

Федеральное государственное автономное образовательное
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Университет ИТМО

Факультет программной инженерии и компьютерной техники

**Отчёт по лабораторной работе №1
по дисциплине «Операционные системы»**

Вариант 176298

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Санкт-Петербург 2022 г.

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:
 - a. Потребления программой сру;
 - b. Нагрузки генерируемой программой на подсистему ввода-вывода;
 - c. Нагрузки генерируемой программой на сетевую подсистему.
 - d. Смены состояния исполнения потоков;

1. Количество потоков создаваемое программой:

Узнаём PID процесса:

```
rd@rd:~$ export PID=`ps -a | grep 176298 | cut -d ' ' -f 3`
rd@rd:~$ echo $PID
1879
```

Количество потоков программы: 27

```
rd@rd:~$ ps -T -p $PID
  PID   SPID TTY          TIME CMD
 1879   1879 pts/1        00:00:00 176298
 1879   1880 pts/1        00:00:10 176298
 1879   1881 pts/1        00:00:07 176298
 1879   1882 pts/1        00:00:10 176298
 1879   1883 pts/1        00:00:07 176298
 1879   1884 pts/1        00:00:10 176298
 1879   1885 pts/1        00:00:07 176298
 1879   1886 pts/1        00:00:00 176298
 1879   1887 pts/1        00:00:00 176298
 1879   1888 pts/1        00:00:00 176298
 1879   1889 pts/1        00:00:00 176298
 1879   1890 pts/1        00:00:00 176298
 1879   1891 pts/1        00:00:00 176298
 1879   1892 pts/1        00:00:00 176298
 1879   1893 pts/1        00:00:00 176298
 1879   1894 pts/1        00:00:00 176298
 1879   1895 pts/1        00:00:00 176298
 1879   1896 pts/1        00:00:00 176298
 1879   1897 pts/1        00:00:00 176298
 1879   1898 pts/1        00:00:00 176298
 1879   1899 pts/1        00:00:00 176298
 1879   1900 pts/1        00:00:00 176298
 1879   1901 pts/1        00:00:00 176298
 1879   1902 pts/1        00:00:00 176298
 1879   1903 pts/1        00:01:33 176298
 1879   1904 pts/1        00:01:33 176298
 1879   1905 pts/1        00:01:33 176298
rd@rd:~$ ps -T -p $PID | wc
 28      140      1089
```

2. Список файлов и сетевых соединений с которыми работает программа

```
rd@rd:~$ sudo strace -e openat -f ./176298
openat(AT_FDCWD, "/etc/ld.so.cache", 0_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/usr/lib/x86_64-linux-gnu/libstdc++.so.6", 0_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", 0_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", 0_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libpthread.so.0", 0_RDONLY|O_CLOEXEC) = 3
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", 0_RDONLY|O_CLOEXEC) = 3
[pid 10909] openat(AT_FDCWD, "/dev/zero", 0_RDONLY) = 14
[pid 10931] openat(AT_FDCWD, "/etc/passwd", 0_RDONLY) = 18
[pid 10911] openat(AT_FDCWD, "3729539308624100051", 0_WRONLY|O_CREAT|O_TRUNC, 0666) = 11
[pid 10913] openat(AT_FDCWD, "15739600861649587119", 0_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>
[pid 10909] openat(AT_FDCWD, "14522619639757134201", 0_WRONLY|O_CREAT|O_TRUNC, 0666) = 14
[pid 10913] <... openat resumed> ) = 5
[pid 10911] openat(AT_FDCWD, "3729539308624100051", 0_RDONLY) = 5
[pid 10911] openat(AT_FDCWD, "3729539308624100051", 0_RDONLY) = 5
[pid 10913] openat(AT_FDCWD, "15739600861649587119", 0_RDONLY) = 11
[pid 10913] openat(AT_FDCWD, "15739600861649587119", 0_RDONLY) = 11
[pid 10912] openat(AT_FDCWD, "9587122758555185056", 0_WRONLY|O_CREAT|O_TRUNC, 0666) = 5
[pid 10909] openat(AT_FDCWD, "14522619639757134201", 0_RDONLY) = 11
[pid 10914] openat(AT_FDCWD, "5616159744732294773", 0_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished ...>
[pid 10909] openat(AT_FDCWD, "14522619639757134201", 0_RDONLY) = 11
[pid 10914] <... openat resumed> ) = 14
[pid 10910] openat(AT_FDCWD, "8305369285128737664", 0_WRONLY|O_CREAT|O_TRUNC, 0666) = 5
[pid 10931] openat(AT_FDCWD, "/etc/passwd", 0_RDONLY) = 5
[pid 10908] --- SIGWINCH {si_signo=SIGWINCH, si_code=SI_KERNEL} ---
[pid 10931] openat(AT_FDCWD, "/etc/passwd", 0_RDONLY) = 5
```

Сетевые подключения

```
rd@rd:~$ sudo strace -e bind,connect -f ./176298
strace: Process 10942 attached
strace: Process 10943 attached
strace: Process 10944 attached
strace: Process 10945 attached
strace: Process 10946 attached
strace: Process 10947 attached
strace: Process 10948 attached
strace: Process 10949 attached
strace: Process 10950 attached
[pid 10948] bind(5, {sa_family=AF_INET, sin_port=htons(6295), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
strace: Process 10953 attached
[pid 10950] bind(7, {sa_family=AF_INET, sin_port=htons(6296), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
strace: Process 10955 attached
<unfinished ...>
[pid 10949] connect(8, {sa_family=AF_INET, sin_port=htons(6295), sin_addr=inet_addr("127.0.0.1")}, 16 <unfinished ...>
[pid 10950] <... bind resumed> ) = 0
[pid 10949] <... connect resumed> ) = 0
strace: Process 10957 attached
strace: Process 10956 attached
strace: Process 10958 attached
[pid 10956] bind(8, {sa_family=AF_INET, sin_port=htons(6299), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
strace: Process 10951 attached
strace: Process 10952 attached
[pid 10952] bind(12, {sa_family=AF_INET, sin_port=htons(6297), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
[pid 10951] connect(11, {sa_family=AF_INET, sin_port=htons(6296), sin_addr=inet_addr("127.0.0.1")}, 16) = 0
strace: Process 10954 attached
[pid 10954] bind(9, {sa_family=AF_INET, sin_port=htons(6298), sin_addr=inet_addr("0.0.0.0")}, 16 <unfinished ...>
[pid 10953] connect(10, {sa_family=AF_INET, sin_port=htons(6297), sin_addr=inet_addr("127.0.0.1")}, 16 <unfinished ...>
[pid 10954] <... bind resumed> ) = 0
[pid 10953] <... connect resumed> ) = 0
[pid 10955] connect(11, {sa_family=AF_INET, sin_port=htons(6298), sin_addr=inet_addr("127.0.0.1")}, 16 <unfinished ...>
[pid 10957] connect(14, {sa_family=AF_INET, sin_port=htons(6299), sin_addr=inet_addr("127.0.0.1")}, 16 <unfinished ...>
[pid 10955] <... connect resumed> ) = 0
strace: Process 10959 attached
```

```
rd@rd:~$ sudo netstat -nlp | grep $PID
tcp        0      0 0.0.0.0:6295          0.0.0.0:*            LISTEN      1879/./176298
tcp        0      0 0.0.0.0:6296          0.0.0.0:*            LISTEN      1879/./176298
tcp        0      0 0.0.0.0:6297          0.0.0.0:*            LISTEN      1879/./176298
tcp        0      0 0.0.0.0:6298          0.0.0.0:*            LISTEN      1879/./176298
tcp        0      0 0.0.0.0:6299          0.0.0.0:*            LISTEN      1879/./176298
tcp        0      0 0.0.0.0:6300          0.0.0.0:*            LISTEN      1879/./176298
tcp        0      0 0.0.0.0:6301          0.0.0.0:*            LISTEN      1879/./176298
tcp        0      0 0.0.0.0:6302          0.0.0.0:*            LISTEN      1879/./176298
```

3. Карта памяти процесса

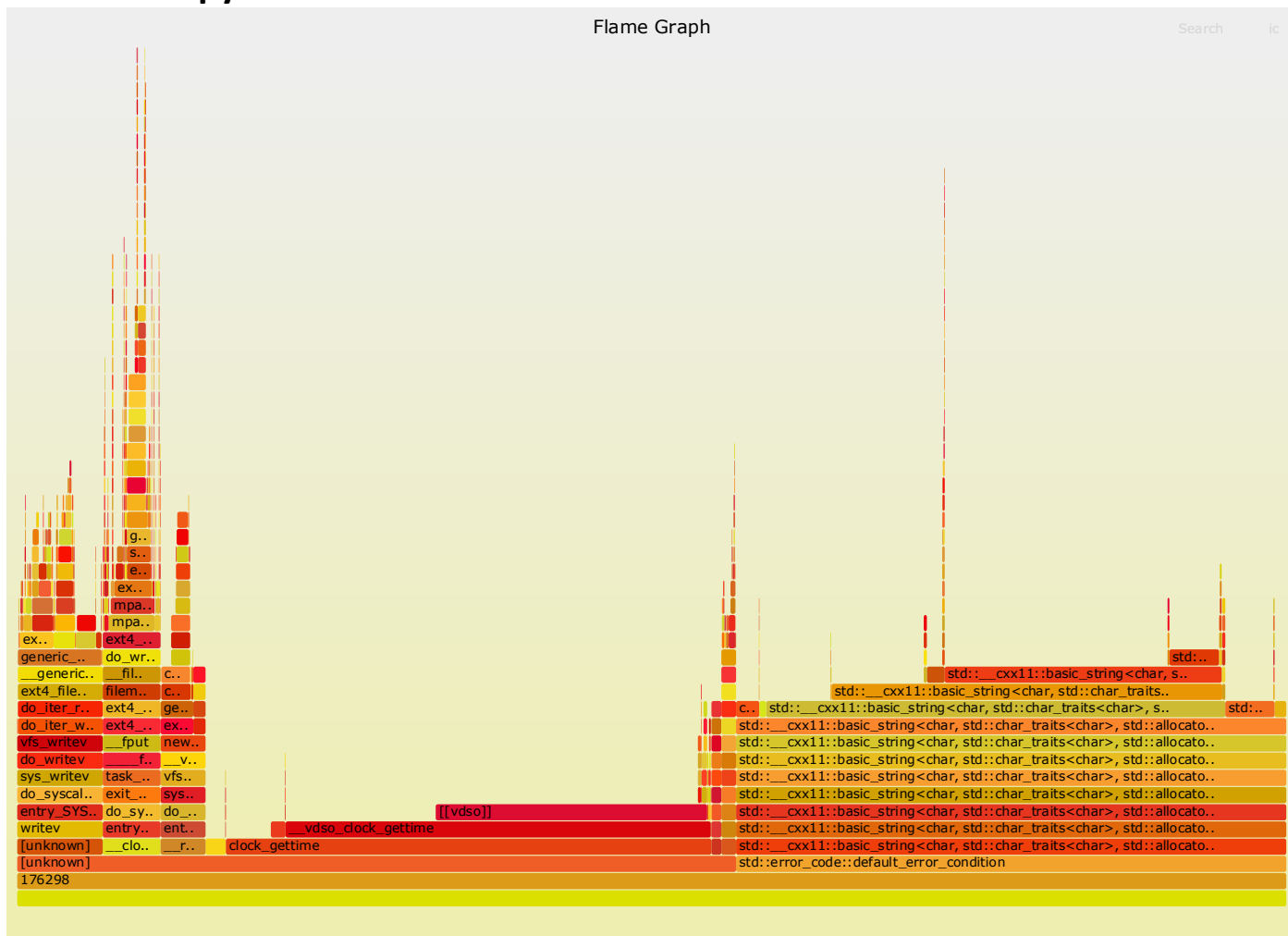
```
rdord::~$ pmap $PID
1879:      ./176298
00000000000400000    216K r-x-- 176298
00000000000635000     4K r---- 176298
00000000000636000     4K rw--- 176298
00000000001637000    132K rw--- [ anon ]
00007fde77300000   144384K rw--- [ anon ]
00007fde80000000    132K rw--- [ anon ]
00007fde80021000   65404K ----- [ anon ]
00007fde88000000    132K rw--- [ anon ]
00007fde88021000   65404K ----- [ anon ]
00007fde8e600000  288768K rw--- [ anon ]
00007fdea0000000    132K rw--- [ anon ]
00007fdea0021000   65404K ----- [ anon ]
00007fdeaeff6000     4K ----- [ anon ]
00007fdeaeff7000   8192K rw--- [ anon ]
00007fdeaf7f7000     4K ----- [ anon ]
00007fdeaf7f8000   8192K rw--- [ anon ]
00007fdeb0000000    132K rw--- [ anon ]
00007fdeb0021000   65404K ----- [ anon ]
00007fdeb7ff8000     4K ----- [ anon ]
00007fdeb7fff000   8192K rw--- [ anon ]
00007fdeb87f9000     4K ----- [ anon ]
00007fdeb87fa000   8192K rw--- [ anon ]
00007fdeb8ffa000     4K ----- [ anon ]
00007fdeb8ffb000   8192K rw--- [ anon ]
00007fdeb97fb000     4K ----- [ anon ]
00007fdeb97fc000   8192K rw--- [ anon ]
00007fdeb9ffc000     4K ----- [ anon ]
00007fdeb9ffd000   8192K rw--- [ anon ]
00007fdeba7fd000     4K ----- [ anon ]
00007fdeba7fe000   8192K rw--- [ anon ]
00007fdebaffeb000     4K ----- [ anon ]
00007fdebafffb000   8192K rw--- [ anon ]
00007fdebb7ff000     4K ----- [ anon ]
00007fdebb800000   8192K rw--- [ anon ]
00007fdec0000000    132K rw--- [ anon ]
00007fdec021000   65404K ----- [ anon ]
00007fdec47f9000     4K ----- [ anon ]
00007fdec47fa000   8192K rw--- [ anon ]
00007fdec4ffa000     4K ----- [ anon ]
00007fdec4ffb000   8192K rw--- [ anon ]
00007fdec57fb000     4K ----- [ anon ]
00007fdec57fc000   8192K rw--- [ anon ]
00007fdec5ffc000     4K ----- [ anon ]
00007fdec5ffd000   8192K rw--- [ anon ]
00007fdec67fd000     4K ----- [ anon ]
00007fdec67fe000   8192K rw--- [ anon ]
00007fdec6ffe000     4K ----- [ anon ]
00007fdec6fff000   8192K rw--- [ anon ]
00007fdec77ff000     4K ----- [ anon ]
00007fdec7800000   8192K rw--- [ anon ]
00007fdec8000000    132K rw--- [ anon ]
00007fdec8021000   65404K ----- [ anon ]
00007fdec8c00000    4K ----- [ anon ]
00007fdec8c7000   8192K rw--- [ anon ]
00007fdec8c9c000     4K ----- [ anon ]
00007fdec8c9c8000   8192K rw--- [ anon ]
00007fdec8d1c8000     4K ----- [ anon ]
00007fdec8d1c9000   8192K rw--- [ anon ]
00007fdec8d9c9000     4K ----- [ anon ]
00007fdec8d9ca000   8192K rw--- [ anon ]
00007fdece1ca000     4K ----- [ anon ]
00007fdece1cb000   8192K rw--- [ anon ]
00007fdece9cb000     4K ----- [ anon ]
00007fdece9cc000   8192K rw--- [ anon ]
00007fdecf1cc000     4K ----- [ anon ]
00007fdecf1cd000   8192K rw--- [ anon ]
00007fdecf9cd000     4K ----- [ anon ]
00007fdecf9ce000   8192K rw--- [ anon ]
00007fded01ce000     4K ----- [ anon ]
00007fded01cf000  441344K rw--- [ anon ]
00007fdeeb0cf000   1948K r-x-- libc-2.27.so
00007fdeeb2b6000  2048K ----- libc-2.27.so
00007fdeeb4b6000    16K r---- libc-2.27.so
00007fdeeb4ba000     8K rw--- libc-2.27.so
00007fdeeb4bc000    16K rw--- [ anon ]
00007fdeeb4c0000   104K r-x-- libpthread-2.27.so
00007fdeeb4da000  2044K ----- libpthread-2.27.so
00007fdeeb6d9000     4K r---- libpthread-2.27.so
00007fdeeb6da000     4K rw--- libpthread-2.27.so
00007fdeeb6db000    16K rw--- [ anon ]
00007fdeeb6df000    92K r-x-- libgcc_s.so.1
00007fdeeb6ff000  2044K ----- libgcc_s.so.1
00007fdeeb8f5000     4K r---- libgcc_s.so.1
00007fdeeb8f6000     4K rw--- libgcc_s.so.1
00007fdeeb8f7000   1652K r-x-- libm-2.27.so
00007fdeeba94000  2044K ----- libm-2.27.so
00007fdeebc93000     4K r---- libm-2.27.so
00007fdeebc94000     4K rw--- libm-2.27.so
00007fdeebc95000  1508K r-x-- libstdc++.so.6.0.25
00007fdeebe0e000  2048K ----- libstdc++.so.6.0.25
00007fdeec00ee000   40K r---- libstdc++.so.6.0.25
00007fdeec018000     8K rw--- libstdc++.so.6.0.25
00007fdeec01a000    16K rw--- [ anon ]
00007fdeec01e000   164K r-x-- ld-2.27.so
00007fdeec237000    64K rw--- [ anon ]
00007fdeec247000     4K r---- ld-2.27.so
00007fdeec248000     4K rw--- ld-2.27.so
00007fdeec249000     4K rw--- [ anon ]
00007ffffb5fca000   132K rw--- [ stack ]
00007ffffb5feb000    12K r---- [ anon ]
00007ffffb5fee000     8K r-x-- [ anon ]
ffffffffffffff600000    4K r-x-- [ anon ]
total          1554580K
```

4. Содержимое передаваемых по сети данных;

```
rd@rd:~$ sudo strace -f -e socket,bind,sendto,recvfrom ./176298
strace: Process 14546 attached
strace: Process 14547 attached
strace: Process 14548 attached
strace: Process 14549 attached
strace: Process 14550 attached
strace: Process 14551 attached
strace: Process 14552 attached
[pid 14552] socket(AF_INET, SOCK_STREAM, IPPROTO_IP) = 5
strace: Process 14553 attached
) = 5
strace: Process 14554 attached
[pid 14554] socket(AF_INET, SOCK_STREAM, IPPROTO_IP) = 6
[pid 14554] bind(6, {sa_family=AF_INET, sin_port=htons(6296), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
[pid 14555] socket(AF_INET, SOCK_STREAM, IPPROTO_TCP) = 7
[pid 14554] <... bind resumed> ) = 0
[pid 14553] socket(AF_INET, SOCK_STREAM, IPPROTO_TCP) = 8
strace: Process 14556 attached
[pid 14552] bind(5, {sa_family=AF_INET, sin_port=htons(6295), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
[pid 14556] socket(AF_INET, SOCK_STREAM, IPPROTO_IP) = 10
[pid 14556] bind(10, {sa_family=AF_INET, sin_port=htons(6297), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
strace: Process 14558 attached
strace: Process 14557 attached
[pid 14558] socket(AF_INET, SOCK_STREAM, IPPROTO_IP) = 11
[pid 14557] socket(AF_INET, SOCK_STREAM, IPPROTO_TCP) = 12
[pid 14558] <... socket resumed> ) = 11
[pid 14557] <... socket resumed> ) = 12
strace: Process 14559 attached
[pid 14559] socket(AF_INET, SOCK_STREAM, IPPROTO_TCP) = 13
[pid 14558] bind(11, {sa_family=AF_INET, sin_port=htons(6298), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
strace: Process 14560 attached
<unfinished ...>
[pid 14560] socket(AF_INET, SOCK_STREAM, IPPROTO_IP) = 14
[pid 14560] bind(14, {sa_family=AF_INET, sin_port=htons(6299), sin_addr=inet_addr("0.0.0.0")}, 16) = 0
[pid 14558] <... bind resumed> ) = 0
strace: Process 14561 attached
[pid 14557] sendto(12, "qjzfvfvybnpsdgj", 17, 0, NULL, 0) = 0
[pid 14561] socket(AF_INET, SOCK_STREAM, IPPROTO_TCP) = 15
[pid 14556] recvfrom(15, <unfinished ...>) = 16
[pid 14561] <... socket resumed> ) = 16
[pid 14560] recvfrom(17, <unfinished ...>) = 17
[pid 14561] sendto(16, "qjzfvfvybnpsdgj", 17, 0, NULL, 0) = 0
```

5. Построить графики

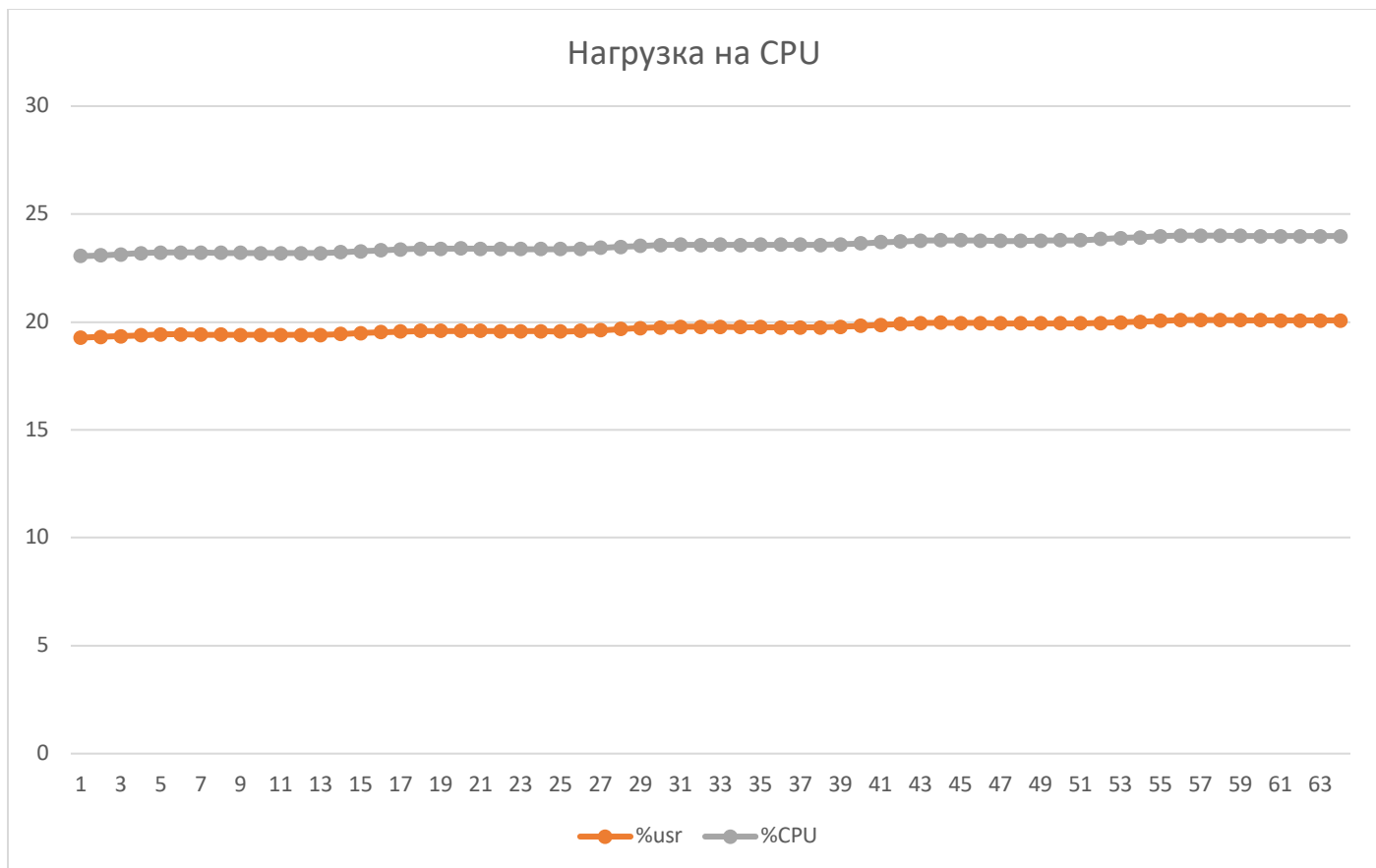
5.1 Нагрузка на CPU



Потребление CPU по Flame-graph

```
sudo perf record -F 99 -a -p $PID -g -- sleep 30
```

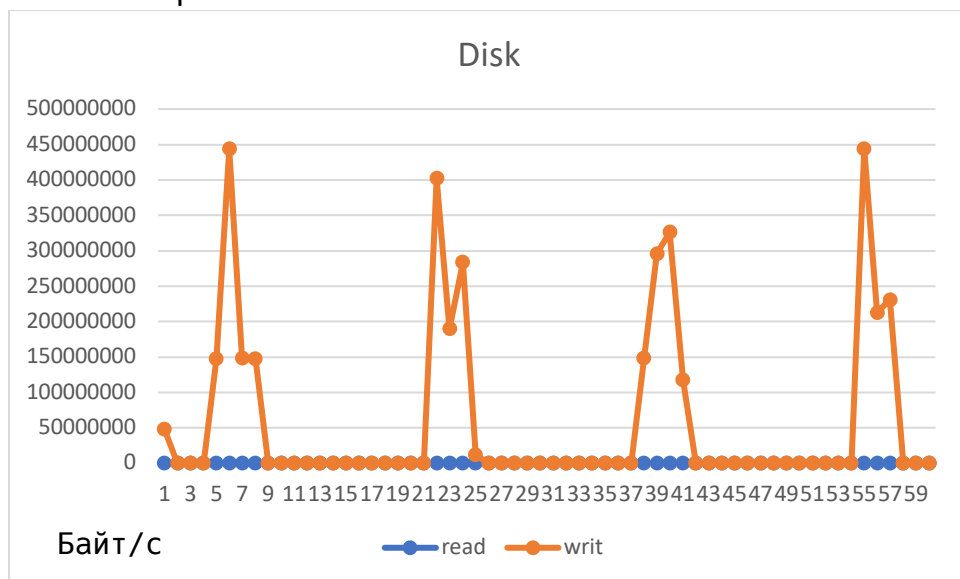
```
sudo perf script | ./stackcollapse-perf.pl > out.perf-folded  
./flamegraph.pl out.perf-folded > perf.svg
```



```
watch -n 1 "pidstat -ul -p $PID >> file"
```

5.2 Нагрузка на систему ввода-вывода

```
dstat --disk --io --output file
```



Выводы:

В ходе выполнения данной лабораторной работы я познакомился с утилитами для мониторинга приложений и системы. Построил графики нагрузки приложения на CPU, систему ввода вывода, сетевой активности приложения.