

1. Wireshark: ICMP

1. Ping

No.	Time	Source	Destination	Protocol	Length	Info
38	2.959370743	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=1/256, ttl=64 (reply in 39)
39	3.039926035	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=1/256, ttl=104 (request in 38)
54	3.960467439	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=2/512, ttl=64 (reply in 55)
55	3.988359593	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=2/512, ttl=104 (request in 54)
59	4.961890415	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=3/768, ttl=64 (reply in 60)
60	4.992593966	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=3/768, ttl=104 (request in 59)
65	5.963004944	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=4/1024, ttl=64 (reply in 66)
66	5.991349012	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=4/1024, ttl=104 (request in 65)
70	6.964849262	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=5/1280, ttl=64 (reply in 71)
71	6.996557667	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=5/1280, ttl=104 (request in 70)
82	7.966124491	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=6/1536, ttl=64 (reply in 83)
83	7.997131781	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=6/1536, ttl=104 (request in 82)
92	8.967533188	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=7/1792, ttl=64 (reply in 93)
93	8.996497113	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=7/1792, ttl=104 (request in 92)
95	9.967979378	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=8/2048, ttl=64 (reply in 96)
96	9.995910939	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=8/2048, ttl=104 (request in 95)
110	10.9695296...	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=9/2304, ttl=64 (reply in 111)
111	10.99773352...	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=9/2304, ttl=104 (request in 110)
113	11.9708132...	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=10/2560, ttl=64 (reply in 114)
114	11.9996809...	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=10/2560, ttl=104 (request in 113)

1) IP-адрес моего хоста - 192.168.1.107, IP-адрес хоста назначения - 8.8.8.8.

2) Потому что ICMP - протокол сетевого уровня.

No.	Time	Source	Destination	Protocol	Length	Info		
38	2.959370743	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=1/256, ttl=64 (reply in 39)		
39	3.039926035	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=1/256, ttl=104 (request in 38)		
Frame 38: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface wlx0d37453911bd, id 0								
Ethernet II, Src: Tp-LinkT_39:11:bd (d0:37:45:39:11:bd), Dst: 60:a4:b7:61:23:00 (60:a4:b7:61:23:00)								
Internet Protocol Version 4, Src: 192.168.1.107, Dst: 8.8.8.8								
Internet Control Message Protocol								
Type: 8 (Echo (ping) request)								
Code: 0								
Checksum: 0x9f7a [correct]								
[Checksum Status: Good]								
Identifier (BE): 2 (0x0002)								
Identifier (LE): 512 (0x0200)								
Sequence number (BE): 1 (0x0001)								
Sequence number (LE): 256 (0x0100)								
[Response frame: 39]								
Timestamp from icmp data: Apr 23, 2022 17:11:34.000000000 MSK								
[Timestamp from icmp data (relative): 0.148546561 seconds]								
Data (48 bytes)								
0000	60	a4	b7	61	23	00 d0 37 45 39 11 bd 08 00 45 00	..a#..7E9...E..	
0010	00	54	26	20	40	00 00 40 01 42 66 c0 a8 01 6b 08 08	T...h...k...	
0020	08	08	08	00	9f	7a 00 02 00 01 16 09 64 62 00 00	...Z...db...	
0030	00	00	1d	44	02	00 00 00 00 10 11 12 13 14 15	...D... ..	
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

3)

ICMP-тип - 8, кодовый номер - 0. Другие поля: контрольная сумма, идентификатор, порядковый номер. На каждое из этих полей приходится по 2 байта.

No.	Time	Source	Destination	Protocol	Length	Info										
38	2.959370743	192.168.1.107	8.8.8.8	ICMP	98	Echo (ping) request id=0x0002, seq=1/256, ttl=64 (reply in 39)										
39	3.039926035	8.8.8.8	192.168.1.107	ICMP	98	Echo (ping) reply id=0x0002, seq=1/256, ttl=104 (request in 38)										
Frame 39: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface wlx037453911bd, id 0																
Ethernet II, Src: 60:a4:b7:61:23:00 (60:a4:b7:61:23:00), Dst: Tp-LinkT_39:11:bd (d0:37:45:39:11:bd)																
Internet Protocol Version 4, Src: 8.8.8.8, Dst: 192.168.1.107																
Internet Control Message Protocol																
Type: 0 (Echo (ping) reply)																
Code: 0																
Checksum: 0xa77a [correct]																
[Checksum Status: Good]																
Identifier (BE): 2 (0x0002)																
Identifier (LE): 512 (0x0200)																
Sequence number (BE): 1 (0x0001)																
Sequence number (LE): 256 (0x0100)																
[Request frame: 38]																
[Response time: 80,555 ms]																
Timestamp from icmp data: Apr 23, 2022 17:11:34.000000000 MSK																
[Timestamp from icmp data (relative): 0.229101853 seconds]																
Data (48 bytes)																
0000	d0	37	45	39	11	bd 60 a4 b7 61 23 00 08 00 45 00 ..7E9...a#...E..										
0010	00	54	00	00	00	00 00 00 00 00 00 00 00 00 00 00 00 ..T...h...k...										
0020	01	6b	00	00	a7	7a 00 02 00 01 16 09 64 62 00 00 ...Z...db...										
0030	00	00	1d	44	02	00 00 00 00 10 11 12 13 14 15 ...D... ..										
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)

ICMP-тип - 0, кодовый номер - 0. Другие поля: контрольная сумма, идентификатор, порядковый номер. На каждое из этих полей приходится по 2 байта.

2. Traceroute

No.	Time	Source	Destination	Protocol	Length	Info
8	1.528872884	192.168.1.107	8.8.8.8	ICMP	74	Echo (ping) request id=0x0004, seq=1/256, ttl=1 (no response found!)
9	1.528942173	192.168.1.107	8.8.8.8	ICMP	74	Echo (ping) request id=0x0004, seq=2/512, ttl=1 (no response found!)
Frame 8: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface wlx037453911bd, id 0						
Ethernet II, Src: Tp-LinkT_39:11:bd (d0:37:45:39:11:bd), Dst: 60:a4:b7:61:23:00 (60:a4:b7:61:23:00)						
Internet Protocol Version 4, Src: 192.168.1.107, Dst: 8.8.8.8						
0100 = Version: 4						
.... 0101 = Header Length: 20 bytes (5)						
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)						
Total Length: 60						
Identification: 0xf3d4 (62420)						
Flags: 0x0000						
Fragment offset: 0						
Time to live: 1						
Protocol: ICMP (1)						
Header checksum: 0xf3c9 [validation disabled]						
[Header checksum status: Unverified]						
Source: 192.168.1.107						
Destination: 8.8.8.8						
Internet Control Message Protocol						

1)

ICMP-пакет с echo запросом отличается значением ttl, в данном случае он равен 1, а в предыдущем задании - 64.

No.	Time	Source	Destination	Protocol	Length	Info
24	1.535126931	10.219.3.254	192.168.1.107	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
25	1.535133369	10.219.3.254	192.168.1.107	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
Frame 24: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) on interface wlx037453911bd, id 0						
Ethernet II, Src: 60:a4:b7:61:23:00 (60:a4:b7:61:23:00), Dst: Tp-LinkT_39:11:bd (d0:37:45:39:11:bd)						
Internet Protocol Version 4, Src: 10.219.3.254, Dst: 192.168.1.107						
Internet Control Message Protocol						
Type: 11 (Time-to-live exceeded)						
Code: 0 (Time to live exceeded in transit)						
Checksum: 0xf4ff [correct]						
[Checksum Status: Good]						
Unused: 00000000						
Internet Protocol Version 4, Src: 192.168.1.107, Dst: 8.8.8.8						
Internet Control Message Protocol						
Type: 8 (Echo (ping) request)						
Code: 0						
Checksum: 0x8272 [unverified] [in ICMP error packet]						
[Checksum Status: Unverified]						
Identifier (BE): 4 (0x0004)						
Identifier (LE): 1024 (0x0400)						
Sequence number (BE): 4 (0x0004)						
Sequence number (LE): 1024 (0x0400)						
Data (32 bytes)						
Data: 48494a4b4c4d4e4f505152535455565758595a5b5c5d5e5f...						
[Length: 32]						

2)

В дополнительных полях содержится информация о ICMP-пакете с echo запросом.

3)

No.	Time	Source	Destination	Protocol	Length	Info
227	7.019619793	8.8.8.8	192.168.1.107	ICMP	74	Echo (ping) reply id=0x0004, seq=75/19200, ttl=104 (request in 221)
228	7.019620736	8.8.8.8	192.168.1.107	ICMP	74	Echo (ping) reply id=0x0004, seq=76/19456, ttl=104 (request in 222)
229	7.019622056	8.8.8.8	192.168.1.107	ICMP	74	Echo (ping) reply id=0x0004, seq=77/19712, ttl=104 (request in 223)

Это пакеты с echo ответом, соответственно, они отличаются от пакетов, сообщающих об ошибках наличием ответа на echo запрос, а также тем, что пакет приходит с нужного IP-адреса - 8.8.8.8. Это объясняется тем, что ttl стал достаточно большим, чтобы echo запрос дошел.

```
gertser@gertser:~$ traceroute 8.8.8.8 -I
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
 0  _gateway (192.168.1.1)  6.720 ms  6.660 ms  6.629 ms
 1  10.219.3.254 (10.219.3.254)  6.114 ms  6.086 ms  6.086 ms
 2  * * *
 3  * * *
 4  * * *
 5  * * *
 6  10.210.116.1 (10.210.116.1)  5.771 ms  2.324 ms  2.293 ms
 7  10.210.116.2 (10.210.116.2)  2.727 ms  2.721 ms  2.749 ms
 8  10.210.116.6 (10.210.116.6)  3.267 ms  3.253 ms  4.597 ms
 9  109.239.133.66 (109.239.133.66)  4.509 ms  4.478 ms  4.450 ms
10  91.108.51.1 (91.108.51.1) 13.243 ms 13.513 ms 13.482 ms
11  178.18.227.7 (178.18.227.7) 23.398 ms 23.371 ms 23.339 ms
12  108.170.250.34 (108.170.250.34) 21.921 ms 21.891 ms 23.117 ms
13  142.251.238.82 (142.251.238.82) 30.541 ms 30.477 ms 30.908 ms
14  142.251.238.70 (142.251.238.70) 29.504 ms 29.405 ms 29.380 ms
15  74.125.253.147 (74.125.253.147) 29.320 ms 29.288 ms 29.217 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  dns.google (8.8.8.8) 81.784 ms 81.749 ms 81.718 ms
```

4)

Задержка в канале 178.18.227.7 - 108.170.250.34 превышает среднее значение. 178.18.227.7 находится в России, а 108.170.250.34 находится в США.

2. Программирование.

1. IP-адрес и маска сети

```
/usr/bin/python3.8 /home/eartser/Learning/comp-networks/lab09/ip_util.py
IP-address: 192.168.1.107
Netmask: 255.255.255.0

Process finished with exit code 0
```

2. Доступные порты

```
/usr/bin/python3.8 /home/eartser/Learning/comp-networks/lab09/port_util.py
Enter IP-address: 127.0.0.1
Enter min port: 630
Enter max port: 635
List of available ports:
630
632
633
634
635

Process finished with exit code 0
```