CS 3305A

Process

Lecture 4

Sept 20 2023

Topics to be discussed

- Fork and Files
  - Process File Descriptor Table

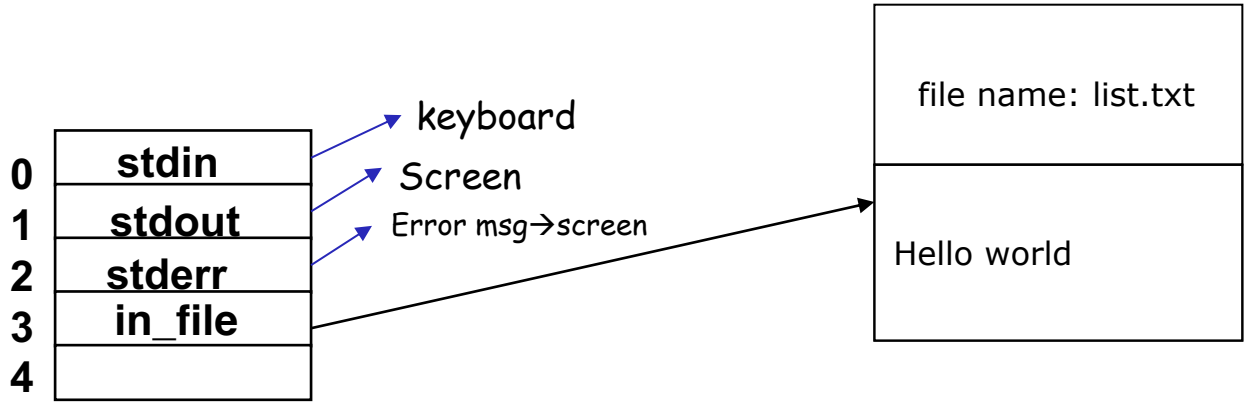
Fork and File

- Every **process** has a process file descriptor table
  - Each entry in process file descriptor table represents stdin, stdout, stderr, and file pointer.

Process File Descriptor Table

Assume that there was something like this in a program

```
int in_file;
in_file = open("list.txt", O_RDONLY);
```



Process File Descriptor table

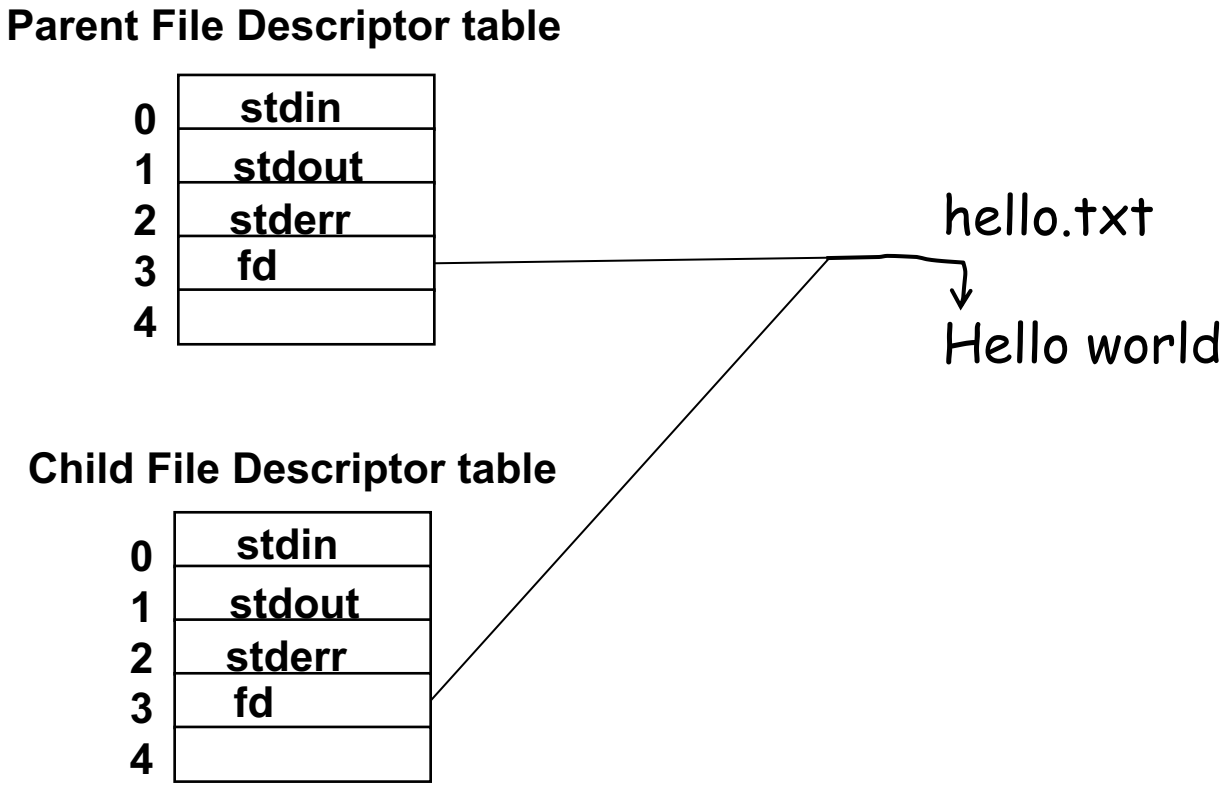
Fork and Files

- Open a file before a fork
  - The child process gets a copy of its parent's process file descriptor table.
  - The child and parent share a file pointer because the open came before the fork.
- Open a file after a fork
  - Assume that parent and child each open a file after the fork
  - They get their own entries in the file descriptor table
    - This implies that the file position information is different

fopen() before fork

```
int main()
{
  int fd;    char c;    pid_t pid;
  fd = open("hello.txt", O_RDONLY);
  pid = fork ();
  if (pid > 0)
  {
     read(fd, &c, 1);
     printf("parent: c = %c\n", c);
     wait(NULL);
   }
  else if (pid == 0)
  {
     read(fd, &c, 1);
     printf("child: c = %c\n", c);
   }
return 0;
}
```

Open a file before fork()



The parent and child point to the same file offset

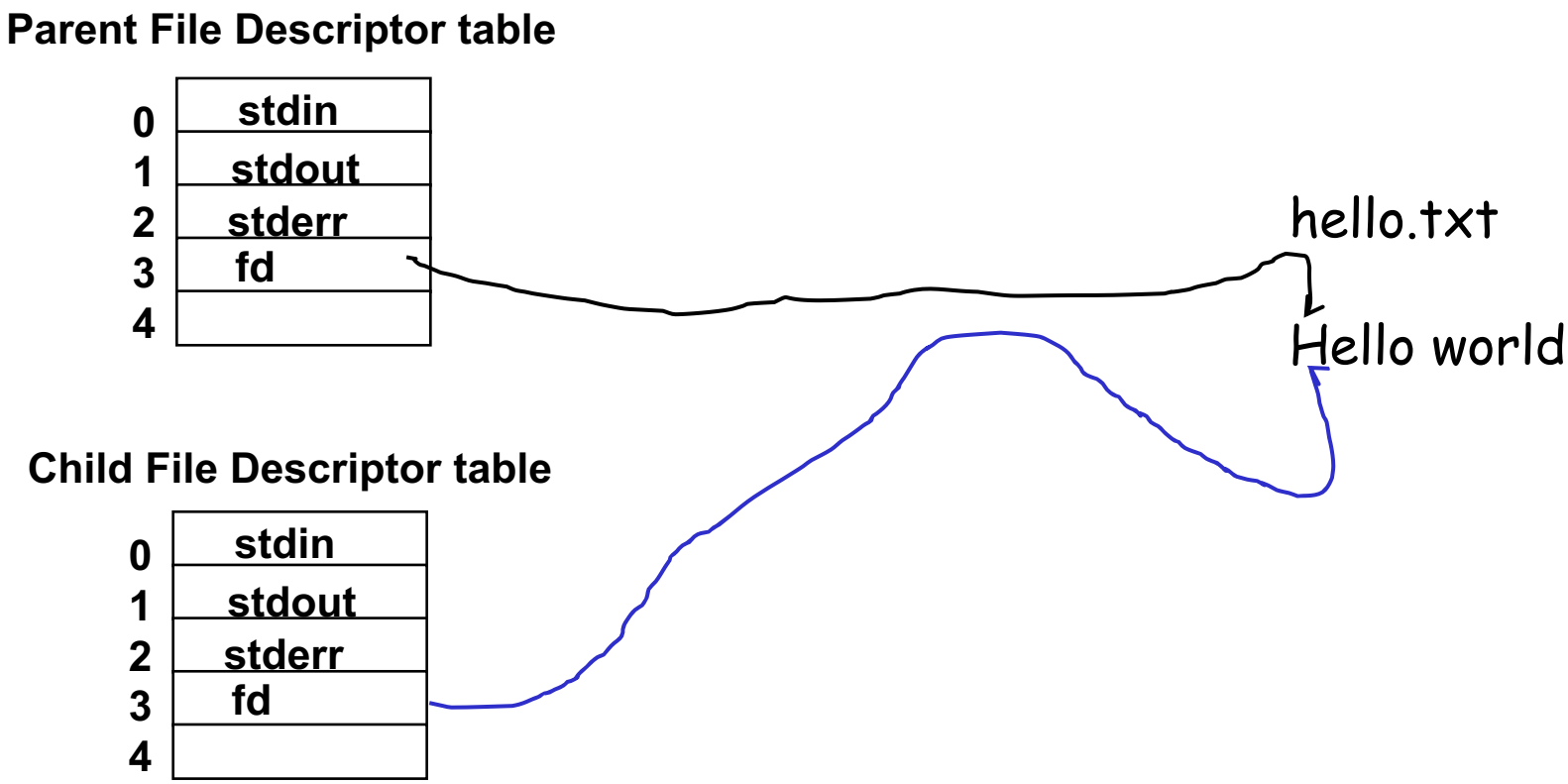
Fork and Files

- Open a file after a fork
  - Assume that parent and child each open a file after the fork
  - They get their own entries
    - This implies that the file position information is different

fopen() after fork

```
int main()
{
  int fd;    char c;    pid_t pid;
  pid = fork ();
  fd = open("hello.txt", O_RDONLY);
   if (pid > 0)
  {
     read(fd, &c, 1);
     printf("parent: c = %c\n", c);
     wait(NULL);
   }
  else if (pid == 0)
  {
     read(fd, &c, 1);
     printf("child: c = %c\n", c);
   }
return 0;
}
```

Open a file after fork()



The parent and child has their own individual entries in the system file descriptor table

Question

- Suppose that hello.txt consists of **`hello world how are you`**. Then what is the output of the following programs?
  - open() before fork()
  - open() after fork()

fopen() before fork

```
int main()
{
  int fd;    char c;    pid_t pid;
  fd = open("hello.txt", O_RDONLY);
  pid = fork ();
  if (pid > 0)
  {
     read(fd, &c, 1);
     printf("parent: c = %c\n", c);
     wait(NULL);
   }
  else if (pid == 0)
  {
     read(fd, &c, 1);
     printf("child: c = %c\n", c);
   }
return 0;
}
```

Parent and child will share their fd pointer

parent

child

hello.txt

hello world

fopen() after fork

Parent and child will have their individual fd pointing to file separately (no sharing)

```
int main()
{
  int fd;    char c;    pid_t pid;
  pid = fork ();
  fd = open("hello.txt", O_RDONLY);
   if (pid > 0)
  {
     read(fd, &c, 1);
     printf("parent: c = %c\n", c);
     wait(NULL);
   }
  else if (pid == 0)
  {
     read(fd, &c, 1);
     printf("child: c = %c\n", c);
   }
return 0;
}
```

parent

child

hello.txt

hello world

Fork and Files

- Be careful
  - It is much better to open files after forks!