

HOW CAN CONFIGURE FIVE DIFFERENT NETWORKS/VLANS WITH ONE PORT OF ROUTER

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ABSTRACT

In this paper, we will set up five different Networks/ VLANS, and each of them will be configured to the same router’s port. Usually when we have some networks or VLANS, they are configured each of them in different ports of router. The network will be designed and simulated by using the Cisco Packet Tracer 7.2 simulator. This is a technical knowledge that is harder to configure but is usable when we have fewer router’s port or fewer network cards in the router. One way is to connect several networks to a single port. This technique called Router on a Stick, and between router and the switch used one Ethernet link that is configured like as an 802.1q trunk link. It is clear that as many ports or network cards have a router, this means higher cost, so with a simple technique we can buy a router more chipper and make this configuration. The traffic between networks goes into the router and out of the router through the same port so we need a router with higher performance that communication cannot interrupted. In this paper we are set up five different Networks or VLANS but of course that you can set up less or more, depend on your needs or data traffic that you have to pass thought to the router. At last we will test the configurations to see that the technique we have used is working.

Keywords: VLAN, Router on a Stick, IP, 802.1q trunk, Cisco Packet Tracer.

1. INTRODUCTION

A local area network (LAN) is a number of computers and peripherals (disc storage devices, printers) connected by high speed data lines within a building or adjacent buildings. LANs originated as ways of interconnecting diverse electronic equipment within an organization, which would permit local processing while also giving access to other devices connected to the network [1]. This is a computer network that interconnects devices within a limited area such as a residence, school, laboratory, university campus or office building[3].

LANs are designed to allow resources to be shared between personal computers or workstations. Common resources may include hardware (eg, a printer), software (eg, an application program), or data. In our paper we will have five LANS. So we will design a WAN network with five different LANS. WAN (Wide Area Network) is a combination of LANs. A Wide Area Network (WAN) is a computer network that connects computers within a large geographical area comprising a region, a country, a continent or even the whole world. *Wide area networks*, generally called WANs, are mostly public, leased or privately-owned networks. They provide a useful way of sharing resources between the end

users such as the long-distance transmission of data, voice, image, and information over large geographical areas. The best example of a Wide Area Network is the Internet which connects many smaller LANs and MANs through Internet service providers. [10].

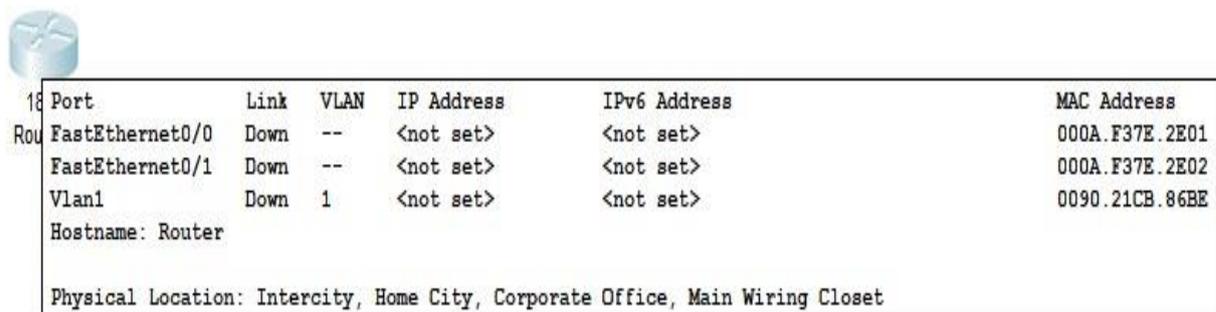
A WAN can be complex when referred to as a switching WAN as the main axis linking the Internet, or so just like a dial-up line that connects a home computer to the Internet or otherwise known as WAN point-to-point. Within a LAN network devices can be connected with cable or wireless connection. Depending on the internal structure that we have in the network, both ways can be applied. The wireless connection provides ease of movement, but there may be timely interruption in data transmission and a low transmission speed, while the cable connection is probably not very comfortable because of the cables but it is safer.

Network Topology means “the way in which the connections are made among all the network entities is called the topology of the network”. Network topology specifically refers to the physical layout of the network, eg, the location of the computers and how the cable is run between them [3].

We will use a topology in our network, that is Star topology, which means that we have a hub or switch in the center and computers with other peripherals are connected to this central device.

2. NETWORK STRUCTURE, DEVICES AND OTHER COMPONENTS

Now will explain how will set up our network. In Cisco Packet Tracer 7.2 simulator we will design the network and will test it if the configurations are correct by sending data or pinging one address from one Network or VLAN to another one. Regarding the equipment, we need a router and in our case will use Router 1841 Model that have two fastethernet ports like in the figure. There are many kinds of routers and of course each of them can use here, but some of them have gigabitethernet ports that are not important in our case with low data traffic. The 1841 router will connect with a switch (in this case we are using 2950 Switch model with 24 fastethernet ports) using one Ethernet link configured as an 802.1q trunk link. In this setup, the switch is configured with multiple VLANs and the *router* performs all *routing* between the different networks/ VLANs. [4]



Port	Link	VLAN	IP Address	IPv6 Address	MAC Address
FastEthernet0/0	Down	--	<not set>	<not set>	000A.F37E.2E01
FastEthernet0/1	Down	--	<not set>	<not set>	000A.F37E.2E02
Vlan1	Down	1	<not set>	<not set>	0090.21CB.86BE

Hostname: Router

Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet

Figure 1. View of the 1841 Router model

From first to fourth networks/ VLANs will use only one host for VLAN and in the last VLAN will design Star topology. A star topology is a network that is designed to look very similar to a star with a central core and many systems connected directly to that core. The systems in a star topology do not connect to each other, but instead pass messages to the central core that, in turn, passes the message to either all other systems or the specific destination system depending on the network design. This topology works well for many smaller networks and works around many of the detriments associated with bus or ring topologies. [8]

In figure 2, is the final network designed in Cisco Packet Tracer. The network structure has five department as: IT Department, Finance Department, Sales Department, Management Department and the last Department is for Human Resource with two hosts. Like you can see in the picture number 2 all the Networks/ VLANs are connecting with one interface in the router, exactly with Fastethernet 0/0.

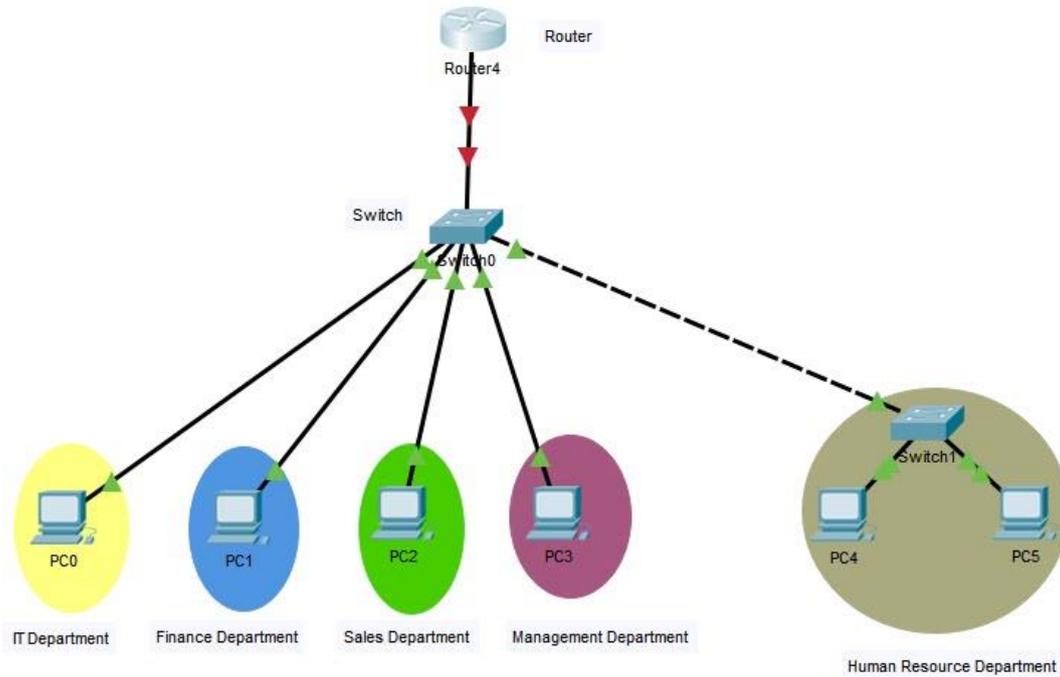


Figure 2. Network Structure

Otherwise would have to use 5 fastethernet ports from the router. And the network topology will looks like in the figure number 3. The difference is clearly instead of having one connection between the router and the switch we have five connections as in Figure 3.

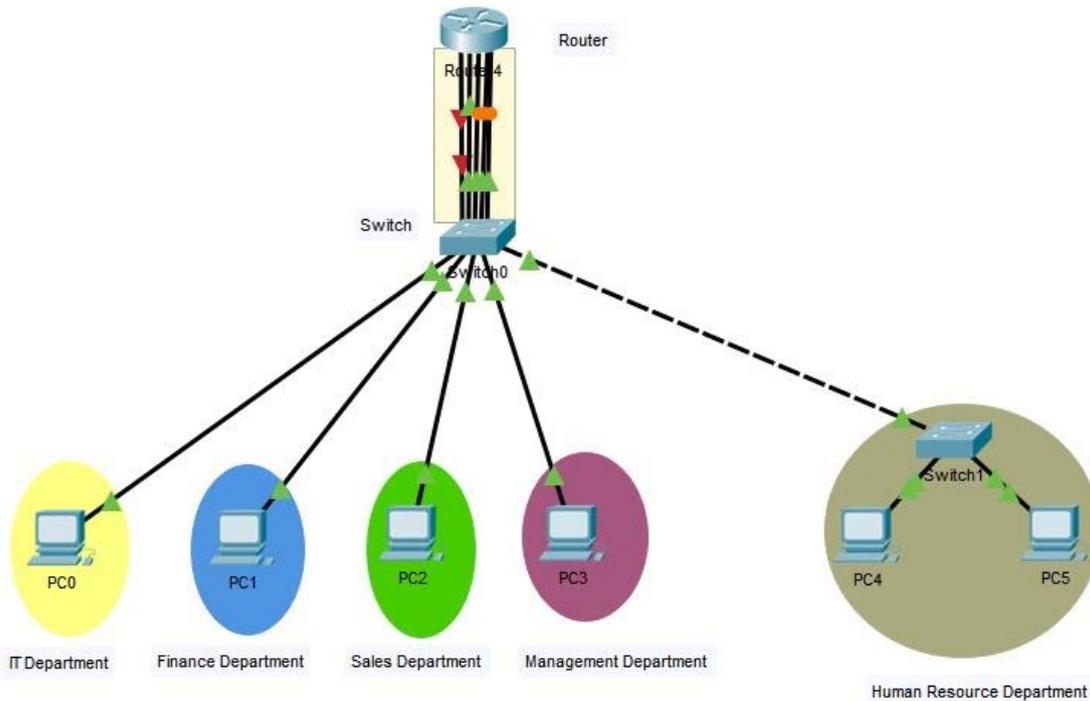


Figure 3. The network topology if don't use trunk link

3. ROUTER, SWITCH AND HOSTS CONFIGURATION

In Cisco Packet Tracer will see the configuration of hosts, switch and router. For hosts will follow those steps: IP address, Subnetmask and IP Default Gateway. The switch that is use in Human Resource Department doesn't need configuration. IP addresses are from C Class. With double click in each Personal Computer we will make configurations. As you can show in the figure number 4, in desktop window we complete the fields that ate required, like: IP address, Subnetmask and IP Default Gateway. We are using C Class addresses so the subnetmask will be /24 to /32, in our case we are using all hosts that support C Class 256 hosts or 254 available hosts, so we won't make subnetting and the subnet mask will be 255.255.255.0.

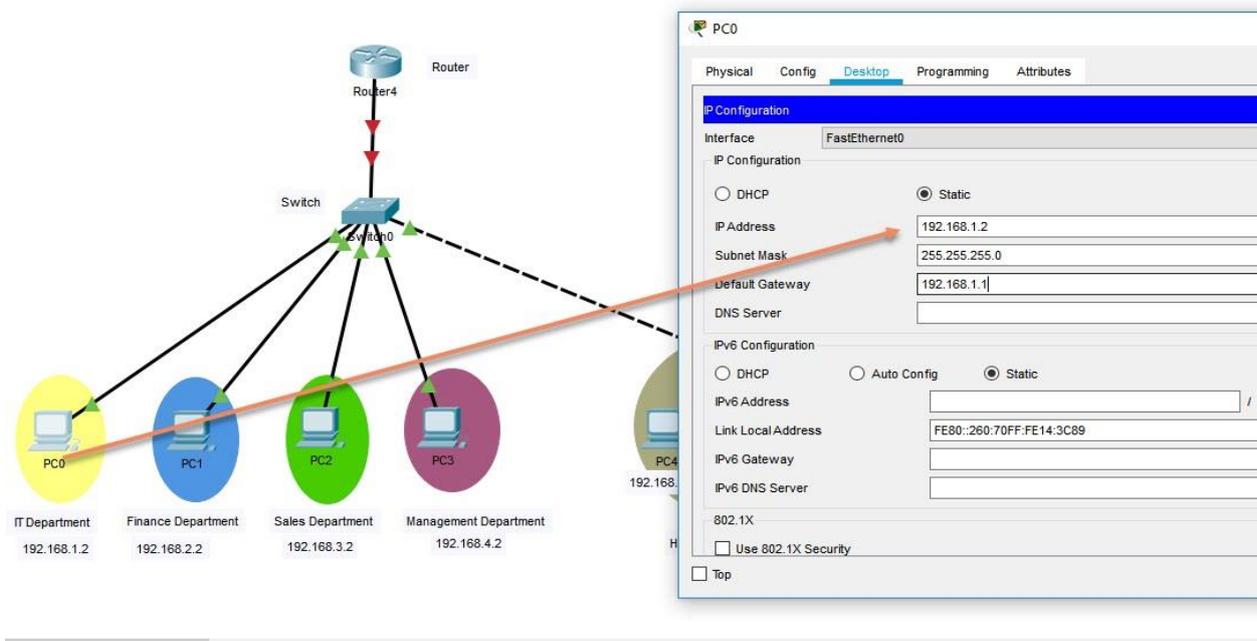


Figure 4. Hosts configuration

For the switch that is between networks and router will follow those steps:

- VLANs, Names
- IP address on interface for Sales Department (192.168.3.3/24)
- Default Gateway (192.168.3.1/24)
- Configure trunk
- Configure trunk native vlan
- Configure switchports vlans

In Figure number 5 will show the first step of switch configuration, creation of VLANs with their names.

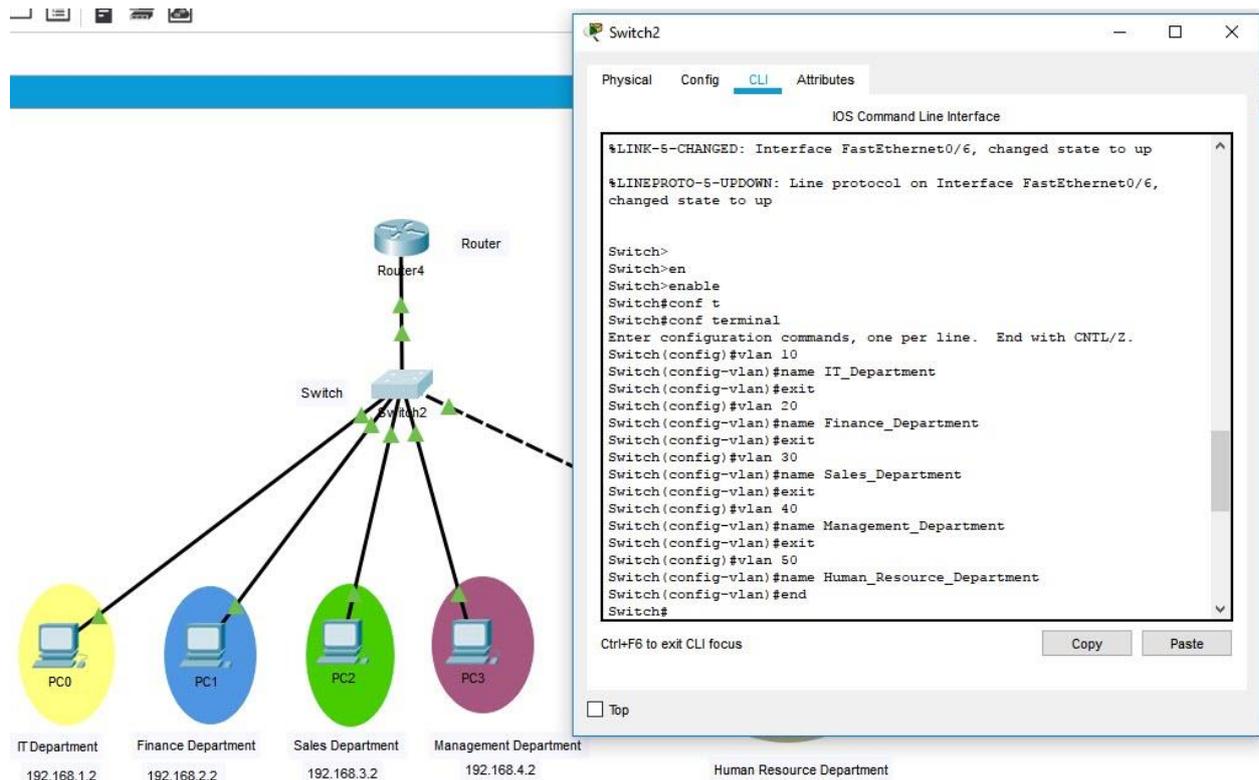


Figure 5. Creation of VLANs with their names

For the other steps we need to make those configuration in the switch.

- switch> enable
- switch# configure terminal
- switch(config)# interface vlan 30
- switch(config-if)# ip address 192.168.3.3 255.255.255.0
- switch(config-if)# exit
- switch(config)# ip default-gateway 192.168.3.1
- switch(config)# interface fa0/1
- switch(config-if)# switchport mode trunk
- switch(config-if)# switchport trunk allowed vlan 1-1005
- switch(config-if)# switchport trunk native vlan 60
- switch(config-if)# interface range fa0/2-6
- switch(config-if)# switchport mode access
- switch(config-if)# exit
- switch(config)# exit
- switch#

When we are in privilege mode (#) can show all the configurations. The command for showing configurations is: switch# show running- config.

In the next figure are showing configurations.

```

interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface Vlan1
no ip address
shutdown
!
interface Vlan30
mac-address 0090.2133.3701
ip address 192.168.3.3 255.255.255.0
!
ip default-gateway 192.168.3.1
!
!
!
!
line con 0
--More--

```

Ctrl+F6 to exit CLI focus

```

Top
interface FastEthernet0/1
switchport trunk native vlan 60
switchport mode trunk
!
interface FastEthernet0/2
switchport mode access
!
interface FastEthernet0/3
switchport mode access
!
interface FastEthernet0/4
switchport mode access
!
interface FastEthernet0/5
switchport mode access
!
interface FastEthernet0/6
switchport mode access
!
interface FastEthernet0/7
!
Switch#

```

Ctrl+F6 to exit CLI focus

Top

Figure 6. Other steps configuration

At least, about the router, the steps configuration are as below:

- router> enable
- router# configure terminal
- router(config)# interface fa0/0
- router(config-if)# no shut down
- router(config-if)# interface fa0/0.10
- router(config-subif)# encapsulation dot1Q 10
- router(config-subif)# ip address 192.168.1.1 255.255.255.0
- router(config-subif)# interface fa0/0.20
- router(config-subif)# encapsulation dot1Q 20
- router(config-subif)# ip address 192.168.2.1 255.255.255.0
- router(config-subif)# interface fa0/0.30
- router(config-subif)# encapsulation dot1Q 30
- router(config-subif)# ip address 192.168.3.1 255.255.255.0

- router(config-subif)# interface fa0/0.40
- router(config-subif)# encapsulation dot1Q 40
- router(config-subif)# ip address 192.168.4.1 255.255.255.0
- router(config-subif)# interface fa0/0.50
- router(config-subif)# encapsulation dot1Q 50
- router(config-subif)# ip address 192.168.5.1 255.255.255.0
- router(config-subif)# exit
- router(config)# exit
- router#

Finally we can test the network if the configurations are correct or no. So if, we will ping from first VLAN (IT Department) the IP address from other VLANs we should get four ping replay, in this case we will ping IP address 192.168.3.2 from Sales Department. View the Figure 7.

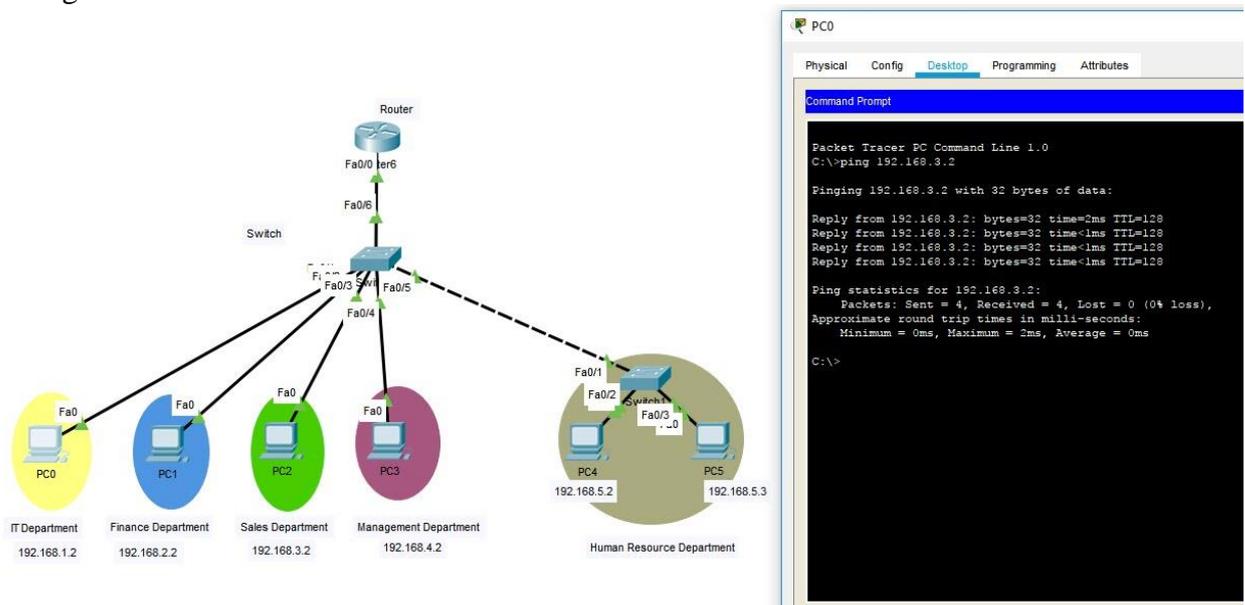


Figure 7. Testing the network

From Figure 7 we can see that configuration is correct because we can communicate with this Personal Computer even though the IP address 192.168.3.2/24 is in other Network/VLAN.

4. CONCLUSIONS

The best way if we have fewer ports or network cards in the router and we want to set up many Networks/ VLANs. It is clear that as many ports or network cards have a router, this means higher cost, so with a simple technique we can buy a router more chipper and make this configuration. The disadvantage is that it's harder or complex to set up configurations compared to other networks, and of course the traffic between networks goes into the router and out of the router through the same Department port so we need a router with higher performance that communication cannot interrupted, and in this paper we chose five different Networks or VLANs but of course that you can set up less or more Networks or VLANs, depend on your needs or data traffic that you have to pass thought to the router.

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