THE "MARCHESATO DI SALUZZO" PROJECT: AN OPENSOURCE BASED WEB/GIS FOR HISTORICAL AND CULTURAL RESEARCH, CONSERVATION AND VALORIZATION

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ABSTRACT:

The creation of a management and analysis instrument of a territorial object, in order to valorize its historical, cultural and artistic properties, makes it necessary to read the land itself, considering many points of view. A general investigation must be carried out, that involves different scientific and humanistic fields, and which brings this different knowledge together in one tool: a Geographic Information System (GIS).
The World Wide Web is proving to be a useful way of sharing this kind of spatial data.
The first and undeniable advantage of using Internet tecnology to publish GIS data consists in the simplicity and economy of the implementation.
Users who access GIS resources, shared using a Web server and published on a specific Web site, no longer need particular hardware configurations or software knowledge: it is sufficient to connect to the WWW, and use a traditional Web browser, possibly with some extensions (for example: plug-in, usually delivered together with server software).
However, to make this solution competitive with a traditional one, (directly using GIS sotware compatible with data structure), when a GIS is published on-line the user should be able to:
- extract information and descriptive data from the database related to the graphical base
- visualize cartographic data in the correct scale
- correlate graphical features to alfanumeric ones
- use standard HTML tools, being sure of a full integration with hypertextual documents.
This paper deals with the setting up of a complex Web/GIS that is completely based on Open Source tecnology. The aim of the work is to show how these tecnologies can be exploited to create low-cost products, that can be customized according to the users' requirements.
Althought the reduction in cost of the commercial products has led to a remarkable increase in the spread of this sofware, the Open Source Web GIS is a valid alternative, if one also considers the chance of undestanding the algorithms that have been implemented. The case under study refers to the realization of a spatial infrastructure of historical and artistic data concerning the "Marchesato di Saluzzo" (CN), an area situated in the north-west of Italy, which in the Middle Ages was under the rule of Marchesi di Saluzzo.

1. PUBLISHING GIS ON INTERNET

When dealing with the problem of preserving and valorizing the cultural heritage of the land, it is very important to collect a great variety of information, in order to construct a data base. Public administrators can use it to support the decisions they have to make and to give a proper direction to their policies. It is evident that this work has to involve different levels of competence. As a matter of fact, the land must be read taking into account its many aspects and dynamics, such as the mutual influence with the human activities. The experts in history, archeology, geology, botany, architecture, engineering, cultural anthropology and art, have to carry out their own researches and analyses. After such a great effort has been made, the next step is to integrate all these data in one efficient tool, so that not a single piece of information is spoilt. If one of these tools is developed, it is possible to carry out interdisciplinary analyses instead of having a partial view of a specific problem.

Considering the aim of the project, that is the promotion of a particular land, it is clear that this amount of information has got a common substract: the land itself. In other words, all the information has to have more or less evident georeferenced aspects. This leads us to organize all the information into what we call a GIS. At this point, the tool we wanted to create is ready. The administrators have another arrow for their bow, and the researchers have a powerful means for their own speculation. But the question is: "Have we done our best in order to meet our starting goal?". The tool we have designed is only usable on the computer where it was made. So next step consists in making possible to people to access this hardly-built tool if they need to, without forcing them to physically go where the tool is. We have to bring the tool to people, not vice versa. In this way, the project is able to score another point towards our goal. If we can bring the information to people, we put administrators and researchers in the condition of doing their own work, and moreover, we can transfer a great deal of information to common person as well. We can raise their awareness and improve how historical, cultural and artistic properties of a land are felt. It is possible to make the land more

visible, enhancing all the attractions offered, promoting cultural tourism.

We're looking for a means to deliver data to people, in an independent way from where they are: the best answer we have today is Internet. It is possible to reach any part of the whole world and it is not difficult to understand the benefits of this solution and the incredible number of potentially reachable people. Besides this solution is economical and simple for users: whatever hardware or software configuration they are using to connect to the WWW, and with elementary computer knowledge, they can access the data shared by the Web/GIS. It is important to add that sharing data on the WWW doesn't mean that anybody can obtain reserved information. The users must see and have the chance of downloading only what we want. Besides data aren't shown in their raw format, but users can usually see only some their elaborations.

Security is one of the main problems of this solution. No one must access or download files they aren't authorized: so it is important to plan the web site in a way that some areas can be used by everyone, whereas others have restricted access; it is also important to plan security devices to prevent unwelcome access and action.

2. MAPSERVER AND OPEN SOURCE[1] APPROACH

The next question is: "How is it possible to achieve all these aims?". The first problem we were faced with in this kind of project concerned the choice of the proper software to manage and deliver all the information to people, individuals researchers or even to tourists. There are three factors we must take into account when choosing the right software: the first is the possibility of using some prebuilt useful functions, which have been implemented in a software: and this is the first difficulty when selecting software from many applications available on the market.

The second one is the possibility of personalizing the software, to solve problems connected to the project. Therefore we need what is usually called an API (Application Programming Interface) in order to interface with the software.

The last one is the economical aspect of the project. It is necessary to reduce the construction costs also because they can be an important factor, in particular in cultural conservation where the are no sponsors.

Besides choosing a commercial product makes you dependant on the solution chosen: you have to accept terms and conditions of the software house, which don't always meet your needs. Just to quote an example, the fact that ESRI decided to stop supporting Avenue language, forced thousands of users who had spent time to learn it to rewrite their applications in Visual Basic for the new version of the GIS software.

This is why the Open Source solution was chosen as the right approach to meet all these goals. All the software employed is rigoursly Open Source and released under the well known GPL License[2], as the "Marchesato di Saluzzo" project.

The first software we used is Mapserver, the GIS environment to distribute the data trough the web. MapServer is an OpenSource development environment for building spatially enabled Internet applications. The software builds upon other popular OpenSource or freeware systems like Shapelib, FreeType, Proj.4, libTIFF, Perl and others. MapServer will run where most commercial systems won't or can't, on Linux/Apache platforms. MapServer is known to compile on most UNIXes and will run under Windows NT/98/95.

The MapServer system supports MapScript which allows popular scripting languages such as Perl, Python, Tk/Tcl, Guile and even Java to access the MapServer C API. MapScript provides a rich environment for developing applications that integrate disparate data. If the data has a spatial component and you can get to it via your favorite scripting enviroment then you can map it. For example, using Perl's DBI module it is possible to integrate data from just about any database vendor (eg. Oracle, Sybase, MySQL) with traditional GIS data in a single map graphics or web page. In addition, there is now a PHP/MapScript module included in the current release- thanks DMSolutions.

There is also the MapServer CGI application which provides a significant number of "out-of-the-box" features. Here is a sampling:

- vector formats supported: ESRI shapefiles, simple embedded features, ESRI ArcSDE (alpha release)
- raster formats supported (8-bit only): TIFF/GeoTIFF, GIF, PNG, ERDAS, JPEG and EPPL7
- quadtree spatial indexing for shapefiles
- fully customizable, template driven output
- feature selection by item/value, point, area or another feature
- TrueType font support
- support for tiled raster and vector data (display only)
- automatic legend and scalebar building
- scale dependent feature drawing and application execution
- thematic map building using logical or regular expression based classes
- feature labeling including label collision mediation
- on-the-fly configuration via URLs
- on-the-fly projection

3. "THE MARCHESATO DI SALUZZO" PROJECT

The case described in this article is about the research project "*Landscape heritage and resource management: an integrated information system of Marchesato di Saluzzo*", funded by

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[1] *"Reporters often ask me the days if I think the open-source community will be corrupted by the influence of big money. I tell them what I believe, which is this: commercial demand for programmers has been so intense for so long that anyone who can be seriously ditracted by money is already gone. Our community has been self-selected for caring about other things-accomplishment, pride, artistic passion, and each other".* Eric S. Raymond, the major contributor to GNU Emacs editor

[2] The General Public License is designed to make sure it is possible to give away or sell copies of free software, to receive source codes or get it if you want, to change the software or use pieces of it in new free programs; besides it makes you know you can do these things.

M.U.R.S.T. (Ministry of University, Scientific Research and Technology), which has the goal of creating an instrument not only for historical and archaeological research but also for the conservation and the valorization of the Valle Po[3] landscape and property, which was built built to be used by researchers, local administrators that have to preserve local cultural heritage, and the common person who wants the land for tourism.

In the last three years a lot of data coming from different fields such as archeology, geology, botany, and cultural antropology, have been collected by experts in different and specific fields, and organized in a database. It is then integrated into a geographic information system by a team from Turin Polithecnic Department, in cooperation with "Marcovaldo" cultural association. The birth of a stand alone GIS permitted us to put together, to compare and to interpret archive data, material data and data from aerial photography interpretation. We believe, in fact, that interdisciplinarity is necessary to understand land transformations and the human role.

After this first step, the next is publishing the GIS on the Internet, a web-site sharing the project and final tool of it.

3.1 Aim of the publication

The aim is to create a portal, a web site able to give visibility of the whole project and that is able to offer different functionalities to users. The web-site is thought of and designed for two kinds of users. The first person has the need of using this tool as part of his work, in the decision making process, or in a research action. He has to use all information available, and could have the need of adding data from developing work. The second person is a user who wants an easy to easy-to-use instrument to discover and get a wide vision of the land of Marchesato di Saluzzo.

We designed the portal considering it was made by different parts: first of all we want to give users a complete idea of the whole project, let them understand its complexity, and appreciate the research and synthesis effort. We want to offer them the chance to know why the project was started, how it was developed, who worked in it, who supported it and how it was carried out. So we arranged information, including the articles written by researchers from different fields, many of which have been presented at sectorial congresses, and where users can express their own ideas, or send them to the administrators' team, who may decide to publish them.

We believe a map is the easiest way to let users discover the land in an simple and personal way.. We built a section where users can interact with a map, having the chance to get simple pan/zoom functionalities and choose what kind of information layer they want to see. If they like, they can query the map, getting information about the object they want. We also developed also a tool to let users center the map on the area of a municipality, chosen from a list that is dynamically generated from the database, of all the municipalities of the Marchesato area. The user interface is conceived to be simple and easy to use.

If users want to get more detailed information about particular structures in a specific zone, they can use the tools implemented in the query part of the website: here users are asked to choose

the option they want from a list which is dynamically generated from the database. We would like to underline that such solution, prevents the user from selecting an unavailable option. It also solves the problem of having to manage text strings introduced by the user. We wanted to make it possible to link MYSQL database with the mapping application and we worked so that the user has the chance to see on the map the structure he has found with a query tool: after finding a structure by chosing different options like the ones we described before, the users can see their selection enhanced on the map, and then they can continue using the mapping tool as usual. While working, researchers need to access the, to modify them with the results of their speculations, and to make multicriterial analysis using the whole content of the database. This is why the website offers the chance to access a restricted area, where authorized people can remotely manage the database itself

3.2 The structure

As you can see in fig. 1 the "Marchesato di Saluzzo" project is basically based on a Mapserver machine, where the Mapserver GIS engine runs with a database Mysql server to store and consult the data. Connections between Mapserver and MySQL data use PHP scripting language. PHP is an HTML-embedded scripting language.
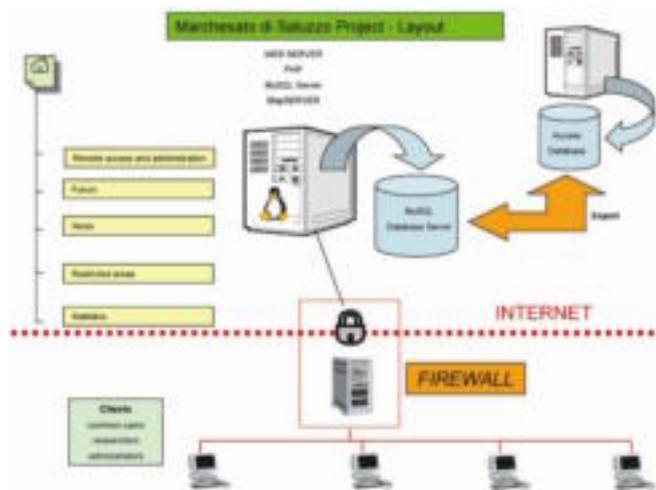

Figure 1. Structure layout

Much of its syntax is borrowed from C, Java and Perl with a couple of unique PHP-specific features thrown in. The goal of the language is to allow web developers to write dynamically generated pages quickly.

All the system is built on a Debian GNU/Linux server. The Apache httpd server enable the connections between the clients and the server. Apache is a powerful, flexible, HTTP/1.1 compliant web server, implements the latest protocols, including HTTP/1.1 (RFC2616), is highly configurable and extensible with third-party modules, can be customised by writing 'modules' using the Apache module API, provides full source code and comes with an unrestrictive license. Runs on Windows NT/9x, Netware 5.x and above, OS/2, and most versions of Unix, as well as several other operating systems, is actively being developed, encourages user feedback through new ideas, bug reports and patches.

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[3] Valle Po is one of the main valley in Marchesato di Saluzzo, an area in the south of the Piedmont region, in the north-west of Italy. In the Middle Ages it knew a period of prosperity, before getting under the power of the Savoy royal family.

We encourage the system administrators to locate all the system behind a firewall, as shown in fig.1. It's important, indeed, to protect all the data, cartographic and tabular as well, to discourage crackers to download any kind of sensible information.

3.3 Functionalities

The web site was built with Nuke technologies. Php-Nuke is a php-made application used to construct and manage via web portal systems. We decided to use it in the spirit of Open Source philosophy. The portal let the user read news about the "Marchesato di Saluzzo" Project, to take part in discussions, to download data and so on. Our aim was to build an interactive site for users interested in Cultural and Historical research.

The first function implemented in our project was the possibility to navigate through the GIS application, fig.2. Mapserver enables the user to view and query the vector data. The first approach is to navigate on the cartography with user friendly panning and zooming procedures.
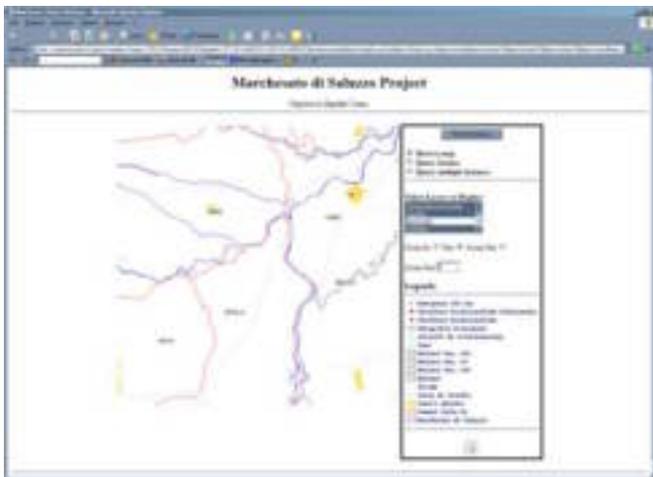
Figure 2. Mapping Interface

The user can also highlight different layers according to the scale of the view. Secondly, Mapserver lets you query the feature you want to analize simply by clicking on it (fig.2). This procedure query the dbf file associated with the shape vector file. In this step we decided to not use MySQL server for graphic queries because the MySQL support is still in beta version and it's not very stable.

The power of this system consists in the possibility to interrogate the MySQL server through a user friendly interface. It is possible to select the kind of feature (churches, cities, castles...) you want to have information about and the municipality where you want to focus your research (fig.4).

Figure 3. Portal Home Page

Figure 4. Query module: structure selection

Figure 5. Query module: municipality selection

Figure 6. Query results

Figure 8. Remote Database Administration: authentication

The results are shown in a table (fig.6) and it is possibile to locate the results on the map. You must click on the record to show and highlight the feature selected on the map (fig.7).
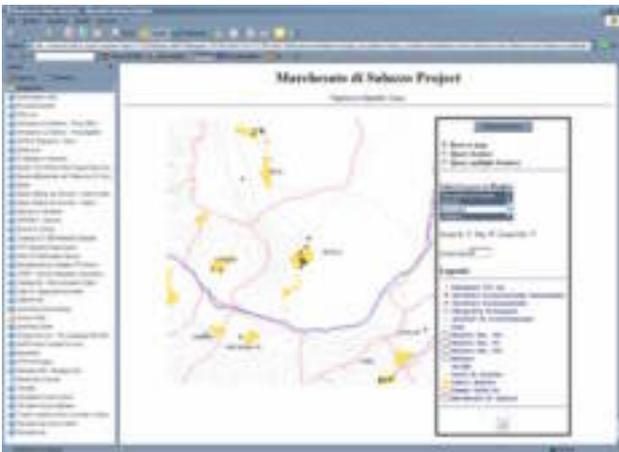
Figure 7. Query results on the map (link between the database and the mapping application)
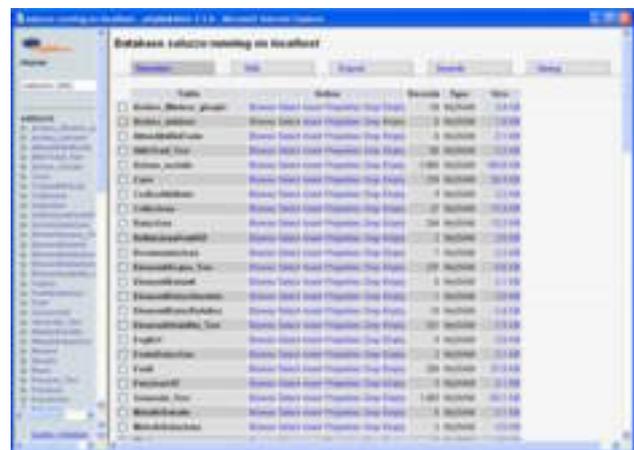
Figure 9 Remote Database Administration: DB structure

From this point users have the opportunity to use the above described interface to interact with the map.

Another possibility given to a selected group of advanced users is to manage the database or part of it, as shown in fig.9. Users can visualize, modify and query all the information in the tables they have the privilege to access. We built this functionality using another open source application called phpMyAdmin. To be able to use this tool you have to log-in (fig. 8). In the so-called "advanced query", specialists can use specific tools developed for their own needs and this is very important in order to achieve our goal, that is cooperation and interaction with the advanced users. We want them to have the best query tools.

If we consider the stand alone GIS realized in this project [Ardissone 2003] and the shared tool that has been illustrated above, it is evident that they don't offer the same functionalities. Let's have a look at the differences. The two systems offer the same functionalities to navigate and query the map. The main difference in the Web application it is the lack of some tools, such as distance measurement. The Web/GIS application wants to be an instrument for sharing information, so each tool needs to be designed by administrators in order to make the site more closer to real users' requests.

The condition and temporal queries aren't yet fully developed and they will be implemented in the future. At the moment only more useful functions are available. The users can interrogate the database in both applications. To be able to use the Web\GIS application they have to be familiar with SQL language, because at the moment there are no pre built masks. However, they have the possibility of querying the whole database, as they are using a normal DB management software like MS Access. If we consider for instance the research of all the castles the results are the same using the two tools (fig 10).
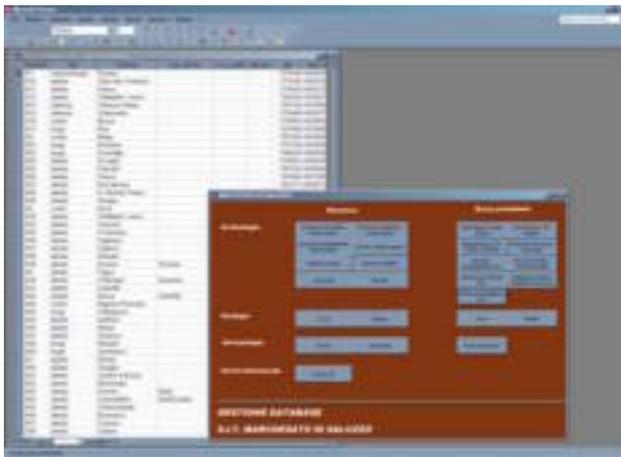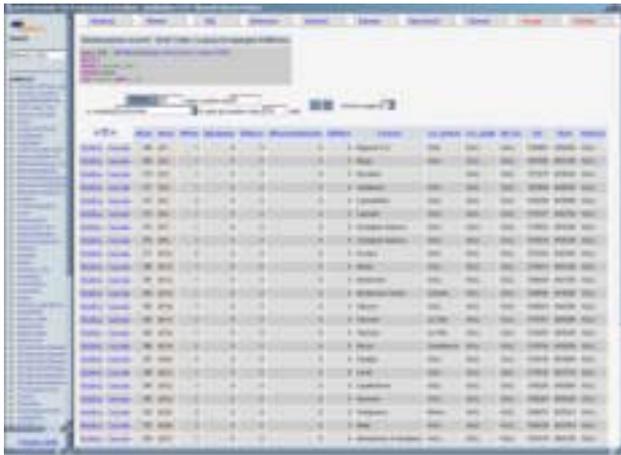
Figure 10. DB queries in both systems (top: web application)

4. CONCLUSIONS

The publication process on the Internet has shown the chance of transforming a complex stand-alone GIS in a shared application: we have illustrated the benefits of an operation of this kind.

It's important to underline how the use of different Open Source applications made it possible to get a completely personalized tool, without spending money on software royalties.

Future perspectives
The project is still in progress and maybe the screenshots you see in this paper may change; next steps will be:

- improving user interface
- developing advanced query tools for selecting objects by location and to manage problems of location likelihood;

- developing a tool for web administration of MapServer configuration mapfiles
- creating a synchronized system for updating the databases, Access and MySQL as well.
- Improving multimedia aspects for the turistic promotion
- Using MySQL support as soon as it becomes stable using it with MapServer in order to avoid having two

different groups of alfanumeric data (database and DBF files)

- Introducing the use of the raster format, which is not available at the moment.

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