

	<b>CSC-203L : Computer Networks Lab</b>	<b>Instructor:</b> Anam Iftikhar
	<b>Lab Project</b>	
	Roll No: _____	<b>Total Marks: 35</b> <b>Marks Obtained:</b> _____ <b>CLO4</b>

**NOTE:**

- You can work in the group of three.
- **Project Deadline: 22<sup>nd</sup> December, 2024.**
- All the members of the group must be present at the time of submission (Viva). Absentee would be graded zeros.
- **The project will be evaluated on the basis of rubrics shared.**

❖ **Deliverables:**

- The designed network should be implemented in packet tracer, with necessary devices and full configuration details (*preferably CLI*)
- The network should be tested for all the mentioned parameters.

❖ **In Report:**

- Network topology (Properly labelled Packet Tracer Network Diagram)
- Sub Nets / VLANs / VLSM details
- Configuration Details
- Test Cases Simulations
- Fill this document according to your project specification and add at start of the report.

**The term unit is to represent the no of departments in the organization or institute selected**

1. You are designing a network for:

Hospital ( All the configuration done by cli)

\*Example: School, College, University, Hospital, Any Organization

2. No of Separate Units in *above mentioned*:

5 Units have separate Networks

\*Should not be less than five

\*Each Unit should have a separate network

3. Define the cost or budget of the *above mentioned* in terms of networking devices:

⊕ No. of Routers:	_____	2
⊕ No. of Switches:	_____	6

4. Define the number of End Devices allowed in each Unit:

## 1. Emergency VLAN:

- **Devices:** 30 PCs, 5 Printers, 10 Phones
- **Total Devices:** 45
- **Required Addresses:**  $45 + 1$  (network address) + 1 (broadcast address) = 47
- **Subnet Mask:** /26 (255.255.255.192)
- **Usable IP Range:** 192.168.0.1 - 192.168.0.62

## 2. Radiology VLAN:

- **Devices:** 20 PCs, 3 Printers
- **Total Devices:** 23
- **Required Addresses:**  $23 + 1$  (network address) + 1 (broadcast address) = 25
- **Subnet Mask:** /27 (255.255.255.224)
- **Usable IP Range:** 192.168.0.65 - 192.168.0.94

### 3. Administration VLAN:

- **Devices:** 10 PCs
- **Total Devices:** 10
- **Required Addresses:**  $10 + 1$  (network address) + 1 (broadcast address) = 12
- **Subnet Mask:** /28 (255.255.255.240)
- **Usable IP Range:** 192.168.0.97 - 192.168.0.110

### 4. Pharmacy VLAN:

- **Devices:** 15 PCs, 2 Printers
- **Total Devices:** 17 (Support up to 30)
- **Required Addresses:**  $30 + 1$  (network address) + 1 (broadcast address) = 32
- **Subnet Mask:** /27 (255.255.255.224)
- **Usable IP Range:** 192.168.0.129 - 192.168.0.158

### 5. General Wards VLAN:

- **Devices:** 25 PCs, 5 Phones
- **Total Devices:** 30
- **Required Addresses:**  $30 + 1$  (network address) + 1 (broadcast address) = 32
- **Subnet Mask:** /27 (255.255.255.224)
- **Usable IP Range:** 192.168.0.161 - 192.168.0.190

VLAN	Network Address	Subnet Mask	Usable Range	Total Devices Supported
Emergency	192.168.0.0	255.255.255.192 (/26)	192.168.0.1 - 192.168.0.62	62
Radiology	192.168.0.64	255.255.255.224 (/27)	192.168.0.65 - 192.168.0.94	30
Administration	192.168.0.96	255.255.255.240 (/28)	192.168.0.97 - 192.168.0.110	14
Pharmacy	192.168.0.128	255.255.255.224 (/27)	192.168.0.129 - 192.168.0.158	30
General Wards	192.168.0.160	255.255.255.224 (/27)	192.168.0.161 - 192.168.0.190	30

5. Define the number of Border Router:

1

\*should be at least one

6. Define the number of Routers connected to ISP for internet:

---

\**should be at least one*  
\*[You can use border router to connect to ISP]

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7. Communication amongst the Units:  
General Wards can Communicate with the Radiology, Pharmacy,

\*At least two units will not be able to communicate with each other

8. Define the number of servers and Types:

There two servers in Hospital networking. Web server and Email Server have static IP and public on Outer router

\*Example: HTTP Server (Google, Yahoo) or FTP or Email Server

\*One unit must have two servers' web and email

9. Un-authorized Access:

Emergency Unit can access Email or Web server. Others can not.

\*One unit can have access to all the servers

\*Restrict remaining units to access one or two servers

10. Routing Protocols used:

a) Between internal routers:

RIP2, DHCP and ACL for efficient security and access

b) With ISP router:

RIP, NAT

\*RIP, RIPv2, Static Routing, OSPF, BGP or any other

11. Private IP used (*select one prefix*):

192.168/16 used

\*Use DHCP to assign IP addresses to two units for rest of the units use static addressing

12. No. of Public Addresses allocated by ISP to *above mentioned*:

192.168.0.10, 192.168.0.9 resersed for Web server or Email server

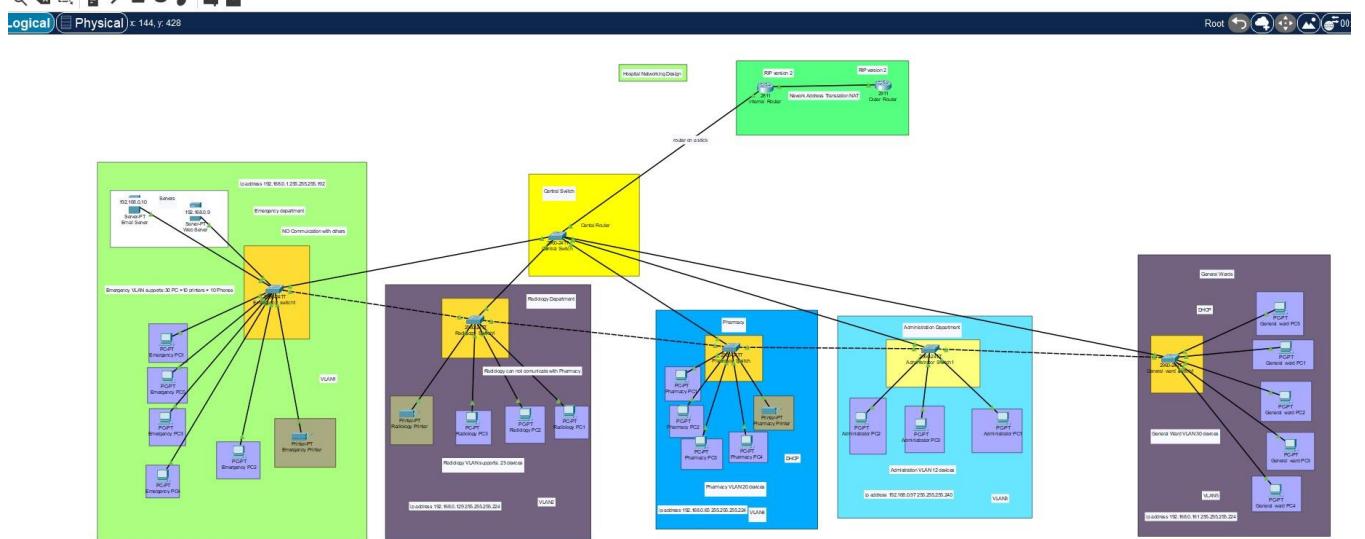
\*Example: The ISP has allocated 10 public addresses for this university, 105.12.32.15 – 24/25.

\*Last two addresses must be reserved for the web server and email server.

\*All private addresses allocated must be translated to public when accessing the Internet.

# REPORT

## 1. Diagram (Topology)



## 2. Sub netting

### a. VLSM

VLAN	Network Address	Subnet Mask	Usable Range	Total Addresses
10	192.168.0.0	255.255.255.192 (/26)	192.168.0.1 - 192.168.0.62	62
20	192.168.0.64	255.255.255.224 (/27)	192.168.0.65 - 192.168.0.94	30
30	192.168.0.96	255.255.255.240 (/28)	192.168.0.97 - 192.168.0.110	14
40	192.168.0.128	255.255.255.224 (/27)	192.168.0.129 - 192.168.0.158	30
50	192.168.0.160	255.255.255.224 (/27)	192.168.0.161 - 192.168.0.190	30

internal\_Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```
% Unknown command or computer name, or unable to find computer address

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#interface FastEthernet0/0.10
Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 192.168.0.1 255.255.255.192
Router(config-subif)#exit
Router(config)#
Router(config)#interface FastEthernet0/0.20
Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.168.0.65 255.255.255.224
Router(config-subif)#exit
Router(config)#
Router(config)#interface FastEthernet0/0.30
Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip address 192.168.0.97 255.255.255.240
Router(config-subif)#exit
Router(config)#
Router(config)#interface FastEthernet0/0.40
Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#ip address 192.168.0.129 255.255.255.224
Router(config-subif)#exit
Router(config)#
Router(config)#interface FastEthernet0/0.50
Router(config-subif)#encapsulation dot1Q 50
Router(config-subif)#ip address 192.168.0.161 255.255.255.224
Router(config-subif)#exit
Router(config)#
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#exit
Router(config)#
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.1.2
Router(config)#
Router(config)#end
Router#write memory
```

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Top

### 3. Configurations

#### a. Switch

Physical Config CLI Attributes

IOS Command Line Interface

```
Switch#
Switch#
Switch#
Switch#
Switch#show vlan brief

VLAN Name          Status      Ports
----  -----
1    default        active      Fa0/6, Fa0/7, Fa0/8, Fa0/9
                           Fa0/10, Fa0/11, Fa0/12, Fa0/13
                           Fa0/14, Fa0/15, Fa0/16, Fa0/17
                           Fa0/18, Fa0/19, Fa0/20, Fa0/21
                           Fa0/22, Fa0/23, Fa0/24, Gig0/1
                           Gig0/2

10   Emergency     active
20   Radiology     active
30   Administration active
40   Pharmacy      active
50   GeneralWards  active
1002 fddi-default active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default  active

Switch#show interfaces trunk

Port      Mode       Encapsulation  Status      Native vlan
Fa0/1    on         802.1q        trunking    1
Fa0/2    on         802.1q        trunking    1
Fa0/3    on         802.1q        trunking    1
Fa0/4    on         802.1q        trunking    1
Fa0/5    on         802.1q        trunking    1

Port      Vlans allowed on trunk
Fa0/1    1-1005
Fa0/2    1-1005
Fa0/3    1-1005
Fa0/4    1-1005
Fa0/5    1-1005

Port      Vlans allowed and active in management domain
Fa0/1    1,10,20,30,40,50
Fa0/2    1,10,20,30,40,50
Fa0/3    1,10,20,30,40,50
Fa0/4    1,10,20,30,40,50
Fa0/5    1,10,20,30,40,50

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/1    10,20,30,40,50
Fa0/2    10,20,30,40,50
Fa0/3    10,20,30,40,50
Fa0/4    10,20,30,40,50
```

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Top

Router#

Physical Config **CLI** Attributes

IOS Command Line Interface

```

Router(config-subif)# encapsulation dot1Q 30
Router(config-subif)# ip address 192.168.0.97 255.255.255.240
Router(config-subif)# no shutdown
Router(config-subif)# exit
Router(config)# interface fastEthernet0/0.40
Router(config-subif)# encapsulation dot1Q 40
Router(config-subif)# ip address 192.168.0.113 255.255.255.240
Router(config-subif)# no shutdown
Router(config-subif)# exit
Router(config)# interface fastEthernet0/0.50
Router(config-subif)# encapsulation dot1Q 50
Router(config-subif)# ip address 192.168.0.129 255.255.255.224
Router(config-subif)# no shutdown
Router(config-subif)# exit
Router(config)#interface fastEthernet0/0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#show ip interface brief
^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief


| Interface          | IP-Address    | OK? | Method | Status                | Protocol |
|--------------------|---------------|-----|--------|-----------------------|----------|
| FastEthernet0/0    | unassigned    | YES | unset  | up                    | up       |
| FastEthernet0/0.10 | 192.168.0.1   | YES | manual | up                    | up       |
| FastEthernet0/0.20 | 192.168.0.65  | YES | manual | up                    | up       |
| FastEthernet0/0.30 | 192.168.0.97  | YES | manual | up                    | up       |
| FastEthernet0/0.40 | 192.168.0.113 | YES | manual | up                    | up       |
| FastEthernet0/0.50 | 192.168.0.129 | YES | manual | up                    | up       |
| FastEthernet0/1    | unassigned    | YES | unset  | up                    | down     |
| Serial0/0/0        | unassigned    | YES | unset  | administratively down | down     |
| Serial0/0/1        | unassigned    | YES | unset  | administratively down | down     |
| Vlan1              | unassigned    | YES | unset  | administratively down | down     |


Router# ping 192.168.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5) round trip min/avg/max = 0/7/15 ms

```

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on

VLAN

192.168.0.0

92.168.0.96 0

92.168.0.128

Router0

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#access-list 100 deny ip 192.168.0.96 0.0.0.15 any
Router(config)# access-list 100 permit ip any any
Router(config)#
Router(config)# interface fastEthernet0/0.30
Router(config-subif)# ip access-group 100 in
Router(config-subif)# exit
Router(config)#
Router(config)#access-list 101 deny ip 192.168.0.96 0.0.0.15 192.168.0.128 0.0.0.31
Router(config)# access-list 101 permit ip any any
Router(config)# interface fastEthernet0/0.30
Router(config-subif)# ip access-group 101 in
Router(config-subif)# exit
Router(config)# access-list 102 deny ip 192.168.0.128 0.0.0.31 192.168.0.96 0.0.0.15
Router(config)# access-list 102 permit ip any any
Router(config)# interface fastEthernet0/0.50
Router(config-subif)# ip access-group 102 in
Router(config-subif)# exit
Router(config)# access-list 103 permit ip 192.168.0.112 0.0.0.15 192.168.0.0 0.0.0.63
Router(config)# access-list 103 deny ip any any
Router(config)# interface fastEthernet0/0.40
Router(config-subif)# ip access-group 103 in
Router(config-subif)# exit
Router(config)# access-list 107 deny ip 192.168.0.64 0.0.0.31 192.168.0.128 0.0.0.31
Router(config)# access-list 107 permit ip any any
Router(config)# interface fastEthernet0/0.20
Router(config-subif)# ip access-group 107 in
Router(config-subif)#exit
Router(config)# access-list 106 deny ip 192.168.0.64 0.0.0.31 192.168.0.96 0.0.0.15
Router(config)# access-list 106 permit ip any any
Router(config)# interface fastEthernet0/0.20
Router(config-subif)# ip access-group 106 in
Router(config-subif)#exit
Router(config)#

```

Top

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Physical    Config    **CLI**    Attributes

VLAN 28 0.

0 0.

IOS Command Line Interface

```
interface fastethernet0/0.10
^
% Invalid input detected at '^' marker.

Router#ip access-group 101 in
^
% Invalid input detected at '^' marker.

Router#
Router#
Router#
Router#interface fastethernet0/0.10
^
% Invalid input detected at '^' marker.

Router#ip access-group 101 in
^
% Invalid input detected at '^' marker.

Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fastethernet0/0.10
Router(config-subif)#ip access-group 101 in
Router(config-subif)#exit
Router(config)#interface fastethernet0/0.40
Router(config-subif)#ip access-group 101 in
Router(config-subif)#exit
Router(config)#
Router(config)#access-list 102 deny ip 192.168.0.160 0.0.0.31 192.168.0.0 0.0.0.255
Router(config)#access-list 102 permit ip any any
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fastethernet0/0.50
Router(config-subif)#ip access-group 102 in
Router(config-subif)#exit
Router(config)#
Router(config)#

```

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**trunking Switch**

Physical Config **CLI** Attributes

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-3-UPDOWN: Interface FastEthernet0/2, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-3-UPDOWN: Interface FastEthernet0/4, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to down
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up

Switch>enable
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# vlan 10
Switch(config-vlan)# name Emergency
Switch(config-vlan)# exit
Switch(config)# vlan 20
Switch(config-vlan)# name Radiology
Switch(config-vlan)# exit
Switch(config)# vlan 30
Switch(config-vlan)# name Administration
Switch(config-vlan)# exit
Switch(config)# vlan 40
Switch(config-vlan)# name Pharmacy
Switch(config-vlan)# exit
Switch(config)# vlan 50
Switch(config-vlan)# name GeneralWards
Switch(config-vlan)# exit
Switch(config)#
Switch(config)#

```

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**24**

**Console Switch**

```
Router(config-subif)#ip address 192.168.0.129 255.255.255.224
% 192.168.0.128 overlaps with FastEthernet0/0.50
Router(config-subif)#exit
Router(config)#interface FastEthernet0/0.40
Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#ip address 192.168.0.129 255.255.255.224
% 192.168.0.128 overlaps with FastEthernet0/0.50
Router(config-subif)#exit
Router(config)#
Router(config)#interface FastEthernet0/0.50
Router(config-subif)#encapsulation dot1Q 50
Router(config-subif)#ip address 192.168.0.161 255.255.255.224
Router(config-subif)#exit
Router(config)#
Router(config)#interface FastEthernet0/0.40
Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#ip address 192.168.0.129 255.255.255.224
Router(config-subif)#exit
Router(config)#end
Router#write memory
Building configuration...
[OK]
Router#
%SYS-5-CONFIG_I: Configured from console by console

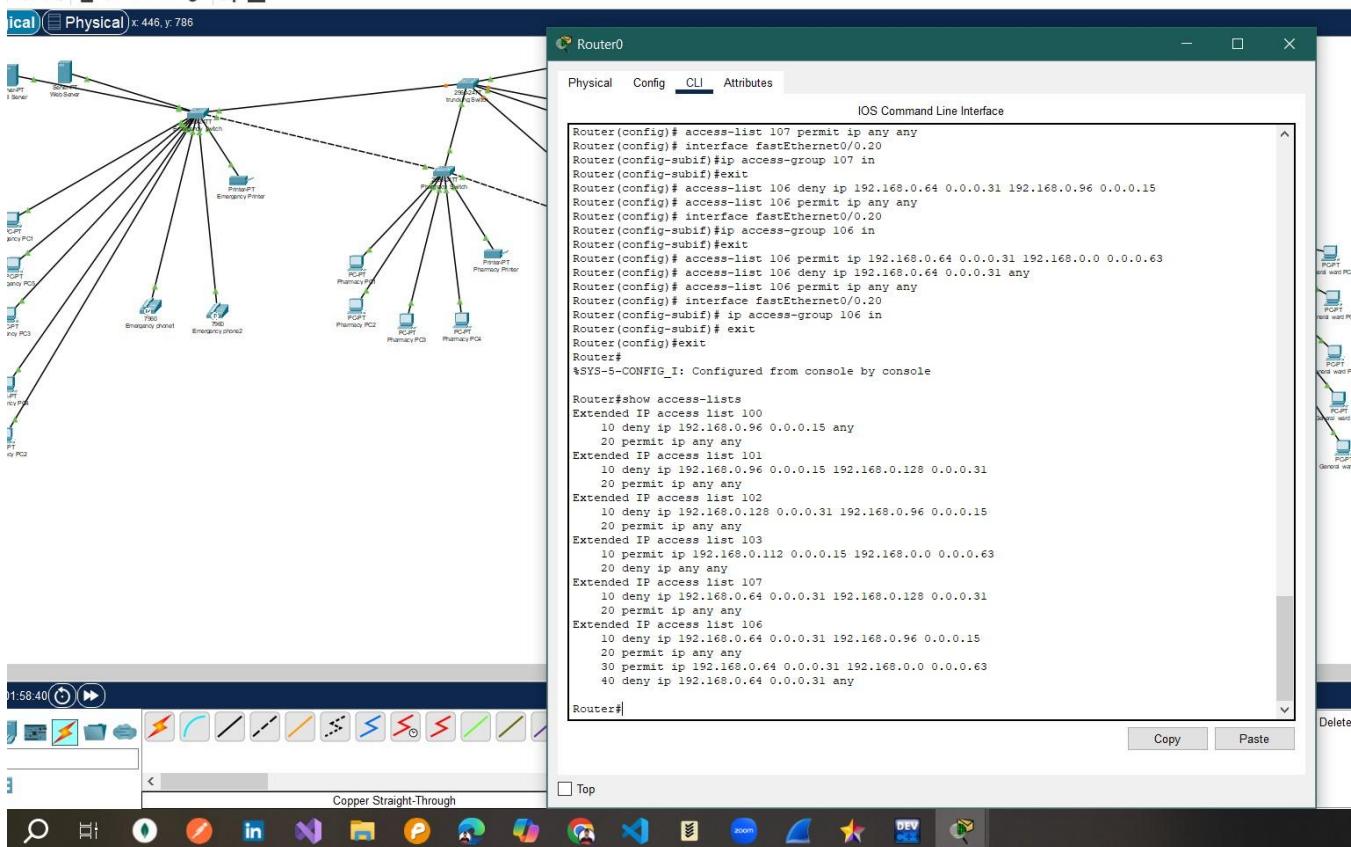
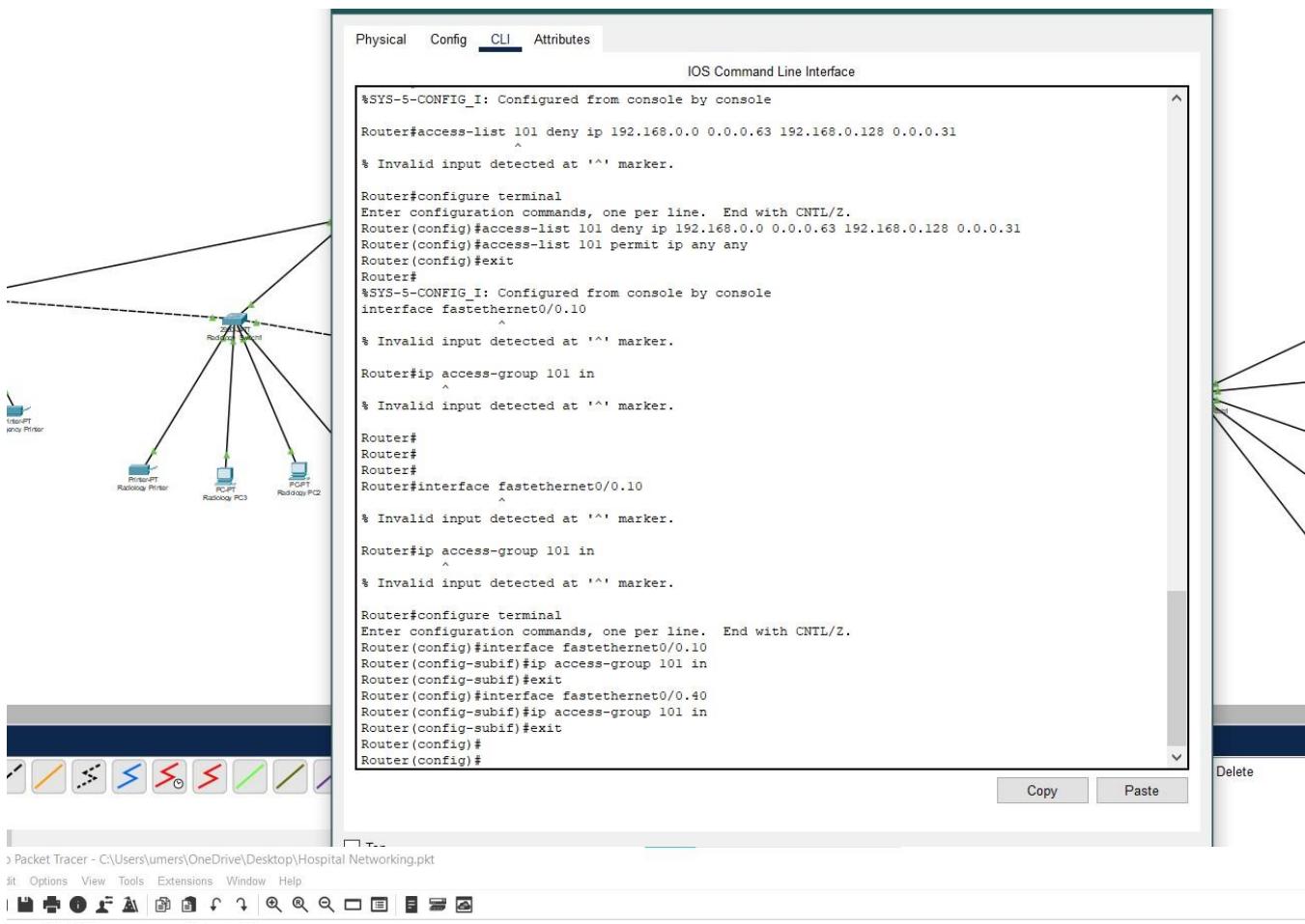
Router#
Router#
Router#end
Translating "end"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

Router#show ip interface brief
Interface          IP-Address      OK? Method Status          Protocol
FastEthernet0/0     unassigned      YES unset administratively down down
FastEthernet0/0.10   192.168.0.1    YES manual administratively down down
FastEthernet0/0.20   192.168.0.65   YES manual administratively down down
FastEthernet0/0.30   192.168.0.97   YES manual administratively down down
FastEthernet0/0.40   192.168.0.129  YES manual administratively down down
FastEthernet0/0.50   192.168.0.161  YES manual administratively down down
FastEthernet0/1      unassigned      YES unset administratively down down
Vlan1              unassigned      YES unset administratively down down
Router#

```

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**Delete**

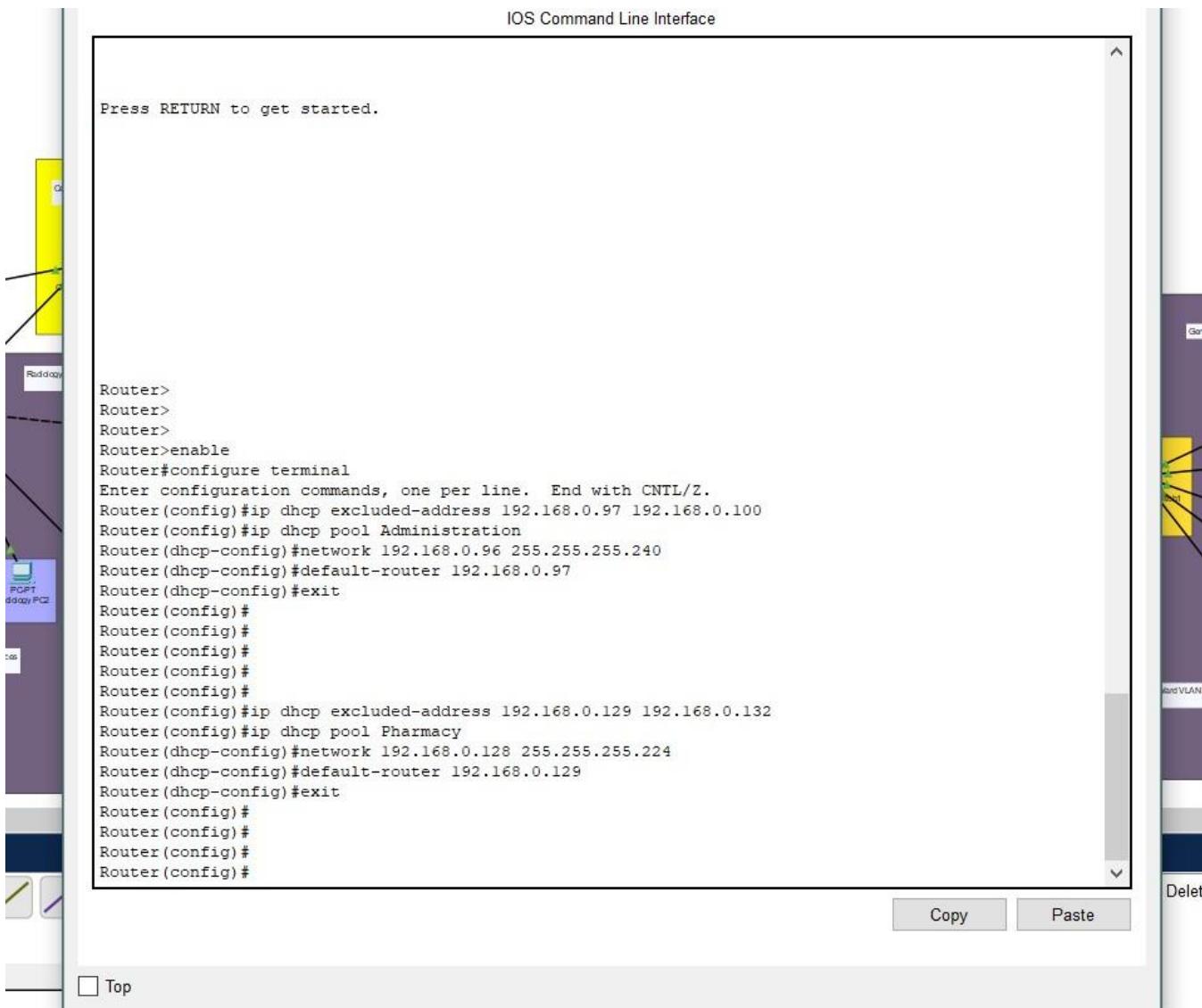


IOS Command Line Interface

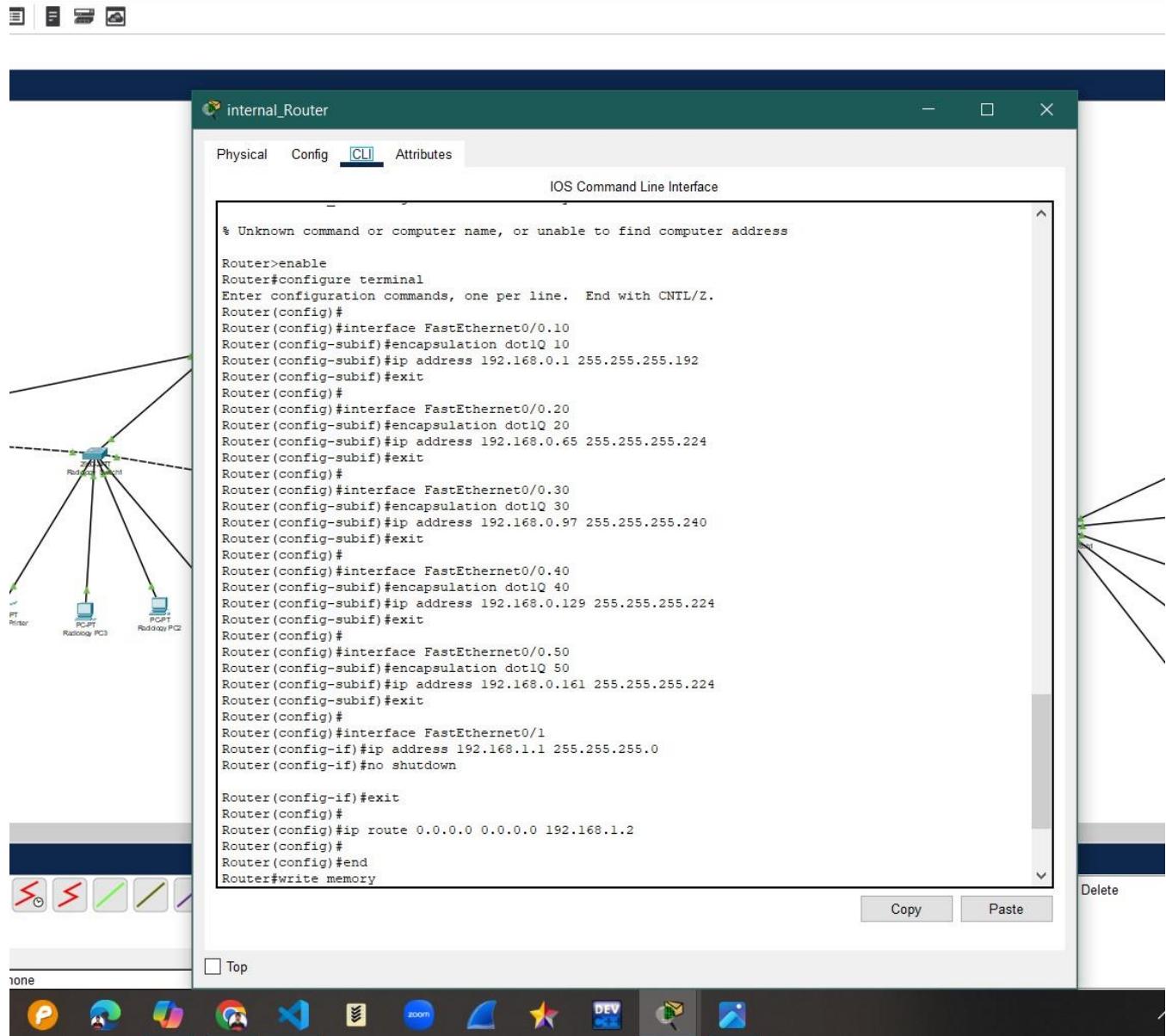
Press RETURN to get started.

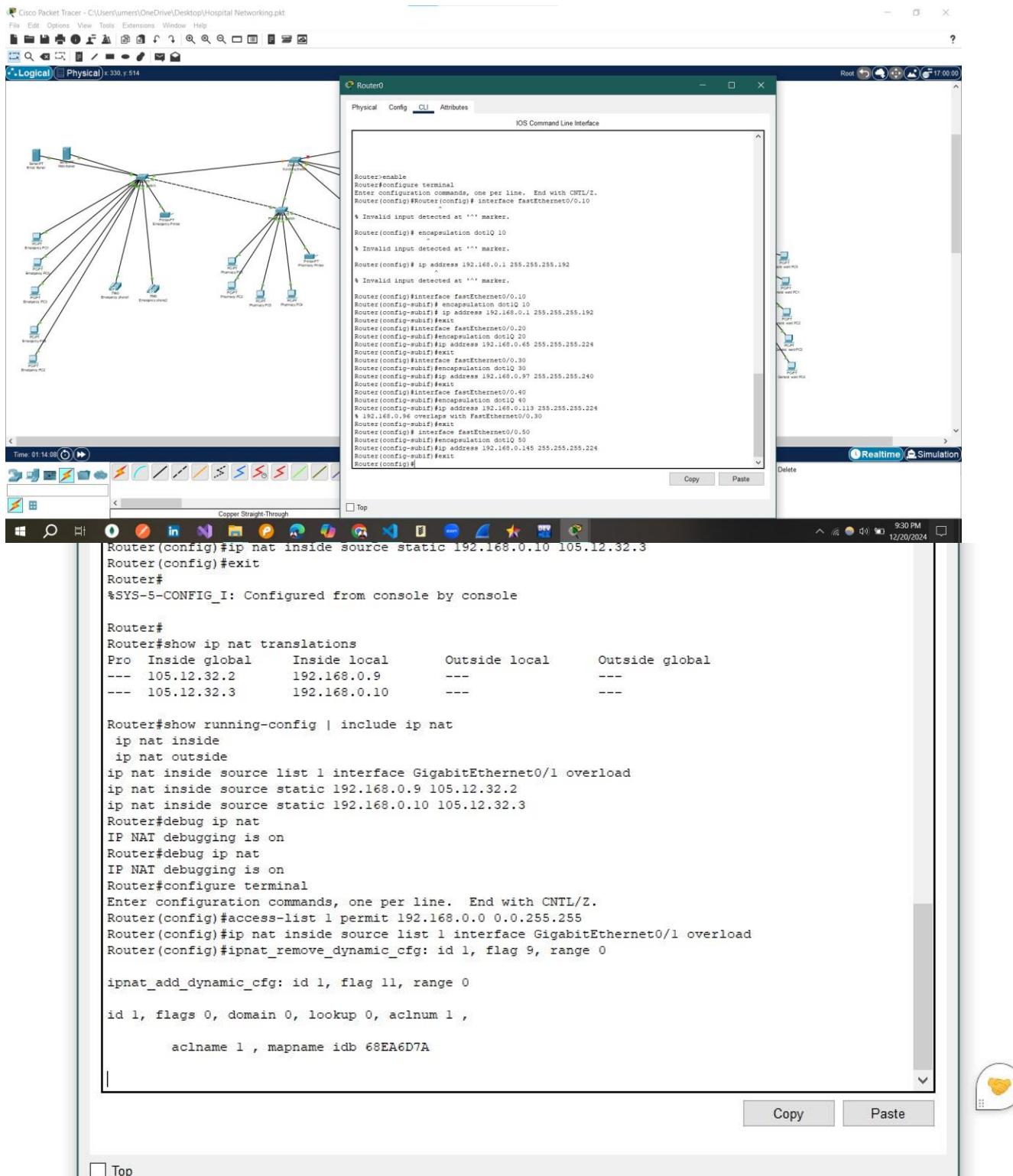
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/working.pkt





internal\_Router

Physical    Config    **CLI**    Attributes

IOS Command Line Interface

```
Pending event : none

1 subnet is currently in the pool
Current index      IP address range          Leased/Excluded/Total
192.168.0.65      192.168.0.65 - 192.168.0.126    0 / 3 / 62

Pool Emergency :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next)   : 0 / 0
Total addresses           : 62
Leased addresses          : 0
Excluded addresses        : 3
Pending event              : none

1 subnet is currently in the pool
Current index      IP address range          Leased/Excluded/Total
192.168.0.1       192.168.0.1 - 192.168.0.62    0 / 3 / 62

Pool Pharmacy :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next)   : 0 / 0
Total addresses           : 30
Leased addresses          : 5
Excluded addresses        : 3
Pending event              : none

1 subnet is currently in the pool
Current index      IP address range          Leased/Excluded/Total
192.168.0.129     192.168.0.129 - 192.168.0.158   5 / 3 / 30

Pool Administration :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next)   : 0 / 0
Total addresses           : 14
Leased addresses          : 0
Excluded addresses        : 3
Pending event              : none

1 subnet is currently in the pool
Current index      IP address range          Leased/Excluded/Total
192.168.0.97      192.168.0.97 - 192.168.0.110   0 / 3 / 14

Router#
```

Top

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```
Router>
Router>
Router>
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#show ip route
^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
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 0.0.0.0 to network 0.0.0.0

  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/0
L        192.168.1.2/32 is directly connected, GigabitEthernet0/0
S*    0.0.0.0/0 is directly connected, GigabitEthernet0/0

Router#
```

Physical Config **CLI** Attributes

IOS Command Line Interface

```
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 0.0.0.0 to network 0.0.0.0

      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/0
L        192.168.1.2/32 is directly connected, GigabitEthernet0/0
S*    0.0.0.0/0 is directly connected, GigabitEthernet0/0

Router#show ip nat translations
Router#ip nat inside source static 192.168.0.9 105.12.32.2
^
% Invalid input detected at '^' marker.

Router#ip nat inside source static 192.168.0.10 105.12.32.3
^
% Invalid input detected at '^' marker.

Router#
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip nat inside source static 192.168.0.9 105.12.32.2
Router(config)#ip nat inside source static 192.168.0.10 105.12.32.3
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

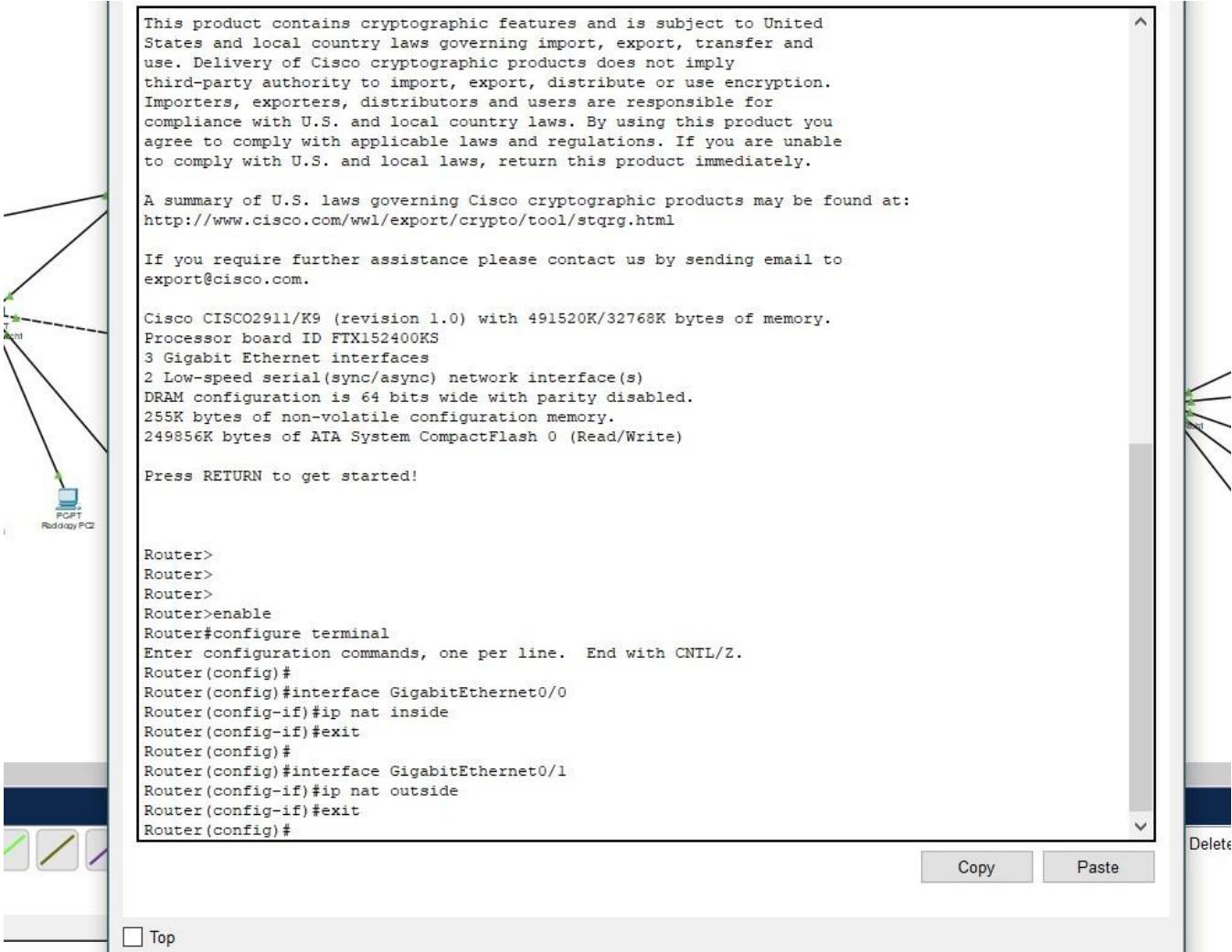
Router#
Router#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
--- 105.12.32.2        192.168.0.9       ---             ---
--- 105.12.32.3        192.168.0.10      ---             ---
```

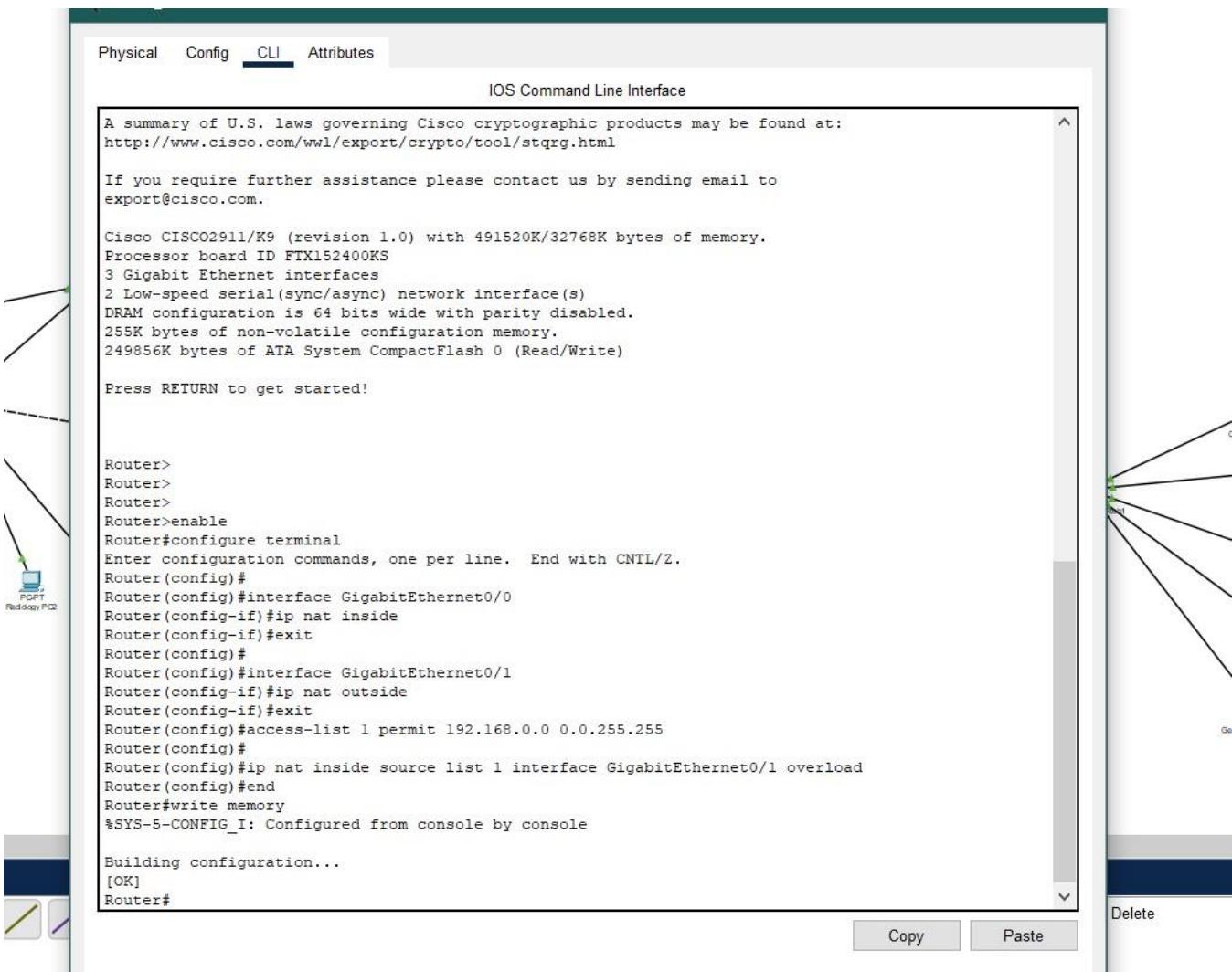
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Outer\_Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Router>
Router>
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#interface GigabitEthernet0/0
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#ip nat inside
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
Router(config)#interface GigabitEthernet0/1
Router(config-if)#ip address 105.12.32.1 255.255.255.240
Router(config-if)#ip nat outside
Router(config-if)#no shutdown

Router(config-if)#exit
Router(config)#
Router(config)#access-list 1 permit 192.168.0.0 0.0.255.255
Router(config)#
Router(config)#ip nat inside source list 1 interface GigabitEthernet0/1 overload
Router(config)#
Router(config)#ip route 0.0.0.0 0.0.0.0 GigabitEthernet0/1
Router(config)#
Router(config)#end
Router#write memory
Building configuration...
[OK]
Router#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%SYS-5-CONFIG_I: Configured from console by console
```

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internal\_Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/25/83 ms

Router#ping 192.168.0.65

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/10/44 ms

Router#ping 192.168.0.97

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/13/49 ms

Router#ping 192.168.0.130

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.130, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router#ping 192.168.0.129

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/3/12 ms

Router#ping 192.168.0.161

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.161, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/3/15 ms

Router#
```

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Physical Config S/W Attributes

IOS Command Line Interface

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/7/15 ms

Router# ping 192.168.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/5/8 ms

Router# ping 192.168.0.65

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/11/21 ms

Router# ping 192.168.0.97

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/10/21 ms

Router# ping 192.168.0.113

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.113, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/9/18 ms

Router# ping 192.168.0.129

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/8/21 ms

Router#

```

Router(config)#
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.1.2
Router(config)#
Router(config)#end
Router#write memory
Building configuration...
[OK]
Router#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%SYS-5-CONFIG\_I: Configured from console by console
Router#
Router#ping 192.168.1.2

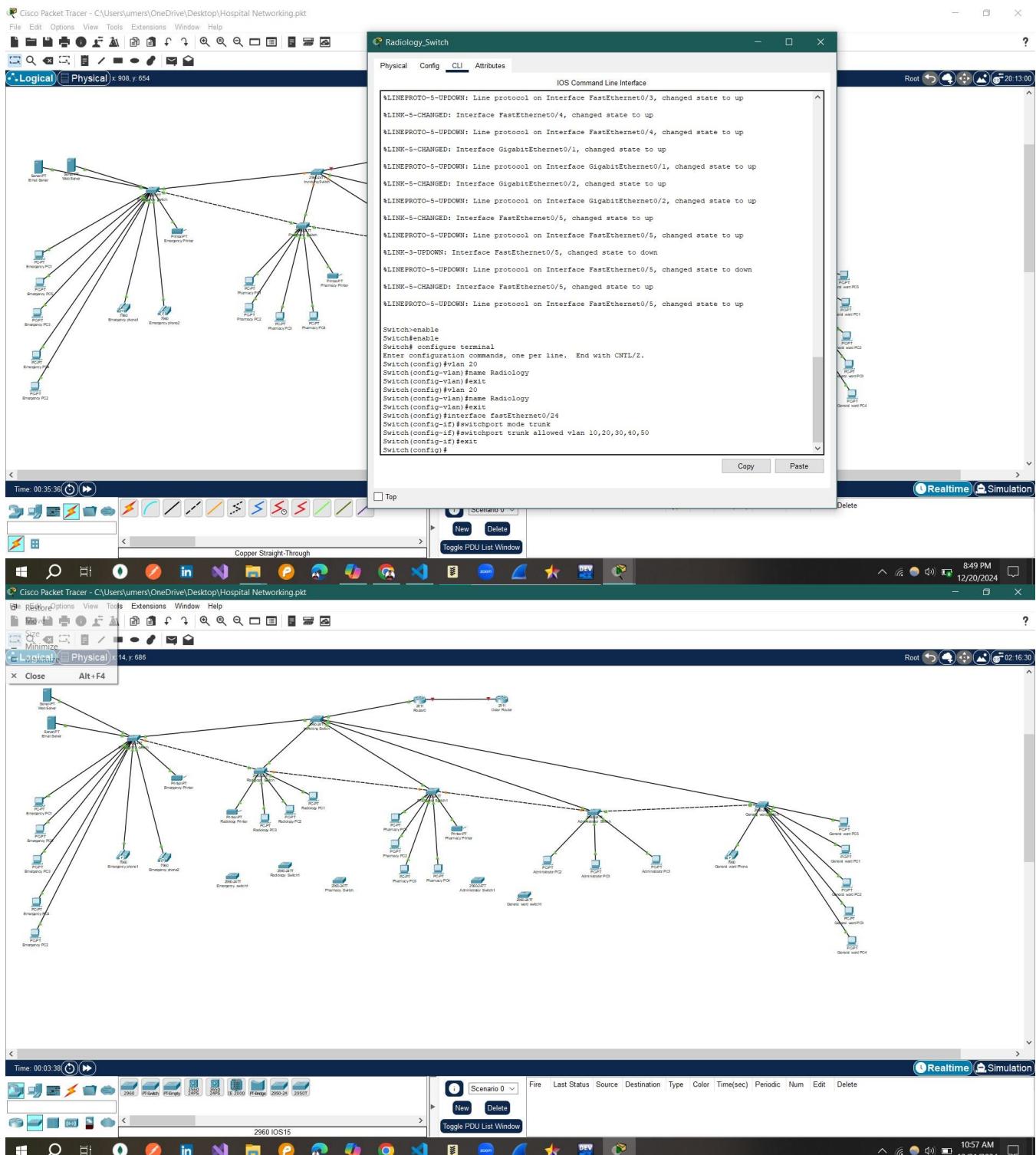
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

Router#

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PCPT Redbox PC2



internal\_Router

Physical Config CLI Attributes

IOS Command Line Interface

```
Router(config-router)#network 192.168.0.0
Router(config-router)#no auto-summary
Router(config-router)#
Router(config-router)#exit
Router(config)#show ip route
^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
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 192.168.1.2 to network 0.0.0.0

  192.168.0.0/24 is variably subnetted, 10 subnets, 4 masks
C    192.168.0.0/26 is directly connected, FastEthernet0/0.10
L    192.168.0.1/32 is directly connected, FastEthernet0/0.10
C    192.168.0.64/27 is directly connected, FastEthernet0/0.20
L    192.168.0.65/32 is directly connected, FastEthernet0/0.20
C    192.168.0.96/28 is directly connected, FastEthernet0/0.30
L    192.168.0.97/32 is directly connected, FastEthernet0/0.30
C    192.168.0.128/27 is directly connected, FastEthernet0/0.40
L    192.168.0.129/32 is directly connected, FastEthernet0/0.40
C    192.168.0.160/27 is directly connected, FastEthernet0/0.50
L    192.168.0.161/32 is directly connected, FastEthernet0/0.50
  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.1.0/24 is directly connected, FastEthernet0/1
L    192.168.1.1/32 is directly connected, FastEthernet0/1
S*   0.0.0.0/0 [1/0] via 192.168.1.2

Router#
Router#
Router#
Router#
```

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```
Router>
Router>
Router>enable
Router#ip routes
^
% Invalid input detected at '^' marker.

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 192.168.1.2 to network 0.0.0.0

  192.168.0.0/24 is variably subnetted, 10 subnets, 4 masks
C    192.168.0.0/26 is directly connected, FastEthernet0/0.10
L    192.168.0.1/32 is directly connected, FastEthernet0/0.10
C    192.168.0.64/27 is directly connected, FastEthernet0/0.20
L    192.168.0.65/32 is directly connected, FastEthernet0/0.20
C    192.168.0.96/28 is directly connected, FastEthernet0/0.30
L    192.168.0.97/32 is directly connected, FastEthernet0/0.30
C    192.168.0.128/27 is directly connected, FastEthernet0/0.40
L    192.168.0.129/32 is directly connected, FastEthernet0/0.40
C    192.168.0.160/27 is directly connected, FastEthernet0/0.50
L    192.168.0.161/32 is directly connected, FastEthernet0/0.50
  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
--More--
```

Co

```
.0 .0 .
-----,-----,-----
Router(config-subif)#ip access-group 102 in
Router(config-subif)#exit
Router(config)#
Router(config)#show access-lists 100
^
% Invalid input detected at '^' marker.

Router(config)#show access-lists 101
^
% Invalid input detected at '^' marker.

Router(config)#show access-lists 102
^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
Router#show access-lists 100
Extended IP access list 100
  deny ip 192.168.0.96 0.0.0.15 192.168.0.0 0.0.0.255
  permit ip any any

Router#show access-lists 101
Extended IP access list 101
  deny ip 192.168.0.0 0.0.0.63 192.168.0.128 0.0.0.31
  permit ip any any

Router#show access-lists 102
Extended IP access list 102
  deny ip 192.168.0.160 0.0.0.31 192.168.0.0 0.0.0.255
  permit ip any any

Router#
```

\$ Code read ou

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**Radiology\_Switch1**

Physical Config **CLI** Attributes

IOS Command Line Interface 32

```

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up

Switch>
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name Radiology
Switch(config-vlan)#exit
Switch(config)#interface range FastEthernet0/1-10
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#exit
Switch(config)#interface FastEthernet0/5
Switch(config-if)#switchport mode trunk

Switch(config-if)#exit
Switch(config)#end
Switch#write memory
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
%SYS-5-CONFIG_I: Configured from console by console

Building configuration...
[OK]
Switch#

```

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**b. Router**

Outer\_Router

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Router>
Router>
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#interface GigabitEthernet0/0
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#ip nat inside
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
Router(config)#interface GigabitEthernet0/1
Router(config-if)#ip address 105.12.32.1 255.255.255.240
Router(config-if)#ip nat outside
Router(config-if)#no shutdown

Router(config-if)#exit
Router(config)#
Router(config)#access-list 1 permit 192.168.0.0 0.0.255.255
Router(config)#
Router(config)#ip nat inside source list 1 interface GigabitEthernet0/1 overload
Router(config)#
Router(config)#ip route 0.0.0.0 0.0.0.0 GigabitEthernet0/1
Router(config)#
Router(config)#end
Router#write memory
Building configuration...
[OK]
Router#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%SYS-5-CONFIG_I: Configured from console by console
```

Top

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Physical Config SLP Attributes

IOS Command Line Interface

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/7/15 ms

Router# ping 192.168.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/5/8 ms

Router# ping 192.168.0.65

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/11/21 ms

Router# ping 192.168.0.97

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/10/21 ms

Router# ping 192.168.0.113

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.113, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/9/18 ms

Router# ping 192.168.0.129

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/8/21 ms

Router#
```

c.

internal\_Router

Physical Config CLI Attributes

IOS Command Line Interface

```
Router(config-router)#network 192.168.0.0
Router(config-router)#no auto-summary
Router(config-router)#
Router(config-router)#exit
Router(config)#show ip route
^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
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 192.168.1.2 to network 0.0.0.0

  192.168.0.0/24 is variably subnetted, 10 subnets, 4 masks
C    192.168.0.0/26 is directly connected, FastEthernet0/0.10
L    192.168.0.1/32 is directly connected, FastEthernet0/0.10
C    192.168.0.64/27 is directly connected, FastEthernet0/0.20
L    192.168.0.65/32 is directly connected, FastEthernet0/0.20
C    192.168.0.96/28 is directly connected, FastEthernet0/0.30
L    192.168.0.97/32 is directly connected, FastEthernet0/0.30
C    192.168.0.128/27 is directly connected, FastEthernet0/0.40
L    192.168.0.129/32 is directly connected, FastEthernet0/0.40
C    192.168.0.160/27 is directly connected, FastEthernet0/0.50
L    192.168.0.161/32 is directly connected, FastEthernet0/0.50
  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.1.0/24 is directly connected, FastEthernet0/1
L    192.168.1.1/32 is directly connected, FastEthernet0/1
S*   0.0.0.0/0 [1/0] via 192.168.1.2

Router#
Router#
Router#
Router#
```

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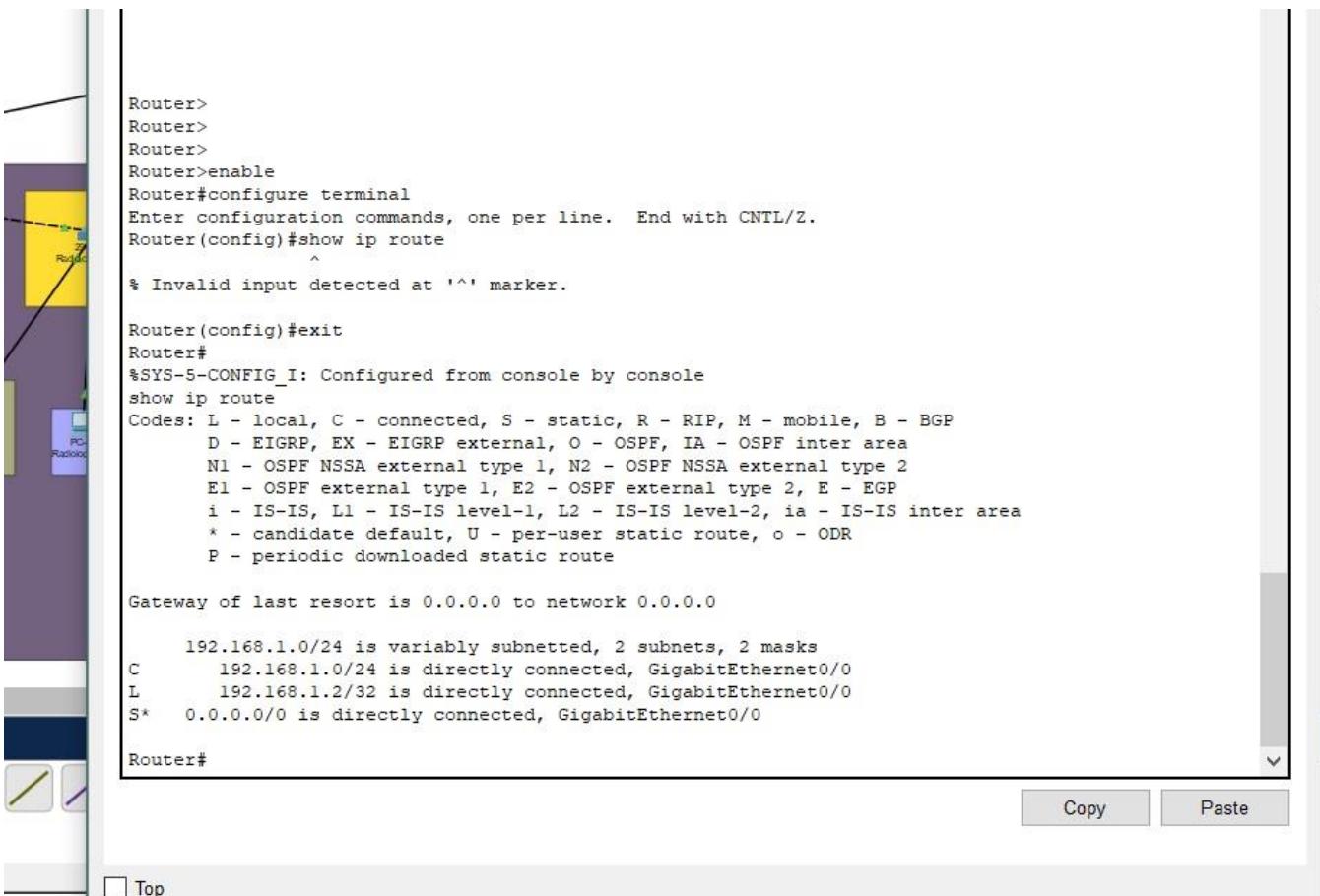
```
Router>
Router>
Router>enable
Router#ip routes
^
% Invalid input detected at '^' marker.

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 192.168.1.2 to network 0.0.0.0

      192.168.0.0/24 is variably subnetted, 10 subnets, 4 masks
C        192.168.0.0/26 is directly connected, FastEthernet0/0.10
L        192.168.0.1/32 is directly connected, FastEthernet0/0.10
C        192.168.0.64/27 is directly connected, FastEthernet0/0.20
L        192.168.0.65/32 is directly connected, FastEthernet0/0.20
C        192.168.0.96/28 is directly connected, FastEthernet0/0.30
L        192.168.0.97/32 is directly connected, FastEthernet0/0.30
C        192.168.0.128/27 is directly connected, FastEthernet0/0.40
L        192.168.0.129/32 is directly connected, FastEthernet0/0.40
C        192.168.0.160/27 is directly connected, FastEthernet0/0.50
L        192.168.0.161/32 is directly connected, FastEthernet0/0.50
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
--More--
```

C



```
Router>
Router>
Router>
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#show ip route
^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
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

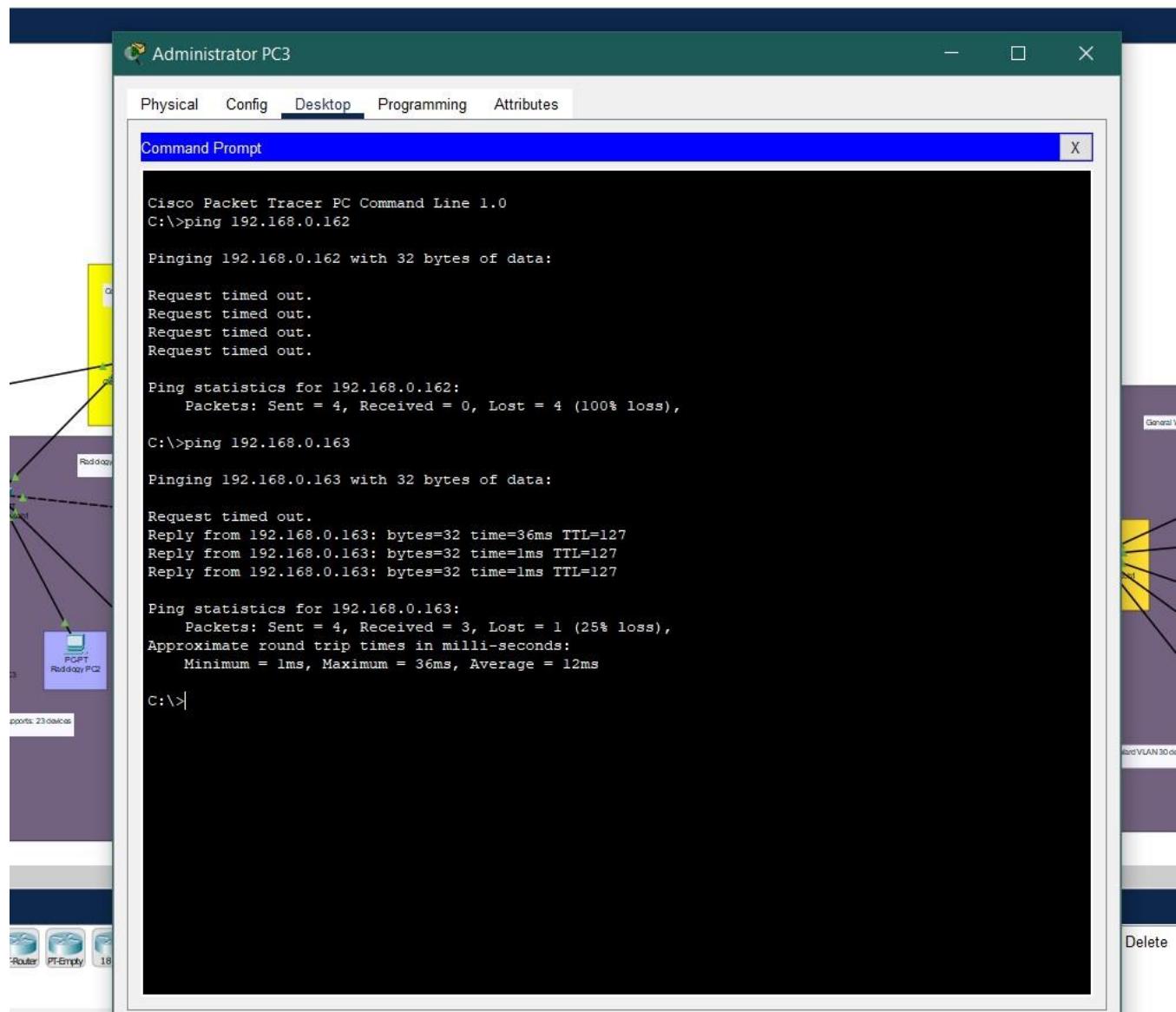
Gateway of last resort is 0.0.0.0 to network 0.0.0.0

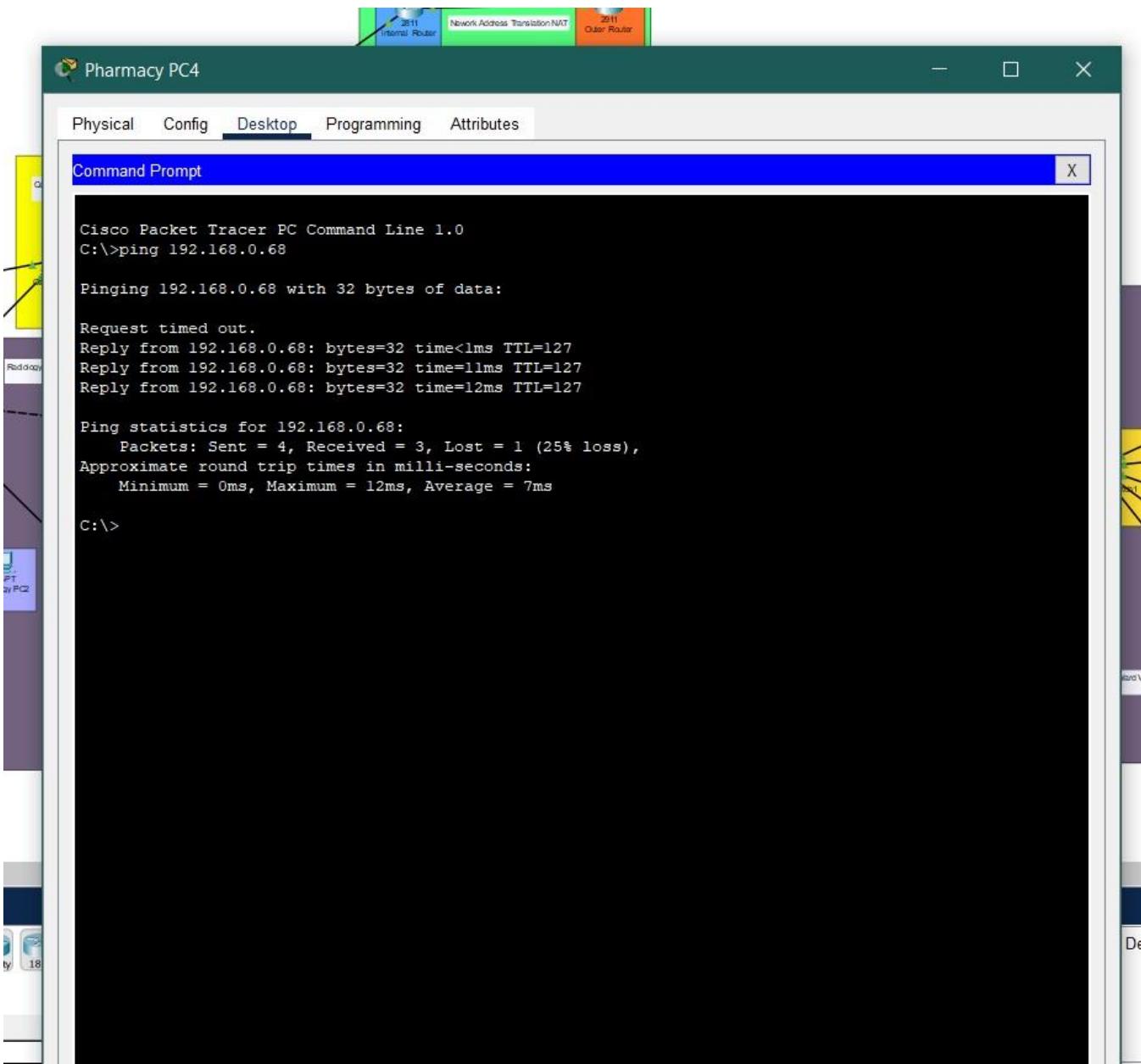
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/0
L        192.168.1.2/32 is directly connected, GigabitEthernet0/0
S*    0.0.0.0/0 is directly connected, GigabitEthernet0/0

Router#
```

Top

#### 4. Simulations





Administrator PC3

Physical Config Desktop Programming Attributes

Command Prompt X

```
Cisco Packet Tracer PC Command Line 1.0
C:\>192.168.0.65
Invalid Command.

C:\>ping 192.168.0.65

Pinging 192.168.0.65 with 32 bytes of data:

Reply from 192.168.0.65: bytes=32 time<1ms TTL=255
Reply from 192.168.0.65: bytes=32 time<1ms TTL=255
Reply from 192.168.0.65: bytes=32 time=12ms TTL=255
Reply from 192.168.0.65: bytes=32 time=16ms TTL=255

Ping statistics for 192.168.0.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 16ms, Average = 7ms

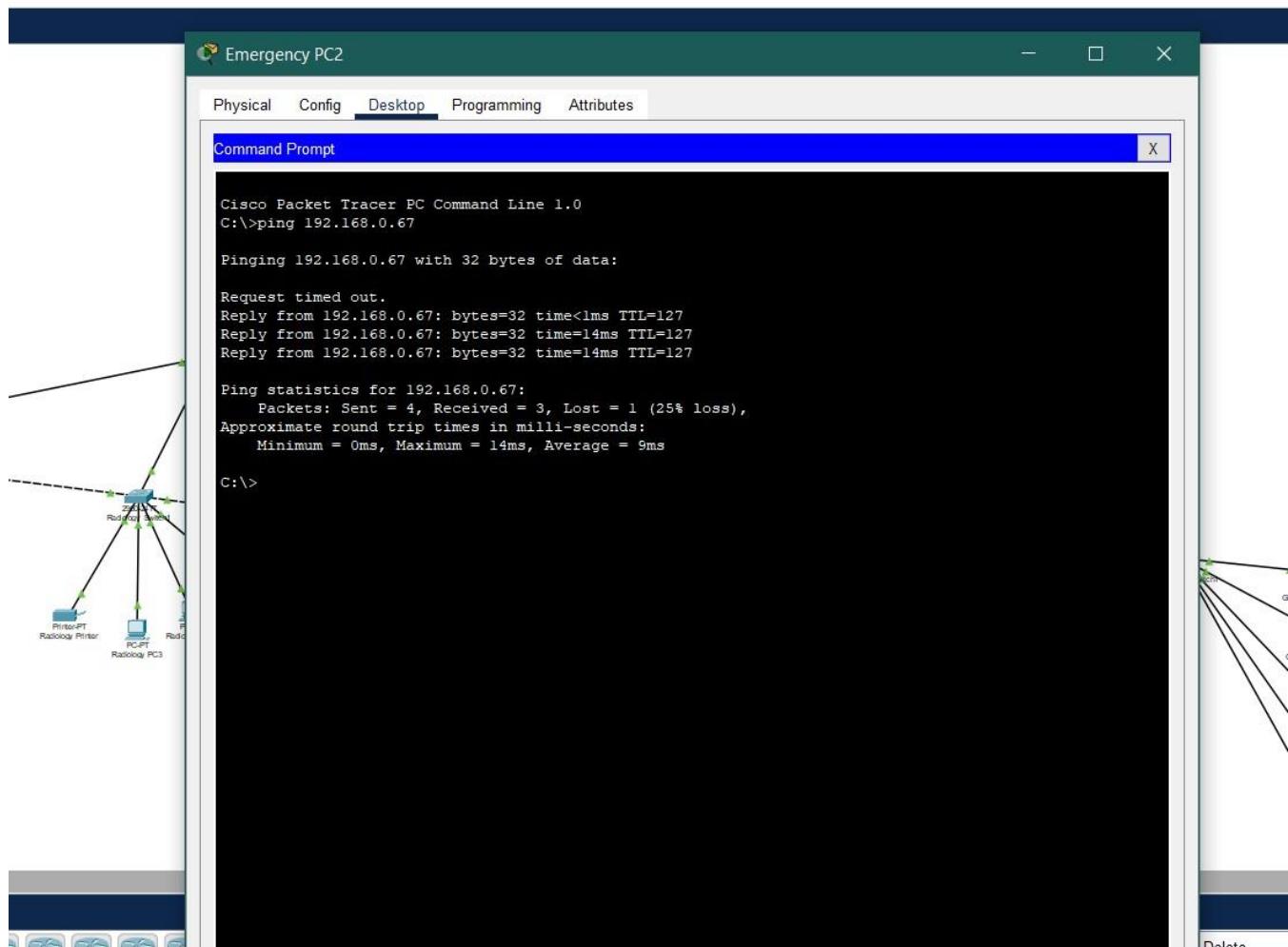
C:\>ping 192.168.0.67

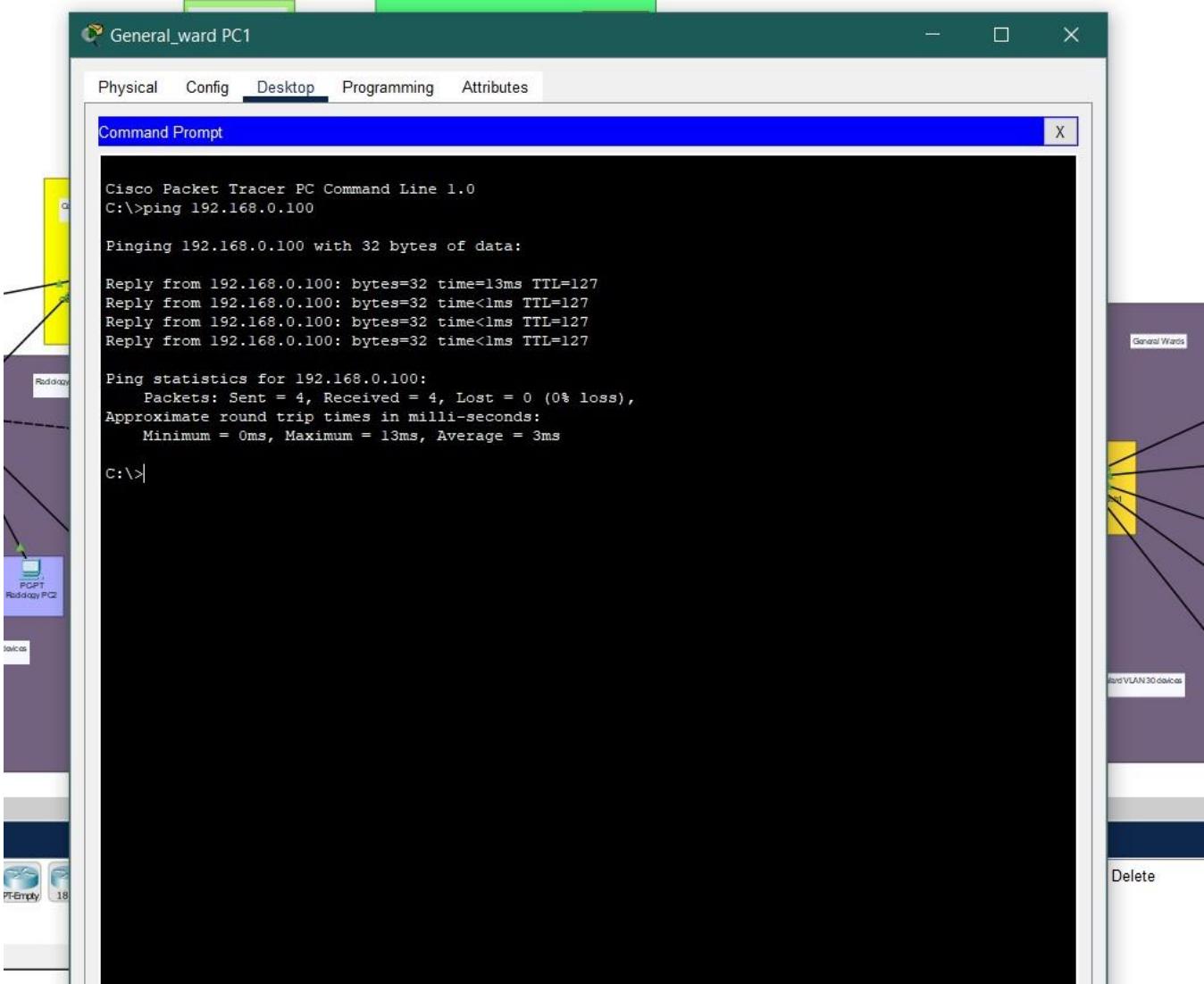
Pinging 192.168.0.67 with 32 bytes of data:

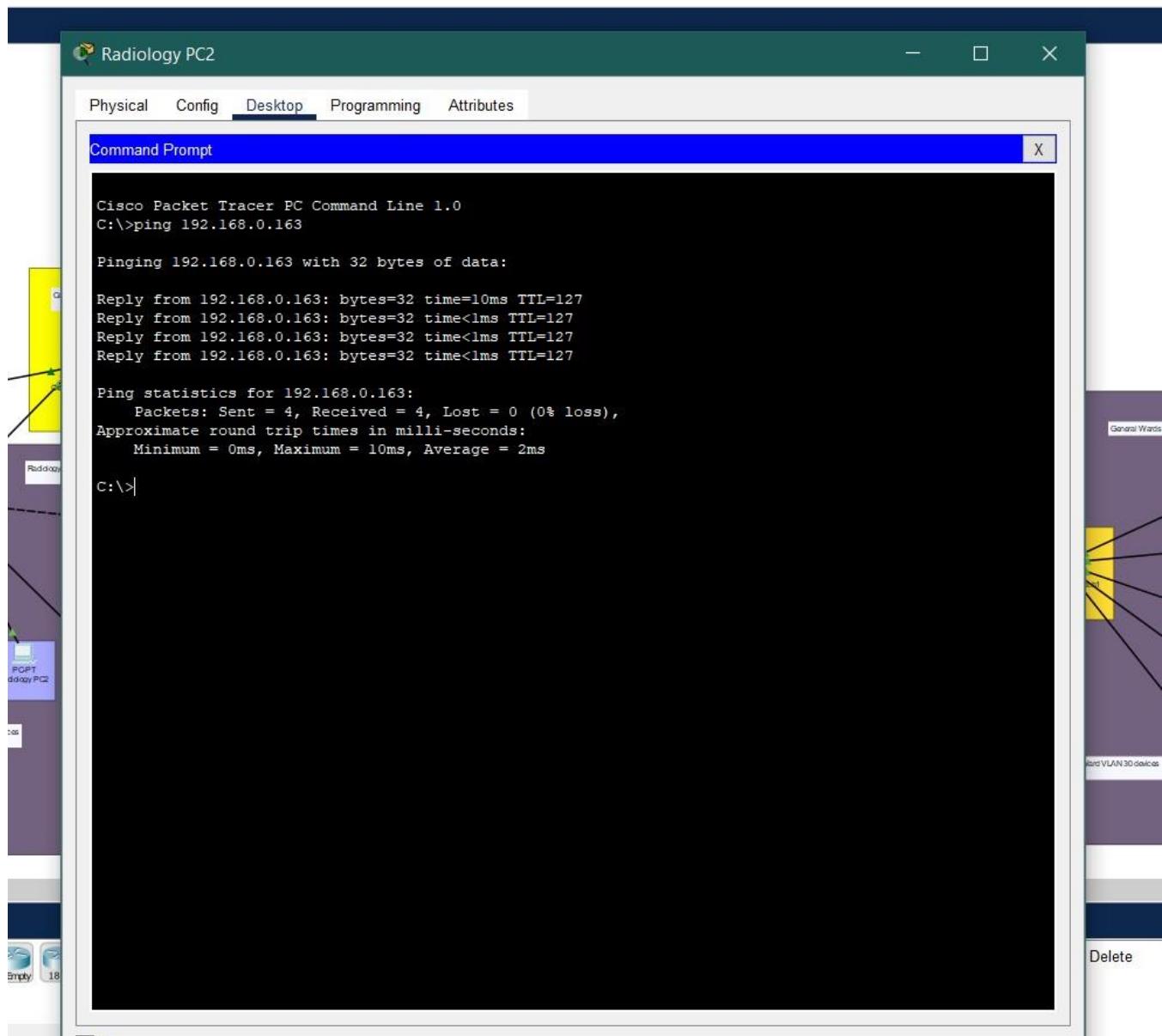
Request timed out.
Reply from 192.168.0.67: bytes=32 time=11ms TTL=127
Reply from 192.168.0.67: bytes=32 time=14ms TTL=127
Reply from 192.168.0.67: bytes=32 time=15ms TTL=127

Ping statistics for 192.168.0.67:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 11ms, Maximum = 15ms, Average = 13ms

C:\>
```







Department of Computer Science, University of Engineering and Technology Lahore, New Campus