Tribhuvan University

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Computer Networks

Lab 8

VLAN Configuration and InterVLAN Routing

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Title
VLAN Configuration and InterVLAN Routing

Objectives

- To be familiar with VLAN and its uses
- To create VLANs and extend it using multiple switches
- To forward packets between computers that are within the same VLAN
- To route packets between computers at different VLANs (InterVLAN Routing)

Required Tool

- Network simulation tool: Packet Tracer

Activities

A Following network topology was setup.

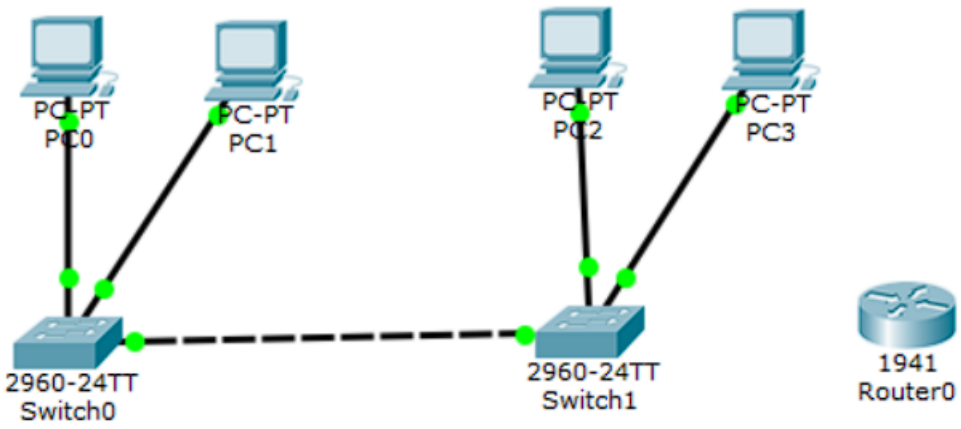

Figure 1: Setup for Lab 8

1 Computers and switches were connected as follows.

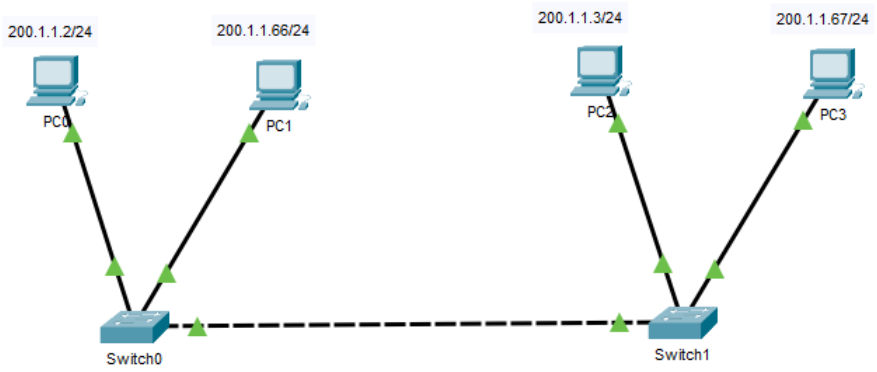

Figure 2: Setup for Activity A

2 The connectivity between each computers was tested.
All the pings were successful.

3 VLAN2 was created in both switches.

```
Switch> enable
Switch# configure terminal
Switch(config)# vlan 2
Switch(config-vlan)# name Vlan_2
Switch(config-vlan)# end
```

4 FastEthernet 0/11, 0/12, 0/13 and 0/14 of both switches were assigned to the newly created VLAN using following steps

```
Switch> enable
Switch# configure terminal
Switch(config)#interface FastEthernet0/11
Switch(config-if)#switchport access vlan 2
Switch(config-if)#end
```

5 The connectivity between each computers was tested.
Pings between PC0 and PC1 were successful because they are in the same VLAN. Similarly, ping from PC0 to any other computers was not successful as they were in VLAN. No pings from PC1 or PC3 were successful as they were in different VLANs.

6 FastEthernet 0/12 of switch 0 was connected FastEthernet 0/12 of switch 1.

7 The connectivity between each computers was tested.
Now PC1 and PC3 can also communicate in addition to PC0 and PC2. However, PC1 or PC3 cannot communicate with PC0 or PC2. This is because they are of different networks.

8 All links between the switches were removed and FastEthernet0/20 was configured as trunk port.

```
Switch> enable
Switch#configure terminal
Switch(config)#interface fa0/20
Switch(config-if)#switchport mode trunk
```

PC0 and PC2 can communicate because they are in same VLAN. PC1 and PC3 can also communicate because they are in same VLAN. PC0 and PC1 cannot communicate.
When comparing the configurations of (7) and (8), the same result is obtained as (7) using only 1 trunk link instead of 2.

B Subnet Mask from Activity A was changed to 255.255.255.192.

1 The connectivity between each computers was tested.
Ping from PC0 to PC2 succeeds while from PC0 to PC3 does not succeed.

2 Default Gateway is set as follows.

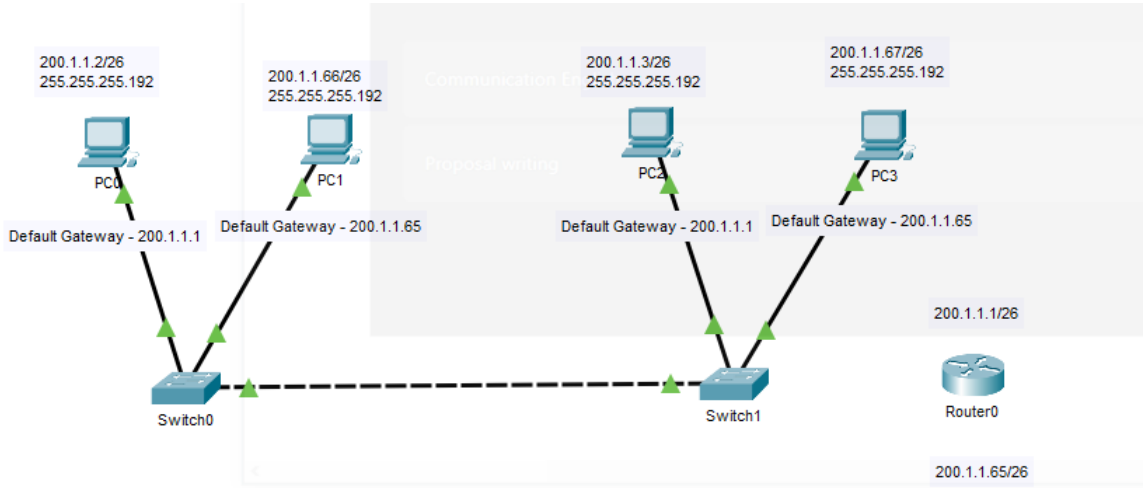

Figure 3: Setup for Activity B

3 FastEthernet0/8 of switch 1 is connected to GigabitEthernet0/0 of Router0 with IP Address of 200.1.1.1/26 and FastEthernet0/14 of Switch1 is connected to GigabitEthernet0/1 of Router0 with IP Address of 200.1.1.65/26

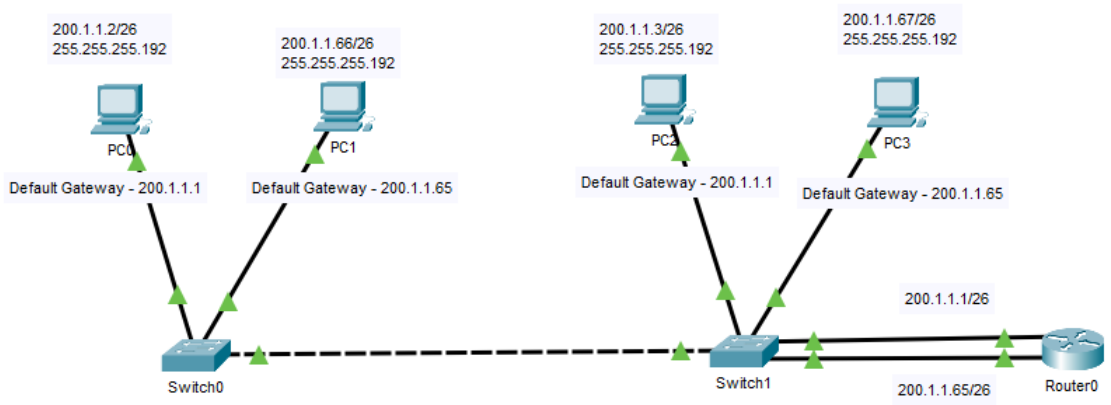

Figure 4: Setup for Activity B

4 The connectivity between each computers was tested.
All the PCs respond to each other.
This is because of the inter-VLAN routing. The packet from VLAN 1 passes through the router with the ethernet interface of the switch configured in VLAN 1 and returns back via VLAN 2, so inter-VLAN routing is possible.

C All links to router 0 were removed. All interfaces IP and subnet masks of Router0 were removed.

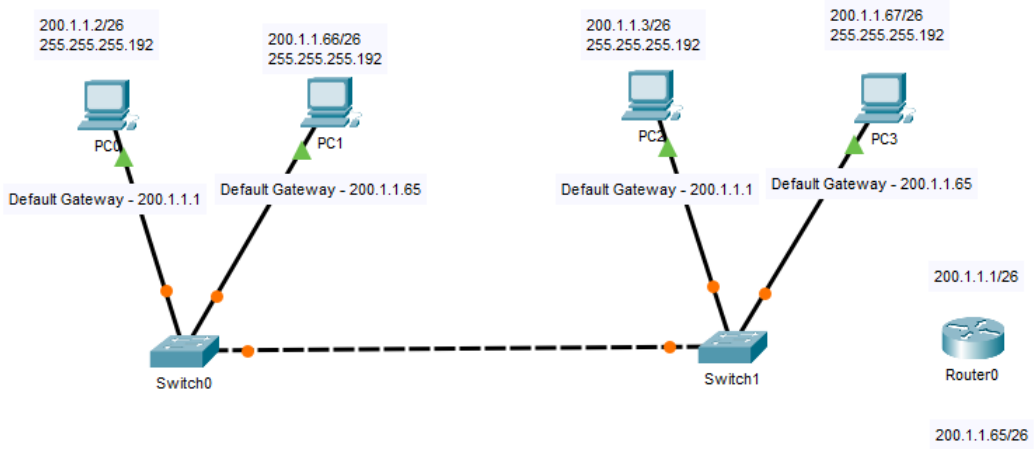

Figure 5: Setup for Activity B

1 FastEthernet0/21 of switch 1 was configured as trunk and connected to GigabitEthernet0/0 of Router0.

```
Switch> enable
```

```
Switch#configure terminal
Switch(config)#interface fa0/21
Switch(config-if)#switchport mode trunk
```

2 Sub interfaces of router 0 were configured as follows:

```
Router0#conf t
Router0(config)#interface gigabitethernet 0/0.1
Router0(config-subif)#
Router0(config-subif)#encapsulation dot1Q 1
Router0(config-subif)#
Router0(config-subif)#ip address 200.1.1.1 255.255.255.192
Router0(config-subif)#exit
Router0(config)#interface gigabitethernet 0/0.2
Router0(config-subif)#
Router0(config-subif)#encapsulation dot1Q 2
Router0(config-subif)#
Router0(config-subif)#ip address 200.1.1.65 255.255.255.192
Router0(config-subif)#exit
Router0(config-if)#no shutdown
```

3 The connectivity between each computers was tested.
All pings were possible.
This is because of Inter VLAN routing similar to Activity B. But, in this instance, we used only one interface (as a trunk port in the switch) instead of one ethernet interface on the router to connect to each VLAN. Each router subinterface allows a packet from a different VLAN to get through.

4 This configuration was compared to that of activity B.
The approach in activity B isn't truly scalable and is now only occasionally utilized because each VLAN requires a connection to a separate Ethernet interface on the router. Thus, we employ a single router interface with trunking turned on. This feature is known as a router on a stick (ROAS). It enables the communication between all VLANs over a single interface, using a sub interface in the router.

Conclusion
In this way "Lab8 :VLAN Configuration and InterVLAN Routing" was completed through the use of Cisco Packet Tracer.

Exercises

1 **What is VLAN? Explain its importance with basic configuration steps.**
When computers are plugged into a switch and give them all IP addresses in the same network, a LAN (Local Area Network) is created. A VLAN (Virtual Local Area Network) is a logical collection of devices that are grouped together

to create separate networks, using layer 2 devices, such as an Ethernet switch. VLANs are important as they can help reduce IT cost, improve network security and performance, provide easier management, as well as ensuring network flexibility.
Configuration of VLAN is a two step process:

- Creating VLANs in a switch

```
Switch> enable
Switch# configure terminal
Switch(config)# vlan [vlan_ID]
Switch(config-vlan)# name [Vlan_2]
Switch(config-vlan)# end
```

- Assigning interfaces to a particular VLAN

```
Switch> enable
Switch# configure terminal
Switch(config)#interface [interface]
Switch(config-if)#switchport access vlan [vlan_ID]
Switch(config-if)#end
```

This can only be done in privileged EXEC mode.

2 **How can packets be forwarded between computers within the same VLAN but connected at different switches? Explain.**
When using VLANs between computers on multiple switches, a trunk often connects the switches. The trunk line can be compared to a highway that connects many tiny roads if we take a highway as an example. Traffic from numerous VLANs can travel between the switches thanks to the trunk link. A trunk port is a member of all VLANs by default, including extended-range VLANs, but membership can be limited by configuring the allowed-VLAN list.

3 **How can packets be routed between computers at different VLANs? Explain.**
There are different ways in which packets can be routed between VLANs:

- Traditional inter-VLAN routing: The simplest way to enable routing between two VLANs is by simply connecting an additional port from each VLAN to a router. The router doesn't realize it has two connections to the same switch, so operates in a normal manner.
- Router on a stick: The router interface might be configured to work as multiple sub interfaces. The router will work with the sub interfaces just like it works when having links in multiple interfaces. The Router will route packets to and from different VLANs using the same interface. A interfaces can have multiple IP addresses as it contains multiple sub interfaces and each sub interfaces has an IP address.

Layer 3 Switch This option uses a Layer 3 switch(Multilayer Switch) instead of a router for the routing process. It has the functionality for routing between VLANs intrinsically.

4 **Note down the results of each and step of above exercises with reason.**
Please refer to the Report above.