

Free Software: The Open (GIS) Source Solution for Local Governments A Case Study: Perspectives, Experience and Possibilities for the City of Frankfurt (Oder)

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1 ABSTRACT

Modernization of public administration, increasing budget deficits and increasing demand for public services are just some of the major processes challenging local government administrations. For many public administrations faced with increasing budget deficits, "free software" (*also referred to as "open source software"*) is often regarded as only a "low budget" solution. Questions with regard to the potential impact of "free software" on traditional methods of dissemination of and access to public sector information within a traditionally rigid administrative structure is often disregarded. Most importantly free software along with open standards provides an open infrastructure to support and enable new public management organizational structures to develop and coexist alongside a traditionally rigid public administration.

In context of the above mentioned organisational environment, this paper will look at the perspectives and experience of the City of Frankfurt (Oder) with an "Open (GIS) Source" solution as well as the possibilities offered by free software in further development of a spatial data infrastructure in a private public partnership.

Keywords: local government, public administration, public sector information, spatial planning, free software, open source software, OpenGIS, open standards eg. WMS and WFS, democracy, information society, spatial planning, spatial data infrastructure, Linux, UMN Mapserver, Mapbender, Postgis, PostgreSQL, MySQL

2 INTRODUCTION

Much has been written about the topic of organisational change in a public administration environment. This paper will not try to attempt to deal with the complex field of organisational change. However, to understand this process of change faced by most local governments, particularly in relation to implementing an electronic data processing (EDP) strategy in their public administrations, one should take into account the visible organisational structure in an historical context as well as the hidden social factors which interact with each other.

In 1949, with the founding of the influential local government advisory institution KGSt ("Kommunale Gemeinschaftsstelle für Verwaltungsvereinfachung") in Germany, local governments began to "simplify" their administrations. However, much has changed since then. The "simplification" of local public administrations is just not enough. Today, the forces of globalization and liberalisation of market economies as well as the "technologization" and "informatization" of society are creating challenges and opportunities for all local governments. Due to these forces local governments can no longer afford to support rigid, bureaucratic and reactive administrations. More than ever local governments are being forced to make fundamental changes in the way they do "business".

In 1993, under the auspices of the KGSt, Prof. Gerhard Banner, one of the most famous proponents of "new public management" in Germany, published the report "das Neue Steuerungsmodell" ("*The New Steering Model*"). The ideal of the "*The New Steering Model*" is a service orientated public administration to be equaled with that of an enterprise in the public sector. With the publication of this report a new era of "new public management" began in Germany. In this report Prof. Banner remarked that the era of growth as we have known it has come to an end. More has to be done with little. The demands on the public administration are clear: an increase in services with less or no growth. The new model proposed by Banner is *not* about whether services should be undertaken or not, it is about getting things done better. Banner proposed a management culture that emphasizes the centrality of the citizen or customer, as well as accountability for results. In order to face the challenges in ever changing world, a "modernized" public administrative system, at the same time encouraging and supporting creativity and innovation from the bottom up, should be flexible, consultative, result-oriented and proactive (Banner 1993).

Although most local governments have taken steps to reform their public administrations, not much has changed since the publishing of Banner's "*New Steering Model*" in 1993. In today's information society public sector information is a basic resource and commodity. In order to govern and provide services to a more demanding public, accessibility to and dissemination of public sector information is a prerequisite for achieving economic and organisational efficiency. However, in most attempts to "restructure" public administrations, it seems the important role of information technology (IT) is disregarded (Reinermann, 1997). For many public administrations faced with increasing budget deficits, "free software" is often regarded as only a "low budget" solution. Questions with regard to the potential impact of "free software" on restructuring a traditionally rigid administrative structure as well as on traditional methods of dissemination of and access to public sector information is often disregarded.

3 FREE SOFTWARE / OPENGIS

Free Software

In order to explain the concept of "Free Software" we quote from the page of the Free Software Foundation (FSF):

"Free software is a matter of freedom: people should be free to use software in all the ways that are socially useful. Software differs from material objects--such as chairs, sandwiches, and gasoline--in that it can be copied and changed much more easily. These possibilities make software as useful as it is; we believe software users should be able to make use of them. Free software is a matter

of liberty, not price. To understand the concept, you should think of "free" as in "free speech," not as in "free beer." Free software is a matter of the users' freedom to run, copy, distribute, study, change and improve the software. (<http://www.gnu.org>)

The item "Open Source" means, that the user can see the source code of the software (e.g. Microsofts® Windows source code is one of the most treasured secrets in the world). There can be software, which is Open Source, but not free software - because you only get the source-code, but you are not allowed to redistribute the software or there can be software, where you can buy the source code. For more details on this topics it's worth to familiarize one's self with the different forms of the General Public Licence, one of the most famous Open Source software licences (<http://www.gnu.org>).

Open GIS

The Open GIS Consortium (OGC) is a non-profit international trade association with a mission of developing interoperable geodata processing standards. The idea is, that "open interface specifications enable content providers, application developers and integrators to focus on delivering more capable products and services to consumers in less time, at less cost and with more flexibility" (<http://www.opengis.org>).

The standards defined by the OGC can be used to bring about interoperability between different software-packages. The basic idea is "whatever software you use, your data should not get lost". For example, with the application of the OGC WebMapService interface (WMS) standard it is possible to overlay a variety of thematic maps from different „map“ servers. What ever the data type and source or distance separating the servers crossing all borders, if they support a WMS interface - in a users browser, freedom of and to spatial information can be supported.

The Software

UMN Mapserver

- a) The UMN Mapserver is a powerful webmap-engine. It supports a great variety of input data formats as well as direct access to geodata from geo-databases like PostGIS, Oracle Spatial or even ArcSDE. The current version 4.01 of the UMN Mapserver supports the OGC WMS specification. WMS provides a standard for Internet-based retrieval of geospatial maps, and is a core component of the OGC Web Services suite.

Mapbender Client Suite

The Mapbender Client Suite is an OSS and provides user interfaces for displaying, navigating and querying interactive maps. Mapbender furthermore contains an interface for user and group administration and provides management functionality for any number of different maps. Based on the WMS standard, Mapbender is able to overlay different WMS services from different servers in one map.

UMN Mapserver and Mapbender together provide a powerful tool for the dissemination of and access to spatial information via the web. However, they do not provide real GIS-functionality. In order to get more GIS functionality like buffering, routing, etc. into webmap-applications, a spatially enabled geodatabase is required.

PostGIS

PostGIS is an extension to the PostgreSQL object-relational database and enables the support for geographic objects just like ESRI's ArcSDE or the Oracle Spatial extension. PostGIS follows the OpenGIS "Simple Features Specification for SQL". The combination PostGIS with the UMN mapserver allows the mapengine to implement real GIS functionality into webGIS applications such as buffering, routing, measuring or digitizing.

Integration of existing GIS Software and Open Source Software

Whatever the IT landscape, if there is a public administration, which works well on a desktop-GIS based on the OGC specifications, a combination between the existing GIS infrastructure and newly planned steps based on OSS are no antagonism.

There is no problem to deliver basic spatial information such as cadastral maps, topographic maps or orthophotos via a WMS service based on the UMN Mapserver. Information can be accessed through a locally installed desktop GIS like ESRI's ArcView® or Intergraphs GeoMedia®. As most of the major GIS companies have accepted the OGC standards, a GIS-infrastructure which is based on the WMS and Simple Features OGC specifications should be able to inter-operate system-wide.

An example is the City of Soest, where the main desktop-GIS applications are based on ArcView® and where the webmap-service is provided via UMN Mapserver and Mapbender Client Suite, both systems access the same data-pool. Experience has demonstrated that often desktop-GIS performance is decreased as it loads raster maps. However, by loading raster maps via a central WMS enabled UMN Mapserver server, performance is unhindered.



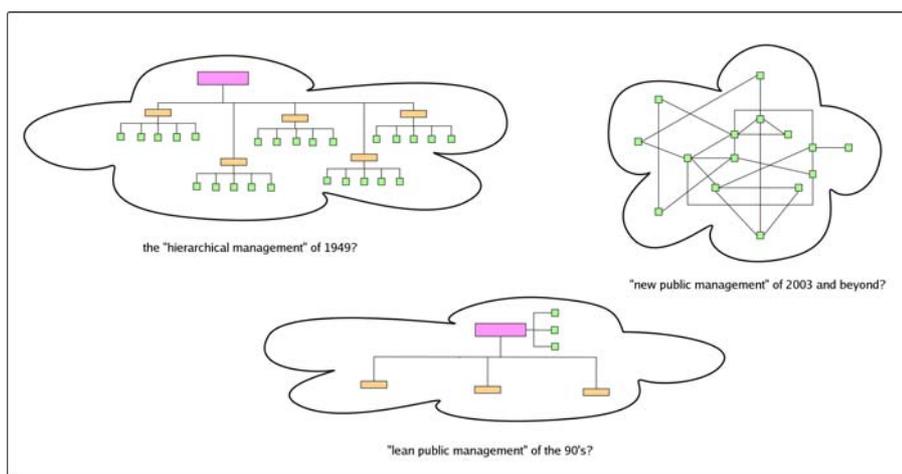
4 PRESENT PERSPECTIVES: CITY OF FRANKFURT (ODER)

As mentioned in the introduction, the main objectives of the Banner's "new public management" is economic and organisational efficiency. The challenges, without doubt, are enormous. The local government of Frankfurt (Oder) is faced with the dilemma of acting as a private sector enterprise along with the reality of harbouring a "traditional", and at times dysfunctional, public administration. If one is to compare the administration of private sector enterprise with that of a local government such as the City of Frankfurt (Oder), one must concede there are differences. The functions and services of public administration are more varied than that of an average large size enterprise. As the organisational structure is determined by the product or services to be delivered, the diversity of organisational environments and responsibilities in which a public administration operates is much greater than those in the private sector.

Some of the major development processes to be observed within the City of Frankfurt (Oder) are modernization of its administration, increasing budget deficits and an increasing demand for services from politicians and citizens alike. *What seems to be a common element to all three developments is a necessity for economic and organisational efficiency.* However, in its attempt to modernize the public administration, it seems the important role of information technology (IT) is often ignored or completely forgotten. If one is to consider the "technologization" and "informatization" of the public administration the role of IT should be an integral part of any modernization strategy.

It is not obvious whether "technologization" and "informatization" of the public services leads to more or less strict boundaries of organizational distribution of work. Situational and social factors might have unexpected consequences in delivering public services as well as in the supporting processes. In implementing an IT strategy the process of change faced by most public administrations must be understood. One should take into account the visible organizational structure in an historical context as well as the hidden social factors. Taking these aspects into account one can observe three organizational structures within the administration of Frankfurt (Oder) at work (see diagram 1). At one extreme there exists a hierarchical or "traditional" form of a long established administrative structure, on the other extreme, a network form of an administrative structure working under the auspices of "new public management" which is mainly based on "personal" contacts or relationships and in the middle lies a form of "lean public management". At times contradicting or competing with each other, they seem to be surviving side by side.

Diagram 1.



As mentioned above, public sector information is a basic resource and commodity. Accessibility to and dissemination of public sector information is a prerequisite for achieving economic and organisational competitiveness survival as well as efficiency. To support the integration of different levels of "social" networking at the same time managing the change, information technology can play a very vital role.

As the Organizational structure is determined by the product or services to be delivered, the questions now arises, how can such diversity in the administration's organizational structure be supported as well as its departments and information flow be optimized to coincide with present objectives of new public management.

The answer is quite simple. Here is a brief look at a formula put forward by Prof. Dr. Heinrich Reinermann (Reinermann, 1997):

$$AIS = f(PAS, IT, X)$$

"This formula is meant to express a functional relation between AIS as the informatic systems as we find them in the public domain, first of all computer hardware, networks, application and operating software as well as data, PAS as the information needs expressed by the political-administrative system, mainly parliaments, governments and administrations, IT as the information technological potential and X as a general term for further influential factors such as the level of liberalization of the telecommunication market which effects price structures and the availability of services among others, the acceptance of technology by society, or legal arrangements.

.....

In other words: the strategies for the development of state and administration and the strategies for the AIS must be integrated, together with the development of the IT-potential and the other influential factors. The strategies for administrative development must include also the AIS. Or, as seen from the other side: the AIS-strategies must be a logical consequence of the strategies for the development of state and administration." (Reinermann, 1997).

As the city administration of Frankfurt (Oder) proceeds with further development of a spatial data infrastructure in context of the aforementioned "environment", experience has demonstrated that Open (GIS) Source solutions are a viable alternative to "traditional" information infrastructures.

5 THE OPEN SOURCE (GIS) SOLUTION: THE FRANKFURT (ODER) EXPERIENCE

Since the first initiative to implement GIS in the city administration in 1993, the IT and GIS landscape was primarily based on proprietary software. In 2000, the city administration decided to "officially" coordinate GIS related activities. In 2001 the first steps were taken to enable access to spatial information from every desktop within the city administration. At this stage, the administration was only in the conceptualization phase of implementing a city wide GIS solution. There was no budget. However, in order to understand the administrations acceptance of new technology and demonstrate the potential of GIS and to identify users as well as potential users needs, it was found essential to give people access to basic spatial information such as cadastral or topographic maps and orthophotos as needed in day to day activities. Everything that was needed was available, except a budget to acquire an "out of the box" solution. Hardware, internet/intranet access, personel, a little bit of IT knowledge and the will to "go where man had gone before" was all there.

In the early stages of the conceptual phase it was also decided to design and implement a spatial data infrastructure founded on the 7 principles mentioned below: The 6 basic principles proposed by INSPIRE (INfrastructure for SPatial InfoRmation in Europe) (<http://inspire.jrc.it/>) and a seventh added by the City of Frankfurt (Oder).

1. Data should be collected once and maintained at the level where this can be done most effectively
2. It should be possible to combine seamless spatial information from different sources and share it between many users and applications
3. It should be possible for information collected at one level to be shared between all the different levels, detailed for detailed investigations, general for strategic purposes
4. Geographic information needed for good governance at all levels should be abundant under conditions that do not refrain its extensive use
5. It should be easy to discover which geographic information is available, fits the needs for a particular use and under which conditions it can be acquired and used
6. Geographic data should become easy to understand and interpret because it can be visualised within the appropriate context selected in a user-friendly way
7. Independance of companies, partners and engineering firms is to be as much as possible minimised (Private-Public Partnerships (PPP) is not necessarily to be omitted).

With these basic principles in mind and a little bit of experimenting as well as many hours of work from people all over the world, spatial information is now accessible through every internet browser in the city administration. There is now no need to wait for basic spatial information. Along with the implementation of OpenGIS standards such as the Simple Features *Specification*, WMS and WFS, spatial information can be accessed by internet browsers and various proprietary GIS packages such as ESRI's ArcView[®].

It is too early to exactly write about how the functional relation between AIS referred to by Reinermann has changed. However, one thing is clear, the way spatial information is to be disseminated and accessed has changed. Everyone now has access to spatial information when they need it and most of the time how they want it. Time and space (social barriers) are not a problem anymore. Further analysis over the year will be needed to look at resulting impact of an "Open (GIS) Source" solution on the integration of different levels of "social" networking and the management of change.

As described above, there is a great diversity of organisational environments and responsibilities in which a public administration operates. Any further development of GIS applications or the spatial data infrastructure, based on the above principles, must be designed accordingly. There is no one "out of the box" software package that can deal with the situation of a local public administration. For information technology to play a vital role, the integration of and adaptation to old and new systems as well as to the users responsibilities and requirements are to be taken into consideration. In context of the predicament in which most local public administrations find themselves today, an Open (GIS) Source solution seems to be the most viable choice. An Open (GIS) Source Solution, as an enabling technology, can integrate existing technology within established structures and allows for change at a pace and at a cost with which everybody can afford – social as well as monetary.

6 THE PUBLIC/PRIVATE PARTNERSHIP ENVIRONMENT

IT service providers working with Open Source software have a complete different business model than those going the "classic" way: Getting the contact, make a presentation of their software and sell it afterwards, eventually together with some services. The Open Source IT service providers ("we") concept is to involve the customer much more in the development processes of the solutions they need. Such a Modern IT service provider has a kind of "toolbox", with elements or „modules“ which can be put together in order to deliver a solution geared to the customers real needs. This requires close co-operation between the service provider and the awarding authority: The process using Open Source software (OSS) is a complete different one, because there is no pre-development followed by a distributor telling the administration where their problems are and then sell them their solution.

For example, many administrations have the problem to convert the EDBS data format to the format of their choice. The idea was to deliver an EDBS to PostGIS converter based on OSS and display the ALK (german cadastral maps) as *WMS* with the UMN Mapserver.

The procedure was as follows: The customers were contacted and made a kind of "collection" for the money required in order to develop the converter. When enough money was in the "pot" and the problems and demands to this piece of software was precisely defined, the development of the solution began. Afterwards the whole software will be released as Open Source. Of course, one can say, *"let's wait until somebody finances this and then I can use it and save the money"*. To understand that somebody finances this and another one that element or „module“ of a „needed“ software solution, the open source requires more idealism or social responsibility.

A re-organisation of the proportion between the public administration and the IT service provider is an essential part when implementing this model. In order to re-organize this proportion, the public administration needs to be involved into the development processes. This requires a higher expertise on the side of the public administration and, of course, an increased co-operation between the public administrations and the IT service provider.

Another point is to involve the public administration directly into the development process. This can only be achieved, when the software is Open Source. As we consider Germany, in every single public administration, there is at least one person who develops some type of software for one hour per week (presumably much more). Together this is a great number of development-hours per week! The problem is, that this development is not well coordinated, so that a lot of this power gets lost (beside the problem, that often the developers are not allowed to share their work with the public because of internal constraints). But OSS has the power and the ability to co-ordinate its own development. This is demonstrated by every well known Open Source project. Linux or MySQL being good examples. The developers of these two software packages are spread over the whole planet, and it works!

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