Al-Najah National University
Network Design Lab

ENTERPRISE SERVICES

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1 Abstract

This lab aims to know how to design distributed network, by configuring InterVlan and one Central DHCP, in the last, we configure the PAT to get access (connect) to the internet.

2 Scenario

The current project is a network for a Caned food company. This company has two branches in two different cities. The main branch is at Nablus city, the second one is at Tubas. Nablus branch has about 300 hosts, and Tubas branch has 100 hosts. The current infrastructure at both sites is one flat LAN at each branch. Both branches are connected via a leased line subscription. The company is asking for a redesign to enhance performance and reliability of the network, they are asking for the following:

1. The main branch is to be divided into multiple different networks based on organizational department: a. HR: 25 employees. b. IT: 12 employees. c. Production department: 200 hosts. d. Sales department:40 employees. e. Financial department: 30 employees
2. Tubas branch is to be divided into Organizational departments as follows:
   a. Sales: 10 employees. b. Production department: 90 hosts.
3. The main branch at Nablus has the internet connection which is a metro Ethernet subscription with PALTEL this should provide internet connectivity for both sites

3 Conceptual Requirements

1. DHCP: all network addresses on both branches should be dynamic through one central DHCP server(use 8.8.8.8 as a DNS server).
2. NAT: for the internet connection (use the Lab network as an ISP network).
3. Router on a stick interVLAN routing.
4. Summary Static Routes

4 Procedure

1. At first, we Design the logical topology as per the requirements, as show in figure 1.

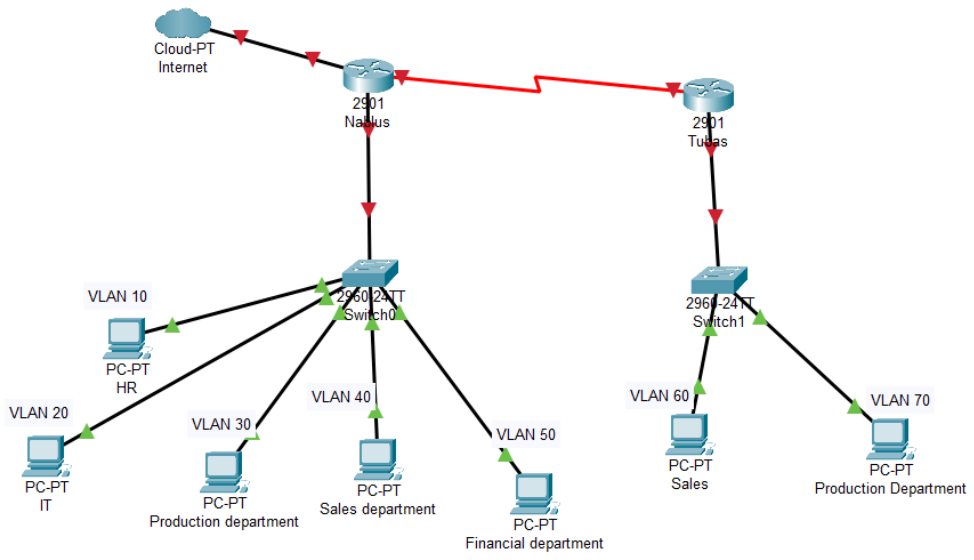

Figure 1: Logical Topology

2. We calculate the subnet mask for this scenario and use the network **192.168.0.0/23** and get the subnet according to VLANs that were used and assigned it as figure 2 shows.

Device	Interface	IP Address
Nablus	S0/0/0	192.168.2.33/30
	F0/1.10	192.168.1.225/27
	F0/1.20	192.168.2.1/28
	F0/1.30	192.168.0.1/24
	F0/1.40	192.168.1.128/26
	F0/1.50	192.168.1.192/27
	F0/0	DHCP from internet
Tubas	S0/0/0	192.168.2.34/30
	F0/1.60	192.168.2.17/28
	F0/1.70	192.168.1.1/25

Figure 2: Address Table

3. In the first we configure VlAN and Router on a stick interVLAN routing on both router as shown in addressing table. Figure 3 show how it done.

```
Router(config)#hostname Tubas
Tubas(config)#int f0/1
Tubas(config-if)#no shut
Tubas(config-if)#exit
Tubas(config)#
*Feb 16 11:30:42.599: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
Tubas(config)#
*Feb 16 11:30:45.671: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to
Tubas(config)#int f0/1.60
Tubas(config-subif)#enca
Tubas(config-subif)#encapsulation d
Tubas(config-subif)#encapsulation dot1Q 60
Tubas(config-subif)#ip add 192.168.2.17 255.255.255.240
Tubas(config-subif)#no shut
Tubas(config-subif)#exit
Tubas(config)#int f0/1.70
Tubas(config-subif)#enca
Tubas(config-subif)#encapsulation do
Tubas(config-subif)#encapsulation dot1Q 70
Tubas(config-subif)#ip add 192.168.1.1 255.255.255.128
Tubas(config-subif)#no shut
Tubas(config-subif)#exit
Tubas(config)#
```

Figure 3: Configure interVLAN routing

4. Second, the network addresses on both branches will be dynamic through one central DHCP server which is nablus and (8.8.8.8 as a DNS server) as shown in figure 4. The other router will be helper address as shown in figure 5. Also we make the interface that connect to internet to get DHCP ip as shown in figure 6

```
ip dhcp pool V30
 network 192.168.0.0 255.255.255.0
 default-router 192.168.0.1
 dns-server 8.8.8.8
!
ip dhcp pool V70
 network 192.168.1.0 255.255.255.128
 default-router 192.168.1.1
 dns-server 8.8.8.8
!
ip dhcp pool V40
 network 192.168.1.128 255.255.255.192
 default-router 192.168.1.129
 dns-server 8.8.8.8
!
ip dhcp pool V50
 network 192.168.1.192 255.255.255.224
 default-router 192.168.1.193
 dns-server 8.8.8.8
!
ip dhcp pool V10
 network 192.168.1.224 255.255.255.224
 default-router 192.168.1.225
 dns-server 8.8.8.8
!
ip dhcp pool V20
 network 192.168.2.0 255.255.255.240
 default-router 192.168.2.1
 dns-server 8.8.8.8
!
ip dhcp pool V60
 network 192.168.2.16 255.255.255.240
 default-router 192.168.2.17
 dns-server 8.8.8.8
!
```

Figure 4: configure DHCP

```
interface FastEthernet0/1
 no ip address
 duplex auto
 speed auto
!
interface FastEthernet0/1.60
 encapsulation dot1Q 60
 ip address 192.168.2.17 255.255.255.240
 ip helper-address 192.168.2.33
!
interface FastEthernet0/1.70
 encapsulation dot1Q 70
 ip address 192.168.1.1 255.255.255.128
 ip helper-address 192.168.2.33
!
```

Figure 5: configure DHCP helper

```
nablus(config-if)#ip add dhcp client-id fastEthernet 0/1
nablus(config-if)#
Jan  2 13:20:12.415: %DHCP-6-ADDRESS_ASSIGN: Interface FastEthernet0/0 assigned DHCP address 172.16.107.19, mask 255.255.255.0, hostname nablus

nablus(config-if)#do   show ip int bri
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            172.16.107.19   YES DHCP   up                    up
FastEthernet0/1            unassigned      YES unset  up                    up
FastEthernet0/1.10         192.168.1.225   YES manual up                    up
FastEthernet0/1.20         192.168.2.1     YES manual up                    up
FastEthernet0/1.30         192.168.0.1     YES manual up                    up
FastEthernet0/1.40         192.168.1.129   YES manual up                    up
FastEthernet0/1.50         192.168.1.193   YES manual up                    up
Serial0/0/0                192.168.2.33    YES manual up                    up
Serial0/0/1                unassigned      YES unset  administratively down down
NVI0                       172.16.107.19   YES unset  up                    up
```

Figure 6: DHCP

5. After that, we configure PAT(port address translate) to can connect to internet, the configuration will done in nablus router, also we configre access list for that pool as shown in figure 7.

```
interface Serial0/0/0
 ip address 192.168.2.33 255.255.255.252
 ip nat inside
 ip virtual-reassembly in
 clock rate 2000000
!
interface Serial0/0/1
 no ip address
 shutdown
 clock rate 2000000
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
!
ip nat inside source list 1 interface FastEthernet0/0 overload
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
ip route 192.168.1.0 255.255.255.128 Serial0/0/0
!
access-list 1 permit 192.168.0.0 0.0.255.255
!
```

Figure 7: configure PAT

6. In the last, we verify the connection and the pat configuration as shown in figures 8 , 9 and 10.

```
C:\Users\User>ping zajel.najah.edu

Pinging zajel.najah.edu [172.67.27.164] with 32 bytes of data:
Reply from 172.67.27.164: bytes=32 time=2ms TTL=52
Reply from 172.67.27.164: bytes=32 time=2ms TTL=52
Reply from 172.67.27.164: bytes=32 time=16ms TTL=52
Reply from 172.67.27.164: bytes=32 time=18ms TTL=52

Ping statistics for 172.67.27.164:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 18ms, Average = 9ms
```

Figure 8: Ping AL-Zajel

```
Pinging www.google.com [142.250.186.68] with 32 bytes of data:
Reply from 142.250.186.68: bytes=32 time=57ms TTL=51
Reply from 142.250.186.68: bytes=32 time=68ms TTL=51
Reply from 142.250.186.68: bytes=32 time=61ms TTL=51
Reply from 142.250.186.68: bytes=32 time=57ms TTL=51

Ping statistics for 142.250.186.68:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 57ms, Maximum = 68ms, Average = 60ms
```

Figure 9: Ping Google

```
nablus# show ip nat translations
Pro Inside global      Inside local       Outside local      Outside global
tcp 172.16.107.19:61956 192.168.0.2:61956 20.198.162.76:443  20.198.162.76:443
tcp 172.16.107.19:61975 192.168.0.2:61975 34.120.186.93:443  34.120.186.93:443
tcp 172.16.107.19:61976 192.168.0.2:61976 35.241.46.245:443  35.241.46.245:443
tcp 172.16.107.19:61982 192.168.0.2:61982 35.241.46.245:443  35.241.46.245:443
tcp 172.16.107.19:61985 192.168.0.2:61985 142.250.186.174:443 142.250.186.174:443
tcp 172.16.107.19:61988 192.168.0.2:61988 34.120.232.48:443  34.120.232.48:443
tcp 172.16.107.19:61989 192.168.0.2:61989 142.250.185.202:443 142.250.185.202:443
tcp 172.16.107.19:62035 192.168.0.2:62035 8.8.8.8:443        8.8.8.8:443
tcp 172.16.107.19:62040 192.168.0.2:62040 34.120.186.93:443  34.120.186.93:443
tcp 172.16.107.19:62042 192.168.0.2:62042 8.8.8.8:443        8.8.8.8:443
tcp 172.16.107.19:62043 192.168.0.2:62043 34.107.195.226:443 34.107.195.226:443
tcp 172.16.107.19:62045 192.168.0.2:62045 34.107.195.226:443 34.107.195.226:443
tcp 172.16.107.19:62048 192.168.0.2:62048 172.16.107.254:80  172.16.107.254:80
tcp 172.16.107.19:62049 192.168.0.2:62049 172.16.107.254:80  172.16.107.254:80
udp 172.16.107.19:50304 192.168.1.2:50304 216.239.32.116:443 216.239.32.116:443
udp 172.16.107.19:52197 192.168.1.2:52197 142.250.186.174:443 142.250.186.174:443
udp 172.16.107.19:52517 192.168.1.2:52517 142.250.185.131:443 142.250.185.131:443
Pro Inside global      Inside local       Outside local      Outside global
udp 172.16.107.19:52804 192.168.1.2:52804 142.250.185.227:443 142.250.185.227:443
udp 172.16.107.19:56491 192.168.1.2:56491 172.217.23.115:443 172.217.23.115:443
udp 172.16.107.19:56846 192.168.1.2:56846 8.8.8.8:443        8.8.8.8:443
udp 172.16.107.19:57942 192.168.1.2:57942 142.250.185.138:443 142.250.185.138:443
udp 172.16.107.19:58299 192.168.1.2:58299 216.58.212.142:443 216.58.212.142:443
udp 172.16.107.19:60130 192.168.1.2:60130 35.241.46.245:443  35.241.46.245:443
tcp 172.16.107.19:62078 192.168.1.2:62078 93.184.220.29:80   93.184.220.29:80
```

Figure 10: Verify pat