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Bringing Together and Accelerating eGovernment Research in EU

State of play for Innovative Government

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Executive summary

The present document addresses the state of play for innovative government as seen through the results of the IST priority in FP6. Research conducted in various areas of potential application has highlighted the role of ICT as a driver for better governance.

Important, possibly radical changes such as the exclusive use of Open Source Software (OSS) in public administrations have been studied. Conclusions drawn out of pilot implementation cases (although indicative of benefits as well as pitfalls which may affect a full scale application) show that OSS is a feasible solution. In addition, FP6 research proposes the adoption of policy measures to promote wider adoption of OSS.

Services-for-all is the cornerstone of innovative government. Research results here offer novel ICT solutions for delivery of services through voice and mobile channels, without the need for compromise: Requests via natural speech can be machine processed and answered; mobile telephony channels can provide a secure and interoperable environment. A series of informed policy recommendations has been produced as a result of studies on the causes and effects of the digital divide.

ICT support for eGovernment has centred on ontologies and semantic web languages applied in local government environments. These are supplemented by pilot implementation of process modelling tools addressing the administrators. Knowledge management has been addressed via a model for the support of multilingual applications in eGovernment.

Finally, results on security and authentication, besides their obvious use in safeguarding privacy of personal data, show the feasibility of cross-border interoperability leading to effective mobility in Europe. This, in turn, calls for priority actions in the policy field.

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1 Introduction

Innovative government embraces a wide spectrum of objectives and accompanying activities. The contribution of IST research in FP6 in this direction is embedded within major EU policy objectives such as electronic procurement, electronic invoicing in public administrations, single-window customs and European Citizenship. Policy aims are set to[1]:

- modernise and innovate public administrations at all levels
- foster good governance
- provide citizens and industries with new service offers and thus create new public value
- contribute to easing mobility of European citizens within the Internal Market, making European Citizenship a reality, and supporting them as active citizens through innovative services and through participation in decision making processes.

These are to be realised through ICT research addressing four specific focal points:

- **eParticipation:** Tools for formulation and enactment of democratic decisions, scalable large scale dialogues and new forms of interactivity in democratic processes

- **Intelligent, personalised eGovernment services for all:** Intuitive interaction, inclusion, multi-channel service delivery platforms, context-awareness and privacy protection

- **Adaptive and proactive eGovernment support systems:** Knowledge-based government, process models, administrative management tools, process transparency technologies, diversity, multi-level governance and multi-linguality.

- **Secure pan-European eGovernment:** Very large scale, heterogeneous, cross-border administration architectures/processes/info-infrastructures, pan-European eGovernment eID management and authentication.

Projects directly addressing the innovative government area (under the focal points described above) in FP6 belong to consortia which responded to the 4th call (March 2005). Starting dates for these projects fall in 2006; this means that no robust results have appeared yet; therefore, for the purposes of this report, we consider projects which belong to the previous call (call 2 of the IST priority). These projects belong to the class of mature and/or completed projects (see report on Methodology), namely those contained in Table 1.

ACRONYM	Instrument	Completed
INTELCITIES	IP	✓
GUIDE		✓
SAFIR		
TERREGOV		
COSPA	STREP	✓
eMAYOR		✓
ONTOGOV		✓
USE-ME.GOV		✓
QUALEG		✓
HOPS		
eUSER	SSA/CA	✓
FLOSSPOLS		✓
eGovRTD2020		

Table 1. Mature and completed projects

[1] European Commission, Call 4, IST priority, 1st December 2004, http://cordis.europa.eu/ist/so/govt/home.html

Although these projects do not directly address the focal points of call 4, their results, with the exception of the first point on eParticipation, can be classified according to them. In what follows, we shall briefly present the contributions to innovative government made by those projects through successful outcomes.

For formal details of the projects (such as full names, starting/finishing dates, etc.) the reader is referred to previous reports such as those on methodology and analysis of projects.

2 Open Source software

ICT-aided government is necessarily affected by the paradigms of software development methods and processes used. Of those, the Open Source model presents the largest promise (and challenge) on the way to innovative government. Open Source Software (OSS) is a high-priority theme in the research agenda of the European Commission, especially for the implementation of eGovernment services (since the eEurope 2005 programme).

Two mature FP6 projects have studied the introduction of OSS in public administration as a means for innovative government

- **COSPA** (Consortium for Open Source Software in Public Administration)
- **FLOSSPOLS** (Free/Libre/Open Source Software: Policy Support)

The COSPA project analyses the effects of the introduction of Open Data Standards (ODS) and OSS for personal productivity and document management in European Public Administrations (PAs). The project has provided fact-finding, analysis, knowledge and possible implementation scenarios for potential OSS migrants with actionable knowledge that will simplify and streamline any decision process about making the transition to OSS. Drawing on fieldwork and an analysis of the literature, COSPA benchmarks the effectiveness of deployed OSS solutions and compares and pools knowledge from an analysis of user requirements. The entire project findings are collected in a dynamic knowledge base available to PAs and citizens seeking an objective, in-depth account of OS parameters, options, experiences, costs, barriers, and opportunities.

Another outcome is a method[2] for selecting an Open Data Standard for a specific application type in a PA undertaking a software migration. It is designed to enable PA managers to find a suitable ODS from a corpus of standards for their specific process requirements.

For word-processing-centric processes, the COSPA method selected the **OpenDocument** format as the best, most relevant Open Standard to ensure that functional requirements were met.

2.1 Policy Issues

FLOSSPOLS examines policy support for Open Source software and open standards. For the case of eGovernment, the studies show that public authorities in practice fail to achieve promotion of increased competition and reduced vendor lock-in goals, as they support strongly anti-competitive behaviour through their procurement policies favouring compatibility with proprietary technologies. Based on an analysis of the economic basis for open standards FLOSSPOLS concludes in the following four recommendations:

1. open standards should be defined in terms of a desired economic effect: supporting full competition in the market for suppliers of a technology and related products and services, even when a natural monopoly arises in the technology itself.
2. open standards for software markets should be defined in order to be compatible with Open Source licenses, to achieve this economic effect
3. compatibility with proprietary technologies should be explicitly excluded from public procurement criteria and replaced by interoperability with products from multiple vendors;
4. open standards should be mandatory for eGovernment services and preferred for all other public procurement of software and software services.

As observed by COSPA, governments today must be aware that **the growth of an Open Source developer base is increasingly an indicator of the innovative capacities (in the software domain) of a national economy.** There are a number of reasons for this: OSS is a public resource with low entry barriers and an excellent training system at no direct cost to

[2] Work Package 5, “Definition of a target ODS to use in the project; development of bridges from existing documents to ODS, also using existing tools” Deliverable 5.1

society. By its nature it is also an automatic source of de facto standards for any number of protocols or systems, both historically as well as those being developed today.

COSPA observes that public administrations are gradually implementing OSS in many of their units, but they have to be aware that its usage generates wide-ranging changes that require time and human resources. Important policy guidelines are proposed for governments, which must act in the communal interest, ensuring that the legal and organisational situation within their must ensure that no person or organisation is prohibited from offering goods and services to them, while contractual conditions must fulfil the further requirement of public welfare. In the case of software, such requirements should include criteria for adequate processing of data from and about citizens and for ensuring its integrity confidentiality and accessibility through time. Measures for the dissemination of OSS to a wider public are also proposed, namely:

- Establish and foster Open Source work groups at national level;
- Develop and introduce statistical systems for monitoring the usage of Open Source in the public and private sector;
- Develop and promote comprehensive policies for improving the usage of OSS in public institutions;
- Help to enable and coordinate OSS migration and implementation in the public sector for small and medium size organisations;
- Coordinate and cooperate with public interest Open Source projects;
- Develop strategies to migrate the public and private educational sector to Open Source requirements;
- Support business models based on OSS;
- Inform and advise SMEs before and during their implementation/migration to OSS. SMEs, in contrast to larger organisations are rarely in a position to invest in basic research or standardisation efforts so as to include OSS at the heart of their business model. It is this imbalance that governments should address actively by suitable policy measures and actions.

2.2 Pilot cases

Pilot cases studied by both projects have shown the feasibility of OSS in the public sector. Cases studied by OCSPA such as:

- Beaumont Hospital, in Dublin, where transition to OSS was mandatory due to unaffordable licence fees
- Hanstholm Kommune, a small Danish PA of nearly 70 employees, which, through participation in the COSPA project, arrived at the conclusion that *"Microsoft Office 2000 was not revolutionary enough to spend money on."*
- Province of Pisa, which adopted Open Data Standards (ODS) and OSS well ahead of national and regional initiatives.
- Consorzio dei Comuni dell'Alto Adige, a consortium of 116 small municipalities in Italy, which successfully worked with pilot implementations of OpenOffice for document creation and conversion for web publishing with promising results for permanent use.

FLOSSPOLS reports on the Province of Bolzano-Bozen, Italy, where transition to OpenOffice proved to be quite successful, with the administration deciding to install OpenOffice on all the PCs of its offices, about 5,000 desktops.

3 Intelligent, personalised eGovernment services for all

In the words of call 4 of the IST priority research in this area *"…should distinctively focus on public service obligations of assuring privacy protection and public services that are provided for all. This addresses citizen-centric, context-aware, intuitive and intelligent interfaces capable to serve every citizen individually through seamless and personalised multi-device service delivery, and application of technologies for novel eGovernment services."*

From the point of view of innovation, measures that seek to facilitate wider (and cheaper) reach of relevant services by providing multi-modal service delivery, including utilisation of more widely available devices and platforms such as SMS, digital TV and mobile devices, have an important role to play. For example, eUSER provides evidence that handheld devices (like mobile phones and PDAs), providing mobile as opposed to fixed access to services, are increasing in importance and are particularly being used by people who are otherwise likely to be digitally excluded. The overall goal must be equivalent quality of service, whatever the mode of access.

Although the eUSER study has identified initiatives in this field in a number of countries, to date there is little systematic information available on the extent to which key services of public interest are available to an equivalent degree of quality for all users, whatever mode of access.

3.1 Multi-channel delivery

The mature level FP6 contribution here is represented by projects addressing delivery of services via alternative channels such as mobile and voice recognition/synthesis technologies.

The only project in the mature group which examines services delivery via mobile technologies (m-government) is **USE-ME.GOV** (Usability Driven Open Platform for Mobile Government). USE-ME.GOV created an open service platform for m-government which meets the most critical interoperability and scalability requirements as well as shared use.

Comprehensive business models for m-government have been elaborated, compiling interests and roles of relevant stakeholders and correlating their roles and interests in distinct service and business scenarios.

The project was completed in March 2006, the service platform has been implemented and successfully validated in the three user sites and further extensions and adaptations are planned.

The USE-ME.GOV platform was designed in order to meet the criteria for openness, interoperability, scalability and security. Following a usability-driven approach, the platform paid particular attention to advanced solutions for discovery and binding of e-government services that are associated with the physical environment of mobile users.

Delivery of services through voice channels has been achieved with the **HOPS** project. The platform implemented by the project uses a variety of technologies to enable people to talk to a computer over the phone in the same way as if they would be talking to a human call centre worker. The aim is that the natural language dialogue made possible by the platform overcomes people's general dislike of talking to automated call centre systems. HOPS has managed to make human-machine dialogue more natural and fluid by merging voice technologies such as Automatic Speech Recognition (ASR) and Text to Speech (TTS) with natural language processing technologies to understand, interpret and respond to callers. These components are then tied into a data management system incorporating Semantic Web technology for finding and extracting the information sought by users. The platform itself is designed to be highly flexible so it can be used in any public administration call centre to provide any service or information. The only thing that really has to be changed depending on where it is deployed is the vocabulary. That could mean different languages or a different lexicon depending on whether it is used to deal with car registrations or cultural events.

Preliminary trials carried out in Barcelona, Camden and Turin proved the flexibility and functionality of the system which was able to provide responses in a range of languages to callers enquiring about two different types of services. One scenario was for callers interested in finding out about cultural events, the other was to schedule a service provided by the council for collecting unwanted furniture and other large items. In both cases the call centre workers from the councils made the calls and the system functioned well.

The HOPS service, as implemented in three pilots, is available for online testing by any user. Testing and eventual roll-out at the end of the project in December 2006 resulted in a second prototype with a third and final version of the platform that will also serve to gauge citizens' reactions. All three town halls involved in the project are planning to employ the finished version of the platform.

The pilots can be accessed as follows:

1. **SECOND PROTOTYPE**
   The available channels are:
   - voice channel: +39 0114815865
   - text channel: http://hops.csp.it:8080/demo/client.jsp
2. **FIRST PILOT IN BARCELONA**
   The available channels are:
   - voice channel: +34 934860746
   - text channel: http://212.15.225.36:8080/demo/client.jsp
3. **FIRST PILOT IN TURIN**
   The available channels are:
   - voice channel: +39 0112913664 (Monolingual: Italian only)
   - voice channel: +39 0112913665 (Multilingual: Italian and English)
4. **FIRST PILOT IN CAMDEN**
   The available channels are:
   - voice channel: +44 1273808461

3.2 Inclusive government

There can be no innovative government without an all-encompassing user-base. Government addresses all citizens. Innovative government uses ICT technology to achieve the same, therefore the defining feature of any innovation should be the degree to which inclusion of all citizens and reduction of the digital divide progressed. The definitive "marker" in the area is the findings of the eUSER (Evidence-based support for the design and delivery of user-centred online public services) Specific Support Action. These resulted in a state-of-the-art resource base on user needs in relation to online public services and on user-oriented methods for meeting these needs. Besides eGovernment, the domains covered are eHealth and eLearning.

Findings of the Action show that eGovernment presents usability problems. The eUSER survey has shown that significant barriers to take-up exist, most of which decrease significantly once eGovernment services are used. Much of this is lack of awareness and unfounded reservations or fears on the part of prospective users, although both these issues vary considerably depending on the type of potential user, so that clear targeting and segmentation will also be needed in many instances.

The Action has also resulted in recommendations for the improvement of services take up and of acceptance by users. These are summarised as follows:

- **Marketing and promotion campaigns**, by governance and policy makers, targeted at promoting the overall benefits, calming fears, and offering general information about what is involved technically, where to find and how to use services.

- **Guidelines for the design of quality and usable eGovernment services**, issued by governance and policy makers, building on existing and best practices from different Member States and service providers.

- **Guidelines for the design of sophisticated and personalisable eGovernment services**, issued by governance and policy makers, building on existing guidelines and best practices from different Member States with a focus on serving individual needs usable within a multi-channel environment.

- **Develop and implement programmes for rolling out eGovernment services and broadband infrastructures**, ensuring that all areas, including rural and peripheral regions, are covered.

- **Develop and implement training and educational initiatives for citizen Internet skills**, by using a mix of online and offline components, with appropriate standardisation across Member States (for example building on the European Computer Driving Licence).

- **Develop, implement and pilot Europe-wide measuring, monitoring and bench-marking activities** to track progress on user-orientation of public online services. A pilot for an appropriate monitoring and benchmarking activity can be set, from which the data gathering work can – if deemed appropriate – be transferred to the European Statistical System at a later stage.

From the socio-demographic point of view, major factors acting as major barriers to eGovernment are to be found in the over 65 age group. As eUSER experts point out, this is due to worries about complexity, the anticipated effort needed and the absence of sufficient technical means[3]. Incorporation of eLearning facilities has been proposed as a teaching aid for this group and evidence shows that distance courses over the Internet can be successful in reaching older persons which are isolated for reasons to do with health/disability, geographical location, or care duties[4]. eUser experts point out however that doubts still remain regarding whether eLearning can play a large role for older adult education mainly because of:

- lack of ICT skills among older age groups;
- low rates of access to the Internet
- preferences which seem to point towards learning environments which allow meeting like-minded people rather than learning from home.

3.3 Attracting users

One of the most interesting findings of the eUSER Action is that existing eGovernment solutions cannot effectively serve individual needs and cannot be personalised. This is manifested by eGovernment users themselves, who are also users of other channels which are amenable to personalisation such as telephone and post.

Within the context of the eLOST (e-government for LOw Socio-economic sTatus groups) Specific Support Action, various experts pointed out that it is vital to consider the reasons for

[3] eUser – Workpackage 5: Synthesis and Prospective Analysis, D5.2/D5.3: Report on current demand/supply match and relevant developments

[4] Swindell, R., Vassella, K. (1999) 'Older Learners Online An evaluation of Internet courses for isolated older persons', Griffith University URL: http://www4.gu.edu.au/ext/u3a/papers/AA%20entire%20report.pdf

non-usage of eGovernment services, especially cultural factors. If people do not use new technologies, this is because they are not designed for them. People do not have to adapt to New Technologies: it is rather the opposite. Focusing on eGovernment from a cultural perspective, there is a risk associated with e-services providers ignoring users' needs and taking decisions based on the existing hierarchy and organisation of public services. Moreover, they conclude that eGovernment requires a multi-channel approach, in agreement with the findings of eUSER.

Regarding Low Socioeconomic Groups (LSGs), which are predominantly the subject of the eLOST study, an interesting contribution comes from INTELCITIES, which considered elderly citizens in Siena, Italy. In the Siena experiment a special "set-top-box" for interactive TV (with fibber-optic cable connection) was developed, to allow an easy interaction of the elderly citizens with different services offered by the municipality of Siena. An important observation that emerged from this experiment was that a critical factor for success, perhaps more important than the technology used, is how to attract the citizens to overcome their reluctance and to try to use the available services. The solution adopted in the Siena experiment was described by the researchers as "Trojan horse": the elderly citizens were offered a free video-on-demand (VoD) service, centred on the "Palio" horse races, which is a major attraction in the area[5].

[5] ELOST, WP4: Foresight Study, Deliverable D4.1: Review of foresight studies and emerging technologies, Deliverable D4.2: Technology-related questions for ELOST surveys

4 eGovernment support systems

eGovernment support systems in IST call 4 refer to research addressing *"…modelling of administrative processes using emerging ontology and semantic web languages. It should include technologies to support the legislative and policy development process such as intelligent tools to develop policy scenarios and to manage administrative processes and content. Research should respond to public service governance requirements such as process transparency, preservation of diversity, multi-level governance, multi-linguality as well as new services and new ways of service provision."*

Application of ontologies and semantic web languages by mature FP6 projects has been made in local government environments. As TERREGOV observes, local government ontologies are necessary for enabling these administrations to deal with information as a strategic resource. The project has developed a Local Government Ontology, which has also been used as the first step of the QUALEG starting ontology (see below). This was later expanded to fit the specific project needs.

Modelling of knowledge for eGovernment in mature FP6 has been dealt with by using ontologies at various levels, structures and degrees of sophistication.

Mature projects which address issues in this area are:

- TERREGOV (Impact on eGovernment on Territorial Government Services)
- eMAYOR (Electronic and Secure Municipal Administration for European Citizens)
- ONTOGOV (Ontology-enabled e-Government Service Configuration)
- INTELCITIES (Intelligent Cities)

4.1 Ontology management and process design

Business process (enterprise) modelling of administrative procedures and actions has been handled by both TERREGOV and ONTOGOV at the intra-enterprise level by using two mechanisms:

- Process design
- Ontology management

The process design level concerns workflow design and management, aiming directly at solutions maintained by the users (process owners) themselves. The ontology maintenance level, although primarily concerning semantics, can affect process maintenance and this is the reason it is mentioned in this section. Actually, in many cases ontology maintenance is considered part of business process modelling and maintenance, i.e. the ontology is the declarative part of the business process. This is the view taken by ONTOGOV, where the definition and maintenance of the ontology is part of the business process modelling layer. This view is not shared by TERREGOV, which separates the ontology part (semantics) from the procedural part (described by the term workflow there). Provided one is aware of the context, both views are valid, although the authors would favour the latter as it allows a clear separation between process and semantics.

As mentioned above, business process modelling in ONTOGOV is done through a semantic description (ontology-based) of eGovernment services. This is done at the relevant Business Modelling layer by the Service Modeller module of the Ontology Management System (OMS). The Service Modeller is an editor for the semantic description of the eGovernment services, which is intended for use by non-IT specialist administrators who act as domain experts. ONTOGOV by-passes the use of the OASIS Web Services Description Language (WSDL) and their composition on the level of business processes (BPEL ver. 1.x) on the grounds of lack of semantic expressivity, which is crucial for capturing service capabilities at abstract levels.

TERREGOV uses BPEL as its web services orchestration language to provide a business process modelling and management system referred to as "eProcedures workflows", which

stands (architecturally) separate from the semantic part. At the same time, it also serves the inter-enterprise nature of the project. This demands that local government agencies provide access to their services and participate in orchestrated procedures involving such services provided by multiple agencies.

In order to provide access to these services, web services technology is coupled with a Workflow Management subsystem designed to enable TERREGOV users to design, execute and monitor eProcedures, i.e. processes required for the fulfilment of citizens' requests. This subsystem of the Terregov platform is to be used by workflow developers, i.e. users responsible for the correct design and implementation of the eProcedures as well as administrators (eg. civil servants) that may initiate an eProcedure upon citizen's requests and are able to monitor its progress. Both categories of users coincide with the "Domain Specialist" function in ONTOGOV.

The Workflow Management subsystem of TERREGOV is a set of modules which provide tools to help users design the eProcedures, an engine able to run and monitor them, and some tools supporting the use of semantically described services at run-time.

4.2 Semantically enriched web services

Both TERREGOV and ONTOGOV use semantically enriched web services. This is a general trend in interoperability technologies which can be found in nearly all IST projects in FP6, due to the dominance of Internet-based services and their inherent technical interoperability features.

As TERREGOV observes[6] "web services constitute the building blocks of Service Oriented Architectures, which offer interoperability between applications in complex systems. Web services standards ensure the definitions of platform and language independent functional interfaces, and enforce the decoupling between such interfaces and their specific implementation. It appears mandatory to declaratively and unambiguously define the meaning of the operations offered by web services. It is possible to find examples of different web services that may present the same functional interface but whose purpose is different. This ambiguity poses some limitations to the potentialities of Service Oriented Architectures. All algorithms having to retrieve dynamically a service from a semantic query is affected by this ambiguity. We can give as examples the dynamic composition of web services or the dynamic substitution of a web service. A dynamic query can not succeed if semantic descriptions of Web Services contain ambiguities."

To resolve these ambiguities, semantic enrichment of services in ONTOGOV is not done through WSDL and BPEL but by extending the OWL-S and WSMO ontologies so that they are able to better support process and lifecycle. The consortium illustrate their technical choices by application scenarios and show the advantages of their chosen methods which utilise the principle of working only with **instances of meta-ontologies**[7]. This allows for strong governance of the modelling as a whole, with inherent semantic checks, which no framework (like BPEL, ivyGrid or others) can provide. For example, adding the same organisational unit to two atomic services in a sequence will evoke a warning (as usually the activities will be performed as one) even though the process flow per se is correct.

On the other hand, TERREGOV researchers facing the same problem have opted for WSDL and semantically enriched BPEL. They conclude that the easiest way of adding semantics in BPEL, and the chosen one, is to wrap it in **standard web services calls BPEL tags**. Being more specific, the main option to consider is to add the semantics as an input parameter of the Semantic Interpreter service call.

The lifecycle of an eGovernment service in the ONTOGOV platform starts when Public Administration managers trigger the generation or the change of a service. In order to accomplish this task, they need to have a high-level view of service models, links to related laws, resources involved and inter-relations with other services. Such a high-level view is provided by the service models developed through the Business Model layer. The service

[6] TERREGOV: "Technological state of the art and research orientations for 2006", Deliverable D1.6, July 2006
[7] D. Apostollou et al. "

ontology (or service model) becomes the main source of information for the Configuration layer. During configuration, the IT Consultant should identify the actual software components (Web Services) that enact the service model and the policy and security level that their SOAP messages should accomplish.

Another noteworthy feature is **semantic interoperability** as implemented by eMAYOR. This is served through transformation of various electronic documents (eForms). The consortium's work transferred those conceptual elements of XForms, which were needed for fulfilling the specifications above to a smaller concept, which they called eMayorForms and which was designed from the beginning to run on a client. In contrast to XForms, which uses the browser's document object model as display, the eMayorForms use Swing for this purpose. This opens possibilities, which are not realisable for XForms and keep the size and complexity of the eMayorForms project very small, at the expense of having the forms tightly coupled to Java.

4.3 Innovation in practice

Both TERREGOV and ONTOGOV have pilots on which application of their results took place. ONTOGOV applied its results in:

- The Swiss "Announcement of Moving" service, a pilot which provides a good example of running a one-stop service that involves different municipalities and is offered by a "broker".

- The Greek "Development of New Urban Areas" service, implemented as a pilot within the municipal technology agency of the Amaroussion municipality in Greece. The end-user local authority evaluated the ONTOGOV platform as having great potential, provided that the user side is attended. Extensive guidance is needed so that the user is able to realise the assets of the platform in a simple way and that scepticism of the staff towards technological changes is overcome. It is worth-noting that the service put in place at the end of the project comprised the first eGovernment service provided by a local government authority in Greece.

- The Spanish "Minor Works License" service, which was implemented in the municipality of Barcelona as a test-case of a SOA paradigm. Due to ONTOGOV, the Spanish agency responsible has taken the crucial decision of setting its systems and platforms to work under a Service-Oriented Architecture rather than legacy ones, an important facet of technology contribution to innovative government

We subsequently refer to two TERREGOV pilots:

- The UK ongoing pilot prototype aims to demonstrate how TERREGOV software and technologies can be used to increase data sharing and transfer between local governments and their clients.

- The TERREGOV pilot prototype in France (the French County Council 47), where a set of approximately 10 web services is used in accordance with 4 project-developed modules. The pilot environment has been completely installed currently running on two project-developed modules.

An important remark made by the TERREGOV consortium in that the project-developed modules, although they are currently at a prototype stage, could replace the existing technologies if the business model of the TERREGOV platform is clear enough; this however is not the case as yet.

4.4 Ontologies for multilingual applications

The definitive knowledge management project among the mature projects in FP6 is **QUALEG** (Quality of Service and Legitimacy in eGovernment) which proposes a knowledge management model for the support of multilingual applications in the field of eGovernment.

The model is based on a global ontology, manually designed for a specific domain, and local contexts, associated with ontology concepts. The combination of ontologies and contexts lends itself well to multilingual applications in which a single ontology fails to capture all nuances that stem from language and cultural differences. The single ontology system proposed, with associated concepts in multiple languages, provides a framework that is both versatile and flexible. The system, functions simultaneously in multiple languages, is low-maintenance, and is easily extended in and adapted to different languages. The model captures cultural as well as lingual differences using contexts, thus allowing easy customization across cultures and languages.

The QUALEG system is as modular as possible so as to be adaptable and configurable in different pilots. Web services and BPEL coupled with workflow models ensure interoperability between modules and external information systems.

The QUALEG architecture was built in a “centralised” way, so that to ensure a productive development, debugging and integration phase(s). A lot of constraints had to be taken into consideration, such as the necessity of operating in three different pilot environments. Each one of these pilots has an infrastructure that meets partially the demands of QUALEG. As a result, the proposed architecture has to be thought as the outcome of the integration of different systems, where a system is composed by subsystems and modules, able to carry out a specific task.

The general QUALEG results showed promising ability of the proposed models to provide language-independent support to local government decision making. QUALEG had pilots in France, Poland, and Germany and thus focused on four languages, three of which are French, Polish, and German. English was also used as a common international representation language. To maintain uniformity and avoid repetitive translations, QUALEG processes the information from the input, such as debates and emails, in the local languages. For the deployment in QUALEG the first step included starting with an existing ontology and expanding it for the specific project needs. The ontology used was the local government ontology developed for TERREGOV.

In the collection step, local government representatives from each of the pilots supplied organisational documents that describe each concept in the ontology collected from previous years. The extraction step created a context for each concept in the ontology using an algorithm developed by the project. The last step involved adding the new contexts to their relevant concepts and storing them. These contexts are monitored according to the system performance and can be updated when needed.

The system was built to support multilingual ontology management and allows an ontology search to be performed, retrieving documents that relate to a specific ontology concept. The mapping of the documents to the ontology concepts is performed using the context recognition algorithm implemented in the Knowledge Extraction module.

Pilot applications were made using the German language, where the advantages of the project techniques in some languages versus others and the extent of language independence of the model were evaluated positively. Further applications of the model of ontology and context were made in the field of opinion analysis.

5 Secure pan-European eGovernment

IST call 4 states that research for secure pan European eGovernment *"…should address the use of secure architectures, environments and information infrastructures, service dependability as well as interoperability challenges, in public administrations across Europe. Particular challenges are to cope with the high degree of heterogeneity, complexity and seeming perseverance of legacy systems in European public administrations. The new environments should be flexible as to allow for new forms of service provision (e.g. via public private partnerships). Research should also address technologies and implementation of pan-European secure and interoperable eGovernment electronic identity management and authentication systems, including the use of smart card technologies, biometrics and trusted services."*

The end-user will not embrace electronic procedures instead of paper forms if transactions with the public administration are not managed in a secure and trustworthy way. Among the group of mature projects in FP6, innovation comes from the results of the following projects.

- GUIDE (Creating a European Identity Management Architecture for eGovernment)
- eMAYOR (Electronic and Secure Municipal Administration for European Citizens)
- TERREGOV (Impact on eGovernment on Territorial Government Services)

5.1 eMAYOR: Certificates and smart cards

Security services and mechanisms have been implemented by eMAYOR for their eGovernment platform. The whole spectrum of web service security technologies and standards was evaluated by taking into account the specific requirements that came up during the system design. These requirements led to the selection of SSL for transport layer security and the usage of XML digital signatures for document authentication and integrity on the business logic level. X.509 certificates and smart cards have been the means for authentication, authorisation and document signing. Access control has been implemented using XACML as an upcoming Web Service security standard and it has been further researched with respect to its overall policy definition capabilities.

The eMAYOR PKI and its components were set up and all relevant PKI policies have been drafted and documented. All the above security components were integrated in the eMAYOR platform and they are able to communicate seamlessly with the core components in order to carry out the security policies as demanded by the supported business processes.

The eMAYOR platform was put into operation at the pilot sites of the Municipalities of Bolzano, Aachen, Siena and Seville. In Greece the pilot site was put into operation at Expertnet, contributing to the technical tests and overall integration, from a "user's" perspective. At the pilot sites the platform was installed on dedicated hardware, and connected to the local Internet feed, as well as integrated with a test version of the legacy back office systems at the municipalities. It was decided that during the trial activities no real operation on real municipal database will be executed, thus a system of databases' replicas were the sufficient support for the Trials. The sample users' real data were extracted from real municipal databases but were then in a "dummy" way by the platform.

The trials set-up was undertaken by the four municipalities themselves in co-operation with one of the technical partners in the eMAYOR project. In Athens the trial version was set up at Expertnet and the city officials were invited for a demonstration and presentation. The trial set up proceeded at a different pace in the four cities involved, due to different back-office systems, organisation and ICT environments.

Innovation value
eMAYOR has contributed to innovation, as it showed the first really large scale set of trials achieving interoperability among European Municipalities. The technologies developed and reworked for these purposes, address a new way of the handling of digital forms, the implementation of security enforcement module, the handling of language issues in cross border eGovernment and the integration into one adaptable and easy to implement

eGovernment platform. eMAYOR is a lightweight implementation of a full eGovernment platform for use with the clients, that fulfils future requirements of exchange of documents between stakeholders and works for users without coding.

The consortium claims that eMAYOR is the first and only project that *shows* how one can practically solve the cross-border interoperability challenge, without making use of a centralised architecture. As such it may form the basis of a number of applications serving mobility in Europe. Apart from the local advantages of eMAYOR, for municipalities and other smaller government organisations this solution for dealing with cross border eGovernment is considered by the consortium as a real possibility to work on real politically important priority actions.

The eMAYOR platform is available for download as an Open Source product through the BerliOS Developer site supported by the Fraunhofer Society institute FOKUS.

5.2 GUIDE: Identification

The GUIDE project aims to create an architecture for eGovernment electronic identity services and transactions for Europe. The project's approach is inter-disciplinary and involves technological, policy, and procedural research and development across all the member states of the EU.

The central organising concept of GUIDE is “identity” which is understood in a broad sense, encompassing its moral philosophical foundations, as well as the legal, technological and government process issues that help shape it. Identity is defined as all information associated with an individual or organisation; not simply a token or digital certificate. Identity management involves maintaining an individual entity's complete information set, spanning multiple contexts and transactions, with the goal of improving data protection, consistency, accuracy, efficiency and security.

The project envisaged a “Circle of Trust” among users, including citizens, businesses and Member States to determine which issues to address in the design phase. An in-depth sociological study pinpointed and contextualised all major concerns regarding electronic identity to give a holistic view of improve identity management (IDM) challenges.

Belgium, The Netherlands and Estonia participated in a trial in the area of social security, using European standard Form E101. , as explained below. The purpose of the E101 trial was to build and test a subset of the GUIDE ‘core’ pan-EU identity interoperability services, using existing member state implementations of E101 applications as a vehicle for invoking these services. The subset of these core services for the GUIDE trials was:

- Pan-EU Authentication & Identification (for citizens and businesses)
- Pan-EU Identity Attribute Provision (for citizens)

The project interviewed national representatives of the following member states on how they perceive authentication and identification with respect to what GUIDE is able to offer. The countries interviewed were: Austria, Belgium, UK, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, The Netherlands, Sweden. In general, the potential offering of GUIDE was perceived positively as it protects infrastructure already in existence and aims to join national infrastructures using gateways. What was also received positively was the ability of the GUIDE architecture to deliver interoperability between countries with unique identifier schemes.

5.3 TERREGOV: Data security and privacy

TERREGOV provides inter-agency services for local government and is particularly concerned with issues of data security. The architectural solution adopted is that of a “clearing house”, in order to establish a clear separation between the responsibility of routing data and the responsibility for data themselves.

The clearing house holds absolutely no core data about citizens; its task is to route every message from one institution to another, in line with the rules jointly decided on and the authorisations granted by an “ad hoc” Committee. The ownership of the databases remains with the institutions which have the most legitimacy to maintain them. This rule is more or less the same as the “double envelope principle” used in other applications which the project studied in Bremen, Germany.

Project researchers have studied the difficulties associated with transactions from one agency to another and the access rights for data transfer. They concluded that for reasons such as:

- adoption or not of a unique identification number for all transactions with public entities (unique ID in Belgium, Denmark, Ireland, but illegal in some counties),
- inter-agency authorisation of access rights,

implementation of an interoperable platform interconnected to several public agencies is a complex issue which needs in-depth collaborative work, in order to define precisely the sharing of responsibilities and policy involved.

Researchers in the project are currently examining integration of the project’s security module in several platform modules to be installed in the pilot sites. Issues involved include:

- The provision of security in the Universal Description, Discovery and Integration Registry (UDDI) for services. The specification UDDI v3 has been released and includes new features in security environment: digital signature and security improvements added.
- The Open Web Single Sign-On project (an open-source implementation of the Single Sign On Open Source initiative by Sun Microsystems Inc., that manages the foundation of identity services for web applications). This implementation will offer the following services: Authentication, Session and Logging. In the TERREGOV project, the modules must control users in order to avoid unexpected accesses to the resources they manage. In an integrated environment, data integrity and coherence is a must. Therefore, every component must ensure that the caller that invokes itself is effectively authenticated and have rights enough for accessing the resources it provides. By the adoption of this architecture, any application involved in TERREGOV environment is able to include security. With the same approach, TERREGOV local agencies are able to log themselves in any TERREGOV application without any effort.

Regarding users information storage, the best option to store such information, together with their credentials, is an LDAP database due to its optimisation in read accesses. In addition, it can be integrated in almost all the application servers. In TERREGOV, the LDAP database is managed by the CA module from the TERREGOV Security Module and is available to the rest of the platform modules.

6 Conclusions

IST research in eGovernment in FP6 has already shown its potential as a contributor to innovative government. Studies on Open Source solutions and policy requirements, ICT support systems managing knowledge in multiple languages, services through alternative means of communication (voice and mobile devices), and security and authentication systems with pan-European application constitute a sizeable toolset to support better governance.

The present document shows that mature IST research has managed to offer novel but applicable solutions which can drive future full scale implementations of information systems and provide high quality services for citizens, administrations and businesses.

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