ADAPTIVE PROCESSES IN E-GOVERNMENT
A Field Report about Semantic-Based Approaches from the EU-Project "FIT"

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Abstract: For increasing the efficiency and effectiveness of public administration as well as improving the usability and adaptability of systems state-of-the-art semantic technologies can be combined with existing business process management (BPM) approaches in e-government. This position paper shows ontology-based approaches as implemented within the EU-project FIT. In FIT the customer approved business process modelling language ADOeGov® has been enriched with business rules in order to provide the necessary transparency, flexibility and efficiency.

1 INTRODUCTION

This paper focuses on the sector of public administration and e-government and presents two advanced prototypes which combine semantic technologies and business process management (BPM).

The concepts discussed in the following represent the current development status of the IST project FIT[1] a project co-funded by the European Commission under the "Information Society Technologies" Sixth Framework Programme (2002-2006). A short introduction to the project will be given in the following:

The overall goal of FIT is defined to "develop, test and validate a self-adaptive e-government framework based on semantic technologies that will ensure that the quality of public services is proactively and continually fit to the changing preferences and increasing expectations of e-citizens" (Stojanovic N. et al, 2006: 1). Through semantic technologies the actual service delivery is adapted during run-time to the specific needs thereby increasing service quality continuously.

Historically, BOC[2] developed a comprehensive BPM method for public administration called ADOeGov® (Palkovits, S. and Karagiannis, D., 2003), (Palkovits, S. and Wimmer, M., 2003), (Palkovits, S. et al, 2004) by extending the general BPM approach implemented in ADONIS® (Karagiannis, D. and Kühn, H., 2002), (Junginger, S. et al, 2000) to the specifics of e-government. Within the above mentioned EU-project, BOC as a project partner has extended the classical BPM approach towards agile BPM using business rules. Thereby the flexibility of end-users of BPM can be increased to meet current e-government requirements.

This paper is organized as follows: Section 2 gives a brief overview of the current challenges in the area of BPM in e-government and gives an introduction to the ADOeGov® modelling method. Section 3 discusses the theoretical background of the ontology-based approach developed within the project, presents the actual implementation and application as a prototype and proof-of-concept. The conclusions will give an outlook on further developments within the project.

[1] FIT – "Fostering self-adaptive e-government service improvement using semantic technologies". Accessible: http://www.fit-project.org, [22 Jan 07]

[2] BOC Homepage. Accessibile: http://www.boc-eu.com, [22 Jan 07]

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2 CURRENT CHALLENGES IN E-GOVERNMENT

In e-government applications and scenarios a number of actors (e.g. authorities, citizens, clerks), multi-organisational business processes and heterogeneous technologies have to be integrated (Kühn, H., 2001), (Palkovits, S. and Wimmer, M., 2003). Therefore they are recognized as being rather complex and difficult to manage. Following this fact and due to the currently running modernisation initiatives (e.g. i2010[3]) of public administration, BPM and reorganization in general are seen as key criteria to successfully implement e-government summarized under the term "New Public Management" (Lane, J., 2000).

Business process modelling and reorganization have many advantages for e-government as has been pointed out by various authors: The purposes of processes models range from a knowledge management perspective to facilitate human understanding, communication, organisational learning and transfer of know-how (Woitsch, R. and Karagiannis, D., 2005) to the management perspective for steering and supporting process improvement and implementing process monitoring and controlling. Through the modelling approach, the derivation of variants and the comparison and testing of alternatives in a save environment become feasible before implementation. This may then directly lead to savings in time and money in the long run (Brücher, H., 2001).

The ADOeGov® toolkit aims at providing a comprehensive BPM solution that integrates different e-government specific aspects. This includes aspects of service orientation through a top-down based life-event approach, process monitoring through the integration of key performance indicators into the process flow as well as a monitoring cockpit and aspects of security modelling on a technical level in order to provide the means for effective implementation of e-government.

Although BPM leads to the aforementioned benefits, still the current solutions lack the necessary transparency, flexibility and efficiency to be adaptive to different scenarios. This stems mainly from the fact that business processes in today's administrations are highly complex, involve many different participants and spawn multiple information systems (Burmeister, B. et al, 2006). Another drawback of the systems is the high complexity to enable effective process management and responsibility leading to the fact, that the domain expert needs to become a process expert to cope with the highly complex scenarios.

The combination of semantic technologies and BPM aims to overcome these drawbacks. The integration of the concept of business rules into traditional business process views marks a feasible solution in this regard. This approach allows agile modelling and execution of business processes, leading to a flexible and efficient way in the usage of business processes. To be able to formulate business rules it also becomes necessary to define a common vocabulary as a semantic reference, thereby leading to increased transparency in BPM.

3 SEMANTICALLY ENRICHED BUSINESS PROCESS MANAGEMENT

The approach developed within the project is ontology-based and results in the definition of transparent, flexible and efficient processes in e-government. Within the FIT project the business rules approach was chosen as it has grown in importance and popularity in the last few years for agile modelling approaches. According to the Business Rules Group (Business Rules Group, 2000) "a business rule is a statement that defines and constraints some business. It is intended to assert business structure or to control or influence the behaviour of the business". It is expressed using a simple, unambiguous language that is accessible to all interested parties: Business owner, business analyst, technical architect etc. (Morgan, T., 2002).

The main goal of the FIT project at this stage was to translate these theoretical requirement defined during various work packages into an effective and easy-to-use modelling method. It should be integrated as a module with the ADOeGov® method providing means to model business rules on different abstraction layers (from business/design view to technical/execution layers) and the actual integration within the BPM approach.

The management of business rules is regarded as a closely related although separate knowledge domain. Modelling business rules as separate entities offers various advantages, according to (Schacher,

[3] i2010 – A European Information Society for growth and employment, Accessible: http://ec.europa.eu/information_society/eeurope/i2010, [22 Jan 07]

M. and Grässle, P., 2006), (Rosenberg, F. and Dustdar, S., 2005) and (von Halle, B., 2001) the major benefits are: Transparency because of a common business vocabulary that defines all terms clearly and consistently, flexibility because business rules can be changed in an easy and controlled way and efficiency as some business rules can be executed automatically.

The following subsections will describe the theoretical frame and the prototypical implementation within ADOeGov®. The concluding paragraphs of this chapter provide examples of the actual application scenarios within the projects by giving a brief overview on the models created and designed as pilots.

3.1 The Business Rules Modelling Procedure: A Framework Description

Within the course of the FIT project the project partner Fachhochschule Nordwestschweiz developed a theoretical framework defining the different steps necessary to get from the first level of "verbal" rule definition to an executable level. Figure 1 depicts these steps accordingly and provides the standards definition and scientific research in this domain.

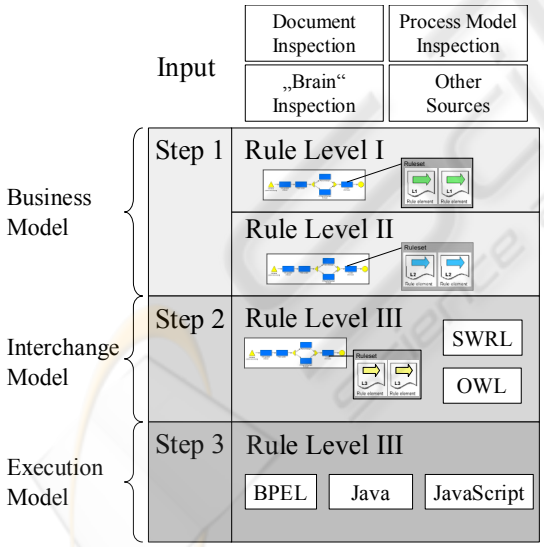

Figure 1: The Business Rules Framework.

The developed framework is defined as follows:

The input for the semi-formal representation of business rules are document sources (e.g. laws, regulations etc.), existing process models or implicit conceptions of domain experts, as rules are often stored in the head of the people. Other sources could be database analyses or actual workflows in the form of programme code. Terms, facts and rules are then defined, grouped to rulesets and assigned to the corresponding activities, decisions or processes. To model these concepts two model types have been created: The "Business process model" and the "Rule level I model".

To simulate and analyse the different paths of the processes, business rules have to be transformed into the second level formalism. This is again a semi-formal representation but makes the rules executable by a process stepper algorithm for easing the rule introspection and dependencies by the user.

The second step of the business rules framework transforms the models into an open accessible format using OWL-S, OWL and SWRL. Process models are represented in OWL-S. Terms and facts are transformed into OWL, whereas business rules are transformed into SWRL. This formal representation of business rules makes them interchangeable with third parties.

The last step is the machine executable representation of processes and business rules. The formal and thus interchangeable models created in step 2 of the framework will be automatically migrated into machine executable format. OWL-S must be transformed into BPEL to execute the workflow, whereas business rules can be exported e.g. into Java or JavaScript.

3.2 The Business Rule Modelling Language: A Realisation Approach

The technical frame concerning business rules as modelling concepts has been implemented using the concepts of the meta-modelling platform ADONIS® (Karagiannis, D. and Kühn, H., 2002). This gives the method engineer the necessary flexibility and efficiency in the customisation of the application accordingly. Details on the meta-modelling approach and customisation can be found in (Karagiannis, D. and Bajnai, J., 2004), (Junginger, S., 2000), (Nemetz, M., 2006), (Fill, H., 2004).

Figure 2 shows an excerpt of the business rules meta-model, showing all relevant model types and the relations between them. The rectangles represent the model types and the arrows the associations between them. The overall model stack of ADOeGov® including all usage scenarios can be found in (Palkovits, S. and Wimmer, M., 2003) and (Palkovits, S. et al, 2004).

As the figure shows business rules are modelled on three different levels, from the semi-formal to the formal and thus interchangeable representation using

standards like OWL and SWRL. Business rules are grouped to rule sets. If a certain rule set is assigned only rules belonging to this rule set will be executed at runtime. Business rules are assigned to the business process model or to the workflow model corresponding to the BPEL standard on a technical level.

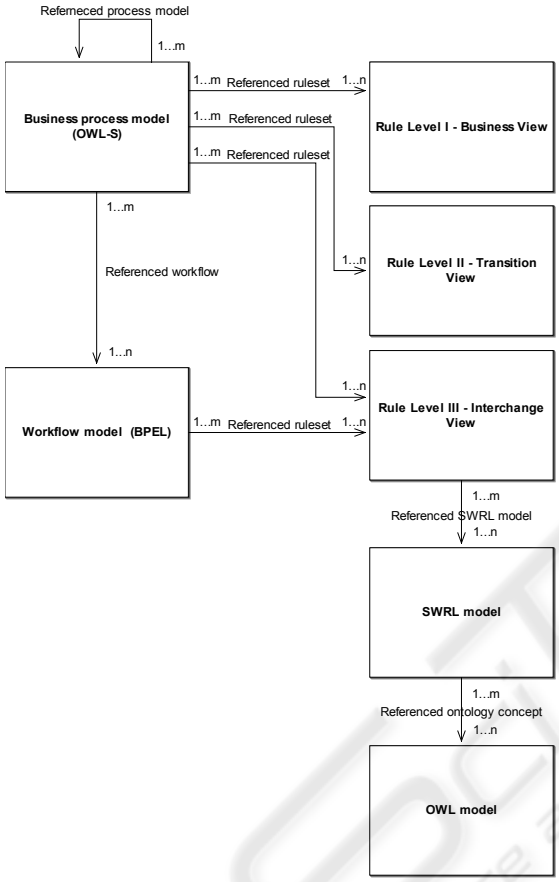

Figure 2: The Business Rules Meta-Model (Excerpt).

The Rule Level I – Business View is a semi-formal representation of business rules according to (von Halle, B., 2001). The added value of this model type is that it can be modelled and understood by business people as well as by IT people as it is clearly structured and offers as well a verbal definition of the rules. The three major concepts, which can be modelled, are terms, facts and rules. Terms and facts represent the semantics behind the rules. Rules are declarative statements that apply logic or computation to information values. Through the execution of rules new information can be discovered or decisions about actions can be made. Rules can be classified into five groups: Constraints, guidelines, action-enabling rules, computations and inferences.

The Rule Level II – Transition View is also a semi-formal representation of business rules. Business rules defined on this level can be used for simulation, variant and alternative testing and represent one step before implementing the rules within execution systems. It is particularly important for allowing an introspection of the dynamic nature of the rules which cannot be accomplished with Level I models.

The Rule Level III is oriented towards a fully machine interpretable representation. To define rules in a formal way two further model types were necessary. The standards agreed upon by the project partners were SWRL and OWL. Concepts for automatically generating a first draft of an ontology and using this information within the SWRL models are currently discussed within the project.

3.3 Application Scenario

The business rules approach implemented within the FIT project is applied within e-government and public administration within the following scenarios:

- Variable process execution to determine activities and processes to be executed during process runtime,
- intelligent resource allocation at run time to select employees based on special skills, to present information depending on user categories or to select a particular web-service and
- Intelligent branching and decision making at runtime to control the process flow accordingly.

For the FIT project a workbench as an organisational frame has been configured and set live providing tools and functionality for collaborative process management using a strict service-oriented approach and online capabilities. The functionalities offered are web-modelling for creation, update and editing of models, the web-documentation for model review and commenting, interfaces for importing and exporting information within the platform to and from highly specialized tools like ontology editors, workflow designers and rule editors. The workbench is regarded as a common knowledge space throughout the project where all model based information can be retrieved and stored.

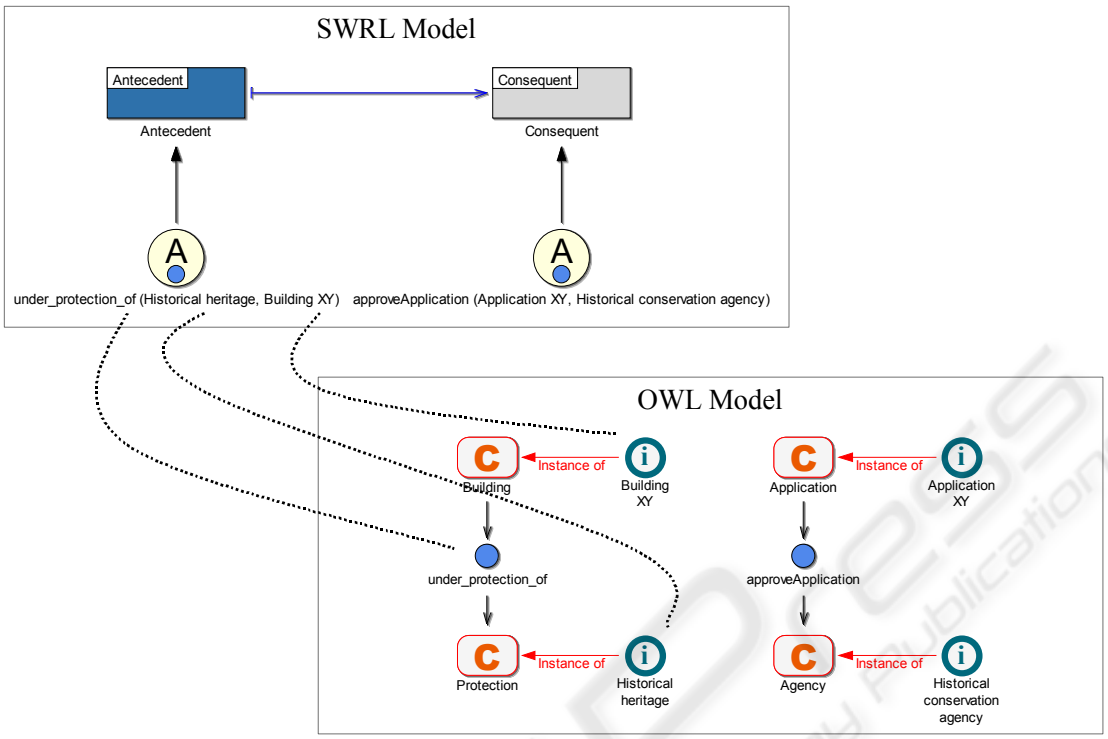

Figure 3: Using OWL to define SWRL rules.

Figure 3 shows how OWL classes, instances and properties can be used to define SWRL rules. This rule evaluates whether an application for building permission has to be approved by the historical conservation agency. The antecedent and the consequent of this rule both consist of one atom with references to object properties and individuals of the OWL notation.

4 CONCLUSIONS

The results presented in this position paper provide an overview on the current stage of development and research within the area of agile process management from the perspective of the e-government project FIT. The presented approach represents a step in the direction making administrative procedures transparent, flexible and efficient by using semantic technologies and concepts.

Currently the applicability of the introduced business rule methodology is evaluated by selected scenarios of the project partners as well as the integration potential into other domains and scenarios is investigated.

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