UNIVERSITY CAMPUS NETWORK

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Project Description

In this project, I am going to set up the network of a university, using Cisco Packet Tracer.

With this work, I learned and understood the functionalities of VLANs, Layer 3 switches, the creating of subinterfaces, and the utility of RIPv2 protocol.

Our LAN is made up from the main campus (which has 3 buildings: A, B and C) and a smaller campus.

Building A has 4 departments: **management, HR, finance and business**.

Building B has 2 departments: **Faculty of Art and Faculty of Computing**

Building C consists of **students' labs and IT department**. The IT department hosts the University Web server and a FTP server. There is also an Email server hosted externally on the cloud.

The smaller campus has the **Faculty of Medicine** (staff and students' labs are situated on separate floors)

For this project, i set some „design" rules:

- each department/faculty is expected to be on its own separate IP network
- the switches should be configured with appropiate VLANs and security settings
- RIPv2 will be used to provide routing for the routers in the internal network and static routing for the external server.
- the devices in building A will be expected to acquire dynamic IP addresses from a router-based DHCP server
- we should use VLAN for every department in every building

Starting Configurations

We are going to use VLAN for every department in this university. The networks' addresses are configured as in figure (1). We need to support routing between VLANs, so I decided to use two layer 3 switches.

The IT department in building C hosts 2 servers: a WEB server and a FTP server.

As usual, we have to start up every router's interfaces. Moreover, because we are using a serial DCE cable, we also have to assign a clock to the interfaces of the „MAIN-CAMPUS ROUTER". The reason we assign a clock rate is to enable the traffic to flow through that cable. The clock rate i gave is 64000, using **„clock rate"** command.

Network's structure

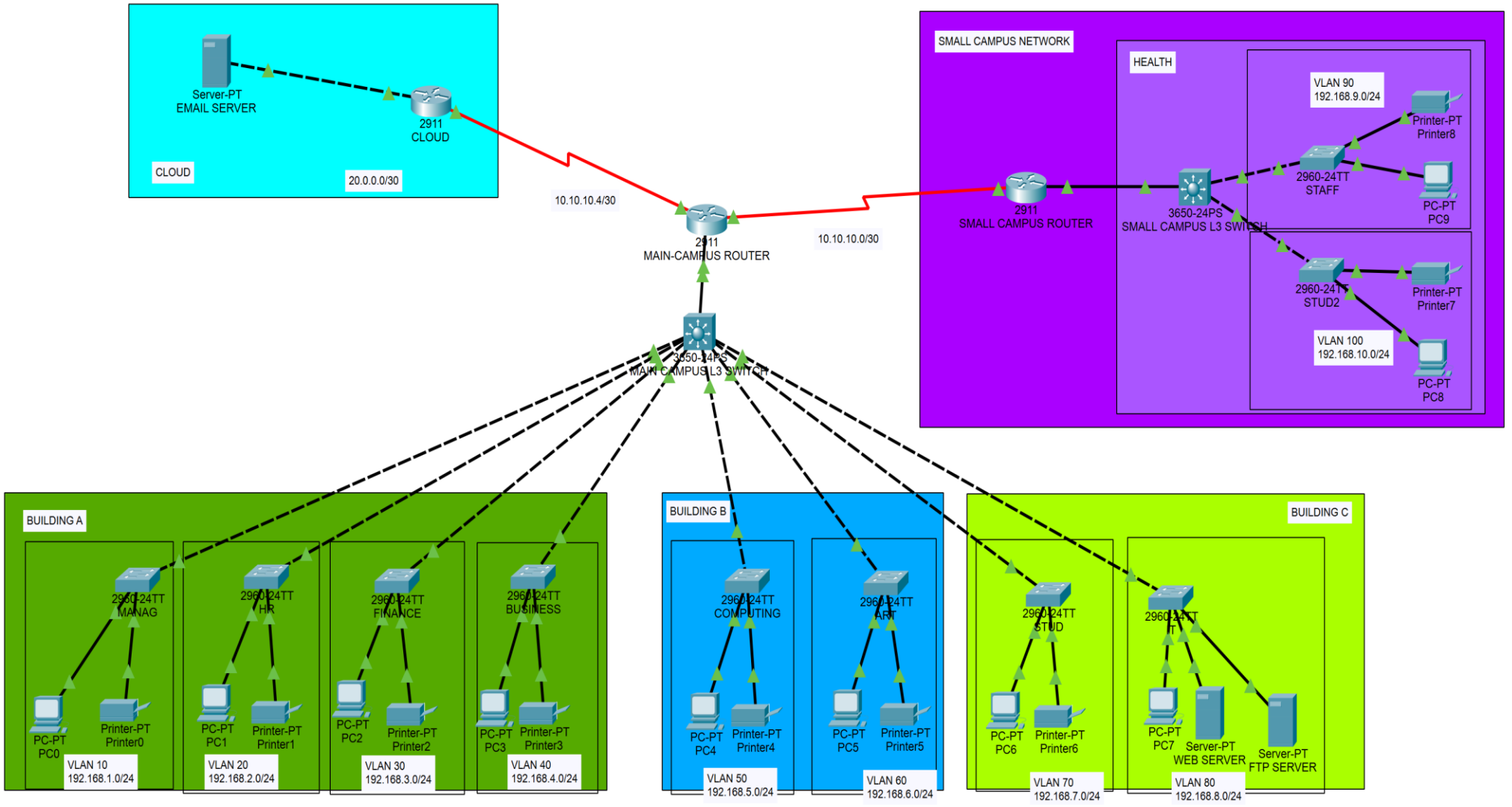


Figure (1). A screenshot of the network's structure

Setting up the VLAN

To set up the VLAN, we have to configure the switches. I'll only insert the configuration of the first L2 switch, the one in the MANAGEMENT department, as the configuration for the others in basically identical.

```
#int range fa0/1-24

#switchport mode access

#switchport access vlan 10

#do wr
```

After these commands, I have set every port to access mode (because the switches are in access layer) and I have assigned a VLAN for each one.

Now, the connecting port from the L3 switch should also be an access port with the same VLAN as the corresponding L2 switch. For example, L3 switch port gig1/0/9 will access VLAN 80.

After configuring the network in the main campus, we should now do the same with the network in the small campus. The commands are basically identical.

For the network in the small campus to work, we need to set the exit port of the L3 switch as a „trunk" port, not as an „access" port. In the same way, we are going to configure the exit port of the L3 switch in the main campus as a „trunk" port, using **„switchport mode trunk"** command.

Router configuration

The first thing to do, after powering up the interfaces, is to assign them an ip address.

Let's take as an example the main campus router. The left and right interfaces will be assigned with the IP addresses of **10.10.10.5 (subnet mask 255.255.255.252)** and **10.10.10.1 (subnet mask 255.255.255.252)** respectively.

We'll do the same process for the CLOUD router

- right interface (**10.10.10.6 & 255.255.255.252**)
- left interface (**20.0.0.1 & 255.255.255.252**) – this will also be a default gateway for the EMAIL SERVER

and for the SMALL CAMPUS router

- left interface (**10.10.10.2 & 255.255.255.252**)

For the interfaces that connect to the L3 switch, we have to create subinterfaces; more exactly, a subinterface for each VLAN that connects with the switch. This applies to the **MAIN CAMPUS** and **SMALL CAMPUS** routers.

The following are the commands that i have used for making sub-interfaces and to enable DHCP on the SMALL CAMPUS router:

```
Router(config)#int gig0/0.90
Router(config-subif)#encapsulation dot1Q 90
Router(config-subif)#ip address 192.168.9.1 255.255.255.0
Router(config)#int gig0/0.100
Router(config-subif)#encapsulation dot1Q 100
Router(config-subif)#ip address 192.168.10.1 255.255.255.0
Router(config)#do wr
Router(config)#service dhcp
Router(config)#ip dhcp pool staff
Router(dhcp-config)#network 192.168.9.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.9.1
Router(dhcp-config)#dns-server 192.168.9.1
Router(dhcp-config)#exit
Router(config)#do wr
Router(config)#ip dhcp pool stud2
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(dhcp-config)#exit

Router(config)#do wr

The commands for the MAIN CAMPUS router are the same, the difference is that we just need to create 8 subinterfaces, one for each VLAN.

An example of DHCP configuration for the HR, FINANCE and COMPUTING departments:

Router(config)#ip dhcp pool hr

Router(dhcp-config)#network 192.168.2.0 255.255.255.0

Router(dhcp-config)#default-router 192.168.2.1

Router(dhcp-config)#dns-server 192.168.2.1

Router(dhcp-config)#

Router(dhcp-config)#exit

Router(config)#ip dhcp pool finance

Router(dhcp-config)#network 192.168.3.0 255.255.255.0

Router(dhcp-config)#default-router 192.168.3.1

Router(dhcp-config)#dns-server 192.168.3.1

Router(dhcp-config)#exit

Router(config)#ip dhcp pool computing

Router(dhcp-config)#network 192.168.5.0 255.255.255.0

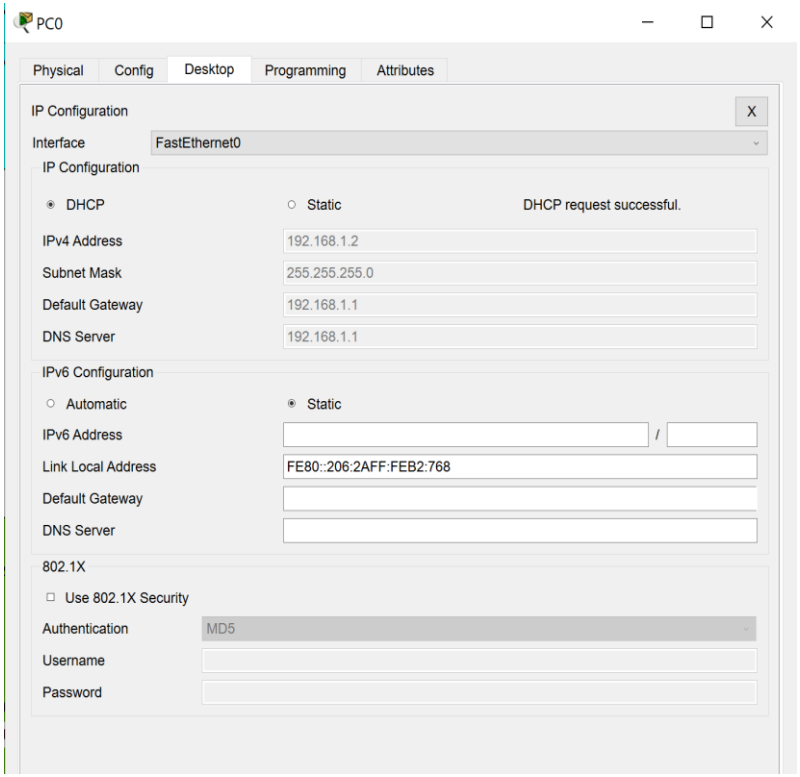
Router(dhcp-config)#default-router 192.168.5.1

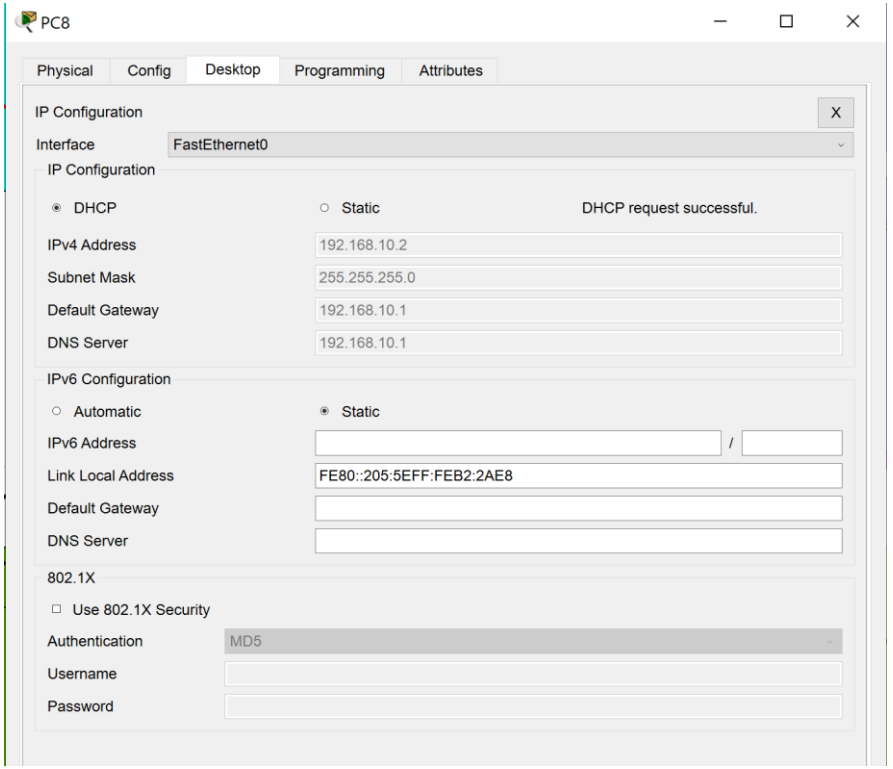
Router(dhcp-config)#dns-server 192.168.5.1

Router(dhcp-config)#exit

Working Test

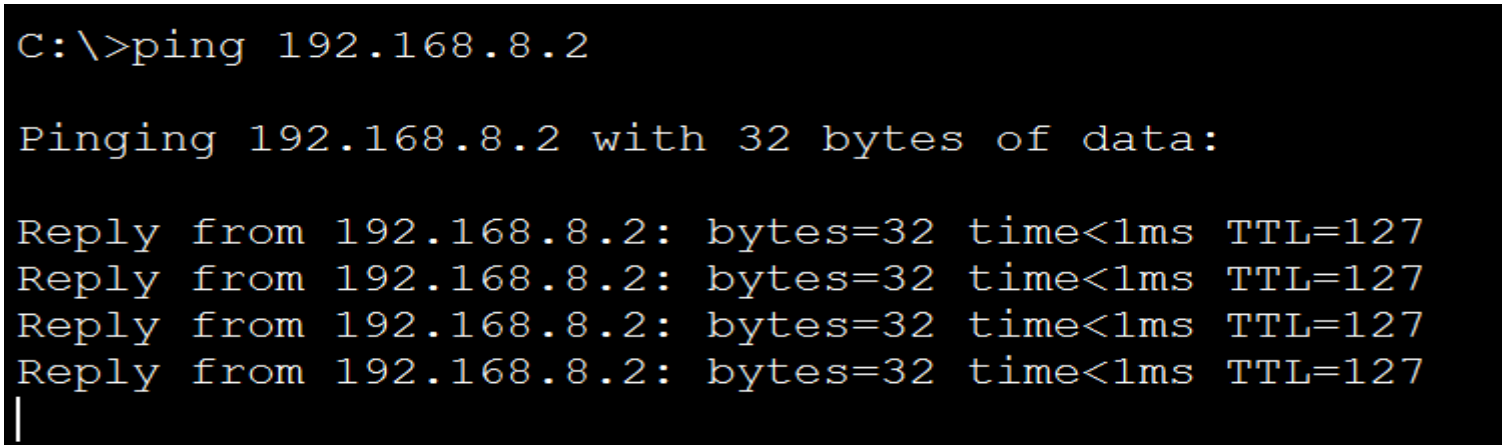
In the end, we need verify our project's functionality. First of all, we have to see if the DHCP server works correctly.





DHCP works for devices in both campuses.

To verify if the inter-VLAN connection is working in the MAIN CAMPUS, we need to see if all devices can communicate with others from other VLAN. To do so, we can use the „ping” command.



PC0 from VLAN 10 can communicate with PC7 from VLAN 80, so the inter VLAN communication is working.

As for now, by default, devices in the MAIN CAMPUS cannot communicate with devices in the SMALL CAMPUS, as we can see in the next figure (figure (2)), because we have not applied a routing protocol.

```
C:\>ping 192.168.10.2

Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Request timed out.
Reply from 192.168.1.1: Destination host unreachable.

Ping statistics for 192.168.10.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

To correct this, I will use the RIPv2 routing protocol.

With the following commands, i have configured RIPv2 on the SMALL CAMPUS router.

The same will be done on the MAIN CAMPUS router, the difference is that we have to assign 10 network IPs

Router(config)#router rip

Router(config-router)#version 2

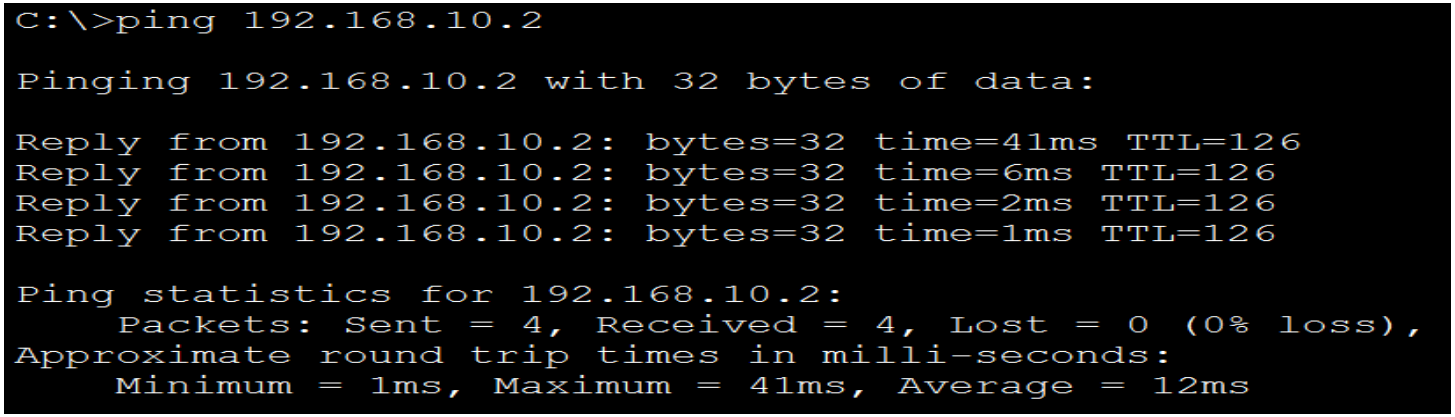
Router(config-router)#network 192.168.9.0

Router(config-router)#network 192.168.10.0

Router(config-router)#network 10.10.10.0

Router(config-router)#exit

Router(config)#do wr



PC0 from VLAN 10 in MAIN CAMPUS can communicate with PC8 from VLAN 100 in SMALL CAMPUS, so the university network is completely functional.