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RIF Overview

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Abstract

This document is an overview of the Rule Interchange Format (RIF). It provides a high-level explanation of RIF concepts and architecture as well as a general survey of RIF documents.

Status of this Document

May Be Superseded

This section describes the status of this document at the time of its publication. Other documents may supersede this document. A list of current W3C publications and the latest revision of this technical report can be found in the W3C technical reports index at http://www.w3.org/TR/.

Set of Documents

This document is being published as one of a set of 10 documents:

1. RIF Overview (this document)
2. RIF Core Dialect

3. RIF Basic Logic Dialect
4. RIF Framework for Logic Dialects
5. RIF RDF and OWL Compatibility
6. RIF Datatypes and Built-Ins 1.0
7. RIF Production Rule Dialect
8. RIF Test Cases
9. RIF Combination with XML data
10. OWL 2 RL in RIF

First Public Working Draft

This document was developed to provide a high-level guide to the RIF documents and and very brief introduction to the RIF architecture. It should serve as a general starting point for the RIF specification.

Please Comment By 29 October 2009

The Rule Interchange Format (RIF) Working Group seeks public feedback on this First Public Working Draft. Please send your comments to public-rif-comments@w3.org (public archive). If possible, please offer specific changes to the text that would address your concern. You may also wish to check the Wiki Version of this document and see if the relevant text has already been updated.

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Table of Contents

W3C Working Draft

1 Introduction

The *Rule Interchange Format* (RIF) Working Group was chartered by the World Wide Web Consortium in 2005 to create a standard for exchanging rules among rule systems, in particular among Web rule engines. RIF focused on exchange rather than trying to develop a single one-fits-all rule language because, in contrast to other Semantic Web standards, such as RDF, OWL, and SPARQL, it was immediately clear that a single language would not cover all popular paradigms of using rules for knowledge representation and business modeling. Even rule exchange alone was quickly recognized to be a daunting task. Known rule systems fall into three broad categories: first-order, logic-programming, and action rules. These paradigms share little in the way of syntax and semantics. Moreover, there are large differences between systems even within the same paradigm.

Given this diversity, what is the most useful notion of rule exchange? The approach taken by the Working Group was to design a family of languages, called *dialects*, with rigorously specified syntax and semantics. The family of RIF dialects is intended to be *uniform* and *extensible*. RIF uniformity means that dialects are expected to share as much as possible of the existing syntactic and semantic apparatus. Extensibility here means that it should be possible for motivated experts to define a new RIF dialect as a syntactic extension to an existing RIF dialect, with new elements corresponding to desired additional functionality. These new RIF dialects would be non-standard when defined, but might eventually become standards.

Because of the emphasis on rigor, the word *format* in the name of RIF is somewhat of an understatement. RIF in fact provides more than just a format. However, the concept of format is essential to the way RIF is intended to be used. Ultimately, the medium of exchange between different rule systems is XML, a format for data exchange. Central to the idea behind rule exchange through RIF is that different systems will provide syntactic mappings from their native languages to RIF dialects and back. These mappings are required to be *semantics-preserving*, and thus rule sets can be communicated from one system to another provided that the systems can talk through a suitable dialect, which they both support.

2 RIF Dialects

The RIF Working Group has focused on two kinds of dialects: *logic-based dialects* and dialects for *rules with actions*. Generally, logic-based dialects include languages that employ some kind of logic, such as first-order logic (often restricted to Horn logic) or non-first-order logics underlying the various logic programming languages (e.g., logic programming under the well-founded or stable semantics). The rules-with-actions dialects include production rule systems, such as Jess,

W3C Working Draft

Drools and JRules, as well as reactive (or event-condition-action) rules, such as Reaction RuleML and XChange. Due to the limited resources of the RIF Working Group, it defined only two logic dialects, the Basic Logic Dialect (RIF-BLD) and a subset, the RIF Core Dialect, shared with RIF-PRD; the Production Rule Dialect (RIF-PRD) is the only rules-with-actions dialect defined by the group. Other dialects are expected to be defined by the various user communities.

Present and future RIF dialects are expected to share datatypes, built-in functions, and built-in predicates as defined by RIF Datatypes and Built-Ins (RIF-DTB). In particular, the current dialects RIF-BLD, RIF-Core, and RIF-PRD all share the foundations of RIF-DTB 1.0.

3 RIF Framework for Logic Dialects

The RIF Working Group spent almost four years on developing the above three dialects, and this begs a question: If dialect development is so time consuming, who will donate the necessary resources for the next round of development and who will ensure the uniformity of community-developed dialects once the RIF Working Group disbands? The Working Group partially addressed these questions by also developing an extensibility framework, called the Framework for Logic Dialects, or RIF-FLD. A comparable framework for rules with actions might be developed later.

Developing RIF-FLD as a framework turned out to be feasible because despite the diversity of logical theories underlying the different logic rule systems, they share much of the same syntactic and semantic machinery. Moreover, the ways to combine the different pieces of that machinery in order to create those logic systems are well studied. However, the RIF-FLD specification is unique in that it digests much of this knowledge, presents it in a coherent form, and uses XML even on the framework level.

RIF-FLD is a very general logic language that includes a great deal of commonly used syntactic and semantic apparatus; however, it purposely leaves certain parameters unspecified to enable designers of concrete dialects to fill in the necessary details. For instance, RIF-FLD provides machinery to tweak the rules of syntax through the notion of *signatures*. It also specifies certain semantic notions, such as models and logical entailment, but it leaves certain other options open (for instance, which exact models are to be used for entailment). A dialect designer can then define the syntax of a dialect by *specializing* it from the syntax of RIF-FLD, and the semantics by specializing it from the semantics of RIF-FLD. While doing so, the designer will make choices by selecting from the options provided by RIF-FLD, but he or she will not have to repeat the definitions of formulas, datatypes, models, entailment, and so on. This approach is illustrated using the RIF-BLD dialect. This dialect is specified in two ways, both normative: directly, by spelling out all the definitions, which takes about 40 dense pages, and by specialization from RIF-FLD -- just about 5 pages. Any discrepancy between the two specifications is to be treated as a *bug* that must be clarified and corrected. This dual specification of RIF-BLD is also intended to serve as an example of dialect

W3C Working Draft

design by specialization from the RIF framework -- the preferred mode of specification for various future logic dialects.

The RIF framework is not a monument that is cut in stone and is likely to see several extensions in the future. One, as we already mentioned, might be to cover the paradigm of actions and reactive rules.

4 RDF and OWL Compatibility

Recognizing that RIF rules should be able to interface with RDF and OWL ontologies, the RIF Working Group has also defined the necessary concepts to ensure compatibility of RIF with RDF and OWL. RIF, RDF, and OWL are exchange languages with dissimilar syntaxes and semantics. How, then, should RIF rules refer to RDF and OWL facts, and what is the logical meaning of the overall language? RIF-RDF and OWL Compatibility defines just that. The basic idea is that RIF uses its frame syntax to communicate with RDF/OWL. These frames are mapped onto RDF triples and a joint semantics is defined for the combination.

5 A General Survey of the RIF Documents

The RIF Working Group has produced ten documents, six of which are intended to become W3C Recommendations. The following general survey can help the reader to navigate these documents.

- RIF-BLD: The Basic Logic Dialect. This is one of the two major dialects, and the main logic-based dialect, developed by the group. Technically, this dialect corresponds to Horn logic with various syntactic and semantic extensions. The main syntactic extensions include the frame syntax and predicates with named arguments. The main semantic extensions include datatypes and externally defined predicates. Although this dialect is not expressive enough for many applications of rules, it covers many existing rule systems, and development of such a dialect was necessary as a starting point for future, more expressive dialects. This future activity is expected to take place within the RIF extensibility framework, RIF-FLD.
- RIF-PRD: The Production Rule Dialect. This is the other major dialect developed by the group, capturing the main aspects of various production rule systems. Serious industrial interest in production rule technology has been demonstrated by major players. Production rules, as they are currently practiced in main-stream systems like Jess or JRules, are defined using ad hoc computational mechanisms, which are not based on a logic. For this reason, RIF-PRD is not part of the suite of logical RIF dialects and stands apart from them. However, significant effort has been extended to ensure as much sharing with the other dialects as possible. This sharing was the main reason for the development of the RIF Core dialect.
- RIF-Core: The Core Dialect. This dialect is a subset of both RIF-BLD and RIF-PRD based on RIF-DTB 1.0, thus enabling limited rule exchange between logic rule dialects and production rules. RIF-Core corresponds to

W3C Working Draft

Horn logic without function symbols (often called 'Datalog') with a number of extensions to support features such as objects and frames as in F-logic, internationalized resource identifiers for concepts, and XML Schema datatypes.

- RIF-FLD: The Framework for Logic Dialects. RIF-FLD is not a dialect in its own right, but rather a general logical extensibility framework. It was introduced in order to drastically lower the amount of effort needed to define and verify new logic dialects that extend the capabilities of RIF-BLD.
- RIF-RDF+OWL: RDF and OWL Compatibility. Rules interchanged via RIF may depend on or be used in combination with RDF data and RDF Schema or OWL ontologies. This document enables interoperability between RIF and these other Semantic Web standards. It defines the syntax and semantics of combined RIF+RDF and RIF+OWL 2 languages.
- RIF-DTB: Datatypes and Built-ins. Rules often refer to built-ins (e.g., arithmetics, string manipulation) and datatypes (e.g., integers, strings, Booleans). To enable semantics-preserving exchange of such rules, it is necessary that most commonly used datatypes and built-in functions and predicates are identified and their semantics are defined precisely. This purpose is served by the RIF-DTB document.
- RIF+XML-Data: RIF Combination with XML Data. Rules should be combinable with XML data sources. This document specifies how such combinations can be done.
- RIF-OWLRL: OWL 2 RL in RIF. OWL 2 RL is an OWL 2 subset defined via a partial axiomatization of the OWL 2 RDF-based semantics in the form of implications. That definition can be used as the basis for a rule-based implementation as shown in this document using RIF.
- RIF-UCR: Use Cases and Requirements. One of the first tasks of the RIF Working Group was to identify classes of applications that the RIF suite of dialects should be able to address, and use that to derive requirements to RIF. To a large extent, the design of RIF dialects was driven by the requirements found in the RIF-UCR document.
- RIF-Test: Test Cases. This document is primarily of concern to RIF implementers. It includes the description of test cases -- both positive and negative -- that can be used in order to give an indication of whether a particular implementation of a RIF dialect is compliant with the specifications. There is a companion repository of the source code for the various test cases.

6 References

[OWL-Reference]
OWL Web Ontology Language Reference, M. Dean, G. Schreiber, Editors, W3C Recommendation, 10 February 2004. Latest version available at http://www.w3.org/TR/owl-ref/.

[RDF-Concepts]
Resource Description Framework (RDF): Concepts and Abstract Syntax], G. Klyne, J. Carrol, Editors, W3C Recommendation, 10 February 2004,

W3C Working Draft

http://www.w3.org/TR/2004/REC-rdf-concepts-20040210/. Latest version available at http://www.w3.org/TR/rdf-concepts/.

[RIF-BLD]
RIF Basic Logic Dialect Harold Boley, Michael Kifer, eds. W3C Candidate Recommendation, 1 October 2009, http://www.w3.org/TR/2009/CR-rif-bld-20091001/. Latest version available at http://www.w3.org/TR/rif-bld/.

[RIF-Core]
RIF Core Dialect Harold Boley, Gary Hallmark, Michael Kifer, Adrian Paschke, Axel Polleres, Dave Reynolds, eds. W3C Candidate Recommendation, 1 October 2009, http://www.w3.org/TR/2009/CR-rif-core-20091001/. Latest version available at http://www.w3.org/TR/rif-core/.

[RIF-DTB]
RIF Datatypes and Built-Ins 1.0 Axel Polleres, Harold Boley, Michael Kifer, eds. W3C Candidate Recommendation, 1 October 2009, http://www.w3.org/TR/2009/CR-rif-dtb-20091001/. Latest version available at http://www.w3.org/TR/rif-dtb/.

[RIF+XML-Data]
RIF Combination with XML Data, Christian de Sainte Marie (Editor), W3C Rule Interchange Format Working Group Draft. Latest Version available at http://www.w3.org/2005/rules/wiki/RIF%2BXML_data-schema.

[RIF-OWLRL]
OWL 2 RL in RIF Dave Reynolds, editor. W3C Working Draft, 1 October 2009, http://www.w3.org/TR/2009/WD-rif-owl-rl-20091001/. Latest version available at http://www.w3.org/TR/rif-owl-rl/.

[RIF-FLD]
RIF Framework for Logic Dialects Harold Boley, Michael Kifer, eds. W3C Candidate Recommendation, 1 October 2009, http://www.w3.org/TR/2009/CR-rif-fld-20091001/. Latest version available at http://www.w3.org/TR/rif-fld/.

[RIF-PRD]
RIF Production Rule Dialect Christian de Sainte Marie, Adrian Paschke, Gary Hallmark, eds. W3C Candidate Recommendation, 1 October 2009, http://www.w3.org/TR/2009/CR-rif-prd-20091001/. Latest version available at http://www.w3.org/TR/rif-prd/.

[RIF-RDF+OWL]
RIF RDF and OWL Compatibility Jos de Bruijn, editor. W3C Candidate Recommendation, 1 October 2009, http://www.w3.org/TR/2009/CR-rif-rdf-owl-20091001/. Latest version available at http://www.w3.org/TR/rif-rdf-owl/.

[RIF-Test]
RIF Test Cases Stella Mitchell, Leora Morgenstern, Adrian Paschke, eds. W3C Working Draft, 1 October 2009, http://www.w3.org/TR/2009/WD-rif-test-20091001/. Latest version available at http://www.w3.org/TR/rif-test/.

W3C Working Draft

[RIF-UCR]
RIF Use Cases and Requirements Adrian Paschke, David Hirtle, Allen Ginsberg, Paula-Lavinia Patranjan, Frank McCabe, eds. W3C Working Draft, 18 December 2008, http://www.w3.org/TR/2008/WD-rif-ucr-20081218/. Latest version available at http://www.w3.org/TR/rif-ucr/.

[SPARQL]
SPARQL Query Language for RDF, E. Prud'hommeaux, A. Seaborne (Editors), W3C Recommendation, World Wide Web Consortium, 12 January 2008, http://www.w3.org/TR/2008/REC-rdf-sparql-query-20080115/. Latest version available at http://www.w3.org/TR/rdf-sparql-query/.

[GL88]
The Stable Model Semantics for Logic Programming, M. Gelfond and V. Lifschitz. Logic Programming: Proceedings of the Fifth Conference and Symposium, pages 1070-1080, 1988.

[GRS91]
The Well-Founded Semantics for General Logic Programs, A. Van Gelder, K.A. Ross, J.S. Schlipf. Journal of ACM, 38:3, pages 620-650, 1991.