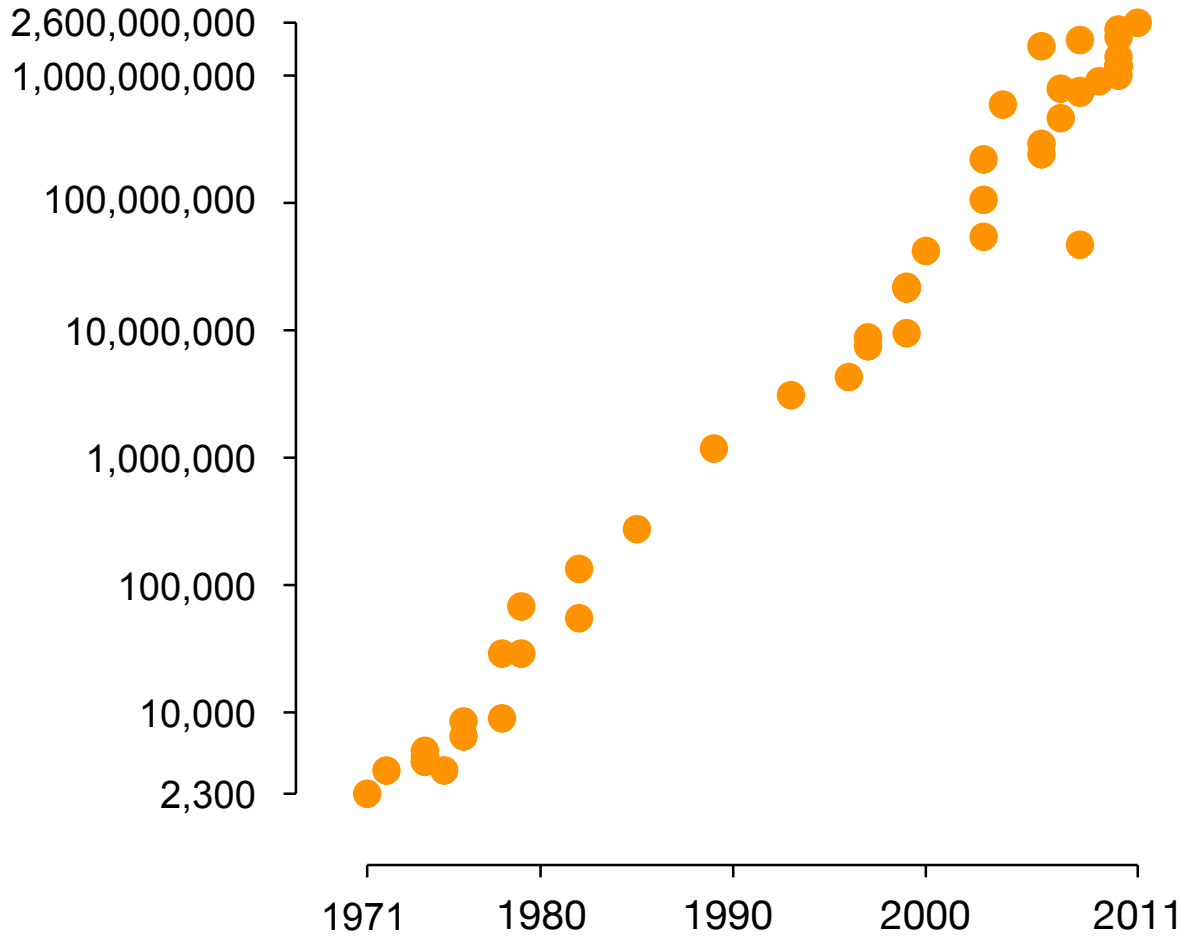
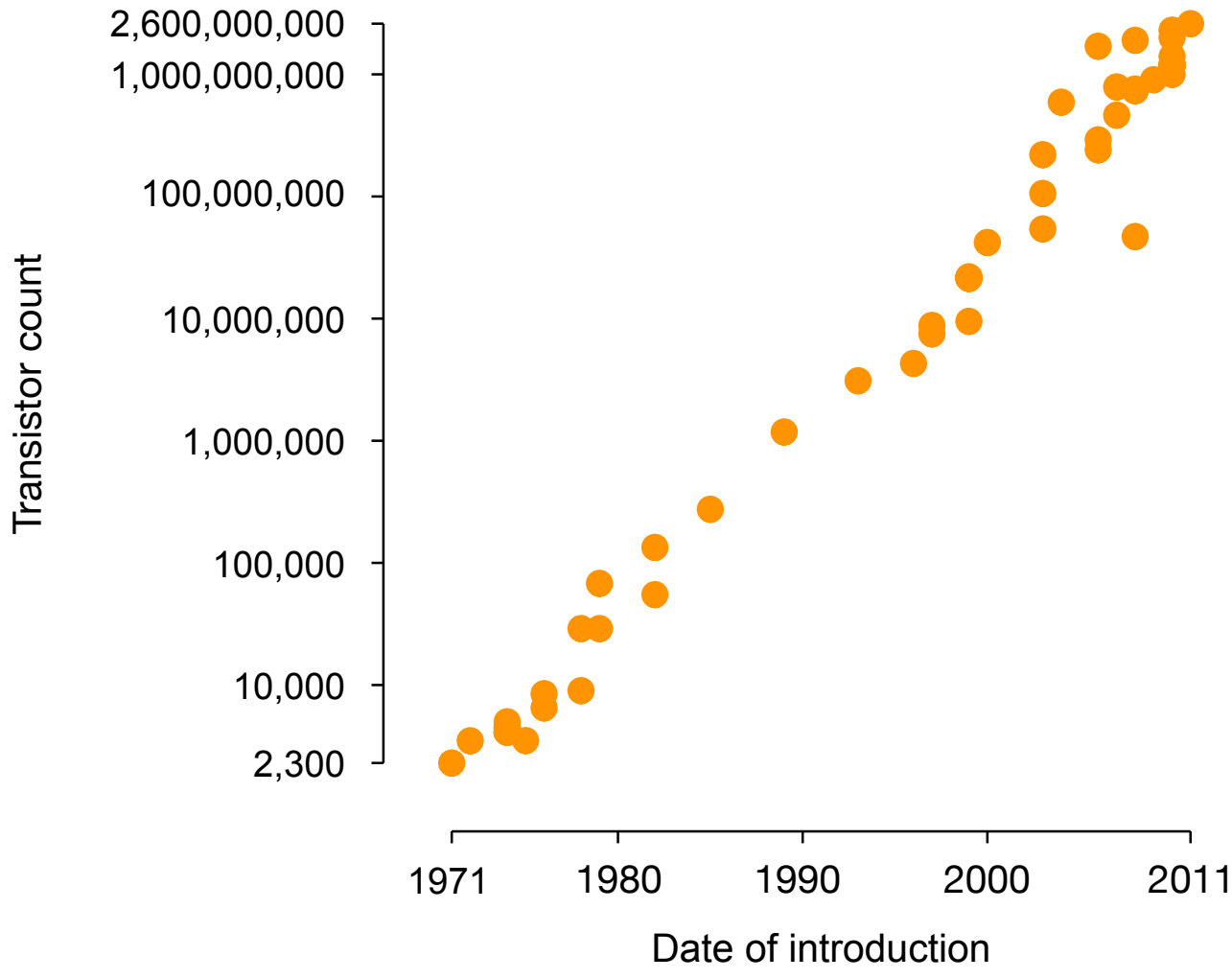
WAS WIRD HIER GEZEIGT?



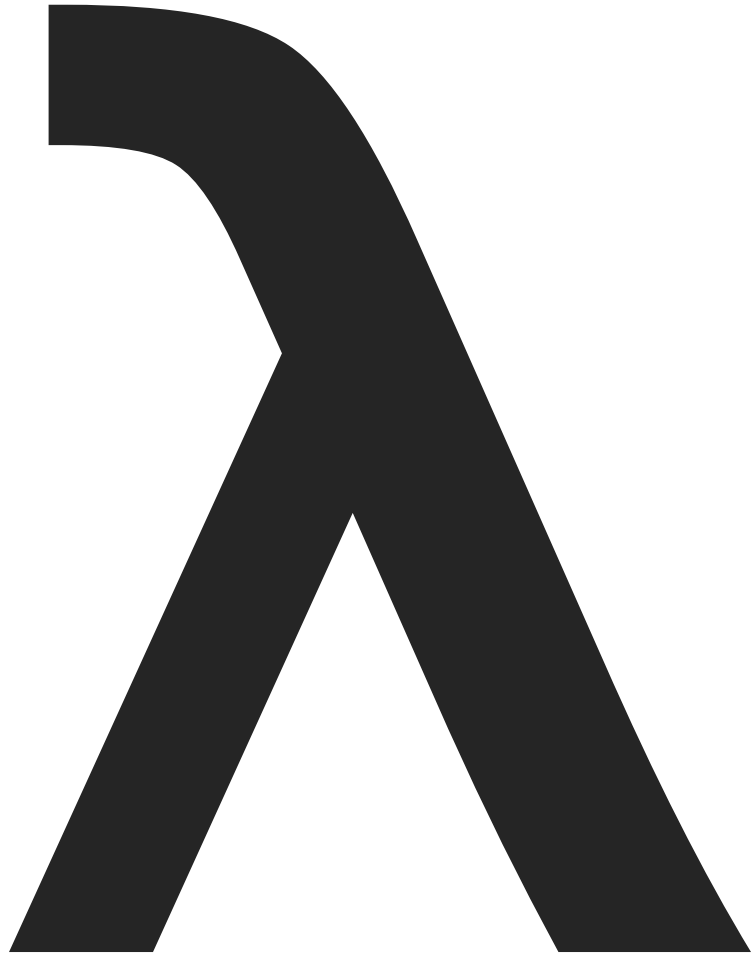
TRANSISTOR COUNTS 1971-2011 & MOORE'S LAW



FUNKTIONALE PROGRAMIERUNG

Nebenläufigkeit & Parallelisierung

Seminar, WS2016



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GLIEDERUNG

1. Nebenläufigkeit / Parallelisierung
2. Threads / Locking
3. Functional Paradigm 101
4. Elixir
5. Fazit

NEBENLÄUFIGKEIT / PARALLELISIERUNG

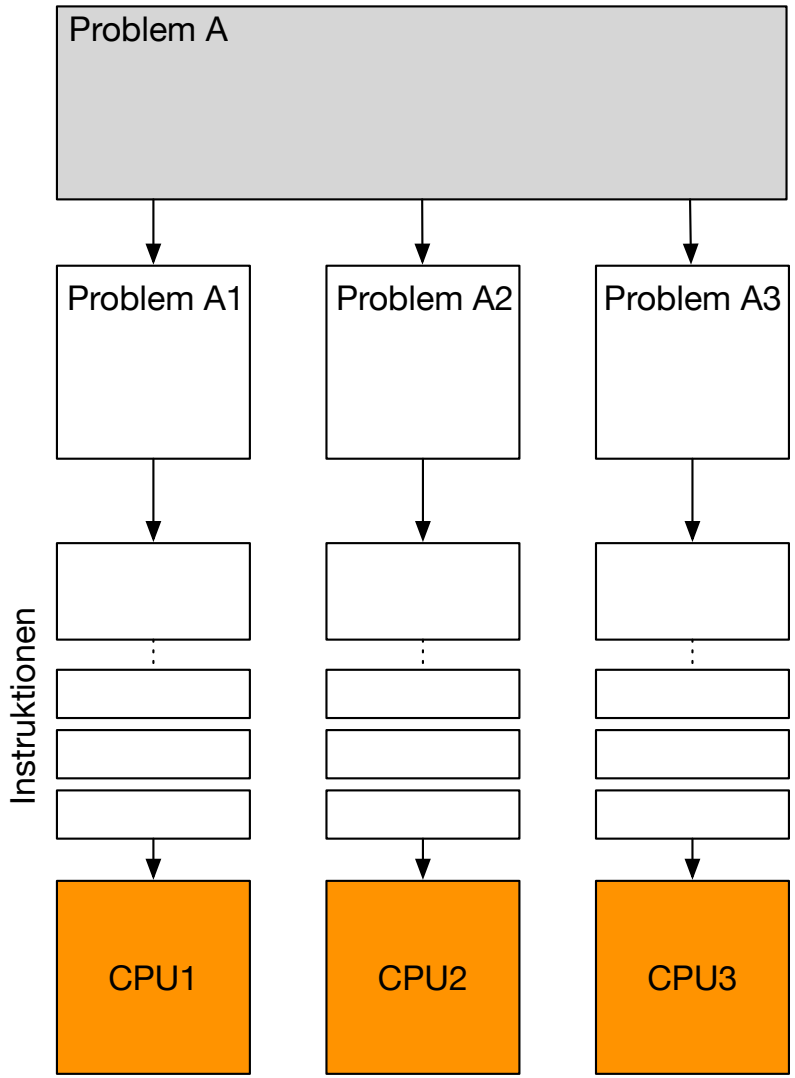
PARALLEL

→ Synonyme:
nebeneinander,
nebenläufig

→ Informatik:
parallel ≠ nebenläufig!

→ „schneller als
sequenzielles Programm,
durch gleichzeitiges
Ausführen von
Anweisungen“

→ Multi-Processing



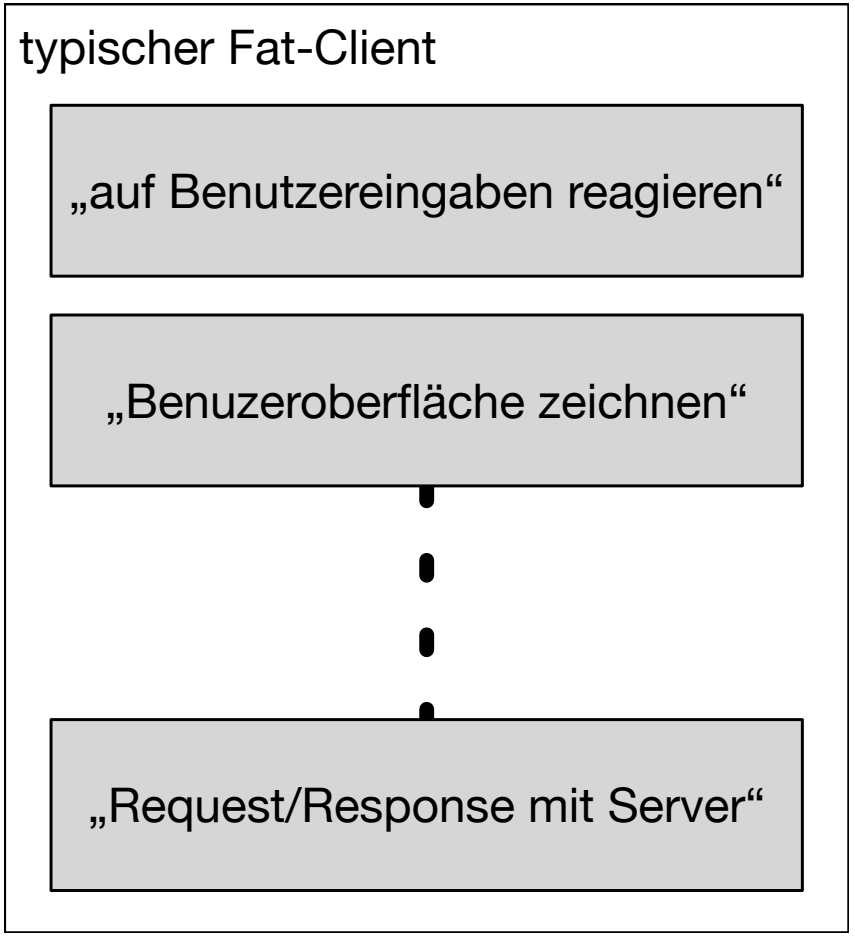
NEBENLÄUFIG

→ concurrent (engl.)

→ „Systeme, welche zur gleichen Zeit mehrere **Aufgaben** haben“

→ muss nicht zwangsläufig parallel sein

→ Multi-Tasking



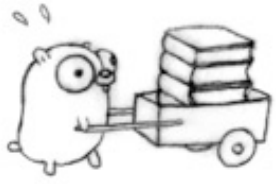
ROB PIKE - 'CONCURRENCY IS NOT PARALLELISM' (1)

→ „Concurrency is about dealing with lots of things at once.“

→ „Parallelism is about doing lots of things at once.“

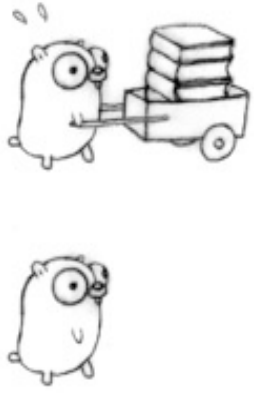
→ „Concurrency is about structure, parallelism is about execution.“

ROB PIKE - 'CONCURRENCY IS NOT PARALLELISM' (2)



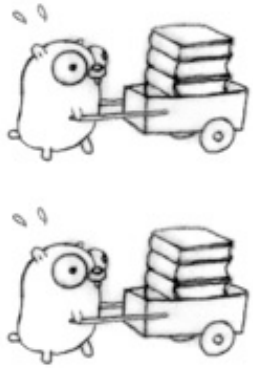
→ sequenziell

ROB PIKE - 'CONCURRENCY IS NOT PARALLELISM' (3)



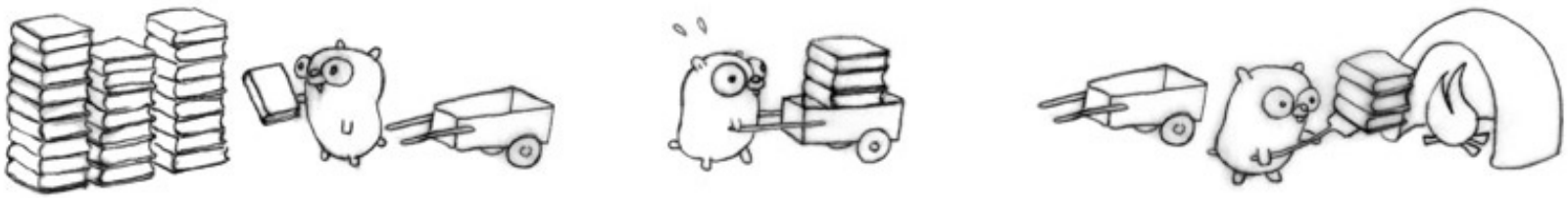
→ mehrere Cores

ROB PIKE - 'CONCURRENCY IS NOT PARALLELISM' (4)



→ parallel

ROB PIKE - 'CONCURRENCY IS NOT PARALLELISM' (5)

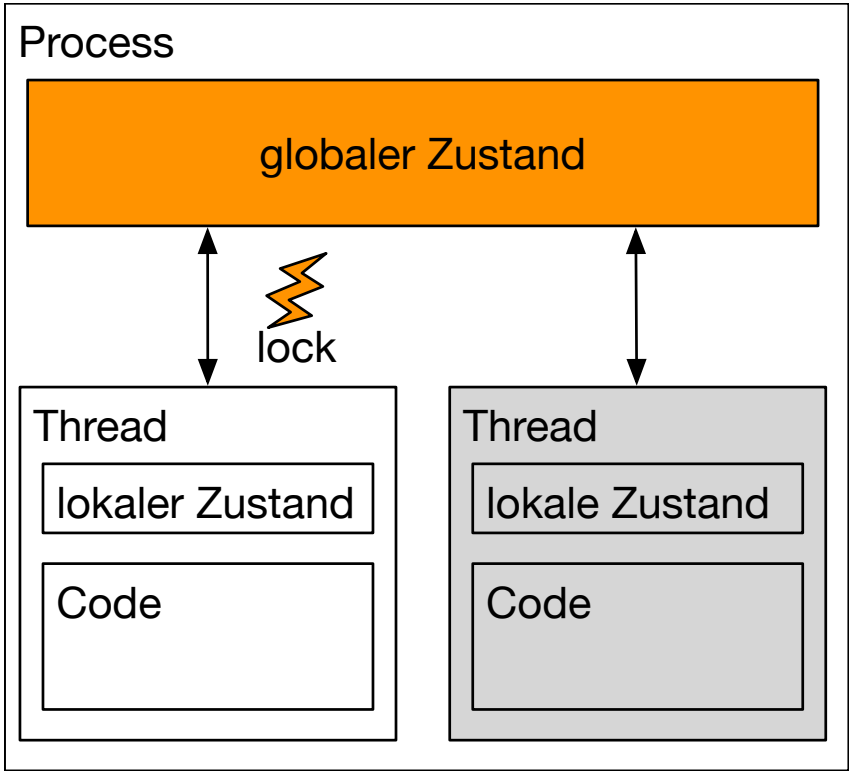


→ concurrent

THREADS / LOCKING

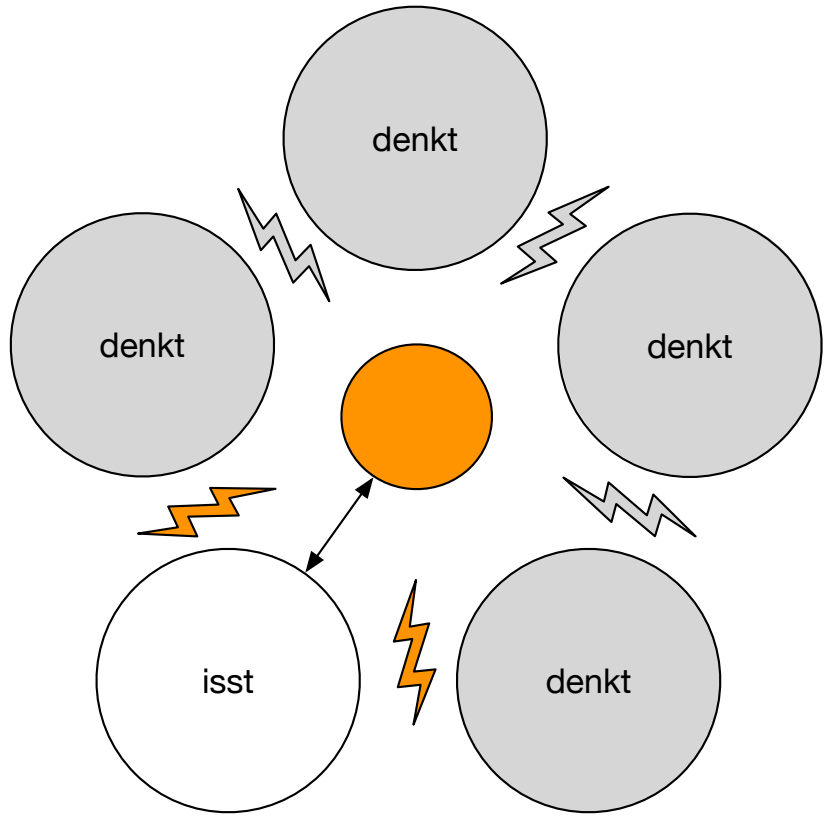
WAS IST EIN THREAD?

→ Shared Memory



WAS IST EIN LOCK?

→ Dining philosophers problem



HÄUFIGE BUGS

Race-Condition

→ ++

→ ++

Deadlock

→ –

→ –

FAZIT: THREADS PROGRAMMING

→ „State is Evil“

FUNCTIONAL PARADIGM 101

FUNCTIONAL PARADIGM 101

→ reine Funktionale Sprachen
→ imutable // mutable
→ no side-effects
→ deterministic
→ data-in <-> data-out
→ functions as first-class citizens
→ lamdas

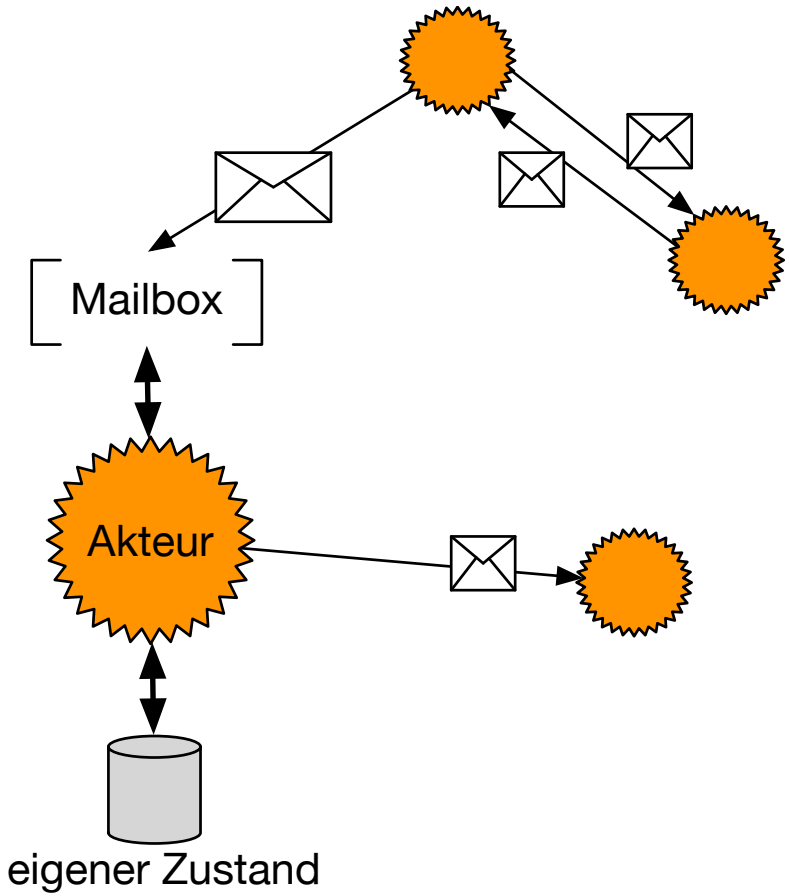
ELIXIR

ELIXIR

→ moderne Variante von Erlang (1987, Ericsson)
→ Beam-VM
→ Fault-Taulerant
→ „Let it crash“
→ Supervision-Trees
→ Shared & Distributed Memory
→ Open Telecom Platform (OTP)

OTP / ACTOR-MODEL

- → unabhängige Akteure
- → Message-Passing
- → FIFO-Verhalten von **Mailboxes**
- → Locks werden nicht gebraucht
- → Alternativen:
  - → Akka (Java/Scala)
  - → Akka.NET
  - → Pykka (Python)
  - → CAF (C++)
  - → Celluloid (Ruby)



LIST-PROCESSING IN ELIXIR: MAP

LIST-PROCESSING IN ELIXIR: REDUCE

LIST-PROCESSING IN ELIXIR: FILTER

ELIXIR-STREAMS

FAZIT

FAZIT: FUNCTIONAL PROGRAMMING

Vorteile

→ composeability of behaviors

→ Art und Abfolge der Anweisung kann genau und deklarativ bestimmt werden

Nachteile

→ Punkt 1

→ Punkt 2

FUNCTIONAL STYLE IN IMPERATIVE LANGUAGES