Office Network with Inter-VLAN Routing using Router-on-a-Stick in Cisco Packet Tracer

Abstract

This project implements an office network with **three departments (HR, IT, Finance)**, each in its own VLAN. To allow communication between VLANs, **Router-on-a-Stick Inter-VLAN Routing** is configured using a Cisco 2811 router and a Catalyst 2960 switch. Sub-interfaces and **802.1Q encapsulation** are used to enable routing over a single physical connection.

Objectives

- Create VLANs for HR, IT, and Finance.

- Assign PCs in each department to their respective VLAN.

- Configure a **trunk link** between switch and router.

- Create **router sub-interfaces** for each VLAN with proper encapsulation.

- Test inter-VLAN communication with pings.

Network Design

- **Router:** Cisco 2811 (Fa0/0 connected to switch Fa0/24)

- **Switch:** Cisco 2960

- **PCs:**

    - HR VLAN 10 → 192.168.10.0/24

    - IT VLAN 20 → 192.168.20.0/24

    - Finance VLAN 30 → 192.168.30.0/24
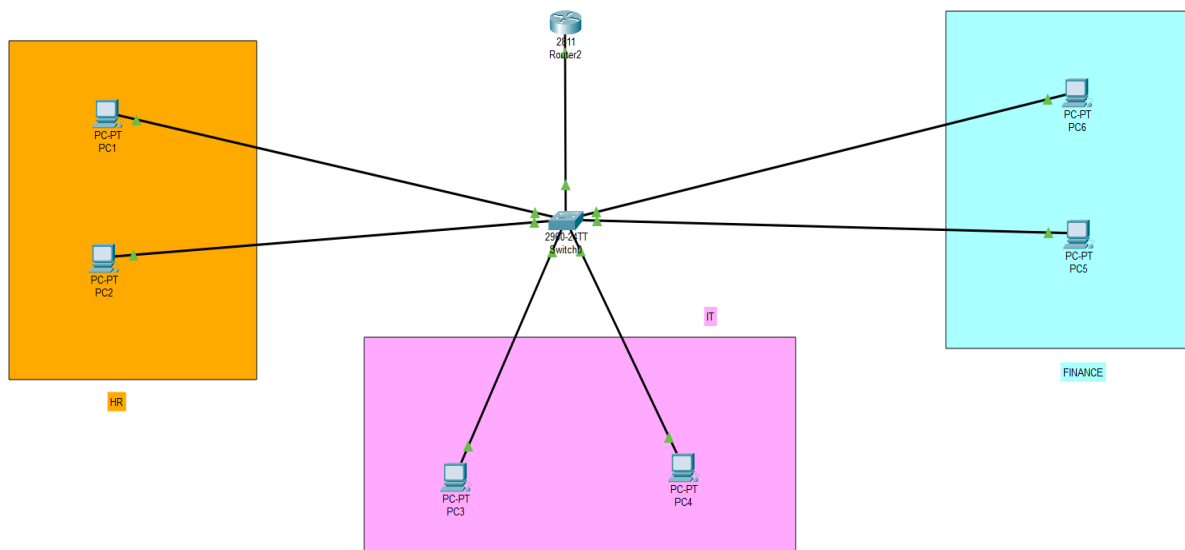
Configuration

◆ **Switch Configuration**

```
Switch> enable
Switch# configure terminal

! Create VLANs
Switch(config)# vlan 10
Switch(config-vlan)# name HR
Switch(config)# vlan 20
Switch(config-vlan)# name IT
Switch(config)# vlan 30
Switch(config-vlan)# name FINANCE

! Assign PCs to VLANs
Switch(config)# interface fa0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 10

Switch(config)# interface fa0/2
Switch(config-if)# switchport mode access
```

```
Switch(config-if)# switchport access vlan 10

Switch(config)# interface fa0/3
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 20

Switch(config)# interface fa0/4
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 20

Switch(config)# interface fa0/5
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 30

Switch(config)# interface fa0/6
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 30

! Make switch-router link trunk
Switch(config)# interface fa0/24
Switch(config-if)# switchport mode trunk
```

- **Router Configuration (Sub-interfaces)**

```
Router> enable
Router# configure terminal

! Sub-interface for HR
Router(config)# interface fa0/0.10
Router(config-subif)# encapsulation dot1Q 10
Router(config-subif)# ip address 192.168.10.1 255.255.255.0

! Sub-interface for IT
Router(config)# interface fa0/0.20
Router(config-subif)# encapsulation dot1Q 20
Router(config-subif)# ip address 192.168.20.1 255.255.255.0

! Sub-interface for Finance
```

```
Router(config)# interface fa0/0.30
Router(config-subif)# encapsulation dot1Q 30
Router(config-subif)# ip address 192.168.30.1 255.255.255.0

! Enable the physical interface
Router(config)# interface fa0/0
Router(config-if)# no shutdown
```

◆ **PC Configuration**

HR VLAN PCs

- PC1: 192.168.10.2 / 255.255.255.0 / GW: 192.168.10.1

- PC2: 192.168.10.3 / 255.255.255.0 / GW: 192.168.10.1

IT VLAN PCs

- PC1: 192.168.20.2 / 255.255.255.0 / GW: 192.168.20.1

- PC2: 192.168.20.3 / 255.255.255.0 / GW: 192.168.20.1

Finance VLAN PCs

- PC1: 192.168.30.2 / 255.255.255.0 / GW: 192.168.30.1

- PC2: 192.168.30.3 / 255.255.255.0 / GW: 192.168.30.1

PC1

Physical   Config   Desktop   Programming   Attributes

IP Configuration   X

Interface   FastEthernet0   ˅

IP Configuration

○ DHCP   ◉ Static

IPv4 Address   192.168.10.2

Subnet Mask   255.255.255.0

Default Gateway   192.168.10.1

DNS Server   0.0.0.0

IPv6 Configuration

○ Automatic   ◉ Static

IPv6 Address   /

Link Local Address   FE80::2D0:97FF:FEE5:D307

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication   MD5   ˅

Username

Password

☐ Top

PC5 — □ ✕

Physical   Config   Desktop   Programming   Attributes

IP Configuration   X

Interface   FastEthernet0   ▾

IP Configuration

◯ DHCP   ⦿ Static

IPv4 Address   192.168.30.2

Subnet Mask   255.255.255.0

Default Gateway   192.168.30.1

DNS Server   0.0.0.0

IPv6 Configuration

◯ Automatic   ⦿ Static

IPv6 Address   [   ] / [   ]

Link Local Address   FE80::210:11FF:FEE0:C8D7

Default Gateway   [   ]

DNS Server   [   ]

802.1X

☐ Use 802.1X Security

Authentication   MD5   ▾

Username   [   ]

Password   [   ]

☐ Top

Results

- PCs within same VLAN communicate without issues.

```
C:\>ping 192.168.20.1

Pinging 192.168.20.1 with 32 bytes of data:

Reply from 192.168.20.1: bytes=32 time<1ms TTL=255
Reply from 192.168.20.1: bytes=32 time<1ms TTL=255
Reply from 192.168.20.1: bytes=32 time<1ms TTL=255
Reply from 192.168.20.1: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.20.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.2: bytes=32 time<1ms TTL=127
Reply from 192.168.20.2: bytes=32 time<1ms TTL=127
Reply from 192.168.20.2: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

- Inter-VLAN communication works via router sub-interfaces.

- The **Router-on-a-Stick method** is successfully demonstrated.

Learning Outcomes

- VLANs provide logical segmentation of networks.

- **802.1Q encapsulation** allows multiple VLANs to share one trunk link.

- Sub-interfaces allow routers to route between VLANs.

- Learned practical steps to configure **Inter-VLAN Routing**.