

INSTITUTO FEDERAL DE
EDUCAÇÃO, CIÊNCIA E TECNOLOGIA
PERNAMBUCO
Campus Igarassu

Rede de Computadores

A odisseia na Internet

Preparando a viagem

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STANLEY KUBRICK's *2001: A Space Odyssey*

2001: a space odyssey



A odisseia na Internet

Preparando a viagem

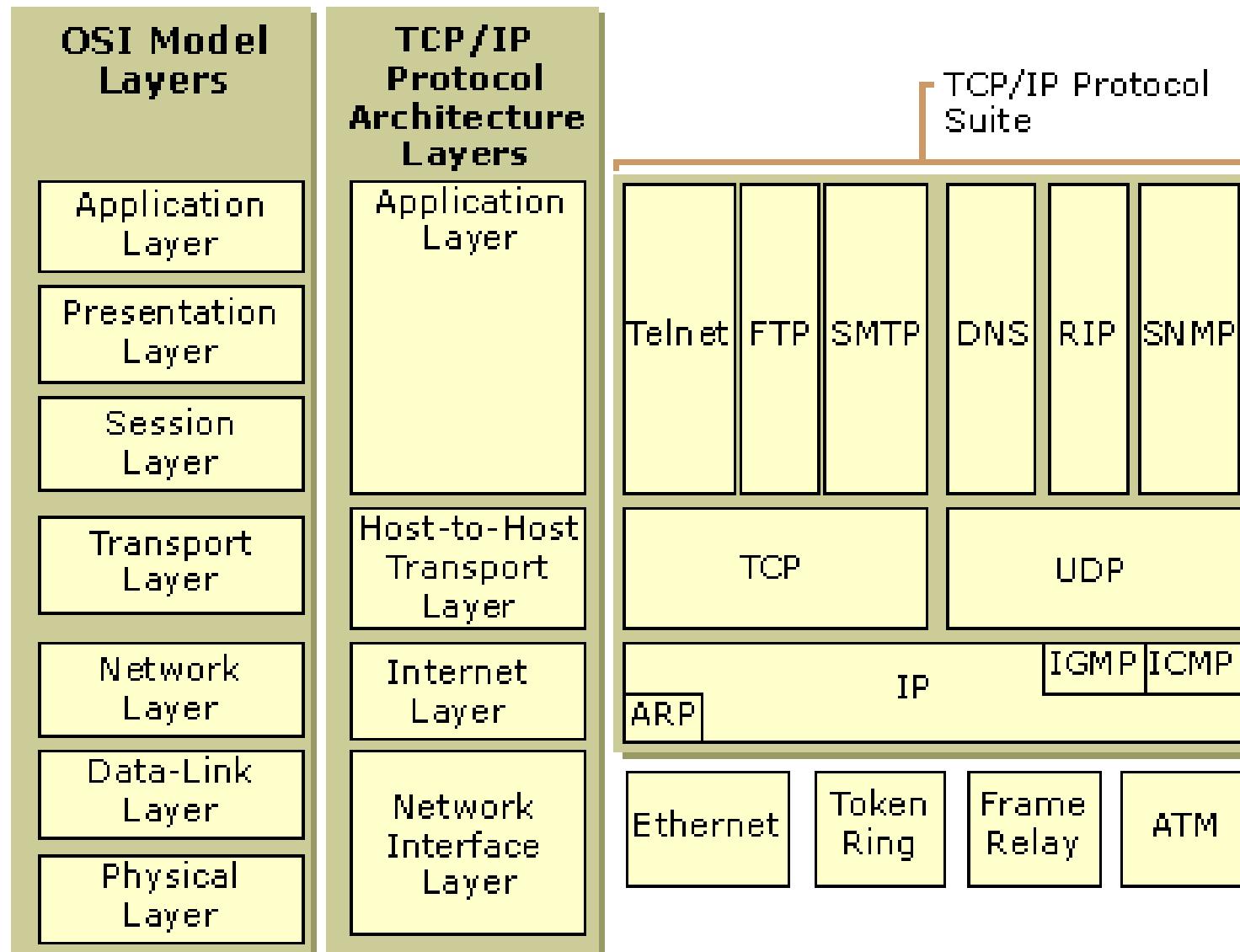
Lembrar dos PROTOCOLOS!

Serviços e usuários estão na **borda da rede**.

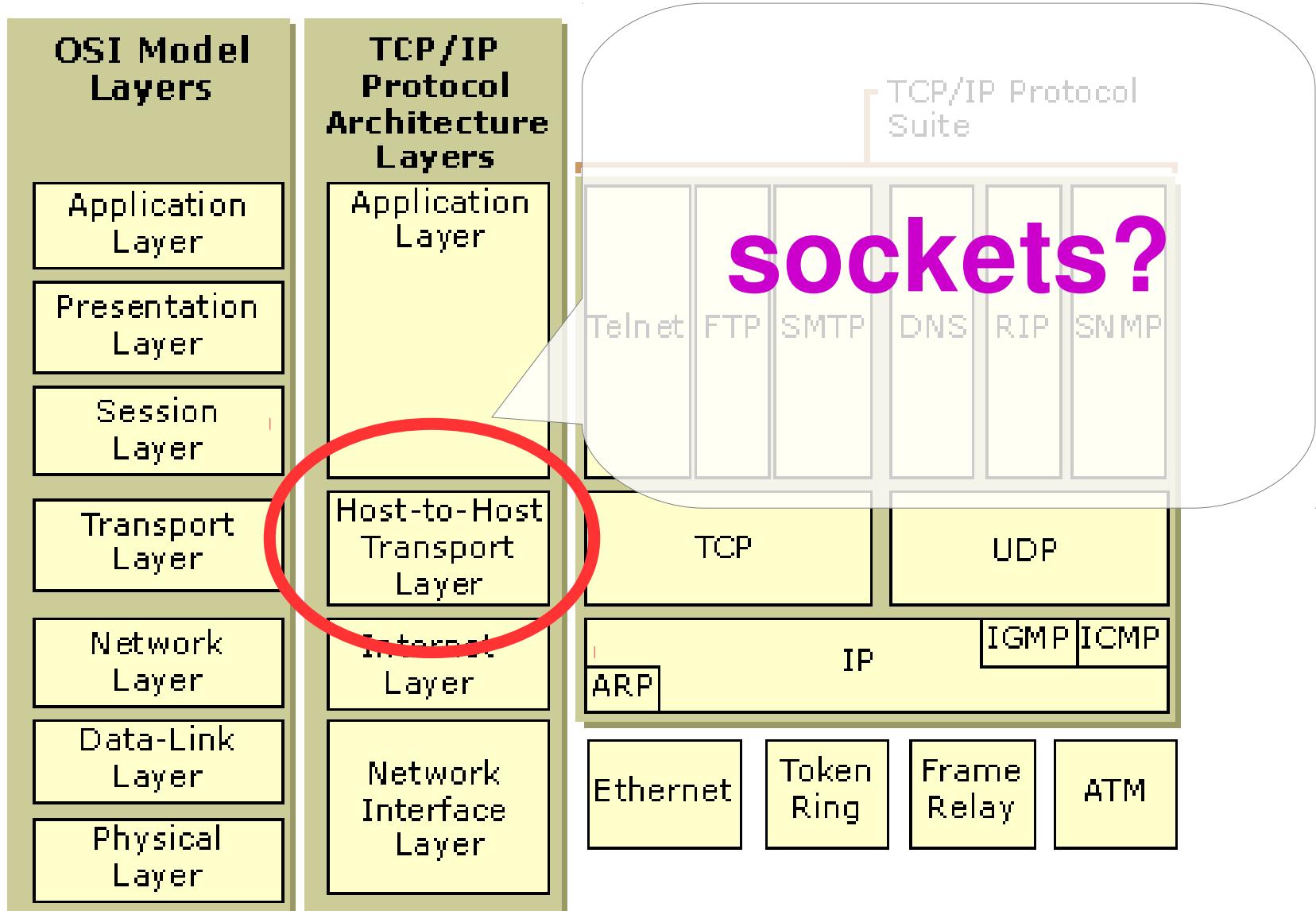
O quê há no núcleo?

A internet funciona baseada na pilha de protocolo TCP/IP.

A odisseia na Internet



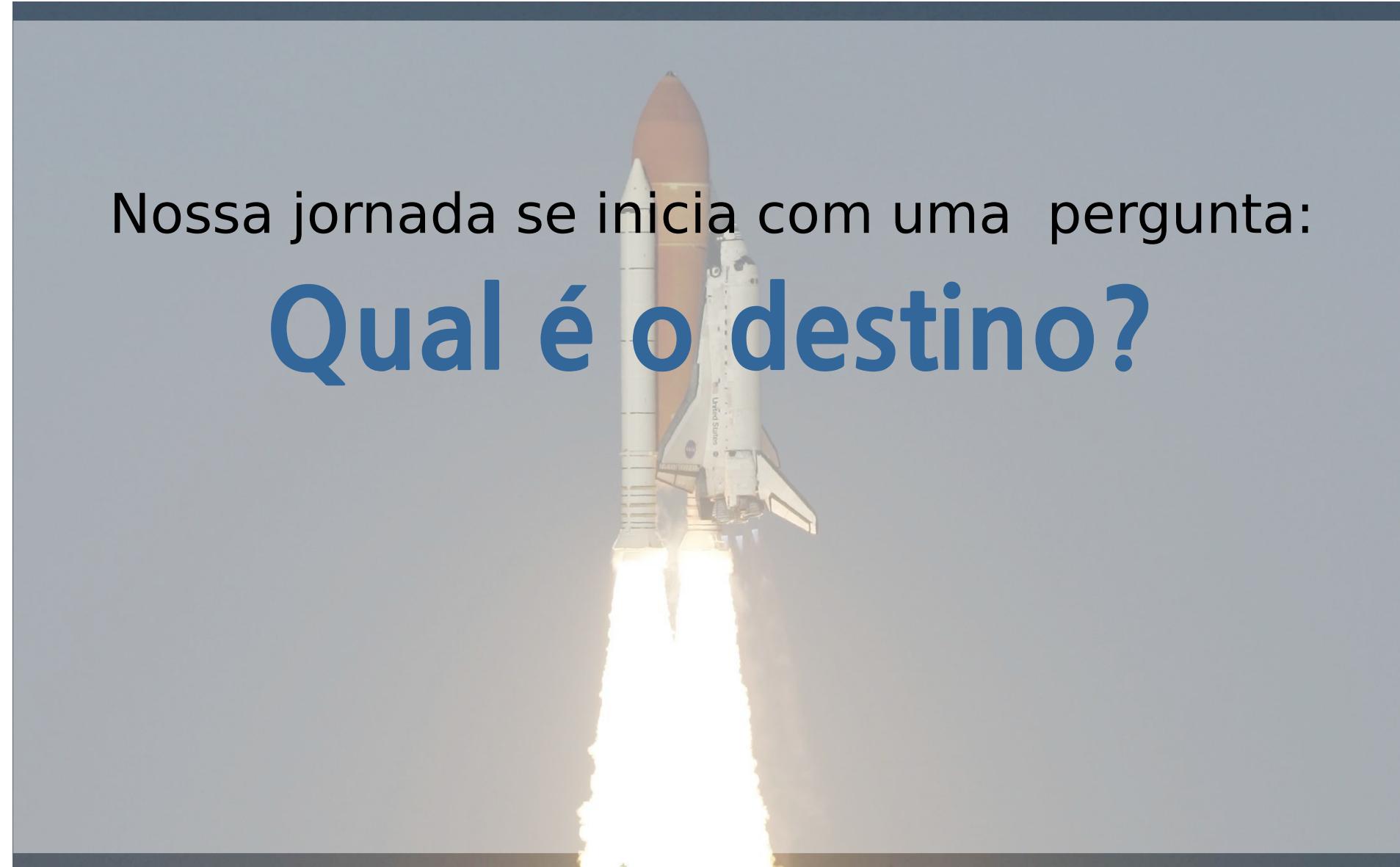
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A odisseia na Internet

Nossa jornada se inicia com uma pergunta:

Qual é o destino?

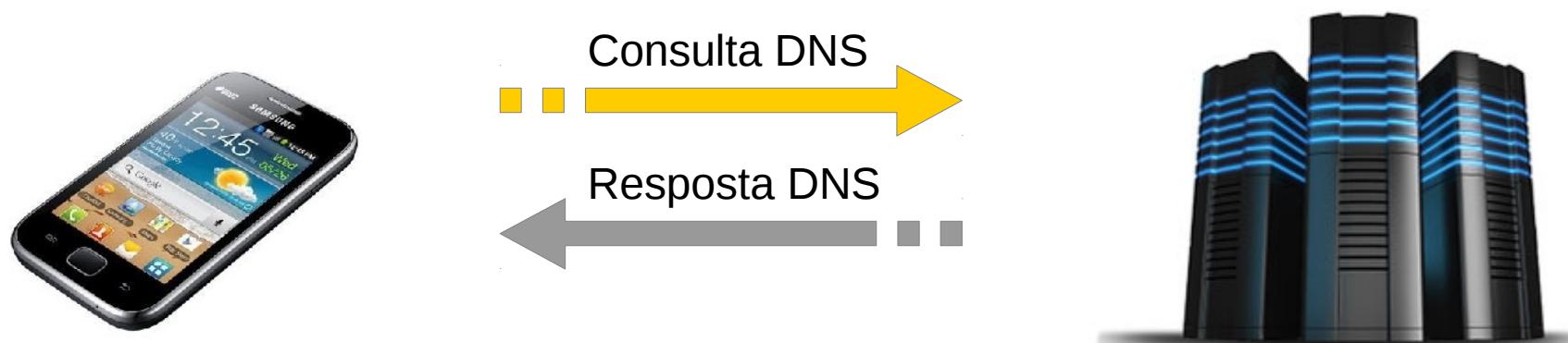


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- Para que um usuário consiga acessar uma página WEB vários protocolos entram em ação. E uma série de procedimentos são realizados.

1. Realizar uma consulta DNS para obter o endereço IP do host desejado.

- ✓ Pessoas utilizam nomes (domínios DNS) para acessarem serviços na Internet;
- ✓ Dispositivos em rede usam os endereços IP para criar as conexões.



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[+] Internet Protocol Version 4, Src: 192.168.4.64 (192.168.4.64), Dst: 186.208.0.1 (186.208.0.1)

[+] User Datagram Protocol, Src Port: 34043 (34043), Dst Port: domain (53)

- Domain Name System (query)

[\[Response In: 69\]](#)

Transaction ID: 0x62cd

[+] Flags: 0x0100 Standard query

Questions: 1

Answer RRs: 0

Authority RRs: 0

Additional RRs: 0

- Queries

- www.google.com.br: type A, cla
Name: www.google.com.br
Type: A (Host address)
Class: IN (0x0001)

CONSULTA DNS

RESPOSTA DA CONSULTA DNS

- Queries

- www.google.com.br: type A, class IN
Name: www.google.com.br
Type: A (Host address)
Class: IN (0x0001)

- Answers

[+] www.google.com.br: type A, class IN, addr 173.194.118.88
[+] www.google.com.br: type A, class IN, addr 173.194.118.95
[+] www.google.com.br: type A, class IN, addr 173.194.118.79
[+] www.google.com.br: type A, class IN, addr 173.194.118.87

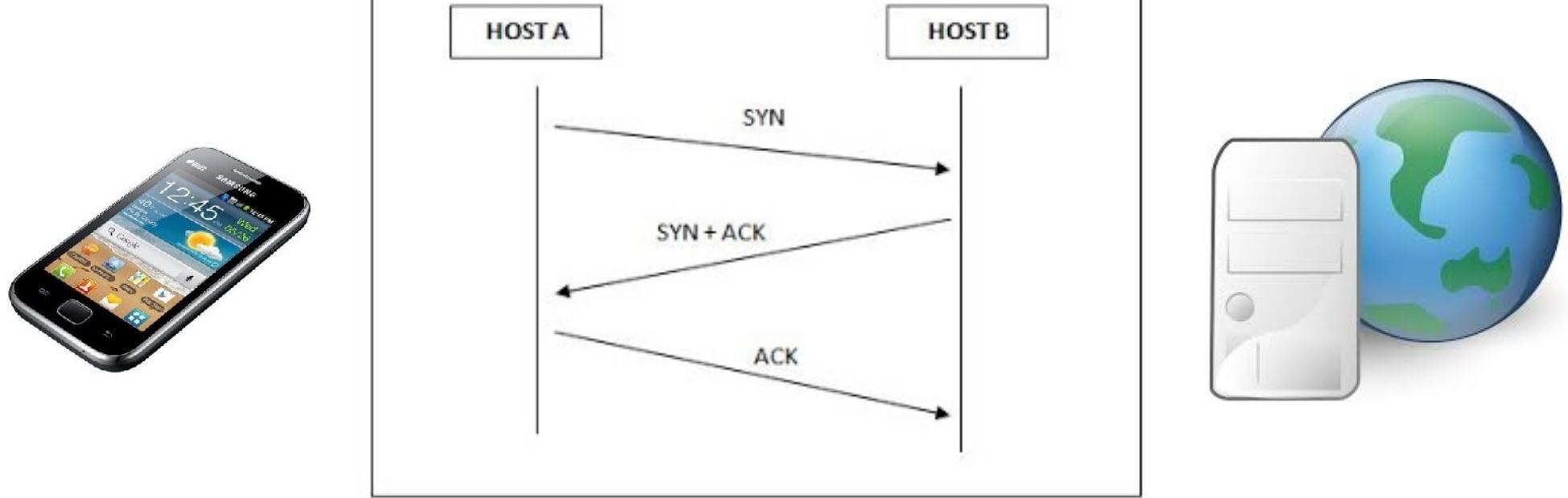
- Authoritative nameservers

[+] br: type NS, class IN, ns a.dns.br
[+] br: type NS, class IN, ns f.dns.br
[+] br: type NS, class IN, ns e.dns.br
[+] br: type NS, class IN, ns c.dns.br
[+] br: type NS, class IN, ns d.dns.br
[+] br: type NS, class IN, ns b.dns.br

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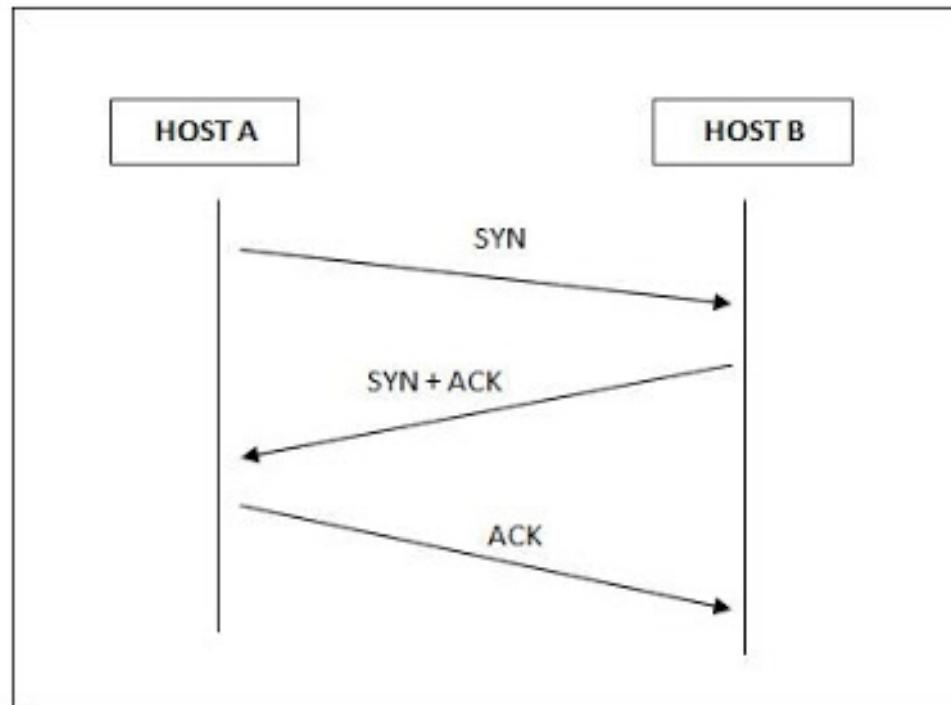
2. Após obter o endereço IP o cliente (navegador WEB) solicita o estabelecimento de uma conexão com o host remoto.

- ✓ O protocolo HTTP precisa da garantia de entrega de seus dados, por isso ele requer o uso do protocolo de transporte TCP;
- ✓ O TCP é considerado um protocolo de transporte confiável porque garante que todas as mensagens serão entregues.



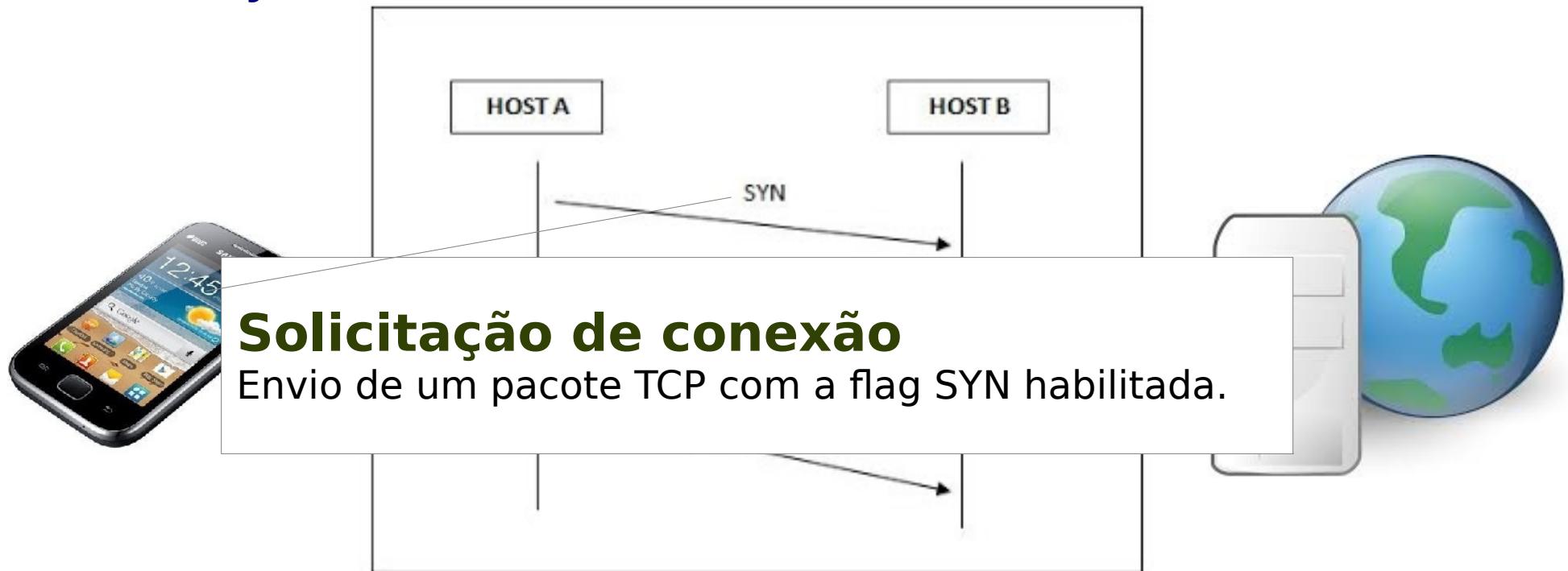
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Three Way Handshake



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Three Way Handshake



A odisseia na Internet

Three Way Handshake

Solicitação de conexão

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|--------------|----------------|----------------|----------|--------|-------------------------|
| 26 | 21.400935000 | 192.168.43.1 | 192.168.43.20 | DNS | 130 | Standard query response |
| 27 | 21.409413000 | 192.168.43.26 | 74.125.229.129 | TCP | 74 | 49412 > https [SYN] |
| 28 | 21.516455000 | 74.125.229.150 | 192.168.43.26 | TCP | 74 | https > 46400 [SYN] |

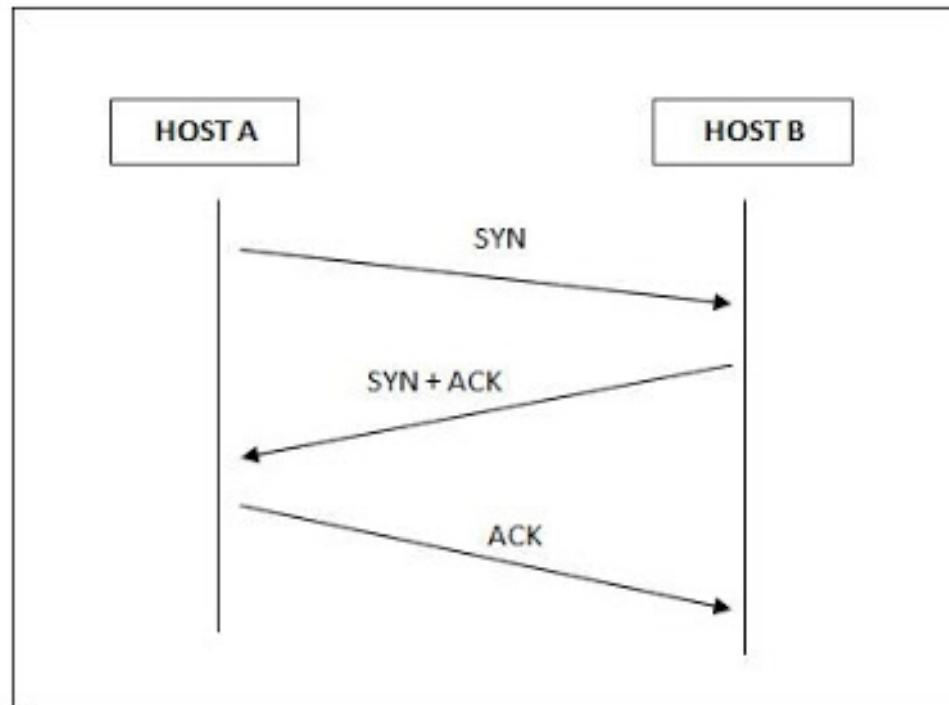
+ Frame 27: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
+ Ethernet II, Src: HonHaiPr_70:35:43 (c0:cb:38:70:35:43), Dst: SamsungE_8a:a0:10 (78:52:1a:8a:a0:10)
+ Internet Protocol Version 4, Src: 192.168.43.26 (192.168.43.26), Dst: 74.125.229.129 (74.125.229.129)
- Transmission Control Protocol, Src Port: 49412 (49412), Dst Port: https (443), Seq: 0, Len: 0

Source port: 49412 (49412)
Destination port: https (443)
[Stream index: 2]
Sequence number: 0 (relative sequence number)
Header length: 40 bytes

+ Flags: 0x002 (SYN)
Window size value: 29200
[Calculated window size: 29200]
+ Checksum: 0xb96 [validation disabled]
+ Options: (20 bytes), Maximum segment size, SACK permitted, Timestamps, No-Operation (NOP), Window scale

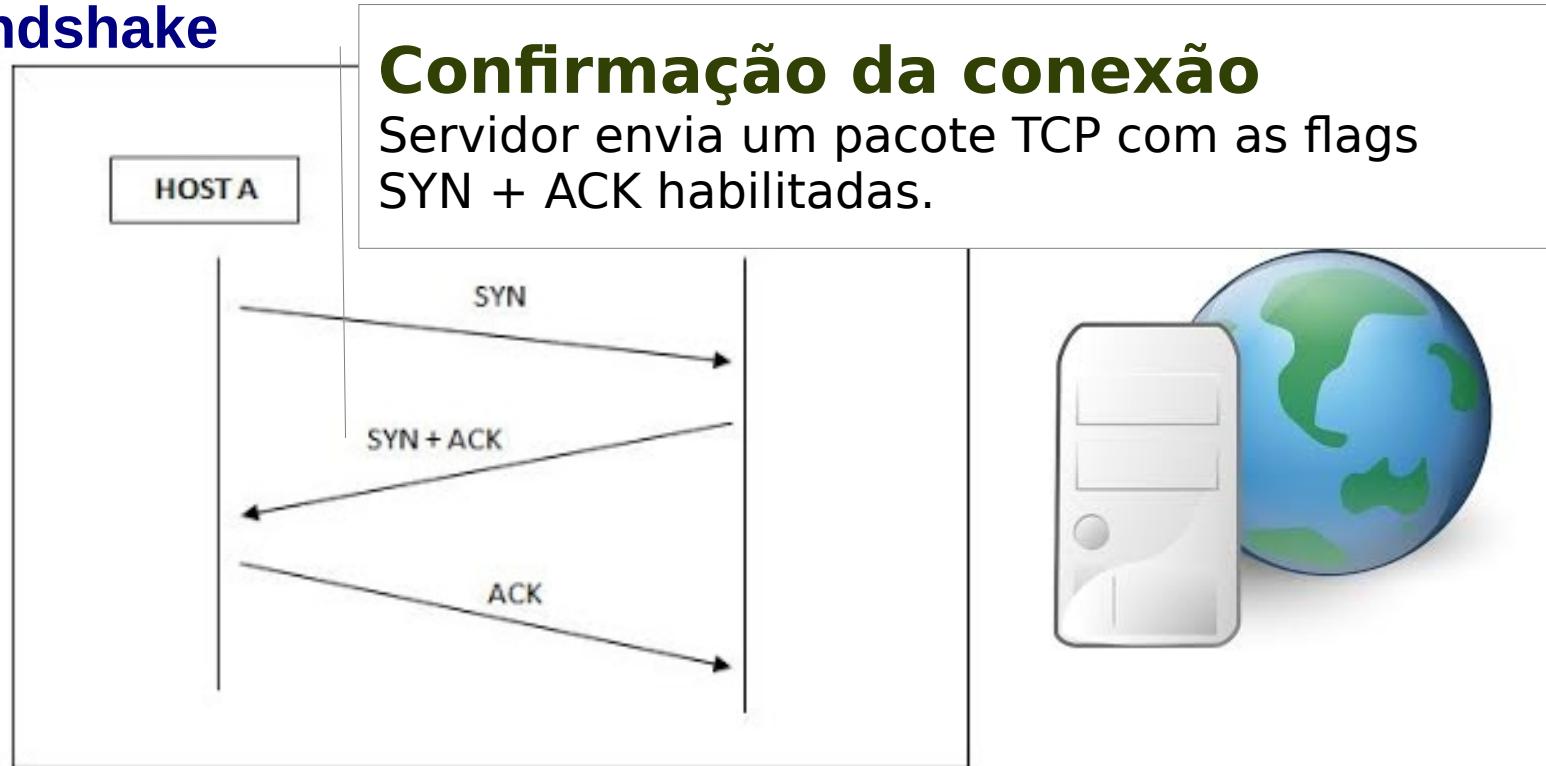
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Three Way Handshake



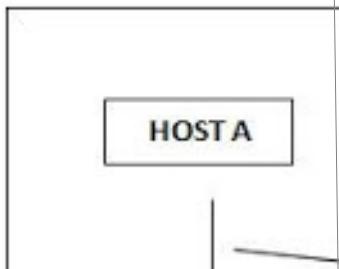
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Three Way Handshake



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Three Way Handshake



Confirmação da conexão

Servidor envia um pacote TCP com as flags SYN + ACK habilitadas.

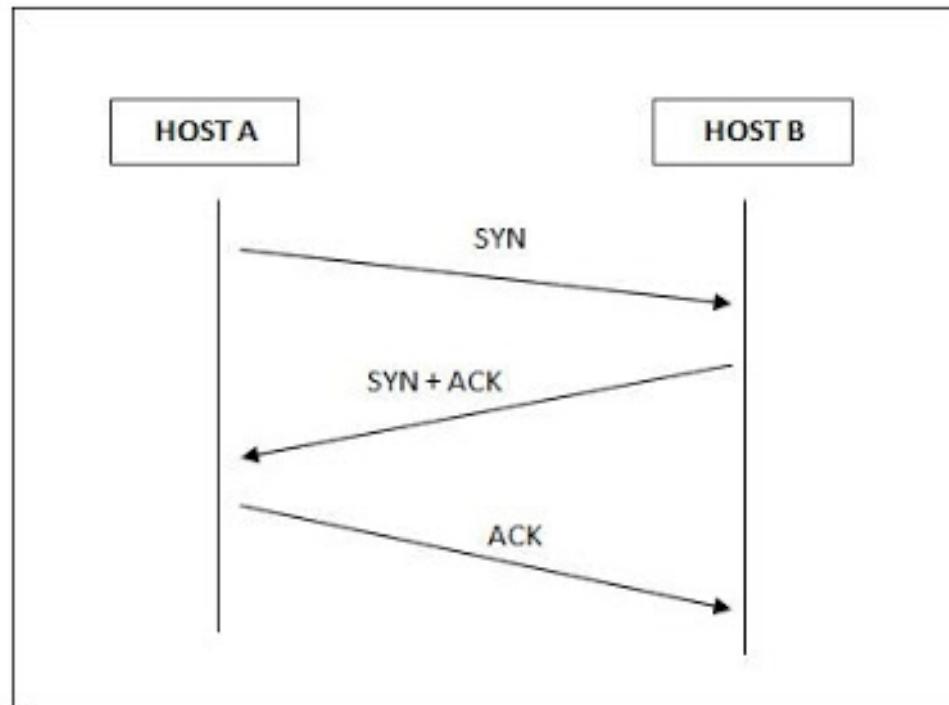
SYN

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|--------------|----------------|----------------|----------|--------|---------------------------|
| 55 | 22.002300000 | 192.168.43.26 | 74.125.229.129 | TCP | 74 | [TCP Retransmission] 4941 |
| 67 | 22.993686000 | 74.125.229.129 | 192.168.43.26 | TCP | 74 | https > 49413 [SYN, ACK] |

Frame 67: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
Ethernet II, Src: SamsungE_8a:a0:10 (78:52:1a:8a:a0:10), Dst: HonHaiPr_70:35:43 (c0:cb:38:70:35:43)
Internet Protocol Version 4, Src: 74.125.229.129 (74.125.229.129), Dst: 192.168.43.26 (192.168.43.26)
Transmission Control Protocol, Src Port: https (443), Dst Port: 49413 (49413), Seq: 0, Ack: 1, Len: 0
Source port: https (443)
Destination port: 49413 (49413)
[Stream index: 3]
Sequence number: 0 (relative sequence number)
Acknowledgment number: 1 (relative ack number)
Header length: 40 bytes
Flags: 0x012 (SYN, ACK)
Window size value: 42540
[Calculated window size: 42540]
Checksum: 0x9139 [validation disabled]
Options: (20 bytes), Maximum segment size, SACK permitted, Timestamps, No-Operation (NOP), Window scale
[SEQ/ACK analysis]

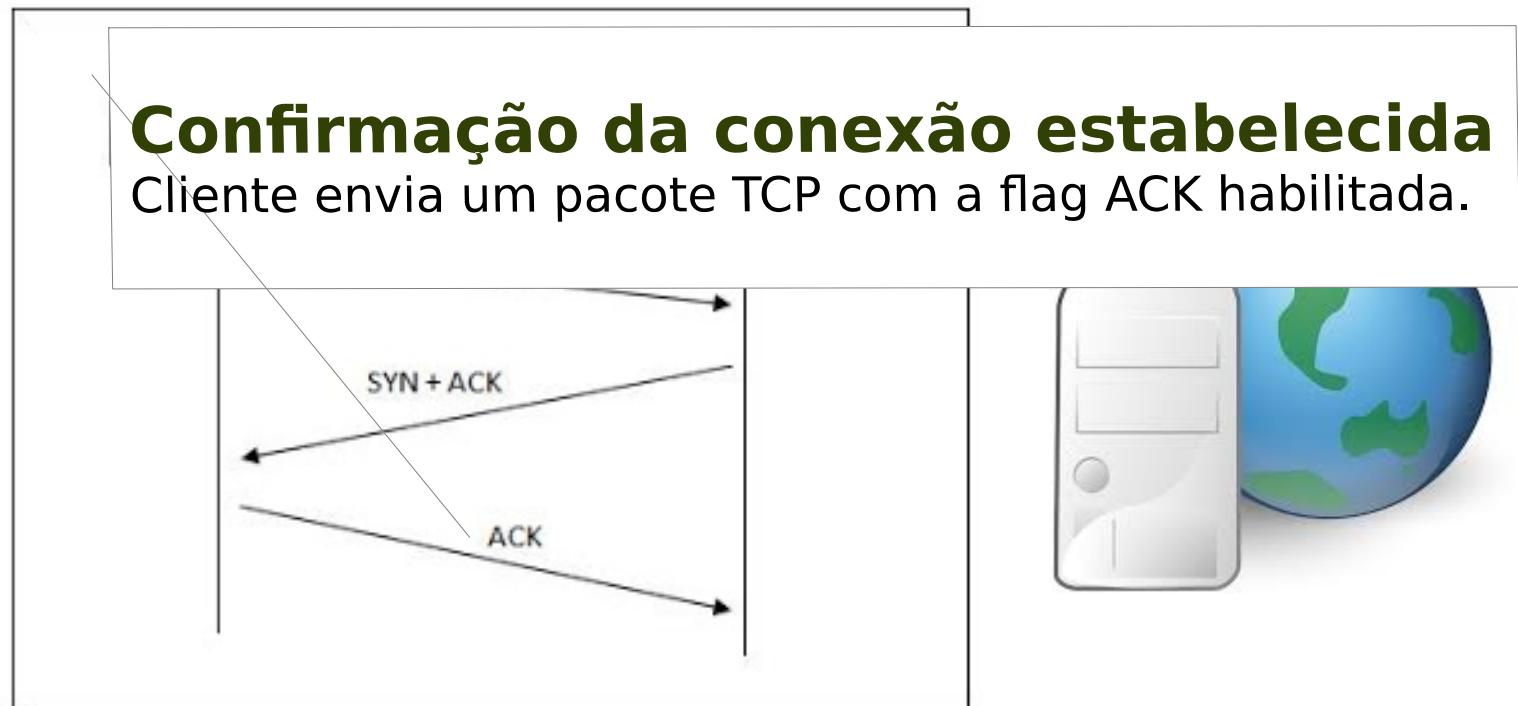
A odisseia na Internet

Three Way Handshake



A odisseia na Internet

Three Way Handshake



A odisseia na Internet

Three Way Handshake

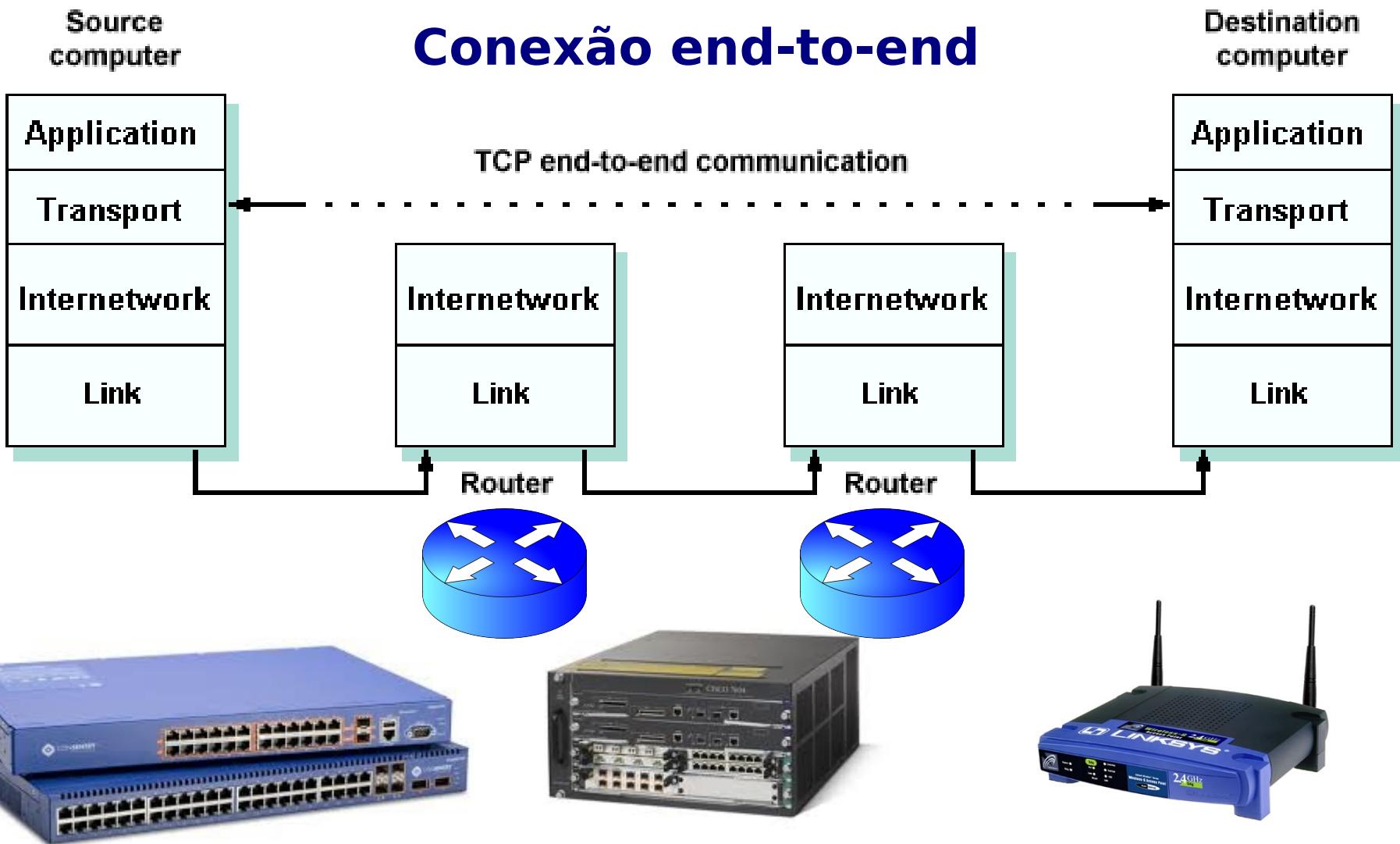
Confirmação da conexão estabelecida
Cliente envia um pacote TCP com a flag ACK habilitada.

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|--------------|----------------|----------------|----------|--------|-------------------------|
| 55 | 22.992505000 | 192.168.43.26 | 74.125.229.129 | TCP | 74 | [TCP Full transmission] |
| 67 | 22.993686000 | 74.125.229.129 | 192.168.43.26 | TCP | 74 | https > 49413 [SYN] |
| 68 | 22.993779000 | 192.168.43.26 | 74.125.229.129 | TCP | 66 | 49413 > https [ACK] |

+ Frame 68: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
+ Ethernet II, Src: HonHaiPr_70:35:43 (c0:cb:38:70:35:43), Dst: SamsungE_8a:a0:10 (78:52:1a:8a:a0:10)
+ Internet Protocol Version 4, Src: 192.168.43.26 (192.168.43.26), Dst: 74.125.229.129 (74.125.229.129)
- Transmission Control Protocol, Src Port: 49413 (49413), Dst Port: https (443), Seq: 1, Ack: 1, Len: 0
 Source port: 49413 (49413)
 Destination port: https (443)
 [Stream index: 3]
 Sequence number: 1 (relative sequence number)
 Acknowledgment number: 1 (relative ack number)
 Header length: 32 bytes
+ Flags: 0x010 (ACK)
 Window size value: 229
 [Calculated window size: 29312]
 [Window size scaling factor: 128]
+ Checksum: 0x5ffa [validation disabled]
+ Options: (12 bytes), No-Operation (NOP), No-Operation (NOP), Timestamps
+ [SEQ/ACK analysis]

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Conexão end-to-end

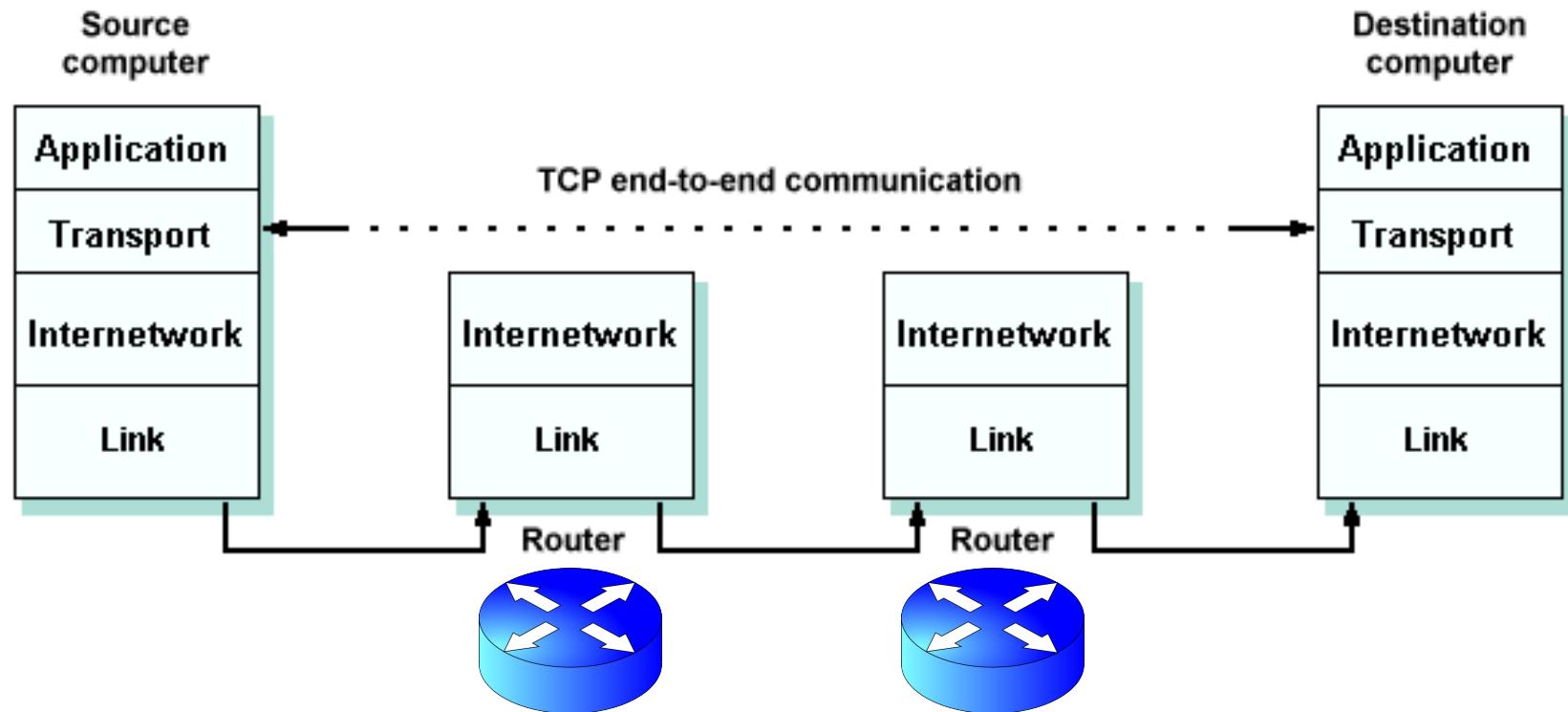


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3. Para a conexão ser estabelecida as informações saíram da máquina de origem e chegaram à máquina de destino.

Como isso acontece?

Qual o protocolo que resolve esse problema?



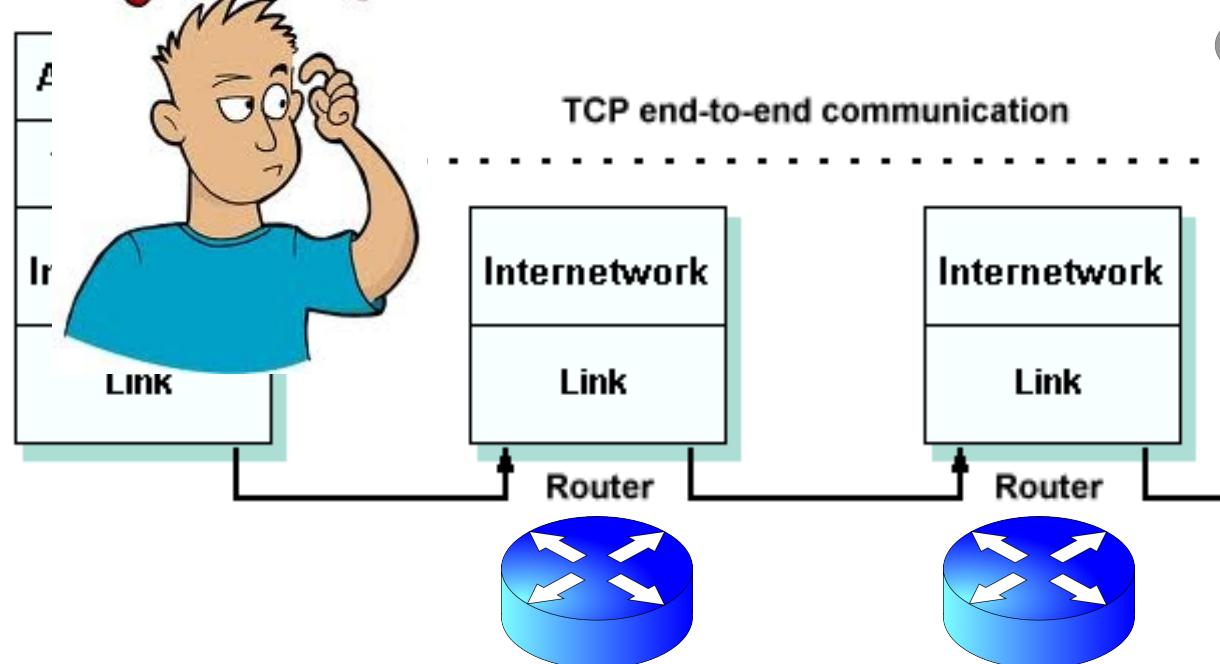
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- Para a conexão ser estabelecida entre duas máquinas de origem e destino, os pacotes saíram da máquina de origem e chegaram à máquina de destino.

Utilizando repasse e roteamento!

Como isso acontece?

Qual é o caminho que os pacotes percorrem?

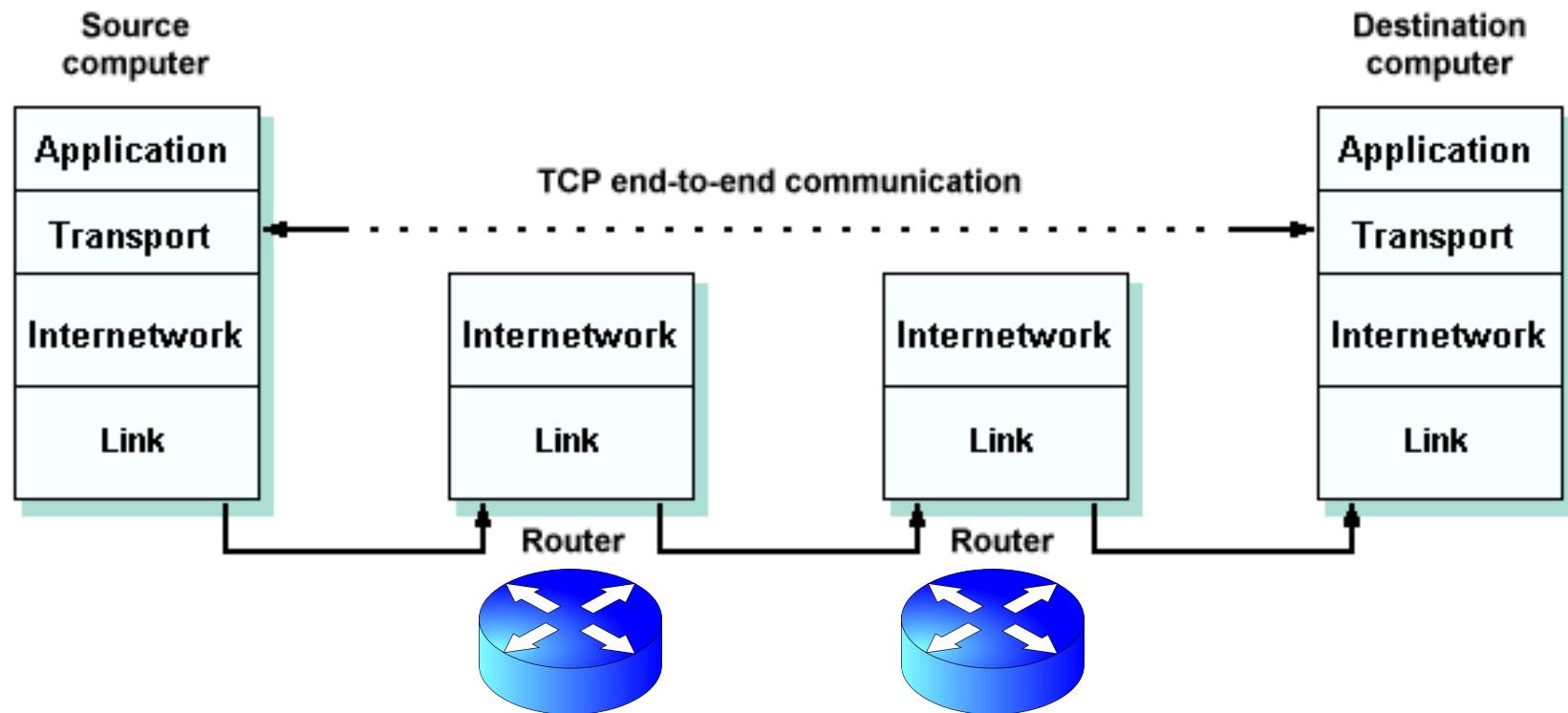


A odisseia na Internet

3. Para a conexão ser estabelecida as informações saíram da máquina de origem e chegaram à máquina de destino.

Como isso acontece?

Qual o protocolo que resolve esse problema?

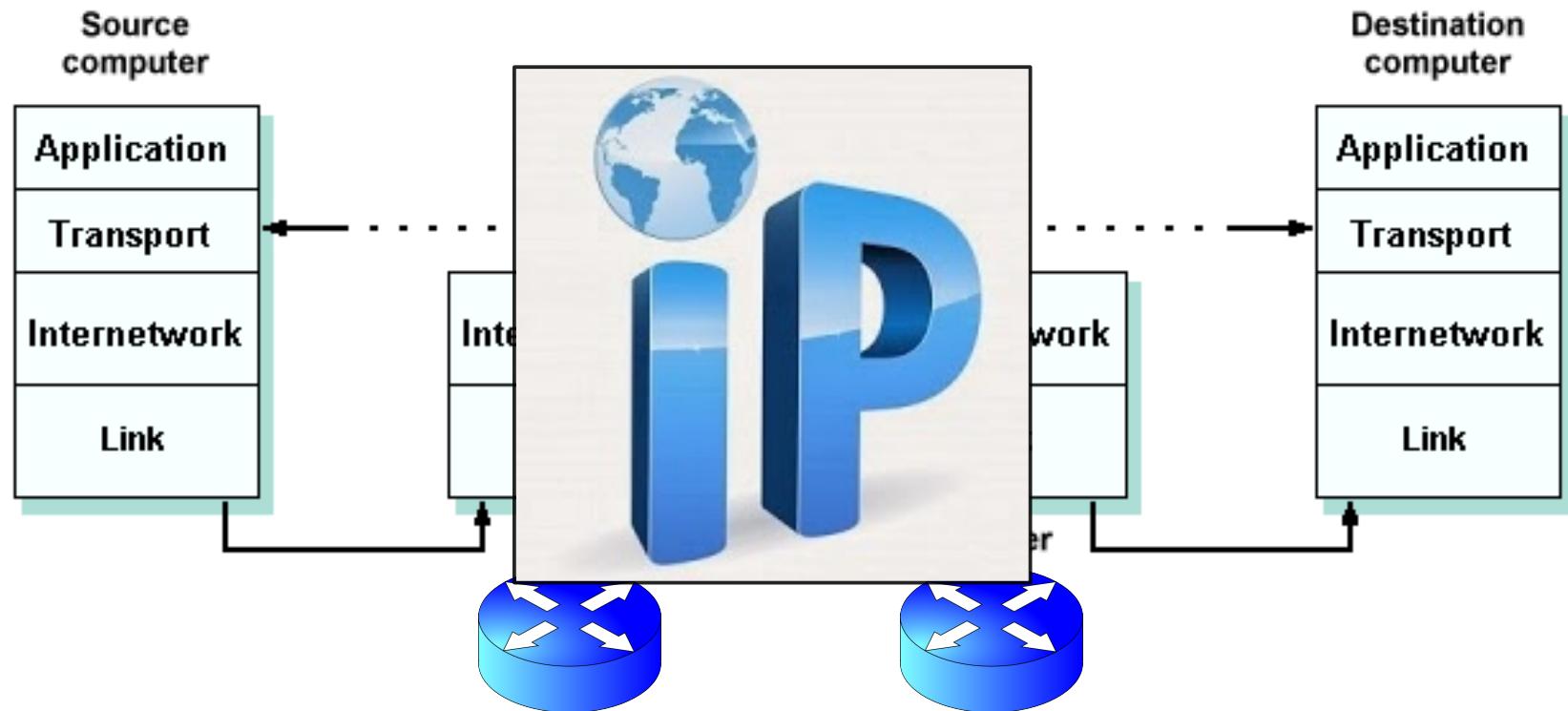


A odisseia na Internet

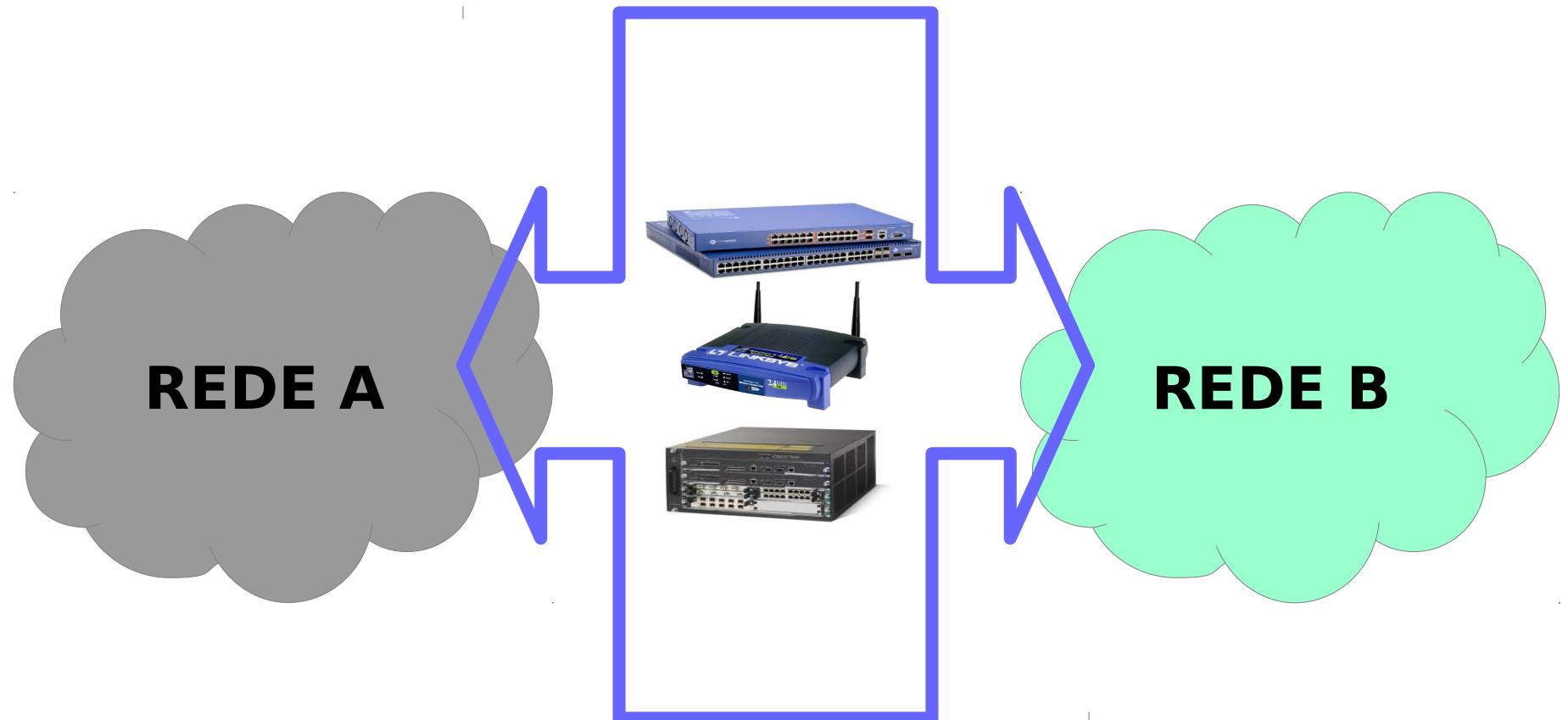
3. Para a conexão ser estabelecida as informações saíram da máquina de origem e chegaram à máquina de destino.

Como isso acontece?

Qual o protocolo que resolve esse problema?



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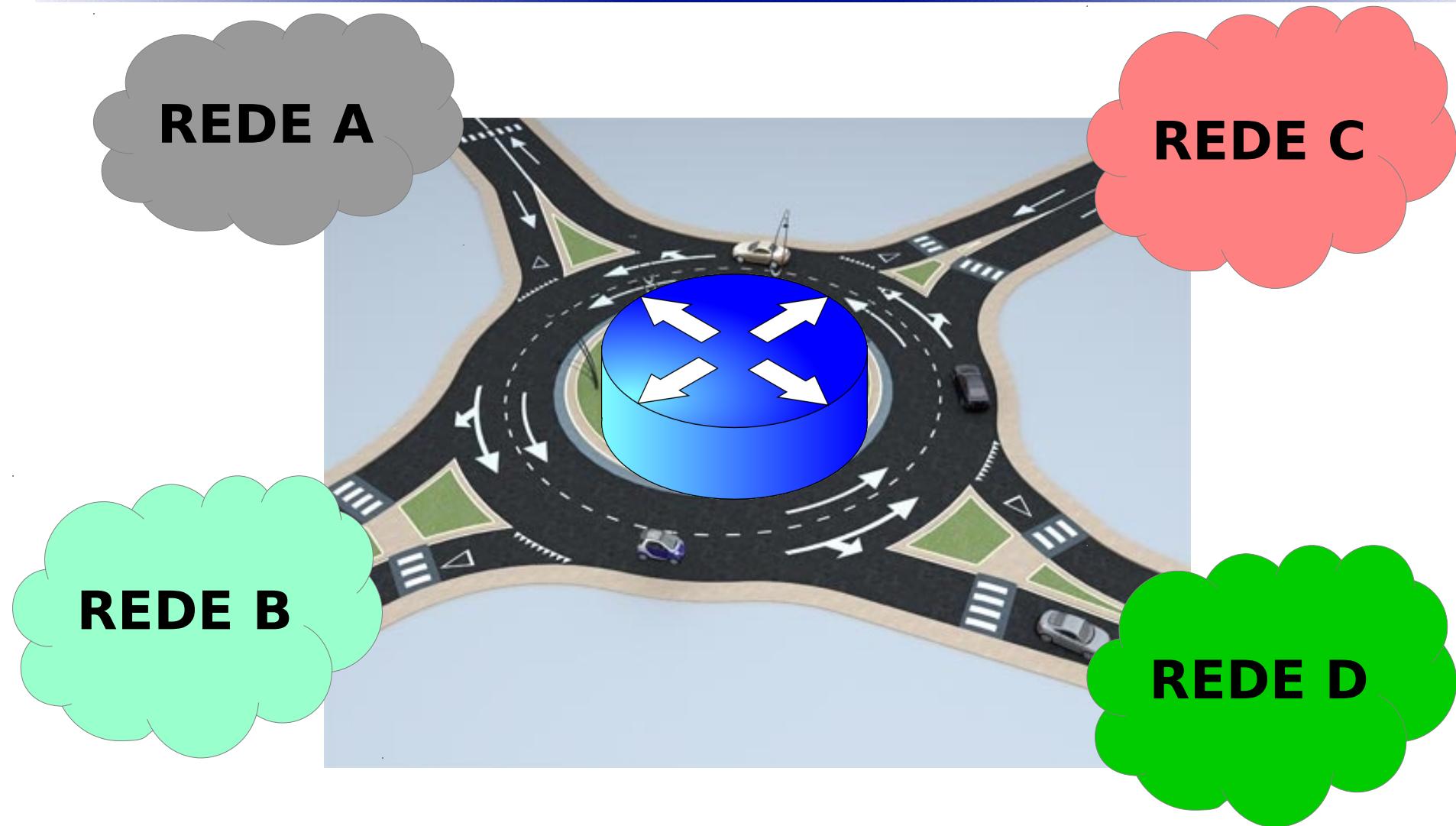


A odisseia na Internet

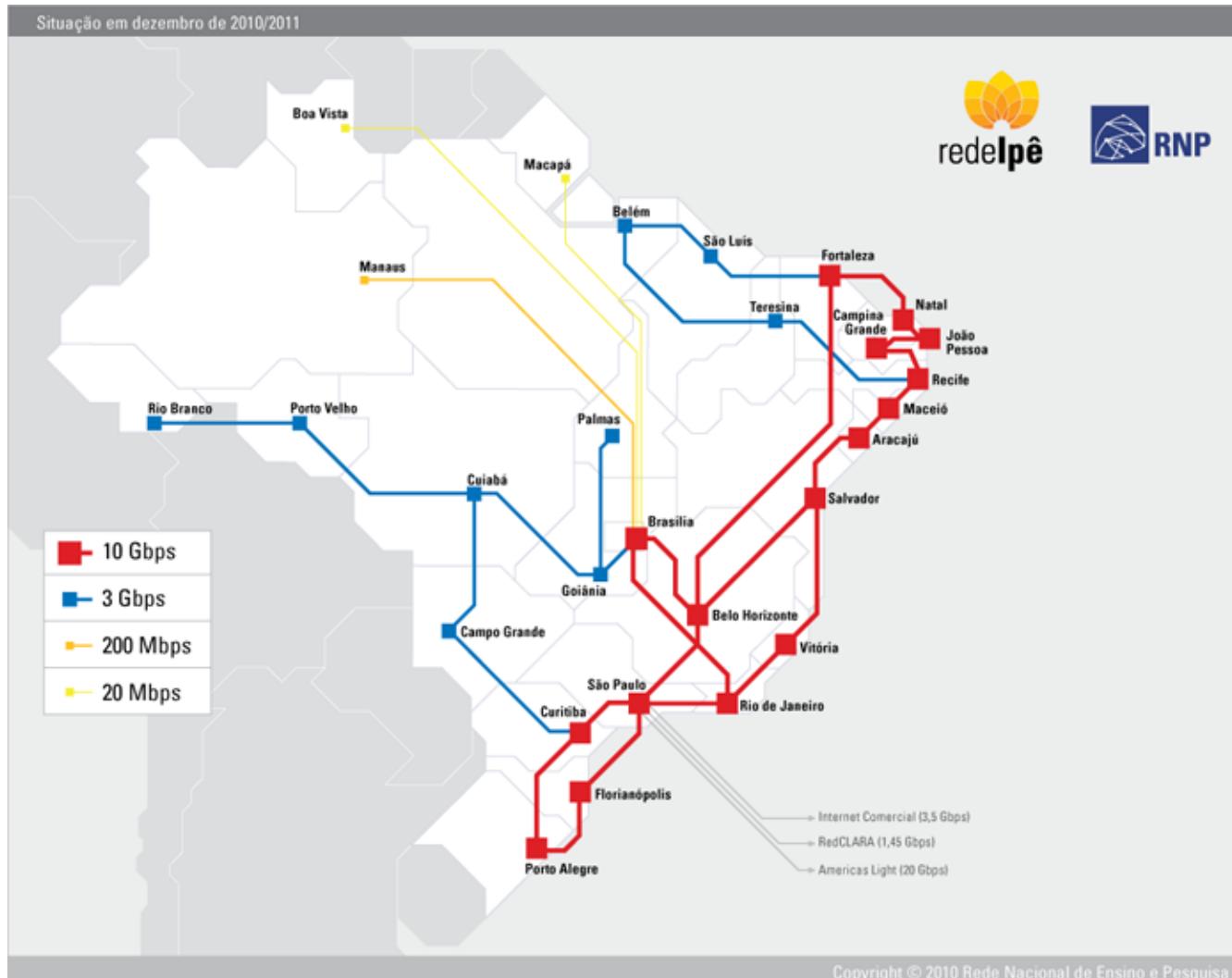
The diagram illustrates the process of packet forwarding. At the top, a blue-bordered rectangle represents a packet. It is shown moving from a vertical blue line labeled "enlace de entrada" (input link) down to another vertical blue line labeled "enlace de saída" (output link). This movement is set against a light yellow background. To the left of the yellow area is a grey cloud-like shape, and to the right is a green cloud-like shape, both partially overlapping the yellow background.

Repassagem envolve a transferência de um pacote de **enlace de entrada para um enlace de saída** dentro de um único roteador.

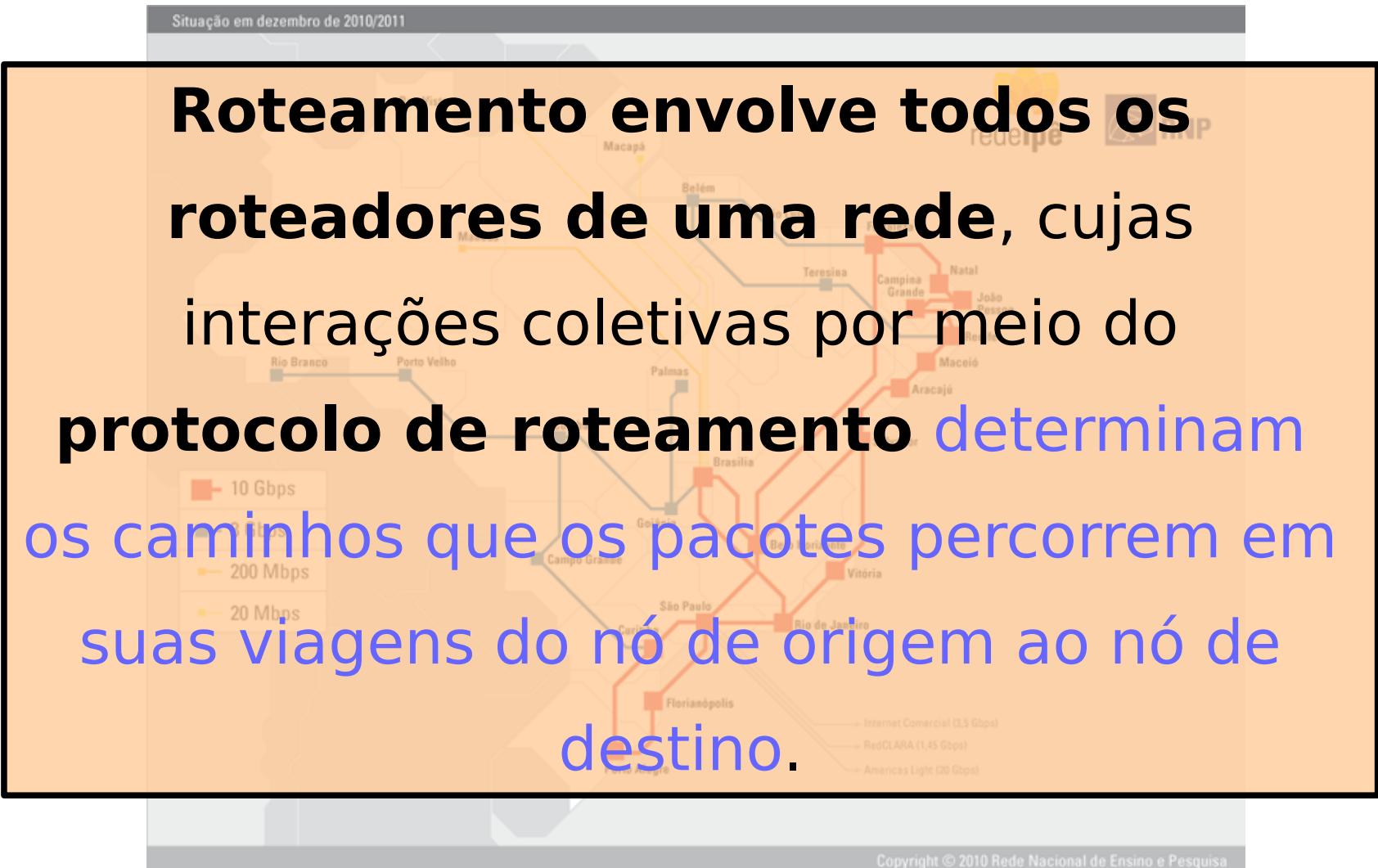
A odisseia na Internet



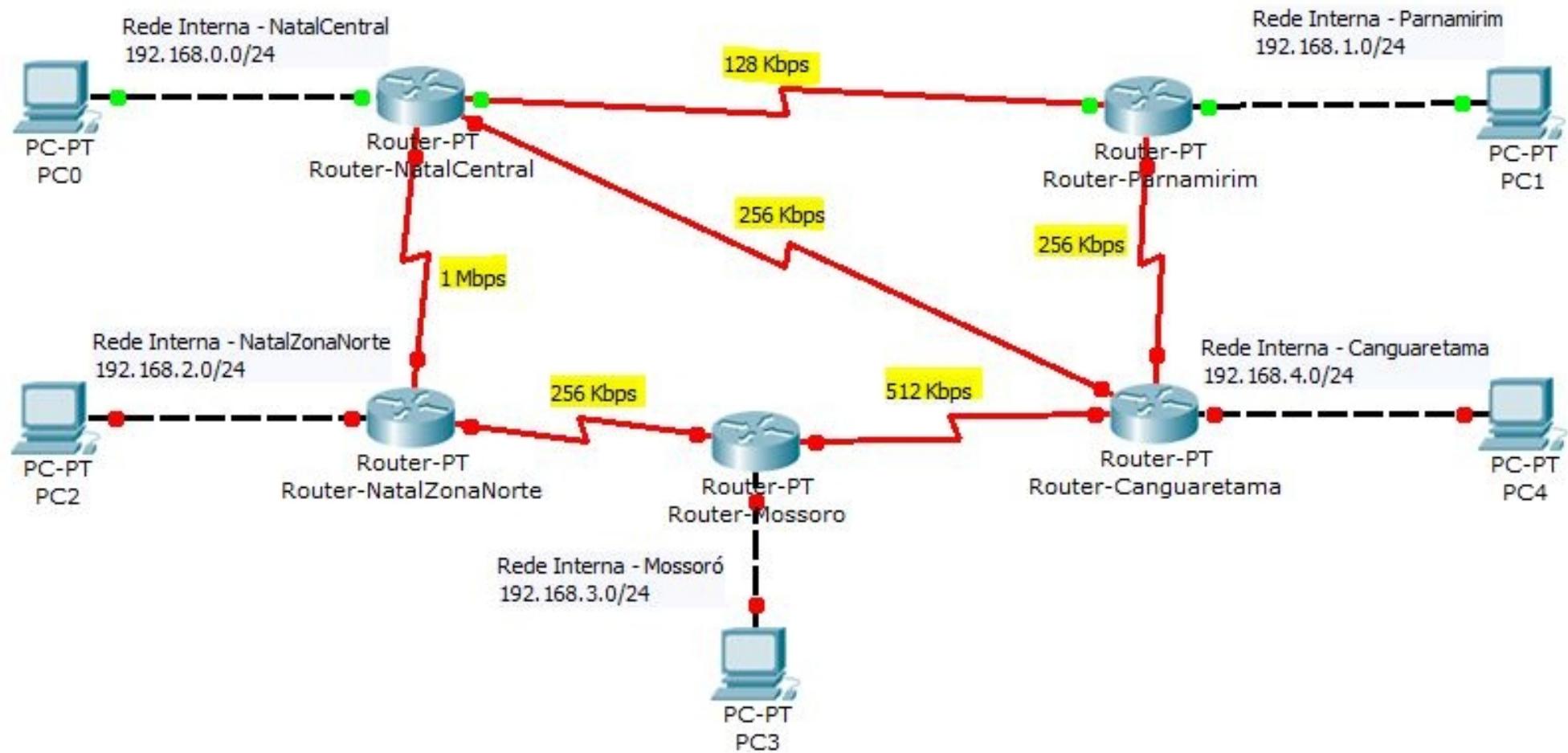
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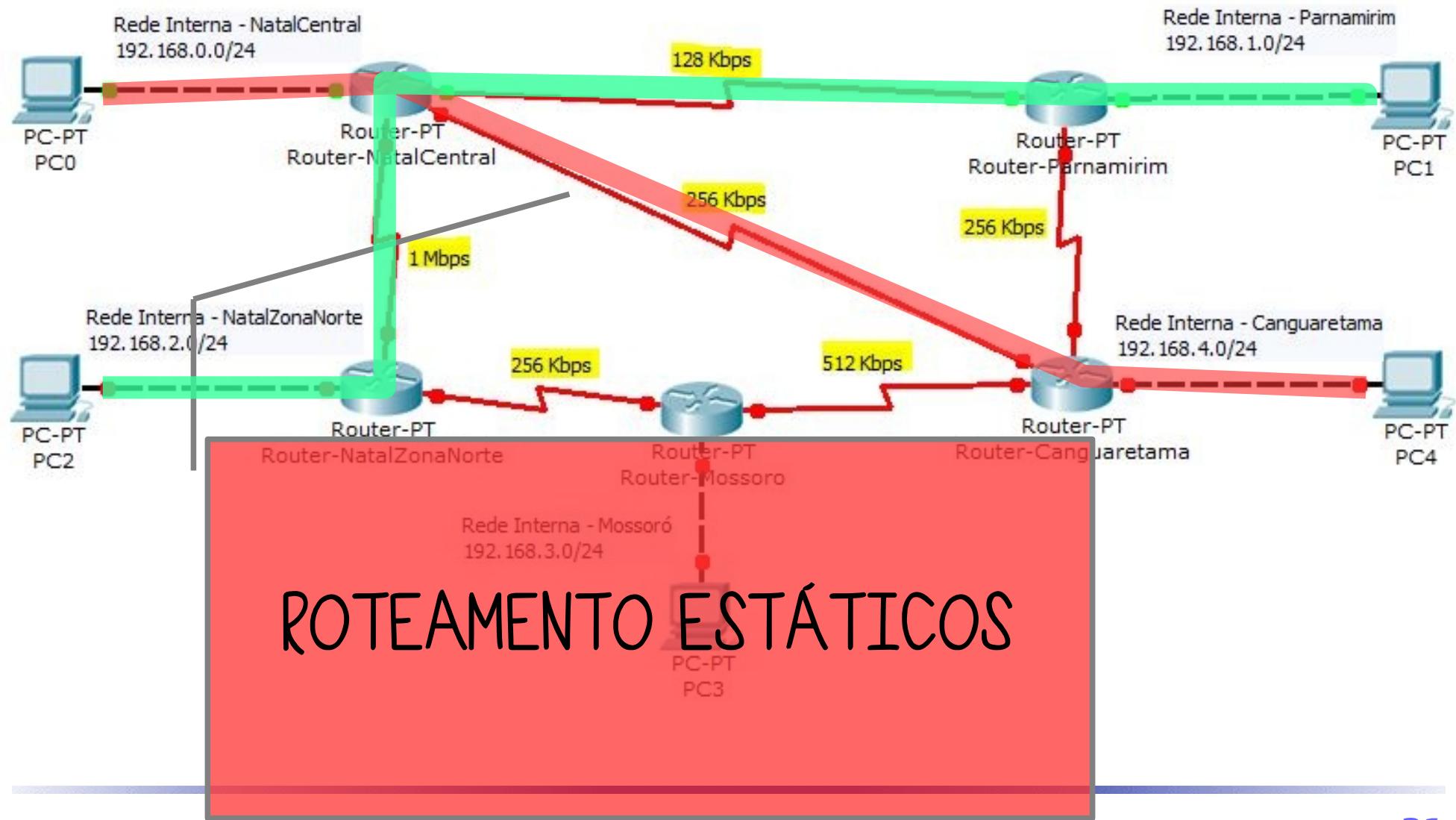
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A odisseia na Internet



A odisseia na Internet



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```
[ramon@nomar ~]$ sudo traceroute 8.8.8.8
```

```
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
```

```
1 192.168.43.1 (192.168.43.1) 5.699 ms 7.216 ms 8.817 ms
```

```
2 * * * Rede Interna - NatalCentral
```

```
3 10.77.8.189 (10.77.8.189) 483.166 ms 483.177 ms 500.927 ms
```

```
4 ip-177-79-213-38.user.vivozap.com.br (177.79.213.38) 514.424 ms 514.512 ms 514.352 ms
```

```
5 P187-100-49-53.dsl.telesp.net.br (187.100.49.53) 513.643 ms 513.344 ms 513.705 ms
```

```
6 187-100-49-25.dsl.telesp.net.br (187.100.49.25) 514.360 ms 167.659 ms 169.411 ms
```

```
7 187-100-49-1.dsl.telesp.net.br (187.100.49.1) 109.101 ms 109.168 ms 108.844 ms
```

```
8 grtssatw1-xe-3-0-0-0.252.52.176.in-addr.arpa (176.52.252.113) 138.431 ms 138.525 ms grtssatw1-xe-3-2-0-0
```

```
(5.53.0.189) 146.954 ms
```

```
9 Xe3-0-1-0-grtriotw1.red.telefonica-wholesale.net (5.53.4.113) 189.639 ms Xe6-1-1-0-grtriotw2.red.telefonica-wholesale.net (176.52.255.149) 197.322 ms Xe3-0-1-0-grtriotw1.red.telefonica-wholesale.net (5.53.4.113) 197.381 ms
```

```
10 PXe1-3-0-0-grtrioem2.red.telefonica-wholesale.net (84.16.15.94) 197.066 ms 219.386 ms 118.706 ms
```

```
PC2 Router-PT Router-NatalZonaNorte Router-PI Router-Cangletama PC4
```

```
11 xe-0-0-6-0-grtsaosi3.red.telefonica-wholesale.net (5.53.5.125) 151.243 ms 159.471 ms 130.159 ms
```

```
12 GOOGLE-1-0-0-GRTSAOSI3.252.52.176.in-addr.arpa (176.52.252.110) 233.301 ms GOOGLE-0-0-0-
```

```
GRTSAOSI3.252.52.176.in-addr.arpa (176.52.252.106) 224.705 ms 204.649 ms
```

```
13 209.85.244.43 (209.85.244.43) 240.596 ms 199.852 ms 265.151 ms
```

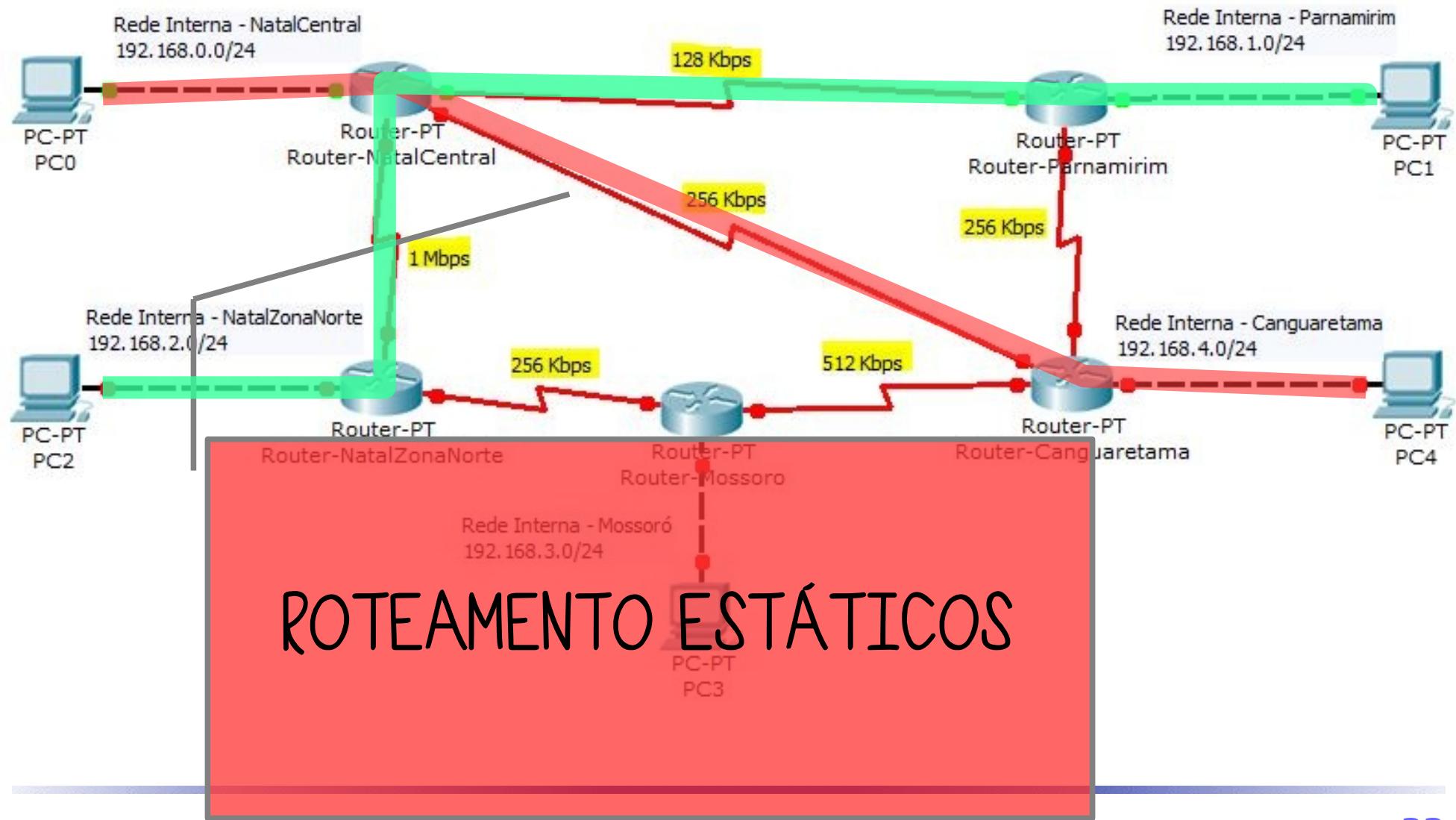
```
14 64.233.175.5 (64.233.175.5) 599.683 ms 209.85.244.79 (209.85.244.79) 601.970 ms 64.233.175.5 (64.233.175.5)  
577.284 ms
```

```
15 72.14.234.181 (72.14.234.181) 568.942 ms 536.369 ms 72.14.234.185 (72.14.234.185) 534.291 ms
```

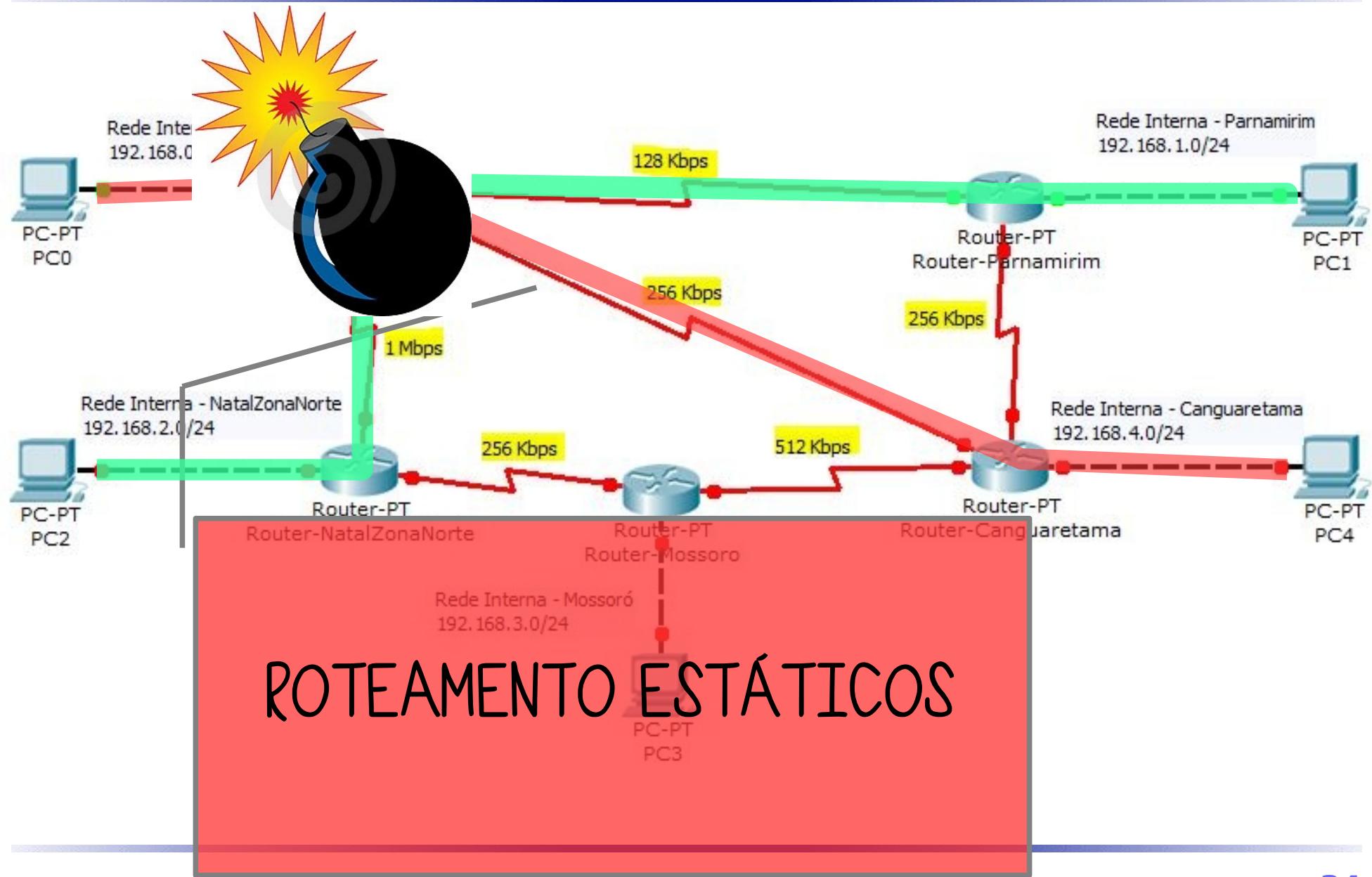
```
16 * * *
```

```
17 google-public-dns-a.google.com (8.8.8.8) 441.510 ms 424.046 ms 396.454 ms
```

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