Get rid of the boilerplate with Scala

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What's boilerplate?

What's boilerplate?

Something you have to write but you don't want to

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Like what?

Like this

```html
<!DOCTYPE html>
<html class="no-js" lang="">
<head>
  <meta charset="utf-8">
  <meta http-equiv="x-ua-compatible" content="ie=edge">
  <title></title>
  <meta name="description" content="">
  <meta name="viewport" content="width=device-width, initial- scale=1, shrink-to-fit=no">
  <link rel="stylesheet" href="css/main.css">
</head>
```

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How to identify boilerplate?

Boilerplate characteristics

- repetitive

- unnecessary

- burdensome

Is it a real problem?

What's your opinion?

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Seems it is

2015 study on popular Java projects shows that 60% of methods can be uniquely identified by the occurrence of 4.6% of its tokens, making the remaining 95.4% boilerplate irrelevant to logic

Martin Velez; Dong Qiu; You Zhou; Earl T. Barr; Zhendong Su (5 Feb 2015). "On the Lexical Distinguishability of Source Code" https://arxiv.org/abs/1502.01410

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Can we really avoid it?

Let's give it a try!

Get rid of boilerplate with Scala

What's scala anyway

- Functional and Object oriented

- concise, high-level language

- statically typed

- runs on JVM, JS and Native with LVM

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How does it help?

Let's see some examples,

Take the good old `hello world` for starters

Java

```java
public class MyMainClass {
    public static void main(String[] args) {
        System.out.println("Hello World!");
    }
}
```

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Python

```python
def main():
    print("hello world")

if __name__ == '__main__':
    main()
```

Python

```python
def main():
  print("hello world")

# this might be omitted depending how Pythonic you feel
if __name__ == '__main__':
  main()
```

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Scala

```scala
@main
def main() =
  println("hello world")
```

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Which one did you like the most?

Let's move on to something more serious

Do you have pets at home?

Because we're gonna model one

Let's model a Pet

Nothing sophisticated, any pet, it has a `name` and an `owner`

Java

```java
public class Pet {
        private String name;
        private String owner;

        public Pet(String name, String owner) {
                this.name = name;
                this.owner = owner;
        }

        public String getName() {
                return name;
        }

        public void setName(String name) {
                this.name = name;
        }

        public String getOwner() {
                return owner;
        }

        public void setOwner(String owner) {
                this.owner = owner;
        }
}
```

Python

```python
class Pet:

    def __init__(self, name, owner):
        self.__name = name
        self.__owner = owner
```

Scala

```scala
case class Pet(owner: String, name: String)
```

Maybe it's the problem with the types then?

Python seems to be doing well in those comparisons

Not exactly

```python
from dataclasses import dataclass

@dataclass()
class Pet:
    name: str
    owner: str

doge = Pet("Doge", "Adam")

doge.name = 128

print(doge)
```

Output

```
Pet(name=128, owner='Adam')
```

Types are not a boilerplate

They make the compiler help you verify the correctness of the program

Speaking of the type system

Scala can do a lot in the compile time

Refined types

Let's model part of the order

Order Line

```scala
case class UnsafeOrderLine(product: String, quantity: Int)

// Valid order line, we want those!
UnsafeOrderLine("123", 10)

// Wait that's illegal
UnsafeOrderLine("", 10)
UnsafeOrderLine("banana", -2)
// ☝ this will cause runtime errors 😱
```

Even with types, the correctness is not verified

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Order Line with validation

```scala
case class UnsafeOrderLine(product: String, quantity: Int)

object UnsafeOrderLine {

  def safeApply(product: String, quantity: Int): UnsafeOrderLine =
    if (product.isEmpty())
      throw new RuntimeException("Product is empty")
    else if (quantity <= 0)
      throw new RuntimeException("Quantity lower than 1")
    else
      UnsafeOrderLine(product, quantity)

}

// Works fine!
UnsafeOrderLine.safeApply("123", 10)
// Throws runtime exception 👇
UnsafeOrderLine.safeApply("", 10)
```

Is there any boilerplate?

Let's try with refined types

```scala
import eu.timepit.refined.auto._
import eu.timepit.refined.types.string._
import eu.timepit.refined.types.numeric._

case class OrderLine(product: NonEmptyString, quantity: PosInt)
OrderLine("123", 10) // Returns OrderLine
OrderLine("", 10) // Doesn't compile
```

With https://github.com/fthomas/refined library for refined types

Even the complete order model

```scala
import cats.data.NonEmptyList
import eu.timepit.refined.api.Refined
import eu.timepit.refined.auto._
import eu.timepit.refined.types.string._
import eu.timepit.refined.types.numeric._

case class OrderLine(product: NonEmptyString, quantity: PosInt)
case class Order(orderId: String Refined Uuid, lines: NonEmptyList[OrderLine])
```

- The compiler verifies the correctness

- No need to write code for validation

- Less code ↔ Less tests

- Interoperability with serialization libs for JSON, XML, Databases etc.

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What makes Scala concise

Let's see a few more techniques that make the code type safe and yet not bloated

Type inference

To make the statically typed language feel like a dynamic one, it needs to be able to guess the types for you

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Type inference

```
val list = List(1, 2, 3)
// is an equivalent to
val list: List[Int] = List(1, 2, 3)
```

Notice how we didn't even need to do `List[Int](1, 2, 3)`,

the compiler has deduced it

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Type inference

```scala
val coordinates = Map(
  "Wrocław" -> (51.107883, 17.038538),
  "Kraków" -> (50.049683, 19.944544)
)
// is an equivalent to
val coordinates: Map[String, (Double, Double)] = Map(
  "Wrocław" -> (51.107883, 17.038538),
  "Kraków" -> (50.049683, 19.944544)
)
```

And so on with even more complex types

Pattern matching

Do you still remember constructs like `switch / case` ?

Pattern matching

Imagine a flow control structure so powerful it can inspect the value, runtime type and even the internal structure of a type

Pattern matching

The simplest example

```
def matchInt(x: Int) = x match {
  case 1 => "one"
  case 2 => "two"
  case _ => "other"
}
```

Pattern matching

Decomposing objects

```scala
def matchList(l: List[Int]) = l match {
  case List(1, 2, 3)                    => "one, two three"
  case 1 :: 1 :: 2 :: 3 :: 5 :: _       => "starts like Fibonacci"
  case anything if anything.forall(_ > 0) => "list of positive numbers"
  case List(9, 9, x)                    => s"nine nine and $x"
  case _                                => "just a list"
}
```

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One more exercise

Remember the Pet model?

It was too generic, let's see how we could model an extensible enum in Scala

Animals

```
enum Animal(name: String):
  case Dog(name: String) extends Animal(name)
  case Burek extends Animal("Burek")
  case Cat(name: String) extends Animal(name)
  case Horse(name: String, weight: Double) extends Animal(name)
  case Snake(name: String, length: Double) extends Animal(name)
```

The enum as you know them, but each implementation can have it's own properties

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Let's play with it a bit

Write a function that takes a sequence of animals, and only returns:

- Cats whose name starts with an `"A"`
- Snakes longer than `1.5m`

The filter

Here comes the power of pattern matching

```scala
def filterAnimals(animals: Seq[Animal]) =
  animals.collect {
    case cat @ Cat(name) if name.startsWith("A")  => cat
    case snake @ Snake(_, length) if length > 1.5 => snake
  }
```

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Let's test it

```scala
import Animal.*

@main
def main() =
  val testData = List(
    Dog("Doge"), Burek, Cat("A"), Cat("B"),
    Snake("Python", 2.0), Snake("Snek", 0.5)
  )
  println(filterAnimals(testData))
```

Output

```
List(Cat(A), Snake(Python,2.0))
```

One more case for boilerplate

Extending someone else's API

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One more case for boilerplate

Extending someone else's API

Say you want to be able to find odd numbers on any `List[Int]`

Extension methods

In this case `List` is a class that comes from library, but let's extend it

```scala
extension (x: List[Int])
  def odds = x.filter(_ % 2 == 1)
```

Extension methods

```scala
extension (x: List[Int])
  def odds = x.filter(_ % 2 == 1)

@main
def main() =
  val testData = (1 to 10).toList
  println(testData.odds)
```

Output

```
List(1, 3, 5, 7, 9)
```

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Extension methods

Notice how selectively we can extend the imported APIs. If we switch to `List[String]` the compiler will prevent us from making a mistake

```scala
extension (x: List[Int])
  def odds = x.filter(_ % 2 == 1)

@main
def main() =
  val testData = List("123", "456")
  println(testData.odds)
```

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Extension methods

Compiler error:

```
value odds is not a member of List[String].
An extension method was tried, but could not be fully constructed:

    odds(testData)    failed with

        Found:    (testData : List[String])
        Required: List[Int]
  println(testData.odds)
          ^^^^^^^^^^^^^
```

There's a lot more

- No more `null`s with `Option`

- Union types and match types

- Async with `Future`, `IO` or `ZIO`

- Typeclass derivation

- Type safe metaprogramming

Try it for yourself

Thank you!

- https://blog.michalp.net

- https://hostux.social/@majkp

- https://github.com/majk-p