On the Development of Industrial Applications with ASP

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Abstract. Answer Set Programming (ASP) is a powerful rule-based language for knowledge representation and reasoning that has been developed in the field of logic programming and nonmonotonic reasoning. After many years of basic research, the ASP technology has become mature for the development of significant real-world applications. In particular, the well-known ASP system DLV has undergone an industrial exploitation by a spin-off company called DLVSYSTEM srl, which has led to its successful usage in a number of industry-level applications. The success of DLV for applications development is due also to its endowment with powerful development tools, supporting researchers and software developers that simplify the integration of ASP in real-world applications which usually require to combine logic-based modules within a complete system featuring user interfaces, services etc. In this talk, we first recall the basics of the ASP language. Then, we overview our advanced development tools, and we report on the recent implementation of some challenging industry-level applications of our system.

1 Introduction

Answer Set Programming (ASP) [1] is a powerful rule-based language for knowledge representation and reasoning that has been developed in the field of logic programming and nonmonotonic reasoning. ASP features disjunction in rule heads, non monotonic negation in rule bodies, aggregate atoms for concise modeling of complex combinatorial problems, and weak constraints for the declarative encoding of optimization problems.

Computational problems, even of high complexity [2], can be solved in ASP by specifying a logic program —i.e., of a set of logic rules— such that its answer sets correspond to solutions, and then, using an answer set solver to find such solutions [1].

After more than twenty years from the introduction of ASP, the theoretical properties of the language are well understood and the solving technology has become mature [6] for practical applications. The high knowledge-modeling power of ASP made it suitable for solving a variety of complex problems arising in scientific applications [6] from several areas ranging from *Artificial Intelligence* to *Knowledge Management* and *Databases* [3].

Recently, the well-known ASP system DLV [8] has undergone an industrial exploitation by a spin-off company called DLVSYSTEM srl, favoring the interest of some industries in ASP and DLV, which has led to its successful usage in a number of industry-level applications [7]. A key advantage of DLV for applications development is its endowment with powerful development tools [5, 4], supporting the activities of researchers and implementors.

In the invited talk, after a brief introduction to the ASP standard language, we illustrate its usage for advanced Knowledge Representation and Reasoning by presenting a number of industry-level real-world applications of ASP, that we have implemented by using the DLV system and its accompanying tools, namely:

– A platform employed by the call-centers of Italia Telecom, which automatically classifies the incoming calls for optimal routing. The platform works in real-time and deals with a very large number of parallel calls.
– A novel architecture for closed domain question answering in natural language in the cultural heritage context. In particular, we implemented a template matching based on ASP for question classification and query extraction.
– A tool for travel agents for the intelligent allotment of touristic packages [?]. Basically, the system selects from service-suppliers blocks of touristic packages to be pre-booked for the next season in such a way that the expected earnings are maximized, and a number of preference criteria are satisfied.
– A tool for the automatic generation of the teams of employees [10] that has been employed in the sea port of Gioia Tauro for intelligent resource allocation.

Moreover, we overview two advanced development tools for ASP, namely AS-PIDE [5] and JDLV [4], that have been developed to address some of the difficulties encountered by applying DLV in the above mentioned applications. ASPIDE is an extensible integrated development environment for ASP, which integrates powerful editing tools with a collection of development tools for program testing and rewriting, database access, solver execution configuration and output-handling. JDLV is a plug-in for Eclipse, supporting a hybrid language that transparently enables a bilateral interaction between ASP and Java. The development tools support researchers and software developers and simplify the integration of ASP in mature widely-adopted development platforms based on imperative and object-oriented programming languages.

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