The Open RuleML Standard for Semantic Web Rule Interchange

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Introduction

- Rules are part of the Semantic Web
- Rule interchange in an open format is important for e-Business
- RuleML is the de facto open language standard for rule interchange/markup
- Collaborating with W3C, OMG, OASIS, and other standards/gov'nt bodies [1]

RuleML Enables ...

$$\text{Rule} \begin{Bmatrix} \text{modelling} \\ \text{markup} \\ \text{translation} \\ \text{interchange} \\ \text{execution} \\ \text{publication} \\ \text{archiving} \end{Bmatrix} \text{in} \begin{Bmatrix} \text{UML} \\ \text{RDF} \\ \text{XML} \\ \text{ASCII} \end{Bmatrix}$$

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RuleML Identifies ...

- Expressive sublanguages
  - for Web rules
  - started with
    - *Derivation* rules: extend SQL views
    - *Reaction* rules: extend SQL triggers
  - to empower their subcommunities

RuleML Specifies ...

- Derivation rules via XML Schema:
  - All sublanguages: (OO) RuleML 0.89
  - First Order Logic: FOL RuleML 0.9
  - With Ontology language: SWRL 0.7
    - A Semantic Web Rule Language Combining OWL (W3C) and RuleML
  - With Web Services language: SWSL 0.9

- Translators in & out (e.g. Jess) via XSLT

Business Rule: Positional

"The **discount** for a *customer* buying a *product* is 5 percent if the *customer* is **premium** and the *product* is **regular**."
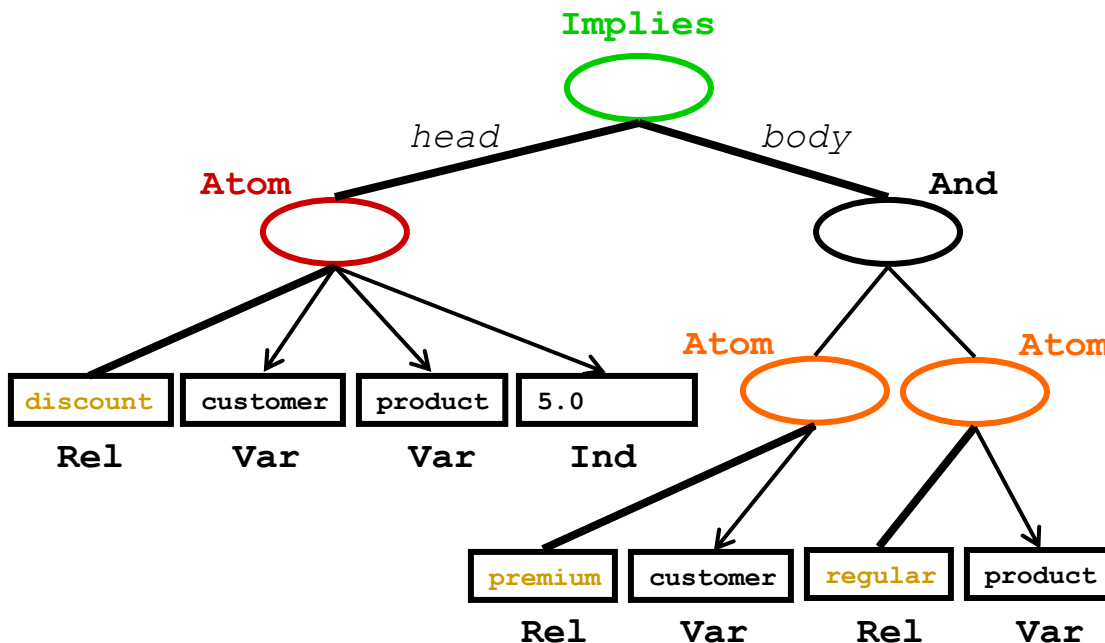

```xml
<Implies>
  <head>
    <Atom>
      <Rel>discount</Rel>
      <Var>customer</Var>
      <Var>product</Var>
      <Ind>5.0</Ind>
    </Atom>
  </head>
  <body>
    <And>
      <Atom>
        <Rel>premium</Rel>
        <Var>customer</Var>
      </Atom>
      <Atom>
        <Rel>regular</Rel>
        <Var>product</Var>
      </Atom>
    </And>
  </body>
</Implies>
```
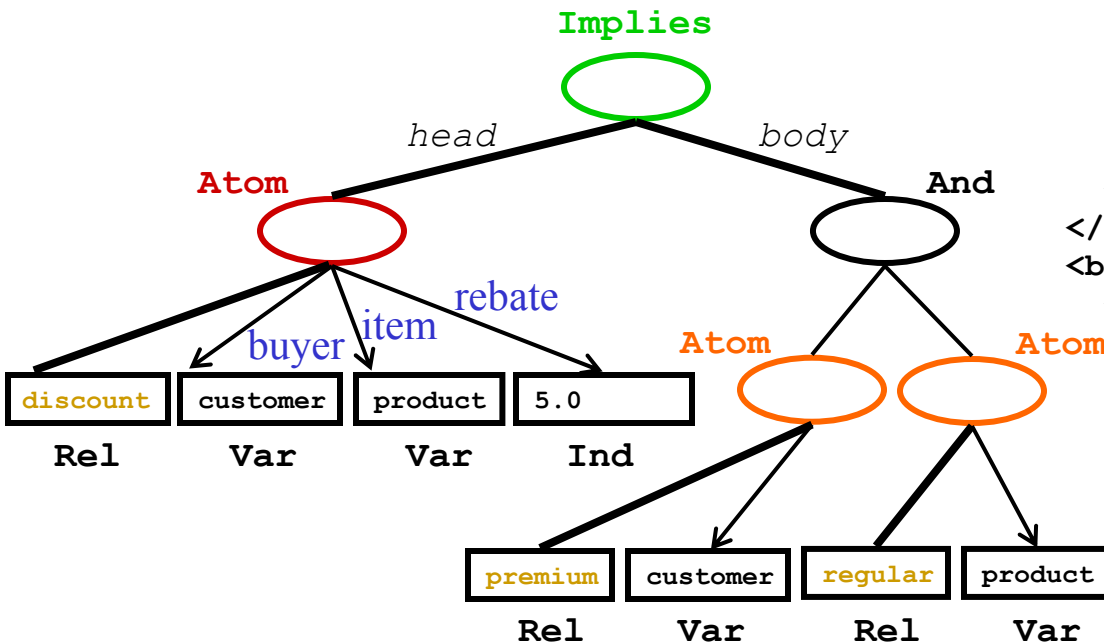
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Business Rule: Slotted (for OO)

"The **discount** for a *customer* buying a *product* is 5 percent if the *customer* is **premium** and the *product* is **regular**."


```
<Implies>
  <head>
    <Atom>
      <Rel>discount</Rel>
      <Slot><Ind>buyer</Ind><Var>customer</Var></Slot>
      <Slot><Ind>item</Ind><Var>product</Var></Slot>
      <Slot><Ind>rebate</Ind><Ind>5.0</Ind></Slot>
    </Atom>
  </head>
  <body>
    <And>
      <Atom>
        <Rel>premium</Rel>
        <Var>customer</Var>
      </Atom>
      <Atom>
        <Rel>regular</Rel>
        <Var>product</Var>
      </Atom>
    </And>
  </body>
</Implies>
```

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RuleML Initiative Structure

- Steering Committee:
  - Asaf Adi (IL)
  - Harold Boley, Co-Chair (CA)
  - Mike Dean (USA)
  - Andreas Eberhart (DE)
  - Benjamin Grosof (USA)
  - Michael Kifer (USA)
  - Steve Ross-Talbot (UK)
  - Bruce Spencer (CA)
  - Said Tabet, Co-Chair (USA)
  - Gerd Wagner (DE)
- Technical Groups:
  - **Reaction Rules** Technical Group, Co-Chairs: A. Adi & G. Wagner
  - **Ontology Combination**, Co-Chairs: B. Grosof & A. Eberhart
  - **Defeasible Rules**, Co-Chairs: G. Antoniou & M. Schroeder
  - **F**rames, **O**bjects, and **RU**le **M**arkup, Co-Chairs: M. Kifer & S. Decker
- Participants:
  - >40, including companies such as IBM, Sun, Oracle, and Sybase

Standards Bodies and RuleML

- W3C: Ongoing technical collaboration
  - Member Submission of SWRL and
    of SWRL FOL (including FOL RuleML)
  - Led to Workshop on Rule Languages for Interoperability
    with papers from (#9 #29 #57, #67) & about (#23, #59) RuleML

- OMG: Responses to Requests For Proposal (RFPs)
  on Business and on Production Rules

- OASIS: Technical Commitee plan for
  Policy RuleML

Government Efforts and RuleML

- DARPA: Joint (Agent Markup Language) Commitee archived discussion list

- NRC:
  - IIT: Hosts portals ruleml.org, jdrew.org, mailing lists (e.g. ruleml-all), and more
  - CISTI: Leads team (with Network Inference and Stanford University) for SWRL submissions to W3C
  - IRAP: Evaluates real-world use scenarios

- DFKI: Hosted startup

RuleML 0.87 (Now: 0.88, Soon: 0.89)

- Complete release announced: 2004-08-12
- Full specification: www.ruleml.org/0.87
  - XML Schemas: www.ruleml.org/0.87/xsd
  - Examples: www.ruleml.org/0.87/exa
  - Auto-Upgrade: www.ruleml.org/0.87/xslt
- Highlights
  - UML model for system of sublanguages
  - Type/role "stripe-skipping" syntax, also for OO RuleML
  - Slot changes for improved F-logic compatibility
  - Validation stability

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FOL RuleML 0.9

- Packaged in SWRL FOL release: 2004-11-04
- First specification: www.ruleml.org/fol
  - Monolithic DTD: www.ruleml.org/fol/#SynSem
  - Examples: www.ruleml.org/fol
  - Auto-Upgrade: forthcoming
- Highlights
  - Modular combination of
    - Quantifier RuleML: explicit 'Forall' and 'Exists'
    - Disjunctive RuleML: 'Or' in the head
  - Connectives for equivalence and negation added
  - Will benefit all other sublanguages of RuleML 0.9 [11]

jDREW

- Java Deductive Reasoning Engine for the Web by Bruce Spencer: www.jdrew.org
- Open Source on SourceForge
- Top-down and bottom-up execution
- RuleML input for rule bases

OO jDREW

- Object-Oriented engine by Marcel Ball: www.jdrew.org/oojdrew
- Top-Down and Bottom-Up Web-Start Applications plus JAR file download
- OO RuleML input for rule bases
- Used for most new applications

Applications

- RACSA, RALOCA, RACOFI: Rule Applying Agents for Comparison Shopping, Learning Object Comparison, and COllaborative FIltering (led to inDiscover.net)
- NBBizKB: New Brunswick Business Knowledge Base uses OO RuleML for data validation and integration
- AgentMatcher: e-Learning metadata interchanged in Weighted OO RuleML
- Teclantic: Startup project descriptions for Atlantic technology transfer in Weighted OO RuleML
- Regulatory guidelines for financial services in the US, Can, and UK by Said Tabet, Inference Web Inc.

Conclusions

- The [POsitional-SLotted](#) **presentation syntax** for OO RuleML will help people; tutorial: http://www.ruleml.org/posl/poslintweb-talk.pdf

- The **Web Rules** and **Open Source** communities should **learn more from each other**, as already prepared by Kendall Clark's [A Web of Rules](#)

- Give **your input for** work towards the release of **RuleML 1.0** by late 2005