

Университет ИТМО  
Факультет ПИиКТ

# Операционные системы

## Лабораторная работа №1

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Вариант:  
165788

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## 1) Задание

Основная цель лабораторной работы - знакомство с системными инструментами анализа производительности и поведения программ. Для этого предлагается для выданной по варианту программы выяснить следующую информацию:

1. Количество потоков, создаваемое программой;
2. Список файлов и сетевых соединений, с которыми работает программа
3. Карту памяти процесса;
4. Содержимое передаваемых по сети данных;
5. Построить графики:
  - Потребления программой сри;
  - Нагрузки генерируемой программой на подсистему ввода-вывода;
  - Нагрузки генерируемой программой на сетевую подсистему.
  - Смены состояния исполнения потоков;

## 2) Выполнение

1. Узнаем PID процесса, воспользовавшись утилитой top:

```
top - 19:44:14 up 53 min, 1 user, load average: 1.53, 1.94, 2.31
Tasks: 296 total, 3 running, 293 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0,3 us, 0,5 sy, 0,0 ni, 99,2 id, 0,0 wa, 0,0 ht, 0,0 st, 0,0 sr
MiB Mem : 5870,8 total, 120,7 free, 3086,6 used, 2663,5 buff/cache
MiB Swap: 10564,0 total, 10337,5 free, 226,5 used. 2479,3 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
119006	tonya	20	0	3266784	1,9g	3228	S	4,0	32,5	6:01.19	165788
119345	tonya	20	0	2471096	138684	88712	R	1,3	2,3	0:06.21	Isolated Web Co
119079	tonya	20	0	3814304	396328	181116	S	1,0	6,6	0:25.91	firefox
958	tonya	20	0	1450420	53180	10984	S	0,7	0,9	0:33.64	Xorg
53962	root	20	0	0	0	0	I	0,3	0,0	0:01.22	kworker/2:0-events
75399	root	20	0	0	0	0	I	0,3	0,0	0:02.70	kworker/u32:0-phy0
118768	tonya	20	0	842772	67200	38648	S	0,3	1,1	0:02.24	terminator
119541	tonya	20	0	12184	4204	3272	R	0,3	0,1	0:00.15	top
1	root	20	0	169872	12292	6780	S	0,0	0,2	0:15.57	systemd
2	root	20	0	0	0	0	S	0,0	0,0	0:00.00	kthreadd
3	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	rcu_gp
4	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	rcu_par_gp
6	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	kworker/0:0H-events_highpri
9	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	mm_percpu_wq
10	root	20	0	0	0	0	S	0,0	0,0	0:00.00	rcu_tasks_rude
11	root	20	0	0	0	0	S	0,0	0,0	0:00.00	rcu_tasks_trace
12	root	20	0	0	0	0	S	0,0	0,0	0:00.41	ksoftirqd/0
13	root	20	0	0	0	0	I	0,0	0,0	0:02.16	rcu_sched
14	root	rt	0	0	0	0	S	0,0	0,0	0:00.01	migration/0
15	root	-51	0	0	0	0	S	0,0	0,0	0:00.00	idle_inject/0
16	root	20	0	0	0	0	S	0,0	0,0	0:00.00	cpuhp/0
17	root	20	0	0	0	0	S	0,0	0,0	0:00.00	cpuhp/1
18	root	-51	0	0	0	0	S	0,0	0,0	0:00.00	idle_inject/1
19	root	rt	0	0	0	0	S	0,0	0,0	0:00.21	migration/1
20	root	20	0	0	0	0	S	0,0	0,0	0:00.34	ksoftirqd/1
22	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	kworker/1:0H-events_highpri
23	root	20	0	0	0	0	S	0,0	0,0	0:00.00	cpuhp/2
24	root	-51	0	0	0	0	S	0,0	0,0	0:00.00	idle_inject/2
25	root	rt	0	0	0	0	S	0,0	0,0	0:00.22	migration/2
26	root	20	0	0	0	0	S	0,0	0,0	0:00.35	ksoftirqd/2
28	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	kworker/2:0H-events_highpri
29	root	20	0	0	0	0	S	0,0	0,0	0:00.00	cpuhp/3
30	root	-51	0	0	0	0	S	0,0	0,0	0:00.00	idle_inject/3
31	root	rt	0	0	0	0	S	0,0	0,0	0:00.21	migration/3
32	root	20	0	0	0	0	S	0,0	0,0	0:00.34	ksoftirqd/3
34	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	kworker/3:0H-events_highpri
35	root	20	0	0	0	0	S	0,0	0,0	0:00.00	cpuhp/4
36	root	-51	0	0	0	0	S	0,0	0,0	0:00.00	idle_inject/4
37	root	rt	0	0	0	0	S	0,0	0,0	0:00.22	migration/4
38	root	20	0	0	0	0	S	0,0	0,0	0:00.36	ksoftirqd/4
40	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	kworker/4:0H-events_highpri
41	root	20	0	0	0	0	S	0,0	0,0	0:00.00	cpuhp/5
42	root	-51	0	0	0	0	S	0,0	0,0	0:00.00	idle_inject/5
43	root	rt	0	0	0	0	S	0,0	0,0	0:00.22	migration/5
44	root	20	0	0	0	0	S	0,0	0,0	0:00.30	ksoftirqd/5
46	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	kworker/5:0H-events_highpri
47	root	20	0	0	0	0	S	0,0	0,0	0:00.00	cpuhp/6
48	root	-51	0	0	0	0	S	0,0	0,0	0:00.00	idle_inject/6

Узнать количество потоков можно через команду ps:

ps hN p 119006 | wc -l

```
tonya@tonya-Lenovo-IdeaPad-S340-14API:~/OS Lab 1$ ps hN p 119006 | wc -l
25
```

2. Список файлов, с которыми работает программа, можно узнать с помощью команды strace:

strace -f -e trace=openat ./165788

```
pid 48683] openat(AT_FDCWD, "2022048254756203850", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 8
pid 48685] openat(AT_FDCWD, "7561982518006718680", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 9
pid 48677] openat(AT_FDCWD, "12271515046363969678", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 5
pid 48687] openat(AT_FDCWD, "6478227200748025043", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>
pid 48679] openat(AT_FDCWD, "3469286547223404889", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>
pid 48675] openat(AT_FDCWD, "12966888916250230423", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>
pid 48687] <... openat resumed> = 6
pid 48681] openat(AT_FDCWD, "11576761484161525814", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>
pid 48675] <... openat resumed> = 4
pid 48681] <... openat resumed> = 7
pid 48673] openat(AT_FDCWD, "10263659426985177859", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3
pid 48679] <... openat resumed> = 10
pid 48683] openat(AT_FDCWD, "2022048254756203850", O_RDONLY) = 8
pid 48683] openat(AT_FDCWD, "2022048254756203850", O_RDONLY) = 8
pid 48687] openat(AT_FDCWD, "6478227200748025043", O_RDONLY) = 5
pid 48687] openat(AT_FDCWD, "6478227200748025043", O_RDONLY) = 5
pid 48684] openat(AT_FDCWD, "6385848987412134065", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 4
pid 48685] openat(AT_FDCWD, "7561982518006718680", O_RDONLY) = 3
pid 48685] openat(AT_FDCWD, "7561982518006718680", O_RDONLY) = 3
pid 48677] openat(AT_FDCWD, "12271515046363969678", O_RDONLY) = 6
pid 48677] openat(AT_FDCWD, "12271515046363969678", O_RDONLY) = 6
pid 48688] openat(AT_FDCWD, "6984463500224149286", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 5
pid 48675] openat(AT_FDCWD, "12966888916250230423", O_RDONLY) = 7
pid 48675] openat(AT_FDCWD, "12966888916250230423", O_RDONLY) = 7
pid 48686] openat(AT_FDCWD, "17284930747909707490", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3
pid 48681] openat(AT_FDCWD, "11576761484161525814", O_RDONLY) = 8
pid 48681] openat(AT_FDCWD, "11576761484161525814", O_RDONLY) = 8
pid 48673] openat(AT_FDCWD, "10263659426985177859", O_RDONLY) = 9
pid 48673] openat(AT_FDCWD, "10263659426985177859", O_RDONLY) = 9
pid 48679] openat(AT_FDCWD, "3469286547223404889", O_RDONLY) = 10
pid 48679] openat(AT_FDCWD, "3469286547223404889", O_RDONLY) = 10
pid 48678] openat(AT_FDCWD, "4965104702427855506", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3
pid 48676] openat(AT_FDCWD, "11049604089384987395", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 4
pid 48682] openat(AT_FDCWD, "13553890257905065566", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 5
pid 48674] openat(AT_FDCWD, "9051488070670766602", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 6
pid 48680] openat(AT_FDCWD, "18134296188166314802", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 7
pid 48683] openat(AT_FDCWD, "2022048254756203850", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3
pid 48687] openat(AT_FDCWD, "6478227200748025043", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 4
pid 48685] openat(AT_FDCWD, "7561982518006718680", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3
pid 48683] openat(AT_FDCWD, "2022048254756203850", O_RDONLY) = 4
pid 48683] openat(AT_FDCWD, "2022048254756203850", O_RDONLY) = 4
pid 48687] openat(AT_FDCWD, "6478227200748025043", O_RDONLY) = 3
pid 48687] openat(AT_FDCWD, "6478227200748025043", O_RDONLY) = 3
pid 48685] openat(AT_FDCWD, "7561982518006718680", O_RDONLY) = 3
pid 48685] openat(AT_FDCWD, "7561982518006718680", O_RDONLY) = 3
pid 48677] openat(AT_FDCWD, "12271515046363969678", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3
pid 48675] openat(AT_FDCWD, "12966888916250230423", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 4
pid 48681] openat(AT_FDCWD, "11576761484161525814", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 5
pid 48673] openat(AT_FDCWD, "10263659426985177859", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 6
pid 48679] openat(AT_FDCWD, "3469286547223404889", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 7
pid 48677] openat(AT_FDCWD, "12271515046363969678", O_RDONLY) = 3
pid 48677] openat(AT_FDCWD, "12271515046363969678", O_RDONLY) = 3
pid 48675] openat(AT_FDCWD, "12966888916250230423", O_RDONLY) = 3
pid 48675] openat(AT_FDCWD, "12966888916250230423", O_RDONLY) = 3
pid 48681] openat(AT_FDCWD, "11576761484161525814", O_RDONLY) = 3
```

Список сетевых соединений через netstat:

netstat -nlp | grep 119006

```
tonya@tonya-Lenovo-IdeaPad-S340-14API:~/OS Lab 1$ sudo netstat -nlp | grep 119006
tcp        0      0 0.0.0.0:4947          0.0.0.0:*        LISTEN      119006/./165788
tcp        0      0 0.0.0.0:4948          0.0.0.0:*        LISTEN      119006/./165788
```

3. Карту памяти процесса посмотрим через rmap:  
rmap -d 119006

```
tonya@tonya-Lenovo-IdeaPad-S340-14API:~/OS Lab 1$ rmap -d 119006
119006: ./165788
Адрес      K6 Mode  Offset      Device      Mapping
0000000000400000      240 r-x-- 0000000000000000 103:00005 165788
000000000063b000       4 r---- 0000000000003b000 103:00005 165788
000000000063c000       4 rw--- 0000000000003c000 103:00005 165788
0000000000197a000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51c4900000  121856 rw--- 0000000000000000 000:00000 [ anon ]
00007f51cc000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51cc021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51d0000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51d0021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51d4000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51d4021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51d8000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51d8021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51dc000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51dc021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51e0000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51e0021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51e4000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51e4021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51e8900000  121856 rw--- 0000000000000000 000:00000 [ anon ]
00007f51f0000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f51f0021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f51f6efe000  365568 rw--- 0000000000000000 000:00000 [ anon ]
00007f5214afe000  365568 rw--- 0000000000000000 000:00000 [ anon ]
00007f522affe000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f522afff000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f522b7ff000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f522b800000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f522c000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f522c021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f52337ff000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f5233800000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f5234000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f5234021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f5238000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f5238021000   65404 ---- 0000000000000000 000:00000 [ anon ]
00007f523c7f9000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f523c7fa000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f523cffa000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f523cffb000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f523d7fb000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f523d7fc000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f523dff0000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f523dff0000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f523e7fd000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f523e7fe000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f523effe000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f523efff000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f523f7ff000       4 ---- 0000000000000000 000:00000 [ anon ]
00007f523f800000    8192 rw--- 0000000000000000 000:00000 [ anon ]
00007f5240000000      132 rw--- 0000000000000000 000:00000 [ anon ]
00007f5240021000   65404 ---- 0000000000000000 000:00000 [ anon ]
```

```

00007f525c953000      4 ---- 0000000000000000 000:00000 [ anon ]
00007f525c954000    8192 rw-- 0000000000000000 000:00000 [ anon ]
00007f525d154000      4 ---- 0000000000000000 000:00000 [ anon ]
00007f525d155000    8192 rw-- 0000000000000000 000:00000 [ anon ]
00007f525d955000      4 ---- 0000000000000000 000:00000 [ anon ]
00007f525d956000    8192 rw-- 0000000000000000 000:00000 [ anon ]
00007f525e156000      4 ---- 0000000000000000 000:00000 [ anon ]
00007f525e157000    8192 rw-- 0000000000000000 000:00000 [ anon ]
00007f525e957000      4 ---- 0000000000000000 000:00000 [ anon ]
00007f525e958000    8192 rw-- 0000000000000000 000:00000 [ anon ]
00007f525f158000      4 ---- 0000000000000000 000:00000 [ anon ]
00007f525f159000   983060 rw-- 0000000000000000 000:00000 [ anon ]
00007f529b15e000     136 r---- 0000000000000000 103:00005 libc-2.31.so
00007f529b180000    1504 r-x-- 00000000000022000 103:00005 libc-2.31.so
00007f529b2f8000     312 r---- 000000000019a000 103:00005 libc-2.31.so
00007f529b346000      16 r---- 00000000001e7000 103:00005 libc-2.31.so
00007f529b34a000       8 rw-- 00000000001eb000 103:00005 libc-2.31.so
00007f529b34c000      16 rw-- 0000000000000000 000:00000 [ anon ]
00007f529b350000      24 r---- 0000000000000000 103:00005 libpthread-2.31.so
00007f529b356000      68 r-x-- 0000000000006000 103:00005 libpthread-2.31.so
00007f529b367000      24 r---- 0000000000017000 103:00005 libpthread-2.31.so
00007f529b36d000       4 r---- 000000000001c000 103:00005 libpthread-2.31.so
00007f529b36e000       4 rw-- 000000000001d000 103:00005 libpthread-2.31.so
00007f529b36f000      16 rw-- 0000000000000000 000:00000 [ anon ]
00007f529b373000      12 r---- 0000000000000000 103:00005 libgcc_s.so.1
00007f529b376000      72 r-x-- 0000000000003000 103:00005 libgcc_s.so.1
00007f529b388000      16 r---- 0000000000015000 103:00005 libgcc_s.so.1
00007f529b38c000       4 r---- 0000000000018000 103:00005 libgcc_s.so.1
00007f529b38d000       4 rw-- 0000000000019000 103:00005 libgcc_s.so.1
00007f529b38e000      52 r---- 0000000000000000 103:00005 libm-2.31.so
00007f529b39b000     668 r-x-- 000000000000d000 103:00005 libm-2.31.so
00007f529b442000     612 r---- 00000000000b4000 103:00005 libm-2.31.so
00007f529b4db000       4 r---- 0000000000014c000 103:00005 libm-2.31.so
00007f529b4dc000       4 rw-- 0000000000014d000 103:00005 libm-2.31.so
00007f529b4dd000     600 r---- 0000000000000000 103:00005 libstdc++.so.6.0.28
00007f529b573000     964 r-x-- 00000000000096000 103:00005 libstdc++.so.6.0.28
00007f529b664000     292 r---- 00000000000187000 103:00005 libstdc++.so.6.0.28
00007f529b6ad000       4 ---- 000000000001d0000 103:00005 libstdc++.so.6.0.28
00007f529b6ae000      44 r---- 000000000001d0000 103:00005 libstdc++.so.6.0.28
00007f529b6b9000      12 rw-- 000000000001db000 103:00005 libstdc++.so.6.0.28
00007f529b6bc000      20 rw-- 0000000000000000 000:00000 [ anon ]
00007f529b6d2000      8 rw-- 0000000000000000 000:00000 [ anon ]
00007f529b6d4000       4 r---- 0000000000000000 103:00005 ld-2.31.so
00007f529b6d5000     140 r-x-- 0000000000001000 103:00005 ld-2.31.so
00007f529b6f8000      32 r---- 00000000000024000 103:00005 ld-2.31.so
00007f529b700000       4 rw-- 0000000000000000 000:00000 [ anon ]
00007f529b701000       4 r---- 0000000000002c000 103:00005 ld-2.31.so
00007f529b702000       4 rw-- 0000000000002d000 103:00005 ld-2.31.so
00007f529b703000       4 rw-- 0000000000000000 000:00000 [ anon ]
00007fff4b323000    132 rw-- 0000000000000000 000:00000 [ stack ]
00007fff4b3dd000      16 r---- 0000000000000000 000:00000 [ anon ]
00007fff4b3e1000       8 r-x-- 0000000000000000 000:00000 [ anon ]
ffffffffffff600000      4 --x-- 0000000000000000 000:00000 [ anon ]
mapped: 3266788K writeable/private: 2148940K shared: 0K
tonya@tonya-Lenovo-IdeaPad-S340-14API:~/OS Lab 1$

```

4. Содержимое передаваемых по сети данных с помощью tcpdump:

`sudo tcpdump -n -A`



```

tonya@tonya-Lenovo-IdeaPad-S340-14API:~/OS Lab 1$ sudo tcpdump -n -A
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on wlp2s0, link-type EN10MB (Ethernet), capture size 262144 bytes
20:26:17.907700 IP 192.168.0.103.34582 > 77.88.21.119.443: Flags [P.], seq 3775325019:3775325058, ack 1657888865, win 873,
options [nop,nop,TS val 24057430 ecr 3170476796], length 39
E..L..@.W...gMX.w.....b.`a...i$.....
.o.V.....".>....;lb...3>..A..Zuj8 C`.7...
20:26:17.910479 IP 192.168.0.103.34582 > 77.88.21.119.443: Flags [FP.], seq 39:63, ack 1, win 873, options [nop,nop,TS val
24057432 ecr 3170476796], length 24
E..L..@.W...gMX.w.....b.`a...i$.....
.o.X.....00..L.R.C.A.ZN....
20:26:17.924931 IP 77.88.21.119.443 > 192.168.0.103.34582: Flags [.], ack 39, win 166, options [nop,nop,TS val 3170530824
ecr 24057430], length 0
E(.4..@.9.W,MX.W...g....b.`a.....
..v..o.V
20:26:17.924938 IP 77.88.21.119.443 > 192.168.0.103.34582: Flags [P.], seq 1:40, ack 64, win 166, options [nop,nop,TS val
3170530824 ecr 24057432], length 39
E(.L..@.9.W,MX.W...g....b.`a.....yw....
..v..o.X..."L{.M.v.<@{....t@....gv"J.X..d....
20:26:17.924940 IP 77.88.21.119.443 > 192.168.0.103.34582: Flags [P.], seq 40:64, ack 64, win 166, options [nop,nop,TS val
3170530824 ecr 24057432], length 24
E(.L..@.9.W,MX.W...g....b.`.....X.....
..v..o.X.....bN....l5.....>....
20:26:17.924942 IP 77.88.21.119.443 > 192.168.0.103.34582: Flags [F.], seq 64, ack 64, win 166, options [nop,nop,TS val 31
70530824 ecr 24057432], length 0
E(.4..@.9.W)MX.W...g....b.`.....
..v..o.X
20:26:17.924992 IP 192.168.0.103.34582 > 77.88.21.119.443: Flags [R], seq 3775325083, win 0, length 0
E(.L..@.W...gMX.w.....P...>...
20:26:17.925024 IP 192.168.0.103.34582 > 77.88.21.119.443: Flags [R], seq 3775325083, win 0, length 0
E(.L..@.W...gMX.w.....P...>...
20:26:17.925034 IP 192.168.0.103.34582 > 77.88.21.119.443: Flags [R], seq 3775325083, win 0, length 0
E(.L..@.W...gMX.w.....P...>...
20:26:20.186930 IP 192.168.0.103.52614 > 77.234.214.82.443: Flags [.], ack 3239799372, win 501, options [nop,nop,TS val 16
80132990 ecr 799235074], length 0
E..4..@.@.(....gM..R....\9o...jL.....r.....
d$.~/./\
20:26:20.211610 IP 77.234.214.82.443 > 192.168.0.103.52614: Flags [.], ack 1, win 1040, options [nop,nop,TS val 799245314
ecr 1680102421], length 0
E..4vo@.3...M..R...g.....jL\9o.....Z.....
/...d$T.

```

5.

С помощью `top` узнаем загрузку `cpu`:

```

import subprocess
import time
import matplotlib.pyplot as plt

measure_time = 10
PID = "2246"

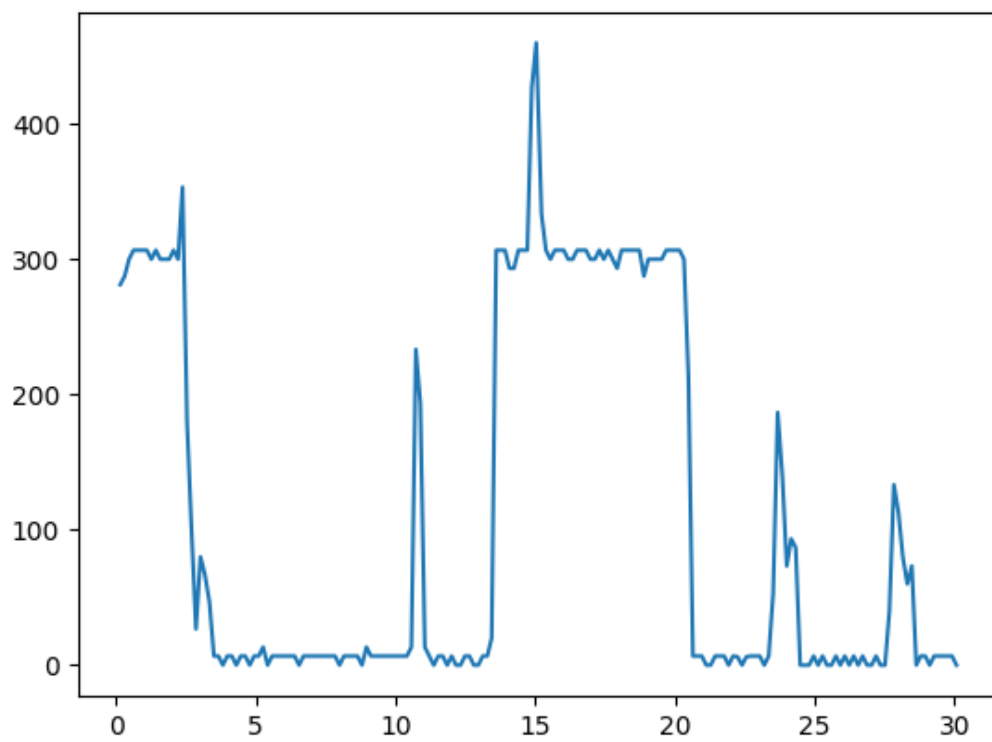
values = []
times = []

start_time = time.time()

while time.time() - start_time < measure_time:
    res = subprocess.check_output(["top", "-b", "-p", PID, "-n",
    "1"]).decode("utf-8").split("\n")[7].split(" ")
    for i in range(50):
        if ' ' in res:
            res.remove(' ')
        values.append(float(res[8].replace(',', '.')))
        times.append(time.time() - start_time)

fig, ax = plt.subplots()
ax.plot(times, values)
plt.show()

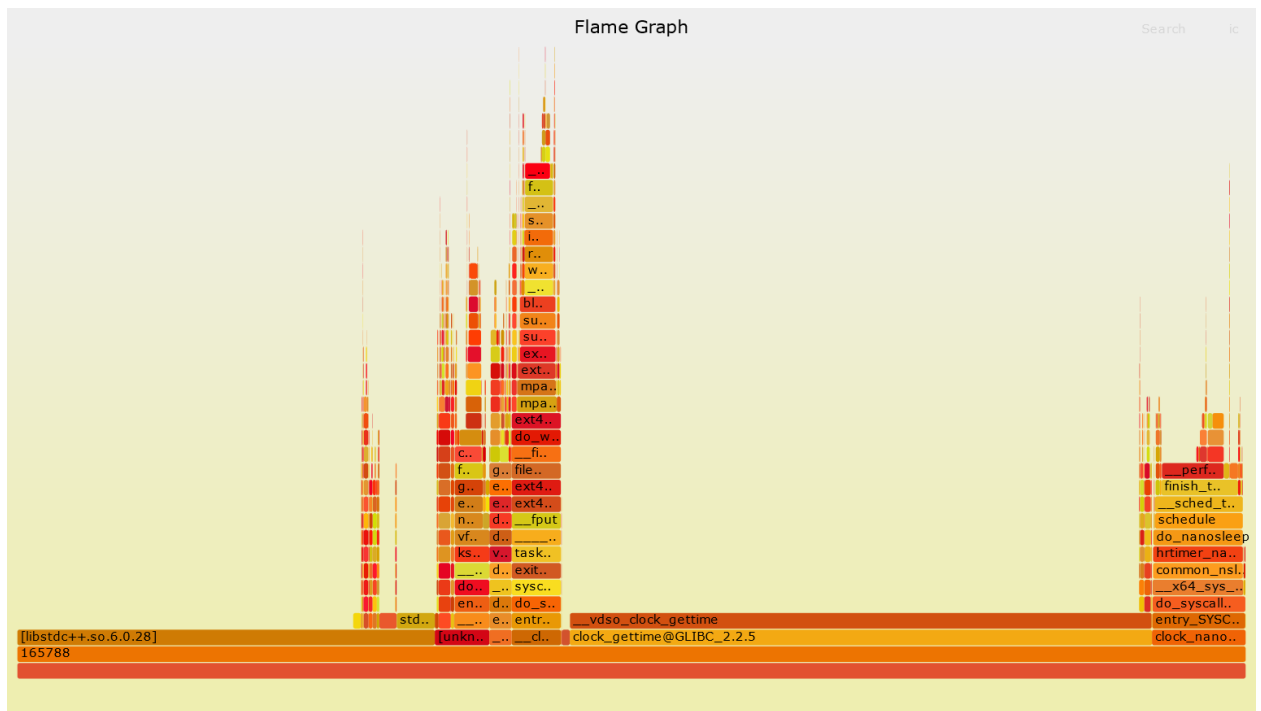
```



FlameGraph всех процессов:







Нагрузку, генерируемую программой на подсистему ввода-вывода, посмотрим через `iostat`:

```
import subprocess
import re
import time
import matplotlib.pyplot as plt

values = []
times = []
time = 0

period = "0.1"
num = "300"

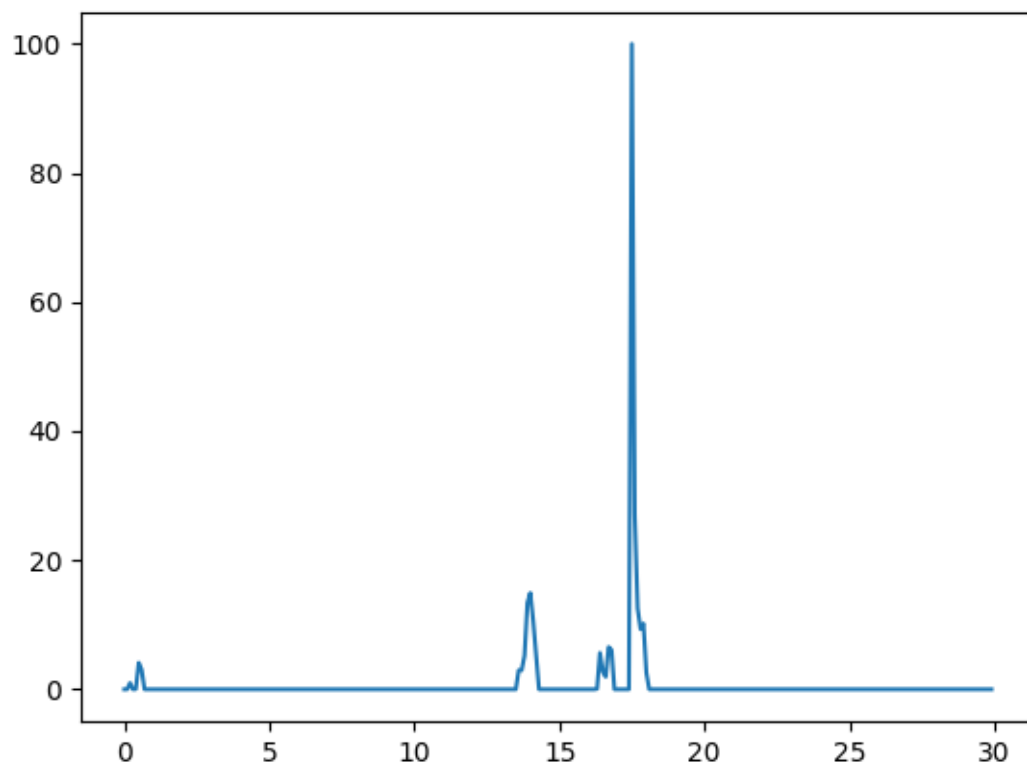
command = "/165788"

res = subprocess.check_output(["sudo", "iostat", "-P", "-b", "-n", num, "-d",
period])

for line in res.decode("utf-8").split("\n"):
    if re.search(command, line):
        sp_line = line.split(" ")
        for i in range(20):
            if ' ' in sp_line:
                sp_line.remove(' ')
            times.append(time)
            time += 0.1

        values.append(float(sp_line[9].replace(',', ' ')))

fig, ax = plt.subplots()
ax.plot(times, values)
plt.show()
```



Для определения нагрузки на сетевую подсистему используем bmon:

```
import subprocess
import re
import time
import matplotlib.pyplot as plt

values = []
times = []
time = 0

timeout = "30"

res = ""

try:
    tmp = subprocess.check_output(["timeout", timeout, "bmon", "-o", "format"])
except subprocess.CalledProcessError as grepxc:
    res = grepxc.output

prev_value = 0

time_add = int(timeout) / (len(res.decode("utf-8").split("\n"))/4)

for line in res.decode("utf-8").split("\n"):
    if re.search("lo", line):
        sp_line = line.split(" ")

        for i in range(20):
            if '' in sp_line:
                sp_line.remove('')
```

```

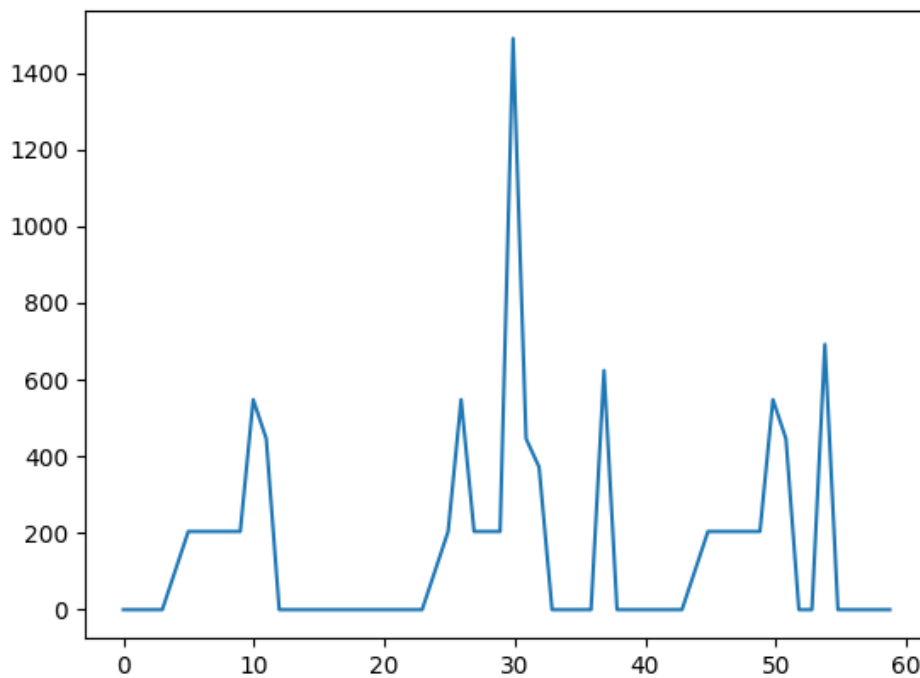
if prev_value == 0:
    prev_value = int(sp_line[1]) + int(sp_line[3])

times.append(time)
time += time_add

values.append((int(sp_line[1]) + int(sp_line[3])) - prev_value)
prev_value = int(sp_line[1]) + int(sp_line[3])

fig, ax = plt.subplots()
ax.plot(times, values)
plt.show()

```



Чтобы построить график смены состояния исполнения потоков, запустим `top` в режиме потоков, а не процессов:

```

import subprocess
import time
import matplotlib.pyplot as plt

threads_num = 25
measure_time = 30
pid = "2246"

values = []
times = []

start_time = time.time()

while time.time() - start_time < measure_time:
    res = subprocess.check_output(["top", "-p", pid, "-H", "-o", "PID", "-b",
    "-n", "1"]).decode("utf-8").split("\n")

```

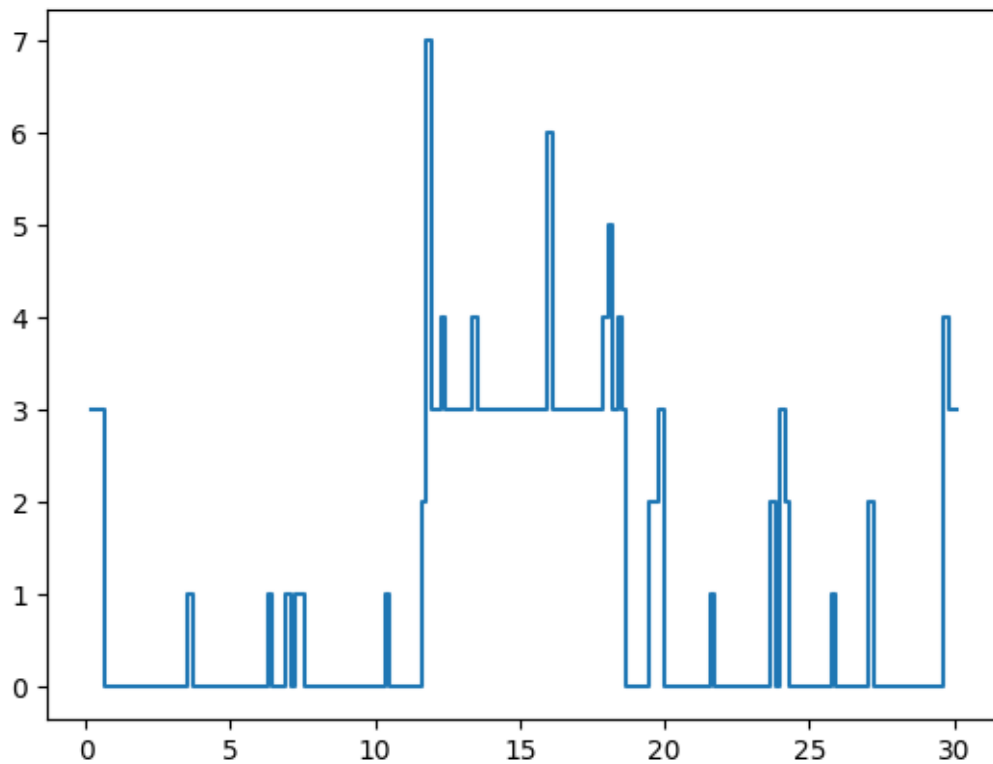
```

summ = 0
for k in range(threads_num):
    res_tmp = res[7 + k].split(" ")
    for i in range(20):
        if '' in res_tmp:
            res_tmp.remove('')

        if res_tmp[7] == "R":
            summ += 1
    times.append(time.time() - start_time)
    values.append(summ)

fig, ax = plt.subplots()
ax.step(times, values)
plt.show()

```



## Вывод:

При выполнении лабораторной работы мною были изучены основные средства мониторинга операционной системы Linux и построены графики соответствующих метрик.