

HACETTEPE UNIVERSITY
COMPUTER ENGINEERING DEPARTMENT
COMPUTER NETWORKS LABORATORY

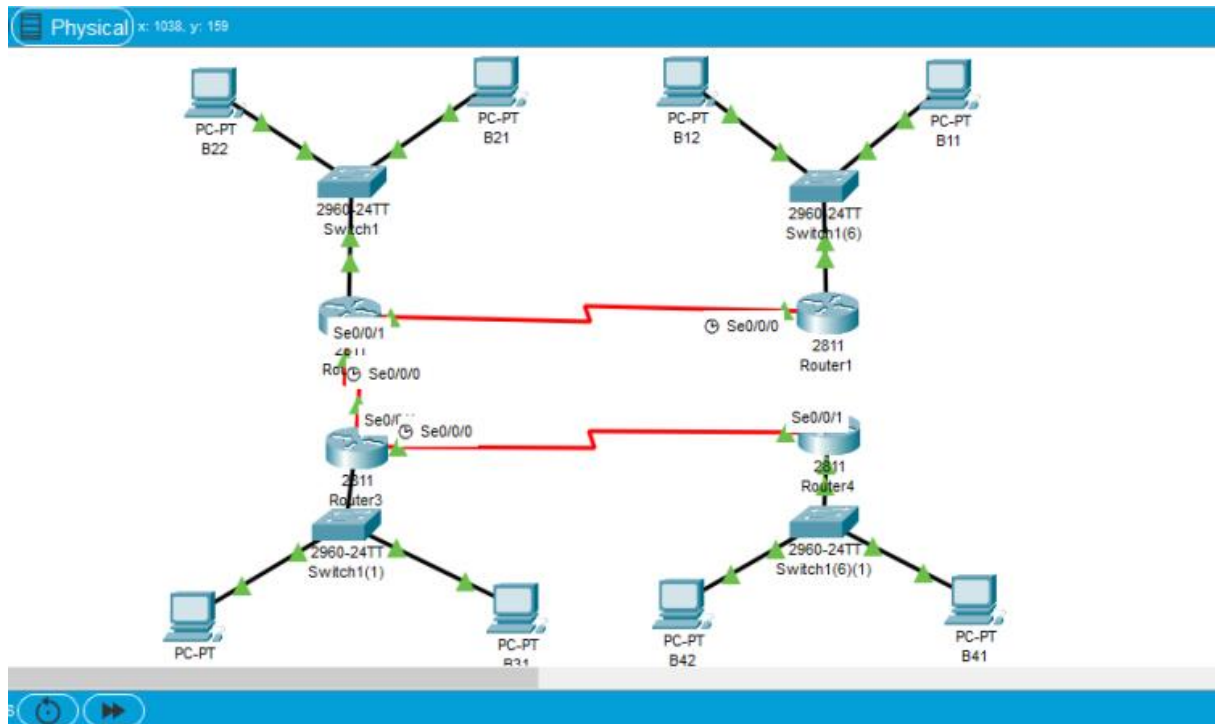


EXPERIMENT
Lab 10 Routing

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Group No:12



Topology

Router3

Physical **Config** CLI Attributes

GLOBAL

- Settings
- Algorithm Settings

ROUTING

- Static
- RIP

SWITCHING

- VLAN Database

INTERFACE

- FastEthernet0/0
- FastEthernet0/1
- Serial0/0/0
- Serial0/0/1**

Serial0/0/1

Port Status ☒ On

Duplex ☐ Full Duplex

Clock Rate 2000000

IP Configuration

IPv4 Address 10.212.2.2

Subnet Mask 255.255.255.0

Tx Ring Limit 10

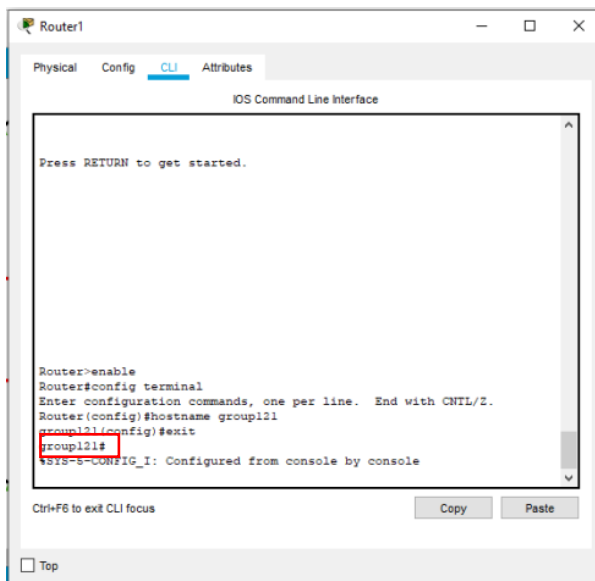
Equivalent IOS Commands

```
group123(config-if)#ip address
% Incomplete command.
group123(config-if)#ip address 10.212.2.2 255.255.255.0
group123(config-if)#ip address 10.212.2.2 255.255.255.0
group123(config-if)#no shutdown
group123(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up
```

☐ Top

To make all of the connections green we configured the IP addresses.

Hostnames are given as group number + router number for example; router 1's hostname is group 12+ router 1 so Group121.



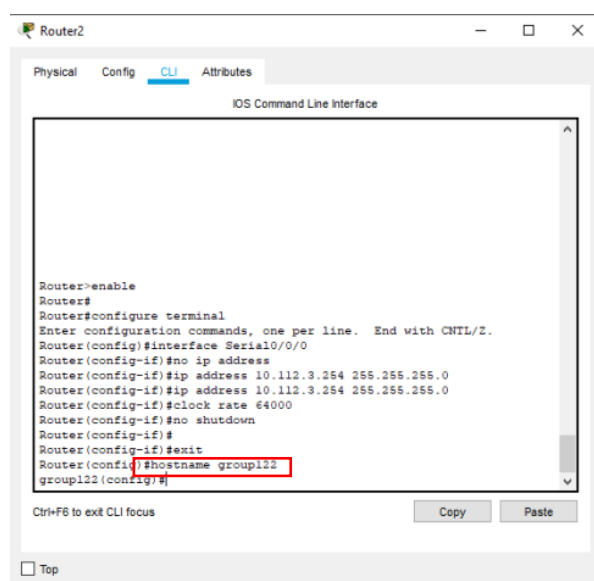
```
Router1
Physical Config CLI Attributes
IOS Command Line Interface

Press RETURN to get started.

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname group121
group121(config)#exit
SYS-5-CONFIG_I: Configured from console by console

Ctrl+F6 to exit CLI focus
```

Hostname Router 1

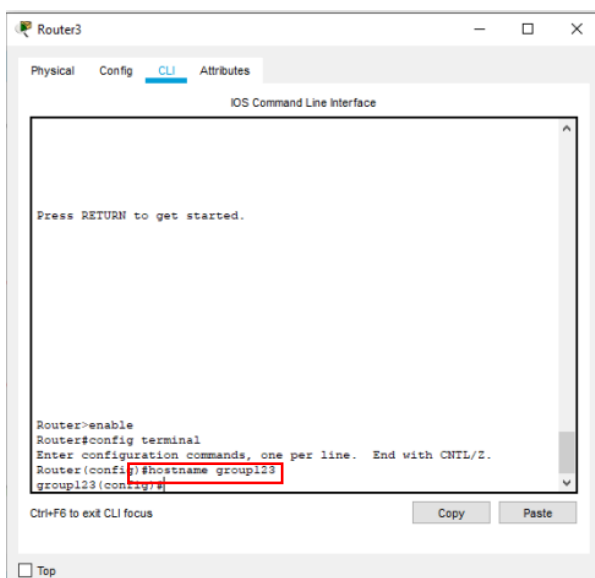


```
Router2
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Serial0/0/0
Router(config-if)#no ip address
Router(config-if)#ip address 10.112.3.254 255.255.255.0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#exit
Router(config)#hostname group122
group122(config)#

Ctrl+F6 to exit CLI focus
```

Hostname Router2



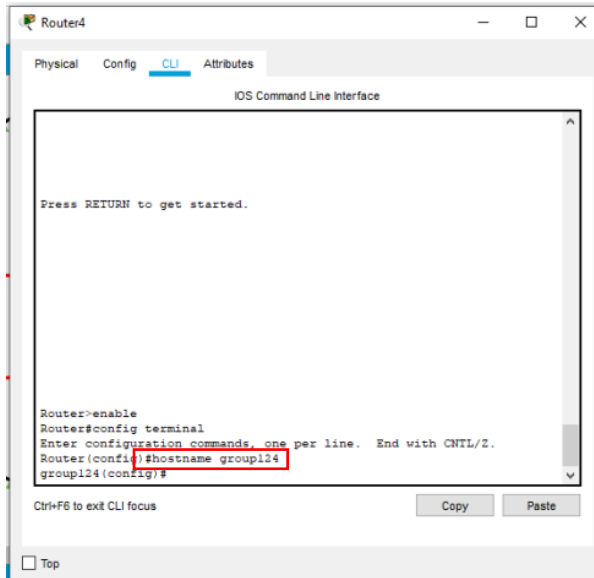
```
Router3
Physical Config CLI Attributes
IOS Command Line Interface

Press RETURN to get started.

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname group123
group123(config)#

Ctrl+F6 to exit CLI focus
```

Hostname Router 3



```
Router4
Physical Config CLI Attributes
IOS Command Line Interface

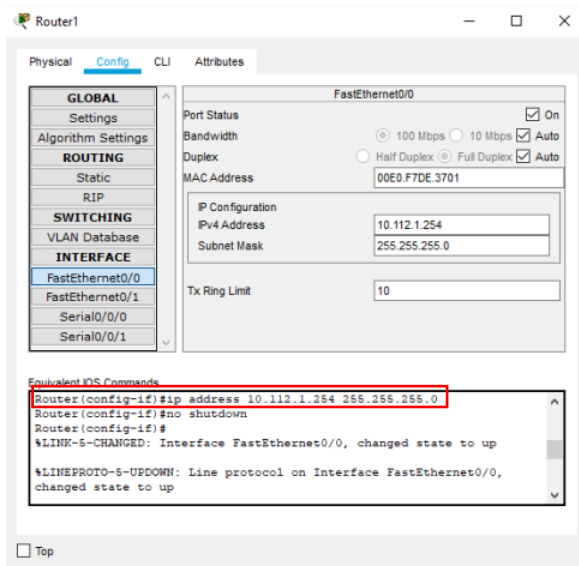
Press RETURN to get started.

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname group124
group124(config)#

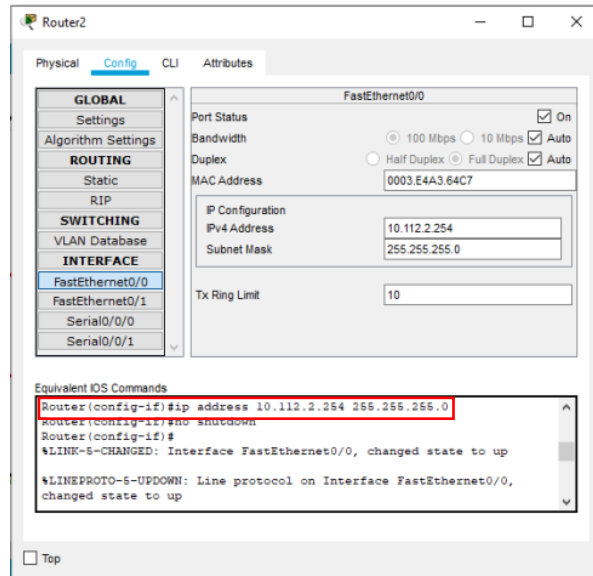
Ctrl+F6 to exit CLI focus
```

Hostname Router 4

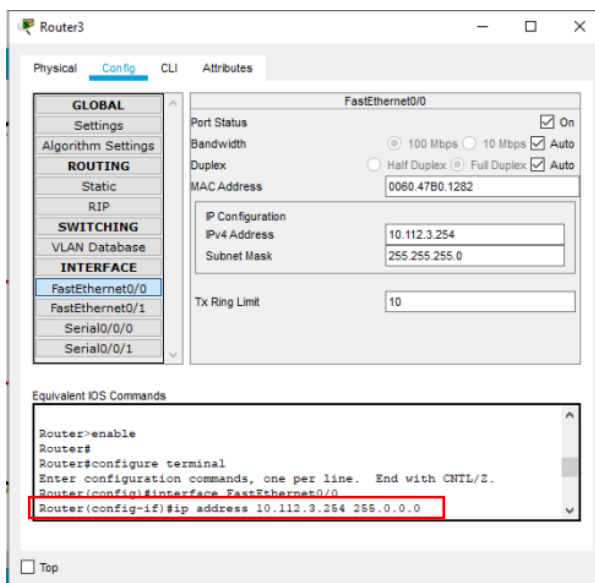
IP configuration, sets up the IP addresses of the interface.



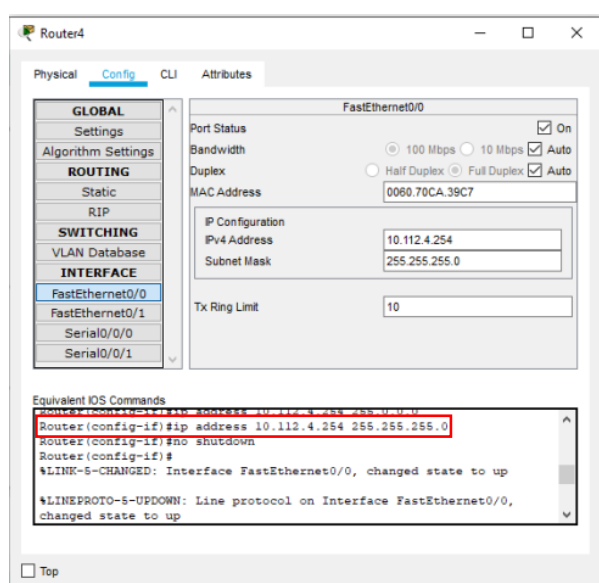
Router 1 IP address



Router 2 IP address



Router 3 IP address



Router 4 IP address

Encapsulation, configures communication links for the serial interfaces.

```
group121(config)#interface Serial0/0/0
group121(config-if)#encapsulation hdlc
group121(config-if)#encapsulation ?
  frame-relay  Frame Relay networks
  hdlc         Serial HDLC synchronous
  ppp         Point-to-Point protocol
group121(config-if)#encapsulation !
```

Router 1 encapsulation

```
group122(config)#interface Serial0/0/0
group122(config-if)#encapsulation hdlc
group122(config-if)#
```

Router 2 encapsulation

```
group123(config)#interface Serial0/0/0
group123(config-if)#encapsulation hdlc
group123(config-if)#
```

Router 3 encapsulation

Router 4 can't be encapsulated because encapsulation is for serial interfaces.

```
group121#show controllers serial 0/0/0
Interface Serial0/0/0
Hardware is PowerQUICC MPC860
DCR V.36, clock rate 1000000
IDB at 0x010918C4, driver data structure at 0x01094AC0
SCC Registers:
General [GSMR]=0x2:0x00000000, Protocol-specific [PSMR]=0x0
Events [SCCE]=0x00000, Mask [SCCM]=0x00000, Status [SCCS]=0x00
Transmit on Demand [TODR]=0x0, Data Sync [DSR]=0x7E7E
Interrupt Registers:
Config [CICR]=0x00000000, Pending [CIPR]=0x00000000
Mask [CIMR]=0x000200000, In-srv [CIIR]=0x00000000
Command register [CR]=0x580
Port A [PADIR]=0x01030, [PAPAR]=0x0FFF
[PADDR]=0x00010, [PADAT]=0xCFFF
Port B [PBDIR]=0x009C0F, [PBPAR]=0x0800E
[PBDOR]=0x00000, [PBRTAT]=0x3FFF
Port C [PCDIR]=0x00C, [PCPAR]=0x200
[PCSO]=0xC20, [PCDAT]=0x0DF3, [PCINT]=0x00F
Receive Ring
rmd(68012830): status 9000 length 60C address 3B6DAC4
rmd(68012838): status B000 length 60C address 3B6D444
Transmit Ring
tmd(680128B0): status 0 length 0 address 0
tmd(680128B8): status 0 length 0 address 0
tmd(680128C0): status 0 length 0 address 0
tmd(680128C8): status 0 length 0 address 0
tmd(680128D0): status 0 length 0 address 0
tmd(680128D8): status 0 length 0 address 0
tmd(680128E0): status 0 length 0 address 0
tmd(680128E8): status 0 length 0 address 0
tmd(680128F0): status 0 length 0 address 0
tmd(680128F8): status 0 length 0 address 0
tmd(68012900): status 0 length 0 address 0
tmd(68012908): status 0 length 0 address 0
tmd(68012910): status 0 length 0 address 0
tmd(68012918): status 0 length 0 address 0
tmd(68012920): status 0 length 0 address 0
--More--

tmd(68012900): status 0 length 0 address 0
tmd(68012908): status 0 length 0 address 0
tmd(68012910): status 0 length 0 address 0
tmd(68012918): status 0 length 0 address 0
tmd(68012920): status 0 length 0 address 0
tmd(68012928): status 2000 length 0 address 0

tx_limited=1(2)
SCC GENERAL PARAMETER RAM (at 0x68013C00)
Rx BD Base [RBASE]=0x2830, Fn Code [RFCR]=0x18
Tx BD Base [TBASE]=0x28B0, Fn Code [TFCR]=0x18
Max Rx Buff Len [MRBLR]=1648
Rx State [RSTATE]=0x0, BD Ptr [RBPTR]=0x2830
Tx State [TSTATE]=0x4000, BD Ptr [TBPTR]=0x28B0

SCC HDLC PARAMETER RAM (at 0x68013C38)
CRC Preset [C_PRES]=0xFFFF, Mask [C_MASK]=0xF0B8
Errors: CRC [CRCRC]=0, Aborts [ABTSC]=0, Discards [DISFC]=0
Nonmatch Addr Cntr [NMARC]=0
Retry Count [RETRC]=0
Max Frame Length [MFLR]=1608
Rx Int Threshold [RFTHR]=0, Frame Cnt [RFCONT]=0
User-defined Address 0000/0000/0000/0000
User-defined Address Mask 0x0000

buffer size 1524

PowerQUICC SCC specific errors:
0 input aborts on receiving flag sequence
0 throttles, 0 enables
0 overruns
0 transmitter underruns
0 transmitter CTS losts
0 aborted short frames

group121#
group121#
```

Router 1 show controllers serial 0/0/0

Clock rate is 20000000 because we didn't set it yet so it shows the default.

```
group122#show controllers serial 0/0/0
Interface Serial0/0/0
Hardware is PowerQUICC MPC860
DCE V.35, clock rate 64000
idb at 0x81081AC4, driver data structure at 0x81084AC0
SCC Registers:
General [GSMR]=0x2:0x00000000, Protocol-specific [PSMR]=0x8
Events [SCCE]=0x0000, Mask [SCCM]=0x0000, Status [SCCS]=0x00
Transmit on Demand [TODR]=0x0, Data Sync [DSR]=0x7E7E
Interrupt Registers:
Config [CICR]=0x00367F80, Pending [CIPR]=0x0000C000
Mask [CIMR]=0x00200000, In-srv [CISR]=0x00000000
Command register [CR]=0x580
Port A [PADIR]=0x1030, [PAPAR]=0xFFFF
[PAODR]=0x0010, [PADAT]=0xCBFF
Port B [PBDIR]=0x09C0F, [PBPAR]=0x0800E
[PBODR]=0x00000, [PBDAT]=0x3FFFD
Port C [PCDIR]=0x00C, [PCPAR]=0x200
[PCSO]=0xC20, [PCDAT]=0xDF2, [PCINT]=0x00F
Receive Ring
  rmd(68012830): status 9000 length 60C address 3B6DAC4
  rmd(68012838): status B000 length 60C address 3B6D444
Transmit Ring
--More--
```

Router 2 show controller

```
group123#show controllers serial 0/0/0
Interface Serial0/0/0
Hardware is PowerQUICC MPC860
DCE V.35, clock rate 2000000
idb at 0x81081AC4, driver data structure at 0x81084AC0
SCC Registers:
General [GSMR]=0x2:0x00000000, Protocol-specific [PSMR]=0x8
Events [SCCE]=0x0000, Mask [SCCM]=0x0000, Status [SCCS]=0x00
Transmit on Demand [TODR]=0x0, Data Sync [DSR]=0x7E7E
Interrupt Registers:
Config [CICR]=0x00367F80, Pending [CIPR]=0x0000C000
Mask [CIMR]=0x00200000, In-srv [CISR]=0x00000000
Command register [CR]=0x580
Port A [PADIR]=0x1030, [PAPAR]=0xFFFF
[PAODR]=0x0010, [PADAT]=0xCBFF
Port B [PBDIR]=0x09C0F, [PBPAR]=0x0800E
[PBODR]=0x00000, [PBDAT]=0x3FFFD
Port C [PCDIR]=0x00C, [PCPAR]=0x200
[PCSO]=0xC20, [PCDAT]=0xDF2, [PCINT]=0x00F
Receive Ring
  rmd(68012830): status 9000 length 60C address 3B6DAC4
  rmd(68012838): status B000 length 60C address 3B6D444
Transmit Ring
--More--
```

Router 3 show controller

Clock rate, configures the clock rate to our serial interface.

```
group121(config)#interface Serial0/0/0
group121(config-if)#clock rate 64000
group121(config-if)#
```

Router 1 clock rate

```
group122(config)#interface Serial0/0/0
group122(config-if)#clock rate 64000
group122(config-if)#
```

Router 2 clock rate

```
group123(config)#interface Serial0/0/0
group123(config-if)#clock rate 64000
group123(config-if)#
group123(config-if)#exit
```

Router 3 clock rate

No shutdown keeps the interface active.

The Packet Tracer when user clicks on the “On” button automatically does this we will show the Router 3’s terminal as an example.

The screenshot shows the configuration window for Router3. The 'Config' tab is selected. On the left, the 'INTERFACE' section is expanded, and 'Serial0/0/0' is selected. The main configuration area for 'Serial0/0/0' is shown. The 'Port Status' is set to 'On' (checked). The 'Duplex' is set to 'Full Duplex'. The 'Clock Rate' is set to '64000'. The 'IP Configuration' section is empty. The 'Tx Ring Limit' is set to '10'. Below the configuration area, the 'Equivalent IOS Commands' section shows the following commands:

```
group123(config)#interface Serial0/0/0
group123(config-if)#clock rate 64000
group123(config-if)#
group123(config-if)#exit
group123(config)#interface Serial0/0/0
group123(config-if)#no shutdown
group123(config-if)#
```

The 'no shutdown' command is highlighted with a red box. At the bottom left, there is a 'Top' button.

Show command is used for lets us check the interface.

```
group121#show ip interface brief
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    10.112.1.254    YES manual up
up
FastEthernet0/1    unassigned      YES unset  administratively
down down
Serial0/0/0        10.212.1.1      YES manual up
up
Serial0/0/1        unassigned      YES unset  administratively
down down
Vlan1              unassigned      YES unset  administratively
down down
group121#
```

Router 1 show ip interface brief

```
group122#show ip interface brief
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    10.112.2.254    YES manual up
up
FastEthernet0/1    unassigned      YES unset  administratively
down down
Serial0/0/0        10.212.2.1      YES manual up
up
Serial0/0/1        10.212.1.2      YES manual up
up
Vlan1              unassigned      YES unset  administratively
down down
group122#
```

Router 2 show ip interface brief

```
group123#show ip interface brief
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    10.112.3.254    YES manual up
up
FastEthernet0/1    unassigned      YES unset  administratively
down down
Serial0/0/0        10.212.3.1      YES manual up
up
Serial0/0/1        10.212.2.2      YES manual up
up
Vlan1              unassigned      YES unset  administratively
down down
group123#
```

Router 3 show ip interface brief

```
group124#show ip interface brief
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    10.112.4.254    YES manual up
up
FastEthernet0/1    unassigned      YES unset  administratively
down down
Serial0/0/0        unassigned      YES unset  administratively
down down
Serial0/0/1        10.212.3.2      YES manual up
up
Vlan1              unassigned      YES unset  administratively
down down
group124#
```

Router 4 show ip interface brief

Show IP route command displays routing table.

```
group121#show ip route
Codes: C - connected, S - static, I - IGRP, 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

    10.0.0.0/24 is subnetted, 2 subnets
C       10.112.1.0 is directly connected, FastEthernet0/0
C       10.212.1.0 is directly connected, Serial0/0/0

group121#
```

Router 1 show ip route

```
group122#show ip route
Codes: C - connected, S - static, I - IGRP, 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

    10.0.0.0/24 is subnetted, 3 subnets
C       10.112.2.0 is directly connected, FastEthernet0/0
C       10.212.1.0 is directly connected, Serial0/0/1
C       10.212.2.0 is directly connected, Serial0/0/0

group122#
```

Router 2 show ip route

```
group123#show ip route
Codes: C - connected, S - static, I - IGRP, 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

    10.0.0.0/24 is subnetted, 3 subnets
C       10.112.3.0 is directly connected, FastEthernet0/0
C       10.212.2.0 is directly connected, Serial0/0/1
C       10.212.3.0 is directly connected, Serial0/0/0

group123#
```

Router 3 show ip route

```

group124#show ip route
Codes: C - connected, S - static, I - IGRP, 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

10.0.0.0/24 is subnetted, 2 subnets
C      10.112.4.0 is directly connected, FastEthernet0/0
C      10.112.3.0 is directly connected, Serial0/0/1
group124#

```

Router 4 show ip route

We can see that networks are directly connected to routers' interfaces which are fast ethernet and serial.

IP route command is used to connect to routers which are not directly connected.

```

group123(config)#ip route 10.112.1.0 255.255.255.0 Serial0/0/1
group123(config)#

```

Router 3 to router 1 IP route

```

group121#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
group121(config)#ip route 10.112.2.0 255.255.255.0 Serial0/0/0
group121(config)#ip route 10.112.3.0 255.255.255.0 Serial0/0/0
group121(config)#

```

Router 1 to router 2 and router 1 to router 3 IP route

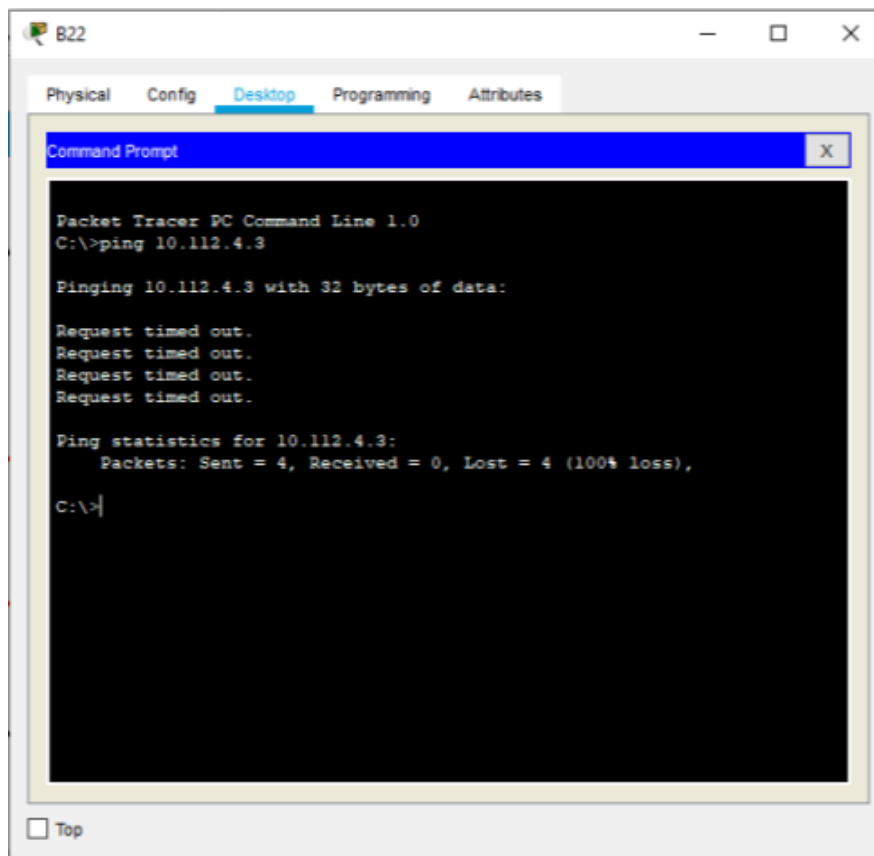
```

group121#ping 10.112.1.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.112.1.3, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/11 ms

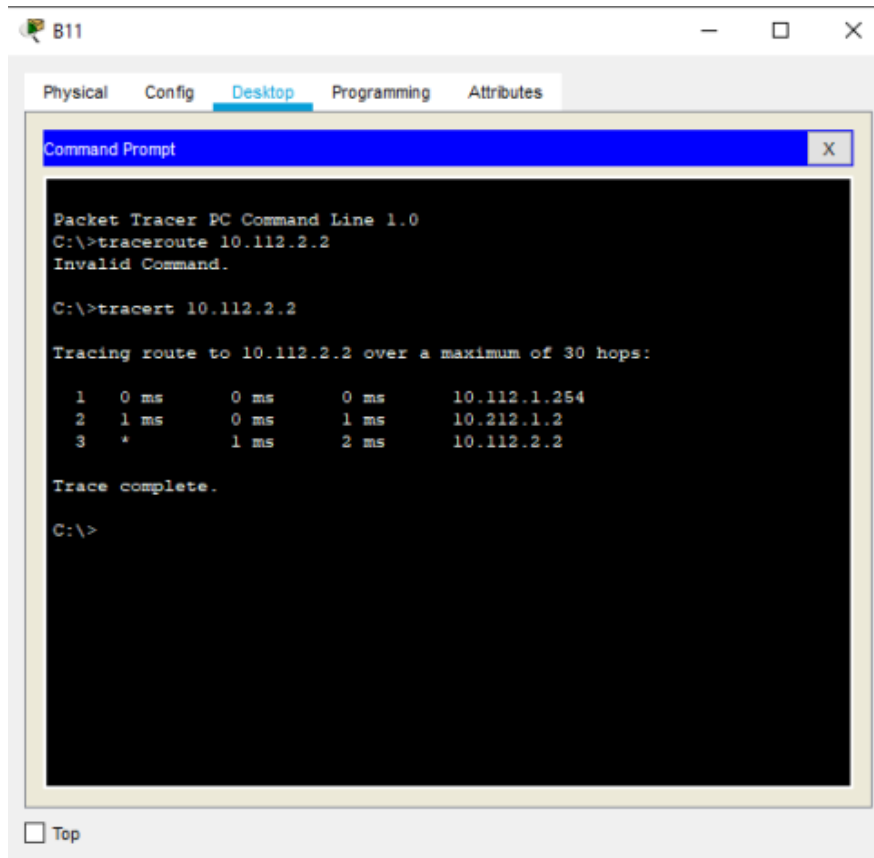
group121#ping 10.112.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.112.1.2, timeout is 2 seconds:
..!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/1 ms
group121#

```

Ping from Router 1 to B11 and B12



Ping from B22 which is a PC to B42 which is in another group.



Traceroute from B11 to B21

DCE / DTE

DTE is a unit that converts information comes from user into signals and reconverts received signals into information. Also, it is known as tail circuits. It can be any device that generates digital data. It needs an intermediary to communicate. It communicates with DCE. Source / destination of data is important. Computers, routers can be an example of DTE device.

DCE contains a functional unit to receive/transmit signal through network. It takes data come from DTE. (It can be used as an interface between DTE and data transmission circuit). Communication is important rather than source/destination of data in DCE. Modems are an example of DCE device.