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Кафедра вычислительной математики и программирования

Лабораторная работа №1 по курсу

«Операционные системы»

Приобретение практических навыков диагностики работы программного обеспечения.

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1. Постановка задачи

При выполнении последующих лабораторных работ необходимо продемонстрировать ключевые системные вызовы, которые в них используются.

Используемые утилиты: strace, ltrace.

2. Описание используемых утилит

Strace — это утилита Linux, отслеживающая системные вызовы, которые представляют собой механизм трансляции, обеспечивающий интерфейс между процессом и операционной системой. Использование данной утилиты позволяет понять, что процесс пытается сделать в данное время. Strace может быть полезен при отладке программ.

Для удобства работы с протоколом утилиты можно использовать следующие ключи:

- -o file – Перенаправить протокол утилиты в файл file
- -e trace=filters – Указать выражения, по которым будут фильтроваться системные вызовы. Например -e trace=write,%process задаёт фильтрацию по системным вызовам write и по группе системных вызовов, связанных с межпроцессорным взаимодействием.
- -f – Отслеживать системные вызовы в дочерних процессах
- -y – Заменить в протоколе все файловые дескрипторы на имена соответствующих им файлов (где возможно).
- -p file – Отслеживать только обращения к файлу file
- -k – Отображать стек вызовов

Ltrace – это утилита Linux, отслеживающая системные вызовы, связанные с динамическими библиотеками. Использование данной утилиты очень похоже на использование strace.

3. Примеры использования утилит

Ниже приведены протоколы strace лабораторных работ. Ключевые строки в протоколе будут выделены красным цветом.

Лабораторная работа 2 – взаимодействие между процессами

parsifal@DESKTOP-3G70RV4:~/OS/Lab2$ strace -o log.txt ./parent
Введите строки:
Qfw FUK   KCGCfufFT1

Результат работы:
qfw_fuk___kcgcfufft1

parsifal@DESKTOP-3G70RV4:~/OS/Lab2$ cat log.txt
execve("./parent", ["./parent"], 0x7fffc785c070 /* 27 vars */) = 0
brk(NULL)   = 0x7fffb8a10000
arch_prctl(0x3001 /* ARCH_??? */, 0x7fffc0b78700) = -1 EINVAL (Invalid argument)
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=32310, ...}) = 0
mmap(NULL, 32310, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f90d7968000
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\0\0\3\0>\0\1\0\0\0\360q\2\0\0\0\0\0"..., 832) = 832

pread64(3, "\6\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
pread64(3, "\4\0\0\0\20\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0", 32, 848) = 32
pread64(3, "\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\363\377?\332\200\270\27\304d\245n\355Y\377\t\334"..., 68, 880) = 68
fstat(3, {st_mode=S_IFREG|0755, st_size=2029224, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f90d79a0000
pread64(3, "\6\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
pread64(3, "\4\0\0\0\20\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0", 32, 848) = 32
pread64(3, "\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\363\377?\332\200\270\27\304d\245n\355Y\377\t\334"..., 68, 880) = 68
mmap(NULL, 2036952, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f90d7770000
mprotect(0x7f90d7795000, 1847296, PROT_NONE) = 0
mmap(0x7f90d7795000, 1540096, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x25000) = 0x7f90d7795000
mmap(0x7f90d790d000, 303104, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x19d000) = 0x7f90d790d000
mmap(0x7f90d7958000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1e7000) = 0x7f90d7958000
mmap(0x7f90d795e000, 13528, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f90d795e000
close(3)   = 0
arch_prctl(ARCH_SET_FS, 0x7f90d79a1380) = 0
mprotect(0x7f90d7958000, 12288, PROT_READ) = 0
mprotect(0x7f90d79aa000, 4096, PROT_READ) = 0
mprotect(0x7f90d799d000, 4096, PROT_READ) = 0
munmap(0x7f90d7968000, 32310)   = 0
pipe([3, 4])   = 0
pipe([5, 6])   = 0
clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD, child_tidptr=0x7f90d79a1650) = 606
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
brk(NULL)   = 0x7fffb8a10000
brk(0x7fffb8a31000)   = 0x7fffb8a31000
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\320\270:\n", 29) = 29
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
read(0, "Qfw FUK   KCGCfufFT1\n", 1024) = 21
read(0, "", 1024)   = 0
close(3)   = 0
write(4, "Qfw FUK   KCGCfufFT1\n\0\0", 23) = 23
close(4)   = 0
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=606, si_uid=1000, si_status=0, si_utime=0, si_stime=0} ---
pipe([3, 4])   = 0
clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD, child_tidptr=0x7f90d79a1650) = 607
close(5)   = 0
close(6)   = 0
close(4)   = 0
read(3, "q", 1)   = 1
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=607, si_uid=1000, si_status=0, si_utime=0, si_stime=0} ---

```
read(3, "f", 1)                 = 1
read(3, "w", 1)                 = 1
read(3, "_", 1)                 = 1
read(3, "f", 1)                 = 1
read(3, "u", 1)                 = 1
read(3, "k", 1)                 = 1
read(3, "_", 1)                 = 1
read(3, "_", 1)                 = 1
read(3, "_", 1)                 = 1
read(3, "k", 1)                 = 1
read(3, "c", 1)                 = 1
read(3, "g", 1)                 = 1
read(3, "c", 1)                 = 1
read(3, "f", 1)                 = 1
read(3, "u", 1)                 = 1
read(3, "f", 1)                 = 1
read(3, "f", 1)                 = 1
read(3, "t", 1)                 = 1
read(3, "1", 1)                 = 1
read(3, "\n", 1)                = 1
read(3, "\0", 1)                = 1
close(3)                        = 0
write(1, "\n", 1)               = 1
write(1, "\320\240\320\265\320\267\321\203\320\273\321\214\321\202\320\260\321\202
\321\200\320\260\320\261\320\276\321\202\321\213:"..., 33) = 33
write(1, "qfw_fuk___kcgcfufft1\n", 21)  = 21
write(1, "\n", 1)               = 1
exit_group(0)                   = ?
+++ exited with 0 +++
```

P.S. Для работы с необходимыми опциями выполним в терминале команду:
«strace -f -e trace=write,read -o strace.txt ./parent».
Таким образом, в файле **strace.txt** будет содержаться информация о системных вызовах **read()** и
write(), а так же дерево процессов. При этом к каждой строке вывода добавляется **pid** процесса,
делающего системный вывод

```
parsifal@DESKTOP-3G70RV4:~/OS/Lab2$ strace -f -e trace=write,read,pipe -o strace.txt ./parent
Введите строки:
udwYDFY  FC

Результат работы:
udwydfy__fc

parsifal@DESKTOP-3G70RV4:~/OS/Lab2$ cat strace.txt
562   read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\360q\2\0\0\0\0\0"..., 832) = 832
562   pipe([3, 4])             = 0
562   pipe([5, 6])             = 0
562   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\320\270:\n", 29) = 29
562   read(0, <unfinished ...>
563   read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\360q\2\0\0\0\0\0"..., 832) = 832
563   read(0, <unfinished ...>
```

```
562  <... read resumed>"udwYDFY FC", 1024) = 11
562  read(0, "\n", 1024)            = 1
562  read(0, "", 1024)           = 0
562  write(4, "udwYDFY FC\n\0\0", 14) = 14
563  <... read resumed>"udwYDFY FC\n\0\0", 4096) = 14
563  read(0, <unfinished ...>
562  pipe( <unfinished ...>
563  <... read resumed>"", 4096)      = 0
562  <... pipe resumed>[3, 4])        = 0
563  write(1, "udwydfy  fc\n\0\0\0\0", 16) = 16
563  +++ exited with 0 +++
562  --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=563, si_uid=1000,
si_status=0, si_utime=0, si_stime=0} ---
562  read(3, <unfinished ...>
564  read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\360q\2\0\0\0\0\0"..., 832) = 832
564  read(0, "u", 1)             = 1
564  read(0, "d", 1)             = 1
564  read(0, "w", 1)              = 1
564  read(0, "y", 1)             = 1
564  read(0, "d", 1)             = 1
564  read(0, "f", 1)             = 1
564  read(0, "y", 1)              = 1
564  read(0, " ", 1)            = 1
564  read(0, " ", 1)            = 1
564  read(0, "f", 1)             = 1
564  read(0, "c", 1)             = 1
564  read(0, "\n", 1)            = 1
564  read(0, "\0", 1)            = 1
564  write(1, "udwydfy__fc\n\0", 13)  = 13
562  <... read resumed>"u", 1)        = 1
562  read(3, "d", 1)             = 1
562  read(3, <unfinished ...>
564  +++ exited with 0 +++
562  <... read resumed>"w", 1)       = 1
562  --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=564, si_uid=1000,
si_status=0, si_utime=0, si_stime=0} ---
562  read(3, "y", 1)             = 1
562  read(3, "d", 1)             = 1
562  read(3, "f", 1)             = 1
562  read(3, "y", 1)             = 1
562  read(3, "_", 1)             = 1
562  read(3, "_", 1)             = 1
562  read(3, "f", 1)             = 1
562  read(3, "c", 1)             = 1
562  read(3, "\n", 1)            = 1
562  read(3, "\0", 1)            = 1
562  write(1, "\n", 1)            = 1
562  write(1, "\320\240\320\265\320\267\321\203\320\273\321\214\321\202\320\260\321\202
\321\200\320\260\320\261\320\276\321\202\321\213:"..., 33) = 33
562  write(1, "udwydfy__fc\n", 12)    = 12
562  write(1, "\n", 1)            = 1
562  +++ exited with 0 +++
```

Лабораторная работа 3 – взаимодействие между потоками

```
parsifal@DESKTOP-3G70RV4:~/OS/Lab3$ cat t.txt
5
1 2 3 4 5
2 3 4 6 7
7 8 9 0 1
1 2 4 7 8
3 4 5 8 9
3
1parsifal@DESKTOP-3G70RV4:~/OS/Lab3$ strace -f -e trace="%process,write" -o
strace_log.txt ./main 4 < t.txt > /dev/null
parsifal@DESKTOP-3G70RV4:~/OS/Lab3$ cat strace_log.txt
3805  execve("./main", ["./main", "4"], 0x7fffccd22c10 /* 27 vars */) = 0
3805  arch_prctl(0x3001 /* ARCH_??? */, 0x7fffc2d85470) = -1 EINVAL (Invalid argument)
3805  arch_prctl(ARCH_SET_FS, 0x7f1e7aff0740) = 0
3805  clone(child_stack=0x7f1e7afdffb0,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SET
TLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[3806], tls=0x7f1e7afe0700,
child_tidptr=0x7f1e7afe09d0) = 3806
3805  clone(child_stack=0x7f1e7a7cffb0,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SET
TLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[3807], tls=0x7f1e7a7d0700,
child_tidptr=0x7f1e7a7d09d0) = 3807
3805  clone(child_stack=0x7f1e79fbffb0,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SET
TLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID <unfinished ...>
3806  exit(0 <unfinished ...>
3805  <... clone resumed>, parent_tid=[3808], tls=0x7f1e79fc0700,
child_tidptr=0x7f1e79fc09d0) = 3808
3806  <... exit resumed>)                 = ?
3806  +++ exited with 0 +++
3807  exit(0 <unfinished ...>
3805  clone(child_stack=0x7f1e797affb0,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SET
TLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID <unfinished ...>
3807  <... exit resumed>)                 = ?
3807  +++ exited with 0 +++
3805  <... clone resumed>, parent_tid=[3809], tls=0x7f1e797b0700,
child_tidptr=0x7f1e797b09d0) = 3809
3808  exit(0)                             = ?
3808  +++ exited with 0 +++
3809  exit(0)                             = ?
3809  +++ exited with 0 +++
3805  write(1, "Enter size of matrix: Enter wind"..., 128) = 128
3805  exit_group(0)                       = ?
3805  +++ exited with 0 +++
```

Лабораторная работа 4 – отображаемые файлы

```
parsifal@DESKTOP-3G70RV4:~/OS/Lab4$ strace -o log.txt ./parent
Введите строки:
MrYaaaaUUuuuu?
Nya Crya cvA
beWARe  of tHe
  WeEpiNg aNgeLs
Or... ..
Puffff!!

Результат работы:
mryaaaauuuuuu?
nya_crya_cva
beware___of_the_
```

```
____weeping_angels
or...__..
puffff!!

parsifal@DESKTOP-3G70RV4:~/OS/Lab4$ cat log.txt
execve("./parent", ["./parent"], 0x7fffefbb3ef0 /* 27 vars */) = 0
brk(NULL)                        = 0x7fffd6c56000
arch_prctl(0x3001 /* ARCH_??? */, 0x7fffdf4cbac0) = -1 EINVAL (Invalid argument)
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=30788, ...}) = 0
mmap(NULL, 30788, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7fad40b25000
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\0\0\3\0>\0\1\0\0\0\360q\2\0\0\0\0\0"..., 832) = 832
pread64(3, "\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
pread64(3, "\4\0\0\0\20\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\3\0\0\0\0\0\0\0"..., 32, 848) = 32
pread64(3, "\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\363\377?\332\200\270\27\304d\245n\355Y\377\t\334"..., 68,
880) = 68
fstat(3, {st_mode=S_IFREG|0755, st_size=2029224, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7fad40b20000
pread64(3, "\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
pread64(3, "\4\0\0\0\20\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\3\0\0\0\0\0\0\0", 32, 848) = 32
pread64(3, "\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\363\377?\332\200\270\27\304d\245n\355Y\377\t\334"..., 68,
880) = 68
mmap(NULL, 2036952, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fad408f0000
mprotect(0x7fad40915000, 1847296, PROT_NONE) = 0
mmap(0x7fad40915000, 1540096, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x25000) = 0x7fad40915000
mmap(0x7fad40a8d000, 303104, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x19d000) =
0x7fad40a8d000
mmap(0x7fad40ad8000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1e7000) = 0x7fad40ad8000
mmap(0x7fad40ade000, 13528, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0)
= 0x7fad40ade000
close(3)                         = 0
arch_prctl(ARCH_SET_FS, 0x7fad40b21380) = 0
mprotect(0x7fad40ad8000, 12288, PROT_READ) = 0
mprotect(0x7fad40b30000, 4096, PROT_READ) = 0
mprotect(0x7fad40b1d000, 4096, PROT_READ) = 0
munmap(0x7fad40b25000, 30788)        = 0
brk(NULL)                        = 0x7fffd6c56000
brk(0x7fffd6c77000)              = 0x7fffd6c77000
fstat(1, {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\320\270:\n", 29) = 29
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
read(0, "MrYaaaaUUuuuu?\n", 1024)      = 15
read(0, "Nya Crya cvA\n", 1024)        = 13
read(0, "beWARe  of tHe \n", 1024)     = 17
read(0, "   WeEpiNg aNgeLs\n", 1024)   = 19
read(0, "Or...  ..\n", 1024)           = 10
read(0, "Puffff!!\n", 1024)            = 9
read(0, "", 1024)                      = 0
openat(AT_FDCWD, "file.txt", O_RDWR|O_CREAT, 0600) = 3
write(3, "MrYaaaaUUuuuu?\nNya Crya cvA\nbeWA"..., 83) = 83
fstat(3, {st_mode=S_IFREG|0600, st_size=83, ...}) = 0
mmap(NULL, 83, PROT_READ|PROT_WRITE, MAP_SHARED, 3, 0) = 0x7fad40b2c000
close(3)                         = 0
```

clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD,
child_tidptr=0x7fad40b21650) = 439
wait4(439, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 439
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=439, si_uid=1000, si_status=0, si_utime=0,
si_stime=0} ---
clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD,
child_tidptr=0x7fad40b21650) = 440
wait4(440, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 440
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=440, si_uid=1000, si_status=0, si_utime=0,
si_stime=0} ---
write(1, "\n", 1)   = 1
write(1, "\320\240\320\265\320\267\321\203\320\273\321\214\321\202\320\260\321\202
\321\200\320\260\320\261\320\276\321\202\321\213:"..., 33) = 33
write(1, "mryaaaauuuuuu?\nnya_crya_cva\nbewa"..., 83) = 83
write(1, "\n", 1)   = 1
unlink("file.txt")   = 0
munmap(0x7fad40b2c000, 83)   = 0
exit_group(0)   = ?
+++ exited with 0 +++

Лабораторная работа 5 – динамические библиотеки

1) ltrace static

```
__isoc99_scanf(0x7f7857000a47, 0x7ffffcf6b894, 0x7ffffcf6b9c8, 0x7f78570009c0)
= 1
__isoc99_scanf(0x7f7857000a44, 0x7ffffcf6b898, 0x7ffffcf6b89c, 16)
= 2
GCF(123, 9, 0x7f78569dd8d0, 24)
= 3
__printf_chk(1, 0x7f7857000a4a, 123, 9)
= 15
__isoc99_scanf(0x7f7857000a47, 0x7ffffcf6b894, 0x7f78569dd8c0, 0)
= 1
__isoc99_scanf(0x7f7857000a5b, 0x7ffffcf6b8a0, 0x7ffffcf6b8a4, 16)
= 2
Square(0, 2, 0x7f78569dd8d0, 0x7ffffcf6b351)
= 2
__printf_chk(1, 0x7f7857000a61, 0x7f78569dd8d0, 0x7ffffcf6b351)
= 19
__isoc99_scanf(0x7f7857000a47, 0x7ffffcf6b894, 0x7f78569dd8c0, 0)
= 0xffffffff
+++ exited (status 0) +++
```

2) ltrace dynamic

```
dlopen("./libfunctions1.so", 2)
= 0x7fffc3083280
dlsym(0x7fffc3083280, "GCF")
= 0x7f42a55e05b4
dlsym(0x7fffc3083280, "Square")
= 0x7f42a55e059a
__isoc99_scanf(0x7f42a6200cdf, 0x7fffcae19150, 1, 0)
= 1
__isoc99_scanf(0x7f42a6200cb5, 0x7fffcae19154, 0x7fffcae19158, 16)
= 2
printf("GCF(%d,%d) = %d\n", 123, 9, 3)
= 15
__isoc99_scanf(0x7f42a6200cdf, 0x7fffcae19150, 0, 0)
= 1
```

```
__isoc99_scanf(0x7f42a6200ccc, 0x7fffcae1915c, 0x7fffcae19160, 16)
= 2
printf("Square = %f\n", 12.000000)
= 19
__isoc99_scanf(0x7f42a6200cdf, 0x7fffcae19150, 0, 0)
= 1
dlclose(0x7fffc3083280)
= 0
dlopen("./libfunctions2.so", 2)
= 0x7fffc3083280
dlsym(0x7fffc3083280, "GCF")
= 0x7f42a55e063d
dlsym(0x7fffc3083280, "Square")
= 0x7f42a55e05ea
__isoc99_scanf(0x7f42a6200cdf, 0x7fffcae19150, 1, 0)
= 1
__isoc99_scanf(0x7f42a6200ccc, 0x7fffcae1915c, 0x7fffcae19160, 16)
= 2
printf("Square = %f\n", 6.000000)
= 18
__isoc99_scanf(0x7f42a6200cdf, 0x7fffcae19150, 0, 0)
= 1
__isoc99_scanf(0x7f42a6200cb5, 0x7fffcae19154, 0x7fffcae19158, 16)
= 2
printf("GCF(%d,%d) = %d\n", 175, 15, 5)
= 16
__isoc99_scanf(0x7f42a6200cdf, 0x7fffcae19150, 0, 0)
= 0xffffffff
dlclose(0x7fffc3083280)
= 0
+++ exited (status 0) +++
```

Лабораторная работа 6 – очереди сообщений

```
parsifal@DESKTOP-3G70RV4:~/OS/Lab6-8$ ./control
create 2 -1
OK: 4163
create 3 -1
OK: 4168
create 2 -1
Error: already exists!
cerate 5 4
Incorrect comand!
Incorrect comand!
Incorrect comand!
create 5 4
Error: parent not found!
remove 3
OK
pingall
OK: -1
exec 2 5 1 2 3 4 5
OK: 15
exit
parsifal@DESKTOP-3G70RV4:~/OS/Lab6-8$ strace -o log.txt ./control
create 2 -1
OK: 4154
exit
parsifal@DESKTOP-3G70RV4:~/OS/Lab6-8$ cat log.txt
execve("./control", ["./control"], 0x7ffff9a3d9e0 /* 27 vars */) = 0
brk(NULL)                               = 0x7fffe0bc4000
arch_prctl(0x3001 /* ARCH_??? */, 0x7fffe8368b50) = -1 EINVAL (Invalid argument)
```

```
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=32310, ...}) = 0
mmap(NULL, 32310, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f513ab98000
close(3)                                 = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libzmq.so.5", O_RDONLY|O_CLOEXEC) = 3
read(3,      "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0`z\1\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=675776, ...}) = 0
mmap(NULL,  8192,  PROT_READ|PROT_WRITE,  MAP_PRIVATE|MAP_ANONYMOUS,  -1,  0) =
0x7f513abd0000
mmap(NULL, 678128, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513aaf0000
mmap(0x7f513ab06000,                 430080,                 PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x16000) = 0x7f513ab06000
mmap(0x7f513ab6f000, 126976, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x7f000) = 0x7f513ab6f000
mmap(0x7f513ab8e000,                  32768,                 PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x9d000) = 0x7f513ab8e000
close(3)                                 = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) =
3
read(3,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\240\341\t\0\0\0\0\0"..., 832)
= 832
fstat(3, {st_mode=S_IFREG|0644, st_size=1952928, ...}) = 0
mmap(NULL,   1968128,   PROT_READ,   MAP_PRIVATE|MAP_DENYWRITE,   3,   0)   =
0x7f513a900000
mprotect(0x7f513a996000, 1286144, PROT_NONE) = 0
mmap(0x7f513a996000,                 983040,                 PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x96000) = 0x7f513a996000
mmap(0x7f513aa86000, 299008, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x186000) = 0x7f513aa86000
mmap(0x7f513aad0000,                  57344,                 PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1cf000) = 0x7f513aad0000
mmap(0x7f513aade000,                  10240,                 PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513aade000
close(3)                                 = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) =
3
read(3,  "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\3405\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=104984, ...}) = 0
mmap(NULL, 107592, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a8e0000
mmap(0x7f513a8e3000,                  73728,                 PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) = 0x7f513a8e3000
mmap(0x7f513a8f5000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x15000) = 0x7f513a8f5000
mmap(0x7f513a8f9000,                   8192,                 PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x18000) = 0x7f513a8f9000
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\0\0\3\0>\0\1\0\0\0\360q\2\0\0\0\0\0"...,
832) = 832
pread64(3, "\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
pread64(3, "\4\0\0\0\20\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0",
32, 848) = 32
pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\363\377?\332\200\270\27\304d\245n\355Y\377\t\
334"..., 68, 880) = 68
```

```
fstat(3, {st_mode=S_IFREG|0755, st_size=2029224, ...}) = 0
pread64(3, "\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
pread64(3, "\4\0\0\0\20\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0",
32, 848) = 32
pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\363\377?\332\200\270\27\304d\245n\355Y\377\t\
334"..., 68, 880) = 68
mmap(NULL,    2036952,    PROT_READ,    MAP_PRIVATE|MAP_DENYWRITE,    3,    0)    =
0x7f513a6e0000
mprotect(0x7f513a705000, 1847296, PROT_NONE) = 0
mmap(0x7f513a705000,              1540096,              PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x25000) = 0x7f513a705000
mmap(0x7f513a87d000, 303104, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x19d000) = 0x7f513a87d000
mmap(0x7f513a8c8000,              24576,              PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1e7000) = 0x7f513a8c8000
mmap(0x7f513a8ce000,              13528,              PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513a8ce000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libsodium.so.23", O_RDONLY|O_CLOEXEC)
= 3
read(3,
"\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\200\302\0\0\0\0\0\0"..., 832)
= 832
fstat(3, {st_mode=S_IFREG|0644, st_size=355016, ...}) = 0
mmap(NULL, 357384, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a680000
mmap(0x7f513a68c000,              229376,              PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xc000) = 0x7f513a68c000
mmap(0x7f513a6c4000, 73728, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x44000) = 0x7f513a6c4000
mmap(0x7f513a6d6000,              8192,              PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x55000) = 0x7f513a6d6000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libpgm-5.2.so.0", O_RDONLY|O_CLOEXEC)
= 3
read(3,  "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\240L\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=302056, ...}) = 0
mmap(NULL, 321584, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a630000
mmap(0x7f513a634000,              163840,              PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x4000) = 0x7f513a634000
mmap(0x7f513a65c000, 118784, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x2c000) = 0x7f513a65c000
mmap(0x7f513a679000,              8192,              PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x48000) = 0x7f513a679000
mmap(0x7f513a67b000,              14384,              PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513a67b000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libnorm.so.1", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\257\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=690344, ...}) = 0
mmap(NULL,  8192,  PROT_READ|PROT_WRITE,  MAP_PRIVATE|MAP_ANONYMOUS,  -1,  0)  =
0x7f513a620000
mmap(NULL,    1420000,    PROT_READ,    MAP_PRIVATE|MAP_DENYWRITE,    3,    0)    =
0x7f513a4c0000
mmap(0x7f513a4ca000,              421888,              PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xa000) = 0x7f513a4ca000
```

```
mmap(0x7f513a531000, 217088, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x71000) = 0x7f513a531000
mmap(0x7f513a566000,                16384,                PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xa5000) = 0x7f513a566000
mmap(0x7f513a56a000,                723680,               PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513a56a000
close(3)                                = 0
openat(AT_FDCWD,               "/lib/x86_64-linux-gnu/libgssapi_krb5.so.2",
O_RDONLY|O_CLOEXEC) = 3
read(3,  "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\321\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=309712, ...}) = 0
mmap(NULL, 312128, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a470000
mmap(0x7f513a47b000,                204800,                PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xb000) = 0x7f513a47b000
mmap(0x7f513a4ad000, 49152, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x3d000) = 0x7f513a4ad000
mmap(0x7f513a4b9000,                16384,                PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x48000) = 0x7f513a4b9000
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\0\0\3\0>\0\1\0\0\0\220\201\0\0\0\0\0\0"...,  832)
= 832
pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0O\305\3743\364B\2216\244\224\306@\261\23\327o"
..., 68, 824) = 68
fstat(3, {st_mode=S_IFREG|0755, st_size=157224, ...}) = 0
pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0O\305\3743\364B\2216\244\224\306@\261\23\327o"
..., 68, 824) = 68
mmap(NULL, 140408, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a44d000
mmap(0x7f513a454000,                69632,                PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x7000) = 0x7f513a454000
mmap(0x7f513a465000, 20480, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x18000) = 0x7f513a465000
mmap(0x7f513a46a000,                8192,                 PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c000) = 0x7f513a46a000
mmap(0x7f513a46c000,                13432,                PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513a46c000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3,
"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\300\363\0\0\0\0\0\0"...,  832)
= 832
fstat(3, {st_mode=S_IFREG|0644, st_size=1369352, ...}) = 0
mmap(NULL,    1368336,    PROT_READ,    MAP_PRIVATE|MAP_DENYWRITE,    3,   0)  =
0x7f513a2fe000
mmap(0x7f513a30d000,                684032,                PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xf000) = 0x7f513a30d000
mmap(0x7f513a3b4000, 618496, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xb6000) = 0x7f513a3b4000
mmap(0x7f513a44b000,                8192,                 PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x14c000) = 0x7f513a44b000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libkrb5.so.3", O_RDONLY|O_CLOEXEC) = 3
read(3,   "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0   ?\2\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=902016, ...}) = 0
```

```
mmap(NULL, 904640, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a220000
mprotect(0x7f513a242000, 700416, PROT_NONE) = 0
mmap(0x7f513a242000,            397312,            PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x7f513a242000
mmap(0x7f513a2a3000, 299008, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x83000) = 0x7f513a2a3000
mmap(0x7f513a2ed000,            65536,            PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xcc000) = 0x7f513a2ed000
close(3)                           = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libk5crypto.so.3", O_RDONLY|O_CLOEXEC)
= 3
read(3,  "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\240D\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=191040, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f513a210000
mmap(NULL, 196696, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a1d0000
mprotect(0x7f513a1d4000, 172032, PROT_NONE) = 0
mmap(0x7f513a1d4000,            114688,            PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x4000) = 0x7f513a1d4000
mmap(0x7f513a1f0000, 53248, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x20000) = 0x7f513a1f0000
mmap(0x7f513a1fe000,            8192,            PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2d000) = 0x7f513a1fe000
mmap(0x7f513a200000,            88,            PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513a200000
close(3)                           = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libcom_err.so.2", O_RDONLY|O_CLOEXEC)
= 3
read(3,  "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\200$\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=22600, ...}) = 0
mmap(NULL, 24744, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a1c0000
mmap(0x7f513a1c2000,            8192,            PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7f513a1c2000
mmap(0x7f513a1c4000, 4096, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x4000) = 0x7f513a1c4000
mmap(0x7f513a1c5000,            8192,            PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x4000) = 0x7f513a1c5000
close(3)                           = 0
openat(AT_FDCWD,                "/lib/x86_64-linux-gnu/libkrb5support.so.0",
O_RDONLY|O_CLOEXEC) = 3
read(3,  "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\3605\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=56096, ...}) = 0
mmap(NULL, 58344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a1b0000
mmap(0x7f513a1b3000,            28672,            PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) = 0x7f513a1b3000
mmap(0x7f513a1ba000, 12288, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xa000) = 0x7f513a1ba000
mmap(0x7f513a1bd000,            8192,            PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xc000) = 0x7f513a1bd000
close(3)                           = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libkeyutils.so.1", O_RDONLY|O_CLOEXEC)
= 3
read(3,     "\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"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=22600, ...}) = 0
mmap(NULL, 24592, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a1a0000
```

```
mmap(0x7f513a1a2000,                8192,                PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x7f513a1a2000
mmap(0x7f513a1a4000, 4096, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x4000) = 0x7f513a1a4000
mmap(0x7f513a1a5000,                8192,                PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x4000) = 0x7f513a1a5000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libresolv.so.2", O_RDONLY|O_CLOEXEC) =
3
read(3,    "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0    G\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=101320, ...}) = 0
mmap(NULL, 113280, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a180000
mprotect(0x7f513a184000, 81920, PROT_NONE) = 0
mmap(0x7f513a184000,                65536,                PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x4000) = 0x7f513a184000
mmap(0x7f513a194000, 12288, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x14000) = 0x7f513a194000
mmap(0x7f513a198000,                8192,                PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17000) = 0x7f513a198000
mmap(0x7f513a19a000,                6784,                PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513a19a000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libdl.so.2", O_RDONLY|O_CLOEXEC) = 3
read(3,    "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0    \22\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=18816, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f513a170000
mmap(NULL, 20752, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a160000
mmap(0x7f513a161000,                8192,                PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) = 0x7f513a161000
mmap(0x7f513a163000, 4096, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x3000) = 0x7f513a163000
mmap(0x7f513a164000,                8192,                PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) = 0x7f513a164000
close(3)                                = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f513a150000
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f513a140000
arch_prctl(ARCH_SET_FS, 0x7f513a151600) = 0
mprotect(0x7f513a8c8000, 12288, PROT_READ) = 0
mprotect(0x7f513a164000, 4096, PROT_READ) = 0
mprotect(0x7f513a198000, 4096, PROT_READ) = 0
mprotect(0x7f513a1a5000, 4096, PROT_READ) = 0
mprotect(0x7f513a1bd000, 4096, PROT_READ) = 0
mprotect(0x7f513a46a000, 4096, PROT_READ) = 0
mprotect(0x7f513a1c5000, 4096, PROT_READ) = 0
mprotect(0x7f513a1fe000, 4096, PROT_READ) = 0
mprotect(0x7f513a2ed000, 57344, PROT_READ) = 0
mprotect(0x7f513a44b000, 4096, PROT_READ) = 0
mprotect(0x7f513a4b9000, 8192, PROT_READ) = 0
mprotect(0x7f513a8f9000, 4096, PROT_READ) = 0
mprotect(0x7f513aad0000, 45056, PROT_READ) = 0
mprotect(0x7f513a566000, 12288, PROT_READ) = 0
mprotect(0x7f513a679000, 4096, PROT_READ) = 0
mprotect(0x7f513a6d6000, 4096, PROT_READ) = 0
mprotect(0x7f513ab8e000, 28672, PROT_READ) = 0
mprotect(0x7f513abe5000, 4096, PROT_READ) = 0
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mprotect(0x7f513abcd000, 4096, PROT_READ) = 0
munmap(0x7f513ab98000, 32310)           = 0
set_tid_address(0x7f513a1518d0)         = 4153
set_robust_list(0x7f513a1518e0, 24)     = 0
rt_sigaction(SIGRTMIN,          {sa_handler=0x7f513a454bf0,          sa_mask=[],
sa_flags=SA_RESTORER|SA_SIGINFO, sa_restorer=0x7f513a4623c0}, NULL, 8) = 0
rt_sigaction(SIGRT_1,           {sa_handler=0x7f513a454c90,          sa_mask=[],
sa_flags=SA_RESTORER|SA_RESTART|SA_SIGINFO, sa_restorer=0x7f513a4623c0}, NULL,
8) = 0
rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=8192*1024}) = 0
brk(NULL)                               = 0x7fffe0bc4000
brk(0x7fffe0be5000)                     = 0x7fffe0be5000
gettimeofday({tv_sec=1621064014,        tv_usec=102374},        {tz_minuteswest=0,
tz_dsttime=0}) = 0
futex(0x7f513aade6bc, FUTEX_WAKE_PRIVATE, 2147483647) = 0
futex(0x7f513aade6c8, FUTEX_WAKE_PRIVATE, 2147483647) = 0
clock_gettime(CLOCK_REALTIME_COARSE, {tv_sec=1621064014, tv_nsec=103668300}) =
0
openat(AT_FDCWD, "/sys/devices/system/cpu/online", O_RDONLY|O_CLOEXEC) = 3
read(3, "0-3\n", 8192)                  = 4
close(3)                                = 0
openat(AT_FDCWD,                                "/sys/devices/system/cpu",
O_RDONLY|O_NONBLOCK|O_CLOEXEC|O_DIRECTORY) = 3
fstat(3, {st_mode=S_IFDIR|0755, st_size=0, ...}) = 0
getdents64(3, /* 9 entries */, 32768)   = 240
getdents64(3, /* 0 entries */, 32768)   = 0
close(3)                                = 0
getpid()                                = 4153
sched_getaffinity(4153, 128, [0, 1, 2, 3]) = 64
openat(AT_FDCWD, "/etc/nsswitch.conf", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=510, ...}) = 0
read(3, "# /etc/nsswitch.conf\n#\n# Example"..., 512) = 510
read(3, "", 512)                        = 0
close(3)                                = 0
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=32310, ...}) = 0
mmap(NULL, 32310, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f513ab98000
close(3)                                = 0
openat(AT_FDCWD,    "/lib/x86_64-linux-gnu/tls/haswell/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu/tls/haswell/x86_64", 0x7fffe8365ba0) = -1 ENOENT
(No such file or directory)
openat(AT_FDCWD,          "/lib/x86_64-linux-gnu/tls/haswell/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu/tls/haswell", 0x7fffe8365ba0) = -1 ENOENT (No such
file or directory)
openat(AT_FDCWD,           "/lib/x86_64-linux-gnu/tls/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu/tls/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such
file or directory)
openat(AT_FDCWD,                  "/lib/x86_64-linux-gnu/tls/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu/tls", 0x7fffe8365ba0) = -1 ENOENT (No such file or
directory)
openat(AT_FDCWD,          "/lib/x86_64-linux-gnu/haswell/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu/haswell/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No
such file or directory)
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openat(AT_FDCWD,                  "/lib/x86_64-linux-gnu/haswell/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu/haswell", 0x7fffe8365ba0) = -1 ENOENT (No such file
or directory)
openat(AT_FDCWD,                  "/lib/x86_64-linux-gnu/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file
or directory)
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libnss_db.so.2", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)
stat("/lib/x86_64-linux-gnu", {st_mode=S_IFDIR|0755, st_size=512, ...}) = 0
openat(AT_FDCWD,                                        "/usr/lib/x86_64-linux-
gnu/tls/haswell/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No
such file or directory)
stat("/usr/lib/x86_64-linux-gnu/tls/haswell/x86_64",   0x7fffe8365ba0)   =   -1
ENOENT (No such file or directory)
openat(AT_FDCWD,        "/usr/lib/x86_64-linux-gnu/tls/haswell/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/x86_64-linux-gnu/tls/haswell", 0x7fffe8365ba0) = -1 ENOENT (No
such file or directory)
openat(AT_FDCWD,         "/usr/lib/x86_64-linux-gnu/tls/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/x86_64-linux-gnu/tls/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No
such file or directory)
openat(AT_FDCWD,                  "/usr/lib/x86_64-linux-gnu/tls/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/x86_64-linux-gnu/tls", 0x7fffe8365ba0) = -1 ENOENT (No such file
or directory)
openat(AT_FDCWD,     "/usr/lib/x86_64-linux-gnu/haswell/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/x86_64-linux-gnu/haswell/x86_64",  0x7fffe8365ba0)  =  -1  ENOENT
(No such file or directory)
openat(AT_FDCWD,             "/usr/lib/x86_64-linux-gnu/haswell/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/x86_64-linux-gnu/haswell", 0x7fffe8365ba0) = -1 ENOENT (No such
file or directory)
openat(AT_FDCWD,              "/usr/lib/x86_64-linux-gnu/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/x86_64-linux-gnu/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such
file or directory)
openat(AT_FDCWD,                     "/usr/lib/x86_64-linux-gnu/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/x86_64-linux-gnu", {st_mode=S_IFDIR|0755, st_size=512, ...}) =
0
openat(AT_FDCWD, "/lib/tls/haswell/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
stat("/lib/tls/haswell/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file or
directory)
openat(AT_FDCWD, "/lib/tls/haswell/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
stat("/lib/tls/haswell", 0x7fffe8365ba0) = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/lib/tls/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
stat("/lib/tls/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/lib/tls/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No
such file or directory)
stat("/lib/tls", 0x7fffe8365ba0)           = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/lib/haswell/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -
1 ENOENT (No such file or directory)
```

```
stat("/lib/haswell/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file or
directory)
openat(AT_FDCWD, "/lib/haswell/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
stat("/lib/haswell", 0x7fffe8365ba0)    = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/lib/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
stat("/lib/x86_64", 0x7fffe8365ba0)     = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/lib/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No
such file or directory)
stat("/lib", {st_mode=S_IFDIR|0755, st_size=512, ...}) = 0
openat(AT_FDCWD,                "/usr/lib/tls/haswell/x86_64/libnss_db.so.2",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)
stat("/usr/lib/tls/haswell/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file
or directory)
openat(AT_FDCWD, "/usr/lib/tls/haswell/libnss_db.so.2", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)
stat("/usr/lib/tls/haswell", 0x7fffe8365ba0) = -1 ENOENT (No such file or
directory)
openat(AT_FDCWD, "/usr/lib/tls/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -
1 ENOENT (No such file or directory)
stat("/usr/lib/tls/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file or
directory)
openat(AT_FDCWD, "/usr/lib/tls/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
stat("/usr/lib/tls", 0x7fffe8365ba0)    = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/usr/lib/haswell/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
stat("/usr/lib/haswell/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file or
directory)
openat(AT_FDCWD, "/usr/lib/haswell/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
stat("/usr/lib/haswell", 0x7fffe8365ba0) = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/usr/lib/x86_64/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
stat("/usr/lib/x86_64", 0x7fffe8365ba0) = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/usr/lib/libnss_db.so.2", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No
such file or directory)
stat("/usr/lib", {st_mode=S_IFDIR|0755, st_size=512, ...}) = 0
munmap(0x7f513ab98000, 32310)           = 0
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=32310, ...}) = 0
mmap(NULL, 32310, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f513ab98000
close(3)                                = 0
openat(AT_FDCWD,                "/lib/x86_64-linux-gnu/libnss_files.so.2",
O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\3005\0\0\0\0\0\0"...,
832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=51832, ...}) = 0
mmap(NULL, 79672, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f513a120000
mmap(0x7f513a123000,            28672,            PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) = 0x7f513a123000
mmap(0x7f513a12a000, 8192, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xa000) = 0x7f513a12a000
mmap(0x7f513a12c000,            8192,            PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xb000) = 0x7f513a12c000
mmap(0x7f513a12e000,            22328,            PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f513a12e000
close(3)                                = 0
mprotect(0x7f513a12c000, 4096, PROT_READ) = 0
```

```
munmap(0x7f513ab98000, 32310)           = 0
openat(AT_FDCWD, "/etc/protocols", O_RDONLY|O_CLOEXEC) = 3
lseek(3, 0, SEEK_CUR)                    = 0
fstat(3, {st_mode=S_IFREG|0644, st_size=2932, ...}) = 0
read(3, "# Internet (IP) protocols\n#\n# Up"..., 512) = 512
lseek(3, 0, SEEK_CUR)                    = 512
read(3, "teway-gateway protocol\nipencap\t4"..., 512) = 512
lseek(3, 0, SEEK_CUR)                    = 1024
read(3, "33\tDCCP\t\t# Datagram Congestion C"..., 512) = 512
lseek(3, 0, SEEK_CUR)                    = 1536
read(3, "06]\nah\t51\tIPSEC-AH\t# Authenticat"..., 512) = 512
lseek(3, 0, SEEK_CUR)                    = 2048
read(3, "tocol\netherip\t97\tETHERIP\t\t# Ethe"..., 512) = 512
lseek(3, 0, SEEK_CUR)                    = 2560
read(3, "r 135 Mobility-Header # Mobility"..., 512) = 372
lseek(3, 0, SEEK_CUR)                    = 2932
read(3, "", 512)                         = 0
close(3)                                 = 0
gettimeofday({tv_sec=1621064014, tv_usec=128448}, NULL) = 0
eventfd2(0, EFD_CLOEXEC)                 = 3
fcntl(3, F_GETFL)                        = 0x2 (flags O_RDWR)
fcntl(3, F_SETFL, O_RDWR|O_NONBLOCK)     = 0
fcntl(3, F_GETFL)                        = 0x802 (flags O_RDWR|O_NONBLOCK)
fcntl(3, F_SETFL, O_RDWR|O_NONBLOCK)     = 0
getrandom("\x1c\xab\x2e\x1d\x87\x30\x3e\xb9\x37\x02\xb5\xe6\x23\xf8\xdb\xe6",
16, 0) = 16
getrandom("\x4e\x83\xcd\xc8\x5f\x93\x02\x6c\x82\x35\x0b\x20\x3e\x27\x3d\x43",
16, 0) = 16
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
read(0, "create 2 -1\n", 1024)          = 12
clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD,
child_tidptr=0x7f513a1518d0) = 4154
eventfd2(0, EFD_CLOEXEC)                 = 4
fcntl(4, F_GETFL)                        = 0x2 (flags O_RDWR)
fcntl(4, F_SETFL, O_RDWR|O_NONBLOCK)     = 0
fcntl(4, F_GETFL)                        = 0x802 (flags O_RDWR|O_NONBLOCK)
fcntl(4, F_SETFL, O_RDWR|O_NONBLOCK)     = 0
clock_gettime(CLOCK_MONOTONIC, {tv_sec=17988, tv_nsec=305114500}) = 0
epoll_create1(EPOLL_CLOEXEC)             = 5
epoll_ctl(5, EPOLL_CTL_ADD, 4, {0, {u32=3770529072, u64=140736963917104}}) = 0
epoll_ctl(5,      EPOLL_CTL_MOD,      4,      {EPOLLIN,      {u32=3770529072,
u64=140736963917104}}) = 0
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7f5139910000
mprotect(0x7f5139911000, 8388608, PROT_READ|PROT_WRITE) = 0
clone(child_stack=0x7f513a10fd30,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|
CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID,      parent_tid=[4155],
tls=0x7f513a110700, child_tidptr=0x7f513a1109d0) = 4155
eventfd2(0, EFD_CLOEXEC)                 = 6
fcntl(6, F_GETFL)                        = 0x2 (flags O_RDWR)
fcntl(6, F_SETFL, O_RDWR|O_NONBLOCK)     = 0
fcntl(6, F_GETFL)                        = 0x802 (flags O_RDWR|O_NONBLOCK)
fcntl(6, F_SETFL, O_RDWR|O_NONBLOCK)     = 0
clock_gettime(CLOCK_MONOTONIC, {tv_sec=17988, tv_nsec=307361000}) = 0
epoll_create1(EPOLL_CLOEXEC)             = 7
epoll_ctl(7, EPOLL_CTL_ADD, 6, {0, {u32=3770531120, u64=140736963919152}}) = 0
epoll_ctl(7,      EPOLL_CTL_MOD,      6,      {EPOLLIN,      {u32=3770531120,
u64=140736963919152}}) = 0
```

```
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7f5139100000
mprotect(0x7f5139101000, 8388608, PROT_READ|PROT_WRITE) = 0
clone(child_stack=0x7f51398ffd30,
flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|
CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID,        parent_tid=[4156],
tls=0x7f5139900700, child_tidptr=0x7f51399009d0) = 4156
clock_gettime(CLOCK_MONOTONIC, {tv_sec=17988, tv_nsec=308280700}) = 0
eventfd2(0, EFD_CLOEXEC)                = 8
fcntl(8, F_GETFL)                       = 0x2 (flags O_RDWR)
fcntl(8, F_SETFL, O_RDWR|O_NONBLOCK)    = 0
fcntl(8, F_GETFL)                       = 0x802 (flags O_RDWR|O_NONBLOCK)
fcntl(8, F_SETFL, O_RDWR|O_NONBLOCK)    = 0
poll([{fd=8, events=POLLIN}], 1, 0)     = 0 (Timeout)
socket(AF_NETLINK, SOCK_RAW|SOCK_CLOEXEC, NETLINK_ROUTE) = 9
bind(9, {sa_family=AF_NETLINK, nl_pid=0, nl_groups=00000000}, 12) = 0
getsockname(9, {sa_family=AF_NETLINK, nl_pid=4153, nl_groups=00000000}, [12])
= 0
clock_gettime(CLOCK_REALTIME_COARSE, {tv_sec=1621064019, tv_nsec=835082200}) =
0
sendto(9,       "\24\0\0\0\22\0\1\3Sy\237`\0\0\0\0\0\0\0\0",       20,       0,
{sa_family=AF_NETLINK, nl_pid=0, nl_groups=00000000}, 12) = 20
recvmsg(9,   {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=80,  type=0x10  /*  NLMSG_???  */,
flags=NLM_F_MULTI,          seq=1621064019,          pid=4153},
"\x00\x00\x01\x00\x04\x00\x00\x00\x43\x10\x00\x00\x00\x00\x00\x00\x0a\x00\x01
\x00\xfc\xaa\x14\x20\x7f\x3d\x00\x00\x08\x00\x1b\x00"...},   iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 80
recvmsg(9,   {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=80,  type=0x10  /*  NLMSG_???  */,
flags=NLM_F_MULTI,          seq=1621064019,          pid=4153},
"\x00\x00\x01\x00\x07\x00\x00\x00\x43\x10\x00\x00\x00\x00\x00\x00\x0a\x00\x01
\x00\x00\x50\x56\xc0\x00\x01\x00\x00\x08\x00\x1b\x00"...},   iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 80
recvmsg(9,   {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=80,  type=0x10  /*  NLMSG_???  */,
flags=NLM_F_MULTI,          seq=1621064019,          pid=4153},
"\x00\x00\x01\x00\x05\x00\x00\x00\x43\x10\x00\x00\x00\x00\x00\x00\x0a\x00\x01
\x00\x00\x50\x56\xc0\x00\x08\x00\x00\x08\x00\x1b\x00"...},   iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 80
recvmsg(9,   {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=76,  type=0x10  /*  NLMSG_???  */,
flags=NLM_F_MULTI,          seq=1621064019,          pid=4153},
"\x00\x00\x04\x03\x01\x00\x00\x00\x49\x00\x00\x00\x00\x00\x00\x00\x0a\x00\x01
\x00\x00\x00\x00\x00\x00\x00\x00\x00\x08\x00\x1b\x00"...},   iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 76
recvmsg(9,   {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=80,  type=0x10  /*  NLMSG_???  */,
flags=NLM_F_MULTI,          seq=1621064019,          pid=4153},
"\x00\x00\x01\x00\x08\x00\x00\x00\x40\x00\x00\x00\x00\x00\x00\x00\x0a\x00\x01
\x00\x00\xff\x78\x0b\xbb\xc3\x00\x00\x08\x00\x1b\x00"...},   iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 80
recvmsg(9,   {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,       msg_iov=[{iov_base={{len=20,       type=NLMSG_DONE,
flags=NLM_F_MULTI, seq=1621064019, pid=4153}, 0}, iov_len=4096}], msg_iovlen=1,
msg_controllen=0, msg_flags=0}, 0) = 20
sendto(9,       "\24\0\0\0\26\0\1\3Ty\237`\0\0\0\0\0\0\0\0",       20,       0,
{sa_family=AF_NETLINK, nl_pid=0, nl_groups=00000000}, 12) = 20
recvmsg(9,   {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=60,  type=0x14  /*  NLMSG_???  */,
```

```
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x02\x18\x00\x00\x04\x00\x00\x00\x08\x00\x01\x00\xc0\xa8\x00\x0c\x08\x00\x04
\x00\xc0\xa8\x00\xff\x14\x00\x06\x00\xc3\x49\x01\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 60
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=64,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x0a\x40\x00\xfd\x04\x00\x00\x00\x14\x00\x01\x00\xfe\x80\x00\x00\x00\x00\x00
\x00\xfc\x6d\x29\x99\x2d\xf4\x30\xa3\x14\x00\x06\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 64
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=60,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x02\x18\x00\x00\x07\x00\x00\x00\x08\x00\x01\x00\xc0\xa8\xe4\x01\x08\x00\x04
\x00\xc0\xa8\xe4\xff\x14\x00\x06\x00\x50\x06\x00\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 60
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=64,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x0a\x40\x00\xfd\x07\x00\x00\x00\x14\x00\x01\x00\xfe\x80\x00\x00\x00\x00\x00
\x00\x49\xd9\x30\x1a\xd0\x91\xe0\x04\x14\x00\x06\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 64
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=60,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x02\x18\x00\x00\x05\x00\x00\x00\x08\x00\x01\x00\xc0\xa8\x91\x01\x08\x00\x04
\x00\xc0\xa8\x91\xff\x14\x00\x06\x00\x50\x06\x00\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 60
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=64,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x0a\x40\x00\xfd\x05\x00\x00\x00\x14\x00\x01\x00\xfe\x80\x00\x00\x00\x00\x00
\x00\x1d\xc1\xa7\xe6\xc6\x51\xa7\x79\x14\x00\x06\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 64
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=60,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x02\x08\x00\x00\x01\x00\x00\x00\x08\x00\x01\x00\x7f\x00\x00\x01\x08\x00\x04
\x00\x7f\xff\xff\xff\x14\x00\x06\x00\xff\xff\xff\xff"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 60
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=64,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x0a\x80\x00\xfe\x01\x00\x00\x00\x14\x00\x01\x00\x00\x00\x00\x00\x00\x00\x00
\x00\x00\x00\x00\x00\x00\x00\x00\x01\x14\x00\x06\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 64
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=60,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x02\x10\x00\x00\x08\x00\x00\x00\x08\x00\x01\x00\xa9\xfe\x9b\x77\x08\x00\x04
\x00\xa9\xfe\xff\xff\x14\x00\x06\x00\xff\xff\xff\xff"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 60
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,  msg_iov=[{iov_base={{len=64,  type=0x14  /*  NLMSG_???  */,
        flags=NLM_F_MULTI,                  seq=1621064020,                  pid=4153},
"\x0a\x40\x00\xfd\x08\x00\x00\x00\x14\x00\x01\x00\xfe\x80\x00\x00\x00\x00\x00
\x00\x05\xcb\x5b\xc9\x1a\x2c\x9b\x77\x14\x00\x06\x00"...},    iov_len=4096}],
msg_iovlen=1, msg_controllen=0, msg_flags=0}, 0) = 64
        recvmsg(9,  {msg_name={sa_family=AF_NETLINK,  nl_pid=0,  nl_groups=00000000},
msg_namelen=12,        msg_iov=[{iov_base={{len=20,        type=NLMSG_DONE,
```

```
flags=NLM_F_MULTI, seq=1621064020, pid=4153}, 0}, iov_len=4096}], msg_iovlen=1,
msg_controllen=0, msg_flags=0}, 0) = 20
close(9)                               = 0
socket(AF_INET, SOCK_STREAM|SOCK_CLOEXEC, IPPROTO_TCP) = 9
setsockopt(9, SOL_SOCKET, SO_REUSEADDR, [1], 4) = 0
bind(9,                  {sa_family=AF_INET,              sin_port=htons(4042),
sin_addr=inet_addr("127.0.0.1")}, 16) = 0
listen(9, 100)                         = 0
getsockname(9,           {sa_family=AF_INET,              sin_port=htons(4042),
sin_addr=inet_addr("127.0.0.1")}, [128->16]) = 0
getsockname(9,           {sa_family=AF_INET,              sin_port=htons(4042),
sin_addr=inet_addr("127.0.0.1")}, [128->16]) = 0
write(6, "\1\0\0\0\0\0\0\0", 8)        = 8
write(8, "\1\0\0\0\0\0\0\0", 8)        = 8
poll([{fd=8, events=POLLIN}], 1, 0)    = 1 ([{fd=8, revents=POLLIN}])
read(8, "\1\0\0\0\0\0\0\0", 8)         = 8
poll([{fd=8, events=POLLIN}], 1, 0)    = 0 (Timeout)
clock_gettime(CLOCK_MONOTONIC, {tv_sec=17988, tv_nsec=315827700}) = 0
poll([{fd=8, events=POLLIN}], 1, 5000) = 1 ([{fd=8, revents=POLLIN}])
read(8, "\1\0\0\0\0\0\0\0", 8)         = 8
poll([{fd=8, events=POLLIN}], 1, 0)    = 0 (Timeout)
write(6, "\1\0\0\0\0\0\0\0", 8)        = 8
poll([{fd=8, events=POLLIN}], 1, -1)   = 1 ([{fd=8, revents=POLLIN}])
read(8, "\1\0\0\0\0\0\0\0", 8)         = 8
poll([{fd=8, events=POLLIN}], 1, 0)    = 0 (Timeout)
write(6, "\1\0\0\0\0\0\0\0", 8)        = 8
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
write(1, "OK: 4154\n", 9)              = 9
read(0, "exit\n", 1024)                = 5
poll([{fd=8, events=POLLIN}], 1, 0)    = 0 (Timeout)
write(6, "\1\0\0\0\0\0\0\0", 8)        = 8
poll([{fd=8, events=POLLIN}], 1, -1)   = 1 ([{fd=8, revents=POLLIN}])
read(8, "\1\0\0\0\0\0\0\0", 8)         = 8
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=4154, si_uid=1000,
si_status=0, si_utime=0, si_stime=0} ---
poll([{fd=8, events=POLLIN}], 1, 0)    = 0 (Timeout)
poll([{fd=8, events=POLLIN}], 1, 0)    = 0 (Timeout)
write(6, "\1\0\0\0\0\0\0\0", 8)        = 8
lseek(0, -1, SEEK_CUR)                 = -1 ESPIPE (Illegal seek)
exit_group(0)                          = ?
+++ exited with 0 +++
```

4. Выводы

Утилиты strace и ltrace – простые и надежные инструменты для отслеживания системных вызовов. Они полезны при отладке и тестировании программ. Несмотря на то, что на первый взгляд протоколы этих утилит кажутся чересчур объёмными и непонятными, при помощи различных ключей можно отфильтровать их «на свой вкус».

Утилита strace позволяет отслеживать большинство системных вызовов. Но если требуется пронаблюдать за более узкими аспектами работы программ, то на помощь придёт ltrace (для отслеживания вызовов динамических библиотек), ftrace (для отслеживания работы операционной системы), perf, SystemTap и многие другие.

Данные утилиты пригодились мне для изучения принципов работы системных вызовов и поиска ошибок в моих лабораторных работах.