

Object Oriented Analysis And Design

Aleenah Khan

Chapter 1

Introduction

Visual Modeling

- Visual Modeling is a way of thinking about problems using models organized around real-world ideas.
- Models are useful for:
 - understanding problems,
 - communicating with everyone involved with the project (customers, domain experts, analysts, designers, etc.),
 - modeling enterprises,
 - preparing documentation, and
 - designing programs and databases.
- Modeling promotes better understanding of requirements, cleaner designs, and more maintainable systems.

Models

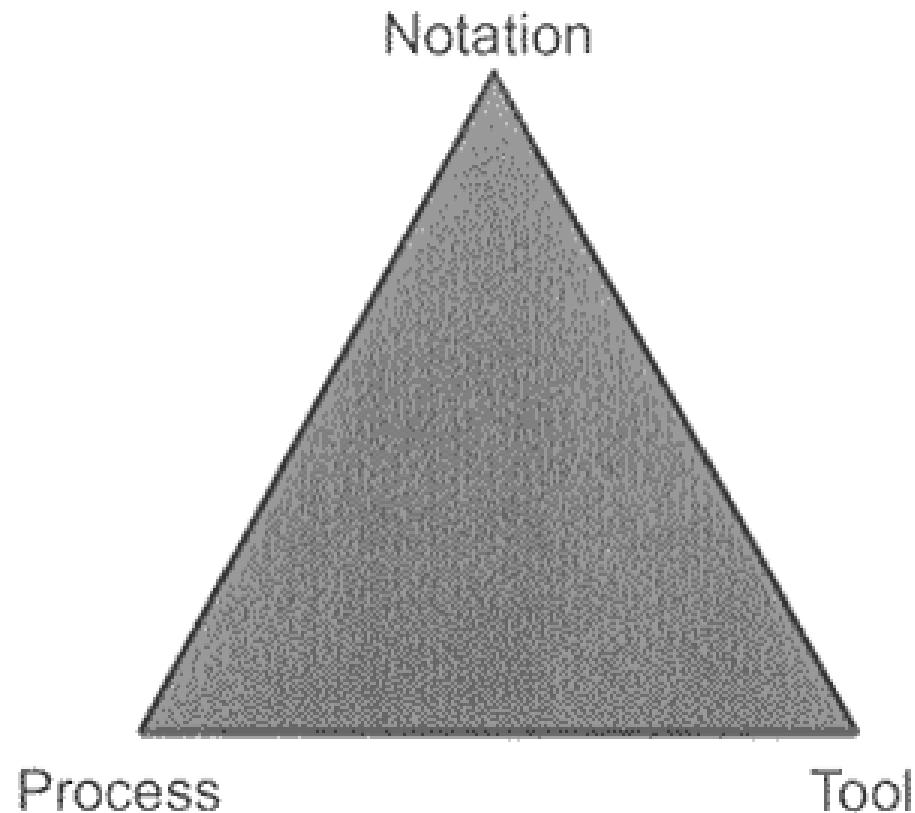
- Models are abstractions that portray the essentials of a complex problem or structure by filtering out nonessential details, thus making the problem easier to understand.
- Models help us organize, visualize, understand, and create complex things.

Models in Software Development

- To build complex systems, the developer must:
 - abstract different views of the system,
 - build models using precise notations,
 - verify that the models satisfy the requirements of the system, and
 - gradually add detail to transform the models into an implementation.

The Triangle For Success

Figure 1-1. Triangle for Success



The Triangle For Success

- The components needed for a successful project:
 - **a notation,**
 - **a process, and**
 - **a tool.**
- You can learn a notation, but if you don't know how to use it (process), you will probably fail.
- You may have a great process, but if you can't communicate the process (notation), you will probably fail.
- And lastly, if you cannot document the artifacts of your work (tool), you will probably fail.

The Role of Notation

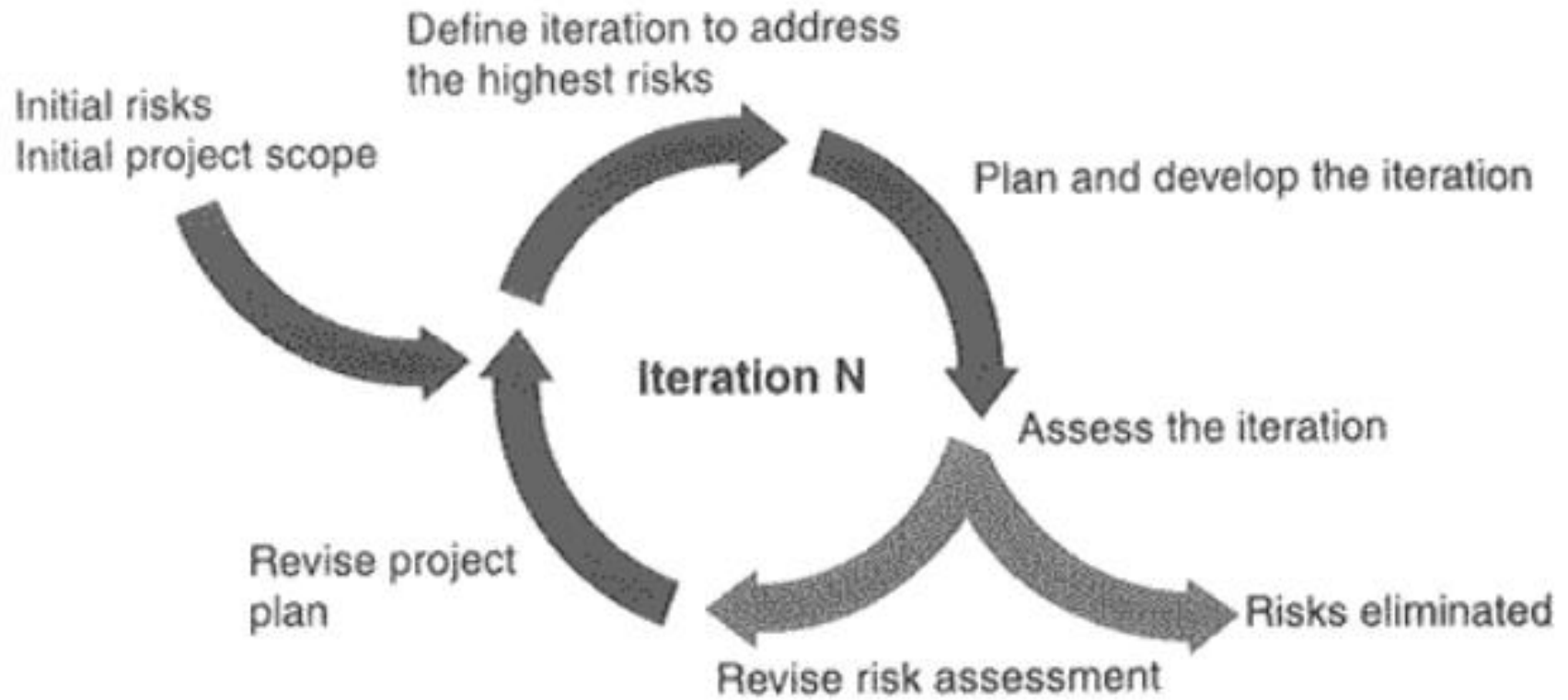
- Notation plays an important part in any model.
- Notation has three roles:
 - It serves as the language for communicating decisions that are not obvious or cannot be inferred from the code itself.
 - It provides semantics that are rich enough to capture all important strategic and tactical decisions.
 - It offers a form concrete enough for humans to reason and for tools to manipulate.
- The Unified Modeling Language (UML) provides a very robust notation, which grows from analysis into design.

The Role of Process

- A successful development project satisfies or exceeds the customer's expectations, is developed in a timely and economical fashion, and is resilient to change and adaptation.
- The development life cycle must promote creativity and innovation.
- At the same time, the development process must be controlled and measured to ensure that the project is indeed completed.
- *"Creativity is essential to the crafting of all well-structured object-oriented architectures, but developers allowed completely unrestrained creativity tend to never reach closure. Similarly, discipline is required when organizing the efforts of a team of developers, but too much discipline gives birth to an ugly bureaucracy that kills all attempts at innovation. "*
- A well-managed iterative and incremental life cycle provides the necessary control without affecting creativity.

Iterative and Incremental Development

Figure 1-3. Iterative and Incremental Development



Iterative and Incremental Development

- In an iterative and incremental life cycle, development proceeds as a series of iterations that evolve into the final system.
- Each iteration consists of one or more of the following process components:
 - business modeling,
 - requirements,
 - analysis,
 - design,
 - implementation,
 - test, and
 - deployment.
- The developers do not assume that all requirements are known at the beginning of the life cycle; indeed change is anticipated throughout all phases.

Iterative and Incremental Development

- This type of life cycle is a risk-mitigating process.
- Technical risks are assessed and prioritized early in the life cycle and are revised during the development of each iteration.
- Risks are attached to each iteration so that successful completion of the iteration alleviates the risks attached to it.
- The releases are scheduled to ensure that the highest risks are tackled first.
- Building the system in this fashion exposes and mitigates the risks of the system early in the life cycle.
- The result of this life cycle approach is less risk coupled with minimal investment.

The Rational Unified Process (RUP)

- Control for an iterative and incremental life cycle is supported by employing the Rational Unified Process.
- RUP is an extensive set of guidelines that address the technical and organizational aspects of software development focusing on requirements analysis and design.

The Rational Unified Process (RUP)

- The Rational Unified Process is structured along two dimensions:
 - 1. Time:** division of the life cycle into phases and iterations
 - 2. Process Components:** production of a specific set of artifacts with well-defined activities

1. Time

Structuring a project along the time dimension involves the adoption of the following time-based phases:

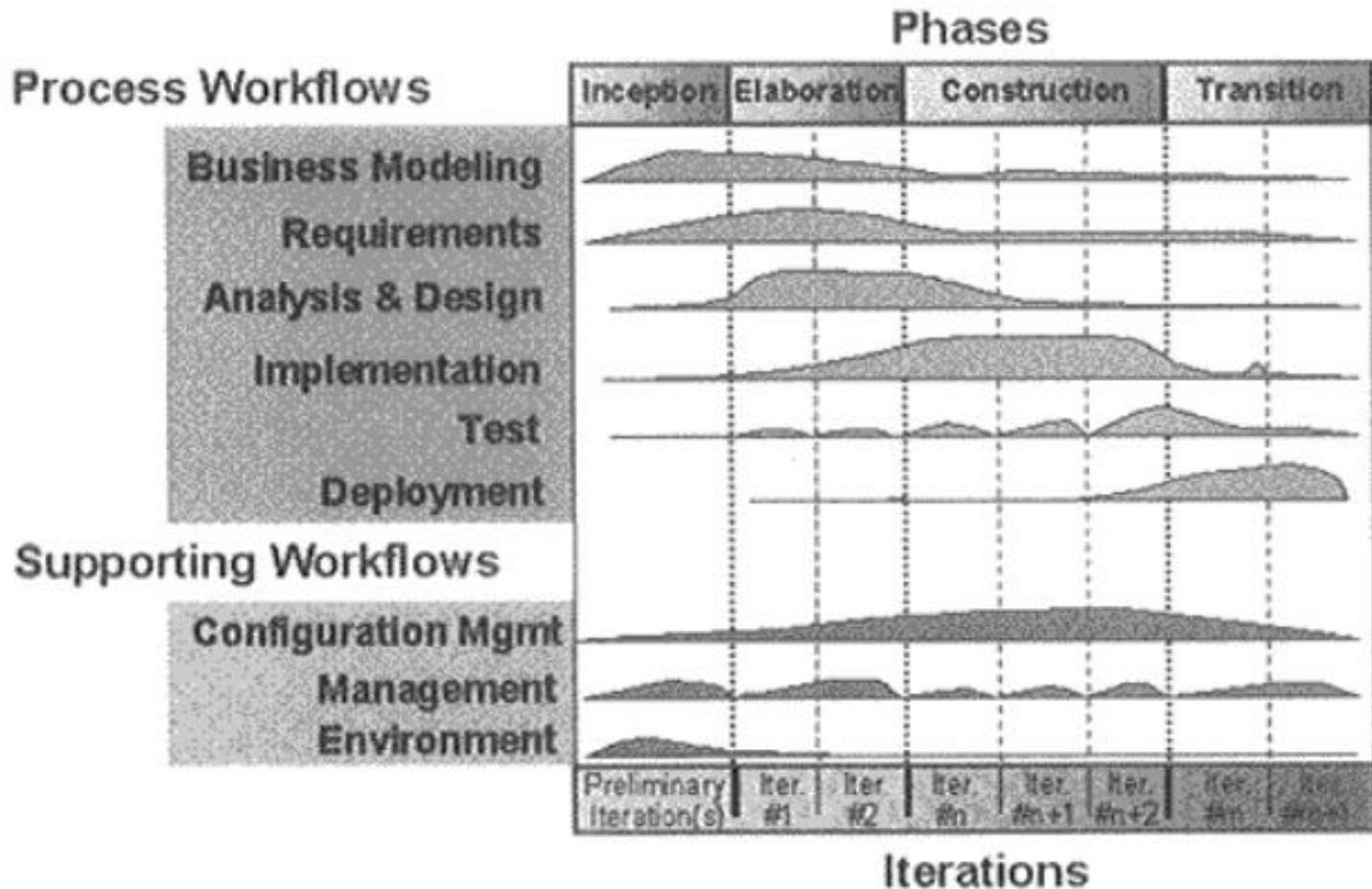
- Inception: specifying the project vision
- Elaboration: planning the necessary activities and required resources; specifying the features and designing the architecture
- Construction: building the product as a series of incremental iterations
- Transition: supplying the product to the user community (manufacturing, delivering, and training)

2. Process Components

Structuring the project along the process component dimension includes the following activities:

- Business Modeling: the identification of desired system capabilities and user needs
- Requirements: a narration of the system vision along with a set of functional and nonfunctional requirements
- Analysis and Design: a description of how the system will be realized in the implementation phase
- Implementation: the production of the code that will result in an executable system
- Test: the verification of the entire system
- Deployment: the delivery of the system and user training to the customer

Process Components applied to each Time-Based Phase



Process Components applied to each Time-Based Phase

- Each activity of the process component dimension typically is applied to each phase of the time-based dimension.
- The degree to which a particular process component is applied is dependent upon the phase of development.
- The majority of the analysis process component occurs during the Elaboration Phase.
- During the Construction Phase of development, the system is completed as a series of iterations.
- Things always crop up as the system is built; thus, you are still doing some analysis.
- Testing is applied throughout the iteration process.

We will concentrates on the use of the UML to capture and document the decisions made during the *Inception* and *Elaboration* phases of development.

The Rational Rose Tool

- A paper and a pencil, can be a basic tool but it leaves a lot to be desired.
- There are many tools on the market today, everything from simple drawing tools to sophisticated object modeling tools.
- We will use the tool **Rational Rose**.
- At every step, there is a description of how to use Rational Rose to complete the step.

The Rational Rose Tool

- The Rational Rose product family is designed to provide the software developer with a complete set of visual modeling tools for development of robust, efficient solutions to real business needs in the client/server, distributed enterprise, and real-time systems environments.
- Rational Rose products share a common universal standard, making modeling accessible to nonprogrammers wanting to model business processes as well as to programmers modeling applications logic.
- An evaluation version of the Rational Rose tool may be obtained at the Rational Software Corporation website at www.rational.com.

Microsoft Visual Modeler

- A subset of the diagrams are available in the Microsoft Visual Modeler tool.
- Microsoft Visual Modeler is the entry-level product, designed specifically for the first-time modeler.

Object Oriented Analysis And Design

Aleenah Khan

Chapter 2

Beginning a Project

Defining the Right Project

- The most important question to ask when developing a system is not a methodological question. It is not a technical question. It is seemingly simple, yet remarkably difficult question:

"Is this the right system to make?"

Eastern State University (ESU)

Background

- The process of assigning professors to courses and the registration of students is a frustrating and time consuming experience.
- After the professors of ESU have decided which courses they are going to teach for the semester, the Registrar's office enters the information into the computer system.
- A batch report is printed for the professors indicating which courses they will teach.
- A course catalog is printed and distributed to the students.
- The students currently fill out (multipart, multicolor) registration forms that indicate their choice in courses, and return the completed forms to the Registrar's office.
- The typical student load is four courses.

Eastern State University (ESU)

Background

- The staff of the Registrar's office then enters the students' forms into the mainframe computer system.
- Once the students' curriculum for the semester has been entered, a batch job is run overnight to assign students to courses.
- Most of the time the students get their first choice; however, in those cases where there is a conflict, the Registrar's office talks with each student to get additional choices.
- Once all the students have been successfully assigned to courses, a hard copy of the students' schedule is sent to the students for their verification.

Eastern State University (ESU)

Background

- Most student registrations are processed within a week, but some exceptional cases take up to two weeks to solve.
- Once the initial registration period is completed, professors receive a student roster for each course they are scheduled to teach.

Risks for the Course Registration Problem

- The Development Team identified that the major risk to the system involved the ability to store and access the curriculum information efficiently.
- They developed several prototypes that evaluated data storage and access mechanisms for each database management system under consideration.
- The results of the prototypes led to the decision that the database risk could be mitigated.
- Additional prototypes were also developed to study the hardware needs for the university as a result of moving to an online registration system.

ESU Course Registration Problem Statement

At the beginning of each semester, students may request a course catalog containing a list of course offerings for the semester. Information about each course, such as professor, department, and prerequisites will be included to help students make informed decisions.

The new system will allow students to select four course offerings for the coming semester. In addition, each student will indicate two alternative choices in case a course offering becomes filled or canceled. No course offering will have more than ten students or fewer than three students. A course offering with fewer than three students will be canceled. Once the registration process is completed for a student, the registration system sends information to the billing system so the student can be billed for the semester.

ESU Course Registration Problem Statement

Professors must be able to access the online system to indicate which courses they will be teaching, and to see which students signed up for their course offerings.

For each semester, there is a period of time that students can change their schedule. Students must be able to access the system during this time to add or drop courses.