E-government and e-participation research aims to re-focus government on its customers—citizens and businesses—and provide the models, technologies, and tools for more effective and efficient public administration systems as well as more participatory decision processes.

To this end, there is currently a growing interest in how this challenging domain can benefit from emerging “intelligent” technologies, tools, and applications—such as the Semantic Web, service-oriented architectures (SOAs), Web 2.0, and social computing. Initiatives and projects both in Europe and the US reflect this interest. In Europe, through the Sixth and Seventh Framework Programmes, projects such as SemanticGov and FIT are currently applying such technologies to e-government. In North America, the Digital Government Society (dg.o) and
the Semantic Interoperability Community of Practice (SICoP, a joint initiative involving industry, academia, and government), both support the use of state-of-the-art technologies in public agencies. W3C, the World Wide Web Consortium, has a running interest group on e-government.

But applying intelligent technologies to the e-government and e-participation domain has proven challenging. Public administrations are huge, divergent, and distributed systems, but they remain modern societies’ major owners and processors of information. Setting up seamless e-government services requires information and process integration involving a wide variety of agencies using their own legacy systems. Such environments need not only cross-organizational collaboration and interoperability, but also a way to handle the manifold semantic differences of interpretation of law, regulations, public services, and administrative processes. These interoperability requirements also apply at the technical level to the great variety of IT solutions that must work together on local, regional, national, and international levels. Another difficulty is that there are no commonly accepted domain models and definitions for e-government and e-participation. This exacerbates communication problems—both internally, between agencies, and externally, between governments and society.

Despite these difficulties, the combination of the two domains seems very promising: e-government and e-participation can provide an ideal testbed for existing intelligent systems research, whereas intelligent systems could provide an ideal platform on which to achieve the vision of both a knowledge-based, user-centered, distributed, and networked e-government and a participatory democracy with active citizens’ involvement. Moreover, owing to their open architecture, e-government and e-participation provide a palette of new research topics, such as interoperability search (searching for additional resources on portals to reply to a primary user or agent request), modeling and processing information coming from mass collaborative networks of people, and exploiting new technologies to enable participatory democracy.

Interestingly, e-government and e-participation also exhibit characteristics that make them even more promising when compared to e-business scenarios. These include, among many others,

- long-running process instances (for example, in urban and regional planning); and
- extreme information imbalances between stakeholders, as well as many different stakeholders in the same process (for example, citizen vs. city council, county council, or federal government).

Now let’s turn to some basic definitions for the two domains in focus, and then look at the main problems and issues to which intelligent systems could provide effective solutions.

**Defining E-government and E-participation**

*E-government* appeared as a term in the literature and practice in the mid to late 1990s. E-participation became a reference term later, after the turn of the century. (E-democracy was for some years an equivalent term but has more recently given way to e-participation; differences between the exact meanings of the two terms are nonetheless discernible.) Interestingly, in the US e-government was never used with the same frequency as it was in the EU; the term digital government was preferred. However, e-government has occasionally been used in the literature to refer to e-participation, or as a super-term to cover both areas, resulting in fuzzy definitions of both terms.

Abstracting from several definitions from international organizations, consulting companies, and the academic and research community, we can define the governance system as the union of the political and administrative subsystems, exposing two major types of identifiable society-governance interfaces that support relevant interactions:

- the society-to-political system interface, which includes interactions through processes of public policy
analysis, formulation, and selection; and
• the society-to-administrative sys-
tem interface, which includes inter-
actions through the public-service
 provision process, covering both
 internal and external communications:
government to government (G2G),
government to citizens (G2C), and
government to busi-
nesses (G2B).

We can identify the use of ICT in
these two interfaces respectively as
e-participation and e-government (see
Figure 1).

How and how much information
and communication technologies
have, could, or should change, or
even revolutionize, these interfaces
still remains a research topic—and at
the same time a tough policy and im-
plementation puzzle for governments
around the globe. In this special is-

issue, we focus on how intelligent tech-
ologies could facilitate this process.

**Intelligent Systems**

**in E-government and E-participation**

Despite investment and active re-
search for over a decade, there still
are serious drawbacks and problems
in e-government and e-participation.
These problems occur in areas in which
intelligent technologies appear to have
a great potential if properly applied.

In this special issue, we identify and
discuss four major areas that could
benefit from intelligent technologies.
The first two—linked data and knowl-
dge creation—are relevant to both
e-government and e-participation. They
relate to the challenge of using, reusing,
and combining information kept iso-
lated in separate “islands” and stove-
pipe systems, to distill, create, and dis-

tribute knowledge within governments.
The other two areas—mass collabora-
tive public networks and complex, dynamic,
cross-organizational processes—relate
to e-participation and e-government
respectively. These four research areas
are indicative of the present and future
research topics for e-government and

e-participation in the emerging Web
3.0 era, which fuses social software
(also known as Web 2.0) and the Se-

mantic Web.

**Linked Data, Information Reuse,**

**and Semantic Interoperability**

Governmental agencies still publish
public-sector information (PSI) us-
ing a wide variety of nonstandardized
and proprietary formats. The sheer
volume and wealth of PSI make the
potential benefits of reusing, combing,
and processing this information
quit

important.

However, agencies typically first
express reluctance to make their data
available, for various cultural, poli-
tical, and institutional reasons. So,
they keep their legacy systems, and
the information stored there, fenced
and isolated. Even if they decide to
move on and free their data, the dif-
ferent data formats, the lack of com-
monly agreed-upon metadata, and
the absence of standardized vocabu-
laries and definitions result in a huge
bulk of practically useless data.

Commonly agreed-upon ontologies
(such as the FEA Ontology, http://
web-services.gov/fea-rmo.html) or vo-
cabularies adopted by wider commu-
nities could provide the infrastructure
for public organizations to publish
data sets annotated with generic and
domain-specific vocabularies—for ex-
ample, using a common and generic
service model to annotate public ser-

vices.6 Examples of generic vocabu-
laries include Dublin Core, Friend
of a Friend (FOAF), Semantically
Interlinked Online Communities
(SIOC), Strategic Markup Language
(StratML), and Simple Knowledge Or-

ganization System (SKOS). Recently,
Tim Berners-Lee advocated for this
lightweight and vocabulary-based ap-
proach, identifying difficulties that
ontologies face as they are created in
a top-down manner. These difficulties
become apparent both during drafting
and later during their actual use and
adoption phases (see www.w3.org/
DesignIssues/GovData.html). The de-
bate over top-down, detailed ontolo-
gies versus lightweight, bottom-up
vocabularies is quite relevant to the
e-government and e-participation do-


cains: If the annotated information
is available, third parties could then pro-

vide query interfaces to reuse, combine,
and process PSI in innovative and unforeseeable ways (see also discussion in the W3C eGovernment Interest Group). Initiatives such as Open Linked Data (see http://linkeddata.org and http://linkeddata.deri.ie) promote this approach, whereas other projects show that the discussion has already become relevant in real-world applications and systems—not only in pilots and demos from research projects. (See, for example, http://webbackplane.com/mark-birbeck/blog/2009/04/23/more-rdfa-goodness-from-uk-government-web-sites.)

Data protection and privacy issues might arise for PSI in an open data environment, but there are many “safe” candidate start-up areas for which information reuse looks quite harmless: for example, data related to geography, statistics, traffic, and public works.

Knowledge Creation, Storage, and Distribution

Knowledge has been and still is government’s most important resource. The presence of highly trained, legally educated, and specialized civil servants has historically been considered a primary prerequisite for successful administrations. Because knowledge is regularly localized or even personal and difficult to share, it becomes immediately evident that although there is indeed a lot of knowledge within governments, it is not necessarily available anywhere, anytime, for anybody. This means that not all parts of a public organization can benefit from that knowledge. Consequently, much “reinventing the wheel” goes on in public administration. Existing approaches for knowledge management in e-government and e-participation attempt to address these problems; however, they mainly focus on the efficient management of isolated knowledge resources and on supporting communication between public administrators. The demands for knowledge-based e-government and e-participation are nevertheless much higher. First, existing approaches don’t take into account the increased granularity of informational resources and the manifold semantic differences in dealing with those resources. Second, because of the complexity of the decision-making processes, effective knowledge management requires a supportive, collaborative culture without the traditional rivalries. Moreover, many administrative processes are collaborative; because their course is not predetermined, it is often up to the public servant in charge of a process step to determine what should be done next. Other people working on the process should therefore be made aware of past actions and current status. Third, using existing knowledge resources is indeed a valid aspiration, but the crucial question is how to create new knowledge.

Because the key to knowledge creation lies in the mobilization and conversion of tacit knowledge, the focus of knowledge management in e-government and e-participation should shift from explicit to tacit knowledge. This means, for example, that written documentation should be enriched with the knowledge public servants have drawn from other documents, and with the knowledge communicated among team members. Finally, ad hoc management of changes in e-government and e-participation systems might work in the short term, but to avoid unnecessary complexity and failures in the long run, systematic management of the process is necessary. To improve the speed of change propagation and to reduce modification costs, knowledge used by a public servant in making decisions must be efficiently reedited. If the underlying knowledge is not up to date, the reliability, accuracy, and effectiveness of e-government and e-participation systems decrease significantly. The overall aim of such research is to radically improve the quality of service provision and hence enhance perceived citizen satisfaction.

Discussing and Formulating Policy

Engaging more people in the discussion and formulation of public policies and then being able to create meaningful summaries of their contributions is clearly a major challenge for e-participation. Several issues relate to this goal.

First, technologies should lower the entry barriers to these types of discussions. Web 2.0 and social software applications have already significantly changed the way people discuss and exchange ideas on the Web, but partly owing to their success, a new problem has emerged.

Let’s imagine that the entry barrier to policy-related discussions has become very low. As a result, thousands of previously excluded people now openly express and exchange their opinions and ideas, creating a vivid community of participation, the foundation of what has been called participatory or deliberative democracy. How can we now easily “sense” what this community wants? For example, how
can we actually capture the trends, main issues, and prevailing ideas discussed in the blogosphere, with contributions from thousands of users on a specific topic? Web 2.0 platforms are providing an easy vehicle for the read-write Web, but at the same time they remain mainly legacy and proprietary systems, which makes information reuse and sharing difficult, if not impossible.

Open Linked Data and the Web vocabularies already discussed seem relevant to these types of situations. To process, present, and query large volumes of input generated in mass collaborative public networks that emerge dynamically over the Web, we need to combine “traditional” intelligent technologies such as natural language processing with applications for argument representation, visualization, and opinion processing. (See, for example, the Wave Project, www.wave-project.eu.)

**Support for Complex, Cross-Organizational, and Dynamic Processes**

The public sector’s service provision process is distributed among hundreds, even thousands of partially independent agencies. Architectural paradigms like SOA and technologies adding semantics and “intelligence” to the “service” notion seem suitable to such an environment.\(^\text{10}\) However, traditional SOA approaches and their effectiveness are questionable from various perspectives. Unlike what usually happens in the private sector, in public service, production and delivery processes commonly cut across the boundaries of one agency and involve numerous actors with various roles. The distributed processes (or network of services) must be orchestrated, but at the same time they must remain flexible enough to accommodate

- different execution environments in the participating agencies;
- different representations of information;
- complex, information- and knowledge-intensive processes with multiple decision points at runtime; and
- mixed manual and automated steps and possible long intervals of pause and waiting time.

Moreover, agencies don’t like the idea of sacrificing autonomy to streamline such demanding and multiparty processes. Last, agencies act and behave within these processes according to a set of predefined rules that tend to change quite frequently; this makes formal specification of these workflows less effective.

Semantic SOAs with formal service ontologies, event-driven architectures, model-driven architectures, social SOA, and Web-based lightweight SOA architectures are only some of the approaches to enabling a new level of service provision in an area where tremendous governmental financial investments (in national e-government portals, for instance) have so far not offered the expected returns.

The articles we have selected for this special issue discuss some interesting aspects of the wide spectrum of problems and technologies presented in this introduction.

Specifically, in “Responsive Knowledge Management for Public Administration: An Event-Driven Approach,” Dimitris Apostolou, Nenad Stojanovic,
and Darko Anicic address the issue of responsiveness—that is, a system’s ability to respond to changing circumstances and deliver relevant and timely information correctly and consistently. The authors examine the challenges of responsiveness in governmental knowledge management systems and propose event-based representation and processing of changes in information resources and work contexts. Their system takes action on relevant events, with relevance being qualified via ontology-based preference rules. The article also discusses empirical evaluations in three field trials.

In “A Flexible, Event-Driven, Service-Oriented Architecture for Orchestrating Service Delivery,” Sietse Overbeek, Bram Klievink, and Marijn Janssen deal with the limitations of traditional SOA approaches for flexibly supporting cross-organizational service delivery. To overcome these limitations, they propose an event-driven architecture based on a formal model (ontology) for creating and managing complex processes. A case study from the Netherlands illustrates their proposal.

“Using Computational Argumentation to Support E-participation,” by Dan Cartwright and Katie Atkinson, deals with the problem of gathering and evaluating arguments to support decision making in public policy issues. The Parmenides tool lets users participate in Web-based discussions and supports a fine-grained analysis of the results by using argumentation frameworks and value-based argumentation frameworks techniques. The tool also visualizes the debate by creating argument maps.

References
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