Usability, Databases and Ontologies

Adrian Walker

Reengineering

Presentation for the Ontolog mini-series on Database and Ontology

http://ontolog.cim3.net/cgi-bin/wiki.pl?ConferenceCall_2007_03_08

Agenda

- Visions for the future of the Web, and a caution
- A view of current work on Semantics
  - Resource Description Framework (RDF)
  - Web Ontology Language (OWL)
  - Rule Interchange Format (RIF)
- A wider technical view -- Semantics1, 2 and 3
- A Wiki for business rules in open vocabulary English
- Summary - from Usability to Authorability of Executable English

Visions for the future of the Web, and a caution

- If HTML and the Web made all the online documents look like one huge book, the Semantic Web will make all the data in the world look like one huge database -- Tim Berners-Lee

- A “Web 2.0” that harnesses users’ collective intelligence via lightweight user interfaces, development models, and business models

  -- Tim O’Reilly

Web 2.0 trademark Registered June 2006 by CMP MEDIA LLC, for arranging trade shows

-- http://tess2.uspto.gov/bin/showfield?f=doc&state=jddaip.2.3

Visions for the future of the Web, and a caution

- Logic, which forms the basis of OWL is a complex format and requires users to sacrifice expressivity and pay enormous costs in translation and maintenance
- New representations *must be easy to translate to and from natural language*
  - (emphasis added)
- The Semantic Web will fail

-- Rob McCool

McCool, R. (2005) Re-thinking the Semantic Web. IEEE Internet Computing 9(6) November 2005

(McCool wrote the first version of what became the Apache web server, the initial spec for the Common Gateway Interface, and contributed to the original Netscape browser.)

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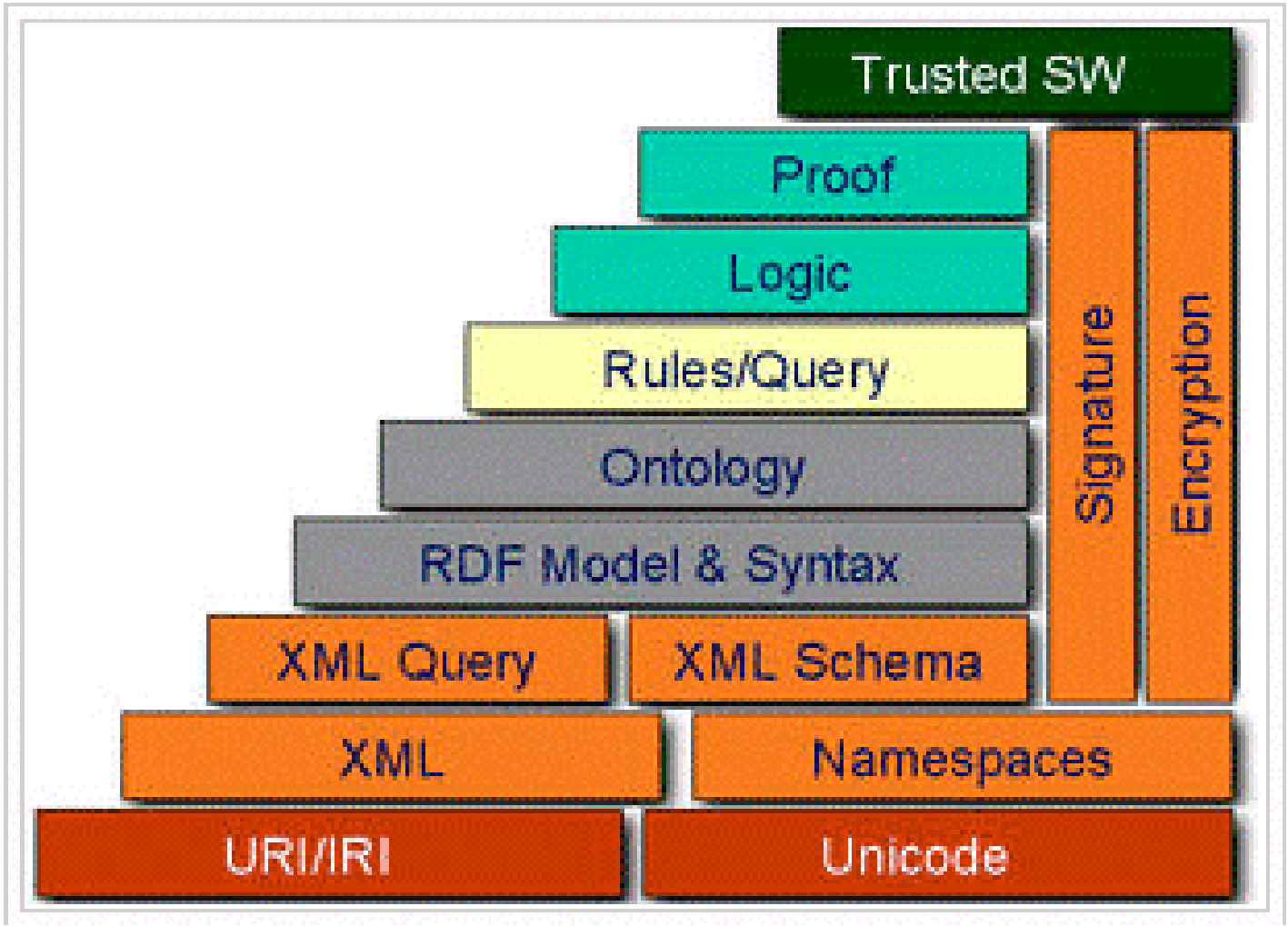
A view of current work on Semantics



Semantic Web Layer Cake, Early Version

A view of current work on Semantics

RDF, OWL, and RIF

- RDF provides a flexible data model for merging data from different sources
- An ontology written in OWL can help to unite data, e.g if differing identifiers were initially selected for the same thing
- Rules can be used to query or mine data

A view of current work on Semantics

Resource Description Framework (RDF)

- Make all the data in the world look like one huge database
- Use Uniform resource Identifiers -- URIs
  - Don't say "colour" say <http://example.com/2002/std6#col>
- Several syntaxes, but idea is to express all structured data as *triples*, using URIs
  - Simplified http://www.cs.vu.nl/~jbroeks/ fact#:email jbroeks@cs.vu.nl
  - Usual Form

```
<rdf:Property rdf:about="#email">
<rdfs:domain rdf:resource="#Person"/>
<rdfs:range
rdf:resource="http://www.w3.org/2001/XMLSchema#STRING"/>
</rdf:Property>

<rdf:Description rdf:about="http://www.cs.vu.nl/~jbroeks/">
<name>Jeen Broekstra</name>
<email>jbroeks@cs.vu.nl</email>
</rdf:Description>
```

A view of current work on Semantics

Resource Description Framework (RDF)

- Make all the data in the world look like one huge database

- RDFizers, tools that can be used to translate other data into RDF
  - D2RQ - treats Non-RDF relational databases as virtual RDF graphs
  - D2RMAP - "database to RDF" mapping language and processor
  - XLS -> RDF - converts Microsoft Excel spreadsheets into RDF
  - CSV -> RDF - converts "comma-separated values" files into RDF

- Real World Data Modeling
  - Engineering, Procurement, Construction in the process industries (oil & gas, chemical)
  - ISO 15926-7, Hans Teijgeler, http://www.infowebml.ws/

A view of current work on Semantics

Web Ontology Language (OWL)

- OWL ontologies capture terminology-level knowledge for standardization
- An ontology can include terminology such as "journal paper" *is_a* "publication"
- RDF and OWL are intended to be read by computers, not by people
- OWL Example:

```
<owl:ObjectProperty rdf:ID="author">
 <rdfs:label>Resource Author</rdfs:label>
 <rdfs:domain rdf:resource="#Resource" />
 <rdfs:range rdf:resource="http://ebiquity.umbc.edu/ontology/person.owl#Person" />
</owl:ObjectProperty>
```

```
<owl:Class rdf:ID="Person">
 <rdfs:label>Person</rdfs:label>
 <rdfs:subClassOf>
 <owl:Restriction>
 <owl:onProperty rdf:resource="#name" />
 <owl:maxCardinality
   rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">1
 </owl:maxCardinality>
 </owl:Restriction>
 </rdfs:subClassOf>
```

A view of current work on Semantics

Web Ontology Language (OWL)

- OWL ontologies capture terminology-level knowledge for standardization
- “The nice thing about standards is that there are so many of them to choose from”
- Reasoning in OWL
  - to bridge between different standards:

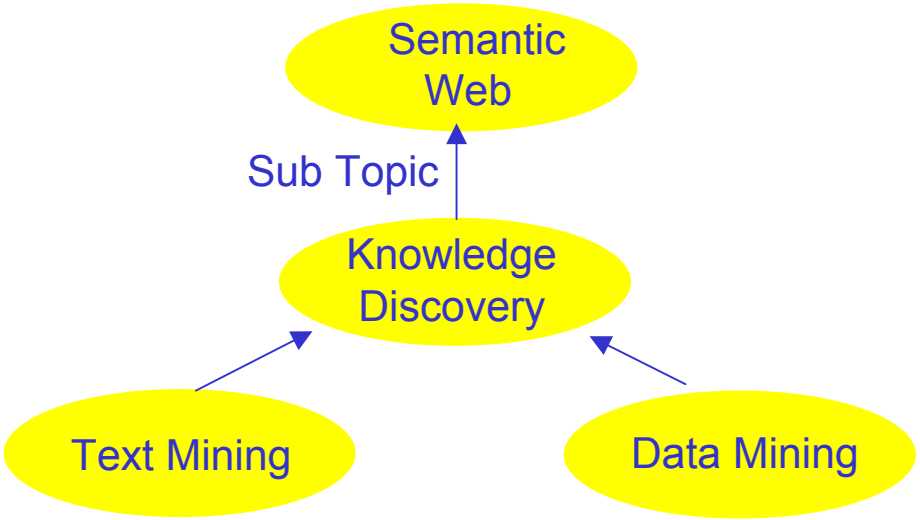
ontA:Bicycle is a subclass of the class of all ontB:landVehicle(s) whith exactly two wheels:

```
ontA:Bicycle
    owl:equivalentClass
    [ a owl:Class ;
    owl:intersectionOf (ontB:LandVehicle
                    [ a owl:Restriction ;
                      owl:cardinality 2 ;
                      owl:onProperty ontB:hasWheels
                    ])
    ] .
```

  - to check an ontology for consistency and completeness

A view of current work on Semantics

Web Ontology Language (OWL)



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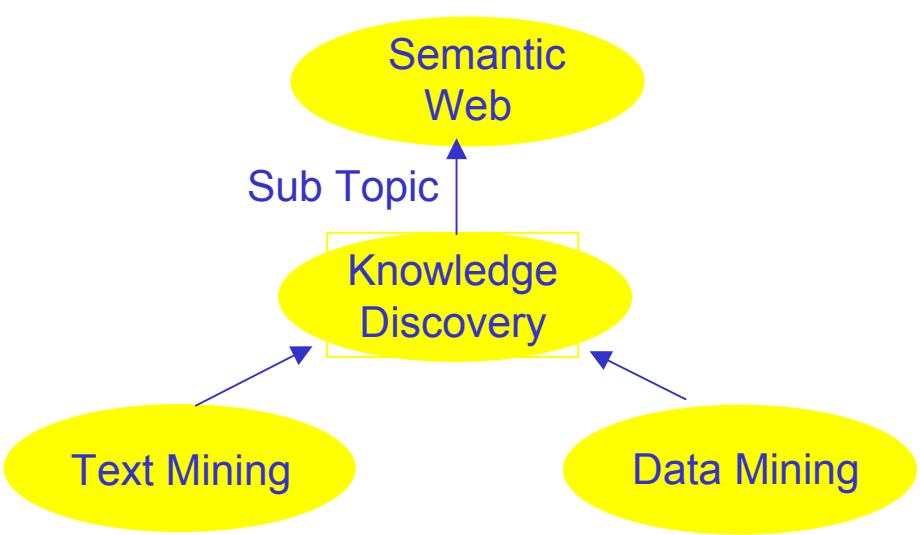

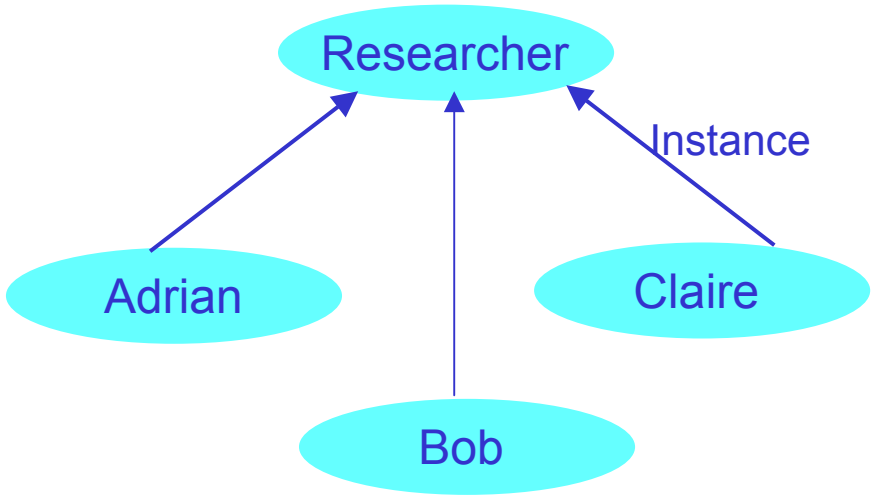

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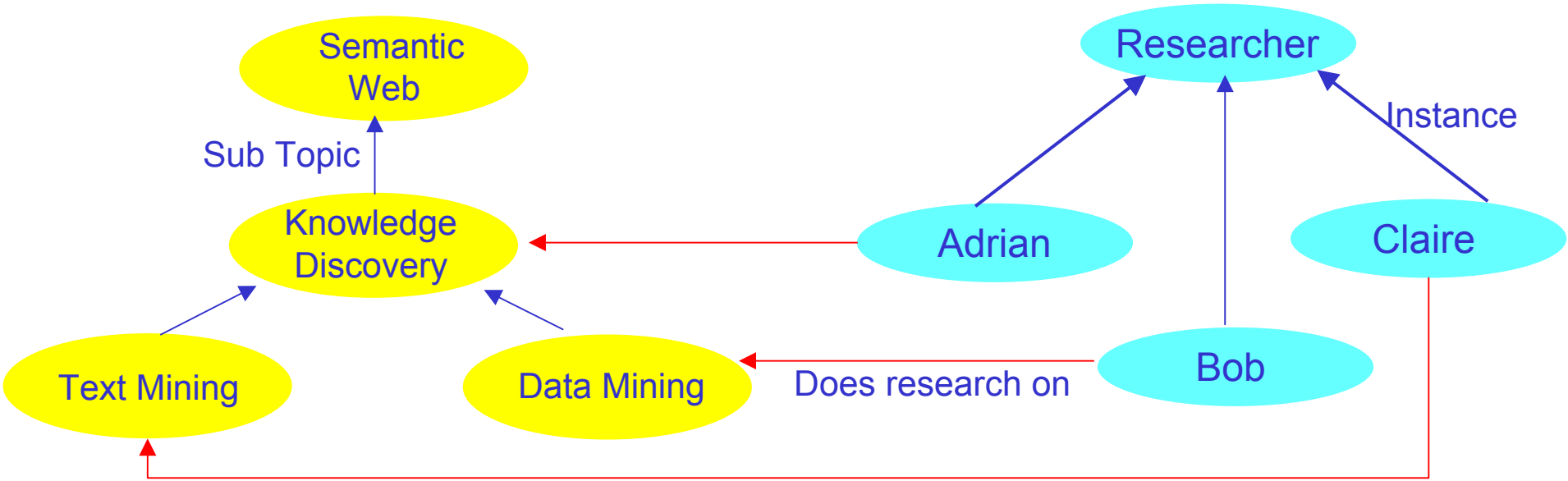
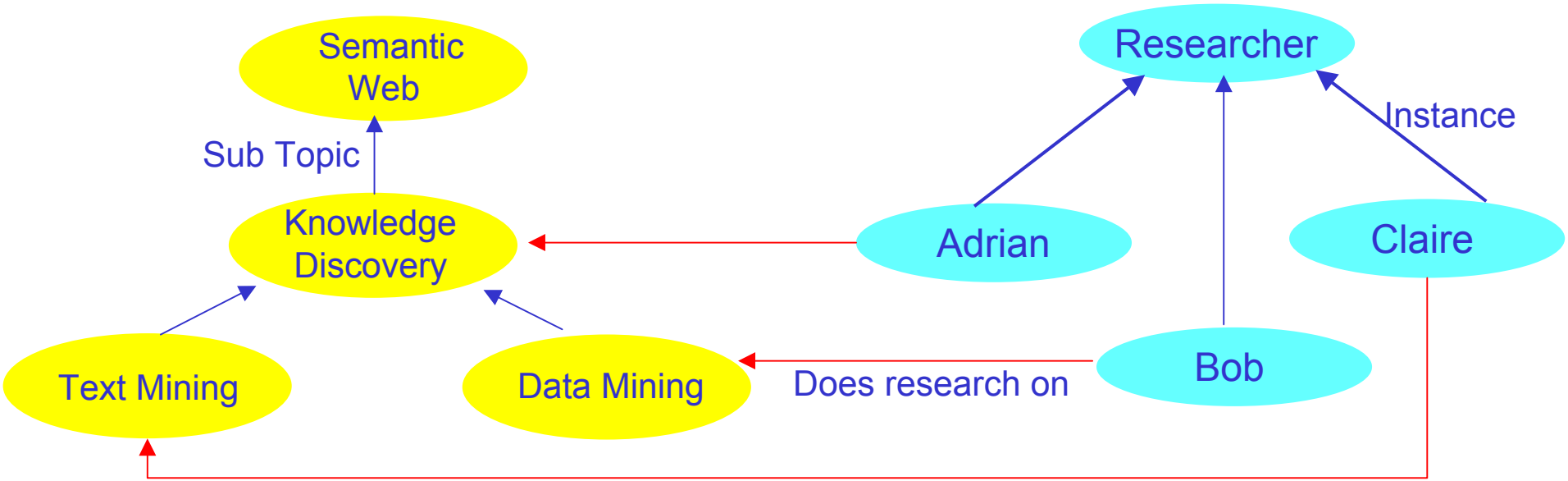


New user asked: how can I use RDF and Owl to find out from the above that "Bob does research into Semantic Web" ?

A view of current work on Semantics

Web Ontology Language (OWL)



New user asked: how can I use RDF and Owl to find out from the above that "Bob does research into Semantic Web" ?

Expert replied: "You can do it by declaring subtopic to be transitive and by using a **rule** such as

ObjectPropertyAtom(worksIn, ?x, ?y) IF
ObjectPropertyAtom(worksIn, ?x, ?z)
AND ObjectPropertyAtom(subtopic, ?z, ?y)

Such rules can be expressed in RuleML or in SWRL, but you would have to find an inference tool for them."

A view of current work on Semantics

Rule Interchange Format (RIF)

Rules can be used to query or mine data

- Rule Markup Language (RuleML) syntax
  - both forward chaining and backward chaining rules in XML

"A customer is premium if their spending has been min 5000 euro in the previous year."

```
<Implies>
  <head>
     <Atom>  <Rel>premium</Rel> <Var>customer</Var> </atom>
  </head>
  <body>
     <Atom>  <Rel>spending</Rel>   <Var>customer</Var>  <Ind>min 5000 euro</Ind>  <Ind>previous year</Ind>
    </Atom>
  </body>
</Implies>
```

A view of current work on Semantics

Rule Interchange Format (RIF)

Rules can be used to query or mine data

- SWRL: A Semantic Web Rule Language

- Combine OWL and RuleMLRules
  - Example:

    Person (?x1) ^ hasSibling(?x1,?x2) ^ Man(?x2) --> hasBrother(?x1,?x2)

- Executing this rule sets x1's hasBrother property to x2

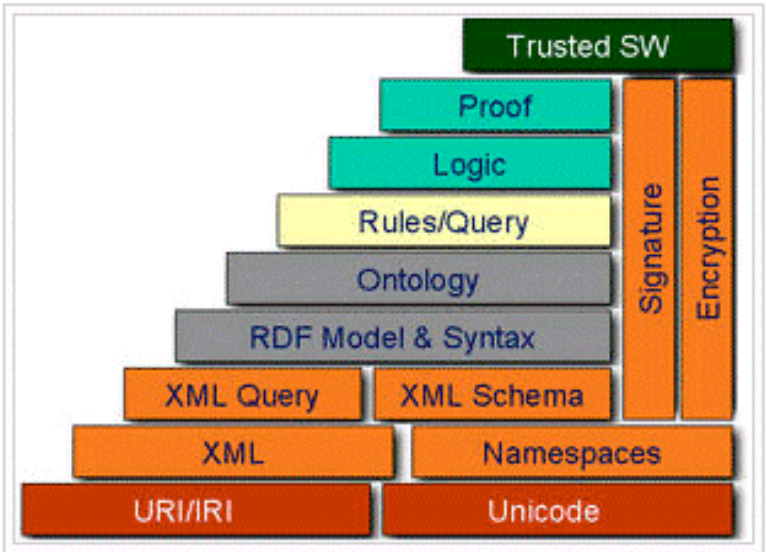
A view of current work on Semantics

Rule Interchange Format (RIF)

- As of early 2007 the W3C has an RIF Working Group in progress
  - http://lists.w3.org/Archives/Public/public-rif-wg
- The Rule Interchange syntax is not yet fixed
- Some issues in interchanging rules
  - given some rules, facts, and a question, different releases of a rule engine may give different answers
  - given some rules, facts, and a question two engines may give different answers
  - these are meaning assignment issues beyond the data semantics of RDF and OWL

A view of current work on Semantics

RDF, OWL and RIF



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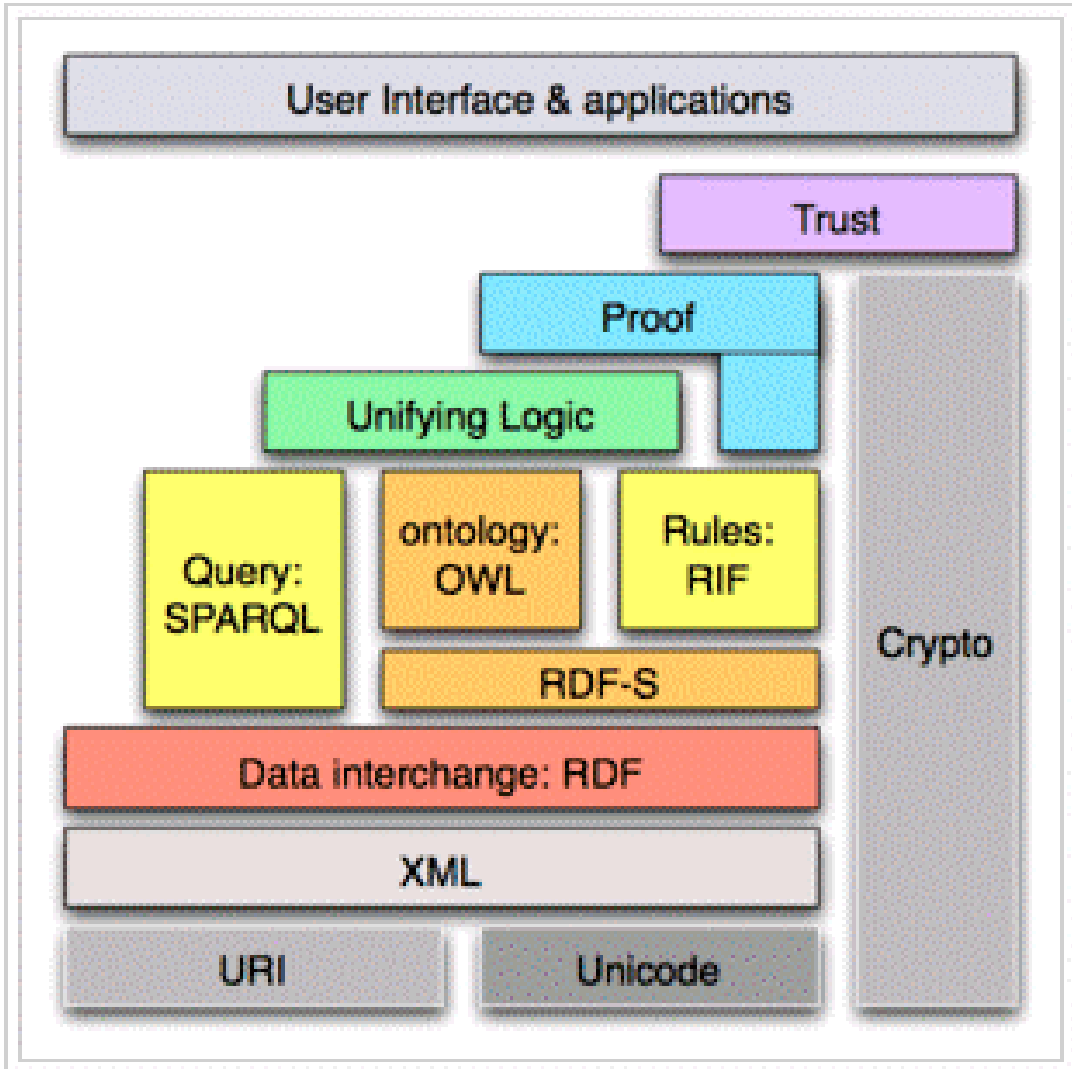

Semantic Web Layer Cake, Recent Version

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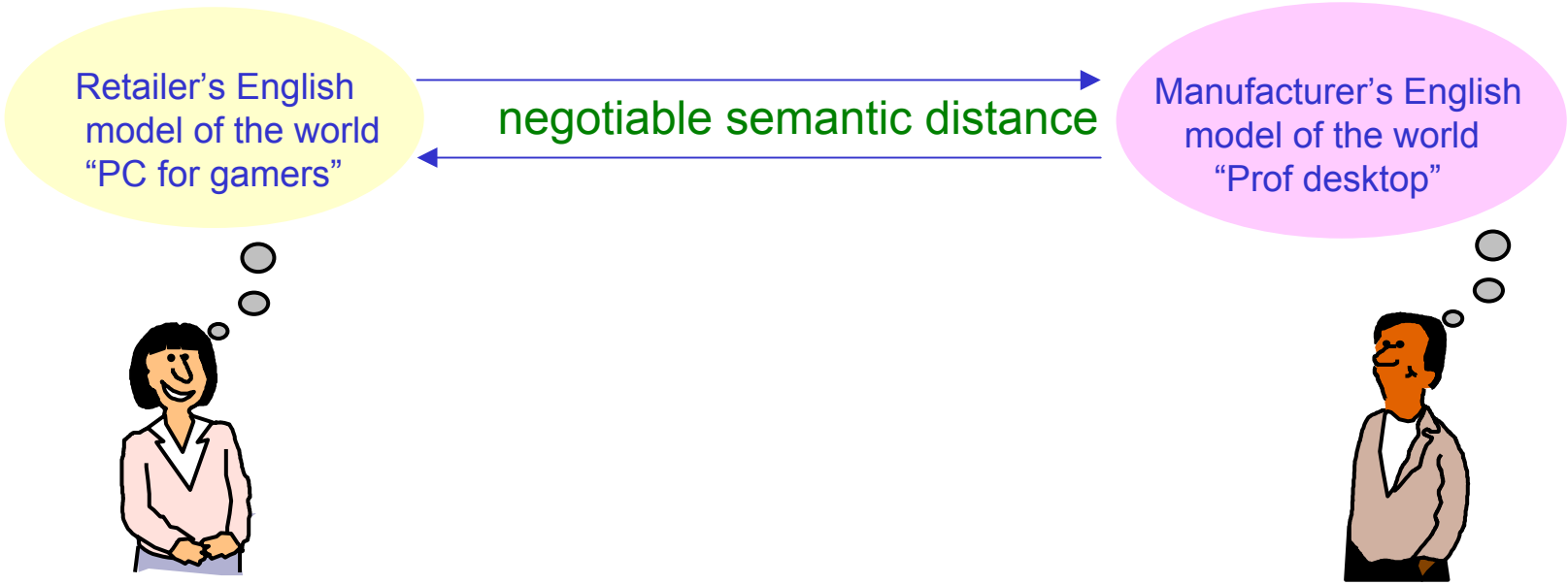
A wider technical view -- Semantics1, 2 and 3



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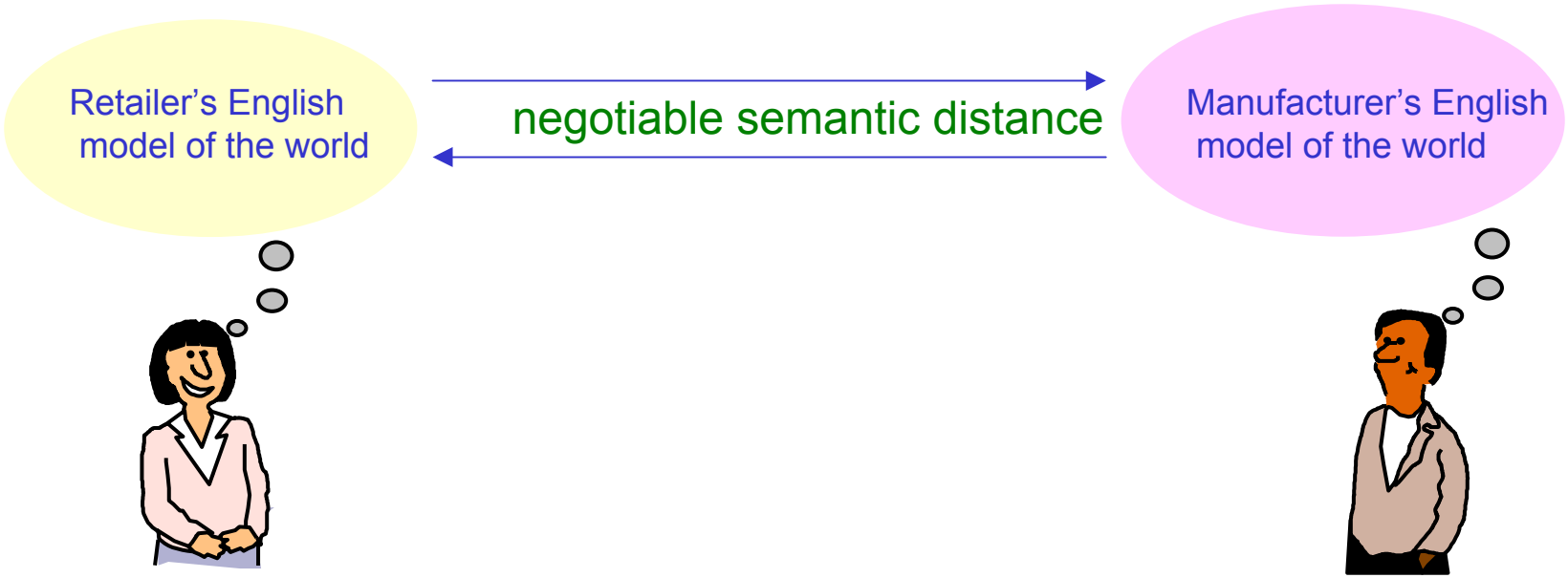

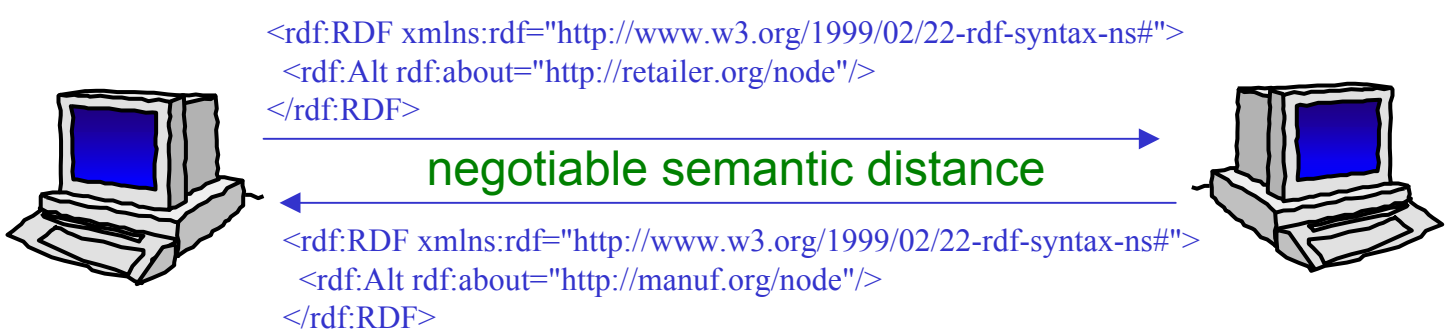

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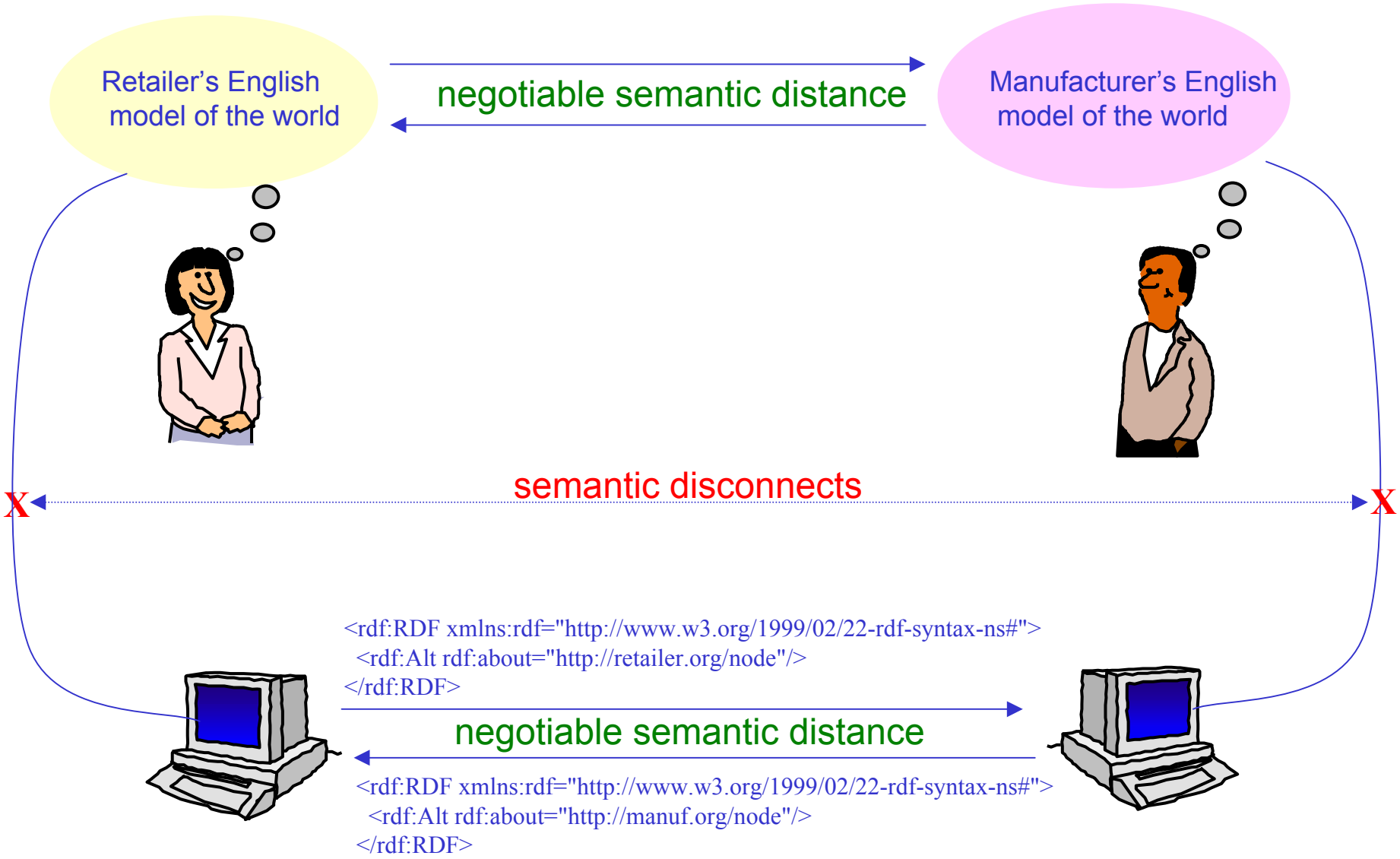

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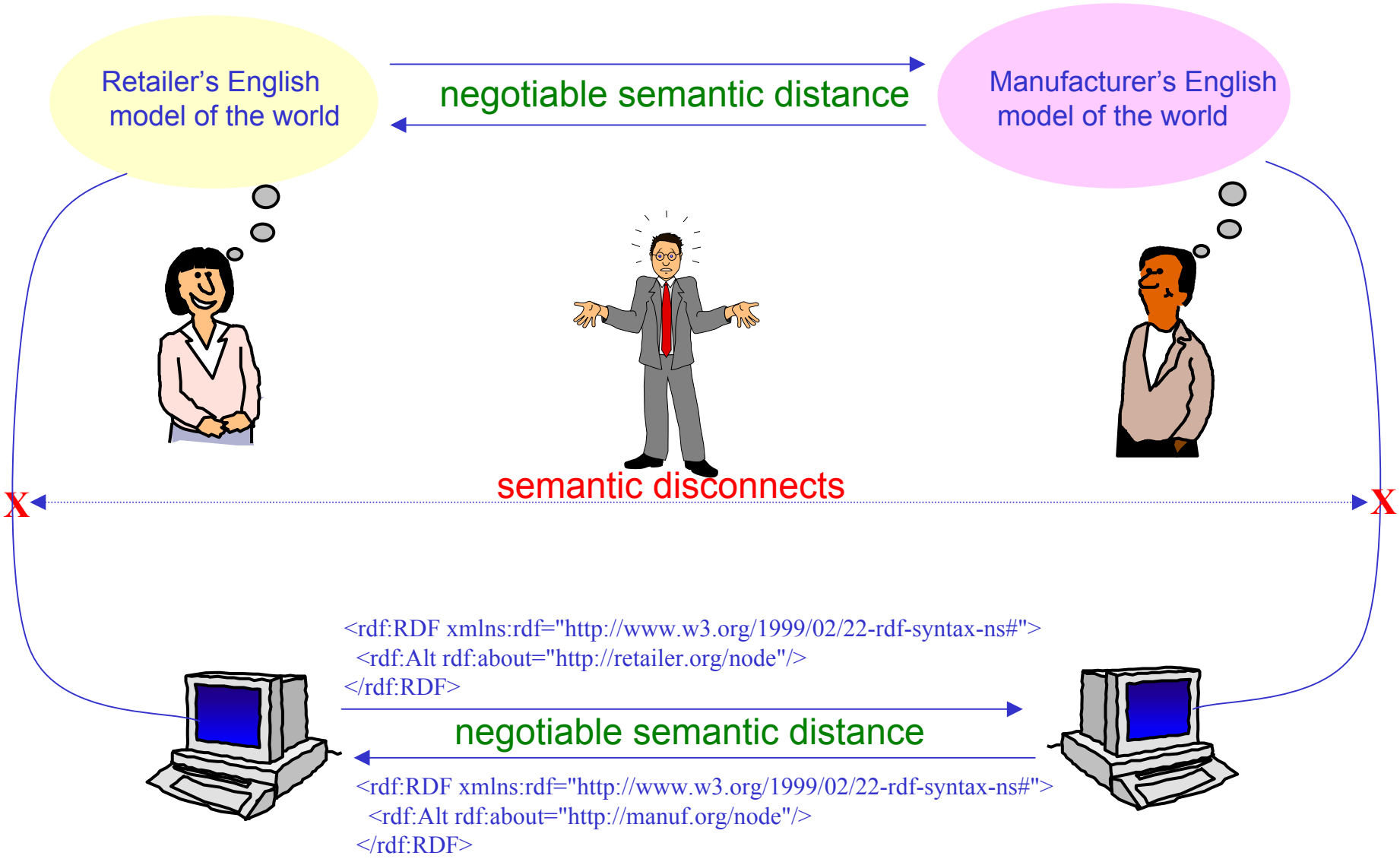

A wider technical view -- Semantics1, 2 and 3

- **Semantics1** is "Data Semantics" as in a relational database, RDF or OWL
- **Semantics2** specifies what a rule engine should do
  - Get general agreement on a logical model theory
  - The model theory is a “gold” standard that specifies what a rule engine should do
    - The theory is clear and simple, but not efficient enough to be used as an engine
  - First make it right, then make it fast
- **Semantics3** is the meaning of English concepts at the author- and user-interface
  - Don’t say ObjectPropertyAtom(p33,?x,?y,?z), but instead say...
  - some-name is an author with email some-email of some-title

A wider technical view -- Semantics1, 2 and 3

Current rule systems:

- Rules are either forward chaining or back chaining
- A collection of rules is a program
- If you change the order of the rules you will get different results
- If the user interface deals with English, then there is a dictionary and a grammar in the system to *control* the vocabulary and syntax
- For rules to work efficiently over a database, someone must write and maintain SQL queries
- If you want explanations from a rule system, you must annotate the rules in English

A wider technical view -- Semantics1, 2 and 3

An emerging rule system:

- Rules are either forward chaining or back chaining
- Rules simply mean what they say, in English
- A collection of rules is a program specification
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- If the user interface deals with English, then there is a there need be no dictionary and a or grammar in the system to *control* the vocabulary and syntax
- For rules to work efficiently over a database, someone must write and maintain SQL queries can be generated and run automatically from the rules
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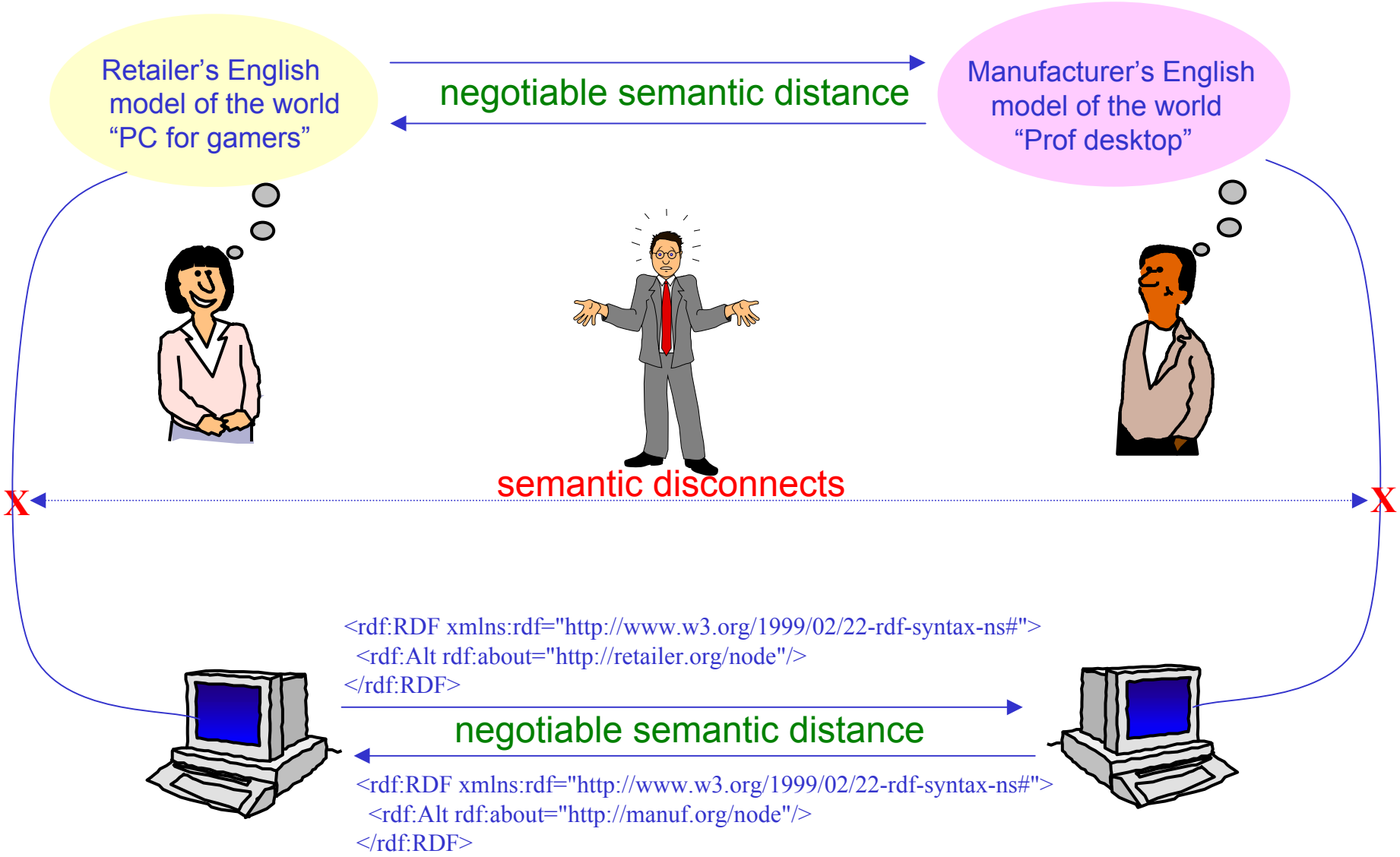
A wider technical view -- Semantics1, 2 and 3



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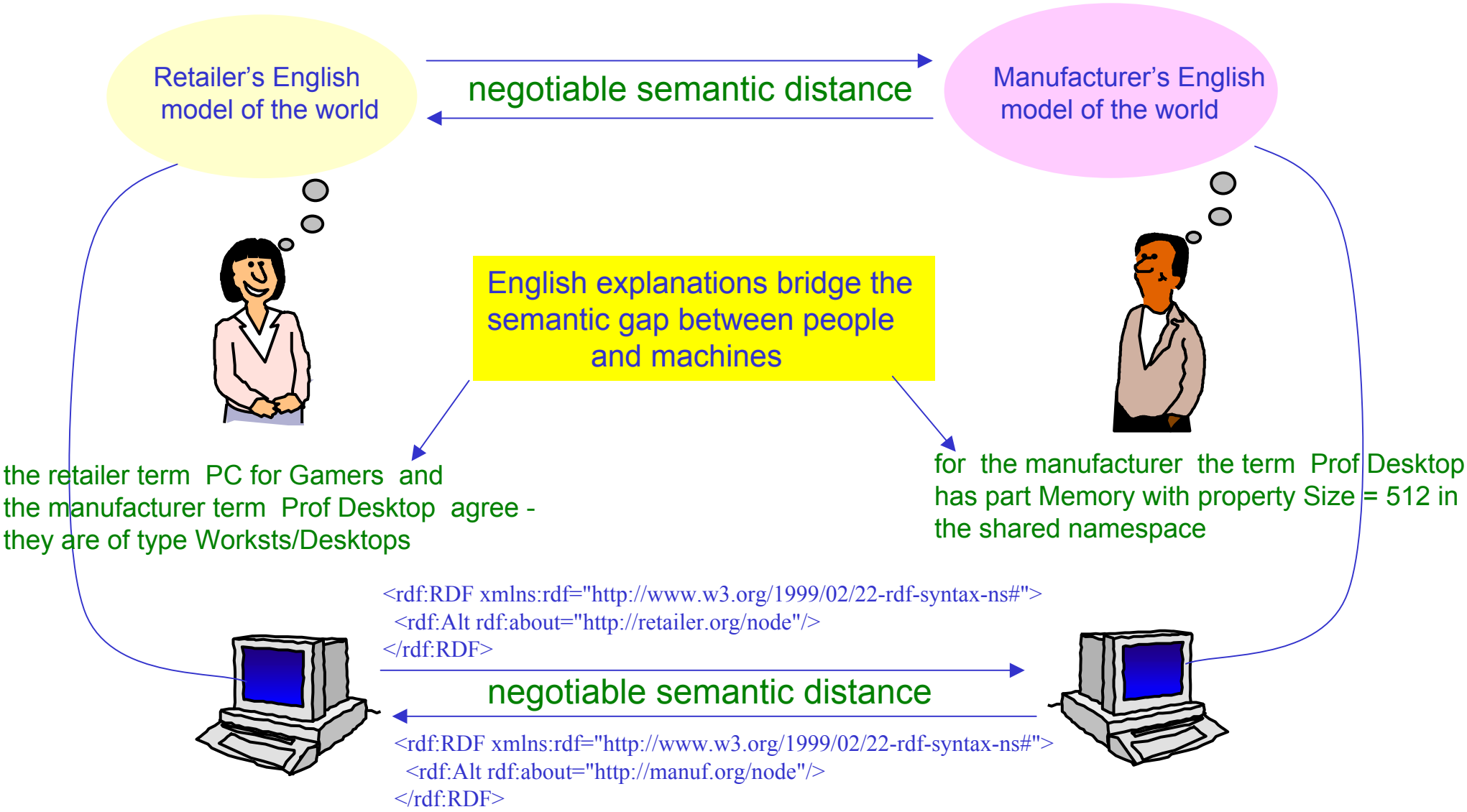

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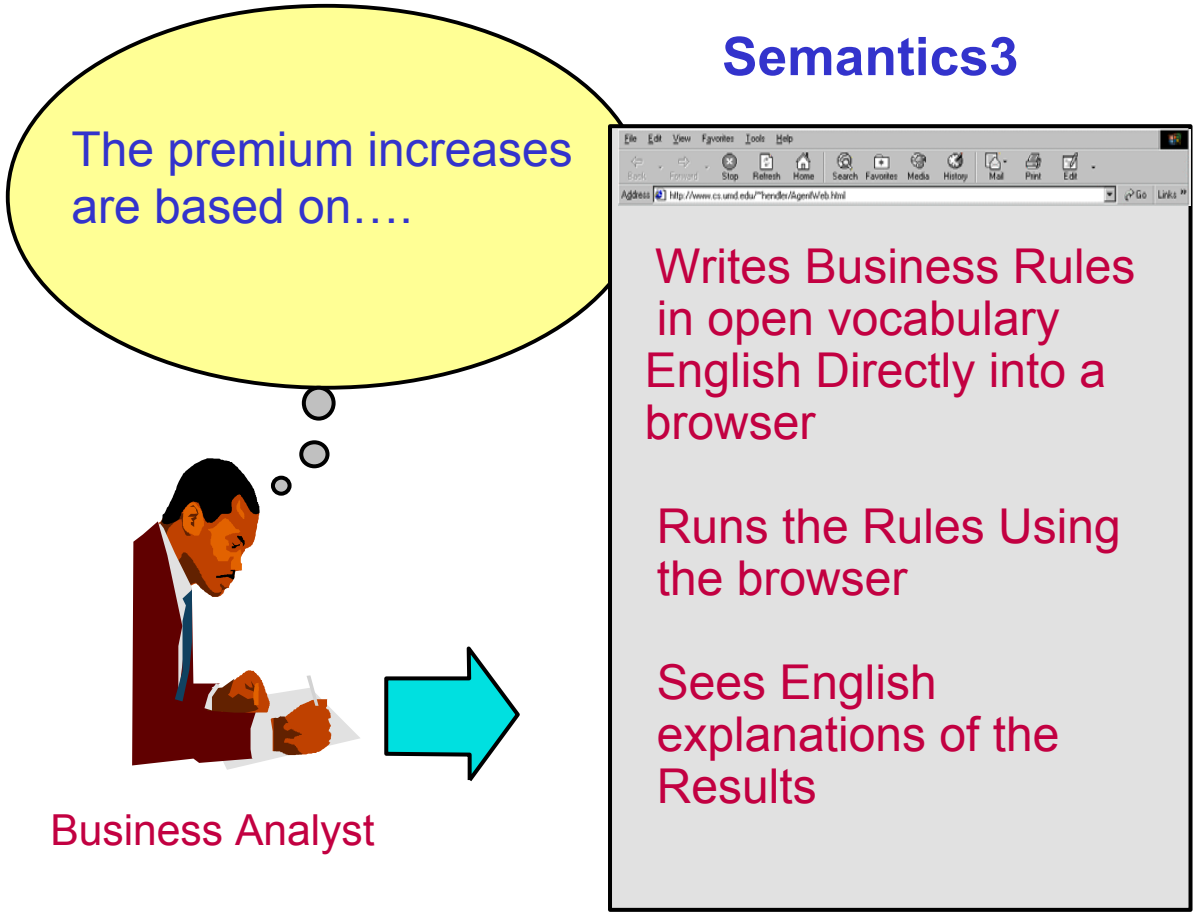

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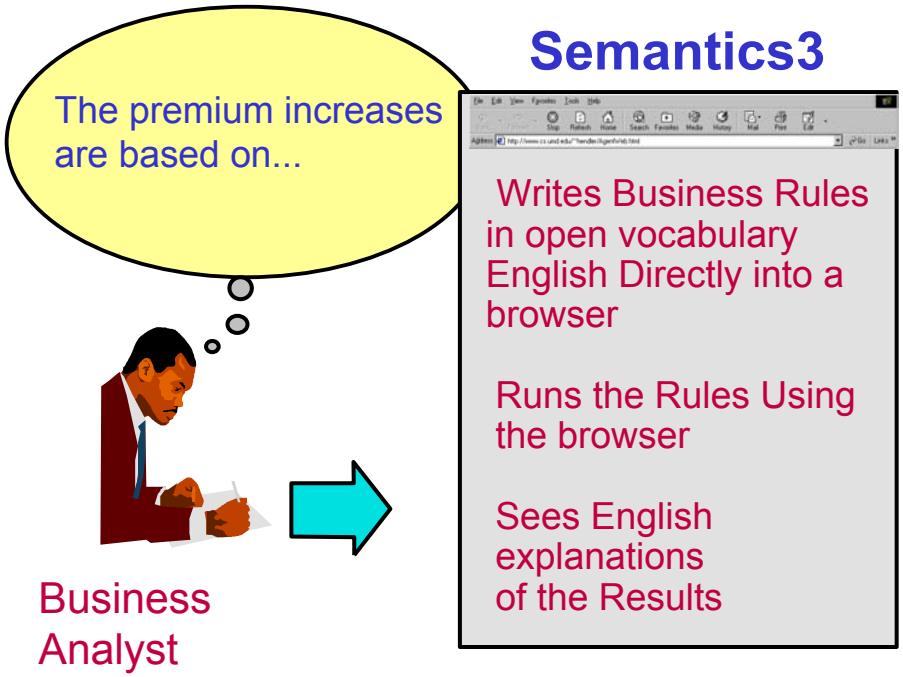

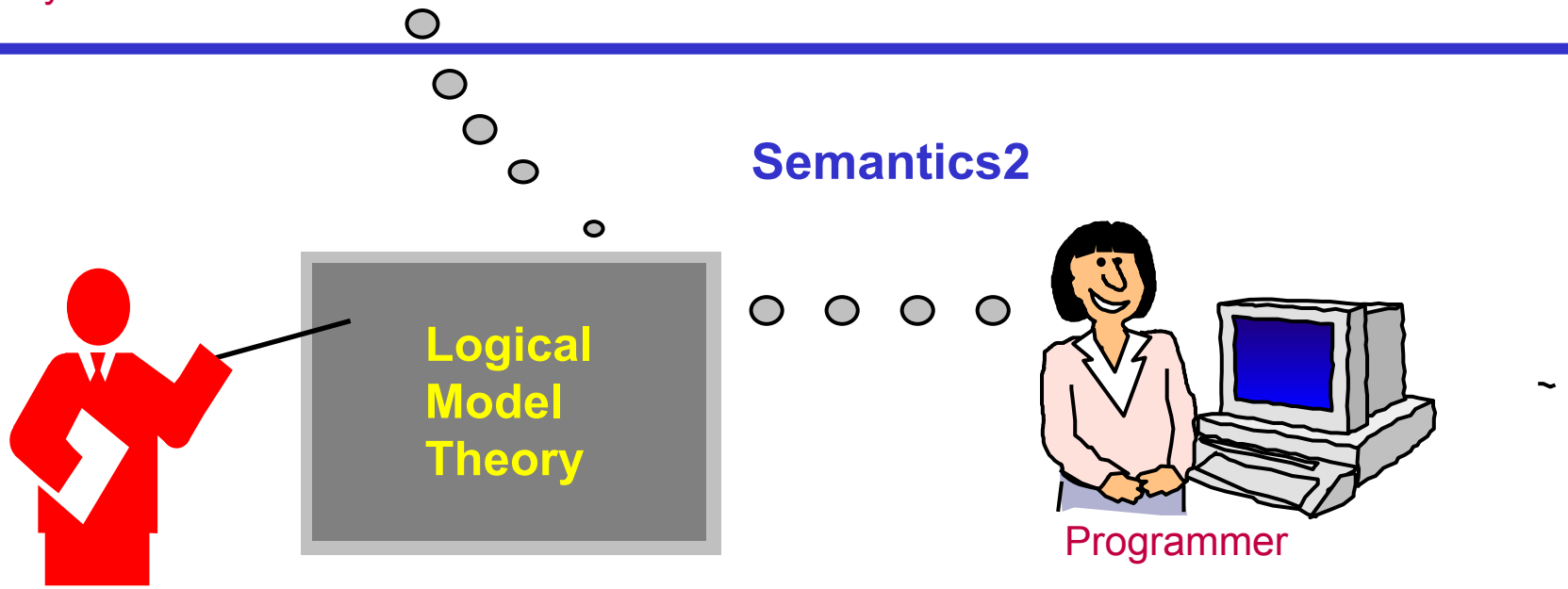

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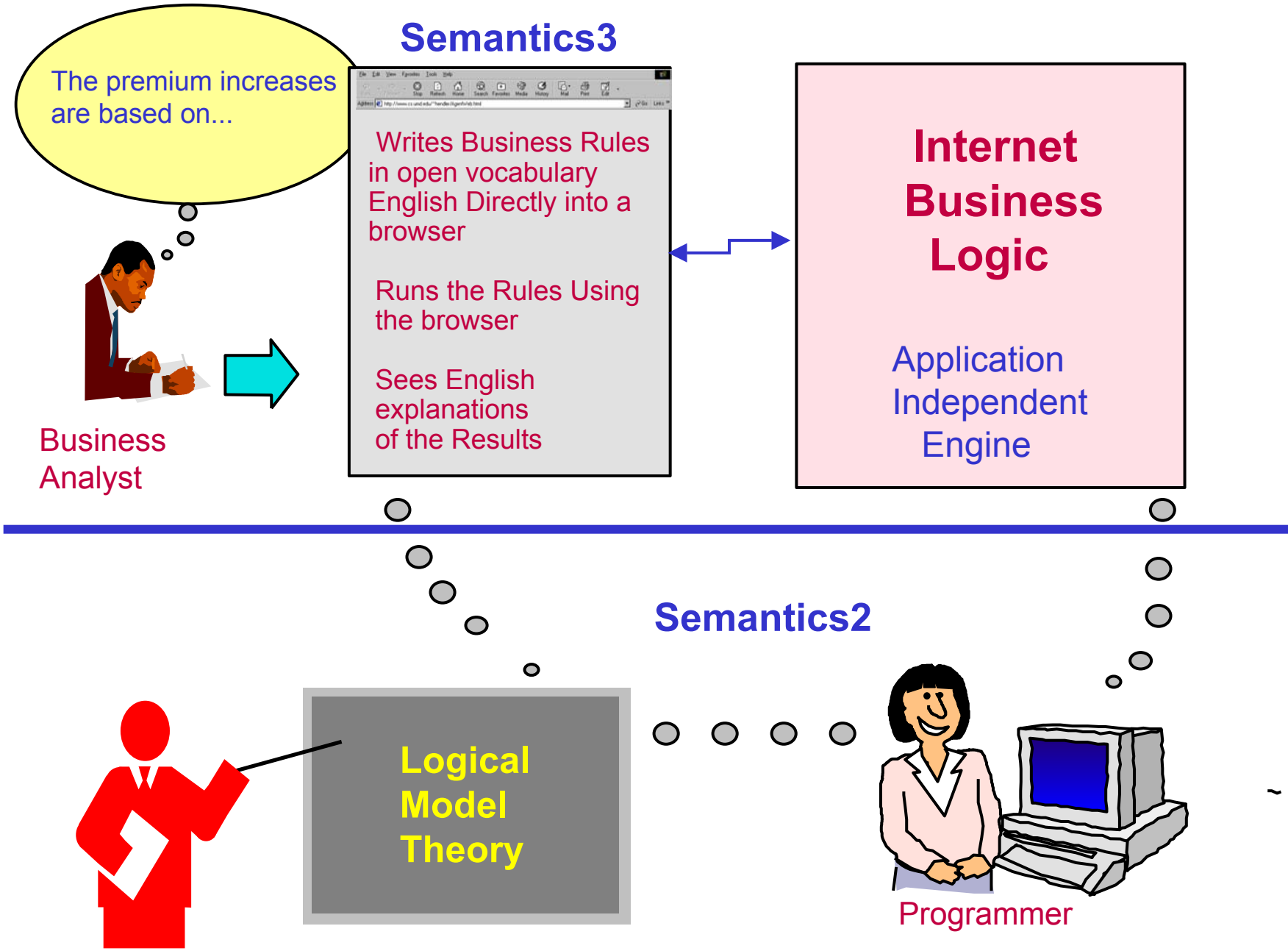

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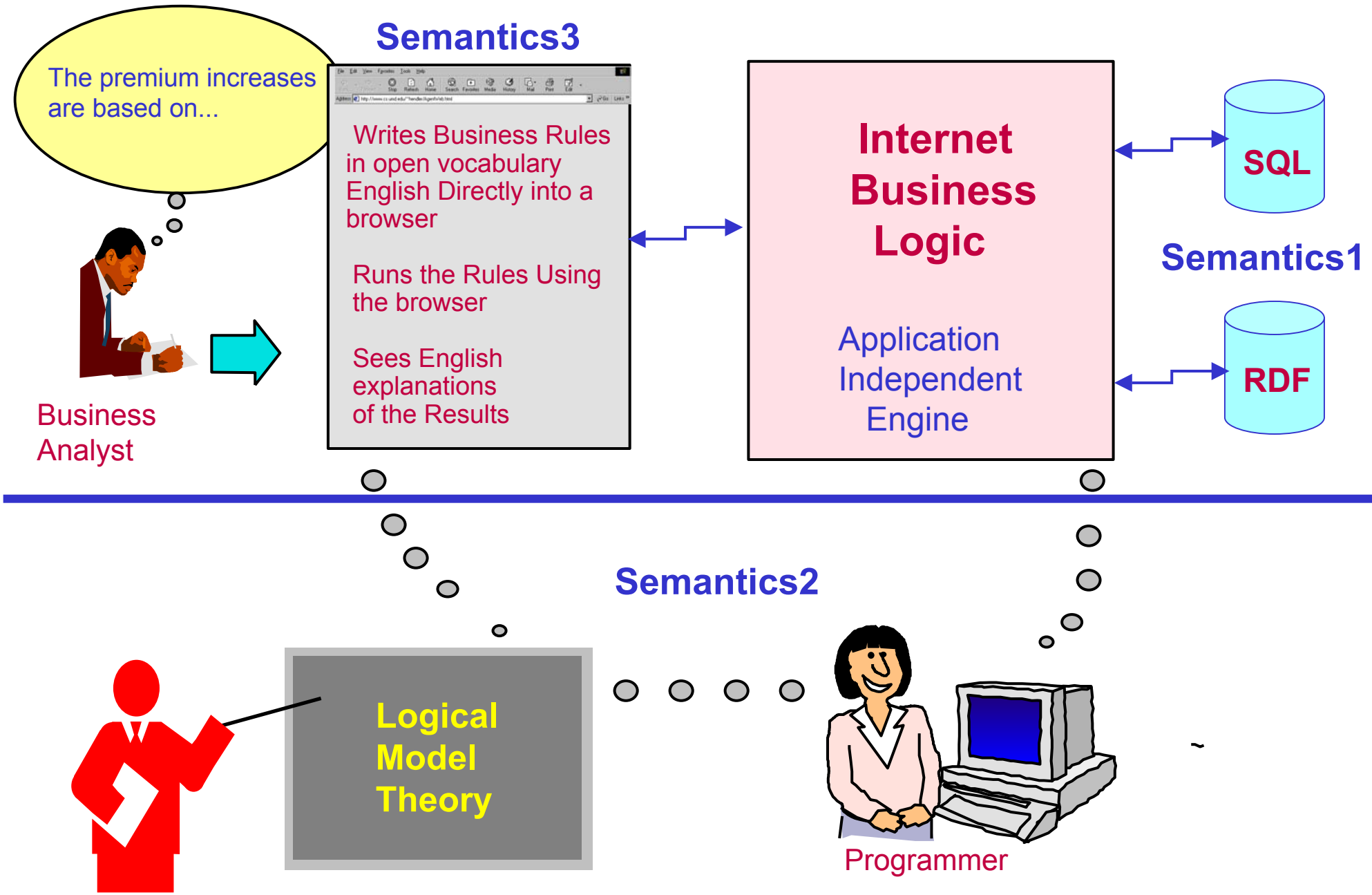
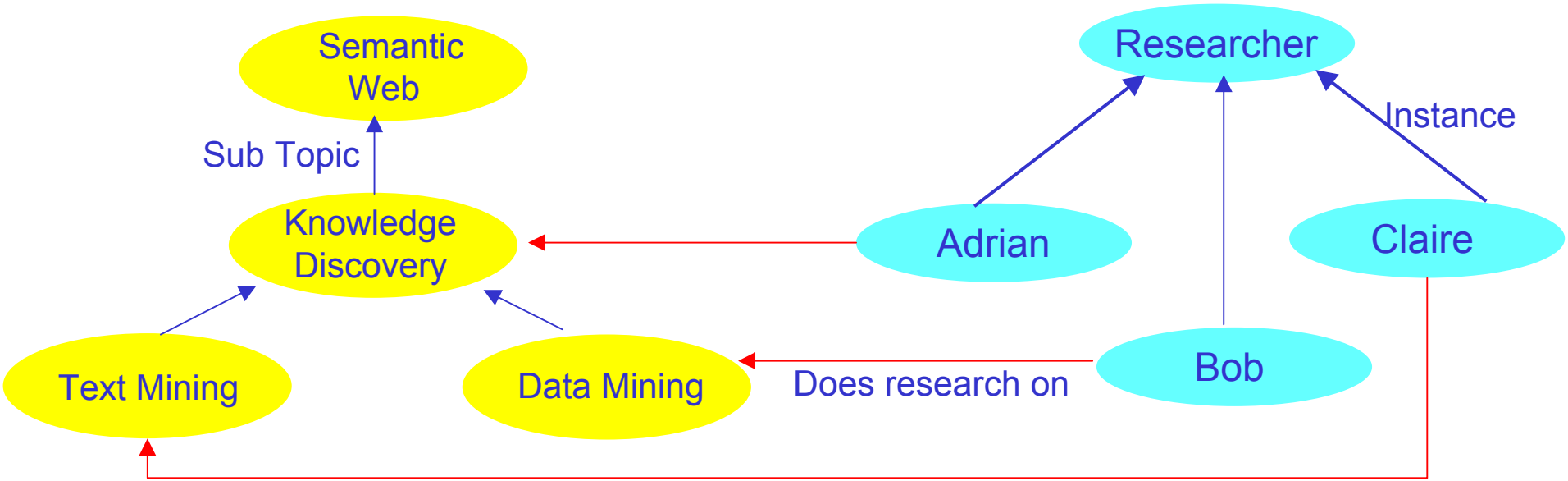


A Wiki for business rules in open vocabulary English

OwlResearchOnt Example -- Rules needed



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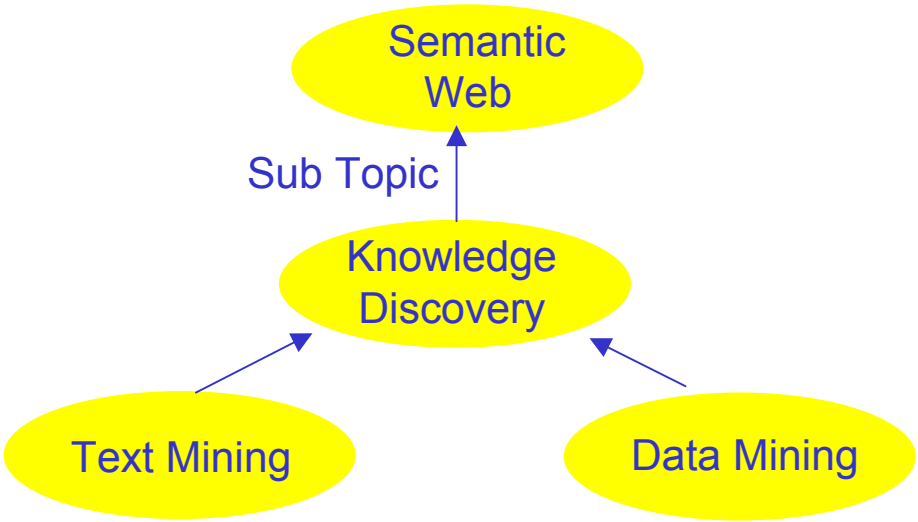


Facts:

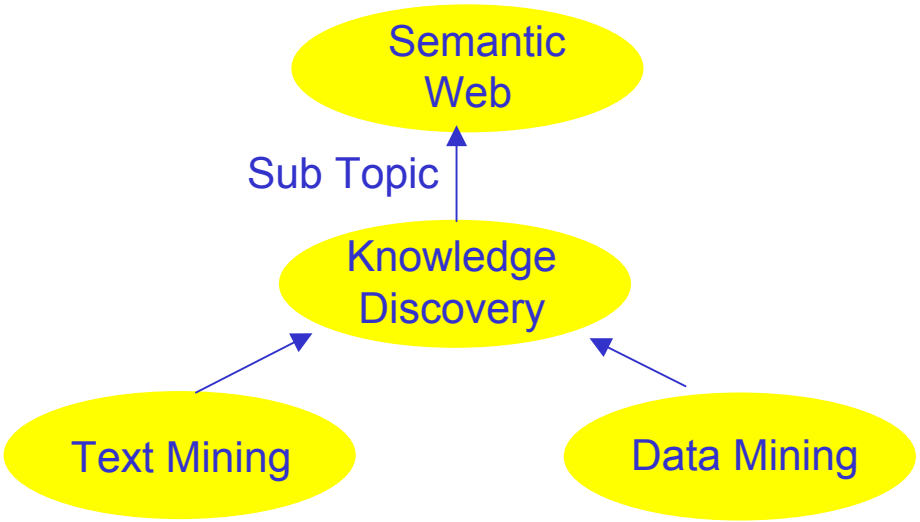
this-item is a sub topic of this-topic

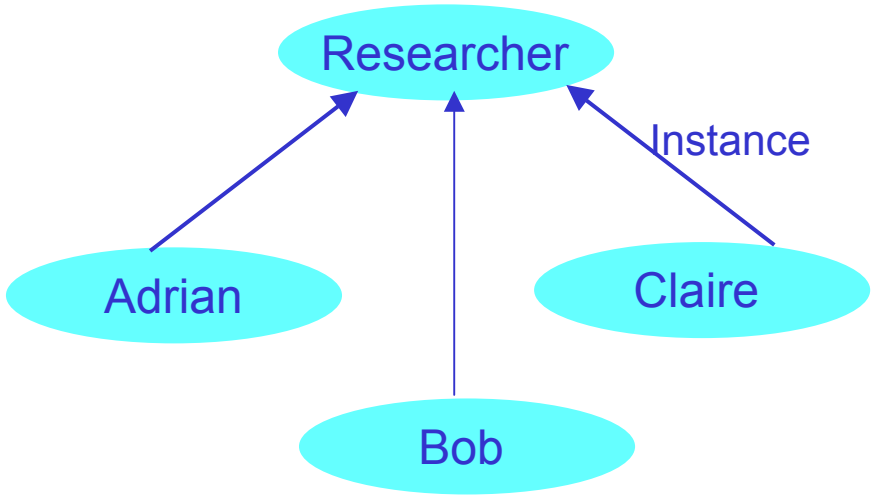
==========

Data Mining	Knowledge Discovery
Text Mining	Knowledge Discovery
Knowledge Discovery	Semantic Web

A Wiki for business rules in open vocabulary English

OwlResearchOnt Example -- Rules needed





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Data Mining	Knowledge Discovery
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Knowledge Discovery	Semantic Web

this-person is a researcher

Adrian
Bob
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A Wiki for business rules in open vocabulary English

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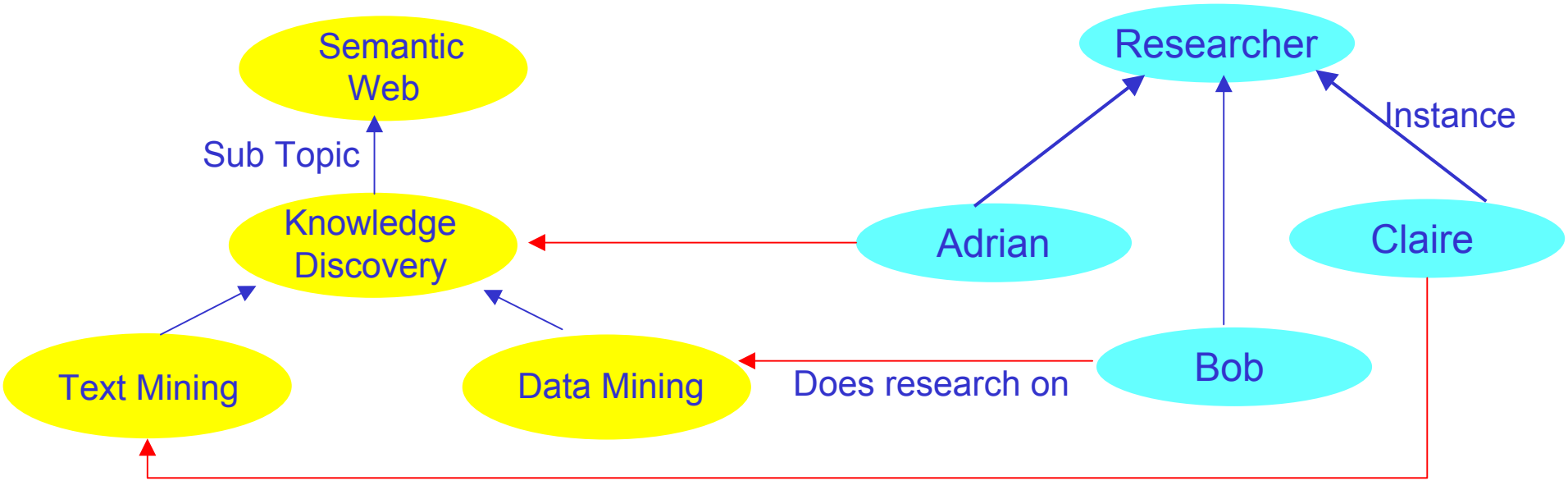


this-item is a sub topic of this-topic

Data Mining	Knowledge Discovery
Text Mining	Knowledge Discovery
Knowledge Discovery	Semantic Web

Facts:

this-person is a researcher

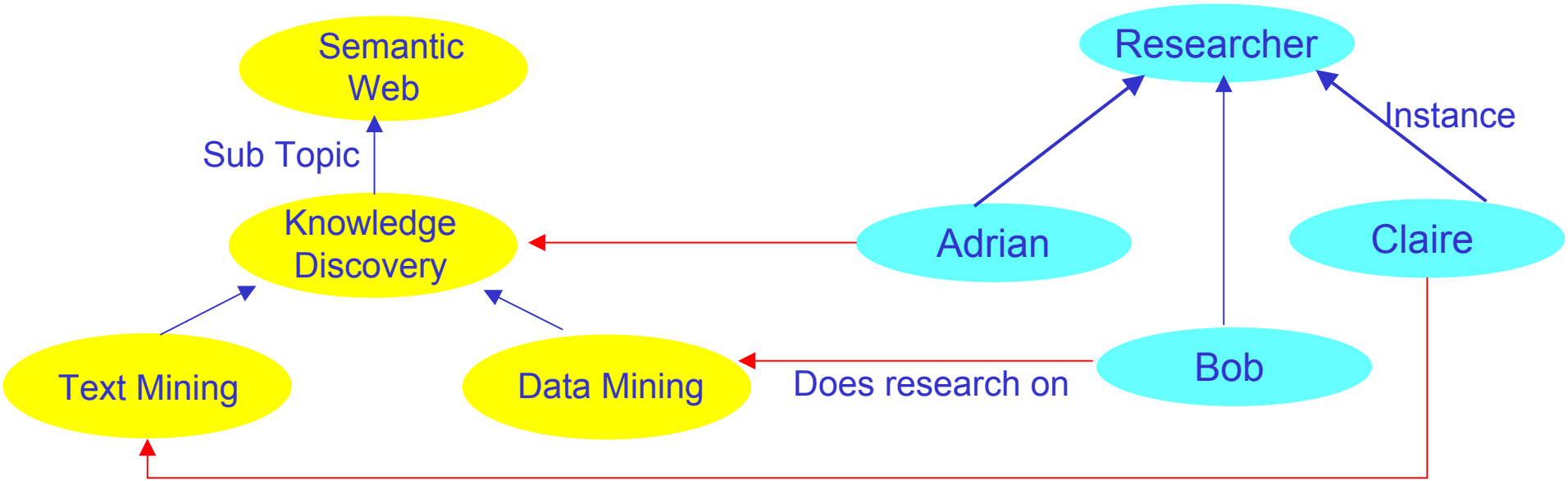
Adrian
Bob
Claire

this-person does research into this-topic

Adrian	Knowledge Discovery
Bob	Data Mining
Claire	Text Mining

A Wiki for business rules in open vocabulary English

OwlResearchOnt Example -- Rules needed



A rule:

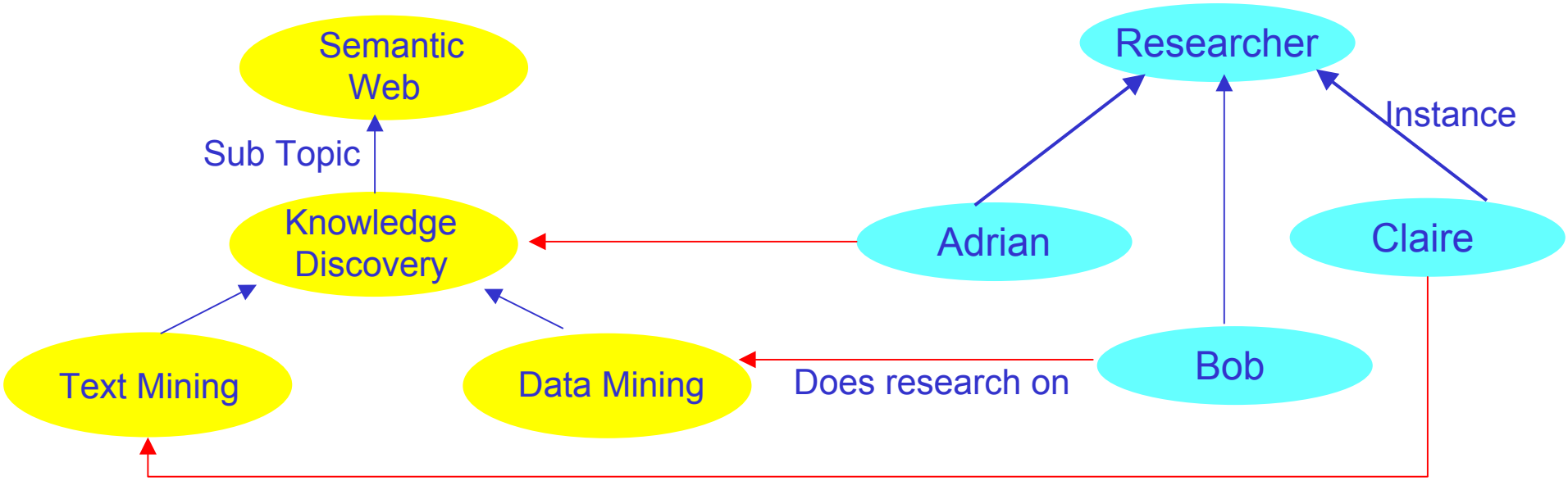
some-subject is a sub topic of some-subject1
that-subject1 is a sub topic of some-topic

---

that-subject is a sub topic of that-topic

A Wiki for business rules in open vocabulary English

OwlResearchOnt Example -- Rules needed



Another rule:

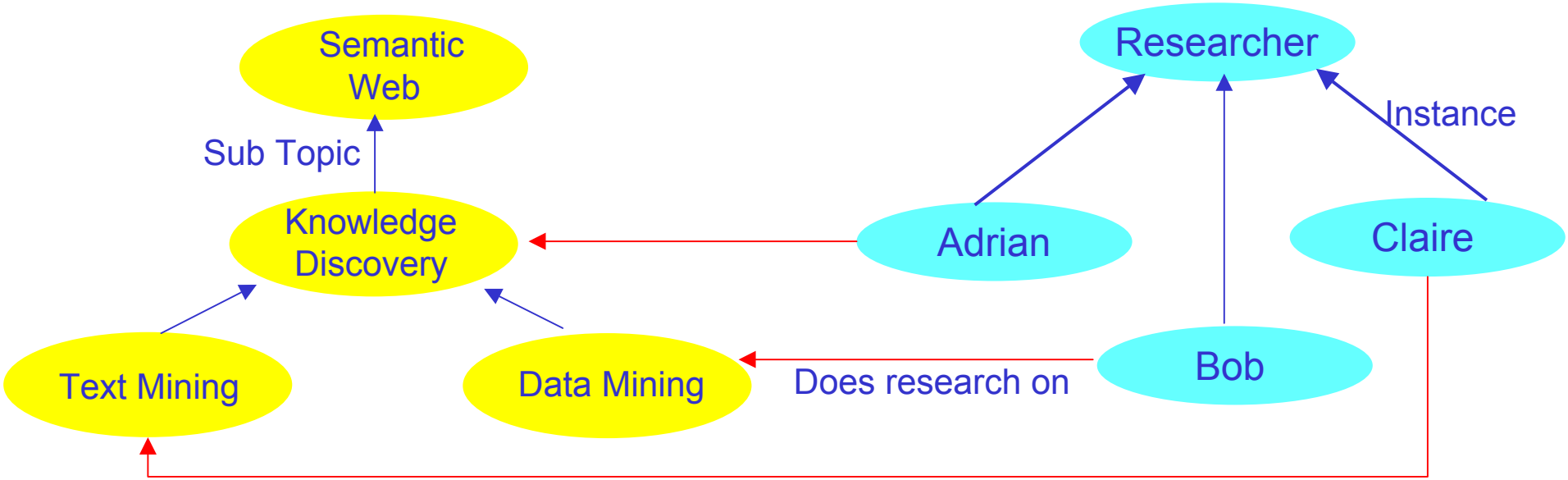
some-subject is a sub topic of some-subject1
that-subject1 is a sub topic of some-topic
---
that-subject is a sub topic of that-topic

some-person does research into some-subject
that-subject is a sub topic of some-topic
---
that-person does research into that-topic

-- To run or change this example, please point IE6, Netscape7 or Mozilla to the demo OwlResearchOnt at www.reengineeringllc.com

A Wiki for business rules in open vocabulary English

OwlResearchOnt Example -- Rules needed



Question: Bob does research into some-topic?

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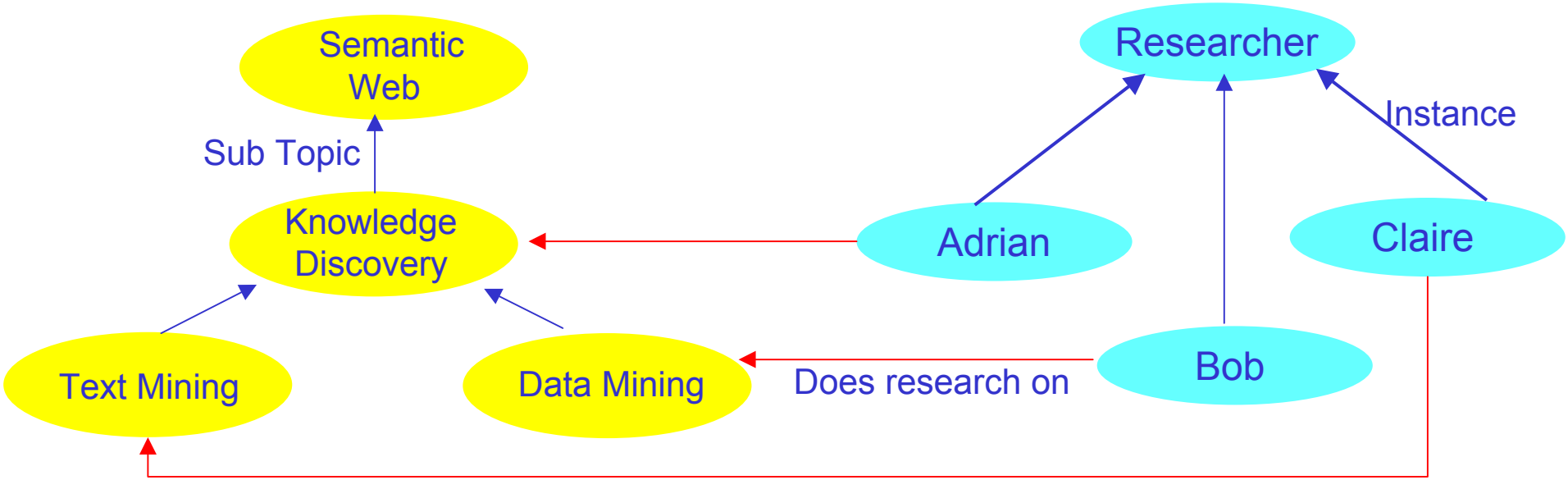

Question: Bob does research into some-topic?

Answer: Bob does research into this-topic

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Data Mining
Knowledge Discovery
Semantic Web

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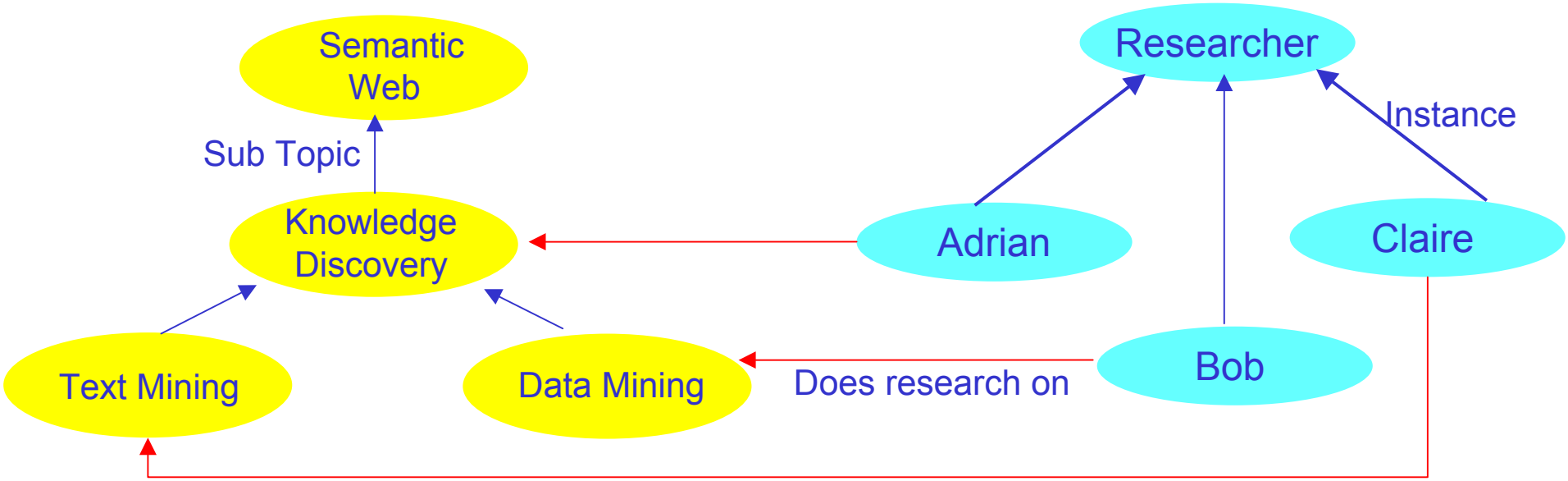


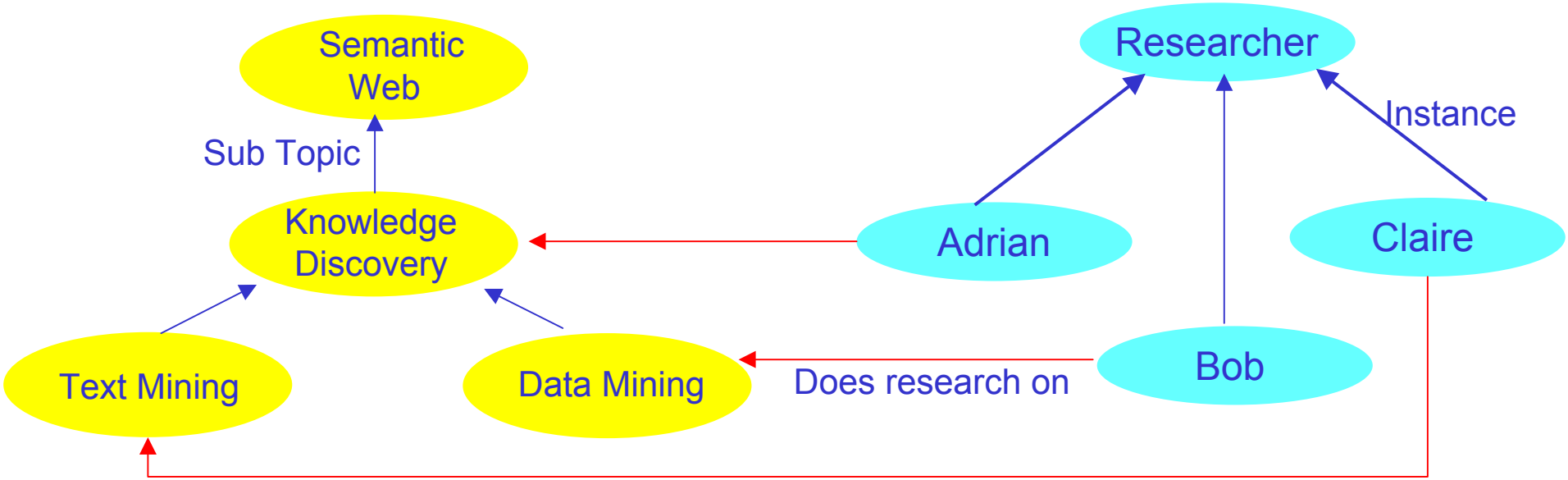
Explanation:

Bob does research into Data Mining
Data Mining is a sub topic of Semantic Web

Bob does research into Semantic Web

A Wiki for business rules in open vocabulary English

OwlResearchOnt Example -- Rules needed



Explanation:

Bob does research into Data Mining
Data Mining is a sub topic of Semantic Web

Bob does research into Semantic Web

Data Mining is a sub topic of Knowledge Discovery
Knowledge Discovery is a sub topic of Semantic Web

Data Mining is a sub topic of Semantic Web

A Wiki for business rules in open vocabulary English

Business Intelligence -- Mining coded medical data

Requirement: look for overlapping in-patient and out-patient treatments
that may be medically inconsistent

Rule:

patient some-number date some-start1 some-fin1 had in-patient treatment for some-condition1
patient that-number date some-start2 some-fin2 had out-patient treatment for some-condition2
the period that-start1 to that-fin1 overlaps with the period that-start2 to that-fin2
---
patient that-number had in-patient treatment that-condition1 overlapping
with out-patient treatment that-condition2

Coded Medical Data:

eg-lno	eg-ccprod	eg-cohort	eg-contract	eg-branch	eg-control	eg-cvgcd	eg-days	eg-daylast	eg-daynext
1	N	8	0	BCA	13660	3	2	0	0
2	N	8	0	BCA	13660	3	2	0	0
3	N	1	0	BCA	13660	3	3	0	0
….									

To view, run and change this example, please point a browser to reengineeringllc.com and select Medmine2

A Wiki for business rules in open vocabulary English

Business Intelligence -- Mining coded medical data -- Running the rules to get an answer

Answer:

patient this-number had in-patient treatment this-conditn1 overlapping with out-patient treatment this-conditn2

521049571	Antepartum, Med Complica	Cataract (Chronic)
521049571	Antepartum, Med Complica	Female infertility (Acute)
521049571	Chemotherapy	Female infertility (Acute)
521049571	Pelv Evis,Rad Hyst,Vulv	Cataract (Chronic)
521049571	Pelv Evis,Rad Hyst,Vulv	Female infertility (Acute)

To view, run and change this example, please point a browser to reengineeringllc.com and select Medmine2

A Wiki for business rules in open vocabulary English

Business Intelligence -- Mining coded medical data -- An explanation

patient 521049571 date 910702 910703 had in-patient treatment for Antepartum, Med Complica
patient 521049571 date 900912 910928 had out-patient treatment for Female infertility (Acute)
the period 910702 to 910703 overlaps with the period 900912 to 910928

---

patient 521049571 had in-patient treatment Antepartum, Med Complica
overlapping with out-patient treatment Female infertility (Acute)

To view, run and change this example, please point a browser to reengineeringllc.com and select Medmine2

A Wiki for business rules in open vocabulary English

Business Intelligence -- Mining coded medical data -- An explanation

patient 521049571 date 910702 910703 had in-patient treatment for Antepartum, Med Complica
patient 521049571 date 900912 910928 had out-patient treatment for Female infertility (Acute)
the period 910702 to 910703 overlaps with the period 900912 to 910928

---

patient 521049571 had in-patient treatment Antepartum, Med Complica
overlapping with out-patient treatment Female infertility (Acute)

910702 is less than or equal 910928
900912 is less than or equal 910703

---

the period 910702 to 910703 overlaps with the period 900912 to 910928

To view, run and change this example, please point a browser to reengineeringllc.com and select Medmine2

A Wiki for business rules in open vocabulary English

Business Intelligence -- Mining coded medical data -- An explanation

patient 521049571 date 910702 910703 had in-patient treatment for Antepartum, Med Complica
patient 521049571 date 900912 910928 had out-patient treatment for Female infertility (Acute)
the period 910702 to 910703 overlaps with the period 900912 to 910928

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patient 521049571 had in-patient treatment Antepartum, Med Complica
overlapping with out-patient treatment Female infertility (Acute)

910702 is less than or equal 910928
900912 is less than or equal 910703

---

the period 910702 to 910703 overlaps with the period 900912 to 910928

line 53 in part 1 of the Case table has an admission date corresponding to 910702
line 53 in part 2 of the Case table has number of days 1
1 day(s) after 910702 is 910703
line 53 in part 3 of the Case table has Diagnosis Related Group 383

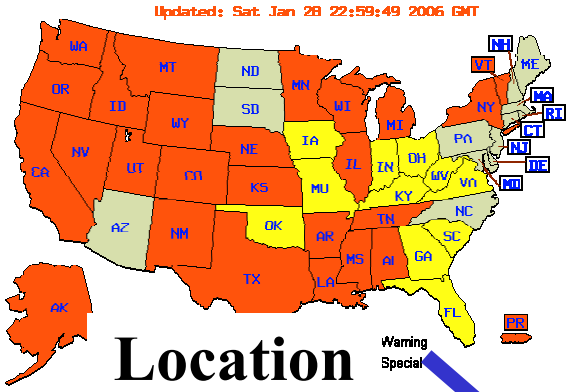
---

the drg code 383 describes the Diagnosis Related Group Antepartum, Med Complica

To view, run and change this example, please point a browser to reengineeringllc.com and select Medmine2

A Wiki for business rules in open vocabulary English

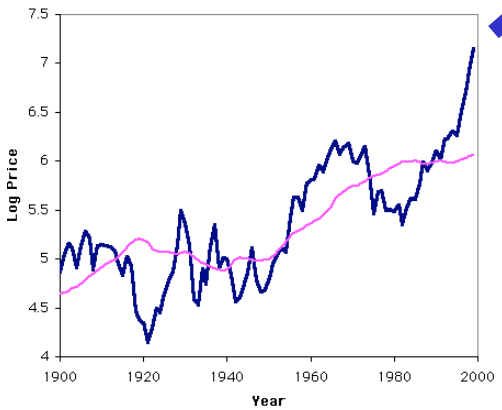
Supply Chain -- oil industry



Location

External Forces

Sales Demand
November

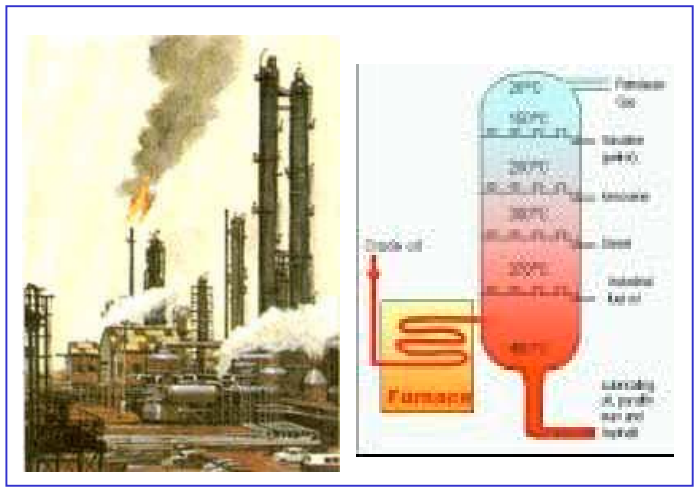


Price

Product

A Wiki for business rules in open vocabulary English

Supply Chain -- oil industry



Refinery

Terminal Storage

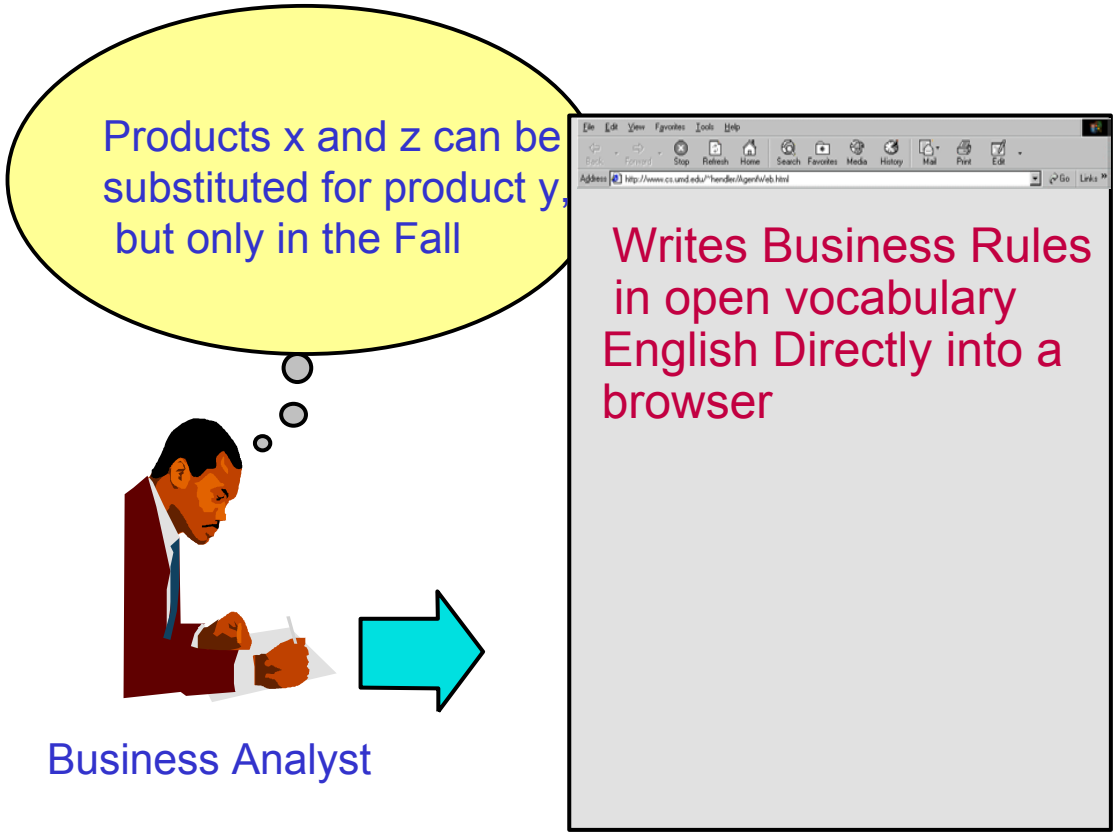
Terminal Pickup

Service Station

A Wiki for business rules in open vocabulary English

Supply Chain -- oil industry

Requirement: Meet customer demand for an oil product, given that other products may be used, depending on the season and the available transportation



To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain -- oil industry **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

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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

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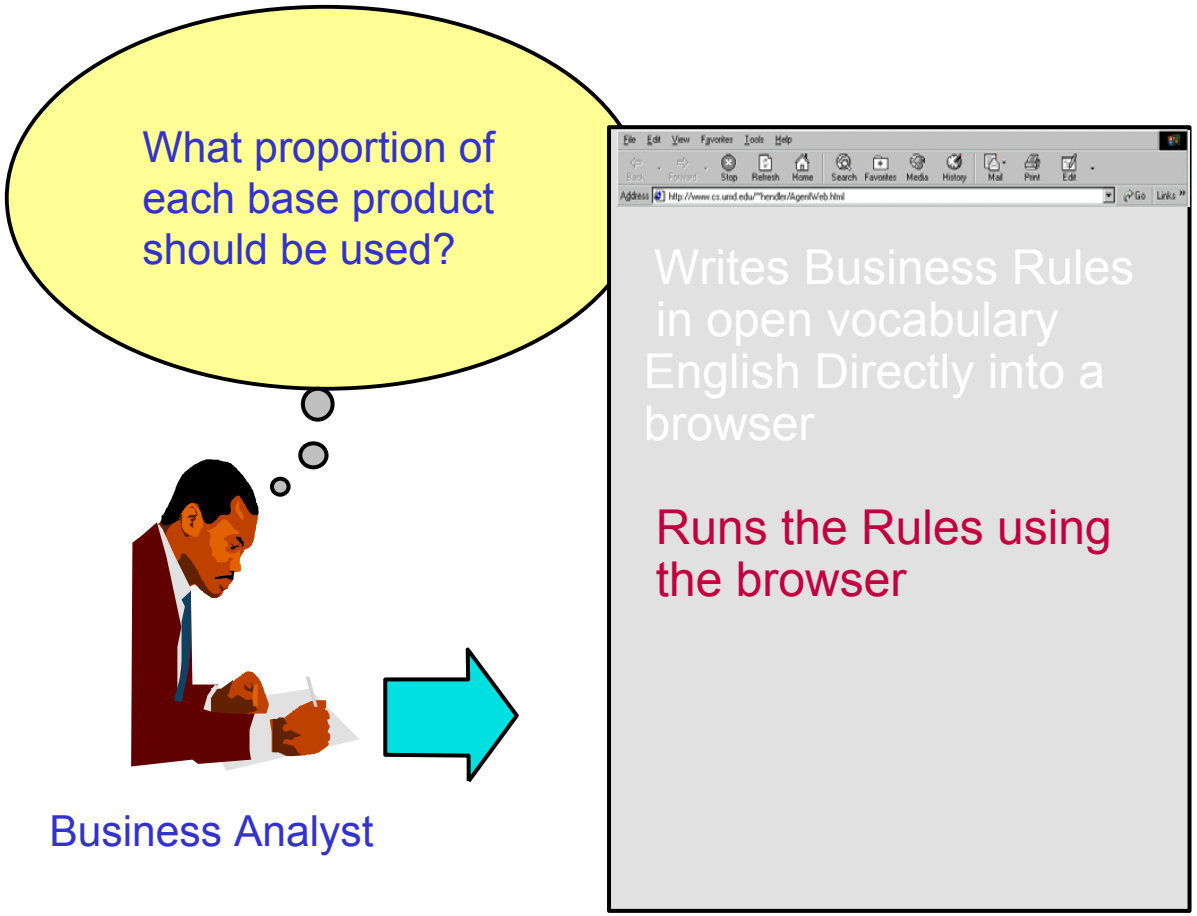
that-amount / that-total = some-long-fraction
that-long-fraction rounded to 2 places after the decimal point is some-fraction
---
for estimated demand that-id that-fraction of the order will be that-product from that-refinery

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

To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain -- oil industry**:**



To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** answer**:**

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

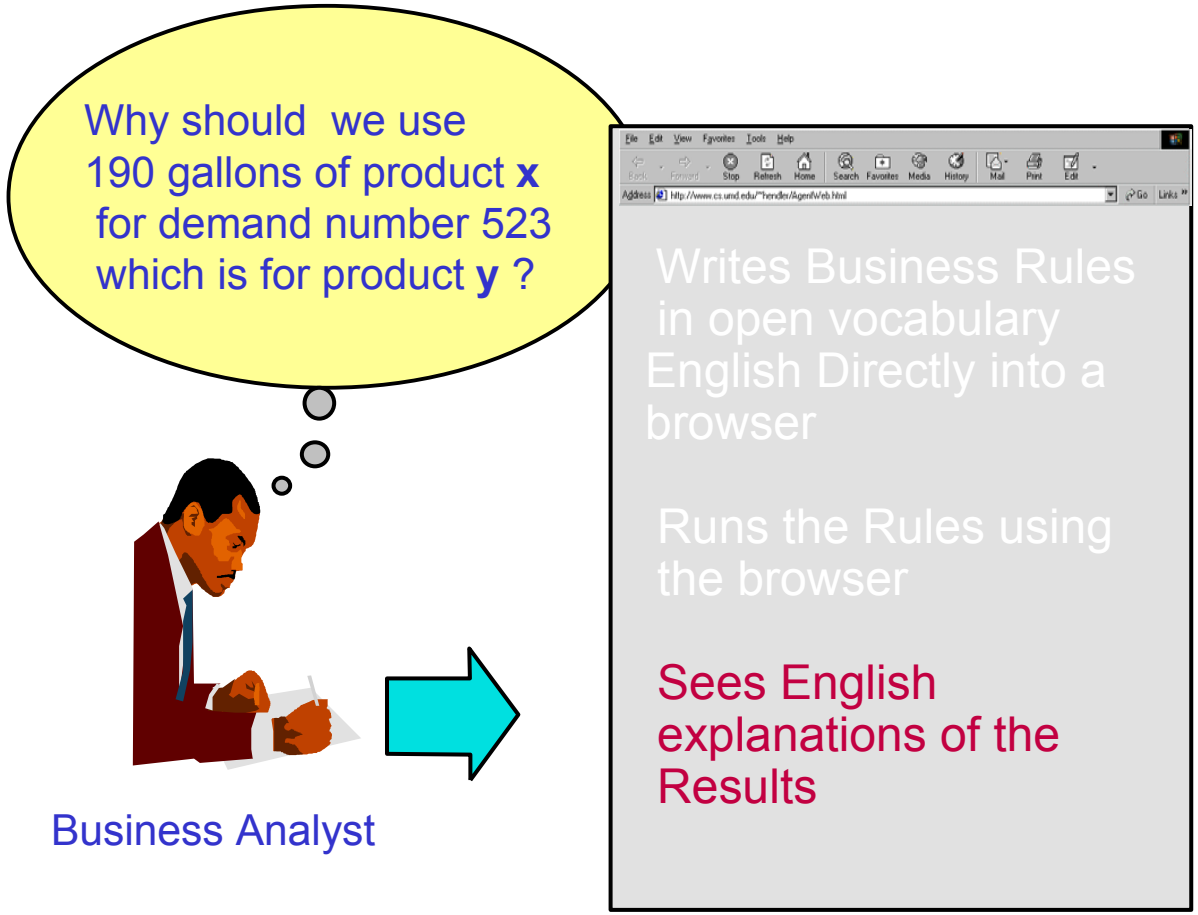
523	NJ	1000	product-y	190.0	product-x	Shell Canada One
523	NJ	1000	product-y	310.0	product-y	Shell Canada One
523	NJ	1000	product-y	500.0	product-z	Shell Canada One

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

To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** explanation**:**



To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** 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

To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** 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

To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** 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
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for demand 523 NJ for 1000 product-y we use 190 product-x from Shell Canada One

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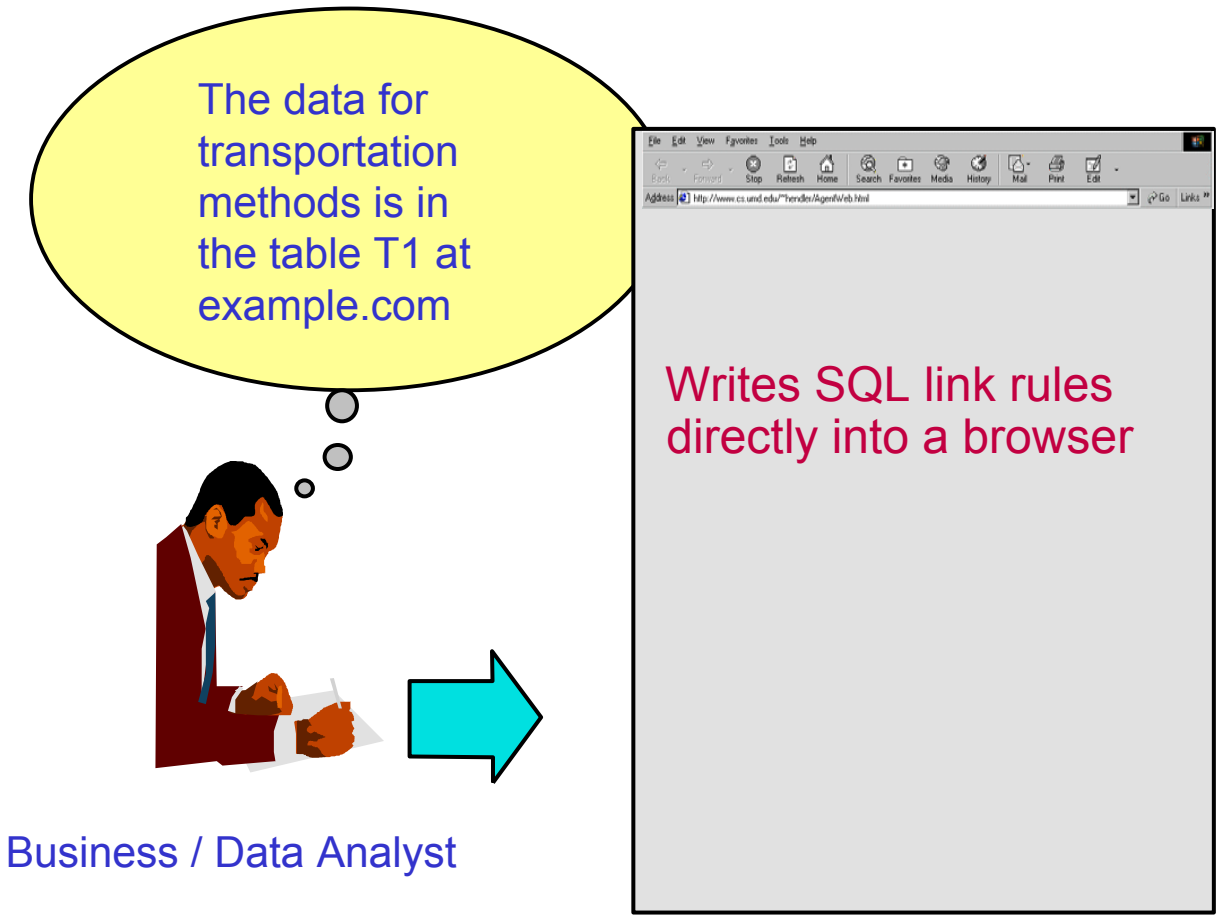
for demand 523 the refineries have altogether 1600 gallons of acceptable base products
300 / 1600 = 0.1875
0.1875 rounded to 2 places after the decimal point is 0.19
---
for estimated demand 523 0.19 of the order will be product-x from Shell Canada One

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

To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** automatic generation of complex SQL queries**:**



To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1MySql1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** finding SQL data on the internet**:**

A data table

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

truck	Shell Canada One	NJ
rail	Shell Canada One	NJ

A link rule that says how to find an equivalent table “T1” on the internet

url:example.com dbms:mysql dbname:transport tablename:T1 port:3306 id:id123 password:pw345

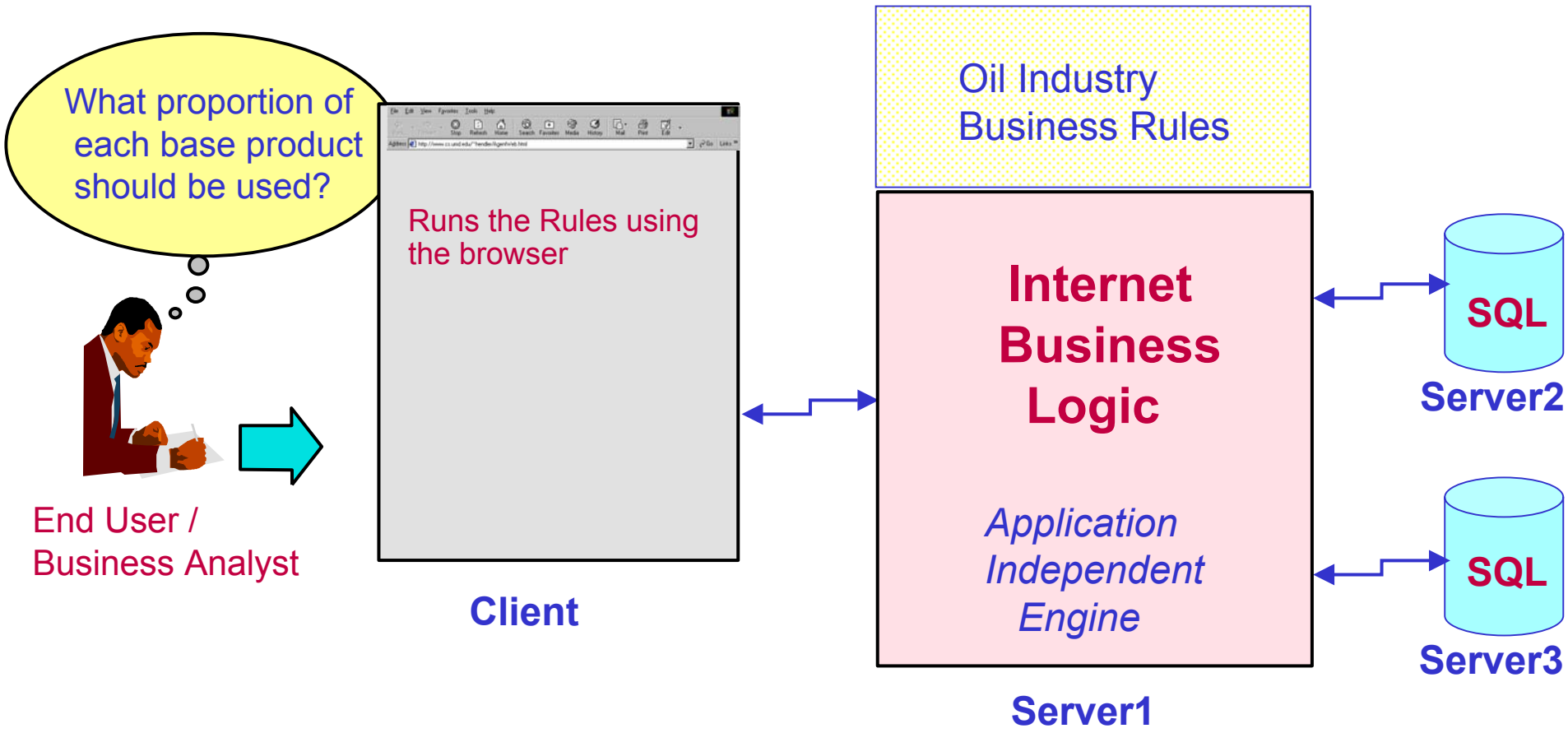
---

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

To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1MySql1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry ---- automatic generation of complex SQL queries **:**



To view, run and change this example, please point a browser to reengineeringllc.com and select Oil-IndustrySupplyChain1MySql1

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** automatic generation of complex SQL queries **:**

```
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=tt2.MONTH1 and T2.PRODUCT=T3.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;
```

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** automatic generation of complex SQL queries **:**

- 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 example is simpler than for a real supply chain !

- How do we know that the automatically generated SQL implements the business rules correctly ?
- Because we can still get step-by-step business level English explanations

A Wiki for business rules in open vocabulary English

Supply Chain ---- oil industry **----** Automatic generation of complex SQL queries **:**

- 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!

A Wiki for business rules in open vocabulary English

- **Combine**, in ***one system*** for non-expert authors and users

A Wiki for business rules in open vocabulary English

- **Combine**, in ***one system*** for non-expert authors and users
  - **Semantics1** - *Data Semantics*
    - the current technology

A Wiki for business rules in open vocabulary English

- **Combine**, in ***one system*** for non-expert authors and users
  - **Semantics1** - *Data Semantics*
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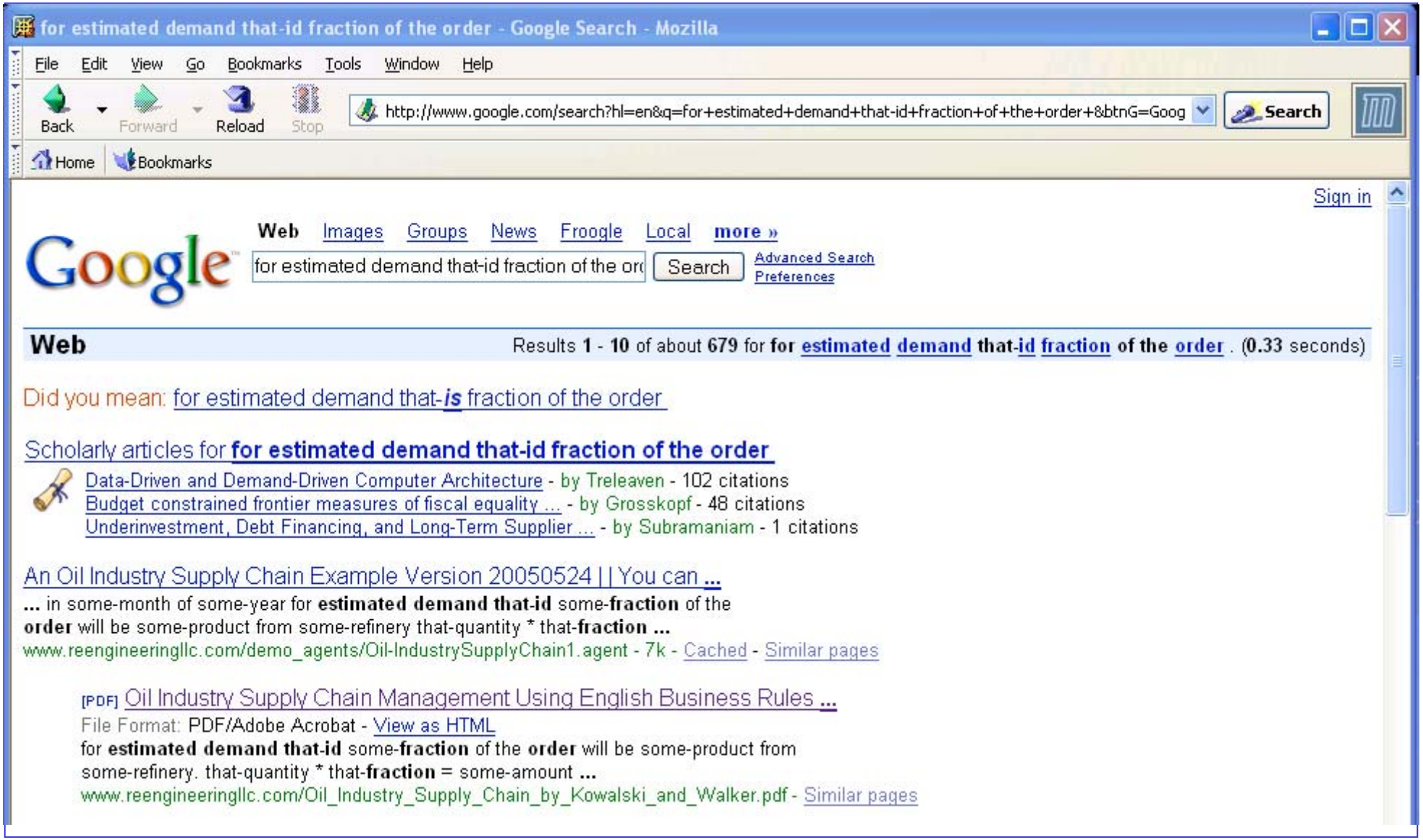
  - **Semantics2** - *Logical Model Theory*
    - specifies what a reasoner **should** do

A Wiki for business rules in open vocabulary English

- **Combine**, in ***one system*** for non-expert authors and users
  - **Semantics1** - *Data Semantics*
    - the current technology
  - **Semantics2** - *Logical Model Theory*
    - specifies what an engine **should** do
  - **Semantics3** - *Application Semantics*
    - English meanings at the author- and user-interface

A Wiki for business rules in open vocabulary English

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



A Wiki for business rules in open vocabulary English

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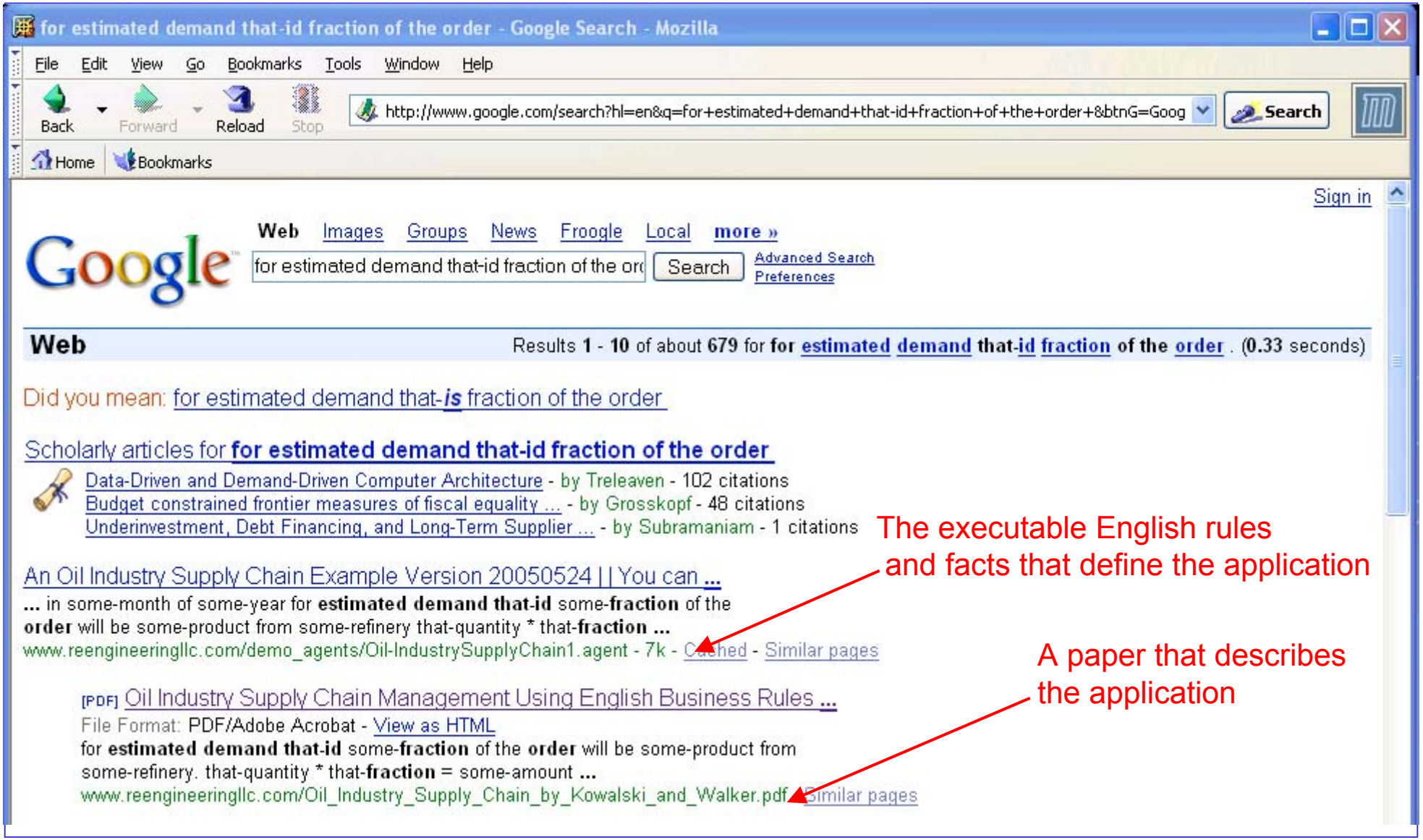

Summary

- Tim Berners-Lee's Vision for the future of the Web, and a McCool caution
- A view of current work on (data) Semantics
  - Resource Description Framework (RDF)
  - Web Ontology Language (OWL)
  - Rule Interchange Format (RIF)
- A wider technical view --
  - Semantics1 -- data semantics
  - Semantics2 what a reasoning engine should do
  - Semantics3 English meaning at the author- and user-interface
- A Wiki for business rules in open vocabulary English
  - Combine the three kinds of semantics in one system
  - Academic, medical data mining, and oil-industry examples
  - Google finds business rules written in English
- From Usability to Authorability of *executable* English content
  - An online system that extends Tim O'Reilly's vision of Web 2.0

Links

1. What an engine **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. There is an overview paper
   www.reengineeringllc.com/A_Wiki_for_Business_Rules_in_Open_Vocabulary_Executable_English.pdf

3. The Oil Industry Supply Chain example is described further in
   www.reengineeringllc.com/Oil_Industry_Supply_Chain_by_Kowalski_and_Walker.pdf

4. A position paper about the W3C Rules Interchange Format project (RIF)
   Understandability and Semantic Interoperability of Diverse Rules Systems
   www.w3.org/2004/12/rules-ws/paper/19

5. The English inferencing examples
   OwlResearchOnt
   MedMine2
   Oil-IndustrySupplyChain1MySql1
   (and many other examples) 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 OwlResearchOnt

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