

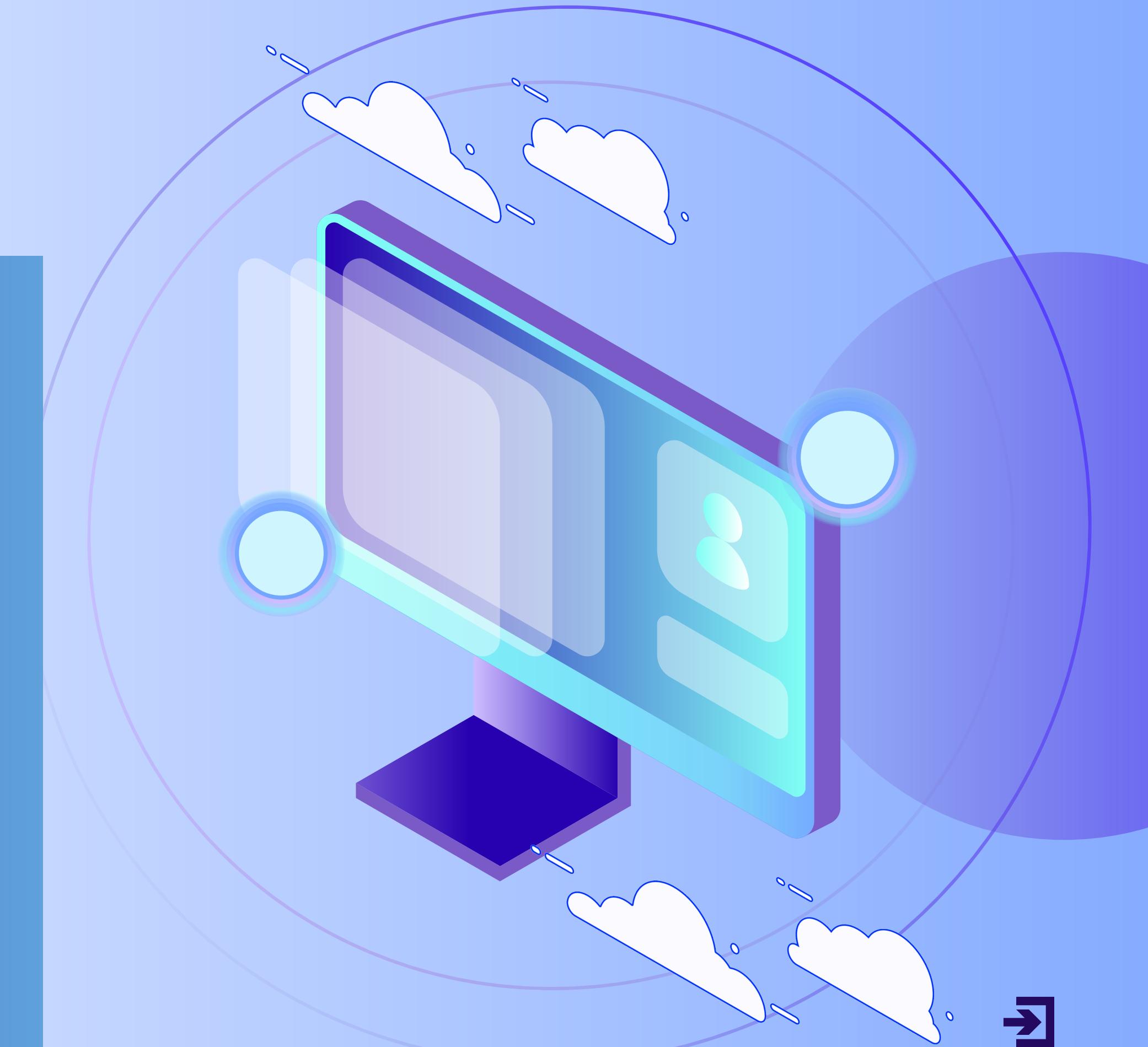
# Efficient Network Setup for Small and Large Enterprises

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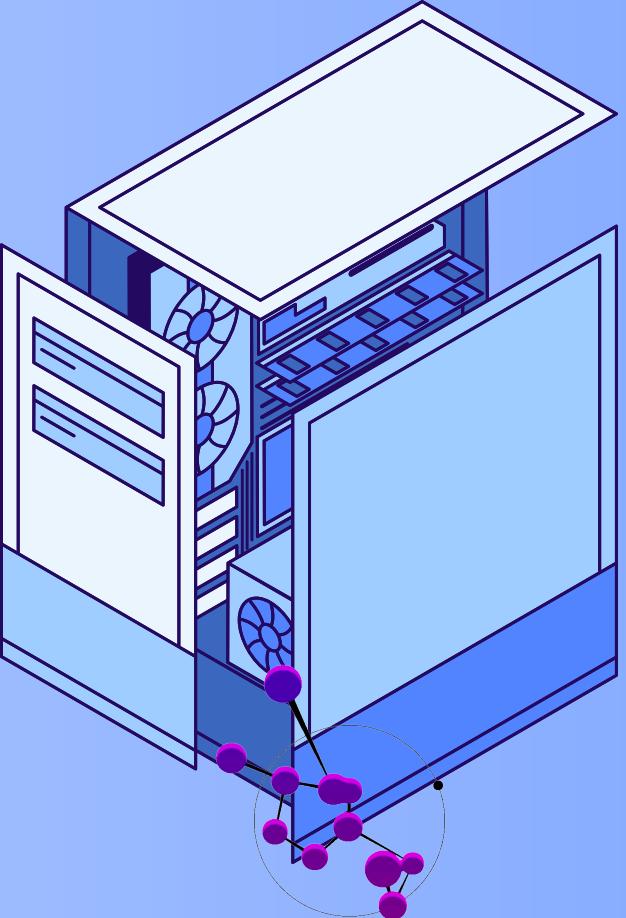
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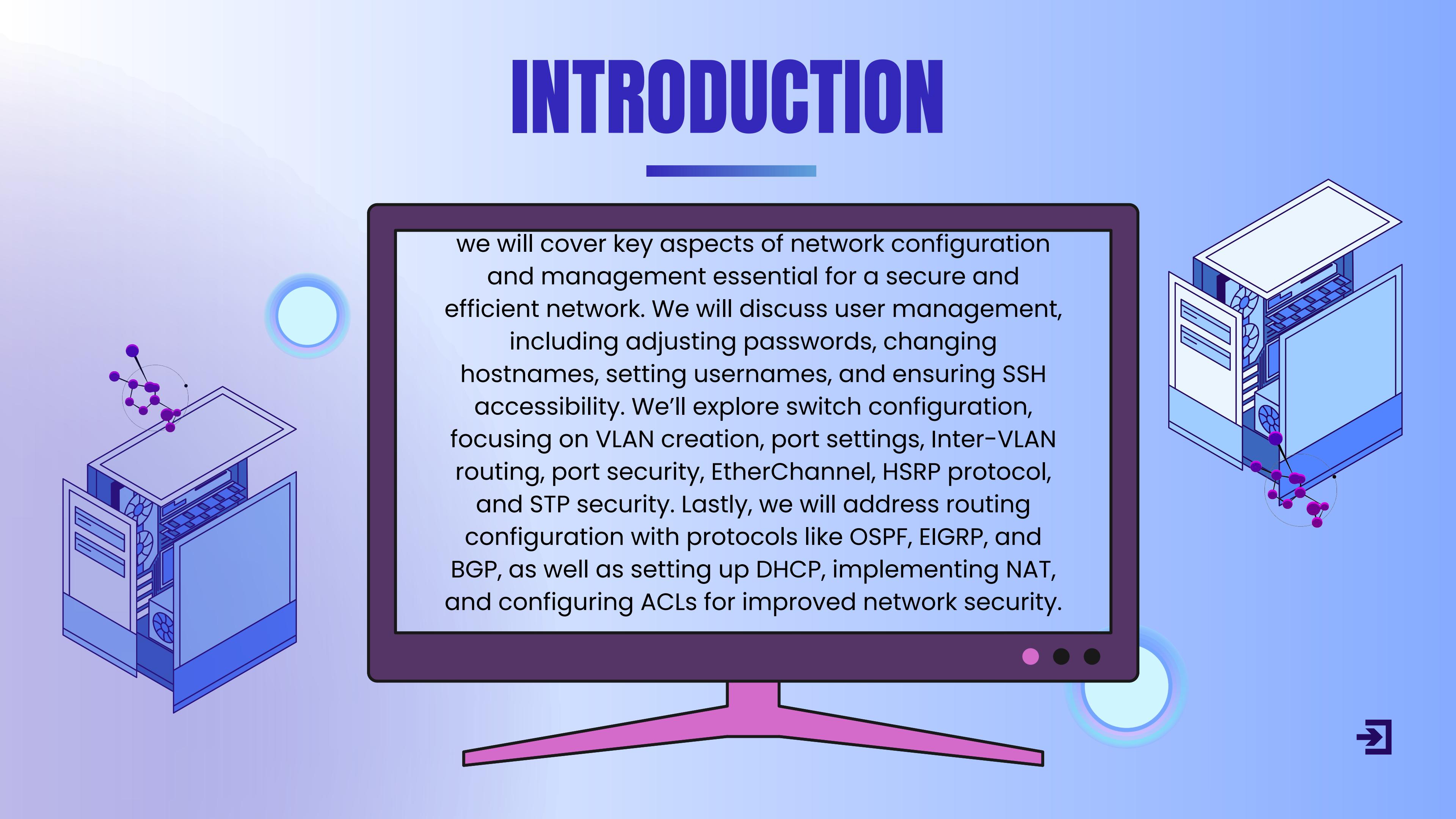
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# INTRODUCTION

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we will cover key aspects of network configuration and management essential for a secure and efficient network. We will discuss user management, including adjusting passwords, changing hostnames, setting usernames, and ensuring SSH accessibility. We'll explore switch configuration, focusing on VLAN creation, port settings, Inter-VLAN routing, port security, EtherChannel, HSRP protocol, and STP security. Lastly, we will address routing configuration with protocols like OSPF, EIGRP, and BGP, as well as setting up DHCP, implementing NAT, and configuring ACLs for improved network security.

# Basic Configuration



In our topology, each switch is configured with a unique hostname and IP for remote administration.

Initially accessed via the console, each switch is placed in privileged EXEC mode, and the hostname and domains "Cairo", "Alex" are set to enable SSH. Console and privileged access are secured with passwords, and VLAN 150 is configured with IP 192.168.150.0/24 on LAN\_Cairo and 172.16.150.0/24 on LAN\_Alex. A local admin account is created for SSH, and VTY lines are set for remote access using SSH version 2. A default gateway of 192.168.5.1 is configured for external connectivity. This process is repeated across all switches, and settings are saved to ensure persistence after reboot.





# 1.CREATE VLANS

We established VLANs 10, 100, 150, and 200, assigning a specific name to each.

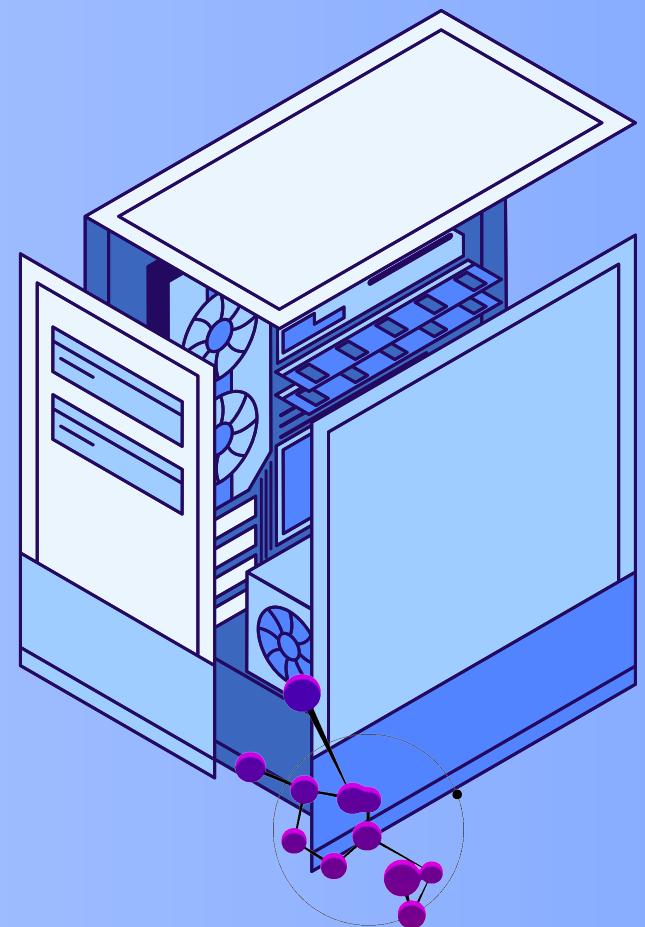
```
Switch(config)#vlan 10
Switch(config-vlan)#name Marketing
Switch(config-vlan)#ex
Switch(config)#vlan 100
Switch(config-vlan)#name Servers
Switch(config-vlan)#ex
Switch(config)#vlan 150
Switch(config-vlan)#name Management
Switch(config-vlan)#ex
Switch(config)#vlan 200
Switch(config-vlan)#name Native
Switch(config-vlan)#ex
```

## 2.Decide which ports will be access or trunk ports

On an interface we can use switchport mode command that we can choose between different modes as there are four modes.

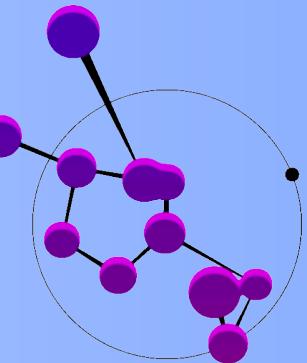
- Access mode is used to assign ports to specific VLAN.
- Trunk mode is used between ports that connect switches to tag each VLAN's traffic.
- Dynamic Auto and Dynamic desirable these two modes are used while DTP (Dynamic Trunk Protocol) is enabled,

```
Switch(config)#interface fastEthernet 0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/2
Switch(config-if)#switchport mode trunk
Switch(config-if)#exit
```



### 3.Apply port-security on access ports

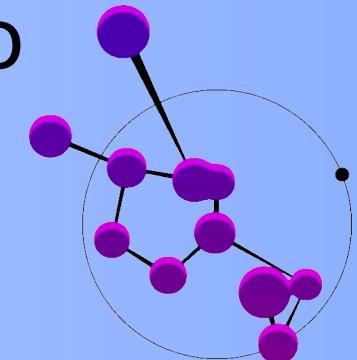
- Enable port-security on an interface by using switchport port-security command
- The command switchport port-security maximum 4 is used to set the maximum number of MAC addresses allowed on a port.
- If the MAC address of a device attached to a port differs from the list of secure addresses, then a port violation occurs and the port enters the error-disabled state



```
Switch(config)#interface fastEthernet 0/1
Switch(config-if)#switchport port-security
Switch(config-if)#switchport port-security maximum 4
Switch(config-if)#switchport port-security mac-address sticky
Switch(config-if)#switchport port-security violation shutdown
Switch(config-if)#switchport port-security aging time 10
Switch(config-if)#switchport port-security aging type inactivit:
```

# 4. Inter VLAN Routing

- We took advantage of layer 3 switches of its capabilities for routing to let it do the job of Inter VLAN Routing
- We create SVI for every VLAN and adjust IP for it
- Apply the command ip routing to enable routing in layer 3 switches



```
Switch(config)#ip routing
Switch(config)#ex
Switch#
%SYS-5-CONFIG_I: Configured from console by console

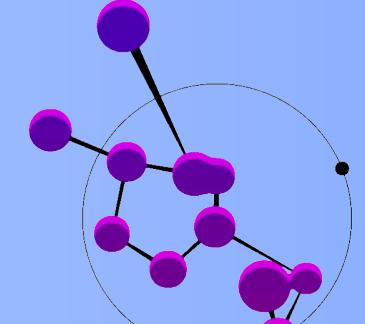
Switch#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      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

C    192.168.10.0/24 is directly connected, Vlan10
C    192.168.20.0/24 is directly connected, Vlan20
```

# 5.Etherchannel

- we make EtherChannel in Networking to provide redundant, high-speed connections between network devices.



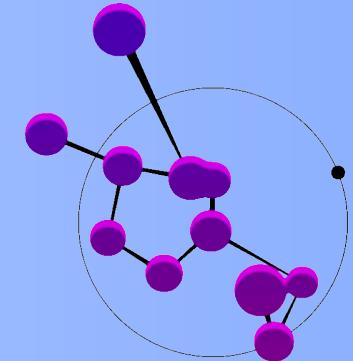
```
Core_2#show etherchannel summary
Flags: D - down          P - in port-channel
      I - stand-alone   S - suspended
      H - Hot-standby (LACP only)
      R - Layer3          S - Layer2
      U - in use           f - failed to allocate aggregator
      u - unsuitable for bundling
      w - waiting to be aggregated
      d - default port

Number of channel-groups in use: 2
Number of aggregators: 2
```

Group	Port-channel	Protocol	Ports
1	Po1 (SU)	-	Fa0/1 (P) Fa0/2 (P)
2	Po2 (SD)	-	Fa0/3 (D) Fa0/4 (D)

# 6.HSRP

- We used HSRP to achieve higher level of redundancy on the network
- HSRP was applied on layer 3 switches and routers
- On layer 3 switches we applied HSRP on SVI with virtual ip of gateway to each VLAN
- On routers we applied HSRP on the interface that connects me to my LAN



```
Core_2#show standby brief
          P indicates configured to preempt.
```

Interface	Grp	Pri	P	State	Active	Standby	Virtual IP
V15	5	100	P	Standby	192.168.5.5	local	192.168.5.254
V110	10	100	P	Standby	192.168.10.2	local	192.168.10.1
V120	20	100	P	Standby	192.168.20.2	local	192.168.20.1
V130	30	120	P	Active	local	192.168.30.2	192.168.30.1
V140	40	120	P	Active	local	192.168.40.2	192.168.40.1
V1100	100	100	P	Standby	192.168.100.2	local	192.168.100.1
V1150	150	120	P	Active	local	192.168.150.5	192.168.150.1



# DHCP SERVER

- Adjusting the pools for VLANS 10,20,30,40 for both networks
- Editing the default gateway for each VLAN,DNS server,start ip,subnet mask,max number of users.

DHCPv6		serverPool							
TFTP		192.168.100.30							
DNS		192.168.100.40							
SYSLOG									
AAA									
NTP									
EMAIL									
FTP									
IoT									
VM Management									
Radius EAP									
Pool Name		serverPool							
Default Gateway		192.168.100.30							
DNS Server		192.168.100.40							
Start IP Address :		192	168	100	0				
Subnet Mask:		255	255	255	0				
Maximum Number of Users :		512							
TFTP Server:		0.0.0.0							
WLC Address:		0.0.0.0							
<a href="#">Add</a>		<a href="#">Save</a>				<a href="#">Remove</a>			
	Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address	
	vlan10	172.16.10.1	192.168.100.40	172.16.10.5	255.255.255.0	250	0.0.0.0	0.0.0.0	
	vlan20	172.16.20.1	192.168.100.40	172.16.20.5	255.255.255.0	250	0.0.0.0	0.0.0.0	
	vlan30	172.16.30.1	192.168.100.40	172.16.30.5	255.255.255.0	250	0.0.0.0	0.0.0.0	
	vlan40	172.16.40.1	192.168.100.40	172.16.40.5	255.255.255.0	250	0.0.0.0	0.0.0.0	
	VLAN_20_Pool	192.168.20.1	192.168.100.40	192.168.20.5	255.255.255.0	250	0.0.0.0	0.0.0.0	
	VLAN_40_Pool	192.168.40.1	192.168.100.40	192.168.40.4	255.255.255.0	250	0.0.0.0	0.0.0.0	
	VLAN_10_Pool	192.168.10.1	192.168.100.40	192.168.10.5	255.255.255.0	250	0.0.0.0	0.0.0.0	
	VLAN_30_Pool	192.168.30.1	192.168.100.40	192.168.30.5	255.255.255.0	250	0.0.0.0	0.0.0.0	
	serverPool	0.0.0.0	0.0.0.0	192.168.100.0	255.255.255.0	512	0.0.0.0	0.0.0.0	

- Using the “IP helper address” command on each layer 3 switch in both LANS

```
switch2 (config-if)#int vlan 10
switch2 (config-if)#ip helper-address 192.168.100.30
switch2 (config-if)#int vlan 20
switch2 (config-if)#ip helper-address 192.168.100.30
switch2 (config-if)#int vlan 30
switch2 (config-if)#ip helper-address 192.168.100.30
switch2 (config-if)#int vlan 40
switch2 (config-if)#ip helper-address 192.168.100.30
```

# DNS SERVER

- Editing the DNS Server's IP address, default gateway, subnet mask,DNS server IP(same as IP address)
- Adding the DNS server IP address in the address log and naming the website

The screenshot shows a network configuration interface with a sidebar and a main content area.

**Left Sidebar:**

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS** (selected)
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

**Main Content Area:**

**DNS Service:**  On  Off

**Resource Records:**

Name	Type
cisco	A Record

**Address:** 192.168.100.10

**Action Buttons:** Add, Save, Remove

**Resource Record Table:**

No.	Name	Type	Detail
0	cisco	A Record	192.168.100.10

# WEB SERVER

- Editing IP address, subnet mask, default gateway, and DNS server IP address.

The screenshot shows a network configuration interface with two main sections: IPv4 Configuration and IPv6 Configuration.

**IPv4 Configuration:**

- Method: Static (selected)
- IPv4 Address: 192.168.100.10
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.100.1
- DNS Server: 192.168.100.40

**IPv6 Configuration:**

- Method: Static (selected)
- IPv6 Address: (empty field)
- Link Local Address: FE80::202:4AFF:FE06:DD05
- Default Gateway: (empty field)
- DNS Server: (empty field)

**802.1X:**

- Use 802.1X Security

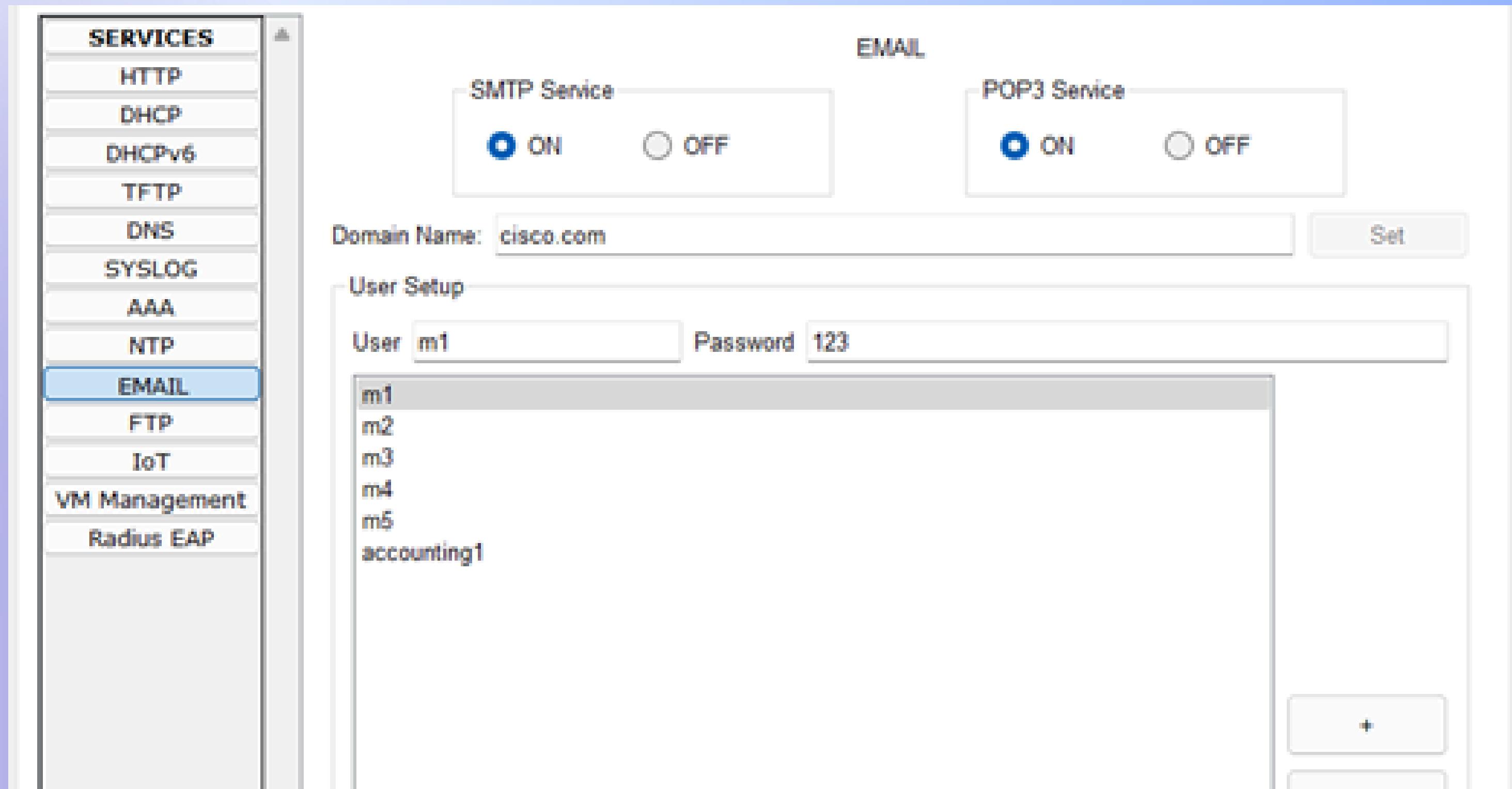
# WEB SERVER

- Making sure all VLANs access the html page



# MAIL SERVER

- After editing ip address,subnet mask,DNS,Default gateway.Adding Individual emails for marketing pcs and left accounting pc so that they could all contact each other.



# MAIL SERVER

- Going to each pc and configuring its email address, mail server ip, username and password.

Your Name:	mariam
Email Address	m1@cisco.com
Server Information	
Incoming Mail Server	192.168.100.20
Outgoing Mail Server	192.168.100.20
Logon Information	
User Name:	m1
Password:	***
<input type="button" value="Save"/>	<input type="button" value="Remove"/>

Physical	Config	Desktop	Programming	Attributes
Configure Mail				
User Information				
Your Name:	mariam			
Email Address	m3@cisco.com			
Server Information				
Incoming Mail Server	192.168.100.20			
Outgoing Mail Server	192.168.100.20			
Logon Information				
User Name:	m3			
Password:	***			
<input type="button" value="Save"/>	<input type="button" value="Remove"/>	<input type="button" value="Clear"/>	<input type="button" value="Reset"/>	

# MAIL SERVER

M1 pc

Physical Config Desktop Programming Attributes

MAIL BROWSER

Mails

Compose Reply Receive Delete Configure Mail

	From	Subject	Received
1	accounting1@cisco.com		Sat Oct 12 2024 00:10:52

Receiving mail from POP3 Server 192.168.100.20

Cancel Top

M4 PC

Physical Config Desktop Programming Attributes

MAIL BROWSER

Mails

Compose Reply Receive Delete Configure Mail

	From	Subject	Received
1	m2@cisco.com	hello	Sat Oct 12 2024 00:08:51

Receiving mail from POP3 Server 192.168.100.20

Cancel Send/Receive

# OSPF

switch2(config)#	ip routing
switch2(config)#	router ospf 1
switch2(config-router)#	network 192.168.5.0 0.0.0.255 area 0
switch2(config-router)#	network 192.168.5.0 0.0.0.255 area 0
switch2(config-router)#	network 192.168.10.0 0.0.0.255 area 0
switch2(config-router)#	network 192.168.20.0 0.0.0.255 area 0
switch2(config-router)#	network 192.168.30.0 0.0.0.255 area 0
switch2(config-router)#	network 192.168.40.0 0.0.0.255 area 0
switch2(config-router)#	network 192.168.100.0 0.0.0.255 area 0
switch2(config-router)#	network 192.168.150.0 0.0.0.255 area 0

•Configuring OSPF Protocol On layer 3 switches

# OSPF

- On routers

```
Router0(config-router)#router ospf 1
Router0(config-router)#network 192.168.5.0 0.0.0.255 area 0
Router0(config-router)#network 10.0.0.0 0.0.0.255 area 0
Router0(config-router)#network 192.168.150.0 0.0.0.255 area 0
Router0(config-router)#exit
```

```
Router1(config)#router ospf 1
Router1(config-router)#network 192.168.5.0 0.0.0.255 area 0
Router1(config-router)#network 11.0.0.0 0.0.0.255 area 0
Router1(config-router)#network 192.168.150.0 0.0.0.255 area 0
Router1(config-router)#exit
```

```
Router2(config)#router ospf 1
Router2(config-router)#network 10.0.0.0 0.0.0.255 area 0
Router2(config-router)#network 11.0.0.0 0.0.0.255 area 0
Router2(config-router)#network 13.0.0.0 0.0.0.255 area 0
Router2(config-router)#exit
```

- On router 3(Middle router)

```
Router3#show ip route o
  10.0.0.0/24 is subnetted, 1 subnets
o    10.0.0.0 [110/128] via 13.0.0.2, 01:55:50, Serial0/1/0
  11.0.0.0/24 is subnetted, 1 subnets
o    11.0.0.0 [110/128] via 13.0.0.2, 01:55:50, Serial0/1/0
o  192.168.5.0 [110/129] via 13.0.0.2, 01:55:10, Serial0/1/0
o  192.168.10.0 [110/130] via 13.0.0.2, 01:28:45, Serial0/1/0
o  192.168.20.0 [110/130] via 13.0.0.2, 01:31:45, Serial0/1/0
o  192.168.30.0 [110/130] via 13.0.0.2, 01:55:10, Serial0/1/0
o  192.168.40.0 [110/130] via 13.0.0.2, 01:55:10, Serial0/1/0
o  192.168.100.0 [110/130] via 13.0.0.2, 01:55:10, Serial0/1/0
o  192.168.150.0 [110/130] via 13.0.0.2, 01:55:10, Serial0/1/0
  200.200.200.0/32 is subnetted, 1 subnets
o    200.200.200.1 [110/65] via 13.0.0.2, 01:55:50, Serial0/1/0
```

# ACCESS LIST

- To allow VLANS 10 and 20 in both networks to communicate with each other only.
- VLANS 30 and 40 are not allowed to communicate with VLANS 10 and 20.
- VLANS 10 and 20 communicate with other Vlans in the network.

## IOS Command Line Interface

```
Core_1#show access-lists
Extended IP access list VLAN10_VLAN20_ACL
 10 deny ip 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255
 20 deny ip 192.168.10.0 0.0.0.255 192.168.40.0 0.0.0.255
 30 deny ip 192.168.20.0 0.0.0.255 192.168.30.0 0.0.0.255
 40 deny ip 192.168.20.0 0.0.0.255 192.168.40.0 0.0.0.255
 50 deny ip 192.168.30.0 0.0.0.255 192.168.10.0 0.0.0.255
 60 deny ip 192.168.30.0 0.0.0.255 192.168.20.0 0.0.0.255
 70 deny ip 192.168.40.0 0.0.0.255 192.168.10.0 0.0.0.255
 80 deny ip 192.168.40.0 0.0.0.255 192.168.20.0 0.0.0.255
 90 deny ip 192.168.10.0 0.0.0.255 172.16.30.0 0.0.0.255
100 deny ip 192.168.10.0 0.0.0.255 172.16.40.0 0.0.0.255
110 deny ip 192.168.20.0 0.0.0.255 172.16.30.0 0.0.0.255
120 deny ip 192.168.20.0 0.0.0.255 172.16.40.0 0.0.0.255
130 deny ip 172.16.10.0 0.0.0.255 192.168.30.0 0.0.0.255
140 deny ip 172.16.10.0 0.0.0.255 192.168.40.0 0.0.0.255
150 deny ip 172.16.20.0 0.0.0.255 192.168.30.0 0.0.0.255
160 deny ip 172.16.20.0 0.0.0.255 192.168.40.0 0.0.0.255
170 deny ip 192.168.30.0 0.0.0.255 172.16.10.0 0.0.0.255
180 deny ip 192.168.30.0 0.0.0.255 172.16.20.0 0.0.0.255
190 deny ip 192.168.40.0 0.0.0.255 172.16.10.0 0.0.0.255
200 deny ip 192.168.40.0 0.0.0.255 172.16.20.0 0.0.0.255
210 deny ip 172.16.30.0 0.0.0.255 192.168.10.0 0.0.0.255
220 deny ip 172.16.30.0 0.0.0.255 192.168.20.0 0.0.0.255
230 deny ip 172.16.40.0 0.0.0.255 192.168.10.0 0.0.0.255
240 deny ip 172.16.40.0 0.0.0.255 192.168.20.0 0.0.0.255
250 permit ip any 192.168.10.0 0.0.0.255 (23 match(es))
260 permit ip 192.168.10.0 0.0.0.255 any (85 match(es))
270 permit ip any 192.168.20.0 0.0.0.255 (15 match(es))
280 permit ip 192.168.20.0 0.0.0.255 any (79 match(es))
290 permit ip any 192.168.30.0 0.0.0.255
300 permit ip 192.168.30.0 0.0.0.255 any
310 permit ip any 192.168.40.0 0.0.0.255
320 permit ip 192.168.40.0 0.0.0.255 any
330 permit ip any any
```

## ACCESS LIST

L3 Switch on  
Cairo\_LAN

# ACCESS LIST

IOS Command Line Interface

```
#show access-lists
      ded IP access list VLAN10_VLAN20_ACL
0 deny ip 172.16.10.0 0.0.0.255 172.16.30.0 0.0.0.255
0 deny ip 172.16.10.0 0.0.0.255 172.16.40.0 0.0.0.255
0 deny ip 172.16.20.0 0.0.0.255 172.16.30.0 0.0.0.255
0 deny ip 172.16.20.0 0.0.0.255 172.16.40.0 0.0.0.255
0 deny ip 172.16.30.0 0.0.0.255 172.16.10.0 0.0.0.255
0 deny ip 172.16.30.0 0.0.0.255 172.16.20.0 0.0.0.255
0 deny ip 172.16.40.0 0.0.0.255 172.16.10.0 0.0.0.255
0 deny ip 172.16.40.0 0.0.0.255 172.16.20.0 0.0.0.255
0 deny ip 192.168.10.0 0.0.0.255 172.16.30.0 0.0.0.255
00 deny ip 192.168.10.0 0.0.0.255 172.16.40.0 0.0.0.255
10 deny ip 192.168.20.0 0.0.0.255 172.16.30.0 0.0.0.255
20 deny ip 192.168.20.0 0.0.0.255 172.16.40.0 0.0.0.255
30 deny ip 172.16.10.0 0.0.0.255 192.168.30.0 0.0.0.255
40 deny ip 172.16.10.0 0.0.0.255 192.168.40.0 0.0.0.255
50 deny ip 172.16.20.0 0.0.0.255 192.168.30.0 0.0.0.255
60 deny ip 172.16.20.0 0.0.0.255 192.168.40.0 0.0.0.255
70 deny ip 192.168.30.0 0.0.0.255 172.16.10.0 0.0.0.255
80 deny ip 192.168.30.0 0.0.0.255 172.16.20.0 0.0.0.255
90 deny ip 192.168.40.0 0.0.0.255 172.16.10.0 0.0.0.255
00 deny ip 192.168.40.0 0.0.0.255 172.16.20.0 0.0.0.255
10 deny ip 172.16.30.0 0.0.0.255 192.168.10.0 0.0.0.255
20 deny ip 172.16.30.0 0.0.0.255 192.168.20.0 0.0.0.255
30 deny ip 172.16.40.0 0.0.0.255 192.168.10.0 0.0.0.255
40 deny ip 172.16.40.0 0.0.0.255 192.168.20.0 0.0.0.255
50 permit ip any 172.16.10.0 0.0.0.255 (56 match(es) )
60 permit ip 172.16.10.0 0.0.0.255 any (133 match(es) )
70 permit ip any 172.16.20.0 0.0.0.255 (57 match(es) )
80 permit ip 172.16.20.0 0.0.0.255 any (130 match(es) )
90 permit ip any 172.16.30.0 0.0.0.255
00 permit ip 172.16.30.0 0.0.0.255 any
10 permit ip any 172.16.40.0 0.0.0.255
20 permit ip 172.16.40.0 0.0.0.255 any
30 permit ip any any
```

L3 Switch on  
Alex\_LAN

On Al-core-sw1

router eigrp 1

network 172.16.5.4 0.0.0.0

network 172.16.10.2 0.0.0.0

network 172.16.20.2 0.0.0.0

network 172.16.30.2 0.0.0.0

network 172.16.40.2 0.0.0.0

network 172.16.150.0 0.0.0.255

no auto-summ

EIGRP

On Al-core-sw2

router eigrp 1

network 172.16.5.5 0.0.0.0

network 172.16.10.3 0.0.0.0

network 172.16.20.3 0.0.0.0

network 172.16.30.3 0.0.0.0

network 172.16.40.3 0.0.0.0

network 172.16.150.0 0.0.0.255

no auto-summ

# EIGRP

## On AL-Active-R

enable

config ter

router eigrp 1

network 172.16.5.2 0.0.0.0

network 172.150.50.4 0.0.0.0

no auto-summ

# EIGRP

## On AL-Standby-R

enable

config ter

router eigrp 1

network 172.16.5.3 0.0.0.0

network 16.0.0.1 0.0.0.0

network 172.150.50.5 0.0.0.0

no auto-summ

# EIGRP

# EIGRP

On R2

enable

config ter

router eigrp 1

network 12.0.0.2 0.0.0.0

network 15.0.0.2 0.0.0.0

network 16.0.0.2 0.0.0.0

no auto-summ

# EIGRP

On R3

enable

config ter

router eigrp 1

network 12.0.0.1 0.0.0.0

no auto-summ

redistribute ospf 1 metric 100 100 50 20 1500

router ospf 1

network 13.0.0.1 0.0.0.0 area 0

redistribute eigrp 1 subnets

exit

# NAT

On Ca-Sandby-R

config ter

int s0/1/0

ip nat outside

exit

int g0/0/0

ip nat inside

exit

access-list 25 permit 192.168.0.0 0.0.255.255

ip nat pool WAN2 200.200.200.130 200.200.200.150 netmask 255.255.255.128

ip nat inside source list 25 pool WAN2

ip route 200.200.200.128 255.255.255.128 null 0

router ospf 1

network 200.200.200.128 0.0.0.127 area 0

exit

# NAT

On Ca-Active-R

config ter

int s0/1/0

ip nat outside

exit

int g0/0/0

ip nat inside

exit

access-list 25 permit 192.168.0.0 0.0.255.255

ip nat pool WAN1 200.200.200.1 200.200.200.20 netmask 255.255.255.128

ip nat inside source list 25 pool WAN1

ip route 200.200.200.0 255.255.255.128 null 0

router ospf 1

network 200.200.200.0 0.0.0.127 area 0

# DHCP & ARP Security

ip dhcp snooping

ip dhcp snooping vlan 10,20,30,40,5,50,150,200

ip arp inspection vlan 10,20,30,40,5,50,150,200

int rang f0/1-2

ip dhcp snooping trust

ip arp inspection trust

int rang f0/3-6

ip dhcp snooping limit rate 20

# **THANK YOU!**