A SOLUTION STUDY OF GEOMATICS DATA INTEROPERABILITY BASED ON ORACLE SPATIAL

Jianguo He [a,b], Dazhi Guo [a]

[a] China University Of Mining And Technology(Beijing), No.11, xueyuan road ,Beijing，100083
[b] Hebei Geomatics Center, No.495, East Road Zhongshan, Shijianzhuang, Hebei Province，China,050031
hejianguo@hebsm.gov.cn

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ABSTRACT:

It is a trend to store geomatics data in Oracle Spatial for different kinds of GIS applications. Normally, the GIS applications depend on the special GIS software platform which have the ability to store geomatics data into Oracle Spatial. However, this kind of geomatics data by use of one GIS software platform can not been accessed by other GIS software platforms. It is called as a problem of data interoperability. In this paper, the main aim is to study a way for the data interoperability between different GIS software. For this purpose, the reasons derived this problem is analyzed, and the difference of data stored in Oracle Spatial by different GIS software platforms is compared. Also, the spatial data types appended to Oracle Spatial and middleware solution for data interoperability are discussed. The key of proposal solution is how to adjust the metadata in Oracle Spatial, which presents the different data stored by different GIS software platform, and to make a set of data stored in Oracle Spatial can been accessed using different kinds of client.

1. THE IMPORTANCE OF SPATIAL DATA INTEROPERABILITY

Interoperability refers to that the different users, application systems and computer systems can work together and share common data regardless the desktops and processing systems used; and the data interoperability refers to that the different systems can indirectly change data via common data conversion standard. While spatial data interoperability model is a standard defined by Open GIS Consortium (OGC), mainly makes GIS users able to access and retrieve the data from different structured database under the common understanding.

At present, most GIS applications are tending to store graphic data and attribute data in common database, and choose Oracle as the database management system. Oracle Spatial has been recognized as a tool to store spatial data especially after Oracle Company releases the Spatial. Regard the Oracle Spatial, although it defines the storage field Geometry and it is open, it only defines the structure of the field without any define of the type code and coordinate sequence. Oracle Spatial can provide an open data structure, however, the different GIS system adopts different data format, together with different definition and expression in databases, it will result in some difficulties while access the data stored by other GIS system, and that data could not be shared, the potential usability of geo-spatial data is much limited.

In short, two problems should be solved when read the spatial data stored in Oracle Spatial using different GIS system: One is necessary to make different GIS systems able to read the data from the same database; Another one, the different GIS system can share the common symbol. In this case, the clients can share not only the common spatial data but also the symbol data.

The emphasis in this paper is to probe the interoperability based on Oracle Spatial for the different users. The geospatial data is stored in common object relation database, and the basic point of the proposal way is to make the different GIS platform able to access the data stored in Oracle Spatial directly, and the geospatial database becomes the fundamental and shared databases in order to provide information for different clients , the fundamental data of the digital city.

2. FACTORS EFFECTING THE INTEROPERABILITY AND SOLUTIONS

Many factors can result in the failure while access and operation of data stored in Oracle Spatial by different systems. Firstly, the different systems have different methods to recognize the spatial data table in the database, Secondly, the different GIS system describes the spatial data in different ways. Therefore, to realize different client system can share the data in the common database, the first thing to do is to find out the reasons of the problem.The follow will describe the main reasons that the spatial data were stored in different structures and modes

2.1 Different GIS Platform Has Different Definition for Oracle Metadata.

When using Oracle, different GIS platform adds its own data structure to Oracle, for example, MapInfo uses its user model to manage the data structure, just the same, Map uses own user model to manage the data structure. The user model used in Oracle is commonly called GIS's metadata in Oracle, it is used to manage the name of spatial data table in GIS database, the field name of spatial data, the field name of symbols, the spatial geometrical area and the geographical projection data etc. The metadata that MapInfo generated in database is MapInfo_mapcatalog, while the metadata that Map generated is Admpfeaturelayer, Admpimportsettings, Admpmetadata, Admpoptions and Admposemetadata. In addition, all GIS softwares add some own attributes in the layer table to store some controll info of the features, such as line colors, width, area filling methods etc. All these made the spatial data show many different structures and schemata in Oracle Spatial .

2.2 Different Description of the Spatial Features

Different GIS software uses the different methods for describing the spatial features stored in Oracle, for example, MapInfo uses two dimensional coordinates (x1，y1，x2，y2……) and coding for objects (point:2001, line:2002, area:2003 etc); while AutoDesk Map uses three dimensional coordinates (x1，y1，z1，x2，y2，z2……) and coding for objects (point: 3001, line:3002, area:3003 etc). It is understood that these data of coordinates and coding are all stored into the databases of their own, however, the different GIS software adopted the different rules, and the rules could not be read each other

As things are at the moment, there are three models that may be selected to solve the problems as mentioned above. One of the models is based on the different software platform, its main objective is to adopt common agreement when describing the spatial object, this model is rather limited. The second one is to work on the object metadata, and the metadata will be further developed based on the knowledge we have got to realize the interoperability. This one will be the emphasis discussed in this paper. The third one is called middleware model, that can be used to develop an interoperation method between Oracle and application system, unfortunately there is no ready middleware so far.

3.   METHOD TO EDIT THE ORACLE METADATA

The central point of this method is to edit the metadata according to the requirements of interoperability by analyzing the differences of the info and structure of metadata in different GIS system.

Let us take MapInfo and Map as an example to explain that how they edit the metadata and can directly access the same spatial data in Oracle Spatial.

3.1 MapInfo Read the Spatial Data in Oracle Spatial Stored by Map

First explain the method that MapInfo stored data in Oracle Spatial, then discuss how MapInfo read the data saved by Map. When uploading data to Oracle using its own user model, MapInfo first register the metadata in MapInfo_mapcatalog according to the basic info of the TAB, then load the object feature data to the table circularly. Meanwhile add some attribute field in the related table that is necessary when MapInfo read the data.

Comparing the table in MapInfo and the table upload to database, three fields have been added

GEOLOC   field to store coordinates
MI_PRINX   primary key of the data table
MI_STYLE   symbol field to store objects symbol info

Meanwhile, a spatial index was established in the field GEOLOC, an unique index has been established in MI_PRINX.

The names of the spatial data field and the unique index field are allowed to be changed, MapInfo only requires the consistency of the registered field name in metadata table and field name in data table. This change of the field name provides

the possibility for MapInfo to read the data saved by other GIS software.

The process for MapInfo to read the spatial data that Map stored in Oracle Spatial:

(1) Add MI_STYLE field in data table, with the content null.
(2) Register the data table in MapInfo_mapcatalog.

Add the name of the field that store the spatial data in data table in SPATIALCOLUM, add MI_PRINX in SYMBOL, and fill in the other corresponding field info.

After these procedures, MapInfo can read the spatial data stored by Map via DBMS data engine.

3.2 Map Access the Spatial Data in Oracle Spatial Stored by MapInfo

First explain how Map stores the data in Oracle Spatial, then discuss how Map can read the spatial data saved in Oracle Spatial by MapInfo.

It is quite similar to MapInfo when Map upload data to Oracle. First register in the metadata table, Map has several metadata tables in database.

Admpfeaturelayer: record the relation between data table in database and the layer in Map, one table in Oracle can relate to one or more layer in Map, but one layer can only relate to one table.
Admpimportsettings: record whether the user has set lock to Oracle schema.
Admpmetadata: record how Map interpret the fields of the table in the database,
Admpoptions: initial status is null, to save the settings for some query information,
Admposemetadata: record projection and boundary info of the data table。

For spatial data table, unlike the OBJECTDATA in DWG format, add fields in table structure:

GEOMETRY: Field to save coordinates
ENTITYID: Primary Key of the data table
MAP: Symbol attribute field that Map used to explain object symbol

In a word, the process for Map to read the data saved by MapInfo is as follows: first add fields in the data table for symbol and layer name etc, and then add corresponding contents. When the table structure and contents are adjusted, next step is to register the data table in above metadata table belong Map schema, and then Map can access the table stored by MapInfo.

It may be seen from above analysis that if we want to access the data stored by MapInfo in Oracle Spatial using AutoDesk Map, we have to built the register info of spatial data table of MapInfo in AutoDesk Map metadata table according to the rules and semanteme, by which Map interprets the spatial data table, and add some symbol info for Map in data table. Also, if we want to access the data stored by Map in Oracle Spatial using MapInfo, we have to built the register info of spatial data table of Map in MapInfo metadata table according to the rules and semanteme, by which MapInfo can interpret spatial data table, and add some symbol info for MapInfo in data table. That

is the main idea to realize interoperability by means of editing the Oracle metadata using program or manual .

4. SUMMARY

It is a trend that spatial data is stored into object relation database. But many technical problems need to solve for really realization of interoperability and data sharing .We have finished this kind of system for three cities in HEBEI province, China, and inputted the data about 6000 sheets in 1:500 scale maps into Oracle Spatial. Also the data in Oracle Spatial database can been accessed directly by MapInfo and AutoDesk Map each other using this method of editing Oracle metadata. But it is not easy way, and further study has still been done.

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