Scripting and dynamic meta-programming for Java developers

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Today's agenda

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

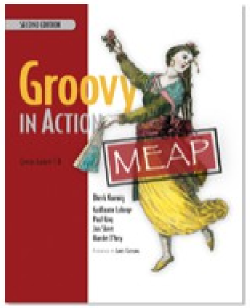
Agenda for the next lesson

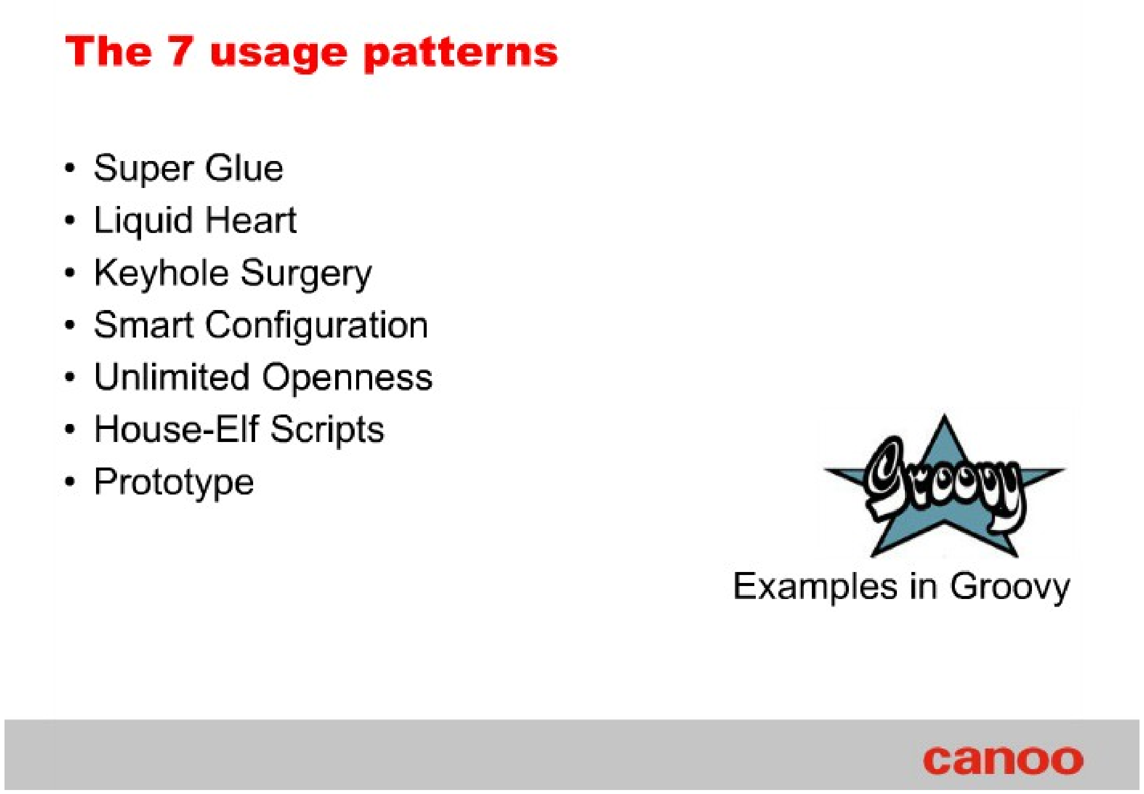
- Static meta-programming
- Builders
- Domain specific languages
- DSL-based frameworks – Grails, Griffon

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

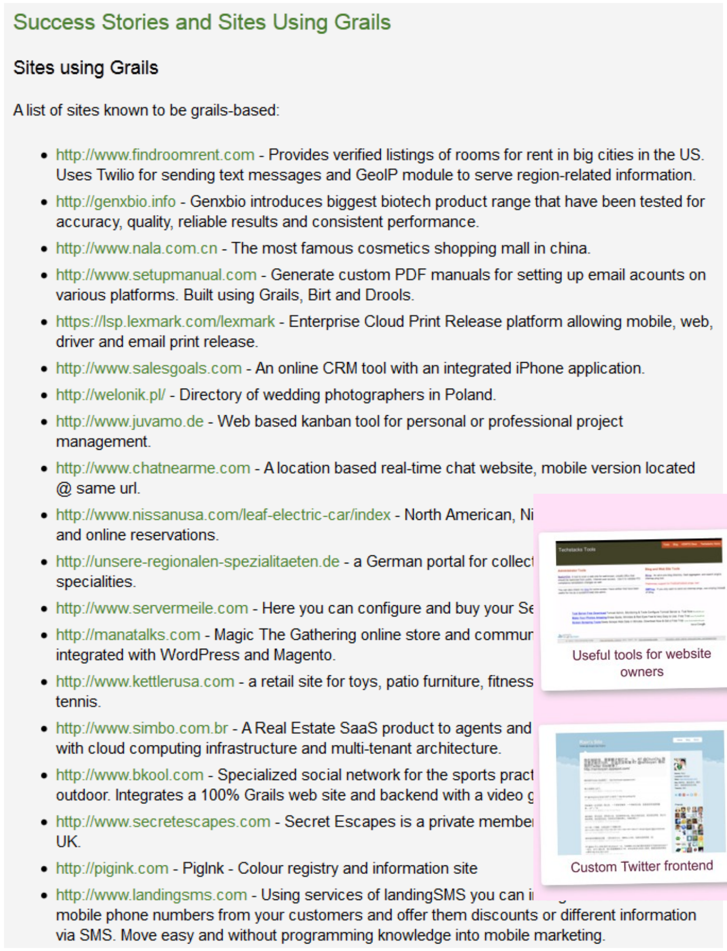
Gradle

GPars, gcontracts, easyb, Spock

CodeNarc, Geb, Gretty, GroovyServ

… (check out http://www.groovy.cz/)

Groovy in the wild

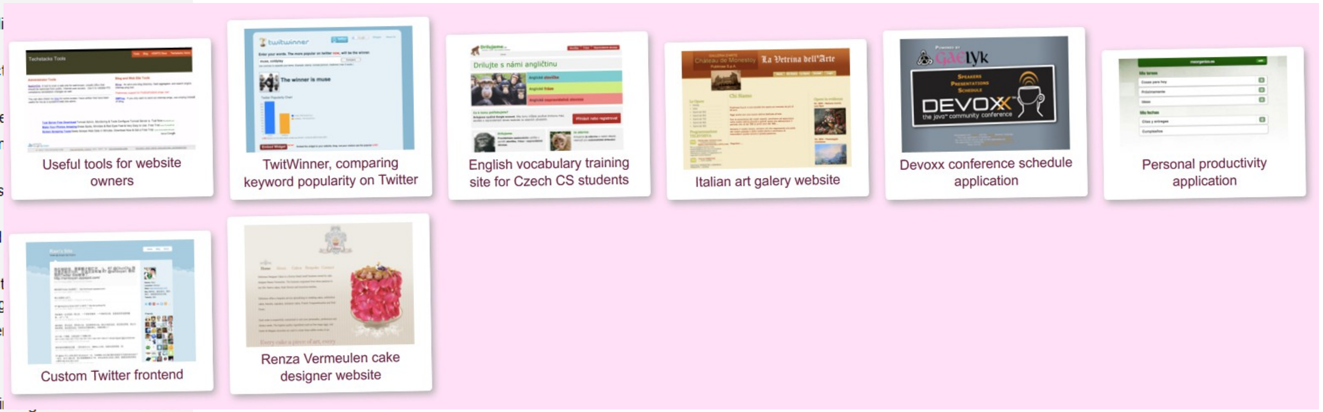


Success Stories and Sites Using Grails

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 collect specialities.
- http://www.servermeile.com - Here you can configure and buy your Se
- http://manatalks.com - Magic The Gathering online store and commun 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.


Useful tools for website owners
TwitWinner, comparing keyword popularity on Twitter
English vocabulary training site for Czech CS students
Italian art galery website
Devoxx conference schedule application
Personal productivity application
Custom Twitter frontend
Renza Vermeulen cake designer website

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;
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Groovy

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    }
}
```

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

- 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)

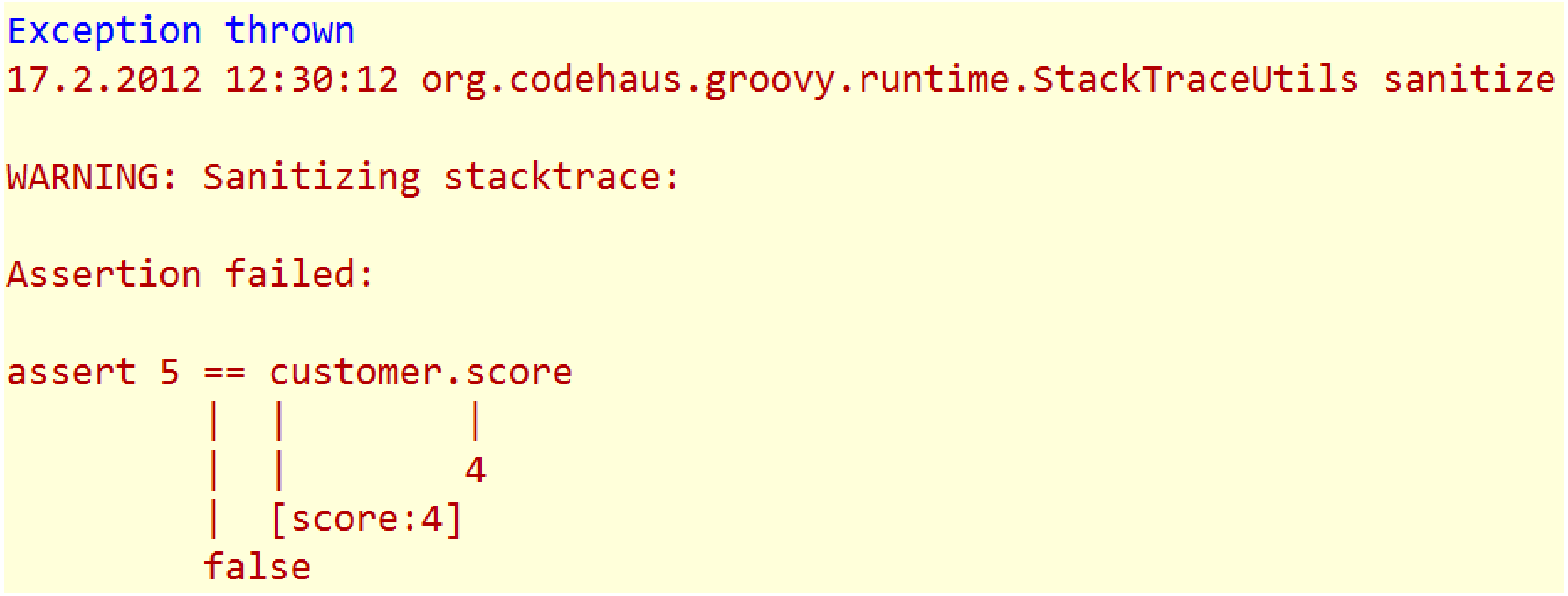
Clever boxing and unboxing

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)
```

Memoize

```
def triple = {3 * it}

def fastTriple = triple.memoize()
```

Closure scope

owner

delegate

this

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)}
```

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

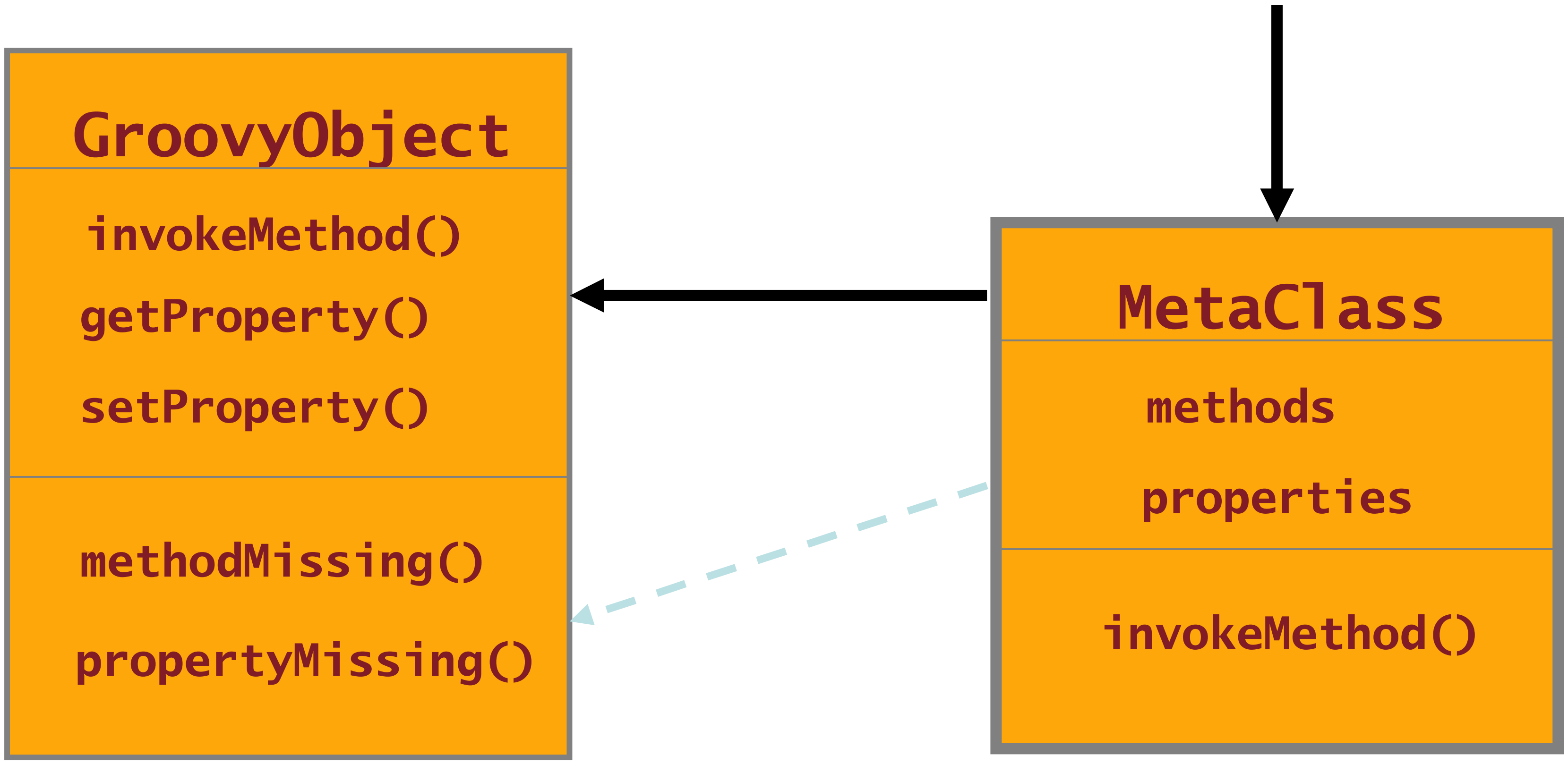
```
Calculator c = [ add : {a, b, → a + b},
                 multiply : {a, b → a * b},
                 increment : {it + 1}
               ] as Calculator

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

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 power 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/