2015 The 5th International Workshop on Computer Science and Engineering
doi: 10.18178/wcse.2015.04.110

Logical Design of Temporal Database for House Sheet

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Keywords: house sheet, ER modeling, temporal database, logical design.

Abstract. In this paper, the house sheet in real estate information system is modeled with ER, and logical design based on temporal information is given; therefore, the data of house sheet could be consistency and integrity in the system, the house sheet could be backtracked in the time and space, related business queries and analysis could be completed correctly.

Introduction

House sheet is the description of the house physical property; it is the key factor that relates to real estate information system within each subsystem[1]-[3]. Therefore, how to build a house sheet is to be studied in all the real estate information system issues. Some existing house sheet in the real estate information system has the following two questions:

1) Each subsystem has its own house sheet to meet their own needs, their basic elements are the same, but data and presentation are different, data cannot be shared, data is redundancy, system cannot guarantee data consistency and integrity of house sheet.

2) House sheet in system almost has no maintenance and management of temporal data, historical data which reflects different periods of house sheet has not been saved.

On the one hand, real estate information system need to keep access to existing data, on the other hand, historical data must be saved in order to query historical business. The two problems described above may lead to the problem that the house sheet could not be backtracked in the time and space. To address these issues, ER modeling for house sheet is needed.

ER Modeling for House Sheet

Because we want to save house sheet with the relational database table, we use ER modeling instead of object-oriented method. In general, house sheets include building, floor, door unit, household and other entities, and some building as a group, known as the group-building (buildings); House sheet and person (natural person, legal person, real estate development enterprises, units, etc), project, land, are closely linked.

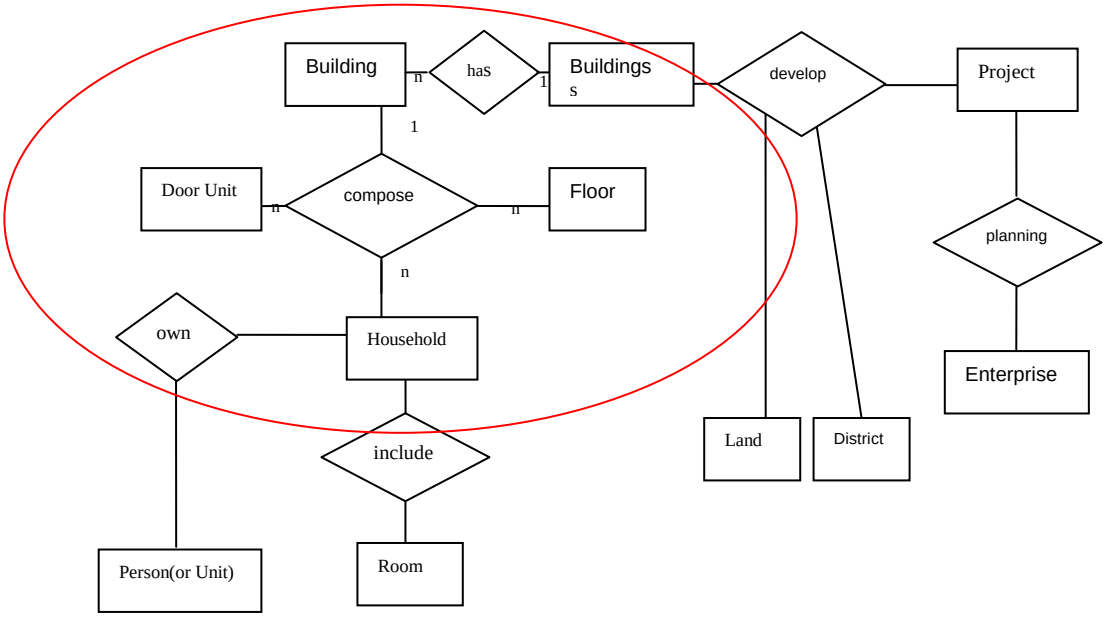

Fig. 1: ER diagram of house sheet

Objects inside range of red line are the entities and relationships of house sheet.

Relational Model of House Sheet

1）Group-building

GroupBuilding(gbID，Name, Structure, LandArea, BuildingArea, HouseUse，XCoordinate，YCoordinate ， HouseNumber ， HouseLocation ， YearBuilt ， ProcessDB-Time ，RealDB-Time，HistoryDB-Time)

Primary key：gbID

YearBuilt，ProcessDB-Time，RealDB-Time，HistoryDB-Time, all of them are temporal data.

2）Building

Building(bID ， gbID ， Name, Structure, LandArea, BuildingArea, HouseUse, NumberOfHousehold，YearBuilt，ProcessDB-Time，RealDB-Time，HistoryDB-Time）

Primary key：bID

Foreign key：gbID

3）Floor

Floor(fID，Name, FloorBuildingArea，ProcessDB-Time，RealDB-Time，HistoryDB-Time)

Primary key：fID

4）Household

Household(hID ， Name, HouseStructure ， HouseType ， HouseBuildingArea ，ProcessDB-Time，RealDB-Time，HistoryDB-Time)

Primary key : hID

5）Door unit

DoorUnit(dID，Name，ProcessDB-Time，RealDB-Time，HistoryDB-Time)

Primary key：dID

6）Building _Floor_DoorUnit_Household Relationship

Building_Floor_Door_House(bID, fID, dID, hID ， ProcessDB-Time ， RealDB-Time ，HistoryDB-Time)

Primary key：bID+fID+dID+hID
Foreign key：bID、fID、dID、hID

7）Development relationship
GBuilding_Project_Land_District(gbID, projectID, landID， distID, ProcessDB-Time，RealDB-Time，HistoryDB-Time)
Primary key：gbID+projectID+landID+distID
Foreign key：gbID、projectID、landID、distID

Temporal Management of House Sheet

1）Depending on different temporal states, house sheets are mapped to the following three databases:

- Real Database

Real database reflects the spatial location and attribute of objects in the present tense, each record in the database is in "active" status.

- Process Database

Process database tracks objects in all phases of the evolution of the process, describes the incident and the whole process of evolution. At the same time, as soon as the event occurs when the condition is not met, the event will roll back until a condition is established, stop or return to the state it was in before the event occurs.

- History Database

After an object changes when caused by an incident, the latest status is saved to the real database, its evolution is saved to the History Database.

All tables of house sheet can be saved in different databases (process database, real database and history database), a record's ID (gbID, bID, fID, dID, hID, and so on) is generated automatically by the machine, so records in tables in different databases are unique.

2）House sheet will change over time. For example, an owner of a commercial shop, he might has part of shop sell at any one time, so that a household into a two household. Therefore, records in different tables of the house sheet are independent parts which can be changed individually. For example, a household changes (one becomes two), but house and floor information does not change, unchanged records are still in real database; changed records are pushed into history database.

All seven tables in house sheet has temporal information. we can use a version-table to manage version information for house sheet.
HouseVersion(VersionNo, VersionName, gbID,bID, dID, fID, hID, RealDB-Time, HistoryDB-Time)

Primary key: VersionNo
Foreign key: gbID、bID、dID、lID、hID

3） Creating and changing of house sheet

3.1） For the new house sheet, planning house sheet is pushed into process database, and a record of planning version is inserted into HouseVersion table. See ① of Figure 2.

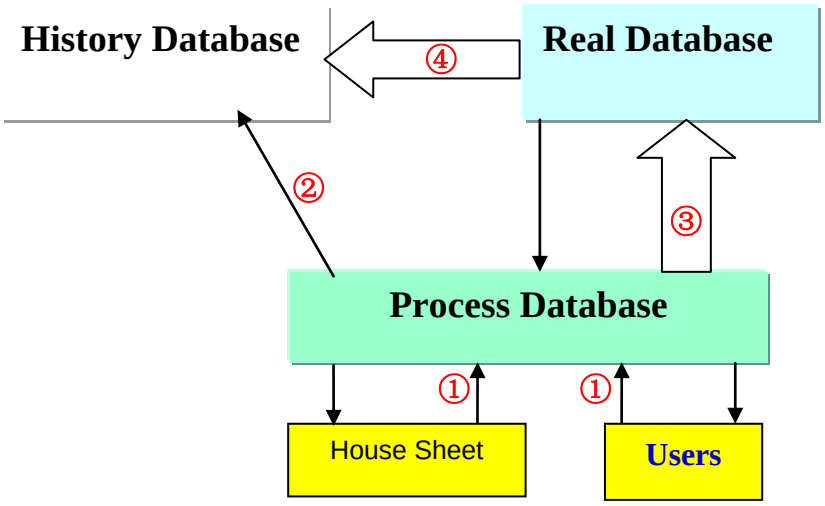

Fig 2: Circulation of house sheet in databases

3.2）If planning house sheet modified, the records that are modified should be pushed into corresponding tables in the history database, and new content should be pushed into the corresponding tables in the process database, and a record should be inserted into the version-table. See ② of Figure 2.

3.3）When a house is completed, the house sheet in real database should be pushed into real database, the house sheet in process database is deleted, and a record(completion version) should be inserted into the version-table. See ③ of Figure 2.

3.4) If the house sheet in real database is modified, for example one household becomes two households:

Two new records are constructed in process database;

After Mapping、registration and examination are finished, system runs a stored procedure as follow:

a) Two new records in process database are pushed into real database;

b) Household records that are modified in real database are pushed into history database; See ④ of Figure 2.

c) A record(completion version n) is inserted into the version-table.

Concluding Remarks

In a real estate information system, actual implementation of house sheet may vary from the method in the paper. For example, in some systems in order to easily find developer and project information, information such as company name and project contents are saved in the table of house sheet; these are wrong approaches because they are inconsistent with the basic principles of relational database design.

The paper is financed by the Fund WHZC-2014-075A (2210、2415、2416)--information construction project of WUHAN housing Security And Management Bureau.

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