RULES FEST

Keynote Address

Roadmap for Rules, Semantics, and Business

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VisionArts communications

strategic thinking • creative action

Summary

- Intelligence – background and context
- Technology – where we are and are not
  - "knowledge engineering"
  - business rules and processes
- Knowledge – what we work with and how
  - overlaps where we are
  - defines where we need to go
- Why vs. What vs. How
  - where we'll be when we get there

Fifth Generation

- an initiative by Japan's Ministry of International Trade and Industry, begun in 1982, to create a "fifth generation computer“

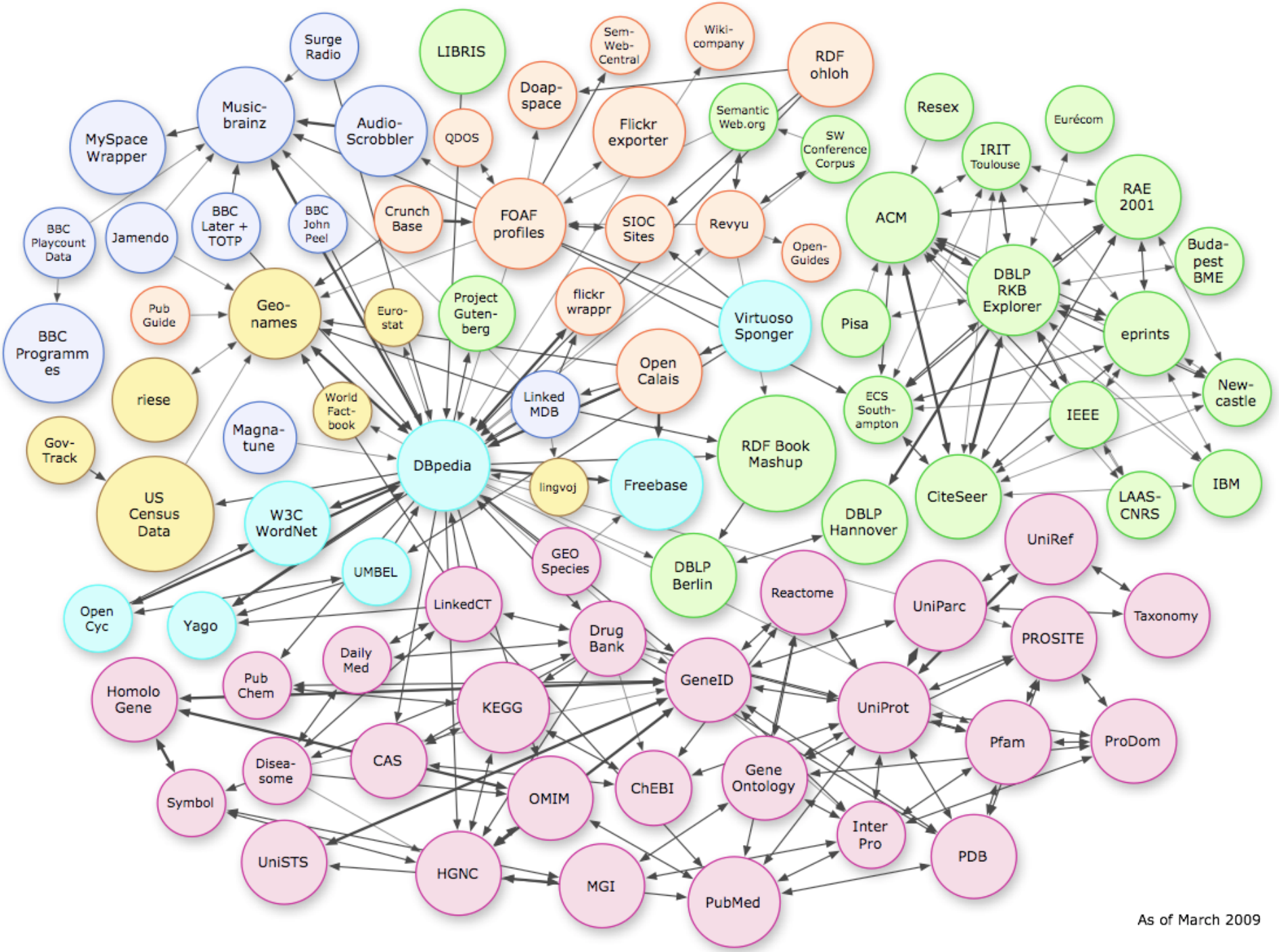
- to create an "epoch-making computer" and a platform for ... artificial intelligence.

http://en.wikipedia.org/wiki/Fifth_generation_computer

- The workstations had no appeal [since] general purpose systems could … outrun them [just as] rule-based systems such as CLIPS [made] expensive Lisp machines unnecessary.[4]

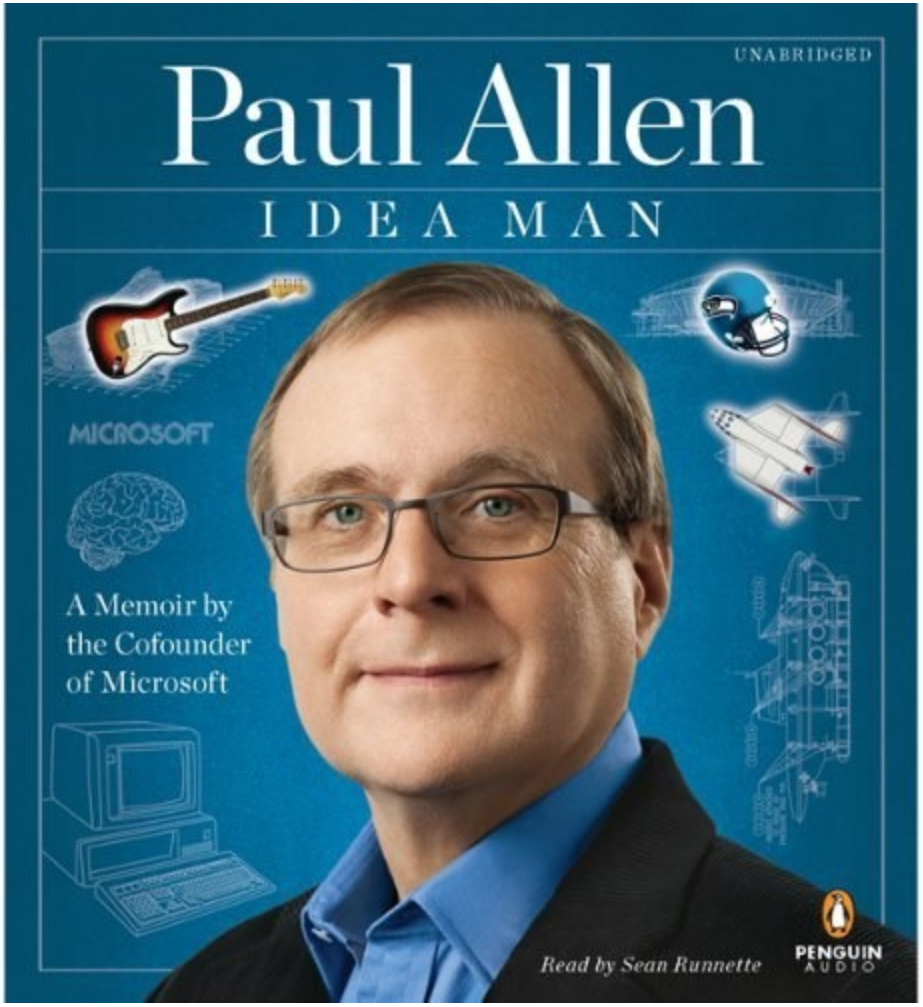
- … many of the approaches envisioned …, such as logic programming distributed over massive knowledge-bases, are now being re-interpreted in current technologies.

- The Web Ontology Language (OWL) employs … logic-based knowledge representation systems, while … **parallel computing** proliferate[s], including multi-core architectures … and massively parallel processing

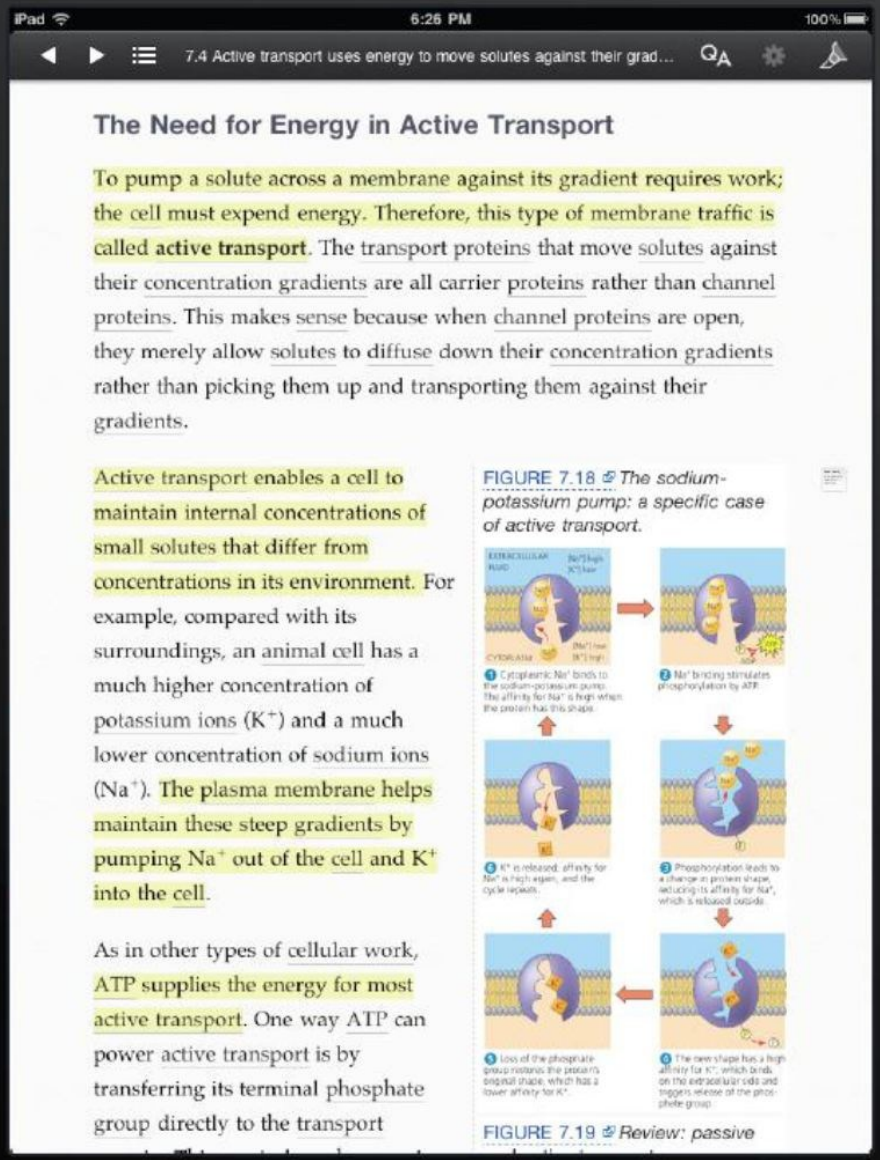


As of March 2009

Vulcan's Project Halo



- Q&A using deep knowledge and inference across the sciences
  - AI taking APs
- Semantic MediaWiki
- Scalable Inference for Large Knowledge
  - aka "SILK"
  - defeasible logic
  - higher-order syntax
- Halobook



inquire BIOLOGY

The *Inquire: Biology* app contains the entire content of Campbell's *Biology*, a textbook used by many U.S. college undergrads and advanced high school students.

In portrait orientation, *Inquire* is optimized for reading, but also supports highlighting and note-taking.

Ask a Question | Answer | New Question | Close

What are the similarities between active-transport and passive-transport?

Active-Transport and Passive-Transport are similar in the following ways:

They are both a kind of Event

High Concentration Region is destination of Active Transport and Passive Transport

Low Concentration Region is origin of Active Transport and Passive Transport

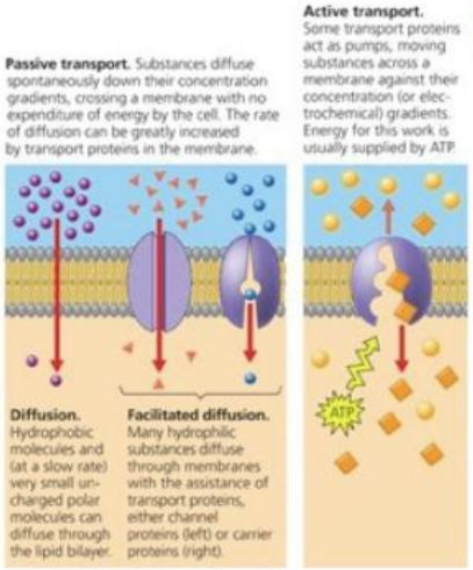


Figure 7.19 Review: passive and active transport.

AURA generates an answer, which includes a relevant image from the text. Links are automatically added for key terms.

My Objectives

- To bring knowledge into focus
- To encourage knowledge sharing
- To encourage more use of standards
- To realize more power from knowledge
- To convey the need for semantics & logic
- To increase the enterprise value of our work

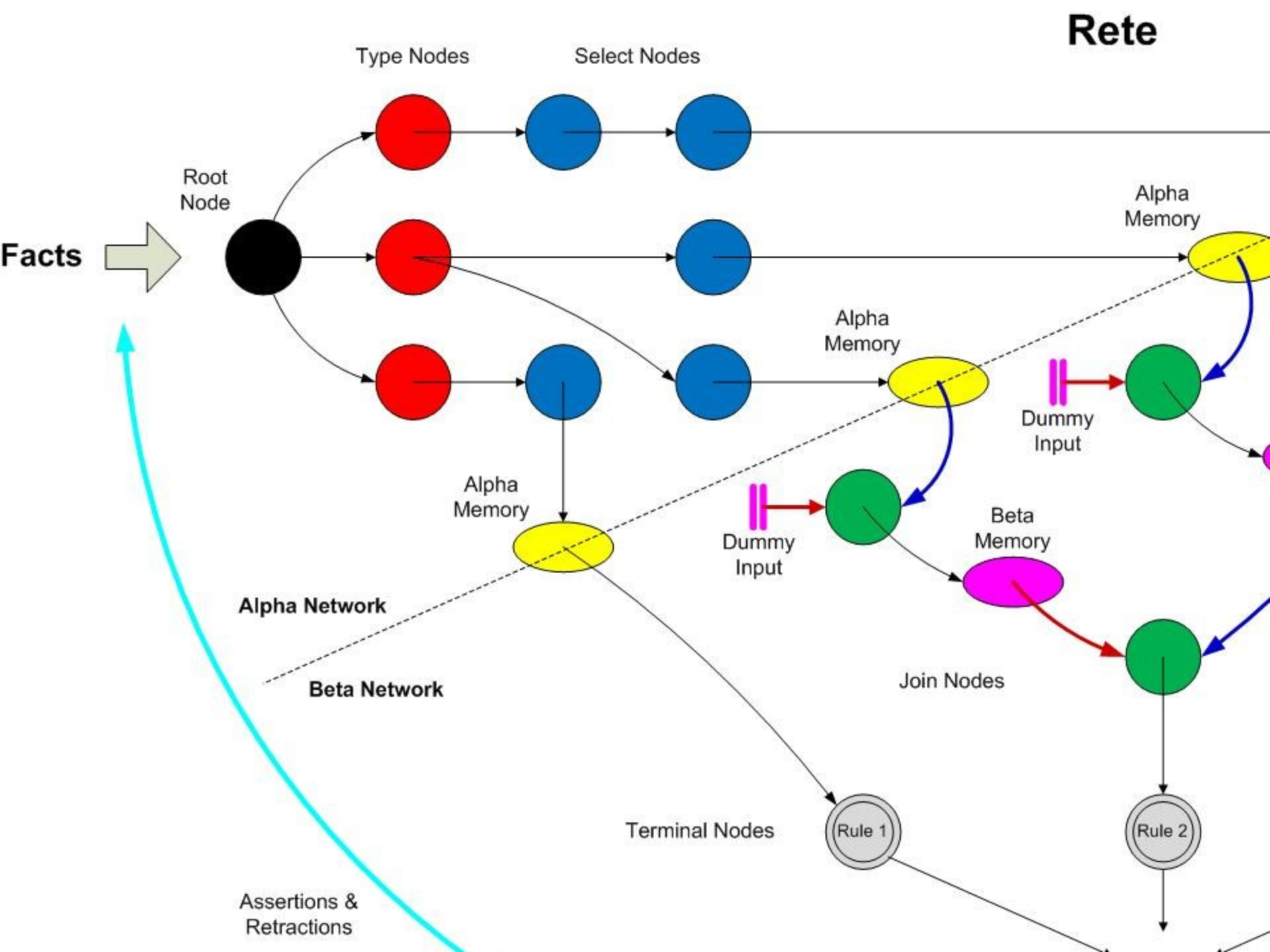
R1

"I always wanted to be a knowledge engineer, now I are one."

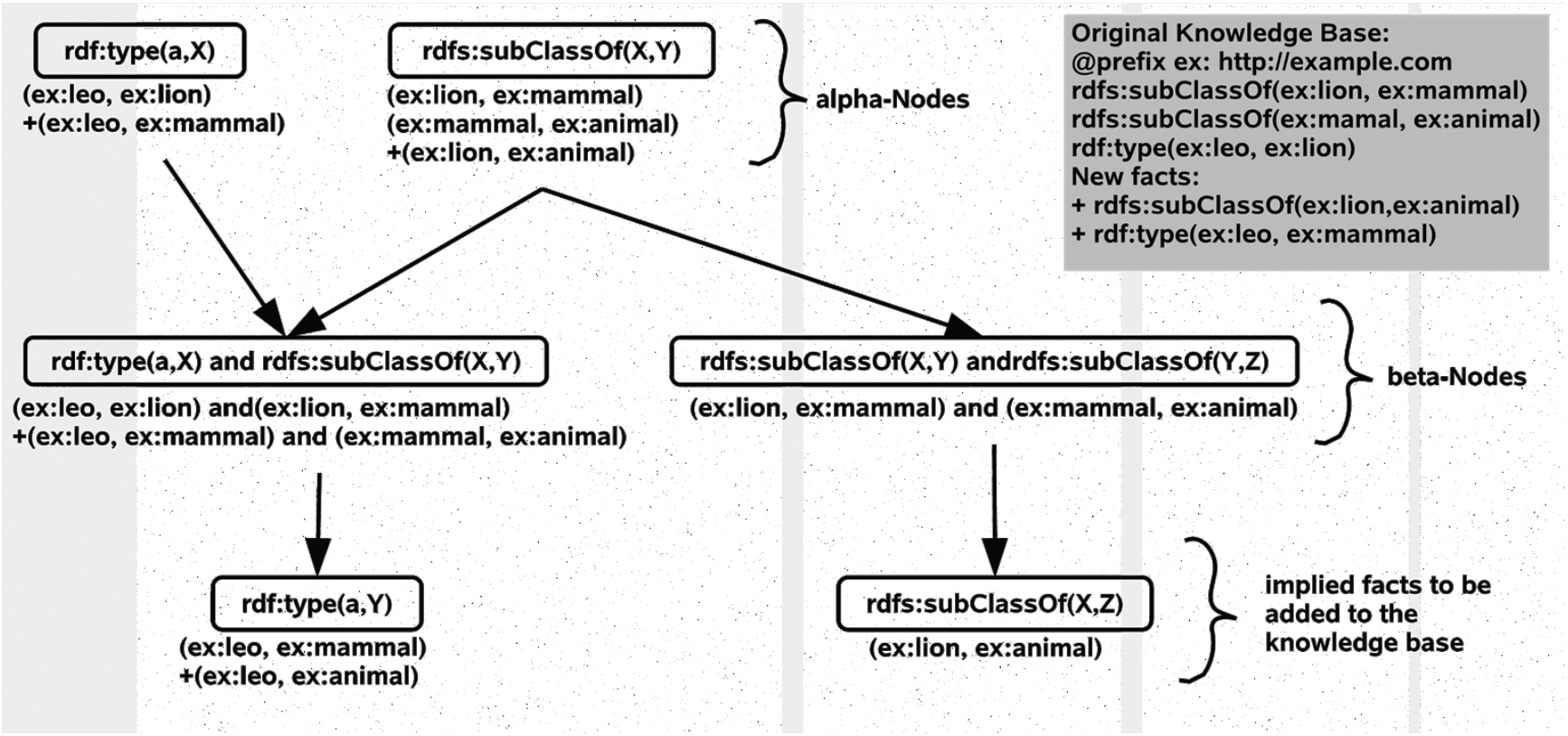
- CMU & Stanford folklore used by John McDermott in naming the first fully commercial expert system.

Are we Knowledge Engineers?

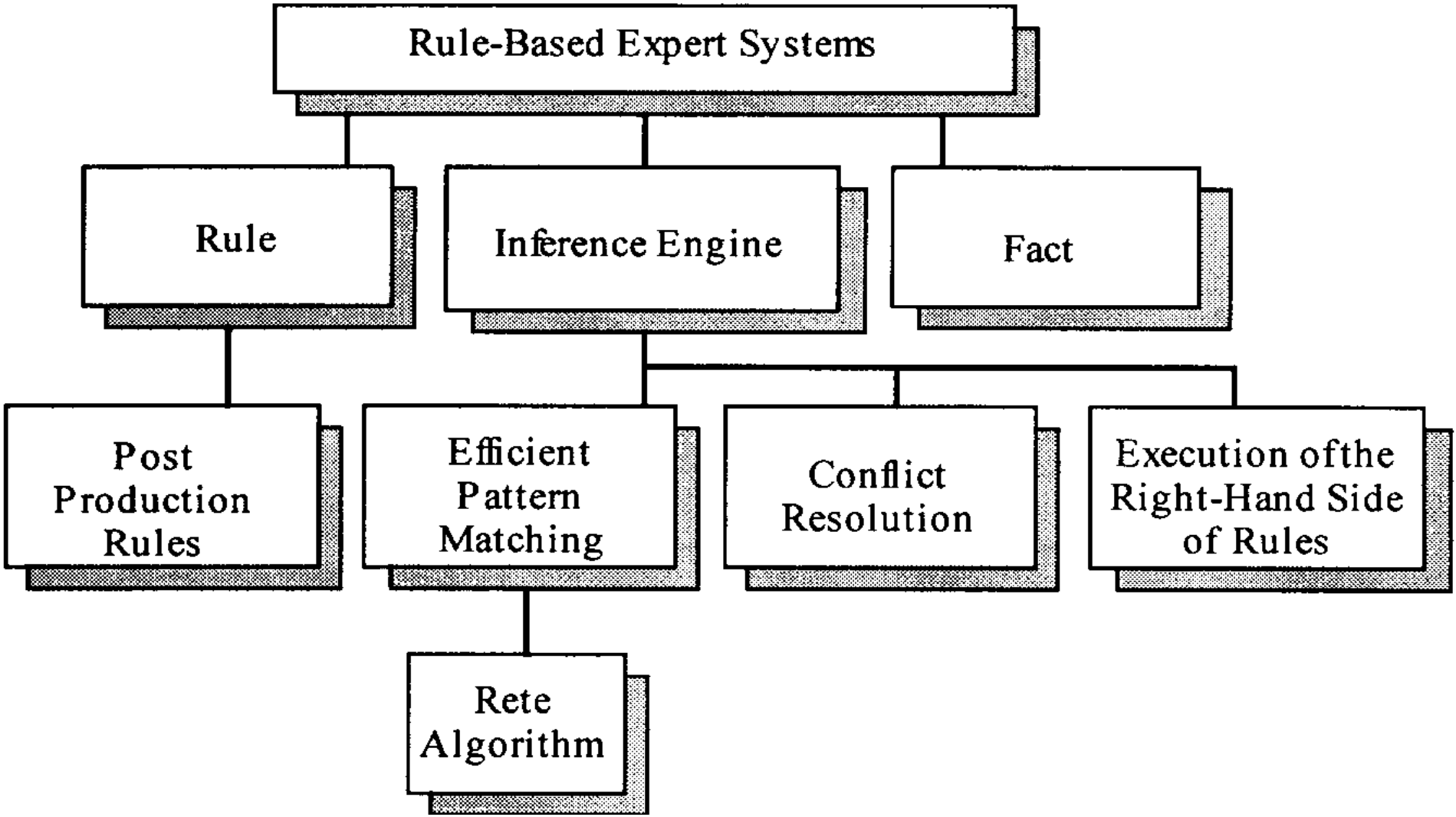
- What does an engineer do with knowledge?

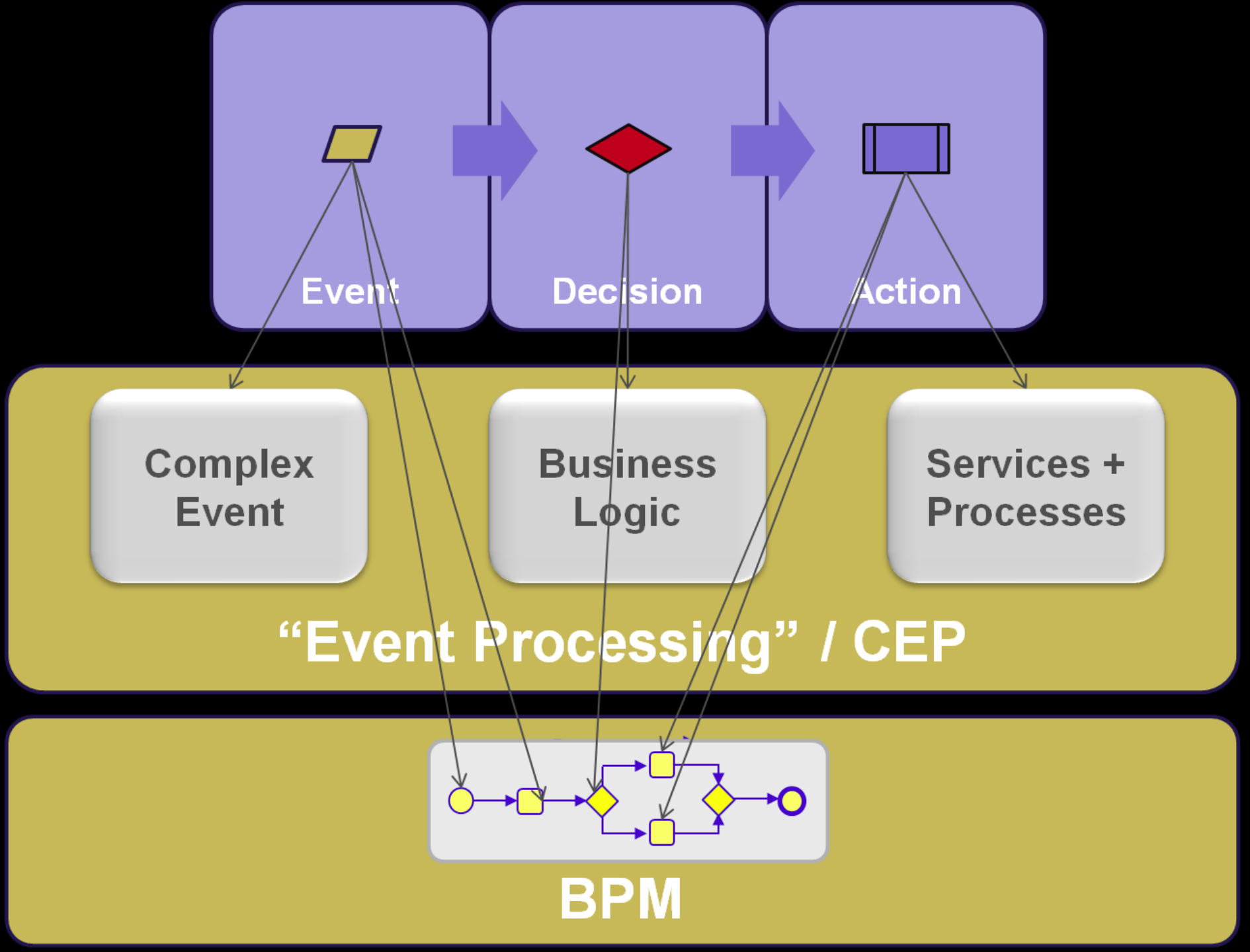

Rete
Type Nodes
Select Nodes
Root Node
Facts
Alpha Memory
Alpha Memory
Dummy Input
Alpha Memory
Dummy Input
Beta Memory
Alpha Network
Beta Network
Join Nodes
Terminal Nodes
Rule 1
Rule 2
Assertions & Retractions

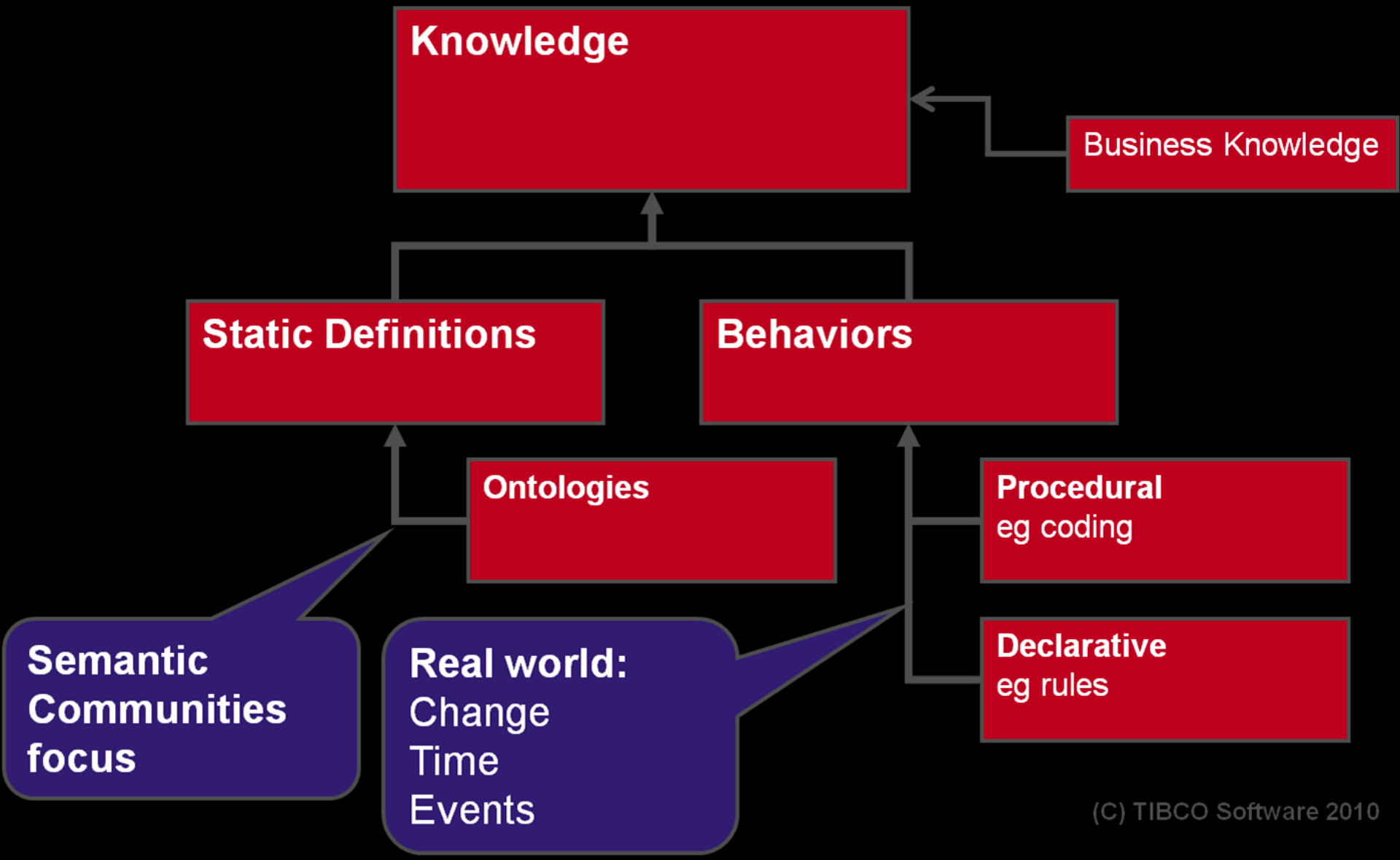
“Engineered” Knowledge?



Where's the Knowledge?



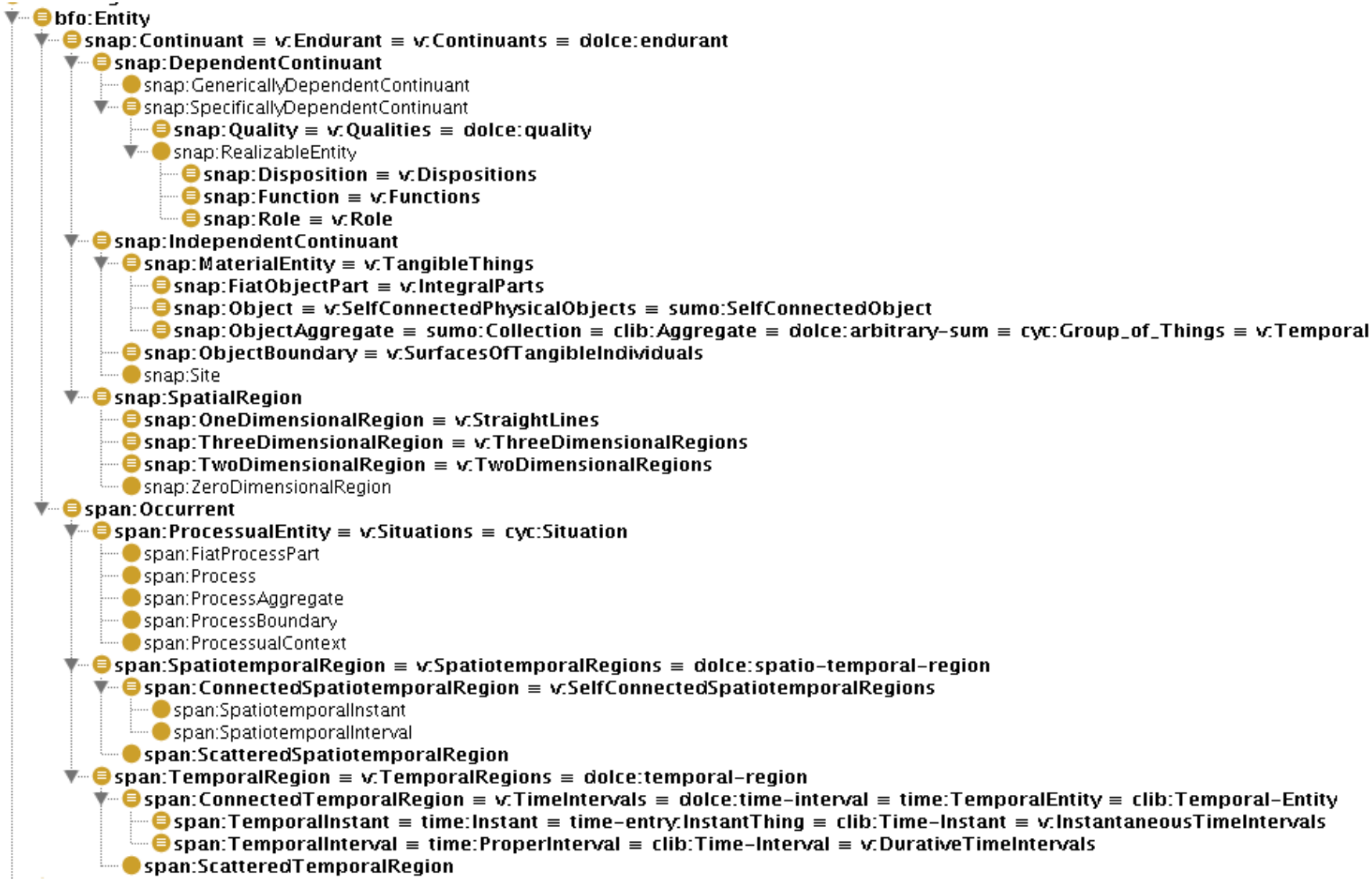

Event
Decision
Action
Complex Event
Business Logic
Services + Processes
“Event Processing” / CEP
BPM



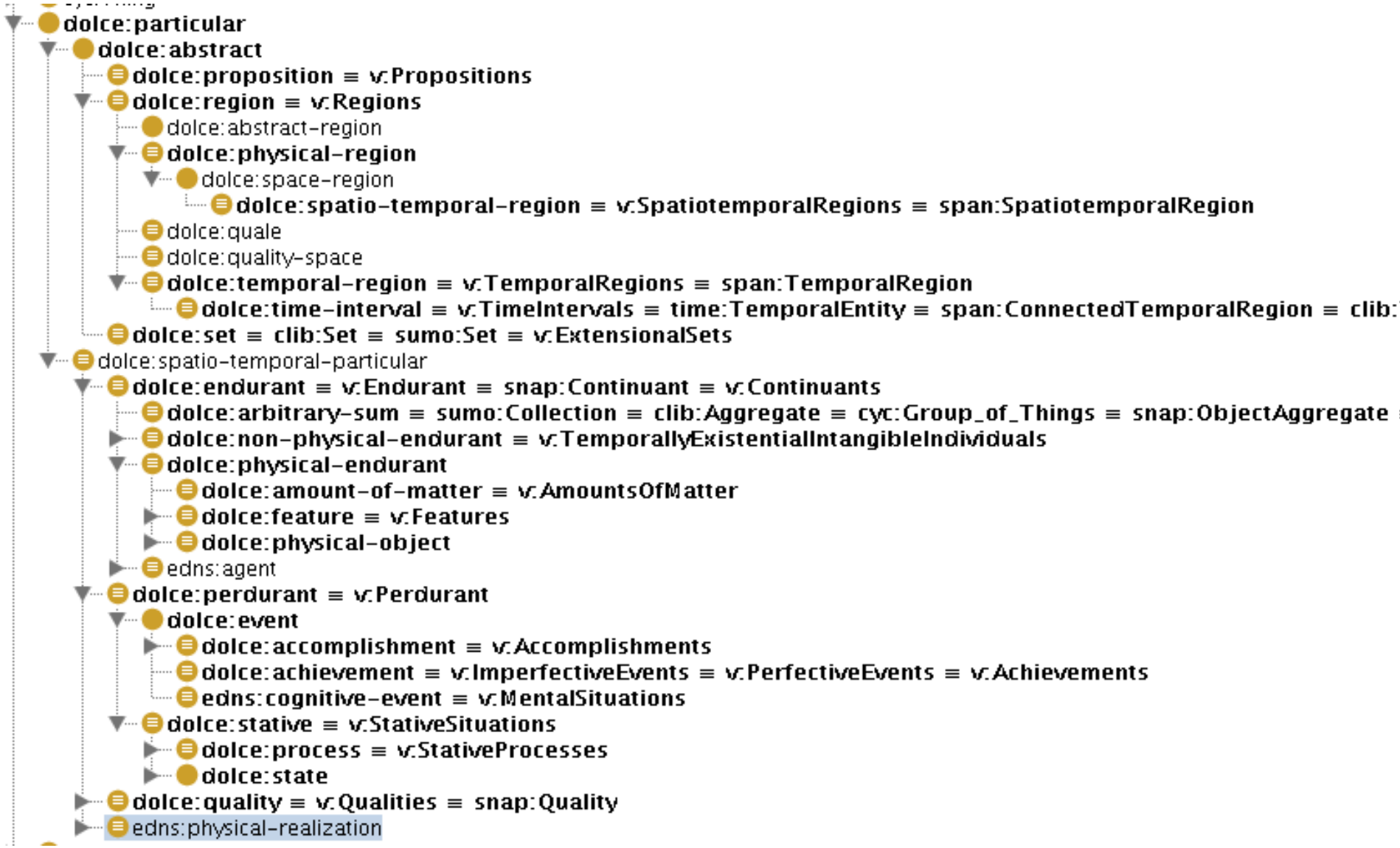
Status of Knowledge in BRMS/BPMS

- Decision Management
  - pidgeon-holing of rules into a black box
  - decisions tend not to point (not process) oriented
- Rules are distant from business knowledge
  - analysts transform natural logic into if-thens
  - more behaviors than truths or objectives
- Tool-specific models and vocabularies limit intra- and inter-enterprise sharing or leverage.
- No leverage of time, process, event, spatial, measurement, engineering, or other ontologies

Basic Formal Ontology (BFO0



DOLCE


dolce:particular
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dolce:proposition ≡ v:Propositions
dolce:region ≡ v:Regions
dolce:abstract-region
dolce:physical-region
dolce:space-region
dolce:spatio-temporal-region ≡ v:SpatiotemporalRegions ≡ span:SpatiotemporalRegion
dolce:quale
dolce:quality-space
dolce:temporal-region ≡ v:TemporalRegions ≡ span:TemporalRegion
dolce:time-interval ≡ v:TimeIntervals ≡ time:TemporalEntity ≡ span:ConnectedTemporalRegion ≡ clib:
dolce:set ≡ clib:Set ≡ sumo:Set ≡ v:ExtensionalSets
dolce:spatio-temporal-particular
dolce:endurant ≡ v:Endurant ≡ snap:Continuant ≡ v:Continuants
dolce:arbitrary-sum ≡ sumo:Collection ≡ clib:Aggregate ≡ cyc:Group_of_Things ≡ snap:ObjectAggregate
dolce:non-physical-endurant ≡ v:TemporallyExistentialIntangibleIndividuals
dolce:physical-endurant
dolce:amount-of-matter ≡ v:AmountsOfMatter
dolce:feature ≡ v:Features
dolce:physical-object
edns:agent
dolce:perdurant ≡ v:Perdurant
dolce:event
dolce:accomplishment ≡ v:Accomplishments
dolce:achievement ≡ v:ImperfectiveEvents ≡ v:PerfectiveEvents ≡ v:Achievements
edns:cognitive-event ≡ v:MentalSituations
dolce:stative ≡ v:StativeSituations
dolce:process ≡ v:StativeProcesses
dolce:state
dolce:quality ≡ v:Qualities ≡ snap:Quality
edns:physical-realization

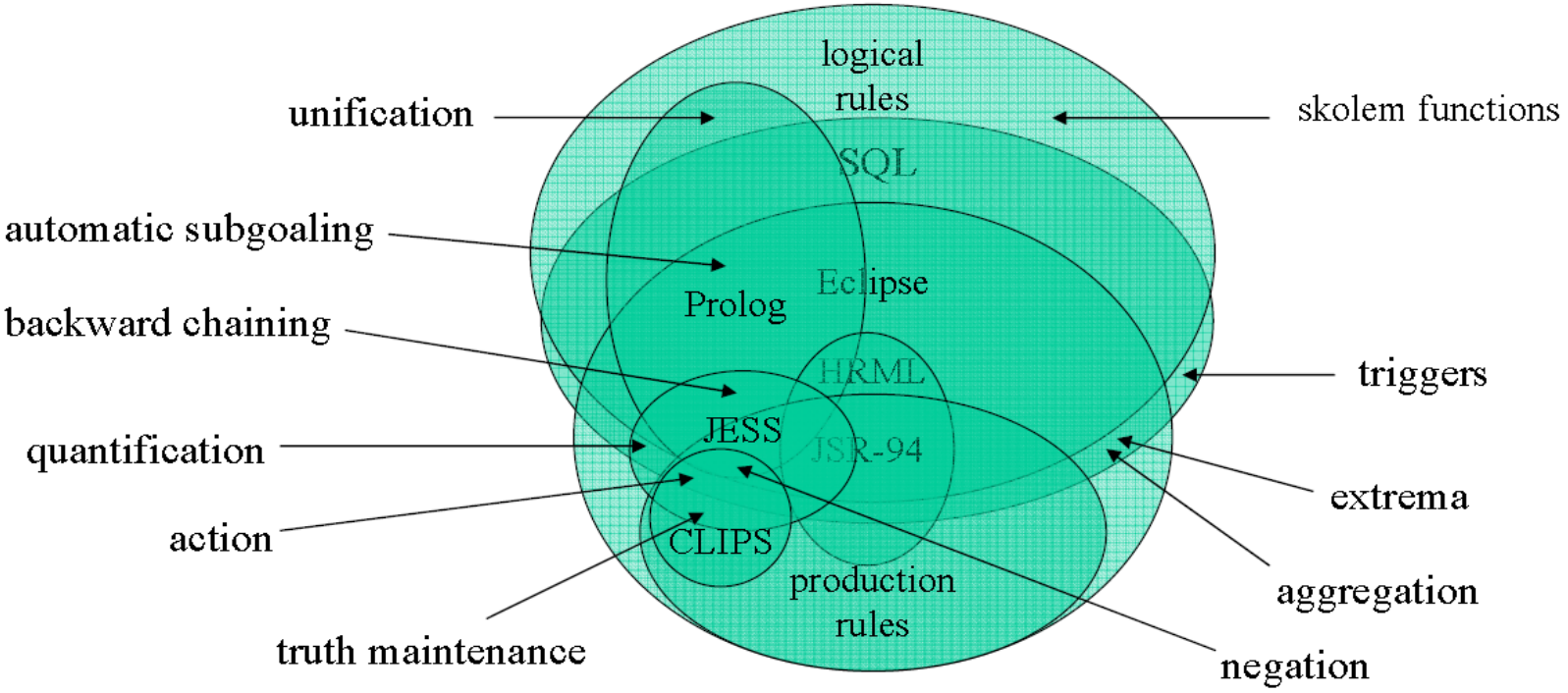
Introduction: Vulcan and SMW

- **What/Who is Vulcan?**
- **Vulcan's Interest in SMW**
  - Not primarily commercial or for internal use
  - The Digital Aristotle Vision
    - Hold a vast amount of scientific knowledge
    - Answer questions based on the knowledge
    - Dramatically accelerate scientific progress
  - What the Digital Aristotle requires:
    1. Technology to enable a global, widely-authored, very large knowledge base about human affairs and science
    2. Technology that answers questions and proactively supplies information
    3. Technology that uses powerful reasoning about rules and processes
    4. Technology that can be customized in its content and actions for individual organizations or people

DIGITAL ARISTOTLE

PROJECT HALO

Logical capabilities of PRR and BRE



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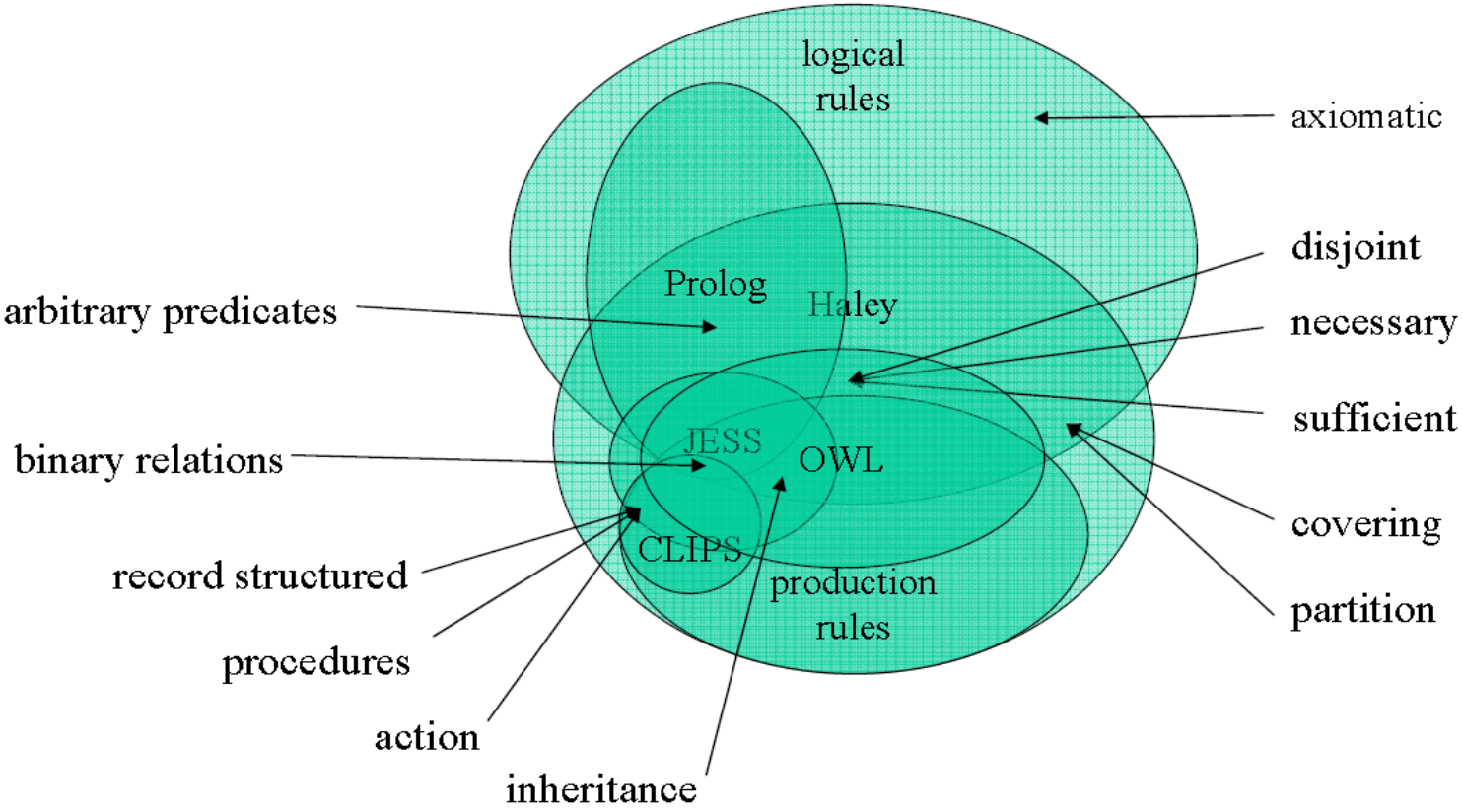
Ontological semantics of OWL and rules



Note that arbitrary OWL in its fullness covers 1st order logic but is practically targeted at ontology definition using description logic

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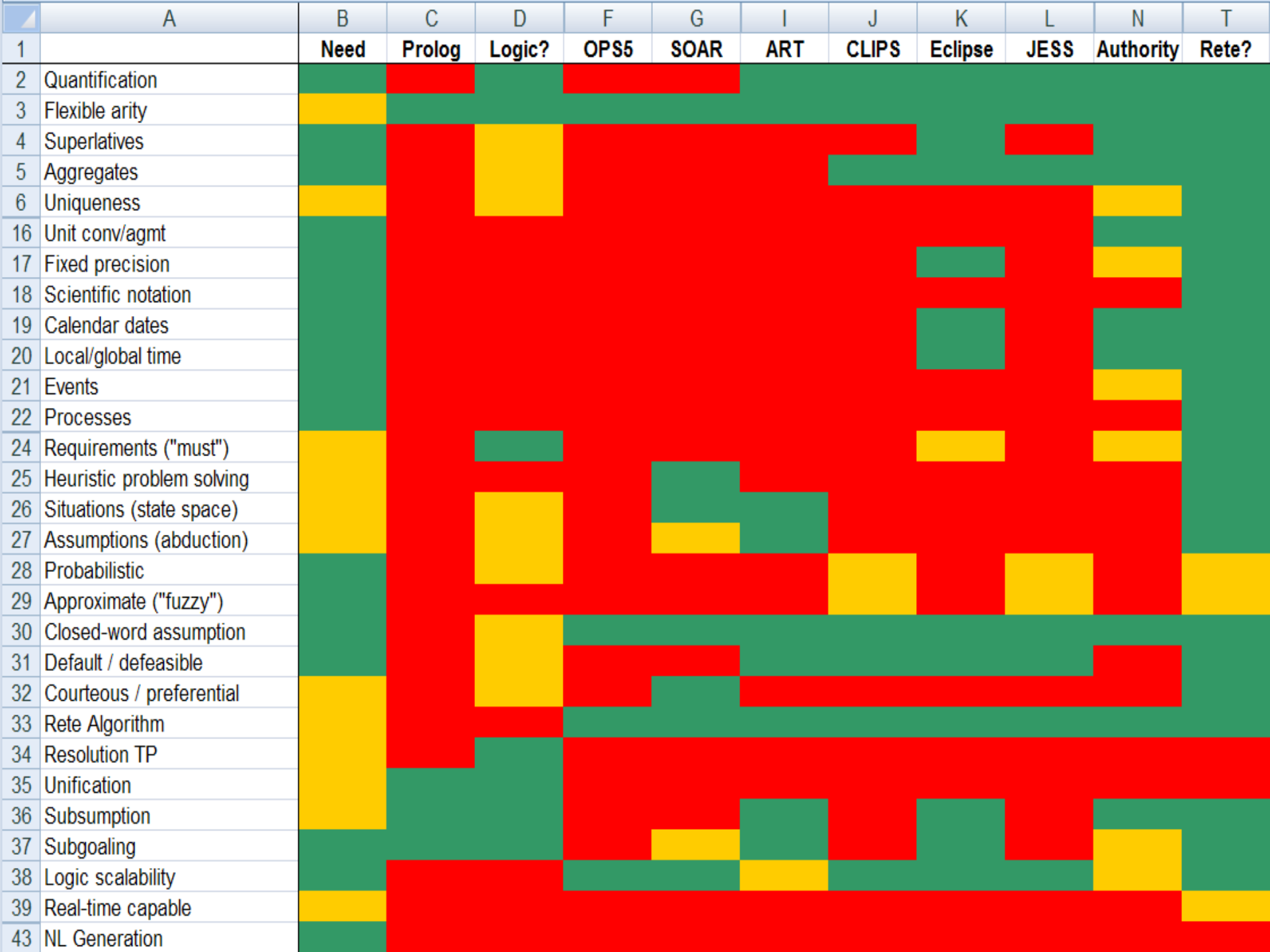
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Logic?
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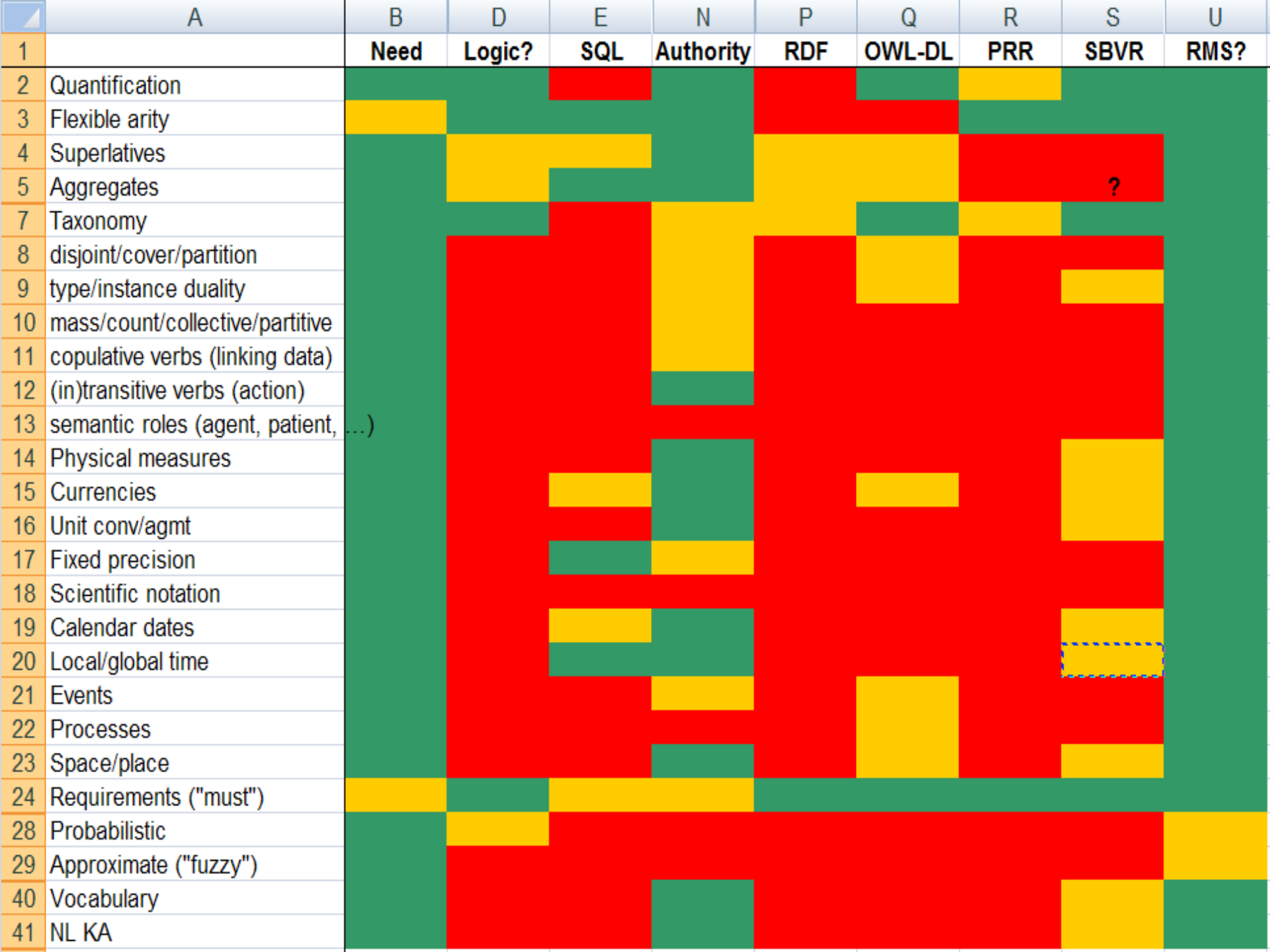
JESS
Authority
Rete?
2 Quantification
3 Flexible arity
4 Superlatives
5 Aggregates
6 Uniqueness
16 Unit conv/agmt
17 Fixed precision
18 Scientific notation
19 Calendar dates
20 Local/global time
21 Events
22 Processes
24 Requirements ("must")
25 Heuristic problem solving
26 Situations (state space)
27 Assumptions (abduction)
28 Probabilistic
29 Approximate ("fuzzy")
30 Closed-word assumption
31 Default / defeasible
32 Courteous / preferential
33 Rete Algorithm
34 Resolution TP
35 Unification
36 Subsumption
37 Subgoaling
38 Logic scalability
39 Real-time capable
43 NL Generation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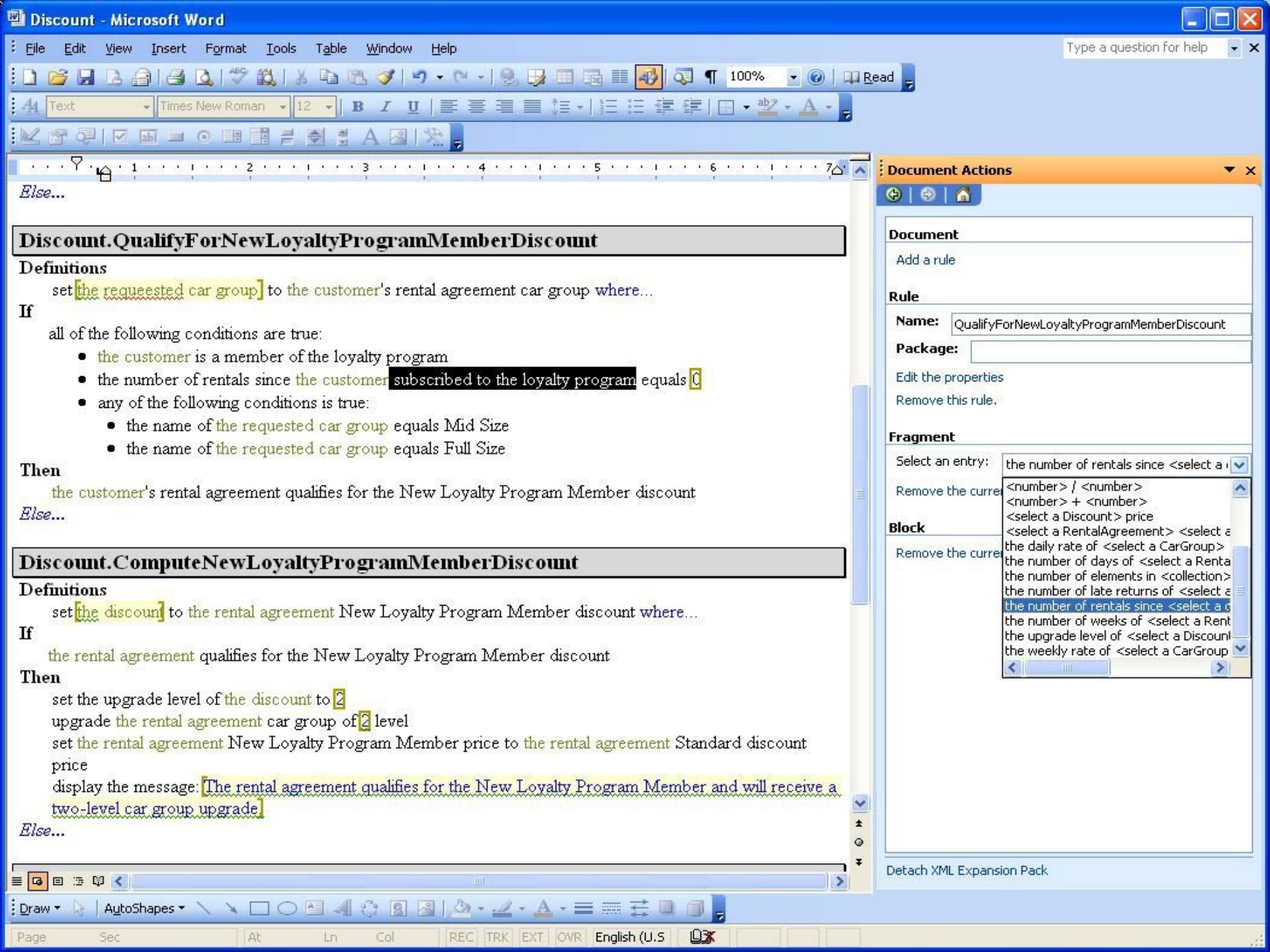
Logic?
SQL
Authority
RDF
OWL-DL
PRR
SBVR
RMS?
2 Quantification
3 Flexible arity
4 Superlatives
5 Aggregates
?
7 Taxonomy
8 disjoint/cover/partition
9 type/instance duality
10 mass/count/collective/partitive
11 copulative verbs (linking data)
12 (in)transitive verbs (action)
13 semantic roles (agent, patient, ...)
14 Physical measures
15 Currencies
16 Unit conv/agmt
17 Fixed precision
18 Scientific notation
19 Calendar dates
20 Local/global time
21 Events
22 Processes
23 Space/place
24 Requirements ("must")
28 Probabilistic
29 Approximate ("fuzzy")
40 Vocabulary
41 NL KA

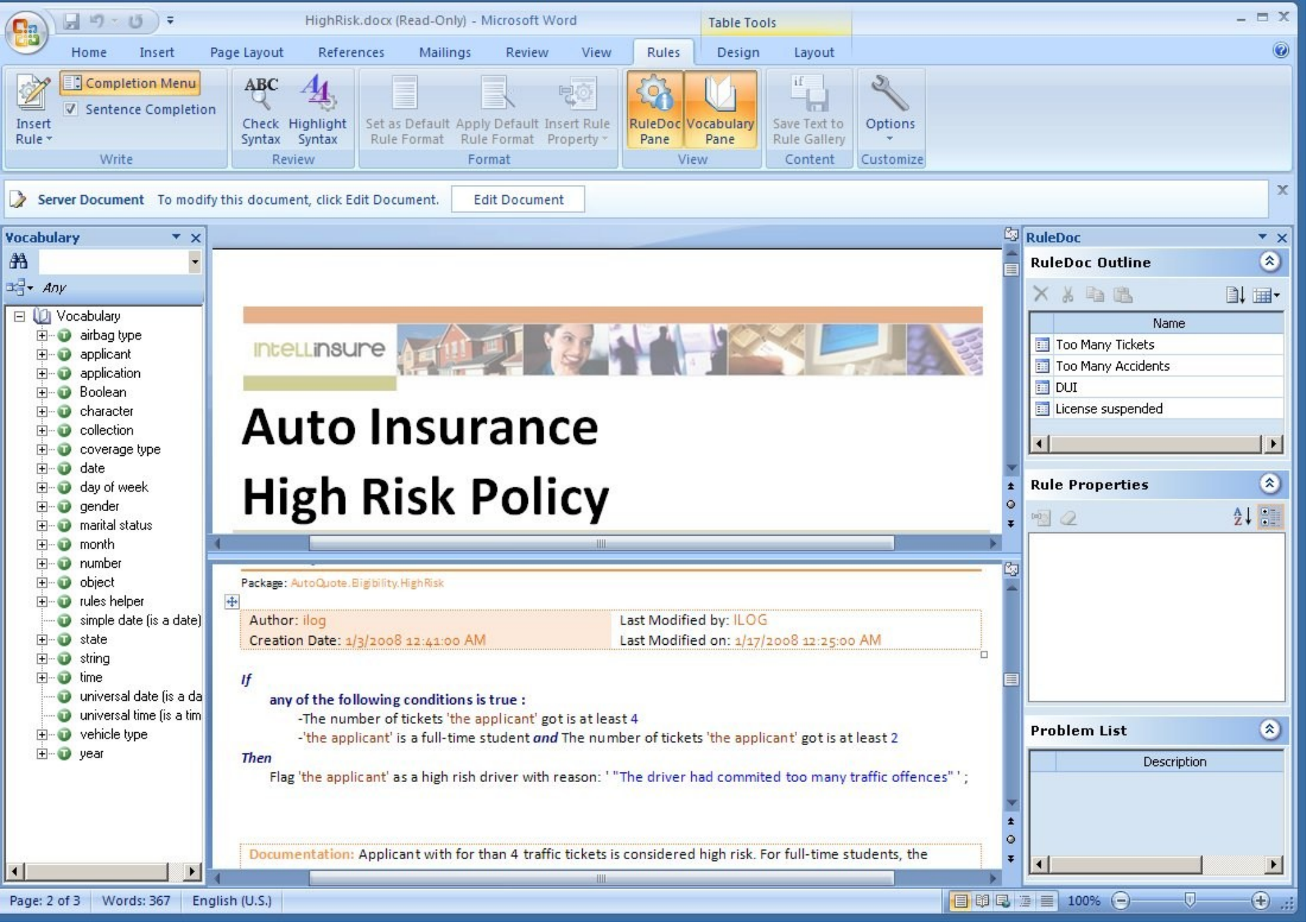
Status of Rules Engines

- Rete Algorithm dominates business rules
  - forward-chaining only (practically, speaking)
  - very weak from a logical reasoning perspective
    - lacks unification, automatic sub-goaling, resolution, …
- Tableaux algorithms rule description logic (DL)
  - e.g., HermIT for Protégé (but DL is too limiting)
- Prolog dominates logic programming (LP)
  - SLG resolution (aka “tabling”) analogous to Rete
- Theorem proving is more than academic
  - e.g., NIST uses with SBVR; significant in GRC
- Rete & Prolog are immature wrt multi-processing

Status of BRMS

- Target uses are not knowledge “engineers”!
- Mixed metaphors, but pseudo-NL clearly leads
  - textual (not linguistic) structure editing
    - IBM, Oracle, JBoss, most SBVR tools
  - Controlled natural language (NL)
    - Haley Authority, Attempto
  - Document cultivation…
  - Tabular metaphors
- The rule engine market “seems” unimportant


Discount - Microsoft Word
File Edit View Insert Format Tools Table Window Help
Type a question for help
Read
Else...
Discount.QualifyForNewLoyaltyProgramMemberDiscount
Definitions
set the requeested car group to the customer's rental agreement car group where...
If
all of the following conditions are true:
the customer is a member of the loyalty program
the number of rentals since the customer subscribed to the loyalty program equals 0
any of the following conditions is true:
the name of the requested car group equals Mid Size
the name of the requested car group equals Full Size
Then
the customer's rental agreement qualifies for the New Loyalty Program Member discount
Else...
Discount.ComputeNewLoyaltyProgramMemberDiscount
Definitions
set the discount to the rental agreement New Loyalty Program Member discount where...
If
the rental agreement qualifies for the New Loyalty Program Member discount
Then
set the upgrade level of the discount to 2
upgrade the rental agreement car group of 2 level
set the rental agreement New Loyalty Program Member price to the rental agreement Standard discount price
display the message: The rental agreement qualifies for the New Loyalty Program Member and will receive a two-level car group upgrade.
Else...
Document Actions
Document
Add a rule
Rule
Name: QualifyForNewLoyaltyProgramMemberDiscount
Package:
Edit the properties
Remove this rule.
Fragment
Select an entry: the number of rentals since <select a
Remove the curre
Block
Remove the curre
<number> / <number>
<number> + <number>
<select a Discount> price
<select a RentalAgreement> <select a
the daily rate of <select a CarGroup>
the number of days of <select a Renta
the number of elements in <collection>
the number of late returns of <select a
the number of rentals since <select a
the number of weeks of <select a Rent
the upgrade level of <select a Discount
the weekly rate of <select a CarGroup
Detach XML Expansion Pack
Draw AutoShapes
Page Sec At Ln Col REC TRK EXT OVR English (U.S



SBVR

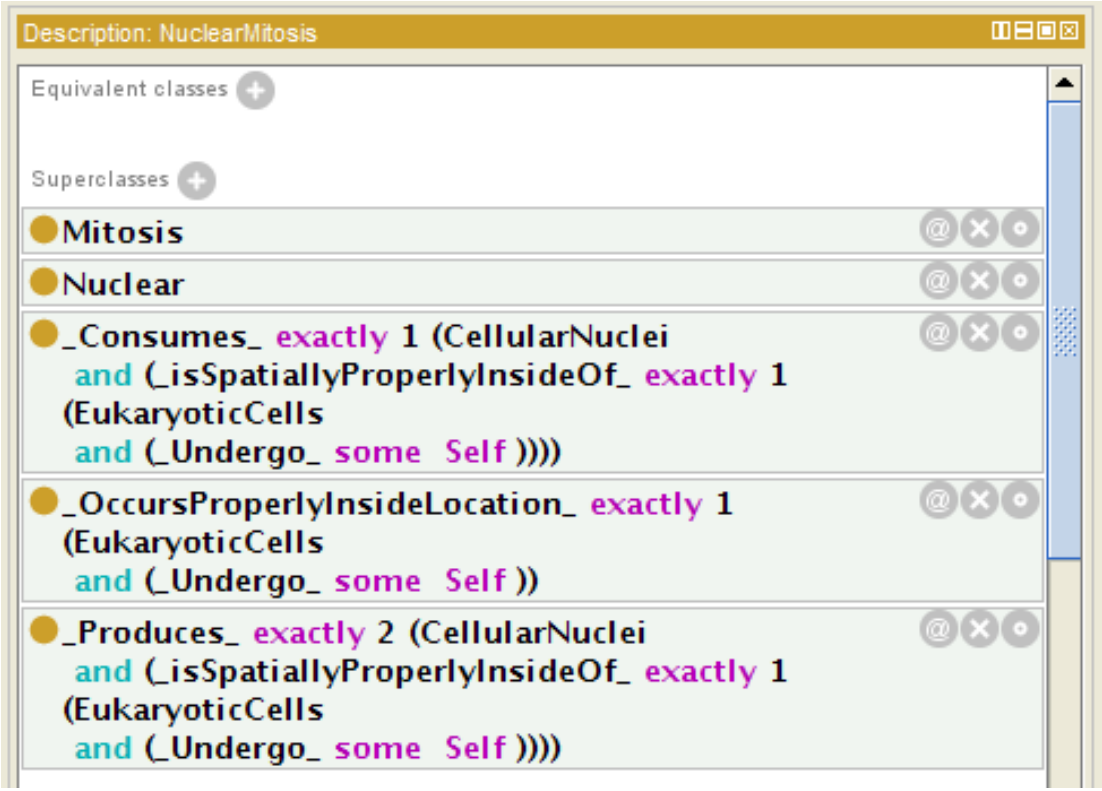
It is permitted that a rental *is open* only if an estimated rental charge *is provisionally charged to* a credit card *of* the renter that *is responsible for* the rental.

Guidance Type:	operative business rule
Description:	While a renter has possession of a car, there is a provisional charge to EU-Rent against his credit card. This will be replaced by an actual charge at the end of the rental
Enforcement Level:	Strict
Supporting fact types:	rental *has* rental charge
	estimated rental charge *is provisionally charged to* credit card
	renter *has* credit card
	rental *has* driver

- Better in several ways than current BRMS
  - vendors continue to add linguistic flexibility
  - vendors increasing integrating with semantic web

Lesson on KA from Protégé

- Nuclear mitosis involving a eukaryotic cell consumes the cellular nucleus that is inside of the cell
- Nuclear mitosis occurs inside the eukaryotic cell that undergoes it
- Nuclear mitosis produces 2 cellular nuclear inside the eukaryotic cell undergoing it



BRE/BRMS Lock-In/Out

- The following are based on 1st order logic (FOL):
  - W3C rule interchange format (RIF)
  - W3C web ontology language (OWL)
  - OMG Semantics of Business Vocabulary & Rules (SBVR)
- Rete can't handle logic of any complexity / sophistication
- OWL is less of a language that a format, as with RIF
  - RIF-Core is a rudimentary fraction of RIF that Rete can handle
  - OWL-RL is a "rule" subset of OWL suitable for forward chaining
- Inadequate logical abstraction and capabilities precludes leverage and inhibits reuse or management of knowledge assets as such

Knowledge Engineering

- Acquiring – largely an interpersonal art
  - some methodology concerning vocabulary
    - lacks substantial formality (e.g., ontology)
    - lacks significant integration with NLP
  - little regarding elicitation of expertise
- Capturing
- Formalizing
- Encoding

Knowledge Engineering

- Acquiring
- Capturing – master document metaphors
  - e.g., requirements spreadsheets
  - e.g., guidelines or policy manuals
  - e.g., legal and regulatory documents
- Formalizing
- Encoding

Knowledge Engineering

- Acquiring
- Capturing
- Formalizing – the semantics (i.e., meaning)
  - disambiguation of terms and text
  - transforming one sentence into multiple rules
- Encoding

Knowledge Engineering

- Acquiring
- Capturing
- Formalizing
- Encoding
  - technical syntax
  - tabular metaphors
  - structured editing of text
  - controlled natural languages

Natural Logic

- Maintains knowledge in natural language
  - requiring FOL expressivity (and then some)
    - sophisticated logic is frequently simple in English
- Translated FOL interpretations into
  - SBVR or RIF-BLD
    - for interchange
    - for semantic web
  - OWL-RL for logic programs & production systems
    - a one to many mapping
- Eliminate much if not all of the encoding step
- Maintain the natural, readable knowledge base

Haley
Thrive on Change

www.haley.com

Using Authorete to Place Advertising

This document shows how you might tell Authorete about scheduling advertisements at a newspaper Web site. We begin by examining some advertising sales department business policies. To tell Authorete how to schedule advertisements, the background knowledge needed to understand the stated policies must be identified before the policies can be restated in clear, English sentences. Once the advertising policies have been clearly formulated, they can be used in an on-line, Web-based ad reservation system.

Advertising Policies

The following sentences are based on real newspaper business policies, most of which are explicitly stated at *The New York Times'* Web site.

1. *Only 6x21" ads can run on the back page of any section in the newspaper.*
2. *For color reservations, pick-ups and multiple appearance ads are not allowed.*
3. *In the NYT Magazine, which only runs on Sundays, the Sophisticated Traveler only runs 4 times a year and should only be available for those specified dates.*
4. *When advertiser "A" runs a 2x7" on pgs 2-3 they should only be charged for a 2x5.25" at their contract rate.*
5. *Book ads shall receive a lower per column inch rate for a 6x21" than for other sizes.*
6. *Ad schedules using the same material with the same reservation number must always be the same size.*
7. *Only advertisers "A", "B", and "C" are allowed to run in the Main News Section of the New York Metro Edition and only for sizes 5x18", 6x18", 6x21", 13x18", 13x21".*
8. *Only motion picture ads or movie theatre directories can run in movies but motion picture ads can run anywhere, while movie theatre directory ads can only run in movies.*
9. *Only retail ads and advertisers "A", "B", and "C" can run in Layout Position = Pages 2-3, 2-3 Top, 2-3 Top Next, or 2-5; and they must run 2x7" or 2x5.25" ads and they must be black and white.*
10. *An ad for a single auto dealer run in the Westchester or Connecticut zone must also be run in the other zone using the same material and reservation number.*

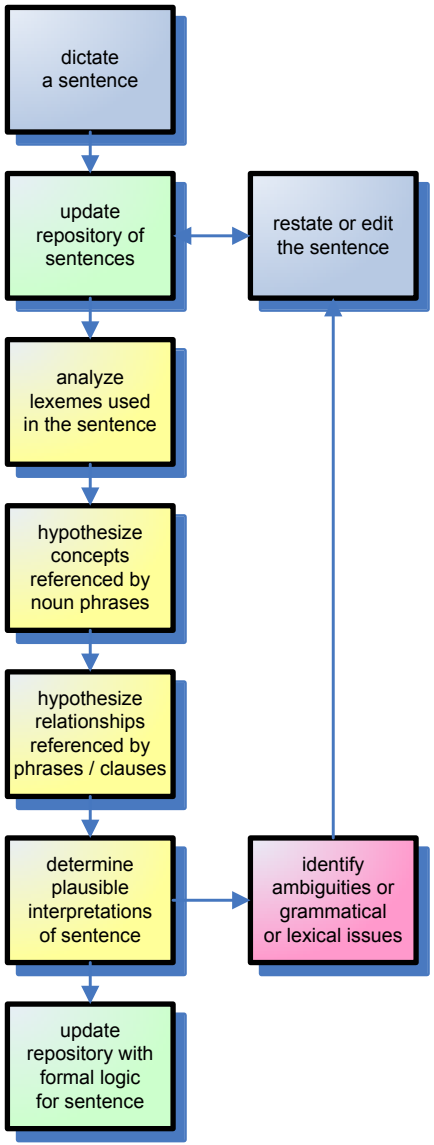
Logical interpretation

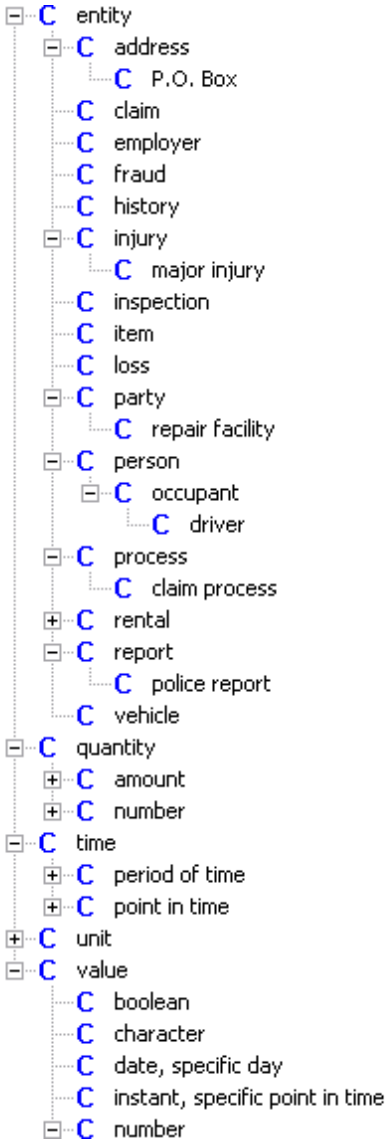
- *Only 6x21” ads can run on the back page of any section in the newspaper.*
- *For color reservations, pick-ups and multiple appearance ads are not allowed.*
- *When Vulcan runs a 2x7” on pgs 2-3 they should only be charged for a 2x5.25” at their contract rate.*
- *Book ads shall receive a lower per column inch rate for a 6x21” than for other sizes.*
- *Ad schedules using the same material with the same reservation number must always be the same size.*

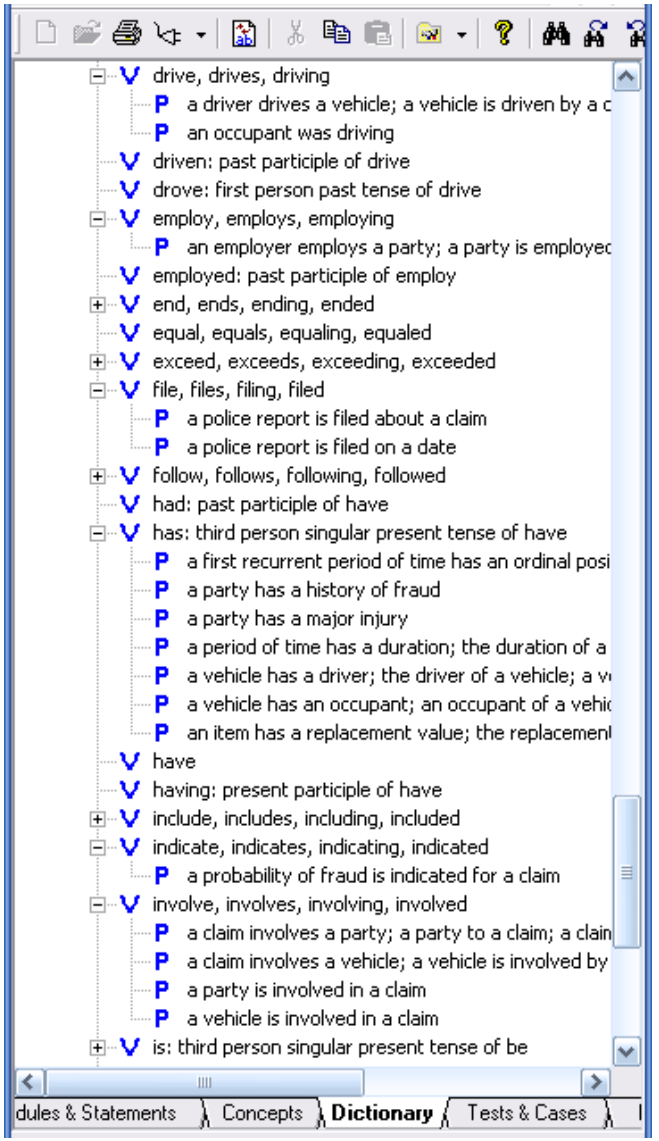
Clarification or Disambiguation

- only full page color ads run on back pages
  - only ads run on back pages
  - ads run on back pages must be color
  - ads run on back pages must be full page
- engage in productive disambiguations dialog
  - a battleground for creativity

NLP and Linguistic Ontology







NL KM&A Today

- 3,000+ ontological concepts
  - NIST PSL, BFO, Dolce
  - OWL Time, SBVR Date Time
  - NASA QUDT, RCC-8, EngMath
- 100,000+ word lexicalized ontology (in OWL)
  - < 10,000 domain independent (e.g., bio textbook)
  - leveraging the English Resource Grammar (ERG)
  - natural logic interpretation w/ disambiguation
- Thin-client, wiki-based platform emphasis
  - ERG “reads” 80% of Wikipedia text “as is”

Comments on Semantics

- SBVR is more important as a logic formalism, such as RIF or OWL.
  - Vocabulary and phraseology are, in fact, optional.
  - SBVR's XMI is roughly interchangeable with RIF and OWL.
- Broad-coverage natural language for SBVR, RIF and OWL promises to open the market for engine-independent knowledge management (beyond rules).
- Suitable execution capability exists, but exhaustive materialization (without robust backward chaining) is usually impractical (i.e., Rete needs careful focusing)

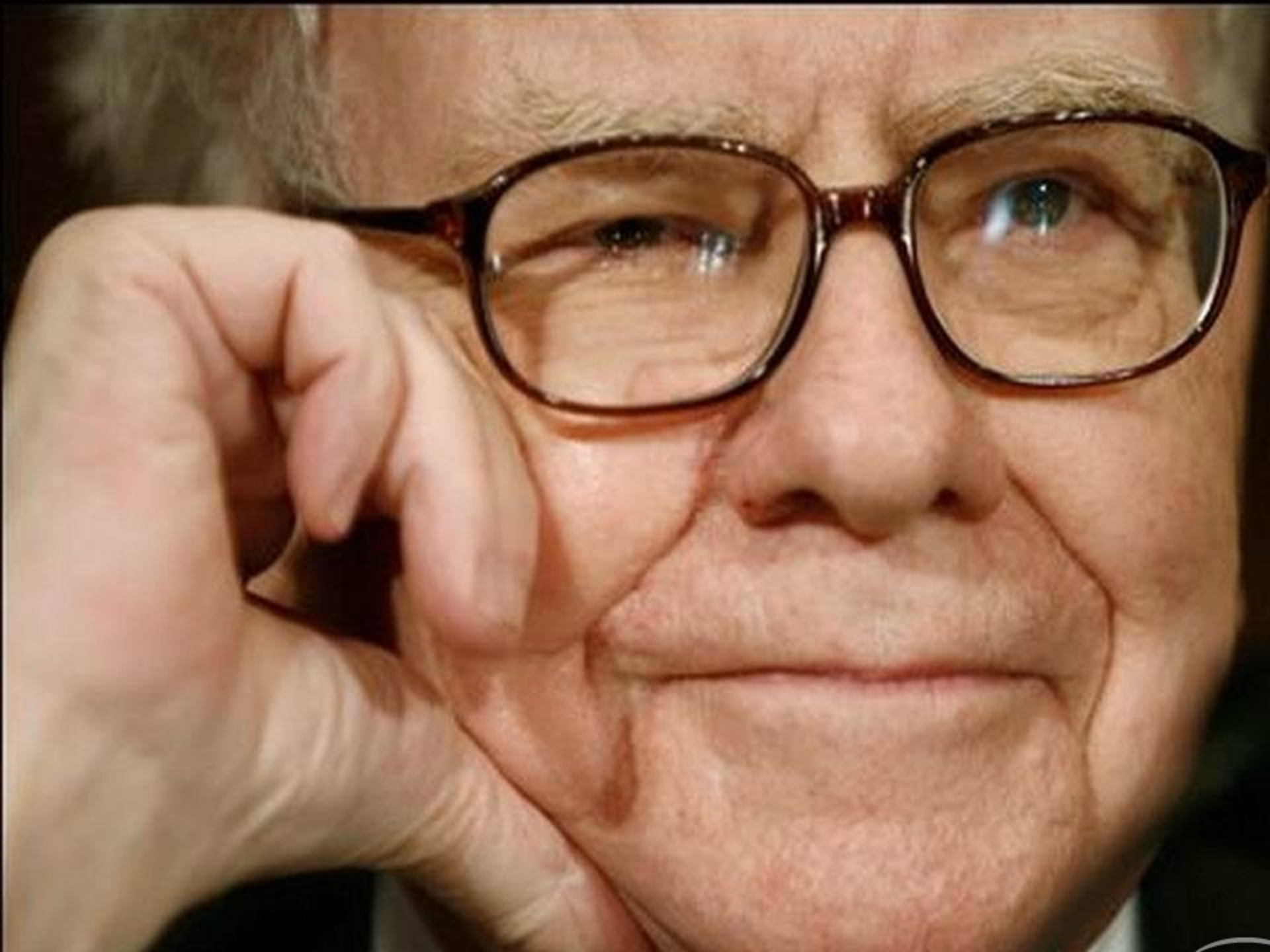
Project Halo

- Vulcan R&D project to develop technology for the Digital Aristotle
  - Similar to an EC Integrated Project or a US DARPA project
  - Coordinate with the (few) other efforts in this area in the world
  - Find the best ideas/teams worldwide, and fund them to change the world

- Three major Project Halo thrusts
  - Textbooks You Can Talk To (Halobook)
  - New directions in knowledge representation (SILK)
    - Tractable nonmonotonic / higher-order rule systems
  - SME-based Knowledge Acquisition (AURA and SMW)
    - Address unscalable authorship costs for complex knowledge bases
    - Develop editorial processes and rules for knowledge authoring
    - Develop specific knowledge authoring technology for subject-matter experts

Comments on Ontology & Logic

- Defeasibility is a practical necessity
  - 1980s frame based systems had it
  - SOAR (Newell, Laird & Rosenbaum) had it
  - SILK and Courteous Logic Programs have it
- Defeasibility tolerates logical inconsistency
  - no real knowledge base can be proven consistent
  - most real knowledge bases are inconsistent
  - deliberative architecture is a must
  - SBVR deontics are important
- Without defeasibility, ontology is intractable
  - e.g., try defining birds that fly in OWL



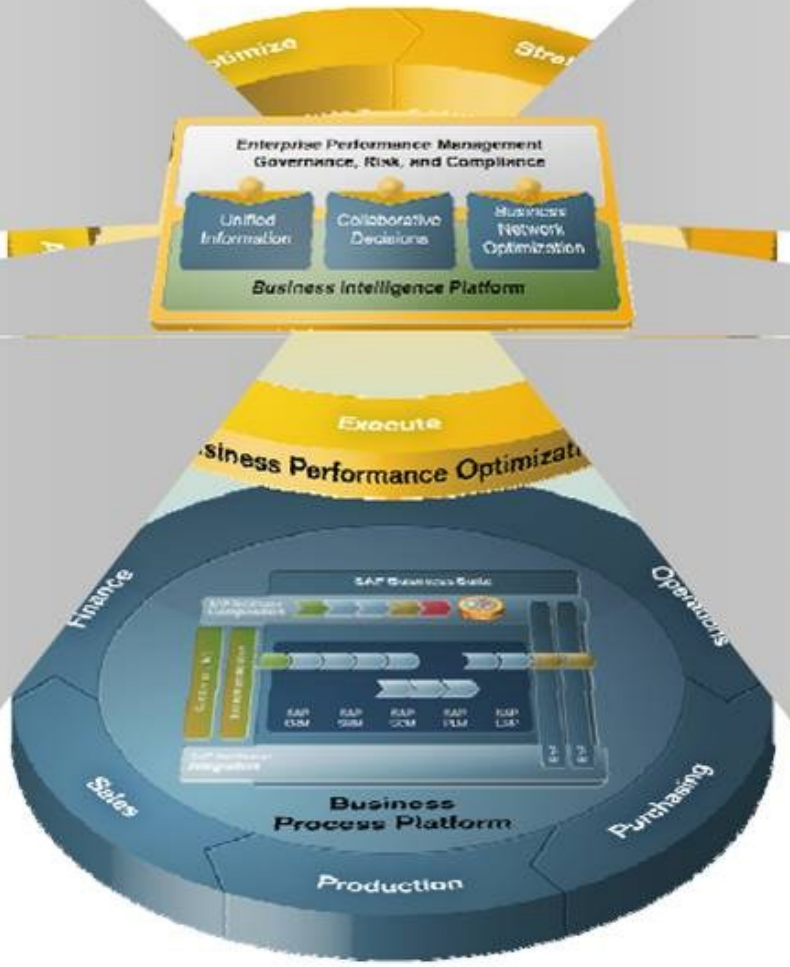
Das SAP BusinessObjects Portfolio

Enterprise Performance Management

- Strategy Management
- Planning, Budgeting and Forecasting
- Profitability and Cost Management
- Consolidation
- Spend and Supply Chain

Governance, Risk and Compliance

- Risk Management
- Access Control
- Process Control
- Global Trade Services
- Environment, Health and Safety



Business Intelligence

- Reporting
- Query, Reporting and Analysis
- Dashboards and Visualization
- Search and Navigation
- Advanced Analytics

Information Management

- Data Integration
- Data Quality Management
- Master Data Management
- Metadata Management

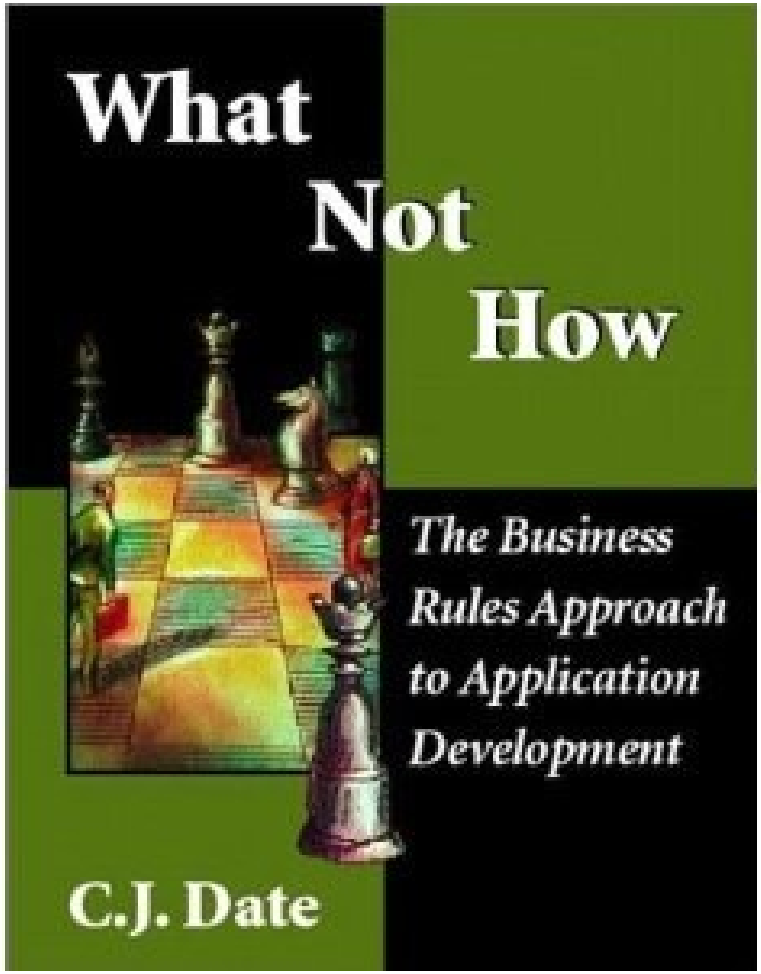
SAP BusinessObjects

Knowledge

- Knowing “why” something should be is typically more valuable than “what” should be

- Knowing “why” things are being done is typically more valuable than knowing “what “ should be done or “how” to handle something

How about Why?



Why vs. What vs. How

- Procedurally “how” to do something is weaker than declaratively “what” should be done.
- Declaring “what” should be done may suffice in the present moment but…
- Some “whats” or “hows” that could address a given “why” can be better than others.

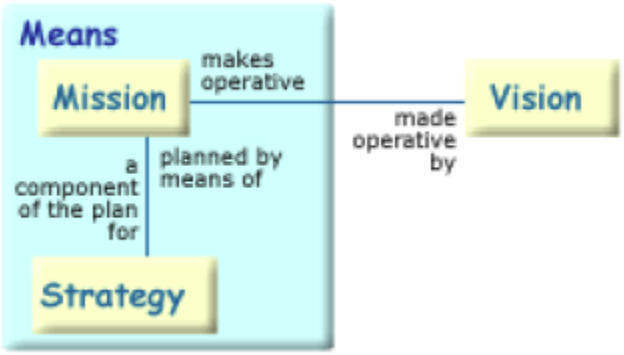
Knowledge-based IT

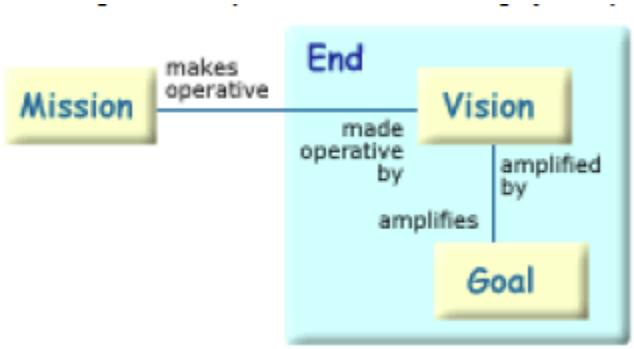
- Business Rule Engines (BRE)
- Business Rule Management Systems (BRMS)
- Business Process Management (BPM/BPMS)
  - including Complex Event Processing (CEP)
- Enterprise Performance Management (EPM)
  - also: Corporate Performance Management (CPM)
- Business Intelligence (BI)
  - statistics / data mining
  - predicative analytics / machine learning

Status of Knowledge in IT

- BRE – much how, much what
- BRMS – some how, mostly what, no why
- BPMS – mostly how, little what, no why
- EPM/CPM – little what, some why
- BI – little what, little why

Why, Why & How





- Vision
- Mission
- Strategies & Tactics
- Goals & Objectives

Vision & Mission

A Mission ...
- makes operative at most one Vision.
- is planned by means of Strategies.

Compared to a Tactic, a Strategy tends to be:
- longer term.
- broader in scope.

A Strategy ...
- is a component of the plan for a Mission.
- may determine Organization Units.
- is implemented by Tactics.

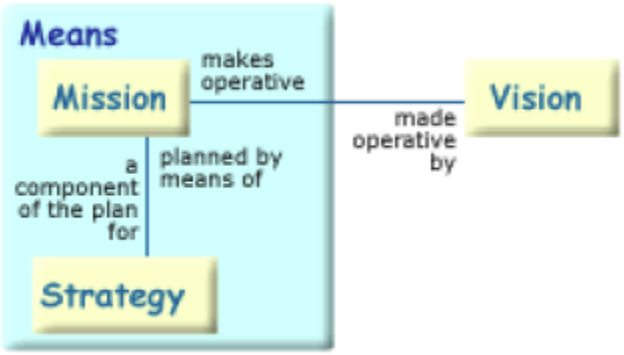
A Goal ...
- amplifies at most one Vision.
- is quantified by Objectives.

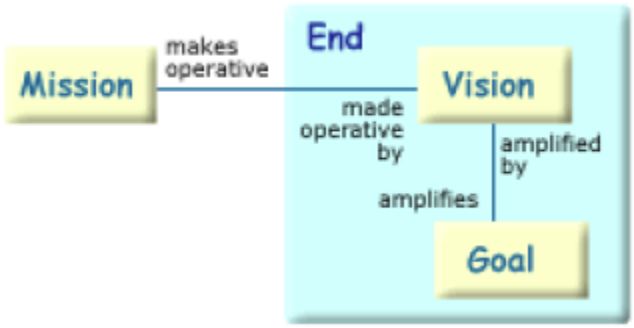
A Tactic ...
- implements Strategies.
- may effect enforcement level for Business Rules.

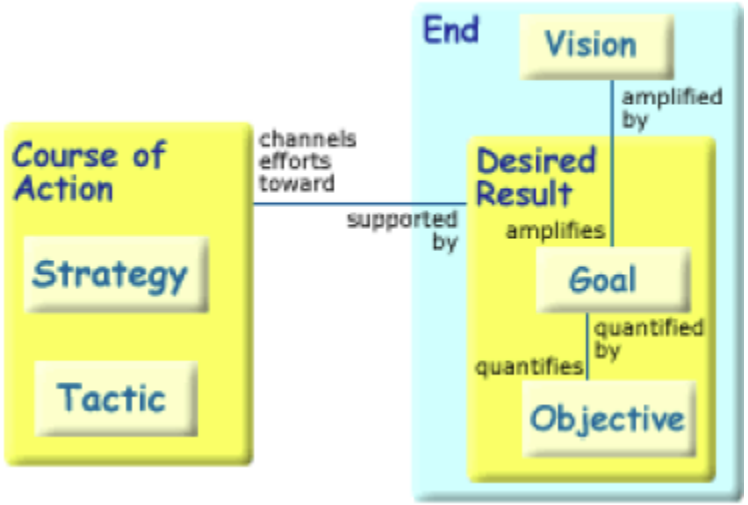
Compared to a Goal, an Objective is:
- short-term.
- not continuing beyond its timeframe (Of course such timeframes can be cyclical — i.e., monthly, quarterly, etc.).

An Objective ...
- quantifies a Goal. (It provides the basis for measures to determine that progress is being made towards the Goal.)

Means & Ends







A Business Rule ...

- is derived from Business Policy.
- guides Business Processes.
- has enforcement level effected by a Tactic.

A Business Policy ...

- is the basis for Business Rules.
- may govern Business Processes.
- may include other Business Policies.
- may be included in other Business Policies.

A Business Process ...

- is the responsibility of an Organization Unit.
- realizes Courses of Action.
- is guided by Business Rules.
- is governed by Business Policies.
- may deliver Offerings.
- may manage Assets.

A Course of Action ...

- is governed by Directives.
- may be formulated based on Directives.
- may enable other Courses of Action.
- may be enabled by other Courses of Action.
- may include other Courses of Action.
- may be included in other Courses of Action.
- channels efforts towards Desired Results.
- is realized by Business Processes.
- may define Offerings.
- may deploy Assets.
- may discharge Liabilities.

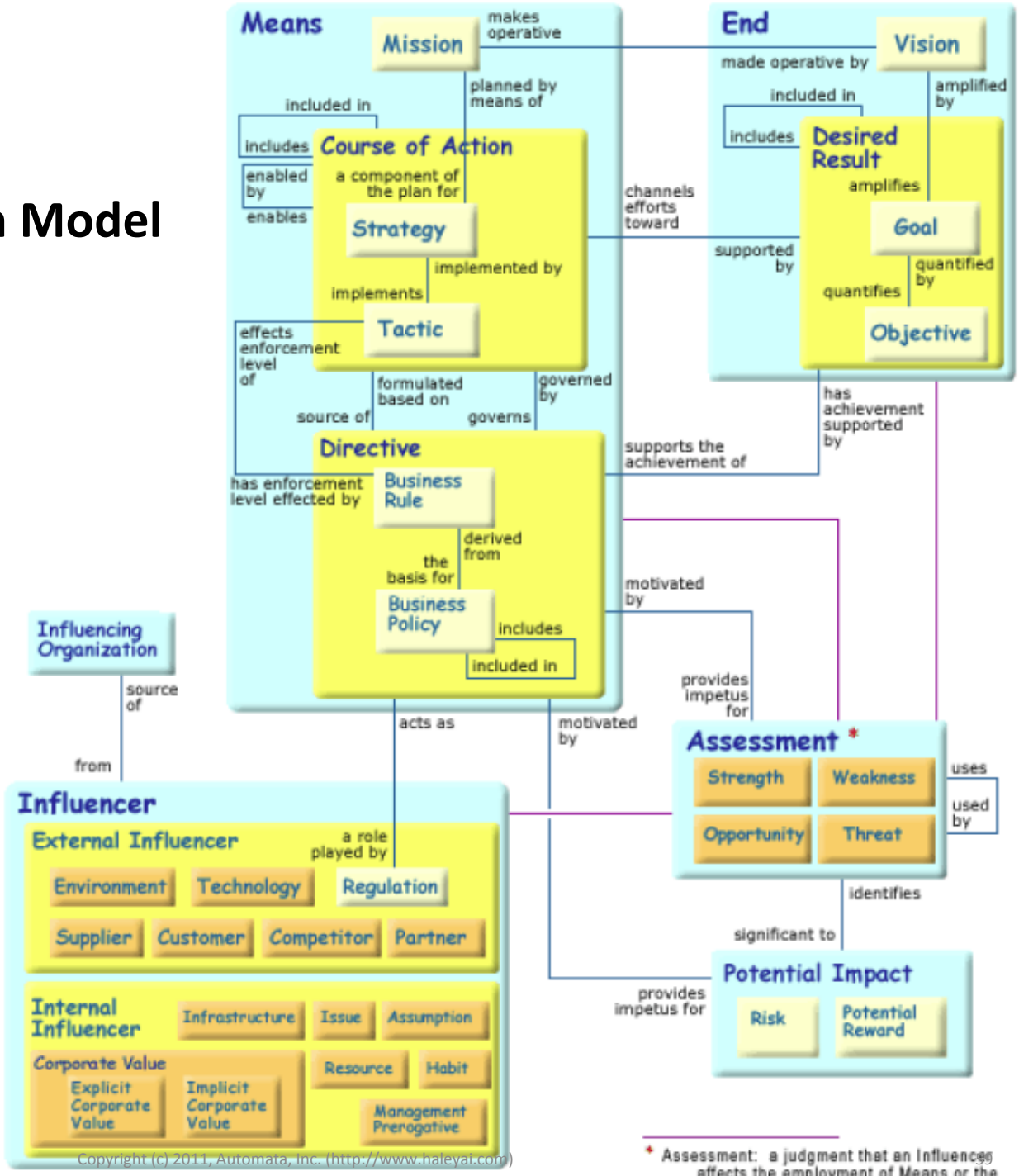
A Directive...

- governs Courses of Action.
- may be the source of Courses of Action.
- supports the achievement of Desired Results.
- may act as some other Organization Unit's Regulation.
- may be motivated by Assessments.
- may be motivated by Potential Impacts.
- may govern use of Assets.

A Desired Result ...

- may have its achievement supported by Directives.
- may include other Desired Results.
- may be included in other Desired Results.
- may be supported by Courses of Action.

OMG's "BMM"
Business Motivation Model



How could “we” matter much more?

- Produce decision and process management systems that assess their own performance and experiment within constraints to optimize their performance
  - a hot, albeit highly skilled, manual endeavor
- Assess the risks and ensure the proper governance and compliance of process and decision logic before deployment into operations
  - a hot research area
- Govern and orchestrate processes with flexibility, adaptability, and experimentation while remaining compliant and managing risk so as to optimize performance
  - the hottest areas in IT spending and CFO interest

Knowledge Engineering

- Acquiring – largely an interpersonal art
  - increase the emphasis on “why”
    - but not just about decisions!
    - too little concern for enterprise goals
  - understanding objectives is critical
    - how can that understanding be used at runtime?
  - business plans beat requirements
- Capturing
- Formalizing
- Encoding


FINAL
C