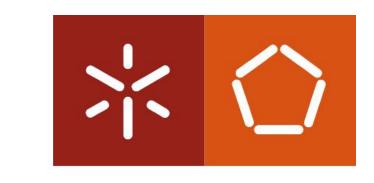
### Operating Systems

(Sistemas Operativos)

Guide 4: Pipes



Inter-Process Communication

#### Through regular files

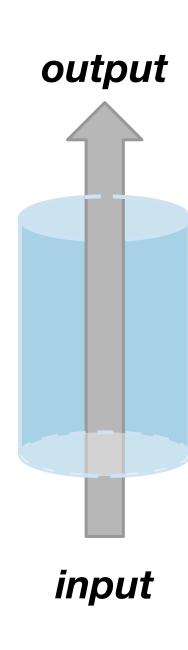
- file writing and reading must be carefully synchronized
- data is written to disk (slow)
- o requires management of names, permissions and inter-process interference

2024-2025 OPERATING SYSTEMS GUIDE 4: PIPE

#### Inter-Process Communication

#### **Anonymous Pipes**

- o Between related processes (e.g., parent child, children of the same parent).
- Produced (written) data is kept in a memory region to be consumed (read).
- The kernel handles writers (producers) and readers (consumers).
- Writers block (wait) if there is no available space, and readers block if there is no data.
- Data flows in a one-way First-in First-out (FIFO) manner.
- o Enables chaining of programs without modifying them (with the help of the other system calls).
  - E.g., \$ Is less



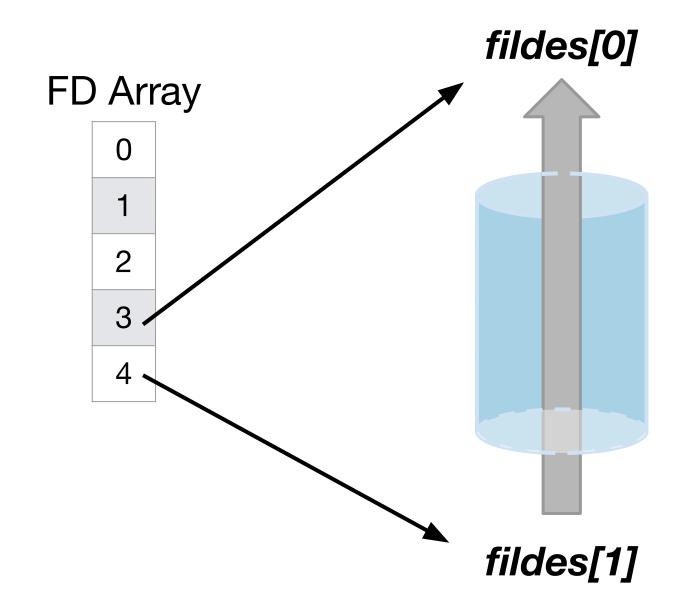
#### **Anonymous Pipes**

#### #include <unistd.h>

- int pipe(int fildes[2])
  - **fildes:** array populated by the function with the *FDs* of the write and read ends of the pipe.
  - Returns: 0 on success, -1 otherwise

#### **Considerations:**

- 1. Data written to fildes[1] (write end) can be read from fildes[0] (read end).
- 2. Reading from fildes[0] reaches EOF only when fildes[1] is closed.
- 3. Processes that read from the pipe should close the write end, and vice-versa
- 4. Leaving unnecessary pipe ends open can lead to deadlocks.
- 5. Writing to a pipe whose read end is closed results in the process being terminated.

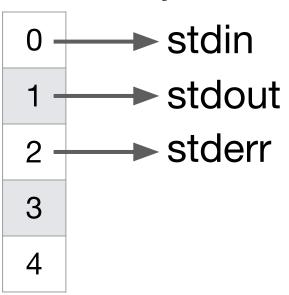


For more information: \$ man 2 pipe

#### Example: Anon Pipe + Fork

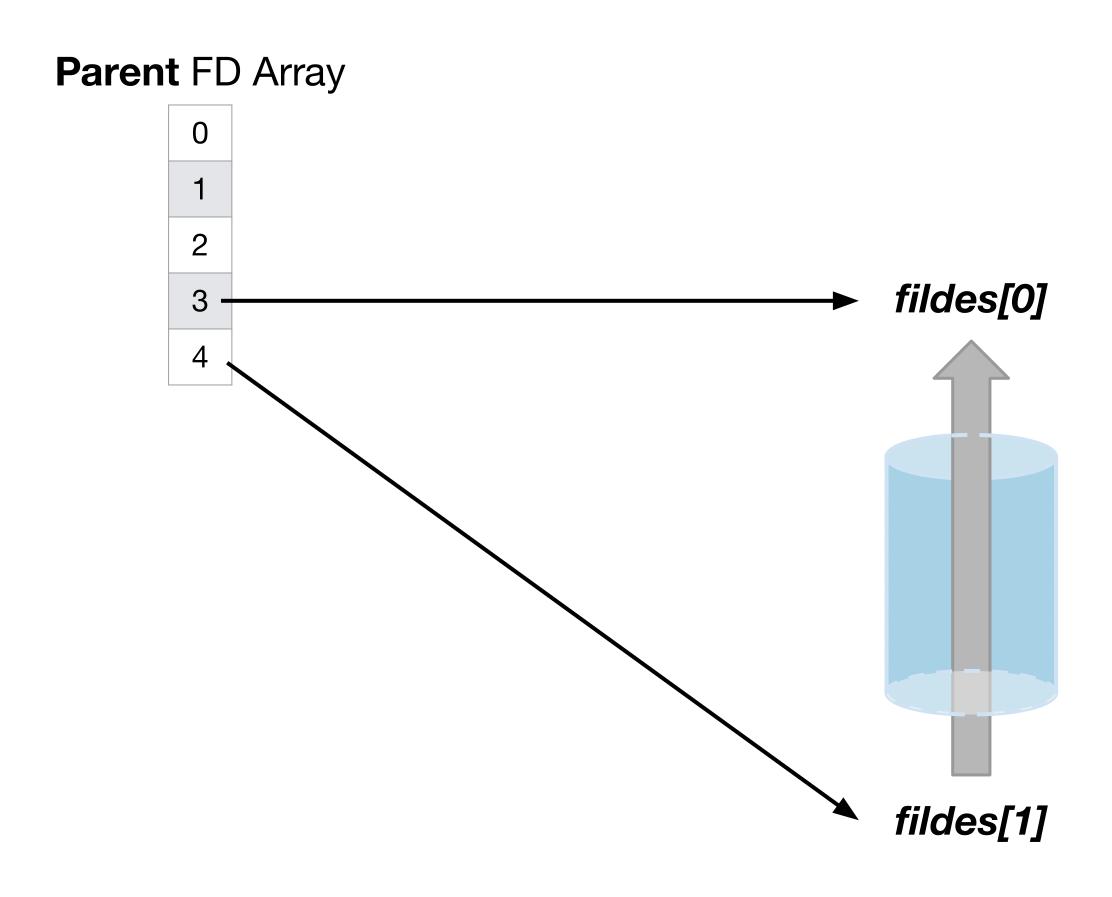
```
1 int main() {
    pid_t pid;
    int fildes[2];
    pipe(fildes);
    if ((pid = fork()) == 0) {
      close(fildes[0])
      // child process
    } else {
      close(fildes[1])
      // parent process
11
    return 0;
```

#### Parent FD Array



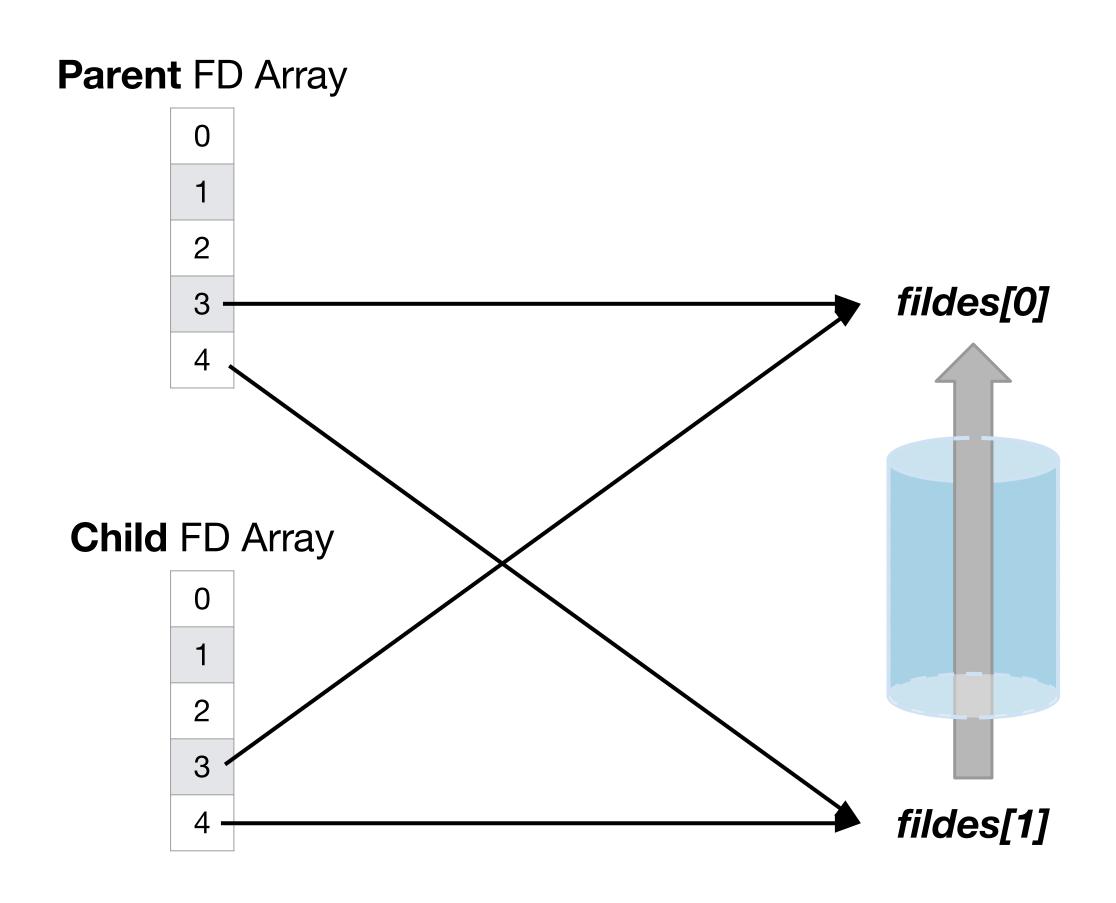
### Example: Anon Pipe + Fork

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    int fildes[2];
    pipe(fildes);
    if ((pid = fork()) == 0) {
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      // child process
    } else {
      close(fildes[1])
      // parent process
11
    return 0;
13 }
```



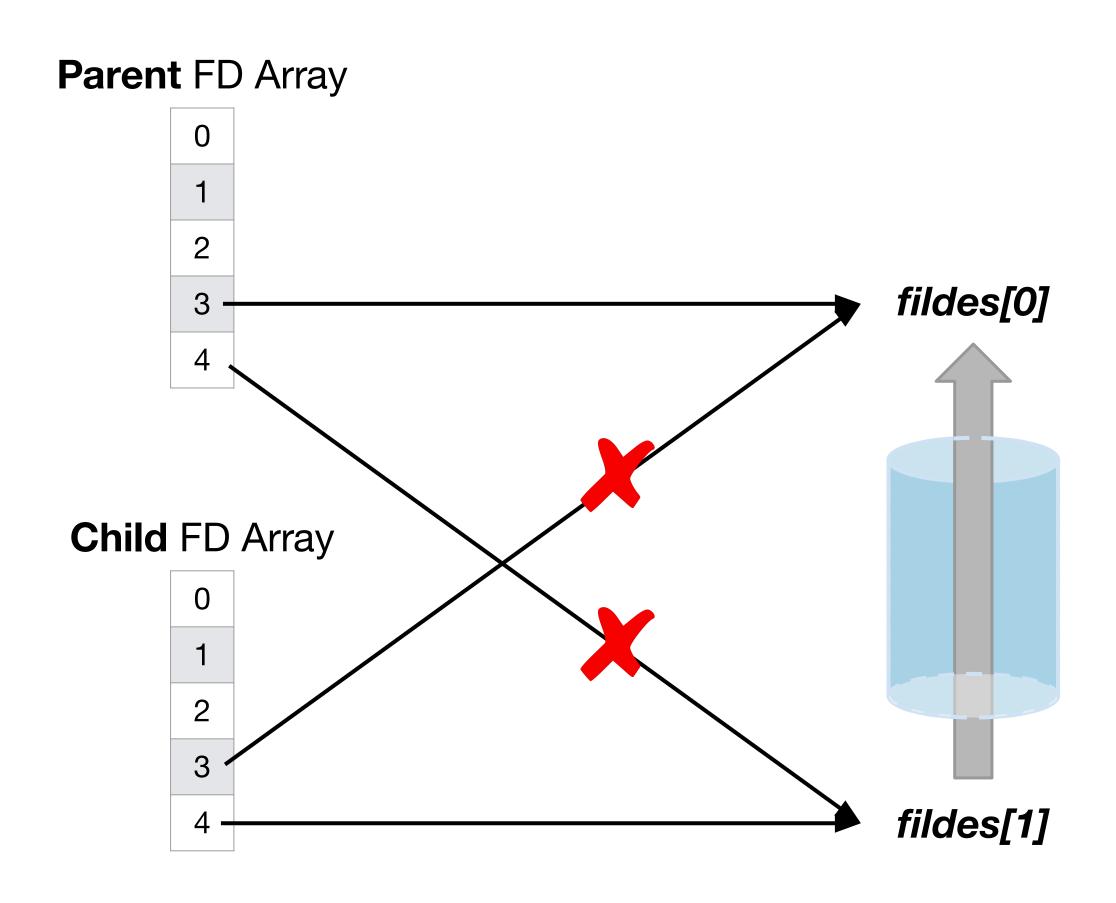
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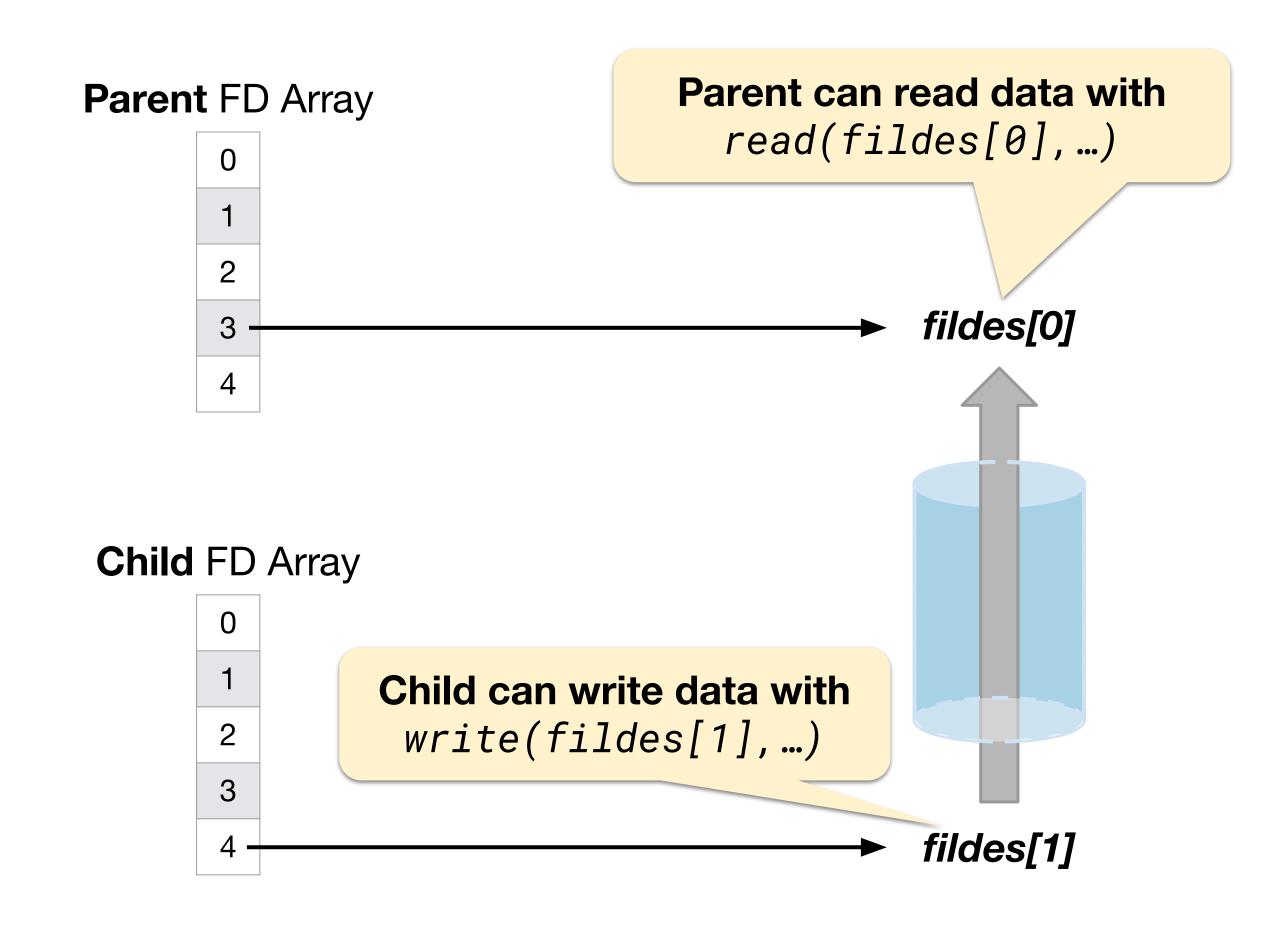
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    return 0;
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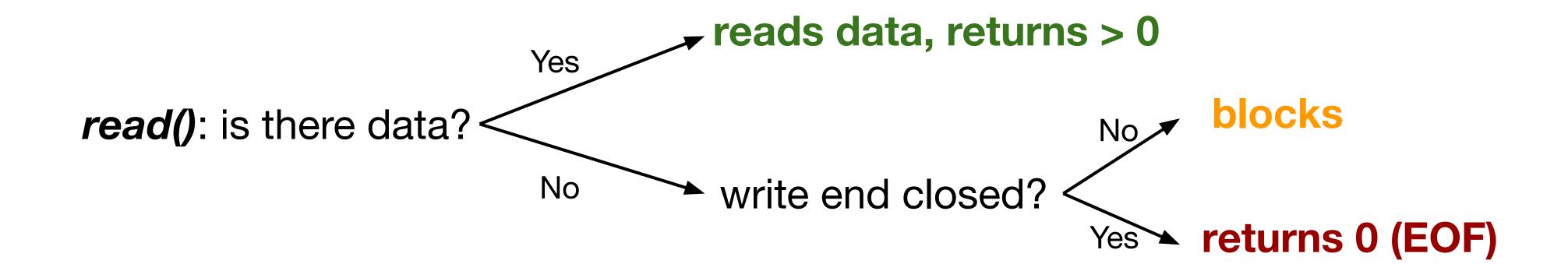


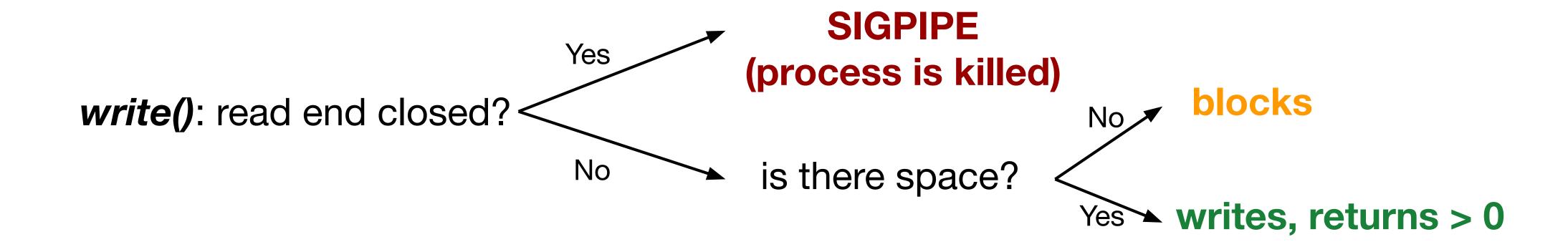
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    return 0;
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### Process API Anonymous Pipes





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