Scala for Java developers

– A three-hour crash course

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Agenda

Background

The aim of Scala: A scalable, pragmatic, real-world language

- en.wikipedia.org/wiki/Scala progrogramming language
- **Multi-paradigm: object-oriented, functional, imperative, concurrent**
- **Designed by: Martin Odersky**
- **Developer: EPFL, Lightbend, OSS**
- **First appeared: January 20, 2004**
- **Stable release: 2.11.8 / March 8, 2016**
- **Typing: static, strong, inferred, structural**
- **Platform: JVM, JavaScript**
- **License: BSD 3-clause**
- **File ext: .scala**
- **Official site:** www.scala-lang.org/

Scala History

Heritage: Algol, Modula-2, Simula, Pizza, Java, Beta, OCaml, Haskell, ...
Time line:

- 2004: 1.0, 1.1, 1.2, 1.3
- 2005: 1.4
- 2006: 2.0, 2.1, 2.2, 2.3; **`scalac` written in Scala**
- 2007: 2.4, 2.5, 2.6
- 2008: 2.7;
- 2010: 2.8; **Play** gets a scala plug-in, **Akka**
- 2011: 2.9; **Typesafe**; **`scala.collection.parallel`**, Play in Scala
- 2013: 2.10 value classes, implicit classes, string interpolators, `Try`, `Future`, `Promise`, `Dynamic`, Akka actors
- 2014: 2.11; optimizations; 10x faster compilation
- 2016: 2.12; Java 8, Scala.js, **Scala Center**@EPFL, **Lightbend**

[Bill Venners, Frank Sommers]

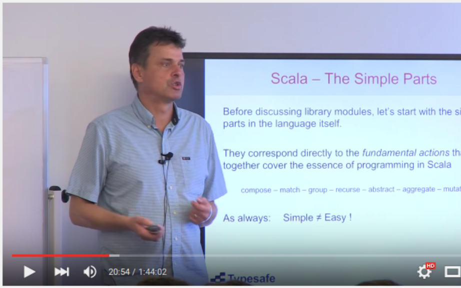
[Marconi Lanna]

Scala – the simple parts

Lecture by **Martin Odersky**: www.youtube.com/watch?v=ecekSCX3B4Q

Scala for every-day dev actions:

1. **Compose:** everything is a composable **expression**
2. **Match:** decompose data with **pattern**-matching
3. **Group:** everything can be grouped and **nested**
4. **Recurse:** compose at any depth; better loops `@tailrec`
5. **Abstract:** functions are objects
6. **Aggregate:** collections aggregate & **transform** data
7. **Mutate:** local, private mutability to optimize perf.


Scala – The Simple Parts

Before discussing library modules, let's start with the si
parts in the language itself.

They correspond directly to the *fundamental actions* th
together cover the essence of programming in Scala

compose – match – group – recurse – abstract – aggregate – mutat

As always: Simple ≠ Easy !

SF Scala: Martin Odersky, Scala -- the Simple Parts

Some similarities between Scala and Java

- Both are object-oriented and imperative
- Both are statically typed (~ 100 times faster than Python)
- Both have C-like block syntax { }
- Both have lambdas (Java 8)
- Both run on the JVM
- Both can execute each other’s byte code

Some differences between Scala and Java

- Scala is a more ”pure” OO language:
  instances of `Int, Double, Char`, etc. are **real objects**
- Scala is a more advanced functional language:
  easy to transform immutable data in functional collections
- Scala unifies OO and functional programming:
  functions are objects with an `apply`-method
- singelton **`object`** instead of Java’s `static`
- Some syntax differences:

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- Some syntax differences:
  - semicolons are inferred; newline btw statements is enough
  - no need for `return` as blocks are values
  - Type *after* names and colon: `val name: String = "Kim"`
  - generic types in `[T]` instead of <T>
  - Five types of members: `def`, `val`, `lazy val`, `var`, `type`
    Methods: `def isChild: Boolean = age < 18`
    Immutable fields: `val gender = "Female"`
    Delayed init: `lazy val r = List.fill(1000)(math.random)`
    Mutable fields: `var age: Int = 42`
    Type alias: `type Matrix = Map[Int, Map[Int, String]]`

Classes in Java and Scala

```java
// this is Java

public class JPerson {
    private String name;
    private int age;

    public JPerson(String n, int a) {
      name = n;
      age = a;
    }

    public JPerson(String n) {
      name = n;
      age = 42;
    }

    public String getName() {
      return name;
    }

    public int getAge() {
      return age;
    }

    public void setAge(int a) {
      age = a;
    }
}
```

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      name = n;
      age = 42;
    }

    public String getName() {
      return name;
    }

    public int getAge() {
      return age;
    }

    public void setAge(int a) {
      age = a;
    }
}
```

```scala
// same in (non-idiomatic) Scala

class SPerson(n: String, a: Int) {
  private var name: String = n
  private var age: Int = a

  def this (n: String): Unit = {
    this(n, 42)
  }

  def getName = name

  def getAge = age

  def setAge(a: Int): Unit = {
    age = a
  }
}
```

Classes in Java and Scala

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// this is Java

public class JPerson {
    private String name;
    private int age;

    public JPerson(String n, int a) {
      name = n;
      age = a;
    }

    public JPerson(String n) {
      name = n;
      age = 42;
    }

    public String getName() {
      return name;
    }

    public int getAge() {
      return age;
    }

    public void setAge(int a) {
      age = a;
    }
}
```

```scala
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class SPerson(n: String, a: Int) {
  private var name: String = n
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  def this (n: String): Unit = {
    this(n, 42)
  }

  def getName = name

  def getAge = age

  def setAge(a: Int): Unit = {
    age = a
  }
}
```

```scala
// this is idiomatic Scala

case class Person(
  name: String,
  age: Int = 42
)
```

Live coding: code-along

Start the REPL:

```
$ scala
Welcome to Scala 2.11.8 (Java HotSpot(TM) VM, Java 1.8.
Type in expressions for evaluation. Or try :help.

scala> case class Person(name: String, age: Int = 42)
defined class Person

scala> Person("Björn", 48)
res0: Person = Person(Björn,48)

scala> Person("Kim")
res1: Person = Person(Kim,42)
```

Functions are first-class values; Try this in REPL:

```
def öka(i: Int) = i + 1

val nums = Vector(1, 2, 3, 4, 42)

nums.map(öka)

nums.map(i => i + 1)

nums.map(_ + 1)

def mappa(xs: Vector[Int], f: Int => Int) = xs.map(f)

mappa(nums, öka)

def upprepa(n: Int)(block: => Unit) = for (i <- 1 to n) block
```

Overview of new LTH Course EDAA45 (was EDA016)

Open Source project, on-going course dev:
https://github.com/lunduniversity/introprog

W	*Modul*	*Övn*	*Lab*
W01	Introduktion	expressions	kojo
W02	Kodstrukturer	programs	–
W03	Funktioner, Objekt	functions	simplewindow
W04	Datastrukturer	data	textfiles
W05	Sekvensalgoritmer	sequences	cardgame
W06	Klasser, Likhet	classes	shapes
W07	Arv, Gränssnitt	traits	turtlerace-team
KS	KONTROLLSKRIVN.	–	–
W08	Mönster, Undantag	matching	chords-team
W09	Matriser, Typparametrar	matrices	maze
W10	Sökning, Sortering	sorting	surveydata-team
W11	Scala och Java	scalajava	scalajava-team
W12	Trådar	threads	life
W13	Design	Uppsamling	Inl.Uppg.
W14	Tentaträning	Extenta	–
T	TENTAMEN	–	–

Workshop: Exercises in Scala

Test our **DRAFT** exercises in Scala:

github.com/lunduniversity/introprog/blob/master/compendium/exercises.pdf

Feedback welcome!

1. Övning **`expressions`**: skim and jump to 17 stringinterp., 19 if, 20 for, 21 foreach, 22 while, 35 scaladoc, 36 stringinterp.
2. Övning **`programs`**: 1 Range, 2 Array, 3 Vector, 4 for-expr, 5 map, 6 foreach, 9 hello app, 11 a)-c) sumbug, 13 name space
3. Övning **`functions`**: 1–15, 18, 19, 21–23
4. Övning **`data`**: 1–4, 6–18, 20, 21, 27, 28
5. Övning **`sequences`** (only half-ready) – 1, 4, 7

If time permits:
We will close with live coding of some more advanced aspects