A Framework for Experience Management in e-Government: The Pellucid Project

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Abstract. The Pellucid project is developing an adaptable and customisable platform for enabling experience management in public organisations. Starting with a study of the three pilot applications, a uniform framework has been developed for experience management, based on the generation of 'active hints' that are presented to the user according to working context. Working context encompasses both position in the work process and domain-specific characteristics, typically similarity to previous cases. The paper discusses the applications and the framework.

1. An introduction to experience management

Human problem solving in many fields is based on extensive experience. *Experience management* is a special kind of knowledge management, focussing on the dissemination of specific knowledge situated in a particular problem-solving context (Bergmann 2002). For experience management, information and communication technologies play an important role, providing the connectivity that is required to share experience.

Pellucid is a project tackling the management of experience in public organisations, particularly those aspects of experience management related to organisational mobility, the movement or circulation of staff from one unit to another within an organisation (Lambert et al. 2003). Organisational mobility is increasingly commonplace in public organisations, and presents both opportunities and challenges: opportunities for improving working practices through the introduction of new perspectives, and challenges arising from the constant loss of experience and the learning curve of the newly arrived staff.

The Pellucid project is developing an adaptable, customisable software platform for creating and integrating experience management systems in organisations. The basic metaphor for experience management is of an intelligent assistant that looks over one's shoulder and answers questions one might have at a

particular point of work (Staab and Schnurr 2002). The assistant detects that an employee is working in a particular context, offering knowledge resources that facilitate their work according to their expertise. To this end, the Pellucid platform integrates technologies such as autonomous cooperating agents, organisational memory, workflow and process modelling, and metadata for accessing document repositories.

This paper presents the experience management framework developed in Pellucid. Section 2 introduces the three knowledge-intensive applications where the framework will be installed. Section 3 describes our experience management framework, it shows the main concepts that constitute our experience management model and the challenges we tackled in its development. Section 4 discusses an important component of the framework, the modelling of the worker context. Section 5 examines integration issues such as obtaining the context from external system as well as document searching and similarity matching. Finally, section 6 concludes the paper by highlighting main finding and outlining future work.

2. Three applications for experience management

Within the Pellucid project, three pilot applications have been chosen in order to test and to show the functionalities of the platform. The three end users involved in the project are:

- Mancomunidad de Municipios del Bajo Guadalquivir (MMBG), an association of local governments in the south of Spain.
- Consejería de la Presidencia (CPRE-JA), a body of the regional government of Andalusia (Junta de Andalucía) in Spain, together with the company SADESI that operates its call centre for telephony problems.
- Municipality of Genoa, Mobility and Transport Directorate (CdG), Italy.

These organisations selected the following processes with experience management needs:

- Management of projects and services (MMBG).

- Management and resolution of fixed telephony breakdowns in the call centre (CPRE-JA/SADESI).
- The installation of new traffic lights (CdG).

These applications cover a wide range of processes existing within the public organisations in several sectors. In this way the Pellucid platform will be tested by different varieties of end users and will be addressed to several employees. Moreover they cover different ranges of organisational mobility. In the cases of MMBG and CdG, there are many different mobility scenarios, in that there are many ways in which staff can move from one position to another, whether vertically through promotion or horizontally from another unit. For SADESI, the mobility arises from the high level of staff turnover—a common situation in call centres generally.

All the processes have much experience to manage and also to capture and to return to new employees: sometimes the experience is technical, and other times it is more related to administrative issues and procedures. For example, it might relate to who to contact with enquiries about a particular case, or how long to expect a certain process to take before it needs checking, or particular factors to take into account in special circumstances.

In the case of MMBG, the management of public funded projects includes all the tasks to be performed from the very early stages of a project (definition of the idea, preparation of the proposal and submission to the funding authority) to the justification of the project's costs and activities, and the preservation of all the documents generated during the project execution. The main problems to be addressed are due to the lack of integration among the departments involved in the different project phases, and to the non-existence of a solid information structure to provide support for external and internal issues, such as contacting potential providers or preparing a proposal. This is however not simply an IT issue; it reflects the varied and ill-structured nature of the work done. Thus staff find themselves without support—not only new employees but also experienced staff who can be involved in very different proposals and projects.

Employees in the Call Centre of SADESI have to adapt in a very short time to a very specific working environment, getting a slight 'on-the-job' training support. These employees suffer from a very high mobility degree, and it has been proven that, due to their working conditions, they typically stay in their position only 6 months as an average. This very unstable environment makes the need for systems for registering, keeping and exploiting efficiently the experience and knowledge of the employees before they leave the Call Centre or leave their jobs.

In the case of CdG, the application related to the installation of a new traffic light exemplifies the important role of experience in the effective execution of the task. This procedure involves many actors and is made up of several phases: a preliminary analysis following a request for a new traffic light; verification of information; design in detail the plant; definitive evaluation of all aspects of the project; definition of financial and administrative aspects; installation of the traffic light; and finally, testing and maintenance. A major source of knowledge management problems is the large number of actors involved, and the need for co-ordination among the several departments in order to get the optimal final result. Less experienced employees have less awareness of who they need to contact at what stage among the external actors, how this contact should be made (by email, by letter, whether there is a standard form for a letter,), and how long the actor normally takes to reply. These are all examples of knowledge that an experienced employee will have acquired, and they should be shared effectively.

The main benefits expected from the Pellucid project are the improvement in efficiency and effectiveness due to the reduction of time spent, and leveraging of experience due to the movement of staff among different roles.

3. Dissemination of experience in practice

3.1 The Pellucid experience management model

The experience management model in Pellucid exploits the experience sharing concepts expressed in (Bergmann 2002).

It is based on two main ideas: every employee in an organisation is both a provider and a user of experience; and employees communicate their experience to a common medium, then retrieving experience in a future from this common medium. Pellucid aims to be such a common medium.

The Pellucid experience management model comprises three phases: *Capture and Store*, *Analysis and Presentation*, and *Experience Evolution*.

The *Capture and Store* phase is concerned with observing and storing experience in a particular context. There are three ways of capturing experience: analysing employees' actions and workflow events, analysing documents entered into the system, and by direct input from workers. Capturing experience from working actions and events is particularly beneficial in repetitive tasks; they are used to create common patterns that can be retrieved in the future in order to assist other employees. Documents constitute an important asset in an organisation. Metadata is added to documents, enabling the system to retrieve in an automatic way documents useful in a particular working context. The direct capture of experience from employees is carried out through free-text notes written by the employees themselves. This constitutes a good source of knowledge, particularly in the transmission of experience from experienced employees to novices.

The purpose of Pellucid is to support and enhance employees' performance by providing them with the knowledge required by the activity they are performing at the time they are actually performing the activity. The *Analysis and Presentation* phase is concerned with providing such knowledge. To do so, the concept of an *active hint* is introduced, a representation of experience within the organisation. An active hint is triggered in a context and includes an action, a knowledge resource and a justification for the hint. The context is determined by the particular activity that is carried out by the employee at that time in a workflow system. An action corresponds to an atomic act on a knowledge resource, for example use a document template, read a document or a note, or consider a contact list. The

justification gives to the employee a reason for the hint. The idea of active hints was borrowed from the DECOR project (Abecker et al. 2002) and worked out in a somewhat different way in Pellucid. Let us now describe the stages included in this phase:

- An employee is performing a particular activity. The system tries to *match* the current working context with other context stored in the organisational memory. In general, every past context is stored with possible solutions (hints) to assist employees in that particular situation.

- Rarely (if not ever) a perfect match occurs. So the system should be able to *adapt* the previous context to the new one as well as the past solution.

- The system suggests the past solution (maybe adapted) in the form of *hint*.

- The user is free to follow or not the hint given by the system. The user should be able to communicate this decision to the system which:

  ◦ If the hint is followed, it also contains a judgment of the proposed solution (it worked well/bad)

  ◦ If the hint is not followed, it also contains a motivation for it (I did not follow it because ...)

- The system should store this information, classifying them maybe with keywords or other techniques.

The aim of *Experience Evolution* is updating the available experience. Due to the rapidly changing environment, experience may have only a limited lifetime. Invalid experience must be identified and removed or updated. To this end, the final Pellucid platform will include a set of methods and semi-automatic tools to allow knowledge engineers and expert users to update the experience stored in the organisational memory.

3.2 Active hints

The main conveyor of experience in Pellucid is an active hint. Active hints present suggestions to the user to assist with the current activity. Table 1 depicts a schematic example of an active hint in the context of a proposal evaluation when managing a project for the MMBG site application, while Table 2 shows an example from the CdG application.

Table 1: An example of an active hint for MMBG

Context:	Proposal Evaluation
Action:	Consider
Resource:	List of People and Documents
Justification:	People in the list have evaluated similar proposals in the past, and they have used the associated documents for such activity.

Table 2: An example of an active hint for CdG

Context:	New employee at Technical Staff level is designing planimetry Installation is located near school or hospital or railway station
Action:	Examine
Resource:	Topographic relief map for the zone
Justification:	Such locations have high pedestrian flows and need special consideration to accommodate it, particularly size of the sidewalk and availability of pedestrian crossing.

Pellucid offers a variety of active hints, which are returned by analysing the current context of an employee and using techniques such as document similarity. Thus, active hints management allow the experience dissemination within the organisation.

The engineering process followed in realising Pellucid experience management model is further explained in (Arenas et al. 2004).

3.3 Some challenges in experience management

In this part we explore some challenges that have arisen in the project concerning experience management.

- **Definition of Experience.** The first challenge concerns with the definition of the word *experience*. During the project, we take a practical view of the word experience, avoiding to be attached to a particular definition. Our view is of a *common medium – Pellucid*- in which users can put and share their experience, like a digital collaborative library into which every one is author and reader. The active hint approach is in agreement with this

view: the system is able to *store* and *fire* hints. A hint is *not* experience, it is only a *representation of a fragment* of experience formulated in a way which is practical for a computer to store and manage.

- **The Start up Problem.** Pellucid uses an *Organisational Memory* containing all relevant information of the organisation. Every Organisational Memory must, at first, store some content which have been collected in the customisation phase, perhaps with the help of end users. The content should be valid and form a *critical mass* after that the system is able to grow independently.

  This is not necessarily a problem, but only an additional cost which cannot be anticipated in the framework, but must be part of the initial set up of the system. In a certain sense the initial set up is the system! The framework, without set up, is fairly useless, like an operating system. It is the union "framework + setup" that creates a usable system.

- **Creation of Hints.** A crucial part of this set up is the creation of hints. To be successful, it is extremely important to have a throughout knowledge of the end users' environment and domain. Writing good domain ontology is necessary, but not sufficient. The creation of hints can be viewed as a knowledge acquisition problem, and the methods and techniques available for knowledge acquisition may be used effectively. In general, it is necessary to understand clearly the needs of the end-users, meeting them regularly and giving them the opportunity to assess intermediate versions of the developing system.

- **Context and Content.** As we mentioned before, a hint is composed of: *context, action, resource* and *justification*.

  Our goal is to have *smart* hints (that is, hints which say intelligent things) presented at the right time. Unfortunately, the smartest hints usually do not have a context which is easily expressible in machine format; on the contrary, hints that can be simple characterised in the context, are usually rather poor in content (they correspond to the class: "look this", "do that"...)

The best we can do in our system is to mix these two classes of hints. That is, we try to have simple hints for the newcomers, which are clearly specified in the context, even if their content is not so smart; and intelligent hints for the experts which, even if they have no a clearly defined context, are nevertheless useful because the expert will give them one. The aim is that either the content or context of each hint (or ideally both) should be rich.

- **Developing for the Future (Scalability, Maintenance).** As the start-up, the future of the system is also a problem. First, the system should be able to forget; otherwise, the database will grow too much and performance will degrade. Second, periodically a person should adapt the system to the changes in the organisations. Hints may become old; some facts could be not true any more; people want to add their personal contribution to the database and so on.

All these aspects are analysed and developed in the Experience Evolution Phase.

3.4 Related experience management models

One of the influential works in the definition of the Pellucid experience management model is (Bergmann 2002). Bergmann's experience model consists of a *Knowledge Kernel*, a *Problem Solving Cycle*, and a *Development and Maintenance Methodology*. The *Knowledge Kernel* contains the experience base and the reuse-related knowledge as well as the vocabulary on which both are based. The *Problem Solving Cycle* describes problem solving that is supported by experience reuse; it includes steps such as problem acquisition, experience evaluation and retrieval, experience adaptation, and experience presentation. The *Development and Maintenance Methodology* addresses the acquisition and maintenance of the knowledge in the knowledge kernel as well as the technical, organisational, and also managerial aspects of the problem solving cycle and its implementation. Bergmann's Knowledge Kernel corresponds to Pellucid's organisational memory, the repository storing the experience, data and

metadata needed by the systems. Some actions of the Capture and Store phase are also linked to the kernel. The Problem Solving cycle is associated with Pellucid's Analysis and Presentation phase, although Bergmann's cycle is more general but strongly linked to case-based reasoning. The active hint approach has the advantage that it can be attached to several reasoning techniques. Finally, the Development and Maintenance Methodology is related to Pellucid's Experience Evolution phase.

The Experience Factory approach defines a framework for experience management based on organisational learning (Basili et al. 2001). An experience factory is a logical and/or physical organisation that supports project development by analysing and synthesizing all kinds of experience, acting as a repository for such experience, and supplying that experience to various projects on demand. The experience consists of informal or formal models and measures of various processes, products, and other forms of knowledge. It is tailored for the software business. The steps in the experience factory are organised into a cycle called the Quality Development Paradigm, including six steps: a characterisation of the project and its environment based on the available information; a definition of the goals of the project; selecting appropriate processes for implementing the project; execution of the project; analysing data collected at the end of the project for identifying reusable experience; and packaging, where the models stored in the experience base are refined on the basis of the new experience. The Experience Factory provides a mechanism for continuous improvement through the experimentation, packaging, and reuse of experience based on the needs of a business. Although specific to a particular domain, it offers important lessons; in particular, the identification of reusable experience and packaging, and thus will influence the final form of the Pellucid platform.

4. Modelling working context

4.1 The Pellucid approach to context modelling

The Pellucid platform enables modelling and handling the working context in order to manage active hints for fulfilling the EM

purpose: supporting the employees in their working situation and make their task easier. The Pellucid approach is that of context-based retrieval information (Bauer et. al. 2002). Thereby, active hints are triggered on the working context characterising the environment of the user. In the Pellucid framework, the relevant contextual information is described by the position in the work process (starting or completing a task, opening a document, …) and domain-specific characteristics.

(Klemke 2000) describes a context typology organised around four aspects: organisational, domain, personal and physical aspects. In the Pellucid approach, the context mainly is the combination of the two first aspects from this context typology. Hence, the organisational aspect is covered by the description of the position in the workflow process and the domain aspect by the domain specific characteristics. The personal aspect is also taken into account, but in a rather simple way, distinguishing different kinds of employees according to their level of experience.

Each aspect of the working context is modelled by means of several concepts extracted from both ontologies: the workflow ontology and the domain ontology. Consequently, the development of ontologies is one of the central threads of modelling work. The workflow ontology deals with the process of an organisation, which is essentially composed of activities, tasks and instances. The domain ontology encompasses the relevant conceptual description about the actions (what the employee is able to do), the resources (document, person) and the relevant descriptive concepts closely related to the domain application (e.g. type of document, topic of document, role of person, etc).

For the modelling of working context, the current position in the workflow is acquired, together with the current user action as stimuli, plus events and the current descriptive concepts as relevant similarity information. So thanks to this modelling, the events trigger appropriate active hints (action, resource, justification) which contain suitable resources according to the similarity information.

4.2 Examples of context for the pilot applications

In the Pellucid project, three pilot applications have been studied. Each of them implements a workflow and is related to a specific domain application, i.e., call centre, traffic light installation and project management. The three applications in the project differ from the domain, the workflow and the so-called WfInstance, i.e.

the key concept throughout a process cycle: an incidence resolution, a dossier and a project.

The context modelling is based on several concepts from both workflow and domain ontologies. Table 3 illustrates part of the working context modelling in the framework of each pilot application.

Table 3: Modelling working context for the pilot applications

Working Context modelling				
Concepts	**Representation**	**Examples**		
		Call centre	**Traffic light control**	**Project management**
Business Entity: Actor	Employee which starts an wfActivity in order to manage the wfInstance	*Id_agent*	*Id_officer*	*Id_project_manager*
WfActivity	The current stage of the process	*Intervention_ request*	*Preliminary_analysis*	Proposal_submission
WfInstance	The studied concept from the application	*Id_incidence*	*Id_dossier*	Id_project
Concept1	Other domain or workflow concepts used as relevant descriptive information in order to compute the similarity measure.	*Id_site*	*Id_crossing_road*	*Id_topic*
Concept2		*Id_severity*	*Id_number_lanes*	*Id_type_document*
Concept3		*Id_type_site*	*Id_existing_traffic_light*	*Id_role_actor*
Concept4, etc		*Id_operator*	*Id_applicant*	*Id_objective*

A more complete description of the development of ontologies and working context modelling in Pellucid is presented in (Kitowski et al. 2004).

4.3 Advantages and applicability

The strong points of Pellucid approach to context modelling lie in the automatic recognition of the context and the fact that this modelling framework allows the dynamic ranking of important contextual dimensions used to perform the similarity measure (Gross et al. 2003), thanks to the process/workflow dimension.

In spite of the pilot application differences, a similar working context structure has been developed (see the first column of the above table) and similar mechanisms in order to help the employees in their task by providing active hints to them. As a result, the Pellucid platform has a high level of applicability and the approach can be exploited for any application based on a workflow and when working context modelling requires to take into account both employees' position in the work process and domain-specific characteristics.

5. Integration issues

5.1 Obtaining context from external systems

It is desirable that the working context should be acquired automatically. The aim is to make the system as unobtrusive as possible (at least in the Capture and Store Phase), so it is necessary to trade this off against completeness. This means that, even though it might have been possible to ask the users to input context information directly into the system, the choice was made to have less information, but collected automatically.

The reasons for this choice are:
- The system is aimed also at less experienced employees and it is not acceptable to ask information of such an employee when he/she does not already know the context him/herself.
- It is difficult, or impossible, to justify the extra work imposed by the system on experienced employees when the help which the system is building is not primarily directed to them.

In other words less experienced employees are the principal targets of the system, but they are not the principal sources of expertise. In order to collect information from experienced employees it is necessary to resort to automatic collection. An exception is the case of free-text notes which are entered directly by employees, but here the context of the note is acquired by the system itself.

To collect information about the actions and type of work of the employees, the use of some kind of workflow tracking system is the best trade-off. This is an auxiliary system whose purpose is to collect context information for the Pellucid system, though it may have other benefits for the user. A conventional workflow management system may be used for the purpose, though a simpler, more flexible system can be developed. To integrate with tracking system or WfMS, the WAPI interface has been adopted, which is a standard. In this way the only work has been to build a bridge that converts the WAPI calls of the WfMS to XML-RPC calls, which is the standard way to interact with Pellucid. Figure 1 shows a screenshot of the user interface of the WFMS developed for the CdG application.
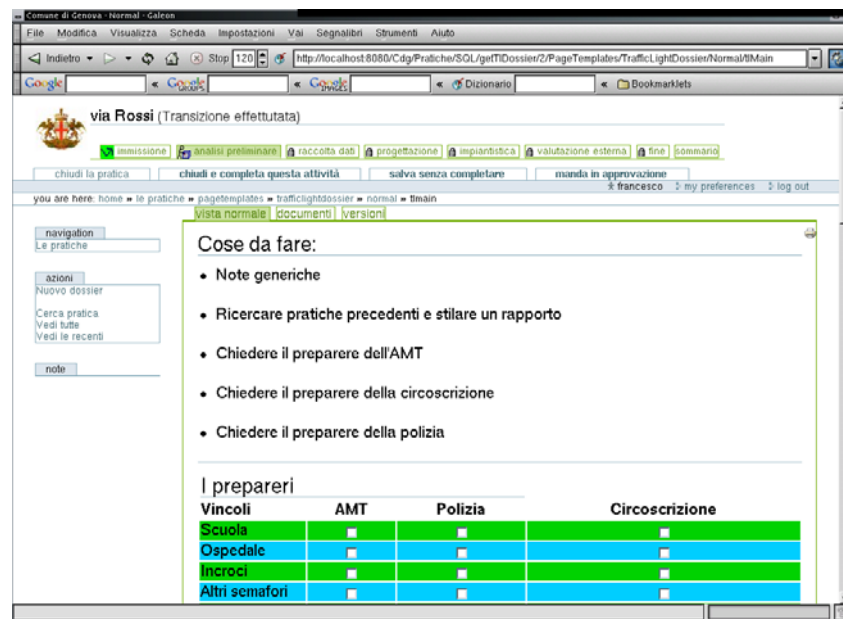

Figure 1: Screenshot of the WFMS for the CdG application

5.2 Document similarity, matching and searching

Public sector organisations generally deal with a large numbers of documents. Locating appropriate information in document repositories could cause difficulties for organisationally mobile employees. Experienced employees, who have knowledge about the domain, want to locate required information rapidly. They are able to describe the desired results with a high level of accuracy, and thus need a precise searching tool. By contrast, novices or relocated employees may not know how and where to search for information necessary at their current work. They could benefit from being notified about useful information.

The idea of active hint fits this situation very well. The organisational repositories are monitored for appearance of new domain-specific information. On the basis of changes in documents' content notifications are generated. Notifications in form of active hints are generated and presented to the inexperienced employees.

One special class of active hint originates from the document management process. The Pellucid system allows description of the content of the document with the help of the concepts from the particular domain of the organisation activity. The domain concepts and relations between them are described in terms of the domain-specific ontology. The ontology also is used to describe, how domain specific information is represented in the documents. The

similarity determination is used for active hints generation. If documents have similar concept-based description, the active hint is generated. Such active hints are later presented to the user working with these particular documents. The similarity functionality is also available for the user directly. If employee finds a useful document, he/she may have presented other similar documents on demand.

5.3 User interface issues

As mentioned before, the Capture and Store Phase is not observable by the user. Pellucid appears as an 'output-only' machine. For the output, a 'least obtrusive' approach has been chosen. In fact, Pellucid output is customisable along with everything else in the platform. The Pellucid core, in fact, does not care about the user interface but returns results in a 'format-free' way. The front end is then free to be built with a look and feel to suit the end user.

For example, if the application is Web based (as in the case of the CdG), it is possible to build a HTML transformation so as to have a web window which integrates with the application. An alternative is for a separate window dedicated to the Pellucid interface, as shown in Figure 2.
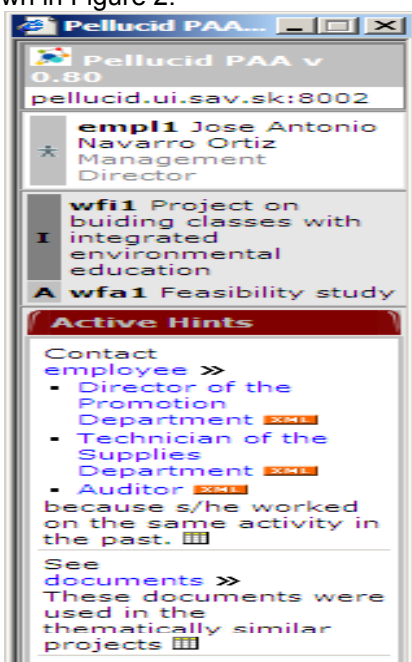
Figure 2: An example of a free-standing user interface for the Pellucid system

6. Conclusions

Having conducted extensive analyses of the experience management needs of its three pilot applications, the customisable platform developed by the Pellucid project is now being set up for each site prior to conducting user evaluations. Preliminary evaluations have shown that the idea of active hints is liked by the users, as a simple and unobtrusive way of conveying experience of many different kinds. One of the strengths of the Pellucid platform is its adaptability: some parts are directly reusable from one application to another (for example, the basic hint firing mechanism), others are reusable with adaptation (the ontologies representing working context), while others may be developed specially for the needs of the application (the user interface). One of the final important tasks of the project will be to define more precisely the nature of the platform and the way in which its components may be customised, providing guidelines for future applications.

7. Acknowledgements

References

Abecker, A., Dioudis, S., van Elst, L., Houy, C., Legal, M., Mentzas, G., Muller, S. and Papavassiliou, G. (2002) 'Enabling workflow-embedded organizational memory access with the DECOR toolkit'. In *Knowledge management and organizational memories*, Dieng-Kuntz and Matta (editors). Kluwer Academic Publishers.

Arenas, A.E., Lambert, S.C. and Miles, A.J. (2004) 'Engineering knowledge-intensive tasks in public organisations'. EU-LAT Workshop on E-Government and E-Democracy. Chile.

Basili, V., Costa, P., Lindvall, M., Mendonca, M., Seaman, C., Tesoriero, R. and Zelkowitz, M. (2001) 'An Experience management system for a software engineering research organization', Software Engineering Workshop, NASA/Goddard Software

Engineering Laboratory, Greenbelt, MD.

Bauer, T. and Leake, D.B. (2002) 'Exploiting information access patterns for context-based retrieval', Proceedings of the 2002 International Conference on Intelligent User Interfaces, IUI-01, ACM Press.

Bergmann, R. (2002) *Experience Management*, Lecture Notes in Artificial Intelligence Series, Vol 2432. Springer.

Gross, T. and Klemke R. (2003) 'Context modelling for information retrieval – requirements and approaches', IADIS International Journal on WWW/Internet Vol 1, No 1, pp29–42.

Kitowski, J., Krawczyk, K., Majewska, M., Dziewierz, M., Slota, R., Lambert, S. C., Miles, A. J., Arenas, A. E., Hluchy, L., Balogh, Z., Laclavik, M., Delaitre, S., Vianno, G., Stringa, S. and Ferrentino, P. (2004) 'Model of experience for public organisations with staff mobility'. 5th Working Conference on Knowledge Management in Electronic Government - KMGov2004.

Klemke R. (2000) 'Context framework – an open approach to enhance organisational memory systems with context modelling techniques', Proceedings of the Third International Conference on Practical Aspects of Knowledge Management, PAKM2000, Basel, Switzerland.

Lambert, S.C., Stringa, S., Vianno, G., Kitowski, J., Slota, R., Krawczyk, K., Dziewierz, M., Delaitre, S., Oroz, M. B., Gomez, A. C., Hluchy, L., Balogh, Z., Laclavik, M., Fassone, M. and Contursi, V. (2003) 'Knowledge management for organisationally mobile public employees', Knowledge Management in Electronic Government: 4th IFIP International Working Conference, KMGov 2003, Lecture Notes in Computer Science Series, Vol 2645, pp203–212. Springer.

Staab, S. and Schnurr, H.P. (2002) 'Knowledge and business processes: approaching an integration', in *Knowledge Management and Organizational Memories*, Dieng-Kuntz and Matta (editors), Kluwer Academic Publishers.