Web-based GIS Solution for Electric Power Supply Network Data Management

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INTRODUCTION

The development and usage of Web applications is one of the most popular directions of research and development in the field of software engineering. Web applications can be of great importance for enterprise information system (IS) development. An example of such IS is electric power supply company IS. Geographic Information System (GIS) is one of typical information systems used in the electrical power supply companies (Kale and Lad, 2006).

Currently, most popular GIS applications are referred to as WebGIS applications (Milosavljević et al, 2005). WebGIS applications are used by most users, because most of them while working with spatial data need only to review the data. WebGIS that we encounter today on the Internet differs from the first implementations of these systems e.g. static or dynamic WebGIS. Nowadays, WebGIS applications have thick clients that implement a large part of the functionality. These solutions are based on the usage of data from various sources and their combining, querying, processing, displaying and changing.

In addition to basic GIS functionalities, WebGIS applications often incorporate additional functionalities which use information from different sources. The introduction of additional functionalities leads WebGIS applications towards becoming tools that have the possibility of combining and processing data from various sources.

GIS SOLUTION FOR ELECTRIC POWER SUPPLY COMPANY

GinisED is the implementation of geographic information system as a project in the field of technological development called "Geographical information system for recording, maintenance and analysis of electric power supply network" (Stoimenov et al, 2006). The project was implemented for the needs of public company PD Jugoistok Niš with the support of the Ministry of Science and Environmental Protection of the Republic of Serbia. Architecture of GinisED GI system is shown in Figure 1. GinisED basic components are:

- Centralized geospatial database – It allows thematic and spatial electric power supply network data storing.
- GinisED Editor – Desktop application for recording, searching and editing spatial and geo electric power supply network data (Stanimirović et al, 2007)
- GinisED Web – WebGIS application that allows quick and easy positioning on a specific geographic area, search and selection of parts of electric power supply networks. This application implements information integration functionalities and uses data from centralized geospatial database.
- WFS (Open Geospatial Consortium, 2002), WMS (Open Geospatial Consortium, 2006) services and other Web services that provide electric power supply network data
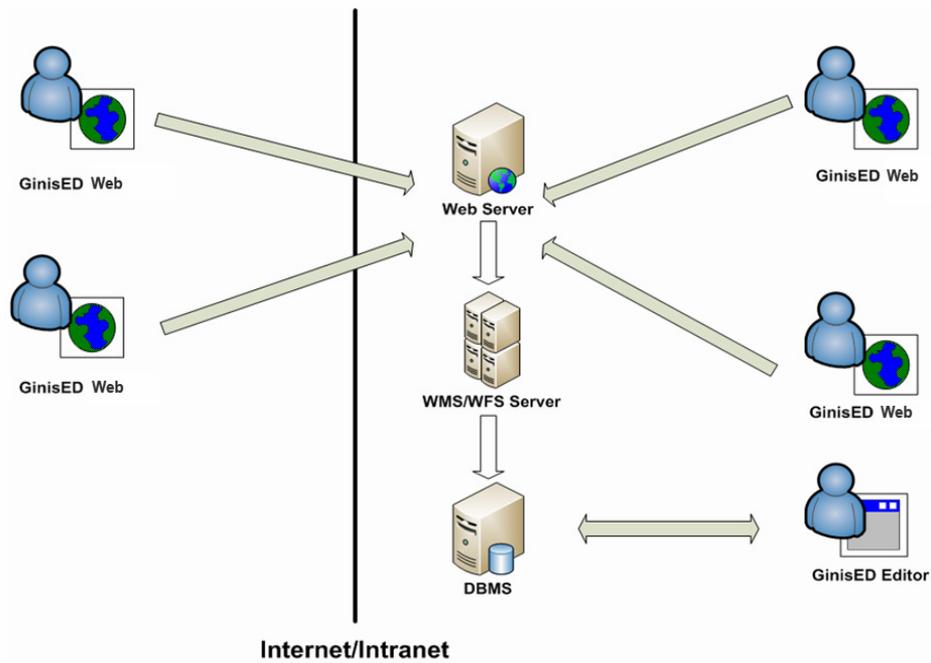
Figure 1: GinisED GIS architecture.

Electric power supply network analysis demands usage of technical information about the electric power supply network elements. In order to implement this analysis, GinisED Web application uses information from a number of heterogeneous and distributed information sources. The position of GinisED system among other information system is presented in Figure 2.
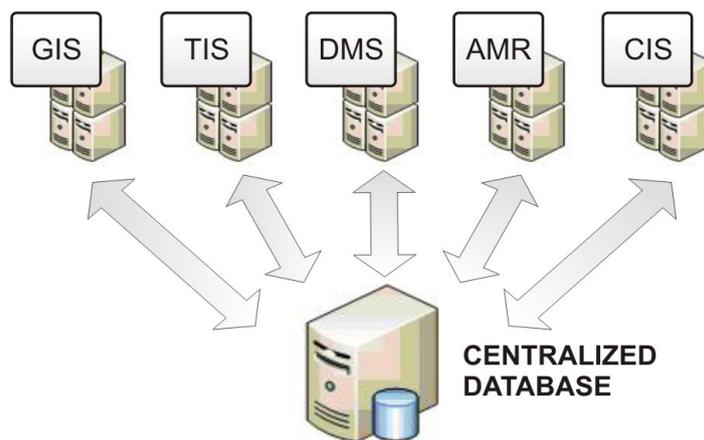

Figure 2: Enterprise information systems.

All systems base their functioning on the centralized relational database. This database stores all information that these systems collect or generate. For the purposes of information integration, it is necessary to establish connections between objects in different information systems e.g. between objects in different parts of centralized database.

GINISED WEB – WEB-BASED SOLUTION FOR DATA MANAGEMENT

GinisED Web is an example of Web 2.0 application (O'Reilly, 2005) used for storing and visualizing geospatial information. It consists of four modules: GIS module, layer selection module, objects search module and information integration subsystem (module). Position of each module in the client is shown in Figure 3.

This kind of application structure allows easy expansion of GinisED Web client functionalities. The main module is a GIS module that implements all of GIS client functionalities. All other modules rely on this module and add new functionality to client: specific data querying, joining thematic data from various sources, generating reports etc.

Figure 3: GinisED Web client.

GinisED Web client implements a standard set of GIS functionality. Characteristics of objects that appear on the map (in this case, the elements of electric power supply networks) vary depending on the object type. Maps visualized by GinisED WebGIS client are divided in two groups of layers: the basic layers and layers of electric power supply networks elements. Basic layers represent different geographical maps (obtained from the WMS) used as basis for the display of electric power supply network elements.

In GinisED GI system, integration of information from different sources is implemented in GinisED Web application e.g. in WebGIS client. In order to isolate the GIS functionalities of WebGIS applications, preserve context and continuity of the application functioning, information integration and presentation of integrated information is allocated into specific components. These components are independent of the main GIS part of Web applications. They communicate with other parts of the system using asynchronous requests.

GinisED Web (WebGIS client) was extended by development of subsystem for the integration of information from different sources. In accordance with the existing WebGIS application architectures, the imposed solution is the usage of Web services as required information aggregators. One of the technologies that meet the requirements is the usage of XML Web services in conjunction with SOAP calls using asinhronih request.
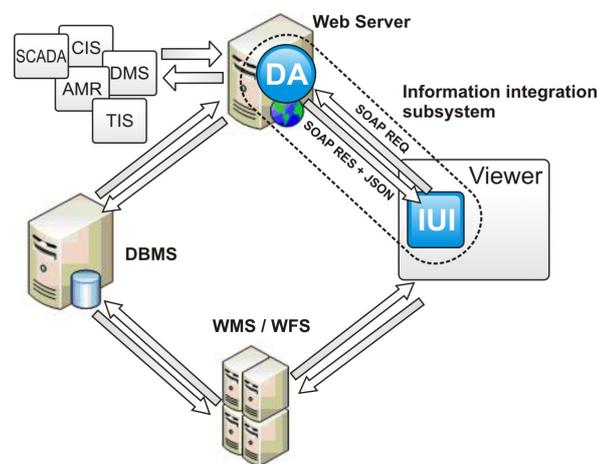

Figure 4: Position of information integration subsystem.

Information integration subsystem consists of two parts presented of Figure 4:

- Data aggregator (DA) – Server-side component responsible for data retrieval and information integration
- Integration user interface (IUI) – Client-side component which retrieves integrated information from data aggregator and displays it inside appropriate WebGIS application interface component

Information aggregating Web services have three basic Web method types. Web method type depends on information source it accesses and can be:

- Methods that retrieve data from centralized relational database
- Methods that retrieve data using HTTP protocol
- Methods for dynamic document creation

Data Aggregator is a custom developed component responsible for integration of information from different sources. It is able to obtain information from different data sources: Web services, Web pages or WMS / WFS servers. Data Aggregator works in pair with WebGIS client and together they make two fundamental components of GinisED Web application. These two components gather, integrate and display information from different sources and couple them with geospatial data.

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