操作系统原理

第四章：进程管理

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February 19, 2016

目录

Outline

Process concept (1/3)

Process concept (1/3)

- Before the advent of process

Process concept (1/3)

- Before the advent of process
  - Batch system

Process concept (1/3)

- Before the advent of process
  - Batch system - **job**;

Process concept (1/3)

- Before the advent of process
  - Batch system - **job**;
  - Multiprogramming or time-sharing

Process concept (1/3)

- Before the advent of process
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- **Process**

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  - Multiprogramming or time-sharing - **program or task**.
- **Process**
  - **An abstraction of a running job/program/task.**

Process concept (2/3)

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  - A program in execution.

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    - A lot of other resources such as open files, etc.

Process concept (3/3)

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- **Process image** in memory

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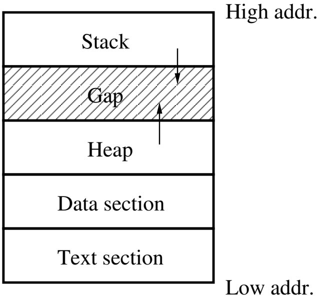

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  - Other resources usually vary.

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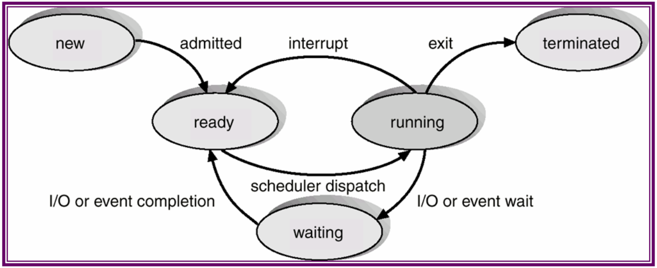

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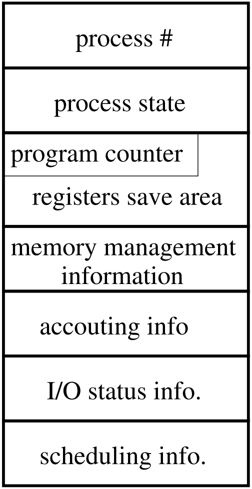

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Outline

Process scheduling

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PCB_A

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PCB_B

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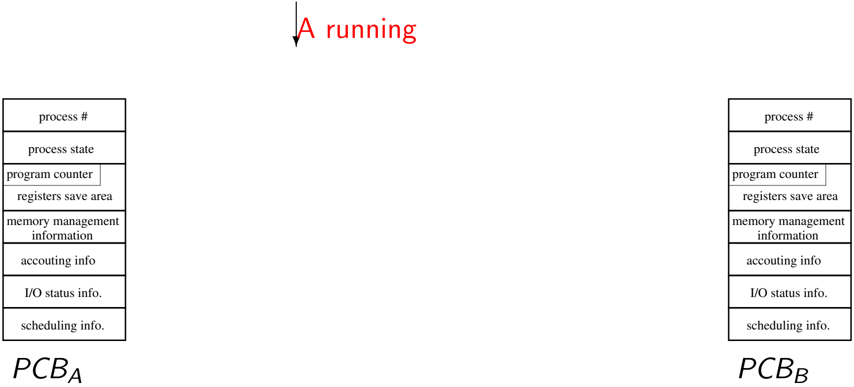

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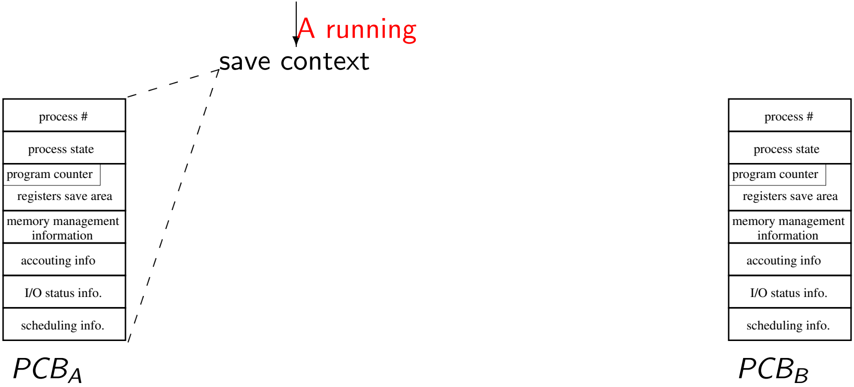

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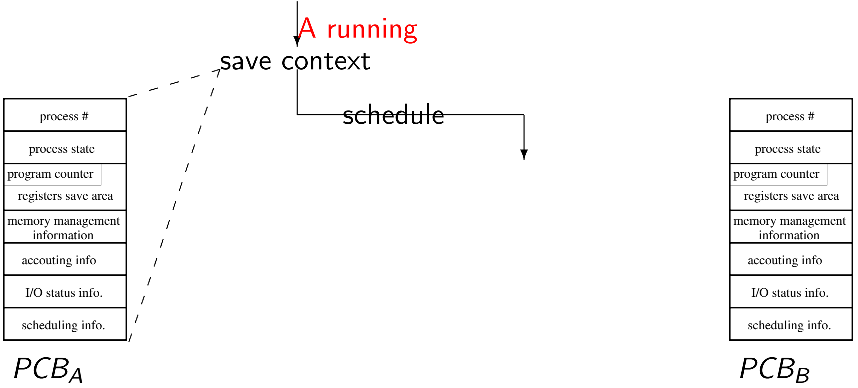

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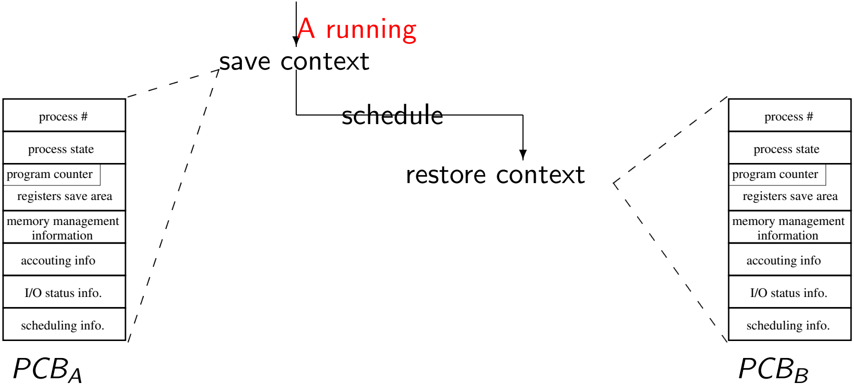

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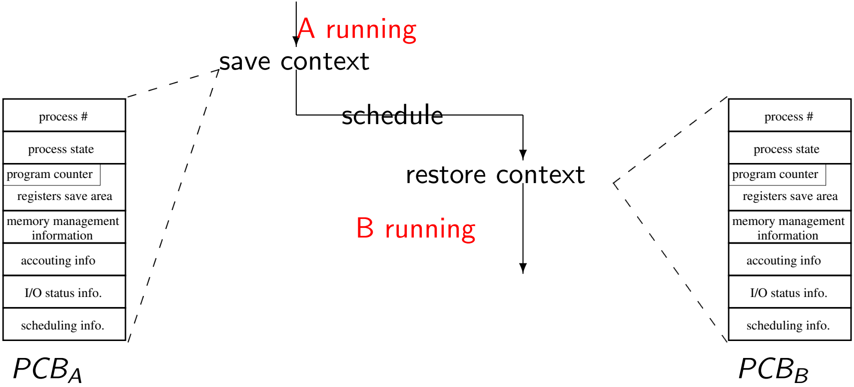

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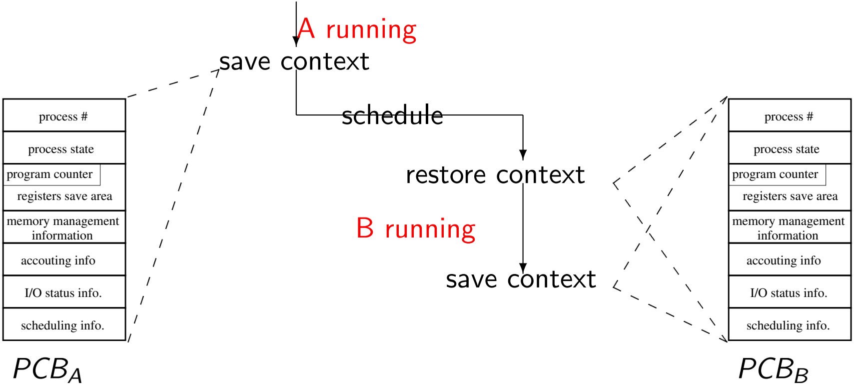

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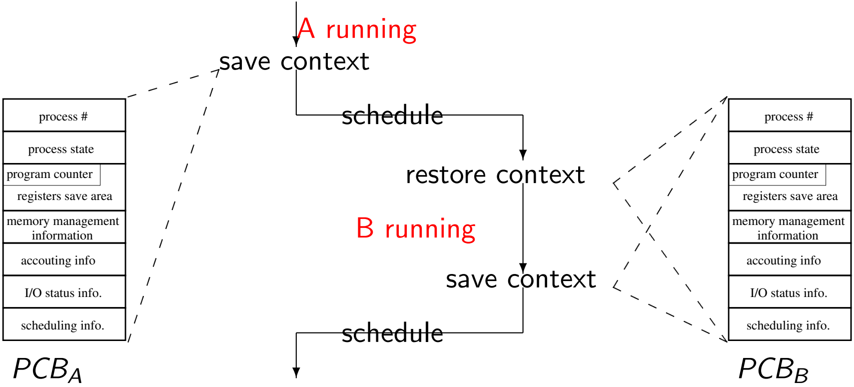

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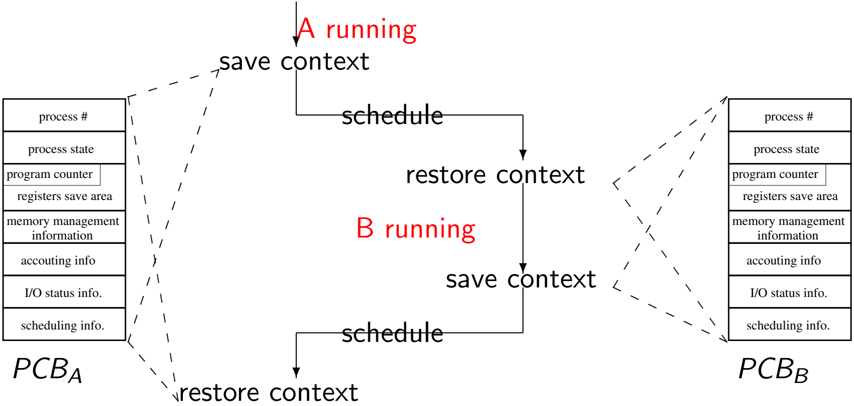

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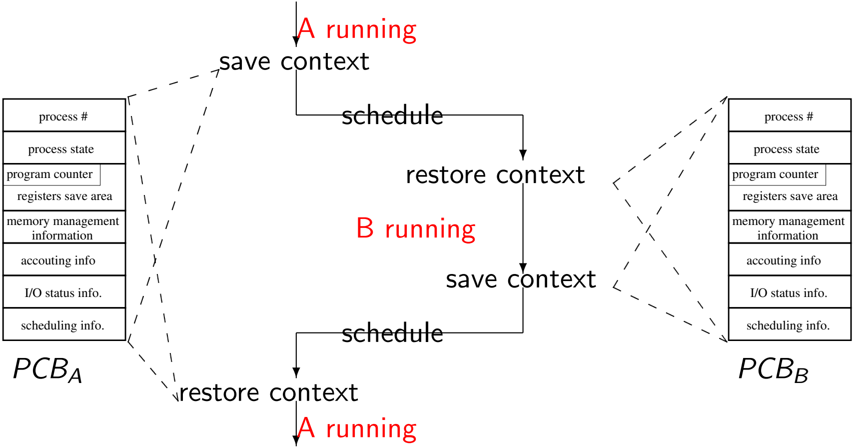

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  - Context switching has become such as performance bottleneck that programmers are using a new structure to avoid it whenever possible.

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Various I/O device queues

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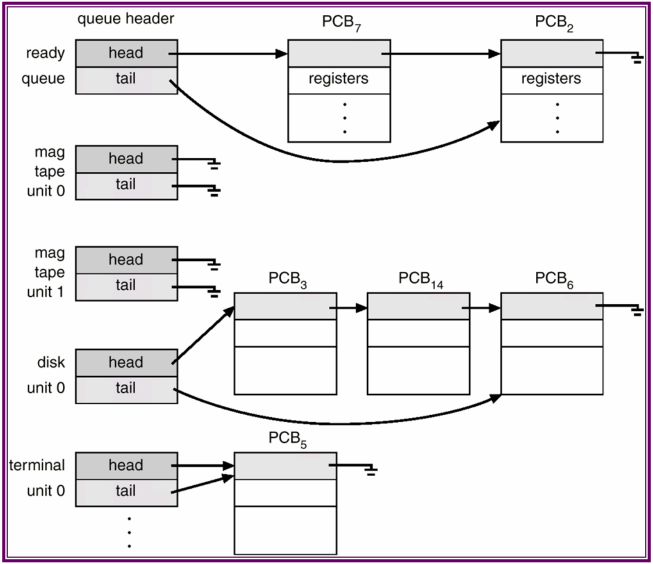

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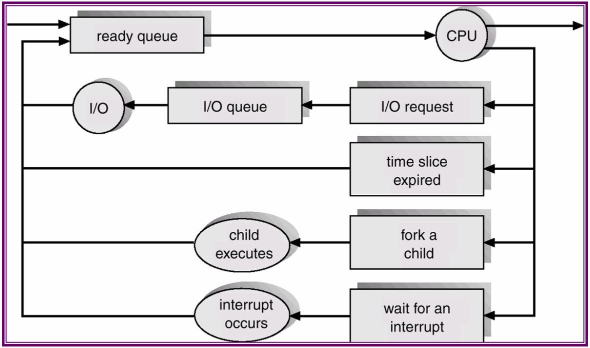

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  - We call this scheduler the **CPU scheduler**.

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Operations on process (1/2)

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```
int main() {
  int pid = fork(); /*fork another process*/
  if(pid < 0) {     /*error occurred*/
    printf("fork failed\n");
    exit(-1);
  } else if (pid == 0) /*in child process*/
    execlp("/bin/ls", "ls", NULL); /*executes a program*/
  else { /*in parent process*/
    waitpid(pid,NULL,0); /*waiting for the child to exit
        */
    printf("Child exited\n");
    exit(0);
  }
}
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  Computation speedup: Break the problem into several subtasks that can be run in parallel;

  Modularity: Separate processes for different functions by design;
- However, concurrent execution of cooperating processes requires mechanisms that allow processes to communicated with one another and to synchronize their actions.

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  - A **producer** process produces information that is consumed by a **consumer** process.
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  - In this case, the programmer must manage the shared buffer themselves.

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```
/* Shared variables */
#define BSIZE 10
struct {
    ....
} item buffer[BSIZE];
int in = 0, out = 0;
/*----------------------------------------------------------------------*/
/*The producer loop*/
while(1) {
  /*produce an item*/
  while(((in + 1) % BSIZE) == out)
      /*do nothing*/;
  buffer[in] = itemProduced;
  in = (in + 1) % BSIZE;
}
```

```
/*The consumer loop*/
while(1) {
  while(in == out)
     /*do nothing*/;
  itemConsumed = buffer[out];
  out = (out + 1) % BSIZE;
  /*consume the item*/
}
```

Questions

- Any questions?

Outline

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    - It can be permanent (as in Linux/Unix) or volatile (as in Windows).

Pipe (2/3)

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```
int main() {
    int fd[2], pid;  char buf;

    if (pipe(fd) == -1) /* Create an anonymous pipe */
    { perror("pipe"); exit(-1); }
    if ((pid = fork()) < 0)
    { perror("fork"); exit(-1); }
    if (pid == 0) {      /* Child reads from pipe */
        close(fd[1]);    /* Close unused write end */

        while (read(fd[0], &buf, 1) > 0)
            write(STDOUT_FILENO, &buf, 1);

        close(fd[0]);
        exit(0);
    } else {      /* Parent writes argv[1] to pipe */
        close(fd[0]);    /* Close unused read end */
        write(fd[1], "Hello, child!", 13);
        close(fd[1]);    /* Reader will see EOF */
        waitpid(pid,NULL,0);        /* Wait for child to
            exit*/
        exit(0);
    }
}
```

Pipe (3/3)

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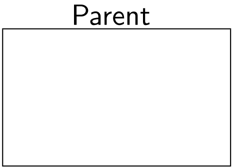

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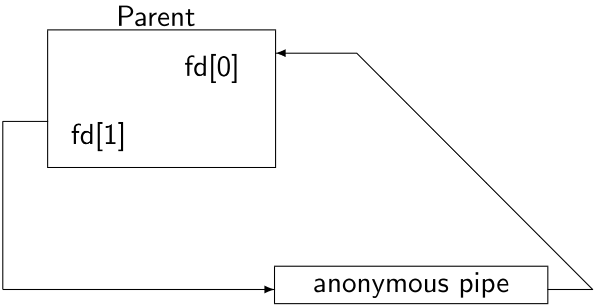

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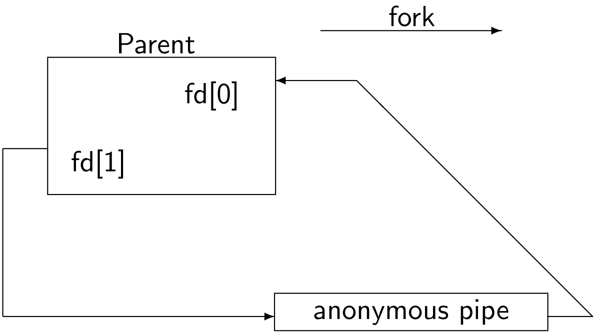

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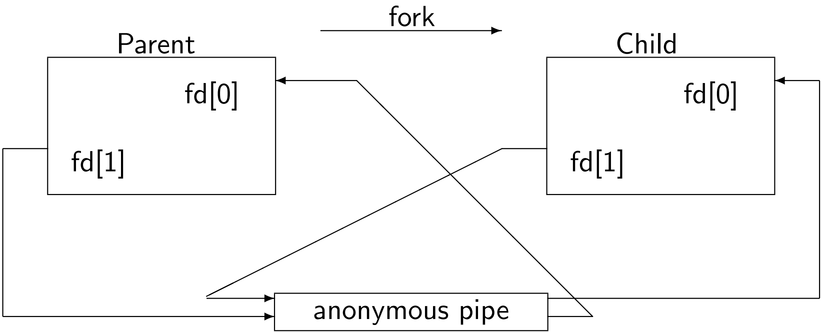

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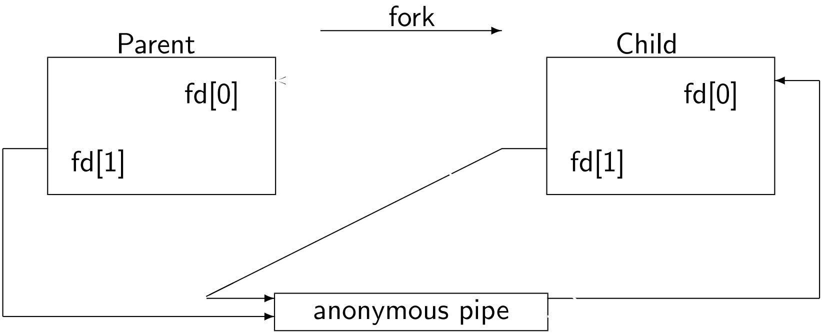

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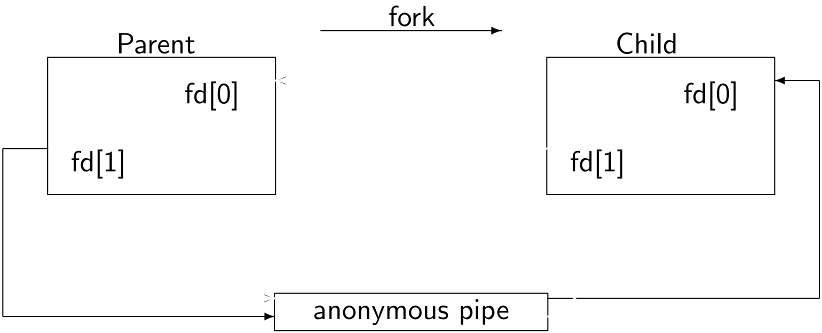

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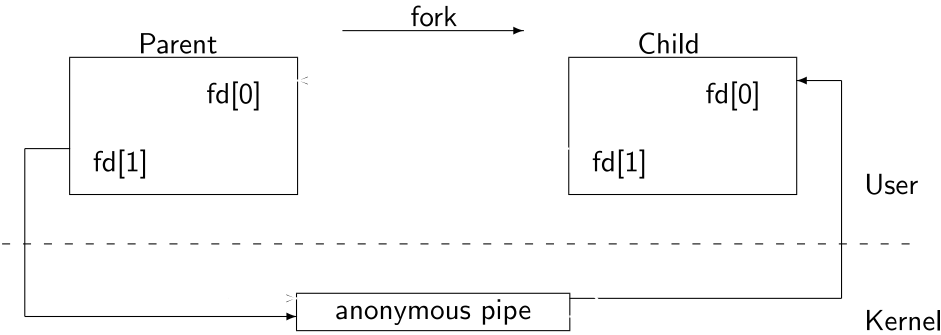
fork
Parent
fd[0]
fd[1]
Child
fd[0]
fd[1]
User
anonymous pipe
Kernel

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