

**SEARCHING INTERNET SERVER FOR THE ELECTRONIC LIBRARIES OF MAPS AND  
GEOSPATIAL INFORMATION METADATA AS A SCIENTIFIC AND PRACTICAL  
PROBLEM OF THE GLOBAL GEOINFORMATIC MAPPING**

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The development and implementation of the searching Internet server for the electronic libraries of maps and geospatial information metadata is considered as a new scientific and practical problem raised due to the integration of huge bank of various information resources (including geospatial information) within Internet. Solution of this problem allows to increase the effectiveness of information supply of fundamental researches in the area of sciences about Earth. It also will promote to form the united geoinformation space and develop its infrastructure. So the Project No. 00-07-90154 carried out under the aegis of the Russian Fundamental Researches Foundation pays main attention to the development of basic project decisions for creation of searching Internet server, structure and content of maps and geospatial information metadata, its modeling, encoding, marking, methods and algorithms for metadata indexation and search, and also for implementation of the Internet server as a real working experimental example and intellectual technology.

In 1991-1999 there was developed theoretical and methodological base, hard- and software, technologies and standards for geospatial data acquisition, collection, analysis, processing, search and retrieving.

Within the system of global geoinformatic mapping there will be organised (through WWW) free access to the query forms for searching maps and geospatial information metadata that is distributed

in various cartographic Web servers. It is planned to apply new approaches for the spatial search of metadata to solve this problem.

Now in archives and the specialized storehouses the big volumes of the cartographical information in paper and electronic forms are saved up. This information integrates results long-term scientific and practical activities of the qualified experts.

The effective utilization of this information in problems of processing, analysis and synthesis of the spatial data in fundamental and applied scientific researches, problems of a supply with information of works in various applied areas, is possible only under condition of use of the formalized mechanisms of the description of the cartographical and geospatial information, the centralized storage of these descriptions and search in them of the required cartographical and - or geospatial information.

One of ways of providing of access to the saved up information resources of the cartographical information can be creation of metadata of maps and the geospatial information storehouse.

Creation of the centralized, high available metadata of maps and the geospatial information storehouse will allow to solve a problem of fast search of the required geoinformation usage of the advanced system of construction of complex retrieval searches.

Let's consider the basic requirements to such centralized storage of a metainformation.

**High availability.** Gathering and storage metadata in the big volumes is meaningful only if it is possible to get not limited access to information resources. Now the most effective way of the organization of round-the-clock universal access to the electronic information is the organization of access to databases with use of opportunities of a network the Internet. Creation searching internet-servers may provide the Internet greatest possible, for today, availability of the information.

**High performance of calls to storage of the information.** Storage of the big information contents entails necessity of organization of effective procedures of the information retrieval. The user should have possibility precisely to formulate retrieval preference and to receive the answer maximum appropriate to search. Thus available mechanisms of storage and a data retrieval should guarantee with a high degree of probability, that the information available in the database can be retrieved. Rise of efficiency of call to storage is caused by several factors:

- Well information structure.
- High level query language.
- Optimum algorithms of search.
- Advanced language of construction of searches.
- Optimal search algorithms for the information.

**User-friendly interface.** Presence of well structured information and the advanced language of construction of searches yet do not guarantee, that at call to storage the user correctly can formulate retrieval preference to a query language. The user interface is called to provide interaction between the user expressing of preference to relatives to him terms and images from area of cartography and the retrieval computer, working with a formal query language. The goal of user interface to provide possibility to formulate search in understandable to the expert the terms used in cartography with usage of traditional images of maps, plans and schemes.

**Actual of information.** The manipulation to maps and the geospatial information storehouse will make sense only if the permanent job on updating, updating and removal of the out-of-date information is conducted. Maintenance of information funds of storehouse in an actual condition is carried out in several ways. First, due to realization of a constant, purposeful work on updating and maintenance in an actual condition of available information funds of matadata. Second, due to granting to holders of the cartographical information to place data, on cartographical primary sources available at them, in a database of storehouse. Third, due to development of the specialized procedures of the automated search and gathering of data on the cartographical information placed in a network by its owners.

For development of the server it is necessary to solve the following tasks:

The analysis of national and international metadata standards for the cartographical information, choice of the most suitable for the purposes of creation of a search site - the first task which is necessary for solving within the framework of development of a search site of the cartographical information.

Development of the formalized description of the query language - the second important task.

Designing of database structure for storage of the metadata fast and effective search of the required information - the third task of creation of a search site.

Development of specialized user query interface the fourth task which is necessary for solving within the framework of operations on creation of the retrieval server.

The chosen approach - creation of a search Internet - server determines base program architecture. At such decision of problems now traditionally use three-layer (generally multilayered) architecture of software. At such construction of a program complex as the basic elements the server of databases, a WWW-server, and client is used. Within the framework of a task in view base elements of a program complex carry out the following functions.

**Server of databases.** Carries out functions of storage and information search. Supports physical and, partly, logic structure of base of metadata of geographical maps and geobjects. Provides storage of qualifiers, dictionaries, the thesaurus, and base means of indexation of the data.

**WWW-server.** It will transform inquiries acting on report HTTP and transfers the information from a database to the client. The additional program module which will transform search inquiries is necessary for realization of complex requests to a database, and formats the received data according to requirements of report HTTP. This program module should realize the specialized search machine for search of the geospatial information.

**Client.** The offered architecture assumes use as the software on the side of the client of a standard browser. Programming of browsers with help DHTML, JavaScript and Java Applets allows essentially to expand functions of the client. It is especially important for qualitative realization of the user interface as the standard set of functions of a browser and opportunity HTML may not provide the decision of a problem of creation of the advanced user interface for formation of inquiries to base geospatial.

The listed principles were fixed in a basis of practical realization searching internet server for for the electronic library of maps and geospatial information metadata.

For creation of a Internet - server the following program and means were used:

- Unix server with FreeBSD operation system;
- PostgreSQL database management system;
- Apache WWW-server;
- HTML and JavaScript language for client programming;

**User interface.** Now the user interface is realized a kind of a set static and dynamic HTML the pages giving to the user access to the basic sections of a server, performance of search inquiries and viewing of results of search. Now on a server the following sections are submitted:

**Start page.** It contains the brief information on problems, the purposes of creation and principles of functioning.

**About project.** Works on creation of a server are carried out at support of the Russian fund of basic researches. On this page the brief information on the project is resulted.

**Results of researches.** It contains information about results of researches.

**The catalogue of library.** The basic section of a server in which opportunities of formation of inquiries to library of metadata and viewing of results of search are concentrated. In section parallel development of two kinds of the user interface - the visual formulation of geographical region simplified with an opportunity for sample and expanded within the framework of which there will be an opportunity of a formulation of complex request, including with use of the built - in language is stipulated.

As a basis for creation of the interface of construction of query to base of the metadata, intended for unskilled users, the metaphor of "a base map" is accepted. The user has an opportunity of navigation on a site with use of a set of base maps of different scale. Consistently passing from a survey map of globe to maps of finer areas of Earth, the user has an opportunity to determine geographical region on which will be is prospected in library of metadata. At the lowermost level (now such levels three) the user has an opportunity to choose the concrete area limited to the next lines of a geographical grid. The choice of this area unequivocally determines coordinates of a trapeze inside which search in library will be carried out. The user may specify parameters of a trapeze manually having corrected the appropriate values in the form of query.

The received results may be used for the further development of an Internet server for the electronic libraries of maps and geospatial information metadata for the purposes of the global geoinformatic mapping.