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Session 06
INTER VLAN

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Topics

- Inter-VLAN Routing
- Traditional Inter VLAN
- Router on Stick
- Inter-VLAN Config

Sources:

- https://ipcisco.com
- https://www.cisco.com/
- https://networklessons.com/cisco/

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Inter VLAN

- In previous chapters, we learnt how VLANs segment broadcast traffic on a switch and segment a switched network into different LANs
- Consider, this, as the **network administrator**, one of your tasks is to **create** and **assign** different users to VLANs in your network, you have three main departments which should be logically segmented using VLANs, **VLAN 10 – FINANCE, VLAN 20 – SALES and VLAN 30 – HR.**
- The use of VLANs means that **users would not be able to communicate across departments**, since they are on different broadcast domains.
- In many enterprises, you will find that information sharing across departments is a requirement, therefore, the question begs, **how do you make users** in the SALES and FINANCE department **communicate**, yet they are on **different VLANS**?`

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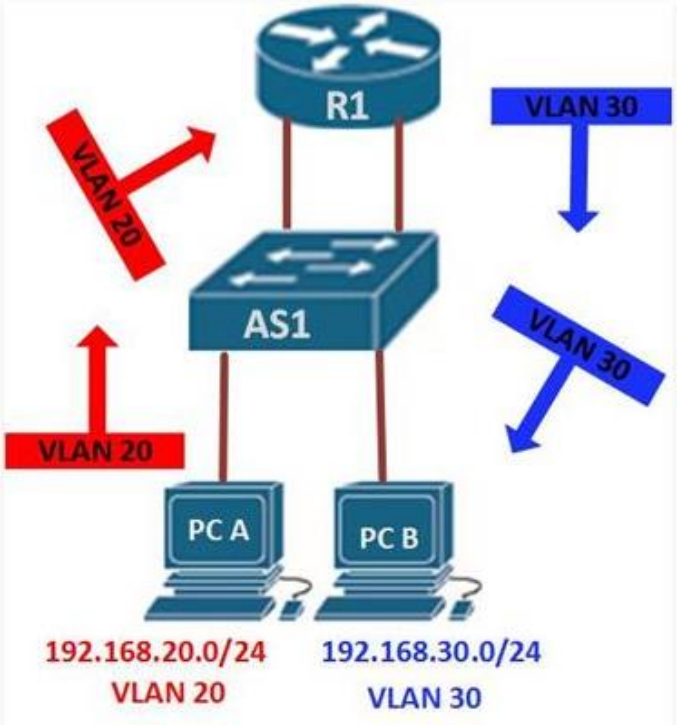
Inter VLAN

- Inter-VLAN routing can be defined as **a way to forward traffic between different VLAN by implementing a router in the network**.
- As we learnt previously, VLANs logically segment the switch into **different subnets**, when a **router** is connected to the **switch**, an administrator can configure the router to forward the traffic between the various VLANs configured on the switch.
- The user nodes in the VLANs forwards traffic to the router which then forwards the traffic to the destination network regardless of the VLAN configured on the switch.

Inter VLAN

- Information destined for PC B, leaves PC A with the VLAN 20 tag, when it gets to R1, the router, changes the format of this message from VLAN 20, to VLAN 30, it then sends it back to the switch and the switch finally sends the message to its intended recipient PC B.

- There are two ways in which inter-VLAN routing can be accomplished.
  - Traditional inter-VLAN routing
  - Router-on-a-stick



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Traditional inter-VLAN routing

- In this type of inter-VLAN routing, **a router is usually connected to the switch using multiple interfaces**.
- **One for each VLAN**. The interfaces on the router are configured as the default gateways for the VLANs configured on the switch.

- The ports that connect to the router from the switch are configured in **access mode in their corresponding VLANs**.

- In this form of inter-VLAN routing, the router **has to have as many LAN interfaces** as the number of VLANs configured on the switch. Therefore, if a **switch has 10 VLANs**, the **router should have the same number** of LAN interfaces.

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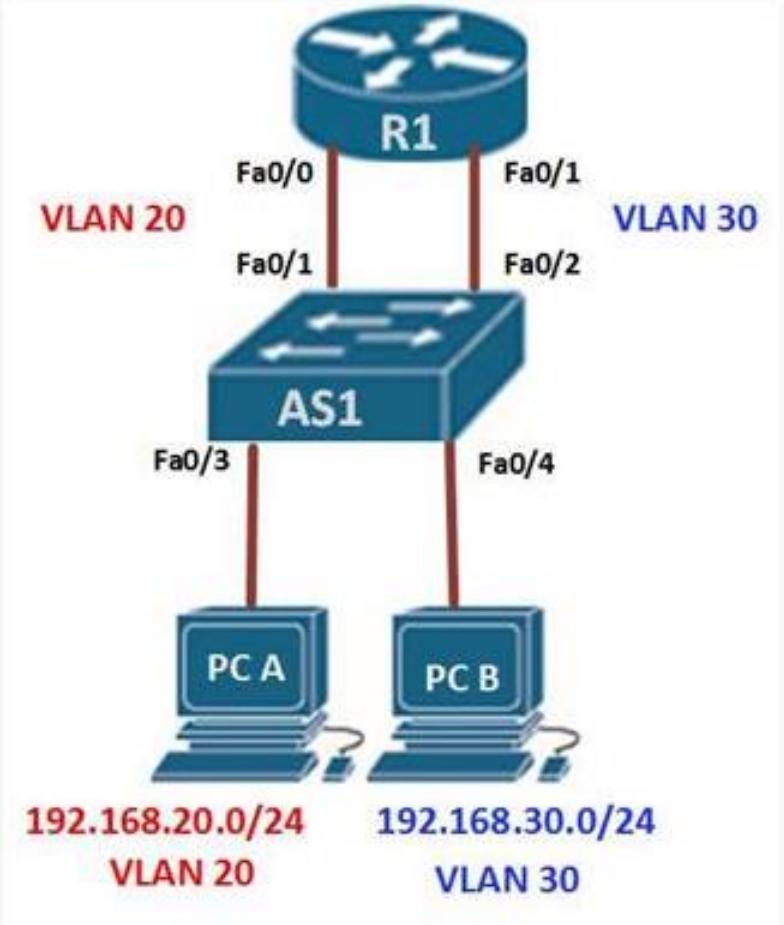
Traditional inter-VLAN routing



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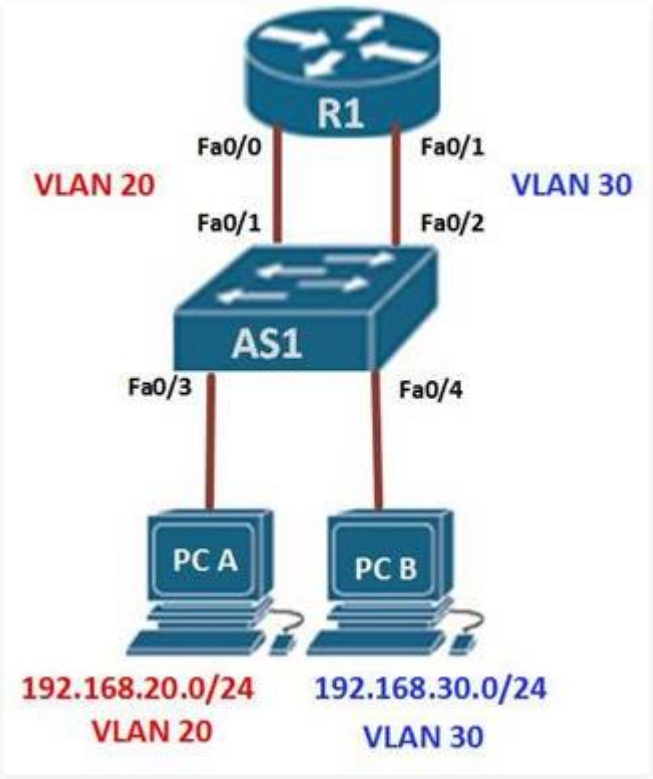
Traditional inter-VLAN routing

- **PC A** would check whether the destination IPv4 address is **in its VLAN** if it is not, it would need to **forward the traffic to its default gateway** which is the ip address on **Fa0/0 on R1**.
- PC A then sends an **ARP request** to AS1 so as to determine the physical address of **Fa0/0 on R1**. Once the router replies, PC A can send the frame to the router as a unicast message, since AS1 has Fa0/0's MAC address, it can forward the frame directly to R1.
- When the router receives the frame, it compares the destination IP address by **referring to its routing table** so as to know to which interface it should send the data towards the destination node.
- The router then sends an **ARP request out the interface** connected to the **destination VLAN** in this case **out Fa0/1**, when the switch receives the message, it would **flood** it to its ports and in this case**, PC B would reply with its MAC address.**
- **R1** would then use this information to frame the packet and finally send it **to PC B as a unicast frame**.

Traditional inter-VLAN routing



Device	Interface	Ip address	Subnet mask	Default gateway
PC A	NIC	192.168.20.2	255.255.255.0	192.168.20.1
PC B	NIC	192.168.30.3	255.255.255.0	192.168.30.1
R1	Fa0/0	192.168.20.1	255.255.255.0	
	Fa0/1	192.168.30.1	255.255.255.0	

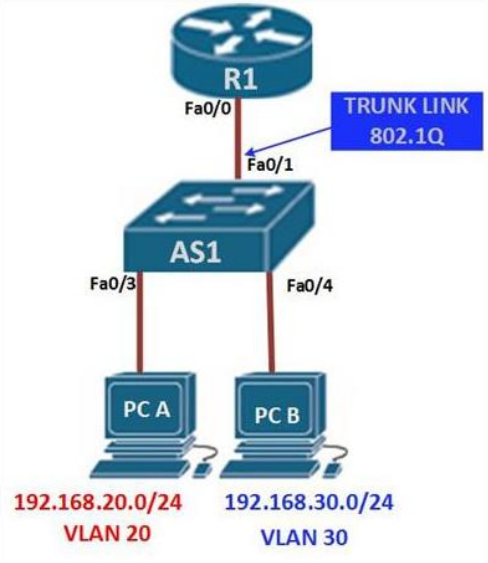
1. *AS1(config)#interface fa0/1*
2. *AS1(config)#switchport mode access*
3. *AS1(config)#switchport access vlan 20*
4. *AS1(config)#exit*

1. *R1(config)#interface fa0/0*
2. *R1(config)#ip address 192.168.20.1 255.255.255.0*
3. *R1(config)#no shutdown*
4. *R1(config)#exit*

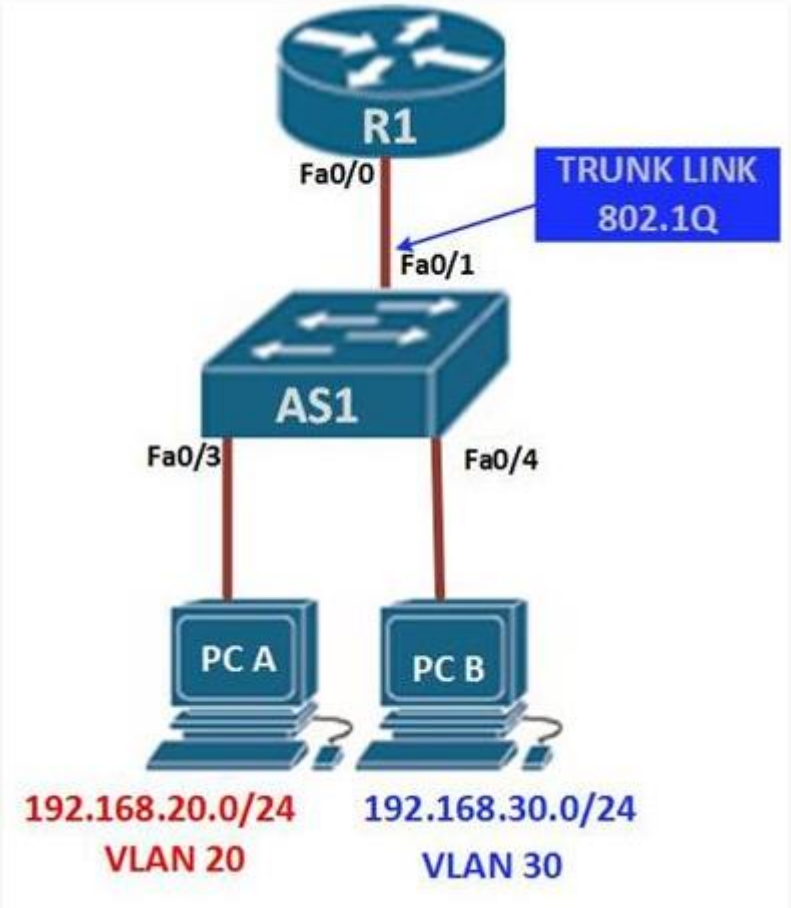
Check on R1 with command *R1#show ip route*

Inter-VLAN routing using router-on-a-stick

- n the second type of inter-VLAN routing which is Router-on-a-stick, the **router is connected to the switch using a single interface.**
- The switchport connecting to the router is configured as a **trunk link**. The single interface on the router is then configured with multiple IP addresses that correspond to the VLANs on the switch.
- This interface **accepts traffic from all the VLANs** and determines the destination network based on the source and destination IP in the packets. It then forwards the data to the switch with the correct VLAN information.



Inter-VLAN routing using router-on-a-stick



Device	Interface	Ip address	Subnet mask	Default gateway
PC A	NIC	192.168.20.2	255.255.255.0	192.168.20.1
PC B	NIC	192.168.30.3	255.255.255.0	192.168.30.1

1. *AS1(config)#interface fa0/1*
2. *AS1(config)#switchport mode trunk*

1. *R1(config)#interface fa0/0.20*
2. *R1(config-subif)#encapsulation dot1q 20*
3. *R1(config-subif)# ip address 192.168.20.1 255.255.255.0*
4. *R1(config-subif)#exit*
5. *R1(config)#no shutdown*
6. *R1(config)#exit*

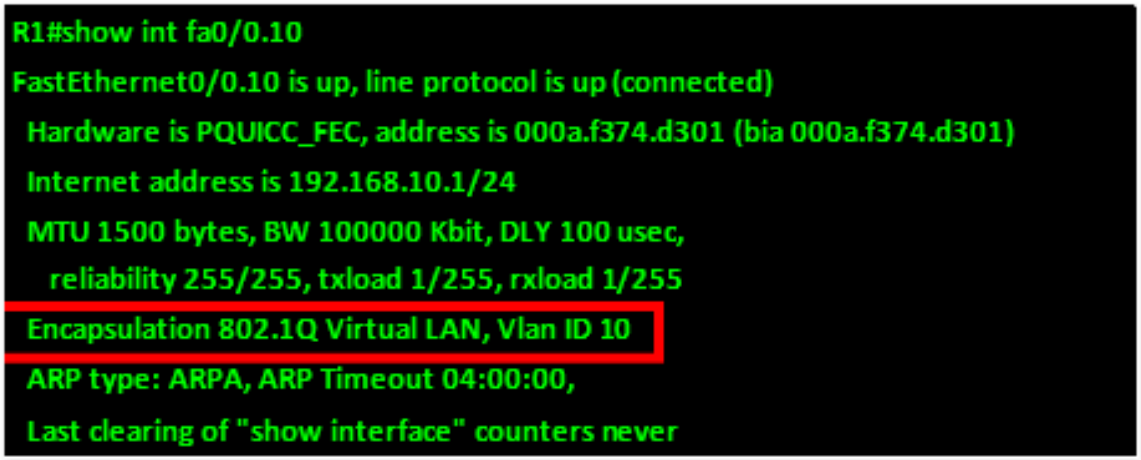
Check on R1 with command *R1#show ip route*

Comparison of router-on-a-stick and traditional inter-VLAN routing

metric	Traditional inter-VLAN routing	Router-on-a-stick
No. of physical interfaces	One physical interface per VLAN	One physical interface for many VLANs
bandwidth	No bandwidth contention	bandwidth contention
Port mode	access mode switch port	Trunk mode switch port
Cost	More expensive	Less expensive
Admin complexity	Less complex configuration	complex configuration

Verifying and troubleshooting inter-VLAN routing issues

- In verifying inter-VLAN routing, the commands mostly used are:
  - Show run
  - Show ip interface brief
  - Show interface <interfaceID.subinterfaceID>



THANK YOU