Language dynamism, scripting and functional programming

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Today's agenda

- Groovy syntax and interoperability
- Language dynamism
- Scripting
- Functional programming

Aug 2016	Aug 2015	Change	Programming Language	Ratings	Change
1	1		Java	19.010%	-0.26%
2	2		C	11.303%	-3.43%
3	3		C++	5.800%	-1.94%
4	4		C#	4.907%	+0.07%
5	5		Python	4.404%	+0.34%
6	7	⌃	PHP	3.173%	+0.44%
7	9	⌃	JavaScript	2.705%	+0.54%
8	8		Visual Basic .NET	2.518%	-0.19%
9	10	⌃	Perl	2.511%	+0.39%
10	12	⌃	Assembly language	2.364%	+0.60%
11	14	⌃	Delphi/Object Pascal	2.278%	+0.87%
12	13	⌃	Ruby	2.278%	+0.86%
13	11	⌄	Visual Basic	2.046%	+0.26%
14	17	⌃	Swift	1.983%	+0.80%
15	6	⌄⌄	Objective-C	1.884%	-1.31%
16	37	⌃⌃	Groovy	1.637%	+1.27%
17	20	⌃	R	1.605%	+0.60%
18	15	⌄	MATLAB	1.538%	+0.31%
19	19		PL/SQL	1.349%	+0.21%
20	95	⌃⌃	Go	1.270%	+1.19%

Groovy

A JVM programming language

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

★ Groovy

Ecosystem

Grails

Gradle

Spock

GPars

Ratpack

Griffon

SDKMAN!

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

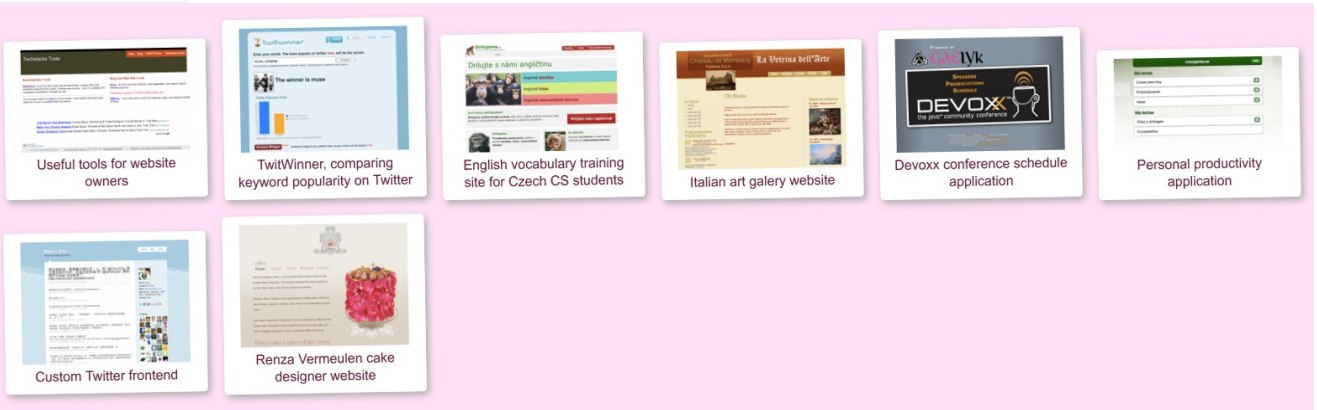
Disney

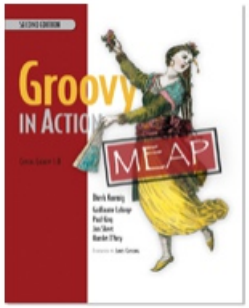
Success Stories and Sites Using Grails

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.





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

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) {
        this.name = name;
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    public String getName() {
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Groovy

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    private final String name
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        this.name = name
    }
    public String getName() {
        name
    }
}
```

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

- 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
```

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

Functional programming

Agenda

- Functors
- Monoids
- Function composition
- Endofunctors
- Monads

Inspired by http://www.slideshare.net/ScottWlaschin/fp-patterns-buildstufflt/

Functors

Dealing with wrapped data

map: ([A], f: A -> B) → [B]

map: (Maybe<A>, f: A -> B) → Maybe<B>

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) → A) → 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

vs.

class CustData {orders, totalAmount}

a monoid

Composing functions

f: A → B

g: B → C

f >> g: A → C

Composing functions

f: A → B

g: B → C

f >> g: A → C

```
def f = {String s → s.size()}

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

def h = f >> g
```

Composing functions

f: A → B

g: B → C

f >> g: A → C

Not a monoid

Endofunctors

f: A → A

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

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

Other monoids of functions

Elements: f: String → Boolean

Other monoids of functions

Elements: f: String → Boolean

id() – returns *true/false*

Operation: logical AND/OR

Monads

A monad is just a monoid in the category of endofunctors!

Monads

A *monad* is just a **monoid** in the **category** of **endofunctors**!

Monads

- Control side-effects – logging, IO, tx
- Manage containment of some sort
- Handle errors

Monads

Chaining functions that return values wrapped in some context

def f = {Integer v → new LoggedValue(v+1, 'Incremented')}

def g = {Integer v → new LoggedValue(v*2, 'Doubled')}

...

Signature: Integer → LoggedValue<Integer>

Monads

Error handling

```
try {
    def y = f(x)
    try {
        def z = g(y)
        try {
            result = g(y)
        } catch(...) {}
    } catch(...) {}
} catch (…) {}
```

Monads

Null-checking

```
if (x!=null) {
    def y = f(x)
    if (y!=null) {
        def z = g(y)
        if (z!=null)
            result = g(y)
        }
    }
}
```

Monads

class Maybe, subclasses Some, None

```
if (x.isSome()) {
    def y = f(x)
    if (y.isSome) {
        def z = g(y)
        if (z.isSome())
            result = g(y)
        }
    }
}
```

Monads

class Maybe, subclasses Some, None

result = x >> f >> g >> h

Monads

Error handling

class *Maybe*, subclasses *Some*, *None*

def f = {Integer v → new Some(v+1)}

def g = {Integer v → v!=0 ? new Some(100/v) : new None()}

Signature of the functions: *Integer* → *Maybe*<*Integer*>

Generalization

Integer → LoggedValue<Integer>

Integer → Maybe<Integer>

A → LoggedValue<A>

A → ContextFor<A>

A → ContextFor<B>

Generalization

A → ContextFor<B>

(Integer → LoggedValue<Integer>)

Such functions do not form a monoid – not composable!

We need to convert them into

ContextFor<A> → ContextFor<B>

(LoggedValue<Integer> → LoggedValue<Integer>)

Monads' functions

Turn A into contextual A

unit: A → [A]

Monads' functions

Turn A into contextual A

unit: A → [A]

Turn a contextual function into a chainable contextual function

bind: ([A], f: A -> [B]) → [B]

Monads' functions

Turn A into contextual A

unit: A → [A]

Turn a contextual function into a chainable contextual function

bind: ([A], f: A -> [B]) → [B]

Turn a plain function into a contextual function

lift: (A → B) → (A → [B])

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/