

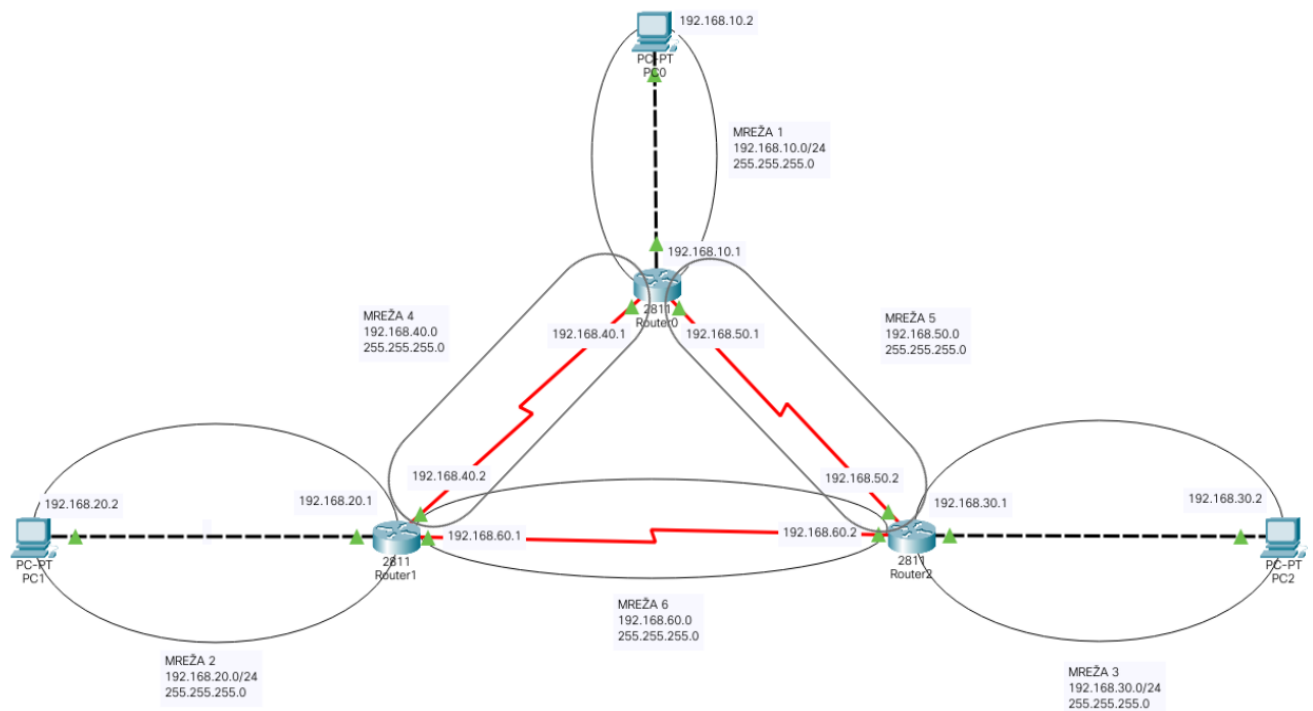
Univerzitet u Sarajevu
Elektrotehnički fakultet

ZADAĆA 1
iz predmeta Računarske mreže

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Sarajevo, mart 2021.

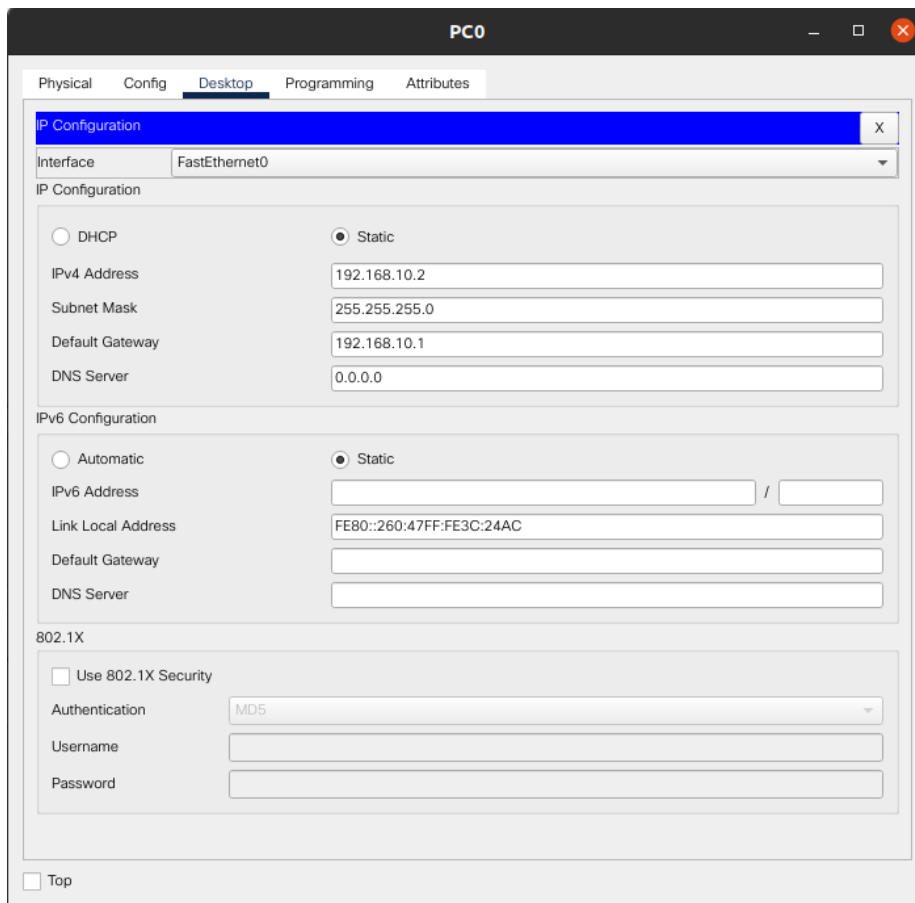
Za izradu ove zadaće bilo je potrebno uspostaviti mrežu datu na slici u postavci zadaće, što je učinjeno koristeći Cisco Packet Tracer. Konačna mreža definisana u ovom alatu prikazana je na slici Slika 1.



Slika 1. Tražena računarska mreža

Na slici Slika 1 možemo vidjeti da u mreži konfiguriraju tri PC-a: PC0, PC1 i PC2, te tri rutera: Router0, Router1 i Router2. Za povezivanje ovih uređaja u jednu mrežu definisano je 6 podmreža:

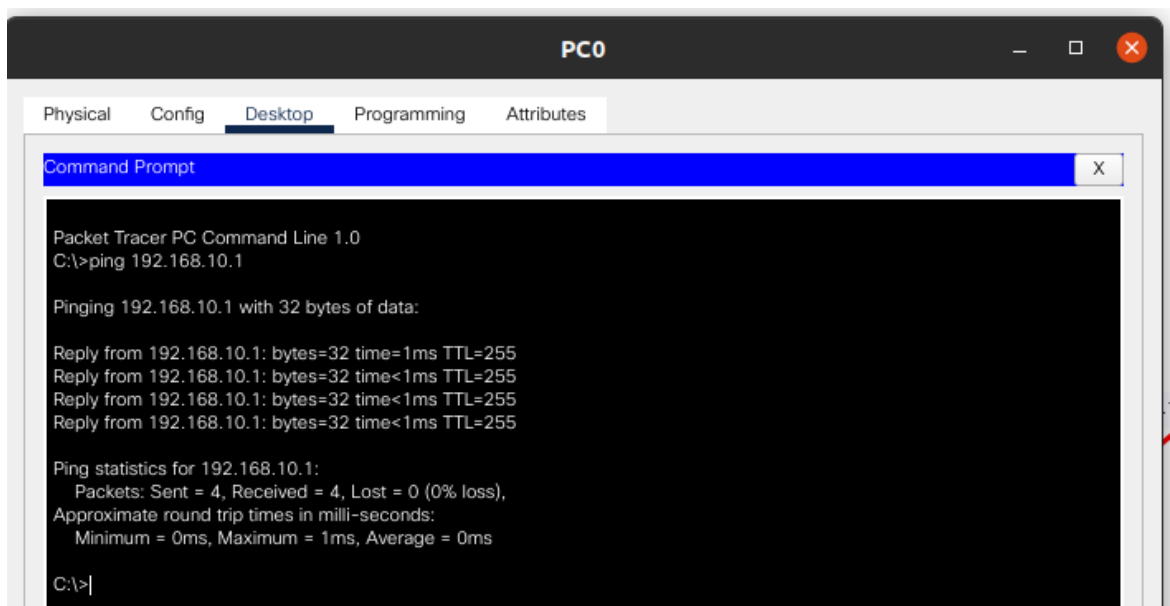
1. Mreža 1(PC0 - Router0)
Dodijeljeni subnet: 192.168.10.0/24
Adresa mreže: 192.168.10.0
Subnetmask: 255.255.255.0
IP adresa PC0: 192.168.10.2
Default gateway: 192.168.10.1
Broadcast: 192.168.10.255



PC0 je spojen svojim Fa0 interfejsom(192.168.10.2)
 Router0 je spojen svojim Fast Ethernet 0/0 interfejsom

```
!
interface FastEthernet0/0
ip address 192.168.10.1 255.255.255.0
duplex auto
speed auto
!
```

Provjera komunikacije u ovoj mreži:



2. Mreža 2(PC1 - Router1)

Dodijeljeni subnet: 192.168.20.0/24

Adresa mreže: 192.168.20.0

Subnetmask: 255.255.255.0

IP adresa PC1: 192.168.20.2

Default gateway: 192.168.20.1

Broadcast: 192.168.20.255

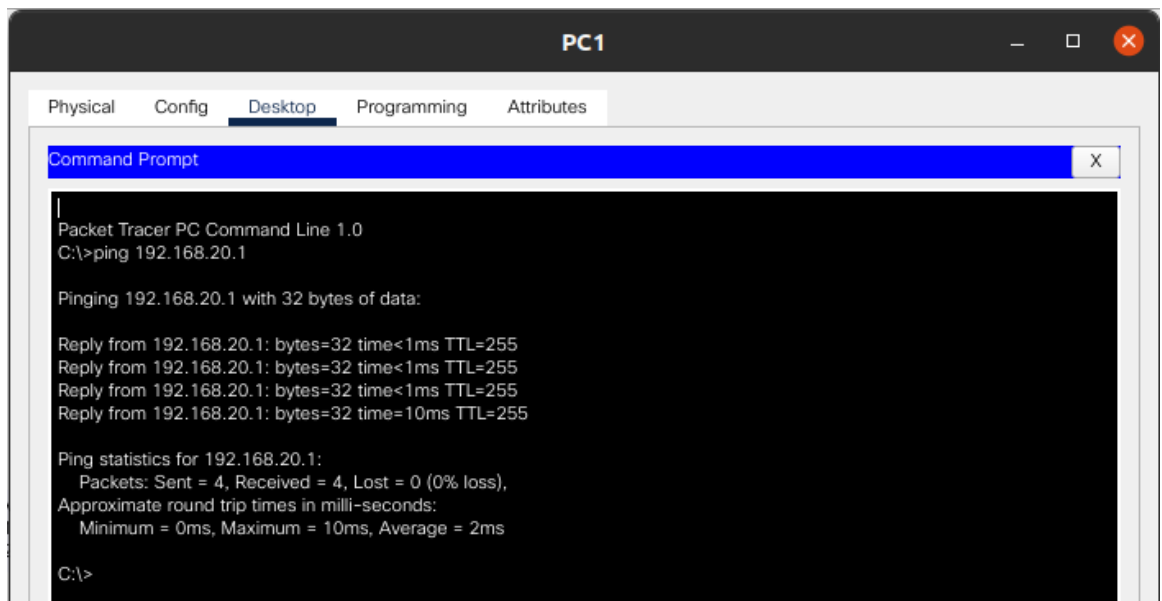
The screenshot shows the 'PC1' configuration window with the 'Desktop' tab selected. The 'IP Configuration' section is active, showing the 'FastEthernet0' interface. The 'Static' radio button is selected for IP Configuration. The fields are filled with: IPv4 Address: 192.168.20.2, Subnet Mask: 255.255.255.0, Default Gateway: 192.168.20.1, and DNS Server: 0.0.0.0. The 'IPv6 Configuration' section also has 'Static' selected, with fields for IPv6 Address, Link Local Address (FE80::20C:85FF:FE19:8E04), Default Gateway, and DNS Server. The '802.1X' section has 'Use 802.1X Security' unchecked, with 'Authentication' set to 'MD5' and empty fields for 'Username' and 'Password'. A 'Top' button is at the bottom left.

PC1 je spojen svojim Fa0 interfejsom(192.168.20.2)

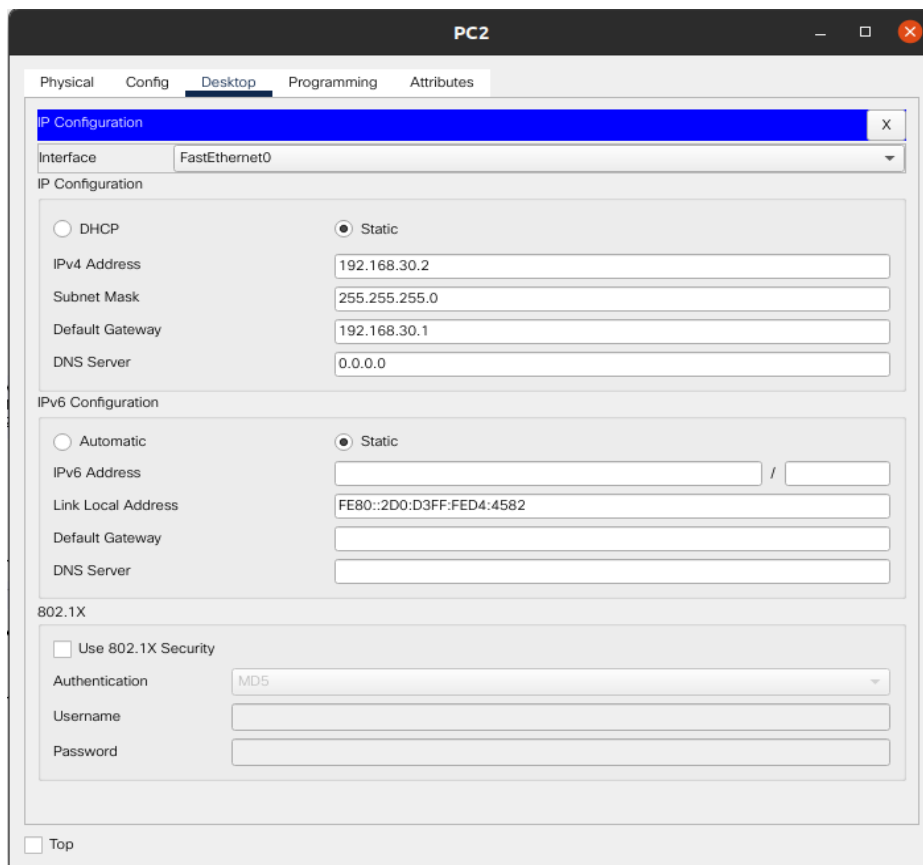
Router1 je spojen svojim Fast Ethernet 0/0 interfejsom

```
interface FastEthernet0/0
ip address 192.168.20.1 255.255.255.0
duplex auto
speed auto
!
```

Provjera komunikacije u ovoj mreži:



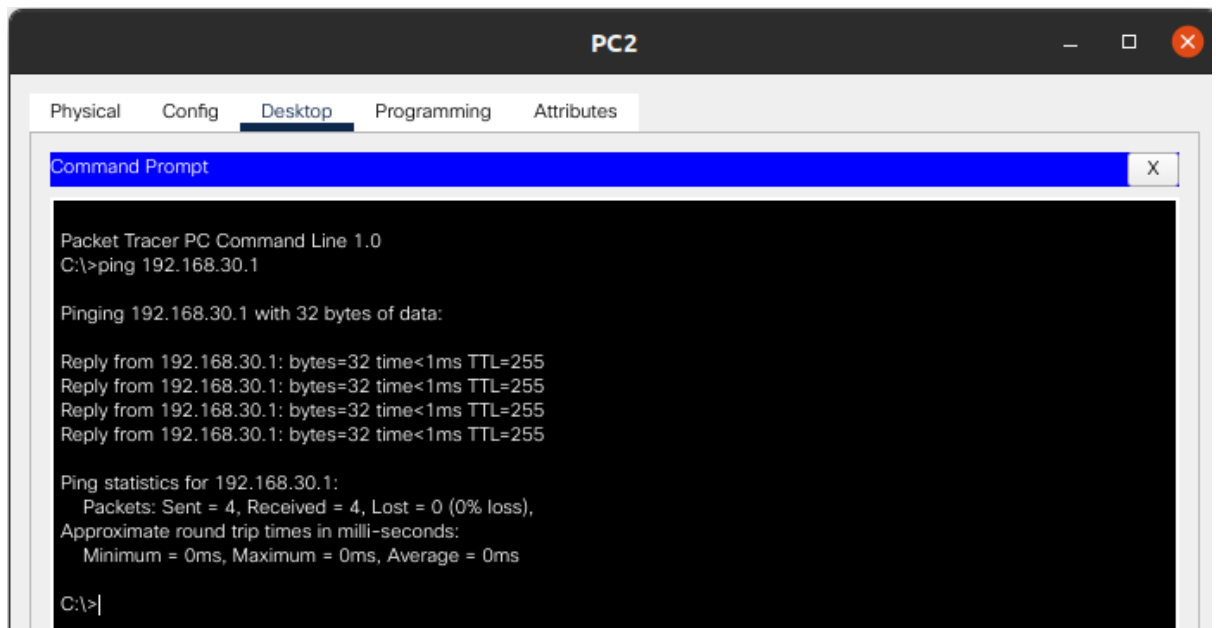
3. Mreža 3(PC2 - Router2)
- Dodijeljeni subnet: 192.168.30.0/24
 Adresa mreže: 192.168.30.0
 Subnetmask: 255.255.255.0
 IP adresa PC2: 192.168.30.2
 Default gateway: 192.168.30.1
 Broadcast: 192.168.30.255



PC2 je spojen svojim Fa0 interfejsom(192.168.30.2)
Router2 je spojen svojim Fast Ethernet 0/0 interfejsom

```
interface FastEthernet0/0
ip address 192.168.30.1 255.255.255.0
duplex auto
speed auto
!
```

Provjera komunikacije u ovoj mreži:



4. Mreža 4(Router0 - Router1)
Dodijeljeni subnet: 192.168.40.0/24
Adresa mreže: 192.168.40.0
Subnetmask: 255.255.255.0
Default gateway: 192.168.40.1
Broadcast: 192.168.40.255

Router0 je spojen svojim Serial 0/0/0 interfejsom

```
interface Serial0/0/0
ip address 192.168.40.1 255.255.255.0
!
interface Serial0/0/1
no ip address
clock rate 2000000
!
```

Router1 je spojen svojim Serial 0/0/0 interfejsom

```
interface Serial0/0/0
ip address 192.168.40.2 255.255.255.0
clock rate 2000000
!
interface Serial0/0/1
no ip address
clock rate 2000000
!
```

5. Mreža 5(Router0 - Router2)

Dodijeljeni subnet: 192.168.50.0/24

Adresa mreže: 192.168.50.0

Subnetmask: 255.255.255.0

Default gateway: 192.168.50.1

Broadcast: 192.168.50.255

Router0 je spojen svojim Serial 0/1/0 interfejsom

```
interface Serial0/1/0
ip address 192.168.50.1 255.255.255.0
clock rate 2000000
!
interface Serial0/1/1
no ip address
clock rate 2000000
!
```

Router2 je spojen svojim Serial 0/1/0 interfejsom

```
interface Serial0/1/0
ip address 192.168.50.2 255.255.255.0
!
interface Serial0/1/1
no ip address
clock rate 2000000
!
```

6. Mreža 6(Router1 - Router2)

Dodijeljeni subnet: 192.168.60.0/24

Adresa mreže: 192.168.60.0

Subnetmask: 255.255.255.0

Default gateway: 192.168.60.1

Broadcast: 192.168.60.255

Router1 je spojen svojim Serial 0/1/0 interfejsom

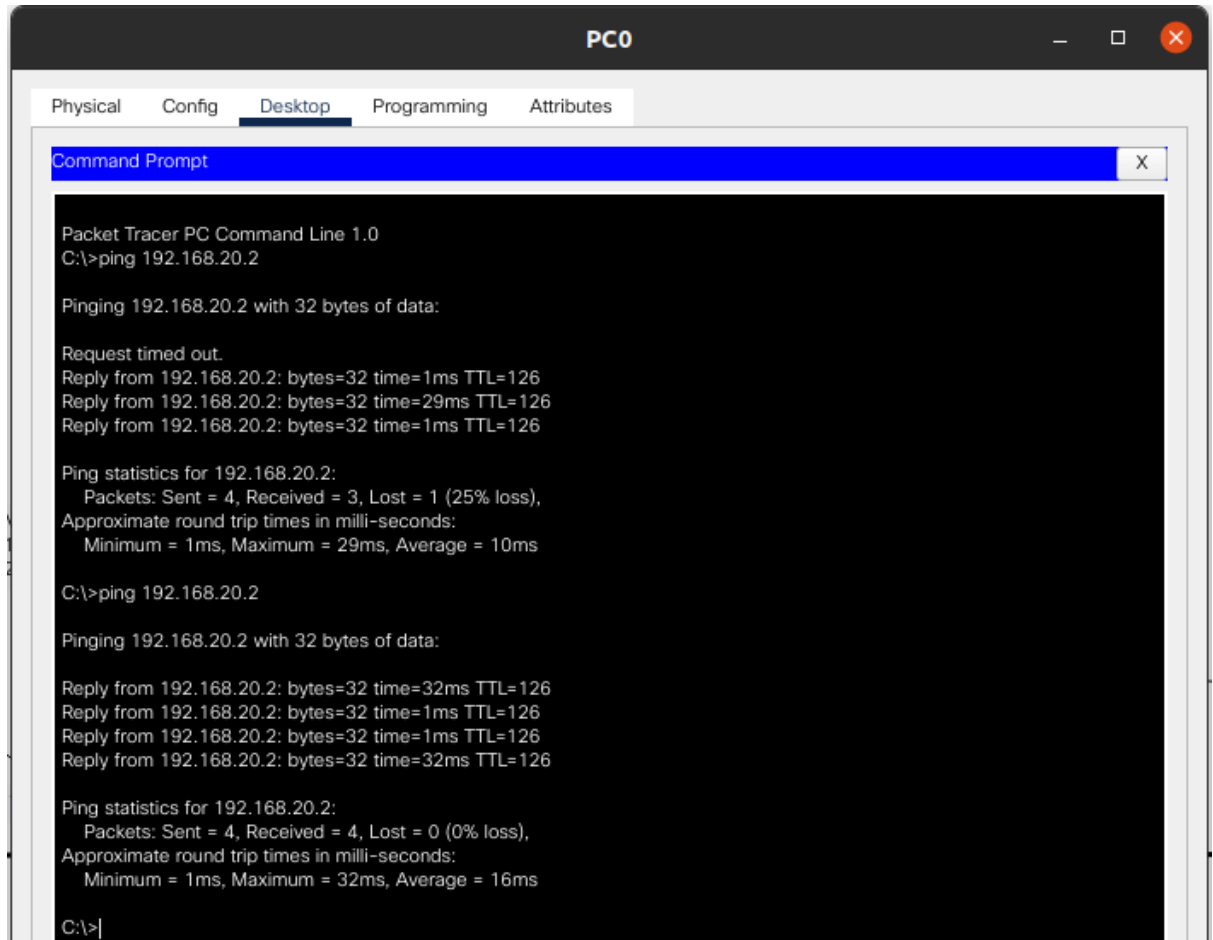
```
interface Serial0/1/0
ip address 192.168.60.1 255.255.255.0
clock rate 2000000
!
interface Serial0/1/1
no ip address
clock rate 2000000
!
```

Router2 je spojen svojim Serial 0/0/0 interfejsom

```
interface Serial0/0/0
ip address 192.168.60.2 255.255.255.0
!
interface Serial0/0/1
no ip address
clock rate 2000000
!
```

Provjera komunikacije svih PC-eva međusobno:

- PC0 i PC1



The screenshot shows the 'PC0' window with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the output of a ping command to 192.168.20.2. The first ping attempt shows a 25% loss of packets. The second attempt shows 0% loss.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.2: bytes=32 time=1ms TTL=126
Reply from 192.168.20.2: bytes=32 time=29ms TTL=126
Reply from 192.168.20.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 29ms, Average = 10ms

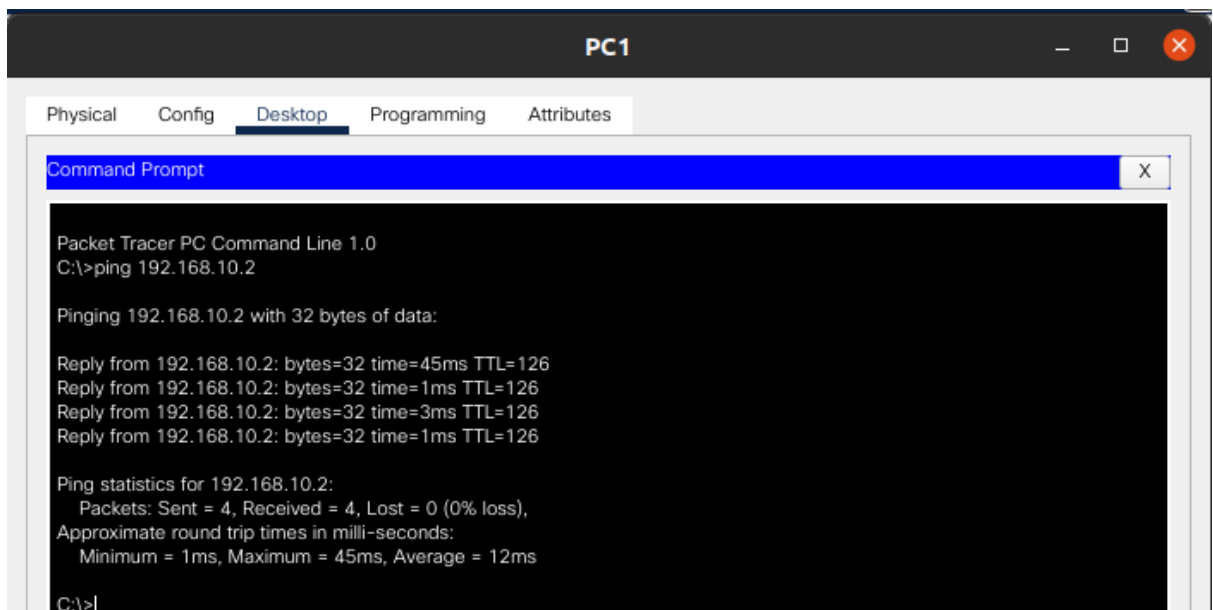
C:\>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Reply from 192.168.20.2: bytes=32 time=32ms TTL=126
Reply from 192.168.20.2: bytes=32 time=1ms TTL=126
Reply from 192.168.20.2: bytes=32 time=1ms TTL=126
Reply from 192.168.20.2: bytes=32 time=32ms TTL=126

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 32ms, Average = 16ms

C:\>|
```



The screenshot shows the 'PC1' window with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the output of a ping command to 192.168.10.2. All four packets were received successfully with 0% loss.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.2

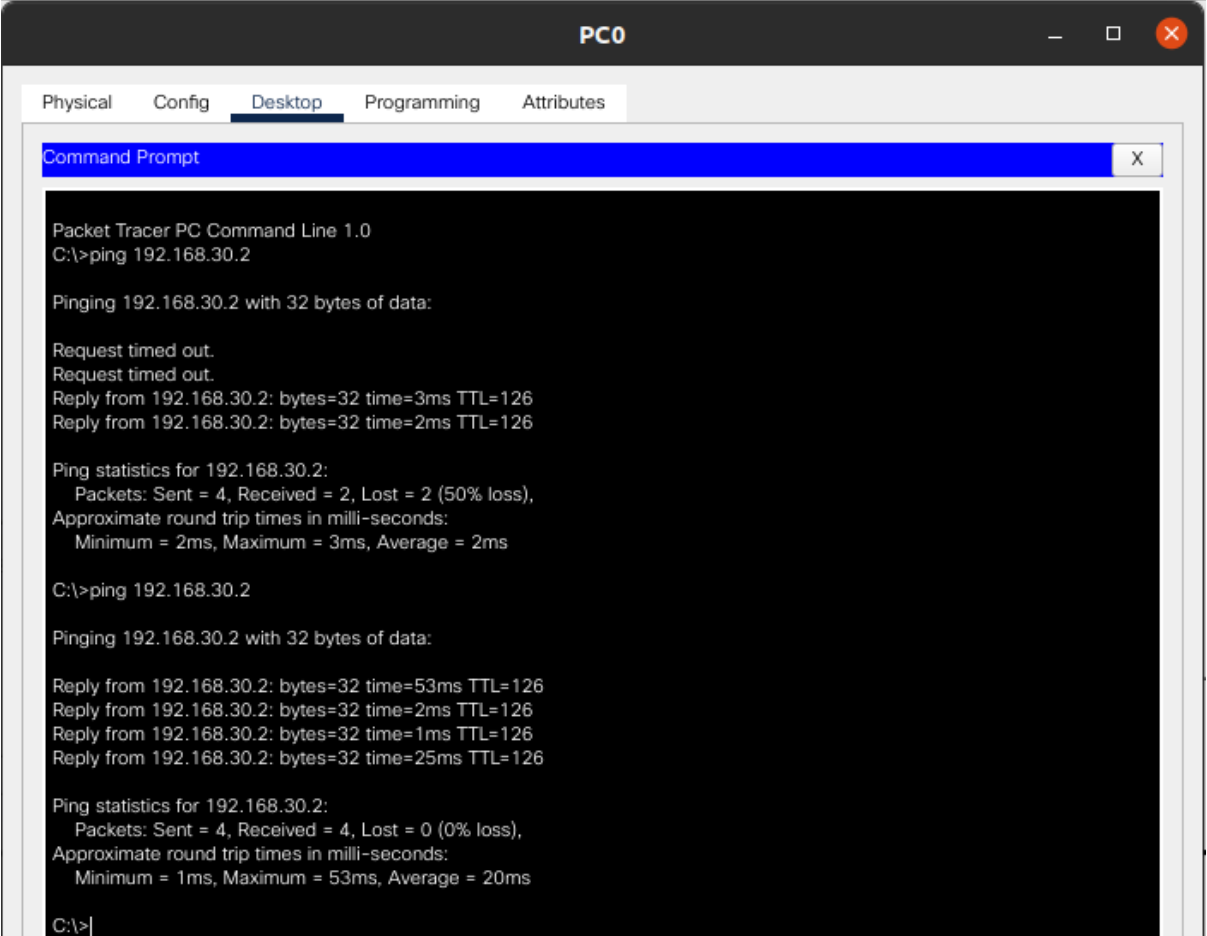
Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.10.2: bytes=32 time=45ms TTL=126
Reply from 192.168.10.2: bytes=32 time=1ms TTL=126
Reply from 192.168.10.2: bytes=32 time=3ms TTL=126
Reply from 192.168.10.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 45ms, Average = 12ms

C:\>|
```


- PC0 i PC2



The screenshot shows the 'PC0' window with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the output of a ping command to 192.168.30.2. The output shows two successful pings with 50% packet loss (2 out of 4 packets received). The statistics indicate a 50% loss, with 2 packets sent and 2 received.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.30.2

Pinging 192.168.30.2 with 32 bytes of data:

Request timed out.
Request timed out.
Reply from 192.168.30.2: bytes=32 time=3ms TTL=126
Reply from 192.168.30.2: bytes=32 time=2ms TTL=126

Ping statistics for 192.168.30.2:
    Packets: Sent = 4, Received = 2, Lost = 2 (50% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 3ms, Average = 2ms

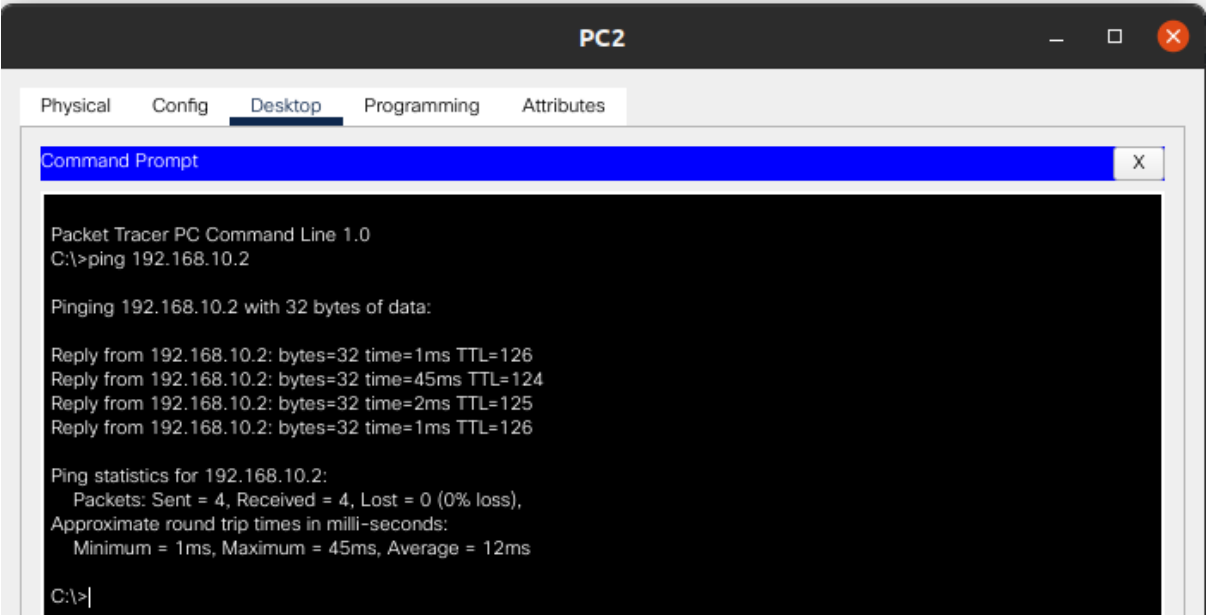
C:\>ping 192.168.30.2

Pinging 192.168.30.2 with 32 bytes of data:

Reply from 192.168.30.2: bytes=32 time=53ms TTL=126
Reply from 192.168.30.2: bytes=32 time=2ms TTL=126
Reply from 192.168.30.2: bytes=32 time=1ms TTL=126
Reply from 192.168.30.2: bytes=32 time=25ms TTL=126

Ping statistics for 192.168.30.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 53ms, Average = 20ms

C:\>
```



The screenshot shows the 'PC2' window with the 'Desktop' tab selected. A 'Command Prompt' window is open, displaying the output of a ping command to 192.168.10.2. The output shows four successful pings with 0% packet loss (4 out of 4 packets received). The statistics indicate 0% loss, with 4 packets sent and 4 received.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.2

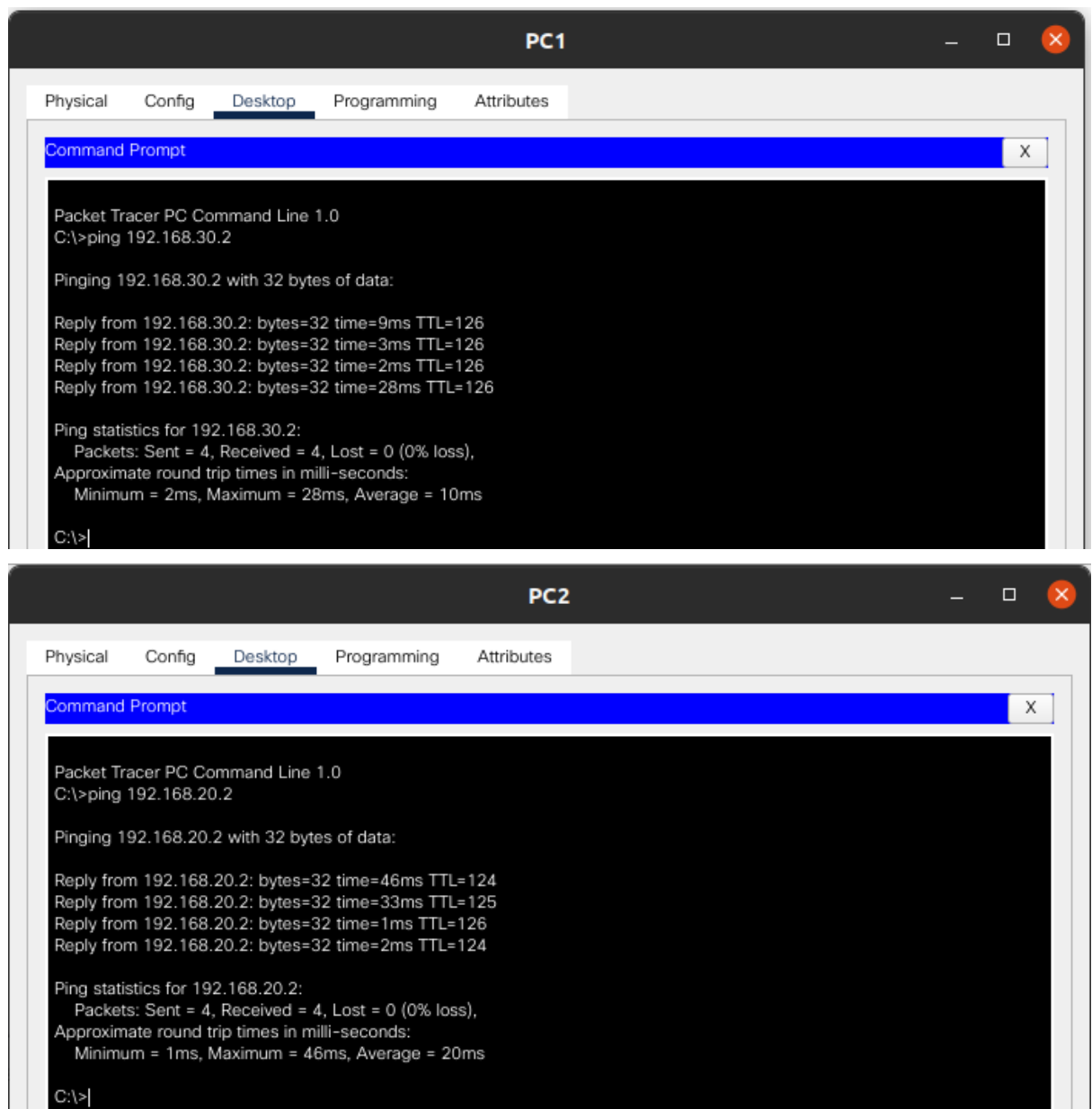
Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.10.2: bytes=32 time=1ms TTL=126
Reply from 192.168.10.2: bytes=32 time=45ms TTL=124
Reply from 192.168.10.2: bytes=32 time=2ms TTL=125
Reply from 192.168.10.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 45ms, Average = 12ms

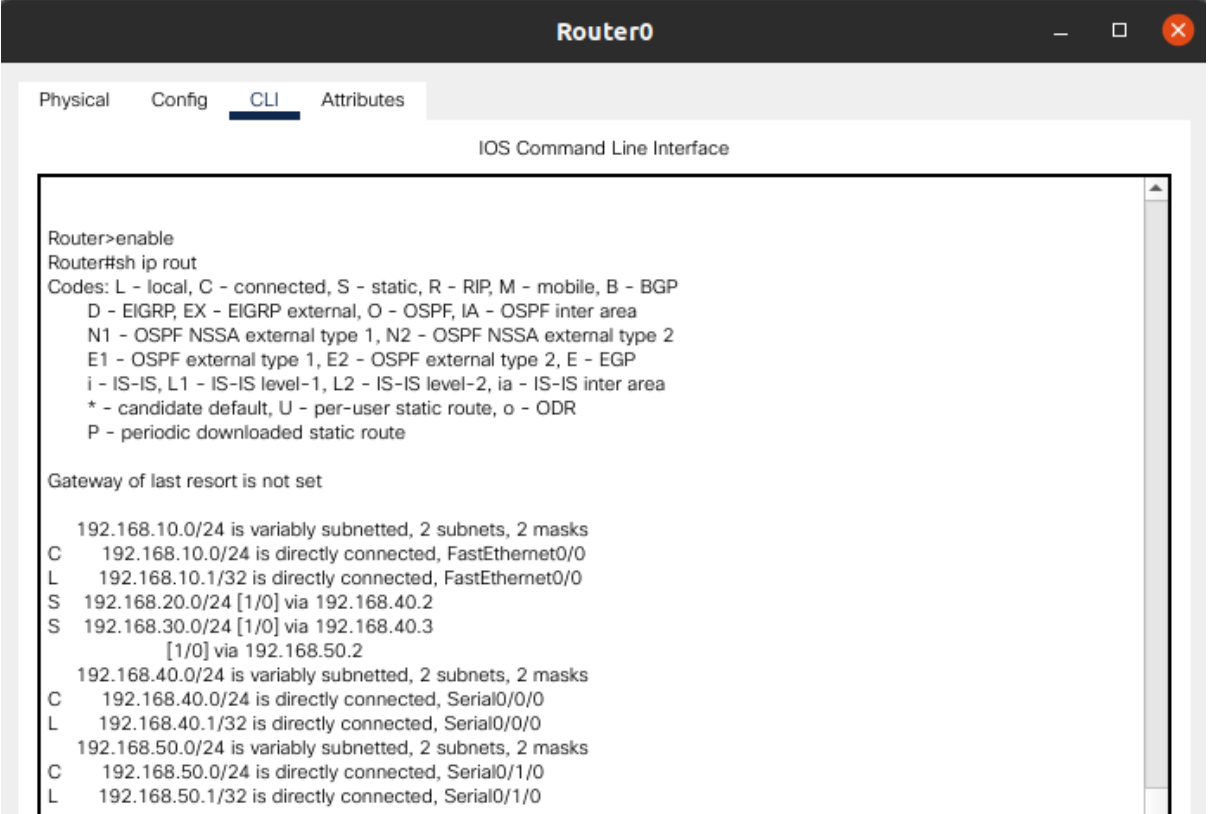
C:\>
```

- PC1 i PC2



Na kraju ćemo prikazati tabele rutiranja za svaki od rutera koje i omogućavaju prethodno prikazanu komunikaciju(što je moguće očitati komandom `sh ip rout`):

- Router0



The screenshot shows the CLI of Router0. The 'CLI' tab is selected. The command 'Router>enable' has been entered, followed by 'Router#sh ip rout'. The output displays the routing table with various codes and routes. The routes include 192.168.10.0/24, 192.168.20.0/24, 192.168.30.0/24, 192.168.40.0/24, 192.168.50.0/24, and 192.168.60.0/24, all marked as 'directly connected'.

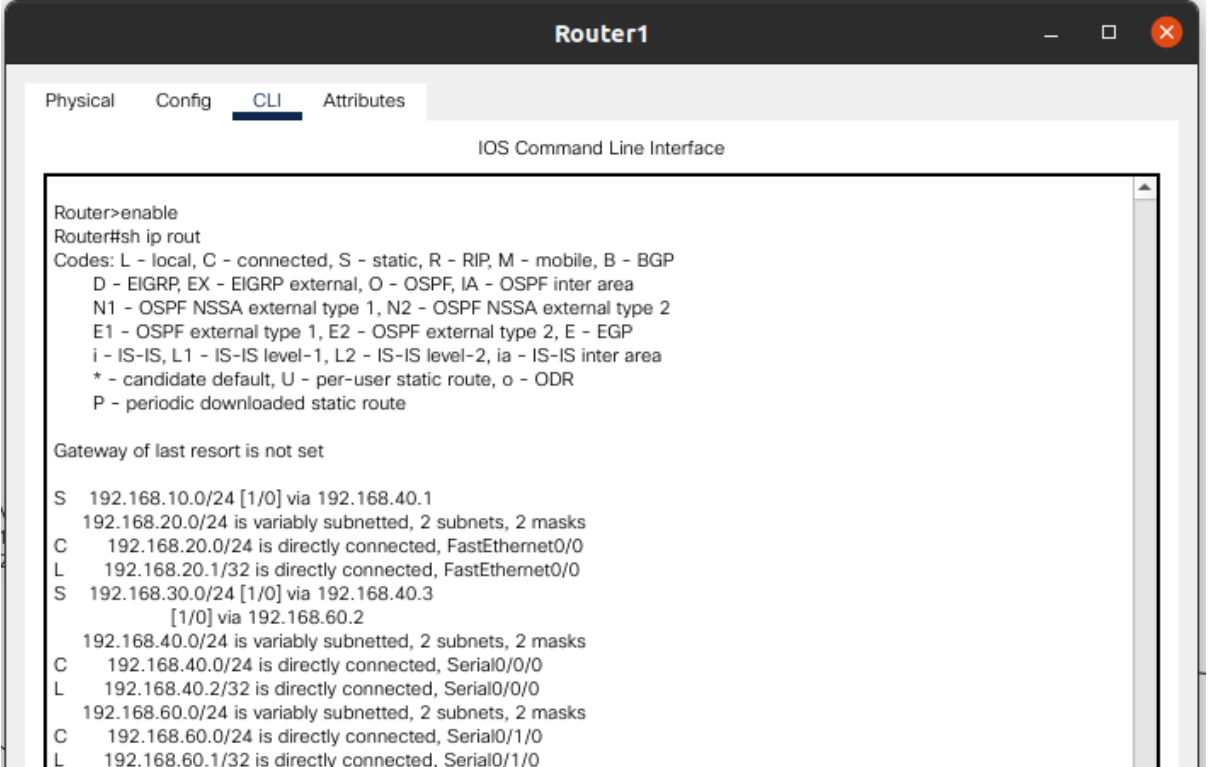
```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#sh ip rout
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, FastEthernet0/0
L   192.168.10.1/32 is directly connected, FastEthernet0/0
S   192.168.20.0/24 [1/0] via 192.168.40.2
S   192.168.30.0/24 [1/0] via 192.168.40.3
    [1/0] via 192.168.50.2
192.168.40.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.40.0/24 is directly connected, Serial0/0/0
L   192.168.40.1/32 is directly connected, Serial0/0/0
192.168.50.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.50.0/24 is directly connected, Serial0/1/0
L   192.168.50.1/32 is directly connected, Serial0/1/0
```

- Router1



The screenshot shows the CLI of Router1. The 'CLI' tab is selected. The command 'Router>enable' has been entered, followed by 'Router#sh ip rout'. The output displays the routing table with various codes and routes. The routes include 192.168.10.0/24, 192.168.20.0/24, 192.168.30.0/24, 192.168.40.0/24, 192.168.60.0/24, and 192.168.60.1/32, all marked as 'directly connected'.

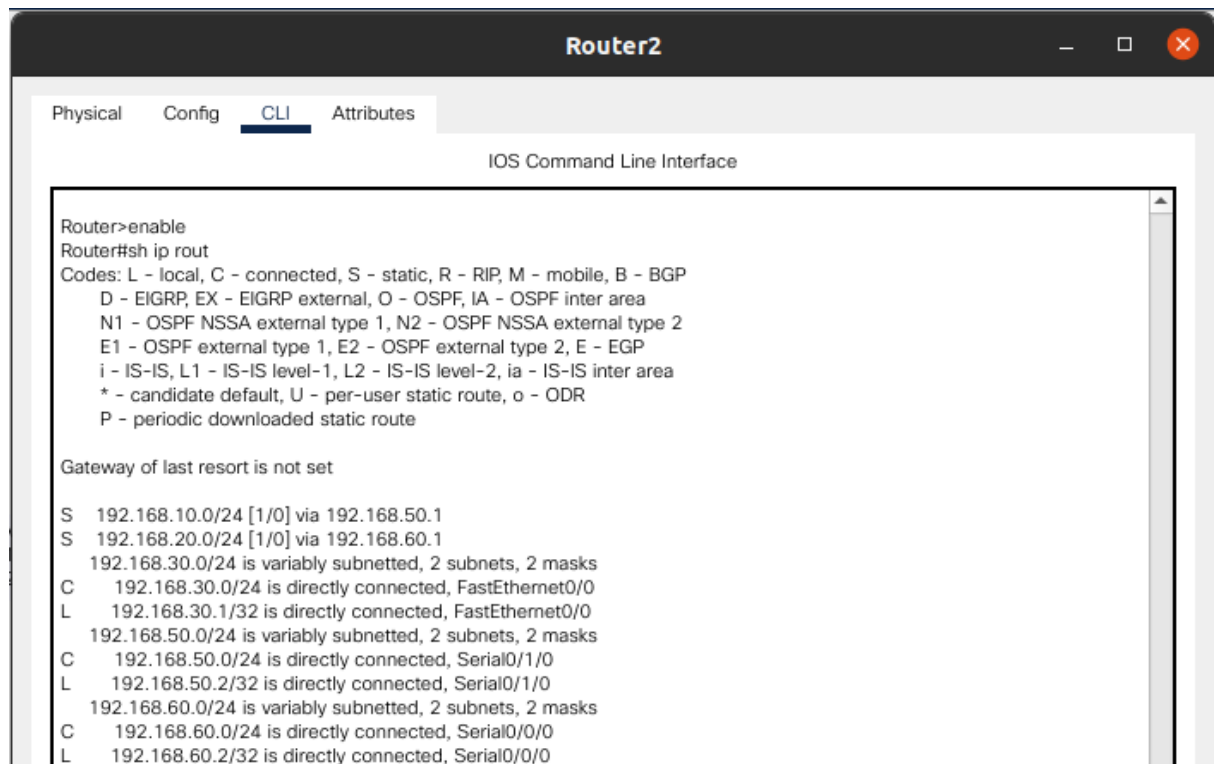
```
Router1
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#sh ip rout
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   192.168.10.0/24 [1/0] via 192.168.40.1
192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.20.0/24 is directly connected, FastEthernet0/0
L   192.168.20.1/32 is directly connected, FastEthernet0/0
S   192.168.30.0/24 [1/0] via 192.168.40.3
    [1/0] via 192.168.60.2
192.168.40.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.40.0/24 is directly connected, Serial0/0/0
L   192.168.40.2/32 is directly connected, Serial0/0/0
192.168.60.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.60.0/24 is directly connected, Serial0/1/0
L   192.168.60.1/32 is directly connected, Serial0/1/0
```

- Router2



```
Router2
Physical Config CLI Attributes
IOS Command Line Interface

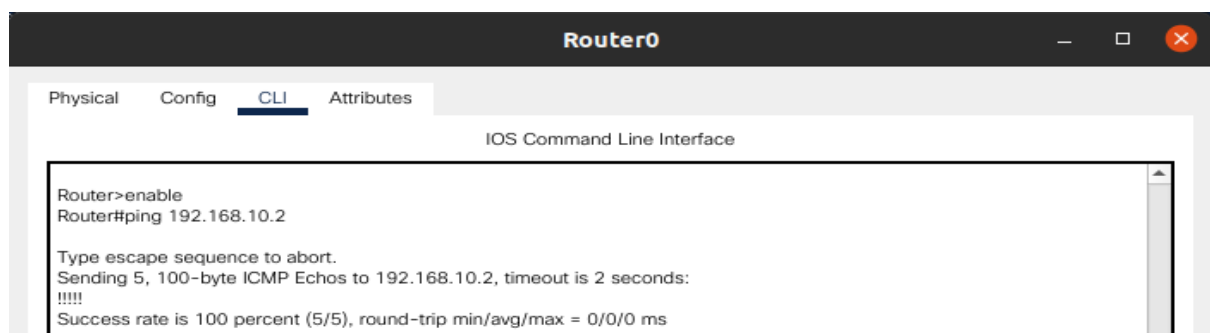
Router>enable
Router#sh ip rout
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external 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 192.168.10.0/24 [1/0] via 192.168.50.1
S 192.168.20.0/24 [1/0] via 192.168.60.1
192.168.30.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.30.0/24 is directly connected, FastEthernet0/0
L 192.168.30.1/32 is directly connected, FastEthernet0/0
192.168.50.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.50.0/24 is directly connected, Serial0/1/0
L 192.168.50.2/32 is directly connected, Serial0/1/0
192.168.60.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.60.0/24 is directly connected, Serial0/0/0
L 192.168.60.2/32 is directly connected, Serial0/0/0
```

Zbog smanjenja opsega izvještaja u ovom dijelu ćemo prikazati samo jedan primjer provjere komunikacije sa rutera unutar lokalne i vanjske mreže. Kako je ranije već pokazano da PC-evi ispravno komuniciraju, ovdje ćemo za primjer uzeti ruter Router0, a analogno se pokazuje i za ostale.

Lokalna mreža

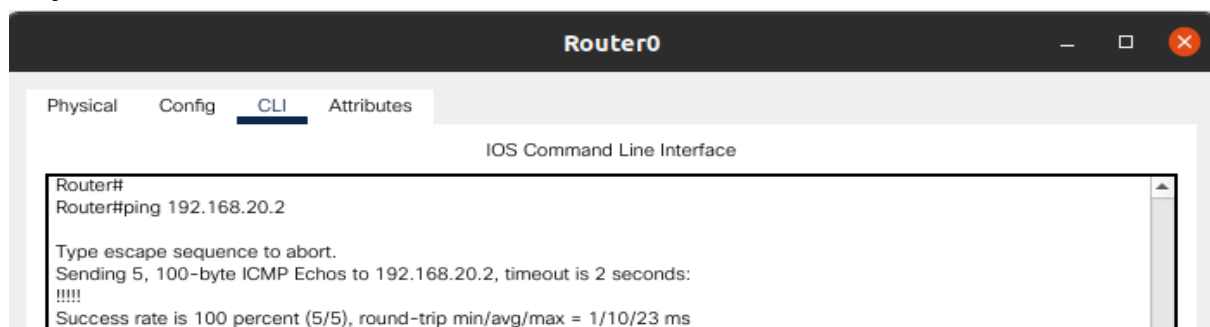


```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms
```

Vanjska mreža



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

Router#
Router#ping 192.168.20.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.20.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/10/23 ms
```