Configuration Approach and Steps Taken

Steps & Configurations:

a) **Classification:** Identify subnet requirements and host demands for each department.
b) **Subnetting with VLSM:** Apply Variable Length Subnet Masking to allocate subnets efficiently across departments and VLANs
c) **Device configuration:** Assign static IP addresses and default gateways to all end devices.
d) **VLAN Creation:** Define VLANs and map switch interfaces to their corresponding VLANs.
e) **Trunking Configuration:** Configure trunk ports to allow inter-VLAN traffic across switches.
f) **Traffic Segmentation Testing:** Verify that VLANs are properly isolating traffic as intended.
g) **Sub-Interface Setup:** Create and configure router sub-interfaces for VLAN routing (Router-on-a-Stick).
h) **Ping Testing:** Conduct ping tests to validate VLAN switching and inter-VLAN routing functionality.

a. Classification

Subnets	VLAN 10	VLAN 20	VLAN 30	VLAN 40	VLAN 50
5	SERVERS / IT	HR	SALES	FINANCE	GUESTS

b. Subnetting with VLSM

VLAN	DEPT	No. usable Hosts	Network	Default Gateway	Broadcast Address	IP Range
10	IT/Server	62	192.168.1.0/26	192.168.1.62	192.168.1.63	192.168.1.0 – 192.168.1.63
20	HR Dept	62	192.168.1.64/26	192.168.1.126	192.168.1.127	192.168.1.64 – 192.168.1.127
30	Sales	30	192.168.1.128	192.168.1.158	192.168.1.159	192.168.1.128 - 192.168.1.159
40	Finance	40	192.168.1.160	192.168.1.190	192.168.1.191	192.168.1.160 - 192.168.1.191
50	Guest	50	192.168.1.192	192.168.1.222	192.168.1.223	192.168.1.192 - 192.168.1.223

c. Device Configuration

VLAN / Dept	Device Name	IP Address	Default Gateway	Connection Type
10 (IT/Servers)	Laptop1	.1	.62	Ethernet
	Server1	.2		
	Server2	.3		
20 (HR)	PC3	.65	126	Ethernet
	PC4	.66		

	PC5	.67		
30 (Sales)	Laptop2	.129	158	Ethernet
	Printer0	.130		
40 (Finance)	PC1	.161	190	Ethernet
	PC2	.162		
50 (Guests)	Laptop3	.193	222	WiFi
	Smartphone0	.194		
	Tablet PC1	.195		
	PC6	.196		
	Laptop4	.197		
	Smartphone1	.198		
	Tablet PC2	.199		

d. VLAN Creation

Switch	VLAN-ID & Interfaces	Trunk Port(s)	Trunk allowed VLANs	Native VLAN
3	**10**: Fa0/5 Fa0/6 Fa0/7	Fa0/1	10,40,50	99
	40: Fa0/2 Fa0/3			
	50: Fa0/4			
1	**20**: Fa0/3 Fa0/4 Fa0/5	Fa0/1 Fa0/2, Gig0/1	10, 40, 50 30, 50 ALL	99
2	**30**: Fa0/3 Fa0/4	Fa0/1	30, 50	99
	50: Fa0/2			

Command to create VLAN: in global configuration mode run:

Switch(config)# vlan *`VLAN-ID`*
Switch(config-vlan)# name *`VLAN name`*
Switch(config-vlan)# *end*

e. Trunking Configuration

Command to create Trunk: in Interface configuration mode run:

```
Switch(config-if)# switchport mode trunk
Switch(config)# switchport access vlan `vlan-ID`
Switch(config)# switchport trunk allowed vlan `vlan-ID`
```

Note: All VLANs intended for trunking must be manually created in the switch's global configuration mode. If a VLAN is not defined on the switch, it will not forward frames tagged with that VLAN ID; even across trunk ports.

f. Traffic Segmentation Testing

Test	Pink domain	Expectations
1	Pinking host-devices on the same subnet.	i. ARP broadcast should not be forwarded to interfaces of other VLANs / Depts / Subnets. ii. Only all interfaces of same VLAN will receive the ARP frame.
2	Pinking host-devices on a different subnet.	i. Device will ARP for Default Gateway MAC address. ii. Arp Frame will only flow through trunk and same VLAN interfaces. iii. Uplink is down and not configured; the switch will drop the packet.

g. Sub-Interface Setup

Sub-Interface	IP Address	Netmask	802.1Q ID
Gig0/0.10	192.168.1.62	225.225.225.192	10
Gig0/0.20	192.168.1.126	225.225.225.192	20
Gig0/0.30	192.168.1.158	225.225.225.224	30
Gig0/0.40	192.168.1.190	225.225.225.224	40
Gig0/0.50	192.168.1.222	225.225.225.224	50

Configuration guide: Configure each interface the following way:

`

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#interface gigabitEthernet0/0.10
Router(config-subif)#ip address 192.168.1.62 255.255.255.192
```

`

Turn UP the parent interface: gig0/0

`

```
Router#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#interface gigabitEthernet0/0
Router(config-subif)#no shutdown
```

h. Ping Testing

Test #	Test Type	Expected Behavior
1	VLAN-Switching	i. ARP broadcasts should **not** be forwarded to interfaces in other VLANs, departments, or subnets. ii. Only interfaces within the **same VLAN** should receive the ARP frame.
2	Inter-VLAN-Routing	i. Devices will send an ARP request for the **default gateway's MAC address**. ii. ARP frames will only traverse **trunk links** and interfaces within the same VLAN. iii. If the uplink is UP and configured, the switch will forward the frame to the respective default gateways. iv. The router's sub-interface will receive the frame, **tag it with the destination VLAN**, perform ARP for the destination MAC, and update the Layer 2 frame before forwarding it to the appropriate sub-interface. v. All traffic destined for a **different network** must pass through the router.

This marks the end of the tutorial for now. I hope the content has been simplified enough for easy understanding and practical application. I'm genuinely happy to share what I've learned; this approach to VLAN configuration reflects one of the most effective and structured methods I've explored so far.

If you'd like to connect or follow my technical journey, feel free to reach out via LinkedIn.

Stay curious, keep building, and never stop refining your skills.

Thank you,

Collins C. Amalimeh
BSc Computer Scientist
collinsama343@yahoo.com

Tutorial topology