Princess Sumaya جامعـــة
University الأميـــرة سميّـــة
for Technology للتكنولوجيا

Princess Sumaya University for Technology

King Abdullah II School for Electrical Engineering

Computer Engineering Department

Computer Networks Lab

Final Project

Name: Mohammed Inshasi 20200841

Name: Ahmad Elayyan 20190184

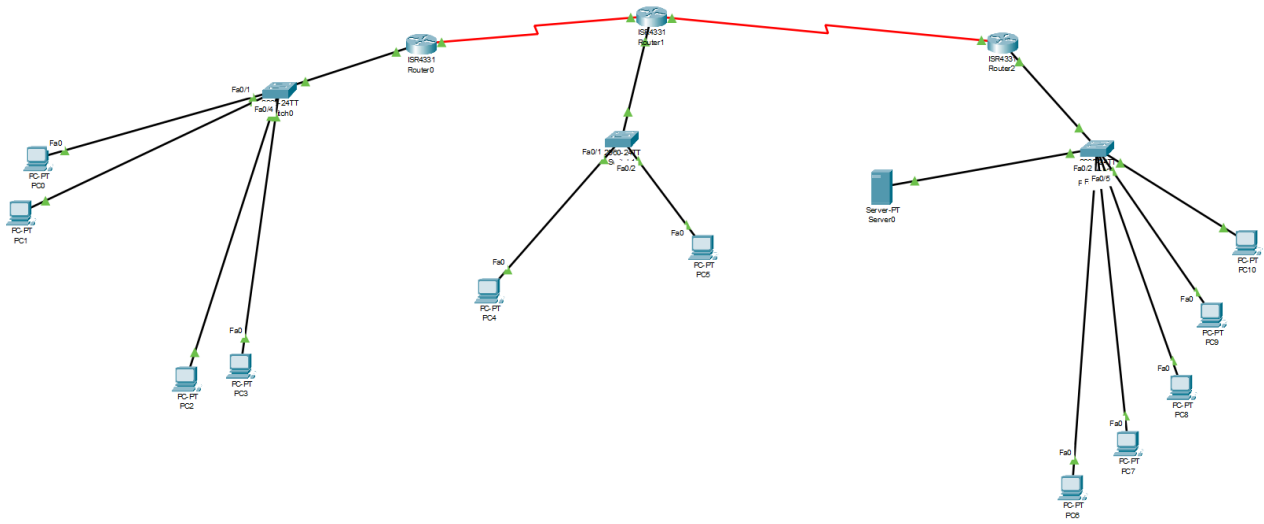
Abstract

This project involves setting up a network with three routers, three switches, 11 PCs, and a server. The goal is to establish a functional network with specific configurations, including VLANs, IP addresses, DHCP, routing, and access control. The focus is on creating a secure and organized network for efficient communication.

Introduction

In today's interconnected world, building a reliable network is crucial. This project aims to create a network with routers, switches, PCs, and a server. We'll follow specific guidelines for setting up VLANs, assigning IP addresses, configuring DHCP, implementing routing, and adding security through access controls. The objective is to design a secure and efficient network that meets specific requirements.

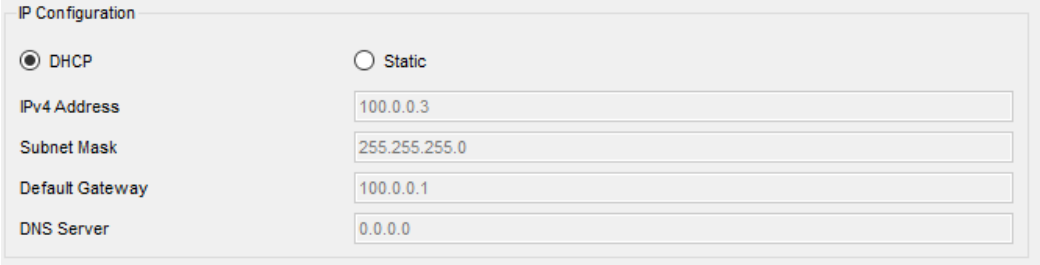
Our topology



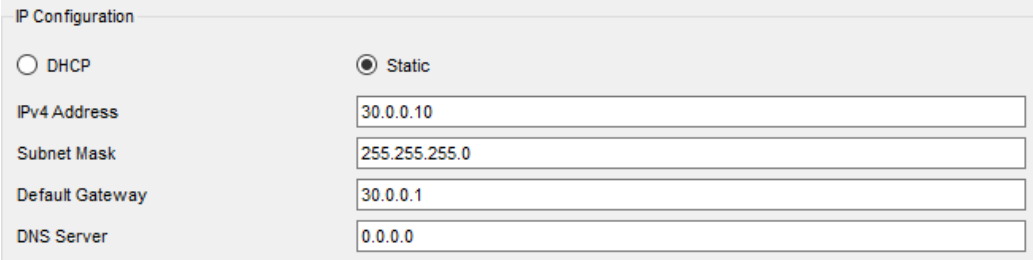
IP configuration

- **PCs**

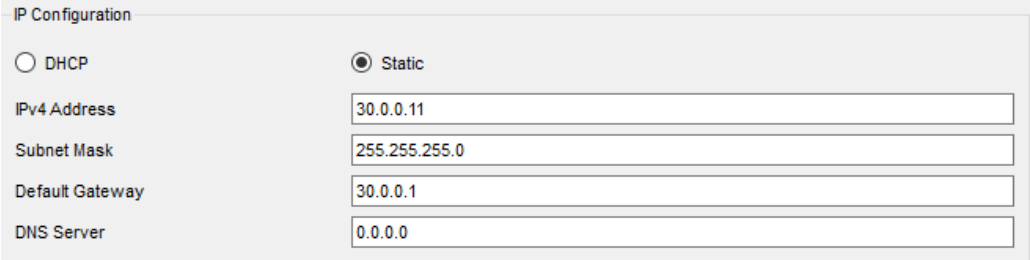
  From PC0-PC3



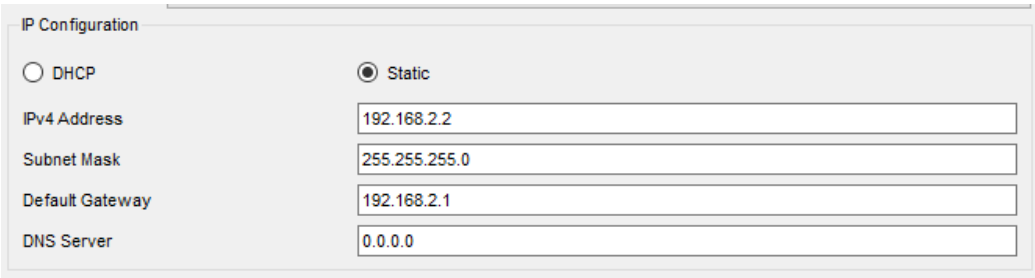
  PC4



  PC5



  PC6-PC10 (.2 → .6)



- **Routers**

#Router0

```
ELAYYAN(config)#interface gigabitEthernet 0/0/0.100
ELAYYAN(config-subif)#encapsu
ELAYYAN(config-subif)#encapsulation d
ELAYYAN(config-subif)#encapsulation dot1Q 100
ELAYYAN(config-subif)#ip address 100.0.0.1 255.255.255.0
```

Student VLAN

```
ELAYYAN(config)#interface gigabitEthernet 0/0/0.200
ELAYYAN(config-subif)#encaps
ELAYYAN(config-subif)#encapsulation do
ELAYYAN(config-subif)#encapsulation dot1Q 200
ELAYYAN(config-subif)#ip address 200.0.0.1 255.255.255.0
```

Staff VLAN

```
Router(config)#interface serial0/1/0
Router(config-if)#ip address 210.0.0.1 255.255.255.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to down
Router(config-if)#ex
```

#Router1

```
(config)#interface gig0/0/0
(config-if)#ip address 10.0.0.1 255.255.255.0
(config-if)#no shutdown

ELAYYAN(config)#interface gigabitEthernet 0/0/0.30
ELAYYAN(config-subif)#encap
ELAYYAN(config-subif)#encapsulation d
ELAYYAN(config-subif)#encapsulation dot1Q 30
ELAYYAN(config-subif)#ip address 30.0.0.1 255.255.255.0
ELAYYAN(config-subif)#ex
```

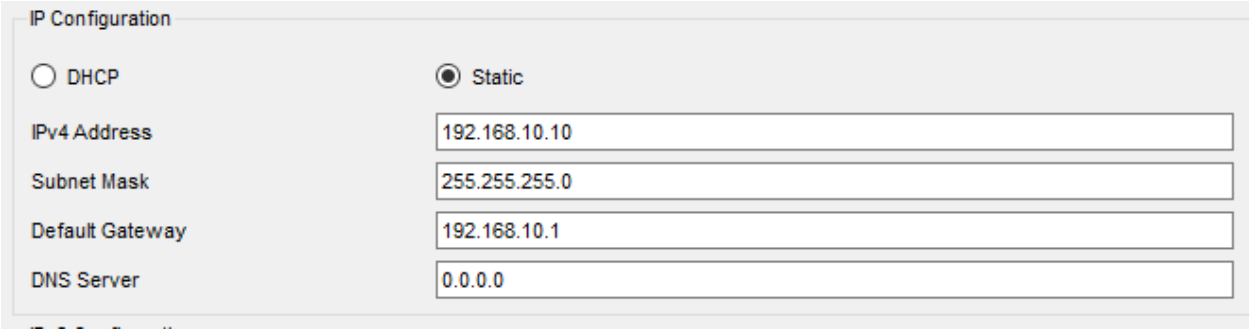
Admin VLAN

```
(config)#interface serial0/1/0
(config-if)#ip address 210.0.0.2 255.255.255.0
(config-if)#no shutdown

(config-if)#
5-CHANGED: Interface Serial0/1/0, changed state to up

(config-if)#ex
(config)#interface
ROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to u
mplete command.
(config)#interface serial 0/1/1
(config-if)#ip address 205.0.0.1 255.255.255.0
(config-if)#no shutdown

5-CHANGED: Interface Serial0/1/1, changed state to down
(config-if)#ex
```

#Router2

```
(config)#interface gigabitEthernet 0/0/0
(config-if)#ip address 192.168.10.1 255.255.255.0
(config-if)#no shutdown

(config-if)#
5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

(config-if)#ex
(config)#interface gig0/0/0.2
(config-subif)#
5-CHANGED: Interface GigabitEthernet0/0/0.2, changed state to up

(config-subif)#ip address 192.168.2.1 255.255.255.0

iguring IP routing on a LAN subinterface is only allowed if that
erface is already configured as part of an IEEE 802.10, IEEE 802.1Q,
 vLAN.

(config-subif)#ex
(config)#interface serial 0/1/1
(config-if)#ip address 205.0.0.2 255.255.255.0



 ELAYYAN(config-subif)#encapsulation do
 ELAYYAN(config-subif)#encapsulation dot1Q 2
 ELAYYAN(config-subif)#ip address 192.168.2.1 255.255.255.0
```

- **Server0**



- **Switch1 (VLAN1)**

  10.0.0.5 /24

  Will Configure it later

VLANs, Access and trunk ports configuration

#sw0

VLAN100

```
Switch(config)#vlan 100
Switch(config-vlan)#name Student
Switch(config-vlan)#ex
```

```
Switch(config)#interface range fa0/1-2
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 100
Switch(config-if-range)#ex
```

VLAN200

```
Switch(config)#vlan 200
Switch(config-vlan)#name Staff
Switch(config-vlan)#ex
```

```
Switch(config)#interface range fastEthernet 0/3-4
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 200
```

Trunk

```
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#ex
```

Show vlan brief command

```
Switch#show vlan brief

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/5, 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
100  Student                           active    Fa0/1, Fa0/2
200  Staff                             active    Fa0/3, Fa0/4
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

#sw1

Vlan30

```
Switch(config)#vlan 30
Switch(config-vlan)#name Admin
Switch(config-vlan)#ex
Switch(config)#interface range fa0/1-2
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 30
```

Trunk

```
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#ex
```

Show vlan brief command

```
Switch#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/4, Fa0/5, 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
30   Admin                            active    Fa0/1, Fa0/2
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

#sw2

Vlan2 & trunk

```
Switch(config)#vlan 2
Switch(config-vlan)#ex
Switch(config)#interface range fa0/2-6
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 2
Switch(config-if-range)#ex
Switch(config)#interface gig0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#ex
```

Show vlan brief command

```
VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, 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
2    VLAN0002                          active    Fa0/2, Fa0/3, Fa0/4, Fa0/5
                                                 Fa0/6
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

DHCP for VLAN 100 & 200 Configuration

#VLAN100

```
ELAYYAN(config)#ip dhcp excluded-address 100.0.0.254
ELAYYAN(config)#ip dhcp pool StudentAddresses
ELAYYAN(dhcp-config)#network 100.0.0.0 255.255.255.0
ELAYYAN(dhcp-config)#default-router 100.0.0.1
ELAYYAN(dhcp-config)#ex

ELAYYAN(config)#interface gigabitEthernet 0/0/0.100
ELAYYAN(config-subif)#enc
ELAYYAN(config-subif)#encapsulation do
ELAYYAN(config-subif)#encapsulation dot1Q 100
ELAYYAN(config-subif)#ip address 100.0.0.1 255.255.255.0
ELAYYAN(config-subif)#ip helper
ELAYYAN(config-subif)#ip helper-address 100.0.0.1
ELAYYAN(config-subif)#ex
```

#VLAN200

```
ELAYYAN(config)#ip dhcp excluded-address 200.0.0.1
ELAYYAN(config)#ip dhcp excluded-address 200.0.0.254
ELAYYAN(config)#ip dhcp pool StaffAddresses
ELAYYAN(dhcp-config)#network 200.0.0.0 255.255.255.0
ELAYYAN(dhcp-config)#default-router 200.0.0.1
ELAYYAN(dhcp-config)#ex


ELAYYAN(config)#interface gigabitEthernet 0/0/0.200
ELAYYAN(config-subif)#en
ELAYYAN(config-subif)#encapsulation d
ELAYYAN(config-subif)#encapsulation dot1Q 200
ELAYYAN(config-subif)#ip addre
ELAYYAN(config-subif)#ip address
ELAYYAN(config-subif)#ip address 200.0.0.1
% Incomplete command.
ELAYYAN(config-subif)#ip address 200.0.0.1 255.255.255.0
ELAYYAN(config-subif)#ip he
ELAYYAN(config-subif)#ip hel
ELAYYAN(config-subif)#ip help
ELAYYAN(config-subif)#ip helper-address 200.0.0.1 255.255.255.0
                                                  ^
% Invalid input detected at '^' marker.

ELAYYAN(config-subif)#ip helper-address 200.0.0.1
ELAYYAN(config-subif)#ex
ELAYYAN(config)#
```

Router protocol Configuration (RIP)

#Router0

```
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 100.0.0.0
Router(config-router)#netwrok 200.0.0.0
                           ^
% Invalid input detected at '^' marker.

Router(config-router)#network 200.0.0.0
Router(config-router)#network 210.0.0.0
Router(config-router)#ex
Router(config)#ip route 0.0.0.0 0.0.0.0 210.0.0.2
```

#Router1

```
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 10.0.0.0
Router(config-router)#network 30.0.0.0
Router(config-router)#network 205.0.0.0
Router(config-router)#network 210.0.0.0
Router(config-router)#exit
Router(config)#ip route 0.0.0.0 0.0.0.0 205.0.0.2
```

#Router2

```
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 205.0.0.0
Router(config-router)#ex
```

Enable, Console, and VTY passwords Configuration

The same configuration for passwords on each network devices (Router/switch)

Password = 1234

```
Switch(config)#enable secret 1234
Switch(config)#line console 0
Switch(config-line)#password 1234
Switch(config-line)#login
```

```
Switch(config)#line vty 0 15
Switch(config-line)#password 1234
Switch(config-line)#login
Switch(config-line)#exit
```

Hostnames Configuration

For each Switch ➔ hostname = INSHASI

```
Switch(config)#hostname INSHASI
INSHASI(config)#
```

For each Router ➔ hostname = ELAYYAN

```
Router(config)#hostname ELAYYAN
ELAYYAN(config)#ena
```

Telnet remote access Configuration

```
INSHASI(config)#interface vlan 1
INSHASI(config-if)#ip address 10.0.0.5 255.255.255.0
INSHASI(config-if)#no shutdown

INSHASI(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up

INSHASI(config-if)#ex
INSHASI(config)#ip de
INSHASI(config)#ip default-gateway 10.0.0.1
INSHASI(config)#line vt
INSHASI(config)#line vty 0 15
INSHASI(config-line)#tra
INSHASI(config-line)#transport input te
INSHASI(config-line)#transport input telnet
INSHASI(config-line)#
```

NAT Configuration

```
Router(config)#ip nat inside source static 192.168.10.10 205.0.0.2
Router(config)#interface gig0/0/0
Router(config-if)#ip nat inside
Router(config-if)#ex
Router(config)#interface serial0/1/1
Router(config-if)#ip nat outside
Router(config-if)#ex
```

PAT Configuration

```
Router(config)#ip nat pool PATNAT 172.40.0.2 172.40.0.2 netmask 255.255.255.0
Router(config)#access-list permit 192.168.2.0 0.0.0.255
                              ^
% Invalid input detected at '^' marker.

Router(config)#access-list 1 permit 192.168.2.0 0.0.0.255
Router(config)#ip nat inside source list 1 pool PATNAT overload
Router(config)#interface gig0/0/0.2
Router(config-subif)#ip nat inside
Router(config-subif)#ex
Router(config)#interface serial 0/1/1
Router(config-if)#ip nat outside
```

Numbered access control list Configuration

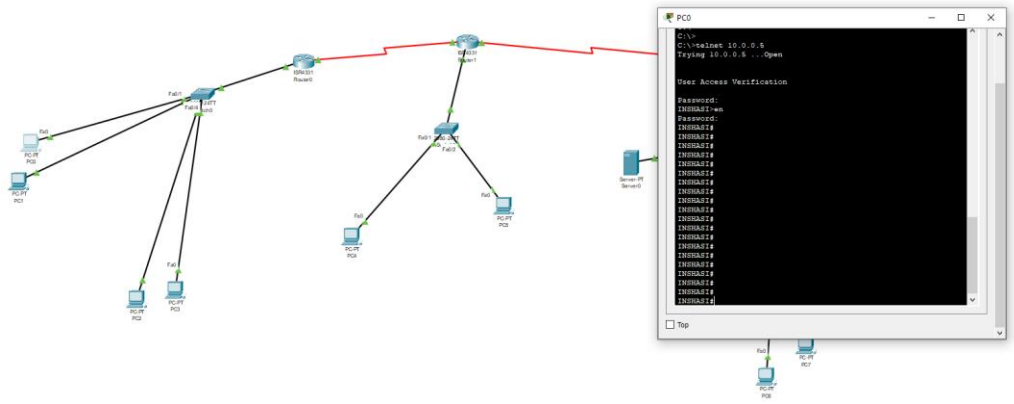
```
ELAYYAN(config)#access-list 101 deny ip host 30.0.0.11 100.0.0.0 0.0.0.255
ELAYYAN(config)#access-list 101 permit ip any any
ELAYYAN(config)#interface serial0/1/0
ELAYYAN(config-if)#ip access-group 101 out
ELAYYAN(config-if)#ex
```

Named access control list Configuration

```
ELAYYAN(config)#ip access-list extended CtrHTT
ELAYYAN(config)#ip access-list extended CtrHTTP
ELAYYAN(config)#ip access-list extended CtrHTTP
ELAYYAN(config)#ip access-list extended CtrHTTP
ELAYYAN(config-ext-nacl)#deny tcp host 30.0.0.10 host 205.0.0.2 eq www
ELAYYAN(config-ext-nacl)#deny tcp host 30.0.0.10 host 205.0.0.2 eq 443
ELAYYAN(config-ext-nacl)#permit ip any any
ELAYYAN(config-ext-nacl)#interface gig0/0/0.30
ELAYYAN(config-subif)#ip access-group CtrHTTP in
ELAYYAN(config-subif)#ex
```

Testing our topology

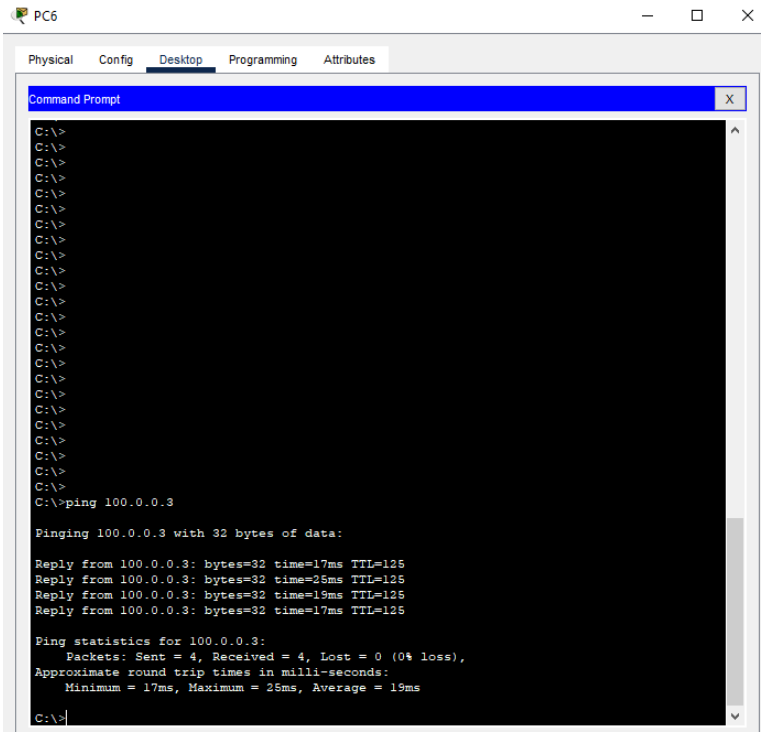
#For Q12, testing telnet




```
C:\>telnet 10.0.0.5
Trying 10.0.0.5 ...Open


User Access Verification

Password:
INSHASI>en
Password:
INSHASI#
```

#For PAT & NAT, we should successfully ping from PC6 to PC0

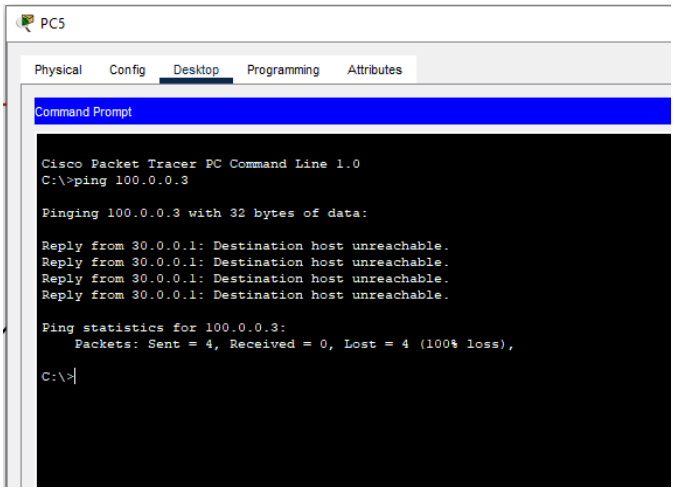
192.168.2.2 ➔ 100.0.0.3



#Testing the access list

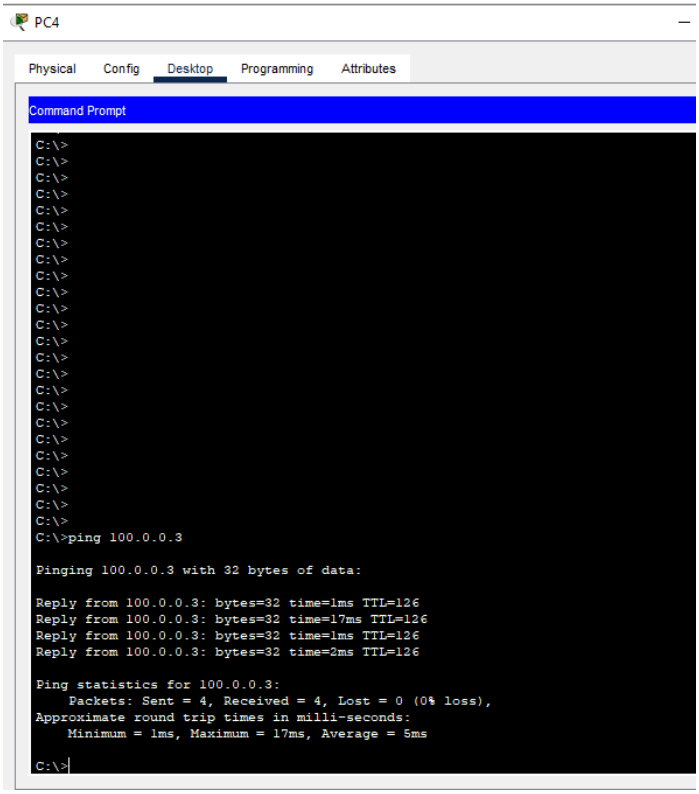
If we try to ping from PC5 ➔ PC0

the result should be host unreachable



On the other hand, if we ping from PC4 ➔ PC0

Should be ping successfully



Conclusion

The successful setup of this network showcases the importance of thoughtful design. By following guidelines for VLANs, IP addresses, DHCP, and routing, we've created a secure environment for communication. Access controls add an extra layer of security. This project emphasizes the significance of careful network design for building a reliable and secure communication infrastructure.