



Digital Egypt Pioneers



# **ENTERPRISE NETWORK DESIGN AND IMPLEMENTATION USING HUAWEI DATACOM TECHNOLOGIES (NETFUSION)**

**HUAWEI ENSP SIMULATION**

**28 Nov, 2025**



# **SPECIAL THANKS TO OUR SUPERVISOR ENG.SAMAH EISSA**

**HUAWEI ENSP SIMULATION**

**30 Nov, 2025**





# TEAM MEMBERS

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**Under the  
supervision of  
Engineer  
Samah Eisa**

# PROJECT OVERVIEW

## Project Objective:

Design a network for two buildings to enable secure and efficient communication.

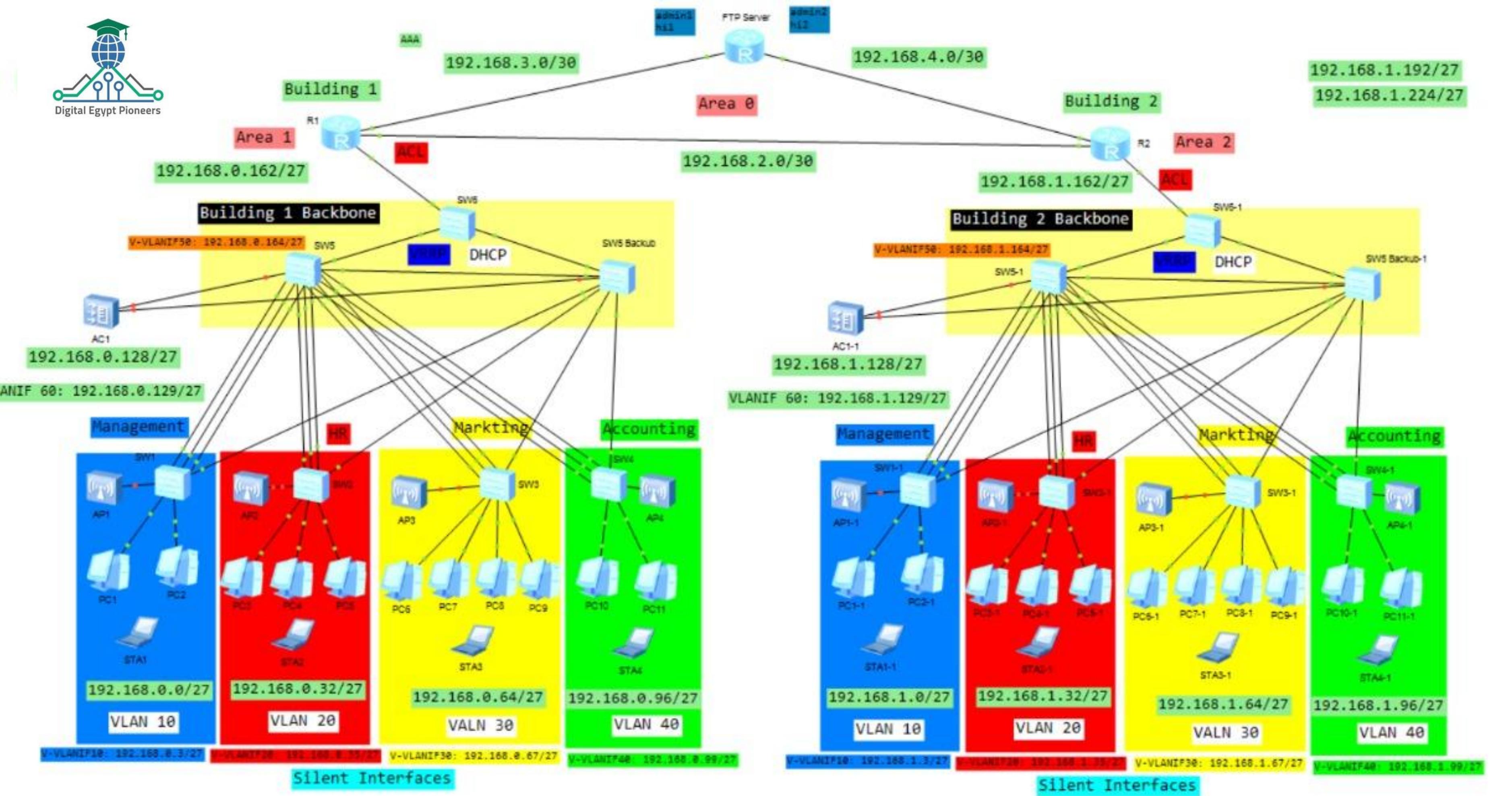
### Implemented Services:

- FTP Service
- VRRP
- STP
- WLAN
- AAA
- ACL
- OSPF
- DHCP

# NETWORK TOPOLOGY

## Topology includes:

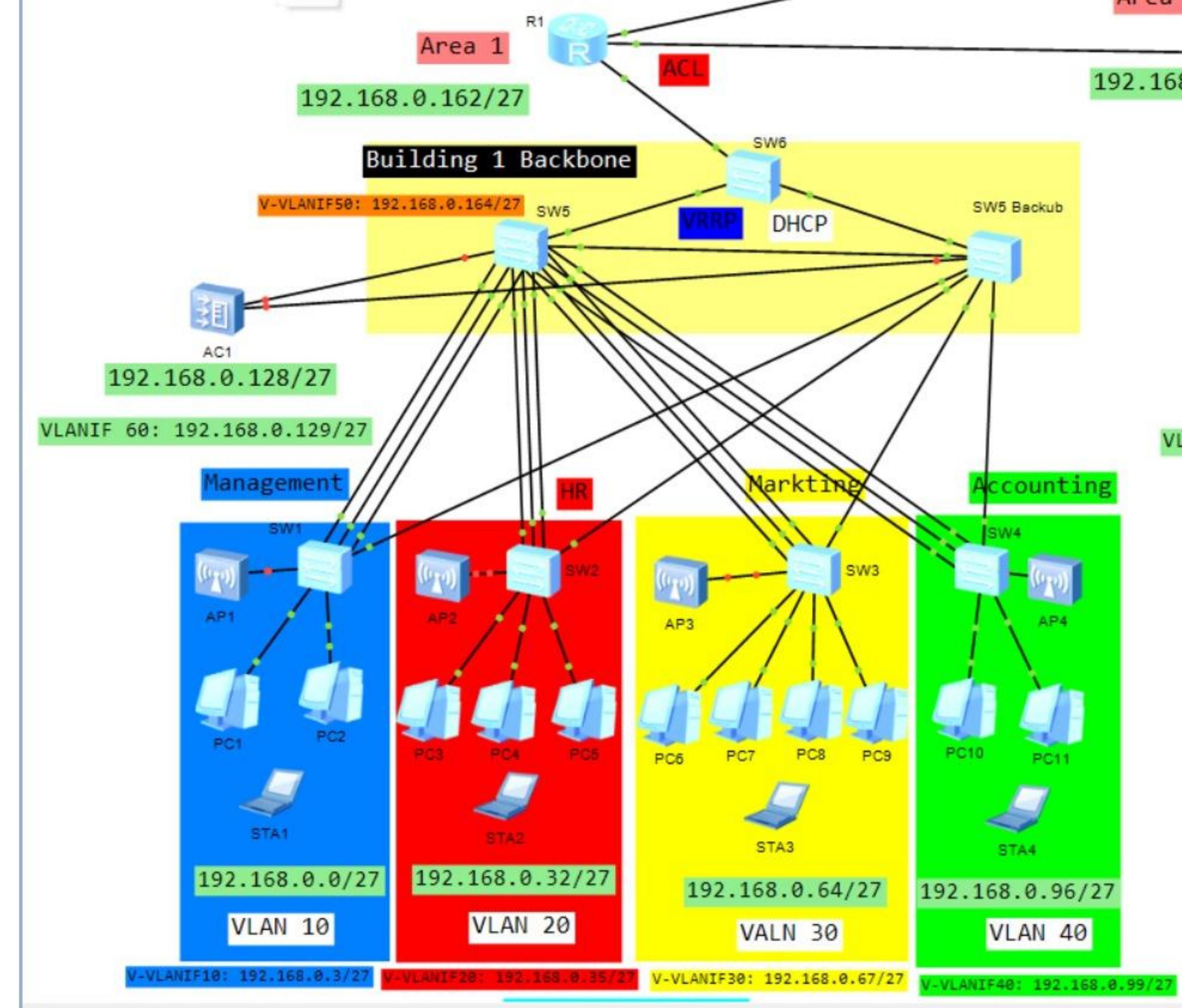
- Building 1 & Building 2
- Core & Backup Switches
- Routers connecting both buildings
- VLANs for departments
- Eth-Trunk connections



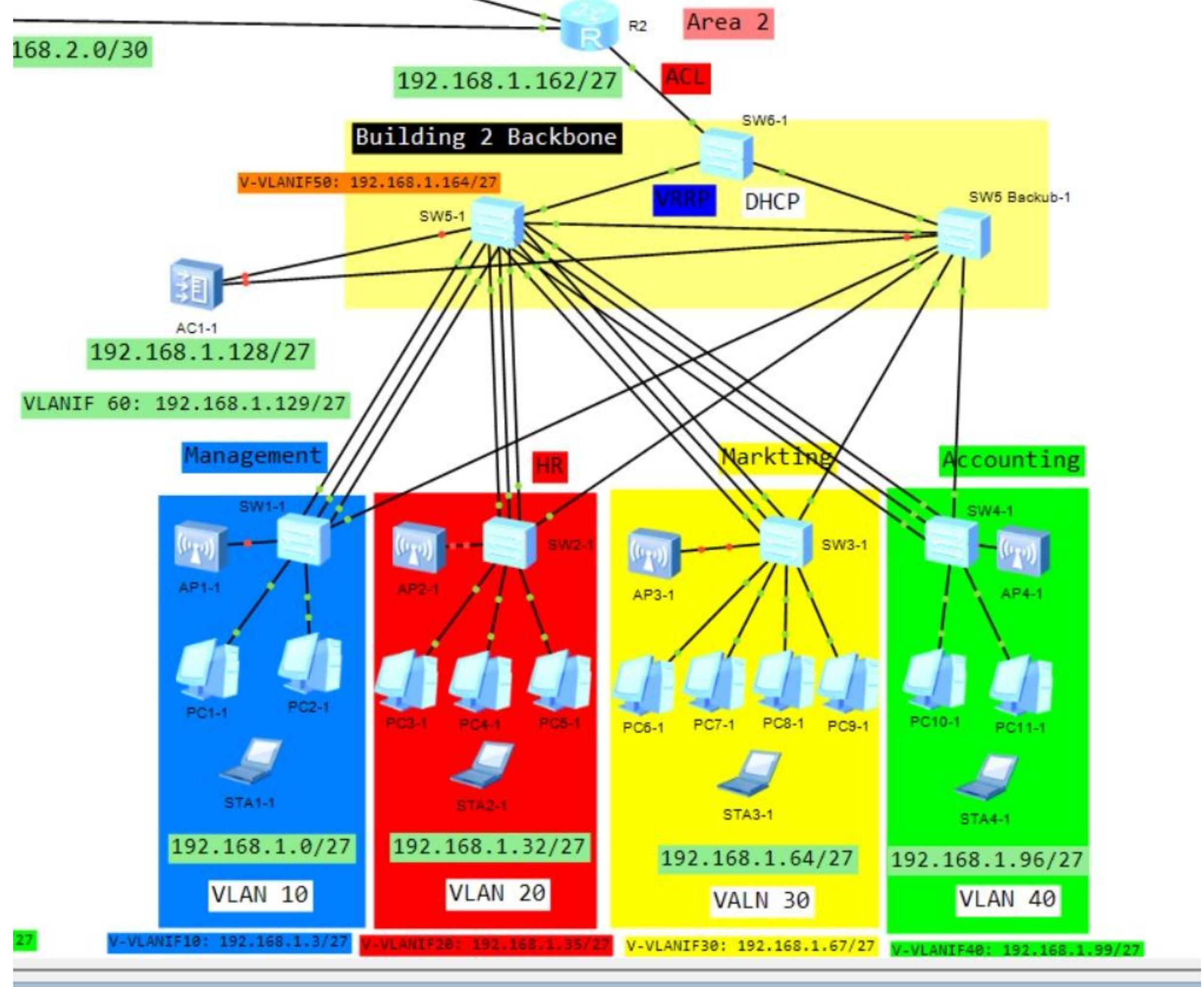
# OUR TOPOLOGY

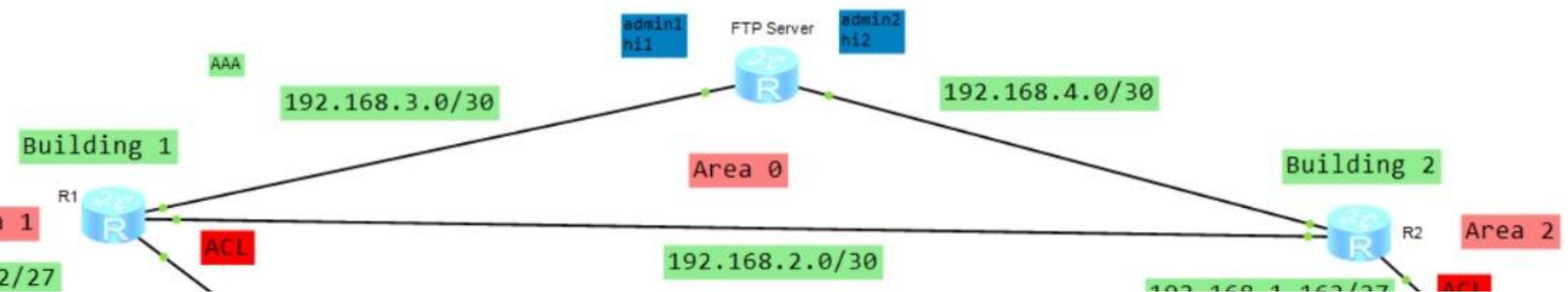


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# BUILDING 1





## FTP SERVER AND OSPF ON ROUTERS



# **DEPARTMENTS & ACL**

**Department segmentation in each building:**

**ACL Usage:**

- Managers can exchange data between buildings
- Other departments are restricted

**Security:**

- All inter-building data passes through Management



# DEPARTMENTS & ACL

PC1

Basic Config Command MCPacket UdpPacket Console

```
0 packet(s) received
100.00% packet loss

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=156 ms
From 192.168.1.30: bytes=32 seq=2 ttl=124 time=156 ms
From 192.168.1.30: bytes=32 seq=3 ttl=124 time=172 ms
From 192.168.1.30: bytes=32 seq=4 ttl=124 time=140 ms
From 192.168.1.30: bytes=32 seq=5 ttl=124 time=172 ms

--- 192.168.1.30 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 140/159/172 ms

PC>
```

Manager ping to another Manager

PC1

Basic Config Command MCPacket UdpPacket Console

```
0.00% packet loss
round-trip min/avg/max = 140/159/172 ms

PCping 192.168.1.69

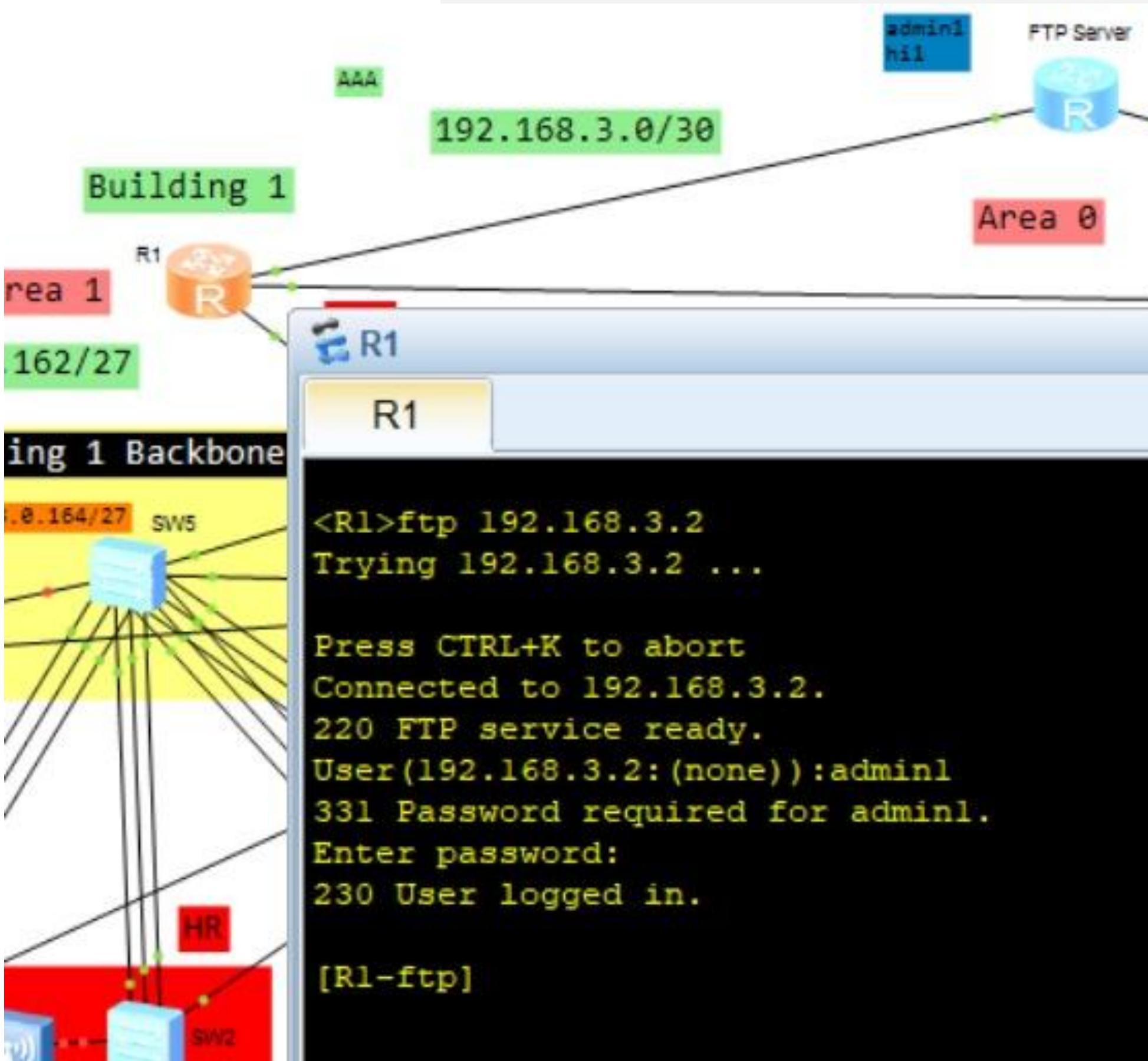
Ping 192.168.1.69: 32 data bytes, Press Ctrl_C to break
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!

--- 192.168.1.69 ping statistics ---
5 packet(s) transmitted
0 packet(s) received
100.00% packet loss

PC>
```

Ping to HR or Marketing or Accounting

# AAA AND FTP SERVER





# VRRP SETUP

- ## Goal: High Availability
- Core Switch + Backup Switch
  - 10 seconds delay before failover
  - Automatic takeover on failure



# VRRP SETUP

SW5

SW5 SW5 Back

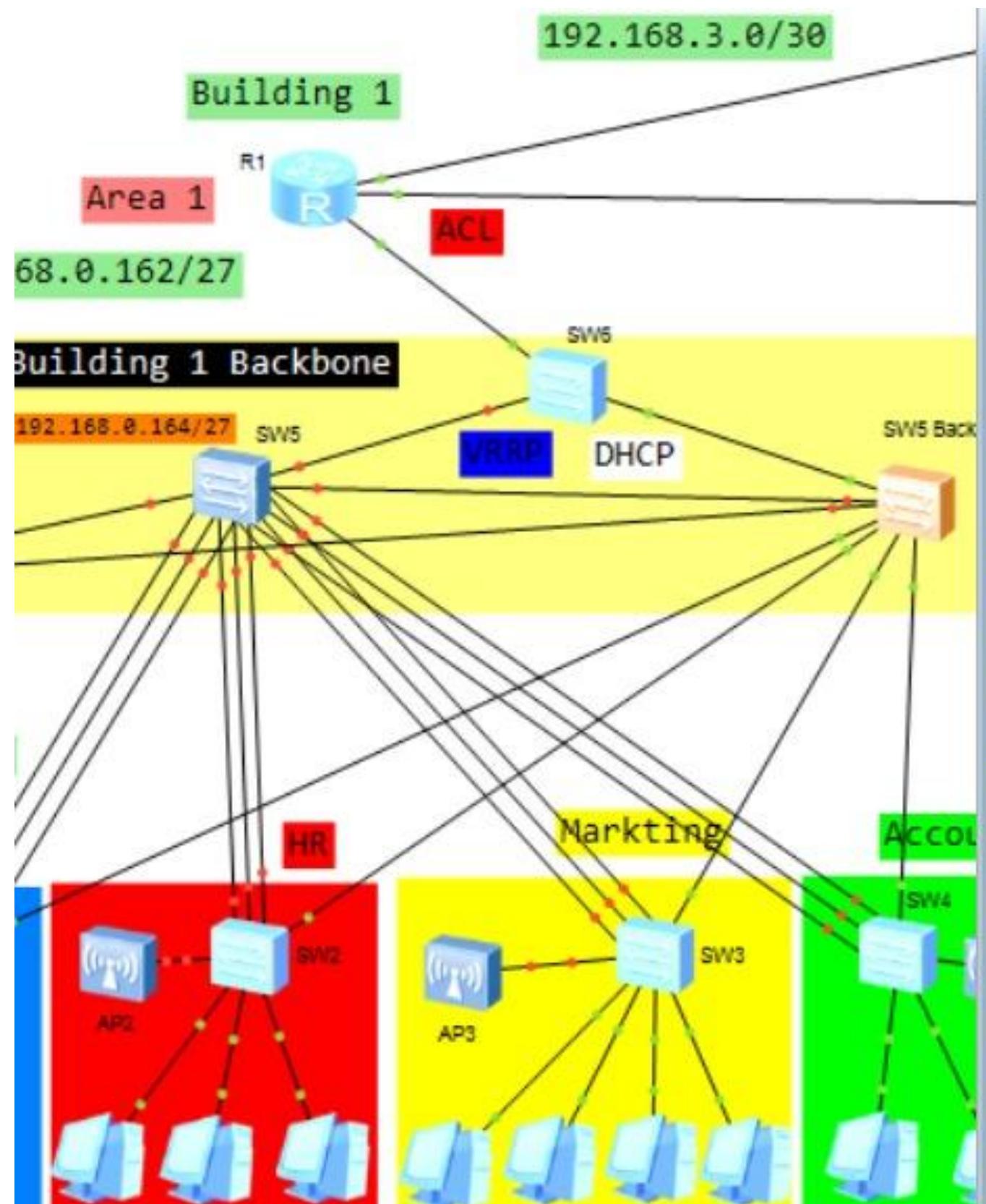
The device is running!

```
<Huawei>
<Huawei>dis vrrp br
VRID State Interface Type Virtual IP
-----
10 Master Vlanif10 Normal 192.168.0.3
20 Master Vlanif20 Normal 192.168.0.35
30 Master Vlanif30 Normal 192.168.0.67
40 Master Vlanif40 Normal 192.168.0.99
50 Master Vlanif50 Normal 192.168.0.164
-----
Total:5 Master:5 Backup:0 Non-active:0
<Huawei>
```

SW5 Backup

SW5 SW5 Back

```
<Huawei>dis vrrp br
VRID State Interface Type Virtual IP
-----
10 Backup Vlanif10 Normal 192.168.0.3
20 Backup Vlanif20 Normal 192.168.0.35
30 Backup Vlanif30 Normal 192.168.0.67
40 Backup Vlanif40 Normal 192.168.0.99
50 Backup Vlanif50 Normal 192.168.0.164
-----
Total:5 Master:0 Backup:5 Non-active:0
<Huawei>
```



**SW5 Backup**

```
<Huawei>dis vrrp br
VRID State Interface Type Virtual IP
----- -----
10 Backup Vlanif10 Normal 192.168.0.3
20 Backup Vlanif20 Normal 192.168.0.35
30 Backup Vlanif30 Normal 192.168.0.67
40 Backup Vlanif40 Normal 192.168.0.99
50 Backup Vlanif50 Normal 192.168.0.164
-----
Total:5 Master:0 Backup:5 Non-active:0
<Huawei>
<Huawei>dis vrrp br
VRID State Interface Type Virtual IP
----- -----
10 Master Vlanif10 Normal 192.168.0.3
20 Master Vlanif20 Normal 192.168.0.35
30 Master Vlanif30 Normal 192.168.0.67
40 Master Vlanif40 Normal 192.168.0.99
50 Master Vlanif50 Normal 192.168.0.164
-----
Total:5 Master:5 Backup:0 Non-active:0
<Huawei>
```

## WHEN MASTER SWITCH FAIL

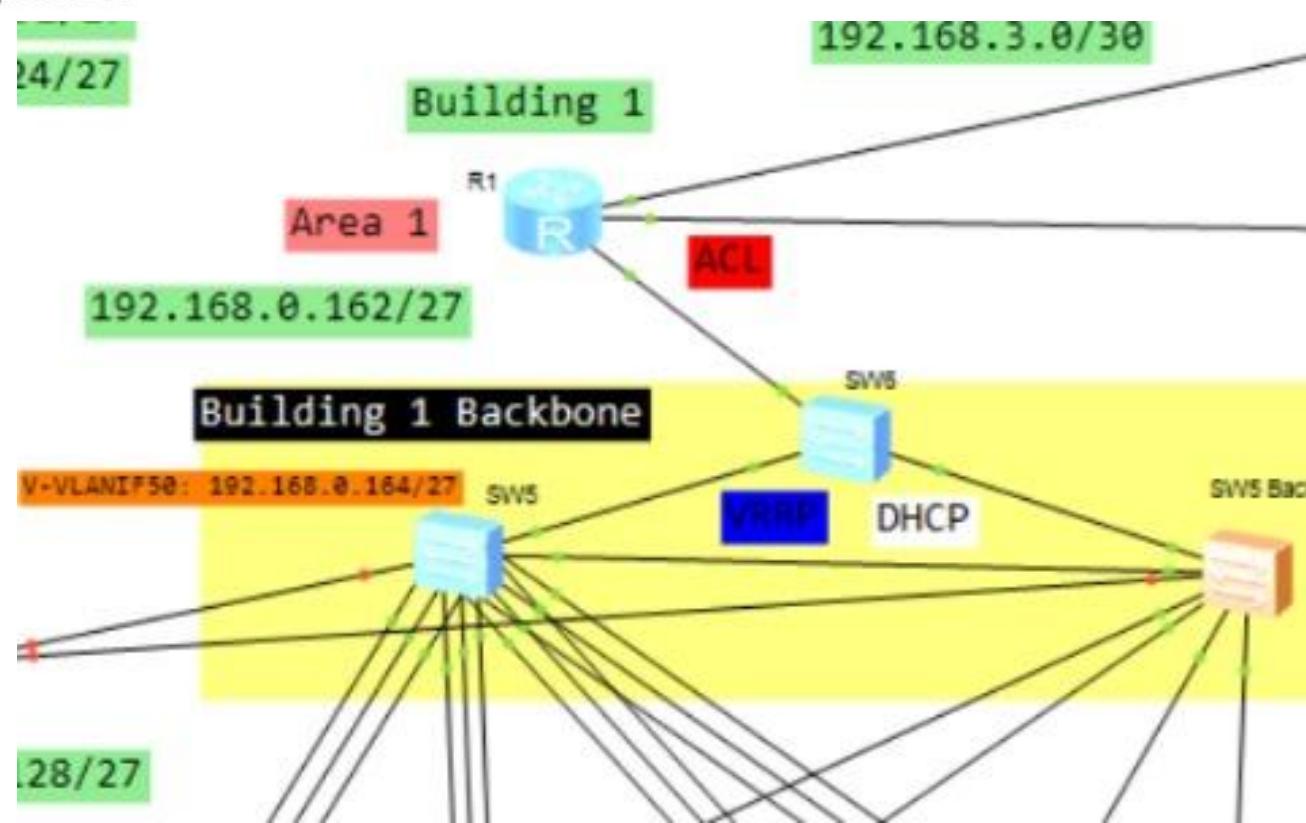
# **STP, VLAN REDUNDANCY & ETH-TRUNK**

- STP prevents loops
- VLAN redundancy between main & backup switches
- Eth-Trunk provides bandwidth aggregation & redundancy



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24/27



28/27

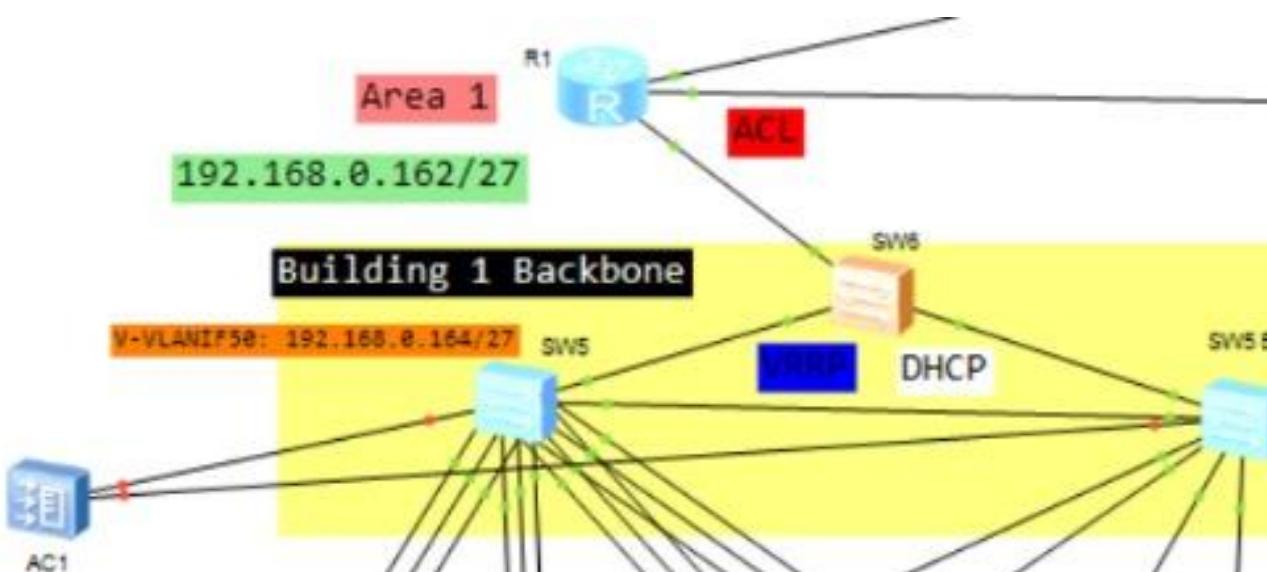
# STP

SW5 Backub

The device is running!

```
<Huawei>
<Huawei>dis stp br
MSTID Port
  0  Ethernet0/0/6
  0  Ethernet0/0/7
  0  Ethernet0/0/11
  0  Ethernet0/0/12
  0  Ethernet0/0/22
  0  GigabitEthernet0/0/1
<Huawei>
```

Role	STP State	Protection
ALTE	DISCARDING	NONE
ROOT	FORWARDING	NONE
DESI	FORWARDING	NONE



SW5

The device is running!

```
<Huawei>
<Huawei>dis stp br
MSTID Port
  0  Ethernet0/0/1
  0  Ethernet0/0/2
  0  GigabitEthernet0/0/1
<Huawei>
```

Role	STP State	Protection
ROOT	FORWARDING	NONE
ALTE	DISCARDING	NONE
DESI	FORWARDING	NONE



# ETH-TRUNK

Eth-Trunk3's state information is:

Local:  
LAG ID: 3 WorkingMode: STATIC  
Preempt Delay: Disabled Hash arithmetic: According to SIP-XOR-DIP  
System Priority: 30000 System ID: 4clf-cca0-4844  
Least Active-linknumber: 1 Max Active-linknumber: 2  
Operate status: up Number Of Up Port In Trunk: 2  
-----  
ActorPortName Status PortType PortPri PortNo PortKey PortState Weight  
Ethernet0/0/3 Selected 100M 32768 4 801 10111100 1  
Ethernet0/0/6 Selected 100M 32768 7 801 10111100 1  
Ethernet0/0/7 Unselect 100M 32768 8 801 10100000 1  
Partner:

-----  
ActorPortName SysPri SystemID PortPri PortNo PortKey PortState  
Ethernet0/0/3 32768 4clf-cce2-5d19 32768 2 801 10111100  
Ethernet0/0/6 32768 4clf-cce2-5d19 32768 3 801 10111100  
Ethernet0/0/7 32768 4clf-cce2-5d19 32768 4 801 10100000

Eth-Trunk4's state information is:

Local:  
LAG ID: 4 WorkingMode: STATIC  
Preempt Delay: Disabled Hash arithmetic: According to SIP-XOR-DIP  
System Priority: 30000 System ID: 4clf-cca0-4844  
Least Active-linknumber: 1 Max Active-linknumber: 2  
Operate status: up Number Of Up Port In Trunk: 2  
-----  
ActorPortName Status PortType PortPri PortNo PortKey PortState Weight

Ethernet0/0/13 Selected 100M 32768 14 1057 10111100 1  
Ethernet0/0/14 Selected 100M 32768 15 1057 10111100 1  
Ethernet0/0/15 Unselect 100M 32768 16 1057 10100000 1

Partner:

-----  
ActorPortName SysPri SystemID PortPri PortNo PortKey PortState  
Ethernet0/0/13 32768 4clf-cc81-667a 32768 4 1057 10111100  
Ethernet0/0/14 32768 4clf-cc81-667a 32768 5 1057 10111100  
Ethernet0/0/15 32768 4clf-cc81-667a 32768 6 1057 10100000

SW5

<Huawei>  
<Huawei>dis eth  
<Huawei>dis eth-trunk  
Eth-Trunk1's state information is:  
Local:  
LAG ID: 1 WorkingMode: STATIC  
Preempt Delay: Disabled Hash arithmetic: According to SIP-XOR-DIP  
System Priority: 30000 System ID: 4clf-cca0-4844  
Least Active-linknumber: 1 Max Active-linknumber: 2  
Operate status: up Number Of Up Port In Trunk: 2  
-----  
ActorPortName Status PortType PortPri PortNo PortKey PortState Weight  
Ethernet0/0/1 Selected 100M 32768 2 289 10111100 1  
Ethernet0/0/4 Selected 100M 32768 5 289 10111100 1  
Ethernet0/0/5 Unselect 100M 32768 6 289 10100000 1

Partner:

-----  
ActorPortName SysPri SystemID PortPri PortNo PortKey PortState  
Ethernet0/0/1 32768 4clf-cc63-354f 32768 2 289 10111100  
Ethernet0/0/4 32768 4clf-cc63-354f 32768 3 289 10111100  
Ethernet0/0/5 32768 4clf-cc63-354f 32768 4 289 10100000

Eth-Trunk2's state information is:

Local:  
LAG ID: 2 WorkingMode: STATIC  
Preempt Delay: Disabled Hash arithmetic: According to SIP-XOR-DIP  
System Priority: 30000 System ID: 4clf-cca0-4844  
Least Active-linknumber: 1 Max Active-linknumber: 2  
Operate status: up Number Of Up Port In Trunk: 2  
-----  
ActorPortName Status PortType PortPri PortNo PortKey PortState Weight

Ethernet0/0/2 Selected 100M 32768 3 545 10111100 1  
Ethernet0/0/8 Selected 100M 32768 9 545 10111100 1  
Ethernet0/0/9 Unselect 100M 32768 10 545 10100000 1

Partner:

-----  
ActorPortName SysPri SystemID PortPri PortNo PortKey PortState  
Ethernet0/0/2 32768 4clf-ccd3-182b 32768 3 545 10111100  
Ethernet0/0/8 32768 4clf-ccd3-182b 32768 4 545 10111100  
Ethernet0/0/9 32768 4clf-ccd3-182b 32768 5 545 10100000



# VLANS AND INTER-VLANS

```
Vlanif10 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-11-29 19:32:24 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 4clf-cca0-4844
Current system time: 2025-11-29 19:53:02-08:00
    Input bandwidth utilization : --
    Output bandwidth utilization : --

Vlanif20 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-11-29 19:32:24 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 4clf-cca0-4844
Current system time: 2025-11-29 19:53:02-08:00
    Input bandwidth utilization : --
    Output bandwidth utilization : --

Vlanif30 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-11-29 19:32:24 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 4clf-cca0-4844
Current system time: 2025-11-29 19:53:06-08:00
    Input bandwidth utilization : --
    Output bandwidth utilization : --
```



# VLANS AND INTER-VLANS

```
Vlanif40 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-11-29 19:32:24 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 4clf-cca0-4844
Current system time: 2025-11-29 19:53:06-08:00
    Input bandwidth utilization : --
    Output bandwidth utilization : --

Vlanif50 current state : UP
Line protocol current state : UP
Last line protocol up time : 2025-11-29 19:32:24 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 4clf-cca0-4844
Current system time: 2025-11-29 19:53:08-08:00
    Input bandwidth utilization : --
    Output bandwidth utilization : --
```

# OSPF ROUTING PROTOCOL

SW5

SW5

```
round-trip min/avg/max = 120/126/140 ms

<Huawei>
<Huawei>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        376      84       8000001F      1
      Router    1.5.5.5          1.5.5.5        375      144      80000010      1
      Router    1.1.1.1          1.1.1.1        377      36       8000000D      1
      Network   192.168.0.163    2.5.5.5        376      36       8000000A      0
      Sum-Net   192.168.4.0      1.1.1.1        1427     28       80000001      2
      Sum-Net   192.168.3.0      1.1.1.1        1470     28       80000001      1
      Sum-Net   192.168.2.0      1.1.1.1        1470     28       80000001      1
      Sum-Net   192.168.1.96    1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.99    1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.64    1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.67    1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.32    1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.35    1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.0      1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.3      1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.164   1.1.1.1        1345     28       80000001      3
      Sum-Net   192.168.1.160   1.1.1.1        1391     28       80000001      2

<Huawei>
```



# OSPF ROUTING PROTOCOL

```
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
        Sum-Net   192.168.0.32     2.2.2.2       448   28   80000002   3
```



# DHCP CONFIGURATION

Enable DHCP service on the device

Create DHCP pools for each VLAN

- Configure:
    - Network address
    - Subnet mask
    - Default gateway (VLANIF interface)
- Ensure APs and wireless clients receive correct IP addresses
- Test DHCP by releasing and renewing IP on end devices



# DHCP CONFIGURATION

**PC8-1**

Welcome to use PC Simulator!

```
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe59:2186
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.1.93
Subnet mask.....: 255.255.255.224
Gateway.....: 192.168.1.67
Physical address.....: 54-89-98-59-21-86
DNS server.....:
```

PC>

**PC10**

Welcome to use PC Simulator!

```
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe01:1bff
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.126
Subnet mask.....: 255.255.255.224
Gateway.....: 192.168.0.99
Physical address.....: 54-89-98-01-1B-FF
DNS server.....:
```

**PC1**

Welcome to use PC Simulator!

```
PC>ipcongig
Invalid command!

PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fea9:60ea
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.29
Subnet mask.....: 255.255.255.224
Gateway.....: 192.168.0.3
Physical address.....: 54-89-98-AF-60-EA
DNS server.....:
```

PC>

**Network Diagram**

The network diagram illustrates the physical connections between the AR201 router, AP1, AP3, AP4, and various client devices (PC1-11, STA1-4). The AR201 is configured with three fixed 8FE interfaces, one WAN-side uplink interface, and one USB interface. It is connected to three VLANs: VLAN 10 (192.168.0.0/24), VLAN 30 (192.168.1.64/27), and VLAN 40 (192.168.1.96/27). The AP1 is connected to PC1, PC2, and STA1. The AP3 is connected to PC6-1 through PC9-1, STA3-1, and AP4-1. The AP4 is connected to PC10-1 and PC11-1, and also to STA4-1.

Total: 57 Selected: 1

Getting help and feedback

Windows taskbar icons: Search, Task View, File Explorer, Google Chrome, WhatsApp, Microsoft Word, MATLAB, Telegram, YouTube, Control Panel, Settings, Task Manager, Power icon.



# **WLAN CONFIGURATION**

- Wireless communication between buildings
- Access Points for user connectivity
- Secure traffic management

# SUMMARY / KEY POINTS

- Network secured with ACL & AAA
- High availability using VRRP
- VLANs & STP ensure continuity
- Eth-Trunk improves bandwidth & redundancy
- Inter-building communication via routers



# THANK YOU

Any  
Questions?

30 Nov, 2025

