Chapter II

Experience With a Functional-Logic Multi-Agent Architecture for Medical Problem Solving

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INTRODUCTION

There exist various experiences in constructing applications in functional and logic languages alone as reported, e.g., in the conference series *Lisp and Functional Programming* and *Practical Applications of Prolog*, respectively. Applications in integrated functional-logic languages (Hanus, 1994) have been less frequent, however, and little has been reported about experiences with them. Historically, functional-logic languages started off with practically oriented, loose couplings of LISP and PROLOG components such as LOGLISP, and LISP-based hybrid expert-system shells often contained some PROLOG-like component. In the few applications written in these LISP-PROLOG couplings and shells, however, one of the integration partners was normally dominating. Later, theoretically oriented, tight syntheses of functional and logic components such as EQLOG were studied. Even in those syntheses that were really implemented, very few applications were
developed—apart from the published examples demonstrating the new paradigm. Later, the accumulated theoretical insights in functional-logic concepts and implementations have led to a new treatment of practical problems, as attempted, e.g., by ALF, BABEL, and RELFUN. For the problems attacked, an initial distinction between internal tools (e.g., the ALF compiler in ALF) and external applications (e.g., the RTPLAST selector in RELFUN) can be made. Application-oriented projects in whose context RELFUN has been developed have exerted some pressure to test its general concepts on the latter category, namely on real-world examples from technical modeling, mostly in mechanical engineering. Experiences with RTPLAST, a RELFUN knowledge base for selecting Recyclable ThermoPLASTtics that satisfy engineering requirements, have for example been reported at a materials-science conference (Boley et al., 1994).

The present paper reports on our experience with applying RELFUN (Boley, 1999) to problems in distributed medical care. This application arose “externally” in the original sense of the word: Massimiliano Campagnoli, working with the LISP-based expert-system shell KEE, supporting frames as well as forward and backward rules, noticed RELFUN on the net and switched to it, since frames are mappable into clauses and RELFUN’s rules offer more versatility than KEE’s. After his initial implementation of a RELFUN-based distributed medical-care system, he contacted the second author, further developing RELFUN, and the Pavia/Kaiserslautern teams joined forces, with the first author also being the expert in the medical domain.

Massimiliano Campagnoli and the authors then set out together on the implementation of a system composed of multiple communicating agents aimed at exploiting the rapidly emerging methodologies addressing computer supported cooperative work (CSCW) for the management of patients affected by acute myeloid leukemia (AML). AML was carefully selected as the application domain since it greatly emphasizes the need for different healthcare professionals to cooperate towards the achievement of a common goal. We first extended RELFUN with a powerful set of KQML (Finin et al., 1992) communication primitives, and then we implemented several agents, each one encapsulating the domain specific and the strategic knowledge belonging to a different professional. The overall prototype described in this paper illustrates the potential of a methodology which may also prove to be useful in improving the quality and reducing the cost-efficiency ratio of the healthcare delivery process by laying down new organizational infrastructures exploiting distributed information technology.
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