On the Role of User Models and User Modeling in Knowledge Management Systems

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Abstract

The paper elaborates on the role of user models and user modeling for enhanced support in Knowledge Management Systems (KMSs). User models in KMSs, often addressed as user profiles, include user's preferences and are often similar to competency definitions. We extend this view with other characteristics of the users (e.g. level of activity, level of knowledge sharing, type of activity etc.) and we explain the rationale for doing this. The proposed user model is defined as a user ontology based on Information Management System Learner Information Package (IMS LIP) specifications and it is integrated in an ontology-based user modeling system. The whole user modeling module is integrated in a ontology-based KMS called Ontologging.

1 Introduction

The dynamic of change in business environments requires the organizations' knowledge workers to learn continuously and adapt in order to remain competitive. Knowledge is considered the most important asset for organizations and the effective management of knowledge has become an important issue. Knowledge in the context of Knowledge Management Systems (KMSs) consists of experience, know-how and expertise of the people (tacit knowledge) and different information artifacts and data stored in documents, reports available within the organization and outside the organization (explicit knowledge). Nowadays the view of KMSs is often focused on the technology, on the process of capturing, organizing and retrieving information based on notions like databases, documents, query languages and knowledge mining. (Thomas, Kellogg et al. 2001)

In this paper we focus our attention on the role of user models and user modeling for enhanced user support within KMSs. The integration of user models in KMSs opens a large number of research questions. Some of these questions are common to the general objectives of user modeling, some are more specific to the HCI and to KM and some are related to the use of ontologies for representing user models. The problem of integrating user models into KMSs can be broken down into several general questions such as: Why is it important to model users in a KMS? What are the most relevant characteristics of the users in a KMS? What type of users' behavior can be distinguished in a KMS? What type of modeling techniques can be applied in order to track the users' behavior and to maintain user models in a KMS? How can a user model improve the interaction with a KMS or more explicitly: What type of adaptive/personalized services can be provided based on these characteristics? What are the advantages/limitations of

applying ontologies in user modeling? What are the perspectives of its use in the context of the Semantic Web? Are security or privacy issues an impediment towards the use of such models and if so how these issues could be overcome?

The aim of this work is to demonstrate the role of user models and user modeling in KMSs so we will address mainly the first three questions within this paper. In the next section we present the rationale for user modeling in KMSs. The third section presents the structure of the user ontology and specific user modeling processes. The fourth section analysis how user model and user modeling processes can enhance the functionality of a KMS. The last section includes conclusions and future research work.

2 User modeling and a next generation of KMSs

Knowledge Management Systems are designed to allow their users to access and utilize the rich sources of data, information and knowledge stored in different forms, but also to support knowledge creation, knowledge transfer and continuous learning for the knowledge workers. Even if traditional KMSs tend to provide more functionality, they are still mainly centered on content manipulation (storing, searching and retrieving). The next generation of KMSs aims to go beyond the mere administration of electronic information; they aim to foster learning processes, knowledge sharing, collaboration between knowledge workers irrespective of their location, etc. In section 4 we will show how user models and user modeling can support these processes and we will emphasize the role of the user model for KMSs. Nabeth and al. (2002) stress that a KMS needs to move from a document-centered approach towards a more user-centered perspective.
Nowadays knowledge management experts see user models or user profiles as the foundation for expertise directories, also known as "people finder systems". Therefore the knowledge workers, the users of KMSs, are usually modeled more from the perspective of skills and competencies similar to the systems for human resources, certain preferences of the users can also be specified.
The research on user modeling is motivated because of two main reasons: 1) differences in individual user's needs and characteristics 2) heterogeneity between different groups of people. Moreover user models and user modeling are the key element for personalized interaction.

3 Building a user ontology for KMSs

The user model is defined as a user ontology describing the different characteristics of a user and the relationships between the different concepts. The definition of the user ontology captures rich metadata about the employee's profiles comprising different characteristics like: name, email, address, competencies, cognitive style, preferences, etc. but also a behavioral profile specific to the user interaction with a KMS. The proposed user model is extending the Information Management System Learner Information Package specification (IMS LIP, 2001).

IMS LIP is structured in eleven groupings in including: Identification, Goal, QCL (Qualifications, Certifications and Licenses), Accessibility, Activity, Competence, Interest, Affiliation, Security Key and Relationship. These groupings are implemented as abstract concepts in the user ontology. The concept Identification contains attributes and other sub concepts that help to identify an individual (name, address, email, etc) within the system. Affiliation includes information on the descriptions of the organizations associated with the user/learner. QCL contains concepts related to the different qualifications, certifications and licenses the user has. Competence contains skills associated with formal or informal training or work history. Activity includes activities related to the education/training work of the user. Accessibility contains concepts related to: user

preferences, language information, disabilities etc. The concept Interest contains information on hobbies and other recreational activities. The concept Goal contains learner's/user's goals.

KMSs need to encourage people to codify their experience, to share their knowledge and to be active in the system. For this purpose we extended the IMS LIP groupings with the Behavior concept. The behavior concept describes some characteristics of a user interacting with a KMS: like type_of_activity, level_of_activity, level_of_knowledge_sharing. The Behavior concept and its subconcepts were introduced to "measure" two processes that are important for the effectiveness of a KMS namely knowledge sharing and knowledge creation.

The user modeling systems classifies the users into three categories: readers, writers or lurkers. These categories are properties of the type_of_activity concept. The level_of_activity comprises four attributes that can be associated with the users: very active, active, passive or inactive. The classification of users according to the type_of_activity or level_of_activity is based on heuristics. As knowledge sharing is a critical aspect for the success of a knowledge management system we have introduced a model, which assigns the users to different categories based on their knowledge sharing behavior. Through the level_of_knowledge_sharing we are capturing the level of adoption of knowledge sharing practices. The level of adoption of knowledge sharing is defined using Near's terminology and mapping it into Roger's theory (see Angehrn and Nabeth 1997). The user states in relation to the level of knowledge sharing are: unaware, aware, interested, trial and adopter. The description of the ontology based user-modeling system and its integration into the KMS can be found in Razmerita et al. (2003).

4 Roles of user models and user modeling in KMSs

An important strand of research in user modeling aims to enhance the interaction between the users and the systems. Numerous researchers have reported on: human-agent interaction, how to construct adaptive systems, how to tailor and filter information, how to personalize help and dialogue systems, how to personalize interaction in e-commerce, e-learning etc. (Brusilovsky, 2001; Kobsa et al., 2000; Stephanidis, 2001; Kay, 2001; Andre et al., 2000; Fink and Kobsa, 2000, etc.) All these traditional application areas of user modeling brought us insights on how user modeling can contribute to enhanced features of KMSs.
The integration of user models and of user modeling processes in a KMS can enhance their functionality in several ways, as represented in Figure 1:
Personalization Personalization is an opportunity to provide more "high touch" features for users. Kobsa and al. (2000), studying personalization in the context of online customer relationship, identify the following categories of adaptive features: adaptation of structure, adaptation of content, adaptation of modality and preferences. We use Kobsa's classification of adaptive features but we adapt it to the context of KMSs.
Adaptation of structure comprises different types of personalized views: personalized view based on job title and personalized view based on the domain interest area. "Personalized views are a way to organize an electronic workplace for the users who need an access to a reasonably small part of a hyperspace for their everyday work." (Brusilovsky, 1998). This category of adaptation exploits mainly the properties of the affiliation concept.

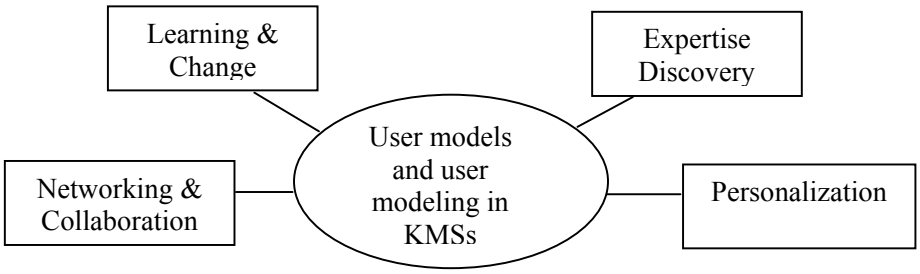

Figure 1: The role of user models and user modeling in knowledge management systems

Adaptation of content could comprise: optional detailed information, personalized recommendations, personalized hints, etc. Different type of agents can be integrated into the system to contribute to a better personalization of knowledge delivery and to provide adapted content (e.g. notification agents, information filtering agents, pedagogical agents, story telling agents etc.) For example, a notification agent could inform a user when new knowledge assets interesting for the user are available to the system. This category of adaptation exploits mainly the properties of the activity and the competency concepts.

Adaptation of presentation and modality can comprise different types of sorting based on various criteria, different types of bookmarks and shortcuts that a user might choose. It empowers the users to choose between different layouts, skins, types of fonts, presence or absence of interface agents, preferred languages, etc. This category of adaptation exploits mainly the properties of the accessibility concept.

Expertise discovery Making the competencies, the qualifications and the domains of interests of the users explicit enables location of domain experts, knowledgeable persons and how to contact them. This is also a valuable option not only for the knowledge workers who need to complete different job related tasks but also for human resource management units especially for big, distributed organizations.

Networking & Collaboration The dichotomy of knowledge as tacit and explicit knowledge implies a requisite for sharing knowledge. The dynamic exchange of tacit knowledge can be facilitated through networking and collaborative tools. Social processes can facilitate networking and collaboration and can be organized to take into account the user's characteristics (hobbies, interests). In certain systems, communities are built based on the user's domain of interests. (Snowdon and Grasso, 2002)

Learning &Change In our view learning is not only a process of acquiring new pieces of knowledge but it often involves a behavioral change for the user at the individual level. We will approach learning from a change management perspective. From this perspective a system can also provide feedback and stimulus for behavioral change at the individual level.

A KMS facilitates storing, searching and retrieving of knowledge assets but a KMS needs also to promote users' participation in knowledge sharing and knowledge creation. Therefore the system tracks a series of "behavioral" characteristics of the user interaction with the system (such as level of activity, level of adoption of knowledge sharing, type of activity etc.). These elements make the user aware of his behavior in the system and are intended to motivate the user to be active in the system. Moreover, based on the identified stages of the users different type of agents can intervene to stimulate and to coach a user towards the adoption of a set of desired behaviors (e.g. adopters of knowledge sharing behavior). More details on the design and the implementation of such a system, called KInCA, are presented in (Angehrn et al., 2001, Roda et al. 2003).

5 Conclusions and future research

Although a lot of research has been conducted in the area of KMSs and many software platforms have been developed as knowledge managing systems, very little work has been done in the field of user modeling for KMSs. In this paper we have identified the different ways in which user modeling can be applied in a KMS. A user model is a key component for providing enhanced features like: personalization, expertise discovery, networking, collaboration and learning. The user modeling system assesses the activity of the users in order to provide feedback or reflection. The user ontology and the user modeling processes described in this paper are part of an ontology-based user modeling system. This user-modeling system is integrated in an ontology-based KMS called Ontologging. Ontologging is an IST EC funded project aiming to implement a next generation of KMSs based on three emerging technologies: ontologies, software agents and user modeling. The evaluation of Ontologging system will provide us further evidence and associated insight to the role of user models and user modeling in KMSs.

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