Московский Авиационный Институт

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Институт №8 “Компьютерные науки и прикладная математика”

Кафедра №806 “Вычислительная математика и программирование”

Лабораторная работа №3 по курсу

«Операционные системы»

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Постановка задачи

Вариант 18.

Составить и отладить программу на языке Си, осуществляющую работу с процессами и взаимодействие между ними в одной из двух операционных систем. В результате работы программа (основной процесс) должен создать для решение задачи один или несколько дочерних процессов. Взаимодействие между процессами осуществляется через системные сигналы/события и/или через отображаемые файлы (memory-mapped files). Необходимо обрабатывать системные ошибки, которые могут возникнуть в результате работы.

Варианты выбираются такие же как и в лабораторной работе №1.

Общий метод и алгоритм решения

Использованные системные вызовы:

- pid_t fork(void); — создание дочерних процессов
- int execl(const char *path, const char *arg, ...); — замена образа процесса
- void *mmap(void *addr, size_t length, int prot, int flags, int fd, off_t offset); — отображение файла в память
- int munmap(void *addr, size_t length); — удаление отображения памяти
- int open(const char *pathname, int flags, mode_t mode); — открытие/создание файла
- int close(int fd); — закрытие файлового дескриптора
- int ftruncate(int fd, off_t length); — изменение размера файла
- pid_t waitpid(pid_t pid, int *status, int options); — ожидание завершения дочерних процессов
- int unlink(const char *pathname); — удаление файла
- int kill(pid_t pid, int sig); — отправка сигнала процессу
- int sigaction(int signum, const struct sigaction *act, struct sigaction *oldact); — установка обработчика сигнала

Алгоритм:

Родительский процесс:

1. Запрашивает имена файлов для child1 и child2
2. Создаёт shared memory файл через open() + mmap()
3. Создаёт два дочерних процесса через fork() + execl()
4. Ждёт готовности детей через флаг в shared memory

5. Читает строки от пользователя:
    - Нечётные строки → child1, чётные → child2
    - Копирует строку в shared memory
    - Будит нужного child сигналом SIGUSR1
    - Ждёт ответного сигнала SIGUSR2
6. После ввода всех строк:
    - Устанавливает флаг завершения shutdown = 1
    - Будит детей для завершения
    - Ждёт завершения детей через waitpid()
    - Выводит содержимое выходных файлов
    - Очищает ресурсы: munmap(), unlink()

Дочерние процессы (child1/child2):

1. Открывают shared memory через mmap()
2. Открывают выходной файл для записи
3. Устанавливают флаг готовности
4. В цикле ждут сигнала SIGUSR1 от родителя:
    - Если получена их строка (for_child == номер_процесса):
        - Читают строку из shared memory
        - Удаляют все гласные буквы
        - Записывают результат в файл
        - Устанавливают processed = 1
        - Отправляют родителю SIGUSR2
    - Если получен флаг shutdown → завершают работу
5. Закрывают файлы и освобождают память

Код программы

parent.c

```
#include <stdio.h>

#include <stdlib.h>

#include <unistd.h>
```

```
#include <string.h>
#include <fcntl.h>
#include <sys/mman.h>
#include <sys/wait.h>
#include <signal.h>

#define SIZE 1024

struct Data {
    int child_ready[3];
    int for_child;
    int processed;
    int shutdown;
    char text[SIZE];
};

volatile sig_atomic_t child_done = 0;

void sigusr2_handler(int sig) {
    child_done = 1;
}

int main() {
    char file1[100], file2[100];

    printf("Введите имя файла для child1: ");
    if (fgets(file1, sizeof(file1), stdin) == NULL) {
        perror("Ошибка чтения имени файла");
        return 1;
    }
    file1[strcspn(file1, "\n")] = '\0';

    printf("Введите имя файла для child2: ");
```

```
if (fgets(file2, sizeof(file2), stdin) == NULL) {
    perror("Ошибка чтения имени файла");
    return 1;
}
file2[strcspn(file2, "\n")] = '\0';

int fd = open("lab3.dat", O_RDWR | O_CREAT | O_TRUNC, 0666);
if (fd == -1) {
    perror("Ошибка создания shared memory файла");
    return 1;
}

if (ftruncate(fd, sizeof(struct Data)) == -1) {
    perror("Ошибка установки размера файла");
    close(fd);
    return 1;
}

struct Data *data = mmap(NULL, sizeof(struct Data),
                         PROT_READ | PROT_WRITE, MAP_SHARED, fd, 0);
if (data == MAP_FAILED) {
    perror("Ошибка mmap");
    close(fd);
    return 1;
}
close(fd);

for (int i = 0; i < 3; i++) data->child_ready[i] = 0;
data->for_child = 0;
data->processed = 1;
data->shutdown = 0;

struct sigaction sa;
```

```
sa.sa_handler = sigusr2_handler;
sigemptyset(&sa.sa_mask);
sa.sa_flags = 0;
sigaction(SIGUSR2, &sa, NULL);

pid_t p1 = fork();
if (p1 == -1) {
    perror("Ошибка fork для child1");
    munmap(data, sizeof(struct Data));
    unlink("lab3.dat");
    return 1;
}

if (p1 == 0) {
    execl("./child", "child", "1", file1, "lab3.dat", NULL);
    perror("Ошибка execl для child1");
    exit(1);
}

pid_t p2 = fork();
if (p2 == -1) {
    perror("Ошибка fork для child2");
    kill(p1, SIGTERM);
    munmap(data, sizeof(struct Data));
    unlink("lab3.dat");
    return 1;
}

if (p2 == 0) {
    execl("./child", "child", "2", file2, "lab3.dat", NULL);
    perror("Ошибка execl для child2");
    exit(1);
}
```

```
while (data->child_ready[1] == 0 || data->child_ready[2] == 0) {}

printf("\nВводите строки (Ctrl+D для завершения):\n");

char line[SIZE];
int line_num = 0;

while (fgets(line, sizeof(line), stdin)) {
    line_num++;
    line[strcspn(line, "\n")] = '\0';

    if (strlen(line) >= SIZE) {
        line[SIZE-1] = '\0';
    }

    strcpy(data->text, line);
    data->for_child = (line_num % 2 == 1) ? 1 : 2;
    data->processed = 0;

    kill((line_num % 2 == 1) ? p1 : p2, SIGUSR1);

    child_done = 0;
    while (!child_done) {}

    printf("[child%d] Обработана строка %d\n", data->for_child, line_num);
}

printf("\nЗавершение работы...\n");

data->shutdown = 1;
kill(p1, SIGUSR1);
kill(p2, SIGUSR1);
```

```
    waitpid(p1, NULL, 0);
    waitpid(p2, NULL, 0);

    printf("\n=== Результаты ===\n");

    printf("\nФайл %s:\n", file1);
    char cmd[256];
    sprintf(cmd, "cat %s 2>/dev/null || echo 'файл не найден'", file1);
    system(cmd);

    printf("\nФайл %s:\n", file2);
    sprintf(cmd, "cat %s 2>/dev/null || echo 'файл не найден'", file2);
    system(cmd);

    munmap(data, sizeof(struct Data));
    unlink("lab3.dat");

    printf("\nРабота завершена.\n");
    return 0;
}
```

child.c

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <fcntl.h>
#include <sys/mman.h>
#include <unistd.h>
#include <ctype.h>
#include <signal.h>

#define SIZE 1024
```

```
struct Data {
    int child_ready[3];
    int for_child;
    int processed;
    int shutdown;
    char text[SIZE];
};

volatile sig_atomic_t got_signal = 0;

void sigusr1_handler(int sig) {
    got_signal = 1;
}

int is_vowel(char c) {
    c = tolower(c);
    return c == 'a' || c == 'e' || c == 'i' || c == 'o' || c == 'u' || c == 'y';
}

int main(int argc, char *argv[]) {
    if (argc != 4) return 1;

    signal(SIGUSR1, sigusr1_handler);

    int my_num = atoi(argv[1]);
    char *out_file = argv[2];
    char *shm_file = argv[3];

    int fd = open(shm_file, O_RDWR);
    if (fd == -1) return 1;

    struct Data *data = mmap(NULL, sizeof(struct Data),
```

```
                        PROT_READ | PROT_WRITE, MAP_SHARED, fd, 0);
if (data == MAP_FAILED) {
    close(fd);
    return 1;
}
close(fd);

data->child_ready[my_num] = 1;

FILE *out = fopen(out_file, "w");
if (!out) {
    munmap(data, sizeof(struct Data));
    return 1;
}

pid_t parent_pid = getppid();
int processed = 0;

while (1) {
    while (!got_signal && !data->shutdown) {}

    if (data->shutdown) break;

    got_signal = 0;

    if (data->for_child == my_num && data->processed == 0) {
        char result[SIZE];
        char *src = data->text;
        char *dst = result;

        while (*src) {
            if (!is_vowel(*src)) *dst++ = *src;
            src++;
```

```
            }
            *dst = '\0';

            fprintf(out, "%s\n", result);
            processed++;
            data->processed = 1;

            kill(parent_pid, SIGUSR2);
        }
    }

    printf("Child%d: %d строк\n", my_num, processed);

    fclose(out);
    munmap(data, sizeof(struct Data));
    return 0;
}
```

Протокол работы программы

Тестирование:

```
$ gcc -o parent parent.c
$ gcc -o child child.c
$ ./parent
Введите имя файла для child1: file1.txt
Введите имя файла для child2: file2.txt

Вводите строки (Ctrl+D для завершения):
Hello World
[child1] Обработана строка 1
Test String
[child2] Обработана строка 2
Operating System
[child1] Обработана строка 3
Bye World
[child2] Обработана строка 4

Завершение работы...
Child1: 2 строк
Child2: 2 строк
```

```
=== Результаты ===

Файл file1.txt:
Hll Wrld
prtng Sstm

Файл file2.txt:
Tst Strng
B Wrld

Работа завершена.
```

Strace:

```
$ strace -f ./parent -f

execve("./parent", ["./parent", "-f"], 0x7ffd6603d590 /* 27 vars */) = 0

brk(NULL)                               = 0x5907d2c67000

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x72e5dd611000

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=41635, ...}) = 0

mmap(NULL, 41635, PROT_READ, MAP_PRIVATE, 3, 0) = 0x72e5dd606000

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) = 0x72e5dd200000

mmap(0x72e5dd228000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x28000) = 0x72e5dd228000

mmap(0x72e5dd3b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1b0000) = 0x72e5dd3b0000

mmap(0x72e5dd3ff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x1fe000) = 0x72e5dd3ff000

mmap(0x72e5dd405000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x72e5dd405000
```

```
close(3)                                = 0

mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x72e5dd603000

arch_prctl(ARCH_SET_FS, 0x72e5dd603740) = 0

set_tid_address(0x72e5dd603a10)         = 649

set_robust_list(0x72e5dd603a20, 24)     = 0

rseq(0x72e5dd604060, 0x20, 0, 0x53053053) = 0

mprotect(0x72e5dd3ff000, 16384, PROT_READ) = 0

mprotect(0x5907ad153000, 4096, PROT_READ) = 0

mprotect(0x72e5dd649000, 8192, PROT_READ) = 0

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

munmap(0x72e5dd606000, 41635)           = 0

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

getrandom("\x17\xab\xbc\x32\xa8\x68\xda\xb0", 8, GRND_NONBLOCK) = 8

brk(NULL)                               = 0x5907d2c67000

brk(0x5907d2c88000)                     = 0x5907d2c88000

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"..., 48Введите имя файла
для child1: ) = 48

read(0, file1.txt

"file1.txt\n", 1024)            = 10

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"..., 48Введите имя файла
для child2: ) = 48

read(0, file2.txt

"file2.txt\n", 1024)            = 10

openat(AT_FDCWD, "lab3.dat", O_RDWR|O_CREAT|O_TRUNC, 0666) = 3

ftruncate(3, 1048)                      = 0

mmap(NULL, 1048, PROT_READ|PROT_WRITE, MAP_SHARED, 3, 0) = 0x72e5dd610000

close(3)                                = 0

rt_sigaction(SIGUSR2, {sa_handler=0x5907ad151409, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, NULL, 8) = 0

clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLDstrace:
Process 650 attached

, child_tidptr=0x72e5dd603a10) = 650
```

```
     [pid   650] set_robust_list(0x72e5dd603a20, 24 <unfinished ...>

     [pid   649] clone(child_stack=NULL,
flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLD <unfinished ...>

     [pid   650] <... set_robust_list resumed>) = 0

     [pid   650] execve("./child", ["child", "1", "file1.txt", "lab3.dat"], 0x7ffe7890f650
/* 27 vars */strace: Process 651 attached

      <unfinished ...>

     [pid   649] <... clone resumed>, child_tidptr=0x72e5dd603a10) = 651

     [pid   651] set_robust_list(0x72e5dd603a20, 24) = 0

     [pid   651] execve("./child", ["child", "2", "file2.txt", "lab3.dat"], 0x7ffe7890f650
/* 27 vars */) = 0

     [pid   650] <... execve resumed>)       = 0

     [pid   651] brk(NULL <unfinished ...>

     [pid   650] brk(NULL <unfinished ...>

     [pid   651] <... brk resumed>)          = 0x61977cef8000

     [pid   650] <... brk resumed>)          = 0x5c2aea265000

     [pid   651] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0
<unfinished ...>

     [pid   650] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0
<unfinished ...>

     [pid   651] <... mmap resumed>)         = 0x7c00743e3000

     [pid   650] <... mmap resumed>)         = 0x7d29df969000

     [pid   651] access("/etc/ld.so.preload", R_OK <unfinished ...>

     [pid   650] access("/etc/ld.so.preload", R_OK <unfinished ...>

     [pid   651] <... access resumed>)       = -1 ENOENT (No such file or directory)

     [pid   650] <... access resumed>)       = -1 ENOENT (No such file or directory)

     [pid   651] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC <unfinished ...>

     [pid   650] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC <unfinished ...>

     [pid   651] <... openat resumed>)       = 3

     [pid   650] <... openat resumed>)       = 3

     [pid   651] fstat(3,  <unfinished ...>

     [pid   650] fstat(3,  <unfinished ...>

     [pid   651] <... fstat resumed>{st_mode=S_IFREG|0644, st_size=41635, ...}) = 0

     [pid   650] <... fstat resumed>{st_mode=S_IFREG|0644, st_size=41635, ...}) = 0

     [pid   651] mmap(NULL, 41635, PROT_READ, MAP_PRIVATE, 3, 0 <unfinished ...>
```

```
     [pid   650] mmap(NULL, 41635, PROT_READ, MAP_PRIVATE, 3, 0 <unfinished ...>

     [pid   651] <... mmap resumed>)         = 0x7c00743d8000

     [pid   650] <... mmap resumed>)         = 0x7d29df95e000

     [pid   651] close(3 <unfinished ...>

     [pid   650] close(3 <unfinished ...>

     [pid   651] <... close resumed>)        = 0

     [pid   650] <... close resumed>)        = 0

     [pid   651] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>

     [pid   650] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC
<unfinished ...>

     [pid   651] <... openat resumed>)       = 3

     [pid   650] <... openat resumed>)       = 3

     [pid   651] read(3,  <unfinished ...>

     [pid   650] read(3,  <unfinished ...>

     [pid   651] <... read
resumed>"\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"..., 832) = 832

     [pid   650] <... read
resumed>"\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"..., 832) = 832

     [pid   651] pread64(3,  <unfinished ...>

     [pid   650] pread64(3,  <unfinished ...>

     [pid   651] <... pread64
resumed>"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64) = 784

     [pid   650] <... pread64
resumed>"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64) = 784

     [pid   651] fstat(3,  <unfinished ...>

     [pid   650] fstat(3,  <unfinished ...>

     [pid   651] <... fstat resumed>{st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

     [pid   650] <... fstat resumed>{st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

     [pid   651] pread64(3,  <unfinished ...>

     [pid   650] pread64(3,  <unfinished ...>

     [pid   651] <... pread64
resumed>"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64) = 784

     [pid   650] <... pread64
resumed>"\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64) = 784

     [pid   651] mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished
...>
```

[pid 650] **mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0 <unfinished ...>**

[pid 651] <... mmap resumed>) = 0x7c0074000000

[pid 650] <... mmap resumed>) = 0x7d29df600000

[pid 651] **mmap(0x7c0074028000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000 <unfinished ...>**

[pid 650] **mmap(0x7d29df628000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000 <unfinished ...>**

[pid 651] <... mmap resumed>) = 0x7c0074028000

[pid 650] <... mmap resumed>) = 0x7d29df628000

[pid 651] **mmap(0x7c00741b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000 <unfinished ...>**

[pid 650] **mmap(0x7d29df7b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000 <unfinished ...>**

[pid 651] <... mmap resumed>) = 0x7c00741b0000

[pid 650] <... mmap resumed>) = 0x7d29df7b0000

[pid 651] **mmap(0x7c00741ff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000 <unfinished ...>**

[pid 650] **mmap(0x7d29df7ff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000 <unfinished ...>**

[pid 651] <... mmap resumed>) = 0x7c00741ff000

[pid 650] <... mmap resumed>) = 0x7d29df7ff000

[pid 651] **mmap(0x7c0074205000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0 <unfinished ...>**

[pid 650] **mmap(0x7d29df805000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0 <unfinished ...>**

[pid 651] <... mmap resumed>) = 0x7c0074205000

[pid 650] <... mmap resumed>) = 0x7d29df805000

[pid 651] close(3 <unfinished ...>

[pid 650] close(3 <unfinished ...>

[pid 651] <... close resumed>) = 0

[pid 650] <... close resumed>) = 0

[pid 651] **mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>**

[pid 650] **mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>**

[pid 651] <... mmap resumed>) = 0x7c00743d5000

```
[pid   651] arch_prctl(ARCH_SET_FS, 0x7c00743d5740 <unfinished ...>
[pid   650] <... mmap resumed>)         = 0x7d29df95b000
[pid   651] <... arch_prctl resumed>)   = 0
[pid   650] arch_prctl(ARCH_SET_FS, 0x7d29df95b740 <unfinished ...>
[pid   651] set_tid_address(0x7c00743d5a10 <unfinished ...>
[pid   650] <... arch_prctl resumed>)   = 0
[pid   651] <... set_tid_address resumed>) = 651
[pid   650] set_tid_address(0x7d29df95ba10 <unfinished ...>
[pid   651] set_robust_list(0x7c00743d5a20, 24 <unfinished ...>
[pid   650] <... set_tid_address resumed>) = 650
[pid   651] <... set_robust_list resumed>) = 0
[pid   650] set_robust_list(0x7d29df95ba20, 24 <unfinished ...>
[pid   651] rseq(0x7c00743d6060, 0x20, 0, 0x53053053 <unfinished ...>
[pid   650] <... set_robust_list resumed>) = 0
[pid   651] <... rseq resumed>)         = 0
[pid   650] rseq(0x7d29df95c060, 0x20, 0, 0x53053053) = 0
[pid   651] mprotect(0x7c00741ff000, 16384, PROT_READ) = 0
[pid   650] mprotect(0x7d29df7ff000, 16384, PROT_READ <unfinished ...>
[pid   651] mprotect(0x6197553e7000, 4096, PROT_READ) = 0
[pid   650] <... mprotect resumed>)     = 0
[pid   651] mprotect(0x7c007441b000, 8192, PROT_READ <unfinished ...>
[pid   650] mprotect(0x5c2aacabe000, 4096, PROT_READ <unfinished ...>
[pid   651] <... mprotect resumed>)     = 0
[pid   650] <... mprotect resumed>)     = 0
[pid   651] prlimit64(0, RLIMIT_STACK, NULL,  <unfinished ...>
[pid   650] mprotect(0x7d29df9a1000, 8192, PROT_READ <unfinished ...>
[pid   651] <... prlimit64 resumed>{rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
[pid   650] <... mprotect resumed>)     = 0
[pid   651] munmap(0x7c00743d8000, 41635 <unfinished ...>
[pid   650] prlimit64(0, RLIMIT_STACK, NULL,  <unfinished ...>
[pid   651] <... munmap resumed>)       = 0
[pid   650] <... prlimit64 resumed>{rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
```

```
     [pid   651] rt_sigaction(SIGUSR1, {sa_handler=0x6197553e52e9, sa_mask=[USR1],
sa_flags=SA_RESTORER|SA_RESTART, sa_restorer=0x7c0074045330},  <unfinished ...>

     [pid   650] munmap(0x7d29df95e000, 41635 <unfinished ...>

     [pid   651] <... rt_sigaction resumed>{sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8)
= 0

     [pid   650] <... munmap resumed>)       = 0

     [pid   651] openat(AT_FDCWD, "lab3.dat", O_RDWR <unfinished ...>

     [pid   650] rt_sigaction(SIGUSR1, {sa_handler=0x5c2aacabc2e9, sa_mask=[USR1],
sa_flags=SA_RESTORER|SA_RESTART, sa_restorer=0x7d29df645330}, {sa_handler=SIG_DFL,
sa_mask=[], sa_flags=0}, 8) = 0

     [pid   650] openat(AT_FDCWD, "lab3.dat", O_RDWR <unfinished ...>

     [pid   651] <... openat resumed>)       = 3

     [pid   650] <... openat resumed>)       = 3

     [pid   651] mmap(NULL, 1048, PROT_READ|PROT_WRITE, MAP_SHARED, 3, 0 <unfinished ...>

     [pid   650] mmap(NULL, 1048, PROT_READ|PROT_WRITE, MAP_SHARED, 3, 0 <unfinished ...>

     [pid   651] <... mmap resumed>)         = 0x7c00743e2000

     [pid   650] <... mmap resumed>)         = 0x7d29df968000

     [pid   651] close(3 <unfinished ...>

     [pid   650] close(3 <unfinished ...>

     [pid   651] <... close resumed>)        = 0

     [pid   650] <... close resumed>)        = 0

     [pid   651] getrandom( <unfinished ...>

     [pid   649] write(1, "\n", 1 <unfinished ...>

     [pid   650] getrandom(

      <unfinished ...>

     [pid   651] <... getrandom resumed>"\x9c\xfd\x83\xfd\xe7\xcc\xf2\x5c", 8,
GRND_NONBLOCK) = 8

     [pid   649] <... write resumed>)        = 1

     [pid   650] <... getrandom resumed>"\x56\x8f\xbc\xdd\x7d\x3d\x64\x49", 8,
GRND_NONBLOCK) = 8

     [pid   649] write(1, "\320\222\320\262\320\276\320\264\320\270\321\202\320\265
\321\201\321\202\321\200\320\276\320\272\320\270 (Ctr"..., 66 <unfinished ...>

     Вводите строки (Ctrl+D для завершения):

     [pid   651] brk(NULL <unfinished ...>

     [pid   649] <... write resumed>)        = 66

     [pid   650] brk(NULL <unfinished ...>
```

```
     [pid   649] read(0,  <unfinished ...>
     [pid   651] <... brk resumed>)          = 0x61977cef8000
     [pid   650] <... brk resumed>)          = 0x5c2aea265000
     [pid   651] brk(0x61977cf19000 <unfinished ...>
     [pid   650] brk(0x5c2aea286000 <unfinished ...>
     [pid   651] <... brk resumed>)          = 0x61977cf19000
     [pid   650] <... brk resumed>)          = 0x5c2aea286000
     [pid   651] openat(AT_FDCWD, "file2.txt", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished
...>
     [pid   650] openat(AT_FDCWD, "file1.txt", O_WRONLY|O_CREAT|O_TRUNC, 0666 <unfinished
...>
     [pid   651] <... openat resumed>)       = 3
     [pid   651] getppid( <unfinished ...>
     [pid   650] <... openat resumed>)       = 3
     [pid   651] <... getppid resumed>)      = 649
     [pid   650] getppid()                   = 649
     Hello World
     [pid   649] <... read resumed>"Hello World\n", 1024) = 12
     [pid   649] kill(650, SIGUSR1)          = 0
     [pid   650] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=649, si_uid=1000}
---
     [pid   650] rt_sigreturn({mask=[]})     = 0
     [pid   650] fstat(3, {st_mode=S_IFREG|0777, st_size=0, ...}) = 0
     [pid   650] kill(649, SIGUSR2 <unfinished ...>
     [pid   649] --- SIGUSR2 {si_signo=SIGUSR2, si_code=SI_USER, si_pid=650, si_uid=1000}
---
     [pid   650] <... kill resumed>)         = 0
     [pid   649] rt_sigreturn({mask=[]})     = 0
     [pid   649] write(1, "[child1]
\320\236\320\261\321\200\320\260\320\261\320\276\321\202\320\260\320\275\320\260
\321\201"..., 45[child1] Обработана строка 1
     ) = 45
     [pid   649] read(0, Test String
     "Test String\n", 1024) = 12
     [pid   649] kill(651, SIGUSR1)          = 0
```

```
     [pid   651] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=649, si_uid=1000}
---

     [pid   651] rt_sigreturn({mask=[]})     = 0

     [pid   651] fstat(3, {st_mode=S_IFREG|0777, st_size=0, ...}) = 0

     [pid   651] kill(649, SIGUSR2 <unfinished ...>

     [pid   649] --- SIGUSR2 {si_signo=SIGUSR2, si_code=SI_USER, si_pid=651, si_uid=1000}
---

     [pid   651] <... kill resumed>)         = 0

     [pid   649] rt_sigreturn({mask=[]})     = 0

     [pid   649] write(1, "[child2]
\320\236\320\261\321\200\320\260\320\261\320\276\321\202\320\260\320\275\320\260
\321\201"..., 45[child2] Обработана строка 2

     ) = 45

     [pid   649] read(0, Operating System

     "Operating System\n", 1024) = 17

     [pid   649] kill(650, SIGUSR1)          = 0

     [pid   650] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=649, si_uid=1000}
---

     [pid   650] rt_sigreturn({mask=[]})     = 0

     [pid   650] kill(649, SIGUSR2 <unfinished ...>

     [pid   649] --- SIGUSR2 {si_signo=SIGUSR2, si_code=SI_USER, si_pid=650, si_uid=1000}
---

     [pid   650] <... kill resumed>)         = 0

     [pid   649] rt_sigreturn({mask=[]})     = 0

     [pid   649] write(1, "[child1]
\320\236\320\261\321\200\320\260\320\261\320\276\321\202\320\260\320\275\320\260
\321\201"..., 45[child1] Обработана строка 3

     ) = 45

     [pid   649] read(0, Bye World

     "Bye World\n", 1024) = 10

     [pid   649] kill(651, SIGUSR1)          = 0

     [pid   651] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=649, si_uid=1000}
---

     [pid   651] rt_sigreturn({mask=[]})     = 0

     [pid   651] kill(649, SIGUSR2 <unfinished ...>

     [pid   649] --- SIGUSR2 {si_signo=SIGUSR2, si_code=SI_USER, si_pid=651, si_uid=1000}
---
```

```
     [pid   651] <... kill resumed>)         = 0

     [pid   649] rt_sigreturn({mask=[]})     = 0

     [pid   649] write(1, "[child2]
\320\236\320\261\321\200\320\260\320\261\320\276\321\202\320\260\320\275\320\260
\321\201"..., 45[child2] Обработана строка 4

     ) = 45

     [pid   649] read(0, "", 1024)           = 0

     [pid   649] write(1, "\n", 1

     )           = 1

     [pid   649] write(1,
"\320\227\320\260\320\262\320\265\321\200\321\210\320\265\320\275\320\270\320\265
\321\200\320\260\320\261\320\276\321\202\321"..., 37Завершение работы...

     ) = 37

     [pid   649] kill(650, SIGUSR1 <unfinished ...>

     [pid   651] fstat(1,  <unfinished ...>

     [pid   650] fstat(1,  <unfinished ...>

     [pid   649] <... kill resumed>)         = 0

     [pid   649] kill(651, SIGUSR1 <unfinished ...>

     [pid   651] <... fstat resumed>{st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) =
0

     [pid   650] <... fstat resumed>{st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) =
0

     [pid   649] <... kill resumed>)         = 0

     [pid   649] wait4(650,  <unfinished ...>

     [pid   651] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=649, si_uid=1000}
---

     [pid   650] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=649, si_uid=1000}
---

     [pid   651] rt_sigreturn({mask=[]} <unfinished ...>

     [pid   650] rt_sigreturn({mask=[]} <unfinished ...>

     [pid   651] <... rt_sigreturn resumed>) = 0

     [pid   651] write(1, "Child2: 2 \321\201\321\202\321\200\320\276\320\272\n", 21
<unfinished ...>

     [pid   650] <... rt_sigreturn resumed>) = 0

     Child2: 2 строк

     [pid   651] <... write resumed>)        = 21
```

```
     [pid   650] write(1, "Child1: 2 \321\201\321\202\321\200\320\276\320\272\n", 21
<unfinished ...>

     [pid   651] write(3, "Tst Strng\nB Wrld\n", 17Child1: 2 строк

      <unfinished ...>

     [pid   650] <... write resumed>)        = 21

     [pid   650] write(3, "Hll Wrld\nprtng Sstm\n", 20 <unfinished ...>

     [pid   651] <... write resumed>)        = 17

     [pid   650] <... write resumed>)        = 20

     [pid   651] close(3 <unfinished ...>

     [pid   650] close(3 <unfinished ...>

     [pid   651] <... close resumed>)        = 0

     [pid   650] <... close resumed>)        = 0

     [pid   651] munmap(0x7c00743e2000, 1048 <unfinished ...>

     [pid   650] munmap(0x7d29df968000, 1048 <unfinished ...>

     [pid   651] <... munmap resumed>)       = 0

     [pid   651] exit_group(0)               = ?

     [pid   650] <... munmap resumed>)       = 0

     [pid   651] +++ exited with 0 +++

     [pid   650] exit_group(0 <unfinished ...>

     [pid   649] <... wait4 resumed>NULL, 0, NULL) = ? ERESTARTSYS (To be restarted if
SA_RESTART is set)

     [pid   649] --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=651, si_uid=1000,
si_status=0, si_utime=2076 /* 20.76 s */, si_stime=0} ---

     [pid   650] <... exit_group resumed>)   = ?

     [pid   649] wait4(650,  <unfinished ...>

     [pid   650] +++ exited with 0 +++

     <... wait4 resumed>NULL, 0, NULL)       = 650

     --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=650, si_uid=1000,
si_status=0, si_utime=2076 /* 20.76 s */, si_stime=0} ---

     wait4(651, NULL, 0, NULL)               = 651

     write(1, "\n", 1

     )                       = 1

     write(1, "===
\320\240\320\265\320\267\321\203\320\273\321\214\321\202\320\260\321\202\321\213 ===\n",
29=== Результаты ===
```

) = 29

write(1, "\n\320\244\320\260\320\271\320\273 file1.txt:\n", 21

Файл file1.txt:

) = 21

rt_**sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x72e5dd245330}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

rt_**sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x72e5dd245330}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0

mmap(NULL, 36864, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x72e5dd607000

rt_sigprocmask(SIG_BLOCK, ~[], [CHLD], 8) = 0

clone3({flags=CLONE_VM|CLONE_VFORK|CLONE_CLEAR_SIGHAND, exit_signal=SIGCHLD, stack=0x72e5dd607000, stack_size=0x9000}, 88strace: Process 652 attached

 <unfinished ...>

[pid   652] rt_sigprocmask(SIG_BLOCK, NULL, ~[KILL STOP], 8) = 0

[pid   652] rt_**sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x72e5dd245330}, NULL, 8) = 0**

[pid   652] rt_**sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x72e5dd245330}, NULL, 8) = 0**

[pid   652] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

[pid   652] execve("/bin/sh", ["sh", "-c", "--", "cat file1.txt 2>/dev/null || ech"...], 0x7ffe7890f650 /* 27 vars */ <unfinished ...>

[pid   649] <... clone3 resumed>)   = 652

[pid   649] **munmap(0x72e5dd607000, 36864) = 0**

[pid   652] <... execve resumed>)   = 0

[pid   649] rt_sigprocmask(SIG_SETMASK, [CHLD], <unfinished ...>

[pid   652] brk(NULL <unfinished ...>

[pid   649] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid   652] <... brk resumed>)   = 0x5ee8538bf000

[pid   649] wait4(652, <unfinished ...>

[pid   652] **mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x78e52c09f000**

[pid   652] access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)

[pid   652] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3

[pid   652] fstat(3, {st_mode=S_IFREG|0644, st_size=41635, ...}) = 0

[pid 652] **mmap(NULL, 41635, PROT_READ, MAP_PRIVATE, 3, 0) = 0x78e52c094000**

[pid 652] close(3) = 0

[pid 652] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3

[pid 652] 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

[pid 652] 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

[pid 652] fstat(3, {st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

[pid 652] 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

[pid 652] **mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) =
0x78e52be00000**

[pid 652] **mmap(0x78e52be28000, 1605632, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x78e52be28000**

[pid 652] **mmap(0x78e52bfb0000, 323584, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x78e52bfb0000**

[pid 652] **mmap(0x78e52bfff000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x78e52bfff000**

[pid 652] **mmap(0x78e52c005000, 52624, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x78e52c005000**

[pid 652] close(3) = 0

[pid 652] **mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x78e52c091000**

[pid 652] arch_prctl(ARCH_SET_FS, 0x78e52c091740) = 0

[pid 652] set_tid_address(0x78e52c091a10) = 652

[pid 652] set_robust_list(0x78e52c091a20, 24) = 0

[pid 652] rseq(0x78e52c092060, 0x20, 0, 0x53053053) = 0

[pid 652] mprotect(0x78e52bfff000, 16384, PROT_READ) = 0

[pid 652] mprotect(0x5ee84c1a2000, 8192, PROT_READ) = 0

[pid 652] mprotect(0x78e52c0d7000, 8192, PROT_READ) = 0

[pid 652] prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024,
rlim_max=RLIM64_INFINITY}) = 0

[pid 652] **munmap(0x78e52c094000, 41635) = 0**

[pid 652] **getuid() = 1000**

[pid 652] **getgid() = 1000**

[pid 652] **getpid() = 652**

[pid 652] rt_sigaction(SIGCHLD, {sa_handler=0x5ee84c197cd0, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x78e52be45330}, NULL, 8) = 0

[pid 652] geteuid() = 1000

[pid 652] getrandom("\xa4\x90\xfd\xc4\x09\xd9\x49\x11", 8, GRND_NONBLOCK) = 8

[pid 652] brk(NULL) = 0x5ee8538bf000

[pid 652] brk(0x5ee8538e0000) = 0x5ee8538e0000

[pid 652] **getppid()** = **649**

[pid 652] newfstatat(AT_FDCWD, "/mnt/c/Dev/Projects/OS_Labs/lab3", {st_mode=S_IFDIR|0777, st_size=4096, ...}, 0) = 0

[pid 652] newfstatat(AT_FDCWD, ".", {st_mode=S_IFDIR|0777, st_size=4096, ...}, 0) = 0

[pid 652] geteuid() = 1000

[pid 652] getegid() = 1000

[pid 652] rt_**sigaction(SIGINT, NULL, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

[pid 652] rt_**sigaction(SIGINT, {sa_handler=0x5ee84c197cd0, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x78e52be45330}, NULL, 8) = 0**

[pid 652] rt_**sigaction(SIGQUIT, NULL, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

[pid 652] rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x78e52be45330}, NULL, 8) = 0

[pid 652] rt_**sigaction(SIGTERM, NULL, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

[pid 652] rt_sigaction(SIGTERM, {sa_handler=SIG_DFL, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x78e52be45330}, NULL, 8) = 0

[pid 652] openat(AT_FDCWD, "/dev/null", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3

[pid 652] fcntl(2, F_DUPFD, 10) = 10

[pid 652] close(2) = 0

[pid 652] fcntl(10, F_SETFD, FD_CLOEXEC) = 0

[pid 652] **dup2(3, 2)** = 2

[pid 652] close(3) = 0

[pid 652] newfstatat(AT_FDCWD, "/usr/local/sbin/cat", 0x7ffe5677e210, 0) = -1 ENOENT (No such file or directory)

[pid 652] newfstatat(AT_FDCWD, "/usr/local/bin/cat", 0x7ffe5677e210, 0) = -1 ENOENT (No such file or directory)

[pid 652] newfstatat(AT_FDCWD, "/usr/sbin/cat", 0x7ffe5677e210, 0) = -1 ENOENT (No such file or directory)

[pid 652] newfstatat(AT_FDCWD, "/usr/bin/cat", {st_mode=S_IFREG|0755, st_size=39384, ...}, 0) = 0

```
     [pid   652] rt_sigprocmask(SIG_SETMASK, ~[RTMIN RT_1], NULL, 8) = 0

     [pid   652] vfork(strace: Process 653 attached

      <unfinished ...>

     [pid   653] rt_sigprocmask(SIG_SETMASK, [], ~[KILL STOP RTMIN RT_1], 8) = 0

     [pid   653] execve("/usr/bin/cat", ["cat", "file1.txt"], 0x5ee8538bf908 /* 27 vars */
<unfinished ...>

     [pid   652] <... vfork resumed>)        = 653

     [pid   652] rt_sigprocmask(SIG_SETMASK, [],  <unfinished ...>

     [pid   653] <... execve resumed>)       = 0

     [pid   652] <... rt_sigprocmask resumed>~[KILL STOP RTMIN RT_1], 8) = 0

     [pid   653] brk(NULL <unfinished ...>

     [pid   652] wait4(-1,  <unfinished ...>

     [pid   653] <... brk resumed>)          = 0x55595a7be000

     [pid   653] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7785527e0000

     [pid   653] access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=41635, ...}) = 0

     [pid   653] mmap(NULL, 41635, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527d5000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3

     [pid   653] 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

     [pid   653] 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

     [pid   653] fstat(3, {st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

     [pid   653] 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

     [pid   653] mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) =
0x778552400000

     [pid   653] mmap(0x778552428000, 1605632, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x778552428000

     [pid   653] mmap(0x7785525b0000, 323584, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x7785525b0000

     [pid   653] mmap(0x7785525ff000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x7785525ff000
```

[pid 653] **mmap(0x778552605000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x778552605000**

[pid 653] close(3) = 0

[pid 653] **mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7785527d2000**

[pid 653] arch_prctl(ARCH_SET_FS, 0x7785527d2740) = 0

[pid 653] set_tid_address(0x7785527d2a10) = 653

[pid 653] set_robust_list(0x7785527d2a20, 24) = 0

[pid 653] rseq(0x7785527d3060, 0x20, 0, 0x53053053) = 0

[pid 653] mprotect(0x7785525ff000, 16384, PROT_READ) = 0

[pid 653] mprotect(0x55592a58b000, 4096, PROT_READ) = 0

[pid 653] mprotect(0x778552818000, 8192, PROT_READ) = 0

[pid 653] prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

[pid 653] **munmap(0x7785527d5000, 41635) = 0**

[pid 653] getrandom("\x83\x28\xc7\xe7\xf2\xc8\x15\x72", 8, GRND_NONBLOCK) = 8

[pid 653] brk(NULL) = 0x55595a7be000

[pid 653] brk(0x55595a7df000) = 0x55595a7df000

[pid 653] openat(AT_FDCWD, "/usr/lib/locale/locale-archive", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 653] openat(AT_FDCWD, "/usr/share/locale/locale.alias", O_RDONLY|O_CLOEXEC) = 3

[pid 653] fstat(3, {st_mode=S_IFREG|0644, st_size=2996, ...}) = 0

[pid 653] read(3, "# Locale name alias data base.\n#"..., 4096) = 2996

[pid 653] read(3, "", 4096) = 0

[pid 653] close(3) = 0

[pid 653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_IDENTIFICATION", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_IDENTIFICATION", O_RDONLY|O_CLOEXEC) = 3

[pid 653] fstat(3, {st_mode=S_IFREG|0644, st_size=258, ...}) = 0

[pid 653] **mmap(NULL, 258, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527df000**

[pid 653] close(3) = 0

[pid 653] openat(AT_FDCWD, "/usr/lib/x86_64-linux-gnu/gconv/gconv-modules.cache", O_RDONLY|O_CLOEXEC) = 3

[pid 653] fstat(3, {st_mode=S_IFREG|0644, st_size=27028, ...}) = 0

[pid 653] **mmap(NULL, 27028, PROT_READ, MAP_SHARED, 3, 0) = 0x7785527d8000**

```
     [pid   653] close(3)                    = 0

     [pid   653] futex(0x77855260472c, FUTEX_WAKE_PRIVATE, 2147483647) = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_MEASUREMENT",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MEASUREMENT",
O_RDONLY|O_CLOEXEC) = 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=23, ...}) = 0

     [pid   653] mmap(NULL, 23, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527d7000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_TELEPHONE",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_TELEPHONE", O_RDONLY|O_CLOEXEC)
= 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=47, ...}) = 0

     [pid   653] mmap(NULL, 47, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527d6000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_ADDRESS", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_ADDRESS", O_RDONLY|O_CLOEXEC) =
3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=127, ...}) = 0

     [pid   653] mmap(NULL, 127, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527d5000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_NAME", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_NAME", O_RDONLY|O_CLOEXEC) = 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=62, ...}) = 0

     [pid   653] mmap(NULL, 62, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527d1000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_PAPER", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_PAPER", O_RDONLY|O_CLOEXEC) = 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=34, ...}) = 0

     [pid   653] mmap(NULL, 34, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527d0000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_MESSAGES", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
```

```
     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MESSAGES", O_RDONLY|O_CLOEXEC)
= 3

     [pid   653] fstat(3, {st_mode=S_IFDIR|0755, st_size=4096, ...}) = 0

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MESSAGES/SYS_LC_MESSAGES",
O_RDONLY|O_CLOEXEC) = 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=48, ...}) = 0

     [pid   653] mmap(NULL, 48, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527cf000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_MONETARY", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MONETARY", O_RDONLY|O_CLOEXEC)
= 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=270, ...}) = 0

     [pid   653] mmap(NULL, 270, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527ce000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_COLLATE", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_COLLATE", O_RDONLY|O_CLOEXEC) =
3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=1406, ...}) = 0

     [pid   653] mmap(NULL, 1406, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527cd000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_TIME", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_TIME", O_RDONLY|O_CLOEXEC) = 3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=3360, ...}) = 0

     [pid   653] mmap(NULL, 3360, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527cc000

     [pid   653] close(3)                    = 0

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_NUMERIC", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)

     [pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_NUMERIC", O_RDONLY|O_CLOEXEC) =
3

     [pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=50, ...}) = 0

     [pid   653] mmap(NULL, 50, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7785527cb000

     [pid   653] close(3)                    = 0
```

```
[pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_CTYPE", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)

[pid   653] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_CTYPE", O_RDONLY|O_CLOEXEC) = 3

[pid   653] fstat(3, {st_mode=S_IFREG|0644, st_size=360460, ...}) = 0

[pid   653] mmap(NULL, 360460, PROT_READ, MAP_PRIVATE, 3, 0) = 0x778552772000

[pid   653] close(3)                    = 0

[pid   653] fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0

[pid   653] openat(AT_FDCWD, "file1.txt", O_RDONLY) = 3

[pid   653] fstat(3, {st_mode=S_IFREG|0777, st_size=20, ...}) = 0

[pid   653] fadvise64(3, 0, 0, POSIX_FADV_SEQUENTIAL) = 0

[pid   653] mmap(NULL, 139264, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x778552750000

[pid   653] read(3, "Hll Wrld\nprtng Sstm\n", 131072) = 20

[pid   653] write(1, "Hll Wrld\nprtng Sstm\n", 20Hll Wrld

prtng Sstm

) = 20

[pid   653] read(3, "", 131072)         = 0

[pid   653] munmap(0x778552750000, 139264) = 0

[pid   653] close(3)                    = 0

[pid   653] close(1)                    = 0

[pid   653] close(2)                    = 0

[pid   653] exit_group(0)               = ?

[pid   653] +++ exited with 0 +++

[pid   652] <... wait4 resumed>[{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 653

[pid   652] --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=653, si_uid=1000,
si_status=0, si_utime=0, si_stime=0} ---

[pid   652] rt_sigreturn({mask=[]})     = 653

[pid   652] wait4(-1, 0x7ffe5677e16c, WNOHANG, NULL) = -1 ECHILD (No child processes)

[pid   652] dup2(10, 2)                 = 2

[pid   652] close(10)                   = 0

[pid   652] exit_group(0)               = ?

[pid   652] +++ exited with 0 +++

<... wait4 resumed>[{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 652

rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, NULL, 8) = 0
```

```
     rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, NULL, 8) = 0

     rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

     --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=652, si_uid=1000,
si_status=0, si_utime=0, si_stime=0} ---

     write(1, "\n\320\244\320\260\320\271\320\273 file2.txt:\n", 21

     Файл file2.txt:

     ) = 21

     rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, 8) = 0

     rt_sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, 8) = 0

     rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0

     mmap(NULL, 36864, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x72e5dd607000

     rt_sigprocmask(SIG_BLOCK, ~[], [CHLD], 8) = 0

     clone3({flags=CLONE_VM|CLONE_VFORK|CLONE_CLEAR_SIGHAND, exit_signal=SIGCHLD,
stack=0x72e5dd607000, stack_size=0x9000}, 88strace: Process 654 attached

      <unfinished ...>

     [pid   654] rt_sigprocmask(SIG_BLOCK, NULL, ~[KILL STOP], 8) = 0

     [pid   654] rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, NULL, 8) = 0

     [pid   654] rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[],
sa_flags=SA_RESTORER, sa_restorer=0x72e5dd245330}, NULL, 8) = 0

     [pid   654] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

     [pid   654] execve("/bin/sh", ["sh", "-c", "--", "cat file2.txt 2>/dev/null ||
ech"...], 0x7ffe7890f650 /* 27 vars */ <unfinished ...>

     [pid   649] <... clone3 resumed>)       = 654

     [pid   649] munmap(0x72e5dd607000, 36864) = 0

     [pid   654] <... execve resumed>)       = 0

     [pid   649] rt_sigprocmask(SIG_SETMASK, [CHLD],  <unfinished ...>

     [pid   654] brk(NULL <unfinished ...>

     [pid   649] <... rt_sigprocmask resumed>NULL, 8) = 0

     [pid   654] <... brk resumed>)          = 0x5b93e3a1f000

     [pid   649] wait4(654,  <unfinished ...>
```

[pid 654] **mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7d052983f000**

[pid 654] access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)

[pid 654] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3

[pid 654] fstat(3, {st_mode=S_IFREG|0644, st_size=41635, ...}) = 0

[pid 654] **mmap(NULL, 41635, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7d0529834000**

[pid 654] close(3) = 0

[pid 654] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3

[pid 654] 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

[pid 654] 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

[pid 654] fstat(3, {st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

[pid 654] 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

[pid 654] **mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7d0529600000**

[pid 654] **mmap(0x7d0529628000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x7d0529628000**

[pid 654] **mmap(0x7d05297b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x7d05297b0000**

[pid 654] **mmap(0x7d05297ff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x7d05297ff000**

[pid 654] **mmap(0x7d0529805000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7d0529805000**

[pid 654] close(3) = 0

[pid 654] **mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7d0529831000**

[pid 654] arch_prctl(ARCH_SET_FS, 0x7d0529831740) = 0

[pid 654] set_tid_address(0x7d0529831a10) = 654

[pid 654] set_robust_list(0x7d0529831a20, 24) = 0

[pid 654] rseq(0x7d0529832060, 0x20, 0, 0x53053053) = 0

[pid 654] mprotect(0x7d05297ff000, 16384, PROT_READ) = 0

[pid 654] mprotect(0x5b93cbc83000, 8192, PROT_READ) = 0

[pid 654] mprotect(0x7d0529877000, 8192, PROT_READ) = 0

[pid 654] prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

[pid 654] **munmap(0x7d0529834000, 41635) = 0**

[pid 654] **getuid() = 1000**

[pid 654] **getgid() = 1000**

[pid 654] **getpid() = 654**

[pid 654] rt_**sigaction(SIGCHLD, {sa_handler=0x5b93cbc78cd0, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x7d0529645330}, NULL, 8) = 0**

[pid 654] geteuid() = 1000

[pid 654] getrandom("\xcc\xa4\xfe\x6a\xfa\x72\x6c\x05", 8, GRND_NONBLOCK) = 8

[pid 654] brk(NULL) = 0x5b93e3a1f000

[pid 654] brk(0x5b93e3a40000) = 0x5b93e3a40000

[pid 654] **getppid() = 649**

[pid 654] newfstatat(AT_FDCWD, "/mnt/c/Dev/Projects/OS_Labs/lab3", {st_mode=S_IFDIR|0777, st_size=4096, ...}, 0) = 0

[pid 654] newfstatat(AT_FDCWD, ".", {st_mode=S_IFDIR|0777, st_size=4096, ...}, 0) = 0

[pid 654] geteuid() = 1000

[pid 654] getegid() = 1000

[pid 654] rt_**sigaction(SIGINT, NULL, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

[pid 654] rt_**sigaction(SIGINT, {sa_handler=0x5b93cbc78cd0, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x7d0529645330}, NULL, 8) = 0**

[pid 654] rt_**sigaction(SIGQUIT, NULL, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

[pid 654] rt_**sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x7d0529645330}, NULL, 8) = 0**

[pid 654] rt_**sigaction(SIGTERM, NULL, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0**

[pid 654] rt_**sigaction(SIGTERM, {sa_handler=SIG_DFL, sa_mask=~[RTMIN RT_1], sa_flags=SA_RESTORER, sa_restorer=0x7d0529645330}, NULL, 8) = 0**

[pid 654] openat(AT_FDCWD, "/dev/null", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3

[pid 654] fcntl(2, F_DUPFD, 10) = 10

[pid 654] close(2) = 0

[pid 654] fcntl(10, F_SETFD, FD_CLOEXEC) = 0

[pid 654] **dup2(3, 2) = 2**

[pid 654] close(3) = 0

[pid 654] newfstatat(AT_FDCWD, "/usr/local/sbin/cat", 0x7fff0e86ff40, 0) = -1 ENOENT (No such file or directory)

[pid 654] newfstatat(AT_FDCWD, "/usr/local/bin/cat", 0x7fff0e86ff40, 0) = -1 ENOENT (No such file or directory)

[pid 654] newfstatat(AT_FDCWD, "/usr/sbin/cat", 0x7fff0e86ff40, 0) = -1 ENOENT (No such file or directory)

[pid 654] newfstatat(AT_FDCWD, "/usr/bin/cat", {st_mode=S_IFREG|0755, st_size=39384, ...}, 0) = 0

[pid 654] rt_sigprocmask(SIG_SETMASK, ~[RTMIN RT_1], NULL, 8) = 0

[pid 654] vfork(strace: Process 655 attached

<unfinished ...>

[pid 655] rt_sigprocmask(SIG_SETMASK, [], ~[KILL STOP RTMIN RT_1], 8) = 0

[pid 655] **execve("/usr/bin/cat", ["cat", "file2.txt"], 0x5b93e3a1f908 /* 27 vars */ <unfinished ...>**

[pid 654] <... vfork resumed>) = 655

[pid 654] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 655] <... execve resumed>) = 0

[pid 654] <... rt_sigprocmask resumed>~[KILL STOP RTMIN RT_1], 8) = 0

[pid 655] brk(NULL <unfinished ...>

[pid 654] wait4(-1, <unfinished ...>

[pid 655] <... brk resumed>) = 0x62cf80cc3000

[pid 655] **mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7830ee048000**

[pid 655] access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=41635, ...}) = 0

[pid 655] **mmap(NULL, 41635, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee03d000**

[pid 655] close(3) = 0

[pid 655] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3

[pid 655] 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

[pid 655] 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

[pid 655] fstat(3, {st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

[pid 655] 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

[pid 655] **mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7830ede00000**

[pid 655] **mmap(0x7830ede28000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x7830ede28000**

[pid 655] **mmap(0x7830edfb0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x7830edfb0000**

[pid 655] **mmap(0x7830edfff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x7830edfff000**

[pid 655] **mmap(0x7830ee005000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7830ee005000**

[pid 655] close(3) = 0

[pid 655] **mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7830ee03a000**

[pid 655] arch_prctl(ARCH_SET_FS, 0x7830ee03a740) = 0

[pid 655] set_tid_address(0x7830ee03aa10) = 655

[pid 655] set_robust_list(0x7830ee03aa20, 24) = 0

[pid 655] rseq(0x7830ee03b060, 0x20, 0, 0x53053053) = 0

[pid 655] mprotect(0x7830edfff000, 16384, PROT_READ) = 0

[pid 655] mprotect(0x62cf62d5d000, 4096, PROT_READ) = 0

[pid 655] mprotect(0x7830ee080000, 8192, PROT_READ) = 0

[pid 655] prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

[pid 655] **munmap(0x7830ee03d000, 41635) = 0**

[pid 655] getrandom("\x3e\x00\xc5\x36\x61\x6a\x47\x11", 8, GRND_NONBLOCK) = 8

[pid 655] brk(NULL) = 0x62cf80cc3000

[pid 655] brk(0x62cf80ce4000) = 0x62cf80ce4000

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/locale-archive", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/usr/share/locale/locale.alias", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=2996, ...}) = 0

[pid 655] read(3, "# Locale name alias data base.\n#"..., 4096) = 2996

[pid 655] read(3, "", 4096) = 0

[pid 655] close(3) = 0

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_IDENTIFICATION", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_IDENTIFICATION", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=258, ...}) = 0

[pid 655] **mmap(NULL, 258, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee047000**

[pid 655] close(3) = 0

[pid 655] openat(AT_FDCWD, "/usr/lib/x86_64-linux-gnu/gconv/gconv-modules.cache", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=27028, ...}) = 0

[pid 655] **mmap(NULL, 27028, PROT_READ, MAP_SHARED, 3, 0) = 0x7830ee040000**

[pid 655] close(3) = 0

[pid 655] **futex(0x7830ee00472c, FUTEX_WAKE_PRIVATE, 2147483647) = 0**

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_MEASUREMENT", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MEASUREMENT", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=23, ...}) = 0

[pid 655] **mmap(NULL, 23, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee03f000**

[pid 655] close(3) = 0

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_TELEPHONE", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_TELEPHONE", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=47, ...}) = 0

[pid 655] **mmap(NULL, 47, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee03e000**

[pid 655] close(3) = 0

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_ADDRESS", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_ADDRESS", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=127, ...}) = 0

[pid 655] **mmap(NULL, 127, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee03d000**

[pid 655] close(3) = 0

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_NAME", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_NAME", O_RDONLY|O_CLOEXEC) = 3

[pid 655] fstat(3, {st_mode=S_IFREG|0644, st_size=62, ...}) = 0

[pid 655] **mmap(NULL, 62, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee039000**

[pid 655] close(3) = 0

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_PAPER", O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

[pid 655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_PAPER", O_RDONLY|O_CLOEXEC) = 3

```
     [pid   655] fstat(3, {st_mode=S_IFREG|0644, st_size=34, ...}) = 0

     [pid   655] mmap(NULL, 34, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee038000

     [pid   655] close(3)                    = 0

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_MESSAGES", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MESSAGES", O_RDONLY|O_CLOEXEC)
= 3

     [pid   655] fstat(3, {st_mode=S_IFDIR|0755, st_size=4096, ...}) = 0

     [pid   655] close(3)                    = 0

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MESSAGES/SYS_LC_MESSAGES",
O_RDONLY|O_CLOEXEC) = 3

     [pid   655] fstat(3, {st_mode=S_IFREG|0644, st_size=48, ...}) = 0

     [pid   655] mmap(NULL, 48, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee037000

     [pid   655] close(3)                    = 0

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_MONETARY", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_MONETARY", O_RDONLY|O_CLOEXEC)
= 3

     [pid   655] fstat(3, {st_mode=S_IFREG|0644, st_size=270, ...}) = 0

     [pid   655] mmap(NULL, 270, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee036000

     [pid   655] close(3)                    = 0

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_COLLATE", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_COLLATE", O_RDONLY|O_CLOEXEC) =
3

     [pid   655] fstat(3, {st_mode=S_IFREG|0644, st_size=1406, ...}) = 0

     [pid   655] mmap(NULL, 1406, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee035000

     [pid   655] close(3)                    = 0

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_TIME", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_TIME", O_RDONLY|O_CLOEXEC) = 3

     [pid   655] fstat(3, {st_mode=S_IFREG|0644, st_size=3360, ...}) = 0

     [pid   655] mmap(NULL, 3360, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee034000

     [pid   655] close(3)                    = 0

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_NUMERIC", O_RDONLY|O_CLOEXEC)
= -1 ENOENT (No such file or directory)
```

```
     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_NUMERIC", O_RDONLY|O_CLOEXEC) =
3

     [pid   655] fstat(3, {st_mode=S_IFREG|0644, st_size=50, ...}) = 0

     [pid   655] mmap(NULL, 50, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830ee033000

     [pid   655] close(3)                    = 0

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.UTF-8/LC_CTYPE", O_RDONLY|O_CLOEXEC) =
-1 ENOENT (No such file or directory)

     [pid   655] openat(AT_FDCWD, "/usr/lib/locale/C.utf8/LC_CTYPE", O_RDONLY|O_CLOEXEC) = 3

     [pid   655] fstat(3, {st_mode=S_IFREG|0644, st_size=360460, ...}) = 0

     [pid   655] mmap(NULL, 360460, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7830edda7000

     [pid   655] close(3)                    = 0

     [pid   655] fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0

     [pid   655] openat(AT_FDCWD, "file2.txt", O_RDONLY) = 3

     [pid   655] fstat(3, {st_mode=S_IFREG|0777, st_size=17, ...}) = 0

     [pid   655] fadvise64(3, 0, 0, POSIX_FADV_SEQUENTIAL) = 0

     [pid   655] mmap(NULL, 139264, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7830edd85000

     [pid   655] read(3, "Tst Strng\nB Wrld\n", 131072) = 17

     [pid   655] write(1, "Tst Strng\nB Wrld\n", 17Tst Strng

     B Wrld

     ) = 17

     [pid   655] read(3, "", 131072)         = 0

     [pid   655] munmap(0x7830edd85000, 139264) = 0

     [pid   655] close(3)                    = 0

     [pid   655] close(1)                    = 0

     [pid   655] close(2)                    = 0

     [pid   655] exit_group(0)               = ?

     [pid   655] +++ exited with 0 +++

     [pid   654] <... wait4 resumed>[{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 655

     [pid   654] --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=655, si_uid=1000,
si_status=0, si_utime=0, si_stime=1 /* 0.01 s */} ---

     [pid   654] rt_sigreturn({mask=[]})     = 655

     [pid   654] wait4(-1, 0x7fff0e86fe9c, WNOHANG, NULL) = -1 ECHILD (No child processes)

     [pid   654] dup2(10, 2)                 = 2

     [pid   654] close(10)                   = 0
```

```
[pid   654] exit_group(0)               = ?

[pid   654] +++ exited with 0 +++

<... wait4 resumed>[{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 654

rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, NULL, 8) = 0

rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER,
sa_restorer=0x72e5dd245330}, NULL, 8) = 0

rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=654, si_uid=1000,
si_status=0, si_utime=0, si_stime=0} ---

munmap(0x72e5dd610000, 1048)            = 0

unlink("lab3.dat")                      = 0

write(1, "\n", 1

)                       = 1

write(1, "\320\240\320\260\320\261\320\276\321\202\320\260
\320\267\320\260\320\262\320\265\321\200\321\210\320\265\320\275\320\260."..., 33Работа
завершена.

) = 33

exit_group(0)                           = ?

+++ exited with 0 +++
```

Вывод

В ходе лабораторной работы были изучены принципы работы с memory-mapped files и системными сигналами для организации взаимодействия между процессами. Программа успешно создавала два дочерних процесса, распределяла строки по четности их номера и синхронизировала обработку через сигналы SIGUSR1 и SIGUSR2. Использование shared memory через mmap позволило эффективно передавать данные без промежуточных копий, а механизм сигналов обеспечил четкую синхронизацию между родительским и дочерними процессами. Работа показала, как системные вызовы (mmap, kill, sigaction, pause) могут использоваться для организации взаимодействия и синхронизации процессов в операционной системе.