



Faculty of Engineering & Technology
Electrical and Computer Engineering Department
ENCS3320 Computer Networks
Project Report

Prepared by:

Afaf Amwas	1203359
Dana Asfour	1211924
Mohammed Salem	1200651

Instructor: Abdalkarim Awad

Section: 1 and 3

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Part 0

IP subnetting and assignment

The ID we used is : 1211924, the number 19 is the second octet of the IP address from the left. The IP address of our project is 200.19.10.0/25, with the first 25 bits representing the network part and the 7 bits represent the host IP. We made subnetting to fill table 1 as shown in details down below.

This is the IP address for our project:

200.19.10.0/25

11001000.00010011.00001010.0 0000000

We need to make 9 subnet from this IP address 200.19.10.0/25

subnetName	Description	Number of Hosts for each subnet
ENCS3320_sub1	from R1 to ethernet (Data Center)	5
ENCS3320_sub2	from R1 to R4 serial	2
ENCS3320_sub3	from R4 Company C office 1 ethernet	10
ENCS3320_sub4	from R4 Company C office 2 ethernet	14
ENCS3320_sub5	from R4 to R3 serial	2
ENCS3320_sub6	from R3 to Company B ethernet	24
ENCS3320_sub7	from R3 to R2 serial	2
ENCS3320_sub8	from R2 to Company A ethernet	26
ENCS3320_sub9	from R2 to R1 serial	2

Table0: Subnetting Table

We took the first subnet and divided them.

subnet1=> 11001000.00010011.00001010.00 000000/26

network_address=>200.19.10.0/26

BroadCast=>200.19.10.63

subnet_mask=>255.255.255.192

#of host => $2^6 - 2 = 62$

1stIpAddress=>200.19.10.1

2ndIpAddress=>200.19.10.2

LastIpAddress=>200.19.10.62

We took the second subnet and divided them.

subnet2=> 11001000.00010011.00001010.01 000000/26

network_address=>200.19.10.64/26

BroadCast=>200.19.10.127

subnet_mask=>255.255.255.192

#of host => $2^6 - 2 = 62$

1stIpAddress=>200.19.10.65

lastIpAddress=>200.19.10.126

subnetting for subnet1 in details

sub netting for subnet1 => 11001000.10011000.00001010.00 000000/26

11001000.00010011.00001010.000 00000/27 subnet1.1

11001000.00010011.00001010.001 00000/27 subnet1.2

subnet1.1=> 11001000.00010011.00001010.000 00000/27

network_address=>200.19.10.0/27

subNetMask=>255.255.255.224

broadCast=>200.19.10.31
#of host => $2^5 - 2 = 30$ host
subnet1.2=>11001000.00010011.00001010.001 00000/27
network_address=>200.19.10.32/27
subNetMask=>255.255.255.224
broadCast=>200.19.10.63
#of host => $2^5 - 2 = 30$ host

subnetting for subnet2 in details

subnet2=> 11001000.00010011.00001010.01 000000/26
subnet2.1=> 11001000.00010011.00001010.010 00000/27
network_address=>200.19.10.64/27
#of host => $2^5 - 2 = 30$ host
subnet2.2=> 11001000.00010011.00001010.011 00000/27
network_address=>200.19.10.96/27
#of host => $2^5 - 2 = 30$ host

Now we have subnet1.1 , subnet1.2 , sunbet2.1 , subnet2.2

we give(assign) for ENCS3320_sub6 <== the subnet1.1

we give(assign) for ENCS3320_sub8 <== the subnet1.2

Now we have just only subnet2.1 , subnet2.2

subnetting for subnet2.1

subnet2.1=> 11001000.00010011.00001010.010 00000/27
subnet2.1.1=> 11001000.00010011.00001010.0100 0000/28
network_address=>200.19.10.64/28
subNetMask=>255.255.255.240
BroadCast=>200.19.10.79
#of host => $2^4 - 2 = 14$
subnet2.1.2=> 11001000.00010011.00001010.0101 0000/28

network_address=>200.19.10.80/28
subNetMask=>255.255.255.240
BroadCast=>200.19.10.95
#of host => $2^4 - 2 = 14$
Now we have subnet2.1.1 , subnet2.1.2 and subnet2.2

we give(assign) for ENCS3320_sub3 <= subnet2.1.1

we give(assign) for ENCS3320_sub4 <= subnet2.1.2

Now we have subnet2.2

we need more subnetting.....

subnetting for subnet2.2

subnet2.2=> 11001000.00010011.00001010.011 00000/27
subnet2.2.1=> 11001000.00010011.00001010.0110 0000/28
network_address=>200.19.10.96/28
subnetmask=>255.255.255.240
broadcast=>200.19.10.111
1stIpAddress=>200.19.10.97
lastIpAddress=>200.19.10.110
#of host => $2^4 - 2 = 14$
.....
subnet2.2.2=> 11001000.00010011.00001010.0111 0000/28
network_address=>200.19.10.112/28
subnetmask=>255.255.255.240
broadcast=>200.19.10.127
1stIpAddress=>200.19.10.113
lastIpAddress=>200.19.10.126
#of host => $2^4 - 2 = 14$

.....
we give(assign) for ENCS3320_sub1 <= subnet2.2.1

now we have just only this network subnet2.2.2
.....

and,Also the network remenders are:

ENCS3320_sub2 needs #ofHost = 2

ENCS3320_sub5 needs #ofHost = 2

ENCS3320_sub7 needs #ofHost = 2

ENCS3320_sub9 needs #ofHost = 2

subnetting for subnet2.2.2

subnet2.2.2=> 11001000.00010011.00001010.0111 0000/28
.....

subnet2.2.2.1=> 11001000.00010011.00001010.01110 000/29

network_address=>200.19.10.112

subnetMask=>

broadCast=>

1stIpAddress=>

lastIpAddress=>

#of host => $2^3 - 2 = 6$

subnet2.2.2.2=> 11001000.00010011.00001010.01111 000/29

network_address=>200.19.10.120

#of host => $2^3 - 2 = 6$
.....

now we have subnet2.2.2.1 , subnet2.2.2.2

.....And we keep dividing the subnets

Subnetting for subnet2.2.2.1

subnet2.2.2.1=> 11001000.00010011.00001010.01110 000/29

.....

subnet2.2.2.1.1=>11001000.00010011.00001010.011100 00/30

network_address=>200.19.10.112

subnetMask=>255.255.255.252

broadcast=>200.19.10.115

#of host =>2^2-2=2

subnet2.2.2.1.2=>11001000.00010011.00001010.011101 00/30

network_address=>200.19.10.116

subnetMask=>255.255.255.252

broadcast=>200.19.10.119

#of host =>2^2-2=2

.....

now we give(assign) for ENCS3320_sub2 <= subnet2.2.2.1.1

and we give(assign) for ENCS3320_sub5 <= subnet2.2.2.1.2

.....

Also the network remenders are:

ENCS3320_sub7 needs #ofHost = 2

ENCS3320_sub9 needs #ofHost = 2

.....

subnetting for subnet2.2.2

subnet2.2.2=> 11001000.00010011.00001010.01111 000/29

subnet2.2.2.1=> 11001000.00010011.00001010.011110 00/30

network_address=>200.19.10.120

networkMask=>255.255.255.252

BroadCast=>200.19.10.123

#of host =>2^2-2=2

subnet2.2.2.2=>11001000.00010011.00001010.011111 00/30

network_address=>200.19.10.124

networkMask=>255.255.255.252

BroadCast=>200.19.10.127

#of host => $2^2-2=2$

.....

now we give(assign) for ENCS3320_sub7 <= subnet2.2.2.2.1

now we give(assign) for ENCS3320_sub9 <= subnet2.2.2.2.2

Subnet	SubnetMask	Network IP address	Broadcast IP	First IP	Last IP	(#ofHost)
ENCS3320_sub1)(subnet2.2.1)	255.255.255.240/28	200.19.10.96/28	200.19.10.111	200.19.10.97	200.19.10.110	$2^4-2=14$
ENCS3320_sub2)(subnet2.2.2.1.1)	255.255.255.252/30	200.19.10.112/30	200.19.10.115	200.19.10.113	200.19.10.114	$2^2-2=2$
ENCS3320_sub3)(subnet2.1.1)	255.255.255.240/28	200.19.10.64/28	200.19.10.79	200.19.10.65	200.19.10.78	$2^4-2=14$
ENCS3320_sub4)(subnet2.1.2)	255.255.255.240/28	200.19.10.80/28	200.19.10.95	200.19.10.81	200.19.10.94	$2^4-2=14$
ENCS3320_sub5)(subnet2.2.2.1.2)	255.255.255.252/30	200.19.10.116/30	200.19.10.119	200.19.10.117	200.19.10.118	$2^2-2=2$
ENCS3320_sub6)(subnet1.1)	255.255.255.224/27	200.19.10.0/27	200.19.10.31	200.19.10.1	200.19.10.30	$2^5-2=30$
ENCS3320_sub7)(subnet2.2.2.2.1)	255.255.255.252/30	200.19.10.120/30	200.19.10.123	200.19.10.121	200.19.10.122	$2^2-2=2$
ENCS3320_sub8)(subnet1.2)	255.255.255.224/27	200.19.10.32/27	200.19.10.63	200.19.10.33	200.19.10.62	$2^5-2=30$
ENCS3320_sub9)(subnet2.2.2.2.2)	255.255.255.252/30	200.19.10.124/30	200.19.10.127	200.19.10.125	200.19.10.126	$2^2-2=2$

Table 1: Subnetting Details

Part 1: Building the topology

Part1.1 Network Topology

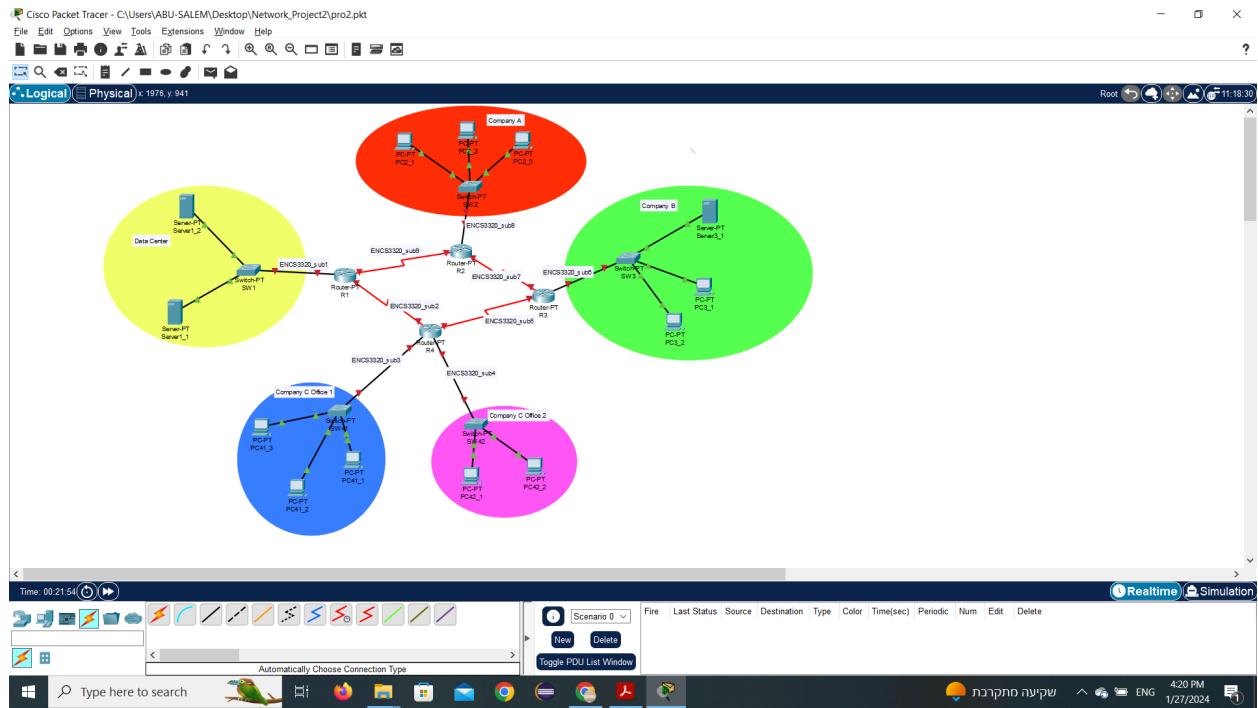
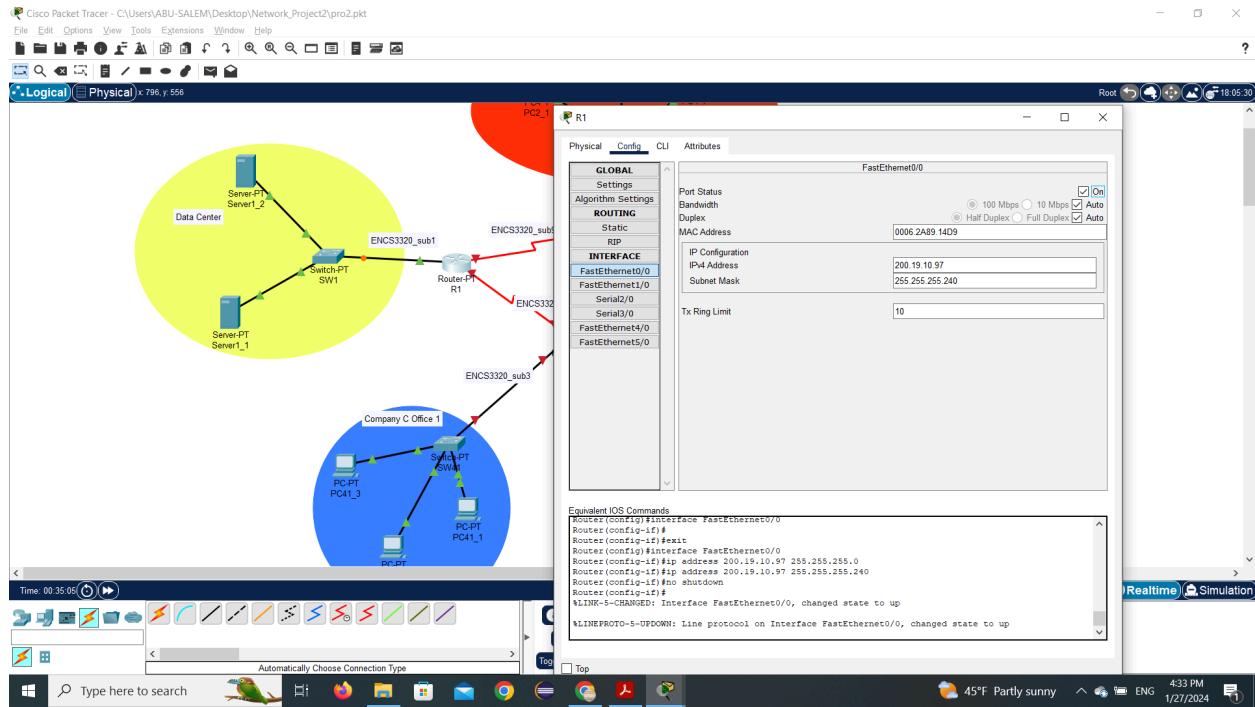


Figure 1: Network Topology

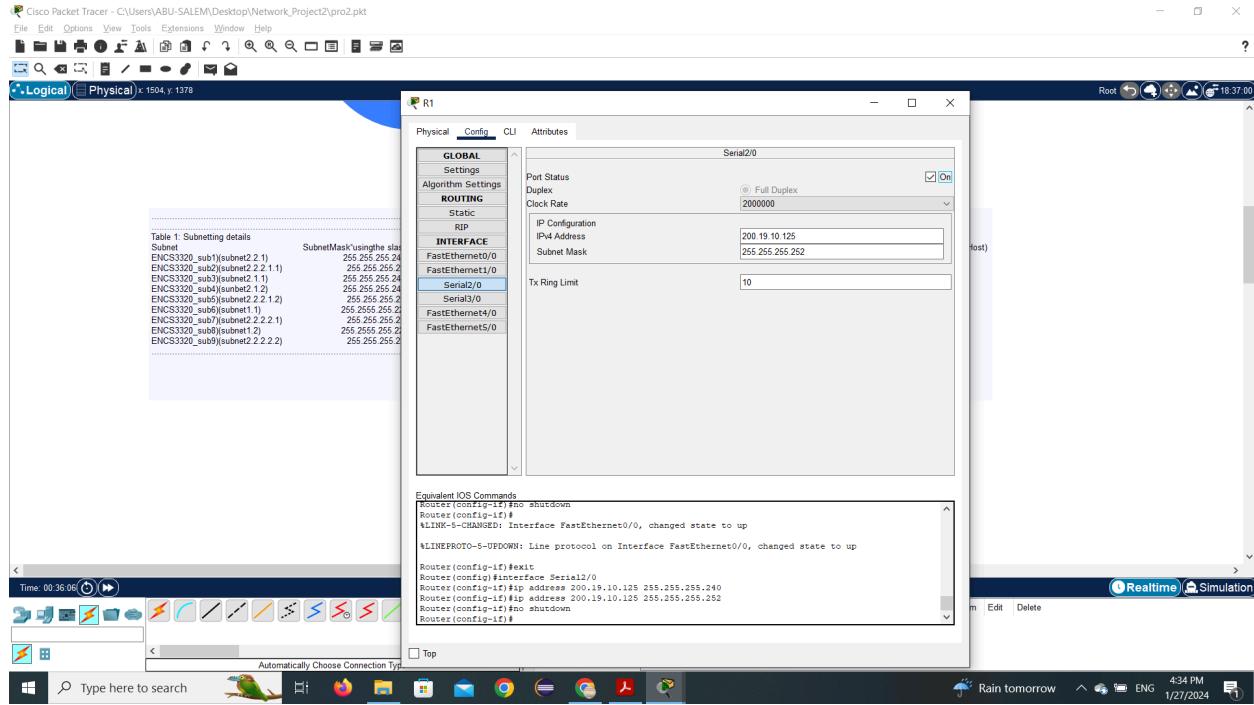
Part1.2: Configuration of Interfaces For All Routers

Configuration for router 1:

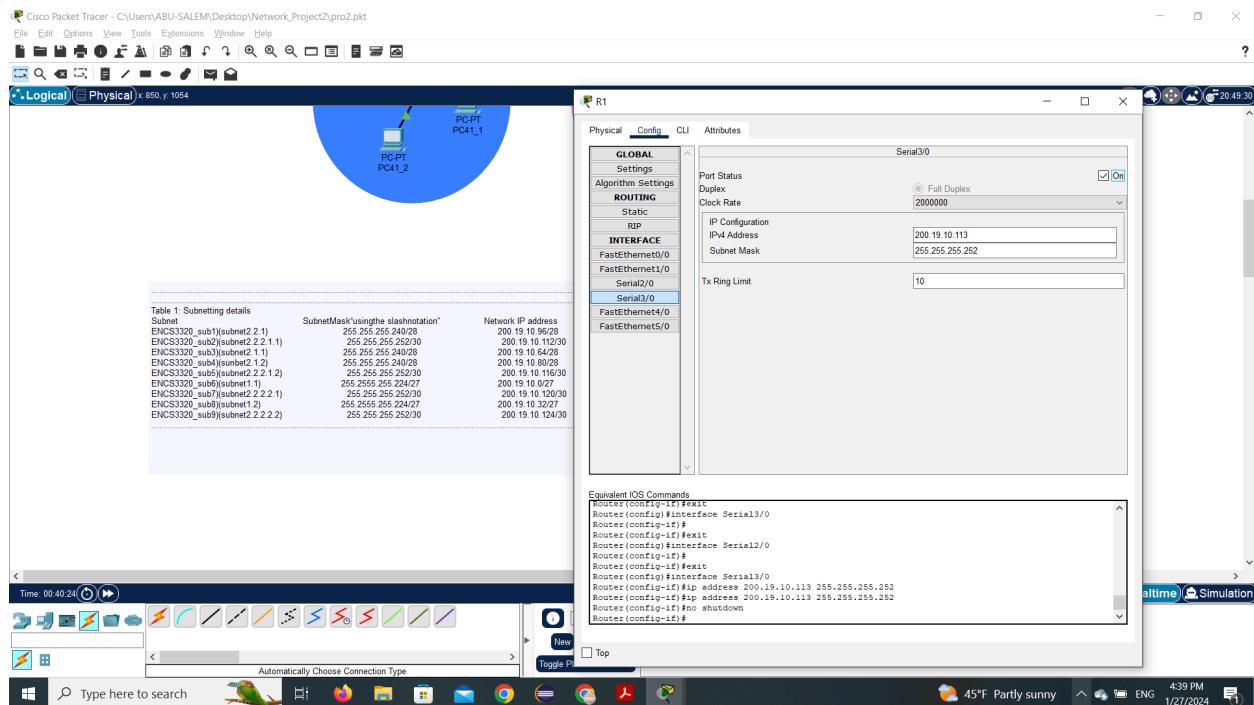
Router 1 Ethernet



R1 Serial 1

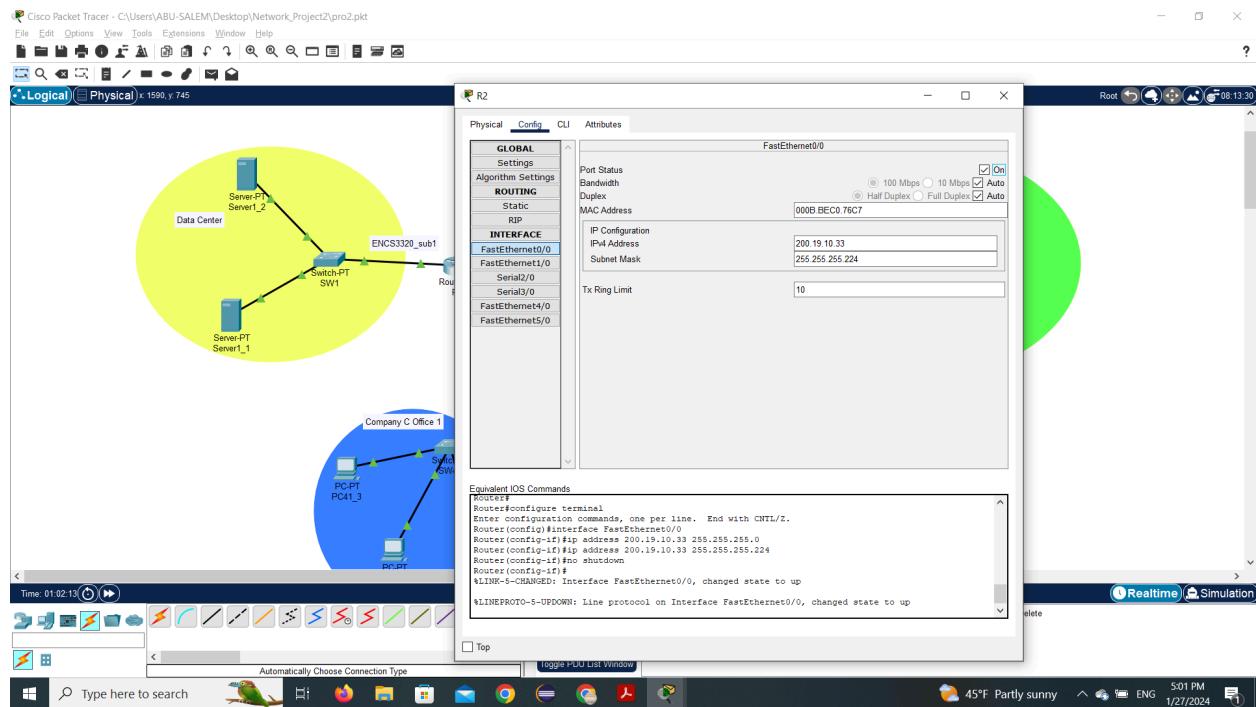


R1 Serial 2

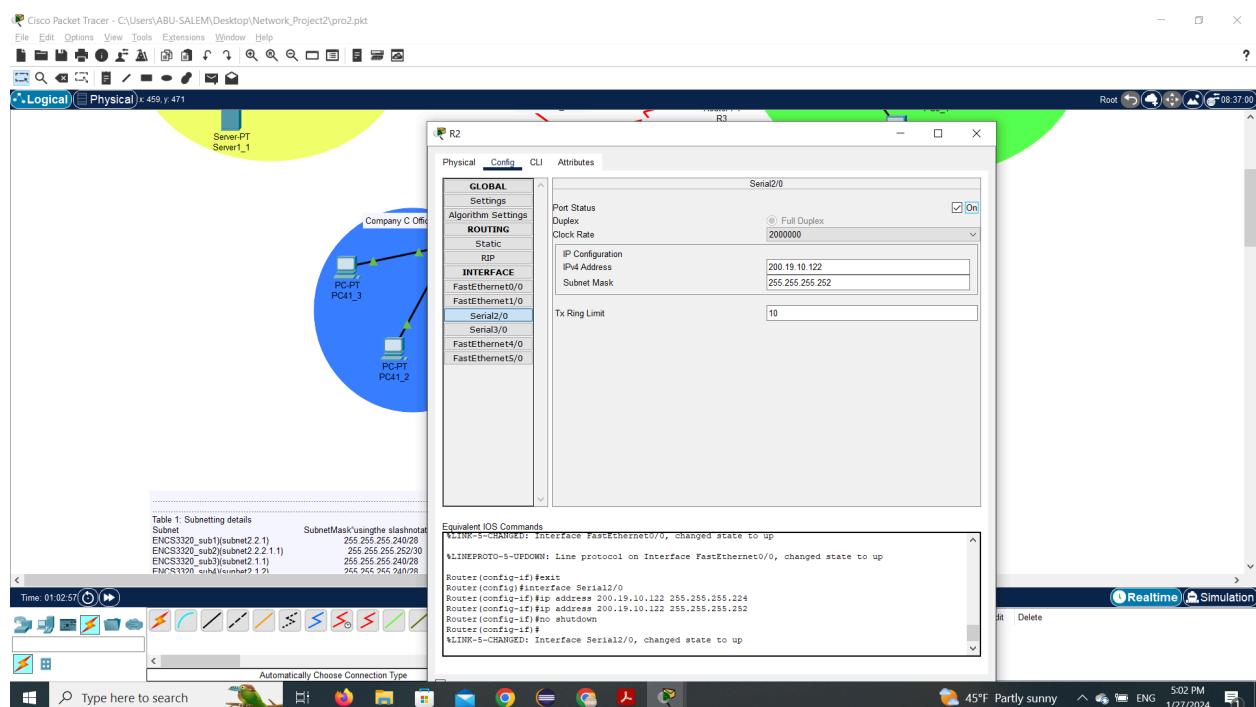


Configuration for router 2:

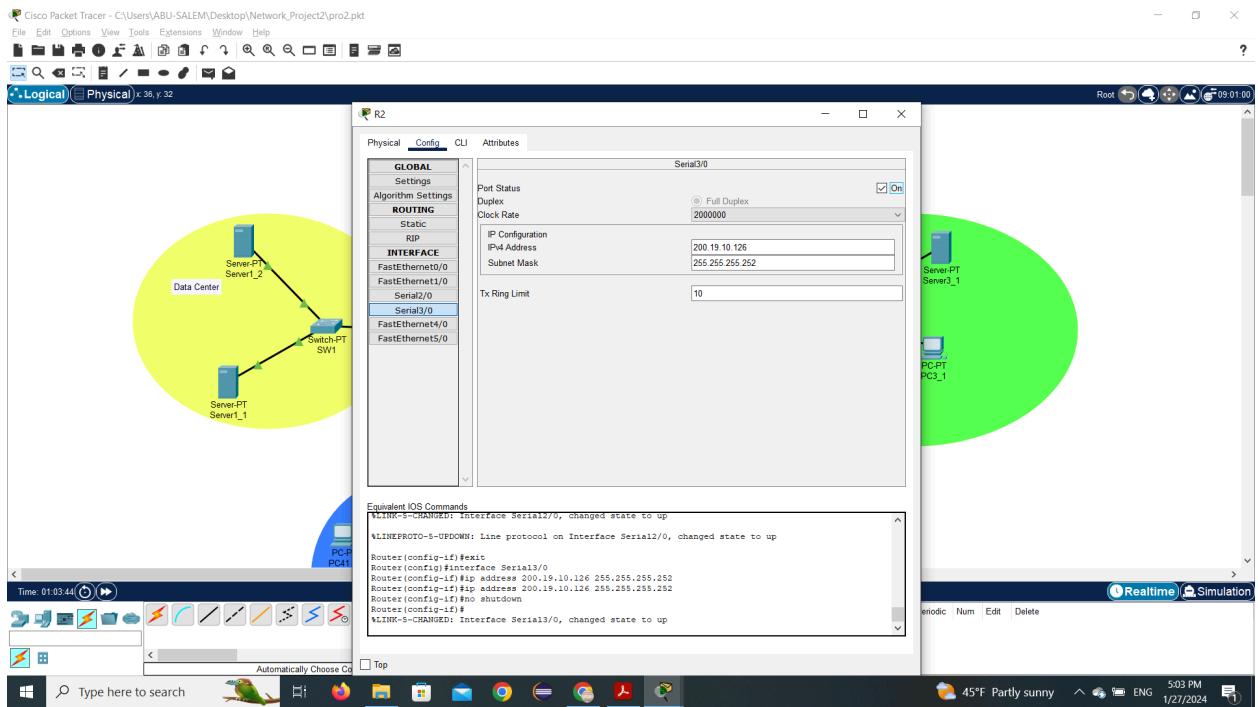
Router 2 Ethernet



R2 Serial 1

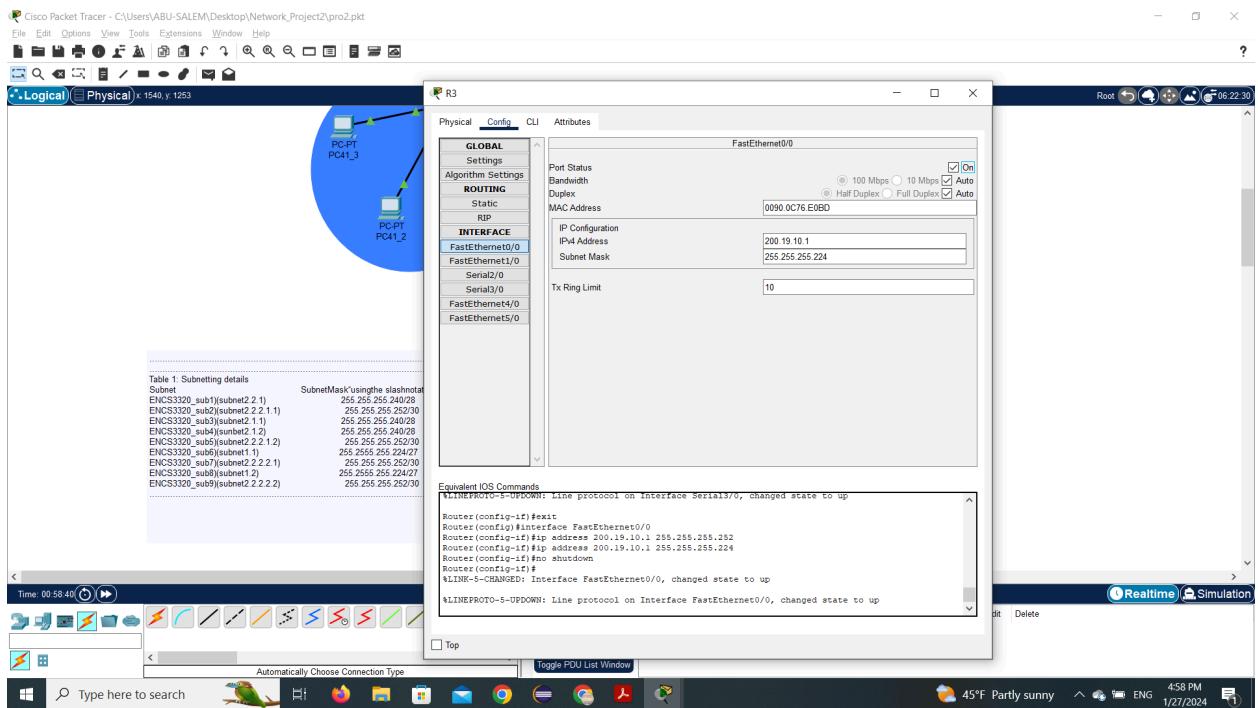


R2 Serial 2

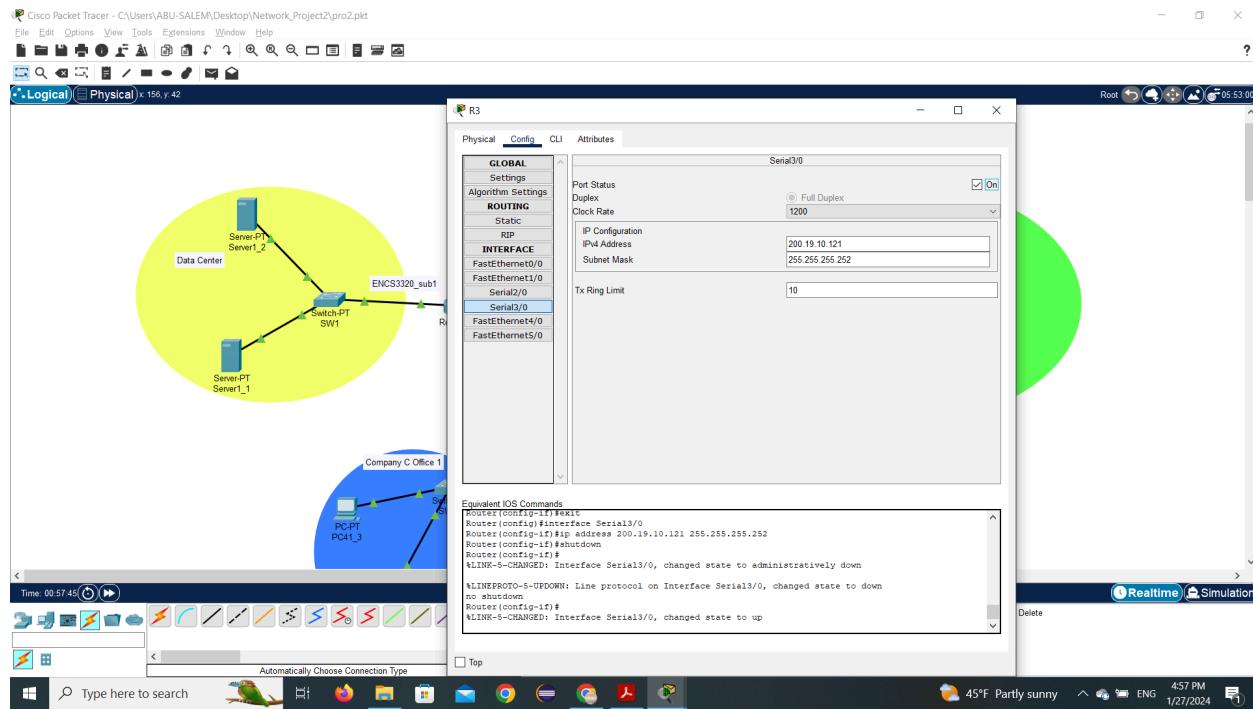


Configuration for router 3:

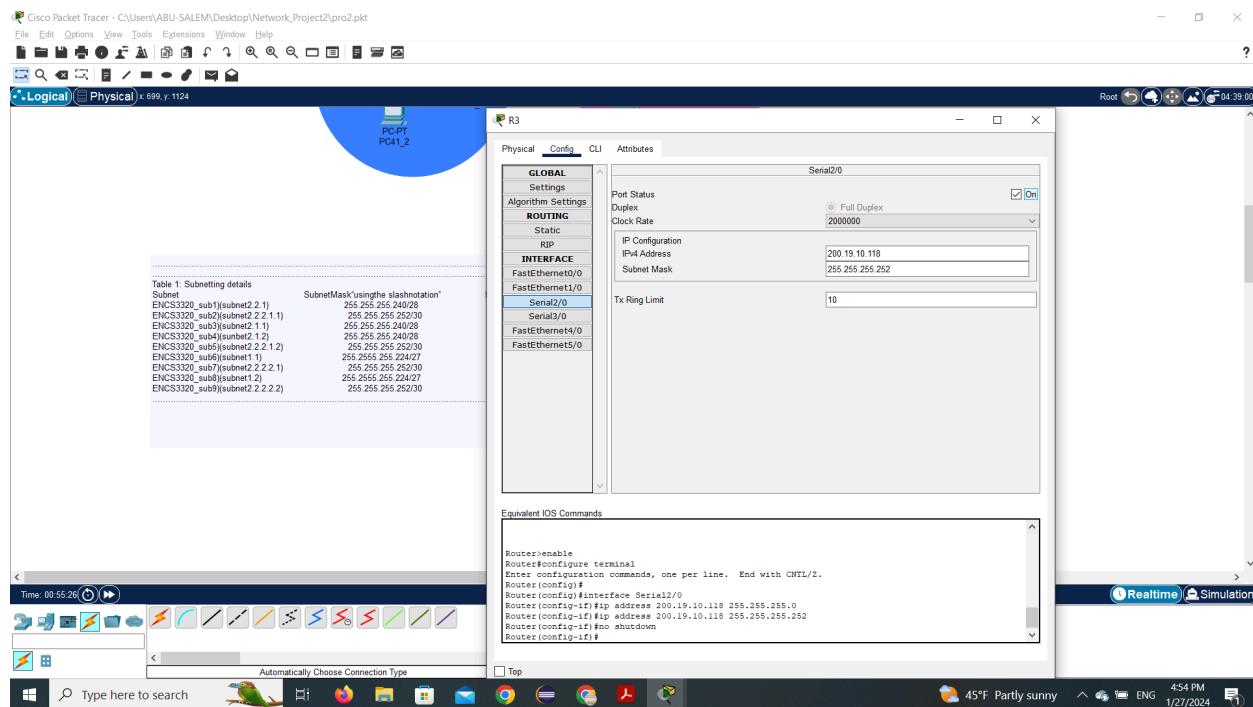
R3 Ethernet



R3 Serial 1

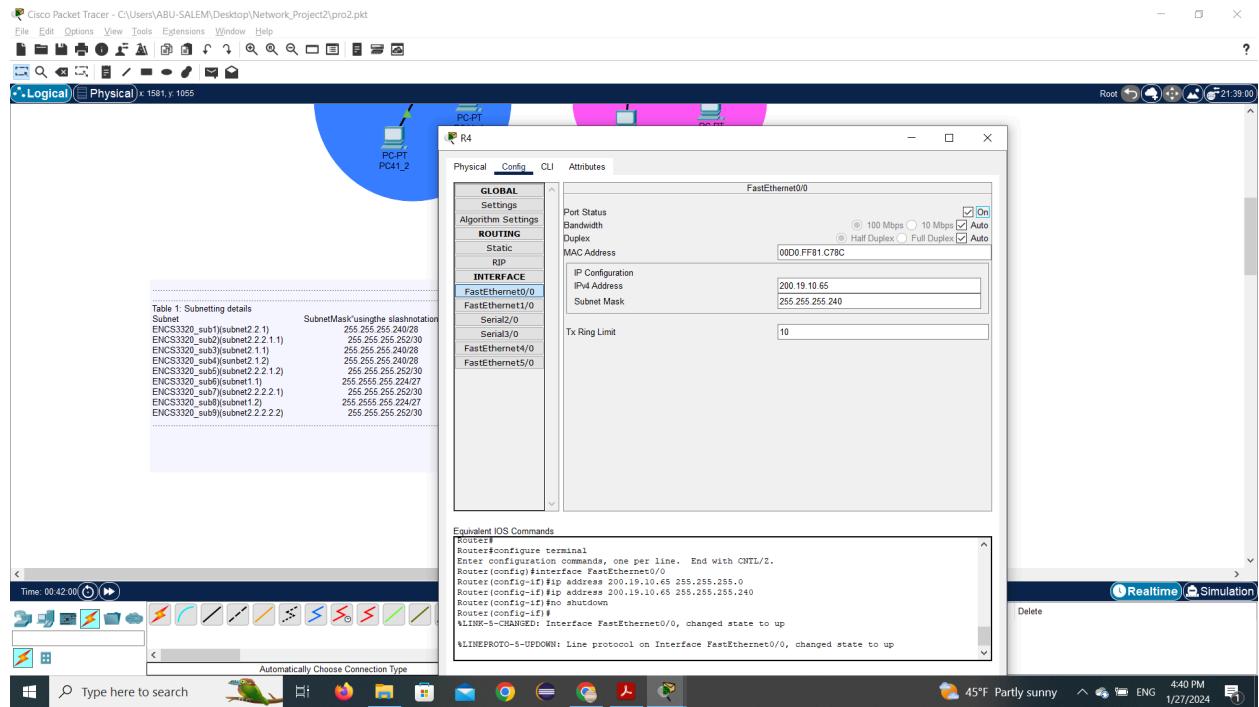


R3 Serial 2

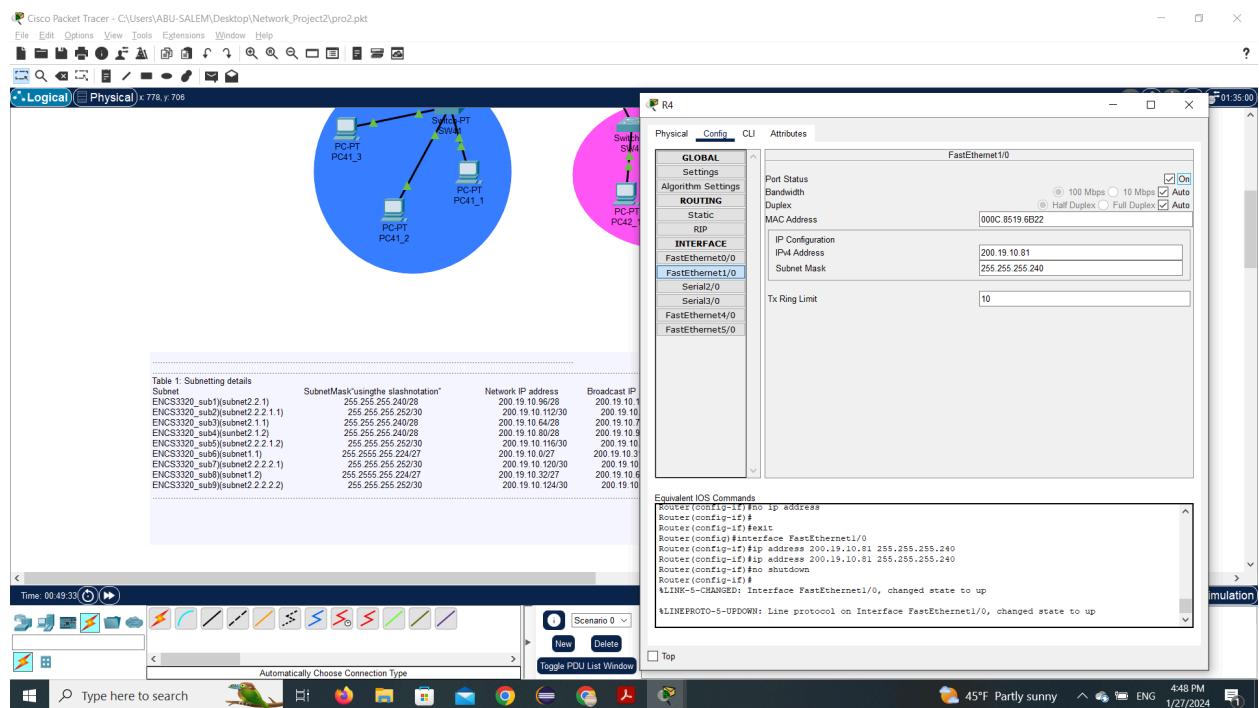


Configuration for router 4:

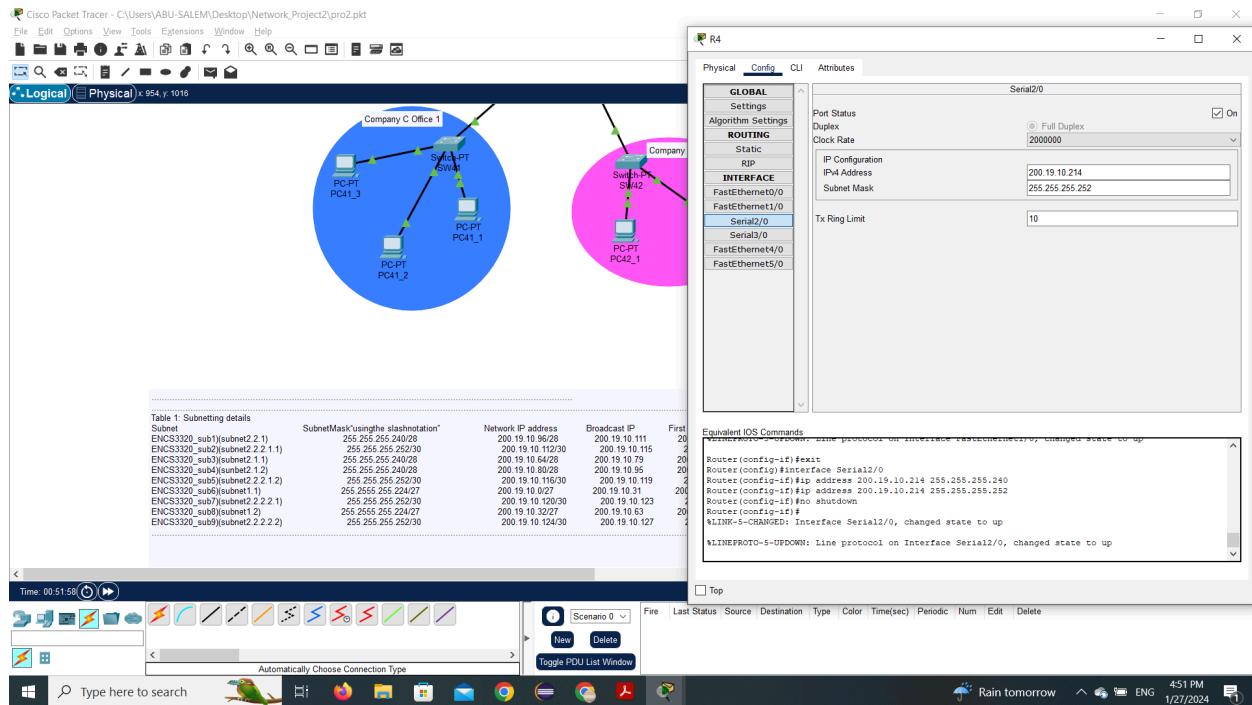
R4 Ethernet 1



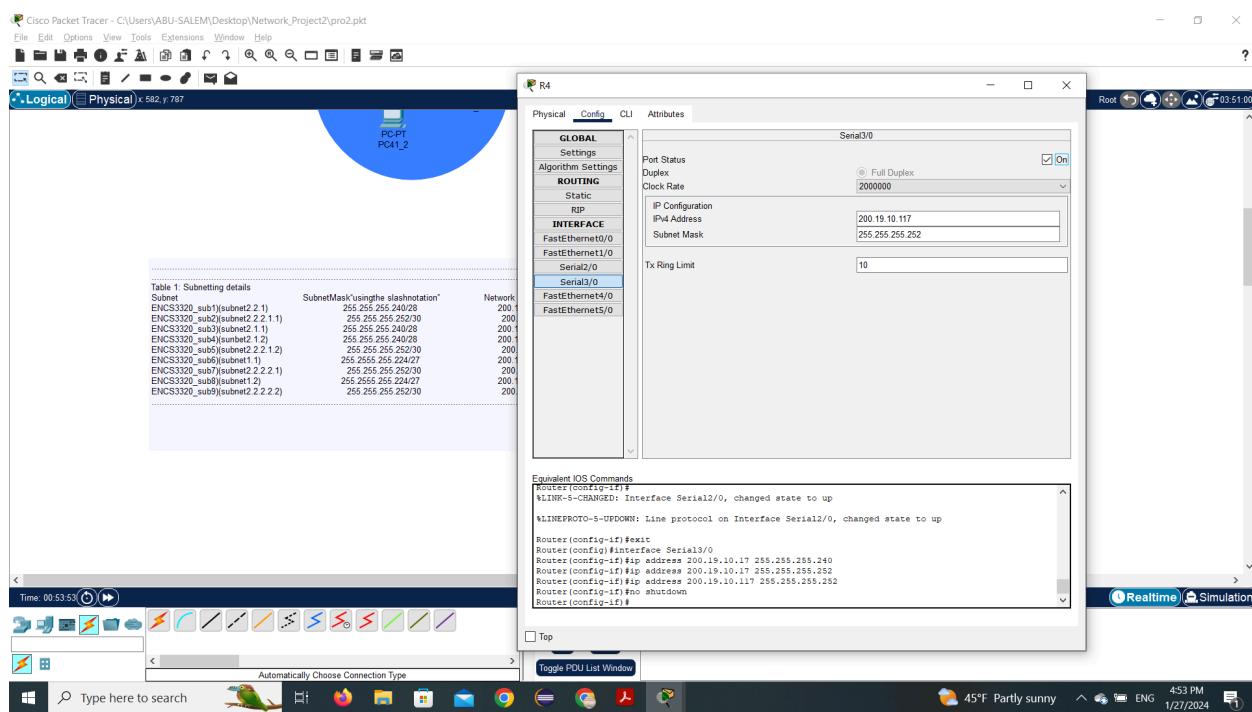
R4 Ethernet 2



R4 Serial 1



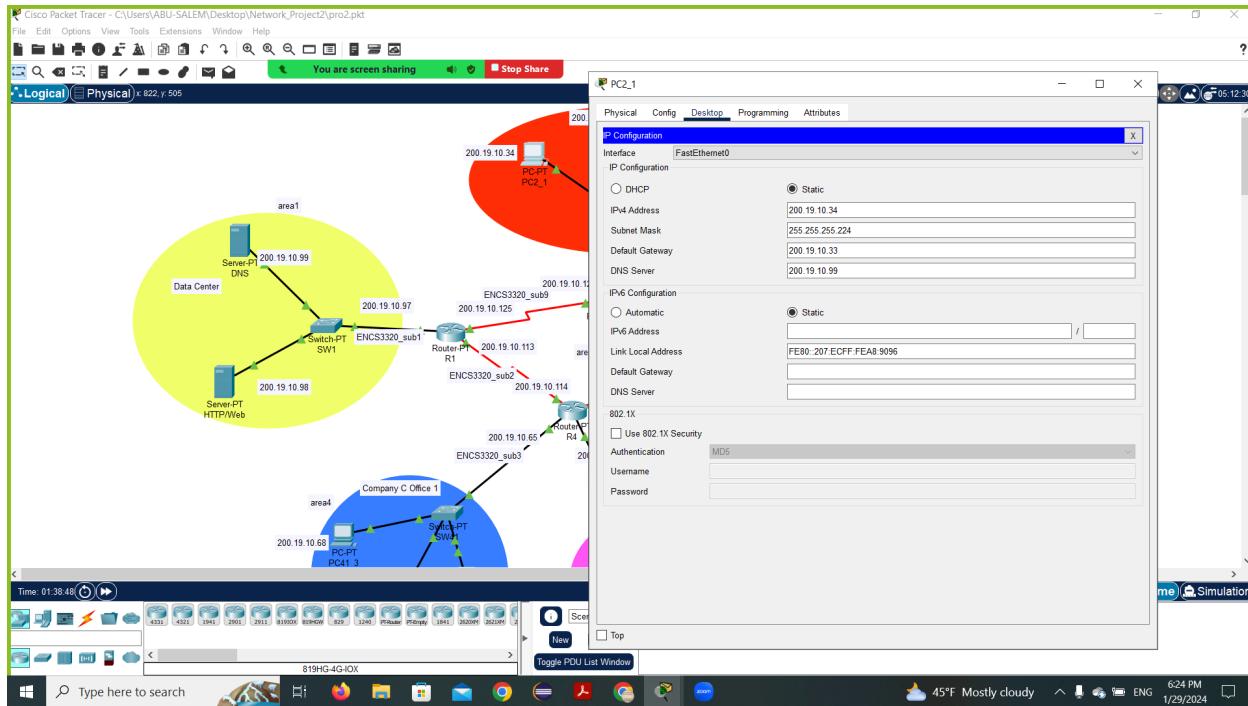
R4 Serial 2



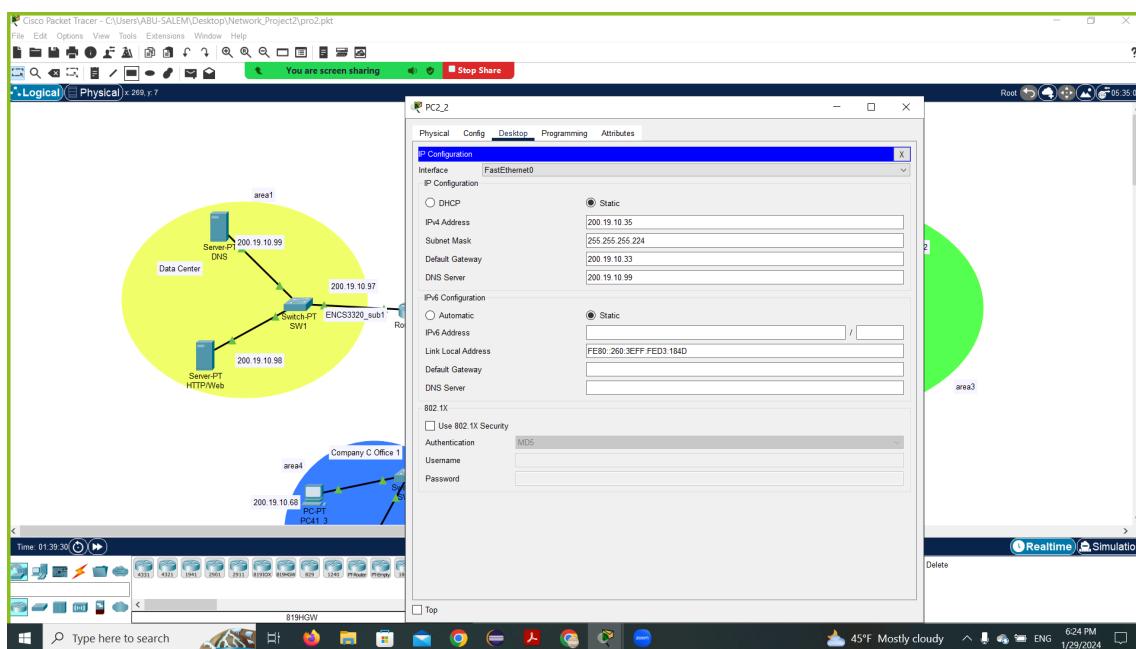
Part1.3: Static IP Addresses for All PC and Servers

Company A

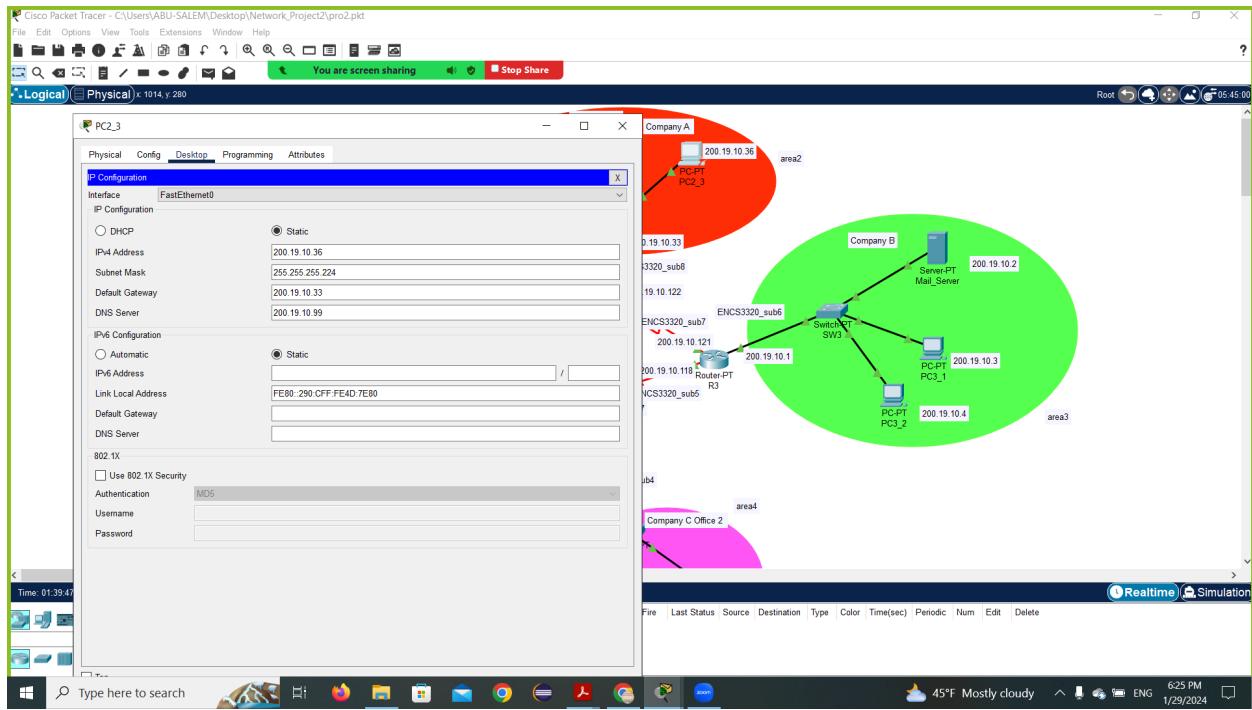
PC2_1



PC2_2

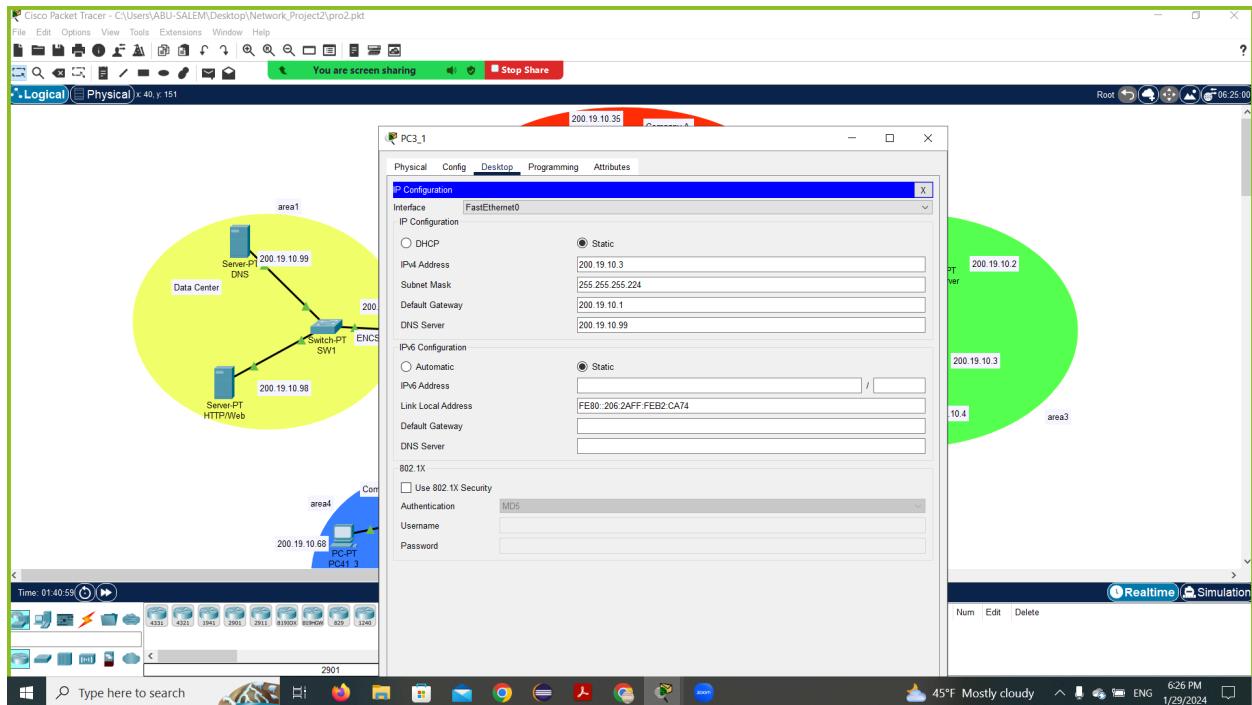


PC2_3

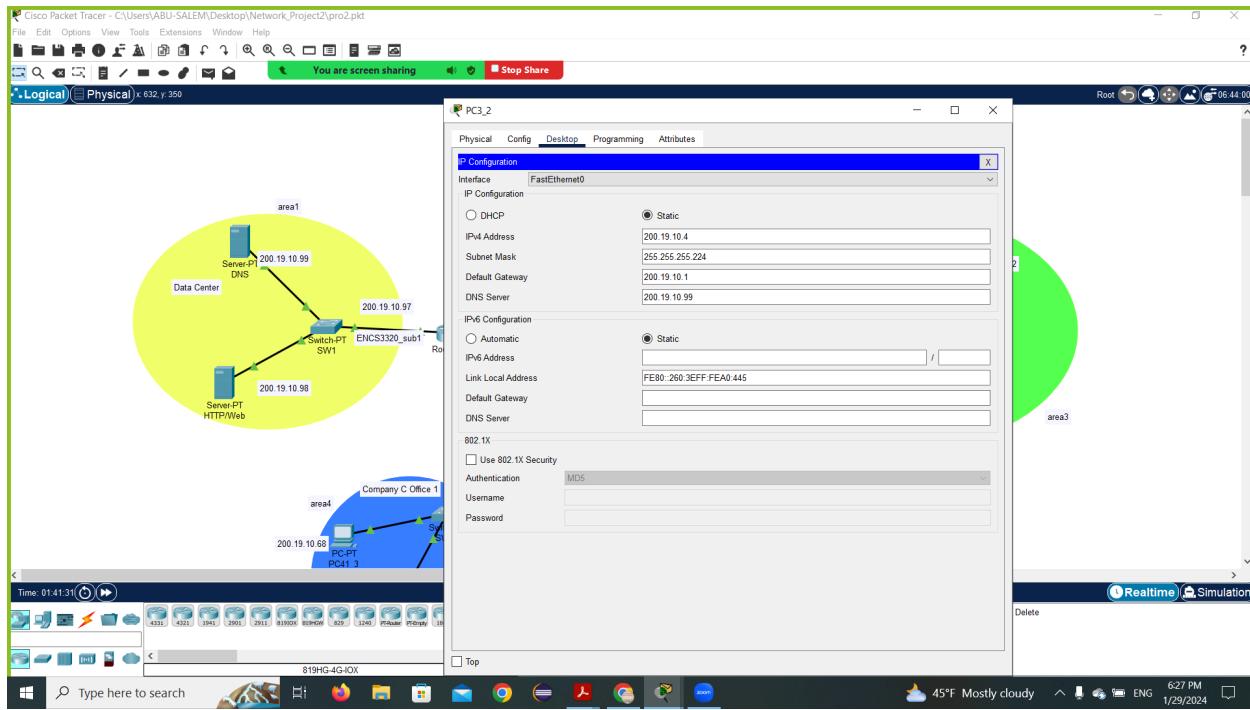


Company B

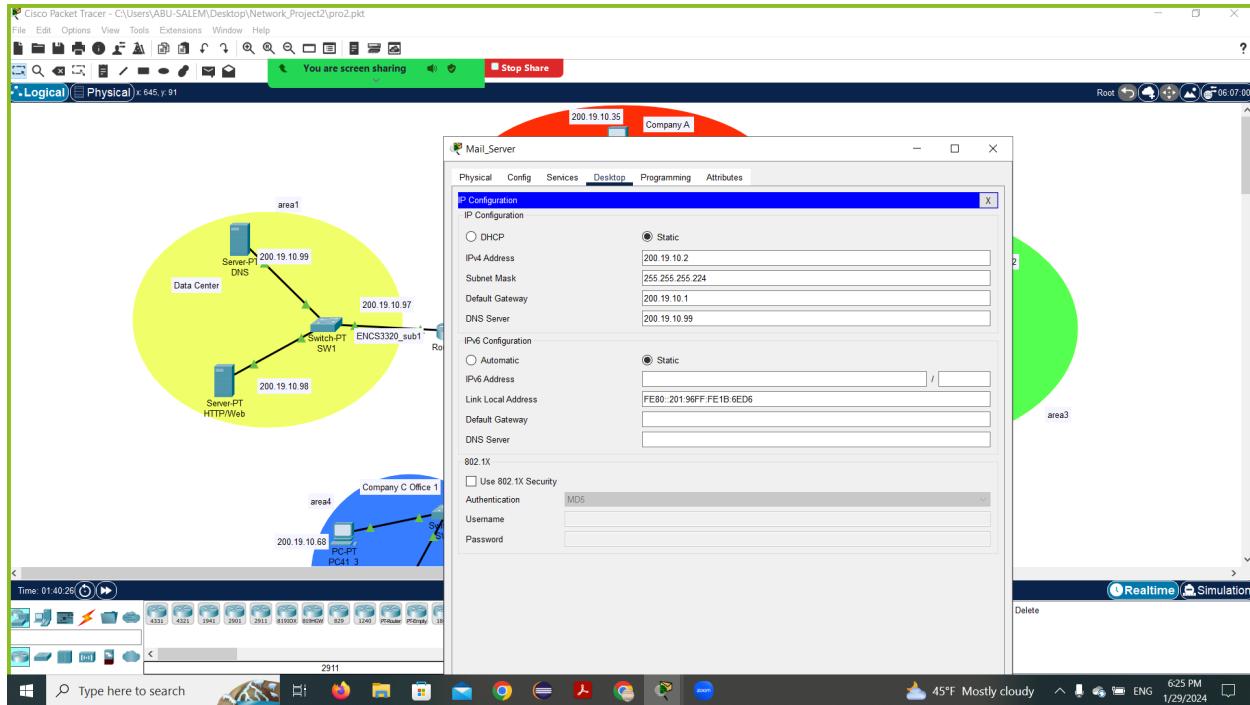
PC3_1



PC3_2

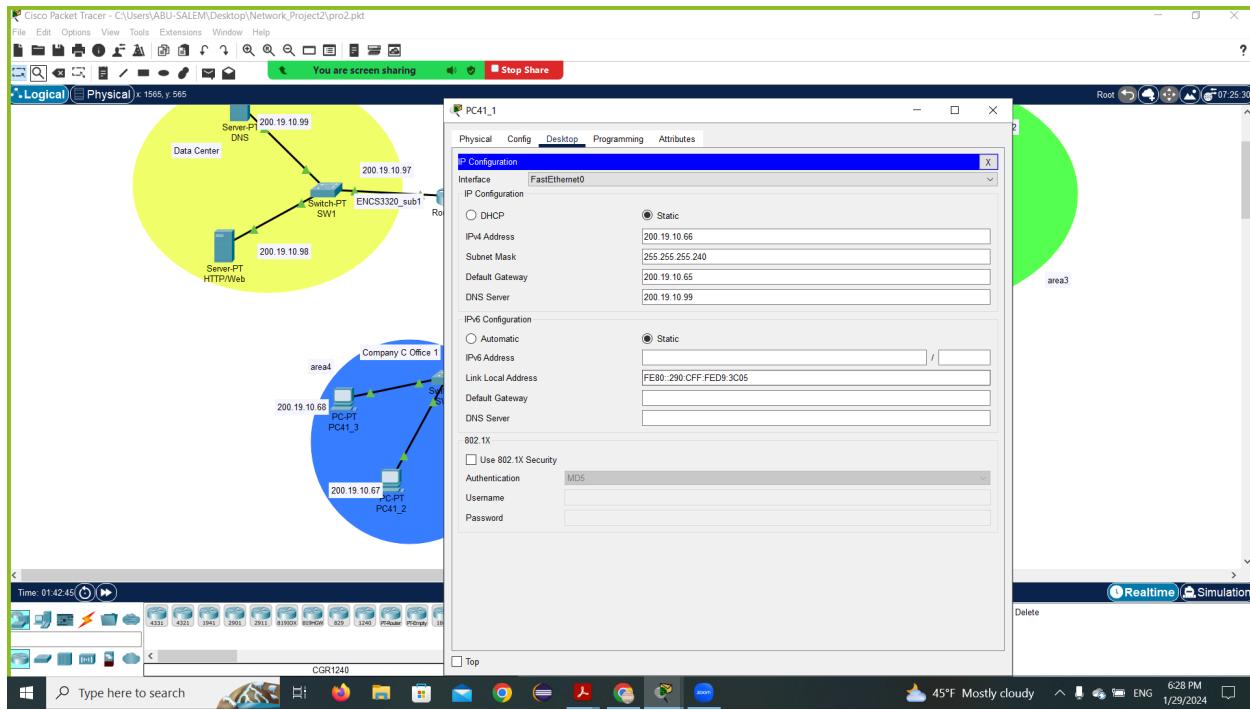


Server3_1 Mail Server

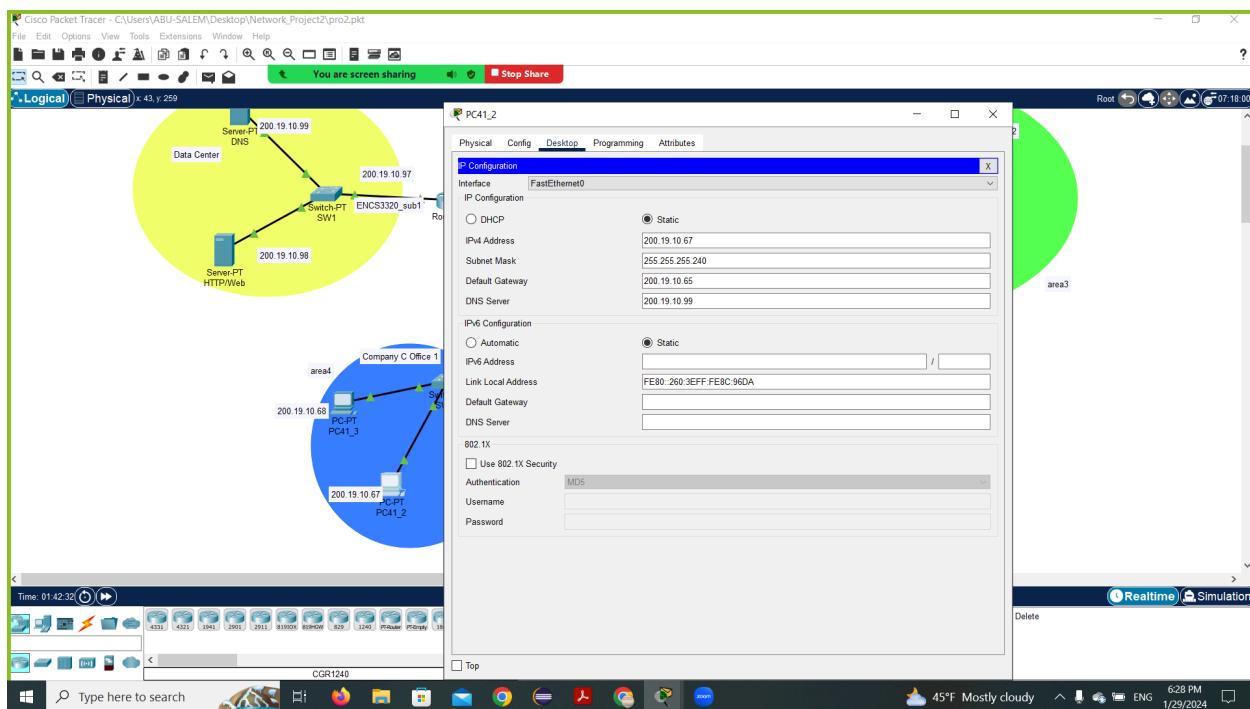


Company C office1

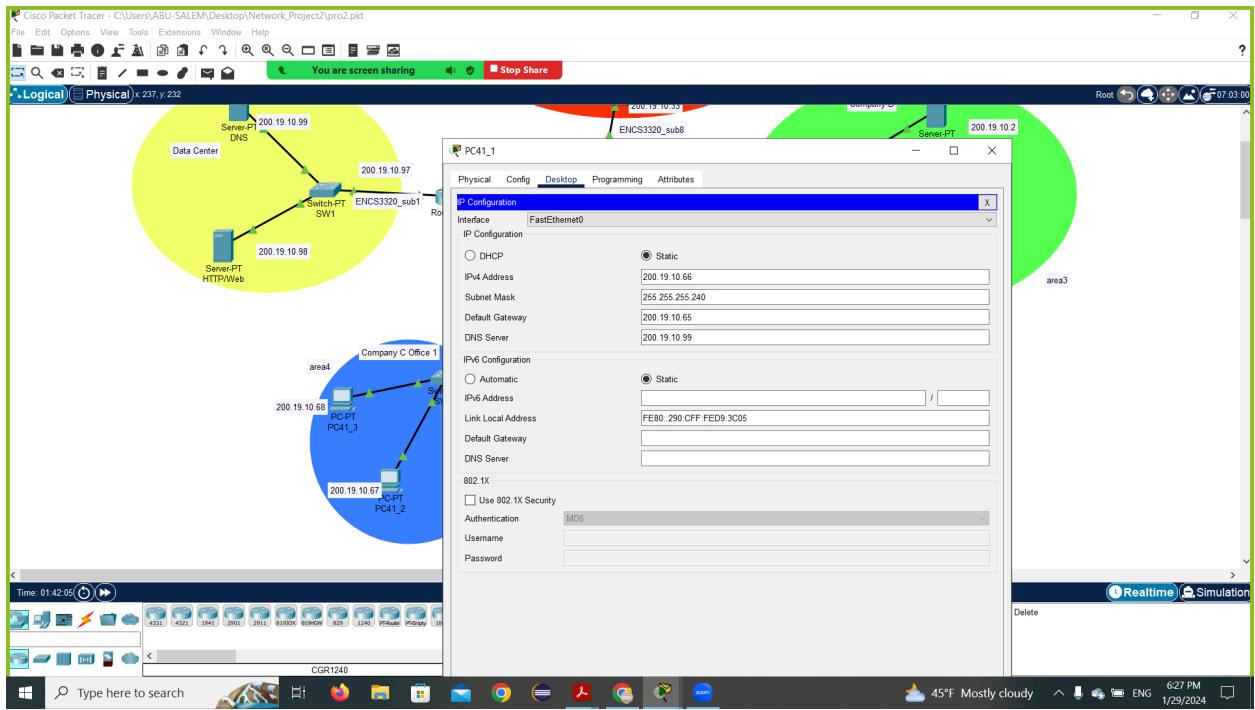
PC41_1



PC41_2

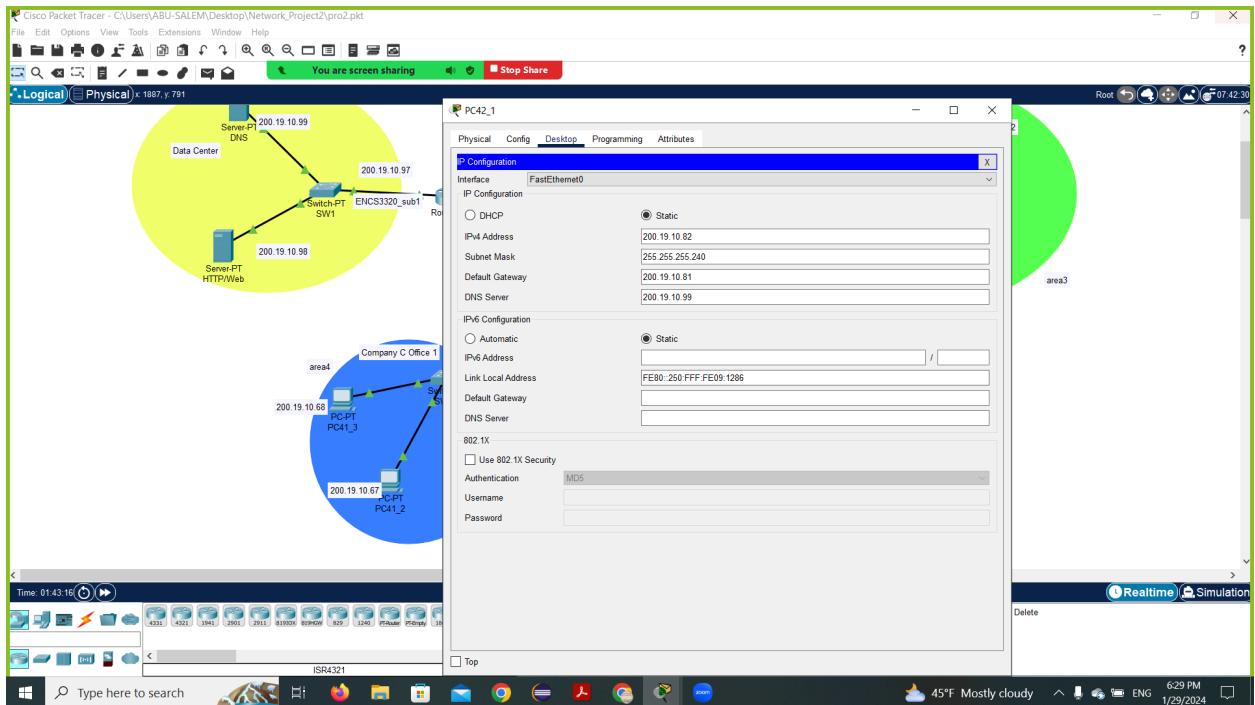


PC41_3

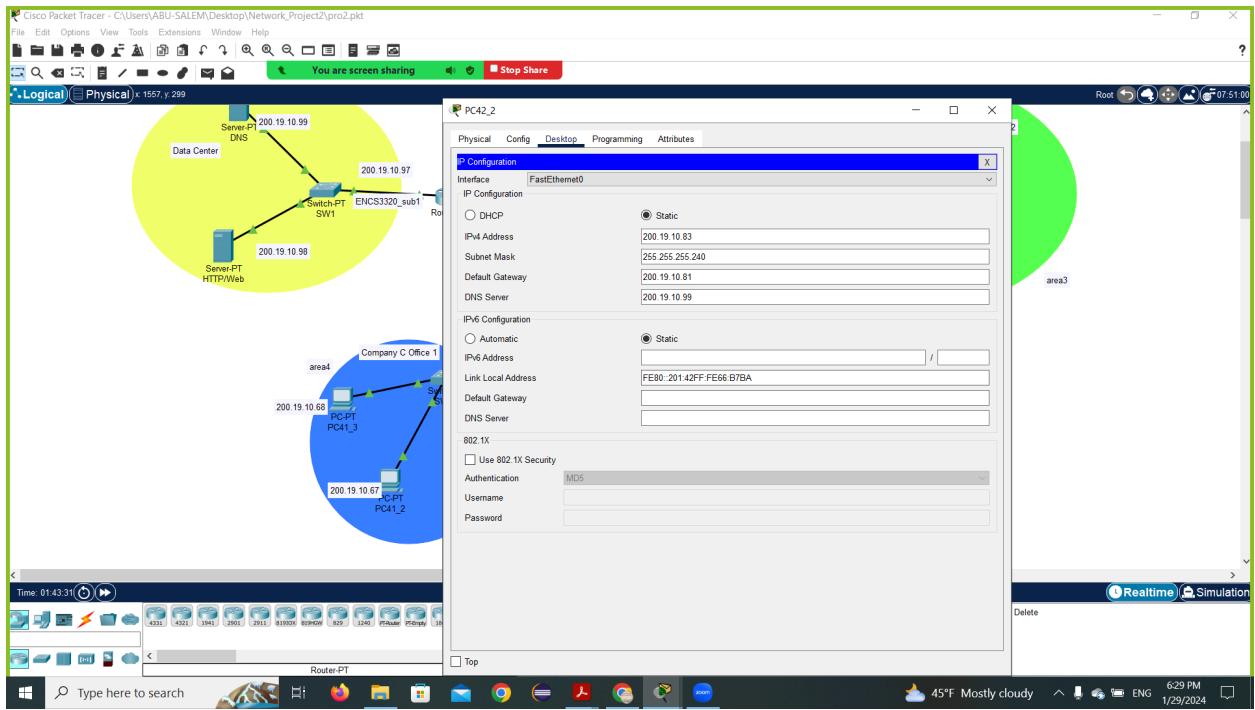


Company C office2

PC42_1

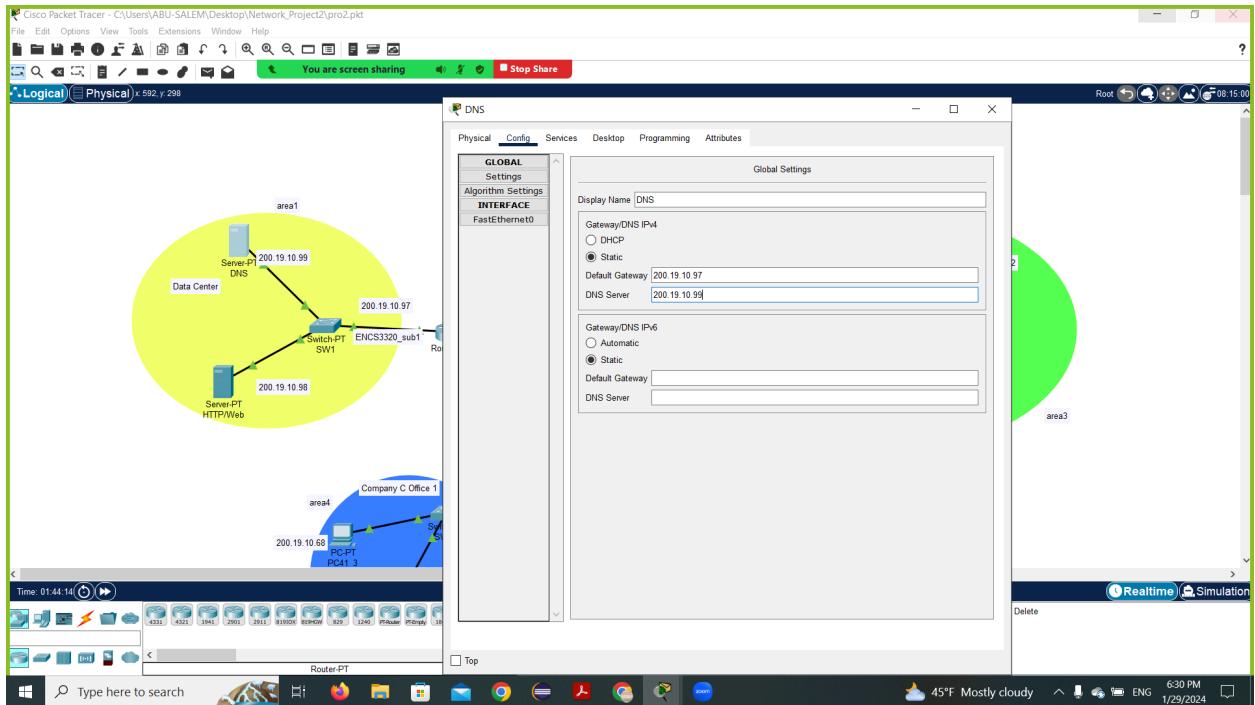


PC42_2

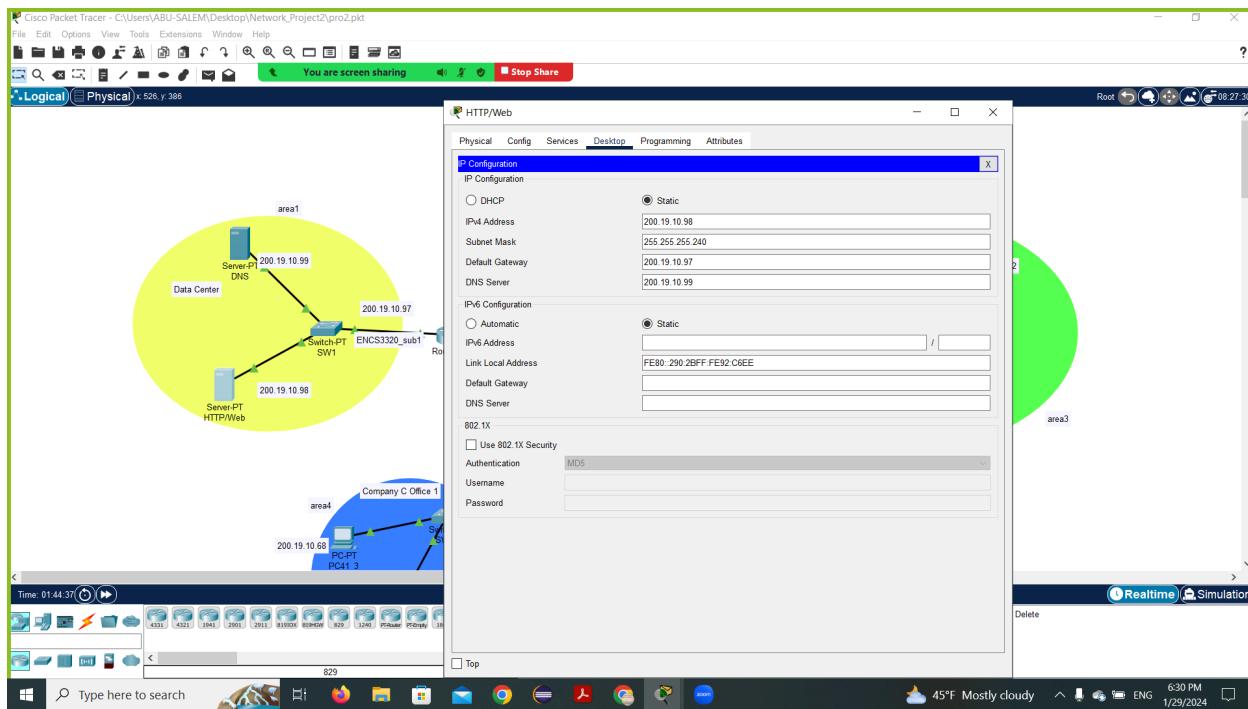


Data Center

DNS Server



HTTP Server



Part 2: Configuring servers

HTML Code on server

website by modifying the index.html file in the HTTP server.

HTTP/Web

Physical Config Services Desktop Programming Attributes

```

SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP

File Name: index.html

<!DOCTYPE html>
<html lang="en">
<title>ENCS320-Course Website</title>
<style>
body {
    font-family: 'Arial', sans-serif;
    background-color: #F0F0F0;
    margin: 0;
    padding: 0;
}

h1, h2, h3 {
    color: #333;
}

.container {
    display: flex;
    justify-content: space-around;
    margin-top: 20px;
}

.box {
    background-color: #FFF;
    border: 1px solid #000;
    padding: 20px;
    margin: 10px;
    width: 300px;
}

.box h3 {
    color: #007BFF;
}

.box p {
    margin: 0;
    padding: 5px 0;
}

span {
    font-weight: bold;
}
</style>
</head>
<body>
<h1>Welcome to <span style="color: rgb(255, 0, 0);>Computer Networks</span> course</h1>
<h2>Group Members</h2>

```

You are screen sharing Stop Share

Mute Start Video Security Participants Chat New Share Pause Share Annotate Remote Control Apps More

File Manager Save

45°F Mostly clear ENG 6:38 PM 1/29/2024

HTTP/Web

Physical Config Services Desktop Programming Attributes

```

SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP

File Name: index.html

.box h2 {
    color: #007BFF;
}

.box p {
    margin: 0;
    padding: 5px 0;
}

span {
    font-weight: bold;
}
</style>
</head>
<body>
<h1>Welcome to <span style="color: rgb(255, 0, 0);>Computer Networks</span> course</h1>
<h2>Group Members</h2>
<section class="container">
<div class="box">
<h3>Aaf Amwas</h3>
<p>Project: Data structures projects like FIFA organization program in C language, Circuit Analysis Project, CPU scheduling project in Operating Systems course.</p>
<p>Skills: leadership, problem solver, and strong debate</p>
<p>Hobbies: Making Sushi dishes, Swimming, and writing novels</p>
</div>
<div class="box">
<h3>Dawar Sharif</h3>
<p>Project: 121824</p>
<p>Projects: Analog electronics Project, Computer Organization Project, and Pizza restaurant Project in Java language</p>
<p>Skills: communication skills, Problem solver, and dealing with pressures</p>
<p>Hobbies: Cooking, Playing Jawaker like Hand game</p>
</div>
<div class="box">
<h3>Muhammad Salem</h3>
<p>Project: 120651</p>
<p>Projects: Data Structure Project: Pharmacy system, Circuit analysis project, and bus station project in Java</p>
<p>Skills: deal with strangers, leadership, and good communication skills</p>
<p>Hobbies: Drawing, Swimming, Make chocolate cake</p>
</div>
</section>
</body>

```

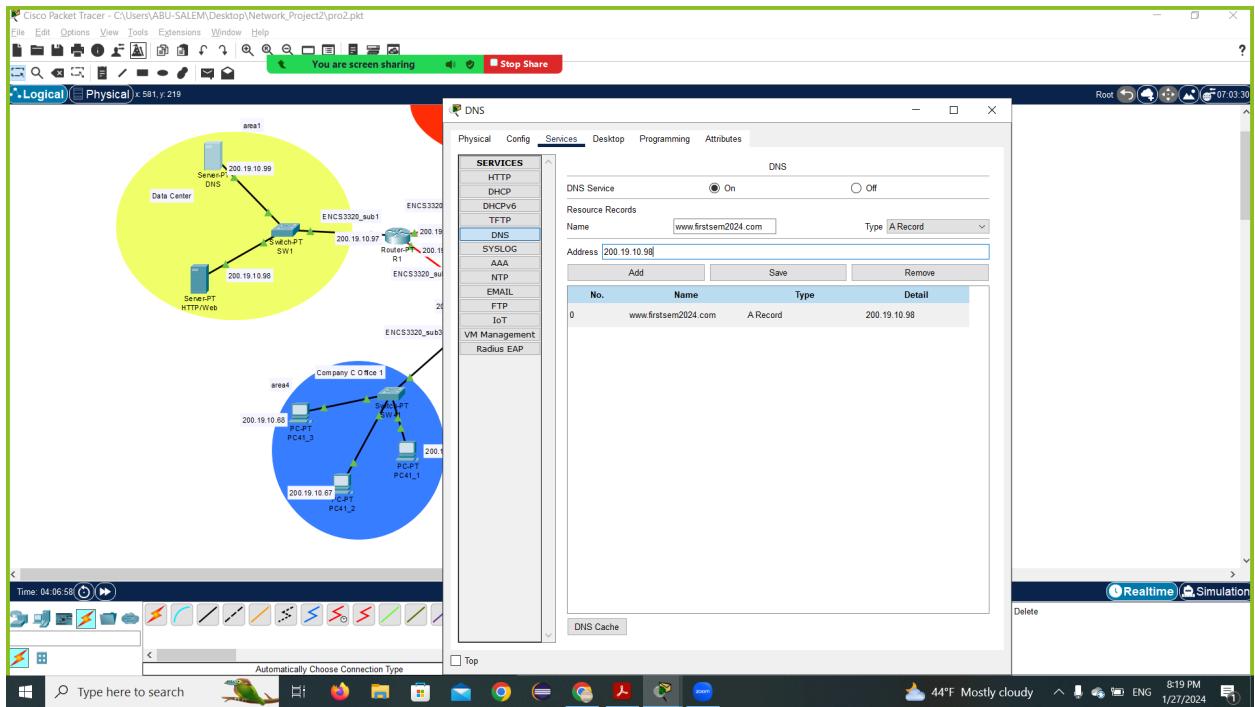
You are screen sharing Stop Share

Mute Start Video Security Participants Chat New Share Pause Share Annotate Remote Control Apps More

File Manager Save

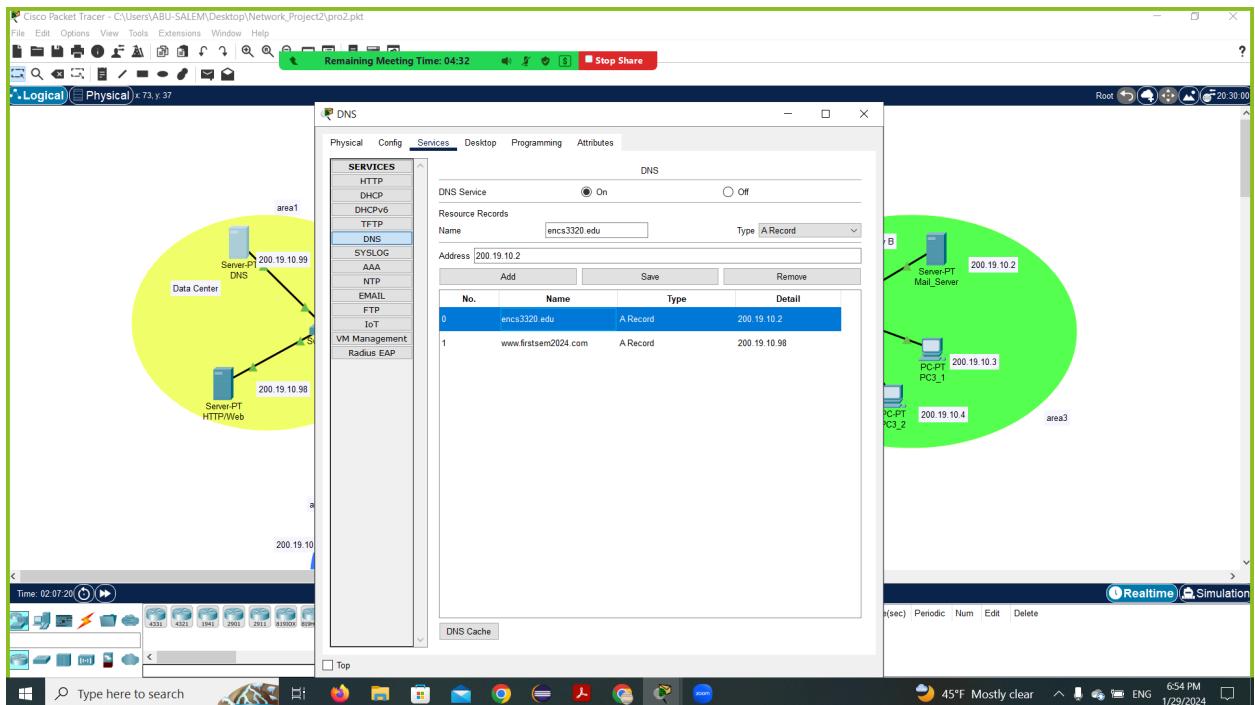
45°F Mostly clear ENG 6:38 PM 1/29/2024

We went to the DNS server and created domain name as shown below

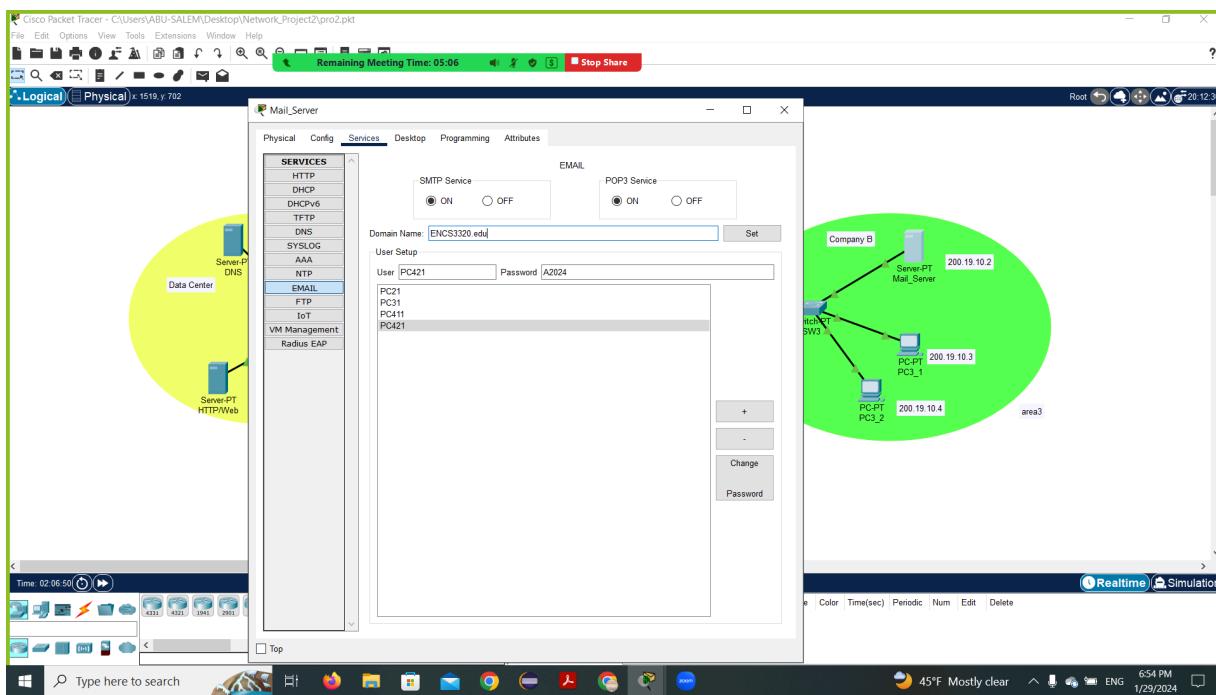


Part2.4: creating Username and Password for Specific PC's

First we assigned the domain name for the mail server on the DNS server as shown below. Then, we set the service “SMTP” to be “ON” to send emails.

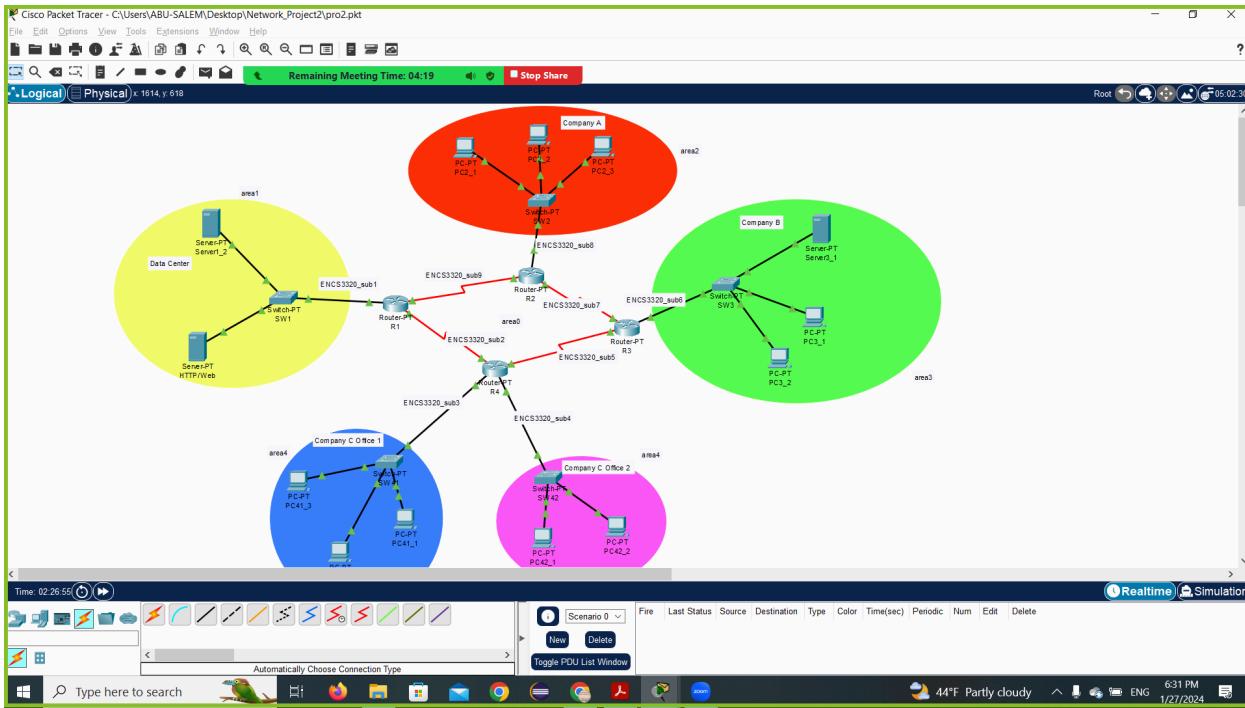


Moreover, We assigned usernames and passwords for each PC required as shown below.

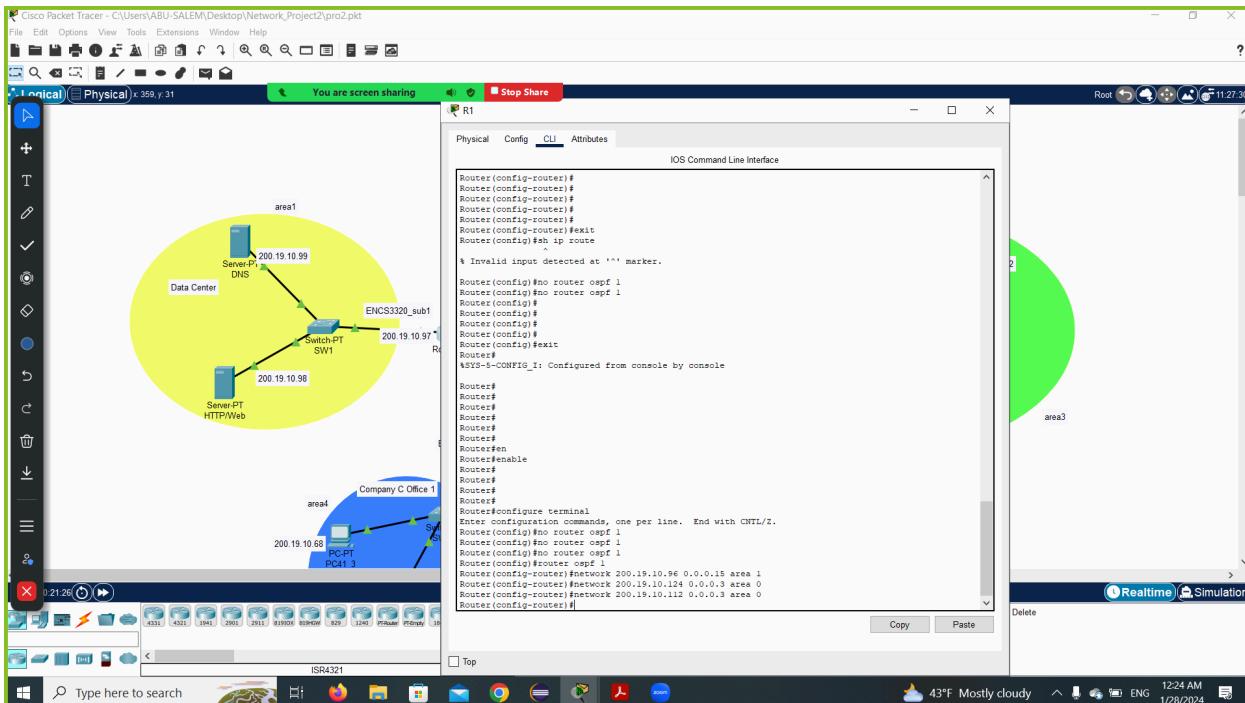


Part3: Applying routing protocol

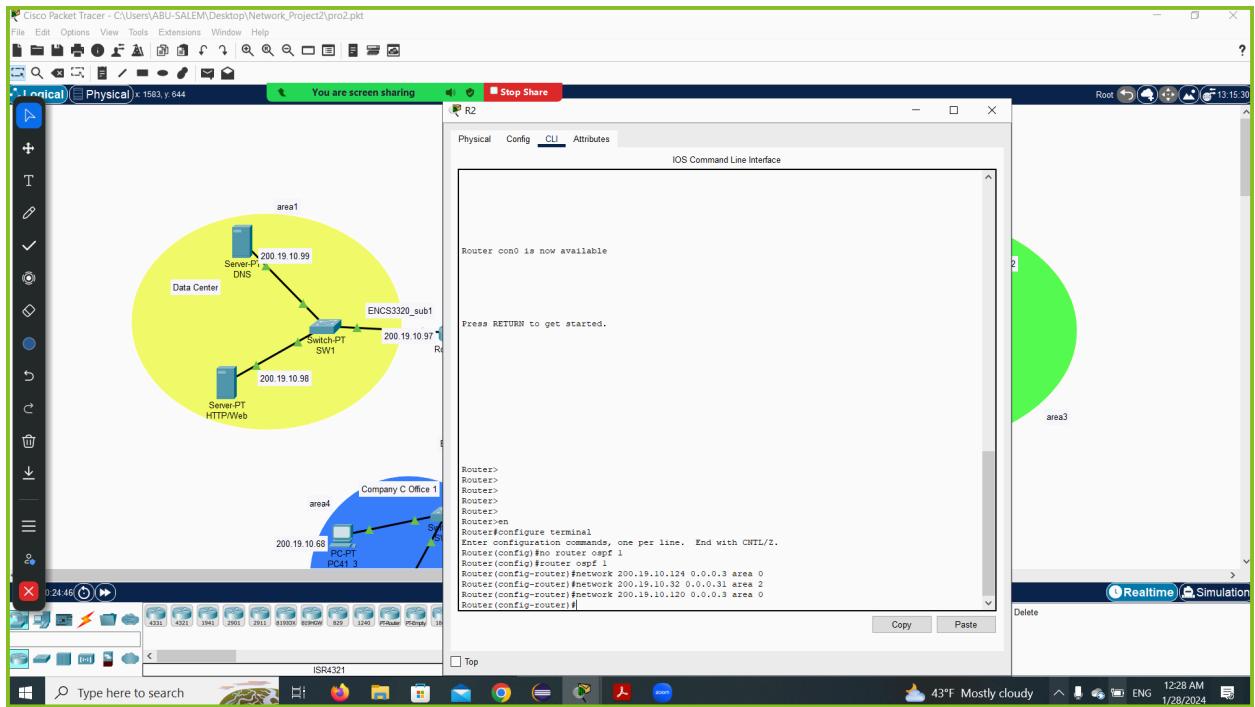
We divided the network into areas, which are area0, area1, area2, area3, and area4 as shown below.



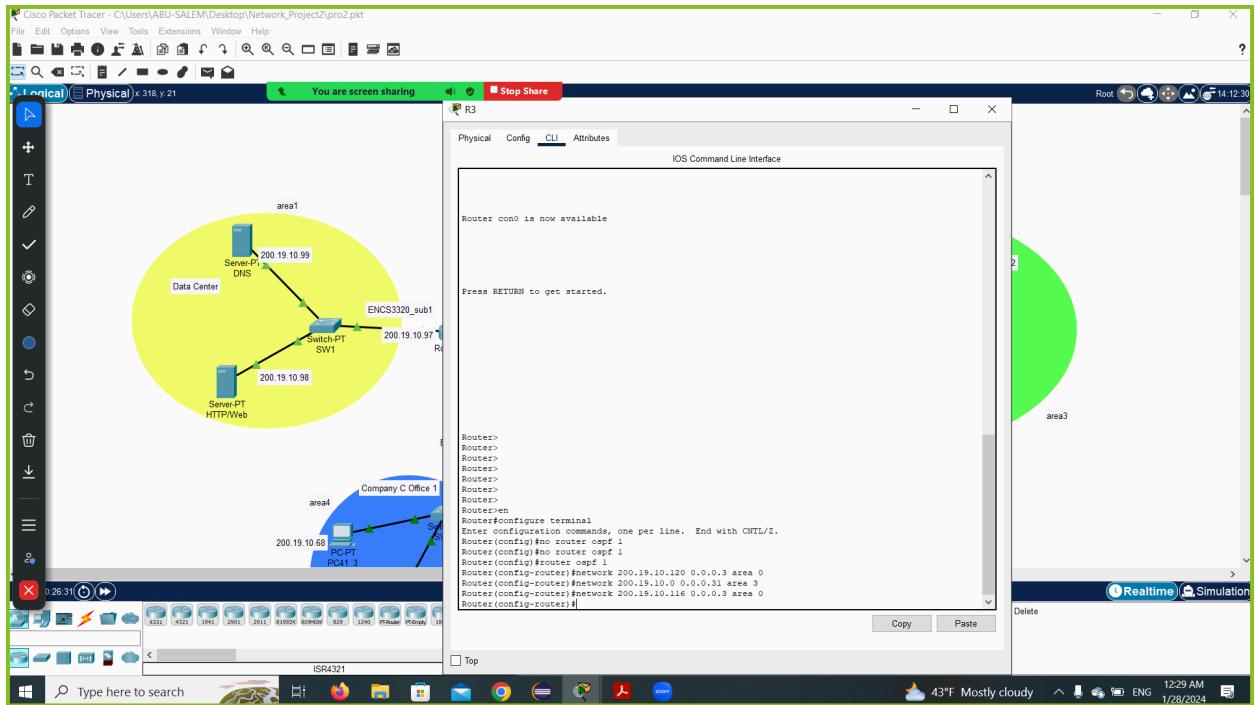
OSPF config For Router 1:



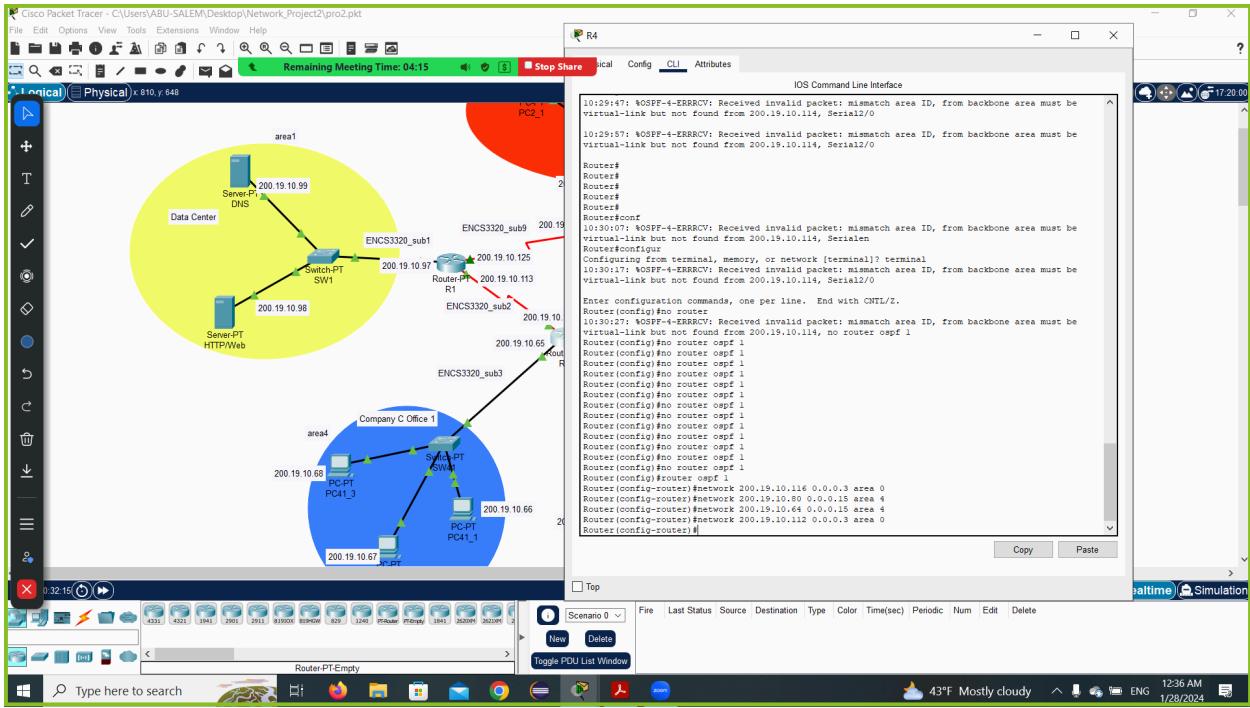
OSPF config For Router 2:



OSPF config For Router 3:



OSPF config For Router 4:



Part4: Testing connectivity, routes, website, and emails:

ping and traceroute from company A to all companies:

The screenshot shows the Cisco Packet Tracer interface with a Command Prompt window. The user has run several ping commands to test connectivity to Company A's network. The results show successful replies from 200.19.10.4, 200.19.10.82, 200.19.10.68, and 200.19.10.98. The ping statistics for each target provide round-trip times and loss percentages. The interface also displays a network diagram where Company A is represented by a green oval containing a switch labeled 'SW1' and a server labeled 'Server-PT Mail_Server'.

```
C:\>ping 200.19.10.4 with 32 bytes of data:
Pinging 200.19.10.4 with 32 bytes of data:
Request timed out.
Reply from 200.19.10.4: bytes=32 time=2ms TTL=126
Reply from 200.19.10.4: bytes=32 time=2ms TTL=126
Reply from 200.19.10.4: bytes=32 time=4ms TTL=126

Ping statistics for 200.19.10.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 4ms, Average = 2ms

C:\>ping 200.19.10.82 with 32 bytes of data:
Request timed out.
Reply from 200.19.10.82: bytes=32 time=4ms TTL=125
Reply from 200.19.10.82: bytes=32 time=4ms TTL=125
Reply from 200.19.10.82: bytes=32 time=4ms TTL=125

Ping statistics for 200.19.10.82:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 4ms, Average = 3ms

C:\>ping 200.19.10.68
Request timed out.
Reply from 200.19.10.68: bytes=32 time=2ms TTL=125
Reply from 200.19.10.68: bytes=32 time=2ms TTL=125
Reply from 200.19.10.68: bytes=32 time=16ms TTL=125

Ping statistics for 200.19.10.68:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 36ms, Average = 28ms

C:\>ping 200.19.10.98
Request timed out.
Reply from 200.19.10.98: bytes=32 time=4ms TTL=126
Reply from 200.19.10.98: bytes=32 time=4ms TTL=126
Reply from 200.19.10.98: bytes=32 time=4ms TTL=126

Ping statistics for 200.19.10.98:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 4ms, Average = 3ms
```

ping and traceroute from company B to all companies:

The screenshot shows the Cisco Packet Tracer interface with a Command Prompt window. The user has run several ping commands to test connectivity to Company B's network. The results show successful replies from 200.19.10.35, 200.19.10.67, 200.19.10.87, and 200.19.10.88. The ping statistics for each target provide round-trip times and loss percentages. The interface also displays a network diagram where Company B is represented by a green oval containing a switch labeled 'SW1' and a server labeled 'Server-PT Mail_Server'. The network diagram also includes areas labeled area3 and area4.

```
C:\>ping 200.19.10.35 with 32 bytes of data:
Request timed out.
Reply from 200.19.10.35: bytes=32 time=38ms TTL=126
Reply from 200.19.10.35: bytes=32 time=12ms TTL=126
Reply from 200.19.10.35: bytes=32 time=19ms TTL=126

Ping statistics for 200.19.10.35:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 12ms, Maximum = 38ms, Average = 23ms

C:\>ping 200.19.10.67
Request timed out.
Reply from 200.19.10.67: bytes=32 time=1ms TTL=126
Reply from 200.19.10.67: bytes=32 time=1ms TTL=126
Reply from 200.19.10.67: bytes=32 time=1ms TTL=126

Ping statistics for 200.19.10.67:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

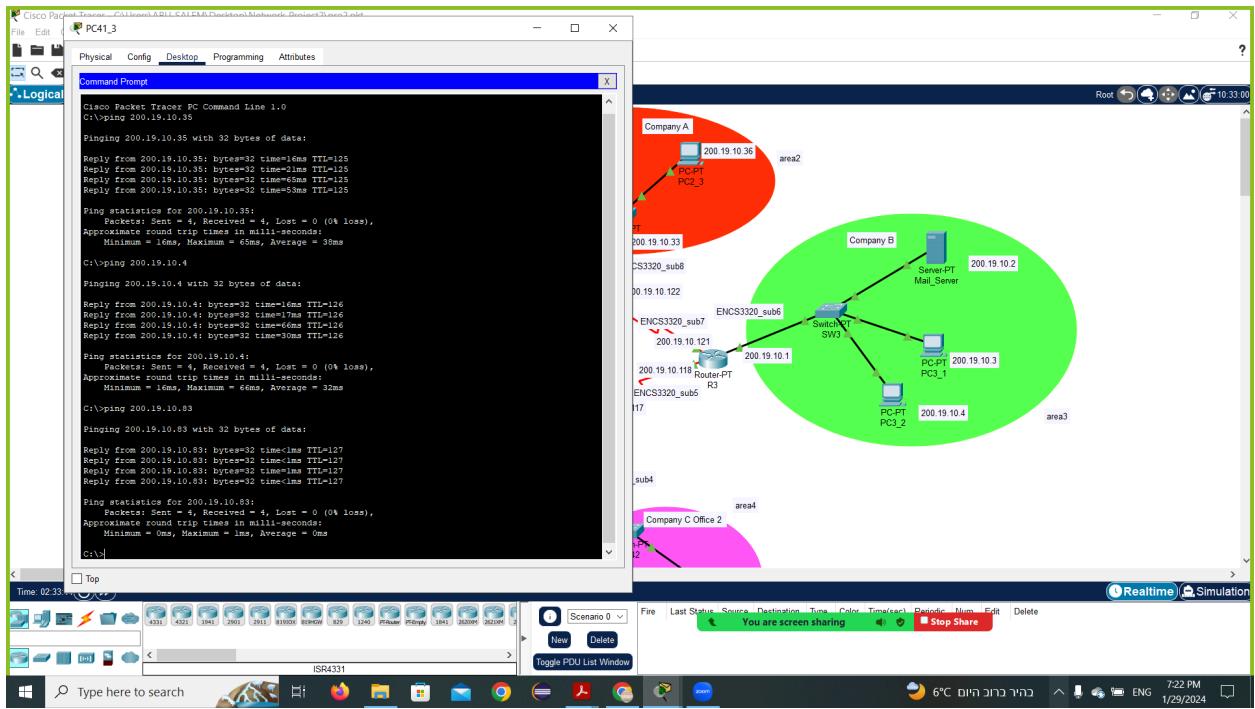
C:\>ping 200.19.10.87
Request timed out.
Reply from 200.19.10.87: bytes=32 time=1ms TTL=126
Reply from 200.19.10.87: bytes=32 time=1ms TTL=126
Reply from 200.19.10.87: bytes=32 time=1ms TTL=126

Ping statistics for 200.19.10.87:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 22ms, Average = 11ms

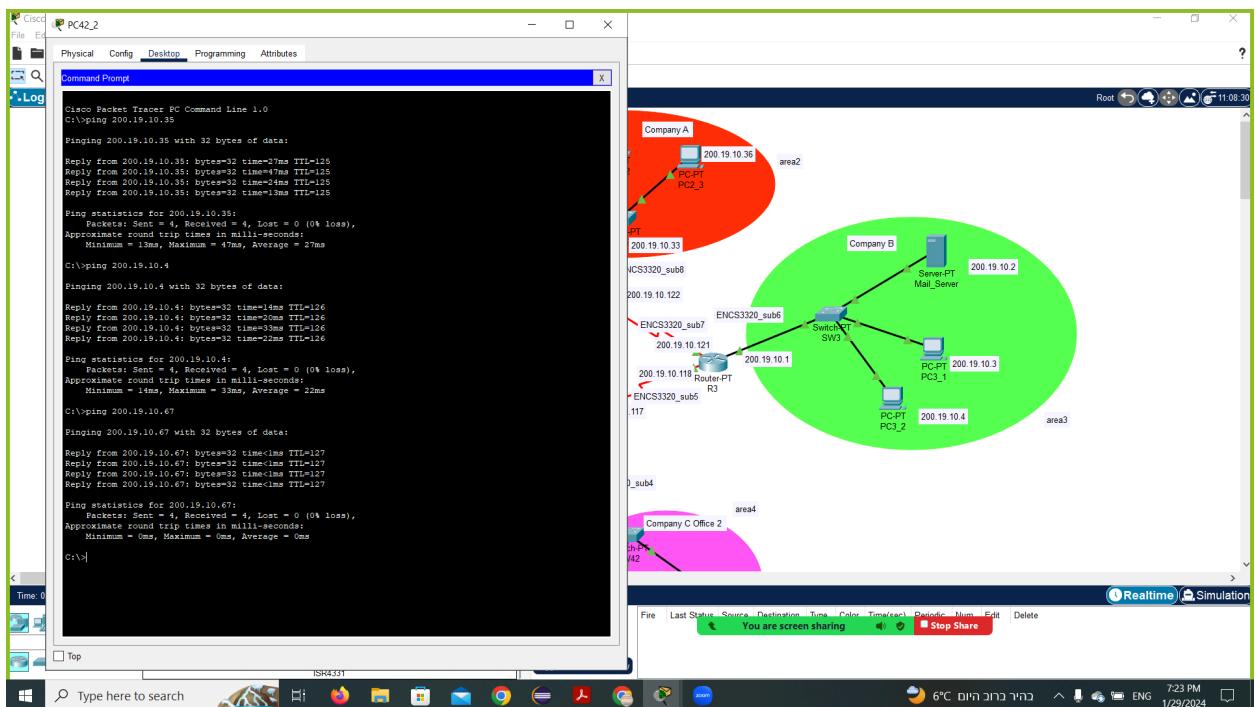
C:\>ping 200.19.10.88 with 32 bytes of data:
Request timed out.
Reply from 200.19.10.88: bytes=32 time=1ms TTL=126
Reply from 200.19.10.88: bytes=32 time=1ms TTL=126
Reply from 200.19.10.88: bytes=32 time=1ms TTL=126

Ping statistics for 200.19.10.88:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 22ms, Average = 11ms
```

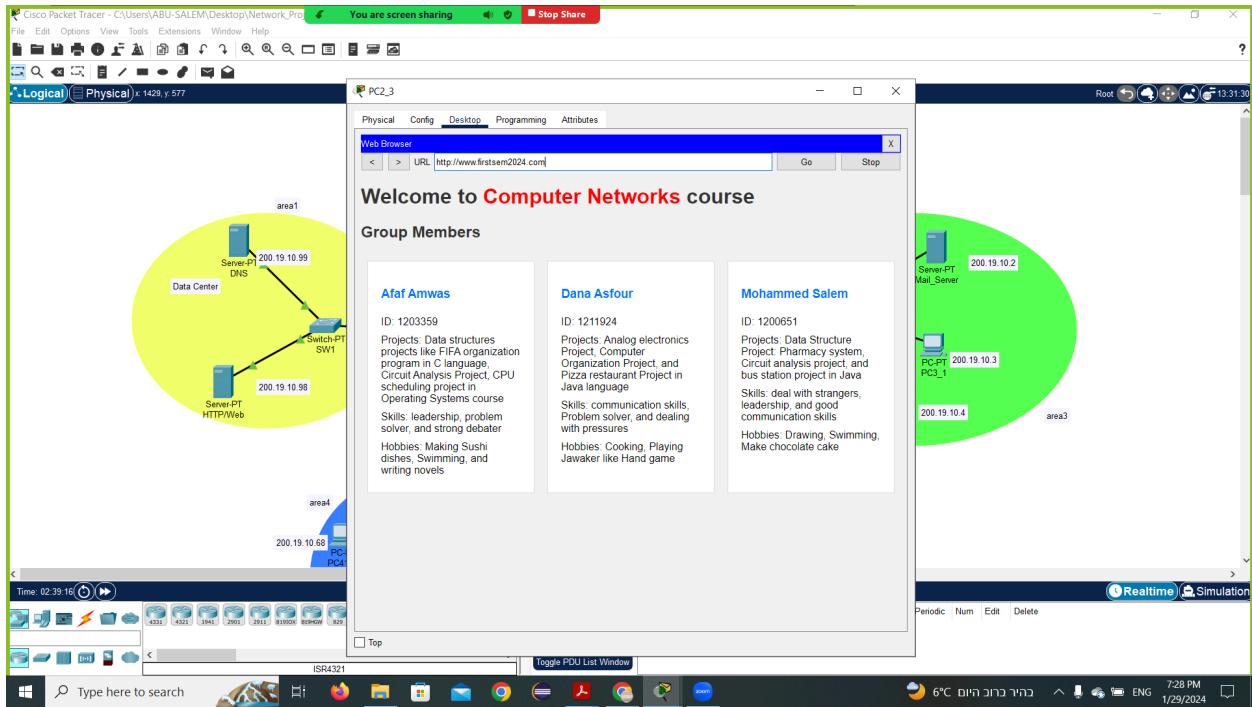
ping and traceroute from company C - office1 to all companies:



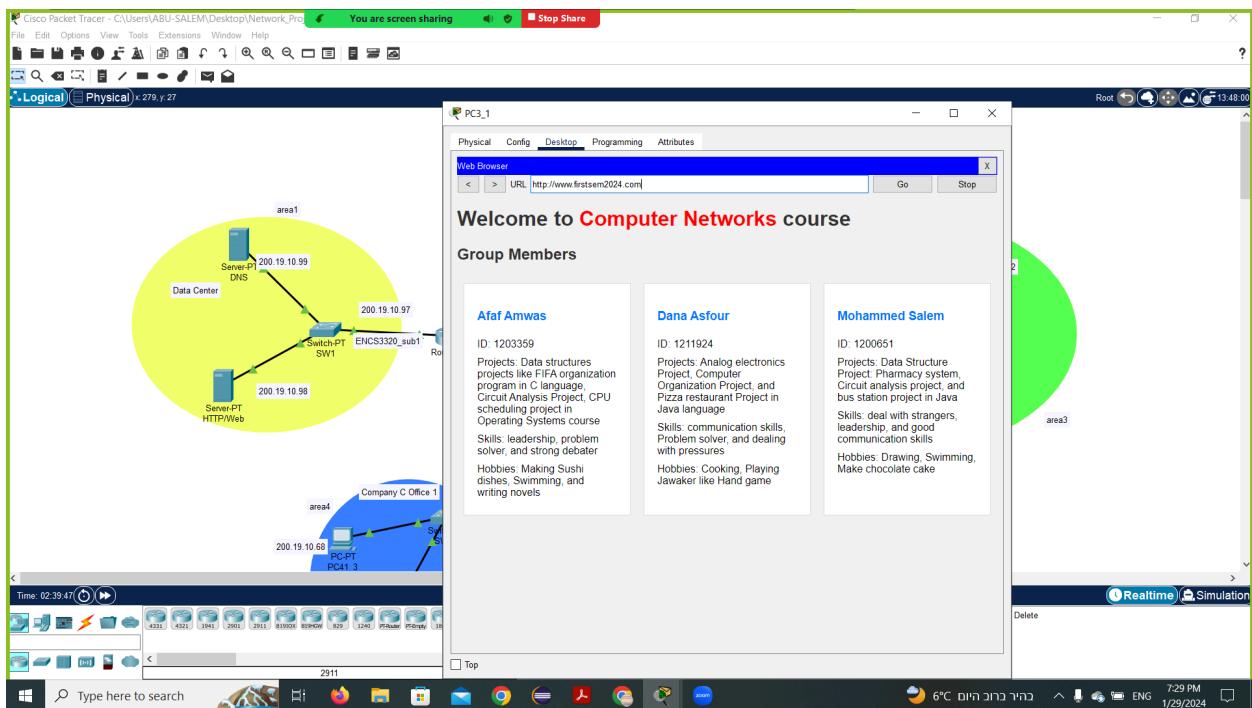
ping and traceroute from company C- office2 to all companies:



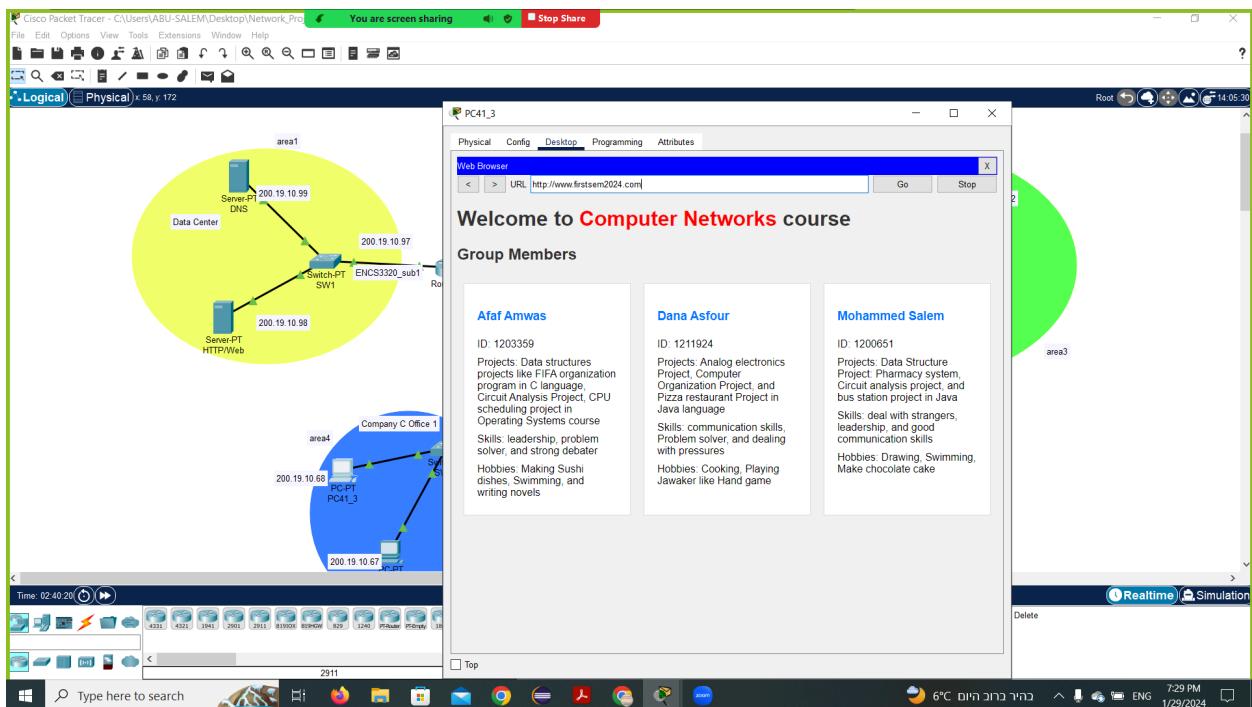
Access www.FirstSem2024.com from all PCs, from Company A to data Center:



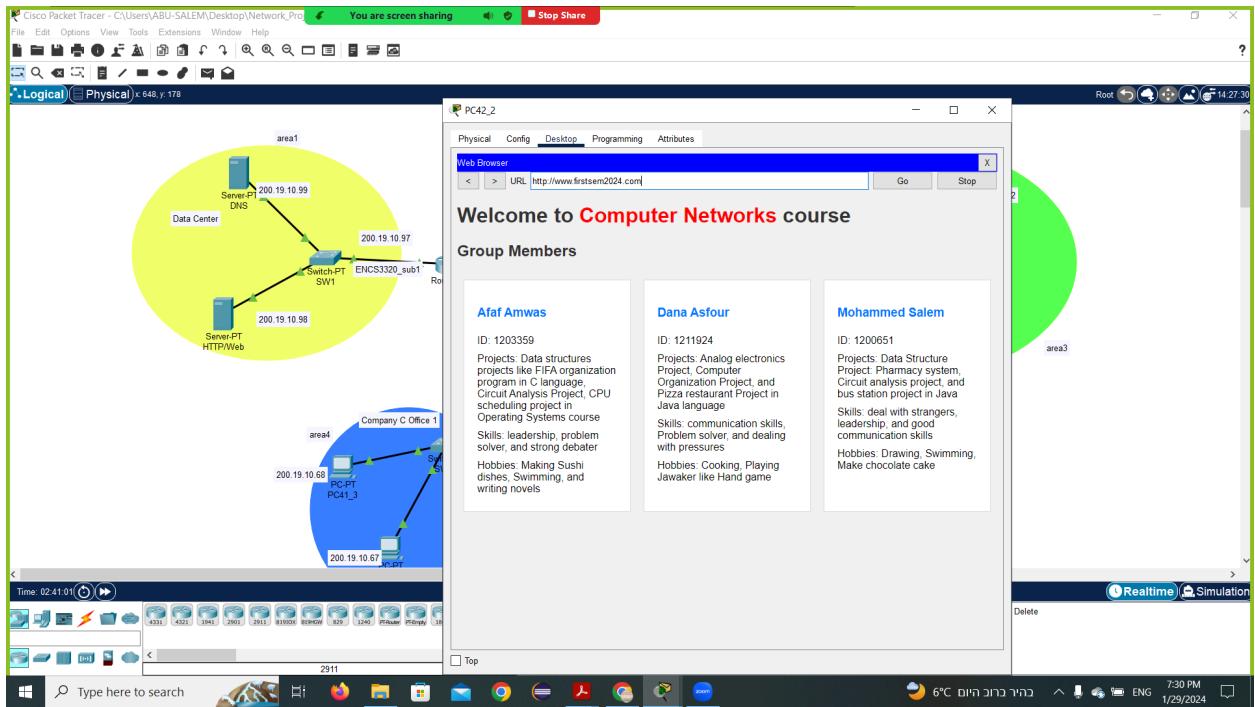
Access www.FirstSem2024.com from all PCs, from Company B to data Center:



Access www.FirstSem2024.com from all PCs, from Company C Office 1 to data Center:



Access www.FirstSem2024.com from all PCs, from Company C Office 2 to data Center:



The tracer file is attached with the report so you can try more test cases.