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Институт №8 “Компьютерные науки и прикладная математика”
Кафедра №806 “Вычислительная математика и программирование”

Лабораторная работа №5 по курсу
«Операционные системы»

Группа: М8О-209БВ-24

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Оценка: _____

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Постановка задачи

Цель работы

Приобретение практических навыков диагностики работы программного обеспечения.

Задание

Продемонстрировать ключевые системные вызовы, которые используются в лабораторных работах и то, что их использование соответствует варианту ЛР.

Общий метод и алгоритм решения

Для наблюдения за взаимодействием программы с ядром операционной системы Linux используем утилиту strace. Эта отладочная утилита позволяет отслеживать системные вызовы, сигналы и изменения состояния процесса в реальном времени. Strace запускает целевую программу и выводит подробную информацию обо всех её обращениях к ядру, что особенно полезно при диагностике аварийных завершений или неожиданного поведения программы. Также в strace с помощью флагов можно вывести дополнительные данные:

- f – отслеживает дочерние процессы, если они будут созданы,
- r - выводить временную метку для каждого системного вызова,
- T - выводит длительность выполнения системного вызова

Протокол работы программы

Лабораторная работа №1

```
root → /workspace/laba1 $ strace -f -s 1000 ./parent
execve("./parent", ["/parent"], 0x7ffc20d169e8 /* 12 vars */) = 0
brk(NULL)                                = 0xae93000
brk(0xae93c40)                           = 0xae93c40
arch_prctl(ARCH_SET_FS, 0xae93300)      = 0
uname({ sysname="Linux", nodename="0e4263317ea3", ... }) = 0
readlink("/proc/self/exe", "/workspace/laba1/parent", 4096) = 23
brk(0xaeb4c40)                           = 0xaeb4c40
brk(0xaeb5000)                           = 0xaeb5000
mprotect(0x4b1000, 12288, PROT_READ)    = 0
pipe([3, 4])                             = 0
pipe([5, 6])                             = 0
pipe([7, 8])                             = 0
clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLDstrace:
Process 50 attached, child_tidptr=0xae935d0) = 50
[pid 49] clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD
<unfinished ...>
[pid 50] close(4)                        = 0
[pid 50] close(5strace: Process 51 attached<unfinished ...>
[pid 49] <... clone resumed>, child_tidptr=0xae935d0) = 51
[pid 49] close(3 <unfinished ...>
[pid 50] <... close resumed>            = 0
[pid 49] <... close resumed>            = 0
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[pid 51] close(6 <unfinished ...>
[pid 49] close(5 <unfinished ...>
[pid 50] close(7 <unfinished ...>
[pid 49] <... close resumed>    = 0
[pid 51] <... close resumed>    = 0
[pid 49] close(6 <unfinished ...>
[pid 50] <... close resumed>    = 0
[pid 49] <... close resumed>    = 0
[pid 51] close(7 <unfinished ...>
[pid 49] close(8 <unfinished ...>
[pid 50] close(8 <unfinished ...>
[pid 49] <... close resumed>    = 0
[pid 51] <... close resumed>    = 0
[pid 50] <... close resumed>    = 0
[pid 51] close(3)              = 0
[pid 50] dup2(3, 0 <unfinished ...>
[pid 51] close(4 <unfinished ...>
[pid 50] <... dup2 resumed>     = 0
[pid 51] <... close resumed>    = 0
[pid 51] dup2(5, 0 <unfinished ...>
[pid 50] dup2(6, 1 <unfinished ...>
[pid 51] <... dup2 resumed>     = 0
[pid 50] <... dup2 resumed>     = 1
[pid 51] dup2(8, 1)            = 1
[pid 50] execve("./child_1", ["child_1"], 0x7ffcf1f8738 /* 12 vars */ <unfinished
...>
[pid 51] execve("./child_2", ["child_2"], 0x7ffcf1f8738 /* 12 vars */ <unfinished
...>
[pid 49] fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
[pid 49] fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
[pid 49] write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265
\321\202\320\265\320\272\321\201\321\202                                \320\264\320\273\321\217
\320\276\320\261\321\200\320\260\320\261\320\276\321\202\320\272\320\270:      ",
53Введите текст для обработки: ) = 53
[pid 49] read(0, <unfinished ...>
[pid 50] <... execve resumed>    = 0
[pid 51] <... execve resumed>    = 0
[pid 50] brk(NULL)              = 0x30700000
[pid 50] brk(0x30700c40)        = 0x30700c40
[pid 51] brk(NULL)              = 0x20f4f000
[pid 51] brk(0x20f4fc40)        = 0x20f4fc40
[pid 50] arch_prctl(ARCH_SET_FS, 0x30700300) = 0
[pid 50] uname({sysname="Linux", nodename="0e4263317ea3", ...}) = 0
[pid 51] arch_prctl(ARCH_SET_FS, 0x20f4f300 <unfinished ...>
[pid 50] readlink("/proc/self/exe", <unfinished ...>
[pid 51] <... arch_prctl resumed> = 0
[pid 51] uname( <unfinished ...>

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[pid 50] <... readlink resumed>"/workspace/lab1/child_1", 4096) = 24
[pid 51] <... uname resumed>{sysname="Linux", nodename="0e4263317ea3", ...}) =
0
[pid 50] brk(0x30721c40) = 0x30721c40
[pid 50] brk(0x30722000) = 0x30722000
[pid 51] readlink("/proc/self/exe", <unfinished ...>
[pid 50] mprotect(0x4af000, 12288, PROT_READ <unfinished ...>
[pid 51] <... readlink resumed>"/workspace/lab1/child_2", 4096) = 24
[pid 50] <... mprotect resumed>) = 0
[pid 51] brk(0x20f70c40) = 0x20f70c40
[pid 51] brk(0x20f71000) = 0x20f71000
[pid 50] read(0, <unfinished ...>
[pid 51] mprotect(0x4af000, 12288, PROT_READ) = 0
[pid 51] read(0, hi my name is pedri and i am a professional football player
<unfinished ...>
[pid 49] <... read resumed>"hi my name is pedri and i am a professional football
player\n", 1024) = 63
[pid 49] write(4, "hi my name is pedri and i am a professional football player\0",
63) = 63
[pid 50] <... read resumed>"hi my name is pedri and i am a professional football
player\0", 255) = 63
[pid 49] close(4 <unfinished ...>
[pid 50] write(1, "HI MY NAME IS PEDRI AND I AM A PROFESSIONAL
FOOTBALL PLAYER\0", 63 <unfinished ...>
[pid 49] <... close resumed>) = 0
[pid 49] read(7, <unfinished ...>
[pid 50] <... write resumed>) = 63
[pid 51] <... read resumed>"HI MY NAME IS PEDRI AND I AM A
PROFESSIONAL FOOTBALL PLAYER\0", 255) = 63
[pid 51] write(1, "HI MY NAME IS PEDRI AND I AM A PROFESSIONAL
FOOTBALL PLAYER\0", 60 <unfinished ...>
[pid 49] <... read resumed>"HI MY NAME IS PEDRI AND I AM A
PROFESSIONAL FOOTBALL PLAYER\0", 255) = 60
[pid 51] <... write resumed>) = 60
[pid 49] write(1, "\320\237\320\276\320\273\321\203\321\207\320\265\320\275
\321\200\320\265\320\267\321\203\320\273\321\214\321\202\320\260\321\202
\320\270\320\267 child_2: 'HI MY NAME IS PEDRI AND I AM A PROFESSIONAL
FOOTBALL PLAYER'\n", 110Получен резултат из child_2: 'HI MY NAME IS
PEDRI AND I AM A PROFESSIONAL FOOTBALL PLAYER'
) = 110
[pid 49] close(7) = 0
[pid 49] wait4(50, <unfinished ...>
[pid 50] exit_group(0 <unfinished ...>
[pid 51] exit_group(0 <unfinished ...>
[pid 50] <... exit_group resumed>) = ?
[pid 51] <... exit_group resumed>) = ?
[pid 50] +++ exited with 0 +++

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[pid 51] +++ exited with 0 +++
<... wait4 resumed>NULL, 0, NULL) = 50
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=50, si_uid=0,
si_status=0, si_utime=0, si_stime=0} ---
wait4(51, NULL, 0, NULL) = 51
write(1,
"\320\237\321\200\320\276\320\263\321\200\320\260\320\274\320\274\320\260
\320\267\320\260\320\262\320\265\321\200\321\210\320\265\320\275\320\260.\n",
39Программа завершена.
) = 39
exit_group(0) = ?
+++ exited with 0 +++

```

Лабораторная работа № 2

```

30      18:01:58.486713  execve("./tim_sort", [ "./tim_sort", "-t", "4",
"random_numbers.txt"], 0x7ffd77fb5840 /* 12 vars */) = 0 <0.052397>
30      18:01:58.549896  brk(NULL) = 0x646cac41d000 <0.000064>
30      18:01:58.550966  access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file
or directory) <0.000055>
30      18:01:58.554589  openat(AT_FDCWD, "/etc/ld.so.cache",
O_RDONLY|O_CLOEXEC) = 3 <0.000232>
30      18:01:58.558779  fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
<0.000174>
30      18:01:58.560979  mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) =
0x7a2c7496c000 <0.000141>
30      18:01:58.562554  close(3) = 0 <0.000097>
30      18:01:58.564347  openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libpthread.so.0",
O_RDONLY|O_CLOEXEC) = 3 <0.001011>
30      18:01:58.568838  read(3, "\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...", 832) = 832 <0.000111>
30      18:01:58.571041  fstat(3, {st_mode=S_IFREG|0755, st_size=149520, ...}) = 0
<0.000256>
30      18:01:58.573950  mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7a2c7496a000 <0.000436>
30      18:01:58.577394  mmap(NULL, 136304, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7a2c74948000 <0.000384>
30      18:01:58.580541  mmap(0x7a2c7494e000, 65536, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x6000) = 0x7a2c7494e000
<0.000608>
30      18:01:58.587652  mmap(0x7a2c7495e000, 24576, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x16000) = 0x7a2c7495e000
<0.000388>
30      18:01:58.592978  mmap(0x7a2c74964000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b000) = 0x7a2c74964000
<0.000178>

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30 18:01:58.595967 mmap(0x7a2c74966000, 13424, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7a2c74966000
<0.000167>
30 18:01:58.598294 close(3) = 0 <0.000241>
30 18:01:58.601070 openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6",
O_RDONLY|O_CLOEXEC) = 3 <0.000136>
30 18:01:58.602393 read(3,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260>\2\0\0\0\0"..., 832) = 832 <0.000042>
30 18:01:58.603447 fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
<0.000063>
30 18:01:58.604380 mmap(NULL, 1914496, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7a2c74774000 <0.000092>
30 18:01:58.605368 mmap(0x7a2c74796000, 1413120, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x7a2c74796000
<0.000069>
30 18:01:58.606083 mmap(0x7a2c748ef000, 323584, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17b000) = 0x7a2c748ef000
<0.000055>
30 18:01:58.607461 mmap(0x7a2c7493e000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c9000) = 0x7a2c7493e000
<0.000176>
30 18:01:58.609290 mmap(0x7a2c74944000, 13952, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7a2c74944000
<0.000085>
30 18:01:58.610612 close(3) = 0 <0.000189>
30 18:01:58.613008 mmap(NULL, 12288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7a2c74771000 <0.000288>
30 18:01:58.614584 arch_prctl(ARCH_SET_FS, 0x7a2c74771740) = 0 <0.000104>
30 18:01:58.615933 mprotect(0x7a2c7493e000, 16384, PROT_READ) = 0
<0.000086>
30 18:01:58.618132 mprotect(0x7a2c74964000, 4096, PROT_READ) = 0 <0.000554>
30 18:01:58.621168 mprotect(0x646c8ddb4000, 4096, PROT_READ) = 0 <0.000092>
30 18:01:58.622600 mprotect(0x7a2c7499c000, 4096, PROT_READ) = 0 <0.000213>
30 18:01:58.626560 munmap(0x7a2c7496c000, 21784) = 0 <0.000357>
30 18:01:58.630393 set_tid_address(0x7a2c74771a10) = 30 <0.000247>
30 18:01:58.633026 set_robust_list(0x7a2c74771a20, 24) = 0 <0.000109>
30 18:01:58.634106 rt_sigaction(SIGRTMIN, {sa_handler=0x7a2c7494e690,
sa_mask=[], sa_flags=SA_RESTORER|SA_SIGINFO, sa_restorer=0x7a2c7495b140},
NULL, 8) = 0 <0.000218>
30 18:01:58.635158 rt_sigaction(SIGRT_1, {sa_handler=0x7a2c7494e730,
sa_mask=[], sa_flags=SA_RESTORER|SA_RESTART|SA_SIGINFO,
sa_restorer=0x7a2c7495b140}, NULL, 8) = 0 <0.000099>
30 18:01:58.636314 rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
<0.000036>
30 18:01:58.638222 prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0 <0.000325>

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30 18:01:58.640841 fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0),
...}) = 0 <0.000147>
30 18:01:58.643108 brk(NULL) = 0x646cac41d000 <0.000144>
30 18:01:58.644756 brk(0x646cac43e000) = 0x646cac43e000 <0.000064>
30 18:01:58.646091 write(1,
"\320\234\320\260\320\272\321\201\320\270\320\274\320\260\320\273\321\214\320\275\32
0\276\321\207\320\270\321\201\320\273\320"..., 52) = 52 <0.000095>
30 18:01:58.647342 openat(AT_FDCWD, "random_numbers.txt", O_RDONLY) = 3
<0.024967>
30 18:01:58.673836 fstat(3, {st_mode=S_IFREG|0644, st_size=384, ...}) = 0
<0.001166>
30 18:01:58.675949 read(3, "320 725 933 70 7 44 182 567 875 "..., 512) = 384
<0.001083>
30 18:01:58.678165 read(3, "", 512) = 0 <0.000569>
30 18:01:58.679804 lseek(3, 0, SEEK_SET) = 0 <0.000054>
30 18:01:58.681059 write(1,
"\320\236\320\261\320\275\320\260\321\200\321\203\320\266\320\265\320\275\320\276
100\321\207\320\270\321\201\320"..., 50) = 50 <0.000057>
30 18:01:58.682523 read(3, "320 725 933 70 7 44 182 567 875 "..., 512) = 384
<0.000700>
30 18:01:58.684215 read(3, "", 512) = 0 <0.000379>
30 18:01:58.685795 close(3) = 0 <0.002076>
30 18:01:58.688563 write(1,
"\320\234\320\270\320\275\320\270\320\274\320\260\320\273\321\214\320\275\321\213\32
0\271\321\200\320\260\320\267\320\274\320"..., 62) = 62 <0.000071>
30 18:01:58.689492 write(1,
"\320\232\320\276\320\273\320\270\321\207\320\265\321\201\321\202\320\262\320\276
\320\277\320\276\320\264\320\274\320\260\321"..., 51) = 51 <0.000064>
30 18:01:58.690269 mmap(NULL, 8392704, PROT_NONE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7a2c73f70000
<0.000059>
30 18:01:58.691184 mprotect(0x7a2c73f71000, 8388608,
PROT_READ|PROT_WRITE) = 0 <0.000047>
30 18:01:58.692290 clone(child_stack=0x7a2c7476ffb0,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|C
LONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLE
ARTID, parent_tid=[31], tls=0x7a2c74770700, child_tidptr=0x7a2c747709d0) = 31
<0.000707>
31 18:01:58.694304 set_robust_list(0x7a2c747709e0, 24 <unfinished ...>
30 18:01:58.695056 mmap(NULL, 8392704, PROT_NONE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>
31 18:01:58.695530 <... set_robust_list resumed>) = 0 <0.000495>
30 18:01:58.696013 <... mmap resumed>) = 0x7a2c7376f000 <0.000500>
31 18:01:58.696518 madvise(0x7a2c73f70000, 8368128, MADV_DONTNEED
<unfinished ...>
30 18:01:58.696985 mprotect(0x7a2c73770000, 8388608,
PROT_READ|PROT_WRITE <unfinished ...>

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31 18:01:58.697437 <... advise resumed>) = 0 <0.000470>
30 18:01:58.697795 <... mprotect resumed>) = 0 <0.000363>
31 18:01:58.698297 exit(0 <unfinished ...>
30 18:01:58.698806 clone(child_stack=0x7a2c73f6efb0,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|C
LONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLE
ARTID <unfinished ...>
31 18:01:58.699478 <... exit resumed>) = ?
30 18:01:58.699856 <... clone resumed>, parent_tid=[32], tls=0x7a2c73f6f700,
child_tidptr=0x7a2c73f6f9d0) = 32 <0.000719>
32 18:01:58.700269 set_robust_list(0x7a2c73f6f9e0, 24 <unfinished ...>
31 18:01:58.700677 +++ exited with 0 +++
30 18:01:58.701214 futex(0x7a2c73f6f9d0, FUTEX_WAIT, 32, NULL <unfinished
...>
32 18:01:58.701499 <... set_robust_list resumed>) = 0 <0.000835>
32 18:01:58.701728 madvise(0x7a2c7376f000, 8368128, MADV_DONTNEED) = 0
<0.000042>
32 18:01:58.702586 exit(0) = ?
30 18:01:58.703390 <... futex resumed>) = 0 <0.001904>
32 18:01:58.703710 +++ exited with 0 +++
30 18:01:58.704032 clone(child_stack=0x7a2c73f6efb0,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|C
LONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLE
ARTID, parent_tid=[33], tls=0x7a2c73f6f700, child_tidptr=0x7a2c73f6f9d0) = 33
<0.000166>
30 18:01:58.704935 futex(0x7a2c73f6f9d0, FUTEX_WAIT, 33, NULL <unfinished
...>
33 18:01:58.705311 set_robust_list(0x7a2c73f6f9e0, 24) = 0 <0.000035>
33 18:01:58.706041 mmap(NULL, 134217728, PROT_NONE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7a2c6b76f000
<0.000058>
33 18:01:58.706829 munmap(0x7a2c6b76f000, 8982528) = 0 <0.000064>
33 18:01:58.707597 munmap(0x7a2c70000000, 58126336) = 0 <0.000052>
33 18:01:58.708191 mprotect(0x7a2c6c000000, 135168,
PROT_READ|PROT_WRITE) = 0 <0.000051>
33 18:01:58.708962 madvise(0x7a2c7376f000, 8368128, MADV_DONTNEED) = 0
<0.000054>
33 18:01:58.709904 exit(0) = ?
30 18:01:58.710949 <... futex resumed>) = 0 <0.005649>
33 18:01:58.711183 +++ exited with 0 +++
30 18:01:58.711439 write(1,
"\320\236\321\202\321\201\320\276\321\200\321\202\320\270\321\200\320\276\320\262\32
0\260\320\275\320\275\321\213\320\271 \320"..., 432) = 432 <0.000100>
30 18:01:58.712812 write(1, "\320\222\321\200\320\265\320\274\321\217
\321\200\320\260\320\261\320\276\321\202\321\213: 0.02248"..., 47) = 47 <0.000261>
30 18:01:58.715148 exit_group(0) = ?
30 18:01:58.718956 +++ exited with 0 +++

```


Лабораторная работа №3

```
root → /workspace/laba3 $ strace -f ./shared_memory_example
execve("./shared_memory_example", ["/shared_memory_example"], 0x7ffc051e60b8
/* 12 vars */) = 0
brk(NULL) = 0x5ec559066000
access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) = 0x79563f7bd000
close(3) = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/librt.so.1", O_RDONLY|O_CLOEXEC) =
3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260#\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=35808, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x79563f7bb000
mmap(NULL, 39904, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x79563f7b1000
mmap(0x79563f7b3000, 16384, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x79563f7b3000
mmap(0x79563f7b7000, 8192, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x6000) = 0x79563f7b7000
mmap(0x79563f7b9000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x7000) = 0x79563f7b9000
close(3) = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libpthread.so.0",
O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\1\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=149520, ...}) = 0
mmap(NULL, 136304, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x79563f78f000
mmap(0x79563f795000, 65536, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x6000) = 0x79563f795000
mmap(0x79563f7a5000, 24576, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x16000) = 0x79563f7a5000
mmap(0x79563f7ab000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b000) = 0x79563f7ab000
mmap(0x79563f7ad000, 13424, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x79563f7ad000
close(3) = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) =
3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\3\0>\0\1\0\0\0\260>\2\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
mmap(NULL, 1914496, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x79563f5bb000
```

```

    mmap(0x79563f5dd000,          1413120,          PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x79563f5dd000
    mmap(0x79563f736000,          323584,          PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17b000) = 0x79563f736000
    mmap(0x79563f785000,          24576,          PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c9000) = 0x79563f785000
    mmap(0x79563f78b000,          13952,          PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x79563f78b000
    close(3)                        = 0
    mmap(NULL,                    12288,          PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x79563f5b8000
    arch_prctl(ARCH_SET_FS, 0x79563f5b8740) = 0
    mprotect(0x79563f785000, 16384, PROT_READ) = 0
    mprotect(0x79563f7ab000, 4096, PROT_READ) = 0
    mprotect(0x79563f7b9000, 4096, PROT_READ) = 0
    mprotect(0x5ec5365e7000, 4096, PROT_READ) = 0
    mprotect(0x79563f7ed000, 4096, PROT_READ) = 0
    munmap(0x79563f7bd000, 21784)      = 0
    set_tid_address(0x79563f5b8a10)    = 145
    set_robust_list(0x79563f5b8a20, 24) = 0
    rt_sigaction(SIGRTMIN, {sa_handler=0x79563f795690, sa_mask=[],
sa_flags=SA_RESTORER|SA_SIGINFO, sa_restorer=0x79563f7a2140}, NULL, 8) = 0
    rt_sigaction(SIGRT_1, {sa_handler=0x79563f795730, sa_mask=[],
sa_flags=SA_RESTORER|SA_RESTART|SA_SIGINFO, sa_restorer=0x79563f7a2140},
NULL, 8) = 0
    rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
    prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0
    statfs("/dev/shm/", {f_type=TMPFS_MAGIC, f_bsize=4096, f_blocks=16384,
f_bfree=16384, f_bavail=16384, f_files=1001495, f_ffree=1001494,
f_fsid={val=[3884477280, 1800598335]}, f_namelen=255, f_fsize=4096,
f_flags=ST_VALID|ST_NOSUID|ST_NODEV|ST_NOEXEC|ST_RELATIME}) = 0
    futex(0x79563f7b0410, FUTEX_WAKE_PRIVATE, 2147483647) = 0
    openat(AT_FDCWD, "/dev/shm/my_shared_memory",
O_RDWR|O_CREAT|O_NOFOLLOW|O_CLOEXEC, 0666) = 3
    ftruncate(3, 864)              = 0
    mmap(NULL, 864, PROT_READ|PROT_WRITE, MAP_SHARED, 3, 0) =
0x79563f7ec000
    fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
    brk(NULL)                      = 0x5ec559066000
    brk(0x5ec559087000)           = 0x5ec559087000
    fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
    write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265
\321\201\321\202\321\200\320\276\320\272\321\203 \320\264\320\273"...
, 55Введите строку для обработки: ) = 55
    read(0, egor likes FOOTBALL
"egor likes FOOTBALL\n", 1024) = 22

```

```

    clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLDstrace:
Process 146 attached
    , child_tidptr=0x79563f5b8a10) = 146
    [pid 145] clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD
<unfinished ...>
    [pid 146] set_robust_list(0x79563f5b8a20, 24) = 0
    strace: Process 147 attached
    [pid 145] <... clone resumed>, child_tidptr=0x79563f5b8a10) = 147
    [pid 147] set_robust_list(0x79563f5b8a20, 24 <unfinished ...>
    [pid 146] exit_group(0 <unfinished ...>
    [pid 145] futex(0x79563f7ec040,
FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0, NULL,
FUTEX_BITSET_MATCH_ANY <unfinished ...>
    [pid 147] <... set_robust_list resumed>) = 0
    [pid 146] <... exit_group resumed>) = ?
    [pid 147] futex(0x79563f7ec040, FUTEX_WAKE, 1 <unfinished ...>
    [pid 146] +++ exited with 0 +++
    [pid 145] <... futex resumed>) = ? ERESTARTSYS (To be restarted if
SA_RESTART is set)
    [pid 147] <... futex resumed>) = 0
    [pid 145] --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=146,
si_uid=0, si_status=0, si_etime=0, si_stime=0} ---
    [pid 145] futex(0x79563f7ec040,
FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 0, NULL,
FUTEX_BITSET_MATCH_ANY <unfinished ...>
    [pid 147] exit_group(0 <unfinished ...>
    [pid 145] <... futex resumed>) = -1 EAGAIN (Resource temporarily unavailable)
    [pid 147] <... exit_group resumed>) = ?
    [pid 145] wait4(146, NULL, 0, NULL) = 146
    [pid 145] wait4(147, <unfinished ...>
    [pid 147] +++ exited with 0 +++
    <... wait4 resumed>NULL, 0, NULL) = 147
    --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=147, si_uid=0,
si_status=0, si_etime=0, si_stime=0} ---
    write(1,
"\320\240\320\265\320\267\321\203\320\273\321\214\321\202\320\260\321\202:
EGOR
LIKES F"..., 40Результат: EGOR LIKES FOOTBALL
) = 40
    munmap(0x79563f7ec000, 864) = 0
    close(3) = 0
    unlink("/dev/shm/my_shared_memory") = 0
    exit_group(0)

```

Лабораторная работа №4

Static.c

static.c

```
150     execve("/usr/bin/env", ["env", "LD_LIBRARY_PATH=.", "./static"],
0x7fff4a7f6428 /* 12 vars */) = 0
150  brk(NULL)                = 0x601985fc5000
150  access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)
150  openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
150  fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
150      mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) =
0x7789b1dda000
150  close(3)                  = 0
150      openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6",
O_RDONLY|O_CLOEXEC) = 3
150  read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260>\2\0\0\0\0"...
832) = 832
150  fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
150      mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7789b1dd8000
150      mmap(NULL, 1914496, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7789b1c04000
150      mmap(0x7789b1c26000, 1413120, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x7789b1c26000
150      mmap(0x7789b1d7f000, 323584, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17b000) = 0x7789b1d7f000
150      mmap(0x7789b1dce000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c9000) = 0x7789b1dce000
150      mmap(0x7789b1dd4000, 13952, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7789b1dd4000
150  close(3)                  = 0
150  arch_prctl(ARCH_SET_FS, 0x7789b1dd9580) = 0
150  mprotect(0x7789b1dce000, 16384, PROT_READ) = 0
150  mprotect(0x60196b3a1000, 4096, PROT_READ) = 0
150  mprotect(0x7789b1e0a000, 4096, PROT_READ) = 0
150  munmap(0x7789b1dda000, 21784) = 0
150  brk(NULL)                = 0x601985fc5000
150  brk(0x601985fe6000)       = 0x601985fe6000
150  execve("./static", ["./static"], 0x601985fc5400 /* 13 vars */) = 0
150  brk(NULL)                = 0x5de7a0443000
150  access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)
150  openat(AT_FDCWD, "/tls/haswell/x86_64/lib1.so", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
150  openat(AT_FDCWD, "/tls/haswell/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
150  openat(AT_FDCWD, "/tls/x86_64/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
```

```

150 openat(AT_FDCWD, "./tls/lib1.so", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
150 openat(AT_FDCWD, "./haswell/x86_64/lib1.so", O_RDONLY|O_CLOEXEC) = -
1 ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./haswell/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./x86_64/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./lib1.so", O_RDONLY|O_CLOEXEC) = 3
150 read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\20\0\0\0\0\0"... , 832)
= 832
150 fstat(3, {st_mode=S_IFREG|0755, st_size=15920, ...}) = 0
150 mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7aa25e722000
150 getcwd("/workspace/laba4", 128) = 17
150 mmap(NULL, 16432, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3, 0) = 0x7aa25e71d000
150 mmap(0x7aa25e71e000, 4096, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) = 0x7aa25e71e000
150 mmap(0x7aa25e71f000, 4096, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7aa25e71f000
150 mmap(0x7aa25e720000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7aa25e720000
150 close(3) = 0
150 openat(AT_FDCWD, "./tls/haswell/x86_64/libc.so.6",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./tls/haswell/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./tls/x86_64/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./tls/libc.so.6", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
150 openat(AT_FDCWD, "./haswell/x86_64/libc.so.6", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./haswell/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./x86_64/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
150 openat(AT_FDCWD, "./libc.so.6", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
150 openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
150 fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
150 mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7aa25e717000
150 close(3) = 0
150 openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6",
O_RDONLY|O_CLOEXEC) = 3

```

```

150 read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260>\2\0\0\0\0\0"..., 832)
= 832
150 fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
150          mmap(NULL,          1914496,          PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7aa25e543000
150          mmap(0x7aa25e565000,  1413120,  PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x7aa25e565000
150          mmap(0x7aa25e6be000,  323584,  PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17b000) = 0x7aa25e6be000
150          mmap(0x7aa25e70d000,  24576,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c9000) = 0x7aa25e70d000
150          mmap(0x7aa25e713000,  13952,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7aa25e713000
150 close(3) = 0
150          mmap(NULL, 12288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7aa25e540000
150 arch_prctl(ARCH_SET_FS, 0x7aa25e540740) = 0
150 mprotect(0x7aa25e70d000, 16384, PROT_READ) = 0
150 mprotect(0x7aa25e720000, 4096, PROT_READ) = 0
150 mprotect(0x5de763383000, 4096, PROT_READ) = 0
150 mprotect(0x7aa25e74e000, 4096, PROT_READ) = 0
150 munmap(0x7aa25e717000, 21784) = 0
150 fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
150 brk(NULL) = 0x5de7a0443000
150 brk(0x5de7a0464000) = 0x5de7a0464000
150 read(0, "1 11 121\n", 1024) = 9
150 fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
150 write(1, "11\n", 3) = 3
150 read(0, "2 3\n", 1024) = 4
150 write(1, "11\n", 3) = 3
150 read(0, 0x5de7a04432a0, 1024) = ? ERESTARTSYS (To be restarted if
SA_RESTART is set)
150 --- SIGINT {si_signo=SIGINT, si_code=SI_KERNEL} ---
150 +++ killed by SIGINT +++

```

Dynamic.c

dlopen.c

```

root → /workspace/laba4 $ strace -f -o dynamic.trace env LD_LIBRARY_PATH=.
./dynamic
1 121 11
11
2 3
11
0
СМЕНЯ ПРОГРАММЫ2
1 121 11
11

```

2 3

10

-1

Strace:

```
172     execve("/usr/bin/env", ["env", "LD_LIBRARY_PATH=", "./dynamic"],
0x7ffdad142678 /* 12 vars */) = 0
172  brk(NULL)                = 0x608dbb557000
172  access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)
172  openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
172  fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
172  mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) = 0x744532aa4000
172  close(3)                  = 0
172                               openat(AT_FDCWD,          "/lib/x86_64-linux-gnu/libc.so.6",
O_RDONLY|O_CLOEXEC) = 3
172  read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260>\2\0\0\0\0\0"...,
832) = 832
172  fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
172                               mmap(NULL,          8192,          PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x744532aa2000
172                               mmap(NULL,          1914496,          PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7445328ce000
172                               mmap(0x7445328f0000,  1413120,  PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x7445328f0000
172                               mmap(0x744532a49000,  323584,  PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17b000) = 0x744532a49000
172                               mmap(0x744532a98000,  24576,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c9000) = 0x744532a98000
172                               mmap(0x744532a9e000,  13952,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x744532a9e000
172  close(3)                  = 0
172  arch_prctl(ARCH_SET_FS, 0x744532aa3580) = 0
172  mprotect(0x744532a98000, 16384, PROT_READ) = 0
172  mprotect(0x608daffb6000, 4096, PROT_READ) = 0
172  mprotect(0x744532ad4000, 4096, PROT_READ) = 0
172  munmap(0x744532aa4000, 21784) = 0
172  brk(NULL)                = 0x608dbb557000
172  brk(0x608dbb578000)      = 0x608dbb578000
172  execve("./dynamic", ["./dynamic"], 0x608dbb557400 /* 13 vars */) = 0
172  brk(NULL)                = 0x5cc86f6f4000
172  access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)
172                               openat(AT_FDCWD,          "./tls/haswell/x86_64/libdl.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
172  openat(AT_FDCWD, "./tls/haswell/libdl.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172  openat(AT_FDCWD, "./tls/x86_64/libdl.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
```

```

172      openat(AT_FDCWD, "./tls/libdl.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./haswell/x86_64/libdl.so.2", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./haswell/libdl.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./x86_64/libdl.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./libdl.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
172      openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
172      fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
172      mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7265affd5000
172      close(3) = 0
172      openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libdl.so.2",
O_RDONLY|O_CLOEXEC) = 3
172      read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0000\21\0\0\0\0\0"...,
832) = 832
172      fstat(3, {st_mode=S_IFREG|0644, st_size=18688, ...}) = 0
172      mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7265affd3000
172      mmap(NULL, 20752, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3, 0) = 0x7265affcd000
172      mmap(0x7265affce000, 8192, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) = 0x7265affce000
172      mmap(0x7265affd0000, 4096, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) = 0x7265affd0000
172      mmap(0x7265affd1000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) = 0x7265affd1000
172      close(3) = 0
172      openat(AT_FDCWD, "./tls/haswell/x86_64/libc.so.6",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./tls/haswell/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./tls/x86_64/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./tls/libc.so.6", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
172      openat(AT_FDCWD, "./haswell/x86_64/libc.so.6", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./haswell/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./x86_64/libc.so.6", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
172      openat(AT_FDCWD, "./libc.so.6", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)

```



```

172          openat(AT_FDCWD,          "/lib/x86_64-linux-gnu/libc.so.6",
O_RDONLY|O_CLOEXEC) = 3
172      read(3, "\\177ELF\\2\\1\\1\\3\\0\\0\\0\\0\\0\\0\\0\\3\\0>\\0\\1\\0\\0\\0\\260>\\2\\0\\0\\0\\0\\0"...,
832) = 832
172  fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
172          mmap(NULL,          1914496,          PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7265afdf9000
172          mmap(0x7265afe1b000,  1413120,  PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x7265afe1b000
172          mmap(0x7265aff74000,  323584,  PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17b000) = 0x7265aff74000
172          mmap(0x7265affc3000,  24576,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c9000) = 0x7265affc3000
172          mmap(0x7265affc9000,  13952,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7265affc9000
172  close(3)          = 0
172          mmap(NULL,  12288,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7265afdf6000
172  arch_prctl(ARCH_SET_FS, 0x7265afdf6740) = 0
172  mprotect(0x7265affc3000, 16384, PROT_READ) = 0
172  mprotect(0x7265affd1000, 4096, PROT_READ) = 0
172  mprotect(0x5cc83127a000, 4096, PROT_READ) = 0
172  mprotect(0x7265b0005000, 4096, PROT_READ) = 0
172  munmap(0x7265affd5000, 21784)  = 0
172  brk(NULL)          = 0x5cc86f6f4000
172  brk(0x5cc86f715000) = 0x5cc86f715000
172  openat(AT_FDCWD, "./lib1.so", O_RDONLY|O_CLOEXEC) = 3
172  read(3, "\\177ELF\\2\\1\\1\\0\\0\\0\\0\\0\\0\\0\\0\\3\\0>\\0\\1\\0\\0\\0P\\20\\0\\0\\0\\0\\0\\0"..., 832)
= 832
172  fstat(3, {st_mode=S_IFREG|0755, st_size=15920, ...}) = 0
172  getcwd("/workspace/laba4", 128) = 17
172  mmap(NULL, 16432, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3, 0) = 0x7265affd6000
172          mmap(0x7265affd7000,  4096,  PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) = 0x7265affd7000
172          mmap(0x7265affd8000,  4096,  PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7265affd8000
172          mmap(0x7265affd9000,  8192,  PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7265affd9000
172  close(3)          = 0
172  mprotect(0x7265affd9000, 4096, PROT_READ) = 0
172  fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
172  read(0, "1 121 11\\n", 1024)  = 9
172  fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
172  write(1, "11\\n", 3)          = 3
172  read(0, "2 3\\n", 1024)      = 4
172  write(1, "11\\n", 3)          = 3

```

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172 read(0, "0\n", 1024)      = 2
172 munmap(0x7265affd6000, 16432) = 0
172 openat(AT_FDCWD, "./lib2.so", O_RDONLY|O_CLOEXEC) = 3
172 read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\20\0\0\0\0\0"..., 832) =
832
172 fstat(3, {st_mode=S_IFREG|0755, st_size=15920, ...}) = 0
172 getcwd("/workspace/laba4", 128) = 17
172 mmap(NULL, 16432, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE,
3, 0) = 0x7265affd6000
172      mmap(0x7265affd7000, 4096, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) = 0x7265affd7000
172      mmap(0x7265affd8000, 4096, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7265affd8000
172      mmap(0x7265affd9000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7265affd9000
172 close(3) = 0
172 mprotect(0x7265affd9000, 4096, PROT_READ) = 0
172      write(1, "\320\241\320\234\320\225\320\235\320\257
\320\237\320\240\320\236\320\223\320\240\320\220\320\234\320\234\320\2532\n", 31) =
31
172 read(0, "1 121 11\n", 1024) = 9
172 write(1, "11\n", 3) = 3
172 read(0, "2 3\n", 1024) = 4
172 write(1, "10\n", 3) = 3
172 read(0, "-1\n", 1024) = 3
172 munmap(0x7265affd6000, 16432) = 0
172 lseek(0, -1, SEEK_CUR) = -1 ESPIPE (Illegal seek)
172 exit_group(0) = ?
172 +++ exited with 0 +++

```

Вывод

В ходе выполнения лабораторной работы были получены навыки по диагностике работы программного обеспечения. Это было рассмотрено на примере команды `strace`. Полученные навыки помогают лучше понять, как программы взаимодействуют с операционной системой и помогает устранять изъяны программы.