Huawei Network Administrator

Group Name: CAI3_ISS5_S1 Huawei Network Administrator

Corporate Campus Network Resilience Design (Net Fusion Team)

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VRRP 17

DHCP 18

WLAN 20

1. Objective:

To design and simulate a fully functional, secure, and scalable network infrastructure connecting two Offices using Huawei eNSp

The objective is to ensure reliable communication between departments, provide high availability, enhance security using ACL and AAA, and implement essential enterprise services such as OSPF, DHCP, WLAN, FTP, VRRP, and STP.

2. Project Goals

• Ensure seamless connectivity between Office 1 and Office 2 through routers and OSPF dynamic routing.

• Provide high availability using VRRP between the core and backup switches to prevent network downtime.

• Enhance network security by implementing AAA for authentication and ACLs to control inter-department communication.

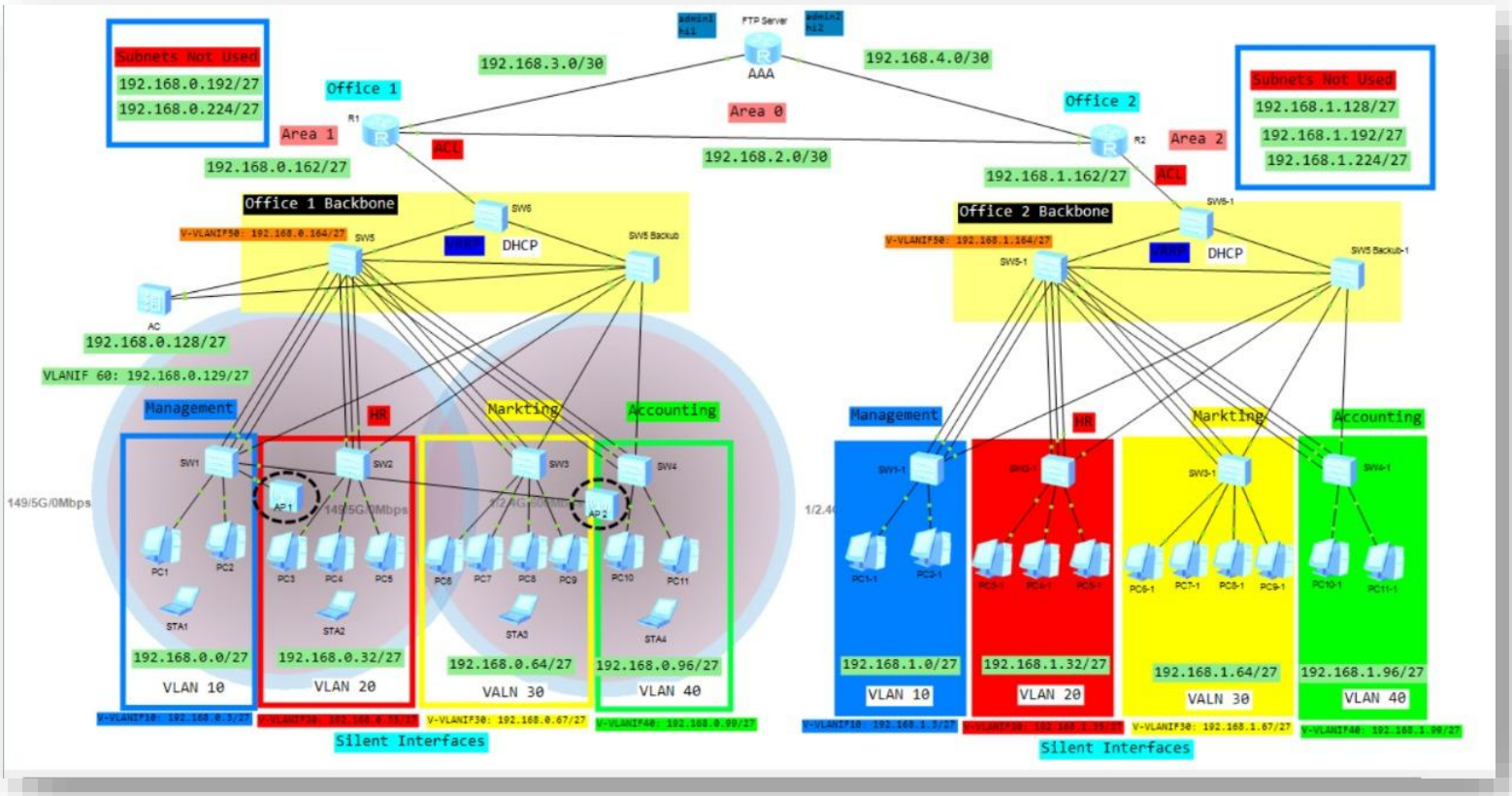
• Organize the network logically through VLAN segmentation for Management, Marketing, Accounting, HR, and other departments.

• Guarantee reliable IP assignment for all wired and wireless devices using DHCP pools per VLAN.

• Deploy wireless access for both Offices using WLAN, APs, and CAPWAP for centralized management.

• Prevent switching loops and maintain stable Layer 2 topology using STP.

• Improve link reliability and bandwidth using Eth-Trunk between the main switch and access switches.


Subnets Not Used
192.168.0.192/27
192.168.0.224/27
Office 1
Area 1
192.168.0.162/27
192.168.3.0/30
AAA
192.168.4.0/30
Area 0
192.168.2.0/30
Office 2
Area 2
192.168.1.162/27
Subnets Not Used
192.168.1.128/27
192.168.1.192/27
192.168.1.224/27
ACL
Office 1 Backbone
Office 2 Backbone
DHCP
AC
192.168.0.128/27
VLANIF 60: 192.168.0.129/27
Management
HR
Narkting
Accounting
192.168.0.0/27
VLAN 10
192.168.0.32/27
VLAN 20
192.168.0.64/27
VALN 30
192.168.0.96/27
VLAN 40
192.168.1.0/27
VLAN 10
192.168.1.32/27
VLAN 20
192.168.1.64/27
VALN 30
192.168.1.96/27
VLAN 40
Silent Interfaces
Silent Interfaces

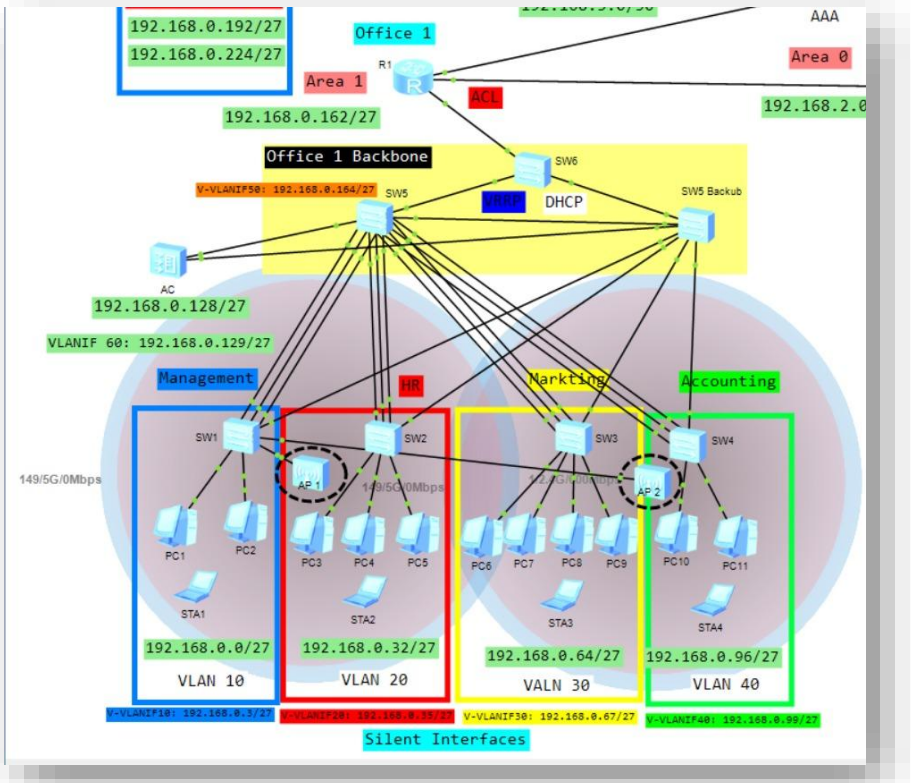
Subnet	Range start	Range End	broadcast	usable	purpose
192.168.0.0/27	192.168.0.1	192.168.0.30	192.168.0.31	30	Management PCs, APs, switches, administrative devices
192.168.0.32/27	192.168.0.33	192.168.0.62	192.168.0.63	30	HR desktops, printers, laptops
192.168.0.64/27	192.168.0.65	192.168.0.94	192.168.0.95	30	Purpose: Marketing PCs and media devices
192.168.0.96/27	192.168.0.97	192.168.0.126	192.168.0.127	30	Accounting systems and financial devices
192.168.0.128/27	192.168.0.129	192.168.0.158	192.168.0.159	30	SVIs, VRRP virtual IPs, DHCP services
192.168.1.0/27	192.168.1.1	192.168.1.30	192.168.1.31	30	Management devices for Office 2
192.168.1.32/27	192.168.1.33	192.168.1.62	192.168.1.63	30	HR devices
192.168.1.64/27	192.168.1.65	192.168.1.94	192.168.1.95	30	Marketing systems
192.168.1.96/27	192.168.1.97	192.168.1.126	192.168.1.127	30	Accounting devices
192.168.1.128/27	192.168.1.129	192.168.1.158	192.168.1.159	30	SVIs, VRRP, DHCP functions
192.168.2.0/30	192.168.2.1	192.168.2.2	192.168.2.3	2	Router-to-router OSPF backbone link
192.168.3.0/30	192.168.3.1	192.168.3.2	192.168.3.3	2	Point-to-point connection to FTP Server
192.168.4.0/30	192.168.4.1	192.168.4.2	192.168.4.3	2	Secondary

VLANs and Inter-VLANs

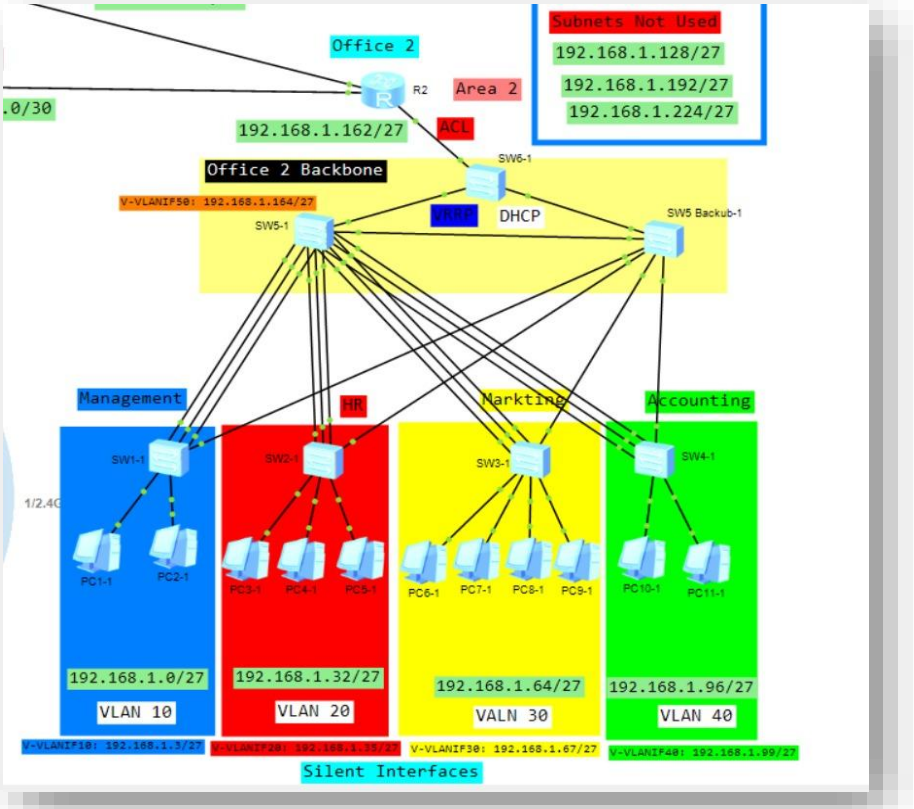
The network is segmented into multiple VLANs to isolate traffic, enhance security, and improve overall performance across the two-Office infrastructure. Each Office uses the same VLAN structure to maintain consistency and simplify management.

Office 1	VLAN 10 – Management	192.168.0.0/27	192.168.0.1	192.168.0.30	192.168.0.31
Office 1	VLAN 20 – HR	192.168.0.32/27	192.168.0.33	192.168.0.62	192.168.0.63
Office 1	VLAN 30 – Marketing	192.168.0.64/27	192.168.0.65	192.168.0.94	192.168.0.95
Office 1	VLAN 40 – Accounting	192.168.0.96/27	192.168.0.97	192.168.0.126	192.168.0.126
Office 1	Infrastructure / VRRP	192.168.0.128/27	192.168.0.129	192.168.0.158	192.168.0.159
Office 1	Extra VLAN (Expansion)	192.168.0.160/27	192.168.0.161	192.168.0.190	192.168.0.191
Office 2	VLAN 10 – Management	192.168.1.0/27	192.168.1.1	192.168.1.30	192.168.1.31
Office 2	VLAN 20 – HR	192.168.1.32/27	192.168.1.33	192.168.1.62	192.168.1.63
Office 2	VLAN 30 – Marketing	192.168.1.64/27	192.168.1.65	192.168.1.94	192.168.1.95
Office 2	VLAN 40 – Accounting	192.168.1.96/27	192.168.1.97	192.168.1.126	192.168.1.127
Office 2	Infrastructure / VRRP	192.168.1.128/27	192.168.1.129	192.168.1.158	192.168.1.159
Office 2	Extra VLAN (Expansion)	192.168.1.160/27	192.168.1.161	192.168.1.190	192.168.1.191

Office 1:



Office 2:



Configurations

SW5

```
<SW5>dis vl
<SW5>dis vlan
<SW5>dis vll
<SW5>dis int
<SW5>dis interface
<SW5>dis interface vl
<SW5>dis interface Vlanif
Vlanif1 current state : UP
Line protocol current state : DOWN
Description:
Route Port,The Maximum Transmit Unit is 1500
Internet protocol processing : disabled
IP Sending Frames' Format is PKTFMT_ETHNT_2, Hardware address is 4c1f-cca0-4844
Current system time: 2025-12-02 01:18:01-08:00
    Input bandwidth utilization  : --
    Output bandwidth utilization : --

Vlanif10 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-12-02 01:01:13 UTC-08:00
Description:
Route Port,The Maximum Transmit Unit is 1500
Internet Address is 192.168.0.1/27
IP Sending Frames' Format is PKTFMT_ETHNT_2, Hardware address is 4c1f-cca0-4844
Current system time: 2025-12-02 01:18:02-08:00
    Input bandwidth utilization  : --
    Output bandwidth utilization : --

Vlanif20 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-12-02 01:01:13 UTC-08:00
Description:
Route Port,The Maximum Transmit Unit is 1500
Internet Address is 192.168.0.33/27
IP Sending Frames' Format is PKTFMT_ETHNT_2, Hardware address is 4c1f-cca0-4844
Current system time: 2025-12-02 01:18:02-08:00
    Input bandwidth utilization  : --
    Output bandwidth utilization : --
```

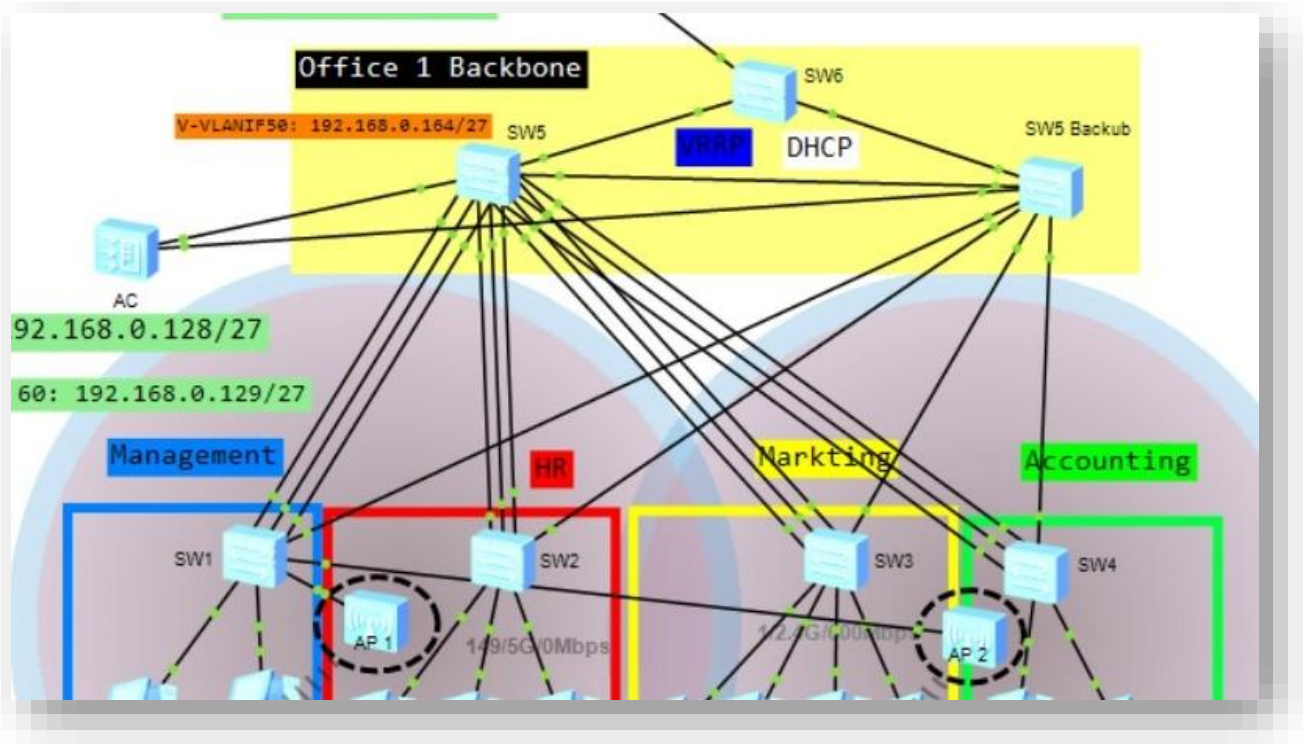
```
Vlanif30 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-12-02 01:01:13 UTC-08:00
Description:
Route Port,The Maximum Transmit Unit is 1500
Internet Address is 192.168.0.65/27
IP Sending Frames' Format is PKTFMT_ETHNT_2, Hardware address is 4c1f-cca0-4844
Current system time: 2025-12-02 01:18:03-08:00
    Input bandwidth utilization  : --
    Output bandwidth utilization : --

Vlanif40 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-12-02 01:01:13 UTC-08:00
Description:
Route Port,The Maximum Transmit Unit is 1500
Internet Address is 192.168.0.97/27
IP Sending Frames' Format is PKTFMT_ETHNT_2, Hardware address is 4c1f-cca0-4844
Current system time: 2025-12-02 01:18:03-08:00
    Input bandwidth utilization  : --
    Output bandwidth utilization : --

Vlanif50 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-12-02 01:01:13 UTC-08:00
Description:
Route Port,The Maximum Transmit Unit is 1500
Internet Address is 192.168.0.161/27
IP Sending Frames' Format is PKTFMT_ETHNT_2, Hardware address is 4c1f-cca0-4844
Current system time: 2025-12-02 01:18:03-08:00
    Input bandwidth utilization  : --
    Output bandwidth utilization : --
```

SW5

```
<SW5>
<SW5>dis vla
<SW5>dis vlan
The total number of vlans is : 7
--------------------------------------------------------------------------------
U: Up;         D: Down;         TG: Tagged;         UT: Untagged;
MP: Vlan-mapping;               ST: Vlan-stacking;
#: ProtocolTransparent-vlan;    *: Management-vlan;
--------------------------------------------------------------------------------

VID  Type    Ports
--------------------------------------------------------------------------------
1    common  UT:Eth0/0/10(D)    Eth0/0/11(D)    Eth0/0/12(D)    Eth0/0/16(U)
                Eth0/0/17(D)    Eth0/0/18(D)    Eth0/0/19(D)    Eth0/0/20(D)
                Eth0/0/21(D)    Eth0/0/22(U)    GE0/0/2(D)      Eth-Trunk1(U)
                Eth-Trunk2(U)   Eth-Trunk3(U)   Eth-Trunk4(U)

10   common  TG:Eth0/0/16(U)    Eth0/0/22(U)    Eth-Trunk1(U)

20   common  TG:Eth0/0/16(U)    Eth0/0/22(U)    Eth-Trunk2(U)

30   common  TG:Eth0/0/16(U)    Eth0/0/22(U)    Eth-Trunk3(U)

40   common  TG:Eth0/0/16(U)    Eth0/0/22(U)    Eth-Trunk4(U)

50   common  UT:GE0/0/1(U)

             TG:Eth0/0/16(U)    Eth0/0/22(U)

60   common  TG:Eth0/0/16(U)    Eth0/0/22(U)    Eth-Trunk1(U)   Eth-Trunk2(U)

                Eth-Trunk3(U)   Eth-Trunk4(U)


VID  Status  Property      MAC-LRN Statistics Description
--------------------------------------------------------------------------------

1    enable  default       enable  disable    VLAN 0001
10   enable  default       enable  disable    VLAN 0010
20   enable  default       enable  disable    VLAN 0020
30   enable  default       enable  disable    VLAN 0030
40   enable  default       enable  disable    VLAN 0040
50   enable  default       enable  disable    VLAN 0050
60   enable  default       enable  disable    VLAN 0060
<SW5>
```

Link Aggregation (Eth-Trunk):

Link Aggregation, implemented using Eth-Trunk on Huawei devices, is a technique that combines multiple physical interfaces into a single logical link. In this project, Eth-Trunk was used to enhance both bandwidth and network reliability between the core switch and the access switches that connect to end devices in each department



Output

SW5

```
<SW5>dis int bri
PHY: Physical
*down: administratively down
(l): loopback
(s): spoofing
(b): BFD down
(e): ETHOAM down
(dl): DLDP down
(d): Dampening Suppressed
InUti/OutUti: input utility/output utility
Interface                   PHY    Protocol InUti OutUti   inErrors  outErrors
Eth-Trunk1                  up     up           0%     0%          0          0
  Ethernet0/0/1             up     up           0%     0%          0          0
  Ethernet0/0/4             up     up           0%     0%          0          0
  Ethernet0/0/5             up     up           0%     0%          0          0
Eth-Trunk2                  up     up           0%     0%          0          0
  Ethernet0/0/2             up     up           0%     0%          0          0
  Ethernet0/0/8             up     up           0%     0%          0          0
  Ethernet0/0/9             up     up           0%     0%          0          0
Eth-Trunk3                  up     up           0%     0%          0          0
  Ethernet0/0/3             up     up           0%     0%          0          0
  Ethernet0/0/6             up     up           0%     0%          0          0
  Ethernet0/0/7             up     up           0%     0%          0          0
Eth-Trunk4                  up     up           0%     0%          0          0
  Ethernet0/0/13            up     up           0%     0%          0          0
  Ethernet0/0/14            up     up           0%     0%          0          0
  Ethernet0/0/15            up     up           0%     0%          0          0
Ethernet0/0/10              down   down         0%     0%          0          0
Ethernet0/0/11              down   down         0%     0%          0          0
Ethernet0/0/12              down   down         0%     0%          0          0
Ethernet0/0/16              up     up           0%     0%          0          0
Ethernet0/0/17              down   down         0%     0%          0          0
Ethernet0/0/18              down   down         0%     0%          0          0
Ethernet0/0/19              down   down         0%     0%          0          0
Ethernet0/0/20              down   down         0%     0%          0          0
Ethernet0/0/21              down   down         0%     0%          0          0
Ethernet0/0/22              up     up           0%     0%          0          0
GigabitEthernet0/0/1        up     up           0%     0%          0          0
GigabitEthernet0/0/2        down   down         0%     0%          0          0
MEth0/0/1                   down   down         0%     0%          0          0
NULL0                       up     up(s)        0%     0%          0          0
Vlanif1                     up     down         --     --          0          0
Vlanif10                    up     up           --     --          0          0
Vlanif20                    up     up           --     --          0          0
Vlanif30                    up     up           --     --          0          0
Vlanif40                    up     up           --     --          0          0
Vlanif50                    up     up           --     --          0          0
<SW5>
```

STP(Spanning-Tree-Protocol)

Spanning Tree Protocol (STP) is a Layer 2 protocol designed to prevent switching loops in networks that contain redundant physical paths. In this project, STP played a critical role in ensuring network stability and avoiding broadcast storms, which can occur when switches are connected using multiple links for redundancy.

Because the network includes Core and Backup Switches, Eth-Trunk uplinks, and multiple interconnected access switches, the physical topology contains several potential loop paths. STP automatically detects these loops and places one or more redundant links into a *blocking* state, while still keeping them available as backups. This ensures that only

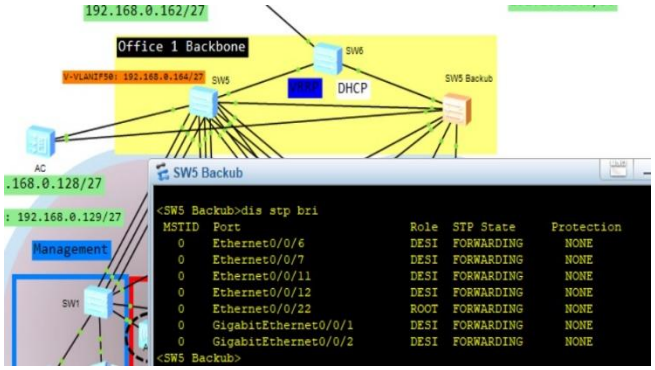
Within the project, STP ensured:

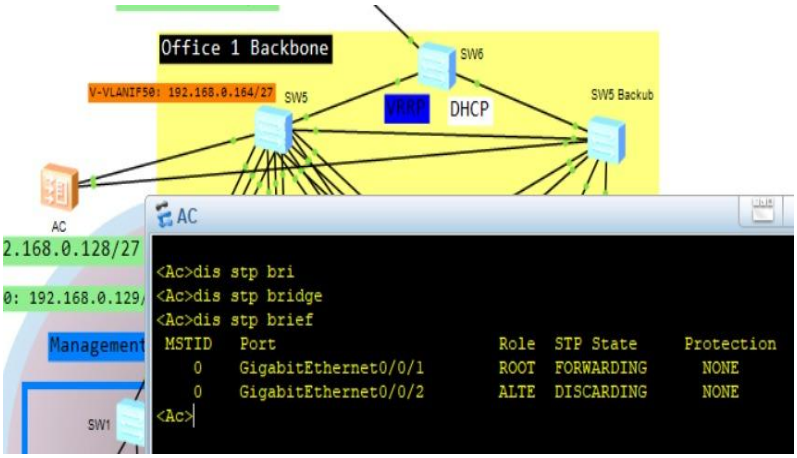
* Safe redundancy between core multiple inter-switch ence during link or failure

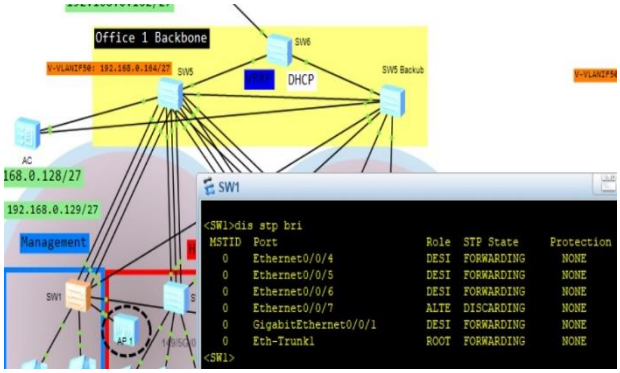
* Smooth coexistence with Eth-Trunk and VRRP failover processes.

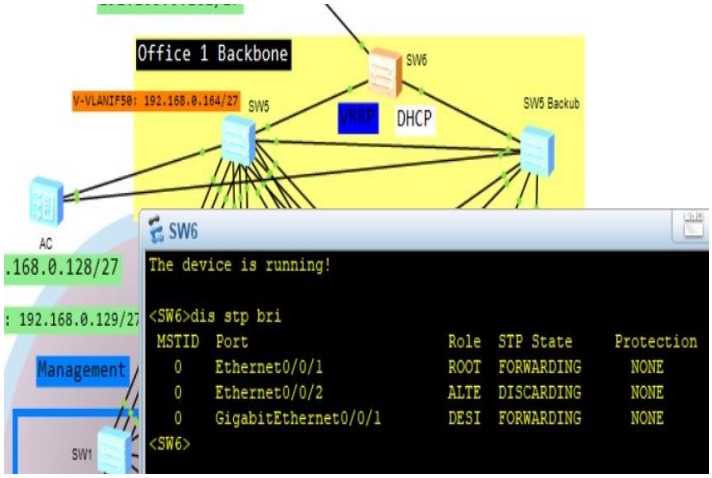
* Prevent any loops between switches and the AC, andbetween the switches and each others.

Here how it was implemented in our project (some configuration on the switches and the AC)



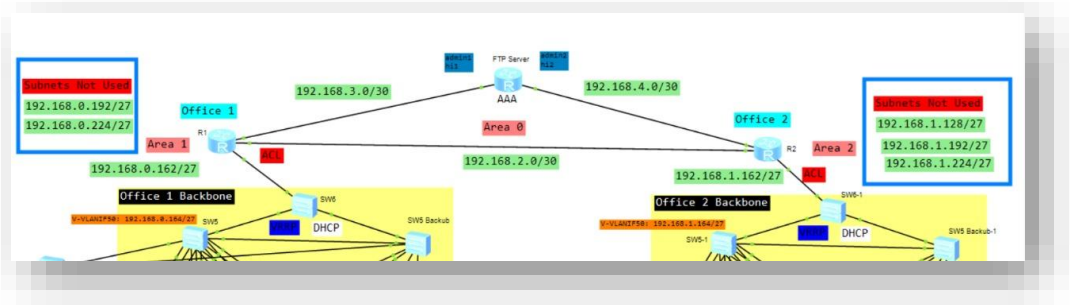






OSPF (Open Shortest Path First):

OSPF is a link-state routing protocol used in IP networks to determine the best path for data. It divides the network into areas for efficient routing and uses the Dijkstra algorithm to calculate shortest paths. OSPF supports fast convergence, scalability, and VLSM (Variable Length Subnet Mask)



The output of the config. On the devices where the OSPF was applied(LSDBs):

SW5

```
<SW5>dis ospf lsdb

      OSPF Process 1 with Router ID 1.5.5.5
            Link State Database

                  Area: 0.0.0.1
Type      LinkState ID    AdvRouter       Age  Len  Sequence   Metric
Router    2.5.5.5         2.5.5.5         101  84   80000038       1
Router    1.5.5.5         1.5.5.5         100  144  8000001A       1
Router    1.1.1.1         1.1.1.1         100  36   8000001B       1
Network   192.168.0.163   2.5.5.5         101  36   80000016       0
Sum-Net   192.168.4.0     1.1.1.1         101  28   80000006       2
Sum-Net   192.168.3.0     1.1.1.1         101  28   80000006       1
Sum-Net   192.168.2.0     1.1.1.1         101  28   80000006       1
Sum-Net   192.168.1.96    1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.99    1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.64    1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.67    1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.32    1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.35    1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.0     1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.3     1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.164   1.1.1.1         101  28   80000004       3
Sum-Net   192.168.1.160   1.1.1.1         101  28   80000006       2
```

SW5 Backup

```
      OSPF Process 1 with Router ID 2.5.5.5
            Link State Database

                  Area: 0.0.0.1
Type      LinkState ID    AdvRouter       Age  Len  Sequence   Metric
Router    2.5.5.5         2.5.5.5         130  84   80000038       1
Router    1.5.5.5         1.5.5.5         131  144  8000001A       1
Router    1.1.1.1         1.1.1.1         130  36   8000001B       1
Network   192.168.0.163   2.5.5.5         130  36   80000016       0
Sum-Net   192.168.4.0     1.1.1.1         131  28   80000006       2
Sum-Net   192.168.3.0     1.1.1.1         131  28   80000006       1
Sum-Net   192.168.2.0     1.1.1.1         131  28   80000006       1
Sum-Net   192.168.1.96    1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.99    1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.64    1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.67    1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.32    1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.35    1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.0     1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.3     1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.164   1.1.1.1         131  28   80000004       3
Sum-Net   192.168.1.160   1.1.1.1         131  28   80000006       2


<SW5 Backub>
```

R1

```
        OSPF Process 1 with Router ID 1.1.1.1
                Link State Database

                    Area: 0.0.0.0
Type       LinkState ID     AdvRouter          Age  Len   Sequence   Metric
Router     2.2.2.2          2.2.2.2            921  48    8000000C        1
Router     1.1.1.1          1.1.1.1            921  48    8000000B        1
Router     3.3.3.3          3.3.3.3            919  48    8000000C        1
Network    192.168.3.2      3.3.3.3            919  32    80000006        0
Network    192.168.4.2      3.3.3.3            975  32    80000006        0
Network    192.168.2.2      2.2.2.2            921  32    80000006        0
Sum-Net    192.168.1.96     2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.99     2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.64     2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.67     2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.32     2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.35     2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.0      2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.3      2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.164    2.2.2.2            773  28    80000003        2
Sum-Net    192.168.1.160    2.2.2.2           1022  28    80000005        1
Sum-Net    192.168.0.96     1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.99     1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.64     1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.67     1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.32     1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.35     1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.0      1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.3      1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.164    1.1.1.1             33  28    80000001        2
Sum-Net    192.168.0.160    1.1.1.1             46  28    80000007        1

                    Area: 0.0.0.1
Type       LinkState ID     AdvRouter          Age  Len   Sequence   Metric
Router     2.5.5.5          2.5.5.5             37  84    80000038        1
Router     1.5.5.5          1.5.5.5             37  144   8000001A        1
Router     1.1.1.1          1.1.1.1             35  36    8000001B        1
Network    192.168.0.163    2.5.5.5             37  36    80000016        0
Sum-Net    192.168.4.0      1.1.1.1             36  28    80000006        2
Sum-Net    192.168.3.0      1.1.1.1             36  28    80000006        1
Sum-Net    192.168.2.0      1.1.1.1             36  28    80000006        1
Sum-Net    192.168.1.96     1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.99     1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.64     1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.67     1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.32     1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.35     1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.0      1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.3      1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.164    1.1.1.1             36  28    80000004        3
Sum-Net    192.168.1.160    1.1.1.1             36  28    80000006        2
```

R2

R2

```
<R2>dis ospf lsdb

        OSPF Process 1 with Router ID 2.2.2.2
                Link State Database

                    Area: 0.0.0.0
Type       LinkState ID     AdvRouter          Age  Len   Sequence   Metric
Router     2.2.2.2          2.2.2.2           1486  48    80000008        1
Router     1.1.1.1          1.1.1.1           1486  48    80000007        1
Router     3.3.3.3          3.3.3.3           1490  48    80000008        1
Network    192.168.3.2      3.3.3.3           1491  32    80000001        0
Network    192.168.4.2      3.3.3.3           1490  32    80000002        0
Network    192.168.2.2      2.2.2.2           1486  32    80000002        0
Sum-Net    192.168.1.96     2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.99     2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.64     2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.67     2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.32     2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.35     2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.0      2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.3      2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.164    2.2.2.2           1408  28    80000001        2
Sum-Net    192.168.1.160    2.2.2.2           1453  28    80000001        1
Sum-Net    192.168.0.96     1.1.1.1            447  28    80000002        2
Sum-Net    192.168.0.99     1.1.1.1            444  28    80000001        2
Sum-Net    192.168.0.64     1.1.1.1            447  28    80000002        2
Sum-Net    192.168.0.67     1.1.1.1            444  28    80000001        2
Sum-Net    192.168.0.32     1.1.1.1            447  28    80000002        2
Sum-Net    192.168.0.35     1.1.1.1            444  28    80000001        2
Sum-Net    192.168.0.0      1.1.1.1            447  28    80000002        2
Sum-Net    192.168.0.3      1.1.1.1            444  28    80000001        2
Sum-Net    192.168.0.164    1.1.1.1            444  28    80000001        2
Sum-Net    192.168.0.160    1.1.1.1           1536  28    80000001        1

                    Area: 0.0.0.2
Type       LinkState ID     AdvRouter          Age  Len   Sequence   Metric
Router     2.5.5.5          2.5.5.5           1411  84    80000011        1
Router     2.2.2.2          2.2.2.2           1410  36    80000004        1
Router     1.5.5.5          1.5.5.5           1415  144   80000010        1
Network    192.168.1.163    2.5.5.5           1411  36    80000004        0
Sum-Net    192.168.4.0      2.2.2.2           1455  28    80000001        1
Sum-Net    192.168.3.0      2.2.2.2           1455  28    80000001        2
Sum-Net    192.168.2.0      2.2.2.2           1455  28    80000001        1
Sum-Net    192.168.0.96     2.2.2.2            448  28    80000002        3
Sum-Net    192.168.0.99     2.2.2.2            445  28    80000001        3
Sum-Net    192.168.0.64     2.2.2.2            448  28    80000002        3
Sum-Net    192.168.0.67     2.2.2.2            445  28    80000001        3
```

FTP (File Transfer Protocol) and AAA ((Authentication, Authorization, Accounting):

*FTP is a standard network protocol used to transfer files between a client and a server over TCP/IP networks. It allows users to upload, download, and manage files on a remote system. FTP can operate in two modes:

Active mode: The server connects back to the client to establish the data transfer.

Passive mode: The client initiates both control and data connections, useful for bypassing firewalls.

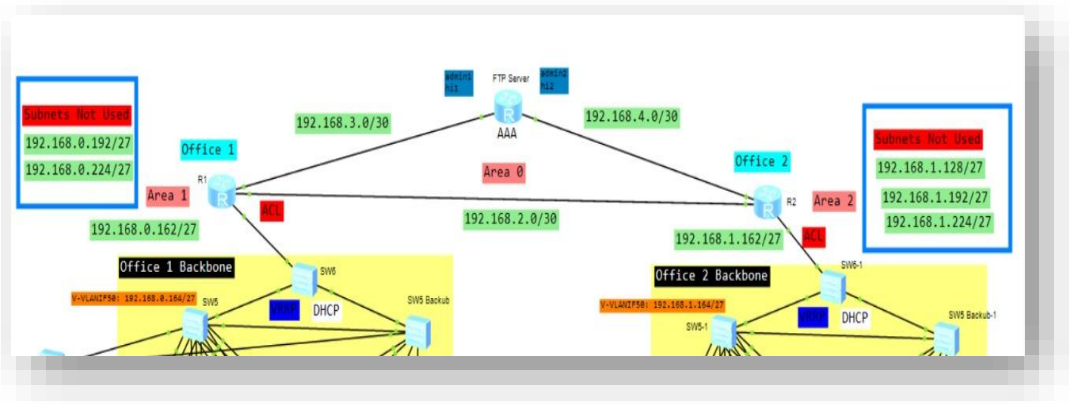
FTP can use authentication (username and password) for access control, though plain FTP is not secure; secure alternatives like FTPS or SFTP are recommended.

*AAA is a framework for controlling access to network devices and resources.

Authentication: Verifies user identity.

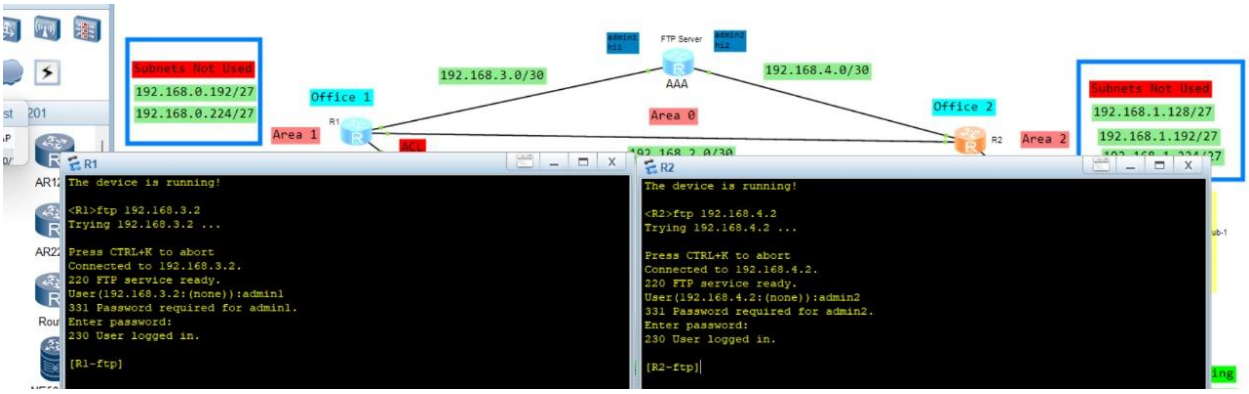
Authorization: Determines what resources or actions the user is allowed.

Accounting: Tracks user activity for auditing and reporting



The output of the config. where the FTP was applied on the routers (R3 is the FTP Server in our topology and the AAA was applied in this part of the

project for security so no one can access this domain except the one who has the username and password) :

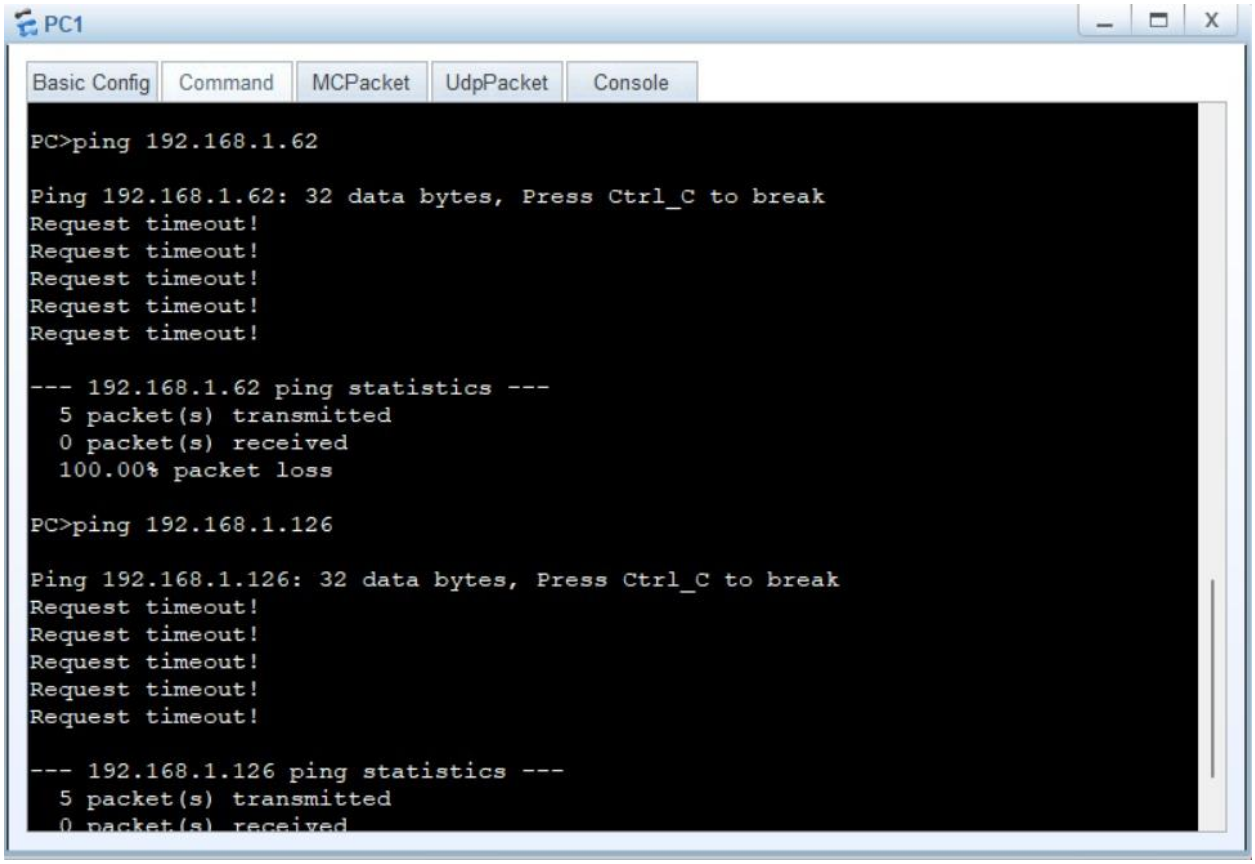


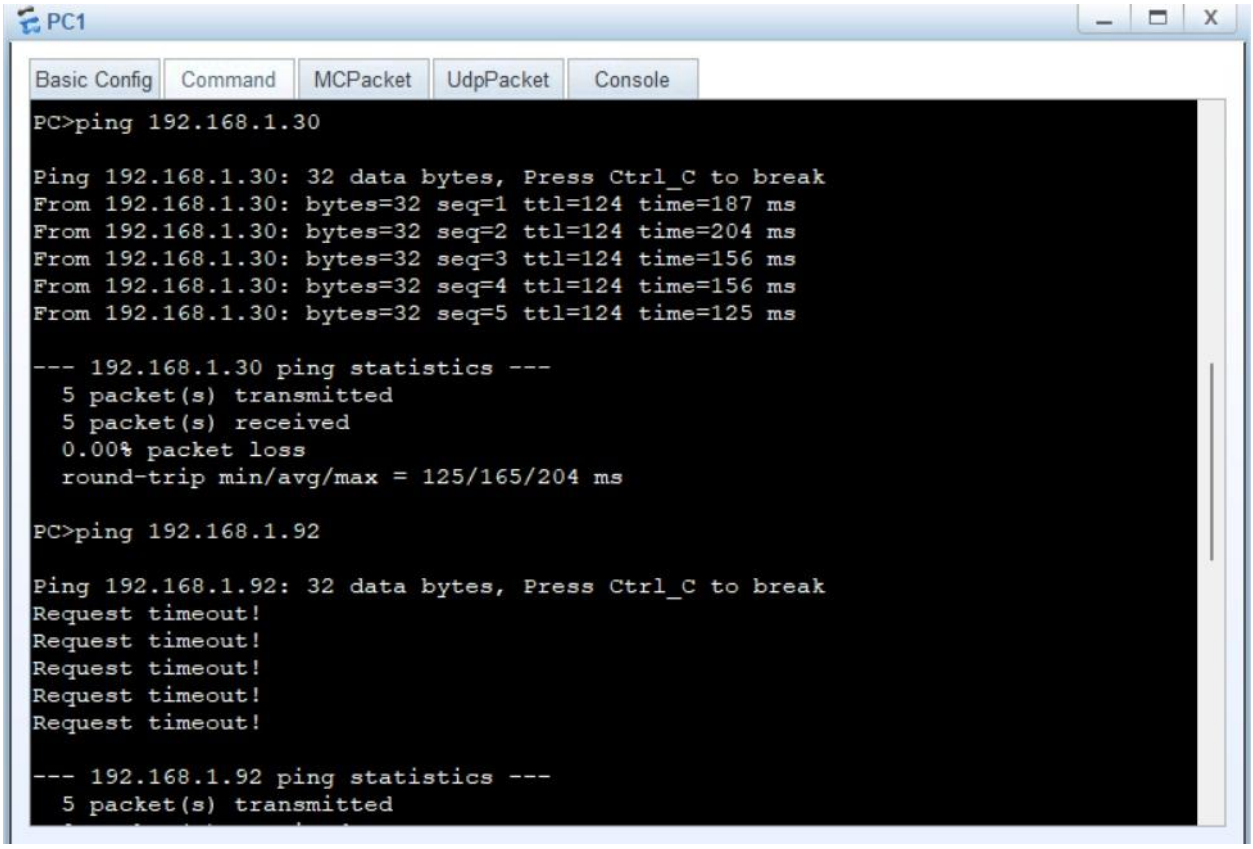
ACL (Access Control List):

An ACL is a set of rules applied to network traffic to permit or deny packets based on criteria like source/destination IP, protocol, or port. ACLs are used for security (firewall-like filtering), traffic management, and controlling network access.

The Ping Test was used to ensure that the ACL Feature that was applied on the departments was working properly

ACL (Mangers in two Offices can only to ping to each other and can't to ping to another sections HR, Accounting and Markting)


PC1
Basic Config
Command
MCPacket
UdpPacket
Console
PC>ping 192.168.1.62
Ping 192.168.1.62: 32 data bytes, Press Ctrl_C to break
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!
--- 192.168.1.62 ping statistics ---
5 packet(s) transmitted
0 packet(s) received
100.00% packet loss
PC>ping 192.168.1.126
Ping 192.168.1.126: 32 data bytes, Press Ctrl_C to break
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!
--- 192.168.1.126 ping statistics ---
5 packet(s) transmitted

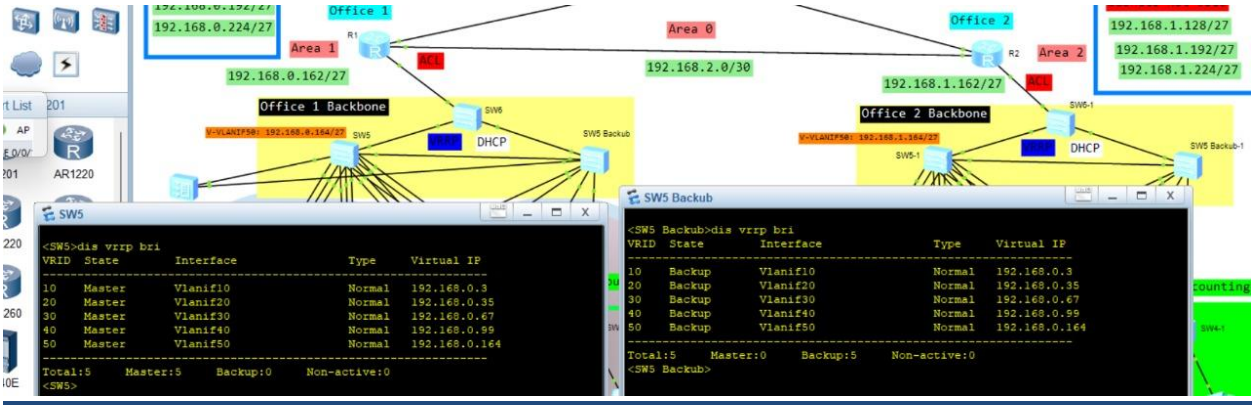

PC1
Basic Config
Command
MCPacket
UdpPacket
Console
PC>ping 192.168.1.30
Ping 192.168.1.30: 32 data bytes, Press Ctrl_C to break
From 192.168.1.30: bytes=32 seq=1 ttl=124 time=187 ms
From 192.168.1.30: bytes=32 seq=2 ttl=124 time=204 ms
From 192.168.1.30: bytes=32 seq=3 ttl=124 time=156 ms
From 192.168.1.30: bytes=32 seq=4 ttl=124 time=156 ms
From 192.168.1.30: bytes=32 seq=5 ttl=124 time=125 ms
--- 192.168.1.30 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 125/165/204 ms
PC>ping 192.168.1.92
Ping 192.168.1.92: 32 data bytes, Press Ctrl_C to break
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!
--- 192.168.1.92 ping statistics ---
5 packet(s) transmitted

VRRP (Virtual Router Redundancy Protocol):

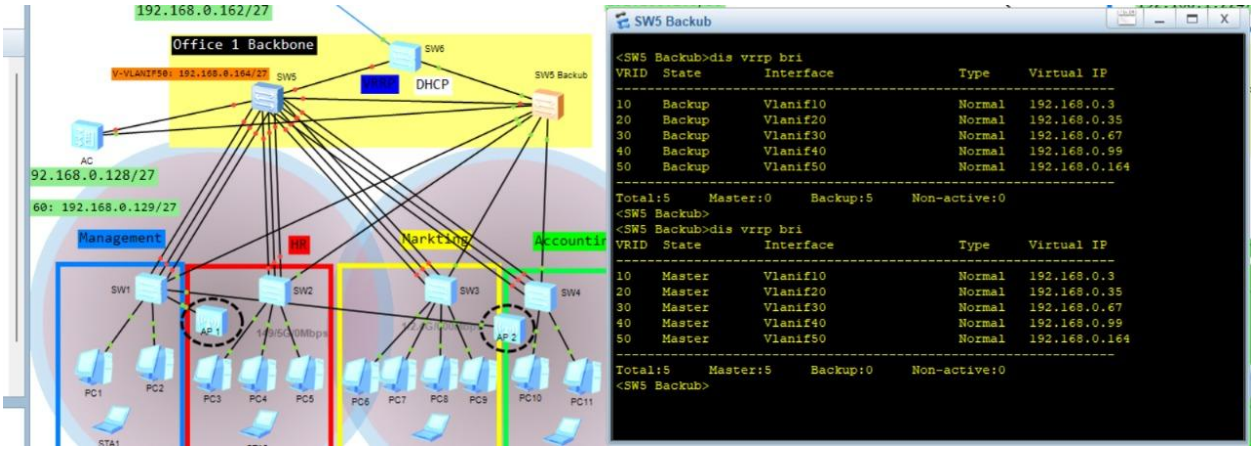
VRRP provides high availability by allowing multiple routers to work together, presenting a single virtual IP as the default gateway. One router is elected as the master to handle traffic, while others act as backups. If the master fails, a backup takes over automatically, ensuring minimal downtime.

.Output:

VRRP When SW5 is ON



VRRP When SW5 is Fail (SW5 Backub become the master)



DHCP (Dynamic Host Configuration Protocol):

DHCP is a network protocol that automatically assigns IP addresses and other network configuration parameters (like subnet mask, default gateway, and DNS servers) to devices on a network. This eliminates the need for manual IP configuration, reduces errors, and allows efficient IP address management.

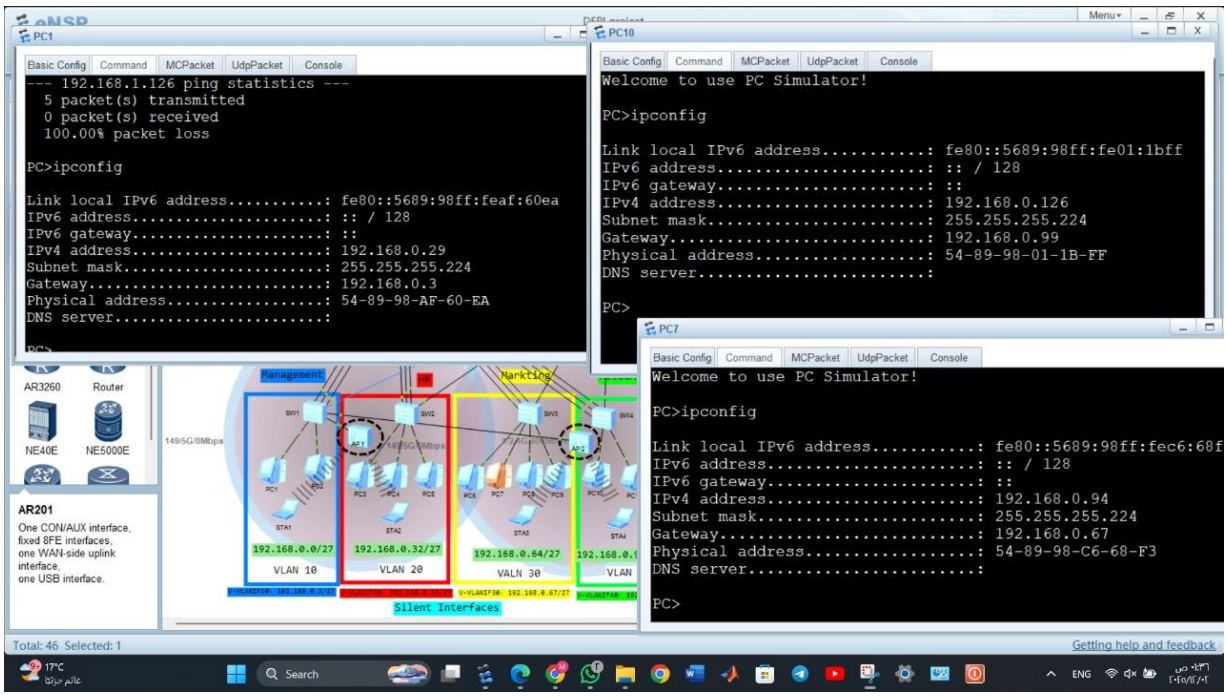
Key features:

*Dynamic allocation: Assigns temporary IP addresses from a pool

*Automatic allocation: Assigns a permanent IP to a device.

*Manual allocation: Admin assigns a fixed IP to a device but uses DHCP for other settings.

Used on the switches to give the PCS IP Addresses:

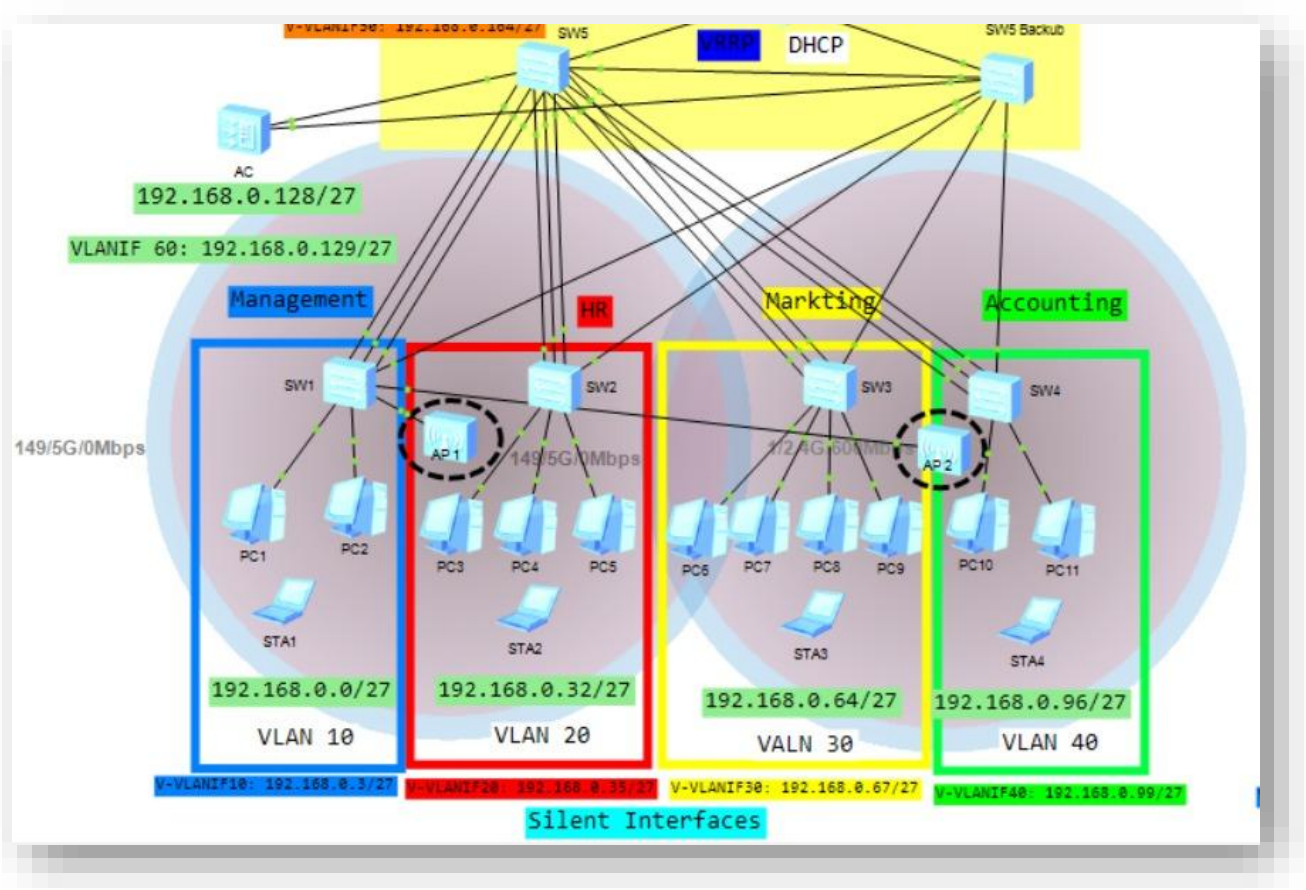


SW5

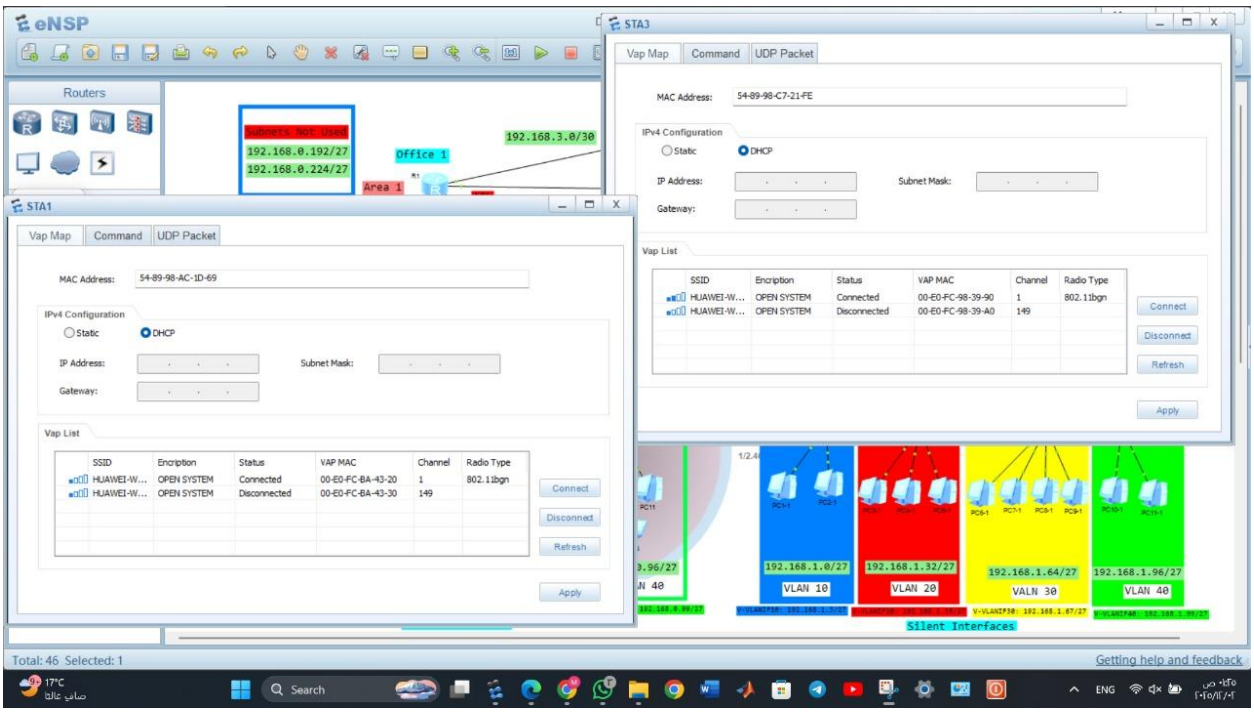
```
#
interface Vlanif10
 ip address 192.168.0.1 255.255.255.224
 vrrp vrid 10 virtual-ip 192.168.0.3
 vrrp vrid 10 priority 120
 vrrp vrid 10 preempt-mode timer delay 5
 vrrp vrid 10 track interface GigabitEthernet0/0/1 reduced 30
 dhcp select global
#
interface Vlanif20
 ip address 192.168.0.33 255.255.255.224
 vrrp vrid 20 virtual-ip 192.168.0.35
 vrrp vrid 20 priority 120
 vrrp vrid 20 preempt-mode timer delay 5
 vrrp vrid 20 track interface GigabitEthernet0/0/1 reduced 30
 dhcp select global
#
interface Vlanif30
 ip address 192.168.0.65 255.255.255.224
 vrrp vrid 30 virtual-ip 192.168.0.67
 vrrp vrid 30 priority 120
 vrrp vrid 30 preempt-mode timer delay 5
 vrrp vrid 30 track interface GigabitEthernet0/0/1 reduced 30
 dhcp select global
#
interface Vlanif40
 ip address 192.168.0.97 255.255.255.224
 vrrp vrid 40 virtual-ip 192.168.0.99
 vrrp vrid 40 priority 120
 vrrp vrid 40 preempt-mode timer delay 5
 vrrp vrid 40 track interface GigabitEthernet0/0/1 reduced 30
 dhcp select global
#
interface Vlanif50
 ip address 192.168.0.161 255.255.255.224
 vrrp vrid 50 virtual-ip 192.168.0.164
 vrrp vrid 50 priority 120
 vrrp vrid 50 preempt-mode timer delay 5
 vrrp vrid 50 track interface GigabitEthernet0/0/1 reduced 30
#
```

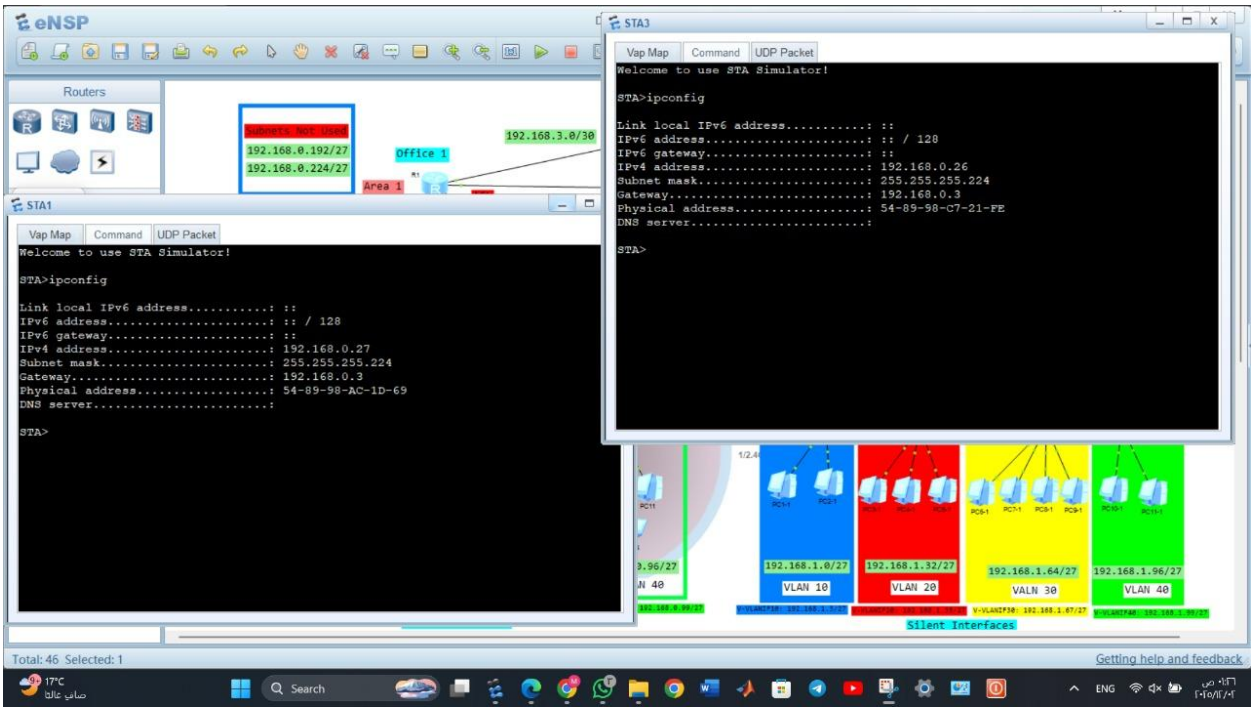
WLAN (Wireless Local Area Network):

WLAN is a network that allows devices to connect and communicate wirelessly within a limited area, such as an office, home, or campus. It uses Wi-Fi standards (like IEEE 802.11) to transmit data over radio waves, enabling mobility and reducing the need for physical cables. WLANs typically consist of access points (APs) that connect wireless devices to the wired network.



The AC is connected to the Aps





The STA's are connected to the WLAN (Wi-Fi) are receiving an IP Address from The AP that is connected to the AC that is one the main components in the design for the WLAN to Work

One of the most important parts that has to be highlighted in the project Offices Backbone:

This name refers to the area in the topology at which almost all the configurations and features were applied on