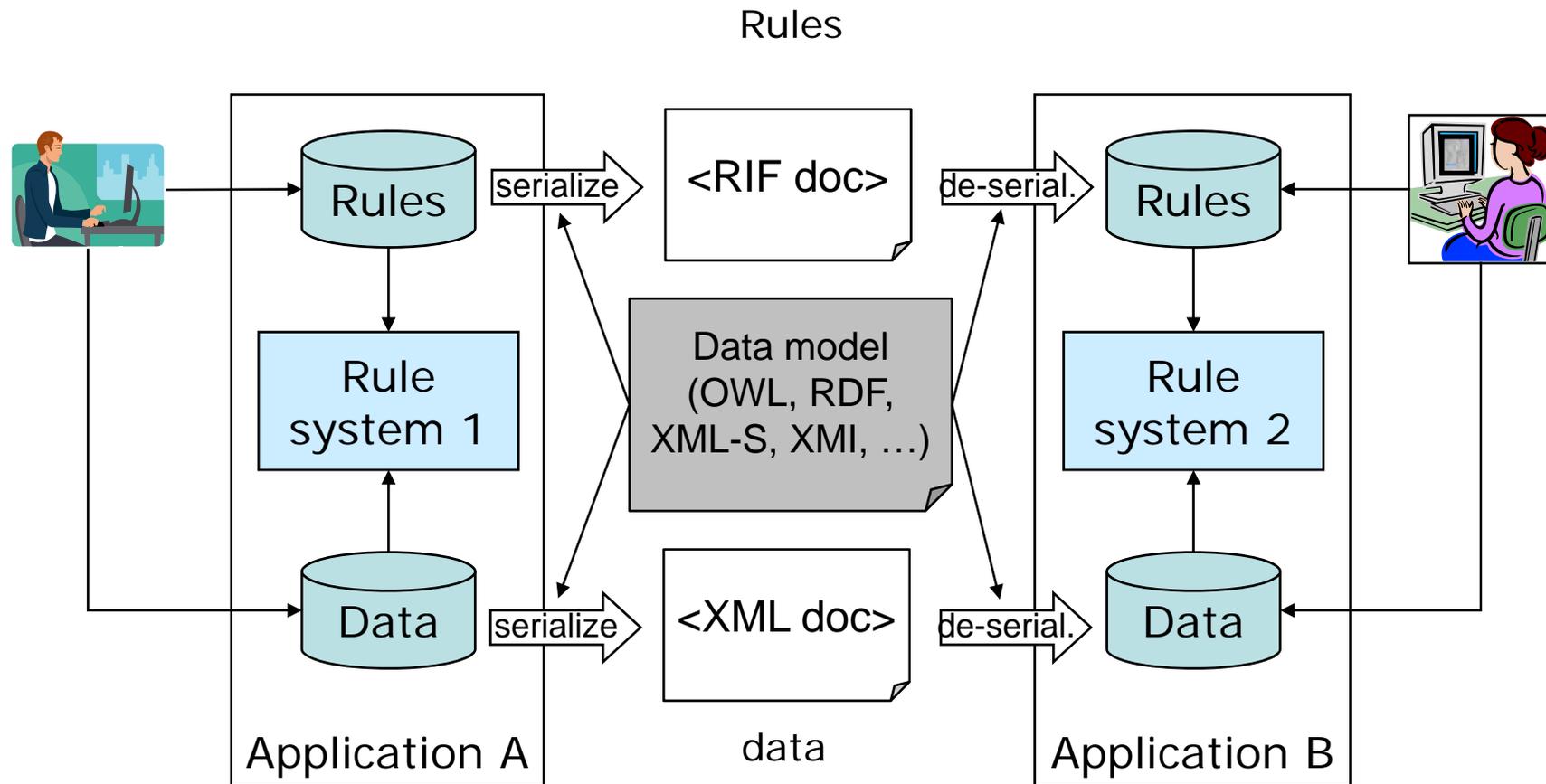


W3C Rule Interchange Format

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Rule interchange



What is the Rule Interchange Format?

- Format for interchanging rules, so they can be used across diverse systems
 - allowing rules written for one application to be published, shared, and re-used in other applications and other rule engines.
 - In a semantic preserving way (between languages with compatible semantics)
 - Encouraging interoperability
 - XML syntax
 - Compatible with relevant standards (PRR, RDF, OWL, ...)
- A rule is (just another) data item
 - RIF provides a standard means to feed rules into an application (at run time)
 - Semantics to prescribe (intended) application's behaviour

RIF Background: semantic Web

- Semantic web approach
 - interoperability requires a formal semantics
- The OWL WG approach
 - Start with something (DAML+OIL)
- Literally *hundreds* of rule system implementations
 - ISO-Prolog, CLIPS, OPS...
 - http://www.w3.org/2005/rules/wg/wiki/List_of_Rule_Systems
 - Already several “SW” rule languages
 - SWRL, RuleML, WRL, SWSL, KAON2, TRIPLE, JenaRules...
 - Everyone wants “their” system/technique/theory to be the SW rule standard

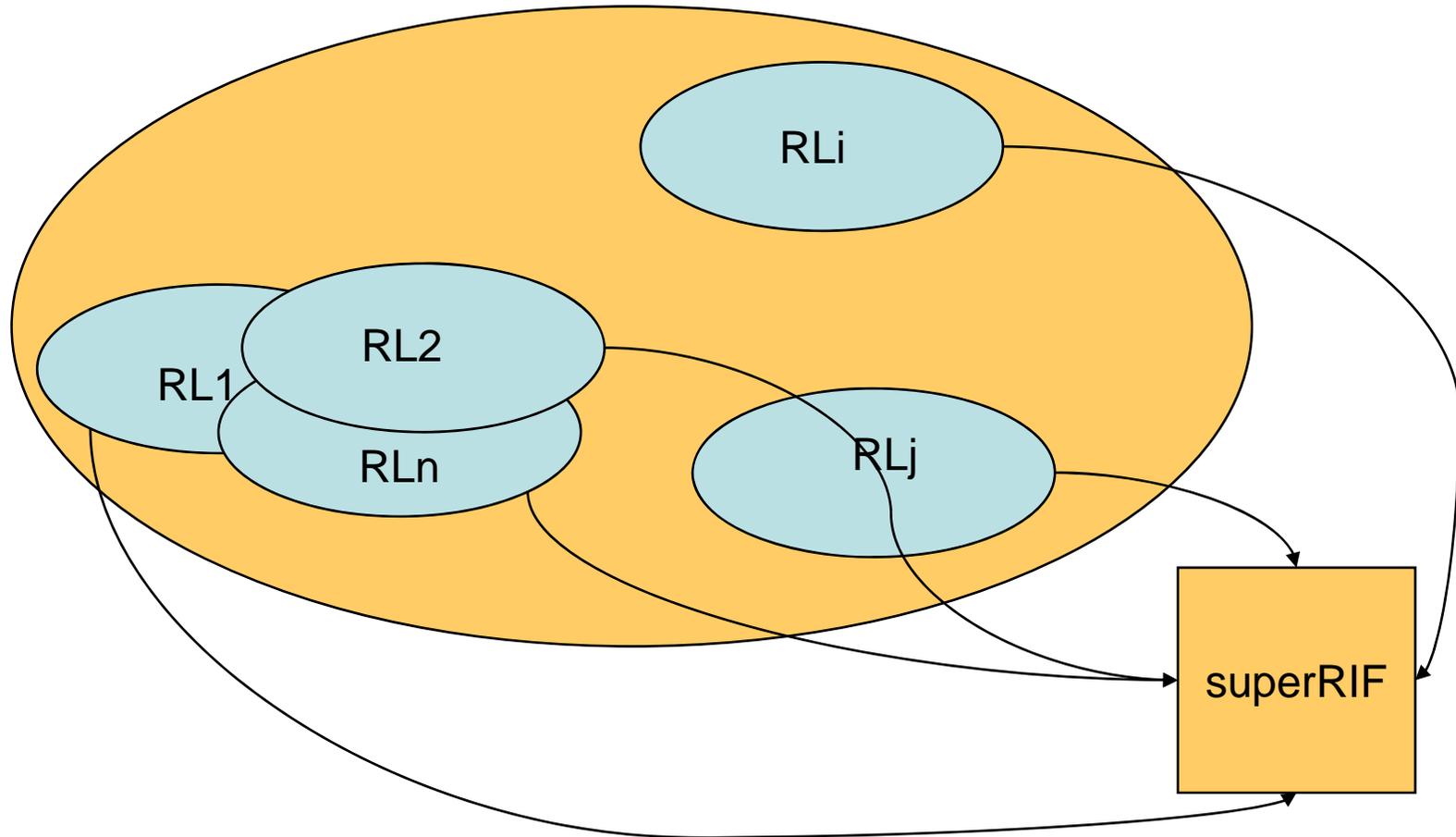
Wherefore the RIFt(s)?

- OWL DL < OWL < FOL
 - Original idea to add full first-order at the logic level
 - Semantic web *very* “open world”
- Most back-end DBs support closed queries
- Many rule systems have non-FO features
 - CWA/NAF
 - Procedural Attachment
 - Rule ordering
 - Non-monotonicity
 - ... can't be layered on OWL
- Not a strict SW layering already
 - OWL restricted dialects (DL) not layered on (all of) RDF/S semantics
 - RDF & RDFS not layered at all

Enter the Vendors

- “Business Rule systems” Vendors
 - \$1B/year existing market
 - 1,000’s end users
 - 1,000,000’s rules in use
 - ILOG, Fair Isaac, Haley, ...
- Database vendors
 - Oracle, IBM
- OMG PRR effort
 - Simple production rules
 - Event-condition-action
 - Vendors understand the value of standardization (see also JSR 94)
 - Interchange already a priority
 - ...a common *semantics*?
- Workshop April ‘05
 - <http://www.w3.org/2004/12/rules-ws/>
 - Outcome: **Nash Equilibrium...**
- RIF WG November ‘05

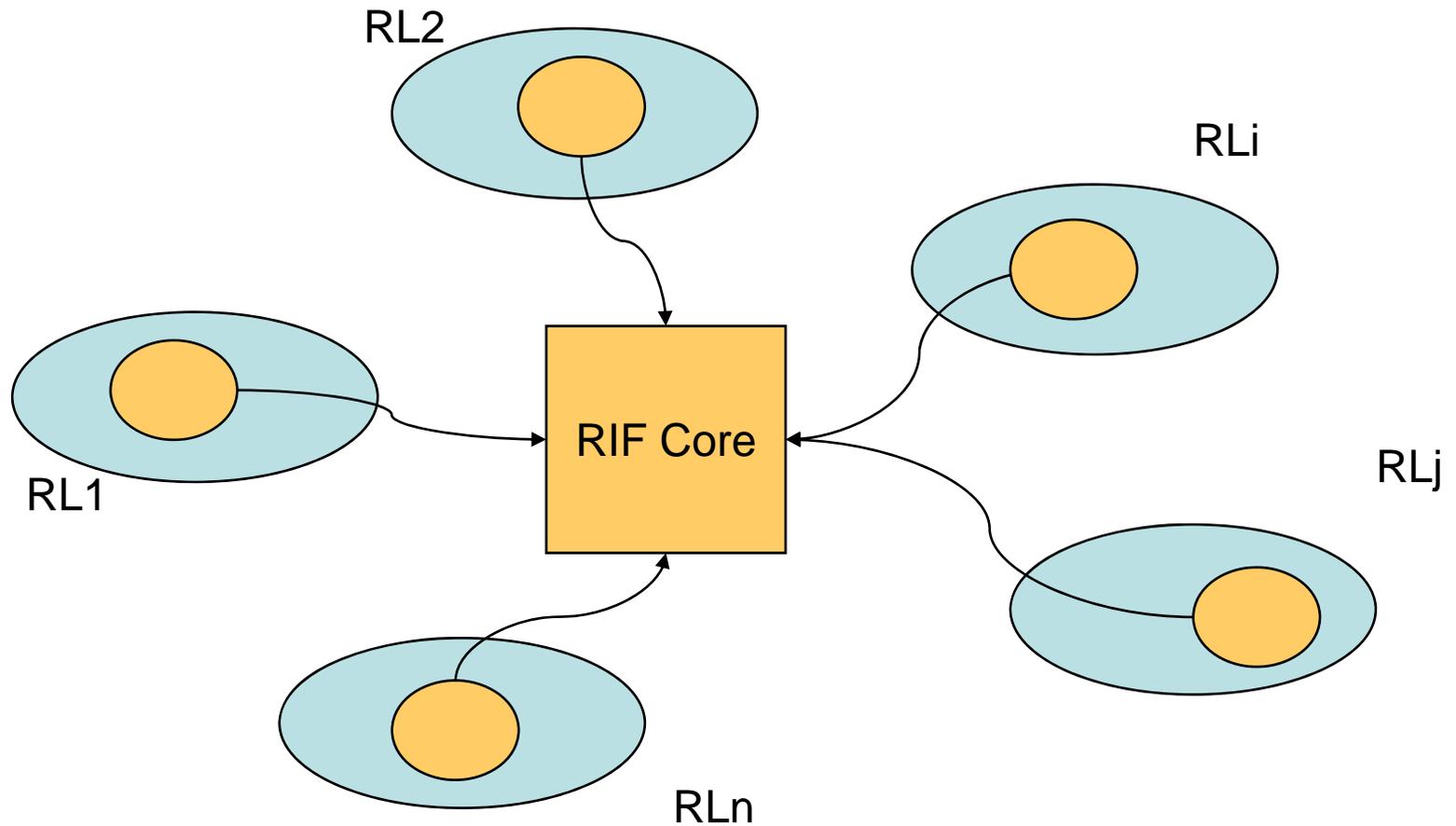
Superset approach



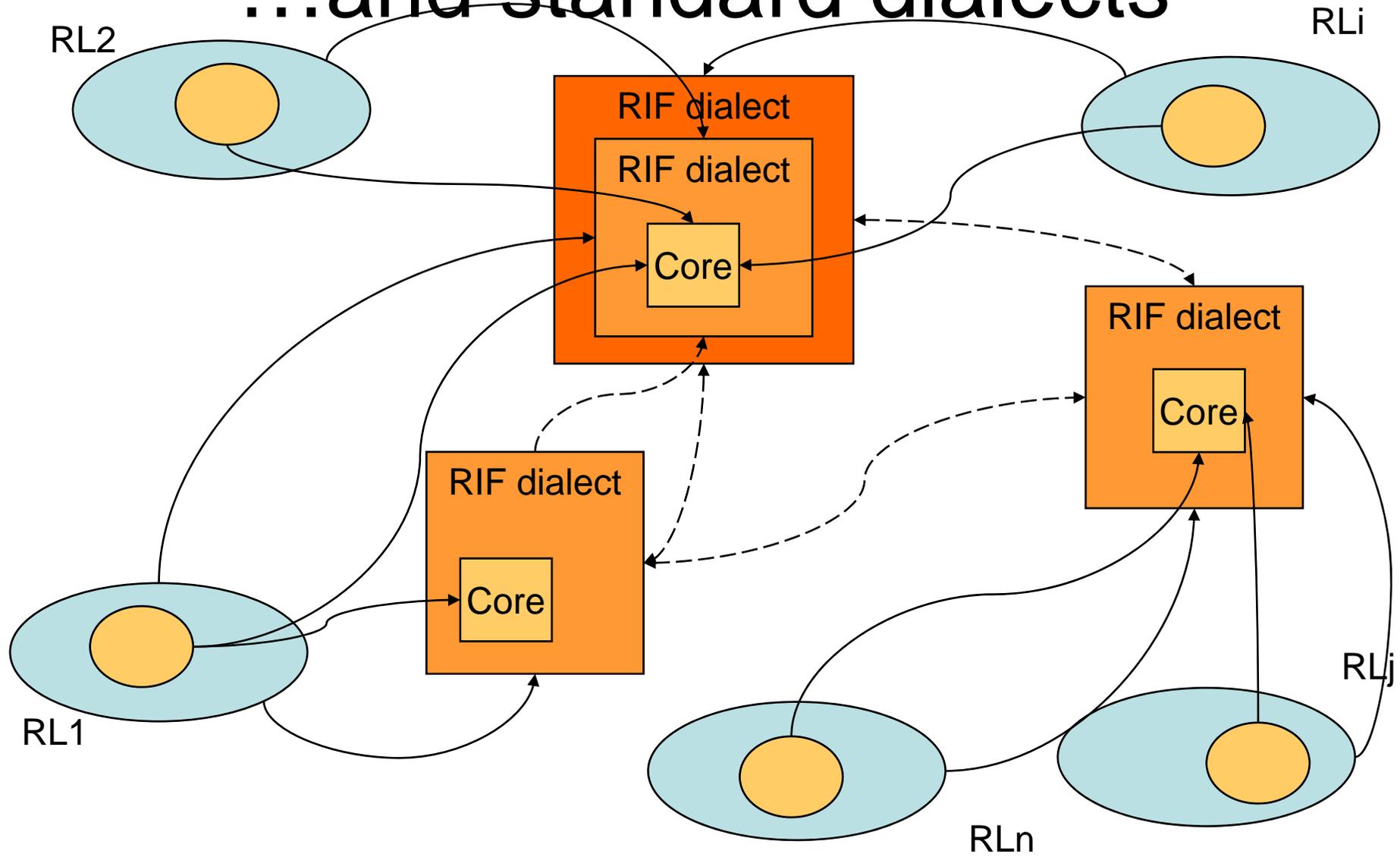
Super-set approach

- Define a super-language so expressive that any language can be translated to/from it
 - The CL and IKL approach
 - @deprecated: infeasible for this group, as major differences appeared irreconcilable (e.g. non-mon vs. mon)

A common core...



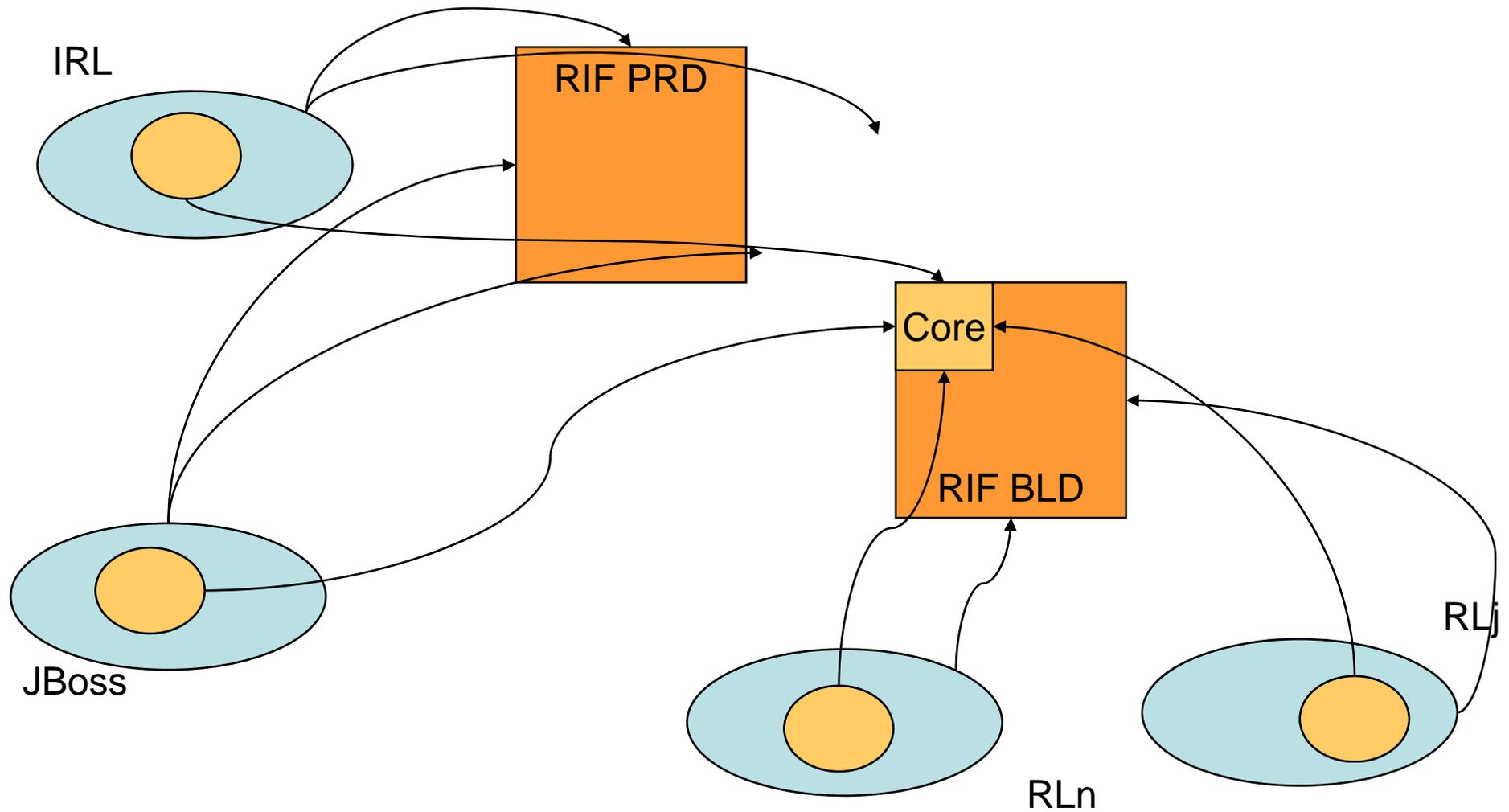
...and standard dialects



Core + standard dialects

- Define a *core* language that accounts for the intersection of all rule language capabilities
 - E.g. Horn, datalog, ...
 - @postponed: The production rule, logic programming, and FO core is not clear

Separate families + Core



Separate families + Core

- Define a logic-based core and a separate production-rule core
- If there is an intersection, define the common core (which may possibly be just a syntax)

@version 0.1: BLD LC (July 08)

@version 0.0.1: PRD FPWD (July 08)

Approach 3a

- Define a *framework* in the form of a menu of syntactic and semantic features that can be combined into dialects
 - @version 0.0.9: FLD

Design principles

- Translation paradigm
 - No intrusion in covered rule languages and rule sets
- Same semantics \Leftrightarrow same syntax
 - Share constructs accross dialects wherever they agree on the semantics
 - Different constructs where semantics do not agree
- Fully striped XML (type-tagged, object-oriented, ...)
 - alternating Class and role tags
 - Metadata can be attached to any class element
- Only XML schema is normative
 - Presentation syntax added for specification's readability (examples, semantics etc)
- Principles are there so you can rest on them...until they break

BLD Overview

- Definite Horn rules
 - Disjunction of atoms with exactly one positive literal
- Equality, functions, and a standard *first-order* semantics
- Syntactic features
 - objects and frames
 - internationalized resource identifiers (IRIs) as identifiers
 - XML Schema data types and builtins
- XML (1.0) syntax with normative XMLS definition
- Non-normative presentation syntax
- Metadata and (RDF+OWL) imports

Symbols

- Used to identify constants, variables, functions, predicates
- "*literal*"^{^^}<symospace-*identifier*>
 - Notable symbol spaces: xsd:string, rif:local, rif:iri
 - “Chris”^{^^}<xsd:string>
 - “<http://www.w3.org/1999/02/22-rdf-syntax-ns#type>”^{^^}<rif:iri>
 - “Person1”^{^^}rif:local

Rules

- IF <condition> THEN <conclusion>
 - <condition> aka rule body, antecedent
 - <conclusion> aka rule head, consequent
- BLD rule:
 - (**Forall** var* <conclusion> :- <condition>)
 - Conclusions may contain conjunction
 - Conditions may contain conjunction, disjunction, and existential
- Restrictions on conclusion
 - No existential, disjunction, external functions

Horn Extensions

- Functions and external calls (DTB)
- Equality (in conclusion and condition)
- Frames
 - Objects with slots and (multiple) values
 - Used to map to RDF and OWL (SWC)
 - Special syntactic treatment of class membership and subclass
- Named argument functions and predicates
 - However all arguments must be provided

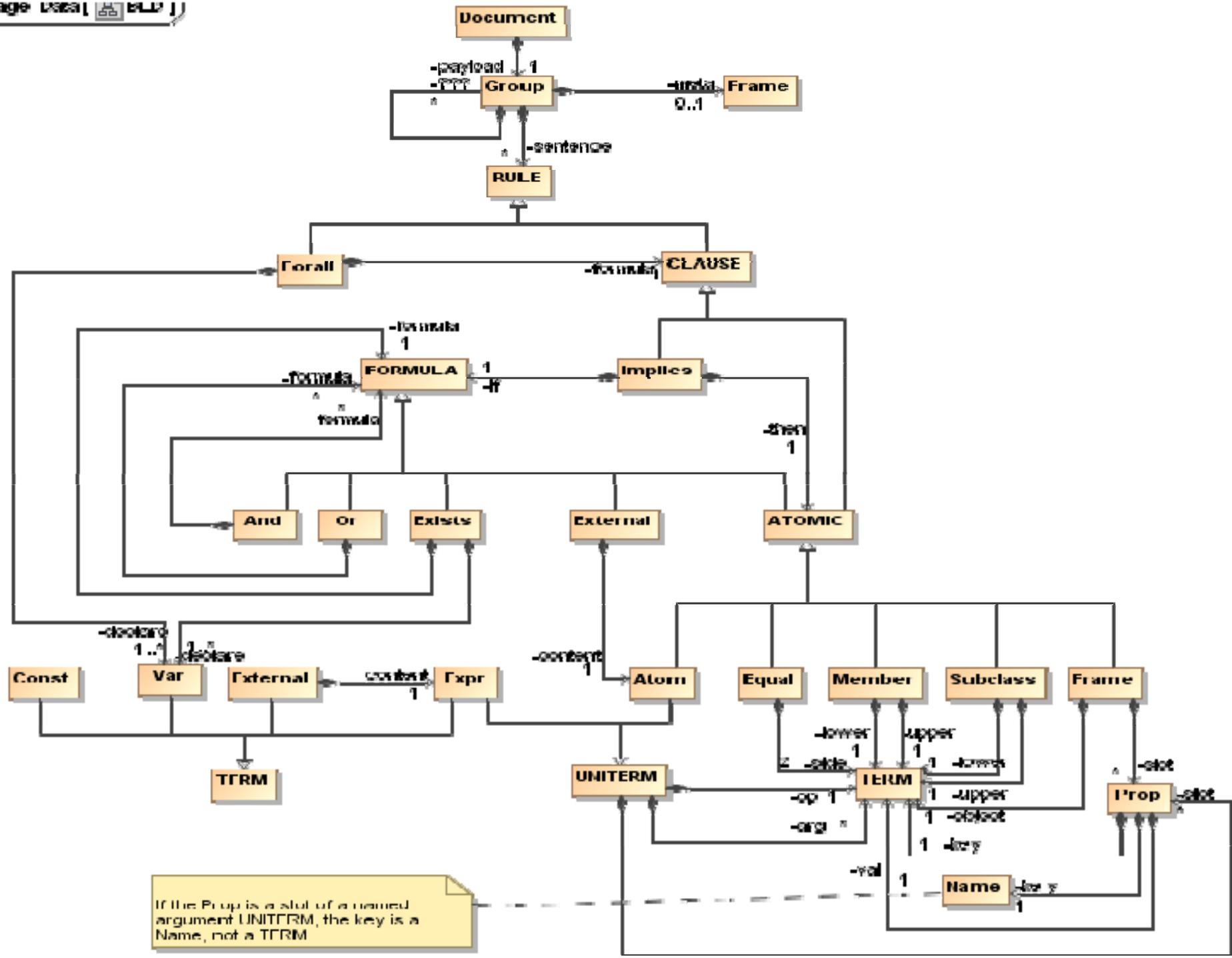
Structure

- Rules occur in Groups

```
Group( (forall ?x _Q(?x) :- _P(?x))  
      (forall ?x _Q(?x) :- _R(?x)) )
```

- Groups occur in Documents

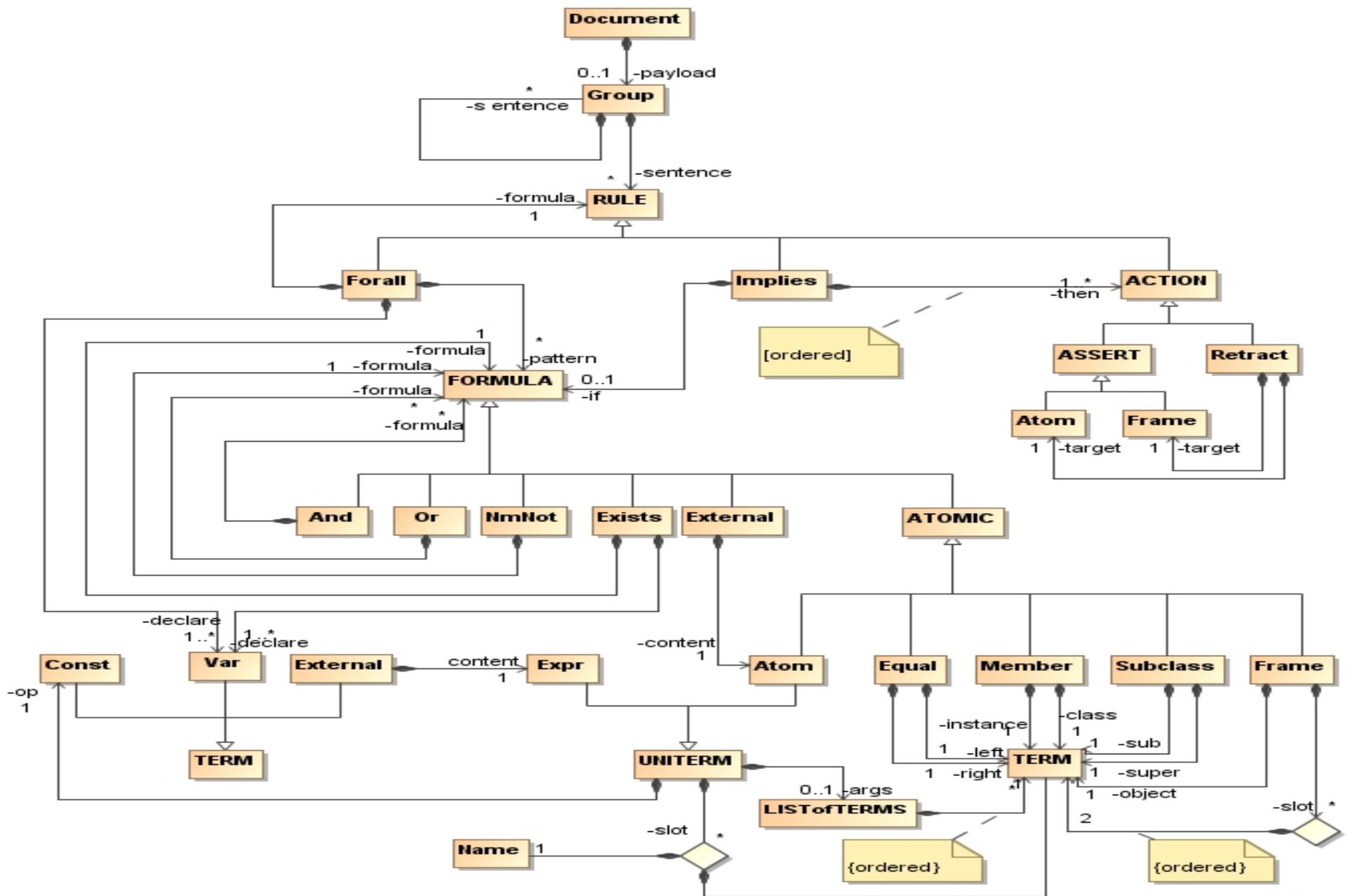
```
Document(  
  Group( (forall ?x _Q(?x) :- _P(?x))  
        (forall ?x _Q(?x) :- _R(?x)) ) )
```



If the I'rop is a slot of a named argument UNITERM, the key is a Name, not a TTRM

PRD Overview

- Production rules
 - FOR <variables> WITH <binding patterns>, IF <condition> THEN <actions>
 - FORALL Var* (IF patterns AND condition THEN action)
 - With an operational semantics as a labelled transition system
- Patterns and condition
 - BLD condition language minus logic functions plus negation
 - With a model-theoretic semantics (compatible with BLD)
- Assert, Retract, New
 - Assign, Remove, Execute
 - Defining a transition relation
- Syntactic features
 - **objects** and frames
 - internationalized resource identifiers (IRIs) as identifiers
 - XML Schema data types and builtins
- Metadata



RIF Documents

- BLD: RIF basic logic dialect
 - LC July 2008
 - REC by May 2009?
- FLD: RIF framework for logic dialects
 - 2nd public WD July 2008
 - LC November 2008?
- PRD: RIF production rule dialect
 - FPWD July 2008
 - LC May 2009?
- DTB: RIF data types and builtins
 - FPWD July 2008
 - LC November 2008?
- SWC: RIF RDF and OWL compatibility
 - LC July 2008
 - REC by May 2008?
- UCR: RIF use cases and requirements
 - 4th public WD July 2008
- Test Cases: FPWD November 2008

Web site: http://www.w3.org/2005/rules/wiki/RIF_Working_Group

Credits

- BLD and FLD Editors
 - Michael Kifer (U. Stonybrook), Harold Boley (NRCC)
- PRD Editors
 - Christian de Sainte Marie (ILOG), Adrian Paschke (U. Dresden), Gary Hallmark (ORACLE)
- SWC Editor
 - Jos de Bruijn (FUB)
- DTB Editors
 - Axel Polleres (DERI Galway)
- UCR Editors
- Test Cases Editors
- Active WG members
 - Adrian Paschke (REVERSE), Axel Polleres (DERI), Dave Reynolds (HP), Gary Hallmark (ORACLE), Hassan Ait-Kaci (ILOG), Igor Mozetic (JFI), John Hall (OMG), Jos de Bruijn (FUB), Leora Morgenstern (IBM), Mike Dean (SRI), Stella Mitchell (IBM), Changhai Ke (ILOG), Stuart Taylor (U Aberdeen)
- WG Team
 - Chris Welty (IBM), Christian de Sainte Marie (ILOG), and Sandro Hawke (W3C/MIT)

Thank you!

Questions?

- jim:owns(?c ?p)


```

      <Atom>
        <op>
          <Const type="rif:iri">http://rif.examples.com/2008/jim#owns</Const>
        </op>
        <args rif:ordered="yes">
          <Var> ?c </Var>
          <Var> ?p </Var>
        </args>
      </Atom>
      
```
- ?c.age = ?a


```

      <Frame>
        <object> <Var> ?c </Var> </object>
        <slot rif:ordered="yes">
          <Const type="rif:iri">
            http://rif.examples.com/2008/jim#Chicken/age
          </Const>
          <Var> ?a </Var>
        </slot>
      </Frame>
      
```

- Exists Chicken(age>8)

<Exists>

<declare> <Var> ?c </Var> </declare>

<declare> <Var> ?a </Var> </declare>

<formula>

<And>

<Member> ?c *jim:Chicken* </Member>

<Frame> ?c.age=?a </Frame>

<External>

<content>

<Atom>

<op>

<Const type="rif:iri"> pred:numeric-greater-than</Const>

</op>

<args rif:ordered="yes">

<Var> ?a </Var>

<Const type="xsd:decimal"> 8 </Const>

</args>

</Atom>

</content>

</External>

</And>

</formula>

</Exists>