Introducing

by Mario Fusco
Red Hat – Senior Software Engineer
mario.fusco@gmail.com
twitter: @mariofusco

Drools Vision

Drools was born as a rule engine, but following the vision of becoming **a single platform for business modelling**, it realized it could achieve this goal only by leveraging **3 complementary business modelling techniques**:

Business Rule Management (Drools Expert)

Business Process Management (Drools Flow)

Complex Event Processing (Drools Fusion)

Drools 5 – Business Logic Integration Platform

Drools Expert

Drools Flow

Drools Fusion

Drools Guvnor

Drools Planner

Business Logic integration System

What a rule-based program is

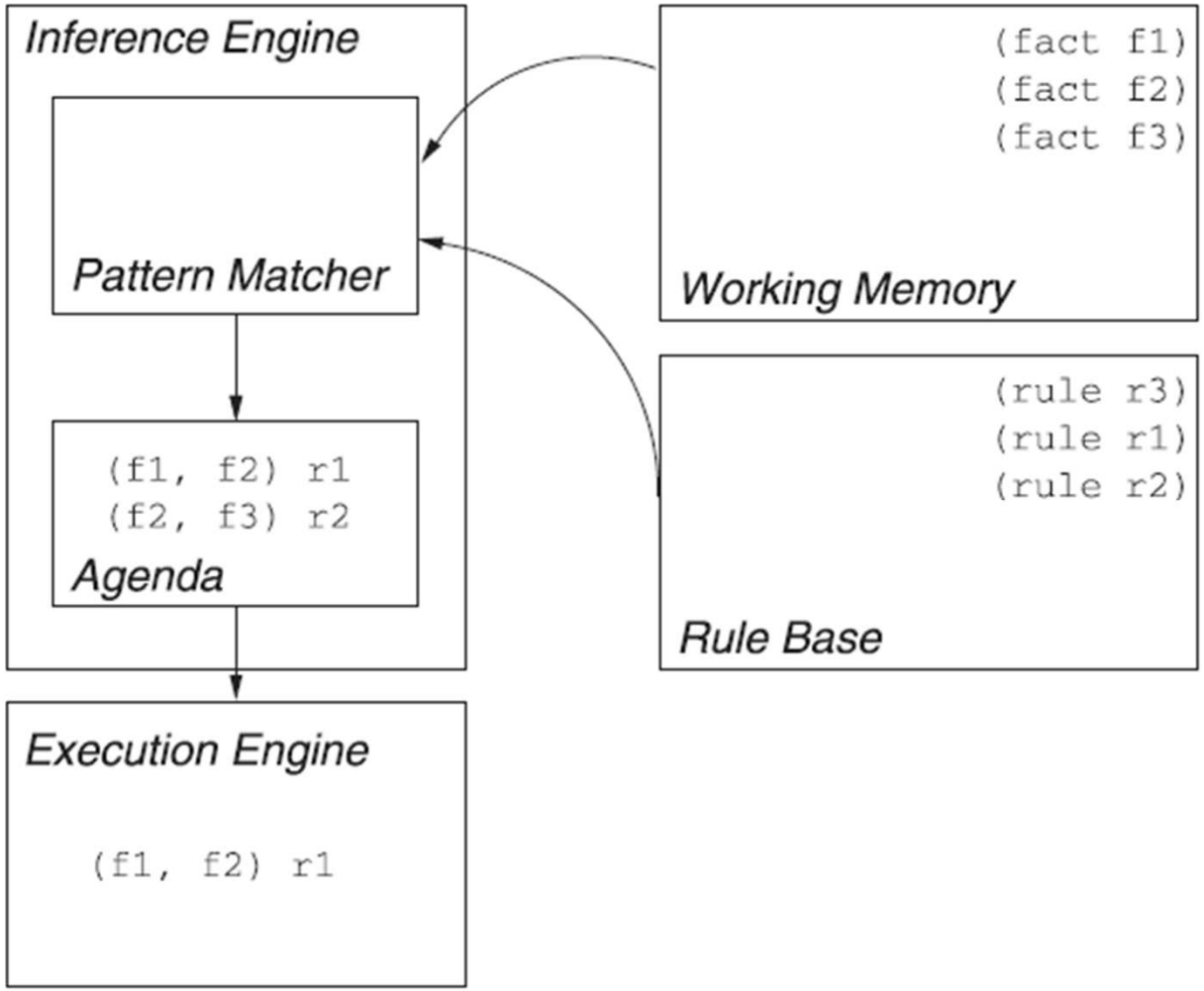
- A rule-based program is made up of **discrete rules**, each of which applies to some subset of the problem
- It is **simpler**, because you can concentrate on the rules for one situation at a time
- It can be more **flexible** in the face of fragmentary or poorly conditioned inputs
- Used for problems involving control, diagnosis, prediction, classification, pattern recognition … in short, all problems without clear algorithmic solutions

Declarative (What to do) Vs. Imperative (How to do it)

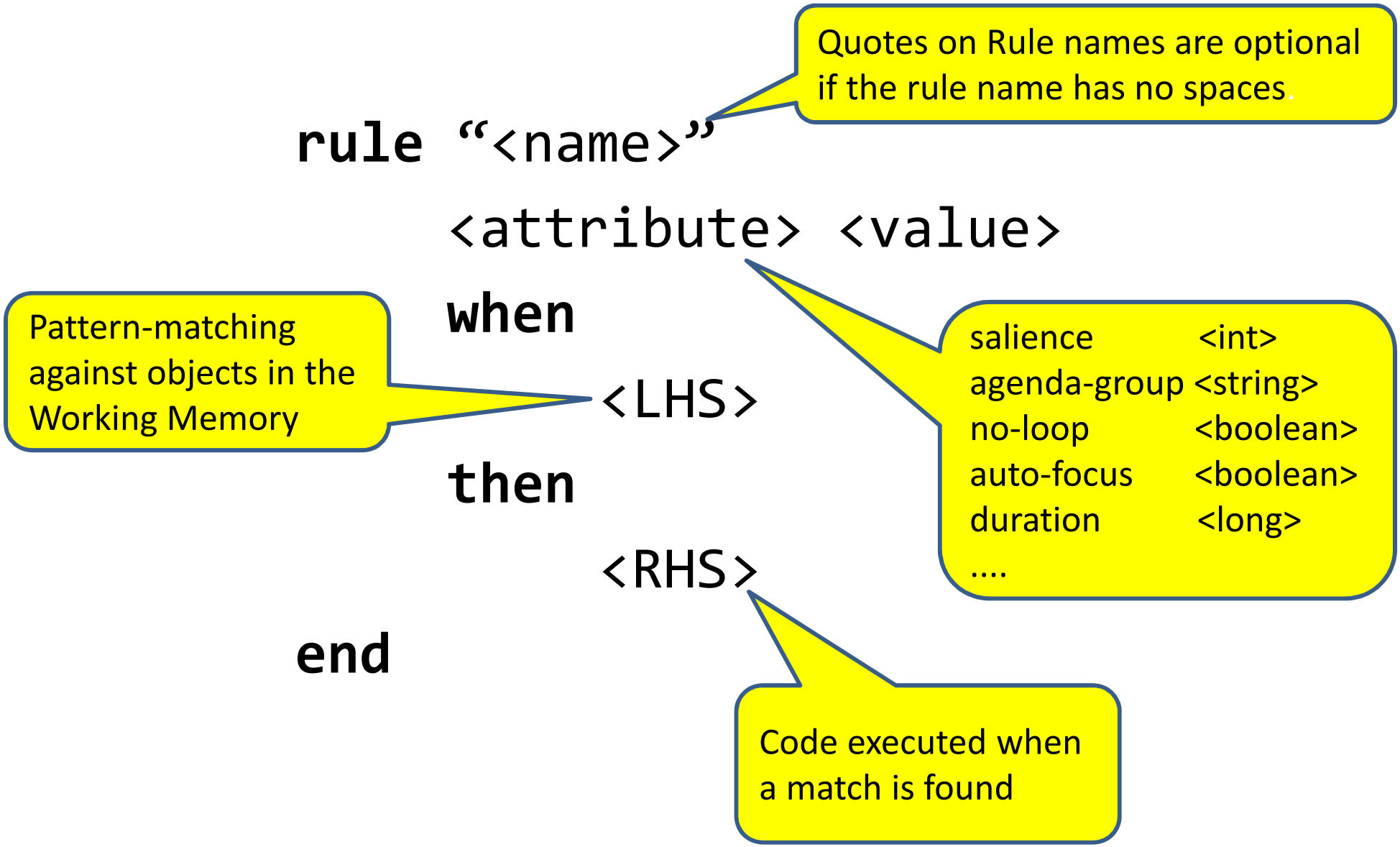
When should you use a Rule Engine?

- The problem is beyond any obvious algorithmic solution or it isn't fully understood
- The logic changes often
- Domain experts (or business analysts) are readily available, but are nontechnical
- You want to isolate the key parts of your business logic, *especially the really messy parts*

How a rule-based system works



Rule's anatomy



Imperative vs Declarative

A method must be called directly

Specific passing of arguments

```
public void helloMark(Person person) {
        if ( person.getName().equals( “mark” ) {
                System.out.println( “Hello Mark” );
        }
}
```

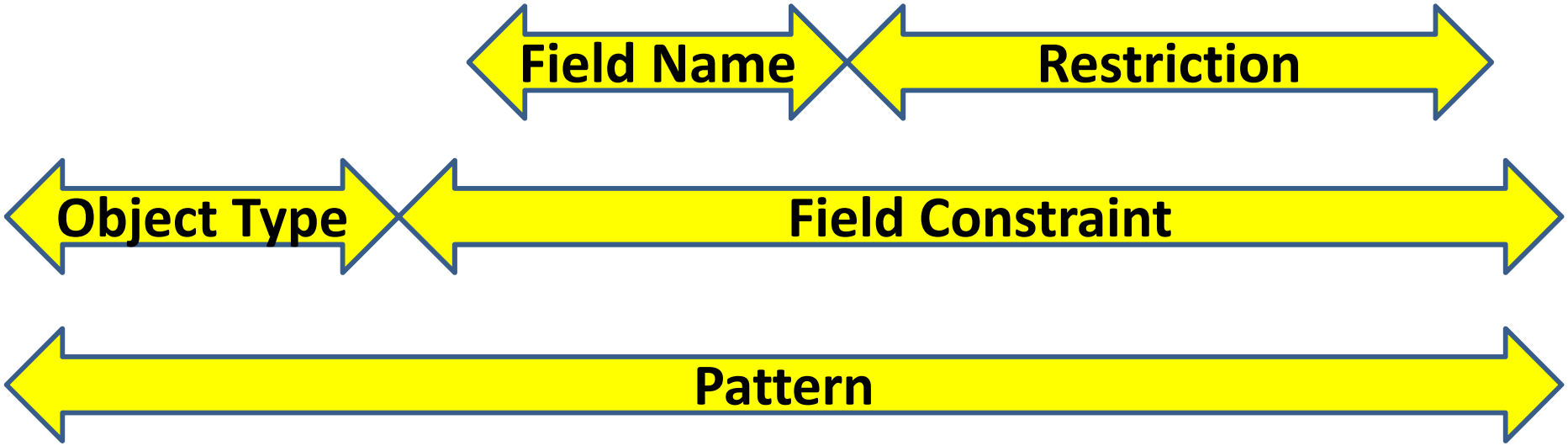
Rules can never be called directly

Specific instances cannot be passed but are automatically selected with pattern-matching

```
rule “Hello Mark”
        when
                Person( name == “mark” )
        then
                System.out.println( “Hello Mark” );
end
```

What is a pattern

```
Person( name == “mark” )
```



Rule's definition

```java
// Java
public class Applicant {
    private String name;
    private int age;
    private boolean valid;
    // getter and setter here
}
```

```
// DRL
declare Applicant
    name : String
    age : int
    valid : boolean
end
```

```
rule "Is of valid age" when
    $a : Applicant( age >= 18 )
then
    modify( $a ) { valid = true };
end
```

Building

```
KnowledgeBuilder kbuilder =
        KnowledgeBuilderFactory.newKnowledgeBuilder();
kbuilder.add(
        ResourceFactory.newClassPathResource("Rules.drl"),
        ResourceType.DRL);
KnowledgeBuilderErrors errors = kbuilder.getErrors();
if (kbuilder.hasErrors()) {
   System.err.println(kbuilder.getErrors().toString());
}
KnowledgeBase kbase =
        KnowledgeBaseFactory.newKnowledgeBase();
kbase.addKnowledgePackages(kbuilder.getKnowledgePackages());
```

Executing

```
StatelessKnowledgeSession ksession =
        kbase.newStatelessKnowledgeSession();
Applicant applicant = new Applicant( "Mr John Smith", 21 );
assertFalse( applicant.isValid() );
ksession.execute( applicant );
assertTrue( applicant.isValid() );
```

More Pattern Examples

```
Person( $age : age )
Person( age == ( $age + 1 ) )

Person(age > 30 && < 40 || hair in (“black”, “brown”) )

Person(pets contain $rover )

Person(pets[’rover’].type == “dog”)
```

Conditional Elements

```
not Bus( color = “red” )
exists Bus( color = “red” )
forall ( $bus : Bus( color == “red” ) )

$owner : Person( name == “mark” )
         Pet( name == “rover” ) from $owner.pets

$zipCode : ZipCode()
Person( ) from $hbn.getNamedQuery(“Find People”)
                   .setParameters( [ “zipCode” : $zipCode ] )
                   .list()
```

Hibernate session

'from' can work on any expression

Timers & Calendars

```
rule R1
    timer 1m30s
when
    $l : Light( status == “on” )
then
   modify( $l ) { status = “off” };
```

When the light is on, and has been on for 1m30s then turn it off

```
rule R3
    calendars "weekday"
    timer (int:0 1h)
when
    Alarm()
then
    sendEmail( ”Alert!” )
```

Execute now and after
1 hour duration only during weekday

```
rule R2
   timer (  cron: 0 0/15 * * * * )
when
    Alarm()
then
   sendEmail( ”Alert!” )
```

Send alert every quarter of an hour

Truth Maintenance System (1)

```
rule "Issue Adult Bus Pass" when
    $p : Person( age >= 18 )
then
    insert(new AdultBusPass( $p ) );
end

rule "Issue Child Bus Pass" when
    $p : Person( age < 18 )
then
    insert(new ChildBusPass( $p ) );
end
```

Coupled logic

What happens when the child becomes adult?

Truth Maintenance System (2)

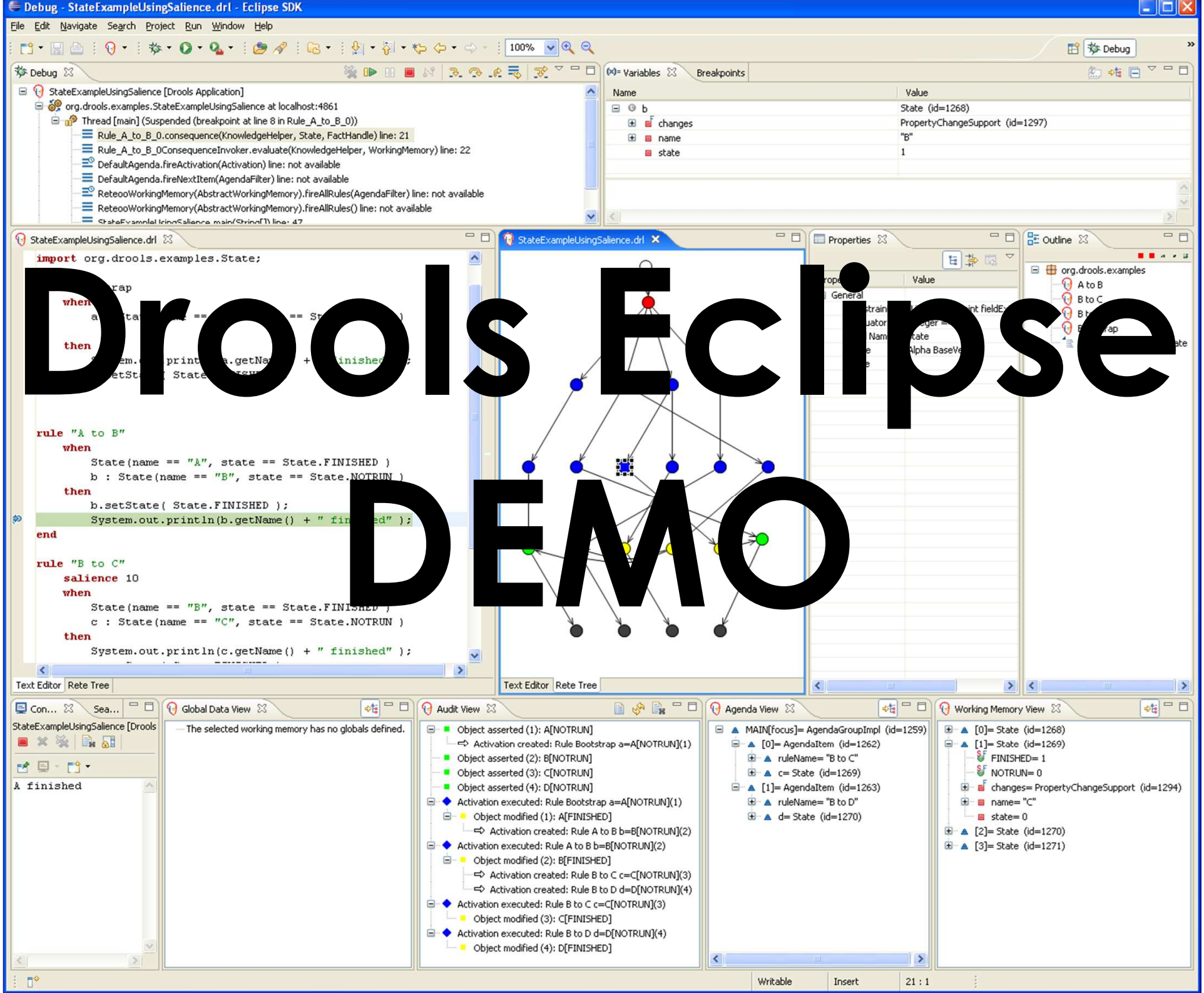
```
rule "Who Is Child" when
    $p : Person( age < 18 )
then
    logicalInsert( new IsChild( $p ) )
end

rule "Issue Child Bus Pass" when
    $p : Person( )
    IsChild( person =$p )
then
    logicalInsert(new ChildBusPass( $p ) );
end
```

De-couples the logic

Encapsulate knowledge providing semantic abstractions for this encapsulation

Maintains the truth by automatically retracting



Drools Eclipse DEMO

Complex Event Processing

Event

A record of state change in the application domain at a particular point in time

Complex Event

An abstraction of other events called its members

Complex Event Processing

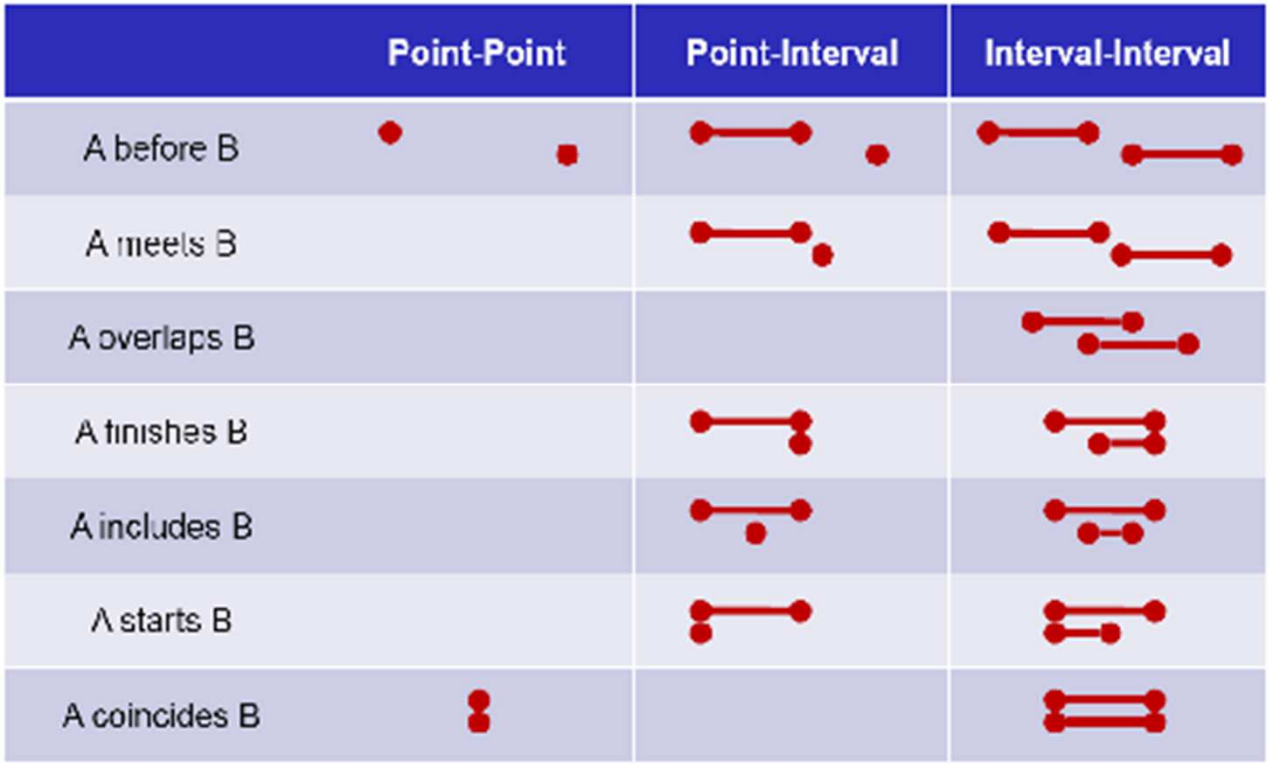
Processing multiple events with the goal of identifying the meaningful events within the event cloud

Drools Fusion

- Drools modules for Complex Event Processing
- Understand and handle events as a first class platform citizen (actually special type of Fact)
- Select a set of interesting events in a **cloud** or **stream** of events
- Detect the relevant relationship (patterns) among these events
- Take appropriate actions based on the patterns detected

Events as Facts in Time

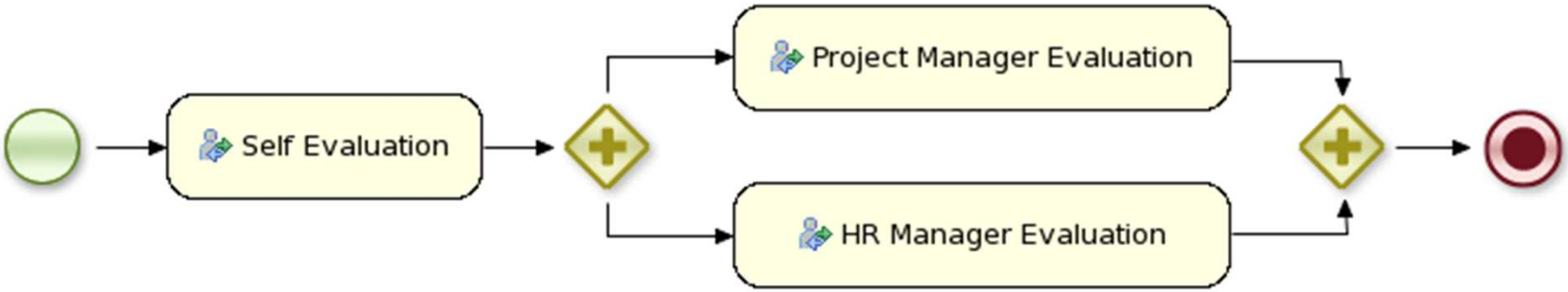
Temporal relationships between events




```
rule
    "Sound the alarm"
when
    $f : FireDetected( )
    not( SprinklerActivated( this after[0s,10s] $f ) )
then
    // sound the alarm
end
```

Workflows as Business Processes

A ***workflow*** is a process that describes the order in which a series of steps need to be executed, using a flow chart.

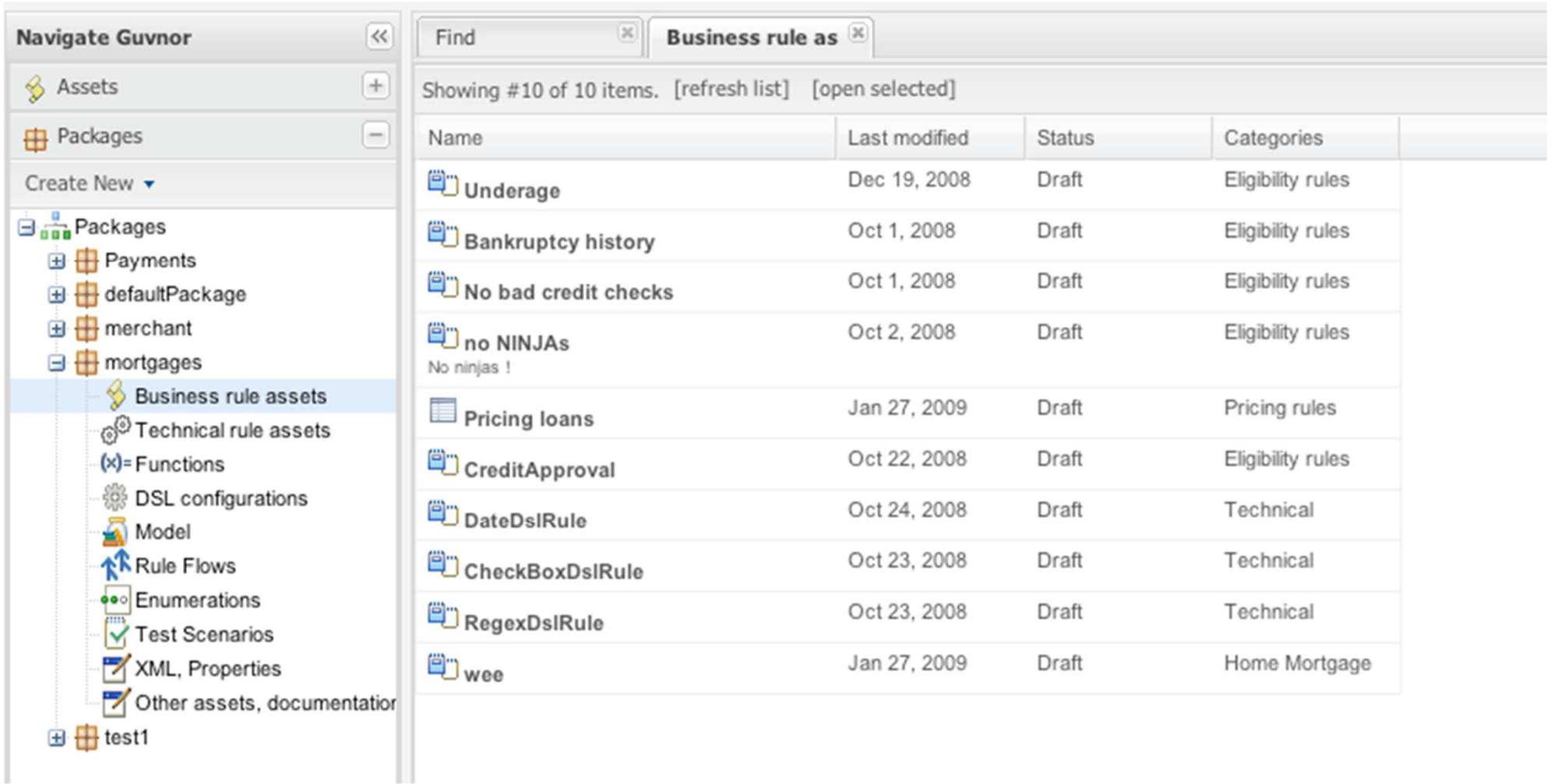


Drools Flow (aka jBPM5)

- Allows to model business processes
- Eclipse-based editor to support workflows graphical creation
- Pluggable persistence and transaction based on JPA / JTA
- Based on BPMN 2.0 specification
- Can be used with Drools to model your business logic as combination of processes, events and rules

Drools Guvnor

- Centralised repository for Drools Knowledge Bases
- Web based GUIs
- ACL for rules and other artifacts
- Version management
- Integrated testing

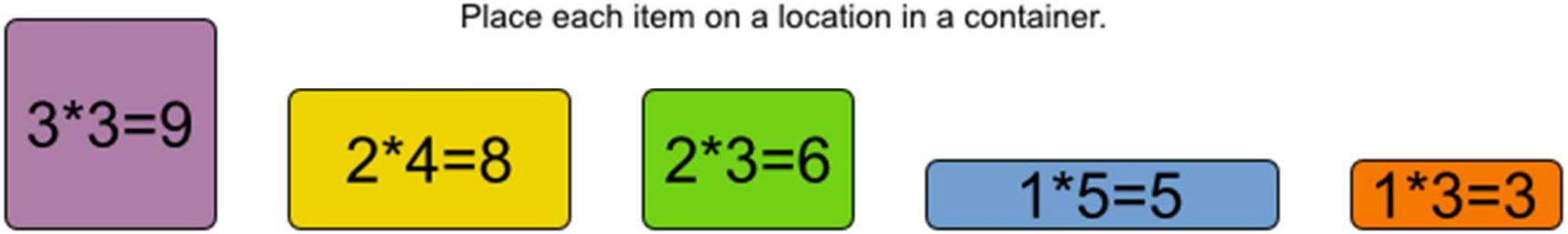

Navigate Guvnor
Assets
Packages
Create New
Packages
Payments
defaultPackage
merchant
mortgages
Business rule assets
Technical rule assets
Functions
DSL configurations
Model
Rule Flows
Enumerations
Test Scenarios
XML, Properties
Other assets, documentatior
test1
Find
Business rule as
Showing #10 of 10 items. [refresh list] [open selected]
Name
Last modified
Status
Categories
Underage
Dec 19, 2008
Draft
Eligibility rules
Bankruptcy history
Oct 1, 2008
Draft
Eligibility rules
No bad credit checks
Oct 1, 2008
Draft
Eligibility rules
no NINJAs
No ninjas !
Oct 2, 2008
Draft
Eligibility rules
Pricing loans
Jan 27, 2009
Draft
Pricing rules
CreditApproval
Oct 22, 2008
Draft
Eligibility rules
DateDslRule
Oct 24, 2008
Draft
Technical
CheckBoxDslRule
Oct 23, 2008
Draft
Technical
RegexDslRule
Oct 23, 2008
Draft
Technical
wee
Jan 27, 2009
Draft
Home Mortgage

Drools Planner

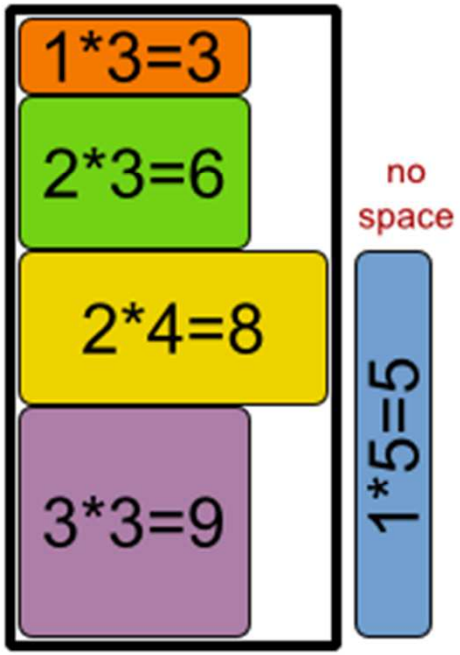
- Works on all kinds of planning problems
  - NP-complete
  - Hard & soft constraints
  - Huge search space
- Planning constraints can be weighted and are written as declarative score rules
- The planner algorithm is configurable. It searches through the solutions within a given amount of time and returns the best solution found

Bin packaging

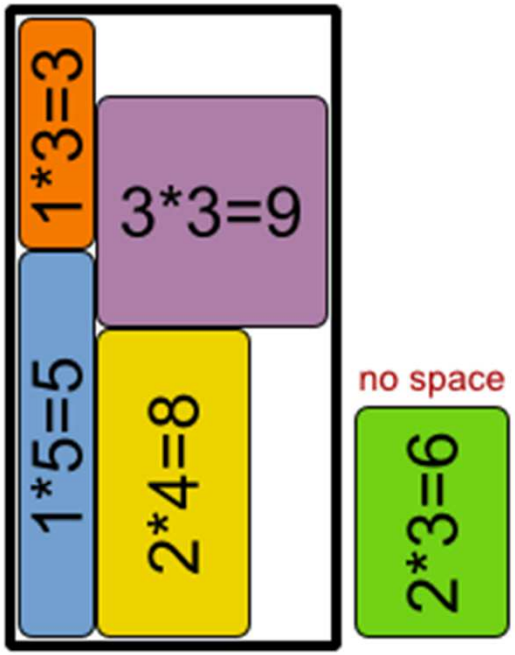
Place each item on a location in a container.



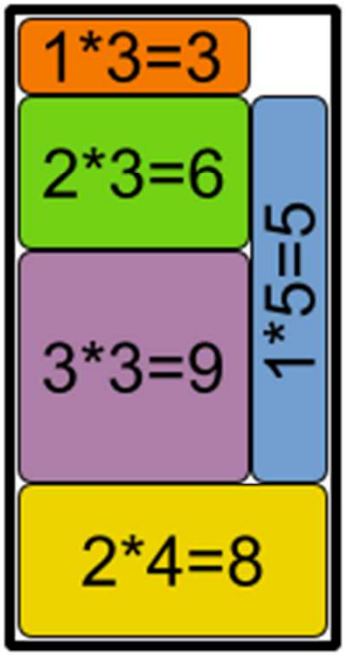
Largest size first

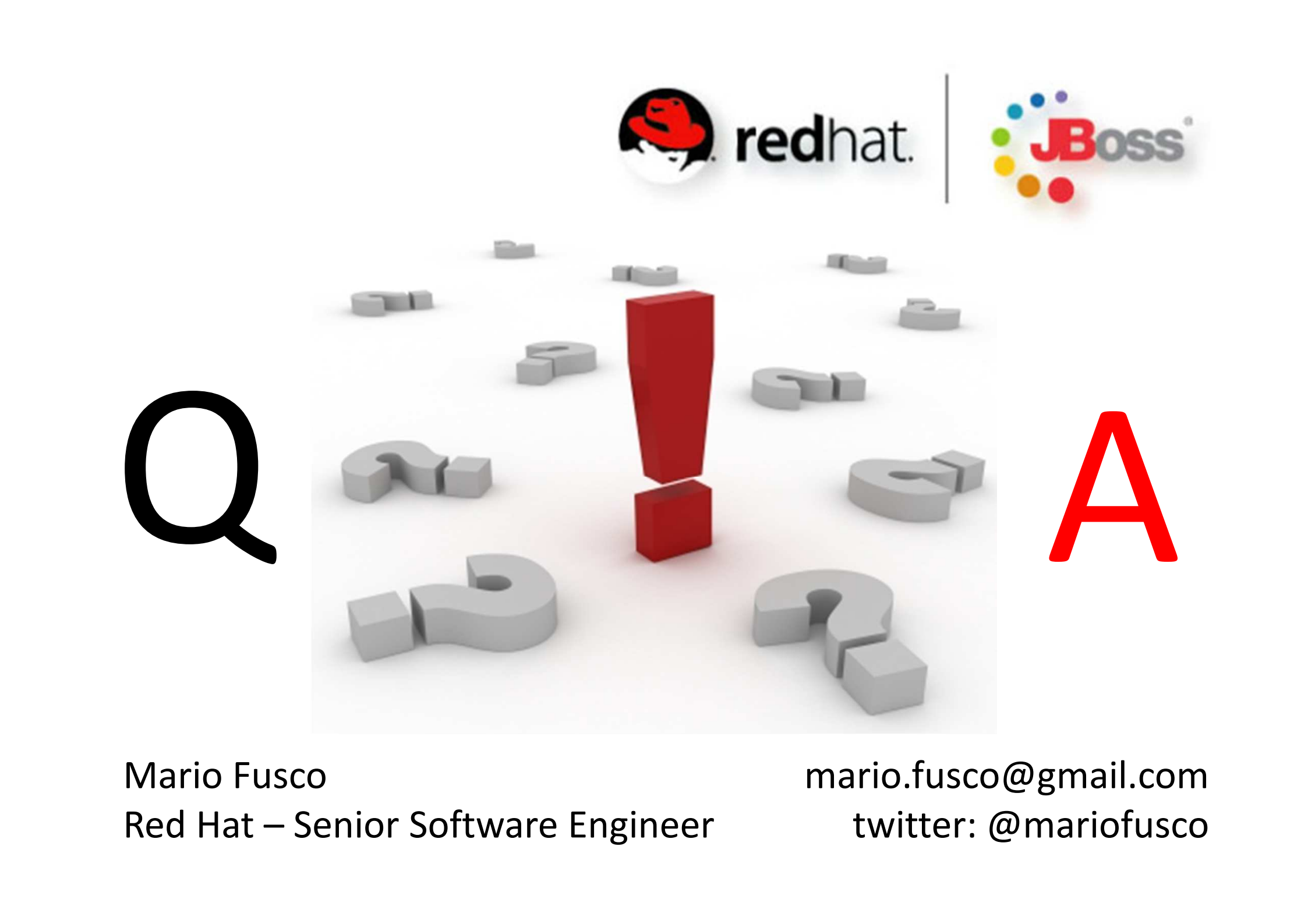


Largest side first



Drools Planner





Mario Fusco
Red Hat – Senior Software Engineer
mario.fusco@gmail.com
twitter: @mariofusco