



HACETTEPE UNIVERSITY

DEPARTMENT OF
COMPUTER ENGINEERING

BBM453: Computer Networks Laboratory Lab 11-12: Dynamic Routing-NAT

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Group 14
Source IP : 192.168.0.27

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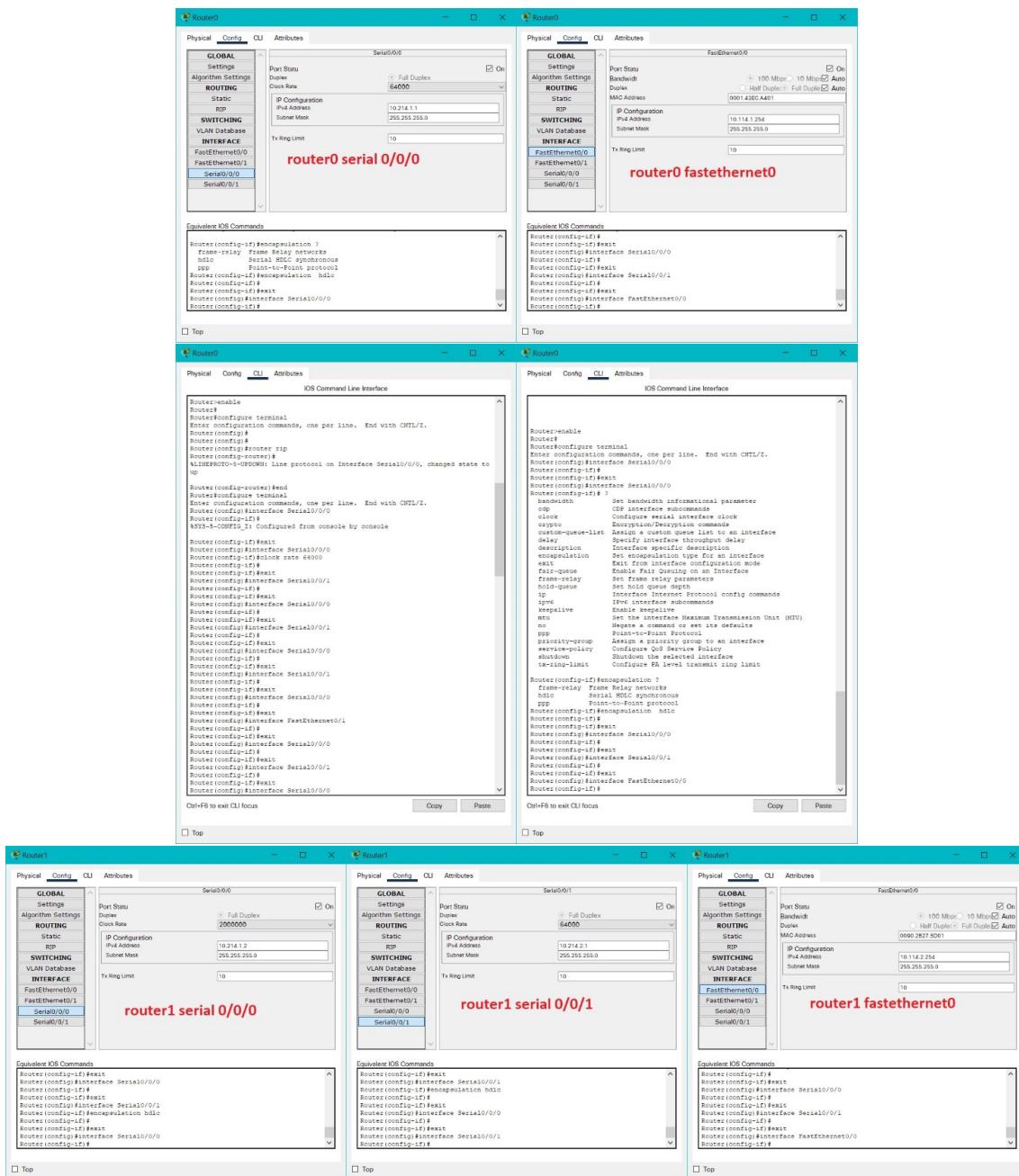
SOLUTIONS

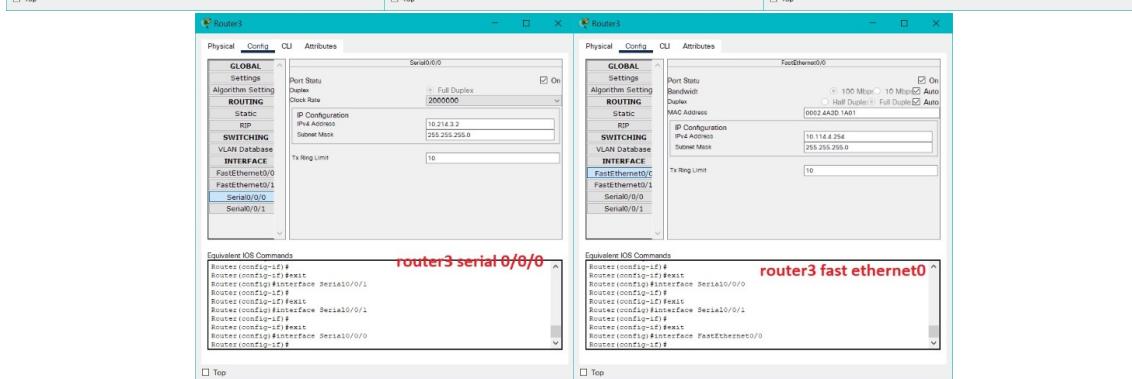
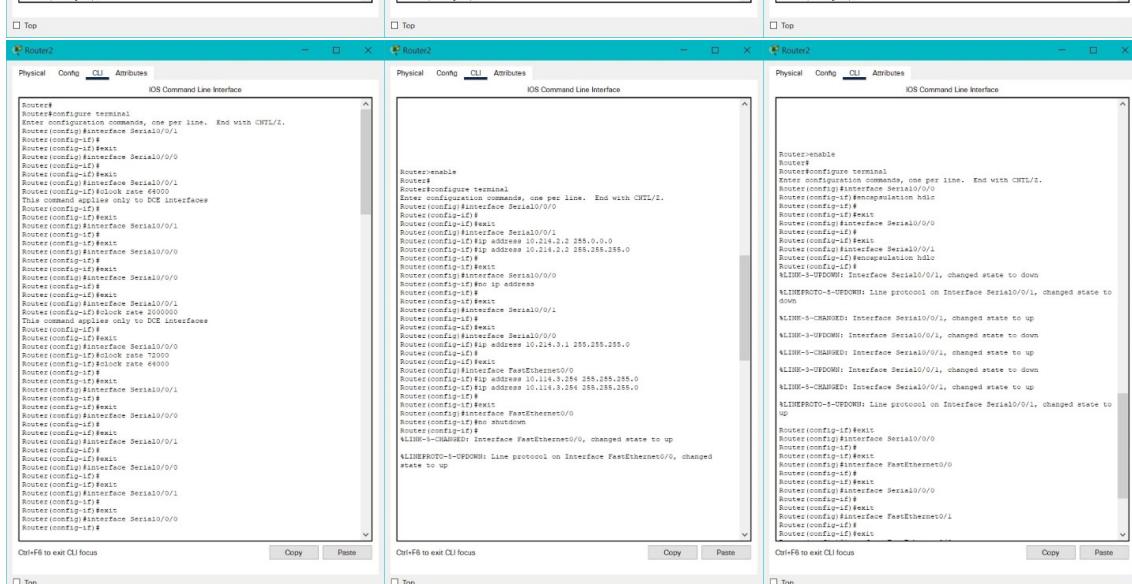
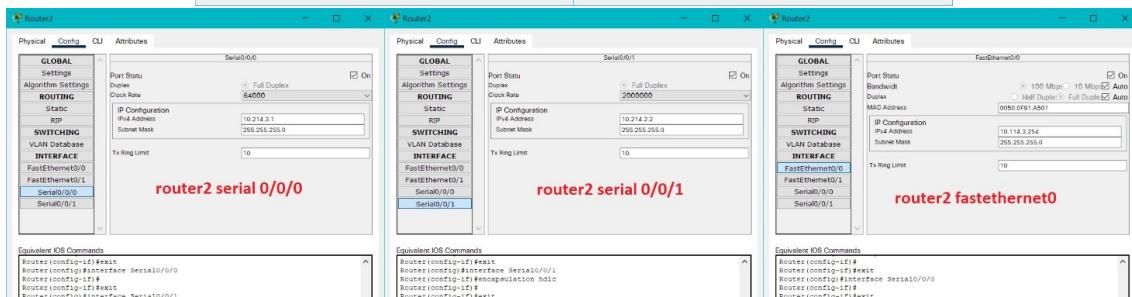
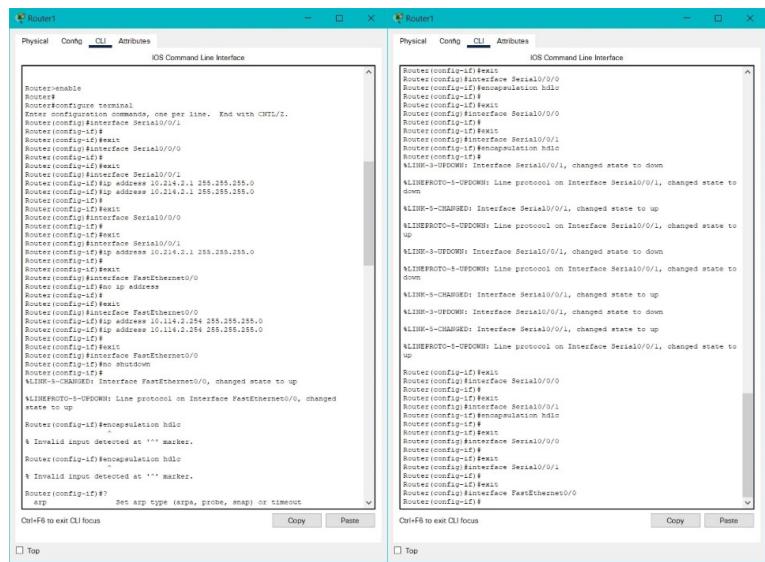
LAB 11

EXPERIMENT STEPS

1. First, you should create lab topology described in the Lab09-Routing Experiment Figure2.

We already created the topology in mentioned lab. So we just copied the according file which also had no unnecessary configurations. Everything is set and ready to move to next step.





Router1

Physical Config CLI Attributes

IOS Command Line Interface

```

program load complete, entry point: 0x0000f000, size: 0x0940
program load complete, entry point: 0x0000f000, size: 0x0940
program load complete, entry point: 0x0000f000, size: 0x0ed130
=====
start booting
=====
shared init is failing: mem
ID: 0 TYPE: MEMORY_PEG
Memory ID: 0
Mainboard: HWIC Board 0
0X00148400 Onboard FRM2 SIMH
0X00148500 Onboard TSM
0X000011B8 Onboard USB
0X000011B9 Onboard ATM
0X000011F0 public buffer pools
0X000011F1 public particle pools
=====
TOTAL: 0X000018428

If any of the above Memory Requirements are
"UNKNOWN", you may be using an unsupported
memory type. It is recommended to use standard
system operation may be compromised.
Allocated 10MEN up to 140M
Usage 2 pieces of memory [140M:512M]

Router con0 is now available

Press RETURN to get started.

Router#
```

Router>enable

Router#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#interface Serial0/0

Router(config-if)#encapsulation hdlc

Router(config-if)#exit

Router(config)#interface Serial0/0/0

Router(config-if)#exit

Router(config)#interface Serial0/0/1

Router(config-if)#exit

Router(config)#interface Serial0/0/2

Router(config-if)#exit

Router(config)#interface Serial0/0/3

Router(config-if)#exit

Router(config)#interface Serial0/0/4

Router(config-if)#exit

Router(config)#interface Serial0/0/5

Router(config-if)#exit

Router(config)#interface Serial0/0/6

Router(config-if)#exit

Router(config)#interface FastEthernet0/0

Router(config-if)#exit

Router(config)#exit

Router#

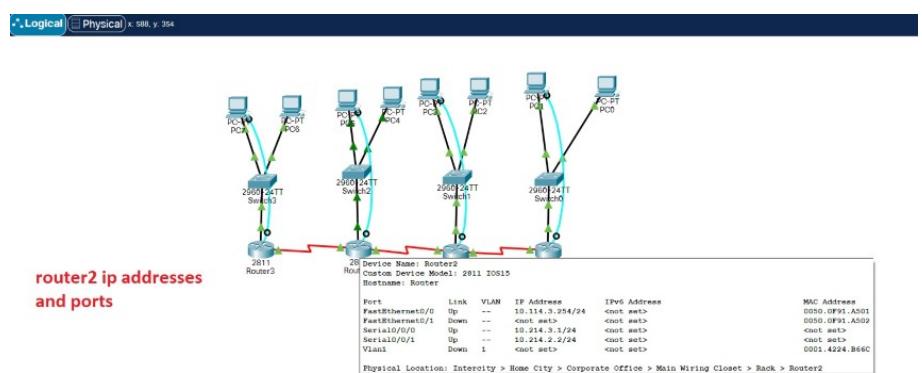
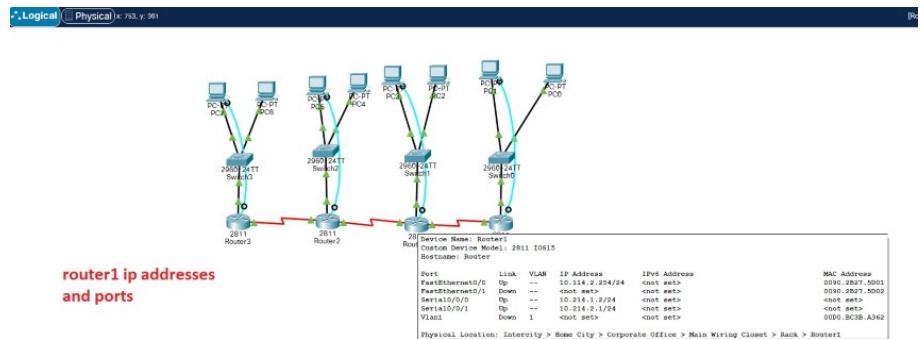
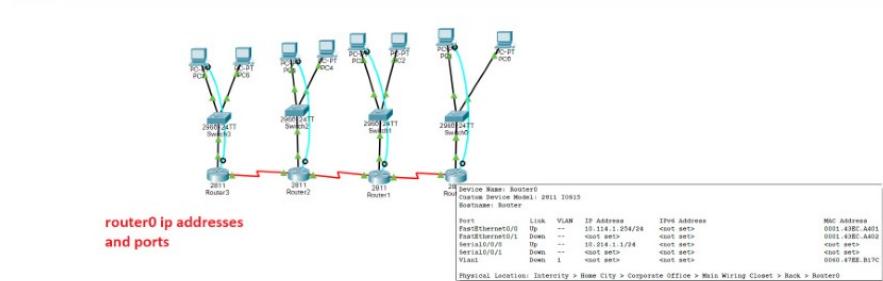
Ctrl+Z to exit CLI mode

Copy Paste

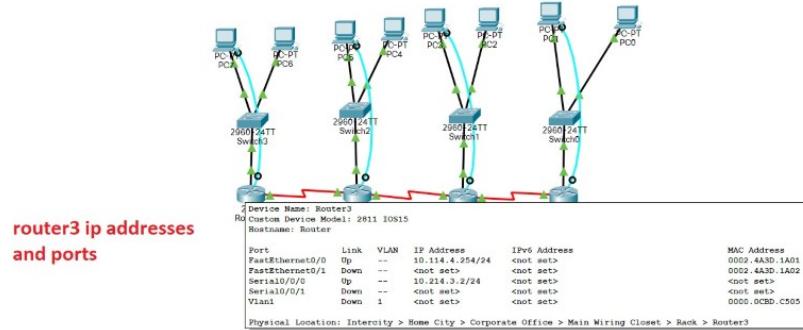
Or Ctrl+F to exec CLI mode

Copy Paste

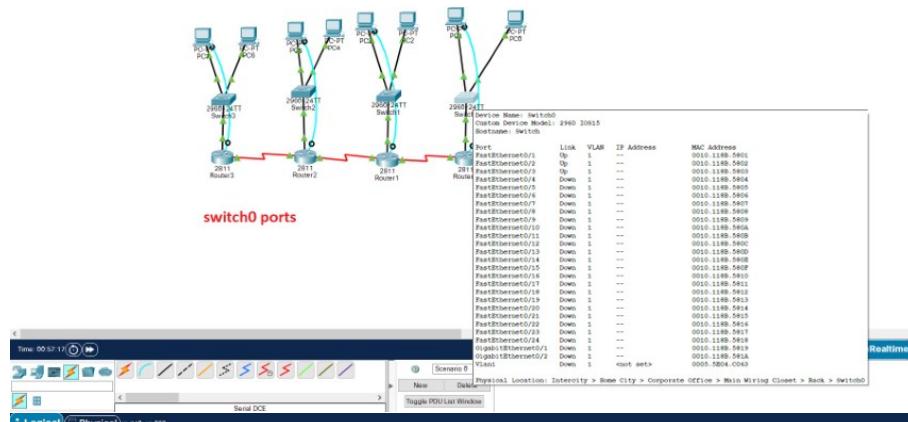
Top



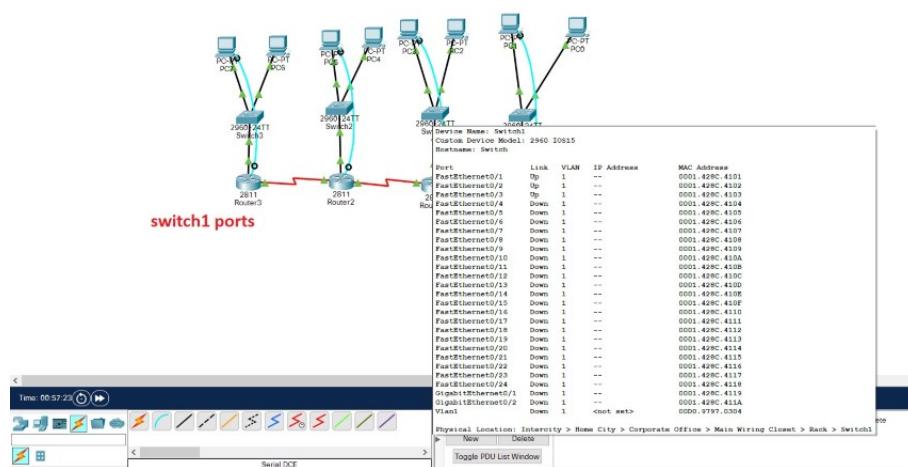
Logical Physical x 412, y 351

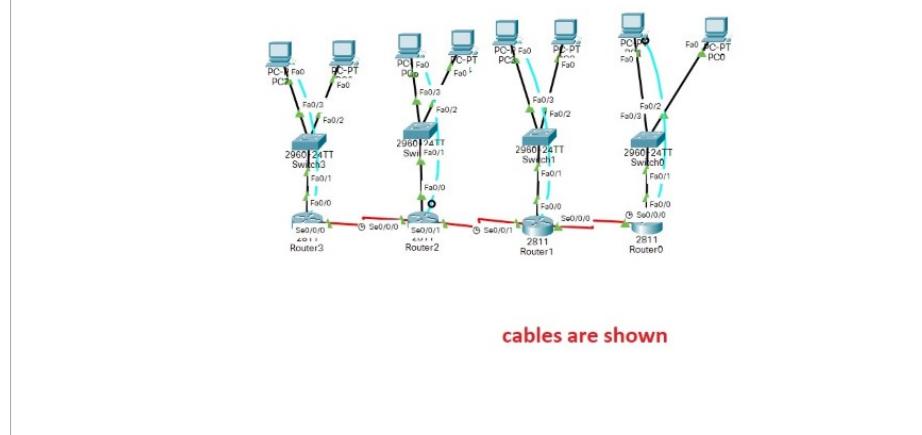
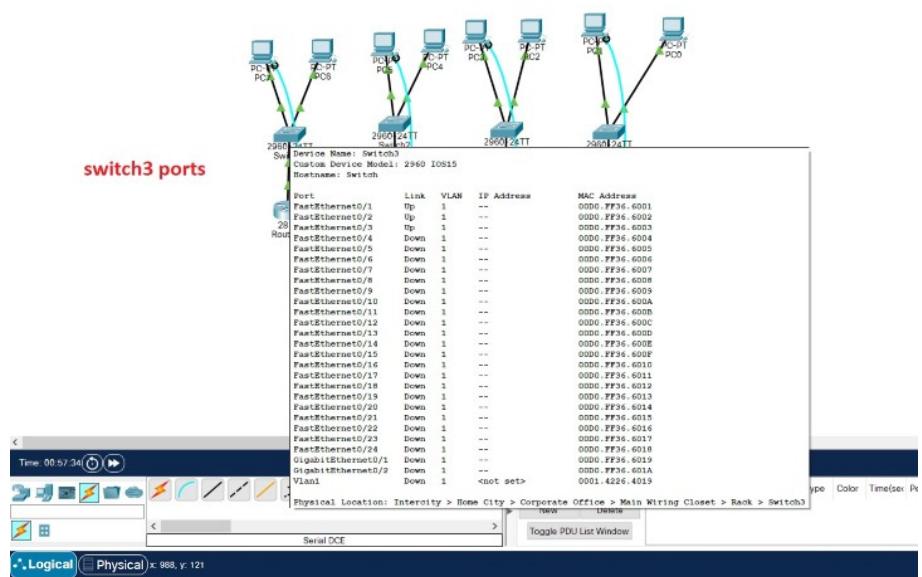
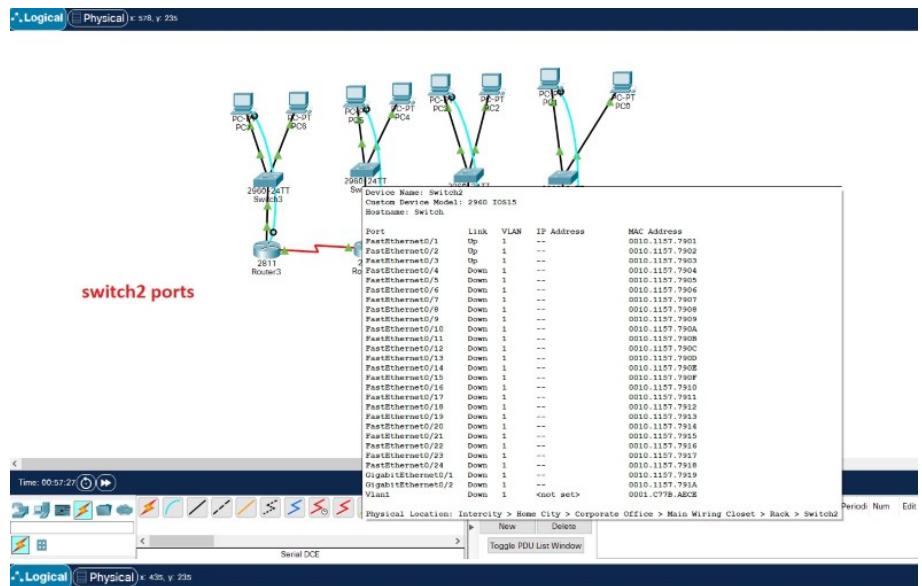


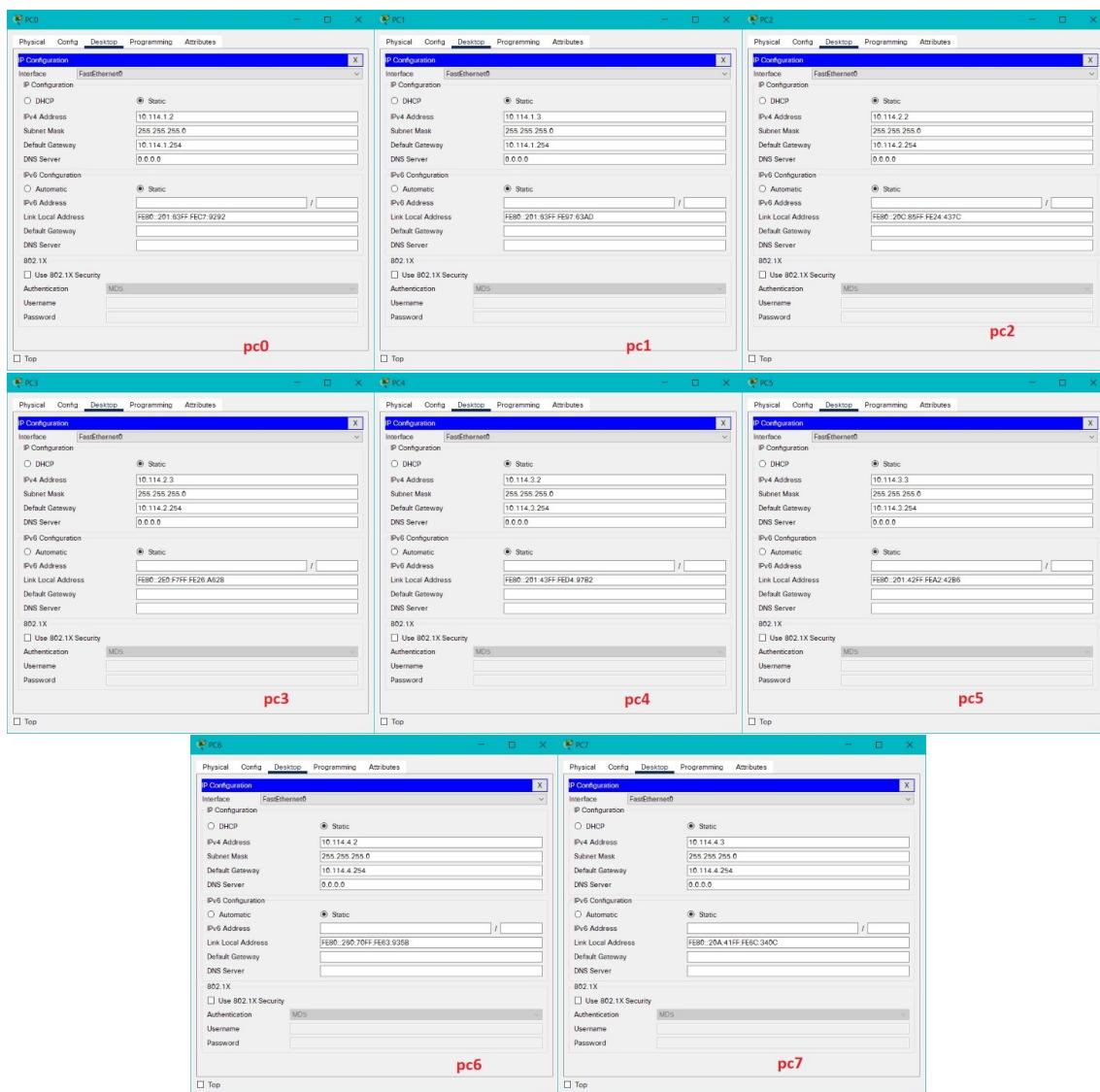
Logical Physical x 800, y 246



Logical Physical x 748, y 239







2. Assign all interfaces (FastEthernet, Serial) described in the Lab Topology

Interfaces are already assigned as shown in the screenshots in the previous question.

3. All groups should use the same dynamic routing protocols simultaneously. You have to research about routing protocol commands for Cisco Router.

We have done our research and added them to References.

4. Configure RIP protocol. Display routing tables and ping from your computer to all other remote computers.

We configured and checked the tables. Then we tested pinging all computers from PC0.

```

PC1 Terminal
Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 10.214.1.0
Router(config-router)#network 10.214.1.1
Router(config-router)#exit
Router>config#exit
Router>
SYS#<5>CONFIGURE_I: Configured from console by console
Router#
```

```

PC3 Terminal
Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 10.214.1.0
Router(config-router)#network 10.214.1.1
Router(config-router)#exit
Router>config#exit
Router>
SYS#<5>CONFIGURE_I: Configured from console by console
Router#
```

```

PC2 Terminal
Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 10.214.2.0
Router(config-router)#network 10.224.3.0
Router(config-router)#network 10.214.3.0
Router(config-router)#exit
Router>config#exit
Router>
SYS#<5>CONFIGURE_I: Configured from console by console
Router#
```

```

PC3 Terminal
Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 10.214.3.0
Router(config-router)#exit
Router>config#exit
Router>
SYS#<5>CONFIGURE_I: Configured from console by console
Router#
```

```

PC1 Terminal
Router>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       I1 - IS-IS level-1, I2 - IS-IS level-2, ia - IS-IS inter-area
       * - candidate default, D - per-user static route, o - ODR
       P - periodic downloaded static route
Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
C 10.0.0.0/8 is directly connected, Serial0/0
R 10.11.1.0/24 [120/1] via 10.214.2.1, 00010027, Serial0/0
C 10.11.1.254/32 is directly connected, FastEthernet0/0
R 10.11.2.0/24 [120/1] via 10.214.3.1, 00010027, Serial0/0
R 10.11.3.0/24 [120/1] via 10.214.3.2, 00010027, Serial0/0
R 10.214.1.0/24 [120/1] via 10.214.1.1, 00010027, Serial0/0
R 10.214.2.0/24 [120/1] via 10.214.2.2, 00010028, Serial0/0
R 10.214.3.0/24 [120/1] via 10.214.3.3, 00010029, Serial0/0
R 10.214.4.0/24 [120/1] via 10.214.4.1, 0001002A, Serial0/0
R 10.214.1.1/32 is directly connected, Serial0/0/0
R 10.214.2.1/32 is directly connected, Serial0/0/1
R 10.214.3.1/32 is directly connected, Serial0/0/2
R 10.214.4.1/32 is directly connected, Serial0/0/3
Router#
```

```

PC3 Terminal
Router>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       I1 - IS-IS level-1, I2 - 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

10.0.0.0/8 is variably subnetted, 10 subnets, 2 masks
R 10.11.1.0/24 [120/1] via 10.214.1.1, 0001002B, Serial0/0
R 10.11.1.254/32 is directly connected, FastEthernet0/0
C 10.11.2.0/24 [120/1] via 10.214.2.2, 0001002B, Serial0/0
R 10.11.3.0/24 [120/1] via 10.214.3.3, 0001002B, Serial0/0
C 10.214.1.0/24 [120/1] via 10.214.1.1, 0001002B, Serial0/0
L 10.214.1.2/32 is directly connected, Serial0/0/0
C 10.214.2.0/24 [120/1] via 10.214.2.2, 0001002B, Serial0/0/1
R 10.214.3.0/24 [120/1] via 10.214.3.3, 0001002B, Serial0/0/2
R 10.214.4.0/24 [120/1] via 10.214.4.1, 0001002B, Serial0/0/3
Router#
```

```

PC2 Terminal
Router>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       I1 - IS-IS level-1, I2 - 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

10.0.0.0/8 is variably subnetted, 10 subnets, 2 masks
R 10.11.1.0/24 [120/1] via 10.214.2.1, 00010027, Serial0/0/1
R 10.11.1.254/32 is directly connected, FastEthernet0/0
C 10.11.2.0/24 [120/1] via 10.214.3.1, 00010027, Serial0/0/0
R 10.11.3.0/24 [120/1] via 10.214.3.2, 00010027, Serial0/0/1
R 10.214.1.0/24 [120/1] via 10.214.1.1, 00010027, Serial0/0/0
R 10.214.2.0/24 [120/1] via 10.214.2.2, 00010028, Serial0/0/1
R 10.214.3.0/24 [120/1] via 10.214.3.3, 00010029, Serial0/0/0
R 10.214.4.0/24 [120/1] via 10.214.4.1, 0001002A, Serial0/0/0
R 10.214.1.1/32 is directly connected, Serial0/0/0
R 10.214.2.1/32 is directly connected, Serial0/0/1
R 10.214.3.1/32 is directly connected, Serial0/0/2
R 10.214.4.1/32 is directly connected, Serial0/0/3
Router#
```

PCD	PCD
<p>Physical Config Desktop Programming Attributes</p> <p>Command Prompt</p> <pre>C:\>ping 10.114.4.2 Pinging 10.114.4.2 with 32 bytes of data: Reply from 10.114.4.2: bytes=32 time=27ms TTL=124 Reply from 10.114.4.2: bytes=32 time=23ms TTL=124 Reply from 10.114.4.2: bytes=32 time=27ms TTL=124 Reply from 10.114.4.2: bytes=32 time=22ms TTL=124 Ping statistics for 10.114.4.2: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 22ms, Maximum = 27ms, Average = 24ms</pre> <p>C:\>ping 10.114.3.2 Pinging 10.114.3.2 with 32 bytes of data: Reply from 10.114.3.2: bytes=32 time=20ms TTL=125 Reply from 10.114.3.2: bytes=32 time=23ms TTL=125 Reply from 10.114.3.2: bytes=32 time=19ms TTL=125 Reply from 10.114.3.2: bytes=32 time=12ms TTL=125 Ping statistics for 10.114.3.2: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 12ms, Maximum = 23ms, Average = 18ms<p>C:\>ping 10.114.2.2 Pinging 10.114.2.2 with 32 bytes of data: Request timed out. Reply from 10.114.2.2: bytes=32 time=6ms TTL=126 Reply from 10.114.2.2: bytes=32 time=11ms TTL=126 Reply from 10.114.2.2: bytes=32 time=9ms TTL=126 Ping statistics for 10.114.2.2: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 6ms, Maximum = 11ms, Average = 8ms<p>C:\>ping 10.114.1.2 Pinging 10.114.1.2 with 32 bytes of data:</p><pre>Reply from 10.114.1.2: bytes=32 time=1ms TTL=128 Reply from 10.114.1.2: bytes=32 time=2ms TTL=128 Reply from 10.114.1.2: bytes=32 time=2ms TTL=128 Reply from 10.114.1.2: bytes=32 time=3ms TTL=128 Ping statistics for 10.114.1.2: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 1ms, Maximum = 3ms, Average = 2ms</pre></p></p>	<p>Physical Config Desktop Programming Attributes</p> <p>Command Prompt</p> <pre>C:\>ping 10.114.2.3 Pinging 10.114.2.3 with 32 bytes of data: Request timed out. Reply from 10.114.2.3: bytes=32 time=10ms TTL=126 Reply from 10.114.2.3: bytes=32 time=8ms TTL=126 Reply from 10.114.2.3: bytes=32 time=5ms TTL=126 Ping statistics for 10.114.2.3: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 5ms, Maximum = 10ms, Average = 7ms</pre> <p>C:\>ping 10.114.1.3 Pinging 10.114.1.3 with 32 bytes of data:</p> <pre>Reply from 10.114.1.3: bytes=32 time=1ms TTL=128 Reply from 10.114.1.3: bytes=32 time=1ms TTL=128 Reply from 10.114.1.3: bytes=32 time=1ms TTL=128 Reply from 10.114.1.3: bytes=32 time=1ms TTL=128 Ping statistics for 10.114.1.3: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 0ms, Maximum = 0ms, Average = 0ms</pre> <p>C:\>ping 10.114.3.3 Pinging 10.114.3.3 with 32 bytes of data:</p> <pre>Request timed out. Reply from 10.114.3.3: bytes=32 time=11ms TTL=125 Reply from 10.114.3.3: bytes=32 time=11ms TTL=125 Reply from 10.114.3.3: bytes=32 time=2ms TTL=125 Ping statistics for 10.114.3.3: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 2ms, Maximum = 11ms, Average = 10ms</pre> <p>C:\>ping 10.114.4.3 Pinging 10.114.4.3 with 32 bytes of data:</p> <pre>Request timed out. Reply from 10.114.4.3: bytes=32 time=17ms TTL=124 Reply from 10.114.4.3: bytes=32 time=17ms TTL=124 Reply from 10.114.4.3: bytes=32 time=20ms TTL=124 Ping statistics for 10.114.4.3: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 17ms, Maximum = 20ms, Average = 19ms</pre>

5. Remove RIP configuration and configure OSPF protocol. Display routing tables and ping from your computer to all other remote computers.

First we erased the RIP configurations and configured the OSPF and then checked the tables. Then we tested pinging all computers from PC0.

```
PC1 Physical Config Desktop Programming Attributes Terminal

Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router>(config)#no router rip
Router>(config)#exit
Router>
4SYS-5-CONFIG-I: Configured from console by console

Router>show ip route
Codes: L - Link State, 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
       * - candidate default, U - user-defined static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

 10.0.0.0/8 is available, subnetted, 6 subnets, 2 masks
C 10.11.1.0/24 is directly connected, Fa0/0
L 10.11.1.254/32 is directly connected, FastEthernet0/0
L 10.11.1.254/32 is directly connected, FastEthernet0/0
D 10.11.1.254/32 is directly connected, Serial0/0
L 10.214.1.1/32 is directly connected, Serial10/0
L 10.214.1.1/32 is directly connected, Serial10/0

Router>exit
Success#
```

```
PC2 Physical Config Desktop Programming Attributes Terminal

Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router>(config)#no router rip
Router>(config)#exit
Router>
4SYS-5-CONFIG-I: Configured from console by console

Router>show ip route
Codes: L - Link State, 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
       * - candidate default, U - user-defined static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

 10.0.0.0/8 is available, subnetted, 6 subnets, 2 masks
C 10.11.2.0/24 is directly connected, Fa0/0
L 10.11.2.254/32 is directly connected, FastEthernet0/0
L 10.11.2.254/32 is directly connected, FastEthernet0/0
D 10.11.2.254/32 is directly connected, Serial0/0
L 10.214.2.0/24 is directly connected, Serial10/0
L 10.214.2.0/24 is directly connected, Serial10/0

Router>exit
Success#
```

```
PC3 Physical Config Desktop Programming Attributes Terminal

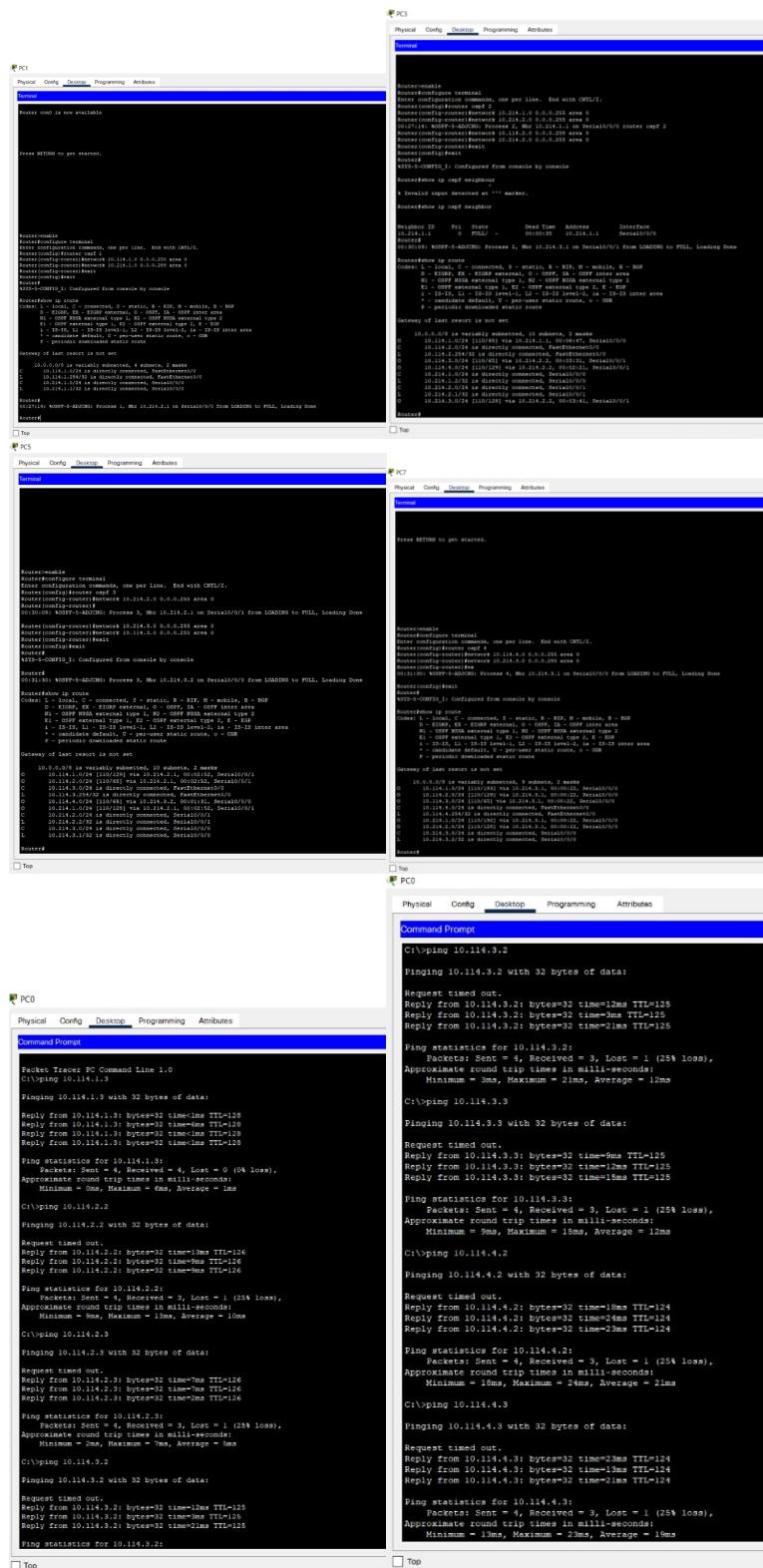
Router>enable
Router>configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router>(config)#no router rip
Router>(config)#exit
Router>
4SYS-5-CONFIG-I: Configured from console by console

Router>show ip route
Codes: L - Link State, 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
       * - candidate default, U - user-defined static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

 10.0.0.0/8 is available, subnetted, 6 subnets, 2 masks
C 10.11.3.0/24 is directly connected, Fa0/0
L 10.11.3.254/32 is directly connected, FastEthernet0/0
L 10.11.3.254/32 is directly connected, FastEthernet0/0
D 10.11.3.254/32 is directly connected, Serial0/0
L 10.214.3.0/24 is directly connected, Serial10/0
L 10.214.3.0/24 is directly connected, Serial10/0

Router>exit
Success#
```



6. Remove OSPF configuration and configure EIGRP protocol. Display routing tables and ping from your computer to all other remote computers.

First we erased the OSPF configurations and configured the EIGRP. While we were configuring we realized it does not show at the first. Further research showed us this was normal because of EIGRP protocol. As we configured other routers the routings were also getting defined. Below are screenshots of the process. Then we tested pinging all

computers from PC0.





PC0

Physical	Config	<u>Desktop</u>	Programming	Attributes
PC0				
Physical	Config	<u>Desktop</u>	Programming	Attributes
Command Prompt				
<pre>C:\>ping 10.114.3.2 Pinging 10.114.3.2 with 32 bytes of data: Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=22ms TTL=128 C:\>ping 10.114.3.3 Pinging 10.114.3.3 with 32 bytes of data: Request timed out. C:\>ping 10.114.2.2 Pinging 10.114.2.2 with 32 bytes of data: Reply from 10.114.2.2: bytes=32 time=1ms TTL=128 Reply from 10.114.2.2: bytes=32 time=1ms TTL=128 Reply from 10.114.2.2: bytes=32 time=1ms TTL=128 Ping statistics for 10.114.2.2: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 1ms, Maximum = 2ms, Average = 1ms C:\>ping 10.114.2.3 Pinging 10.114.2.3 with 32 bytes of data: Request timed out. C:\>ping 10.114.3.2 Pinging 10.114.3.2 with 32 bytes of data: Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Ping statistics for 10.114.3.2: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 1ms, Maximum = 1ms, Average = 1ms C:\>ping 10.114.4.2 Pinging 10.114.4.2 with 32 bytes of data: Request timed out. C:\>ping 10.114.4.3 Pinging 10.114.4.3 with 32 bytes of data: Request timed out. C:\>ping 10.114.4.4 Pinging 10.114.4.4 with 32 bytes of data: Request timed out. C:\></pre>				
<input type="checkbox"/> Top				

PC0

Physical	Config	<u>Desktop</u>	Programming	Attributes
PC0				
Physical	Config	<u>Desktop</u>	Programming	Attributes
Command Prompt				
<pre>C:\>ping 10.114.3.2 Pinging 10.114.3.2 with 32 bytes of data: Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=22ms TTL=128 C:\>ping 10.114.3.3 Pinging 10.114.3.3 with 32 bytes of data: Request timed out. C:\>ping 10.114.2.2 Pinging 10.114.2.2 with 32 bytes of data: Reply from 10.114.2.2: bytes=32 time=1ms TTL=128 Reply from 10.114.2.2: bytes=32 time=1ms TTL=128 Reply from 10.114.2.2: bytes=32 time=1ms TTL=128 Ping statistics for 10.114.2.2: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 1ms, Maximum = 2ms, Average = 1ms C:\>ping 10.114.2.3 Pinging 10.114.2.3 with 32 bytes of data: Request timed out. C:\>ping 10.114.3.2 Pinging 10.114.3.2 with 32 bytes of data: Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Reply from 10.114.3.2: bytes=32 time=1ms TTL=128 Ping statistics for 10.114.3.2: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 1ms, Maximum = 1ms, Average = 1ms C:\>ping 10.114.4.2 Pinging 10.114.4.2 with 32 bytes of data: Request timed out. C:\>ping 10.114.4.3 Pinging 10.114.4.3 with 32 bytes of data: Request timed out. C:\>ping 10.114.4.4 Pinging 10.114.4.4 with 32 bytes of data: Request timed out. C:\></pre>				
<input type="checkbox"/> Top				

LAB 12

EXPERIMENT STEPS

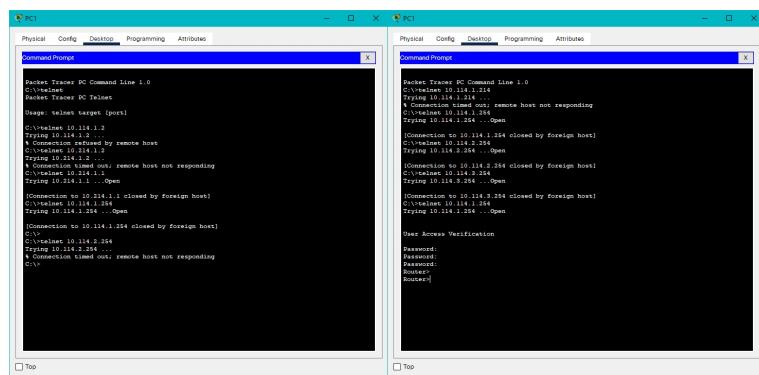
1. Your aim is to configure NAT on your router and translate your PC's IP address in your group to a single IP from your subnet. After translation process, you will be able to test your address translation with pinging to new IP addresses and using show commands. Another way to test your configuration is to connect remotely to another group's router and running show user command to see logged in users on that router.

Yes we are going to configure them down below.

Basic Router Configurations

2. You are going to use telnet for remote connection. To be able to use telnet, you have to configure necessary password steps for security restrictions. For example try to telnet (from your PC) to another group's Router (IP address of Serial interface), and understand why you are not able connect to the Router.

We tried first and it was not able connect because there was no routing. We set basic ospf routing and it was able to connect but needed to configure the password. When we configure password in the next steps, it was able to connect.



3-4-5. You have to set enable password and telnet password for remote connection. Display your configuration changes on running-config and try logout from Router using disable command and then enable again. You should observe that all text passwords can be easily seen in config file. That is also a security bug. You should use encryption service for encrypting password texts.

We added specified passwords to all routers and configured the encrypting texts.

Router1

```

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable password cisco
Router(config)#username cisco password cisco
Router(config)#line vty 0 4
Router(config-line)#password cisco
Router(config-line)#exit
Router#  

*Mar 24 00:02:11.129%ROUTER1: Configured from console by console
Router#show running-config
Building configuration...
Current configuration : 552 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
enable password cisco
!
!
no ip cef
no ip vrf cef
!
!
license udi pid CISCO2811/R2 sn FTX10178YU7-
!
!
spanning-tree mode pvrst
!
!
interface FastEthernet0/0
 ip address 10.114.2.254 255.255.255.0
 duplex auto
 speed auto
!
!
!
!
```

On#(Router1) to exit CLI/focus Copy Paste

Too

Router1 password is encrypted

Router2

```

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable password cisco
Router(config)#username cisco password cisco
Router(config)#line vty 0 4
Router(config-line)#password cisco
Router(config-line)#exit
Router#  

*Mar 24 00:02:11.129%ROUTER1: Configured from console by console
Router#show running-config
Building configuration...
Current configuration : 568 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
enable password cisco123456
!
!
no ip cef
no ip vrf cef
!
!
license udi pid CISCO2811/R2 sn FTX10178YU7-
!
!
spanning-tree mode pvrst
!
!
interface FastEthernet0/0
 ip address 10.114.2.254 255.255.255.0
 duplex auto
 speed auto
!
```

On#(Router2) to exit CLI/focus Copy Paste

Too

router1 password is encrypted

Router2

```

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable password cisco
Router(config)#username cisco password cisco
Router(config)#line vty 0 4
Router(config-line)#password cisco
Router(config-line)#exit
Router#  

*Mar 24 00:02:11.129%ROUTER1: Configured from console by console
Router#show running-config
Building configuration...
Current configuration : 542 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
enable password cisco
!
!
no ip cef
no ip vrf cef
Router#show running-config
Building configuration...
Current configuration : 552 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
enable password cisco123456
!
!
no ip cef
no ip vrf cef
!
```

On#(Router2) to exit CLI/focus Copy Paste

Too

Router2

```

Router# 
Router>enable
Router>config terminal
Router>conf t
Router(config)#password cisco
Router(config)#username cisco password cisco
Router(config)#
*2015-01-25 11:11:51: Configured from console by console
Router>show running-config
Building configuration...
Current configuration : 940 bytes
version 13.1
no service timestamp log datetime msec
no service timestamp log uptime msec
service password-encryption
hostname Router
!
enable password cisco1234567890
!
no ip cef
no ipx cef
!
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```

On<F9> to exit CLI/Config

router 2 password is encrypted

Router3

```

Router# 
Router>enable
Router>config terminal
Router>conf t
Router(config)#password cisco
Router(config)#username cisco password cisco
Router(config)#
*2015-01-25 11:11:51: Configured from console by console
Router>show running-config
Building configuration...
Current configuration : 908 bytes
version 13.1
no service timestamp log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname Router
!
enable password cisco
!
no ip cef
no ipx cef
!
!
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```

On<F9> to exit CLI/Config

router 2 password is encrypted

Router1

```

Router# 
Router>enable
Router>config terminal
Router>conf t
Router(config)#password cisco
Router(config)#username cisco password cisco
Router(config)#
*2015-01-25 11:11:51: Configured from console by console
Router>show running-config
Building configuration...
Current configuration : 921 bytes
version 13.1
no service timestamp log datetime msec
no service timestamps debug datetime msec
service password-encryption
hostname Router
!
enable password cisco1234567890
!
no ip cef
no ipx cef
!
!
!
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!
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!
!
!
!
!
!
!
```

On<F9> to exit CLI/Config

router 3 password is encrypted

Router2

```

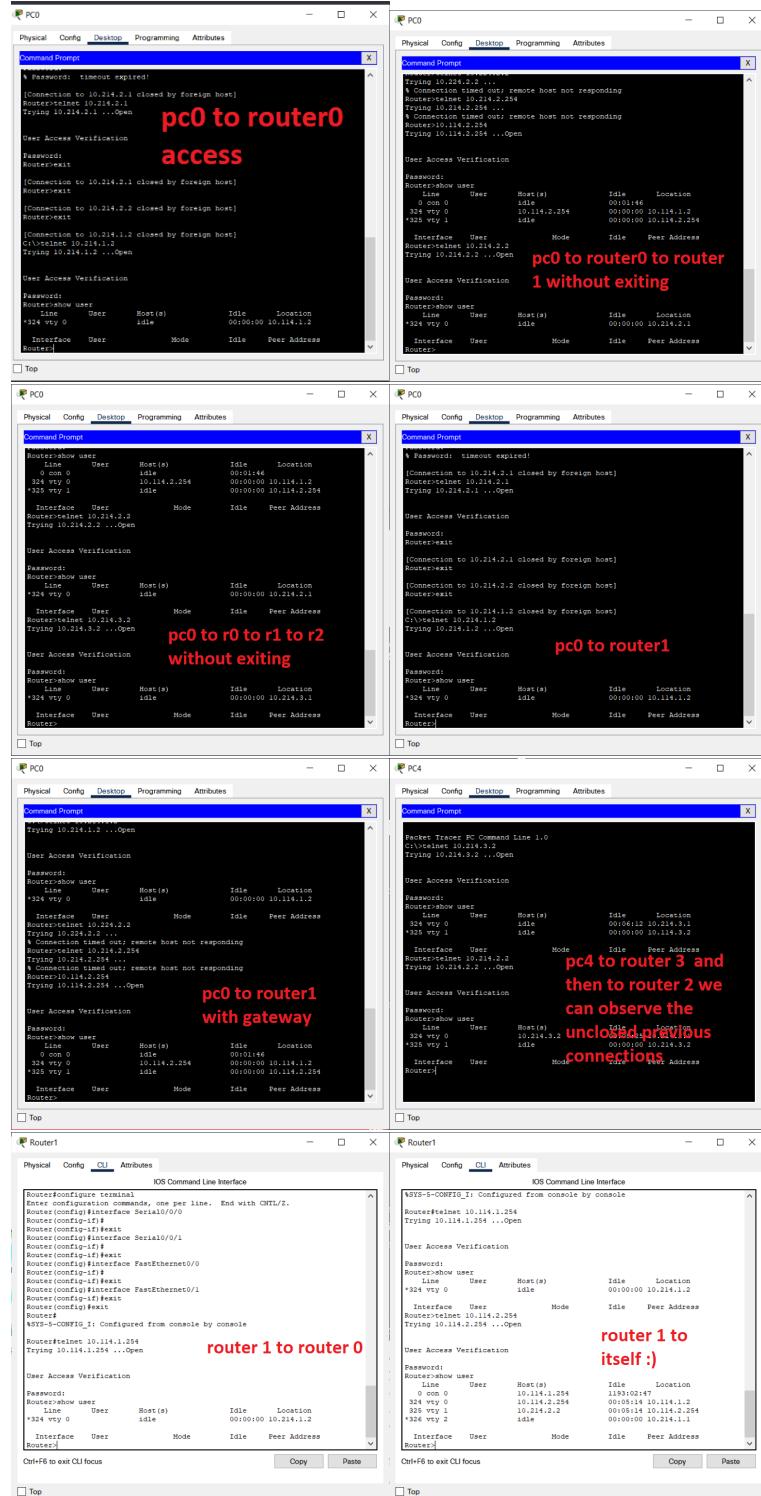
Router# 
Router>enable
Router>config terminal
Router>conf t
Router(config)#password cisco
Router(config)#username cisco password cisco
Router(config)#
*2015-01-25 11:11:51: Configured from console by console
Router>show running-config
Building configuration...
Current configuration : 940 bytes
version 13.1
no service timestamp log datetime msec
no service timestamp log uptime msec
service password-encryption
hostname Router
!
enable password cisco1234567890
!
no ip cef
no ipx cef
!
!
!
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!
```

On<F9> to exit CLI/Config

router 3 password is encrypted

6. Now you are ready to telnet (from your PC) to another remote Routers. Enter their telnet and enable passwords and login to their router. Use show user command to display logged-in connections on the router in this session. Observe your IP address of your client. The * shows your connection.

We have tested all possible scenarios. Accessed all routers with different methods. Accessed from routers, accessed within routers, left connection open and accessed from another PC etc. Check down below for screenshots of some test covering cases:



7. If a router supports address translation, then the connection interfaces to which the address translation is to be applied, must be specified and defined as inside or outside. This is done using the ip nat [inside | outside] command while in the sub-configuration mode.

This part was really hard and took us lots of trying. So the screenshots of exact configuration moments might be lacking but we will add complete logs and describe which commands we entered to achieve the results. First of all we must clear this out: It is a known and real issue that two computers behind NAT networks are unable to reach other. For this there are various methods to punch a hole, but for any of them to work there must be a static NAT translation. Our current choice of NAT translation which is overload uses 1 IP for outer world and uses ports for inner world. The game breaking thing is the translation is cleared out when it is unused. So when a PC from outer world wants to reach a PC from inside with a NAT attained IP it is really hard because at a given moment that PC might not even be on the NAT list or who know which port is assigned to it. This is a real issue in p2p networks etc.

Another thing to mention is routing. With NAT routing is simple as inside world => whole internet. However by enforcing this topology we need to ensure all routing are done and encapsulated with static routing.

In our experiment for realistic test and ensuring results we chose this method. Router 0 and router 3 are NAT routers. Their NAT IP is 10.114.101.1 for router 0, 10.114.103.1 for router 3. All routers route this IP addresses accordingly and all PC networks and router networks.

Expected result, which is confirmed by screenshots below, is this: PC4 and PC5 can access outer world and their IP will NAT ed to 10.114.103.1. PC0 and PC1 will be NAT ed to 10.114.101.1. Other PCs are not behind a NAT network. NAT ed PCs can not be accessed from other NAT ed PCs. From outside world NAT ed PCs can be accessed by their inner IPs however returned message will be NAT ed. From NAT ed pcs they can access routers and PCs with their NAT ed IPs (Not the NAT ed PCs).

```

Router2# config terminal
Router2(config)# ip nat pool NATPOOL141 10.114.103.1 10.114.103.100 netmask 255.255.255.0
Router2(config)# ip nat inside source list 141 pool NATPOOL141 overload
Router2(config)# interface fastethernet0/0
Router2(config-if)# ip nat outside
Router2(config-if)# ip address 10.114.101.1 255.255.255.0
Router2(config-if)# no shutdown
Router2(config-if)# exit
Router2(config)# exit
Router2# write memory
Router2# exit
Router2#

```

```

Router2# config terminal
Router2(config)# interface fastethernet0/0
Router2(config-if)# ip nat inside
Router2(config-if)# ip address 10.114.101.1 255.255.255.0
Router2(config-if)# no shutdown
Router2(config-if)# exit
Router2(config)# interface fastethernet0/1
Router2(config-if)# ip nat outside
Router2(config-if)# ip address 10.114.103.1 255.255.255.0
Router2(config-if)# no shutdown
Router2(config-if)# exit
Router2(config)# exit
Router2# write memory
Router2# exit
Router2#

```

Commands we entered for router 2 are shown above. Similar commands are entered for router 0 but with NATPOOL141, access-list 141 and ip 10.114.101.1 and of course according interfaces and permitted IPs. We are aware of one thing we might not have done here which is defining a range like 10.114.103.1 10.114.103.100. This is unnecessary considering overloaded NATs will always have 1 IP address. However changing or redoing this was also unnecessary. Other thing to mention is after configuring NAT we used write memory because it wouldn't register sometimes.

Now below are log results for current routers using show ip route, show ip nat *, show running-config. Notice router 1 and 3 does not have NAT:

8. You are going to configure dynamic overloading NAT. Commands are same as dynamic NAT configuration with overload command at the end. You should translate your client IP to another IP from your subnet (for example: 10.100.X.99) using dynamic overloading NAT commands:

We have bundled this part with previous because of tons of testing etc. Check previous screen shots.

9. After NAT configuration, try to ping other groups client IP addresses and translated IP addresses. Discuss the results.

As expected when we pinged, trace routed, telnet accessed from a PC behind NAT their IP got overwritten. When we pinged a NAT ed client IP from non NAT ed PC the returned result had NAT ed IP. Reaching a NAT ed PC from another NAT ed PC was unable, as it should be. Reaching a NAT ed PC with their translated IP address worked only if that PC recently used network meaning they were in translate list. Otherwise it was also not possible.

The image displays four separate windows of the Windows Command Prompt, each showing network traffic analysis and trace routing results.

- PC1:** Shows a Command Prompt window with the title "With telnet we can observe our ip adress is overwritten by NAT". The output shows a telnet session to 10.114.2.3, which is being forwarded through 10.114.1.101.1. It also shows a ping to 10.114.2.3 and a traceroute to 10.114.101.1.
- PC2:** Shows a Command Prompt window with the title "This is relateed to Question 11". The output shows a telnet session to 10.114.2.3, which is being forwarded through 10.114.1.101.1. It also shows a ping to 10.114.2.3 and a traceroute to 10.114.101.1.
- PC3:** Shows a Command Prompt window with the title "Another NAT ed pc, pc 5, when we telnet we can see our IP is NAT ed, and we can see our other NAT ed pc1 is also not disconnected yet." The output shows a telnet session to 10.114.2.3, which is being forwarded through 10.114.1.101.1. It also shows a ping to 10.114.2.3 and a traceroute to 10.114.101.1.
- PC5:** Shows a Command Prompt window with the title "We can see that pc5 and pc 1 are not disconnected yet and their ip adresses are NAT ed." The output shows a ping to 10.114.2.3 and a traceroute to 10.114.101.1.

10. Use show ip nat translation command to show translated IP addresses and port numbers. Discuss each column on the table (inside/outside, local/global). If you didn't see any output, you should successfully ping remote clients and also your PC should be pinged from outside.

When we use ip nat translation on non NAT ed routers obviously we get nothing. We are also observing ip nat statistics. When we use this commands on NATed ip, still there is a chance translation list might be empty if router was idle. When we ping or telnet or traceroute it becomes active.

The image contains three separate windows of a Router's Command Line Interface (CLI). Each window has tabs for Physical, Config, CLI, and Attributes, with CLI selected.

- Screenshot 1:** Shows a routing table with several routes. A red box highlights the following text at the top of the table area:

We can observe that telnet connections that were online was defined in a list, then we pinged to another pc and ICMP definitions also added to the list
- Screenshot 2:** Shows a routing table with several routes. A red box highlights the following text at the top of the table area:

This router is not NAT ed so there is no result
- Screenshot 3:** Shows a routing table with several routes. A red box highlights the following text at the top of the table area:

There are a few translations in router 2 because it was not used for that much.

In the above screenshots we see that PRO column which is short for Protocol. This defines that translation protocol which is allowed for that translation. We also see Inside global, Inside local IP addresses. These are for our translated PC's IP addresses. Global one is the overwritten one and local is the insider one. We can see that port numbers are used to forward the IP. Outside global and Outside Local IP's seem to be the reached IP. Since we did not have a rule for that they are not changed.

11. Finally, connect to other remote Routers using telnet, and display connected users and observe your IP address.

We have observed telnets in question 9. Check the purple written experiments. Also down below is one extra experiment with a full user list. The observation results are expected. The NATed IPs overwritten. Down below we see pc0 and pc1 have same IP address. Because they are behind same NAT.

The screenshot shows a terminal window titled "PC4" with the following content:

```

Packet Tracer PC Command Line 1.0
C:\>telnet 10.114.4.254
Trying 10.114.4.254 ...Open

User Access Verification

Password:
Router>show users
Line       User        Host(s)        Idle        Location
324 vty 0   idle        00:01:07 10.114.101.1
325 vty 1   idle        00:00:59 10.114.101.1
326 vty 2   idle        00:00:47 10.114.2.2
327 vty 3   idle        00:00:39 10.114.2.3
*328 vty 4   idle        00:00:00 10.114.103.1

Interface    User        Mode        Idle        Peer Address
Router>
  
```

A large red box covers the bottom half of the terminal window, containing the following text:

NATed IPs are overwritten, others are not. They are connected right now.

REFERENCES

LaTex Tutorials
Assignment Paper Lab11
Assignment Paper Lab12
Cisco Networking Academy Introduction
Cisco IOS Lan Book
Cisco VLAN Configuration
DTE Explanation
DCT Explanation
Serial Cables Configuration
Dynamic Routing
RIP Configuration
OSPF Configuration
EIGRP Configuration
Cisco NAT
NAT Overload
Access-list Bug