



Haute école d'ingénierie et d'architecture Fribourg
Hochschule für Technik und Architektur Freiburg

Interprocess Communication (IPC)

Unix pipes (|)

Sockets

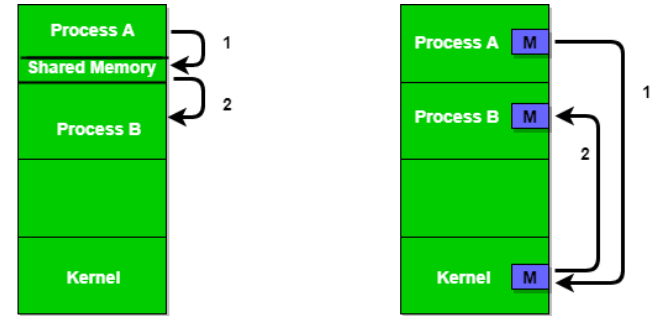
What is IPC

- **Inter-Process Communication (IPC)**

- **Definition:**

- Inter-process communication (IPC) refers to mechanisms that allow processes to communicate and synchronize with each other, either:

- on the **same machine**, or
 - across **different machines** (networked systems)



<https://www.geeksforgeeks.org/inter-process-communication-ipc/>

Main IPC technics

1. Memory-Based Communication

- **Shared Memory**
 - Multiple processes access the same memory space
 - Very fast (no data copying)
 - Requires synchronization (e.g., mutexes, semaphores)

2. Message-Based Communication

- **Message Queues**
 - Exchange of discrete messages
 - Can be:
 - **Synchronous** (blocking)
 - **Asynchronous** (non-blocking)
- **Pipes**
 - Unidirectional or bidirectional data streams
 - Typically used between related processes (e.g., parent-child)
- **Sockets**
 - Communication over a network or locally
 - Flexible and widely used (client/server models)



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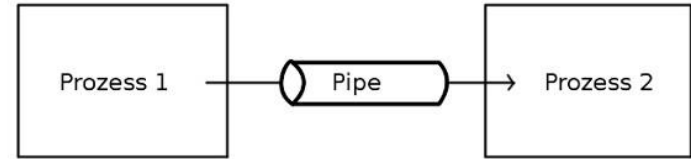
Interprocess Communication (IPC)

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(Unix) pipes

- What are pipes ?



- Pipes (Symbol in the shell: |) allow one or more processes to have information flow between them
 - Most common example is within the shell

- Example:

```
ls | wc -l      (ls: directory listing, wc: word count)
```



What will be executed?

(Unix) pipes – An example

Output of the 10 biggest log files (in descending order) found in
`/var/log/*`

```
du -sk /var/log/* | sort -r -n | head -10
```

`du`: display disk usage statistics

`sort`: sort/merge records (lines) of text/bin files

`head`: display first lines of a file



(Unix) pipes – An example

Have a look at this one-liner. Try to analyse the one-liner and explain what it can do for you?

```
paste <(ls) <(ls | tr A-Z a-z) | while read OLD NEW; \  
do echo mv -v $OLD $NEW; done
```

< is an input redirection, thus <(ls) sends the output of the command in brackets (in this example the content of the current directory) to the command (paste)



(Unix) pipes – References

- Some nice *one-liners* can be found on the Internet

<https://onceupon.github.io/Bash-Oneliner/>

<https://www.bashoneliners.com/oneliners/newest/>



Python multiprocessing.Pipe()

- In multiprocessing, a pipe is a connection between **two** processes in Python.
- It is used to send data from one process which is received by another process.
 - Two connection objects (one for sending, one for receiving)
- A pipe can also be configured to be **duplex** so that each connection object can both send and receive data.

Key take-away messages



- Interprocess Communication (IPC)
 - Communication between different processes
 - Information exchange
 - Memory based
 - Message passing based
- Pipes (based on shell commands)
 - Information flow between the processes