

**Федеральное государственное автономное
образовательное учреждение высшего образования**

«Национальный исследовательский университет ИТМО»

факультет программной инженерии и компьютерной техники

Дисциплина: Операционные системы

Лабораторная работа №1

Вариант 167745

Выполнил:

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г. Санкт-Петербург
2022

Цель работы:

Знакомство с системными инструментами анализа производительности и поведения программ.

1. Количество потоков создаваемое программой;


```
ivan@ip13-Nitro-AN515-54:~/Documents/study/OS$ sudo strace -e openat -f ./167745
[sudo] password for ivan:
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libpthread.so.0", O_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
strace: Process 644037 attached
strace: Process 644038 attached
strace: Process 644039 attached
strace: Process 644040 attached
[pid 644037] openat(AT_FDCWD, "/dev/zero", O_RDONLY) = 3
[pid 644039] openat(AT_FDCWD, "/dev/zero", O_RDONLY) = 4
strace: Process 644041 attached
strace: Process 644042 attached
[pid 644041] openat(AT_FDCWD, "/dev/zero", O_RDONLY) = 5
strace: Process 644043 attached
strace: Process 644044 attached
[pid 644043] openat(AT_FDCWD, "/dev/zero", O_RDONLY) = 6
strace: Process 644045 attached
strace: Process 644046 attached
strace: Process 644047 attached
strace: Process 644048 attached
strace: Process 644049 attached
strace: Process 644050 attached
strace: Process 644051 attached
strace: Process 644052 attached
strace: Process 644053 attached
[pid 644053] openat(AT_FDCWD, "/proc/meminfo", O_RDONLY) = 11
strace: Process 644054 attached
strace: Process 644055 attached
strace: Process 644056 attached
[pid 644043] openat(AT_FDCWD, "488279190879408311", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>)
[pid 644037] openat(AT_FDCWD, "2451864942053774057", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>)
[pid 644039] openat(AT_FDCWD, "6402949763457948271", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>)
[pid 644041] openat(AT_FDCWD, "14882549174776689833", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>)
[pid 644043] <... openat resumed> = 6
[pid 644037] <... openat resumed> = 3
[pid 644039] <... openat resumed> = 4
[pid 644041] <... openat resumed> = 5
[pid 644041] openat(AT_FDCWD, "14882549174776689833", O_RDONLY) = 3
[pid 644041] openat(AT_FDCWD, "14882549174776689833", O_RDONLY) = 3
[pid 644042] openat(AT_FDCWD, "11892699575998298074", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>)
[pid 644039] openat(AT_FDCWD, "6402949763457948271", O_RDONLY) = 4
[pid 644039] openat(AT_FDCWD, "6402949763457948271", O_RDONLY) = 4
[pid 644043] openat(AT_FDCWD, "488279190879408311", O_RDONLY) = 5
[pid 644043] openat(AT_FDCWD, "488279190879408311", O_RDONLY) = 5
[pid 644037] openat(AT_FDCWD, "2451864942053774057", O_RDONLY) = 6
[pid 644037] openat(AT_FDCWD, "2451864942053774057", O_RDONLY) = 6
[pid 644042] <... openat resumed> = 3
[pid 644040] openat(AT_FDCWD, "1845952177369816948", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>)
[pid 644038] openat(AT_FDCWD, "9680032535549941385", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>)
[pid 644044] openat(AT_FDCWD, "3524250063691808895", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 5
```

Список соединений:

```
ivan@ip13-Nitro-AN515-54:~$ sudo netstat -tulpn | grep 615181
[sudo] password for ivan:
tcp        0      0 0.0.0.0:6906        0.0.0.0:*           LISTEN     615181/./167745
tcp        0      0 0.0.0.0:6907        0.0.0.0:*           LISTEN     615181/./167745
tcp        0      0 0.0.0.0:6905        0.0.0.0:*           LISTEN     615181/./167745
tcp        0      0 0.0.0.0:6908        0.0.0.0:*           LISTEN     615181/./167745
```

3. Карту памяти процесса;

```
ivan@ip13-Nitro-AN515-54:~$ pmap -p 615181
615181: ./167745
0000000000400000      232K r-x-- /home/ivan/Documents/study/OS/167745
000000000063a000       4K r---- /home/ivan/Documents/study/OS/167745
000000000063b000       4K rw--- /home/ivan/Documents/study/OS/167745
0000000000b30000      132K rw--- [ anon ]
00007f8065300000 111616K rw--- [ anon ]
00007f806c000000      132K rw--- [ anon ]
00007f806c021000     65404K ----- [ anon ]
00007f8074000000      132K rw--- [ anon ]
00007f8074021000     65404K ----- [ anon ]
00007f8078000000      132K rw--- [ anon ]
00007f8078021000     65404K ----- [ anon ]
00007f807c000000      132K rw--- [ anon ]
00007f807c021000     65404K ----- [ anon ]
00007f8087900000 334848K rw--- [ anon ]
00007f809c000000      132K rw--- [ anon ]
00007f809c021000     65404K ----- [ anon ]
00007f80a0000000      132K rw--- [ anon ]
00007f80a0021000     65404K ----- [ anon ]
00007f80a47f9000       4K ----- [ anon ]
00007f80a47fa000     8192K rw--- [ anon ]
00007f80a4ffa000       4K ----- [ anon ]
00007f80a4ffb000     8192K rw--- [ anon ]
00007f80a57fb000       4K ----- [ anon ]
00007f80a57fc000     8192K rw--- [ anon ]
00007f80a5ffc000       4K ----- [ anon ]
00007f80a5ffd000     8192K rw--- [ anon ]
00007f80a67fd000       4K ----- [ anon ]
00007f80a67fe000     8192K rw--- [ anon ]
00007f80a6ffe000       4K ----- [ anon ]
00007f80a6fff000     8192K rw--- [ anon ]
00007f80a77ff000       4K ----- [ anon ]
00007f80a7800000     8192K rw--- [ anon ]
00007f80a8000000      132K rw--- [ anon ]
00007f80a8021000     65404K ----- [ anon ]
00007f80ac000000      132K rw--- [ anon ]
00007f80ac021000     65404K ----- [ anon ]
00007f80b07f9000       4K ----- [ anon ]
00007f80b07fa000     8192K rw--- [ anon ]
00007f80b0ffa000       4K ----- [ anon ]
00007f80b0ffb000     8192K rw--- [ anon ]
00007f80b17fb000       4K ----- [ anon ]
00007f80b17fc000     8192K rw--- [ anon ]
00007f80b1ffc000       4K ----- [ anon ]
00007f80b1ffd000     8192K rw--- [ anon ]
00007f80b27fd000       4K ----- [ anon ]
00007f80b27fe000     8192K rw--- [ anon ]
00007f80b2ffe000       4K ----- [ anon ]
00007f80b2fff000     8192K rw--- [ anon ]
00007f80b37ff000       4K ----- [ anon ]
00007f80b3800000     8192K rw--- [ anon ]
00007f80b4000000      132K rw--- [ anon ]
00007f80b4021000     65404K ----- [ anon ]
00007f80b87d3000       4K ----- [ anon ]
00007f80b87d4000     8192K rw--- [ anon ]
00007f80b8fd4000       4K ----- [ anon ]
00007f80b8fd5000     8192K rw--- [ anon ]
00007f80b97d5000       4K ----- [ anon ]
```



```

00007f80b27fe000 8192K rw--- [ anon ]
00007f80b2ffe000 4K ----- [ anon ]
00007f80b2fff000 8192K rw--- [ anon ]
00007f80b37ff000 4K ----- [ anon ]
00007f80b3800000 8192K rw--- [ anon ]
00007f80b4000000 132K rw--- [ anon ]
00007f80b4021000 65404K ----- [ anon ]
00007f80b87d3000 4K ----- [ anon ]
00007f80b87d4000 8192K rw--- [ anon ]
00007f80b8fd4000 4K ----- [ anon ]
00007f80b8fd5000 8192K rw--- [ anon ]
00007f80b97d5000 4K ----- [ anon ]
00007f80b97d6000 8192K rw--- [ anon ]
00007f80b9fd6000 4K ----- [ anon ]
00007f80b9fd7000 8192K rw--- [ anon ]
00007f80ba7d7000 4K ----- [ anon ]
00007f80ba7d8000 8192K rw--- [ anon ]
00007f80bafd8000 4K ----- [ anon ]
00007f80bafd9000 454676K rw--- [ anon ]
00007f80d6bde000 160K r---- /usr/lib/x86_64-linux-gnu/libc.so.6
00007f80d6c06000 1620K r-x-- /usr/lib/x86_64-linux-gnu/libc.so.6
00007f80d6d9b000 352K r---- /usr/lib/x86_64-linux-gnu/libc.so.6
00007f80d6df3000 16K r---- /usr/lib/x86_64-linux-gnu/libc.so.6
00007f80d6df7000 8K rw--- /usr/lib/x86_64-linux-gnu/libc.so.6
00007f80d6df9000 52K rw--- [ anon ]
00007f80d6e06000 4K r---- /usr/lib/x86_64-linux-gnu/libpthread.so.0
00007f80d6e07000 4K r-x-- /usr/lib/x86_64-linux-gnu/libpthread.so.0
00007f80d6e08000 4K r---- /usr/lib/x86_64-linux-gnu/libpthread.so.0
00007f80d6e09000 4K r---- /usr/lib/x86_64-linux-gnu/libpthread.so.0
00007f80d6e0a000 4K rw--- /usr/lib/x86_64-linux-gnu/libpthread.so.0
00007f80d6e0b000 12K r---- /usr/lib/x86_64-linux-gnu/libgcc_s.so.1
00007f80d6e0e000 92K r-x-- /usr/lib/x86_64-linux-gnu/libgcc_s.so.1
00007f80d6e25000 16K r---- /usr/lib/x86_64-linux-gnu/libgcc_s.so.1
00007f80d6e29000 4K r---- /usr/lib/x86_64-linux-gnu/libgcc_s.so.1
00007f80d6e2a000 4K rw--- /usr/lib/x86_64-linux-gnu/libgcc_s.so.1
00007f80d6e2b000 56K r---- /usr/lib/x86_64-linux-gnu/libm.so.6
00007f80d6e39000 496K r-x-- /usr/lib/x86_64-linux-gnu/libm.so.6
00007f80d6eb5000 364K r---- /usr/lib/x86_64-linux-gnu/libm.so.6
00007f80d6f10000 4K r---- /usr/lib/x86_64-linux-gnu/libm.so.6
00007f80d6f11000 4K rw--- /usr/lib/x86_64-linux-gnu/libm.so.6
00007f80d6f12000 616K r---- /usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30
00007f80d6fac000 1088K r-x-- /usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30
00007f80d70bc000 444K r---- /usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30
00007f80d712b000 44K r---- /usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30
00007f80d7136000 12K rw--- /usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30
00007f80d7139000 12K rw--- [ anon ]
00007f80d714a000 24K rw--- [ anon ]
00007f80d7150000 8K r---- /usr/lib/x86_64-linux-gnu/ld-linux-x86-64.so.2
00007f80d7152000 168K r-x-- /usr/lib/x86_64-linux-gnu/ld-linux-x86-64.so.2
00007f80d717c000 44K r---- /usr/lib/x86_64-linux-gnu/ld-linux-x86-64.so.2
00007f80d7187000 4K rw--- [ anon ]
00007f80d7188000 8K r---- /usr/lib/x86_64-linux-gnu/ld-linux-x86-64.so.2
00007f80d718a000 8K rw--- /usr/lib/x86_64-linux-gnu/ld-linux-x86-64.so.2
00007ffccc5fc000 132K rw--- [ stack ]
00007ffccc65f000 16K r---- [ anon ]
00007ffccc663000 8K r-x-- [ anon ]
fffffffffff600000 4K --x-- [ anon ]
total 1652984K

```

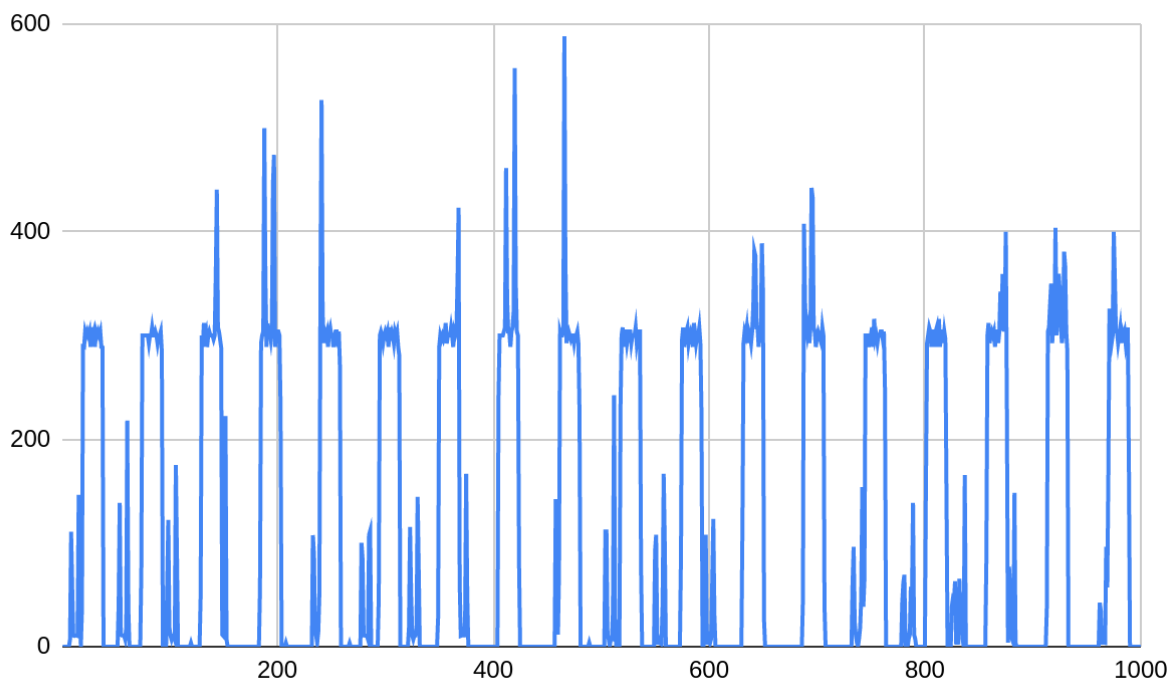
4. Содержимое передаваемых по сети данных;

```
lwan@ip13-Mitro-ANSIS-94: $ sudo tcpdump -i any port 6906
tcpdump: data link type LINUX_SLL2
tcpdump: verbose output suppressed, use -v[v]... for full protocol decode
listening on any, link-type LINUX_SLL2 (Linux cooked v2), snapshot length 262144 bytes
10:06:40.750924 lo In IP localhost.57474 > localhost.6906: Flags [S], seq 1203894245, win 65495, options [mss 65495,sackOK,TS val 2350339971 ecr 0,nop,wscale 7], length 0
10:06:40.750951 lo In IP localhost.6906 > localhost.57474: Flags [R.], seq 0, ack 1203894246, win 0, length 0
10:06:41.751247 lo In IP localhost.57490 > localhost.6906: Flags [S], seq 1203894248, win 65495, options [mss 65495,sackOK,TS val 2350340972 ecr 0,nop,wscale 7], length 0
10:06:41.751276 lo In IP localhost.6906 > localhost.57490: Flags [R.], seq 0, ack 1203894249, win 0, length 0
10:06:42.751448 lo In IP localhost.57496 > localhost.6906: Flags [S], seq 1203894251, win 65495, options [mss 65495,sackOK,TS val 2350341972 ecr 0,nop,wscale 7], length 0
10:06:42.751458 lo In IP localhost.6906 > localhost.57496: Flags [R.], seq 0, ack 1203894252, win 0, length 0
10:06:43.751708 lo In IP localhost.57500 > localhost.6906: Flags [S], seq 1203894254, win 65495, options [mss 65495,sackOK,TS val 2350342972 ecr 0,nop,wscale 7], length 0
10:06:43.751734 lo In IP localhost.6906 > localhost.57500: Flags [R.], seq 0, ack 1203894255, win 0, length 0
10:06:44.751873 lo In IP localhost.59104 > localhost.6906: Flags [S], seq 1203894257, win 65495, options [mss 65495,sackOK,TS val 2350343972 ecr 0,nop,wscale 7], length 0
10:06:44.751884 lo In IP localhost.6906 > localhost.59104: Flags [R.], seq 0, ack 1203894258, win 0, length 0
10:06:45.752012 lo In IP localhost.59114 > localhost.6906: Flags [S], seq 1203894260, win 65495, options [mss 65495,sackOK,TS val 2350344972 ecr 0,nop,wscale 7], length 0
10:06:45.752022 lo In IP localhost.6906 > localhost.59114: Flags [R.], seq 0, ack 1203894261, win 0, length 0
10:06:46.752202 lo In IP localhost.59126 > localhost.6906: Flags [S], seq 1203894263, win 65495, options [mss 65495,sackOK,TS val 2350345973 ecr 0,nop,wscale 7], length 0
10:06:46.752209 lo In IP localhost.6906 > localhost.59126: Flags [R.], seq 0, ack 1203894264, win 0, length 0
10:06:47.752280 lo In IP localhost.59138 > localhost.6906: Flags [S], seq 1203894266, win 65495, options [mss 65495,sackOK,TS val 2350346973 ecr 0,nop,wscale 7], length 0
10:06:47.752292 lo In IP localhost.6906 > localhost.59138: Flags [R.], seq 0, ack 1203894267, win 0, length 0
10:06:48.752400 lo In IP localhost.59146 > localhost.6906: Flags [S], seq 1203894269, win 65495, options [mss 65495,sackOK,TS val 2350347973 ecr 0,nop,wscale 7], length 0
10:06:48.752411 lo In IP localhost.6906 > localhost.59146: Flags [R.], seq 0, ack 1203894270, win 0, length 0
10:06:49.752654 lo In IP localhost.59148 > localhost.6906: Flags [S], seq 1203894272, win 65495, options [mss 65495,sackOK,TS val 2350348973 ecr 0,nop,wscale 7], length 0
10:06:49.752668 lo In IP localhost.6906 > localhost.59148: Flags [R.], seq 0, ack 1203894273, win 0, length 0
10:06:50.752962 lo In IP localhost.59154 > localhost.6906: Flags [S], seq 1203894275, win 65495, options [mss 65495,sackOK,TS val 2350349973 ecr 0,nop,wscale 7], length 0
10:06:50.752986 lo In IP localhost.6906 > localhost.59154: Flags [R.], seq 0, ack 1203894276, win 0, length 0
10:06:51.753208 lo In IP localhost.59168 > localhost.6906: Flags [S], seq 1203894278, win 65495, options [mss 65495,sackOK,TS val 2350350974 ecr 0,nop,wscale 7], length 0
10:06:51.753315 lo In IP localhost.6906 > localhost.59168: Flags [S.], seq 1273989084, ack 1203894279, win 65483, options [mss 65495,sackOK,TS val 2350350974 ecr 2350350974,nop,wscale 7], length 0
10:06:51.753341 lo In IP localhost.59168 > localhost.6906: Flags [.] , ack 1, win 512, options [nop,nop,TS val 2350350974 ecr 2350350974], length 0
10:06:51.753411 lo In IP localhost.59168 > localhost.6906: Flags [P.], seq 1:4, ack 1, win 512, options [nop,nop,TS val 2350350974 ecr 2350350974], length 3
10:06:51.753432 lo In IP localhost.6906 > localhost.59168: Flags [.] , ack 4, win 512, options [nop,nop,TS val 2350350974 ecr 2350350974], length 0
10:06:51.753472 lo In IP localhost.59168 > localhost.6906: Flags [F.], seq 4, ack 1, win 512, options [nop,nop,TS val 2350350974 ecr 2350350974], length 0
10:06:51.753627 lo In IP localhost.6906 > localhost.59168: Flags [F.], seq 1, ack 5, win 512, options [nop,nop,TS val 2350350974 ecr 2350350974], length 0
10:06:51.753649 lo In IP localhost.59168 > localhost.6906: Flags [.] , ack 2, win 512, options [nop,nop,TS val 2350350974 ecr 2350350974], length 0
10:07:05.753774 lo In IP localhost.47970 > localhost.6906: Flags [S], seq 3241991121, win 65495, options [mss 65495,sackOK,TS val 2350364974 ecr 0,nop,wscale 7], length 0
10:07:05.753795 lo In IP localhost.6906 > localhost.47970: Flags [R.], seq 0, ack 3241991122, win 0, length 0
10:07:06.753968 lo In IP localhost.47982 > localhost.6906: Flags [S], seq 3241991124, win 65495, options [mss 65495,sackOK,TS val 2350365974 ecr 0,nop,wscale 7], length 0
10:07:06.753989 lo In IP localhost.6906 > localhost.47982: Flags [R.], seq 0, ack 3241991125, win 0, length 0
10:07:07.754112 lo In IP localhost.47984 > localhost.6906: Flags [S], seq 3241991127, win 65495, options [mss 65495,sackOK,TS val 2350366974 ecr 0,nop,wscale 7], length 0
10:07:07.754122 lo In IP localhost.6906 > localhost.47984: Flags [R.], seq 0, ack 3241991128, win 0, length 0
10:07:08.754285 lo In IP localhost.47990 > localhost.6906: Flags [S], seq 3241991130, win 65495, options [mss 65495,sackOK,TS val 2350367975 ecr 0,nop,wscale 7], length 0
10:07:08.754307 lo In IP localhost.6906 > localhost.47990: Flags [R.], seq 0, ack 3241991131, win 0, length 0
```

5. Построить графики:

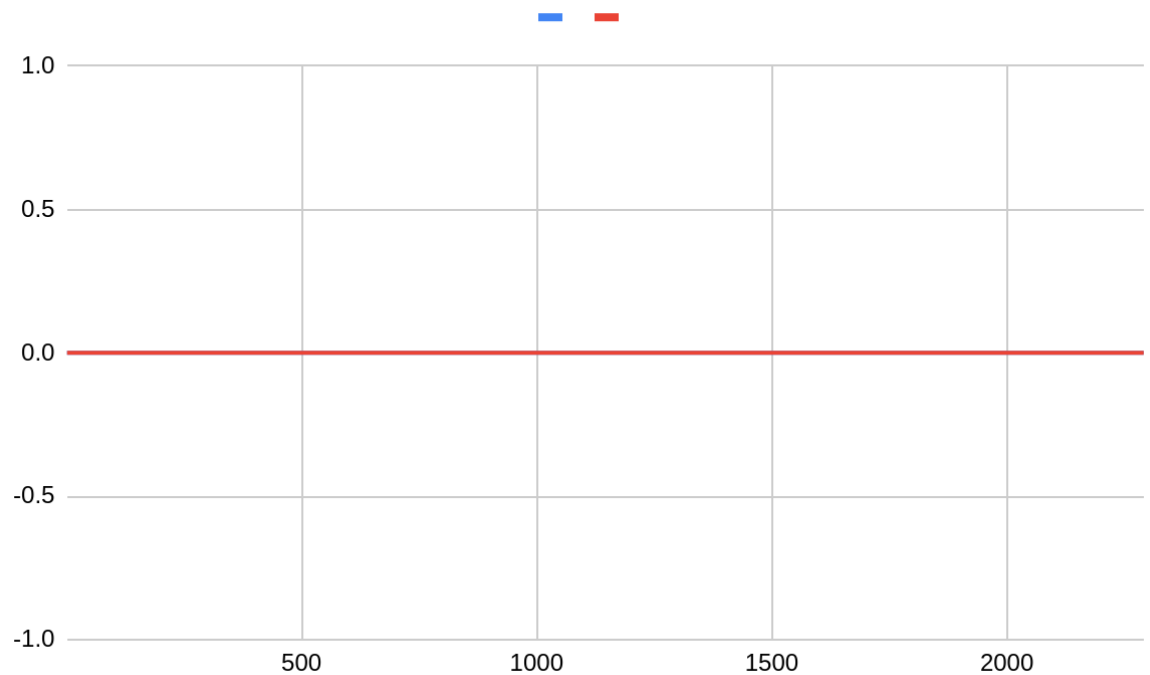
а. Потребления программой cpu;

top -b -n 1000 -d 0.25 | grep 615181 | awk '{print \$9}' > cpu.txt



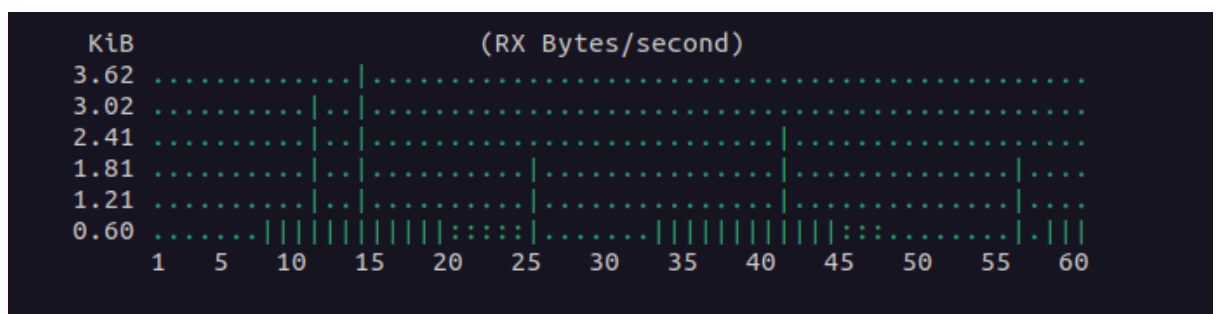
б. Нагрузки генерируемой программой на подсистему ввода-вывода;

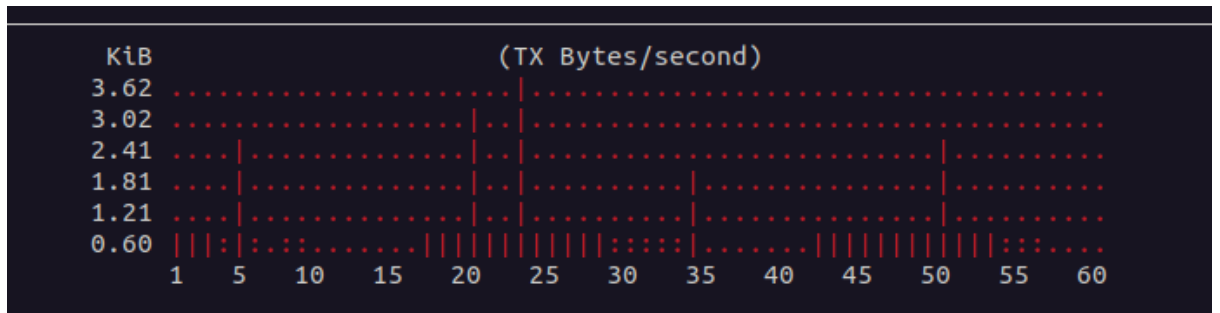

```
sudo iotop -b -n 1000 -d 0.25 | grep 615181 | awk '{print $4, $6}' > io.txt
```



с. Нагрузки генерируемой программой на сетевую подсистему.

Interfaces	RX bps	pps	%	TX bps	pps	%
lo	918B	0		918B	13	
qdisc none (noqueue)	0	0		0	0	
enp7s0	5.57KiB	0		10.10KiB	24	
qdisc none (fq_codel)	0	0		10.10KiB	24	
wlp8s0	254B	0		157B	1	
qdisc none (noqueue)	0	0		0	0	
docker0	0	0		0	0	
qdisc none (noqueue)	0	0		0	0	





d. Смены состояния исполнения потоков;

```
top -b -H -n 20 -d 0.25 -p 615181 | awk '{print $1, $8}' > thread.txt
```

```
cat thread.txt | grep 615 > thread_state.txt
```

thread/ time	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
615181	S	S	S	S	S	S	S	S	S	S	S	S
615182	S	S	S	S	S	S	S	S	S	S	S	S
615183	S	S	S	S	S	S	S	S	S	S	S	S
615184	S	S	S	S	S	S	S	S	S	S	S	S
615185	S	S	S	S	S	S	S	S	S	S	S	S
615186	S	S	S	S	S	S	S	S	S	S	S	S
615187	S	S	S	S	S	S	S	S	S	S	S	S
615188	S	S	S	S	S	S	S	S	S	S	S	S
615189	S	S	S	S	S	S	S	S	S	S	S	S
615190	S	S	S	S	S	S	S	S	S	S	S	S
615191	S	S	S	S	S	S	S	S	S	S	S	S
615192	S	S	S	S	S	S	S	S	S	S	S	S
615193	S	S	S	S	S	S	S	S	S	S	S	S
615194	S	S	S	S	S	S	S	S	S	S	S	S
615195	S	S	S	S	S	S	S	S	S	S	S	S
615196	S	S	S	S	S	S	S	S	S	S	S	S
615197	S	S	S	S	S	S	S	S	S	S	S	S
615198	S	S	S	S	S	S	S	S	S	S	S	S
615199	R	R	R	R	R	R	R	S	S	S	S	S
615200	R	R	R	R	R	R	R	S	S	S	S	S
615201	R	R	R	R	R	R	R	S	S	S	S	S