Московский Авиационный Институт

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Кафедра вычислительной математики и программирования

Лабораторная работа №8 по курсу

«Операционные системы»

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Содержание

Репозиторий

Задание

Продемонстрировать ключевые системные вызовы, используемые в лабораторной работе и то, что их использование соответствует варианту ЛР на примере лабораторной работы No1.

Описание strace

Диагностику программы мы будем проводить в операционной системе Linux с использованием утилиты strace. Она перехватывает и записывает любые системные вызовы, выполняемые командой. Кроме того, также записывает любой сигнал Linux, отправляемый процессу. Затем мы можем использовать эту информацию для отладки или диагностики программы.

Некоторые флаги утилиты:

- **-i** — выводить указатель на инструкцию во время выполнения системного вызова;

- **-k** — выводить стек вызовов для отслеживаемого процесса после каждого системного вызова;

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

- **-q** — не выводить сообщения о подключении о отключении от процесса;

- **-qq** — не выводить сообщения о завершении работы процесса;

- **-r** — выводить временную метку для каждого системного вызова;

- **-s** — указать максимальный размер выводимой строки, по умолчанию 32;

- **-t** — выводить время суток для каждого вызова;

- **-tt** — добавить микросекунды;

- **-ttt** — добавить микросекунды и количество секунд после начала эпохи Unix;

- **-T** — выводить длительность выполнения системного вызова;

- **-x** — выводить все не ASCI-строки в шестнадцатеричном виде;
- **-xx** — выводить все строки в шестнадцатеричном виде;
- **-y** — выводить пути для файловых дескрипторов;
- **-yy** — выводить информацию о протоколе для файловых дескрипторов;
- **-c** — подсчитывать количество ошибок, вызовов и время выполнения для каждого системного вызова;
- **-O** — добавить определённое количество микросекунд к счетчику времени для каждого вызова;•
- **-S** — сортировать информацию выводимую при опции -c. Доступны поля time, calls, name и nothing. По умолчанию используется time;
- **-w** — суммировать время между началом и завершением системного вызова;
- **-e** — позволяет отфильтровать только нужные системные вызовы или события;
- **-P** — отслеживать только системные вызовы, которые касаются указанного пути;
- **-v** — позволяет выводить дополнительную информацию, такую как версии окружения, статистику и так далее;
- **-b** — если указанный системный вызов обнаружен, трассировка прекращается;
- **-f** — отслеживать также дочерние процессы, если они будут созданы;
- **-ff** — если задана опция -o, то для каждого дочернего процесса будет создан отдельный файл с именем имя_файла.pid.
- **-I** — позволяет блокировать реакцию на нажатия Ctrl+C и Ctrl+Z;
- **-E** — добавляет переменную окружения для запускаемой программы;
- **-p** — указывает pid процесса, к которому следует подключиться;
- **-u** — запустить программу, от имени указанного пользователя.

Вывод strace

```
hacker@warmachine:~/prog/my_os_labs/build/lab1$ strace -f
./lab1
execve("./lab1", ["./lab1"], 0x7ffee46d3ab8 /* 27 vars */) =
0
brk(NULL)
= 0x556be3095000
arch_prctl(0x3001 /* ARCH_??? */, 0x7ffcd5ac0730) = -1 EINVAL
(Invalid argument)
mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f13f4766000
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
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=22019, ...},
AT_EMPTY_PATH) = 0
mmap(NULL, 22019, PROT_READ, MAP_PRIVATE, 3, 0) =
0x7f13f4760000
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\0\0\0\0\0\0
\0"..., 832) = 832
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=2260296,
...}, AT_EMPTY_PATH) = 0
mmap(NULL, 2275520, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3,
0) = 0x7f13f4534000
mprotect(0x7f13f45ce000, 1576960, PROT_NONE) = 0
mmap(0x7f13f45ce000, 1118208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x9a000) =
0x7f13f45ce000
mmap(0x7f13f46df000, 454656, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1ab000) =
0x7f13f46df000
mmap(0x7f13f474f000, 57344, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x21a000) =
0x7f13f474f000
```

```
mmap(0x7f13f475d000, 10432, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) =
0x7f13f475d000
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\0\0\0\0\0\0
\0"..., 832) = 832newfstatat(3, "", {st_mode=S_IFREG|0644,
st_size=125488, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 127720, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3,
0) = 0x7f13f4514000
mmap(0x7f13f4517000, 94208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) =
0x7f13f4517000
mmap(0x7f13f452e000, 16384, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000) =
0x7f13f452e000
mmap(0x7f13f4532000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1d000) =
0x7f13f4532000
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\0P\237\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
\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0"...,
48, 848) = 48
pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\302\211\332Pq\2439\235\350\22
3\322\257\201\326\243\f"..., 68,
```

```
896) = 68
newfstatat(3, "", {st_mode=S_IFREG|0755, st_size=2220400,
...}, AT_EMPTY_PATH) = 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"..., 784, 64) = 784
mmap(NULL, 2264656, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3,
0) = 0x7f13f42eb000
mprotect(0x7f13f4313000, 2023424, PROT_NONE) = 0
mmap(0x7f13f4313000, 1658880, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) =
0x7f13f4313000
mmap(0x7f13f44a8000, 360448, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1bd000) =
0x7f13f44a8000
mmap(0x7f13f4501000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x215000) =
0x7f13f4501000
mmap(0x7f13f4507000, 52816, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) =
0x7f13f4507000
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\0\0\0\0\0\0
\0"..., 832) = 832
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=940560,
...}, AT_EMPTY_PATH) = 0
mmap(NULL, 942344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3,
0) = 0x7f13f4204000
mmap(0x7f13f4212000, 507904, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xe000) =
0x7f13f4212000
mmap(0x7f13f428e000, 372736, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x8a000) =
0x7f13f428e000
```

```
mmap(0x7f13f42e9000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xe4000) =
0x7f13f42e9000
close(3)
= 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f13f4202000
arch_prctl(ARCH_SET_FS, 0x7f13f42033c0) = 0
set_tid_address(0x7f13f4203690)= 22670
set_robust_list(0x7f13f42036a0, 24)= 0
rseq(0x7f13f4203d60, 0x20, 0, 0x53053053) = 0
mprotect(0x7f13f4501000, 16384, PROT_READ) = 0
mprotect(0x7f13f42e9000, 4096, PROT_READ) = 0
mprotect(0x7f13f4532000, 4096, PROT_READ) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f13f4200000
mprotect(0x7f13f474f000, 45056, PROT_READ) = 0
mprotect(0x556be15a8000, 4096, PROT_READ) = 0
mprotect(0x7f13f47a0000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0
munmap(0x7f13f4760000, 22019)
= 0
getrandom("\x06\x84\xe8\xa9\x1b\x6e\xd2\x22", 8,
GRND_NONBLOCK) = 8
brk(NULL)
= 0x556be3095000brk(0x556be30b6000)
= 0x556be30b6000
futex(0x7f13f475d77c, FUTEX_WAKE_PRIVATE, 2147483647) = 0
newfstatat(0, "", {st_mode=S_IFCHR|0620,
st_rdev=makedev(0x88, 0x3), ...}, AT_EMPTY_PATH) = 0
read(0, file1
"file1\n", 1024)
= 6
read(0, file2
"file2\n", 1024)
= 6
pipe2([3, 4], 0)= 0
```

```
pipe2([5, 6], 0)= 0
openat(AT_FDCWD, "file1", O_WRONLY|O_CREAT|O_TRUNC, 0644) = 7
openat(AT_FDCWD, "file2", O_WRONLY|O_CREAT|O_TRUNC, 0644) = 8
clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLDstrace:
Process 22704
attached
, child_tidptr=0x7f13f4203690) = 22704
[pid 22704] set_robust_list(0x7f13f42036a0, 24 <unfinished
...>
[pid 22670] clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD
<unfinished ...>
[pid 22704] <... set_robust_list resumed>) = 0
[pid 22704] clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLDstrace:
Process
22705 attached
<unfinished ...>
[pid 22670] <... clone resumed>, child_tidptr=0x7f13f4203690)
= 22705
[pid 22705] set_robust_list(0x7f13f42036a0, 24 <unfinished
...>
[pid 22670] close(3strace: Process 22706 attached
)
= 0
[pid 22705] <... set_robust_list resumed>) = 0
[pid 22670] close(5 <unfinished ...>
[pid 22706] set_robust_list(0x7f13f42036a0, 24 <unfinished
...>
[pid 22670] <... close resumed>)
= 0
[pid 22705] close(3 <unfinished ...>
[pid 22704] <... clone resumed>, child_tidptr=0x7f13f4203690)
= 22706
[pid 22670] close(7 <unfinished ...>
[pid 22706] <... set_robust_list resumed>) = 0
[pid 22705] <... close resumed>)= 0
```

```
[pid 22670] <... close resumed>)= 0
[pid 22706] close(5 <unfinished ...>
[pid 22704] close(5 <unfinished ...>
[pid 22670] close(8 <unfinished ...>
[pid 22706] <... close resumed>)
= 0
[pid 22705] close(4 <unfinished ...>
[pid 22670] <... close resumed>)
= 0
[pid 22706] close(6 <unfinished ...>
[pid 22704] <... close resumed>)
[pid 22670] read(0,
= 0
<unfinished ...>
[pid 22706] <... close resumed>)= 0
[pid 22705] <... close resumed>)= 0
[pid 22706] close(4 <unfinished ...>
[pid 22704] close(6 <unfinished ...>
[pid 22705] close(6 <unfinished ...>
[pid 22706] <... close resumed>)= 0
[pid 22704] <... close resumed>)= 0
[pid 22706] close(8 <unfinished ...>
[pid 22705] <... close resumed>)
= 0[pid 22706] <... close resumed>)
= 0
[pid 22704] close(4 <unfinished ...>
[pid 22706] dup2(3, 0 <unfinished ...>
[pid 22705] close(7 <unfinished ...>
[pid 22706] <... dup2 resumed>)= 0
[pid 22704] <... close resumed>)= 0
[pid 22706] dup2(7, 1 <unfinished ...>
[pid 22705] <... close resumed>)= 0
[pid 22706] <... dup2 resumed>)= 1
[pid 22704] close(8 <unfinished ...>
[pid 22706] close(7 <unfinished ...>
[pid 22705] dup2(5, 0 <unfinished ...>
[pid 22706] <... close resumed>)= 0
[pid 22704] <... close resumed>)= 0
```

```
[pid 22706] close(3 <unfinished ...>
[pid 22705] <... dup2 resumed>)= 0
[pid 22706] <... close resumed>)= 0
[pid 22704] dup2(3, 0 <unfinished ...>
[pid 22706]
execve("/home/hacker/prog/my_os_labs/build/lab1/child",
["child"], 0x7ffcd5ac0908 /* 27 vars
*/ <unfinished ...>
[pid 22705] dup2(8, 1 <unfinished ...>
[pid 22704] <... dup2 resumed>)= 0
[pid 22705] <... dup2 resumed>)= 1
[pid 22704] dup2(7, 1 <unfinished ...>
[pid 22705] close(8 <unfinished ...>
[pid 22704] <... dup2 resumed>)
= 1
[pid 22706] <... execve resumed>)= 0
[pid 22705] <... close resumed>)= 0
[pid 22704] close(7 <unfinished ...>
[pid 22706] brk(NULL <unfinished ...>
[pid 22705] close(5 <unfinished ...>
[pid 22706] <... brk resumed>)
= 0x55d23139a000
[pid 22704] <... close resumed>)= 0
[pid 22705] <... close resumed>)= 0
[pid 22706] arch_prctl(0x3001 /* ARCH_??? */, 0x7fff75b06340
<unfinished ...>
[pid 22704] close(3 <unfinished ...>
[pid 22706] <... arch_prctl resumed>)
= -1 EINVAL (Invalid argument)
[pid 22705]
execve("/home/hacker/prog/my_os_labs/build/lab1/child,
["child"], 0x7ffcd5ac0908 /* 27 vars
*/ <unfinished ...>
[pid 22704] <... close resumed>)
= 0
[pid 22706] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22704]
```

```
execve("/home/hacker/prog/my_os_labs/build/lab1/child,
["child"], 0x7ffcd5ac0908 /* 27 vars
*/ <unfinished ...>
[pid 22706] <... mmap resumed>)
= 0x7fd9f223d000
[pid 22706] access("/etc/ld.so.preload", R_OK <unfinished
...>
[pid 22705] <... execve resumed>)= 0
[pid 22706] <... access resumed>)= -1 ENOENT (No such file or
directory)
[pid 22705] brk(NULL <unfinished ...>
[pid 22706] openat(AT_FDCWD, "/etc/ld.so.cache",
O_RDONLY|O_CLOEXEC <unfinished ...>
[pid 22704] <... execve resumed>)= 0
[pid 22705] <... brk resumed>)= 0x5636424a6000
[pid 22706] <... openat resumed>)= 3[pid 22704] brk(NULL
<unfinished ...>
[pid 22706] newfstatat(3, "",
<unfinished ...>
[pid 22705] arch_prctl(0x3001 /* ARCH_??? */, 0x7ffec12257f0
<unfinished ...>
[pid 22706] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=22019, ...}, AT_EMPTY_PATH) = 0
[pid 22704] <... brk resumed>)
= 0x55ead79d9000
[pid 22706] mmap(NULL, 22019, PROT_READ, MAP_PRIVATE, 3, 0
<unfinished ...>
[pid 22705] <... arch_prctl resumed>)= -1 EINVAL (Invalid
argument)
[pid 22706] <... mmap resumed>)= 0x7fd9f2237000
[pid 22704] arch_prctl(0x3001 /* ARCH_??? */, 0x7ffce5f32c20
<unfinished ...>
[pid 22706] close(3 <unfinished ...>
[pid 22705] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22706] <... close resumed>)= 0
[pid 22704] <... arch_prctl resumed>)= -1 EINVAL (Invalid
argument)
```

```
[pid 22706] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22705] <... mmap resumed>)= 0x7faed01ac000
[pid 22706] <... openat resumed>)= 3
[pid 22704] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22706] read(3,
<unfinished ...>
[pid 22705] access("/etc/ld.so.preload", R_OK <unfinished
...>
[pid 22706] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22704] <... mmap resumed>)
[pid 22706] newfstatat(3, "",
= 0x7fbcb493b000
<unfinished ...>
[pid 22705] <... access resumed>)
= -1 ENOENT (No such file or directory)
[pid 22706] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=2260296, ...}, AT_EMPTY_PATH) = 0
[pid 22704] access("/etc/ld.so.preload", R_OK <unfinished
...>
[pid 22706] mmap(NULL, 2275520, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22705] openat(AT_FDCWD, "/etc/ld.so.cache",
O_RDONLY|O_CLOEXEC <unfinished ...>
[pid 22706] <... mmap resumed>)= 0x7fd9f200b000
[pid 22704] <... access resumed>)= -1 ENOENT (No such file or
directory)
[pid 22706] mprotect(0x7fd9f20a5000, 1576960, PROT_NONE
<unfinished ...>
[pid 22705] <... openat resumed>)= 3
[pid 22706] <... mprotect resumed>)= 0
[pid 22704] openat(AT_FDCWD, "/etc/ld.so.cache",
O_RDONLY|O_CLOEXEC <unfinished ...>
```

```
[pid 22706] mmap(0x7fd9f20a5000, 1118208,
PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x9a000 <unfinished ...>
[pid 22705] newfstatat(3, "",
<unfinished ...>
[pid 22706] <... mmap resumed>)= 0x7fd9f20a5000
[pid 22704] <... openat resumed>)= 3
[pid 22706] mmap(0x7fd9f21b6000, 454656, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1ab000
<unfinished ...>
[pid 22705] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=22019, ...}, AT_EMPTY_PATH) = 0
[pid 22706] <... mmap resumed>)
[pid 22704] newfstatat(3, "",
= 0x7fd9f21b6000
<unfinished ...>
[pid 22706] mmap(0x7fd9f2226000, 57344, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x21a000 <unfinished ...>
[pid 22705] mmap(NULL, 22019, PROT_READ, MAP_PRIVATE, 3, 0
<unfinished ...>
[pid 22706] <... mmap resumed>)
= 0x7fd9f2226000
[pid 22704] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=22019, ...}, AT_EMPTY_PATH) = 0
[pid 22706] mmap(0x7fd9f2234000, 10432, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0
<unfinished ...>
[pid 22705] <... mmap resumed>)
= 0x7faed01a6000[pid 22706] <... mmap resumed>)
= 0x7fd9f2234000
[pid 22704] mmap(NULL, 22019, PROT_READ, MAP_PRIVATE, 3, 0
<unfinished ...>
[pid 22706] close(3 <unfinished ...>
[pid 22705] close(3 <unfinished ...>
[pid 22706] <... close resumed>)= 0
[pid 22704] <... mmap resumed>)= 0x7fbcb4935000
[pid 22706] openat(AT_FDCWD,
```

```
"/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22705] <... close resumed>)= 0
[pid 22706] <... openat resumed>)= 3
[pid 22704] close(3 <unfinished ...>
[pid 22706] read(3,
<unfinished ...>
[pid 22705] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22706] <... read
resumed>"\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22704] <... close resumed>)
[pid 22706] newfstatat(3, "",
= 0
<unfinished ...>
[pid 22705] <... openat resumed>)
= 3
[pid 22706] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=125488, ...}, AT_EMPTY_PATH) = 0
[pid 22704] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22706] mmap(NULL, 127720, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22705] read(3,
<unfinished ...>
[pid 22706] <... mmap resumed>)= 0x7fd9f1feb000
[pid 22704] <... openat resumed>)= 3
[pid 22706] mmap(0x7fd9f1fee000, 94208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x3000 <unfinished ...>
[pid 22705] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
```

```
[pid 22706] <... mmap resumed>)
[pid 22704] read(3,
= 0x7fd9f1fee000
<unfinished ...>
[pid 22706] mmap(0x7fd9f2005000, 16384, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000
<unfinished ...>
[pid 22705] newfstatat(3, "",
<unfinished ...>
[pid 22706] <... mmap resumed>)
= 0x7fd9f2005000
[pid 22704] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22706] mmap(0x7fd9f2009000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1d000 <unfinished ...>
[pid 22705] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=2260296, ...}, AT_EMPTY_PATH) = 0
[pid 22706] <... mmap resumed>)
[pid 22704] newfstatat(3, "",
= 0x7fd9f2009000
<unfinished ...>
[pid 22706] close(3 <unfinished ...>
[pid 22705] mmap(NULL, 2275520, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22706] <... close resumed>)
= 0
[pid 22704] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=2260296, ...}, AT_EMPTY_PATH) = 0
[pid 22706] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22705] <... mmap resumed>)= 0x7faecff7a000
[pid 22706] <... openat resumed>)= 3
[pid 22704] mmap(NULL, 2275520, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
```

```
[pid 22706] read(3,
<unfinished ...>
[pid 22705] mprotect(0x7faed0014000, 1576960, PROT_NONE
<unfinished ...>
[pid 22706] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\
2\0\0\0\0\0"..., 832) =
832[pid 22704] <... mmap resumed>)
[pid 22706] pread64(3,
= 0x7fbcb4709000
<unfinished ...>
[pid 22705] <... mprotect resumed>)
= 0
[pid 22706] <... pread64
resumed>"\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
[pid 22704] mprotect(0x7fbcb47a3000, 1576960, PROT_NONE
<unfinished ...>
[pid 22706] pread64(3,
<unfinished ...>
[pid 22705] mmap(0x7faed0014000, 1118208,
PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x9a000 <unfinished ...>
[pid 22706] <... pread64 resumed>"\4\0\0\0
\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0"...,
48,
848) = 48
[pid 22704] <... mprotect resumed>)
[pid 22706] pread64(3,
= 0
<unfinished ...>
[pid 22705] <... mmap resumed>)
= 0x7faed0014000
[pid 22706] <... pread64
resumed>"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\302\211\332Pq\2439\23
5\350\223\322\257\201\326\243\f"..., 68, 896)
= 68
```

```
[pid 22704] mmap(0x7fbcb47a3000, 1118208,
PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x9a000 <unfinished ...>
[pid 22706] newfstatat(3, "",
<unfinished ...>
[pid 22705] mmap(0x7faed0125000, 454656, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1ab000
<unfinished ...>
[pid 22706] <... newfstatat resumed>{st_mode=S_IFREG|0755,
st_size=2220400, ...}, AT_EMPTY_PATH) = 0
[pid 22704] <... mmap resumed>)
[pid 22706] pread64(3,
= 0x7fbcb47a3000
<unfinished ...>
[pid 22705] <... mmap resumed>)
= 0x7faed0125000
[pid 22706] <... pread64
resumed>"\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"..., 784,
64) = 784
[pid 22704] mmap(0x7fbcb48b4000, 454656, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1ab000
<unfinished ...>
[pid 22706] mmap(NULL, 2264656, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22705] mmap(0x7faed0195000, 57344, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x21a000 <unfinished ...>
[pid 22706] <... mmap resumed>)= 0x7fd9f1dc2000
[pid 22704] <... mmap resumed>)= 0x7fbcb48b4000
[pid 22706] mprotect(0x7fd9f1dea000, 2023424, PROT_NONE
<unfinished ...>
[pid 22705] <... mmap resumed>)= 0x7faed0195000
[pid 22706] <... mprotect resumed>)= 0
[pid 22704] mmap(0x7fbcb4924000, 57344, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x21a000 <unfinished ...>
[pid 22706] mmap(0x7fd9f1dea000, 1658880,
```

PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x28000 <unfinished ...>
[pid 22705] mmap(0x7faed01a3000, 10432, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0
<unfinished ...>
[pid 22706] <... mmap resumed>)= 0x7fd9f1dea000
[pid 22704] <... mmap resumed>)= 0x7fbcb4924000
[pid 22706] mmap(0x7fd9f1f7f000, 360448, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1bd000
<unfinished ...>
[pid 22705] <... mmap resumed>)= 0x7faed01a3000
[pid 22706] <... mmap resumed>)= 0x7fd9f1f7f000
[pid 22704] mmap(0x7fbcb4932000, 10432, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0
<unfinished ...>[pid 22706] mmap(0x7fd9f1fd8000, 24576,
PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x215000 <unfinished ...>
[pid 22705] close(3 <unfinished ...>
[pid 22706] <... mmap resumed>)= 0x7fd9f1fd8000
[pid 22704] <... mmap resumed>)= 0x7fbcb4932000
[pid 22706] mmap(0x7fd9f1fde000, 52816, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0
<unfinished ...>
[pid 22705] <... close resumed>)= 0
[pid 22706] <... mmap resumed>)= 0x7fd9f1fde000
[pid 22704] close(3 <unfinished ...>
[pid 22706] close(3 <unfinished ...>
[pid 22705] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22706] <... close resumed>)= 0
[pid 22704] <... close resumed>)= 0
[pid 22706] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22705] <... openat resumed>)= 3
[pid 22706] <... openat resumed>)= 3
[pid 22704] openat(AT_FDCWD,

```
"/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22706] read(3,<unfinished ...>
[pid 22705] read(3,<unfinished ...>
[pid 22706] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22704] <... openat resumed>)
[pid 22706] newfstatat(3, "",
= 3
<unfinished ...>
[pid 22705] <... read
resumed>"\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22706] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=940560, ...}, AT_EMPTY_PATH) = 0
[pid 22704] read(3,
<unfinished ...>
[pid 22706] mmap(NULL, 942344, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22705] newfstatat(3, "",
<unfinished ...>
[pid 22706] <... mmap resumed>)
= 0x7fd9f1cdb000
[pid 22704] <... read
resumed>"\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22706] mmap(0x7fd9f1ce9000, 507904, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe000 <unfinished ...>
[pid 22705] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=125488, ...}, AT_EMPTY_PATH) = 0
[pid 22706] <... mmap resumed>)
[pid 22704] newfstatat(3, "",
= 0x7fd9f1ce9000
```

```
<unfinished ...>
[pid 22706] mmap(0x7fd9f1d65000, 372736, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x8a000
<unfinished ...>
[pid 22705] mmap(NULL, 127720, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22706] <... mmap resumed>)
= 0x7fd9f1d65000
[pid 22704] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=125488, ...}, AT_EMPTY_PATH) = 0
[pid 22706] mmap(0x7fd9f1dc0000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe4000 <unfinished ...>
[pid 22705] <... mmap resumed>)= 0x7faecff5a000
[pid 22706] <... mmap resumed>)= 0x7fd9f1dc0000
[pid 22704] mmap(NULL, 127720, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22706] close(3 <unfinished ...>
[pid 22705] mmap(0x7faecff5d000, 94208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x3000 <unfinished ...>
[pid 22706] <... close resumed>)
= 0[pid 22704] <... mmap resumed>)= 0x7fbcb46e9000
[pid 22705] <... mmap resumed>)= 0x7faecff5d000
[pid 22706] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22704] mmap(0x7fbcb46ec000, 94208, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x3000 <unfinished ...>
[pid 22706] <... mmap resumed>)
= 0x7fd9f1cd9000
[pid 22705] mmap(0x7faecff74000, 16384, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000
<unfinished ...>
[pid 22706] arch_prctl(ARCH_SET_FS, 0x7fd9f1cda3c0
<unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb46ec000
[pid 22706] <... arch_prctl resumed>)= 0
```

```
[pid 22705] <... mmap resumed>)= 0x7faecff74000
[pid 22706] set_tid_address(0x7fd9f1cda690 <unfinished ...>
[pid 22704] mmap(0x7fbcb4703000, 16384, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000
<unfinished ...>
[pid 22706] <... set_tid_address resumed>) = 22706
[pid 22705] mmap(0x7faecff78000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1d000 <unfinished ...>
[pid 22706] set_robust_list(0x7fd9f1cda6a0, 24 <unfinished
...>
[pid 22704] <... mmap resumed>)
= 0x7fbcb4703000
[pid 22706] <... set_robust_list resumed>) = 0
[pid 22705] <... mmap resumed>)
= 0x7faecff78000
[pid 22706] rseq(0x7fd9f1cdad60, 0x20, 0, 0x53053053
<unfinished ...>
[pid 22704] mmap(0x7fbcb4707000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1d000 <unfinished ...>
[pid 22706] <... rseq resumed>)
= 0
[pid 22705] close(3 <unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb4707000
[pid 22705] <... close resumed>)= 0
[pid 22706] mprotect(0x7fd9f1fd8000, 16384, PROT_READ
<unfinished ...>
[pid 22704] close(3 <unfinished ...>
[pid 22706] <... mprotect resumed>)
= 0
[pid 22705] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22706] mprotect(0x7fd9f1dc0000, 4096, PROT_READ
<unfinished ...>
[pid 22704] <... close resumed>)= 0
[pid 22706] <... mprotect resumed>)= 0
```

```
[pid 22705] <... openat resumed>)= 3
[pid 22706] mprotect(0x7fd9f2009000, 4096, PROT_READ
<unfinished ...>
[pid 22704] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22706] <... mprotect resumed>)
[pid 22705] read(3,
= 0
<unfinished ...>
[pid 22704] <... openat resumed>)
= 3
[pid 22705] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\
2\0\0\0\0\0"..., 832) =
832
[pid 22704] read(3,
<unfinished ...>
[pid 22705] pread64(3,
<unfinished ...>
[pid 22706] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22704] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\
2\0\0\0\0\0"..., 832) =
832
[pid 22706] <... mmap resumed>)
= 0x7fd9f1cd7000
[pid 22705] <... pread64
resumed>"\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"..., 784,
64) = 784[pid 22704] pread64(3,<unfinished ...>
[pid 22705] pread64(3,<unfinished ...>
[pid 22704] <... pread64
resumed>"\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"..., 784,
64) = 784
[pid 22705] <... pread64 resumed>"\4\0\0\0
```

```
\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0"...,
48,
848) = 48
[pid 22704] pread64(3,<unfinished ...>
[pid 22705] pread64(3,<unfinished ...>
[pid 22704] <... pread64 resumed>"\4\0\0\0
\0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0"...,
48,
848) = 48
[pid 22705] <... pread64
resumed>"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\302\211\332Pq\2439\23
5\350\223\322\257\201\326\243\f"..., 68, 896)
= 68
[pid 22704] pread64(3,
<unfinished ...>
[pid 22705] newfstatat(3, "",
<unfinished ...>
[pid 22704] <... pread64
resumed>"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\302\211\332Pq\2439\23
5\350\223\322\257\201\326\243\f"..., 68, 896)
= 68
[pid 22706] mprotect(0x7fd9f2226000, 45056, PROT_READ
<unfinished ...>
[pid 22705] <... newfstatat resumed>{st_mode=S_IFREG|0755,
st_size=2220400, ...}, AT_EMPTY_PATH) = 0
[pid 22706] <... mprotect resumed>)
[pid 22704] newfstatat(3, "",
[pid 22705] pread64(3,
= 0
<unfinished ...>
<unfinished ...>
[pid 22706] mprotect(0x55d230c1c000, 4096, PROT_READ
<unfinished ...>
[pid 22704] <... newfstatat resumed>{st_mode=S_IFREG|0755,
st_size=2220400, ...}, AT_EMPTY_PATH) = 0
[pid 22706] <... mprotect resumed>)
= 0
[pid 22705] <... pread64
```

resumed>"\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"..., 784,
64) = 784
[pid 22704] pread64(3,
<unfinished ...>
[pid 22706] mprotect(0x7fd9f2277000, 8192, PROT_READ
<unfinished ...>
[pid 22705] mmap(NULL, 2264656, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22706] <... mprotect resumed>)
= 0
[pid 22704] <... pread64
resumed>"\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"..., 784,
64) = 784
[pid 22706] prlimit64(0, RLIMIT_STACK, NULL,
[pid 22705] <... mmap resumed>)
<unfinished ...>
= 0x7faecfd31000
[pid 22706] <... prlimit64 resumed>{rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0
[pid 22704] mmap(NULL, 2264656, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22706] munmap(0x7fd9f2237000, 22019 <unfinished ...>
[pid 22705] mprotect(0x7faecfd59000, 2023424, PROT_NONE
<unfinished ...>
[pid 22706] <... munmap resumed>)
= 0
[pid 22704] <... mmap resumed>)= 0x7fbcb44c0000
[pid 22705] <... mprotect resumed>)= 0
[pid 22706] getrandom(<unfinished ...>
[pid 22704] mprotect(0x7fbcb44e8000, 2023424, PROT_NONE
<unfinished ...>
[pid 22706] <... getrandom
resumed>"\x29\xb3\x81\xd1\xbd\x9a\xcf\x67", 8, GRND_NONBLOCK)
= 8
[pid 22705] mmap(0x7faecfd59000, 1658880,
PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,

```
0x28000 <unfinished ...>
[pid 22706] brk(NULL <unfinished ...>
[pid 22704] <... mprotect resumed>)= 0
[pid 22706] <... brk resumed>)= 0x55d23139a000
[pid 22705] <... mmap resumed>)= 0x7faecfd59000[pid 22704]
mmap(0x7fbcb44e8000, 1658880, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x28000 <unfinished ...>
[pid 22706] brk(0x55d2313bb000 <unfinished ...>
[pid 22705] mmap(0x7faecfeee000, 360448, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1bd000
<unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb44e8000
[pid 22706] <... brk resumed>)= 0x55d2313bb000
[pid 22705] <... mmap resumed>)= 0x7faecfeee000
[pid 22704] mmap(0x7fbcb467d000, 360448, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1bd000
<unfinished ...>
[pid 22706] futex(0x7fd9f223477c, FUTEX_WAKE_PRIVATE,
2147483647 <unfinished ...>
[pid 22705] mmap(0x7faecff47000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x215000 <unfinished ...>
[pid 22706] <... futex resumed>)= 0
[pid 22704] <... mmap resumed>)= 0x7fbcb467d000
[pid 22705] <... mmap resumed>)= 0x7faecff47000
[pid 22704] mmap(0x7fbcb46d6000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x215000 <unfinished ...>
[pid 22705] mmap(0x7faecff4d000, 52816, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0
<unfinished ...>
[pid 22706] newfstatat(0, "",
<unfinished ...>
[pid 22704] <... mmap resumed>)
= 0x7fbcb46d6000
[pid 22706] <... newfstatat resumed>{st_mode=S_IFIFO|0600,
st_size=0, ...}, AT_EMPTY_PATH) = 0
```

```
[pid 22705] <... mmap resumed>)
[pid 22706] read(0,
= 0x7faecff4d000
<unfinished ...>
[pid 22704] mmap(0x7fbcb46dc000, 52816, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0
<unfinished ...>
[pid 22705] close(3 <unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb46dc000
[pid 22705] <... close resumed>)= 0
[pid 22704] close(3 <unfinished ...>
[pid 22705] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22704] <... close resumed>)= 0
[pid 22705] <... openat resumed>)= 3
[pid 22704] openat(AT_FDCWD,
"/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>
[pid 22705] read(3,
<unfinished ...>
[pid 22704] <... openat resumed>)
= 3
[pid 22705] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22704] read(3,
<unfinished ...>
[pid 22705] newfstatat(3, "",
<unfinished ...>
[pid 22704] <... read
resumed>"\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0
\0\0\0\0\0"..., 832) =
832
[pid 22705] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=940560, ...}, AT_EMPTY_PATH) = 0
[pid 22704] newfstatat(3, "",
```

```
<unfinished ...>
[pid 22705] mmap(NULL, 942344, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22704] <... newfstatat resumed>{st_mode=S_IFREG|0644,
st_size=940560, ...}, AT_EMPTY_PATH) = 0
[pid 22705] <... mmap resumed>)
= 0x7faecfc4a000
[pid 22704] mmap(NULL, 942344, PROT_READ,
MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>
[pid 22705] mmap(0x7faecfc58000, 507904, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe000 <unfinished ...>
[pid 22704] <... mmap resumed>)
= 0x7fbcb43d9000[pid 22705] <... mmap resumed>)
= 0x7faecfc58000
[pid 22704] mmap(0x7fbcb43e7000, 507904, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe000 <unfinished ...>
[pid 22705] mmap(0x7faecfcd4000, 372736, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x8a000
<unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb43e7000
[pid 22705] <... mmap resumed>)= 0x7faecfcd4000
[pid 22704] mmap(0x7fbcb4463000, 372736, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x8a000
<unfinished ...>
[pid 22705] mmap(0x7faecfd2f000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe4000 <unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb4463000
[pid 22705] <... mmap resumed>)= 0x7faecfd2f000
[pid 22704] mmap(0x7fbcb44be000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe4000 <unfinished ...>
[pid 22705] close(3 <unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb44be000
[pid 22705] <... close resumed>)= 0
[pid 22704] close(3 <unfinished ...>
```

```
[pid 22705] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22704] <... close resumed>)= 0
[pid 22705] <... mmap resumed>)= 0x7faecfc48000
[pid 22704] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22705] arch_prctl(ARCH_SET_FS, 0x7faecfc493c0
<unfinished ...>
[pid 22704] <... mmap resumed>)= 0x7fbcb43d7000
[pid 22705] <... arch_prctl resumed>)= 0
[pid 22704] arch_prctl(ARCH_SET_FS, 0x7fbcb43d83c0
<unfinished ...>
[pid 22705] set_tid_address(0x7faecfc49690 <unfinished ...>
[pid 22704] <... arch_prctl resumed>)
= 0
[pid 22705] <... set_tid_address resumed>) = 22705
[pid 22704] set_tid_address(0x7fbcb43d8690 <unfinished ...>
[pid 22705] set_robust_list(0x7faecfc496a0, 24 <unfinished
...>
[pid 22704] <... set_tid_address resumed>) = 22704
[pid 22705] <... set_robust_list resumed>) = 0
[pid 22704] set_robust_list(0x7fbcb43d86a0, 24 <unfinished
...>
[pid 22705] rseq(0x7faecfc49d60, 0x20, 0, 0x53053053
<unfinished ...>
[pid 22704] <... set_robust_list resumed>) = 0
[pid 22705] <... rseq resumed>)
= 0
[pid 22704] rseq(0x7fbcb43d8d60, 0x20, 0, 0x53053053) = 0
[pid 22705] mprotect(0x7faecff47000, 16384, PROT_READ) = 0
[pid 22704] mprotect(0x7fbcb46d6000, 16384, PROT_READ
<unfinished ...>
[pid 22705] mprotect(0x7faecfd2f000, 4096, PROT_READ
<unfinished ...>
[pid 22704] <... mprotect resumed>)= 0
[pid 22705] <... mprotect resumed>)= 0
[pid 22704] mprotect(0x7fbcb44be000, 4096, PROT_READ
<unfinished ...>
```

```
[pid 22705] mprotect(0x7faecff78000, 4096, PROT_READ
<unfinished ...>
[pid 22704] <... mprotect resumed>)= 0
[pid 22705] <... mprotect resumed>)= 0
[pid 22704] mprotect(0x7fbcb4707000, 4096, PROT_READ) = 0
[pid 22705] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22704] mmap(NULL, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>
[pid 22705] <... mmap resumed>)
= 0x7faecfc46000[pid 22704] <... mmap resumed>)
= 0x7fbcb43d5000
[pid 22705] mprotect(0x7faed0195000, 45056, PROT_READ
<unfinished ...>
[pid 22704] mprotect(0x7fbcb4924000, 45056, PROT_READ
<unfinished ...>
[pid 22705] <... mprotect resumed>)= 0
[pid 22704] <... mprotect resumed>)= 0
[pid 22705] mprotect(0x563641440000, 4096, PROT_READ
<unfinished ...>
[pid 22704] mprotect(0x55ead5b0d000, 4096, PROT_READ
<unfinished ...>
[pid 22705] <... mprotect resumed>)= 0
[pid 22704] <... mprotect resumed>)= 0
[pid 22705] mprotect(0x7faed01e6000, 8192, PROT_READ
<unfinished ...>
[pid 22704] mprotect(0x7fbcb4975000, 8192, PROT_READ
<unfinished ...>
[pid 22705] <... mprotect resumed>)= 0
[pid 22704] <... mprotect resumed>)= 0
[pid 22705] prlimit64(0, RLIMIT_STACK, NULL,<unfinished ...>
[pid 22704] prlimit64(0, RLIMIT_STACK, NULL,<unfinished ...>
[pid 22705] <... prlimit64 resumed>{rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0
[pid 22704] <... prlimit64 resumed>{rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0
[pid 22705] munmap(0x7faed01a6000, 22019 <unfinished ...>
[pid 22704] munmap(0x7fbcb4935000, 22019 <unfinished ...>
```

```
[pid 22705] <... munmap resumed>)= 0
[pid 22704] <... munmap resumed>)= 0
[pid 22705] getrandom( <unfinished ...>
[pid 22704] getrandom( <unfinished ...>
[pid 22705] <... getrandom
resumed>"\x9c\x1e\x6d\x54\x9a\x1f\xbe\x15", 8, GRND_NONBLOCK)
= 8
[pid 22704] <... getrandom
resumed>"\xfa\x3b\xe8\x53\x41\x85\x36\x73", 8, GRND_NONBLOCK)
= 8
[pid 22705] brk(NULL <unfinished ...>
[pid 22704] brk(NULL <unfinished ...>
[pid 22705] <... brk resumed>)= 0x5636424a6000
[pid 22704] <... brk resumed>)= 0x55ead79d9000
[pid 22705] brk(0x5636424c7000 <unfinished ...>
[pid 22704] brk(0x55ead79fa000 <unfinished ...>
[pid 22705] <... brk resumed>)= 0x5636424c7000
[pid 22704] <... brk resumed>)= 0x55ead79fa000
[pid 22705] futex(0x7faed01a377c, FUTEX_WAKE_PRIVATE,
2147483647 <unfinished ...>
[pid 22704] futex(0x7fbcb493277c, FUTEX_WAKE_PRIVATE,
2147483647 <unfinished ...>
[pid 22705] <... futex resumed>)= 0
[pid 22704] <... futex resumed>)= 0
[pid 22705] newfstatat(0, "",<unfinished ...>
[pid 22704] newfstatat(0, "",<unfinished ...>
[pid 22705] <... newfstatat resumed>{st_mode=S_IFIFO|0600,
st_size=0, ...}, AT_EMPTY_PATH) = 0
[pid 22704] <... newfstatat resumed>{st_mode=S_IFIFO|0600,
st_size=0, ...}, AT_EMPTY_PATH) = 0
[pid 22705] read(0,
<unfinished ...>
[pid 22704] read(0, 123
<unfinished ...>
[pid 22670] <... read resumed>"123\n", 1024) = 4
[pid 22670] write(6, "123\n", 4)
= 4
[pid 22705] <... read resumed>"123\n", 4096) = 4
```

```
[pid 22670] read(0,
<unfinished ...>
[pid 22705] newfstatat(1, "", {st_mode=S_IFREG|0644,
st_size=0, ...}, AT_EMPTY_PATH) = 0
[pid 22705] write(1, "321\n", 4)
[pid 22705] read(0, 1234
<unfinished ...>
= 4[pid 22670] <... read resumed>"1234\n", 1024) = 5
[pid 22670] write(4, "1234\n", 5)
= 5
[pid 22706] <... read resumed>"1234\n", 4096) = 5
[pid 22670] read(0,
<unfinished ...>
[pid 22706] newfstatat(1, "", {st_mode=S_IFREG|0644,
st_size=0, ...}, AT_EMPTY_PATH) = 0
[pid 22706] write(1, "4321\n", 5)
= 5
[pid 22706] read(0, qwe
<unfinished ...>
[pid 22670] <... read resumed>"qwe\n", 1024) = 4
[pid 22670] write(6, "qwe\n", 4)
= 4
[pid 22705] <... read resumed>"qwe\n", 4096) = 4
[pid 22670] read(0,
<unfinished ...>
[pid 22705] write(1, "ewq\n", 4)
= 4
[pid 22705] read(0, qwer
<unfinished ...>
[pid 22670] <... read resumed>"qwer\n", 1024) = 5
[pid 22670] write(4, "qwer\n", 5)
= 5
[pid 22704] <... read resumed>"qwer\n", 4096) = 5
[pid 22670] read(0,
<unfinished ...>
[pid 22704] newfstatat(1, "", {st_mode=S_IFREG|0644,
st_size=5, ...}, AT_EMPTY_PATH) = 0
[pid 22704] write(1, "rewq\n", 5)
```

```
[pid 22704] read(0,
= 5
<unfinished ...>
[pid 22670] <... read resumed>"", 1024) = 0
[pid 22670] close(4)
= 0
[pid 22706] <... read resumed>"", 4096) = 0
[pid 22704] <... read resumed>"", 4096) = 0
[pid 22670] close(6 <unfinished ...>
[pid 22706] exit_group(0 <unfinished ...>
[pid 22670] <... close resumed>)= 0
[pid 22706] <... exit_group resumed>)= ?
[pid 22705] <... read resumed>"", 4096) = 0
[pid 22704] exit_group(0 <unfinished ...>
[pid 22670] wait4(22704,
<unfinished ...>
[pid 22705] exit_group(0 <unfinished ...>
[pid 22704] <... exit_group resumed>)
= ?
[pid 22706] +++ exited with 0 +++
[pid 22705] <... exit_group resumed>)
= ?
[pid 22705] +++ exited with 0 +++
[pid 22704] +++ exited with 0 +++
<... wait4 resumed>[{WIFEXITED(s) && WEXITSTATUS(s) == 0}],
0, NULL) = 22704
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED,
si_pid=22705, si_uid=1000, si_status=0, si_utime=0,
si_stime=0} ---
wait4(22705, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0,
NULL) = 22705
exit_group(0)
= ?
+++ exited with 0 +++
```

Анализ вывода strace

В самом начале видно, как программа подключает стандартные библиотеки из ld.so.cache, путем отображения их в память с помощью mmap. Далее программа делает системный вызов pipe для создания каналов для дочерних процессов, потом программа делает системный вызов clone для создания дочерних процессов, они в свою очередь делают вызов dup2 для того, чтобы сделать каналы стандартными файлами ввода. Далее идет череда вызовов write/read для чтения из канала и записи в файл. В конце программы мы видим вызов wait, который заставляет родительский процесс ждать завершения дочернего.

Выводы

В ходе выполнения лабораторной работе я узнал много новых системных вызовов и научился осуществлять диагностику программ с помощью утилиты strace.