Company Network Implementation using Cisco Packet Tracer

Cosmin-Nicolae Tianu

Contents

1 Introduction

This document provides detailed documentation for the project titled *Company Network Implementation using Cisco Packet Tracer*. The project involves designing, configuring, and simulating a network for a company using Cisco Packet Tracer. The company has three departments, each assigned to its own VLAN for improved network segmentation and management. The network includes functionalities such as IP addressing, routing, VLANs, DHCP, NAT.

2 Project Assumptions

The following assumptions were made during the development of the project:

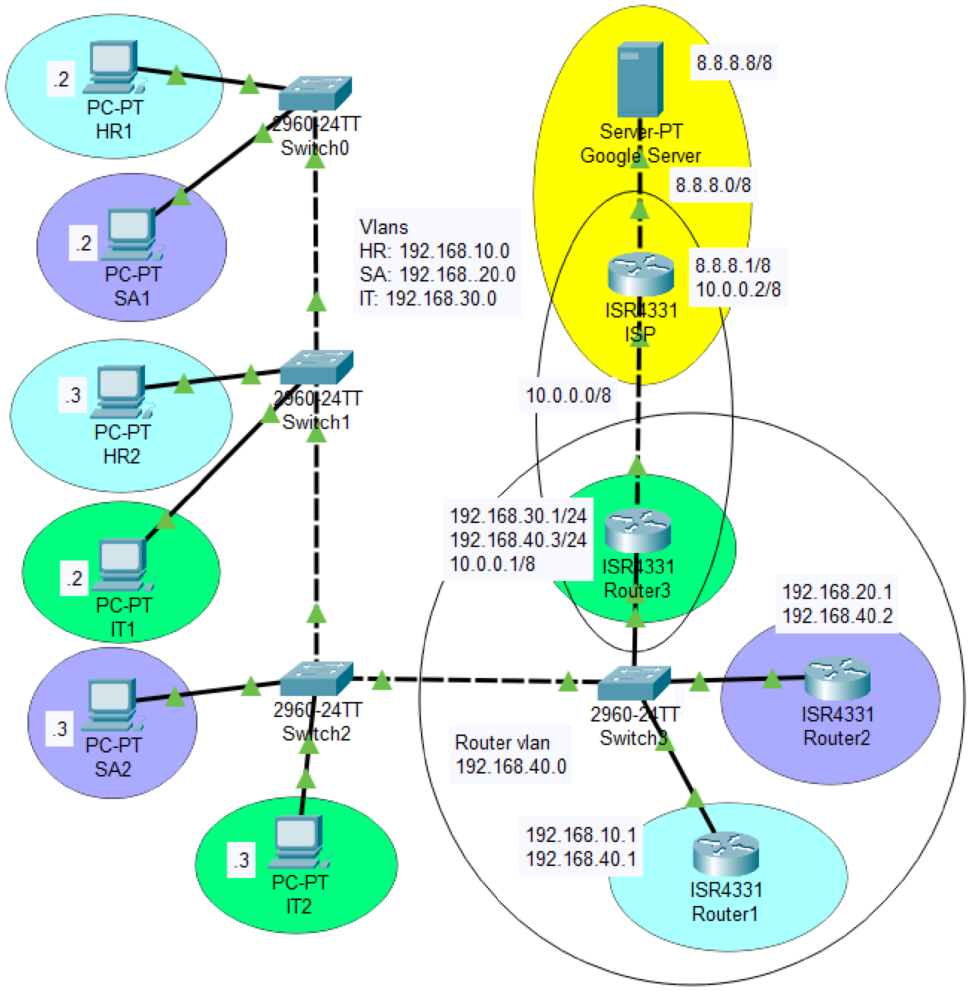
- The network is designed for a company with three departments: HR, Sales, and IT.
- The simulation environment is Cisco Packet Tracer and all devices, such as routers, switches, and hosts, are available to use.
- Sub-netting is performed to allocate IP addresses to different networks efficiently using static addressing and Dynamic Host Configuration Protocol (DHCP) .
- Routing between the sub-networks is done effectively using the dynamic Routing Information Protocol (RIP) version 2.
- Creating a virtual local area network (VLAN) infrastructure that is efficient and applicable in a real-life scenario.
- Using Network address translation (NAT) to assign public ips to the devices of the network, so they communicate with the `Internet`.

3 Schematic of the System

The network consists of three sub-networks interconnected via routers and switches. Each sub-network represents a department within the company:

- VLAN 10: Human Resources (HR).
- VLAN 20: Sales (SA).
- VLAN 30: Information Technology (IT).

Below is the schematic representation:



4 Implementation Details

4.1 Network Design

The network is designed with three sub-networks:

- Sub-network 1: HR department with IP address `192.168.10.0/24`.
- Sub-network 2: Sales department with IP address `192.168.20.0/24`.
- Sub-network 3: IT department with IP address `192.168.30.0/24`.

4.2 IP Addressing

The HR department's sub-net, which will later become VLAN 10, benefits of DHCP dynamic addressing, meaning that after configuring this protocol on the sub-net's router (Router1), each end device will receive an ip address dynamically. The configuration is the following:

```
Router(config)# service dhcp
Router(config)# ip dhcp excluded-address 192.168.10.1
Router(config)# ip dhcp pool HR
Router(dhcp-config)# network 192.168.10.0 255.255.255.0
Router(dhcp-config)# default-router 192.168.10.1
Router(dhcp-config)# dns-server 8.8.8.8
Router(config)# end
```

The rest of the network's ip addresses are configured in a static manner.

4.3 Routing Configuration - Dynamic

Dynamic routes were configured using RIPv2, by adding all the networks that the router is part of to its pool of networks:

```
Router(config)# router rip
Router(config-router)# network 192.168.10.0
Router(config-router)# network 192.168.40.0
Router(config-router)# version 2
Router(config-router)# no auto-summary
```

At this point all the end devices can communicate with devices from the other sub-networks (departments).

4.4 VLAN Configuration

VLANs were implemented to segment the network into logical domains for the company's departments:

- VLAN 10: HR department.
- VLAN 20: Sales department.
- VLAN 30: IT department.

Configuration example of Switch0, which has 2 access ports to vlan 10 and 20:

```
Switch(config)# vlan 10
Switch(config-vlan)# name HR
Switch(config)# interface FastEthernet0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 10
Switch(config)#
Switch(config)# vlan 20
Switch(config-vlan)# name SA
Switch(config)# interface FastEthernet0/2
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 20
```

Now the switch (Switch3) recognizes the given vlans. For effiency reasons, the switches communicate through one cross-over cable at a time which have been configured in the trunk mode, meaning different vlan can pass through one cable. Also, for security purposes and optimization of the network, on all the trunk connections access of only the needed vlans is facilitated, and the other ones are sent to the vlan 99.

```
Switch(config)# interface FastEthernet 0/2
Switch(config-if)# switchport mode trunk
Switch(config-if)# switchport trunk allowed vlan 20,40
Switch(config-if)# switchport trunk native vlan 99
Switch(config-if)# exit
Switch(config)# show interface trunk
Port        Mode        Encapsulation  Status        Native vlan
Fa0/1       on          802.1q         trunking      99
Fa0/2       on          802.1q         trunking      99
Fa0/3       on          802.1q         trunking      99
Fa0/24      on          802.1q         trunking      99

Port        Vlans allowed on trunk
Fa0/1       10,40
Fa0/2       20,40
Fa0/3       30,40
Fa0/24      10,20,30

Port        Vlans allowed and active in management domain
Fa0/1       10,40
Fa0/2       20,40
Fa0/3       30,40
Fa0/24      10,20,30
```

```
Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       10,40
Fa0/2       20,40
Fa0/3       30,40
Fa0/24      10,20,30
```

Interface Fa0/2 connects also through a trunk to a router (Router2). For a router to be able to handle multiple vlans on the same port, **Routing on a Stick** is used. Sub-interfaces are created, each with the same tag as the vlan, and they also use the dot1Q encapsulation, to be able to tell the vlan of origin.

```
Router(config)# interface GigabitEthernet0/0/0
Router(config-if)# no shutdown
Router(config-if)# interface GigabitEthernet0/0/0.20
Router(config-subif)# encapsulation dot1Q 20
Router(config-subif)# ipaddress 192.168.20.1 255.255.255.0
Router(config-if)# interface GigabitEthernet0/0/0.40
Router(config-subif)# encapsulation dot1Q 40
Router(config-subif)# ipaddress 192.168.40.2 255.255.255.0
Router(config-subif)# end
Router#show ip interface brief
Interface              IP-Address      OK? Method Status  Protocol
GigabitEthernet0/0/0   unassigned      YES manual up      up
GigabitEthernet0/0/0.20192.168.20.1    YES manual up      up
GigabitEthernet0/0/0.40192.168.40.2    YES manual up      up
```

4.5 NAT Configuration

NAT was configured to allow internal hosts to access external networks, in this case **Router3**, which has a sub-interface as an inside nat port, and a full interface as an outside nat port. Also, Port Address Translation (PAT), also known as NAT overload has been used to allow all the devices of a network to get a translation.

```
Router(config)# int GigabitEthernet 0/0/0
Router(config-if)#int GigabitEthernet 0/0/0.40
Router(config-subif)#ip nat inside
Router(config)# int GigabitEthernet 0/0/1
Router(config-subif)#ip nat outside
Router(config)# access-list 1 permit 192.168.0.0 0.0.255.255
```

```
Router(config)# ip nat inside source list 1 int Gig0/0/1 overload
Router#show ip nat translations
Pro  Inside global   Inside local      Outside local Outside global
icmp 10.0.0.1:234    192.168.10.2:234  8.8.8.8:234   8.8.8.8:234
icmp 10.0.0.1:235    192.168.10.2:235  8.8.8.8:235   8.8.8.8:235
icmp 10.0.0.1:236    192.168.10.2:236  8.8.8.8:236   8.8.8.8:236
```

5 Pictures of Application in Operation

6 Source Project

The project is available in the following Git repository:

- https://github.com/cosmintianu/Company-Network

7 Summary

This project demonstrates the implementation of a robust network design for a company in Cisco Packet Tracer. Key functionalities such as IP addressing, routing, VLANs, DHCP, and NAT were successfully configured and tested. The project highlights the integration of networking concepts into practical simulations for a corporate environment.