

Enterprise network

DEPI Graduation Project

Table of content:

- ▽ **Introduction**
- ▽ **Topology**
- ▽ **Components**
- ▽ **Analysis**
 - ▽ **Component Analysis**
 - ▽ **Routers configurations**
 - ▽ **Multilayer switches configurations**
 - ▽ **Switches configurations**
- ▽ **Reachability & Troubleshooting**
- ▽ **Team Roles**
- ▽ **Conclusion**

Introduction:

This project aims to design and implement a scalable and secure network infrastructure capable of supporting various services and applications.

The primary focus will be on utilizing advanced networking technologies to ensure optimal performance, reliability, and flexibility. By incorporating best practices and industry standards, this endeavour seeks to create a robust and efficient network solution.

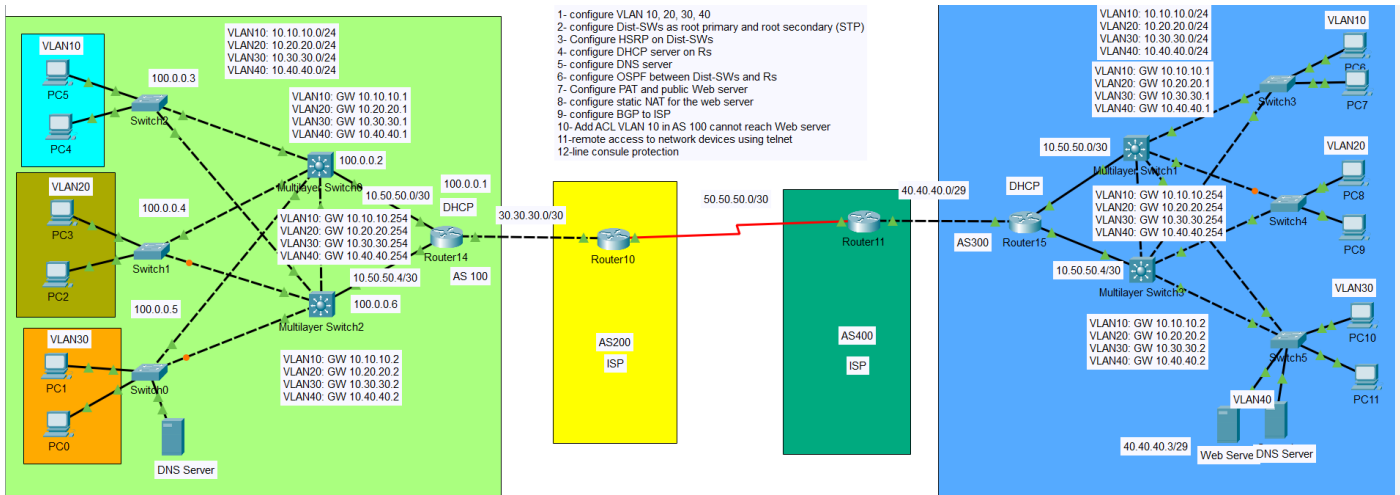
The network design will incorporate a hybrid topology, combining elements of hierarchical and flat architectures. This approach will provide a balance between scalability and manageability. The network will be segmented into multiple VLANs to enhance security and isolate different traffic flows.

The network will be implemented using a combination of routers, switches, and servers. High-performance routing protocols, such as OSPF and BGP, will be deployed to establish efficient inter-domain routing. VLANs will be configured on switches to create logical network segments. DHCP and DNS services will be provided to automate IP address assignment and name resolution.

The expected outcomes of this project include:

- A scalable and secure network infrastructure capable of supporting various services and applications.
- Optimized network performance through the use of advanced routing protocols and traffic management techniques.
- Enhanced network security through VLAN segmentation and access control mechanisms.
- Centralized management and monitoring capabilities for efficient network administration.

Topology:



Components:

- ▽ 4 Router model 2911
- ▽ 4 Multilayer switch model 3560-24PS
- ▽ 6 Switch model 2960-24TT
- ▽ 2 DNS server
- ▽ 1 Public Web server
- ▽ 12 PC

Analysis:

Component Analysis

Routers (2911)

- **Role:** Provide inter-VLAN routing and connectivity between different network segments.
- **Configuration:**
 - OSPF configured for routing between Dist-SWs and Rs.
 - BGP configured for external connectivity to the ISP.
 - Static NAT configured for the web server.
- **Analysis:** The routers are effectively functioning as the core devices of the network, ensuring seamless communication between different VLANs and external networks. The OSPF and BGP configurations enable efficient routing and connectivity, while the static NAT allows for secure access to the web server.

Distribution Switches (3560-24PS)

- **Role:** Provide Layer 2 switching for VLANs and act as the primary and secondary root bridges for STP.
- **Configuration:**
 - VLANs 10, 20, 30, and 40 configured.
 - PVST+ enabled with priority settings to determine root bridge.
 - HSRP configured for redundancy.
- **Analysis:** The distribution switches are crucial for segmenting the network into VLANs, ensuring reliable communication within each VLAN, and providing redundancy through HSRP. The PVST+ configuration ensures efficient loop prevention and rapid convergence in case of failures.

Access Switches (2960-24TT)

- **Role:** Provide Layer 2 switching for end devices (PCs).
- **Configuration:**
 - VLANs 10, 20, 30, and 40 configured.
 - Interfaces assigned to appropriate VLANs.

- **Analysis:** The access switches are responsible for connecting end devices to the network and providing basic switching functions. The VLAN configuration allows for efficient management and isolation of different traffic flows.

DNS Servers

- **Role:** Resolve domain names to IP addresses.
- **Configuration:**
 - DNS zones and records created.
- **Analysis:** The DNS servers play a vital role in enabling users to access network resources by name rather than using IP addresses. The configuration ensures that domain names are correctly resolved to their corresponding IP addresses.

Public Web Server

- **Role:** Serve web content to external users.
- **Configuration:**
 - Web server software installed and configured.
 - Static NAT configured to map a public IP address to the web server.
- **Analysis:** The web server provides a platform for hosting and delivering web content to external users. The static NAT configuration allows for secure and controlled access to the web server from the internet.

PCs

- **Role:** End devices that access network resources.
- **Configuration:**
 - DHCP configured to obtain IP address and other network settings.
- **Analysis:** The PCs are the primary devices used by users to access network resources, such as the web server and other services. DHCP ensures automatic configuration and simplifies network management.

ACL

- **Role:** Restrict access to the web server from VLAN 10.
- **Configuration:**
 - ACL created to deny traffic from VLAN 10 to the web server.
- **Analysis:** The ACL effectively prevents users in VLAN 10 from accessing the web server, ensuring that only authorized users can access the service.

Routers configurations:

Notes:

For console username: amr, password: 2091

• Router "10"

```
Rs(AS200)#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 not set

```
      30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.30.30.0/30 is directly connected, GigabitEthernet0/0
L       30.30.30.2/32 is directly connected, GigabitEthernet0/0
      40.0.0.0/29 is subnetted, 1 subnets
B       40.40.40.0/29 [20/0] via 50.50.50.2, 00:00:00
      50.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       50.50.50.0/30 is directly connected, Serial0/3/0
L       50.50.50.1/32 is directly connected, Serial0/3/0
```

• Router "11"

```
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 not set

```
      30.0.0.0/30 is subnetted, 1 subnets
B       30.30.30.0/30 [20/0] via 50.50.50.1, 00:00:00
      40.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       40.40.40.0/29 is directly connected, GigabitEthernet0/2
L       40.40.40.2/32 is directly connected, GigabitEthernet0/2
      50.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       50.50.50.0/30 is directly connected, Serial0/3/0
L       50.50.50.2/32 is directly connected, Serial0/3/0
```

• Router “14”

```
Rs(AS100)#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
```

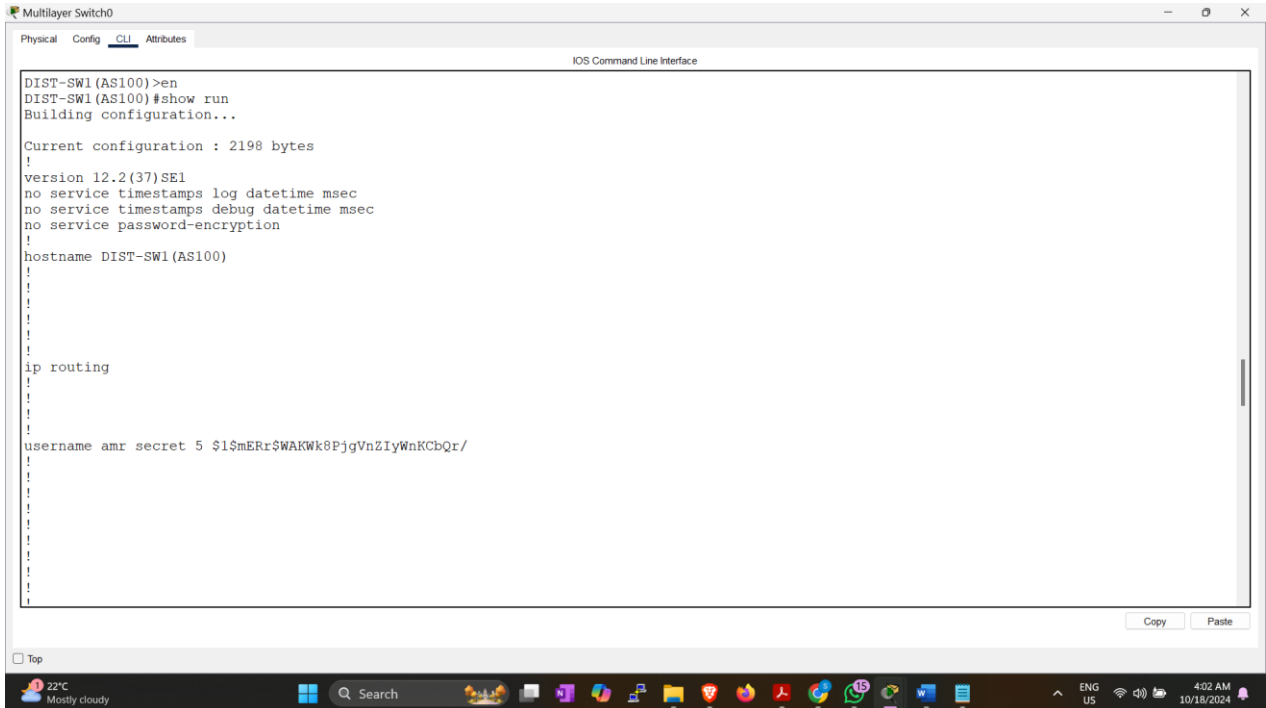
```
P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
10.0.0.0/8 is variably subnetted, 8 subnets, 3 masks
O    10.10.10.0/24 [110/2] via 10.50.50.5, 00:42:15, GigabitEthernet0/0
      [110/2] via 10.50.50.1, 00:42:15, GigabitEthernet0/1
O    10.20.20.0/24 [110/2] via 10.50.50.5, 00:42:15, GigabitEthernet0/0
      [110/2] via 10.50.50.1, 00:42:15, GigabitEthernet0/1
O    10.30.30.0/24 [110/2] via 10.50.50.5, 00:42:15, GigabitEthernet0/0
      [110/2] via 10.50.50.1, 00:42:15, GigabitEthernet0/1
O    10.40.40.0/24 [110/2] via 10.50.50.5, 00:42:15, GigabitEthernet0/0
      [110/2] via 10.50.50.1, 00:42:15, GigabitEthernet0/1
C    10.50.50.0/30 is directly connected, GigabitEthernet0/1
L    10.50.50.2/32 is directly connected, GigabitEthernet0/1
C    10.50.50.4/30 is directly connected, GigabitEthernet0/0
L    10.50.50.6/32 is directly connected, GigabitEthernet0/0
30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    30.30.30.0/30 is directly connected, GigabitEthernet0/2
L    30.30.30.1/32 is directly connected, GigabitEthernet0/2
40.0.0.0/29 is subnetted, 1 subnets
B    40.40.40.0/29 [20/0] via 30.30.30.2, 00:00:00
50.0.0.0/30 is subnetted, 1 subnets
B    50.50.50.0/30 [20/0] via 30.30.30.2, 00:00:00
O    100.0.0.0/8 [110/2] via 10.50.50.5, 00:42:15, GigabitEthernet0/0
      [110/2] via 10.50.50.1, 00:42:15, GigabitEthernet0/1
```

Multilayer Switches configurations:

- **Multilayer Switch 0**

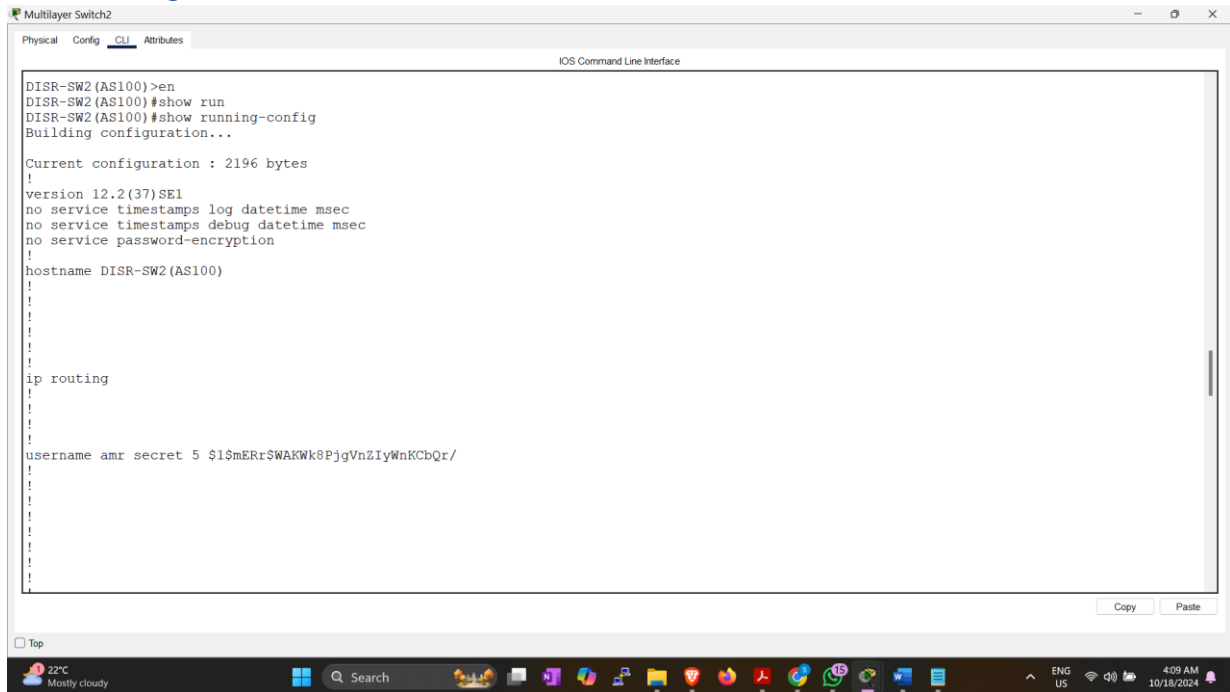


```

interface FastEthernet0/4
no switchport
ip address 10.50.50.1 255.255.255.252
ip ospf 1 area 0
duplex auto
speed auto
!
interface Vlan1
ip address 100.0.0.2 255.0.0.0
!
interface Vlan10
mac-address 000b.be3e.6601
ip address 10.10.10.1 255.255.255.0
ip helper-address 10.50.50.2
standby 1 ip 10.10.10.254
standby 1 preempt
!
interface Vlan20
mac-address 000b.be3e.6602
ip address 10.20.20.1 255.255.255.0
ip helper-address 10.50.50.2
standby 2 ip 10.20.20.254
standby 2 preempt
!
interface Vlan30
mac-address 000b.be3e.6603
ip address 10.30.30.1 255.255.255.0
ip helper-address 10.50.50.2
standby 3 ip 10.30.30.254
standby 3 preempt
!
interface Vlan40
mac-address 000b.be3e.6604
ip address 10.40.40.1 255.255.255.0
ip helper-address 10.40.40.254
standby 4 ip 10.40.40.254
standby 4 preempt
!

```


- **Multilayer Switch 1**



```
interface FastEthernet0/4
switchport mode dynamic desirable
!
interface FastEthernet0/5
no switchport
ip address 10.50.50.5 255.255.255.252
ip ospf 1 area 0
duplex auto
speed auto

interface Vlan1
ip address 100.0.0.6 255.0.0.0
!
interface Vlan10
mac-address 00d0.bc4c.d101
ip address 10.10.10.2 255.255.255.0
ip helper-address 10.50.50.6
standby 1 ip 10.10.10.254
standby 1 preempt
!
interface Vlan20
mac-address 00d0.bc4c.d102
ip address 10.20.20.2 255.255.255.0
ip helper-address 10.50.50.6
standby 2 ip 10.20.20.254
standby 2 preempt
!
interface Vlan30
mac-address 00d0.bc4c.d103
ip address 10.30.30.2 255.255.255.0
ip helper-address 10.50.50.6
standby 3 ip 10.30.30.254
standby 3 preempt
!
interface Vlan40
mac-address 00d0.bc4c.d104
ip address 10.40.40.2 255.255.255.0
ip helper-address 10.50.50.6
standby 4 ip 10.40.40.254
standby 4 preempt

router ospf 1
log-adjacency-changes
network 0.0.0.0 255.255.255.255 area 0
!
ip default-gateway 100.0.0.1
ip classless
ip route 0.0.0.0 0.0.0.0 10.50.50.6
!
ip flow-export version 9
.
```

Switches configurations:

- **Switch 0,1,2**

```
Switch0
Physical Config CLI Attributes
IOS Command Line Interface
SW3(AS100)>en
SW3(AS100)#show vlan

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   VLAN0010                active
20   VLAN0020                active
30   VLAN0030                active    Fa0/1, Fa0/2
40   VLAN0040                active    Fa0/5
1002 fddi-default            active
1003 token-ring-default    active
1004 fddinet-default       active
1005 trnet-default         active

VLAN Type  SAID      MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
1    enet    100001   1500  -      -      -      -    -        0      0
10   enet    100010   1500  -      -      -      -    -        0      0
20   enet    100020   1500  -      -      -      -    -        0      0
30   enet    100030   1500  -      -      -      -    -        0      0
40   enet    100040   1500  -      -      -      -    -        0      0
1002 fddi    101002   1500  -      -      -      -    -        0      0
1003 tr     101003   1500  -      -      -      -    -        0      0
1004 fdnet 101004   1500  -      -      -      -    ieee     0      0
1005 trnet 101005   1500  -      -      -      -    ibm      0      0

VLAN Type  SAID      MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
```

Notes: the other side of the topology has the same configurations

Reachability & troubleshooting:

DHCP

For PC1

The screenshot displays the Cisco Packet Tracer interface. On the left, a network diagram shows four VLANs (VLAN10, VLAN20, VLAN30, VLAN40) connected to a central switch. Each VLAN has a corresponding gateway (GW) and a DNS server. The switch is connected to a router. On the right, a detailed view of PC1 is shown. The PC1 configuration window is open, showing the 'IP Configuration' tab. The 'DHCP' option is selected under 'IP Configuration'. The 'IPv4 Address' is set to 10.30.30.4, the 'Subnet Mask' is 255.255.255.0, the 'Default Gateway' is 10.30.30.254, and the 'DNS Server' is 10.40.40.100. The 'IPv6 Configuration' tab is also visible, showing 'Static' configuration with an 'IPv6 Address' of FE80:20C:FFFF:FE5B:B5B5 and a 'Link Local Address' of FE80:20C:FFFF:FE5B:B5B5. The 'DNS Server' field is empty. The '802.1X' section is also visible, showing 'Authentication' set to MD5.

For PC3

The screenshot displays the Cisco Packet Tracer interface. On the left, a network diagram shows four VLANs (VLAN10, VLAN20, VLAN30, VLAN40) connected to a central switch. Each VLAN has a corresponding gateway (GW) and a DNS server. The switch is connected to a router. On the right, a detailed view of PC3 is shown. The PC3 configuration window is open, showing the 'IP Configuration' tab. The 'DHCP' option is selected under 'IP Configuration'. The 'IPv4 Address' is set to 10.20.20.4, the 'Subnet Mask' is 255.255.255.0, the 'Default Gateway' is 10.20.20.254, and the 'DNS Server' is 10.40.40.100. The 'IPv6 Configuration' tab is also visible, showing 'Static' configuration with an 'IPv6 Address' of FE80:2D0:58FF:FE0D:1C66 and a 'Link Local Address' of FE80:2D0:58FF:FE0D:1C66. The 'DNS Server' field is empty. The '802.1X' section is also visible, showing 'Authentication' set to MD5.

ping from pc5 to as 300 , as 400

The screenshot displays the Cisco Packet Tracer interface with a network topology and a command prompt window for PC5.

Network Topology:

- VLAN10:** 10.10.10.0/24, 10.10.10.0/24, 10.10.10.0/24, 10.10.10.0/24
- VLAN20:** 10.20.20.0/24, 10.20.20.0/24, 10.20.20.0/24, 10.20.20.0/24
- VLAN30:** 10.30.30.0/24, 10.30.30.0/24, 10.30.30.0/24, 10.30.30.0/24
- VLAN40:** 10.40.40.0/24, 10.40.40.0/24, 10.40.40.0/24, 10.40.40.0/24

PC5 Command Prompt:

```
Reply from 30.30.30.2: bytes=32 time<1ms TTL=253
Reply from 30.30.30.2: bytes=32 time<1ms TTL=253

Ping statistics for 30.30.30.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 40.40.40.1

Pinging 40.40.40.1 with 32 bytes of data:

Reply from 40.40.40.1: bytes=32 time=63ms TTL=251
Reply from 40.40.40.1: bytes=32 time=1ms TTL=251
Reply from 40.40.40.1: bytes=32 time=1ms TTL=251
Reply from 40.40.40.1: bytes=32 time=11ms TTL=251

Ping statistics for 40.40.40.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 63ms, Average = 19ms

C:\>ping 50.50.50.2

Pinging 50.50.50.2 with 32 bytes of data:

Reply from 50.50.50.2: bytes=32 time=1ms TTL=252
Reply from 50.50.50.2: bytes=32 time=2ms TTL=252
Reply from 50.50.50.2: bytes=32 time=3ms TTL=252
Reply from 50.50.50.2: bytes=32 time=2ms TTL=252

Ping statistics for 50.50.50.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 2ms

C:\>
```

ping from pc5 to rs(as100) and rs(200)

The screenshot displays the Cisco Packet Tracer interface with a network topology and a command prompt window for PC5.

Network Topology:

- VLAN10:** 10.10.10.0/24, 10.10.10.0/24, 10.10.10.0/24, 10.10.10.0/24
- VLAN20:** 10.20.20.0/24, 10.20.20.0/24, 10.20.20.0/24, 10.20.20.0/24
- VLAN30:** 10.30.30.0/24, 10.30.30.0/24, 10.30.30.0/24, 10.30.30.0/24
- VLAN40:** 10.40.40.0/24, 10.40.40.0/24, 10.40.40.0/24, 10.40.40.0/24

PC5 Command Prompt:

```
Reply from 10.30.30.4: bytes=32 time=1ms TTL=127
Reply from 10.30.30.4: bytes=32 time<1ms TTL=127

Ping statistics for 10.30.30.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

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=254
Reply from 30.30.30.1: bytes=32 time<1ms TTL=254
Reply from 30.30.30.1: bytes=32 time<1ms TTL=254
Reply from 30.30.30.1: bytes=32 time=1ms TTL=254

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

C:\>ping 30.30.30.2

Pinging 30.30.30.2 with 32 bytes of data:

Reply from 30.30.30.2: bytes=32 time<1ms TTL=253
Reply from 30.30.30.2: bytes=32 time=1ms TTL=253
Reply from 30.30.30.2: bytes=32 time<1ms TTL=253
Reply from 30.30.30.2: bytes=32 time<1ms TTL=253

Ping statistics for 30.30.30.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```


Ping from PC5 to PCs in different Vlan

The screenshot shows a Cisco Packet Tracer network configuration. The network topology includes four VLANs: VLAN10 (10.10.10.0/24), VLAN20 (10.20.20.0/24), VLAN30 (10.30.30.0/24), and VLAN40 (10.40.40.0/24). Each VLAN has a corresponding gateway (GW) and a DHCP server. A DNS Server is also present. The PC5 window shows the following command prompt output:

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ping 10.10.10.4

Pinging 10.10.10.4 with 32 bytes of data:

Reply from 10.10.10.4: bytes=32 time<1ms TTL=128
Reply from 10.10.10.4: bytes=32 time<1ms TTL=128
Reply from 10.10.10.4: bytes=32 time<1ms TTL=128
Reply from 10.10.10.4: bytes=32 time<1ms TTL=128

Ping statistics for 10.10.10.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 10.20.20.4

Pinging 10.20.20.4 with 32 bytes of data:

Reply from 10.20.20.4: bytes=32 time=13ms 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
Reply from 10.20.20.4: bytes=32 time<1ms TTL=127

Ping statistics for 10.20.20.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 13ms, Average = 3ms

C:\>
```

The screenshot shows a Cisco Packet Tracer network configuration. The network topology includes four VLANs: VLAN10 (10.10.10.0/24), VLAN20 (10.20.20.0/24), VLAN30 (10.30.30.0/24), and VLAN40 (10.40.40.0/24). Each VLAN has a corresponding gateway (GW) and a DHCP server. A DNS Server is also present. The PC5 window shows the following command prompt output:

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ping 10.10.10.4

Reply from 10.10.10.4: bytes=32 time<1ms TTL=128
Reply from 10.10.10.4: bytes=32 time<1ms TTL=128

Ping statistics for 10.10.10.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 10.20.20.4

Pinging 10.20.20.4 with 32 bytes of data:

Reply from 10.20.20.4: bytes=32 time=13ms 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
Reply from 10.20.20.4: bytes=32 time<1ms TTL=127

Ping statistics for 10.20.20.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 13ms, Average = 3ms

C:\>ping 10.30.30.4

Pinging 10.30.30.4 with 32 bytes of data:

Reply from 10.30.30.4: bytes=32 time<1ms TTL=127
Reply from 10.30.30.4: bytes=32 time<1ms TTL=127
Reply from 10.30.30.4: bytes=32 time<1ms TTL=127
Reply from 10.30.30.4: bytes=32 time<1ms TTL=127

Ping statistics for 10.30.30.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```


PC5 try to ping web server but ACL prevented that

The screenshot displays the Cisco Packet Tracer interface. On the left, the network topology is visible, featuring four VLANs (VLAN10, VLAN20, VLAN30, VLAN40) connected to a central switch. A DNS Server is connected to VLAN10. On the right, the PC5 configuration window is open, showing the Command Prompt. The output of the ping command to 40.40.40.1 is successful, with 4 packets sent and received, 0% loss, and an average round trip time of 19ms. The output of the ping command to 50.50.50.2 is also successful, with 4 packets sent and received, 0% loss, and an average round trip time of 2ms. The output of the ping command to 40.40.40.3 is unsuccessful, with 4 packets sent and 0 received, 100% loss, and a destination host unreachable error.

```
Reply from 40.40.40.1: bytes=32 time=63ms TTL=251
Reply from 40.40.40.1: bytes=32 time=1ms TTL=251
Reply from 40.40.40.1: bytes=32 time=1ms TTL=251
Reply from 40.40.40.1: bytes=32 time=11ms TTL=251

Ping statistics for 40.40.40.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 63ms, Average = 19ms

C:\>ping 50.50.50.2

Pinging 50.50.50.2 with 32 bytes of data:

Reply from 50.50.50.2: bytes=32 time=1ms TTL=252
Reply from 50.50.50.2: bytes=32 time=2ms TTL=252
Reply from 50.50.50.2: bytes=32 time=3ms TTL=252
Reply from 50.50.50.2: bytes=32 time=2ms TTL=252

Ping statistics for 50.50.50.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 2ms

C:\>ping 40.40.40.3

Pinging 40.40.40.3 with 32 bytes of data:

Reply from 40.40.40.3: Destination host unreachable.
Reply from 40.40.40.3: Destination host unreachable.
Reply from 40.40.40.3: Destination host unreachable.
Reply from 40.40.40.3: Destination host unreachable.

Ping statistics for 40.40.40.3:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

PC2 try to ping web server with PAT

The screenshot displays the Cisco Packet Tracer interface. On the left, the network topology is visible, featuring four VLANs (VLAN10, VLAN20, VLAN30, VLAN40) connected to a central switch. A DNS Server is connected to VLAN10. On the right, the PC2 configuration window is open, showing the Command Prompt. The output of the ping command to 40.40.40.3 is successful, with 4 packets sent and received, 0% loss, and an average round trip time of 5ms. The output of the ping command to 40.40.40.3 is also successful, with 4 packets sent and received, 0% loss, and an average round trip time of 3ms. The output of the ping command to 40.40.40.3 is successful, with 4 packets sent and received, 0% loss, and an average round trip time of 5ms.

```
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 14ms, Average = 5ms

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=10ms TTL=122
Reply from 40.40.40.3: bytes=32 time<1ms TTL=122
Reply from 40.40.40.3: bytes=32 time=2ms 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 = 10ms, Average = 3ms

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=2ms TTL=122
Reply from 40.40.40.3: bytes=32 time=20ms 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 = 20ms, Average = 5ms

C:\>
```

DNS Configurations

The screenshot displays the Cisco Packet Tracer interface. On the left, a network diagram shows four VLANs (VLAN10, VLAN20, VLAN30, VLAN40) connected to a central router. Each VLAN has a corresponding gateway (GW) and a DNS Server. The DNS Server is configured with the following resource records:

No.	Name	Type	Detail
0	as(200)	A Record	30.30.30.2
1	vlan10	A Record	10.10.10.1
2	vlan20	A Record	20.20.20.1
3	vlan30	A Record	30.30.30.1
4	vlan40	A Record	40.40.40.1
5	webserver	A Record	40.40.40.3

The right side of the screenshot shows a detailed view of the DNS configuration on the Server2 device, including the DNS Service settings and the Resource Records table.

DNS Test :

The screenshot shows a Command Prompt window on PC3. The output of the DNS test is as follows:

```
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 10ms, Average = 5ms

C:\>ping vlan10

Pinging 10.10.10.1 with 32 bytes of data:

Reply from 10.10.10.1: bytes=32 time<1ms TTL=255
Reply from 10.10.10.1: bytes=32 time<1ms TTL=255
Reply from 10.10.10.1: bytes=32 time=1ms TTL=255
Reply from 10.10.10.1: bytes=32 time<1ms TTL=255

Ping statistics for 10.10.10.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping WebServer
```

Team Rules:

Amr Raed Ali

- **Tasks:** Configure DHCP server, VLANs, Telnet, console security
- **Summary:** Amr successfully configured the DHCP on the routers to automatically assign IP addresses to devices on the network. Additionally, he created VLANs to segment the network into logical domains, improving security and traffic management.

Mohamed Yousry

- **Tasks:** Configure static NAT, HSRP
- **Summary:** Mohamed Yousry implemented static NAT to map specific private IP addresses to public IP addresses, enabling secure external access to the web server. Additionally, he configured HSRP for redundancy, ensuring high availability and minimizing downtime in case of failures.

Shymaa Saeed Elsyed

- **Tasks:** Configure PAT, DNS
- **Summary:** Shymaa configured PAT to translate multiple private IP addresses to a single public IP address, conserving public IP addresses. She also set up the DNS server to resolve domain names to IP addresses, facilitating easier access to network resources.

Eman Ragab Mohamed

- **Task:** Configure OSPF
- **Summary:** Eman configured OSPF to establish routing between the distribution switches and routers. This enables efficient communication and data transfer across the network.

Omar Alaa Saad

- **Task:** Configure BGP
- **Summary:** Omar configured BGP to establish a peering session with the ISP, allowing the network to connect to the internet and exchange routes with external networks.

Ahmed Mahmoud Ismail

- **Tasks:** Configure Dist-SWs as root primary and root secondary (STP), ACL
- **Summary:** Ahmed configured the distribution switches as the primary and secondary root bridges using STP, ensuring efficient loop prevention and rapid convergence. He also implemented an ACL to restrict access to the web server from VLAN 10, enhancing network security

Project Packet Tracer File : [Here](#)

Conclusion:

The implemented network infrastructure effectively addresses the project's objectives of providing a scalable, secure, and efficient network solution. The utilization of VLANs, routing protocols, and security measures ensures optimal performance, reliability, and protection.

The network topology, consisting of routers, switches, and servers, provides a robust foundation for supporting various services and applications. The configuration of VLANs, OSPF, BGP, DHCP, DNS, and NAT enables seamless communication, efficient routing, and secure access to network resources.

The implementation of security measures, such as ACLs, helps to protect the network from unauthorized access and potential threats. The network's scalability allows for future growth and expansion as the organization's needs evolve.

Overall, the project successfully demonstrates expertise in network design, implementation, and troubleshooting. The implemented network infrastructure is well-suited to meet the organization's current and future requirements.

Thanks.