GEOGRAPHIC INFORMATION SYSTEM - TOBEL

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ABSTRACT:

TOBEL is Geographic Information System entirely developed by one of the leading Bulgarian Geo-information companies - "Mapex" JSC. The system is based on modern information technology and it is especially designed for Bulgarian authorities. GIS - TOBEL provides to municipalities extraordinary quantitative and qualitative benefits. The system offers a method of quick access, evaluation, and format conversion. It also allows producing interactive maps from different sources, leveraging database information, and automating work processes. The paper contains a description of the main functions of the system, the used data and the whole process of development and system integration in Bulgarian Municipalities. The examples of successful working GIS systems integrated from our company are demonstrated.

1. INTRODUCTION

Bulgaria is located in the Central part of the Balkan Peninsula in South-Eastern Europe. The country has an ancient culture and remarkable history. Bulgarian territory has always been at a crossroad between Europe, Asia and Africa, which influenced the dynamics of the regional development throughout different periods. The country area is 111,000 sq.km, 58% of which belong to agricultural land, and is divided into 264 municipalities.

The concept of Geographic information systems (GIS) in Bulgaria is not a novelty. Recently, there has been a noticeable trend towards increasing the understanding of the high value that a GIS adds to the management of different processes, both in the public and private sector. Such geographic systems provide options for managing spatial information and attribute data for performing spatial analyses of varying complexity, optimizing the processes of decision-making at different levels within an organization or network of organizations.

The development and implementation of GIS technology in the government sector in Bulgaria is closely related to the European Union's efforts to build quality intergovernmental coordination.

According to the framework of Directive 2007/2/EC of the European Parliament and the Council, the so-called INSPIRE, the need for timely and effective sharing of quality information at the European level leads to the decision for building a spatial data infrastructure with equal criteria for maximum interoperability.

The establishment of the European spatial data infrastructure can be performed with the implementation of GIS systems at the municipal level and their integration with other public structures. The quality of widely used Geographic information systems, like ESRI, is indisputable but their functionalities are too complicated for some Bulgarian administrations. This is why systems that integrate more and more features from other application areas, to meet the requirements of specific users, were developed recently in Bulgaria. These systems successfully combine functionalities for processing and production of maps and sophisticated tools for analyzing spatial information in graphical and tabular form according to user's needs.

For more than 10 years "Mapex" Jsc. developed in the sphere of information system design, developing and implementing software solutions according to specific customer requirements.

One of the latest products of the company is especially designed for the Bulgarian administrations Geographic information system - Tobel which is based on modern information technology.

It allows continuous improvement of services in accordance to the changing needs of businesses, citizens and administration. The system has a stylish interface in Bulgarian language and incorporates modular distribution of data, making it easy and pleasant to use.

The system has a range of applications in the public administration at a central and local level. It is a system facilitating the implementation of Electronic Administrative Services.

GIS - TOBEL provides the organizational framework for developing efficient e-government at state and corporate levels with visualization, search, manipulation, comparison and analysis of all types of geospatial data.

This allows the administration easily to produce reports, statements and balances, official documents in the approved format.

1.1. The main advantages after GIS - TOBEL integration

For municipal government and local administration:

- Improves the efficiency of the municipal administration services to the citizens;
- Gives an opportunity for integration between different agencies that use geospatial data;
- The data in the administration is systematized with strict access regulation;
- The process for document issuing is automated and the time spent for the services is reduced;
- Possibility for automatic report and document producing;
- Integration with data from different registers and property information.

For the public:

- Easier access to services;
- Quality of administrative services;
- Easy and quick information visualisation;
- Transparency of operations.

1.2. Data maintained from Tobel

- Data from cadastral map and cadastral registers;
- Development plans;
- Digital model of zoning and building plans;
- Raster images - scanned and geo-referenced plans, maps and orthophotoplans;
- Underground ducts and facilities;
- Administrative map of the territory.

2. TECHNICAL SPECIFICATIONS (GIS-TOBEL)

2.1. Architecture

GIS-TOBEL architecture follows the best practice in the field. Based on the following 3-tier architecture model:

- Custom applications layer;
- Business logic layer and service;
- Data layer (information base).

The system is expanded to seven layer model, which provides flexibility and high scalability. This is done because the traditional 3-tier architectures (Presentation layer– Business logic - data) do not cover many different aspects associated with the provision of services and orchestrate them into more complex business processes.

What is typical for the architecture of the Figure 1 is that it focuses on complex business processes ("Business Processes" layer) which uses services ("Services" layer) provided by different components ("Components" layer). Each component layer ("components") can be presented with the traditional three-layer architecture.

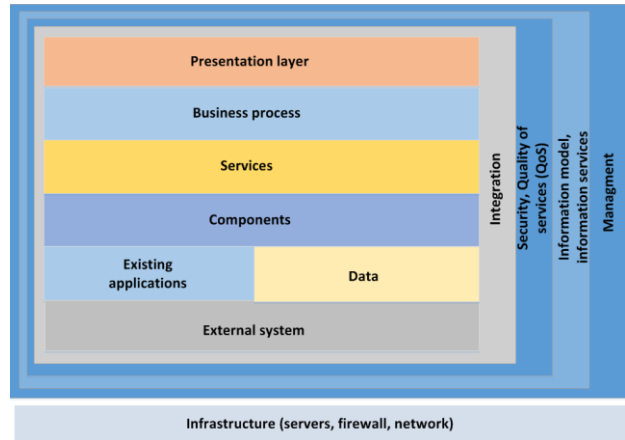On the Figure 1 the 7 layer model is displayed

Figure 1. Service-oriented architecture

On the figure above, layers: „Integration", "Security, Quality of Services (QoS)", "Information Model, Information Services" and "Management" are displayed vertically. The reason for this is that the functionality provided by these 4 layers is used by all other layers.

GIS-TOBEL layers:

Layer	Description
Presentation layer	This is the entry point for users of the application. Provides different access channels to the applications.
Business process	Responsible for providing services that are complex and lead to added value.
Services	Discrete services that are not technological by nature. One business process used services at specific stage during the performance.
Components	Components are responsible for the implementation of the services. There are two types: functional and technical. The functional requirements are realized first. The technical components are a set of libraries and support functional components.
Data	Physical data organization in the form of databases, charts, tables, views, index files, file system, etc.
Internal systems	Systems that are under the control of clients and with them GIS-TOBEL exchanges information.

GIS-TOBEL is built on modular principle and one of the biggest advantages over other competitive products is the availability to add additional data types, additional types of queries, and additional types of searches and other xml-based configuration files. This happens without need to revise base structure or redesign of the architecture of the system and there

is no need of technical education or special programming knowledge.

2.2. Components

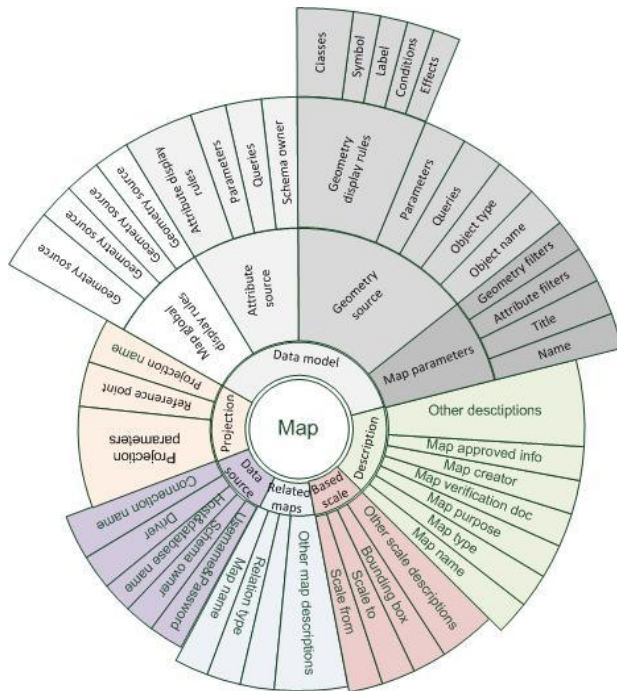The system consists of small components presented on the Figure 2.

Figure 2. Components

GIS-TOBEL is designed and developed to manage any kind of geographic data, regardless of the subject area - ecology, cadastre, geodesy, military, environment, and others which have geographical representation. Product development was made independently of the data and their labelling. That was made by the separation mainly of the following components

- **Data model** – XML-based, configuration of how to present and visualize different data loaded GIS-TOBEL.
- **Data source** – origin of the data - XML-based configuration, which describes the specific data model, the source for loaded – database, file, protocol;
- **Description** – Data description – meta data for maps - creator, date, name and etc.;
- **Based scale** – description of a defined scale for map visualization;
- **Projection** – coordinate systems and projections configuration.

One of the main advantages of GIS-TOBEL is the component Data source that describes the connections to data sources. There are no other products on the market that with such a functionality.

Supported data:

- **Data base**
  - o Oracle;

- o MS Sql Server;
- o PostgreSQL;
- o ESRI ArcSDE.

- **Files formats**
  - o Bulgarian standards for vector file formats;
    - CAD -file format;
    - ZEM – file format;
    - КОР/КПТ/ДПИ – file formats.

  - o World-approved file formats:
    - Autodesk dxf/dwg;
    - ESRI shape;
    - Mapinfo tab;
    - GML;
    - Png/jpg/tiff file formats;
  - o Text file formats.

- **Protocols for geographic information exchange:**
  - o WMS protocol;
  - o WFS protocol.

2.3. User interface

For GIS-TOBEL development were used two basic programming languages:
- C++

The core of the system displaying geographic information is programmed in C ++, which reaches high-speed data retrieval and visualization in GIS-TOBEL.
- C#

Graphical User interface is programmed in C#, using WPF (Windows Presentation Foundation) technology provided by Microsoft Corp. This allowed the graphic user interface (GUI) to use the so-called Ribbon controls, and to accelerate the "rendering" of the interface, making the most of the resources of the video card on the workstation.

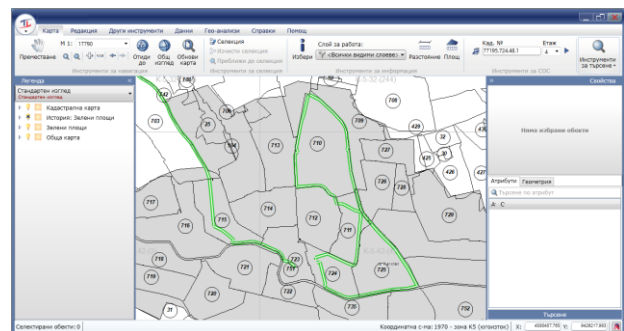On the next screen the GIS-TOBEL interface is presented.

Figure 3. Interface

3. ADVANTAGES OVER OTHER GIS

GIS-TOBEL basic technological advantages over other GIS

- Interface in Bulgarian;
- Support barcode for all generated reports and output documentations;

- Electronic signature system for all administrative documentation is supported;
- Transformation and working with all local coordinate systems used in Bulgaria (1950, 1970, Sofia);
- Ribbon controls for better usability;
- Working with multiple sources of information according to Bulgarian standards for exchange of geospatial information;
- Modular working principle and configuration of GIS-TOBEL without need to know any programming language;
- Fully developed by "Mapex" Jsc. core visualization with the possibilities for changes according to the client needs.

GIS-TOBEL supports data from different areas like:

- Strategic and territory planning;
- Cadaster;
- Zoning planning;
- Management of territory planning;
- Management of municipal property;
- Management of the investment process;
- Management of urban mobility and transport;
- Administrative services, including local taxes and fees;
- Management of kindergartens;
- Management of movable objects;
- Management of advertising media;
- Management of urban transport;
- Management of rubbish-transportation;
- Management of green areas;
- Protection and conservation of cultural and historical heritage and tourism development and etc.

4. CONCLUSIONS

Lately, more companies are moving away from the isolated usage of desktop GIS applications. The aim is to integrate the systems with Internet portals, setting the milestones for effective and functional e-government in Bulgaria.

Mapex has successful integrations of geographic information systems (desktop and web) in Sofia Municipality, Bourgas, Pazardjik, Silistra, Svishtov, Svilengrad, Bozhurishte, Vratza, Ljubimetz. On the figure bellow you can see one example for working GIS developed for the Sofia Municipality.

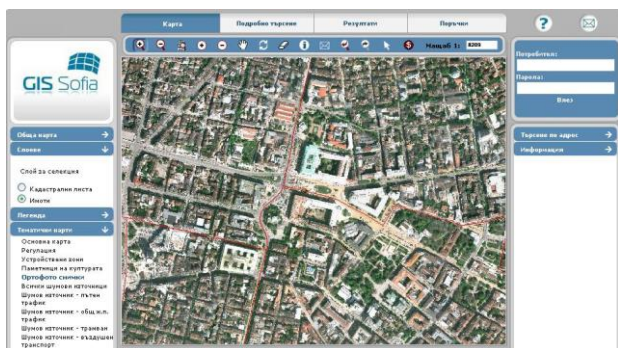The company has successfully developed also the information system of the Bulgarian Agency for Geodesy, Cartography and Cadastre.

Figure 4. WEB GIS for Sofia Municipality