

EXPERIMENT 8 – Basic Routing

Objective:

To understand the basic functionality of a router and how does a router route the traffic between directly connected networks.

Router:

Router is a layer 3 (Network layer) device that connects two or more packet-switched networks or subnetworks. Routing is the process of selecting a path across one or more networks. In packet-switching networks, such as the Internet, routing selects the paths for IP packets to travel from their origin to their destination. These Internet routing decisions are made by specialized pieces of network hardware called routers.

Routing Table:

To direct packets effectively, a router uses an internal routing table — a list of paths to various network destinations. The router reads a packet's header to determine where it is going, then consults the routing table to figure out the most efficient path to that destination. It then forwards the packet to the next network in the path.

Routers work in the following way: when a router receives a packet, it reads the header of the packet to see its intended destination. It then determines where to route the packet based on information in its routing tables. Routers do this millions of times a second with millions of packets. As a packet travels to its destination, it may be routed several times by different routers.

Routing tables can either be static or dynamic. Static routing tables do not change. A network administrator manually sets up static routing tables.

Command Syntax:

Following is the command syntax for association of IP address on a router interface:

```
Router(config)# interface gig0/0  
Router(config-if)# ip address 192.168.10.10 255.255.255.0  
Router(config-if)# no shutdown
```

Topology:

Basic routing topology consists of two LAN segments (Network 1 and Network 2) that are connected to each other using a Cisco 2911 router. Each LAN segment contains a Cisco 2960 switch and one endpoint (PC) connected to that switch. Each LAN segment is connected to a separate router interface.

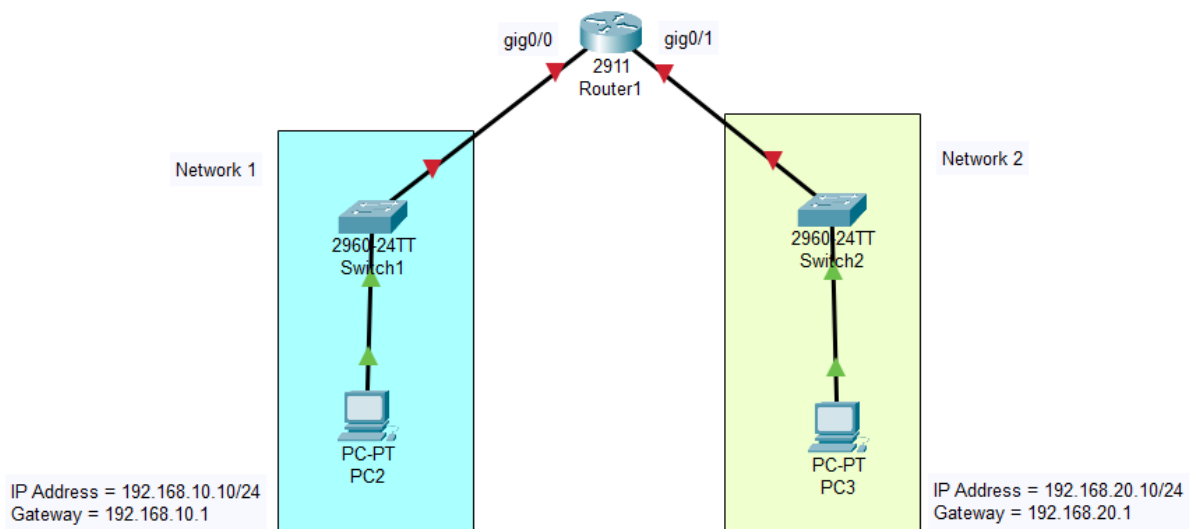
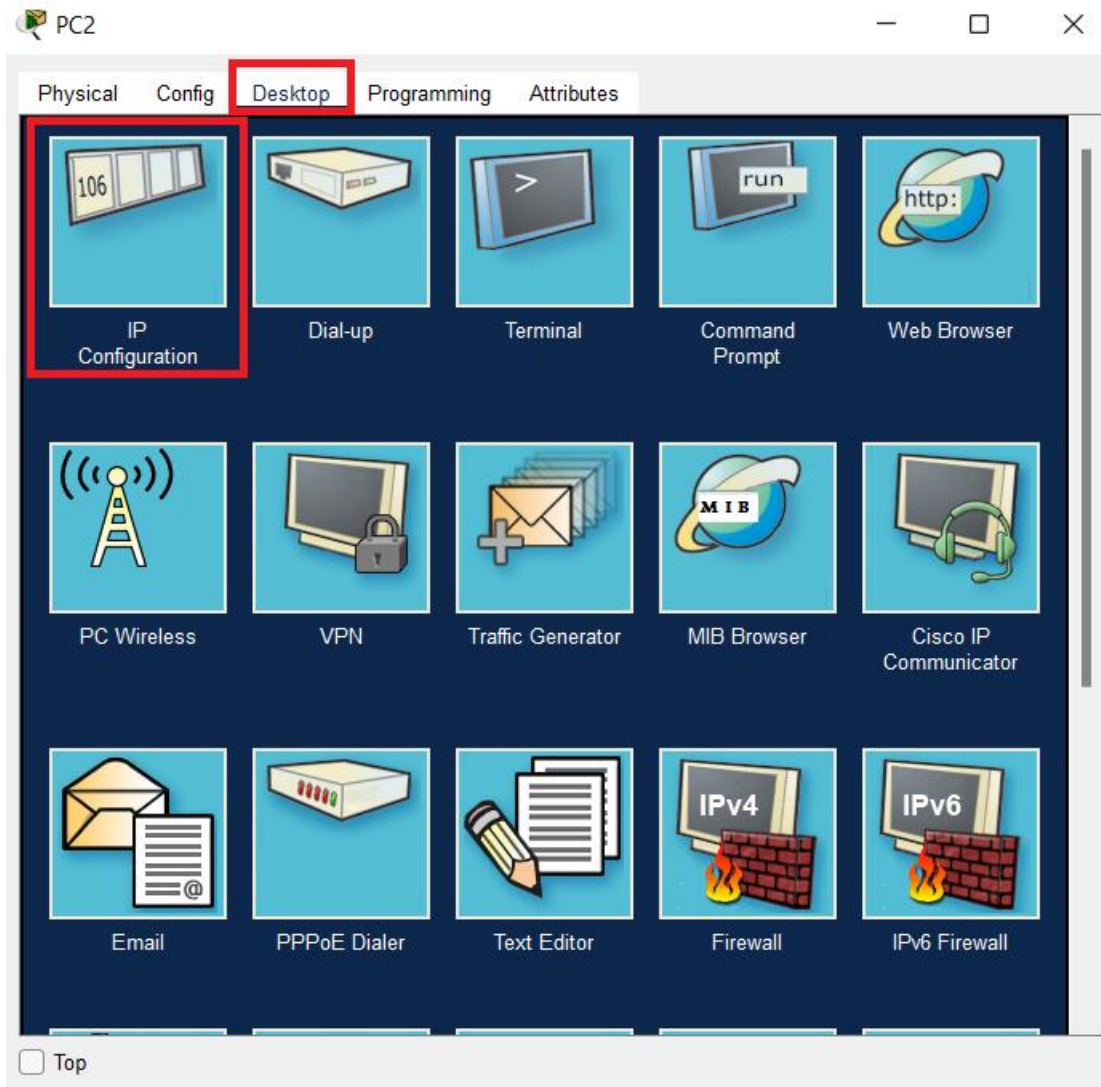


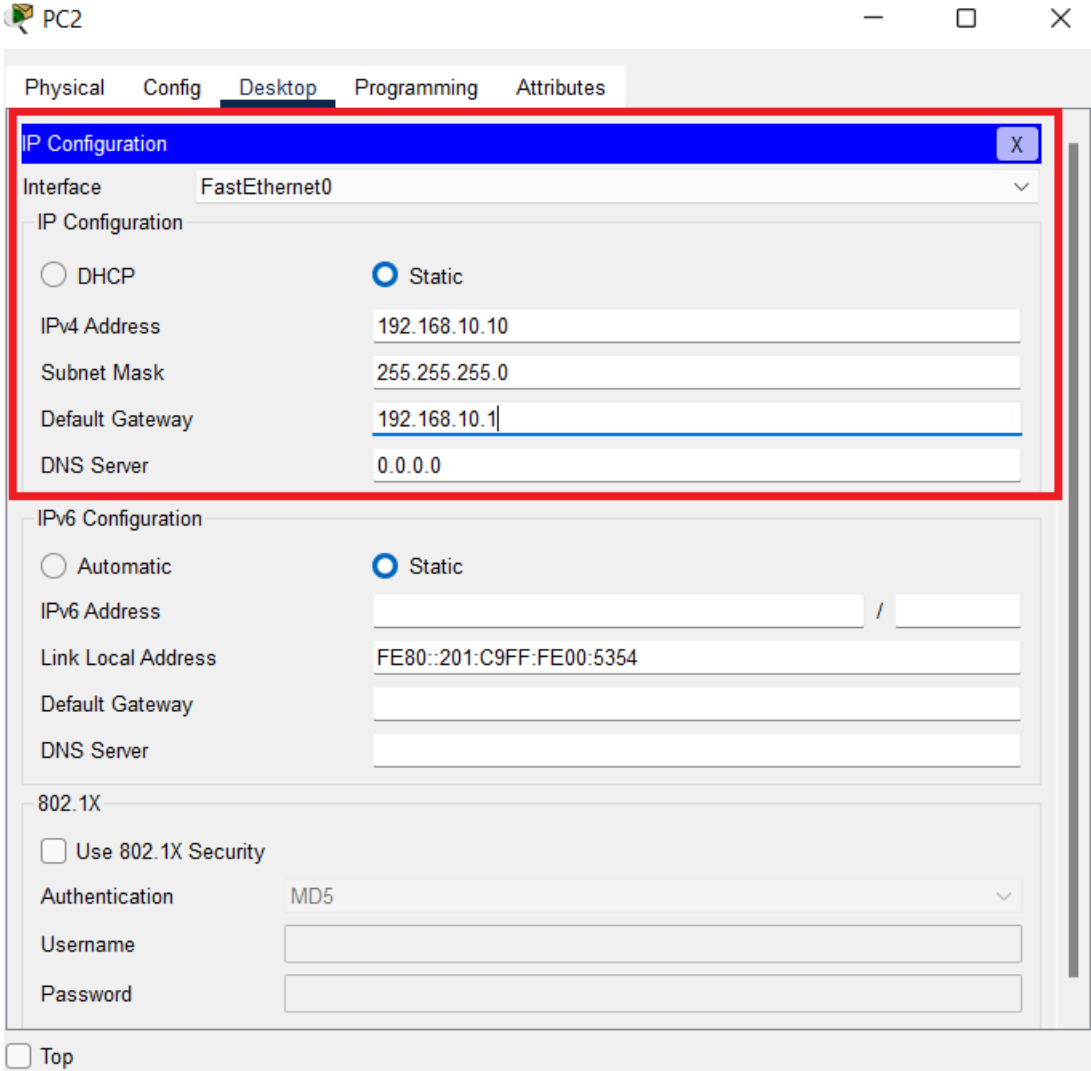
Figure 1 - Basic Routing Topology

Steps:

Select the first endpoint and click on “Desktop” tab and select “IP configuration” as shown below:



Assign the static IP address, subnet mask and default gateway as shown below:

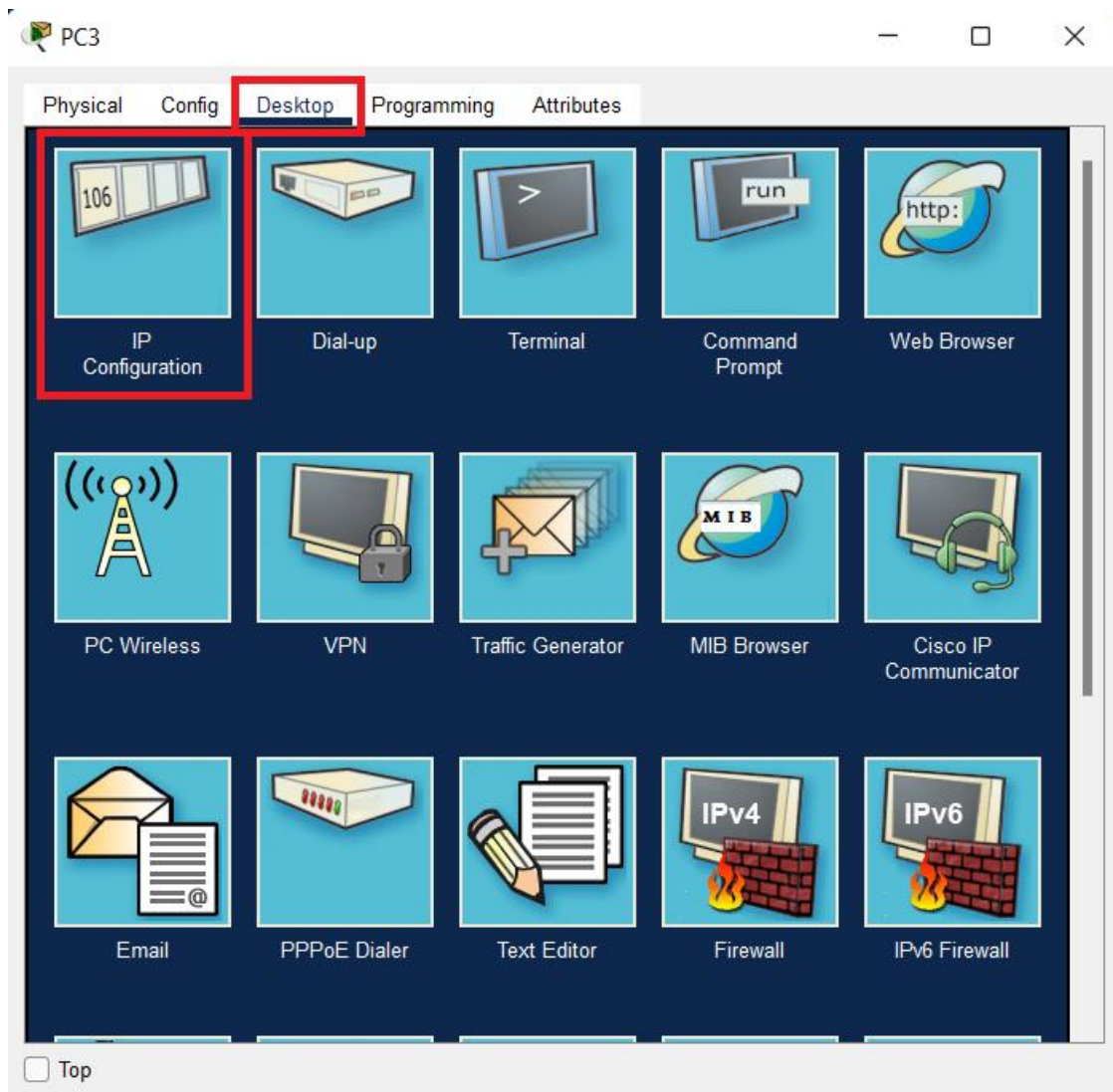


The screenshot shows a configuration window for a device labeled "PC2". The window has tabs for "Physical", "Config", "Desktop", "Programming", and "Attributes". The "Desktop" tab is selected. Within this tab, the "IP Configuration" section is highlighted with a red border. This section is for the "FastEthernet0" interface. It shows two configuration options: "DHCP" (unselected) and "Static" (selected). The "Static" configuration includes the following fields:

Field	Value
IPv4 Address	192.168.10.10
Subnet Mask	255.255.255.0
Default Gateway	192.168.10.1
DNS Server	0.0.0.0

Below the IPv4 configuration, there is an "IPv6 Configuration" section with "Automatic" (unselected) and "Static" (selected) options. The "Static" options include fields for "IPv6 Address", "Link Local Address" (FE80::201:C9FF:FE00:5354), "Default Gateway", and "DNS Server". At the bottom, there is a "802.1X" section with a checkbox for "Use 802.1X Security" (unchecked), a dropdown for "Authentication" (MD5), and fields for "Username" and "Password". A "Top" button is located at the bottom left of the window.

Select the second endpoint and click on “Desktop” tab and select “IP configuration” as shown below:



Assign the static IP address, subnet mask and default gateway as shown below:

PC3

Physical Config **Desktop** Programming Attributes

IP Configuration [X]

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.20.10

Subnet Mask 255.255.255.0

Default Gateway 192.168.20.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::200:CFF:FE77:639E

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

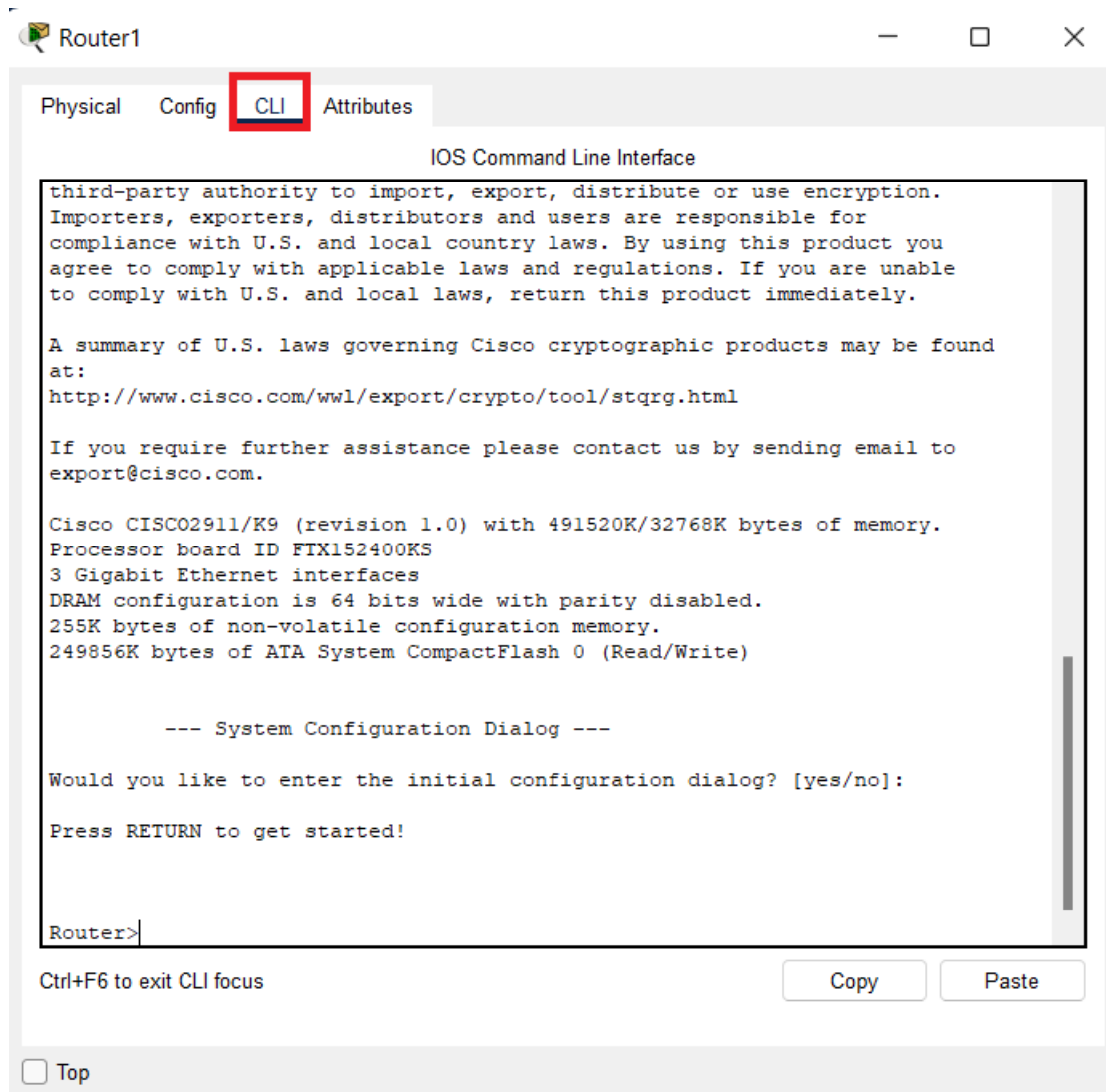
Authentication MD5

Username

Password

☐ Top

Select the Router and click on CLI tab. Do not enter the initial configuration dialog as shown below:



As shown in the topology diagram, we need to configure two router interfaces gig0/0 and gig0/1 with respective gateway IP addresses. We will configure the gateway IP addresses on both router interfaces followed by “no shutdown” command:

```
--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gig0/0
Router(config-if)#ip address 192.168.10.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to up

Router(config-if)#exit
Router(config)#
Router(config)#interface gig0/1
Router(config-if)#ip address 192.168.20.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed
state to up

Router(config-if)#|
```


We can check the routing table of router using “**show ip route**” command from the privileged exec mode. Entries in routing table that start with C represent directly connected networks, these are the network segments that are directly connected with the router, for example, in our topology network 1 (192.168.10.0/24) and network 2 (192.168.20.0/24) are directly connected networks for router.

```
Router>
Router>
Router>
Router>enable
Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

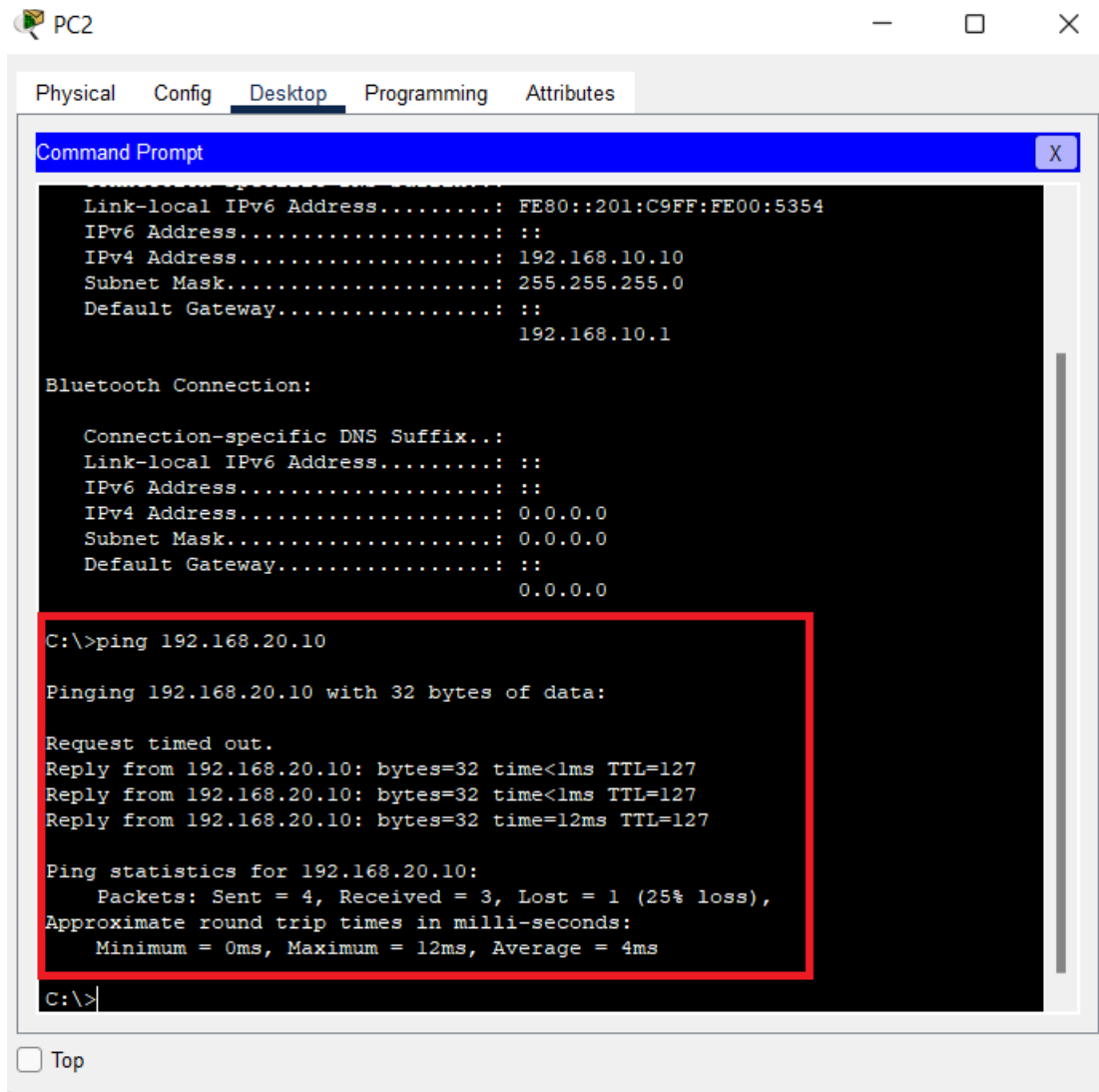
Gateway of last resort is not set

    192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.10.0/24 is directly connected, GigabitEthernet0/0
L       192.168.10.1/32 is directly connected, GigabitEthernet0/0
    192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, GigabitEthernet0/1
L       192.168.20.1/32 is directly connected, GigabitEthernet0/1

Router#
Router#
```

Connectivity check:

Navigate to the command prompt on first PC (connected in network 1) to second PC (connected in network 2) and verify the network connectivity.



The screenshot shows a window titled "PC2" with tabs for Physical, Config, Desktop, Programming, and Attributes. The "Desktop" tab is active, displaying a "Command Prompt" window. The Command Prompt shows the following network configuration:

```
Link-local IPv6 Address.....: FE80::201:C9FF:FE00:5354
IPv6 Address.....: ::
IPv4 Address.....: 192.168.10.10
Subnet Mask.....: 255.255.255.0
Default Gateway.....: ::
                        192.168.10.1
```

Below the network configuration, it shows a "Bluetooth Connection:" section with the following details:

```
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
```

The Command Prompt then shows a ping command being executed:

```
C:\>ping 192.168.20.10
```

The output of the ping command is as follows:

```
Pinging 192.168.20.10 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.10: bytes=32 time<1ms TTL=127
Reply from 192.168.20.10: bytes=32 time<1ms TTL=127
Reply from 192.168.20.10: bytes=32 time=12ms TTL=127

Ping statistics for 192.168.20.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 4ms
```

The Command Prompt prompt is now "C:\>".

Key take aways:

Routers do the routing between directly connected networks by default, without any additional configuration.