DSLs and static meta-programming for Java developers

Václav Pech

http://jroller.com/vaclav

http://www.vaclavpech.eu

@vaclav_pech

Last time agenda

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

Agenda for today

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

Part 1

Groovy syntax and interoperability

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
```

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)
```

Closure scope

owner

delegate

this

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
```

Part 2

Scripting

Scripting

Evaluate custom Groovy code

At run-time!!!

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

http://groovyconsole.appspot.com/

Part 3

Dynamic 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

Duck-typing

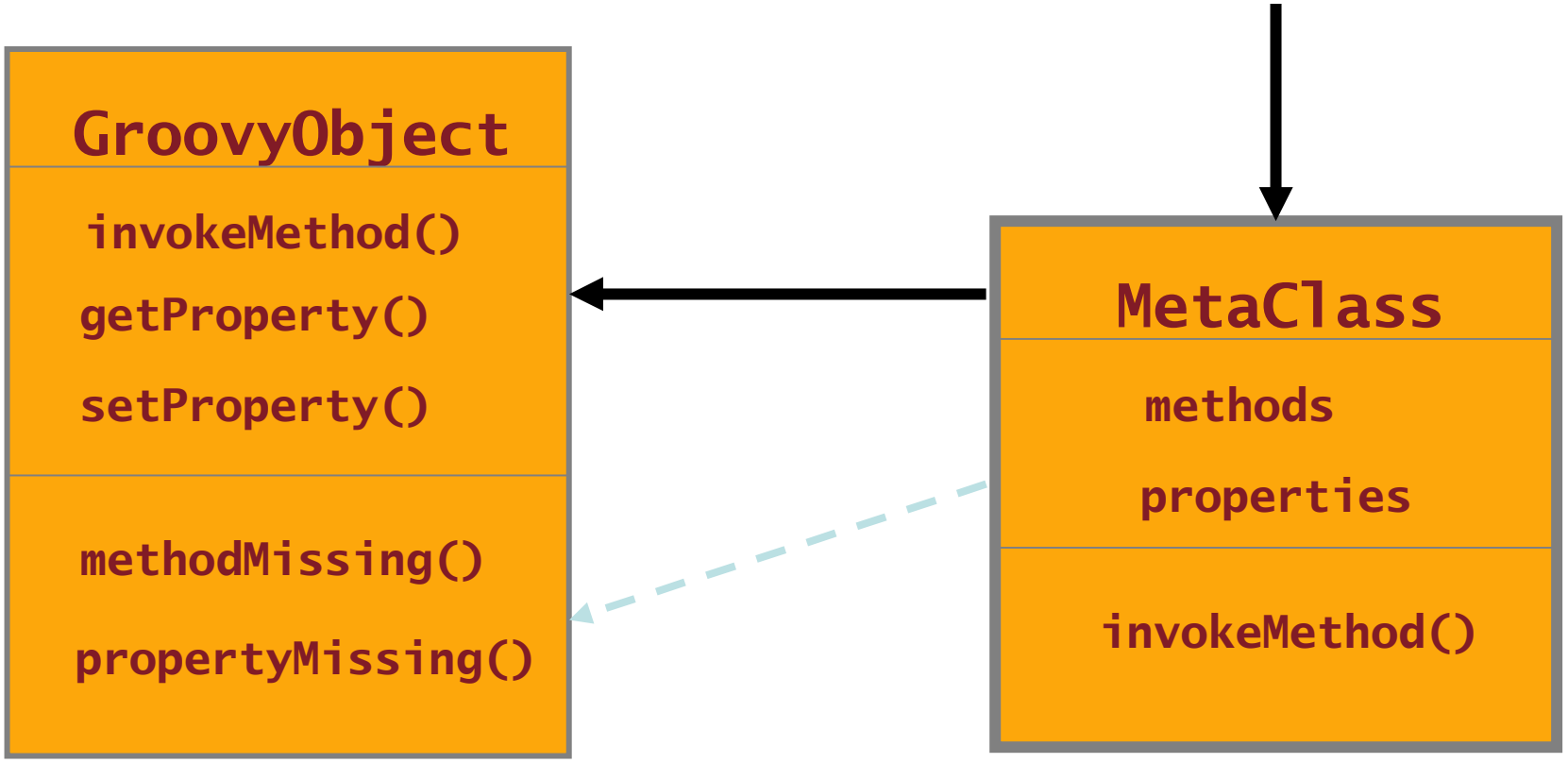
```
Calculator c = [ add : {a, b, → a + b},
                 multiply : {a, b → a * b},
                 increment : {it + 1}
               ] as Calculator

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

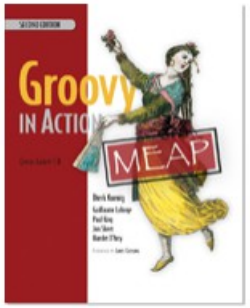
Categories

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

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

Dynamic method invocation





The 7 usage patterns

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

Examples in Groovy

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

Part 4

Domain Specific Languages

Agenda

- Domain-specific languages
- Builders
- DSL frameworks – Grails, Griffon

Grails

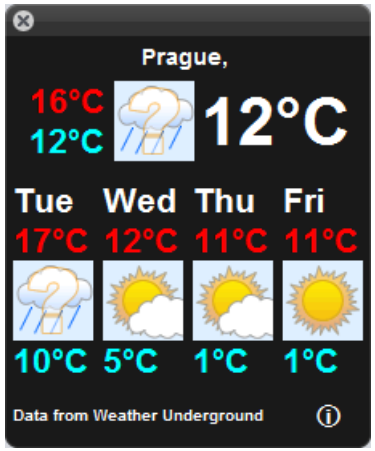
Web applications on JVM

- Hibernate, Spring, ...
- Groovy DSLs
- Scaffolding
- Convention over configuration
- DRY
- KISS

Griffon

Rich-client applications on JVM

- Swing
- Groovy DSLs
- Scaffolding
- Convention over configuration
- DRY
- KISS



DSL

- Limited purpose language
- Targeted to a particular domain
- Friendlier API to a framework
  - External
    - SQL, HTML, CSS, …
  - Internal

DSL – Date manipulation

```
use(org.codehaus.groovy.runtime.TimeCategory) {
    println "Tomorrow: ${1.day.from.today}"
    println "A week ago: ${1.week.ago}"
    println "Date: ${1.month.ago + 1.week + 2.hours - 5.minutes}"
    println "Date ${(1.month + 10.days).ago}"
}
```

DSL – Hibernate criteria

```
def participants = Participant.createCriteria().list {
    gt('age', age)
    or{
        eq('interest', 'Java')
        eq('interest', 'Groovy')
    }
    jug {
        ilike('country', 'de')
    }
    order('lastName', 'asc')
}
```

DSL – Account manipulation

```
Money money = new Money(amount: 350, currency: 'eur')
getAccount('Account1').withDraw money
getAccount('Account3').deposit money
```

```
"Account1" >> 350.eur >> "Account3"
```

order cake with plums and apples
and cream to "Malostranske namesti"

```
order(cake).with(plums).and(apples)
.and(cream).to("Malostranske namesti")
```

Builders

- Construct hierarchies

```
xml.records() {
    order(id: 'PL19826714', date: '21-01-2008') {
        item(quantity: 10) {
            product(id: '76327')
            price(base: 100) {
                volumeDiscount(value: 5)
            }
        }
```

Builders - GAnt

```
ant.sequential {
    myDir = "target/AntTest/"
    mkdir(dir: myDir)
    copy(todir: myDir) {
        fileset(dir: "src/test") {
            include(name: "**/*.groovy")
        }
    }
    List dirs = ['core', 'lib', 'engine', 'gui', 'db']
    for(String currentDir:dirs) {
        String targetDir="target/$currentDir"
        mkdir(dir:targetDir)
```

Cli Builder

```groovy
def cli = new CliBuilder (usage:'simpleHtmlServer -p PORT -d DIRECTORY')
cli.with {
 h longOpt:'help', 'Usage information'
 p longOpt:'port',argName:'port', args:1, type:Number.class,'Default is 8080'
 d longOpt:'dir', argName:'directory', args:1, 'Default is .'
}

def opts = cli.parse(args)
if(!opts) return
if(opts.help) {
  cli.usage()
  return
}
```

Builders – Spring config

```
dataSource(BasicDataSource) {
    driverClassName = "org.hsqldb.jdbcDriver"
    url = "jdbc:hsqldb:mem:shopDB"
}

sessionFactory(ConfigurableLocalSessionFactoryBean) {
    dataSource = dataSource
    hibernateProperties = ["hibernate.hbm2ddl.auto": "create-drop",
            "hibernate.show_sql": true]
}

calculator(demo.shop.CalculatorImpl) {bean ->
    bean.singleton = true
    bean.autowire = 'byType'
}
```

BDD - Spock

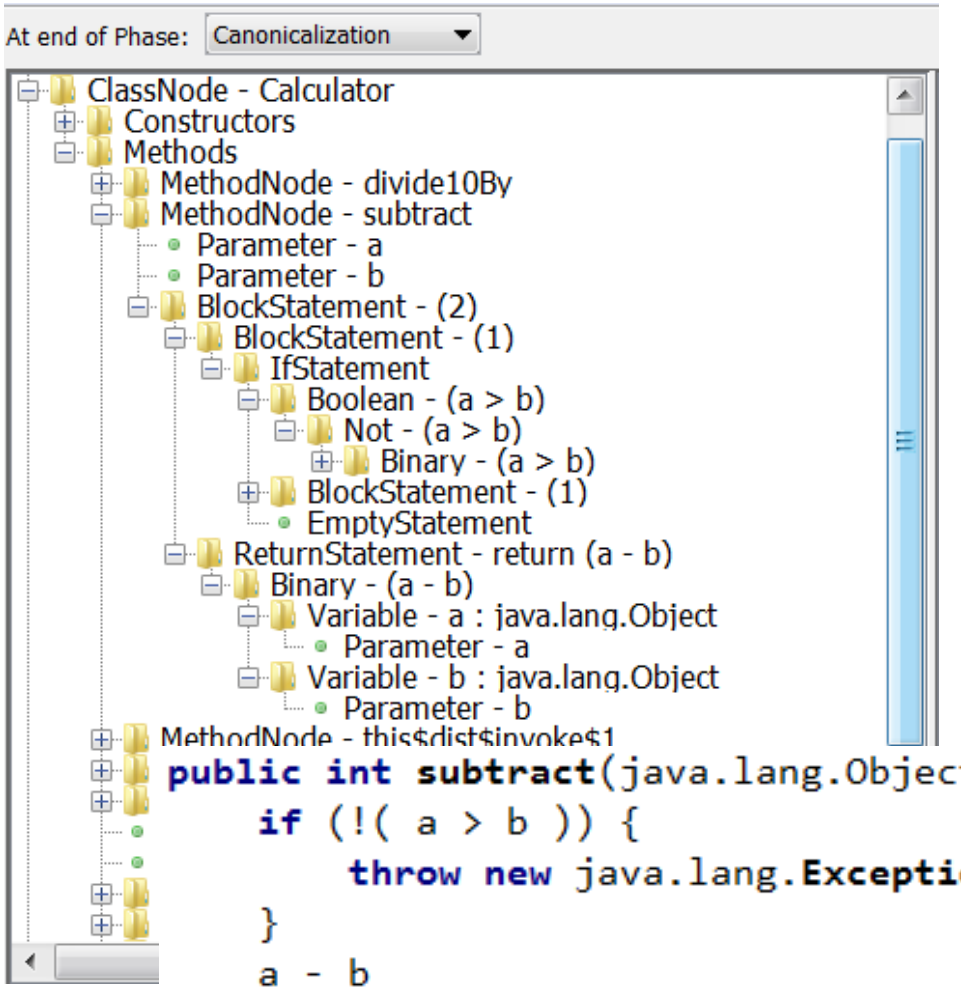
```
class DataDriven extends Specification {
    def "maximum of two numbers"() {
        expect:
        Math.max(a, b) == c
        where:
        a | b | c
        7 | 3 | 7
        4 | 5 | 5
        9 | 9 | 9
} }
```

http://code.google.com/p/spock/

Part 5

Static meta-programming

AST




```
public int subtract(java.lang.Object a, java.lang.Object b) {
    if (!( a > b )) {
        throw new java.lang.Exception('Precondition violated: {a > b}')
    }
    a - b
}
```

AST Transformations

```
class Registrations {
    @Delegate List items = []
}

def people = new Registrations()
people.addAll(["Joe", "Dave"])
assert ["Dave", "Joe"] == people.reverse()
```

@Delegate, @Immutable, @Singleton

@Lazy

@TupleConstructor

@InheritConstructors

@Canonical

@ToString

@EqualsAndHashCode

@Log, @Log4j, @Commons

@Synchronized

@WithReadLock

@WithWriteLock

@AutoClone, @AutoExternalize

...

Creating AST Transformations

```
new AstBuilder()
                    .buildFromString()
                    .buildFromCode()
                    .buildFromSpec()
```

```
.buildFromString ('''
                    Integer.parseInt("$param")
''')
```

```
.buildFromCode (
                    Integer.parseInt("$param")
)
```

```
.buildFromSpec {
    method('convertToNumber', ACC_PUBLIC, Integer) {
            parameters { parameter 'parameter': String.class }
            exceptions {}
            block {
                returnStatement {
                    staticMethodCall(Integer, "parseInt") {
                        argumentList {
                            variable "parameter"
                        }
        }   }   }   }   }
```

Summary

The power of Ruby for Java programmers

http://jroller.com/vaclav
vaclav@vaclavpech.eu

References

http://www.groovy.cz

http://groovy.codehaus.org

http://grails.org

http://groovyconsole.appspot.com/

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