Universidade do Minho
Escola de Engenharia
Licenciatura em Engenharia Informática

COMUNICAÇÕES POR COMPUTADOR

TP3: Serviço de Resolução de Nomes (DNS)

2021/2022

PL7 – Grupo 77

Joana Alves A93290

Jorge Vieira A84240

PARTE I

ALÍNEA A) *Qual o conteúdo do ficheiro /etc/resolv.conf e para que serve essa informação?*

Resposta: O ficheiro */etc/resolv.conf* é um ficheiro de texto dinâmico, criado pelo administrador de rede ou por aplicações que gerem as tarefas de configuração do sistema, que conecta clientes locais ao DNS e lista todos os domínios de pesquisa configurados.

ALÍNEA B) *Os servidores* www.di.uminho.pt. *e* www.europa.eu. *têm endereços IPv6? Se sim, quais?*

```
core@xubuncore:~$ nslookup www.europa.eu.
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
www.europa.eu   canonical name = ip-europa.ec.europa.eu.
Name:   ip-europa.ec.europa.eu
Address: 147.67.34.25
Name:   ip-europa.ec.europa.eu
Address: 147.67.210.25
Name:   ip-europa.ec.europa.eu
Address: 2a01:7080:24:100::666:25
Name:   ip-europa.ec.europa.eu
Address: 2a01:7080:14:100::666:25

core@xubuncore:~$ nslookup www.di.uminho.pt.
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
www.di.uminho.pt        canonical name = www5.di.uminho.pt.
Name:   www5.di.uminho.pt
Address: 193.136.19.38

core@xubuncore:~$
```

Figura 1 - Endereços www.europa.eu e www.di.uminho.pt

Resposta: O servidor *www.di.uminho.pt.* apenas tem endereço IPv4. Já o servidor *www.europa.eu.* possui tanto endereço IPv4 como endereço IPv6, sendo estes últimos: 2a01:7080:24:100::666:25 e 2a01:7080:14:100::666:25.

ALÍNEA C) *Quais os servidores de nomes definidos para os domínios: "*gov.pt.*" e "."?*

```
core@xubuncore:~$ nslookup
> set q=NS
> .
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
.       nameserver = a.root-servers.net.
.       nameserver = d.root-servers.net.
.       nameserver = c.root-servers.net.
.       nameserver = b.root-servers.net.
.       nameserver = j.root-servers.net.
.       nameserver = k.root-servers.net.
.       nameserver = g.root-servers.net.
.       nameserver = m.root-servers.net.
.       nameserver = f.root-servers.net.
.       nameserver = e.root-servers.net.
.       nameserver = h.root-servers.net.
.       nameserver = l.root-servers.net.
.       nameserver = i.root-servers.net.

Authoritative answers can be found from:
>
```

Figura 2 – Servidores de Nome do domínio "."

```
core@xubuncore:~$ nslookup
> set q=NS
> gov.pt.
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
gov.pt  nameserver = ns02.fccn.pt.
gov.pt  nameserver = dns1.gov.pt.
gov.pt  nameserver = a.dns.pt.
gov.pt  nameserver = europe1.dnsnode.net.
gov.pt  nameserver = nsp.dnsnode.net.

Authoritative answers can be found from:
> .
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
.       nameserver = h.root-servers.net.
.       nameserver = f.root-servers.net.
.       nameserver = d.root-servers.net.
.       nameserver = k.root-servers.net.
.       nameserver = j.root-servers.net.
.       nameserver = b.root-servers.net.
.       nameserver = c.root-servers.net.
.       nameserver = e.root-servers.net.
.       nameserver = g.root-servers.net.
.       nameserver = i.root-servers.net.
.       nameserver = a.root-servers.net.
.       nameserver = m.root-servers.net.
.       nameserver = l.root-servers.net.

Authoritative answers can be found from:
>
```

Figura 3 - Servidores de Nome do domínio "gov.pt."

ALÍNEA D) *Existe o domínio* efiko.academy.*? Com base na informação obtida do DNS, nomeadamente os registos associados a esse nome, diga se o considera um* host *ou um* domínio de nomes.

```
core@xubuncore:~$ nslookup
> set q=NS
> efiko.academy.
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
efiko.academy   nameserver = ns4.combell.net.
efiko.academy   nameserver = ns3.combell.net.

Authoritative answers can be found from:
>
```

Figura 4 - Query Name Server para o domínio "efiko.academy."

Resposta: Como o domínio *efiko.academy.* possui servidores de nome, então concluímos que é *host*.

ALÍNEA E) *Qual é o servidor DNS primário definido para o domínio* gov.pt.? *Este servidor primário (*master*) aceita* queries *recursivas? Porquê?*

```
core@xubuncore:~$ nslookup -type=soa gov.pt.
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
gov.pt
        origin = dnssec.gov.pt
        mail addr = dns.ceger.gov.pt
        serial = 2019072050
        refresh = 18000
        retry = 7200
        expire = 2419200
        minimum = 86400

Authoritative answers can be found from:
```

Figura 5 - Query SOA para o domínio "gov.pt."

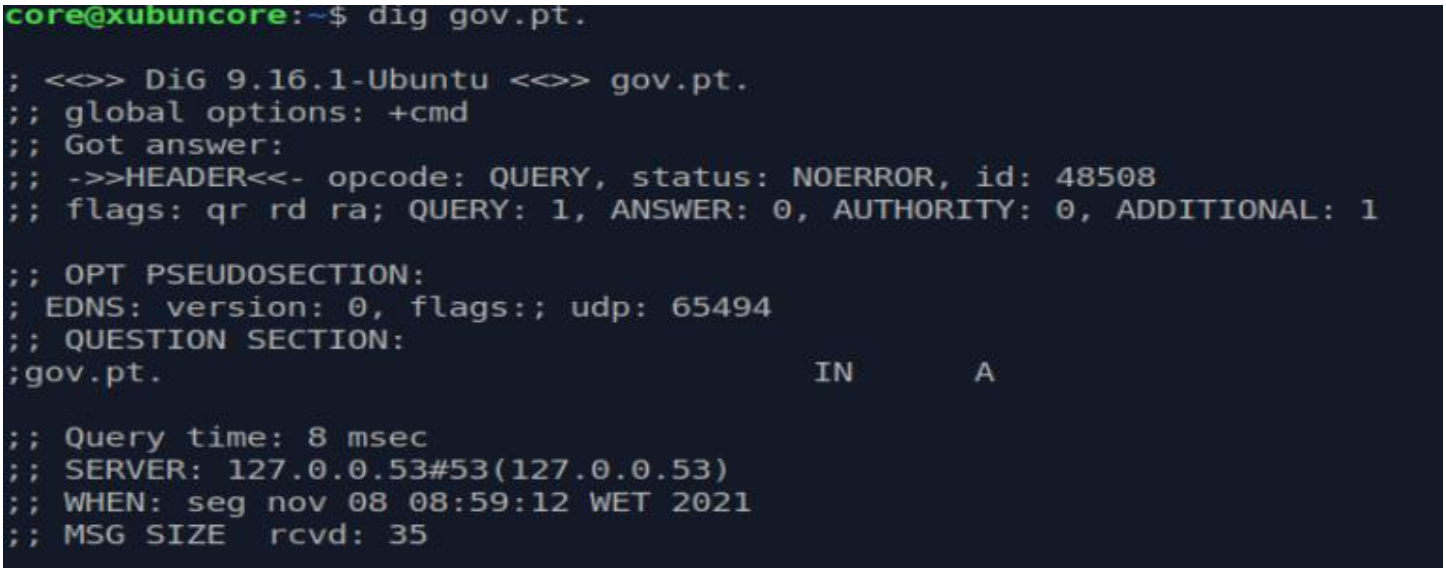

Figura 6 - Comando 'dig' para o domínio "gov.pt."

Resposta: O servidor primário do domínio "gov.pt." é "dnssec.gov.pt" e este aceita *queries* recursivas uma vez que na execução do comando 'dig gov.pt.', a flag 'ra' está disponível.

ALÍNEA F) *Obtenha uma resposta "autoritativa" para a questão anterior.*

R: Não conseguimos obter uma resposta autoritativa uma vez que, como demonstrado pela Figura 5, não existe a possibilidade de 'authorititative answers'.

ALÍNEA G) *Onde são entregues as mensagens de correio eletrónico dirigidas a marcelo@presidencia.pt?*

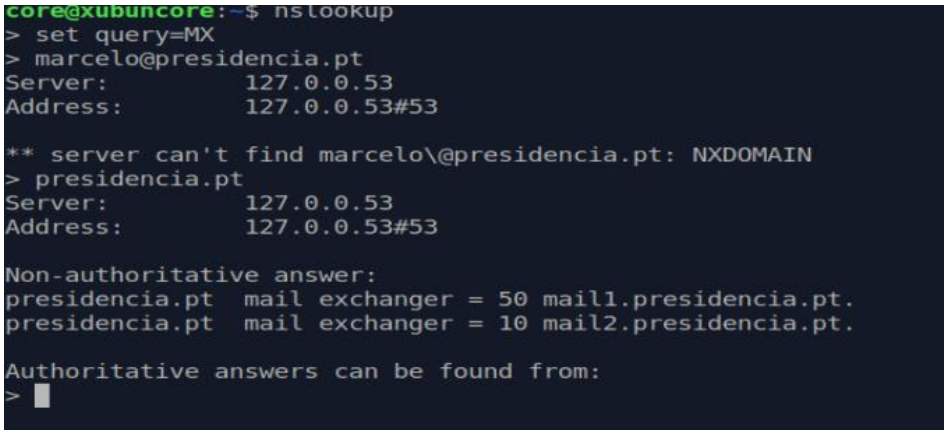

Figura 7 - Mail Servers do domínio "presidencia.pt"

R: As mensagens de correio eletrónico são entregues em: "mail1.presidencia.pt" e "mail2.presidencia.pt".

ALÍNEA H) *Que informação é possível obter, via DNS, acerca de gov.pt?*

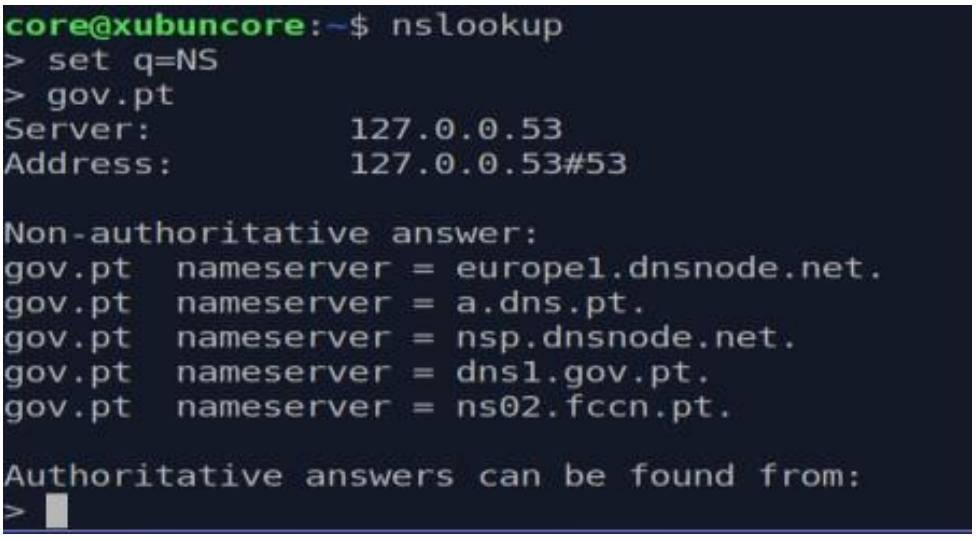

Figura 8 - Servidores de Nome do domínio "gov.pt"

R: Para além disto, conseguimos obter a informação presente na Figura 6 através do comando 'dig gov.pt'.

ALÍNEA I) *Consegue interrogar o DNS sobre o endereço IPv6 2001:690:2080:8005::38 usando algum dos clientes DNS? Que informação consegue obter? Supondo que teve problemas com esse endereço, consegue obter um contacto do responsável por esse IPv6?*

Figura 9 - Dedução do domínio através do endereço IPv6

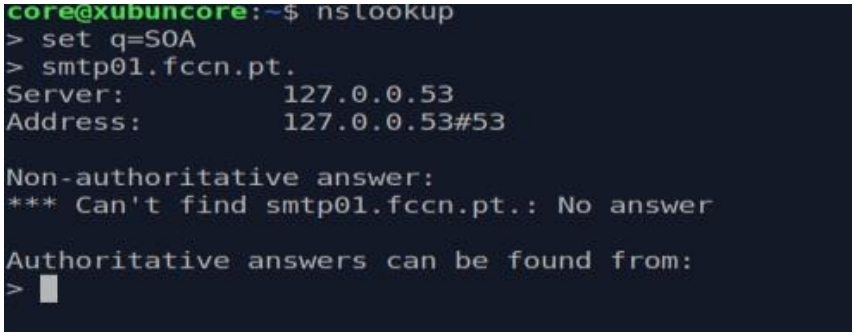

Figura 10 - Domínio "smtp01.fccn.pt." não encontrado

R: Através da execução de uma query de PTR (pointer) do nslookup, conseguimos obter o domínio "smtp01.fccn.pt.", no entanto, não conseguimos obter nenhuma informação sobre o mesmo como mostra a figura 10.

ALÍNEA J) *Os secundários usam um mecanismo designado por "*Transferência de zona*" para se atualizarem automaticamente a partir do primário, usando os parâmetros definidos no Record do tipo SOA do domínio. Descreve sucintamente esse mecanismo com base num exemplo concreto (ex:* uminho.pt*).*

R: A transferência de zona DNS é uma *query* DNS usada para replicar uma zona ou a totalidade da base de dados do servidor DNS que a recebe. A transferência é feita através de uma ligação TCP que inicia uma verificação. Essa verificação determina se a transferência é necessária, pois em caso do conteúdo do servidor que envia o pedido for igual ao do servidor consultado, a transferência é anulada, uma vez que a base de dados é a mesma e, portanto, não necessita de atualização.

PARTE II

PASSO 1)

```
core@xubuncore:~$ cd ~/primario; ls;
bind.keys   db.255     named.conf                named.conf.options
db.0        db.empty   named.conf.default-zones  rndc.key
db.127      db.local   named.conf.local          zones.rfc1918
core@xubuncore:~/primario$
```

```
core@xubuncore:~$ cd ~/secundario; ls;
bind.keys   db.255     named.conf                named.conf.options
db.0        db.empty   named.conf.default-zones  rndc.key
db.127      db.local   named.conf.local          zones.rfc1918
core@xubuncore:~/secundario$
```

PASSO 2)

```
● named.service - BIND Domain Name Server
     Loaded: loaded (/lib/systemd/system/named.service; enabled; vendor preset: enabled)
     Active: active (running) since Wed 2021-11-17 14:00:16 WET; 1h 36min ago
       Docs: man:named(8)
   Main PID: 539 (named)
      Tasks: 5 (limit: 2312)
     Memory: 25.4M
     CGroup: /system.slice/named.service
             └─539 /usr/sbin/named -f -u bind

nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './DNSKEY/IN': 2001:7fd::1#53
nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './NS/IN': 2001:7fd::1#53
nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './DNSKEY/IN': 2001:500:1::53#53
nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './NS/IN': 2001:500:1::53#53
nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './DNSKEY/IN': 2001:500:200::b#53
nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './NS/IN': 2001:500:200::b#53
nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './DNSKEY/IN': 2001:500:2d::d#53
nov 17 15:00:18 xubuncore named[539]: network unreachable resolving './NS/IN': 2001:500:2d::d#53
nov 17 15:00:19 xubuncore named[539]: managed-keys-zone: Key 20326 for zone . is now trusted (acceptance timer complete)
nov 17 15:00:19 xubuncore named[539]: resolver priming query complete
~
~
```

```
core@xubuncore:~$ sudo systemctl status bind9.service
● named.service - BIND Domain Name Server
     Loaded: loaded (/lib/systemd/system/named.service; enabled; vendor preset: enabled)
     Active: inactive (dead) since Wed 2021-11-17 15:38:04 WET; 9s ago
       Docs: man:named(8)
    Process: 539 ExecStart=/usr/sbin/named -f $OPTIONS (code=exited, status=0/SUCCESS)
    Process: 1895 ExecStop=/usr/sbin/rndc stop (code=exited, status=0/SUCCESS)
   Main PID: 539 (code=exited, status=0/SUCCESS)

nov 17 15:38:03 xubuncore named[539]: no longer listening on 127.0.0.1#53
nov 17 15:38:03 xubuncore named[539]: no longer listening on ::1#53
nov 17 15:38:03 xubuncore named[539]: no longer listening on fe80::1521:1260:7f1d:c627%2#53
nov 17 15:38:03 xubuncore named[539]: no longer listening on 10.0.2.15#53
nov 17 15:38:03 xubuncore named[539]: shutting down: flushing changes
nov 17 15:38:03 xubuncore named[539]: stopping command channel on 127.0.0.1#953
nov 17 15:38:03 xubuncore named[539]: stopping command channel on ::1#953
nov 17 15:38:04 xubuncore named[539]: exiting
nov 17 15:38:04 xubuncore systemd[1]: named.service: Succeeded.
nov 17 15:38:04 xubuncore systemd[1]: Stopped BIND Domain Name Server.
core@xubuncore:~$
```

PASSO 3)

```
core@xubuncore:~$ sudo systemctl status apparmor.service
● apparmor.service - Load AppArmor profiles
     Loaded: loaded (/lib/systemd/system/apparmor.service; enabled; vendor preset: enabled)
     Active: active (exited) since Wed 2021-11-17 14:00:15 WET; 1h 39min ago
       Docs: man:apparmor(7)
             https://gitlab.com/apparmor/apparmor/wikis/home/
    Process: 394 ExecStart=/lib/apparmor/apparmor.systemd reload (code=exited, status=0/SUCCESS)
   Main PID: 394 (code=exited, status=0/SUCCESS)

nov 17 14:00:14 xubuncore systemd[1]: Starting Load AppArmor profiles...
nov 17 14:00:14 xubuncore apparmor.systemd[394]: Restarting AppArmor
nov 17 14:00:14 xubuncore apparmor.systemd[394]: Reloading AppArmor profiles
nov 17 14:00:14 xubuncore apparmor.systemd[411]: Skipping profile in /etc/apparmor.d/disable: usr.bin.firefox
nov 17 14:00:15 xubuncore apparmor.systemd[415]: Skipping profile in /etc/apparmor.d/disable: usr.sbin.rsyslogd
nov 17 14:00:15 xubuncore systemd[1]: Finished Load AppArmor profiles.
core@xubuncore:~$
```

Figura 11 - Apparmor pré-alteração do ficheiro

```
# /etc/bind should be read-only for bind
# /var/lib/bind is for dynamically updated zone (and journal) files.
# /var/cache/bind is for slave/stub data, since we're not the origin of it.
# See /usr/share/doc/bind9/README.Debian.gz
/etc/bind/** r,
/home/core/primario/** r,
/home/core/secundario/** r,
/var/lib/bind/** rw,
/var/lib/bind/ rw,
/var/cache/bind/** lrw,
/var/cache/bind/ rw,
```

Figura 122 - Alteração do ficheiro

```
core@xubuncore:~$ sudo systemctl status apparmor.service
● apparmor.service - Load AppArmor profiles
     Loaded: loaded (/lib/systemd/system/apparmor.service; enabled; vendor preset: enabled)
     Active: active (exited) since Wed 2021-11-17 15:41:42 WET; 8s ago
       Docs: man:apparmor(7)
             https://gitlab.com/apparmor/apparmor/wikis/home/
    Process: 1934 ExecStart=/lib/apparmor/apparmor.systemd reload (code=exited, status=0/SUCCESS)
   Main PID: 1934 (code=exited, status=0/SUCCESS)

nov 17 15:41:42 xubuncore systemd[1]: Starting Load AppArmor profiles...
nov 17 15:41:42 xubuncore apparmor.systemd[1934]: Restarting AppArmor
nov 17 15:41:42 xubuncore apparmor.systemd[1934]: Reloading AppArmor profiles
nov 17 15:41:42 xubuncore apparmor.systemd[1944]: Skipping profile in /etc/apparmor.d/disable: usr.bin.firefox
nov 17 15:41:42 xubuncore apparmor.systemd[1948]: Skipping profile in /etc/apparmor.d/disable: usr.sbin.rsyslogd
nov 17 15:41:42 xubuncore systemd[1]: Finished Load AppArmor profiles.
core@xubuncore:~$
```

Figura 13 - Apparmor pós-alteração do ficheiro

2.1. CONFIGURAÇÃO DO SERVIDOR PRIMÁRIO

1)

```
core@xubuncore:~$ cat /etc/hosts
127.0.0.1       localhost
127.0.1.1       xubuncore

10.2.2.1 Servidor1 ns.cc.pt
10.3.3.2 Golfinho ns2.cc.pt


110.2 The following lines are desirable for IPv6 capable hosts
::1     ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
core@xubuncore:~$
```

2)

```
core@xubuncore:~$ cat primario/named.conf.options
options {
        directory "/var/cache/bind";

        // If there is a firewall between you and nameservers you want
        // to talk to, you may need to fix the firewall to allow multiple
        // ports to talk.  See http://www.kb.cert.org/vuls/id/800113

        // If your ISP provided one or more IP addresses for stable
        // nameservers, you probably want to use them as forwarders.
        // Uncomment the following block, and insert the addresses replacing
        // the all-0's placeholder.

         forwarders {
                193.136.9.240;
                193.136.19.1;
        };

        //========================================================================
        // 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;

        listen-on-v6 { any; };
};
core@xubuncore:~$
```

3)

```
core@xubuncore:~$ cat primario/named.conf
// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, *BEFORE* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/home/core/primario/named.conf.options";
include "/home/core/primario/named.conf.local";
include "/home/core/primario/named.conf.default-zones";
core@xubuncore:~$
```

```
core@xubuncore:~$ cat primario/named.conf.default-zones
// prime the server with knowledge of the root servers
zone "." {
        type hint;
        file "/usr/share/dns/root.hints";
};

// be authoritative for the localhost forward and reverse zones, and for
// broadcast zones as per RFC 1912

zone "cc.pt" {
        type master;
        file "/home/core/primario/db.cc.pt";
        allow-transfer{10.3.3.2};
};

zone "2.2.10.in-addr.arpa" {
        type master;
        file "/home/core/primario/db.2-2-10.rev";
        allow-transfer{10.3.3.2};
};

zone "1.1.10.in-addr.arpa" {
        type master;
        file "/home/core/primario/db.1-1-10.rev";
        allow-transfer{10.3.3.2};
};

zone "3.3.10.in-addr.arpa" {
        type master;
        file "/home/core/primario/db.3-3-10.rev";
        allow-transfer{10.3.3.2};
};

zone "4.4.10.in_addr.arpa" {
        type master;
        file "/home/core/primario/db.4-4-10.rev"
        allow-transfer{10.3.3.2};
};
```

4)

```
$TTL 604800
@       IN      SOA     ns.cc.pt. g77pl07.cc.pt. (
                      3     ; Serial
                 604800     ; Refresh
                  86400     ; Retry
                2419200     ; Expire
                 604800 )   ; Negative Cache TTL

;
@               IN      NS      ns.cc.pt.
@               IN      NS      ns2.cc.pt.

Servidor1       IN      A       10.2.2.1
ns              IN      A       10.2.2.1

;
;
Servidor2       IN      A       10.2.2.2
www             IN      CNAME   Servidor2
@               IN      MX      10      Servidor2

Servidor3       IN      A       10.2.2.3
pop             IN      CNAME   Servidor3
imap            IN      CNAME   Servidor3
@               IN      MX      20      Servidor3

;
;

; LAN 3
Orca            IN      A       10.3.3.1
Golfinho        IN      A       10.3.3.2
ns2             IN      A       10.3.3.2
Foca            IN      A       10.3.3.3


; LAN 4
Grilo           IN      A       10.4.4.1
Vespa           IN      A       10.4.4.3
Cigarra         IN      A       10.4.4.2

; LAN 1
Portatil1       IN      A       10.1.1.1
g77             IN      A       10.1.1.1
Portatil2       IN      A       10.1.1.2
Portatil3       IN      A       10.1.1.3
```

Figura 14 - Ficheiro db.cc.pt

5)

```
;
; BIND reverse data file for local loopback interface
;
$TTL    604800
@       IN      SOA     cc.pt.          admin.cc.pt. (
                              3         ; Serial
                         604800         ; Refresh
                          86400         ; Retry
                        2419200         ; Expire
                         604800 )       ; Negative Cache TTL
;

@       IN      NS      ns.cc.pt.
@       IN      NS      ns2.cc.pt.

2.2.10  IN      PTR     ns.cc.pt.
3.3.10  IN      PTR     ns2.cc.pt.


1       IN      PTR     ns.cc.pt.
1       IN      PTR     Servidor1.cc.pt.
2       IN      PTR     mail.cc.pt.
2       IN      PTR     www.cc.pt.
2       IN      PTR     Servidor2.cc.pt.
3       IN      PTR     pop.cc.pt.
3       IN      PTR     imap.cc.pt.
3       IN      PTR     mail2.cc.pt.
3       IN      PTR     Servidor3.cc.pt.
```

Figura 15 - Domínio reverso 2-2-10

```
$TTL 604800
@       IN      SOA     cc.pt.          admin.cc.pt. (
                              3         ; Serial
                         604800         ; Refresh
                          86400         ; Retry
                        2419200         ; Expire
                         604800 )       ; Negative Cache TTL
;

       IN      NS      ns.cc.pt.
       IN      NS      ns2.cc.pt.

2.2.10  IN      PTR     ns.cc.pt.
3.3.10  IN      PTR     ns2.cc.pt.


1       IN      PTR     Portatil1.cc.pt.
1       IN      PTR     g77.cc.pt.
2       IN      PTR     Portatil2.cc.pt.
3       IN      PTR     Portatil3.cc.pt.
```

Figura 16 - Domínio Reverso 1-1-10

```
$TTL    604800
@       IN      SOA     cc.pt.          admin.cc.pt. (
                              3         ; Serial
                         604800         ; Refresh
                          86400         ; Retry
                        2419200         ; Expire
                         604800 )       ; Negative Cache TTL
;

        IN      NS      ns.cc.pt.
        IN      NS      ns2.cc.pt.

2.2.10  IN      PTR     ns.cc.pt.
3.3.10  IN      PTR     ns2.cc.pt.


1       IN      PTR     Orca.cc.pt.
2       IN      PTR     Golfinho.cc.pt.
2       IN      PTR     ns2.cc.pt.
3       IN      PTR     Foca.cc.pt.
```

Figura 17 - Domínio Reverso 3-3-10

```
$TTL 604800
@       IN      SOA     cc.pt.          admin.cc.pt. (
                              3         ; Serial
                         604800         ; Refresh
                          86400         ; Retry
                        2419200         ; Expire
                         604800 )       ; Negative Cache TTL
;

        IN      NS      ns.cc.pt.
        IN      NS      ns2.cc.pt.

2.2.10  IN      PTR     ns.cc.pt.
3.3.10  IN      PTR     ns2.cc.pt.


1       IN      PTR     Grilo.cc.pt.
2       IN      PTR     Vespa.cc.pt.
3       IN      PTR     Cigarra.cc.pt.
```

Figura 18 - Domínio Reverso 4-4-10

6)

```
core@xubuncore:~$ /usr/sbin/named-checkconf -z /home/core/primario/named.conf
zone cc.pt/IN: loaded serial 2
zone 2.2.10.in-addr.arpa/IN: loaded serial 1
zone 1.1.10.in-addr.arpa/IN: loaded serial 1
zone 3.3.10.in-addr.arpa/IN: loaded serial 1
zone 4.4.10.in_addr.arpa/IN: loaded serial 1
zone localhost/IN: loaded serial 2
zone 127.in-addr.arpa/IN: loaded serial 1
zone 0.in-addr.arpa/IN: loaded serial 1
zone 255.in-addr.arpa/IN: loaded serial 1
core@xubuncore:~$
```

```
core@xubuncore:~$ /usr/sbin/named-checkzone cc.pt /home/core/primario/db.cc.pt
zone cc.pt/IN: loaded serial 2
OK
core@xubuncore:~$ /usr/sbin/named-checkzone 1.1.10.in-addr.arpa /home/core/primario/db.1-1-10.rev
zone 1.1.10.in-addr.arpa/IN: loaded serial 1
OK
core@xubuncore:~$ /usr/sbin/named-checkzone 2.2.10.in-addr.arpa /home/core/primario/db.2-2-10.rev
zone 2.2.10.in-addr.arpa/IN: loaded serial 1
OK
core@xubuncore:~$ /usr/sbin/named-checkzone 3.3.10.in-addr.arpa /home/core/primario/db.3-3-10.rev
zone 3.3.10.in-addr.arpa/IN: loaded serial 1
OK
core@xubuncore:~$ /usr/sbin/named-checkzone 4.4.10.in-addr.arpa /home/core/primario/db.4-4-10.rev
zone 4.4.10.in-addr.arpa/IN: loaded serial 1
OK
core@xubuncore:~$
```

7)

```
17-Nov-2021 17:56:23.762 managed-keys-zone: loaded serial 148
17-Nov-2021 17:56:23.762 zone 0.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 17:56:23.762 zone 3.3.10.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 17:56:23.762 zone 1.1.10.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 17:56:23.762 zone 2.2.10.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 17:56:23.774 zone 255.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 17:56:23.778 zone 4.4.10.in_addr.arpa/IN: loaded serial 1
17-Nov-2021 17:56:23.778 zone localhost/IN: loaded serial 2
17-Nov-2021 17:56:23.782 zone 127.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 17:56:23.782 zone cc.pt/IN: loaded serial 2
17-Nov-2021 17:56:23.782 all zones loaded
17-Nov-2021 17:56:23.786 running
17-Nov-2021 17:56:23.786 zone 1.1.10.in-addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 17:56:23.786 zone 3.3.10.in-addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 17:56:23.786 zone 2.2.10.in-addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 17:56:23.786 zone 4.4.10.in_addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 17:56:23.786 zone cc.pt/IN: sending notifies (serial 2)
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:200::b#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:2d::d#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:12::d0d#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:2f::f#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:dc3::35#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:503:ba3e::2:30#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:7fe::53#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:2::c#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:503:c27::2:30#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:1::53#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:7fd::1#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:9f::42#53
17-Nov-2021 17:56:23.786 network unreachable resolving './NS/IN': 2001:500:a8::e#53
17-Nov-2021 17:56:23.806 REFUSED unexpected RCODE resolving './DNSKEY/IN': 193.136.19.1#53
17-Nov-2021 17:56:23.858 managed-keys-zone: Key 20326 for zone . is now trusted (acceptance timer complete)
17-Nov-2021 17:56:23.858 managed-keys.bind.jnl: open: permission denied
17-Nov-2021 17:56:23.858 managed-keys-zone: keyfetch_done:dns_journal_open -> unexpected error
17-Nov-2021 17:56:23.858 managed-keys-zone: error during managed-keys processing (unexpected error): DNSSEC validation may be at risk
17-Nov-2021 17:56:24.150 resolver priming query complete
```

Figura 19 - Últimas linhas do resultado do comando "sudo /usr/sbin/named -c /home/core/primario/named.conf -g"

2.2. CONFIGURAÇÃO DO CLIENTE E TESTE DO PRIMÁRIO

```
core@xubuncore:~$ nslookup - 127.0.0.1
> www.cc.pt
Server:         127.0.0.1
Address:        127.0.0.1#53

www.cc.pt       canonical name = Servidor2.cc.pt.
Name:   Servidor2.cc.pt
Address: 10.2.2.2
>
```

```
17-Nov-2021 18:15:30.495 all zones loaded
17-Nov-2021 18:15:30.495 running
17-Nov-2021 18:15:30.495 zone cc.pt/IN: sending notifies (serial 2)
17-Nov-2021 18:15:30.495 zone 3.3.10.in-addr.arpa/IN: sending notifies (serial 1
)
17-Nov-2021 18:15:30.495 zone 2.2.10.in-addr.arpa/IN: sending notifies (serial 1
)
17-Nov-2021 18:15:30.499 zone 4.4.10.in_addr.arpa/IN: sending notifies (serial 1
)
17-Nov-2021 18:15:30.499 zone 1.1.10.in-addr.arpa/IN: sending notifies (serial 1
)
17-Nov-2021 18:15:31.702 timed out resolving './DNSKEY/IN': 193.136.19.1#53
17-Nov-2021 18:15:32.906 timed out resolving './DNSKEY/IN': 193.136.9.240#53
17-Nov-2021 18:15:40.502 managed-keys-zone: Unable to fetch DNSKEY set '.': time
d out
17-Nov-2021 18:15:40.502 managed-keys.bind.jnl: open: permission denied
17-Nov-2021 18:15:40.502 managed-keys-zone: keyfetch_done:dns_journal_open -> un
expected error
17-Nov-2021 18:15:40.502 managed-keys-zone: error during managed-keys processing
 (unexpected error): DNSSEC validation may be at risk
17-Nov-2021 18:15:40.506 resolver priming query complete
```

Figura 200 - Últimas linhas do resultado do comando "sudo /usr/sbin/named -c /home/core/primario/named.conf" na topologia

```
root@Portatil1:/tmp/pycore.38331/Portatil1.conf# nslookup www.cc.pt 10.2.2.1
Server:         10.2.2.1
Address:        10.2.2.1#53

www.cc.pt       canonical name = Servidor2.cc.pt.
Name:   Servidor2.cc.pt
Address: 10.2.2.2
```

2.3. CONFIGURAÇÃO DO SERVIDOR SECUNDÁRIO

```
core@xubuncore:~$ cat secundario/named.conf.options
options {
        directory "/var/cache/bind/";

        // If there is a firewall between you and nameservers you want
        // to talk to, you may need to fix the firewall to allow multiple
        // ports to talk.  See http://www.kb.cert.org/vuls/id/800113

        // If your ISP provided one or more IP addresses for stable
        // nameservers, you probably want to use them as forwarders.
        // Uncomment the following block, and insert the addresses replacing
        // the all-0's placeholder.

        forwarders {
                193.136.9.240;
                193.136.19.1;
        };

        //========================================================================
        // 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;

        listen-on-v6 { any; };
};
core@xubuncore:~$
```

```
core@xubuncore:~$ cat secundario/named.conf
// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, *BEFORE* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/home/core/secundario/named.conf.options";
include "/home/core/secundario/named.conf.local";
include "/home/core/secundario/named.conf.default-zones";
core@xubuncore:~$
```

```
core@xubuncore:~$ cat secundario/named.conf.local
//
// Do any local configuration here
//

zone "cc.pt" {
        type slave;
        file "db.cc.pt";
        masters {10.2.2.1;};
};

zone "2.2.10.in-addr.arpa" {
        type slave;
        file "db.2-2-10.rev";
        masters{10.2.2.1;};
};

zone "1.1.10.in-addr.arpa" {
        type slave;
        file "db.1-1-10.rev";
        masters {10.2.2.1;};
};

zone "3.3.10.in-addr.arpa" {
        type slave;
        file "db.3-3-10.rev";
        masters {10.2.2.1;};
};

zone "4.4.10.in-addr.arpa" {
        type slave;
        file "db.4-4-10.rev";
        masters {10.2.2.1;};
};
```

```
core@xubuncore:~$ /usr/sbin/named-checkconf -z /home/core/secundario/named.conf
zone localhost/IN: loaded serial 2
zone 127.in-addr.arpa/IN: loaded serial 1
zone 0.in-addr.arpa/IN: loaded serial 1
zone 255.in-addr.arpa/IN: loaded serial 1
core@xubuncore:~$
```

```
17-Nov-2021 19:05:52.841 automatic empty zone: HOME.ARPA
17-Nov-2021 19:05:52.845 none:100: 'max-cache-size 90%' - setting to 1786MB (out of 1985MB)
17-Nov-2021 19:05:52.845 configuring command channel from '/etc/bind/rndc.key'
17-Nov-2021 19:05:52.849 open: /etc/bind/rndc.key: permission denied
17-Nov-2021 19:05:52.849 couldn't add command channel 127.0.0.1#953: permission denied
17-Nov-2021 19:05:52.849 configuring command channel from '/etc/bind/rndc.key'
17-Nov-2021 19:05:52.849 open: /etc/bind/rndc.key: permission denied
17-Nov-2021 19:05:52.849 couldn't add command channel ::1#953: permission denied
17-Nov-2021 19:05:52.849 not using config file logging statement for logging due to -g option
17-Nov-2021 19:05:52.853 managed-keys-zone: loaded serial 148
17-Nov-2021 19:05:52.857 zone 0.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 19:05:52.857 zone 1.1.10.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 19:05:52.857 zone 2.2.10.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 19:05:52.857 zone 3.3.10.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 19:05:52.861 zone 127.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 19:05:52.869 zone localhost/IN: loaded serial 2
17-Nov-2021 19:05:52.869 zone 255.in-addr.arpa/IN: loaded serial 1
17-Nov-2021 19:05:52.869 zone cc.pt/IN: loaded serial 2
17-Nov-2021 19:05:52.869 zone 4.4.10.in_addr.arpa/IN: loaded serial 1
17-Nov-2021 19:05:52.869 all zones loaded
17-Nov-2021 19:05:52.873 running
17-Nov-2021 19:05:52.873 zone cc.pt/IN: sending notifies (serial 2)
17-Nov-2021 19:05:52.873 zone 3.3.10.in-addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 19:05:52.873 zone 1.1.10.in-addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 19:05:52.877 zone 2.2.10.in-addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 19:05:52.877 zone 4.4.10.in_addr.arpa/IN: sending notifies (serial 1)
17-Nov-2021 19:05:54.078 timed out resolving './DNSKEY/IN': 193.136.19.1#53
17-Nov-2021 19:05:55.278 timed out resolving './DNSKEY/IN': 193.136.9.240#53
17-Nov-2021 19:06:02.874 managed-keys-zone: Unable to fetch DNSKEY set '.': timed out
17-Nov-2021 19:06:02.874 managed-keys.bind.jnl: open: permission denied
17-Nov-2021 19:06:02.874 managed-keys-zone: keyfetch_done:dns_journal_open -> unexpected error
17-Nov-2021 19:06:02.874 managed-keys-zone: error during managed-keys processing (unexpected error): DNSSEC validation may be at risk
17-Nov-2021 19:06:02.878 resolver priming query complete
```

Figura 21 - Configuração Inicial do servidor Secundário

```
18-Nov-2021 10:22:50.626 all zones loaded
18-Nov-2021 10:22:50.630 running
18-Nov-2021 10:22:50.630 zone cc.pt/IN: sending notifies (serial 2)
18-Nov-2021 10:22:50.630 zone 3.3.10.in-addr.arpa/IN: Transfer started.
18-Nov-2021 10:22:50.630 transfer of '3.3.10.in-addr.arpa/IN' from 10.2.2.1#53: connected using 10.3
.3.2#47365
18-Nov-2021 10:22:50.634 zone 3.3.10.in-addr.arpa/IN: transferred serial 3
18-Nov-2021 10:22:50.634 transfer of '3.3.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer status: suc
cess
18-Nov-2021 10:22:50.634 transfer of '3.3.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer completed:
1 messages, 10 records, 316 bytes, 0.004 secs (79000 bytes/sec)
18-Nov-2021 10:22:50.634 zone 3.3.10.in-addr.arpa/IN: sending notifies (serial 3)
18-Nov-2021 10:22:51.130 zone 4.4.10.in-addr.arpa/IN: Transfer started.
18-Nov-2021 10:22:51.130 zone 2.2.10.in-addr.arpa/IN: Transfer started.
18-Nov-2021 10:22:51.134 zone 1.1.10.in-addr.arpa/IN: zone transfer deferred due to quota
18-Nov-2021 10:22:51.134 transfer of '2.2.10.in-addr.arpa/IN' from 10.2.2.1#53: connected using 10.3
.3.2#44109
18-Nov-2021 10:22:51.134 transfer of '4.4.10.in-addr.arpa/IN' from 10.2.2.1#53: connected using 10.3
.3.2#51901
18-Nov-2021 10:22:51.138 zone 2.2.10.in-addr.arpa/IN: transferred serial 3
18-Nov-2021 10:22:51.138 zone 1.1.10.in-addr.arpa/IN: Transfer started.
18-Nov-2021 10:22:51.138 transfer of '2.2.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer status: suc
cess
18-Nov-2021 10:22:51.138 transfer of '2.2.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer completed:
1 messages, 15 records, 421 bytes, 0.004 secs (105250 bytes/sec)
18-Nov-2021 10:22:51.138 zone 2.2.10.in-addr.arpa/IN: sending notifies (serial 3)
18-Nov-2021 10:22:51.138 zone 4.4.10.in-addr.arpa/IN: transferred serial 3
18-Nov-2021 10:22:51.138 transfer of '4.4.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer status: suc
cess
18-Nov-2021 10:22:51.138 transfer of '4.4.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer completed:
1 messages, 9 records, 303 bytes, 0.001 secs (303000 bytes/sec)
18-Nov-2021 10:22:51.146 zone 4.4.10.in-addr.arpa/IN: sending notifies (serial 3)
18-Nov-2021 10:22:51.146 transfer of '1.1.10.in-addr.arpa/IN' from 10.2.2.1#53: connected using 10.3
.3.2#40157
18-Nov-2021 10:22:51.194 zone 1.1.10.in-addr.arpa/IN: transferred serial 3
18-Nov-2021 10:22:51.194 transfer of '1.1.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer status: suc
cess
18-Nov-2021 10:22:51.194 transfer of '1.1.10.in-addr.arpa/IN' from 10.2.2.1#53: Transfer completed:
1 messages, 10 records, 331 bytes, 0.048 secs (6895 bytes/sec)
18-Nov-2021 10:22:51.194 zone 1.1.10.in-addr.arpa/IN: sending notifies (serial 3)
```

Figura 22 - Sincronização do servidor secundário com o servidor primário

Figura 23 - Servidor primário após algumas sincronizações

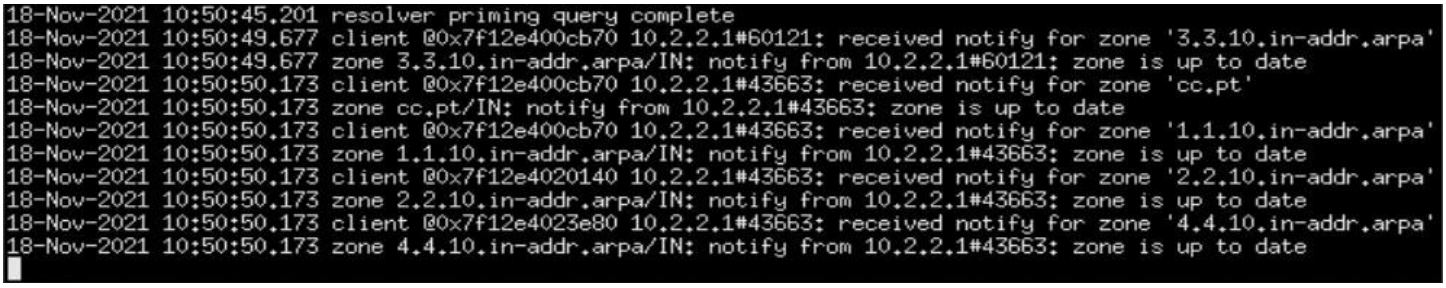

Figura 24 - Servidor secundário após algumas sincronizações

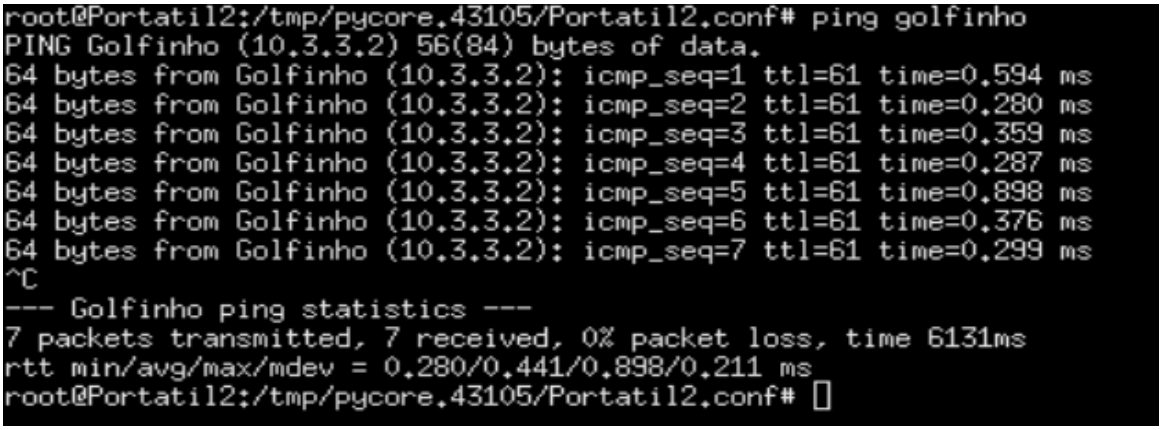

Figura 25 - No final da configuração dos servidores, conseguimos fazer "ping golfinho"

CONCLUSÃO

Este trabalho prático auxiliou na consolidação de conhecimentos da matéria teórica uma vez que nos permitiu operar com exemplos práticos da mesma. Em particular, sentimo-nos mais cientes do modo de funcionamento do DNS (Serviço de Resolução de Nomes).

Na resolução da primeira parte deste trabalho, aprendemos diferentes formas de interrogar o DNS, como, por exemplo, efetuar *queries* de NS (Name Server), MX (Mail Exchanger) e SOA (Start of Authority).

De seguida, na segunda parte, foi-nos proposto configurar dois servidores (primário e secundário) com o objetivo de estes estabelecerem uma ligação com transferência de zona. Como tal, recorrendo a informação presente no site* cedido pelo docente, construímos os ficheiros de domínio e domínios reversos. Finalmente, conseguimos construir uma ligação entre os servidores e permitir a troca de ficheiros necessária para a característica de transferência de zona do servidor secundário.

Em suma, consideramos este trabalho conveniente para a melhor compreensão do DNS como também a configuração de ficheiros de domínio.

* https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/6/html/deployment_guide/s2-bind-zone