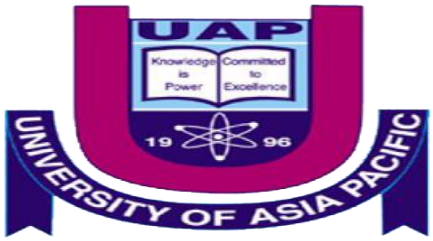

UNIVERSITY OF ASIA PACIFIC

Department of Computer Science & Engineering

VLSM with RIP

Course Code : CSE 320

Course Title : Computer Networks Lab

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Definition of RIP

Routing Information Protocol (RIP) is a **dynamic distance-vector routing protocol**. Routers running the distance-vector protocol send all or a portion of their routing tables in routing-update messages to their neighbors. We can use RIP to configure the hosts as part of a RIP network. It uses hop count as a routing metric to find the best path between the source and the destination network. It is a distance-vector routing protocol that has an AD value of 120 and works on the Network layer of the OSI model. RIP uses port number 520.

Features of RIP

-Updates of the network are exchanged periodically.
-Updates (routing information) are always broadcast.
- Full routing tables are sent in updates.
- Routers always trust routing information received from neighbor routers. This is also known as *Routing on rumors*.

RIP Versions

There are three versions of routing information protocol – **RIP Version1**, **RIP Version2**, and **RIPng**.

RIP Version-1:

It is an open standard protocol means it works on the various vendor's routers. It works on most of the routers, it is classful routing protocol. Updates are broadcasted. Its administrative distance value is 120, it means it is not reliable, The lesser the administrative distance value the reliability is much more. Its metric is hop count and max hop count is 15. There will be a total of 16 routers in the network. When there will be the same number of hop to reach the destination, Rip starts to perform load balancing. Load balancing means if there are three ways to reach the destination and each way has same number of routers then packets will be sent to each path to reach the destination. This reduces traffic and also the

load is balanced. It is used in small companies, in this protocol routing tables are updated in each 30 sec. Whenever link breaks rip trace out another path to reach the destination. It is one of the slowest protocol.

RIP Version-2:

The **Routing Information Protocol, version 2 (RIPv2)** is an enhanced version of RIP that includes support for important routing features such as class-less addressing and variable-length subnet masks. RIPv2 is a distance-vector protocol that has been in use for many years.

RIPng:

The RIPng IGP uses the Bellman-Ford distance-vector algorithm to determine the best route to a destination, using hop count as the metric. RIPng allows hosts and routers to exchange information for computing routes through an IP-based network. RIPng is intended to act as an IGP for moderately-sized autonomous systems.
RIPng is a distinct routing protocol from RIPv2. The Junos OS implementation of RIPng is similar to RIPv2.

VLSM

We have a limited number of private IPv4 addresses that can be used in every organization. As the Internet and most organizations are aggressively growing, we need a way to eliminate wasting IPv4 addresses. One of the ways that we can maximize the use of private IPv4 addresses in the organization is through subnetting.
The reason why we need subnetting is to efficiently distribute an IPv4 address with the least wastage and to create more networks with the smaller broadcast domains. To efficiently use subnetting, we can use Variable-Length Subnet Mask (VLSM).
It is a concept that is used to divide a network into multiple subnetworks of different lengths and sizes. VLSM is very commonly

used in various fields. For example, a college has a huge network that is divided into multiple sub-networks (one sub-network for the administration department, another for the academics department, etc.).

With Variable-Length Subnet Mask (VLSM), we can allot the closest required number of IP addresses into a subnetwork in our LAN. We don't need to use a /23 subnet mask in all of our subnets.

Advantages of VLSM over FLSM –

1. In Fixed length subnet mask subnetting (FLSM), all subnets are of equal size and have equal number of hosts but in VLSM the size is variable and it can have variable number of hosts thus making the IP addressing more efficient by allowing a routed system of different mask length to suit requirements.

2. In FLSM there is a wastage of IP addresses but in VLSM there is a minimum wastage of IP addresses, it leads to lesser wastage of IP addresses since variable-sized sub-networks are allowed in VLSM.

3. FLSM is preferred for private IP addresses while for public IP addresses VLSM is the best option.

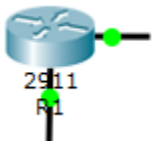
4. VLSM gives us more flexibility in creating a sub-network because of its variable size sub-network nature.

5. VLSM is suitable for public network IP addressing since, in the public domain, the size of a network can vary. In contrast, FLSM is used for private network IP addresses.

How to implement **VLSM with RIP**

Step-1: Open a project in Cisco Packet Tracer. Take router, switch, PC & laptop's from the drop down menu. The amount of these equipment's depends on the architecture of the project.

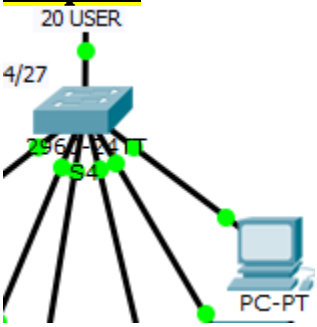
Step-2: Rename the equipment's to avoid confusion.



Step-3: Connect the individual routers.

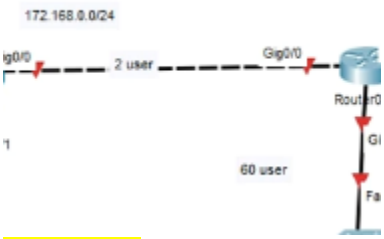
Step-4: Connect router with switch.

Step-5: Connect switches with PC's and laptops.

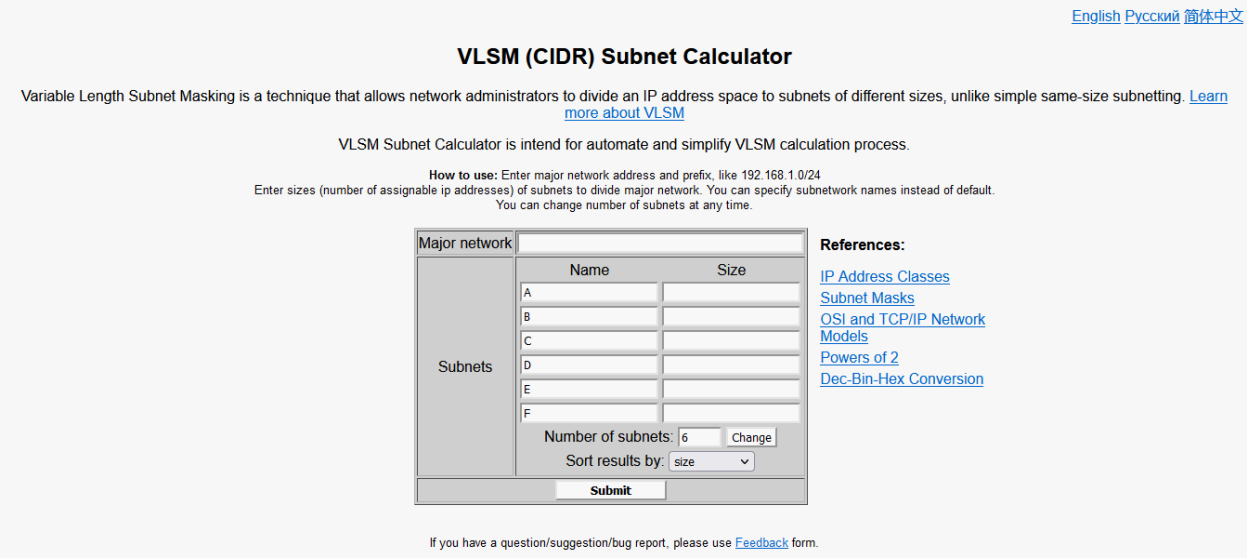


Step-6: Note down the IP addresses.

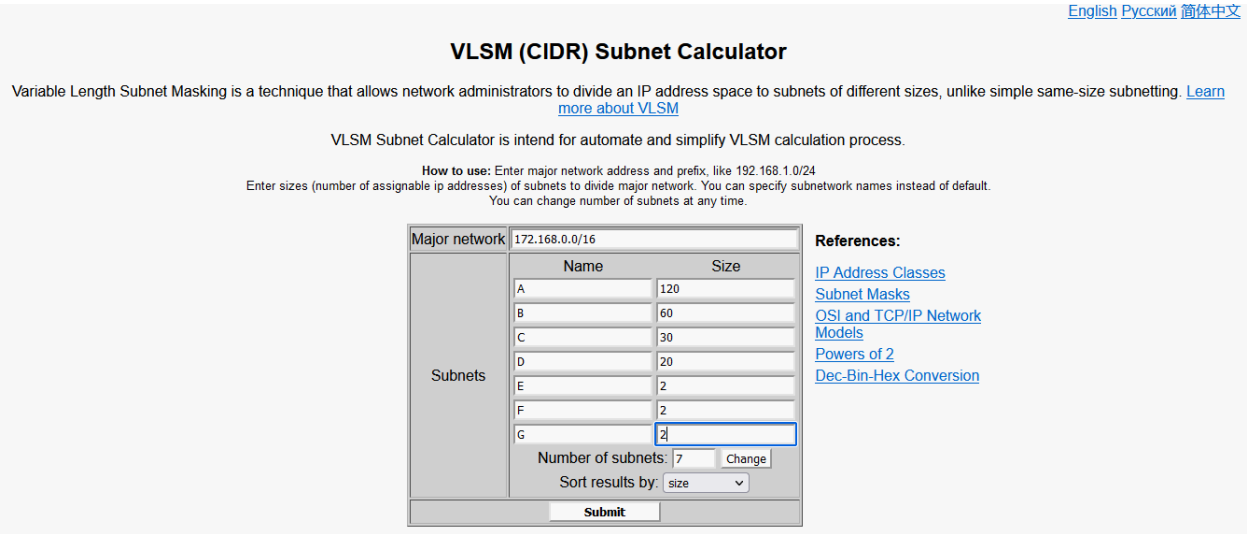
Step-7: Define user limits.



Step-8: Open a web browser, go to http://www.vlsmcalc.com/



Step-9: Input major network, number of subnets and size.



Step-10: Click submit, subnetting is successful.

Subnetting Successful

Major Network: **172.168.0.0/16**
Available IP addresses in major network: **65534**
Number of IP addresses needed: **236**
Available IP addresses in allocated subnets: **254**
About **0%** of available major network address space is used
About **93%** of subnetted network address space is used

Subnet Name	Needed Size	Allocated Size	Address	Mask	Dec Mask	Assignable Range	Broadcast
A	120	126	172.168.0.0	/25	255.255.255.128	172.168.0.1 - 172.168.0.126	172.168.0.127
B	60	62	172.168.0.128	/26	255.255.255.192	172.168.0.129 - 172.168.0.190	172.168.0.191
C	30	30	172.168.0.192	/27	255.255.255.224	172.168.0.193 - 172.168.0.222	172.168.0.223
D	20	30	172.168.0.224	/27	255.255.255.224	172.168.0.225 - 172.168.0.254	172.168.0.255
E	2	2	172.168.1.0	/30	255.255.255.252	172.168.1.1 - 172.168.1.2	172.168.1.3
F	2	2	172.168.1.4	/30	255.255.255.252	172.168.1.5 - 172.168.1.6	172.168.1.7
G	2	2	172.168.1.8	/30	255.255.255.252	172.168.1.9 - 172.168.1.10	172.168.1.11

Back to form New calculation

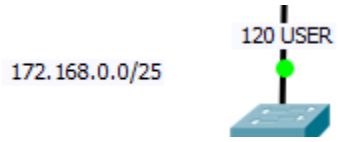
If you have a question/suggestion/bug report, please use Feedback form.

Hosted at Novgorod State University

Step-11: Note down the addresses. The addresses are-

For 120, 60 and 30 user-
172.168.0.0/25
172.168.0.128/26
172.168.0.192/27
172.168.0.224/27

For 3 users, the IP addresses are-
172.168.1.0/30
172.168.1.4/30
172.168.1.8/30



Step-12: Configure each routers. For router 1,2,3 and 4 the codes are-

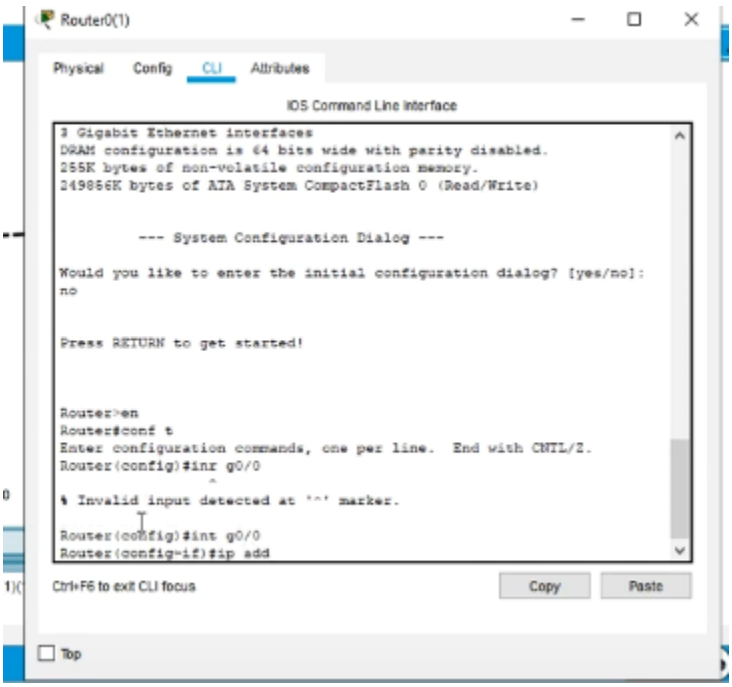
enable
configure terminal
int g0/0
ip address 172.168.1.1 255.255.255.252
no shutdown
exit
int g0/1
ip address 172.168.0.1 255.255.255.128
no shutdown

enable
configure terminal
int g0/0
ip address 172.168.1.2 255.255.255.252
no shutdown
exit
int g0/2
ip address 172.168.0.129 255.255.255.192
no shutdown
exit
int g0/1
ip address 172.168.1.5 255.255.255.252
no shutdown

enable
configure terminal
int g0/0
ip address 172.168.1.6 255.255.255.252
no shutdown
exit
int g0/2
ip address 172.168.0.193 255.255.255.224
no shutdown

exit
int g0/1
ip address 172.168.1.9 255.255.255.252
no shutdown

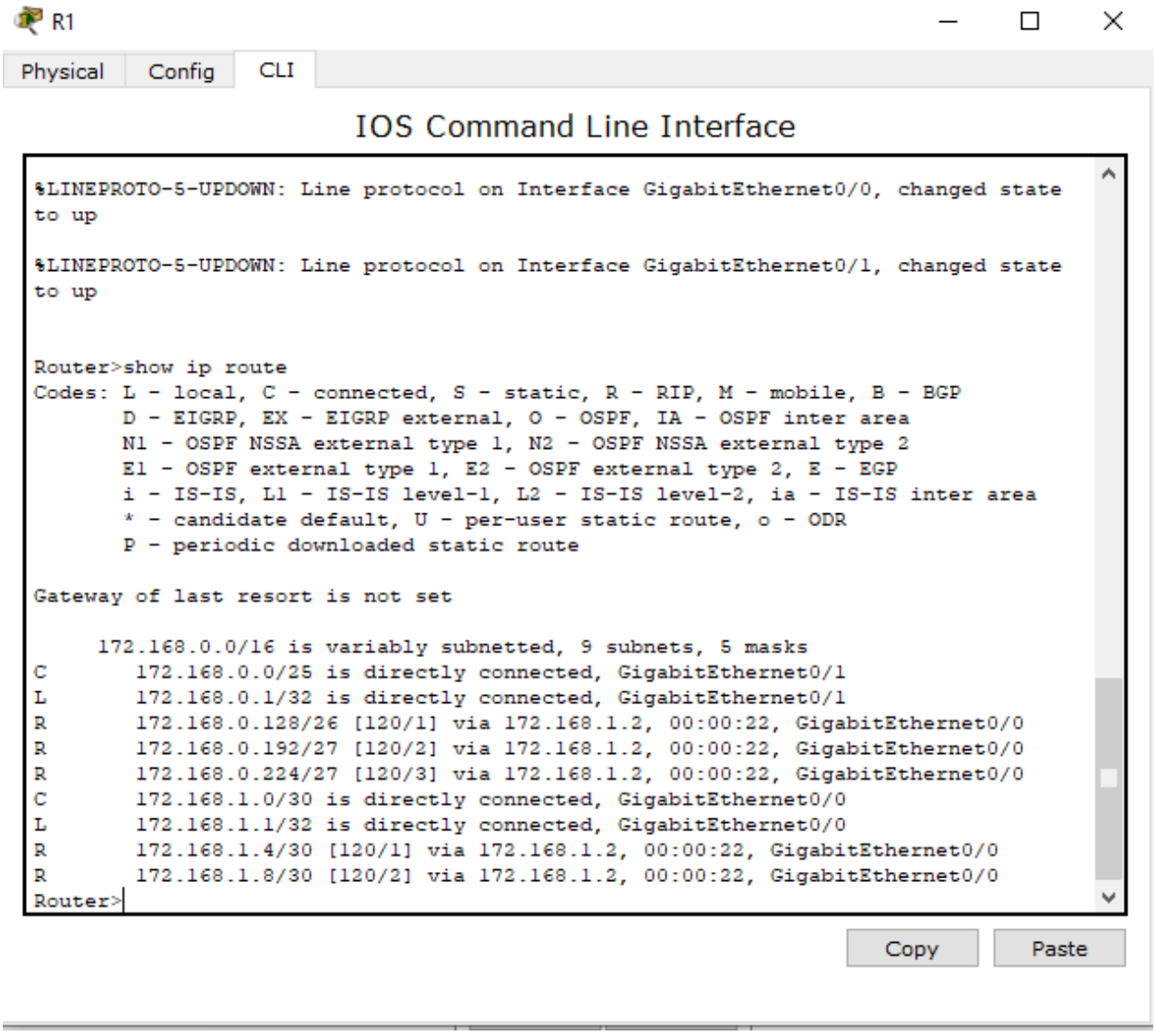
enable
configure terminal
int g0/0
ip address 172.168.1.10 255.255.255.252
no shutdown
exit
int g0/1
ip address 172.168.0.225 255.255.255.224
no shutdown

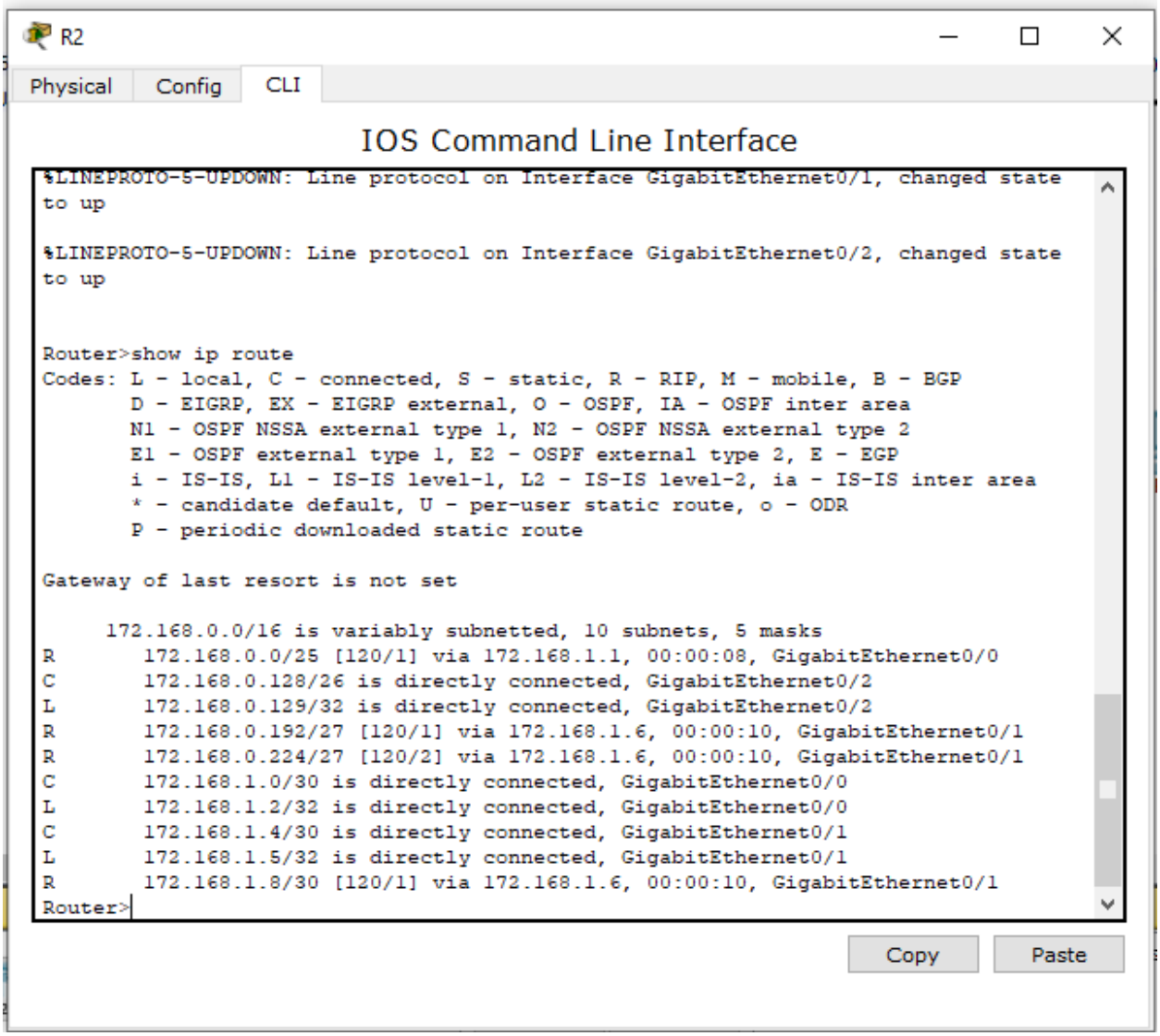


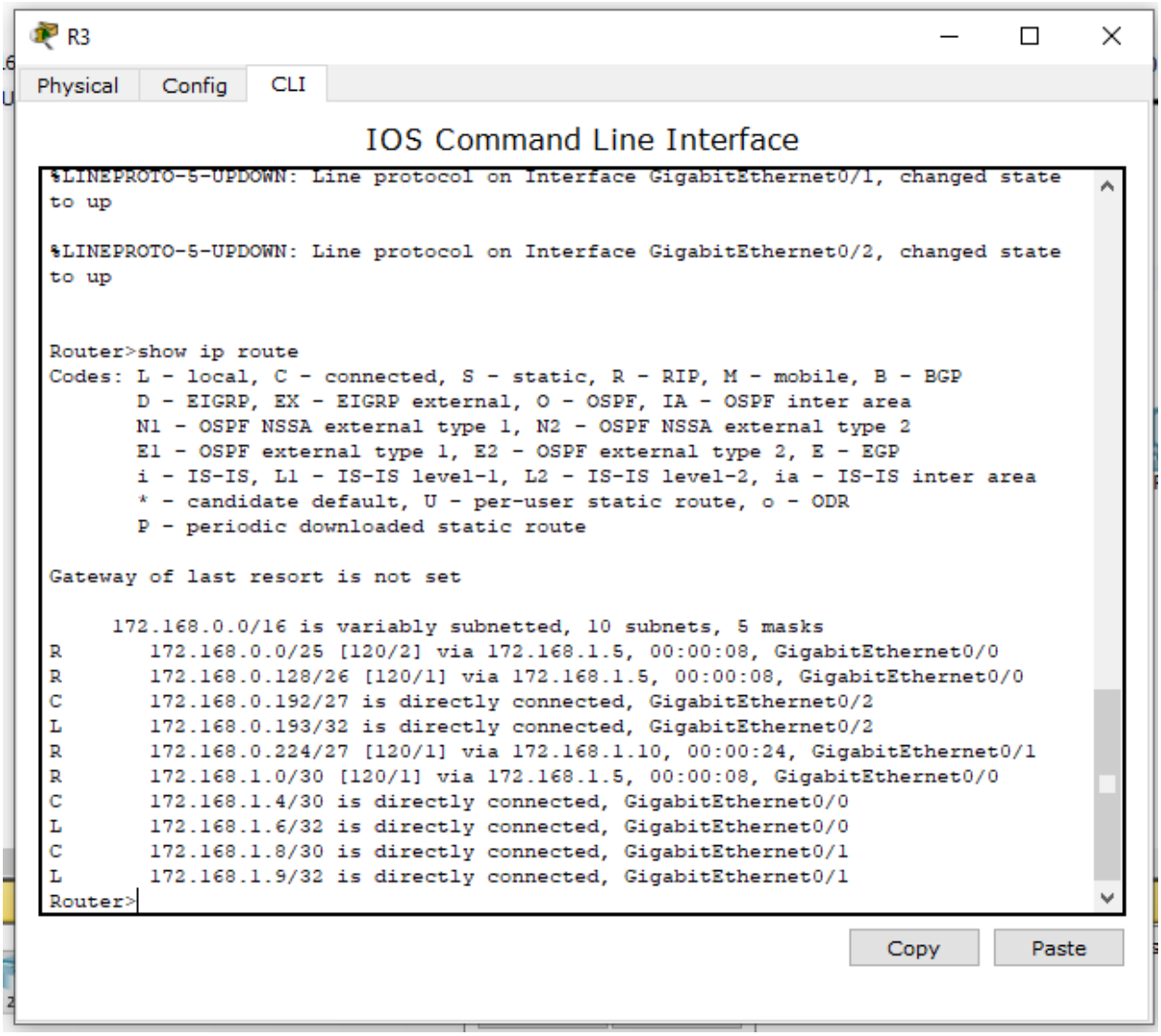
Step-13: Go to CLI of each routers and command-

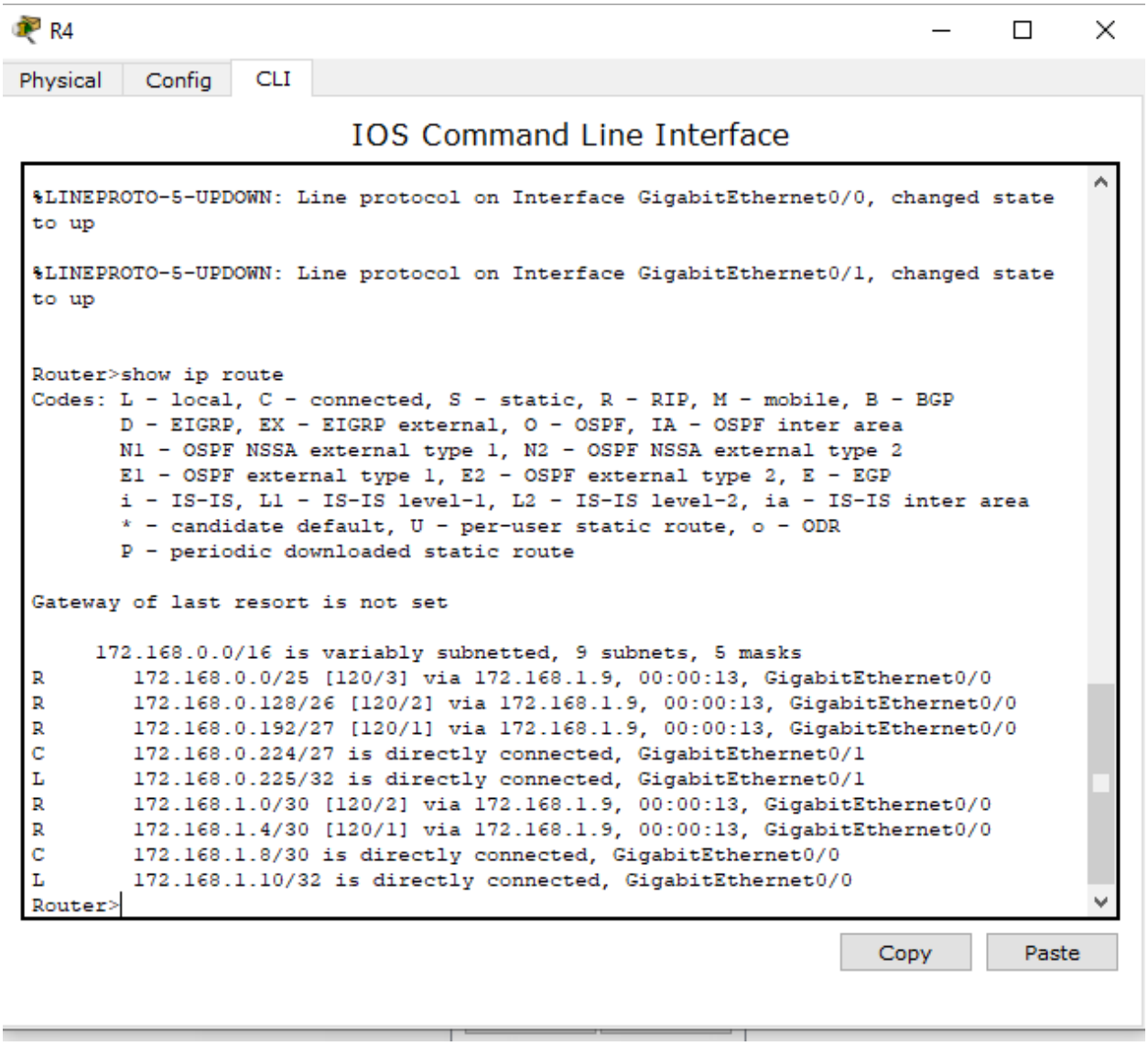
show ip route

to see directly connected ip addresses-




R2
Physical
Config
CLI
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up
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
172.168.0.0/16 is variably subnetted, 10 subnets, 5 masks
R 172.168.0.0/25 [120/1] via 172.168.1.1, 00:00:08, GigabitEthernet0/0
C 172.168.0.128/26 is directly connected, GigabitEthernet0/2
L 172.168.0.129/32 is directly connected, GigabitEthernet0/2
R 172.168.0.192/27 [120/1] via 172.168.1.6, 00:00:10, GigabitEthernet0/1
R 172.168.0.224/27 [120/2] via 172.168.1.6, 00:00:10, GigabitEthernet0/1
C 172.168.1.0/30 is directly connected, GigabitEthernet0/0
L 172.168.1.2/32 is directly connected, GigabitEthernet0/0
C 172.168.1.4/30 is directly connected, GigabitEthernet0/1
L 172.168.1.5/32 is directly connected, GigabitEthernet0/1
R 172.168.1.8/30 [120/1] via 172.168.1.6, 00:00:10, GigabitEthernet0/1
Router>
Copy
Paste


R3
Physical
Config
CLI
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up
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
172.168.0.0/16 is variably subnetted, 10 subnets, 5 masks
R 172.168.0.0/25 [120/2] via 172.168.1.5, 00:00:08, GigabitEthernet0/0
R 172.168.0.128/26 [120/1] via 172.168.1.5, 00:00:08, GigabitEthernet0/0
C 172.168.0.192/27 is directly connected, GigabitEthernet0/2
L 172.168.0.193/32 is directly connected, GigabitEthernet0/2
R 172.168.0.224/27 [120/1] via 172.168.1.10, 00:00:24, GigabitEthernet0/1
R 172.168.1.0/30 [120/1] via 172.168.1.5, 00:00:08, GigabitEthernet0/0
C 172.168.1.4/30 is directly connected, GigabitEthernet0/0
L 172.168.1.6/32 is directly connected, GigabitEthernet0/0
C 172.168.1.8/30 is directly connected, GigabitEthernet0/1
L 172.168.1.9/32 is directly connected, GigabitEthernet0/1
Router>
Copy
Paste



Step-14: Go to router 1 and write down the above code in CLI-

configure terminal
router rip
network 172.168.0.0
network 172.168.1.0
no auto-summary
version 2

Similarly, go to router 2 and write down the above code in CLI-

configure terminal
router rip
network 172.168.0.128
network 172.168.1.0
network 172.168.1.4
no auto- summary
version 2

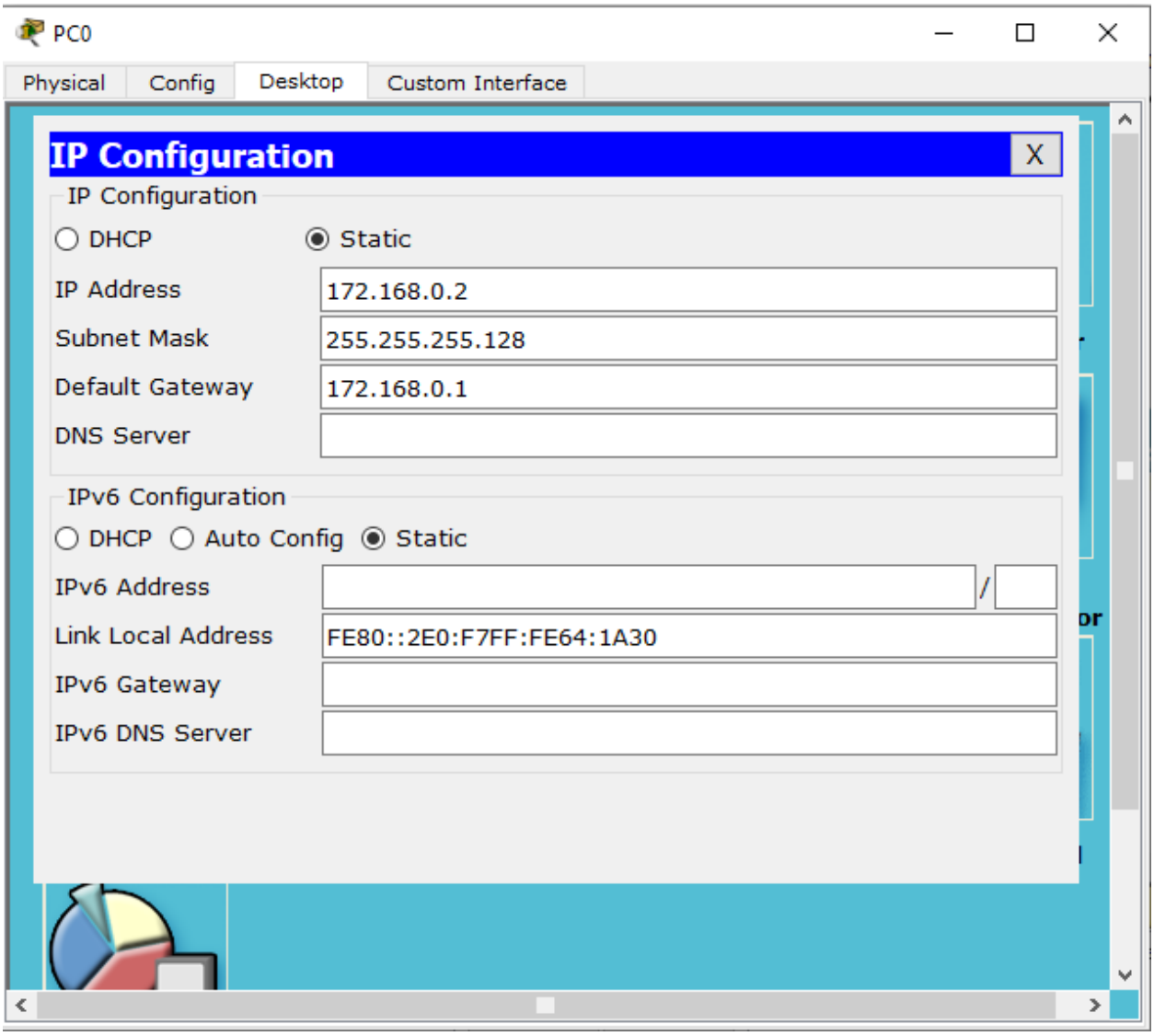
Similarly, go to router 3 and write down the above code in CLI-

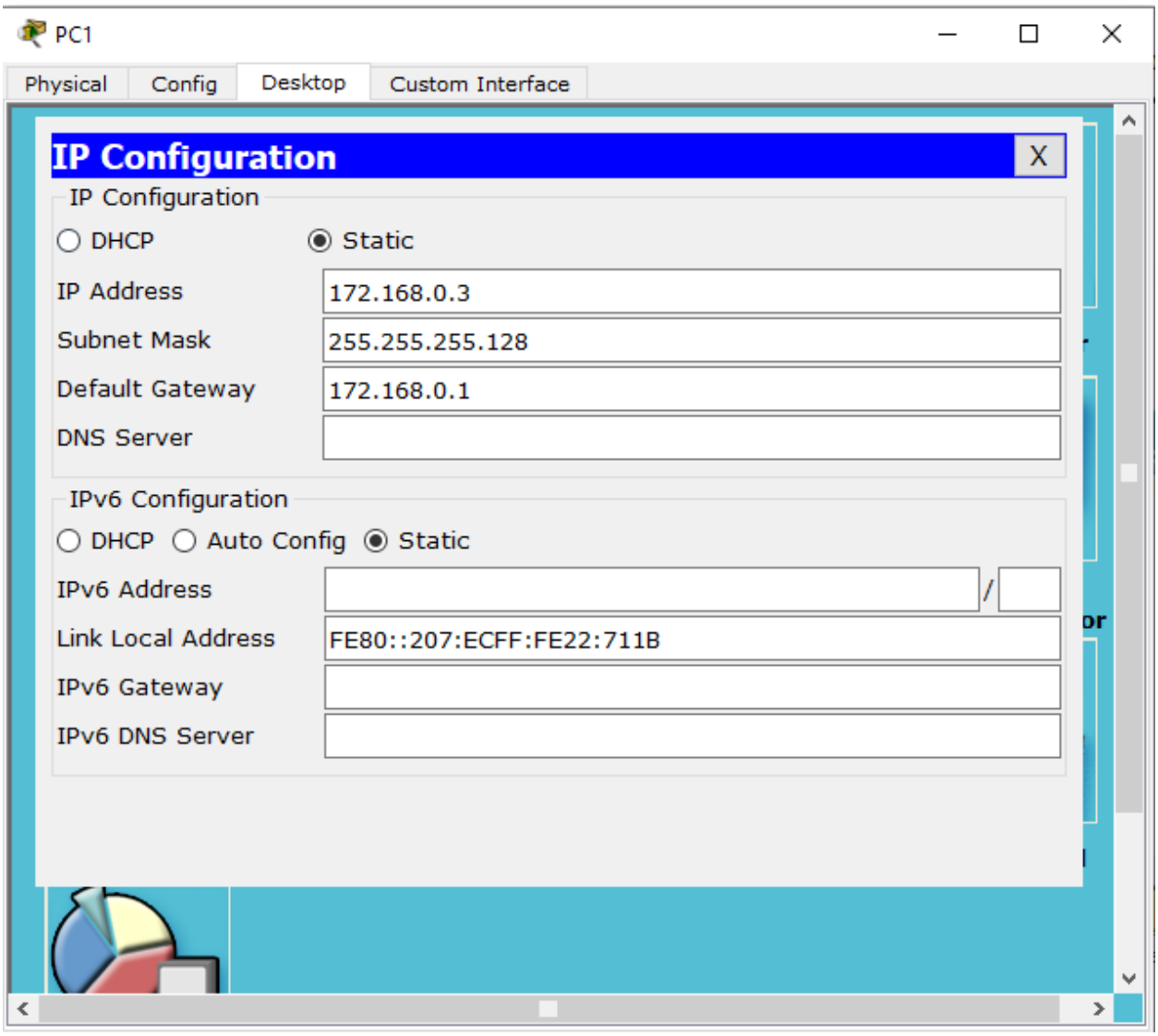
configure terminal
router rip
network 172.168.0.192
network 172.168.1.4
network 172.168.1.8
no auto-summary
version 2

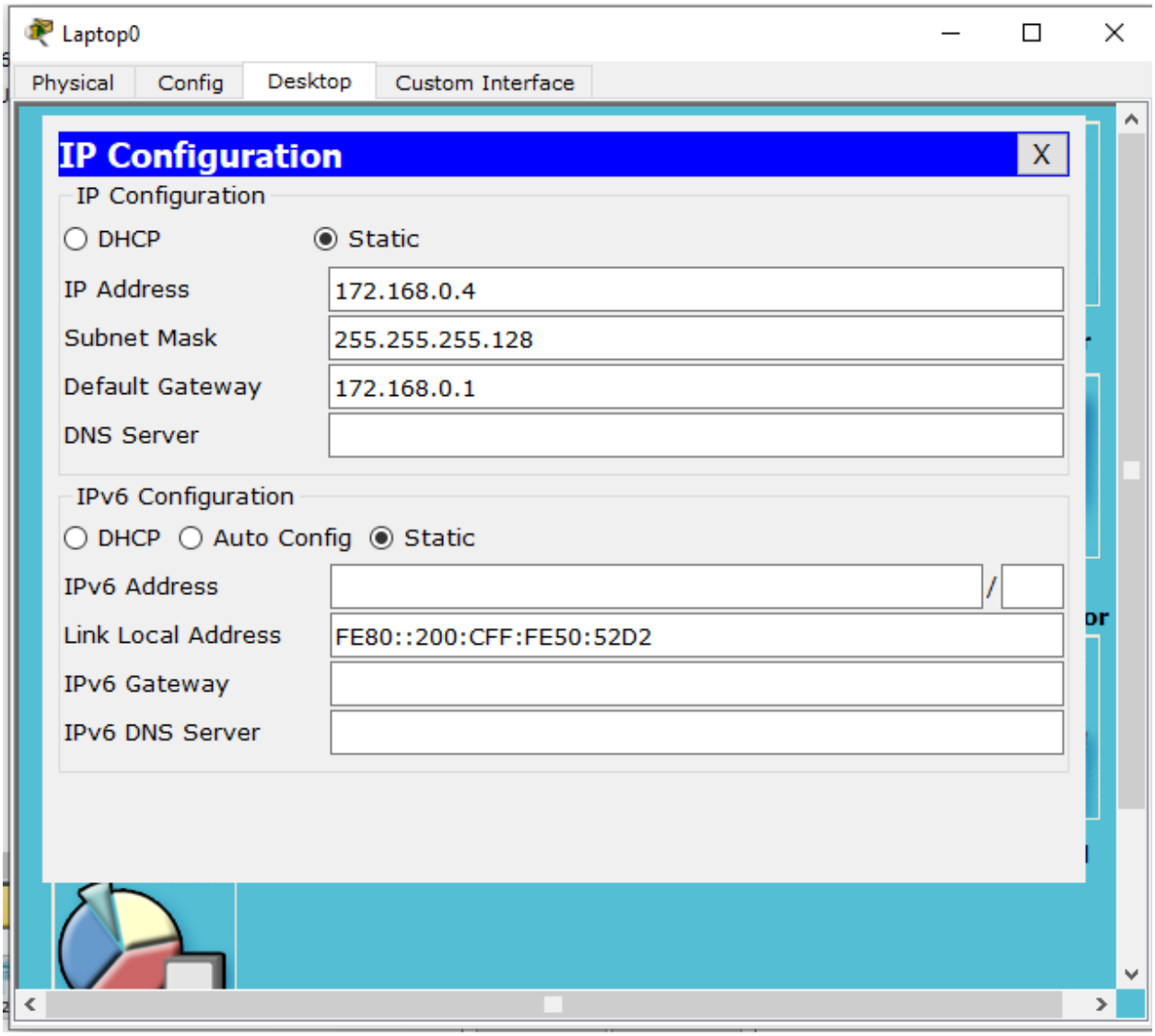
Similarly, go to router 4 and write down the above code in CLI-

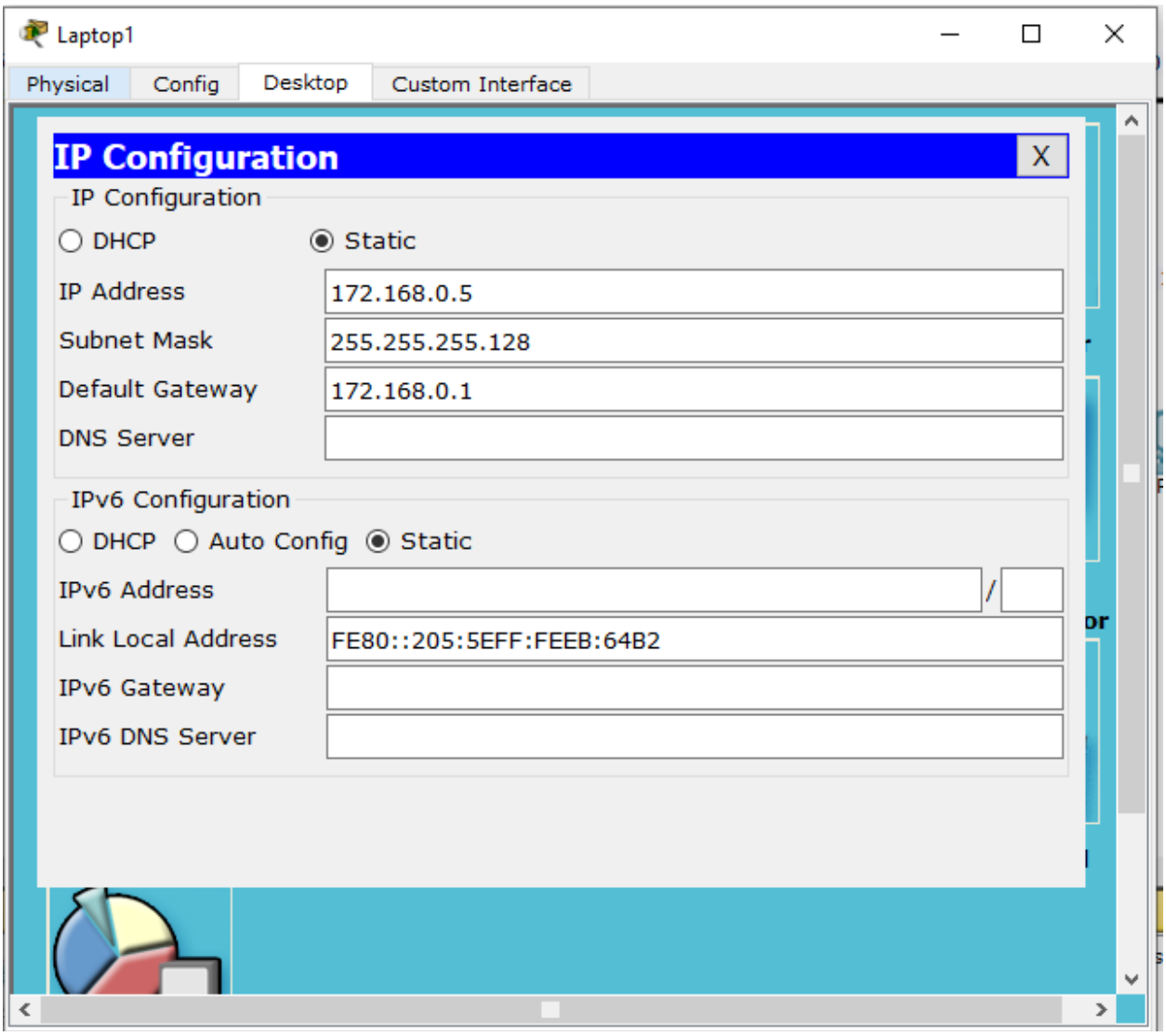
configure terminal
router rip
network 172.168.0.224
network 172.168.1.8
no auto-summary
version 2

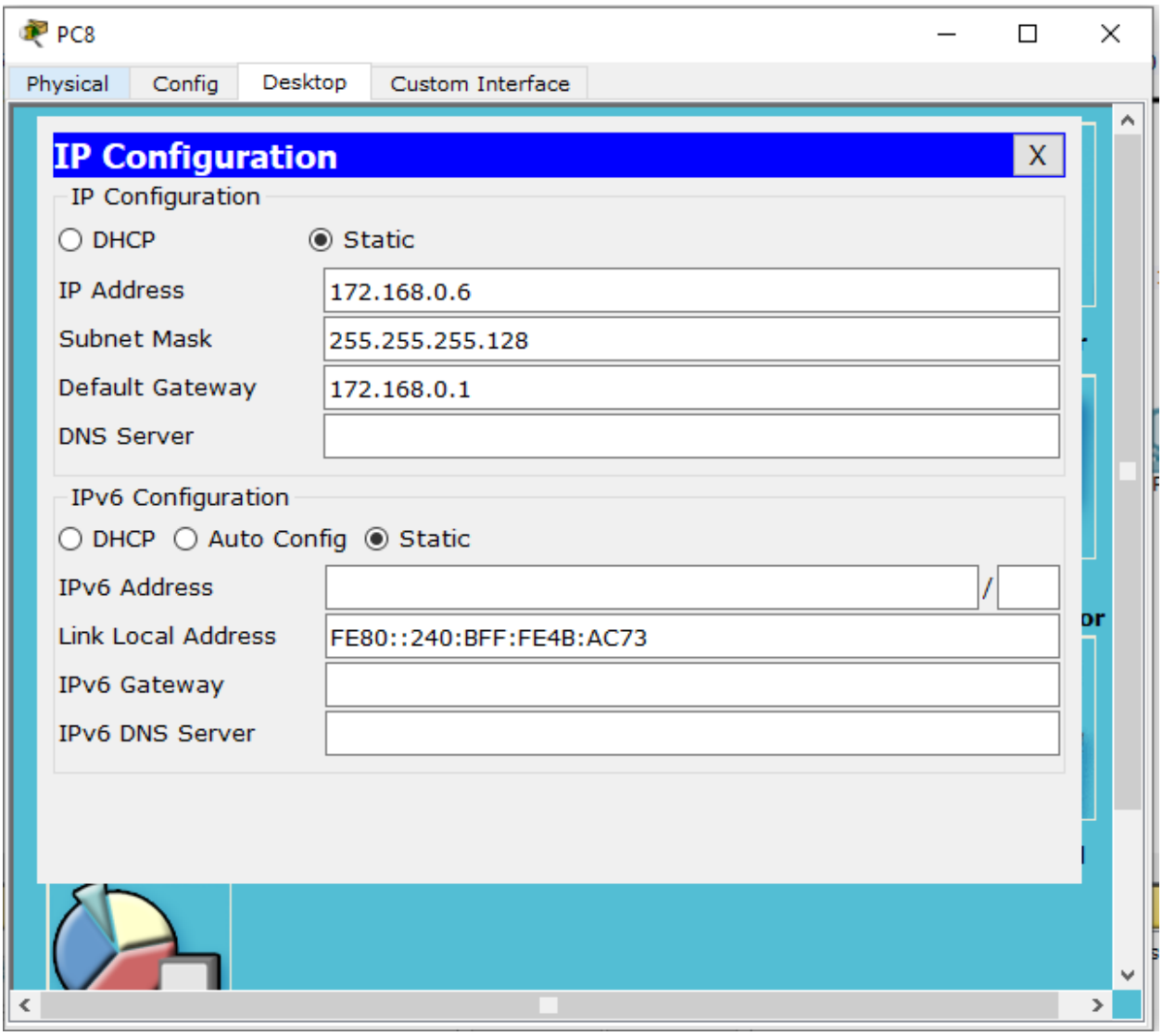
Step-15: Go to pc/laptop, then click on desktop and then ip configuration. Set ip address, subnet mask and default gateway. I'm using (for router 1)-

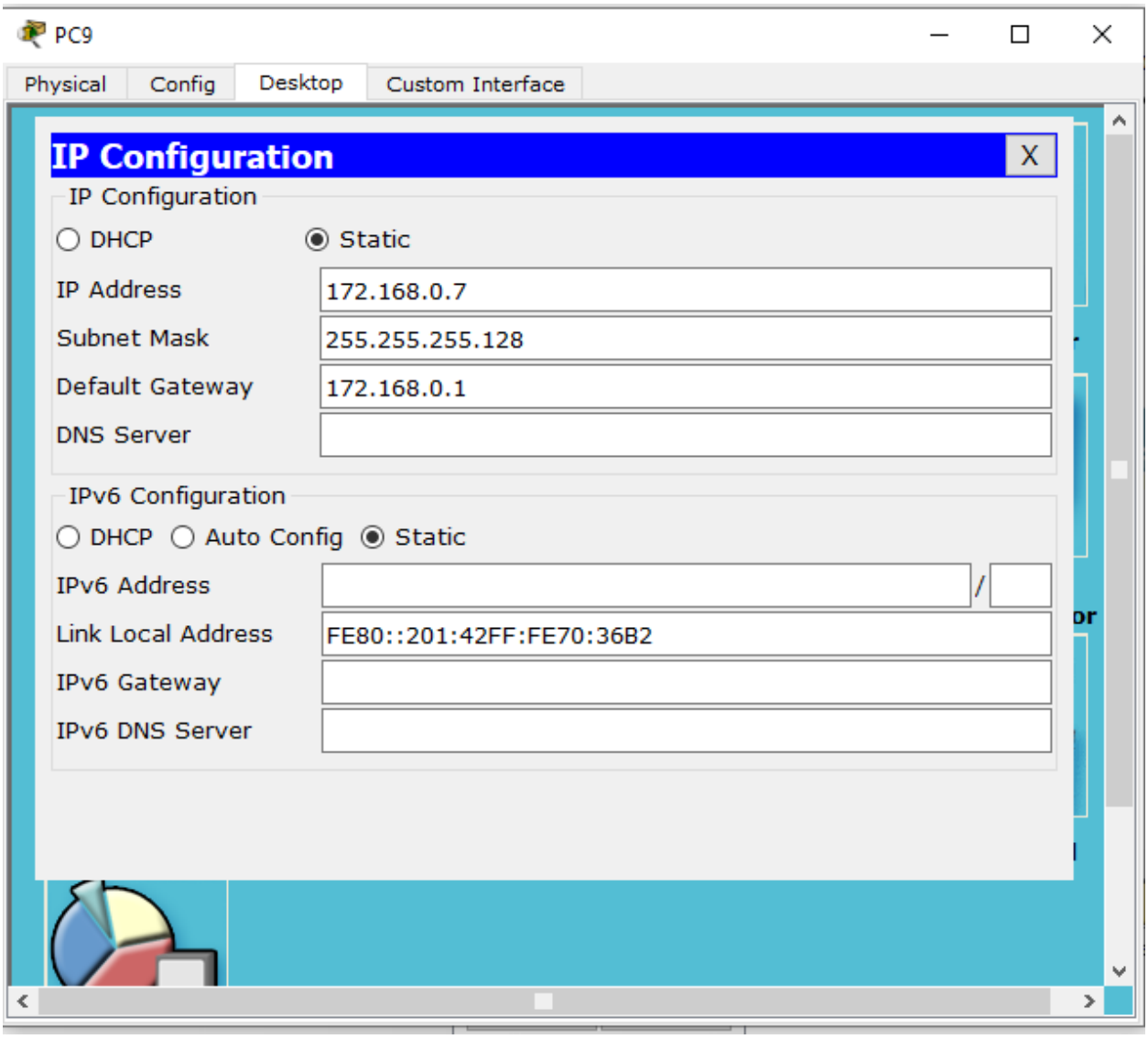



PC1
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.3
Subnet Mask
255.255.255.128
Default Gateway
172.168.0.1
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::207:ECFF:FE22:711B
IPv6 Gateway
IPv6 DNS Server

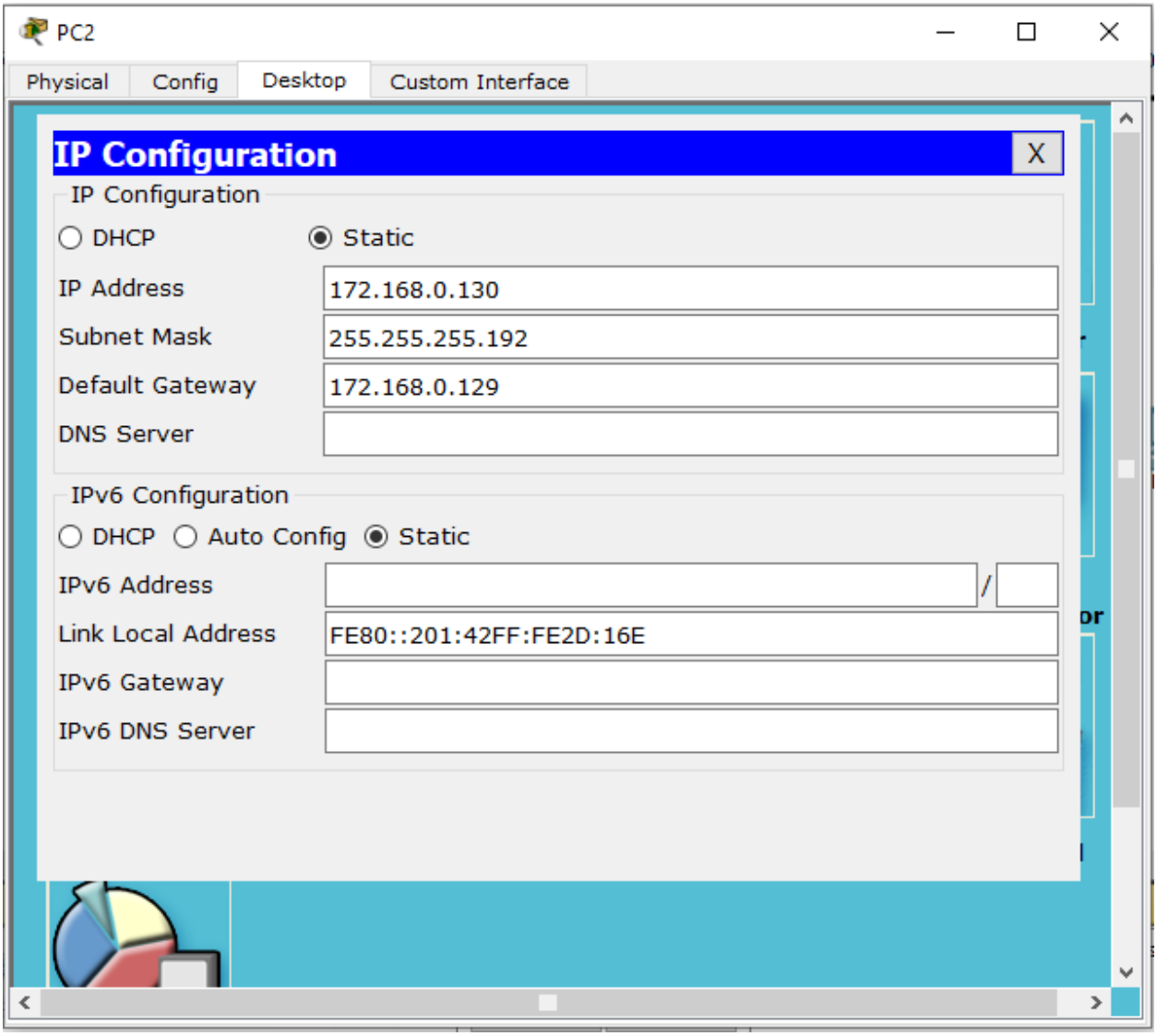

Laptop0
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.4
Subnet Mask
255.255.255.128
Default Gateway
172.168.0.1
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::200:CFF:FE50:52D2
IPv6 Gateway
IPv6 DNS Server

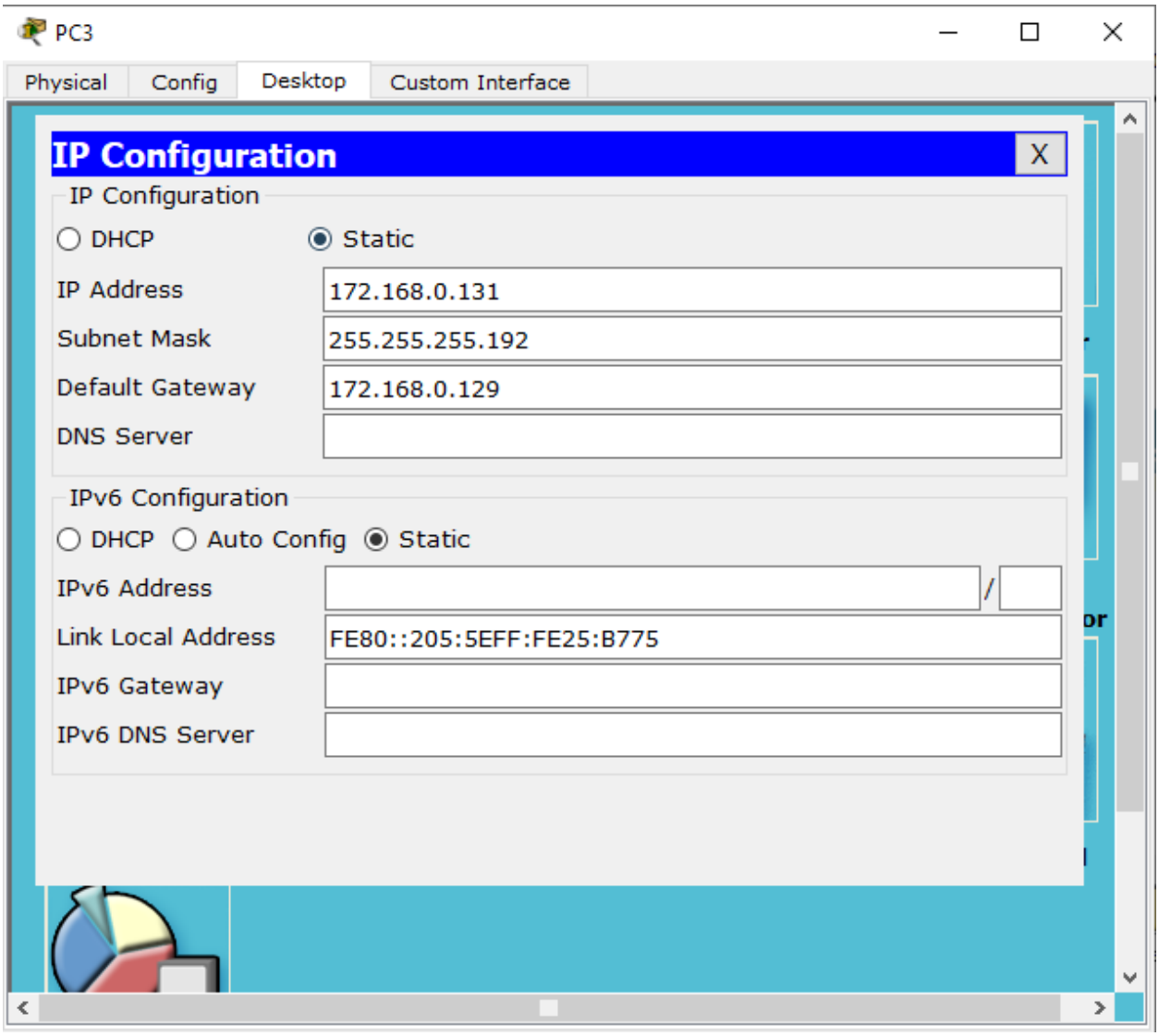

Laptop1
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.5
Subnet Mask
255.255.255.128
Default Gateway
172.168.0.1
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::205:5EFF:FEEB:64B2
IPv6 Gateway
IPv6 DNS Server

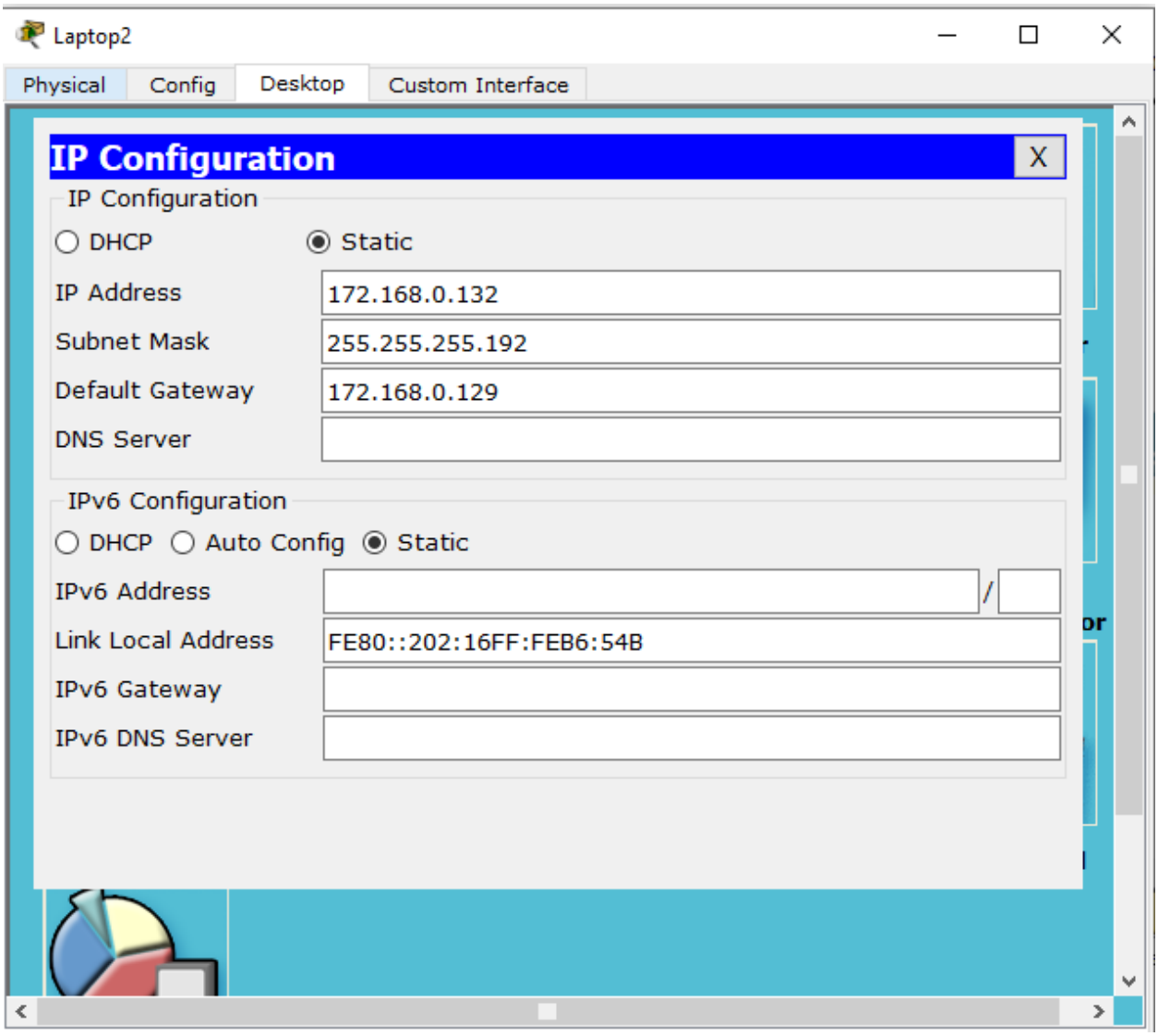

PC8
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.6
Subnet Mask
255.255.255.128
Default Gateway
172.168.0.1
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::240:BFF:FE4B:AC73
IPv6 Gateway
IPv6 DNS Server

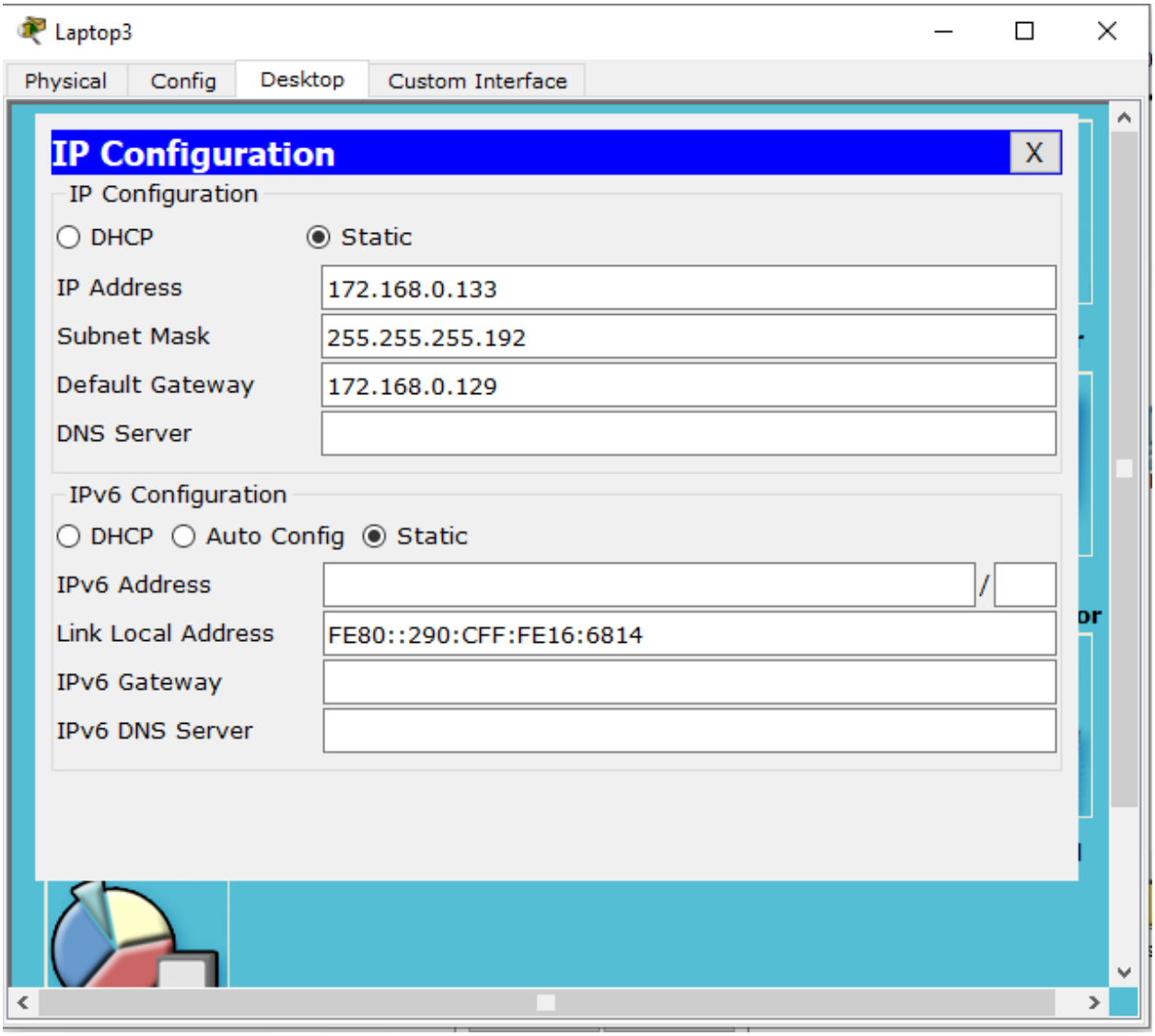

PC9
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.7
Subnet Mask
255.255.255.128
Default Gateway
172.168.0.1
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::201:42FF:FE70:36B2
IPv6 Gateway
IPv6 DNS Server

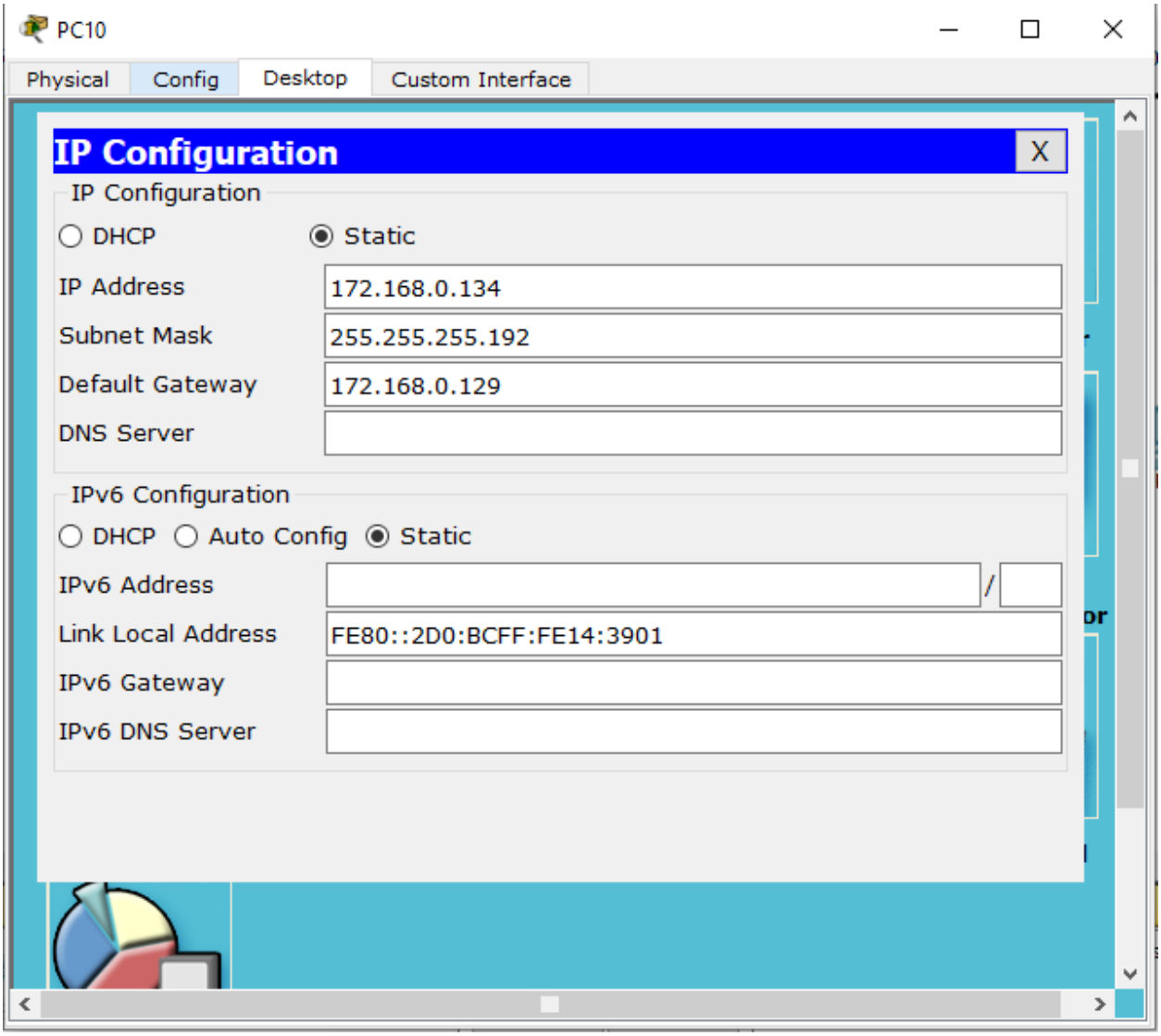
For router-2

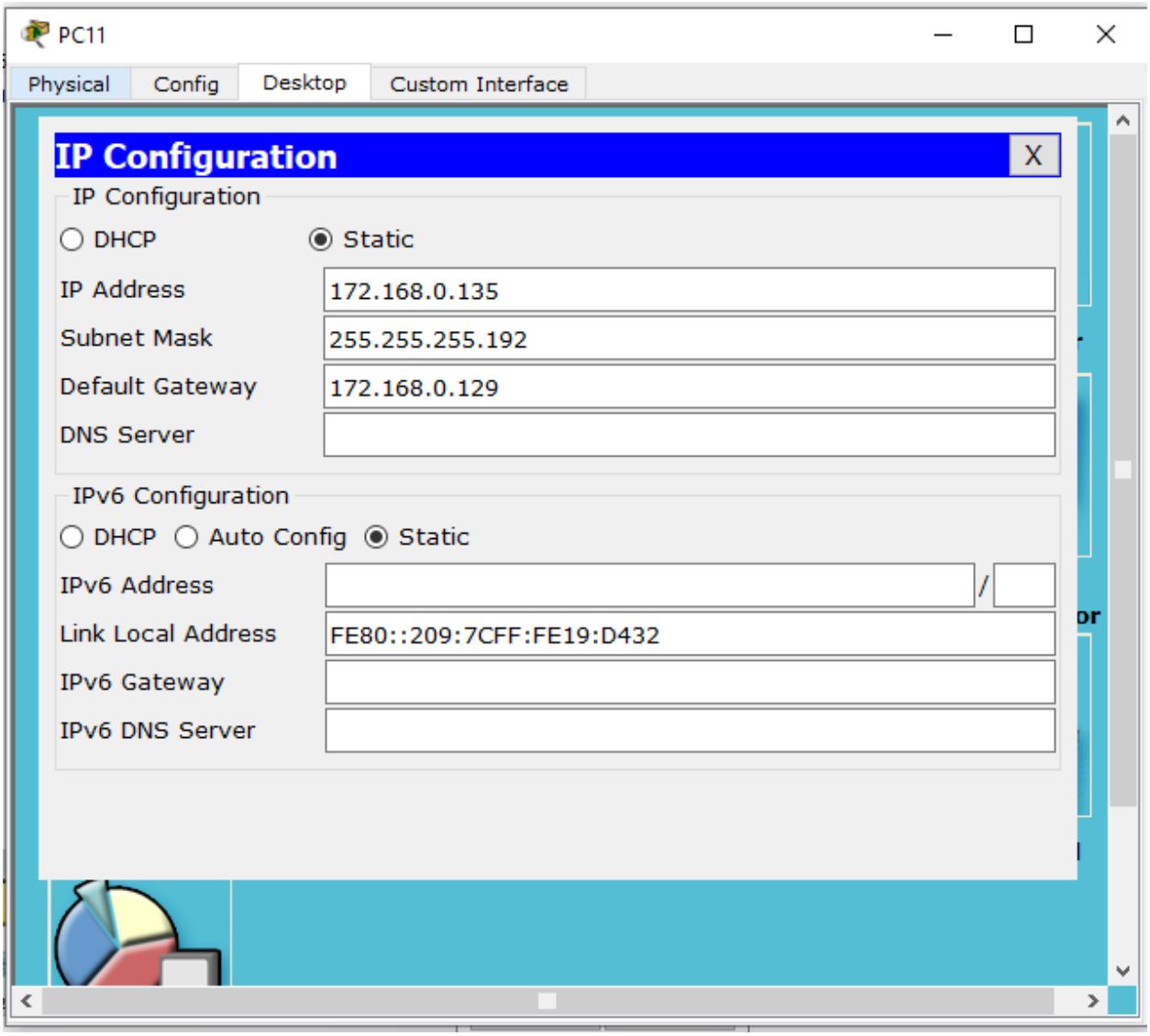

PC2
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.130
Subnet Mask
255.255.255.192
Default Gateway
172.168.0.129
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::201:42FF:FE2D:16E
IPv6 Gateway
IPv6 DNS Server


PC3
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.131
Subnet Mask
255.255.255.192
Default Gateway
172.168.0.129
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::205:5EFF:FE25:B775
IPv6 Gateway
IPv6 DNS Server

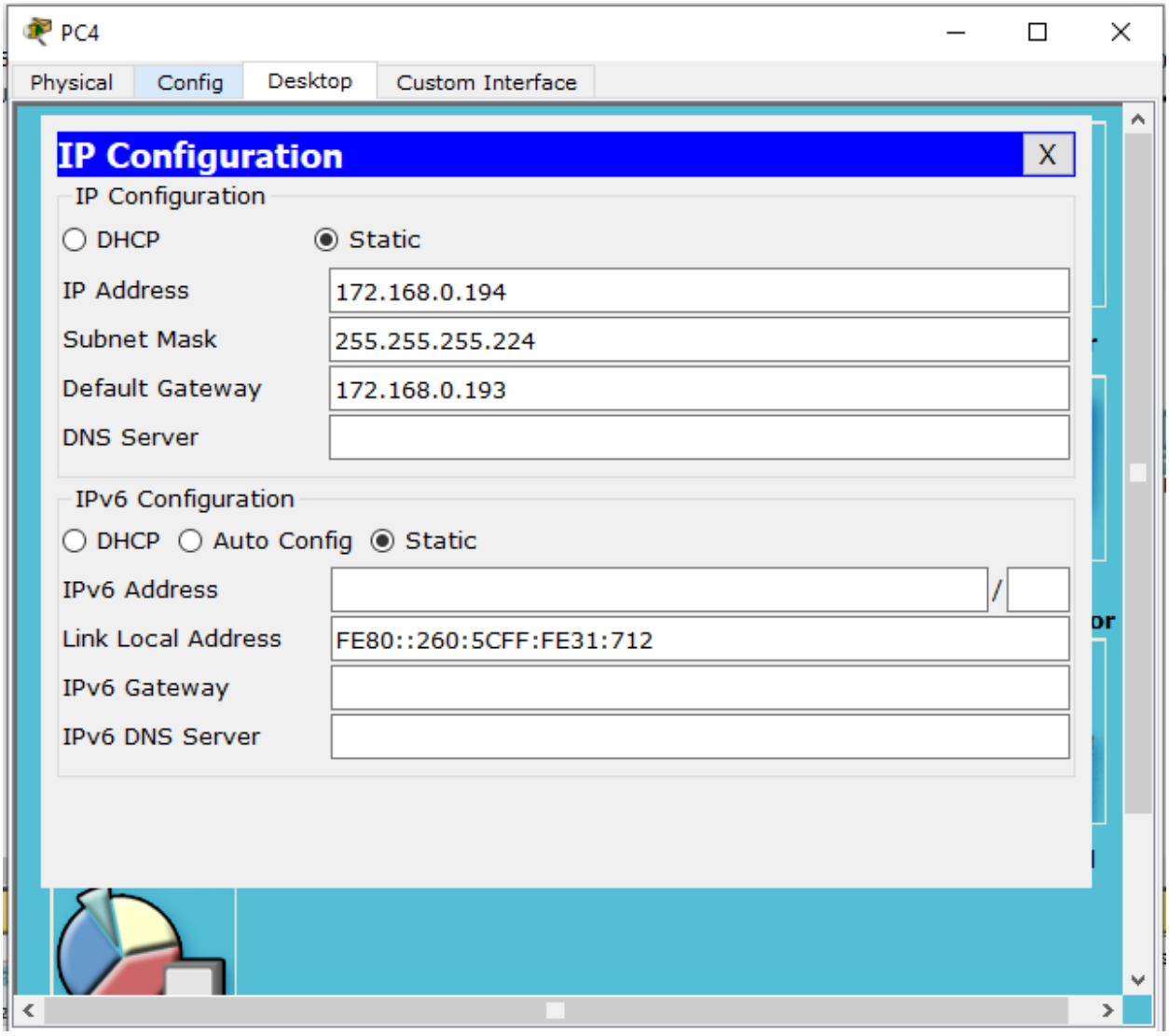

Laptop2
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.132
Subnet Mask
255.255.255.192
Default Gateway
172.168.0.129
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::202:16FF:FEB6:54B
IPv6 Gateway
IPv6 DNS Server

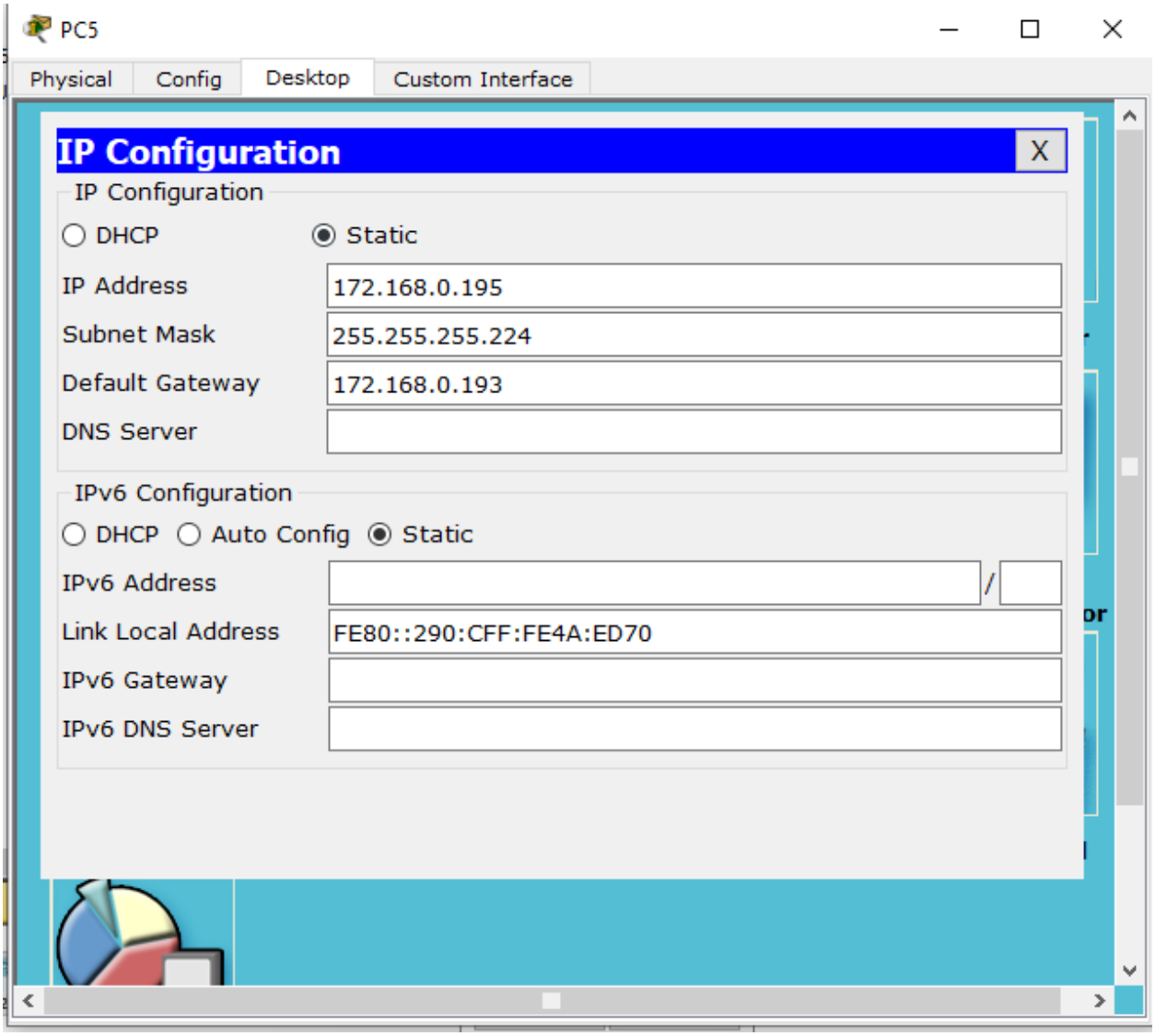

Laptop3
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.133
Subnet Mask
255.255.255.192
Default Gateway
172.168.0.129
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::290:CFF:FE16:6814
IPv6 Gateway
IPv6 DNS Server

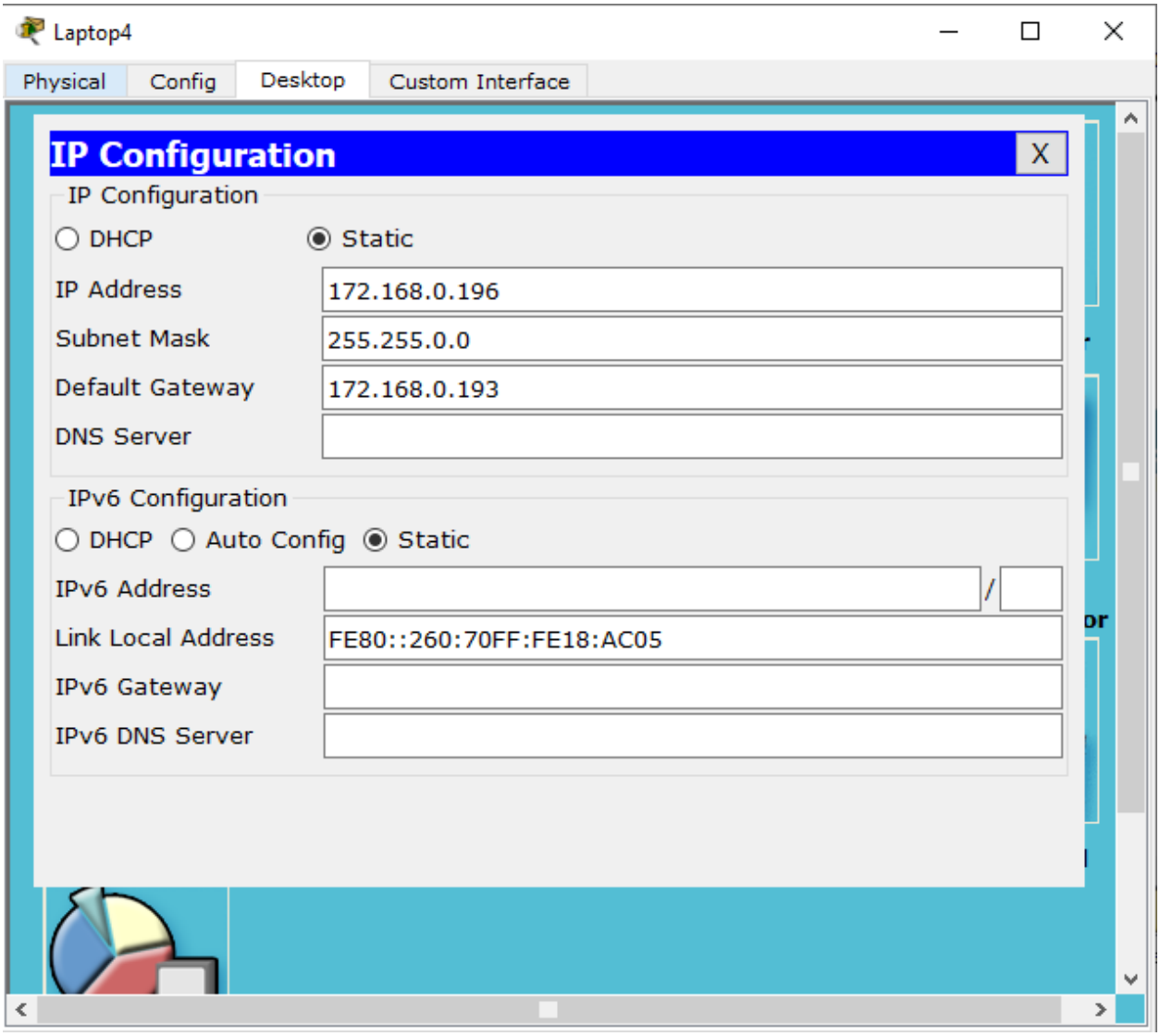

PC10
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.134
Subnet Mask
255.255.255.192
Default Gateway
172.168.0.129
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::2D0:BCFF:FE14:3901
IPv6 Gateway
IPv6 DNS Server

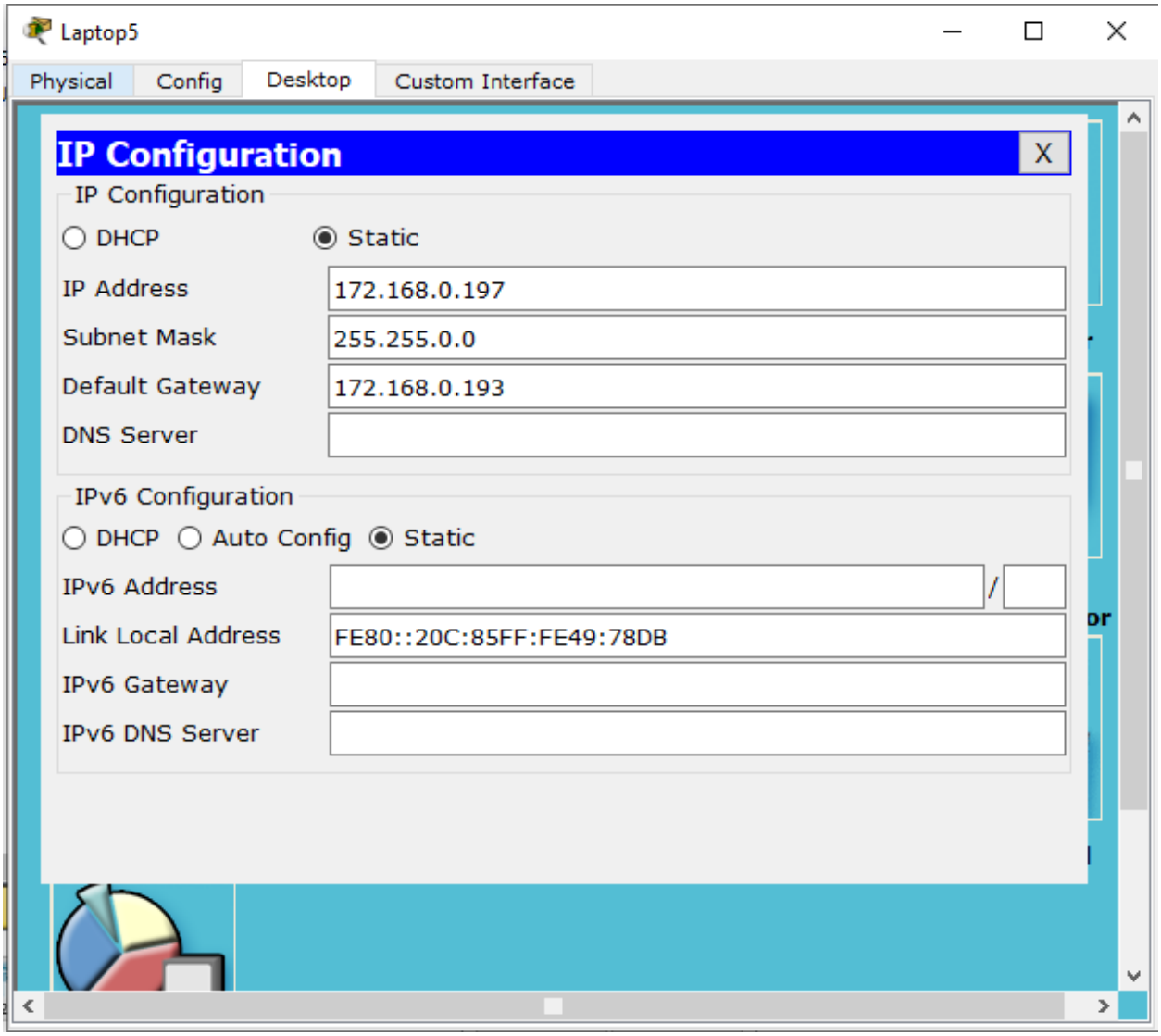

PC11
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.135
Subnet Mask
255.255.255.192
Default Gateway
172.168.0.129
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::209:7CFF:FE19:D432
IPv6 Gateway
IPv6 DNS Server

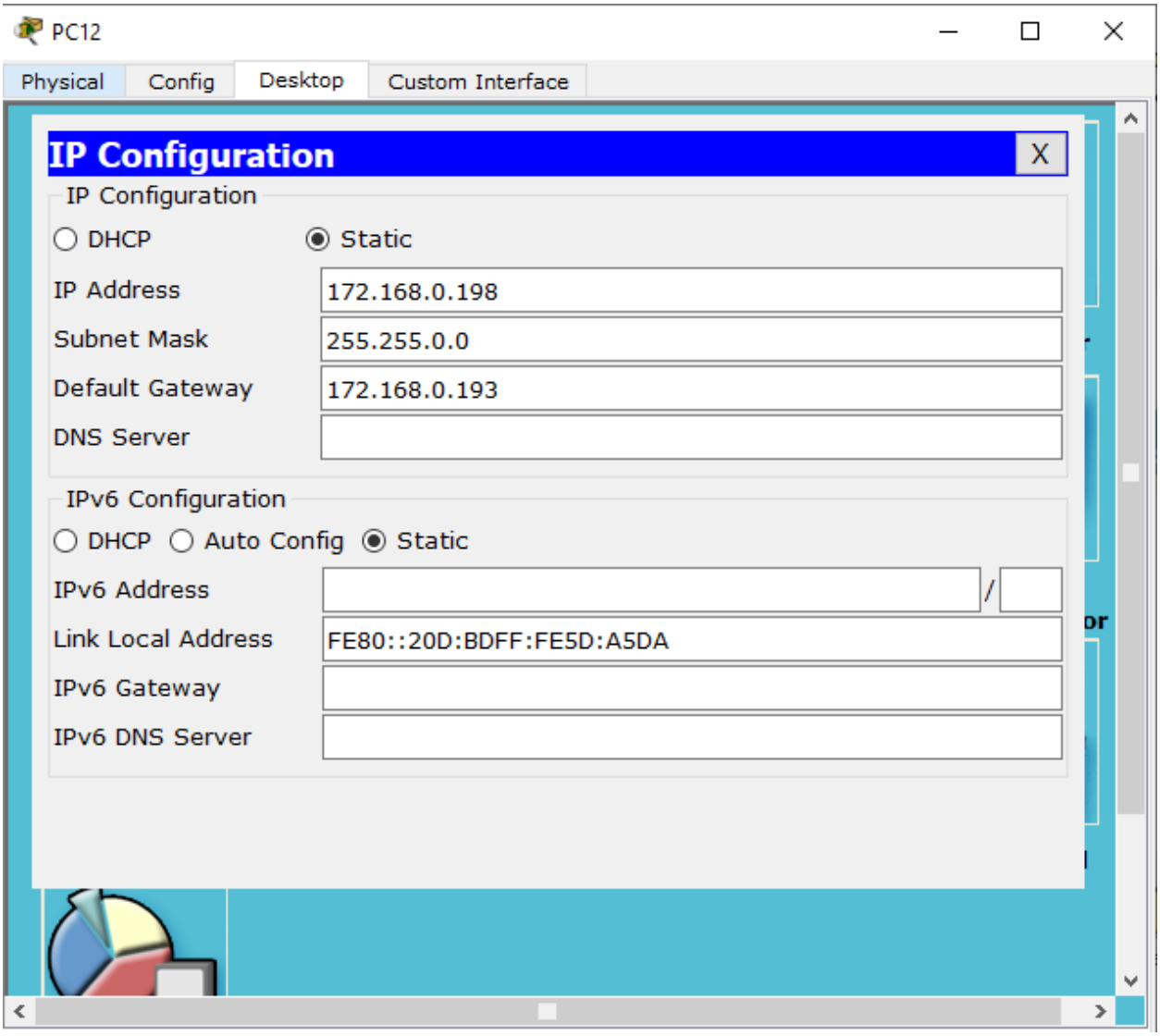
For router-3

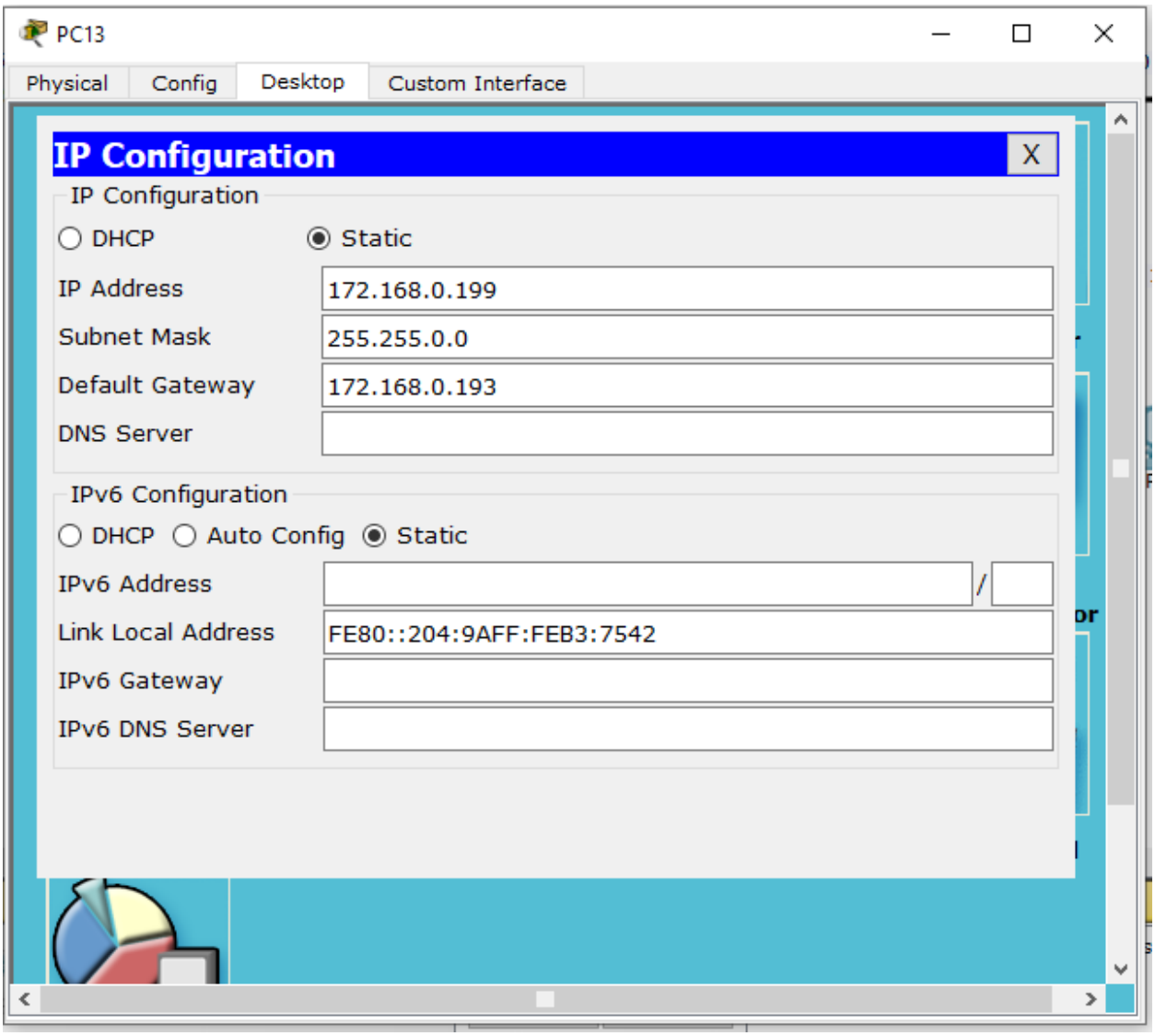

PC4
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.194
Subnet Mask
255.255.255.224
Default Gateway
172.168.0.193
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::260:5CFF:FE31:712
IPv6 Gateway
IPv6 DNS Server


PC5
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.195
Subnet Mask
255.255.255.224
Default Gateway
172.168.0.193
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::290:CFF:FE4A:ED70
IPv6 Gateway
IPv6 DNS Server

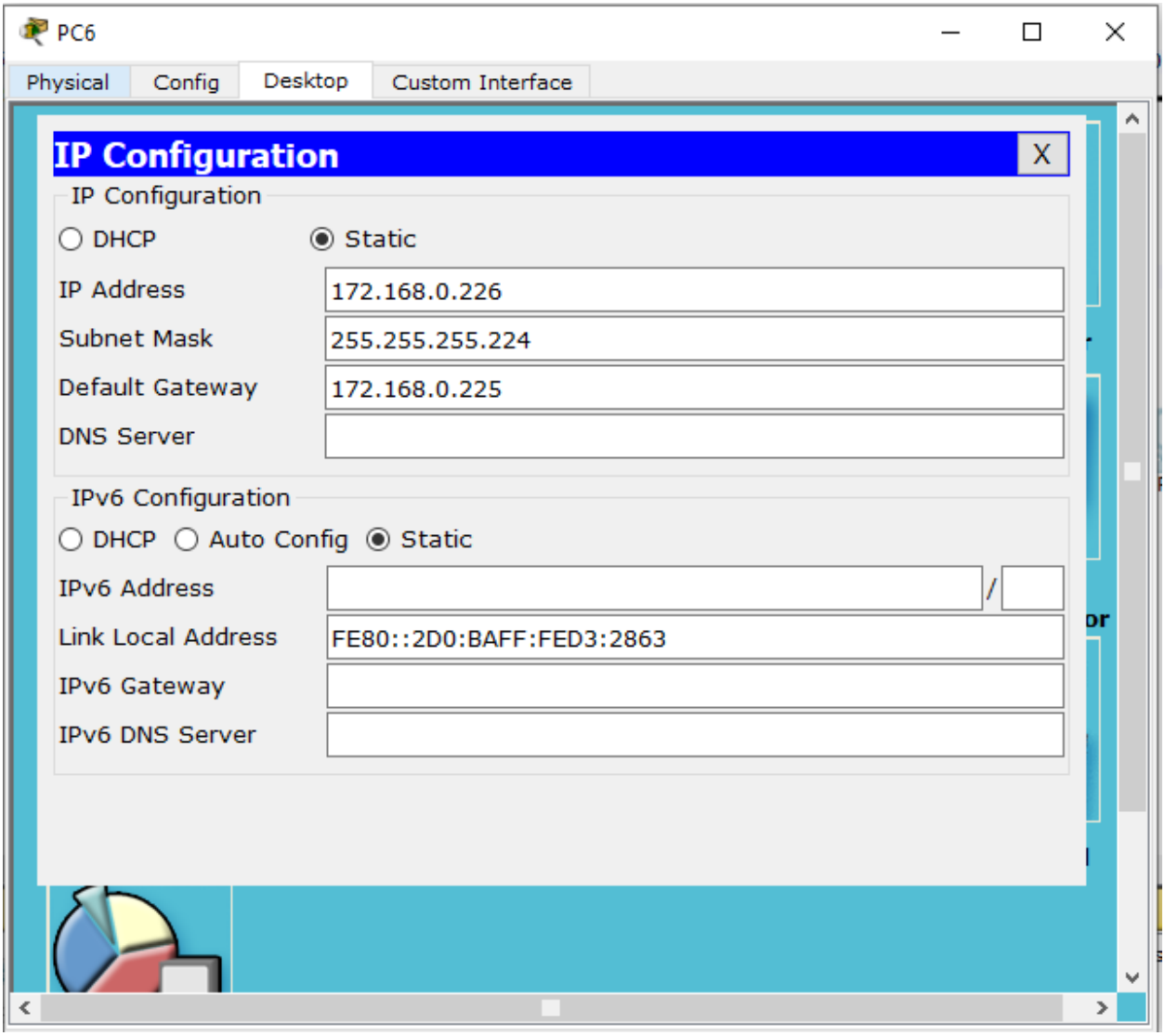

Laptop4
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.196
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.193
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::260:70FF:FE18:AC05
IPv6 Gateway
IPv6 DNS Server

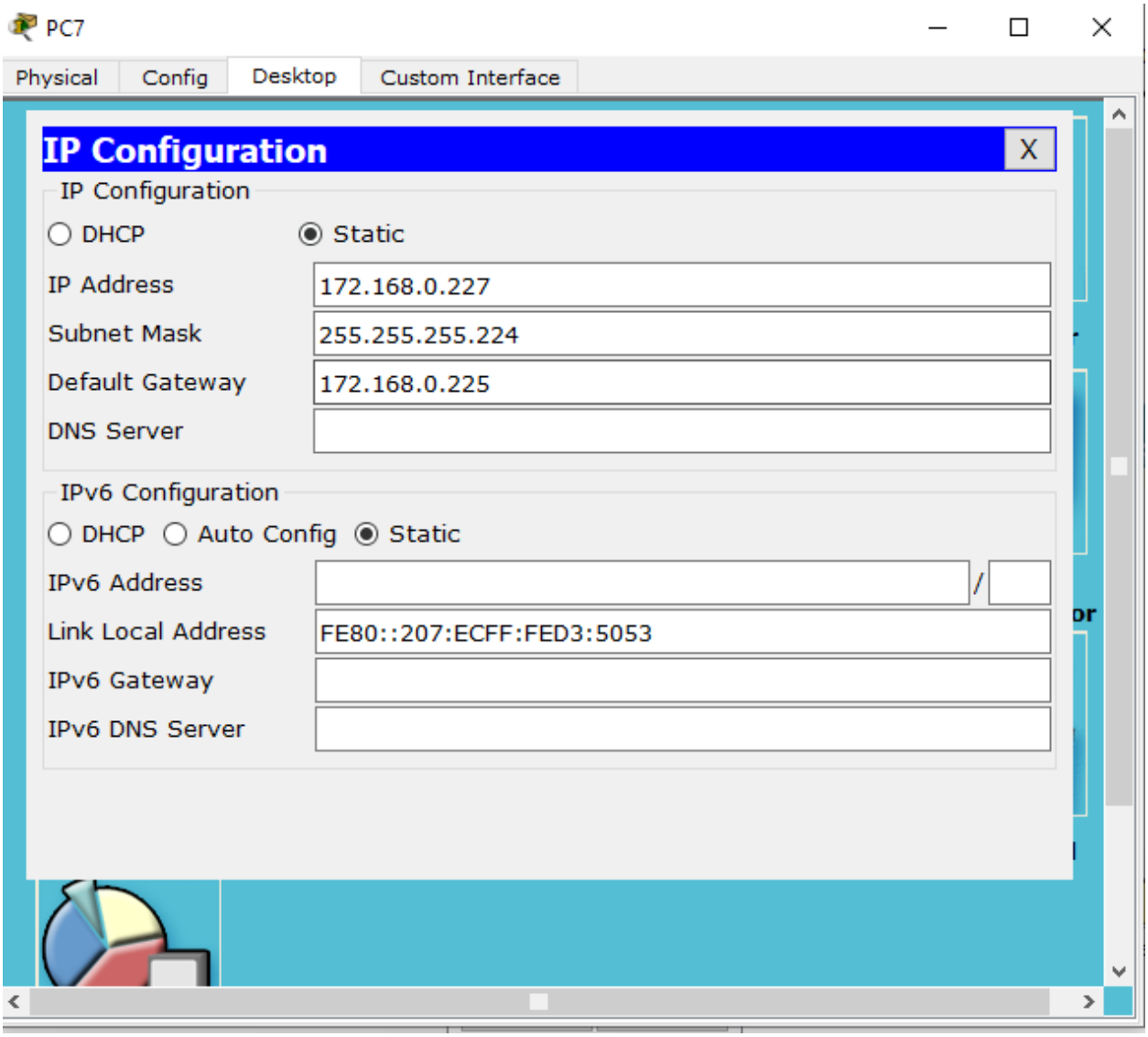

Laptop5
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.197
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.193
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::20C:85FF:FE49:78DB
IPv6 Gateway
IPv6 DNS Server

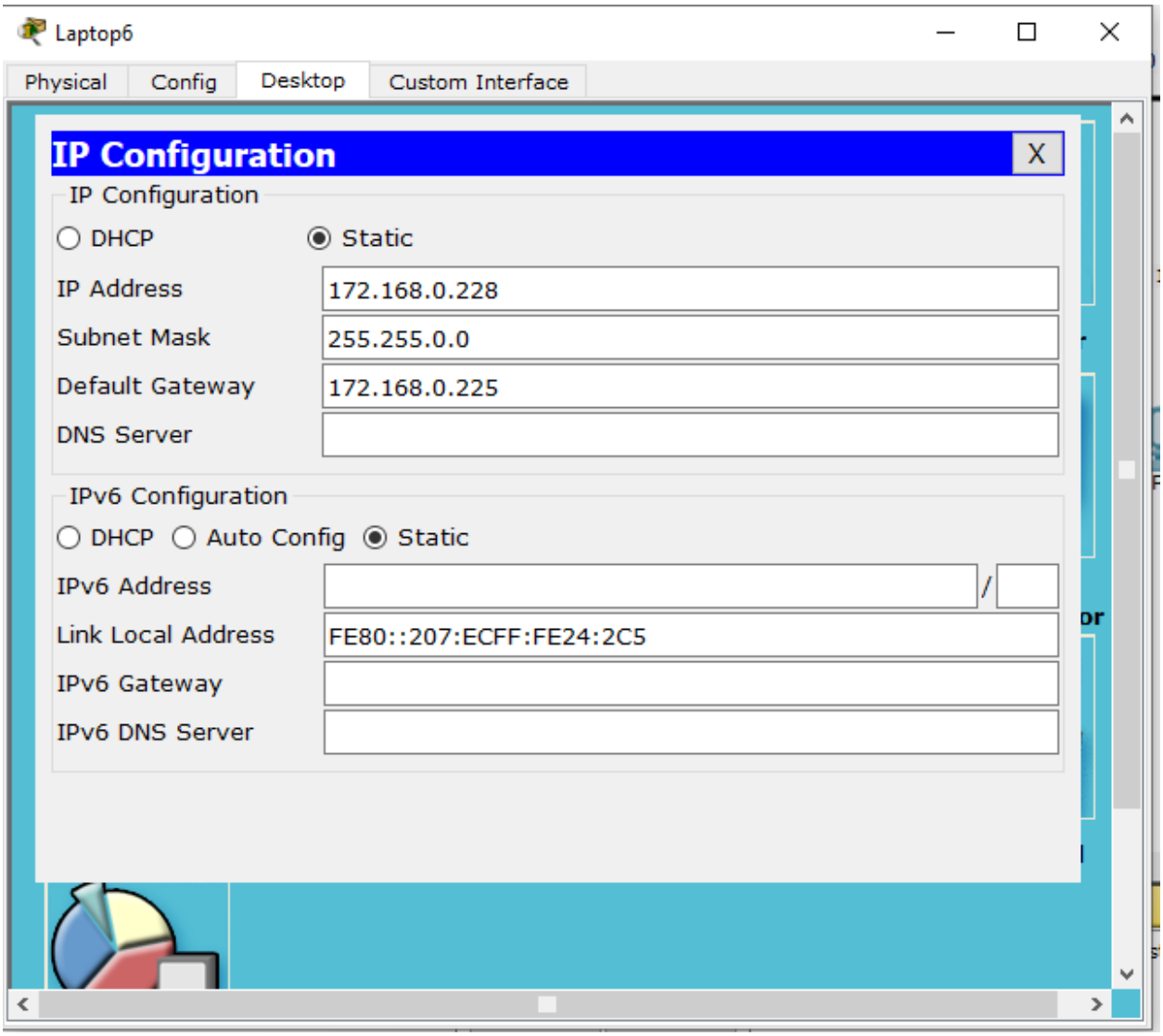

PC12
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.198
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.193
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::20D:BDFF:FE5D:A5DA
IPv6 Gateway
IPv6 DNS Server

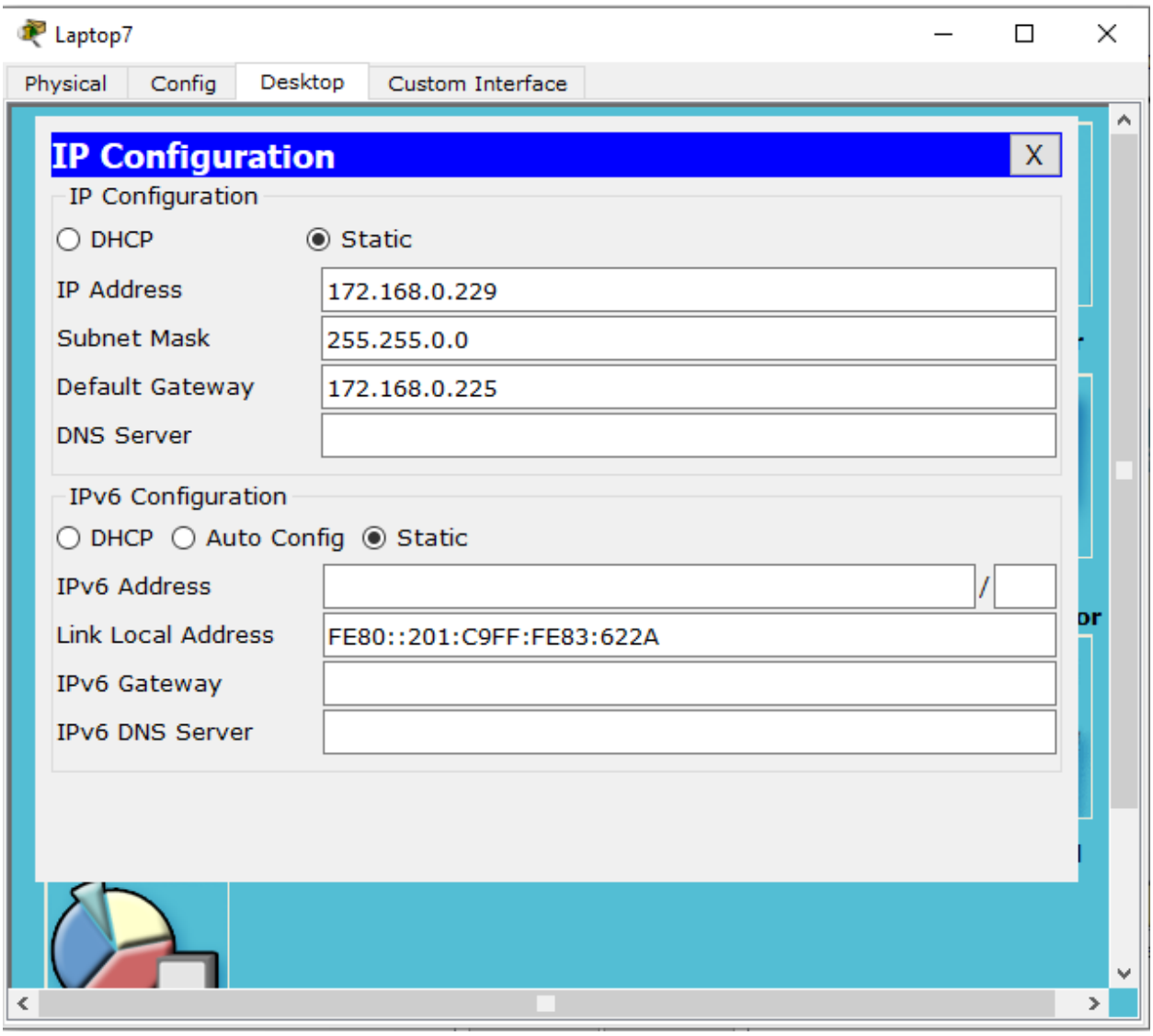

PC13
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.199
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.193
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::204:9AFF:FEB3:7542
IPv6 Gateway
IPv6 DNS Server

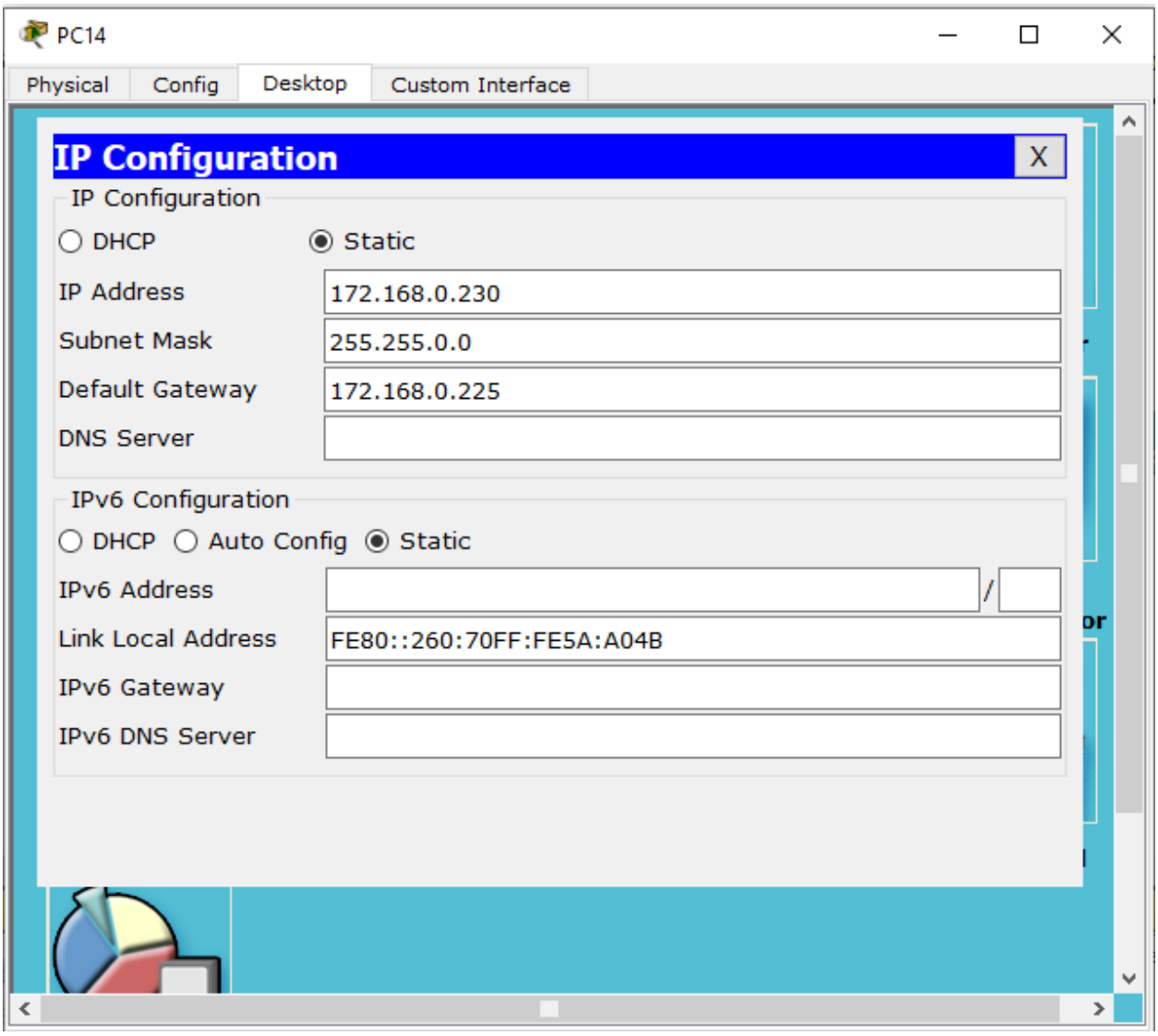
For router-4

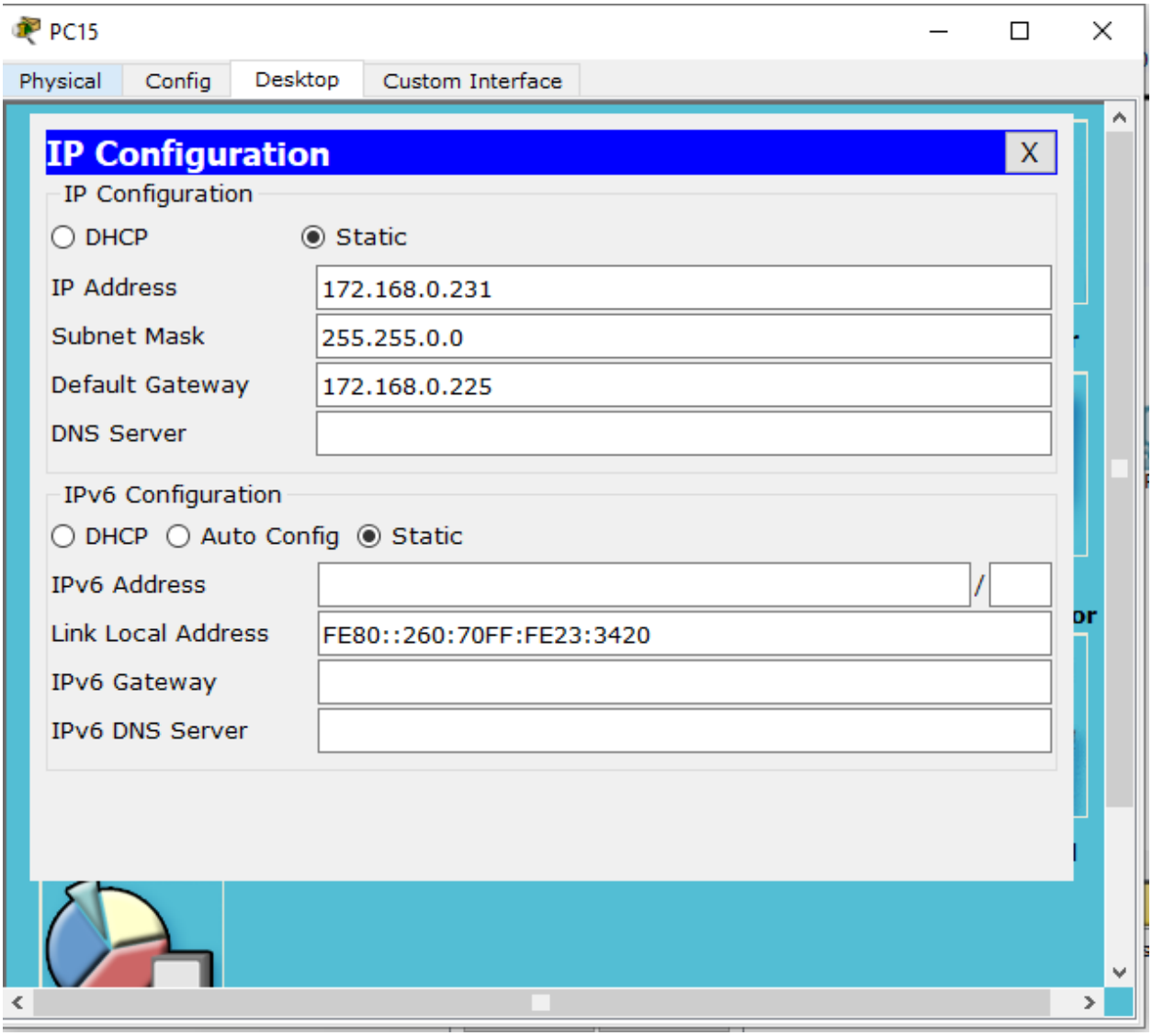

PC6
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.226
Subnet Mask
255.255.255.224
Default Gateway
172.168.0.225
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::2D0:BAFF:FED3:2863
IPv6 Gateway
IPv6 DNS Server


PC7
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.227
Subnet Mask
255.255.255.224
Default Gateway
172.168.0.225
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::207:ECFF:FED3:5053
IPv6 Gateway
IPv6 DNS Server

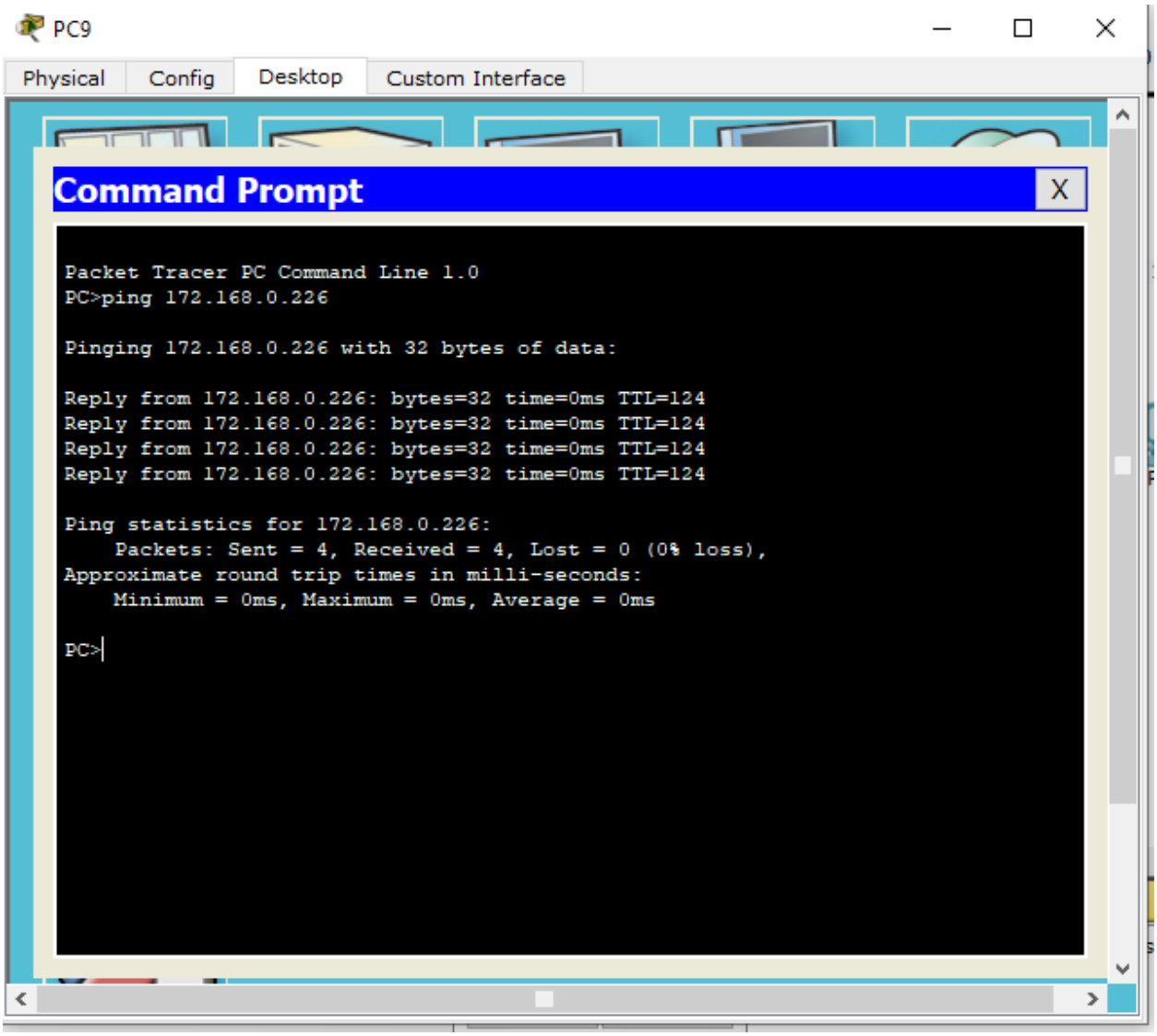

Laptop6
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.228
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.225
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::207:ECFF:FE24:2C5
IPv6 Gateway
IPv6 DNS Server


Laptop7
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.229
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.225
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::201:C9FF:FE83:622A
IPv6 Gateway
IPv6 DNS Server


PC14
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.230
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.225
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::260:70FF:FE5A:A04B
IPv6 Gateway
IPv6 DNS Server

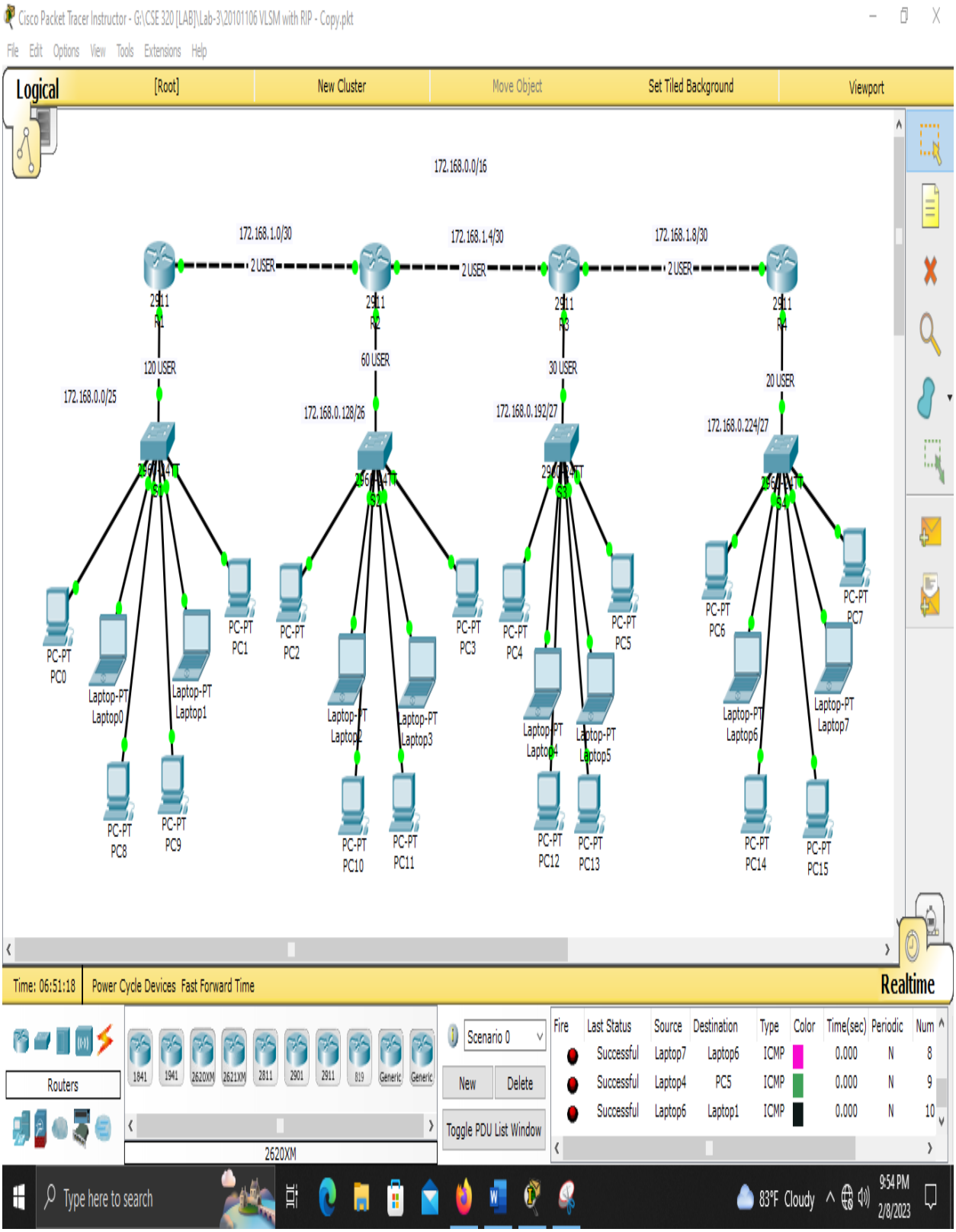

PC15
Physical
Config
Desktop
Custom Interface
IP Configuration
X
IP Configuration
DHCP
Static
IP Address
172.168.0.231
Subnet Mask
255.255.0.0
Default Gateway
172.168.0.225
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::260:70FF:FE23:3420
IPv6 Gateway
IPv6 DNS Server

Step-16: Verify by pinging each pc/laptops.

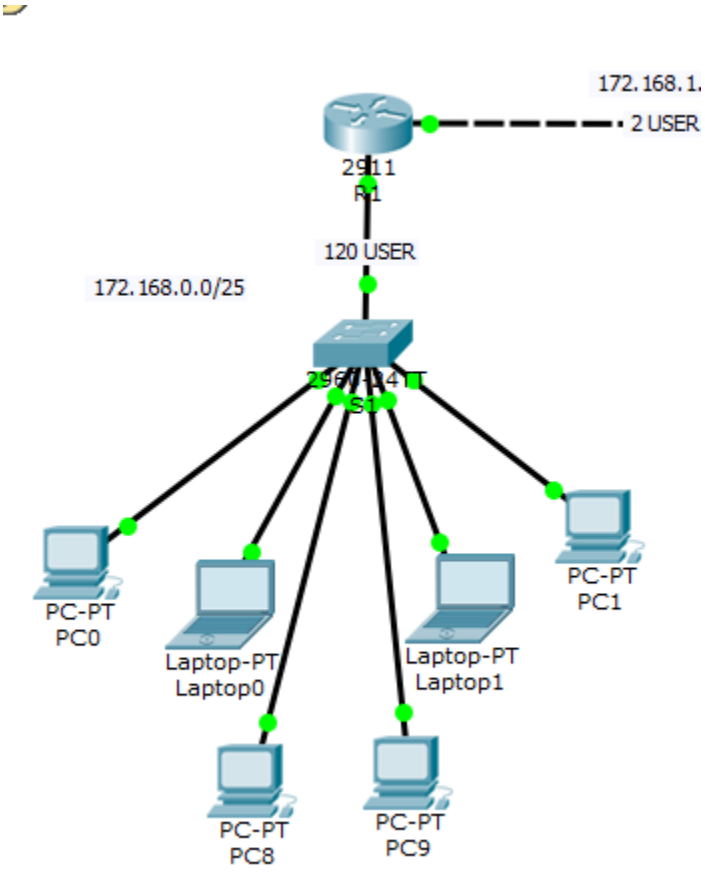


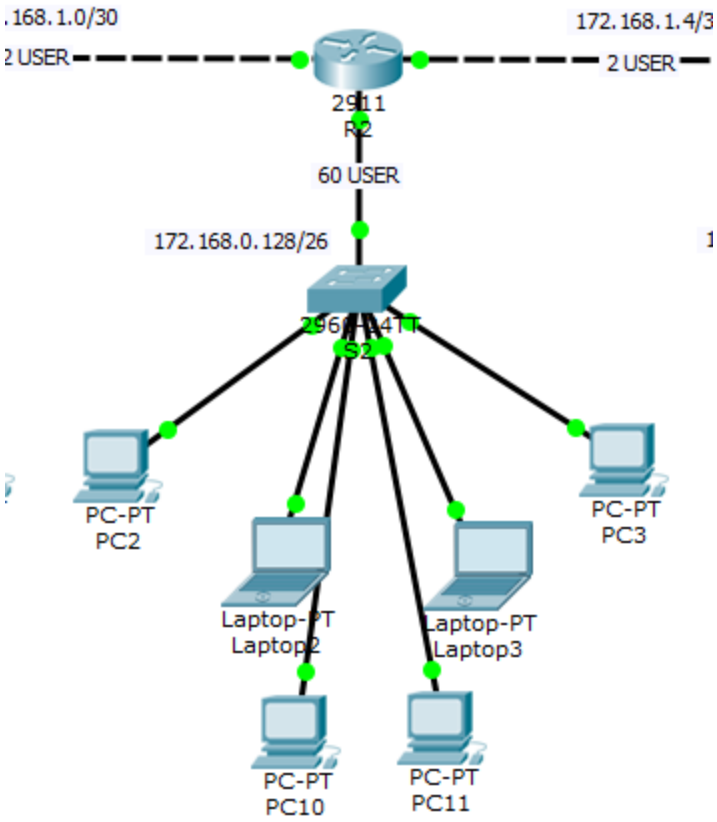
We will see the success rate is 100% after it has founded the route.

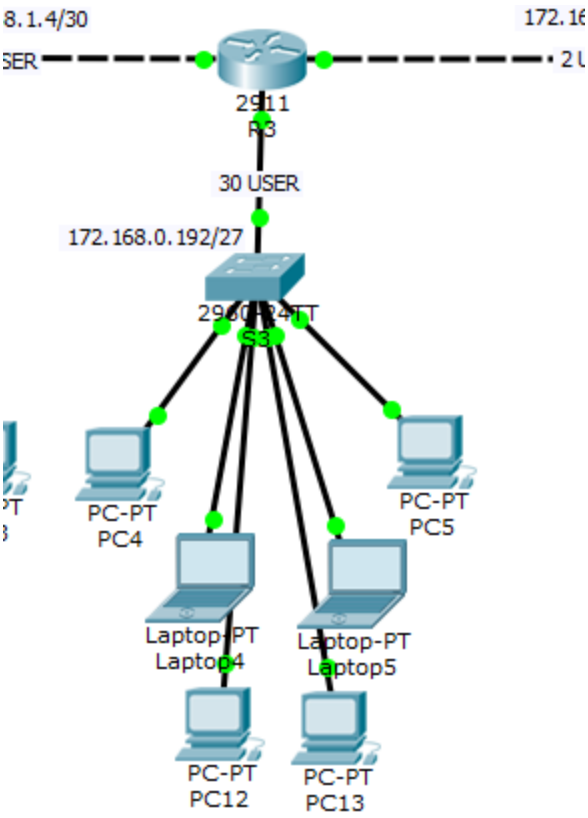
Overall screenshot of the whole architecture-

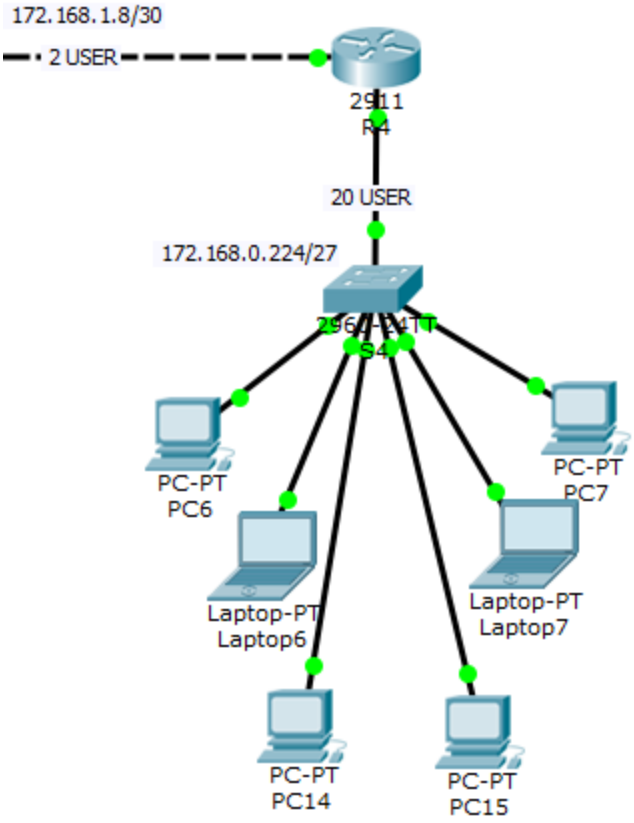


Part by part view-

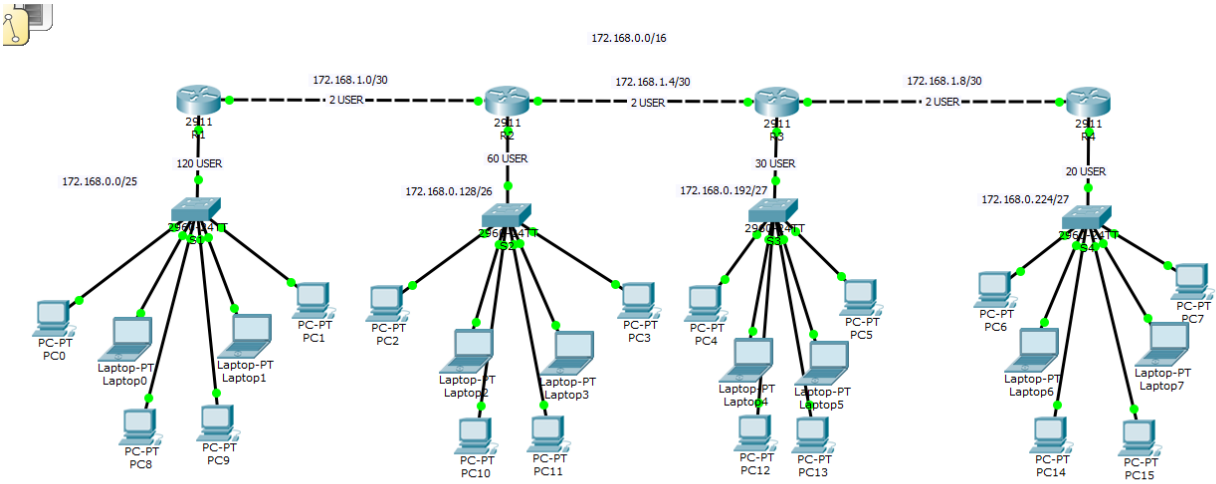



.168.1.0/30
2 USER
172.168.1.4/3
2 USER
2911
R2
60 USER
172.168.0.128/26
S2
PC-PT
PC2
PC-PT
PC3
Laptop-PT
Laptop2
Laptop-PT
Laptop3
PC-PT
PC10
PC-PT
PC11


8.1.4/30
172.16
SER
2U
2911
R3
30 USER
172.168.0.192/27
2960-24TT
S3
PC-PT
PC4
PC-PT
PC5
Laptop-PT
Laptop4
Laptop-PT
Laptop5
PC-PT
PC12
PC-PT
PC13



Detailed view-



----------THANK YOU FOR READING----------