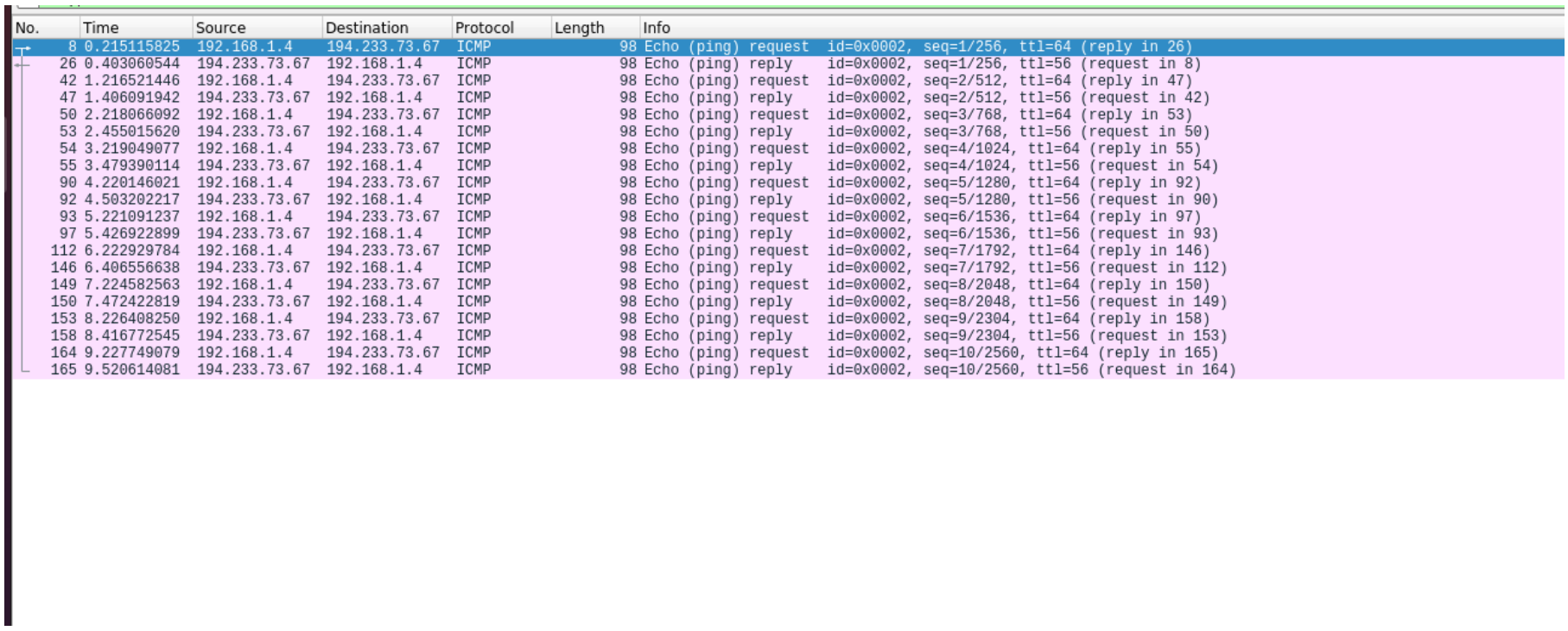
Home work 9

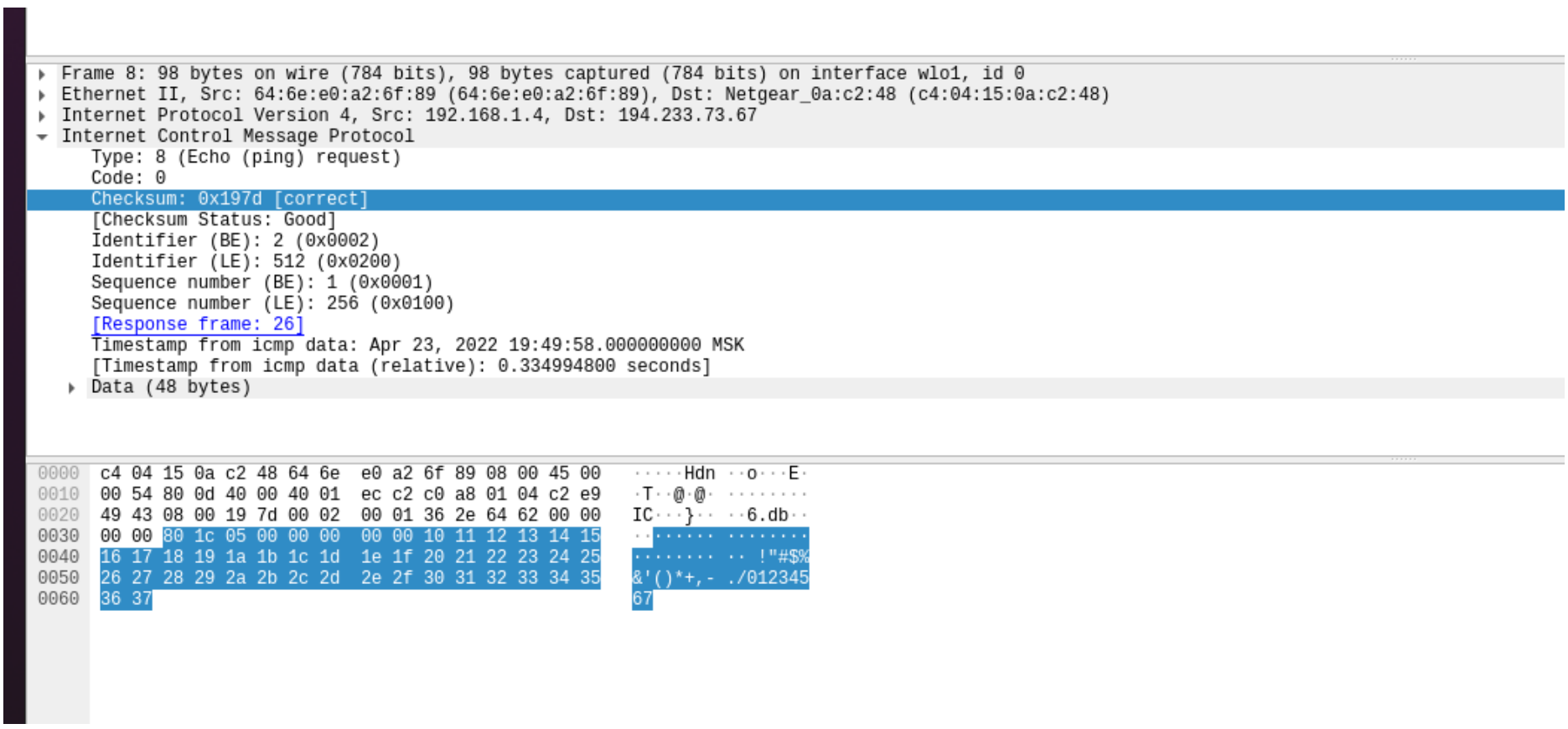
1.1 ping

1. Source: 192.168.1.4, Destination [onepiece.store]: 194.233.73.67



No.	Time	Source	Destination	Protocol	Length	Info
8	0.215115825	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=1/256, ttl=64 (reply in 26)
26	0.403060544	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=1/256, ttl=56 (request in 8)
42	1.216521446	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=2/512, ttl=64 (reply in 47)
47	1.406091942	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=2/512, ttl=56 (request in 42)
50	2.218066092	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=3/768, ttl=64 (reply in 53)
53	2.455015620	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=3/768, ttl=56 (request in 50)
54	3.219049077	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=4/1024, ttl=64 (reply in 55)
55	3.479390114	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=4/1024, ttl=56 (request in 54)
90	4.220146021	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=5/1280, ttl=64 (reply in 92)
92	4.503202217	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=5/1280, ttl=56 (request in 90)
93	5.221091237	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=6/1536, ttl=64 (reply in 97)
97	5.426922899	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=6/1536, ttl=56 (request in 93)
112	6.222929784	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=7/1792, ttl=64 (reply in 146)
146	6.406556638	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=7/1792, ttl=56 (request in 112)
149	7.224582563	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=8/2048, ttl=64 (reply in 150)
150	7.472422819	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=8/2048, ttl=56 (request in 149)
153	8.226408250	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=9/2304, ttl=64 (reply in 158)
158	8.416772545	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=9/2304, ttl=56 (request in 153)
164	9.227749079	192.168.1.4	194.233.73.67	ICMP	98	Echo (ping) request id=0x0002, seq=10/2560, ttl=64 (reply in 165)
165	9.520614081	194.233.73.67	192.168.1.4	ICMP	98	Echo (ping) reply id=0x0002, seq=10/2560, ttl=56 (request in 164)

2. Номера портов для транспортного уровня, а ICMP на сетевом
3. Type: 8 (Echo (ping) request); Code: 0; Checksum: 0x197d [correct]; Identifier (BE): 2 (0x0002) Identifier (LE): 512 (0x0200); Sequence number (BE): 1 (0x0001); Sequence number (LE): 256 (0x0100) ; по 2 байта



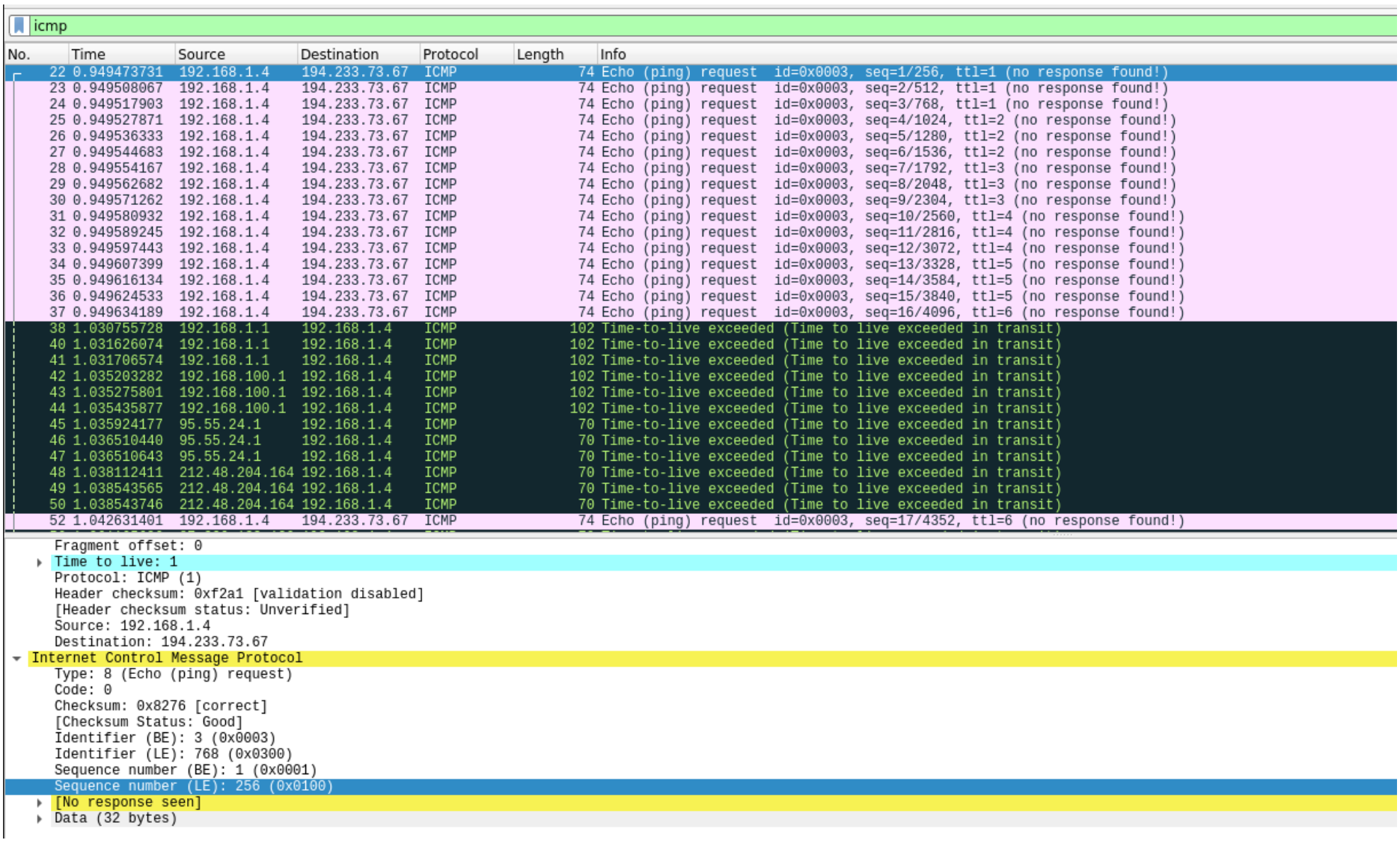
```
▸ Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface wlo1, id 0
▸ Ethernet II, Src: 64:6e:e0:a2:6f:89 (64:6e:e0:a2:6f:89), Dst: Netgear_0a:c2:48 (c4:04:15:0a:c2:48)
▸ Internet Protocol Version 4, Src: 192.168.1.4, Dst: 194.233.73.67
▾ Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x197d [correct]
    [Checksum Status: Good]
    Identifier (BE): 2 (0x0002)
    Identifier (LE): 512 (0x0200)
    Sequence number (BE): 1 (0x0001)
    Sequence number (LE): 256 (0x0100)
    [Response frame: 26]
    Timestamp from icmp data: Apr 23, 2022 19:49:58.000000000 MSK
    [Timestamp from icmp data (relative): 0.334994800 seconds]
  ▸ Data (48 bytes)
```

```
0000  c4 04 15 0a c2 48 64 6e  e0 a2 6f 89 08 00 45 00   ·····Hdn ··o···E·
0010  00 54 80 0d 40 00 40 01  ec c2 c0 a8 01 04 c2 e9   ·T··@·@· ········
0020  49 43 08 00 19 7d 00 02  00 01 36 2e 64 62 00 00   IC···}·· ··6.db··
0030  00 00 80 1c 05 00 00 00  00 00 10 11 12 13 14 15   ········ ········
0040  16 17 18 19 1a 1b 1c 1d  1e 1f 20 21 22 23 24 25   ········ ·· !"#$%
0050  26 27 28 29 2a 2b 2c 2d  2e 2f 30 31 32 33 34 35   &'()*+,- ./012345
0060  36 37                                             67
```

4. Type: 0 (Echo (ping) reply); Code: 0; такие же еще, как выше, по 2 байта также

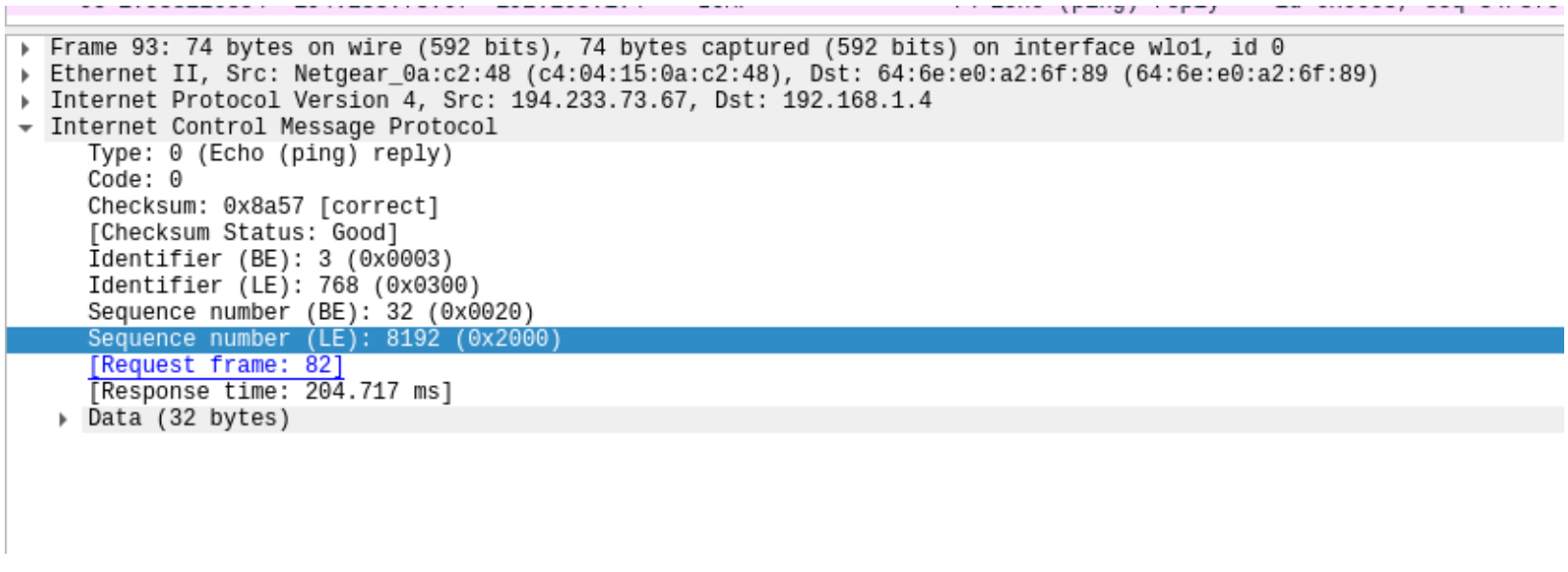
1.2 traceroute

1. отличаются ttl, id, checksum

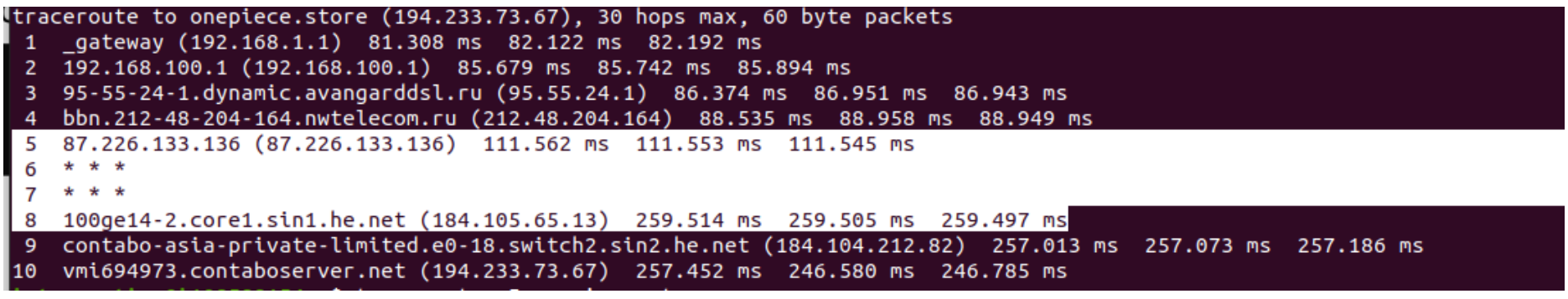


2. -

3. Отличие есть, потому что дошли до хоста. Отличаются тип, TTL



4. from **Sweden** to **Singapore**



3

1.1.

Отправим пакетов

$$\sum_{i=0}^{W/2}\left(\frac{W}{2}+i\right)=\frac{W}{2}\left(\frac{W}{2}+1\right)+\sum_{i=0}^{W/2}i=\frac{W}{2}\left(\frac{W}{2}+1\right)+\frac{W}{2}\cdot\frac{\left(\frac{W}{2}+1\right)}{2}=\frac{W^2}{4}+\frac{W}{2}+\frac{W^2}{8}+\frac{W}{4}=\frac{3W^2}{8}+\frac{3W}{4}$$

А L по определению — сколько потеряли поделить на сколько отправили, а потеряли один пакет.

1.2.

Почти всегда $\frac{3W}{4}$ можно пренебречь, поэтому $W \approx \sqrt{\frac{8}{3L}}$

Откуда средняя скорость

$$\frac{3}{4} \cdot \sqrt{\frac{8}{3L}} \cdot \frac{MSS}{RTT}$$

А это то, что нужно.

2.1. То же самое, что в предыдущей домашке

Пакетов отравим во время расширения

$$N = \sum_{i=0}^{\log_{a+1} 2} \frac{w}{2} \cdot (1+a)^i = w \cdot \frac{2a+1}{2a}$$

Искомая зависиость — обратная к N: $\frac{2a}{w \cdot (2a+1)}$

2.2.

Времени нужно для расширения окна

$$RTT \cdot \log_{a+1} 2$$

Видно, что оно зависит только от RTT и a.