

Company Network Implementation using Cisco Packet Tracer

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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**.

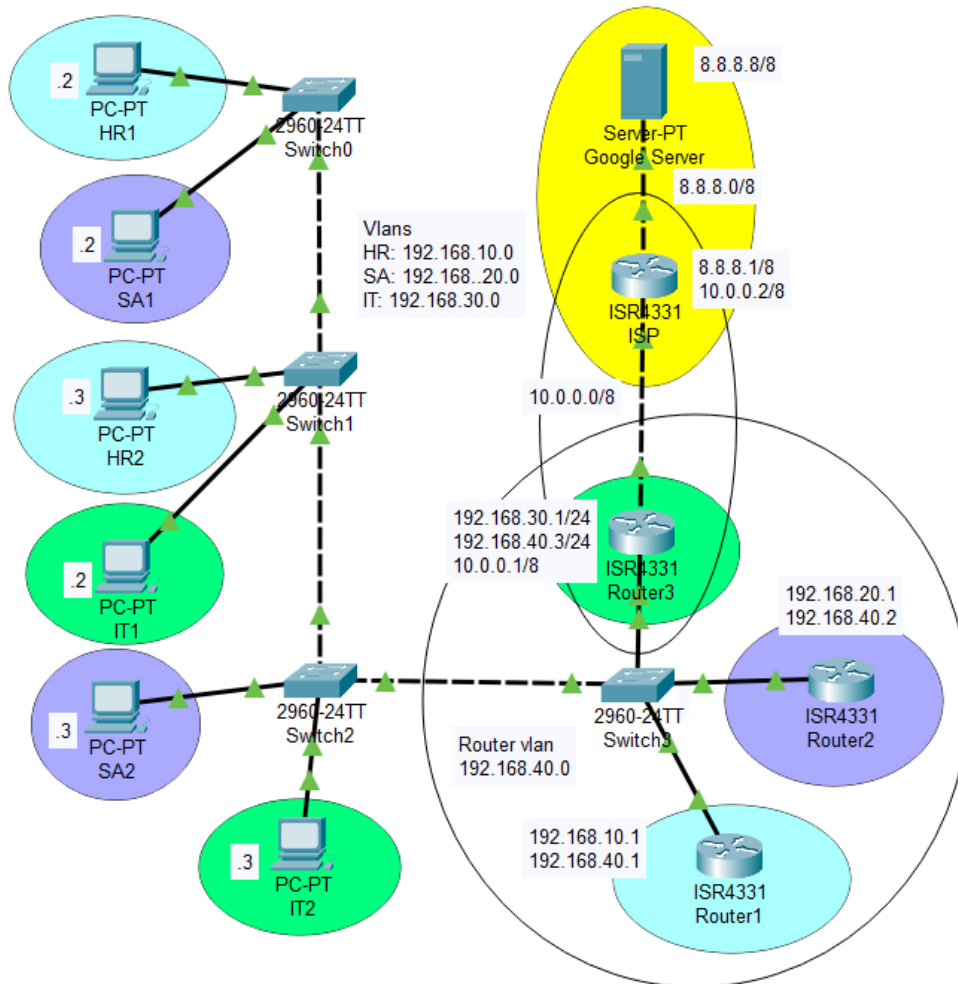
3 Schematic of the System

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).

- VLAN 40: a vlan for the routers.

Below is the schematic representation:



4 Implementation Details

4.1 Network Design

The network is designed with four 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.

- Sub-network 4: routers' sub-net with IP address 192.168.40.0/24.

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 192.168.10.1
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.

- VLAN 40: routers' communication.

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 efficiency reasons, the switches communicate through one cross-over cable at a time which has 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
GigabitEthernet0/0/0.20	192.168.20.1	YES	manual	up	up
GigabitEthernet0/0/0.40	192.168.40.2	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
```

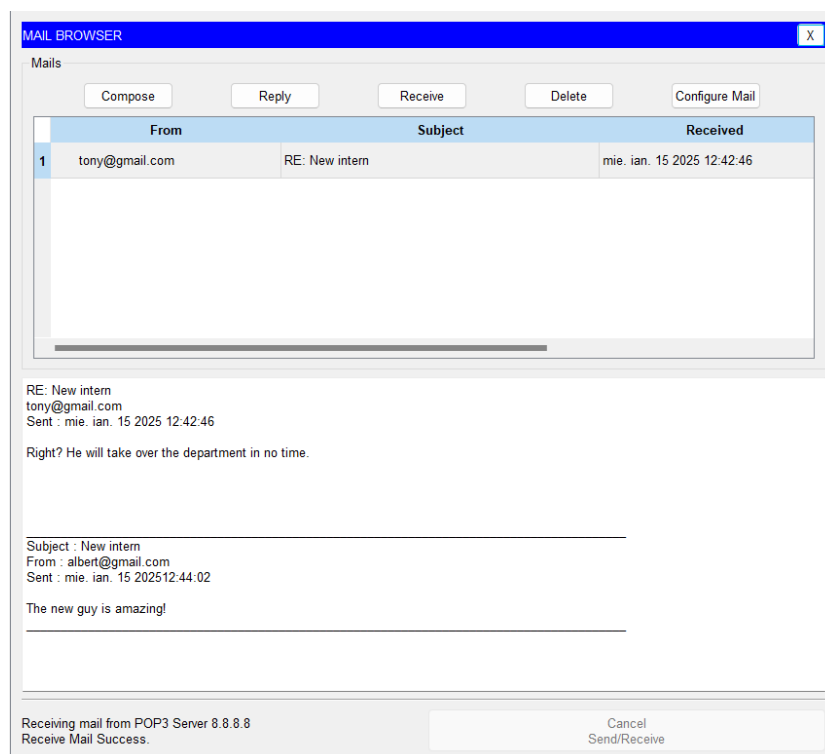
```

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 E-mail configuration

The e-mail configuration is easy and very straight-forward. First we add the user accounts to the server, then set up on each pc that will use e-mail the incoming/outcoming mail server and the correct login credentials. After all this, the end devices of the network are able to communicate through e-mail.



Here we can see that e-mail communication works effectively between

Tony(PC HR1) and Albert (PC HR2).

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.