Computer Network - Project

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1 Project's Assumptions

Scope of the Project
The project will focus on designing and implementing the network infrastructure for a hotel environment.
In addition to basic network requirements, the project will include the provision of public Wi-Fi for hotel guests.

1. **Network Design**
   The implementation will involve the design of three networks.
   Routing between subnetworks will be established, utilizing dynamic routing.

2. **VLAN**
   Virtual Local Area Networks will be used for divide the administration and guests network.

3. **DHCP**
   DHCP will be implemented to automate IP address assignments for devices within the guests network.

4. **NAT**
   NAT will be used for efficient the using of public IP addresses.

5. **Public Wi-Fi**
   Using a wireless router a public wi-fi for the guest is implemented

6. **Servers**
   The servers were used to transmit images to the televisions in the various rooms

1.1 Dynamic routing

In dynamic routing is not necessary the knowledge of network topology because dynamic routing protocols are used to determine the routes.
To update their routing tables, the routers send messages among themselves, the task of which is to inform each other about the state of the network.
The dynamic routing protocol used in this project is the RIP protocol, which is a distance vector protocol: in this case the router knows only direction to send packets and number of hops.

```
R# configure terminal
R(config)# router rip
R(config-router)# network 192.168.10.0
R(config-router)# network 192.168.20.0
R(config-router)# exit
R# show ip route
```

The result of the last command is the one in figure 1.

```
Router(config)#do show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 10.10.10.1, 00:00:22, GigabitEthernet0/0
R    2.0.0.0/8 [120/1] via 10.10.30.2, 00:00:05, GigabitEthernet0/1
R    8.0.0.0/8 [120/2] via 10.10.10.1, 00:00:22, GigabitEthernet0/0
               [120/2] via 10.10.30.2, 00:00:05, GigabitEthernet0/1
     10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C       10.10.10.0/30 is directly connected, GigabitEthernet0/0
L       10.10.10.2/32 is directly connected, GigabitEthernet0/0
C       10.10.30.0/30 is directly connected, GigabitEthernet0/1
L       10.10.30.1/32 is directly connected, GigabitEthernet0/1
R    192.168.1.0/24 [120/1] via 10.10.10.1, 00:00:22, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/28 is directly connected, GigabitEthernet0/2
L       192.168.2.1/32 is directly connected, GigabitEthernet0/2
R    192.168.3.0/24 [120/1] via 10.10.30.2, 00:00:05, GigabitEthernet0/1
```

Figure 1: IP Route

1.2 VLAN

Vlans restricts broadcasts in the local network.
In access connection (switch port configuration) I use the old frame and two wires, in trunk connection I use a new frame which include the number of the VLAN and just one wire.
In this project the trunk connection between switches is used.
The first thing to do is create the VLAN and, after that, assign it to an interface:

```
1 Switch1# configure terminal
2 Switch1(config)# vlan 20
3 Switch1(config-vlan)# name owner
4 Switch1(config-vlan)# exit
5 Switch1(config)# interface fastEthernet 0/1
6 Switch1(config-if)# switchport mode access
7 Switch1(config-if)# switchport access vlan 20
8 Switch1(config-if)# end
9 Switch1# show vlan brief
```

The result of the last command is the one in figure 2.

```
Switch#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                                Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                                Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                                Fa0/18, Fa0/19, Fa0/20, Fa0/21
                                                Fa0/22, Fa0/23, Fa0/24, Gig0/2
20   owner                            active    Fa0/1, Fa0/2, Fa0/4, Fa0/5
                                                Gig0/1
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Figure 2: VLAN brief

After that I want to configure the trunk mode between switches. To do that i will use the following command:

```
Switch1(config)# interface fastEthernet 0/3
Switch1(config-if)# switchport mode trunk
Switch1(config-if)# switchport trunk allowed vlan 20
Switch1(config-if)# switchport trunk native vlan 99
Switch1(config-if)# exit
Switch1# show interface trunk
```

The result of the last command is the one in figure 3.

```
Switch(config-if)#do show interface trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/3       on           802.1q         trunking      99

Port        Vlans allowed on trunk
Fa0/3       20

Port        Vlans allowed and active in management domain
Fa0/3       20

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/3       20
```

Figure 3: Interface trunk

1.3 DHCP

Domain Host Name Protocol (DHCP) is a dynamic host configuration protocol. It is implemented in devices that support the ISO / OSI model network layer, like routers. It is a communication protocol that allows hosts to obtain configuration data from the server:

- IP address (host and gateway)
- DNS server address
- Subnet mask

```
Rxy(config)# service dhcp
Rxy(config)# ip dhcp excluded-address adres_from [adres_to] (or
    just one address)
Rxy(config)# ip dhcp pool pula1
Rxy(dhcp-config)# network 192.168.2.0 255.255.255.240
Rxy(dhcp-config)# default-router 192.168.2.1
```

In this project the wireless router takes care of automatically assigning IP addresses to all connected devices.

In figure 4 The DHCP protocol setting in the wireless router is presented.

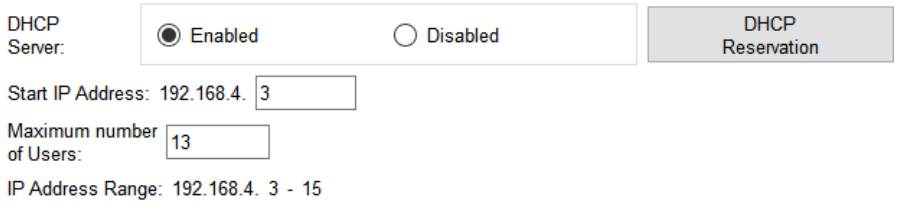

Figure 4: DHCP - Wireless Router

1.4 NAT

NAT (Network Address Translation) takes care of mapping private network addresses to public network addresses.
Thanks to NAT, local networks can access the internet from a public IP address.

```
Router7# configure terminal
Router7(config)# interface fastEthernet 0/0
Router7(config-if)# ip nat inside
Router7(config-if)# interface fastEthernet 0/1
Router7(config-if)# ip nat outside
Router7(config-if)# exit
```

In this project NAT is used to connect all the LAN to the public internet (8.8.8.8).

1.5 Public Wi-Fi

The public wi-fi has been implemented using a wireless router WRT300N.
It's import, as well as setting the IP address of the router itself, set the internet IP address and the default gateway otherwise communication with all other devices will not be possible.

The wi-fi was designed as free and open wi-fi, so a password was not set.
The configuration can be seen in figure 5

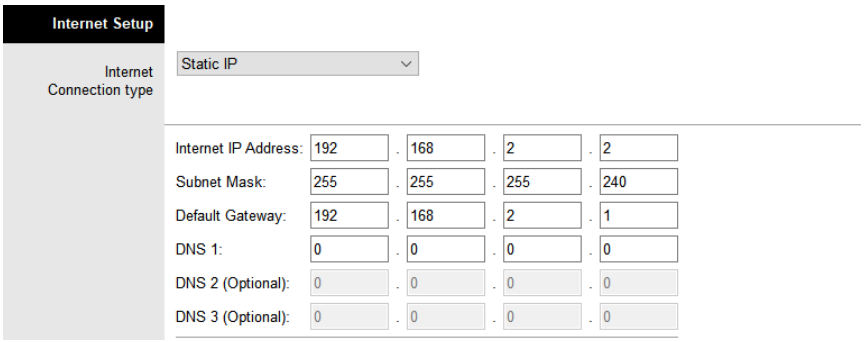

Figure 5: Internet IP Address Configuration

1.6 Servers

The servers are more of an aesthetic addition to the project.
They were used to ensure that images of Krakow can be seen on the televisions in the rooms.
To do this, the desired images were imported into the "TV setting" option.

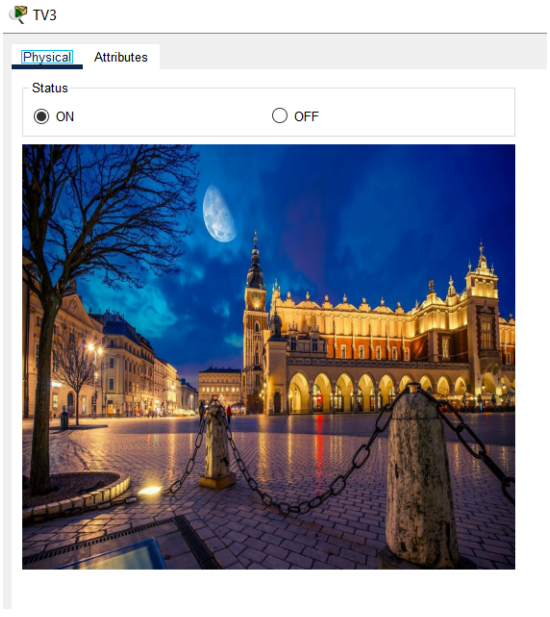

Figure 6: TV screen

2 Network Layout

The network layout of the project is presented in the following figure:

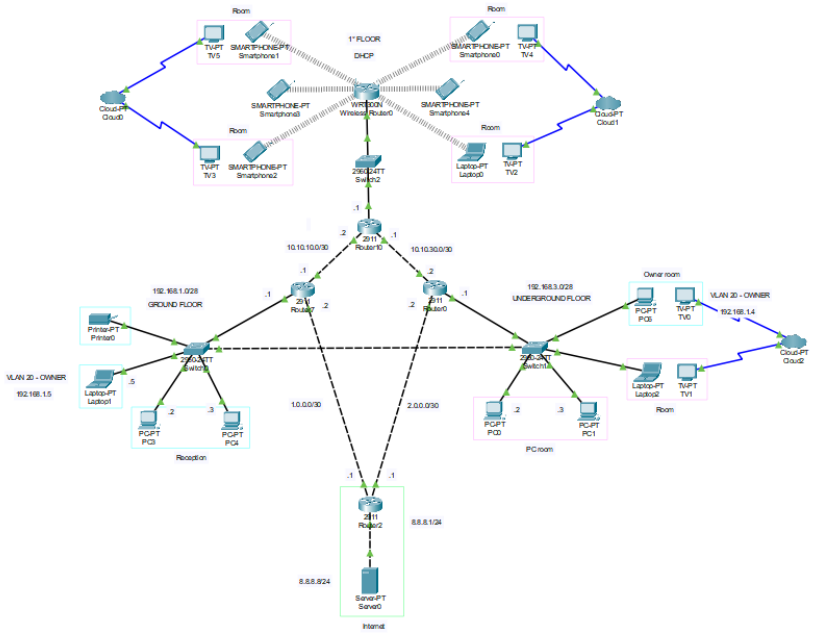

Figure 7: Network Layout

There are 3 networks, the first one in the ground floor (reception) and in the underground floor, which is reserved to the owners of the hotel, the second one in the underground floor (PC room and room) and the third one in the first floor, which is used by the guests of the hotel.

All the devices connected to the wireless router receives automatically an IP-address thanks to DHCP protocol implemented.

The communication between ground and underground floor, for the owner, is secure thanks to VLAN 20.

Using Router2, an internet connection is present (connected to 8.8.8.8 server).

3 Testing

In this section the network will be tested.
As first test, a ping from a PC inside the VLAN (ground floor) to another device inside the VLAN (underground floor) will be send.
In the same test, a ping from a PC inside the VLAN to a device outside the VLAN will be send.

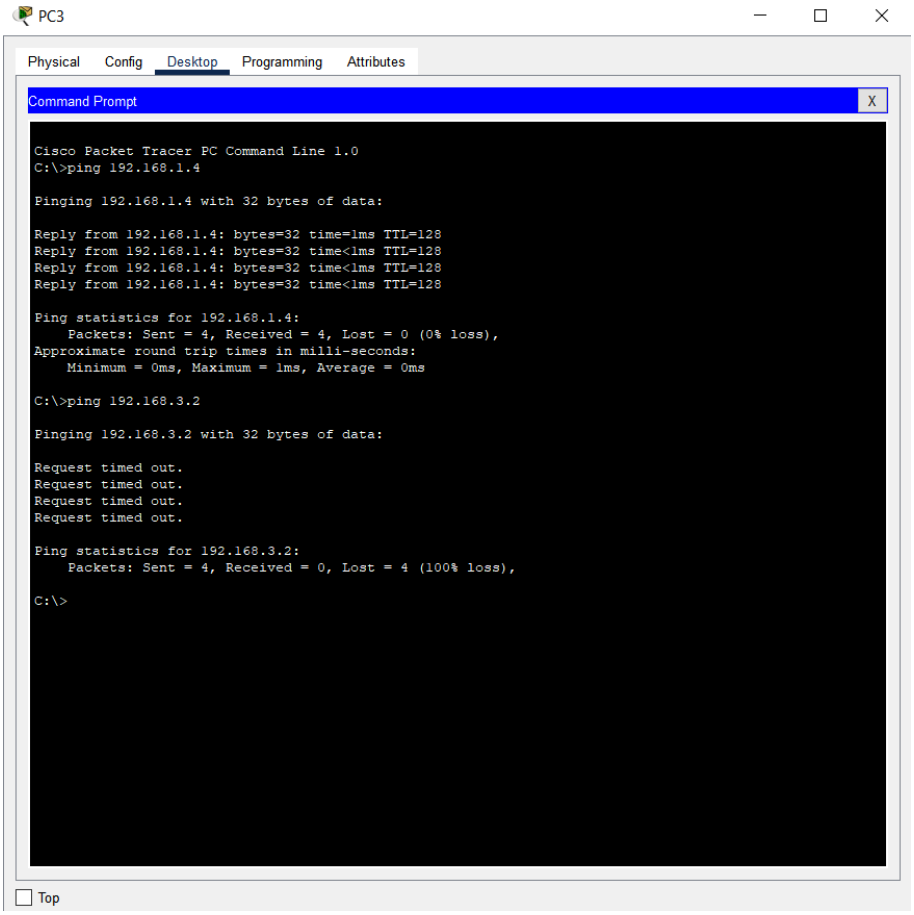

Figure 8: Test VLAN

The second test is the one of the DHCP protocol.

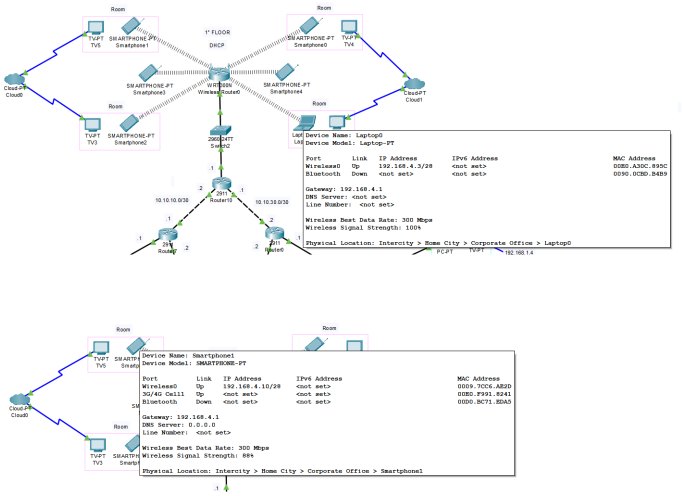

Figure 9: DHCP Test

From this devices I also want to try the connection to internet.

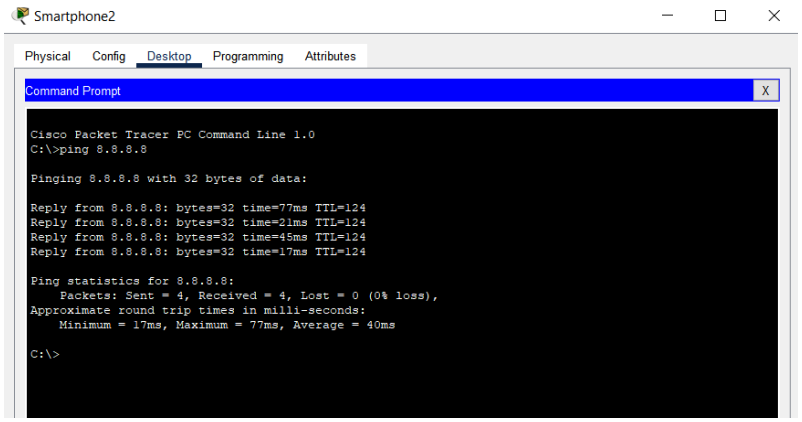

Figure 10: Ping 8.8.8.8