ADVANCED DATABASES AND METADATA

ERCIM News No.35 - October 1998

KINE - A Knowledge INtegration Environment

by Patrizia Asirelli

The main goal of the KINE project is to design and implement a programming environment for the 'semantic' integration of heterogeneous knowledge bases. Technology developed in the Logic Programming and Deductive (Logic-based) Database areas is being used. The programming language employed is MedLan, a Definite Deductive Database Logic language, which has been extended in order to handle multiple separate theories as a single database and furnished with a set of operators for the composition of logic theories. KINE is a three year collaboration between the IEI and CNUCE Institutes of the Italian National Research Council (CNR) and the Department for Computer Science of the University of Pisa; it is supported by the CNR Committee for Information Sciences and Technology.

Nowadays, there is a general tendency to re-organise and re-structure business and production agencies as nets of decentralized and autonomous units so that the resulting organizations are more flexible and better equipped to adapt to new and changing market requirements. One of the consequences of the Internet and Web revolution is that there is an increasing demand for knowledge and systems integration and this is expected to grow even more in the near future. The provision of semantic heterogeneity and secure integration of information sources/databases is thus crucial for the development of future distributed/ integrated/federated applications.
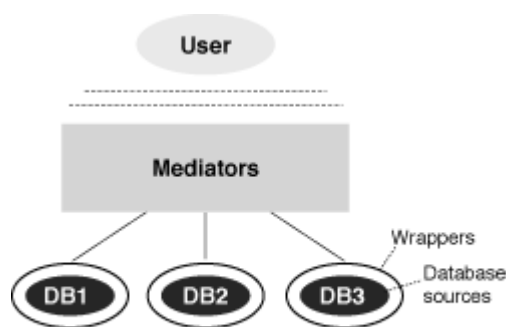
A Mediator Architecture.

The architecture for knowledge integration that we consider is a Mediator-like architecture (see Figure). In particular, wrappers are logic theories (programs) that define the meta-data, ie they map the relations of the different database sources into the general model of the integrated environment defined at the mediator level. Mediators are also logic theories (programs) and define the application environment for the resulting integration. The user interacts with this environment.

In this framework, the MedLan language is used to build a set of logical theories (mediators and wrappers) that constitute the middle layers of the integrated architecture. As can be seen in the figure, these layers stand between the database sources and the final user who can only see part of the information. Two aspects are merged: the semantic integration between database sources and the implementation of security policies.

MedLan has been given an operational and denotational semantics and a

kind of semi-naive implementation has also been defined. The extensions offered by MedLan with respect to classic deductive database languages consist in: the partitioning of the deductive database into a collection of theories; the operators to combine them: Union (U), Intersection (Ô), Constraint (/), and the in operator that implements a message passing feature.

The Constraint (/) operator is the most important of the MedLan operators for security aspects as it enables security policies to be easily included into a logic database. The in feature is also relevant since it permits a database to be split into a number of theories and then perform deduction over these theories when necessary. This aspect is very important since it allows a generalisation of distribution and integration over different databases.

Future work will include the study of different existing security models and enforcing policies, as documented in the literature, in order to evaluate the feasibility and the effectiveness of our approach in real systems.

The project has an application to GIS systems. The MedLan language has been implemented as an initial prototype to be used in an integration with the ARCHINFO GIS system. In parallel, MedLan has also been implemented within the GEDBLOG prototype system (a deductive database management system) that already presents some of the features of MedLan. In particular we are concentrating on the implementation of the in feature of MedLan. A Web version of the prototype (Jebdlog) can be seen at: http://mascagni.iei.pi.cnr.it/Jdblog/ webJedblog.html, and an example of an application example of the system can be found at: http://mascagni.iei.pi.cnr.it/flight.

KINE is a three-year project and is now entering its final year. It has benefited greatly from the strong tradition and the wealth of experience in the fields of Logic Programming and Logic Databases built up over the years here in Pisa.

Please contact:

Patrizia Asirelli - IEI-CNR
Tel: +39 0 50 593 477
E-mail: asirelli@iei.pi.cnr.it

return to the contents page