PW 3 - VLAN Lab Exercise: Inter-VLAN Routing with Router-on-a-Stick

Dr. Mohamed Amine Ferrag
Guelma University

07/03/2025

Objective

- Create multiple VLANs on a Cisco switch.
- Assign switch ports to appropriate VLANs.
- Configure a trunk link between the switch and a router.
- Set up inter-VLAN routing using a router-on-a-stick configuration.
- Verify connectivity between devices in different VLANs.

Lab Topology and IP Scheme

Devices Required:

- 1 Cisco Router (e.g., 2901)
- 1 Cisco Switch (e.g., 2960)
- 3 or more PCs (at least one per VLAN)

Connections:

- Connect the router's GigabitEthernet interface to the switch.
- Connect the PCs to the switch.

IP Scheme and VLANs:

- **VLAN 10 (Sales):** Network `192.168.10.0/24`
  - Default Gateway: `192.168.1.1`
  - Example PC IP: `192.168.10.2`
- **VLAN 20 (HR):** Network `192.168.20.0/24`
  - Default Gateway: `192.168.1.1`
  - Example PC IP: `192.168.20.2`

- **VLAN 30 (IT):** Network `192.168.30.0/24`
  - Default Gateway: `192.168.1.1`
  - Example PC IP: `192.168.30.2`

Lab Exercise Steps

Part 1: Configure VLANs on the Switch

Step 1.1: Create VLANs and Name Them

```
Switch> enable
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
```

Listing 1: Create and Name VLANs on the Switch

Step 1.2: Assign Switch Ports to VLANs

Assume the following port assignments:

- FastEthernet0/1: VLAN 10 (Sales)
- FastEthernet0/2: VLAN 20 (HR)
- FastEthernet0/3: VLAN 30 (IT)

```
Switch(config)# interface FastEthernet0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 10
Switch(config-if)# exit

Switch(config)# interface FastEthernet0/2
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 20
Switch(config-if)# exit

Switch(config)# interface FastEthernet0/3
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 30
Switch(config-if)# exit
```

Listing 2: Assign Ports to VLANs

Step 1.3: Configure the Trunk Port to the Router

Assume the trunk link is on FastEthernet0/24.

```
Switch(config)# interface FastEthernet0/24
Switch(config-if)# switchport mode trunk
Switch(config-if)# switchport trunk allowed vlan 10,20,30
```

```
Switch(config-if)# exit
```

Listing 3: Configure Trunk Port

Part 2: Configure Router-on-a-Stick for Inter-VLAN Routing

Step 2.1: Configure the Router's Physical Interface

Assume the router interface connected to the switch is GigabitEthernet0/0.

```
Router> enable
Router# configure terminal
Router(config)# interface GigabitEthernet0/0
Router(config-if)# no shutdown
Router(config-if)# exit
```

Listing 4: Enable Physical Interface

Step 2.2: Create Subinterfaces for Each VLAN

```
Router(config)# interface GigabitEthernet0/0.10
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 GigabitEthernet0/0.20
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 GigabitEthernet0/0.30
Router(config-subif)# encapsulation dot1q 30
Router(config-subif)# ip address 192.168.30.1 255.255.255.0
Router(config-subif)# exit
```

Listing 5: Configure Subinterfaces for Each VLAN

Part 3: Configure IP Addresses on PCs

On each PC, go to the **Desktop** tab and then **IP Configuration**. Use static IP addressing:

- **PC in VLAN 10:**
  - IP Address: `192.168.10.2`
  - Subnet Mask: `255.255.255.0`
  - Default Gateway: `192.168.1.1`
- **PC in VLAN 20:**
  - IP Address: `192.168.20.2`
  - Subnet Mask: `255.255.255.0`
  - Default Gateway: `192.168.1.1`
- **PC in VLAN 30:**
  - IP Address: `192.168.30.2`
  - Subnet Mask: `255.255.255.0`
  - Default Gateway: `192.168.1.1`

Part 4: Verify Connectivity (Solutions Included)

Step 4.1: Test Intra-VLAN Connectivity

- From a PC in VLAN 10 (IP: `192.168.10.2`), open the Command Prompt and run:

```
ping 192.168.10.2
```

Listing 6: Ping within VLAN 10

(If you have more than one PC in the same VLAN, ping the other PC's IP.)

Step 4.2: Test Inter-VLAN Connectivity

- From the PC in VLAN 10 (IP: `192.168.10.2`), ping the default gateway of VLAN 20:

```
ping 192.168.20.1
```

Listing 7: Ping from VLAN 10 to VLAN 20 Gateway

- From the PC in VLAN 20 (IP: `192.168.20.2`), ping the default gateway of VLAN 30:

```
ping 192.168.30.1
```

Listing 8: Ping from VLAN 20 to VLAN 30 Gateway

- You can also test by pinging between PCs in different VLANs (e.g., from VLAN 10 to VLAN 30).

Expected Result: Successful ping replies indicate that inter-VLAN routing is properly configured and devices in different VLANs can communicate via the router.

Conclusion

In this lab exercise, students:

- Created three VLANs (Sales, HR, IT) on a switch.
- Assigned switch ports to the respective VLANs.
- Configured a trunk port between the switch and router.
- Set up router-on-a-stick with subinterfaces for inter-VLAN routing.
- Verified both intra-VLAN and inter-VLAN connectivity.

This comprehensive lab provides hands-on experience with VLAN segmentation and inter-VLAN routing, preparing students for more advanced network design and troubleshooting.