МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ

ФЕДЕРАЦИИ

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Кафедра 806 "Вычислительная математика и программирование"

Лабораторная работа №8

По курсу «Операционные системы»

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**Тема:** Диагностика программного обеспечения

**Цель работы:** Приобретение практических навыков диагностики работы программного обеспечения.

**Задачи:**

1. Провести диагностику программ, написанных в ходе работ 1-7 с помощью утилиты *strace.*
2. Привести краткий анализ написанных программ.

**Ход работы:**

1. Трассировка использования *strace:*

**Работа №1:**  
execve("./lab1", ["./lab1"], 0x7ffd6e49d8d0 /\* 27 vars \*/) = 0

brk(NULL) = 0x5586a8b6b000

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fba0e444000

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=21863, ...}) = 0

mmap(NULL, 21863, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7fba0e43e000

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\220\243\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

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2125328, ...}) = 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

mmap(NULL, 2170256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7fba0e22c000

mmap(0x7fba0e254000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7fba0e254000

mmap(0x7fba0e3dc000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000) = 0x7fba0e3dc000

mmap(0x7fba0e42b000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000) = 0x7fba0e42b000

mmap(0x7fba0e431000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7fba0e431000

close(3) = 0

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fba0e229000

arch\_prctl(ARCH\_SET\_FS, 0x7fba0e229740) = 0

set\_tid\_address(0x7fba0e229a10) = 92488

set\_robust\_list(0x7fba0e229a20, 24) = 0

rseq(0x7fba0e22a060, 0x20, 0, 0x53053053) = 0

mprotect(0x7fba0e42b000, 16384, PROT\_READ) = 0

mprotect(0x5586943f2000, 4096, PROT\_READ) = 0

mprotect(0x7fba0e47c000, 8192, PROT\_READ) = 0

prlimit64(0, RLIMIT\_STACK, NULL, {rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

munmap(0x7fba0e43e000, 21863) = 0

pipe2([3, 4], 0) = 0

pipe2([5, 6], 0) = 0

fstat(0, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

getrandom("\x57\x3d\x6e\x3f\x19\x18\x69\xe4", 8, GRND\_NONBLOCK) = 8

brk(NULL) = 0x5586a8b6b000

brk(0x5586a8b8c000) = 0x5586a8b8c000

read(0, first

"first\n", 1024) = 6

read(0, second

"second\n", 1024) = 7

clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLD, child\_tidptr=0x7fba0e229a10) = 92620

clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLD, child\_tidptr=0x7fba0e229a10) = 92621

close(3) = 0

close(5) = 0

read(0, abc

"abc\n", 1024) = 4

write(4, "abc\0", 4) = 4

clock\_nanosleep(CLOCK\_REALTIME, 0, {tv\_sec=1, tv\_nsec=0}, 0x7ffee1101b00) = 0

read(0, abcd

"abcd\n", 1024) = 5

write(6, "abcd\0", 5) = 5

clock\_nanosleep(CLOCK\_REALTIME, 0, {tv\_sec=1, tv\_nsec=0}, 0x7ffee1101b00) = 0

read(0, q

"q\n", 1024) = 2

write(4, "q\0", 2) = 2

clock\_nanosleep(CLOCK\_REALTIME, 0, {tv\_sec=1, tv\_nsec=0}, {tv\_sec=0, tv\_nsec=986957675}) = ? ERESTART\_RESTARTBLOCK (Interrupted by signal)

--- SIGCHLD {si\_signo=SIGCHLD, si\_code=CLD\_EXITED, si\_pid=92620, si\_uid=0, si\_status=0, si\_utime=0, si\_stime=0} ---

restart\_syscall(<... resuming interrupted clock\_nanosleep ...>) = 0

close(4) = 0

close(6) = 0

wait4(-1, NULL, 0, NULL) = 92620

wait4(-1, NULL, 0, NULL) = 92621

--- SIGCHLD {si\_signo=SIGCHLD, si\_code=CLD\_EXITED, si\_pid=92621, si\_uid=0, si\_status=0, si\_utime=0, si\_stime=0} ---

exit\_group(0) = ?

+++ exited with 0 +++

Использовавшиеся системные вызовы:

1. *execve* – Выполняет запуск нового процесса, заменяя текущий процесс указанной программой.
2. *brk* – Управляет границей сегмента данных для выделения памяти в куче.
3. *mmap* – Отображает файлы или устройства в память, а также выделяет анонимную память.
4. *access* – Проверяет доступность файла по заданным правам (чтение, запись, выполнение).
5. *openat* – Открывает файл или каталог, относительно заданного файлового дескриптора.
6. *fstat* – Получает информацию о файле по его дескриптору.
7. *read* – Считывает данные из файла или ввода.
8. *pread64* – Читает данные из файла с определённого смещения, не изменяя позицию указателя.
9. *close* – Закрывает файловый дескриптор.
10. *arch\_prctl* – Настраивает параметры архитектуры, например, указывает адрес указателя сегмента FS для текущего потока.
11. *set\_tid\_address* – Устанавливает адрес для хранения идентификатора потока.
12. *set\_robust\_list* – Устанавливает указатель на список «робастных мьютексов» (защищённых от прерываний).
13. *rseq* – Регистры последовательных операций для оптимизации потоков.
14. *mprotect* – Изменяет права доступа к памяти (например, разрешение на чтение/запись/выполнение).
15. *prlimit64* – Получает или изменяет текущие ограничения ресурсов (например, размер стека).
16. *munmap* – Освобождает ранее отображённую память.
17. *pipe2* – Создаёт неименованный канал и возвращает файловые дескрипторы для чтения и записи с дополнительными флагами.
18. *getrandom* – Генерирует случайные числа из ядра.
19. *clone* – Создаёт новый процесс или поток.
20. *write* – Записывает данные в файл или вывод.
21. *clock\_nanosleep* – Приостанавливает выполнение потока на указанное время.
22. *restart\_syscall* – Повторяет прерванный системный вызов.
23. *wait4* – Ожидает завершения дочернего процесса, возвращая его статус.
24. *exit\_group* – Завершает выполнение всех потоков текущего процесса.

Краткий итог:

* Рассмотрен базовый случай организации межпроцессного взаимодействия с помощью технологии каналов, создания дочерних процессов непосредственно в процессе выполнения программы.
* Реализована миниатюрная распределённая система, в которой родительский процесс получает информацию от пользователя и передаёт её дочерним процессам, которые производят необходимые преобразования.

**Работа №2:**

strace ./lab2 10 i

execve("./lab2", ["./lab2", "10", "i"], 0x7ffe43b44ec0 /\* 27 vars \*/) = 0

brk(NULL) = 0x55b2bdfe0000

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7ff9d17d8000

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=21863, ...}) = 0

mmap(NULL, 21863, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7ff9d17d2000

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\220\243\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

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2125328, ...}) = 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

mmap(NULL, 2170256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7ff9d15c0000

mmap(0x7ff9d15e8000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7ff9d15e8000

mmap(0x7ff9d1770000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000) = 0x7ff9d1770000

mmap(0x7ff9d17bf000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000) = 0x7ff9d17bf000

mmap(0x7ff9d17c5000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7ff9d17c5000

close(3) = 0

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7ff9d15bd000

arch\_prctl(ARCH\_SET\_FS, 0x7ff9d15bd740) = 0

set\_tid\_address(0x7ff9d15bda10) = 100753

set\_robust\_list(0x7ff9d15bda20, 24) = 0

rseq(0x7ff9d15be060, 0x20, 0, 0x53053053) = 0

mprotect(0x7ff9d17bf000, 16384, PROT\_READ) = 0

mprotect(0x55b298893000, 4096, PROT\_READ) = 0

mprotect(0x7ff9d1810000, 8192, PROT\_READ) = 0

prlimit64(0, RLIMIT\_STACK, NULL, {rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

munmap(0x7ff9d17d2000, 21863) = 0

fstat(1, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

getrandom("\xcb\xf6\xe0\x40\x5e\x1b\x42\xe5", 8, GRND\_NONBLOCK) = 8

brk(NULL) = 0x55b2bdfe0000

brk(0x55b2be001000) = 0x55b2be001000

fstat(0, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265 \320\272\320\276\320\273\320\270\321\207\320\265\321\201\321\202\320"..., 74Введите количество элементов в массиве: ) = 74

read(0, 3

"3\n", 1024) = 2

write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265 \321\215\320\273\320\265\320\274\320\265\320\275\321\202\321\213 "..., 48Введите элементы массива:

) = 48

read(0, 3

"3\n", 1024) = 2

read(0, 2

"2\n", 1024) = 2

read(0, 1

"1\n", 1024) = 2

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"..., 45Отсортированный массив:

) = 45

write(1, "1\n", 21

) = 2

write(1, "2\n", 22

) = 2

write(1, "3\n", 23

) = 2

write(1, "\n", 1

) = 1

lseek(0, -1, SEEK\_CUR) = -1 ESPIPE (Illegal seek)

exit\_group(0) = ?

+++ exited with 0 +++

Использовавшиеся системные вызовы (помимо ранее перечисленных):

1. *lseek* – Изменяет текущую позицию чтения или записи в открытом файле. В данном случае попытка выполнить этот вызов привела к ошибке ESPIPE, что указывает на невозможность установки позиции в файловом объекте (например, в канале или терминале).

Краткий итог:

* Установлена зависимость ускорения алгоритма от числа потоков и размера данных.
* Экспериментально подтверждено, что превышение оптимального числа потоков снижает эффективность из-за накладных расходов.

**Работа №3:**execve("./lab3", ["./lab3"], 0x7ffe61ed86f0 /\* 27 vars \*/) = 0

brk(NULL) = 0x56005b885000

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fc3af705000

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=21863, ...}) = 0

mmap(NULL, 21863, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7fc3af6ff000

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\220\243\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

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2125328, ...}) = 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

mmap(NULL, 2170256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7fc3af4ed000

mmap(0x7fc3af515000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7fc3af515000

mmap(0x7fc3af69d000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000) = 0x7fc3af69d000

mmap(0x7fc3af6ec000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000) = 0x7fc3af6ec000

mmap(0x7fc3af6f2000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7fc3af6f2000

close(3) = 0

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fc3af4ea000

arch\_prctl(ARCH\_SET\_FS, 0x7fc3af4ea740) = 0

set\_tid\_address(0x7fc3af4eaa10) = 103631

set\_robust\_list(0x7fc3af4eaa20, 24) = 0

rseq(0x7fc3af4eb060, 0x20, 0, 0x53053053) = 0

mprotect(0x7fc3af6ec000, 16384, PROT\_READ) = 0

mprotect(0x56005b67b000, 4096, PROT\_READ) = 0

mprotect(0x7fc3af73d000, 8192, PROT\_READ) = 0

prlimit64(0, RLIMIT\_STACK, NULL, {rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

munmap(0x7fc3af6ff000, 21863) = 0

unlink("/dev/shm/sem.sem\_read1") = -1 ENOENT (No such file or directory)

unlink("/dev/shm/sem.sem\_read2") = -1 ENOENT (No such file or directory)

unlink("/dev/shm/sem.sem\_write") = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/dev/shm/sem.sem\_read1", O\_RDWR|O\_NOFOLLOW|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

getrandom("\xa6\xb8\xa1\xa0\x65\x86\x66\x87", 8, GRND\_NONBLOCK) = 8

newfstatat(AT\_FDCWD, "/dev/shm/sem.gS68VK", 0x7ffecdbd2130, AT\_SYMLINK\_NOFOLLOW) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/dev/shm/sem.gS68VK", O\_RDWR|O\_CREAT|O\_EXCL|O\_NOFOLLOW|O\_CLOEXEC, 0666) = 3

write(3, "\0\0\0\0\0\0\0\0\200\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0", 32) = 32

mmap(NULL, 32, PROT\_READ|PROT\_WRITE, MAP\_SHARED, 3, 0) = 0x7fc3af704000

link("/dev/shm/sem.gS68VK", "/dev/shm/sem.sem\_read1") = 0

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=32, ...}) = 0

getrandom("\xc6\xf1\xe0\x5e\x75\x87\xeb\xb7", 8, GRND\_NONBLOCK) = 8

brk(NULL) = 0x56005b885000

brk(0x56005b8a6000) = 0x56005b8a6000

unlink("/dev/shm/sem.gS68VK") = 0

close(3) = 0

openat(AT\_FDCWD, "/dev/shm/sem.sem\_read2", O\_RDWR|O\_NOFOLLOW|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

getrandom("\x42\x7e\x20\x5f\xad\x10\x50\xb2", 8, GRND\_NONBLOCK) = 8

newfstatat(AT\_FDCWD, "/dev/shm/sem.wyvHhz", 0x7ffecdbd2130, AT\_SYMLINK\_NOFOLLOW) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/dev/shm/sem.wyvHhz", O\_RDWR|O\_CREAT|O\_EXCL|O\_NOFOLLOW|O\_CLOEXEC, 0666) = 3

write(3, "\0\0\0\0\0\0\0\0\200\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0", 32) = 32

mmap(NULL, 32, PROT\_READ|PROT\_WRITE, MAP\_SHARED, 3, 0) = 0x7fc3af703000

link("/dev/shm/sem.wyvHhz", "/dev/shm/sem.sem\_read2") = 0

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=32, ...}) = 0

unlink("/dev/shm/sem.wyvHhz") = 0

close(3) = 0

openat(AT\_FDCWD, "/dev/shm/sem.sem\_write", O\_RDWR|O\_NOFOLLOW|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

getrandom("\xe8\xb3\x43\x59\xe8\x3e\x04\x22", 8, GRND\_NONBLOCK) = 8

newfstatat(AT\_FDCWD, "/dev/shm/sem.IL0W8W", 0x7ffecdbd2130, AT\_SYMLINK\_NOFOLLOW) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/dev/shm/sem.IL0W8W", O\_RDWR|O\_CREAT|O\_EXCL|O\_NOFOLLOW|O\_CLOEXEC, 0666) = 3

write(3, "\0\0\0\0\0\0\0\0\200\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0", 32) = 32

mmap(NULL, 32, PROT\_READ|PROT\_WRITE, MAP\_SHARED, 3, 0) = 0x7fc3af702000

link("/dev/shm/sem.IL0W8W", "/dev/shm/sem.sem\_write") = 0

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=32, ...}) = 0

unlink("/dev/shm/sem.IL0W8W") = 0

close(3) = 0

openat(AT\_FDCWD, "/dev/shm/memory", O\_RDWR|O\_CREAT|O\_NOFOLLOW|O\_CLOEXEC, 0666) = 3

ftruncate(3, 1024) = 0

mmap(NULL, 1024, PROT\_READ|PROT\_WRITE, MAP\_SHARED, 3, 0) = 0x7fc3af701000

fstat(0, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

read(0, first

"first\n", 1024) = 6

read(0, second

"second\n", 1024) = 7

clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLD, child\_tidptr=0x7fc3af4eaa10) = 103671

clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLD, child\_tidptr=0x7fc3af4eaa10) = 103672

read(0, abc

"abc\n", 1024) = 4

futex(0x7fc3af704000, FUTEX\_WAKE, 1) = 1

futex(0x7fc3af702000, FUTEX\_WAIT\_BITSET|FUTEX\_CLOCK\_REALTIME, 0, NULL, FUTEX\_BITSET\_MATCH\_ANY) = 0

read(0, abcd

"abcd\n", 1024) = 5

futex(0x7fc3af703000, FUTEX\_WAKE, 1) = 1

futex(0x7fc3af702000, FUTEX\_WAIT\_BITSET|FUTEX\_CLOCK\_REALTIME, 0, NULL, FUTEX\_BITSET\_MATCH\_ANY) = 0

read(0, q

"q\n", 1024) = 2

futex(0x7fc3af704000, FUTEX\_WAKE, 1) = 1

futex(0x7fc3af703000, FUTEX\_WAKE, 1) = 1

wait4(-1, NULL, 0, NULL) = 103671

--- SIGCHLD {si\_signo=SIGCHLD, si\_code=CLD\_EXITED, si\_pid=103672, si\_uid=0, si\_status=0, si\_utime=0, si\_stime=1 /\* 0.01 s \*/} ---

wait4(-1, NULL, 0, NULL) = 103672

munmap(0x7fc3af704000, 32) = 0

unlink("/dev/shm/sem.sem\_read1") = 0

munmap(0x7fc3af703000, 32) = 0

unlink("/dev/shm/sem.sem\_read2") = 0

munmap(0x7fc3af702000, 32) = 0

unlink("/dev/shm/sem.sem\_write") = 0

munmap(0x7fc3af701000, 1024) = 0

close(3) = 0

unlink("/dev/shm/memory") = 0

exit\_group(0) = ?

+++ exited with 0 +++

Использовавшиеся системные вызовы (помимо ранее перечисленных):

1. *newfstatat* — проверка существования и свойств файла или объекта.
2. *ftruncate* — изменение размера файла.
3. *futex* — операции синхронизации между потоками.
4. *link* — создание жёсткой ссылки.
5. *unlink* — удаление файла или символической ссылки.
6. *mmap с флагом MAP\_SHARED* — отображение файла с разделяемым доступом.

Краткий итог:

* Рассмотрено использование альтернативного каналам способа межпроцессного взаимодействия в виде отображаемых файлов.
* Установлено, что использование отображаемых файлов не менее эффективно, чем использование каналов, в том числе, благодаря доступным для работы с несколькими процессами отображаемым примитивам синхронизации (в нашем случае, семафором).

**Работа №4:**

execve("./lab4d", ["./lab4d"], 0x7ffc38dc5be0 /\* 27 vars \*/) = 0

brk(NULL) = 0x55f0d6365000

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fe2d7a60000

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=21863, ...}) = 0

mmap(NULL, 21863, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7fe2d7a5a000

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\220\243\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

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2125328, ...}) = 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

mmap(NULL, 2170256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7fe2d7848000

mmap(0x7fe2d7870000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7fe2d7870000

mmap(0x7fe2d79f8000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000) = 0x7fe2d79f8000

mmap(0x7fe2d7a47000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000) = 0x7fe2d7a47000

mmap(0x7fe2d7a4d000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7fe2d7a4d000

close(3) = 0

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fe2d7845000

arch\_prctl(ARCH\_SET\_FS, 0x7fe2d7845740) = 0

set\_tid\_address(0x7fe2d7845a10) = 109845

set\_robust\_list(0x7fe2d7845a20, 24) = 0

rseq(0x7fe2d7846060, 0x20, 0, 0x53053053) = 0

mprotect(0x7fe2d7a47000, 16384, PROT\_READ) = 0

mprotect(0x55f0b3b0d000, 4096, PROT\_READ) = 0

mprotect(0x7fe2d7a98000, 8192, PROT\_READ) = 0

prlimit64(0, RLIMIT\_STACK, NULL, {rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

munmap(0x7fe2d7a5a000, 21863) = 0

getrandom("\x1e\x46\x2f\x43\xb9\x04\xe7\x57", 8, GRND\_NONBLOCK) = 8

brk(NULL) = 0x55f0d6365000

brk(0x55f0d6386000) = 0x55f0d6386000

openat(AT\_FDCWD, "./libfirst.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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0777, st\_size=17208, ...}) = 0

getcwd("/mnt/c/Users/\320\234\320\270\321\205\320\260\320\270\320\273/CLionProjects/o/build/LW4", 128) = 52

mmap(NULL, 16408, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7fe2d7a5b000

mmap(0x7fe2d7a5c000, 4096, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1000) = 0x7fe2d7a5c000

mmap(0x7fe2d7a5d000, 4096, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7fe2d7a5d000

mmap(0x7fe2d7a5e000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7fe2d7a5e000

close(3) = 0

openat(AT\_FDCWD, "/etc/ld.so.cache", O\_RDONLY|O\_CLOEXEC) = 3

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=21863, ...}) = 0

mmap(NULL, 21863, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7fe2d783f000

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\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=952616, ...}) = 0

mmap(NULL, 950296, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7fe2d7756000

mmap(0x7fe2d7766000, 520192, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x10000) = 0x7fe2d7766000

mmap(0x7fe2d77e5000, 360448, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x8f000) = 0x7fe2d77e5000

mmap(0x7fe2d783d000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xe7000) = 0x7fe2d783d000

close(3) = 0

mprotect(0x7fe2d783d000, 4096, PROT\_READ) = 0

mprotect(0x7fe2d7a5e000, 4096, PROT\_READ) = 0

munmap(0x7fe2d783f000, 21863) = 0

openat(AT\_FDCWD, "./libsecond.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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0777, st\_size=16672, ...}) = 0

getcwd("/mnt/c/Users/\320\234\320\270\321\205\320\260\320\270\320\273/CLionProjects/o/build/LW4", 128) = 52

mmap(NULL, 16400, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7fe2d7840000

mmap(0x7fe2d7841000, 4096, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1000) = 0x7fe2d7841000

mmap(0x7fe2d7842000, 4096, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7fe2d7842000

mmap(0x7fe2d7843000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7fe2d7843000

close(3) = 0

mprotect(0x7fe2d7843000, 4096, PROT\_READ) = 0

fstat(1, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

write(1, "Usage:\n", 7Usage:

) = 7

write(1, "\t\10-1 - exit\n", 12-1 - exit

) = 12

write(1, "\t0 - change implementation\n", 27 0 - change implementation

) = 27

write(1, "\t1 - find Pi\n", 13 1 - find Pi

) = 13

write(1, "\t2 - find E\n", 12 2 - find E

) = 12

fstat(0, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

write(1, "command> ", 9command> ) = 9

read(0, 1 10000

"1 10000\n", 1024) = 8

write(1, "3.141498\n", 93.141498

) = 9

write(1, "command> ", 9command> ) = 9

read(0, 0

"0\n", 1024) = 2

write(1, "Implementation changed to second"..., 33Implementation changed to second

) = 33

write(1, "command> ", 9command> ) = 9

read(0, 1 10000

"1 10000\n", 1024) = 8

write(1, "3.141330\n", 93.141330

) = 9

write(1, "command> ", 9command> ) = 9

read(0, 2 10000

"2 10000\n", 1024) = 8

write(1, "2.718282\n", 92.718282

) = 9

write(1, "command> ", 9command> ) = 9

read(0, -1

"-1\n", 1024) = 3

munmap(0x7fe2d7a5b000, 16408) = 0

munmap(0x7fe2d7756000, 950296) = 0

munmap(0x7fe2d7840000, 16400) = 0

lseek(0, -1, SEEK\_CUR) = -1 ESPIPE (Illegal seek)

exit\_group(0) = ?

+++ exited with 0 +++

Использовавшиеся системные вызовы (помимо ранее перечисленных):

1. *getcwd* – возвращает текущую рабочую директорию.

Краткий итог:

* Рассмотрены и опробованы на практике различия в работе между статической линковкой и динамической загрузкой библиотек.
* Динамическая загрузка позволяет менять реализацию функций во время выполнения, что обеспечивает гибкость, но требует дополнительных затрат вычислительных ресурсов, статическая линковка, в свою очередь, утяжеляет исполняемый файл.

**Работа №5-7:**execve("./lab567", ["./lab567"], 0x7ffc20ff7a90 /\* 27 vars \*/) = 0

brk(NULL) = 0x565389e18000

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f095090c000

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=21863, ...}) = 0

mmap(NULL, 21863, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f0950906000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=663584, ...}) = 0

mmap(NULL, 661336, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f0950864000

mmap(0x7f095087d000, 425984, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x19000) = 0x7f095087d000

mmap(0x7f09508e5000, 98304, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x81000) = 0x7f09508e5000

mmap(0x7f09508fd000, 36864, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x99000) = 0x7f09508fd000

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\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=2592224, ...}) = 0

mmap(NULL, 2609472, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f09505e6000

mmap(0x7f0950683000, 1343488, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x9d000) = 0x7f0950683000

mmap(0x7f09507cb000, 552960, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1e5000) = 0x7f09507cb000

mmap(0x7f0950852000, 57344, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x26b000) = 0x7f0950852000

mmap(0x7f0950860000, 12608, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f0950860000

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\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=183024, ...}) = 0

mmap(NULL, 185256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f09505b8000

mmap(0x7f09505bc000, 147456, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4000) = 0x7f09505bc000

mmap(0x7f09505e0000, 16384, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7f09505e0000

mmap(0x7f09505e4000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2b000) = 0x7f09505e4000

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\220\243\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

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2125328, ...}) = 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

mmap(NULL, 2170256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f09503a6000

mmap(0x7f09503ce000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7f09503ce000

mmap(0x7f0950556000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000) = 0x7f0950556000

mmap(0x7f09505a5000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000) = 0x7f09505a5000

mmap(0x7f09505ab000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f09505ab000

close(3) = 0

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libbsd.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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=80888, ...}) = 0

mmap(NULL, 86208, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f0950390000

mmap(0x7f0950394000, 49152, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4000) = 0x7f0950394000

mmap(0x7f09503a0000, 12288, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x10000) = 0x7f09503a0000

mmap(0x7f09503a3000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x12000) = 0x7f09503a3000

mmap(0x7f09503a5000, 192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f09503a5000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=355040, ...}) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f095038e000

mmap(NULL, 353336, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f0950337000

mmap(0x7f0950343000, 233472, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xc000) = 0x7f0950343000

mmap(0x7f095037c000, 65536, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x45000) = 0x7f095037c000

mmap(0x7f095038c000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x55000) = 0x7f095038c000

close(3) = 0

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libpgm-5.3.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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=285568, ...}) = 0

mmap(NULL, 301040, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f09502ed000

mmap(0x7f09502f1000, 159744, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4000) = 0x7f09502f1000

mmap(0x7f0950318000, 102400, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2b000) = 0x7f0950318000

mmap(0x7f0950331000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x44000) = 0x7f0950331000

mmap(0x7f0950333000, 14320, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f0950333000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=366760, ...}) = 0

mmap(NULL, 1092032, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f09501e2000

mmap(0x7f09501eb000, 274432, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x9000) = 0x7f09501eb000

mmap(0x7f095022e000, 45056, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4c000) = 0x7f095022e000

mmap(0x7f0950239000, 16384, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x56000) = 0x7f0950239000

mmap(0x7f095023d000, 719296, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f095023d000

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\0\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=338696, ...}) = 0

mmap(NULL, 341080, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f095018e000

mmap(0x7f095019a000, 237568, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xc000) = 0x7f095019a000

mmap(0x7f09501d4000, 40960, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x46000) = 0x7f09501d4000

mmap(0x7f09501de000, 16384, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4f000) = 0x7f09501de000

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\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=952616, ...}) = 0

mmap(NULL, 950296, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f09500a5000

mmap(0x7f09500b5000, 520192, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x10000) = 0x7f09500b5000

mmap(0x7f0950134000, 360448, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x8f000) = 0x7f0950134000

mmap(0x7f095018c000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xe7000) = 0x7f095018c000

close(3) = 0

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libmd.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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=55536, ...}) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f09500a3000

mmap(NULL, 57448, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f0950094000

mmap(0x7f0950096000, 36864, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7f0950096000

mmap(0x7f095009f000, 8192, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xb000) = 0x7f095009f000

mmap(0x7f09500a1000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xc000) = 0x7f09500a1000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=823488, ...}) = 0

mmap(NULL, 822032, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f094ffcb000

mmap(0x7f094ffeb000, 397312, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x20000) = 0x7f094ffeb000

mmap(0x7f095004c000, 233472, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x81000) = 0x7f095004c000

mmap(0x7f0950085000, 61440, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xba000) = 0x7f0950085000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=178648, ...}) = 0

mmap(NULL, 176392, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f094ff9f000

mmap(0x7f094ffa3000, 110592, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4000) = 0x7f094ffa3000

mmap(0x7f094ffbe000, 45056, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1f000) = 0x7f094ffbe000

mmap(0x7f094ffc9000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2a000) = 0x7f094ffc9000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=18504, ...}) = 0

mmap(NULL, 20552, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f094ff99000

mmap(0x7f094ff9b000, 4096, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7f094ff9b000

mmap(0x7f094ff9c000, 4096, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f094ff9c000

mmap(0x7f094ff9d000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f094ff9d000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=47904, ...}) = 0

mmap(NULL, 50128, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f094ff8c000

mmap(0x7f094ff8f000, 24576, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f094ff8f000

mmap(0x7f094ff95000, 8192, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x9000) = 0x7f094ff95000

mmap(0x7f094ff97000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xa000) = 0x7f094ff97000

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\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=22600, ...}) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f094ff8a000

mmap(NULL, 24592, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f094ff83000

mmap(0x7f094ff85000, 8192, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7f094ff85000

mmap(0x7f094ff87000, 4096, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4000) = 0x7f094ff87000

mmap(0x7f094ff88000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x4000) = 0x7f094ff88000

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\0\0\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=68104, ...}) = 0

mmap(NULL, 75912, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f094ff70000

mmap(0x7f094ff73000, 40960, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f094ff73000

mmap(0x7f094ff7d000, 8192, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xd000) = 0x7f094ff7d000

mmap(0x7f094ff7f000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0xf000) = 0x7f094ff7f000

mmap(0x7f094ff81000, 6280, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f094ff81000

close(3) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f094ff6e000

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f094ff6b000

arch\_prctl(ARCH\_SET\_FS, 0x7f094ff6b9c0) = 0

set\_tid\_address(0x7f094ff6bc90) = 115129

set\_robust\_list(0x7f094ff6bca0, 24) = 0

rseq(0x7f094ff6c2e0, 0x20, 0, 0x53053053) = 0

mprotect(0x7f09505a5000, 16384, PROT\_READ) = 0

mprotect(0x7f094ff7f000, 4096, PROT\_READ) = 0

mprotect(0x7f094ff88000, 4096, PROT\_READ) = 0

mprotect(0x7f094ff97000, 4096, PROT\_READ) = 0

mprotect(0x7f094ff9d000, 4096, PROT\_READ) = 0

mprotect(0x7f094ffc9000, 4096, PROT\_READ) = 0

mprotect(0x7f0950085000, 53248, PROT\_READ) = 0

mprotect(0x7f09500a1000, 4096, PROT\_READ) = 0

mprotect(0x7f095018c000, 4096, PROT\_READ) = 0

mprotect(0x7f09501de000, 8192, PROT\_READ) = 0

mprotect(0x7f09505e4000, 4096, PROT\_READ) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f094ff69000

mprotect(0x7f0950852000, 45056, PROT\_READ) = 0

mprotect(0x7f0950239000, 12288, PROT\_READ) = 0

mprotect(0x7f0950331000, 4096, PROT\_READ) = 0

mprotect(0x7f095038c000, 4096, PROT\_READ) = 0

mprotect(0x7f09503a3000, 4096, PROT\_READ) = 0

mprotect(0x7f09508fd000, 32768, PROT\_READ) = 0

mprotect(0x565350fca000, 4096, PROT\_READ) = 0

mprotect(0x7f0950944000, 8192, PROT\_READ) = 0

prlimit64(0, RLIMIT\_STACK, NULL, {rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

munmap(0x7f0950906000, 21863) = 0

futex(0x7f09508607bc, FUTEX\_WAKE\_PRIVATE, 2147483647) = 0

getrandom("\xeb\x77\x3c\xf3\x2f\x2f\xb2\xa0", 8, GRND\_NONBLOCK) = 8

brk(NULL) = 0x565389e18000

brk(0x565389e39000) = 0x565389e39000

openat(AT\_FDCWD, "/sys/devices/system/cpu/online", O\_RDONLY|O\_CLOEXEC) = 3

read(3, "0-7\n", 1024) = 4

close(3) = 0

openat(AT\_FDCWD, "/sys/devices/system/cpu/possible", O\_RDONLY|O\_CLOEXEC) = 3

read(3, "0-7\n", 1024) = 4

close(3) = 0

getpid() = 115129

sched\_getaffinity(115129, 128, [0 1 2 3 4 5 6 7]) = 32

newfstatat(AT\_FDCWD, "/etc/nsswitch.conf", {st\_mode=S\_IFREG|0644, st\_size=526, ...}, 0) = 0

newfstatat(AT\_FDCWD, "/", {st\_mode=S\_IFDIR|0755, st\_size=4096, ...}, 0) = 0

openat(AT\_FDCWD, "/etc/nsswitch.conf", O\_RDONLY|O\_CLOEXEC) = 3

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=526, ...}) = 0

read(3, "# /etc/nsswitch.conf\n#\n# Example"..., 4096) = 526

read(3, "", 4096) = 0

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=526, ...}) = 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=21863, ...}) = 0

mmap(NULL, 21863, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f0950906000

close(3) = 0

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v3/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v3/", 0x7fffa80297d0, 0) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v2/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v2/", 0x7fffa80297d0, 0) = -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)

newfstatat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/", {st\_mode=S\_IFDIR|0755, st\_size=36864, ...}, 0) = 0

openat(AT\_FDCWD, "/usr/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v3/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/usr/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v3/", 0x7fffa80297d0, 0) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/usr/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v2/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/usr/lib/x86\_64-linux-gnu/glibc-hwcaps/x86-64-v2/", 0x7fffa80297d0, 0) = -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)

newfstatat(AT\_FDCWD, "/usr/lib/x86\_64-linux-gnu/", {st\_mode=S\_IFDIR|0755, st\_size=36864, ...}, 0) = 0

openat(AT\_FDCWD, "/lib/glibc-hwcaps/x86-64-v3/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/lib/glibc-hwcaps/x86-64-v3/", 0x7fffa80297d0, 0) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/glibc-hwcaps/x86-64-v2/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/lib/glibc-hwcaps/x86-64-v2/", 0x7fffa80297d0, 0) = -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)

newfstatat(AT\_FDCWD, "/lib/", {st\_mode=S\_IFDIR|0755, st\_size=4096, ...}, 0) = 0

openat(AT\_FDCWD, "/usr/lib/glibc-hwcaps/x86-64-v3/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/usr/lib/glibc-hwcaps/x86-64-v3/", 0x7fffa80297d0, 0) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/usr/lib/glibc-hwcaps/x86-64-v2/libnss\_db.so.2", O\_RDONLY|O\_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT\_FDCWD, "/usr/lib/glibc-hwcaps/x86-64-v2/", 0x7fffa80297d0, 0) = -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)

newfstatat(AT\_FDCWD, "/usr/lib/", {st\_mode=S\_IFDIR|0755, st\_size=4096, ...}, 0) = 0

munmap(0x7f0950906000, 21863) = 0

openat(AT\_FDCWD, "/etc/protocols", O\_RDONLY|O\_CLOEXEC) = 3

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=3144, ...}) = 0

lseek(3, 0, SEEK\_SET) = 0

read(3, "# Internet (IP) protocols\n#\n# Up"..., 4096) = 3144

read(3, "", 4096) = 0

close(3) = 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

getpid() = 115129

getpid() = 115129

getrandom("\xc7\x87\x93\xa2\x17\x17\xbd\x7a\xdf\x2a\x69\x8a\xfd\xb8\x7a\x10", 16, 0) = 16

getrandom("\xcd\x6e\x18\xc3\xef\xe6\xa7\x26\x6f\x4d\x00\x20\xa0\x20\x66\x30", 16, 0) = 16

fstat(1, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

write(1, "command> ", 9command> ) = 9

fstat(0, {st\_mode=S\_IFCHR|0600, st\_rdev=makedev(0x88, 0x4), ...}) = 0

read(0, create 123

"\321\201\320\272\321create 123\n", 1024) = 16

write(1, "Error: Unknown command\n", 23Error: Unknown command

) = 23

write(1, "command> ", 9command> ) = 9

read(0, create 123

"create 123\n", 1024) = 11

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

getpid() = 115129

epoll\_create1(EPOLL\_CLOEXEC) = 5

epoll\_ctl(5, EPOLL\_CTL\_ADD, 4, {events=0, data={u32=2313332208, u64=94916795606512}}) = 0

epoll\_ctl(5, EPOLL\_CTL\_MOD, 4, {events=EPOLLIN, data={u32=2313332208, u64=94916795606512}}) = 0

getpid() = 115129

rt\_sigaction(SIGRT\_1, {sa\_handler=0x7f095043f520, sa\_mask=[], sa\_flags=SA\_RESTORER|SA\_ONSTACK|SA\_RESTART|SA\_SIGINFO, sa\_restorer=0x7f09503eb320}, NULL, 8) = 0

rt\_sigprocmask(SIG\_UNBLOCK, [RTMIN RT\_1], NULL, 8) = 0

mmap(NULL, 8392704, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_STACK, -1, 0) = 0x7f094f768000

mprotect(0x7f094f769000, 8388608, PROT\_READ|PROT\_WRITE) = 0

rt\_sigprocmask(SIG\_BLOCK, ~[], [], 8) = 0

clone3({flags=CLONE\_VM|CLONE\_FS|CLONE\_FILES|CLONE\_SIGHAND|CLONE\_THREAD|CLONE\_SYSVSEM|CLONE\_SETTLS|CLONE\_PARENT\_SETTID|CLONE\_CHILD\_CLEARTID, child\_tid=0x7f094ff68990, parent\_tid=0x7f094ff68990, exit\_signal=0, stack=0x7f094f768000, stack\_size=0x7ffd00, tls=0x7f094ff686c0} => {parent\_tid=[115432]}, 88) = 115432

rt\_sigprocmask(SIG\_SETMASK, [], NULL, 8) = 0

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

getpid() = 115129

epoll\_create1(EPOLL\_CLOEXEC) = 7

epoll\_ctl(7, EPOLL\_CTL\_ADD, 6, {events=0, data={u32=2313332960, u64=94916795607264}}) = 0

epoll\_ctl(7, EPOLL\_CTL\_MOD, 6, {events=EPOLLIN, data={u32=2313332960, u64=94916795607264}}) = 0

mmap(NULL, 8392704, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_STACK, -1, 0) = 0x7f094ef67000

mprotect(0x7f094ef68000, 8388608, PROT\_READ|PROT\_WRITE) = 0

rt\_sigprocmask(SIG\_BLOCK, ~[], [], 8) = 0

clone3({flags=CLONE\_VM|CLONE\_FS|CLONE\_FILES|CLONE\_SIGHAND|CLONE\_THREAD|CLONE\_SYSVSEM|CLONE\_SETTLS|CLONE\_PARENT\_SETTID|CLONE\_CHILD\_CLEARTID, child\_tid=0x7f094f767990, parent\_tid=0x7f094f767990, exit\_signal=0, stack=0x7f094ef67000, stack\_size=0x7ffd00, tls=0x7f094f7676c0} => {parent\_tid=[115433]}, 88) = 115433

rt\_sigprocmask(SIG\_SETMASK, [], NULL, 8) = 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

getpid() = 115129

getpid() = 115129

poll([{fd=8, events=POLLIN}], 1, 0) = 0 (Timeout)

brk(0x565389e5a000) = 0x565389e5a000

futex(0x7f09508607c8, FUTEX\_WAKE\_PRIVATE, 2147483647) = 0

getpid() = 115129

write(6, "\1\0\0\0\0\0\0\0", 8) = 8

getpid() = 115129

write(8, "\1\0\0\0\0\0\0\0", 8) = 8

clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLD, child\_tidptr=0x7f094ff6bc90) = 115434

futex(0x7f0948000030, FUTEX\_WAKE\_PRIVATE, 1) = 1

write(1, "Ok: 115434\n", 11Ok: 115434

) = 11

write(1, "command> ", 9command> ) = 9

read(0, exec 123 2 1 2

"exec 123 2 1 2\n", 1024) = 15

mmap(NULL, 8392704, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_STACK, -1, 0) = 0x7f094e766000

mprotect(0x7f094e767000, 8388608, PROT\_READ|PROT\_WRITE) = 0

rt\_sigprocmask(SIG\_BLOCK, ~[], [], 8) = 0

clone3({flags=CLONE\_VM|CLONE\_FS|CLONE\_FILES|CLONE\_SIGHAND|CLONE\_THREAD|CLONE\_SYSVSEM|CLONE\_SETTLS|CLONE\_PARENT\_SETTID|CLONE\_CHILD\_CLEARTID, child\_tid=0x7f094ef66990, parent\_tid=0x7f094ef66990, exit\_signal=0, stack=0x7f094e766000, stack\_size=0x7ffd00, tls=0x7f094ef666c0} => {parent\_tid=[115659]}, 88) = 115659

rt\_sigprocmask(SIG\_SETMASK, [], NULL, 8) = 0

clock\_nanosleep(CLOCK\_REALTIME, 0, {tv\_sec=0, tv\_nsec=50000000}, 0x7fffa802c3c0) = 0

futex(0x565389e39fa8, FUTEX\_WAKE\_PRIVATE, 2147483647) = 0

write(1, "Ok:123: 3\n", 10Ok:123: 3

) = 10

write(1, "command> ", 9command> ) = 9

read(0, pingall

"pingall\n", 1024) = 8

getpid() = 115129

poll([{fd=8, events=POLLIN}], 1, 0) = 0 (Timeout)

getpid() = 115129

write(6, "\1\0\0\0\0\0\0\0", 8) = 8

getpid() = 115129

poll([{fd=8, events=POLLIN}], 1, 2000) = 1 ([{fd=8, revents=POLLIN}])

getpid() = 115129

read(8, "\1\0\0\0\0\0\0\0", 8) = 8

getpid() = 115129

poll([{fd=8, events=POLLIN}], 1, 0) = 0 (Timeout)

write(1, "Ok: -1\n", 7Ok: -1

) = 7

write(1, "command> ", 9command> ) = 9

read(0, exit

"exit\n", 1024) = 5

wait4(115434, NULL, WNOHANG, NULL) = 0

getpid() = 115129

poll([{fd=8, events=POLLIN}], 1, 0) = 0 (Timeout)

getpid() = 115129

write(6, "\1\0\0\0\0\0\0\0", 8) = 8

getpid() = 115129

poll([{fd=8, events=POLLIN}], 1, 2000) = 1 ([{fd=8, revents=POLLIN}])

getpid() = 115129

read(8, "\1\0\0\0\0\0\0\0", 8) = 8

getpid() = 115129

poll([{fd=8, events=POLLIN}], 1, 0) = 0 (Timeout)

getpid() = 115129

write(4, "\1\0\0\0\0\0\0\0", 8) = 8

kill(115434, SIGKILL) = 0

wait4(115434, NULL, 0, NULL) = 115434

--- SIGCHLD {si\_signo=SIGCHLD, si\_code=CLD\_KILLED, si\_pid=115434, si\_uid=0, si\_status=SIGKILL, si\_utime=0, si\_stime=3 /\* 0.03 s \*/} ---

getpid() = 115129

getpid() = 115129

write(4, "\1\0\0\0\0\0\0\0", 8) = 8

getpid() = 115129

poll([{fd=3, events=POLLIN}], 1, -1) = 1 ([{fd=3, revents=POLLIN}])

getpid() = 115129

read(3, "\1\0\0\0\0\0\0\0", 8) = 8

getpid() = 115129

write(6, "\1\0\0\0\0\0\0\0", 8) = 8

close(7) = 0

close(6) = 0

close(5) = 0

close(4) = 0

close(3) = 0

exit\_group(0) = ?

+++ exited with 0 +++

Использовавшиеся системные вызовы (помимо ранее перечисленных):

1. *fcntl* — Управляет параметрами файла (например, установкой флагов).
2. *epoll\_create1* — Создаёт новый файловый дескриптор для epoll.
3. *epoll\_ctl* — Управляет интересующими событиями для epoll.
4. *poll* — Ожидает событий на файловых дескрипторах.
5. *eventfd2* — Создаёт файловый дескриптор для управления событиями.
6. *rt\_sigaction* — Устанавливает действия для сигнала.
7. *rt\_sigprocmask* — Управляет блокировкой сигналов.
8. *kill* — Отправляет сигнал процессу.

Краткий итог:

* Рассмотрено использование технологии очередей сообщений для межпроцессного взаимодействия в рамках сложной (по сравнению с первой работой) распределённой вычислительной системы.
* Реализована распределённая вычислительная система, в которой основной узел принимает команды от пользователей, и в случае необходимости, перенаправляет их с помощью очереди сообщений на дочерние вычислительные узлы, размещённые в соответствии с топологией, для выполнения, и обрабатывает полученные результаты.

**Вывод:** В ходе работы была выполнена диагностика программ, созданных ранее, с использованием инструмента *strace*. Исследование системных вызовов продемонстрировало их важность в работе обеспечении взаимодействия программ с ресурсами операционной системы. В ходе анализа выявлены используемые методы взаимодействия с памятью, синхронизацией процессов, вводом-выводом, обменом сообщениями. Полученные данные подтвердили соответствие работы программ теоретическим ожиданиям и их корректность при работе с различными механизмами операционной системы.