A Business Process Analysis and Modeling Architecture for E-Government

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Extended Abstract

National and local governments are automating bureaucratic cumbersome services by interacting fully or partially with their citizens, with the industry and commerce, and with other state offices through electronic means. Although, information and communication technologies spread at a dazzling speed bringing with them hopes of a more efficient government and more accessible information and services, the risks during the conception and implementation of e-government projects are also significant. A careful and thorough analysis of the administrative processes to be implemented must define not only the best way to do it through business process modeling and optimization, but also determine the areas of high chances of success. This paper describes a business process analysis architecture developed with the aim of delivering comprehensive analyses of e-government projects taking advantage of state-of-the-art technology, including the Semantic Web.

Broadly defined, e-government is the use of information and communication technology (ICT) to promote more efficient and effective government, facilitate more accessible government services, allow greater public access to information, and make government more accountable to citizens. (The Working Group on E-Government in the Developing World, 2002) Customers of e-government services and products are not only individuals, but also the industry and commerce, other public institutions and its own employees. Although, in e-government the specific demands of each user groups are to be satisfied by electronic means, this does not mean that e-government is only about implementing technology. Rather, it has to do more with a deep and extensive reorganization including a readjustment of the way of thinking at every organizational level (i.e. management and employees). It requires re-engineering the government's business processes, both within individual agencies and across government.

A business process analysis (BPA) will serve as the connecting layer between the strategic management policies and technological decisions. Such an analysis should deliver a comprehensive picture of the chances, the risks and the political strategic actions appertaining to an extensive re-organization in public offices. It should serve as an important impulse for further rectification of administrative processes in public institutions.

Moreover, a business process analysis should embrace the interests and mission of the commissioning party, which will define the goals of the analysis. It should identify the theoretic potentially high success areas. The analysis and modeling of the is-processes which will lead to the development of a model of should-processes. This analysis must include technical components relevant to the processes (front-office and back-office systems). Finally, the analysis will identify the principal political, legal, organizational and technical preconditions for the realization of an e-government project.

In order to develop such an analysis, the following information is crucial for the modeling:

- Process duration, process costs and process frequency.
- Interaction schemes of the participating organizational units in processes.
- Detail information about software and hardware systems with special focus on their interoperability.
- Identification of system breaks and communication media breaks.
- Classification of products and services according to the "Information, Communication and Transaction"1 model.
- A semantic standardization of the processes and the information objects (including products and services).

The overall outcome of this analysis will be an indicator of the readiness for the implementation of e-government in the target area. Here, it must be pointed out that "e-readiness" begins principally with the political will to introduce changes and take "ownership" of the project. The business process analysis will only present evidence and guidelines for its implementation.

The state-of-the-art technology in our approach borrows ideas of the "Semantic Web". We have created formal models of the organization's reality (products, processes

[1] Classification scheme for products and services within the added-value chain in public institutions. See please refer to http://www.bund.de/nn_6946/Content/BundOnline-2005/Download/Download-knoten.html

and resources) and expressed them as ontologies[2] and process models. Reference models are developed and used in a decentralized way. The Internet or the organization's intranet will be the means of distribution for such models.

BPA in e-government projects

Our experience has also shown us that e-government projects normally target specific products and/or services rather than an organizational unit bringing about a customer orientated government. The customer must be also very well identified and the point of view of process analysis will be that of the customer and not the standpoint of a specific organizational unit. Therefore, due to the magnitude of the changes in the way of thinking and linear business process in public administration, the complexity of e-government projects is enormous.

Experience has also demonstrated that every project is unique, even when the product or service is the same in two different projects. Reasons for this are different organizational structures, different technical infrastructure, continuing oral tradition, access to technology from the side of the customer, lack of expertise and information, etc.

We have developed a modular architecture which allows the process analysis and modeling to be easily adapted to each situation. It has the requirement that every module must be fully compatible with other modules. Furthermore, to reduce costs and time of modeling, the information used and produced in each module is reusable in the same project or in other projects. In this way, we can define modularity, integration and semantic consistence as cornerstones of our methodology.

Methodology and architecture

Our approach pretends to transform traditional administration models into semantic webs in order to facilitate knowledge-intensive activities within public offices. Therefore, our in-house developed methodology begins with the compilation of the product catalogue and its storage by electronic means. The electronic product catalogue includes all the products and services provided by a specific public office. Such products and corresponding services are defined as outputs of activities in order to facilitate the management of the administrative units. Moreover, a product catalogue will contain a hierarchical structure consisting of services, products and product groups. Services are grouped in products according to technical factors, and the task and goal orientation. Services are evaluated and prioritized with regard to their e-government suitability and e-government relevance. The electronic catalogue and its evaluation is done by an officer using the online application *eGovernment Masterplan*.

[2] Ontologies serve as metadata schemas, providing a controlled vocabulary of concepts, each with explicitly defined and machine-processable semantics. (Maedche and Staab, 2001)

Separately, the product and service documentation will be semantically analyzed resulting in a lattice of concepts and interactions important for the functional reorganization of the public office. The online application *Knowledge Base Builder* allows the semantic analysis of stored documents in the online library *Greenstone*[3]. Goal of a semantic analysis is to understand the relationships between the most important concepts in the context of the document and thus model the semantic relationships between products, services, actors, technical and legal guidelines and procedures.

By these means, we have on the one side, the output of the *eGovernment Masterplan* as a model of the product catalogue for a specific office. On the other side, the result of the *Knowledge Base Builder* is a reference glossary. This reference glossary contains all the concepts that are important for the execution of the project. Each concept will consist of a definition, attributes, applicable actions (methods), a hierarchy of concepts and relationships to other concepts.

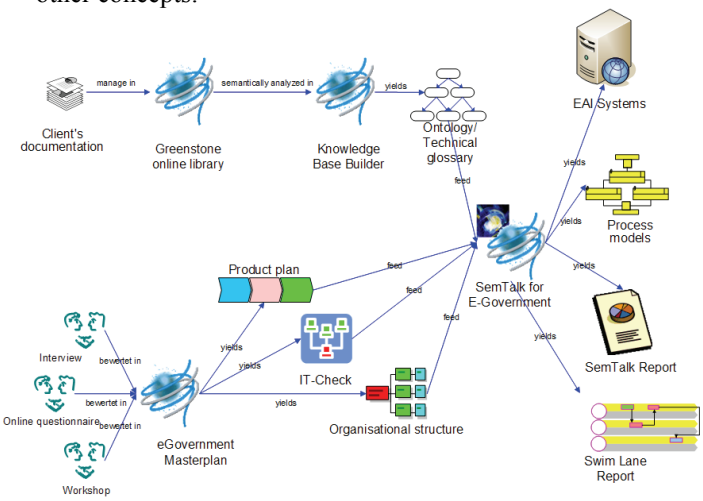

Figure 1 Modular and semantically integrated business process analysis architecture.

Both tools can export their repositories as OWL files. These OWL files are in fact reference models that can be imported by the tool *SemTalk for E-Government* as class models and use them to create activities in process models. After several e-government projects we decided to use communication structural analysis (CSA)[4] method for business process modeling. In CSA a process consists of interfaces between activities connected by information flows made up of information and media. Class models help to form structured and linguistic consistent process components. This improves reuse and allows object oriented reporting. (Fillies and Sure, 2002). It is important

[3] Greenstone is a suite of software for building and distributing digital library collections.
See: http://www.greenstone.org

[4] See: http://www.sysedv.cs.tu-berlin.de/Homepage/SYSEDV.nsf/

here to noticed, that following the Semantic Web philosophy, SemTalk's object base needs no relational databank to store the objects, their attributes and the relations between them. Instead *SemTalk for E-Government* creates RDF schemas of the objects and it references them (and not copies them) when reused within a model or several models. In *SemTalk for E-Government* an agent maintains this consistency by searching at real-time (i.e. while modeling) the object name in a reference model and offering the possibility to convert this object into a hyperlink to the other model. But even if modelling is supported by an agent-based infrastructure, human experts will be always needed to review models and to control quality.

Much attention has been placed on *SemTalk for E-Government's* reporting functions. In business process analysis in public institutions the flow of control is always of special interest, but the CSA method reflects the flow of information instead. *SemTalk for E-Government's* includes the generation of reports using the swim lane notation to point up the responsibility of organizational units or the change of IT-systems. Moreover, *SemTalk for E-Government* includes a set of Microsoft Excel reports which cover process costs, interaction tables, IT-systems breaks, etc. Process models can be published as HTML pages for human reference.

Object classes in references models can be used, for example to create process models using different notations. For example, *SemTalk for EAI* can use the same objects used in a CSA process model to develop BPMN[5] models. BPMN and its direct mapping to computer executable languages like BPEL[6] allow us to model specific sections of business process that are suitable for their implementation as Web Services and generate almost automatically computer code for enterprise application systems like Microsoft BizTalk Server, IBM WebSphere or SAP NetWeaver.

All this can be done by reusing very efficiently the same information objects of previously made process models and ontologies and maintaining their semantic consistence.

Summary

Facing the risks and high socio-economical impacts that e-government projects have, it is necessary to analyze thoroughly the existing public organization with all its attributes. Only then it is possible to identify high success chance areas and minimize the risks and efforts of re-engineering such complex organizations.

The methodology and architecture presented in this paper summarize years of research and learning by doing in e-government projects and business process modeling.

[5] Business Process Modelling Notation. For more information visit www.bpmi.org

[6] Business Process Execution Language for Web Services. It provides a means to formally specify business processes and interaction protocols.

Four different applications have been integrated providing numerous consulting features to address the problem stated. The configuration of this architecture allows enough freedom to not only configure each tool and the architecture as a whole to the customer needs, but also to extend it into other areas like change management, quality management (e.g. a Balanced Score Card module), etc. This is mainly possible through the XML protocol and the development of semantic richer languages OWL.

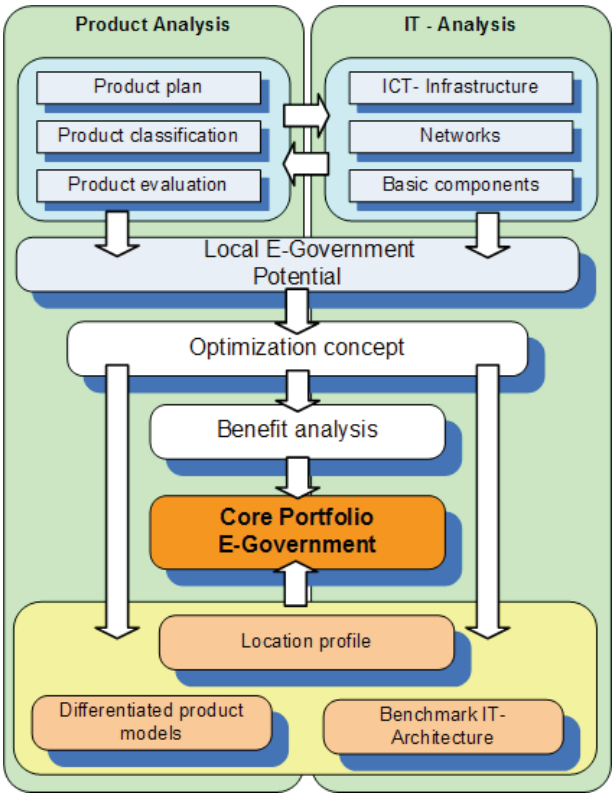

Figure 2 Summarized procedure model of the presented methodology

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