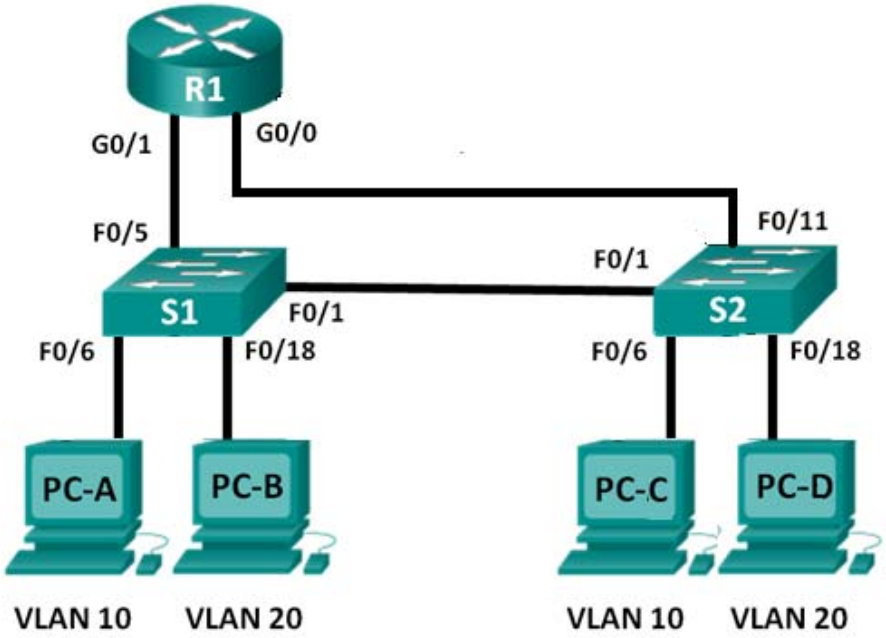
Lab 5 – Configuring Inter-VLAN Routing

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	192.168.20.1	255.255.255.0	N/A
	G0/1	192.168.10.1	255.255.255.0	N/A
S1	VLAN 1	192.168.1.11	255.255.255.0	192.168.1.1
S2	VLAN 1	192.168.1.12	255.255.255.0	192.168.1.1
PC-A	NIC	192.168.10.22	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.20.22	255.255.255.0	192.168.20.1
PC-C	NIC	192.168.10.33	255.255.255.0	192.168.10.1
PC-D	NIC	192.168.20.33	255.255.255.0	192.168.20.1

Objectives

Part 1: Build the Network and Configure Basic Device Settings

Part 2: Configure Switches with VLANs

Part 3: Configure Per-Interface Inter-VLAN Routing

Part 4: Configure Trunk-Based Inter-VLAN Routing

Background / Scenario

Legacy inter-VLAN routing is seldom used in today's networks; however, it is helpful to configure and understand this type of routing before moving on to **router-on-a-stick** (trunk-based) inter-VLAN routing or configuring Layer-3 switching. Also, you may encounter per-interface inter-VLAN routing in organizations with very small networks. One of the benefits of legacy inter-VLAN routing is ease of configuration.

In this lab, you will set up one router with two switches attached via the router Gigabit Ethernet interfaces. Two separate VLANs will be configured on the switches, and you will set up routing between the VLANs in two ways (Per-Interface and Trunk-based).

Note: This lab provides minimal assistance with the actual commands necessary to configure the router and switches. The required switch VLAN configuration commands are provided in previous labs. Test your knowledge by trying to configure the devices without referring to other labs.

Note: Make sure that the routers and switches have been erased and have no startup configurations. If you are unsure, use the **show** commands.

Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and clear any configurations, if necessary.

Step 1: Cable the network as shown in the topology.

Switch Port Assignment Specifications

Ports	Assignment	Network
S1 F0/1	802.1Q Trunk	N/A
S2 F0/1	802.1Q Trunk	N/A
S1 F0/5	VLAN 10 – Students	192.168.10.0/24
S1 F0/6	VLAN 10 – Students	192.168.10.0/24
S1 F0/18	VLAN 20 – Faculty	192.168.20.0/24
S2 F0/6	VLAN 10 – Students	192.168.10.0/24
S2 F0/11	VLAN 20 – Faculty	192.168.20.0/24
S2 F0/18	VLAN 20 – Faculty	192.168.20.0/24

Step 2: Initialize and reload the switches.

Step 3: Configure basic settings on S1 and S2.

- Disable DNS lookup.
- Assign the device name.

- Assign **class** as the privileged EXEC mode encrypted password.
- Assign **cisco** as the console and vty line password and enable login.

Step 4: Configure basic settings on the PCs.

Configure the PCs (PC-A, PC-B, PC-C and PC-D) with IP addresses and a default gateway address according to the Addressing Table.

Part 2: Configure Switches with VLANs

In Part 2, you will configure the switches with VLANs.

Step 1: Configure VLANs on S1.

- Create VLAN 10. Assign **Student** as the VLAN name.
- Create VLAN 20. Assign **Faculty** as the VLAN name.
- Assign ports F0/5 and F0/6 to VLAN 10 and configure both as access ports.
- Assign port F0/18 to VLAN 20 and configure it as access ports.
- Assign an IP address to VLAN 1 and enable it. Refer to the Addressing Table.
- Configure the default gateway according to the Addressing Table.

Step 2: Configure VLANs on S2.

- Create VLAN 10. Assign **Student** as the VLAN name.
- Create VLAN 20. Assign **Faculty** as the VLAN name.
- Assign port F0/6 to VLAN 10 and configure it as access ports.
- Assign ports F0/11 and F0/18 to VLAN 20 and configure both as access ports.
- Assign an IP address to VLAN 1 and enable it. Refer to the Addressing Table.
- Configure the default gateway according to the Addressing Table.

Step 3: Verify VLANs on both S1 and S2.

- Issue a **show vlan brief** command on both S1 and S2. Verify that VLANs 10 and 20 are active and that the proper ports on the switches are in the correct VLANs.

VLAN 1 VLAN 10 VLAN 20

S1 Ports: .....

S2 Ports: .....

Part 3: Configure Per-Interface Inter-VLAN Routing

Step 1: Configure Trunking between Switches.

- On both S1 and S2, configure F0/1 as a trunk port.
- Issue a **show vlan brief** command on both S1 and S2. Why is F0/1 not listed in any of the active VLANs?

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Step 2: Initialize and reload the router.

Step 3: Configure basic settings for R1.

- Disable DNS lookup.
- Assign the device name.
- Assign **class** as the privileged EXEC mode encrypted password.
- Assign **cisco** as the console and vty line password and enable login.
- Configure addressing on G0/0 and G0/1 and enable both interfaces.

Step 4: Verify the R1 routing table.

- On R1, issue the **show ip route** command. What routes are listed on R1?

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- Ping from PC-A in VLAN 10 to PC-D in VLAN 20. **If Inter-VLAN routing** is functioning correctly, the pings between the 192.168.10.0 network and the 192.168.20.0 should be successful. Explain the path (interfaces and cables) that ping-packets are passing between PC-A and PC-D.

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- Ping from PC-A to PC-C in VLAN 10 (similarly from PC-B to PC-D in VLAN 20). If **trunking** functioning correctly, the pings between these PCs should be successful. Explain the path (interfaces and cables) that ping-packets are passing between PC-A and PC-C (or PC-B and PC-D).

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- Ping from PC-B in VLAN 20 to PC-C in VLAN 10 (similarly from PC-C in VLAN 10 to PC-B in VLAN 20). If both **trunking** and **Inter-VLAN routing** functioning correctly, the pings between these PCs should be successful. Explain the path (interfaces and cables) that ping-packets are passing from PC-B to PC-C (and vice versa from PC-C to PC-B).

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- Verify connectivity between the PCs. You should be able to ping between all PCs and from any PC to the router's interface (default gateway). Troubleshoot if pings are not successful.
- However it is only possible to ping between switches (SVIs) but not from any PC to any switch, why? Explain.

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Part 4: Configure Trunk-based Inter-VLAN Routing

A second method of providing routing and connectivity for multiple VLANs is through the use of an 802.1Q trunk between one or more switches and a single router interface. This method is also known as router-on-a-stick inter-VLAN routing. In this method, the physical router interface is divided into multiple sub-interfaces that provide logical pathways to all VLANs connected.

In this part, you will configure IEEE 802.1Q trunk-based inter-VLAN routing and verify connectivity to hosts on different VLANs as well as with a loopback on the router.

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1.1	192.168.1.1	255.255.255.0	N/A
	G0/1.10	192.168.10.1	255.255.255.0	N/A
	G0/1.20	192.168.20.1	255.255.255.0	N/A
	Lo0	209.165.200.225	255.255.255.224	N/A
S1	VLAN 1	192.168.1.11	255.255.255.0	192.168.1.1
S2	VLAN 1	192.168.1.12	255.255.255.0	192.168.1.1

You will now configure R1 to route to multiple VLANs by creating sub-interfaces for each VLAN.

Step 1: Disconnect and shut down the interface G0/0 on the router R1.

- Disconnect the cable between port F0/11 on S2 and the interface G0/0 on R1.
- Issue the command **no ip address** to the interface G0/0 on R1.
- Issue the command **shutdown** to the interface G0/0 on R1.
- Configure IP address for the loopback interface Lo0 as shown in the Address Table.

Step 2: Remove the IP address on the interface G0/1 on the router R1.

- Issue the command **no ip address** to the interface G0/1 on R1.

Step 3: Configure a sub-interface for VLAN 1.

- Create a sub-interface on R1 G0/1 for VLAN 1 using 1 as the sub-interface ID. Issue the commands:

```
R1(config-if)# interface G0/1.1
R1(config-subif)# encapsulation dot1q 1
R1(config-subif)# ip address 192.168.1.1 255.255.255.0
```

Step 4: Configure a sub interface for VLAN 10.

- Create a sub-interface on R1 G0/1 for VLAN 10 using 10 as the sub-interface ID.
- Configure the sub-interface to operate on VLAN 10.
- Configure the sub-interface with the address from the Address Table.

Step 5: Configure a sub-interface for VLAN 20.

- Create a sub-interface on R1 G0/1 for VLAN 20 using 20 as the sub-interface ID.
- Configure the sub-interface to operate on VLAN 20.
- Configure the sub-interface with the address from the Address Table.

Step 6: Enable the G0/1 interface.

- Because the router interfaces are down by default, the physical interface is enabled using the **`no shutdown`** command, Then virtual interfaces will be up by default.
- The sub-interface can use any number that can be described with 32 bits, but it is good practice to assign the number of the VLAN as the interface number, as has been done in steps 3-5 above .
- The **native** VLAN is specified on the layer-3 device (the router) so that it is consistent with the switches. Otherwise, VLAN 1 would be the native VLAN by default, and there would be no communication between the router and the management VLAN on the switches.
- Confirm creation and status of the sub-interfaces with the **`show ip interface brief`** command

Step 7: Verify connectivity.

Enter the command to view the routing table on R1. What networks are listed?

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- From PC-A, is it possible to ping the default gateway for VLAN 10? .....
- From PC-A, is it possible to ping PC-B? .....
- From PC-A, is it possible to ping Lo0? .....
- From PC-A, is it possible to ping S2? .....
- If the answer is **no** to any of these questions, troubleshoot the configurations and correct any errors.

Reflection

What are the advantages of trunk-based or router-on-a-stick inter-VLAN routing?

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