Project Report

Course Title:

Computer network

Submitted to:

Sir Ghulam Raza

Submitted by:

Name:

Verdat Fatima (24083)

Program:

BSCS-SP24- 3rd Semester

1. Objectives

- Design and implement a full-scale enterprise network using Cisco Packet Tracer.
- Configure multiple routing protocols (RIP, EIGRP, OSPF).
- Enable inter-protocol communication through redistribution.
- Implement DHCP and Email Server communication.
- Demonstrate interconnectivity across routers with varied subnetting.
- ACL configuration
- NAT configuration

2. Network Topology Description

The network comprises 14 routers (R1 to R14), forming three autonomous domains:

- RIP domain: Routers R1–R4, is used for forming RIP network with multiple IP addresses with subnetting.
- EIGRP domain: Routers R9–R12 is used for forming EIGRP network with multiple IP addresses with subnetting.
- OSPF domain: Routers R5–R8 with area 0 is used for forming OSPF network with multiple IP addresses with subnetting.
- Router 13 serves as the redistribution point between RIP, OSPF, and EIGRP.

3. IP Addressing Table

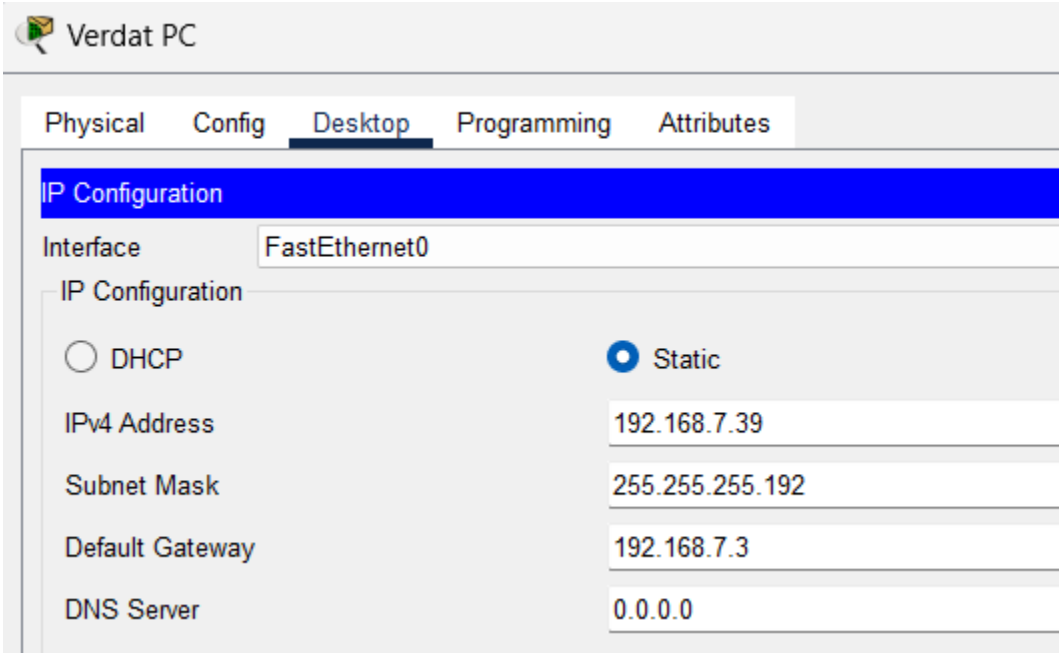
Router	Interface	IP Address	Subnet Mask	Protocol
R2	S0/1/0	192.168.2.39	255.255.255.192	RIP
R2	S0/2/0	30.30.30.1	255.0.0.0	----
R2	S0/1/1	192.168.3.39	255.255.255.240	RIP
R2	G0/0/0	192.168.1.3	255.255.255.128	RIP

R14	S0/2/0	30.30.30.2	255.0.0.0	----
R14	G0/0/0	20.20.20.3	255.0.0.0	----
R3	S0/1/0	192.168.3.40	255.255.255.240	RIP
R3	S0/1/1	192.168.4.39	255.255.255.128	RIP
R4	S0/1/0	192.168.5.39	255.255.255.240	RIP
R4	S0/2/0	192.168.6.39	255.255.255.128	RIP
R1	S0/2/0	192.168.5.40	255.255.255.240	RIP
R1	S0/2/1	192.168.2.40	255.255.255.192	RIP
R9	S0/1/0	192.168.11.39	255.255.255.128	EIGRP
R9	S0/1/1	192.168.9.38	255.255.255.240	EIGRP
R10	S0/1/0	192.168.8.39	255.255.255.192	EIGRP
R10	S0/1/1	192.168.9.39	255.255.255.240	EIGRP
R11	S0/1/0	192.168.10.39	255.255.255.224	EIGRP
R11	S0/1/1	192.168.8.38	255.255.255.192	EIGRP
R12	S0/1/0	192.168.11.38	255.255.255.128	EIGRP
R12	S0/1/1	192.168.10.38	255.255.255.224	EIGRP
R12	S0/2/0	192.168.12.40	255.255.255.240	EIGRP
R12	G0/0/0	192.168.7.3	255.255.255.192	EIGRP
R7	S0/1/0	192.168.17.2	255.255.255.224	OSPF
R7	S0/1/1	192.168.16.1	255.255.255.128	OSPF
R8	S0/1/0	192.168.17.1	255.255.255.224	OSPF
R8	S0/1/1	192.168.15.1	255.255.255.240	OSPF
R8	S0/2/0	192.168.18.2	255.255.255.192	OSPF
R5	G0/0/0	192.168.13.3	255.255.255.192	OSPF
R5	G0/0/1	10.10.10.1	255.0.0.0	-----
R5	S0/1/0	192.168.15.2	255.255.255.240	OSPF
R5	S0/1/1	192.168.14.1	255.255.255.224	OSPF
R6	S0/1/1	192.168.16.2	255.255.255.128	OSPF
R6	S0/1/0	192.168.14.2	255.255.255.224	OSPF
R13	S0/1/0	192.168.6.40	255.255.255.128	RIP
R13	S0/2/0	192.168.12.39	255.255.255.240	EIGRP
R13	S0/1/1	192.168.18.1	255.255.255.192	OSPF

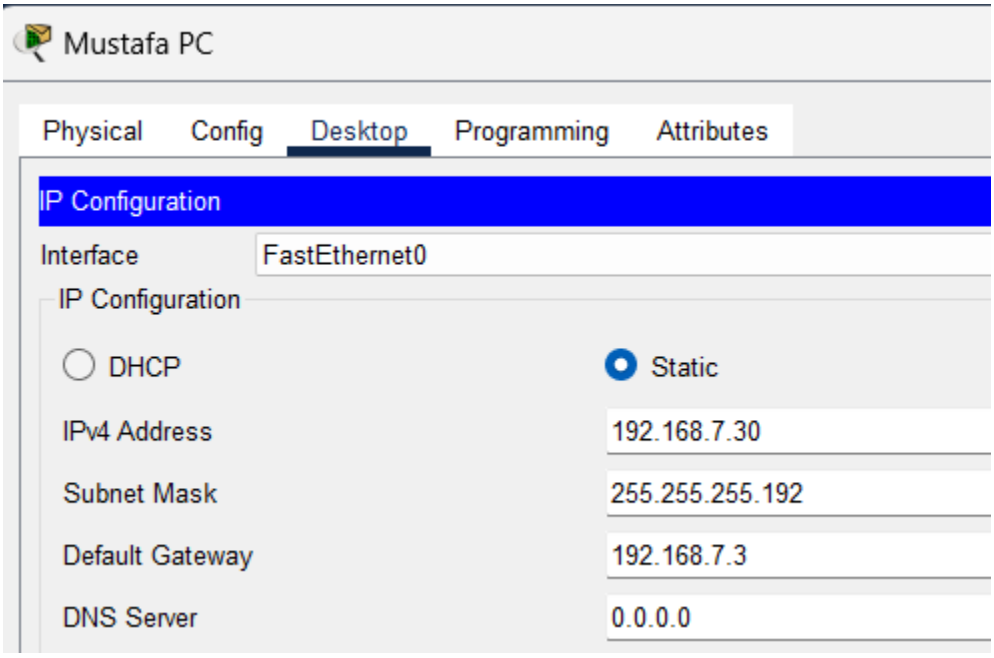
- Router 13 is used for redistribution where it is linked with all protocols

4. Configuration of devices

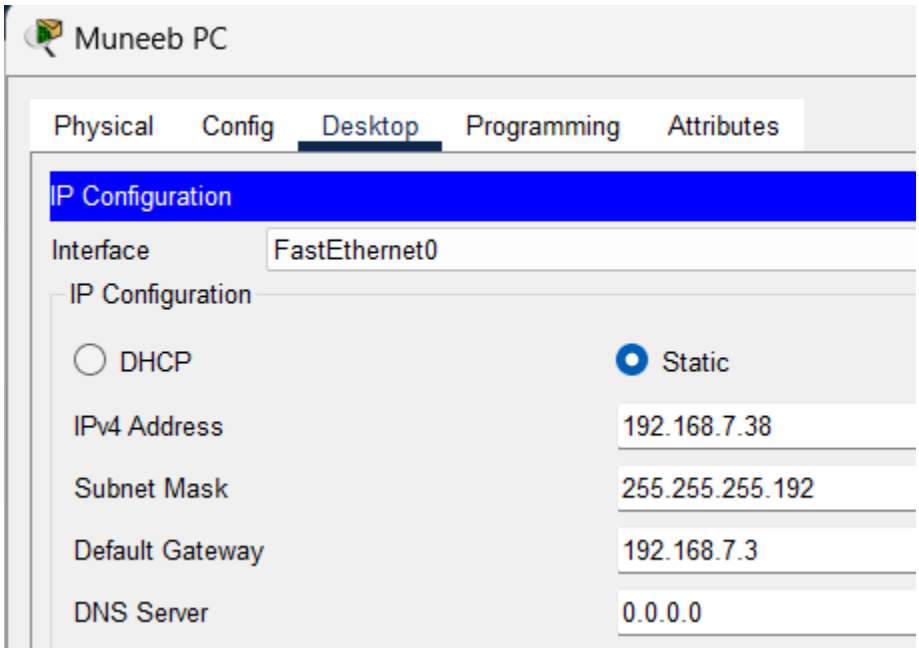
- **Verdat PC**



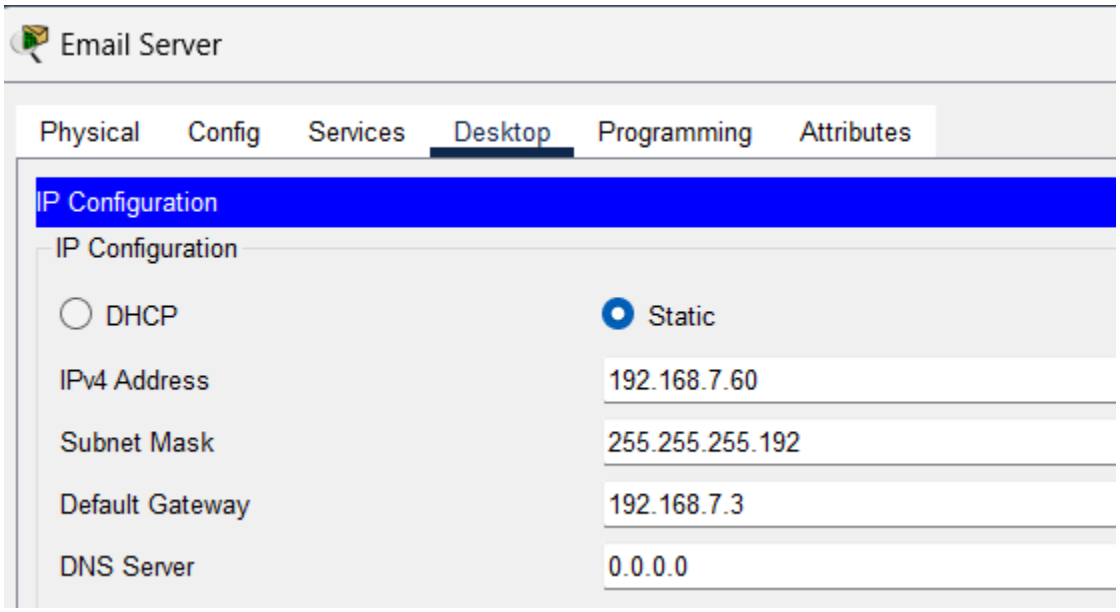
- **Mustafa PC**



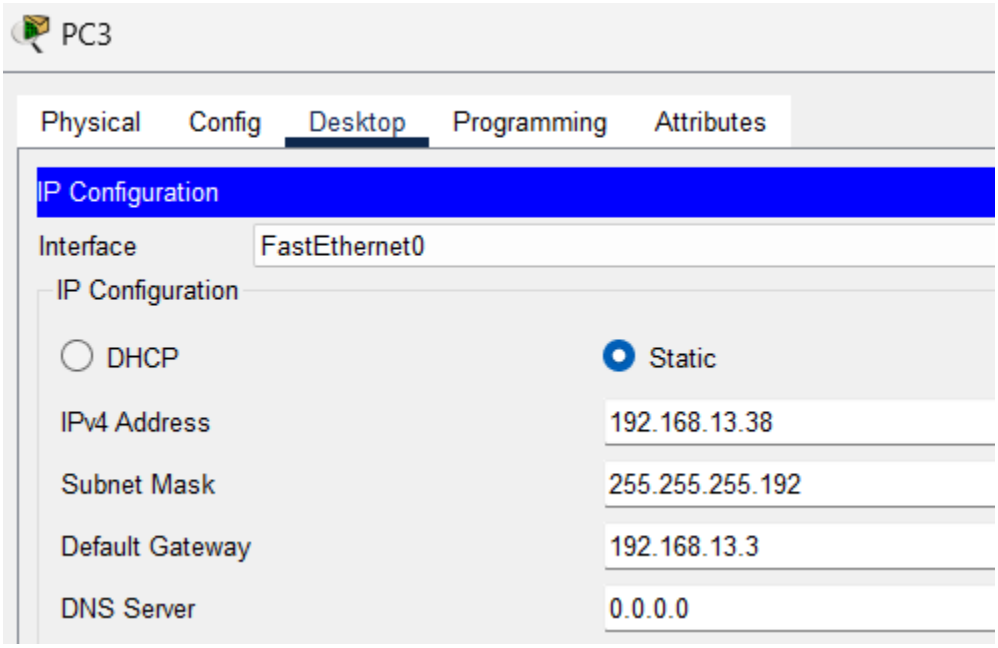
- **Muneeb PC**



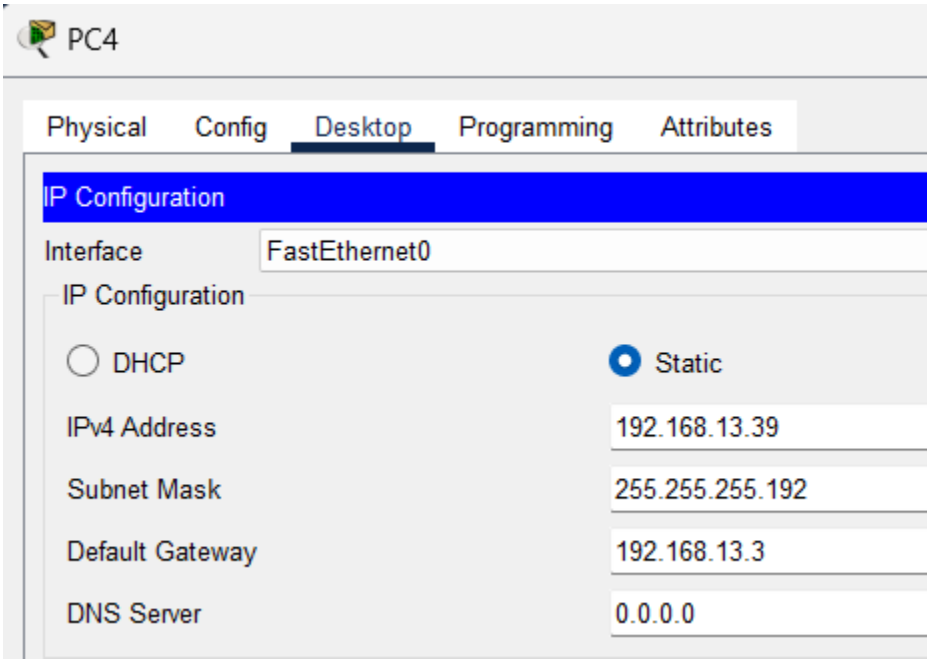
- **Email Server**



- **PC3**


PC3
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.13.38
Subnet Mask
255.255.255.192
Default Gateway
192.168.13.3
DNS Server
0.0.0.0

- **PC4**


PC4
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Config
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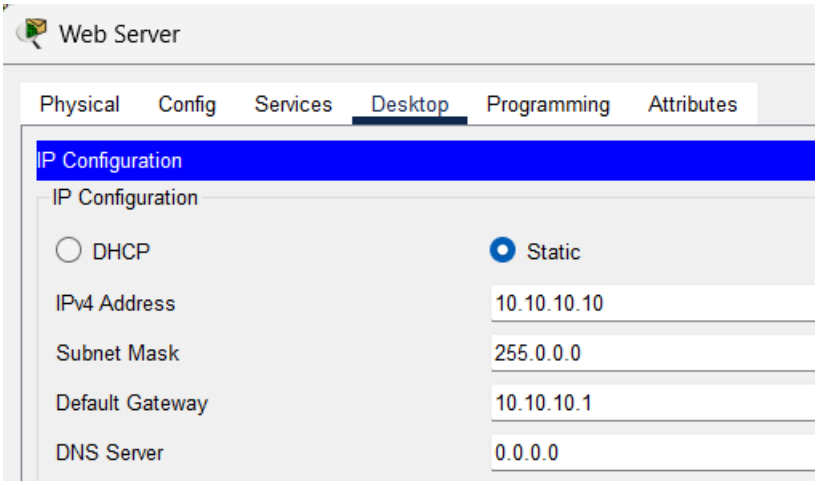
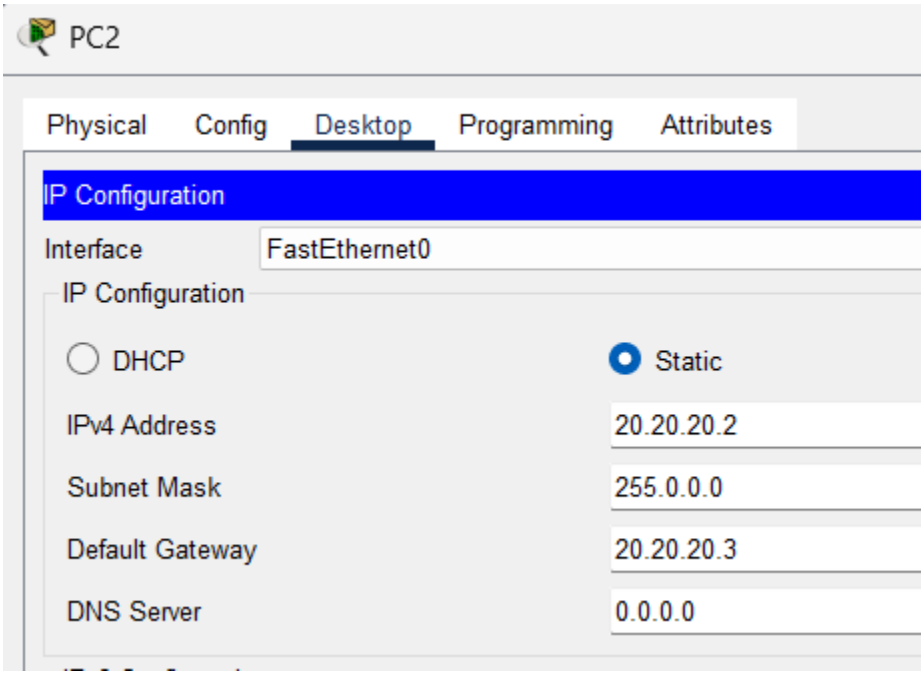
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.13.39
Subnet Mask
255.255.255.192
Default Gateway
192.168.13.3
DNS Server
0.0.0.0

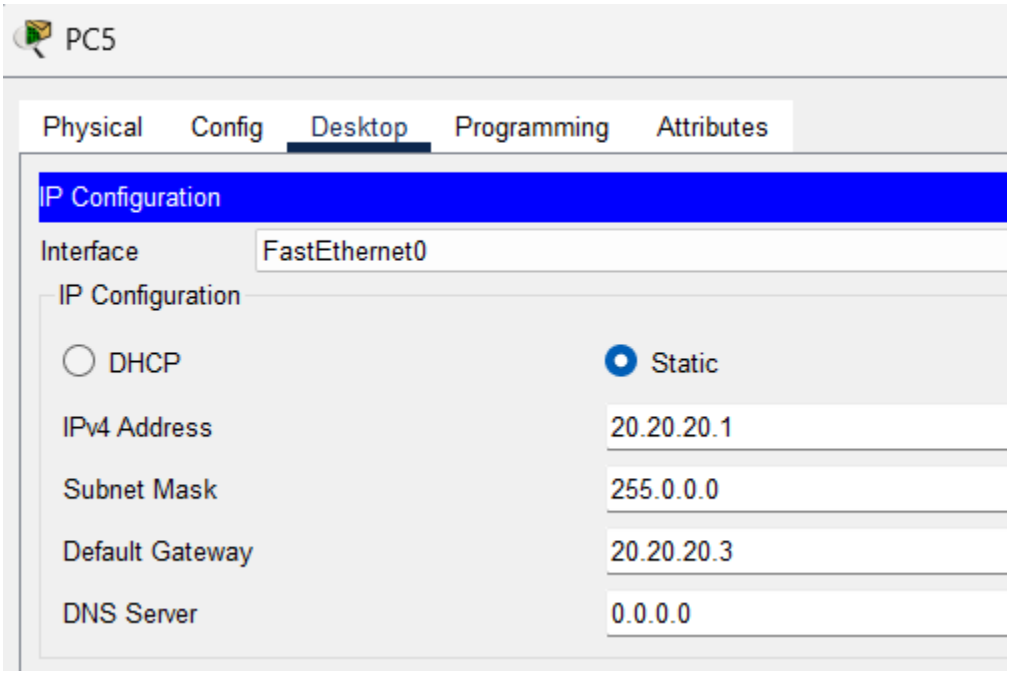
- **Web Server configuration**



- **PC2**

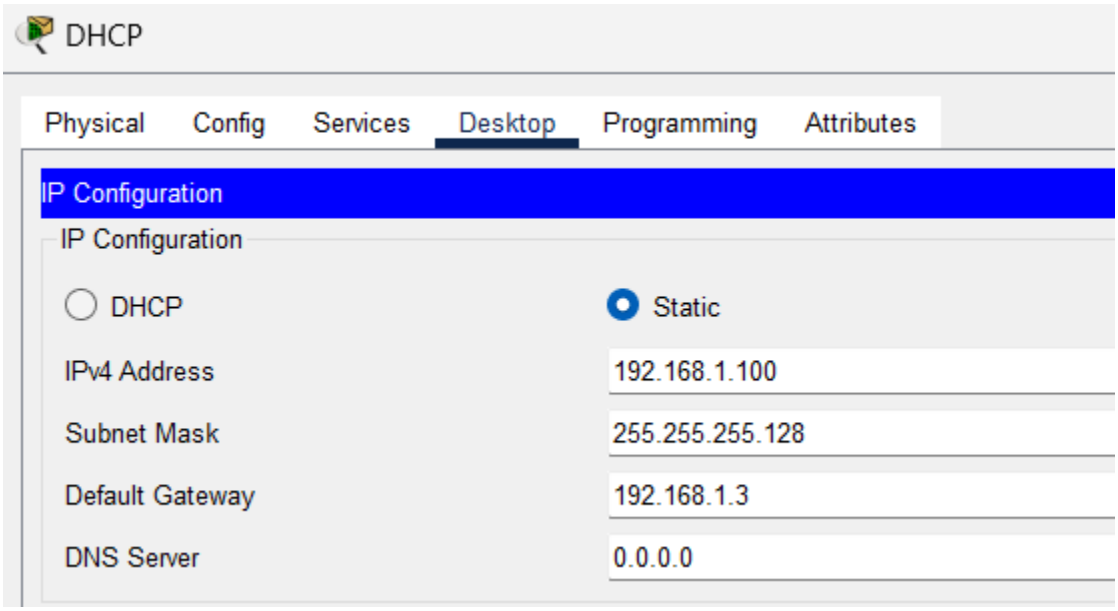


- **PC5**

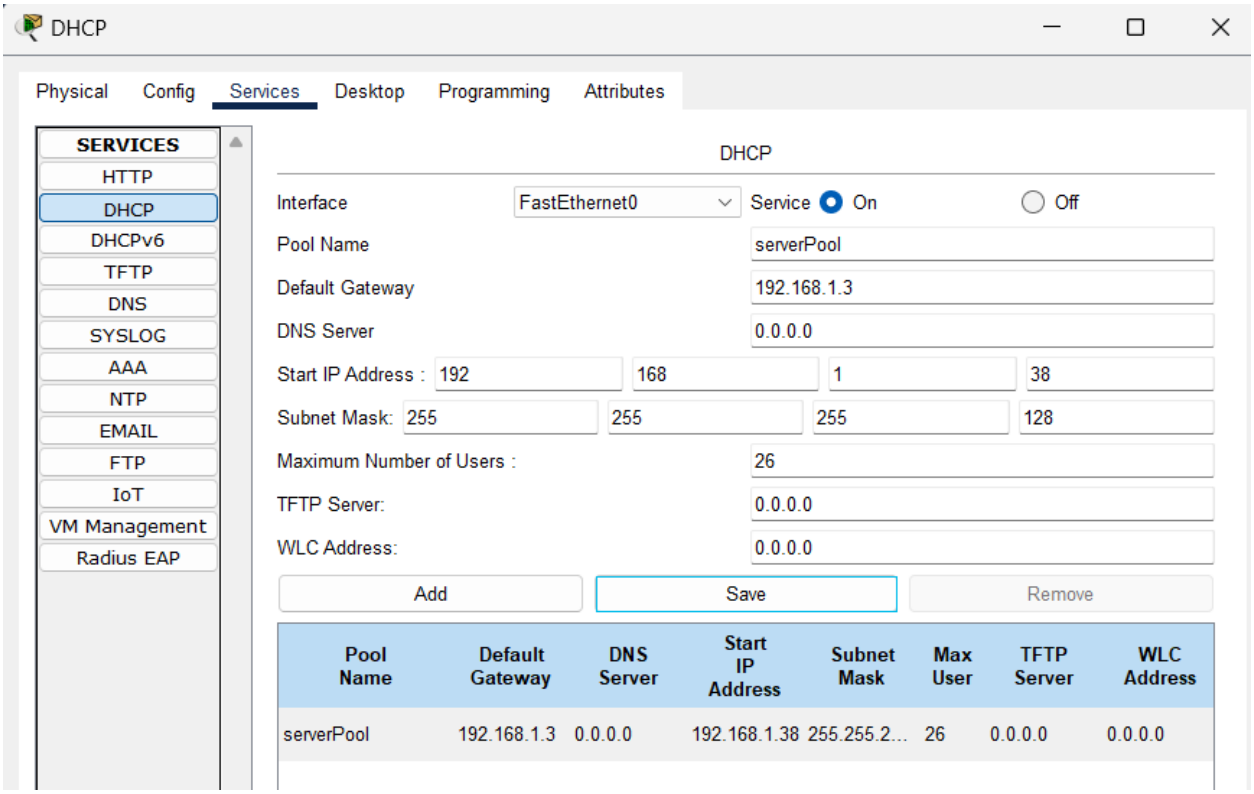


DHCP configuration

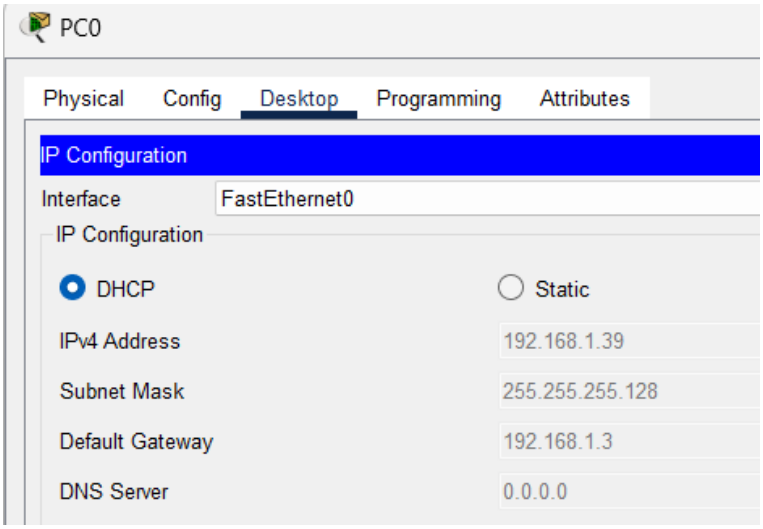
- **DHCP server**



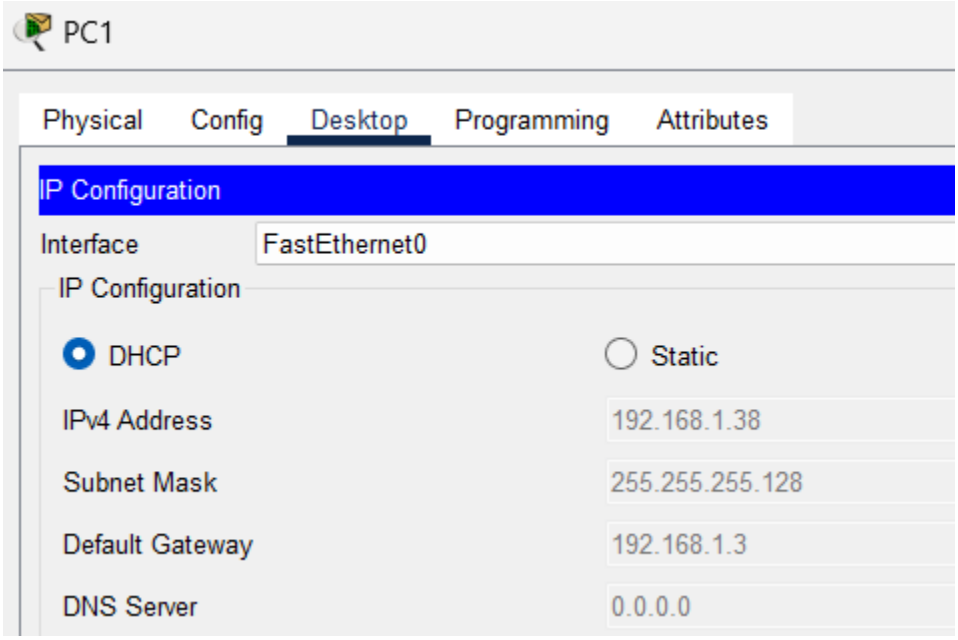
- **Services -> DHCP**



- **PC0 -> DHCP assigned**



- **PC1 -> DHCP assigned**



5. Configuration of Routers

Router 2

```
interface GigabitEthernet0/0/0
 ip address 192.168.1.3 255.255.255.128
 no shutdown

interface Serial0/1/0
 ip address 192.168.2.39 255.255.255.192
no shutdown

interface Serial0/2/0
 ip address 30.30.30.1 255.0.0.0
no shutdown


interface Serial0/1/1
 ip address 192.168.3.39 255.255.255.240
no shutdown
```

Router 14

```
interface Serial0/2/0
 ip address 30.30.30.2 255.0.0.0
no shutdown

interface GigabitEthernet0/0/0
```

```
 ip address 20.20.20.3 255.0.0.0
 no shutdown
```

Router 1

```
interface Serial0/2/0
 ip address 192.168.5.38 255.255.255.240
no shutdown

interface Serial0/2/1
 ip address 192.168.2.38 255.255.255.192
no shutdown
```

Router 3

```
interface Serial0/1/0
 ip address 192.168.3.38 255.255.255.240
no shutdown

interface Serial0/1/1
 ip address 192.168.4.39 255.255.255.128
no shutdown
```

Router 4

```
interface Serial0/1/0
 ip address 192.168.5.39 255.255.255.240
no shutdown

interface Serial0/1/1
 ip address 192.168.4.38 255.255.255.128
no shutdown

interface Serial0/2/0
 ip address 192.168.6.39 255.255.255.128
no shutdown
```

Router 13

```
interface Serial0/1/0
 ip address 192.168.6.38 255.255.255.128
no shutdown

interface Serial0/1/1
 ip address 192.168.18.1 255.255.255.192
no shutdown

interface Serial0/2/0
 ip address 192.168.12.39 255.255.255.240
no shutdown
```

Router 9

```
interface Serial0/1/0
 ip address 192.168.11.39 255.255.255.128
no shutdown

interface Serial0/1/1
 ip address 192.168.9.38 255.255.255.240
no shutdown
```

Router 10

```
interface Serial0/1/0
 ip address 192.168.8.39 255.255.255.192
no shutdown

interface Serial0/1/1
 ip address 192.168.9.39 255.255.255.240
no shutdown
```

Router 11

```
interface GigabitEthernet0/0/0
 ip address 192.168.7.3 255.255.255.192
no shutdown

interface Serial0/1/0
 ip address 192.168.10.39 255.255.255.224
no shutdown

interface Serial0/1/1
 ip address 192.168.8.38 255.255.255.192
no shutdown
```

Router 12

```
interface Serial0/1/0
 ip address 192.168.11.38 255.255.255.128
no shutdown
interface Serial0/1/1
 ip address 192.168.10.38 255.255.255.224
no shutdown

interface Serial0/2/0
 ip address 192.168.12.38 255.255.255.240
no shutdown
```

Router 8

```
interface Serial0/1/0
 ip address 192.168.17.1 255.255.255.224
no shutdown
```

```
interface Serial0/1/1
 ip address 192.168.15.1 255.255.255.240
no shutdown

interface Serial0/2/0
 ip address 192.168.18.2 255.255.255.192
no shutdown
```

Router 7

```
interface Serial0/1/0
 ip address 192.168.17.2 255.255.255.224
 no shutdown

interface Serial0/1/1
 ip address 192.168.16.1 255.255.255.128
no shutdown
```

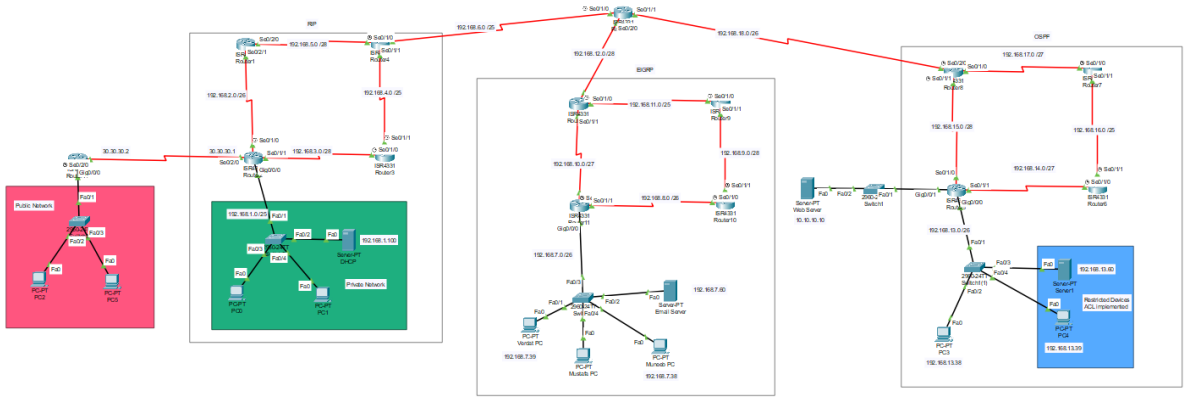
Router 6

```
interface Serial0/1/0
 ip address 192.168.14.2 255.255.255.224
 no shutdown

interface Serial0/1/1
 ip address 192.168.16.2 255.255.255.128
no shutdown
```

Router 5

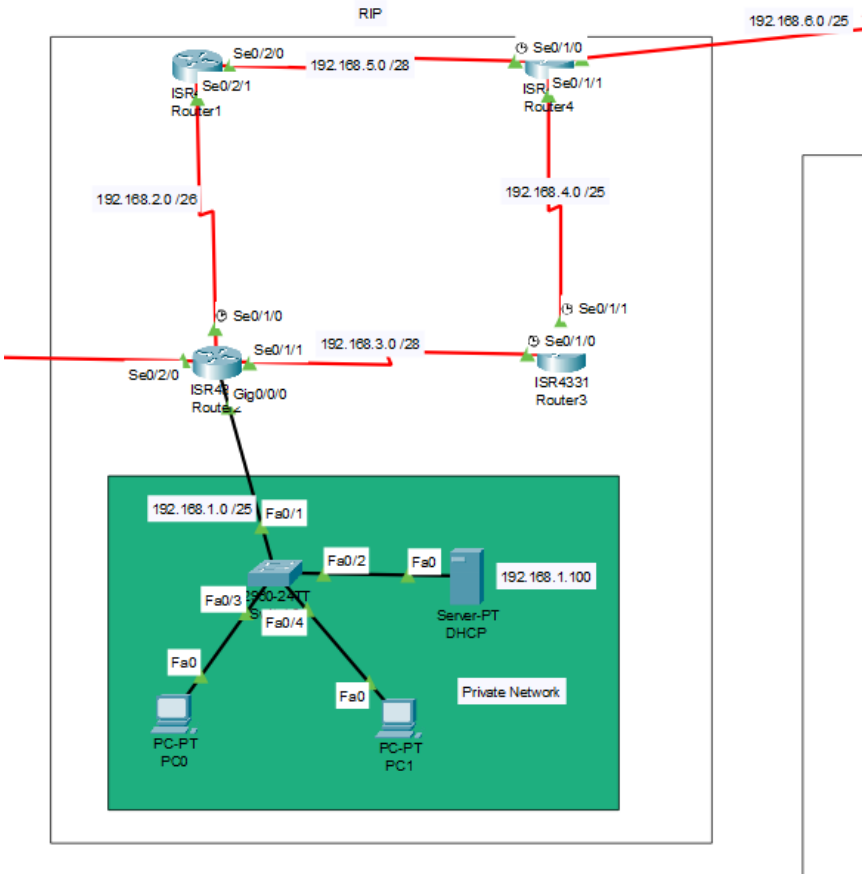
```
interface GigabitEthernet0/0/0
 ip address 192.168.13.3 255.255.255.192
no shutdown

interface GigabitEthernet0/0/1
 ip address 10.10.10.1 255.0.0.0
no shutdown

interface Serial0/1/0
 ip address 192.168.15.2 255.255.255.240
no shutdown

interface Serial0/1/1
 ip address 192.168.14.1 255.255.255.224
no shutdown
```

Screenshot of Topology



RIP Configuration

RIP Network



Router 1

```
router rip
network 192.168.2.0
network 192.168.5.0
```

Router 2

```
router rip
 network 192.168.1.0
 network 192.168.2.0
 network 192.168.3.0
```

Router 3

```
router rip
 network 192.168.3.0
 network 192.168.4.0
```

Router 4

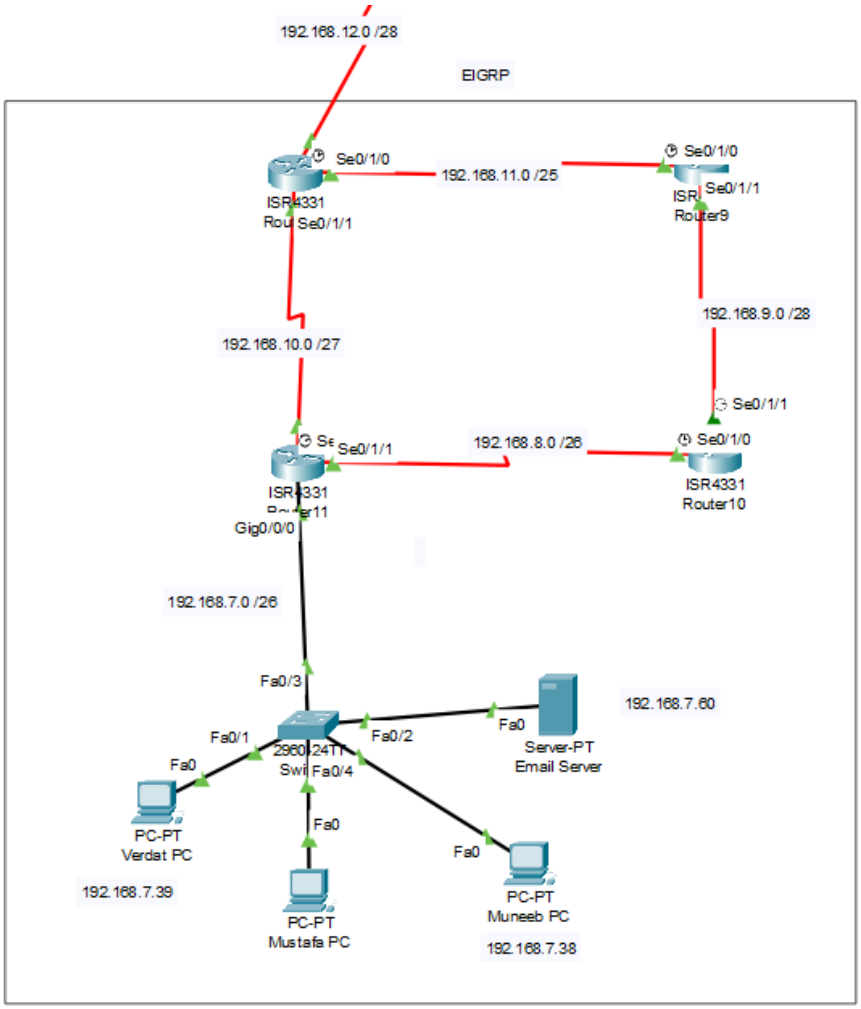
```
router rip
 network 192.168.4.0
 network 192.168.5.0
 network 192.168.6.0
```

Router 13

```
router rip
  network 192.168.6.0
```

EIGRP Configuration

EIGRP Network



Router 9

```
router eigrp 10
 network 192.168.11.0
 network 192.168.9.0
```

Router 10

```
router eigrp 10
 network 192.168.8.0
 network 192.168.9.0
```

Router 11

```
router eigrp 10
 network 192.168.7.0
 network 192.168.10.0
 network 192.168.8.0
```

Router 12

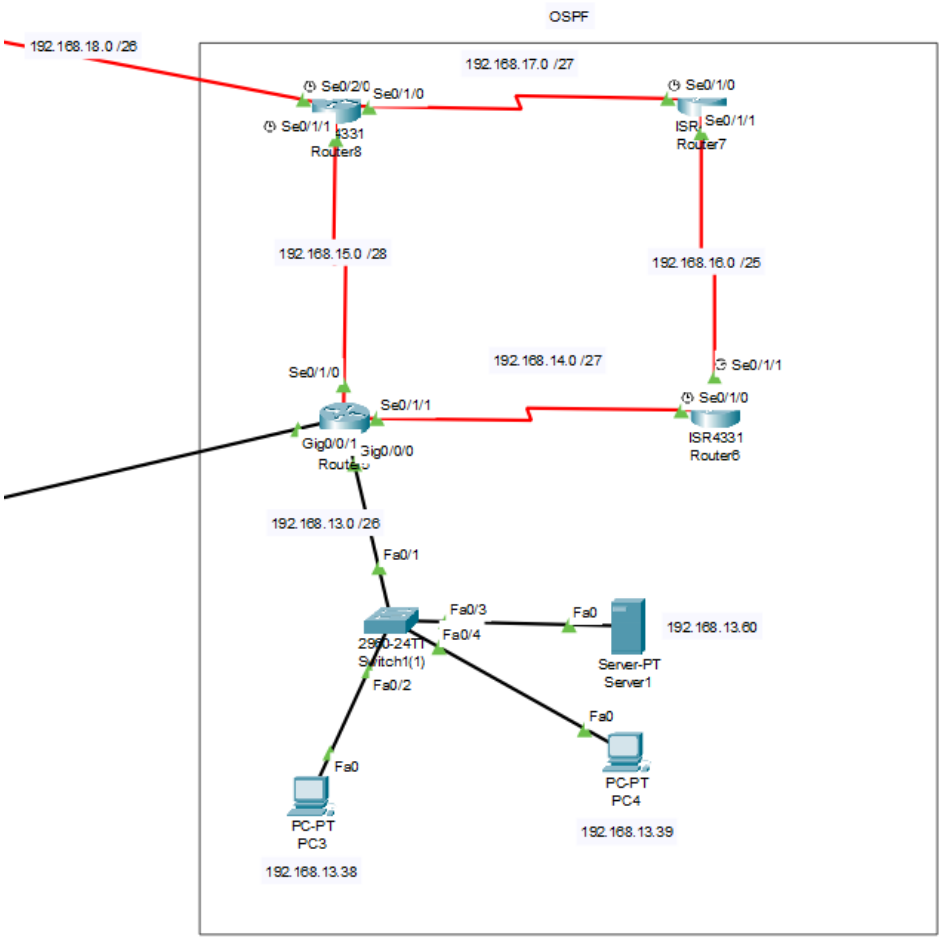
```
router eigrp 10
 network 192.168.10.0
 network 192.168.11.0
 network 192.168.12.0
```

Router 13

```
router eigrp 10
  network 192.168.12.0
```

OSPF Configuration

OSPF Network



Router 5

```
router ospf 1
 network 192.168.14.0 0.0.0.31 area 0
 network 192.168.15.0 0.0.0.15 area 0
 network 192.168.13.0 0.0.0.63 area 0
```

Router 6

```
router ospf 1
 network 192.168.16.0 0.0.0.127 area 0
 network 192.168.14.0 0.0.0.31 area 0
```

Router 7

```
router ospf 1
 network 192.168.16.0 0.0.0.127 area 0
 network 192.168.17.0 0.0.0.31 area 0
```

Router 8

```
router ospf 1
 network 192.168.18.0 0.0.0.63 area 0
 network 192.168.17.0 0.0.0.31 area 0
 network 192.168.15.0 0.0.0.15 area 0
```

Router 13

```
router ospf 1
 network 192.168.18.0 0.0.0.63 area 0
```

Redistribution Configuration (On Router 13)

Router 13

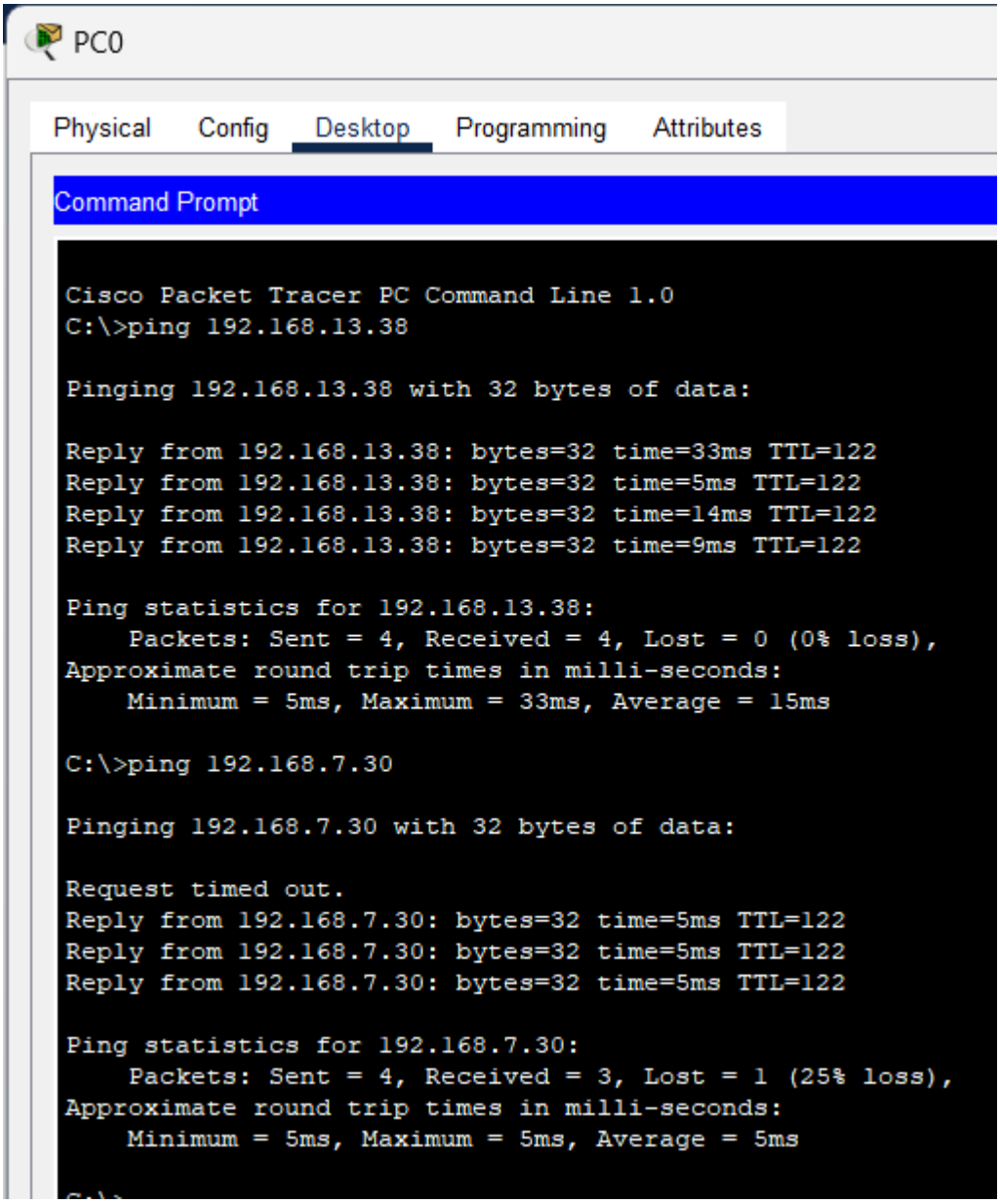
```
router rip
 redistribute eigrp 10 metric 2
 redistribute ospf 1 metric 2
 exit

router eigrp 10
 redistribute rip metric 1 1 255 1 1
 redistribute ospf 1 metric 1 1 255 1 1
 exit

router ospf 1
```

```
redistribute rip subnets
redistribute eigrp 10 subnets
exit
```

These command of redistribution on router 13 will help to communicate each protocol with each other

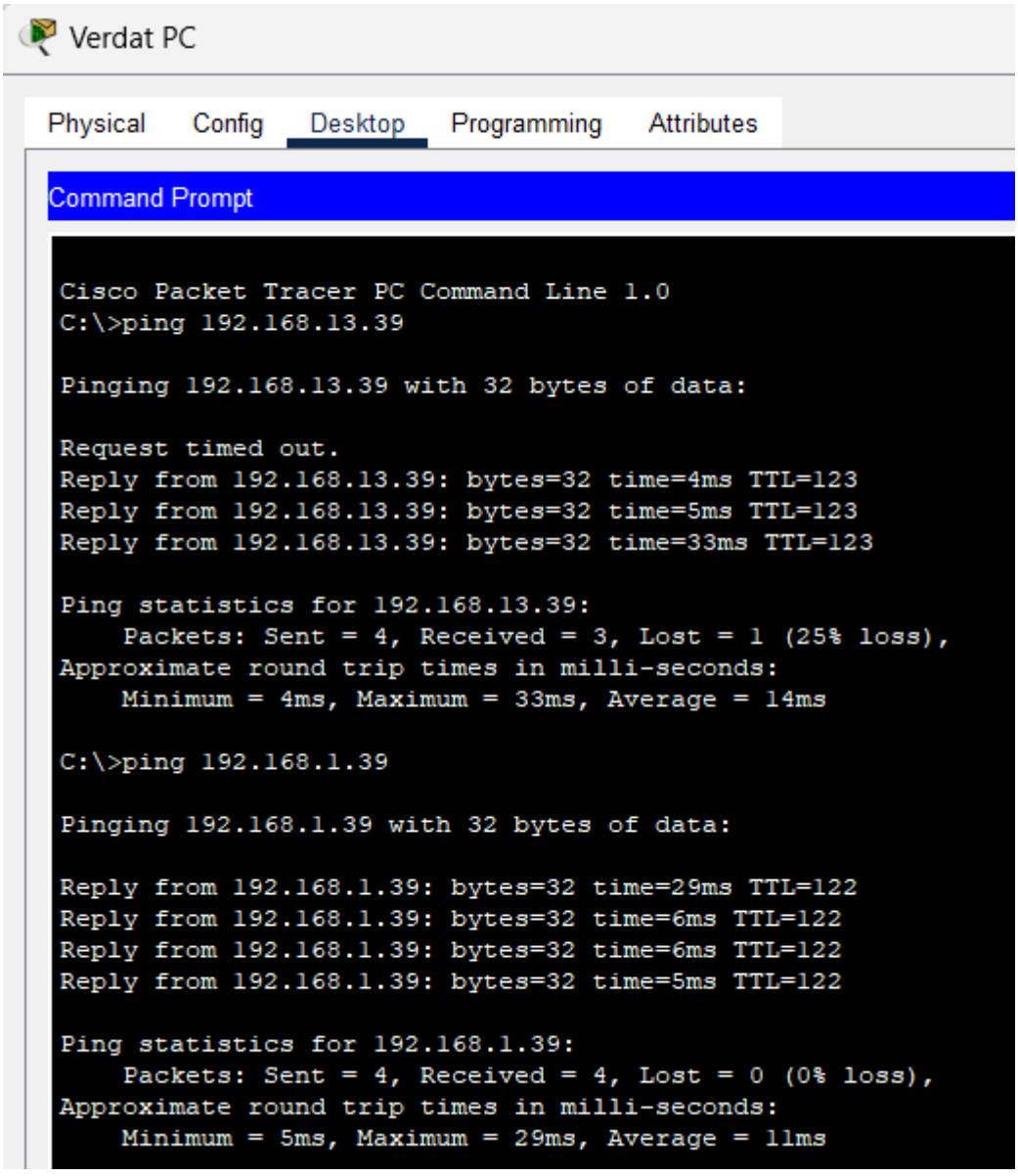
Test Network Connectivity Using Ping

- **PC0 with PC3 and Mustafa PC**



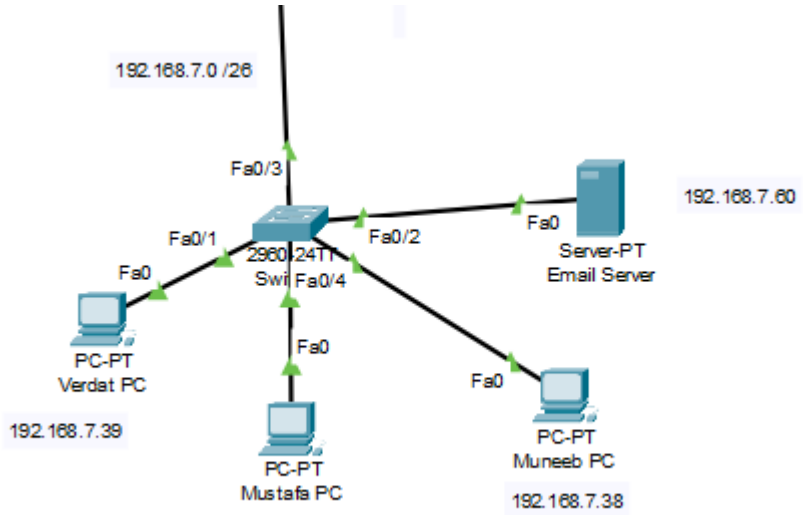
This shows that RIP protocol is successfully communicating with OSPF protocol and EIGRP protocol

- **Verdat PC with PC1 and PC4**

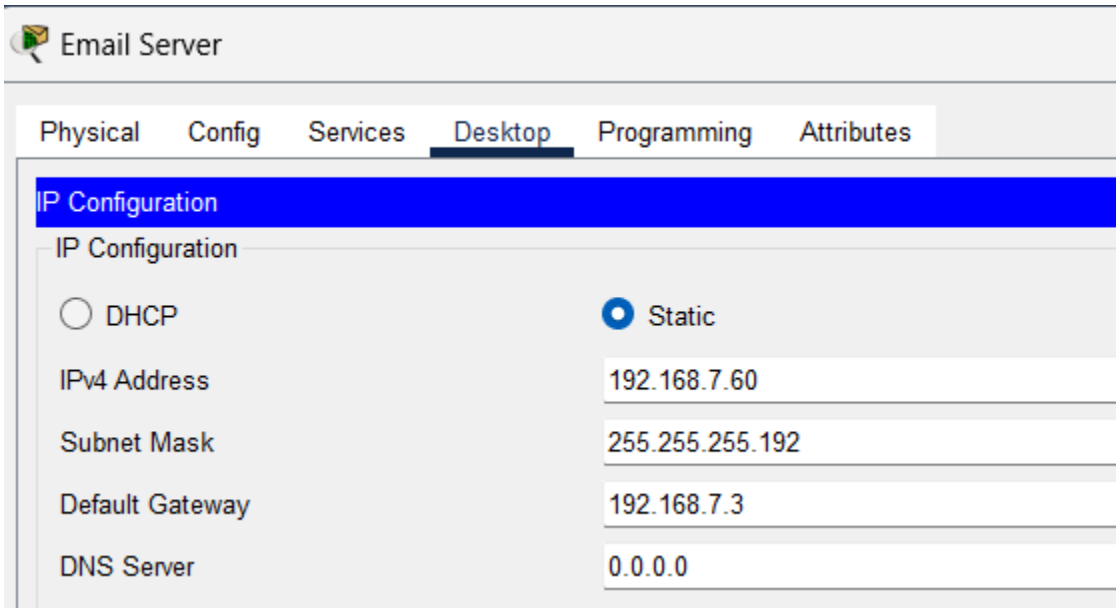


This shows that EIGRP protocol is successfully communicating with OSPF protocol and RIP protocol and vice versa. Hence all networks are successfully communicating with each other.

Email Configuration

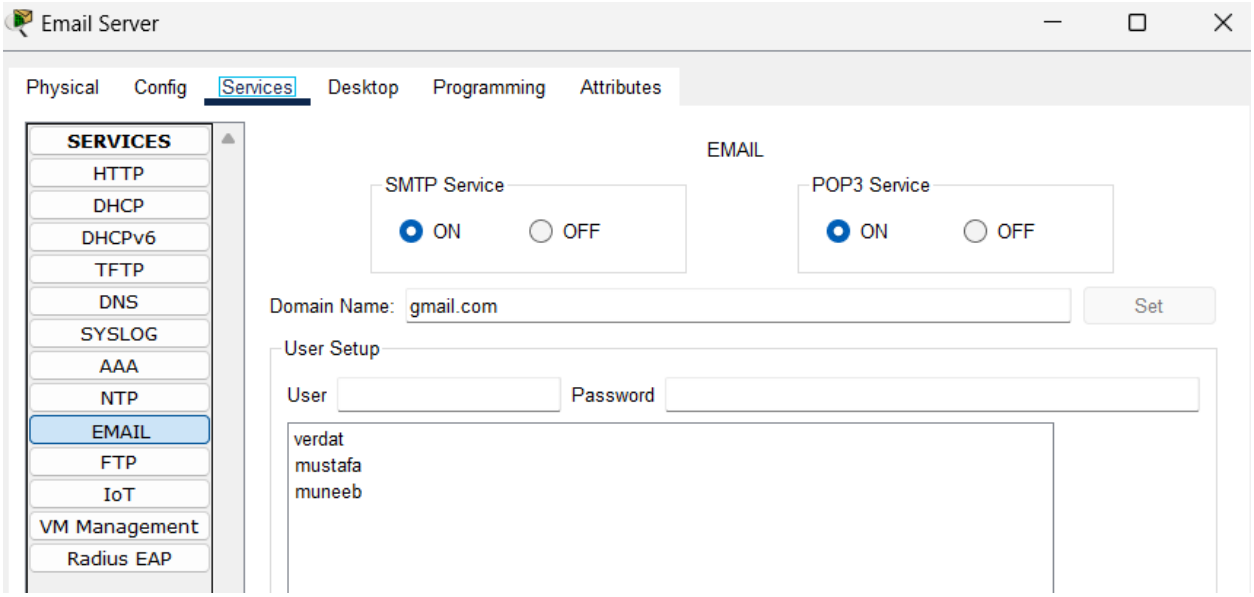


- **Email Server**



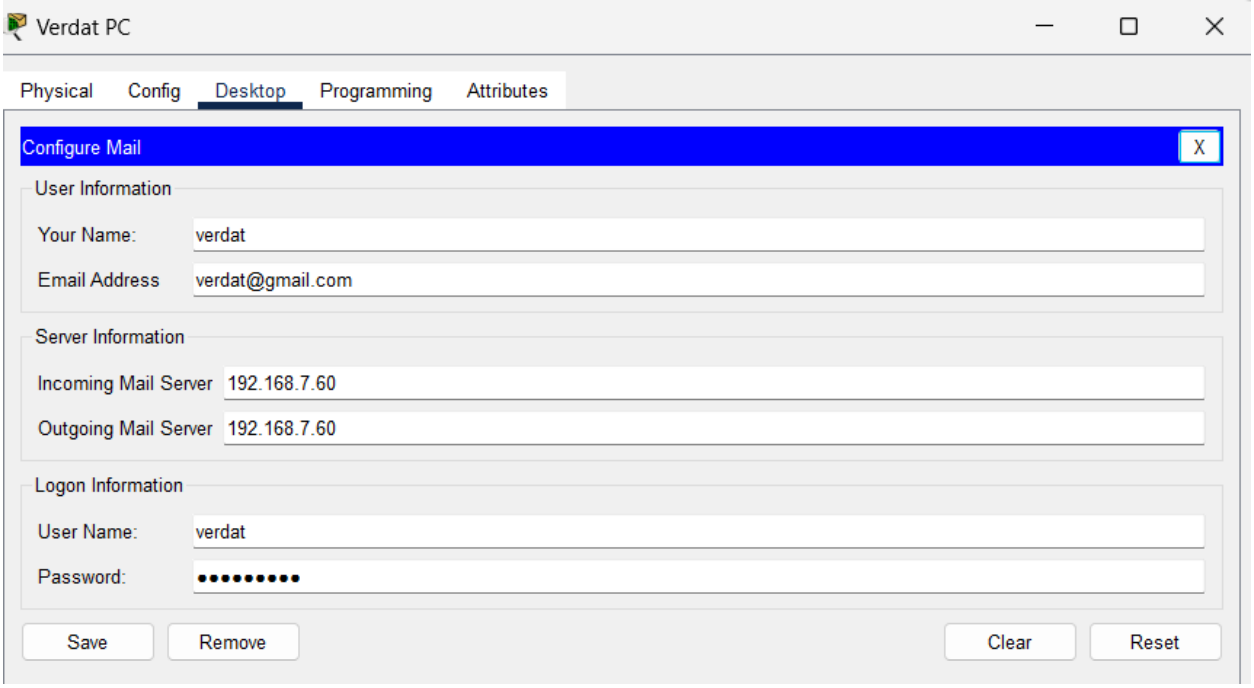
- **Services -> Email**

First add the domain name then enter users name with relevant password

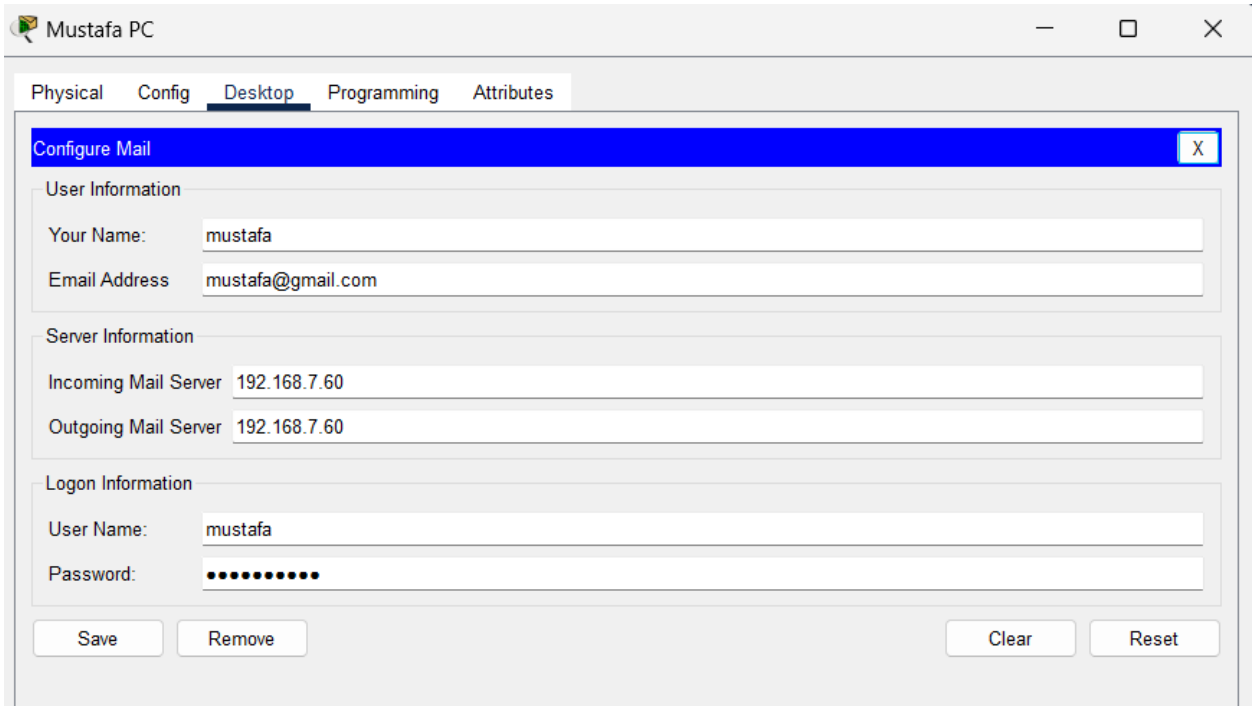


Now Configure Email on Each User PCS which was defined in server and save it on each PCs

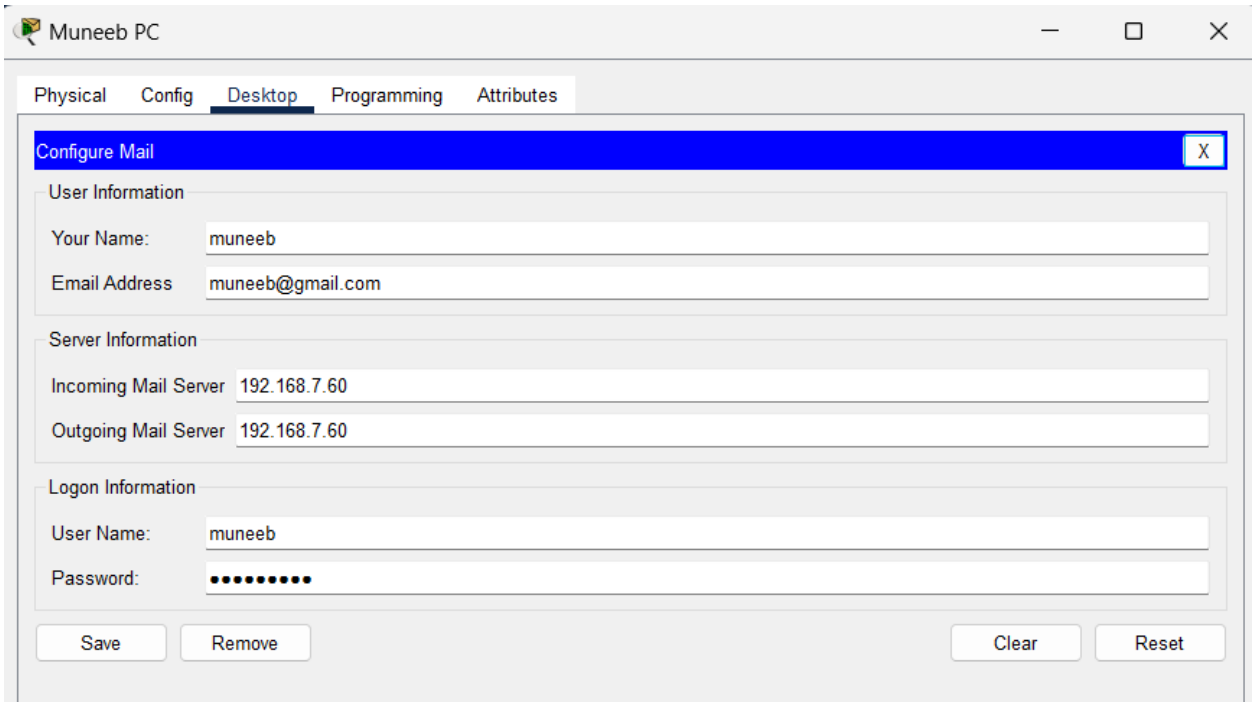
- **Verdat PC**



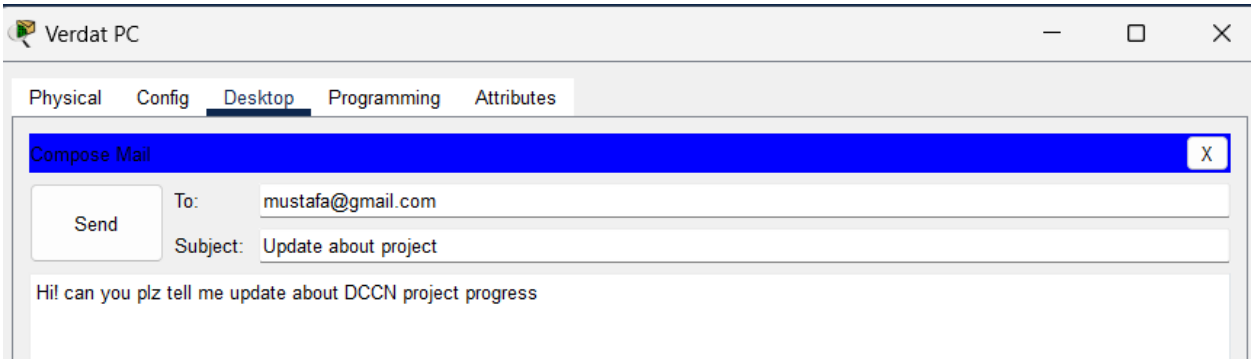
- **Mustafa PC**



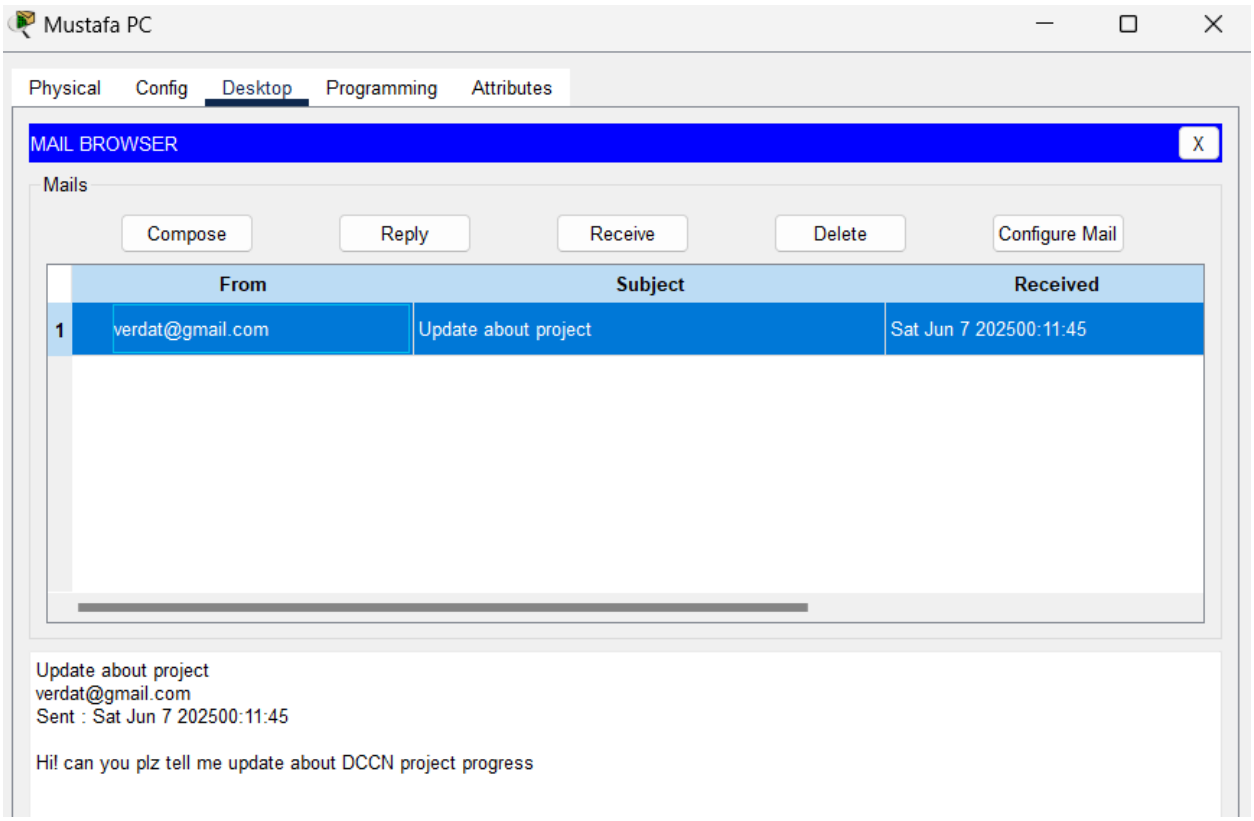
- **Muneeb PC**



Now check if email is sending and receiving from on PC to another

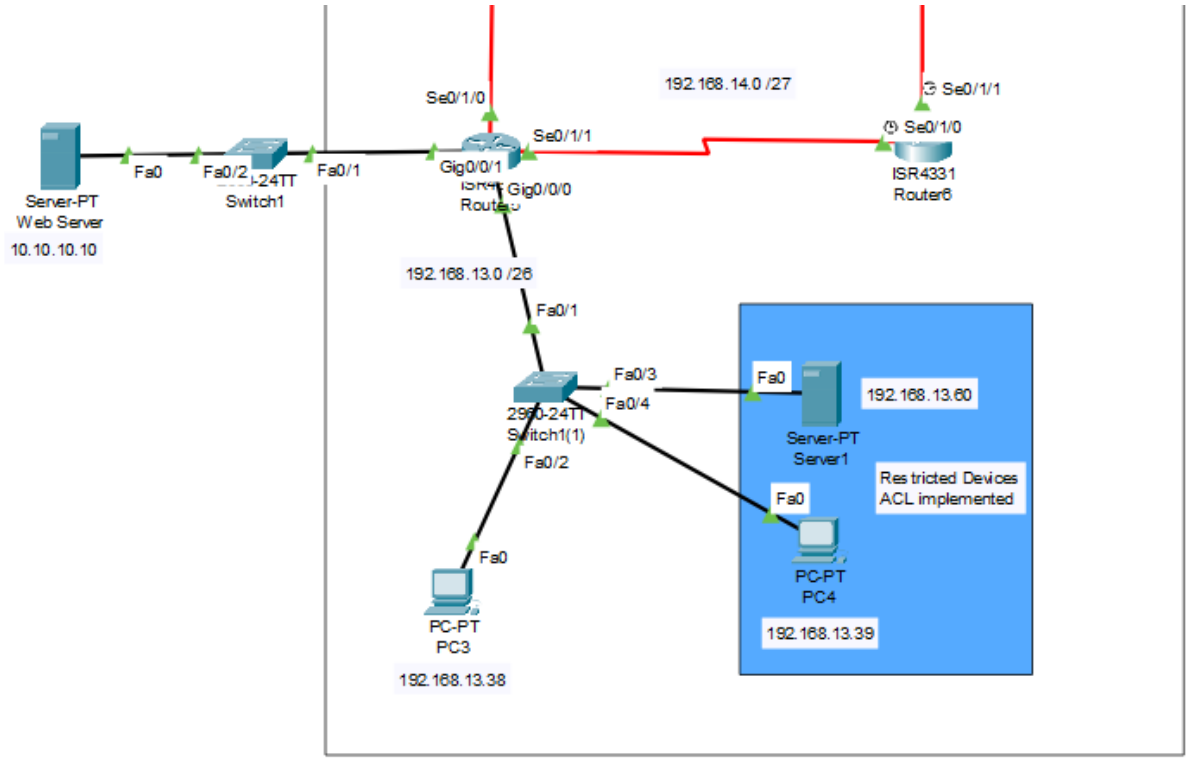


Verdat PC has sent an email to Mustafa PC now, let's check if Mustafa PC received it successfully

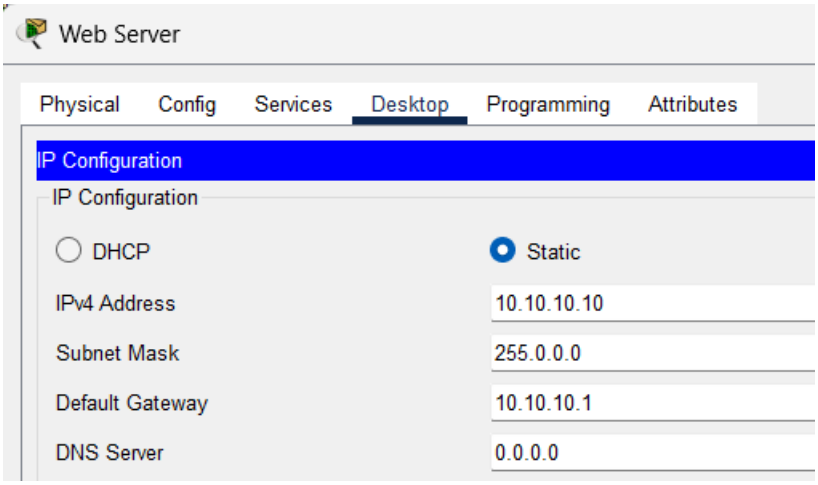


Mustafa's PC successfully receives the email

Standard ACL Configuration



Web Server configuration



ACL configuration on Router 5

Type command

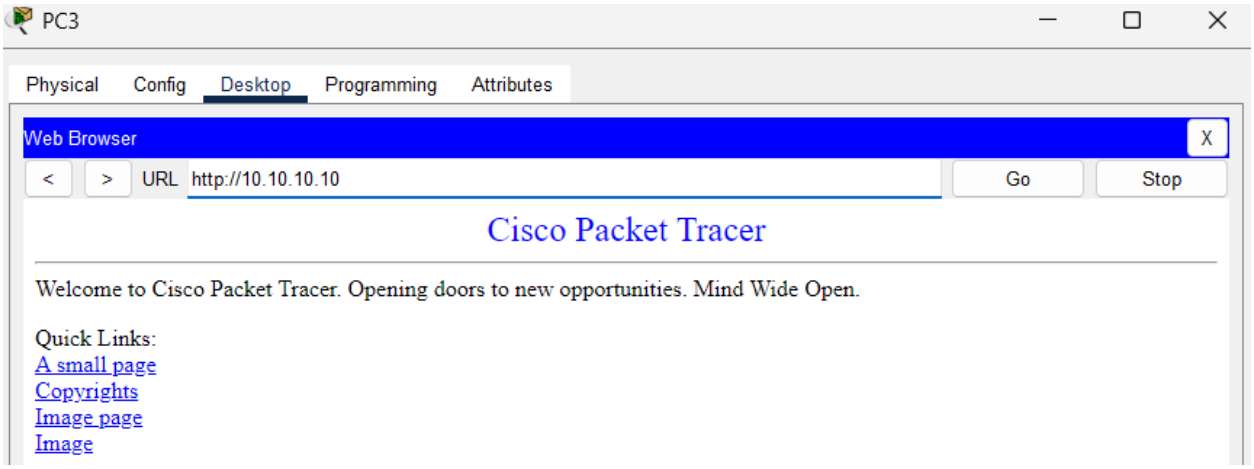
```
Router(config)#access-list 10 permit host 192.168.13.38
Router(config)#
Router(config)#access-list 10 deny any
```

```
Router(config-if)#int gig0/0/0
Router(config-if)#
Router(config-if)#ip access-group 10 in
Router(config-if)#
Router(config-if)#exit
Router(config)#
Router(config)#do wr
Building configuration...
[OK]
```

Type command Show access-list

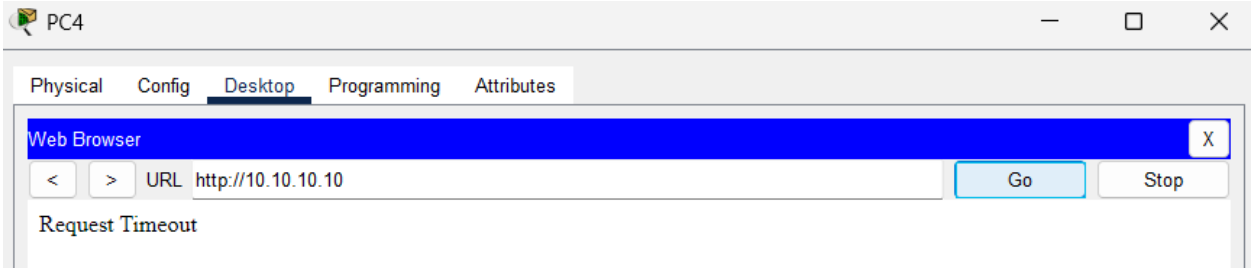
```
Router#sh access-list
Standard IP access list 10
    10 permit host 192.168.13.38
    20 deny any
```

For confirmation check from PC3 (192.168.13.38) to WebServer



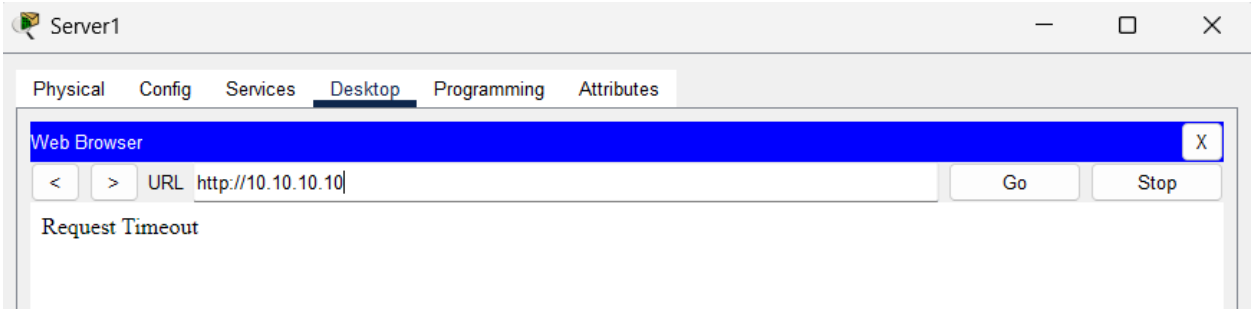
This shows that PC3 is able to communicate with web server which we have defined in ACL configuration

From PC4 (192.168.13.38) to Web server



This shows that PC4 was unable to communicate with Web server which we have defined in ACL configuration

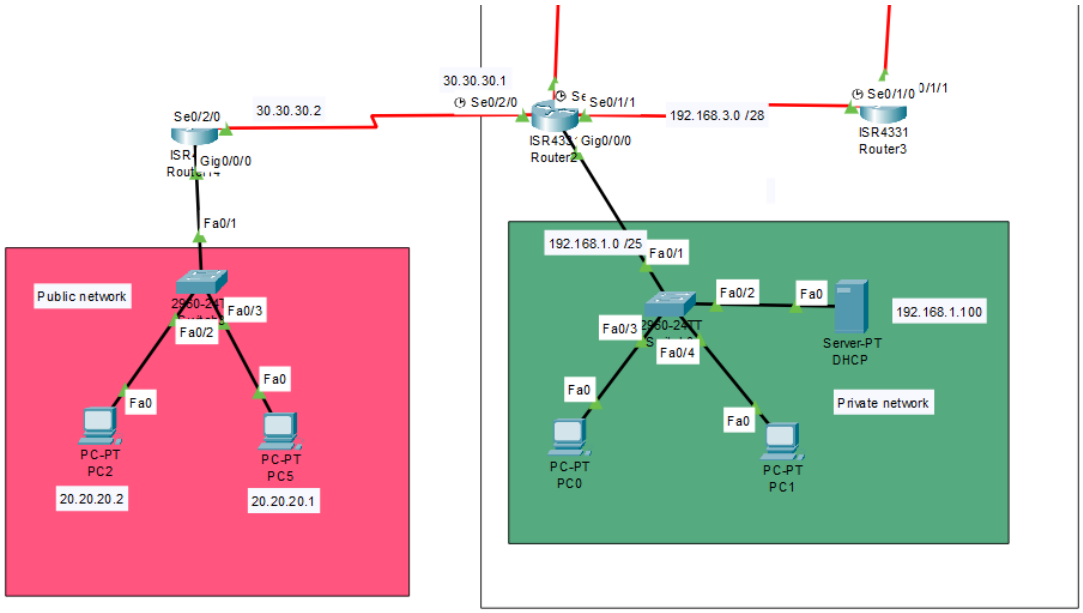
From Server 1 (192.168.13.60) to Web server



This shows that Server1 was unable to communicate with Web server which we have defined in ACL configuration

Static NAT configuration

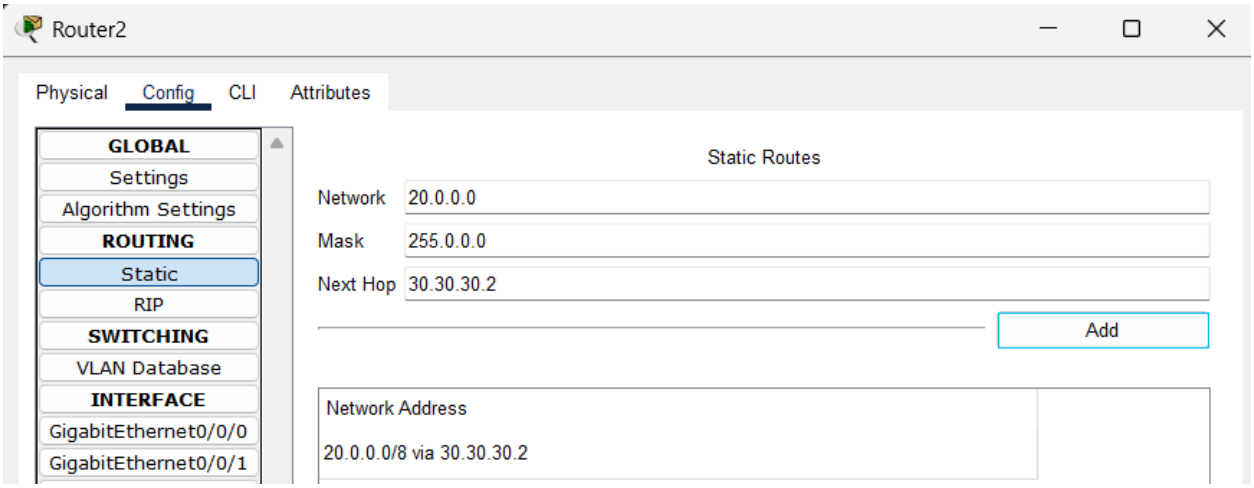
NAT Network



NAT configuration on Router 2

Type command

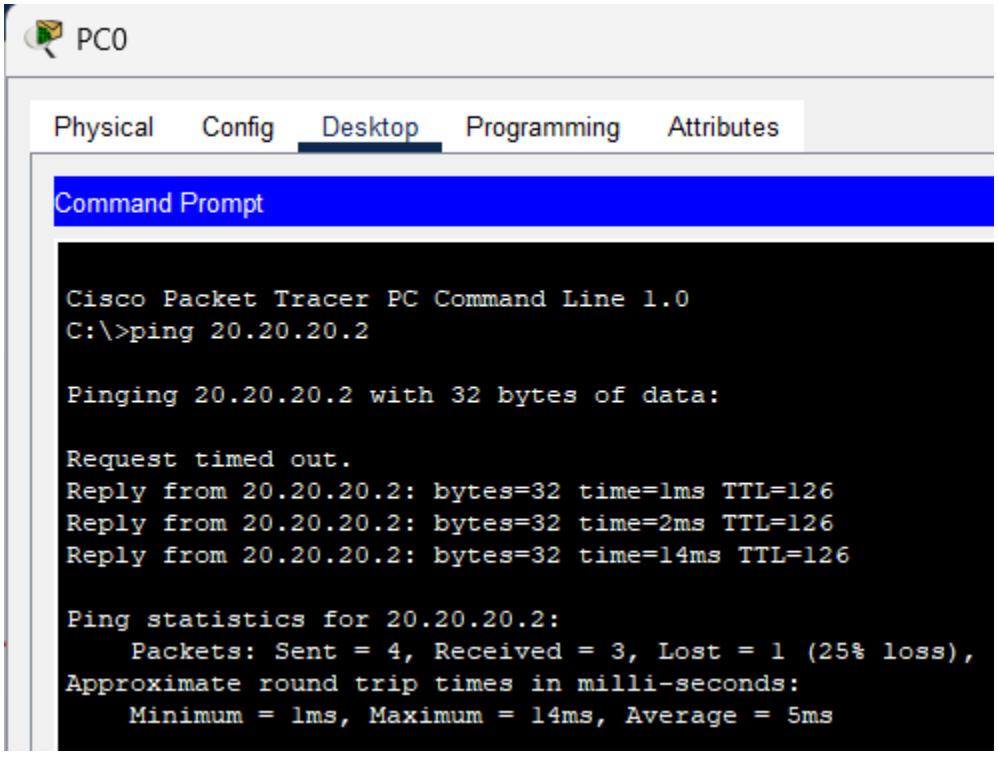
```
Router(config-if)#ip nat inside source static 192.168.1.38 30.30.30.1
Router(config)#ip nat inside source static 192.168.1.39 30.30.30.1
Router(config)#ip nat inside source static 192.168.1.100 30.30.30.1
Router(config)#
Router(config)#int gig0/0/0
Router(config-if)#ip nat inside
Router(config-if)#int se0/2/0
Router(config-if)#ip nat outside
Router(config-if)#
Router(config-if)#exit
```



This will allow private network to access with public network, but public network cannot access private network this is how NAT works

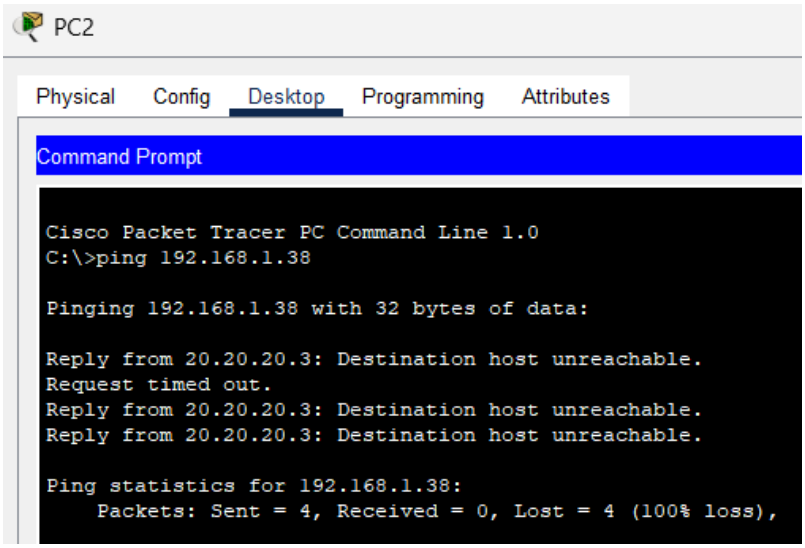
Test connectivity using ping

- **From PC0 to PC2**



This shows that private network PC can communicate with public network PC

- **From PC2 to PC0**



This shows that public network PC cannot communicate with private network PC. This shows that NAT is working properly.

Conclusion

In this project, we successfully designed and implemented a complete enterprise-level computer network using Cisco Packet Tracer. The network was divided into three autonomous systems operating with RIP, OSPF, and EIGRP, and Router 13 was configured as the central redistribution point to enable seamless communication between all protocols. Subnetting were applied to ensure efficient utilization of IP addresses, while DHCP was implemented to automate IP assignment across hosts. Additional services such as an Email Server and a Web Server were configured to simulate real-world enterprise communication. Network Address Translation (NAT) was applied to allow controlled communication between private and public networks, and Access Control Lists (ACL) were used to enforce security policies by restricting access to specific devices. Connectivity tests through ping and email exchange confirmed successful end-to-end communication across domains, demonstrating that the design met all functional requirements. Overall, this project provided practical exposure to advanced networking concepts including routing, redistribution, subnetting, and

network services, thereby reinforcing our understanding of enterprise network design and implementation.