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Publisher's version / Version de l'éditeur:

*The Association of Logic Programming (ALP) Newsletter, 20, August and
November 3-4, 2007*

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Boley, H., Kifer, M.
August and November 2007

* published in The Association of Logic Programming (ALP) Newsletter.
Volume 20 Numbers 3 and 4. August and November 2007. NRC 50341.

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The Rule Interchange Format: An Interim Report

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The W3C Rule Interchange Format (RIF) Working Group (<http://www.w3.org/2005/rules/wg/wiki/FrontPage>) is an effort to define a standard *Rule Interchange Format* for facilitating exchange of rule sets among different systems and to promote the development of intelligent rule-based application for the Semantic Web. The group began working in December 2005 and is expected to complete Phase 1 of its job by 31 May 2008. The group includes representatives and experts from industry, academia, and research labs. As of today, the group has published working drafts including the following documents:

- RIF Use Cases and Requirements (latest working draft, 10 July 2007): <http://www.w3.org/TR/rif-ucr/>
- RIF Basic Logic Dialect (latest working draft, 30 October 2007): <http://www.w3.org/TR/rif-bld/>
- RIF RDF and OWL Compatibility (latest working draft, 30 October 2007): <http://www.w3.org/TR/rif-rdf-owl/>

Why develop a rule *interchange format* and not a single standardized rule *language*, like the OWL language for the specification of ontologies? One reason was the concern that a Web standard for just one rule language could stymie the progress in this active area of research. Furthermore, given the diversity of the existing rule-based systems, it was felt that defining a single unifying language is neither possible nor tenable. As a result, the RIF architecture calls for a family of languages, called *dialects*.

A *RIF dialect* is a rule-based language with an XML syntax and a well-defined semantics. A dialect \mathbf{D}_1 can *extend* a dialect \mathbf{D}_2 if the syntax of \mathbf{D}_1 is a superset of the syntax of \mathbf{D}_2 , and the dialects are semantically compatible. Given such a family of RIF dialects, a rule system, \mathbf{A} , can interchange its native

ruleset R with a system \mathbf{B} if there is a RIF dialect, \mathbf{D} , such that \mathbf{A} can map R to a ruleset in \mathbf{D} , $R^{\mathbf{D}}$, in a semantics-preserving manner, and \mathbf{B} can map $R^{\mathbf{D}}$ to its native ruleset S , again preserving the semantics. The key point here is that both the syntax and the semantics of a RIF dialect, such as \mathbf{D} , will be standardized, and to be RIF-compliant the rule systems \mathbf{A} and \mathbf{B} must “implement” one or more dialects (e.g., \mathbf{D}). A rule system *implements* a dialect if the native language of the system is a syntactic variant of the language of the dialect with possible extensions. So, if \mathbf{A} and \mathbf{B} implement \mathbf{D} then there are semantics-preserving mappings from \mathbf{D} onto some subsets of the languages of \mathbf{A} and \mathbf{B} , and vice versa. The existence of such mappings enables the interchange of rules between \mathbf{A} and \mathbf{B} , if the rules fall into the aforesaid subsets of the two systems.

To ensure a maximum degree of coherence among the various dialects, RIF defines *frameworks*, i.e., general formalisms that can be *specialized* to particular dialects by “tweaking” features. At present, the RIF working group is focusing on two families of dialects: *logic based dialects* and *production rule dialects*. The logic-based family of dialects will cover rule systems that are based on logic programming, deductive database paradigms and, possibly, on pure first-order logic. The production rule family is intended to account for many commercial condition-action (CA) rule systems and will possibly be extended to event-condition-action (ECA) rules. Except for the condition part to be in the shared “core” of the logic and production rule families of dialects, it is not clear at this point how much machinery can be reused across the different families, although reuse is expected to be significant within each family.

At present, only a framework for the logic-based family of dialects has been worked out. The specification of the production rule family is currently at an early stage. The *RIF framework for logic dialects* has the following main components:

- *Syntactic framework*. This framework defines the mechanisms for specifying the formal presentation syntax of RIF’s logic dialects. The presentation syntax is used in RIF to define the semantics of the dialects and to illustrate the main ideas with examples. The presentation syntax of a dialect is not intended to be a concrete syntax for that dialect. For instance, the presentation syntax of RIF-BLD deliberately omits details such as the delimiters of the various syntactic components, parenthesizing, precedence of operators, escape symbols, and the like. Instead, as components of an interchange format, RIF dialects use XML as their concrete syntax.
- *Semantic framework*. The semantic framework describes the mechanisms that are used for specifying the models of RIF logic-based dialects.
- *XML serialization framework*. This framework defines the general principles that logic-based dialects are to use for specifying their concrete XML-based syntaxes. For each dialect, its concrete XML syntax is a derivative of the dialect’s presentation syntax. It can be seen as a serialization of that syntax.

The RIF syntactic framework for logic dialects is quite general. Along with the Prolog-like *positional* terms, it supports *slotted terms* (which are akin to tuples in relational databases, where columns are named and the order of the columns is immaterial) and *frames* (which are assertions about objects and their properties à la F-logic). The syntactic framework can be specialized to a particular dialect by removing (or adding) features and through a number of mechanisms, such as “symbol spaces” and “signatures”. For instance, the language of a dialect can be made higher-order (à la HiLog), polymorphic and/or polyadic depending on the signatures that the dialect allows for the symbols in its language. The semantic framework can be specialized by tweaking the set of truth values, data types, and the entailment relation.

In Phase 1, the RIF working group is defining the *Basic Logic Dialect* (RIF-BLD), which semantically corresponds to a Horn rule language with equality. However, RIF-BLD has a number of syntactic extensions with respect to ‘regular’ Horn rules, and the dialect will come with a standard set of builtins. Moreover, RIF-BLD is a *Web language* in that it supports the use of IRIs (Internationalized Resource Identifiers) and XML Schema data types, as well as formalizing its RDF and OWL compatibility. In Phase II, other dialects will be defined. These are likely to include higher-order extensions, well-founded negation, and a dialect based on stable model semantics. It is expected that various user groups will develop additional dialects including, e.g., uncertainty reasoning. Phase II is also expected to introduce, based on Phase I *Production Rule Dialect* (RIF-PRD) work, one or more full-fledged dialects supporting the production rule paradigm.

In parallel, the RIF group is working towards a general extensibility framework, which tackles issues like forward and backward compatibility, fallback mechanisms to handle unknown pieces of syntax, and other issues. For more information, see the working group’s Wiki page at <http://www.w3.org/2005/rules/wg/wiki/FrontPage>.