Отчёт по лабораторной работе «Механизмы протокола TCP»

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Содержание

1. Установка и разрыв соединения

Установка соединения между **c2**(telnet) и **c6**(discard). Дампим на **c3**

```
IP 10.20.0.1.35614 > 10.50.0.2.9: Flags [S], seq 4177652366, win 14520,
↪ options [mss 1452,sackOK,TS val 68755 ecr 0,nop,wscale 2], length 0
IP 10.50.0.2.9 > 10.20.0.1.35614: Flags [S.], seq 3097162115, ack
↪ 4177652367, win 14480, options [mss 536,sackOK,TS val 68772 ecr
↪ 68755,nop,wscale 2], length 0
IP 10.20.0.1.35614 > 10.50.0.2.9: Flags [.], ack 1, win 3630, options
↪ [nop,nop,TS val 68755 ecr 68772], length 0
IP 10.20.0.1.35614 > 10.50.0.2.9: Flags [F.], seq 1, ack 1, win 3630,
↪ options [nop,nop,TS val 69195 ecr 68772], length 0
IP 10.50.0.2.9 > 10.20.0.1.35614: Flags [F.], seq 1, ack 2, win 3620,
↪ options [nop,nop,TS val 69210 ecr 69195], length 0
IP 10.20.0.1.35614 > 10.50.0.2.9: Flags [.], ack 2, win 3630, options
↪ [nop,nop,TS val 69195 ecr 69210], length 0
```

2. Окно получателя

Передача данных от **c1** до **c4** с дампом на **c3**:

```
16:22:13.480745 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [S.], seq
↪ 3326672987, ack 3156559790, win 5240, options [mss 536,sackOK,TS val 3441
↪ ecr 3489,nop,wscale 2], length 0
16:22:13.481204 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 525, win
↪ 1572, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481208 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 1049,
↪ win 1834, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481215 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 1573,
↪ win 2096, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481224 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 2097,
↪ win 2358, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481236 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 2621,
↪ win 2620, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481239 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 3145,
↪ win 2882, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481242 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 3669,
↪ win 2882, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481245 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 4193,
↪ win 2882, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481253 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 4717,
↪ win 2882, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481256 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 5241,
↪ win 2882, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.481350 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 6289,
↪ win 2882, options [nop,nop,TS val 3441 ecr 3490], length 0
16:22:13.518284 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 51633,
↪ win 1259, options [nop,nop,TS val 3445 ecr 3490], length 0
16:22:13.518723 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 56157,
↪ win 1310, options [nop,nop,TS val 3445 ecr 3494], length 0
16:22:13.519031 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 56681,
↪ win 1572, options [nop,nop,TS val 3445 ecr 3494], length 0
16:22:13.559487 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 62969,
↪ win 667, options [nop,nop,TS val 3449 ecr 3494], length 0
16:22:13.559846 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 65589,
↪ win 786, options [nop,nop,TS val 3449 ecr 3498], length 0
16:22:13.600446 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 68733,
↪ win 435, options [nop,nop,TS val 3453 ecr 3498], length 0
16:22:13.641286 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 70305,
↪ win 179, options [nop,nop,TS val 3457 ecr 3502], length 0
16:22:13.682194 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 70829,
↪ win 48, options [nop,nop,TS val 3461 ecr 3506], length 0
16:22:13.905307 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 71021,
↪ win 179, options [nop,nop,TS val 3484 ecr 3532], length 0
```

```
16:22:13.946182 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 71353,
↪ win 96, options [nop,nop,TS val 3488 ecr 3532], length 0
16:22:14.164420 IP 10.30.0.2.3002 > 10.10.0.2.48686: Flags [.], ack 71737,
↪ win 0, options [nop,nop,TS val 3510 ecr 3558], length 0
```

3. Окно отправителя

Передача данных от **c1** до **c5**(с установленным delay 100ms) с дампом на **c2.eth0**:

```
17:21:11.312960 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 1:101, ack
↪ 1, win 3650, options [nop,nop,TS val 148322 ecr 96758], length 100
17:21:11.323208 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 101:201,
↪ ack 1, win 3650, options [nop,nop,TS val 148323 ecr 96758], length 100
17:21:11.333312 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 201:301,
↪ ack 1, win 3650, options [nop,nop,TS val 148324 ecr 96758], length 100
17:21:11.343492 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 301:401,
↪ ack 1, win 3650, options [nop,nop,TS val 148325 ecr 96758], length 100
17:21:11.353724 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 401:501,
↪ ack 1, win 3650, options [nop,nop,TS val 148326 ecr 96758], length 100
17:21:11.364025 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 501:601,
↪ ack 1, win 3650, options [nop,nop,TS val 148327 ecr 96758], length 100
17:21:11.374114 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 601:701,
↪ ack 1, win 3650, options [nop,nop,TS val 148328 ecr 96758], length 100
17:21:11.384259 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 701:801,
↪ ack 1, win 3650, options [nop,nop,TS val 148329 ecr 96758], length 100
17:21:11.394407 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 801:901,
↪ ack 1, win 3650, options [nop,nop,TS val 148330 ecr 96758], length 100
17:21:11.404531 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 901:1001,
↪ ack 1, win 3650, options [nop,nop,TS val 148331 ecr 96758], length 100
17:21:11.414728 IP 10.40.0.2.9 > 10.10.0.2.47440: Flags [.], ack 101, win
↪ 3620, options [nop,nop,TS val 96768 ecr 148322], length 0
17:21:11.414813 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 1001:1101,
↪ ack 1, win 3650, options [nop,nop,TS val 148332 ecr 96768], length 100
17:21:11.424914 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 1101:1201,
↪ ack 1, win 3650, options [nop,nop,TS val 148333 ecr 96768], length 100
17:21:11.435120 IP 10.40.0.2.9 > 10.10.0.2.47440: Flags [.], ack 201, win
↪ 3620, options [nop,nop,TS val 96769 ecr 148323], length 0
17:21:11.435127 IP 10.40.0.2.9 > 10.10.0.2.47440: Flags [.], ack 301, win
↪ 3620, options [nop,nop,TS val 96770 ecr 148324], length 0
17:21:11.435203 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 1201:1301,
↪ ack 1, win 3650, options [nop,nop,TS val 148334 ecr 96769], length 100
17:21:11.445333 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 1301:1401,
↪ ack 1, win 3650, options [nop,nop,TS val 148335 ecr 96770], length 100
17:21:11.455411 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 1401:1501,
↪ ack 1, win 3650, options [nop,nop,TS val 148336 ecr 96770], length 100
17:21:11.465502 IP 10.10.0.2.47440 > 10.40.0.2.9: Flags [P.], seq 1501:1601,
↪ ack 1, win 3650, options [nop,nop,TS val 148337 ecr 96770], length 100
17:21:11.475712 IP 10.40.0.2.9 > 10.10.0.2.47440: Flags [.], ack 401, win
↪ 3620, options [nop,nop,TS val 96771 ecr 148325], length 0
```

4. Нейгл и Мишналь

Передача данных от **c1** до **c5**(с установленным delay 500ms) с дампом на **c2.eth0**:

```
17:38:03.834014 IP 10.10.0.2.47446 > 10.40.0.2.9: Flags [S], seq 3735186387,
↪  win 14600, options [mss 1460,sackOK,TS val 249573 ecr 0,nop,wscale 2],
↪  length 0
17:38:04.138901 IP 10.40.0.2.9 > 10.10.0.2.47446: Flags [S.], seq
↪  3582204113, ack 3735186388, win 14480, options [mss 1460,sackOK,TS val
↪  198020 ecr 249573,nop,wscale 2], length 0
17:38:04.139055 IP 10.10.0.2.47446 > 10.40.0.2.9: Flags [.], ack 1, win
↪  3650, options [nop,nop,TS val 249604 ecr 198020], length 0
17:38:04.139119 IP 10.10.0.2.47446 > 10.40.0.2.9: Flags [P.], seq 1:101, ack
↪  1, win 3650, options [nop,nop,TS val 249604 ecr 198020], length 100
17:38:04.299233 IP 10.10.0.2.47446 > 10.40.0.2.9: Flags [.], seq 101:1549,
↪  ack 1, win 3650, options [nop,nop,TS val 249620 ecr 198020], length 1448
17:38:04.439314 IP 10.40.0.2.9 > 10.10.0.2.47446: Flags [.], ack 101, win
↪  3620, options [nop,nop,TS val 198051 ecr 249604], length 0
17:38:04.439436 IP 10.10.0.2.47446 > 10.40.0.2.9: Flags [P.], seq 1549:2801,
↪  ack 1, win 3650, options [nop,nop,TS val 249634 ecr 198051], length 1252
17:38:04.598004 IP 10.10.0.2.47446 > 10.40.0.2.9: Flags [.], seq 2801:4249,
↪  ack 1, win 3650, options [nop,nop,TS val 249650 ecr 198051], length 1448
17:38:04.608478 IP 10.40.0.2.9 > 10.10.0.2.47446: Flags [.], ack 1549, win
↪  4344, options [nop,nop,TS val 198067 ecr 249620], length 0
17:38:04.740257 IP 10.40.0.2.9 > 10.10.0.2.47446: Flags [.], ack 2801, win
↪  5068, options [nop,nop,TS val 198081 ecr 249634], length 0
17:38:04.740472 IP 10.10.0.2.47446 > 10.40.0.2.9: Flags [P.], seq 4249:5601,
↪  ack 1, win 3650, options [nop,nop,TS val 249664 ecr 198081], length 1352
```

5. Аггрессивная буферизация

Передача данных от **c1** до **c5**(с установленным delay 500ms) с дампом на **c2.eth0**:

```
18:25:22.994327 IP 10.10.0.2.47449 > 10.40.0.2.9: Flags [S], seq 2778847741,
↪ win 14600, options [mss 1460,sackOK,TS val 533489 ecr 0,nop,wscale 2],
↪ length 0
18:25:23.296530 IP 10.40.0.2.9 > 10.10.0.2.47449: Flags [S.], seq 38680355,
↪ ack 2778847742, win 14480, options [mss 1460,sackOK,TS val 481937 ecr
↪ 533489,nop,wscale 2], length 0
18:25:23.296678 IP 10.10.0.2.47449 > 10.40.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 533520 ecr 481937], length 0
18:25:23.439871 IP 10.10.0.2.47449 > 10.40.0.2.9: Flags [.], seq 1:1449, ack
↪ 1, win 3650, options [nop,nop,TS val 533534 ecr 481937], length 1448
18:25:23.586428 IP 10.10.0.2.47449 > 10.40.0.2.9: Flags [.], seq 1449:2897,
↪ ack 1, win 3650, options [nop,nop,TS val 533549 ecr 481937], length 1448
18:25:23.741621 IP 10.10.0.2.47449 > 10.40.0.2.9: Flags [.], seq 2897:4345,
↪ ack 1, win 3650, options [nop,nop,TS val 533564 ecr 481937], length 1448
18:25:23.752535 IP 10.40.0.2.9 > 10.10.0.2.47449: Flags [.], ack 1449, win
↪ 4344, options [nop,nop,TS val 481981 ecr 533534], length 0
18:25:23.889340 IP 10.10.0.2.47449 > 10.40.0.2.9: Flags [.], seq 4345:5793,
↪ ack 1, win 3650, options [nop,nop,TS val 533579 ecr 481981], length 1448
18:25:23.900028 IP 10.40.0.2.9 > 10.10.0.2.47449: Flags [.], ack 2897, win
↪ 5068, options [nop,nop,TS val 481996 ecr 533549], length 0
18:25:24.046259 IP 10.40.0.2.9 > 10.10.0.2.47449: Flags [.], ack 4345, win
↪ 5792, options [nop,nop,TS val 482011 ecr 533564], length 0
18:25:24.056889 IP 10.10.0.2.47449 > 10.40.0.2.9: Flags [.], seq 5793:7241,
↪ ack 1, win 3650, options [nop,nop,TS val 533596 ecr 482011], length 1448
18:25:24.190007 IP 10.40.0.2.9 > 10.10.0.2.47449: Flags [.], ack 5793, win
↪ 6516, options [nop,nop,TS val 482026 ecr 533579], length 0
```

6. Отправка без задержки

Передача данных от **c1** до **c5**(с установленным delay 1000ms) с дампом на **c2.eth0**:

```
18:37:40.701770 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [S], seq 1192593265,
↪ win 14600, options [mss 1460,sackOK,TS val 607260 ecr 0,nop,wscale 2],
↪ length 0
18:37:41.695536 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [S], seq 1192593265,
↪ win 14600, options [mss 1460,sackOK,TS val 607360 ecr 0,nop,wscale 2],
↪ length 0
18:37:41.705908 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [S.], seq
↪ 3843955545, ack 1192593266, win 14480, options [mss 1460,sackOK,TS val
↪ 555707 ecr 607260,nop,wscale 2], length 0
18:37:41.706041 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 607361 ecr 555707], length 0
18:37:41.706085 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1:101, ack
↪ 1, win 3650, options [nop,nop,TS val 607361 ecr 555707], length 100
18:37:41.716291 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 101:201,
↪ ack 1, win 3650, options [nop,nop,TS val 607362 ecr 555707], length 100
18:37:41.730083 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 201:301,
↪ ack 1, win 3650, options [nop,nop,TS val 607363 ecr 555707], length 100
18:37:41.740655 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 301:401,
↪ ack 1, win 3650, options [nop,nop,TS val 607364 ecr 555707], length 100
18:37:41.754269 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 401:501,
↪ ack 1, win 3650, options [nop,nop,TS val 607366 ecr 555707], length 100
18:37:41.764533 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 501:601,
↪ ack 1, win 3650, options [nop,nop,TS val 607367 ecr 555707], length 100
18:37:41.775037 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 601:701,
↪ ack 1, win 3650, options [nop,nop,TS val 607368 ecr 555707], length 100
18:37:41.785294 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 701:801,
↪ ack 1, win 3650, options [nop,nop,TS val 607369 ecr 555707], length 100
18:37:41.795386 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 801:901,
↪ ack 1, win 3650, options [nop,nop,TS val 607370 ecr 555707], length 100
18:37:41.805542 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 901:1001,
↪ ack 1, win 3650, options [nop,nop,TS val 607371 ecr 555707], length 100
18:37:42.703638 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [S.], seq
↪ 3843955545, ack 1192593266, win 14480, options [mss 1460,sackOK,TS val
↪ 555807 ecr 607260,nop,wscale 2], length 0
18:37:42.703662 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [S.], seq
↪ 3843955545, ack 1192593266, win 14480, options [mss 1460,sackOK,TS val
↪ 555807 ecr 607260,nop,wscale 2], length 0
18:37:42.703931 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 607461 ecr 555707], length 0
18:37:42.703951 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 607461 ecr 555707], length 0
18:37:42.714354 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 101, win
↪ 3620, options [nop,nop,TS val 555808 ecr 607361], length 0
```

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18:37:42.714617 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1001:1101,
↪ ack 1, win 3650, options [nop,nop,TS val 607462 ecr 555808], length 100
18:37:42.725324 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 201, win
↪ 3620, options [nop,nop,TS val 555809 ecr 607362], length 0
18:37:42.725404 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1101:1201,
↪ ack 1, win 3650, options [nop,nop,TS val 607463 ecr 555808], length 100
18:37:42.735929 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1201:1301,
↪ ack 1, win 3650, options [nop,nop,TS val 607464 ecr 555809], length 100
18:37:42.735954 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 301, win
↪ 3620, options [nop,nop,TS val 555810 ecr 607363], length 0
18:37:42.752401 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 401, win
↪ 3620, options [nop,nop,TS val 555811 ecr 607364], length 0
18:37:42.752479 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1301:1401,
↪ ack 1, win 3650, options [nop,nop,TS val 607466 ecr 555810], length 100
18:37:42.771062 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 501, win
↪ 3620, options [nop,nop,TS val 555813 ecr 607366], length 0
18:37:42.771073 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 601, win
↪ 3620, options [nop,nop,TS val 555814 ecr 607367], length 0
18:37:42.771145 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1401:1501,
↪ ack 1, win 3650, options [nop,nop,TS val 607467 ecr 555811], length 100
18:37:42.789757 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 701, win
↪ 3620, options [nop,nop,TS val 555815 ecr 607368], length 0
18:37:42.789767 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 801, win
↪ 3620, options [nop,nop,TS val 555816 ecr 607369], length 0
18:37:42.789776 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1501:1601,
↪ ack 1, win 3650, options [nop,nop,TS val 607469 ecr 555814], length 100
18:37:42.804441 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 901, win
↪ 3620, options [nop,nop,TS val 555817 ecr 607370], length 0
18:37:42.804457 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1601:1701,
↪ ack 1, win 3650, options [nop,nop,TS val 607471 ecr 555816], length 100
18:37:42.814813 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1701:1801,
↪ ack 1, win 3650, options [nop,nop,TS val 607472 ecr 555817], length 100
18:37:42.814906 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 1001, win
↪ 3620, options [nop,nop,TS val 555818 ecr 607371], length 0
18:37:42.825292 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1801:1901,
↪ ack 1, win 3650, options [nop,nop,TS val 607473 ecr 555818], length 100
18:37:42.835466 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 1901:2001,
↪ ack 1, win 3650, options [nop,nop,TS val 607474 ecr 555818], length 100
18:37:42.845763 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 2001:2101,
↪ ack 1, win 3650, options [nop,nop,TS val 607475 ecr 555818], length 100
18:37:42.855941 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 2101:2201,
↪ ack 1, win 3650, options [nop,nop,TS val 607476 ecr 555818], length 100
18:37:42.866165 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 2201:2301,
↪ ack 1, win 3650, options [nop,nop,TS val 607477 ecr 555818], length 100
18:37:42.876438 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 2301:2401,
↪ ack 1, win 3650, options [nop,nop,TS val 607478 ecr 555818], length 100
```

```
18:37:42.886716 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [P.], seq 2401:2501,
↪ ack 1, win 3650, options [nop,nop,TS val 607479 ecr 555818], length 100
18:37:43.716458 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 1101, win
↪ 3620, options [nop,nop,TS val 555909 ecr 607462], length 0
18:37:43.716614 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], seq 2501:3949,
↪ ack 1, win 3650, options [nop,nop,TS val 607562 ecr 555909], length 1448
18:37:43.716624 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], seq 3949:5397,
↪ ack 1, win 3650, options [nop,nop,TS val 607562 ecr 555909], length 1448
18:37:43.727165 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 1201, win
↪ 3620, options [nop,nop,TS val 555910 ecr 607463], length 0
18:37:43.727314 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], seq 5397:6845,
↪ ack 1, win 3650, options [nop,nop,TS val 607563 ecr 555910], length 1448
18:37:43.727321 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], seq 6845:8293,
↪ ack 1, win 3650, options [nop,nop,TS val 607563 ecr 555910], length 1448
18:37:43.737583 IP 10.40.0.2.9 > 10.10.0.2.47455: Flags [.], ack 1301, win
↪ 3620, options [nop,nop,TS val 555911 ecr 607464], length 0
18:37:43.737729 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [.], seq 8293:9741,
↪ ack 1, win 3650, options [nop,nop,TS val 607564 ecr 555911], length 1448
18:37:43.737738 IP 10.10.0.2.47455 > 10.40.0.2.9: Flags [FP.], seq
↪ 9741:10001, ack 1, win 3650, options [nop,nop,TS val 607564 ecr 555911],
↪ length 260
```

7. Быстрый повтор

Передача данных от **c1** до **c6** с дампом на **c3.eth0**:

```
18:57:12.918105 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [S], seq 2927325625,
↪ win 14600, options [mss 1460,sackOK,TS val 724481 ecr 0,nop,wscale 2],
↪ length 0
18:57:13.912526 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [S], seq 2927325625,
↪ win 14600, options [mss 1460,sackOK,TS val 724581 ecr 0,nop,wscale 2],
↪ length 0
18:57:13.912959 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [S.], seq
↪ 1088111466, ack 2927325626, win 14480, options [mss 536,sackOK,TS val
↪ 933457 ecr 724581,nop,wscale 2], length 0
18:57:13.913148 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 724581 ecr 933457], length 0
18:57:13.913336 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 1:101, ack
↪ 1, win 3650, options [nop,nop,TS val 724581 ecr 933457], length 100
18:57:13.913461 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [.], ack 101, win
↪ 3620, options [nop,nop,TS val 933457 ecr 724581], length 0
18:57:13.923721 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 101:201,
↪ ack 1, win 3650, options [nop,nop,TS val 724582 ecr 933457], length 100
18:57:13.923933 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [.], ack 201, win
↪ 3620, options [nop,nop,TS val 933458 ecr 724582], length 0
18:57:13.934212 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 201:301,
↪ ack 1, win 3650, options [nop,nop,TS val 724583 ecr 933458], length 100
18:57:13.934357 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [.], ack 301, win
↪ 3620, options [nop,nop,TS val 933459 ecr 724583], length 0
18:57:13.962547 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 301:401,
↪ ack 1, win 3650, options [nop,nop,TS val 724586 ecr 933459], length 100
18:57:13.962731 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [.], ack 401, win
↪ 3620, options [nop,nop,TS val 933462 ecr 724586], length 0
18:57:13.973020 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 401:501,
↪ ack 1, win 3650, options [nop,nop,TS val 724587 ecr 933462], length 100
18:57:13.983415 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 501:601,
↪ ack 1, win 3650, options [nop,nop,TS val 724588 ecr 933462], length 100
18:57:13.983614 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [.], ack 401, win
↪ 3620, options [nop,nop,TS val 933464 ecr 724586,nop,nop,sack 1
↪ {501:601}], length 0
18:57:13.993882 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 601:701,
↪ ack 1, win 3650, options [nop,nop,TS val 724589 ecr 933464], length 100
18:57:13.994043 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [.], ack 401, win
↪ 3620, options [nop,nop,TS val 933465 ecr 724586,nop,nop,sack 1
↪ {501:701}], length 0
18:57:14.012916 IP 10.10.0.2.35098 > 10.50.0.2.9: Flags [P.], seq 701:801,
↪ ack 1, win 3650, options [nop,nop,TS val 724591 ecr 933465], length 100
18:57:14.013215 IP 10.50.0.2.9 > 10.10.0.2.35098: Flags [.], ack 401, win
↪ 3620, options [nop,nop,TS val 933467 ecr 724586,nop,nop,sack 1
↪ {501:801}], length 0
```

8. Обычный повтор

Передача данных от **c1**(delay 100) до **c6** с дампом на **c3.eth0**(delay 300):

```
19:07:56.682040 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [S], seq 1956035176,
↪ win 14600, options [mss 1460,sackOK,TS val 788857 ecr 0,nop,wscale 2],
↪ length 0
19:07:57.670097 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [S], seq 1956035176,
↪ win 14600, options [mss 1460,sackOK,TS val 788957 ecr 0,nop,wscale 2],
↪ length 0
19:07:57.973980 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [S.], seq
↪ 1891691775, ack 1956035177, win 14480, options [mss 536,sackOK,TS val
↪ 997832 ecr 788957,nop,wscale 2], length 0
19:07:57.974283 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 788987 ecr 997832], length 0
19:07:57.974384 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 1:101, ack
↪ 1, win 3650, options [nop,nop,TS val 788987 ecr 997832], length 100
19:07:58.075135 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 101:201,
↪ ack 1, win 3650, options [nop,nop,TS val 788997 ecr 997832], length 100
19:07:58.182286 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 201:301,
↪ ack 1, win 3650, options [nop,nop,TS val 789008 ecr 997832], length 100
19:07:58.283492 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 101, win
↪ 3620, options [nop,nop,TS val 997863 ecr 788987], length 0
19:07:58.283579 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 301:401,
↪ ack 1, win 3650, options [nop,nop,TS val 789018 ecr 997832], length 100
19:07:58.376553 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 201, win
↪ 3620, options [nop,nop,TS val 997873 ecr 788997], length 0
19:07:58.387114 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 401:501,
↪ ack 1, win 3650, options [nop,nop,TS val 789029 ecr 997873], length 100
19:07:58.488522 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 501:601,
↪ ack 1, win 3650, options [nop,nop,TS val 789039 ecr 997873], length 100
19:07:58.488543 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 301, win
↪ 3620, options [nop,nop,TS val 997884 ecr 789008], length 0
19:07:58.590171 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 601:701,
↪ ack 1, win 3650, options [nop,nop,TS val 789049 ecr 997884], length 100
19:07:58.694458 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 301, win
↪ 3620, options [nop,nop,TS val 997904 ecr 789008,nop,nop,sack 1
↪ {401:501}], length 0
19:07:58.694765 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 701:801,
↪ ack 1, win 3650, options [nop,nop,TS val 789059 ecr 997884], length 100
19:07:58.796082 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 801:901,
↪ ack 1, win 3650, options [nop,nop,TS val 789070 ecr 997904], length 100
19:07:58.806668 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 301, win
↪ 3620, options [nop,nop,TS val 997914 ecr 789008,nop,nop,sack 1
↪ {401:601}], length 0
19:07:58.898049 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 301, win
↪ 3620, options [nop,nop,TS val 997924 ecr 789008,nop,nop,sack 1
↪ {401:701}], length 0
```

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```
19:07:58.898205 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 901:1001,
↪  ack 1, win 3650, options [nop,nop,TS val 789080 ecr 997914], length 100
19:07:58.898289 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 301:401,
↪  ack 1, win 3650, options [nop,nop,TS val 789080 ecr 997924], length 100
19:07:59.000769 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 301, win
↪  3620, options [nop,nop,TS val 997935 ecr 789008,nop,nop,sack 1
↪  {401:801}], length 0
19:07:59.000983 IP 10.10.0.2.35103 > 10.50.0.2.9: Flags [P.], seq 1001:1101,
↪  ack 1, win 3650, options [nop,nop,TS val 789090 ecr 997935], length 100
19:07:59.205224 IP 10.50.0.2.9 > 10.10.0.2.35103: Flags [.], ack 301, win
↪  3620, options [nop,nop,TS val 997955 ecr 789008,nop,nop,sack 1
↪  {401:1001}], length 0
```

9. Опыт с PMTU

Передача данных от **c1** до **c6** с дампом на **c2.eth0**:

```
19:20:05.686249 IP 10.10.0.2.54474 > 10.50.0.2.9: Flags [S], seq 3052735652,
↪ win 14600, options [mss 1460,sackOK,TS val 4294941021 ecr 0,nop,wscale
↪ 2], length 0
19:20:05.686529 IP 10.50.0.2.9 > 10.10.0.2.54474: Flags [S.], seq
↪ 3965002350, ack 3052735653, win 14480, options [mss 1460,sackOK,TS val
↪ 15706 ecr 4294941021,nop,wscale 2], length 0
19:20:05.686579 IP 10.10.0.2.54474 > 10.50.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 4294941021 ecr 15706], length 0
19:20:08.985039 IP 10.10.0.2.54474 > 10.50.0.2.9: Flags [F.], seq 1, ack 1,
↪ win 3650, options [nop,nop,TS val 4294941351 ecr 15706], length 0
19:20:08.985328 IP 10.50.0.2.9 > 10.10.0.2.54474: Flags [F.], seq 1, ack 2,
↪ win 3620, options [nop,nop,TS val 16036 ecr 4294941351], length 0
19:20:08.985370 IP 10.10.0.2.54474 > 10.50.0.2.9: Flags [.], ack 2, win
↪ 3650, options [nop,nop,TS val 4294941351 ecr 16036], length 0
19:20:13.546200 IP 10.10.0.2.54475 > 10.50.0.2.9: Flags [S], seq 2234991961,
↪ win 14600, options [mss 1460,sackOK,TS val 4294941806 ecr 0,nop,wscale
↪ 2], length 0
19:20:13.546579 IP 10.50.0.2.9 > 10.10.0.2.54475: Flags [S.], seq
↪ 3690269800, ack 2234991962, win 14480, options [mss 1460,sackOK,TS val
↪ 16492 ecr 4294941806,nop,wscale 2], length 0
19:20:13.546703 IP 10.10.0.2.54475 > 10.50.0.2.9: Flags [.], ack 1, win
↪ 3650, options [nop,nop,TS val 4294941807 ecr 16492], length 0
19:20:13.697883 IP 10.10.0.2.54475 > 10.50.0.2.9: Flags [.], seq 1:1449, ack
↪ 1, win 3650, options [nop,nop,TS val 4294941822 ecr 16492], length 1448
19:20:13.697896 IP 10.10.0.1 > 10.10.0.2: ICMP 10.50.0.2 unreachable - need
↪ to frag (mtu 1492), length 556
19:20:13.697981 IP 10.10.0.2.54475 > 10.50.0.2.9: Flags [.], seq 1:1441, ack
↪ 1, win 3650, options [nop,nop,TS val 4294941822 ecr 16492], length 1440
19:20:13.697992 IP 10.10.0.2.54475 > 10.50.0.2.9: Flags [.], seq 1441:1449,
↪ ack 1, win 3650, options [nop,nop,TS val 4294941822 ecr 16492], length 8
19:20:13.698119 IP 10.20.0.2 > 10.10.0.2: ICMP 10.50.0.2 unreachable - need
↪ to frag (mtu 576), length 556
19:20:13.698368 IP 10.50.0.2.9 > 10.10.0.2.54475: Flags [.], ack 1, win
↪ 3620, options [nop,nop,TS val 16507 ecr 4294941807,nop,nop,sack 1
↪ {1441:1449}], length 0
19:20:13.698451 IP 10.10.0.2.54475 > 10.50.0.2.9: Flags [.], seq 1:525, ack
↪ 1, win 3650, options [nop,nop,TS val 4294941822 ecr 16507], length 524
```

10. Соединение с неверным портом

Попытка передачи данных от **c1** до **c6:10** с дампом на **c2.eth0**:

```
19:27:10.866781 IP 10.10.0.2.49598 > 10.50.0.2.10: Flags [S], seq 824893507,
↪ win 14600, options [mss 1460,sackOK,TS val 4294942054 ecr 0,nop,wscale
↪ 2], length 0
19:27:10.867320 IP 10.50.0.2.10 > 10.10.0.2.49598: Flags [R.], seq 0, ack
↪ 824893508, win 0, length 0
```