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**Trabalho Prático nº 3**

Serviço de Resolução de Nomes (DNS)

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**Grupo 1 - PL1**

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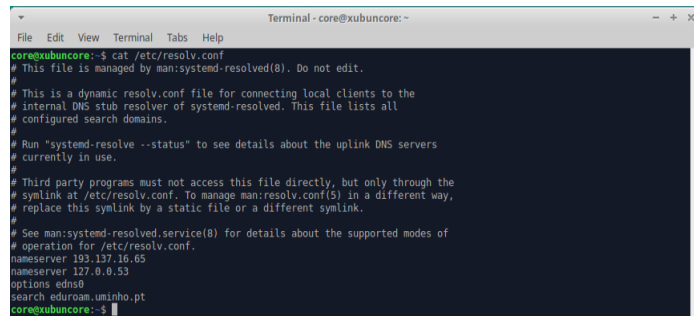
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## Parte I - Questões e Respostas

a)

**Q:** Qual o conteúdo do ficheiro `/etc/resolv.conf` e para que serve essa informação?

A terminal window titled 'Terminal - core@xubuncore: ~' showing the output of the command 'cat /etc/resolv.conf'. The output is a text file with comments and configuration for the system's DNS resolver. It lists nameservers 193.137.16.65 and 127.0.0.53, and search domains edns0 and eduroam.uminho.pt.

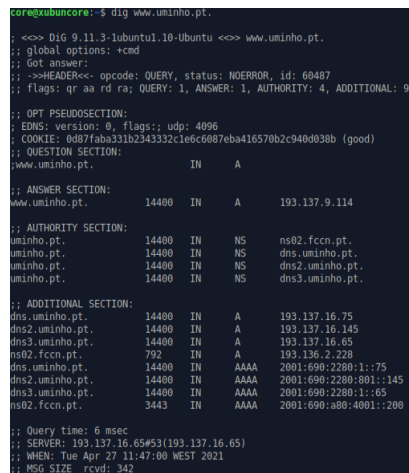
```
core@xubuncore:~$ cat /etc/resolv.conf
# This file is managed by man:systemd-resolved(8). Do not edit.
#
# This is a dynamic resolv.conf file for connecting local clients to the
# internal DNS stub resolver of systemd-resolved. This file lists all
# configured search domains.
#
# Run "systemd-resolve --status" to see details about the uplink DNS servers
# currently in use.
#
# Third party programs must not access this file directly, but only through the
# symlink at /etc/resolv.conf. To manage man:resolv.conf(5) in a different way,
# replace this symlink by a static file or a different symlink.
#
# See man:systemd-resolved.service(8) for details about the supported modes of
# operation for /etc/resolv.conf.
nameserver 193.137.16.65
nameserver 127.0.0.53
options edns0
search eduroam.uminho.pt
core@xubuncore:~$
```

**Figura 1:** Conteúdo do ficheiro `resolv.conf`

Este ficheiro contém os servidores DNS por defeito da máquina, estabelecidos pelo administrador de rede, que serão os responsáveis por fazer a resolução de nomes e IPs.

b)

**Q:** Os servidores `www.uminho.pt` e `www.ubuntu.com` têm endereços IPv6? Se sim, quais?

A terminal window showing the output of the command 'dig www.uminho.pt.'. The output displays various DNS record sections including PSEUDOSECTION, QUESTION SECTION, ANSWER SECTION, AUTHORITY SECTION, and ADDITIONAL SECTION. It shows the IP address 193.137.9.114 for www.uminho.pt and lists several nameservers and their IP addresses.

```
core@xubuncore:~$ dig www.uminho.pt.
; <<>> Dig 9.11.3-lubuntu1.10-Ubuntu <<>> www.uminho.pt.
;; global options: +cmd
;; Got answer:
;;->>>HEADER<<< opcode: QUERY, status: NOERROR, id: 60487
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 9
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:;, udp: 4096
; COOKIE: 0d87faba31b2343332c1e6c6087eba416570b2c940d038b (good)
;; QUESTION SECTION:
;www.uminho.pt.                IN      A
;; ANSWER SECTION:
www.uminho.pt.                14400   IN      A      193.137.9.114
;; AUTHORITY SECTION:
uminho.pt.                    14400   IN      NS      ns02.fcfn.pt.
uminho.pt.                    14400   IN      NS      dns.uminho.pt.
uminho.pt.                    14400   IN      NS      dns2.uminho.pt.
uminho.pt.                    14400   IN      NS      dns3.uminho.pt.
;; ADDITIONAL SECTION:
dns.uminho.pt.                14400   IN      A      193.137.16.75
dns2.uminho.pt.               14400   IN      A      193.137.16.145
dns3.uminho.pt.               14400   IN      A      193.137.16.65
ns02.fcfn.pt.                 792     IN      A      193.136.2.228
dns.uminho.pt.                14400   IN      AAAA   2001:690:2280:11::175
dns2.uminho.pt.               14400   IN      AAAA   2001:690:2280:801::145
dns3.uminho.pt.               14400   IN      AAAA   2001:690:2280:11::65
ns02.fcfn.pt.                 3443    IN      AAAA   2001:690:a80:4001::200

;; Query time: 6 msec
;; SERVER: 193.137.16.65#53(193.137.16.65)
;; WHEN: Tue Apr 27 11:47:00 WEST 2021
;; MSG SIZE rcvd: 342
```

**Figura 2:** Comando `dig` para `www.uminho.pt`.

```

core@ubuntu:~$ dig www.ubuntu.com. AAAA
; <<> Dig 9.11.3-ubuntu1.10-Ubuntu <<> www.ubuntu.com. AAAA
;; global options: +cmd
;; Got answer:
;; ->HEADER<< opcode: QUERY, status: NOERROR, id: 24706
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 3, ADDITIONAL: 4
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 85bb0b0ec0976aa4634a9126087f075398bc27a6b13c833 (good)
;; QUESTION SECTION:
;www.ubuntu.com.                IN      AAAA

;; ANSWER SECTION:
www.ubuntu.com.                60      IN      AAAA    2001:67c:1360:8001::2c
www.ubuntu.com.                60      IN      AAAA    2001:67c:1360:8001::2b

;; AUTHORITY SECTION:
ubuntu.com.                    3305    IN      NS      ns2.canonical.com.
ubuntu.com.                    3305    IN      NS      ns1.canonical.com.
ubuntu.com.                    3305    IN      NS      ns3.canonical.com.

;; ADDITIONAL SECTION:
ns1.canonical.com.            3305    IN      A       91.189.94.173
ns2.canonical.com.            3305    IN      A       91.189.95.3
ns3.canonical.com.            3305    IN      A       91.189.91.139

;; Query time: 333 msec
;; SERVER: 193.137.16.65#53(193.137.16.65)
;; WHEN: Tue Apr 27 12:07:33 WEST 2021
;; MSG SIZE rcvd: 239

```

**Figura 3:** Comando dig para www.ubuntu.com.

Para verificar a existência de endereços IPv6 num servidor foi necessário procurar a ocorrência do identificador AAAA nas informações do comando dig. Sendo assim, podemos verificar que para os servidores www.uminho.pt. identifica-se que os 4 existentes possuem endereços IPv6, sendo eles:

2001:690:2280:1::75  
2001:690:2280:801::145  
2001:690:2280:1::65  
2001:690:a80:4001::200

Para o caso do www.ubuntu.com. também se verifica a existência de 2 endereços IPv6:

2001:67c:1360:8001::2c  
2001:67c:1360:8001::2b

c)

**Q: Quais os servidores de nomes definidos para os domínios: “sapo.pt.”, “pt.” e “.”?**

Para identificar os servidores de nomes de um domínio foi necessário utilizar o comando dig com a flag NS. Para cada um dos domínios “sapo.pt.”, “pt.” e “.” estão identificados os respetivos servidores na secção de resposta.

```

core@xubuncore:~$ dig sapo.pt. NS

; <> DiG 9.11.3-lubuntu1.10-Ubuntu <> sapo.pt. NS
;; global options: +cmd
;; Got answer:
;; ->HEADER<- opcode: QUERY, status: NOERROR, id: 17260
;; flags: qr rd ra; QUERY: 1, ANSWER: 4, AUTHORITY: 0, ADDITIONAL: 7

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 8f1afed8ab841d9801d824986087f1a7581642a7fef626f2 (good)
;; QUESTION SECTION:
;sapo.pt.                IN      NS

;; ANSWER SECTION:
sapo.pt.                544     IN      NS      dns01.sapo.pt.
sapo.pt.                544     IN      NS      dns02.sapo.pt.
sapo.pt.                544     IN      NS      ns2.sapo.pt.
sapo.pt.                544     IN      NS      ns.sapo.pt.

;; ADDITIONAL SECTION:
ns.sapo.pt.            544     IN      A       212.55.154.202
ns2.sapo.pt.           544     IN      A       212.55.154.194
dns01.sapo.pt.         1441    IN      A       213.13.28.116
dns02.sapo.pt.         1441    IN      A       213.13.30.116
dns01.sapo.pt.         1441    IN      AAAA    2001:8a0:2106:4:213:13:28:116
dns02.sapo.pt.         1441    IN      AAAA    2001:8a0:2206:4:213:13:30:116

;; Query time: 6 msec
;; SERVER: 193.137.16.65#53(193.137.16.65)
;; WHEN: Tue Apr 27 12:12:39 WEST 2021
;; MSG SIZE rcvd: 259

```

Figura 4: Comando dig para sapo.pt.

```

core@xubuncore:~$ dig pt. NS

; <> DiG 9.11.3-lubuntu1.10-Ubuntu <> pt. NS
;; global options: +cmd
;; Got answer:
;; ->HEADER<- opcode: QUERY, status: NOERROR, id: 12844
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 9, AUTHORITY: 0, ADDITIONAL: 19

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: ff2aa7dc31ad109414fec20e6087f1ccd2651409cdc45839 (good)
;; QUESTION SECTION:
;pt.                     IN      NS

;; ANSWER SECTION:
pt.                    51      IN      NS      a.dns.pt.
pt.                    51      IN      NS      ns2.nic.fr.
pt.                    51      IN      NS      e.dns.pt.
pt.                    51      IN      NS      h.dns.pt.
pt.                    51      IN      NS      ns.dns.br.
pt.                    51      IN      NS      c.dns.pt.
pt.                    51      IN      NS      b.dns.pt.
pt.                    51      IN      NS      g.dns.pt.
pt.                    51      IN      NS      d.dns.pt.

```

Figura 5: Comando dig para pt.

```

core@xubuncore:~$ dig . NS

; <> DiG 9.11.3-lubuntu1.10-Ubuntu <> . NS
;; global options: +cmd
;; Got answer:
;; ->HEADER<- opcode: QUERY, status: NOERROR, id: 57503
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 9137b2562609e9e617a0701e6087f24b8d0b0ade79e57738 (good)
;; QUESTION SECTION:
;.                       IN      NS

;; ANSWER SECTION:
.                    1804    IN      NS      l.root-servers.net.
.                    1804    IN      NS      f.root-servers.net.
.                    1804    IN      NS      m.root-servers.net.
.                    1804    IN      NS      e.root-servers.net.
.                    1804    IN      NS      c.root-servers.net.
.                    1804    IN      NS      b.root-servers.net.
.                    1804    IN      NS      g.root-servers.net.
.                    1804    IN      NS      k.root-servers.net.
.                    1804    IN      NS      j.root-servers.net.
.                    1804    IN      NS      h.root-servers.net.
.                    1804    IN      NS      d.root-servers.net.
.                    1804    IN      NS      i.root-servers.net.
.                    1804    IN      NS      a.root-servers.net.

```

Figura 6: Comando dig para .

d)

**Q: Existe o domínio open.money.? Será que open.money. é um host ou um domínio?**

Sim, existe o domínio open.money. e é um host porque possui um endereço IP como pode verificar na figura abaixo.

```
core@xubuncore:~$ host open.money.  
open.money has address 35.154.208.116  
open.money mail is handled by 10 mailstore1.secureserver.net.  
open.money mail is handled by 0 smtp.secureserver.net.  
open.money mail is handled by 5 alt2.aspmx.l.google.com.  
open.money mail is handled by 10 alt4.aspmx.l.google.com.  
open.money mail is handled by 1 aspmx.l.google.com.  
open.money mail is handled by 10 alt3.aspmx.l.google.com.  
open.money mail is handled by 5 alt1.aspmx.l.google.com.
```

**Figura 7:** Comando host para open.money.

e)

**Q: Qual é o servidor DNS primário definido para o domínio un.org.? Este servidor primário (master) aceita queries recursivas? Porquê?**

DNS primário: ns1.un.org.

Este servidor aceita queries recursivas uma vez que na resposta ao comando dig está presente 'ra' que significa *recursion available*.

```
core@xubuncore:~$ host -t soa un.org.  
un.org has SOA record ns1.un.org. root.un.org. 2021042400 1200 3600 1209600 300
```

**Figura 8:** Comando host para un.org.

```

core@xubuncore:~$ dig ns1.un.org.
; <<> DiG 9.11.3-lubuntu1.10-Ubuntu <<> ns1.un.org.
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 47406
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 3, ADDITIONAL: 3
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 78c0fc7abd7f76e70e06ba736087f88f5dadc2800b2ec69b (good)
;; QUESTION SECTION:
;ns1.un.org.                IN      A

;; ANSWER SECTION:
ns1.un.org.                3       IN      A      157.150.185.28

;; AUTHORITY SECTION:
un.org.                    132     IN      NS      ns1.un.org.
un.org.                    132     IN      NS      ns3.un.org.
un.org.                    132     IN      NS      ns2.un.org.

;; ADDITIONAL SECTION:
ns2.un.org.                3057    IN      A      157.150.34.57
ns3.un.org.                3057    IN      A      157.150.241.25

;; Query time: 4 msec
;; SERVER: 193.137.16.65#53(193.137.16.65)
;; WHEN: Tue Apr 27 12:42:06 WEST 2021
;; MSG SIZE rcvd: 165

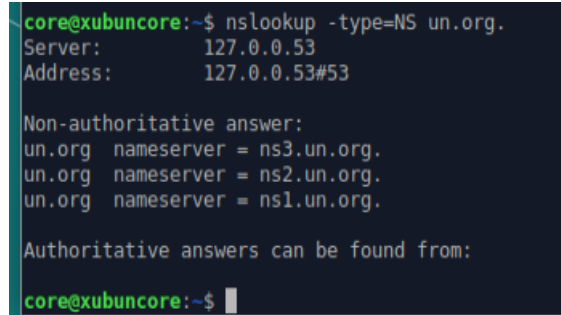
```

Figura 9: Comando dig para un.org.

f)

**Q: Obtenha uma resposta “autoritativa” para a questão anterior.**

Para obter uma resposta autoritativa foi necessário a utilização de uma query do tipo NS. Para o domínio un.org, não foi possível obter uma resposta autoritativa

A terminal window with a dark background and green text. The prompt is 'core@xubuncore:~\$'. The command entered is 'nslookup -type=NS un.org.'. The output shows the server and address as 127.0.0.53. It then displays 'Non-authoritative answer:' followed by three lines of nameserver information for un.org: ns3.un.org, ns2.un.org, and ns1.un.org. It concludes with 'Authoritative answers can be found from:' and returns to the prompt.

```
core@xubuncore:~$ nslookup -type=NS un.org.
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
un.org  nameserver = ns3.un.org.
un.org  nameserver = ns2.un.org.
un.org  nameserver = ns1.un.org.

Authoritative answers can be found from:

core@xubuncore:~$
```

**Figura 10:** Comando nslookup -type=NS un.org.



g)

**Q: Onde são entregues as mensagens de correio eletrónico dirigidas a presidency@eu.eu ou presidencia@2021portugal.eu?**

Para verificar onde são entregues as mensagens de correio eletrónico utilizamos queries MX, isto é, "Mail Exchanger". Deste modo foi possível concluir o seguinte :

» No caso do eu.eu., as mensagens são entregues no servidor mxg.eu.mpssec.net.

```
core@xubuncore:/$ dig eu.eu. MX
; <<>> DiG 9.11.3-lubuntu1.14-Ubuntu <<>> eu.eu. MX
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 6104
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;eu.eu.                                IN      MX
;; ANSWER SECTION:
eu.eu.                3583    IN      MX      10 smtp01.level27.be.
eu.eu.                3583    IN      MX      20 smtp02.level27.be.
;; Query time: 0 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Apr 27 11:55:58 WEST 2021
;; MSG SIZE rcvd: 90
```

Figura 11: Comando dig para eu.eu.

» Para 2021portugal.eu., as mensagens são entregues nos servidores smtp01.level27.be. e smtp02.level27.be.

```
core@xubuncore:/$ dig 2021portugal.eu. MX
; <<>> DiG 9.11.3-lubuntu1.14-Ubuntu <<>> 2021portugal.eu. MX
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 46116
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;2021portugal.eu.                IN      MX
;; ANSWER SECTION:
2021portugal.eu.                300     IN      MX      10 mxg.eu.mpssec.net.
;; Query time: 941 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Apr 27 11:52:33 WEST 2021
;; MSG SIZE rcvd: 77

core@xubuncore:/$ dig mxg.eu.mpssec.net.
; <<>> DiG 9.11.3-lubuntu1.14-Ubuntu <<>> mxg.eu.mpssec.net.
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 35891
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;mxg.eu.mpssec.net.              IN      A
;; ANSWER SECTION:
mxg.eu.mpssec.net.              3600    IN      A      54.77.99.92
;; Query time: 194 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Apr 27 11:52:58 WEST 2021
;; MSG SIZE rcvd: 62
```

Figura 12: Comando dig para 2021portugal.eu.

```
core@xubuncore:/$ dig smtp01.level27.be.

;<<> DiG 9.11.3-lubuntu1.14-Ubuntu <<> smtp01.level27.be.
;; global options: +cmd
;; Got answer:
;; ->HEADER<- opcode: QUERY, status: NOERROR, id: 19287
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;smtp01.level27.be.                IN      A

;; ANSWER SECTION:
smtp01.level27.be.                600     IN      A      91.208.211.164

;; Query time: 265 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Apr 27 11:56:09 WEST 2021
;; MSG SIZE rcvd: 62

core@xubuncore:/$ dig smtp02.level27.be.

;<<> DiG 9.11.3-lubuntu1.14-Ubuntu <<> smtp02.level27.be.
;; global options: +cmd
;; Got answer:
;; ->HEADER<- opcode: QUERY, status: NOERROR, id: 24474
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;smtp02.level27.be.                IN      A

;; ANSWER SECTION:
smtp02.level27.be.                600     IN      A      178.62.250.131

;; Query time: 61 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Apr 27 11:56:27 WEST 2021
;; MSG SIZE rcvd: 62
```

Figura 13: Comando dig para servidores smtp01.level27.be. e smtp02.level27.be.

h)

**Q: Que informação é possível obter, via DNS, acerca de gov.pt?**

Utilizando o comando dig com a flag ANY é possível obter várias informações acerca do domínio gov.pt. Como se pode verificar na imagem abaixo foram obtidas 7 respostas onde as primeiras 5 identificam os servidores de nomes. Por outro lado, é possível também observar que as opções *recursive available* e *recursive desirable* estão ativas.

```
core@xubuncore:/$ dig gov.pt ANY

;<<> DiG 9.11.3-lubuntu1.14-Ubuntu <<> gov.pt ANY
;; global options: +cmd
;; Got answer:
;; ->HEADER<- opcode: QUERY, status: NOERROR, id: 39678
;; flags: qr rd ra; QUERY: 1, ANSWER: 7, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;gov.pt.                          IN      ANY

;; ANSWER SECTION:
gov.pt.                133     IN      NS      ns02.fccn.pt.
gov.pt.                133     IN      NS      europal.dnsnode.net.
gov.pt.                133     IN      NS      dns1.gov.pt.
gov.pt.                133     IN      NS      nsp.dnsnode.net.
gov.pt.                133     IN      NS      a.dns.pt.
gov.pt.                133     IN      RRSIG  NS 10 2 600 20210518083510 20210504083510 57803 gov.pt. lph6uA7JhL5X8hcc+P6g/7wFggz0Y52+Py6NfVAjC+fxnqRj 13w38EjY2g1yPB8e200Pfu17/aiH00Rq1d13j19K0bw70cypV3w rvgi4+H0TUMfATrMAj51mh1LeyjX8Me38FTTY+1bTv0Ccx1a1P
A07 7w320B1tcq5P21ILjH7ezp0811y0/c4qy7H6N2V2x5q0d0Uw gahq22yph+5027z7H6Nf1BAku2yE18dPHAnPLAD1Aqpf 1hgp8W73kLev0RDr5h2u676d5qy1P903ed0m+de1lgmP2 14V9be
gov.pt.                133     IN      RRSIG  NS 10 2 600 20210518083510 20210504083510 60871 gov.pt. Zp/WMR5ShyXx1NE8rev31n1r1pcv5AdkT0w6201574PCG054CE/U7 89q8075mew1F79/qvCh1h112BRx2019KofYembyjj20CaG0q121he h/Fx19VCE18K2kum59Q3VbnZp+vwJvw200hTscs+rT1nJ8T
5fn R9gdk4Gn8b8efpdm1Rgtk6t54qByuY1xj31J0E8ug7T3rv0Rn8 zaL1Ez1N0BT2k0QZ2c13v8R9ux7Zn2v0y8rv0nna70M5j03566Lb EB0K1fVW0C156389Yj6xqZ0WJnPF/rK003q0E8Jw/C45PM/5npB w1J1a==

;; Query time: 39 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue May 04 10:05:11 WEST 2021
;; MSG SIZE rcvd: 737

core@xubuncore:/$
```

Figura 14: Comando dig gov.pt.

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?

Utilizando o comando `nslookup` é possível interrogar o DNS sobre este endereço. Da sua resposta podemos obter o nome do domínio associado a este IP, que é `smtpp01.fccn.pt`.

[illegible]

**Figura 15:** Interrogação nslookup com o endereço IPv6

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: di.uminho.pt ou o domínio cc.pt que vai ser criado na topologia virtual).

O mecanismo de "Transferência de zona" permite replicar uma porção ou a totalidade da base de dados DNS do servidor primário para o secundário. Além disso, esta transferência é realizada sempre sobre TCP, assumindo a forma de uma transação cliente-servidor, onde o cliente que solicita a transferência trata-se de um servidor "slave" ou secundário.

Por exemplo, analisando os parâmetros definidos e os campos no Record do tipo SOA do domínio di.uminho.pt, é possível observar o campo SERIAL, que representa o número de série da zona em questão. Caso um servidor secundário observar um incremento neste número então irá assumir que esta zona já foi atualizada e irá inicializar a "transferência de zona", caso contrário, isto é, caso o número de série seja o mesmo ou inferior então a transferência não irá ocorrer, uma vez que o servidor secundário que está a solicitar o pedido contém uma versão da base de dados igual ou mais atual.

Note-se também na existência de outros campos no Record do SOA que contém valores temporais, tais como, o refresh, retry, expire e minimum.

```

core@xubuncore:~$ dig di.uminho.pt SOA +multiline

;<<> DiG 9.11.3-lubuntu1.15-Ubuntu <<> di.uminho.pt SOA +multiline
; global options: +cmd
; Got answer:
; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 14048
; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
; QUESTION SECTION:
di.uminho.pt.          IN SOA

; ANSWER SECTION:
di.uminho.pt.          6819 IN SOA dns.di.uminho.pt. dnsadmin.di.uminho.pt. (
                        2021043002 ; serial
                        28800      ; refresh (8 hours)
                        7200       ; retry (2 hours)
                        2419200    ; expire (4 weeks)
                        43200      ; minimum (12 hours)
                        )

; Query time: 1 msec
; SERVER: 127.0.0.53#53(127.0.0.53)
; WHEN: Sat May 01 03:47:12 WEST 2021
; MSG SIZE rcvd: 90

```

**Figura 16:** Comando dig di.uminho.pt. SOA

## Parte II - Criação de um domínio de nomes cc.pt

```
// 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 "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";

zone "cc.pt" {
    type master;
    file "/home/core/primario/db.cc.pt";
    allow-transfer{
        10.2.2.2;
    };
};

zone "1.1.10.in-addr.arpa"{
    type master;
    file "/home/core/primario/db.1-1-10.rev";
    allow-transfer{
        10.2.2.2;
    };
};
```

Figura 17: primario/named.conf

```

;
; BIND data file for local loopback interface
;
$TTL      604800
@         IN      SOA      Server1.cc.pt. PL01G01.cc.pt. (
                        1      ; Serial
                        604800  ; Refresh
                        86400   ; Retry
                        2419200 ; Expire
                        604800 ) ; Negative Cache TTL
;
@         IN      NS       Server1.cc.pt.
@         IN      NS       Mercurio.cc.pt.
;
ns        IN      CNAME     Server1.cc.pt.
ns2       IN      CNAME     Mercurio.cc.pt.
;
Server1   IN      A         10.1.1.1
Mercurio  IN      A         10.2.2.2
;
www       IN      CNAME     Server2.cc.pt.
mail      IN      CNAME     Server2.cc.pt.
pop       IN      CNAME     Server3.cc.pt.
imap      IN      CNAME     Server3.cc.pt.
;
Server2   IN      A         10.1.1.2
Server3   IN      A         10.1.1.3
;
g01       IN      CNAME     Laptop1.cc.pt.
;
Laptop1   IN      A         10.4.4.1
;
@         IN      MX       20  Server2
@         IN      MX       10  Server3
;
Venus     IN      A         10.2.2.3
Marte     IN      A         10.2.2.4

```

Figura 18: primario/db.cc.pt

```

;
; BIND reverse file for local loopback interface
;
$TTL      604800
1.1.10.in-addr.arpa.    IN      SOA      Server1.cc.pt. PL01G01.cc.pt. (
                        1      ; Serial
                        604800  ; Refresh
                        86400   ; Retry
                        2419200 ; Expire
                        604800 ) ; Negative Cache TTL
;
@         IN      NS       Server1.cc.pt.
@         IN      NS       Mercurio.cc.pt.
;
1         IN      PTR      Server1.cc.pt.
2         IN      PTR      Server2.cc.pt.
3         IN      PTR      Server3.cc.pt.
~
~

```

Figura 19: primario/db.1-1-10.rev

```

// 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 "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";

zone "cc.pt" {
    type slave;
    file "/var/cache/bind/db.cc.pt";
    masters{
        10.1.1.1;
    };
};

zone "1.1.10.in-addr.arpa" {
    type slave;
    file "/var/cache/bind/db.1-1-10.rev";
    masters{
        10.1.1.1;
    };
};

```

Figura 20: secundario/named.conf

Na próxima figura está representada a transferência da base de dados entre o servidor primário (*master*), que neste caso consiste no "Server1" e o secundário (*slave*), tratando-se do "Mercurio". Além disso, estão também demonstradas algumas queries feitas aos servidores de DNS.

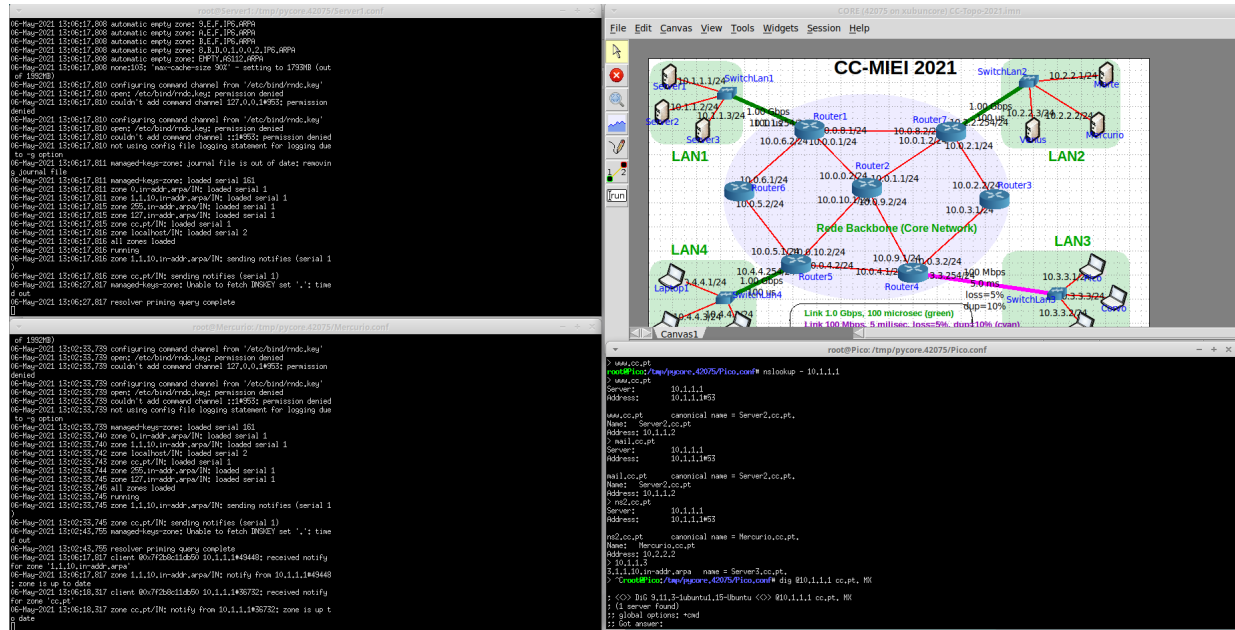


Figura 21: Demonstração da transferência da DB + queries nslookup

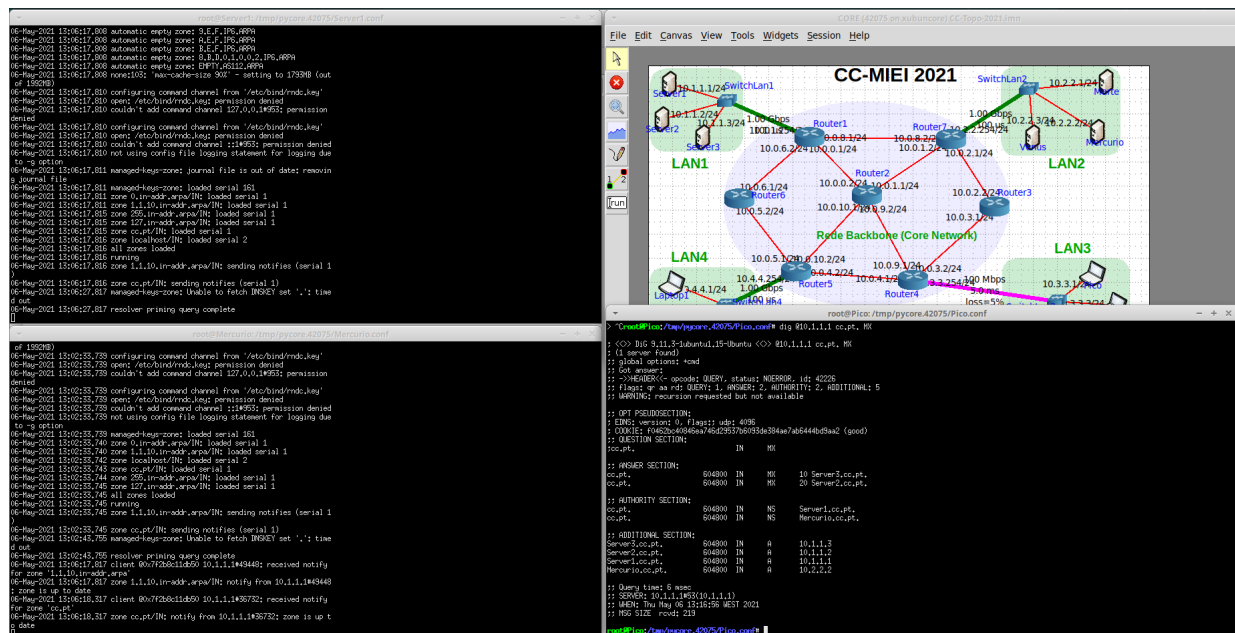


Figura 22: Query do tipo MX



Além disso, ainda foi capturado tráfego DNS através da ferramenta *wireshark*.

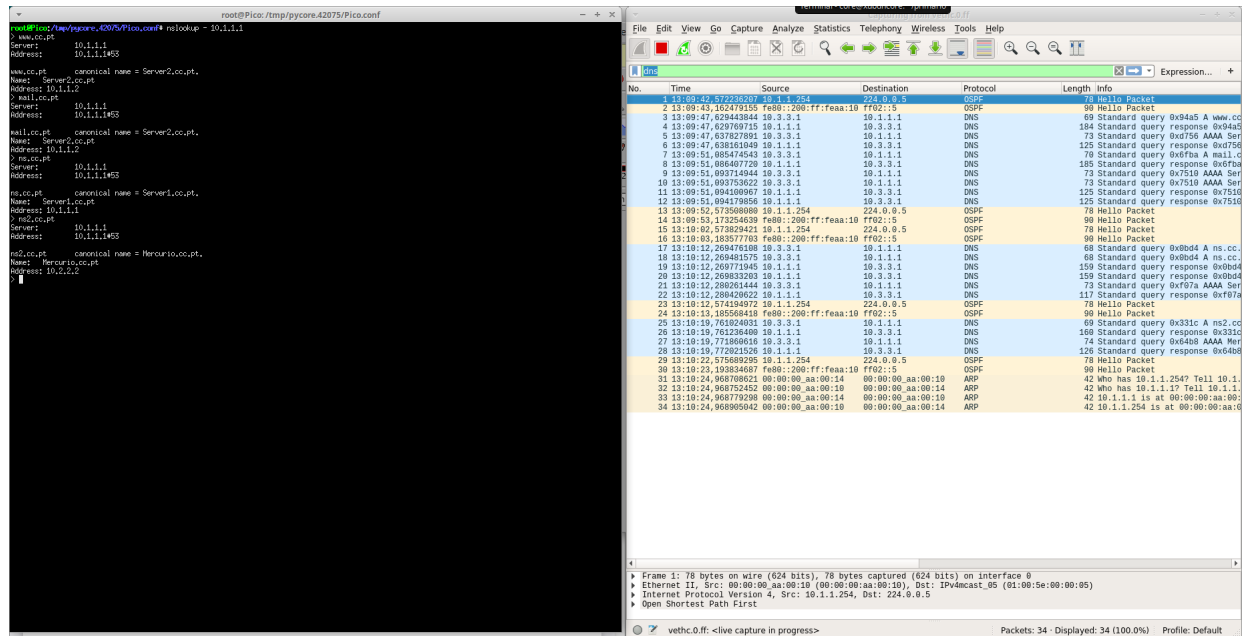


Figura 23: Tráfego DNS

Por fim, de forma a testar a redundância do sistema, isto é, se deitando o servidor primário abaixo, o secundário continuaria a funcionar, foram feitos vários testes através dos seguintes comandos representados nas figuras abaixo:

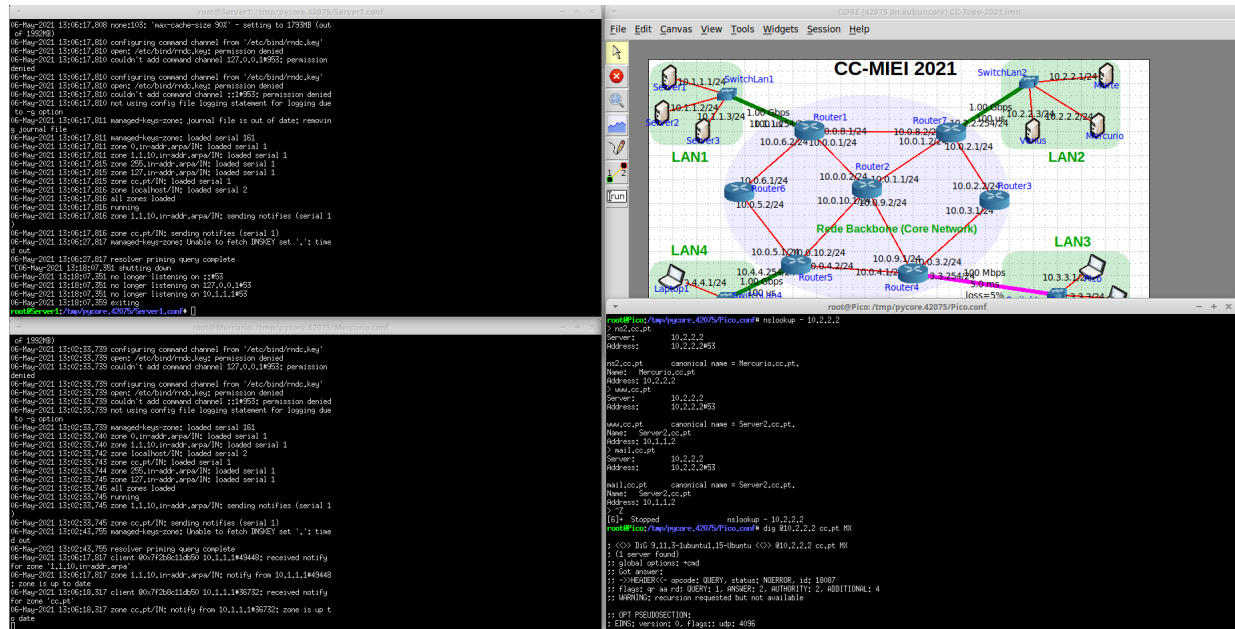


Figura 24: Query nslookup no servidor secundário

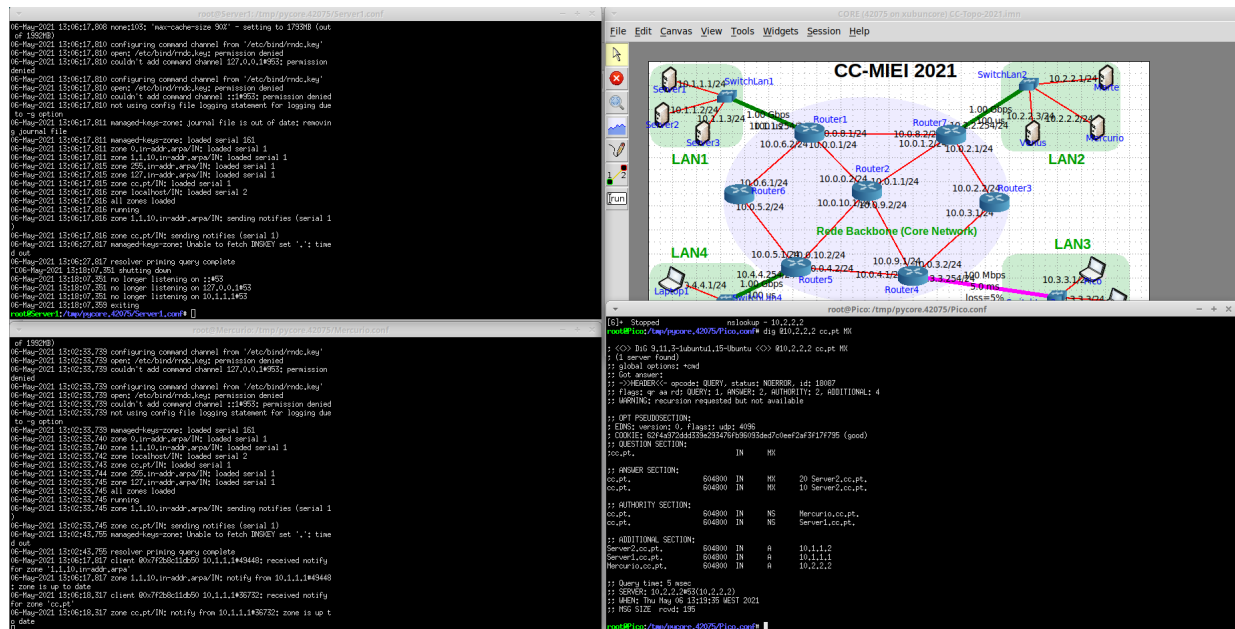


Figura 25: Query dig do tipo MX no servidor secundário

```
06-May-2021 15:06:17.800 named[68]: wa-cache-size 500 - setting to 173398 (out of 180288)
06-May-2021 15:06:17.810 configuring command channel from '/etc/bind/rndc.key'
06-May-2021 15:06:17.810 open: /etc/bind/rndc.key: permission denied
06-May-2021 15:06:17.810 couldn't add command channel 127.0.0.1#5353: permission denied
06-May-2021 15:06:17.810 configuring command channel from '/etc/bind/rndc.key'
06-May-2021 15:06:17.810 open: /etc/bind/rndc.key: permission denied
06-May-2021 15:06:17.810 couldn't add command channel 11#5353: permission denied
06-May-2021 15:06:17.810 not using config file logging statement for logging due to -g option
06-May-2021 15:06:17.811 managed-keys-zone: journal file is out of date: removing journal file
06-May-2021 15:06:17.811 managed-keys-zone: loaded serial 163
06-May-2021 15:06:17.811 zone 0.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:06:17.811 zone 1.1.1.0.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:06:17.811 zone 255.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:06:17.811 zone 127.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:06:17.811 zone cc.pt/IN: loaded serial 1
06-May-2021 15:06:17.811 zone localhost/IN: loaded serial 2
06-May-2021 15:06:17.811 all zones loaded
06-May-2021 15:06:17.811 running
06-May-2021 15:06:17.811 zone 1.1.1.0.in-addr.arpa/IN: sending notifies (serial 1)
06-May-2021 15:06:17.811 zone cc.pt/IN: sending notifies (serial 1)
06-May-2021 15:06:17.817 managed-keys-zone: Unable to fetch INKEY set '': time out
06-May-2021 15:06:17.817 resolver priming query complete
06-May-2021 15:18:07.351 shutting down
06-May-2021 15:18:07.351 no longer listening on 1#5353
06-May-2021 15:18:07.351 no longer listening on 127.0.0.1#5353
06-May-2021 15:18:07.351 no longer listening on 10.1.1.1#5353
06-May-2021 15:18:07.351 exiting
root@server1: /tmp/pscore_42075/Pico.conf#

of 180288)
06-May-2021 15:02:35.739 configuring command channel from '/etc/bind/rndc.key'
06-May-2021 15:02:35.739 open: /etc/bind/rndc.key: permission denied
06-May-2021 15:02:35.739 couldn't add command channel 127.0.0.1#5353: permission denied
06-May-2021 15:02:35.739 configuring command channel from '/etc/bind/rndc.key'
06-May-2021 15:02:35.739 open: /etc/bind/rndc.key: permission denied
06-May-2021 15:02:35.739 couldn't add command channel 11#5353: permission denied
06-May-2021 15:02:35.739 not using config file logging statement for logging due to -g option
06-May-2021 15:02:35.740 managed-keys-zone: loaded serial 163
06-May-2021 15:02:35.740 zone 0.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:02:35.740 zone 1.1.1.0.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:02:35.740 zone localhost/IN: loaded serial 2
06-May-2021 15:02:35.740 zone 255.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:02:35.740 zone 127.in-addr.arpa/IN: loaded serial 1
06-May-2021 15:02:35.740 all zones loaded
06-May-2021 15:02:35.740 running
06-May-2021 15:02:35.740 zone 1.1.1.0.in-addr.arpa/IN: sending notifies (serial 1)
06-May-2021 15:02:35.740 zone cc.pt/IN: sending notifies (serial 1)
06-May-2021 15:02:45.755 managed-keys-zone: Unable to fetch INKEY set '': time out
06-May-2021 15:02:45.755 resolver priming query complete
06-May-2021 15:06:17.817 client 0x7f2b6c1d850 10.1.1.1#43448: received notify for zone 1.1.1.0.in-addr.arpa
06-May-2021 15:06:17.817 zone 1.1.1.0.in-addr.arpa/IN: notify from 10.1.1.1#43448
1 zone is up to date
06-May-2021 15:06:18.317 client 0x7f2b6c1d850 10.1.1.1#36782: received notify for zone localhost
06-May-2021 15:06:18.317 zone cc.pt/IN: notify from 10.1.1.1#36782: zone is up to date

root@Pico: /tmp/pscore_42075/Pico.conf#
```

Figura 26: Query dig do tipo NS e SOA no servidor secundário

## Conclusão

Ao longo deste trabalho prático, foi possível aplicar e consolidar todo o conhecimento adquirido ao longo das aulas teóricas e práticas de Comunicação por Computadores.

Na primeira parte, Questões e Respostas, foi necessário analisar o ficheiro que contém os servidores, */etc/resolv.conf*, além de ter sido pedido, nas várias alíneas, que se obtivesse outras informações , sendo utilizados para isso, os comandos `dig` e `nslookup`.

A segunda parte do trabalho, consistiu na instalação, configuração e teste de um domínio CC.PT.

Desta forma, o grupo considera que concluiu este desafio com sucesso, uma vez que todos os requisitos foram cumpridos e todas as funcionalidades pedidas foram implementadas.