University of Porto
Faculdade de Engenharia

IP addressing and DNS Service
Lab work 3

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Contents

1   Introduction

The purpose of this assignment is better understand the requirements of the IP addressing scheme and purpose of DNS.

2   IP addressing – Part 1

The final assignment of addresses is in Table 1.

|	NETWORK	BROADCAST	GATEWAY	DNS
HEADQUARTERS	192.168.2.0/23	192.168.3.255	192.168.3.254	192.168.2.1
STORE1_VLAN1	192.168.0.0/27	192.168.0.31	192.168.0.30	192.168.0.1
STORE1_VLAN2	192.168.0.32/27	192.168.0.63	192.168.0.62	192.168.0.33
STORE2_VLAN1	192.168.0.64/27	192.168.0.95	192.168.0.94	192.168.0.65
STORE2_VLAN2	192.168.0.96/27	192.168.0.127	192.168.0.126	192.168.0.97
STORE3_VLAN1	192.168.0.128/27	192.168.0.159	192.168.0.158	192.168.0.129
STORE3_VLAN2	192.168.0.160/27	192.168.0.191	192.168.0.190	192.168.0.161
WAREHOUSE	192.168.0.192/27	192.168.0.223	192.168.0.222	192.168.0.193
DMZ	20.49.51.160/28	20.49.51.175	20.49.51.174	20.49.51.161
HEADQUARTERS_SERVER	192.168.0.224/28	192.168.0.239	192.168.0.238	192.168.0.225

Table 1: Configuration of IP addresses
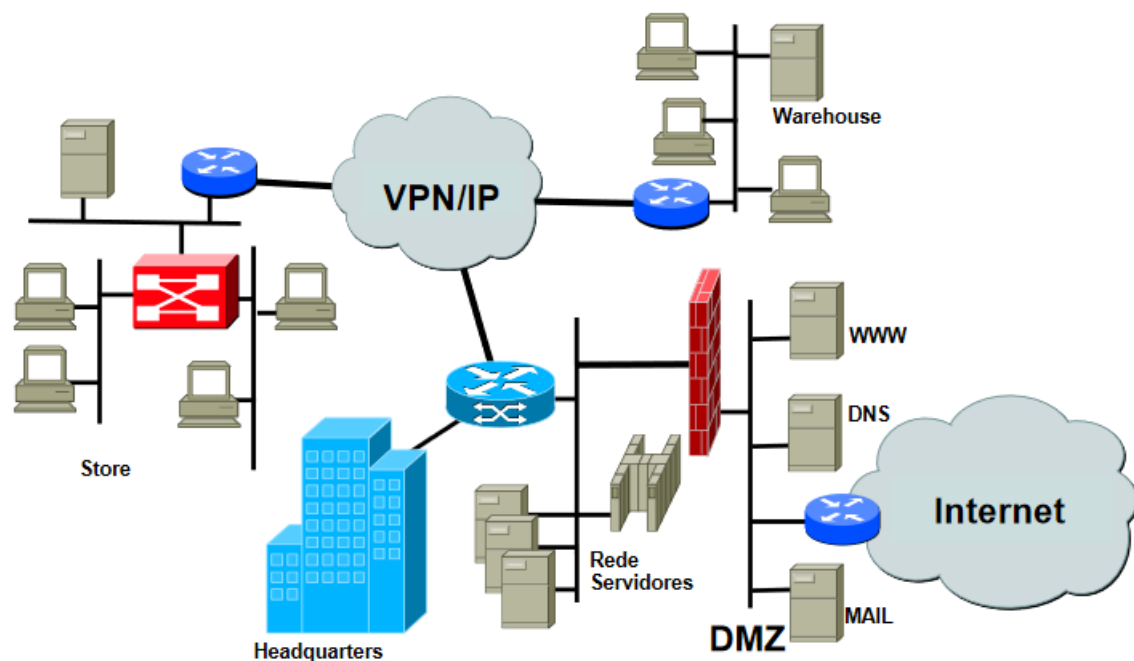
Figure 1: Scheme of Enterprise system

Switch	Host	Vlan	Network	IP	Location	Gateway	
Fa0/1	gnu31	eth0	1	172.16.1.0/24			
Fa0/19		eth1	5	20.49.51.160/28	20.49.51.161	DMZ	20.49.51.174
Fa0/2	gnu32	eth0	1	172.16.1.0/24			
Fa0/13		eth1	3	192.168.0.192/27	192.168.0.193	Warehouse	192.168.0.222
Fa0/3	gnu33	eth0	1	172.16.1.0/24			
Fa0/15		eth1	4	192.168.0.224/28	192.168.0.225	HQ	192.168.0.238
Fa0/4	gnu34	eth0	1	172.16.1.0/24			
Fa0/17		eth1	2	192.168.0.0/27	192.168.0.1	Store1	192.168.0.30

Table 2: Table with detailed configuration

3   DNS – Part 2

Our task was to configure the DNS service for the company QQUMA Ltd, with the domain **qquma.pt**. The first section describes configuration and set-up of computers and the second section shows results.

3.1   Configuration of DNS

In Figure 2 there is our scheme using four computers to simulate given scenario. Warehouse (TUX2) was configured as a DNS cache server that forwards all DNS requests to the main server located in the headquarters (ip 192.168.0.225) – option *forward only*. All zones information are synchronized by master. Warehouse configuration can be seen in Listing 6. Similar configuration is for computer TUX4 (Store1).

The most difficult set up was for primary server on TUX3. The configuration of *named.conf* is located in Listing 7. Headquarters forwards Intranet to external DNS server with Internet connectivity (to IP address 20.49.51.161). It has two view – internal for his zones (company IP addresses) and external for the rest of the world. For this reason we had to create two zone files - one for external queries (*db.out_ qquma.pt*) and one for internal (*/etc/bind/db.qquma.pt*) as can be seen in Listing 7.

DMZ (demilitarized zone of the network) serves as a direct connection to the Internet. There are only servers visible from the outside: DNS (*ns.qquama.pt*), E-mail (*mail.qquma.pt*) and Web (*www.qquma.pt*) as is shown in zone configuration file (*db.qqumaoutside.pt*) in Listing 5.
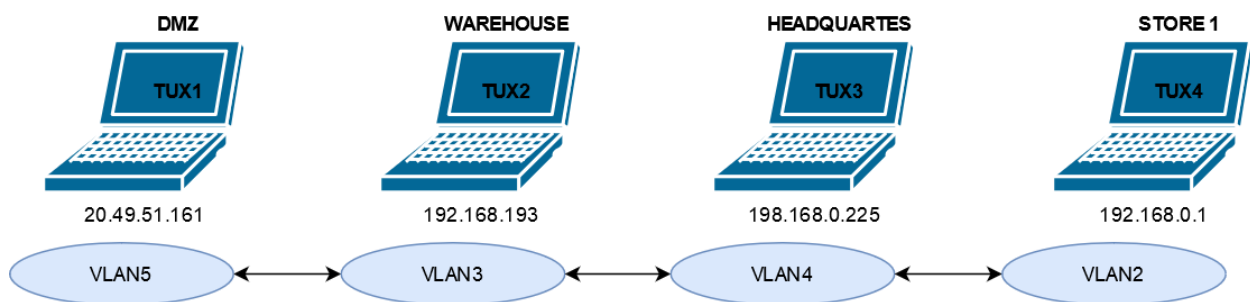

Figure 2: Graphical scheme of computer's set up

3.2 Results

We activated the generation of logs for the BIND servers on each computer and we tested if the setting is correct. On each computer we made requests on 4 different services (web, email, proxy, local) and we uploaded the results to this report. To prove the proper functioning we also added logs of one query. Logs are stored in */var/log/syslog* file.

TUX1 – DMZ

DNZ is a host that deals with DNS queries on Internet domain. There are installed only servers visible from the outside: Web, E-mail and DNS, that is why it does not know other internal services.

(a) Look up name server for www.qquma.pt

(b) Look up name server for mail.qquma.pt

(c) Look up name server for proxy.lojaX.qquma.pt

(d) Look up name server for armazem.qquma.pt

Figure 3: DNS requests on TUX1 (DMZ)

TUX2 – WAREHOUSE

Warehouse is the cache server that forwards the query to headquarters as can be seen in Figure 4.

Listing 1: Logs after lookup www.qquma.pt

```
Apr 29 15:18:43 localhost named[23551]: client @0x7f3e1003c690 192.168.0.193#45435
    (www.qquma.pt): query: www.qquma.pt IN AAAA + (192.168.0.193)

Apr 29 15:18:46 localhost named[23551]: client @0x7f3e1003c690 192.168.0.193#49335
    (11.109.168.192.in-addr.arpa): query: 11.109.168.192.in-addr.arpa IN PTR +
    (192.168.0.193))
```

(a) Look up name server for www.qquma.pt

(b) Look up name server for mail.qquma.pt

(c) Look up name server for proxy.lojaX.qquma.pt

(d) Look up name server for armazem.qquma.pt

Figure 4: DNS requests on TUX2 (WAREHOUSE)

TUX3 – HEADQUARTERS

In computer 3 there is a solution for split DNS using 2 views. The internal view points to private IP addresses and the external view points to public IP addresses.

Listing 2: Logs after lookup www.qquma.pt from internal and then external view

```
Apr 29 14:47:43 localhost named[30126]: client @0x7fd34000bc60 192.168.0.225#46210
    (www.qquma.pt): view internal: query: www.qquma.pt IN A + (192.168.0.225)

Apr 29 14:47:43 localhost named[30126]: client @0x7fd3500bbf40 192.168.0.225#33799
    (www.qquma.pt): view internal: query: www.qquma.pt IN AAAA + (192.168.0.225)

Apr 29 14:47:44 localhost named[30126]: client @0x7fd3500bbf40 192.168.0.225#34616
    (11.109.168.192.in-addr.arpa): view internal: query: 11.109.168.192.in-addr.arpa IN PTR
    + (192.168.0.225)

Apr 29 16:22:17 localhost named[30126]: client @0x7fd34000bc60 20.49.51.161#34202
    (www.qquma.pt): view external: query: www.qquma.pt IN A +E(0) (192.168.0.225)

Apr 29 16:22:17 localhost named[30126]: client @0x7fd3500bbf40 20.49.51.161#43304
    (11.109.168.192.in-addr.arpa): view external: query: 11.109.168.192.in-addr.arpa IN PTR
    + (192.168.0.225)
```

(a) Look up name server for www.qquma.pt

(b) Look up name server for mail.qquma.pt

(c) Look up name server for proxy.lojaX.qquma.pt

(d) Look up name server for armazem.qquma.pt

Figure 5: DNS requests on TUX3 (HEADQUARTERS)

TUX4 – STORE 1

The store is composed by the DNS server and the HTTP proxy.

Listing 3: Logs after lookup www.qquma.pt

```
Apr 29 15:21:10 localhost named[18034]: client @0x7f53a00e4280 192.168.0.1#49452
    (www.qquma.pt): query: www.qquma.pt IN A + (192.168.0.1)

Apr 29 15:21:10 localhost named[18034]: client @0x7f53a00e4280 192.168.0.1#37900
    (www.qquma.pt): query: www.qquma.pt IN AAAA + (192.168.0.1)
```


(a) Look up name server for www.qquma.pt

(b) Look up name server for mail.qquma.pt

(c) Look up name server for proxy.lojaX.qquma.pt

(d) Look up name server for armazem.qquma.pt

Figure 6: DNS requests on TUX4 (STORE1)

4   Conclusion

We managed to accomplish successfully the tasks given in Part 1 and the Part 2 of the assignment. We felt that was a little complicated at first to configure the workbench remotely because there were always small errors that could only be solved in the laboratory and that took us a lot of work time. As a consequence of this we agreed not to make the NAT configuration that theoretically would give Internet access to the DMZ computer and that would allow the resolution of public addresses requested by the Intranet.

References

[1]   *DNS. [Online, last update 08.3.2020]. URL* `https://en.wikipedia.org/wiki/Domain_`
`Name_System`

[2]   *How To Configure BIND as a Private Network DNS Server on Ubuntu 14.04. [Online,*
last update 12.8.2014]. URL `https://www.digitalocean.com/community/tutorials/`
`how-to-configure-bind-as-a-private-network-dns-server-on-ubuntu-14-04`

[3]   *Understanding views in BIND 9, by example [Online, last update 6.9.2018]. URL* `https:`
`//kb.isc.org/docs/aa-00851`

[4]   *Configuring Bind9 logs [Online, last update 9.10.2019]. URL* `https://ixnfo.com/en/`
`configuring-bind9-logs.html`

A   APENDIX

A.1   TUX1 – DMZ

Listing 4: Configuration of /etc/bind/named.conf of TUX1

```
acl "trusted" {
     192.168.0.225; # headquarters
};
options {
        directory "/etc/bind/";
        pid-file       "/var/run/named.pid";
        recursion yes;
        allow-recursion { trusted; };
        listen-on { 20.49.51.161; };
        allow-transfer { trusted; };
        allow-query{any;};
        forwarders {
              8.8.8.8;
              8.8.4.4;
        };
        dnssec-enable yes;
        dnssec-validation yes;
        auth-nxdomain no;  # conform to RFC1035
        listen-on-v6 { any; };
};
zone "qquma.pt" {
        type master;
        file "/etc/bind/db.qqumaoutside.pt";
};
```

Listing 5: Configuration of /etc/bind/db.qqumaoutside.pt of TUX1

```
$TTL    604800
@       IN      SOA     ns.qquma.pt. admin.ns.qquma.pt. (
                            4          ; Serial
                         604800        ; Refresh
                          86400        ; Retry
                        2419200        ; Expire
                         604800 )      ; Negative Cache TTL
;
; name servers - NS records
        IN      NS      ns.qquma.pt.

; name servers - A records
ns.qquma.pt.            IN      A       20.51.49.161
; Rede interna - A records
mail.qquma.pt.          IN      A       20.51.49.161
www.qquma.pt.           IN      A       20.51.49.161
ftp.qquma.pt.           IN      A       20.51.49.161
```

A.2 TUX2 – WAREHOUSE

Listing 6: Configuration of /etc/bind/named.conf of TUX2

```
acl "trusted" {
        192.168.0.225;
        192.168.0.193;
        192.168.0.1;
        20.49.51.161;
};
options {
        directory       "/etc/bind/";
        pid-file        "/var/run/named.pid";
        recursion yes;
        allow-recursion { trusted; };
        listen-on { 192.168.0.193; };
        allow-transfer { trusted; };
        forwarders {
                192.168.0.225;
        };
        forward only;
        dnssec-enable yes;
        dnssec-validation yes;
        auth-nxdomain no;  # conform to RFC1035
        listen-on-v6 { any; };
};
zone "qquma.pt" {
        type slave;
        masters{192.168.0.225;};
        file "/etc/bind/db.qquma.pt";
};
```

A.3 TUX3 – HEADQUARTERS

Listing 7: Configuration of /etc/bind/named.conf of TUX3

```
acl "trusted" {
        192.168.0.225; # host33 - tux33 HQ
        192.168.0.193; # tux32 warehouse
        192.168.0.1;  # host34 - tux34 Store_1
        20.49.51.161;
};
options {
        directory       "/etc/bind/";
        pid-file        "/var/run/named.pid";
        recursion yes;
        allow-recursion { trusted; };
        listen-on { 192.168.0.225;};
        forwarders {
                20.49.51.161;
        };
        dnssec-enable yes;
        dnssec-validation yes;
        auth-nxdomain no;  # conform to RFC1035
        listen-on-v6 { any; };
};
acl "company" { 192.168.0.0/21; };

view "internal" {
        match-clients { "company"; };

        allow-recursion { "company"; };
        zone "qquma.pt" {
                type master;
                file "/etc/bind/db.qquma.pt";
        };
};
view "external" {
        match-clients { any; };
        zone "qquma.pt" {
                type master;
                file "/etc/bind/db.out_qquma.pt";
        };
};
```

Listing 8: Configuration of /etc/bind/db.qquma.pt of TUX3

```
$TTL    604800
@       IN      SOA     ns.qquma.pt. admin.ns.qquma.pt. (
                            5           ; Serial
                        604800          ; Refresh
                         86400          ; Retry
                       2419200          ; Expire
                        604800 )        ; Negative Cache TTL
;
; name servers - NS records
        IN      NS      ns.qquma.pt.

; name servers - A records
ns.qquma.pt.   IN     A       192.168.0.225
; Rede interna - A records
```

```
mail.qquma.pt.        IN    A     192.168.0.225
www.qquma.pt.         IN    A     192.168.0.225
ns.lojaX.qquma.pt.    IN    A     192.168.0.1
proxy.lojaX.qquma.pt. IN    A     192.168.0.1
armazem.qquma.pt.     IN    A     192.168.0.193
```

Listing 9: Configuration of /etc/bind/db.out_qquma.pt of TUX3

```
$TTL    604800
@       IN    SOA     ns.qquma.pt. admin.ns.qquma.pt. (
                          5         ; Serial
                     604800         ; Refresh
                      86400         ; Retry
                    2419200         ; Expire
                     604800 )       ; Negative Cache TTL
;
; name servers - NS records
        IN    NS      ns.qquma.pt.

; name servers - A records
ns.qquma.pt.   IN     A      20.49.51.161
; Rede interna - A records
mail.qquma.pt.        IN    A      20.49.51.161
www.qquma.pt.         IN    A      20.49.51.161
```

A.4 TUX4 – STORE

```
acl "trusted" {
        192.168.0.193;  #  tux32 warehouse
        192.168.0.225;  # host1 - tux33 HQ
        192.168.0.1;  # host2 - tux34 Store_1
   20.49.51.161;
};

options {
        directory       "/etc/bind/";
        pid-file        "/var/run/named.pid";
        recursion yes;
        allow-recursion { trusted; };
        listen-on { 192.168.0.1; };
        allow-transfer { trusted;};

        forwarders {
                192.168.0.225;
        };


        //========================================================================
        // If BIND logs error messages about the root key being expired,
        // you will need to update your keys. See https://www.isc.org/bind-keys
        //========================================================================
        #dnssec-validation auto;
       dnssec-enable yes;
        dnssec-validation yes;

        auth-nxdomain no;  # conform to RFC1035
        listen-on-v6 { any; };
};

        zone "qquma.pt" {
            type slave;
          masters{192.168.0.225;};
          file "/etc/bind/db.qquma.pt";

};
```