Московский Авиационный Институт

(Национальный Исследовательский Университет)

Факультет информационных технологий и прикладной математики

Кафедра вычислительной математики и программирования

**Лабораторная работа №1 по курсу**

**«Операционные системы»**

Студент: Николаева Елизавета Сергеевна

Группа: М8О-201Б-20

Вариант: -

Преподаватель: Миронов Евгений Сергеевич

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**Репозиторий**

https://github.com/esnikolaeva/OS\_1

**Постановка задачи**

Задача: подробно рассказать о каждом системном вызове, отображенном утилитой strace. Разбор системных вызовов осуществляется на примере пятой лабораторной работы курса “Операционные системы”.

**Демонстрация работы с утилитой strace и подробное объяснение каждого системного вызова**

execve("./m2", ["./m2"], 0x7ffe2b236cf0 /\* 20 vars \*/) = 0

brk(NULL) = 0x558b49c37000

arch\_prctl(0x3001 /\* ARCH\_??? \*/, 0x7ffe504578c0) = -1 EINVAL (Invalid argument)

access("/etc/ld.so.preload", R\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/x86\_64/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/x86\_64/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./libdl.so.2", O\_RDONLY|O\_CLOEXEC) = -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=32071, ...}) = 0

mmap(NULL, 32071, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f44d39a7000

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) = 0x7f44d39a5000

mmap(NULL, 20752, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f44d399f000

mmap(0x7f44d39a0000, 8192, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1000) = 0x7f44d39a0000

mmap(0x7f44d39a2000, 4096, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f44d39a2000

mmap(0x7f44d39a3000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f44d39a3000

close(3) = 0

openat(AT\_FDCWD, "./tls/x86\_64/x86\_64/libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/x86\_64/libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./libstdc++.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

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`\341\t\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=1956992, ...}) = 0

mmap(NULL, 1972224, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f44d37bd000

mprotect(0x7f44d3853000, 1290240, PROT\_NONE) = 0

mmap(0x7f44d3853000, 987136, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x96000) = 0x7f44d3853000

mmap(0x7f44d3944000, 299008, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x187000) = 0x7f44d3944000

mmap(0x7f44d398e000, 57344, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1d0000) = 0x7f44d398e000

mmap(0x7f44d399c000, 10240, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f44d399c000

close(3) = 0

openat(AT\_FDCWD, "./tls/x86\_64/x86\_64/libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/x86\_64/libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./libc.so.6", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

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\t\233\222%\274\260\320\31\331\326\10\204\276X>\263"..., 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\t\233\222%\274\260\320\31\331\326\10\204\276X>\263"..., 68, 880) = 68

mmap(NULL, 2036952, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f44d35cb000

mprotect(0x7f44d35f0000, 1847296, PROT\_NONE) = 0

mmap(0x7f44d35f0000, 1540096, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x25000) = 0x7f44d35f0000

mmap(0x7f44d3768000, 303104, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x19d000) = 0x7f44d3768000

mmap(0x7f44d37b3000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1e7000) = 0x7f44d37b3000

mmap(0x7f44d37b9000, 13528, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f44d37b9000

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) = 0x7f44d347c000

mmap(0x7f44d348b000, 684032, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xf000) = 0x7f44d348b000

mmap(0x7f44d3532000, 618496, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xb6000) = 0x7f44d3532000

mmap(0x7f44d35c9000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x14c000) = 0x7f44d35c9000

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) = 0x7f44d3461000

mmap(0x7f44d3464000, 73728, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f44d3464000

mmap(0x7f44d3476000, 16384, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x15000) = 0x7f44d3476000

mmap(0x7f44d347a000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x18000) = 0x7f44d347a000

close(3) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f44d345f000

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f44d345c000

arch\_prctl(ARCH\_SET\_FS, 0x7f44d345c740) = 0

mprotect(0x7f44d37b3000, 12288, PROT\_READ) = 0

mprotect(0x7f44d347a000, 4096, PROT\_READ) = 0

mprotect(0x7f44d35c9000, 4096, PROT\_READ) = 0

mprotect(0x7f44d398e000, 45056, PROT\_READ) = 0

mprotect(0x7f44d39a3000, 4096, PROT\_READ) = 0

mprotect(0x558b49944000, 4096, PROT\_READ) = 0

mprotect(0x7f44d39dc000, 4096, PROT\_READ) = 0

munmap(0x7f44d39a7000, 32071) = 0

brk(NULL) = 0x558b49c37000

brk(0x558b49c58000) = 0x558b49c58000

fstat(1, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0), ...}) = 0

write(1, "Enter the start library:\n", 25) = 25

write(1, "\t1 for first library\n", 21) = 21

write(1, "\t2 for second library\n", 22) = 22

fstat(0, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0), ...}) = 0

read(0, "1\n", 1024) = 2

openat(AT\_FDCWD, "./tls/x86\_64/x86\_64/libd1.so", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libd1.so", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/x86\_64/libd1.so", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./tls/libd1.so", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/x86\_64/libd1.so", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libd1.so", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./x86\_64/libd1.so", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "./libd1.so", 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\20\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0777, st\_size=16184, ...}) = 0

getcwd("/mnt/c/Users/\320\235\320\260\321\201\321\202\321\217", 128) = 24

mmap(NULL, 16440, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f44d39aa000

mmap(0x7f44d39ab000, 4096, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1000) = 0x7f44d39ab000

mmap(0x7f44d39ac000, 4096, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7f44d39ac000

mmap(0x7f44d39ad000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7f44d39ad000

close(3) = 0

mprotect(0x7f44d39ad000, 4096, PROT\_READ) = 0

write(1, "Please read the nexst ruls? befo"..., 86) = 86

write(1, "\t1 for calculating the SinIntegr"..., 37) = 37

write(1, "\t2 for calculating the Derivativ"..., 36) = 36

write(1, "Please enter your command: ", 27) = 27

read(0, "2\n", 1024) = 2

read(0, "1\n", 1024) = 2

read(0, "2\n", 1024) = 2

write(1, "Derivative(1,2)=-0.765147\n", 26) = 26

write(1, "Please enter your command: ", 27) = 27

read(0, "1\n", 1024) = 2

read(0, "2 3 5\n", 1024) = 6

write(1, "SinIntegral(2,3,5)=4.54649\n", 27) = 27

write(1, "Please enter your command: ", 27) = 27

read(0, "-1\n", 1024) = 3

write(1, "You had to enter only 0, 1 or 2!"..., 33) = 33

write(1, "Please enter your command: ", 27) = 27

read(0, "", 1024) = 0

munmap(0x7f44d39aa000, 16440) = 0

exit\_group(0) = ?

+++ exited with 0 +++

Подробнее:

execve(…) - запускает программу  
brk(…) - устанавливает конец сегмента данных в значение NULL  
access(…) - проверяет права доступа к файлу, возвращает -1 как код ошибки  
**openat(…)** - открывает файл, имеет в качестве возвращаемого значения файловый дескриптор  
fstat(…) - собирает информацию из файла  
mmap(…) - отображает файл на память  
mprotect(…) - контролирует доступ к памяти  
close(…) - закрывает файловый дескриптор  
read(…) - считывает из файлового дескриптора  
arch\_prctl(…) - устанавливает специфичное для архитектуры значение ядра  
munmap(…) - освобождает память, отведенную для отображения файла  
write(…) - пишет в консоль  
pread64(…) – читает из файлового дескриптора

getcwd(…) - получить текущую рабочую директорию

**Выводы**

В данной лабораторной работе я углублённо разобрала strace и убедилась, что это довольно полезная утилита, которая позволяет узнать всё о работе программы.