# SUPPORTING SELF-ORGANIZATION IN POLITICS BY THE SEMANTIC WEB TECHNOLOGIES

*Václav Belák[1],Vojtěch Svátek[2]*

*We present a use of knowledge technologies in support of self-organization of people with joint political goals. We argue for the use of the semantic web technologies to enhance interoperability between eParticipation systems and to provide better user experience. We claim that ontology-supported eParticipation may increase the impact of eParticipation projects to public policy, because it enables better linkage of users and sharing of knowledge across different systems. In order to enable these scenarios, we built a core eParticipation ontology in RDF/OWL. The suitability of this approach is preliminarily demonstrated in a design and implementation of a proof-of-concept social-semantic web application Ontopolis.net. It is wholly backed by the ontology and thus demonstrates the possible openness of such an approach. This system leverages various knowledge technologies and resources like WordNet thesaurus in order to provide an intelligent recommendation of content or users. Hence it is designed to help people establish groups centred around joint goals and interests, which may subsequently lead to an emergence of public initiatives and joint actions.*

## 1. Introduction

Recent widespread use of so-called social-web or web 2.0 applications points to the new possibilities of decentralized large-scale collaboration and self-organization which have been unthinkable in the pre-Internet era. Sæbø et al. [7] argue for the consideration of social networking sites in eParticipation, because whereas many of the current eParticipation projects are rather unsuccessful to attract participants, and thus the outcomes are quite unrepresentative, social networking sites have been very successful in being adopted by users, and the interactivity of these sites leads to many spontaneous bottom-up public initiatives. However, the problems caused by heterogeneity of eParticipation systems remain, because even if there is a large level of participation, how will the overall overview of citizens' opinions and knowledge be able to be determined if these are dispersed throughout several existing systems? Moreover, even if this information is linked across them, won't be the citizens discouraged to participate in the emerging information overflow? How will one be able to determine what is worthy of his/her attention and what is not? How will a government and other public stakeholders realize what is really demanded no matter what systems are used by the participants? The potential of an eParticipation project to have an impact to public policy is to a great extent determined by the amount of its participants and their ability to make a joint action. Having one silver-bullet solution for all eParticipation use-cases does not

[1] Digital Enterprise Research Institute, National University of Ireland, Galway, vaclav.belak@deri.org
[2] Department of Information and Knowledge Engineering, University of Economics, Prague, svatek@vse.cz

seem reasonable due to the regional, cultural, and legislative differences. Moreover, a large portion of the public discourse is actually realized outside of specialized eParticipation systems, e.g. in blogs and general discussions. The more appropriate way to rise an impact may be to link existing systems together, as then the users may better form interests groups across systems' boundaries as well as they may benefit from sharing of common knowledge (e.g. solutions of public issues). The ability to group together can also be enhanced by more intelligent navigation and recommendation of users or content.

The combination of social web and knowledge technologies seems to be a natural step to tackle these issues, because the former raises the interactivity and employs wisdom of the crowd, whereas the latter are able to connect present information silos together and provide more powerful navigation and recommendation. In fact, the lack of knowledge technologies used has been identified recently as one of the research gaps in eParticipation [4]. The main aim of this paper is to present such a possible combination of social web with the semantic web technologies in eParticipation. We embodied the aim in a creation of a core eParticipation ontology and in a design and implementation of a prototype social-semantic web Ontopolis.net application that is wholly backed by that ontology. The system allows its users to specify public issues, to propose solutions to those issues, and to self-organize themselves around these solutions, and thus to form a bottom-up public initiatives. As the system is implemented using the semantic web technologies, these use cases are not limited only to the system, but will be able to be realized in a distributed manner across different systems sharing this ontology in the future. For example, the public issues and their solutions could be shared across various systems this way, so if one is solving the issue of bark beetle in a national park in Germany, s/he will be able to re-use recommended similar solutions of problems with bark beetle in forests of the Czech Republic. Moreover, this would enable the user to contact directly the Czech participant in order to get more information, experience, or even to establish deeper collaboration.

The remainder of the paper is structured as follows. Next section surveys some related research and projects. Section 3 describes the component-based structure of the ontology that underlies our approach. Section 4 outlines the overall architecture of our web portal and sketches the typical usage scenarios. Finally, Section 5 wraps up and outlines directions for future work.

## 2. Related Work

Openpolitics.ca is a political wiki where the users can specify issues, take a position, and vote for or against issues and/or positions. Localocracy.org allows its users to vote for or against public issues, to rank comments of other users about issues, and to vote in electronic elections. There is no separation between issues and their solutions, so it is potentially hard to link different proposed solutions of a given issue across different systems. Whitehouse2.gov is also a web application where the users can declare their priorities in the political world or vote on the priorities of others. General overview is then presented on the main page of the site. Zmenpolitiku.cz is another web application very similar to Whitehouse2.gov. Users are divided between two groups: the first consists of commentators who were selected in a public poll in Facebook, and the other consists of everybody else. This site provides opportunities to organize electronic petitions and declare (dis)agreement with an opinion of someone else. To the best of our knowledge, neither of these systems is capable to do advanced matching of issues or proposed solutions based on the meaning of their descriptions, and so it is quite easy

to get lost in the information glut while using them. Moreover, these systems are not backed by any formal ontology.

Van Atteveldt [5] describes various ontologies for description of political reality and the approach chosen in his work for formalizing political roles and issues has been our source of inspiration. Our ontology is to a great extent complementary to the eParticipation ontology developed by Wimmer [6], which aims to map the whole eParticipation domain and does not allow us to represent the aforementioned knowledge, though. A proposal of representation of opinions has been published by the microformats community, but neither this one is able to tackle aforementioned issues.[3]

## 3. Ontopolis Schema

### 3.1 Motivations and Overall Schema

The Ontopolis ontology or simply OPOL, which has been developed as a central artefact of the Ontopolis.net project, is used as a schema for all data in the system whose architecture is presented in the next section. The main purpose of this ontology can be characterized by the following competency questions [2]:

- What are actual political issues that people are interested in?
- How are these issues interrelated?
- What are possible solutions of these issues?
- Which of these solutions are more worthy of attention?
- Given one particular proposed solution of some issue, what are similar solutions?
- Who is interested in similar political topics as a given user?

Another motivation for creation of this ontology is to provide a vocabulary to be shared between similar eParticipation systems or even to annotate opinions of users on their blogs. Various popular ontologies are re-used (i.e. imported) in OPOL in order to be as compatible with other systems as possible. The FOAF[4] schema is used for description of persons, users, their groups and mutual relationships. The SIOC[5] ontology is then complementary to FOAF, because it describes the relations between the users and the content they have created. This content is described using the DCMI Terms[6] vocabulary. The users can also describe issues and their solutions by tags, which are disambiguated using the WordNet thesaurus. To represent the meaning of each occurrence of the tag we used the WordNet 2.0 Basic[7] schema. For description of political goals and proposed solutions we used DOLCE, which is a foundational ontology that "*has a clear cognitive bias, in the sense that it aims at capturing the ontological categories underlying natural language and human commonsense*" [1]. This feature of DOLCE allows us to represent various concepts and relations in political reality like goals of a political candidate "*in a post-hoc way, reflecting more or less the surface*

[3] See http://microformats.org/wiki/vote-links.
[4] See http://xmlns.com/foaf/spec/.
[5] See http://sioc-project.org/.
[6] See http://dublincore.org/documents/dcmi-terms/.
[7] See http://www.w3.org/TR/wordnet-rdf/#basicfull.

*structure of language and cognition*" (*ibid*). We have chosen the simplified version of DOLCE, DOLCE-Lite, with Plans, Modal Descriptions and ExtendedDnS modules.

Note that for the sake of brevity we do not present an overview of the whole ontology,[8] but we focus on the most important and novel part of it, which models political programs.

### 3.2 Representation of Political Programs using DOLCE

Our use of DOLCE and related concepts of OPOL is illustrated in Figure 1.[9] Van Atteveldt [5, p. 153] discusses various ways to represent dynamic (i.e. changing in time) political roles and argue for creation of an *adjunct instance* for each role played by a person, because it allows easier reasoning and querying. For the same reasons, we decided to represent roles in this way. An agent, i.e. a person or a group, can play one of two political roles: it is either a *opol:Supporter* or a *opol:PoliticalCandidate*. A new instance is created for each role played by an agent in a plan (see below). Political candidate is a role of a politically engaged agent, who wants to be supported by others so as to be e.g. elected in a poll. Supporter is also a role of a politically engaged agent, but of one that has generally not so strong political ambitions. A supporter only declares his/her support to the candidate by the *opol:Following* commitment that means the supporter is a follower of the candidate and it is expected the follower will not behave counter to this commitment.

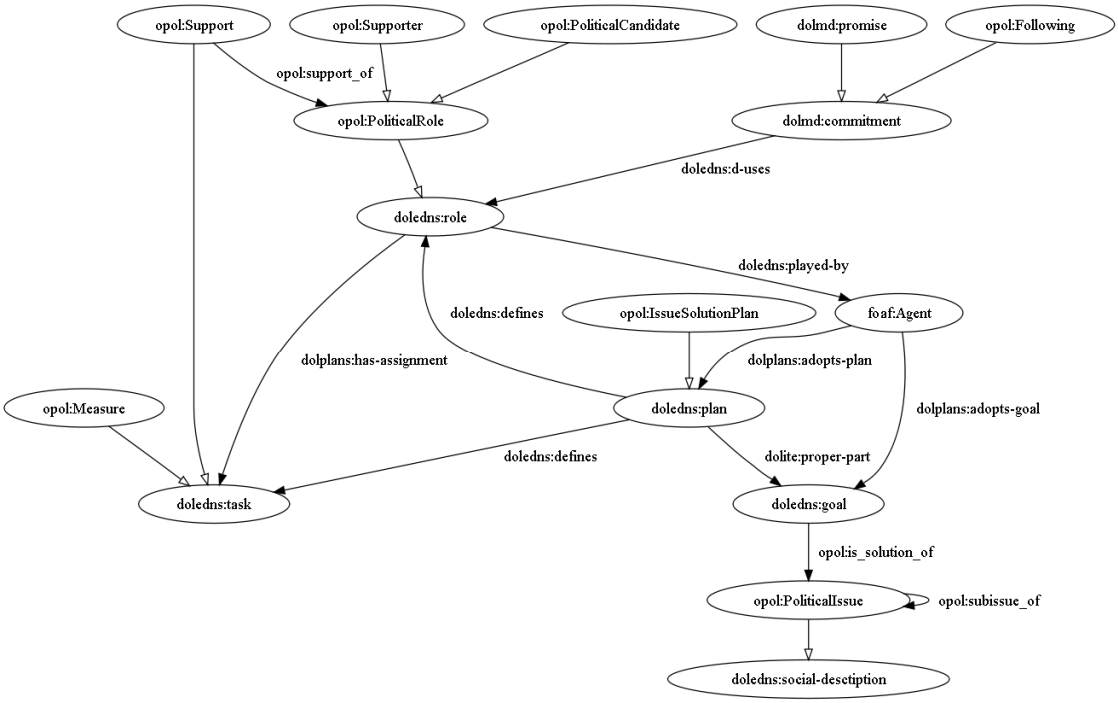


**Figure 1 Political programs representation**

[8] More information about the ontology including the overview can be found at http://www.ontopolis.net/home/opol.

[9] Note that *opol*, *dolite*, *dolmd*, *doledns* and *dolplans* are prefixes for Ontopolis, DOLCE-Lite, ModalDescriptions, ExtendedDnS and Plans ontologies, respectively.

Political issues are naturally hierarchical. Various ways how to represent this hierarchy are discussed by Van Atteveldt [5, p. 155] and finally it is argued there for creation of hierarchy of instances. Similarly to this approach, we defined the *opol:subissue_of* property, which is a subclass of *skos:broader* from the SKOS ontology (*ibid*, p. 156).[10] Any problem to be solved in politics is described by an instance of *opol:PoliticalIssue*. An issue can be a sub-issue of another issue. "High criminality in city X" is an example of issue. A political candidate defines a plan around an instance of *opol:SolutionPlan*, which is a subclass of *doledns:plan*. A *plan* is a description defining or using at least one *task*, one agentive *role* and that has a *goal* as a proper part. The goal of the plan is a description of the desired state of the world, which is supposed to be a solution of the issue. For example, "City X is safe" is a goal that can be declared to be a solution of the aforementioned issue. The plan defines at least one instance of *opol:measure*, which is a sub-class of *doledns:task* and assigned to the political candidate who adopts the plan. The agent who plays the political candidate role defined by the plan adopts the plan and its goal as well. The author of the plan always plays a role of political candidate in it. Measures represent activities which are needed to be accomplished in order to reach the goal. "More police patrols during nights" is an example of measure. A solution plan can also define an instance of *opol:Support*, which is a task assigned to a supporter. When an agent adopts the plan, it makes a promise, represented as an instance of *dolmd:promise*, which can be perceived as a commitment to realize the plan. The solution plan represents a set of its goal, measures and issues it solves as a whole. "Strategy for Combating of Criminality" can be an example of solution plan.

# 4. Ontopolis Portal

## 4.1 Portal Architecture and Implementation

The Ontopolis.net[11] has been implemented as a proof-of-concept social-semantic web application based on the Grails,[12] a framework for development of WWW applications on the top of the Java platform. The application has a 3-tier architecture according to the MVC pattern.[13] The user interacts with an interface implemented as a set of interlinked web pages on the server side. A user's request is dispatched by the framework to a controller, which calls an appropriate service. Services provide an application logic and serve as a façade for corresponding objects from the ontology. All data are stored in Jena's SDB[14] RDF store which uses the PostgreSQL database at the backend. Jena's rule engine is used for real-time reasoning over RDF data and the Pellet reasoner[15] is used for constraint checking.

[10] Simple Knowledge Organization System (SKOS) ontology is intended to help to create classification schemes, thesauri, etc. Property *skos:broader* should be read as „*has as broader topic*". See http://www.w3.org/2004/02/skos/.

[11] See an online demo at http://www.ontopolis.net.

[12] See http://www.grails.org.

[13] See http://java.sun.com/blueprints/patterns/MVC.html.

[14] See http://jena.sourceforge.net/SDB/.

[15] See http://clarkparsia.com/pellet/.

### 4.2 User and Content Recommendation

Issues and plans can be tagged and the actual meaning of each tag is determined during the process of disambiguation. Every word sense in WordNet is represented as a synset (a set of synonyms). When the tagged item is about to be saved into the RDF store, the tags are disambiguated using the similarity measure published by Lin [3]. The synset for a given tag is determined by the highest similarity to other accompanying tags of the item. Consequently, the overall similarity between two tagged items can be computed. The items with similarity above a certain threshold are considered as similar and the corresponding similarity relations are saved. These related items are then selected from the store and presented to the user in context of the original item. Even items tagged by lexically different tags like *Prague* and *Praha* can thus be related.

### 4.3 Usage Scenarios

Each page in the system has a three-column layout as depicted in Figure 2. The middle column provides the main information of the page and the side columns provide compact information boxes with related content. For example, during the creation of a new object (i.e. a plan, an issue, etc.), the list of recently added items is displayed in order to prevent creation of duplicates. A visitor of Ontopolis.net is provided with answers to some of the competency questions (see Section 3) as early as on the frontpage of the site. S/he sees what the pressing political issues are, which solution plan was added recently, and who is the most trusted or the most active person in the system. The last two kinds of information are very important in every social site, because they motivate users to be active. The user's activity is measured by the count of issues, plans or groups s/he created. The most trusted person list is computed by ordering the users by the headcount of their support.

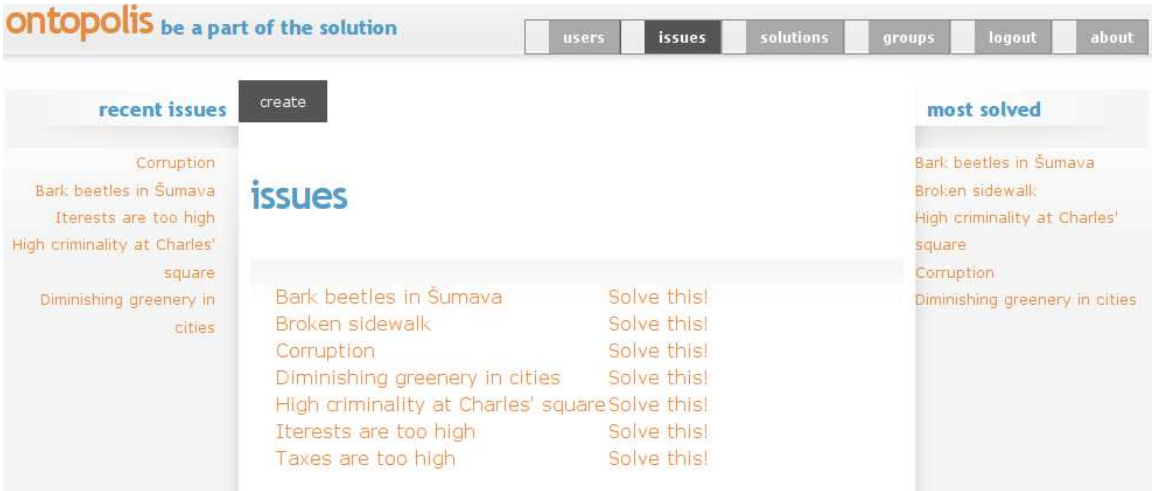


**Figure 2 User interface layout**

When the user logs in, s/he sees the user's details page with his/her profile. Besides essential user information like name, lists of known or similar users are displayed as well. This provides a user with the possibility to create a linkage even to unknown, yet similar-minded user.

The Issues section provides a list of all issues and lists of the most recent and the most actively addressed issues. In the detail page of the issue, similar issues are displayed and it is

possible to start a wizard for creation of a solution plan for the issue. In the wizard, the user specifies any additional issues s/he wants to solve, the goal of the plan, its measures, and finally s/he describes the plan as a whole. Contextual help is provided in the side information box during this process. At the end of the wizard, the plan's detail page is displayed that shows who is the author of the plan, who are the followers, what issues this plan may solve and what are the similar plans. The user can also lists all plans, which are then sorted by the headcount of the support that the author of each particular plan enjoys. This support can be declared at the plan's detail page.

Any user can also create a group and then s/he tacitly becomes its administrator who has the permission to add a plan to the group. Only a plan authored by the administrator can be added, hence it is not possible to “steal” a plan of someone else. Currently only the founder of the group can be its administrator. After the plan has been adopted by the group, this group plays a role of political candidate in the plan and it is possible for other members to adopt it as well. Therefore the creation of a group is the only way to share a plan with others. The group's detail page then contains information about the goals of the group, its members and their roles. The role can be one of a candidate, a follower, or there is no role at all. This typology of roles follows the idea that whereas one person only wants to declare his/her belonging to a group and so s/he becomes a member without a role, another one wants to declare his/her support to a particular candidate and plan and s/he consequently becomes a follower, and finally another one publicly declares the promise to implement the plan and hence s/he becomes a candidate.

So far, only the use cases *inside* the system have been discussed, but as all data are represented by the ontology, the system also provide high level of possible interoperability and reuse of knowledge. In particular, the system publishes its content by SPARQL,[16] which is a protocol and query language for the semantic web. This way, any third party can easily obtain from the system in a machine processable form e.g. a list of issues or its solutions, similar solutions to a given solution, friends of a given person or a list of similar persons, etc. In future, other system can thus provide by far more knowledge about possible solutions or similar-minded people than it actually contains in its own database. The impact of such an eParticipation system may be thus higher than if it would operate separately, because it will synergistically leverage existing knowledge and social capital. Even a more distributed scenario is conceivable: the ontology can be used by an extension for some of any popular blogging platform (e.g. WordPress) that will enable a blogger to specify the issue or solution s/he is writing about. Subsequently, this knowledge could be extracted from these blogs and integrated with knowledge from dedicated eParticipation systems.

## 5. Conclusions and Future Work

We have presented a core ontology for description of political programs, commitments and trust between people, as well as their mutual relationship. The complexity of the underlying domain is tackled by leveraging on multiple well-established ontologies (FOAF, SIOC, DOLCE, Dublin Core, SKOS and WordNet), thus both adhering to 'best practices' and potentially allowing for high degree of interoperability with other tools. Therefore, it may

[16] See http://www.w3.org/TR/rdf-sparql-query/. The description of the endpoint can be found at http://www.ontopolis.net/home/sparql.

help overcome existing limits of present similar eParticipation systems, especially wrt. interoperability, information search, and user and content recommendation. Development of an ontology to be shared among different systems is a very complex and error-prone process, and we are fully aware of the fact that further development is necessary. In particular, we assume that aligning the whole set of ontologies imported to OPOL with DOLCE could be fruitful, because it will make the underlying assumptions of all defined concepts more clear and it will bring better interoperability with other schemas.

The proposed ontology have been used in the implementation of the fully functional prototype, which still has, however, rather constrained capabilities. We further plan to enhance the system so as to test the whole concept in a real world use-case. First, in order to allow easy user adoption, an integration with existing systems like Facebook or OpenSocial API will be implemented. The second pending task is to implement the hierarchies of issues and the third is to allow update operations on items in the system.

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