Scala cruise

Snorkelling in some of the Scala features

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Itinerary

1. Let's meet Scala
2. Tools
3. The Play framework
4. Learn more

Let's meet Scala

Figure 1: Martin Odersky, the creator of Scala

Scala programming language is:

- general purpose
- strongly statically typed (with type inference)
- compiling primarily to JVM 8+ bytecode[1]
- interoperable with Java 8+

[1] `scala.js` compiles to JS; `scala native` targets LLVM; jdk 9+ compatibility might require support; there is a Scala REPL.

Scala supports

- OOP
- FP

```
val value : Int  = 2;
val text : String = "hello";
```

```
val value : Int  = 2
val text : String = "hello"
```

```
val value = 2
val text = "hello"
```

```
val value = 2
val text = "hello"

print(text)
print(s"$value-$text") // string interpolation
print(s"${value*2}")
```

```
var value = 2
val text = "hello"

value = 4
text = "hello" // !!! forbidden
```

```
def square(x : Int) : Int = {
  return x*x
}
```

```
def square(x : Int) = x*x
```

```
def abs(x : Int) =
  if (x >= 0) // if statement
    x
  else
    -x
```

```
def id(x : Int) : Int = {
  if (x >= 0) { // if control flow  (imperative)
    print(s"$x")
  }
  x
}

id(-2)
id(2)
```

```
def square(x : Int) = x*x

square(2+3+4) // <-- how is this evaluated?
```

```
def div(x : Double) : Double = 1/x

div(1) // 1
div(2) // 0.5
div(0) // java.lang.ArithmeticException: / by zero
```

```
def div(x : Double) : Double =
  if ( x != 0 )
     1/x
  else
     null // !!!
```

```
def div(x : Double) : Option[Double] =
  if ( x != 0 )
     Some[Double](1/x)
  else
     None
```

```
def div(x : Double) : Option[Double] =
  if ( x != 0 )
     Some(1/x)
  else
     None
```

```
def div(x : Double) =
  if ( x != 0 )
     Some(1/x)
  else
     None
```

```
def square(x : Double) = x*x

def div(x : Double) =
  if ( x != 0 ) Some(1/x) else None

square(div(3)) // !! Type mismatch

val twice = 2*div(3) // !! Type mismatch
```

```
def div(x : Double) =
  if ( x != 0 ) Some(1/x) else None

val twice : Option[Double]
   = div(3).map( value => 2*value)
```

```
def div(x : Double) =
  if ( x != 0 ) Some(1/x) else None

div(3).map(2*_)
```

```
def square(x : Int) = x*x

def div(x : Int) =
  if ( x != 0 ) Some(1/x) else None

div(0).map(value => square(value))
div(0).map(square)
```

```
def div(x : Double) =
  if ( x != 0 ) Some(1/x) else None

def someFunction(x : Double) : Option[Double] = ???

div(0).flatMap(anotherFunction)
```

Crash course in Monads

All told, a monad is just a monoid in the category of endo-functors

S. Mac Lane

Monads are return types at guide you through the happy path

E. Mejier

Monads are like burritos

Brent Yorgey

```
def f(a:A) : Future[B]
def g(b:B) : Future[C]

val a : A = ???

f(a).flatMap(g)
```

- Option[Option[A]] $\rightarrow$ Option[A]
- Future[Future[A]] $\rightarrow$ Future[A]
- List[List[A]] $\rightarrow$ List[A]

Compare this to *ad-hoc* Kotlin syntax for nullable types

```
var value : Int? = 0

value?.let { it }
```

```scala
// value classes
class ProductId(val id: Int) extends AnyVal

// case classes
case class ProductDetails(
  id: ProductId,
  description: String
) // notice: no val/var
```

```
def fetchIds() : Future[Seq[ProductId]] = ???

def fetchDetails(ids : Set[ProductId])
    : Future[Map[ProductId, ProductDetails] = ???

def hydrate() =
    fetchIds().flatmap( ??? )
```

There is much more than that in terms of language features:

- higher order functions
- currying
- different evaluation strategies (call by value vs call by name)
- immutable collections
- pattern matching
- algebraic data types (sealed traits, etc)
- variance and contravariance
- value classes
- for comprehension
- implicits ...

In additionI to language features, there is the Scala ecosystem of libraries:

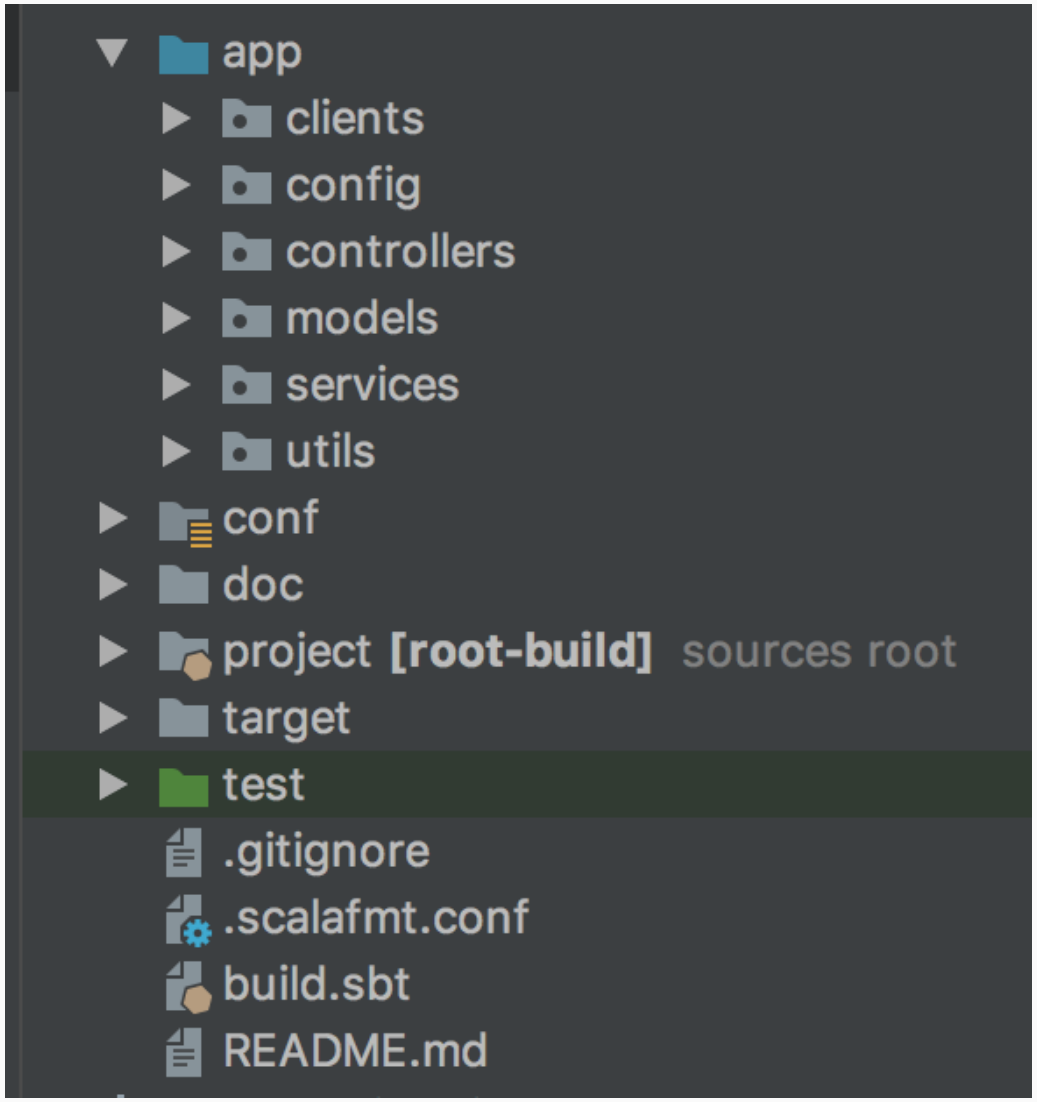
- Akka HTTP
- Akka actors
- scalaz
- cats
- etc

Tools

- IDE: intellij with Scala plugin
- Build tool: sbt
- Tests: scalatest vs specs2

The Play framework

Structure of a Play project



Routes file

```
GET    /fetch/:id
         controllers.Controller.fetch(id: Int)
```

A taste of contract driven development:

- apiary / blueprint
- dredd testing (local / staging)

Controllers: keep them simple

```
@Singleton // JSR 330, guice by default
class ProductClient @Inject()(wsClient: WSClient)
  (implicit ex: ExecutionContext) { // implicits !!

  def fetch() =  // using  Play wsclient
    wsClient.url("http://test.com").get()

}
```

There is much more than this:

- Json serialization/deserialization
- From futures to HTTP response codes (200, non-200)
- etc

Learn more

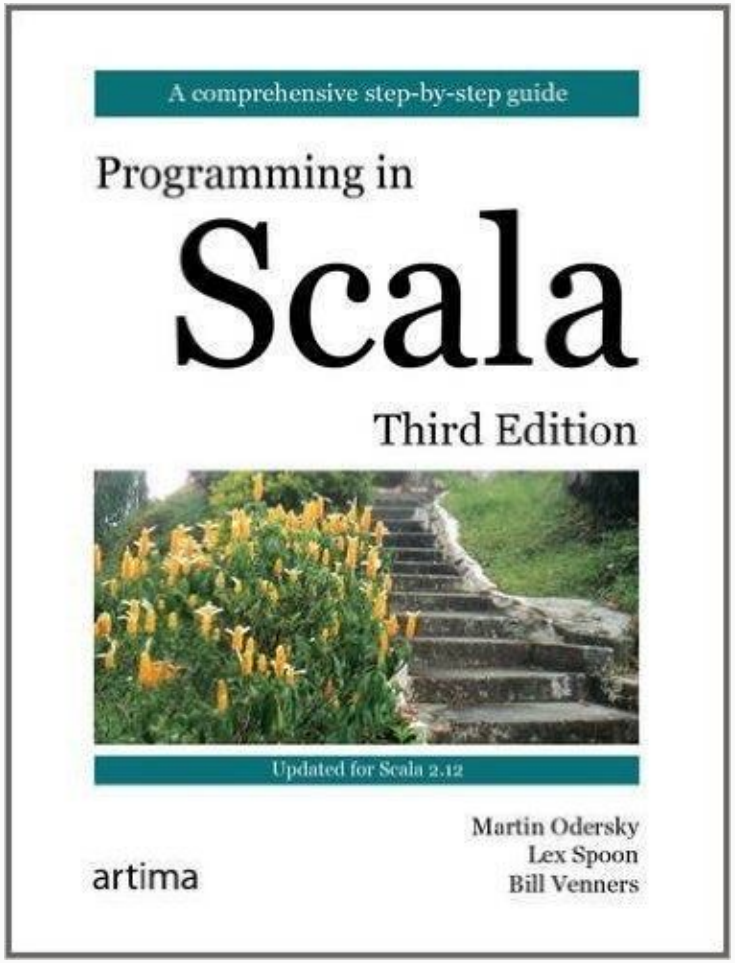


Figure 2: The reference guide

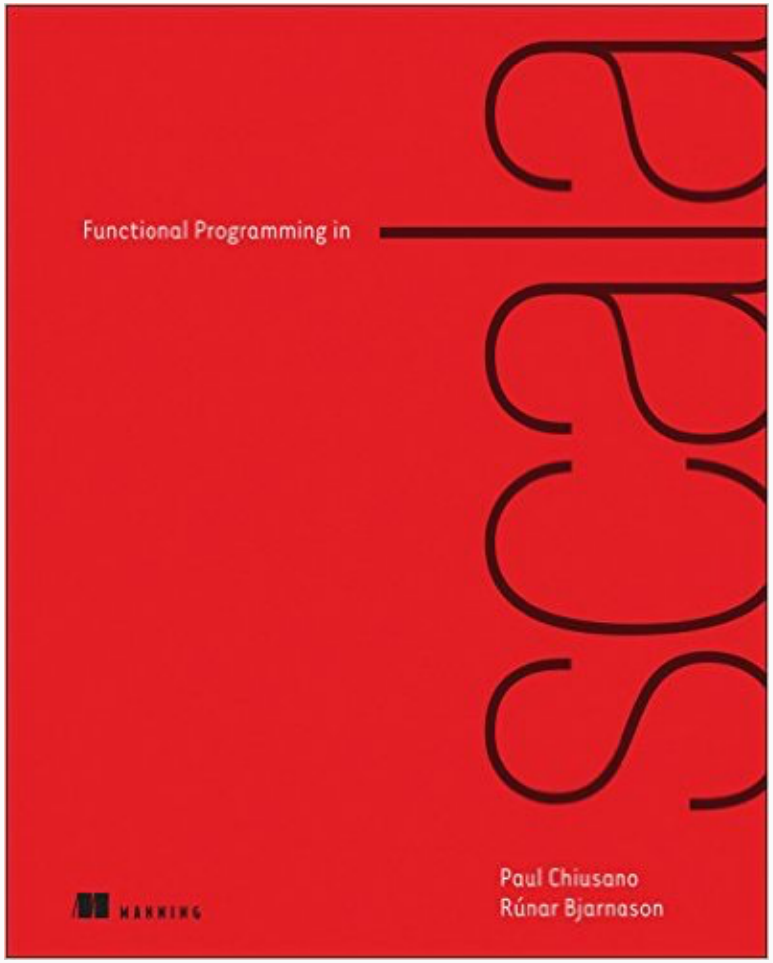


Figure 3: Gym to master FP in Scala

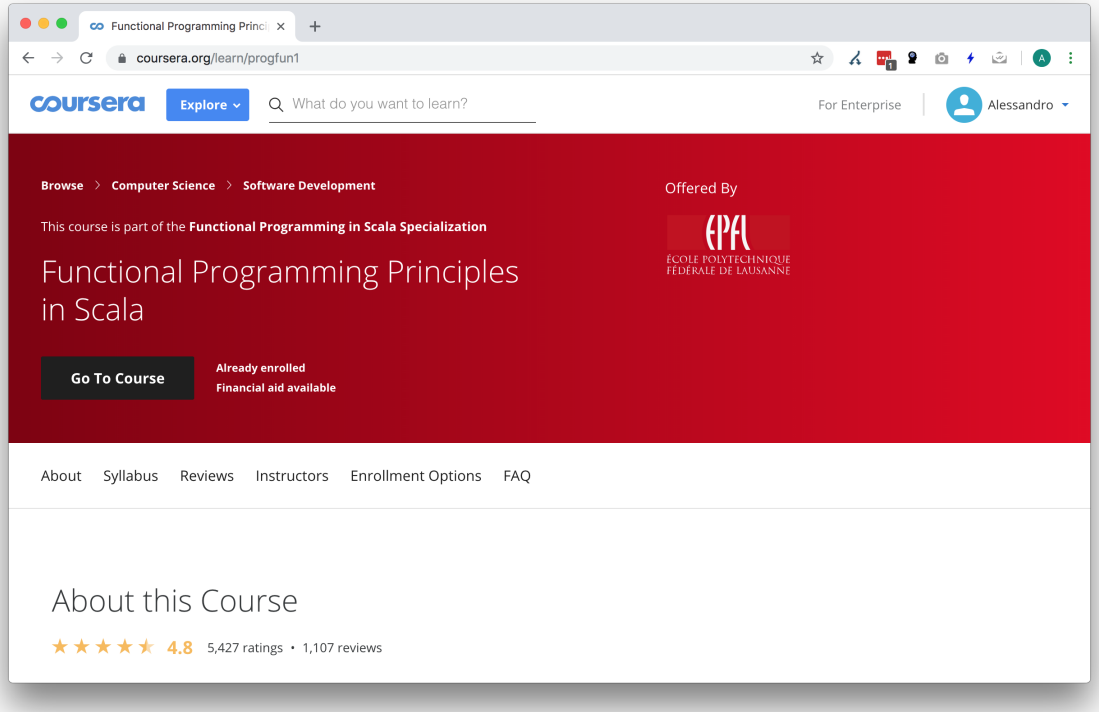


Figure 4: Functional programming principles in Scala MOOC by Martin Odersky

Online exercises:

- `https://www.scala-exercises.org/`
- `http://www.scalakoans.org/`

If you are interested in FP in Scala with attention to mathematical details...

Sergei Winitzki's *Functional programming in the mathematical spirit* video tutorials .

"Long and difficult, yet boring explanations given in excruciating detail." (quoting from the posts)

First lecture here:

- `https://www.youtube.com/watch?v=0Ld79Lnzx_o`

Questions?