Start: 8:01

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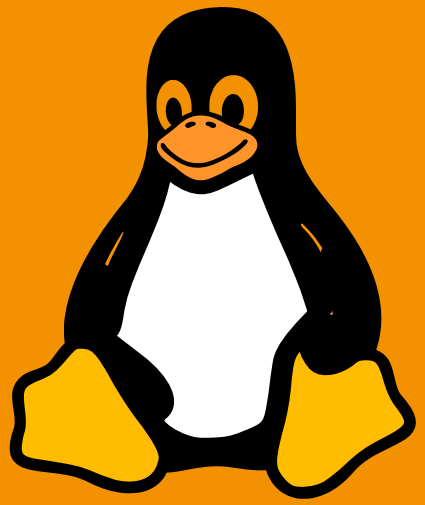
Technical University of Applied Sciences

Prof. Dr. Florian Künzner
Technical University of Applied Sciences Rosenheim, Computer Science

Bitte: Vorname + Nachname
⇒ selbständig umbenennen

OS 9 – Communication 2



source: iconspng.com

The lecture is based on the work and the documents of Prof. Dr. Ludwig Frank

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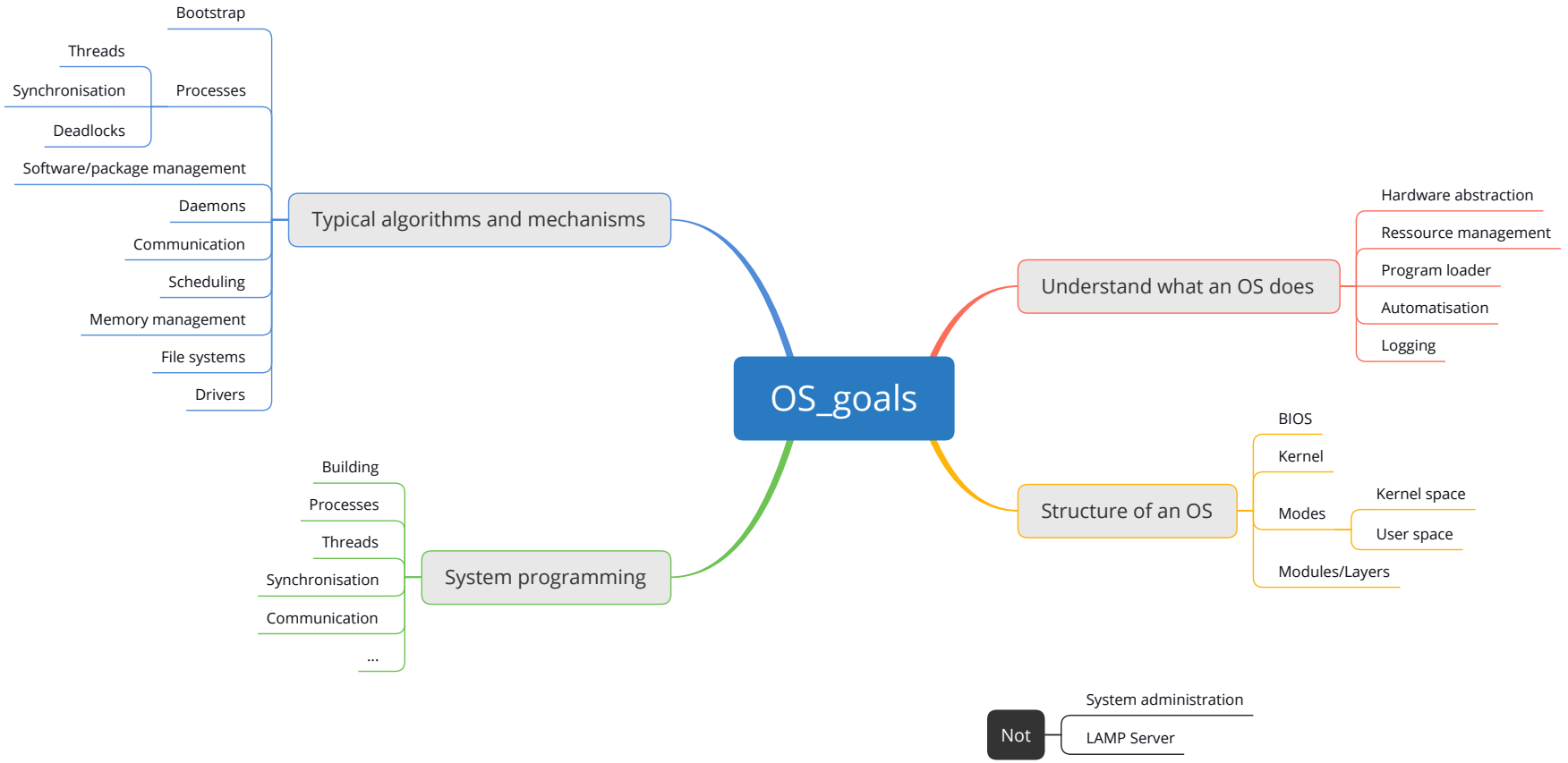
Goal



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Goal

OS::Communication

- Message queue
- Shared memory
- Process communication summary

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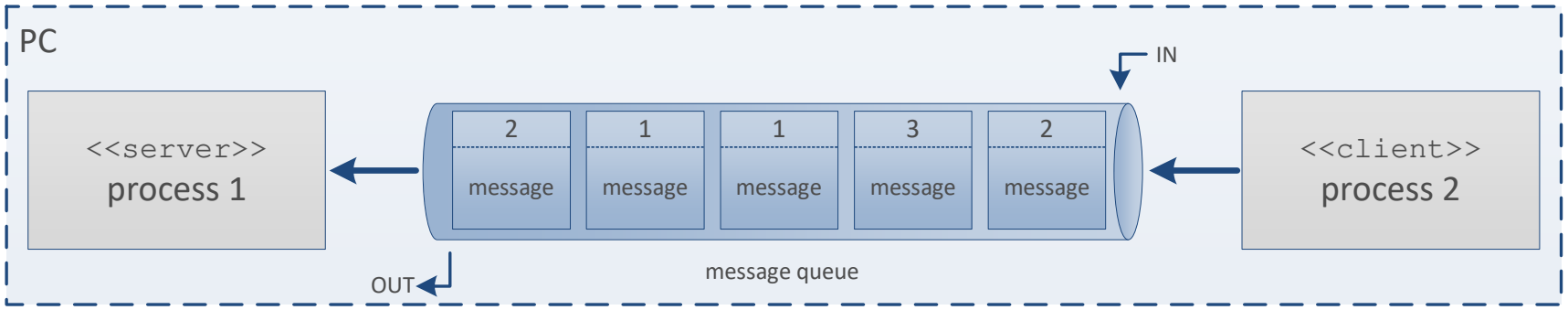
Message queue



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Message queue

Message queue concept

- Queue to **store messages**
- Inter-process communication (IPC) between processes on one PC.
- Messages have **priority/type**.
- Internal stored as a linked list.
- **Send** into queue **does not require** an **active receiver**
- **Read** from queue **does not require** an **active sender**
- Max queue size (default: 16 KiB on Linux).
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Message queue

Message structure

```
1 struct message {
2     long priority;     //priority or type
3     char message[64]; //buffer for message bytes
4 };
```

Message priority/type

- The lower the number, the higher the priority
- The priority can be interpreted as a type (each type has its own number)

Message queue usage scenarios (`PRIO_FETCH_FLAG`)

- Read message after message (FIFO principle) (`priority == 0`)
- Read only message with specific priority/type (`priority == N`)
- Read the messages with the highest priority/type first, up to a certain number (`priority == -N`)

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0 is not allowed!
1 highest prio
>1 lower prio

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Message queue: Pseudo C code

```c
struct message { //structure for messages
  long priority;
  char message[64];
};

void receiver() {
  //create message queue
  msgget(...);


  //receive message
  //blocks if message queue is empty
  msgrcv(...);

  //... work with message

  //remove message queue
  msgctl(...);
}

void sender() {
  //open existing message queue
  msgget(...);

  //prepare message

  //send message
  //blocks if message queue is full
  msgsnd(...);

  //close not needed


}
```

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Message queue: Linux commands

Command	Description
`ipcs`	Show information on IPC facilities
`ipcs -q`	Shows active message queues in the system
`ipcmk`	Make various IPC resources
`ipcmk -Q`	Create a message queue
`ipcrm`	Remove certain IPC resources
`ipcrm -q 1`	Remove message queue with id 1
`ipcrm -Q 2`	Remove message queue with key 2

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Message queue

C example

*Please find the source file(s) in the repository.

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Questions?

All right? ⇒ 

Question? ⇒  and use **chat**

or

speak *after* I ask you to

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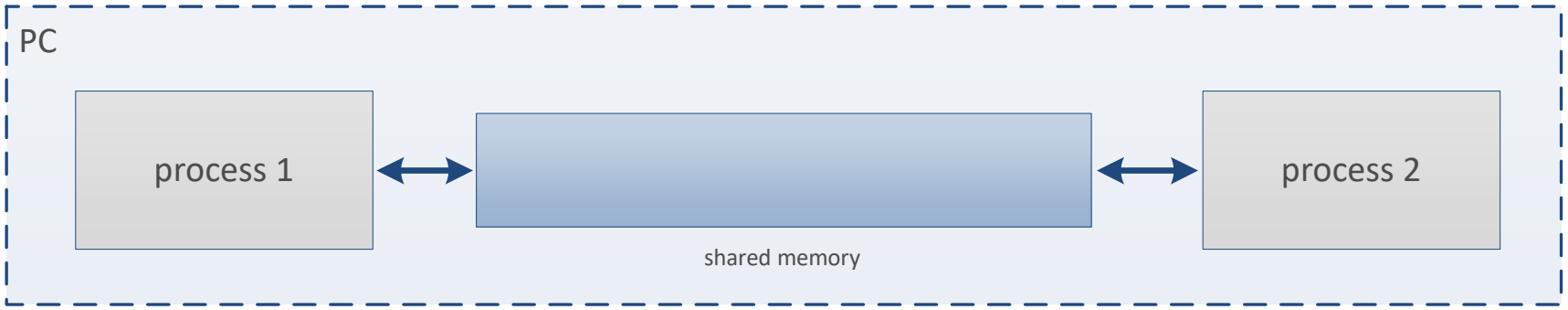
Shared memory



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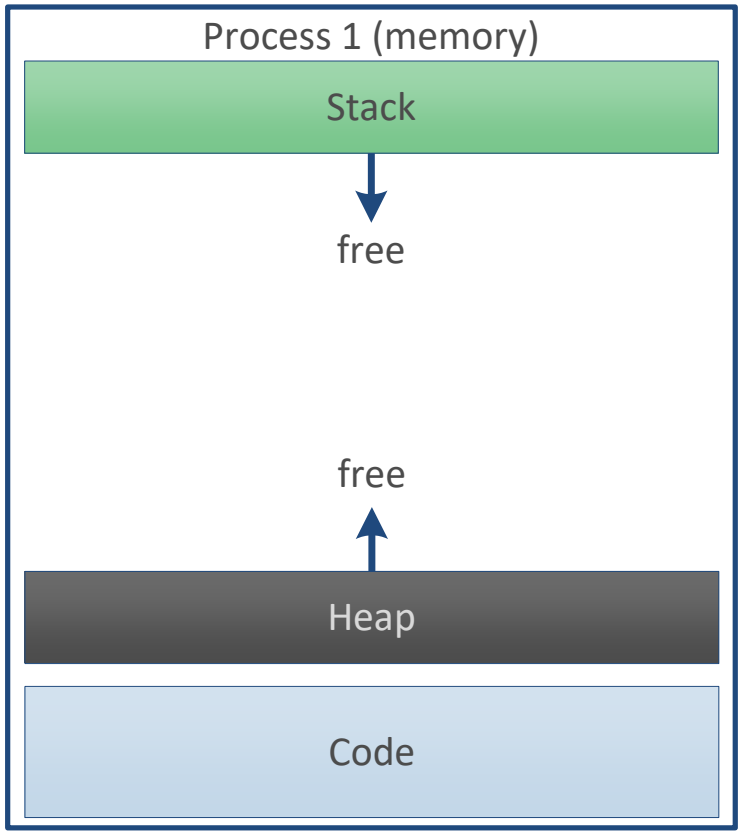

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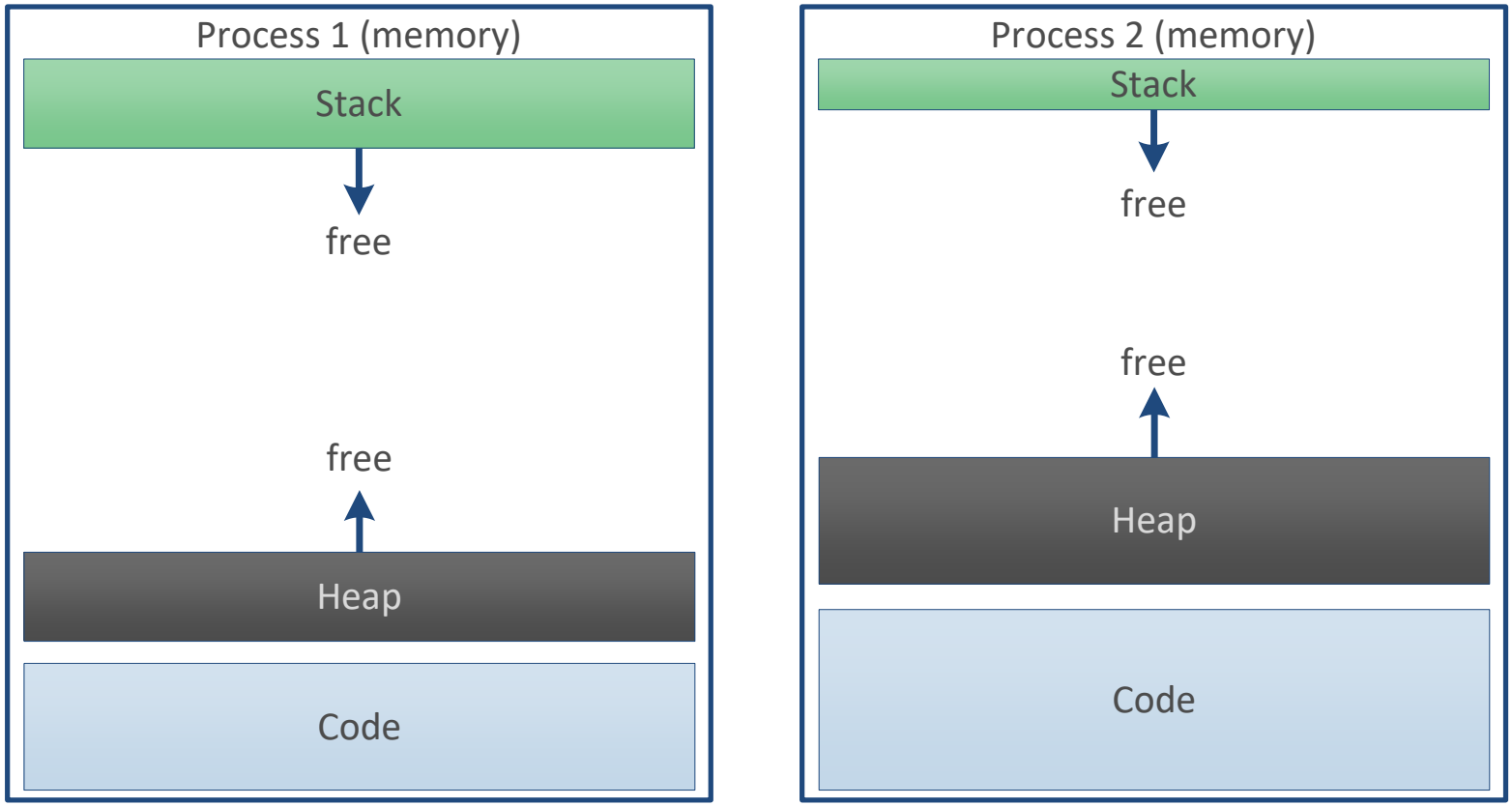

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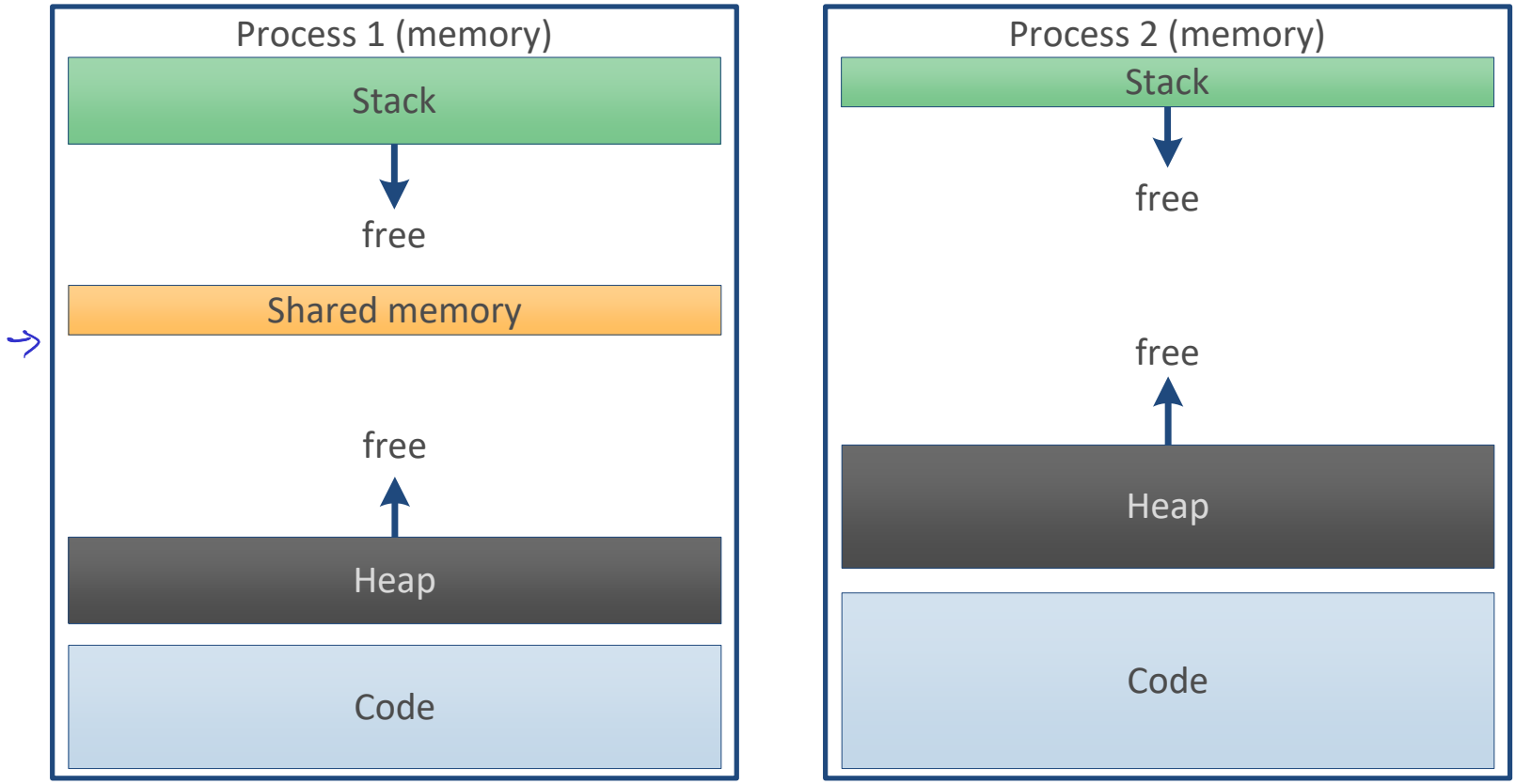

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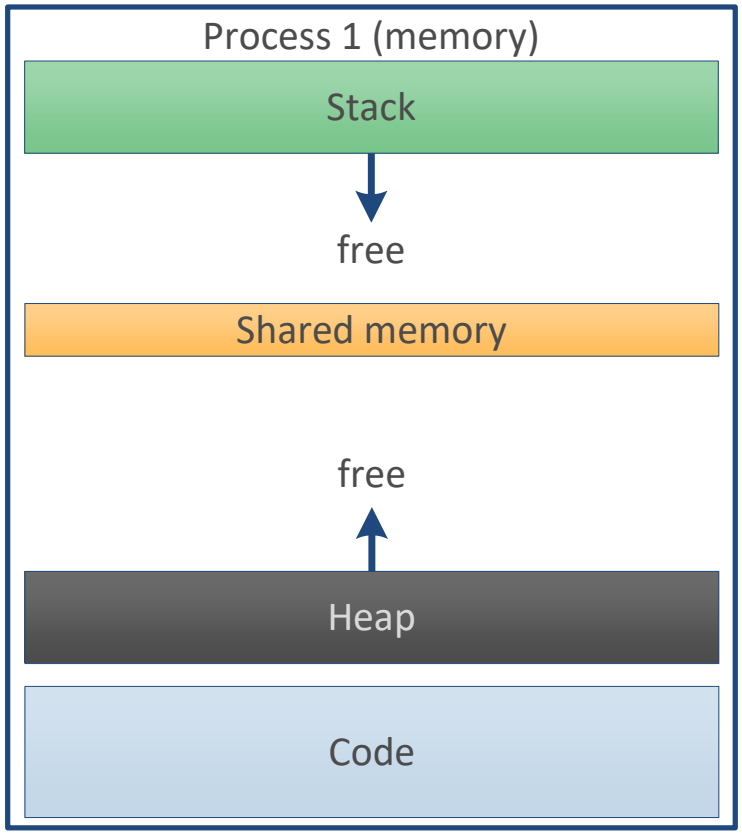

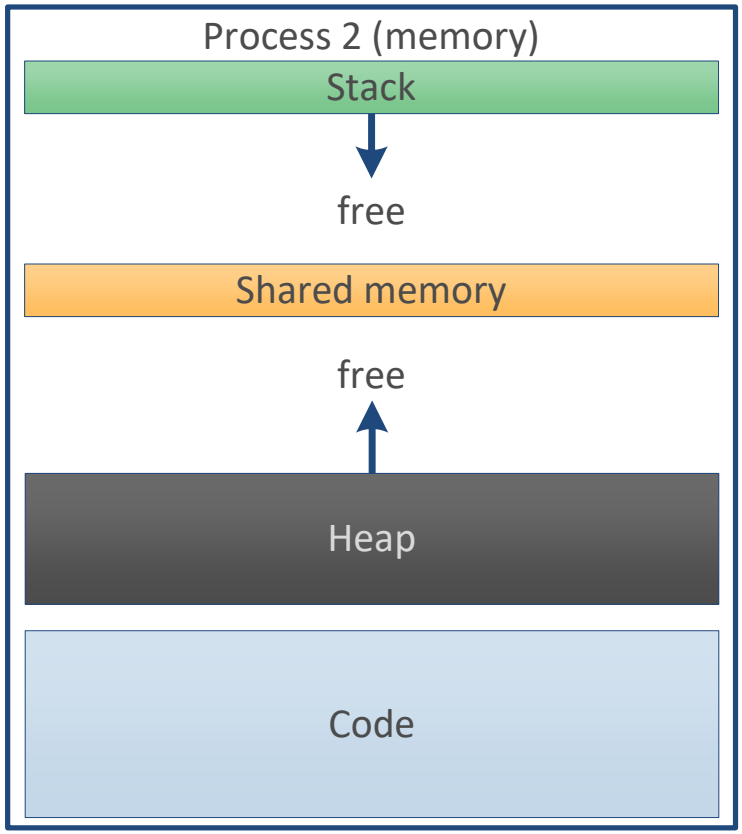

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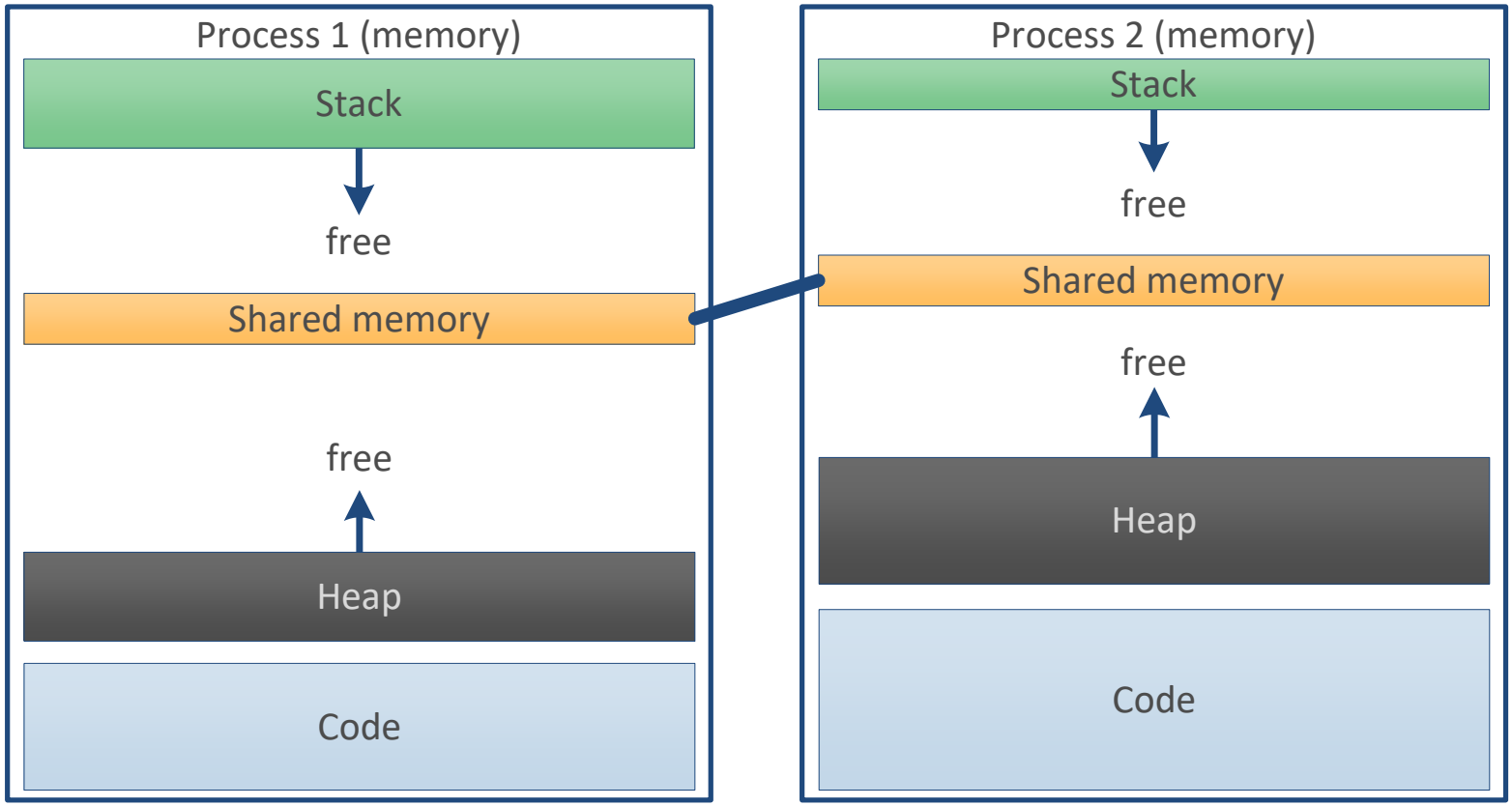

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Shared memory

Shared memory concept

- Shared memory area between processes
- Inter-process communication (IPC) between processes on one PC.
- It is a **plain memory area** with a certain size
- Access **needs to be synchronised** (e.g. semaphore)
- Access is **very fast** (comparable with own memory access)

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Shared memory: Pseudo C code

```
1  seminit(READY_TO_WRITE, 1); //declare and initialise semaphore
2  seminit(READY_TO_READ,  0); //declare and initialise semaphore
3  void receiver() {
4    //create shared memory
5    shmget(...);
6    //attach the shared memory
7    shared_mem_address = shmat(...);
8
9
10
11
12   //copy data from shared memory
13   P(READY_TO_READ);
14   copy(data, shared_mem_address); //data = sm
15   V(READY_TO_WRITE);
16
17   //... work with data
18   work_with(data);
19
20   //detach shared memory
21   shmdt(...);
22   //remove shared memory
23   shmctl(...);
24 }
25 void sender() {
26   //get existing shared memory
27   shmget(...);
28   //attach the shared memory
29   shared_mem_address = shmat(...);
30
31   //... prepare data
32   data = prepare_data();
33
34   //copy data into shared memory
35   P(READY_TO_WRITE);
36   copy(shared_mem_address, data); //sm = data
37   V(READY_TO_READ);
38
39
40
41
42   //detach shared memory
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44
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Shared memory: Linux commands

Command	Description
`ipcs`	Show information on IPC facilities
`ipcs -m`	Shows active shared memory in the system
`ipcmk`	Make various IPC resources
`ipcmk -M 8`	Create a shared memory with 8 bytes
`ipcrm`	Remove certain IPC resources
`ipcrm -m 1`	Remove shared memory with id 1
`ipcrm -M 2`	Remove shared memory with key 2

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Shared memory

C example

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Process communication summary

Mechanism	data	store	access contr.	remote	bidirect.	fast	prio.	sync req.
signal								
unix socket								
network socket								
message queue								
shared memory								

Comparison of different communication mechanism: `https://www.programering.com/a/MTO0AzMwATI.html`

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Process communication summary

Mechanism	data	store	access contr.	remote	bidirect.	fast	prio.	sync req.
signal						X		
unix socket	X		X		X	X		
network socket	X			X	X			
message queue								
shared memory								

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network socket	X			X	X			
message queue	X	X	X			X	X	
shared memory	XX	XX	X		X	XX		X

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Questions?

All right? ⇒ 

Question? ⇒  and use **chat**

or

speak *after* I ask you to

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Summary and outlook

Summary

- Message queue
- Shared memory
- Process communication summary

Outlook

- Deadlocks
- Deadlock analysis
- Deadlock prevention

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