GEOGRAPHICAL DATABASE - STRUCTURES

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ABSTRACT

The data management is the of great importance to Geographic Information System, therefore often it needs help from a Database Management System - DBMS.

Normaly, the DBMS that may be obtained are not prepared to work with complex structures.

This work is about the mainly adaptation that we have to do to DBMS and, the cartographic view in developing Geographic Database.

1. INTRODUCTION

The volume of information available for those responsable for the politics, economics, environmental and social decisions is very large. In all aspects of the human knowledge, the amount and speed of the data update grow very much. This data, due to its volume, is not used in a proper way and sometimes not used at all.

When we introduce the geographical element, the quantity of data increases even more making its use almost impossible.

Another important problem is the information access. The process used to enable this access must be rapid and reliable enough so that information will prove to be usefull.

The solution for the logical use of the information is the application of the Database technology.

In the same way, with the joint of the geographical information, we have the Geographical Database-GDB, which relates the literal information with the geographical. To do this, in the beginning, single adjusts were used for the Convencional Database-CDB, what normally, its not a good solution.

This work introduces the principal focus about Geographical Database and the trends about this technology.

2. THE GIS CONCEPTION

One may think a GIS as an Information System, whose functions are the acquisition, management, analisys and presentation of the information spaciously organized about a certain region.

From de above idea, one of the most important GIS function is the information management, usually executed with help of one Database Structure.

3. THE GDB E CDB DIFFERENCES

A database can be defined as a collection of the real world representation in form of related data, as coherent as possible, stored with controlled redundance and structured in way to facilitate its usage and to satisfy a large variety of demands.

This concept has been widely used in commercial applications, denoting mainly the sistematic aspect. When we introduce a new element, the geographical feature, we have the Geographical Database, which has a close association with the literal and geographical information.

The objects that belong to the GDB, although having more information, must be manipulate as only one unit of processing. The mentioned objects are normaly called complex objects.

The main differences among the objects belonging to GDB and CDB are:

- The CDB records are usually of fixed length, whereas the GDB records have variable length or one chain of records for store long objects;

- The data volume for the GDB is larger than the used for the CDB;

- In the GDB, the number of records in the same entity is big, but the number of entity is small, occuring the contrary in the CDB;

- The query languages and the access methods used by both are differents;

- The GDB stores, beyond of his data, its topology.

4. THE MAIN REPRESENTATIONS

In this part, the main representations for complex objects will be represented, from the simplest to the most recent researchs on this topic.

The first two representations have both the literal and the geographical data separated, while the others have them together.

4.1 Text File

This approach has all the literals data stored in specific files or in a database which has a external interface. The graphics data are stored in specifics structures and also has a extern

interface. In a high level there are a **management program for the transit of** informations between both. So, for example, to associate a data from the graphic file to the literal file, is necessary to create a text file from the graphics file which is read by the management program and related with his homologous in the literal file. The same process is used for inverse case.

The relationship between the two types of information is usually executed through geocodes. This process is usefull due his implementation facility, but has, as disavantage the time necessary to execute the process. This problem can be decrease if we use binary code for the transit of information.

4.2 Interface Language

Another interface possibility between the two informations is through the direct relationship between its structures. To do this, others information are added in the literal or graphic file, in order to store the address of his homologous in the other structure.

For example, lets take the case when the relation structure is together with the graphic information. The management program must access this structure and through it execute the relationship between both, in one of following ways:

- after identifying the graphic element, the management program reads the literal information addresses and accesses the correspondent entity through the query language;

- choose one literal record, the management program, through pointers system, identify the especific graphic information.

This process has been used in some systems mainly because they don't need a very hard development and utilizes the graphic and literal structures already available. As disavantage we have the difficult for updating due to the fact the information are related to one object in two differents places.

4.3 Relational Model Extent

The relational model represents a database descrition through simple and well known mathematics concepts. Its goal is to allow the user to visualize the database as a set of tables where each line represents a record and its attributes.

The 1NF (First Normal Form) is important for the database implementation, therefore when using complex objects this form must be out, considering the characteristics of those objects. So, the relation has as attributes one n-uple of objects or a set of objects. Among others, we will introduce three possibilities for applicating the relational model to complex objects.

4.3.1 Relational hierarchal structures

Each complex object is represented by one or more relations. This way, the chain is made from the root row to the rows hierarchal dependent, creating one strong relationship between the table.

The problem with this idea is that due to the global dependency created between the table, when we take out one n-upla from it, we need to take out also the data for all the others tables.

4.3.2 The use of Abstract Data Type - ADT

The abstract data type is characterized as:

- by definition of one set of objects, using one or more type definition;

- by definition of one set of operators applicable to the objects;

- by the encapsulate of the objects in a way that one normal user only sees it through defined operators.

By ADT the designer can better defined as the set of operators for its application beyond, of promove the modularity in relation of the system changes.

As a tool for complex objects representations, the ADT has the folowing approach:

- use of the relation or domain as ADT allowing the freedom of data as well the abstration of the operation to one level;

- only use the domains as ADT, where the objects must stay all the time in the memory. In this case one can use a host language, self-contained or other specifically developed for it;

- use of hierarchy of types through the relationship between types and sub-types.

4.3.3 The relational algebra application

The relational operator in the convencional relational algebra only are efficients when used with common data type. When using complex objects, one new set of operators must be created to attend its peculiarity, either through the increase of its operationals characteristics or by the definition of other operators.

4.4 Object-Oriented

This representation is the most recent and has been of great attention to the researchers.

The convencional systems needs the entity decomposition in elements simpler than considering that they are record oriented.

In the object-oriented we represent any entity belonging to the real world by only one object, independent of this complexity.

His definition involves basically two ideas:

- the inherit concept

- the ADT propriety.

Some important concepts such as types, operations, messages, objects and others are used for various systems already implemented. For specifics applications of GDB, one of the more important concepts is the abstraction. The principals abstractions related to object-oriented are:

- classification,which means a set of objects that share commons characteristc;

- generalization, which describe the characteristics of a class from others class;

- agregation, which represents one object of any complexy with one hierarchy of step by step more primitives objects;

- composition, which is a ampliation of the concept of agregration, represents the complex objects through the shared objects and levels of abstractions which allow to have a lot of representations;

- face, which allows to take the differents applications or differents levels of abstrations.

5. CONCLUSION

The application of complex objects concepts within the Not Convencional Database context has expanded for others areas, as Office Automation, CAD and Decision Systems. All this applications try to represent the objects for modelling as near as the image that the user do of then.

The ADT concepts attend partially this idea considering that the object representation is near of its real vision. The object orientation gave other important characteristic to the ADT, that is the inheritage, allowing the transmission of characteristics from one to another. These ideas are presented in all the most recents researchs and will lead the next systems in the market.

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