

Research on Object-oriented System Analysis Modeling Based on Transitional Modeling with UML

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Abstract—Development of information systems is becoming more and more complicated, especially in business fields. The major development mode is based on UP, which can be called a development process standard. In this paper, the probable problem of abrupt conversion from business modeling to system modeling based on UP is presented. As a solution, the transitional modeling is put forward as a complement to UP. Meanwhile, situations, to which the transitional modeling is applicable, are also presented.

Keywords—Information system development, Object-oriented, Business modeling, Transitional modeling

I. INTRODUCTION

The research on and construction of information systems have become one major subject that causes common concerns from all those disciplines that treat information as their object of study and process[1]. One of the most commonly used and oldest approaches to analyzing and designing information systems is based on system modeling. As a remainder, a system model is a picture of a system that represents reality or a desired reality. System models facilitate improved communication between system users, system analysts, system designers and system builders[2]. By now, there have been some different information system development methodologies because of the difference of modeling objectives, modeling objects and modeling phases[3]. An information system can be developed based on some development methodologies such as process-oriented approach which is also called structured development approach, data-centered approach and object-oriented approach. These different methodologies have a common characteristic: analyzing and designing information systems through modeling.

System analysis is an important step in information system engineering and how to do system analysis well has been one of concerned problems[4]. Similarly, there are some common system analysis methods: function decomposition method, data flow method, information modeling and object-oriented analysis (OOA) method. And by now, OOA has become a major analysis method[5]. Major concepts included in object-oriented approach are: object and class, structure and association, inheritance, encapsulation, and message communication. It has a better than other methods in understanding problem domain and system responsibilities, improving communication, adapting

to requirement, and supporting the reusability of software[6]. Unified Modeling Language(UML) is a typical modeling tool for object-oriented approach. As the generation of UML, to some extent, the system modeling tool standard has been established. The tool makes system modeling visualized and it can be used to any kind of software process[7].

UML has been used to establish various types of models in information system engineering. As a standard, UP has been widely used in establishing models. In this paper, the probable problem of analysis modeling based on UP is presented and the transitional model with UML is put forward as a complement to UP.

II. OBJECT-ORIENTED APPROACH AND UNIFIED PROCESS

Being different from structured approach, object-oriented approach realizes the smooth transition from system analysis phase to system design phase, although both of them experience same phases such as requirement acquisition, analysis, design and construction. Today, most information system development projects are based on object-oriented approach.

Booch, Jacobson and Rumbaugh, three founders of UML put forward Unified Process (UP), which is matched to object-oriented approach, while UML was created in 1998. They made core processes to be modeled. A UP project covers four major phases: inception, elaboration, construction and transition. The workflows of UP are business modeling, requirement, designing, construction, testing, deployment, management of configuration and change, project management and environment. The relative workload changes as the phase changes[8]. The combination of UML and UP is the best choice for system development based on object-oriented thought[9].

This paper focuses on system analysis modeling. In this paper, system analysis modeling refers to the modeling process from business modeling to system modeling.

III. GENERAL SYSTEM ANALYSIS MODELING PROCESS BASED ON UP

The lifecycle phases of UP are used to guide the development of an information system. And a development case can be written in a form shown as in Table.1. Generally, requirement modeling starts just after business modeling has been established, as shown in Figure 1.

(Use cases are core of object-oriented development and also for the goal of simplification, in this paper, class diagram, sequence diagram, and some other diagrams that should be described in business modeling and system modeling are omitted.)

Today, the development of information systems is often very large and complicated. Under the circumstance, the granularity of use case is also big and business use cases are very rough. However, system use cases must be small so that they can meet the demand of software development. The granularity of system use case should be small and even be a small one that suitable to realize a computer interaction. Obviously, it is very difficult to get a good system model consisting of many use cases with fine and small granularity from a business model consisting of use cases with rough and big granularity. Take a complicated information system as an example. The development of a management information system involves several organizations such as manufactures, dealers, retailers, customers, suppliers, banks, and logistics, as shown in Figure 4.

Under the circumstance, business use cases with suitable granularity are **Manufacturer—Produce Products**, **Suppliers – Supply Materials**, **Logistics Companies—Deliver Goods** and so on for business modeling, as shown in Figure 3. And the granularity of any of above use cases is equivalent to a subsystem. Accordingly, business objects and use case scenarios derived from these huge business use cases are very rough. And this make it very difficult to extract suitable system use cases with small granularity. A good way to solve the problem is to add transitional modeling between business modeling and system modeling.

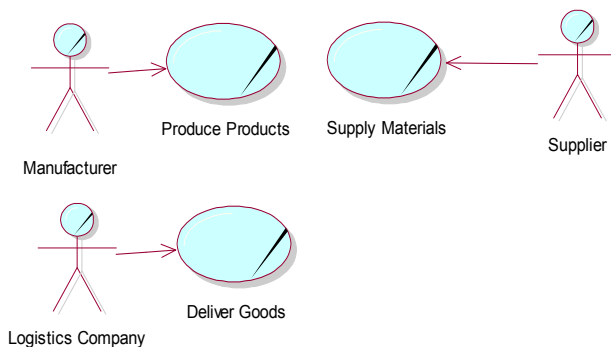


Figure 3 Business use cases example with rough granularity

IV. ANALYSIS MODELING BASED ON TRANSITIONAL MODELING

Transitional modeling means that to break those business use cases with large granularity into some key and core work units. Then modeling is done based on these work units so that business can be simplified. And a group of use cases with contracted granularity are generated, which plays a role as bridge between business modeling and

system modeling and also help understand business deeply. The results of breaking business use cases are transitional use cases, which play a transitional role from business use cases to system use cases. The extracted use cases are connected with basic business use cases through including, extending and generalizing relationships. Actually, in a large and complicated system, any business use cases may be consists of several smaller use cases. Transitional use cases refer to those core use cases which support main and key businesses. The point for transitional modeling is “precise and accurate” but not comprehensive, which requires that extracted use cases must be key and core use cases.

The steps of analysis modeling based on transitional modeling for a complicated information system are:

- (1) Set up business use cases with rough granularity, as shown in Figure 4.
- (2) Extract key and core business use cases according to business requirement and get a simplified business model, as shown in Figure 5.
- (3) Identify transitional use cases based on the simplified model.
- (4) Set up transitional model, as shown in Figure 8.
- (5) Set up system model based on the transitional model.

The transitional modeling make the transition from business modeling to system modeling more smooth and natural.

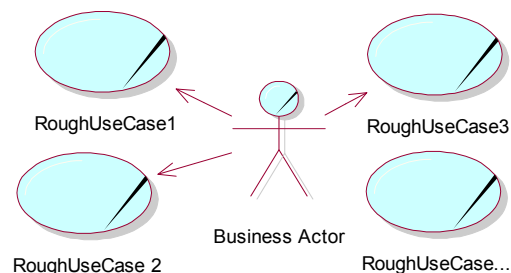


Figure 4 Business use cases modeling with rough granularity

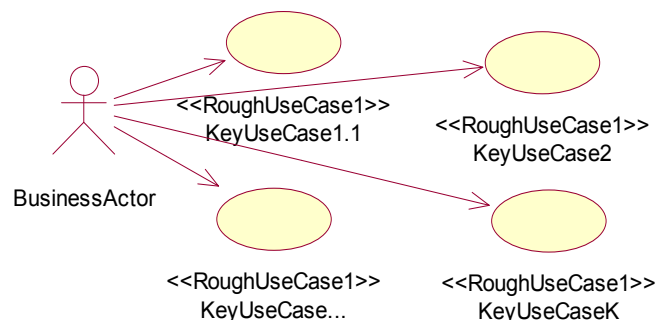


Figure 5 Extra key and core business use cases

V. SITUATIONS USING TRANSITIONAL MODELING

Transitional modeling is a bridge between business modeling and system modeling. The situations, in which, the transitional modeling is applicable can be the followings:

- (1) The objective system are complicated and large, and the granularity of business use cases is large and rough.
- (2) It is difficult to get use cases with smaller granularity for system modeling.
- (3) The system involov several business fields and workflows are acrosseed among those business fields.
- (4) It is difficult to describe use case scenery with activity diagram because of the complexty of a business use case with too many steps and branches.
- (5) If the number of swing lanes in a lane diagram is too many to describe business acitivities.

VI. SUMMARIES

Transitional modeling, as a complement to UP under some developmemnt situations has been put forward in this paper. So based on UP, the whole process of system analysis modeling with the transitional modeleling can be described as: business modeling, transitional modeling, system modeling. Of course, in each phase, sequence diagram, class diagram and some other diagram should be added to explain use cases. The transitional modeling is

also a guarrant measure to the quality of a complicated infomaiton system's development.

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REFERENCES

- [1] YAN Yi-min; Study of Informatics and Information Systems, Journal of Intelligence [J], 1998.4, PP243-259
- [2] Lonnie D. Bentley; Jeffrey L. Whitten. System analysis and design for the Global Enterprise [M], Higher Education Press, 2008
- [3] XU Bao-xiang; ZHANG Yun-zhong. Research on the Development of Information System Modeling Theory, Journal of Intelligence [J], 2010.5, PP70-73
- [4] ZGANG Feng-ying; ZOU Xian-lin. Object-oriented Analysis Based on Domain Model with UML, Computer Applications and Software [J], 2004.6, PP112-114.
- [5] Ronald J. Norman. Object-Oriented Systems Analysis and Design [M], Tsinghua University Press, 1996
- [6] SHAO Wei-zhong; YANG Fu-qing. Object-Oriented System Analysis [M], Tsinghua University Press, 1998
- [7] Rumbaugh; Ivar Jacobson; Grady Booch. UML Reference Manual [M], China Machine Press,2002
- [8] Craig Larman. Applying UML and Patterns[M]. China Machine Press, 200407
- [9] DIAO Jia-cheng. UML System Modeling and Analysis and Design [M], China Machine Press, 20

TABLE I. GENERAL DEVELOPMENT PROCESS [9]

Workflow	Work component	Inception I1	Elaboration E1..En	Construction C1..Cn	Transition T1..Tn
Business Modeling	Domain Modeling		s		
Requirement Modeling	Use Case Modeling	s	r		
	Glossory				
...	...				

Note: s stands for starting creation; r stands for refining

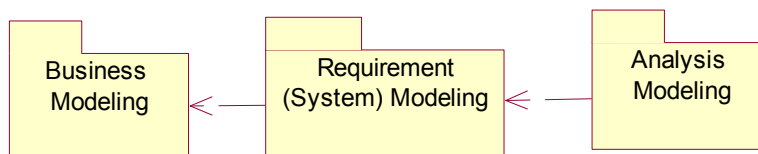


Figure 1 General analysis modeling process

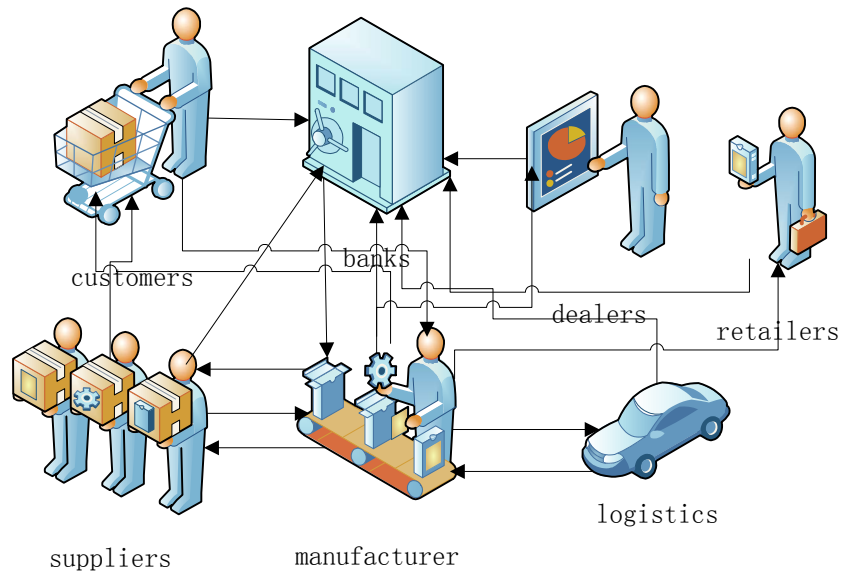


Figure 2 A complicated and large scale information system

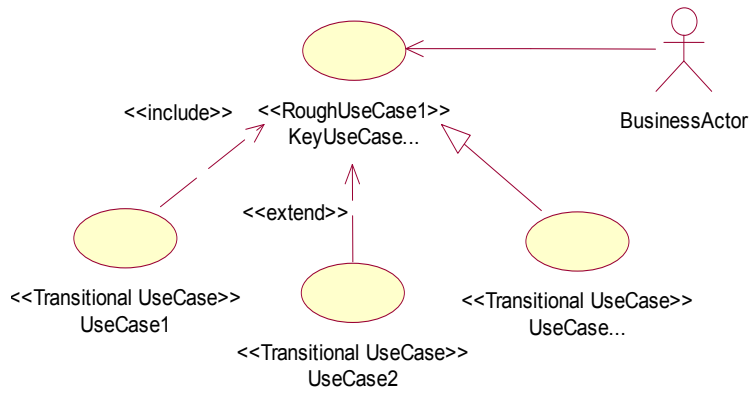


Figure 6 Transitional model