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

Synchronous Message Passing

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Haute Ecole Spécialisée de Suisse occidentale
Fachhochschule Westschweiz

(A)Synchronous Message Passing

https://en.wikipedia.org/wiki/Message_passing

- In concurrency theory, **synchronous message passing** means:
  - A sender and receiver must meet at the same time for a message to be transferred.
  - The sender **blocks until another thread receives the message**.

Producer thread/process		Consumer/process thread
put(item) (waiting)	----->	take() (receives item)

Java syntax

(A)Synchronous Message Passing

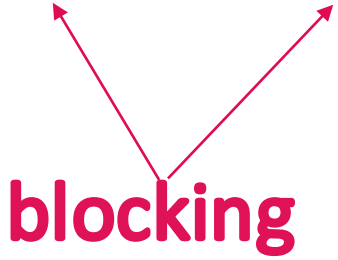
- In asynchronous message passing, channels contain unbounded num of messages.
  - If p1 sends a msg to p2 and needs to be sure p2 received it, it must wait for a reply!
  - If there is a delivery failure, p1 has no way to know the state of msg.
  - Message have to be buffered (no infinite space!). If too many msg arrive, program will crash or send() will be blocked.

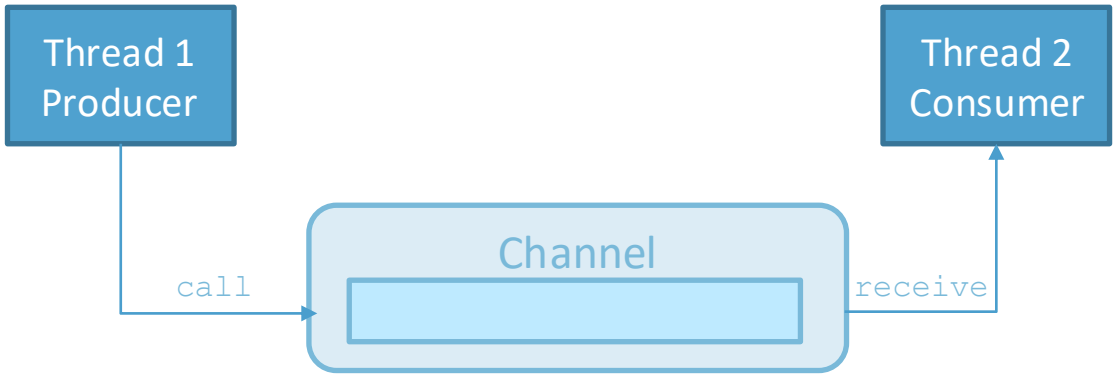
- Synchronous Message passing avoid these situations

(A)Synchronous Message Passing

https://en.wikipedia.org/wiki/Message_passing

- Processes share **channels** …
  - Abstraction of a physical communication network
- … to communicate between processes
  - `call` and `receive`





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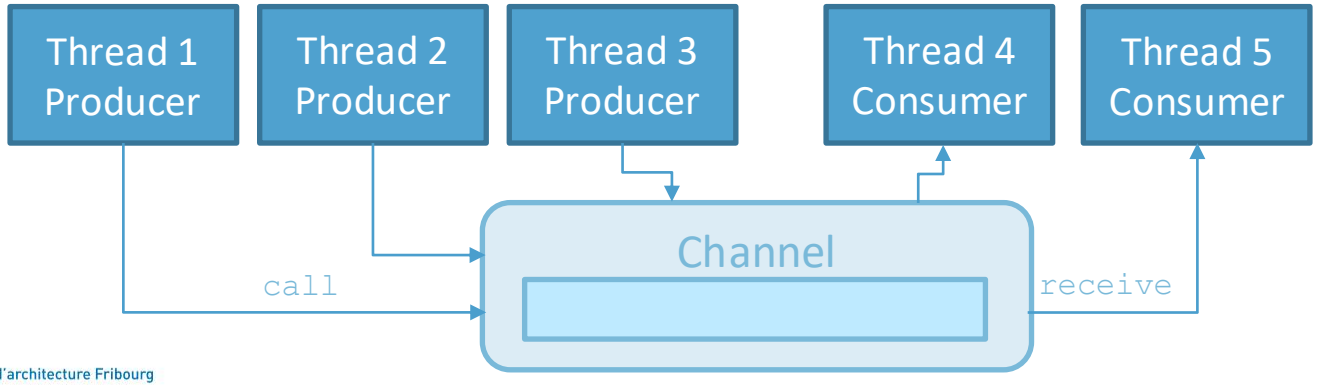
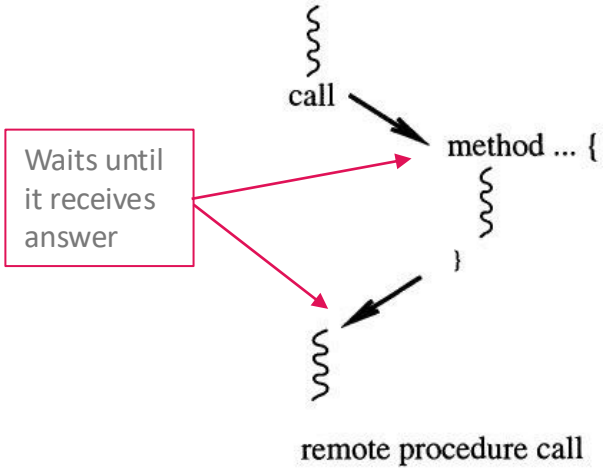
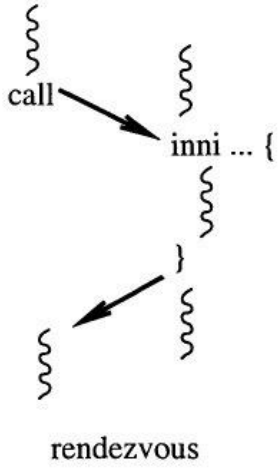


Synchronous



remote procedure call



rendezvous

Serviced by: **method (`op`)** **input statement (`inni`)** (e.g. JR)

Sync msg passing – Pros / Cons

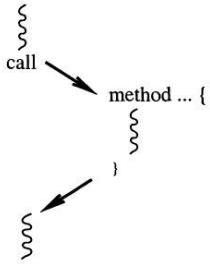
- The sending part decides if it is synchronous or asynchronous
- Synchronous - sender **blocks** until the receiver picks up the message

➔ Guarantee that the message is received by the receiver

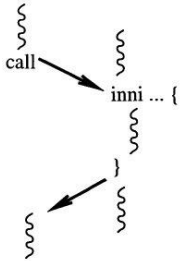
- It's like making a (remote) function call
  - RPC (remote procedure call) will be shown later
- A broken receiver breaks also the caller!

Key take away messages

- Sender puts message in channel and blocks
- Consuming the message deblocks the sender



remote procedure call



rendezvous

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Java

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AbstractQueues – Once again…

- Again, we can use the `AbstractQueue` interface from `java.util.concurrent`
- The Java counterpart for the synchronous message passing is

`SynchronousQueue()`

- `offer()`, `poll()`, `put()`, …
- Information on the official Oracle site: https://cutt.ly/Ft1Iw0T

SynchronousQueue – Some limitations

- Compared to the `AbstractQueues`, the **`SynchronousQueue`** has some limitations
  - Zero internal capacity!
  - `peek()` is not possible
  - Iteration over the queue is not possible... don't forget, there are no elements in the queue
  - The `SynchronousQueue` acts as an empty collection
  - *Null* elements are not permitted

Fairness

- Optional fairness policy
  - Ordering waiting producer and consumer threads

- By default, ordering is not guaranteed

Constructor	Description
`SynchronousQueue()`	Creates a `SynchronousQueue` with nonfair access policy.
`SynchronousQueue (boolean fair)`	Creates a `SynchronousQueue` with the specified fairness policy.

Key take away messages

- `SynchronousQueue`
- Usage of the well-known methods …
- … but with limitations …
- … because zero size buffer