CSE 380
Computer Operating Systems

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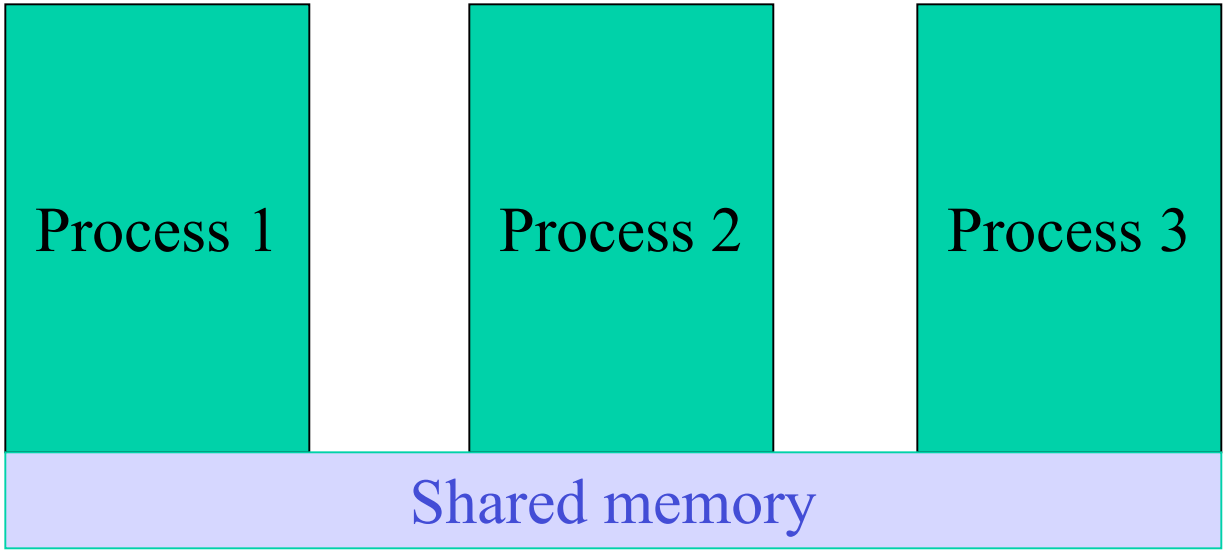
Lecture Note 2.6: Message-Based Communication

Interprocess communication

- Shared Memory
- Message Passing
  - Signals

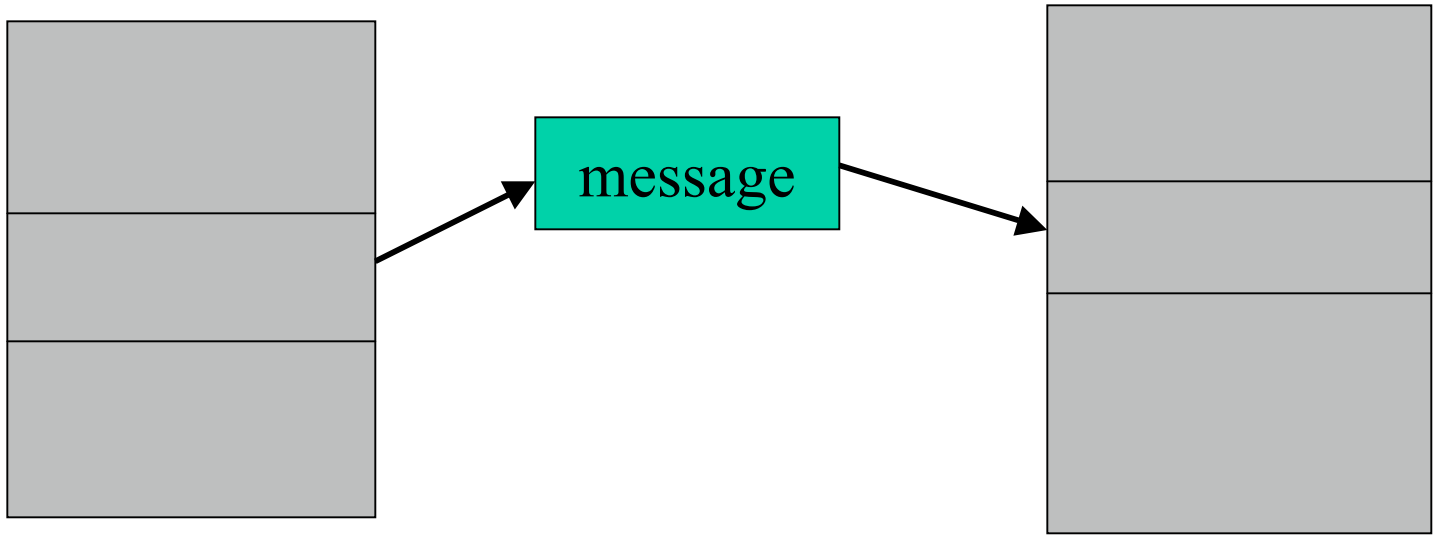
Shard Memory



Shared Memory in Solaris

- Processes can share the same segment of memory directly when it is mapped into the address space of each sharing process
- Faster communication
- System calls:
  - *int shmget(key_t key, size_t size, int shmflg) :* creates a new region of shared memory or returns an existing one
  - *void *shmat(int shmid, const void *shmaddr, int shmflg) :* attaches a shared memory region to the virtual address space of the process
  - *int shmdt(char *shmaddr):* detaches a shared region
- Mutual exclusion must be provided by processes using the shared memory

Message Passing



Design Attributes

- Naming
  - Process id, mailbox
- Buffering
  - Size: zero, bounded, unbounded
  - Place: kernel space, user space
- Send operation
  - Synchronous vs. asynchronous
- Receive operation
  - Blocking vs. non-blocking

Interprocess Communication

Message Passing

Many possible naming schemes. One is direct naming:

```
send(process_id, message)
receive(process_id, buffer)
```

Example

```
process P1:                process P2:
  declare x integer          declare y integer
          .                          .
  send(P2, x)                receive(P1, y)
          .                          .
end process                end process
```

Effect of this communication is

```
              y := x
              |    \
        local var   local var
        of P2       of P1
```

Buffering

- A buffer, with bounded-buffer synchronization, can be associated with each pair of communicating processes.
- A "zero-capacity" buffer means processes must "handshake" in order to communicate.
- A buffer can reside in memory of receiving process or in OS addres space.

Examples:

- `no buffer needed`

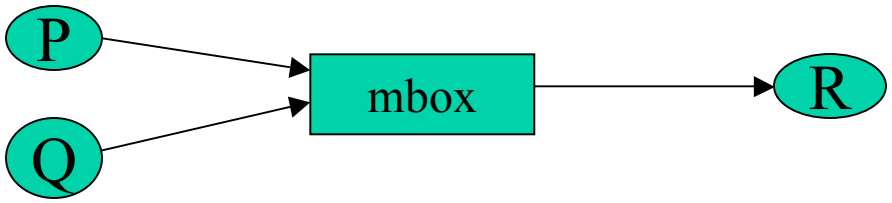
```
P1: send(P2, x)        P2: receive(P1, x)
    receive(P2, y)         send(P1, y)
```

- `buffer needed`

```
P1: send(P2, x)        P2: send(P1, x)
    receive(P2, y)         receive(P1, y)
```

Mailboxes

- Also known as message queues, ports
- The explicit and symmetric naming of processes in direct naming
- Limited modularity since changing the name of a process requires changes elsewhere, i.e., in definitions of other processes



P or Q call

```
send(mbox-id, message)
```

R calls

```
receive(mbox-id, message)
```

Mailbox Issues

- communication is no longer “point-to-point”; e.g., a message received by R may be from P or Q
- “fair merge” property --- do not starve Q from queuing messages by allowing continual queuing of messages only from P
- natural extension to multiple receivers. Possible semantics:
  - Multicast to all in the group gets the same message
  - The first receiver removes it
  - Bulletin board: each receiver decides