

Language dynamism, scripting and functional programming



Václav Pech

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<http://jroller.com/vaclav>

<http://www.vaclavpech.eu>

@vaclav_pech

Today's agenda

Groovy syntax and interoperability

Language dynamism

Scripting

Functional programming

Groovy



A JVM programming language

- Dynamic
- Dynamically-typed
- Scripting
- Object-oriented
- Building on Java syntax

★ Groovy



Ecosystem

Grails

Gradle

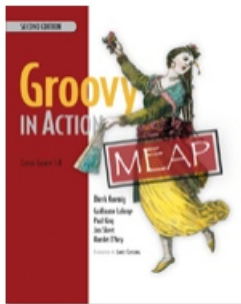
Spock

GPars

Ratpack

Griffon

SDKMAN!



The 7 usage patterns

- Super Glue
- Liquid Heart
- Keyhole Surgery
- Smart Configuration
- Unlimited Openness
- House-Elf Scripts
- Prototype



Examples in Groovy

canoo

Part 1

Groovy syntax and interoperability

Interoperability

Groovy and *Java* can **implement**, **extend**, **refer** and **call** each other at will.

Groovy sources compile into *.class* files

IDEs provide cross-reference support

Java

```
public class Person {  
    private final String name;  
    public Person(String name) {  
        this.name = name;  
    }  
    public String getName() {  
        return name;  
    }  
}
```


Groovy

```
public class Person {  
    private final String name;  
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    public String getName() {  
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    private final String name  
    Person(String name) {  
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    }  
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```

Groovy

```
class Person {  
    final String name  
    Person(String name) {  
        this.name = name  
    }  
}
```


Groovy

```
class Person {  
    final String name  
    Person(String name) {  
        this.name = name  
    }  
}
```

Groovy is Java

```
class Person {  
    final String name  
}
```

Variables, constants, params

String a

def a

final a

Intuitiveness

Equality `a == b`

Identity `a.is(b)`

() sometimes optional: `println 'Joe'`

String interpolation

```
final s = 'Hi Joe'
```

```
final s = "Hi Dave"
```

```
final s = "Hi $name"
```

```
final s = "Hi ${user.name}"
```

```
final s = """Hi Dave,
```

```
How are you?
```

```
"""]
```

Numbers and primitive types

15 - integer

15G - BigInteger

1.5 - BigDecimal

1.5d - Double

All values are objects: 5.upto(10)

Clever boxing and unboxing

Properties

```
class City {  
    String name  
    int size  
    boolean capital = false  
}
```

```
City c1 = new City(name: 'Praha', size: 1200000, capital: true)
```

```
City c2 = new City(name: 'Písek', size: 25000)
```

```
print c1.name
```

```
c2.size = 25001
```

Power assert

assert 5 == customer.score

Exception thrown

17.2.2012 12:30:12 org.codehaus.groovy.runtime.StackTraceUtils sanitize

WARNING: Sanitizing stacktrace:

Assertion failed:

assert 5 == customer.score

```
| | |
| | 4
| [score:4]
false
```


Closures

Closure multiply = {**int** a, **int** b -> **return** a * b}

Closures

Closure multiply = {**int** a, **int** b -> a * b}

Closures

Closure multiply = $\{a, b \rightarrow a * b\}$

Closures – implicit parameter

```
def triple1 = {int number -> number * 3}
```

```
def triple2 = {number -> number * 3}
```

```
def triple3 = {it * 3}
```

Groovy is functional

```
def multiply = {a, b -> a * b}  
def double = multiply.curry(2)  
def triple = multiply.curry(3)  
  
assert 4 == multiply(2, 2)  
assert 8 == double(4)  
assert 6 == triple(2)
```

Currying vs. Partial application

def multiply = {a, b \rightarrow a * b}

def partial = multiply.curry(3)

def curried1 = {x \rightarrow {y \rightarrow multiply(x, y)}}

def curried2 = {x \rightarrow multiply.curry(x)}

Memoize

```
def triple = {3 * it}
```

```
def fastTriple = triple.memoize()
```

Closure scope

owner

delegate

this

`closure.resolveStrategy =`

`DELEGATE_FIRST / OWNER_FIRST`

`DELEGATE_ONLY / OWNER_ONLY`

Collections

```
final emptyList = []
```

```
final list = [1, 2, 3, 4, 5]
```

```
final emptyMap = [:]
```

```
final capitals = [cz : 'Prague', uk : 'London']
```

```
final list = [1, 2, 3, 4, 5] as LinkedList
```

```
final emptyMap = [:] as ConcurrentHashMap
```

Collections API

```
(1..10).each {println it}  
2.step(10, 2) {println it}
```

```
(10..20).findAll{it%2==0}  
    .collect {3*it}  
    .inject(0){acc, v -> acc + v}
```

map, filter, and reduce explained with emoji 🤔

```
map([🐮, 🍌, 🐔, 🌽], cook)  
=> [🍔, 🍟, 🍗, 🍿]
```

```
filter([🍔, 🍟, 🍗, 🍿], isVegetarian)  
=> [🍟, 🍿]
```

```
reduce([🍔, 🍟, 🍗, 🍿], eat)  
=> 🤩
```

(Not exhaustive) list

each (aka for loop)

collect (aka map)

inject (aka reduce)

findAll (aka filter)

sum, size, findFirst, grep, groupBy

any, every, min, max, ...

Some more operators

```
['Java', 'Groovy']*.toUpperCase()
```

```
customer?.shippingAddress?.street
```

```
return user.locale ?: defaultLocale
```

GDK = JDK + FUN

- `java.util.Collection`
 - `each()`, `find()`, `join()`, `min()`, `max()` ...
- `java.lang.Object`
 - `any()`, `every()`, `print()`, `invokeMethod()`, ...
- `java.lang.Number`
 - `plus()`, `minus()`, `power()`, `upto()`, `times()`, ...

Tip: Ask *DefaultGroovyMethods* for help

Syntax enhancements

- Dynamic (duck) typing – optional!
- GDK
- Syntax enhancements
 - Properties, Named parameters
 - Closures
 - Collections and maps
 - Operator overloading
 - ...

List comprehension (Python)

```
odd = [x for x in range(0, 100) if x % 2 != 0]
```

```
squares = [x*x for x in odd]
```


Generators (Python)

```
def fibonacci():  
    a = 0  
    b = 1  
    yield b  
    while True:  
        a, b = b, a + b  
        yield b  
  
allFibs = fibonacci()
```

Part 2

Scripting

Agenda

- Scripting
- Script engine customization
- Grabbing libraries

Scripting

Evaluate custom Groovy code

At run-time!!!

```
new GroovyShell().evaluate('println Hi!')
```

<http://groovyconsole.appspot.com/>

Script customization

CompilerConfiguration

CompilationCustomizer

ImportCustomizer

ASTCustomizer

SecureASTCustomizer

Functors

Dealing with wrapped data

$\text{map}: ([A], f: A \rightarrow B) \rightarrow [B]$

$\text{map}: (\text{Maybe}\langle A \rangle, f: A \rightarrow B) \rightarrow \text{Maybe}\langle B \rangle$

Functors are *mappable* (they have a **map** operation)

Monoids

Aggregating data and operations

Monoids

Aggregating data and operations

- A set of elements
- An operation that combines two elements
- An 'id' element neutral with respect to the operation
- Closure of the set with respect to the operation

$$1. a + id = id + a = a$$

$$2. (a + b) + c = a + (b + c)$$

$$3. a \in M \ \& \ b \in M \Rightarrow a+b \in M$$

Monoids

Reducible – any set of elements from a monoid can be reduced into a single value

reduce: $([A], f: (A, A) \rightarrow A) \rightarrow A$

Monoids

```
class Customer {name, address, orders}
```

vs.

```
class CustData {orders, totalAmount}
```

Monoids

class Customer {name, address, orders}

not a monoid

vs.

class CustData {orders, totalAmount}

a monoid

Monoids

class Customer {name, address, orders}

not a monoid

transform

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class CustData {orders, totalAmount}

a monoid

Composing functions

$f: A \rightarrow B$

$g: B \rightarrow C$

$f \gg g: A \rightarrow C$

Composing functions

$f: A \rightarrow B$

$g: B \rightarrow C$

$f \gg g: A \rightarrow C$

```
def f = {String s → s.size()}
```

```
def g = {Integer i → i%2==0 ? true : false}
```

```
def h = f >> g
```

Composing functions

$f: A \rightarrow B$

$g: B \rightarrow C$

$f \gg g: A \rightarrow C$

Not a monoid

Endofunctors

$f: A \rightarrow A$

with composition ($>>$) and an **id()** function
form a monoid

`[f1, f2, f3, f4, f5, ...].reduce(id, >>)`

Other monoids of functions

Elements: $f: \text{String} \rightarrow \text{Boolean}$

Other monoids of functions

Elements: $f: \text{String} \rightarrow \text{Boolean}$

`id()` – returns *true/false*

Operation: logical AND/OR

Summary



The joy of Ruby for Java programmers

<http://jroller.com/vaclav>
vaclav@vaclavnech.eu



References

<http://www.groovy.cz>

<http://groovy.codehaus.org>

<http://grails.org>

<http://groovyconsole.appspot.com/>

<http://www.manning.com/coenig2/>