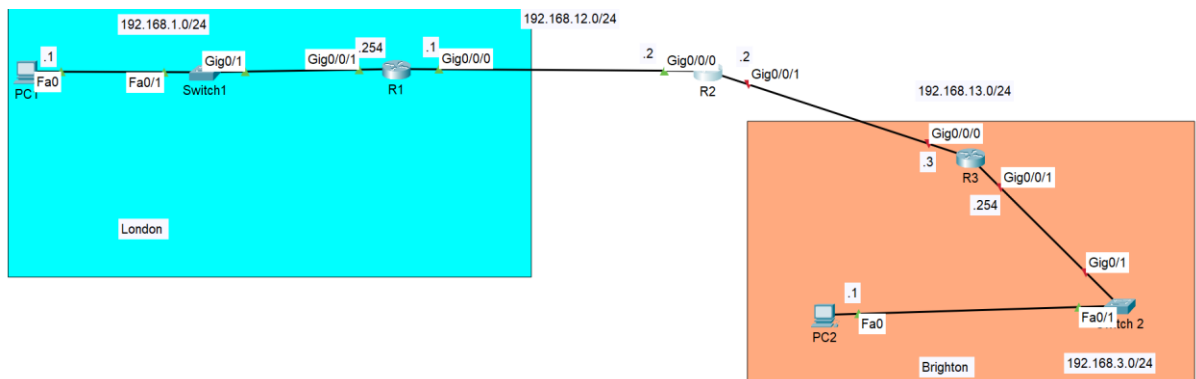


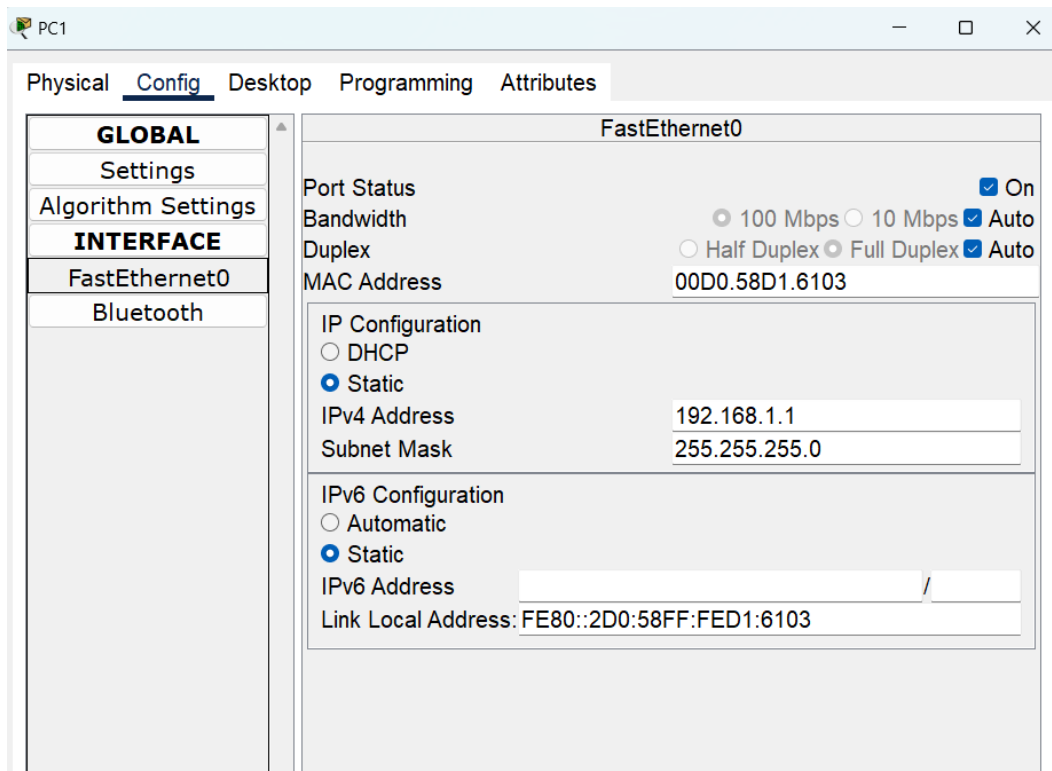
4.1 Design a network to meet specified requirements.

Requirements

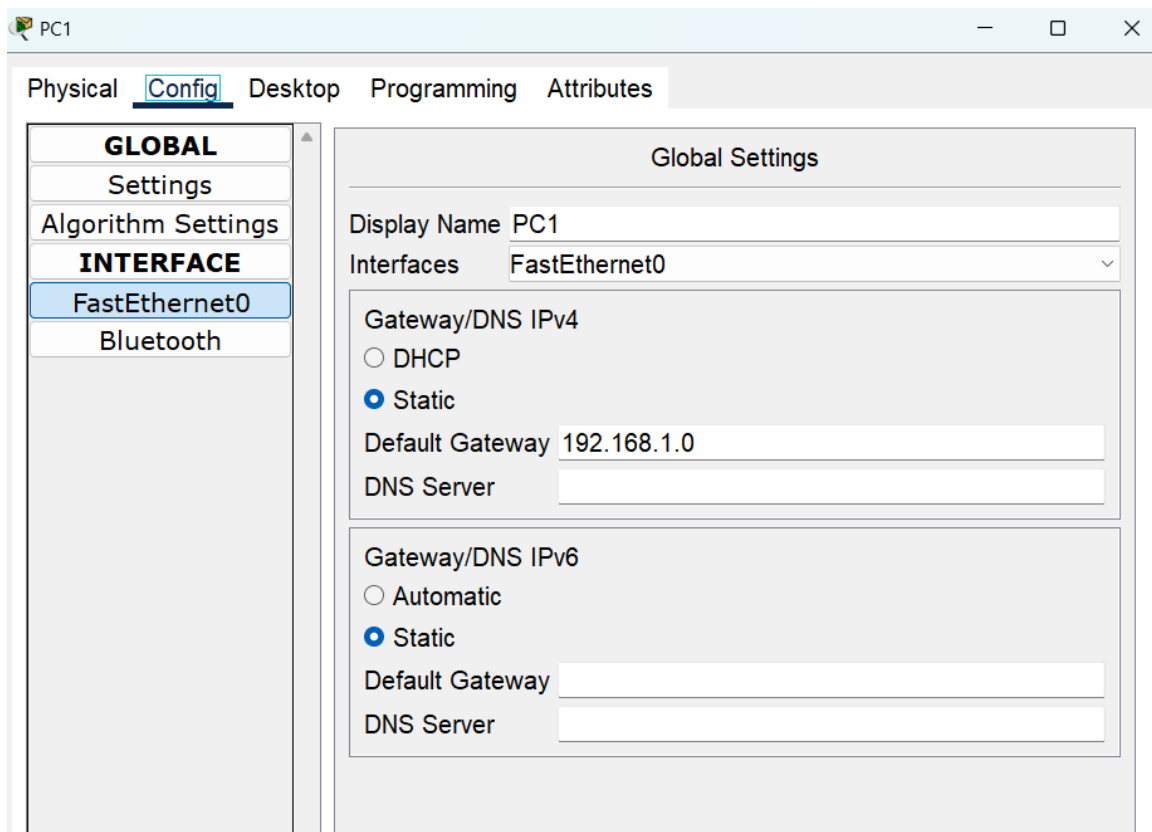
1. Build two LANs. Use at least one PC, one switch, one router for each LAN.
2. Configure the PCs and routers by assigning them hostnames, IP addresses, gateway.
(No need to configure switch)
3. Configure static routes on the routers.



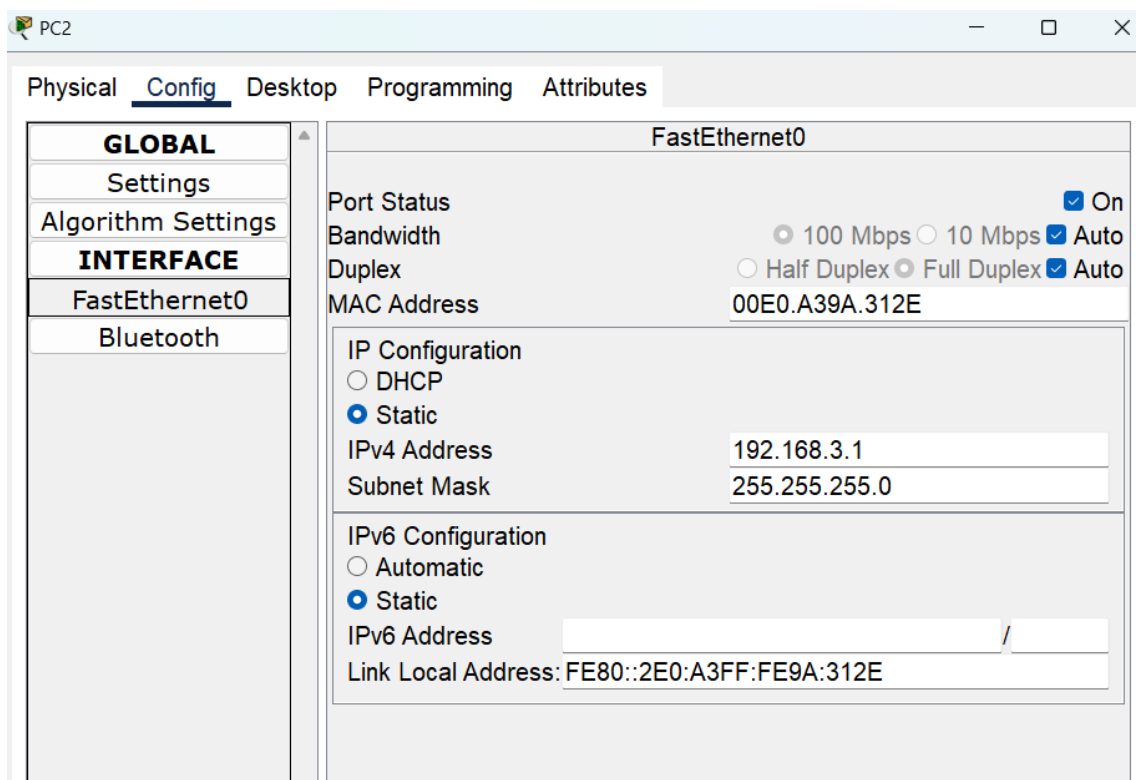
An example LAN design for office in London and Brighton. This network design is aim to configure static routes on the routers to enable PC 1 to successfully ping PC 2.



Assigning IP address and subnet mask for PC1.



Configuring default gateway in PC1.



Assigning IP address and subnet mask for PC2.

PC2

Physical Config Desktop Programming Attributes

GLOBAL

Settings

Algorithm Settings

INTERFACE

FastEthernet0

Bluetooth

Global Settings

Display Name PC2

Interfaces FastEthernet0

Gateway/DNS IPv4

☐ DHCP

☒ Static

Default Gateway 192.168.3.254

DNS Server

Gateway/DNS IPv6

☐ Automatic

☒ Static

Default Gateway

DNS Server

Configuring gateway in PC2.

IOS Command Line Interface

```
R1(config-if)#exit
R1(config)#int
R1(config)#interface g0/0/0
R1(config-if)#ip address 192.168.12.1 255.255.255.0
R1(config-if)#desc
R1(config-if)#description ## to R2 ##
R1(config-if)#no shu
R1(config-if)#no shutdown

R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

R1(config-if)#do sh ip
R1(config-if)#do sh ip interface brief
Interface                IP-Address      OK? Method Status
Protocol
GigabitEthernet0/0/0     192.168.12.1    YES manual up
down
GigabitEthernet0/0/1     192.168.1.254   YES manual up
up
GigabitEthernet0/0/2     unassigned      YES unset  administratively down
down
Vlan1                    unassigned      YES unset  administratively down
down
R1(config-if)#exit
R1(config)#help
^
% Invalid input detected at '^' marker.

R1(config)#exit
R1#
```

Router 1 configuration

IOS Command Line Interface

```
R2(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

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

R2(config-if)#no shut
R2(config-if)#no shutdown
R2(config-if)#int
R2(config-if)#interface g 0/0/1
R2(config-if)#ip address 192.168.13.2 255.255.255.0
R2(config-if)#desc
R2(config-if)#description ## to R3 ##
R2(config-if)#no shut
R2(config-if)#no shutdown

R2(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1, changed state to up

R2(config-if)#do show ip int brief
Interface                IP-Address      OK? Method Status
Protocol
GigabitEthernet0/0/0     192.168.12.2    YES manual up
up
GigabitEthernet0/0/1     192.168.13.2    YES manual up
down
GigabitEthernet0/0/2     unassigned      YES unset  administratively down
down
Vlan1                    unassigned      YES unset  administratively down
down
R2(config-if)#?
  arp                  Set arp type (arpa, probe, snap) or timeout
```

Router 2 configuration

IOS Command Line Interface

```
R3(config-if)#int
R3(config-if)#inte
R3(config-if)#interface g0/0/1
R3(config-if)#ip ad
R3(config-if)#ip address 192.168.3.254 255.255.255.0
R3(config-if)#des
R3(config-if)#description ## to SW2 ##
R3(config-if)#no shu
R3(config-if)#no shutdown

R3(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/1,
changed state to up

R3(config-if)#do show ip int brief
Interface                IP-Address      OK? Method Status
Protocol
GigabitEthernet0/0/0     192.168.13.3    YES manual up
GigabitEthernet0/0/1     192.168.3.254   YES manual up
GigabitEthernet0/0/2     unassigned      YES unset  administratively down
down
Vlan1                    unassigned      YES unset  administratively down
down
R3(config-if)#exit
R3(config)#exit
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#wr
R3#write
Building configuration...
[OK]
R3#
```

Router 3 configuration

Breakdown explanation for static route configuration

After we are done with the basic configuration, all we need to do next is to configure static routes. For this, we need two-way reachability:

- To reach PC1's ping to PC2
- Then PC2 reply can reach to PC1

So, **R1** is already connected to 192.168.1.0/24 network but it needs a route to 192.168.3.0/24 network.

Likewise, **R3** is already connected to 192.168.3.0/24 network and it needs a route to 192.168.1.0/24 network.

But **R2** is not connected to either of these networks, so it will need routes to both.

So that means a total of **four routes** need to be configured. One each on R1 and R3, and two on R2.

```
IOS Command Line Interface
R1(config)#ip route ?
  A.B.C.D Destination prefix
R1(config)#ip route 192.168.3.0 ?
  A.B.C.D Destination prefix mask
R1(config)#ip route 192.168.3.0 255.255.255.0 ?
  A.B.C.D Forwarding router's address
  Dialer Dialer interface
  Ethernet IEEE 802.3
  FastEthernet FastEthernet IEEE 802.3
  GigabitEthernet GigabitEthernet IEEE 802.3z
  Loopback Loopback interface
  Null Null interface
  Serial Serial
  Vlan Catalyst Vlans
R1(config)#ip route 192.168.3.0 255.255.255.0 192.168.12.2 ?
  <1-255> Distance metric for this route
  <cr>
R1(config)#ip route 192.168.3.0 255.255.255.0 192.168.12.2
R1(config)#do 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

    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0/1
L       192.168.1.254/32 is directly connected, GigabitEthernet0/0/1
S       192.168.3.0/24 [1/0] via 192.168.12.2
    192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.12.0/24 is directly connected, GigabitEthernet0/0/0
L       192.168.12.1/32 is directly connected, GigabitEthernet0/0/0
```

Step by step configuration of a route on R1

IOS Command Line Interface

```
% Invalid input detected at '^' marker.

R2(config)#ip route 192.168.1.0 255.255.255.0 g0/0/0
%Default route without gateway, if not a point-to-point interface, may
impact performance
R2(config)#show ip route
^
% Invalid input detected at '^' marker.

R2(config)#do 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

S    192.168.1.0/24 is directly connected, GigabitEthernet0/0/0
S    192.168.3.0/24 [1/0] via 192.168.13.3
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.12.0/24 is directly connected, GigabitEthernet0/0/0
L    192.168.12.2/32 is directly connected, GigabitEthernet0/0/0
      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.13.0/24 is directly connected, GigabitEthernet0/0/1
L    192.168.13.2/32 is directly connected, GigabitEthernet0/0/1

R2(config)#
```

Two configured static routes in R2

IOS Command Line Interface

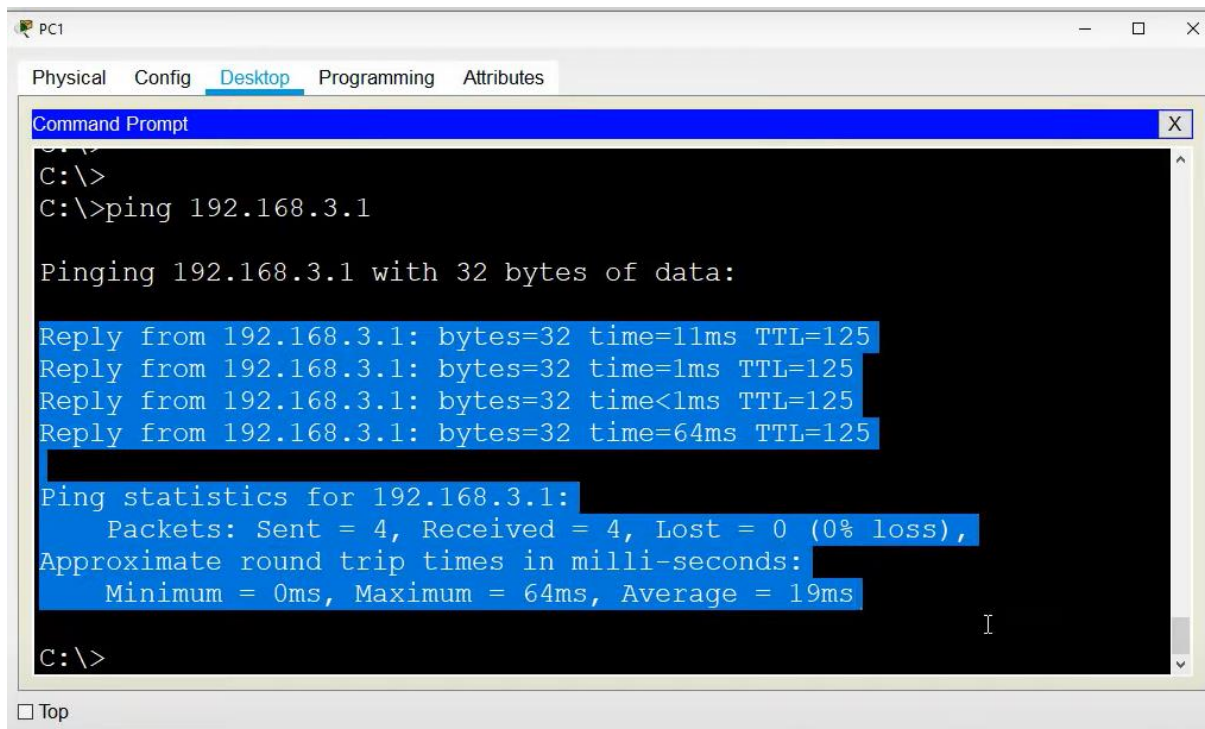
```
R3>
R3>en
R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#ip route 192.168.1.0 255.255.255.0 192.168.13.2
R3(config)#do show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B -
BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - 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

S    192.168.1.0/24 [1/0] via 192.168.13.2
    192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.3.0/24 is directly connected, GigabitEthernet0/0/1
L    192.168.3.254/32 is directly connected, GigabitEthernet0/0/1
    192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.13.0/24 is directly connected, GigabitEthernet0/0/0
L    192.168.13.3/32 is directly connected, GigabitEthernet0/0/0

R3(config)#
```

Static route configuration in R3. This figure shows one static route and the connected and local routes for each interface.



The screenshot shows a Cisco Packet Tracer interface for PC1. The 'Desktop' tab is selected, and a Command Prompt window is open. The user has entered the command 'ping 192.168.3.1'. The output shows four successful replies from 192.168.3.1 with varying times and a TTL of 125. The ping statistics indicate 4 packets sent, 4 received, 0% loss, and an average round trip time of 19ms.

```
PC1
Physical Config Desktop Programming Attributes
Command Prompt
C:\>
C:\>ping 192.168.3.1

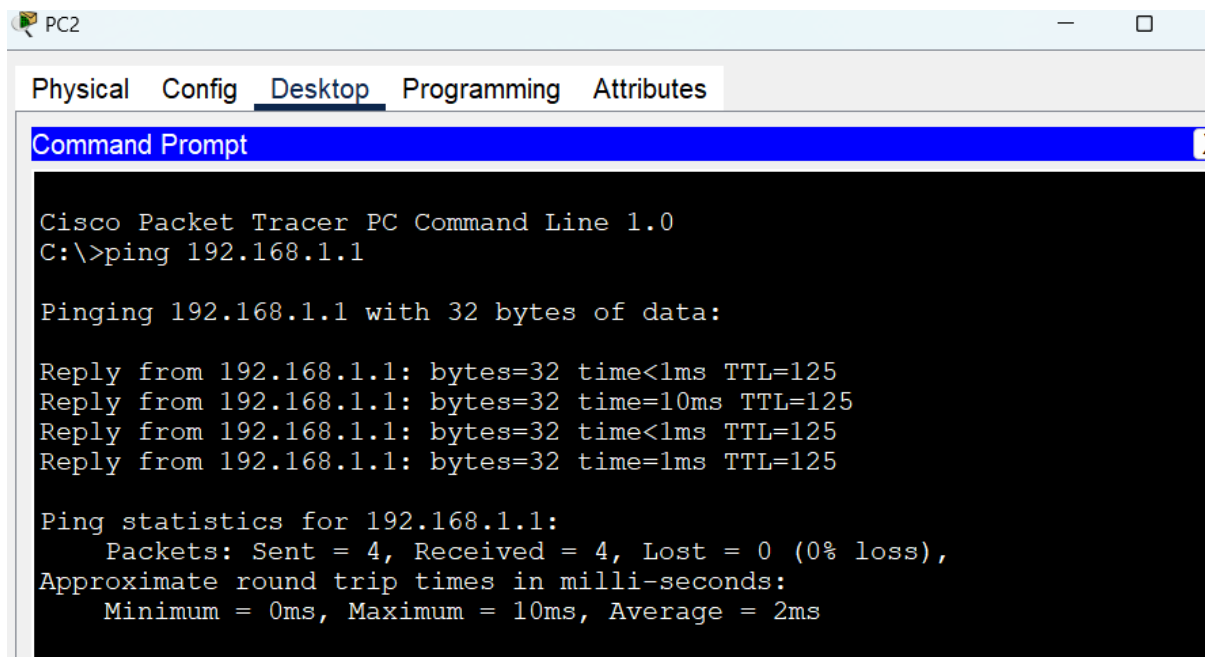
Pinging 192.168.3.1 with 32 bytes of data:

Reply from 192.168.3.1: bytes=32 time=11ms TTL=125
Reply from 192.168.3.1: bytes=32 time=1ms TTL=125
Reply from 192.168.3.1: bytes=32 time<1ms TTL=125
Reply from 192.168.3.1: bytes=32 time=64ms TTL=125

Ping statistics for 192.168.3.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 64ms, Average = 19ms

C:\>
```

Here you can see PC 1 can successfully ping to PC 2 which means PC 2 is able to ping PC1 as well.



The screenshot shows a Cisco Packet Tracer interface for PC2. The 'Desktop' tab is selected, and a Command Prompt window is open. The user has entered the command 'ping 192.168.1.1'. The output shows four successful replies from 192.168.1.1 with varying times and a TTL of 125. The ping statistics indicate 4 packets sent, 4 received, 0% loss, and an average round trip time of 2ms.

```
PC2
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time<1ms TTL=125
Reply from 192.168.1.1: bytes=32 time=10ms TTL=125
Reply from 192.168.1.1: bytes=32 time<1ms TTL=125
Reply from 192.168.1.1: bytes=32 time=1ms TTL=125

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 2ms
```

PC 2 ping is reachable to PC 1 in this figure.

