Operating Systems Concepts

Implementing IPC

CS 4375, Fall *2025*
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Summery

- Threads
  - Concurrent programming
  - Why threads?
  - Threads vs Processes
  - Thread pools
  - Threading implementation & multithreading models
  - Threading issues
    - Semantics of fork() and exec()
    - Thread cancellation
    - Signal handling

Agenda

- More xv6 system calls
- Inter process communication
  - Pipes
- In class activity
  - Implement IPC through pipes

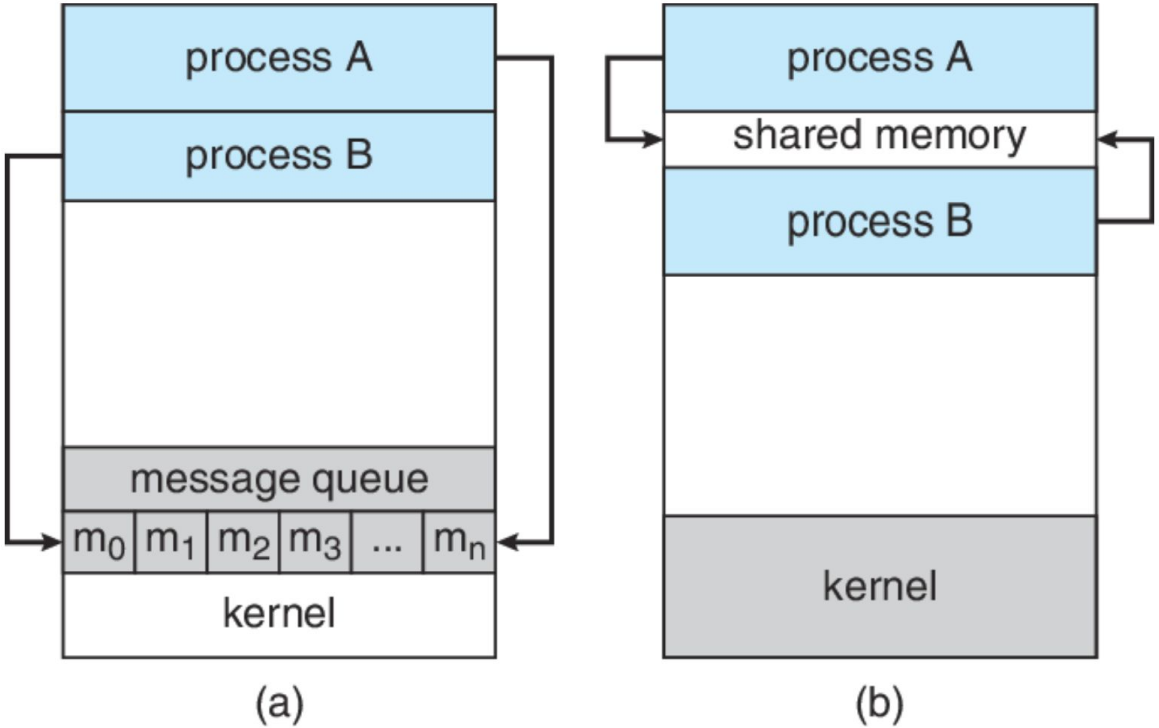
File descriptor

- Unique identifier for a file or I/O resource
- “Small integer representing a kernel-managed object that a process may read from or write to”
- Usage instances
  - Opening a file/directory
  - Opening a device
  - Creating a **pipe**
  - Duplicating a existing ***fd***

File descriptor (cont'd)

- Standard input *(fd := 0)*
  - Process reads
- Standard output *(fd := 1)*
  - Process writes
- Standard error *(fd := 2)*
  - Process writes error messages

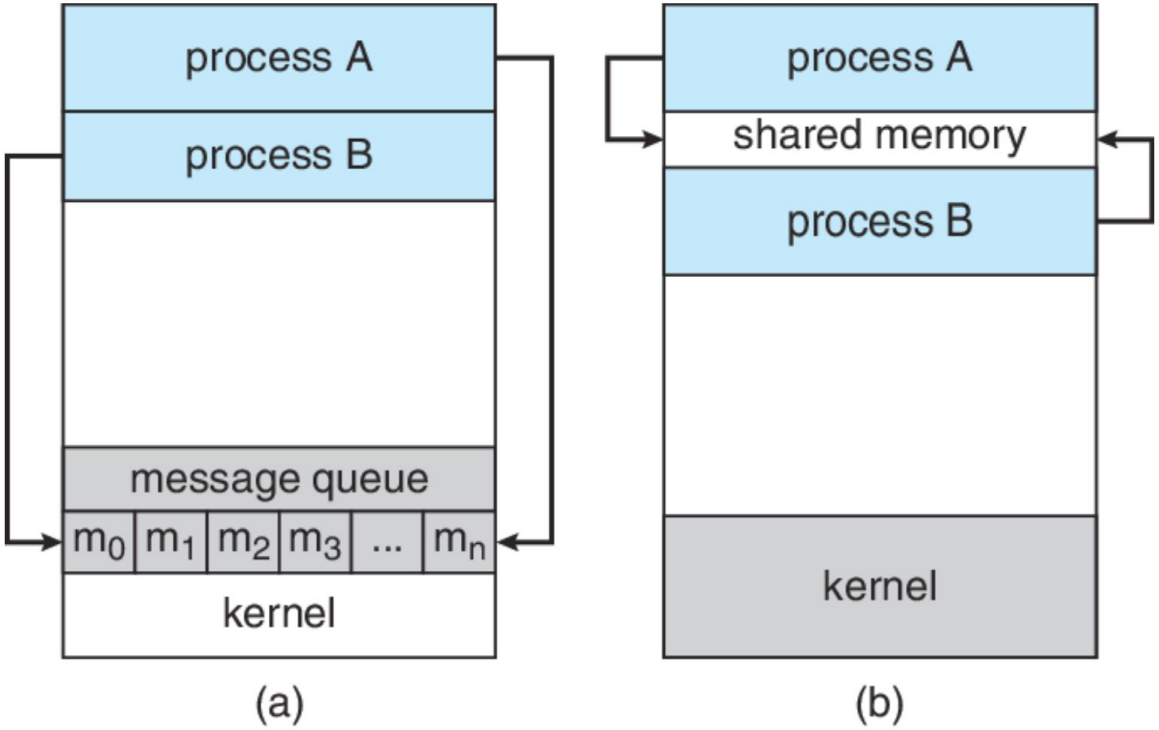
Inter process communication



Message Passing

Shared Memory

Inter process communication



Message Passing

Shared Memory

Pipes

- A pair of small *kernel* buffers for processes
  - As file descriptor
  - Read & Write
- Prodive a message passing IPC for two processes

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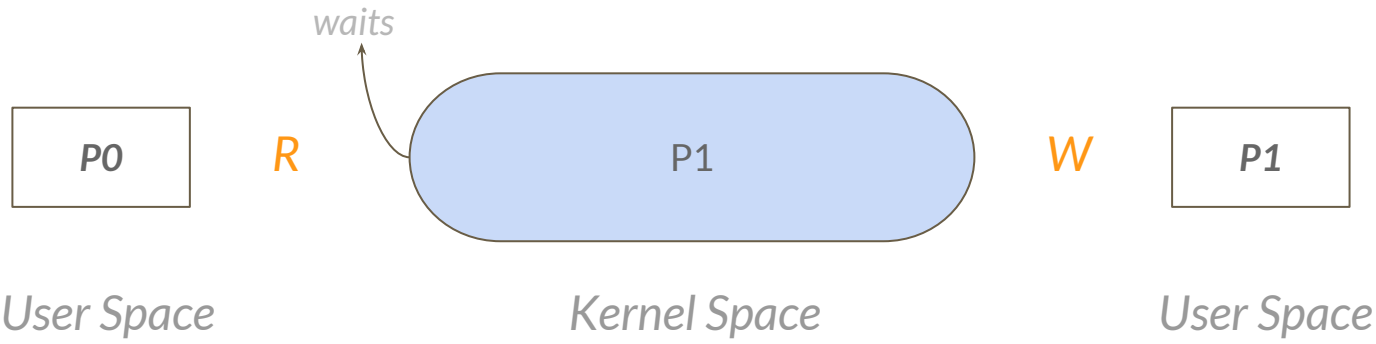
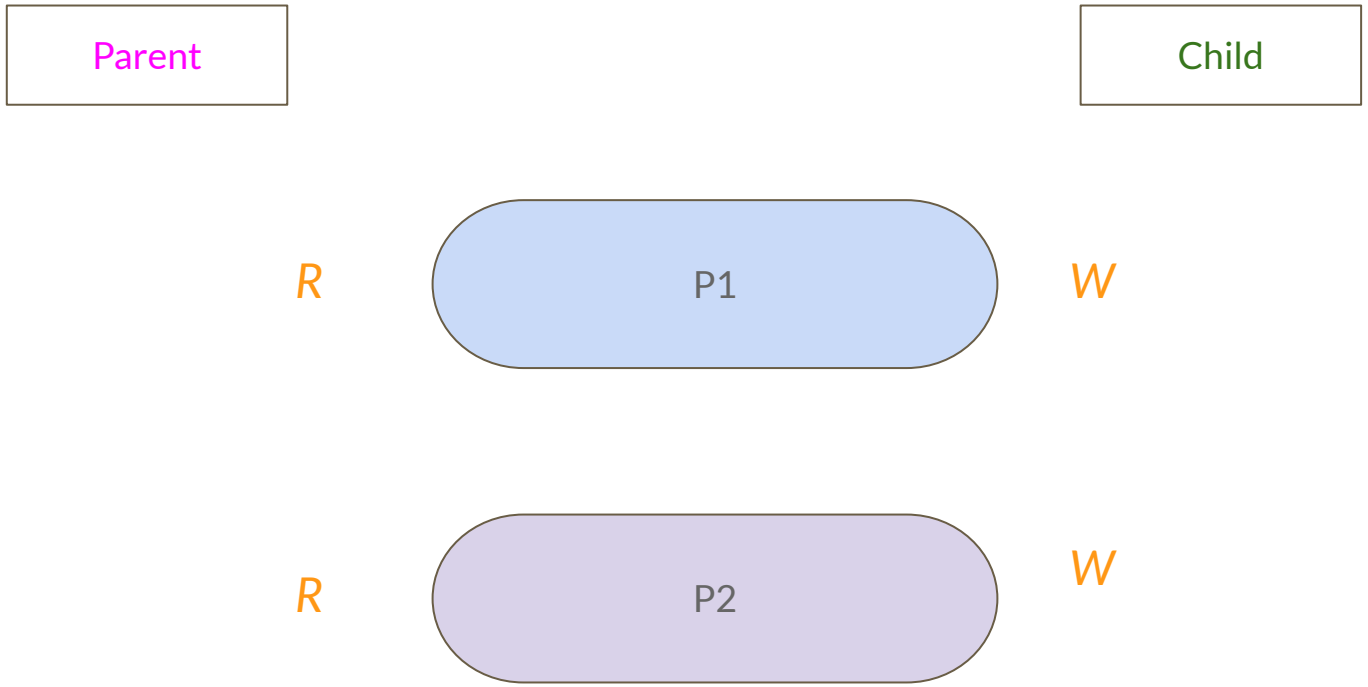


In class activity

- **Write a program that uses UNIX system calls to "*ping-pong*" a byte between two processes over a pair of pipes, *one for each direction*.**
- ***Optional/take home:*** **Measure the program's performance, in exchanges per second.**

In class activity



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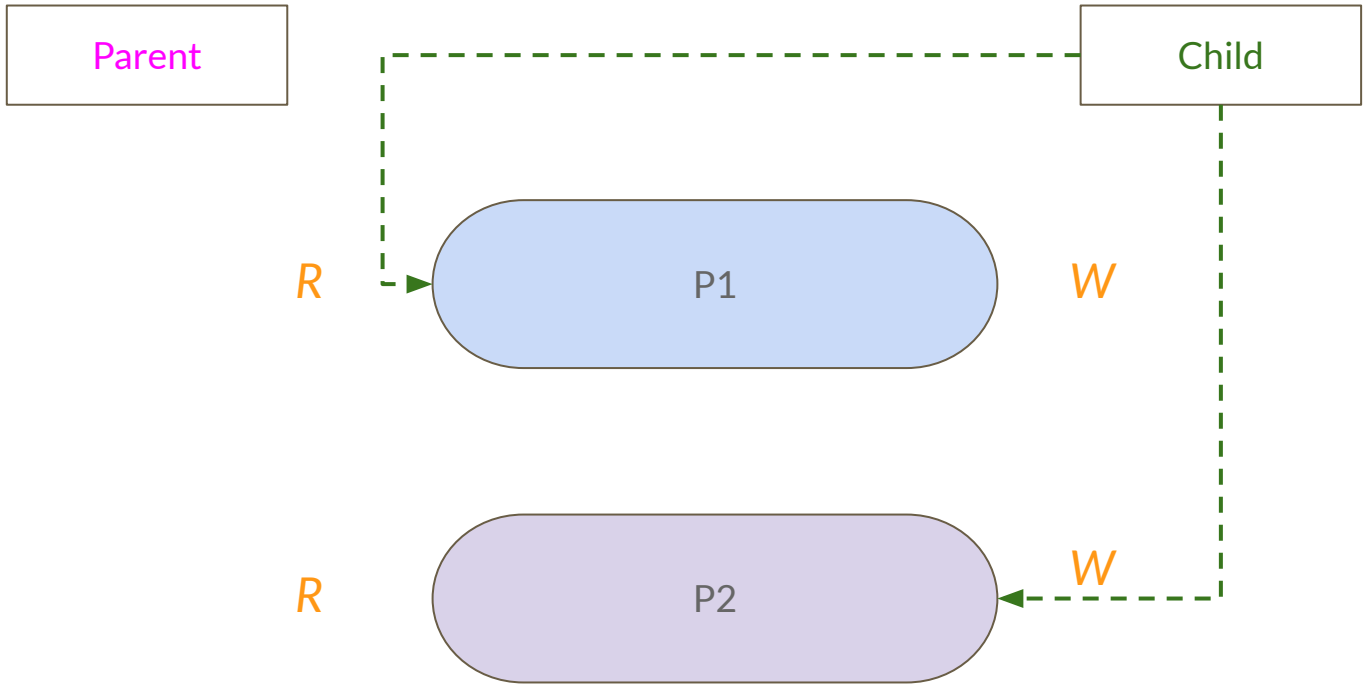

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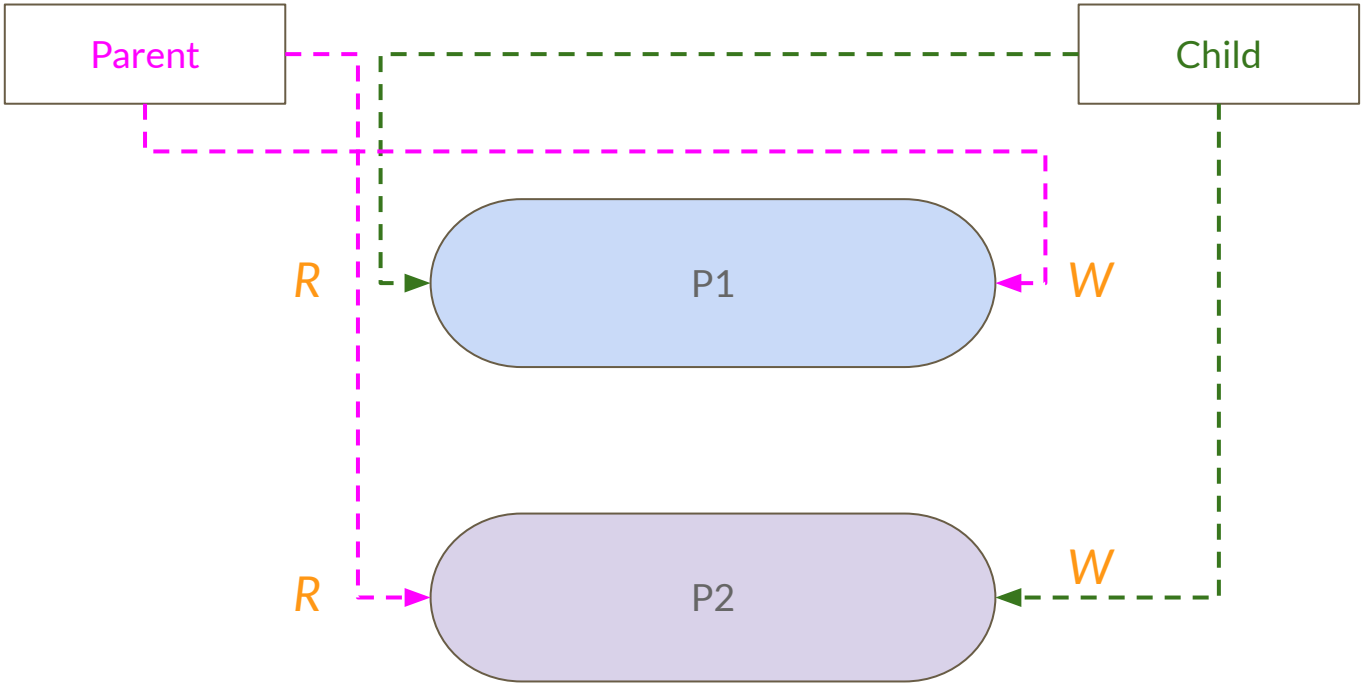

Announcement

- Homework 1
  - Due Monday September 22nd
- THERE WILL BE CHECKS ON HOMEWORK SUBMISSION
  - **Randomly** picked 20 student per assignment
  - Look for emails from the TA regarding the assignment checks
  - Your responsibility is schedule the meeting with the TA
    - Within a week of the assignment submission
  - You would need to explain everything you submitted for the assignment