BERZIET UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER ENGINEERING

Lab Experiment Switching and VLANs part1&2
Experiment #5&6

Prepared by: **Nehal Aljolani 1150292**

Partners: **Salma Murrar 1152274**

Instructor: **Imad Tartir**

Teacher assistant: **Rajaie Imseeh**

BIRZEIT

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Abstract:

In these experiments we used Cisco Packet Tracer software to create the topology so that we will be able to study switching and the different operations that the switch does. The experiments discus two main concepts of VLANs, the first one is called router on stick and the other one is called switch virtual interface.

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1. Introduction

1.1. Switching

In general, switching is an asset of computer networking. It's the mechanism of exchanging information between different computer networking or directing a data element towards a particular destination. [1]

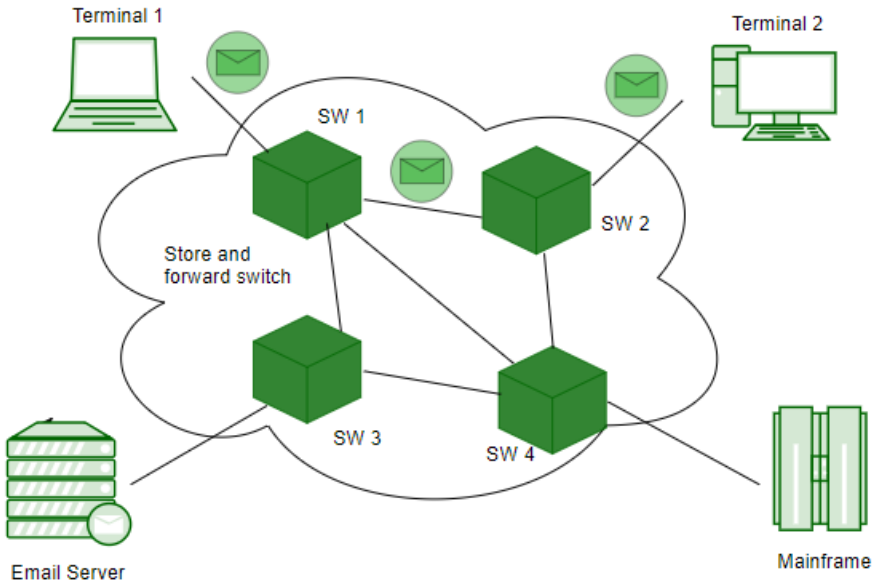

Figure 1- 1 Switching

1.2. VLANs

Virtual local area network which groups a number of machines together in a logical or non-physical way so it's possible to be free of the limitations of the physical architecture. The VLAN is associated in a broadcast domain and it's usually composed of one or more Ethernet switches. Each VLAN provides data link access to all hosts connected to switch ports configured with the same VLAN ID. [2]

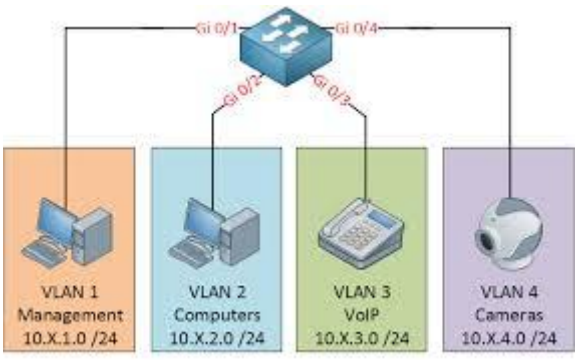

Figure 1- 2 VLAN

1.3. Trunk

A trunk is a communications line or link designed to carry multiple signals simultaneously to provide network access between two points. Trunks typically connect switching centers in a communications system. The signals can convey any type of communications data. A trunk can consist of multiple wires, cables or fiber optic strands bundled together to maximize the available bandwidth in a single physical cable, or it can consist of a single high-capacity link over which many signals are multiplexed. [3]

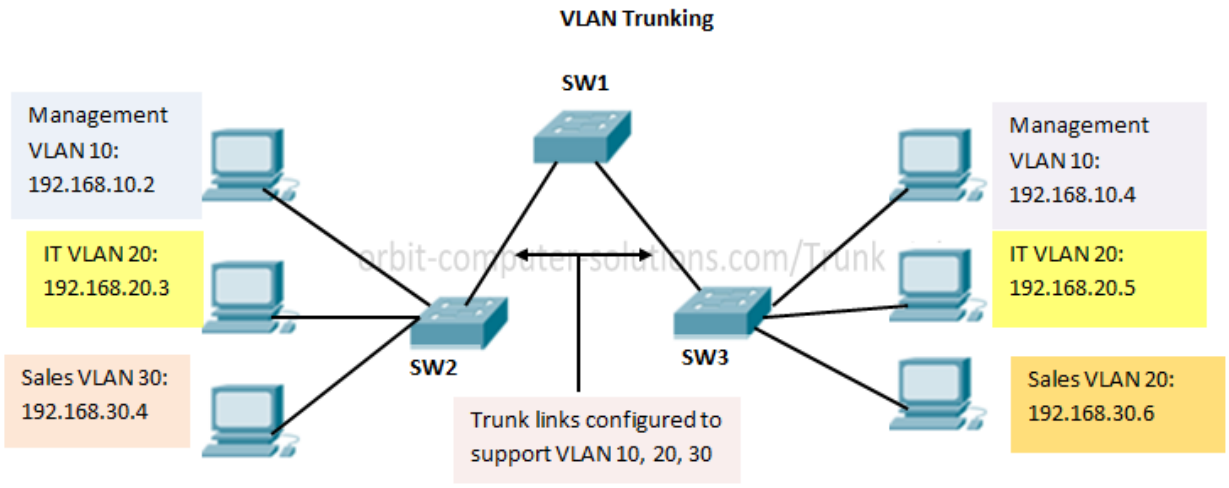

Figure 1- 3 Trunk

2. Concepts and configuration:

2.1. Creating the topology

We created the topology using Cisco Packet Tracer by its various devices, we used Routers, switches, PCs and Laptop-PT to build the topology and we connected them using wires.

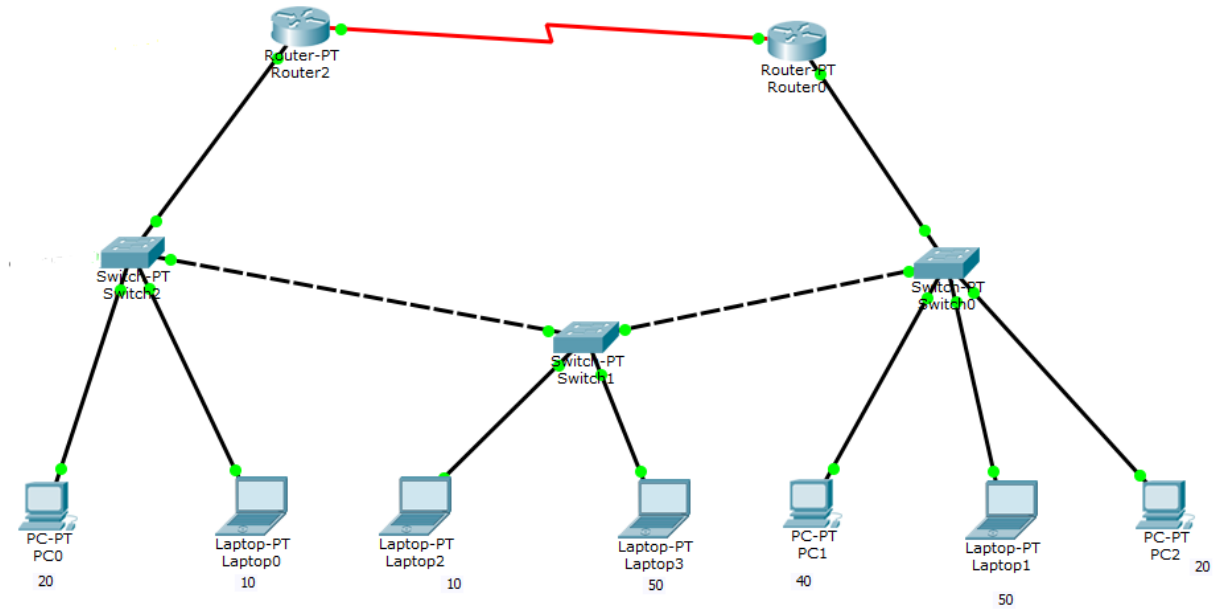

Figure 2- 1 topology

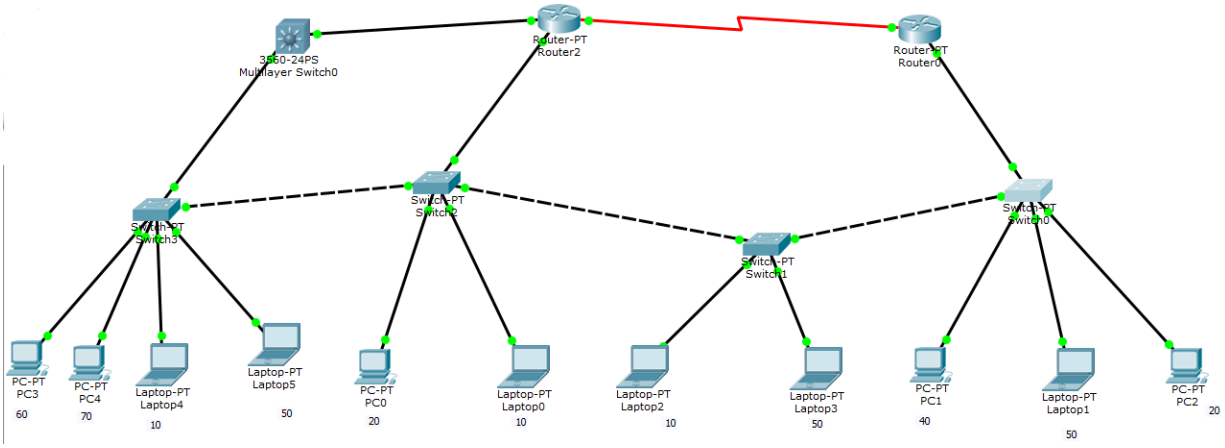

Figure 2- 2 topology2

2.1.1. Devices configuration

Table 2-1 Router0

Router 0 interfaces			
Interface	IP address	Subnet mask	Wildcard mask
Se2/0	192.168.30.2	255.255.255.0	0.0.0.255

Table 2-2 Router 1

Router 1 interfaces			
Interface	IP address	Subnet mask	Wildcard mask
Fa1/0	192.168.80.2	255.255.255.0	0.0.0.255
Se2/0	192.168.30.1	255.255.255.0	0.0.0.255

2.1.2. PC's Configuration

We enabled the IP address, subnet mask, and the gate way for each pc in the network by clicking on the pc then go to desktop and write all of the above in the space allocated for it.

Here is PC0 as an example

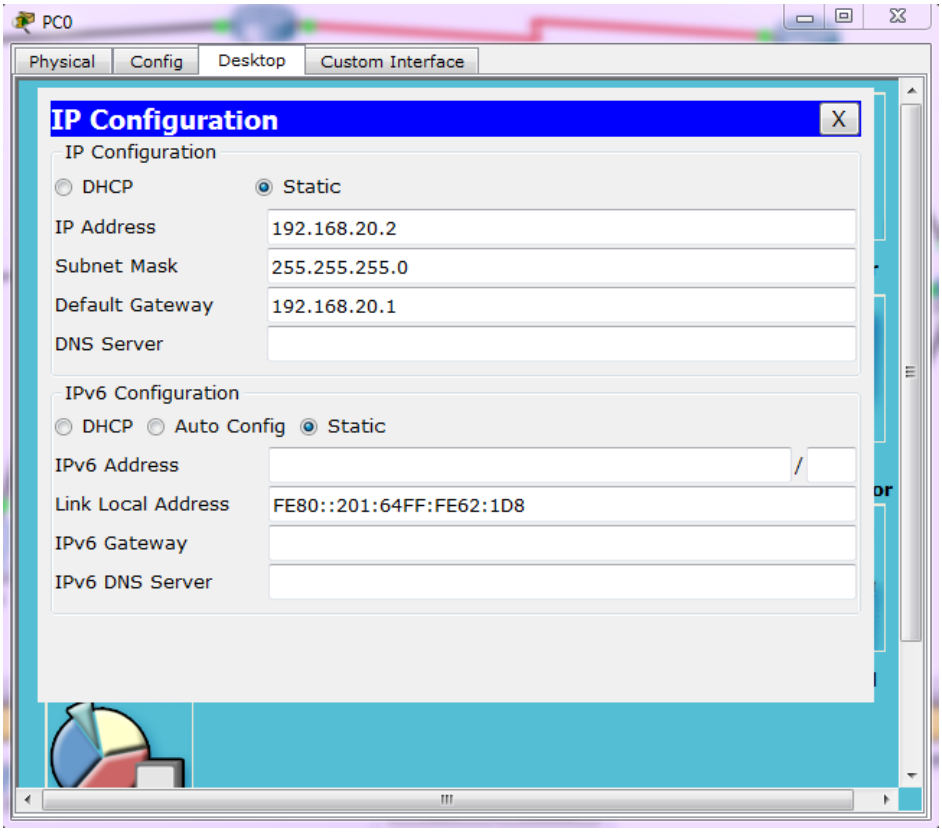

Figure 1 PC0 configuration

Table 2-3 PCs configuration

PC configuration			
PC	IP address	Subnet mask	Gateway
Pc0	192.168.20.2	255.255.255.0	192.168.20.1
Pc1	192.168.40.2	255.255.255.0	192.168.40.1
Pc2	192.168.20.3	255.255.255.0	192.168.20.1
Pc3	192.168.60.2	255.255.255.0	192.168.60.1
Pc4	192.168.70.2	255.255.255.0	192.168.70.1
Laptop 0	192.168.10.3	255.255.255.0	192.168.10.1
Laptop 1	192.168.50.2	255.255.255.0	192.168.50.1
Laptop 2	192.168.10.2	255.255.255.0	192.168.10.1
Laptop 3	192.168.50.3	255.255.255.0	192.168.50.1
Laptop 4	192.168.10.4	255.255.255.0	192.168.10.1
Laptop 5	192.168.50.4	255.255.255.0	192.168.50.1

2.2. VLANs configuration and Trunk mode

For switch0

```
interface FastEthernet0/1
 switchport mode trunk
!
interface FastEthernet1/1
 switchport access vlan 40
!
interface FastEthernet2/1
 switchport access vlan 50
!
interface FastEthernet3/1
 switchport mode trunk
!
interface FastEthernet4/1
!
interface FastEthernet5/1
!
interface FastEthernet6/1
 switchport access vlan 20
!
```

Figure 2- 3 switch0

For switch 1

```
spanning-tree mode pvst
!
interface FastEthernet0/1
 switchport access vlan 10
!
interface FastEthernet1/1
 switchport access vlan 50
!
interface FastEthernet2/1
 switchport mode trunk
!
interface FastEthernet3/1
 switchport mode trunk
!
interface FastEthernet4/1
!
interface FastEthernet5/1
!
interface FastEthernet6/1
!
```

Figure 2- 4 switch1

For switch2

```
!
interface FastEthernet0/1
 switchport mode trunk
!
interface FastEthernet1/1
 switchport access vlan 20
!
interface FastEthernet2/1
 switchport access vlan 10
!
interface FastEthernet3/1
 switchport mode trunk
!
interface FastEthernet4/1
!
interface FastEthernet5/1
!
interface FastEthernet6/1
 switchport mode trunk
!
```

Figure 2- 5 switch2

For switch 3

```
interface FastEthernet0/1
 switchport mode trunk
!
interface FastEthernet1/1
 switchport access vlan 60
!
interface FastEthernet2/1
 switchport access vlan 70
!
interface FastEthernet3/1
 switchport access vlan 10
!
interface FastEthernet4/1
!
interface FastEthernet5/1
!
interface FastEthernet6/1
 switchport access vlan 50
!
interface FastEthernet7/1
 switchport mode trunk
!
```

Figure 2- 6 switch3

2.3. configuring multilayer switch

2.3.1. Multilayer switch interfaces

```
interface FastEthernet0/1
 no switchport
 ip address 192.168.80.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/2
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface FastEthernet0/3
 switchport access vlan 60
!
interface FastEthernet0/4
 switchport access vlan 70
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan60
 ip address 192.168.60.1 255.255.255.0
!
interface Vlan70
 ip address 192.168.70.1 255.255.255.0
!
```

Figure 2- 7 multilayer switch interfaces

2.3.2. Router rip

```
router rip
 network 192.168.60.0
 network 192.168.70.0
 network 192.168.80.0
!
```

Figure 2- 8 router rip

2.4. Configuring routers

2.4.1. For router 0

```
interface FastEthernet0/0
 no ip address
 duplex auto
 speed auto
!
interface FastEthernet0/0.40
 encapsulation dot1Q 40
 ip address 192.168.40.1 255.255.255.0
!
interface FastEthernet0/0.50
 encapsulation dot1Q 50
 ip address 192.168.50.1 255.255.255.0
!
interface FastEthernet1/0
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial2/0
 ip address 192.168.30.2 255.255.255.0
!
interface Serial3/0
 no ip address
 clock rate 2000000
 shutdown
!
```

Figure 2- 9 router0

```
router rip
 network 192.168.30.0
 network 192.168.40.0
 network 192.168.50.0
 network 192.168.80.0
!
```

Figure 2- 10 router0 rip

2.4.2. For router1

```
!
interface FastEthernet0/0
 no ip address
 duplex auto
 speed auto
!
interface FastEthernet0/0.10
 encapsulation dot1Q 10
 ip address 192.168.10.1 255.255.255.0
!
interface FastEthernet0/0.20
 encapsulation dot1Q 20
 ip address 192.168.20.1 255.255.255.0
!
interface FastEthernet1/0
 ip address 192.168.80.2 255.255.255.0
 duplex auto
 speed auto
!
interface Serial2/0
 ip address 192.168.30.1 255.255.255.0
 clock rate 2000000
!
interface Serial3/0
 no ip address
 clock rate 2000000
 shutdown
!
```

Figure 2- 11 router1

```
router rip
 network 192.168.10.0
 network 192.168.20.0
 network 192.168.30.0
 network 192.168.80.0
!
```

Figure 2- 12 router1 rip

3. Results

3.1. Testing Multilayer switch0

We used (show ip route) command for testing if the multilayer switch0 is configured correctly

```
Switch>
Switch>en
Switch#show ip route
Codes: C - connected, S - static, I - IGRP, 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    192.168.10.0/24 [120/1] via 192.168.80.2, 00:00:25, FastEthernet0/1
R    192.168.20.0/24 [120/1] via 192.168.80.2, 00:00:25, FastEthernet0/1
R    192.168.30.0/24 [120/1] via 192.168.80.2, 00:00:25, FastEthernet0/1
R    192.168.40.0/24 [120/2] via 192.168.80.2, 00:00:25, FastEthernet0/1
R    192.168.50.0/24 [120/2] via 192.168.80.2, 00:00:25, FastEthernet0/1
C    192.168.60.0/24 is directly connected, Vlan60
C    192.168.70.0/24 is directly connected, Vlan70
C    192.168.80.0/24 is directly connected, FastEthernet0/1
```

Figure 3- 1 ip route

3.2. Testing routers

3.2.1. Router 0

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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    192.168.10.0/24 [120/1] via 192.168.30.1, 00:00:05, Serial2/0
R    192.168.20.0/24 [120/1] via 192.168.30.1, 00:00:05, Serial2/0
C    192.168.30.0/24 is directly connected, Serial2/0
C    192.168.40.0/24 is directly connected, FastEthernet0/0.40
C    192.168.50.0/24 is directly connected, FastEthernet0/0.50
R    192.168.60.0/24 [120/2] via 192.168.30.1, 00:00:05, Serial2/0
R    192.168.70.0/24 [120/2] via 192.168.30.1, 00:00:05, Serial2/0
R    192.168.80.0/24 [120/1] via 192.168.30.1, 00:00:05, Serial2/0
```

Figure 3- 2 testing router0

3.2.2. Router 1

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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

C    192.168.10.0/24 is directly connected, FastEthernet0/0.10
C    192.168.20.0/24 is directly connected, FastEthernet0/0.20
C    192.168.30.0/24 is directly connected, Serial2/0
R    192.168.40.0/24 [120/1] via 192.168.30.2, 00:00:03, Serial2/0
R    192.168.50.0/24 [120/1] via 192.168.30.2, 00:00:03, Serial2/0
R    192.168.60.0/24 [120/1] via 192.168.80.1, 00:00:12, FastEthernet1/0
R    192.168.70.0/24 [120/1] via 192.168.80.1, 00:00:12, FastEthernet1/0
C    192.168.80.0/24 is directly connected, FastEthernet1/0
```

Figure 3- 3 testing router1

3.3. Ping from PC2 to PC0

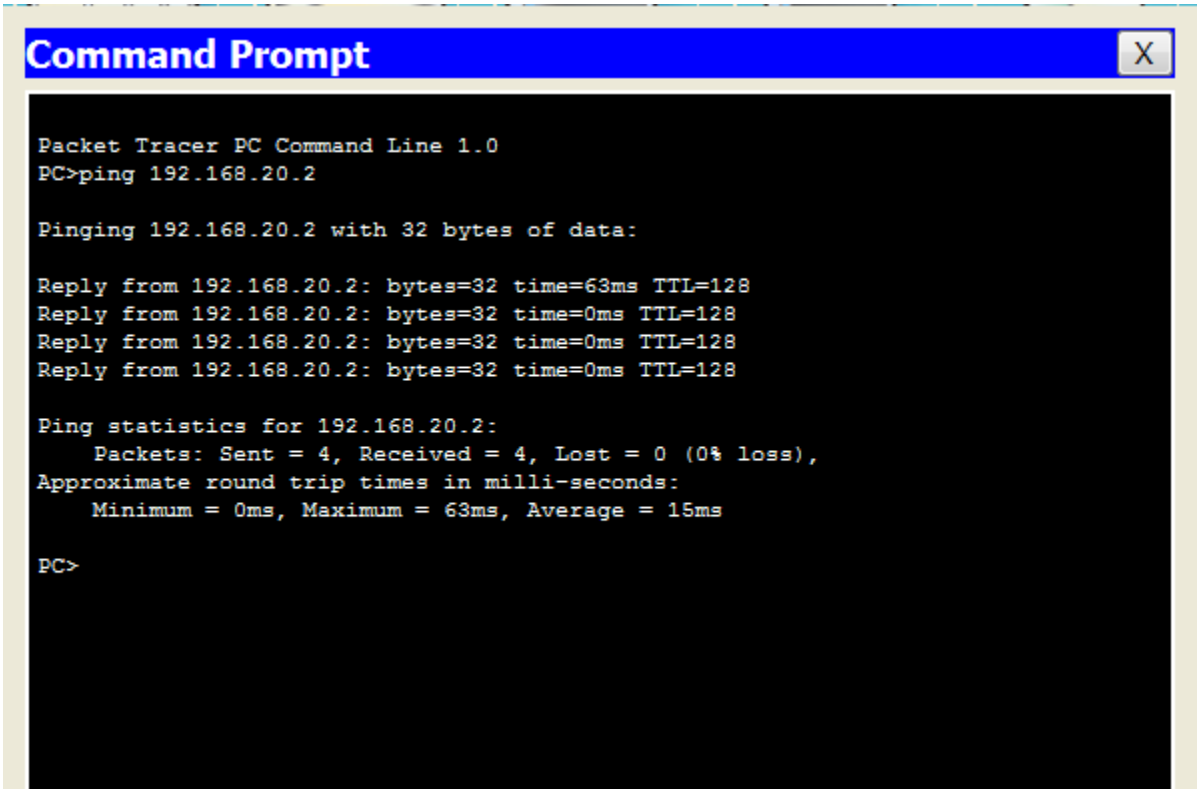

Figure 3- 4 ping from pc2 to pc0

3.4. Ping from PC1 to PC3

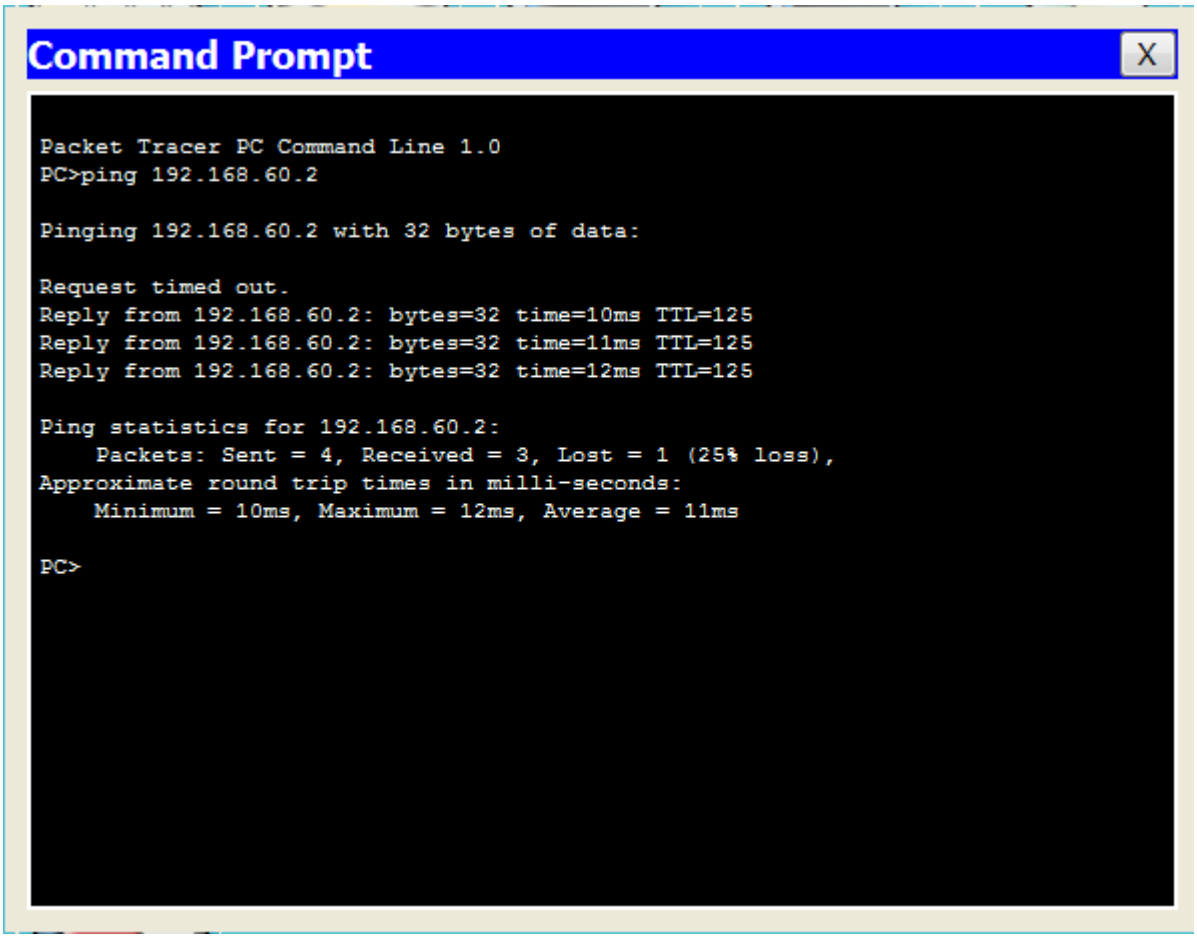

Figure 3- 5 ping from pc1 to pc

4. Conclusion

In these experiments we discussed some important concepts of VLANs, how to use them, when to use them, there advantages and the way to assign them. By the end of these experiments we began more familiar to use VLANs and with concepts of "Trunk". We also learned how the 3rd layer switch works the same way that the router works.

5. References

[1] "techopedia," [Online]. Available: https://www.techopedia.com/definition/22411/switching. [Accessed 23 april 2019].

[2] "techtarget," [Online]. Available: https://searchnetworking.techtarget.com/definition/virtual-LAN. [Accessed 23 april 2019].

[3] "techtarget," [Online]. Available: https://searchnetworking.techtarget.com/definition/trunk. [Accessed 23 april 2019].