XML based Map Web Publication Technologies

Shi Ruizhi, Wu Changzhi; Zhengzhou Institute of Surveying and Mapping, Zhengzhou,Henan/China

Abstract

The use of map is coming closer and closer to people's life. With the popularity of the Internet, it is more convenient for people to publish the maps on the network. In the past few years, due to the limitation of the HTML, there are lots of unsolvable technical difficulties for map web publication to overcome. Recently with its advantages of favorable data storage format, extensibility, high structured and easy to network information organization and network transition, the XML has well solved the drawbacks that the HTML has while on describing structured documents. The GML (Geography Markup Language) and SVG (Scalable Vector Graphics) which are based on XML provide powerful technical supports for map web publication. This article researched on XML based map web publication model, GML based multi-source spatial data integration model and SVG based spatial data visualization, which provide a solution for the realization of efficient map data web publication, sharing and user interaction.

HTML (Hyper Text Markup Language) is the most extensive language in Internet at present. It is a universal web language used to create web page and promulgate information. It is easy to study and use. However, with the extensive and deep use of the Internet technology, the HTML expresses too briefly, the link is very easy to be interrupted, the search is not convenient, the expansibility is not easy to enlarge and bad segments are more and more evident, especially it is not convenient to describe geographical spatial data which is most of vector data and complicated geographical spatial objects, so that there are many technical difficulties which is not easy to solve in web publication of map. Recently, W3C(Wide World Web Consortium) has established XML(extensible Markup Language) which has good data storage formats, expansibility, extreme structure, and is convenient in web information organization and web transmission, so it has well solved the limitation of HTML in document description. The extrusion of GML(Geography Markup Language) based on XML and the standard of SVG (Scalable Vector Graphics) provide perfect methods for the sharing and operation geospatial data respectively , and provide technology sustain for the web publication of geospatial information. This article researches on the model of map web publication which uses XML, and brings forward the integration of multi-source map spatial data and the visual methods of spatial data.

1. XML based Map Web Publication Model

Just as the figure 1 shows, XML based Map Web Publication Model is made of three parts:

1.1 The acquiring of spatial data based on XML

Converting the existed document and data base into XML document. This information should be transformed by program; in the mean time the client can add new information into the process according if requiring. Establish the XML based integration and sharing model of spatial data.

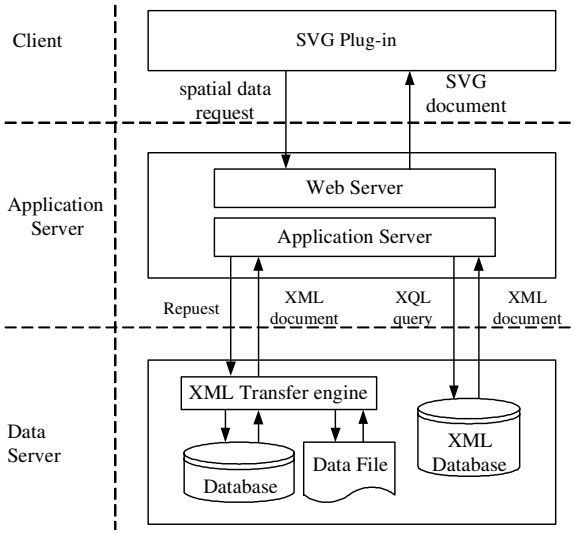

Figure 1 XML based Map Web Publication Model

1.2 The organization and storage based on XML

Encoding geographical data into GML, and storing and managing the spatial data in the form of GML to found the spatial information database. Then client can maintain and use these data conveniently, and ensure the data safe and integrated.

1.3 The description and release of map data based on XML

The spatial data are released in the form of SVG, the client accepts the map data and displays map data through the browser plug-ins, and carries out graphical interoperation in the client, such as zooming in, zooming out, information inquiring and so on.

The 3 points concerned above can be summed up as the integration of multi-source spatial data and the visualization of spatial data.

2. GML based integration model of multi-source spatial data

2.1 GML based integration model of multi-source spatial data

Just as the figure 2 shows, GML based integration model of multi-source spatial data mainly be made of three parts, data application layer, data integration layer, data source layer, thereto, data integration layer is also made of three parts: management module of data integration, GML based virtual data source, data transform program.

In the solve scheme of GML based integration model of multi-source spatial data, isomerous data source keeps their own data in fact, and the integrated data can be taken as virtual data which is stored in the GML database. GML database can exists physically, it conserves the data which is integrated from each isomerous data source, in case of that , the program directly accesses GML database' data through integration management module.

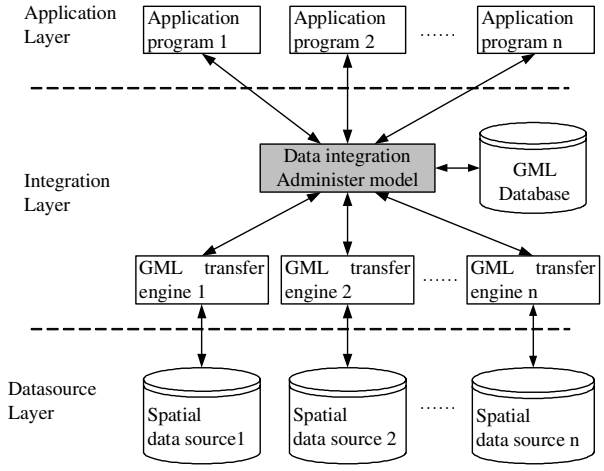

Figure 2 *GML based multi-source spatial data integration model*

2.2 The implementation of GML based spatial data integration

There are mainly three steps to get the implementation of GML based spatial data integration: building GML-based data model, conversion engine from source data to GML and management module of data integration.

In order to make application access the data after integration in real time, it's necessary to build a universal data model among the sorts of data source that have different data mode so that the application can be independent of the data source and to access the data after integrating.

3. The description of SVG-based map symbols

3.1 The description of point symbol

Point symbol is made of geometric graphical units with different shapes. After analysis to the geometric shape of point symbol, the geometric graphical units can be divided into: point, circle, arc, ellipse, rect, polygon, line, polyline etc. SVG supplies six kinds of basic graphical element including circle, ellipse, line, polyline, rect, polygon, and can finish the description of basic unit of point symbols.

Point symbol almost has specific location and direction in the map. According to the directionality of point symbol, we can divide point symbol into two types: one is direction-unchangeable, such as GPS point, triangulation point and bench mark and so on; the other is direction-changeable, such as not comply scale station, bridge , dyke and so on.

For the point symbol, it could be achieved by using the basic figure elements that are offered by SVG to describe. But for the second kind of point symbol, the direction of symbol is not fixed. Its direction could be fixed due to actual condition of concrete geographical elements. So for this kind of symbol, the control of its direction could be made when this symbol is transferred. It could be achieved by setting the property "rotate" that belongs to the figure elements in orders.

3.2 The description of line symbol

The line symbol could be used to show the one-dimension geographical phenomena in space. It has a notable character that has a visible or invisible directional line. According to the disassemble character and figure symmetrical character. We could also divide these line symbols into two kinds: one kind is the general line symbol, such as contour line, isobaths, alley and so on; the other kind is the pattern line symbol, this kind symbols settle the directional line as norm, and are made by a basic figure unit as circulative body along directional line, such as freeway、railway、road-bank and so on. The symbols of the first species linear upper things could be described simply by using polyline or path, and set by relevant line-color、line-width etc; The second species are relative complex.

Most visualized elements can use the attribute of "style" to define the mode fill-mode of graphics in SVG document. The parameter of "style" is various. It almost covers all of aspects from character to graphics and from color to filter. So we can set proper parameter to the different symbols for the first line symbol.

The description of the second line symbol is more complicated than first line symbol. It can not use polyline or path to come true directly. The drawing of this line symbol has some rules: All of drawings are based on basic element by circulatory drawing. So we can describe a basic element beforehand and we can cite the element in drawing the line by using the means of line symbol's configuration in GIS.

3.3 The description of area symbol

The area symbol is used to express the geographical phenomena of two dimensions in space. It has one or more closed borderlines that have shape or don't have shape. Area symbol often uses some ways of fill to distinguish the property of ground feature and the property of quantity and quality of spatial distribution of geographical phenomena. By the different ways of fill, the area symbol has three species: the first area symbol is filled by color, such as the follow scale lake, river and so on; the second area symbol is filled by cross hatching, such as the follow swampland, saline and so on; the third area symbol is filled by point symbol, such as the grass land, forest and so on., the figure 3 shows an example:

For the first area symbol, setting filled color is OK. it is easy to come true. For the second and the third area symbol, pattern-filling way can be adopted. Firstly, define the using filled pattern, that is defining the using filled picture, the element of definition pattern is<pattern>, and set "id" of the pattern. Then quote this pattern when the filled district needs rendering, the format of the pattern is url(#id).The definition principle of the pattern is: First, define a rectangle district as the basic filled unit. Then describe the filled pattern according to the forming description of the area symbol.

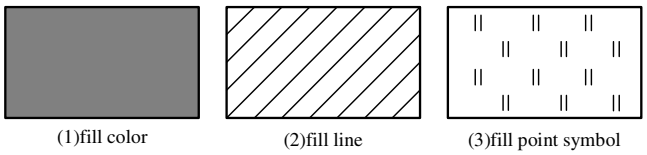

Figure 3 *the style of area symbol*

4. The data organization of map data based on SVG

4.1 The data organization

Because the SVG only supports some basic graphics elements currently, and can't support the topology structure, in order to describe the geographical space data using SVG effectively, I use simple layer organization pattern to organize data. Just as what the figure 4 shows, the model divides the objects into simple ones and complicated ones, and simple objects can divides into point ones, line ones and area ones by geometry character. Complicated objects are composed of many simple ones. An object is a geographical entity, and is composed of geometry data and attribute data describing the geographical entity. Several geographical entities can be taken as a layer, and a layer can include geographical entities of different types. Several layers form a map.

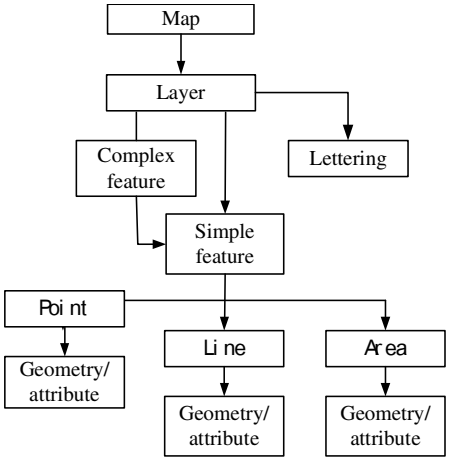

Figure 4 *Data layers structure model*

4.2 The data coding

From above analysis, it can be seen that objects that need to be described contain three major types: map objects, layer objects and ground feature (including simple ones and complicated ones) objects. In order to carry on the valid operation to the described objects, we take the grouping element <g> supported by SVG as main element. For the map object, the attribute id of grouping element represents the map serial number, with the letter "M" as a prefix. For map layer objects, the attribute id of grouping element represents the layer serial number, with the letter "L" as prefix. For ground feature (geographical entity) object, the attribute id of grouping element represents the ground feature identification (feature coding), with the letter "P"," L"," A" as prefix for point ground feature, line ground feature and area ground feature respective.

References

[1] Wang Jiayao, Sun Qun, Wang Guangxia, Jiang Nan, Lv Xiaohua. The Map Science. Zhengzhou Surveying and Mapping Institute, 2003.

[2] Liu Zhen, Shi Ruizhi, Wei Bin, Xu Dehe. The Principle and Technology of Computer Electronic Prepress System. Zhengzhou Institute of Surveying and Mapping, 2003.

Author Biography

Shi Ruizhi, with a doctor' degree of Engineering, is a professor of Surveying and Mapping Institute in Zhengzhou. She devotes herself to the teaching and research on graphics and image processing as well as printing and Publishing.