

RIF RuleML FOAF:

# Web Rules for Social Networking

– *Short Version* –

Jie Li, Jing Mei, David Hirtle,  
Harold Boley, Virendrakumar C. Bhavsar

IIT - e-Business, NRC & Faculty of Computer Science, UNB

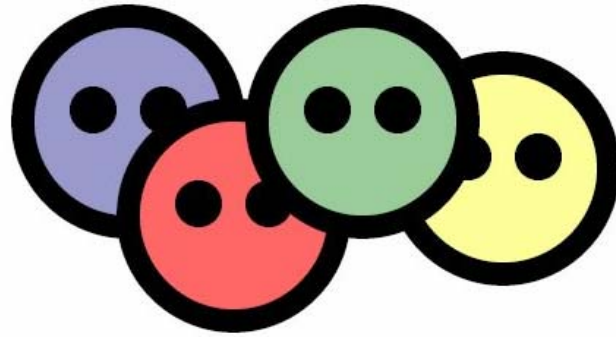
**Rule Interchange Format (RIF) Working Group**  
**Face-to-Face meeting F2F1, 8-9 December 2005**  
**Burlingame, California, USA**

# Contents

- Introduction
- Background
- Objectives
- Scenarios
- Proposed Work
- Open Issues
- Hybrid Rules
- RIF Requirements

# A Semantic Web Application

*FOAF*



- Web-based social networking
- Friend-Of-A-Friend
- Describes people and their relationships
- Provides structured links
- Realised in RDF/XML
- A Semantic Web vocabulary (ontology)
- Contains only facts

# Enhancing FOAF

- Absence of rule-based deduction
- Opportunity for applying RIF RuleML
  - Deriving new FOAF facts
  - Enables XML-based
    - Formalisation
    - Interchange
    - Execution

# Focussed Rule Languages & Engines

- RuleML (Rule Markup Language)
- RIF (Rule Interchange Format) RuleML
- POSL (Positional-Slotted Language)
- OO jDREW (Object Oriented Java Deductive Reasoning Engine for the Web)
- XSLT and XML Spy

# Rules Extending FOAF Profiles for Social Networking

- Make **implicit** properties and relationships **explicit**
- Constitute person-centric metadata properties **conditional** on other persons, the time, the location, ...

# Objectives

## *Develop FOAF Vocabulary*

➤ New elementary properties

➤ Rule-derivable properties

- Generated by ***taxonomic derivations***

(RDF's `subPropertyOf`)

`knows(?A, ?B) :- knowsWell(?A, ?B).`

- Generated by ***general derivations***

`knowsWell(?A, ?B) :- collaborate(?A, ?B, ?Topic),  
like(?A, ?Hobby),  
like(?B, ?Hobby).`

# Objectives

## *Enrich FOAF Facts by RIF RuleML Rules*

### ➤ Two categories of rules

- **Local:** single person argument:

`atWork(Peter, ?Time) :- inInterval(?Time, 9, 17).`

- **Global:** two or more person arguments:

`knowsWell(?A, ?B) :- collaborate(?A, ?B, ?Topic),  
like(?A, ?Hobby),  
like(?B, ?Hobby).`



# Objectives

## *Vocabulary & Normal Forms*

- Develop general RIF RuleML FOAF **vocabulary** for rules
- Implement fact-oriented and rule-oriented **normal forms**

# Proposed Work

## *Foundations*

- FOAF vocabularies in RIF RuleML (via POSL)
- XSLT translation of RIF RuleML facts to RDF
- Design FOAF vocabulary for local and global rules
- Compute derived FOAF properties in social networks
  - Merging rules of different persons (eliminating possible duplicates)
  - Running OO jDREW on (merged) rulebases

# Proposed Work

## *Two Normal Forms*

- **Rule-oriented Normal Form (RNF):**
  - The RNF includes rules as well as the (elementary) facts that are needed by the premises of the rules, omitting derivable facts
  - **Advantage:** the RNF is more compact
- **Fact-oriented Normal Form (FNF):**
  - The FNF includes elementary facts and derived facts, but omits the rules
  - **Advantage:** the FNF (XSLT-)corresponds to RDF FOAF facts

# Proposed Work

## *Local-Rule Example (Original Rulebase)*

- (rule-1)

fanOf(?Person, ?Band) :-

hasCD(?Person, ?Band, ?amount),  
greaterThan(?amount, 3:Integer),  
watchTVLive(?Person, ?Band).

- (rule-2)

fanOf(?Person, ?Band) :-

go2Concert(?Person, ?Band, ?frequency),  
greaterThan(?frequency, 2:Integer),  
Naf(talkIn(?OtherPerson, ?Person, ?Band)).

- (fact-0)

fanOf(Bill, U2).

- (fact-1)

fanOf(Peter, U2).

- (fact-2)

hasCD(Peter, U2, 4:Integer).

- (fact-3)

watchTVLive(Peter, U2).

- (fact-4)

go2Concert(Peter, U2, 3:Integer).

- (fact-5)

go2Concert(Lucy, U2, 5:Integer).

# Proposed Work

## *Local-Rule Example (RNF)*

- (rule-1)

fanOf(?Person, ?Band) :-

hasCD(?Person, ?Band, ?amount),  
greaterThan(?amount, 3:Integer),  
watchTVLive(?Person, ?Band).

- (rule-2)

fanOf(?Person, ?Band) :-

go2Concert(?Person, ?Band, ?frequency),  
greaterThan(?frequency, 2:Integer),  
Naf(talkIn(?OtherPerson, ?Person, ?Band)).

- (fact-0)

fanOf(Bill, U2).

- (fact-1)

-----

- (fact-2)

hasCD(Peter, U2, 4:Integer).

- (fact-3)

watchTVLive(Peter, U2).

- (fact-4)

go2Concert(Peter, U2, 3:Integer).

- (fact-5)

go2Concert(Lucy, U2, 5:Integer).

- (fact-6)

-----

# Proposed Work

## *Local-Rule Example (FNF)*

- (rule-1)

-----

- (rule-2)

-----

- (fact-0)

fanOf(Bill, U2).

- (fact-1)

fanOf(Peter, U2).

- (fact-2)

hasCD(Peter, U2, 4:Integer).

- (fact-3)

watchTVLive(Peter, U2).

- (fact-4)

go2Concert(Peter, U2, 3:Integer).

- (fact-5)

go2Concert(Lucy, U2, 5:Integer).

- (fact-6)

fanOf(Lucy, U2). **\*Newly derived\***

# Proposed Work

## *Use Cases, UI, Evaluation*

- Use Cases for RIF RuleML FOAF
  - Music: Amazon categorization
  - Computer Science: UNB research areas
  - Resumes: DERI vocabulary
- FOAF-a-matic-Extended UI [7]
- Evaluation of Results
  - Collaboration with DERI and DFKI

# Open Issues

- Which properties should be **computed** by rules rather than **stored** as facts?
- Which – RDF facts XSLT-generated from-derived facts should be **cached** (FNF) and which should be **re-computed** (RNF)?
- **Scalability** of (path-finding) global-rule computations
- Which information/knowledge using the vocabulary should be represented in a (shared) **ontology** rather than in **rules**?



# Hybrid Rules

## *Integrating Ontologies and Rules*

Query to possiblyKnows(Laura, Ben)

<i>SHIQ</i> DL	$\text{FOAFPerson} \sqsubseteq \exists \text{ knows.FOAFPerson}$ $\text{FOAFFan} = \text{FOAFPerson} \sqcap \forall \text{ knowsWell.FOAFPerson}$ $\text{FOAFStar} = \text{FOAFPerson} \sqcap \geq 2 \text{ isKnownBy.FOAFPerson}$ $\text{isKnownBy} = \text{knows}^{-}$ $\text{knowsWell} \sqsubseteq \text{knows}$ $\text{knowsWell}(\text{Jing}, \text{Jie}) \text{ isKnownBy}(\text{Jie}, \text{Laura})$ $\text{knowsWell}(\text{Jing}, \text{Ben}) \text{ knows}(\text{Jie}, \text{Ben}) \text{ FOAFFan}(\text{Jing})$
Datalog	$\text{close2FOAF}(\text{?X}) \text{ :- } \text{Q-knows}(\text{?X}, \text{?Y}), \text{Q-FOAFPerson}(\text{?Y})$ $\text{possiblyKnows}(\text{?X}, \text{?Y}) \text{ :- } \text{close2FOAF}(\text{?X}), \text{Q-FOAFStar}(\text{?Y})$

$\exists \text{ knows.FOAFPerson}(\text{Laura}) \sqcap \text{FOAFStar}(\text{Ben})$

# RIF Requirements

- Person-centric, local rules require a scoping construct also for positive queries
- Such scopes need to be merged, so require import of local rulebases into a new scope
- Since the current FOAF is based on RDF, it is required that
  - the FOAF subset of RDF also be expressible as facts of the rule language
  - the rules are able to deal with such facts
  - the rule-derived facts can be (XSLT-)translated back to RDF
- (Scoped) Negation as failure
- Integrating ontologies and rules via hybrid rules

# Conclusion

- General methodology for rule-augmented FOAF elaborated in RuleML FOAF [1]
- Extended factual FOAF vocabulary with selected properties defined via RuleML rules
- Rule engine OO jDREW [2] (integrated with RACER) employed to run (hybrid) FOAF rules
- With other RIF Use Cases & Requirements:  
Should lead to a community rule application

[1] <http://www.ruleml.org/usecases/foaf>

[2] <http://www.jdrew.org/ojdrew>

# References

- [1] Friendster. <http://www.friendster.com/>, Oct 20 2005.
- [2] Stumbleupon. <http://www.stumbleupon.com/>, Sep 30 2005.
- [3] Michelle Anderson, Marcel Ball, Harold Boley, Stephen Greene, Nancy Howse, Daniel Lemire, and Sean Mc-Grath. Racofi: A rule-applying collaborative filtering system. In *Proceedings of COLA'03*. IEEE/WIC, October 2003.
- [4] Marcel Ball. OO jdrew. <http://www.jdrew.org/oojdrew/>, Sep 27 2005. Version 0.88.
- [5] Harold Boley. Integrating positional and slotted knowledge on the semantic web. <http://www.ruleml.org/posl/poslintweb-talk.pdf>, March 15th 2005.
- [6] Harold Boley. Ruleml homepage. <http://www.ruleml.org/>, Oct 10 2005.
- [7] Dan Brickley. The friend of a friend (foaf) project. <http://www.foaf-project.org/>, Nov 20 2005.
- [8] Dan Brickley and Libby Miller. Foaf vocabulary specification. <http://xmlns.com/foaf/0.1/>, Oct 10 2005.
- [9] Elizabeth F. Churchill and Christine A. Halverson. *Social Networks and Social Networking*, volume 9, chapter IEEE Internet Computing, pages 14{19. IEEE Computer Society, 2005.
- [10] Edd Dumbill. Xml watch: Finding friends with xml and rdf. <http://www.128.ibm.com/developerworks/xml/library/x-foaf.html>, Jun 01 2002. Introductory.
- [11] Stefania Ghita, Wolfgang Nejdl, and Raluca Paiu. Semantically rich recommendations in social networks for sharing and exchanging semantic context. In *Proc.4th International Semantic Web Conference (ISWC2005)*, Galway,Ireland, November 6-10 2005.
- [12] Gunnar Aastrand Grimnes, Pete Edwards, and Alun Preece. Learning Meta-Descriptions of the FOAF Net-work, chapter *ISWC 2004*, LNCS 3298, page 152{165. Springer-Verlag Berlin Heidelberg 2004, 2004.
- [13] RSS-DEV Working Group. Rdf site summary (rss) 1.0. <http://web.resource.org/rss/1.0/spec>, Oct 27 2005.
- [14] Masahiro Hamasaki, Junichiro Mori, Hideaki Takeda, and Koiti Hasida. Ontological Consideration on Human Relationship Vocabulary for FOAF. In *1st Workshop on Friend of a Friend, Social Networking and the Semantic Web*, 2004.
- [15] Elliotte Rusty Harold. Chapter 17:XSL Transformations, chapter *The XML Bible*, 2nd Edition. ISBN:0764549863. John Wiley Sons, 2001.
- [16] William Kearney. Foaf page: William kearney. <http://www.ideaspace.net/users/wkearney/foaf.xrdf>, Aug 29, 2005.
- [17] Mandarax. <http://java-source.net/open-source/rule-engines/mandarax>, Sep 10 2005.
- [18] Luke McDowell, Oren Etzioni, Steven D. Gribble, Alon Halevy, Hank Levy, William Pentney, Deepak Verma, and Stani Vlasheva. Mangrove: Enticing ordinary people onto the semantic web via instant gratification. In *Proc. 2nd International Semantic Web Conference (ISWC2003)*, pages 754{770, Sanibel Island, Florida, USA, October 20-23 2003. Springer.
- [19] Luke McDowell, Oren Etzioni, Steven D. Gribble, Alon Halevy, Henry Levy, William Pentney, Deepak Verma, and Stani Vlasheva. Evolving the semantic web with mangrove. Technical Report UWCSE030201, Department of Computer Science and Engineering, University of Washington, Seattle, WA 98195 U.S.A, Feb 2003.
- [20] Ikki Ohmukai1, Hideaki Takeda, Masahiro Hamasaki1, Kosuke Numa, and Shin Adachi. Metadata-Driven Personal Knowledge Publishing, chapter *ISWC 2004*, LNCS 3298, page 591{604. Springer-Verlag Berlin Heidelberg 2004, 2004.
- [21] Bruce Spencer. jdrew. <http://www.jdrew.org/jDREWWebsite/jDREW.html>, Oct 20 2005.
- [22] SweetRules. <http://sweetrules.projects.semwebcentral.org/>, Sep 15 2005.