DIP

Data, Information and Process Integration with Semantic Web Services

FP6 - 507483

Deliverable

WP 9: Case Study eGovernment

D9.16

Summative report on potential applications of SWS in eGovernment

Robert Davies

January 31st, 2007

21/02/2007

EXECUTIVE SUMMARY

The successful development of eGovernment is widely acknowledged as a key contribution to achievement of the European Union's Lisbon agenda goals. There has also been increasing attention to the role of the public sector in the system of innovation, not only as a regulator or a financer, but as a set of economic organisations able to make a contribution.

The full application potential of some SWS technologies, including Semantic Web Services (SWS) is not yet realised because of a lack of large-scale testing domains. It is thus argued that large, dynamic, heterogeneous and shared information spaces are required in order to enable effective evaluation. The development of ontologies and semantics, necessary for the interoperability of eGovernment applications, is potentially the first large-scale deployment of the Semantic Web.

The eGovernment domain is unique because of the enormous challenges it faces in achieving interoperability and the need to manage complex causes of change. A key obstacle is the difficulty of automatically mediating the different meanings of data objects and interfaces. Setting up seamless e-Government services requires information integration as well as process integration involving a variety of objects with specific semantics.

Among the major barriers and constraints to be addressed are: migration to semantic technologies; the slow pace of transition toward implementation; the need for industrial support; the greater involvement of users in service design; standardisation; the integration of semantic concepts; and key issues of privacy , security and trust. It will also be vital for future endeavours to promote the application of SWS in eGovernment by making the case in cost-benefit terms which are widely understood in the sector and to communicate potential benefits widely.

The eGovernment use case (DIP WP9) has developed and tested two prototypes based on SWS in co-operation with Essex County Council (ECC), a large local authority in South East England (UK): a Change of Circumstances prototype and an Emergency Planning prototype (e-Merges). The first of these illustrated how SWS can in principle be integrated with industrial strength EAI The second has provided innovative results in the context of integration of SWS and the Geospatial Web, the integration of Web 2.0 interface and visualisation approaches, data integration and context-based navigation

Important knowledge has been gained in relation to: SWS infrastructure; commercialisation; organisational and social aspects; privacy security and trust; ease-of-use; and standardisation issues; the comparative potential of SWS and standalone WS; and those of SWS and other ontology-based approaches. The WSMO-based approach adopted across DIP as well as by this use case can support dealing with interoperability among heterogeneous knowledge sources and mediation among several viewpoints (users, multiple providers, etc.).

The adoption of SWS in eGovernment appears to be a natural, if gradual, development. SWS technology promises to provide added value joined up services: allowing software agents to create interoperating services transparently to users; enable formalization of government business processes in an unambiguous structure; reduce risk and cost by: moving from "hard coding" services to reusable functionality, and provide better

support to front line by allowing one-stop, customer focused, and multiple viewpoint access to services and shared information.

However, demonstrating this to the e-Government community will require the achievement of several preconditions, including. creation of compelling demonstrators and prototypes; establishing visible standards; stable and mature technology and products; and convincing business cases. In this context, among the main forward issues for resolution are: increasing trust in automated data sharing; improving awareness of WS; up-front infrastructure costs; market development; and standardisation issues.

The results of DIP can contribute to raising awareness of the potential benefits of SWS in e-Government and may be used to guide the efforts of new eGovernment applications/projects; influence the eGovernment standards and strategic environment so as to encourage take up of SWS technologies.

Document Information

IST Project Number	FP6 – 507483	**Acronym**	DIP
Full title	Data, Information, and Process Integration with Semantic Web Services		
Project URL	http://dip.semanticweb.org		
Document URL			
EU Project officer	Werner Janusch		

Deliverable	**Number**	9.16	**Title**	Summative report on potential applications of SWS in eGovernment
Work package	**Number**	9	**Title**	Case Study eGovernment

Date of delivery	**Contractual**	M 36	**Actual**	30-Jan-07
Status	version 1.0		final ☑	
Nature	Prototype ☐ Report ☑ Dissemination ☐ Ontology ☐			
Dissemination Level	Public ☑ Consortium ☐			

Authors (Partner)	Robert Davies, MDR			
Responsible Author			**Email**	rob.davies@mdrpartners.com
	Partner	MDR	**Phone**	00 44 208 876 3121

Abstract (for dissemination)	
Keywords	

Version Log			

Reviewer				
			Email	
	Partner		**Phone**	
			Email	
	Partner		**Phone**	

Project Consortium Information

Partner	Acronym	Contact
National University of Ireland Galway	NUIG	Dr. Sigurd Harand Digital Enterprise Research Institute (DERI) National University of Ireland, Galway Galway Ireland Email: sigurd.harand@deri.org Tel: +353 91 495112
Fundacion De La Innovacion.Bankinter	Bankinter	Monica Martinez Montes Fundacion de la Innovation. BankInter Paseo Castellana, 29 28046 Madrid, Spain Email: mmtnez@bankinter.es Tel: 916234238
British Telecommunications Plc.	BT	Dr John Davies BT Exact (Orion Floor 5 pp12) Adastral Park Martlesham Ipswich IP5 3RE, United Kingdom Email: john.nj.davies@bt.com Tel: +44 1473 609583
Swiss Federal Institute of Technology, Lausanne	EPFL	Prof. Karl Aberer Distributed Information Systems Laboratory École Polytechnique Féderale de Lausanne Bât. PSE-A 1015 Lausanne, Switzerland Email : Karl.Aberer@epfl.ch Tel: +41 21 693 4679
Essex County Council	Essex	Mary Rowlatt, Essex County Council PO Box 11, County Hall, Duke Street Chelmsford, Essex, CM1 1LX United Kingdom. Email: maryr@essexcc.gov.uk Tel: +44 (0)1245 436524
Forschungszentrum Informatik	FZI	Andreas Abecker Forschungszentrum Informatik Haid-und-Neu Strasse 10-14 76131 Karlsruhe Germany Email: abecker@fzi.de Tel: +49 721 9654 0
Institut für Informatik, Leopold-Franzens Universität Innsbruck	UIBK	Prof. Dieter Fensel Institute of computer science University of Innsbruck Technikerstr. 25 A-6020 Innsbruck, Austria Email: dieter.fensel@deri.org Tel: +43 512 5076485

Partner	Acronym	Contact
ILOG SA	ILOG	Christian de Sainte Marie 9 Rue de Verdun, 94253 Gentilly, France Email: csma@ilog.fr Tel: +33 1 49082981
inubit AG	Inubit	Torsten Schmale inubit AG Lützowstraße 105-106 D-10785 Berlin Germany Email: ts@inubit.com Tel: +49 30726112 0
Intelligent Software Components, S.A.	iSOCO	Dr. V. Richard Benjamins, Director R&D Intelligent Software Components, S.A. Pedro de Valdivia 10 28006 Madrid, Spain Email: rbenjamins@isoco.com Tel. +34 913 349 797
MDR Partners	MDR	Rob Davies MDR Partners 8 St. Andrew Street Hertford, Herts. United Kingdom, SG14 1JA, Email: rob.davies@mdrpartners.com +44 (0)208 8763121
Hanival Internet Services GmbH	HANIVAL	Alexander Wahler Hanival Internet Services GmbH Kirchengasse 13/1a A-1070 Wien Email: wahler@niwa.at Tel:+43(0)1 3195843-11 |
The Open University	OU	Dr. John Domingue Knowledge Media Institute The Open University, Walton Hall Milton Keynes, MK7 6AA United Kingdom Email: j.b.domingue@open.ac.uk Tel.: +44 1908 655014
SAP AG	SAP	Dr. Elmar Dorner SAP Research, CEC Karlsruhe SAP AG Vincenz-Priessnitz-Str. 1 76131 Karlsruhe, Germany Email: elmar.dorner@sap.com Tel: +49 721 6902 31

Partner	Acronym	Contact
Sirma AI Ltd.	Sirma	Atanas Kiryakov, Ontotext Lab, - Sirma AI EAD Office Express IT Centre, 3rd Floor 135 Tzarigradsko Chausse Sofia 1784, Bulgaria Email: atanas.kiryakov@sirma.bg Tel.: +359 2 9768 303
Unicorn Solution Ltd.	Unicorn	Jeff Eisenberg Unicorn Solutions Ltd, Malcha Technology Park 1 Jerusalem 96951 Israel Email: Jeff.Eisenberg@unicorn.com Tel.: +972 2 6491111
Vrije Universiteit Brussel	VUB	Pieter De Leenheer Starlab- VUB Vrije Universiteit Brussel Pleinlaan 2, G-10 1050 Brussel ,Belgium Email: Pieter.De.Leenheer@vub.ac.be Tel.: +32 (0) 2 629 3749

LIST OF KEY WORDS/ABBREVIATIONS

API	Application Programming Interface
CoC	Change of Circumstances
ECC	Essex County Council
EMS	Emergency Management System
ICT	Information and Communication Technologies
IDABC	Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens.
IRS	Internet Reasoning Service
ISO	International Standards Organisation
OASIS	Organization for the Advancement of Structured Information Standards.
OWL	Web Ontology Language
QOS	Quality of Service
SEE	Semantic Execution Environment
SOA	Service Oriented Architecture(s)
SW	Semantic Web
SWS	Semantic Web Services
WS	Web Services
WSML	Web Service Modeling Language
WSMO	Web Service Modeling Ontology
WSMX	Web Service Execution Environment
XML	eXtensible Markup Language

TABLE OF CONTENTS

1 Introduction

2 SEMANTIC WEB SERVICES IN e-Government

2.1 State of the Art

2.1.1 eGovernment in Europe

The Telecom Council of Ministers held in Brussels on 20 November 2003 formally endorsed the EU e-government priorities for the coming years in *The role of eGovernment for Europe's Future* [1]. Its conclusions acknowledged the importance of eGovernment for reaching the Lisbon goals of making the European economy more competitive. They also stressed the need to identify demand-oriented pan-European eGovernment services for citizens and businesses and to make them available gradually to advance the Internal Market and European Citizenship.

The intended results were greater co-operation, innovation, centres of expertise and a set of pan-European eGovernment pilot projects to evaluate needs, requirements, obstacles and solutions with immediate priority being given to company registration and electronic public procurement. The development of joint actions to build up experience, reuse and validate advanced solutions concerning common approaches to key aspects of seamless pan-European e-government service provision (e.g. accessibility, user identification, security, and interoperability, including data definitions and procedures) was also encouraged. Emphasis was given to the development of open standards. Finally, attention was drawn to the need to identify and take action to eliminate remaining legal and regulatory barriers to eGovernment at national level.

A Decision on *Interoperable Delivery of pan-European eGovernment Services to Public Administrations, Businesses and Citizens' (IDAbc)* [2] was also reached, building on previous work under the IDA.programme.

Subsequently in 2006, the draft final report of The Institute of Prospective Technological Studies (IPTS) *Towards the eGovernment vision for EU in 2010: Research Policy Challenges* [3] analysed a series of eGovernment research areas and mapped them against some of the main Lisbon 2010 policy goals.

The results of this last study show that a major amount of recent research has been carried out in the area of the back-office and the interface between the back- and front-office, including data and knowledge management, technical interoperability, service design and production, and trust and security. Future research challenges are also identified such as understanding user needs, reflecting the move towards a better understanding of how eGovernment can contribute to general EU policies such as competitiveness, job creation, growth, and cohesion. eGovernment is seen in general as a prominent application area in the transition towards a socially inclusive and sustainable knowledge society. :

2.1.2 Public sector innovation and SWS

There has also been increasing attention to the role of the public sector in the system of innovation, not only as a regulator or a financer, but as a set of economic organizations able to make a contribution [4]. Whilst current measurement of eGovernment impact mainly addresses efficiency and cost savings, a need is identified to demonstrate and assess how eGovernment contributes to the creation of public value, in activities such as the provision of public services; the development of policies and regulation; the guarantee of democratic political processes and social inclusion.

The public sector is a major purchaser of ICT goods and services, an important service provider to business and citizens through ICT (e.g. tax declarations and submission of bids to the public tenders) and a large employer of ICT skilled employees: about 50 million Europeans are employed in the public sector. There is therefore a clear opportunity for the public sector to have a positive impact in the innovation system. The public sector is a major user of ICT and can create market opportunities for new products whose price will decrease and then become affordable also for smaller enterprises, allowing them to introduce process innovations.

In this last respect, the public sector can impact at different stages:

- at an early stage in emerging breakthrough technologies, by guaranteeing sufficient demand to lower the risk of private firms to research and develop these technologies;
- at a more advanced stage, when the product or service has been researched but has to be demonstrated, where it can provide an effective testbed;
- when the product or service has been demonstrated, where it can provide an early market of a sufficient size to guarantee the deployment of production facilities, thereby lowering production costs and expanding the market;
- when the product or service is available on the market, but still expensive, a large-scale order by the public sector can contribute to lower the production costs and thereby make the product available also to small firms;
- when a product or service is available but still not widespread, and it is perceived to be contributing to innovation and competitiveness, usage in the public sector could encourage or even compel business to adopt these technologies.

However, for innovation to happen, some contextual factors have to be taken into account. The skills of the public sector, the market conditions, the degree of similarity between public and private requirements, the management of risk, the political commitment, and the governance of intellectual property rights are all important issues.

A fundamental common characteristic of successful innovation driven by the public sector is that this does not usually arise from technology objectives, but from social needs. Emerging technologies need to be rigorously monitored and assessed in relation to present and future public needs,

In this context, several emerging technologies where the public sector could play an active role in the innovation system have been identified, including:

- Embedded systems
- Emerging wireless technologies.
- Long-term digital archiving
- Biometrics.
- and critically in terms of the scope of this document, *the development of ontologies and semantics, necessary for the interoperability of eGovernment application, could be the first large-scale deployment of the Semantic Web.*

2.1.3 Benchmarking eGovernment priorities

The OECD and EU Member States have agreed two key indicators for eGovernment benchmarking.

- Percentage of basic public services available online,
- Use of online public services by the public.

To make these operational, Member States agreed to a common list of 20 basic public services, 12 for citizens and 8 for businesses. Progress in bringing these services online is measured using a four stage framework, as follows:

1 posting of information online;

2 one-way interaction;

3 two-way interaction;

4 full online transactions including delivery and payment.

Data has been collected in regular surveys [5]. Progress is indicated below:

Table 1 Public Services for citizens

Income taxes: declaration, notification of assessment	4
Student grants	4
Car registration (new, used and imported cars)	4
Application for building permission	4
Enrolment in higher education / university	4
Health related services (interactive advice on the availability of services in different hospitals; appointments for hospitals)	4
Job search services by labour offices	3
Personal documents (passport and driver's licence)	3
Declaration to the police (e.g. in case of theft)	3
Public libraries (availability of catalogues, search tools)	3
Certificates (birth and marriage): request and delivery	3
Announcement of moving (change of address)	3
Social security contributions (3 out of the following)	3
Unemployment benefits	
Child allowances	
Medical costs (reimbursement or direct settlement)	

Table 2 Public Services for Businesses

Social contribution for employees	4
VAT: declaration, notification	4
Registration of a new company	4
Customs declarations	4
Environment-related permits (incl. reporting)	4
Public procurement	4
Corporation tax: declaration, notification	4
Submission of data to statistical offices	3

The IDABC eGovernment Observatory [6] has been established is a reference information tool on eGovernment issues and developments across Europe, offering a number of services including: eGovernment news; factsheets providing progress overviews; a library repository of essential documentation; case studies, best practices and projects and events, from across Europe

2.2 SWS in eGovernment

The Semantic Web has been the focus of the AI community for more than five years. However, after years of intensive research and impressive scientific results, real-world use cases are needed in order to demonstrate its added (business) value. The full application potential of some SWS technologies, including Semantic Web Services (SWS) is not yet realised because of a lack of large-scale testing domains. It is thus argued that large, dynamic, heterogeneous and shared information spaces are required in order to enable effective evaluation.

The eGovernment domain is unique because of the enormous challenges it faces in achieving interoperability, given for example the manifold semantic differences of interpretation in areas such as law, regulations, citizen services, administrative processes, best practices, and the many different languages to be taken into account across Europe. These semantic differences are related to a great variety of IT solutions (on a local, regional, national, and international level) which will need to be networked (despite standardization efforts). A key obstacle is the difficulty of automatically mediating the different meanings of data objects and interfaces. Setting up seamless e-Government services requires information integration as well as process integration involving a variety of objects with specific semantics.

Moreover, due to its open architecture, eGovernment provides a range of new research questions for SW, such as interportal search (e.g. searching for additional resources on other portals in response to a primary user or agent request).

In moving towards a knowledge-based, user-centric, distributed and networked eGovernment, specific and demanding characteristics need to be taken into account, for example:

- the high degree of formality of some key areas (e.g. law);

- the need to enable similar decisions in similar situations;
- the high demand to take into account security, privacy, and trust;
- the longevity of some process instances (e.g. in urban and regional planning);
- information imbalances between stakeholders;
- the involvement of many different stakeholders in the same process (citizen,. city council, county council, federal government etc)

Web Services

Most countries have begun supporting eGovernment initiatives. The ultimate goal is to improve government-citizen interactions through an infrastructure often built in one way or another around the 'life experiences' of citizens. Efforts have been made to wrap applications in modular Web Services (WS). Adopting WS in eGovernment enables public authorities and agencies to provide value-added services by defining a new service that outsources from other e-government services; to uniformly handle privacy issues; and to standardize description, discovery, and invocation.

Composition

Service composition is also gaining momentum as one potential 'silver bullet' for the envisioned Semantic Web. Applications expected to take advantage of Web Service composition include those in eGovernment. To date, enabling composite services has largely been an ad hoc, time-consuming, and error-prone process involving repetitive low-level programming. The need for an ontology-based framework for the automatic composition of Web Services is acknowledged increasingly.

Reasoning

Actors in the eGovernment domain also require reasoning to decide on critical issues such as organisational cost/benefit, "user" involvement, technical integration, and implementation strategy [7]

2.2.1 Change management

eGovernment systems are subject to continual change. The most frequent changes are those relating to existing business processes in the adaptation of business goals, organisational structure or the drive to improve organisation .The changes to be managed mainly lie within and are controlled by the public administrations. A modification in one part of the system may generate many inconsistencies in other parts of the same system. This variety of causes and consequences of the changes makes change management a very complex operation that should be considered as both an organisational and a technical process.

Change management may be defined as timely adaptation of a system to the changes in business requirements, users' needs, etc. as well as the consistent propagation of these changes. Existing approaches in eGovernment focus mainly on manual managing of a particular, isolated service and on supporting mainly message-based communication between public administrators.

This means that public administrators can exchange 'raw information', but not semantically more complex structures, such as decisions, since e.g. they are missing a commonly agreed description of problems. Moreover, existing approaches require a growing number of highly skilled personnel, making maintenance costly. Finally, the changes that affect each system are resolved and propagated in an ad-hoc manner. Change management must also take into account the response to changes over which the public administration exercises little or no control (legislation, social and political upheaval, the actions of competitors, shifting economic trends etc).

To address this need, projects such as OntoGov [8] has sought to move towards formal verification of service descriptions as well as the use of formal methods for achieving consistency when a problem is discovered. In this case, by arriving at a set of ontologies for modelling eGovernment services involving Legal, Organisational, Lifecycle, Domain, Process, Profile and Life-Event ontologies, based on OWL-S. The Life-Event ontology, based on a Swiss eGovernment standard, aims to give an overview over all relevant eGovernment services includes concepts such as residential affairs, residential permissions, identification certifications, naturalization citizenship, moving, education etc. The inventory comprises 1,200 eGovernment services. The lexical layer of the Life-Event ontology enables handling of different languages. One of the services modelled is "Announcement of moving" (see 2.1.3 above) which addresses the typical involvement of various private and public sector agencies.

2.2.2 Interoperability

Interoperability can be seen as the ability of several software components based on different platforms to interact, exchange services and cooperate in solving complex tasks. However, ISO TC204 defines interoperability as "the ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enabled them to operate effectively together". SWS link up distributed services and information automatically and enable their automatic processing.

eGovernment reflects many of the integration (horizontal/vertical) and interoperation problems of other domains. eGovernment deals with different information infrastructures, human beings, administration models and the relations between these entities. The semantics of eGovernment is tied to corporate cultures within the many institutions and agencies of government at its various levels.

In addition, in the context of eGovernment transformation, there is interest in information integration at semantic level: mapping concepts across institutions, departments and agencies, expressed as domain ontologies to help achieve semantic integration and interoperability. eGovernment semantics are often characterized by vagueness in terms of granularity: the people involved reason at multiple levels of granularity. It is argued that a basic agreement on the meaning of terms and processes is necessary before any form of alignment of ontologies can take place.

Although the creation of government Web portals which assemble related services around concepts such as Life Events is a noticeable improvement towards integration, the bulk of the back office processing burden has not changed. The need to achieve a greater degree online maturity in order to address the problems of seamless integration and interoperability has stimulated some actors in eGovernment to consider combining Semantic Web and Web Service technologies as a means to achieve integration and interoperation in the emerging 'service transformation' phase. This technology becomes really useful mainly when an ensemble of related distributed eGovernment services are composed in order to create a new one.

Until now, to design a platform for service delivery, government interoperability frameworks have usually reflected eCommerce developments in Web Services technology, based on Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP) and Uniform Description, Discovery and Integration (UDDI)

2.2.3 Emerging priorities for SWS in eGovernment

The agenda of the European W3C Symposium on eGovernment, held in Gijón, Asturias, Spain, 1-2 February 2007 [9] provides an interesting insight into the current state of thinking on eGovernment technologies at the interstices between international web standards bodies and eGovernment policy makers, practitioners, consultants and industrial suppliers. The Symposium aimed to enable greater understanding of specific government and citizens' needs related to eGovernment services, identify aspects that put Web interoperability at risk and find how governments can deliver better and more efficient services through computer technologies. Topics to be discussed at this symposium included:

- Learning more about eGovernment requirements.
- Challenges in the use of IT for governments and users.
- Interaction, accessibility and mobile Web within eGovernment services.
- Web Services and eGovernment.
- Semantic Web and eGovernment.
- Security and privacy within the eGovernment transactions.

Specific programme topics (in addition to an opening speech asking: 'has eGovernment lost its way?', included: Open Web Standards and eGovernment, policy, standards and legislation in eGovernment; citizen experience with eGovernment; Web Services: Building Blocks and Prospective; the IDABC programme - The European Interoperability Framework; the offer and promises of Semantic Web; and WSMO-PA: Towards a generic PA Service Model; semantic tools for the e-Citizen; and Semantic Web: bridging the gap between eGovernment and citizens.

2.3 Barriers and constraints

2.3.1 Migration to semantic technologies

Preparing for the adoption of Semantic Web technologies is especially a challenge for small sized administrations. Major migration challenges to address the requirements generated by the existence of many handcrafted HTML websites and web pages automatically generated by content management systems which had been designed for displaying content for humans to read. The migration path is not trivial, and existing migration approaches are unlikely to provide sufficient support for small administrations to avoid unfeasible levels of cost and effort. At the same time, the immediate local benefits of migration are limited.

The EU-funded project Access-eGov is seeking to work with stakeholders to introduce a framework for analyzing migration support requirements with the aim of developing tools, concepts and strategies to lower these barriers. The theory of its approach is that migration requires a more or less elaborated ontology (and often ontology mapping), a migration methodology, as well as tool support. However, these approaches may not be sufficient support for small administrations which face severe restrictions in financing and staffing migration projects.

2.3.2 Slow transition toward implementation

Although municipalities provide virtually identical services, implementation of these takes place individually and is continually repeated. The relatively high expenditure, often linked with substantial investment in building up the required IT infrastructure necessary to realise eGovernment services, and, at the same time, benefits which still appear minimal to some, have led to a situation where the implementation of e-Government is still progressing relatively slowly. Perhaps because technological possibility rather than user needs have determined the development of ‘front offices’, a large percentage of potential users of eGovernment still prefer to access government services through traditional channels (mostly face-to-face).

Users, especially those without web experience, are often lost in the information space of a portal and need specific help e.g. in filling up a form. The state of the art in the development of front offices remains basically to publish a service in isolation, without considering all the contexts in which it can be used or expressing the cross-dependencies between services. There is often one static grouping of services, although there are many possible ways to structure them depending on the current user’s . context for access. This helps to explain why finding the most suitable service for a particular need is one of the most reported usability problems in eGovernment. In order to support continuing improvement of the quality of public services, the focus of a front office may need to be shifted in the direction of an intelligent platform for discovering needs for service improvement that will meet users’ expectations.

In general, while there appear to be examples of real usage of semantic applications in the public sector in the USA, Europe: seems not yet to have many good real case examples. Movement toward a ‘self-adaptive’ eGovernment framework, based on semantic technologies that will ensure that the quality of public services is proactively and continually fitted to the changing preferences and increasing expectations of ‘e-citizens’ has also been identified as a need and is being addressed by the FIT project [11] in FP6.

The need for advances in reference modelling has also been identified by OntoGov, which has developed reference process models, using ontologies, at various abstraction layers within its system with the intention that public administrations can adapt these reference models to their specific needs and make them available for citizens and that subsequent changes in the reference models can be transferred to all the depending models.

In practice, many public administrations are not at present generally ready to use Web Services and the introduction of SWS presents a significant challenge. Building SWS on existing WS appears to be the logical way forward. Special attention is required to the semantics applied to service descriptions, to enable definition, invocation and reuse of services among different platforms.

The value added case for eGovernment in using SWS relates to the potential to solve heterogeneity issues e.g. by introducing greater data interoperability through domain ontologies and data mediation. The extent of process interoperability as an issue is less clear. It is possible that SWS could help in formalising service models, via Business Process Modelling, using WSMO [12] and WSML

Further evidence from use cases and pilot implementation in the eGovernment sector can help provide verification of SWS frameworks and feedback to SWS development

2.3.3 Need for industrial support

In terms of the applicability of SWS to e-Government: from a technical point of view, in principle, eGovernment systems can be seen as Service Oriented Architectures (SOA). From an organisational point of view, people in eGovernment need to better understand the potential benefits of WS and SOA in eGovernment, implying a need for widespread education and awareness raising activities. The further development of Web Services requires the support of companies that governments can rely on protocols.

2.3.4 User involvement in design

eGovernment development includes aspects of human-computer interaction (HCI), software/systems engineering, Web and Web Service design. If all citizens are to have access to eGovernment, there are also “digital divide” issues to be considered. The Semantic Web (SW) can enable citizen users, facilitate eGovernment processes and resolve many HCI and access problems related to the digital divide. Ethnocentric software studies, observation of public employees and users accessing public computing facilities often leads to the identification of considerations that are crucial in general eGovernment system development, including: the nature of services to be provided; the need for stakeholders’ participation in design; the need for user training, ease of use; and issues of security, privacy and trust. .Some citizens may not know that if they need one government service, they may need another related service. The SW can provide ‘service clustering’ by incorporating Web-service discovery and

SW technology can benefit all of these areas, enabling online services to be organised around what the citizen wants rather than how government departments are organised. Recommender Systems could be incorporated into eGovernment processes. There may always be citizens who need to consult intermediaries, but the more user-centric eGovernment development becomes, the less the socio-technical digital divide and the more successful eGovernment is likely to be.

2.3.5 Standardisation

As far as eGovernment is concerned, the most relevant standardisation issues appear to be W3C standardization efforts in SWS (SWS IG, Semantics for WS) and OASIS standardization efforts in SEE TC

“Standardization” processes at national levels. such as common data models for public administrations and domain ontology infrastructures are also helpful

2.3.6 Integrating semantic concepts

Using SWS can assist discovery of information and services when compared with information structured in traditional ways. Some of the main barriers to progress lie in integrating semantic concepts and technologies in current solutions. There is a need for more semantically enriched applications and exploratory search mechanisms, including the use of ontologies, taxonomies and advanced annotations, linking terms and knowledge objects from different domains and mapping of terms from different contexts / environments.

Other key requirements include:

- the classification of knowledge objects in reusable concepts, simplification of integration of knowledge objects;
- the need for service integrators or service connectors;
- intelligent agents / proxies to provide advanced services.

It has been observed [13] that despite much discussion of the potential benefits for a decade of ontologies as a central building block of the Semantic Web and other types of semantic systems, the number and quality of actual, 'non-toy' ontologies for various domains available on the Web today is insufficient. For many relevant domains, actual ontologies are yet to be built. Current practices in ontology engineering do not sufficiently address a number of fundamental constraints on building and committing to ontologies, including:

- can the ontology be built fast enough to reflect quickly evolving domains?
- Is it justifiable to build a particular ontology from a resources point of view in terms of the gains that would be made?
- Can the individuals using an ontology for annotating data or expressing queries easily grasp the meaning of all ontology elements as intended by the ontology creators?
- Is the structure of incentives for relevant actors in the process compatible with the contributions required from all of them?
- Standards are often subject to Intellectual Property Rights. It is often not trivial to establish the legal framework for deriving ontologies from relevant standards.

The author identifies an 'expressivity/community-size frontier': the more detailed and expressive an ontology is, the smaller the actual user community will be. In practice, useful ontologies must be small enough to have reasonable familiarisation and commitment costs and they must be big enough so that there is a substantial value added by using the ontology. FOAF is offered as an example of the way that shallow, small ontologies have driven the Semantic Web to date, pointing out that ten of most popular ontologies are less than 50 KB in size, eight of them 10 KB and less. Research is needed to address these as well as purely technical issues.

2.3.7 Security, privacy and trust

Government providers not only have different goals in the design, organization, management and delivery of services than the private sector but face massive challenges under different constraints. Among the most important of these challenges are:

- safety, security, and integrity of online interactions with government;
- privacy and confidentiality of personal and business information within government;
- and information management with respect to accuracy and relevance when merging data across departments and agencies.

Although security technology for Web Services addresses the safety, integrity and confidentiality concerns through cryptography, digital certificates and trusted third-party authorities, it is neither convenient nor stable enough to inspire trust.

Current research [19] has shown that it is possible to automatically discover, select and compose Web Services on syntactic, semantic and pragmatic (location, QoS, policy) levels. However, to date, no Web Service infrastructure has the capability of dealing with laws on e.g. Privacy Laws, e.g. related to the use and sharing of personal information where the explicit written consent of a subject is required. Last, but not least, the current composition schemes of Web Services mention neither the ability to check the accuracy nor the relevance of data being merged. This may raise the question: are Web Services a sound technological choice for implementing service transformation in eGovernment?

In many cases, online government services are still organised around specific topics: to gain access, the user must visit a constellation of websites whose architecture does not allow integrated service provision such as one-time change of address across several administrations. In addition, the personal data protection laws may require each government organization to build and manage its own secure online database with no possibility of sharing personal information on citizens and businesses. Organisations may have differing concepts of identification with various rules and restrictions. Even where a single online change of address facility has been implemented each destination still bears the burden of validating the address change and a high proportion of online addresses is rejected during validation.

The effectiveness of Web Services technology in transforming government will need to be measured to the extent that it accommodates all aspects of interoperability including technical, semantic, cultural and organizational interoperability as well as security, confidentiality, data protection, privacy and freedom of information obligations.

Web Services alone cannot deal with organisational culture or different ways of doing things e.g. issues of personal power over specific information. There are, of course, many examples of a lack of cooperation between government agencies and departments at al levels. Web Services architectures have no way of semantically processing information from standards built in different administrative environments. Although they may achieve technically some of the aspects of interoperability and integration of information, they are clearly unable to enable complete service transformation.

Semantic enhancements are needed to resolve security issues, provide an integration platform and facilitate use, supporting more user-centric e-Government development and success. The SW can provide a platform for information integration, affiliating appropriate access permissions with appropriate levels of users, employing SW middleware between users and services. A SW agent might decide if a machine accessing Web-based software is public, and then cause the software to act appropriately. Trustworthiness of eGovernment information and its providers can be assessed with SW inference mechanisms. Privacy appliances could be installed as a firewall between data and those who access it. De-identification techniques are being developed to protect innocent bystanders in image data mining

Among the most challenging constraints in Europe, where privacy is a very big issue, are its data protection laws. The USA appears to be much somewhat more open to the exchange and combination of information

Attempts to address issues of personal privacy in a world of computerised databases and information networks typically proceed from the perspective of controlling or preventing access to information. It is argued that this perspective has become inadequate and obsolete, overtaken by the ease of sharing and copying data and of aggregating and searching across multiple data bases, to reveal private information from public sources and likewise proposed that issues of privacy protection currently viewed in terms of data access be re-conceptualized in terms of data use. A ‘Policy Aware Web’ would support transparent and accountable data use on the Web, requiring a new legal and regulatory regime that supports privacy through provable accountability to usage rules rather than merely data access restrictions. Technologies such as XML, Web Services, grids, and the Semantic Web would all contribute to this transformation of the Web.

Greatly increased transparency and accountability of the inferencing process would be entailed, meaning that the history of data manipulations and inferences is maintained so that would be possible to check whether the policies that govern data manipulations and inferences were in fact adhered to. The same argument holds that it is possible to develop general purpose transparency mechanisms for Semantic Web reasoning and then apply those tools in data mining environments. It follows that transparent reasoning will be important for a variety of applications on the Web of the future, including compliance with laws and assessing the trustworthiness of conclusions presented by reasoning agents such as search engines.

3 The Cost-Benefit Case

3.1 Types of e-government evaluation methodologies

There is insufficient evidence from the DIP use case to construct a cost basis for the widespread deployment of SWS in a single local authority, much less across national or regional systems. However, it will be vital for future endeavours to promote the application of SWS in eGovernment by making the case in cost-benefit terms which are widely understood in the sector. A variety of ways of assessing cost-benefit ratios are prevalent in eGovernment across Europe.

Table 3 Approaches to cost-benefit assessment in eGovernment

Method	Description	Use
Transaction costs	Uses segmentation methods to calculate use and benefits to different user groups	Quick and easy way to estimate potential cost savings from the introduction of e-government
Net present value	A straightforward method that examines monetary values and measures tangible benefits	Relatively straightforward; use when cash flows are private and benefits tangible
Cost-benefit analysis	A flexible method that measures tangible and intangible benefits and assesses these against net total cost	Good consideration of all benefits, but can be expensive and time consuming
Cost effectiveness analysis	Focuses on achieving specific goals in relation to marginal costs	Good for considering incremental benefits against specific goals
Portfolio analysis	A complex method that quantifies aggregate risks relative to expected returns for a portfolio of initiatives	Good for consideration of risk, must use a consistent approach across a portfolio
Value assessment	A complex method that captures and measures benefits unaccounted for in traditional ROI calculations	Used by several governments to consider performance against all policy goals

3.2 Generic benefits of ICT in eGovernment

3.2.1 Benefits to government

The benefits to government of investments in ICT may be driven and assessed according to one or more

Table 4 ICT benefits to government

Direct cash benefits	Improved service delivery
Efficiency savings (monetisable benefits)	Enhancements to policy process
Time savings	Enhancements to democracy
Information benefits	Increased user involvement, participation, contribution and transparency
Risk benefits	Improved data collection
Future cost avoidance	Improved security
Resource efficiency	

3.2.2 Benefits to users

From a user perspective benefits may be drawn from the following table

Table 5 ICT benefits to users

Reduced prices for charged-for services, avoidance of future price increases	Value-based non-monetary benefits
Reduced cost of transmitting information – phone, post, paperless interactions, etc.	Quicker response
Reduced travel costs	Improved information
Reduced associated costs, such as professional advice, software tools, equipment, etc. (predominantly for businesses)	Enhanced democracy and empowerment
Revenue-generating opportunities for citizens, businesses and intermediaries	Improved reliability
Reduced user time (hours saved)	Choice and convenience
Reduced need for multiple submission of data for different services and events	Premium service
Reduced travel time	

3.3 Generic costs of ICT in eGovernment

The costs involved for government may include the following

Table 6: ICT-related cost types

Business planning and options analysis	IT training
Market research	System operations and maintenance
Due diligence and plan audit	Telecoms network charges
Tendering	Operations and management support
System planning and development	On-going training
Hardware	On-going monitoring and evaluation
Software licence fees	Financing costs
Development support	Market and process implementation
Design studies	Personnel
System acquisition and implementation	Marketing and communications
Procurement	Customer inducements and rebates
Personnel	Legal advice

From a user perspective, costs may include a rage of direct costs and time factors

3.4 Business impact risks

Some of the main business impact risks may be classified as follows:

- *Impact on business processes (includes changed processes)*: Impact that the project will have on the organisation (during development and after implementation).
- *Impact on government services at implementation*: Impact that the project will have outside the organisation, for example on other agencies, the public and businesses during development and after implementation.
- *Impact on other projects and changes*: Degree to which the project is dependent on and connected to other projects and changes.

3.5 Technological risks

These may include:

- *Technological dependence*: Dependence on new technology or new methods.
- *Degree of innovation*: Extent to which the project involves innovative solutions and staff experience to deal with innovation.
- *Impact and integrity with legacy systems*: Degree to which the project will need to develop interfaces with existing systems and data.
- *Security*: Robustness of physical and technological security controls.
- *Scope of IT supply*: Extent of IT consultant and supplier activity, support and maintenance now and in the future.

3.6 Change and uncertainty factors

These may include:

Table 7 Change and uncertainty factors

Change management	Uncertainty
Culture change required (*e.g.* working practices)	Inexperience in dealing with third-party suppliers
Leadership direction	Dependence on third-party suppliers
Management resistance	Use of untried methods
Lack of staff experience and inadequate training to accommodate change	Time constraints and critical deadlines
Lack of motivation	Economic or market changes
Poor communication with appropriate staff	
Lack of responsiveness to change	

The communication of benefits is a further key issue: They need to be demonstrated in a competitive and comparable context with other technologies so that they can be seen and understood to contribute to eGovernment business cases and in runtime to provide benefits of the types listed above

4 THE DIP CONTRIBUTION

The eGovernment use case (DIP WP9) has been able to co-operate with and use as its testbed Essex County Council (ECC), a large local authority in South East England (UK) with a population of 1.3M. It developed and tested two prototype services based on SWS:

- Change of Circumstances
- e-Merges (Emergency Planning)

4.1 First prototype: Change of Circumstances

The Change-of-Circumstance prototype [15] addressed a specific use case in Essex County Council [ECC]. Whenever the circumstances in which a given citizen's life changes, they might be eligible for a set of services and benefits provided by ECC and other governmental agencies/public service providers. The example chosen was that of an elderly, partly disabled woman moving in together with her daughter.

Such an event changes the circumstances of both the mother and the daughter. As a result, the mother might for example no longer receive a ”Meals-on-Wheels” service whereas the daughter might get financial support for caring for her mother.

Even an apparently simple process such as this requires the interaction of a number of different government agencies. Each of the involved agencies had different legacy systems in place to keep track of citizen records, provided services, third party service providers, etc. In ECC one such legacy system is called SWIFT. The system of one of Essex's partner agencies (a supplier of appliances for disabled people) is called ELMS. In order to integrate these different systems and to provide an integrated solution for providing services to the citizens in Essex the Change-of-Circumstance application was developed.

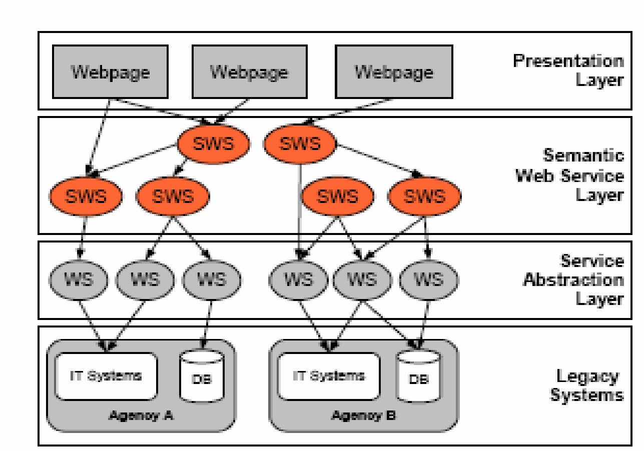

Fig 1 High level overview of CoC prototype architecture

The prototype consisted of four layers, namely i) the legacy system layer, ii) the service abstraction layer, iii) the Semantic Web Service layer and iv) the presentation layer. Due to privacy and data security issues it was not possible to use the real databases running at the two agencies for the prototype. Therefore test databases containing dummy data were developed. These databases had a similar design to the real databases. Furthermore dummy data was created that mimicked the real data available in the systems by including duplicate, inconsistent and conflicting records. As a result the same challenges wee confronted as if the real databases had been used.

Technically, SWS were developed in and executed by the IRS III server, a runtime environment developed by the Open University. The user interface was a web application available using a standard web browser. It used the standard Java API provided by the IRS III server to communicate with the Semantic Web Service layer of the prototype. The User Interface Layer was based on SAPWeb Dynpro which provided a comprehensive environment for the model-driven design of user interfaces

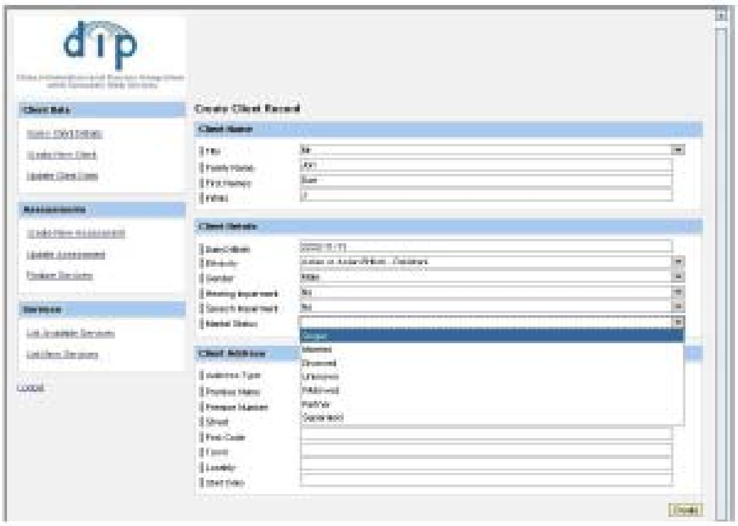

Fig 2 Screen-shot of the user interface.

.

A highly distributed set-up for the prototype was chosen in order to show the feasibility of operating a SWS based application across several physically distributed locations, thereby enabling agencies to benefit from an integrated solution without the need to change their existing systems.

The development of the Change-of-Circumstance application mainly posed challenges on two levels. The main initial challenge was the need to communicate effectively with the domain experts, to understand their processes and to gather their knowledge of the government domain in order to enable the development of the eGovernment ontology and to develop the necessary SWS...

This application illustrated how Semantic Web Services [SWS] and current state-of-the-art Enterprise Application Integration [EAI] software could be combined in order to integrate government applications and information across different agencies enabling the creation of integrated eGovernment solutions.

4.2 Second prototype: eMerges [16]

Following several interviews with spatial data holders in the ECC it was decided to focus the scenario on the ECC Emergency Planning department, and specifically on a previous emergency situation: the snowstorm which occurred in the vicinity of Stansted airport on the 31st of January 2003. Because of the snow, drivers were trapped for several hours in their cars on the M11, a motorway in the UK. As a result, access to Stansted Airport became very difficult, and individuals required transport to nearby shelters, or to hospitals in some cases.

eMerges was designed as the underlying conceptual framework to implement a decision support system assisting Emergency Officers in handling the dynamics of the emergency situation and in gathering information related to a specific event, faster and with increased precision.

Data was integrated from three different sources: the UK Meteorological Office providing snow level information; ViewEssex, a centralized database maintained by British Telecommunications (BT) managing spatial-data for the ECC; and Buddy Space, an Instant Messaging client built on top of the Jabber protocol and providing lightweight means of communication and collaboration. Services were described by using domain ontologies which were mapped to integration ontologies. This process involved building goals and mediators to provide added value to the services, for example through composition.

A prototyping approach was followed that produced three main cycles. The result of each cycle was valued by involved stakeholders (Emergency Planning Department in ECC) and external agencies from Essex and other local and central government authorities other. On the basis of their feedback subsequent cycles were planned. Stakeholder's requirements and knowledge were captured and used in the application and existing processes were represented, eventually simplified, and automated.

In order to successfully create applications from SWS, four key activities need to be carried out as follows:

1. **Requirements capture the** requirements for the overall application are captured using standard software engineering methodologies and tools. The resulting documents describe the stakeholders, the main users, roles, and goals, any

potential providers for Web services, and any requirements on the deployed infrastructure and interfaces.

2. **Goal description** using the requirements documents above relevant goals are identified and semantically described. Any required supporting domain ontologies are either created from scratch or existing ontologies will be re-used.
3. **Web Service description:** descriptions of relevant Web services are created. Any domain ontologies required to support the Web Service descriptions are either defined or re-used as necessary.
4. **Mediator description:** mismatches between the ontologies used, and mismatches within and between the formal goal and Web Service descriptions are identified and appropriate mediators created.

The first two steps are user/client centric and therefore involve discussions with the relevant client stakeholders and domain experts, whereas Step 3 will require dialogue with the Web Service providers and domain experts. Steps 2 and 3 are mostly independent and in the future it can be expected that libraries of goals and Web Services will become generally available to support reuse.

By providing formal descriptions with well defined semantics the machine interpretation of WS descriptions is facilitated. The key areas of interest are:

- **Discovery**: finding WS which can fulfil a task. Discovery usually involves matching a formal task description against semantic descriptions of Web services.
- **Mediation:** it cannot be assumed that the software components found are compatible. Mediation aims to overcome all incompatibilities involved. Typically this means mismatches at the level of data format, message protocol and underlying business processes.
- **Composition:** often no single service is available to satisfy a request. In this case, it is necessary to create a new service by composing existing components. AI planning engines are typically used to compose Web Service descriptions from high goals.

Architecture and standards

In order to provide semantics and step toward the creation of added value services, WSMO (Web Service Modelling Ontology) and IRS-III [17] a tested implementation of this standard were adopted. WSMO is a formal ontology for describing the various aspects of services to enable the automation of WS discovery, composition, mediation and invocation. The meta-model of WSMO defines four top level elements: Ontologies, Goals, Web Services, and Mediators.

.

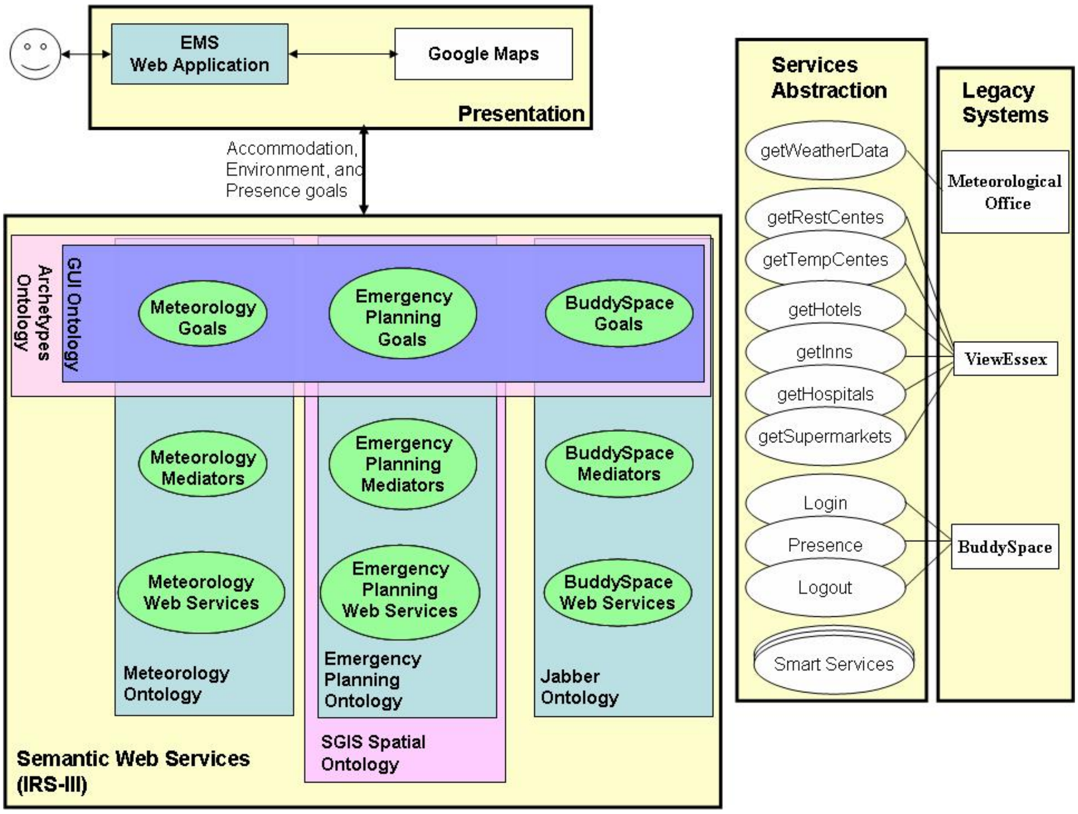

Fig 3 Generic architecture for IRS-III based eGovernment applications

This architecture is comparable with well-known SOA. The added value is introduced at the Semantic Web Service layer where integration and interoperability of existing heterogeneous services are accomplished at run-time.

The prototype incorporated and extended the WSMO Goals, a concept existing in WSMO to describe user's needs as distinct from specific WS functionalities, demonstrating a more intuitive way of interacting with clients in a Semantic Web (SW) context.

The prototype was also produced in a version using the WSMX version of the DIP architecture, demonstrating the same scenario as these previous releases, but featuring a completely new front-end web application which integrates the functionality a Semantic Execution Environment (SEE) provides by means of the DIP API. The functionality and data provided by this version is similar to the IRS-III version, proving the interoperability of the two SEE.

The Geospatial Web

The eMerges approach also applied SWS technologies to the Geospatial Web, illustrating the way in which spatially related data delivered through SWS can ease the management of specific use cases by aggregating data originating from different sources and presenting it in a consistent and task relevant way..

The prototype implementation integrated a web interface using Google Maps for the spatial representation part of the application. The interface was built using the Google Web Toolkit, using AJAX techniques on the client to communicate with a Java servlet, which itself connects to IRS-III through its Java API. The most significant component of the interface is a central map, supporting spatial objects. A spatial object can have an area based location, in which case it is displayed as a polygon, or a point based one, in which case it is displayed as a symbol. All objects present the same interface, with affordances and features, displayed in a pop up window or in a hovering transparent region above it

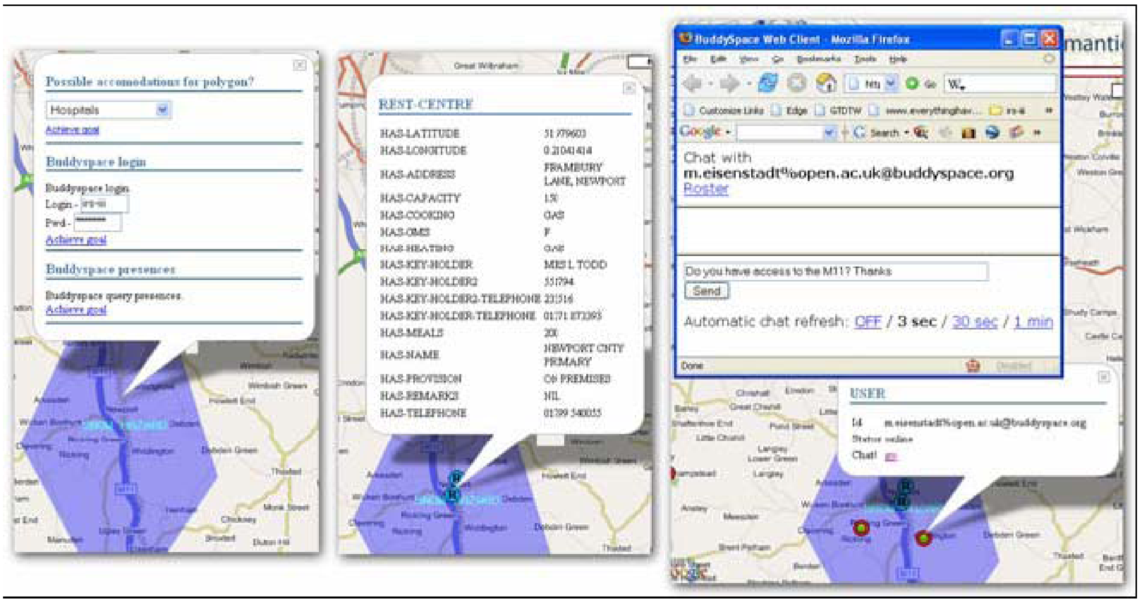

Fig 4 Three views of the application in use: Goals available for the snow hazard; obtaining detailed information for a specific rest centre; initiating a discussion with an online emergency worker.

Web 2.0 interfaces

Closed, static and symbolic traditional web map applications are being progressively replaced by Web 2.0 maps employing new means to achieve a map reality effect, leading to an explosion of mashups, minimal applications developed by independent technically skilled users which aggregate data in a spatial context in order to fulfil a specific goal. However mashups, as isolated attempts at data integration, do not have to cope with the semantic complexity of multiple heterogeneous data sources; usually the service providing the data is integrated by the developer as a single and isolated map layer, making the related semantics clear. To allow large scale integration, semantic descriptions are needed.

Data integration and context based navigation

Integration of new data sources is relatively simple in eMerges, although not entirely trivial. IRS-III SWS integration allows the description of any XML data source available on the web. From an expert point of view the data source integration approach presents notable advantages compared to approaches based on standards .These advantages are framework openness (i.e. standards make integration easier but are not mandatory) and high level service support (i.e. all the benefits of the underlying SWS platform, such as discovery, composition, etc. are immediately available).

The eMerges approach to spatial data integration presents advantages for the end user as well as for the data integration expert. Indeed it allows the end user to handle tasks in a data rich environment without being overwhelmed by the amount of information or by the complexity of the queries, and to the expert an easier approach to data integration.

Impact on Emergency Planning processes

The result is a decision support system, which assists the Emergency Planning Officer in the tasks of retrieving, processing, displaying, and interacting with only emergency relevant information, more quickly and accurately [18].

In 2006 the eMerges prototype won a prize at ESCW for the integration of web scripting technologies with those for the Semantic Web ones and was also selected amongst the five finalists of the Semantic Web Challenge at ISCW in November 2006..

In the future, a new era of emergency management can be envisaged, in which collaboration takes place through the Internet to provide relevant information in emergency situations through SWS technology. In this way, involved agencies can extend their knowledge about a particular emergency situation making use of different functionalities based on data hold by other agencies which otherwise might not be accessible to them or slow to obtain.

Follow up to the work of DIP WP9 in and around Essex is likely to involve the formation of a user group. Several neighbouring counties (Cambridgeshire, Hertfordshire, Suffolk) have expressed interest in being part of such a group. British Telecom has a contractual relationship with Essex which it would like to use to deploy the benefits of SWS and also plans to continue the line of research with internal funding, in the context of exploitation within Essex and other local authorities in the UK. Open University also has plans to continue research and to support the development of an infrastructure of IRS servers. Funding may also be sought from Central Government in the UK to spread awareness of the benefits of SWS within the UK.

In terms of possible uptake in the Emergency Planning field, legislation will be a major driver, such as the Civil Contingencies Act, Home Land Security etc. The way that people need to share data in Emergency Planning depends to a large extent on the type and conditions of the emergency. Currently this is most often through phone, fax and email and much less often via the Web. Delivery channels such as mobile phones are an important issue which needs to be taken into account in designing SWS interfaces.

4.3 What have we learned?

Since SWS technology is young and e-Government is a very complex domain, far from every issue is completely addressed. :

4.3.1 SWS infrastructure.

WSMO is an ongoing research, and some of its main features - e.g. orchestration, non functional properties, and quality of services (QOS)-based discovery - are still under development. Such aspects are likely to yield very useful results in e-Government. The conceptual distinction between goal and Web Services - introduced by WSMO – allows developers to easily design business processes known a *priori* (e.g. emergency procedures) in terms of composition of goals, and to move the (automatic) identification of the most suitable service at run-time

4.3.2 Commercialisation

The transition of the currently available systems into a stable and robust infrastructure is one of the major challenges that need to be solved, before a SWS-based solution can be deployed into a productive environment. However, the prototyping development of carefully targeted applications with clear objectives can lead to real-world operational systems. Increasing the number of WS data sources in order to make it possible to address scalability issues is an important prerequisite for real success. Data licensing may also have an impact on costs.

4.3.3 Organisational and social aspects

The employees of governmental agencies usually perform tasks using well established procedures: the inappropriately-handled introduction of new processes or applications may lead to a reluctance to use them Active participation of stakeholders and end-users in the design and development processes allows developers to deploy applications that respect current procedures and, at the same time, ease the work of staff, leading to improved acceptance.

4.3.4 Privacy, Security and Trust

These are fundamental requirements in e-Government. At the syntax level, efficient solutions for addressing privacy and security issues already exist or else there is relevant ongoing research. The semantic level should extend the syntactic solutions by ontologically describing security and privacy policies of accessing data and processes. Moreover, trust-based discovery of SWS is a crucial issue, in order to avoid invocation of malicious or unreliable services, for which there are no defined standards by which SWS may expose their policies and trust features. The key to enabling a trust-based selection for SWS lies in a common ontological representation, where Web Service and client perform their trust guaranties and requirements [19].

4.3.5 Ease of use of SWS technology in e-Government.

Full integration between e-Government and SWS is not an easy task. In order to address these issues, a more complex semantic layer – i.e. an explicitly e-Government framework - needs to be modelled.

4.3.6 Standardisation.

Currently, reference standards for (semantic) service oriented applications in e-Government do not exist. The eGovernment community is still debating which approach to follow between, as broadly described options, standardization versus. integration (i.e. focusing on interoperation among several existing approaches). The approach developed by DIP is open to both approaches and its results may contribute to the investigation of possible standards.

4.3.7 SWS vs Web Services.

Using WS, data and functionalities can be shared with anyone through the Internet. The supplied services are autonomous and platform-independent computational elements. The syntactic definitions used in these specifications allow fast composition and good results in term of application performance. However, they do not completely describe the capability of a service and cannot be understood by software programs. A human developer is required to interpret the meaning of inputs, outputs and applicable constraints, as well as the context in which services can be used. Moreover, WS lack in flexibility; for instance, if a new WS is deployed, the application developers need to re-model several syntax descriptions – introducing a cost - in order to integrate it in a specific context.

On the other hand, the SWS approach is able to model the background knowledge of a context together to the requested and provided capabilities, and hence address automatic reasoning and reuse. The execution sequence of a complex SWS is not hard-coded, but it is dynamically created using a goal-based discovery and invocation: several WS may be associated with a goal, and only the best one will be discovered and invoked at runtime only; if a new service will be available, the developers simply describe and then link it to an existing goal; if a service changes, only the specific semantic description is affected, and not the whole business process. Finally, developing WS takes time. However, the DIP approach allows the publishing of SWS simply from lisp functions and java methods, reducing the time of deploying legacy system functionalities.

4.3.8 SWS vs other ontology based approaches

Creating and managing ontologies is a bottleneck: understanding a domain, acquiring and representing knowledge, populating with instances and evolving ontologies are big tasks for the application developers. In the context of a semantic-based application, this is a cost that cannot be avoided, but one that may be contained. In a complex domain such as eGovernment, centralised ontologies would require an unrealistic development effort with no guarantee of satisfactory results in terms of capturing domain knowledge.

Moreover, government agencies deal with huge datasets (e.g. demographic, GIS, etc.) that cannot easily transposed to ontology instances. SWS technology makes knowledge capture and maintenance processes simpler and more efficient: the only knowledge which must be modeled is related to the exposed functionality implemented by the WS involving simply the concepts used by WS and the instances created (lifted) when invoking the Web service.

This minimalist approach also improves the management of the ontology evolution and maintenance; (ii) the knowledge capturing is distributed among all of the stakeholders: each partner describes – and it is responsible for – its particular domain; in this way, the several viewpoints (requesters and providers) can be independently and concurrently described by the proper knowledge holders. Partners can also reuse already existing ontologies.

SWS could help address some of the challenges described in 2.3.6, especially through shared ontologies, shared mediation and the definition of goals described according to their Web Services. If the benefits are seen as sufficient, communities may be willing to create shared ontologies (e.g. through industry consortia).

The ability to share ontologies could be enhanced by the establishment of ontology repositories and mapping between ontologies. The extent to which this has yet been attempted is unclear. Choice of standards for ontology languages (OWL v WSML) remain an important issue. If WSML, is to be preferred further promotion and awareness raising among the eGovernment technical communities will be required.

4.3.9 Mediation

Differently from both WS and other semantic approaches, this WSMO based approach can support dealing with interoperability among heterogeneous knowledge sources and mediation among several viewpoints (users, multiple providers, etc.). WSMO mediators are mappings that solve existing mismatches and do not affect service descriptions. In DIP applications, the following mediation requirements and solutions have been gathered:

- **Data mediation (oo-mediators)**: organizations have their own databases and hence different data formats for the same concept. Different data formats can be lifted to same or multiple concepts within domain ontologies. At a semantic level, different concepts can be mapped through mediators.
- **Goal mediation (wg-mediators):** organizations can define one goal that can be satisfied in different ways by applicable Web services developed within different agencies. Multiple Web services can be linked to the same goal via mediators.
- **Process mediation (gg-mediators):** organization processes behave in different ways according to their own set of operational procedures, requirements and constraints. Each Web service presents a choreography describing how a client talks to the deployed service. Furthermore, sub-Goals can be composed together for providing the functionality of one Web service through the orchestration

5 CONCLUSION

The adoption of SWS in e-Government appears to be a natural, if gradual, development.

Specifically, SWS technology promises to:

- Provide added value joined up services: allowing software agents to create interoperating services transparently to users, and hence automate integration, reasoning and mediation among heterogeneous data sources and processes available at different governmental levels.
- Enable formalization of government business processes in an unambiguous structure: allowing the creation of a common understanding of processes, and visualization of the knowledge involved. This could eventually lead to a reengineering of governmental systems and. simplification of processes.
- Reduce risk and cost by: moving from "hard coding" services to reusable functionality, for example through utility computing of shared services (e.g. payment platforms, legal resources, etc.); keeping government organizations' autonomy in the description/management of their domain; increasing flexibility; enabling discovery of new or previously unknown services; aggregating services on the basis of user preferences; providing better service to third-parties and customers; and addressing the evolution and change of existing services and scenarios.
- Provide better support to front line by allowing one-stop, customer focused, and multiple viewpoint access to services and shared information.

However, demonstrating this to the e-Government community will require the achievement of several preconditions, including.

  - creation of compelling demonstrators and prototypes

- establishing visible standards
- stable and mature technology and products
- and convincing business cases.

Among the major barriers and perceptions constraints which, however, remain to be addressed effectively in practice are:

- **Trust in automated data sharing.** Governmental organizations are concerned about: (i) ownership, control and quality among service providers; (ii) security, data protection, confidentiality, and privacy issues.
- **Patchy awareness of WS**. Stakeholders are often unclear about the distinction between WS and general services available via Web. Responses from DIP WP9 user workshops held in Austria, Germany, Spain and the UK during 2006 indicated that even where public sector data suppliers (such as Ordnance Survey, the UK Mapping Agency, make Web Services available they are as yet little exploited within eGovernment).
- **Lack of understanding of the potential benefits** and of clear information, data sharing and business models for the exploitation of Web Services.
- **Up-front Infrastructure costs** (e.g. investment in WS). Governmental organizations are reluctant to be the pioneers which take the initial financial 'hit', in implementing SWS, as with almost any new technology.
- **Market development** in terms of raising the awareness of potential SWS benefits in e-Government, increasing pilot applications, and promoting the availability of working SWS platforms.
- **Standardisation issues**. For example, ECC Traffic Department wishes to exchange data with the National traffic Control centre on road which pass through Essex but is unable to so because they use differing versions of a key data format. An adequate network of Service Level Agreements is also lacking.

We believe that the results of DIP can contribute to raising awareness of the potential benefits of SWS in e-Government. Perhaps more importantly, its results may also be used to guide the efforts of new e-Government applications/projects; influence the e-Government standards environment and the e-Government strategic environment so as to encourage take up of SWS technologies.

References

[1] Commission of the European Communities. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. The role of eGovernment for Europe's future. Brussels, Com (2003) 567 final. 26 September, 2003. http://ec.europa.eu/information_society/eeurope/2005/doc/all_about/egov_communication_en.pdf

[2] Commission of the European Communities. Communication from the Commission to the Council and the European Parliament. Interoperability for pan-European eGovernment services. Com (2006) 45 final. Brussels, 13.February 2006. http://europa.eu.int/idabc/servlets/Doc?id=24117

[3] Towards the eGovernment Vision for the EU in 2010: Research Policy Challenges. (Draft). Editors: J Berce, A Bianchi, C Centeno and D Osimo ((IPTS-DG JRC), Institute for Prospective Technological Studies. For European Commission Joint Research Centre, August 2006. http://fiste.jrc.es/pages/documents/eGovresearchpolicychallenges-DRAFTFINALWEBVERSION.pdf

[4] Public sector innovation in the knowledge economy, 2006 http://www.prisma-eu.net/deliverables/SG7eGovInnovation.pdf.

[5] Online availability of public services: how is Europe progressing? Web based survey on electronic public services Report of the fifth measurement, October 2004. CapGemini for European Commission. Directorate General for Information Society and Media. March, 2005. http://ec.europa.eu/information_society/eeurope/2005/doc/all_about/online_5th_measurement_fv4.pdf

[6] The IDABC eGovernment Observatory http://ec.europa.eu/idabc/en/chapter/140

[7] Klischewski, Ralf. Hamburg University, Informatics Department, Semantic Web for e-Government. Electronic Government. Lecture Notes in Computer Science, 2004. Pages 288-295. Springer Berlin / Heidelberg. ISBN 978-3-540-40845-9

[8] OntoGov: Ontology-enabled e-Gov Service Configuration, Project IST-507237 [FP6] http://www.ontogov.com/

[9] European W3C Symposium on eGovernment, Gijón, Asturias, Spain, 1-2 February 2007 http://www.w3c.es/Eventos/2007/eGov/Program/index.html.en

[10] Access-eGov Project. Access to e-Government Services Employing Semantic Technologies, Project FP6-2004-27020. http://www.accessegov.org/acegov/web/uk/index.jsp

[11] FIT Project. Fostering self-adaptive e-government service improvement using semantic Technologies. Project IST-2004-27090. http://www.fit-project.org/index.htm

[12] Web Service Modeling Ontology (WSMO). http://www.wsmo.org/

[13] Hepp, Martin, Digital Enterprise Research Institute, University of Innsbruck Possible Ontologies: How Reality Constrains the Development of Relevant Ontologies. Internet Computing. January/February 2007 (Vol. 11, No. 1) pp. 90-96. http://csdl2.computer.org/persagen/DLAbsToc.jsp?resourcePath=/dl/mags/ic/&toc=comp/mags/ic/2007/01/w1toc.xml&DOI=10.1109/MIC.2007.20

[14] Proposal for work on an inventory of eGovernment business case indicators. OECD eGovernment Project. February, 2006. http://webdomino1.oecd.org/COMNET/PUM/egovproweb.nsf/viewHtml/index/$FILE/GOV.PGC.EGOV.2006.3.doc

[15] Drumm, Christian. Integrating eGovernment Services using Semantic Web Technologies. SAP Research Center CEC Karlsruhe, 2005. http://dip.semanticweb.org/documents/DRUMM-Integrating-eGovernment-Services-using-Semantic-Web-Technologies.pdf

[16] Tanasescu, V., Gugliotta, A., Domingue, J., Gutiérrez Villarías, L., Davies, R., Rowlatt, M., Richardson, M., Stincic, S., (2007) Geospatial Data Integration with Semantic Web Services: the eMerges Approach. Geospatial Data Integration with

Semantic Web Services: the eMerges Approach, In .eds Arno Scharl, Klaus Tochtermann The Geospatial Web, Springer, 2007
http://kmi.open.ac.uk/projects/dip/resources/papers/eMerges_book_2007_final.pdf

[17] IRS-III: A Broker for Semantic Web Services based Applications. Cabral, L., Domingue, J., Galizia, S., Gugliotta, A., Norton, B., Tanasescu, V., Pedrinaci, C.: In proceedings of the 5th International Semantic Web Conference (ISWC 2006), Athens, USA, 2006.

. [18] Gugliotta, A., Davies, R., Gutiérrez-Villarías, L., Tanasescu, V., Domingue, J., Rowlatt, M., Richardson, M., Stincic, S., Enhancing Data and Processes Integration and Interoperability in Emergency Situations: a SWS based Emergency Management System. Workshop: First International Workshop on Applications and Business Aspects, Fifth International Semantic Web Conference (ISWC 2006), Athens, Georgia, USA, 2006

[19] Creating a Policy-Aware Web: Discretionary, Rule-based Access for the World Wide Web. Weitzner, Daniel, Hendler, James, Berners-Lee, Tim and Connolly, Dan. In "Web and Information Security" , 2004.
http://www.mindswap.org/~hendler/2004/PAW-final.pdf