

## Personalized Access to Meeting Recordings for Knowledge Transfer and Learning Purposes in Companies

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Meetings increasingly take place in our daily business life. Knowledge workers and managers spend between 20 and 80 % of their working time in meetings. Consequently a huge amount of knowledge is addressed or even generated in such meetings. In light of that an important but also challenging task is to manage that knowledge as part of the corporate knowledge repository and make it accessible for further usage. The aim of the MISTRAL research project is to deal with those problems. The MISTRAL core system automatically annotates multi-modal meeting recordings on a semantic level, such as information about the attendees of a meeting, topics addressed and speech-to-text transcripts. MISTRAL's semantic application deals with indexing and retrieval of this semantic information for knowledge transfer and learning purposes. In this paper we want to focus in particular on personalization issues in that context. Our approach enables personalized access to background information, or more concrete meeting information, based on the concept level for a given context, such as a particular learning or working tasks. Based on our Context-sensitive Concept Modeling System enhanced with personalization functionality, an architecture, first implementation results and lessons learned are presented.

**Keywords** multimedia meeting recording; meeting information; semantic annotation; semantic search; personalization; knowledge transfer; vocational education; lifelong learning

### 1. Introduction

According to [1], meetings are becoming an increasing part of our daily business life, where knowledge workers and managers spend between 20 and 80 % of their working time. *Face-to-face meetings*, *virtual meetings* applying video conferencing and trends towards *hybrid meetings* (a combination of face-to-face and virtual meetings) characterize modern teamwork and collaboration. In light of that a great deal of knowledge is addressed or even generated in such meetings. In order to be lastingly successful and competitive, this knowledge must be accumulated as part of the corporate knowledge and must also be easily accessible for employees' daily business decisions and activities [2-4]. In the last few years an integrative approach to the management and access of various types of information (such as stored in different media files, synchronous and asynchronous communication threads) has gained increasingly interest as *personal information manager (PIM)* [5]. Information system vendors also focus increasingly on more integrative solutions and the linkage of documents, task lists and communication activities. Further, research and development have emerged for supporting learning tasks "*in the user's immediate work environment and context*" [6], such as the APOSDLE research project. In such application domains multimedia meeting recordings and their semantic annotations can provide a further interesting and valuable source of information.

The aim of the MISTRAL research project is to annotate semantically various modalities of multimedia meeting recording, merge and enrich extracted information as well as make meeting recording information accessible on a semantic level [7-8]. Unlike comparable research projects, our main focus on the meeting recording information retrieval level is its smooth integration in knowledge transfer and knowledge acquisition activities. Typical scenarios in daily business activities and vocational education are outlined in [9]. Former experiences in the e-learning domain and first findings in the MISTRAL project have led us to develop a personalized access to meeting recording information for knowledge transfer and learning activities, which will be discussed in the remainder of this paper.

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## 2. Personalized Concept-based Information Access

Our solution approach to personalized concept-based information access to knowledge transfer and learning activities dates back to our former research work on the *Dynamic Background Repository* (see for further information [10]) and its enhancements with a *Context-sensitive Concept Modeling System - CsCMS* (see for details [11]). The main idea is to manage background knowledge and make it accessible on the concepts level. Unlike most other solution approaches which statically link resources, we follow a flexible approach by dynamically linking topical resources by means of requesting or querying diverse information systems. As various information needs are caused by situations or activities of specific contexts, our system can cope with this requirement, what we call *context sensitiveness*.

The basic solution approach is discussed briefly in this paragraph followed by an architectural overview outlined in the remainder of this chapter (see also Figure 1). The CsCMS enables to manage various contexts, such as courses or projects. For the purpose of a more fine-grained structure, different context items can be assigned to each context. A context item can be linked to one or more content pages, such as learning objects, knowledge assets or workflow tasks. Thus, for each context item in a specific context the background knowledge can be modelled by a set of concepts. Each of the concepts can link dynamically to topical resources of various information systems by applying specific requests or queries. For further simplicity we will name both terms 'requests' and 'queries' for short *queries* in the remainder of the paper. For the purpose of a flexible support of various information systems, the CsCMS allows to manage (add, edit and remove) arbitrary instances of information systems and corresponding sets of query templates. By *query template* we mean a kind of predefined query by applying a flexible placeholder mechanism. Placeholders can be defined to replace parts of the query, such as to fill in a query term by a concrete concept instance or to enrich the query with user group or user information. For representation purposes, query templates can be logically clustered by structure elements. Each concept managed by the CsCMS can be initialized with the default set of information systems and predefined query templates, and some of them can also be deselected or rewritten. The functionality described so far is the generic, non-personalized level of the context-sensitive concept model. In addition, concept modelling on the group and user level enhances the system by personalization features. The same functions as described for the generic level above are also applicable on these two levels. In addition, data from generic level can be wholly or partly inherited and overwritten to the group and further to the user level.

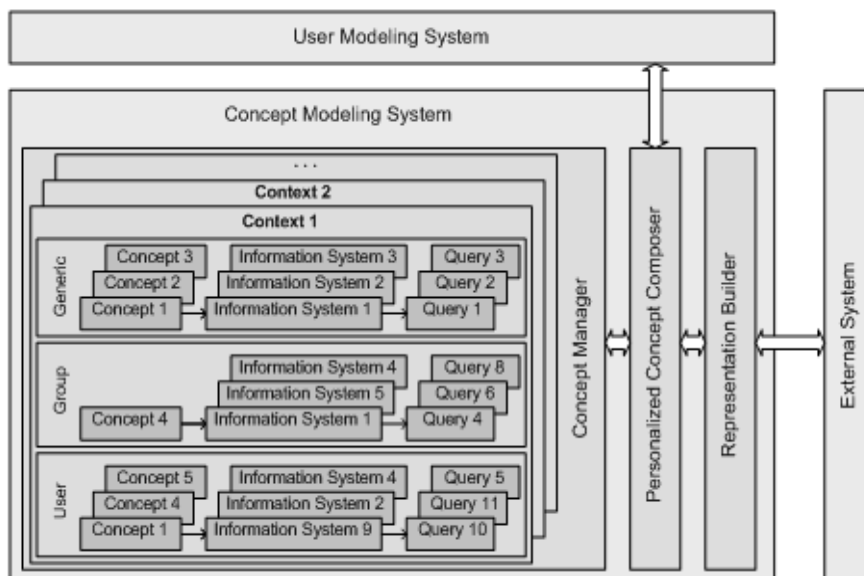


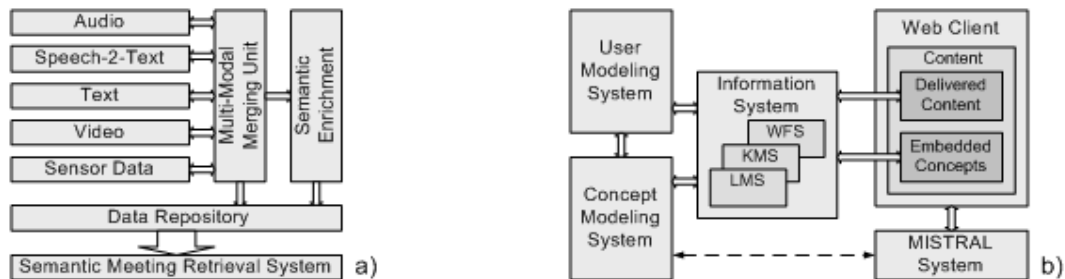
Fig. 1 Context-sensitive Concept Modeling System with personalization capabilities.

Figure 1 depicts the conceptual architecture of CsCMS and its interaction with other systems. External systems send requests, which include information about the context, the specific context item, the user id and the result representation. It is worth mentioning that a secured communication is also part of the overall architecture for privacy and security issues. The CsCMS returns a set of concepts and corresponding queries either in XML or XHTML for further processing and presentation. By narrowing down to the CsCMS architecture, concepts as well as logically linked information systems and their queries are managed on the generic, group and user level by the *Concept Manager Unit (CMU)*. The *Personalized Concept Composer (PCC)* is basically responsible for merging concepts, linked information systems and queries from generic, group and user level. For the purpose of personalized merging and replacing placeholder with personalized information, the PCC communicates with the *User Modeling System*. The *Representation Builder (RB)* compiles the results and delivers them to the external systems in accordance with their information requests.

### 3. Solution Approach and First Prototype Implementation

Our solution approach can be split into two logical parts: (a) meeting recording information extraction and management as well as its access, which is handled by the MISTRAL system, and (b) an integrated access to relevant meeting information in employees' working environments.

The overall architecture of the MISTRAL system is depicted on the left side of figure 2. The multi-modal meeting recordings include audio, video, related meeting documents as well as information about user interaction with the presenter computer. These modalities are processed by *Audio*, *Speech-to-Text*, *Text* and *Sensor Data Unit*, merged and enriched by the *Multi-modal Merging and Semantic Enrichment Unit*. Meeting recordings and relevant meeting documents together with semantically extracted meeting recording information are managed in the *Data Repository* and make them accessible by the *Semantic Meeting Retrieval System*. Users can search for and retrieve semantic information on the level of whole meetings including related meeting documents, on the level of agenda segments and on the level of speaker segments. Further details can be found in [12].



**Fig. 2** Architecture of the MISTRAL System (a) and overall architecture for personalized access to multi-modal meeting recordings (b).

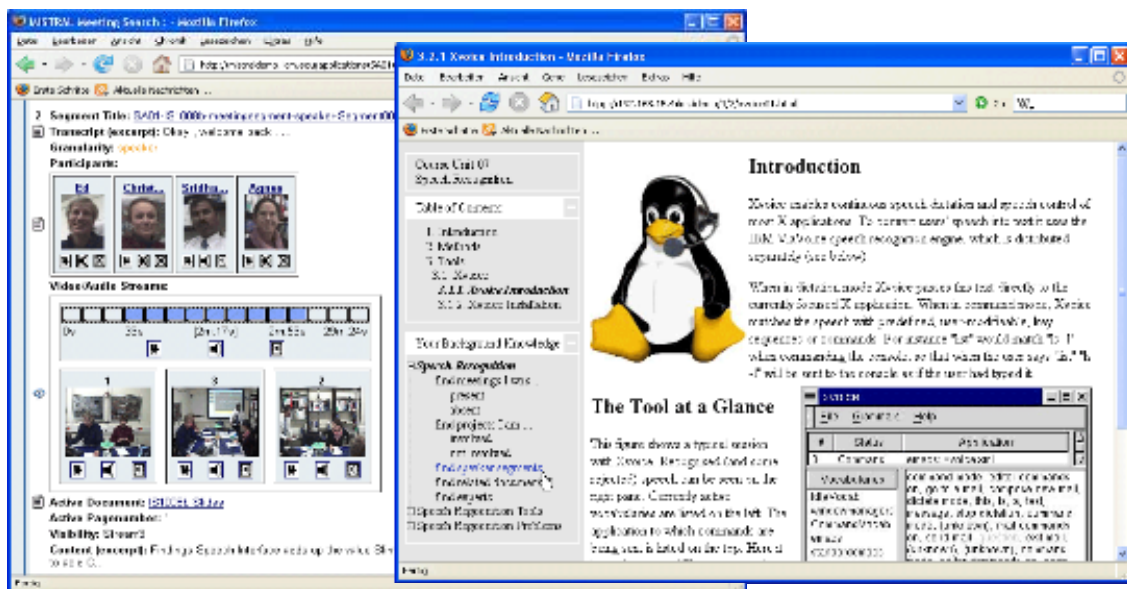
On the right side of figure 2 an overall architecture is outlined for the purpose of linking personalized, relevant meeting recording information and meeting recordings to employees' daily business activities. In order to be flexible our solution approach enables an easy integration in various types of information systems, such as *Learning Management Systems (LMS)*, *Knowledge Management Systems (KMS)* and *Work Flow Systems (WFS)*. Information about the user (such as user record information, expertise, user roles in project and user behavior) is managed by the *User Modeling System* (for details see [Guelt et al. 2005c]) and is accessed by information systems and the *Context-sensitive Concept Modeling System (CsCMS)*. By applying the CsCMS, semantic and personalized access to meeting recording information can be modeled by means of context items, linked concepts and proper query templates. Thus, any

trusted information system can request personalized information for specific users by sending information about the context, a more specific context item, the user and the representation format. Results can either be delivered in XML or in XHTML for further processing and rendering by the information system, such as embedding them in the content or in navigation and control sidebars. Finally, the user can follow personalized and semantic information requests in order to receive topical meeting recording information.

To clarify the approach stated so far an example is given as follows: the new project manager Miriam is in the planning stage of a project and needs information about a particular technology method. This is reflected by the workflow task 'get information about relevant methods and identify problems' guided by a WFS. At this stage, the WFS requests background information for the context 'project planning', context item 'methods research and problems', user 'Miriam' and representation 'XML'. She receives relevant concepts related to her task and can follow links to information, which is dynamically compiled on request, for example about 'speech recognition problems'.

Our prototype implementation focuses on vocational learning and training activities. The right browser window in figure 3 shows exemplarily one content page of a training course. The embedded background knowledge is rendered as a kind of sidebar at the lower left side of the browser window. A personalized set of concepts and related hyperlink queries enables users to request topical meeting recording information. The left browser window of figure 3 depicts partly the result representation for the information need 'find speaker segments about the topic speech recognition'. The user request was initialized by clicking on the corresponding hyperlink at the background knowledge sidebar.

For the prototype described above, a set of query templates was defined for querying the MISTRAL information system. Furthermore, a context for the training course was created as well as proper context items and linked concepts in accordance to the learning content pages were defined on the generic level and on the group level. For each concept the whole set of query templates was initialized, some of them were overwritten on the group level according to project roles. Based on that, the following information can be searched for each concept: (1) speaker segments, (2) meeting relevant documents, (3) experts, (4) meetings, the user being present or absent, and (5) projects the user is or is not involved in.



**Fig. 3** Personalized concept-based hyperlinks to background knowledge embedded in e-learning content (lower left sidebar of right browser window) and meeting recording search results for the predefined query 'find speaker segments about the topic speech recognition' (left browser window).

## 4. Conclusions and Future Work

In this paper we have focused on the personalized access of multi-modal meeting recording information extracted and managed by the MISTRAL system. A solution approach for a context-dependent semantic access based on the Context-sensitive Concept Modeling System (CsCMS) was outlined. First experiences have shown, that (1) the concept approach can hide complexity of the MISTRAL retrieval system and enables novice users to perform powerful information requests on a semantic level, (2) the query template mechanism allows to predefine queries, which can be initialized and rewritten easily and efficiently for each concept, and (3) concept and query management on the generic, group and user level seems to be an promising approach for efficient personalized access to background knowledge. Future work will focus on an automated concept import from the MISTRAL system and on a semi-automatic adaptation of concepts and queries on group and user level based on group and user modeling information.

The overall architecture seems to be a good starting point for a solution approach to provide an integrated access to relevant meeting information in employees' working environments. In order to gain further finding, prototype setups with various types of information systems will also be done as future work. And last but not least, pilot installations and user surveys will be conducted for evaluating the usefulness of the integrated access to meeting information in employees' working environments.

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