

RIF RuleML FOAF: Web Rules for Social Networking

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What is the Semantic Web?

- Machine-readable data
- Not just for display purposes

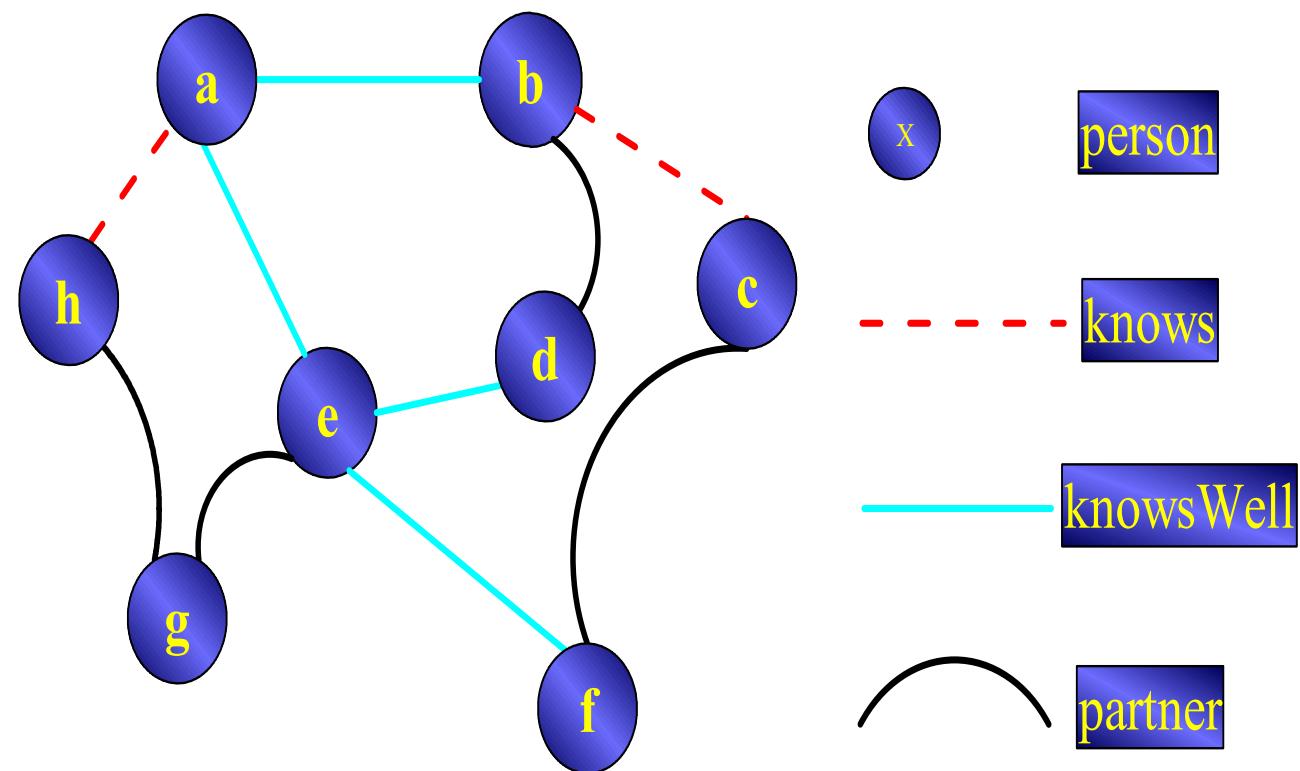
But also for

- Automation
- Integration
- Reuse

What is Social Networking?

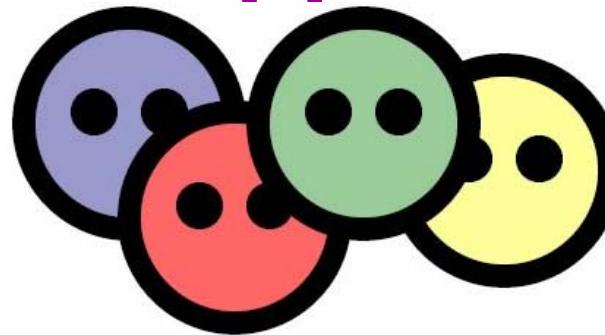
An example

- Individuals
- Relationships
- Determinable structure [9]



A Semantic Web Application

FOAF

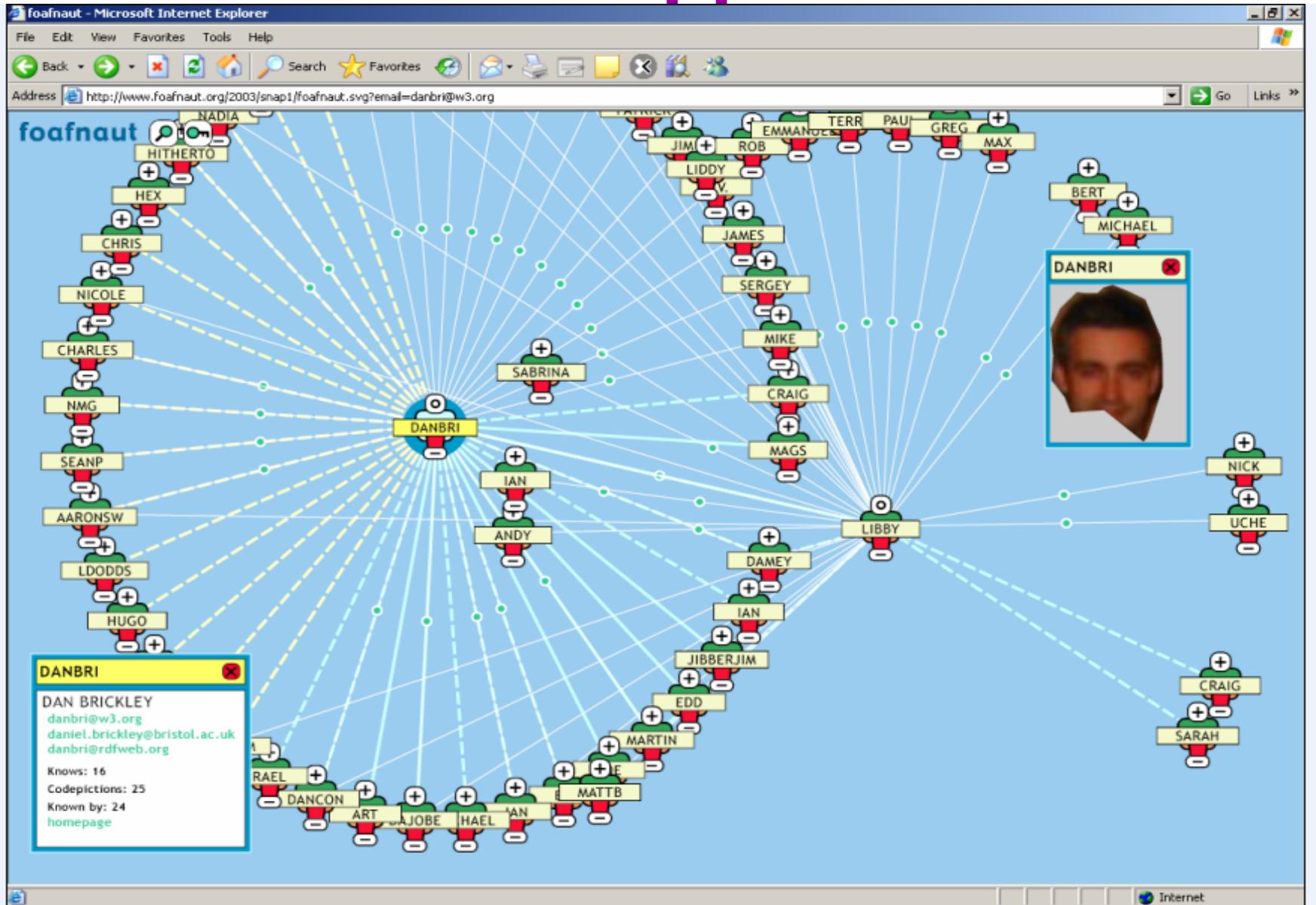


- Web-based social networking
- Friend-Of-A-Friend
- Describes people and their relationships
- Provides structured links
- Realised in RDF/XML
- A Semantic Web vocabulary (ontology)
- Contains only facts

FOAF Motivations

- Group people with similar interests
- Analyse social networks
- Examples
 - E-mail filtering
 - Expertise finding
 - Photo co-depiction

FOAF Application



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:

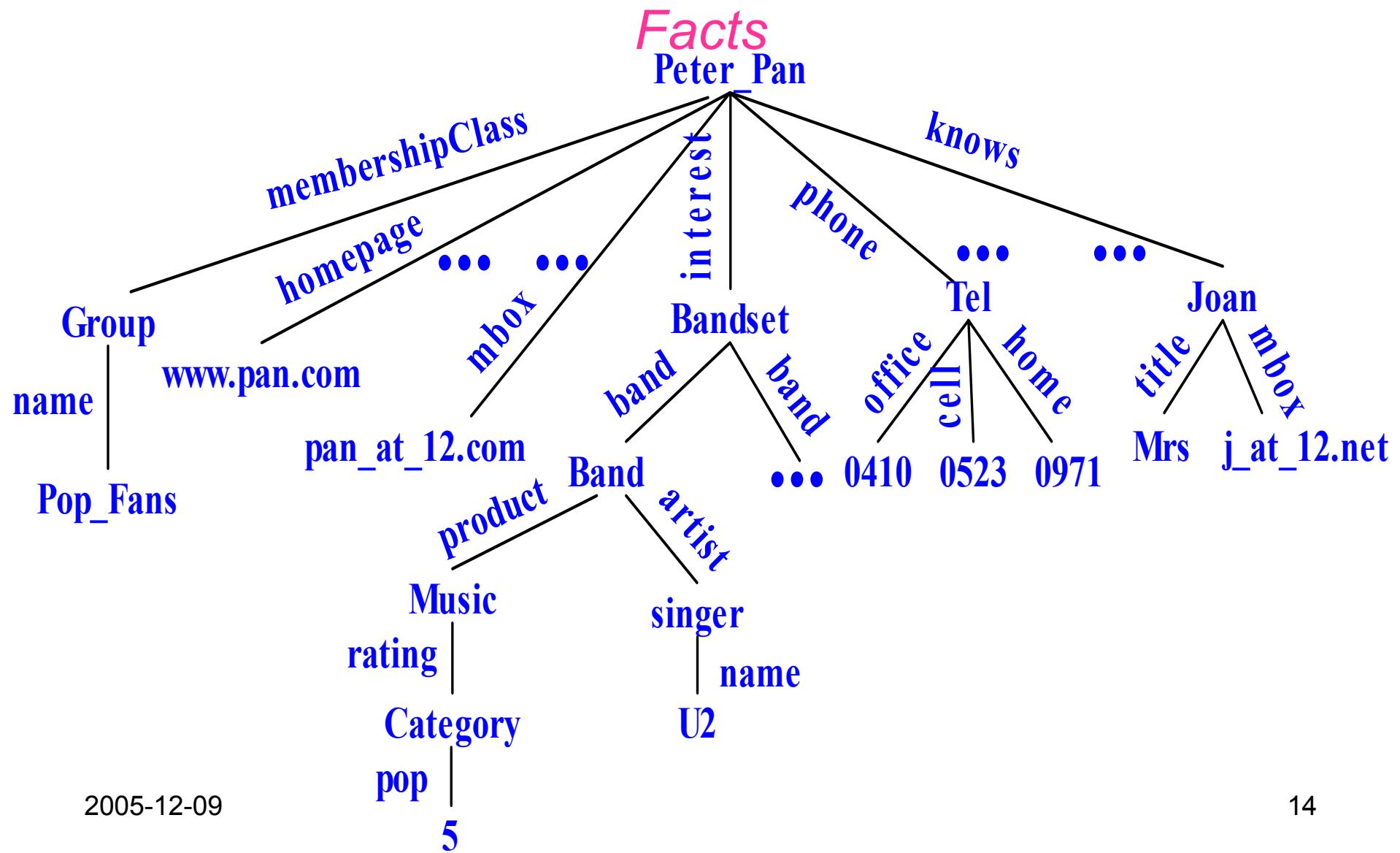
knowsWell(?A, ?B) :- collaborate(?A, ?B, ?Topic),
 like(?A, ?Hobby),
 like(?B, ?Hobby).

Objectives

Vocabulary & Normal Forms

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

Scenario Motivating Rule-Extended FOAF Profiles



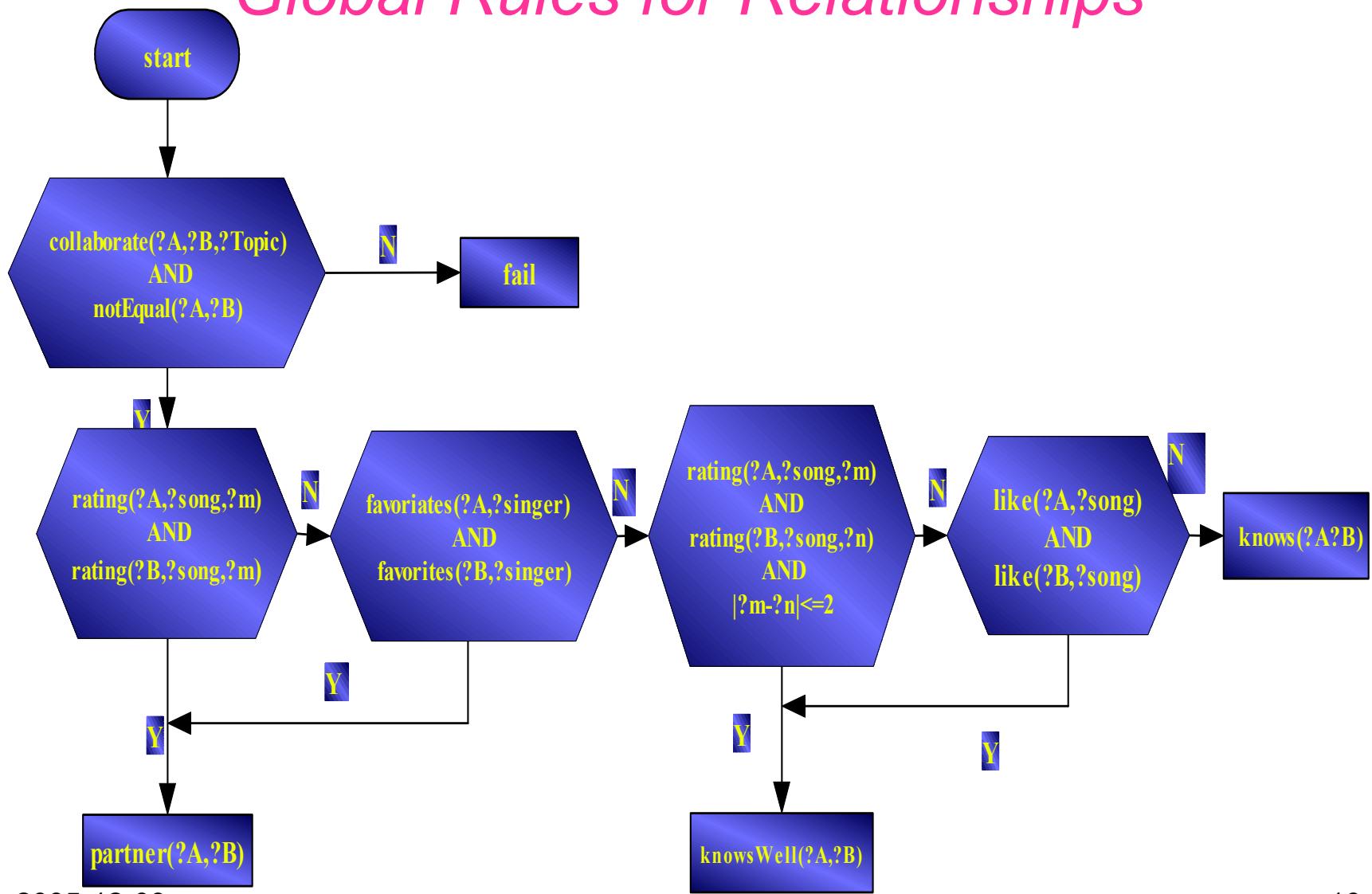
Scenario

Facts (POSL Version)

```
Peter_Pan[  
foaf:interest->  
    ex:Bandset[ex:band->  
        ex:Band[ex:product->  
            ex:Music[ex:rating->  
                ex:Category[ex:pop->5]];  
            ex:artist->ex:Singer[foaf:name->U2]];  
    ...  
];  
...  
foaf:membershipClass->foaf:Group[foaf:name->Pop Fans;  
    ...];  
ex:phone->ex:Tel[ex:office->0410;  
    ex:cell->0523;  
    ex:home->0971]].
```

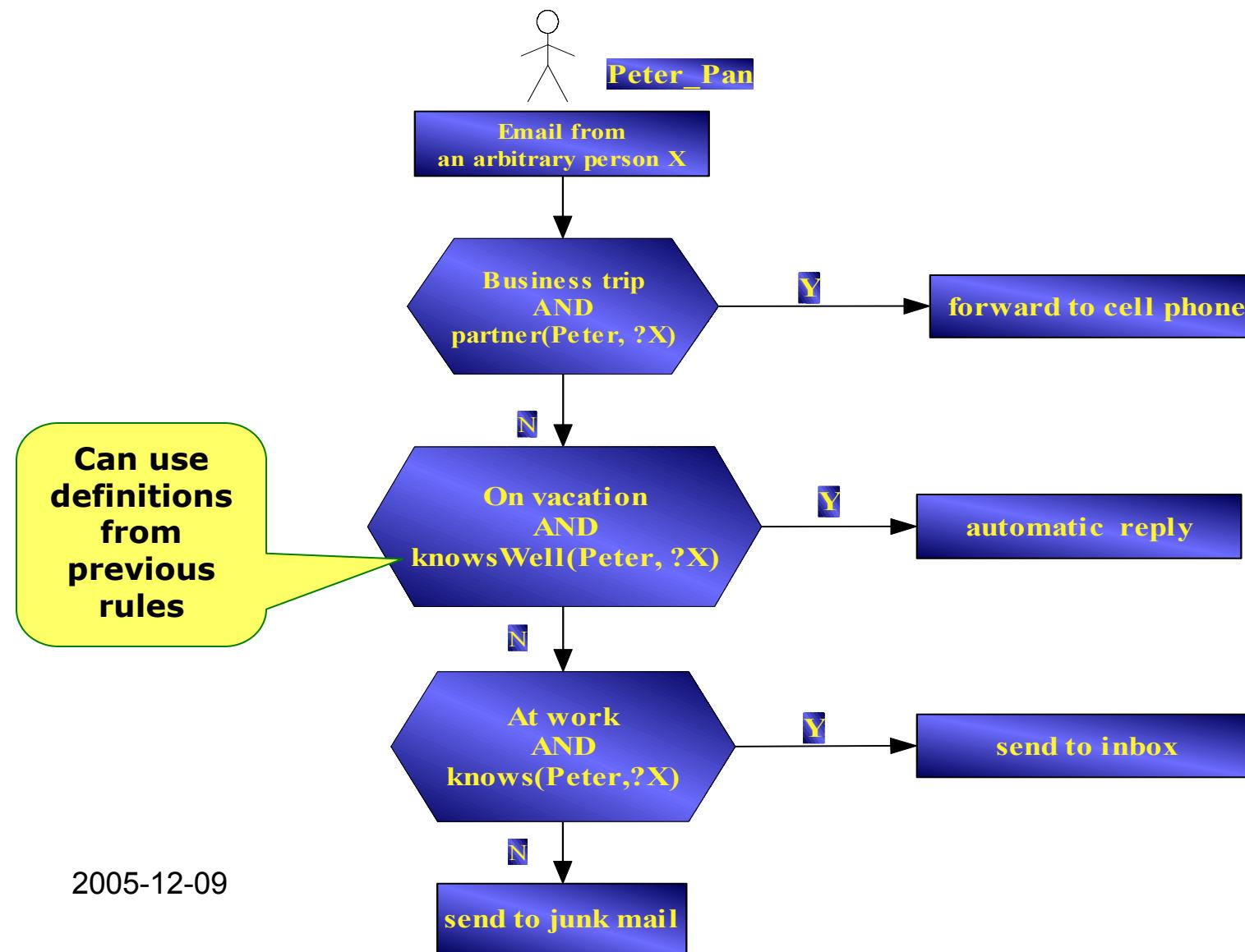
Scenario

Global Rules for Relationships



Scenario

Local Rules for Email Delivery



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

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

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/oojdrew>

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