

1. Wireshark: ICMP

в unix в ping опция для задания кол-ва запросов -n

1. Ping

No.	Time	Source	Destination	Protocol	Length	Info
80	7.131418934	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=1/256, ttl=64
83	7.236850399	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=1/256, ttl=64
89	8.132628075	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=2/512, ttl=64
90	8.255831697	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=2/512, ttl=64
102	9.134116368	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=3/768, ttl=64
111	9.196357537	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=3/768, ttl=64
122	10.135734180	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=4/1024, ttl=64
123	10.203204825	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=4/1024, ttl=64
149	11.137574904	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=5/1280, ttl=64
156	11.200013630	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=5/1280, ttl=64
170	12.139388364	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=6/1536, ttl=64
171	12.202010405	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=6/1536, ttl=64
192	13.141305669	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=7/1792, ttl=64
193	13.203616062	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=7/1792, ttl=64
196	14.143084929	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=8/2048, ttl=64
197	14.241000000	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=8/2048, ttl=64

Frame 80: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface wlx7062b8b3c121, id 0

Ethernet II, Src: D-LinkIn_b3:c1:21 (70:62:b8:b3:c1:21), Dst: D-LinkIn_69:a6:18 (c4:12:f5:69:a6:18)

Internet Protocol Version 4, Src: 192.168.0.141, Dst: 96.16.90.215

0100 = Version: 4

.... 0101 = Header Length: 20 bytes (5)

Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)

Total Length: 84

Identification: 0x60af (24751)

Flags: 0x40, Don't fragment

...0 0000 0000 0000 = Fragment Offset: 0

Time to Live: 64

Protocol: ICMP (1)

Header Checksum: 0x5ddd [validation disabled]

[Header checksum status: Unverified]

Source Address: 192.168.0.141

Destination Address: 96.16.90.215

1) IP-адрес моего хоста -- 192.168.0.141. IP-адрес назначения – 96.16.90.215 (см. описание IP-пакета)

2) Протокол ICMP (хотя и работает поверх протокола IP) по сути находится на 3-ем уровне модели ISO/OSI, под транспортным уровнем, поэтому понятия порта тут нет.

3)

No.	Time	Source	Destination	Protocol	Length	Info
80	7.131418934	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=1/256, ttl=64 (reply in 83)
83	7.236859399	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=1/256, ttl=58 (request in 80)
89	8.132628075	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=2/512, ttl=64 (reply in 90)
90	8.255831697	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=2/512, ttl=58 (request in 89)
102	9.134116368	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=3/768, ttl=64 (reply in 111)
111	9.196357537	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=3/768, ttl=58 (request in 102)
122	10.135734188	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=4/1024, ttl=64 (reply in 123)
123	10.203294825	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=4/1024, ttl=58 (request in 122)
149	11.137574904	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=5/1280, ttl=64 (reply in 156)
156	11.200013630	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=5/1280, ttl=58 (request in 149)
170	12.139388364	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=6/1536, ttl=64 (reply in 171)
171	12.202010405	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=6/1536, ttl=58 (request in 170)
192	13.141395669	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=7/1792, ttl=64 (reply in 193)
193	13.203616062	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=7/1792, ttl=58 (request in 192)
196	14.143084929	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=8/2048, ttl=64 (reply in 197)
197	14.204010405	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=8/2048, ttl=58 (request in 196)
Frame 80: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface wlx7062b8b3c121, id 0						
Ethernet II, Src: D-LinkIn_b3:c1:21 (70:62:b8:b3:c1:21), Dst: D-LinkIn_69:a6:18 (c4:12:f5:69:a6:18)						
Internet Protocol Version 4, Src: 192.168.0.141, Dst: 96.16.90.215						
Internet Control Message Protocol						
Type: 8 (Echo (ping) request)						
Code: 0						
Checksum: 0x39ec [correct]						
[Checksum Status: Good]						
Identifier (BE): 6 (0x0006)						
Identifier (LE): 1536 (0x0600)						
Sequence Number (BE): 1 (0x0001)						
Sequence Number (LE): 256 (0x0100)						
[Response frame: 83]						
Timestamp from icmp data: Apr 22, 2023 23:26:28.000000000 MSK						
[Timestamp from icmp data (relative): 0.168661710 seconds]						
Data (48 bytes)						
Data: c4920200000000000101112131415161718191a1b1c1d1e1f202122232425262728292a2b...						
[Length: 48]						
0000	c4 12 f5 69 a6 18	70 62 b8 b3 c1 21	08 00 45 00	...	i	pb ...E
0010	00 54 00 af 00 00	00 01 5d dd c0 a8	00 8d 60 10	T	@]
0020	5a d7 08 00 39 ec	00 06 00 01 f4	42 44 64 00	00	Z	9 ...Bdd
0030	00 00 c4 92 02 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		

ICMP-тип первого запроса – echo (значение 8 в поле Type). Значение подтипа – 0 (единственный возможный при type=8). Также в пакете есть поле identifier, sequence number, checksum, timestamp. Размер identifier, checksum, SN – 2 байта.

4)

No.	Time	Source	Destination	Protocol	Length	Info
80	7.131418934	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=1/256, ttl=64 (reply in 83)
83	7.236859399	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=1/256, ttl=58 (request in 80)
89	8.132628075	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=2/512, ttl=64 (reply in 90)
90	8.255831697	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=2/512, ttl=58 (request in 89)
102	9.134116368	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=3/768, ttl=64 (reply in 111)
111	9.196357537	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=3/768, ttl=58 (request in 102)
122	10.135734188	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=4/1024, ttl=64 (reply in 123)
123	10.203294825	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=4/1024, ttl=58 (request in 122)
149	11.137574904	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=5/1280, ttl=64 (reply in 156)
156	11.200013630	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=5/1280, ttl=58 (request in 149)
170	12.139388364	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=6/1536, ttl=64 (reply in 171)
171	12.202010405	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=6/1536, ttl=58 (request in 170)
192	13.141395669	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=7/1792, ttl=64 (reply in 193)
193	13.203616062	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=7/1792, ttl=58 (request in 192)
196	14.143084929	192.168.0.141	96.16.90.215	ICMP	98	Echo (ping) request id=0x0006, seq=8/2048, ttl=64 (reply in 197)
197	14.204010405	96.16.90.215	192.168.0.141	ICMP	98	Echo (ping) reply id=0x0006, seq=8/2048, ttl=58 (request in 196)
Frame 83: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface wlx7062b8b3c121, id 0						
Ethernet II, Src: D-LinkIn_69:a6:18 (c4:12:f5:69:a6:18), Dst: D-LinkIn_b3:c1:21 (70:62:b8:b3:c1:21)						
Internet Protocol Version 4, Src: 96.16.90.215, Dst: 192.168.0.141						
Internet Control Message Protocol						
Type: 0 (Echo (ping) reply)						
Code: 0						
Checksum: 0x41ec [correct]						
[Checksum Status: Good]						
Identifier (BE): 6 (0x0006)						
Identifier (LE): 1536 (0x0600)						
Sequence Number (BE): 1 (0x0001)						
Sequence Number (LE): 256 (0x0100)						
[Request frame: 80]						
[Response time: 105,431 ms]						
Timestamp from icmp data: Apr 22, 2023 23:26:28.000000000 MSK						
[Timestamp from icmp data (relative): 0.274093175 seconds]						
Data (48 bytes)						
Data: c4920200000000000101112131415161718191a1b1c1d1e1f202122232425262728292a2b...						
[Length: 48]						
0000	70 62 b8 b3 c1 21	c4 12 f5 69 a6 18	08 00 45 00	pb	...	i ...E
0010	00 54 d4 35 00 00	3a 01 30 57 60 10	5a d7 c0 a8	T	5	...
0020	00 8d 00 00 41 ec	00 06 00 01 f4	42 44 64 00	00	A	...
0030	00 00 c4 92 02 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		

IC<P-тип первого ответа – echo reply (значение 0 в поле Type). Значение подтипа – 0 (единственный возможный при type=0). Пакет имеет те же поля, что и запрос. SN, checksum, identifier занимают 2 байта.

2. Traceroute

tracert -I nsa.gov (-I чтобы использовать ICMP)

1)

No.	Time	Source	Destination	Protocol	Length	Info
12	1.789661846	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=1/256, ttl=1 (no response found!)
13	1.789654535	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=2/512, ttl=1 (no response found!)
14	1.789684801	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=3/768, ttl=1 (no response found!)
15	1.789707822	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=4/1024, ttl=2 (no response found!)
16	1.789733267	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=5/1280, ttl=2 (no response found!)
17	1.789756610	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=6/1536, ttl=2 (no response found!)
18	1.789781194	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=7/1792, ttl=3 (no response found!)
19	1.789813603	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=8/2048, ttl=3 (no response found!)
20	1.789830692	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=9/2304, ttl=3 (no response found!)
21	1.789861057	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=10/2560, ttl=4 (no response found!)
22	1.789889948	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=11/2816, ttl=4 (no response found!)
23	1.789907317	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=12/3072, ttl=4 (no response found!)
24	1.789938880	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=13/3328, ttl=5 (no response found!)
25	1.789965316	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=14/3584, ttl=5 (no response found!)
26	1.789982484	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=15/3840, ttl=5 (no response found!)
* Frame 12: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface wlx7062b8b3c121, id 0						
* Ethernet II, Src: D-LinkIn_b3:c1:21 (70:62:b8:b3:c1:21), Dst: D-LinkIn_69:a6:18 (c4:12:f5:69:a6:18)						
* Internet Protocol Version 4, Src: 192.168.0.141, Dst: 96.16.90.215						
* Internet Control Message Protocol						
Type: 8 (Echo (ping) request)						
Code: 0						
Checksum: 0x8271 [correct]						
[Checksum Status: Good]						
Identifier (BE): 8 (0x0008)						
Identifier (LE): 2048 (0x0800)						
Sequence Number (BE): 1 (0x0001)						
Sequence Number (LE): 256 (0x0100)						
* [No response seen]						
* Data (32 bytes)						
Data: 48494a4b4c4d4e4f505152535455565758595a5b5c5d5e5f6061626364656667						
[Length: 32]						
0000 c4 12 f5 69 a6 18 70 62 b8 b3 c1 21 08 00 45 00 ...i..pb...f..E..						
0010 00 3c c7 68 00 00 01 01 76 3c c0 a8 00 8d 60 10 ...<..h...v<.....						
0020 5a d7 08 00 82 71 00 08 00 01 48 49 4a 4b 4c 4d Z.....HIJKLM						
0030 4e 4f 50 51 52 53 54 55 56 57 58 59 5a 5b 5c 5d NOPQRSTU VWXYZ[\]						
0040 5e 5f 60 61 62 63 64 65 66 67 ^.....abcde fg						

можно видеть, что сам ICMP-пакет ничем не отличается от ICMP-пакета из первого задания. Есть различие на уровне IP-протокола (TTL=1).

2)

Ответ с сообщением об ошибке:

No.	Time	Source	Destination	Protocol	Length	Info
12	1.789601946	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=1/256, ttl=1 (no response found!)
13	1.789654535	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=2/512, ttl=1 (no response found!)
14	1.789684001	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=3/768, ttl=1 (no response found!)
15	1.789707022	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=4/1024, ttl=2 (no response found!)
16	1.789733267	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=5/1280, ttl=2 (no response found!)
17	1.789756610	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=6/1536, ttl=2 (no response found!)
18	1.789781194	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=7/1792, ttl=3 (no response found!)
19	1.789813603	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=8/2048, ttl=3 (no response found!)
20	1.789836692	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=9/2304, ttl=3 (no response found!)
21	1.789861057	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=10/2560, ttl=4 (no response found!)
22	1.789889948	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=11/2816, ttl=4 (no response found!)
23	1.789907317	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=12/3072, ttl=4 (no response found!)
24	1.789938880	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=13/3328, ttl=5 (no response found!)
25	1.789965316	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=14/3584, ttl=5 (no response found!)
26	1.789982484	192.168.0.141	96.16.90.215	ICMP	74	Echo (ping) request id=0x0008, seq=15/3840, ttl=5 (no response found!)
Frame 12: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface wlx7062b8b3c121, id 0 Ethernet II, Src: D-LinkIn_b3:c1:21 (70:62:b8:b3:c1:21), Dst: D-LinkIn_69:a6:18 (c4:12:f5:69:a6:18) Internet Protocol Version 4, Src: 192.168.0.141, Dst: 96.16.90.215 Internet Control Message Protocol Type: 8 (Echo (ping) request) Code: 0 Checksum: 0x8271 [correct] [Checksum Status: Good] Identifier (BE): 8 (0x0008) Identifier (LE): 2048 (0x0800) Sequence Number (BE): 1 (0x0001) Sequence Number (LE): 256 (0x0100) [No response seen] Data (32 bytes) Data: 48494a4b4c4d4e4f505152535455565758595a5b5c5d5e5f6061626364656667 [Length: 32]						
0000	c4 12 f5 69 a6 18 70 62 b8 b3 c1 21 00 00 45 90	...i.pb...!..E..				
0010	00 3c c7 60 00 00 01 01 76 3c c0 a8 00 0d 60 10	<..h...vc.....				
0020	5a d7 08 00 82 71 00 08 00 01 48 49 4a 4b 4c 4d	Z...q...HIJKL				
0030	4e 4f 50 51 52 53 54 55 56 57 58 59 5a 5b 5c 5d	NOPQRSTU VWXYZ[\				
0040	5e 5f 60 61 62 63 64 65 66 67	^_abcde fg				

видно, что тип ICMP-пакета – 1 – TTL Exceeded. Кроме того, пакет содержит данные ICMP-запроса. Также среди полей пакета – только подтип и checksum.

3)

последние 3 пакета, которые пришли пакета на исходный (мой) хост, это ICMP echo reply от искомого хоста (nsa.gov, 184.84.25.195). Собственно, это последние пакеты, потому что ICMP-пакеты дошли до искомого хоста и он ответил на 3 наших запроса.

4)

viralpraxis@primary: ~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c\$	
tracert nsa.gov	
tracert to nsa.gov (184.84.25.195), 30 hops max, 60 byte packets	
1	192.168.1.1 (192.168.1.1) 2.046 ms 2.458 ms 2.647 ms
2	ip.178-70-210-1.avangardsl.ru (178.70.210.1) 5.426 ms 5.967 ms 6.645 ms
3	so-2-1-0-s16.M120-1-PSKV.nwtelecom.ru (212.48.194.38) 7.359 ms 7.691 ms 7.938 ms
4	109.172.24.67 (109.172.24.67) 19.658 ms 19.871 ms 20.327 ms
5	ae53.edge4.Stockholm2.Level3.net (213.249.107.129) 20.104 ms * 21.072 ms
6	ae2.3204.edge7.Amsterdam1.level3.net (4.69.162.181) 46.017 ms 39.511 ms 53.878 ms
7	212.72.47.190 (212.72.47.190) 86.589 ms 86.851 ms 87.191 ms
8	ae2.r02.ams01.icn.netarch.akamai.com (23.210.55.40) 45.504 ms 48.873 ms 50.964 ms
9	ae8.r02.par01.icn.netarch.akamai.com (95.100.192.225) 65.498 ms 69.021 ms 76.434 ms
10	ae5.r02.mad01.icn.netarch.akamai.com (95.100.192.119) 80.013 ms 80.948 ms 81.292 ms
11	ae2.r02.mad01.icn.netarch.akamai.com (23.210.58.41) 103.306 ms 103.514 ms 103.684 ms
12	as20940-gw-max.cw.net (195.2.24.118) 76.650 ms 73.441 ms 72.833 ms
13	* * *
14	* * *
15	a184-84-25-195.deploy.static.akamaitechnologies.com (184.84.25.195) 74.713 ms 76.723 ms 76.079 ms

относительно большая задержка между ae53.edge4.Stockholm2.Level3.net (213.249.107.129) и ae2.3204.edge7.Amsterdam1.level3.net (213.249.107.129) (видимо, Стокгольм и Амстердам)

Программирование

Ruby MRI ~> 3.0.0

Задание А

ruby task_a/task_a.rb <network-interface-identifier>

```
(kivy_venv) viralpraxis@primary:~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_a$ ifconfig | grep 192.168.0.141 -A10 -B1
wlx7062b8b3c121: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.141 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::97cd:2f05:c5d3:91e6 prefixlen 64 scopeid 0x20<link>
    ether 70:62:b8:b3:c1:21 txqueuelen 1000 (Ethernet)
    RX packets 65673 bytes 60741037 (60.7 MB)
    RX errors 0 dropped 2590 overruns 0 frame 0
    TX packets 46540 bytes 10912333 (10.9 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

(kivy_venv) viralpraxis@primary:~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_a$ ruby task_a.rb wlx7062b8b3c121
proto      address      netmask
IPv4       192.168.0.141 255.255.255.0
IPv6       fe80         ffff:ffff:ffff:ffff::
(kivy_venv) viralpraxis@primary:~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_a$
```

Задание В

`ruby task_b/task_b.rb --ip-address=<...> --ports-range=<...> --mode=<...>`

--ip-address: IP-адрес для скана

--ports-range: Отрезок портов для скана в формате start:end

--mode: open или busy, busy – занятые порты, open – свободные (по поводу работы с UDP см. Комментарии в коде)

```
(kivy_venv) viralpraxis@primary:~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_b$ ruby task_b.rb --ip-address 127.0.0.1 --ports-range 1024:65535 --mode=busy
TCP scan started
5432/TCP
6379/TCP
7070/TCP
8000/TCP
9000/TCP
14148/TCP
40291/TCP
TCP scan ended
UDP scan started
56764/UDP
UDP scan ended
(kivy_venv) viralpraxis@primary:~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_b$
```

Задание С

python 3.10.0

зависимости: task_c/requirements.txt (сгенерировано pip freeze)

`python task_c/broad.py --port <port> --broadcast-period <float-seconds> --inactive-peer-period <float-seconds>`

Параметры:

port: число, порт на который биндится приложение

broadcast-period: float, кол-во секунд, раз в которое делается бродкаст

inactive-peer-period: float, кол-во секунд такое, что если в течение большего периода не получены UDP-пакеты от хоста, он считается неактивным

Запустим инстанс приложения на порту 4000 (python3 broad.py --port 4000):

```
(kivy_venv) viralpraxis@primary: ~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c$ python3 broad.py -- --port 4000
[INFO ] [Kivy      ] v2.1.0
[INFO ] [Kivy      ] Installed at "/home/viralpraxis/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c/kivy_venv/lib/python3.10/site-packages/kivy/___init___py"
[INFO ] [Python    ] v3.10.0 (default, Apr 24 2023, 20:18:35) [GCC 11.3.0]
[INFO ] [Python    ] Interpreter at "/home/viralpraxis/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c/kivy_venv/bin/python3"
[INFO ] [Factory   ] 189 symbols loaded
[INFO ] [Image     ] Providers: img_tex, img_dds, img_sdl2, img_pil (img_ffpyplayer ignored)
[INFO ] [Text      ] Provider: sdl2
[INFO ] [Window    ] Provider: sdl2
[INFO ] [GL        ] Using the "OpenGL" graphics s
[INFO ] [GL        ] Backend used <sdl2>
[INFO ] [GL        ] OpenGL version <b'4.6 (Compat
[INFO ] [GL        ] OpenGL vendor <b'Intel'>
[INFO ] [GL        ] OpenGL renderer <b'Mesa Intel
[INFO ] [GL        ] OpenGL parsed version: 4, 6
[INFO ] [GL        ] Shading version <b'4.60'>
[INFO ] [GL        ] Texture max size <16384>
[INFO ] [GL        ] Texture max units <32>
[INFO ] [Window    ] auto add sdl2 input provider
[INFO ] [Window    ] virtual keyboard not allowed,
[INFO ] [Window    ] observing state..
[INFO ] [Base      ] Start application main loop
[INFO ] [Base      ] updated UI
[INFO ] [Base      ] 0
[INFO ] [GL        ] NPOT texture support is avail
[INFO ] [Base      ] ready to receive on 4000
[INFO ] [Clipboard ] Provider: xclip
[INFO ] [CutBuffer ] cut buffer support enabled
WARNING: running xinput against an Xwayland server. Se
[INFO ] sent broadcast UDP message
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
[INFO ] [Base      ] Start application main loop
[INFO ] [Base      ] updated UI
[INFO ] [Base      ] 0
[INFO ] [GL        ] NPOT texture support is avail
```

Запустим еще один инстанс на порту 4001 (python3 broad.py -- --port 4001):

```
viralpraxis@primary: ~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c$ python3 broad.py -- --port 400
Traceback (most recent call last):
  File "/home/viralpraxis/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c/broad.py", line 5, in <module>
    from kivy.app import App
ModuleNotFoundError: No module named 'kivy'

(kivy_venv) viralpraxis@primary: ~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c$ source kivy_venv/bin/activate
(kivy_venv) viralpraxis@primary: ~/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c$ python3 broad.py -- --port 4001
[INFO ] [Kivy      ] v2.1.0
[INFO ] [Kivy      ] Installed at "/home/viralpraxis/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c/kivy_venv/lib/python3.10/site-packages/kivy/___init___py"
[INFO ] [Python    ] v3.10.0 (default, Apr 24 2023, 20:18:35) [GCC 11.3.0]
[INFO ] [Python    ] Interpreter at "/home/viralpraxis/Documents/spbu/2023-spring/networks/spbu-masters-compnet/homeworks/09/task_c/kivy_venv/bin/python3"
[INFO ] [Factory   ] 189 symbols loaded
[INFO ] [Image     ] Providers: img_tex, img_dds,
[INFO ] [Text      ] Provider: sdl2
[INFO ] [Window    ] Provider: sdl2
[INFO ] [GL        ] Using the "OpenGL" graphics s
[INFO ] [GL        ] Backend used <sdl2>
[INFO ] [GL        ] OpenGL version <b'4.6 (Compat
[INFO ] [GL        ] OpenGL vendor <b'Intel'>
[INFO ] [GL        ] OpenGL renderer <b'Mesa Intel
[INFO ] [GL        ] OpenGL parsed version: 4, 6
[INFO ] [GL        ] Shading version <b'4.60'>
[INFO ] [GL        ] Texture max size <16384>
[INFO ] [GL        ] Texture max units <32>
[INFO ] [Window    ] auto add sdl2 input provider
[INFO ] [Window    ] virtual keyboard not allowed,
[INFO ] [Window    ] observing state..
[INFO ] [Base      ] Start application main loop
[INFO ] [Base      ] updated UI
[INFO ] [Base      ] 0
[INFO ] [GL        ] NPOT texture support is available
[INFO ] [Base      ] ready to receive on 4001
[INFO ] [Clipboard ] Provider: xclip
[INFO ] [CutBuffer ] cut buffer support enabled
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
WARNING: running xinput against an Xwayland server. Se
[INFO ] [Base      ] Start application main loop
[INFO ] [Base      ] updated UI
[INFO ] [Base      ] 0
[INFO ] [GL        ] NPOT texture support is available
[INFO ] [Base      ] [received Message from Client]b'HELLO' from Client IP Address:('192.168.0.141', 4000)
```

Через какое-то время второе приложение получит broadcast-пакет от первого и добавит его в список:

