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WEBMAPPING IN THE HISTORICAL AND ARCHAEOLOGICAL SCIENCES. AN INTRODUCTION

1. Introduction

The definition of webmapping is easy to give: mapping by the web! But the development of the computerization of spatial data has also involved a large extension of the semantics of the word "mapping": is it only maps? Or is it also GIS? Or is it all the methods exploiting spatial data either by their coordinates (vector mode) or by pixels (raster mode) applied to various applications in the human and social sciences, including Archaeology? And by the web, we mean, of course, a data network for the communication at any distance between two actors, using a computer.

Webmapping concerns all the methods and applications using spatial data, at any distance, between two actors equipped with computers, either in a collaborative mode (two workstations among many workstations) or in a client-server mode (a server and a workstation among many workstations). The alternative is of course a stand-alone workstation used by a searcher or a server in a laboratory shared by a certain number of local or nomad workstations used by the searchers of the laboratory.

The second case is already the beginning of a webmapping when searchers are nomad and need to connect, for example, from an archaeological site during excavations or a museum when studying a collection. Therefore, it is clear that the choice between "stand-alone" mapping and webmapping does not concern computerized techniques (the technical solutions have been available for more than ten years) but the users and their applications.

2. The computerized context of webmapping

2.1 *Hardware and architecture*

Webmapping applications are integrated in the context of the classical and historical triangle of the hardware architecture:

– the centralized server of the golden period of the sixties and seventies (the mainframe);
– the network connecting all the systems ("networkcentered") of the eighties (the X25 standard and the Videotex, the precursor of the present web), refunded by the web revolution from the years 2000;
– the workstation, born from the marriage of the terminal and the personal computer in the nineties, developed as a microcomputer first used as a stand-alone system and now connected to the web.

Webmapping is an example of a spatial computerized application starting on a stand-alone workstation of various levels of performance (from microcomputers to special powerful workstations) to network connection to a server by the web. The worldwide development of the web, increasingly used for professional purposes, despite the lack of network administration and security, but boosted by the low cost use of the network, is the explanation for the growing transfer from stand-alone to connected applications, including webmapping.

2.2 *The duality Process versus Data*

In computerized applications, the duality Process versus Data is as old as the first computers. By Data, we generally mean Data Bank, Data Base, Meta-Data, lexicon and thesaurus, maps, reports, books, etc. In Archaeology, typologies or archaeological maps are Data.

By Process, we generally mean a task using as entry data or events and producing data or events. A program, a real time task, a decision, a procedure, a method are all processes. In Archaeology, data retrieving, survey, excavation, rescue operation, edition, authorization for excavations, post-depositional processes, cleaning and use of dumping areas, abandonment process, sedimentation processes, manufacturing process (*chaine operatoire*), taphonomic process, raw material procurement, cultural change and transition, etc., all are processes. The concept of archaeological object may be also conceptualized as a process (Lefebvre *et al.*, this volume).

We cannot ignore that the concept of Process has been used to name the so-called “Processual Archaeology”, best known as “New Archaeology”, as dedicated to the renewal of archaeological research from classical typological approaches.

Archaeological webmapping is data oriented, for cartography. But Data (various maps) and Process (archaeological applications) may be integrated in a global approach, when GIS are used for the development of models of landscape exploitation (raw material procurement, food resource management; location site studies, etc.) or Cultural Resource Management (CRM).

2.3 *The duality free software versus editor software*

Archaeologists are more and more concerned by the question of a strategy based on the use of free software or by software distributed by the Editors. To summarize, free softwares are free, proprietary softwares are costly and archaeologists have very limited budgets! Unfortunately, there is no spontaneous generation for the cost reduction! What is free in one place has to be paid for in another. And the user in most cases does not control the process.

In the history of computers, UNIX may be viewed as a victory of software editors over hardware manufacturers, to avoid duplicating a version for each proprietary Operating System. The debate about free software may be viewed also as a struggle between Editors and Engineering companies. The revenue is much more important for engineering companies when they have to adapt and integrate free software than when they have only to parameter the package of an Editor. The added value of a package cannot be neglected. The choice for the free software is particularly recommended in the case of a monopoly or a cartel of software Editors and when the user has a team with enough know-how and stability to have the guarantee of a long term availability of the application.

It is not the place here to list all the modules available in the open source world or all the products of various GIS Editors of the market. We will only give an example of a choice between open source and proprietary software for a webmapping application: the open source MapServer software has been developed by the University of Minnesota (UMN) in cooperation with the NASA and the Minnesota Department of Natural Resources (USA). ArcGISserver and GIS Portal toolkit are two products distributed by the Editor leader in GIS, ESRI, dedicated for building a Geoportal.

3. What interest for webmapping in social and human sciences?

Due to important needs in hardware resource (memory, powerful graphic boards, UC, etc.) and costly proprietary software, the beginning of mapping and GIS was started on dedicated powerful workstations (Sun, HP, or even high performance Silicon Graphics machines) and immediately under Unix OS. Such environments were generally installed in specialized laboratories providing know-how and support both in computers, mapping software or GIS and even applications.

Progressively, the evolution of hardware and the development of multimedia applications have offered users better performing workstations at lower costs. Moreover, performing mobile computers may be used as workstations for the same purpose.

The democratization of the mapping applications and the reduced price of software licenses have naturally convinced the users to become autonomous from the specialized laboratories and to use their workstations for mapping applications as well as for other general applications, like an on-line machine, connected to the Internet network.

However, the development of mapping applications in a context of a stand-alone machine and a stand-alone searcher is a source of problems, particularly in Archaeology, for many reasons:

– the GIS projects are technically difficult for historians and archaeologists, who, in most cases, do not have a solid technical background;
– the searchers do not know how to formalize their problems and how to

specify their needs, in a comprehensive and consistent way, to manage top-down projects;
– in the Humanities, the searchers have not been trained to be project managers, to optimize the contribution of the technical staff or the data acquisition needed for the project. How can the technical staff be supported, while keeping their motivation high?
– data acquisition cannot be a clearly defined task at the beginning of the project. Data acquisition, in History or Archaeology, may be the most difficult aspect of the project and may cause significant delays or limitations;
– the GIS tools are always difficult to control for searchers who do not use them continuously or directly by themselves, requiring on-line support for users having problems;
– archaeological projects need numerous interactions among actors of different levels of computer know-how: users, data producers, searchers, GIS specialists, who need to find collaborative tools in the available software;
– for complex projects, the designed systems involve heterogeneous teams, located in different places: remote data acquisition, nomad connections, and collaboration are now essential.

4. Solutions for webmapping architecture

4.1 *The server for webmapping applications*

The hardware architecture of the server is based on a well performing computer, configured to be connected to a network (generally Internet) and shared among numerous on-line users working on workstations (generally PC) connected to the network. The server is designed as an Internet portal. It may be easily upgraded by adding new hardware components. The server no longer needs to be located in a special computer center.

The user may work in a stand-alone mode on his workstation. When he is connected to the server, in an on-line mode, he needs to have his own private user environment, administrated by the server. The configuration of the server in the client-server mode or in the light terminal mode is not considered here as adequately open for scientific searchers.

The software architecture of the server must adopt modern technical solutions including the choice of ISO standards and others, like the use of Java servlets and of API for interfacing software.

The European Community has recently published a directive for spatial information: INSPIRE is a Directive (2007/2/EC) of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in the European Community. The purpose of such an infrastructure is to assist policy-making in relation to policies and activities that may have a direct or indirect impact on the environment. The Directive entered into force on the 15th of May

2007 (Draft Implementing Rules for Metadata, Version 3, 26/10/2007).

Metadata and cataloguing is a major functional module for webmapping. ISO standards 19115, 109110, 19139 have been referenced for this purpose: describing geographical data and maps necessary for documentary query. Open source softwares are available: Geonetwork at present in the version V2.2.0 and its French application Geosource, developed by the BRGM (in a version V1.1 dated 07/2007).

A webmapping open source software also needs a database (like PostGis a spatial extension based on the open source relational database PostgreSQL, using the SQL standard), a cartographic engine (like Geoserver or Mapserver), a framework for application development (like Mapguide), a webservice (like Mapfish or Cartoweb on Mapserver).

4.2 *The main functions of a webmapping server*

The functional architecture of the applications installed on the server is designed by modern BPM (Business Process Management) methods and tools, involving the progressive urbanization of the archaeological information system.

The main functions of a webmapping server are:
– remote controlled acquisition of data and maps;
– recovery of maps and data regarding archaeological and historical projects;
– visualization of various maps (viewer);
– a spatial meta-data catalog;
– on-line technical support and learning;
– collaborative work;
– messaging service for data diffusion;
– interface of communication with the public;
– integration in the archaeological information system;
– data security;
– directory service and authentication of users (LDAP);
– data backup;
– access to a common application and software, shared by a collaborating team.

4.3 *The Geoportals*

The webmapping server is a part of a more global Geoportal. Wikipedia says that «a **geoportal** is a type of *web portal* used to find and access *geographic* information (*geospatial* information) and associated geographic services (display, editing, analysis, etc.) via the *Internet*. Geoportals are important for effective use of *geographic information systems* (GIS) and a key element of *Spatial Data Infrastructure* (SDI)».

For example, in the definition of the GEOportal realized by ESA (European Space Agency), the GEOportal is providing an entry point to access remote sensing, geospatial static and *in-situ* data, information and services:

«To that extent the GEOportal will provide access to information, data and services to better understand, monitor, conserve, predict, or simply improve the management of:

– Natural or human-induced disasters e.g. earthquake, flood disaster.
– Health and well-being issues e.g. air or water pollution, food security.
– Energy resources e.g. renewable energy, energy exploitation.
– Climate changes and variability e.g. impact on vegetation.
– Water resources e.g. safe water, soil moisture.
– Weather forecasting and warning.
– Ecosystems e.g. impact on terrestrial, coastal and marine resources.
– Agriculture e.g. impact on poverty, land use, farm system, and desertification.
– Biodiversity e.g. conditions of ecosystems, evolution of species.

The GEOportal will allow the users:

– To discover which data, information and services are available in GEOSS.
– To access the GEO Clearinghouse to search data catalogues and data sets.
– To visualize geographical information, maps and imagery from various sources, e.g. from different GEO Societal Benefit Areas through WMS services.
– To browse through a comprehensive directory of services providers e.g. related to GEO Members and Participating Organizations.
– To retrieve Earth observation education, training and capacity building resources and services of many types. E.g. tutorials on Earth observation techniques, data analysis, interpretation, or use.
– To access information from GEONetcast».

The INSPIRE Community Geoportal is Europe's Internet access point to a collection of geographic data and services within the framework of the infrastructure for Spatial Information in Europe Inspire Directive.

Since 2006, numerous Geoportals have been realized: Google Earth for satellite images, the French "Géoportail" made by IGN (Chaumet, this volume); the US Geospatial One Stop (GOS) Geoportal; and many others like the interregional Geoportal GRISI financed by the European Community.

In France, the Ministry of Culture started in 2000 a project of Geoportal called "Atlas de l'Architecture et du Patrimoine" which is not yet operational today and is based on the prototype of the "Atlas du Patrimoine de la Seine-Saint-Denis" (Héron, this volume).

A project of Geoportal of SHS (Human and Social Sciences, CNRS) also started in 2006, under the responsibility of the M^2ISA laboratory, but the portal is not yet operational.

4.4 *A theoretical archaeological Geoportal*

4.4.1 General functions of an archaeological Geoportal

– access control and authorization control, based on a LDAP directory;
– collaborative working;
– mapping functions;
– BPM archaeological functions;
– system administration services.

4.4.2 The BPM functions of an archaeological Geoportal

– archaeological documentation management;
– archaeological risk management;
– archaeological rescue and programmed operation management;
– archaeological publishing management;
– Cultural Resource Management (CRM) for Archaeology;
– information diffusion management for public.

4.4.3 The Geoportal hardware and software architecture

The architecture of a Geoportal owns the characteristics of a modular and opened Web 2.0 portal:

– a N-level system architecture, using a web platform (Apache, etc.);
– a GIS software (either proprietary or open source) configured in a server mode;
– general mapping functions: map sharing, map consultation, map retrieval, map manipulation, map extraction, map visualization, map specialization, etc.;
– general functions for nomad acquisition, collaborative work, e-learning, e-support, global Web 2.0 portal, etc.;
– technical team offering a centralized service;
– the choice of software offering a quality of performance, evolutionary, timelessness, availability, whatever their OS environment;
– the choice of existing and forthcoming standards.

5. Archaeological applications

During the Paris webmapping Conference, archaeological applications were presented and many of them showed the partial or global characteristics of webmapping. This is the case for one of the more ancient webmapping project, the ECAI project (Electronic Cultural Atlas Initiative), active since 2000. The ECAI server is using the software TimeMap developed by I. Johnson (Johnson, this volume).

In France, prototypes have been developed and may be considered as good experimental models for the development of webmapping applications: the Seine-Saint Denis Atlas (Héron, this volume), the Sigur project for the city of Rennes in France (Lohro, this volume), the Aspro Atlas of the Middle East archaeological sites (Barge *et al.*, this volume), the Val-d'Oise Atlas (Costa, Robert, this volume), the urban atlas of the city of Toulouse (Urban-Hist).

It is also possible to say that the hardware and software are ready for realizing an archaeological Geoportal, using either proprietary software (ESRI, this volume) or open source solutions (Coutard *et al.* 2005; Jamet, Guillaume, this volume), and we are still waiting for operational Geoportal in our institutions (CNRS, Ministry of Culture). The IGN "Géoportail" is announced as being ready to integrate archaeological applications.

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ABSTRACT

The paper introduces the concept of webmapping in the archaeological and historical sciences. The interest in offering an online mapping service is developed in terms of collaborative working, technical support, e-learning, mapping functions, and hardware and software architecture. The integration of the webmapping functions in the more general case of a Geoportal is also considered. Examples of operational Geoportals and projects in progress are also briefly described, most of them being detailed by their authors in the present volume.