RuleML FOAF:
Web Rules for Social Networking

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I. OVERVIEW

Web-based Social Networking is emerging as a major application area for the Semantic Web. Recently, a number of portals have become popular to support Web-based collaboration. In particular, the RDF-based Friend-Of-A-Friend (FOAF) project has gained momentum in the last few years and is attracting increasing attention of researchers as well as practitioners. However, FOAF only provides (person-centric) facts. Therefore, we propose RuleML FOAF, a combination of the RDF-based FOAF and the Rule Markup Language (RuleML) extending the factual FOAF vocabulary by RuleML rules. FOAF facts are complemented by rules that can derive further FOAF facts, before (RDF) FOAF publication and, on demand, from published (RuleML) FOAF pages. Correspondingly, we have implemented a Fact-oriented Normal Form (FNF) and a Rule-oriented Normal Form (RNF), in the Objected Oriented java Deductive Reasoning Engine for the Web (OO jDREW). While the RNF strives for compactness, the FNF directly corresponds to RDF FOAF facts. The RNF includes rules as well as the (elementary) facts that are needed by the premises of rules. All facts derivable from rules with OO jDREW BU (Bottom Up) are removed from the knowledge base. Corresponding queries will be proved by OO jDREW TD (Top Down). The FNF includes elementary facts and derived facts. Rules are removed from the published knowledge base after all possible facts are derived by running OO jDREW BU. Whenever there are new elementary facts asserted, the (unpublished) rules will be triggered to derive (and publish) further facts.

Our running example is a music scenario. We consider the following rules and facts as the original knowledge base:

```
(rule-1)
 fanOf(?Person,?Band) :-
    hasCD(?Person,?Band,?amount),
    greaterThan(?amount,3),
    watchTVLive(?Person,?Band).
(rule-2)
 fanOf(?Person,?Band) :-
    go2Concert(?Person,?Band,?frequency),
    greaterThan(?frequency,2),
    naf(talkedIn(?Person,?OtherPerson,?Band)).
```

```
(fact-0)  fanOf(Bill,U2).
(fact-1)  fanOf(Peter,U2).
(fact-2)  hasCD(Peter,U2,4).
(fact-3)  watchTVLive(Peter,U2).
(fact-4)  go2Concert(Peter,U2,3).
(fact-5)  go2Concert(Lucy,U2,5).
```

II. TWO NORMAL FORMS

Since RuleML FOAF is an extension to the current RDF-based FOAF, we provide different normal forms to RuleML FOAF users with different interests: people from the RDF community may only be interested in publishing given and newly derived facts; people from the rule community, on the other hand, may find it acceptable to keep a rule engine at runtime.

OO jDREW (http://www.jdrew.org/oojdrew) is employed as a rule engine to run RuleML FOAF knowledge bases: The RNF generation is supported by OO jDREW TD, while the FNF is generated by OO jDREW BU.

A. Rule-Oriented Normal Form (RNF)

The RNF corresponding to the original knowledge base of our music scenario is shown below (cf. Fig. 1):

```
(rule-1)
fanOf(?Person,?Band) :-
    hasCD(?Person,?Band,?amount),
    greaterThan(?amount,3),
    watchTVLive(?Person,?Band).
(rule-2)
fanOf(?Person,?Band) :-
    go2Concert(?Person,?Band,?frequency),
    greaterThan(?frequency,2).

(fact-0)
fanOf(Bill,U2).  * Only stored *
(fact-2)
hasCD(Peter,U2,4).
(fact-3)
watchTVLive(Peter,U2).
(fact-4)
go2Concert(Peter,U2,3).
(fact-5)
go2Concert(Lucy,U2,5).
```

The RNF integrates all the rules from different sources: individually tailored rules from user profiles and universal rules from global agent profiles. The RNF retains the non-derivable facts and discards the rule-derivable ones.

Therefore, the RNF includes all rules as well as the (elementary) facts that cannot be derived by the rules. Those facts that are derivable from the rules by a top-down engine such as OO jDREW TD are removed from the knowledge base. The advantages of the RNF are as follows:

- The RNF achieves greater compactness: All facts that, posed as queries, can be derived by applying rules through a top-down engine are removed.
- The rules in a published RNF can be reused and adapted by others for building their own profiles.
- All queries that are provable by the original knowledge base can still be proved, on demand, by the RNF.

B. Fact-Oriented Normal Form (FNF)

The FNF corresponding to the original knowledge base of our music scenario is shown below (cf. Fig. 2):

```
(fact-0)
fanOf(Bill,U2).  * Only stored *
(fact-1)
fanOf(Peter,U2).  * Stored & derived *
(fact-2)
hasCD(Peter,U2,4).
(fact-3)
watchTVLive(Peter,U2).
(fact-4)
go2Concert(Peter,U2,3).
(fact-5)
go2Concert(Lucy,U2,5).
(fact-6)
fanOf(Lucy,U2).  * Newly derived *
```

Complementing the RNF, the FNF is introduced. Since RuleML FOAF originated from RDF-based FOAF, one of its goal is to benefit the current FOAF community. The FNF thus targets at achieving RDF compatibility.

Facts in the RuleML FOAF vocabulary using a subset of RuleML can be easily mapped back to RDF facts via our XSLT translator (*ruleml2rdf.xslt*) when necessary. In cases where only facts are needed in RuleML FOAF, their RDF FOAF form can be automatically generated using this XSLT stylesheet.

There are the advantages of the FNF:

- The FNF achieves greater efficiency: Re-computation of derivable facts is avoided because a bottom-up engine has generated all facts.
- The FNF provides a bridge from the original knowledge base to RDF FOAF so that RDF FOAF users can also make indirect use of rules.
- Although rules are omitted from a published knowledge base, when new facts are added, the rules can be applied to them to derive further facts to obtain a new FNF.

III. CONCLUSION

Our RuleML FOAF profiles only require Datalog RuleML expressiveness. For Datalog, each non-ground fact can be recast as a set of ground facts, which simplifies RNF generation
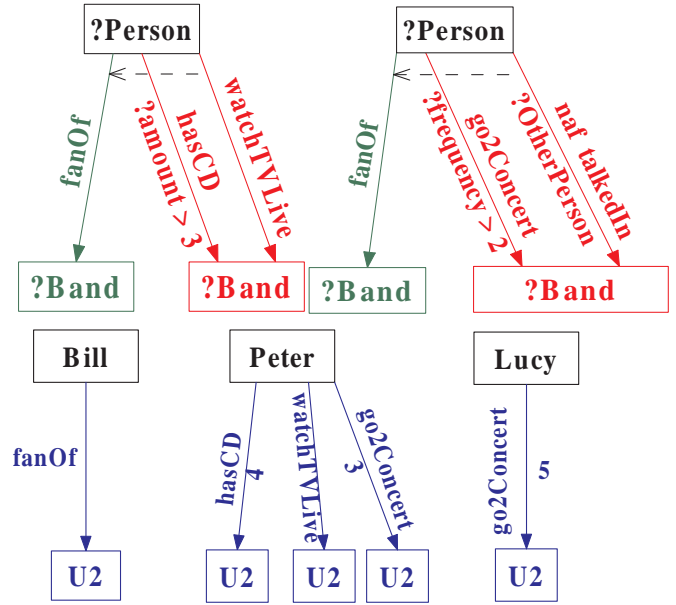

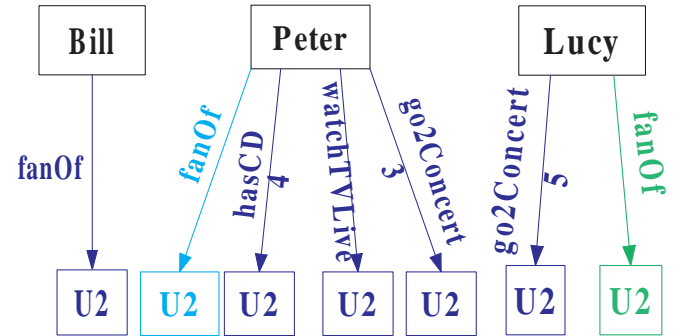Fig. 1. The RNF of our music scenario: fanOf(Peter,U2) omitted

Fig. 2. The FNF of our music scenario: fanOf(Lucy,U2) added

via top-down queries. All RuleML FOAF tools are available open source (http://www.ruleml.org/usecases/foaf).

REFERENCES

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