The Scala programming ecosystem

Leveraging functional, OO, libraries and frameworks

Markus Dale, 2016

Scala - The Good

The Scala Programming Language

- Martin Odersky, EPFL, Switzerland
  - Worked on javac (1.3)
  - Java Generics
- Lightbend (formerly Typesafe)
- Multi-paradigm language
  - Functional and Object-Oriented
- Statically typed
- Scalable language - script to large program
- Stretch your mind - functions and immutability

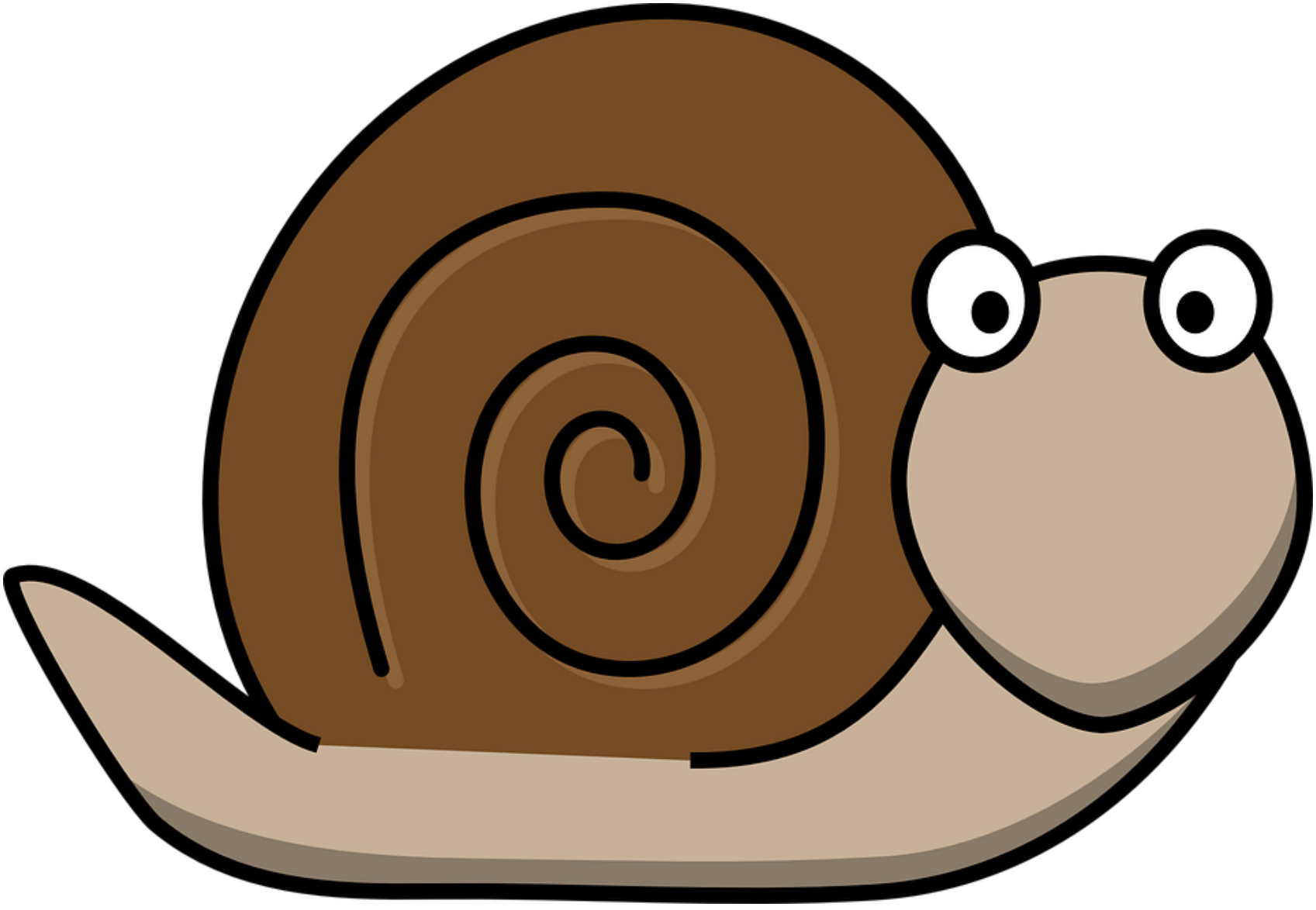
Sca(lable) la(nguage)

- Apache Kafka (LinkedIn)
- Apache Spark (Databricks)
- Finagle (Twitter)
- Akka (Lightbend)
- Lucid Software - scala.js presentation
- Play Web Framework
  - Lichess Online Chess
- Lightbend customers: Walmart, Verizon, Twitter, LinkedIn, Coursera, The Guardian, Airbnb...

Scala to Java bytecode

- Leverage Java Virtual Machine (JVM)
  - Over 20 years of optimizations
  - Java Interpreter and Just-in-time (JIT) compilers
  - Portability and Security
  - Ever-evolving garbage collectors
- Full interoperability with Java and Java libraries

Exploration - Scala Shell and Worksheet



Scala Tour

- Conciseness
- Mixed Paradigms
  - Object Oriented
  - Functional
- Options, Collections
- Functional Pattern Matching
- Implicits
- Spark

Vals and vars but no semicolons

```
val helloWorld = "Hello, Scala World!"

//vals are immutable
//helloWorld2 = "this is a different string"

val names = List("Markus", "Joe", "Jane")

//vars are mutable
var allHellos = ""

names.foreach(name =>
    allHellos += s"Hello, ${name}! ")

println(allHellos)
> Hello, Markus! Hello, Joe! Hello, Jane!
```

Defining a function, higher-order functions

```
def hasAtLeastThreeLetters(input: String): Boolean = {
    if ((input != null) && (!input.isEmpty)) {
        val letters = input.filter(c => c.isLetter)
        letters.size >= 3
    } else {
      false
    }
}
```

Calling a function - syntactic sugar

```
val testInputs = List(null, "", "lower", "Upper")

testInputs.map((input: String) =>
    hasAtLeastThreeLetters(input))

testInputs.map((input) =>
        hasAtLeastThreeLetters(input))

testInputs.map(input => hasAtLeastThreeLetters(input))

testInputs.map(hasAtLeastThreeLetters(_))

testInputs.map(hasAtLeastThreeLetters)
> res0: List[Boolean] = List(false, false, true, true)
```

Assigning functions/function literals to variables

```
val vowels = List('a','e','i','o','u')

val threeLs: String => Boolean = hasAtLeastThreeLetters

threeLs("abcd")
> res1: Boolean = true

val removeVowels: (String) => String = { (str) =>
    str.filter(c => !vowels.contains(c))
}

val removeNonLetters: String => String = { str =>
    str.filter(c => c.isLetter)
}

removeVowels("wabbit")
> res2: String = wbbt
```

Everything's an object, more syntactic sugar, == equality

```
3 * 10

3.*(10)

1 to 10
1.to(10)
> res2: scala.collection.immutable.Range.Inclusive =
 Range(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

val foo = "foo"
val bar = new String("foo")

foo == bar
```

Built-in tuples

```
val tuple = ("hello", 42)

val tuple2: (String, Int) = ("hello", 42)

val tuple3: Tuple2[String, Int] = ("hello", 42)

val triple = ("123-22-2111", "Joe", "443.998.8899")

tuple._1
tuple._2

val (word, count) = tuple
> word: String = hello
> count: Int = 5
```

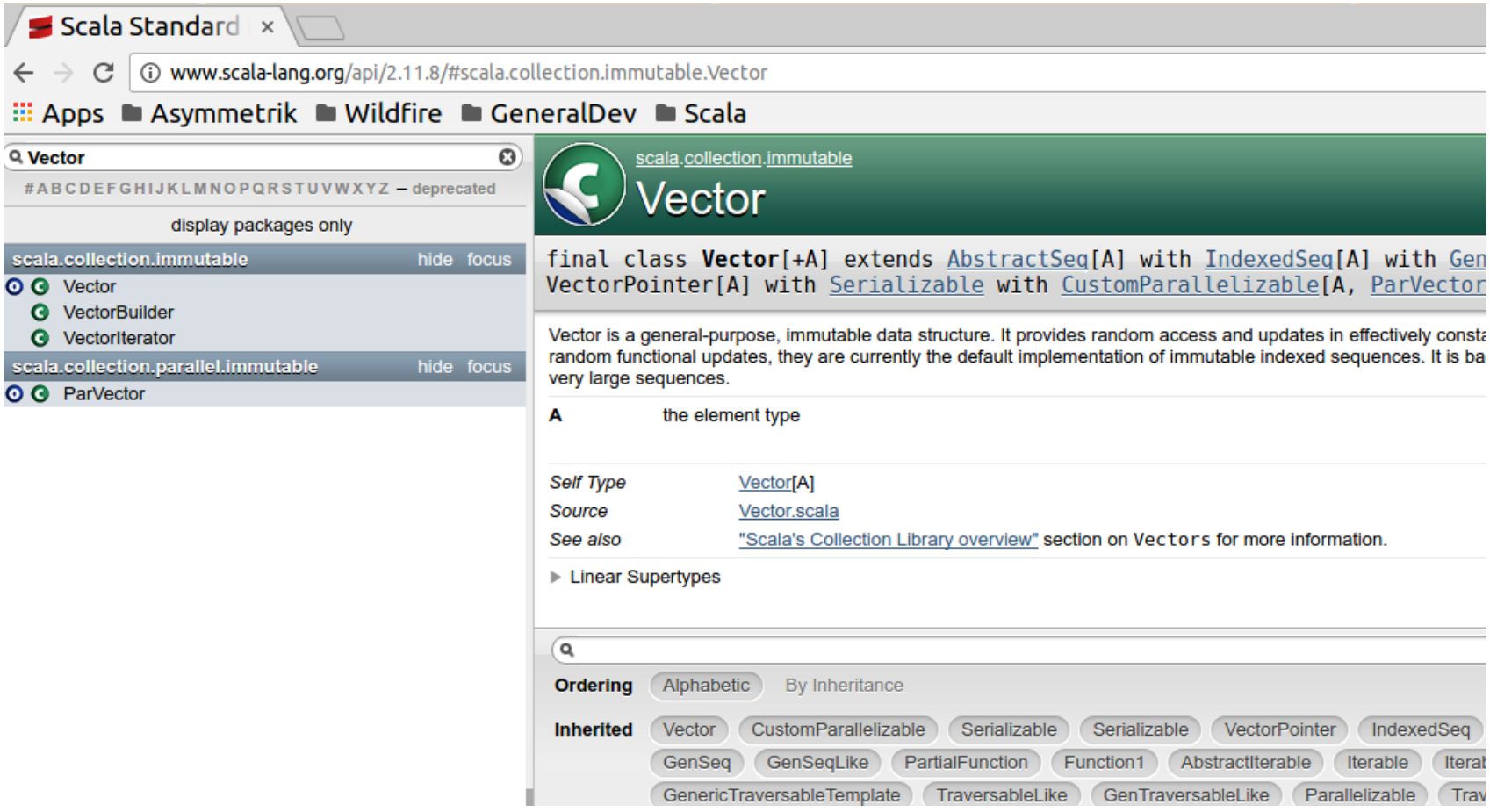
Options - no more NullPointerExceptions!

```
val portOpt: Option[Int] = Some(5123)
val port2Opt: Option[Int] = None
portOpt.get
> res0: Int = 5123

port2Opt.get -
> java.util.NoSuchElementException: None.get

port2Opt.getOrElse(3306)
> res1: Int = 3306

portOpt.foreach(port => println(s"opening port ${port}"))
> res2: Unit = ()

Option(null)
> res3: Option[Null] = None
```

scalatour/06-Collections

- Array
- Immutable, mutable data structures
  - List
  - Higher-order functions
    - filter, map, flatMap, reduce, fold...
  - Map
  - Set, Vector...

Scala Docs


Scala Standard
www.scala-lang.org/api/2.11.8/#scala.collection.immutable.Vector
Apps
Asymmetrik
Wildfire
GeneralDev
Scala
Vector
#ABCDEFGHIJKLMNOPQRSTUVWXYZ – deprecated
display packages only
scala.collection.immutable hide focus
Vector
VectorBuilder
VectorIterator
scala.collection.parallel.immutable hide focus
ParVector
scala.collection.immutable
Vector
final class Vector[+A] extends AbstractSeq[A] with IndexedSeq[A] with Gen
VectorPointer[A] with Serializable with CustomParallelizable[A, ParVector
Vector is a general-purpose, immutable data structure. It provides random access and updates in effectively consta
random functional updates, they are currently the default implementation of immutable indexed sequences. It is ba
very large sequences.
A the element type
Self Type Vector[A]
Source Vector.scala
See also "Scala's Collection Library overview" section on Vectors for more information.
Linear Supertypes
Ordering Alphabetic By Inheritance
Inherited Vector CustomParallelizable Serializable Serializable VectorPointer IndexedSeq
GenSeq GenSeqLike PartialFunction Function1 AbstractIterable Iterable
GenericTraversableTemplate TraversableLike GenTraversableLike Parallelizable

scalatour/07-MultilineStrings

- Triple quotes
- substitution (f for printf formatting)

scalatour/08-FunctionalPatternMatching

- match construct
- match by type, structure
- default case or MatchError

scalatour/09-ParsingConfig

- Match on regular expressions
- Go Options

scalatour/10-ClassesTraitsMixins

- class - constructor/body
- constructor args - val, var, no modifier
- traits

scalatour/11-CaseClasses

- provide val accessors
- apply/unapply, hashCode, toString
- pattern matching

scalatour/12-Scripting

- In the small
- sys.process
- sys.env
- sys.props

scalatour/13-JavaInterop

- to/from Java/Scala collections
- BeanProperty for getters/setters

scalatour/14-Implicits

- Use sparingly!
- Powerful way to extend closed classes

scalatour/Spark15

- Implemented in Scala
- Powerful functional primitives for scalable cluster processing

Resources

- Coursera/EPFL Functional Programming in Scala Specialization
- Odersky et al., Programming in Scala, 3rd Edition
- Payne, Wampler, Programming Scala, 2nd Edition
- Alexander, Scala Cookbook
- Chiusano, Bjarnason, Functional Programming in Scala
- Twitter Scala School