

Migrating Small Governments' Websites to the Semantic Web

Ralf Klischewski

German University in Cairo
Al Tagamoa Al Khames
New Cairo City, Egypt
ralf.klischewski@guc.edu.eg

Abstract

Getting ready for the Semantic Web is a challenge especially for small size administrations. The migration path is not trivial, and existing migration approaches cannot be considered as sufficient support for small administrations which must avoid high cost and effort. Focusing on salient stakeholders, their migration activities and artifacts utilized, this paper introduces a framework for analyzing migration support requirements with the aim of developing tools, concepts and strategies to lower the barrier of entering the Semantic Web. Within the EU-funded project Access-eGov, this framework will contribute to improve distributed e-government information management and the semantic interoperability of e-government services as Semantic Web unfolds.

The Small Governments' Migration Challenge

In the IT world, migration is the movement of an application system to a new environment motivated by a need to serve the business of the enterprise more effectively. Migration helps protect the current investment in data and functionality critical to the business and establishes a path for growth. It usually spans a great "distance" and the movement is either continuous or in a series of steps.

In the area of Semantic Web for e-government, we do face the challenge of migration: the world is populated by handcrafted HTML websites and web pages automatically generated by content management systems which had been designed for displaying content for humans to read. Now, for the Semantic Web, we need at least machine readable enhancements based on understanding of the content and, in many cases, a reorganization of coding and content at the same time. This cannot be done by a simple one-step procedure.

It has been discussed before that the barrier of entering the Semantic Web is too high especially for "small size" participants: "Unfortunately, given this currently limited usability, it is hard especially for individuals and small institutions to take the initial migration step to the

Semantic Web" (Haustein and Pleumann 2002). This applies also to the area of e-government. On one hand, there is a great need of managing distributed e-government information and improving the semantic interoperability of e-government services, especially in areas with federated government systems (such as in Germany). On the other hand, getting ready for the Semantic Web is a challenge especially for small size administrations (even though the overall benefits for moving into the direction of Semantic Web seem obvious). The migration path is not trivial, and in most cases the environment is not supportive and necessary resources such as well trained staff and adequate tool support are lacking. At the same time, the immediate local benefits of migration are limited which adds to the barrier of entering the Semantic Web age.

Through the last couple of years, since Semantic Web technologies are ready for use, research has elaborated migration paths on how to enrich or transform existing data to be accessible through semantic applications. In principle, it is understood that this migration requires a more or less elaborated ontology (and often ontology mapping), a migration methodology, as well as tool support. However, these approaches cannot be considered as sufficient support for small administrations which face severe restrictions in financing and staffing migration projects.

Only recently, semantic Web for e-government has become a research topic in itself (cf. Klischewski 2003). In this area, the topic of migration to the Semantic Web is yet to unfold. For example, systematic analysis on barriers and success factors of migration of web content to Semantic Web in the area of e-government is not yet available. To close the gap, this paper seeks to present a framework for the analysis of requirements for supporting small governments in their Semantic Web migration efforts. This research is part of the EU-funded project Access-eGov which aims at developing new methodologies and tools for preparing distributed e-government information for the Semantic Web and improving the semantic interoperability of e-government services.

The paper is organized as follows: The next section introduces the research approach and the basic assumptions for developing the requirement analysis framework. After this, the case of Schleswig-Holstein (one of the German states comprising more than one thousand municipalities) will be introduced, which is part of the real-life

environment for this research and one of the framework's application areas. The framework itself is developed in two steps: the analysis of the salient stakeholders in the migration process, and the analysis of the process itself as an organizational project interrelating content preparation with upgrading and using an enhanced IT infrastructure. Based on this framework, it is considered how existing migration approaches should be enhanced, and the last section discusses how the framework shall be used in the future research.

Research Approach

As research on e-government is maturing, it becomes well accepted that this is a multi-perspective endeavor which calls for research methods from various backgrounds. On one hand we can draw on the rich body of information systems research, on the other hand we need to combine this with insights from administration science and related areas. The research presented relates mainly to the e-government areas of information management, (service) integration and interoperability.

In e-Government practice the integration and interoperability encounter multiple challenges and a number of serious constraints (Klischewski/Scholl 2006): constitutional/legal, jurisdictional, collaborative, organizational, informational, managerial, cost, and performance constraints. For the framework development, we will not investigate all of the above constraints, but assume basically that

- The constitutional, legal, and jurisdictional constraints set sharp limits to the extent of e-Government integration and interoperation, which cannot (or, even should not) be overcome
- Especially small governments are facing tight budget constraints and their decisions (e.g. to migrate to the Semantic Web) are driven mainly by cost-benefit considerations
- All in all, governments and their administrations are in favour of enhancing e-government, but the required knowledge and capabilities usually have to be developed with the help from outside actors

The topic of migration has already been discussed in Semantic Web research, and the basic concepts and approaches we can take from there. However, introducing the Semantic Web to e-government is different from the commercial field where mainly the big players are in the lead. E-government serves public goals per definition, i.e. applications may only be considered successful if they are comprehensive and include (almost) *all* informational sources which are relevant in a given area or subject. In the case of the responsibility finder (see next section), for example, it would not be acceptable if only 30% of the municipalities can be found whereas the others are ignored. For this reason it is of utmost importance that small governments and their administrations are included in the

migration process from the very beginning – even though they might have the most difficulties in migration.

The first step in developing the framework is the analysis of the salient stakeholders in the migration process. Stakeholder analysis has been recommended by several authors (e.g. Scholl 2001, Flak/Rose 2005) as the starting point for e-government research. Here, we seek to identify the primarily responsible and supporting actors of migration (as well as the beneficiaries) in order to identify their scope of activities and collaboration.

The second step is the analysis of the migration process itself as an organizational project interrelating content preparation with upgrading and using an enhanced IT infrastructure. The focal point is the annotation of web content (as prerequisite of providing machine readable information through the internet) and the combination of activities and artifacts leading to this accomplishment. Special emphasis is given to highlighting the interrelation of technical activities (e.g. integrating annotation tools into the given IT infrastructure) and administrative activities such as developing and providing a common semantic model.

Based on the above, the required activities can be mapped onto the stakeholders, and for each of these mappings potential barriers, cost and possible support for carrying out the activities can be discussed and specific issues for the requirement analysis can be raised (e.g. for developing a questionnaire). Furthermore, we can review existing migration approaches and tools in the light of the above findings and specify needs for further developments.

Beyond the scope of this paper is the analysis of the expected migration benefits which is essential to especially small governments when taking migration decisions on a cost-benefit basis.

Aiming at Distributed e-Government Information Management in Schleswig-Holstein

This paper focuses on identifying the requirements of small municipalities on their path to the Semantic Web as a basis for developing new methodologies and tools to serve these special needs. The real-life environment for this research includes Schleswig-Holstein, one of the German states comprising more than one thousand municipalities.

Seeking information online and dealing with one's affairs through web applications have become an integrated part of the life of many German citizens. In many use cases, the starting point for the citizens' e-government activities are services for providing them with orientation: web pages serving as simple directories for their municipality, or portals combining administrative information with information about business, culture, non-government organizations etc. Some websites also offer specific citizen information services (CIS) such as "citizen's directory" or "responsibility finder": in response to the user specifying his/her concern (and, if needed, providing other case-based related data such as residential address, nationality, marital status) the service provides information about the responsible

agency, where to find it, what to do and when, about the forms to use, the documents needed, fees, time limits etc. This kind of citizen information services shall be implemented also in Schleswig-Holstein, the most northern of the 16 German states with less than 3 million people. The state is structured in eleven counties with more than one thousand municipalities, and four cities. The state government is located in Kiel (the state capital), employing about 60,000 staff in nine departments. The state government departments, the cities, the counties and most of the municipalities run their own technical infrastructure; only some municipalities have aligned to share a common information system and web server. Basically, we find two types providing online information and other services:

- Static HTML websites, hosted by a commercial internet provider: often only one administration member (part-time) is in charge for occasionally editing the content.
- Dynamic websites, based on a commercial content management system: usually several administration members (part-time) contribute to the content on a more frequent basis, drawing on the assistance of the CMS vendor if needed

Whereas the neighbouring state, the city state of Hamburg, has already implemented a responsibility finder on the basis of a centralized information management system (see <http://fhh.hamburg.de/stadt/Aktuell/hamburgservice/zustandigkeitsfinder/start.html>), this centralized approach is not feasible in Schleswig-Holstein. All actors involved share the opinion that (a) local and regional websites should continue to operate, (b) maintaining an up-to-date information base locally and centrally is highly inefficient (and the small municipalities simply do not have the work force to do the extra work), and therefore (c) any central or overarching e-government application must obtain the needed and relevant information from the local sources.

Initial investigation has shown that implementing a responsibility finder in Schleswig-Holstein is a case for Semantic Web (Klischewski 2005): The information sources used are geographically distributed, have diverse ownerships, are syntactically, structurally, and semantically heterogeneous. Furthermore, it is an open world with permanent change of information seekers and providers and with never complete information. Plus, the implementation of a responsibility finder must use (some) formal description of the meaning of the data based on the controlled vocabulary which is about to be standardized for all the e-government actors.

That means, basically, that CIS are in the range of application for which it is reasonable to apply Semantic Web technologies. But do these technologies really help regional e-government networks to enable or improve their CIS? Or, more precisely, what kind of tailored Semantic Web technologies are the key for solving the problem of cross-organizational information management as a prerequisite for citizen information services? And what is a feasible migration path for the information providers involved? What kind of methods and tools should they use, given their limited resources and benefits?

Answers to these questions determine how the municipalities will decide on whether and when they should climb the barrier to the Semantic Web. The state government of Schleswig-Holstein has decided recently that it favours this strategy over any other approach. However, to make the Semantic Web based responsibility finder a successful application it needs a high adoption rate at the side of the municipalities. In order to motivate especially the small municipalities to devote their own resources (human, technical, financial) to meeting the Semantic Web challenge, we must identify their requirements and provide them new methodologies and tools serving their special needs.

Who is who in the Migration Process: Identifying Salient Stakeholders

For the developing the requirements analysis framework we will first identify the stakeholders involved, i.e. those who are responsible for or support the preparation and migration of web content to the Semantic Web. Since this kind of migration is a socio-technical challenge based on collaboration (see next section), we need to include a variety of involved roles such as content providers, standard providers, technology providers, annotators, service providers – and service users as they are the peer reference group for those who embark on migration.

In the settings to be investigated, the governments (in a narrow sense) are the decision makers, and the actors responsible for actually providing web content are the administrations. The organizational setup of administrations can vary significantly. In Germany, for example, administrative units as web content providers can range from a few dozen (in small municipalities) to tens of thousands (e.g. almost 40,000 in the Hamburg city state administration). For the sake of simplicity, we identify two types of administrations in order to demonstrate how different the organizational capabilities are for actually carrying out the migration steps:

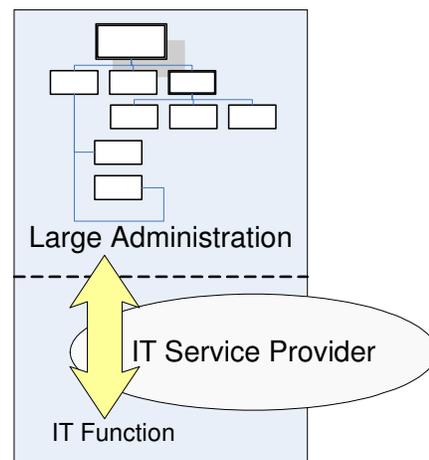


Figure 1: type “large administration”

- The *large administration* type (see figure 1) is characterized by an elaborated hierarchical organizational structure which is the basis for all intra-organizational process management. The structure includes an IT function (one or even several dedicated IT departments) which receives assignments on a project basis or has long-term commitments for maintenance. Usually, the IT function has at least one strong partner as IT service provider (a commercial and/or semi-public organization) which is tightly aligned, involved in all major IT projects and thus is very influential concerning the IT infrastructure development.
- The *small administration* type (see figure 2) is characterized by a rather flat organizational structure, and individual cooperation is the main basis for intra-organizational process management. There, we usually do not find an IT function, but rather individuals (e.g. a Web administrator) carrying out assignments ad hoc, on a project basis or based on long-term commitments for maintenance. However, compared to the large administration, naturally the task load is small, the IT expertise is limited, and the ability to enable socio-technical change is low. Usually we find steady relations with commercial IT vendors and ISPs, but because of the overall low IT budget these interactions are not as intense as in large administrations.

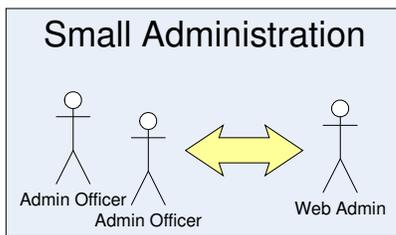


Figure 2: type "small administration"

Actors essential for supporting migration are on one hand providers for a common semantic model (COSMO) and on the other hand IT vendors and/or ISPs which provide tools and/or migration environments in addition to hard- and software, network services, content management systems and/or other related applications which are needed for running e-government websites (see next section). The provision of the common semantic model for the e-government web content could be drawn from any source. However, for standardization of content, but also for harmonizing the IT infrastructures and related investments, there should be an e-government steering committee setting directions accepted by all stakeholders involved. Figure 3 provides a principle salient stakeholder map for migrating e-government web content. It depicts only the most important actors which are likely to be found in real e-government settings (like in Schleswig-Holstein) as being responsible for the migration process or supporting it through concepts, technology, and services (i.e. steering committees, COSMO groups, IT vendors, IT service providers and ISPs).

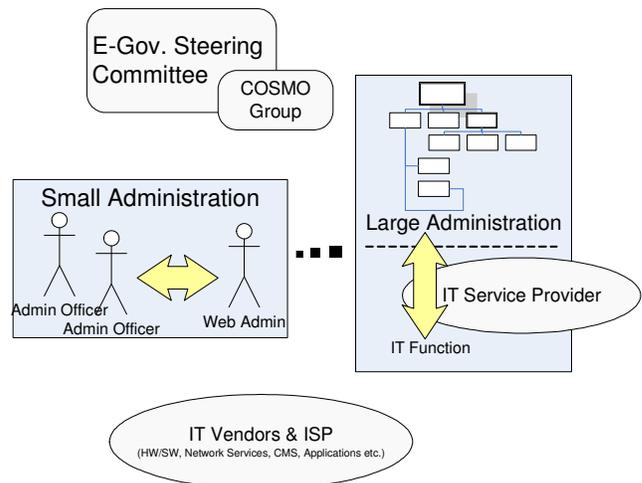


Figure 3: principle salient stakeholder map for migrating e-government web content

Of course, empirical investigation might reveal significant deviations from this schema. In particular, real-life administrations mostly will not match simply the ideal type but can rather be allocated somewhere in the continuum between small and large type administrations. However, it is assumed that, because of the coarse granularity of the stakeholder analysis, the majority of the cases will have a rather good fit and that requirement elicitation based on this stakeholder approach allows an adequate contextualization of the findings.

The downside of this granularity is that the stakeholder map is not detailed enough for depicting those roles that actually perform the conceptual and/or technical annotation. Since migration in e-government has not yet started on a large scale, this kind of task assignment is difficult to foresee. The stakeholder map should be revisited as soon as more insights from applying the requirements analysis framework are available.

So far we have focused on the information provision side of the Semantic Web. If we extend the principle salient stakeholder map to embracing the information consumers, we would also have to include citizens (households) and various types of businesses and administrations because many of the Semantic Web applications in e-government will fall in the G2B or G2G category (such as the responsibility finder mentioned in the section before).

Migration as an Organizational Project

Before focusing on migration approaches from the technical point of view, we need to consider the migration process as a whole and how it is related to the organizational environment. We reflect the process as a socio-technical challenge, interrelating content preparation with upgrading and using an enhanced IT infrastructure. The aim is to understand the combination of social activities and technical artifacts leading to the provision of machine

readable e-government information for which the annotation of web content is prerequisite.

Since migration is (hopefully) a one-time effort, it is to be framed as a project and assigned to some responsible organizational unit or individual. As substantial resources are required (working time, IT acquisition etc.), any government will call for a cost-benefit analysis before making a “go”-decision and allocating the resources. Given the low budgets of especially small administrations, an unfavorable balance at this point could easily bury any migration effort before it even had started. Highlighting the benefits of migration and how to include them in the balance is out of the scope of this paper. Rather, we will focus on the “cost” of the migration, i.e. how the burden of the task is perceived by the governmental decision makers in the light of the available support through technology and from other partners. As stated in the beginning, the aim here is to develop a framework for the analysis of requirements for *supporting* small governments in their Semantic Web migration efforts.

Reflecting the migration process within a project frame, we have to consider at least the following steps:

- *Project initialization*: this step includes assignment of responsibilities, definition of scope and procedures, team building (including alignment to external partners), and allocation of resources.
- *Web content analysis and definition of migration goals*: the migration performers need to have awareness and common understanding about the starting point (i.e. volume and current state of web content) and target of the migration.
- *Preparation of method, tools and IT infrastructure*: from the technical point of view a number of highly interrelated preparatory steps are required such as (a) an explicit method must be selected and communicated with all participants (e.g. through training), (b) in order to support various migration tasks following the method one or more tools must be selected, installed and trained, (c) the IT infrastructure most likely needs some enhancements (e.g. to support the tools, to enable annotation of dynamic content from data bases etc.), (d) an agreement must be reached which technical standards are applied.
- *COSMO import (and adaptation)*: most sensitive to the application domain is the selection and acceptance of one or more common semantic models (e.g. taxonomy, ontology) as the basis for all conceptual migration tasks. If the fit of the models is not satisfactory (e.g. not sufficiently supporting the migration goals), amendments and adaptation might be performed.
- *Web content preparation*: in view of the COSMO the web content should be revisited and revised to make sure that it can be processed (i.e. annotated) on the basis of the available semantic framework, migration method and IT support. Ideally guidelines are given, which help administrative officers also to prepare new web content.

- *Web content annotation*: this is the core of the migration process which should be guided by the selected method and which draws on all preparations and artefacts introduced above. The method defines start, end and the steps in between. Variations in this subprocess depend, amongst others, on the volume of content to be migrated, the degree of possible automation and the static or dynamic type of data.
- *Test and fine-tuning*: even though the annotation process itself has been completed successfully (including some test routine), further testing and most likely some technical fine-tuning is essential to assure that designated information consumers (e.g. a responsibility finder agent) are actually able to read and process the annotated content automatically. This step is even more important when e-government services with non-trivial interfaces are included in the migration.
- *Publication and information alignment*: the last step within the project frame is the actual release of the annotated web content along with the abandoning outdated material. This release could also include the start of new alignments providing information for and receiving from other partners (e.g. replacing a proprietary responsibility finder by a Semantic Web agent and a user interface).

The above steps may be interpreted as a process model for migrating web content. However, the primary purpose is to elaborate a frame on the basis of which a requirement analysis can elucidate the support needed especially for small administrations. The analysis of the necessary support should focus on each of the above steps as well as on the process as a whole. The dimensions of analysis are the support through technical artefacts and the support through aligned partners which provide guidance and conceptual help during the migration process.

An overview of the migration project steps (top level granularity) is given in figure 4. On the right side, the most important technical artefacts are depicted which are specifically needed for the migration process. In the figure, these are aligned to those process steps in which they are invoked for the first time. The migration tool set may comprise a number of backend applications as well as user support (such as the ontology editor and the web annotator which are introduced as single applications again when administrative staff is in need of such support). On the left side, conceptual support such as an overall process model, guidelines for several activities, migration method(s) and coaching (including go life support) is depicted which is expected to have a positive impact, to say the least, or might even be an essential success factor for the migration (depends on the knowledge and experience of the project members involved). Again, the identification and alignment of conceptual support and technical artefacts is tentative and hypothetical – the application of the framework will certainly give rise to its refinement.

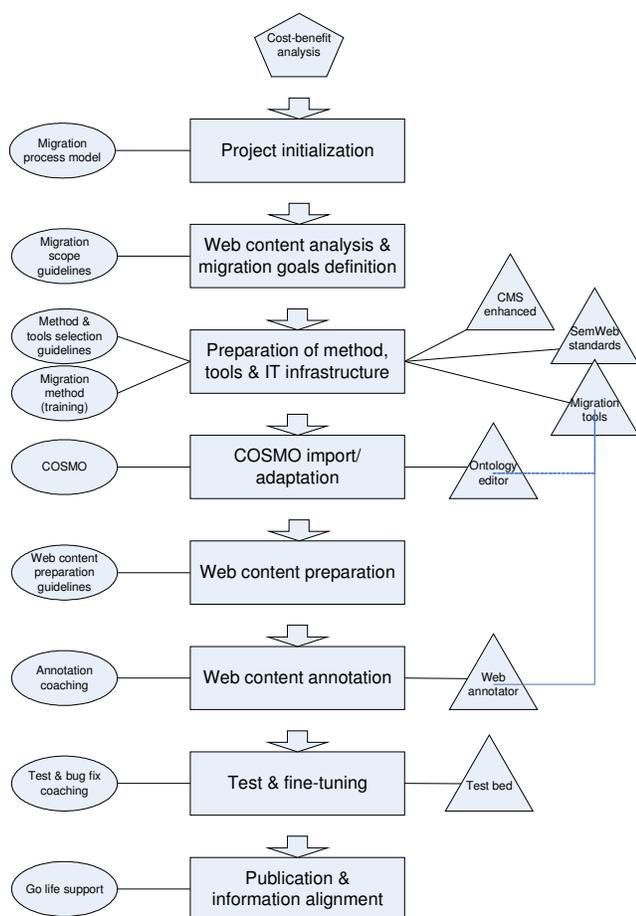


Figure 4: web content migration process model with input of conceptual support (left side) and technical artefacts (right side)

The description of a tentative migration process model is one part of the framework for requirement analysis. If we combine this with the stakeholder model of the previous section, we can assume the following actor-activity relations:

- Administrations as owners of web content are the responsible actors for initializing and carrying out migration projects
- The e-government steering group and the COSMO group provide conceptual support (coaching might involve additional service providers)
- The IT function (as far as being capable) arranges for the necessary infrastructure setup (e.g. installing Semantic Web tools); IT service providers, IT vendors and ISPs assist (if needed) and provide further technical artefacts

Considering the challenge of successfully carrying out such migration projects, we must admit that small administrations may be easily overwhelmed by the complexity of the issue, the amount of different tasks to be accomplished and the sophisticated technology to be mastered. Thus, as we seek to understand the requirements for migration support, we must inquire the options for

strengthening the support and reducing the cost for the individual (small) administration so that a local cost-benefit analysis will be in favour of starting migration projects.

Seeking to Improve Migration Approaches

Migration should establish a basis for effectively harnessing modern IT to satisfy current and future needs – also for small governments. But even if we presuppose successful Semantic Web applications in e-government, the small governments' benefit of getting ready for the Semantic Web is rather marginal and often difficult to quantify. Taking this into account, any migration of small governments' websites to the Semantic Web must appear as a rather easy step requiring only minimal (additional) resources. However, our tentative framework for identifying required migration support alerts us to the special problem of small governments: their administrations are likely to refrain from migration due to perceivable high effort and lack of adequate resources and support. As we seek to improve the situation we first must take into account what already existing migration approaches already contribute to cater the needs of small administrations.

In the literature, we find a many publications on (legacy) systems migration, but for many years the focus has been on the technical issues without taking into account any semantics. For the last couple of years, since Semantic Web technologies are ready for use, research has elaborated also migration paths on how to enrich or transform existing data to be accessible through semantic applications. In principle, it is understood that this migration requires a more or less elaborated ontology (and often ontology mapping), a migration methodology, as well as tool support (e.g. Golbeck et al. 2002, Handschuh and Staab 2002, Volz et al. 2003). Variations along these axes depend, amongst others, on the degree of possible automation and the static or dynamic type of data.

However, the scope of these approaches is of technical nature: e.g. as Ding (2005, pp. 45f.) has stated, automated semantic annotation systems typically take web pages to be annotated and a domain ontology as inputs, extract instances from web pages, perform a set of heuristics for mapping, and finally generate and store the annotations that ontology-aware machine agents can process. This is the basic process model, even if some of the steps (mainly the heuristics and the mapping) are not automated but require case-based decisions by humans.

In principle, this process model can work also in the area of e-government. But two aspects require that we seek for substantial enhancements before applying this kind of approach:

- The debate on e-government ontology is just beginning, an accepted domain-specific COSMO for annotation is not yet available; therefore, given the great diversity of e-government web content, for the next couple of years administrations will have to perform migration of their

individual content, ontology crafting/adaptation and content revision at the same time – which requires special support for local administrative officers for those tasks which cannot be automated by any means. In this respect, existing approaches seem to be too general (i.e. too technical, no domain specific support, too many degrees of freedom where it is not needed) and, at the same time, not enough focused on the migration tasks which administrations are actually facing.

- As pointed out in the sections before, decisive barriers and success factors for web content migration are beyond the scope of existing migration approaches. And as long as these approaches implicitly presuppose that the environment is supportive and necessary resources (well trained staff, finances for tools and service) are available, especially small administrations will be hardly convinced that web content migration is a project they can easily control and will benefit from in the end.

The issue of complexity seems to gain increasing attention also in the area of Semantic Web and e-government. For example, Stojanovic et al. (2004) have suggested an approach to (re-)organizing the knowledge modeling in order to reduce the complexity of describing e-government (web) services and to support their change management. In order to provide more flexibility, they elaborate on a meta ontology to be included in the domain and service ontologies. This is a logical and valuable further development, and there might be even use cases for this in practice. But at the same time this approach introduces yet another level of abstraction (the authors rightly claim the general applicability of their contribution) that is far beyond the capability of the average (small) administration and their staff to make use of this in meeting their practical challenges. This is just an example suggesting that research in this area maybe should not only explore the abstraction levels above existing migration approaches, but also the options for their domain-specific and actor-specific contextualization and “localization”.

Experience from the past has shown (e.g. in the UK), that the overall e-government achievements in a given area are positively influenced by creating a network of e-government actors and supporting this community in their various effort through facilitating communication and through provision of guidelines, methods and tools. Being pragmatic some US researchers and practitioners are now taking a similar approach by forming a “Semantic Interoperability Community of Practice (SICoP)” (<http://web-services.gov>); amongst the various efforts in helping each other to proceed we find an “Ontology and Taxonomy Coordinating Work Group” that could serve as a role model for the COSMO group introduced in the stakeholder map.

All in all, taking the above considerations into account, the hypothesis for future research is: Migration methods and tools for small administrations must be tailored and comprehensive with the aim of minimizing effort in conceptual decision making and in changing the local IT infrastructure – thus minimizing the need for working time,

expertise and financial investments. At the same time, these migration methods and tools should be provided by trusted stakeholders, and especially small governments must be able to draw easily on external expertise and experience to solve any problems during the application process.

This hypothesis will guide the application of the requirement analysis framework within the research context described in the last section.

Learning from Cases to Support Large-scale Adoption

The research outlined in this article is carried out within the frame of the EU-funded project Access-eGov (started in January 2006). By employing semantic technologies the Access-eGov project aims at providing solutions for the management of distributed e-government information as well as for semantic interoperability of e-government services across organizational, regional and linguistic borders. For service providers the project seeks to enable the introduction of (new) e-services to the world of e-government interoperability in an easy way. Any government service identified may be localized, contracted and used automatically through agents and other IT components.

To reach the projects objectives in the area of service enhancements (i.e. providing CIS and agent-based services for life event support within a security infrastructure), the key is to enable ontology-guided mark-up of local e-government information and service interfaces. Deliverables include ontologies, methodology and tools ready to be used in municipalities. All the Access-eGov components will be delivered as an open source solution. Pilot applications are planned for at various sites in Eastern European countries. The most challenging field test, i.e. the “roll out” of the concepts and technology to a large network of e-government actors, will be conducted in Schleswig-Holstein.

The research will apply the requirement analysis framework and focus on elucidating Semantic Web expectations of the salient stakeholders involved, their capability of mastering the concepts and technology, the available resources, technical & organizational constraints, applicability of existing migration approaches in a given context, as well as drivers, motives, distractors and environmental factors. As we expect support relations to unfold, the requirement analysis must be must focus on the support needed (e.g. by small governments) as well as on the capability to give such support (e.g. by e-government steering committees).

Towards the end of the project, research is expected lead to further recommendations specifically relevant to small administrations, covering e.g. the quality of the shared reference ontology (e.g. how to compromise between powerful logic and simplicity, or how to mediate between different local and central concepts and interpretations; cf. Klischewski 2003a), the state-wide support for

municipalities (from the technical and administrative point of view), and a framework of incentives for municipalities and IT companies involved in local e-government service provision.

All in all, the project Access-eGov is expected to have a significant impact in Schleswig-Holstein and beyond. The scenario we find in this German state is typical for many e-government settings. For example, the initiative for implementing a responsibility finder for whole Germany also takes into account the Schleswig-Holstein approach in order to learn from the experience and to investigate the feasibility on the federal level.

On the level of research, the application of the introduced requirement analysis framework for support of e-government web content migration will reveal the strength and weaknesses of this approach and give rise to reconsideration and refinement. The same applies to the elaborated hypothesis that migration methods and tools for small administrations must be (a) tailored and comprehensive with the aim of minimizing effort and cost, and (b) provided and supported by trusted stakeholders on a reliable basis. By any means, the project's field trial will provide a rich set of empirical data which will enable future research to add even more momentum to the large-scale adoption of Semantic Web for e-government.

References

- Ding, Y. 2005. *Study of Design Issues on an Automated Semantic Annotation System*, AIS SIGSEMIS Bulletin, vol.2 (3 & 4), pp. 45-51
- Flak, L.S., Rose, J. 2005. *Stakeholder Governance: Adapting Stakeholder Theory to E-Government*, Communications of the Association for Information Systems, vol. 16, pp. 662-664
- Golbeck, J. Grove, M. Parsia, B. Kalyanpur, A. Hendler, J. 2002. *New Tools for the Semantic Web*, in: Proceedings of EKAW, LNCS 2473, Springer, pp. 392-400.
- Handschuh, S. Staab, S. 2002. *Authoring and annotation of Web pages in CREAM*, in: Proceedings of the 11th International World Wide Web Conference (WWW), Honolulu, Hawaii, ACM Press, pp. 462-473.
- Haustein, S., Pleumann, J. 2002. *Is Participation in the Semantic Web Too Difficult?* I. Horrocks and J. Hendler eds.: ISWC 2002, LNCS 2342, Springer, Berlin, pp. 448-453.
- Klischewski, R. 2005. *Citizen Information Services Enabled by Semantic Web? The Case of Schleswig-Holstein Responsibility Finder*, in: Andersen, K., Grönlund, A., Traunmüller, R., Wimmer, M. (eds.), Electronic Government. Workshop Proceedings of the Fourth International EGOV Conference, Linz: Traunstein, pp. 328-335.
- Klischewski, R., 2003. *Semantic Web for e-Government*, in: Traunmüller, R. (ed.) Proceedings of EGOV 2003. Springer, LNCS 2739, Berlin, pp. 288-295.
- Klischewski, R. 2003a. *Top Down or Bottom Up? How to Establish a Common Ground for Semantic Interoperability within e-Government Communities*. in: Traunmüller, R., Palmirani, M. (eds.) E-Government: Modelling Norms and Concepts as Key Issues. Proceedings of 1st International Workshop on E-Government at ICAIL 2003. Bologna: Gedit edizioni, pp. 17-26.
- Klischewski, R., Scholl, H.J., 2006. *Information Quality as a Common Ground for Key Players in e-Government Integration and Interoperability*, Proceedings of the 39th Hawaii International Conference on System Sciences, Los Alamitos, CA: IEEE.
- Scholl, H.J., 2001. *Applying stakeholder theory to e-Government: benefits and limits*, Schmid, B., et al. (ed.): Towards the E-Society: E-commerce, E-business, and E-government (Proceedings I3E 2001, IFIP), Dordrecht: Kluwer, pp. 735-748
- Stojanovic, L., Abecker, A., Stojanovic, N., Studer, R. 2004. *On Managing Changes in the Ontology-Based E-government*. Meersman, R., Zahir Tari, Z. (eds.) Proceedings CoopIS, DOA, and ODBASE. LNCS 3291, Springer, Berlin.
- Volz R., Handschuh, S., Staab, S., Stojanovic, L., Stojanovic, N. 2004. *Unveiling the hidden bride: deep annotation for mapping and migrating legacy data to the Semantic Web*. Journal of Web Semantics, vol. 1, pp. 187-206.