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Supporting Knowledge Work with Knowledge Stance-Oriented Integrative Portals

Thomas Haedrich
Martin Luther Universitat Halle-Wittenberg, haedrich@wiwi.uni-halle.de

Torsten Priebe
Martin Luther Universitat Halle-Wittenberg, torsten.priebe@wiwi.uni-regensburg.de

SUPPORTING KNOWLEDGE WORK WITH KNOWLEDGE STANCE-ORIENTED INTEGRATIVE PORTALS

Hädrich, Thomas, Chair for Management Information Systems, Martin-Luther-University Halle-Wittenberg, D-06099 Halle (Saale), Germany, haedrich@wiwi.uni-halle.de

Priebe, Torsten, Department of Information Systems, University of Regensburg, D-93040 Regensburg, Germany, torsten.priebe@wiwi.uni-regensburg.de

Abstract

Portals are an enabling technology for knowledge management (KM): They provide users with a consolidated interface that allows accessing various types of structured and semi-structured information. From the view of KM, their success depends not only on their ability to provide information and knowledge depending on the user's tasks in business processes (exploitation of knowledge) but also on their ability to support unstructured, creative and learning-oriented actions of knowledge work (exploration of knowledge). However, knowledge management lacks concepts for integrated support of these orientations of knowledge work. The concept of knowledge stance is seen as a promising starting point. This paper presents the INWISS portal prototype that employs Semantic Web technologies for context-based integration of various information sources and applications on a semantic level and discusses extensions to this portal for the support of knowledge stances.

Keywords: Knowledge Work, Knowledge Stance, Portals, Context.

1 INTRODUCTION

Knowledge work can be characterized by a high degree of variety and exceptions, strong communication needs, weakly structured processes, networks and communities and as requiring a high level of skill and expertise as well as a number of specific practices (Schulze, 2003). Process-oriented knowledge management (KM) suggests to focus on enhancing efficiency of knowledge work in the context of business processes and by this way to link KM efforts to the value chains of organizations (Edwards & Kidd, 2003; Maier & Remus, 2003). Various types of information and communication technologies (ICT) are deployed to support knowledge work, ideally forming an enterprise-wide knowledge infrastructure (EKI) (Maier, Hädrich, & Peinl, 2005). Portals are an important part of the EKI since they provide users with a consolidated, personalized interface that allows accessing various types of structured and semi-structured information as well as applications simultaneously. Models are a foundation to design supporting ICT in general and integrative portals in particular. However, process-oriented KM lacks ways to model knowledge work in the context of business processes, especially the knowledge-oriented actions connected to the tasks accomplished in business processes. Here, the concept of knowledge stance can be seen as a promising starting point (Hädrich & Maier, 2004). This paper discusses how the concept of knowledge stance can be applied for designing integrative portals. It presents the results from implementing a portal prototype that deploys Semantic Web technologies to integrate various information sources and applications on a semantic level (Priebe, 2004; Priebe & Pernul, 2003) and discusses extensions for supporting knowledge stances.

The remainder of this paper is organized as follows: The concept of knowledge stance is outlined in section 2 together with its conceptual foundations. Section 3 presents the INWISS knowledge portal prototype and how it applies Semantic Web technologies to provide a context-based portlet integration approach. Section 4 proposes extensions to the portal based on knowledge stances and discusses how these could be implemented. Section 5 concludes the paper and gives an outlook on future research.

2 MODELING KNOWLEDGE WORK

Modeling approaches applied in KM can be classified according to the concepts that they primarily emphasize into four categories: (1) person (e.g., communication relationships and structural organization), (2) process (e.g., business processes and tasks), (3) topic (e.g., knowledge structure defined by an ontology) and (4) tool (e.g., software architecture and interaction of components) (Maier, 2004). From the view of KM, particularly the interconnections between concepts in these categories are of interest, e.g., “Markus Schmidt” (person) is experienced in “project management” (topic). When choosing a process-oriented KM approach, the relationships between the categories process and topic are of primary interest, i.e. the link between functions and tasks accomplished in business processes and the knowledge applied and created in this context. This section describes two perspectives on knowledge work that correspond to these two categories: a process-oriented and an activity-oriented perspective. The concept of knowledge stance is one possible way to connect these perspectives.

2.1 Process Modeling vs. Activity Modeling

Examples for traditional process modeling approaches are ADONIS (Junginger, Kühn, Strobl, & Karagiannis, 2000), ARIS (Scheer, 2001), IEM (Spur, Mertins, & Jochem, 1996), MEMO (Frank, 2002), PROMET (Österle, 1995), SOM (Ferstl & Sinz, 1994), UML-based process modeling (Oestereich, Weiss, Schröder, Weilkiens, & Lenhard, 2003) and IDEF. Examples for approaches that extend process modeling for KM are ARIS with extensions (Allweyer, 1998), PROMET®I-NET (Bach & Österle, 2000; Kaiser & Vogler, 1999), GPO WM (Heisig, 2002), KMDL (Gronau, 2003), Knowledge MEMO (Schauer, 2004) and PROMOTE (Karagiannis & Woitsch, 2003). Main extensions are the introduction of additional object types like knowledge object, i.e. topics of interest, documented knowledge, and skill as well as the introduction of model types like knowledge structure diagram and communication diagram. Even though the added concepts describe a portion of the context of knowledge work, they are not suited to model the often unstructured and creative learning and knowledge practices in knowledge work and particularly their link to business processes.

Activity theory has been proposed to guide the analysis of knowledge work (Blackler, 1995) and to design of information systems (Clases & Wehner, 2002; Hasan & Gould, 2003; Kuutti, 1997). The underlying thesis is that knowledge is not an object, a passive unit. Rather, the processes of knowing and doing take place in so-called activity systems (Blackler, 1995) which are the basic unit of analysis of activity theory. The core idea of activity theory is that human activity is a dialectic relationship between individuals (called agents or subjects) and objects (the purpose of human activity) that is mediated (a) by tools and instruments like language and technologies and (b) by communities of people that are involved within the transformation process of the activity (see figure 1). The relation between subject and community is determined by implicit or explicit social rules. A division of labour (e.g., role system) defines the relation of the community to the object of the activity system. The outcomes of the activities’ transformation process are intended or unintended results.

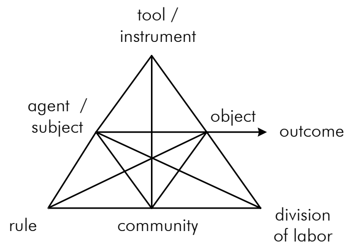

Figure 1. Socially-distributed activity system (Blackler, 1995; Kuutti, 1997)

Another important feature of activity theory is that activities have a hierarchical structure: (1) The activity is driven by a common motive which reflects a collective need and the reason why the activity exists (Engeström, 1999). (2) It is accomplished by actions directed to goals coupled to the motive of the activity. Actions consist of an orientation and an execution phase: the first comprises the planning for action, the latter its execution by a chain of operations (Kuutti, 1997). Repeated exercise leads to better planning of the action that then can be conducted more successfully. Due to learning and routinization, the planning phase can become obsolete and actions collapse into operations. (3) Operations are executed under certain conditions. They are clearly structured and can easily be automated. These levels are characterized by a dynamic relationship: Elements of higher levels collapse to constructs of lower levels if learning takes place. They unfold to higher levels if changes occur and learning is necessary. Activity modeling comprises identification of activity systems together with their context and history. It emphasizes analysis of the mediating relationships and tensions between their constituting components and other activity systems.

Compared to process modeling, activity theory contributes the concept of mediation, consideration of individual and group motives, the notion of communities and ways to conceptualize learning by routinization. The concepts provided by activity theory are well suited to analyze the creative, unstructured and learning-oriented practices of knowledge work. However, activities primarily aim at the joint creation of knowledge (exploration of knowledge). They lack integration with the value chain and it is not ensured that they are oriented towards creating customer value (exploitation of knowledge). Therefore, concepts of process and of activity modeling have to be combined in order to get a more comprehensive picture of knowledge work in a business context.

2.2 The Concept of Knowledge Stance

As we have seen, activity modeling differentiates between the levels motives, goals and conditions. Approaches for process modeling distinguish between three corresponding levels of granularity: (1) Value chains arrange value-adding activities (Porter, 1985), (2) business processes connect functions and (3) workflows orchestrate tasks. Figure 2 contrasts both perspectives. An important difference is that in the process-oriented perspective, a change from a higher to a lower level corresponds to refinement whereas in the activity-oriented perspective this is associated with routinization. We propose to connect both perspectives on the level of goals by the concept of knowledge stance.

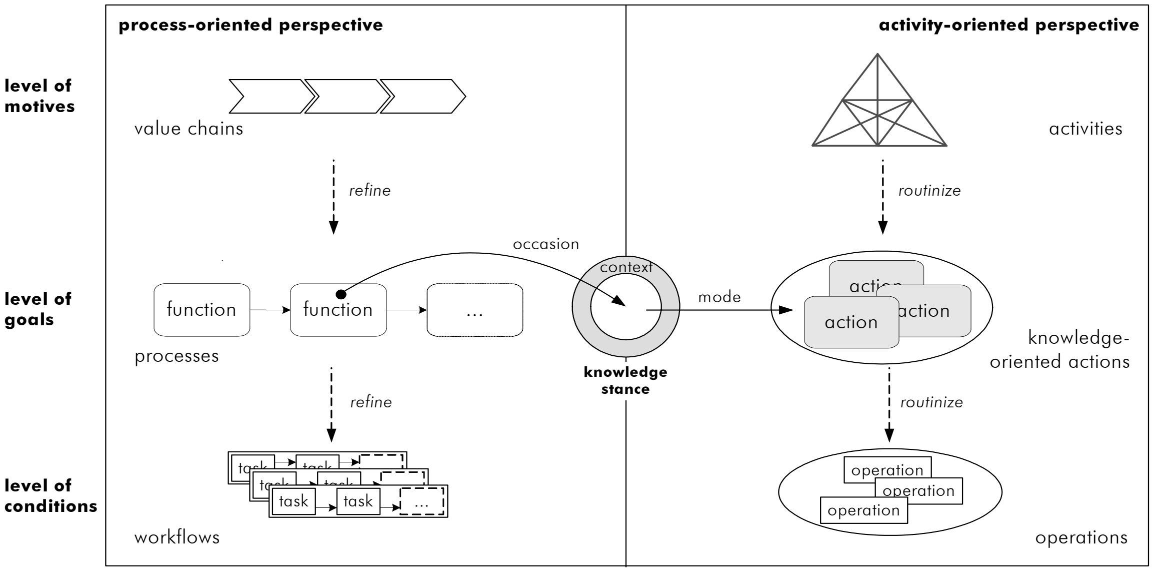

Figure 2. Concept of knowledge stance

A knowledge stance is a class of recurring situations in knowledge work defined by occasion, context, and mode resulting in knowledge-oriented actions (Hädrich & Maier, 2004). It describes a situation in which a knowledge worker can, should, or must switch from a business-oriented function to a knowledge-oriented action. In a process-oriented perspective, an employee accomplishes functions on the level of goals that belong to a value chain on the level of motives by fulfilling a sequence of tasks on the level of conditions. Simultaneously, she can be involved in an activity framing knowledge-oriented actions and corresponding operations. It can (a) be focused on the business process or (b) pursue a motive not related to the business process (e.g., an effort to build competencies) and thus may make a direct or a more indirect contribution to the process goal.

A business process offers several occasions to learn and to generate knowledge related to the core competencies of the organization. Occasions trigger knowledge stances and are associated with the functions of the business process by offering the opportunity or the need for knowledge-related actions. A knowledge stance is not limited to the generation of knowledge, but may also include the translation and application of knowledge created outside the knowledge stance.

The context includes all dimensions suitable to describe the current situation of the worker. It comprises the process context consisting of elements such as involved organizational units, roles, and resources as well as elements of the activity context, e.g., purpose and outcomes of related activities as well as participating communities. Additionally, person-related data and information such as required skill level and communication relationships between roles are part of the context.

The mode classifies what actions can be performed and refers to four informing practices (Schulze, 2000; Schulze, 2003): (a) expressing is the practice of self-reflexive conversion of individual knowledge and subjective insights into informational objects that are independent of the person, (b) monitoring describes continuous non-focused scanning of the environment and gathering of useful “just in case”-information, (c) translating involves creation of information by ferrying it across different contexts until a coherent meaning emerges, and (d) networking is the practice of building and maintaining relationships with people inside and outside the organization.

During the process of modeling, context, mode and occasion are means to specify the set of available, allowed or required knowledge-oriented actions. Examples for actions are evaluate source, indicate level of certitude, compare sources, link content, relate to prior information, add meta-data, notify and alert, ask questions, and offer interaction (Eppler, 2003). In contrast to the clearly defined sequences of functions in the process-oriented perspective, there is no predetermined flow of actions. They are accomplished by executing operations suited to serve the goals of the action. Table 1 summarizes the components of a knowledge stance.

Component	Description
Occasion	is a type of opportunity to learn and to generate knowledge related to the (core) competencies of the organization within the function of a business process.
Context	describes the actual work situation, i.e. process context, activity context and person-related information
Mode	classifies knowledge-oriented actions into ex-pressing, monitoring, translating and networking.
Action	refers to an unstructured knowledge-oriented action and is specified by occasion, context and mode.

Table 1. Components of the knowledge stance

An example for a knowledge stance is “learning about product features”, which is related by the occasion “product introduced by vendor” to the procurement process of a company that sells home electronics. It is linked to an activity that aims at gathering knowledge about relevant products and their features and thus related to the core competency “offering the right product at superior prices to the customer”. Shop assistants involved in the sales process and consigned with the tasks to consult customers are part of this activity. The knowledge stance thus links multiple processes, activities and people in support of learning and generation of new knowledge. Examples for knowledge-related actions triggered by the knowledge stance are “contact a shop assistant”, “look-up information about product features” as well as “access guidelines regulating the company’s procurement process”.

2.3 Supporting Knowledge Stances with ICT

We propose the following steps to model knowledge stances and to design supporting ICT systems:

1. Activities are identified by analyzing the core competencies of the organization and by identifying groups and communities concerned with developing knowledge related to them.
2. Selected business processes are detailed and their functions are analyzed with regard to occasions to learn or to generate new knowledge relevant to develop these core competencies. Here, knowledge stances are linked to the process.
3. The context of each knowledge stance is defined based on elements of the process-oriented and activity-oriented perspective.
4. Knowledge-oriented actions triggered by the occasion are defined and linked to the knowledge stance.

Knowledge stances can be supported at different levels and by different means, e.g., by portals or workspaces that bundle KM functions and filter content for knowledge stances, by user agents that guide through an action, by workflows that routinize parts of actions or by functions that enable for communication and collaboration between individuals that is triggered by the knowledge stance.

Ideally, an integrative knowledge portal provides a platform with advanced knowledge services for publication, discovery, collaboration and learning, which brings together the various heterogeneous data and information sources and applications of the organization (Priebe & Pernul, 2003). Ontologies help to organize and link knowledge elements from multiple systems on a semantic level, represent the semantics of the organizational knowledge base and to structure the context of the knowledge elements. Thus, it seems to be fruitful to apply the concept of knowledge stance to an integrative portal. Semantic Web technologies play a crucial role for the integration of system functions and information sources on a semantic level and for representing and transferring the context.

3 INWISS – AN INTEGRATIVE ENTERPRISE KNOWLEDGE PORTAL

Using web-based technologies, knowledge portals are an emerging approach for providing a single point of access to various information sources and applications. Today’s portal systems allow combining different portal components, so-called portlets, side by side on a single portal webpage (Wege, 2002). However, there is only little interaction between those portlets, which means that the user needs to manually transfer the context. Earlier, we presented an approach for integrative knowledge portals communicating the user context among portlets using Semantic Web technologies (Priebe & Pernul, 2003). For example, the query context of a reporting portlet, i.e. the information shown within a certain online analytical processing (OLAP) report (Chaudhuri & Dayal, 1997), can be used by a search portlet to automatically provide the user with related intranet articles or documents. The approach is implemented within the INWISS knowledge portal prototype[1] (Priebe, 2004).

The use of Semantic Web technologies within knowledge portals has also been proposed in other works such as SEAL (Stojanovic, Maedche, Staab, Studer, & Sure, 2001). There however, metadata and ontologies are only used for content management and searching. Within INWISS we use a

[1] http://www.inwiss.org, last accessed April 1, 2005

semantic representation of the user context to allow portlets to communicate with each other. Context in this case means roles and task descriptions, but also and in particular information revealed by the current interaction of a user with the system (see section 4.1) in contrast to work on context mediation and interchange for data integration (Tan, Madnick, & Tan, 2004) which considers an application rather than user context.

3.1 Context-based Portlet Integration and Retrieval

Current portal systems provide only limited inter-portlet communication capabilities. If they are offered at all, they require extensive individual programming and are not suitable for portlets that are supposed to be deployed as standard software components. The IBM WebSphere Portal[2] provides a concept called Click-to-Action and Cooperative Portlets which add advanced capabilities for managing portlet messaging. The communication paths between portlets no longer have to be explicitly coded but can be bound dynamically, i.e. the communication targets do not need to be known when the portlets are developed. However, interpretation of messages and back-end integration is not addressed by IBM. The SAP Enterprise Portal[3] provides a technology called Drag&Relate. It allows dragging objects from a portlet onto a navigation panel invoking certain navigation actions. Drag&Relate only works for special Unifier iViews (portlets), which can be used to access (and combine) information from structured data sources such as relational databases or legacy systems. It handles the backend integration by means of a so-called unification server. However, it cannot be used to integrate third party portlets, especially those of standard software vendors.

Our generic portlet integration approach within INWISS is based on communicating the user context among portlets, utilizing Semantic Web technologies for context representation and back-end integration. Usually, portlets only provide their portlet content for rendering the user interface (Wege, 2002). In addition, we introduce a context management service, where portlets can publish their current context, i.e. a semantic representation of what the user sees. Other portlets can pick that context up and use it to display related information. Figure 3 shows the overall architecture of our context-based portlet integration.

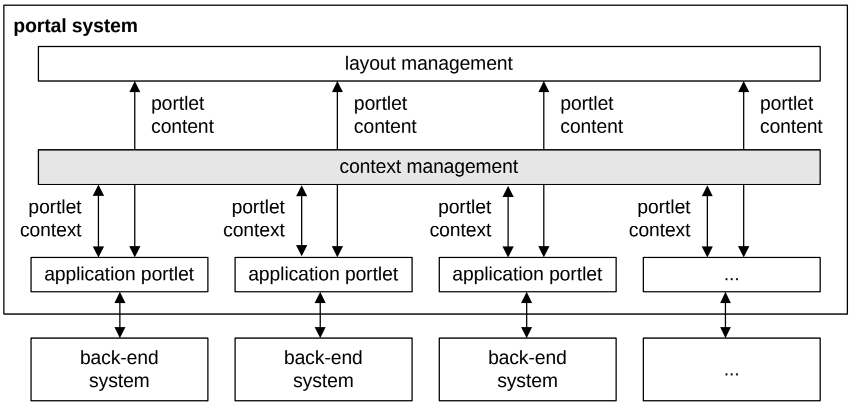

Figure 3. Architecture for context integration

In order to be able to map the semantics of context elements between portlets, we base our approach on Semantic Web standards and technologies. The main idea is to use the Resource Description Framework (RDF) (W3C, 2005) to represent the context, i.e. portlets should annotate their content with RDF metadata. For example, if a user displays an OLAP report, the context can be represented as the set of elements such as product categories shown on the report (see figure 4) or a portlet

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[2] http://www.ibm.com/software/genservers/portal/, last accessed April 1, 2005
[3] http://www.sap.com/solutions/netweaver/enterpriseportal/, last accessed April 1, 2005

representing a customer relationship management (CRM) system displaying information about a certain customer can point to a customer object to represent its context.

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:mstr="http://www.microstrategy.com/terms/">

<rdf:Description>
  <mstr:metric rdf:resource="http://www.microstrategy.com/metrics/DollarSales"/>
  <mstr:element rdf:resource=
    "http://www.microstrategy.com/elements/Quarter_199801"/>
  <mstr:element rdf:resource=
    "http://www.microstrategy.com/elements/Quarter_199802"/>
  <mstr:element rdf:resource=
    "http://www.microstrategy.com/elements/Quarter_199803"/>
  <mstr:element rdf:resource=
    "http://www.microstrategy.com/elements/Quarter_199804"/>
  <mstr:element rdf:resource="http://www.microstrategy.com/elements/Subcategory_1"/>
  <mstr:element rdf:resource="http://www.microstrategy.com/elements/Subcategory_7"/>
  <mstr:element rdf:resource="http://www.microstrategy.com/elements/Subcategory_9"/>
</rdf:Description>

</rdf:RDF>
```

Figure 4. Sample portlet context

The anonymous RDF description of the context represents the elements shown on the report by identifying them with URIs. Web Ontology Language (OWL) subclassing and concept mapping (W3C, 2005) (e.g., “owl:sameClassAs” and “owl:sameInstanceAs”) and an inference engine can be used to map these to business objects from an enterprise ontology. Hence, the portlets can use their own “language” to represent and interpret the context.

A major application for our context-based portlet integration is to provide implicit searches based on the current user context. In order to be able to perform context-based searches, we use metadata queries, rather than fulltext searches, due to semantics that can be used, e.g. by utilizing an ontology. For example, a document could be annotated with the Dublin Core[4] metadata shown in figure 5.

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dc="http://purl.org/dc/elements/1.1/">

<rdf:Description rdf:about=
  "http://www.inwiss.org/documents/FreeplaySolarRadio.pdf">

  <dc:type rdf:resource="http://www.inwiss.org/ontology#ExperienceReport"/>
  <dc:title>Freeplay Solar Radio Report</dc:title>
  <dc:creator rdf:resource="ldap://cn=Tina Techwriter,ou=Sales,o=MyCompany"/>
  <dc:date>1998-04-05</dc:date>
  <dc:format>application/pdf</dc:format>
  <dc:description>The Freeplay(TM) Solar Radio never needs batteries – the crank-up radio
    that runs for an hour on a single crank up. Solar power provides additional play
    time.</dc:description>
  <dc:subject rdf:resource=
    "http://www.inwiss.org/topics/Sales"/>
  <dc:coverage rdf:resource=
    "http://www.inwiss.org/ontology#FreeplaySolarRadio"/>
</rdf:Description>

</rdf:RDF>
```

Figure 5. Sample document meta-data

[4] http://www.dublincore.org, last accessed April 1, 2005

Assuming that the described product belongs to one of the categories in the report, a search initiated by the above context from figure 4 should also find this document as being related. Firstly, the concepts used by the context provider (in this case an OLAP system) need to be mapped to the ones used by the search engine. For example, the product category identified by the URI “http://www.microstrategy.com/elements/Subcategory_1” needs be mapped to something like “http://www.inwiss.org/ontology#Audio”. Secondly, inference rules need to be used to provide that documents annotated with products belonging to it are also annotated with the category. Finally, the property “mstr:element” needs to be considered as semantically identical with “dc:coverage”. Note that all this can be achieved by means of OWL or a similar ontology language, combined with an inference engine, requiring no modification to the portlets themselves.

Besides ontological concept mapping, such implicit queries require a fuzzy retrieval approach. Current metadata querying techniques, however, do not support vague queries. Hence, we developed a metadata-based information retrieval approach similar to classical retrieval models like the Vector Space Model (VSM) (Baeza-Yates & Ribeiro-Neto, 1999). It is based on the similarity of RDF descriptions: Both, the query and the resources are represented as RDF descriptions and the ranking of the search results is done using a similarity measure (Priebe, Schläger, & Pernul, 2004).

Such a metadata-based search engine will of course only work if the documents are properly annotated. This requires a certain critical mass of metadata-enriched documents. Users will only manually annotate documents, if they see a significant benefit from it. An extension to INWISS approaches the problem of meta-data creation by means of text mining and (semi) automated annotation (Priebe, Kiss, & Kolter, 2005).

3.2 Prototype

Figure 6 shows a screenshot of the INWISS prototype. Presently, we provide four portlets: One is responsible for displaying intranet articles. A second one provides OLAP access to a data warehouse. The navigation portlet represents a taxonomy-based topic browser. Finally, a fourth portlet is responsible for metadata-based searches.

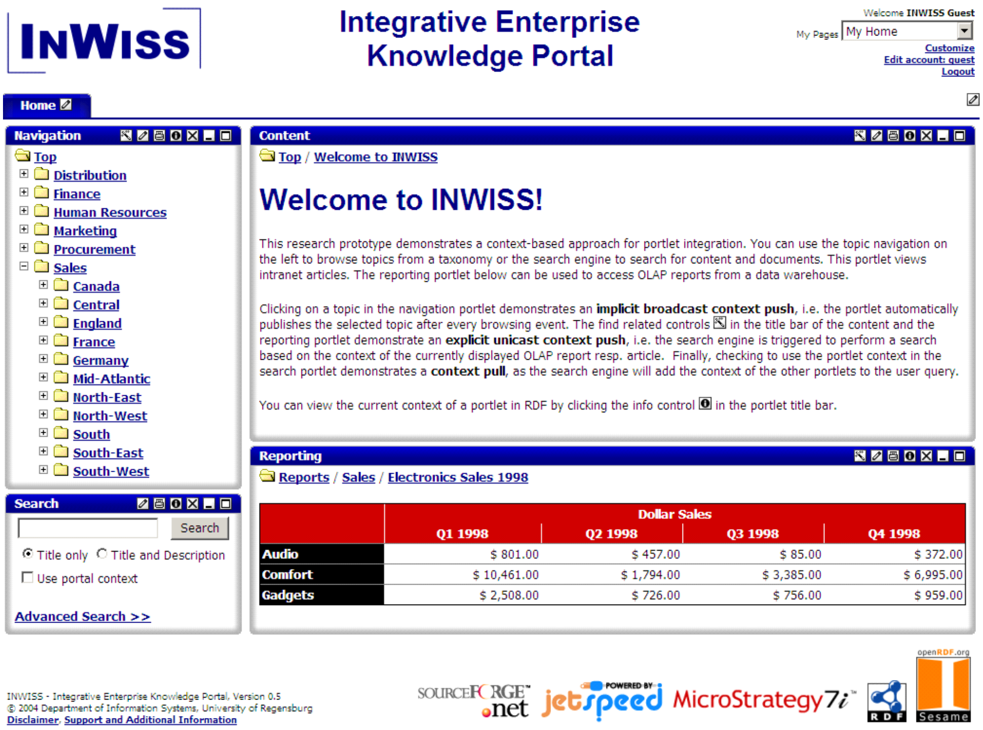

Figure 6. Screenshot of the INWISS prototype

INWISS demonstrates different context integration scenarios. The navigation portlet publishes its topic to the other portlets, triggered implicitly by browse events. The search portlet accepts context messages from the content and the reporting portlet. In this case the context push is triggered explicitly when the user clicks a “find related” control in the portlet title bar. Finally, when checking to use the portal context in the search portlet, the search engine will query the context of the other portlets and add it to the user query.

The context management is implemented as an extension to the Apache Jetspeed Portal platform[5]. For the data warehouse access we use the MicroStrategy 7i business intelligence system[6]. The open source Sesame RDF Framework[7] (Broekstra, Kampman, & van Harmelen, 2002) is used as a repository that contains resource metadata, a taxonomy, and an ontology.

4 TOWARDS A KNOWLEDGE STANCE-ORIENTED INTEGRATIVE PORTAL

User actions can be supported by various functions and services of the ICT infrastructure presented within the portlets of the portal. This comprises services for operational tasks and specifically those services part of a knowledge portal targeting support of knowledge-related actions and learning connected to the current function of the business process. These are (a) publication services to create, store and edit documents and to complement them with meta-data, (b) discovery services to navigate the system, retrieve documented knowledge and discover subject matter experts, (c) collaboration services that allow for knowledge exchange over various media and cooperation between users, and (d) learning services that facilitate creation and use of electronic courses or evaluations (Maier, 2004; Maier et al., 2005).

4.1 User Context Types

A user model (Mertens & Höhl, 1999) contains information about users, e.g., their skills, interests, and membership in groups and communities and allows for personalization of the portal and further filtering of contents. Henrich & Morgenroth (2002, 2003) define a user model for context-supported information retrieval which distinguishes three types of context:

- The physical and organizational *user context* (e.g., location, skills, and devices used),
- the user’s *working context* that characterizes the current tasks she performs,
- the user’s *interaction context* that reflects past and current interactions with the application systems, e.g., the portlets and the content they currently present.

We base our approach to support knowledge stances on this user context model. If the same ontology is used for representing the context of the user as well as of knowledge elements or concepts are properly mapped, the system can proactively search for resources that are related to the current user context.

INWISS so far concentrates on interaction context elements. In addition, a static user context can easily be defined in RDF and queried together with the interaction context. A major improvement would be to regard the working context within the portal and to transfer this context to the above-mentioned services that support (parts of) knowledge-oriented actions. We propose to add the idea of knowledge stances explicitly to the system. Hence, the context of a knowledge stance (see section 2.2) should be used to represent the working context.

[5] http://portals.apache.org/jetspeed-1/, last accessed April 1, 2005
[6] http://www.microstrategy.com, last accessed April 1, 2005
[7] http://www.openrdf.org, last accessed April 1, 2005

4.2 Supporting Knowledge Stances

Ideally, the portal would automatically recognize occasions by processing information of the current interaction context. It could then notify the user about occasions and present supportive contents and functions. Challenges are whether the portal contains enough information to conclude to the user's working context and to define rules that allow concluding from interaction to working context elements. Since users are only confronted with a manageable number of occasions (usually five to ten occasions, depending on her tasks), a straightforward way is to let the user manually choose from a list of occasions.

It is desirable to guide or even automate the operations that execute knowledge-oriented actions. Hence, an expedient extension to the INWISS portal would be a "My Work" portlet as shown in figure 7. Current occasion, process and activity are presented in this portlet and may be changed by the user. Depending on his choices, appropriate actions are shown in the list below. If a corresponding workflow is defined, the user can select from the available workflow tasks and is taken to a supporting portlet, activating the desired application function and presenting appropriate content based on the current context. The workflows are modeled in advance at the time when knowledge stances and corresponding actions are defined. Knowledge elements (e.g., topics, business objects, resources) related to the knowledge stance can be linked to activities and workflow tasks.

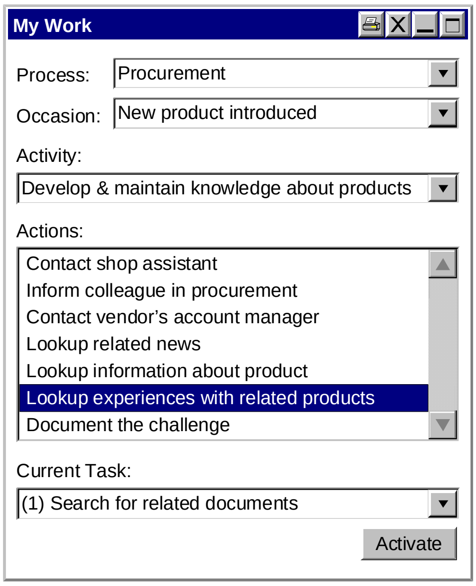

Figure 7. Screen design of a "My Work" portlet

Figure 8 shows a possible working context as provided by the "My Work" portlet. The working context comprises knowledge stance elements as well as semantic context elements that can be inferred from an underlying knowledge stance model. Everything with the subject "procurement" is considered as possibly relevant to the current knowledge stance. In addition, the activity definition includes a link to the "purchaser" and "salesperson" roles which might guide the user to find other persons that are worth being contacted. Finally, the current action reveals that documents of type "experience report" might be of interest. The definition of the "search for related documents" task is assumed to specify the search portlet as the corresponding target application. Hence, when the user clicks the "Activate" button, the system will guide him to this portlet in order to search for related documents. It can be expected that the inclusion of the context information in the query will be significantly improve the search performance.

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:inwiss=http://www.inwiss.org/schema# xmlns:dc="http://purl.org/dc/elements/1.1/">

<rdf:Description>
  <inwiss:process rdf:resource="http://www.inwiss.org/processes/Procurement"/>
  <inwiss:occasion rdf:resource=
    "http://www.inwiss.org/occasions/NewProductByVendor"/>
  <inwiss:activity rdf:resource=
    "http://www.inwiss.org/activities/DevelopKnowledgeAboutProducts"/>
  <inwiss:action rdf:resource=
    "http://www.inwiss.org/actions/LookupRelatedProductExperiences"/>
  <inwiss:task rdf:resource=
    "http://www.inwiss.org/tasks/SearchForRelatedDocuments"/>

  <!-- Inferred working context -->
  <dc:type rdf:resource="http://www.inwiss.org/ontology#ExperienceReport"/>
  <inwiss:role rdf:resource="http://www.inwiss.org/roles/Purchaser"/>
  <inwiss:role rdf:resource="http://www.inwiss.org/roles/Salesperson"/>
  <dc:subject rdf:resource="http://www.inwiss.org/topics/Procurement"/>
</rdf:Description>

</rdf:RDF>
```

Figure 8. Sample working context

So far, the interaction context has been volatile and bound to a user session in INWISS. As an extension we propose to bind it to a workflow instance. This way the context will persist for the lifetime of the workflow instance and can even be transported from one user to the other if different responsibilities are defined. This idea of communicating the interaction context among users of course raises security and privacy issues. Also when using collaboration technology sending the context along with the user messages seems promising as the message can automatically be enriched with and carry the current context. The recipient can thus easily use the portal to find information related to the message received.

5 CONCLUSION AND FUTURE WORK

This paper discussed how the concept of knowledge stance can be applied to portals which are an important technology to support knowledge work in the context of business processes. We presented the experiences from developing a prototype that applies Semantic Web technologies, proposed extensions and discussed how they could be implemented. A semantic description of information resources and therefore Semantic Web standards and technologies are constitutional for the implementation.

The next steps are to develop the portal further based on our proposals. The open source workflow engine jBpm[8] and the workflow editor JaWE[9] could serve as a basis. A modeling notation to model knowledge stances needs to be defined. So far, we considered the working context as statically resulting from modeling. As future work the context arising from occasions should not be considered statically defined but rather evolving so that knowledge stances can continuously evolve by gathering knowledge related to specific instances of processes, activities, and user actions. In addition, the context could also flow between users by means of knowledge-related actions and workflows. Finally, ways for automatic detection of occasions need to be studied, which could be based on detection of identifying patterns in the history of the interaction context. Altogether, knowledge stance-oriented portals can be seen as a step towards making knowledge work in business processes more efficient by supporting integrated and context-oriented access to heterogeneous systems.

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[8] http://www.jbpm.org, last accessed April 1, 2005
[9] http://jawe.objectweb.org, last accessed April 1, 2005

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