A Wiki and SOA Endpoint for Rules in Open Vocabulary, Executable English

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reengineeringllc.com

Background Slides for a Demo at the International RuleML Symposium on Rule Interchange and Applications
October 2007, Orlando, Florida
Experience

• Author of over 20 papers, and an Addison-Wesley book, on rules systems and databases

• Assistant professor at Rutgers University

• Manager of principles and applications of logic programming, IBM Yorktown Research Laboratory

• Manager, internet development at Eventra

(A manufacturing supply chain company)
Agenda

• Enabling closer dialog between SOA stakeholders
  – Users, business analysts, enterprise architects, and system engineers

• A wiki for content in open vocabulary, executable English
  – Write applications a rules in English, run them, and get English explanations

• Google indexes and retrieves content in executable English
  – Acts as a kind of registry

• The wiki engine as an SOA knowledge endpoint on the web

• A supply chain example

• Automatic generation of complex, distributed SQL
  – With English explanations of results

• Capturing generated SQL for re-use

• Summary
Enabling Closer Dialog Between SOA Stakeholders

Customer’s English model of the world

negotiable semantic distance

Supplier’s English model of the world
Enabling Closer Dialog Between SOA Stakeholders

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Enabling Closer Dialog Between SOA Stakeholders

Customer’s English model of the world

negotiable semantic distance

Supplier’s English model of the world

semantic disconnects
Enabling Closer Dialog Between SOA Stakeholders

the customer term PC for Gamers and
the manufacturer term Prof Desktop agree -
they are of type Worksts/Desktops

for the supplier the term Prof Desktop
has part Memory with property Size = 512 in
the shared namespace

English explanations bridge the
semantic gap between people
and machines

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negotiable semantic distance
Supplier’s English model of the world
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A Wiki for content in open vocabulary, executable English

Products x and z can be substituted for product y, but only in the Fall

End User / Business Analyst

Semantics3

Writes Business Rules in open vocabulary English Directly into a browser

Runs the Rules Using the browser

Sees English explanations of the Results
A Wiki for content in open vocabulary, executable English

End User / Business Analyst

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Semantics3

- Writes Business Rules in open vocabulary English Directly into a browser
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Theory of Declarative Knowledge

Semantics2

Programmer

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Writes Business Rules in open vocabulary English Directly into a browser

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Internent Business Logic

Application Independent

Theory of Declarative Knowledge

Semantics2

Programmer
A Wiki for content in open vocabulary, executable English

End User / Business Analyst

What proportion of each base product should be used?

Theory of Declarative Knowledge

Semantics1

Semantics2

Semantics3

Internet Business Logic

Application Independent

End User / Business Analyst

End User / Business Analyst

Programmer

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A Wiki for content in open vocabulary, executable English

- The vocabulary is open, and so -- to a large extent -- is the syntax
  - *not* yet-another-controlled-English-system
- No dictionary or grammar maintenance is needed
- Strict English semantics is achieved via a trade off
  - if you want two English sentences to mean the same thing, you must say so
  - you must use place holders, such as “some-name” and “a-number”
- But, you are free to write executable English knowledge containing...
  - technical terms or jargon -- Wildcat, Upstream, Mud (oil industry)
  - government acronyms and usage -- SRB, Single Regeneration Budget
  - logical expressions -- \((A \text{ c,t}) \rightarrow (E \text{ c1}) \rightarrow (\text{ that-C c1 t and c partof c1 at t })\)
- Although the system is open vocabulary, it can be used to query and manage:
  - controlled vocabularies, taxonomies and ontologies
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Google indexes and retrieves content in executable English

Search: for estimated demand that-id fraction of the order

The executable English rules and facts that define the application

A paper that describes the application

Did you mean: for estimated demand that-is fraction of the order

Scholarly articles for for estimated demand that-id fraction of the order

Data-Driven and Demand-Driven Computer Architecture - by Treleaven - 102 citations
Budget constrained frontier measures of fiscal equality ... - by Grosskopf - 46 citations
Underinvestment, Debt Financing, and Long-Term Supplier ... - by Subramaniam - 1 citations

An Oil Industry Supply Chain Example Version 20050524 || You can ...
... in some-month of some-year for estimated demand that-id some-fraction of the order will be some-product from some-refinery that-quantity * that-fraction ...
www.reengineeringllc.com/demo_agents/Oil-IndustrySupplyChain1.agent - 7k - Cached - Similar pages

[PDF] Oil Industry Supply Chain Management Using English Business Rules ...
File Format: PDF/Adobe Acrobat - View as HTML
for estimated demand that-id some-fraction of the order will be some-product from some-refinery that-quantity * that-fraction = some-amount ...
www.reengineeringllc.com/Oil_Industry_Supply_Chain_by_Kowalski_and_Walker.pdf - Similar pages
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The Wiki engine as an SOA endpoint on the Web

Your Customers

Your Added Java

Java Client Stub

Internet Business Logic

Application Independent

SQL

RDF

Downloadable from http://www.reengineeringllc.com/iblClient1.java
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A supply chain example

Refinery → Terminal Storage → Service Station → Terminal Pickup
A supply chain example

• A customer needs 1000 gallons of product y in October

• Products x and z can be substituted for product y, but only in the Fall

• Combine products x, y and z to fill the order

• Combination depends on:
  • How much of each product is available from each refinery
  • Available transportation from each refinery to the customer area

-- Example based on
“Oil Industry Supply Chain Management Using English Business Rules Over SQL”
by Ted Kowalski and Adrian Walker,
www.reengineeringllc.com/Oil_Industry_Supply_Chain_by_Kowalski_and_Walker.pdf
A supply chain example

Facts:

estimated demand this-id in this-region is for this-quantity gallons of this-finished-product in this-month of this-year

<table>
<thead>
<tr>
<th>id</th>
<th>region</th>
<th>quantity</th>
<th>product</th>
<th>month</th>
<th>year</th>
</tr>
</thead>
<tbody>
<tr>
<td>523</td>
<td>NJ</td>
<td>1000</td>
<td>product-y</td>
<td>October</td>
<td>2005</td>
</tr>
</tbody>
</table>

in this-season an order for this-product1 can be filled with the alternative this-product2

<table>
<thead>
<tr>
<th>season</th>
<th>product1</th>
<th>product2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>product-y</td>
<td>product-x</td>
</tr>
<tr>
<td>Fall</td>
<td>product-y</td>
<td>product-z</td>
</tr>
</tbody>
</table>

in this-month the refinery this-name has committed to schedule this-amount gallons of this-product

<table>
<thead>
<tr>
<th>month</th>
<th>refinery</th>
<th>amount</th>
<th>product</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>Shell Canada One</td>
<td>500</td>
<td>product-y</td>
</tr>
<tr>
<td>October</td>
<td>Shell Canada One</td>
<td>300</td>
<td>product-x</td>
</tr>
<tr>
<td>October</td>
<td>Shell Canada One</td>
<td>800</td>
<td>product-z</td>
</tr>
<tr>
<td>October</td>
<td>Shell Canada One</td>
<td>10000</td>
<td>product-w</td>
</tr>
</tbody>
</table>

we have this-method transportation from refinery this-name to region this-region

<table>
<thead>
<tr>
<th>method</th>
<th>from</th>
<th>to</th>
</tr>
</thead>
<tbody>
<tr>
<td>truck</td>
<td>Shell Canada One</td>
<td>NJ</td>
</tr>
<tr>
<td>rail</td>
<td>Shell Canada One</td>
<td>NJ</td>
</tr>
</tbody>
</table>
A supply chain example

Rules:

estimated demand some-id in some-region is for some-quantity gallons of some-finished-product in some-month of some-year
for estimated demand that-id some-fraction of the order will be some-product from some-refinery
that-quantity * that-fraction = some-amount

for demand that-id that-region for that-quantity that-finished-product we use that-amount that-product from that-refinery

estimated demand some-id in some-region is for some-quantity gallons of some-finished-product in some-month of some-year
for demand that-id for that-finished-product refinery some-refinery can supply some-amount gallons of some-product
for demand that-id the refineries have altogether some-total gallons of acceptable base products
that-amount / that-total = some-long-fraction
that-long-fraction rounded to 2 places after the decimal point is some-fraction

for estimated demand that-id that-fraction of the order will be that-product from that-refinery

estimated demand some-id in some-region is for some-amount gallons of some-product in some-month of some-year
sum a-num:
for demand that-id for that-product refinery some-name can supply some-num gallons of some-product1 = a-total
for demand that-id the refineries have altogether that-total gallons of acceptable base products
### A supply chain example

#### An answer table:

<table>
<thead>
<tr>
<th>this-id</th>
<th>this-region</th>
<th>this-quantity</th>
<th>this-finished-product</th>
<th>this-amount</th>
<th>this-product</th>
<th>this-refinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>523</td>
<td>NJ</td>
<td>1000</td>
<td>product-y</td>
<td>190.0</td>
<td>product-x</td>
<td>Shell Canada One</td>
</tr>
<tr>
<td>523</td>
<td>NJ</td>
<td>1000</td>
<td>product-y</td>
<td>310.0</td>
<td>product-y</td>
<td>Shell Canada One</td>
</tr>
<tr>
<td>523</td>
<td>NJ</td>
<td>1000</td>
<td>product-y</td>
<td>500.0</td>
<td>product-z</td>
<td>Shell Canada One</td>
</tr>
</tbody>
</table>

To run or change this example, please point IE6, Netscape7 or Mozilla to the demo Oil-IndustrySupplyChain1 at www.reengineeringllc.com
A supply chain example

An explanation:

estimated demand 523 in NJ is for 1000 gallons of product-y in October of 2005
for estimated demand 523 0.19 of the order will be product-x from Shell Canada One
1000 * 0.19 = 190
---------------------------------------------------------------
for demand 523 NJ for 1000 product-y we use 190 product-x from Shell Canada One

estimated demand 523 in NJ is for 1000 gallons of product-y in October of 2005
for demand 523 for product-y refinery Shell Canada One can supply 300 gallons of product-x
for demand 523 the refineries have altogether 1600 gallons of acceptable base products
300 / 1600 = 0.1875
0.1875 rounded to 2 places after the decimal point is 0.19
---------------------------------------------------------------
for estimated demand 523 0.19 of the order will be product-x from Shell Canada One

estimated demand 523 in NJ is for 1000 gallons of product-y in October of 2005
sum eg-amount :
  for demand 523 for product-y refinery eg-refinery can supply eg-amount gallons of eg-product1 = 1600
------------------------------------------------------------------------------------------------------------------
for demand 523 the refineries have altogether 1600 gallons of acceptable base products

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Automatic generation of complex, distributed SQL

Rules for finding SQL data on the Internet:

A data table

we have this-method transportation from refinery this-name to region this-region

<table>
<thead>
<tr>
<th>truck</th>
<th>Shell Canada One</th>
<th>NJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>rail</td>
<td>Shell Canada One</td>
<td>NJ</td>
</tr>
</tbody>
</table>

A rule that says how to find the table on the internet

url:www.example.com dbms:9i dbname:ibldb tablename:T1 port:1521 id:anonymous password:oracle

we have this-method transportation from refinery this-name to region this-region

To run or change this example, please point IE6, Netscape7 or Mozilla to the demo Oil-IndustrySupplyChain1 at www.reengineeringllc.com
A SQL query generated automatically from the supply chain knowledge:

```sql
select distinct x6,T2.PRODUCT,T1.NAME,T2.AMOUNT,x5 from
T6 tt1,T6 tt2,T5,T4,T3,T2,T1,T6,
(select x3 x6,T6.FINISHED_PRODUCT x7,T6.ID x8,tt1.ID x9,tt2.ID x10,sum(x4) x5 from
T6,T6 tt1,T6 tt2,
((select T6.ID x3,T3.PRODUCT1,T1.NAME,T2.AMOUNT x4,T2.PRODUCT from
T1,T2,T3,T4,T5,T6,T6 tt1,T6 tt2 where
T1.NAME=T2.NAME and T1.REGION=T6.REGION and T2.MONTH1=T4.MONTH1 and
T2.MONTH1=T6.MONTH1 and T2.PRODUCT=T3.PRODUCT2 and T4.MONTH1=T6.MONTH1 and
T3.PRODUCT1=T6.FINISHED_PRODUCT and T3.SEASON=T4.SEASON and T3.SEASON=T5.SEASON and
T4.SEASON=T5.SEASON and T6.ID=tt1.ID and T6.ID=tt2.ID and tt1.ID=tt2.ID)
union
(select T6.ID x3,T2.PRODUCT,T1.NAME,T2.AMOUNT x4,T2.PRODUCT from
T1,T2,T3,T4,T5,T6,T6 tt1,T6 tt2 where
T1.NAME=T2.NAME and T1.REGION=T6.REGION and T2.MONTH1=T6.MONTH1 and
T2.PRODUCT=T6.FINISHED_PRODUCT and T6.ID=tt1.ID and T6.ID=tt2.ID and tt1.ID=tt2.ID))
) group by T6.FINISHED_PRODUCT,T6.ID,tt1.ID,tt2.ID,x3
) where
T6.ID=tt2.ID and tt1.ID=T6.ID and T6.FINISHED_PRODUCT=x7 and T6.ID=x8 and tt1.ID=x8 and
tt2.ID=x8 and T1.NAME=T2.NAME and T1.REGION=tt2.REGION and T2.MONTH1=T4.MONTH1 and
T2.MONTH1=tt1.MONTH1 and T2.PRODUCT=tt2.PRODUCT2 and
T3.PRODUCT1=tt1.FINISHED_PRODUCT and T3.PRODUCT1=tt2.FINISHED_PRODUCT and
T3.SEASON=T4.SEASON and T3.SEASON=T5.SEASON and T4.MONTH1=tt2.MONTH1 and
T4.SEASON=T5.SEASON and T6.ID=x6 and tt1.FINISHED_PRODUCT=tt2.FINISHED_PRODUCT and
tt1.ID=tt2.ID and tt1.ID=x6 and tt2.ID=x6
order by x6,T2.PRODUCT,T1.NAME,T2.AMOUNT,x5;
```
Automatic generation of complex, distributed SQL

• It would be difficult to
  • write the SQL query reliably by hand
  • manually reconcile it with the business knowledge specified in the rules.
• Yet this is a *simple* example!

• How do we know that the automatically generated SQL yields results that are correct with respect to the business rules?
• We can get step-by-step business level English explanations
  • same as in the non-SQL case
Automatic generation of complex, distributed SQL

• Could a programmer write more readable SQL by hand?

• Yes, but we would need to add comments in English to help people to reconcile the hand-written query with the business knowledge

• By their nature, the comments would not be used during machine processing
  • Correctness of the hand written-SQL would rely on lengthy, and error prone manual verification

• Comments are sometimes not kept up to date with the code!
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Capturing generated SQL for re-use

**Oil-IndustrySupplyChain1**

<table>
<thead>
<tr>
<th>Id</th>
<th>Demand Region</th>
<th>Demand Amount</th>
<th>Product</th>
<th>Demand Price</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>523</td>
<td>NJ</td>
<td>1000</td>
<td>product-y</td>
<td>190.0</td>
<td>Shell Canada One</td>
</tr>
<tr>
<td>523</td>
<td>NJ</td>
<td>1000</td>
<td>product-y</td>
<td>310.0</td>
<td>Shell Canada One</td>
</tr>
<tr>
<td>523</td>
<td>NJ</td>
<td>1000</td>
<td>product-z</td>
<td>500.0</td>
<td>Shell Canada One</td>
</tr>
</tbody>
</table>

Please see FAQ #4 at www.reengineeringllc.com/internet_business_logic_FAQs.html

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1. Semantics2 -- what a reasoner *should* do:

Backchain iteration: towards a practical inference method that is simple enough to be proved
Terminating, sound and complete. Journal of automated reasoning, 11:1-22

2. The English inferencing examples

   *Oil-industrysupplychain1*
   
   *Oil-industrysupplychain1mysql1*

   (And many other examples provided) can be run, changed, and re-run as follows:
   1. Point internet explorer 6, netscape 7, firefox or mozilla to www.reengineeringllc.com
   2. Click on Internet Business Logic
   3. Click on the go button
   4. Click on the help button to see how to navigate through the pages
   5. Select *oil-industrysupplychain1* or *oil-industrysupplychain1mysql1*

3. You are cordially invited to write and run your own examples. Shared use of the system is free