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Summary of the KEML-96 workshop, Paris, January 15–16, 1996, CNRS, Gif sur Yvette (Paris)

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The KEML (Knowledge Engineering Methods and Languages) workshop which took place in a suburb of Paris was the sixth in a series, and was preceded by workshops in Bonn (1991 and 1993), Karlsruhe (1992) and Amsterdam (1994 and 1995). Originally, the workshops were dedicated to formal specification languages for KADS models, but later the scope was widened to include methods and languages for Knowledge Engineering in general. However, the emphasis of the KEML workshops remains on formal languages and techniques, and this distinguishes it from the more general Knowledge Acquisition workshops such as KAW (Banff, Canada), EKAW (Europe) and JKAW (Japan).

Besides the annual workshop, the KEML community has a mailing list (subscribe by sending a mail to keml-request@swi.psy.uva.nl) and a home page on the World Wide Web (ftp://swi.psy.uva.nl/pub/keml/keml.html), where the proceedings of this workshop can be found.

This year's local organizer was Christine Pierret-Golbreich of the Laboratoire de Recherche en Informatique from the University of Paris-Sud. Members of the program committee were Christine Pierret-Golbreich (LRI), Dieter Fensel (University of Amsterdam), Enrico Motta (Open University, UK) and Mark Willems (Free University, Amsterdam).

Contributions came from six different countries: Canada (1), Egypt (1), France (5), Germany (1), the Netherlands (6) and the United Kingdom (3). There were about 30 participants.

In the following, we summarize the message of the three invited speakers, then discuss the workshop in a session-based manner, and finally, we list some general conclusions.

Invited speakers

Gilles Bernot (University of Evry, France) gave a talk on the role of formal specifications in Software Engineering. He argued in favor of special-purpose languages, rather than general-purpose languages. Special purpose languages enhance the readability of the specifications because many details can be left out, as they are embedded in the semantics of such languages. He argued also that during the refinement process from user requirements to an implemented system, validation has to take place as early as possible. This enables the correction of faults as soon as possible (i.e. in high-level specifications, rather than in the implementation).

John Fox (Imperial Cancer Research Fund, London) presented some of the work performed in his laboratory on medical KBS applications. A major challenge in their applications is to systematize treatment-procedures (protocols), which includes the management of patients over time (minutes or months). Doctors are beginning to accept that they need to access knowledge rapidly, that they need prompts and reminders of what to do when, that they need help in data-interpretation, and that they need computer-based checks on the appropriateness of their actions. Fox presented a general model for decision making (called DOMINO), and demonstrated two systems which were based on this general model (one for drug advice to a family doctor and one for treatment of asthma patients in an emergency ward).

Ian Filby (AIAI, University of Edinburgh) talked about the ESPRIT project "Euroknowledge", which aims at a European industrial standard for knowledge technology. The standard encompasses knowledge-level representation formalisms, knowledge-level ontologies and knowledge-level problem-solving models.

Sessions

Session 1: From specification to implementation

There are several ways to go from a conceptual model to an implemented system. B. Charreton (Centre d'Etudes de Saclay, France, "From knowledge specification to executable specification", B. Charreton, J.L. Ermine) presented the MOISE methodology which uses a graphical specification language and an Object-Oriented language for implementation. The VT-domain (Vertical Transportation) served as an illustration. Xavier Talon (LRI, University of Paris-Sud, "TASK, a framework for the different steps of a KBS construction", X. Talon, C. Pierret-Golbreich) presented the TASK-approach which describes a framework for the different steps in the construction process of a knowledge-based system (KBS). Three models are distinguished that are increasingly more specific descriptions of the KBS: TML (conceptual), TFL (formal: abstract data-types (ADTs)) and TASK+ (operational). In TASK, control knowledge can be specified deterministically or opportunistically. Eliana Coelho (University of Montreal, Canada, "From KADS models to operational problem-solving methods: perspectives on the domain view", E. Coelho, G. Lapalme, V. Patel) gave a concrete operationalization for the KADS domain view by distinguishing a small set of fixed operators ("satisfies", "inverse", "project", "compose", "rename") which are implemented in the KLONE-based language LOOM. The operators are used for the mapping from the inference layer to the domain layer which is illustrated with Cover & Differentiate.

Session 2: Specification of problem-solving methods

In this session, three of the four presentations were about assumptions of problem-solving methods (PSMs). The basic idea is that PSMs can be used to achieve goals under certain assumptions. Dieter Fensel (University of Amsterdam, "The Mincer metaphor for problem-solving methods, making assumptions for reasons of efficiency", D. Fensel, R. Straatman, F. van Harmelen) argued that PSMs can achieve goals in an efficient manner because of assumptions. He identified three types of assumptions, based on the architecture of a PSM. Richard Benjamins (University of Amsterdam, "Assumptions of problem-solving methods", V.R. Benjamins, C. Pierret-Golbreich) presented a similar organization of assumptions (about domain knowledge and about the goal to achieve). Emphasis was put on formalizing assumptions in such a way that it enables their automatic verification in a particular domain. Niek Wijngaards (Free University, Amsterdam, "Assumptions on the VT task model in DESIRE", F. Brazier, P. van Langen, J. Treur, N. Wijngaards) spoke about assumptions in general and distinguished three different levels which are respectively related to (1) the principles of task modeling, (2) the specification language DESIRE and (3) the specific application. All three talks used the VT-domain and the Propose & Revise PSM for illustration. In the fourth presentation, Frank van Harmelen (Free University, Amsterdam, "Formal specification of reflective agents", F. Brazier, J. Treur) explained how reflective agents can be modeled in DESIRE. To illustrate the approach, the "two wise men hat problem" was used.

Session 3: Semantics and proofs

Rix Groenboom (University of Groningen, the Netherlands, "A formal semantics and axiomatization for specifying the dynamics of knowledge-based systems", D. Fensel, R. Groenboom) presented MLCM++, a formal specification language based on algebraic states which gives

semantics for the specification of dynamic reasoning behavior of KBSs. MLCM++ can be used to specify the dynamic behavior of $(ML)^2$ and KARL, and, because MLCM++ is fully axiomatized, it provides a proof system for these languages. Christine Pierret-Golbreich (University of Paris-Sud, "Modular and Reusable Specifications in Knowledge Engineering: Formal Specification of Goals and their Development", C. Pierret-Golbreich) suggested a formalization of goals, that distinguishes between the "what" and the "how". In a step-wise refinement process, using ADTs, goals are made increasingly more specific. VT was used as an example. Mark Willems (Free University, Amsterdam, "Modelling Cooperative Behaviour for Resource Access in a Multi-Agent Environment", F. Brazier, P. van Eck, J. Treur) showed that DESIRE can be used to model a task as a collection of autonomous, interacting agents, as opposed to a task decomposition in which subtasks are executed in a fixed order. Manal Ismail (Atomic Energy Authority, Egypt, "Petri nets as a formal representation for dynamic object modelling", I. Manal, S. Akram, B. Osman) presented Petri nets as a formalism to model dynamic systems.

Session 4: Support for KBS development

Francoise Tort (LRI, University van Paris-Sud, "Semi-automatic Construction of a Reasoning Model", Tort F.) suggested how to (semi) automatically construct problem-solving methods based on input/output types of inference steps that can be recognized in the domain knowledge. Pat Fothergill (University of Aberdeen, UK, "RE-design knowledge representation with DEK-LARE", J. Forster, I. Arana, P. Fothergill) presented how the results of the ESPRIT project DEKLARE, which is concerned with supporting re-design of mechanical devices, can be applied to model VT.

Conclusions, further issues, future workshops, etc.

- The work on formal methods for Knowledge Engineering is still quite lively. The set of languages has stabilized, and the existing, actively used, languages are limited to a small number.
- The work on formal languages focuses on extensions and adaptations of existing languages. We can notice that these modifications are most of the time proposed by the developers of the languages (with the exception of KADS).
- People are looking more and more for practical applications of their languages. The VT-domain is often selected as an application. In this sense, the SISYPHUS-II experiment is a success.
- Besides formal languages and methods, other knowledge engineering topics also receive attention (which might indicate a possible overlap with the more general knowledge acquisition workshops).

The next KEML-workshop will probably take place in January 1997 at the Artificial Intelligence Application Institute (AIAI) in Edinburgh with Ian Filby and Enrico Motta as local organizers. By choosing for AIAI, we hope to attract more application-oriented researchers.