

## CHINESE NATIONAL GEOGRAPHICAL NAMES DATA BASE MANAGEMENT SYSTEM

*Ji W.*

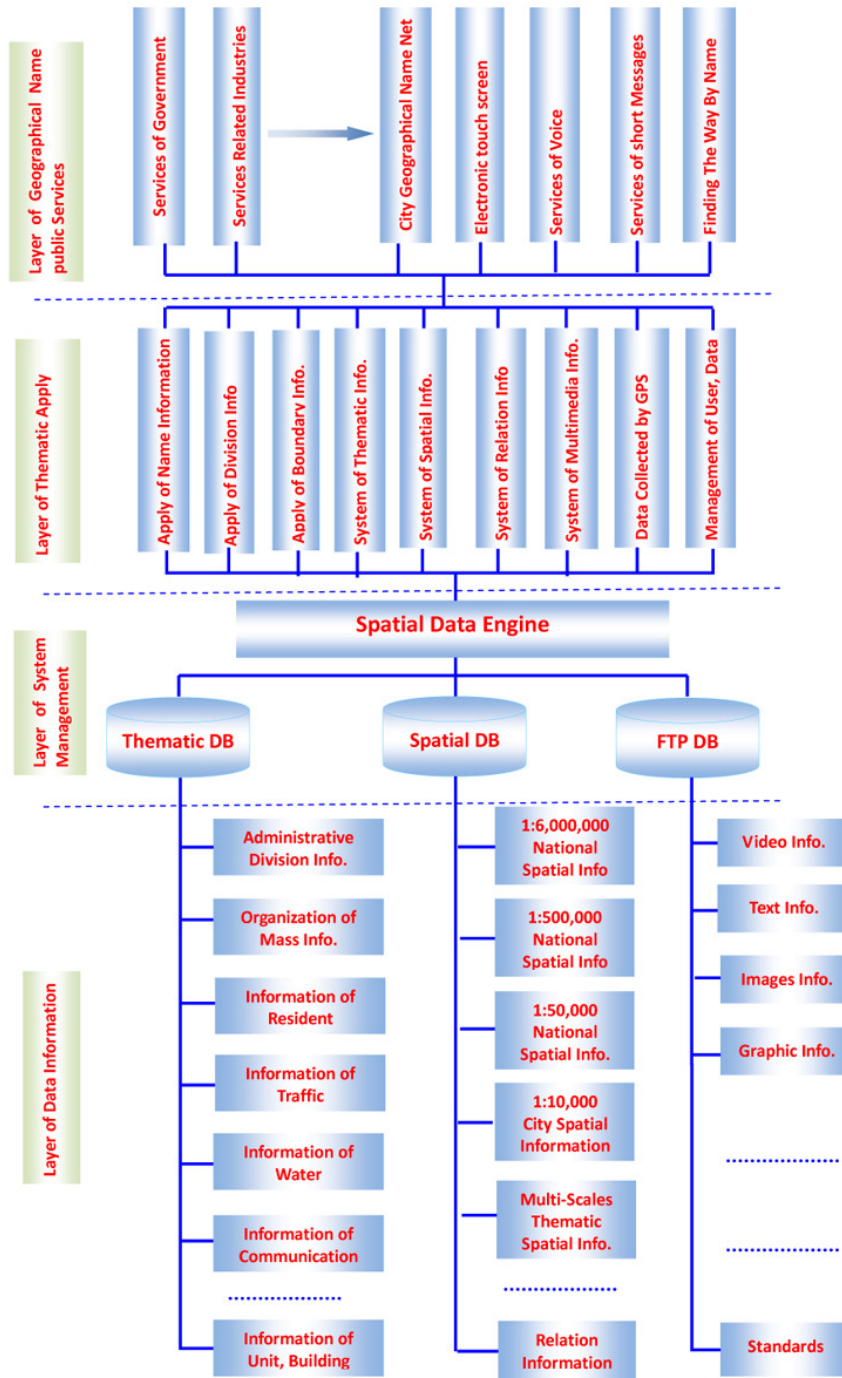
*University of Waterloo, WATERLOO, CANADA*

### **1. BACKGROUND**

The “National Geographical Names Database Management System (NGNDMS) was established in China in 2006, was led by the Public Geographical Names Sever Lead Board of Chinese (GNSLBC); it was distributed to all the department of civil administration in the same year, so far, more than 30,000,000 records of geographic names information and 20,000 maps spatial information have been collected. The types of geographic names are regulated and expended by this system, which also covered all kinds of information about geographic names, administrative division, and boundary information. It was based on spatial data of 1:6,000,000, 1:500,000, 1:50,000, and 1:10,000 and was core database of the four level database of geographic names, administrative division, boundary information, and public geographic name services. All data are updated in two ways, one way is updated on a daily basis in the area that special network was built; another way is updated on term basis in the area that special network has not been built. In NGNDMS, massive spatial data was managed by distributing data base, which has good stability and opening, to ensure the information and system security.

### **2. THE ARCHITECTURE OF NGNDMS**

NGNDMS was run on the Windows environment; it was managed by SQL Server 2000, SQL Server 2008, or Oracle. There are three modes in NGNSMS, it is Stand-alone, C/S, or B/S. There are four information layers, data information layer, system management layer, professional application layer, and geographical name services application layer (see Scheme 1).



Scheme 1, system architecture

### 2.1 Data Information layer

Data information layer is the content of data, which includes the geographic names data, GIS data, multimedia data, connection related information, relevant attribute data, metadata, data standards, and other data.

#### (1) Thematic Geographical Name Attribute information

Thematic Geographical Name Attribute name information is the main information of NGNSMS, including 12 categories and 74 sub-categories. The 12 categories are administrative area, non-administrative areas, mass self-organization, residential, transportation, water conservancy, electricity, communications, monuments and tourist attractions, buildings, units, sea, land water, land topography. The information can be summarized as the basic information and special information, basic information includes: standard names, minority languages written, the Roman alphabet, geographic names pronunciation, alias, short title, classes name, time zone, location, language, security classification, meanings, origin, history transformation, geography entity overview, multimedia information. Special information is different based on sub-category. Currently 30 million geographical names information has been collected; eventually it will reach up to 1 - 5 billion.

#### (2) Geographic Information Data

Geographic Information Data includes digital maps of four scales, it is the National Administrative Maps of 1:6,000,000, National Topographic Maps of 1:500,000, National Topographic Maps of 1:50,000, City Maps of 1:10,000. The main elements of Maps of 1:6,000,000 was administrative divisions above the county level as national index maps. There are all elements in Topographic Maps of 1:50,000, it were transition maps as view. Topographic Maps of 1:50,000 were basic maps, there are most of geographical names in it, in addition to the names that it is so dense too described. City Maps of 1:10,000 includes these elements of urban, such as such as residential areas, buildings, units and so on. Currently, only Maps of 1:50,000 include 24,000 maps (including the Department of the sea), City Maps of 1:10,000 includes 20,000 maps. All of information reaches to hundreds of millions.

#### (3) multimedia information:

Multimedia information includes information of images, information of text, information of video, information of graphics. That is additional information for geographical names, such as documents of reply boundary demarcation, referrals to programs, Boundary agreement, original work maps, meeting notes, attached maps of conference, annual inspection program, annual inspection reports, and so on.

#### (4) Relational information

Relational information is used to describe these relations between geographical name items and its item of spatial position, graph text, images, video, the thematic information, and so on. The main purpose of build link information is to get its spatial position by item of geographical name, to get information of geographical name by its spatial position, to get its information of texts, images, graphs, videos by item of geographical names.

### ***2.2 system management layer***

The system management layer includes the engine of spatial data, thematic data, multimedia data, it is an integral part of the NGNDMS. It is used to build connections between NGNDMS and SQL SERVER, ORACLE, FTP Servers by ODBC.

### ***2.3 Professional Application Layer***

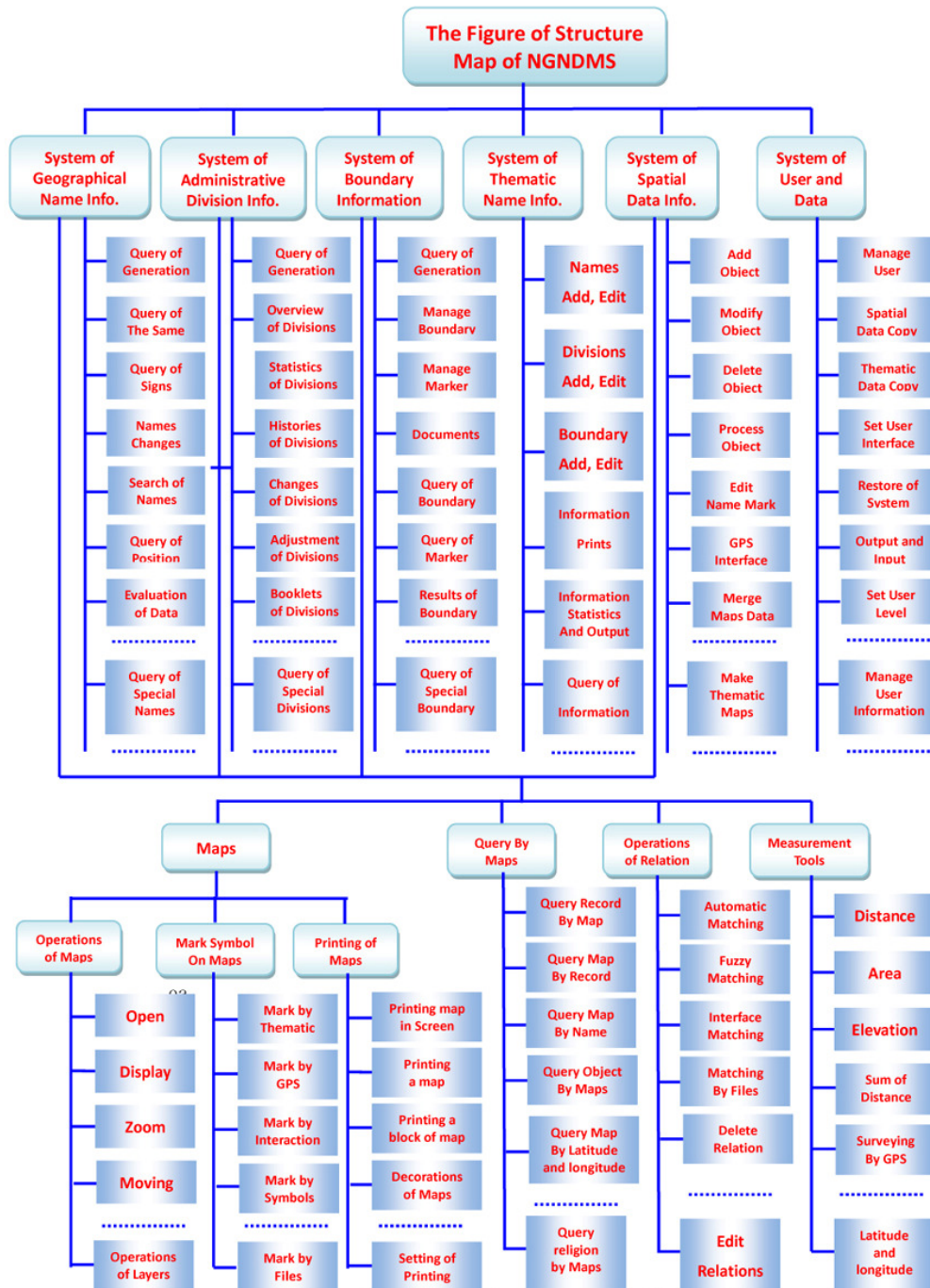
Professional application layer is used to working and maintenance of government agencies of management geographical name. It include the informational system of geographical name, the informational system of administrative divisions, the informational system of boundary, the system of spatial data base, the system of thematic geographical name data base, and so on.

### ***2.4 Geographical Name Services Application Layer***

Geographical name services application layer provides comprehensive public services for government and public servers. It includes government services, related industries services, city names web service, touch-screen services, voice services, SMS services, names inquiry, finding the way buy geographical name, etc.

## **3. FUNCTIONAL STRUCTURE OF NGNDMS**

NGNDMS includes six sub-systems in the functional structure, these are the informational system of geographical name, the informational system of administrative divisions, the informational system of boundary, the system of spatial data base, the system of thematic geographical name data base, management system of data and users ( Scheme 2).



Scheme 2, the figure of structure map of NGNDMS

The main functions of the informational system of geographical name, the informational system of administrative divisions, the informational system of boundary are general query and special query of geographical name information, administrative divisions information, boundary information; to get its spatial position by these information, to get these information by its spatial position; to query multimedia

information; to search special name; to search geographical name; to mark by maps; to mark by GPS; to build the relational information between spatial data and attribute data; and so on.

The main functions of the system of spatial data base are inquiry of spatial information; statistics of spatial information; to add spatial information; to edit spatial information; to modify spatial information; spatial information summary; etc.

The main functions of the system of thematic geographical name data base are inquiry of thematic geographical name; statistics of thematic geographical name; to add thematic geographical name; to edit thematic geographical name; to modify thematic geographical name; thematic geographical name summary; etc.

The main functions of management system of data and users are to set user level; to backup data; to recovery data; to manage operation records.

There are many kind of the print functions in these six systems, these are to print maps, to print spatial information, to print thematic geographical name, and to print table.

The functions can be generalized as following:

### ***3.1 The Function of Management and Storage of Thematic Geographical Name***

thematic geographical names system can manage and store thematic geographical data in effect. For the huge thematic geographical names, data standard had be made at first, and these data must be divided into 12 categories and 74 sub-categories. Secondly, System had provided many functions, these are to add, to delete, to edit, to input, to output, to merge of thematic geographical name data. to modify thematic geographical name; thematic geographical name summary. Finally it had been implemented in this system that these functions of statistics, analysis, condition query, fuzzy query, combined query, and so on.

### ***3.2 The Function of Management and Storage of Spatial Information***

Spatial information system can manage and store spatial data in effect,. Spatial information includes maps of 1:6,000,000, 1:500,000, 1:50,000, 1:10,000, All records has reached hundreds of millions. Spatial information system provided many tools that it used to add spatial data, to delete spatial data, to edit spatial data, to query spatial data, to input and output spatial data, to merge spatial data, and so on.

In order to simplify the map operation, The spatial data was linked with the thematic data in the system, Many way of map adding was provided, such as adding by mapping, adding by Latitude and longitude, adding by GPS, and so on.

### ***3.3 The Function of Management and Applications of the maps of different scales and sheets***

In the system, the map elements of different scale and sorts were browsed, added, edited seamlessly. These operations are not limited by scales, sheets and sorts of maps.

### ***3.4 The Function of built relation between spatial and thematic information***

Relation between spatial and thematic name has been built in this system, these tools have been provided that you can get spatial position of thematic name by its information, get information of geographical name by its spatial position, region query, etc.

Many ways have been used to build the relation between spatial and thematic name. When you used these tools of thematic name marked, Latitude and longitude marked, graphic object linked, GPS marked, GPS data imported, the relation will be established automatically. You can used “automatic matching” when the thematic name is the same as graphic name and graphic name is only one. When the thematic name is different from graphic name, or graphic name is not only one, you can find its position with “fuzzy query”, then build the relation with the function of “establish relation”. In the case of one of thematic name correspond many graphic objects, the function of “link graphic object” can be used.

### ***3.5 The Function of Data Merged***

Data merged includes spatial data merged, thematic geographical name merged, multimedia data merged, and relational data merged. When stand-alone version is used, you must used data merged. Because there are many different boundary in one map sheet, It is difficult to merged spatial data.

### ***3.6 The Function of Printing***

There are two kind of printing functions in this system, it is printing of maps and printing of thematic name table. Maps can be printed in different size of paper and different kind of printers according any scale, any area. It include printing maps of achievement, decoration of maps, etc. printing of thematic name table include printing of registration form, printing of catalog form, printing results form, printing tables.

### ***3.7 The Function of expansion of symbols, graphical attributes, multimedia information***

In this system, thousands of kind of symbols had been stored, and you can expand symbols base, graphic attribute. For the thematic names, text, graphics, images, videos can be added. Because the space of multimedia information is huge, multimedia information was stored and managed by FTP servers.

### ***3.8 Measurement Tools***

In system, many measurement tools had been provided. You can use these tools to get the value of Latitude and longitude, elevation, area, distance, etc, and to put the value of measurement into the forms of thematic name table.

## **4. CONCLUSION**

NGNDMS has been updated from 2006 to now, from version 1.0 to version 3.0, the content has been modified, and the function have been expanded year by year. To the end of 2010, the records of thematic names information reach up to 30,000,000, and it will reach to up hundred millions in the next three years, the ultimate number will reach to billions. NGNDMS can store and share the huge thematic graphical name resources, which will improve the capability of the government administrations public service, also improve the working efficiency of geographic names, administrative division, boundary, and strengthen Chinese information construction.