Towards a Foundational Ontology for Reactive Rules
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Introduction
The Semantic Web is based on peer-to-peer communication between autonomous, and autonomously developing, nodes and it should support (not only querying, but also) propagation of knowledge and changes in a semantic way. Such evolution depends on the cooperation of nodes, and the heterogeneity of concepts for expressing behavior requires an appropriate handling on the semantic level. It is really unlikely that there will be a unique language for describing behavior throughout the entire Web.

Heterogeneous Reactivity. A suitable common model (described in [4, 5, 2]) for dealing with such heterogeneity is provided by reactivity together with its formalization as Event-Condition-Action (ECA) rules, bearing a clean separation between the content of a rule and the generic semantics of the rules themselves, an inherent loosely coupled nature, allowing the declarative combination of functionality from different Web sites (providing events and services).

Resourceful Reactive Rules. Much research effort is currently being targeted upon rule interchange formats, and upon defining rules for about ontologies. In what concerns the former, most of proposals are XML-markup based and rely on specific abstract syntax, ignoring the fact that rules do not only operate on the Semantic Web, but are themselves also part of it. Rules must be first class citizens of the Semantic Web, especially if one wants to express and reason about evolution of behavior (towards dynamic behavior and behavior policies).

The r³ Ontology. This calls for a foundational ontology for (ECA) rules that, according to the heterogeneity requirement previously identified, must allow also the description of different languages to be used and composed at the rule component level. The OWL-DL r³ ontology [2] (here presented using UML diagrams) is an intermediate step towards that goal reflecting work in progress in the r³ project [9].

Describing Reactive Rules
The component structure of an ECA rule (which is shared by other kinds of reactive rules) is core to the r³ ontology.

Describing Language Elements
Language constructs include atomic functions and compositional operators.

Describing Rule Components
Rule Components

Present State
A working prototype [1] of the r³ framework is available, for a previous version of this ontology, including a supporting library used to implement several component languages. A new version of the r³ ontology is currently being defined allowing the description of derivation rules for higher-level events and actions. This new version will constitute the basis for a full re-implementation of the prototype.

Related Work. To the present, there are only two ontology proposals for describing rules: WRL [3] and SBVR [7]. The latter is not targeted to the Semantic Web but does address language heterogeneity, and does not exclude reactive rules (waiting on [6]). It is also worth mentioning that the MARS project [8] (with which r³ shares its ideas) is pursuing a complementary approach to these issues at the OWL-Full level [2].

References