Developing SWS for e-Government

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ABSTRACT

Categories and Subject Descriptors
C3 Special-purpose and application-based systems H4.2 Types of system

General Terms
Management, Design, Experimentation Human Factors, Standardization.

Keywords
DIP, ECC, e-Government, GIS, Ontology, Semantic Web Services.

1. INTRODUCTION
Essex County Council (ECC) - a local governmental authority within the UK - is the leader of the eGovernment case study within the European Commission-funded project DIP (Data, Information and Process Integration with Semantic Web Services (SWS)). Its aims are: to identify potential application areas for Semantic Web Services (SWS) as an infrastructure in real e-Governmental scenarios; and to improve the way in which multiple organisms (different departments within an organization, organizations and their customers, partners and suppliers) operate together to provide better services to the citizens. Among the identified potential scenarios, two have been chosen for prototype implementation, in order to test the technology infrastructure for SWS created by DIP.

2. DIP Integrated Project
DIP's objective is to develop and extend Semantic Web and Web Service technologies in order to produce a new technology infrastructure for Semantic Web Services (SWS) - an environment in which different web services can discover and cooperate with each other automatically **Error! Reference source not found.**. SWS are a new technology infrastructure which combines and enhances the Semantic Web and Web Service Technologies.

DIP uses the Web Service Modeling Ontology (WSMO) as the overall framework for semantically enriching web services. WSMO is a formal ontology for describing the various aspects related to SWS following the Web Services Modeling Framework (WSMF), namely: Goals, Web Services, Ontologies and Mediators. WSMF is based on the following principle: *maximal de-coupling* and a *scalable mediation service* [1].
ECC's task within DIP is to create real use case implementations in the e-Government sector using a SWS architecture following WSMO.

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3. SWS in e-Government
Joined up services in e-Government almost always imply sharing scattered and heterogeneous data. SWS technology can help to integrate, mediate and reason between these datasets. SWS technology applied to the e-Government field promises to reduce risk and cost by: moving from "hard coding" services to reusable functionality; increase flexibility; enabling discovery of new or previously unknown services; aggregating services on the basis of user preferences; and providing better service to third-parties and customers
Nevertheless, there are several prerequisites for the adoption of SWS in e-Government: creation of compelling demonstrators/ prototypes, establishing standards which are visible to the eGovernment community; stable and mature technology/products; and convincing business cases.
ECC as the e-Government use case leader in DIP is working to provide a proof of concept in order to promote the benefits of the application of SWS technology in the e-Government field.

4. Change of Circumstances (CoC) Scenario
The first e-Government prototype within DIP is the "Change of Circumstances Scenario". This scenario is based on the *announcement of moving (change of address),* which is one of the twelve public services for citizens identified within the European Interoperability Framework for which the online sophistication is being benchmarked at national level.

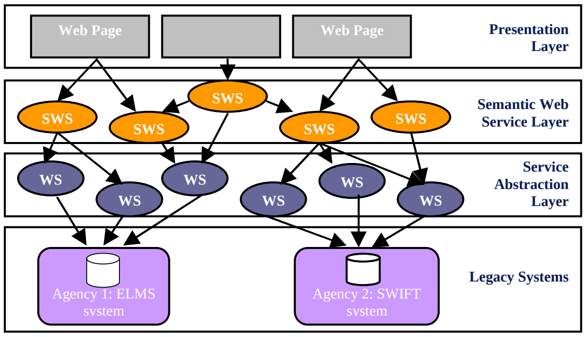
Current service delivery to citizens is affected by a complicated inter-agency collaboration –a cross different tiers of Government (National, County, District or Borough) and external agencies – which makes it difficult to find the appropriate service to fulfil citizen's requirements. Relevant data has to be discovered and retrieved from a widespread array of heterogeneous data sources. SWS have the potential to be the technology which overcomes these difficulties and provides better services to the citizens.

4.1 CoC scenario definition
The CoC scenario involves*"a single woman in part-time employment moving into a new house, in order to look after her disabled mother"*. When this change occurs several agencies have to be notified (e.g.: County Social Services, District Housing Department, Department of Work and Pensions, etc.). The scenario makes use of SWS to seamlessly notify all the relevant agencies and provide to the citizen the benefits and/or services he is entitled to.

4.1.1 *CoC architecture*

The CoC prototype is a distributed system based on SWS. **Figure 1** depicts the system architecture

Figure 1 - CoC architecture



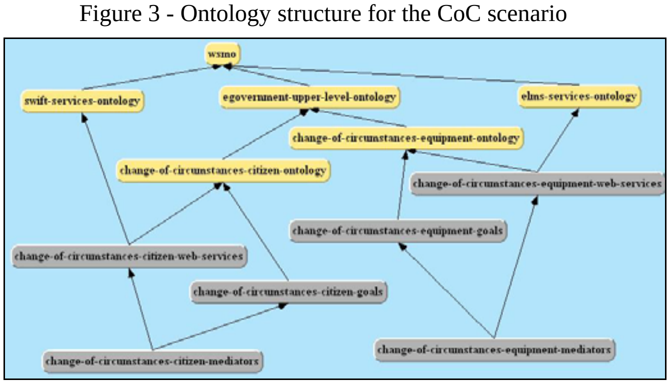
The CoC prototype accesses and automatically combines information from two real systems, namely the SWIFT and ELMS databases. The former stores information about citizens registered in ECC and their entitlement to services and benefits, while the latter stores information about equipment which is provided to citizens registered in Essex. The functionalities from these systems are accessed by means of Web Services, which are used as the basis for the SWS created. The Semantic Web Service Layer is WSMO compliant (consists of ontologies, mediators, web service descriptions and goals). This prototype is accessible from the user through a web GUI, depicted below in **Figure 2**.

Figure 2 - CoC interface

4.1.2 *CoC Ontologies*

This scenario is supported by several Ontologies. **Figure 3** depicts this Ontology structure.

Figure 3 - Ontology structure for the CoC scenario

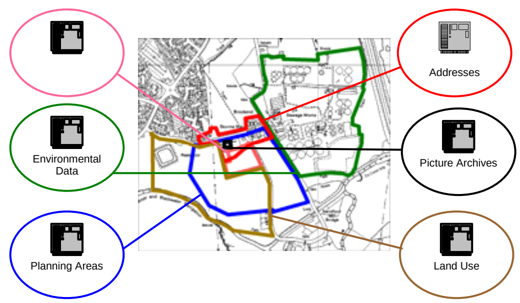


The main ontologies are: an e-Government domain ontology that models a wide range of e-Government and community services and information, a specific task ontology about the SWIFT services and another about the ELMS services, which model how several agencies should be notified of a change of address or other circumstances of any person living in their area of competency in order to provide them with services and/or equipment.

5. GIS Emergency Planning Prototype

The second prototype focuses on a Geographic Information environment. Many public organisations hold a large amount of Spatial-related Data (SRD) and manage a number of Geographical Information Systems (GIS). This wide distribution across the organisation causes duplication of data and lack of communication among SRD holders (see **Figure 4**). Through implementation of a SWS-GIS system all the data would be made available through the web and its automated management would be possible (discovery, composition and invocation).

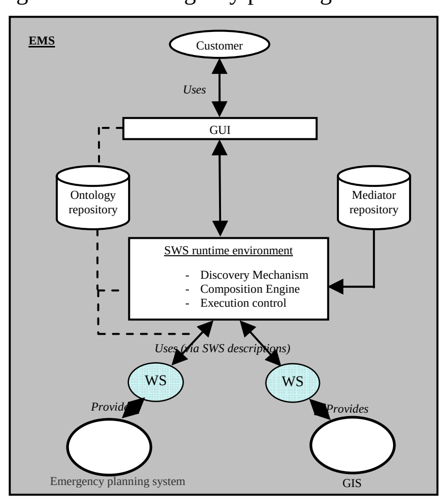
Figure 4 – Heterogeneity in GIS



The SRD was developed though a process of interviews with SRD holders in ECC. The focus is ECC Emergency Planning Department. More concretely, the scenario addresses a real past emergency situation around the Stansted airport area, namely the snowstorm on 31ST January 2003, in order to ensure the availability of real data. The prototype is a decision support system (DSS), which assists the end user (emergency planners, police, ambulance, army, etc) in gathering information related to a certain type of event, quicker and more accurately.

5.1.1.1 *Datasets*

Figure 5- GIS emergency planning architecture



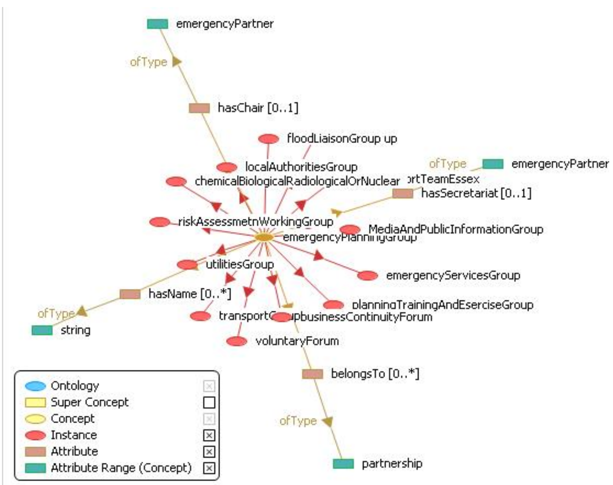
Several emergency stakeholders are involved in order to create the most possible realistic scenario. Other agencies, together with ECC Emergency Planning Department, who are collaborating in sharing their data, processes and expertise – to be modeled in the ontologies – are: Ordnance Survey (the UK mapping agency) and the Meteorological Office (UK).

The prototype emergency management system (EMS) is a distributed application which semantically selects and aggregates WS from the relevant agencies for a given emergency scenario – The emergency planning officer (EPO) accesses the application through a web-based GUI, selecting and invoking a goal from the repository. This goal triggers the execution of one or more SWS. As stated in the WSMO model, several mediators can be invoked in order to cope with semantic mismatches between the services invoked. Several Ontologies support the semantic description of the remaining WSMO components. **Figure 5** depicts the system architecture of the WSMO based EMS.

5.1.2 Task Ontologies

A number of Ontologies have been developed to semantically support the SWS. Figure 6 depicts the “emergency planning group” concept from the “emergency ontology”. This ontology has been designed to model the expertise of ECC emergency planners. Several other ontologies have also been created, namely: *“basic”*, *“date and time”*, *“geographical concepts”*, and *“meteorology.* Expertise from domain experts (e.g.: OS, Met Office) has been taken into account while creating these ontologies.

Figure 6 – Partial View of Emergency Ontology



The Ontologies have been created in WSML (Web Service Modeling Language), a language that that formalizes the Web Service Modeling Ontology (WSMO), and which is being developed by DIP and other clustered projects. New ontologies from other sources are also added to this prototype (e.g.: OWL Emergency Shelter Ontology created by OS [3]) in order to broaden its scope and demonstrate its modularity and versatility.

These ontologies provide the semantic support to all the other WSMO components (WS, Goals and Mediators). Some of them describe the user’s point of view (those describing the Goals) while some others describe the providers’ point view of the world (those giving support to WS and Mediators). The inputs of the WS (XML in our particular scenario, but any other format could be provided) are lifted to the ontology, which means the ontology classes are instantiated with this data in order to provide the semantic support to the rest of the components. After invoking a Goal, the results are lowered back into XML so the results can be displayed back to the user.

6. CONCLUSION

6.1 Foreseen Advantages

Sharing information cost-effectively between disparate systems is a perpetual problem for companies, which represents billions of dollars in technology spending. It is estimated that 30% of worldwide IT budgets is dedicated to Enterprise Application Integration (EAI) projects **Error! Reference source not found.**. By making use of SWS technology enterprises can exchange information and processes over the internet in a cost-effective way.

6.2 Overcome Difficulties

The foreseen advantages of SWS are completely new to the eGovernment sector and are chiefly visible only to academic/industrial research participants in the sector. Web Services - needed as the foundation for SWS - are only now beginning to be introduced as infrastructure (often experimental) in some government authorities. Despite this slow adoption, the awareness of need for semantic enrichment is increasing within the governmental sector and the DIP use case is contributing to this process.

6.3 Scalability

We believe in the great scalability of this prototype or any similar application built following this architecture. When a new agency wants to join it just has to make its WS and semantic descriptions available trough the EMS. The new user can reuse any of the ontologies published by previous users in the ontology repository in order to describe his WSMO components (SWS, goals and mediators). If these ontologies do not fully adjust to the new user’s necessities they can be adapted (merged, pruned, specialized, extended, etc) or new ones can be published into the system. The new WS published in the system can be discovered by other users’ requests (goals) both in design or runtime, therefore automatically integrated and part of the system.

7. ACKNOWLEDGMENTS

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