

Tools and Techniques for Easing the Application of Answer Set Programming

1. Abstract

Answer Set Programming (ASP) is a well-established declarative problem solving paradigm; it features high expressiveness and the ability to deal with incomplete knowledge, so it became widely used in AI and it is now recognized as a powerful tool for knowledge representation and reasoning (KRR).

Thanks to the expressive language and the availability of diverse robust systems, Answer Set Programming has recently gained popularity and has been applied fruitfully to a wide range of domains. This made clear the need for proper tools and interoperability mechanisms that ease the development of ASP-based applications. Also, the spreading of ASP from a strictly theoretical ambit to more practical aspects requires additional features for easing the interoperability and integration with other software; furthermore, improving the performance of actual ASP system is crucial for allowing the use of the potential of ASP in new practical contexts.

The contribution of this thesis aims at addressing such challenges; we introduce new tools and techniques for easing the application of ASP. In particular, we present EmbAsp: a framework for the integration of ASP in external systems for general applications to different platforms and ASP reasoners. The framework features explicit mechanisms for two-way translations between strings recognisable by ASP solvers and objects in the programming language.

Furthermore, we define proper means for handling external computations in ASP programs, and implement a proper framework for explicit calls to Python scripts via external atoms into the ASP grounder I-DLV. We also define and implement, into the same system, an additional framework for creating ad-hoc directives for interoperability and make use of it for providing some ready-made ones for the connection with relational and graph databases.

Eventually, we work at improving the ASP computation, and present two new ASP systems: DLV2 and I-DLV-MS. DLV2 updates DLV with modern evaluation techniques, combining I-DLV with the solver wasp, while I-DLV-MS is a new ASP system that integrates I-DLV, with an automatic solver selector for inductively choose the best solver, depending on some inherent features of the instantiation produced by I-DLV.