Design and implementation of a new meteorology geographic information system

WeiJiang Zheng, Bing. Luo, Zhengguang. Hu, Zhongliang. Lv
National Meteorological Center, China Meteorological Administration, PRC,
Beijing,, China
NO 46, Zhongguancun nandajie Beijing,China

Abstract: Meteorology Geographic Information System (MeteoGIS) is a professional meteorological GIS platform of completely independent intelligent properties. It fully utilizes the national innovative GIS technologies in the meteorological scenario; MeteoGIS supports multiple databases, browsers and a variety of development environments, has a good cross-platform capability. It also has a massive vector and raster data management and distribution capacity and supports accessing, importing, and exporting a variety of common GIS data formats directly, with support for data editing, spatial analysis, thematic mapping, layouting, and printing. MeteoGIS has extended the meteorological data models and data sets, and is able to show meteorological data in a standard way, produce thematic maps and layout and print cartographic maps. It has integrated algorithms for meteorological purposes and special-use analysis. The platform is comprised of developing kits, data engines, desktop software, and Web development platforms.

Key words: Meteorology Geographic Information System, developer kits, MeteoGIS database engine, desktop application, web development platform, meteorological analysis algorithms,

1. Introduction

In recent years, the international community generally carried out to GIS technology in meteorological research and got some results, but the application of GIS for meteorological foundation platform for the industry still does not appear, the existing meteorological softwares are developed independently or extended by commercial GIS platform. The existing Commercial GIS software cannot fully meet the GIS application of meteorological industry, the causes are: (1) cannot handle well huge mount of spatial-temporal data [1]; (2) cannot be well supported meteorological model integration [2].

To solve those deficiencies, China Meteorological Administration proposed the building of Meteorology Geographic Information System (MeteoGIS for short) with independent intellectual property rights. the system which is supporting meteorological applications is a professional GIS application development platform, it contains a generic GIS data access, storage and management, analysis, processing, output capability, but also combines the application of

meteorological algorithm model for the business, internal support for meteorological data access ,model, analysis and processing, and visualization, and other professional functions.

2. Framework of MeteoGIS

MeteroGIS is a comprehensive, powerful, and cross-platform meteorological GIS platform that is comprised of data engines, developing kits, desktop software, and Web development platforms, to meet the needs of developing meteorological GIS applications of different types and scales. The structure of MeteoGIS is shown in Figure1.
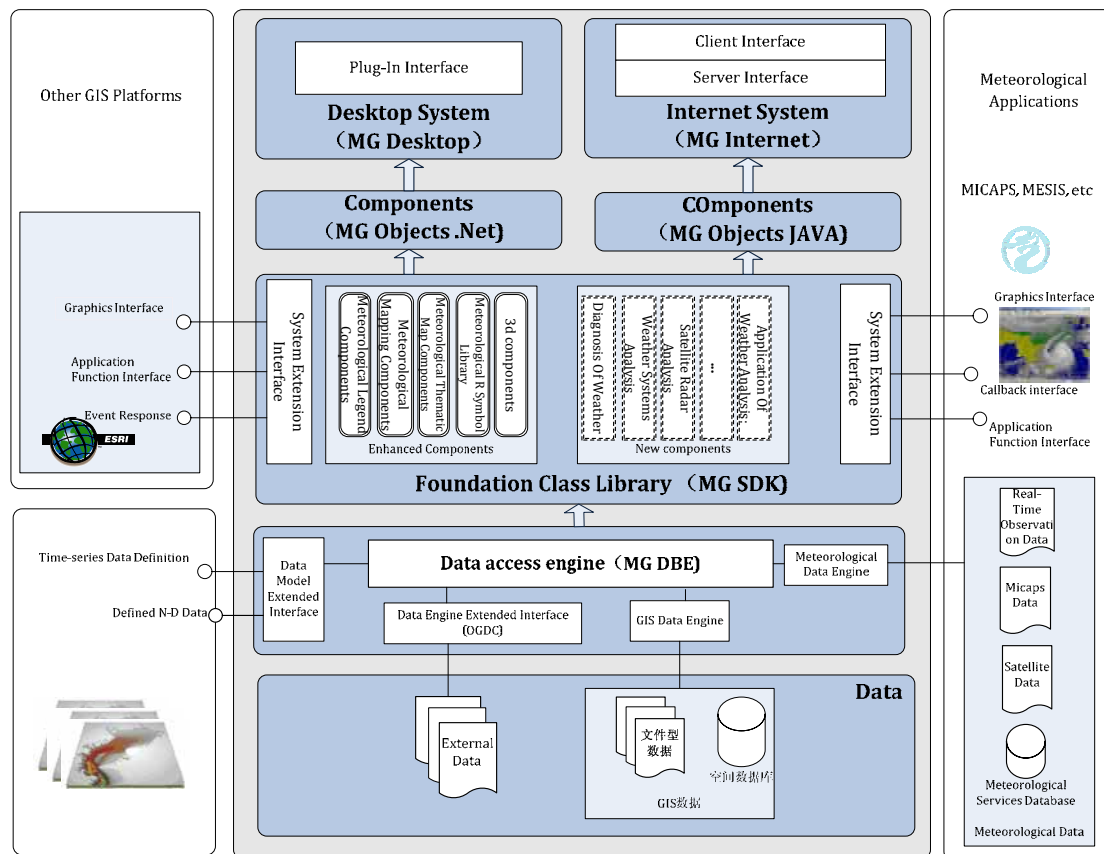

Figure1 MeteoGIS Composition Structure

(1)MG DBE

MG DBE (MeteoGIS Database Engine) is the spatial data engine that is used to manage and access common GIS data formats and meteorological data formats.

MG DBE can directly read 14 common GIS data formats, and 9 major categories of meteorological data formats, and directly integrate WMS and WFS services from other GIS systems.MG DBE also has extended 5 categories of meteorological data models and meteorological data sets, further facilitating the data access and management.

(2)MG Objects

MG Objects is comprised of MG SDK, MG Objects.Net and MG Objects Java, supporting developing meteorological applications with C + +, .Net and Java. It covers most of the standard GIS functionalities and provides standardized

interfaces, for an easier customization and development of meteorological applications in C/S architecture. MG Objects provides all the core functions in MeteoGIS, including modules for data management, editing, visualization, spatial analysis, professional meteorological analysis, layout and printing, 3D visualization and spatial analysis, etc.

(3)MG Desktop

MG Desktop is developed by MG Objects. NET and is a professional desktop application for meteorological GIS. It provides a variety of common GIS and meteorological functions, and as a extensible framework, it can be extended by way of plug-ins. Meteorological personnel can use MG Desktop to perform editing, analysis, mapping, printing and other functions on meteorological data, and accomplish specific professional capabilities by loading different plug-ins,.

(4)MG Internet

MG Internet is comprised of MG Internet Server and RIA client applications.

MG Internet Server is a high performance Web platform for publishing and sharing a variety of common GIS and meteorological data, with an integration of caching, load balancing and clustering technologies. MG Internet Server is based on the ServiceGIS architecture, with full support for publishing and aggregating OGC W * S services, and SOA-based application development.MG Internet has three RIA clients for AJAX, Silverlight and Flex, compared with traditional client-side application, it provides a more powerful client interaction and performance. For instance, the Flex client provides a professional client for displaying meteorological information and an online service for interpolation analysis.

3. Key issues of MeteoGIS

(1)Cross-Platform technology

The core library (Software Development Kit, SDK) uses standard C plus plus language. Standard C plus plus language supports for mainstream operating systems. The mainstream development language and development platform provides most of the interface and the C Plus plus Language Integrated [4]. C ++ can achieve "write once, compile everywhere". Pattern design (such as flyweight, template method, strategy, proxy, memento) can eliminate some dependence of function components.

(2)Meteorological data engine technology

In order to solve the problem of heterogeneous data access, and support other platforms to provide data format conversion, the framework is as shown in figure 2:
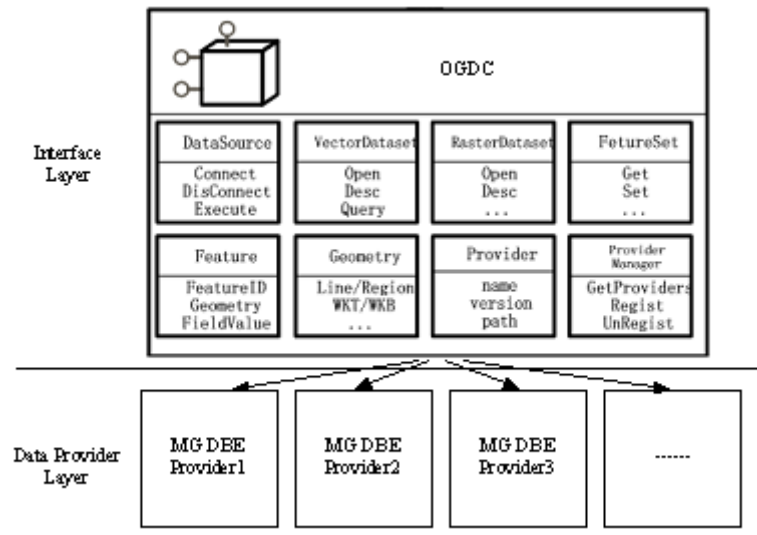
Figure 2 Main Framework of MG DBE

The engine is based on Open Geospatial Database Connectivity standard (OGDC) [3], and built on standard C plus plus, with universal adaptability and cross-platform kernel. It implements the geometry object, data model definitions and data engine mechanism, on this basis, reads and writes multiple files are achieved through the file parser, and the unified of imports and exports data are implemented by unified schedule of data conversion modules. File parser implements the vector, raster data conversion into a scalable mechanism to define a data format, a new format data import and export only need to implement a new file parser.

(3)Meteorological graphics engine technology

In order to implement Map drawing, symbolic display, thematic map performance, MeteoGIS achieves a visual representation of meteorological information Based on a common graphics engine technology, the structure of meteorological graphics engine is as follows (figure 3):
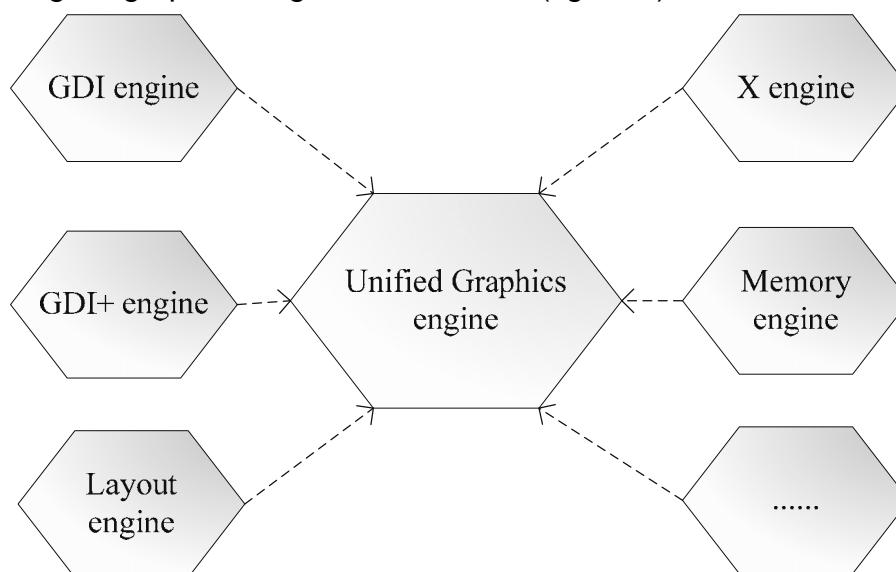

Figure 3 Structure of meteorological graphics engine

The middle structure is consistent graphics interface, which provides for the general public of the entire graphics engine interface, All other actual engines are based on the definition of a unified graphical interface. Based on different graphics platform, can be achieved with GDI + graphics engine, engine, X engine, memory engine, print engine, and other embedded devices on the graphics engine, and so on. GDI + engine is based on the Windows operating system GDI + graphics device interface, mainly on Windows. X engine X11-based graphical development interface to Xlib implementation, mainly in the UNIX / Linux use. Memory engine renders the graphics in memory block, and is mainly used in the WebGIS application.

(4)Component packaging technology

In order to achieve other main language Components on the basis of the core library, MeteoGIS uses C plus plus/CLI (Common Language Infrastructure) to implement .NET Components packaging and JNI (Java Native Interface) to implement JAVA Components packaging.

4. Conclusions

Based on the MeteoGIS platform, the national meteorological center of china meteorological administration has development meteorological services system, traffic services system and Meteorological Data Dissemination System. The application of MeteoGIS can strongly improve the level of the meteorological development of GIS application, implement spatial data storage and analysis.

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