Scripting and dynamic meta-programming for Java developers

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Today's agenda

- Functional programming
- Scripting
- Dynamic typing
- Dynamic meta-programming

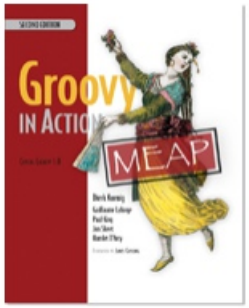
Agenda for the next lesson

- Static meta-programming
- Builders
- Domain specific languages
- DSL-based frameworks – Grails, Griffon

Groovy

A JVM programming language

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



The 7 usage patterns

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

Examples in Groovy

canoo

http://www.slideshare.net/gr8conf/groovy-usage-patterns-by-dierk-knig

Groovy eco-system

Grails, Griffon

Gaelyk

Gradle

GPars, gcontracts, easyb, Spock

CodeNarc, Geb, Gretty, GroovyServ

… (check out http://www.groovy.cz/)

Groovy in the wild

springsource
A division of vmware

sky

canoo
› your provider for business web solutions ›

twitsms

APPSatori
Cesta vašeho IT do oblak

Berliner Flughäfen

Genxbio
TECHNOLOGY FOR LIFE

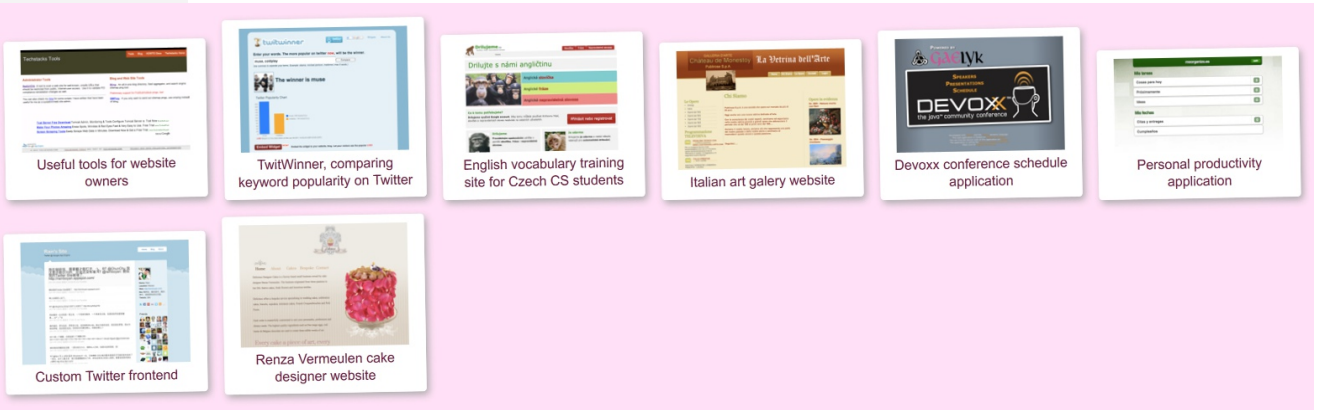
Disney

Success Stories and Sites Using Grails

Sites using Grails

A list of sites known to be grails-based:

- http://www.findroomrent.com - Provides verified listings of rooms for rent in big cities in the US. Uses Twilio for sending text messages and GeoIP module to serve region-related information.
- http://genxbio.info - Genxbio introduces biggest biotech product range that have been tested for accuracy, quality, reliable results and consistent performance.
- http://www.nala.com.cn - The most famous cosmetics shopping mall in china.
- http://www.setupmanual.com - Generate custom PDF manuals for setting up email acounts on various platforms. Built using Grails, Birt and Drools.
- https://lsp.lexmark.com/lexmark - Enterprise Cloud Print Release platform allowing mobile, web, driver and email print release.
- http://www.salesgoals.com - An online CRM tool with an integrated iPhone application.
- http://welonik.pl/ - Directory of wedding photographers in Poland.
- http://www.juvamo.de - Web based kanban tool for personal or professional project management.
- http://www.chatnearme.com - A location based real-time chat website, mobile version located @ same url.
- http://www.nissanusa.com/leaf-electric-car/index - North American, Ni
and online reservations.
- http://unsere-regionalen-spezialitaeten.de - a German portal for collec
specialities.
- http://www.servermeile.com - Here you can configure and buy your Se
- http://manatalks.com - Magic The Gathering online store and commur
integrated with WordPress and Magento.
- http://www.kettlerusa.com - a retail site for toys, patio furniture, fitness
tennis.
- http://www.simbo.com.br - A Real Estate SaaS product to agents and
with cloud computing infrastructure and multi-tenant architecture.
- http://www.bkool.com - Specialized social network for the sports pract
outdoor. Integrates a 100% Grails web site and backend with a video g
- http://www.secretescapes.com - Secret Escapes is a private membe
UK.
- http://pigink.com - PigInk - Colour registry and information site
- http://www.landingsms.com - Using services of landingSMS you can i
mobile phone numbers from your customers and offer them discounts or different information via SMS. Move easy and without programming knowledge into mobile marketing.



Position Oct 2013	Position Oct 2012	Delta in Position	Programming Language	Ratings Oct 2013	Delta Oct 2012	Status
1	1	=	C	17.246%	-2.58%	A
2	2	=	Java	16.107%	-1.09%	A
3	3	=	Objective-C	8.992%	-0.49%	A
4	4	=	C++	8.664%	-0.60%	A
5	6	↑	PHP	6.094%	+0.43%	A
6	5	↓	C#	5.718%	-0.81%	A
7	7	=	(Visual) Basic	4.819%	-0.30%	A
8	8	=	Python	3.107%	-0.79%	A
9	23	↑↑↑↑↑↑↑↑↑↑	Transact-SQL	2.621%	+2.13%	A
10	11	↑	JavaScript	2.038%	+0.78%	A
11	18	↑↑↑↑↑↑↑	Visual Basic .NET	1.933%	+1.33%	A
12	9	↓↓↓	Perl	1.607%	-0.52%	A
13	10	↓↓↓	Ruby	1.246%	-0.56%	A
14	14	=	Pascal	0.753%	-0.09%	A
15	17	↑↑	PL/SQL	0.730%	+0.10%	A
16	13	↓↓↓	Lisp	0.725%	-0.22%	A
17	12	↓↓↓↓↓	Delphi/Object Pascal	0.701%	-0.40%	A
18	53	↑↑↑↑↑↑↑↑↑↑	Groovy	0.658%	+0.53%	B
19	19	=	MATLAB	0.614%	+0.02%	B
20	26	↑↑↑↑↑↑	COBOL	0.599%	+0.15%	B

Part 1

Groovy syntax and interoperability

Interoperability

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

groovyc supports mixed mode

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;
    public Person(String name) {
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}
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Groovy

```
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        this.name = name
    }
}
```

Groovy is Java

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

Variables, constants, params

String a

def a

final a

- 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 ProgrammingLanguage {
    String name
    String version
    boolean easy=true
}
def groovy=new ProgrammingLanguage(
        name:'Groovy', version:'1.5', easy:true)

def java=new ProgrammingLanguage(name:'Java')
java.version='1.6'
```

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 multiply1 = {int a, int b -> return a * b}

Closure multiply2 = {int a, int b -> a * b}

Closure multiply3 = {a, b -> a * b}

def multiply4 = {a, b -> 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 → a * b}

def partial = multiply.curry(3)

def curried = {x → 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

Iterations

```
(1..10).each{number -> println number * 3}

1.upto(10) {println it * 3}


Closure triple = {it * 3}

1.step(11, 1){println triple(it)}
```

(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, ...

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
```

Parallel collections

```
images.eachParallel {it.process()}

documents.sumParallel()

candidates.maxParallel {it.salary}.marry()
```

Some 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
  - …

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

Grab

```groovy
@Grab(group='org.codehaus.groovy.modules', module='groovyws', version='0.5.2')
import groovyx.net.ws.WSClient

proxy = new WSClient("http://www.w3schools.com/webservices/tempconvert.asmx?WSDL",
                     this.class.classLoader)
proxy.initialize()

result = proxy.CelsiusToFahrenheit(0)
println "You are probably freezing at ${result} degrees Farhenheit"
```

Part 3

Dynamic meta-programming

Agenda

Dynamic dispatch

Dynamic cast

Dynamic object creation

Categories

Meta-programming

Dynamic dispatch

The target method is decided at run-time using run-time type of the arguments

def calculate(String value)

def calculate(Integer value)

calculate('10' as Integer) ???

Dynamic object creation

```
Runnable r = {println 'Asynchronous'} as Runnable
```

Dynamic object creation

Duck-typing

```
Calculator c = [ add : {a, b, → a + b},
                 multiply : {a, b → a * b},
                 increment : {it + 1}
               ] as Calculator

assert 6 == c.multiply(2, 3)
```

Traits

```
trait Flying {
    void fly() {println "I am flying!"}
}
trait Quacking {
    void quack() {println "Quack!"}
}
class Duck implements Flying, Quacking {}
```

Traits

- Componentisation of the design
- Generalized delegation
- Stackable
- Can be specified as argument types

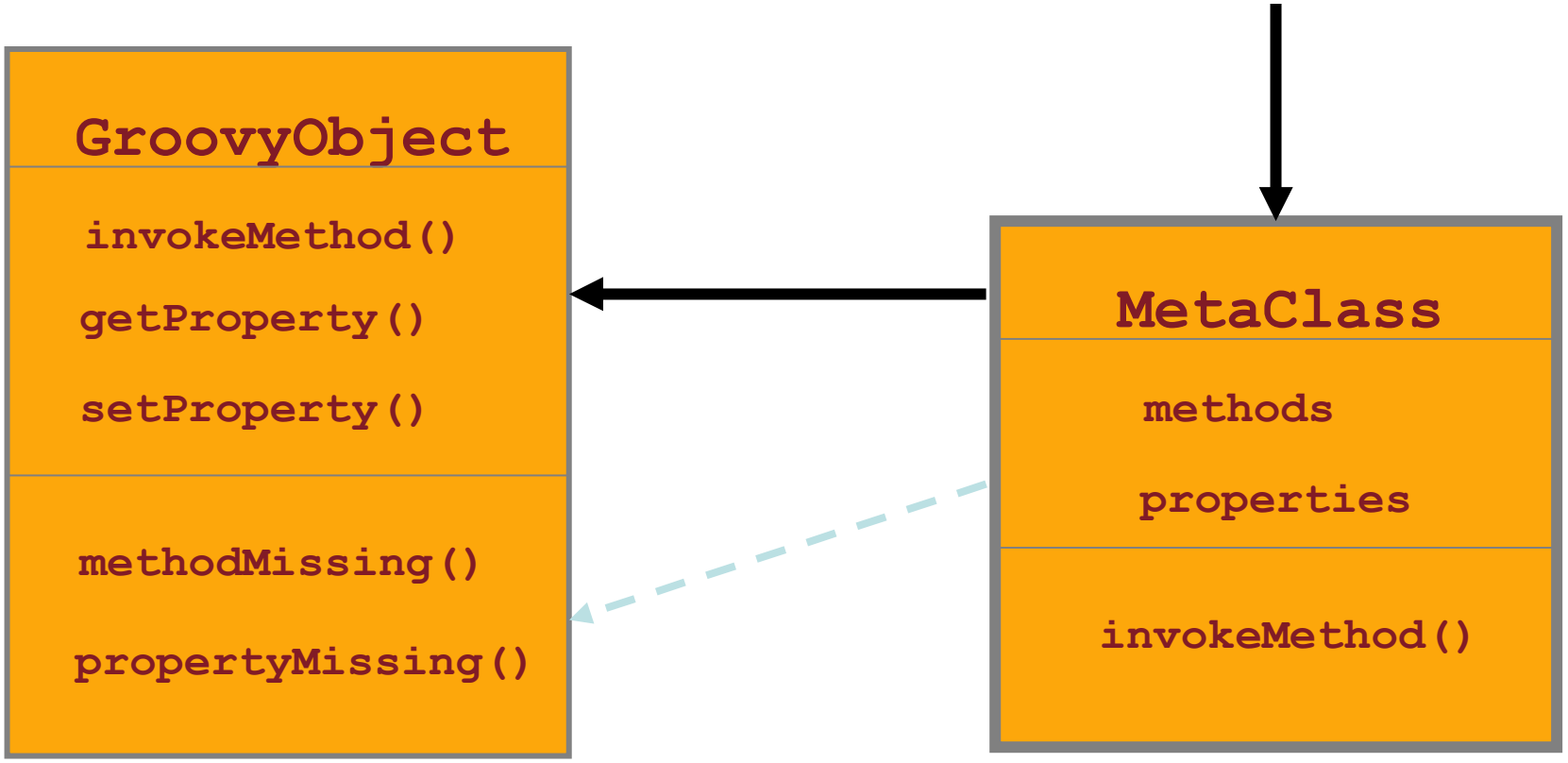
https://speakerdeck.com/melix/rethinking-api-design-with-traits

Categories

```
StringUtils.countMatches(myString, 'Groovy')
```

```
use(StringUtils) {
    myString.countMatches('Groovy')
}
```

Dynamic method invocation



Querying objects' methods

o.respondsTo()

o.hasProperty()

o.metaClass.getMetaMethod(name, args)

o.metaClass.getMetaProperty(name)

Summary

The joy of Ruby for Java programmers

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References

http://www.groovy.cz

http://groovy.codehaus.org

http://grails.org

http://groovyconsole.appspot.com/

http://www.manning.com/koenig2/