Semantic Service Oriented Architectures for eGovernment Platforms

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Abstract

eGovernmnet solutions are getting momentum. Nowadays, we can notice that every country is providing and developing their own solutions, projects and initiatives. As result, we can find a lack of interoperability among them. We can even find interoperability lacks in solutions from the same administration. To overcome this situation we propose the use of a semantic platform where all these solutions may cooperate to expand the accessibility of services in a broad sense. As result, we will present a semantic platform to develop and host eGovernment applications.

Introduction

After a brief review of the current state of art, we can notice that a high level of resources is being devoted to eGovernment solutions. As results, a soaring number of solutions are becoming available. Limitations and drawbacks are patent when we look for a homogenous access to the provided functionalities, i.e., we can find several projects aimed to the provision of personal information but when trying to recover personal data along all European countries that may be aware of it, we notice the lack of a simple way to recover that data. It seems to us that the battlefield for this problem is no longer the data level: we must aim it at the semantic level to address these problems with some guarantees of success. The semantic applied to the provision of services will improve largely the availability and accurateness of the provided operations and services.

This paper is be organized as follows: firstly we will present some relevant points about semantic applied to our field and how semantic plays a role in the definition of the architecture proposed. Later on, we present in deepth the semantic support developed in our system. This includes the ontology itself, the definition of services and how they are used. Finally, some conclusions will be yielded.

Semantic as a higher point of view

As result of the current background in the area of eGovernment (United Nations 2005; SAP 2005), we can state that little interaction is currently possible in the data level. No simple schemas can be provided for a global infrastructure where all services can play its role. So, we propose a solution in the upper level: the semantic one. By mean of semantic we can overcome the problem, or at least begin the process towards an interoperable platform where services can be used.

The support for the semantic development in this case is mainly carried out by the use of ontologies. Ontologies are, as defined in the literature, "a formal and explicit way to define a conceptualization about a shared knowledge"(Gruber 1993). The idea behind the use of these technologies is to make computers capable of understanding data with little or no human intervention. Special attention must be paid to semantic applied to service descriptions. This is a major aspect of the problem in this environment as it will allow us to define, invoke and reuse services among different platforms by mean of semantic descriptions.

Semantic Service Oriented Architectures

In order to design architectures, several approaches can be proposed. In our case, we decided to use a service oriented approach. Main reasons for these are: high rate of change on the conditions of services, need for composition of services from several sources, requirements for high flexibility on services, ...

In our case, we are dealing with a SOA(OASIS 2005) proposal but taking advantage of semantic features to obtain some advances such as new capabilities on invoking, composing and discovering services. We are going to refer to this approach, here after, as SSOA, Semantic Service Oriented Architecture. Main actors in the proposed architecture for our SSOA solutions are:

- Semantic matcher or Blue Page Server in our framework. We need in this architecture some elements to solve the problem of locating services. So, this element is the one responsible for matching the request from the client expressed in semantic terms with the desired service. This service is nowadays being carrying out by UDDI servers. These servers are responsible for locating the proper server to each request users make by looking up in an internal repository based on plain data.

  This solution brings up problems about semantic searches and constrains for providing advanced services. There-

fore, we will implement this function using an OWL-S matcher that uses the provided ontology for describing services. This server accepts requests from agents in the system and submit the result of searches after identifying the suitable service in each case.

Of course, these elements have to take care of the current state of art. A major weakness is related to the provision of an accurate Semantic Matcher.

- Intelligent client. This component is the responsible for discovering semantic services needed for its purpose and invoking it. This component acts in behalf of the citizen. A wide range of agents may be involved in the interchange of information. As a matter of fact, support for service should be completely independent from the user's platform.

  Besides, in our proposal, agents will be responsible for tasks related to composition and orchestration of operations. As these agents can use information from different sources and invoke service from different Public Administrations, we can provide a higher level of flexibility in the system. It is important to note that agents in this platform are, by default, assumed to be mobile agents as they will be responsible for the biggest part of the workflow of operations.

- Service Provider. This component must fulfil requests from the client according to its semantic description and are the final responsible for the service provision. This role is usually assigned to Public Administrations. These components are responsible for the eventual execution of expected services. In this approach, we propose the provision of a fine-grain solution for services. As already stated, citizen are responsible for the orchestration and invocation of services. So, as they have available a large amount of simple service to invoke, they would be able to compose these services in the more suitable way for the own convenience.

- In our platform we also include some additional actors, using a UML terminology, that provide additional features. We would like to outline the existence of other two of them: monitoring agents, responsible for tasks related mainly to security; and brokers, involved on the provision of higher level services and task related to increase interoperability among further platforms.

Semantic in Use

From the review of the on-going-projects, we can not be confident on achieving an acceptable level of interoperability using the data-based level or the functional level. That is the point why we are prone to use semantic as the base of the system.

Our proposal is based in the use of the semantic as a backbone of the system. As previously stated, the ontology in the system includes the definition of actors, features and every piece of information that can be granted or dealt with in the system. As a matter of fact, if something is not present in the ontology it can not be achieved or even referred to. That is the reason why we devoted so large amount of resources to the design of the former. In this task, we can learn valuable lessons from other projects such as Ontogov(Ont 2005b).

Before dealing with the definition of the ontology itself, we have to decide which methodology are we going to use. In this way, we make up a decision among several options: Cyc(Lenat, DB & Guha, RV 1990), method Uschold & King(Uschold M & Grüninger M), method Grninger & Fox, KACTUS Aproximation (Schreiber, ATh & others 1995), METHONTOLOGY(Fernández-López, M., Gómez-Perez, A, & Juristo, N. 1997), method SENSUS, On-To-Knowledge(Ont 2005a). Even all of them look for the same final goal, a proper definition of a methodology, the approach in each case significantly differs one from the other. The chosen option in our case was Methontology. Main reasons in this election are: good support with software tools (such as Protègè-2000 or OntoEdit), independent from platform, it is recommend by FIPA for ontology development, it has been tested in several large scale projects, ...

Gathering an ontology

During the definition of the ontology itself, we follow the guidelines presented in the chosen methodology. In this sense, we develope a model composed of different layers to modell different features. As result, several pieces of ontology were constructed:

- life-events. They provide a definition of the events that establish transitions in citizen's life. These events define a single point in the time that represents a meaningful situation. Some examples are BeBorn. GetMarried, BecomeResident,...
- Variable status. This component includes definition of status that requires a particular treatment and defines the situation of the citizen. In our case a relevant status are the professional status, licenses available, official degrees, ...
- Legal documents. This module includes the definition of different documents that may be used by the citizen in any deal with the administration.

As a matter of fact, these features or characteristics expressed by the ontology drive the definition and design of the whole system.

It is clear that the presented ontology is centered in the citizen itself. This way, our ontology defines the citizen as an actor in the system that is susceptible of being labeled under different characteristics and features and capable of requesting services.

Expected features in the ontology are flexibility and adaptability. We must keep in mind that our context is changing at a constant rate due to technical, legal and political features and our semantic support must be ready to accept those changes and keep on working. As a matter a fact, a mechanism for tracking different version of documents is provided, i.e., we can refer to legal specification that are not currently applicable but must be kept in mind to deal with past information.

Definition of services

Apart from providing the proper definition on actors and life-events, our platform must deal with service definition

and invocation. To achieve this feature, we must use an additional semantic technology. In our case, we decide to use OWL-S(OWL-S Coalition 2005). The key actor in service description in our proposal is the Blue Server as it is responsible for matching requests from user with provided services.

In the design of our prototype, we assume that the only possible request is about a service. So, the Blue Page Server accepts requests where the key inputs are the life-event wanted, involved actors and the expected output in terms of the generated document. This allows this limited version of the OWL-S Matcher to look through those services included in its own database for the proper one or ones.

It is, even, possible that the same service may be available under different circumstances, i.e., there may be the same service offered by different administrations or with different security constraints.

For obvious reason, the mechanism to upload those records containing the definition of the services must be a secure procedure. As citizens will interchange critical data with entities addressed in that file, the Blue Page Server must be responsible of the submitted data, i.e., that information must be signed by the server.

Documental support for operations fulfilled

A common feature in all democracies all along the world is the use of documental support for every operation undertaken by public administrations. Thus, every operation must turn out into legal documents where information and result from the former is stated. This is the mechanism to force both administration and citizen to support the outcome of their transactions. In our platform, as result of any operation performed, the service provider implemented by the administration will send a document with all data presented using the ontology to describe the outcome of the operation. The use of the semantic technology for this task brings us several advantages, such as:

- Support for intelligent tools in data managing. The use of semantic in documents provides the chance to develop tools that may mine data in a smart way.
- Facilities in further operations. These documents, expressed in terms of the ontology, may be used for further operations in a quite simple manner.
- Advanced services. From semantically-marked documents, we can provide advanced services by mean of brokers, another actor in the system capable of more advanced operation involving different service providers.

Conclusions

The provision of eGovernment solutions is, at the present moment, a high speed race that involves all countries in the so-called first world. This amount of projects fulfils solutions useful for the citizen but also brings some kind of shortcomings and drawbacks. One of the major problems is related to the interoperability among different solutions. This paper addresses the provision of a semantic-based environment where a platform for eGovernment solutions can be developed. A key feature for this proposal is the advantage derived from semantic applied to eGovernment. Of course, we have to deal with the limitations from the current state of art such as those related to semantic matchers. If we scan the future of this proposal, we can hopefully foresee a common and global place where solutions could be developed in an integral, homogenous and friendly way.

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References

Fernández-López, M.; Gómez-Perez, A; and Juristo, N. 1997. METHONTOLOGY: From Ontological Art Towards Ontological Engineering. *Symposium on Ontological Art Towards Ontological Engineering of AAAI*. 33–40.

Gruber, T. 1993. A translation approach to portable ontology specifications. *Knowledge Acquisition* 199–220.

Lenat, DB, and Guha, RV. 1990. *Building Large Knowledge-based Systems: Representattion and Inference in the Cyc Project*.

OASIS. 2005. OASIS SOA Reference Model TC. Web available. `http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=soa-rm`.

2005a. on-to-knowledge. Web available. `http://www.ontoknowledge.org/`.

2005b. Ontogov. Web available. `http://www.ontogov.com/`.

OWL-S Coalition. 2005. OWL-S: Semantic Markup for Web Services. Web available. `http://www.daml.org/services/owl-s/1.1/`.

SAP. 2005. eEurope 2005 - A study of the degree of alignment of the new member states and the candidate countries. Web available. `http://www.dree.org/elargissement/RapportsSite/INSEADeEuropeCompar0408%.pdf`.

Schreiber, ATh, et al. 1995. The KACTUS View on the ’O’ World. *IJCAI95. Workshop on Basic Ontological Issues in Knowledge Sharing*. 28–37.

United Nations. 2005. Benchmarking e-government: A global perspective. Web available. `http://www.unpan.org/egovernment4.asp`.

Uschold M, and Grüninger M. Ontologies: Principles, methods and applications. *Knowledge Engineering Review 11* 93–115.