



CISCO Network Administrator

Graduation Project

Design and Implementation of a Multi-VLAN Network with Dynamic Routing and Redundancy Protocols

By

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Abstract:

This project focuses on the design and implementation of a scalable, multi-VLAN network architecture that ensures high performance, security, and redundancy. The network is divided into multiple VLANs, enhancing traffic management, security, and network segmentation. OSPF (Open Shortest Path First) is used for dynamic routing, ensuring optimal data flow between routers. DHCP automates IP address assignment, reducing administrative overhead.

To ensure high availability, HSRP (Hot Standby Router Protocol) is implemented, providing automatic failover between routers and minimizing downtime. Key services, such as DNS and web servers, are isolated in dedicated VLANs for security. Multi-layer switches are used to enhance data flow and scalability, supporting high-speed communication and load distribution.

This project demonstrates expertise in dynamic routing, redundancy, and network service integration, offering a resilient, high-performance network suitable for enterprise environments.

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Introduction

"Our network project aimed to design and implement a robust, scalable, and secure infrastructure that meets the dynamic needs of modern organizations. The primary focus was on integrating advanced networking technologies to optimize performance, enhance security, and ensure high availability. The project's architecture encompassed multiple key components, including VLANs for network segmentation, DHCP for dynamic IP management, and OSPF for efficient internal routing.

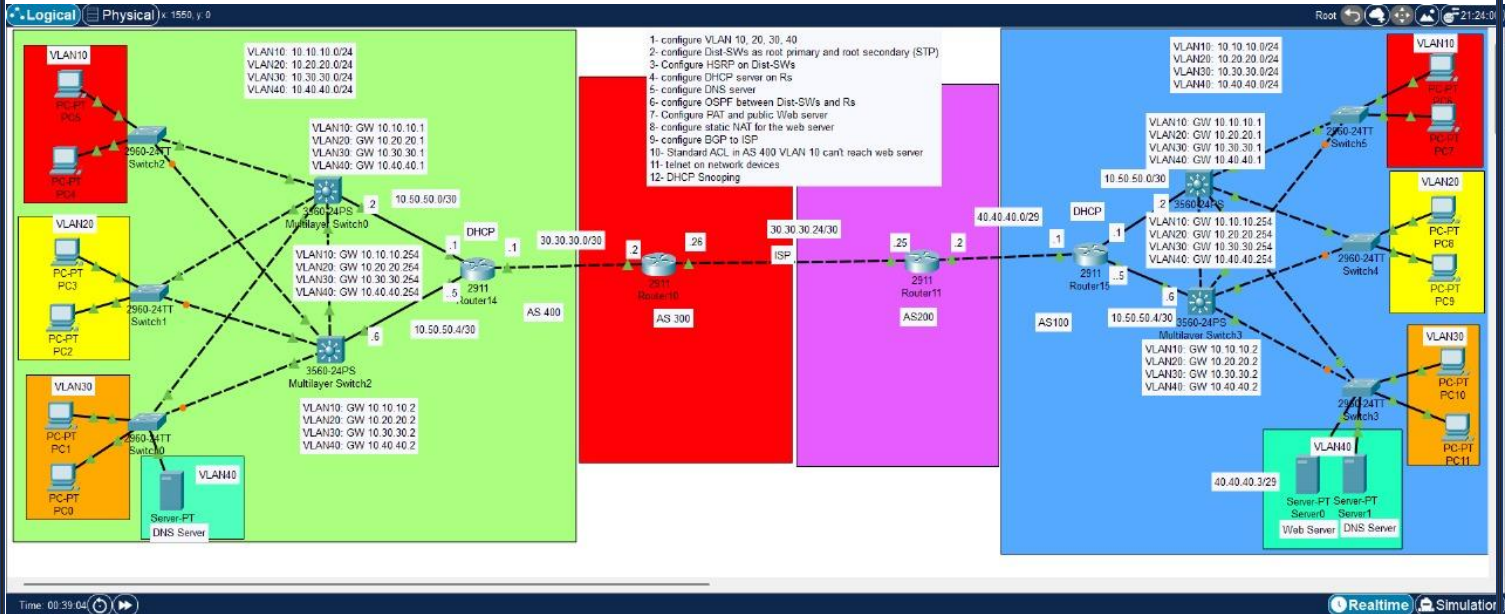
In addition to these core elements, our team implemented critical routing protocols like BGP for inter-domain connectivity, NAT/PAT for secure address translation, and HSRP to provide redundancy and maintain continuous network availability. Security and management were equally prioritized, with the integration of DHCP Snooping to prevent unauthorized access and Telnet for easy remote management of network devices.

This project not only highlights the technical expertise of each team member but also demonstrates our ability to coordinate and integrate diverse networking solutions into a cohesive system capable of supporting both current and future business needs."

Components

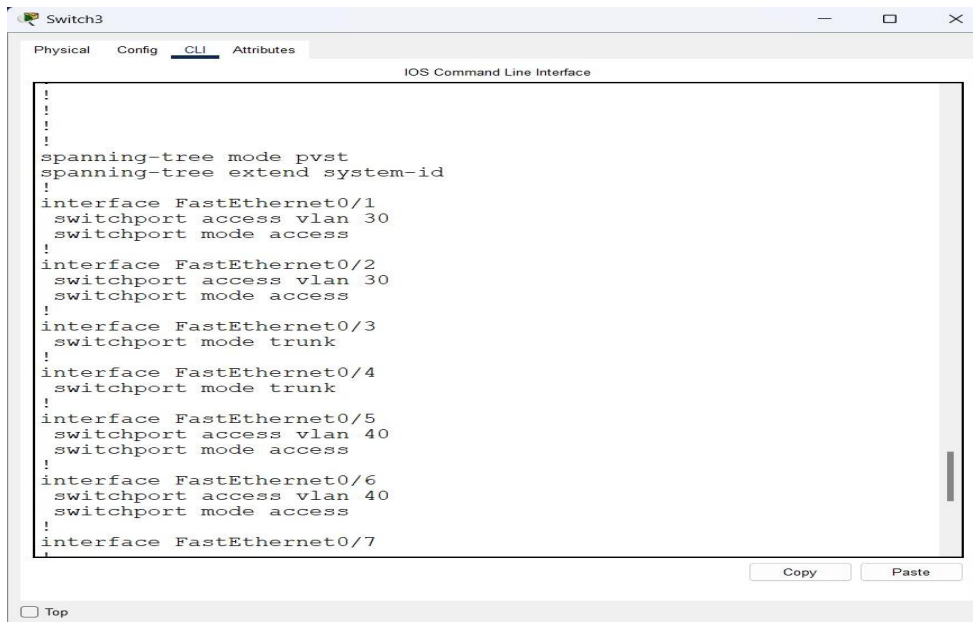
- 1) **L2 Switch (6 Type 2960-24TT) .**
- 2) **Multilayer Switch (4 Type 3560-24ps) .**
- 3) **Router (4 Type 2911) .**
- 4) **Pcs (6) .**
- 5) **Server (3) .**

System Design



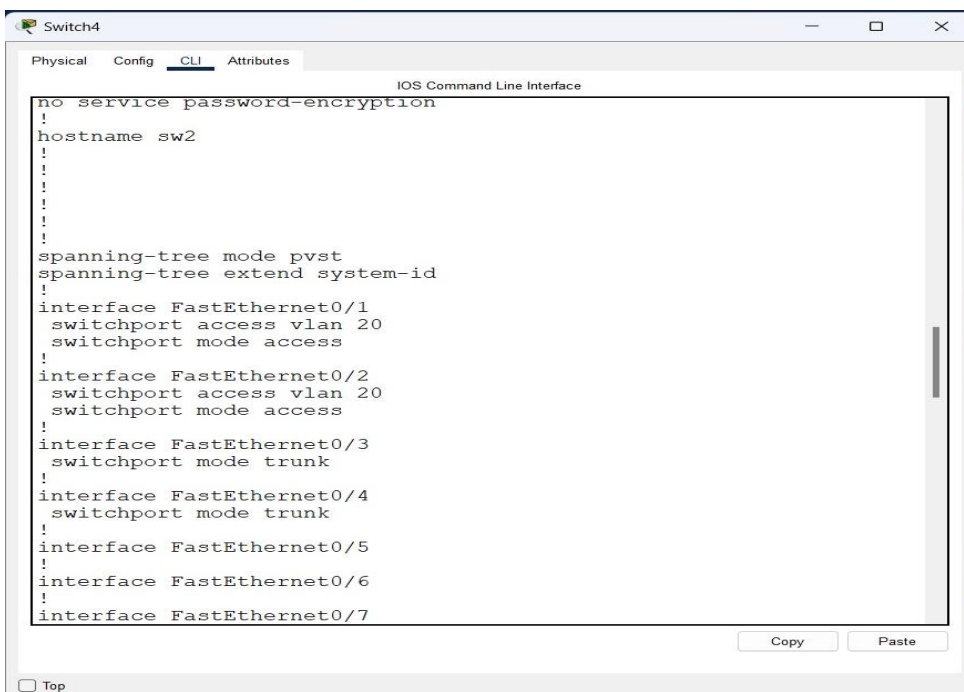
Configurations

1. Configurations of switch 3 (same as switch 0)

A screenshot of a network configuration window titled 'Switch3'. The window has tabs for 'Physical', 'Config', 'CLI', and 'Attributes', with 'CLI' selected. The main area is labeled 'IOS Command Line Interface' and contains a list of configuration commands. The commands are: '!', '!', '!', '!', 'spanning-tree mode pvst', 'spanning-tree extend system-id', '!', 'interface FastEthernet0/1', 'switchport access vlan 30', 'switchport mode access', '!', 'interface FastEthernet0/2', 'switchport access vlan 30', 'switchport mode access', '!', 'interface FastEthernet0/3', 'switchport mode trunk', '!', 'interface FastEthernet0/4', 'switchport mode trunk', '!', 'interface FastEthernet0/5', 'switchport access vlan 40', 'switchport mode access', '!', 'interface FastEthernet0/6', 'switchport access vlan 40', 'switchport mode access', '!', 'interface FastEthernet0/7', and '!'. At the bottom left is a 'Top' button, and at the bottom right are 'Copy' and 'Paste' buttons.

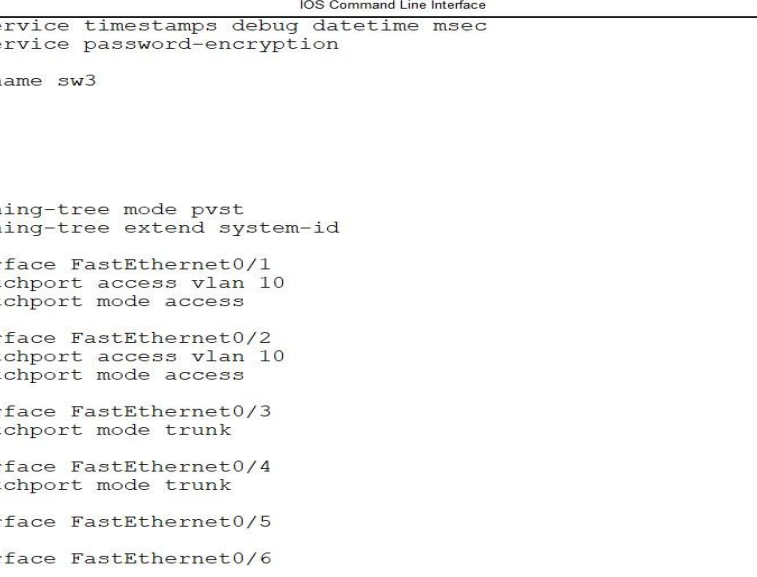
```
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
 switchport access vlan 30
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 30
 switchport mode access
!
interface FastEthernet0/3
 switchport mode trunk
!
interface FastEthernet0/4
 switchport mode trunk
!
interface FastEthernet0/5
 switchport access vlan 40
 switchport mode access
!
interface FastEthernet0/6
 switchport access vlan 40
 switchport mode access
!
interface FastEthernet0/7
!
```

2. Configurations of switch 4 (same as switch 1)

A screenshot of a network configuration window titled 'Switch4'. The window has tabs for 'Physical', 'Config', 'CLI', and 'Attributes', with 'CLI' selected. The main area is labeled 'IOS Command Line Interface' and contains a list of configuration commands. The commands are: 'no service password-encryption', 'hostname sw2', '!', '!', '!', '!', '!', '!', '!', 'spanning-tree mode pvst', 'spanning-tree extend system-id', '!', 'interface FastEthernet0/1', 'switchport access vlan 20', 'switchport mode access', '!', 'interface FastEthernet0/2', 'switchport access vlan 20', 'switchport mode access', '!', 'interface FastEthernet0/3', 'switchport mode trunk', '!', 'interface FastEthernet0/4', 'switchport mode trunk', '!', 'interface FastEthernet0/5', '!', 'interface FastEthernet0/6', '!', 'interface FastEthernet0/7', and '!'. At the bottom left is a 'Top' button, and at the bottom right are 'Copy' and 'Paste' buttons.

```
no service password-encryption
!
hostname sw2
!
!
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
 switchport access vlan 20
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 20
 switchport mode access
!
interface FastEthernet0/3
 switchport mode trunk
!
interface FastEthernet0/4
 switchport mode trunk
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
```

3. Configurations of switch 5 (same as switch 2)



The screenshot shows a web-based configuration interface for a network switch named "Switch5". The interface has a top navigation bar with tabs for "Physical", "Config", "CLI", and "Attributes". The "CLI" tab is currently selected, displaying the "IOS Command Line Interface". The main area contains a list of configuration commands for a switch named "sw3". The commands are as follows:

```
no service timestamps debug datetime msec
no service password-encryption
!
hostname sw3
!
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/3
 switchport mode trunk
!
interface FastEthernet0/4
 switchport mode trunk
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
```

At the bottom of the interface, there are two buttons: "Copy" and "Paste". A "Top" link is also visible in the bottom left corner.

4. Configurations of Multilayer Switch 1 (same as Multilayer Switch 0)

[illegible]

!
interface Vlan10
mac-address 00d0.d3c0.3a01
ip address 10.10.10.1 255.255.255.0
ip helper-address 10.50.50.1
standby version 2
standby 1 ip 10.10.10.254
standby 1 priority 200
standby 1 preempt
!
interface Vlan20
mac-address 00d0.d3c0.3a02
ip address 10.20.20.1 255.255.255.0
ip helper-address 10.50.50.1
standby version 2
standby 2 ip 10.20.20.254
standby 2 priority 200
standby 2 preempt
!
interface Vlan30
mac-address 00d0.d3c0.3a03
ip address 10.30.30.1 255.255.255.0
ip helper-address 10.50.50.1
standby version 2
standby 3 ip 10.30.30.254
standby 3 priority 200
standby 3 preempt
!
interface Vlan40
mac-address 00d0.d3c0.3a04
ip address 10.40.40.1 255.255.255.0
ip helper-address 10.50.50.1
standby version 2
standby 4 ip 10.40.40.254
standby 4 priority 200
standby 4 preempt
!

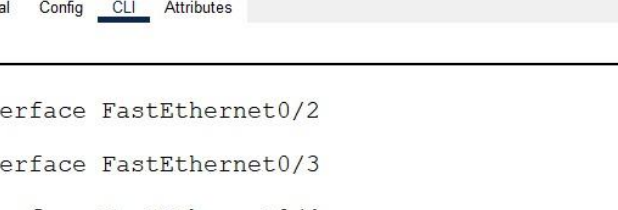
```

ip helper-address 10.50.50.1
 standby version 2
 standby 4 ip 10.40.40.254
 standby 4 priority 200
 standby 4 preempt
!
router ospf 1
 log-adjacency-changes
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.50.50.1
!
ip flow-export version 9
!
!
!
!
no cdp run
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
!
!
!
!
end


```

```
00:04:12: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan10 from
LOADING to FULL, Loading Done
00:04:20: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan20 from
LOADING to FULL, Loading Done
00:04:25: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan30 from
LOADING to FULL, Loading Done
00:04:28: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan40 from
LOADING to FULL, Loading Done
```


5. Configurations Multilayer Switch 3 (same as Multilayer Switch 2)

[illegible]

```
!
interface FastEthernet0/2
!
interface FastEthernet0/3
!
interface FastEthernet0/4
!
interface FastEthernet0/5
  switchport trunk encapsulation dot1q
  switchport mode trunk
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8/9
```



The screenshot displays the configuration of a Cisco Multilayer Switch3. The interface is titled "Multilayer Switch3" and has tabs for "Physical", "Config", "CLI", and "Attributes". The "CLI" tab is selected, showing the following configuration:

```

:
interface Vlan10
 mac-address 000c.cfae.2802
 ip address 10.10.10.2 255.255.255.0
 ip helper-address 10.50.50.5
 standby version 2
 standby 1 ip 10.10.10.254
!
interface Vlan20
 mac-address 000c.cfae.2803
 ip address 10.20.20.2 255.255.255.0
 ip helper-address 10.50.50.5
 standby version 2
 standby 2 ip 10.20.20.254
!
interface Vlan30
 mac-address 000c.cfae.2804
 ip address 10.30.30.2 255.255.255.0
 ip helper-address 10.50.50.5
 standby version 2
 standby 3 ip 10.30.30.254
!
interface Vlan40
 mac-address 000c.cfae.2805
 ip address 10.40.40.2 255.255.255.0
 ip helper-address 10.50.50.5
 standby version 2
 standby 4 ip 10.40.40.254
!
router ospf 1
 log-adjacency-changes
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.50.50.5
!
ip flow-export version 9
!
!

```

```
00:04:12: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan10 from
LOADING to FULL, Loading Done
00:04:20: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan20 from
LOADING to FULL, Loading Done
00:04:25: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan30 from
LOADING to FULL, Loading Done
00:04:28: %OSPF-5-ADJCHG: Process 1, Nbr 10.50.50.6 on Vlan40 from
LOADING to FULL, Loading Done
```

Copy

Paste

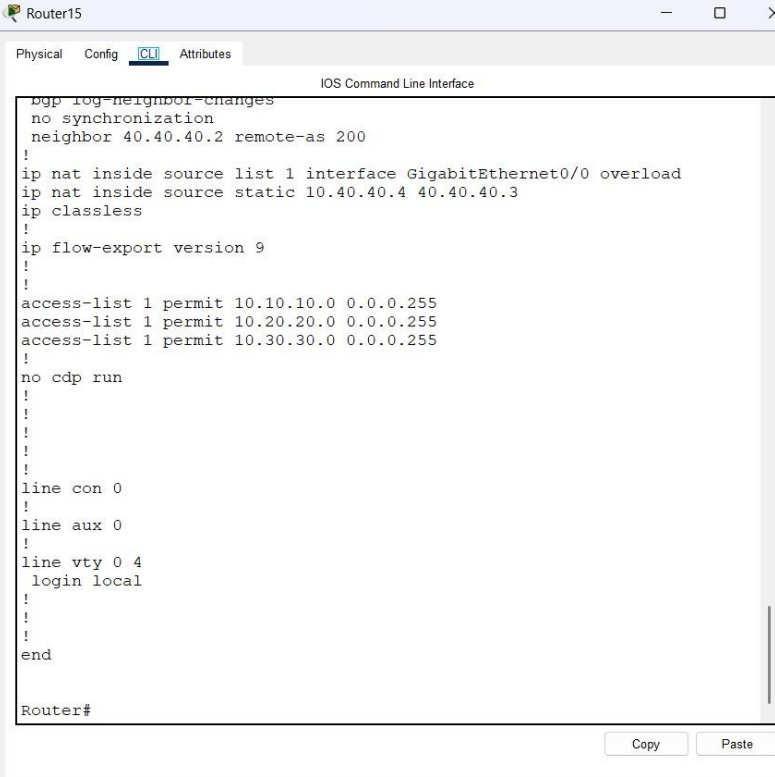
[□ Top](#)

6. Configurations of Router 15

```
Router15
```

Physical	Config	CLI	Attributes
<pre>! ! ! ip dhcp excluded-address 10.10.10.1 ip dhcp excluded-address 10.20.20.1 ip dhcp excluded-address 10.30.30.1 ip dhcp excluded-address 10.40.40.1 ip dhcp excluded-address 10.40.40.2 ip dhcp excluded-address 10.10.10.2 ip dhcp excluded-address 10.20.20.2 ip dhcp excluded-address 10.30.30.2 ip dhcp excluded-address 10.40.40.3 ip dhcp excluded-address 10.10.10.254 ip dhcp excluded-address 10.40.40.254 ip dhcp excluded-address 10.30.30.254 ip dhcp excluded-address 10.20.20.254 ip dhcp excluded-address 10.40.40.4 ! ip dhcp pool t1 network 10.10.10.0 255.255.255.0 default-router 10.10.10.254 dns-server 10.40.40.3 ip dhcp pool t2 network 10.20.20.0 255.255.255.0 default-router 10.20.20.254 dns-server 10.40.40.3 ip dhcp pool t3 network 10.30.30.0 255.255.255.0 default-router 10.30.30.254 dns-server 10.40.40.3 ip dhcp pool t4 network 10.40.40.0 255.255.255.0 default-router 10.40.40.254 dns-server 10.40.40.3 ! ! !</pre>			

```
Router15
Physical Config CLI Attributes
!
!
interface GigabitEthernet0/0
 ip address 40.40.40.1 255.255.255.248
 ip nat outside
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 10.50.50.1 255.255.255.252
 ip ospf 1 area 0
 ip nat inside
 duplex auto
 speed auto
!
interface GigabitEthernet0/2
 ip address 10.50.50.5 255.255.255.252
 ip ospf 1 area 0
 ip nat inside
 duplex auto
 speed auto
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
!
router bgp 100
 bgp log-neighbor-changes
 no synchronization
 neighbor 40.40.40.2 remote-as 200
!
ip nat inside source list 1 interface GigabitEthernet0/0 overload
ip nat inside source static 10.40.40.4 40.40.40.3
ip classless
```



The screenshot shows a Cisco Router CLI interface with the title "Router1". The interface has tabs for "Physical", "Config", and "Attributes", with "CLI" selected. The main window displays the "IOS Command Line Interface" with the following configuration commands:

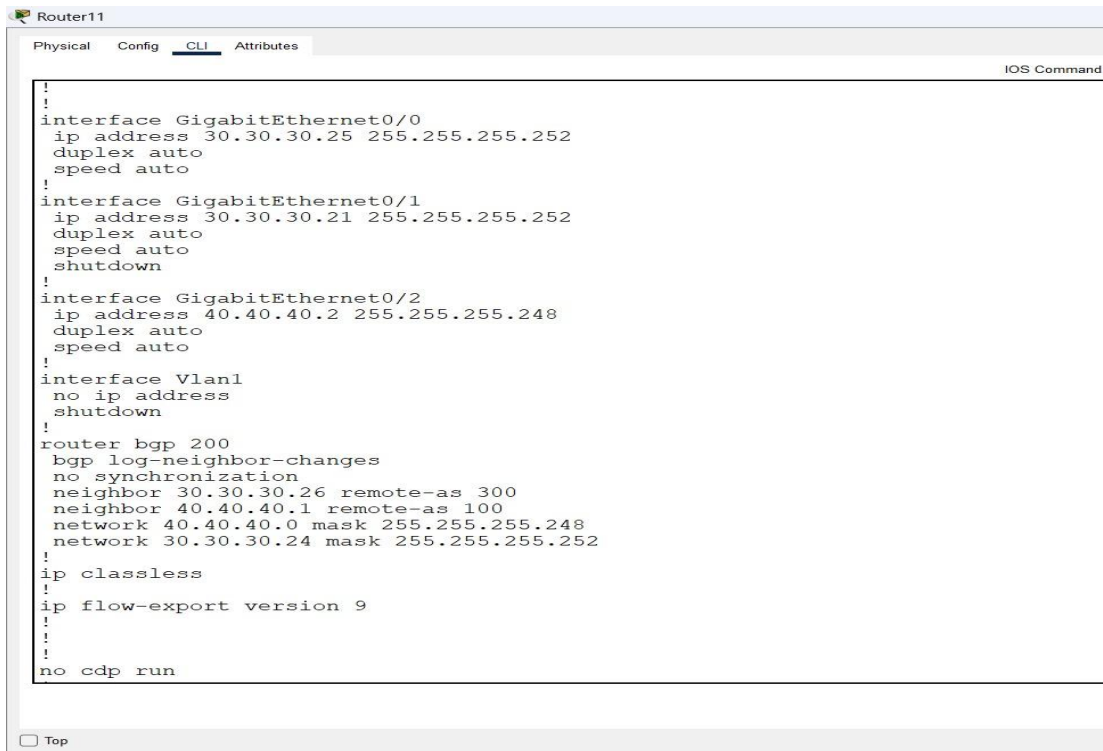
```

ospf log-neighbor-changes
no synchronization
neighbor 40.40.40.2 remote-as 200
!
ip nat inside source list 1 interface GigabitEthernet0/0 overload
ip nat inside source static 10.40.40.4 40.40.40.3
ip classless
!
ip flow-export version 9
!
!
access-list 1 permit 10.10.10.0 0.0.0.255
access-list 1 permit 10.20.20.0 0.0.0.255
access-list 1 permit 10.30.30.0 0.0.0.255
!
no cdp run
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
  login local
!
!
!
end
Router#

```

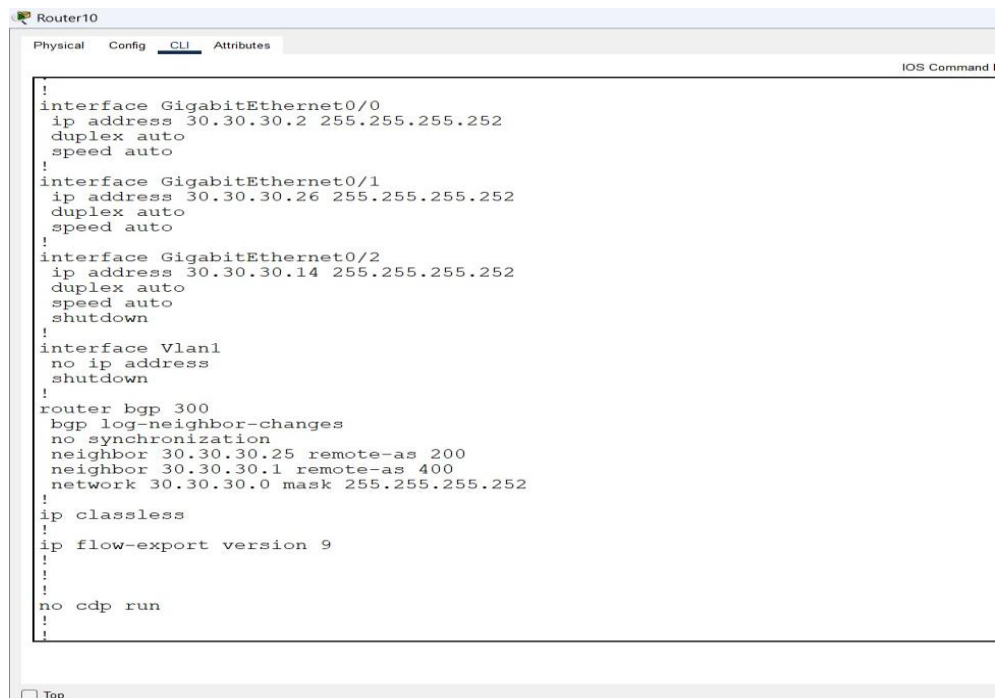
At the bottom of the interface, there are "Copy" and "Paste" buttons. A "Top" button is located at the bottom left of the entire window.

7. Configurations of Router 11

The screenshot shows a configuration window for Router11. At the top, there are tabs for 'Physical', 'Config', 'CLI', and 'Attributes', with 'CLI' being the active tab. The main area displays the configuration commands for the router. The configuration includes three GigabitEthernet interfaces (0/0, 0/1, and 0/2) with their respective IP addresses, duplex settings, and speeds. Interface 0/1 is also configured with a shutdown command. A Vlan1 interface is configured with no IP address and a shutdown command. BGP is configured with an AS of 200, including log-neighbor-changes, no synchronization, and two neighbors (30.30.30.26 and 40.40.40.1) with their respective remote-ASes (300 and 100). A network statement is also present for 40.40.40.0. The configuration ends with 'ip classless', 'ip flow-export version 9', and 'no cdp run'. A 'Top' button is located at the bottom left of the configuration area.

```
!
!
interface GigabitEthernet0/0
ip address 30.30.30.25 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/1
ip address 30.30.30.21 255.255.255.252
duplex auto
speed auto
shutdown
!
interface GigabitEthernet0/2
ip address 40.40.40.2 255.255.255.248
duplex auto
speed auto
!
interface Vlan1
no ip address
shutdown
!
router bgp 200
bgp log-neighbor-changes
no synchronization
neighbor 30.30.30.26 remote-as 300
neighbor 40.40.40.1 remote-as 100
network 40.40.40.0 mask 255.255.255.248
network 30.30.30.24 mask 255.255.255.252
!
ip classless
!
ip flow-export version 9
!
!
!
no cdp run
```

8. Configurations of Router 10

The screenshot shows a configuration window for Router10. At the top, there are tabs for 'Physical', 'Config', 'CLI', and 'Attributes', with 'CLI' being the active tab. The main area displays the configuration commands for the router. The configuration includes three GigabitEthernet interfaces (0/0, 0/1, and 0/2) with their respective IP addresses, duplex settings, and speeds. Interface 0/2 is configured with a shutdown command. A Vlan1 interface is configured with no IP address and a shutdown command. BGP is configured with an AS of 300, including log-neighbor-changes, no synchronization, and two neighbors (30.30.30.25 and 30.30.30.1) with their respective remote-ASes (200 and 400). A network statement is also present for 30.30.30.0. The configuration ends with 'ip classless', 'ip flow-export version 9', and 'no cdp run'. A 'Top' button is located at the bottom left of the configuration area.

```
!
!
interface GigabitEthernet0/0
ip address 30.30.30.2 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/1
ip address 30.30.30.26 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/2
ip address 30.30.30.14 255.255.255.252
duplex auto
speed auto
shutdown
!
interface Vlan1
no ip address
shutdown
!
router bgp 300
bgp log-neighbor-changes
no synchronization
neighbor 30.30.30.25 remote-as 200
neighbor 30.30.30.1 remote-as 400
network 30.30.30.0 mask 255.255.255.252
!
ip classless
!
ip flow-export version 9
!
!
!
no cdp run
!
!
```

9. Configuration of router 14

Router14

Physical Config CLI Attributes

IOS Command

```
!
!
ip dhcp excluded-address 10.10.10.1
ip dhcp excluded-address 10.10.10.2
ip dhcp excluded-address 10.10.10.254
ip dhcp excluded-address 10.20.20.1
ip dhcp excluded-address 10.20.20.2
ip dhcp excluded-address 10.20.20.254
ip dhcp excluded-address 10.30.30.1
ip dhcp excluded-address 10.30.30.2
ip dhcp excluded-address 10.30.30.254
ip dhcp excluded-address 10.40.40.1
ip dhcp excluded-address 10.40.40.2
ip dhcp excluded-address 10.40.40.3
ip dhcp excluded-address 10.40.40.254
!
ip dhcp pool t1
network 10.10.10.0 255.255.255.0
default-router 10.10.10.254
ip dhcp pool t2
network 10.20.20.0 255.255.255.0
default-router 10.20.20.254
ip dhcp pool t3
network 10.30.30.0 255.255.255.0
default-router 10.30.30.254
ip dhcp pool t4
network 10.40.40.0 255.255.255.0
default-router 10.40.40.254
dns-server 10.40.40.3
!
!
ip cef
no ipv6 cef
!
!
```

☐ Top

Router14

Physical Config CLI Attributes

IOS Command

```
!
!
interface GigabitEthernet0/0
ip address 10.50.50.5 255.255.255.252
ip ospf 1 area 0
ip nat inside
duplex auto
speed auto
!
interface GigabitEthernet0/1
ip address 10.50.50.1 255.255.255.252
ip ospf 1 area 0
ip nat inside
duplex auto
speed auto
!
interface GigabitEthernet0/2
ip address 30.30.30.1 255.255.255.252
ip nat outside
duplex auto
speed auto
!
interface Vlan1
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
!
router bgp 400
bgp log-neighbor-changes
no synchronization
neighbor 30.30.30.2 remote-as 300
!
ip nat inside source list 1 interface GigabitEthernet0/2 overload
ip classless
!
```

☐ Top

Router14

Physical Config CLI Attributes

IOS Command Line Interface

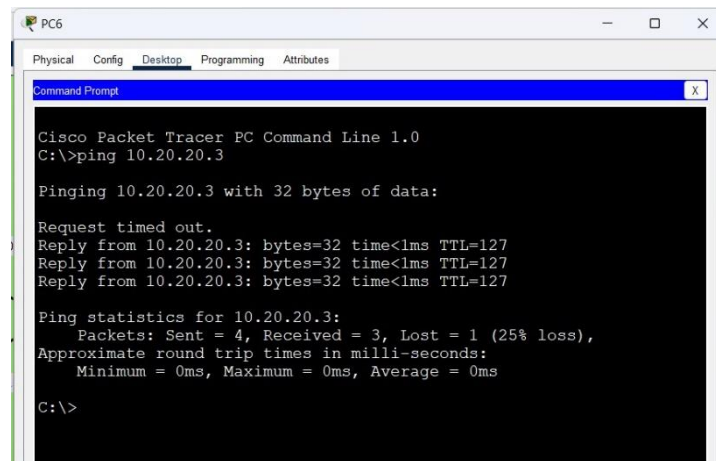
```
!
router bgp 400
bgp log-neighbor-changes
no synchronization
neighbor 30.30.30.2 remote-as 300
!
ip nat inside source list 1 interface GigabitEthernet0/2 overload
ip classless
!
ip flow-export version 9
!
!
access-list 1 permit 10.40.40.0 0.0.0.255
access-list 1 permit 10.30.30.0 0.0.0.255
access-list 1 permit 10.20.20.0 0.0.0.255
!
no cdp run
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login local
!
!
!
end
```

☐ Top

Copy Paste

Results and Analysis

1. Ping from PC6 “ VLAN 10 “ to PC8 “ VLAN 20 “ , same AS100 :



```
PC6
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.20.20.3

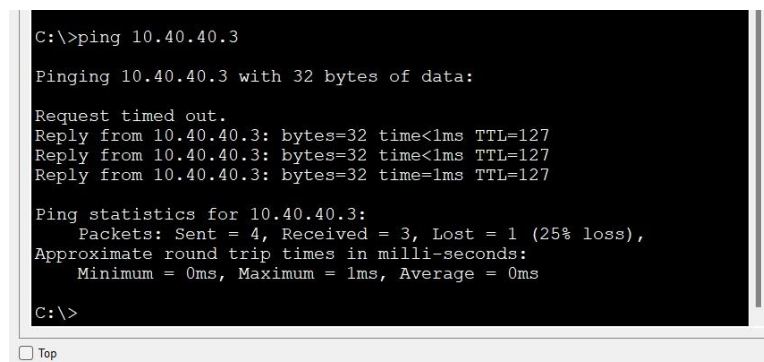
Pinging 10.20.20.3 with 32 bytes of data:

Request timed out.
Reply from 10.20.20.3: bytes=32 time<1ms TTL=127
Reply from 10.20.20.3: bytes=32 time<1ms TTL=127
Reply from 10.20.20.3: bytes=32 time<1ms TTL=127

Ping statistics for 10.20.20.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

2. Ping from PC6 “ VLAN 10 “ to DNS Server , same AS100 :



```
C:\>ping 10.40.40.3

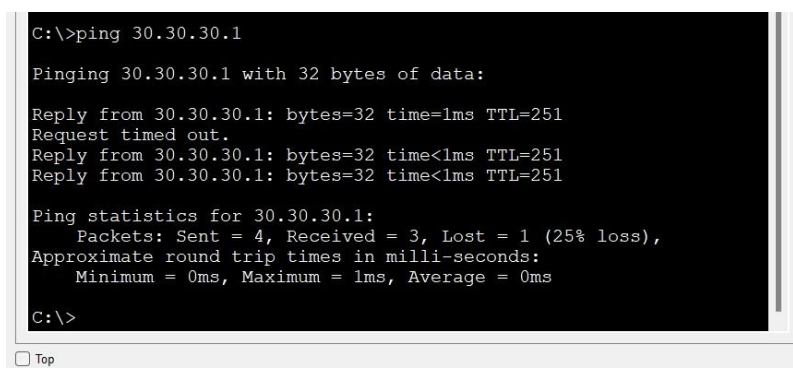
Pinging 10.40.40.3 with 32 bytes of data:

Request timed out.
Reply from 10.40.40.3: bytes=32 time<1ms TTL=127
Reply from 10.40.40.3: bytes=32 time<1ms TTL=127
Reply from 10.40.40.3: bytes=32 time<1ms TTL=127

Ping statistics for 10.40.40.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

3. Ping from PC6 “ VLAN 10 “ at AS 100 to public IP at AS400 :



```
C:\>ping 30.30.30.1

Pinging 30.30.30.1 with 32 bytes of data:

Reply from 30.30.30.1: bytes=32 time=1ms TTL=251
Request timed out.
Reply from 30.30.30.1: bytes=32 time<1ms TTL=251
Reply from 30.30.30.1: bytes=32 time<1ms TTL=251

Ping statistics for 30.30.30.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

4. Ping from PC6 “ VLAN 10 “ to web server , same AS100 :

```
C:\>ping 10.40.40.4

Pinging 10.40.40.4 with 32 bytes of data:

Request timed out.
Reply from 10.40.40.4: bytes=32 time<1ms TTL=127
Reply from 10.40.40.4: bytes=32 time<1ms TTL=127
Reply from 10.40.40.4: bytes=32 time=8ms TTL=127

Ping statistics for 10.40.40.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 8ms, Average = 2ms

C:\>
```

☐ Top

5. Ping from PC5 “ VLAN 10 “ to VLAN 20 , same AS400 :

PC5

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.20.20.4

Pinging 10.20.20.4 with 32 bytes of data:

Request timed out.
Reply from 10.20.20.4: bytes=32 time<1ms TTL=127
Reply from 10.20.20.4: bytes=32 time<1ms TTL=127
Reply from 10.20.20.4: bytes=32 time<1ms TTL=127

Ping statistics for 10.20.20.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

6. Ping from PC5 “ VLAN 10 “ to DNS server , same AS400 :

```
C:\>ping 10.40.40.3

Pinging 10.40.40.3 with 32 bytes of data:

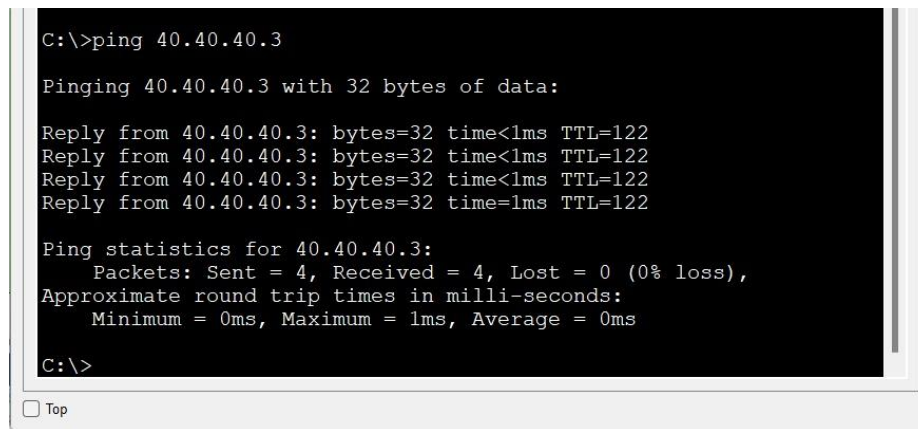
Request timed out.
Reply from 10.40.40.3: bytes=32 time<1ms TTL=127
Reply from 10.40.40.3: bytes=32 time<1ms TTL=127
Reply from 10.40.40.3: bytes=32 time<1ms TTL=127

Ping statistics for 10.40.40.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

☐ Top

7. Ping from PC5 “VLAN 10 “ to web server , same AS400 :



```
C:\>ping 40.40.40.3

Pinging 40.40.40.3 with 32 bytes of data:

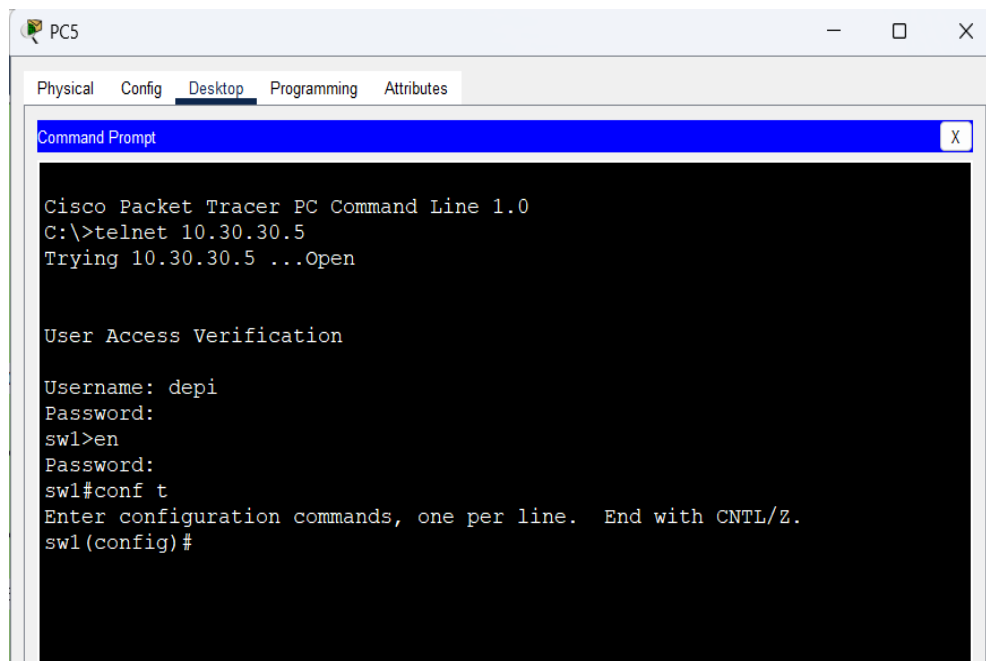
Reply from 40.40.40.3: bytes=32 time<1ms TTL=122
Reply from 40.40.40.3: bytes=32 time<1ms TTL=122
Reply from 40.40.40.3: bytes=32 time<1ms TTL=122
Reply from 40.40.40.3: bytes=32 time=1ms TTL=122

Ping statistics for 40.40.40.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

☐ Top

8. Telnet from PC5 “VLAN 10” to layer 2 switch “Switch0”, same AS400



```
PC5
Physical Config Desktop Programming Attributes
Command Prompt X

Cisco Packet Tracer PC Command Line 1.0
C:\>telnet 10.30.30.5
Trying 10.30.30.5 ...Open

User Access Verification

Username: depi
Password:
swl>en
Password:
swl#conf t
Enter configuration commands, one per line. End with CNTL/Z.
swl(config)#
```

```
Switch3
Physical Config CLI Attributes
IOS
hostname sw1
!
enable secret 5 $1$mERr$3HhIgMGBA/9qNmzgzcuxv0
!
!
!
!
username depi secret 5 $1$mERr$3HhIgMGBA/9qNmzgzcuxv0
!
!
ip dhcp snooping vlan 30,40
no ip dhcp snooping information option
ip dhcp snooping
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
 switchport access vlan 30
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 30
 switchport mode access
!
interface FastEthernet0/3
 ip dhcp snooping trust
 switchport mode trunk
!
interface FastEthernet0/4
 ip dhcp snooping trust
 switchport mode trunk
!
interface FastEthernet0/5
 switchport access vlan 40
 switchport mode access
!
interface FastEthernet0/6
 switchport access vlan 40
 switchport mode access
!
!
Top
```

```
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan30
 ip address 10.30.30.5 255.255.255.0
!
ip default-gateway 10.30.30.254
!
!
!
line con 0
!
line vty 0 4
 login local
line vty 5 15
 login
!
!
!
end
sw1#
```

Optional Configurations

- Configuration on switch 3 (same as switch 0):
- Configurations of switch 4 (same as switch 1):


```
Switch5
Physical Config CLI Attributes
IOS Command

!
hostname sw3
!
enable secret 5 $1$mERr$3HhIgMGBA/9qNmzgzcuxv0
!
!
!
!
username depi secret 5 $1$mERr$3HhIgMGBA/9qNmzgzcuxv0
!
!
ip dhcp snooping vlan 10
no ip dhcp snooping information option
ip dhcp snooping
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
switchport access vlan 10
switchport mode access
!
interface FastEthernet0/2
switchport access vlan 10
switchport mode access
!
interface FastEthernet0/3
ip dhcp snooping trust
switchport mode trunk
!
interface FastEthernet0/4
ip dhcp snooping trust
switchport mode trunk
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8

Top
```

```
!
interface Vlan1
no ip address
shutdown
!
interface Vlan10
ip address 10.10.10.5 255.255.255.0
!
ip default-gateway 10.10.10.254
!
!
!
!
line con 0
!
line vty 0 4
login local
line vty 5 15
login
!
!
!
!
end
sw3#

Top
```

• Configurations of switch 5 (same as switch 2):

```
Switch4
Physical Config CLI Attributes
IOS Command Line In

!
hostname sw2
!
enable secret 5 $1$mERr$3HhIgMGBA/9qNmzgzcuxv0
!
!
!
!
username depi secret 5 $1$mERr$3HhIgMGBA/9qNmzgzcuxv0
!
!
ip dhcp snooping vlan 20
no ip dhcp snooping information option
ip dhcp snooping
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/2
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/3
ip dhcp snooping trust
switchport mode trunk
!
interface FastEthernet0/4
ip dhcp snooping trust
switchport mode trunk
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8

Top
```

```
!
interface Vlan1
no ip address
shutdown
!
interface Vlan20
ip address 10.20.20.5 255.255.255.0
!
ip default-gateway 10.20.20.254
!
!
!
!
line con 0
!
line vty 0 4
login local
line vty 5 15
login
!
!
!
!
end
sw2#

Top
```

Team Roles

1. Abdelrahman Ahmed → VLAN Configuration .

Abdelrahman designed and implemented 8 VLANs, optimizing network segmentation and security. His work ensured proper isolation between critical segments such as production, guest, and management networks, reducing broadcast traffic and enhancing performance. By configuring VLAN trunking across switches, he enabled seamless communication between VLANs while maintaining security policies.

2. Ahmed Saeed→ OSPF Configuration .

Ahmed was responsible for configuring OSPF across 6 network areas , enabling efficient routing and reducing latency. He also fine-tuned OSPF cost values to ensure traffic took the most optimal paths, especially in high-priority segments. His work guaranteed that the network maintained dynamic routing capabilities, allowing for quick adaptation to any topology changes without manual intervention.

3. Mariam Magdi→ NAT, PAT, and Public Web Server Configuration .

Mariam implemented both NAT and PAT on the edge routers, allowing internal devices to communicate with external networks using a pool of 2 public IP addresses. She also configured Port Address Translation (PAT)to enable multiple devices to share a single public IP, optimizing resource

utilization. Additionally, Mariam set up a public web server, ensuring secure access to the server while maintaining internal network protection.

4. Tarek Mohamed → BGP, STP Configuration, DHCP and leading the team .

Tarek led the project team, providing guidance and coordination throughout the implementation. He was responsible for configuring BGP to ensure efficient inter-domain routing, deploying STP to prevent network loops, and managing DHCP services to streamline IP address allocation across the network.

5. Rehab Hassan → HSRP Setup .

Rehab configured HSRP on the core routers, ensuring high availability and automatic failover. Her implementation reduced downtime during testing by allowing a seamless switch to backup routers in the event of a failure. The collaborative work with Tarek on routing protocols ensured that the HSRP setup complemented the BGP configuration, contributing to the network's overall redundancy strategy.

6. Mohamed Hesham → DHCP Snooping and Telnet .

Mohamed played a key role in enhancing network security by implementing DHCP Snooping to prevent unauthorized devices from receiving IP addresses. Additionally, he configured Telnet for remote access and management of network devices, ensuring efficient and secure control of network resources.

Conclusion

"In conclusion, our team worked collaboratively to design and implement a highly efficient and secure network infrastructure, addressing both scalability and redundancy needs. By creating multiple VLANs, we achieved optimal traffic segmentation, enhancing security and improving overall network performance. The implementation of DHCP ensured dynamic IP address allocation, facilitating seamless device connectivity across the network. Additionally, OSPF was deployed to provide scalable, dynamic routing between internal network segments, while NAT and PAT configurations were applied to ensure secure, efficient IP address translation for external network communication.

To further strengthen the network's capabilities, we utilized BGP for inter-domain routing, enabling effective communication between multiple networks and ensuring reliable data exchange. The deployment of HSRP added an extra layer of redundancy, enhancing network availability by preventing single points of failure. Tarek led the effort in these critical areas, driving the success of the network's core routing and switching elements.

On the security side, Mohamed implemented DHCP Snooping, which played a crucial role in protecting against malicious or rogue devices attempting to gain unauthorized access to the network. Additionally, the inclusion of Telnet allowed for simplified remote management and troubleshooting of network devices, ensuring that administrators could monitor and adjust the network efficiently.

This project has demonstrated our team's ability to integrate complex network technologies into a unified, resilient infrastructure, capable of meeting both current operational demands and future

growth requirements. The combination of technical expertise and strategic coordination ensured the network's reliability, security, and performance."