Distribution and Modularity in Nonmonotonic Logic Programming

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In the recent years, there has been a trend towards considering computation in a distributed setting, due to the fact that increasingly not only data is linked via media such as the internet, but also computational entities which process and exchange data and knowledge. This leads to the formation of (possibly complex) systems of interlinked entities, based on possibly heterogenous formalisms, posing challenging issues on semantics and computation. The concept of modularity, which in computer science and engineering is a key to structured program development, naturally links to this as a tool for defining semantics of distributed systems, and has been widely studied, e.g., in the area of ontologies. In line with the general development, distribution and modularity have been also been receiving increased attention in logic programming, at several levels of language expressiveness, from distributed (plain) datalog to advanced nonmonotonic logic programming semantics.

In this talk, we shall address the issue of distribution and modularity for logic programming under the answer set semantics, which is one of the most widely used semantics for nonmontonic logic programs do date and at the heart of the Answer Set Programming paradigm for declarative problem solving. It appeared that the issue of modularity for answer set semantics is nontrivial, due to its nonmonotonicity. For the same reason, also the issue of efficient distributed evaluation, assuming a reasonable behavior of the semantics for a program composed of distributed modules, is a challenging problem. We shall discuss these issues, pointing out that modularity and distribution admit different solutions for semantics, depending on the underlying view of a system of logic programs. We then illustrate this view on particular formalisms that have been developed at the Vienna University of Technology in the last years, including modular nonmonotonic logic programs (Modular ASP) and nonmonotonic multi-context systems (MCS). For these formalisms, various semantics have been developed, as well as experimental prototype implementations that take local or distributed evaluation into account, adopting different realization schemes. While considerable progress has been achieved, further work is needed to arrive at highly efficient solvers.

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