

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: Андреев Александр Олегович  
Группа: М8О-206Б-20  
Вариант:  
Преподаватель: Соколов Андрей Алексеевич  
Оценка: \_\_\_\_\_  
Дата: \_\_\_\_\_  
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## Постановка задачи

При выполнении последующих лабораторных работ необходимо продемонстрировать ключевые системные вызовы, которые в них используются и то, что их использование соответствует варианту ЛР.

По итогам выполнения всех лабораторных работ отчет по данной должен содержать краткую сводку по исследованию последующих ЛР.

## Сведения о программе

strace – утилита для Linux, которая позволяет отследить выполнение системных вызовов (system call) и сигналов к ядру системы.

Для удобства пользования есть некоторые ключи:

- **-o** - выводить всю информацию о системных вызовах не в стандартный поток ошибок, а в файл;
- **-f** - отслеживать также дочерние процессы, если они будут созданы;
- **-u** - выводить пути для файловых дескрипторов;
- **-p** - указывает pid процесса, к которому следует подключиться;

## Демонстрация работы программы

```
execve("./prog2", ["./prog2"], 0x7ffdf091e200 /* 56 vars */) = 0
```

```
brk(NULL) = 0x562d93fe6000
```

```
arch_prctl(0x3001 /* ARCH_??? */, 0x7ffc3643950) = -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=94457, ...}) = 0
mmap(NULL, 94457, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f9b2a8d8000
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) = 0x7f9b2a8d6000
mmap(NULL, 20752, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0)
= 0x7f9b2a8d0000
mmap(0x7f9b2a8d1000, 8192, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) =
0x7f9b2a8d1000
mmap(0x7f9b2a8d3000, 4096, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) =
0x7f9b2a8d3000

```

```

mmap(0x7f9b2a8d4000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x3000) =
0x7f9b2a8d4000
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\3\0>\0\1\0\0\0\360A\2\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"...,
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", 32,
848) = 32

```

```

pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\237\333t\347\262\27\320\223\27*\202C\370T\1
77"... , 68, 880) = 68
fstat(3, {st_mode=S_IFREG|0755, st_size=2029560, ...}) = 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"... ,
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", 32,
848) = 32
pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\237\333t\347\262\27\320\223\27*\202C\370T\1
77"... , 68, 880) = 68
mmap(NULL, 2037344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3,
0) = 0x7f9b2a6de000
mmap(0x7f9b2a700000, 1540096, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) =
0x7f9b2a700000
mmap(0x7f9b2a878000, 319488, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x19a000) =
0x7f9b2a878000
mmap(0x7f9b2a8c6000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1e7000) =
0x7f9b2a8c6000
mmap(0x7f9b2a8cc000, 13920, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f9b2a8cc000
close(3) = 0
mmap(NULL, 12288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9b2a6db000
arch_prctl(ARCH_SET_FS, 0x7f9b2a6db740) = 0
mprotect(0x7f9b2a8c6000, 16384, PROT_READ) = 0
mprotect(0x7f9b2a8d4000, 4096, PROT_READ) = 0

```

```

mprotect(0x562d9223f000, 4096, PROT_READ) = 0
mprotect(0x7f9b2a91d000, 4096, PROT_READ) = 0
munmap(0x7f9b2a8d8000, 94457) = 0
openat(AT_FDCWD, "./tls/x86_64/x86_64/lib1.so", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "./tls/x86_64/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./tls/x86_64/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./tls/lib1.so", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
openat(AT_FDCWD, "./x86_64/x86_64/lib1.so", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)
openat(AT_FDCWD, "./x86_64/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./x86_64/lib1.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./lib1.so", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\`20\0\0\0\0\0"..., 832) =
832
brk(NULL) = 0x562d93fe6000
brk(0x562d94007000) = 0x562d94007000
fstat(3, {st_mode=S_IFREG|0775, st_size=16232, ...}) = 0
getcwd("/home/missclick3/Desktop/OSLabs/lab5/l5Dynamic", 128) = 47
mmap(NULL, 16432, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0)
= 0x7f9b2a8eb000
mmap(0x7f9b2a8ec000, 4096, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) =
0x7f9b2a8ec000

```

```

mmap(0x7f9b2a8ed000, 4096, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) =
0x7f9b2a8ed000
mmap(0x7f9b2a8ee000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) =
0x7f9b2a8ee000
close(3) = 0
mprotect(0x7f9b2a8ee000, 4096, PROT_READ) = 0
openat(AT_FDCWD, "./tls/x86_64/x86_64/lib2.so", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "./tls/x86_64/lib2.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./tls/x86_64/lib2.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./tls/lib2.so", O_RDONLY|O_CLOEXEC) = -1 ENOENT
(No such file or directory)
openat(AT_FDCWD, "./x86_64/x86_64/lib2.so", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)
openat(AT_FDCWD, "./x86_64/lib2.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./x86_64/lib2.so", O_RDONLY|O_CLOEXEC) = -1
ENOENT (No such file or directory)
openat(AT_FDCWD, "./lib2.so", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\20\0\0\0\0\0"..., 832) =
832
fstat(3, {st_mode=S_IFREG|0775, st_size=16232, ...}) = 0
getcwd("/home/missclick3/Desktop/OSLabs/lab5/l5Dynamic", 128) = 47
mmap(NULL, 16432, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0)
= 0x7f9b2a8e6000

```



```

mmap(0x7f9b2a8e7000, 4096, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) =
0x7f9b2a8e7000
mmap(0x7f9b2a8e8000, 4096, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) =
0x7f9b2a8e8000
mmap(0x7f9b2a8e9000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) =
0x7f9b2a8e9000
close(3) = 0
mprotect(0x7f9b2a8e9000, 4096, PROT_READ) = 0
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
write(1, "0.Change lib.\n", 140.Change lib.
) = 14
write(1, "1. For searching pi.\n", 211. For searching pi.
) = 21
write(1, "2. For searching e.\n", 202. For searching e.
) = 20
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
write(1, "Enter number the command and arg"..., 35Enter number the command
and args: ) = 35
read(0, 0
"0\n", 1024) = 2
write(1, "Enter number the command and arg"..., 35Enter number the command
and args: ) = 35
read(0, 2000
"2000\n", 1024) = 5
write(2, "Undefined command\n", 18Undefined command
) = 18
write(1, "0.Change lib.\n", 140.Change lib.

```

```

)      = 14
write(1, "1. For searching pi.\n", 211. For searching pi.
) = 21
write(1, "2. For searching e.\n", 202. For searching e.
) = 20
write(1, "Enter number the command and arg"..., 35Enter number the command
and args: ) = 35
read(0, 1
"1\n", 1024)      = 2
read(0, 2000
"2000\n", 1024)      = 5
write(1, "This is vallis realise of pi\n", 29This is vallis realise of pi
) = 29
write(1, "pi = 3.141200\n", 14pi = 3.141200
)      = 14
write(1, "Enter number the command and arg"..., 35Enter number the command
and args: ) = 35
read(0, 0
"0\n", 1024)      = 2
write(1, "Enter number the command and arg"..., 35Enter number the command
and args: ) = 35
read(0, 2
"2\n", 1024)      = 2
read(0, 20000
"20000\n", 1024)      = 6
write(1, "e = 2.718214\n", 13e = 2.718214
)      = 13
write(1, "Enter number the command and arg"..., 35Enter number the command
and args: ) = 35
read(0, "", 1024)      = 0

```

`munmap(0x7f9b2a8eb000, 16432) = 0`

`munmap(0x7f9b2a8e6000, 16432) = 0`

`exit_group(0) = ?`

`+++ exited with 0 +++`

## **Выводы**

В ходе данной лабораторной работы я познакомился с утилитой `strace`. Она позволяет разобраться в работе программы и обнаружить ошибку.