The INKASS Information Ontology for Knowledge Asset Trading

Andreas Abecker
Forschungszentrum Informatik (FZI) an der Universität Karlsruhe

Sylvio Tabor
DFKI GmbH Kaiserslautern

Ralph Traphöner, Jasmin Franz
Empolis Knowledge Management GmbH Kaiserslautern

Wolfgang Maass, Wolf-Christian Eickhoff
mcm Institut, Hochschule St. Gallen

1 Introduction

INKASS is an ongoing European RTD project that addresses the area at the intersection of Knowledge Management and Electronic Commerce (Apostolou et al., 2002; Inkass, 2002b). This area refers to the trade of explicit and implicit knowledge at an inter-organisational level. It addresses the opportunities and risks found in the purchase and selling of knowledge at the business-to-business (B2B) environment, the need for supporting long-lasting relationships of knowledge exchange, and the requirement for facilitating digital community contexts where knowledge seekers can find suitable knowledge providers, and knowledge providers can advertise and sell their knowledge. To this end, we develop a total solution consisting of:

- A managed repository of **knowledge products** providing **matchmaking facilities** between the knowledge requirements of buyers and the knowledge products provided by sellers.
- A **business and community infrastructure** to support members participating in knowledge exchange.
- An e-Commerce platform supporting **business models and pricing schemes** for knowledge products.

At the core of the above mentioned "managed repository" – which is implemented on top of Empolis' content management solutions - stands a catalogue of knowledge product descriptions which instantiate a metadata schema that we call **Information Ontology** (Abecker et al., 1998). In our talk we describe the current status of the work in progress on this Information Ontology. This shall be designed to act as a reference model for future Knowledge Trading projects. Details of our approach can be found in (Maass et al., 2003).

2 Existing Theories and Work

Since a couple of years there exists an active research community working on intelligent methods for e-Commerce solutions. Most of them focus on aspects of intelligent agents taking part in trading and negotiation processes (Dignum & Sierra, 2001; Moukas et al., 2000; Dignum & Cortés, 2001; Liu & Ye, 2001). Most of these works are more or less independent from the question which kinds of goods are traded, and virtually nobody explicitly takes into account the particularities of knowledge as a tradeable good. Hence, the resulting solutions neglect many efforts made in the Knowledge Management (O'Leary, 1998), the Digital Library[1], or the e-Learning[2] area dealing with the question how Knowledge Objects like, e.g., Lessons Learned (Aha & Weber, 2000), Experts' Skills, Intellectual Properties (IP, (Schaaf et al., 2002)), or Consulting Services are described best. Normally, the few existing knowledge marketplaces treat knowledge more or less like all other tangible goods, i.e. a knowledge

[1] See, for instance the Dublin Core Metadata Initiative, http://dublincore.org/
[2] See, for instance the IEEE Learning Object Metadata (LOM) Standard, http://ltsc.ieee.org/wg12/

object is represented by a simple, static metadata set, content is described by referring to a taxonomy of subject matters, few other attributes are provided, e.g., for quality assessments by simple Amazon-like five-star ratings.

(Kafentzis et al., 2002; Inkass, 2002) provide a detailed overview of existing knowledge marketplaces, including their Information Ontologies. In the work presented here, we aim at a comprehensive upper-level Information Ontology which covers the different most common knowledge products to be traded; which spans all relevant dimensions for Knowledge Object desription in a trading platform; which provides the representation means to plug-in and represent in a declarative manner evaluation, versioning, and trading aspects; and which is – in all dimensions - easily extensible with specific new attributes and specific ontologies describing the ranges of allowed attribute values.

Such a flexible knowledge representation scheme should allow, e.g., to plug-in easily relevant external developments, like the work presented in (Delgado et al., 2002) about ontologies for describing IPR issues, or Gordijn's work about service modelling (Gordijn, 2002). It should also make use of links between knowledge object descriptions, e.g., for bundling several isolated knowledge products into more complex aggregates which provide much more functionality and can be designed much better to serve specific customer needs.

3 Research Approach

As mentioned above, we develop methods and tools for a total Knowledge Trading solution, the technical core of which is an e-Commerce platform implemented using the commcercial e-Commerce middleware offered by Empolis[3]. This platform – based upon the Case-Based Retrieval approach to realize matchmaking between offers and demand – provides expressive means for describing structures of Knowledge Products and background knowledge for retrieval.

The idea of an Information Ontology was introduced by (Abecker et al., 1998) in the Knowledge Management area and normally referred to as a metadata schema in the Digital Library, or, e.g., the e-Learning areas. Its purpose is to provide a declarative specification of the knowledge representation schema used describing knowledge products and the related background knowledge. This shall be the basis for more content-type specific characterizations of knowledge products that allow better search and retrieval; it shall also be the basis for powerful new services (e.g. in the areas of collaborative filtering, or elaborated versioning and evaluation mechanisms); and it shall allow to transport easier an encapsulated Knowledge Object description from one trading platform to the other, because it is self-contained to a great extent.

In INKASS we followed a combined bottom-up / top-down approach to define a comprehensive Information Ontology for knowledge trading. Bottom-up means concretely that we analyzed the specific requirements of three real-world case studies to be implemented in the project, as well as the metadata schemas found in the existing marketplaces (Inkass, 2002). Top-down means that we analysed both what is provided in an "ideal" knowledge trading scenario and can be derived from our overall trading framework, and what metadata are foreseen in the Dublin Core Digital Library standard, the IEEE Learning Object Metadata standard, and two earlier industrial projects done by the INKASS partners.

4 Findings

The Inkass information ontology comprises the following metadata facets which will be discussed in more detail in our talk: (1) content description; (2) context description; (3) community aspects; (4) domain description; (5) history record; (6) evaluation aspects; (7) method aspects; (8) transition aspects; (9) business aspects; (10) legal aspects; (11) security aspects. In the talk we will discuss the definition of the several facets and concrete attributes plus ontologies characterizing the possible values for these attributes, we will show how these basic dimensions are concretely elaborated in two real-world INKASS pilot applications (one in the area of technology consulting about joining and welding, one in management consulting), and we will show how to implement the Information Ontology in the INKASS e-Commerce software.

[3] http://www.empolis.com

5 Conclusion

The presented Information Ontology is derived from a broad range of scientific and practical inputs thus guaranteeing a quite good coverage of applications. In our talk we can present first results from its practical usage in the INKASS pilot applications and can discuss its general contributions to Knowledge Trading as a basic enabling discipline for Agile Enterprises in the networked economy of tomorrow.

References

Abecker, A., et al. (1998): Towards a Technology for Organizational Memories. *IEEE Intelligent Systems,* 13(3), May/June.

Aha, D.W., & Weber, R. (Eds.) (2000): *Intelligent Lessons Learned Systems: Papers from the 2000 Workshop* (Technical Report AIC-00-005). Washington, DC: Naval Research Laboratory, Navy Center for Applied Research in Artificial Intelligence.

Apostolou, D., G. Mentzas, A. Abecker, W.-C. Eickhoff, P. Georgolios, K. Kafentzis (2002): Challenges and Directions in Knowledge Asset Trading. In: D. Karagiannis, U. Reimer (eds.): *PAKM2002 - Fourth International Conference on Practical Aspects of Knowledge Management*. Springer LNAI 2569.

Delgado, J., Gallego, I., Garcia, R., Gil, R. (2002): An Ontology for Intellectual Property Rights: IPROnto. In: *1st Int. Semantic Web Conference (ISWC2002).*

Dignum, F., Cortés, U., eds. (2001): *Agent-Mediated Electronic Commerce III.* Springer LNCS 2003.

Dignum, F., Sierra, C., eds. (20001): *Agent Mediated Electronic Commerce - The European AgentLink Perspective.* Springer LNAI 1991.

Gordijn, J. (2002): *Value based requirements engineering: Exploring innovative e-commerce ideas.* Ph.D. Thesis, Vrije Universiteit Amsterdam.

Inkass Project Team (2002): Survey of Knowledge Marketplaces. Inkass Whitepaper. URL: http://www.inkass.com/library.htm

Inkass Project Team (2002b): The e-Marketplace Evolution and the Emergence of Knowledge Marketplaces. Inkass Whitepaper. URL: http://www.inkass.com/library.htm

Inkass Project Team (2002c): Research Issues for Knowledge Marketplaces. Inkass Whitepaper. URL: http://www.inkass.com/library.htm

Kafentzis, K., Apostolou, D., Mentzas, G., and Georgolios, P. (2002): A Framework for Analysis and a Review of Knowledge Asset Marketplaces. In: D. Karagiannis, U. Reimer (eds.): *PAKM2002 - Fourth Int. Conference on Practical Aspects of Knowledge Management.* Springer LNAI 2569.

Liu, J., Ye, Y., eds. (2001): *E-Commerce Agents, Marketplace Solutions, Security Issues, and Supply and Demand.* Springer LNCS 2033.

Maass, W; Eickhoff, W.-C.; Stahl, F.; Schaefer, M.-F.: A Generic Structure for Information Objects in Knowledge Sharing and Trading Contexts. Mcm institute, University of St. Gallen, St. Gallen. mcminstitute-Working Paper 2003.

Moukas, A., Sierra, C., Ygge, F., eds. (2000): *Agent Mediated Electronic Commerce II - Towards Next-Generation Agent-Based Electronic Commerce Systems.* Springer LNCS 1788.

O'Leary, D. E. (1998): Using AI in Knowledge Management: Knowledge Bases and Ontologies. IEEE Intelligent Systems 13(3): 34-39.

Schaaf, M., Visarius, M., Bergmann, R., Maximini, R., Spinelli, M., Lessmann, J., Hardt, W., Ihmor, S., Thronicke, W., Franz, J., Tautz, C., Traphöner, R. (2002): IPCHL - A Description Language for Semantic IP Characterization, Forum on Specification & Design Languages, September 2002.