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Using Process Modeling for Well-Directed Distribution of Knowledge Assets

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Abstract Knowledge is a very key in nearly every business process. The flow of knowledge in process is supported by various so called knowledge assets which embody either implicit knowledge which is bound to persons or explicit knowledge which is incorporated in organizational documents, handbooks or code artifacts. A large store of knowledge assets, however, is worthless, if these assets stay unused. Thus, the hot-spots of creation and distribution of knowledge have to be identified and assigned to the respective assets. As a consequence, the techniques used to store knowledge assets and to make them available has to go hand in hand with the support for the organizational distribution of knowledge assets in business processes.

Key Words: Knowledge modeling, information assets, knowledge distribution, knowledge management system integration
Category: H.1, K.6.1

1 Introduction

Business processes become more knowledge intensive. Two different approaches have evolved to deal with knowledge management [Mentzas et al., 2003]. The first approach is product-centred and results from the pragmatic gathering of knowledge and its representatives. It is basically concerned with the creation and use of knowledge artifacts within the company. The second, more process-centred approach regards knowledge management as related to stepwise fulfillment of tasks by different collaborating knowledge workers. Several varieties of both approaches exist. The knowledge management approach by Davenport [Davenport and Prusak, 2000] tries to improve business processes themselves, many other approaches based on the work of Davenport have evolved (see [Remus, 2002] for a good overview of the topic), though still problems dealing with the creation and distribution of knowledge within those processes exist. Knowledge assets, however, and the knowledge processes, which produce these assets and make use of them, cannot be considered in isolation

The approach described in this contribution combines product- and process-oriented knowledge management based on the knowledge modeling description language KMDL ®[1] and the infoAsset Broker software. The KMDL ® is used

[1] KMDL ® is a registered german trademark under the DPMA number 30470023.1

to elicit processes and data used in the infoAsset Broker. The following sections 2 and 3 describe the two approaches in short, only mentioning their features relevant for the combination focussing on codification and personalization [Hansen et al., 1999]. Section 4 describes the advantages of an integration of both approaches with a focus on modeling and supporting processes equipped with actual knowledge assets. The paper closes with a description of steps that have been carried out so far in order to implement the integration of the KMDL ® into the infoAsset Broker.

2 Knowledge Modeling Description Language

The knowledge modeling description language KMDL [Gronau and Weber, 2004] is a graphical description language used to model business processes. It has the capability to model tasks and information needed within those tasks connected in sequential process-chains. Additionally, tasks are carried out by certain roles. These roles, e.g. software developer, are equipped with special requirements needed for fulfilling a task, the so called role requirements. Persons can be assigned to roles and are connected to knowledge objects, which hold a description of their tacit knowledge combined with a degree describing how solid their respective knowledge is. Knowledge objects describe a person's ability to fulfill the requirements of the assigned role. Those six objects form the very foundation of the KMDL ®. Furthermore, the method can model all four knowledge conversions as described by [Nonaka et al., 2000]. Therefore, the modeling expert can describe knowledge flows along business processes, hot-spots where new knowledge is interchanged between persons, new knowledge is created and knowledge is needed. Furthermore, an anti-pattern system supports finding generic weaknesses in knowledge-intensive processes [Gronau and Uslar, 2004].

3 infoAsset Broker

The infoAsset Broker is a standard software for the realisation of organisational knowledge portals [Raulf et al., 2001]. It follows the product-oriented knowledge management approach by providing access to a variety of different knowledge assets as e.g. explicit knowledge contained in documents, implicit knowledge represented by persons equipped with certain skills, but also knowledge about projects or about other organisations appearing as either project partners or competitors. One central type of knowledge asset is given by the concepts relevant in the organisation, which are closely connected to the other assets in the portal. E.g. a concept could represent the topic of a document, a skill of a person or the application domain of a project.

The infoAsset portal links different knowledge assets by providing paths between them. E.g. a user could navigate from a person to a document authored

by this person, then find a concept which is one of the document's topics and finally look up all the projects which have been accomplished within the respective subject area. In addition to navigation the infoAsset Broker also supports direct search for the different assets. The assets visited by the user can be stored within personal portfolios making up personal reference libraries for the tasks at hand. Against this background the infoAsset Broker in fact enables knowledge intensive business processes. These processes, however, are not actively supported by the system, but are initiated by the user himself, step by step collecting the required knowledge.

4 Integration of the two techniques

Collecting knowledge as can be done with the infoAsset Broker has to be regarded as only one constituent of organisational knowledge management where knowledge has to be gathered in dependence on the organisation's requirements and has to be brought to the right desk at the right time.

Modeling knowledge-intensive business processes with the KMDL ® can have a stake in improving knowledge management within the organisation. However, modeling can be time consuming and expensive. It has to be based on the experiences of all knowledge workers concerned with the respective process and has to integrate their different ways of using knowledge. Furthermore, modeling is only an initial step which has to be followed by an implementation of the resulting models embedded in an overall knowledge management strategy.

Hence, integrating KMDL ® knowledge modeling with knowledge collection and use in infoAsset portals represents one step further towards a holistic organisational knowledge management. In our approach infoAsset portals serve as both source and destination of the KMDL ® knowledge modeling activity. On the one hand, the portal is the place where knowledge intensive business processes already happen, yet in an uncontrolled way. The observation of these processes can provide a first basis for modeling. On the other hand, process models describe what kind of explicit and implicit knowledge is needed and can therefore be used as a means to steer processes within the portal in several ways.

4.1 Modeling support by monitoring infoAsset Broker activities

Modeling knowledge intensive business processes with KMDL ® means becoming aware of what kind of documents are used and produced within these processes, who is involved and what kind of expertise the respective persons need. Sometimes the answer to these questions is not obvious, but could be derived from monitoring daily business within a knowledge portal such as the infoAsset Broker. The following facts could be collected within infoAsset portals in order to support KMDL ® modeling:

– In an infoAsset portal persons can declare themselves as experts with regard to certain knowledge concepts. In a KMDL ® context, the relationships between a person and a set of knowledge concepts signify this person's capability to fill a certain role and to carry out the related task in the modelled process.

  In addition to relying on persons to explicitly nominate themselves as experts the infoAsset Broker's data model also allows for drawing conclusions from persons being authors of documents or being rated as experts for a certain concept by other persons. From this information an even broader pool of rolefillers can be derived and also be visualized for knowledge management strategists in an expert map which graphically assigns persons to knowledge regions.

– In an infoAsset portal persons consume existing and produce new documents. Both relationships are explicitly represented by the underlying datamodel and can thus be explored for the creation of KMDL ® models. Knowing who searched for a certain document or who is the author of another document, this person can be interviewed to find out in what kind of knowledge intensive process the respective documents were used or produced. The process carried out in reality therefore serves as an example for an abstract model of a number of processes with tasks named by the knowledge worker and the information connecting those tasks given by portal documents.

  In a next step, the infoAsset Broker can be extended by a functionality to automatically record different steps in a knowledge process as for example searching for documents, navigating through several concepts, downloading existing documents, or uploading new documents. The record of such steps can then be used for automatically deriving a KMDL ® model of the respective process.

The specified aspects can serve as first examples of how to use an infoAsset portal as source for modeling knowledge processes with KMDL. As the underlying data model enables a variety of relationships between documents, persons, concepts, and further knowledge assets, other monitoring strategies can be imagined.

4.2 Process support by using KMDL models as basis for knowledge processes

Knowledge processes within infoAsset portals are usually not subject to any superordinate coordination but take place in an explorative manner exclusively steered by the knowledge worker himself. Relying on a preexisting process model expressed in the KMDL ® the process can take place in a more goal-oriented

way. The infoAsset Broker can for example be extended by the following functionalities in order to benefit from KMDL ® models:

- When a user carries out certain activities within an infoAsset portal he can specify the KMDL ® process in which he is currently engaged in order to influence his activity. E.g. he might name the process or a task within the process when searching the portal for documents or experts. The underlying retrieval algorithm will then make use of the given information and produce a result list adequate for the specified process or task.
- A user could furnish his working environment with regard to a special KMDL ® process decription. When he instantiates the process within the infoAsset portal, a new personal portfolio containing links to all documents required and to all people being capable to fill certain rolls within the process is generated. This portfolio also contains hints stating which knowledge asset is needed for which task.
- KMDL ® diagrams can be stored as graphical representations of knowledge processes with underlying links directly leading to documents, experts, or search forms already filled in. In this context KMDL ® diagrams can serve as graphical support for process oriented navigation and retrieval based on the current holding of the portal.

The listed examples reveal the spectrum of methods for steering processes within a knowledge portal which reach from the simple support of single tasks or subtasks up to the support of whole processes in the sense of knowledge workflow support. Their use has to be customized according to the requirements of the organisation and to the nature of the knowledge processes to be carried out.

4.3 Implementation Experiences

A first step towards the realisation of the goals described above is the extension of the infoAsset Broker's object-oriented data model as depicted in figure 1. Within this data model all relevant kinds of information and knowledge assets are represented by subclasses of the class *Asset* [Wegner, 2002]. The basic characteristic of an asset is that it can be described and linked to other assets. For the sake of clarity the specialisation relationship between the class *Asset* and its subclasses has been omitted in figure 1. As a matter of fact, all of the classes in the figure are direct or indirect subclasses of *Asset*. This holds also true for most of the classes representing relationships between different assets. The class *Expertise* describing existing knowledge of a person with regard to a certain concept in the lower right of figure 1 is one example of a subclass of *Relationship*, which itself again is a direct subclass of *Asset*. Relationships can therefore be

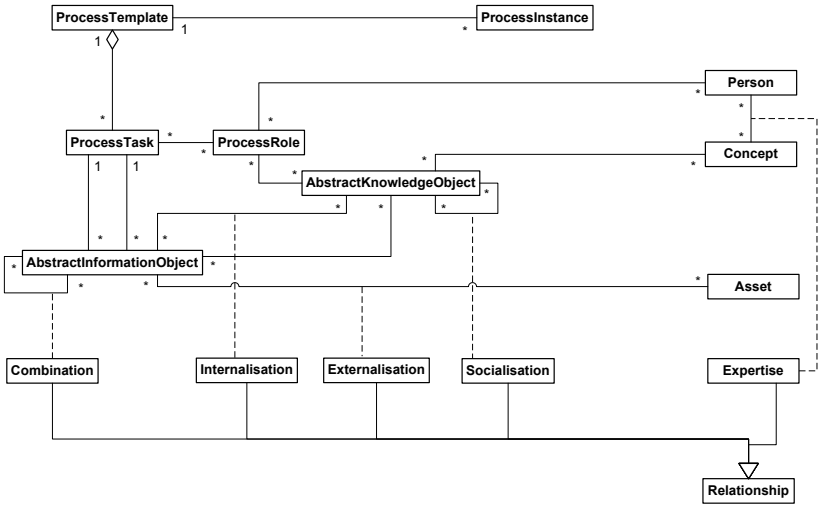

Figure 1: Introducing processes into the infoAsset Broker's data model

used like all other assets within the infoAsset Broker, e.g. be described, stored in portfolios etc.

The structure given by the data model enables the seamless integration of additional assets and relationships into the system and was used to extend the data model by knowledge intensive processes. The five rightmost classes in figure 1 are classes from the original infoAsset Broker data model also relevant for the implementation of knowledge-intensive processes. All other classes in the figure have been added in order to bring KMDL ® representations into the system.

KMDL processes are represented by the *ProcessTemplate* class. Like in KMDL ® a process template consists of a number of *ProcessTask*s. Information objects are represented by the class *AbstractInformationObject* and are related to process tasks in a twofold way. On the one hand they provide input necessary for a task, on the other hand they contain the output delivered by the task. Information objects can be subject to the knowledge conversion of combination as described by [Nonaka et al., 2000]. Carrying out a process task a person needs to fill a certain role which calls for a number of skills or knowledge objects respectively represented by the class *AbstractKnowledgeObject*. Knowledge objects can be converted into each other by socialisation. The conversion from knowledge objects into information objects and vice versa happens by externalisation and by internalisation respectively.

In the context of the infoAsset Broker, KMDL ® information objects are instantiated by arbitrary *Asset*s. In most cases these *Asset*s will be documents, but a number of other *Asset*s e.g. project metadata, forum messages, or user annota-

tions can also be imagined to serve as information objects within a knowledge-intensive process. KMDL ® knowledge objects are instantiated by infoAsset Broker *Concept*s because *Concept*s amongst other things can be related to *Person*s, hence representing people's expertise. Finally, KMDL ® roles are filled by *Person* objects. The infoAsset Broker's *Expertise* relationship can be used to deduce which *Person*s hold the tacit knowledge described by the knowledge object and thus required for the process task.

As the notion of a process template implies, KMDL ® descriptions serve as more or less abstract patterns which can be instantiated by process instances which are then actually accomplished. An example for a process template could be "Requirements engineering in software projects". This template could then be instantiated by an actual process like e.g. "Requirements engineering in the Electricity Ltd. project". Our implementation distinguishes between *ProcessTemplates* and *ProcessInstances* and represents them by special *Asset* classes, as the description of both of them within the infoAsset Broker can be valuable for an organisation's knowledge and process management.

Unfortunately, KMDL ® does not make any difference between abstract knowledge and information objects and their actual instances, as opposed to distinguishing between roles and persons. Hence, a KMDL ® model does not describe whether information and knowledge objects have to be instantiated or already represent the final instances. The above example process template "Requirements engineering in software projects" might e.g. require "domain knowledge" as knowledge object, which has to be considered an abstract knowledge object, which has to be instantiated within the process instances. The process instance "Requirements engineering in the Electricity Ltd. project" might for example refine "domain knowledge" by "knowledge of the energy sector". Our implementation is aware of the difference between abstract objects and their instances and supports the user in deciding whether the instantiation has to take place within the process template or the process instance.

Using the data model as described above we have started to implement our ideas of the integration of product- and process-oriented knowledge management. As a starting point we have chosen to store graphical KMDL ® representations together with further textual process description as mentioned in section 4.2. Furthermore, we have connected these representations to other assets relevant in this context.

5 Conclusion

Process-oriented and product-oriented knowledge management offer different views on knowledge intensive work. The combination of both approaches enables both the enrichment of process modelling with underlying information extracted

from knowledge processes actually taking place within an organisation as well as the goal-oriented use of knowledge portals in order to find information and knowledge objects required for the task at hand.

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