The Power of ~~LOVE~~... Actors

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Overview

What are Actors?

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Act-or: to act: **”to do something for a particular purpose or to solve a problem”** (From the Cambridge dictionary)

What are Actors?

Wikipedia:

- A mathematical model of concurrent computation

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    - Create more actors
    - Send more messages

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- Actors can hold and modify private state
- Affect each other through messages only
- In response to a message that it receives, an actor can:
    - Make local decisions
    - Create more actors
    - Send more messages
    - Respond to the incoming message

Actors in the real world

WhatsApp

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- Every user has an actor representing her

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- When sending a message my actor sends a message to all related users

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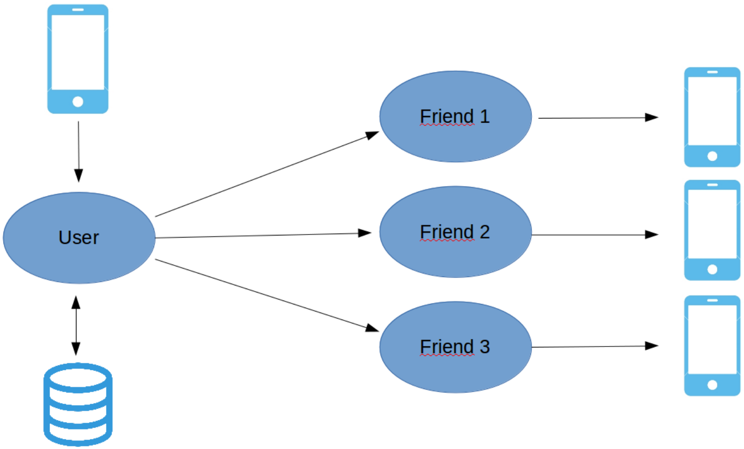
WhatsApp

- Every user has an actor representing her
- When sending a message my actor sends a message to all related users
- The users receiving a message ensure the message is delivered.

Actors in the real world



Actors in Elixir

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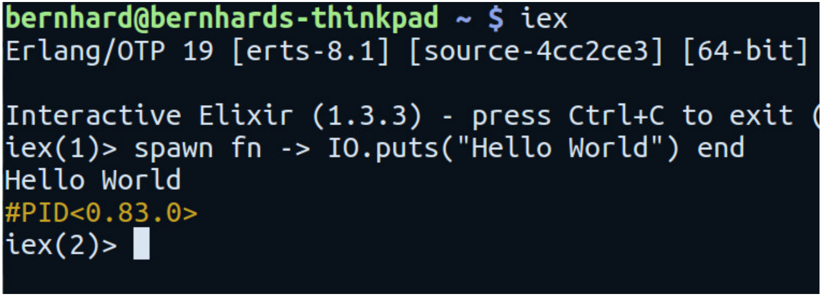
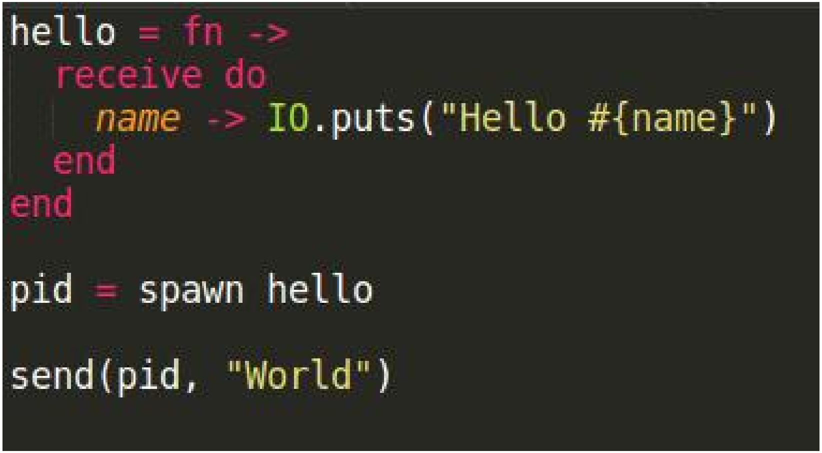


```
bernhard@bernhards-thinkpad ~ $ iex
Erlang/OTP 19 [erts-8.1] [source-4cc2ce3] [64-bit]

Interactive Elixir (1.3.3) - press Ctrl+C to exit (
iex(1)> spawn fn -> IO.puts("Hello World") end
Hello World
#PID<0.83.0>
iex(2)>
```

Actors in Elixir

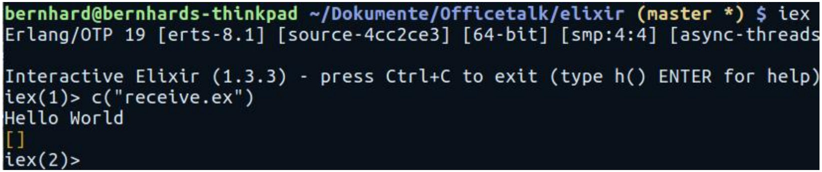


```
hello = fn ->
  receive do
    name -> IO.puts("Hello #{name}")
  end
end

pid = spawn hello

send(pid, "World")
```

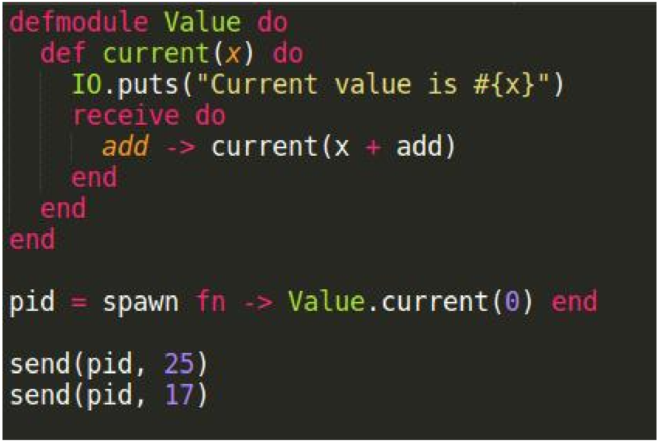
Actors in Elixir



```
bernhard@bernhards-thinkpad ~/Dokumente/Officetalk/elixir (master *) $ iex
Erlang/OTP 19 [erts-8.1] [source-4cc2ce3] [64-bit] [smp:4:4] [async-threads

Interactive Elixir (1.3.3) - press Ctrl+C to exit (type h() ENTER for help)
iex(1)> c("receive.ex")
Hello World
[]
iex(2)>
```

Actors in Elixir

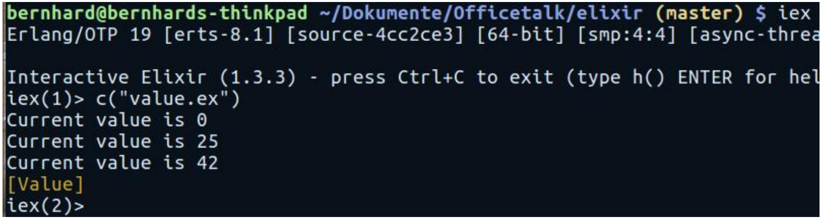


```elixir
defmodule Value do
  def current(x) do
    IO.puts("Current value is #{x}")
    receive do
      add -> current(x + add)
    end
  end
end

pid = spawn fn -> Value.current(0) end

send(pid, 25)
send(pid, 17)
```

Actors in Elixir



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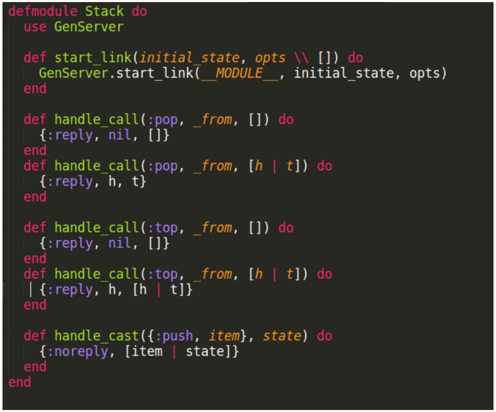
Interactive Elixir (1.3.3) - press Ctrl+C to exit (type h() ENTER for hel
iex(1)> c("value.ex")
Current value is 0
Current value is 25
Current value is 42
[Value]
iex(2)>
```

Actors in Elixir



```
defmodule Stack do
  use GenServer

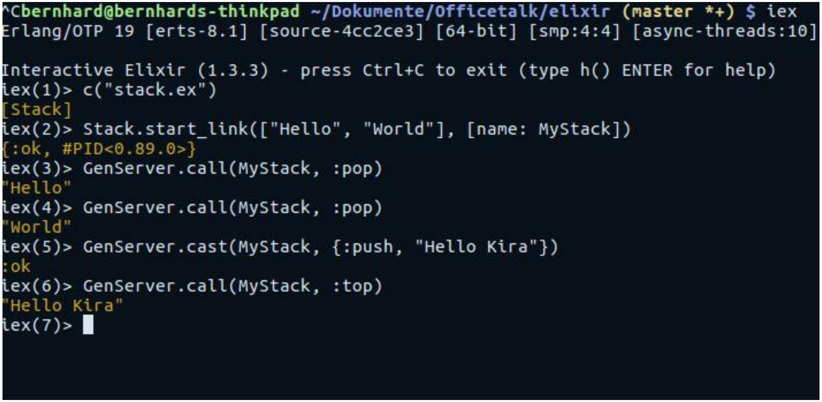
  def start_link(initial_state, opts \\ []) do
    GenServer.start_link(__MODULE__, initial_state, opts)
  end

  def handle_call(:pop, _from, []) do
    {:reply, nil, []}
  end
  def handle_call(:pop, _from, [h | t]) do
    {:reply, h, t}
  end

  def handle_call(:top, _from, []) do
    {:reply, nil, []}
  end
  def handle_call(:top, _from, [h | t]) do
    {:reply, h, [h | t]}
  end

  def handle_cast({:push, item}, state) do
    {:noreply, [item | state]}
  end
end
```

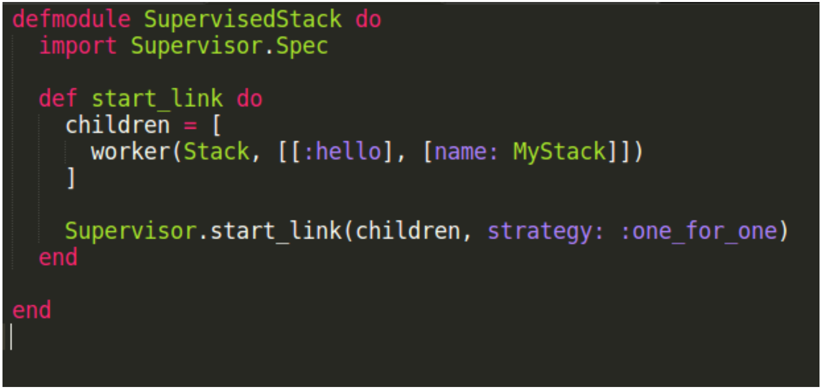
Actors in Elixir



```
^Cbernhard@bernhards-thinkpad ~/Dokumente/Officetalk/elixir (master *+) $ iex
Erlang/OTP 19 [erts-8.1] [source-4cc2ce3] [64-bit] [smp:4:4] [async-threads:10]

Interactive Elixir (1.3.3) - press Ctrl+C to exit (type h() ENTER for help)
iex(1)> c("stack.ex")
[Stack]
iex(2)> Stack.start_link(["Hello", "World"], [name: MyStack])
{:ok, #PID<0.89.0>}
iex(3)> GenServer.call(MyStack, :pop)
"Hello"
iex(4)> GenServer.call(MyStack, :pop)
"World"
iex(5)> GenServer.cast(MyStack, {:push, "Hello Kira"})
:ok
iex(6)> GenServer.call(MyStack, :top)
"Hello Kira"
iex(7)>
```

Actors in Elixir



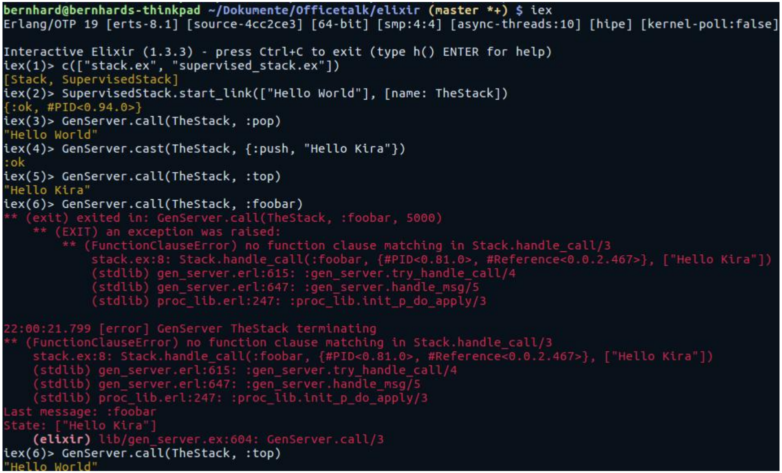
```
defmodule SupervisedStack do
  import Supervisor.Spec

  def start_link do
    children = [
      worker(Stack, [[:hello], [name: MyStack]])
    ]

    Supervisor.start_link(children, strategy: :one_for_one)
  end

end
```

Actors in Elixir



```
bernhard@bernhards-thinkpad ~/Dokumente/Officetalk/elixir (master *+) $ iex
Erlang/OTP 19 [erts-8.1] [source-4cc2ce3] [64-bit] [smp:4:4] [async-threads:10] [hipe] [kernel-poll:false]

Interactive Elixir (1.3.3) - press Ctrl+C to exit (type h() ENTER for help)
iex(1)> c(["stack.ex", "supervised_stack.ex"])
[Stack, SupervisedStack]
iex(2)> SupervisedStack.start_link(["Hello World"], [name: TheStack])
{:ok, #PID<0.94.0>}
iex(3)> GenServer.call(TheStack, :pop)
"Hello World"
iex(4)> GenServer.cast(TheStack, {:push, "Hello Kira"})
:ok
iex(5)> GenServer.call(TheStack, :top)
"Hello Kira"
iex(6)> GenServer.call(TheStack, :foobar)
** (exit) exited in: GenServer.call(TheStack, :foobar, 5000)
    ** (EXIT) an exception was raised:
        ** (FunctionClauseError) no function clause matching in Stack.handle_call/3
            stack.ex:8: Stack.handle_call(:foobar, {#PID<0.81.0>, #Reference<0.0.2.467>}, ["Hello Kira"])
            (stdlib) gen_server.erl:615: :gen_server.try_handle_call/4
            (stdlib) gen_server.erl:647: :gen_server.handle_msg/5
            (stdlib) proc_lib.erl:247: :proc_lib.init_p_do_apply/3

22:00:21.799 [error] GenServer TheStack terminating
** (FunctionClauseError) no function clause matching in Stack.handle_call/3
    stack.ex:8: Stack.handle_call(:foobar, {#PID<0.81.0>, #Reference<0.0.2.467>}, ["Hello Kira"])
    (stdlib) gen_server.erl:615: :gen_server.try_handle_call/4
    (stdlib) gen_server.erl:647: :gen_server.handle_msg/5
    (stdlib) proc_lib.erl:247: :proc_lib.init_p_do_apply/3
Last message: :foobar
State: ["Hello Kira"]
    (elixir) lib/gen_server.ex:604: GenServer.call/3
iex(6)> GenServer.call(TheStack, :top)
"Hello World"
```

Actors in Scala

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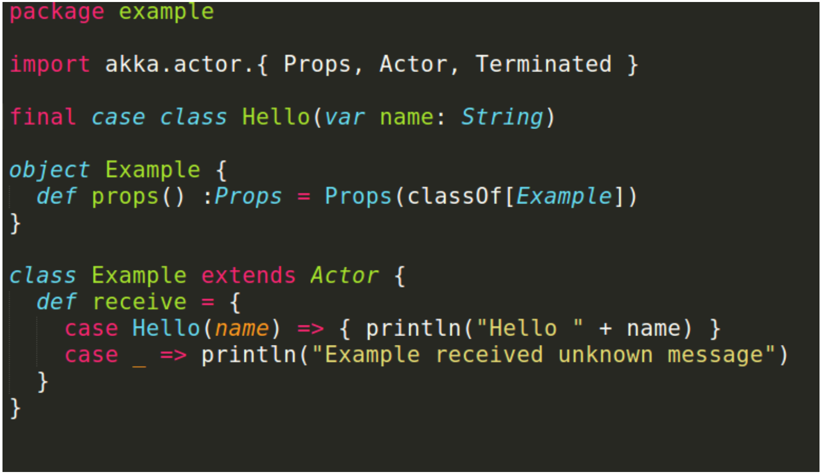
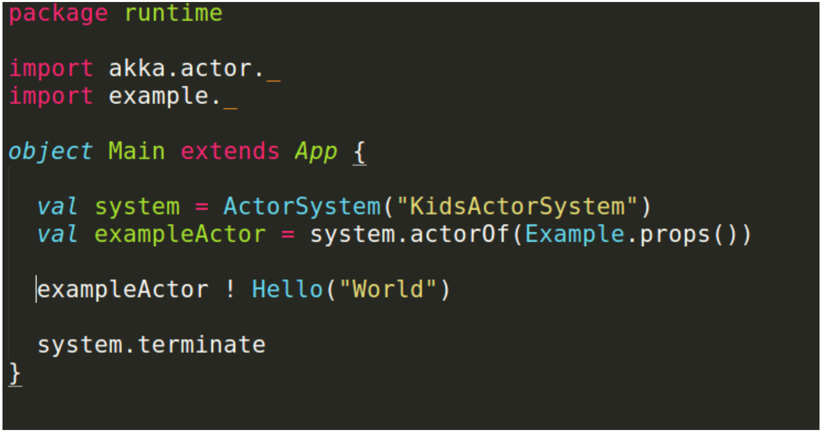


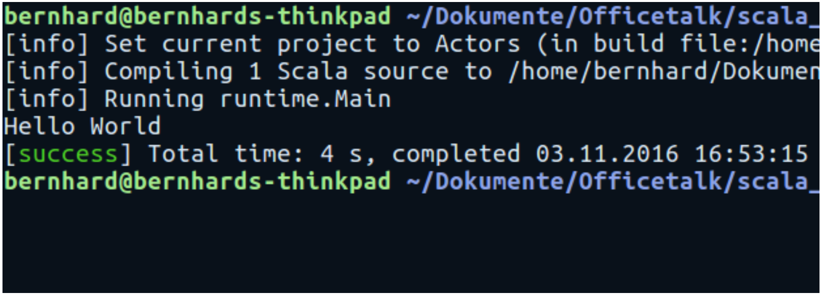
```scala
package example

import akka.actor.{ Props, Actor, Terminated }

final case class Hello(var name: String)

object Example {
  def props() :Props = Props(classOf[Example])
}

class Example extends Actor {
  def receive = {
    case Hello(name) => { println("Hello " + name) }
    case _ => println("Example received unknown message")
  }
}
```

Actors in Scala



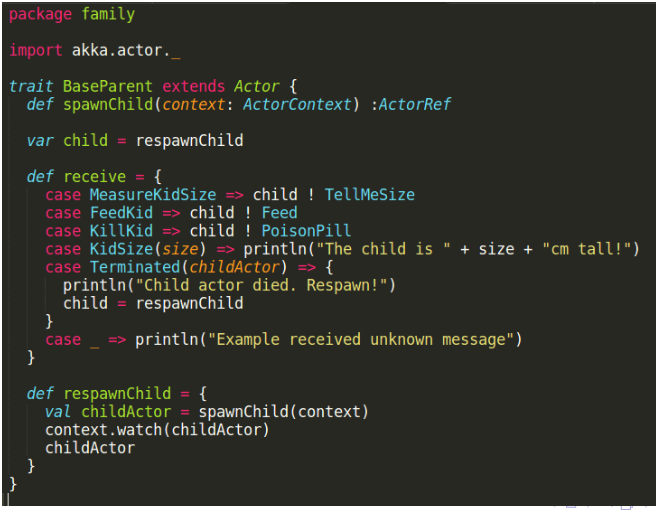
```
package runtime

import akka.actor._
import example._

object Main extends App {

  val system = ActorSystem("KidsActorSystem")
  val exampleActor = system.actorOf(Example.props())

  exampleActor ! Hello("World")

  system.terminate
}
```

Actors in Scala



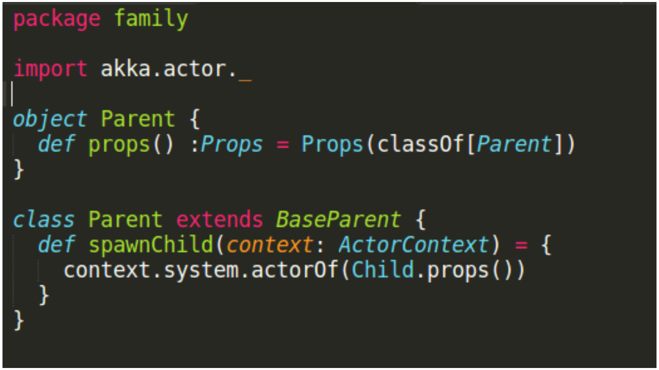
```
bernhard@bernhards-thinkpad ~/Dokumente/Officetalk/scala_
[info] Set current project to Actors (in build file:/home
[info] Compiling 1 Scala source to /home/bernhard/Dokumen
[info] Running runtime.Main
Hello World
[success] Total time: 4 s, completed 03.11.2016 16:53:15
bernhard@bernhards-thinkpad ~/Dokumente/Officetalk/scala_
```

Actors in Scala



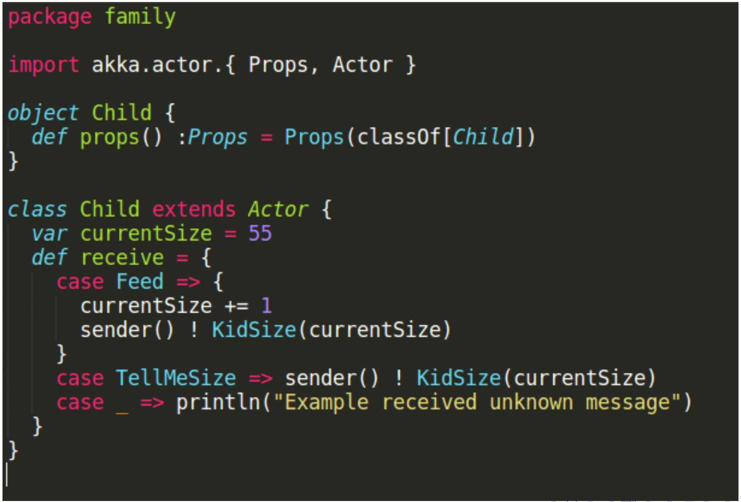
```scala
package family

import akka.actor._

trait BaseParent extends Actor {
  def spawnChild(context: ActorContext) :ActorRef

  var child = respawnChild

  def receive = {
    case MeasureKidSize => child ! TellMeSize
    case FeedKid => child ! Feed
    case KillKid => child ! PoisonPill
    case KidSize(size) => println("The child is " + size + "cm tall!")
    case Terminated(childActor) => {
      println("Child actor died. Respawn!")
      child = respawnChild
    }
    case _ => println("Example received unknown message")
  }

  def respawnChild = {
    val childActor = spawnChild(context)
    context.watch(childActor)
    childActor
  }
}
```

Actors in Scala



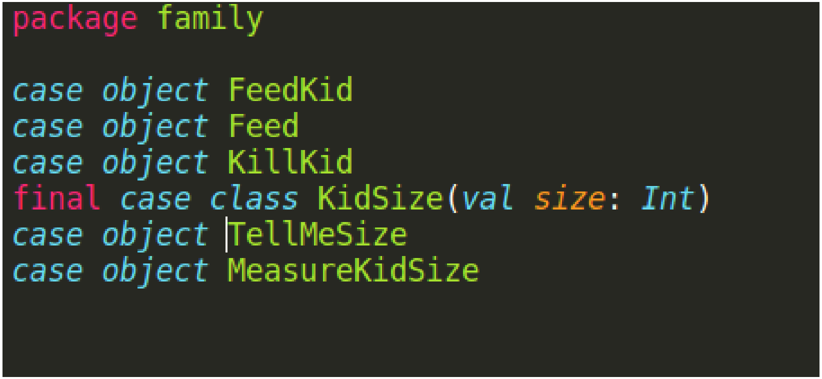
```scala
package family

import akka.actor._

object Parent {
  def props() :Props = Props(classOf[Parent])
}

class Parent extends BaseParent {
  def spawnChild(context: ActorContext) = {
    context.system.actorOf(Child.props())
  }
}
```

Actors in Scala



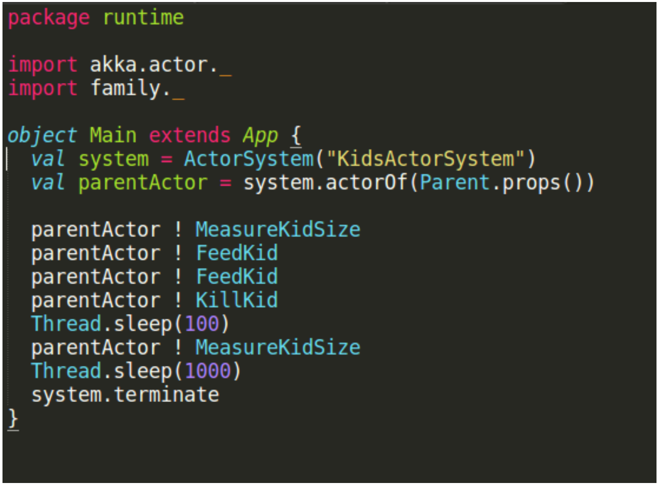
```scala
package family

import akka.actor.{ Props, Actor }

object Child {
  def props() :Props = Props(classOf[Child])
}

class Child extends Actor {
  var currentSize = 55
  def receive = {
    case Feed => {
      currentSize += 1
      sender() ! KidSize(currentSize)
    }
    case TellMeSize => sender() ! KidSize(currentSize)
    case _ => println("Example received unknown message")
  }
}
```

Actors in Scala



```
package family

case object FeedKid
case object Feed
case object KillKid
final case class KidSize(val size: Int)
case object TellMeSize
case object MeasureKidSize
```

Actors in Scala



```scala
package runtime

import akka.actor._
import family._

object Main extends App {
  val system = ActorSystem("KidsActorSystem")
  val parentActor = system.actorOf(Parent.props())

  parentActor ! MeasureKidSize
  parentActor ! FeedKid
  parentActor ! FeedKid
  parentActor ! KillKid
  Thread.sleep(100)
  parentActor ! MeasureKidSize
  Thread.sleep(1000)
  system.terminate
}
```

Summary

Elixir	Scala
• BEAM	• JVM
• Everything is immutable	• Choice between mutable and immutable
• Actors are recursive functions	• Actors are objects
• Actors are independent from each other	• Actors are organized in a tree structure
• Errors are handled by supervisor only	• Errors are handled or escalated to parent actor

Summary

Scala

- ... is faster regarding pure computation speed

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- ... can use eco system of all JVM languages

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Scala

- ... is faster regarding pure computation speed
- ... can use eco system of all JVM languages
- ... is conceptual easier for beginners due to object orientation

Summary

Elixir

- ...'s BEAM is optimized for actor handling

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- ... is much easier to test

Summary

Elixir

- ...'s BEAM is optimized for actor handling
- ... is more pragmatic (get things done much faster)
- ... is much easier to test
- ... can use Erlang eco system

Summary

Actors

- ... are fault tolerant

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- ... are fault tolerant
- ... asynchronous

Summary

Actors

- ... are fault tolerant
- ... asynchronous
- ... scalable

Summary

Actors

- ... are fault tolerant
- ... asynchronous
- ... scalable
- ... efficient (garbage collection)

The End