

INSTITUTO FEDERAL
SANTA CATARINA

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SECRETARIA DE EDUCAÇÃO PROFISSIONAL E TECNOLÓGICA

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CURSO DE ENGENHARIA DE TELECOMUNICAÇÕES - CÂMPUS SÃO JOSÉ

RELATÓRIO TÉCNICO

LABORATÓRIO - DNS

Arthur Cadore Matuella Barcella

TAREFA:

Serviço de Nomes (DNS)

Leitura recomendada

- [Detalhes sobre DNS](#)

Objetivos

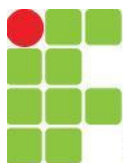
O Domain Name System (DNS) traduz nomes de hosts em endereços Internet Protocol (IP), preenchendo uma lacuna crítica na infraestrutura da Internet. Neste laboratório, observaremos mais de perto:

1. o lado cliente do DNS e
2. uma pequena análise do protocolo

Lembre-se de que o papel do cliente no DNS é relativamente simples - um cliente envia uma consulta ao seu DNS, e obtém uma resposta. Muito pode acontecer "por baixo dos panos", de forma invisível aos clientes DNS, enquanto os servidores DNS, organizados hierarquicamente, comunicam-se entre si para, ou recursivamente ou iterativamente, resolver uma consulta DNS de um cliente. Do ponto de vista do cliente DNS, contudo, o protocolo é bastante simples - uma consulta é feita ao seu servidor DNS e uma resposta é recebida deste servidor.

1) Inicialmente consulte e anote quem são os servidores DNS instalados na sua máquina. É para estes servidores que serão conduzidas as perguntas DNS. Use a ferramenta nm-tool ou acesso ao arquivo de configuração do sistema:

nmcli dev show | grep DNS ou cat /etc/resolv.conf



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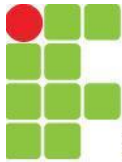
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```
aluno: ~$ nmcli dev show | grep DNS
IP4.DNS[1]: 191.36.8.66
IP4.DNS[2]: 191.36.8.1
IP4.DNS[3]: 191.36.8.4
IP4.DNS[4]: 191.36.8.6
IP4.DNS[5]: 191.36.8.7
IP4.DNS[6]: 191.36.8.25
aluno: ~$ cat /etc/resolv.conf
nameserver 191.36.8.2
```

Endereço IPV4 configurado na máquina: 191.36.8.2

icmp dns						
No.	Time	Source	Destination	Protocol	Length	Info
4.99229...		191.36.8.2	191.36.13.12	DNS	538	Standard query response 0x00d6 A ssl.gstatic.com A 142.251.128
4.99256...		191.36.8.2	191.36.13.12	DNS	550	Standard query response 0xc0cb AAAA ssl.gstatic.com AAAA 2800:
11.0414...		191.36.13.12	191.36.8.2	DNS	91	Standard query 0x5071 A signaler-pa.clients6.google.com
11.0415...		191.36.13.12	191.36.8.2	DNS	91	Standard query 0xe43f AAAA signaler-pa.clients6.google.com
11.0423...		191.36.8.2	191.36.13.12	DNS	554	Standard query response 0x5071 A signaler-pa.clients6.google.c
11.0427...		191.36.8.2	191.36.13.12	DNS	550	Standard query response 0xe43f AAAA signaler-pa.clients6.googl
18.9952...		191.36.13.12	191.36.8.2	DNS	75	Standard query 0xae96 A play.google.com
18.9953...		191.36.13.12	191.36.8.2	DNS	75	Standard query 0x5010 AAAA play.google.com
18.9962...		191.36.8.2	191.36.13.12	DNS	538	Standard query response 0xae96 A play.google.com A 142.251.132
18.9963...		191.36.8.2	191.36.13.12	DNS	550	Standard query response 0x5010 AAAA play.google.com AAAA 2800:
47.2243...		191.36.13.12	191.36.8.2	DNS	77	Standard query 0x3d8b A gabrielluizep.dev
47.2243...		191.36.13.12	191.36.8.2	DNS	77	Standard query 0xe530 AAAA gabrielluizep.dev
47.9249...		191.36.8.2	191.36.13.12	DNS	540	Standard query response 0x3d8b A gabrielluizep.dev A 76.76.21.
47.9251...		191.36.8.2	191.36.13.12	DNS	170	Standard query response 0xe530 AAAA gabrielluizep.dev SOA ns-c
47.9254...		191.36.13.12	76.76.21.21	ICMP	98	Echo (ping) request id=0x1da1, seq=1/256, ttl=64 (reply in 15
47.9377...		76.76.21.21	191.36.13.12	ICMP	98	Echo (ping) reply id=0x1da1, seq=1/256, ttl=113 (request ir
47.9380...		191.36.13.12	191.36.8.2	DNS	84	Standard query 0xe1dd PTR 21.21.76.76.in-addr.arpa
49.7042...		191.36.8.2	191.36.13.12	DNS	138	Standard query response 0xe1dd No such name PTR 21.21.76.76.ir
49.7043...		191.36.13.12	76.76.21.21	ICMP	98	Echo (ping) request id=0x1da1, seq=2/512, ttl=64 (reply in 16
49.7166...		76.76.21.21	191.36.13.12	ICMP	98	Echo (ping) reply id=0x1da1, seq=2/512, ttl=113 (request ir
72.7192...		191.36.13.12	191.36.8.2	DNS	91	Standard query 0x44a4 A signaler-pa.clients6.google.com
72.7192...		191.36.13.12	191.36.8.2	DNS	91	Standard query 0x4e61 AAAA signaler-pa.clients6.google.com
72.7207...		191.36.8.2	191.36.13.12	DNS	554	Standard query response 0x44a4 A signaler-pa.clients6.google.c
72.7213...		191.36.8.2	191.36.13.12	DNS	550	Standard query response 0x4e61 AAAA signaler-pa.clients6.googl
112.991...		191.36.13.12	191.36.8.2	DNS	75	Standard query 0xc081 A ssl.gstatic.com
112.991...		191.36.13.12	191.36.8.2	DNS	75	Standard query 0x32c6 AAAA ssl.gstatic.com
112.992...		191.36.8.2	191.36.13.12	DNS	538	Standard query response 0xc081 A ssl.gstatic.com A 142.251.128
112.992...		191.36.8.2	191.36.13.12	DNS	550	Standard query response 0x32c6 AAAA ssl.gstatic.com AAAA 2800:



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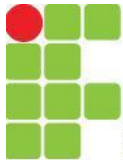
```
Frame 1523: 77 bytes on wire (616 bits), 77 bytes captured (616 bits) on interface 0
Ethernet II, Src: AsrockIn_10:c6:9e (a8:a1:59:10:c6:9e), Dst: Cisco_8e:eb:78 (00:af:1f:8e:eb:78)
Internet Protocol Version 4, Src: 191.36.13.12, Dst: 191.36.8.2
User Datagram Protocol, Src Port: 44693, Dst Port: 53
Domain Name System (query)
  Transaction ID: 0x3d8b
  Flags: 0x0100 Standard query
  Questions: 1
  Answer RRs: 0
  Authority RRs: 0
  Additional RRs: 0
  Queries
    gabrielluizep.dev: type A, class IN
      Name: gabrielluizep.dev
      [Name Length: 17]
      [Label Count: 2]
      Type: A (Host Address) (1)
      Class: IN (0x0001)
[Response In: 1526]
```

2) Perguntas a serem respondidas, baseado nos pacotes "Standard query", "Standard query response" e comandos do terminal:

- Quem são os servidores DNS da sua máquina?

```
aluno: ~$ nmcli dev show | grep DNS
IP4.DNS[1]: 191.36.8.66
IP4.DNS[2]: 191.36.8.1
IP4.DNS[3]: 191.36.8.4
IP4.DNS[4]: 191.36.8.6
IP4.DNS[5]: 191.36.8.7
IP4.DNS[6]: 191.36.8.25
aluno: ~$ cat /etc/resolv.conf
nameserver 191.36.8.2
```

Endereço IPV4 configurado na máquina: 191.36.8.2 (considerado apenas o escrito no arquivo de configuração de DNS).



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- O ping gerou perguntas para cada um deles?

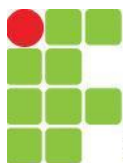
47.2243...	191.36.13.12	191.36.8.2	DNS	77	Standard query 0x3d8b A gabrielluizep.dev
47.2243...	191.36.13.12	191.36.8.2	DNS	77	Standard query 0xe530 AAAA gabrielluizep.dev
47.9249...	191.36.8.2	191.36.13.12	DNS	540	Standard query response 0x3d8b A gabrielluizep.dev A 76.76.21.21 NS m.
47.9251...	191.36.8.2	191.36.13.12	DNS	170	Standard query response 0xe530 AAAA gabrielluizep.dev S0A ns-cloud-ci.
47.9254...	191.36.13.12	76.76.21.21	ICMP	98	Echo (ping) request id=0x1da1, seq=1/256, ttl=64 (reply in 1529)
47.9377...	76.76.21.21	191.36.13.12	ICMP	98	Echo (ping) reply id=0x1da1, seq=1/256, ttl=113 (request in 1528)
47.9380...	191.36.13.12	191.36.8.2	DNS	84	Standard query 0xe1dd PTR 21.21.76.76.in-addr.arpa
49.7042...	191.36.8.2	191.36.13.12	DNS	138	Standard query response 0xe1dd No such name PTR 21.21.76.76.in-addr.ar
49.7043...	191.36.13.12	76.76.21.21	ICMP	98	Echo (ping) request id=0x1da1, seq=2/512, ttl=64 (reply in 1663)
49.7166...	76.76.21.21	191.36.13.12	ICMP	98	Echo (ping) reply id=0x1da1, seq=2/512, ttl=113 (request in 1662)

Não, gerou apenas para o servidor DNS principal.

- Qual o tipo da RR associada a pergunta (*Queries*). O que significa?

```
Checksum: 0x9210 [unverified]
[Checksum Status: Unverified]
[Stream index: 51]
▼ Domain Name System (query)
  Transaction ID: 0x3d8b
  ▼ Flags: 0x0100 Standard query
    0... .. = Response: Message is a query
    .000 0... .. = Opcode: Standard query (0)
    .... ..0. .... = Truncated: Message is not truncated
    .... ..1 .... = Recursion desired: Do query recursively
    .... ..0.. .... = Z: reserved (0)
    .... ..0 .... = Non-authenticated data: Unacceptable
  Questions: 1
  Answer RRs: 0
  Authority RRs: 0
  Additional RRs: 0
  ▼ Queries
    ▼ gabrielluizep.dev: type A, class IN
      Name: gabrielluizep.dev
      [Name Length: 17]
      [Label Count: 2]
      Type: A (Host Address) (1)
      Class: IN (0x0001)
      [Response In: 1526]
```

Significa uma solicitação do tipo A, classe IN



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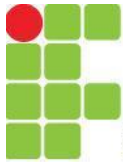
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3) Qual endereço IP retornado da solicitação da resolução de www.ifsc.edu.br?

```
▼ Domain Name System (response)
  Transaction ID: 0x3d8b
  ▼ Flags: 0x8180 Standard query response, No error
    1... .. = Response: Message is a response
    .000 0... .. = Opcode: Standard query (0)
    .... .0.. .. = Authoritative: Server is not an authority
    .... ..0. .... = Truncated: Message is not truncated
    .... ...1 .... = Recursion desired: Do query recursively
    .... .... 1... .. = Recursion available: Server can do recursion
    .... .... .0.. .. = Z: reserved (0)
    .... .... ..0. .... = Answer authenticated: Answer/authority
    .... .... ...0 .... = Non-authenticated data: Unacceptable
    .... .... .... 0000 = Reply code: No error (0)
  Questions: 1
  Answer RRs: 1
  Authority RRs: 13
  Additional RRs: 11
  ▼ Queries
    ▼ gabrielluizep.dev: type A, class IN
      Name: gabrielluizep.dev
      [Name Length: 17]
      [Label Count: 2]
      Type: A (Host Address) (1)
      Class: IN (0x0001)
  ▼ Answers
    ▼ gabrielluizep.dev: type A, class IN, addr 76.76.21.21
      Name: gabrielluizep.dev
      Type: A (Host Address) (1)
      Class: IN (0x0001)
      Time to live: 3600 (1 hour)
      Data length: 4
      Address: 76.76.21.21
```

Endereço IP associado: 76.76.21.21



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Qual endereço IP usado no ping (ver pacote REQUEST ICMP)?

47.9254...	191.36.13.12	76.76.21.21	ICMP	98	Echo (ping) request id=0x1da1, seq=1/
47.9377...	76.76.21.21	191.36.13.12	ICMP	98	Echo (ping) reply id=0x1da1, seq=1/
47.9380...	191.36.13.12	191.36.8.2	DNS	84	Standard query 0xe1dd PTR 21.21.76.76.
48.7842...	191.36.8.2	191.36.13.12	DNS	128	Standard query response 0xe1dd No such

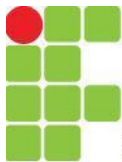
▶ Frame 1528: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
▶ Ethernet II, Src: AsrockIn_10:c6:9e (a8:a1:59:10:c6:9e), Dst: Cisco_8e:eb:78 (00:af:1f:8e:eb:78)
▼ Internet Protocol Version 4, Src: 191.36.13.12, Dst: 76.76.21.21
0100 = Version: 4
.... 0101 = Header Length: 20 bytes (5)
▶ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
Total Length: 84
Identification: 0x615d (24925)
▶ Flags: 0x4000, Don't fragment
Fragment offset: 0
Time to live: 64
Protocol: ICMP (1)
Header checksum: 0xabba [validation disabled]
[Header checksum status: Unverified]
Source: 191.36.13.12
Destination: 76.76.21.21
▼ Internet Control Message Protocol
Type: 8 (Echo (ping) request)
Code: 0
Checksum: 0xd6ac [correct]
[Checksum Status: Good]
Identifier (BE): 7585 (0x1da1)
Identifier (LE): 41245 (0xa11d)
Sequence number (BE): 1 (0x0001)
Sequence number (LE): 256 (0x0100)
[Response frame: 1529]
Timestamp from icmp data: Oct 3, 2022 09:58:36.000000000 -03
[Timestamp from icmp data (relative): 0.892585578 seconds]
▼ Data (48 bytes)
Data: 809e0d0000000000101112131415161718191a1b1c1d1e1f...
[Length: 48]

Endereço IP de origem: 191.36.13.12

Endereço IP de destino: 76.76.21.21

Qual protocolo de transporte, camada 4, que foi usado para transportar as mensagens de aplicação DNS?

Foi utilizado o protocolo de transporte UDP, conforme abaixo:



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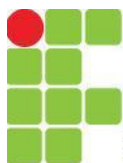
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```
▶ Frame 1523: 77 bytes on wire (616 bits), 77 bytes captured (616 bits) on interface 0
▶ Ethernet II, Src: AsrockIn_10:c6:9e (a8:a1:59:10:c6:9e), Dst: Cisco_8e:eb:78 (00:af:1f:8e:eb:78)
▶ Internet Protocol Version 4, Src: 191.36.13.12, Dst: 191.36.8.2
▼ User Datagram Protocol, Src Port: 44693, Dst Port: 53
  Source Port: 44693
  Destination Port: 53
  Length: 43
  Checksum: 0x9210 [unverified]
  [Checksum Status: Unverified]
  [Stream index: 51]
▶ Domain Name System (query)
```

4) No QUERY realizado foi solicitado consulta recursiva. O servidor aceitou esta solicitação? (ver a resposta do servidor)

```
▼ Domain Name System (response)
  Transaction ID: 0x3d8b
  ▼ Flags: 0x8180 Standard query response, No error
    1... .. = Response: Message is a response
    .000 0... .. = Opcode: Standard query (0)
    ....0... .. = Authoritative: Server is not an authority for domain
    ....0... .. = Truncated: Message is not truncated
    ....1... .. = Recursion desired: Do query recursively
    ....1... .. = Recursion available: Server can do recursive queries
    ....0... .. = Z: reserved (0)
    ....0... .. = Answer authenticated: Answer/authority portion was not authenticated by the server
    ....0... .. = Non-authenticated data: Unacceptable
    ....0000 = Reply code: No error (0)
  Questions: 1
  Answer RRs: 1
  Authority RRs: 13
  Additional RRs: 11
```

Sim, aceito a solicitação de DNS recursivo feita pelo cliente, conforme a imagem acima.



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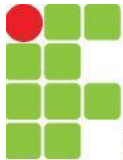
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Quais os servidores autorizados (*Authoritative nameservers*) foram repassados como resultado de sua consulta?

```
Questions: 1
Answer RRs: 1
Authority RRs: 13
Additional RRs: 11
▼ Queries
  ▶ gabrielluizep.dev: type A, class IN
▼ Answers
  ▶ gabrielluizep.dev: type A, class IN, addr 76.76.21.21
▼ Authoritative nameservers
  ▶ <Root>: type NS, class IN, ns m.root-servers.net
  ▶ <Root>: type NS, class IN, ns f.root-servers.net
  ▶ <Root>: type NS, class IN, ns h.root-servers.net
  ▶ <Root>: type NS, class IN, ns d.root-servers.net
  ▶ <Root>: type NS, class IN, ns a.root-servers.net
  ▶ <Root>: type NS, class IN, ns e.root-servers.net
  ▶ <Root>: type NS, class IN, ns b.root-servers.net
  ▶ <Root>: type NS, class IN, ns k.root-servers.net
  ▶ <Root>: type NS, class IN, ns l.root-servers.net
  ▶ <Root>: type NS, class IN, ns i.root-servers.net
  ▶ <Root>: type NS, class IN, ns c.root-servers.net
  ▶ <Root>: type NS, class IN, ns j.root-servers.net
  ▶ <Root>: type NS, class IN, ns g.root-servers.net
▼ Additional records
  ▶ a.root-servers.net: type A, class IN, addr 198.41.0.4
  ▶ a.root-servers.net: type AAAA, class IN, addr 2001:503:ba3e::2:30
  ▶ b.root-servers.net: type A, class IN, addr 199.9.14.201
  ▶ b.root-servers.net: type AAAA, class IN, addr 2001:500:200::b
  ▶ c.root-servers.net: type A, class IN, addr 192.33.4.12
  ▶ c.root-servers.net: type AAAA, class IN, addr 2001:500:2::c
  ▶ d.root-servers.net: type A, class IN, addr 199.7.91.13
  ▶ d.root-servers.net: type AAAA, class IN, addr 2001:500:2d::d
  ▶ e.root-servers.net: type A, class IN, addr 192.203.230.10
  ▶ e.root-servers.net: type AAAA, class IN, addr 2001:500:a8::e
  ▶ f.root-servers.net: type A, class IN, addr 192.5.5.241
```

Os servidores DNS repassados estão dispostos acima, são todos os roots, o endereço IPv4 e v6 dos iniciais também estão exibidos acima.



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icmp dns					
Time	Source	Destination	Protocol	Length	Info
47.9251...	191.36.8.2	191.36.13.12	DNS	170	Standard query response 0xe530 AAAA gabrielluizep.c
47.9254...	191.36.13.12	76.76.21.21	ICMP	98	Echo (ping) request id=0x1da1, seq=1/256, ttl=64 (
47.9377...	76.76.21.21	191.36.13.12	ICMP	98	Echo (ping) reply id=0x1da1, seq=1/256, ttl=113
47.9380...	191.36.13.12	191.36.8.2	DNS	84	Standard query 0xe1dd PTR 21.21.76.76.in-addr.arpa
49.7042...	191.36.8.2	191.36.13.12	DNS	138	Standard query response 0xe1dd No such name PTR 21.
49.7043...	191.36.13.12	76.76.21.21	ICMP	98	Echo (ping) request id=0x1da1, seq=2/512, ttl=64 (

▶ Frame 1530: 84 bytes on wire (672 bits), 84 bytes captured (672 bits) on interface 0
▶ Ethernet II, Src: AsrockIn_10:c6:9e (a8:a1:59:10:c6:9e), Dst: Cisco_8e:eb:78 (00:af:1f:8e:eb:78)
▶ Internet Protocol Version 4, Src: 191.36.13.12, Dst: 191.36.8.2
▶ User Datagram Protocol, Src Port: 32855, Dst Port: 53
▼ Domain Name System (query)
Transaction ID: 0xe1dd
▼ Flags: 0x0100 Standard query
0... .. = Response: Message is a query
.000 0... .. = Opcode: Standard query (0)
... ..0. = Truncated: Message is not truncated
... ..1 = Recursion desired: Do query recursively
... ..0. = Z: reserved (0)
... ..0 = Non-authenticated data: Unacceptable
Questions: 1
Answer RRs: 0
Authority RRs: 0
Additional RRs: 0
▼ Queries
▼ 21.21.76.76.in-addr.arpa: type PTR, class IN
Name: 21.21.76.76.in-addr.arpa
[Name Length: 24]
[Label Count: 6]
Type: PTR (domain name PoinTeR) (12)
Class: IN (0x0001)
[Response In: 1661]

- Qual o IP que se pretende resolver?

R: A Solicitação de DNS PTR (DNS reverso) é para o IP 21.21.76.76

- Qual o nome retornado?

R: A solicitação não obteve retorno de nomes de dominio, conforme abaixo:



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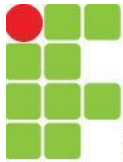
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```
Questions: 1
Answer RRs: 0
Authority RRs: 1
Additional RRs: 0
▼ Queries
  ▼ 21.21.76.76.in-addr.arpa: type PTR, class IN
    Name: 21.21.76.76.in-addr.arpa
    [Name Length: 24]
    [Label Count: 6]
    Type: PTR (domain name PoinTeR) (12)
    Class: IN (0x0001)
  ▼ Authoritative nameservers
    ▼ 76.in-addr.arpa: type SOA, class IN, mname z.arin.net
      Name: 76.in-addr.arpa
      Type: SOA (Start Of a zone of Authority) (6)
      Class: IN (0x0001)
      Time to live: 10800 (3 hours)
      Data length: 42
      Primary name server: z.arin.net
      Responsible authority's mailbox: dns-ops.arin.net
      Serial Number: 2017034587
      Refresh Interval: 1800 (30 minutes)
      Retry Interval: 900 (15 minutes)
      Expire limit: 691200 (8 days)
      Minimum TTL: 10800 (3 hours)
      \[Request In: 1530\]
      [Time: 1.766155496 seconds]
```

Agora descubra e anote no relatório quem é o servidor DNS responsável por cada um dos domínios dos nomes acima.

Para isso consulte o valor do registro NS associado a esses domínios. Por exemplo, com o programa *host* ou *dig* isso pode ser feito assim:



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```
aluno: ~$ dig www.google.com

; <<>> DiG 9.10.3-P4-Debian <<>> www.google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 25826
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 13, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.google.com.                IN      A

;; ANSWER SECTION:
www.google.com.                83      IN      A      142.250.218.196
```

IP: 142.250.218.196

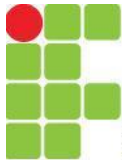
```
aluno: ~$ dig www.gmail.com

; <<>> DiG 9.10.3-P4-Debian <<>> www.gmail.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 45338
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 13, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.gmail.com.                IN      A

;; ANSWER SECTION:
www.gmail.com.                300     IN      A      142.250.218.197
```

IP: 142.250.218.197



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```
86400 IN NSEC aaa. NS SOA RRSIG NSEC DNSKEY
86400 IN RRSIG NSEC 8 0 86400 20221003040000 18733 . Q/ctpiK3hRE/A0l9QLRIW8V0yTk8gSuP5sKG3LdMuC
baaa8e0pP7Ybq Xqmu4E/W2la+b1bxQ00WvT0nBHWIBfQdjVKNGL0bU4gSpqmU10rhyPh SuHZVXdH6Gh+0KeSr70FdpQL8UhZpkzTZT0cfcYghxwE+YA2CptUSSiW ZgzLEmSBjllEdEY
Tb+WBtQ71SezEC+pEeBnBYah1N54IYC0vqviz7Et 6zVIXbjoBxSb1zzGLw650Uws1x0eHG0M1BpZ5t+m/vaxhv032kyZF6k k1iHX5/eN/y3IXFYZ5GIzrDgsNK7/yr4SrxQw5VZeF40m
pEgyDBZjyY ucm8Gw==
;; Received 708 bytes from 2001:500:2f::f53(f.root-servers.net) in 5 ms

454370 IN NS m.root-servers.net.
454370 IN NS f.root-servers.net.
454370 IN NS b.root-servers.net.
454370 IN NS e.root-servers.net.
454370 IN NS d.root-servers.net.
454370 IN NS h.root-servers.net.
454370 IN NS l.root-servers.net.
454370 IN NS j.root-servers.net.
454370 IN NS g.root-servers.net.
454370 IN NS c.root-servers.net.
454370 IN NS a.root-servers.net.
454370 IN NS k.root-servers.net.
454370 IN NS i.root-servers.net.
454370 IN RRSIG NS 8 0 518400 20221015170000 20221002160000 18733 . tFyh90ebJVucTqmz0WqkvIJAFJeTnTBISGLahrwZhIs
qhFEeWLS7ly4 0vjXWq77VJZfZifI0x5LioPRe2AntYCWtq33pq0RTmcYc3ces0Yz14DJ nhvERTzQt6DBpabp/prXziZTZly6iSuef1XjXEpFvaoK2RaM0tb33hJ0 XPPVI0hoFj+ac90J
65Q6eStobJigt3y5x0HwZLTJeoRZ5I5TbVLNrm y2CuRVWZG35I7AAxUf8WxzQY08P2cRmTNl9uekLGP0/Hokd0VWZiL053 FxuA+Y0No3A0L2qoVl00rn+he/1i9vhHhhAQt4jEJYxs
TWwL81T++ 6smV6A==
;; Received 1097 bytes from 191.36.8.2#53(191.36.8.2) in 0 ms

ru. 172800 IN NS a.dns.ripn.net.
ru. 172800 IN NS b.dns.ripn.net.
ru. 172800 IN NS d.dns.ripn.net.
ru. 172800 IN NS e.dns.ripn.net.
ru. 172800 IN NS f.dns.ripn.net.
ru. 86400 IN DS 33257 8 2 641A0BA027A1027D2FD17B5743931804EEBB329B8B514A357D1EF290 F159D79F
ru. 86400 IN RRSIG DS 8 1 86400 20221016050000 20221003040000 18733 . VUN7JK+jUqHZDjIkFbmGCsgK7eTtXmjDcr9H0AFUkjaH
KYcZDI0HNaH WtId+68E3TPsGdZ35H3GHeswcSSdvY5RjW3eBdbqP7nFQgkxYKcWji+ vUigxppaFhncCRASi+ALdAdU1fGvpPf05/abezbjdkUyvt7C6prN0Qrh f32XK9KPd8G1EG/MM
DznZ1i00jc+R+BqA6jxfVyTseHS/WG1ZzqT/ub ee5h0CdIBF0XvEFCHvihnBumCnNTtj5GisuSMzdlR2amtHQMciqfvmv ECBUYzUDx5DQKX1GExHVpV/XmM6FSM2+d7cDhMp0rV/uQIf
Eq/GL/Fy zM0eAQ==
;; Received 683 bytes from 192.203.230.10#53(e.root-servers.net) in 5 ms

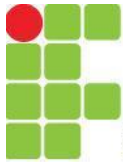
MAIL.RU. 345600 IN NS ns3.mail.ru.
MAIL.RU. 345600 IN NS ns2.mail.ru.
MAIL.RU. 345600 IN NS ns1.mail.ru.
D20C0QKDHUA3CUMNKST289FF06U25Q91.ru. 3600 IN NSEC3 1 1 0 - J21C11SH00TMOEQKPRM91C8AGL4886M6 NS SOA RRSIG DNSKEY NSEC3PARAM
D20C0QKDHUA3CUMNKST289FF06U25Q91.ru. 3600 IN RRSIG NSEC3 8 2 3600 20221027070619 20220926121955 33540 ru. CTGiz9tQCih2fMok01lexGBnquFSRnrhQP6cZ
ANzHRI/H5ccHk/j3vP qafb3/Vf7DF00+Aj4hUmtMnR7/s+vfGK73xjbtMcMEq2GjmEqZ46HDD+ eIt1+9YSZcxQiRV3ieysgDimmFLuY9FMw0rWK8Lk5sE0fzL2rpVBRmg G/M=
UI68RDB76N8TRSIHGPCK981SK28G1U8.ru. 3600 IN NSEC3 1 1 0 - UIMTEF14VRQK6F8NPT1RHH00DSR5P97 NS DS RRSIG
UI68RDB76N8TRSIHGPCK981SK28G1U8.ru. 3600 IN RRSIG NSEC3 8 2 3600 20221106153617 20220927061941 33540 ru. mYXhWWYbCwK17q2MiAcRfL65ahqdJyR9m+Nkb
B9SsiuQNLqvm03X0YE qRi2Y9uB0H7BpgrTYLox3eURDFebQYyChUw1q+Ar6yuFGTWHn+LVP0uH 00eG0fljr0pmAyakWANAuV/Tu+8WrcUXmM94d9mdQ6zyCbxXUNSE9xsw lc4=
;; Received 645 bytes from 2001:678:18:0:194:190:124:17#53(d.dns.ripn.net) in 186 ms

mail.ru. 60 IN A 94.100.180.200
mail.ru. 60 IN A 217.69.139.202
mail.ru. 60 IN A 217.69.139.200
mail.ru. 60 IN A 94.100.180.201
mail.ru. 600 IN NS ns1.mail.ru.
mail.ru. 600 IN NS ns2.mail.ru.
mail.ru. 600 IN NS ns3.mail.ru.
;; Received 286 bytes from 94.100.180.138#53(ns2.mail.ru) in 260 ms
```

No terminal de sua máquina faça uma consulta e responda: qual o endereço IPv6 dos hosts? Por exemplo:

```
dig AAAA google.com
host -t AAAA google.com
```

- **webmail.ufsc.br**



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```
aluno: ~$ dig AAAA webmail.ufsc.br

; <<>> DiG 9.10.3-P4-Debian <<>> AAAA webmail.ufsc.br
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 64688
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;webmail.ufsc.br.                IN      AAAA

;; AUTHORITY SECTION:
webmail.ufsc.br.                3600    IN      SOA     slave.ufsc.br. admin.ufsc.br. 1567689525 14400 3600
864000 86400
```

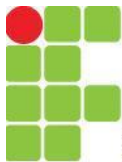
```
aluno: ~$ dig AAAA slave.ufsc.br

; <<>> DiG 9.10.3-P4-Debian <<>> AAAA slave.ufsc.br
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59054
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 13, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;slave.ufsc.br.                  IN      AAAA

;; ANSWER SECTION:
slave.ufsc.br.                  43196   IN      AAAA     2801:84:0:1001:150:162:1:84
slave.ufsc.br.                  43196   IN      AAAA     2801:84:0:1242:150:162:242:74
```

O endereço IPv6 está exibido acima.



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- **www.sj.ifsc.edu.br**

```
aluno: ~$ dig AAAA www.sj.ifsc.edu.br

; <<>> DiG 9.10.3-P4-Debian <<>> AAAA www.sj.ifsc.edu.br
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 672
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.sj.ifsc.edu.br.          IN      AAAA

;; ANSWER SECTION:
www.sj.ifsc.edu.br.         3600    IN      CNAME   ingress-cloud.sj.ifsc.edu.br.

;; AUTHORITY SECTION:
sj.ifsc.edu.br.             3600    IN      SOA      ns0.sj.ifsc.edu.br. ctic\sjc.listas.ifsc.edu.br. 2022022501
3600 600 14400 3600
```

```
aluno: ~$ dig AAAA ns0.sj.ifsc.edu.br

; <<>> DiG 9.10.3-P4-Debian <<>> AAAA ns0.sj.ifsc.edu.br
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 37698
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;ns0.sj.ifsc.edu.br.         IN      AAAA

;; AUTHORITY SECTION:
sj.ifsc.edu.br.             3488    IN      SOA      ns0.sj.ifsc.edu.br. ctic\sjc.listas.ifsc.edu.br. 2022022501
3600 600 14400 3600
```

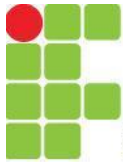
Sem endereço IPv6 associado a este servidor.

Agora vamos fazer a consulta reversa. Qual é o nome de host dos seguintes endereços? Por exemplo:

dig -x 2001:12ff::10

dig -x 2001:12ff::10 +short

host 2001:12ff::10



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- 2001:12d0:0:126::183:244

Domínio associado: rubus.uspnet.usp.br

```
aluno: ~$ dig -x 2001:12d0:0:126::183:244

; <<> DiG 9.10.3-P4-Debian <<> -x 2001:12d0:0:126::183:244
;; global options: +cmd
;; Got answer:
;; ->>HEADER<- opcode: QUERY, status: NOERROR, id: 54151
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 13, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;4.4.2.0.3.8.1.0.0.0.0.0.0.0.0.6.2.1.0.0.0.0.0.d.2.1.1.0.0.2.ip6.arpa. IN PTR

;; ANSWER SECTION:
4.4.2.0.3.8.1.0.0.0.0.0.0.0.0.6.2.1.0.0.0.0.0.d.2.1.1.0.0.2.ip6.arpa. 21595 IN PTR rubus.uspnet.usp.br.

;; AUTHORITY SECTION:
.          454602 IN      NS       j.root-servers.net.
.          454602 IN      NS       h.root-servers.net.
.          454602 IN      NS       l.root-servers.net.
.          454602 IN      NS       e.root-servers.net.
.          454602 IN      NS       k.root-servers.net.
.          454602 IN      NS       d.root-servers.net.
.          454602 IN      NS       c.root-servers.net.
.          454602 IN      NS       b.root-servers.net.
.          454602 IN      NS       i.root-servers.net.
.          454602 IN      NS       g.root-servers.net.
.          454602 IN      NS       m.root-servers.net.
.          454602 IN      NS       a.root-servers.net.
.          454602 IN      NS       f.root-servers.net.
```