Software Engineering I

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2021

Chapter 7
Moving To Design(I)

Steps(I)

1. Preparing proposal
2. Requirements determination
   - ➢ User story
3. Abstract Business Process Modelling
4. Analysis
   - ➢ Functional Modelling
   - ➢ Structural Modelling
   - ➢ Behavioral Modelling

Steps(II)

5. Design
    - ➢ Optimization
    - ➢ Database Management
    - ➢ User Interface
    - ➢ Physical Architecture

The purpose of **analysis** is to figure out what the business needs are.

The purpose of **design** is to decide how to build the system.

Introduction

- The major activity that takes place during *design* is evolving the set of analysis representations into design representations.
- Throughout design, the project team carefully considers the new system with respect to the current environment and systems that exist within the organization as a whole.
- Major considerations in determining how the system will work include environmental factors, such as integrating with existing systems, converting data from legacy systems, and leveraging skills that exist in-house.
- Although the planning and analysis are undertaken to develop a possible system, the goal of design is to create a blueprint for a system that can be implemented.

Introduction(Cnt’d)

- An important initial part of design is to examine several design strategies and decide which will be used to build the system.
- Systems can be built from scratch, purchased and customized, or outsourced to others, and the project team needs to investigate the viability of each alternative.
- At the same time, detailed design of the individual classes and methods that are used to map out the nuts and bolts of the system and how they are to be stored must still be completed.
- Techniques such as CRC cards, class diagrams, contract specification, method specification, and database design provide the final design details in preparation for the implementation phase, and they ensure that programmers have sufficient information to build the right system efficiently.

Introduction(Cnt’d)

- Design also includes activities such as designing the user interface, system inputs, and system outputs, which involve the ways that the user interacts with the system.
- Physical architecture decisions are made regarding the hardware and software that will be purchased to support the new system and the way that the processing of the system will be organized.

Verifying and Validating the Analysis Models

- Balancing Functional and Structural Models
- Balancing Functional and Behavioral Models
- Balancing Structural and Behavioral Models

Balancing Functional and Structural Models

- First, every class on a class diagram and every CRC card must be associated with at least one use-case, and vice versa.
- Second, every activity or action contained in an activity diagram and every event contained in a use-case description should be related to one or more responsibilities on a CRC card and one or more operations in a class on a class diagram and vice versa.
- Third, every object node on an activity diagram must be associated with an instance of a class on a class diagram and a CRC card or an attribute contained in a class and on a CRC card.
- Fourth, every attribute and association/aggregation relationships contained on a CRC card (and connected to a class on a class diagram) should be related to the subject or object of an event in a use-case description.

Balancing Functional and Behavioral Models

- First, the sequence and communication diagrams must be associated with a use case on the use-case diagram and a use-case description.
- Second, actors on sequence diagrams, communication diagrams must be associated with actors on the use-case diagram or referenced in the use-case description, and vice versa.
- Third, messages on sequence and communication diagrams, transitions on behavioral state machines must be related to activities and actions on an activity diagram and events listed in a use-case description, and vice versa.

Balancing Structural and Behavioral Models

- First, because behavioral state machines represent the life cycle of complex objects, they must be associated with instances (objects) of classes on a class diagram and with a CRC card that represents the class of the instance.
- Second, communication and sequence diagrams contain objects that must be an instantiation of a class that is located on a class diagram.
- Third, messages contained on the sequence and communication diagrams, transitions on behavioral state machines must be associated with responsibilities and associations on CRC cards and operations in classes and associations connected to the classes on class diagrams.
- Forth, the states in a behavioral state machine must be associated with different values of an attribute or set of attributes that describe an object.

Evolving the Analysis Models into Design Models

- The analysis activities defined the functional requirements and ignored nonfunctional requirements.
- In contrast, the primary purpose of the design models is to increase the likelihood of successfully delivering a system that implements the functional requirements in a manner that is affordable and easily maintainable. Therefore, in systems design, we address both the functional and nonfunctional requirements.

Evolving the Analysis Models into Design Models(Cnt’d)

- From an object-oriented perspective, system design models simply refine the system analysis models by adding system environment (or solution domain) details to them and refining the problem domain information already contained in the analysis models.

Is the current representation of the evolving system optimal?

A good design is one that balances trade-offs to minimize the total cost of the system over entire life time.

Reference

- **Dennis, Wixon, Tegarden**, “**System Analysis and Design, An Object Oriented Approach with UML”, 5th Edition, 2015.**