DISSEMINATION OF THE
SPATIAL DATA USING INTERNET

Dang Van Duc and Le Quoc Hung
Institute of Information Technology
18, Hoang Quoc Viet Rd., Cau Giay Dist., Hanoi, Vietnam
Email: dvduc@ioit.ncst.ac.vn; lqhung@ioit.ncst.ac.vn

ABSTRACT

This paper introduces our GIS software called MapOnline (a tool for distributing spatial data through the Internet) and its capacity of applying. The structure of this paper is as follows: after mentioning about the context of the MapOnline development, two architectures chosen for the system design will be described. Lastly, we will present some applications that have been designed and developed on the MapOnline.

1. INTRODUCTION

Nowadays, Internet becomes the best environment for distributing and exchanging information to users all over the world. The Internet increases also in the efficiency and effectiveness of the ways in which users obtain, use, and share geographic information in all its forms. In recent years, some Distributed Geographic Information softwares (DGI software) - Geographic Information Systems online (GIS online) are developed. DGI softwares deal with the use of Internet technologies to give people access to geographic information in a variety of forms, including maps, images, data sets, analysis, operations and reports in real time (Brandon Plewe, 1997).

The basic architecture of DGI applications is similar to the client/server model. In this model, the client presents the data to the end-user, the server processes the client's request and contains data and applications. However, according to (Brandon Plewe, 1997), basing on the distribution work for client and server, it can be assorted to four types of client/server balance as summarization in the table 1. Columns represent the possible solutions to the separation of client and server tasks whereas the rows represent the tasks accomplished by the client and server in each solution.

Table 1. Types of client/server balance

|	**Thin Client**	**Balanced**	**Thick Client**	**GIS Client**
Server Tasks	Map browsing Query Analysis Map Drawing	Query Analysis Map Drawing	Analysis Map Drawing	File serving
Transfer	Raster maps	Raster/vector	Vector maps	Raw data
Client Tasks	Display	Display Map browsing Query input	Display Map browsing Query	Display Map browsing Query Map drawing Analysis

When build a DGI application, the selection of efficient architecture must depend on the purpose of service and current infrastructure of network. This paper introduces the solution of building GIS online software called MapOnline, which is suitable to Vietnam conditions.

2. MAPONLINE

The MapOnline is a GIS-Web integration. It is a tool for distributing spatial data through the Internet. It offers wide range of functions for geographic information management and decision support. Customers can use MapOnline to build and manage one or more GIS databases for different purposes. Two versions of MapOnline basing on the Balanced architecture and Thick Client architecture have been developed; it gives more choices to different kind of customers. What version will customer use? The answer depends on many factors: network traffic, audience number and software maintenance requirement.

2.1 Balanced Architecture of the MapOnline

Figure 1 is the general design of MapOnline basing on Balanced architecture. This model follows the Three-Tier Client/Server Architecture of Internet Interaction (Ramesh Chandak, 1998). In this architecture, the client with a web browser assumes an extended GIS program in form of ActiveX/Java Applet, which provides addition functions to mapping and data processing in order to decrease the server's workload. The server is installed Web services, GIS Interface & Manager Program, GIS softwares and GIS database(s).
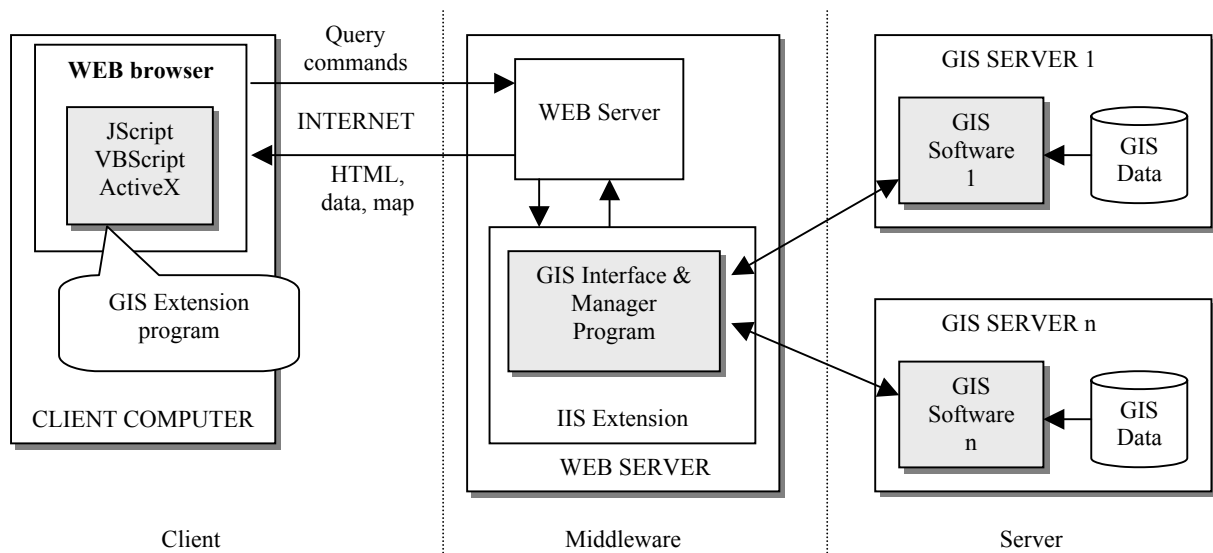
Figure 1. Balanced Architecture of the MapOnline

When someone makes a request for map or data, an URL command is created by GIS Extension program on client, this URL is sent over Internet to the Web server. The server recognizes it as a DGI request and passes it to GIS Interface & Manager Program, which analyses preliminarily and translates it into internal command. This is passed to the suitable GIS software. The GIS software processes command, creates result (map, text, HTML or raw data file) and return result to GIS Interface & Manager Program. The GIS Interface & Manager Program is then responsible for reformatting the output into an Internet-standard

format. The reformatted is then returned by the Web server to the client. GIS Extension program on client receives the data result; more processes the data and display final result.

This architecture enables most clients draw out geographical information as requested; the installation and maintenance take place in the server side only. But it also requires the servers need to be highly configured to meet demands on time delay and access rate from clients.

2.2   Thick Client Architecture of the MapOnline

This architecture (Figure 2) fully uses working capacity of clients, whereas servers are not required to be powerful hence save initial budget for servers. In this architecture, the client sends request for data and maps from the server, then analyzes, processes and displays results, thus minimize the access rate to the server. From the server side, GIS Interface & Manager Program receives requests through HTTP protocol, pulls out data and maps from an appropriate GIS Software and send back to the client through HTTP and FTP protocols.

This architecture requires powerful clients that are preloaded with the GIS Software.
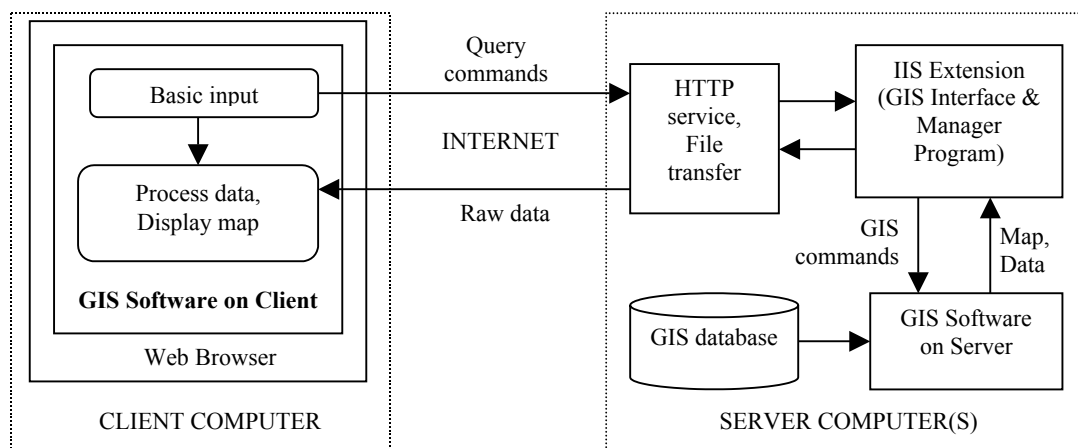
Figure 2. Thick Client Architecture of the MapOnline

2.3   Programming MapOnline

MapOnline is developed by Microsoft Visual C++ and the Internet Map Server (IMS) programming tool of ESRI (ESRI Inc., 1998). Visual C++ is used to build the interface with GIS database.

The GIS Interface & Manager Program on server is the Internet Information Server Extension (IIS Extension), which is written by Visual C++ with IMS library. The program receives request from clients, manages server's GIS Software as a GIS gateway.

GIS Software on Server is developed by Visual C++ in combination with ESRI map library. Visual C++ is used to build the interface with GIS database. GIS database is designed on the basis of PopMap (a GIS product that we developed for the United Nations and it is widely applied in many domestic and foreign agencies (United Nations, 1998)). The database

is accessed using Microsoft's ODBC. HTML and JavaScript templates are also used to deliver final HTML pages.

The clients require Microsoft Web Browser, which can handle ActiveX and JavaScript. Written by Visual C++, ActiveX is able to exchange information with the server, access the local disk and display results. JavaScript is used to perform simple data processes such as calculation or evaluate inputs. With thick client model, map processing and displaying is enhanced by ESRI map library and Fomula One graphic library.

3.   MAPONLINE'S APPLICATIONS

MapOnline has been developed and installed on network of the Institute of Information Technology - National Centre for Natural Science and Technology of Vietnam. It has full of GIS basic functions for retrieving data, browsing and mapping. It also offers programs to control and manage MapOnline's users.

Retrieving data, browsing and mapping

MapOnline Data Retrieval System (Figure 3) offers a sequence of steps to get the base map and the data, to look at the data as a table or as a graph, and to create thematic maps dynamically. The user's interface of the MapOnline is similar to the PopMap for Windows. This is intended to enable a PopMap's end-user to use MapOnline application database without any specific training or support.
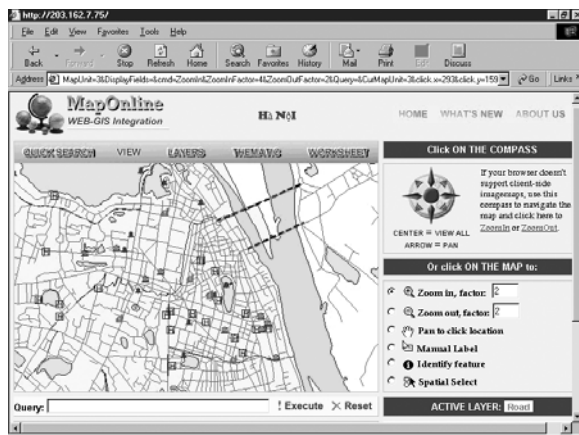

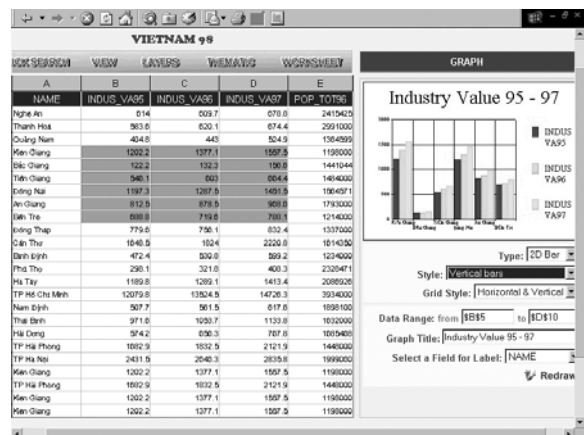| Figure 3. MapOnline with MS Internet Explorer | Figure 4. MapOnline's worksheet & graph |

MapOnline Data Retrieval System offers a simple, efficient way to access, analyze, and display data geographically. The built-in spreadsheet provides users with an embedded environment to process data, and graph data. After starting MapOnline Data Retrieval System on the server, the users can use any Internet browser (MS Internet Explorer, Netscape Communicator) to:
- Load administrative map and related features;
- Browse, zoom, "point-and-shoot" information display, measure distance, calculate summary statistics;

- Query data and retrieve database information by topic, variable, and time reference;
- Transfer retrieved data to the MapOnline spreadsheet for graphing (Figure 4);
- Generate thematic maps.

MapOnline Administrator

MapOnline Administrator is used to control and manage the MapOnline's users. It runs on HTTP server to filter data travelling to and from the server. The filter registers notification of events, such us logging on or URL mapping. MapOnline Administrator can be used to provide enhanced logging of HTTP request, to track who is logging on to server where MapOnline Data Retrieval System is, to maintain the list of users. MapOnline is subsidiary to Internet Map Server Administrator of the ESRI (ESRI Inc., 1998) which lets us

- Start and stop map services on one or more map server computers.
- Set properties of map services, such as allowing data download and specifying the number of map service instances to be created.
- Administer map services remotely by connecting to the network using telephony remote networking procedures.
- Check the status of map services, maintain the list of current services.
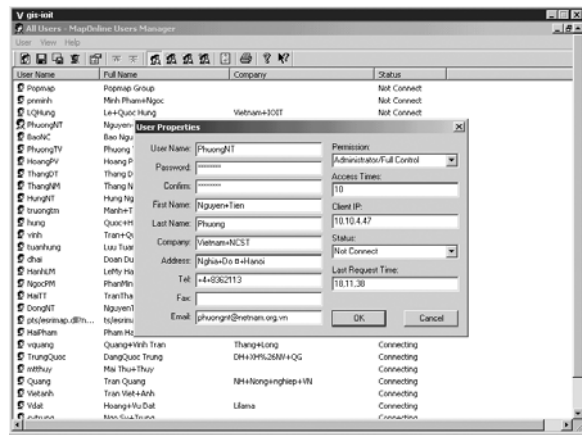- Manage MapOnline's users: add user, remove user, set user's permission (Figure 5)

Figure 5. MapOnline's User Manager

With current design and functions of MapOnline, managers can use MapOnline to develop useful GIS applications for many purpose in fields:
- Managing statistic data with maps,
- Managing transport systems,
- Tourism,
- Enviroment.

Some MapOnline's applications in statistics have been installed. Users can access http://www.ioit.ac.vn/gis-ioit to retrieve GIS data.

In tourism, we are collaborating with some other members to build the Hanoi Application. This application will give users many information about Hanoi, it also will have a series of useful functions allowing users can visit Hanoi virtualy or build their scheme's tour, ...

4. CONCLUSION

The paper has instroduced two architectures of MapOnline (an GIS online) and its capacity of applying. We are supplementing new special functions for retrieving and analysing spatial data such as overlay, buffering, ... We are also researching problems about 3D processing, parallel processing for spatial data and improving security of system and data.

5.   ACKNOWLEDGEMENT

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