Lab 9: Implementation of Dynamic interior/ Exterior Routing (RIP, OSPF, BGP)

Theory

a. **Dynamic Interior Routing / Exterior Routing**

Dynamic routing automates the process of routing data across networks by using protocols that adapt to changes in the network topology. Interior routing protocols (like RIP and OSPF) operate within a single organization, while exterior routing protocols (like BGP) manage routing between different organizations or large networks.

b. RIP, OSPF, BGP

- **RIP (Routing Information Protocol):** A distance-vector protocol that uses hop count as a routing metric. It's simple but limited due to its max hop count of 15.
- **OSPF (Open Shortest Path First):** A link-state protocol that uses Dijkstra's algorithm to calculate the shortest path based on the state of the network.
- **BGP (Border Gateway Protocol):** An exterior routing protocol used to exchange routing information between autonomous systems (AS). It's the protocol that keeps the internet functioning.

c. Network Diagram

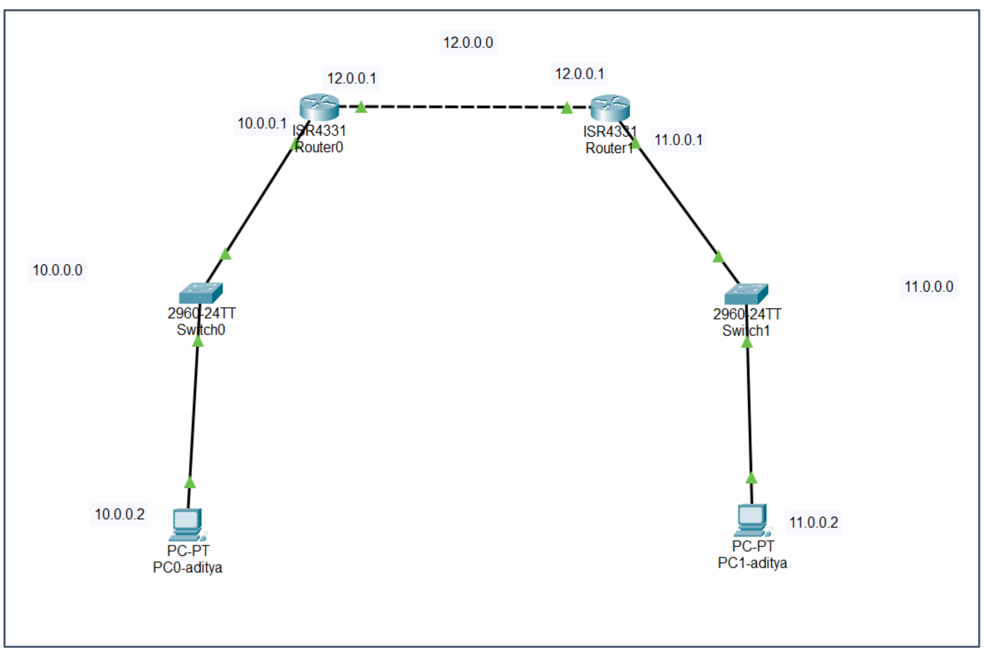


Fig: connection of different network using router

Implementation Sequence

Here is the implementation sequence for Implementation of Dynamic Interior/ Exterior Routing (RIP, OSPF, BGP).

i. Configuring Network

1. **Open cisco packet tracer and connect the devices.**

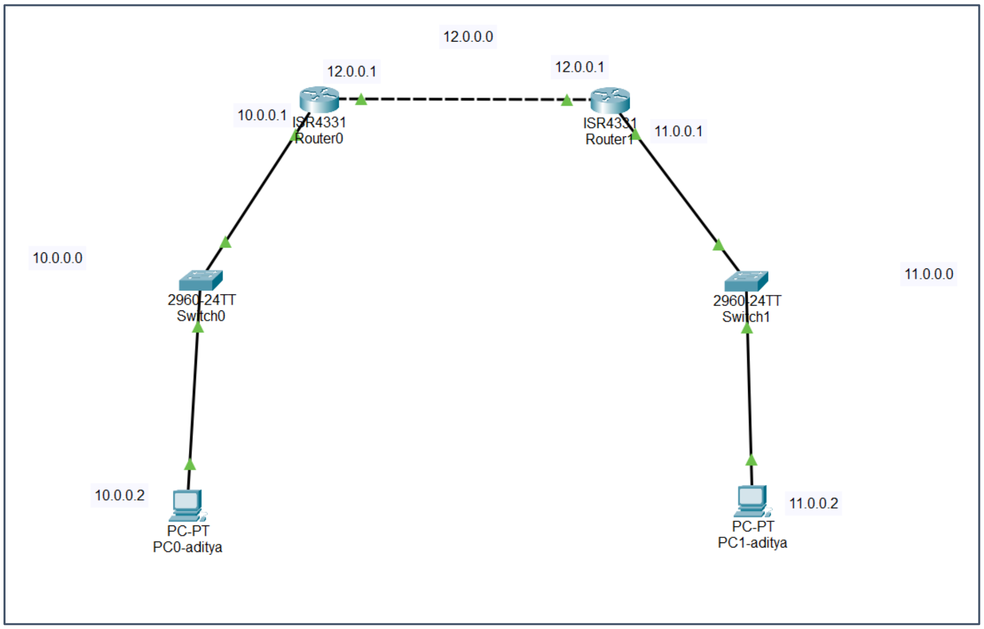


Fig: setting up a network in packet tracer

2. **Now configuring Ip addresses on the pc**

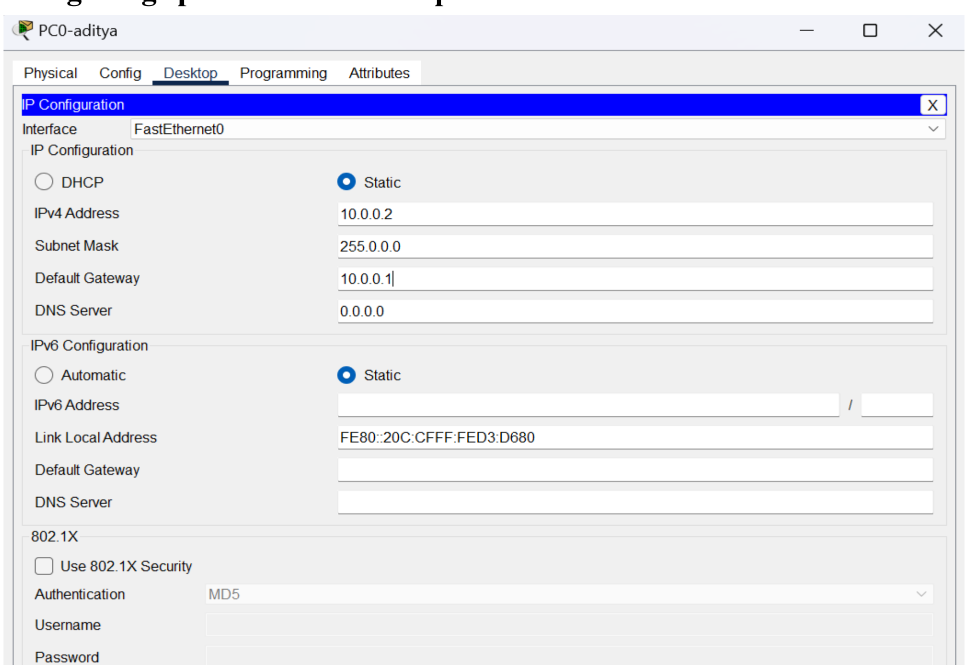


Fig: Setting up Ip and default gateway on pcs

3. **Now configuring the gigabit ethernet connections.**

   To configure the gigabit ethernet connection enter the given command on the routers CLI.

   Router>en

   Router #conf t

   Router(config)#interface gig0/0/1

   Router(config-if) #ip address 10.0.0.1 255.0.0.0

   Router(config-if) #no shutdown

   Router(config-if) #interface gig0/0/0

   Router(config-if) #ip address 12.0.0.1 255.0.0.0

   Router(config-if) #no shutdown

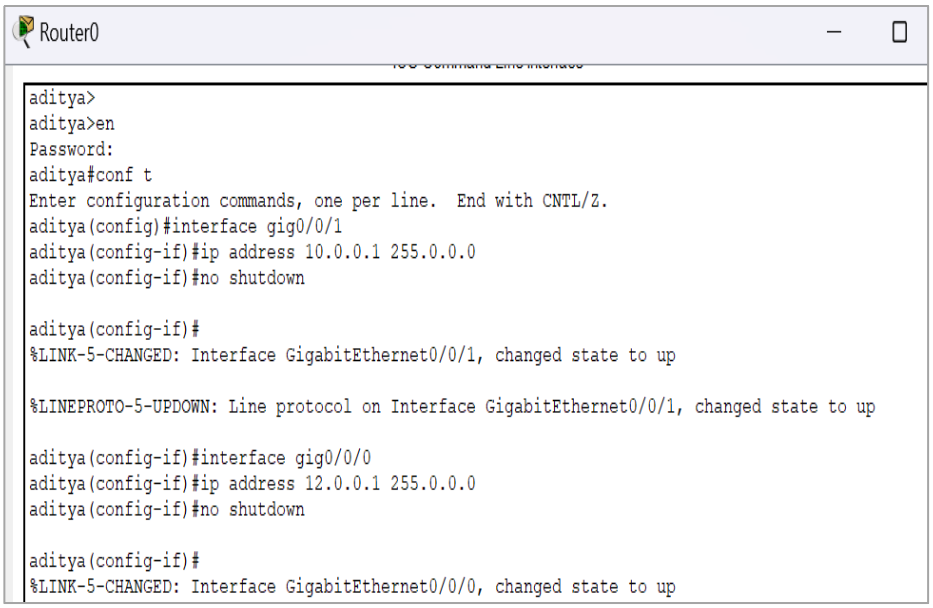


Fig: Configuring gigabit Ethernet

ii. Implementation & Explain the Need for Dynamic Routing:

Implementation of Dynamic Routing Dynamic routing protocols, such as RIP, OSPF, and BGP, are used to enable routers to automatically exchange and update routing information based on changes in the network. The implementation process involves:

Network Configuration: Set up our network by configuring routers and PCs, and assign IP addresses to each device.

Dynamic Routing Setup: Enable the chosen dynamic routing protocol (RIP, OSPF, or BGP) on each router. This allows routers to automatically share and update routing information.

Testing: Use tools like ping to verify that the network configuration is correct and that connectivity is established across the routers.

Need for Dynamic

Routing Dynamic routing is crucial for modern networks due to the following reasons:

Automatic Route Updates: As network conditions change—such as when links fail or new devices are added—dynamic routing protocols automatically update the routing tables. This keeps the network connected without requiring manual adjustments.

Scalability: In large or rapidly changing networks, manually configuring static routes can be impractical. Dynamic routing protocols handle the growth of the network efficiently, making it easier to scale.

Efficient Path Selection: Dynamic protocols continuously evaluate network conditions and choose the best path for data. This helps in optimizing performance and reducing delays.

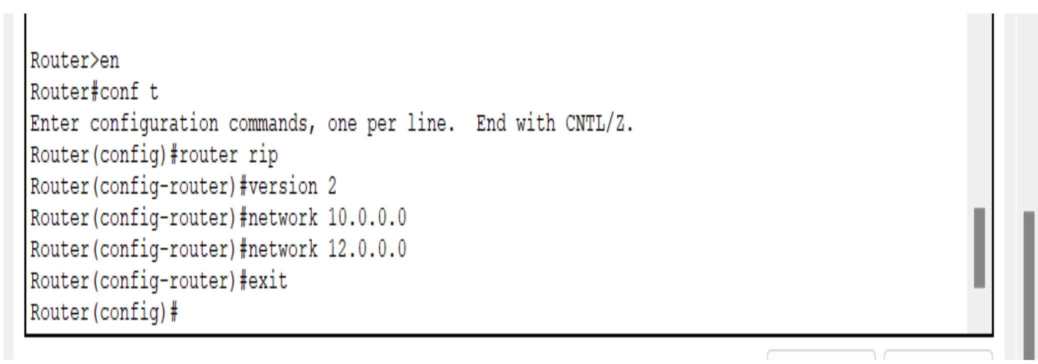
Redundancy and Fault Tolerance: These protocols improve network reliability by quickly adapting to failures and rerouting traffic through alternative paths, minimizing downtime.

Improve Load Balancing: Dynamic routing protocols can distribute network traffic evenly across multiple paths. This load balancing ensures that no single path is overloaded, enhancing overall network efficiency and performance.

Dynamic Routing Configuration

Using RIP Command

1. **Open the router's CLI and run the following commands on both routers.**
   Router>en
   Router #conf t
   Router(config) #router rip
   Router(config-router) #10.0.0.0
   Router(config-router) #12.0.0.0



Fig; Router configuration using rip command

2. **Testing and validation**

Now testing the connection established by pinging the nodes on different network and checking if there is any response.

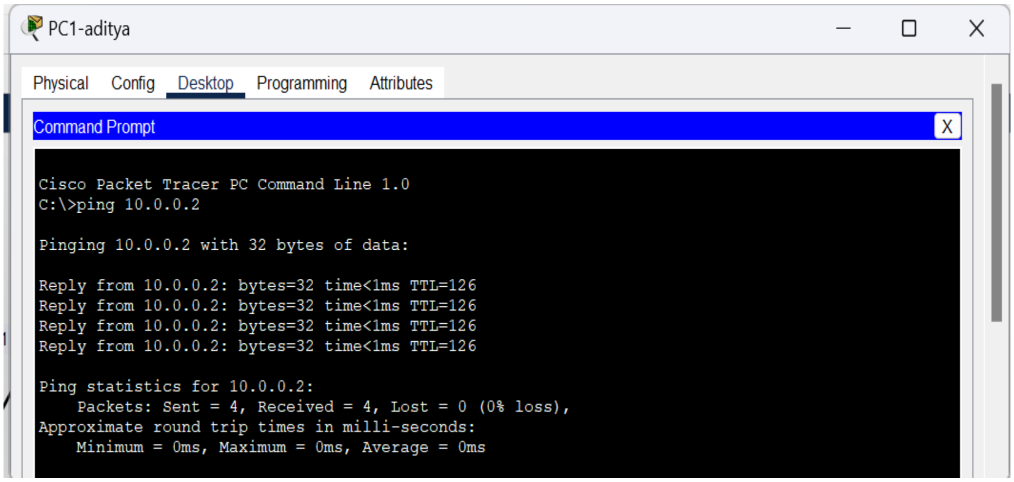


Fig: Pinging node in different network

Above figure shows the results of a ping test between two PCs on a network. The ping test was successful, indicating that there is connectivity between the two devices. The output of the ping test shows the number of packets sent, received, and lost, as well as the approximate round trip time for each packet.

Using OSPF Command

Network Diagram

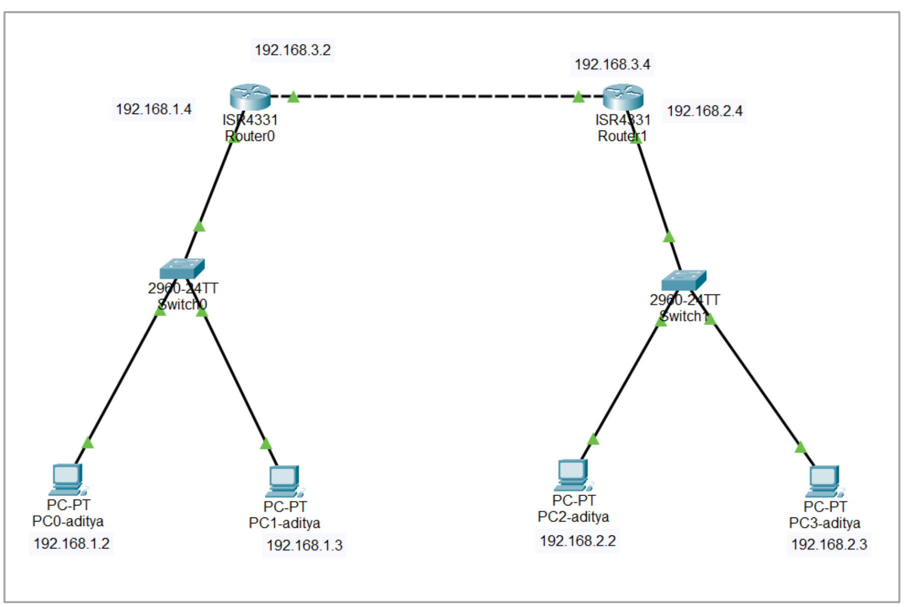


Fig: Network Diagram

1. **Open routers CLI and enter following commands.**

    Router #conf t
    Router(config) #router ospf 1
    Router(config-router) #network 192.168.1.0 0.0.0.255 area 0
    Router(config-router) # network 192.168.3.0 0.0.0.255 area 0

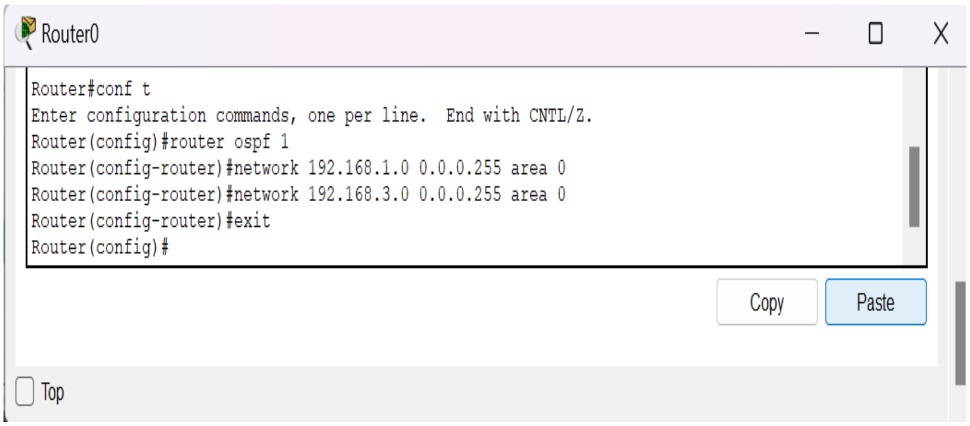


Fig: OSPF configuration in router

2. **Testing and validation**
    Now test the connection established by pinging node in different network and checking if any reply comes from the node.

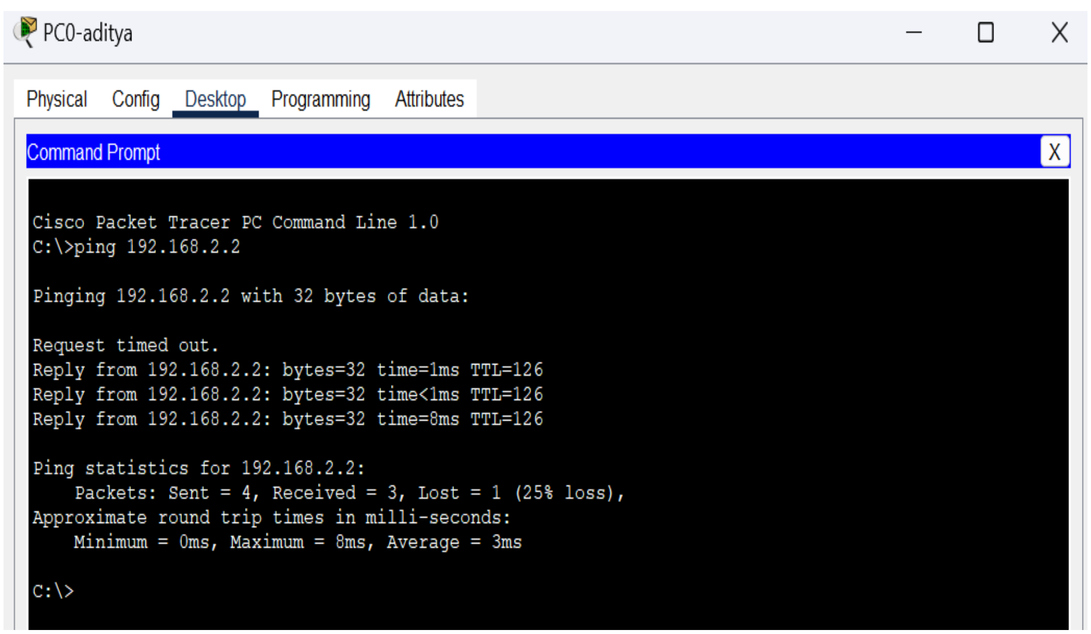


Fig: testing connection of network

As we can see we are getting reply from the targeted node i.e. connection has been successfully established between two networks using ospf protocol.

Using BGP command

Network Diagram

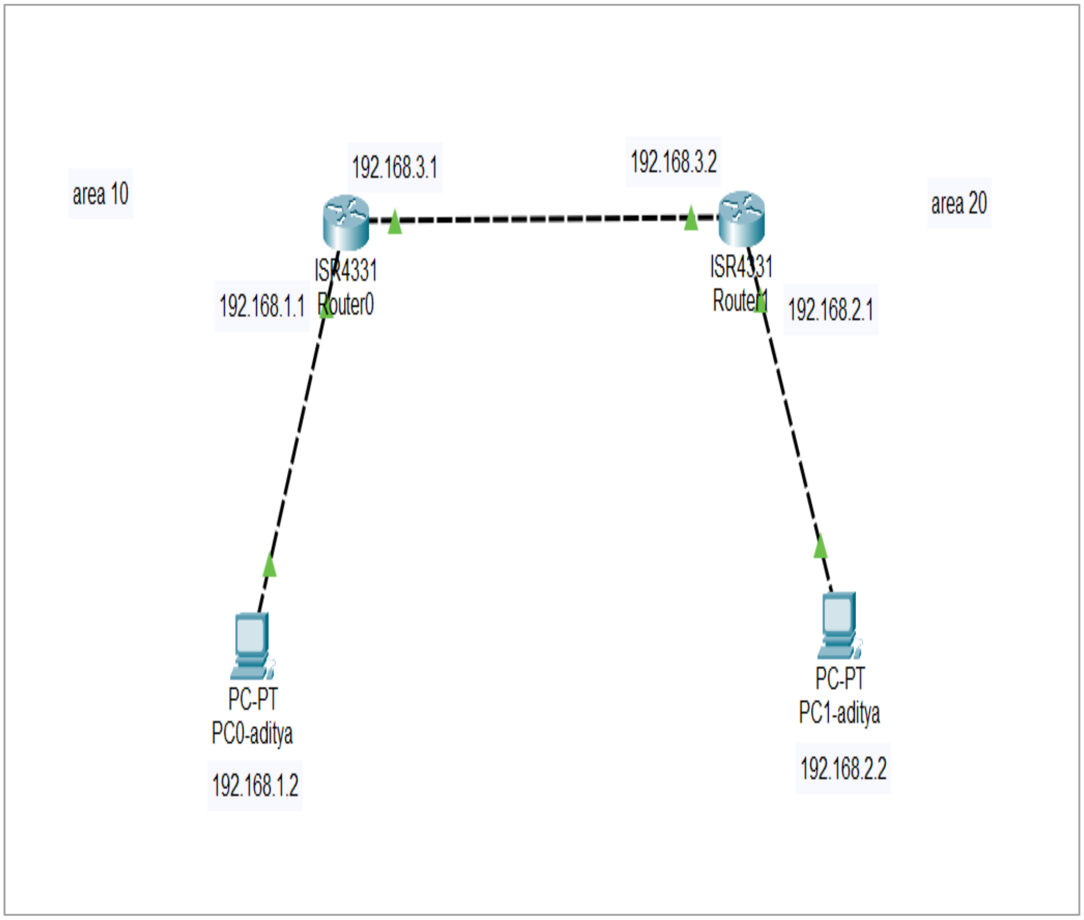


Fig: Network Diagram

1. Open router's CLI and run the following commands.

Router#conf t

Router(config)#router bgp 20

Router(config-router) #network 192.168.2.0

Router(config-router) #network 192.168.3.0

Router(config-router) #network 192.168.1.0

Router(config-router) #neighbor 192.168.3.1 remote-as 10

Router(config-router) #neighbor 192.168.1.1 remote-as 10

Router(config-router) #end

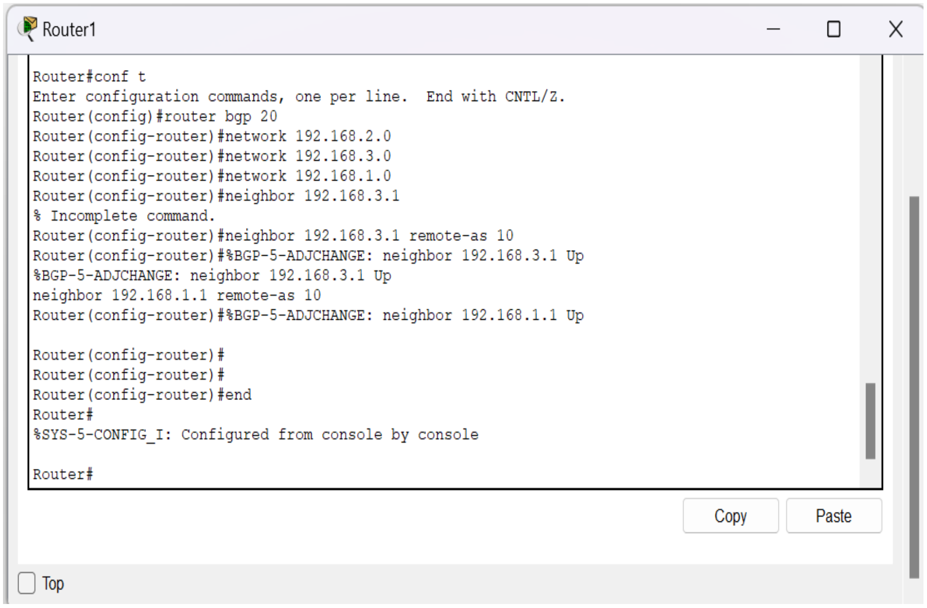


Fig: BGP configuration on router

2. **Testing and validation**
   Now test the connection established by pinging node in different network and checking if any reply comes from the node.

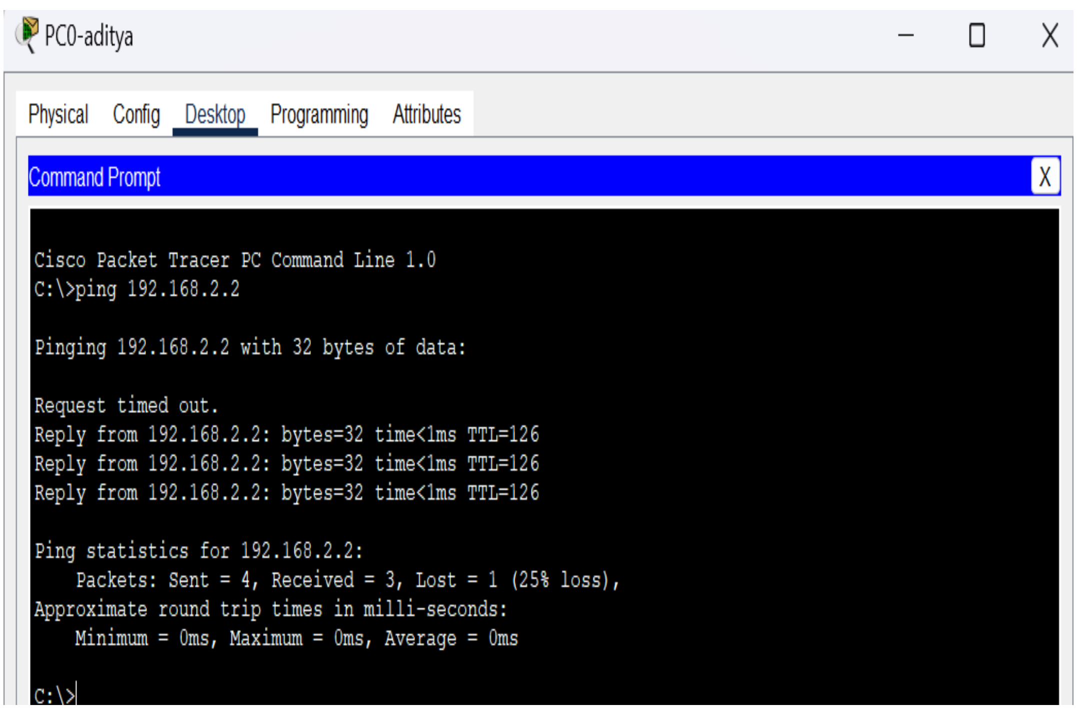


Fig: Testing connectivity

As we can see we are getting reply from the targeted node i.e. connection has been successfully established between two networks using bgp protocol.

Conclusion

In this lab, we implemented and tested dynamic routing protocols (RIP, OSPF, and BGP) across a multi-router network. Each protocol plays a significant role in managing traffic dynamically and efficiently, adapting to changes in the network topology. RIP is more suitable for small, simple networks, while OSPF and BGP are ideal for larger, more complex networks requiring efficient and scalable routing solutions.