

Introduction to the Special Issue on Logic Programming and the Web

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The World Wide Web is nowadays the most famous and widespread information system. Its success is witnessed by its enormous size and rate of growth: however, the same success of the Web has brought to a situation where more sophisticated techniques are urgently needed to properly handle this mass of information. In this sense, the more ambitious plan for an evolution of a Web is the so called Semantic Web, envisioned by the inventor of the Web itself, Tim Berners-Lee. In this architectural vision, there is the need for further layers of semantics, properly enriching the data that now overflow the classic Web: ontologies, rules, logic, proofs, trust are all ingredients of this ambitious picture. Given these premises, it should not come as a surprise the fact that this evolution is bringing the Web closer and closer to another field, that since quite some time has been facing similar problems of logical organization of knowledge: logic programming. Early examples, like the Metalog system in the World Wide Web Consortium (W3C), had shown that connecting logic programming and the Semantic Web was quite a natural and fruitful step: and in fact, the burst of research in Semantic Web developments has eventually started to touch, connect and reinterpret many topics that were and are mainstream of the logic programming area. We feel this is a necessary progression, as the Semantic Web, and more generally the Web of the future, has a lot to learn from research in the logic programming area. And, conversely, in these new scenarios there are lot of new applied problems that can be challenging and rewarding from a logic programming perspective. This calls for a tighter interaction between the Web and logic programming, which was the reason to motivate this special issue as well: gathering together a selection of the best contributions that could showcase the potential of the cross-breeding.

The special issue begins with a paper co-authored by Tim Berners-Lee himself: “N3Logic: A Logic for the Web”. In this paper the inventor of the Web and his colleagues propose a new system to deal with logical rules in the Web. Their system extends the basic Semantic Web layer with a set of fundamental functionalities, showing how many exciting paths are nowadays open to the challenging problem of integrated reasoning in the Semantic Web.

An alternate path is followed by the next paper, “Building Rules on Top of Ontologies for the Semantic Web with Inductive Programming” by Francesca Lisi, where the potential of inductive logic programming is wisely turned into a general framework for learning rules on top of ontologies, thereby enriching the Semantic Web,

The special issue then proceeds with the paper “Translating OWL and Semantic Web Rules into Prolog: Moving Toward Description Logic Programs”: here, Ken Samuel and his co-authors bring to higher levels the translational approach the Metalog project had also used, and analyze the problem of reasoning in the semantic web as a domain translation, using Prolog as the back-engine, therefore interestingly exploring how much of the Semantic Web can be reconciled within a pure logic programming framework.

A translational approach is also taken by the next paper, “Querying XML Documents in Logic Programming”, although the spirit here is different: Jesus Almendros-Jiménez and co-authors, in a bold move, show us that logic programming as a back-engine can be useful not only for the Semantic Web, but even for XML documents, therefore casting new light on the enormous potential that logic programming and its derivatives can have as unifying mechanism for logical reasoning in the Web and beyond.

The fundamental importance of logic programming in the translational picture depicted by the above papers would be only theoretical, without a Prolog system to actually rely upon. In the following paper, “SWI-Prolog and the Web”, Jan Wielemaker and colleagues describe one of the most successful systems ever designed in this context, namely SWI-Prolog, and show us how Prolog itself can gracefully evolve to a web programming language, by appropriate extensions that link its inference power to the external Web environment.

The special issue ends with two contributions that have been selected as the best ones of the ALPSWS (Applications of Logic Programming in the Semantic Web and Semantic Web Services) International Workshop. In “Query Evaluation and Optimization in the Semantic Web”, Edna Ruckhaus and co-authors study how efficiently Web ontologies can be queried, and introduce the new concept of a Deductive Ontology Base, showing how part of the Semantic Web can be effectively implemented this way. Later, in “Guarded Hybrid Knowledge Bases”, Stijn Heymans and colleagues introduce a new reasoning paradigm that nicely cross-breeds between description logics and logic programming, therefore trying to reconcile these two so far different approaches for web reasoning.

Before letting the reader enjoy the papers, some thanks are in order. Apart from the authors of the papers, who are to thank for providing the excellent food for brain, I would like to thank the anonymous referees, that took the load of reviewing all the papers, and finally selecting the above ones. Thanks to Axel Polleres, for efficiently coordinating the ALPSWS paper track. And last but not least, thanks to the Editor in Chief, Annalisa Bossi, for her big support, motivation and assistance in the finalization of this special issue.