Geo-Database Model of the Republic of Macedonia

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Abstract. *This paper presents the basic model of the geo-database for the Republic of Macedonia. The model is based on the latest information technologies using GIS and integrated database, allowing further development and upgrading the geo-database. A list of digital data and maps is made which are to be included into the geo-database. The logical structure for entering data into the database, the service architecture of applications and the data redundancy are shown.*

Keywords. Geo-database, national data repository, GIS, vector map, digitalization, and vectorization.

1. Introduction

Based on the geo-database models from the developed countries (Canada, USA and the Netherlands) [1], the centralized geo-database model for the Republic of Macedonia is developed. This will allow efficient management of mineral resources, urban planning, ecology, and many other sectors.

Macedonian geo-database will be a focal point where ministries, private companies, faculties, and others will be searching for geoscience data and information. The geo-database will enable government institutions to be more efficient in controlling and managing geo-resources. Those data should be available to citizens and companies as well. It is the basis for the upcoming research and investments that will bring economical benefit to the country.

Financial justification of the geo-database is more than obvious. Dutch experience shows that the annual government investment in geo-scientific information is 0.1% from the value of the managed data and information resources [4].

Presently there is no government strategy for processing and archiving geo-information. Therefore every government institution in the Republic of Macedonia (ministry, university, and government agencies) is doing their own geo-data processing using different hardware and software solutions. This creates confusion and obstructs access to geo-data. The need for centralized geo-database and national policy for geosciences data and information is more than obvious.

This paper presents the first step towards building the geo-database of the Republic of Macedonia. It includes a selection of the basic maps, scale and data needed for the geo-database repository system. Logical description, service architecture and data redundancy of the geo-database are explained.

2. Motivation and related experience

In the past years, a team from the Faculty of Mining, Geology and Polytechnic worked on the digitalization/vectorization of paper maps and data. The goal was to include digital data into the geo-data repository system. Alongside with the digitalization, the strategy is being built of which data and maps should be processed. Digitalization of the maps is done with scanning and their vectorization. A number of graduation papers and master theses were involved in the research [3].

The team worked on the vectorizing of the basic geological map in scale 1:200000, hydro-geological maps in scale 1:200000, and other maps and data.

3. Geo-database model of the Republic of Macedonia

The geo-database model of the Republic of Macedonia is built on the framework taken from the developed countries. The model is based on the latest information technologies using GIS and integrated database providing further development and upgrading.

The first task is to determine the needs and strategy for creating centralized geo-database of the Republic of Macedonia. The strategy should contain a plan for including data into centralized geo-database. The process of including data into the geo-database should start with scanning paper data. Scanning paper data is of highest priority for the conservation of data. This means that all paper documents, maps, reports, pictures, should be professionally scanned and archived digitally. After scanning, digital documents should be organized and used as starting point for developing geo-database of raster maps and scanned documents.

Along with the scanning of paper documents there is a need for a plan to vectorize important maps and OCR documents. For this reason, several experiments and investigations were done by a team of scientists from the Faculty of Mining, Geology, and Polytechnics. The goal of the research was to select what scale of the map should be taken as a reference for the geo-database. A scale 1:200000 was selected to be vectorized because it holds most relevant data for the territory. Maps with higher scale lack relevant data while smaller scale maps are overloaded with data and time needed for vectorization is much longer. Selecting scale 1:200000 as reference is an original solution for Macedonian geo-database.

A basic geological map 1:200000 of the Republic of Macedonia is selected by the team as the foundation of the geo-database [2]. This map holds relevant data for the territory of the Republic of Macedonia and can be included in many applications in the field of geology. In addition to with basic geological map, the following list of maps and data are vectorized:

1. Location data (roads, rivers, springs, lakes, etc);
2. Tectonic map 1:200000;
3. Hydrogeology map 1:200000, and
4. Scan of the basic geological map 1:100000 together with paper data.

These maps are covering the whole Macedonian territory and can be used for starting the geo-database. These maps should be included for completing the geo-database,:

5. Geophysics;
a) Map of geomagnetic anomalies 1:500000;
b) Map of geomagnetic field 1:100000;
c) Map of seizmogenic zones;
d) Map of thermal field;
e) Map of gravimetric anomalies 1:500000;
6. Geochemical map;
7. Physical-mechanical and chemical laboratory data;
8. Map of boreholes of the Republic of Macedonia;
9. Engineering-geological map;
10. Metal genetic map 1:200000;
11. Map of mining deposits;
12. Data of geological explorations of the Republic of Macedonia;
13. Map of concessions;
a) Map of concession for exploration;
b) Map of concession for exploitation;
14. Database of raster map;
15. Database of reports, and
16. Other.

The list of maps is not definitive and geo-database should be open to all geo-scientific information. All maps and data have their attributes that should be considered before including them into the geo-database. Consequently, there is a need to form a team of experts in geology, geophysics, geodesy, and IT, who will define data and attributes. The maps and data are to be grouped into databases that together are to form the central geo-database repository.

Figure 1 shows the logical scheme of the geo-database of the Republic of Macedonia. We can see an information dataflow. The first step is to digitalize paper data with the scanning of paper maps, vectrorization of scanned images, entering data, etc. After the digitalization of the data, a processing must be done to get an appropriate form. A special team of experts has to verify the quality of the processed data and if they meet the requirements, they will be included into the geo-database.

The data entered into the geo-database are archived and grouped by type. The model anticipates a presentation of data over the internet and a direct access to government institutions.

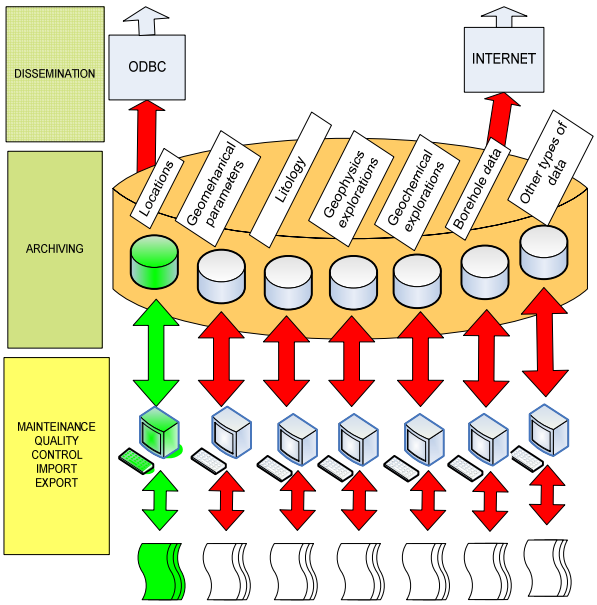

Fig. 1 - Logical description of the geo-database

Figure 2 shows the service architecture of the model. Geo-database consists of three layers. The first layer consists of the core data stored in the relational database. There are defined metadata for efficient searching of the database. The second layer is a service application which enables communication between users and geo-database. Here, the services and their capacities are defined. The user layer holds applications that access the geo-database. This model provides access through browsers, GIS programs, Arc GIS, and MapInfo and others.

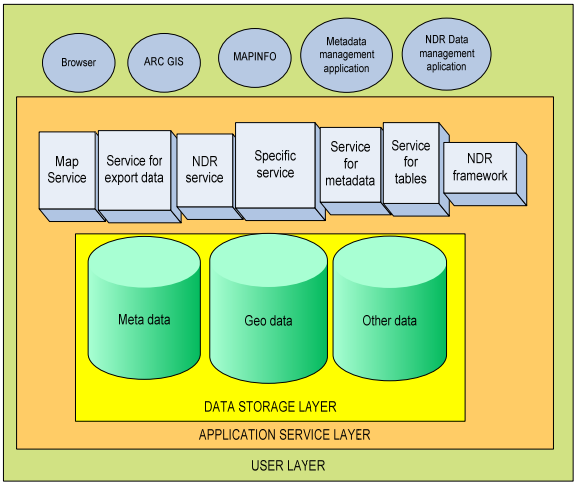

Fig.2- Service architecture of NDR (National Data Repository)

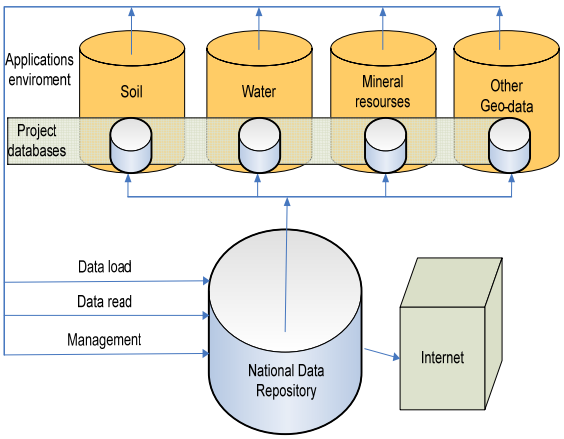

Fig 3 – Central and independent databases

The model of the geo-database envisions the forming of several geo-databases for different type of data (Fig.3).This splits the centralized geo-database into more independent databases that could be easily managed. Every independent database holds different type of information. Independent databases are redundant with the central geo-database, and this provides architecture for higher protection of the geo-database data.

Geo-database in the earlier stage should consist of one centralized geo-database. When size and processing rise, it is normal to extend the geo-database capabilities. A detailed analysis of additional cost for independent database should be considered.

4. Conclusion

This paper presents the basic geo-database model of the Republic of Macedonia. The presented model is based on experiences from the developed countries, taking into consideration and implementing the existing Macedonian maps and data. The experiments have shown that the basic geologic map 1:200000 should be a foundation map in the geo-database. A list of maps and data has been made to complete the geo-database. The logical structure, service architecture, redundancy, and data-saving have been shown as well. For the completion and creation of the geo-database, government support is required.

5. References

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