Use of German State's Rhineland-Palatinate Spatial Data Infrastructure for e-Government

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Key words: Spatial Data Infrastructures (SDI), Spatial Data Usability, e-government, GIS-Implementation

SUMMARY

This case study contains a description of the research project "GIS implementation at the German regional public administration level". The ambition of this project is to develop a conceptual model for the implementation of a GIS at the 24 local authorities which cover the complete federal state Rheinland-Pfalz of the Federal Republic Germany. Actally, our institute is doing that work for one pilot authority. The results obtained with the pilot will be disseminated to the other 23 local authorities step by step. One crucial point is that every local authority starts from a different point of IT development and has slightly different requirements. Some of them already use a GIS, some others use spatial data with a different structure, a variety of organisational structures is existing, and so on. The goal of the project is to develop a requirement specification which will be suited to serve athe basis for one tendering procedure for as may organisational units as possible. The project started in Juli, 2003 and will in its first stage end in December, 2004.

ZUSAMMENFASSUNG

Als Fallstudie wird das Forschungsprojekt 'GIS Implementierung auf der regionalen Verwaltungsebene in Deutschland' beschrieben. Das Projekt will ein konzeptionelles Modell entwickeln für die GIS-Implementierung bei 24 Landkreisverwaltungen, die das deutsche Bundesland Rheinland-Pfalz vollständig umfassen. Zur Zeit wird die Projektarbeit für eine Piloteinheit durchgeführt. Die Ergebnisse werden Schritt für Schritt auf die anderen 23 Einheiten übertragen. Zu beachten ist, dass jede Verwaltungs IT-technisch unterschiedlich weit entwickelt ist und auch geringfügig andere Anforderungen hat. Einige Verwaltungen haben bereits GIS im Einsatz, andere nutzen unterschiedlich strukturierte raumbezogene Daten, der organistorische Aufbau ist unterschiedlich, etc. Projektziel ist es, eine Anforderungsdefinition zu entwickeln, die die gemeinsame Basis für eine Systembeschaffung in möglichst vielen Verwaltungen liefert. Projektstart war im Juli 2003, die erste Projektphase wird im Dezember 2004 enden.

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1. SDI LEVELS

The term Spatial Data Infrastructure (SDI) encompasses the policies, standards and institutional arrangements involved in delivering spatially related information from all available sources to all potential users. A spatial data infrastructure provides a basis for spatial data discovery, evaluation, download and application for users and providers within all levels of government, the commercial sector, the non-profit sector, academia and the general public.

Currently, many regional and national Spatial Data Infrastructure initiatives are taking place. According to Smits et al. (2002), most of those initiatives are very much in line with the ISO/TC211 and the OpenGIS Consortium developments. In order to get regional and national SDIs interoperable, the INSPIRE - Infrastructure for Spatial Information in Europe initiative was founded. One of its outcomes is an architecture reference model and foundation standards proposed in a Position Paper of the AST - Architecture And Standards Working Group.

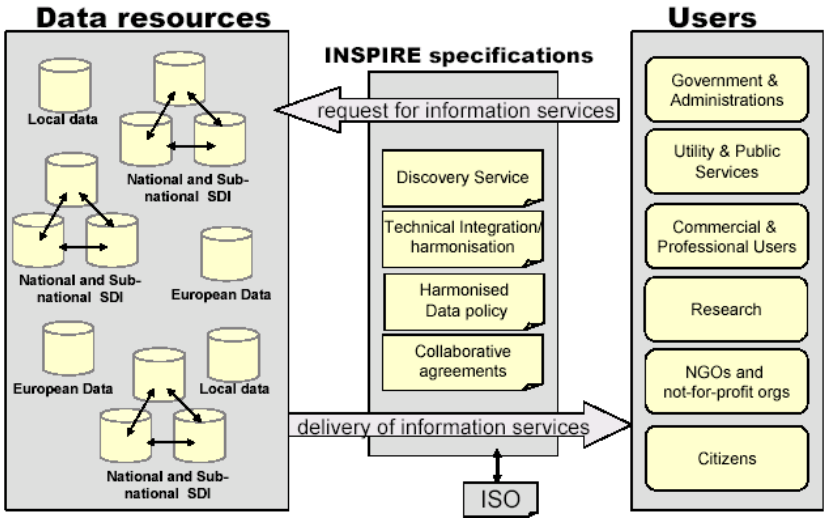

Figure 1: INSPIRE Information Flow (Source: Smits et al. 2002)

INSPIRE is the large current initiative of the European Commission to promote the multipurpose availability of feasible geographic information. The purpose of this initiative is to support European Community policies with a territorial dimension or impact. INSPIRE is supposed to address technical standards and protocols, organisational and co-ordination issues, data policy issues including data access and the creation and maintenance of spatial information in the context of a European Spatial Data Infrastructure ESDI. The INSPIRE

vision outlines a Spatial Data Infrastructure which addresses data resources at the European level, at the national and sub-national level and at the local level, as well. The INSPIRE initiative even links with relevant initiatives at the global level such as the work concerned with a Global Spatial Data Infrastructure (GSDI). Therefore, the INSPIRE principles should be considered at all levels of an SDI implementation.

At the sub-national or regional level, one of the main goals is to process all relevant geographic information by jointly linking it to the information available at the two adjacent administrative levels, namely to the national level at the one hand and to the local level at the other hand, respectively. The needs of potential users have to be elaborated in detail with regard to access to transformed data, pictures, maps, reports, multi-media content, to metadata search and retrieval for data and services, to data access at distributed content repositories located at different geo-spatial data servers and so forth.

The following sections describe a project which supports the implementation of a regional level SDI. Special credit is given to the situation in one of the German Laender, Rheinland-Pfalz.

2. THE REGIONAL LEVEL IN GERMANY

2.1 Background

Germany is a federal republic consisting of 16 states (so called "Länder"). One of these federal states is Rheinland-Pfalz with 4 million inhabitants. Rheinland-Pfalz itself consists of 24 rural district areas.

The Nomenclature of Territorial Units for Statistics (NUTS) was established by Eurostat in order to provide a single uniform breakdown of territorial units for the production of regional statistics for the whole European Union. Every NUTS-territory has an individual alphanumeric code attached. The German Länder form the German part of the European NUTS 1 level territories, the same holds for the German rural district areas forming the NUTS 3 level territories. For all 24 rural district areas (NUTS 3) being part of Rheinland-Pfalz (NUTS 1) a GIS implementation is planned.

The tasks of a local authority, one for each rural district area, are very complex. Several hundred employees care about the needs of the citizens, which concern nearly all areas of life: Education, sports, civil protection, nature conservation, preservation of ancient monuments, building inspection, motorcar permit, social welfare, youth matters, decrees, The tasks of a local authority, one for each rural district area, are very complex. Several hundred employees care about the needs of the citizens, which concern nearly all areas of life: Education, sports, civil protection, nature conservation, preservation of ancient monuments, building inspection, motorcar permit, social welfare, youth matters, decrees, and so on.

The federal state of Rheinland-Pfalz, like entire Germany, faces two big challenges. It has to work with less money and at the same time it should change the service for the citizen and the economy for the better. The intention should be a modern public administration which is

Figure 2: Administrative formation of the state Rheinland-Pfalz

Figure 3: The area of Rheinland-Pfalz in NUTS level 3 notation

efficient and transparent, accomplishes more and costs less. One of the steps towards that direction is the implementation of a GIS-System which a spatial data infrastructure demands for.
In the past, the local authorities had invested – if they had done so – into systems which are able to work with structured data only inside a closed local authority unit.
Important information, which is of prime importance for these organisations, is available in a wide range of different formats being maintained on inconsistent systems like special data-servers, general purpose web-servers, data bases or they are still only available in analogue form like on paper sheets and paper maps. According to a study of the DELPHI-group, co-workers of public administrations spend 30 % of their time to search for information.

The government of the federal state Rheinland-Pfalz intends to promote the GIS-implementation in context of an overall e-government solution.

2.2 Motivation

There has been a contract between the LVermGeo Rheinland-Pfalz and the local authorities.
There is one regional authority which is responsible for the provision of the geo-spatial basic data of the state, called LvermGeo Rheinland-Pfalz. In 2002 the LVermGeo contracted with the Landkreistag Rheinland-Pfalz, the umbrella organisation of all 24 local authorities.

According to this contract the local authorities are licensed to use all geospatial public administration basic data available in

– the Automated Real Estate Register – ALB which includes information about land parcels (e.g. key numbers, location, ...), type of property, ownership, etc.
– the Automated Real Estate Map – ALK

- which comprises cadastral boundaries, landscape parcels, landuse, buildings, special topographic features, house numbers, etc.,
- Digital Landscape Models – DLM
- Digital Topographic Maps – DTK
- Digital Terrain Models – DGM
- Digital Orthophotos – DOP

In the past - every local authority had to pay a specific licence fee to the LVermGeo for every data set they needed. As a result of the contract they get all the data they want for a lump sum which is to be transferred once a year from their umbrella organisation to the authorities providing for the geospatial data.

3. GOALS

The ambition of the study is to develop a conceptual model, where the business processes of a local authority are mapped as far as they are directly linked to GIS matters. The benefit and the application potential of a GIS will be clarified by documentation and analysis of these business processes.

The conceptual model has to be compatible with the ISO-standards and the recommendations of the Open GIS-Consortium. ISO as the "International Organisation for Standardisation" is a network of national standards institutes from 147 countries working in partnership with international organisations, governments, industry, business and consumer representatives. The Open GIS Consortium, Inc. (OGC) is a member-driven, non-profit international trade association that is leading the development of geoprocessing interoperability computing standards.

It was assumed that in all the 24 local authorities the same business processes (combined intersection) are running – which in the meantime could be shown to be true in reality.

The project develops a GIS implementation strategy for one exemplary local authority. The strategy has to support the modular build-up of a GIS. The requirements for the GIS solution will be described in detail in a set of specifications. This set will become the basis for the tendering procedure later.

By means of the modular build-up it will be reached that the results of the study will support local authorities:

- which have still no GIS in use
- which already use a GIS-System, and want to optimise it
- which use a GIS-System and want to develop it for other uses

This ensures that all local authorities addressed by the study can take their benefits from the project no matter in which stage of the GIS implementation they are. Another point of interest within the study is to develop a strategy how to build up a spatial data infrastructure for the co-operation and the data exchange inside the local authorities themselves on the one, and in

between the local authorities and other public administration bodies on the other side. All existing spatial data have to be integrated.

4. PROJECT ORGANISATION

The first stage of the project has a runtime of 18 month and started in July 2003. It will be financed by the Landkreistag Rheinland-Pfalz, which is the local central association.

- One of the 24 local authorities was selected as a *pilot authority*.
- Our institute performs the work for every item of the workplan in the pilot authority
- The work results are presented to a project group on a regular 3 months time basis
- The *project group* exists of 22 experts.
  The group members are co-workers of those local authorities which already have got experience in the tasks of how to build up and to maintain a Spatial Data Infrastructure. This group is responsible for the continuos audit of the attained results, with the purpose to achieve transferable results from the pilot unit to the other 23 local authorities.

- After passing the project group audit, the results are presented to the GIS plenum 4 weeks later:
- *The GIS plenum* – exists of about 50 people.
  The plenum consists of 2 responsables from all affected 24 local authorities.
  The members of this group transfer the study results to their own local authority.

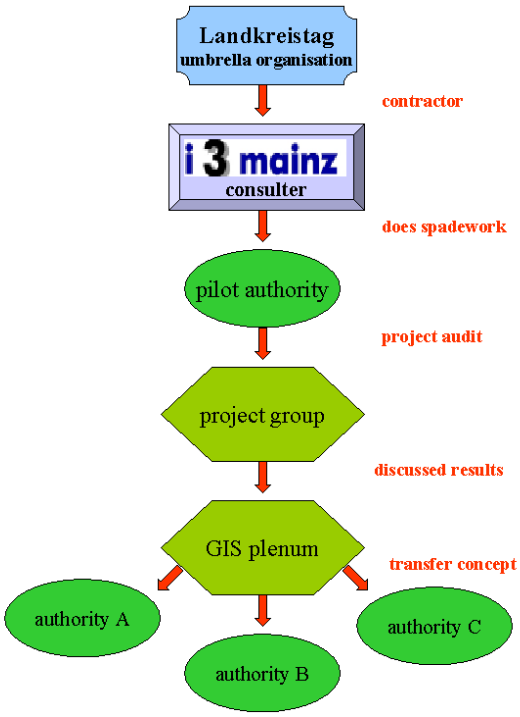

Figure 4: Project organisation chart

5. PRINCIPAL WORKPLAN

The following procedure model defines the stages of the project workplan.

- *System analysis, including:*
  - strategic planning
  - actual field research and analysis
  - conceptional modelling
  - professional concept
  - IT-concept
  - cost-benefit-analyses
- *System choice, including:*
  - public tender
  - offer rating
  - functional tests
  - system rating, system recommendation
- *System implementation, including:*
  - system installation, system acceptance
  - data acquisition, data migration
  - system use

6. CURRENT ACTIVITIES

At the moment of writing this paper, the following activities were in progress.

System analysis - strategic planning
The study will be performed in joint cooperation with the project-group. All elaborated documents will be collected and archived to generate medium-term and long-term valid guidelines for the GIS implementation in Rheinland-Pfalz, Germany.

System analysis - field research and analysis
Firstly, the local authority of Bernkastel-Wittlich was chosen as the pilot authority.
The pilot authority consists of 20 departments. Like in a production environment, the work results of an administrational unit can be labeled with the term ‘products’. Every department is responsible for a specific list of such ‘products’.

The field research bases upon the ‘products’ as it’s principal unit. The reasons therefore were:
- the meaning of the term ‘product’ is well established and well understood in all units
- project results obtained for ‘products’ can be easily transferred to the other 23 local authorities, because they use them, too.
- ‘products’ are well suited to show the GIS application potential.

Altogether about 170 different ‘products’ were identified. ‘Products’ for example are:

– tourism	support the tourism in the region
– building administration	management of the buildings owned by the authority
– finances	borrow credits, safeguard credits, financial statistics
– roadworks	to ensure save roads
– traffics	organisation of school buses, public traffic
– heavy loads	control of heavy loads crossing the region
– infection prevention	avoidance of infectious illnesses
– land use regulation	control of the land use in the region
– landscape architecture	guarantee the arranged development of cities and villages
– protection of species	protection of the wildlife habitats
– drinking water control	securing the drinking water quality
– agrarian subsidy	distribute special subsidies for farmers

To analyse the user requirements for all ‘products’ two questionnaires were developed.

6.1 Questionnaire 1

Questionnnarie 1 gives us an overview about the ‘products’. For all products it includes the following items:

- What is the purpose of the product?
- What data are in use?
- How is the spatial data reference defined?
- What software will be established?
- What formats will be used?
- Is a a GIS-System / Online-GIS-System still in use?
- Is it possible to support this product by a GIS-application?
- Is it possible to use the geo-spatial basicdata provided by LVermGeo?
- Which other authorities take part in the results?
- How many people access the data?
- Are there some special problems?

After survey completion all products were sorted in 5 categories to get a first idea of the existing GIS potential.

The meaning of the categories is:

- Spatial data exists – GIS-applications are already in use
- Spatial data exists – user-potential clearly identified – highest priority for implementation
- Spatial data exists – implementation priority depending on cost-benefit-analysis

- no spatial data exists – no own spatial data processing, GIS-analysis and –results to be used
- no spatial data exists – only administration procedures, no GIS is possible / benefiting

Evaluation category	Number of products	Percentage
1	8	5 %
2	8	5 %
3	134	77 %
4	3	2 %
5	19	11 %
Sum of 'products':	172	100 %

Table 1: Summary of product evaluation

Most of the 'products' are in category 3. This means that a GIS application would be possible in the most cases, but we have to check up the cost/benefit ratio before investing. Not every product with spatial data will become a GIS-application.

- The next step was to develop the questionnaire 2 for all products in the evaluation categories 1 till 3.

We use this questionnaire only for the products in categories 1 to 3, because only these 'products' have a GIS-potential, thus reducing the amount of exploration work for many project participants.

6.2 Questionnaire 2

Questionnaire 2 is dedicated to gather more in depth information concerning data-structures. It queries for the following items:

- Notation of the data
- How much analogue, how much digital data is existing?
- Is it graphic or alphanumeric data?
- Where will the data come from, who will produce it?
- How accurate is the spatial data?
- Are there regular data updates?
- Exist data for the same subject with different time validity (historical data)?
- Will metadata be considered?
- How is the data availability?
- Exists synergy effects with other products?
- Exists a data protection / privacy policy?

This questionnaire was filled out during personal interviews with the persons who produce the according products. Thanks to the fact that the interviewed persons had joined a presentation about GIS in the past, they knew what a geo information system (GIS) could

perform and what it could handle, which helped to speed up the interview process. General information concerning the IT structure was gathered directly from the IT department. Some interesting information which is still missing like currently available skills of the potential users, for instance, will be collected in a later project phase.

Following the principal work plan the results were presented to the project working-group, passed the audit and will be presented to the GIS plenum.

7. FIRST SURVEY RESULTS

- A local authority produces about 170 different 'products'.
- About 85% of the 'products' of the local authorities have a spatial data component.

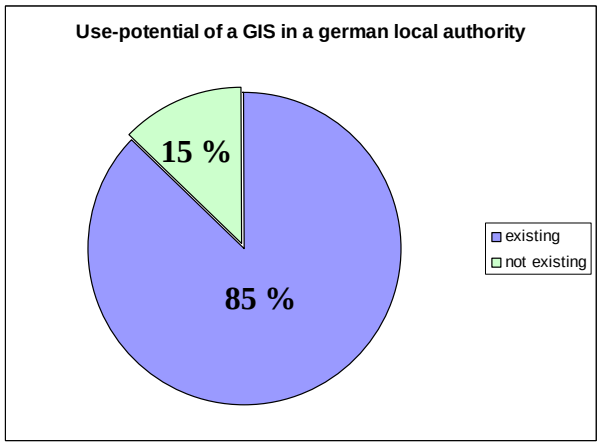

Figure 5:
GIS potential in a German public local authority

- Geospatial basic data could be used in the production process of about 87 % of the 'products'.
- The transfer of the results of the study to other local authorities is possible.

8. NEXT STEPS

The next step will be to model the processes and the use-cases in the UML.

UML: The Unified Modelling Language (UML) has become an industry standard for specifying, visualising, constructing, and documenting the artefacts of models for software-systems, business-models and other non-software-systems. It simplifies complex processes, by making a "blueprint" for the construction.

The following reasons to use UML in this project were identified.
- Connections between actors and use cases can be shown
- Connections between different use cases can be shown
- When modelling the system we can use object-oriented concepts
- UML is in use in a new conceptual model for the geospatial basic-data.
- UML can help us to structure the problem
- UML can help us with the documentation.
- UML will help us to prepare for the functional specification.

As a first diagram class, we use the use-case-diagram, which shows the connections in a simple way.

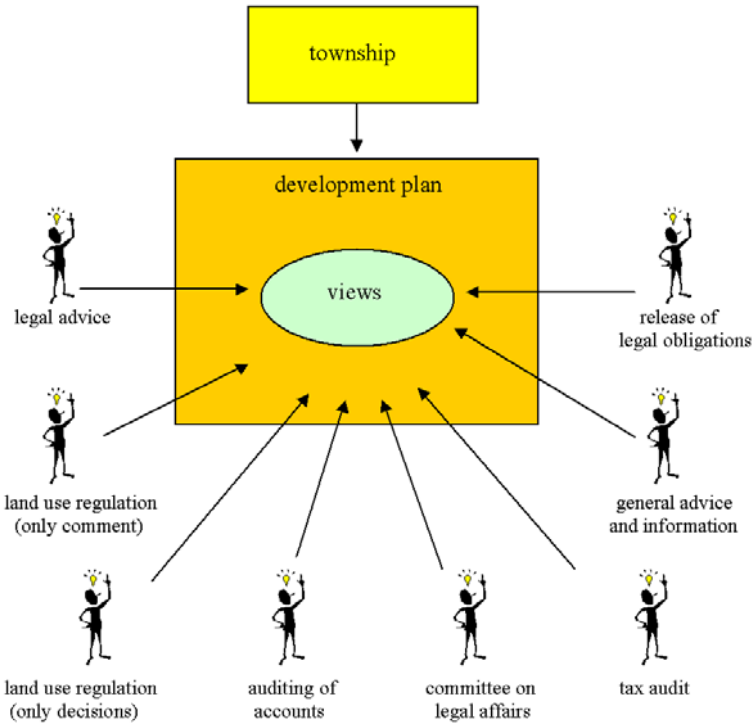

Figure 6: First example of a use-case diagram

As the next steps we will describe all processes with a UML class-diagram, including:
- Attributes
- Operations between each other
- Semantics

This class-diagrams will be an ideal base to prepare for the functional specifications to be worked out in the subsequent project stages.

9. CONCLUSIONS

Geographic information systems (GIS) are an important technology for managing spatial information at local, regional, national, and global levels. Digital map data is used for managing the natural environment, economic planning, emergency response, environmental conservation, public health programs, and a variety of other challenges facing the public administration in the twenty-first century. By an in-depth analyses user needs can be explored to serve as a basis for the implementation of a feasible spatial information infrastructure. Specific tasks to be performed in that context are in depth considerations concerning the existing spatial data infrastructure, further enhancement of communication networks, spatial management aspects at technical and administrational level and many others.

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