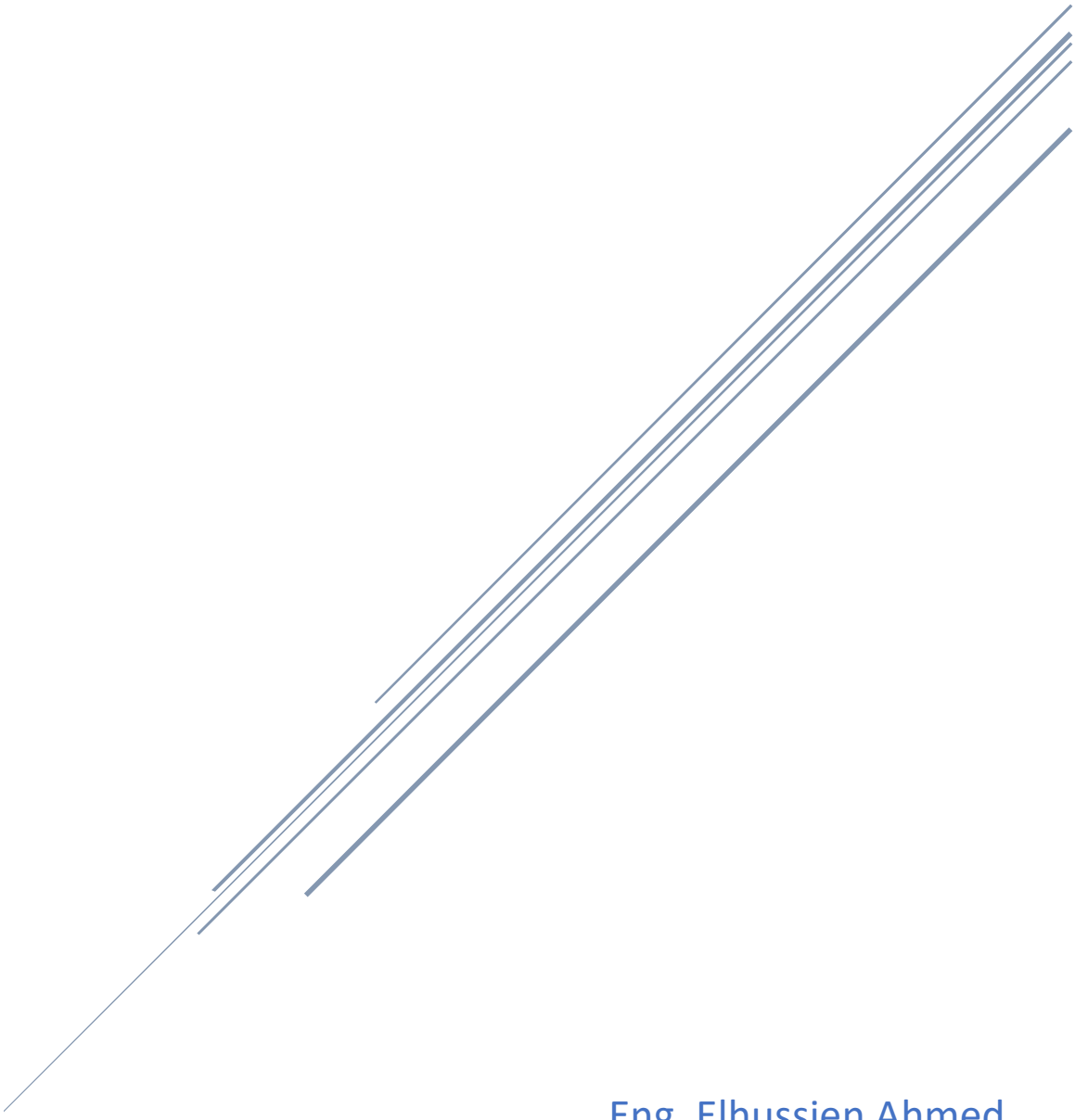
PROJECT DOCUMENTATION



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1. Network Design Overview

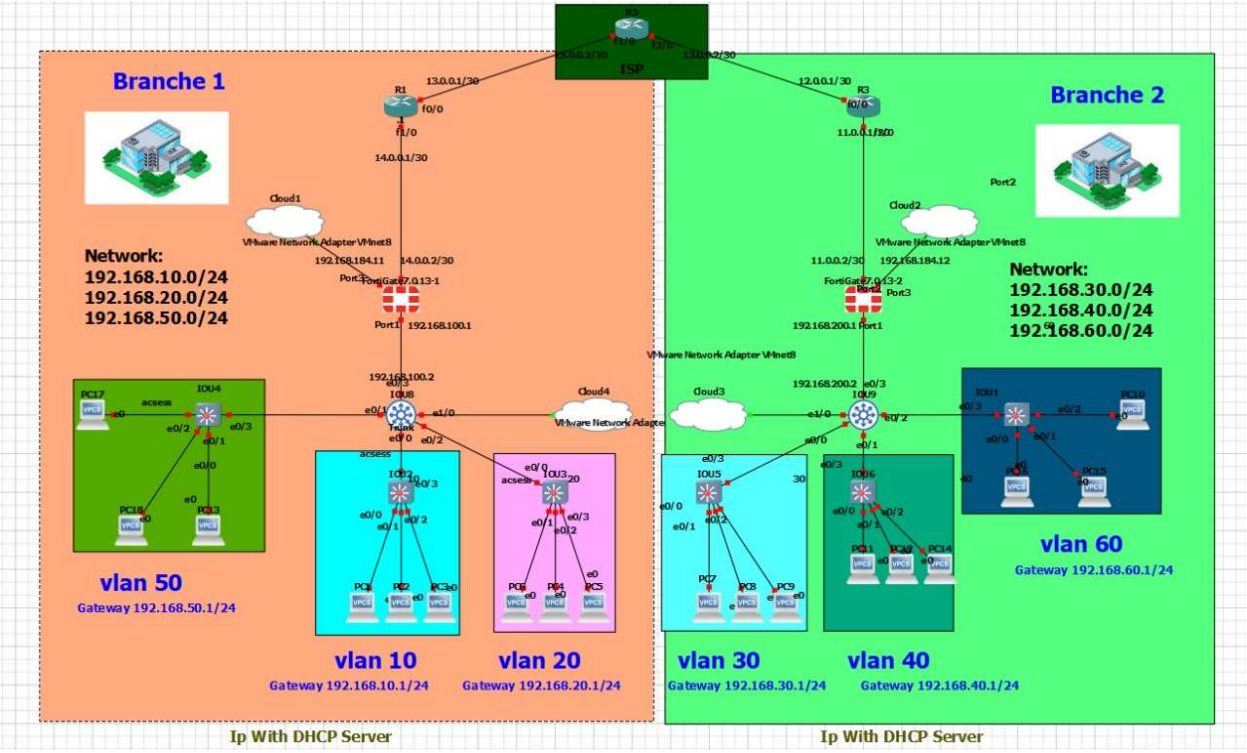
The network consists of **two main branches (Branch 1 and Branch 2)** connected through an **ISP router (R5)**.
Each branch includes a **FortiGate firewall**, a **Layer 3 switch**, multiple VLANs, DHCP and internal routing.
The core routing between the two branches is done using **OSPF**, implemented on **R1, R3, and R5**, while the firewalls operate using a combination of **Static Routes + OSPF** toward internal networks.

The topology is divided into:

- **Branch 1** (VLAN 10, VLAN 20, VLAN 50)
- **Branch 2** (VLAN 30, VLAN 40, VLAN 60)
- **ISP backbone** for inter-branch connectivity
- **FortiGate devices** securing and routing traffic between branches and local networks

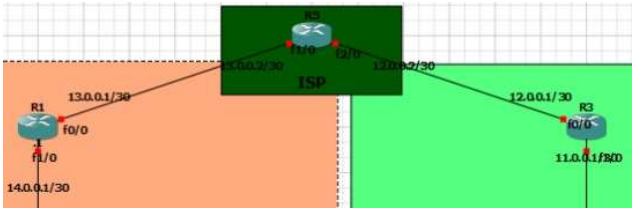
The design ensures:

- Logical segmentation of departments.
- Secure routing between branches.
- Controlled traffic inspection through firewalls.
- Dynamic routing using OSPF between core routers.
- Static + OSPF hybrid configuration on FortiGate firewalls.



2. Topology Structure

The topology follows a hierarchical model:

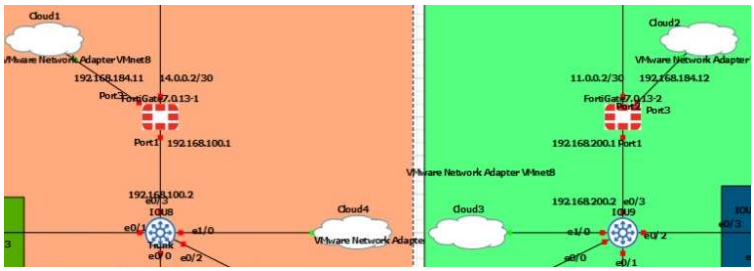


A. Core Layer

- **R5** acts as the service provider connecting both branches.
- Handles OSPF adjacency with R1 and R3.

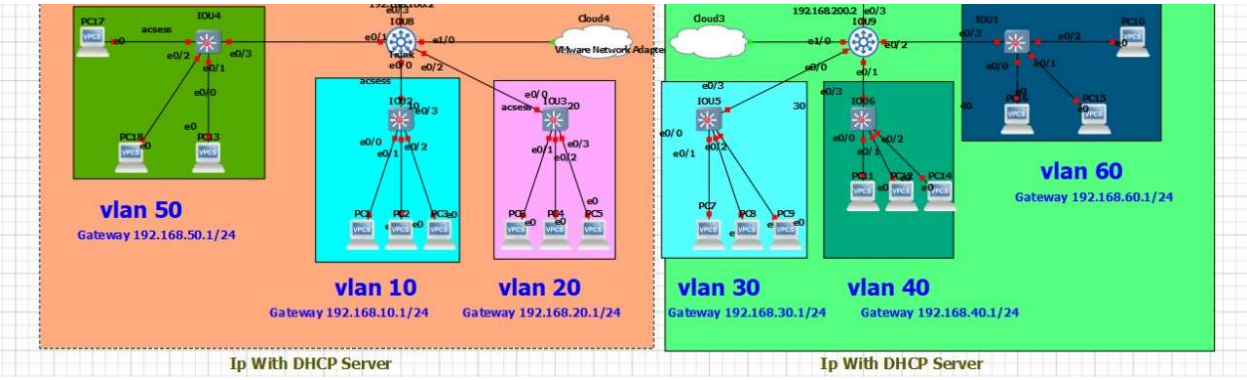
B. Distribution / Security Layer

- Each branch uses a **FortiGate** model.
- Functions:
    - Static & OSPF routing
    - NAT
    - IPS/IDS security inspection
    - DHCP server per VLAN
    - IPsec S2S VPN termination



C. Access Layer

- Three VLAN blocks per branch.
- Switches configured with:
    - Trunk uplinks to dist. switches
    - Access ports assigned per VLAN
    - DHCP delivered by FortiGate



3. IP Addressing Scheme

The addressing scheme is structured to maintain clear separation of departments, simplified routing, and consistent subnet allocation across both branches.

A. Branch 1 (Left Side)

Contains three main networks:

VLAN	Subnet	Default Gateway
VLAN 10	192.168.10.0/24	192.168.10.1
VLAN 20	192.168.20.0/24	192.168.20.1
VLAN 50	192.168.50.0/24	192.168.50.1

WAN / Routing Links:

- R1 → R5: **13.0.0.1/30 ↔ 13.0.0.2/30**
- FortiGate Port2 → R1: **14.0.0.1/30 ↔ 14.0.0.2/30**
- FortiGate Port1 (LAN): **192.168.100.1**

B. Branch 2 (Right Side)

Contains three main networks:

VLAN	Subnet	Default Gateway
VLAN 30	192.168.30.0/24	192.168.30.1
VLAN 40	192.168.40.0/24	192.168.40.1
VLAN 60	192.168.60.0/24	192.168.60.1

WAN / Routing Links:

- R3 → R5: **12.0.0.1/30 ↔ 12.0.0.2/30**
- FortiGate Port3 → R3: **11.0.0.1/30 ↔ 11.0.0.2/30**
- FortiGate Port1 (LAN): **192.168.200.1**

C. ISP Router (R5)

R5 connects both branches using two independent OSPF-enabled WAN links:

- To Branch 1: **13.0.0.2**
- To Branch 2: **12.0.0.2**

R5 operates as the central OSPF area ensuring route exchange between R1 and R3.

4. VLAN Structure & Inter-VLAN Routing

VLANs were created to segment the network into separate logical domains, each representing a department or service zone.
This reduces broadcast traffic, enhances performance, and enforces security boundaries.

Inter-VLAN routing was enabled using Layer 3 interfaces and the FortiGate firewall.
All VLAN-to-VLAN communication passes through the firewall, allowing the application of access rules, monitoring, and logging.
This approach provides strict control over which departments or servers can communicate.

Each branch is segmented into three VLANs to isolate services and users.

Branch 1 VLANs

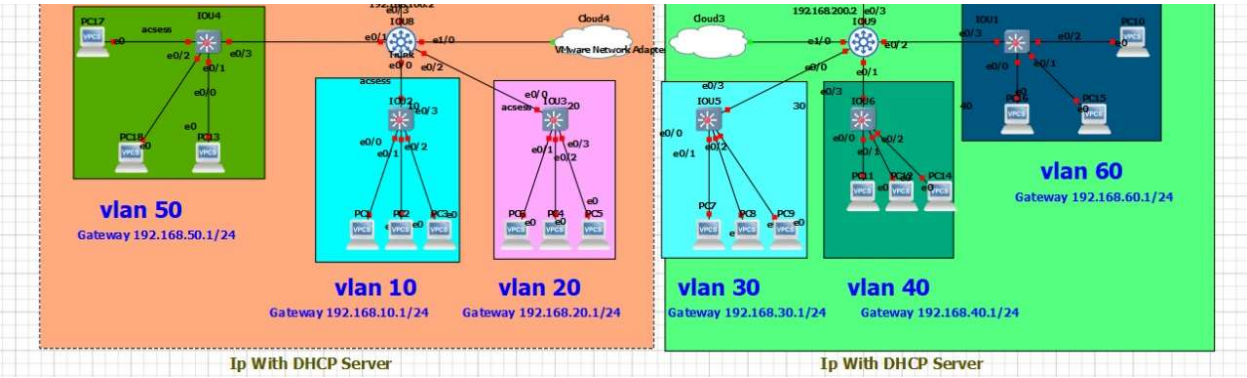
- **VLAN 10** – Users / Clients
- **VLAN 20** – Management / Special Service
- **VLAN 50** – Admin / Servers

Branch 2 VLANs

- **VLAN 30** – Sales / Employees
- **VLAN 40** – HR / Finance
- **VLAN 60** – Administration

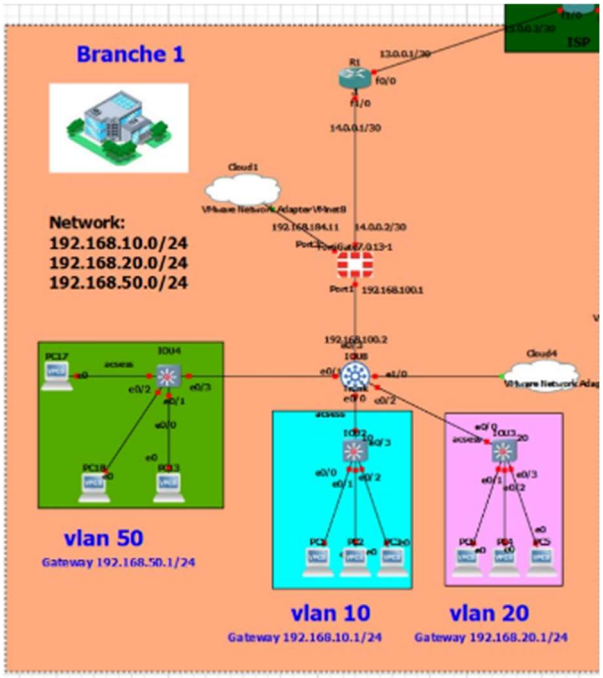
Each VLAN has:

- A dedicated DHCP pool
- A unique gateway on the FortiGate
- Inter-VLAN routing through the firewall



5. Vlan & Intervlan configuration

➢ Branche 1:



▪ IOU4 Config

```
// Create VLAN
vlan 50
 name VLAN50

// Uplink to IOU8
interface e0/3
 switchport mode trunk
 switchport trunk allowed vlan 50

// Access ports for VLAN 50 PCs
interface range e0/0 , e0/1 , e0/2
 switchport mode access
 switchport access vlan 50
```

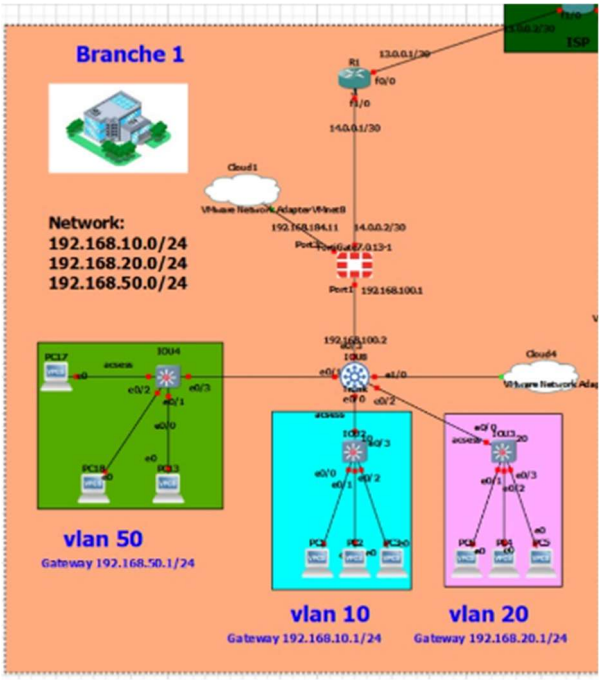
▪ IOU2 Config

```
// Create VLAN
vlan 10
 name VLAN10

// Uplink to IOU8
interface e0/3
 switchport mode trunk
 switchport trunk allowed vlan 10

// Access ports for VLAN 10
interface range e0/0 , e0/1 , e0/2
 switchport mode access
 switchport access vlan 10
```

▪ IOU3 Config

```
// Create VLAN
vlan 20
 name VLAN20

// Uplink to IOU8
interface e0/3
 switchport mode trunk
 switchport trunk allowed vlan 20

// Access ports for VLAN 20
interface range e0/0 , e0/1 , e0/2
 switchport mode access
 switchport access vlan 20
 spanning-tree portfast
```

- **IOU8 Config**




```
// Create VLANs
vlan 10
 name VLAN10
vlan 20
 name VLAN20
vlan 50
 name VLAN50

// Trunk to IOU4 (VLAN 50 switch)
interface e0/0
 switchport mode trunk
 switchport trunk allowed vlan 50

// Trunk to IOU2 (VLAN 10 switch)
interface e0/1
 switchport mode trunk
 switchport trunk allowed vlan 10

// Trunk to IOU3 (VLAN 20 switch)
interface e0/2
 switchport mode trunk
 switchport trunk allowed vlan 20

// Uplink to FortiGate (L3 connection)
interface e0/3
 switchport trunk encapsulation dot1q
 switchport mode trunk
 switchport trunk allowed vlan 10,20,50
```

Inter-VLAN Routing (SVIs):

- **on IOU8**

```
ip routing

interface Vlan10
 ip address 192.168.10.1 255.255.255.0

interface Vlan20
 ip address 192.168.20.1 255.255.255.0

interface Vlan50
 ip address 192.168.50.1 255.255.255.0

// Default route to FortiGate
ip route 0.0.0.0 0.0.0.0 192.168.100.1
```

➢ Branche 2:

▪ IOU5 Config

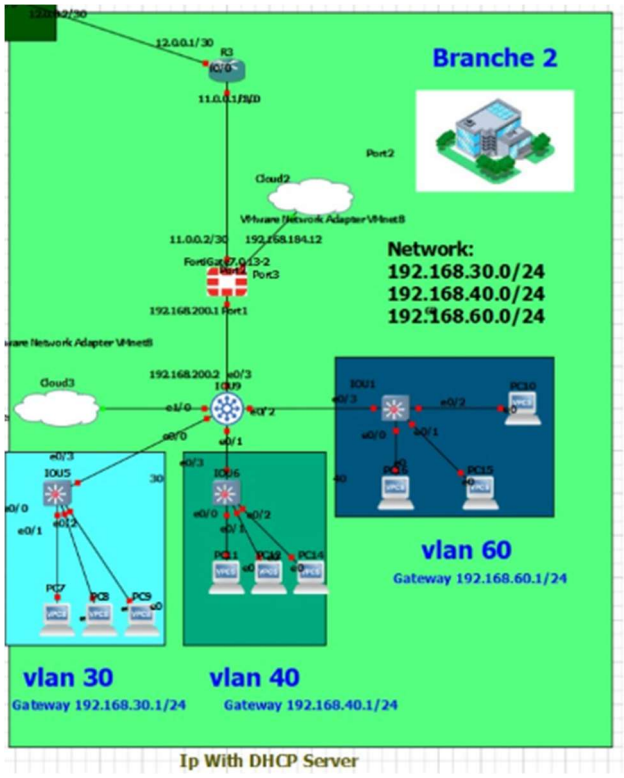
```
// Create VLAN
vlan 30
 name VLAN30

// Uplink to IOU9
interface e0/3
 switchport mode trunk
 switchport trunk allowed vlan 30

// Access ports for VLAN 30 PCs
interface range e0/0 , e0/1 , e0/2
 switchport mode access
 switchport access vlan 30
```

▪ IOU6 Config

```
// Create VLAN
vlan 40
 name VLAN40

// Uplink to IOU9
interface e0/3
 switchport mode trunk
 switchport trunk allowed vlan 40

// Access ports for VLAN 40 PCs
interface range e0/0 , e0/1 , e0/2
 switchport mode access
 switchport access vlan 40
```

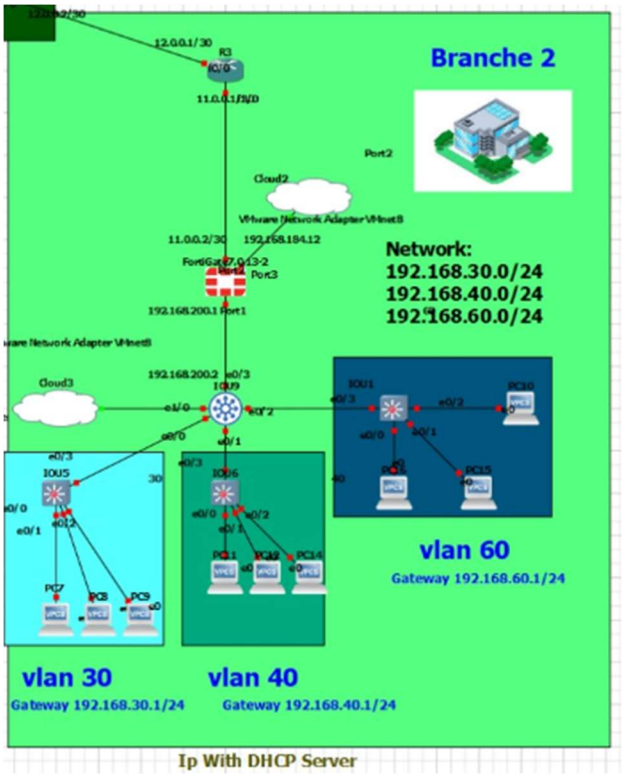
▪ IOU1 Config

```
// Create VLAN
vlan 60
 name VLAN60

// Uplink to IOU9
interface e0/3
 switchport mode trunk
 switchport trunk allowed vlan 60

// Access ports for VLAN 60 PCs
interface range e0/0 , e0/1 , e0/2
 switchport mode access
 switchport access vlan 60
```



- **IOU9 Config**

```
// Create VLANs
vlan 30
 name VLAN30
vlan 40
 name VLAN40
vlan 60
 name VLAN60

// Trunk to IOU5 (VLAN 30)
interface e0/0
 switchport mode trunk
 switchport trunk allowed vlan 30

// Trunk to IOU6 (VLAN 40)
interface e0/1
 switchport mode trunk
 switchport trunk allowed vlan 40

// Trunk to IOU1 (VLAN 60)
interface e0/2
 switchport mode trunk
 switchport trunk allowed vlan 60

// Trunk uplink to FortiGate
interface e0/3
 switchport trunk encapsulation dot1q
 switchport mode trunk
 switchport trunk allowed vlan 30,40,60
```



Inter-VLAN Routing (SVIs)

- **on IOU9:**

```
ip routing

interface Vlan30
 ip address 192.168.30.1 255.255.255.0

interface Vlan40
 ip address 192.168.40.1 255.255.255.0

interface Vlan60
 ip address 192.168.60.1 255.255.255.0

// Default route to FortiGate
ip route 0.0.0.0 0.0.0.0 192.168.200.1
```

6. Routing Design

- **Layer 2 Switches (IOU1–IOU6, IOU4, IOU2, IOU3, IOU5):** Only VLANs and trunk/access ports. No routing.
- **Layer 3 Switches (IOU8, IOU9):** Inter-VLAN routing for their assigned VLANs. Static default routes point toward the FortiGate.
- **Routers (R1, R3, R5):** OSPF in Area 0 for WAN links (/30 networks) and all VLAN subnets

▪ R1 (Core Router with OSPF)

➢ OSPF configuration:

```
router ospf 1
 network 13.0.0.0 0.0.0.3 area 0
 network 14.0.0.0 0.0.0.3 area 0
 network 192.168.10.0 0.0.0.255 area 0
 network 192.168.20.0 0.0.0.255 area 0
 network 192.168.30.0 0.0.0.255 area 0
 network 192.168.40.0 0.0.0.255 area 0
 network 192.168.50.0 0.0.0.255 area 0
 network 192.168.60.0 0.0.0.255 area 0
 network 192.168.100.0 0.0.0.255 area 0
 network 192.168.200.0 0.0.0.255 area 0
```

➢ Interfaces:

```
FastEthernet0/0  13.0.0.1/30
FastEthernet1/0  14.0.0.1/30
```

▪ R3 (Core Router with OSPF)

➢ OSPF configuration:

```
router ospf 1
 network 11.0.0.0 0.0.0.3 area 0
 network 12.0.0.0 0.0.0.3 area 0
 network 192.168.10.0 0.0.0.255 area 0
 network 192.168.20.0 0.0.0.255 area 0
```

network 192.168.30.0 0.0.0.255 area 0

network 192.168.40.0 0.0.0.255 area 0

network 192.168.50.0 0.0.0.255 area 0

network 192.168.60.0 0.0.0.255 area 0

network 192.168.100.0 0.0.0.255 area 0

network 192.168.200.0 0.0.0.255 area 0

- **Interfaces:**

FastEthernet0/0 12.0.0.1/30

FastEthernet1/0 11.0.0.1/30

R5 (Core Router with OSPF)

router ospf 1

network 12.0.0.0 0.0.0.3 area 0

network 13.0.0.0 0.0.0.3 area 0

network 192.168.10.0 0.0.0.255 area 0

network 192.168.20.0 0.0.0.255 area 0

network 192.168.30.0 0.0.0.255 area 0

network 192.168.40.0 0.0.0.255 area 0

network 192.168.50.0 0.0.0.255 area 0

network 192.168.60.0 0.0.0.255 area 0

network 192.168.100.0 0.0.0.255 area 0

network 192.168.200.0 0.0.0.255 area 0

- **Interfaces:**

FastEthernet1/0 13.0.0.2/30

FastEthernet2/0 12.0.0.2/30