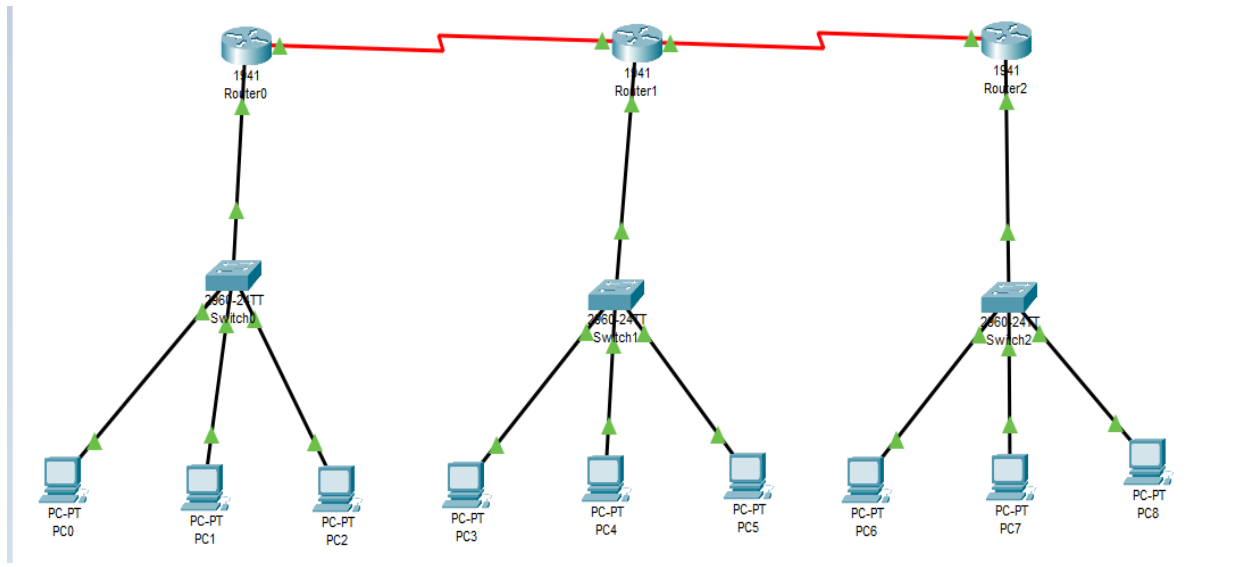
Open shortest path first (OSPF) is developed by Internet Engineering Task Force (IETF) as one of the Interior Gateway Protocol (IGP), i.e., the protocol which aims at moving the packet within a large autonomous system or routing domain.

OSPF advantages –

1. Both IPv4 and IPv6 routed protocols
2. Load balancing with equal-cost routes for the same destination
3. Unlimited hop counts
4. Trigger updates for fast convergence
5. A loop-free topology using SPF algorithm
6. Run-on most routers
7. Classless protocol

There are some disadvantages of OSPF like, it requires an extra CPU process to run the SPF algorithm, requiring more RAM to store adjacency topology, and being more complex to set up and hard to troubleshoot.

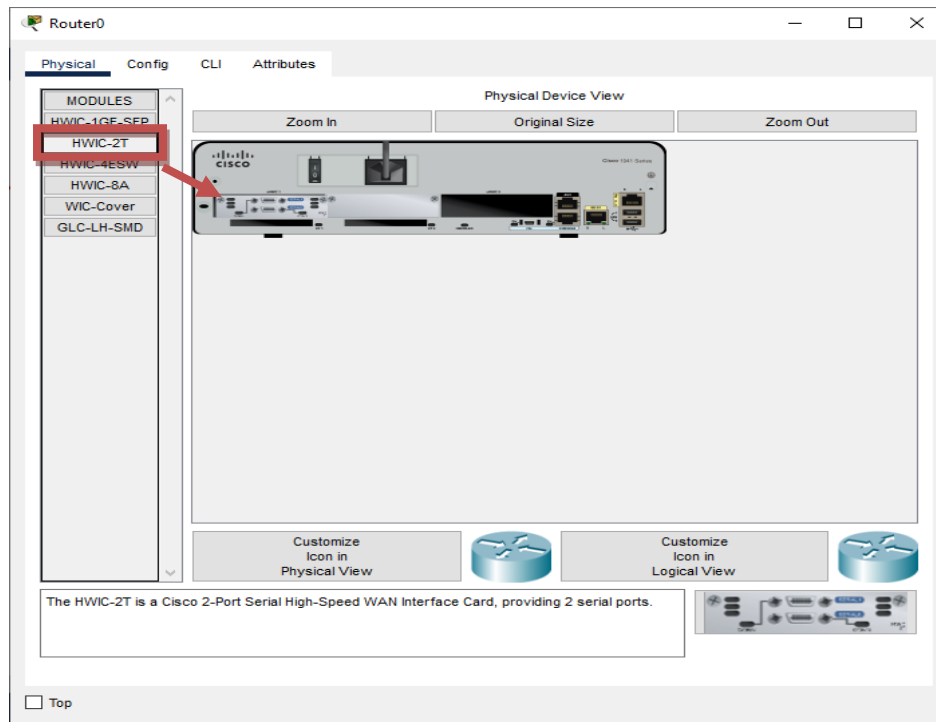
We use the following topology for the present case



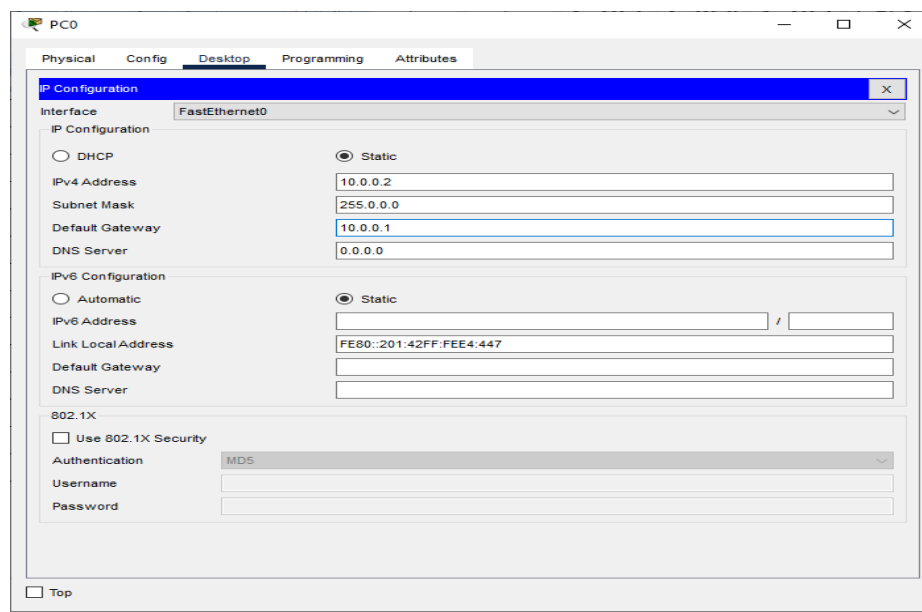
We configure the above network using the following IP addresses

Host	Interface	IP address	Default Gateway	Subnet Mask	Wildcard Mask
Router 0	G0/0	10.0.0.1		255.0.0.0	0.255.255.255
	S0/1/0	40.0.0.1			
Router 1	G0/0	20.0.0.1			
	S0/1/0	40.0.0.2			
	S0/1/1	50.0.0.1			
Router 2	G0/0	30.0.0.1			
	S0/1/1	50.0.0.2			
PC0	FastEthernet0	10.0.0.2	10.0.0.1		
PC1	FastEthernet0	10.0.0.3			
PC2	FastEthernet0	10.0.0.4			
PC3	FastEthernet0	20.0.0.2	20.0.0.1		
PC4	FastEthernet0	20.0.0.3			
PC5	FastEthernet0	20.0.0.4			
PC6	FastEthernet0	30.0.0.2	30.0.0.1		
PC7	FastEthernet0	30.0.0.3			
PC8	FastEthernet0	30.0.0.4			

Adding Serial Interface in each Router



Configuring PC0:



Configuring PC1:

The screenshot shows the 'PC1' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'FastEthernet0' interface. The 'Static' radio button is selected for both IPv4 and IPv6 configurations. The IPv4 configuration includes an IP Address of 10.0.0.3, Subnet Mask of 255.0.0.0, Default Gateway of 10.0.0.1, and DNS Server of 0.0.0.0. The IPv6 configuration includes a Static IP Address, Link Local Address of FE80::205:5EFF:FE88:E00C, and a Default Gateway. The 802.1X section is also visible, with 'Use 802.1X Security' unchecked, Authentication set to MDS, and empty fields for Username and Password.

PC1

Physical Config Desktop Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 10.0.0.3

Subnet Mask 255.0.0.0

Default Gateway 10.0.0.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address

Link Local Address FE80::205:5EFF:FE88:E00C

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MDS

Username

Password

☐ Top

Configuring PC2:

The screenshot shows the 'PC2' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is expanded, showing settings for the 'FastEthernet0' interface. The 'Static' radio button is selected for both IPv4 and IPv6 configurations. The IPv4 configuration includes an IP Address of 10.0.0.4, Subnet Mask of 255.0.0.0, Default Gateway of 10.0.0.1, and DNS Server of 0.0.0.0. The IPv6 configuration includes a Static IP Address, Link Local Address of FE80::2D0:BAFF:FE8E:684C, and a Default Gateway. The 802.1X section is also visible, with 'Use 802.1X Security' unchecked, Authentication set to MDS, and empty fields for Username and Password. A warning message 'This address is already used in the network.' is displayed next to the IPv4 Static configuration.

PC2

Physical Config Desktop Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static This address is already used in the network.

IPv4 Address 10.0.0.4

Subnet Mask 255.0.0.0

Default Gateway 10.0.0.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address

Link Local Address FE80::2D0:BAFF:FE8E:684C

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MDS

Username

Password

☐ Top

Configuring PC3:

The screenshot shows the configuration window for PC3. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 20.0.0.2, Subnet Mask to 255.0.0.0, Default Gateway to 20.0.0.1, and DNS Server to 0.0.0.0. Under 'IPv6 Configuration', the 'Static' radio button is also chosen. The IPv6 Address field is empty, and the Link Local Address is set to FE80::202:17FF:FE81:A06. The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to MD5, and empty fields for Username and Password. A 'Top' button is at the bottom left.

IP Configuration	
Interface: FastEthernet0	
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	20.0.0.2
Subnet Mask	255.0.0.0
Default Gateway	20.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::202:17FF:FE81:A06
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

☐ Top

Configuring PC4:

The screenshot shows the configuration window for PC4. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 20.0.0.3, Subnet Mask to 255.0.0.0, Default Gateway to 20.0.0.1, and DNS Server to 0.0.0.0. Under 'IPv6 Configuration', the 'Static' radio button is also chosen. The IPv6 Address field is empty, and the Link Local Address is set to FE80::20A:41FF:FE13:AB7E. The '802.1X' section has 'Use 802.1X Security' unchecked, 'Authentication' set to MD5, and empty fields for Username and Password. A 'Top' button is at the bottom left.

IP Configuration	
Interface: FastEthernet0	
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	20.0.0.3
Subnet Mask	255.0.0.0
Default Gateway	20.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::20A:41FF:FE13:AB7E
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

☐ Top

Configuring PC5:

The screenshot shows the configuration window for PC5. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 20.0.0.4, Subnet Mask to 255.0.0.0, Default Gateway to 20.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has 'Static' selected, with a Link Local Address of FE80::2E0:F9FF:FE0D:3AA. The 802.1X section is collapsed.

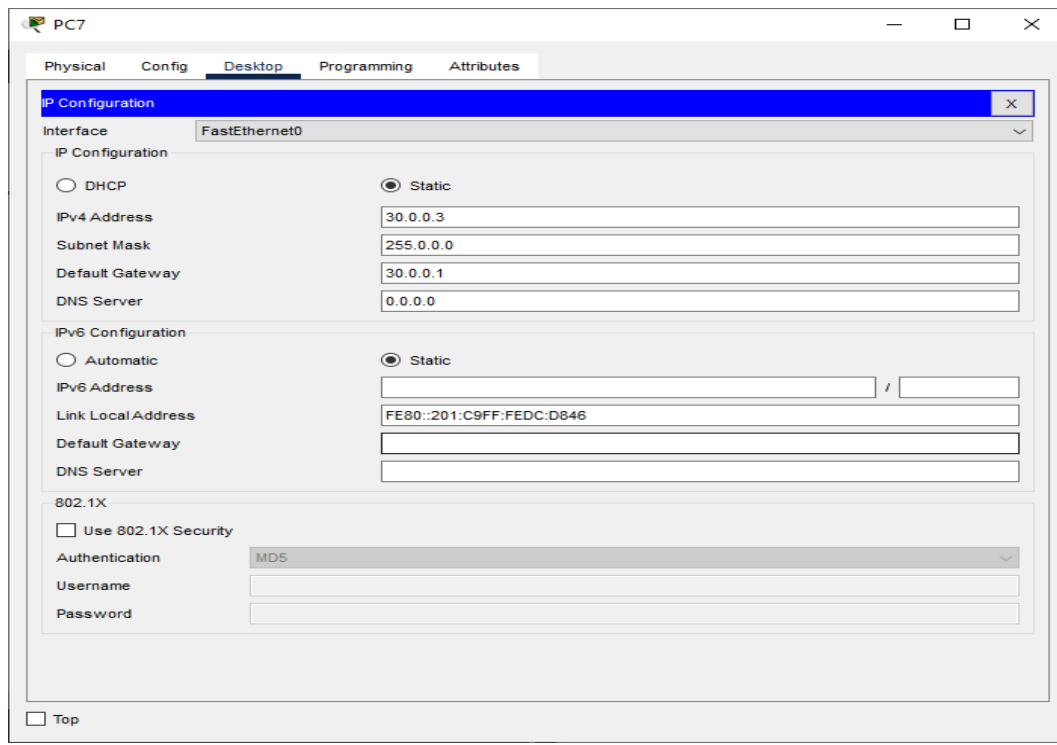
Interface	FastEthernet0
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	20.0.0.4
Subnet Mask	255.0.0.0
Default Gateway	20.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::2E0:F9FF:FE0D:3AA
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

Configuring PC6:

The screenshot shows the configuration window for PC6. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 30.0.0.2, Subnet Mask to 255.0.0.0, Default Gateway to 30.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has 'Static' selected, with a Link Local Address of FE80::2E0:F9FF:FE9A:D3AA. The 802.1X section is collapsed.

Interface	FastEthernet0
IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	30.0.0.2
Subnet Mask	255.0.0.0
Default Gateway	30.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	
<input type="radio"/> Automatic	<input checked="" type="radio"/> Static
IPv6 Address	
Link Local Address	FE80::2E0:F9FF:FE9A:D3AA
Default Gateway	
DNS Server	
802.1X	
<input type="checkbox"/> Use 802.1X Security	
Authentication	MD5
Username	
Password	

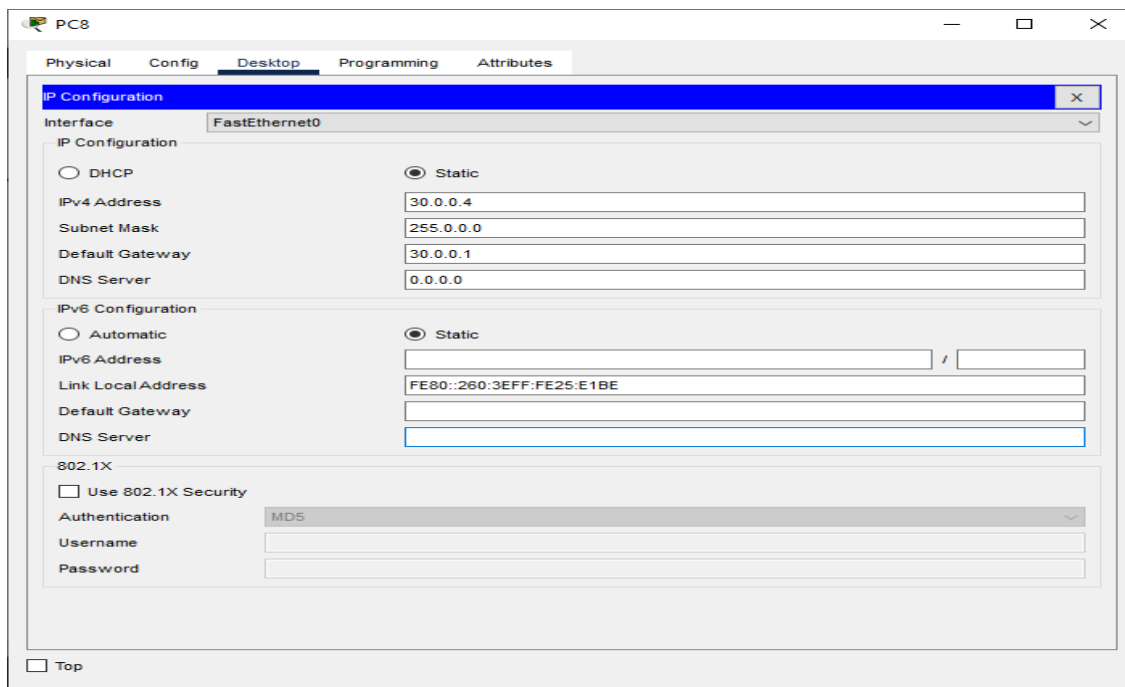
Configuring PC7:



The screenshot shows the configuration window for PC7. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 30.0.0.3, Subnet Mask to 255.0.0.0, Default Gateway to 30.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has the 'Static' radio button selected, with the Link Local Address set to FE80::201:C9FF:FEDC:D846. The 802.1X section is collapsed.

Field	Value
Interface	FastEthernet0
IP Configuration	Static
IPv4 Address	30.0.0.3
Subnet Mask	255.0.0.0
Default Gateway	30.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::201:C9FF:FEDC:D846
Default Gateway	
DNS Server	
802.1X	Use 802.1X Security: <input type="checkbox"/>
Authentication	MDS
Username	
Password	

Configuring PC8:



The screenshot shows the configuration window for PC8. The 'Desktop' tab is selected. Under 'IP Configuration', the 'Static' radio button is chosen. The IPv4 Address is set to 30.0.0.4, Subnet Mask to 255.0.0.0, Default Gateway to 30.0.0.1, and DNS Server to 0.0.0.0. The IPv6 Configuration section has the 'Static' radio button selected, with the Link Local Address set to FE80::260:3EFF:FE25:E1BE. The 802.1X section is collapsed.

Field	Value
Interface	FastEthernet0
IP Configuration	Static
IPv4 Address	30.0.0.4
Subnet Mask	255.0.0.0
Default Gateway	30.0.0.1
DNS Server	0.0.0.0
IPv6 Configuration	Static
IPv6 Address	
Link Local Address	FE80::260:3EFF:FE25:E1BE
Default Gateway	
DNS Server	
802.1X	Use 802.1X Security: <input type="checkbox"/>
Authentication	MDS
Username	
Password	

Configuring IP addresses on Router 0

i) Interface G0/0

The screenshot shows the configuration window for Router0, specifically for the GigabitEthernet0/0 interface. The left sidebar lists various configuration categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, GigabitEthernet0/0 is selected. The main configuration area for GigabitEthernet0/0 includes the following settings:

- Port Status: ☒ On
- Bandwidth: ☐ 1000 Mbps ☒ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 0030.A3E4.1201
- IP Configuration:
 - IPv4 Address: 10.0.0.1
 - Subnet Mask: 255.0.0.0
- Tx Ring Limit: 10

ii) Interface S0/1/0

The screenshot shows the configuration window for Router0, specifically for the Serial0/1/0 interface. The left sidebar lists various configuration categories: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under the INTERFACE category, Serial0/1/0 is selected. The main configuration area for Serial0/1/0 includes the following settings:

- Port Status: ☒ On
- Duplex: ☒ Full Duplex
- Clock Rate: 1200
- IP Configuration:
 - IPv4 Address: 40.0.0.1
 - Subnet Mask: 255.0.0.0
- Tx Ring Limit: 10

Configuring IP addresses on Router 1

i) Interface G0/0

The screenshot shows the configuration window for Router1, specifically for the GigabitEthernet0/0 interface. The left sidebar shows the configuration tree with 'INTERFACE' selected and 'GigabitEthernet0/0' highlighted. The main panel displays the following settings:

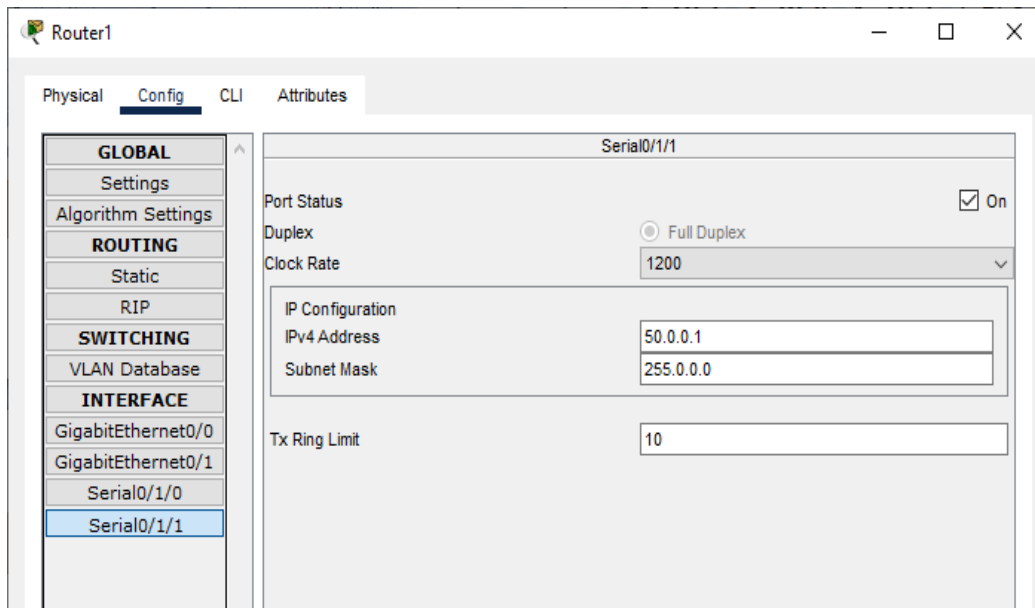
- Port Status:** ☒ On
- Bandwidth:** ☐ 1000 Mbps ☒ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex:** ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address:** 0001.C711.B701
- IP Configuration:**
 - IPv4 Address:** 20.0.0.1
 - Subnet Mask:** 255.0.0.0
- Tx Ring Limit:** 10

ii) Interface S0/1/0

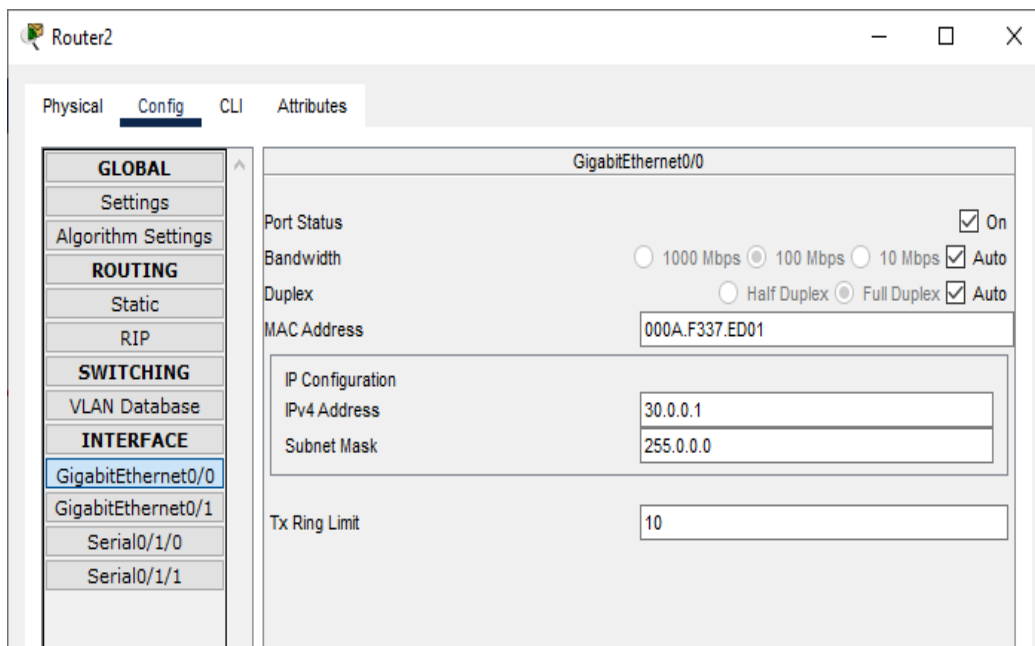
The screenshot shows the configuration window for Router1, specifically for the Serial0/1/0 interface. The left sidebar shows the configuration tree with 'INTERFACE' selected and 'Serial0/1/0' highlighted. The main panel displays the following settings:

- Port Status:** ☒ On
- Duplex:** ☒ Full Duplex
- Clock Rate:** 2000000
- IP Configuration:**
 - IPv4 Address:** 40.0.0.2
 - Subnet Mask:** 255.0.0.0
- Tx Ring Limit:** 10

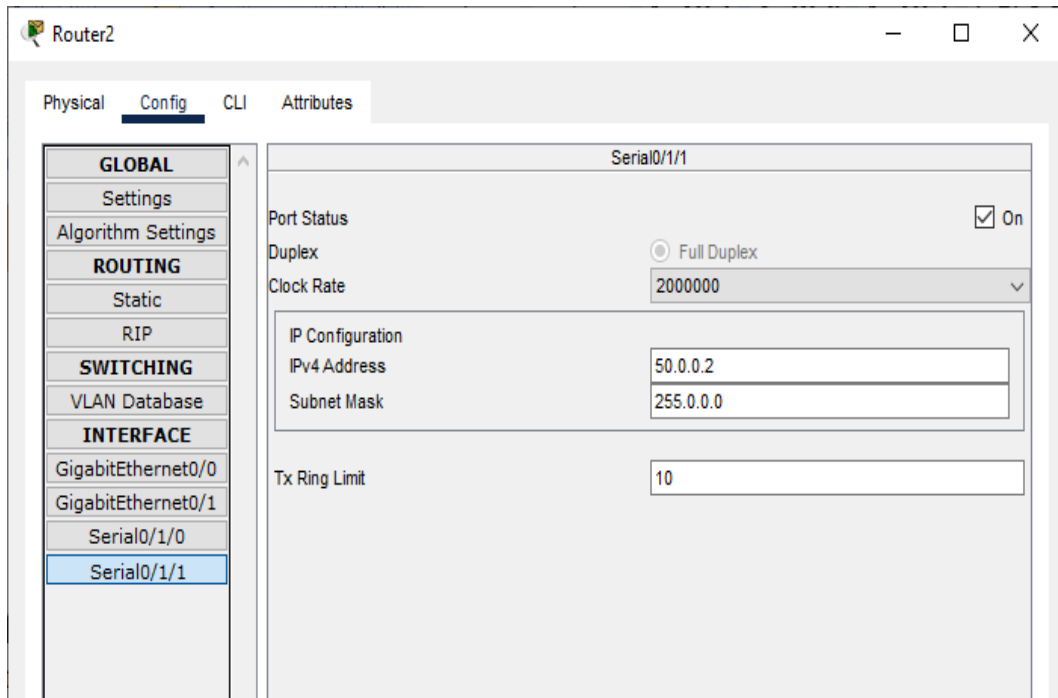
iii) Interface S0/1/1

**Configuring IP addresses on Router 2**

i) Interface G0/0



ii) Interface S0/1/1

**Configuring Router 0 for OSPF (using the CLI mode)**

```
Router(config)#
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.0.0.255 area 1
Router(config-router)#network 40.0.0.0 0.0.0.255 area 1
Router(config-router)#exit
Router(config)#
```

Configuring Router 1 for OSPF (using the CLI mode)

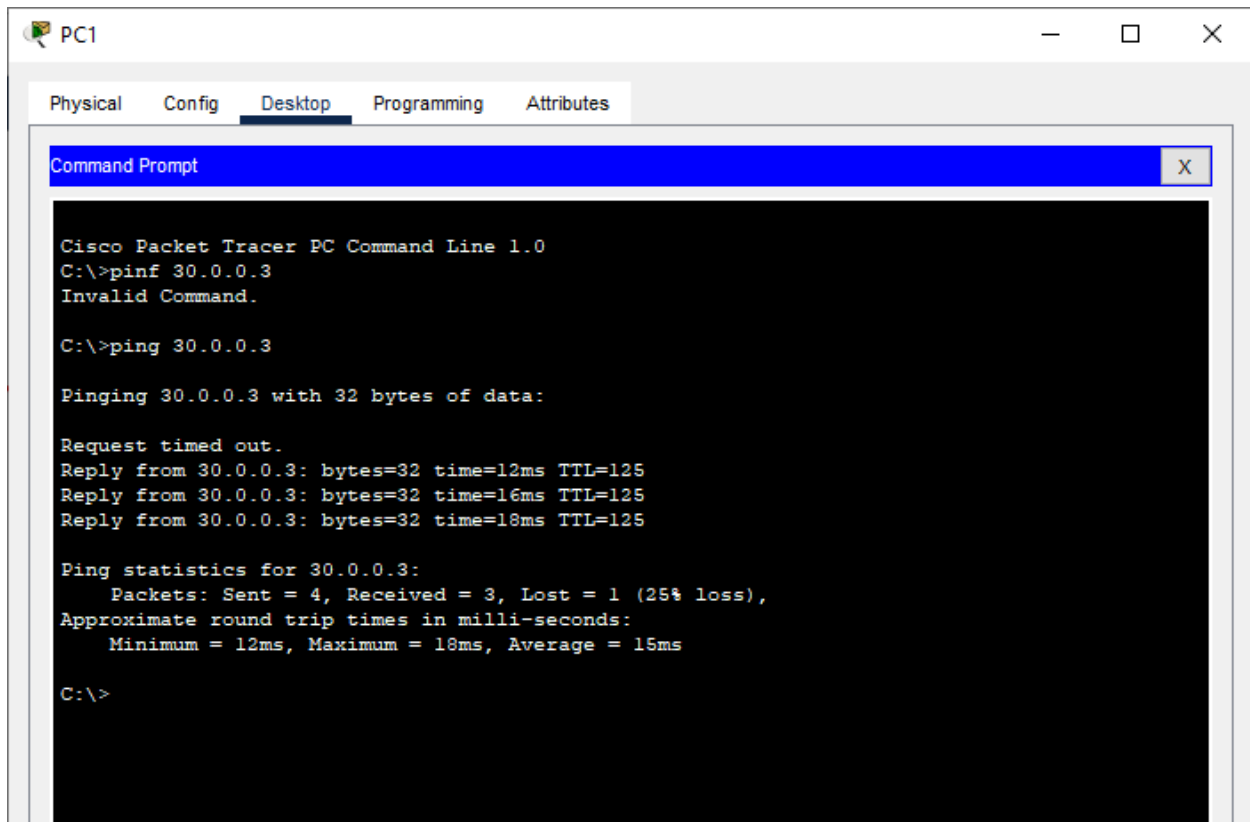
```
Router(config)#
Router(config)#router ospf 1
Router(config-router)#
Router(config-router)#network 20.0.0.0 0.0.0.255 area 1
Router(config-router)#network 40.0.0.0 0.0.0.255 area 1
Router(config-router)#network 50.0.0.0 0.0.0.255 area 1
Router(config-router)#exit
Router(config)#
```

Configuring Router 2 for OSPF (using the CLI mode)

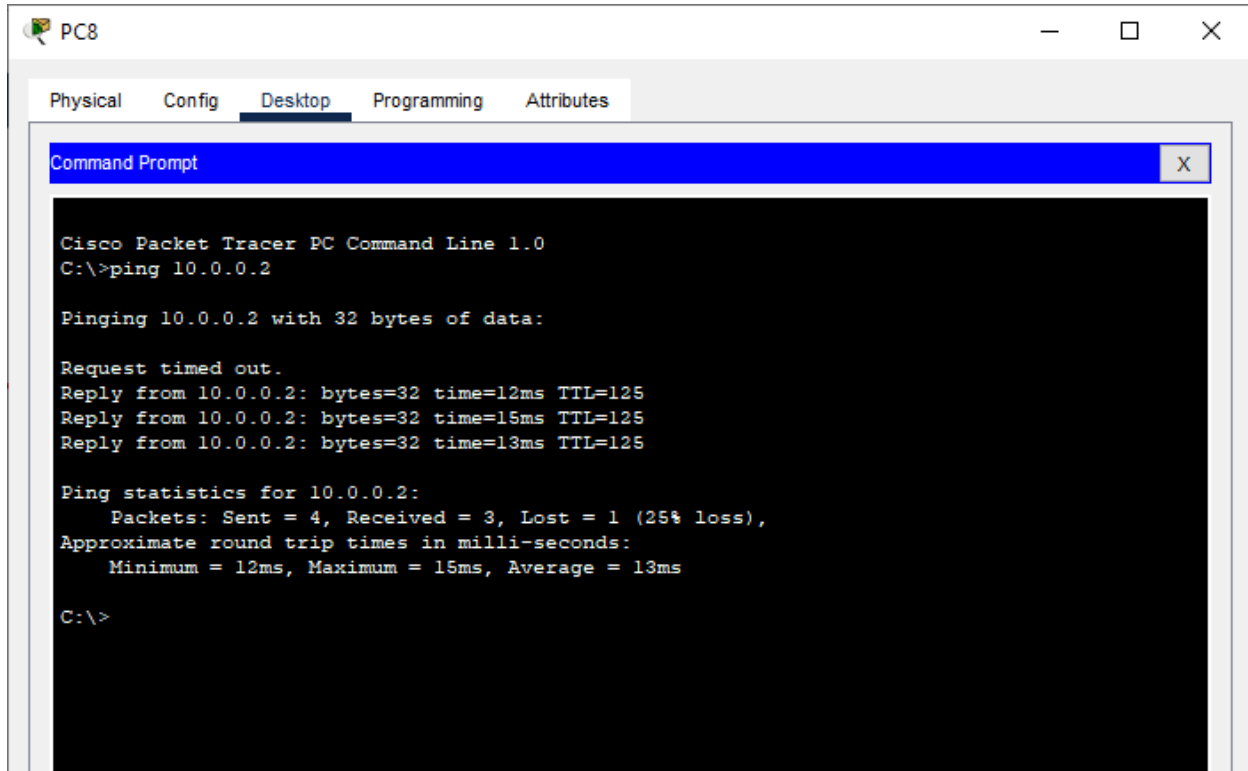
```
Router(config)#  
Router(config)#router ospf 1  
Router(config-router)#  
Router(config-router)#network 30.0.0.0 0.0.0.255 area 1  
Router(config-router)#network 50.0.0.0 0.0.0.255 area 1  
Router(config-router)# exit  
Router(config)#
```

Checking the connectivity by using the ping command

- i) Pinging PC8 (ip address 10.30.0.4) from PC1



ii) Pinging PC0 (ip address 10.10.0.2) from PC8



```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Request timed out.
Reply from 10.0.0.2: bytes=32 time=12ms TTL=125
Reply from 10.0.0.2: bytes=32 time=15ms TTL=125
Reply from 10.0.0.2: bytes=32 time=13ms TTL=125

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 12ms, Maximum = 15ms, Average = 13ms

C:\>
```

Result:

Hence the OSPF has been studied and verified through the given network

Link for the video demonstration of the practical:

<https://youtu.be/PVaQ3M-Jiq8>