Software implementation of the geo-database model of the Republic of Macedonia

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Abstract

This paper presents software implementation of the geo-database model of the Republic of Macedonia. Geo-database model is developed using the latest information technology, GIS, .NET and relational database. All phases of the software implementation are explained, starting from creating relational database Текton in SQL Server 2000, enabling geo-database Текton using SpatialWare 4.8 for entering spatial data, inserting vector maps into geo-database Текton and developing specialized applications (Desktop Tools and GeoWeb) with MapXtreme 2005 and Visual Studio .NET. This is complete software solution for the implementation of the geo-database model of the Republic of Macedonia.

Keywords: Geo-database, GIS, MapInfo , vector map,

1. Introduction

World experiences show that most of the developed countries have their own centralized geo-database. Centralized geo-database enables efficient state management and archiving of geo-data. Geo-database ha**s** major contribution for development of: urban planning, mineral resources, ecology and other sectors.

Macedonian geo-database will be central point where ministry, private companies, faculties and general public will search for geosciences data and information. Data of the geo-database will produce new investigations, investments and economics income in the country. Economics justification of the geo-database is confirmed from Dutch experience where government investment is 0, 1% of the managed data and information [8].

This paper describes software implementation of the geo-database model of the Republic of Macedonia. Section 2 shows previous project concerning GIS, digitalization/vectorization of maps and other data. Section 3 describes support for spatial data in relational databases and the capabilities of Mapinfo SpatialWare. Section 4 presents

procedure for entering spatial data into SQL Server 2000 and which data is included in geo-database Tekton. Section 5 explains two developed application for the geo-database Tekton and section 6 discuss results and conclusions.

2. Motivation and related experiece

In the past several years a team from the Faculty of Mining Geology and Polytechnic worked on digitalization/vectorization on paper maps and digitalization of data. The team vectorized Basic Geological Map of the Republic of Macedonia 1:200 000, Tectonic Map of the Republic of Macedonia 1:200 000, Hidro-geological map of the Republic of Macedonia 1:200 000, other maps and data. Alongside with digitalization/vectorization of data, building of information system started where this data would be archived, managed and presented over internet. All these activities were part of master work [4] and several graduated final works.

3. Support of spatial data in relational database

In the early development relational databases did not provided support for non-standard types of data. Application and disciplines with demands outside the typical structures of data were ignored from major database developers. Therefore CAD, GIS and other science modeling systems developed their own system for data management.

The internet produced enormous increase in needs of data, analysis, presentations where maps and spatial data are needed component. Primal goal is improving access and value of data. This resulted with new techniques for investigation and visualization of data and increased the need for database support of spatial data. Today all known relational database have direct support for spatial data. Capabilities of relational databases permit spatial data to use systems for organization, administration, archiving and distributing of data.

MapInfo SpatialWare is used for enabling relational databases to accept spatial data. Spatialware is upgrade of Oracle, Informix®, Microsoft® SQL Server and IBM® DB2 databases for support of spatial data like points, lines, regions etc. SpatialWare is using ISO Multimedia/Spatial standard for spatial data. This software allows archiving, management and processing of spatial data without using additional programs. Integrated database solution is created that allows users access to spatial data and database tools. SpatialWare archive**s** spatial and traditional data together enabling efficient access to data, integrity and safety.

4. Entering spatial data into relational database

Spatial data from the geo-database model of the Republic of Macedonia are entered into SQL Server 2000. SQL Server 2000 is configured for accepting spatial data with SpatialWare 4.8. New database Tecton is created as foundation of the geo-database. Configuration of the geo-database Tecton to work with spatial data is complex procedure of structuring the geo-database with columns, attributes and other settings for accepting spatial data. Application Easyloader is used for entering spatial data into geo-database Tecton. Easyloader is Mapinfo addition, which enables simple entering of Mapinfo data into geo-database Tecton using ODBC (Open DataBase Conectivity). With application Easyloader all

vector maps are included into centralized geo-database Tecton. Geo-database Tecton contains these vector maps:

- Border of the Republic of Macedonia with neighboring states.
- Basic infrastructure: roads, railways, towns etc
- Mountain peaks, rivers, lakes
- Tectonic elements (faults, crust, tectonic regions)
- Litology composition and other data

Tekton allows centralized management of data using the advantages of the relational geo-databases. Structure of geo-database Tecton supports quick and easy access to geological data of the Republic of Macedonia. Tecton data can be used as a starting model for the geo-database of the Republic of Macedonia. Every map is represented by four files that contain vector and tabular data. Tekton generates table called MapInfo Catalog that contains all layers of data entered into geo-database. Applications are using MapInfo Catalog to access the data from the geo-database Tekton. Data access in geo-database Tekton is done by ODBC standard shown on figure 1. Applications have capabilities in searching geo-database by attributes from the map and data can be viewed/changed depending of user privilege.

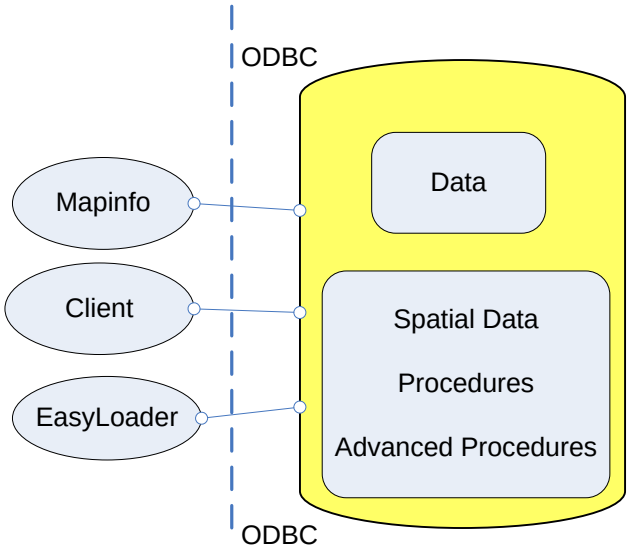

Figure 1. Access to geo-database using ODBC

5. Deskton and client/server application for geo-database Tekton

Previous chapters describe how data is entered into geo-database Tekton. Next step is creating applications for geo-database Tekton. Applications should provide control of data access, different types of users, searching the geo-database etc. Microsoft Visual Studio 2005 and MapXtreme 2005 which is part form software package MapInfo, are used for creating special spatial applications. MapXtreme 2005 is programming tool that provides .NET support for creating spatial desktop and client/server applications. Two examples of desktop and client/server application are presented here.

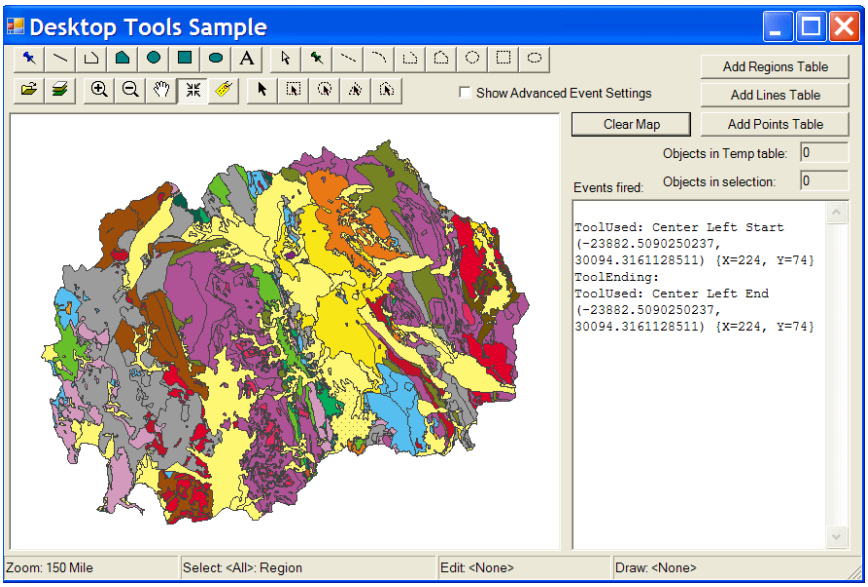

Figure 2. View of application Desktop tools

Desktop Tool is application created for the needs of geo-database Tekton using Microsoft Visual Studio 2005 and MapXtreme 2005. This application has capabilities of editing layer of data, drawing new objects, labeling, making thematic maps and other. Desktop Tools is using ODBC to access data from geo-database Tekton. Except working with data from the geo-database Tekton application has possibilities to work directly with Mapinfo files. An application Desktop Tool is shown on figure 3 using data from geo-database Tekton. With upgrade this application can provide more advanced features like different types of users, access levels etc.

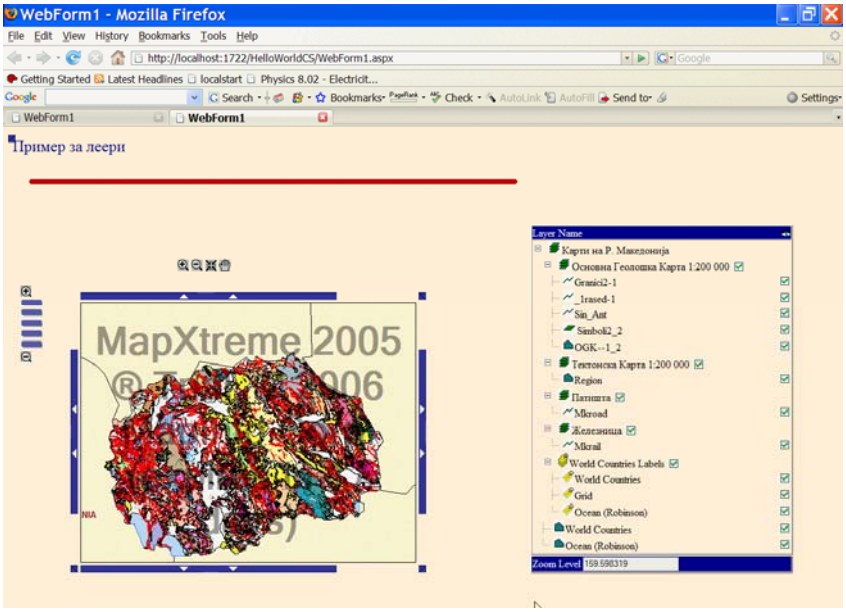

Figure 3 Presentation of maps from geo-database Tekton on the internet

Web application GeoWeb is build using Microsoft Visual Studio 2005 and MapXtreme 2005 figure 3. GeoWeb presents vector maps from geo-database Tekton on the internet. Geoweb application needs Mapinfo Workspase file. This file contains all the maps that will be presented on the web page. Mapinfo Workspase file is created using Workspace Manager,

which is part from MapXtreme. Web form is designed for efficient presentation of maps from Tekton geo-database. An application is web portal for viewing the maps from geo-database Tekton and has possibilities of zooming and selecting of maps presented.

6. Conclusion

In this paper software implementation of the geo-database Tekton of the Republic of Macedonia is shown. Starting from creating database Tekton in SQL Server 2000, configuring geo-database Tekton using SpatialWare 4.8 to support spatial data, entering vector maps into geo-database using Easyloader, making specialized application Desktop tools and GeoWeb with Visual Studio 2005 and MapXtreme 2005 and presenting the maps over internet figure 5.

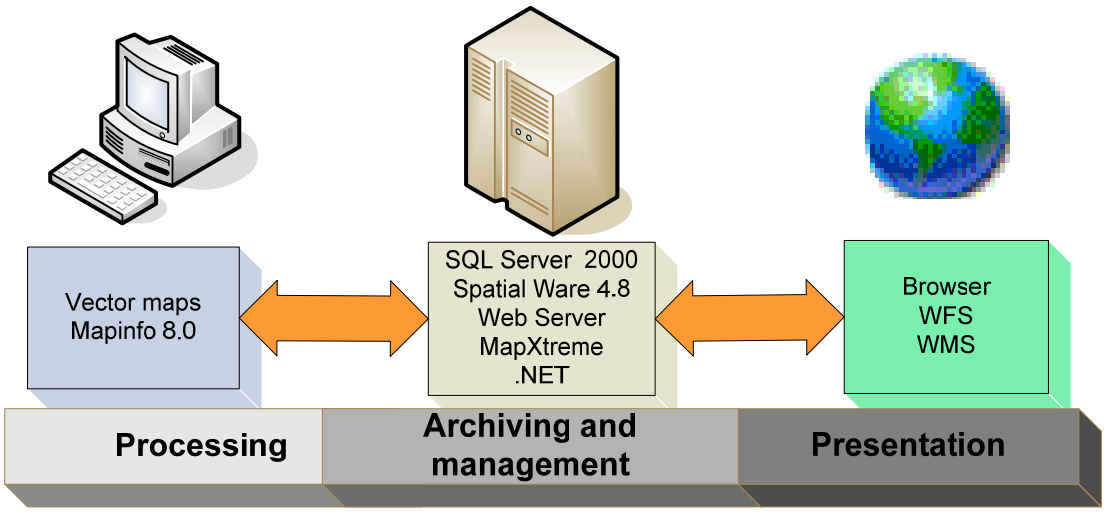

Figure 5. Logical scheme of geo-base Tekton

In presented software implementation the part for organization of raster maps and other data is not defined. Geo-database should support and include ArcGIS data as integral part. Although software implementation of the model is complete solution that can be used for creation of state geo-database.

7. Literature

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