Introducing RuleML: Organization, Language, and Technology

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The 7th International Web Rule Symposium:
Research Based and Industry Focused (RuleML 2013)

July 11-13, 2013, Seattle, USA

RuleML Organization

- Has an open **non-profit** structure

- Drives the specification of standard **semantic-technology & business rules**

- Coordinates rule research & development and holds international meetings

- Cf. http://wiki.ruleml.org/index.php/Organizational_Structure

RuleML Standards Effort

- Connects **Web rule** efforts across
  - Academia
  - Standards bodies
  - Industry
- Dovetails with **Web ontology** efforts, e.g. as part of the semantic-technology stack
- Provides a **de facto standard** for Web knowledge representation

RuleML Interoperation

XML-based interchange between (sublanguages of) RIF, CL, SBVR, PRR, N3, Prolog, as well as Rulelog etc.
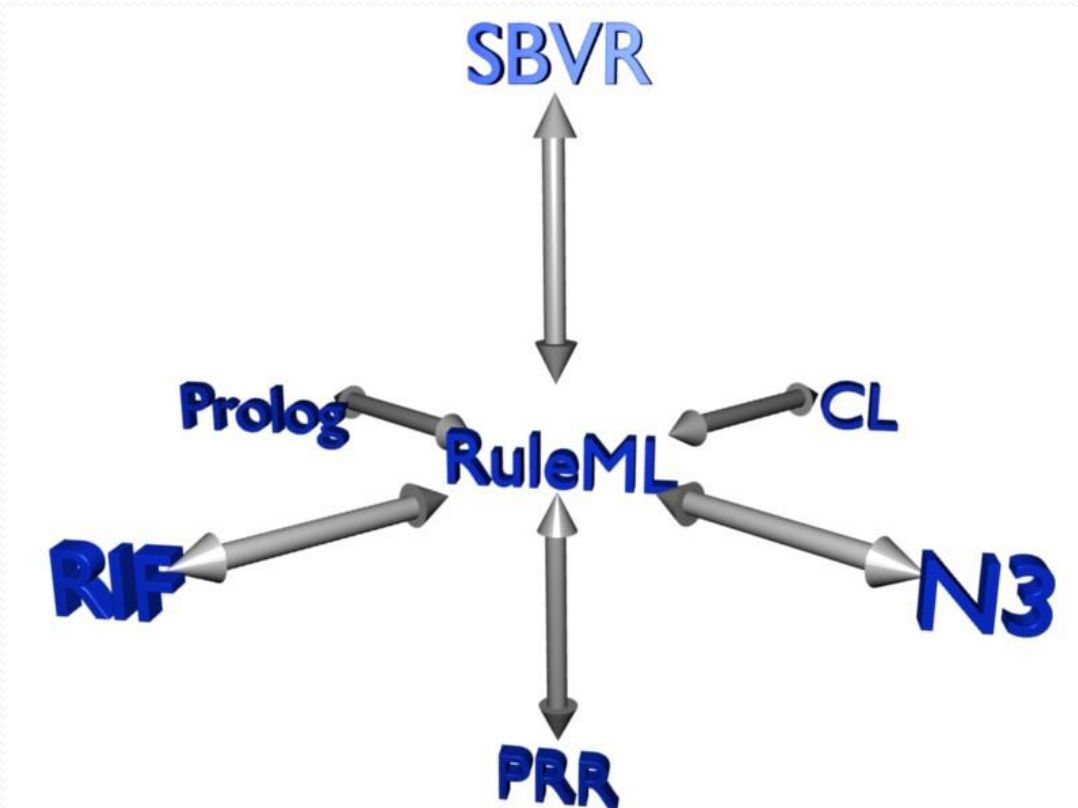
RuleML Family of Sublanguages (1)
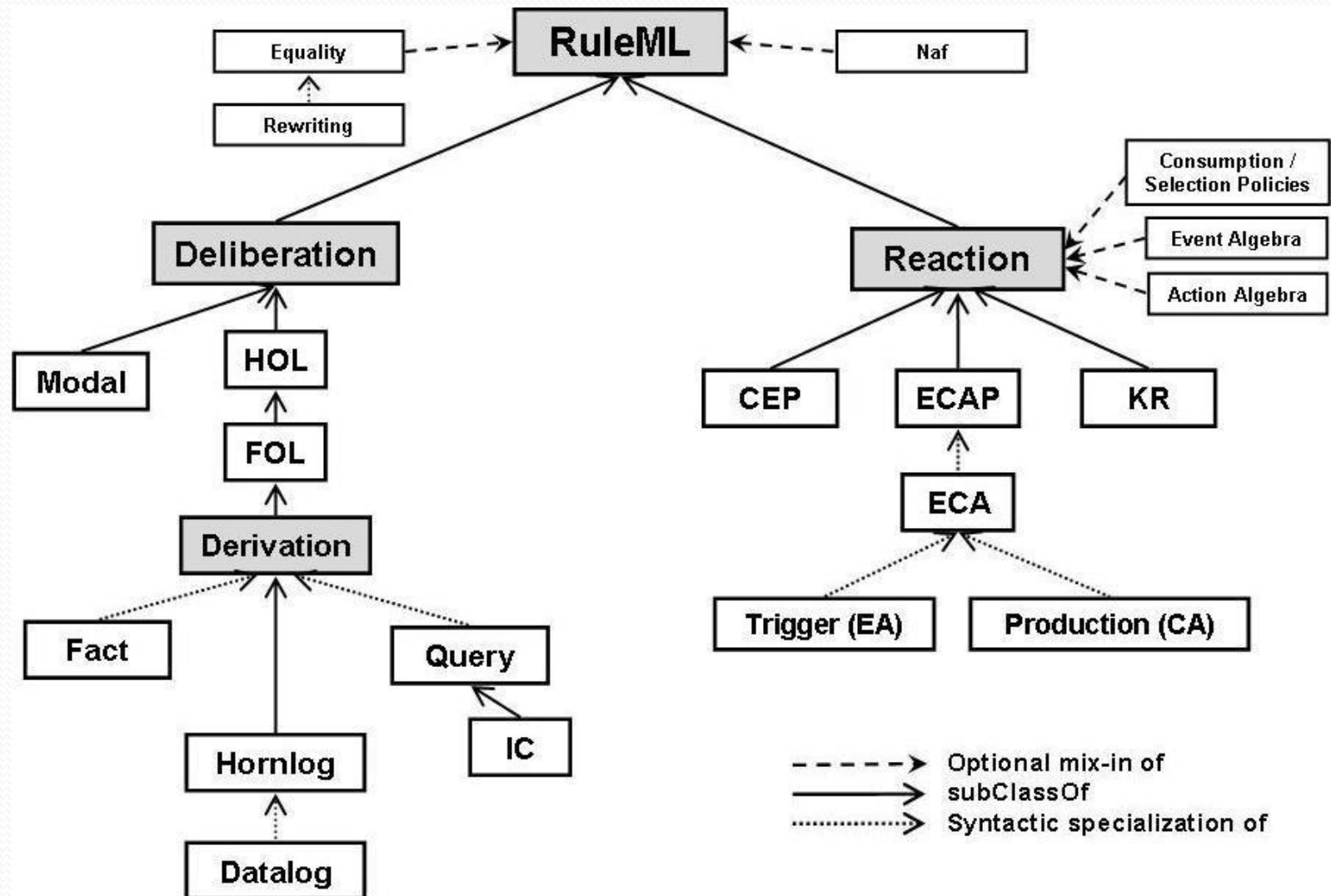
RuleML Family of Sublanguages (2)

- RuleML family covers a wide rule spectrum, from **Deliberation** rules to **Reaction** rules
  - Rule condition part reused across the spectrum
  - Syntactic uniformity enables further reuse
- Family constitutes a deep sublanguage lattice
  - Major sublanguage inclusion path:

    Deliberation $\supset$ HOL $\supset$ **FOL** $\supset$ Derivation $\supset$ **Hornlog** $\supset$ Datalog $\supset$ ...

- Naf mix-in customization of Hornlog RuleML (Naf Hornlog RuleML) leads to Logic Programs

Foundational RuleML Technology

- User syntaxes (for knowledge acquisition and querying)
  - Presentation (symbolic): Positional-Slotted Language (POSL), Prova, …
  - Visualization (graphical): Graph inscribed logic (Grailog), …
- Serialization syntax (for knowledge exchange): Valid w.r.t. XML schemas
  - In Relax NG (RNG)
    - MYNG Web GUI generates RNG for fine-grained schema customization
  - In XML Schema Definition Language (XSD)
  - *RuleML 1.0*: RNG and XSD separate. *Planned*: generate XSD from RNG
- Transformations
  - XSLT normalizers (to the most explicit or most concise RuleML/XML)
  - JAXB unmarshalling of RuleML/XML into Java objects
- Model-theoretic semantics
  - For (Naf-free, OID/slot-free) FOL, Hornlog, Datalog RuleML: Classical
  - For Positional-Slotted Object-Applicative (PSOA) RuleML: RIF-style
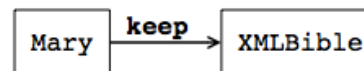- Engines (OO jDREW, Prova, DR-DEVICE, VampirePrime, …)

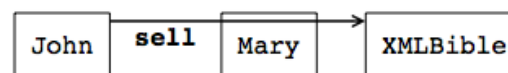# Sub…Sublanguage Datalog RuleML
from XML Serialization to Grailog Visualization

```
44 ▽ <Assert mapClosure="universal">
45
46 ▽ <Implies>
47       <!-- explicit 'And' -->
48 ▽      <And>
49 ▽        <Atom>
50            <Rel>buy</Rel>
51            <Var>person</Var>
52            <Var>merchant</Var>
53            <Var>object</Var>
54          </Atom>
55 ▽        <Atom>
56            <Rel>keep</Rel>
57            <Var>person</Var>
58            <Var>object</Var>
59          </Atom>
60        </And>
61 ▽      <Atom>
62          <Rel>own</Rel>
63          <Var>person</Var>
64          <Var>object</Var>
65        </Atom>
66
67 </Implies>
68
```
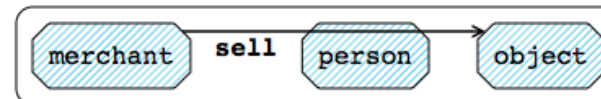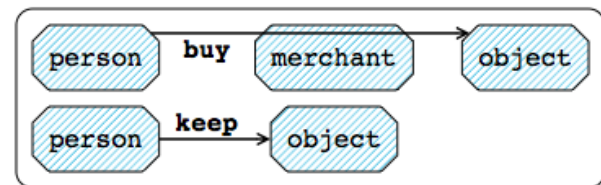
Grailog KS Viz

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RuleML Sublanguages Customized by MYNG as Relax NG Schemas (1)

`ruleml.org/1.0/myng/` Google

Selection Form

Instructions

Make a selection from the form below, then click "Refresh Schema" to update the Schema URL. The main module is also displayed below the form. To reset the form to the default (supremum) values, click "Reset Form".

[Reset Form] [Refresh Schema]

Schema URL = http://ruleml.org/1.0/relaxng/schema_rnc.php?backbone=x3f&default=x7&termseq=x7&lng=x1&propo=x3ff&implies=x7&terms=xf3f&quant=x7&expr=xf&serial=xf

Expressivity "Backbone" (Check One)
- ○ Atomic Formulas
- ○ Ground Fact
- ○ Ground Logic
- ○ Datalog
- ○ Horn Logic
- ○ Disjunctive Logic
- ⦿ Full First-Order Logic

Treatment of Attributes With Default Values (Check One)
- ○ Required to be Absent
- ○ Required to be Present
- ⦿ Optional

Term Sequences: Number of Terms (Check One)
- ○ None
- ○ Binary (Zero or Two)
- ⦿ Polyadic (Zero or More)

Language (Check One)
- ⦿ English Abbreviated Names
- ○ English Long Names
- ○ French Long Names

Serialization Options (Check Zero or More)
- ☑ Unordered Groups
- ☑ Stripe-Skipping
- ☑ Explicit Datatyping
- ☑ Schema Location Attribute

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RuleML Sublanguages Customized by MYNG as Relax NG Schemas (2)

Propositional Options
(Check Zero or More)
- ☑ IRIs
- ☑ Rulebases
  - ☑ Entailments
- ☑ Degree of Uncertainty
- ☑ Strong Negation
- ☑ Weak Negation (Negation as Failure)
- ☑ Node Identifiers
- ☑ In-Place Annotation
- ☑ XML base
- ☑ XML id

Implication Options
(Check Zero or More)
- ☑ Equivalences
- ☑ Inference Direction
- ☑ Non-Material

Term Options
(Check Zero or More)
- ☑ Object Identifiers
- ☑ Slots
  - ☑ Slot Cardinality
  - ☑ Slot Weight
- ☑ Equations
  - ☑ Oriented Equations
- ☑ Term Typing
- ☑ Data Terms
- ☑ Skolem Constants
- ☑ Reified Terms

Quantification Options
(Check Zero or More)
- ☑ Implicit Closure
- ☑ Slotted Rest Variables
- ☑ Positional Rest Variables

Expression Options
(Check Zero or More)
- ☑ Generalized Lists
- ☑ Set-valued Expressions
- ☑ Interpreted Expressions

Extended RuleML Technology

- Editors ([Mandarax](), [S2REd](), [Rawe]())
- Translators (interchange/interoperation tools)
  - RuleML $\leftrightarrow$ POSL
  - PSOA $\rightarrow$ TPTP
  - Attempto Controlled English (ACE) $\rightarrow$ RuleML
  - Translators between RuleML and Prolog, Jess, N3, …
- APIs ([Rulestore API](), [API4KB]())
- Multi-agent frameworks ([Rule Responder](), [EMERALD]())
- More tools ([http://wiki.ruleml.org/index.php/RuleML_Implementations]())

RuleML as Basis for other Languages

- Semantic Web Rule Language ([SWRL](#))
  - Uses RuleML Version 0.89
- Semantic Web Services Language ([SWSL](#))
  - Uses RuleML Version 0.89
- [LegalRuleML](#)
  - Uses RuleML Version 1.0

RuleML Uses

- Specific use cases (http://ruleml.org/usecases)
  - ChemXelem (Chemical XML Elements)
  - WineOnto (Wine Ontology)
  - NBBizKB (New Brunswick Business Knowledge Base)
  - FindXpRT (Find an eXpert via Rules and Taxonomies)
  - eTourPlan (eTourism Route and Activity Planner)
  - …
- Rule Responder instantiations (http://responder.ruleml.org)
  - SymposiumPlanner (formalizing RuleML 20xy in RuleML)
  - WellnessRules, PatientSupporter
- Uses as basis for other languages (see above)

RuleML Version Roadmap

- **RuleML 1.0** is expanding by *sublanguage augmentation,* including for Modal RuleML 1.0 and Reaction RuleML 1.0

- **RuleML 1.05** is in preparation,
  with focus on *feature improvement*

- **RuleML 1.1** is being designed,
  with focus on *feature addition*

RuleML Meetings

- International Web Rule Symposium (starting in 2002 as a Workshop)
- Special Tracks
  - 2013: Human Language Technology
  - 2014 (planned):
    - Human Language Technology
    - Rules and Machine Learning
    - Building and Querying Large Knowledge Bases
- International Rule Challenge (since 2007)
- RuleML Doctoral Consortium (since 2011)
- Birds-of-a-Feather Sessions
  - Controlled Language
  - Reaction RuleML
  - Common Logic

RuleML Online Community

- RuleML MediaWiki (http://wiki.ruleml.org)

- Mailing lists (http://ruleml.org/mailman/listinfo)

- Technical Groups
  (http://wiki.ruleml.org/index.php/Organizational_Structure#Technical_Groups)

  - Uncertainty Reasoning

  - Defeasible Logic

  - Reaction Rules

  - Multi-Agent Systems

  - …

- RuleML sources are hosted on Github
  (https://github.com/RuleML)

RuleML and You: Getting Involved

- Participate in meetings
  - RuleML 2014 (http://2014.ruleml.org)
- Contribute online to the wiki and in mailing lists
- Give feedback on existing specifications
  - http://ruleml.org/1.0
- Give input on emerging specifications
  - http://wiki.ruleml.org/index.php/:Category:Issues

RuleML Partners

- The RuleML **symposium series** is grateful to its annual Sponsors and Partners

- The RuleML **non-profit organization** acknowledges its long-term Partners

- The RuleML Symposium and Organization Co-Chairs can be contacted about Sponsoring or Partnering

- Cf. http://ruleml.org

Further Reading

- RuleML wiki page corresponding to this talk (http://wiki.ruleml.org/index.php/Introducing_RuleML)
- RuleML 1.0: The Overarching Specification of Web Rules
  - Talk (http://cs.unb.ca/~boley/talks/RuleML-Overarching-Talk.pdf)
  - Paper (http://link.springer.com/chapter/10.1007%2F978-3-642-16289-3_15)
- Reaction RuleML 1.0: Standardized Semantic Reaction Rules
  - Talk (http://www.slideshare.net/swadpasc/reaction-ruleml-ruleml2012paschketutorial)
  - Paper (http://link.springer.com/chapter/10.1007%2F978-3-642-32689-9_9)
- Grailog 1.0: Graph-Logic Visualization of Ontologies and Rules
  - Talk (http://cs.unb.ca/~boley/talks/RuleMLGrailog.pdf)
  - Paper (http://link.springer.com/content/pdf/10.1007%2F978-3-642-39617-5_9)