Academic Year: 2023-24 **Semester:** V
Class/Branch: TE/DS **Subject:** WCN

Experiment No. 07

1. **Aim**: To design and simulate the environment for Dynamic routing using Cisco packet tracer/ GNS3.

2. **Software used**: CISCO Packet Tracer

3. **Theory:** -

Routing is a procedure of making decisions in which the router (*which is a hardware device used in networking to receive and send data in the form of packets on a network*) selects the best path to make data transfer from source to destination. A router exists in the network layer in the OSI as well as TCP/IP model. Some functions of a router are:

1. Building an optimal path on a network to reach its destination (in which static and dynamic routing take place).
2. Taking routing decisions.
3. Balancing load.

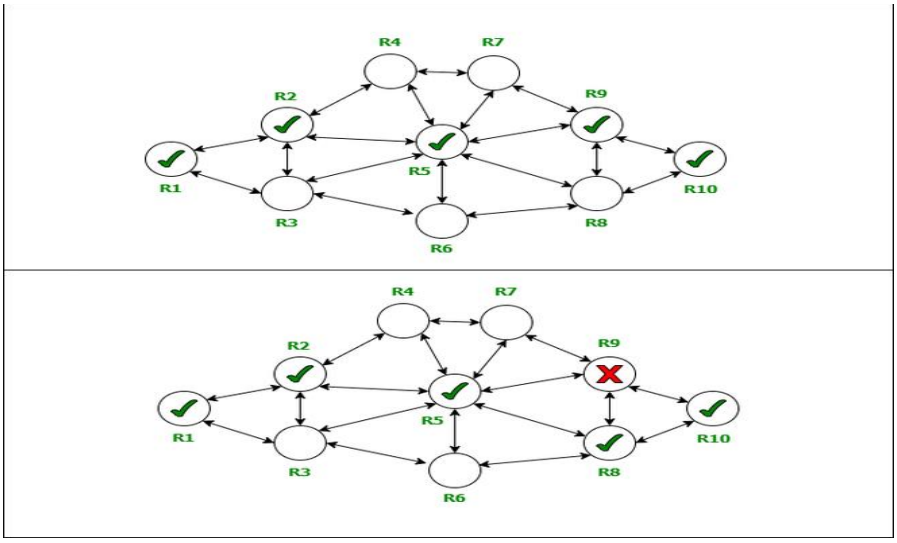
Types of Routing:

1. **Static routing**
2. **Default routing**
3. **Dynamic routing**

Dynamic Routing

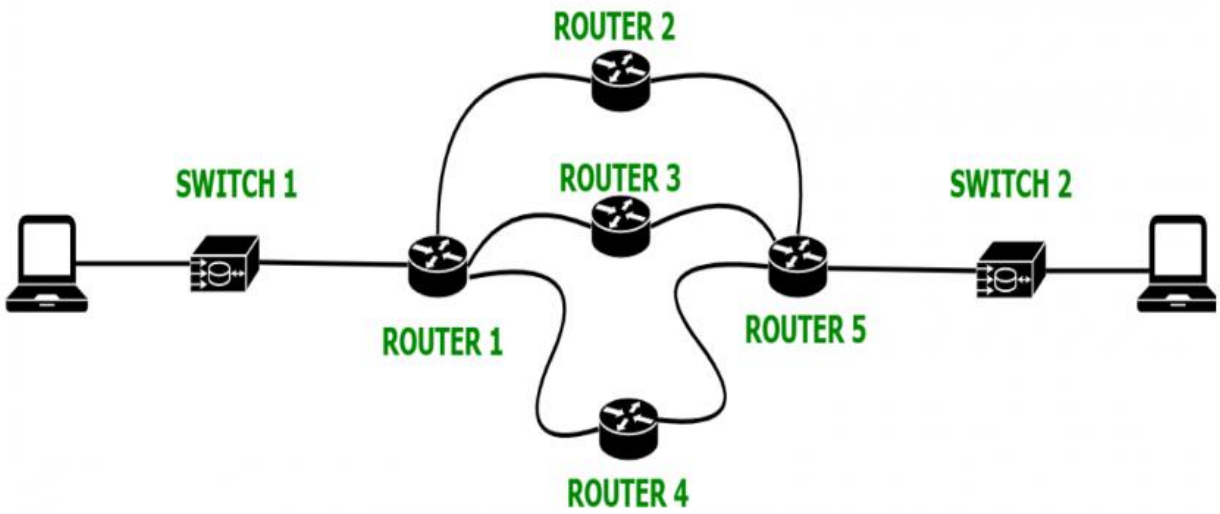
Dynamic routing is known as a technique of finding the best path for the data to travel over a network in this process a router can transmit data through various different routes and reach its destination on the basis of conditions at that time of communication circuits.

Dynamic routers are smart enough to take the best path for data based on the condition of the present scenario at that time of the network. In case one section fails in the network to transfer data forward dynamic router will use its algorithm (in which they use routing protocols to gather and share information of the current path among them) and it will re-route the previous network over another network in real-time. And this amazing capability and functionality to change paths in real-time over the network by sharing status among them is the key functionality of Dynamic Routing. OSPF (open shortest path first) and RIP are some protocols used for dynamic routing.



In the image above the upper image depicts the path *R1->R2->R5->R9->R10* to take data from **R1** (source) to **R10** (destination) but, then due to some reason **R9** fails to process its work then it dynamically builds a new path which is *R1->R2->R5->R8->R10*.
Unlike the static routers in which the admin was there to reconfigure the change in the router, here it itself changes the route and finds the best network/path.

Working of Dynamic Routing



First, A routing protocol (*a protocol that states how the information is going to share between routers and how are they going to communicate with each other to share/distribute information between nodes on a network*) must be installed in each router in the network to share information among each other.

Second, it is started manually to go to the first routing table of the router with router information, and then after that it goes on automatically with the help of a dynamic routing algorithm and dynamically forms the routing table for the rest of the routers in the network.

Third, then the routing information is exchanged among the routers so in case if the network goes down or the router fails to work and share information with its connected

routers then the routing table of each router is modified correctly to that present condition so that it never fails to deliver information to the destination.

Fourth, hosts are present to check or match the default gateway address to the IP addresses of the local router.

Purpose

Dynamic protocols were introduced to:

1. Explore every single path and choose the best path.
2. Sharing of information about the network with each other router present in the network.
3. Updating the path on its own and rerouting the best possible path.

Components

There are three main components that were used in dynamic routing:

1. Data structure (to structure information)
2. Algorithm (to construct or re-update path)
3. The routing protocol (to share information about the network)

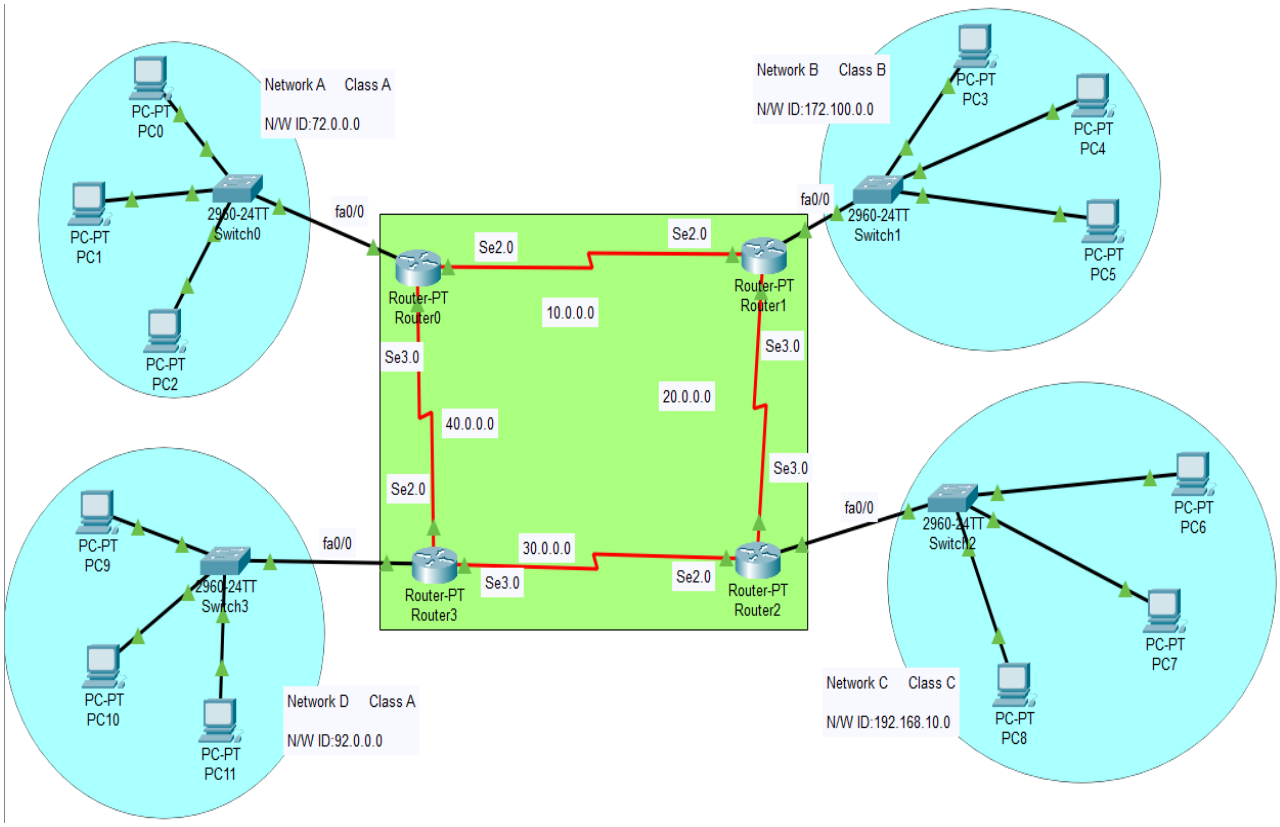
Advantages

1. Beneficial in Performance as well as scalable networking with a high frequency of data on nodes.
2. Makes fewer mistakes as it reroutes itself compared to other routing protocols.
3. No need to be manually configured by the admin.
4. Shares information about the network with each other makes them more reliable to work efficiently.

Disadvantages

1. Requires more heavy and reliable powerful hardware.
2. Higher maintenance compared to static protocol

Procedure:



In the above network diagram, we have 4 networks A, B, C, D with 72.0.0.0, 172.100.0.0, 192.168.10.0, 92.0.0.0 respectively.

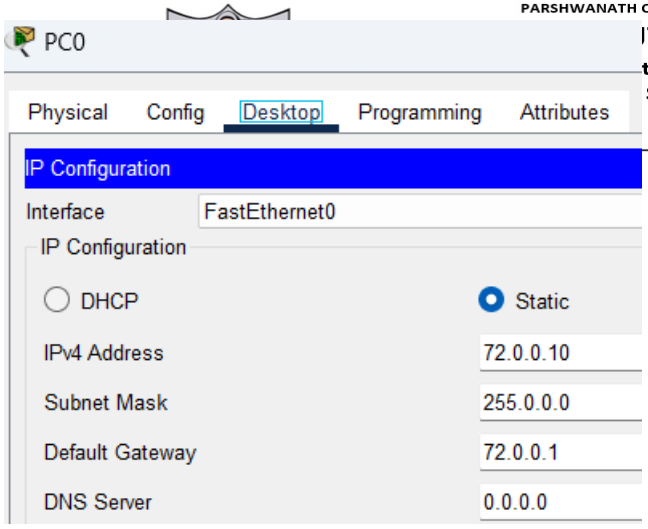
PC 0 to PC 9 are computers (end devices) in this network.

Router 0 to Router 3 are routers in this network.

Black strong lines are Copper Straight-Through cables which use to connect different types of devices.

Red color lines are Serial DCE cables which are building the connection between two routers.

STEP 1: NETWORK CONFIGURATION



Assign IP address to PCs

Double click **PC0** and click **Desktop** menu item and click **IP Configuration**. Assign IP address 72.0.0.10/8 to PC0.

Repeat the same process to assign IP address to all other PCs of all networks.

Device	Interface	IP Configuration	Gateway	Switch	Connected with
PC0	Fast Ethernet0	72.0.0.10/8	72.0.0.1	Switch0	Router0's Fa0/0
PC1	Fast Ethernet0	72.0.0.11/8	72.0.0.1	Switch0	Router0's Fa0/0
PC2	Fast Ethernet0	72.0.0.12/8	72.0.0.1	Switch0	Router0's Fa0/0
PC3	Fast Ethernet0	172.100.0.10/8	172.100.0.1	Switch1	Router1's Fa0/0
PC4	Fast Ethernet0	172.100.0.11/8	172.100.0.1	Switch1	Router1's Fa0/0
PC5	Fast Ethernet0	172.100.0.12/8	172.100.0.1	Switch1	Router1's Fa0/0
PC6	Fast Ethernet0	192.18.10.10/8	192.18.10.1	Switch2	Router2's Fa0/0
PC7	Fast Ethernet0	192.18.10.11/8	192.18.10.1	Switch2	Router2's Fa0/0
PC8	Fast Ethernet0	192.18.10.12/8	192.18.10.1	Switch2	Router2's Fa0/0
PC9	Fast Ethernet0	92.0.0.10/8	92.0.0.1	Switch3	Router3's Fa0/0
PC10	Fast Ethernet0	92.0.0.11/8	92.0.0.1	Switch3	Router3's Fa0/0
PC11	Fast Ethernet0	92.0.0.12/8	92.0.0.1	Switch3	Router3's Fa0/0

STEP 2: ROUTER CONFIGURATION

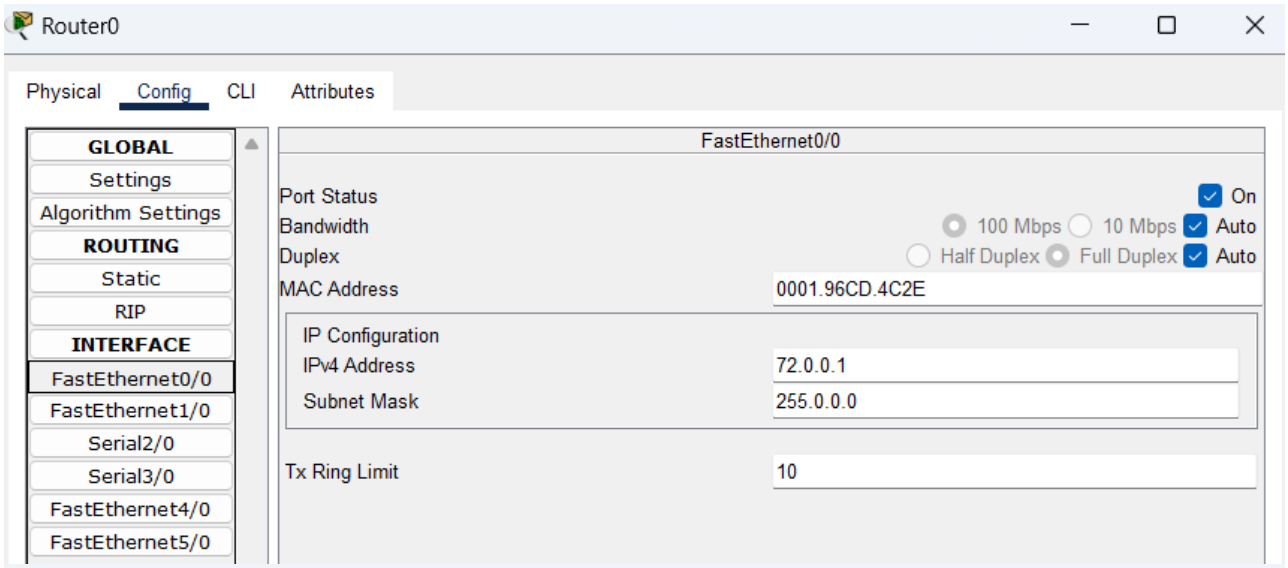
Router 0

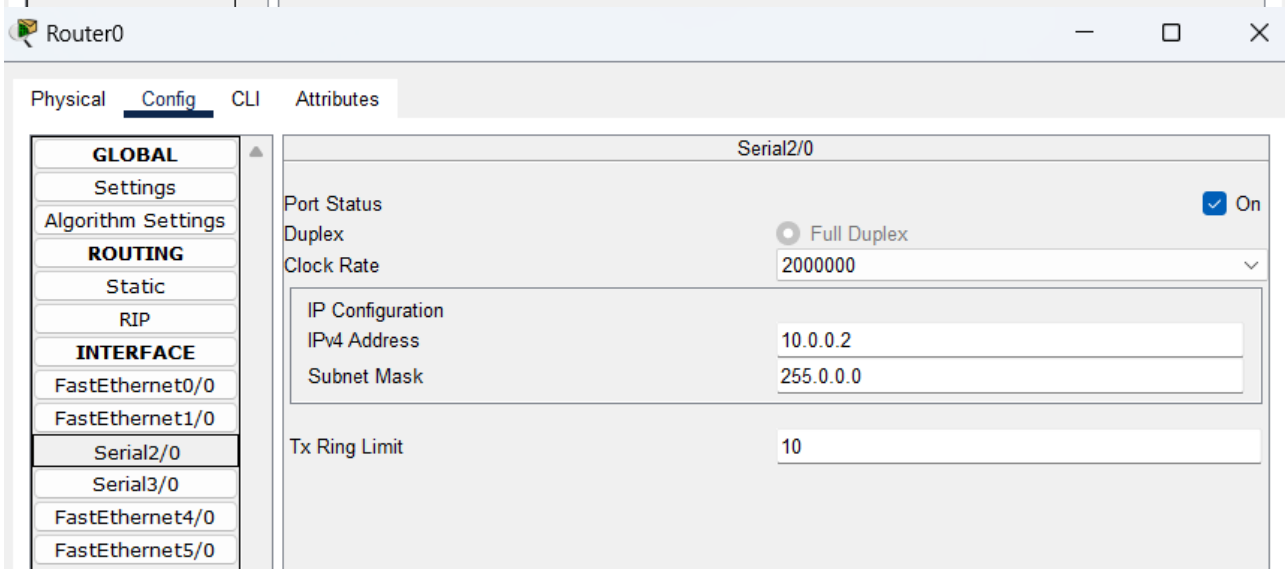
Device	Interface	IP Configuration	Switch	Connected with
Router0	Fa0/0	72.0.0.1/8	Switch0	N/W A's Fa0/0
Router0	Se2/0	10.0.0.2/8	--	Router1's Se2/0
Router0	Se3/0	40.0.0.2/8	--	Router3's Se2/0

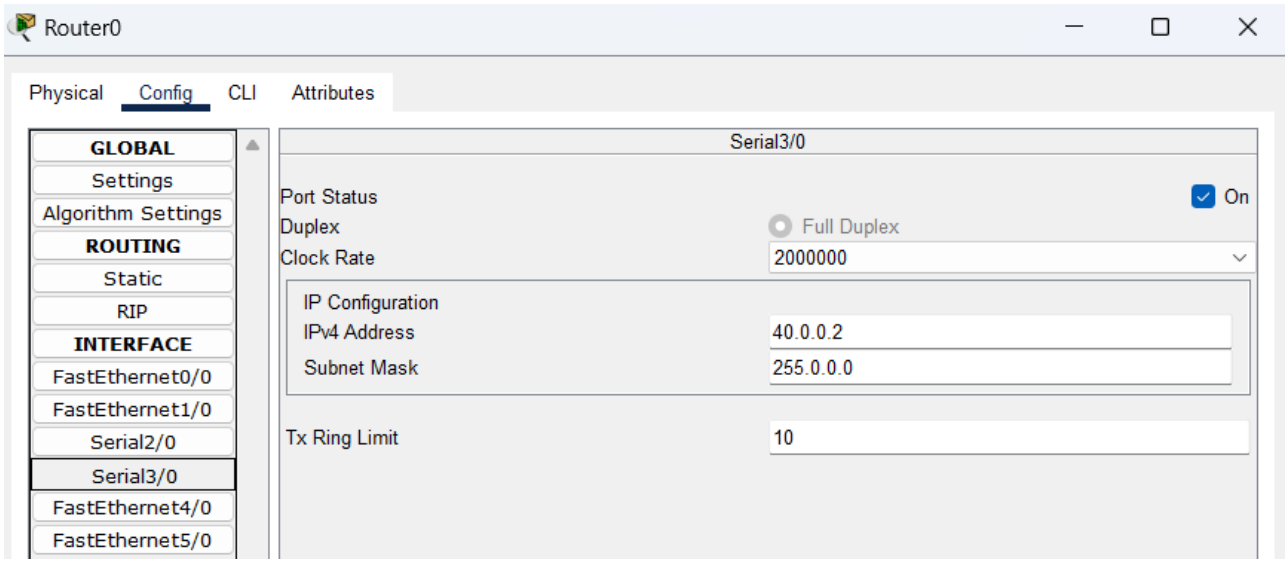
```
Device Name: Router0
Device Model: Router-PT
Hostname: Router

Port              Link   IP Address        IPv6 Address                            MAC Address
FastEthernet0/0   Up     72.0.0.1/8        <not set>                               0001.96CD.4C2E
FastEthernet1/0   Down   <not set>         <not set>                               0050.0F75.B717
Serial2/0         Up     10.0.0.2/8        <not set>                               <not set>
Serial3/0         Up     40.0.0.2/8        <not set>                               <not set>
FastEthernet4/0   Down   <not set>         <not set>                               0005.5E32.EA36
FastEthernet5/0   Down   <not set>         <not set>                               0050.0F76.A470

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > Router0
```





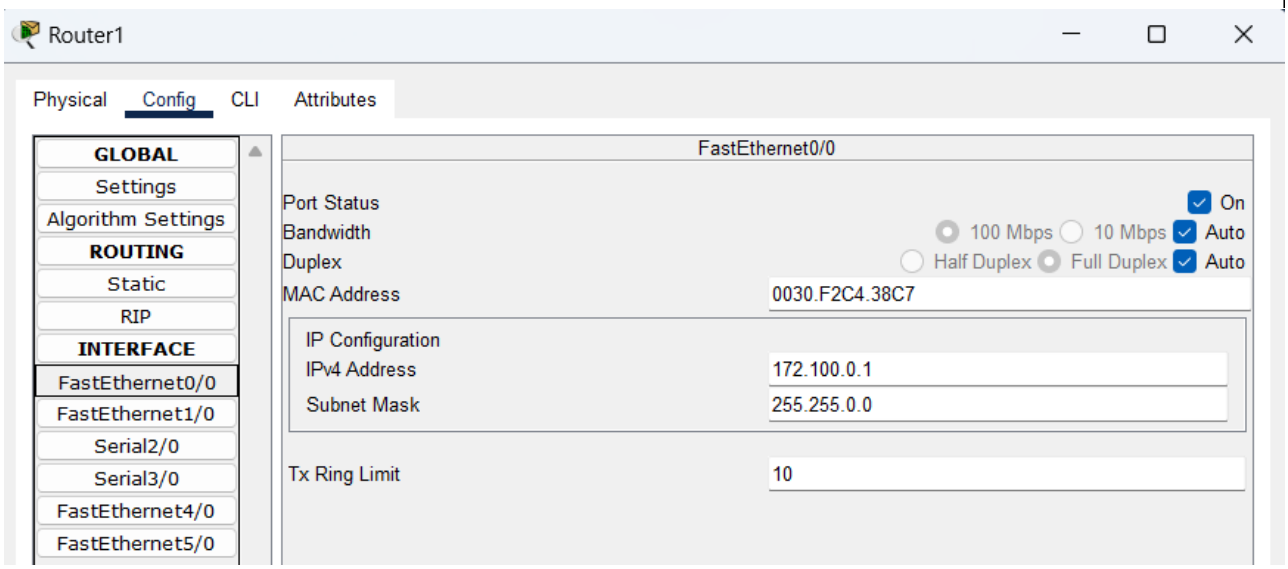


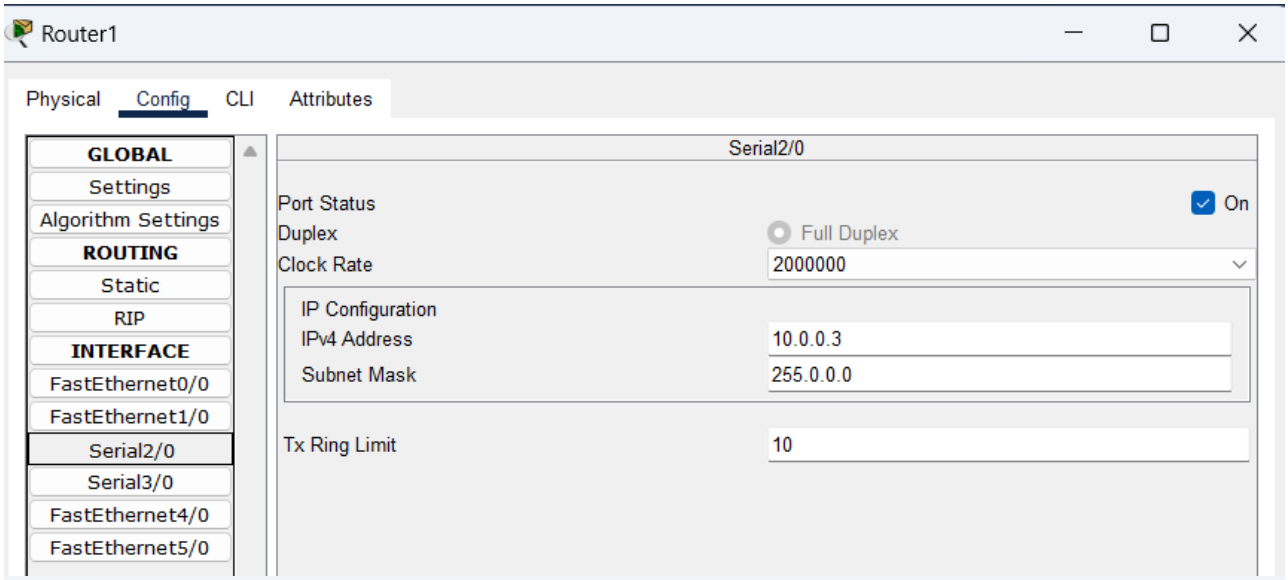
Router 1

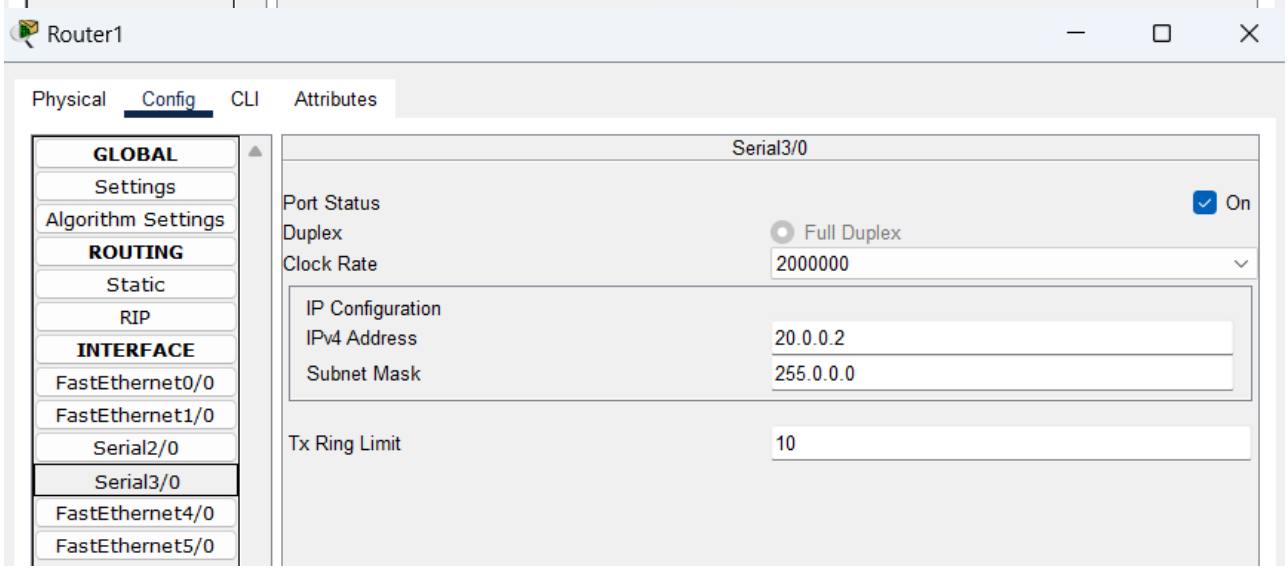
Device	Interface	IP Configuration	Switch	Connected with
Router1	Fa0/0	172.100.0.1/8	Switch1	N/W B's Fa0/0
Router1	Se2/0	10.0.0.3/8	--	Router0's Se2/0
Router1	Se3/0	20.0.0.2/8	--	Router2's Se3/0

```
Device Name: Router1
Device Model: Router-PT
Hostname: Router

Port            Link   IP Address       IPv6 Address                            MAC Address
FastEthernet0/0 Up     172.100.0.1/16   <not set>                               0030.F2C4.38C7
FastEthernet1/0 Down   <not set>        <not set>                               0001.C9B2.73A8
Serial2/0       Up     10.0.0.3/8       <not set>                               <not set>
Serial3/0       Up     20.0.0.2/8       <not set>                               <not set>
FastEthernet4/0 Down   <not set>        <not set>                               00E0.F975.5982
FastEthernet5/0 Down   <not set>        <not set>                               00D0.5800.0208
```





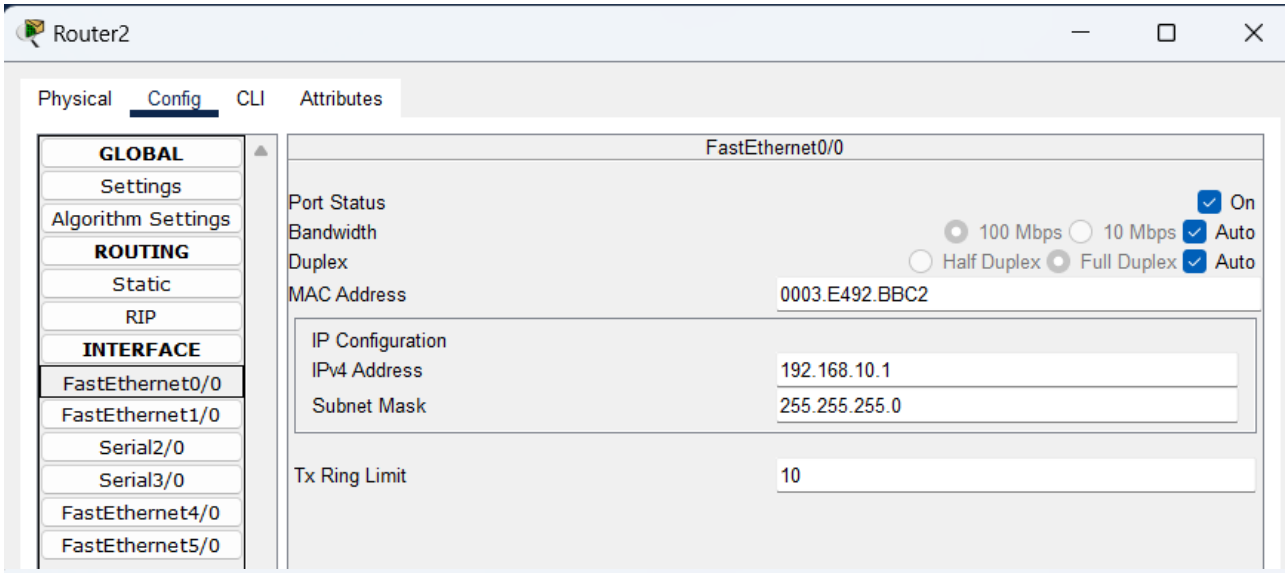


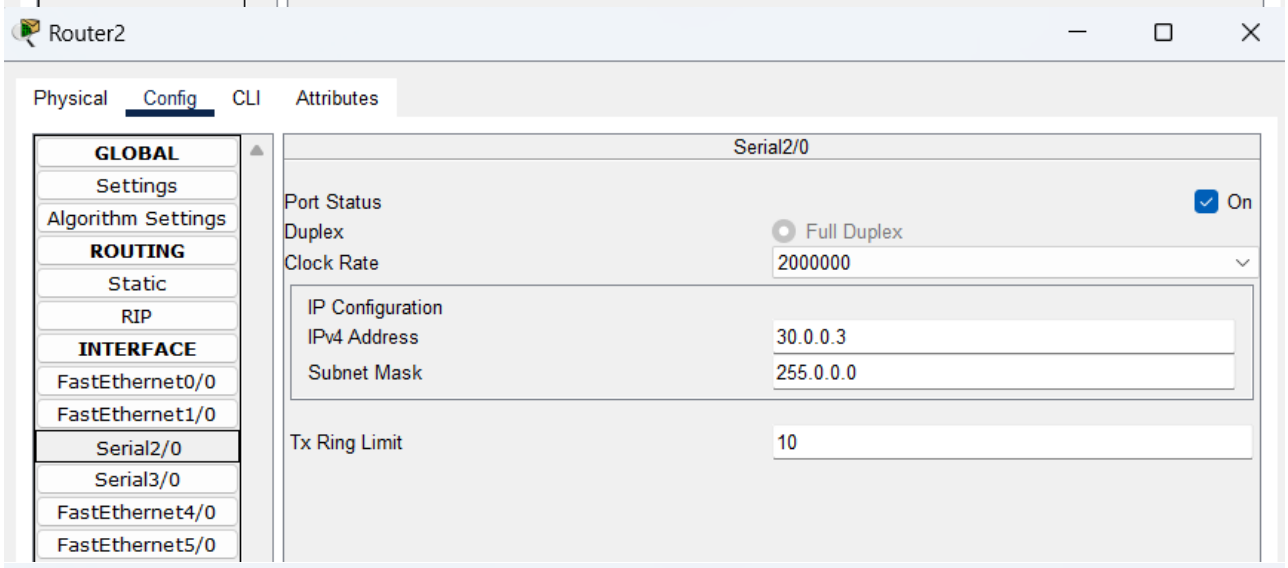
Router 2

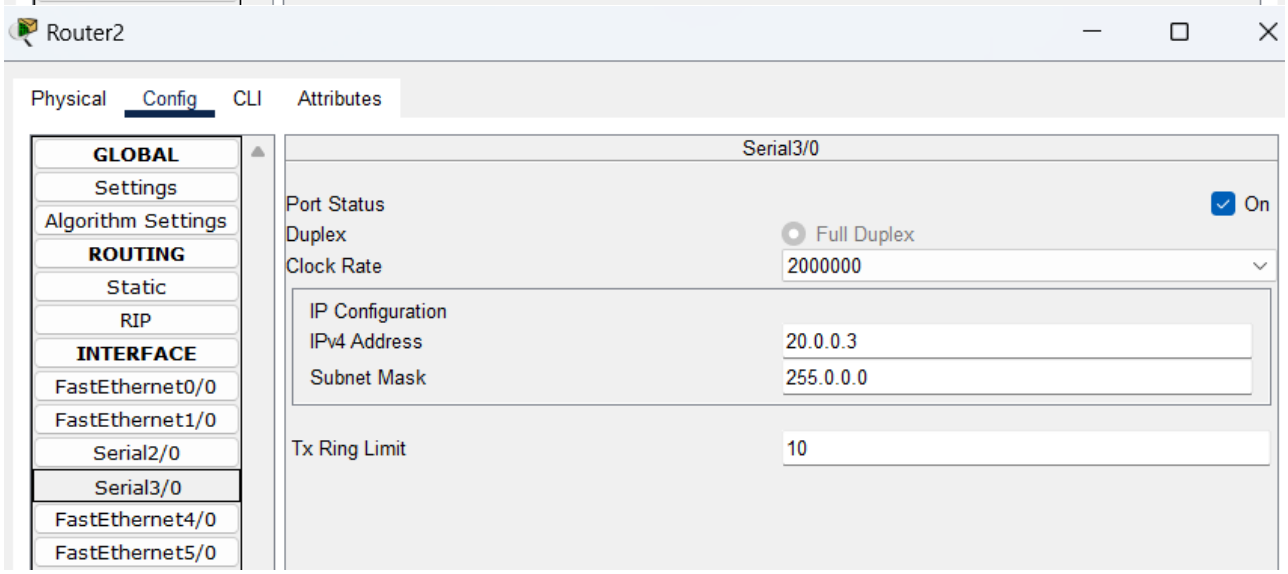
Device	Interface	IP Configuration	Switch	Connected with
Router2	Fa0/0	192.18.10.1/8	Switch2	N/W C's Fa0/0
Router2	Se2/0	30.0.0.3/8	--	Router3's Se3/0
Router2	Se3/0	20.0.0.3/8	--	Router1's Se3/0

```
Device Name: Router2
Device Model: Router-PT
Hostname: Router

Port              Link   IP Address        IPv6 Address                            MAC Address
FastEthernet0/0   Up     192.168.10.1/24   <not set>                               0003.E492.BBC2
FastEthernet1/0   Down   <not set>         <not set>                               000A.F343.2A2C
Serial2/0         Up     30.0.0.3/8        <not set>                               <not set>
Serial3/0         Up     20.0.0.3/8        <not set>                               <not set>
FastEthernet4/0   Down   <not set>         <not set>                               0050.0F89.B3A9
FastEthernet5/0   Down   <not set>         <not set>                               0060.47B5.EB8A
```


Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0003.E492.BBC2
IP Configuration
IPv4 Address
192.168.10.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10


Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
30.0.0.3
Subnet Mask
255.0.0.0
Tx Ring Limit
10

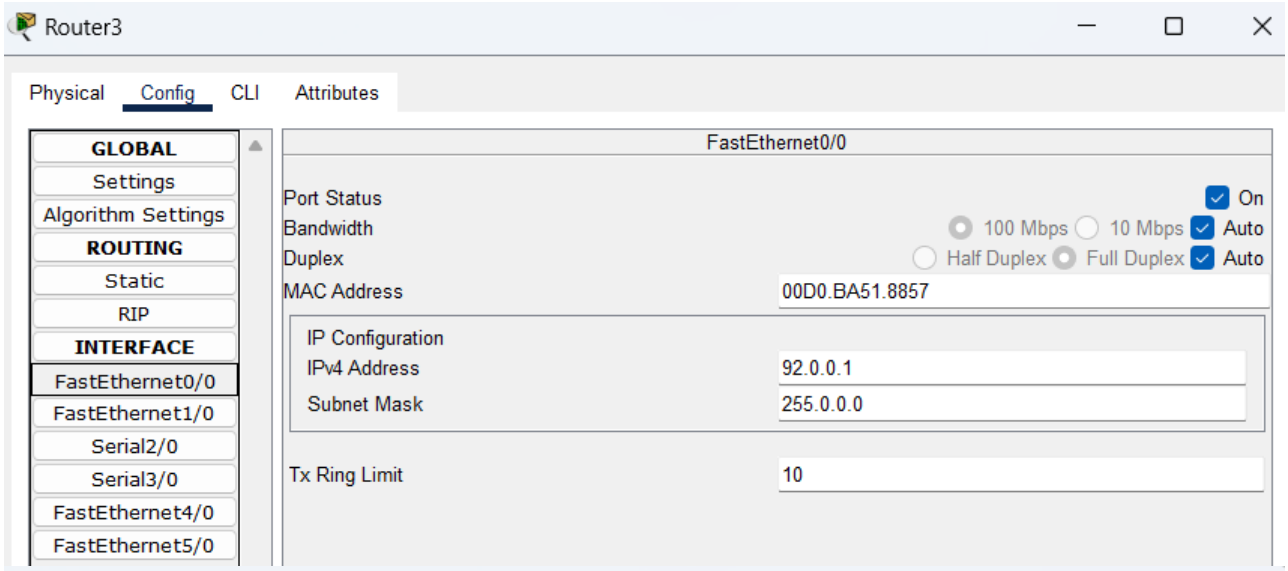

Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
On
Duplex
Full Duplex
Clock Rate
2000000
IP Configuration
IPv4 Address
20.0.0.3
Subnet Mask
255.0.0.0
Tx Ring Limit
10

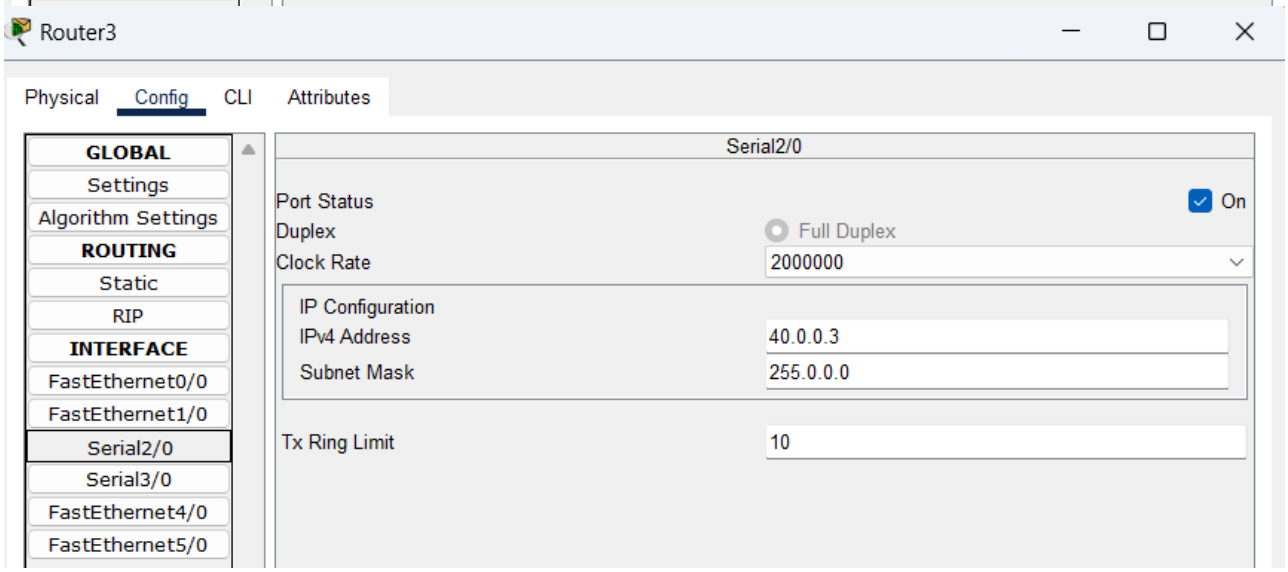
Router 3

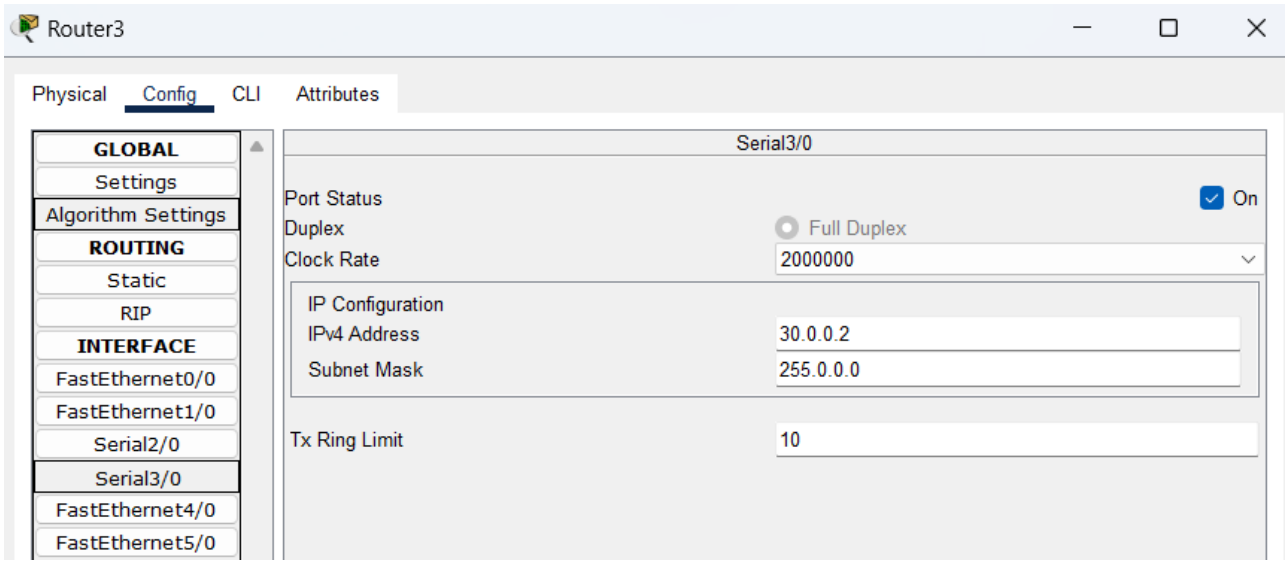
Device	Interface	IP Configuration	Switch	Connected with
Router3	Fa0/0	92.0.0.1/8	Switch3	N/W D's Fa0/0
Router3	Se2/0	40.0.0.3/8	--	Router0's Se3/0
Router3	Se3/0	30.0.02/8	--	Router2's Se2/0

```
Device Name: Router3
Device Model: Router-PT
Hostname: Router

Port              Link   IP Address      IPv6 Address                            MAC Address
FastEthernet0/0   Up     92.0.0.1/8      <not set>                               00D0.BA51.8857
FastEthernet1/0   Down   <not set>       <not set>                               0004.9AC9.4AD1
Serial2/0         Up     40.0.0.3/8      <not set>                               <not set>
Serial3/0         Up     30.0.0.2/8      <not set>                               <not set>
FastEthernet4/0   Down   <not set>       <not set>                               00D0.97C7.3460
FastEthernet5/0   Down   <not set>       <not set>                               00D0.9735.C3B7
```







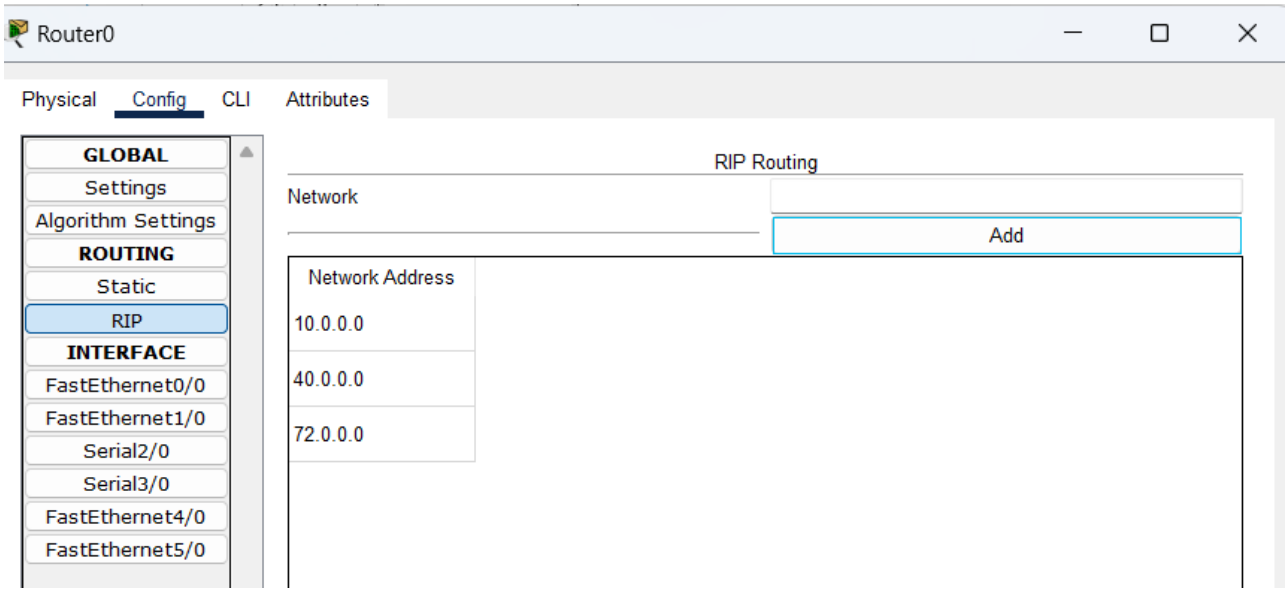
STEP 3: CONFIGURING RIP ROUTING PROTOCOL

Configuration of RIP protocol is much easier than you think. It requires only two steps to configure the RIP routing.

- Enable RIP routing protocol from global configuration mode.
- Tell RIP routing protocol which networks you want to advertise.

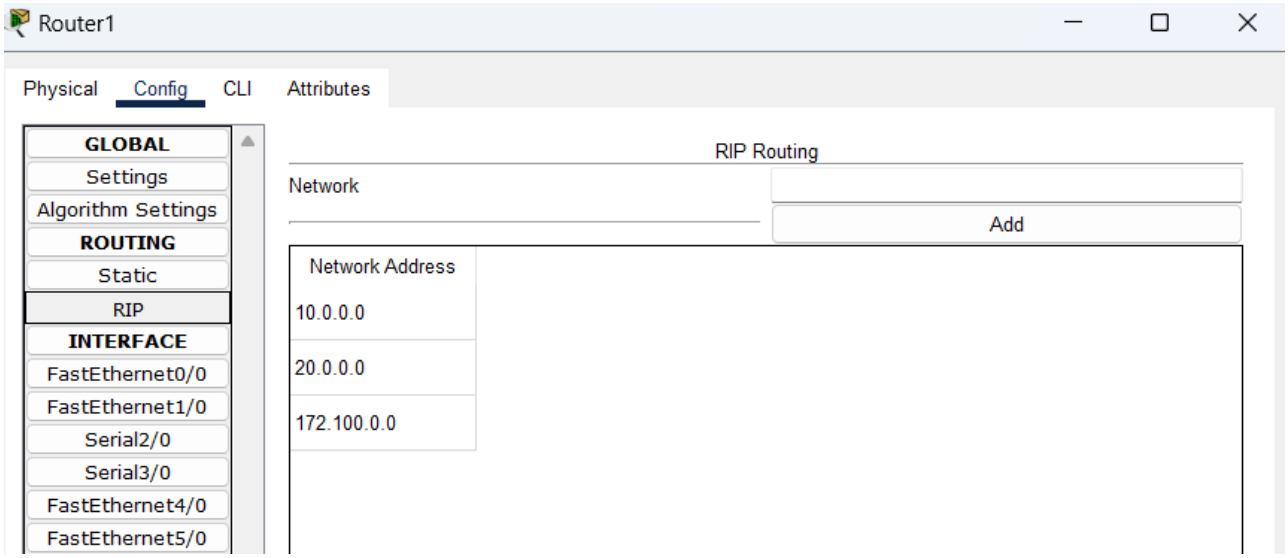
Let's configure it in **Router0**

```
Router0(config)#router rip
Router0(config-router)# network 10.0.0.0
Router0(config-router)# network 40.0.0.0
Router0(config-router)# network 72.0.0.0
```



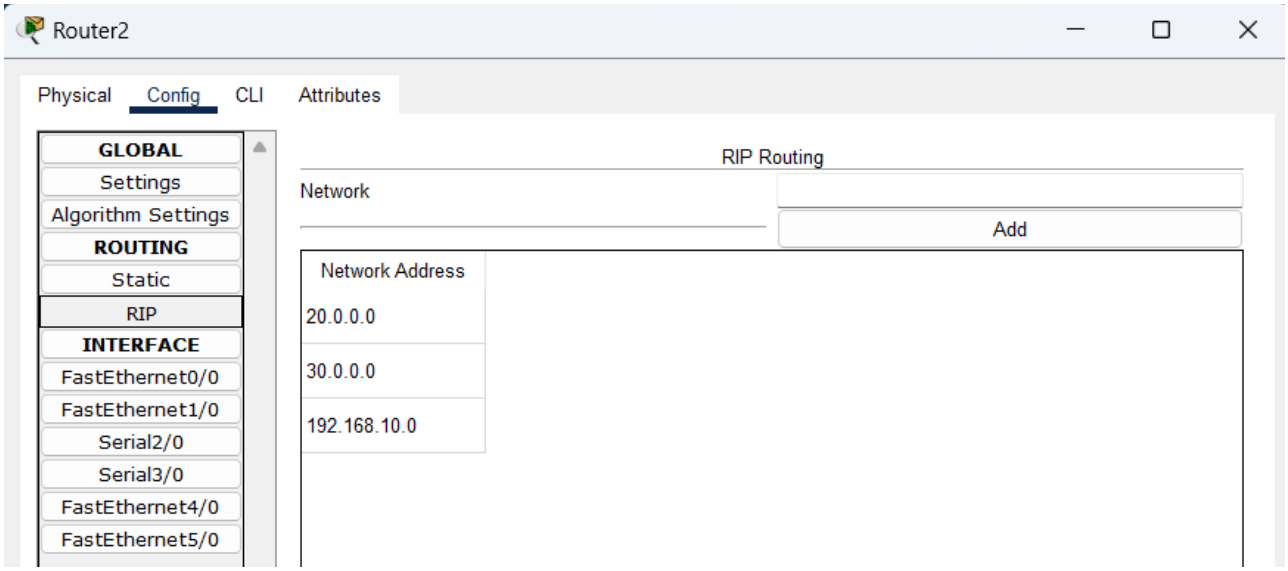
Router1

```
Router1(config)#router rip
Router1(config-router)# network 10.0.0.0
Router1(config-router)# network 20.0.0.0
Router1(config-router)# network 172.100.0.0
```



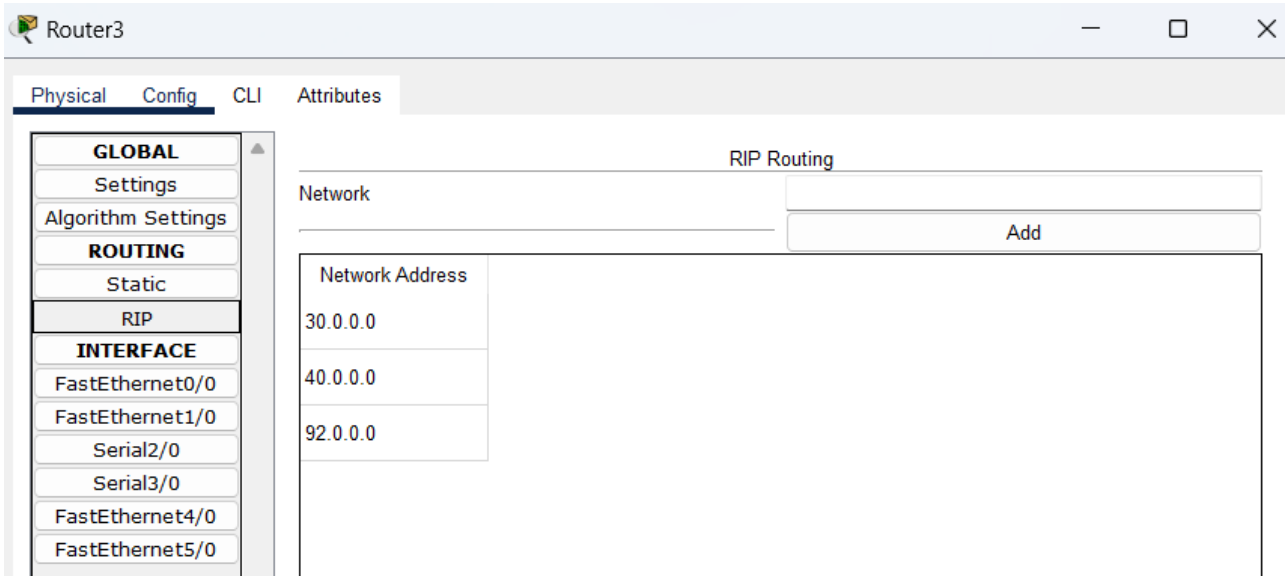
Router2

```
Router2(config)#router rip
Router2(config-router)# network 20.0.0.0
Router2(config-router)# network 30.0.0.0
Router2(config-router)# network 192.168.10.0
```



Router3

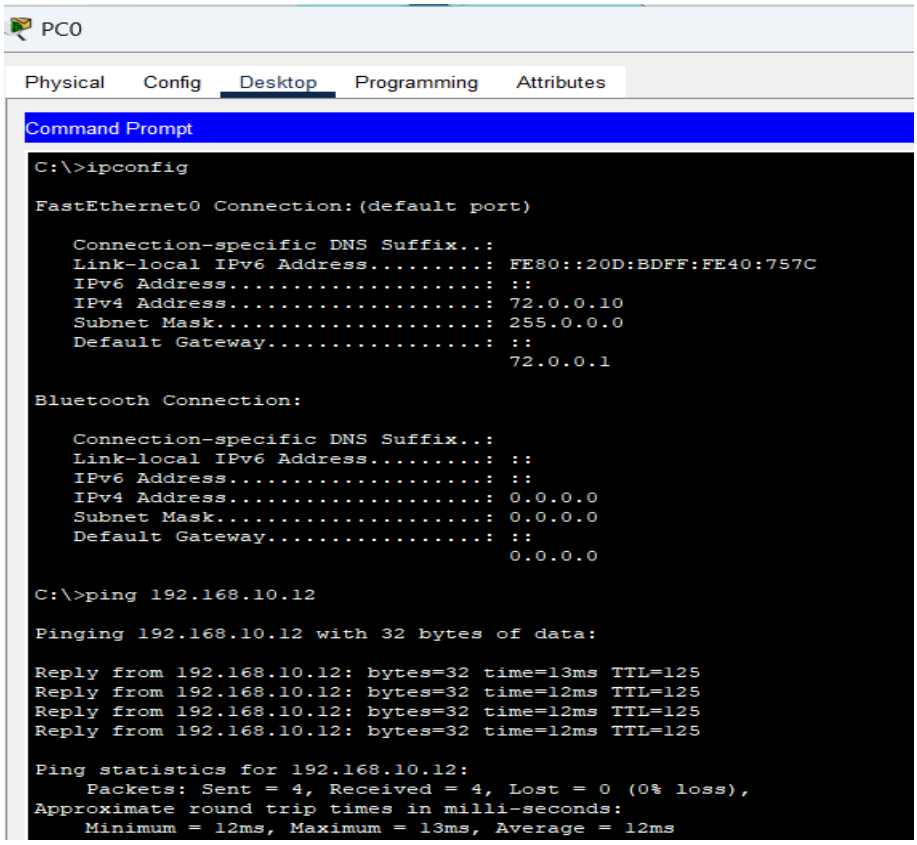
```
Router3(config)#router rip
Router3(config-router)# network 30.0.0.0
Router3(config-router)# network 40.0.0.0
Router3(config-router)# network 92.0.0.0
```



That's it. Our network is ready to take the advantage of RIP routing. To verify the setup, we will use ping command. ping command is used to test the connectivity between two devices.

STEP 4: DATA TRANSMISSION

Access the command prompt of **PC8** and use *ping* command to test the connectivity from **PC0**.


PC0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
C:\>ipconfig
FastEthernet0 Connection:(default port)
Connection-specific DNS Suffix..:
Link-local IPv6 Address.....: FE80::20D:BDFF:FE40:757C
IPv6 Address.....: ::
IPv4 Address.....: 72.0.0.10
Subnet Mask.....: 255.0.0.0
Default Gateway.....: ::
72.0.0.1
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:\>ping 192.168.10.12
Pinging 192.168.10.12 with 32 bytes of data:
Reply from 192.168.10.12: bytes=32 time=13ms TTL=125
Reply from 192.168.10.12: bytes=32 time=12ms TTL=125
Reply from 192.168.10.12: bytes=32 time=12ms TTL=125
Reply from 192.168.10.12: bytes=32 time=12ms TTL=125
Ping statistics for 192.168.10.12:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 12ms, Maximum = 13ms, Average = 12ms

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.001	PC0	Switch0	ICMP
	0.002	Switch0	Router0	ICMP
	0.003	Router0	Router1	ICMP
	0.004	Router1	Router2	ICMP
	0.005	Router2	Switch2	ICMP
	0.006	Switch2	PC8	ICMP
	0.007	PC8	Switch2	ICMP
	0.008	Switch2	Router2	ICMP
	0.009	Router2	Router3	ICMP
	0.010	Router3	Router0	ICMP
	0.011	Router0	Switch0	ICMP
	0.012	Switch0	PC0	ICMP

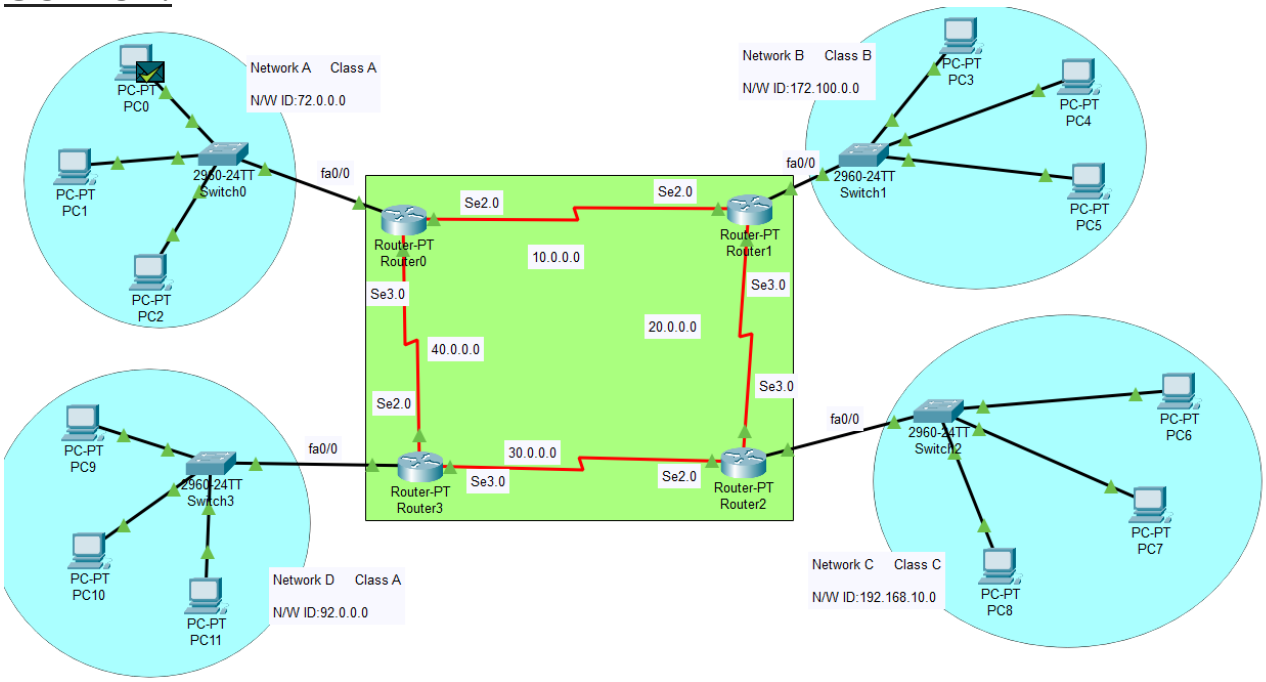
Reset Simulation | Constant Delay | Captured to: 224.419 s

Play Controls

Event List Filters - Visible Events
ICMP

Edit Filters | Show All/None

OUTPUT:



CONCLUSION:

We have successfully designed and simulated the environment for Dynamic routing by implementing RIP routing in our network using Cisco packet tracer.