Московский Авиационный Институт

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Институт №8 “Компьютерные науки и прикладная математика”

Кафедра №806 “Вычислительная математика и программирование”

**Лабораторная работа №1 по курсу**

**«Операционные системы»**

Группа: М8О-215Б-23

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**Постановка задачи**

**Вариант 16.**

**Правило проверки: строка должна оканчиваться на “.” или “;”.**

**Общий метод и алгоритм решения**

Использованные системные вызовы:

* pid\_t pid = fork(void); – создает дочерний процесс.
* int pipe1[2], pipe2[2]; - создание каналов.
* close(pipe); - закрытие стороны канала.
* dup2(pipe, STDXX\_FILENO); - перенаправление канала.
* execpl(); - запуск сторонней исполняемой программы.
* waitpid(); - ожидание завершения дочернего процесса.

Родительский процесс выполняет следующие действия:

1. Создает два канала для двусторонней связи между процессами.
2. Создает дочерний процесс с помощью fork().
3. В дочернем процессе перенаправляет стандартный ввод и вывод на каналы и запускает исполняемый файл дочернего процесса с помощью execlp().

Дочерний процесс выполняет следующие действия:

1. Читает имя файла из стандартного ввода и открывает его для записи.
2. Читает сообщение из стандартного ввода.
3. Проверяет, оканчивается ли сообщение на точку или точку с запятой.
4. Закрывает файл и завершает работу.

**Код программы**

**parent.c**

#include <stdio.h>

#include <stdlib.h>

#include <unistd.h>

#include <string.h>

#include <sys/types.h>

#include <sys/wait.h>

int main() {

int pipe1[2];

int pipe2[2];

pid\_t pid;

if (pipe(pipe1) == -1 || pipe(pipe2) == -1) {

perror("pipe failed");

return 1;

}

pid = fork();

if (pid == -1) {

perror("fork failed");

return 1;

}

// pipe[0] - чтение, pipe[1] - запись

if (pid == 0) {

close(pipe1[1]);

close(pipe2[0]);

dup2(pipe1[0], STDIN\_FILENO); // Перенаправляем стандартный ввод на pipe1[0]

dup2(pipe2[1], STDOUT\_FILENO); // Перенаправляем стандартный вывод на pipe2[1]

close(pipe1[0]);

close(pipe2[1]);

execlp("./child", "child", NULL);

perror("execlp failed");

exit(1);

}

else {

char msg[100];

char read\_msg[100];

close(pipe1[0]);

close(pipe2[1]);

printf("Write a doc name\n");

fgets(msg, sizeof(msg), stdin);

write(pipe1[1], msg, strlen(msg) + 1);

while (1) {

printf("Enter a message (exit for exit)\n");

fgets(msg, sizeof(msg), stdin);

if (strncmp(msg, "exit", 4) == 0) {

break;

}

write(pipe1[1], msg, strlen(msg) + 1);

read(pipe2[0], read\_msg, sizeof(read\_msg));

printf("Status: %s\n", read\_msg);

}

close(pipe1[1]);

close(pipe2[0]);

waitpid(pid, NULL, 0);

}

return 0;

}

**child.c**

#include <stdio.h>

#include <stdlib.h>

#include <unistd.h>

#include <string.h>

int main() {

char read\_msg[100];

char response\_msg[100];

// Читаем имя файла из stdin

read(STDIN\_FILENO, read\_msg, sizeof(read\_msg));

FILE \*fp = fopen(read\_msg, "w");

if (!fp) {

perror("file error");

return -1;

}

while (1) {

int bytes\_read = read(STDIN\_FILENO, read\_msg, sizeof(read\_msg));

if (bytes\_read <= 0) {

break;

}

int len = strlen(read\_msg);

if (len > 0 && (read\_msg[len - 2] == ';' || read\_msg[len - 2] == '.')) {

fputs(read\_msg, fp);

strcpy(response\_msg, "Success");

}

else {

strcpy(response\_msg, "Not over in ';' or '.'");

}

// Пишем данные в stdout

write(STDOUT\_FILENO, response\_msg, strlen(response\_msg) + 1);

}

fclose(fp);

return 0;

}

**Протокол работы программы**

**Тестирование**

$ ./parent

Write a doc name

hellow

Enter a message

hellow;

Status: Success

Enter a message:

qwe

Status Not over in ';' or '.'

Enter a message

asfdd;

Status: Success

Enter a message

xddddd;

Status: Success

Enter a message

exit

**Strace:**

$ strace -f ./parent

execve("./parent", ["./parent"], 0x7ffd5c20faa8 /\* 50 vars \*/) = 0

brk(NULL) = 0x5cec77aeb000

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=121423, ...}) = 0

mmap(NULL, 121423, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7fb904dc3000

close(3) = 0

openat(AT\_FDCWD, "/usr/lib/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\340\_\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=2014520, ...}) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fb904dc1000

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, 2034616, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7fb904bd0000

mmap(0x7fb904bf4000, 1511424, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x24000) = 0x7fb904bf4000

mmap(0x7fb904d65000, 319488, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x195000) = 0x7fb904d65000

mmap(0x7fb904db3000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1e3000) = 0x7fb904db3000

mmap(0x7fb904db9000, 31672, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7fb904db9000

close(3) = 0

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7fb904bcd000

arch\_prctl(ARCH\_SET\_FS, 0x7fb904bcd740) = 0

set\_tid\_address(0x7fb904bcda10) = 36016

set\_robust\_list(0x7fb904bcda20, 24) = 0

rseq(0x7fb904bce060, 0x20, 0, 0x53053053) = 0

mprotect(0x7fb904db3000, 16384, PROT\_READ) = 0

mprotect(0x5cec42537000, 4096, PROT\_READ) = 0

mprotect(0x7fb904e1b000, 8192, PROT\_READ) = 0

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

munmap(0x7fb904dc3000, 121423) = 0

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

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

clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLD, child\_tidptr=0x7fb904bcda10) = 36017

strace: Process 36017 attached

[pid 36016] close(3) = 0

[pid 36016] close(6 <unfinished ...>

[pid 36017] set\_robust\_list(0x7fb904bcda20, 24 <unfinished ...>

[pid 36016] <... close resumed>) = 0

[pid 36016] fstat(1, <unfinished ...>

[pid 36017] <... set\_robust\_list resumed>) = 0

[pid 36016] <... fstat resumed>{st\_mode=S\_IFCHR|0620, st\_rdev=makedev(0x88, 0), ...}) = 0

[pid 36016] getrandom("\x30\x10\xd3\x1b\xe3\x53\x96\x65", 8, GRND\_NONBLOCK) = 8

[pid 36016] brk(NULL) = 0x5cec77aeb000

[pid 36017] close(4 <unfinished ...>

[pid 36016] brk(0x5cec77b0c000) = 0x5cec77b0c000

[pid 36017] <... close resumed>) = 0

[pid 36016] write(1, "write a doc name\n", 17 <unfinished ...>

write a doc name

[pid 36017] close(5 <unfinished ...>

[pid 36016] <... write resumed>) = 17

[pid 36017] <... close resumed>) = 0

[pid 36016] fstat(0, {st\_mode=S\_IFCHR|0620, st\_rdev=makedev(0x88, 0), ...}) = 0

[pid 36017] dup2(3, 0 <unfinished ...>

[pid 36016] read(0, <unfinished ...>

[pid 36017] <... dup2 resumed>) = 0

[pid 36017] dup2(6, 1) = 1

[pid 36017] close(3) = 0

[pid 36017] close(6) = 0

[pid 36017] execve("./child", ["child"], 0x7ffc5812e4b8 /\* 50 vars \*/) = 0

[pid 36017] brk(NULL) = 0x569d17ded000

[pid 36017] access("/etc/ld.so.preload", R\_OK) = -1 ENOENT (No such file or directory)

[pid 36017] openat(AT\_FDCWD, "/etc/ld.so.cache", O\_RDONLY|O\_CLOEXEC) = 3

[pid 36017] fstat(3, {st\_mode=S\_IFREG|0644, st\_size=121423, ...}) = 0

[pid 36017] mmap(NULL, 121423, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x74a86bff5000

[pid 36017] close(3) = 0

[pid 36017] openat(AT\_FDCWD, "/usr/lib/libc.so.6", O\_RDONLY|O\_CLOEXEC) = 3

[pid 36017] read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\340\_\2\0\0\0\0\0"..., 832) = 832

[pid 36017] 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 36017] fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2014520, ...}) = 0

[pid 36017] mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x74a86bff3000

[pid 36017] 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 36017] mmap(NULL, 2034616, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x74a86be02000

[pid 36017] mmap(0x74a86be26000, 1511424, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x24000) = 0x74a86be26000

[pid 36017] mmap(0x74a86bf97000, 319488, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x195000) = 0x74a86bf97000

[pid 36017] mmap(0x74a86bfe5000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1e3000) = 0x74a86bfe5000

[pid 36017] mmap(0x74a86bfeb000, 31672, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x74a86bfeb000

[pid 36017] close(3) = 0

[pid 36017] mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x74a86bdff000

[pid 36017] arch\_prctl(ARCH\_SET\_FS, 0x74a86bdff740) = 0

[pid 36017] set\_tid\_address(0x74a86bdffa10) = 36017

[pid 36017] set\_robust\_list(0x74a86bdffa20, 24) = 0

[pid 36017] rseq(0x74a86be00060, 0x20, 0, 0x53053053) = 0

[pid 36017] mprotect(0x74a86bfe5000, 16384, PROT\_READ) = 0

[pid 36017] mprotect(0x569cef063000, 4096, PROT\_READ) = 0

[pid 36017] mprotect(0x74a86c04d000, 8192, PROT\_READ) = 0

[pid 36017] prlimit64(0, RLIMIT\_STACK, NULL, {rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

[pid 36017] munmap(0x74a86bff5000, 121423) = 0

[pid 36017] read(0, hellow

<unfinished ...>

[pid 36016] <... read resumed>"hellow\n", 1024) = 7

[pid 36016] write(4, "hellow\n\0", 8) = 8

[pid 36017] <... read resumed>"hellow\n\0", 100) = 8

[pid 36016] write(1, "Enter a message: ", 17 <unfinished ...>

[pid 36017] getrandom(Enter a message: <unfinished ...>

[pid 36016] <... write resumed>) = 17

[pid 36017] <... getrandom resumed>"\xaa\x27\x82\x44\x3f\x93\xbb\x5e", 8, GRND\_NONBLOCK) = 8

[pid 36016] read(0, <unfinished ...>

[pid 36017] brk(NULL) = 0x569d17ded000

[pid 36017] brk(0x569d17e0e000) = 0x569d17e0e000

[pid 36017] openat(AT\_FDCWD, "hellow\n", O\_WRONLY|O\_CREAT|O\_TRUNC, 0666) = 3

[pid 36017] read(0, hellow;

<unfinished ...>

[pid 36016] <... read resumed>"hellow;\n", 1024) = 8

[pid 36016] write(4, "hellow;\n\0", 9) = 9

[pid 36017] <... read resumed>"hellow;\n\0", 100) = 9

[pid 36016] read(5, <unfinished ...>

[pid 36017] fstat(3, {st\_mode=S\_IFREG|0644, st\_size=0, ...}) = 0

[pid 36017] write(1, "\320\243\321\201\320\277\320\265\321\210\320\275\320\276\0", 15) = 15

[pid 36016] <... read resumed>"\320\243\321\201\320\277\320\265\321\210\320\275\320\276\0", 100) = 15

[pid 36017] read(0, <unfinished ...>

[pid 36016] write(1, "Parent read: \320\243\321\201\320\277\320\265\321\210\320\275\320\276\n", 28Parent read: Успешно

) = 28

[pid 36016] write(1, "Enter a message: ", 17Enter a message: ) = 17

[pid 36016] read(0, bye

"bye\n", 1024) = 4

[pid 36016] write(4, "bye\n\0", 5) = 5

[pid 36017] <... read resumed>"bye\n\0", 100) = 5

[pid 36016] read(5, <unfinished ...>

[pid 36017] write(1, "\320\237\321\200\320\265\320\264\320\273\320\276\320\266\320\265\320\275\320\270\320\265 \320\275\320\265 \320\276\320\272"..., 69 <unfinished ...>

[pid 36016] <... read resumed>"\320\237\321\200\320\265\320\264\320\273\320\276\320\266\320\265\320\275\320\270\320\265 \320\275\320\265 \320\276\320\272"..., 100) = 69

[pid 36017] <... write resumed>) = 69

[pid 36016] write(1, "Parent read: \320\237\321\200\320\265\320\264\320\273\320\276\320\266\320\265\320\275\320"..., 82 <unfinished ...>

[pid 36017] read(0, Parent read: Предложение не оканчивается на . или ;

<unfinished ...>

[pid 36016] <... write resumed>) = 82

[pid 36016] write(1, "Enter a message: ", 17Enter a message: ) = 17

[pid 36016] read(0, asd;

"asd;\n", 1024) = 5

[pid 36016] write(4, "asd;\n\0", 6) = 6

[pid 36017] <... read resumed>"asd;\n\0", 100) = 6

[pid 36016] read(5, <unfinished ...>

[pid 36017] write(1, "\320\243\321\201\320\277\320\265\321\210\320\275\320\276\0", 15) = 15

[pid 36016] <... read resumed>"\320\243\321\201\320\277\320\265\321\210\320\275\320\276\0", 100) = 15

[pid 36017] read(0, <unfinished ...>

[pid 36016] write(1, "Parent read: \320\243\321\201\320\277\320\265\321\210\320\275\320\276\n", 28Parent read: Успешно

) = 28

[pid 36016] write(1, "Enter a message: ", 17Enter a message: ) = 17

[pid 36016] read(0, exit

"exit\n", 1024) = 5

[pid 36016] close(4) = 0

[pid 36017] <... read resumed>"", 100) = 0

[pid 36016] close(5) = 0

[pid 36017] write(3, "hellow;\nasd;\n", 13 <unfinished ...>

[pid 36016] wait4(36017, <unfinished ...>

[pid 36017] <... write resumed>) = 13

[pid 36017] close(3) = 0

[pid 36017] exit\_group(0) = ?

[pid 36017] +++ exited with 0 +++

<... wait4 resumed>NULL, 0, NULL) = 36017

--- SIGCHLD {si\_signo=SIGCHLD, si\_code=CLD\_EXITED, si\_pid=36017, si\_uid=1000, si\_status=0, si\_utime=0, si\_stime=0} ---

exit\_group(0) = ?

+++ exited with 0 +++

**Вывод**

Программа успешно демонстрирует использование каналов для межпроцессного взаимодействия, позволяя родительскому и дочернему процессам обмениваться данными. Родительский процесс отправляет сообщения дочернему процессу, который проверяет их и записывает в файл, если они соответствуют заданным условиям.