Interprocess communication (IPC). An introduction
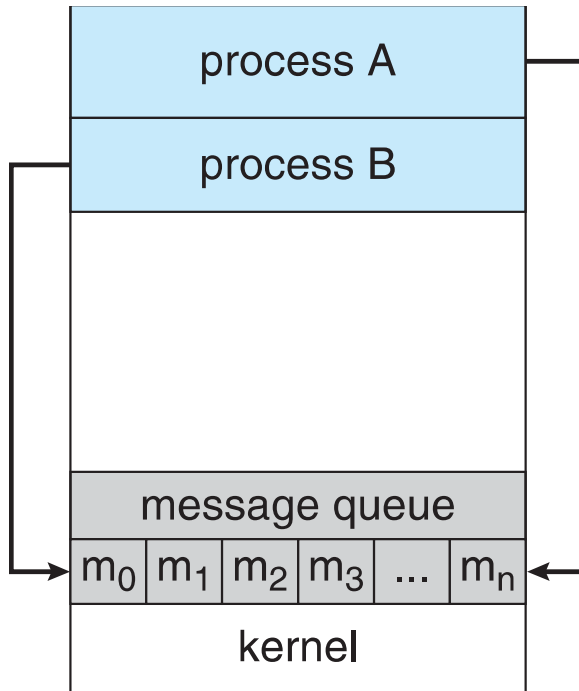
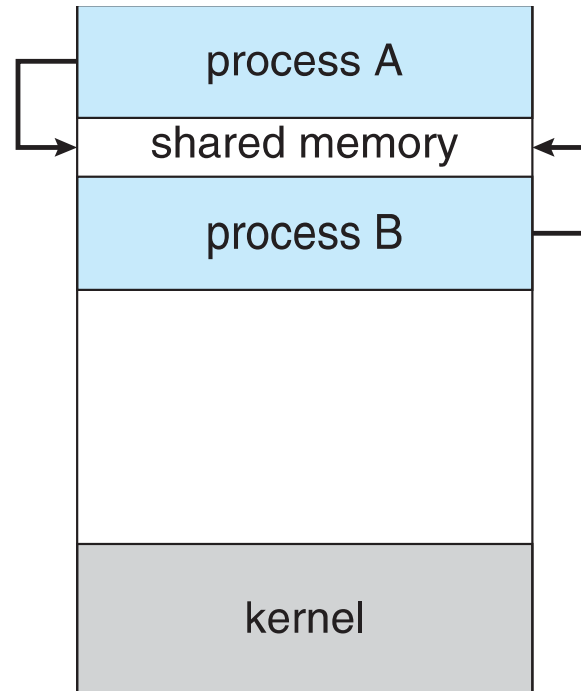Last modified: 18.02.2019

Cooperating processes

- Processes within a system may be *independent* or *cooperating*

- Cooperating process can affect or be affected by other processes, including sharing data

- Reasons for cooperating processes:
    - Information sharing
    - Computation speedup
    - Modularity
    - Convenience

- Cooperating processes need **interprocess communication** (**IPC**)

- Two fundamental models of IPC
    - **Shared memory**
    - **Message passing**

Fundamental IPC models

(a) message passing.   (b) shared memory.

| process A |
| process B |
| |
| message queue |
| m_0 \| m_1 \| m_2 \| m_3 \| ... \| m_n |
| kernel |

(a)

| process A |
| shared memory |
| process B |
| |
| kernel |

(b)

Features of fundamental IPC models

- Shared memory
    - **+** the communication is under control of the users processes not the operating system – once the system created shared access to a memory region.
        - **+** provides maximum communication speed (if synchronization allows)
        - **-** synchronization of buffer read/write operation is a major issue

- Message passing
    - **+** producer and consumer do not share a region of memory (they can even run on different systems)
    - **+** synchronization can be provided by system (blocking implementations of **send**() / **receive**() operations)
    - **-** typically implemented with system calls -> overhead of user-kernel-user switches
    - **-** data copying makes for a comm. overhead, but can be avoided by copying a reference instead (to a buffer, protected from modification till content is consumed).

IPC in the Operating Systems 1/2 courses

Means of IPC covered in OPS1 course:

- **Signals**

- **Shared files**

- **Mutexes**

- **Process exit code** (functions **exit**(), **wait**(),…)

- **Standard streams** of a process (**stdin**, **stdout**, **stderr**)

OPS2 course:

- **POSIX pipes** and **FIFOs**

- Two sets of interfaces to: **shared memory**, **message queues** and **semaphores** (the older interface of the POSIX Std XSI Option Group, known also as the UNIX System V IPC interface, will be not be used for lab work).

- Network-based **sockets** interface