SEXTANTE: A geographic information system for the Spanish region of Extremadura

SEXTANTE is a geographical information system (GIS) developed under the auspices of the government of the Spanish autonomous region of Extremadura. Built to fit the needs of the region's forestry department, the software is fast becoming an important tool for the management of Extremadura's diverse landscape. Its numerous analysis functions set SEXTANTE apart from other geographical information software.

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Quick facts

Name	SEXTANTE
Sector	Public sector
Start date	2004
End date	N/A
Objectives	Development of a geographic information system (GIS) for the government of the Extremadura region in Spain
Target group	Mainly forestry department, but also a much broader community (open source software)
Scope	Regional
Budget	About 90.000¬ per year
Funding	Public (from the government)
Achievements	Software is already deployed and used at the forestry department

Introduction

The region of Extremadura has very distinct natural characteristics, with its landscape ranging from the Targus river basin to mountains more than 2400 meters high. It contains the Parque Nacional Monfragüe (Monfragüe National Park) and the Parque Natural Rio Tajo internacional (International Tagus River Natural Park), which substantially shape the region's nature and wildlife characteristics.

In 2004 Victor Olaya, then a student of hydrological analysis and forest management, approached Juan Carlos Giménez, the coordinator of the forestry department of the University of Placencia, about the development of a geographical information system (GIS). Olaya had worked on similar projects such as [SAGA](#), which is a open source GIS developed at the University of Göttingen in

Germany. Giménez found this idea very interesting, and saw the potential such a software held for the region. After a presentation of the project, the regional government quickly decided to deploy SEXTANTE in the forestry department. There, the program was welcomed, as the software deployed beforehand was hardly used, and most people were not even aware of how a GIS could enhance the productivity of their work, such as analysis functions, which allow for much more accurate reports and predictions. The advantage SEXTANTE had over other GIS with regard to the forestry department was the fact that it offered a much bigger catalogue of analysis functions,which could be extended specifically according to their needs in the future.

Organisation and political background

SEXTANTE was built mainly by the developer Victor Olaya, with the coordination and support from Juan Carlos Giménez. While Olaya has previous experience in developing geographical analysis software, Giménez is a teacher at the forestry department, with only very little technical experience in programming; their skills complement each other. Giménez acts as project coordinator, and handles most administrative aspects and financial matters. Since he also works full-time at the university, his involvement in the project is limited to only a few hours per week. At the moment, Olaya is the only person working full-time for the project. He is in charge of the development and all other technical aspects of the software. Even though both of them agree that being a small team keeps decision processes simple, they are hoping to add more people in the future.

Project coordinator Juan Carlos Giménez

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The project is hosted at the University of Placencia. Importantly, the university has good relations with the local government of Extremadura, and the two have already cooperated on other occasions. Giménez says that universities generally find it easier to get support for a project than the private sector. This was also the case with the SEXTANTE project. Extremadura's diverse landscape and widely varying climate mean that the forestry department needs a powerful tool to enter and process geographical information, which moreover has to be adaptable according to their needs. This is exactly SEXTANTE's strength, as its small structure as well as Olaya's expertise make it possible to quickly tailor the software to specific requests.

Olaya says that initially, the software was more focused on forest management, and slightly changed the focus [&] and we are now developing things that are useful for geographic analysis in general . There are certain key aspects that the government wants SEXTANTE to cover: mainly the analysis of hydrological processes, forest fire coordination, and forest optimisation for the

generation of wood, Giménez says. For the future, Olaya hopes to extend the project not only with regard to staff, but also from a developer's point of view, by making the application increasingly relevant to users of other fields. A growing catalogue of analysis functions with a wider application range is a goal for the future.

Budget and Funding

Due to the good relationship of the University and the local government of Extremadura, and in particular that of Giménez and the forestry department, finding funds for SEXTANTE did not prove too difficult.

The scope of the funding was set at ¬ 66.000 annually for the first four-year contract, starting in 2004. The cooperation has been extended for another three years until 2011. SEXTANTE also receives financial support from the gvSIG project of the Valencia region, which is a less specialised tool to manage geographic information with more focus on vector based analysis (see Technical issues below). The support from gvSIG amounts to nearly ¬20.000 per year. The rationale for this support is that both Extremadura and Valencia benefit from the development of SEXTANTE, as Olaya and Giménez share their improvements with gvSIG.

In the future, the SEXTANTE team hopes to find new sources of funding, in order to expand the project. This should ensure continuing financial support for the project, gradually weaning it from its dependency on the local government. Talks in this respect are already ongoing, Giménez says, and he is optimistic.

About 80% of the budget go towards Olaya's full-time position. Giménez, being fully employed at the university of Placiencia, does not receive additional benefits for his work on SEXTANTE. The remaining 20% of funds are used for attending conferences and travel expenses.

Technical issues

Large parts of SEXTANTE's initial architecture come from SAGA, which is a GIS developed at the University of Göttingen in Germany that has a strong focus on geo-analysis. At the start of the project, Olaya developed an additional 70 analysis modules on the basis of SAGA, which already comprised around 120. At some point it became clear that the capabilities of the SAGA system would no longer meet the needs of the SEXTANTE project, as it was foreseeable that the analytical capabilities of SAGA would not satisfy the specific needs of the regional

System developer Victor Olaya

foresters at some point. A new infrastructure was necessary to further improve the system. At this point, the options were to either continue modifying SAGA, or to take SAGA's analytical algorithms and put implement them on top of a different base. We took the decision of moving everything from SAGA to gvSIG , which is a powerful GIS developed in the region of Valencia and which is also freely available under the GPL license, Olaya says. More or less half of the SEXTANTE algorithms have been written from scratch by me, and the other half is just adapted [to gvSIG] from SAGA . Since gvSIG offered the functionality that they needed, but was lacking in some analytical aspects, the move was not only beneficial for SEXTANTE, but equally so for the gvSIG team, as the gvSIG version of SEXTANTE enhanced both systems simultaneously.

The migration to the new base went rather smoothly, Olaya says: Basically it was just moving the ideas that were in SAGA that were quite good and stable and then adding a couple of things and testing those . Since he had already worked with SAGA and had gained further experience in the early days of the SEXTANTE project, he had the necessary skills to manage the transition. At the moment, SEXTANTE is available as an independent Java library, which enables it not only to be used in the gvSIG framework, but also in other GIS applications.

Even though the project is mainly oriented towards the needs of the local government, its user base is constantly growing, as people from many other fields can also use the software for their purposes and contribute to its development. At the moment there are a several other applications besides gvSIG that use SEXTANTE as a source of geoanalytical components. Examples of this are openJUMP, OrbisGIS and uDig.

Legal issues

SEXTANTE is developed and distributed as open source software under the GNU General Public License (GPL).

Setting up the project was relatively easy, as it is relatively common for the local government to contract universities. Giménez says, there was no tender or anything like that necessary and once [the regional government] gave the OK for the project, just a few bureaucratic steps were necessary for the project to receive funding . Giménez says that setting up a similar arrangement with a private firm instead of a university would have been much more complicated.

From a financial perspective, the funding for the project comes from regional sources, primarily the local government. Giménez highlights that there is a big difference between local funding and national or European funding. The latter usually involve more paperwork and higher legal requirements. In the case of SEXTANTE the local government quickly saw their benefits of the

project when the idea was presented to them, and agreed to the funding, without any further legal procedures.

Effect on government services

Before SEXTANTE was introduced to the forestry department, there was little use of computer programs to make the agency's work more efficient Though a software application aiming to facilitate the work of the foresters was already deployed, hardly anyone was actually using it, or knew how to use it. The aim of SEXTANTE was to make more efficient the daily work of the foresters, who were still relying to a large extent on their practical knowledge of nature. Victor Olaya says that it's been a little difficult for the people from the local government to adapt to the program, as many of them have not used any kind of GIS software, or anything beyond office software, before . However, he sees changes already, as the software is used more widely and the foresters are getting into it . Giménez explains: More people are getting to know how to use the program, largely because of the training sessions and direct help from Victor [Olaya] and me . This advice and training is vital. As the program has many functions and options, it is sometimes difficult for the users to find exactly what they want. But once this barrier is overcome, the program can be used much more extensively.

It is the SEXTANTE team's aim to see the foresters use the program on a daily basis. To ensure this, several training sessions as well as lectures and conferences take place that give the users in the government a better understanding of the software, and make them aware of the benefits for their daily work. Although this training was already part of the initial project contract, it plays an even larger role in the project's new three-year contract, which runs until 2011. There will be approximately 15 hours of training for each relevant user as well as the possibility to contact the team for any questions.

Cooperation with other bodies

The SEXTANTE team has very good relations with the SAGA GIS team, and there is a frequent exchange of ideas between the two. The two teams have occasional meetings where they can exchange their ideas and present their work. Though the two programs are in competition to some extent, they are aiming at different user groups. The open source nature of both software packages also means that both groups are likely to benefit from this cooperation.

The relations with gvSIG are friendly as well, as both parties contribute to a mutual improvement of their systems. As such, whenever SEXTANTE is being promoted at a conference gvSIG is

promoted at the same time, and vice versa. Olaya further says most users see [gvSIG and SEXTANTE] as a pack, which underlines cooperation between the two programs. Even though the library of SEXTANTE can also be used with other GIS packages, most users actually refer to gvSIG, just as the SEXTANTE team does. There is no competition between the two, since gvSIG is less specialised in its functionality, and SEXTANTE functions as an extension of the software with improved spatial data analysis tools that enhance the capabilities of the system.

The team also is present at the OSOR.eu platform, where it actively participates with the community by frequently updating its status, and offering direct contact with its users. Through this, the project could present itself to a larger community, which is very important for SEXTANTE. An increased number of users provides the team with important feedback, which helps improving the software, and gives them valuable input for new functionalities.

Evaluation

With regard to the way the project has been started and developed over time, both Olaya and Giménez are very confident. Olaya says that since the project is rather small in its financial and organizational dimensions, the open source mechanisms have contributed a lot to its success. The team has tried to keep contact with its users base since the beginning, and users' feedback has guided them substantially in the development of the software. Today the number of users is increasing steadily, and the people that contribute to the development of the software is growing, since the code is freely available. The users that contact the team, Olaya says, come from all over the world; from South America, to other European countries. He describes the development of SEXTANTE until now as a natural success, as it could mature and evolve over time.

Through increasing exchange of ideas and contact with people from all over the world, the project itself is becoming part of a large network of business partners and research institutes, which voice their interest in the software and use it for their own means. The OSOR.EU platform illustrates this networking process very well. This in turn creates more opportunities for the development new functions of the software it. With an eye on funding, networking also is essential for making new contacts and meeting possible partners. Moreover, the software helps other bodies to pursue their work more successfully, which contributes to the growing network of SEXTANTE users. Within the relatively short time of three years, SEXTANTE has found a remarkable user base and has achieved significant recognition.

The freedom Olaya enjoys in the development of SEXTANTE is another important aspect of the project, as this guarantees a wide range of functions and simultaneously extends the user group dramatically. As the algorithms he creates are not only made for the regional foresters but can be

used in a wide range of other fields, this ensures SEXTANTE's diversity. Especially with regard to the sustainability of the program, this is an essential aspect. The positive effects eventually can be felt by the government as well, both because of the positive publicity this implies, and due to the new aspects that community-oriented developments can bring for their work. An example of this is that bugs and other issues the software might have are discovered much faster, and so do not affect users for long.

Achievements / Lessons learned

It was and still is important for the success of the project to be able to grow at a natural pace and to adapt to new possibilities and requirements step by step.

In this respect the initial starting point of SEXTANTE on the SAGA platform can be considered vitally important, as it laid the foundation for SEXTANTE's success on a larger scale. The move to gvSIG was equally important, since more and more users found their way to SEXTANTE, and furthermore it improved the ability for Olaya to develop the software according the needs or the regional foresters.

For the success of the SEXTANTE project, the cooperation with the regional government is essential. As they are not only the main funding partner, but also the most important group of users of the program, SEXTANTE's existence at least at the moment very much depends on them. However, with regard to the programming work Olaya does, the government leaves a lot of leeway, and he can develop functions that go beyond the relevant aspects for the government. Olaya explains that the government has realized that general improvements of the software in the end are also beneficial for the government, not only where functionality is concerned but also for reasons of prestige and publicity, since it helps substantially in developing a program that is used increasingly world wide. In short he summarizes, the better it is for SEXTANTE, the better it is for them .

Another important factor of SEXTANTE's increasing popularity is its presence at the OSOR.EU platform, where information on the project can be found along with the program and its source code. As OSOR.EU offers a perfect meeting place for those interested in SEXTANTE, and moreover open source GIS in general, this is an important source of feedback. The content is updated frequently, which enables users to keep track of new algorithms and other improvements. Users can read about future development plans and contact Olaya and Giménez directly. For a project such as SEXTANTE the opportunities created through OSOR.EU are an important ingredient for success and popularity.

Future plans

Looking to the future, SEXTANTE is trying to create a new infrastructure and form of organisation in order be able to cooperate more with external bodies and persons. Giménez says that one of the critical points the project still faces is that only Olaya is working on a 100% basis. This makes it difficult for the project to reach a higher level of organisation, which makes this transformation of infrastructure necessary at some point. Only with more staff that is dedicated to the project on a full-time basis can SEXTANTE grow in its dimensions, Giménez explains.

The development of SEXTANTE will certainly go on in the coming years, and additional algorithms and functions are being developed constantly. Even though many things have been achieved already, especially with regard to the functionality for the foresters, there are still several aspects that Olaya and Giménez are discussing and eventually will develop. In this respect the project is an ongoing process that has not come to an end yet.

As the funding for the years after 2011 is still uncertain, since the contract with the local government might not be extended, new sources of funding have to be found. Maybe in three years all the things they needed are developed, which is why we are looking for further funding resources , Giménez states. Even though no new major funding partner has yet come forward, he is optimistic, as talks with other bodies and institutes are already ongoing.

For a project as small as SEXTANTE, on the one hand it is easier to work and to establish clear aims, but at the same time it is more difficult compared to larger projects to broaden the functionality of the project. It appears thus that expanding the structures of SEXTANTE will be a task for the future, if the team wants the project to grow and to ensure sustainability in the future. The financial aspects are not to be forgotten as well, as its existence mostly depends on the funding of one governmental agency. The SEXTANTE team is well aware of this problematic, and they are working on finding new partners and sources of funding. It further appears that the specialization of the project on the needs of the foresters could be a barrier in this respect, which underlines the necessity to broaden the functionality of the software once more.

Apart from the financial aspects and the need to enlarge the organizational structures of the project, especially Olaya's expertise is an essential ingredient for SEXTANTE's success. His knowledge of the subject matter, but also of technical matters of developing are certainly a prerequisite for the projects existence. This, supported by Giménez' theoretical input, as well as the good contact with users of all sorts- especially the local foresters - enable Olaya to meet the demands of his users directly.

Especially compared to project of larger dimensions SEXTANTE has the advantage that less

bureaucracy is involved in their work. Even though the work depends on the funding of the regional government, the software itself is not likely to fall victim to political debates, as it is largely accepted in the government and moreover a rather neutral project, with regard to different political interests. This certainly facilitates the work of the project. Moreover, the effects of the project on the foresters work are largely positive. There is thus broad acceptance, and little controversy about the need for a software like SEXTANTE.

Links

SEXTANTE

gvSIG

OSOR Forge: SEXTANTE

SAGA

OSOR GIS Software Community