

CITIZEN INFORMATION SERVICES ENABLED BY SEMANTIC WEB? THE CASE OF THE SCHLESWIG-HOLSTEIN RESPONSIBILITY FINDER

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This research in progress seeks to explore and substantiate to what extent the vision and the technologies of the Semantic Web are the key for solving the problem of cross-organizational information management as a prerequisite for citizen information services. As a first step, this paper reflects on a case in which all actors involved seek for a practical solution to implement a state-wide responsibility finder as the primary citizen information service, given that a central information system to support this application is not feasible. The case analysis highlights the requirements for cross-organizational information management with respect to informational requirements, service priorities and IT infrastructure. Then, the potential of Semantic Web technologies for this and similar cases is assessed by referring to the criteria of Semantic Web applications and existing interoperability recommendations. The paper concludes with pointing to the next required steps of research which can contribute to practical solutions and bring about a breakthrough of Semantic Web for e-government.

Introduction: E-Government Facing the Semantic Challenge

Administrations are increasingly facing the problem of cross-organizational information management, because they seek to enhance computer support and automation in process collaboration and providing integrated services. This problem is especially prevalent for applications which must draw on up-to-date data from many distributed sources to serve the informational needs of the users. In e-government we may call these citizen information services (CIS), meaning that the application in focus provides the right kind of information targeted to answer the situated concern or demand of citizens.

This research in progress seeks to explore and substantiate, to what extent the vision and the technologies of the Semantic Web are the key for solving the problem of cross-organizational information management as a prerequisite for such citizen information services. The World Wide Web Consortium (W3C) defines the vision of the Semantic Web as “the idea of having data on the web defined and linked in a way that it can be used by machines not just for display purposes, but for automation, integration and reuse of data across various applications” (www.w3.org/2001/sw). The vision of the next-generation internet (a “Web for machines”), posted by Tim Berners-Lee and others [1], has inspired many to work on technologies, tools and solutions of which RDF and OWL already have become standards (see www.w3.org for details).

The promises of Semantic Web technologies are manifold. Most of the envisioned applications are based on anticipated advances in knowledge representation, intelligent retrieval (inference) and facilitation of communication (or a combination of those), mostly based on the use of ontologies (i.e. formally specified shared conceptualisations). Ongoing research and application development in the Semantic Web area (e.g. [2, 3, 4]) are mainly focusing on how

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to build adequate ontologies, how to build agents making intelligent use of the metadata, how to design and how to solve semantic interoperability problems. Although the basic technologies and standards for the Semantic Web are mostly available, from the application point of view it does not yet have a critical mass to demonstrate its full potential or to justify large investments from the perspective of application owners.

In e-government, semantics have become an issue mainly from the perspective of systems interoperability (cf. [7]). For example, the European Interoperability Framework for pan-European eGovernment Services [5] includes a number of recommendations for administrations on the technical, semantic and organizational level. For the sharing of information, semantic interoperability is the key issue “ensuring that the precise meaning of exchanged information is understandable by any other application that was not initially developed for this purpose” and it “enables systems to combine received information with other information resources and to process it in a meaningful manner.” In order to improve semantic interoperability, the Commission calls the responsible administrations (1) to publish information on the corresponding data elements involved at national level, (2) to draft proposals for and agree on the data and the related data dictionaries required at pan-European level, and (3) to draft proposals for and agree on multilateral mapping tables between the various national and pan-European data elements.

So the vision, the basic technologies and a general road map are there – but how do they help, for example, regional e-government networks to enable or improve their CIS? As a first step, this paper reflects on the case of Schleswig-Holstein: There, all actors involved seek for a practical solution to implement a state-wide CIS and responsibility finder, given that a central information system to support this application is not feasible. The collection of data for the case is based on the author’s involvement as participating and advising researcher. The case analysis highlights the requirements for cross-organizational information management with respect to informational requirements, service priorities and IT infrastructure. Then, the potential of Semantic Web technologies for this and similar cases is assessed by referring to the criteria of Semantic Web applications and to the above interoperability recommendations. The paper concludes with pointing to the next required steps of research which can contribute to practical solutions and bring about a breakthrough of Semantic Web for e-government.

Citizen Information Services: The Case of Schleswig-Holstein

After introducing the concept of citizen information services (CIS), this section describes the case of implementing a CIS in Schleswig-Holstein (1) and analyses the requirements for cross-organizational information management with respect to informational requirements (2), service priorities (3) and IT infrastructure (4).

Informing us online and dealing with our affairs through web applications have become an integrated part of the life of many citizens. Likewise user expectations towards e-government have risen. To address these user needs and demands e-government projects intend to improve their services. The starting point for all e-government activities are services for informing the citizens: web pages serving as simple directories for their municipality, portals combining administrative information with information about business, culture, non-government organizations etc. Some websites also offer specific citizen information services such as “citizen’s directory” or “responsibility finder” (see also below): 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 services provides information about the

responsible agency, where to find it, what to do and when, about the forms to use and the documents needed, fees and time limits etc.

These information services are quite useful as long as they can draw on up-to-date data concerning all the issues about which information may be requested. Some administrations can offer powerful service applications because of a highly integrated and computer-supported information management within their jurisdiction. But in federated administrative structures, the municipalities are usually too small to develop and operate such services, while the administrative bodies on higher levels (e.g. the state government) cannot easily obtain the data required.

Implementing CIS is a multi-dimensional task. The challenges of offering such services include provision of high quality information and setting strategic priorities, actor involvement and collaboration, as well as information sharing and the technical infrastructure. The following analysis is to provide detailed insights regarding these challenges

The Case of Schleswig-Holstein: Implementing a Responsibility Finder

Schleswig-Holstein is 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).

The main IT service provider for the states of Schleswig-Holstein and Hamburg is Dataport, a public enterprise (about 1200 employees) merged in 2004 from the preexisting IT centers of the two states. In Hamburg, the state and the company hamburg.de GmbH operate the responsibility finder (German: Zuständigkeitsfinder) DiBIS (“Direkte Bürger-Information-Services”, see http://www.hamburg.de/Dibis/form/info_englisch.htm) for many years. And in 2004, a central system (called “HaSI”) along with a number of organizational procedures has been established to serve as the single information source for this application.

Since the CIS setup in Hamburg is regarded a successful implementation, discussions have been going on for several years how to implement a similar service in Schleswig-Holstein. However, in this area information integration is a cross-organizational task spanning borders of jurisdiction and IT infrastructures. Therefore, it turned out that a central information system is not a feasible solution – but other solutions seemed not to be ready at hand (e.g. in Germany, none of the federated states have solved this problem yet). To explore the options more thoroughly and to suggest practical solutions, from July until December 2004 a project has been carried out to analyze the requirements of a cross-organizational information management as a basis for CIS and to suggest a method how to proceed implementing it. The author has been involved in this project participating and advising researcher. One of the activities was to prepare, conduct and document two full-day workshops in August 2004 in Kiel (Germany); each of them was attended by about ten persons in charge of the e-government services in selected cities, counties and municipalities (now referred to as the CIS experts).

The first workshop focused on questions such as: What goals shall the web-based responsibility finding serve in Schleswig-Holstein? For whom and in what quality? Which kind of information should be provided? To answer what kind of requests? The second workshop focused on (1) identification of data and information to be shared, (2) collecting and evaluating

the options for cross-organizational data sharing given the existing IT infrastructure, (3) information management (organizational and technical tasks), and (4) development and discussion of a road map for the state-wide implementation. The following subsections draw on the results of those workshops [6].

Informational Requirements

Public administration is a field with many different topics and issues. The concern of the inquiring citizens may be manifold; therefore the information base must be comprehensive. As users are approaching an administration they expect all information to be reliable and up-to-date. Besides, they may have different strategies how to acquire information and how to use websites.

Concerning the scope of information to be provided, the Schleswig-Holstein CIS experts concluded from their experience and evaluation that the most frequent informational needs of citizens are the following:

- Questions related to a specific *administrative service*: who (or what) is responsible? What do I (as a citizen) have to know before approaching the responsible agent? What are the next steps to do?
- Orientation in *administrative structures*: what authorities or institutions are there (in my region)? Who (or what) is responsible for which topic? How do I reach the authorities XY (address, telephone, email)? How do I find the responsible agent?
- *Forms*: How do I find the right form for interacting with the authorities?
- Questions related to *general topics*, e.g.: Where do I find a specific text of law? When is the next meeting of the XYZ committee in my municipality? Where can I file a complaint? What are the public offers for recreation (e.g. sports facilities, cultural events)? Who can help in case of e.g. health problems? What job offerings are there? etc.

To discriminate the responsibility finder from other possible CIS, its mission has been defined as ([6], p. 7: translated from German): “The *responsibility finder Schleswig-Holstein* offers citizens, institutions, and companies concise and coherent information about the services of the administration throughout the state. It informs the information seekers about who is responsible for his/her/its concern, how to reach the agency in charge, and what kinds of documents are required. In many cases form or leaflets are available for download.”

Within this scope, the unambiguous identification of the user’s concern and answering this concern are the two core tasks within the responsibility finding. However, the service is not necessarily limited to this because through the user’s dialogue with the system administrative information has to be conveyed to achieve an unambiguous identification of the concern. E.g. if the users enter “new driver’s license” as his/her concern, they should receive an orientation about the different administrative services related to this subject and get a chance to specify the concern.

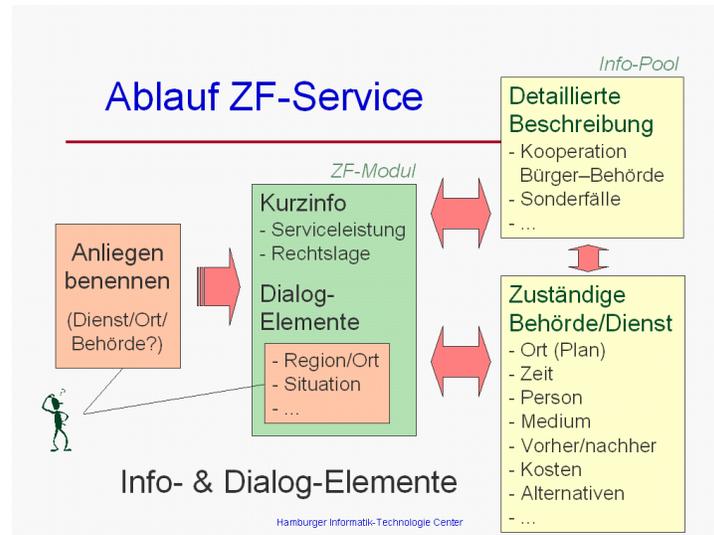


Figure 1. Responsibility finding as a two step procedure ([6], p. 5)

Thus, it was agreed on that responsibility finding (in most cases) is a two step procedure: after the user's initial specification of his/her concern, the system displays short listed information to choose from as well as dialogue elements to enable the users to further specify their concern and/or location. Based on the users input the service should display the relevant information (see figure 1 as one result of the workshop discussion). For the identification of their concern and/or location, users should have the choice of entering key words or selecting terms from (structured) lists. The selection of terms should relate to a catalogue of administrative services and localities (including synonyms) which has been agreed on by all information service providers.

Service Priorities

As mentioned above, public administration is a field with many different topics and issues. Therefore, not all informational requests for all kind of users can be answered right away from the start. As the service will be developed and enhanced step by step, it needs priorities on whom and what should be served from the very beginning (minimal scope), what are the service goals for the near future (projected scope) and for a long-term vision (desirable scope). In this case, setting the priorities for requirements of the responsibility finder service and its implementation were set along the following dimensions:

- Target groups (citizens, companies, institutions: even distinguished user profiles)
- Service catalog (just copied from DiBIS/HaSI, or all services of great demand or all services operational via internet)
- Scope of information related to a service (e.g. name of service, synonym, description, and many other attributes)
- Scope of information related to an agency (e.g. name of service, synonym, description, and many other attributes)
- Scope of information related to contact persons or functional units (name, location, phone, fax, email, postal address, room number etc.)

- Regional coverage (services of the state only or as directed by the state; or all services provided independently by the municipalities)
- Quality of information (rudimental and sometimes incomplete, appropriate and consolidated, or comprehensive, dynamic and interrelated)
- Functionality of responsibility finder (e.g. no user dialogue except for localizing the user, or several basic user dialogues enable specification user's concern, or intelligent evaluation of user input and processing information of user context (e.g. profile) and additional general Web sources)

Technical Infrastructure

Whatever the scope of the CIS is in the beginning or later, users expect the integration of the relevant information. Therefore, cross-organizational information management is indispensable for the web based responsibility finding. From the technical point of view there are several options how to achieve this integration. However, each option implies significantly different benefits and cost (i.e. investments, operating expenses) and would distribute them differently among the actors involved. One option is to obtain and centralize the required data (e.g. similar to the Hamburg solution) while the opposite option is to rely on decentralized and local information supplies; combinations of those basic options are also possible. From the cost/benefit point of view, the local information provider (the cities, counties and municipalities) refuse to maintain their local information pool as well as additionally a central pool with redundant data. On the other hand, the state or any service provider on its behalf is not willing or able to collect the required data from potentially hundreds of different local systems. Given this dilemma, the vision of the Semantic Web and its technologies (see next section) may lead to a feasible solution by retrieving the data from locally annotated websites. The discussion among the CIS experts in Schleswig-Holstein revealed that (a) a common understanding of the relevant information and a model of the data to be shared (specified centrally and adopted/adapted locally) is indispensable in all cases, whereas (b) each strategy of automated data sharing requires significant efforts of the actors involved which are difficult to relate to a cost/benefit analysis and to balance evenly among them (see table 1 for summary).

<i>Effort of</i>	all actors involved	local data providers	central service provider
<i>Data sharing strategy</i>			
<i>Delivery to central system interface</i>	agree on shared data/information model	adoption to central interface	specification of data structure & interface
<i>Retrieval from local system interfaces</i>	agree on shared data/information model	negotiation of local interfaces	specification of data structure & negotiation interfaces
<i>Retrieval from annotated Web sites</i>	agree on shared data/information model	markup of websites with metadata	specification of metadata schema

Table 1. Required effort for each strategy of automated data sharing

As of May 2005, the project shall be continued. But still a solution is not in reach which is technically well understood, feasible and satisfying the service requirements and the concerns of the actors involved. However, as Semantic Web and its technologies may offer this solution, there is now a readiness to explore this option.

Are Citizen Information Services a Case for Semantic Web Research?

According to the organizers of the “Semantic Web Challenge”, a Semantic Web application has to meet the following minimal requirements (see <http://challenge.semanticweb.org>):

1. The information sources used are geographically distributed, have diverse ownerships (i.e. no control of evolution), are heterogeneous (syntactically, structurally, and semantically), and contain real world data (i.e. are more than toy examples).
2. An open world is assumed (i.e. the information is never complete).
3. The application uses (some) formal description of the meaning of the data.

The analysis in the previous section shows that all of these characteristics apply to the case of the Schleswig-Holstein responsibility finder. 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, to what extent are Semantic Web technologies the key for solving the problem of cross-organizational information management as a prerequisite for citizen information services? Answers to this question may determine how many of their resources (human, technical, financial) governments will devote to meeting the Semantic Web challenge.

The case analysis reveals that an e-government application drawing on a number of geographically distributed information sources (such as the responsibility finder) requires a virtual information space in which up-to-date data can be shared “easily”. To achieve this, the obstacles mentioned above are to be addressed on different levels (according to the three levels of recommendations provided by the EC [5]; see above):

- **Technical:** establishing protocols and standards for interfaces and data structures
- **Semantic:** reaching for a common agreement on the types of information and on the meaning of the data to be shared within this space
- **Organizational:** settling for a cooperation agreement which for all partners involved avoids any extra effort unless it produces an equivalent value for this partner (or is otherwise compensated)

The hypothesis of the research to be performed now is that the vision of the Semantic Web and the available technologies satisfactorily address all three levels:

1. *Technical:* available standards such as RDF and OWL are sufficient to model all the data structures which are in the focus of e-government applications – thus all data exchange can be handled on this basis as long as all partners employing these technologies (for modeling and resource annotation), accept the Internet as the prior exchange media and reach an agreement on semantic interoperability.
2. *Semantic:* the state-of-the-art for approaching Semantic Web applications is to use ontologies for specifying the types of information and the meaning of the data to be shared – this is feasible also in the administrative area since all action follows well specified concepts and must be accountable in the end (even though there are many local differences and there is much room for administrative discretion).
3. *Organizational:* (a) reaching for a sufficient agreement on semantic interoperability is a tedious effort, but any central administration initiating, supporting and monitoring this process is rewarded by a higher level of integration within its area of jurisdiction which

will lead to efficiency gains, service improvements and improved outside recognition; (b) the Semantic Web approach clearly calls for the information owner to perform the first steps and (within his own Web infrastructure) get his data ready for (outside) machines to interpret it – but the effort is rewarded (potentially) because the value of e.g. Web resource annotation rests with the information owner and becomes an asset for any future relations based on internet supported information sharing.

If it holds true that the vision of the Semantic Web and the available technologies satisfactorily address all the three levels, then the development and dissemination of tailored ontologies, tools, and guidelines for the administrative area would satisfy a demand situation of administrative networks (trying to establish virtual information spaces for e-government applications) and even could bring about a breakthrough of Semantic Web for e-government. Therefore, the next step of research is to focus on developing these tailored ontologies, tools, and guidelines and apply them in pilot environments such as Schleswig-Holstein. The evaluation based on the hypothesis above will provide enough data to challenge its assumptions and to guide further research to focus rather on technical, semantic or organizational issues.

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