

# Structure and Realization of Electronic Atlases

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## **ABSTRACT**

*Usually the decision with one of the two types of media (CD ROM or Internet) to be applied for electronic atlas depends mainly of the target audience as both two medias have their own advantages and disadvantages. Nevertheless according to the in full force enlargement and development of the World Network as new media for information exchange, the products disseminated by it are considered as an extension of the electronic atlases issued on CD ROM. In the paper the structures of the two types of media are investigated as the technologies for realization including mixed solutions.*

Usually the decision with one of the two kind media (CD-ROM or Internet) to be applied for electronic atlas depends mainly from target audience because both the media have its advantages and disadvantages. In spite of this in connection with the fast enlargement and growing of the World web as new media for exchange of information the products distributed by it are considered as extension to the electronic atlases issued on CD-ROM. Internet electronic atlases derive automatically the advantages of CD-ROM atlases. For example: the interactive presentation, the connection to data base, functions for analysis and the integration with multimedia remain the same. In addition they have the follow advantages:

- **Better and easier accessibility**

The access is possible from any computer, in any time.

- **More often refresh**

The refresh cycle could be very short by request. Both and the back connection with the user is extremely easy realizable.

- **Simplified and economical profitably dissemination**

The CD-ROM atlases have similar volume of sells, marketing and distribution as ordinary atlases printed on paper. Internet atlases save up the expenses for printing, recording, transport and distribution.

- **Less efforts for independence from computer platform**

The independence from computer platform means for CD\_ROM that the application has to work at least under Windows and Mac OS operation systems normally that means development of two applications. Concerning Internet atlases the independence means that the content could be examined in all actual browsers. Theoretically each one computer with browser what support Web standards independent from operation system can be considered as separate platform. But reality is that the different browsers of various software companies more often are different under different operation systems and very often also one other then second by the method for web-site presentation, therefore they have to be considered as separate platforms. Despite this the independence from the platform can be achieved comparatively easy now and in the future it is expected to do this with fewer efforts.

- **Unlimited volume of information**

The capacity of one CD-ROM is limited to 700 MB and one DVD-ROM disk – to 4 GB, as the distributive media theoretically could have unlimited volume depending from technology applied for the creation of application. From other side one CD-ROM has extremely higher transfer of data that permits work with much more detailed and bigger map products.

Depending of the task of the electronic atlas the combination from both media could be done. For example one CD-ROM atlas could be update via Internet and vice versa one Internet atlas could have a version on CD-ROM. More of electronic Internet atlases could be issued by this way. The back is however very difficult to realize.

## **Structure an realization of CD-ROM electronic atlas**

Two approaches exist for realization of one CD-ROM atlas: using GIS software and some multimedia elements in addition and using software for creation of multimedia applications and GIS functionality in addition.

### **Multimedia in GIS software**

This approach uses the available commercial GIS software, extended with additional multimedia elements. The built in functions for keeping and processing of space data are mainly advantage of this approach. All the same these systems are created mostly for analysis and more often they could not offer some multimedia tools as well as to produce maps with minimum cartographic quality. Also the interface that they use is very complex and requires some knowledge that is why the atlases created by this way are more complicated to use.

In this approach for creation of electronic atlas the so-called GIS visualizers could be used what permits to explore and mapping a preliminary prepared spatial and statistical information. Such free visualizers are developed by more producers of GIS software as for example ArcExplorer from ESRI and ProViewer from MapInfo.

### **GIS functionality in multimedia software**

In this approach the tools for creation of multimedia applications are used what are extended with definite GIS and mapping capabilities from authors of atlas. Such approach leads to high quality of visualization and easy integration of all kind multimedia. As usual these applications are more flexible and this contributes for propose of simplified graphical interface and independence from applied GIS environment.

Despite the advantages this approach has his disadvantages. A big part of existing tools for development of multimedia application are expensive products that do not offer built in mapping or GIS possibilities. Their realization is very labour-consumption and require excellent programming skills. That is why a lot of existing multimedia electronic atlases do not have GIS possibilities over simple distance measuring, request to data base and inserting or exclusion of layers.

## **Structure and realization of Internet atlas**

The realization of cartographic internet product consists a lot different tasks. Different approaches exist for this depending from the target of application varying from simple collection of static maps to the dynamic GIS applications what permit to users themselves to create maps.

The Internet atlases could be classified by the kind of maps they use. The common in all approaches is the use of one client-server structure in what one application has been separated to tasks what are exchanged between the client and the server. Depending of distribution of the tasks there are client-side and side-client technologies for realization of Internet atlases.

### **Client-side technologies for realization**

The use of these technologies supposes that all the information and map application are loaded in user's computer (client). Once loaded the application is completely functionally and could work even without connection to the Internet. Client-side technologies have the following advantages: the processing of information is completing using the computer client and the capacity of Web-browser. Therefore the speed of processing depends only from the speed of user's computer, which permits fast interaction and remove the defect of comparative slow transfer of data via Internet. Other advantage is the link between capacity of server and it loading. In other words if the server has limited computing capacity the processing of data in the client-computer permits the serving from server of more clients simultaneously. Client-side technologies have also its disadvantages. The biggest one is appearing with more quantity volume of information. Then the users have to wait some time for the loading of application. Despite the speed of data transfer is increasing constantly the download still require some time. The users have a little patience with pages witch are loading slowly. "If the time exceeds 6-10 seconds the user stops to focus on the current page and will try to do some other work during this time, when hi waits answer from system" (Nielsen, Y).

The difference between existing browsers is also important disadvantage. Today's browsers are developed to some much more then simple readers of data. Each one of them has different tool for transforming of graphic and different interpreters of script languages, and, also different devices for security and additional extensions. The built in capacities of each browser have to be considered when an Internet application is designed in order to affect equal on the different systems. Despite there is some level of equation due to the efforts for standardization of presentation of

content in Internet, taken by W3C, at the moment each one of the different browsers has different capacities. More used browsers at the moment are **Internet Explorer, Mozilla Firefox, Opera** and **Netscape Navigator**. They are used in different versions what leads to many efforts in the creation of applications that are independent from the platform. Client-side technologies are HTML/XHTML, JavaScript and Document Object Model (DOM), Flash, SVG, Java applets (based on the object oriented language Java) etc. as the realization of the cartographic applications lies on one or combination of few technologies in order to reach the better result.

## Server-side technologies for realization

Server-side processing of information means that one query or action of the user is forwarded to the server where an appropriate answer is determined by fixed program. After the preparation of the answer the server send it as static HTML page. The server-side application could be developed using different technologies what could work on different computer platforms. Server-side technologies are what is behind the dynamic development of Web-sites and maps, the emailing, the access to the remote data base and more other tasks. The server-side scripts could be written by different script and program languages. The more popular are: Perl, PHP, Python, Java, C, ColdFusion, ASP, ASP.NET etc. Concerning Internet maps and atlases the server-side approaches have few advantages. They do not have limitations for the volume of information as the space and statistical data could be saved in data bases what are accessible on the server. The server-side programs accept the requests of the maps users and change the current content of related data bases and after that forward the new content via Internet. This way reach significant decreasing of the data transfer as only the requested information could be transferred not the whole composition of data.

The other advantage is the dropping out of necessity for the additional attention to the compatibility with the Web browser on the user computer as the server offer the interactive part.

The disadvantage of this technology is that each user act, for example zoom, and call a determined procedure on the server and some time passes till the result appears. This from one side requires the user to be connected to Internet permanently and from other side is not comfort when the time between the request and the answer is very long. This time depends from the power of the user computer, from the speed of the connection transfer and from the capacity of the server. All the servers have limited computing power despite the development of technologies increases their capacity, the delay often is because of overloading with requires. The fast and direct work with the maps is exclusive important for the keeping of its interactive nature.

The more widespread approaches for development of server-side internet cartographic application are described bellow:

**CGI (Common Gateway Interface)** – CGI is classical approach for realization of server-side application. It permits to the developers of such application to use a great diversity of program languages (for example Perl, C etc.). CGI is set of rules what conduct communication between HTTP (Hypertext Transfer Protocol) server and the programs that work on it. This that makes one program CGI program is the way in witch it accepts and reply the information received from Web server. It does not contact directly with the Web browser but receives query from server and sends answer, after that the server forwards the information to the browser. The disadvantage of this approach is that the connection with the server has to be cut off and set up again each time the user acts or makes requiring.

**Java Servlet** – Java Servlet is similar to CGI technology for communication between server and client. These are programs written in language Java what work on the server. Java Servlet has some advantages comparing to CGI scripts because it is initialized once and after that it stays residential in the memory. This leads to high effectiveness. The bigger advantage of this technology is that it is not commercial product but follows the philosophy of open source.

**PHP** – PHP (recursive abbreviation from Hypertext Preprocessor) is script language with open source for development of Web pages and offers excellent possibilities for its connection with the more of popular systems for data base management as, for example MySQL, Oracle, ODBC, Sybase and others. In difference to Java Servlet it is easier for realization and offer high effectiveness and security that is why it is the fast developed language for server-side applications.

**ASP** – Active Server Pages (ASP) is technology of Microsoft for development of dynamic Web pages with connection to data base using built in scripts written in VBScript or Jscript (the alternative of Microsoft to JavaScript).

Despite the mentioned disadvantages server-side applications are potentially more powerful than client-side applications. The use of server-side technologies for realization of cartographic product requires specific developed applications. This requires excellent skills in programming and good knowledge of all components of the system. More of the GIS software developers offer alternative: *the so-called map servers* in order to assist the development of Internet cartographic products.

## Map servers

This term generalizes in it the different, in more case commercial, software decisions what offer ready approaches for fast, effectiveness and without problems realization of cartographic visualization in Internet. In more cases the applications are designed to operate fast and precise with limited kind functions for analysis of space information without the need of development of additional software for server by cartographer. The HTTP server and the map server could be on one computer or on two different computers.

Nowadays the map servers offer some GIS functions and because of this the terms **Internet GIS** and **Internet mapping** are often fitted together with them.

The main advantage of map servers is that the cartographers could trust them for interactive processing and to concentrate on design of graphic interface and the content. From other side the use of map server presumes commitment with definitive GIS products that leads to high price and predetermined functions. That means they do not permit input of new specific functions as in more cases the source-code of commercial cartographic products is not accessible. Also, as the other server-side applications, the map servers are depended from the speed of connection to Internet in order to support interactive environment.

Examples for such servers are:

- ArcIMS of *ESRI*;
- MapXtreme of *MapInfo*;
- MapGuide of *AutoDesk*;
- Sicad Internet Suite of *Siemens*;
- GeoMedia Professional of *Intergraph*.

## Mixed decisions

Frequently in practice mixed decisions are used – combining powerful sides of both technologies in order to satisfy the needs of target audience. For example it could use SVD maps what ensure the functions *zoom* and *pan* together with programmed in JavaScript additional functions (for example displaying additional information, switching over layers ore choosing of map theme). In this case server-side applications could be used for support of data base with statistic information needed for representation of different thematic maps or answer of requires.

The most attractive and popular cartographic application in Internet nowadays – <http://maps.google.com> is created exactly by mixed decision achieving an extremely interactive and speed of representation. The main technologies for realization of this application are dynamic HTML (DHTML) and JavaScript with, in order to reach better speed, use of built in possibilities of some browsers, precisely XSLTProcessor what permits XML data to convert to HTML but this is on client not as expected on server, because of this there is economize of computing power of server and capacity to serve of millions requires of maps per second. From other side the entire graphic information is on servers and is organized and saved in format RMF (Reach Map Format – format with high compression of data property of company Telecontar). This application works only in some of more widespread browsers as the XSLTProcessor is accessible only there.