

To Assign and Control the Right Accessing Geo-Database by Access Control Cube

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Abstract. The geo-database of a provincial government agency stores spatial data and the attributes of objects which the agency administrates in particular geographic areas. Because of the security of private data, it is very necessary to control all accesses to the geo-database. The geo-database of a geographic information system for administration of a government agency in a province comprises many subjects, each subject consists of many object layers, each layer many data tables. For the organization of a provincial agency, an agent is in charge of some objects of a certain subject in a particular zone. The agent has not only right updating data of the objects of which he is in charge, but also needs view data of other concerning objects. The Access Control Cube describes the control of access rights of view or update on a certain data layer in a particular geographic zone. In this paper, the concept of Access Control Cube is developed as an Object Access Control Cube to apply for every object of geo-database. Object Access Control Cubes is divided into View Access Control Cube and Update Access Control Cube. A cell of View Access Control Cube can be kept by one or some agents while one cell of Update Access Control Cube is kept by only one agent.

Keywords: Access control, Geo-database access control, Access Control Cube

1. Introduction

In a geo-database of a provincial governmental agency, access rights must be controlled to ensure the accuracy and the completeness of data of the geo-database and the individual responsibility of the agent who is in charge of the quality of data. Based on the assigned responsibility, each agent is privileged to react on a certain data layer of geo-database. These assignments are indicated to view or update data. The update right of data includes rights of view, insert, delete data.

Regarding to the functions and works of the agency, agents working on geo-database have various responsibilities in the agency. Based on agents' role at the agency, the administrator of geo-database uses an access control system to assign to every agent the rights corresponding to his role and responsibility to access geo-database.

This paper analyses the structure of a geo-database of a provincial governmental agency and develop the model of Object Access Control Cube (OACC) based on model of Access Control Cube (ACC) [8]. The Object Access Control Cube structuralizes the rights accessing geo-database of agent based on geographical zone, spatial object of data layer. The rights accessing geo-database indicated in Object Access Control Cube consist of View and Update. Consequently, an Object Access Control Cube is divided into View Object Access Control Cube and Update Object Access Control Cube. A View cell of View Access Control Cube can be kept by one or some agents while an Update cell of Update Access Control Cube is kept by only one agent.

2. System Description

Provincial government agency is an organisation which takes charge of matters of one or some subjects in a province. For example, Public Security Agency is in charge of security matters in the whole province; Education Agency is in charge of education matters in the whole province, Industry and Commerce Agency is in charge of matters of industry and commerce, and so on.

A provincial agency has departments responsible for matters of a certain subject belonging to the administrating responsibility of the agency in the entire province. For example, a provincial education agency has department of elementary in charge of issues of elementary education, department of secondary in charge of issues of secondary education, etc. in the whole province.

Each agent of a subject department is assigned the function administrating some objects of this subject in a particular zone of the province.

In the scope of governmental agencies administrating social matters, a geo-database is designed to store all data for administrative matters of a particular agency. It comprises several subjects installed on the provincial basic spatial database with the level of detail to every house in the entire province. In the scope of social administration, every member in house contributes to social activities and events. For example, children going to school, man and woman going to their companies are social activities.

For infrastructure administration, different agencies manage various facilities concerning a house, such as power, water, sewage, telephone, television, and so on.

For social administration, government needs administrate the activities of people living in every house. Accordingly, house is considered as a basic object in provincial geo-database. It is also a place generating and contributing several social matters such as education, health, environment, producing, trading, and so on.

This view indicates that various governmental agencies and their agents administrate one house together.

Technically, there are many agencies and agents managing data concerning a house. Two major requirements of the problem controlling access geo-database of a provincial government agency are:

- Many agents need view data of an object in geo-database: To deal with a particular issue, a responsible agent needs not only data concerning the object but also data from other subjects and zones.
- Only one agent is permitted to update data of an object in geo-database: Because data of an object vary vs. time, they need to be updated in time. This task is allotted to one and only one agent to ensure the correctness, reliability, timeliness of data. The responsibility on the data quality depends on only one agent.

3. Object Access-Control-Cube

As a 3-dimension space [1,8], an Object-Access-Control-Cube (OACC) is proposed to depict the rights accessing geo-database of a provincial government agency (Fig.1). Object Access-Control-Cube is classified according to its functions of View OACC (V-OACC), Update OACC (U-OACC). V-OACC depicts the right to view only and U-OACC depicts the right to update certain data of determined objects. The components of Object-Access-Control-Cubes are:

Location (l): is collection of geographic zones. Geographic area of a study province is divided into many geographic zones which can be administrative units such as districts, wards or smaller.

Data layer (d): is a data table of a kind of objects. For example, a data layer of object of NHA is a set of polygons representing houses in province.

Time (t): is used to indicate time assigning and removing access right.

Agent (a): is an official who is privileged to access geo-database.

Operation: View (v) / Update (u) (including insert, delete, update).

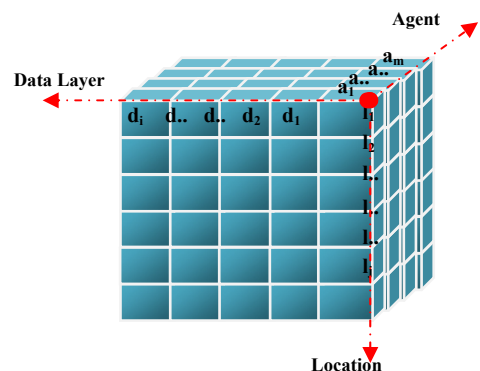


Fig.1: An Object Access Control Cube

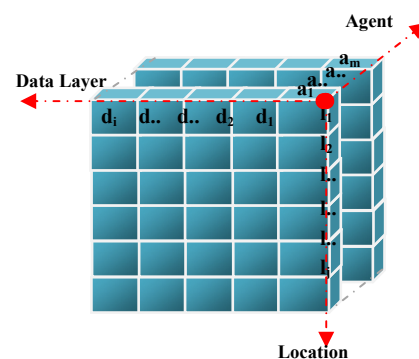


Fig.2: Agent matrix

Regarding to V-OACC or U-OACC, x axis indicates data layer, y axis location and z axis agent. The view or update right of a particular agent is determined on one zone of location and one kind of object of data layer.

For V-OACC, the relation between agent and location is many-many; between agent and data layer is many-many. One agent is permitted to view one or some objects. Similarly, data of one kind of object in one zone are viewed by one or some agents. For viewing, one agent can keep one or some cells of V-OACC and one cell of V-OACC can be kept by many agents [8].

For U-OACC, the relation between agent and location is many-many and the relation between agent and data layer is one-many. One agent is permitted to react on one or some zones. On the contrary, one kind of object is updated by one and only one agent. For updating, one agent keeps one or some cells of U-OACC and one cell of the U-OACC is kept by only one agent.

A slice perpendicular to agent axis of V-OACC or U-OACC provides with the View Matrix or Update Matrix of the agent corresponding with the intersection of the slice and agent axis. The marked cells of the matrices indicate the kind of objects this agent is assigned access right, the view right for marked cells belonging to view matrix and the update right for marked cells belong to update matrix (Fig.2).

The access rights of each agent are determined by a matrix integrated from view matrix and update matrix. In the integrated matrix of one agent, one axis is location of many zones and another is data layer of several kinds of objects. Each cell of the matrix are marked N (None) or V (View) or U (Update) to indicate the agent's right on a particular kind of object in a certain zone (Fig.3).

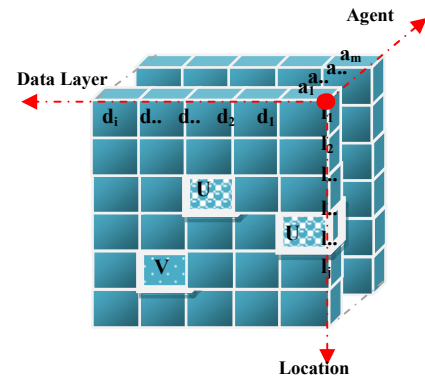


Fig.3: Integrated Matrix

View Cube (Fig.1) → View Matrix (Fig.2)
 Update Cube(Fig.1) → Update Matrix (Fig.2) } Integrated Matrix (Fig.3)

Adding a time axis into the integrated matrix of an agent [4][7], an Agent Cube of OACC (A-OACC) is built to determine the time interval during which the agent is responsible for every cell of the integrated matrix (Fig.4) [8].

Accordingly, using cubes of OACC, the administrator assigns rights viewing or updating objects to every agent via integrated matrix and control the agent's responsibility on data of every kind of object based on A-OACC.

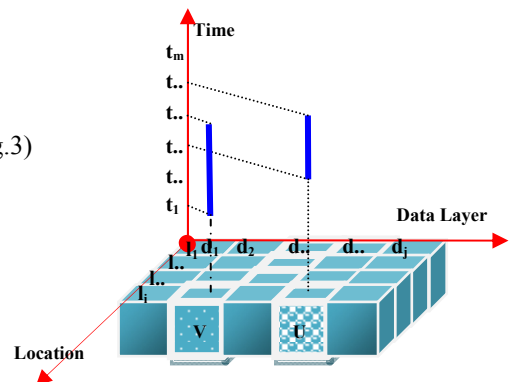


Fig.4: Agent Cube

4. Implementation

Based on the concepts of Object Access Control Cube, software, titled PACC (Provincial Access Control Cube), is designed by the TRANTECH Ltd (GlobalGIS) to install for the GIS systems for public administration in Vietnamese provinces. The PACC ver 1.0 has been installed for Binhduong Geo-database for Habitant Administration.

After entering correct password to log in the geo-database, windows of the software appear in turn to control the agent's privilege of view as the following process: Login → Subject → Zone → Data Layer → Object → Attribute, and the procedures of update only appear when the agent selects a kind of object which he is permitted to update.

5. Conclusion

It is very necessary for the administrator to control the user's access to multi-user geo-databases. Especially, the geo-databases of government agencies have to ensure the correctness, the reliability, the consistency and the timeliness. With the scale of a provincial agency, the management of data quality has to

allot to several agents. Based on the decentralization of a provincial government agency, this study proposes Object Access Control Cube model to assign and control access right of geo-database users.

The Object Access Control Cube not only indicates the task of users interacting geo-database but also determines the responsibility of every agent for the data accuracy of every object in geo-database. It also contributes to the solutions preventing illegal access to geo-databases of provincial government agencies.

The advantage of the OACC model in provincial government GIS systems is not only to assign rights viewing or updating every object to an agent but also to control the agent's responsibility for data of every object.

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7. Biography

Phuoc Tran-Vinh is Associate Professor of Informatics, Vice Rector and Chair of the GIS Program at the University of Information Technology (UIT) in Vietnam. He received his Ph.D. in Informatics from Vietnam National University. From 1994 to 2006, he was founder and Director of the Center for Developing IT and GIS (DITAGIS), one of the first research institutes about GIS in Vietnam in 1990s. In 2005, he obtained the gold medal from MOST for his contribution to the development of science and technology, specially GIS in Vietnam. He is also a technical consultant of TRANTECH Ltd.(GlobalGIS), a company focuses on developing government GIS systems and spatial tracking systems in Vietnam. His interests include real-time spatial information system, geo-visualization, real-time geo-visualization, GIS for administration, access control in government GISystems, real-time GIS for disaster and climate change. His contact information is Phuoc.gis@gmail.com

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