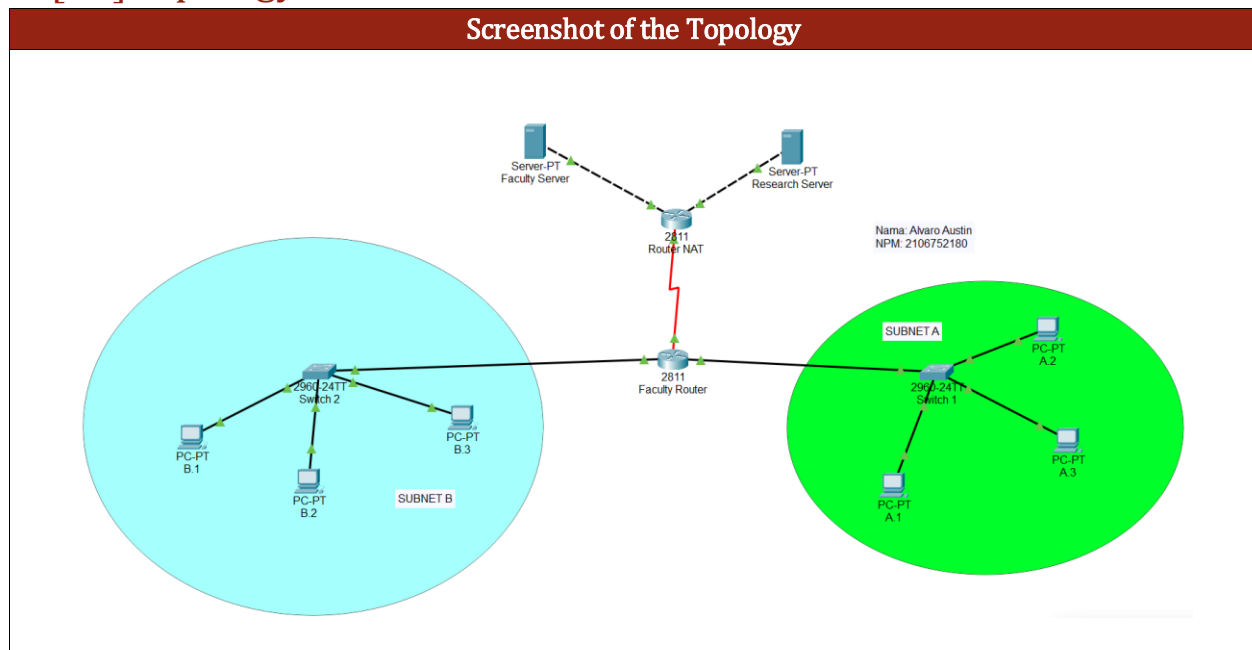




Answer Sheet
Hands On - H03
NAT and OSPF

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1. [10]Topology Screenshot



2. [20]IP address Allocation

Subnetting Distribution using VLSM Method

Subnet	Network Address	Slash	Subnet Mask	First Device IP Address	Last Device IP Address	Default Gateway
A	192.168.0.0	/26	255.255.255.192	192.168.0.2	192.168.0.62	192.168.0.1
B	192.168.0.64	/27	255.255.255.224	192.168.0.66	192.168.0.94	192.168.0.65

IPv4 Address Distribution

Device Name	IPv4 Address	Subnet Mask	Default Gateway
Research Server	34.16.12.33	255.255.224.0	34.16.0.1
Faculty Server	10.5.2.0	255.255.248.0	10.5.0.1
A.1	192.168.0.2	255.255.255.192	192.168.0.1
A.2	192.168.0.3	255.255.255.192	192.168.0.1
A.3	192.168.0.4	255.255.255.192	192.168.0.1
B.1	192.168.0.66	255.255.255.224	192.168.0.65

B.2	192.168.0.67	255.255.255.224	192.168.0.65
B.3	192.168.0.68	255.255.255.224	192.168.0.65

Screenshots of Configuration for each Device

Faculty Router configuration for Interface Serial 1/0, FA 0/0, and FA 0/1

Interface Se1/0:

The screenshot shows the configuration window for the Faculty Router, specifically for the Serial1/0 interface. The window has tabs for Physical, Config, CLI, and Attributes. The Config tab is active, showing a tree view on the left with categories: GLOBAL (Settings, Algorithm Settings), ROUTING (Static, RIP), SWITCHING (VLAN Database), and INTERFACE (FastEthernet0/0, FastEthernet0/1, Serial1/0, Serial1/1, Serial1/2, Serial1/3). The Serial1/0 interface is selected. The main configuration area shows the following settings:

- Port Status: ☒ On
- Duplex: ☐ Full Duplex
- Clock Rate: 2000000
- IP Configuration:
 - IPv4 Address: 192.168.2.1
 - Subnet Mask: 255.255.255.252
- Tx Ring Limit: 10

Below the configuration area, there is a section for Equivalent IOS Commands:

```
Router(config-if)#exit
Router(config)#interface Serial1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial1/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#
```

At the bottom left, there is a checkbox labeled "Top".

Interface Fa0/0:

Faculty Router

PhysicalConfigCLIAttributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

FastEthernet0/0

FastEthernet0/1

Serial1/0

Serial1/1

Serial1/2

Serial1/3

FastEthernet0/0

Port Status

On

Bandwidth

100 Mbps

10 Mbps

Duplex

Half Duplex

Full Duplex

MAC Address000B.BE59.8B01

IP Configuration

IPv4 Address192.168.0.65

Subnet Mask255.255.255.224

Tx Ring Limit10

Equivalent IOS Commands

Router(config-if)#ip address 192.168.0.65 255.255.255.0

Router(config-if)#ip address 192.168.0.65 255.255.255.224

Router(config-if)#

Router(config-if)#

Router(config-if)#exit

Router(config)#interface FastEthernet0/0

Router(config-if)#

Top

Interface Fa0/1:

Faculty Router

PhysicalConfigCLIAttributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

FastEthernet0/0

FastEthernet0/1

Serial1/0

Serial1/1

Serial1/2

Serial1/3

FastEthernet0/1

Port Status

On

Bandwidth

100 Mbps

10 Mbps

Duplex

Half Duplex

Full Duplex

MAC Address000B.BE59.8B02

IP Configuration

IPv4 Address192.168.0.1

Subnet Mask255.255.255.192

Tx Ring Limit10

Equivalent IOS Commands

Router(config-if)#

Router(config-if)#

Router(config-if)#exit

Router(config)#interface FastEthernet0/1

Router(config-if)#ip address 192.168.0.1 255.255.255.224

Router(config-if)#ip address 192.168.0.1 255.255.255.192

Router(config-if)#

Top

NAT Router configuration for Interface Serial 1/0, FA 0/0, and FA 0/1

Interface Se1/0:

Router NAT

Physical **Config** CLI Attributes

GLOBAL

- Settings
- Algorithm Settings

ROUTING

- Static
- RIP

SWITCHING

- VLAN Database

INTERFACE

- FastEthernet0/0
- FastEthernet0/1
- Serial1/0**
- Serial1/1
- Serial1/2
- Serial1/3

Serial1/0

Port Status ☒ On

Duplex ☐ Full Duplex

Clock Rate 2000000

IP Configuration

IPv4 Address 192.168.2.2

Subnet Mask 255.255.255.252

Tx Ring Limit 10

Equivalent IOS Commands

```
Router(config-if)#shutdown
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial1/0
Router(config-if)#ip address 192.168.2.2 255.255.255.0
Router(config-if)#ip address 192.168.2.2 255.255.255.252
Router(config-if)#
```

☐ Top

Interface Fa0/0:

Router NAT

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

FastEthernet0/0

FastEthernet0/1

Serial1/0

Serial1/1

Serial1/2

Serial1/3

FastEthernet0/0

Port Status

On

Bandwidth

100 Mbps

10 Mbps

Duplex

Half Duplex

Full Duplex

MAC Address0004.9A10.5901

IP Configuration

IPv4 Address10.5.0.1

Subnet Mask255.255.248.0

Tx Ring Limit

10

Equivalent IOS Commands

Router(config-if)#

Router(config-if)#exit

Router(config)#interface FastEthernet0/0

Router(config-if)#ip address 10.5.0.1 255.0.0.0

Router(config-if)#ip address 10.5.0.1 255.255.248.0

Router(config-if)#

Top

Interface Fa0/1:

Router NAT

PhysicalConfigCLIAttributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

FastEthernet0/0

FastEthernet0/1

Serial1/0

Serial1/1

Serial1/2

Serial1/3

FastEthernet0/1

Port Status

On

Bandwidth

100 Mbps

10 Mbps

Duplex

Half Duplex

Full Duplex

MAC Address

0004.9A10.5902

IP Configuration

IPv4 Address

34.16.0.1

Subnet Mask

255.255.224.0

Tx Ring Limit

10

Equivalent IOS Commands

Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#ip address 34.16.0.1 255.0.0.0
Router(config-if)#ip address 34.16.0.1 255.255.224.0
Router(config-if)#

☐ Top

Research Server

Research Server

Physical

Config

Services

Desktop

Programming

Attributes

IP Configuration

IP Configuration

DHCP

Static

IPv4 Address

34.16.12.33

Subnet Mask

255.255.224.0

Default Gateway

34.16.0.1

DNS Server

0.0.0.0

IPv6 Configuration

Automatic

Static

IPv6 Address

/

Link Local Address

FE80::20C:CFFF:FE2B:DA58

Default Gateway

DNS Server

802.1X

Use 802.1X Security

Authentication

MD5

Username

Top

Faculty Server

Faculty Server

Physical Config Services **Desktop** Programming Attributes

IP Configuration X

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 10.5.2.0

Subnet Mask 255.255.248.0

Default Gateway 10.05.0.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::250:FFF:FE6D:D8E1

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

☐ Top

PC A.1, A.2, and A.3

PCA.1:

A.1

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

Interface

FastEthernet0

IP Configuration

DHCP

Static

IPv4 Address

192.168.0.2

Subnet Mask

255.255.255.192

Default Gateway

192.168.0.1

DNS Server

0.0.0.0

IPv6 Configuration

Automatic

Static

IPv6 Address

/

Link Local Address

FE80::2E0:A3FF:FEC7:602

Default Gateway

DNS Server

802.1X

Use 802.1X Security

Authentication

MD5

Top

PC A.2:

A.2

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

Interface

FastEthernet0

▼

IP Configuration

☐ DHCP

☒ Static

IPv4 Address

192.168.0.3

Subnet Mask

255.255.255.192

Default Gateway

192.168.0.1

DNS Server

0.0.0.0

IPv6 Configuration

☐ Automatic

☒ Static

IPv6 Address

/

Link Local Address

FE80::290:2BFF:FE19:3489

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication

MD5

▼

☐ Top

PCA.3:

A.3

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.0.4

Subnet Mask 255.255.255.192

Default Gateway 192.168.0.1

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::260:2FFF:FED3:82A1

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

☐ Top

PC B.1, B.2, and B.3

PC B.1:

B.1

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

Interface

FastEthernet0

IP Configuration

DHCP

Static

IPv4 Address

192.168.0.66

Subnet Mask

255.255.255.224

Default Gateway

192.168.0.65

DNS Server

0.0.0.0

IPv6 Configuration

Automatic

Static

IPv6 Address

/

Link Local Address

FE80::260:2FFF:FE62:7B2E

Default Gateway

DNS Server

802.1X

Use 802.1X Security

Authentication

MD5

Top

PC B.2:

B.2

Physical

Config

Desktop

Programming

Attributes

IP Configuration

X

Interface

FastEthernet0

IP Configuration

DHCP

Static

IPv4 Address

192.168.0.67

Subnet Mask

255.255.255.224

Default Gateway

192.168.0.65

DNS Server

0.0.0.0

IPv6 Configuration

Automatic

Static

IPv6 Address

/

Link Local Address

FE80::200:CFF:FE9B:5A80

Default Gateway

DNS Server

802.1X

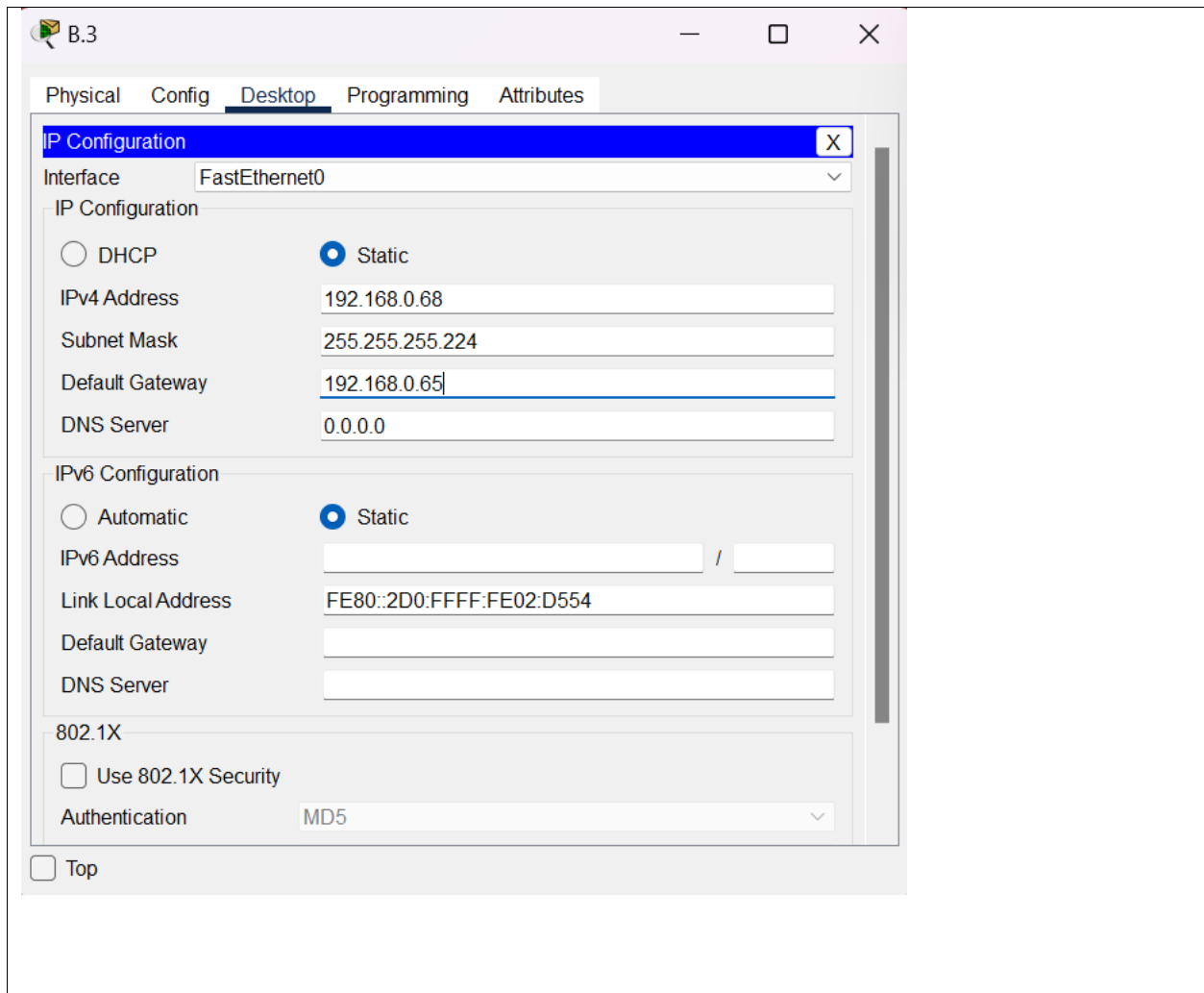
Use 802.1X Security

Authentication

MD5

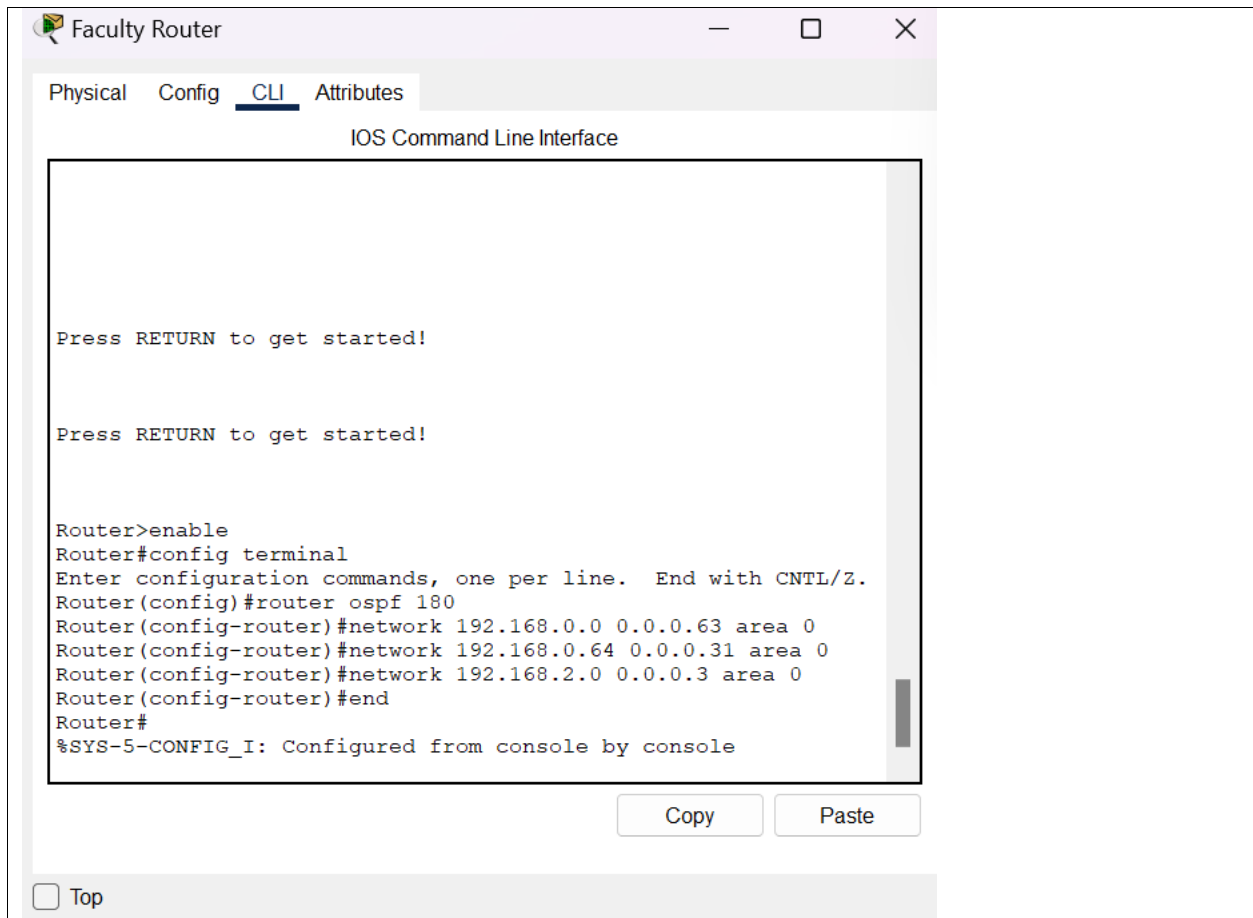
Top

PC B.3:

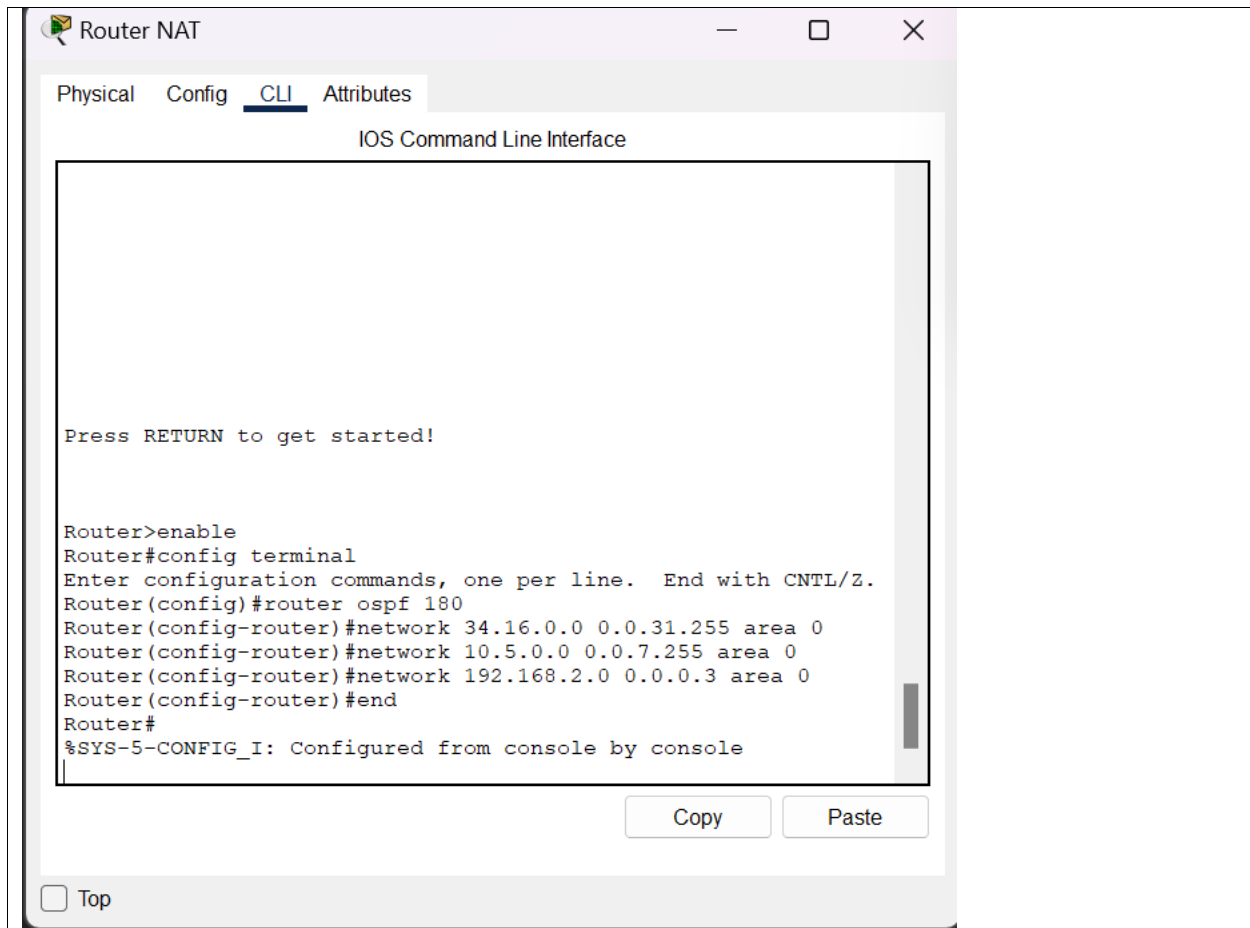


3. [30]OSPF Configuration

CLI for Faculty Router



CLI for NAT Router



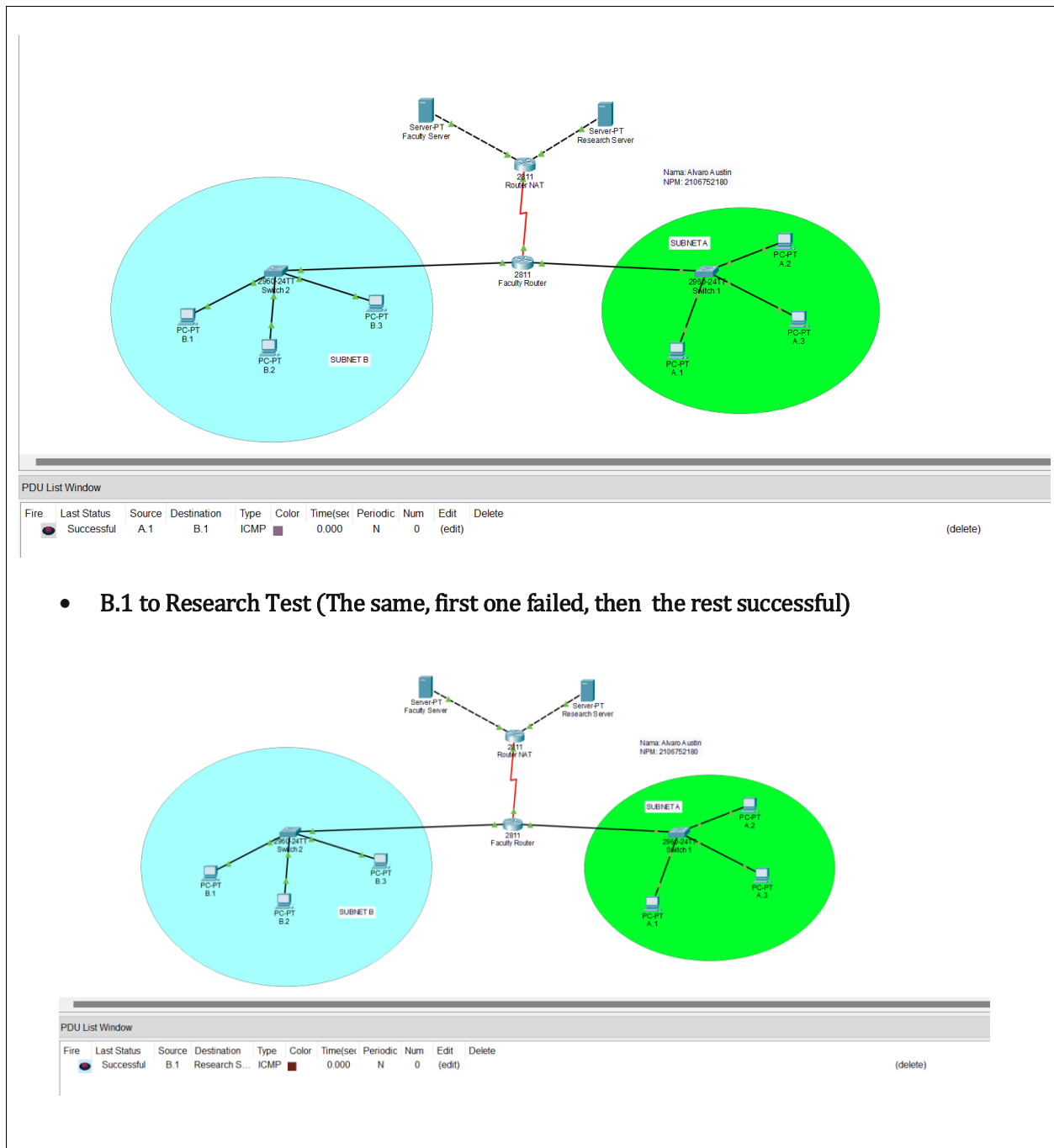
Connectivity Test

Answers:

- A.1 to B.1 Test = **success**
- B.1 to Research Server = **success**

Proof:

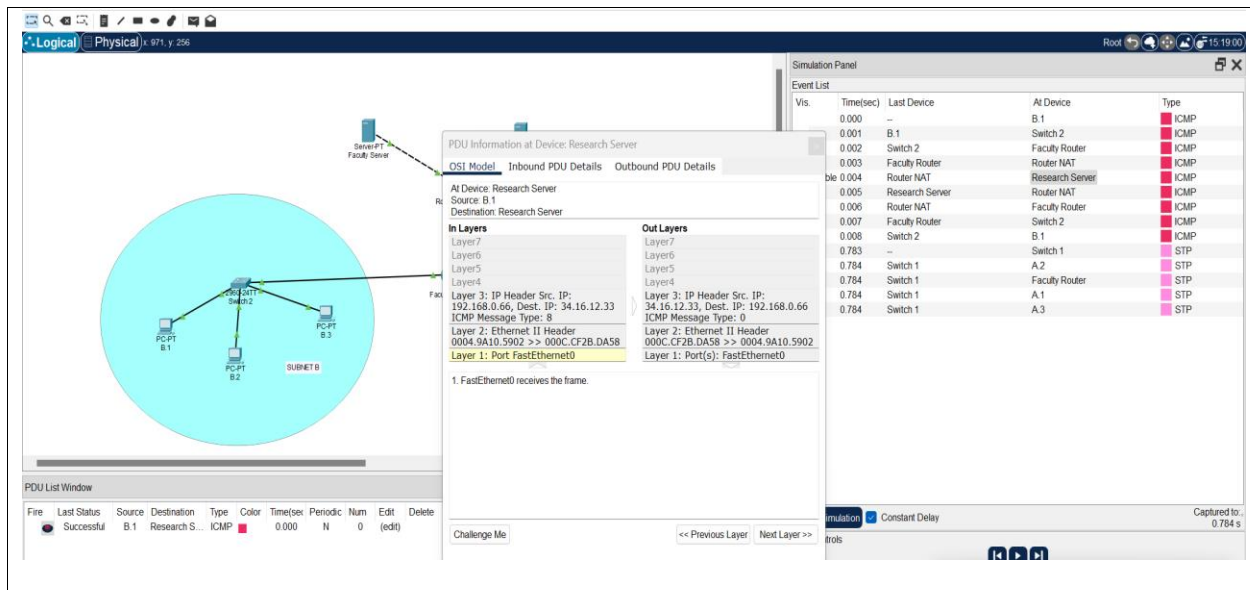
- A.1 to B.1 Test (First time failed but the rest successful)



- B.1 to Research Test (The same, first one failed, then the rest successful)

OSI Model

OSI Model at Device Research Server



4. [20]NAT Configuration

CLI for NAT Router

Router NAT
— □ ×

Physical
Config
CLI
Attributes

IOS Command Line Interface

```

Router>ip nat outside
      ^
% Invalid input detected at '^' marker.

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip nat pool 2106752180_pool 10.5.0.0
10.5.0.127 netmask 255.255.248.0
Router(config)#access-list 1 permit 192.168.0.0 0.0.0.127
Router(config)#access-list 1 permit 192.168.2.0 0.0.0.3
Router(config)#ip nat inside source list 1 pool
2106752180_pool
Router(config)#int se1/0
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)#int fa0/0
Router(config-if)#ip nat outside
Router(config-if)#exit
Router(config)#int fa0/1
Router(config-if)#ip nat outside
Router(config-if)#end
Router#
          
```

Copy
Paste

☐ Top

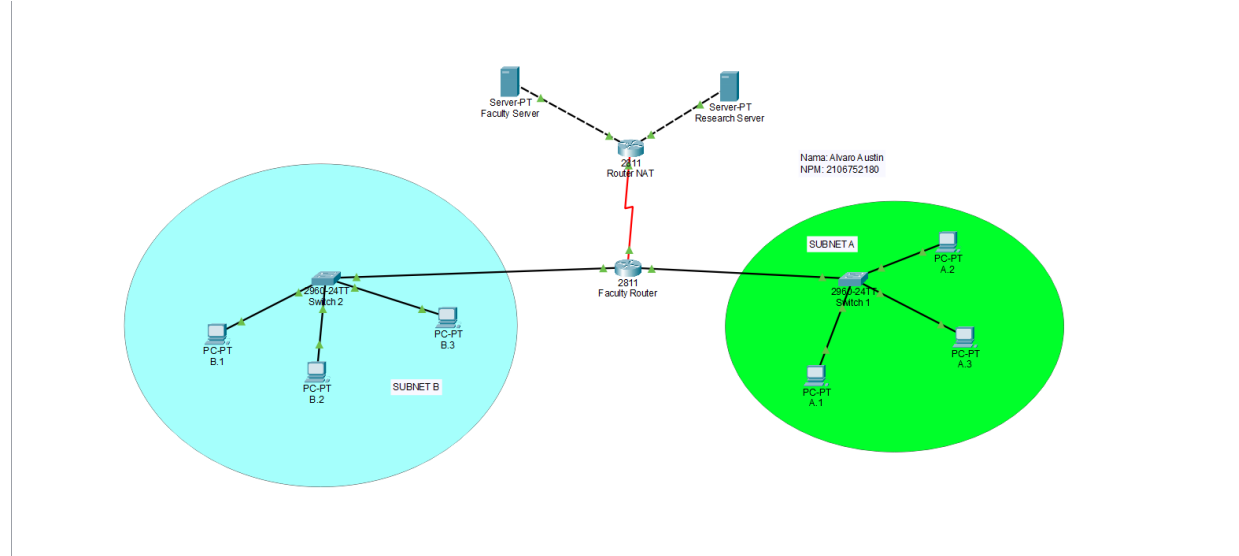
Connectivity Test

Answers:

- A.1 to B.1 Test = **success**
- B.1 to Research Server = **success**

Proof:

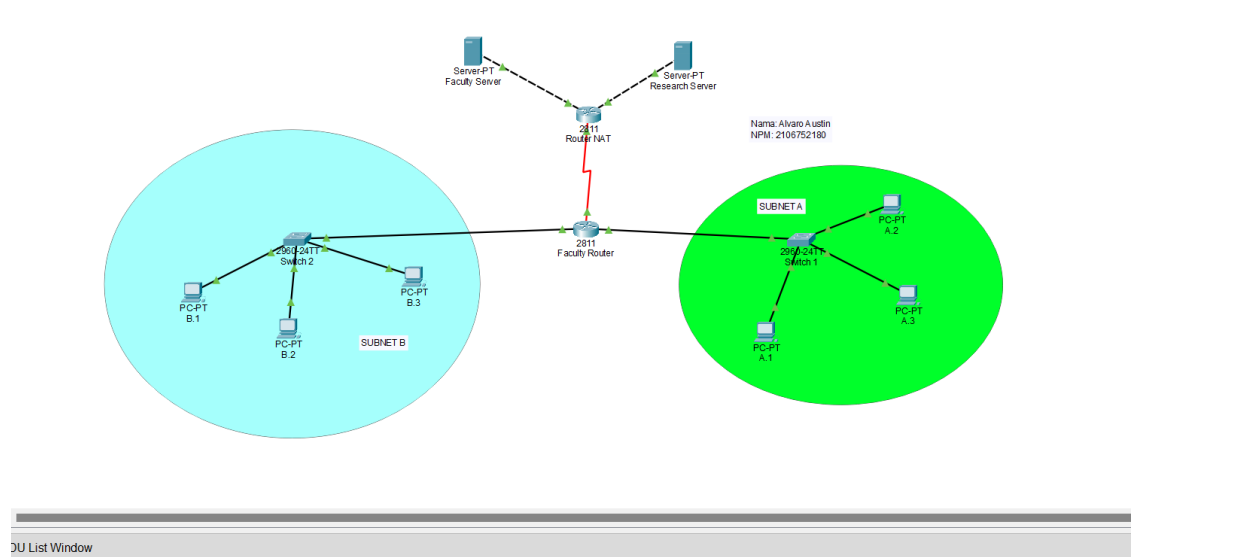
- A.1 to B.1



PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	A.1	B.1	ICMP		0.000	N	0	(edit)	(delete)

- B.1 to Research Server



PDU List Window

ire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	B.1	Research S...	ICMP		0.000	N	0	(edit)	(delete)

OSI Model

OSI Model at Device Research Server

The screenshot displays a network simulation environment. On the left, a network diagram shows a central switch connected to several PCs (B.1, B.2, B.3) and a Faculty Server. A central window titled 'PDU Information at Device: Research Server' provides a detailed view of the OSI model layers for a specific packet. The layers are listed as follows:

- In Layers:** Layer 7, Layer 6, Layer 5, Layer 4
- Out Layers:** Layer 7, Layer 6, Layer 5, Layer 4
- Layer 3:** IP Header Src. IP: 10.5.0.1, Dest. IP: 34.16.12.33 ICMP Message Type: 8
- Layer 2:** Ethernet II Header 0004.9A10.5902 >> 000C.CF2B.DA58
- Layer 1:** Port FastEthernet0

Below the layers, a status message indicates: '1. FastEthernet0 receives the frame'. On the right, an 'Event List' table shows a sequence of events, including ICMP, OSPF, and STP messages, with columns for Time(sec), Last Device, At Device, and Type.

5. [10]Connectivity Test









	A.1	A.2	A.3	B.1	B.2	B.3	Research	Faculty
A.1	✓	✓	✓	✓	✓	✓	✓	✓
A.2	✓	✓	✓	✓	✓	✓	✓	✓
A.3	✓	✓	✓	✓	✓	✓	✓	✓
B.1	✓	✓	✓	✓	✓	✓	✓	✓
B.2	✓	✓	✓	✓	✓	✓	✓	✓
B.3	✓	✓	✓	✓	✓	✓	✓	✓

Research	✓	✓	✓	✓	✓	✓	✓	✓
Faculty	✓	✓	✓	✓	✓	✓	✓	✓









Give ✓ if connectivity test is successful or ✗ if the connectivity test fails. Or you may give colors (example: green for success, red for fails).

Proof of Connectivity Test









From A.1 (Row 1):

Fire	Last Status	Source	Destination	Type
	Successful	A.1	A.1	ICMP
	Successful	A.1	A.2	ICMP
	Successful	A.1	A.3	ICMP
	Successful	A.1	B.1	ICMP
	Successful	A.1	B.2	ICMP
	Successful	A.1	B.3	ICMP
	Successful	A.1	Research Server	ICMP
	Successful	A.1	Faculty Server	ICMP









From A.2 (Row 2):

Fire	Last Status	Source	Destination	Type
	Successful	A.2	A.1	ICMP
	Successful	A.2	A.2	ICMP
	Successful	A.2	A.3	ICMP
	Successful	A.2	B.1	ICMP
	Successful	A.2	B.2	ICMP
	Successful	A.2	B.3	ICMP
	Successful	A.2	Research Server	ICMP
	Successful	A.2	Faculty Server	ICMP









From A.3 (Row 3):

Fire	Last Status	Source	Destination	Type
	Successful	A.3	A.1	ICMP
	Successful	A.3	A.2	ICMP
	Successful	A.3	A.3	ICMP
	Successful	A.3	B.1	ICMP
	Successful	A.3	B.2	ICMP
	Successful	A.3	B.3	ICMP
	Successful	A.3	Research Server	ICMP
	Successful	A.3	Faculty Server	ICMP









From B.1 (Row 4):

Fire	Last Status	Source	Destination	Type
	Successful	B.1	A.1	ICMP
	Successful	B.1	A.2	ICMP
	Successful	B.1	A.3	ICMP
	Successful	B.1	B.1	ICMP
	Successful	B.1	B.2	ICMP
	Successful	B.1	B.3	ICMP
	Successful	B.1	Research Server	ICMP
	Successful	B.1	Faculty Server	ICMP

From B.2 (Row 5):

Fire	Last Status	Source	Destination	Type
	Successful	B.2	A.1	ICMP
	Successful	B.2	A.2	ICMP
	Successful	B.2	A.3	ICMP
	Successful	B.2	B.1	ICMP
	Successful	B.2	B.2	ICMP
	Successful	B.2	B.3	ICMP
	Successful	B.2	Research Server	ICMP
	Successful	B.2	Faculty Server	ICMP









From B.3 (Row 6):

Fire	Last Status	Source	Destination	Type
	Successful	B.3	A.1	ICMP
	Successful	B.3	A.2	ICMP
	Successful	B.3	A.3	ICMP
	Successful	B.3	B.1	ICMP
	Successful	B.3	B.2	ICMP
	Successful	B.3	B.3	ICMP
	Successful	B.3	Research Server	ICMP
	Successful	B.3	Faculty Server	ICMP

From Research (Row 7):

Fire	Last Status	Source	Destination	Type
	Successful	Research Server	A.1	ICMP
	Successful	Research Server	A.2	ICMP
	Successful	Research Server	A.3	ICMP
	Successful	Research Server	B.1	ICMP
	Successful	Research Server	B.2	ICMP
	Successful	Research Server	B.3	ICMP
	Successful	Research Server	Research Server	ICMP
	Successful	Research Server	Faculty Server	ICMP

From Faculty (Row 8):

Fire	Last Status	Source	Destination	Type
	Successful	Faculty Server	A.1	ICMP
	Successful	Faculty Server	A.2	ICMP
	Successful	Faculty Server	A.3	ICMP
	Successful	Faculty Server	B.1	ICMP
	Successful	Faculty Server	B.2	ICMP
	Successful	Faculty Server	B.3	ICMP
	Successful	Faculty Server	Research Server	ICMP
	Successful	Faculty Server	Faculty Server	ICMP

6. [10]Analysis

- In the NAT configuration step, the Serial 1/0 is used for "ip nat inside", and not "ip nat outside". What is the reasoning behind the configuration? What will happen if we switch the "inside" and "outside" of the NAT configuration?

Answers:

The command of ip nat Inside and ip nat outside is used to connect an interface to private or public, where private means ip nat inside and public for ip nat outside. In this case, the reason Serial 1/0 interface uses ip nat inside is to convert to a public IP address before being sent to Internet. This is needed to be done because NAT Translation is needed for private IP to be translated to public IP for the sake of communication. In this case, Serial 1/0 is to connect the server with local pcs that uses private IP address. For the sake of it, we have to convert that private IP address to public IP address so it can be used to communicate.

If we switch inside and outside, it could cause communication failure between internal and external network. This happened because the process is reversed. At first we used ip nat inside to convert private IP address from local pcs , but if we change it to outside, then it can't communicate to the Internet.

- Pay attention to the OSI model on the 3rd and 4th part.
 - Are there any differences? Highlight the differences, if any.
 - Explain why there's any/no differences between both OSI models.

Answers:

Yes there are differences.

OSI Model on 3rd part:

Layer 3: IP Header Src. IP: 192.168.0.66, Dest. IP: 34.16.12.33
ICMP Message Type: 8

Layer 3: IP Header Src. IP: 34.16.12.33, Dest. IP: 192.168.0.66
ICMP Message Type: 0

OSI Model on 4th part:

Layer 3: IP Header Src. IP: 10.5.0.1, Dest. IP: 34.16.12.33 ICMP Message Type: 8

Layer 3: IP Header Src. IP: 34.16.12.33, Dest. IP: 10.5.0.1 ICMP Message Type: 0

1. In Layers:
 - 3rd part:
 - ✓ Source IP: 192.168.0.66
 - ✓ Destination IP: 34.16.12.33
 - 4th part:
 - ✓ Source IP: 10.5.0.1
 - ✓ Destination IP: 34.16.12.33
2. Out Layers:
 - 3rd part:
 - ✓ Source IP: 34.16.12.33
 - ✓ Destination IP: 192.168.0.66
 - 4th part:
 - ✓ Source IP: 34.16.12.33
 - ✓ Destination IP: 10.5.0.1

The difference between OSI models is on NAT that translate private IP address to public IP address. It translates the private IP addresses on 4th part source address to public IP address.