Interconnecting networks with switches.
Virtual Local Area Networks (VLAN)

Experimental Development

Exercise 1: Creating VLANs and trunk links using the 802.1Q protocol

The aims of this exercise are:

1. Creating a switch-based configuration and testing it;
2. Creating VLANs, naming VLANs, and assigning ports to VLANs;
3. Creating trunk links using the 802.1Q protocol for intra-VLAN communications;
4. Testing the functionality of VLANs by testing the connectivity between stations.

1.1 Initial configuration
Open Packet Tracer 5.3 and design the following topology:

1.2. Creating VLANs and ports assignation
The following set of commands illustrates the configuration for Switch0:

Switch>enable
Switch#configure terminal
Switch(config)#hostname Switch0
Switch0(config)# hostname Switch0
Switch0(config)# vlan 2
Switch0(config-vlan)#name Telecom
Switch0(config-vlan)#exit
Switch0(config)#vlan 3
Switch0(config-vlan)#name Radiocom
Switch0(config-vlan)#CTR^Z

Switch0#show vlan brief

<table>
<thead>
<tr>
<th>VLAN</th>
<th>Name</th>
<th>Status</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>default</td>
<td>active</td>
<td>Fa0/1, Fa0/2, Fa0/3, Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/12, Fa0/13, Fa0/14, Fa0/15, Fa0/16, Fa0/17, Fa0/18, Fa0/19, Fa0/20, Fa0/21, Fa0/22, Fa0/23, Fa0/24</td>
</tr>
<tr>
<td>2</td>
<td>Telecom</td>
<td>active</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Radiocom</td>
<td>active</td>
<td></td>
</tr>
<tr>
<td>1002</td>
<td>fddi-default</td>
<td>active</td>
<td></td>
</tr>
<tr>
<td>1003</td>
<td>token-ring default</td>
<td>active</td>
<td></td>
</tr>
<tr>
<td>1004</td>
<td>fddinet-default</td>
<td>active</td>
<td></td>
</tr>
<tr>
<td>1005</td>
<td>trnet-default</td>
<td>active</td>
<td></td>
</tr>
</tbody>
</table>

Switch0#configure terminal
Switch0(config)#interface fastethernet 0/4 // selection of the interface (Ethernet port)
Switch0(config-if)#switchport mode access //setting the port for the access mode
Switch0(config-if)#switchport access vlan 2 //assigning the port to the corresponding VLAN
Switch0(config-if)#exit
Switch0(config)#interface fa 0/7
Switch0(config-if)#switchport mode access
Switch0(config-if)#switchport access vlan 3
Switch0(config-if)#CTRL^Z

Switch0#show vlan brief

<table>
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<tr>
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<td>active</td>
<td>Fa0/1, Fa0/2, Fa0/3, Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/12, Fa0/13, Fa0/14, Fa0/15, Fa0/16, Fa0/17, Fa0/18, Fa0/19, Fa0/20, Fa0/21, Fa0/22, Fa0/23, Fa0/24</td>
</tr>
<tr>
<td>2</td>
<td>Telecom</td>
<td>active</td>
<td>Fa 0/4</td>
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<tr>
<td>3</td>
<td>Radiocom</td>
<td>active</td>
<td>Fa 0/7</td>
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<tr>
<td>1002</td>
<td>fddi-default</td>
<td>active</td>
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<tr>
<td>1003</td>
<td>token-ring default</td>
<td>active</td>
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<tr>
<td>1004</td>
<td>fddinet-default</td>
<td>active</td>
<td></td>
</tr>
<tr>
<td>1005</td>
<td>trnet-default</td>
<td>active</td>
<td></td>
</tr>
</tbody>
</table>

Now, save the configuration:
Switch0# write memory

*** Configure Switch1 in a similar manner.
1.3. Creating an 802.1Q trunk
For each switch, execute the following operations: enter the configuration mode (using the ‘#configure terminal’ command) and set to the trunk mode the interface that connects the present switch with the other switch (cross-over link).

The following set of commands illustrates the trunk configuration for Switch0:

```
Switch0(configure)#interface fa0/1
Switch0 (config-if) #switchport mode trunk
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
Switch0 (config-if)# CTRL^Z
```

```
Switch0# show interface trunk
```
```
***
Port    Mode     Encapsulation Status    Native vlan
Fa0/1    on       802.1q           trunking   1

Port    Vlans allowed on trunk
Fa0/1    1-1005

*** In a similar manner, configure the corresponding interface from Switch1.

1.4 Checking the connectivity
Now, you will check the connectivity between stations from the same VLAN using ‘ping’. First, set the computers belonging to the same VLAN with the IP addresses from the same network as in the table below.

<table>
<thead>
<tr>
<th>Computer</th>
<th>VLAN</th>
<th>IP</th>
<th>MASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC0</td>
<td>2 Telecom</td>
<td>192.168.2.1</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>PC1</td>
<td>2 Telecom</td>
<td>192.168.2.2</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>PC2</td>
<td>3 Radiocom</td>
<td>192.168.3.1</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>PC3</td>
<td>3 Radiocom</td>
<td>192.168.3.2</td>
<td>255.255.255.0</td>
</tr>
</tbody>
</table>

Using ping, check the connectivity between 2 computers belonging to different VLANs, but connected to the same switch. What is the result?

Check the connectivity between 2 computers belonging to the same VLAN, but connected to different switches. What is the result?

Check the connectivity between 2 computers belonging to different VLANs, but connected to different switches. What is the result?
Exercise 2: Inter-VLAN routing
The aims of this exercise are to create and test an inter-vlan configuration:

1. Starting from the configuration in exercise 1, add new devices (1 router and 1 switch) to allow an inter-vlan communication;

2. Add “trunk” links between switches;

3. Configure the router interface to encapsulate both VLANs. For this purpose, router sub-interfaces are created to set the VLANs’ encapsulations;

4. Test the functionality of VLANs by testing the connectivity between computers.

2.1 Initial settings
Open Packet Tracer 5.3 and design the following topology:

2.2. Configuring the trunk links
Switch0(config)#interface fastethernet 0/2  // configure port fa 0/2 as “trunk”
Switch0(config-if)#switchport mode trunk
%LINEPROTO=5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down
%LINEPROTO=5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch1(config)#interface fastethernet 0/2  // configure port fa 0/2 as “trunk”
Switch1(config-if)#switchport mode trunk
%LINEPROTO=5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down
%LINEPROTO=5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
Switch>enable
Switch#configure terminal
Switch(config)#hostname Switch2
Switch2(config)#interface fastethernet 0/2
Switch2(config-if)#switchport mode trunk
Router0%
Router0%
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Now, set the computers with the IP addresses as in the table below.

<table>
<thead>
<tr>
<th>Computer</th>
<th>VLAN</th>
<th>IP</th>
<th>MASK</th>
<th>Default Gateway</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC0</td>
<td>2 Telecom</td>
<td>192.168.2.1</td>
<td>255.255.255.0</td>
<td>192.168.2.254</td>
</tr>
<tr>
<td>PC1</td>
<td>2 Telecom</td>
<td>192.168.2.2</td>
<td>255.255.255.0</td>
<td>192.168.2.254</td>
</tr>
<tr>
<td>PC2</td>
<td>3 Radiocom</td>
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Check the connectivity between 2 computers belonging to different VLANs, but connected to different switches. What is the result?