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Лабораторная работа №8 по курсу
«Операционные системы»

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Содержание

Репозиторий

https://github.com/Imariiii/os_labs

Постановка задачи

Приобретение практических навыков диагностики работы программного обеспечения.

Задание

Продемонстрировать ключевые системные вызовы, используемые в лабораторной работе и то, что их использование соответствует варианту ЛР на примере лабораторной работы №3.

Описание strace

Команда strace является инструментом диагностики в Linux. Она перехватывает и записывает любые системные вызовы, выполняемые командой.

Кроме того, также записывает любой сигнал Linux, отправляемый процессу.

Затем мы можем использовать эту информацию для отладки или диагностики

программы.

В самом простом варианте strace запускает переданную команду с её аргументами и выводит в стандартный поток ошибок все системные вызовы

команды.

Возможные флаги:

• -k - выводить стек вызовов для отслеживаемого процесса после каждого системного вызова

• -o - выводить всю информацию о системных вызовах не в стандартный поток ошибок, а в файл

• -c - подсчитывать количество ошибок, вызовов и время выполнения для каждого системного вызова

• -T - выводить длительность выполнения системного вызова

• -y - выводить пути для файловых дескрипторов

- -yy - выводить информацию о протоколе для файловых дескрипторов
- -p - указывает pid процесса, к которому следует подключиться
- -f - отслеживать также дочерние процессы, если они будут созданы

Демонстрация работы

```
anna@anna-virtual-machine:~/labs_3sem/os_labs/build/lab3$
PATH_TO_CHILD=child_lab3 strace -fyT ./lab3
execve("./lab3", ["./lab3"], 0x7ffd15d221c8 /* 62 vars */) = 0 <0.000505>
brk(NULL)                               = 0x5612b008b000 <0.000021>
arch_prctl(0x3001 /* ARCH_??? */, 0x7ffdc79919e0) = -1 EINVAL (Недопустимый
аргумент) <0.000009>
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f1108914000 <0.000025>
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (Нет такого файла или
каталога) <0.000020>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>, "/etc/ld.so.cache",
O_RDONLY|O_CLOEXEC) = 3</etc/ld.so.cache> <0.000033>
newfstatat(3</etc/ld.so.cache>, "", {st_mode=S_IFREG|0644, st_size=112403,
...}, AT_EMPTY_PATH) = 0 <0.000018>
mmap(NULL, 112403, PROT_READ, MAP_PRIVATE, 3</etc/ld.so.cache>, 0) =
0x7f11088f8000 <0.000030>
close(3</etc/ld.so.cache>)              = 0 <0.000008>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>, "/lib/x86_64-linux-
gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) = 3</usr/lib/x86_64-linux-
gnu/libstdc++.so.6.0.30> <0.000033>
read(3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0"..., 832) =
832 <0.000019>
newfstatat(3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>, "",
{st_mode=S_IFREG|0644, st_size=2260296, ...}, AT_EMPTY_PATH) = 0 <0.000018>
mmap(NULL, 2275520, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3</usr/lib/x86_64-
linux-gnu/libstdc++.so.6.0.30>, 0) = 0x7f1108600000 <0.000032>
mprotect(0x7f110869a000, 1576960, PROT_NONE) = 0 <0.000035>
mmap(0x7f110869a000, 1118208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libstdc++.so.6.0.30>, 0x9a000) = 0x7f110869a000 <0.000036>
mmap(0x7f11087ab000, 454656, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>, 0x1ab000) = 0x7f11087ab000
<0.000030>
mmap(0x7f110881b000, 57344, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libstdc++.so.6.0.30>, 0x21a000) = 0x7f110881b000 <0.000028>
mmap(0x7f1108829000, 10432, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f1108829000 <0.000025>
close(3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>) = 0 <0.000015>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>, "/lib/x86_64-linux-
gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) = 3</usr/lib/x86_64-linux-
gnu/libgcc_s.so.1> <0.000021>
read(3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>,
"\177ELF\2\1\1\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0"..., 832) =
832 <0.000019>
newfstatat(3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>, "",
{st_mode=S_IFREG|0644, st_size=125488, ...}, AT_EMPTY_PATH) = 0 <0.000017>
mmap(NULL, 127720, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3</usr/lib/x86_64-
linux-gnu/libgcc_s.so.1>, 0) = 0x7f11088d8000 <0.000047>
mmap(0x7f11088db000, 94208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libgcc_s.so.1>, 0x3000) = 0x7f11088db000 <0.000044>
```

```
mmap(0x7f11088f2000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>, 0x1a000) = 0x7f11088f2000
<0.000031>
mmap(0x7f11088f6000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libgcc_s.so.1>, 0x1d000) = 0x7f11088f6000 <0.000026>
close(3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>) = 0 <0.000014>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>, "/lib/x86_64-linux-
gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3</usr/lib/x86_64-linux-gnu/libc.so.6>
<0.000021>
read(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\2\0\0\0\0\0"..., 832) =
832 <0.000016>
pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64)
= 784 <0.000016>
pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>, "\4\0\0\0
\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0"..., 48, 848) = 48
<0.000015>
pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\302\211\332Pq\2439\235\350\223\322\257\201\32
6\243\f"..., 68, 896) = 68 <0.000015>
newfstatat(3</usr/lib/x86_64-linux-gnu/libc.so.6>, "", {st_mode=S_IFREG|0755,
st_size=2220400, ...}, AT_EMPTY_PATH) = 0 <0.000016>
pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64)
= 784 <0.000016>
mmap(NULL, 2264656, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3</usr/lib/x86_64-
linux-gnu/libc.so.6>, 0) = 0x7f1108200000 <0.000024>
mprotect(0x7f1108228000, 2023424, PROT_NONE) = 0 <0.000032>
mmap(0x7f1108228000, 1658880, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libc.so.6>,
0x28000) = 0x7f1108228000 <0.000028>
mmap(0x7f11083bd000, 360448, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libc.so.6>, 0x1bd000) = 0x7f11083bd000 <0.000024>
mmap(0x7f1108416000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libc.so.6>,
0x215000) = 0x7f1108416000 <0.000025>
mmap(0x7f110841c000, 52816, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f110841c000 <0.000023>
close(3</usr/lib/x86_64-linux-gnu/libc.so.6>) = 0 <0.000014>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>, "/lib/x86_64-linux-
gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3</usr/lib/x86_64-linux-gnu/libm.so.6>
<0.000020>
read(3</usr/lib/x86_64-linux-gnu/libm.so.6>,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0"..., 832) =
832 <0.000016>
newfstatat(3</usr/lib/x86_64-linux-gnu/libm.so.6>, "", {st_mode=S_IFREG|0644,
st_size=940560, ...}, AT_EMPTY_PATH) = 0 <0.000016>
mmap(NULL, 942344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3</usr/lib/x86_64-
linux-gnu/libm.so.6>, 0) = 0x7f1108519000 <0.000026>
mmap(0x7f1108527000, 507904, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libm.so.6>,
0xe000) = 0x7f1108527000 <0.000037>
mmap(0x7f11085a3000, 372736, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libm.so.6>, 0x8a000) = 0x7f11085a3000 <0.000030>
mmap(0x7f11085fe000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libm.so.6>,
0xe4000) = 0x7f11085fe000 <0.000028>
close(3</usr/lib/x86_64-linux-gnu/libm.so.6>) = 0 <0.000014>
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f11088d6000 <0.000022>
arch_prctl(ARCH_SET_FS, 0x7f11088d73c0) = 0 <0.000014>
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set_tid_address(0x7f11088d7690)         = 33152 <0.000014>
set_robust_list(0x7f11088d76a0, 24)     = 0 <0.000014>
rseq(0x7f11088d7d60, 0x20, 0, 0x53053053) = 0 <0.000014>
mprotect(0x7f1108416000, 16384, PROT_READ) = 0 <0.000030>
mprotect(0x7f11085fe000, 4096, PROT_READ) = 0 <0.000025>
mprotect(0x7f11088f6000, 4096, PROT_READ) = 0 <0.000030>
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f11088d4000 <0.000024>
mprotect(0x7f110881b000, 45056, PROT_READ) = 0 <0.000038>
mprotect(0x5612afcf2000, 4096, PROT_READ) = 0 <0.000032>
mprotect(0x7f110894e000, 8192, PROT_READ) = 0 <0.000034>
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0 <0.000015>
munmap(0x7f11088f8000, 112403)          = 0 <0.000043>
getrandom("\xd7\x1d\xa4\xdf\x06\x2c\xba\x76", 8, GRND_NONBLOCK) = 8
<0.000021>
brk(NULL)                               = 0x5612b008b000 <0.000014>
brk(0x5612b00ac000)                     = 0x5612b00ac000 <0.000019>
futex(0x7f110882977c, FUTEX_WAKE_PRIVATE, 2147483647) = 0 <0.000014>
newfstatat(0</dev/pts/2>, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88,
0x2), ...}, AT_EMPTY_PATH) = 0 <0.000017>
read(0</dev/pts/2>, qqq.txt
"qqq.txt\n", 1024)  = 8 <8.232917>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>, "qqq.txt",
O_RDONLY) = 3</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt> <0.000021>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.shared_memoryW", O_RDWR|O_NOFOLLOW) = -1 ENOENT (Нет такого
файла или каталога) <0.000337>
getrandom("\x08\xf2\x8f\x5f\x23\xce\x63\xfb", 8, GRND_NONBLOCK) = 8
<0.000016>
getrandom("\x89\xf9\x87\xdc\xae\x3a\xe4\x84", 8, GRND_NONBLOCK) = 8
<0.000015>
newfstatat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.tjUO3b", 0x7ffdc7991550, AT_SYMLINK_NOFOLLOW) = -1 ENOENT (Нет
такого файла или каталога) <0.000021>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.tjUO3b", O_RDWR|O_CREAT|O_EXCL, 0600) = 4</dev/shm/sem.tjUO3b>
<0.000031>
write(4</dev/shm/sem.tjUO3b>,
"\1\0\0\0\0\0\0\200\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0", 32) =
32 <0.000025>
mmap(NULL, 32, PROT_READ|PROT_WRITE, MAP_SHARED, 4</dev/shm/sem.tjUO3b>, 0) =
0x7f110894d000 <0.000033>
link("/dev/shm/sem.tjUO3b", "/dev/shm/sem.shared_memoryW") = 0 <0.000024>
newfstatat(4</dev/shm/sem.tjUO3b>, "", {st_mode=S_IFREG|0600, st_size=32,
...}, AT_EMPTY_PATH) = 0 <0.000658>
unlink("/dev/shm/sem.tjUO3b")           = 0 <0.000027>
close(4</dev/shm/sem.tjUO3b (deleted)>) = 0 <0.000016>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.shared_memoryR", O_RDWR|O_NOFOLLOW) = -1 ENOENT (Нет такого
файла или каталога) <0.000043>
getrandom("\xb6\x7c\xba\x13\x1e\xb4\x9e\x3c", 8, GRND_NONBLOCK) = 8
<0.000022>
newfstatat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.aH4jcO", 0x7ffdc7991550, AT_SYMLINK_NOFOLLOW) = -1 ENOENT (Нет
такого файла или каталога) <0.000027>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.aH4jcO", O_RDWR|O_CREAT|O_EXCL, 0600) = 4</dev/shm/sem.aH4jcO>
<0.000038>
write(4</dev/shm/sem.aH4jcO>,
"\0\0\0\0\0\0\0\200\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0", 32) =
32 <0.000037>
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```
mmap(NULL, 32, PROT_READ|PROT_WRITE, MAP_SHARED, 4</dev/shm/sem.aH4jcO>, 0) =
0x7f1108913000 <0.000045>
link("/dev/shm/sem.aH4jcO", "/dev/shm/sem.shared_memoryR") = 0 <0.000033>
newfstatat(4</dev/shm/sem.aH4jcO>, "", {st_mode=S_IFREG|0600, st_size=32,
...}, AT_EMPTY_PATH) = 0 <0.000025>
unlink("/dev/shm/sem.aH4jcO")           = 0 <0.000027>
close(4</dev/shm/sem.aH4jcO (deleted)>) = 0 <0.000022>
openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/shared_memory", O_RDWR|O_CREAT|O_NOFOLLOW|O_CLOEXEC, 0600) =
4</dev/shm/shared_memory> <0.000035>
ftruncate(4</dev/shm/shared_memory>, 8) = 0 <0.000026>
mmap(NULL, 8, PROT_WRITE, MAP_SHARED, 4</dev/shm/shared_memory>, 0) =
0x7f1108912000 <0.000060>
clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD,
child_tidptr=0x7f11088d7690) = 33191 <0.000304>
close(3</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt>) = 0 <0.000021>
futex(0x7f1108913000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0, NULL,
FUTEX_BITSET_MATCH_ANYstrace: Process 33191 attached
 <unfinished ...>
[pid 33191] set_robust_list(0x7f11088d76a0, 24) = 0 <0.000021>
[pid 33191] dup2(3</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt>,
0</dev/pts/2>) = 0</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt>
<0.000022>
[pid 33191] close(3</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt>) = 0
<0.000020>
[pid 33191] execve("child_lab3", ["child"], 0x7ffdc7991bb8 /* 62 vars */) = 0
<0.002102>
[pid 33191] brk(NULL)                   = 0x55c89ca65000 <0.000020>
[pid 33191] arch_prctl(0x3001 /* ARCH_??? */, 0x7fffdd428f10) = -1 EINVAL
(Недопустимый аргумент) <0.017080>
[pid 33191] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS,
-1, 0) = 0x7f6986ed8000 <0.000304>
[pid 33191] access("/etc/ld.so.preload", R_OK) = -1 ENOENT (Нет такого файла
или каталога) <0.000034>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3</etc/ld.so.cache> <0.000050>
[pid 33191] newfstatat(3</etc/ld.so.cache>, "", {st_mode=S_IFREG|0644,
st_size=112403, ...}, AT_EMPTY_PATH) = 0 <0.000038>
[pid 33191] mmap(NULL, 112403, PROT_READ, MAP_PRIVATE, 3</etc/ld.so.cache>,
0) = 0x7f6986ebc000 <0.000044>
[pid 33191] close(3</etc/ld.so.cache>)  = 0 <0.000059>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) =
3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30> <0.000041>
[pid 33191] read(3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0"..., 832) =
832 <0.000258>
[pid 33191] newfstatat(3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>, "",
{st_mode=S_IFREG|0644, st_size=2260296, ...}, AT_EMPTY_PATH) = 0 <0.000044>
[pid 33191] mmap(NULL, 2275520, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>, 0) = 0x7f6986c00000
<0.000045>
[pid 33191] mprotect(0x7f6986c9a000, 1576960, PROT_NONE) = 0 <0.000062>
[pid 33191] mmap(0x7f6986c9a000, 1118208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libstdc++.so.6.0.30>, 0x9a000) = 0x7f6986c9a000 <0.000043>
[pid 33191] mmap(0x7f6986dab000, 454656, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libstdc++.so.6.0.30>, 0x1ab000) = 0x7f6986dab000 <0.000039>
[pid 33191] mmap(0x7f6986e1b000, 57344, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libstdc++.so.6.0.30>, 0x21a000) = 0x7f6986e1b000 <0.000048>
```

```
[pid 33191] mmap(0x7f6986e29000, 10432, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f6986e29000 <0.000046>
[pid 33191] close(3</usr/lib/x86_64-linux-gnu/libstdc++.so.6.0.30>) = 0
<0.000024>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) =
3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1> <0.000032>
[pid 33191] read(3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>,
"\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0"..., 832) =
832 <0.000025>
[pid 33191] newfstatat(3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>, "",
{st_mode=S_IFREG|0644, st_size=125488, ...}, AT_EMPTY_PATH) = 0 <0.000029>
[pid 33191] mmap(NULL, 127720, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>, 0) = 0x7f6986e9c000 <0.000087>
[pid 33191] mmap(0x7f6986e9f000, 94208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libgcc_s.so.1>, 0x3000) = 0x7f6986e9f000 <0.000064>
[pid 33191] mmap(0x7f6986eb6000, 16384, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libgcc_s.so.1>, 0x1a000) = 0x7f6986eb6000 <0.000089>
[pid 33191] mmap(0x7f6986eba000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-
gnu/libgcc_s.so.1>, 0x1d000) = 0x7f6986eba000 <0.000037>
[pid 33191] close(3</usr/lib/x86_64-linux-gnu/libgcc_s.so.1>) = 0 <0.000023>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3</usr/lib/x86_64-
linux-gnu/libc.so.6> <0.000037>
[pid 33191] read(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\2\0\0\0\0\0"..., 832) =
832 <0.000050>
[pid 33191] pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64)
= 784 <0.000010>
[pid 33191] pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>, "\4\0\0\0
\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0"..., 48, 848) = 48
<0.000009>
[pid 33191] pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\302\211\332Pq\2439\235\350\223\322\257\201\32
6\243\f"..., 68, 896) = 68 <0.000044>
[pid 33191] newfstatat(3</usr/lib/x86_64-linux-gnu/libc.so.6>, "",
{st_mode=S_IFREG|0755, st_size=2220400, ...}, AT_EMPTY_PATH) = 0 <0.000030>
[pid 33191] pread64(3</usr/lib/x86_64-linux-gnu/libc.so.6>,
"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64)
= 784 <0.000036>
[pid 33191] mmap(NULL, 2264656, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libc.so.6>, 0) = 0x7f6986800000 <0.000033>
[pid 33191] mprotect(0x7f6986828000, 2023424, PROT_NONE) = 0 <0.000028>
[pid 33191] mmap(0x7f6986828000, 1658880, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libc.so.6>,
0x28000) = 0x7f6986828000 <0.000319>
[pid 33191] mmap(0x7f69869bd000, 360448, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libc.so.6>,
0x1bd000) = 0x7f69869bd000 <0.000023>
[pid 33191] mmap(0x7f6986a16000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libc.so.6>,
0x215000) = 0x7f6986a16000 <0.000302>
[pid 33191] mmap(0x7f6986a1c000, 52816, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f6986a1c000 <0.000014>
[pid 33191] close(3</usr/lib/x86_64-linux-gnu/libc.so.6>) = 0 <0.000010>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3</usr/lib/x86_64-
linux-gnu/libm.so.6> <0.000015>
```

```
[pid 33191] read(3</usr/lib/x86_64-linux-gnu/libm.so.6>,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0"..., 832) =
832 <0.000011>
[pid 33191] newfstatat(3</usr/lib/x86_64-linux-gnu/libm.so.6>, "",
{st_mode=S_IFREG|0644, st_size=940560, ...}, AT_EMPTY_PATH) = 0 <0.000018>
[pid 33191] mmap(NULL, 942344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3</usr/lib/x86_64-linux-gnu/libm.so.6>, 0) = 0x7f6986b19000 <0.000032>
[pid 33191] mmap(0x7f6986b27000, 507904, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libm.so.6>,
0xe000) = 0x7f6986b27000 <0.000042>
[pid 33191] mmap(0x7f6986ba3000, 372736, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libm.so.6>,
0x8a000) = 0x7f6986ba3000 <0.000032>
[pid 33191] mmap(0x7f6986bfe000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3</usr/lib/x86_64-linux-gnu/libm.so.6>,
0xe4000) = 0x7f6986bfe000 <0.000029>
[pid 33191] close(3</usr/lib/x86_64-linux-gnu/libm.so.6>) = 0 <0.000019>
[pid 33191] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS,
-1, 0) = 0x7f6986e9a000 <0.000028>
[pid 33191] arch_prctl(ARCH_SET_FS, 0x7f6986e9b3c0) = 0 <0.000018>
[pid 33191] set_tid_address(0x7f6986e9b690) = 33191 <0.000018>
[pid 33191] set_robust_list(0x7f6986e9b6a0, 24) = 0 <0.000017>
[pid 33191] rseq(0x7f6986e9bd60, 0x20, 0, 0x53053053) = 0 <0.000018>
[pid 33191] mprotect(0x7f6986a16000, 16384, PROT_READ) = 0 <0.000032>
[pid 33191] mprotect(0x7f6986bfe000, 4096, PROT_READ) = 0 <0.000035>
[pid 33191] mprotect(0x7f6986eba000, 4096, PROT_READ) = 0 <0.000029>
[pid 33191] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS,
-1, 0) = 0x7f6986e98000 <0.000029>
[pid 33191] mprotect(0x7f6986e1b000, 45056, PROT_READ) = 0 <0.000033>
[pid 33191] mprotect(0x55c89c69e000, 4096, PROT_READ) = 0 <0.000066>
[pid 33191] mprotect(0x7f6986f12000, 8192, PROT_READ) = 0 <0.000051>
[pid 33191] prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0 <0.000018>
[pid 33191] munmap(0x7f6986ebc000, 112403) = 0 <0.000088>
[pid 33191] getrandom("\x07\xa0\xad\x23\xc3\x72\x9f\x71", 8, GRND_NONBLOCK) =
8 <0.000021>
[pid 33191] brk(NULL)                   = 0x55c89ca65000 <0.000060>
[pid 33191] brk(0x55c89ca86000)         = 0x55c89ca86000 <0.000063>
[pid 33191] futex(0x7f6986e2977c, FUTEX_WAKE_PRIVATE, 2147483647) = 0
<0.000019>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.shared_memoryW", O_RDWR|O_NOFOLLOW) =
3</dev/shm/sem.shared_memoryW> <0.000037>
[pid 33191] newfstatat(3</dev/shm/sem.shared_memoryW>, "",
{st_mode=S_IFREG|0600, st_size=32, ...}, AT_EMPTY_PATH) = 0 <0.000035>
[pid 33191] mmap(NULL, 32, PROT_READ|PROT_WRITE, MAP_SHARED,
3</dev/shm/sem.shared_memoryW>, 0) = 0x7f6986f11000 <0.000063>
[pid 33191] close(3</dev/shm/sem.shared_memoryW>) = 0 <0.000028>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/sem.shared_memoryR", O_RDWR|O_NOFOLLOW) =
3</dev/shm/sem.shared_memoryR> <0.000033>
[pid 33191] newfstatat(3</dev/shm/sem.shared_memoryR>, "",
{st_mode=S_IFREG|0600, st_size=32, ...}, AT_EMPTY_PATH) = 0 <0.000353>
[pid 33191] mmap(NULL, 32, PROT_READ|PROT_WRITE, MAP_SHARED,
3</dev/shm/sem.shared_memoryR>, 0) = 0x7f6986ed7000 <0.000034>
[pid 33191] close(3</dev/shm/sem.shared_memoryR>) = 0 <0.000022>
[pid 33191] openat(AT_FDCWD</home/anna/labs_3sem/os_labs/build/lab3>,
"/dev/shm/shared_memory", O_RDWR|O_CREAT|O_NOFOLLOW|O_CLOEXEC, 0600) =
3</dev/shm/shared_memory> <0.001982>
[pid 33191] ftruncate(3</dev/shm/shared_memory>, 8) = 0 <0.000025>
[pid 33191] mmap(NULL, 8, PROT_WRITE, MAP_SHARED, 3</dev/shm/shared_memory>,
0) = 0x7f6986ed6000 <0.000036>
```

```
[pid 33191] newfstatat(0</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt>,
"", {st_mode=S_IFREG|0664, st_size=28, ...}, AT_EMPTY_PATH) = 0 <0.000033>
[pid 33191] read(0</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt>, "10 1
5\n22 11 1\n53 53 1\n1 1 1", 4096) = 28 <0.000038>
[pid 33191] futex(0x7f6986ed7000, FUTEX_WAKE, 1 <unfinished ...>
[pid 33152] <... futex resumed>)        = 0 <0.038057>
[pid 33191] <... futex resumed>)        = 1 <0.000053>
[pid 33152] newfstatat(1</dev/pts/2>, "",  <unfinished ...>
[pid 33191] futex(0x7f6986f11000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0,
NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 33152] <... newfstatat resumed>{st_mode=S_IFCHR|0620,
st_rdev=makedev(0x88, 0x2), ...}, AT_EMPTY_PATH) = 0 <0.000039>
[pid 33152] write(1</dev/pts/2>, "2\n", 22
) = 2 <0.000017>
[pid 33152] futex(0x7f110894d000, FUTEX_WAKE, 1) = 1 <0.000018>
[pid 33191] <... futex resumed>)        = 0 <0.000185>
[pid 33152] futex(0x7f1108913000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0,
NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 33191] futex(0x7f6986ed7000, FUTEX_WAKE, 1 <unfinished ...>
[pid 33152] <... futex resumed>)        = -1 EAGAIN (Ресурс временно
недоступен) <0.000036>
[pid 33191] <... futex resumed>)        = 0 <0.000049>
[pid 33152] write(1</dev/pts/2>, "2\n", 2 <unfinished ...>
[pid 33191] futex(0x7f6986f11000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0,
NULL, FUTEX_BITSET_MATCH_ANY2
 <unfinished ...>
[pid 33152] <... write resumed>)        = 2 <0.000037>
[pid 33152] futex(0x7f110894d000, FUTEX_WAKE, 1) = 1 <0.000019>
[pid 33191] <... futex resumed>)        = 0 <0.000109>
[pid 33152] futex(0x7f1108913000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0,
NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 33191] futex(0x7f6986ed7000, FUTEX_WAKE, 1 <unfinished ...>
[pid 33152] <... futex resumed>)        = -1 EAGAIN (Ресурс временно
недоступен) <0.000042>
[pid 33191] <... futex resumed>)        = 0 <0.000044>
[pid 33152] write(1</dev/pts/2>, "1\n", 2 <unfinished ...>
1
[pid 33191] read(0</home/anna/labs_3sem/os_labs/build/lab3/qqq.txt>,
<unfinished ...>
[pid 33152] <... write resumed>)        = 2 <0.000063>
[pid 33191] <... read resumed>"", 4096) = 0 <0.000041>
[pid 33152] futex(0x7f1108913000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0,
NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 33191] futex(0x7f6986ed7000, FUTEX_WAKE, 1 <unfinished ...>
[pid 33152] <... futex resumed>)        = -1 EAGAIN (Ресурс временно
недоступен) <0.000042>
[pid 33191] <... futex resumed>)        = 0 <0.000044>
[pid 33152] write(1</dev/pts/2>, "1\n", 2 <unfinished ...>
1
[pid 33191] futex(0x7f6986f11000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0,
NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 33152] <... write resumed>)        = 2 <0.000052>
[pid 33152] futex(0x7f110894d000, FUTEX_WAKE, 1) = 1 <0.000018>
[pid 33191] <... futex resumed>)        = 0 <0.000141>
[pid 33152] futex(0x7f1108913000, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0,
NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 33191] futex(0x7f6986ed7000, FUTEX_WAKE, 1 <unfinished ...>
[pid 33152] <... futex resumed>)        = -1 EAGAIN (Ресурс временно
недоступен) <0.000055>
[pid 33191] <... futex resumed>)        = 0 <0.000058>
[pid 33152] wait4(-1,  <unfinished ...>
[pid 33191] munmap(0x7f6986ed7000, 32)  = 0 <0.000043>
[pid 33191] munmap(0x7f6986f11000, 32)  = 0 <0.000034>
```

```
[pid 33191] munmap(0x7f6986ed6000, 8)    = 0 <0.000023>
[pid 33191] exit_group(0)                = ?
[pid 33191] +++ exited with 0 +++
<... wait4 resumed>NULL, 0, NULL)        = 33191 <0.000726>
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=33191, si_uid=1000,
si_status=0, si_utime=0, si_stime=0} ---
unlink("/dev/shm/shared_memory")         = 0 <0.000022>
unlink("/dev/shm/sem.shared_memoryW")    = 0 <0.000017>
unlink("/dev/shm/sem.shared_memoryR")    = 0 <0.000015>
munmap(0x7f1108913000, 32)               = 0 <0.000074>
munmap(0x7f110894d000, 32)               = 0 <0.000049>
munmap(0x7f1108912000, 8)                = 0 <0.000021>
lseek(0</dev/pts/2>, -1, SEEK_CUR)       = -1 ESPIPE (Недопустимая операция
смещения) <0.000018>
exit_group(0)                            = ?
+++ exited with 0 +++
```

Выводы

В результате выполнения данной лабораторной работы получены навыки использования средства диагностики strace, с помощью которого можно отследить системные вызовы, выполняемые программой. Были улучшены навыки диагностики работы программного обеспечения.