**Router-on-a-Stick (Inter-VLAN Routing) Lab**

**📘 Overview**

This project demonstrates **Router-on-a-Stick** configuration to enable inter-VLAN communication between multiple VLANs using a single physical interface on a router.  
In this lab, I configured:

* **1 Router**
* **1 Switch**
* **6 PCs**
* **3 VLANs** (each VLAN has 2 PCs)

The goal was to:

1. Create and assign VLANs on the switch
2. Configure trunking between switch and router
3. Create subinterfaces on the router for each VLAN
4. Assign IP addresses and enable inter-VLAN routing
5. Verify connectivity between hosts in different VLANs

**🖥️ Network Topology**

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| Router |

| G0/0 |

+-------+--------+

|

| Trunk Link

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+------+------+

| Switch |

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VLAN 10 VLAN 20 VLAN 30

(PC1, PC2) (PC3, PC4) (PC5, PC6)

**⚙️ Step 1: VLAN Configuration on Switch**

**Create VLANs**

Switch# configure terminal

Switch(config)# vlan 10

Switch(config-vlan)# name SALES

Switch(config-vlan)# exit

Switch(config)# vlan 20

Switch(config-vlan)# name HR

Switch(config-vlan)# exit

Switch(config)# vlan 30

Switch(config-vlan)# name IT

Switch(config-vlan)# exit

**Assign Ports to VLANs**

Switch(config)# interface range fa0/1 - 2

Switch(config-if-range)# switchport mode access

Switch(config-if-range)# switchport access vlan 10

Switch(config-if-range)# exit

Switch(config)# interface range fa0/3 - 4

Switch(config-if-range)# switchport mode access

Switch(config-if-range)# switchport access vlan 20

Switch(config-if-range)# exit

Switch(config)# interface range fa0/5 - 6

Switch(config-if-range)# switchport mode access

Switch(config-if-range)# switchport access vlan 30

Switch(config-if-range)# exit

**Verify VLANs**

Switch# show vlan brief

📝 *Explanation:*  
Each pair of PCs is assigned to a specific VLAN. VLANs logically segment the network, reducing broadcast domains.

**⚙️ Step 2: Configure Trunk Between Switch and Router**

Switch(config)# interface fa0/24

Switch(config-if)# switchport mode trunk

Switch(config-if)# switchport trunk encapsulation dot1q

Switch(config-if)# exit

📝 *Explanation:*  
The trunk port carries traffic from multiple VLANs to the router using **802.1Q tagging**. This is essential for Router-on-a-Stick to work.

**⚙️ Step 3: Router Subinterface Configuration**

Router# configure terminal

Router(config)# interface g0/0.10

Router(config-subif)# encapsulation dot1q 10

Router(config-subif)# ip address 192.168.10.1 255.255.255.0

Router(config-subif)# exit

Router(config)# interface g0/0.20

Router(config-subif)# encapsulation dot1q 20

Router(config-subif)# ip address 192.168.20.1 255.255.255.0

Router(config-subif)# exit

Router(config)# interface g0/0.30

Router(config-subif)# encapsulation dot1q 30

Router(config-subif)# ip address 192.168.30.1 255.255.255.0

Router(config-subif)# exit

Router(config)# interface g0/0

Router(config-if)# no shutdown

Router(config-if)# exit

📝 *Explanation:*  
Each **subinterface** acts as a gateway for its respective VLAN.  
The encapsulation dot1q <vlan-id> command tags VLAN traffic appropriately.  
For example, VLAN 10 hosts will use 192.168.10.1 as their default gateway.

**⚙️ Step 4: Configure PC IP Addresses**

| **VLAN** | **Device** | **IP Address** | **Subnet Mask** | **Default Gateway** |
| --- | --- | --- | --- | --- |
| 10 | PC1 | 192.168.10.10 | 255.255.255.0 | 192.168.10.1 |
| 10 | PC2 | 192.168.10.11 | 255.255.255.0 | 192.168.10.1 |
| 20 | PC3 | 192.168.20.10 | 255.255.255.0 | 192.168.20.1 |
| 20 | PC4 | 192.168.20.11 | 255.255.255.0 | 192.168.20.1 |
| 30 | PC5 | 192.168.30.10 | 255.255.255.0 | 192.168.30.1 |
| 30 | PC6 | 192.168.30.11 | 255.255.255.0 | 192.168.30.1 |

📝 *Explanation:*  
Assigning static IPs to PCs within their respective VLAN subnets allows routing to work correctly once the router subinterfaces are configured.

**🧠 Step 5: Verification**

**1️⃣ Check Router Interfaces**

Router# show ip interface brief

Expected output: All subinterfaces (G0/0.10, G0/0.20, G0/0.30) should be **up/up**.

**2️⃣ Check VLANs and Trunk on Switch**

Switch# show vlan brief

Switch# show interfaces trunk

**3️⃣ Ping Test**

From PC1 (VLAN 10), ping:

* PC2 (same VLAN)
* PC3 (different VLAN)
* PC5 (different VLAN)

All should reply successfully if routing is correct.

**🧾 Step 6: Save Configuration**

Switch# copy running-config startup-config

Router# copy running-config startup-config

**✅ Conclusion**

This lab successfully demonstrated **Router-on-a-Stick inter-VLAN routing**.  
By using subinterfaces and trunking, we enabled devices in different VLANs to communicate without needing multiple physical router interfaces.

**Key Concepts Learned:**

* VLAN segmentation and management
* Trunk link configuration
* Router subinterface setup
* Inter-VLAN communication testing

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