

Scala cruise

Snorkelling in some of the Scala features

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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+ bytecode¹
- interoperable with Java 8+

¹scala.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[Double]
```

```
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 endofunctors

S. Mac Lane

Monads are return types at guide you through the happy path

E. Meijer

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)
```

```
// 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( ??? )
```

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

```
var value : Int? = 0
```

```
value?.let { it }
```


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)
- value classes
- for comprehension
- implicits ...

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

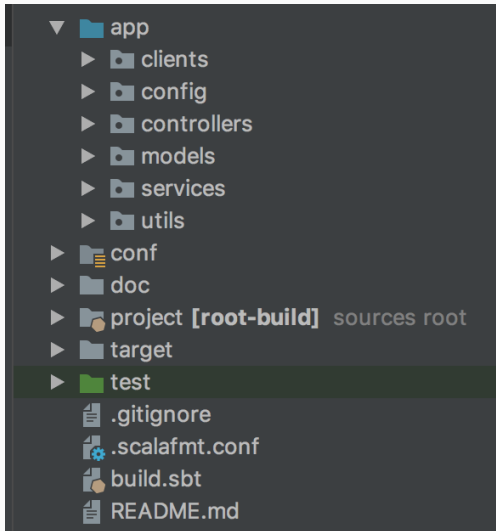
- Akka HTTP
- Akka actors
- scalaz
- cats
- etc

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: WSCClient)
  (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

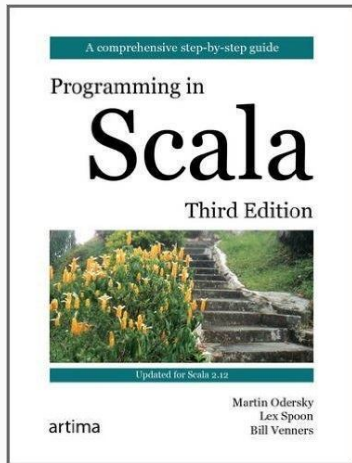


Figure 2: The reference guide



Figure 3: Gym to master FP in Scala

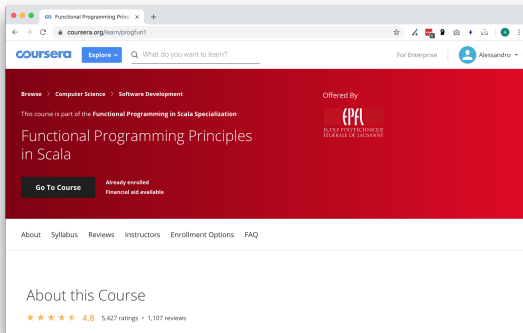


Figure 4: Functional programming principles in Scala MOOC by Martin Odersky

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?