Utilizing the Rational Rose OOAD CASE tool for Visual Modeling using the UML in the Systems Analysis and Design Sequence

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Abstract

The use of visual modeling in object-oriented analysis and design (OOAD) has many advantages in the current software development environment. A software CASE tool that can automate the development of these visual models utilizing the very popular Unified Modeling Language (UML) is Rational Rose 2000 from Rational Software Corporation. This software is available from the Rational Software Corporation to qualifying educational institutions as part of its SEED program. After obtaining Rational Rose 2000 under the SEED program, this software was successfully used in a two course Systems Analysis and Design sequence.

Keywords: UML, Rational Rose 2000, visual modeling, systems analysis, systems design

1. Introduction to Visual Modeling

The IS '97 model curriculum guidelines for the Analysis and Logical Design course suggests that among the items students should master is the ability, "to show how to develop a logical design, and develop and analyze alternatives involving implementation using packages, tailoring of packages, constructing software, or CASE tools." Similarly, the guidelines for the Physical Design and Implementation with DBMS course suggest students should be able, "to develop skills with use of a combination of code generators and language facilities to implement multi-user departmental or simple enterprise level systems." The visual modeling tool Rational Rose 2000 provides a mechanism with which to satisfy both of these goals while addressing the ongoing need for graduates who are adept at object-oriented analysis and design concepts and technologies.

Rational Rose 2000 is a powerful tool for implementing visual modeling which implements and automates software development using the Unified Modeling Language. The UML is metalanguage specifying a standardized set of graphical notations and their syntax for use in object-oriented analysis and design. Strong industry support for the UML has emerged from such companies as Microsoft, Hewlett Packard, Oracle, and IBM and it has been accepted by the OMG (Object Management Group) as a standard for object-oriented modeling. The UML is not, however, a complete methodology for OOAD such as is contained in the Rational Unified Process also developed by Rational Software Corporation.

The advantages of visual modeling are numerous and convincing. Visual modeling is a potent method for facilitating client communications and understanding, for modeling complex business objects and services, and for supporting a team approach to object-oriented software development. Visual modeling in software development can be compared to the use of blueprints in the construction industry in that they encompass the specifications of business objects and services and promote the mutual understanding of these specifications. Furthermore, visual modeling provides a means of developing massive enterprise-wide applications from components. In addition, once developed these components can often be reused, resulting in more efficient software development within an organization.

2. Rational Rose 2000 CASE tool

Among Rational Rose 2000's many advantages as a UML visual modeling tool is its flexibility. This flexibility comes in part from its support for many object-oriented languages including Java, MFC C++, Visual Basic, as well as Oracle 8i databases. Rational Rose 2000's use in OOAD has many potential benefits including the promotion of component reuse and a more efficient utilization of software development resources. According to Rational Corporation's CD-ROM, Inside the Unified Modeling Language, Rational Rose 2000 supports both round-trip engineering and reverse engineering.

The former implies that a visual model of a system created in Rational Rose 2000 can be used to generate code, while the latter relates to Rational Rose's ability to convert existing code into visual model specifications. This same CD-ROM states that a 1998 market survey of object-oriented analysis, design, and modeling software tools by International Data Corporation found that Rational Corporation's market by revenue was larger than the next three of its competitors combined indicating a wide base of existing users.

There are a number of different methodologies for OOAD using the UML including the Rational Unified Process mentioned previously as well as a methodology proposed by Joseph Daniel at ISECON '98. These methodologies often share the idea that the visual modeling component of OOAD should begin with the development of use case models. The use case model allows a user-perspective view of the system requirements to be created. According to Philippe Kruchten, "the use-case model is a model of the system's intended functions and its environment, and it serves as a contract between the customer and the developments."

The use case model below (Figure 1) was created with Rational Rose 2000 and demonstrates the interface used by the program. The principle components of the use case model: actors and use cases, both of which can be easily drawn using the icons that appear on the context sensitive toolbar. In

cases, Rent a tape, Return a tape, and Return a tape late. Use cases can be related to other uses cases as is the case between Return a tape and Return a tape late where the <<extend>> stereotype is used to indicate that under certain conditions you might follow a variation (Return a tape late) of the normal situation (Return a tape). As Jesse Liberty points out, with <<extend>>, "Not everyone gets this path, but if some special condition is met ..., then you can use this extension of an existing use case". Equally important to the visual modeling of the business use cases are the scenarios or use case descriptions that accompany and describe each use case. These scenarios which describe the behavior of objects in a use case can be documented as part of the specifications for a particular use case or alternatively can be created in separate documents (for example a Microsoft Word file) and linked to the use case specification. Rational Rose 2000 greatly facilitates the drawing of and documenting of the various UML models.

Using Rational Rose 2000 to develop visual models has several advantages including the fact that the various UML models are integrated by the software. If, for example, a new object instance is identified during the creation of a sequence diagram then the class that instantiated that object can be easily added to the model and if necessary to a class diagram. Furthermore, if methods are developed on a sequence diagram they can be readily assigned to a class that has been previous identified or to a new class as required.
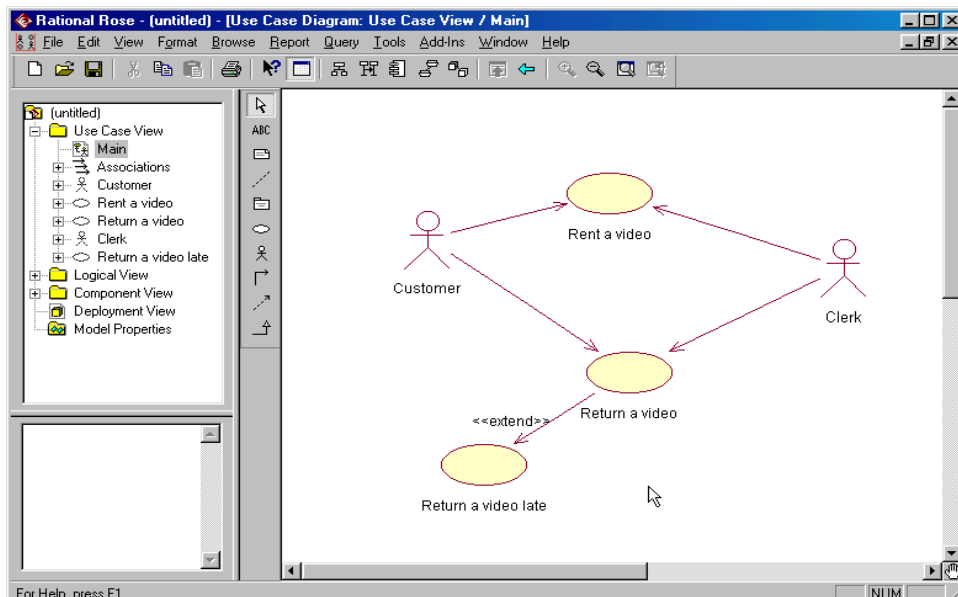

Figure 1

the example provided in Figure 1, the actors, Customer and Clerk, are represented by the stickman stereotype while the oval is used to represent the use

3. Use of Rational Rose 2000 in a Systems Analysis and Design sequence

In the Fall semester of 1999, Rational Rose 2000 was utilized in both a Systems Analysis (ISC 360) and a Systems Design (ISC 362) course at the University of (name deleted). The Rational Rose Enterprise Suite 1.5, which includes the Rational Rose 2000 program, was obtained by the school under Rational's SEED program which is explained in more detail in the following section. Students in both courses used the Rational Rose software to work a number of smaller problems as well as a larger, end-of-semester, project involving multiple diagrams and models. The work done in this semester was all performed on an individual level, however, future course offerings will incorporate a more realistic team-based development project.

During the Systems Analysis class, students focused on the object-oriented analysis aspects of the software including the identification and description of use cases, use case models, and the interaction diagrams which describe object interactions within the context of a use case. In addition, students developed initial class diagrams and related them to their other diagrams. In the Systems Design class the focus shifted to development of system artifacts such as component diagrams, and state transition diagrams. Using the Rational Rose 2000 software allowed students in both classes to extensively practice the creation and refinement of various UML diagrams.

The OOAD process is iterative which leads to a natural delineation of material between the two courses in addition to allowing adequate time to master the software. As Jack Russell notes, many systems analysis and design concepts and techniques require sufficient time to master and the UML is, in my experience, not an exception. Student comments were generally favorable concerning the incorporation of Rational Rose 2000 into the class material. The program is daunting at first exposure due to its large number of features and options. A separate textbook or guidebook related to the use of Rational Rose 2000 was not utilized, however, this is one recommendation I would make to possibly improve student performance and reduce startup time and frustration.

4. Rational Software Corporation's SEED Program

The Rational Software Corporation offers a Software Engineering Educational Development (SEED) program which provides copies of various software packages and training materials including Rational Rose 2000 to qualifying educational institutions. Information about the SEED program may be obtained from seed@rational.com or from the company web site at http://www.rational.com. The SEED program can provide both individual 1-year licenses that can be provided to both students and faculty to use the Rational Rose software as well as server licenses so that the software can be installed in a laboratory environment. In addition to Rational Rose 2000, many other software tools are also available under the SEED program such as those for configuration management or real-time system development. The SEED program can also make available training materials for various courses related to OOAD, UML, and Rational Rose 2000, for example.

5. Conclusion

The Rational Rose 2000 UML CASE software obtained under the SEED program was a valuable tool when incorporated into the curriculum of a two course Systems Analysis and Design sequence. The software helped illustrate important concepts of OOAD and gave the students hands-on experience with a popular UML CASE tool.

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