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

Лабораторная работа №5 по курсу
«Операционные системы»

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Оценка: _____

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Постановка задачи

Цель работы

Приобретение практических навыков диагностики работы программного обеспечения.

Задание

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

Общий метод и алгоритм решения

Для демонстрации системных вызовов будем использовать утилиту strace в операционной системе linux. Strace — это утилита в операционных системах Linux, предназначенная для мониторинга и анализа взаимодействия процессов с ядром системы. Она широко применяется для диагностики, отладки и обучения, позволяя отслеживать системные вызовы, получение сигналов и изменения состояния процессов. Чаще всего strace используется для запуска программы с одновременным выводом списка выполняемых ею системных вызовов. Это особенно полезно при расследовании причин аварийных завершений программы или её неожиданного поведения.

С помощью дополнительных флагов можно расширить вывод strace полезной информацией, например:

-f — отслеживать системные вызовы не только основного процесса, но и его дочерних процессов;

-r — выводить относительные временные метки для каждого системного вызова;

-T — показывать время, затраченное на выполнение каждого системного вызова.

Протокол работы программы

Лабораторная работа №1

```
$ strace -f ./parent
execve("./parent", ["./parent"], 0x7ffe6bf59de8 /* 29 vars */) = 0
brk(NULL)                      = 0x62a0d8d28000
access("/etc/ld.so.preload", R_OK)    = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
```

```
fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) = 0x708ec1446000
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\0\3\0>\0\1\0\0\0\260>\2\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x708ec1444000
mmap(NULL, 1914496, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x708ec1270000
mmap(0x708ec1292000, 1413120, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|
MAP_DENYWRITE, 3, 0x22000) = 0x708ec1292000
mmap(0x708ec13eb000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x17b000) = 0x708ec13eb000
mmap(0x708ec143a000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1c9000) = 0x708ec143a000
mmap(0x708ec1440000, 13952, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) =
0x708ec1440000
close(3) = 0
arch_prctl(ARCH_SET_FS, 0x708ec1445540) = 0
mprotect(0x708ec143a000, 16384, PROT_READ) = 0
mprotect(0x62a0beb2d000, 4096, PROT_READ) = 0
mprotect(0x708ec1476000, 4096, PROT_READ) = 0
munmap(0x708ec1446000, 21784) = 0
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
brk(NULL) = 0x62a0d8d28000
brk(0x62a0d8d49000) = 0x62a0d8d49000
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265 \320\270\320\274\321\217
\321\204\320\260\320\271\320\273\320\260"..., 34Ведите имя файла: ) = 34
read(0,
"\n", 1024) = 1
access("", F_OK) = -1 ENOENT (No such file or directory)
write(1, "\320\236\321\210\320\270\320\261\320\272\320\260: \321\204\320\260\320\271\320\273 "
\320\275\320\265 \321"..., 52Ошибка: файл " не существует
) = 52
```

exit_group(1) = ?

+++ exited with 1 +++

Лабораторная работа №2

```
$ strace ./a.out 10 4
```

```
execve("./a.out", ["../a.out", "10", "4"], 0x7ffe4048eb50 /* 34 vars */) = 0
```

brk(NULL) = 0x5b44a8f49000

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

openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3

```
fstat(3, {st_mode=S_IFREG|0644, st_size=21784, ...}) = 0
```

```
mmap(NULL, 21784, PROT_READ, MAP_PRIVATE, 3, 0) = 0x78866e522000
```

close(3) = 0

```
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libpthread.so.0", O_RDONLY|O_CLOEXEC) = 3
```

`fstat(3, {st_mode=S_IFREG|0755, st_size=149520, ...}) = 0`

```
mmap(NULL, 8192, PROT_READ | PROT_WRITE, MAP_PRIVATE | MAP_ANONYMOUS, -1, 0) = 366e520000
```

```
mmap(NULL, 136304, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x78866e4fe000
```

```
mmap(0x78866e504000, 65536, PROT_READ | PROT_EXEC, MAP_PRIVATE | MAP_FIXED |  
_DENYWRITE, 3, 0x6000) = 0x78866e504000
```

```
mmap(0x78866e514000, 24576, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x16000) = 0x78866e514000
```

```
mmap(0x78866e51a000, 8192, PROT_READ | PROT_WRITE, MAP_PRIVATE | MAP_FIXED | MAP_DENYWRITE, 3, 0x1b000) = 0x78866e51a000
```

mmap(0x78866e51c000, 13424, PROT_READ | PROT_WRITE, MAP_PRIVATE | MAP_FIXED | MAP_ANONYMOUS, -1, 0) = 0x78866e51c000

close(3) = 0

```
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
```

```
fstat(3, {st_mode=S_IFREG|0755, st_size=1901536, ...}) = 0
```

```
mmap(NULL, 1914496, PROT_READ, MAP_PRIVATE | MAP_DENYWRITE, 3, 0) = 0x78866e32a000
```

```
mmap(0x78866e34c000, 1413120, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x22000) = 0x78866e34c000
```

```
mmap(0x78866e4a5000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17b000) = 0x78866e4a5000
```

```
mmap(0x78866e4f4000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c9000) = 0x78866e4f4000
```

```
mmap(0x78866e4fa000, 13952, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x78866e4fa000

close(3) = 0

mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x78866e327000

arch_prctl(ARCH_SET_FS, 0x78866e327740) = 0

mprotect(0x78866e4f4000, 16384, PROT_READ) = 0

mprotect(0x78866e51a000, 4096, PROT_READ) = 0

mprotect(0x5b44a6e90000, 4096, PROT_READ) = 0

mprotect(0x78866e552000, 4096, PROT_READ) = 0

munmap(0x78866e522000, 21784) = 0

set_tid_address(0x78866e327a10) = 55406

set_robust_list(0x78866e327a20, 24) = 0

rt_sigaction(SIGRTMIN, {sa_handler=0x78866e504690, sa_mask=[], sa_flags=SA_RESTORER|SA_SIGINFO, sa_restorer=0x78866e511140}, NULL, 8) = 0

rt_sigaction(SIGRT_1, {sa_handler=0x78866e504730, sa_mask=[], sa_flags=SA_RESTORER|SA_RESTART|SA_SIGINFO, sa_restorer=0x78866e511140}, NULL, 8) = 0

rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0

prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

brk(NULL) = 0x5b44a8f49000

brk(0x5b44a8f6a000) = 0x5b44a8f6a000

fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0

write(1, "==|320|247|321|221|321|202|320|275|320|276-|320|275|320|265|321|207|321|221|321|202|320|275|320|260|321|217 "..., 72== Чётно-нечётная сортировка Бетчера ==

) = 72

write(1, "|320|240|320|260|320|267|320|274|320|265|321|200|320|274|320|260|321|201|321|201|320|270|320|262|320|260: 10,"..., 52Размер массива: 10, Потоков: 4

) = 52

write(1, "|320|235|320|265|320|276|321|202|321|201|320|276|321|200|321|202|320|270|321|200|320|276|320|262|320|260|320|275|320|275|321|213"... , 78Неотсортированный массив: 19 68 43 13 53 12 58 55 65 8

) = 78

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x78866db26000

mprotect(0x78866db27000, 8388608, PROT_READ|PROT_WRITE) = 0
```

```
clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[55407], tls=0x78866e326700, child_tidptr=0x78866e3269d0) =  
55407
```

```
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =  
0x78866d325000
```

```
mprotect(0x78866d326000, 8388608, PROT_READ|PROT_WRITE) = 0
```

```
clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) =  
55408
```

```
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =  
0x78866cb24000
```

```
mprotect(0x78866cb25000, 8388608, PROT_READ|PROT_WRITE) = 0
```

```
clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) =  
55409
```

```
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =  
0x78866c323000
```

```
mprotect(0x78866c324000, 8388608, PROT_READ|PROT_WRITE) = 0
```

```
clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[55410], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) =  
55410
```

```
clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55411
```

```
clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[55412], tls=0x78866d324700, child_tidptr=0x78866d3249d0) =  
55412
```

```
clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) =  
55413
```

```
clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55414
```

```
clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55415
```

```
clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|
```

CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) = 55416

clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) = 55417

clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55418

clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55419

clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) = 55420

clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[55421], tls=0x78866db25700, child_tidptr=0x78866db259d0) = 55421

clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[55422], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55422

clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55423

clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) = 55424

clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) = 55425

clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55426

clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55427

clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) = 55428

clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) = 55429

clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55430

clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55431

clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) = 55432

clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) = 55433

clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[55434], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55434

clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55435

clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) = 55436

clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[55437], tls=0x78866db25700, child_tidptr=0x78866db259d0) = 55437

clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55438

clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55439

clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) = 55440

clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) = 55441

```
clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) = 55442
```

```
clone(child_stack=0x78866cb22fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[55443], tls=0x78866cb23700, child_tidptr=0x78866cb239d0) =  
55443
```

```
clone(child_stack=0x78866d323fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866d324700, child_tidptr=0x78866d3249d0) =  
55444
```

```
clone(child_stack=0x78866db24fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866db25700, child_tidptr=0x78866db259d0) =  
55445
```

```
clone(child_stack=0x78866e325fb0, flags=CLONE_VM|CLONE_FS|CLONE_FILES|  
CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|  
CLONE_CHILD_CLEARTID, parent_tid=[0], tls=0x78866e326700, child_tidptr=0x78866e3269d0) = 55446
```

```
write(1, "\320\241\320\276\321\200\321\202\320\270\321\200\320\276\320\262\320\272\320\260  
\320\267\320\260\320\262\320\265\321\200\321"..., 64Сортировка завершена за 5 итераций
```

) = 64

```
write(1,  
"\320\236\321\202\321\201\320\276\321\200\321\202\320\270\321\200\320\276\320\262\320\260\320\275\320\275\321\213\320\271 \320"..., 74Отсортированный массив: 8 12 13 19 43 53 55 58 65 68
```

) = 74

```
write(1, "\320\237\321\200\320\276\320\262\320\265\321\200\320\272\320\260:  
\320\236\320\242\320\241\320\236\320\240\320\242\320\230"..., 64Проверка: ОТСОРТИРОВАНО  
КОППЕКTHO
```

) = 64

exit_group(0) = ?

+++ exited with 0 +++

Лабораторная работа №3

strace ./parent commands.txt

```
execve("./parent", ["../parent", "commands.txt"], 0x7ffc38fda038 /* 27 vars */) = 0
```

```
brk(NULL) = 0x635e575d6000
```

```
arch_prctl(0x3001 /* ARCH_??? */, 0x7fff97bd2820) = -1 EINVAL (Invalid argument)
```

```
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =  
0x7a7ea3a85000
```

```
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
```



```
brk(0x635e575f7000) = 0x635e575f7000
openat(AT_FDCWD, "commands.txt", O_RDONLY) = 3
openat(AT_FDCWD, "/dev/shm/lab3_shm", O_RDWR|O_CREAT|O_NOFOLLOW|O_CLOEXEC, 0666) = 4
ftruncate(4, 1036) = 0
mmap(NULL, 1036, PROT_READ|PROT_WRITE, MAP_SHARED, 4, 0) = 0x7a7ea3abe000
clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD, child_tidptr=0x7a7ea3a73a10) = 986
newfstatat(3, "", {st_mode=S_IFREG|0777, st_size=60, ...}, AT_EMPTY_PATH) = 0
read(3, "10 2 2.5\r\n0 3 2\r\n15 3 5\r\n20 \321\217\320\261"..., 4096) = 60
clock_nanosleep(CLOCK_REALTIME, 0, {tv_sec=0, tv_nsec=10000000}, Calculation: 10.00 / 2.00 / 2.50 = 2.00
NULL) = 0
clock_nanosleep(CLOCK_REALTIME, 0, {tv_sec=0, tv_nsec=10000000}, Calculation: 0.00 / 3.00 / 2.00 = 0.00
NULL) = 0
clock_nanosleep(CLOCK_REALTIME, 0, {tv_sec=0, tv_nsec=10000000}, Calculation: 15.00 / 3.00 / 5.00 = 1.00
NULL) = 0
clock_nanosleep(CLOCK_REALTIME, 0, {tv_sec=0, tv_nsec=10000000}, Calculation: 20.00 / 0.00 -> ERROR: division by zero!
NULL) = 0
close(3) = 0
munmap(0x7a7ea3abe000, 1036) = 0
close(4) = 0
unlink("/dev/shm/lab3_shm") = 0
exit_group(0) = ?
+++ exited with 0 +++
```

Лабораторная работа №4

```
strace -f ./dynamic_program
```

```
execve("./dynamic_program", ["/./dynamic_program"], 0x7ffcd6b58838 /* 27 vars */) = 0
```

```
brk(NULL) = 0x60f99e756000
```

```
arch_prctl(0x3001 /* ARCH_??? */, 0x7ffc027af860) = -1 EINVAL (Invalid argument)
```

```
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x78f2a5843000
```



```
mmap(0x78f2a5840000, 4096, PROT_READ, MAP_PRIVATE|MAP_FIXED|  
MAP_DENYWRITE, 3, 0x2000) = 0x78f2a5840000  
  
mmap(0x78f2a5841000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|  
MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x78f2a5841000  
  
close(3) = 0  
  
mprotect(0x78f2a5841000, 4096, PROT_READ) = 0  
  
write(1, "\320\221\320\270\320\261\320\273\320\270\320\276\321\202\320\265\320\272\320\260  
\320\277\320\265\321\200\320\265\320\272\320"..., 60Библиотека переключена на: ./lib2.so  
) = 60  
  
read(0, 1  
"1\n", 1024) = 2  
  
read(0, 1  
"1\n", 1024) = 2  
  
read(0, 20  
"20\n", 1024) = 3  
  
write(1, "PrimeCount(1, 20) = 8\n", 22PrimeCount(1, 20) = 8  
) = 22  
  
read(0, -1  
"-1\n", 1024) = 3  
  
write(1, "\320\222\321\213\321\205\320\276\320\264.\n", 12Выход.  
) = 12  
  
munmap(0x78f2a583e000, 16448) = 0  
  
lseek(0, -1, SEEK_CUR) = -1 ESPIPE (Illegal seek)  
  
exit_group(0) = ?  
  
+++ exited with 0 +++
```

Вывод

В ходе выполнения работы были получены навыки по диагностике работы программного обеспечения с помощью консольной команды strace. Полученные в итоге навыки помогли лучше понять, как операционная система и программы взаимодействуют между собой.