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A Study of Translation from OCL to SQL Taking Consistency into Consideration

Kunihiro Yoshidumi (010123)

School of Information Science,
Japan Advanced Institute of Science and Technology

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Object-oriented methodologies are effective for software developments. In such methodologies, software is considered as a collection of objects that incorporate both data structure and behavior. A lot of object-oriented methodologies such as OMT, OOSE, Catalysis have been proposed. UML was proposed by unifying these methodologies. Currently, UML is widely used as standard notation for object-oriented developments, and standardized by OMG(Object Management Group).

There are nine diagrams in UML. We can describe the various views of a target system. In designing the system, we construct multiple models using them. At that time, the models may contain inconsistencies among diagrams. It is important to provide consistency among diagrams as such inconsistencies make the system unreliable. The models for a large systems, tend to be very complex. Therefore, it is difficult to detect inconsistencies of such models by hand. In this paper, we propose a method to support how to detect inconsistencies of the model.

In this paper, our concern is to consider consistency of the description. Inconsistencies of the description can be automatically detected with a computer system using a comparatively shallow inference. Consistencies of the description have effectiveness; for example, consistency condition concerning appearance of model element.

Constraint of the model is described with OCL(Object Constraint Language) which is the standard language for constraint notation of UML. Constraint is described on class diagram and defines consistency condition of object diagram. We managed UML models with the RDB(Relational Data-Base). Some advantages are obtained by using the RDB.

- The introduction is comparatively easy.

- A development cost can be reduced.

- Reliability improves.

Consistency conditions are translated to SQL query. Inconsistencies of the UML model can be detected by issuing SQL query to RDB. Then, the translation method from a part of OCL to SQL query was defined. t First of all, we must define the specification

of tables. We generate tables for each classes in model. The object made from the class must be identified. Therefore, *id* which is an identifier to each object is introduced into the proposed table as an attribute. Besides, the table has the operation and the attribute of the class as an attribute of table. Moreover, starting from a specific object, we can navigate an association on the class diagram to refer to other objects and their attribute and operation. This reference is called a navigation. Navigation properties are introduced into the table as attribute. Because, to achieve the function of the navigation in RDB. A navigation property identified the class of association end. The function of the navigation of OCL is achieved by doing the join operation and this attribute in RDB.

We define the translation method from the subset of OCL to SQL query. A value of Boolean type returns When a OCL expression is evaluated. A return value of SQL query is always a table. Therefore, it is necessary to associate some meanings with the table. If a table of a return value is empty, it is "True". And if it is not empty, it is "False".

And, I implement the translator. Implement of the translator used C language. Bison was used for the part of parsing. And the part of lexical analysis used flex.

Moreover, a suitable model was set, some consistency conditions described with OCL was translated by using the translator for SQL query, and the example of the inconsistency detection was shown.