# Semantic-enabled Agile Knowledge-based e-government

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**Abstract**

In this paper, we introduce SAKE, a STREP Project sponsored by the European Union starting March in 2006. The overall objective of SAKE is to specify, develop and deploy a holistic framework and supporting tools for an agile knowledge-based e-government that will be sufficiently flexible to adapt to changing and diverse environments and needs. We give a brief overview on the SAKE approach including the technical architecture and indicate where and how we plan to utilize Semantic Web technologies.

## Motivation

Knowledge has been and is still government's most important resource. The presence of highly trained, legally educated and specialized civil servants has been considered as one of the main characteristics of government. Since knowledge is regularly localized or even personal and difficult to share, it becomes immediately evident that even though there is indeed a lot of knowledge, it is not necessarily available anywhere, anytime for anybody. It means that not all parts of a public organization can necessarily benefit from that knowledge. Consequently, a lot of "wheel reinventing" is going on in public administration. Even worse, a recently performed study[1] shows that a frequently reported problem regarding users' satisfaction with the e-government is the heterogeneity of decisions, i.e. the decision process still heavily depends on the knowledge of a public servant. Indeed, in the case-handling the servants have a certain room for discretion. They may ignore some relevant information given by a citizen, or simply not ask for it. If the fit between the situation of the citizen and the applicable rules is not completely clear, they may assume a certain fit at their discretion. This puts forward the issue of transparency of the decision making process, which is one of the strategic objectives of the e-government beyond 2005.

Therefore, it is crucial to understand knowledge in public administration as belonging to the human domain (so called tacit knowledge) and not only as a material object (so called explicit knowledge). Tacit knowledge cannot be easily managed. It is created, developed and distributed in processes of human action and interaction.



[1] http://www.iccs-isac.org/eng/pubs.htm

On the other hand, several factors make knowledge in public administrations subject to continual change:

First, the environment in which an e-government system operates can change, thereby invalidating assumptions made when the system was built. For example, new laws and regulations require adaptation of tacit knowledge;

Second, public servants' requirements often change after the e-government system has been built, warranting system adaptation. For example, hiring new employees might lead to low competencies and greater diversity in the government, which the system must reflect;

Third, the processing of unpredictable requests and exceptions arises unanticipated "knowledge needs". Increasing citizen migration and movement across the EU creates complex cases for public administrations. For example, a request for issuing an EU driving license based on an existing domestic driving license demands a quite complex decision making process depending on many parameters like the origin country, driving experience etc.

The importance of supporting better management of continually changing knowledge is nowadays more important due to the evolution of Europe towards a multicultural, more open and international society with changing common values, increasing levels of education, demographic involvement and adoption of new technologies (EU report, 2004). This is especially true for the New Member States and Candidate Countries, since European integration has paved the way for new legislation, regulations and corresponding changes that affect the way Public Administrations in the Enlarge Europe are organized and operate.

In this paper we introduce the SAKE (Semantic-enabled Agile Knowledge-based e-government) project that will specify, develop and deploy a holistic framework and supporting tools for an agile knowledge-based e-government that will be sufficiently flexible to adapt to changing and diverse environments and needs. Indeed, it will provide an innovative framework, supported by an integrated platform, for realizing agile knowledge-based e-government system, based on semantic technologies.

## SAKE approach

Existing approaches for knowledge management in e-government focus mainly on the efficient management of a particular, isolated knowledge resource and on supporting

only message-based[1] communication between public administrators. Moreover, the changes that affect the system are resolved and propagated in an ad-hoc manner. However, the demands for knowledge-based e-government are much higher:

- First, the existing approaches do not take into account the increased granularity of informational resources and the manifold semantic differences in dealing with those resources, which is one of the research challenges of the knowledge-enhanced e-government (i.e. "dealing with heterogeneous and fragmented sources of knowledge" [2]).
- Second, due to complexity of the decision making processes, effective knowledge management requires the creation of a supportive, collaborative culture while eliminating traditional rivalries. Moreover, many administrative processes are collaborative, and since their course is not predetermined, it is often up to the public servant in charge of a process step to determine what should be done next. Other persons working on the process should therefore be made aware of the current status and of past actions.
- Third, the usage of existing knowledge resources is indeed a valid aspiration, but for realizing a learning e-government, the crucial question is how to create *new* knowledge. Since the key to knowledge creation lies in the mobilization and conversion of tacit knowledge (Nonaka, Takeuchi, 1995), the focus of the e-government organizational memory should be shifted from explicit to tacit knowledge. It means that written documentation should be enriched with the knowledge that servants have drawn from using the documents and/or replaced by communication among team members.
- Finally, ad hoc management of the changes in e-government systems might work in the short term, but to avoid unnecessary complexity and failures in the long run, management must be done in a systematic way. To improve change propagation speed and to reduce modification costs, the knowledge that a public servant uses in making decisions must be efficiently reedited. If the underlying knowledge is not up-to-date, then the reliability, accuracy and effectiveness of the e-government system decrease significantly. Moreover, as the number of administrative services increases, the complexity of change management increases respectively. It is necessary to provide support for propagating changes to all dependent artifacts by ensuring the consistency of the whole system. In other words, a knowledge management approach that enables agile response to inpredictable, frequent changes in the environment is needed.

Figure 1 illustrates the above presented problems in existing e-government systems; Figure 2 shows how SAKE will address these problems. More specifically, SAKE intends to provide:

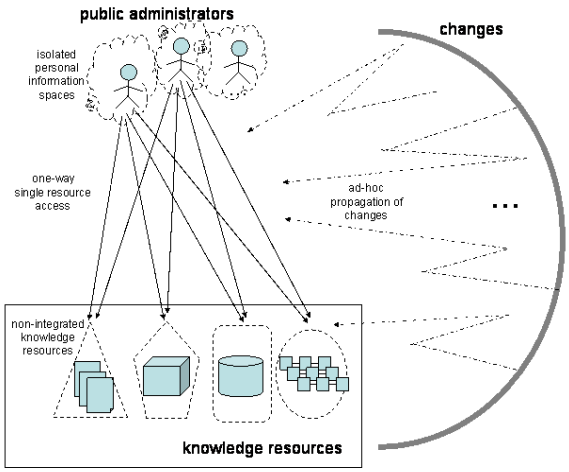


Figure 1: As-Is situation

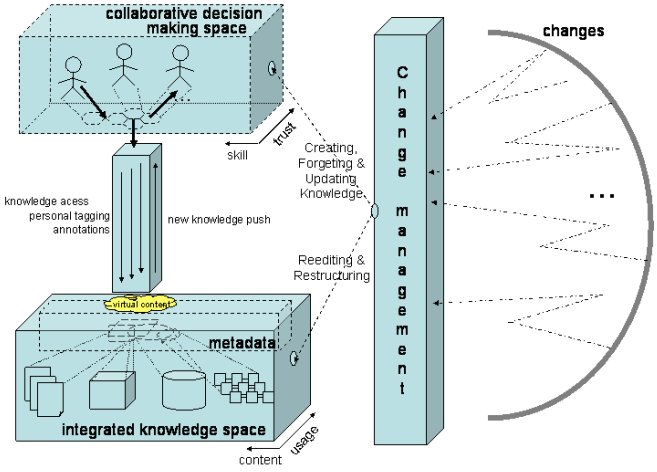


Figure 2: To be situation

- an integrated knowledge space (instead of a set of isolated and heterogeneous knowledge resources) that will unify different perspectives and interpretations of knowledge resources and will enable their treatment on a far more fine grained level: now any bit of information or any knowledge object could be given identity (so called virtual content) and assigned attributes (metadata) allowing for more sophisticated applications and services in e-government;
- a collaborative working environment (instead of a single person decision making process) that will bring every public servant to the same level of effectiveness and productivity and will ensure more efficient knowledge sharing by guaranteeing at the same the time the reliability and the consistency of the decision making process;
- a change management system (instead of ad-hoc management of changes) that will ensure harmonization of requests for changes, resolution of changes in a systematic way and their consistent and unified propagation to the collaborative and knowledge space, in order to ensure the high quality of the decision-making process;

[1] It means that users can exchange row information, but not semantically more complex structures, like decisions, since, e.g. they are missing a common agreed description of resources

[2] http://europa.eu.int/information_society/activities /egovernment_research/focus/organisational_innovation/ index_en.htm#future_research

- a platform for proactive delivery of knowledge (instead of an one-way knowledge access) that enables creation of an adaptable knowledge sharing environment through learning from the collaboration between public servants and their interaction with the knowledge repository and supporting in that way a full empowerment of public servants.

In the aforementioned ways, SAKE provides a framework for an agile knowledge-based e-government, which enables efficient satisfaction of "unpredictable" knowledge needs of public administrators in order to ensure the high and homogeneous quality of the decision making process, especially in a highly changing environment.

Due to its formal nature, semantic technologies promise a support for resolving previously mentioned drawbacks in existing knowledge management systems for e-government, as stressed in the recently performed analysis of the research challenges for e-government in the next decade (EU Report 2004). Indeed, the integration of the heterogeneous and fragmented knowledge sources can be done on a common conceptual (ontological) level. This level will support a unified view on the usage of knowledge sources that is a prerequisite for an efficient learning process. Next, an ontology-based approach can be performed for the explicitation and the diffusion of personal information spaces. Finally, the formal and unified representation of changes using an ontology will ensure their harmonization and consistent propagation through the ontology-based knowledge- and collaboration-spaces.

Therefore, the SAKE project aims to provide an innovative framework, supported by an integrated platform, for realizing agile knowledge-based e-government system, based on semantic technologies.

## SAKE Architecture

Based on the analysis shown in Figure 1 and 2 and the need for applying semantic technologies, we have identified three main SAKE's technological components (Figure 3):

1. *Semantic-based change management* ensures the high quality of the knowledge update (reediting) process by:
- developing a change management process that will enable the consistent propagation of changes to each knowledge stakeholder in order to ensure the quality of the decision making process;
- formal and explicit modelling of the changes in public regulations and their relations to the depending artefacts in the form of the Change Ontology, which will serve as the backbone of the change management approach;
- developing methods and tools for verification of an existing knowledge repository in order to make it easier to understand and cheaper to manage without any loss of information content;
- developing methods and tools for simulation in order to illustrate, in an animate manner, the impact of simulated changes or decisions related to the administrative processes;

2. *Semantic-based content management system* enables efficient provision of knowledge in the context of a PA process by:
- semi-automatic population of the Information ontology by using Text Mining methods (Ontology Learning);
- developing methods and tools for ontology-based tagging of: (i) the content of a knowledge item, (ii) usage of an item and (iii) the relations between particular items developing methods and tools for realizing context-aware searching for virtual content;
- developing methods and tools for editorial process, to satisfy the knowledge items evaluation requirements;

3. *Semantic-based Groupware system* supports more efficient knowledge sharing by developing:
- methods and tools for ontology-based tagging the interaction between public administrators;
- methods and tools for enabling building community of practice from interaction log and their specific vocabularies by social tagging;
- methods and tools for collaborative knowledge creation methods and tools for pushing of knowledge and for searching for experts.

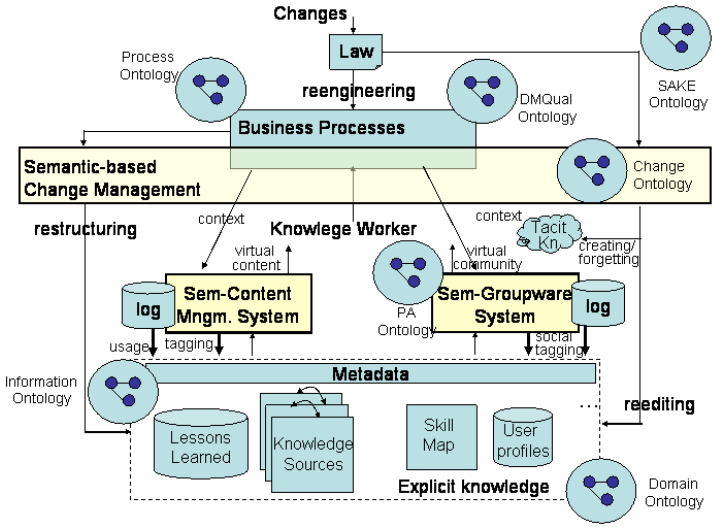


Figure 3: The architecture of the SAKE system

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