

Laboratory 4c:
Configuring Routers and Layer-3 Switch for Inter-VLAN Routing

LEARNING OUTCOMES

Upon completion of this laboratory exercise, you should be able to:

- Configure per-interface inter-VLAN routing
- Configure 802.1Q trunk-based inter-VLAN routing
- Configure layer-3 switch inter-VLAN routing

REQUIRED HARDWARE

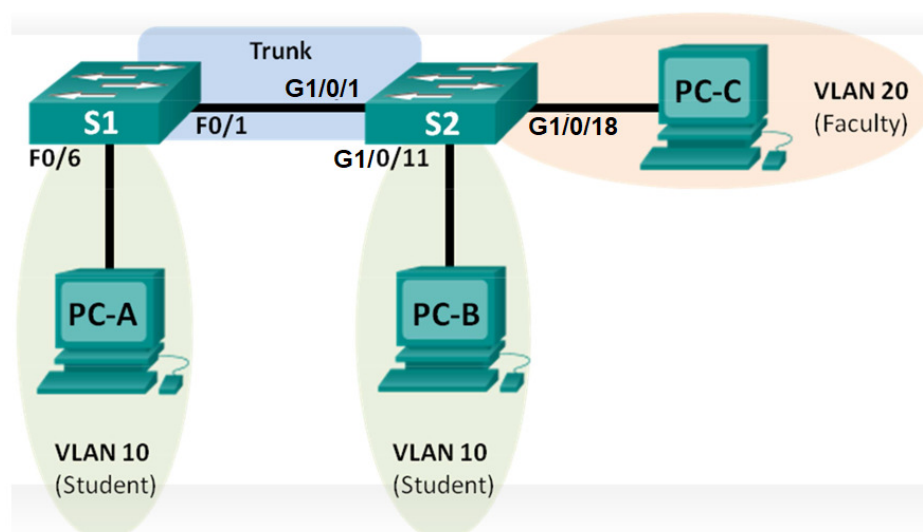
- 1 x Rack of Cisco network devices
- 1 x Box of Cables containing
 - USB-to-DB9/DB9-to-RJ45 console cables
 - Ethernet cables
- 2 x Laptops

REQUIRED SOFTWARE

- Tera Term 4.105 <https://ttssh2.osdn.jp/>

INTRODUCTION

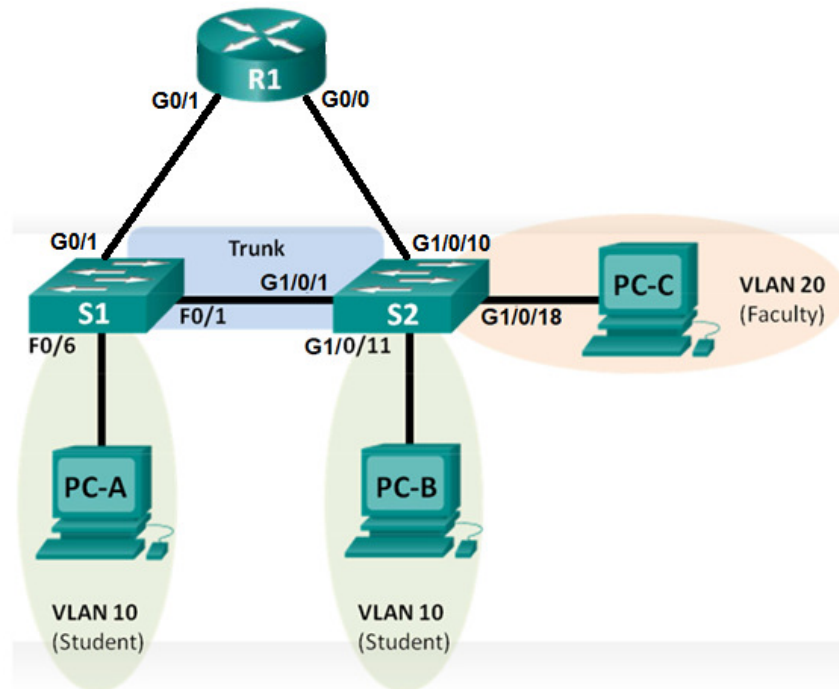
In Lab 3a, you have learned the configuration of VLAN and trunking but PC-A and PC-B in VLAN 10 were not able to ping PC-C in VLAN 20 and vice versa.



In this Lab, you are going to learn the configuration of routers and layer-3 switch to allow inter-VLAN communication as discussed in the lectures.

Lab – Configuring Per-Interface 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
PC-A	NIC	192.168.10.3	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.10.4	255.255.255.0	192.168.10.1
PC-C	NIC	192.168.20.3	255.255.255.0	192.168.20.1

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) and layer-3 switch inter-VLAN routing. 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.

Part 1: Configure Switches with VLANs and Trunking

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

Step 2: Configure basic settings on PC-A, PC-B and PC-C.

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

Step 3: Configure VLANs on S1.

- a. Assign S1 as the device name.
- b. On S1, create VLAN 10. Assign Student as the VLAN name.
- c. Create VLAN 20. Assign Faculty as the VLAN name.
- d. Configure F0/1 as a trunk port.
- e. Configure both F0/6 and G0/1 as access ports and assign them to VLAN 10.

Step 4: Configure VLANs on S2.

- a. Assign S2 as the device name.
- b. On S2, create VLAN 10. Assign Student as the VLAN name.
- c. Create VLAN 20. Assign Faculty as the VLAN name.
- d. Configure G1/0/1 as a trunk port.
- e. Configure G1/0/11 as an access port and assign it to VLAN 10.
- f. Configure G1/0/10 and G1/0/18 as access ports and assign them to VLAN 20.

Part 2: Configure Router with IP addresses

Step 1: Configure basic settings for R1.

- a. Assign R1 as the device name.
- b. Configure addressing on G0/0 and G0/1 according to the Addressing Table and enable both interfaces.

Part 3: Verify Trunking, VLANs, Routing and Connectivity

Step 1: Verify routing table in R1.

- a. On R1, issue the **show ip route** command. What routes are listed on R1?
- b. On both S1 and S2, issue the **show interface trunk** command. Are both S1 F0/1 and S2 G1/0/1 ports set to trunk?

- c. 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. Why is S1 F0/1 and S2 G1/0/1 not listed in any of the active VLANs?
- d. Ping from PC-A in VLAN 10 to PC-C in VLAN 20. If inter-VLAN routing is setup correctly, the pings between the 192.168.10.0 network and the 192.168.20.0 should be successful.

Note: It may be necessary to disable the PC firewall to ping between PCs.

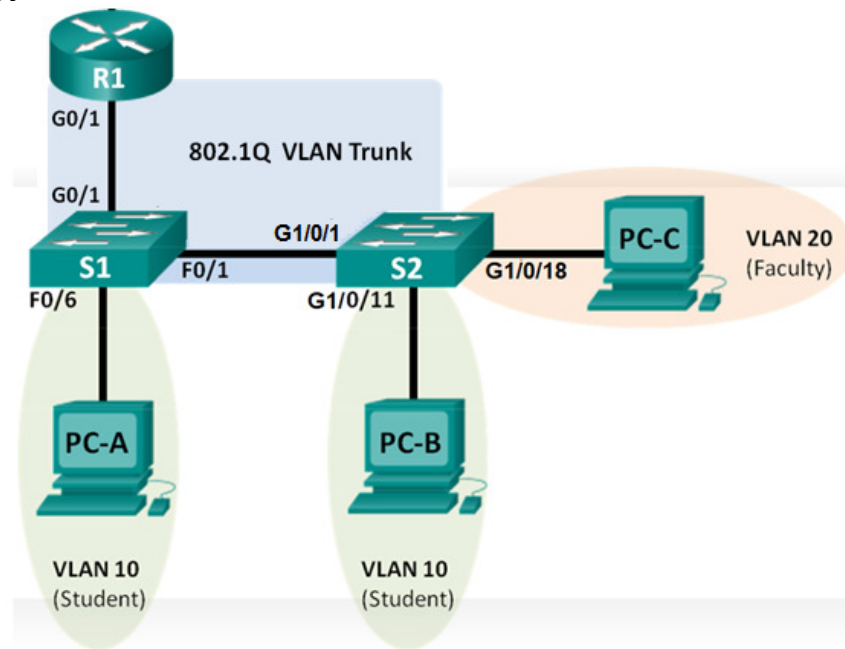
- e. Verify connectivity between devices. You should be able to ping between all devices. Troubleshoot if you are not successful.

Reflection

- a. What is an advantage of using legacy inter-VLAN routing?

Lab – Configuring 802.1Q Trunk-Based Inter-VLAN Routing

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	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
PC-A	NIC	192.168.10.3	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.10.4	255.255.255.0	192.168.10.1
PC-C	NIC	192.168.20.3	255.255.255.0	192.168.20.1

Background / Scenario

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 subinterfaces that provide logical pathways to all VLANs connected.

In this lab, you will configure trunk-based inter-VLAN routing and verify connectivity to hosts on different VLANs.

Part 1: Configure Switches with VLANs and Trunking

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

Step 2: Configure basic settings on PC-A, PC-B and PC-C.

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

Step 3: Configure VLANs on S1.

- a. Configure F0/1 as a trunk port.
- b. Configure F0/6 as an access port and assign it to VLAN 10.
- c. Configure G0/1 as a trunk port instead.

Step 4: Configure VLANs on S2.

- a. Configure G1/0/1 as a trunk port.
- b. Configure G1/0/11 as an access port and assign it to VLAN 10.
- c. Configure G1/0/18 as an access port and assign it to VLAN 20.

Part 2: Configure Router for Trunk-Based Inter-VLAN Routing

In Part 2, you will configure R1 to route to multiple VLANs by creating subinterfaces for each VLAN. This method of inter-VLAN routing is called router-on-a-stick.

Step 1: Configure a subinterface for VLAN 10.

- a. Create a subinterface on R1 g0/1 for VLAN 10 using 10 as the subinterface ID.

```
R1(config)# interface g0/1.10
```

- b. Configure the subinterface to operate on VLAN 10.

```
R1(config-subif)# encapsulation dot1q 10
```

- c. Configure the subinterface with the address from the Address Table.

```
R1(config-subif)# ip address 192.168.10.1 255.255.255.0
```

Step 2: Similarly, configure a subinterface for VLAN 20.

Step 3: Enable the g0/1 interface.

```
R1(config)# interface g0/1  
R1(config-if)# no shutdown
```

Part 3: Verify Connectivity**Step 1: Verify routing table in R1.**

- a. Enter the command to view the routing table in R1. What networks are listed?
- b. From PC-A, is it possible to ping the default gateway for VLAN 10?
- c. From PC-A, is it possible to ping PC-C?

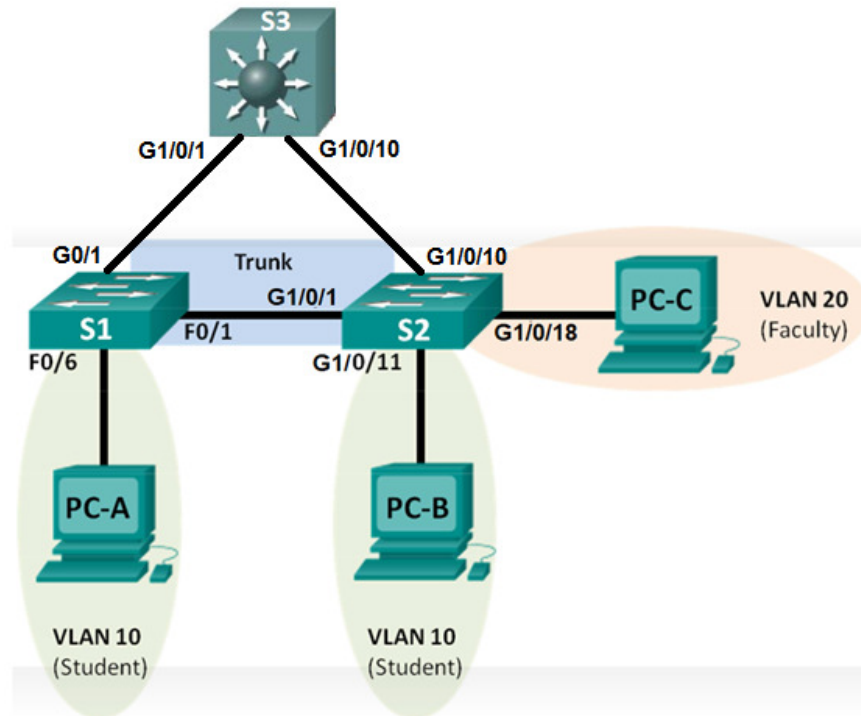
If your answer is no to any of these questions, troubleshoot the configurations and correct any errors.

Reflection

What is the advantage of trunk-based or router-on-a-stick inter-VLAN routing?

Lab – Configuring Layer-3 Switch Inter-VLAN Routing

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
S3	VLAN 10	192.168.10.1	255.255.255.0	N/A
	VLAN 20	192.168.20.1	255.255.255.0	N/A
PC-A	NIC	192.168.10.3	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.10.4	255.255.255.0	192.168.10.1
PC-C	NIC	192.168.20.3	255.255.255.0	192.168.20.1

Background / Scenario

A third method of providing routing and connectivity for multiple VLANs is through the use of a layer-3 switch between the access switches. In this method, the switched virtual interfaces (SVIs) within the layer-3 switch are configured to function like router interfaces to provide logical pathways to all VLANs connected.

In this lab, you will configure layer-3 switch inter-VLAN routing and verify connectivity to hosts on different VLANs.

Part 1: Configure Switches with VLANs and Trunking

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

Step 2: Configure basic settings on PC-A, PC-B and PC-C.

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

Step 3: Configure VLANs on S1.

- a. Configure F0/1 as a trunk port.
- b. Configure F0/6 as an access port and assign it to VLAN 10.
- c. Configure G0/1 as a trunk port.

Step 4: Configure VLANs on S2.

- a. Configure G1/0/1 as a trunk port.
- b. Configure G1/0/11 as an access port and assign it to VLAN 10.
- c. Configure G1/0/18 as an access port and assign it to VLAN 20.
- d. Configure G1/0/10 as a trunk port.

Part 2: Configure Layer-3 Switch for Inter-VLAN Routing

In Part 2, you will configure Layer-3 switch S3 to support inter-VLAN routing by configuring multiple SVIs (Switched Virtual Interfaces), one for each VLAN, which function like the interfaces of a router.

Step 1: Configure basic settings for layer-3 switch S3.

- a. Assign S3 as the device name.
- b. On S3, create VLAN 10. Assign Student as the VLAN name.
- c. Create VLAN 20. Assign Faculty as the VLAN name.
- d. Configure G1/0/1 and G1/0/10 as trunk ports.

Step 2: Configure a Switched Virtual Interface (SVI) for VLAN 10.

- a. Create an SVI for VLAN 10.

```
S3(config)# interface vlan 10
```

- b. Configure the SVI with the IP address from the Address Table.

```
S3(config-if)# ip address 192.168.10.1 255.255.255.0  
S3(config-if)# no shutdown
```

Step 3: Similarly, configure a Switched Virtual Interface (SVI) for VLAN 20.

Step 4: Enable IP routing in S3.

```
S3(config)# ip routing
```

Part 3: Verify Connectivity

Step 1: Verify routing table in S3.

- a. Enter **show ip route** command to view the routing table in S3. What networks are listed?
- b. From PC-A, is it possible to ping the default gateway for VLAN 10?
- c. From PC-A, is it possible to ping PC-C?

If your answer is no to any of these questions, troubleshoot the configurations and correct any errors.

Reflection

What is the advantage of using layer-3 switch for inter-VLAN routing?