RuleML Overview and Position Statement

The RuleML Initiative

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http://www.ruleml.org
The Web Rule Language in its Context
RuleML, WSML, SWSL View

- FOL++
- Rules
- OWL
- RDF(S)
- XML
- Unicode
- URI
Introduction

• The RuleML Initiative was formed in 2000 to provide a neutral platform for semantic **interoperation** of rules, across the Web, between commercially important rule systems:
  – Production rules
  – Relational databases
  – Prolog
  – Event-Condition-Action rules

• … → Enable rule-based Semantic Web Services

• Pioneered webized representation of a modular family of rule sublanguages, catering to a variety of needs on the Web
RuleML is …

An open *semantic* standard for

- *Semantics* founded on logical knowledge representation

1. Rule Modeling:
   - Data model integrates
     - Ordered XML trees
     - Labeled RDF graphs
   - Abstract syntax uses MOF
     - Mappings for OMG PRR [53] and SBVR [85]

2. Rule Classification: Modular Family of
   - XML Schemas and associated
   - (Model-Theoretic, Well-Founded) Semantics
RuleML is ...

An open semantic standard for Rule

3. **Serialization**: XML, RDF, Presentation

4. **Distributedness**: Fully webized, cf. N3 [94]

5. **Interoperation**:
   - Mature experience with RDF/RuleML [93] and OWL: SWRL [81]; also with F-logic: SWSL [124]
   - Adapt Sublanguages, write XSLT, ... Translators, or establish APIs such as JSR94 [107]

6. **Execution**: Mandarax, jDREW [49], Jess, XSB ...

7. **Tools**: SweetRules V2.1, IW Editor, ...
RuleML Identifies ...

- Expressive sublanguages
  - for Web rules
  - explored mostly with
    - *Derivation* rules: to derive beliefs
    - *Reaction* rules: to perform actions
  - empowering their subcommunities
SWRL FOL, SWSL-Rules in RuleML Family

RuleML

Derivation rules
- FOL RuleML
- SWSL-Rules
- Courteous LP
- Hornlog

Reaction rules
- SWRL FOL
- SCLP RuleML
- Situated LP
- Datalog

ECA

PR RuleML

Description LP

Unary/Binary Datalog

OWL-DL
RuleML Specification & Interoperation

- Rule Family specified via XML Schemas
  - All sublanguages, pre-release: RuleML 0.89
- First Order Logic, cf. SCL [103]: FOL RuleML 0.9
- With Ontology language, cf. [81]: SWRL 0.7
  - A Semantic Web Rule Language combining OWL and RuleML
- With Services language, cf. [124]: SWSL 0.91

- Rule Translators in & out (e.g. Jess, XSB)
  - Interoperation between many commercially important rule systems
FOL RuleML: Syntax and Semantics

• **Spec:** [http://www.w3.org/Submission/2005/SUBM-FOL-RuleML-20050411](http://www.w3.org/Submission/2005/SUBM-FOL-RuleML-20050411)

• **Modular** combination of syntactically characterized new sublanguages with:
  - Explicit quantifiers
  - Head disjunctions
  - Equivalence and Negation

• Semantics is FOL model theory

• (Pragmatics via performatives)
Slotted (FOL) RuleML Extension

• N-ary relations and constructors can contain set of slots (‘user-labeled arcs’) - Enables Object Oriented modeling:
  • rdf:Descriptions (rather than triples)
  • RDFS and OWL class descriptions
    - Positional logic ☠ Frame logic (F-logic)

• Serialization of SWSL-Rules
Some RuleML Use Cases

- RACSA, RALOCA, RACOFI: Rule Applying Agents for Comparison Shopping, Learning Object Comparison, and COllaborative FIItering (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 Inference Web Inc.
- MITRE Convoy Mission [28]
SweetRules & MIT RuleML Use Cases

• Contracts/negotiation, advertising/discovery
  – E-procurement, E-selling
  – Pricing, terms & conditions, supplier qualification, …

• Monitoring:
  – Exception handling, e.g., of contract violations
    • Late delivery, refunds, cancellation, notifications
  – Notifications, personal messaging, and other workflow

• Trust Policies: authorization, confidentiality & privacy, security, access control
  – E.g., financial services, health care
    • Extensive analysis of business case/value

• Semantic mediation: rule-based ontology translation, context-based information integration

• Object-oriented process ontologies: MIT Process Handbook
  – With default inheritance
Lessons from RuleML Experience

• Rule standardization process requires
  – Long-term vision
  – Engaging with all stakeholders
  – Full understanding of needs of various communities

• Each sublanguage also requires very strict and explicit scope to guarantee delivery of mature results in a phased fashion

• Focussing on certain sublanguages will be necessary for planned W3C Working Group
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Position Based on Experience

• Since 2000 the RuleML Initiative has engaged/collaborated with:
  – Large variety of use cases: finance, insurance, e-commerce, supply-chain, security & trust, biomed, ...
  – RDF, N3, TRIPLE
  – OWL, DL, Joint Committee
  – Semantic Web Services, SWSI, WSMO
  – Development of dozens of tools

• Pioneered webized representation of modular family of rule sublanguages, catering to a variety of needs on the Web
Position: Proposed Scope of WG (1)

First Phase (ca. 9 months):

• Start with LP expressiveness including Datalog Horn + NAF + logical functions

• Enable use of RDF and of OWL-DL [81]

• Draw especially on:
  – Use cases
  – RuleML, SWSL [124], WSML [44, 128], N3 [94], TRIPLE [98], SCL/KIF [103]
Position: Proposed Scope of WG (2)

First Phase (cont’d):

- Add some subset of following ten features:
  - Slotted/Frame syntax; webized OIDs/labels
  - Datatyping; lists
  - Signature declarations
  - Lloyd-Topor: syntactic sugar for enriched connectives
  - Integrity constraints, mutual exclusions, functional dependency
  - Prioritized conflict handling, cf. Courteous
  - Procedural attachments, cf. Situated:
    - built-ins/tests/sensors
    - actions/effectors
    - events/time
  - Hilog: syntactic sugar for restricted higher-order
  - User-defined head equality and functions
  - Reification
Position: Proposed Scope of WG (3)

**Second Phase** (additional ca. 6-9 months):

- Extend for more expressiveness as required by more use cases and doable in that period
  - Vote now for your top k out of 10 😊
Upcoming Events

• Workshop on Protégé with Rules
  • Will be held in conjunction with 8th Intl. Protégé Conference, on 8 July 2005
  • Deadline for paper or abstract submissions: 1 June 2005
  • http://www.med.univ-rennes1.fr/~cgolb/Protege2005/ProtegeWithRulesCFP.htm

• RuleML-2005: International Conference on Rules and Rule Markup Languages for the Semantic Web
  • Will be held in conjunction with ISWC-2005, on 10-11 November 2005
  • Deadline for paper submissions: 1 July 2005
  • http://2005.ruleml.org