



UNIVERSIDADE FEDERAL DA PARAÍBA

CENTRO DE INFORMÁTICA

ENGENHARIA DE COMPUTAÇÃO

**Relatório – Laboratório de Redes
TCP/UDP**

Thiago Gonzaga Gomes - 11504760

Orientador: Profa. Dra. Giorgia de Oliveira Mattos

João Pessoa – 22 de abril de 2019

TCP

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|------------|----------------|----------------|----------|--------|--|
| 16 | 6.70718900 | 192.168.43.36 | 128.119.245.12 | TCP | 66 | 66 http > 58278 [SYN] Seq=0 win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 28 | 7.86820700 | 128.119.245.12 | 192.168.43.36 | TCP | 66 | 66 http > 58278 [SYN, ACK] Seq=0 Ack=1 win=29200 Len=0 MSS=1400 SACK_PERM=1 WS=128 |
| 29 | 7.86852100 | 192.168.43.36 | 128.119.245.12 | TCP | 54 | 54 58278 > http [ACK] Seq=1 Ack=1 win=65792 Len=0 |
| 31 | 7.94763800 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 32 | 7.94772500 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 33 | 7.94778500 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 34 | 7.94784600 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 47 | 9.12503000 | 128.119.245.12 | 192.168.43.36 | TCP | 66 | 66 http > 58278 [SYN, ACK] Seq=0 Ack=1 win=29200 Len=0 MSS=1400 SACK_PERM=1 WS=128 |
| 48 | 9.12523800 | 192.168.43.36 | 128.119.245.12 | TCP | 66 | [TCP Dup ACK 34#1] 58278 > http [ACK] Seq=3601 Ack=1 win=65792 Len=0 SLE=0 SRE=1 |
| 49 | 9.12618500 | 128.119.245.12 | 192.168.43.36 | TCP | 54 | 54 http > 58278 [ACK] Seq=1 Ack=1401 win=32128 Len=0 |
| 50 | 9.12642500 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 51 | 9.12648900 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 52 | 9.12690900 | 128.119.245.12 | 192.168.43.36 | TCP | 54 | 54 http > 58278 [ACK] Seq=1 Ack=5601 win=40576 Len=0 |
| 53 | 9.12709600 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 54 | 9.12715700 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 55 | 9.12721400 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 56 | 9.12726700 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 57 | 9.12732500 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 58 | 9.12737900 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 66 | 9.51440800 | 128.119.245.12 | 192.168.43.36 | TCP | 54 | 54 http > 58278 [ACK] Seq=1 Ack=7001 win=43520 Len=0 |
| 67 | 9.51465200 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 68 | 9.51472200 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 69 | 9.53427800 | 128.119.245.12 | 192.168.43.36 | TCP | 54 | 54 http > 58278 [ACK] Seq=1 Ack=8401 win=46464 Len=0 |
| 70 | 9.53450500 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 71 | 9.53457800 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 72 | 9.55427900 | 128.119.245.12 | 192.168.43.36 | TCP | 54 | 54 http > 58278 [ACK] Seq=1 Ack=9801 win=49280 Len=0 |
| 73 | 9.55448900 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 74 | 9.55455700 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 75 | 9.58632600 | 128.119.245.12 | 192.168.43.36 | TCP | 54 | 54 http > 58278 [ACK] Seq=1 Ack=11201 win=52224 Len=0 |
| 76 | 9.58653600 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |
| 77 | 9.58661100 | 192.168.43.36 | 128.119.245.12 | TCP | 1454 | [TCP segment of a reassembled PDU] |

- 1) Source: 192.168.0.5, a porta TCP é a 5010 (telepathstart).
- 2) IP do gaia: 128.119.245.12, a porta TCP é a 80.
- 3) IP: 192.168.43.36, a porta TCP é a 58278.

| |
|---|
| Destination port: rearch-polling (1101) |
| [Stream index: 0] |
| Sequence number: 0 (relative sequence number) |
| Acknowledgment number: 1 (relative ack number) |
| Header length: 28 bytes |
| <input checked="" type="checkbox"/> Flags: 0x012 (SYN, ACK) |
| 000. = Reserved: Not set |
| ...0 = Nonce: Not set |
| 0... = Congestion window Reduced (CWR): Not set |
|0.. = ECN-Echo: Not set |
|0. = Urgent: Not set |
|1 = Acknowledgment: Set |
| 0... = Push: Not set |
|0.. = Reset: Not set |
| <input checked="" type="checkbox"/>1. = Syn: Set |

- 4) A flag do SYN é setada para 1, e ela indica que o segmento em questão é um SYN.
- 5) A sequencia enviada do SYNACK pelo servidor do gaia.cs.umass.edu para o client no reply para o SYN é 0, o ACK é 1, o SYNACK é 1.

```

⊞ Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)
⊞ Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
⊞ Internet Protocol Version 4, Src: 192.168.1.102 (192.168.1.102), Dst: 128.119.245.12 (128.119.245.12)
⊞ Transmission Control Protocol, Src Port: health-polling (1161), Dst Port: http (80), Seq: 1, Ack: 1, Len: 565
    Source port: health-polling (1161)
    Destination port: http (80)
    [Stream index: 0]
    Sequence number: 1 (relative sequence number)
    [Next sequence number: 566 (relative sequence number)]
    Acknowledgment number: 1 (relative ack number)
    Header length: 20 bytes
    ⊞ Flags: 0x018 (PSH, ACK)
        000. .... = Reserved: Not set
        ...0 .... = Nonce: Not set
        .... 0... = Congestion window reduced (CWR): Not set

```

6) O número é 1.

7) *Statistics->TCP Stream Graph->Round Trip Time Graph.*

Segment 1 sequence number: 1

Segment 2 sequence number: 566

Segment 3 sequence number: 2026

Segment 4 sequence number: 3486

Segment 5 sequence number: 4946

Segment 6 sequence number: 6406

| | Tempo p/ envio | ACK received time | RTT (s) |
|-------------------|----------------|-------------------|----------|
| Segmento 1 | 0.026477 | 0.053937 | 0.02746 |
| Segmento 2 | 0.041737 | 0.077297 | 0.035557 |
| Segmento 3 | 0.054026 | 0.124085 | 0.070059 |
| Segmento 4 | 0.054690 | 0.169118 | 0.11443 |
| Segmento 5 | 0.077405 | 0.217299 | 0.13989 |
| Segmento 6 | 0.078157 | 0.267802 | 0.18964 |

$$RTTEstimado = 0.875 * RTTEstimado + 0.125 * SampleRTT$$

RTTEstimado depois do recebimento do ACK do segmento 1:

RTTEstimado = RTT p/ segmento 1 = 0.02746 segundos

RTTEstimado depois do recebimento do ACK do segmento 2:

RTTEstimado = $0.875 * 0.02746 + 0.125 * 0.035557 = 0.0285$ segundos

RTTEstimado depois do recebimento do ACK do segmento 3:

RTTEstimado = $0.875 * 0.0285 + 0.125 * 0.070059 = 0.0337$ segundos

RTTEstimado depois do recebimento do ACK do segmento 4:

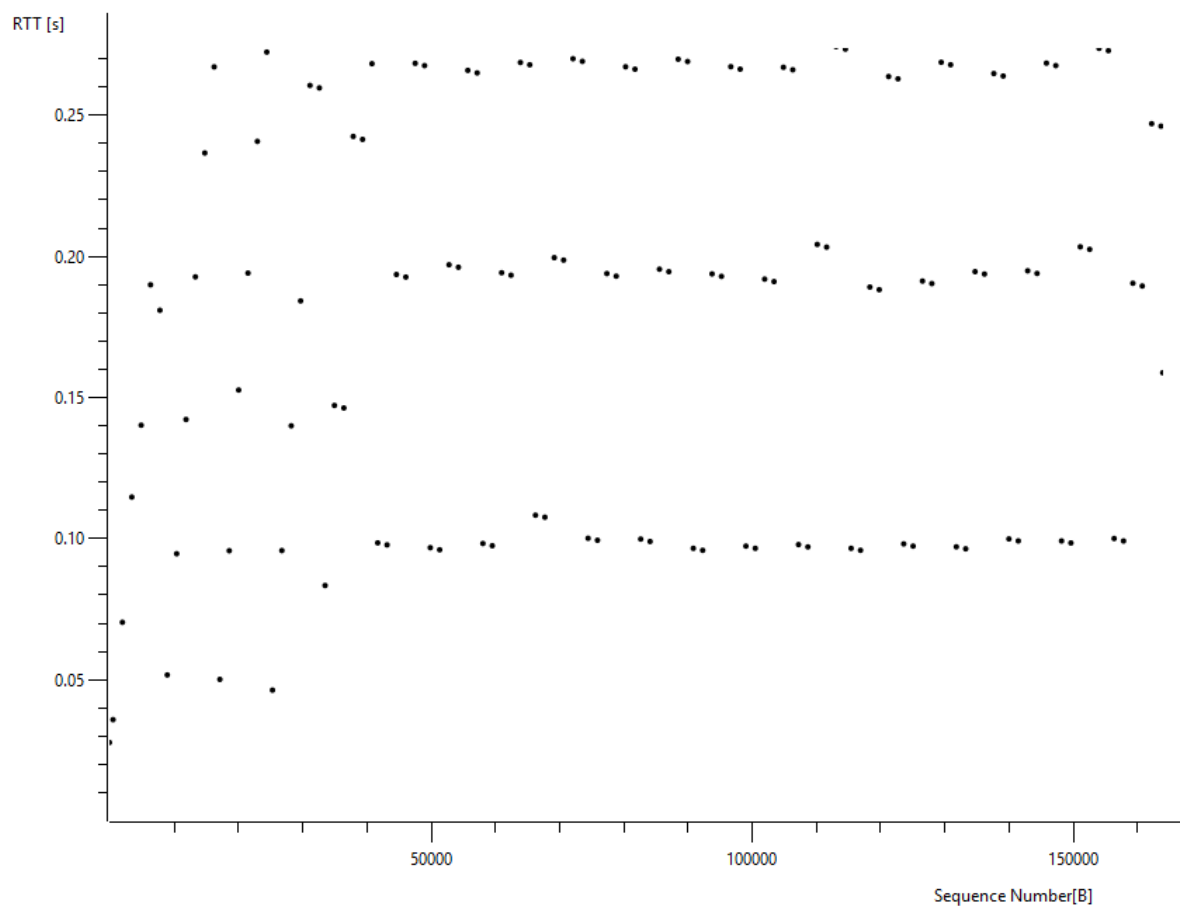
RTTEstimado = $0.875 * 0.0337 + 0.125 * 0.11443 = 0.0438$ segundos

RTTEstimado depois do recebimento do ACK do segmento 5:

RTTEstimado = $0.875 * 0.0438 + 0.125 * 0.13989 = 0.0558$ segundos

RTTEstimado depois do recebimento do ACK do segmento 6:

RTTEstimado = $0.875 * 0.0558 + 0.125 * 0.18964 = 0.0725$ segundos

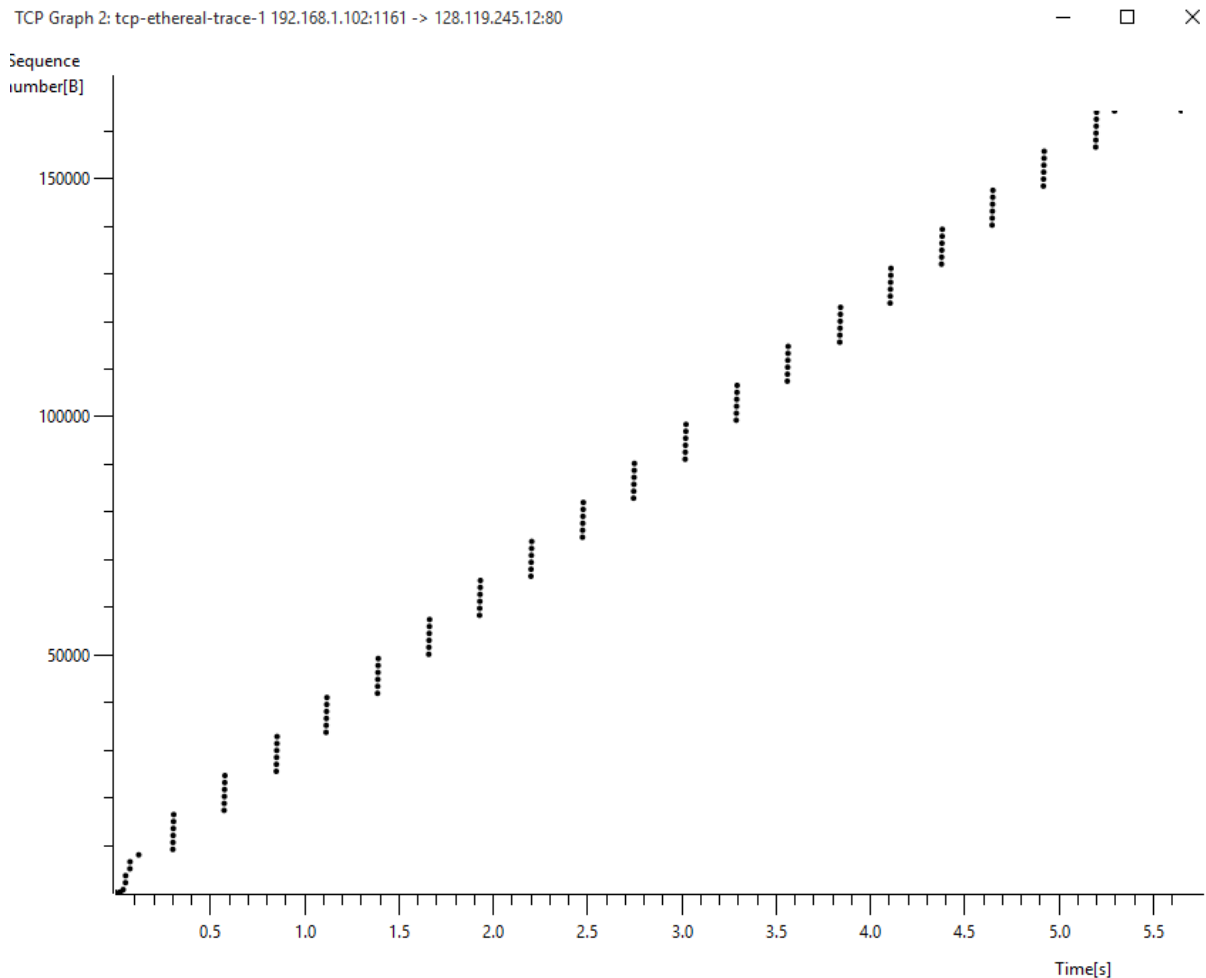


```

<
.... 0... .... = Congestion Window Reduced (CWR): Not set
.... .0.. .... = ECN-Echo: Not set
.... ..0. .... = Urgent: Not set
.... ...1 .... = Acknowledgment: Set
.... .... 0... = Push: Not set
.... .... .0.. = Reset: Not set
.... .... ..0. = Syn: Not set
.... .... ...0 = Fin: Not set
window size value: 17520
[Calculated window size: 17520]
[window size scaling factor: -2 (no window scaling used)]
+ Checksum: 0x9583 [validation disabled]
+ [SEQ/ACK analysis]
[Reassembled PDU in frame: 199]
TCP segment data (1460 bytes)

```

8) Contendo o HTTP POST (565 bytes), outros 5 segmentos TCP (1460 bytes).



9) Não existe nenhum segmento retransmitido. Verificando a sequência dos segmentos TCP no gráfico (todas as sequencias estão aumentando uniformemente com o tempo, se houvesse retransmissão, alguma das sequencias seria menor que os segmentos vizinhos).

10) Depende da janela média de tempo avaliada. A quantidade total de dados transmitidos pode ser computada pela diferença entre a sequência do primeiro segmento TCP (1 byte pro segmento #4) e a sequência reconhecida do último ACK (164091 bytes para o segmento #202). Um total de $164091 - 1 = 164090$ bytes.

A tempo total da transmissão é a diferença do tempo do primeiro segmento TCP (0,026477 para o segmento #4) para o tempo do último ACK (5,455830s para o segmento #202). O tempo total da transmissão é de $5,455830 - 0,026477 = 5,4294$ s.

O throughput pode ser calculado como tamanho total/tempo total;

$164090/5.4294 = 30.222$ KByte/s.

UDP

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|----------|------------------------------------|--|----------|--------|---|
| 183 | 4.153827 | 2804:14c:da80:82bc:2cdb:814a:70... | 2804:14c:da10:672:187:64:0:34 | DNS | 112 | Standard query 0x1e66 AAAA gc.kis.v2.scr.kaspersky-labs.com |
| 184 | 4.166840 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 194 | Standard query response 0x1e66 AAAA gc.kis.v2.scr.kaspersky-labs.co |
| 1377 | 6.357851 | 2804:14c:da80:82bc:2cdb:814a:70... | 2804:14c:da10:672:187:64:0:34 | DNS | 112 | Standard query 0xa675 AAAA gc.kis.v2.scr.kaspersky-labs.com |
| 1389 | 6.372277 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 194 | Standard query response 0xa675 AAAA gc.kis.v2.scr.kaspersky-labs.co |
| 1771 | 7.155053 | 2804:14c:da80:82bc:2cdb:814a:70... | 2804:14c:da10:672:187:64:0:34 | DNS | 117 | Standard query 0x94b9 A r5---sn-xhcg5uxa-4vge.googlevideo.com |
| 1772 | 7.155222 | 2804:14c:da80:82bc:2cdb:814a:70... | 2804:14c:da10:672:187:64:0:34 | DNS | 117 | Standard query 0xfd54 AAAA r5---sn-xhcg5uxa-4vge.googlevideo.com |
| 1773 | 7.167449 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 167 | Standard query response 0x94b9 A r5---sn-xhcg5uxa-4vge.googlevideo. |
| 1774 | 7.172434 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 179 | Standard query response 0xfd54 AAAA r5---sn-xhcg5uxa-4vge.googlevid |

| |
|---|
| < |
| > Frame 1771: 117 bytes on wire (936 bits), 117 bytes captured (936 bits) on interface 0 |
| ▼ Ethernet II, Src: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9), Dst: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75) |
| > Destination: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75) |
| > Source: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9) |
| Type: IPv6 (0x86dd) |
| ▼ Internet Protocol Version 6, Src: 2804:14c:da80:82bc:2cdb:814a:704e:eaf9 (2804:14c:da80:82bc:2cdb:814a:704e:eaf9), Dst: 2804:14c:da10:672:187:64:0:34 (2804:14c:da10:672:187:64:0:34) |
| 0110 = Version: 6 |
| > 0000 0000 = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT) |
| 0100 1110 0111 0111 0100 = Flow Label: 0x4e774 |
| Payload Length: 63 |
| Next Header: UDP (17) |
| Hop Limit: 64 |
| Source: 2804:14c:da80:82bc:2cdb:814a:704e:eaf9 (2804:14c:da80:82bc:2cdb:814a:704e:eaf9) |
| Destination: 2804:14c:da10:672:187:64:0:34 (2804:14c:da10:672:187:64:0:34) |
| ▼ User Datagram Protocol, Src Port: 55648, Dst Port: 53 |
| Source Port: 55648 |
| Destination Port: 53 |
| Length: 63 |
| Checksum: 0x0e08 [unverified] |
| [Checksum Status: Unverified] |
| [Stream index: 2] |
| > [Timestamps] |
| > Domain Name System (query) |

1) 4 campos (source port, destination port, length, checksum).

```

▼ User Datagram Protocol, Src Port: 55648, Dst Port: 53
    Source Port: 55648
    Destination Port: 53
    Length: 63
    Checksum: 0x0e08 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 2]
    > [Timestamps]
    > Domain Name System (query)

```

| | |
|------|---|
| 0000 | bc 2e 48 d2 21 75 bc ec 23 c3 3e e9 86 dd 60 04 |
| 0010 | e7 74 00 3f 11 40 28 04 01 4c da 80 82 bc 2c db |
| 0020 | 81 4a 70 4e ea f9 28 04 01 4c da 10 06 72 01 87 |
| 0030 | 00 64 00 00 00 34 d9 60 00 35 00 3f 0e 08 94 b9 |

2) 2 bytes.

3) 63 bytes equivalentes a soma do header (8 bytes) com o tamanho do restante dos dados encapsulados (55 bytes).

4) O tamanho máximo do payload do UDP é de 2^{16} bytes menos os bytes utilizados pelo header, isso nos dá **65535 – 8 = 65527 bytes**.

5) A maior porta possível é 2^{16} ou 65535.

```

.... 0100 1110
Payload Length: 63
Next Header: UDP (17)
Hop Limit: 64

```

6) O protocolo pro UDP é 17 (decimal) ou 0x11 (hexadecimal).

7) O checksum é calculado como o complemento de 16 bits da soma do complemento de um pseudo-header de informações do header do IP, do header UDP e dos dados encapsulados. Ele é preenchido conforme necessário com 0 bytes no final para fazer um múltiplo de 2 bytes. Se o checksum calculado for 0, ele deve ser setado para 0xFFFF.

| | | | | | | |
|------|----------|------------------------------------|--|-----|-----|---|
| 1771 | 7.155053 | 2804:14c:da80:82bc:2cdb:814a:70... | 2804:14c:da10:672:187:64:0:34 | DNS | 117 | Standard query 0x94b9 A r5---sn-xhcg5uxa-4vge.googlevideo.c |
| 1772 | 7.155222 | 2804:14c:da80:82bc:2cdb:814a:70... | 2804:14c:da10:672:187:64:0:34 | DNS | 117 | Standard query 0xfd54 AAAA r5---sn-xhcg5uxa-4vge.googlevide |
| 1773 | 7.167449 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 167 | Standard query response 0x94b9 A r5---sn-xhcg5uxa-4vge.goog |
| 1774 | 7.172434 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 179 | Standard query response 0xfd54 AAAA r5---sn-xhcg5uxa-4vge.g |

<

> Frame 1771: 117 bytes on wire (936 bits), 117 bytes captured (936 bits) on interface 0

> Ethernet II, Src: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9), Dst: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75)

> Internet Protocol Version 6, Src: 2804:14c:da80:82bc:2cdb:814a:704e:eaf9 (2804:14c:da80:82bc:2cdb:814a:704e:eaf9), Dst: 2804:14c:da10:672:187:64:0:34 (2804:14c:da10:672:187:64:0:34)

> User Datagram Protocol, Src Port: 55648, Dst Port: 53

Source Port: 55648

Destination Port: 53

Length: 63

Checksum: 0x0e08 [unverified]

[Checksum Status: Unverified]

[Stream index: 2]

> [Timestamps]

> Domain Name System (query)

| | | | | | | |
|------|----------|------------------------------------|--|-----|-----|---|
| 1772 | 7.155222 | 2804:14c:da80:82bc:2cdb:814a:70... | 2804:14c:da10:672:187:64:0:34 | DNS | 117 | Standard query 0xfd54 AAAA r5---sn-xhcg5uxa-4vge.googlevideo.c |
| 1773 | 7.167449 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 167 | Standard query response 0x94b9 A r5---sn-xhcg5uxa-4vge.googlevideo.com CNAI |
| 1774 | 7.172434 | 2804:14c:da10:672:187:64:0:34 | 2804:14c:da80:82bc:2cdb:814a:704e:e... | DNS | 179 | Standard query response 0xfd54 AAAA r5---sn-xhcg5uxa-4vge.googlevideo.com |

<

> Frame 1773: 167 bytes on wire (1336 bits), 167 bytes captured (1336 bits) on interface 0

> Ethernet II, Src: ArrisGro_d2:21:75 (bc:2e:48:d2:21:75), Dst: Shenzhen_c3:3e:e9 (bc:ec:23:c3:3e:e9)

> Internet Protocol Version 6, Src: 2804:14c:da10:672:187:64:0:34 (2804:14c:da10:672:187:64:0:34), Dst: 2804:14c:da80:82bc:2cdb:814a:704e:eaf9 (2804:14c:da80:82bc:2cdb:814a:704e:eaf9)

> User Datagram Protocol, Src Port: 53, Dst Port: 55648

Source Port: 53

Destination Port: 55648

Length: 113

Checksum: 0xa69a [unverified]

[Checksum Status: Unverified]

[Stream index: 2]

> [Timestamps]

> Domain Name System (response)

8) A relação entre as portas é que a porta do source na query de envio é igual a porta do destino na query de response. A porta de destino na query de envio é também a mesma da porta do source na query de response.