DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Object Oriented Software Engineering (CSE- 4.1.8)

SIR C.R.REDDY COLLEGE OF ENGINEERING
ELURU – 534 007

Object Oriented software Engineering Laboratory (CSE 4.1.8)

Laboratory Syllabus

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1. OBJECT ORIENTED SOFTWARE ENGINEERING LAB

Instruction: 3 periods/ week	Sessional marks: 50
UNIV: 3 hours	UNIV-Exam marks: 50

Sessional marks allotment:

Monthly meeting participation	10%
Monthly progress report	15%
Design / code document	15%
Presentation	10%
Proto type demonstration	10%
Final project	30%
Final project report	10%

Course Objectives:

- To Design & implement complex software solutions using state of the art software solutions using state of art software Engineering Techniques.
- To provide working knowledge of UML (Unified Modeling Languages) Sources control and project Management.
- To provide working knowledge of the technologies essentially for incorporating in the project.
- To expertise for testing and document software.
- To inculcate and excel working capabilities as part of software term and develop significant projects under a tight deadline time / schedules.
- To present the project in a professional manner.

TOPICS TO BE COVERED:

1: Introduction and Project Definition

2: Software Requirements Specification

3: Introduction to Unified Modeling Languages (UML) and Use case Diagram

4: System Modeling (DFD or ER or Both)

5: Flow of Events and Activity Diagrams

6: OO Analysis: Discovering classes

7: Interaction Diagrams: Sequence and Collaboration Diagrams

8: Software Design: Software Architecture and Object Oriented Design

9: State Chart Diagram

10: Component and Deployment Diagrams

11: Software Testing

12: Presentations

Introduction and Project Definition

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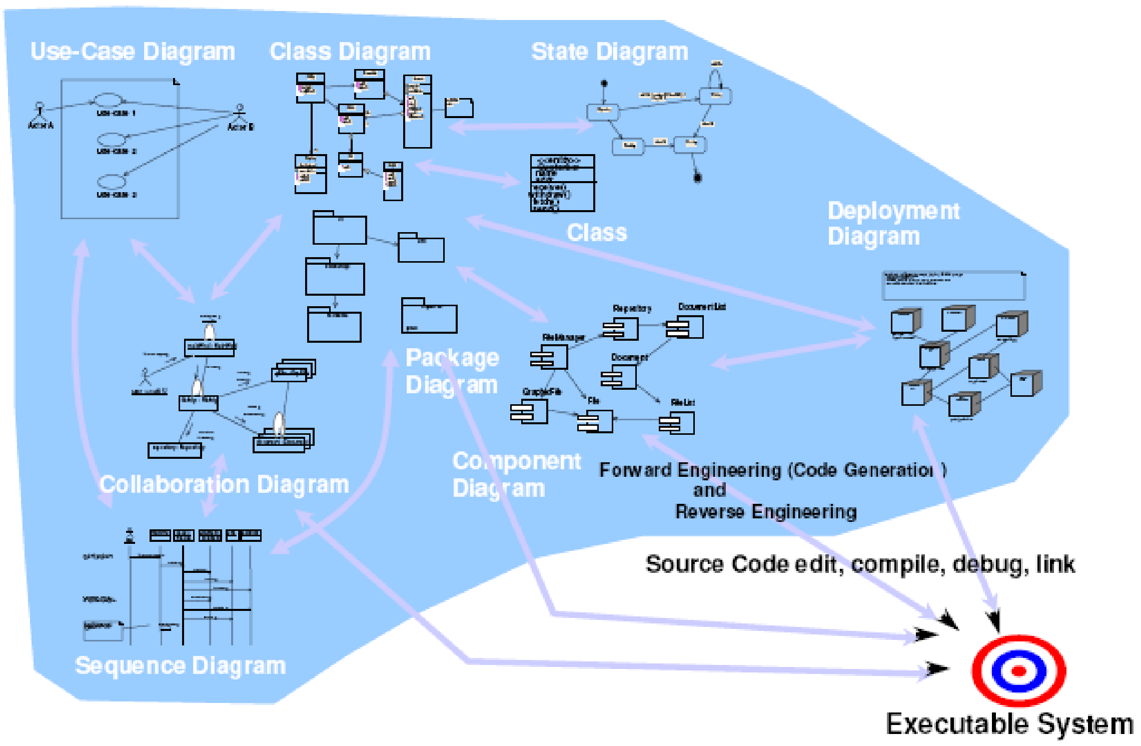

Lab 2: Introduction and Project Definition

Objectives

- Introduce the lab environment and tools used in the software engineering lab.
- Discuss the project and learn how to write project definition.

1. Outline

- Introduction to the lab plan and objectives.
- Project definition.

2. Background

The software engineer is a key person and analyzing the business, identifying opportunities for improvement, and designing information systems to implement these ideas. It is important to understand and develop through practice the skills needed to successfully design and implement new software systems.

2.1 Introduction

- In this lab you will practice the software development life cycle (Project Management, Requirements Engineering, System Modeling, Software Design, Prototyping and Testing) using CASE tools within a team work environment.
- UML notation is covered in this lab as the modeling language for analysis and design.

2.2 Tools used in the lab

- Software Engineering lab is one of the most challenging of all labs. Developing a complete software application requires from each of you a good level of know – how of various tools.
- There are some tools which will be taught, but there are some which are assumed you already know, if you don't then you learn should it individually.
    - Rational Rose for UML diagrams (Object Oriented Analysis and Design)

2.3 Software Engineering Lab Objectives

- Learn the software life cycle phases (Project management, requirements engineering, software design, prototyping and testing).
- Practice the software phases using a project.

- Learn a number of CASE tools and use them in a project within a team work environment.
- Get familiar with UML (modeling language for analysis and design).

2.4 Lab Plan

Week #	Lab Content	Deliverables	Tool
Week 1	Introduction and project definition		
Week 2	Software requirements Specification	Plan doc	
Week 3	Introduction to UML and use case diagrams		Requirement and design tool (Rational Rose)
Week 4	System modeling (DFD or ER)		Microsoft Word
Week 5	Flow of events and activity diagram	SRS doc	Rational Rose
Week 6	OO analysis: discovering classes		Rational Rose
Week 7	Interaction diagrams: sequence and collaboration diagrams		Rational Rose
Week 8	Software Design: software architecture and object oriented design	Design doc (ver. 1)	Rational Rose
Week 9	State Transition Diagram		Rational Rose
Week 10	Component and deployment diagrams	Design doc (Final ver.)	Rational Rose
Week 11	Template Code Generation		Rational Rose
Week 12	Presentations	Final document	Microsoft Word

3. CASE tools – No tools are used for this lab.

4. Exercises

1. Form groups of 4 students (with one of them as a leader).
2. Brainstorm and list 3 suitable project titles
3. Present these to the class
4. Choose one of the projects from your list
5. Try to write (a hypothetical) project definition for it.

6. Present it to the instructor/ class

5. Deliverables

- Form teams of 4 students for the term mini-project.
- Suggest/ research a project and write a project definition/ problem statement.

Software Requirement Specification

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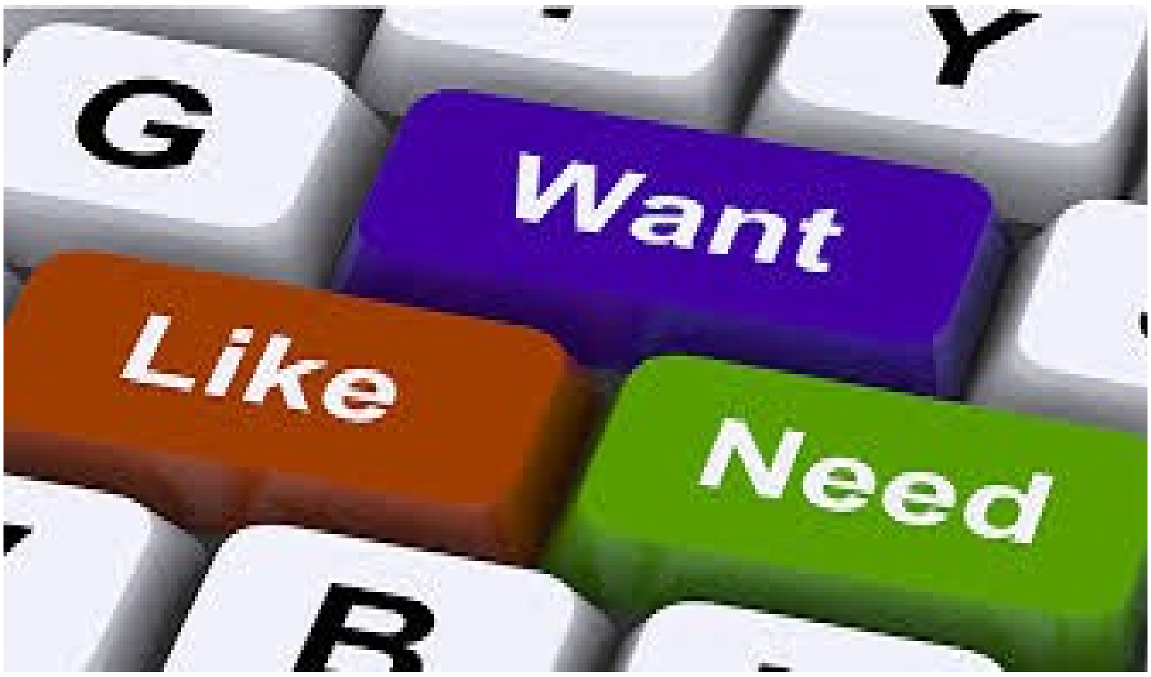


Lab 3: Software Requirement Specification (SRS)

Objectives

- Gain a deeper understanding of the Software Requirement Specification phase and the Software Requirement Specification (SRS).
- Learn how to write requirements and specifications.

1. Outline

- Review of the requirements engineering process.
- Write requirements and specifications.
- Software Requirement Specification (SRS).

2. Background

A requirement is a statement of a behavior or attribute that a system must possess for the system to be acceptable to a stakeholder.

Software Requirement Specification (SRS) is a document that describes the requirements of a computer system from the user's point of view. An SRS document specifies:

- The required behavior of a system in terms of: input data, required processing, output data, operational scenarios and interfaces.
- The attributes of a system including: performance, security, maintainability, reliability, availability, safety requirements and design constraints.

Requirements management is a systematic approach to eliciting, organizing and documenting the requirements of a system. It is a process that establishes and maintains agreement between the customer and the project team on the changing requirements of a system.

Requirements management is important because, by organizing and tracking the requirements and managing the requirement changes, you improve the chances of completing the project on time and under budget. Poor change management is a key cause of project failure.

2.1 Requirements Engineering Process

Requirements engineering process consists of four phases:

- Requirements elicitation: getting the customers to state exactly what the requirements are.
- Requirements analysis: making qualitative judgments and checking for consistency and feasibility of requirements.
- Requirements validation: demonstrating that the requirements define the system that the customer really wants.

- Requirements management: the process of managing changing requirements during the requirements engineering process and system development, and identifying missing and extra requirements.

2.2 Writing Requirements

Requirements always need to be correct, unambiguous, complete, consistent, and testable.

2.2.1 **Recommendations When Writing Requirements**

- Never assume: others do now know what you have in mind.
- Use meaningful words; avoid words like: process, manage, perform, handle, and support.
- State requirements not features:
    - Feature: general, tested only for existence.
    - Requirement: specific, testable, measurable.
- Avoid:
    - Conjunctions: ask yourself whether the requirement should it be split into two requirements.
    - Conditionals: if, else, but, except, although.
    - Possibilities: may, might, probably, usually.

2.3 Writing Specifications

Specification is a description of operations and attributes of a system. It can be a document, set of documents, a database of design information, a prototype, diagrams or any combination of these things.

Specifications are different from requirements: specifications are sufficiently complete - not only what stakeholders say they want; usually, they have no conflicts; they describe the system as it will be built and resolve any conflicting requirements.

Creating specifications is important. However, you may not create specifications if:

- You are using a very incremental development process (small changes).
- You are building research or proof of concept projects.
- You rebuilding very small projects.
- It is not cheaper or faster than building the product.

2.4 Software Requirement Specification (SRS)

Remember that there is no “Perfect SRS”. However, SRS should be:

- Correct: each requirement represents something required by the target system.
- Unambiguous: every requirement in SRS has only one interpretation.
- Complete: everything the target system should do is included in SRS (no sections are marked TBD-to be determined).
- Verifiable: there exists some finite process with which a person/machine can check that the actual as-built software product meets the requirements.
- Consistent in behavior and terms.
- Understandable by customers.
- Modifiable: changes can be made easily, completely and consistently.
- Design independent: doesn't imply specific software architecture or algorithm.
- Concise: shorter is better.
- Organized: requirements in SRS are easy to locate; related requirements are together.
- Traceable: each requirement is able to be referenced for later use (by the using paragraph numbers, one requirement in each paragraph, or by using convention for indication requirements)

3. CASE Tools – Nil

4. In-Class Demo

An overview of the requirements engineering process, and writing requirements and specifications.

5. Exercises

Write SRS for your project

6. Deliverables

SRS for your project

Introduction to UML and Use Case Diagram

4

UNIFIED
MODELING
LANGUAGE

Lab 4: Introduction to UML and Use Case Diagram

Objectives

- Study the benefits of visual modeling.
- Learn use case diagrams: discovering actors and discovering use cases.
- Practice use cases diagrams using Rational Rose.

1. Outline

- Visual modeling.
- Introduction to UML.
- Introduction to visual modeling with UML.
- Use case diagrams: discovering actors and use cases.

2. Background

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.

2.1 Visual Modeling

- Capture the structure and behavior of architectures and components.
- Show how the elements of the system fit together.
- Hide or expose details appropriate for the task.
- Maintain consistency between a design and its implementation.
- Promote unambiguous communication.

2.2 What is UML?

The UML is the standard language for visualizing, specifying, constructing and documenting the artifacts of a software-intensive system. UML can be used with all processes throughout the development life cycle and across different implementation technologies.

2.3 History of UML

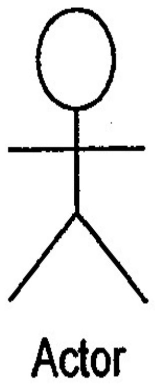
The UML is an attempt to standardize the artifacts of analysis and design: semantic models, syntactic notation and diagrams. The first public draft (version 0.8) was introduced in October 1995. Feedback from the public and Ivar Jacobson's input were included in the next two versions (0.9 in July 1996 and 0.91 in October 1996). Version 1.0 was presented to the Object Management Group (OMG) for standardization in July 1997. Additional enhancements were incorporated into the 1.1 version of UML, which was presented to the OMG in September 1997. In November 1997, the UML was adopted as the standard modeling language by the OMG.

2.4 Putting UML into Work: Use Case Diagram

The behavior of the system under development (i.e. what functionality must be provided by the system) is documented in a use case model that illustrates the system's intended functions (use cases), its surroundings (actors), and relationships between the use cases and actors (use case diagrams).

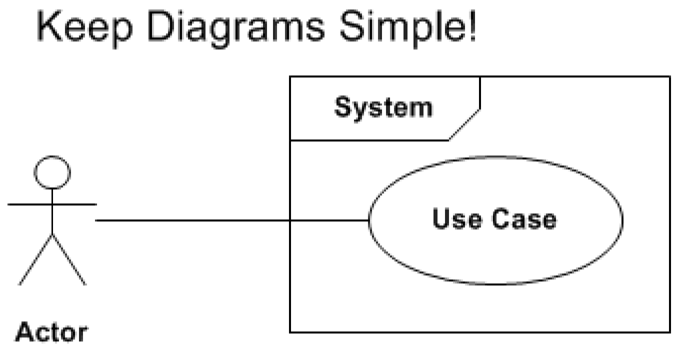
2.5 Actors

- Are NOT part of the system – they represent anyone or anything that must interact with the system.
- Only input information to the system.
- Only receive information from the system.
- Both input to and receive information from the system.
- Represented in UML as a stickman.



2.6 Use Case

- A sequence of transactions performed by a system that yields a measurable result of values for a particular actor
- A use case typically represents a major piece of functionality that is complete from beginning to end. A use case must deliver something of value to an actor.



2.7 Use Case Relationships

- Between actor and use case.
- Association / Communication.
- Arrow can be in either or both directions; arrow indicates who initiates communication.
- Between use cases (generalization):

  – Include

    - Where inclusion use case is compulsory.

  – Extends

    - Optional behavior.
    - Behavior only runs under certain conditions (such as alarm).
    - Several different flows run based on the user's selection.

3. CASE Tools

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.

4. In-Class Example

Now you will learn how to apply the above-mentioned methods to draw use case diagrams from the problem statement. Please refer to Lab 5 slides which explain the process in detail with some examples.

5. Exercises

Read carefully the following problem statement

We are after a system that controls a recycling machine for returnable bottles and cans. The machine will allow a customer to return bottles or cans on the same occasion. When the customer returns an item, the system will check what type has been returned. The system will register how many items each customer returns and, when the customer asks for a receipt, the system will print out what he deposited, the value of the returned items and the total return sum that will be paid to the customer. The system is also be used by an operator. The operator wants to know how many items of each type have been returned during the day. At the end of the day, the operator asks for a printout of the total number of items that have been deposited in the machine on that particular day. The operator should also be able to change information in the system, such as the deposit values of the items. If something is amiss, for example if a can gets stuck or if the receipt roll is finished, the operator will be called by a special alarm signal.

After reading the above problem statement, find:

1. **Actors**

2. **Use cases** with each actor

3. Find **extend** or **include** use cases (if applicable)

4. Finally: draw the main u**se case diagram**:

6. Deliverables

You should submit the solutions for the previous exercises.

You should use these techniques to draw use case diagrams for your term project using Rational Rose.

System Modeling

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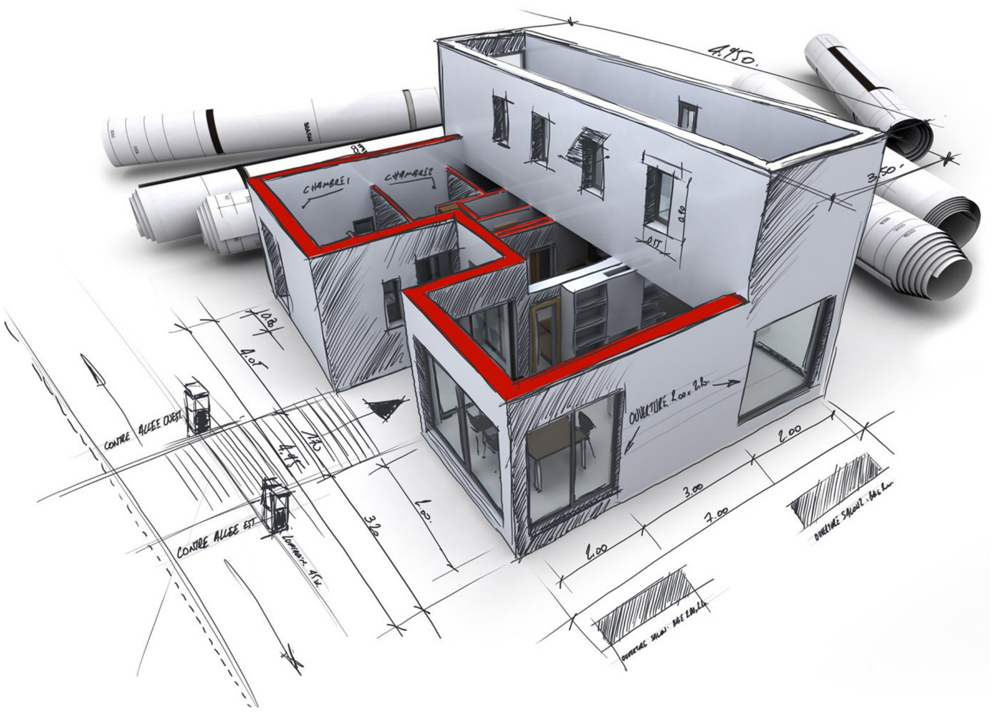


Lab 5: System Modeling

Objective
Deeper understanding of System modeling:
- Data model: entity-relationship diagram (ERD).
- Functional model: data flow diagram (DFD).

1. Outline

System analysis model elements:
- Data model: entity-relationship diagram (ERD)
- Functional model: data flow diagram (DFD)

2. Background

Modeling consists of building an abstraction of reality. These abstractions are simplifications because they ignore irrelevant details and they only represent the relevant details (what is relevant or irrelevant depends on the purpose of the model).

2.1 Why Model Software?

Software is getting larger, not smaller; for example, Windows XP has more than 40 million lines of code. A single programmer cannot manage this amount of code in its entirety. Code is often not directly understandable by developers who did not participate in the development; thus, we need simpler representations for complex systems (modeling is a mean for dealing with complexity). A wide variety of models have been in use within various engineering disciplines for a long time. In software engineering a number of modeling methods are also available.

2.2 Analysis Model Objectives
- To describe what the customer requires.
- To establish a basis for the creation of a software design.
- To define a set of requirements that can be validated once the software is built.

2.3 The Elements of the Analysis Model

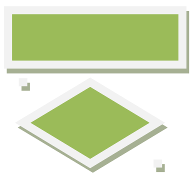
The generic analysis model consists of:
- An entity-relationship diagram (data model).
- A data flow diagram (functional model).
- A state transition diagram (behavioral model).

NOTE: state transition diagram will be covered in lab 9.

2.3.1 Entity Relationship Diagram

An entity relationship diagram (ERD) is one means of representing the objects and their relationships in the data model for a software product.

Entity Relationship diagram notation:



Entity

Relationship

To create an ERD you need to:

- Define "objects" by underlining all nouns in the written statement of scope: producers/consumers of data, places where data are stored, and "composite" data items.
- Define "operations" by double underlining all active verbs: processes relevant to the application and data transformations.
- Consider other "services" that will be required by the objects.
- Then you need to define the relationship which indicates "connectedness": a "fact" that must be "remembered" by the system and cannot be or is not computed or derived mechanically.

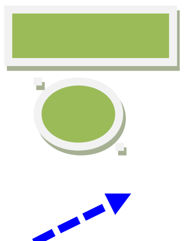
2.3.2 Data Flow Diagram

A data flow data diagram is one means of representing the functional model of a software product. DFDs do not represent program logic like flowcharts do.

Data flow diagram notation:

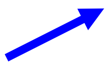
External Entity

Process



Data Flow

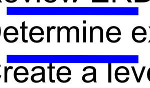
Control Flow



Data Store

To create a DFD you need to:

- Review ERD to isolate data objects and grammatical parse to determine operations.
- Determine external entities (producers and consumers of data).
- Create a level 0 DFD "Context Diagram" (one single process).
- Balance the flow to maintain data flow continuity.
- Develop a level 1 DFD; use a 1:5 (approx.) expansion ratio.



Data Flow Diagram Guidelines:

- All icons must be labeled with meaningful names.
- Always show external entities at level 0.
- Always label data flow arrows.
- Do not represent procedural logic.
- Each bubble is refined until it does just one thing.

3. CASE Tools

You can use MS word to create your ERD and DFD since we do not have a license for a case tool that supports these diagrams.

4. In-Class Example

Now you will learn how to create ERD and DFD.

5. Exercises

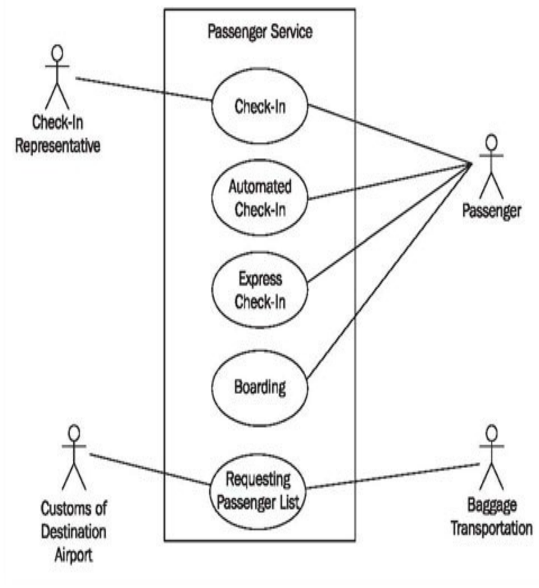
ERD and DFD for your Project

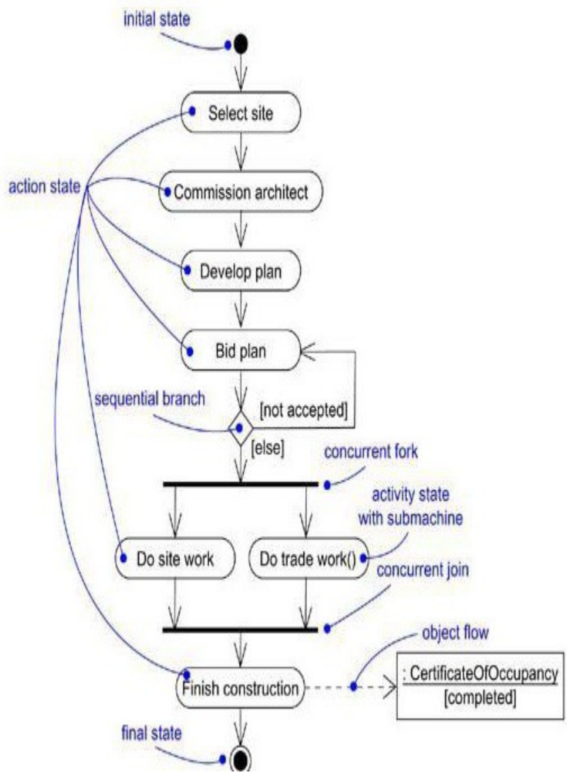
6. Deliverables

You should create ERD and DFD for your term project

Documenting Use Cases and Activity Diagrams

6


Passenger Service
Check-In
Automated Check-In
Express Check-In
Boarding
Requesting Passenger List
Check-In Representative
Passenger
Customs of Destination Airport
Baggage Transportation


initial state
Select site
action state
Commission architect
Develop plan
Bid plan
sequential branch
[not accepted]
[else]
concurrent fork
activity state with submachine
Do site work
Do trade work()
concurrent join
object flow
Finish construction
: CertificateOfOccupancy
[completed]
final state

Lab 6: Documenting Use Cases and Activity Diagrams

Objectives

- Study how to document use cases in detail.
- Know about scenarios (flow of events) and its importance.
- Deeper understanding of UML activity diagrams.
- Practicing flow of events and activity diagrams using Rational Rose.

1. Outline

- Writing flow of events.
- Flow of events template and example.
- Activity diagrams.
- Examples.

2. Background

Each use case is documented with a flow of events. The flow of events for a use case is a description of the events needed to accomplish the required behavior of the use case. Activity diagrams may also be created at this stage in the life cycle. These diagrams represent the dynamics of the system. They are flow charts that are used to show the workflow of a system; that is, they show the flow of control from one activity to another in the system.

2.1 Flow of Events

A description of events required to accomplish the behavior of the use case, that:

- Show WHAT the system should do, not HOW the system does it.
- Written in the language of the domain, not in terms of implementation.
- Written from an actor point of view.

A flow of events document is created for each use case:

- Actors are examined to determine how they interact with the system.
- Break down into the most atomic actions possible.

2.2 Contents of Flow of Events

- When and how the use case starts and ends.
- What interaction the use case has with the actors.
- What data is needed by the use case.
- The normal sequence of events for the use case.
- The description of any alternate or exceptional flows.

2.3 Template for the flow of events document

Each project should use a standard template for the creation of the flow of events document. The following template seems to be useful.

X Flow of events for the <name> use case
X.1 Preconditions
X.2 Main flow
X.3 Sub-flows (if applicable)
X.4 Alternative flows
where X is a number from 1 to the number of use cases.

A sample completed flow of events document for the *Select Courses to Teach* use case follows.

1. Flow of Events for the Select Courses to Teach Use Case

1.1 Preconditions

Create course offerings sub-flow of the maintain course information use case must execute before this use case begins.

1.2 Main Flow

This use case begins when the professor logs onto the registration system and enters his/her password. The system verifies that the password is valid (E-1) and prompts the professor to select the current semester or a future semester (E-2). The professor enters the desired semester. The system prompts the Professor to select the desired activity: ADD, DELETE, REVIEW, PRINT, or QUIT.

If the activity selected is ADD, the S-1: add a course offering sub-flow is performed.

If the activity selected is DELETE, the S-2: delete a course offering sub-flow is performed.

If the activity selected is REVIEW, the S-3: review schedule sub-flow is performed.

If the activity selected is PRINT, the S-4: print a schedule sub-flow is performed.

If the activity selected is QUIT, the use case ends.

1.3 Sub-flows

S-1: Add a Course Offering:
The system displays the course screen containing a field for a course name and number. The professor enters the name and number of a course (E-3). The system displays the course offerings for the entered course (E-4). The professor selects a course offering. The system links the professor to the selected course offering (E-5). The use case then begins again.

S-2: Delete a Course Offering:
The system displays the course offering screen containing a field for a course offering name and number. The professor enters the name and number of a course offering (E-6). The system removes the link to the professor (E-7). The use case then begins again.

S-3: Review a Schedule:
The system retrieves (E-8) and displays the following information for all course offerings for which the professor is assigned: course name, course number, course offering number, days of the week, time, and location. When the professor indicates that he or she is through reviewing, the use case begins again.

S-4: Print a Schedule
The system prints the professor schedule (E-9). The use case begins again.

1.4 Alternative Flows

E-1: An invalid professor ID number is entered. The user can re-enter a professor ID number or terminate the use case.

E-2: An invalid semester is entered. The user can re-enter the semester or terminate the use case.

E-3: An invalid course name/number is entered. The user can re-enter a valid name/number combination or terminate the use case.

E-4: Course offerings cannot be displayed. The user is informed that this option is not available at the current time. The use case begins again.

E-5: A link between the professor and the course offering cannot be created. The information is saved and the system will create the link at a later time. The use case continues.

E-6: An invalid course offering name/number is entered. The user can re-enter a valid course offering name/number combination or terminate the use case.

E-7: A link between the professor and the course offering cannot be removed. The information is saved and the system will remove the link at a later time. The use case continues.

E-8: The system cannot retrieve schedule information. The use case then begins again.

E-9: The schedule cannot be printed. The user is informed that this option is not available at the current time. The use case begins again.
Use case flow of events documents are entered and maintained in documents external to Rational Rose. The documents are linked to the use case.

2.4 Activity Diagrams
Activity diagrams are flow charts that are used to show the workflow of a system.
They also:

- Represent the dynamics of the system.
- Show the flow of control from activity to activity in the system.
- Show what activities can be done in parallel, and any alternate paths through the flow.

Activity diagrams may be created to represent the flow across use cases or they may be created to represent the flow within a particular use case. Later in the life cycle, activity diagrams may be created to show the workflow for an operation.

2.5 Activity Diagram Notation

- **Activities-** performance of some behavior in the workflow.
- **Transition-** passing the flow of control from activity to activity.
- **Decision-** show where the flow of control branches based on a decision point:
  - Guard condition is used to determine which path from the decision point is taken.
- **Synchronization-**what activities are done concurrently? What activities must be completed before processing may continue (join).

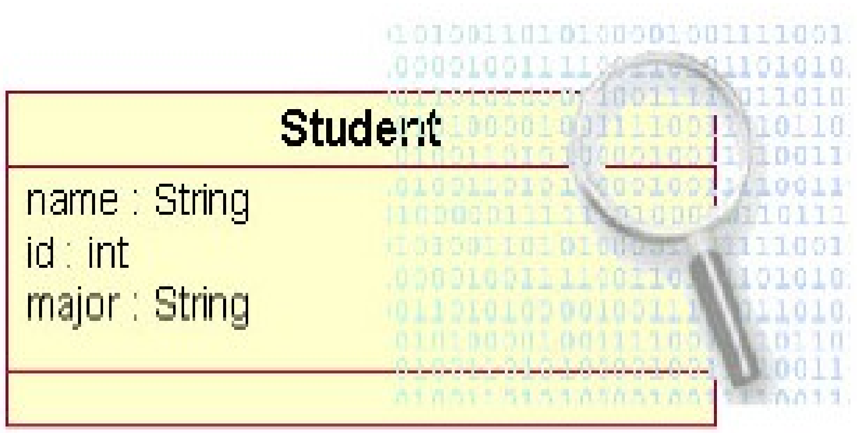
3. CASE Tools
Rational Rose.

4. In-Class Example
Now you will learn how to apply the above mentioned methods to write flow of events and drawing activity diagrams from the use case(s) flow of events.

5. Exercises
Apply to your Project

6. Deliverables

You should use these techniques to write flow of events and draw activity diagrams for your term project.


Student
name : String
id : int
major : String

Object Oriented Analysis: Discovering Classes

7

Lab 7: Object-Oriented Analysis: Discovering Classes

Objective
- Learn the object-oriented analysis phase by understanding the methods of class elicitation and finding the classes in an object-oriented system.

1. Outline
- Object-Oriented concepts
- Discovering classes' approaches: noun phrase approach, common class patterns, use case driven method, CRC (Class-Responsibility-Collaboration) and mixed approach.
- Examples.

2. Background
Classes: a description of a group of objects with common properties (attributes), common behavior (operations), common relationships to other objects and common semantics.

2.1 Object-Oriented Concepts
- Attribute: the basic data of the class.
- Method (operation): an executable procedure that is encapsulated in a class and is designed to operate on one or more data attributes that are defined as part of the class.
- Object: when specific values are assigned to all the resources defined in a class, the result is an instance of that class. Any instance of any class is called an object.

2.2 Discovering Classes
Discovering and defining classes to describe the structure of a computerized system is not an easy task. When the problem domain is new or unfamiliar to the software developers it can be difficult to discover classes; a cookbook for finding classes does not exist.

2.3 Classes Categories
Classes are divided into three categories:

- Entity: models information and associated behavior that is long-lived, independent of the surrounding, application independent, and accomplishes some responsibility
- Boundary: handles the communication between the system surroundings and the inside of the system, provides interface, and facilitates communication with other systems
- Control: model sequencing behavior specific to one or more use cases. Control classes coordinate the events needed to realize the behavior specified in the use case, and they are responsible for the flow of events in the use case.

2.4 Discovering Classes Approaches

- Methods of discovering classes:

2.4.1 Noun Phrase Approach: Examine the requirements and underline each noun. Each noun is a candidate class; divide the list of candidate classes into:

- Relevant classes: part of the application domain; occur frequently in requirements.
- Irrelevant classes: outside of application domain
- Fuzzy classes: unable to be declared relevant with confidence; require additional analysis

2.4.2 Common Class Patterns: Derives candidate classes from the classification theory of objects; candidate classes and objects come from one of the following sources:

- Tangible things: e.g. buildings, cars.
- Roles: e.g. teachers, students.
- Events: things that happen at a given date and time, or as steps in an ordered sequence: e.g. landing, request, interrupt.
- Interactions: e.g. meeting, discussion.
- Sources, facilities: e.g. departments.
- Other systems: external systems with which the application interacts.
- Concept class: a notion shared by a large community.
- Organization class: a collection or group within the domain.
- People class: roles people can play.
- Places class: a physical location relevant to the system.

2.4.3 Use Case Driven Method: The scenarios - use cases that are fundamental to the system operation are enumerated. Going over each scenario leads to the identification of the objects, the responsibilities of each object, and how these objects collaborate with other objects.

2.4.4 CRC (Class-Responsibility-Collaboration): Used primarily as a brainstorming tool for analysis and design. CRC identifies classes by analyzing how objects collaborate to perform business functions (use cases). A CRC card contains: name of the class, responsibilities of the class and collaborators of the class. Record name of class at the top; record responsibilities down the left-hand side; record other classes (collaborators) that may be required to fulfill each responsibility on the right-hand side. CRC cards are effective at analyzing scenarios; they force you to be concise and clear; they are cheap, portable and readily available.

2.4.5 Mixed Approach: A mix of these approaches can be used, one possible scenario is:

- Use CRC for brainstorming.
- Identify the initial classes by domain knowledge.

- Use common class patterns approach to guide the identification of the classes.
- Use noun phrase approach to add more classes.
- Use the use case approach to verify the identified classes.

2.5 Class Elicitation Guidelines

- A class should have a single major role.
- A class should have defined responsibilities (use CRC cards if needed).
- Classes should be of a manageable size: if a class has too many attributes or operations, consider splitting it.
- A class should have a well-defined behavior, preferably by implementing a given requirement or an interface.

3. CASE Tools

Rational Rose.

4. In-Class Example

Now you will learn how to apply the above mentioned methods of finding classes from the problem statement.

5. Exercises

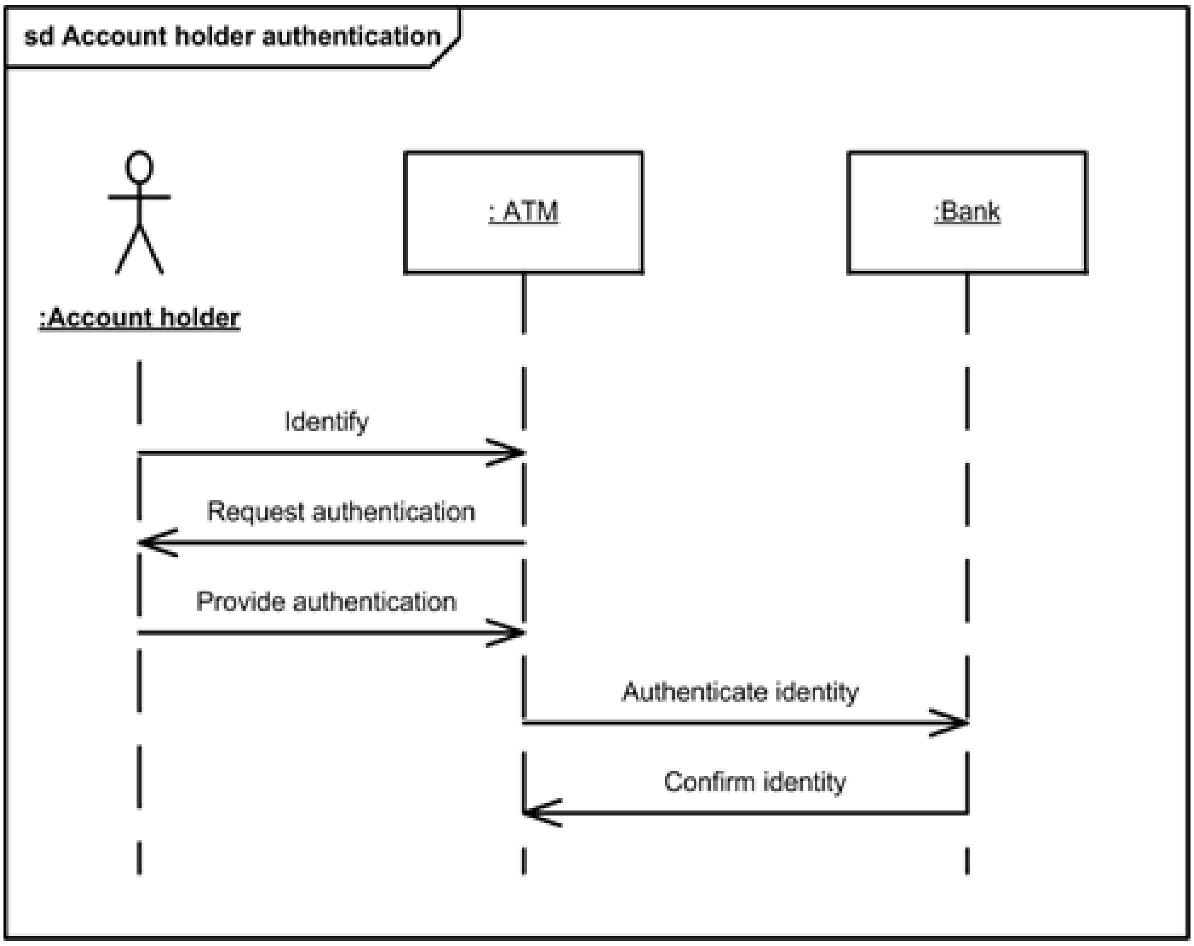
Apply to your Project

6. Deliverables

You should use these class elicitation techniques to identify the classes for your term project.

Interaction Diagrams: Sequence and Collaboration Diagrams

8



Lab 8: Interaction Diagrams: Sequence & Collaboration Diagrams

Objectives

- Better understanding of the interaction diagrams.
- Get familiar with sequence & collaboration diagrams.
- Practice drawing the interaction diagrams using Rational Rose.

1. Outline

Interaction diagrams:

- Sequence diagrams
- Collaboration diagrams

2. Background

Interaction diagrams describe how groups of objects collaborate in some behavior. An interaction diagram typically captures the behavior of a single use case. Interaction diagrams do not capture the complete behavior, only typical scenarios.

2.1 Analyzing a System's Behavior

UML offers two diagrams to model the dynamics of the system: sequence and collaboration diagrams. These diagrams show the interactions between objects.

2.2 Sequence Diagrams

Sequence diagrams are a graphical way to illustrate a scenario:

- They are called sequence diagrams because they show the sequence of message passing between objects.
- Another big advantage of these diagrams is that they show when the objects are created and when they are destructed. They also show whether messages are synchronous or asynchronous.

2.3 Creating Sequence Diagrams

- You must know the scenario you want to model before diagramming sequence diagrams.
- After that specify the classes involved in that scenario.
- List the involved objects in the scenario horizontally on the top of the page.
- Drop a dotted line beneath every object. They are called lifelines.
- The scenario should start by a message pass from the first object.
- You must know how to place the objects so that the sequence is clear.
- You may start the scenario by an actor.
- Timing is represented vertically downward.
- Arrows between life lines represents message passing.
- Horizontal arrows may pass through the lifeline of another object, but must stop at some other object.

- You may add constraints to these horizontal arrows.
- Objects may send messages to themselves.

- Long, narrow rectangles can be placed over the lifeline of objects to show when the object is active. These rectangles are called activation lines.

2.4 Collaboration Diagrams
They are the same as sequence diagrams but without a time axis:
- Their message arrows are numbered to show the sequence of message sending.
- They are less complex and less descriptive than sequence diagrams.
- These diagrams are very useful during design because you can figure out how objects communicate with each other.

2.5 Notes
- Always keep your diagrams simple.
- For "IF... then ..." else scenarios, you may draw separate sequence diagrams for the different branches of the "if statement". You may even hide them, (at least during the analysis phase) and document them by the text description accompanying the sequence diagrams.

3. CASE Tools
Rational Rose.

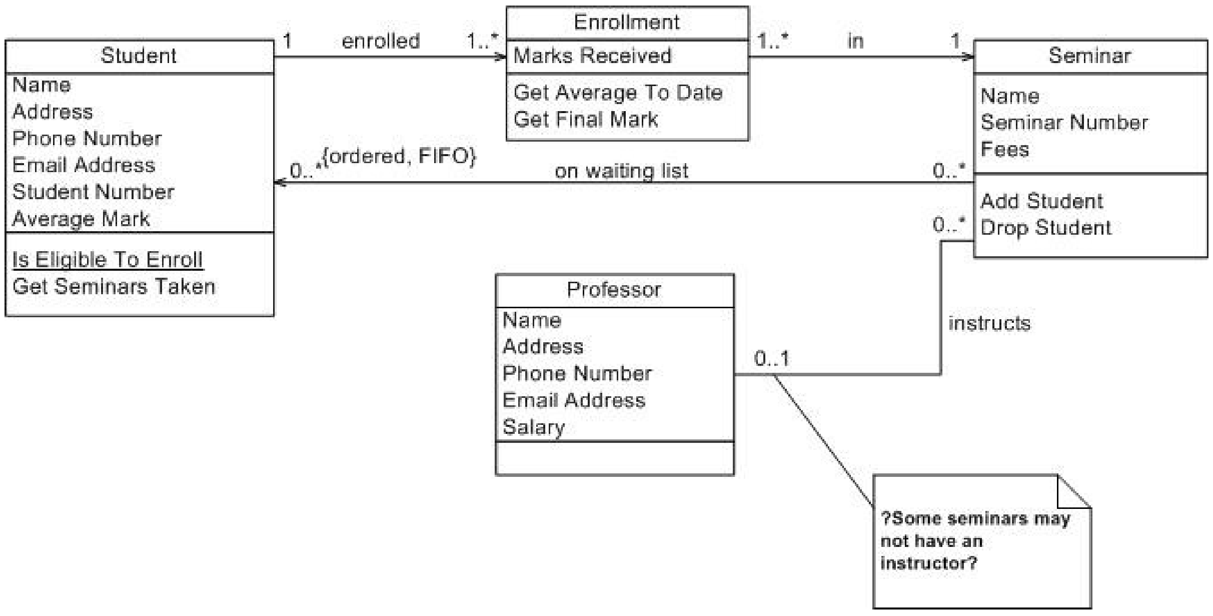
4. In-Class Example
Now you will learn how to apply the above mentioned methods of drawing sequence and collaboration diagrams from the problem statement.

5. Exercises
Apply to your Project.

6. Deliverables
You should use these techniques to create sequence and collaboration diagrams for your term project.

Software Design: Software Architecture and Object Oriented Design

9



Lab 9: Software Design: Software Architecture and Object-Oriented Design

Objectives

- Deeper understanding of software design and the software design document (SDD).
- Learn how to find the relationships between classes to create UML class diagram.

1. Outline

- Software design concepts and principals.
- Software architecture.
- Specifying the attributes and the operations and finding the relationships between classes.
- Creating UML class diagram.
- Software design document.

2. Background

The purpose of software design is “to produce a workable (implementable) solution to a given problem.” David Budgen in Software Design: An Introduction.

2.1 The Design Process

Software design is an iterative process that is traceable to the software requirements analysis process. Many software projects iterate through the analysis and design phases several times. Pure separation of analysis and design may not always be possible.

2.2 Design Concepts

- The design should be based on requirements specification.
- The design should be documented (so that it supports implementation, verification, and maintenance).
- The design should use abstraction (to reduce complexity and to hide unnecessary detail).
- The design should be modular (to support abstraction, verification, maintenance, and division of labor).
- The design should be assessed for quality as it is being created, not after the fact.
- Design should produce modules that exhibit independent functional characteristics.
- Design should support verification and maintenance.

2.3 Software Architecture

Software architecture is a description of the subsystems and components of a software system and the relationships between them.
You need to develop an architectural model to enable everyone to better understand the system, to allow people to work on individual pieces of the system in isolation, to prepare for extension of the system and to facilitate reuse and reusability.

2.4 Describing an Architecture Using UML

All UML diagrams can be useful to describe aspects of the architectural model. Four UML diagrams are particularly suitable for architecture modeling:

- Package diagrams
- Subsystem diagrams
- Component diagrams
- Deployment diagrams

2.5 Specifying Classes

Each class is given a name, and then you need to specify:

- Attributes: initially those that capture interesting object states. Attributes can be public, protected, private or friendly/package.
- Operations: can be delayed till later analysis stages or even till design. Operations also can be public, protected, private or friendly/package.
- Object-Relationships:
    - Associations: denote relationships between classes.
    - An aggregation: a special case of association denoting a “consists of” hierarchy.
    - Composition: a strong form of aggregation where components cannot exist without the aggregate.
    - Generalization relationships: denote inheritance between classes.

This will build the class diagram, which is a graphical representation of the classes (including their attributes and operations) and their relationship with other classes.

3. CASE Tools

Rational Rose.

4. In-Class Example

Now you will learn how to specify classes’ attributes, methods and the relationships between the classes.

6. Exercises

Apply to your Project

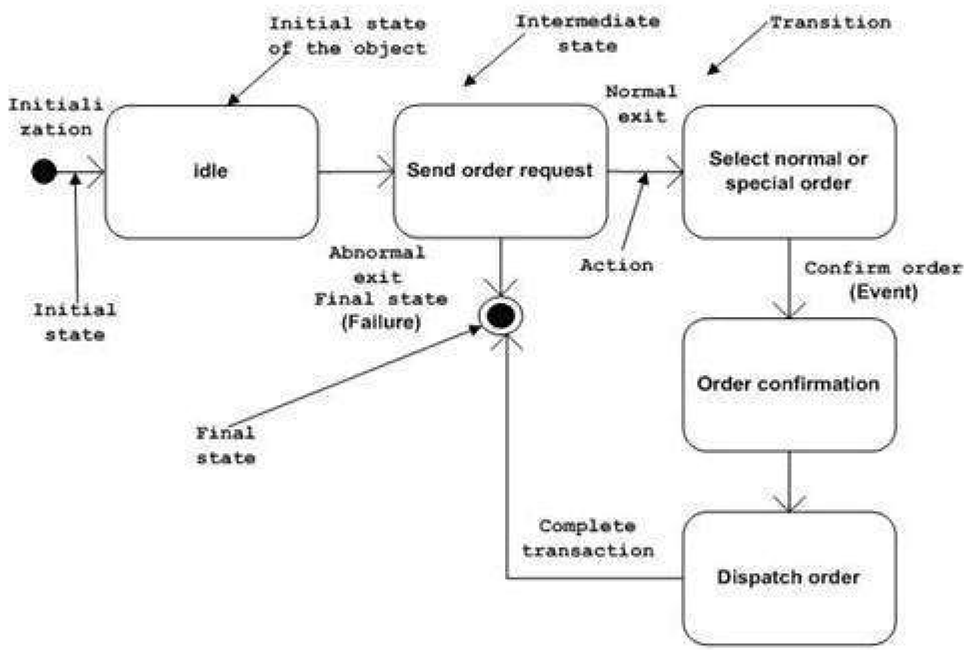
7. Deliverables

Also you should use specifying class attributes, methods and the relationship with other classes you learned in your term project.

State Chart Diagram

10

Statechart diagram of an order management system



Lab 10: State Transition Diagrams

Objectives
- Deeper understanding of UML state transition diagrams (STD).
- Practicing using Rational Rose.

1. Outline
- UML state diagrams.
- UML state diagram notation
- UML state details
- Examples

2. Background
Mainly, we use interaction diagrams to study and model the behavior of objects in our system. Sometimes, we need to study the behavior of a specific object that shows complex behavior to better understand its dynamics. For that sake, UML provides state transition diagrams used to model the behavior of objects of complex behavior. In this Lab, UML state transition diagrams will be introduced. We will study their notation and how can we model them using Rational Rose.

2.1 UML State Diagrams
State diagrams show how one specific object changes state as it receives and processes messages:
- Since they are very specific, they are used for analyzing very specific situations if we compare them with other diagrams.
- A state refers to the set of values that describe an object at a specific moment in time.
- As messages are received, the operations associated with the object's parent class are invoked to deal with the messages.
- These messages change the values of these attributes.
- There is no need to prepare a state diagram for every class you have in the system.

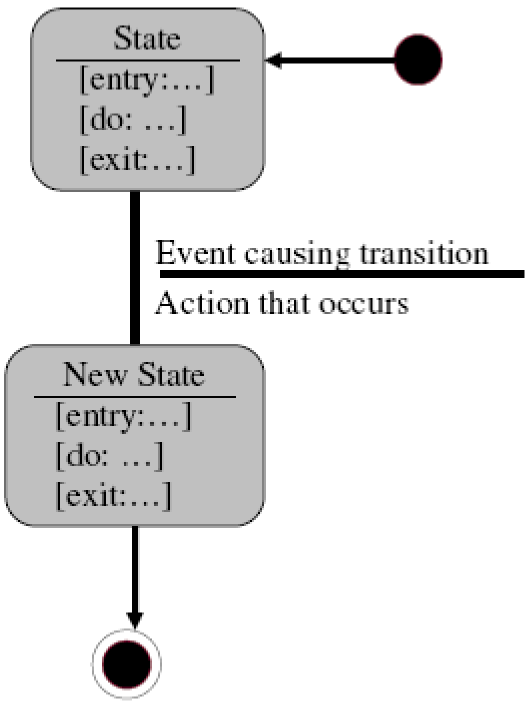
2.2 Creating State Transition Diagrams
- States are represented by rectangles with rounded corners with an attribute name with a values associated with it.
- The name of the state is placed within the box.
- Events are shown by arrows.
- An event occurs when at an instant in time when a value is changed.
- A message is data passed from one object to another.
- The name of a state usually refers to the name of the attribute and the values associated to it.
- Example, a student object may receive a message to change its name. The state of that object changes from the first name state to the new state name.
- The name of the state is placed in the top compartment.
- State variables are placed in the next compartment.
- The operations associated with the state are listed in the lowest compartment of the state box.
- In the operations part, we usually use one of the following reserved words:
  - **Entry:** a specific action performed on the entry to the state.

  - **Do:** an ongoing action performed while in the state.
  - **On:** a specific action performed while in the state.
  - **Exit:** a specific action performed on exiting the state.
- There are two special states added to the state transition diagram- start state and end state.
- Notation of start state is a solid black circle and for the end state a bull's eye is used.

2.3 State Transition Details

- A state transition may have an action and/or guard condition associated with it and it may also trigger an event.
- An action is the behavior that occurs when the state transition occurs.
- An event is a message that is sent to another object in the system.
- A guard condition is a Boolean expression of attribute values that allows a state transition only if the condition is true.
- Both actions and guards are behaviors of the object and typically become operations. Also they are usually private operations (used by the object itself).
- Actions that accompany all state transitions into a state may be placed as an entry action within the state.
- Actions that accompany all state transitions out of a state may be placed as exit actions within the state.
- A behavior that occurs within the state is called an activity.
- An activity starts when the state is entered and either completes or is interrupted by an outgoing state transition.
- A behavior may be an action, or it may be an event sent to another object.
- This behavior is mapped to operations on the object.

State transition diagram notation:



3. CASE Tools
Rational Rose.

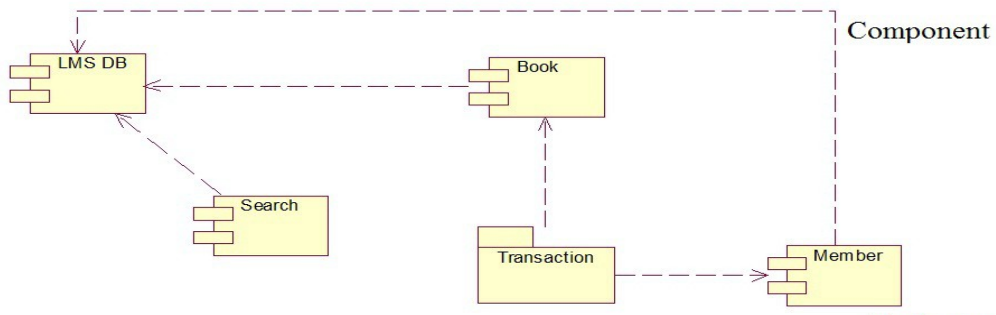
4. In-Class Example
Now you will learn how to apply the above mentioned methods of drawing state transition diagrams (STD).

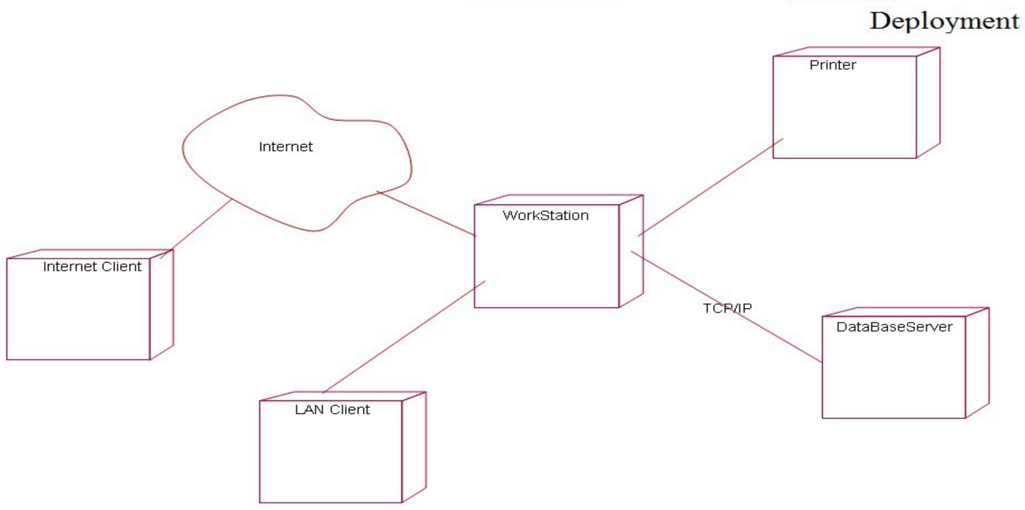
5. Exercises
Apply to your Project.

6. Deliverables
You should use these techniques to create state transition diagrams for your term project.

Implementation Diagrams: Component and Deployment Diagrams

11


Component
LMS DB
Book
Search
Transaction
Member


Deployment
Printer
Internet
WorkStation
Internet Client
TCP/IP
DataBaseServer
LAN Client

Lab 11: Implementation Diagrams: Component & Deployment Diagrams

Objectives

- Become familiar with the implementation diagrams: component and deployment diagrams.
- Practice using Rational Rose.

1. Outline

- Implementation diagrams: component and deployment diagrams.
- Examples.

2. Background

Implementation diagrams capture design information. The main implementation diagrams in UML are: component and deployment diagrams. In this Lab we will study these diagrams and their notation.

2.1 UML Implementation Diagrams

The main implementation diagrams we have in UML are: component diagrams and deployment diagrams. These diagrams are high level diagrams in comparison with old diagrams you have already learned.

2.2 UML Component Diagram

Component diagrams capture the physical structure of the implementation.

- Remember always that when you talk about components, you are talking about the physical models of code.
- You can name them and show dependency between different components using arrows.
- A component diagram shows relationships between component packages and components.
- Each component diagram provides a physical view of the current model.
- Component diagrams contain icons representing:
    - Component packages.
    - Components.
    - Main programs.
    - Packages.
    - Subprograms.
    - Tasks.
    - Dependencies.

2.3 Deployment Diagrams

A deployment diagram shows processors, devices and connections. Each model contains a single deployment diagram which shows the connections between its processors and devices, and the allocation of its processes to processors.

2.3.1 Deployment Diagrams: Processor

A processor is a hardware component capable of executing programs.

- A processor is given a name and you should specify the processes that will run on that processor.
- You can also specify the scheduling of these processes on that processor.

- Types of scheduling are:
    - Pre-emptive: a higher priority process may take the process from lower priority one.
    - Non-preemptive: a process will own the processor until it finishes
    - Cyclic: control passes from one process to another.
    - Executive: an algorithm controls the scheduling of the processes.
    - Manual: scheduling buy the user.

2.3.2 Deployment Diagrams: Device

A device is a hardware component with no computing power. Each device must have a name. Device names can be generic, such as "modem" or "terminal."

2.3.3 Deployment diagrams: Connection

A connection represents some type of hardware coupling between two entities. An entity is either a processor or a device. The hardware coupling can be direct, such as an RS232 cable, or indirect, such as satellite-to-ground communication. Connections are usually bi-directional.

3. CASE Tools

Rational Rose.

4. In-Class Example

Now you will learn how to apply the above mentioned methods of creating component and deployment diagrams.

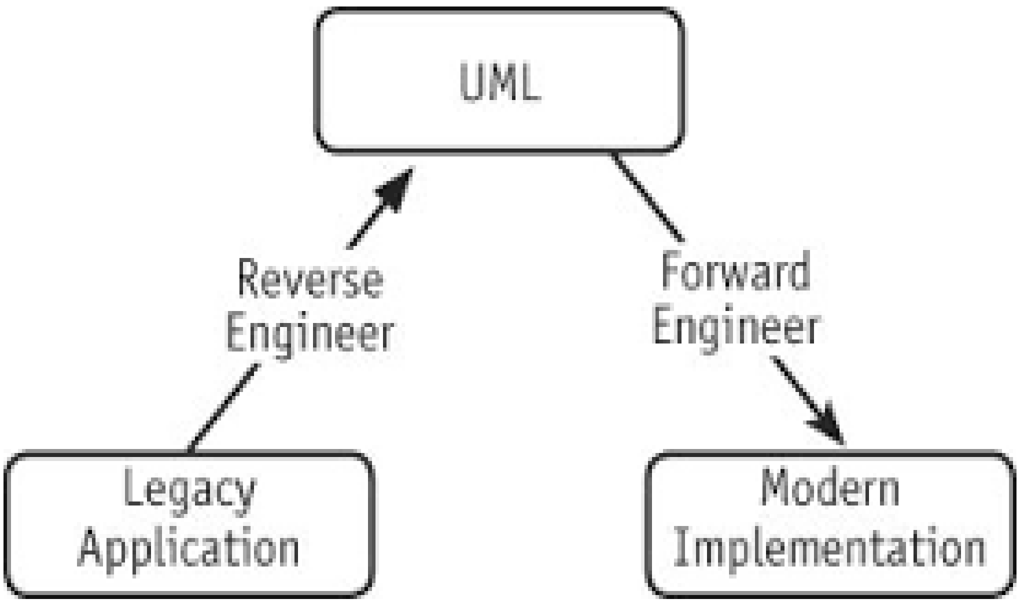
5. Exercises

Apply system and its components and draw deployment and component diagrams.

6. Deliverables

You should use these techniques to create component and deployment diagrams for your term project.

Template Code 12



Lab 12: Template Code

Objectives
- Generating Template Code.
- Practicing using Rational Rose.

1. Outline
- Forward Engineering.
- Reverse Engineering.
- Examples.

2. Background
We can generate template code using Rational Rose. Logic should be written by student after obtaining template code. Template code will be generated by unique identity number for every generation.
In this Lab, UML template code generation will be introduced. We will study their generation and how can we add logic code to template code.

2.1 Forward Engineering
From model to code.

2.2 Reverse Engineering
From code to model.

3. CASE Tools
Rational Rose.

4. In-Class Example
Now you will learn how to generate template code.

5. Exercises
Apply to your Project

6. Deliverables
You should use these techniques to generate template code for your term project.

Appendix A

RATIONAL ROSE

Rational Rose is the visual modeling ware solution that lets you create, analyze, design, view, modify and manipulate components. You can graphically depict on overview of the behavior your system with a use case diagram .Rational Rose provides the collaboration diagram as an alternative to a use case diagram .It shows object interactions organized around objects and their links to one another. The state chart diagram provides additional analysis techniques for classes with significant dynamic behavior .Activity diagrams provide a way to model a class operation or the work flow of a business process.

Rational Rose provides the notation needed to specify and document the system architecture .The logical architecture is captured in class diagrams that contain the classes and relationships that represent the key abstractions of the system under development .The component architecture is captured in component diagrams that focus

on the actual software module organization with in the development environment .The deployment architecture is captured in deployment diagrams that map software to processing nodes showing the configuration of the run time processing elements and their software processes .

FEATURES

Rational Rose provides the following features facilitates the analysis, design and iterative construction of your application

- ✓ Use-Case Analysis
- ✓ Object –Oriented Modeling
- ✓ User-configurable Support for UML ,COM ,OMT and Booch'93
- ✓ Semantic Checking
- ✓ Support for Controlled Iterative Development
- ✓ Round-Trip Engineering
- ✓ Parallel Multi- user Development.
- ✓ Integration with Data Modeling tools
- ✓ Document generation
- ✓ Rational Rose scripting for integration and Extensibility
- ✓ OLE Linking

- ✓ OLE Automation
- ✓ Multi Platform Availability

EXTENDING RATIONAL ROSE

The add-in feature allows you to quickly and accurately customize your Rational Rose environment depending on your development needs. Using the add-in tool, you can install language and non language tools while in Rational Rose.

When an add-in is installed, it is automatically in an activated state. Add-ins can install

- ✓ Menus(.mnu files)
- ✓ Help files(.hlp files)
- ✓ Contents tab files(.cnt files)
- ✓ Properties (.pty files)
- ✓ Executables (.exe)
- ✓ Script files(.ebs script source file and .ebx compiled script file)
- ✓ OLE servers(.dll files)

Additionally, an add-in can define fundamental types, predefined stereotypes, and metafiles. Note that an add-in is not to be considered strictly a one-to one association with a round-trip engineering integration.

ADD-IN MANAGER

The Add-in Manager allows you to control the state of the add-in, whether it is activated or deactivated. If the add-in is deactivated, it is still visible through the Add-in Manager. However, the add-in's properties and menus are not available.

The student is expressed to take up about five mini-projects and model them and produce Use Cases, Anal

Actors in the University Course Registration System:

1.Student want to register for courses.

2.Professors want to select courses to teach

3.The register must create the curriculum to teach

4.The register must maintain all the information about courses ,professors and students.

5.The billing system must receive billing information from the system.

The actors identified are:

1 Student

2 Professors

3 Register

A use case represents the functionality provided by the system.

The following questions will help to identify the use cases in the system:

1. What are the tasks of each actor?
2. Will any actor create, store,change ,remove,or read this information?
3. What use case will create ,store,change,remove or read this information?
4. Does any actor need to be informed about certain occurance in the system?
5. What use cases will support and maintain the system?
6. Can all functional requirements be performed by the use access?

The following needs must be addressed by the system.

1 The student actor needs to use the system to register for courses.

2 After the courses selection process is completed ,the billing system must be supplied with billing information.

3 The professor actor needs to use the system to select the course to teach for a semester and must be able to receive a course roster from the system.

4 The register is responsible for the generation of the course for a semester and for the maintenance of all information about the curriculum, the students and the professors needed by the system.

The uses cases identified are

1. Register for courses
2. Select courses to teach
3. Request for roster
4. Maintain courses information
5. Maintain professor information
6. Maintain student information
7. Create course catalog.

Creating Class Diagrams:

The purpose of a class diagram is to specify the structural makeup of the system. This includes class relationship and the attributes and behaviors associated with class. Class diagrams are remarkable at inheritance and composite relations hips.

A good class captures one and only one abstraction-it should have one major theme.

The following questions will help to identify the classes in the system:

1. Identify the main members of the problem given.
2. Determine how they are related to each other
3. Identify the characteristics of each member of the problem.
4. Find relations among the members.
5. Decide the inheritance of personal traits and characters.

The following needs must be addresses by the system for classes are:

1 Courses that are offered by the system for classes are:

2 Details about the professors present.

3 Information about the students that are taking admissions.

4 Information about the university

The classes that are identified are:

1 Courses

2 professor

3 student

4 Home

The following questions will help to identify the attributes for classes:

1 What it is going to do with a property or characteristic?

2 How it is going to collaborate with other classes?

3 What it need to know?

4 What state information it should remember over time?

5 In what sates it will exist?

For example for the class student the attributes are name, age ,roll no, address, branch etc**.**

Guidelines for identifying methods for classes:

Object provides and describes abstract data. Method or behaviour or operations usually corresponding to queries about attributes.

For example for the class student the methods are get detail (), registration request () etc.

Guidelines for identifying relationship between classes:

1. **Is the class of fulfilling the required task by itself?**
2. **If not, what does it need?**
3. **From what other class can it require it needs?**

For example there is a relationship between students class and professor's class.

<u>Creating interaction diagrams:</u>

There are two of interaction diagrams: sequence and collaboration diagrams.

A Sequence diagram is a model that describe how groups of objects Collaboration in some behaviour over time. The Sequence diagram captures the behaviour of a single use case and shows the objects and the messages that are passed between these objects in the timeframe of the specific use case The Sequence diagram does not show relationships between objects.

The sequence diagram may be used to:

1. Describe the overall sequence of the flow of control when there are many short methods in different classes.
2. Show concurrent processes and activations.
3. Show time sequences that are not easily depicted in a Collaboration diagram.
4. Show general forms that do not deal with objects but with class interaction.

Guidelines for identifying relationship between objects:

1 We need to identify a set of software objects with clearly defined responsibilities.

2 Use of Jacobsen's 'interference', 'control', and 'entity' categories, or of the CRC technique,

are well –defined and fruitful approaches.

3 The initial development of object interaction diagrams (sequence diagrams and collaboration

Diagrams) provides much of the information required to develop an initial class diagram.

4 Messages received by an object require you to define corresponding operations in the object's class

5 Parameters or return data involved in the message imply a requirement for attributes; interaction between two objects implies some form of relation between their classes.

CERATING ACTIVITY DIAGRAM:

Activity diagram represent the dynamics of the system. They are used to show the flow of control from activity to activity in the system, what activities can be done in parallel and any alternate paths through the flow. Activity diagrams may be created to represent the flow with in a particular use cases or across the use cases. It may be created to shoe the work flow for an operation

THE FOLLOWING POINTS TO DRAW THE ACTIVITY DIAGRAM IN THE SYSTEM:

1. Identify the scope of the activity diagram.

   Begin by identifying what it is you are modeling. Is it a single use case? A portion of a use case? A business process that includes several use cases? A single method of a class? Once you identify the scope of your diagram, you should a label at the top, using a note, indicating an appropriate title for the diagram and a unique identifier for it. you may also want to include the date and even the names of the authors of the diagram.

2. Add start and end points

   Every activity diagram has a starting point and ending point.
3. add activities

   if you are modeling a use case, introduce an activity in each major step initiated by an actor if you are modeling a high level business process, introduce an activity for each major process, often a usecase or a package of usecases. finally if you are modelling a method, then it is common to9 have an activity for this step in the code.
4. Add transitions from the activities.

My Style is always to exit an activity even if it is simply toan ending point.whwnever there is more than one transition out of activity,you must label each transition appropriately.

5. Add decision points

Sometimes the logic of what you are modelling calls for a decision to be made.

6.Identity oppurtunities for parallel activities

Two Activities can occur in parallel when no direct relationship exits between them and tehey must both finish before a third activity can.

The activities identified are:

1.create the curriculum

2.select courses to each

3.create catalogue

4.Open registration

5.Assign professors to teach

6.Place catalogue in the book store

7.Mail catalogue to students.

Appendix B

A Point-of-Sale (POS) system

Project Analysis:

A POS system is a computerized application used to record sales and handle payments; it is typically used in retail store. It includes hardware components such as a computer and bar code scanner , and software to run to run the system. It interfaces to various applications, such as third party tax calculator and inventory control. These systems must be relatively fault tolerant; that is ,even if remote services are temporarily unavailable they must still be of capturing sales and handling at least cash payments . A POS system must support multiple and varied client-side terminals and interfaces such as browser, PDAs, touch-screens.

Creating Use case Diagrams:

Identifying actors:

1. Supermarket is a hardware thing where goods are brought
2. Customer is a person who buys items in a super market.
3. Staff is a person who interacts with super market.
4. Bank is a actor who gives loan to super market.
5. Items are part of super market

Identifying use cases:

1. **Sell items**
2. **Pay salaries**
3. **Maintenance**
4. **Issue bills**
5. **Take salary**
6. **Select items**
7. **Buy items**
8. **Give loans**
9. **Collect loans**
10. **Display**
11. **Sales**
12. **Profit**
13. **Loss**
14. **Pay money**

Identifying relationships:

Association:

1. Supermarket Sell items
2. Supermarket Pay salaries
3. Supermarket Maintain
4. Supermarket Issue bills
5. Staff works in Supermarket
6. Customer selects items
7. Star takes salaries
8. Customer selects items
9. Bank gives loans

10. Bank collects loans
11. Items are display in supermarket

Creating Class Diagrams:

Identifying classes:

1. Supermarket
2. Customer
3. Cash payment
4. Staff
5. Items
6. Bank
7. Sales
8. Cashier
9. Profit
10. Loss
11. Billing system
12. hardware
13. software
14. scanner
15. Barcode reader
16. Determine tax
17. Stationary

Identifying relationship between classes:

Aggregation:

1. Staff is a part of supermarket
2. Items are a part of supermarket
3. Billing system is a part of supermarket

Association:

1. Items are sold through sales
2. Bank provide loans to supermarket
3. Customer pays the cash payment
4. Cashier determine the tax
5. Sale are done by supermarket
6. Billing system determine the tax

Generalization:

1. Stationary is a kind of item
2. Vegetables is a kind of item
3. Chocolates is a kind of item
4. Fruits is a kind of item
5. Glossaries is a kind of item
6. Hardware is a kind of billing system
7. Software is a kind of billing system
8. Scanner is a kind of hardware

9. Barcode reader is a kind of hardware

Dependency:

1. Profit is dependent on sales
2. Loss is dependent on sales

Identifying attributes:

1. Supermarket: name, location, branches, code
2. Cash payment: cheque, credit card, debit card, cash
3. Billing system: sensors, serial no
4. Barcode scanner
5. Loss
6. Customer: name, credit card
7. Bank; name, location
8. Sales: no of items sold, cost of item sold
9. Staff: name, id, designation
10. Items: name, code, cost, quantity
11. Cashier: name, id
12. Hardware: name, serial no
13. Software
14. Scanner
15. Determine tax: amount, percentage
16. Glossaries
17. Stationary
18. Profit

Identifying operations

1.Supermaket:sell items

2.Customer:buy items

3.Cash patment:display

4.Staff:Worktimings:salary

5.Items:display

6.Sales:Display

7.Cashier:Collect cash

8.profit:display

9.loss:display

10.billing system:issuable,display

11.hardware

12.software

13.scanner:scam code

14.barcode reader:barcodescan

15.determine tax;display

16.staionary:display

Creating collaboration diagrams:

Identifying objects:

1.s.supermarket

2.cp.cash payment

3.st.staff

4.i.items5.b.bank

6.sl.sales

7.cs.cashier

8.bs.billing systems

9.br.barcode reader

Identifying messages:

1.Supermarket exhibit items to customer

2.Supermarket gives item details to customers

3.customer enters to super market

4.pos check password of customer

5.customer selects item

6.staff guide customer

7.Barcode scanner identify product of super market

8.Super market produces the billing from

9.Cashier verifies the account of customer

10.customer pay bill system

11.Cashier give product to customer

Creating activity diagrams:

Identifying activities:

1. Take loans from bank
2. Customer enters supermarket
3. Staff shows the items
4. Customer selects the items
5. Select
6. Decline
7. Selected items submit at cashier
8. Enter details in billing system
9. Issue the bill
10. Pay bill
11. Cashier collects the bill

ONLINE BOOKSHOP Example

Project Analysis:

Online book shop is an application used to maintain information about the items that are generally available in that book shop. Any customer can access the information about the item and he can also order item through online by creating his login in that site. Customer can change the already entered details. The items information in that site is entered by the bookshop staff and it can be change if there are any modifications.

Creating use case diagrams:

The following needs must be addressed by the system for actors are:

1. Customers to order books, access the details of the books and to receive books.
2. Bookshop staff provides the details of books and to send the books.

Actors identified are:

1. Costumer
2. Bookshop staff

The following needs must be addressed by the system for use cases are:

1. Customer registers the details of the books that are required and his personal details.
2. Customer browses the site of bookshop and selects the required books and orders.
3. The books that ordered by the customers are delivered to the appropriate customers.
4. If customer wants to change his details that are registered then it is possible through customer update details.
5. If any new items enter the book shop or any items that removed are entered by the bookshop details.

The uses cases identified are:

1. Customer registers details
2. Customer browses and orders items
3. Bookshop staff ships to customer
4. Customer updates details
5. Bookshop staff updates items

Creating class diagrams:

The following needs must be addressed by the system for classes are:

1. Home page of the bookshop is placed in the class book.
2. Details of customer who wants to order books.
3. Information about the items those are present the bookshop.

The main classes identified are:

1. Book
2. Item
3. Customer

From these classes sub classes can be identified. They are:

1. Bookshop staff

2. Music cd
3. Software
4. Book
5. Address

For each class attributes, relationships must be made.

For example the book attributes are book name, book id, author name etc.

Identifying relationships between classes:

Inheritance:

1. Book is an item
2. Music cd is an item
3. Software is an item
4. Billing address is an address
5. Shipping address is an address

Aggregation:

1. Item is part of book shop
2. Bookshop staff is a part of bookshop

Association:

1. address is given to customer
2. Billing address is given to customer
3. Shipping address is given to bookshop

Dependency:

1. Order is dependent on bookshop.
2. Customer is dependent on bookshop.
3. Item order is dependent on customer.

Identify attributes:

1. Bookshop: name, address
2. Bookshop staff: name, id
3. Item: title, publisher, year published, price
4. Book: author
5. Music cd: software
6. Software: version

7 Item order: item, quantity
8 Order: sales tax, shipping fee, total
9 Customer: name, id, password
10 Address: street number, street name, city, state, country, postcode
11 Shopping cart
12 Billing address
13 Shipping address

Identifying operations for classes:

Bookshop

Welcome message

Login and password

Error message

Browse and order

Show order and cost

Book:

Display

Music cd:

Display

Software:

Display

Shopping cart:

Additem

Display

Itemorder

Order:

Computeitemstotal

Printinvoice

Display

Itemorder

Customer:

Verifypassward

Additemtoshoppingcart

Creat order

Printbillinglable

Printshppinglable

Address:

Print

Billingaddress:

Print

Shippingadrress:

Print

Creating collaboration diagram:

Identifying objects:

1. B.Bookshop
2. Bs.Bookshop staff
3. O.Order
4. C.Customer
5. a.Address
6. sc.Shopping

Identifying messages:

1. Bookshop gives welcome message to customer
2. Bookshop checks password of customer
3. Customer gets verify of password from bookshop
4. Item are displayed for the customers
5. Staff explains to customer
6. Customer selects an item
7. Staff maintains customer details
8. Bookshop takes order from customer
9. Bookshop sends items to customers
10. Customer pay bill to bookshop
11. A bookshop collects travelling charges from customers
12. Bookshop sends item to the customers address

Creating activity diagrams:

The following needs must be the addresses by the systems for the activities are:

1. When the custom opens the site then welcome message must be displayed.
2. If the customer wants to order books then he creates the login name and password.

3. Authentication is done after the customer login.
4. Customer can login the desired books.
5. The ordered books are transferred to the appropriate customers.
   Activities identified are:

1. System welcome message.

2. Customer login

3. System validates password.

4. Customer browses.

5. System displays item information.

6. Customer selects number

7. System creates order

8. Customer done

9. System creates order

10. System shows order and cost

11. Customer agree to pay

12. System sends invoice to customer

13. Bookshop staff ships to customer

An Automated Company

Projected Analysis:

Automate a small manufacturing company. The resulting application will enable the user to take out a loan, purchase a machine, and over a series of monthly production runs, follow the performance of their company.

Creating use case diagram:

Identifying actors

1. Company is hardware thing
2. Employee is a person in company
3. Technical employee is a person in company
4. Non technical employee is person in company
5. Bank is hardware thing that gives loan to company
6. Customer is a person who buys goods

Identifying use cases

1. Recruit employee
2. Give salary
3. Pay for raw materials
4. Maintain machines
5. Dismiss employee
6. Product goods
7. Work
8. Maintain union
9. Take salary
10. Give loan
11. Collect interest
12. Collect loan
13. Bye goods
14. Pay money

Identifying relationships

Generalization

1. Technical staff is a type of employee
2. Non technical staff is a type of employee

Association

1.Company recruits employee

2.Company gives salaries.

3.Company pays for raw materials

4.Company maintains machines

5.Company dismisses employee.

6.Company product goods

7.Employee works in company.

8.Employee takes salary.

9.Bank gives loan

10.Bank collect interest

11.Customer buy goods

12.Customer pays

Create class diagrams:

Identifying classes:

1.Company

2.Bank

3.Employees

4.Technical

5.Non technical

6.Customers

7.Shares

8.Machines

9.Goods

10.Customer

11.Market

12.Sales

13.Status

14.Profit

15.Loss

16.Rawmaterials

17.Department

Identifying relationships between classes:

Inheritence:

1.status contains profit

2.status contains loss

3.employee contais non technical

Aggregation:

1.employee is a part of company

2.machines are part of company

3.department is a part of company

Association:

1.shares are provided by the company

2.bank provide loan for company

3.machines produce the goods

4.raw materials are given to the company

5.sales tells the status

6.customer buys goods through sales in market

Dependency:

1.market is dependent on goods

Identifying attributes:

1.company:name,code,address

2.bank:name,address,branchname

3.employee:department,hrswork

4.technical:name,id,hourswork

5.nontechnical:name,id,hourswork

6.shares:code

7.machines:type,cost,size,capacity

8.goods:name,code

9.customer:name

10.market:name,address

11.sales:quantity,quantity sold, quantity left

12.status:mention status

13.profit

14.loss

15.rawmaterials:type,code, quality type

16.department:name of dept, type

Identifying operations for classes:

Company:

1.check attendance

2.give salary

3.pay for salary

4.maintained machines

5.sell goods to markets

6.recruit employee

7.dismiss employee

8.note raw materials

Customer:

1.buy goods

2.pay money

Bank:

1.give loan

2.collect interest

3.collect loan

Employee:

1.work

2.take salary

3.maintain union

Non technical:

1.work

2.take salary

3.maintain union

Shares

1.increase on profit

2.decrease on loss

machines

1.process raw materials

2.give finished goods

market

1.receive goods

2.sell goods

3.pay for company

4.collect form customer

sales

1.calculate status

Status

profit

1.compute profit or loss

2.calculate status

3.profit amount

loss

1.compute profit or loss

2.calculate status

3.loss amount

Creating collaboration diagram:

Identifying objects

1.c:company

2.s:shares

3.r:raw materials

4.m:machinery

5.sa:sales

6.c:customer

7. m:market

8.g:goods

9.e:employee

10.b:bank

Identifying messages

1.company plans for its development

2.company request loan from bank

3.bank check account of the company

4.company purchase machinery

5.company purchase raw materials

6.company receives order

7.company decides the quality of products

8.company manufactures the products

9.company analyze quality in market

10.customer buys from market

11.production analyses the sales depending on market

12.monthly production decides profit or loss depending on sales

Creating activity diagrams:

Identification of activities:

1.company takes loan from banks2.buy raw materials

Multi-threaded airport automation

Automate the operations in an airport. your application should support multi aircrafts using several run ways and gates avoiding collisions/conflicts. landing: an aircraft uses the runway, lands and then taxes over to the terminal. Take-off: an air craft taxies to the run way and then takes off.

Creating use case diagram:

Identifying the cases:

1. check luggage
2. give ticket
3. ticket booking
4. take money
5. maintainance
6. give salary
7. take off
8. land off
9. visa check
10. shopping stalls
11. timings
12. pays the amount
13. management

Identifying relationships:

Genenaralization:

1.technical is a kind of staff

2.non technical is a kind of staff

3.local plane are part of aero planes

4.non local planes are part of aero planes

Association:

1. Staff checks luggage
2. Staff gives ticket
3. Staff does the ticket booking
4. Staff maintains the airport

5. Pilot makes the aero plane to take off
6. Pilot makes the aero plane to lane
7. Passenger books the ticket
8. Passenger pays the amount

Include

1. After ticket booking money should be taken
2. Management should give salaries

Extend

1 .after ticket booking the air plane may or may not come in time

Creating class diagram:

Identifying classes:

1. Airport
2. Location management
3. Staff
4. Security
5. Technical staff
6. Non technical staff
7. Customer
8. Visa check
9. Ticket booking
10. online booking
11. aeroplane
12.local planes
13.international planes
14. stopping stalls
15. bakery
16. stationary
17. electronic restaurant

18. Timings

19. Pilots

20. Helpdesk

Identifying relationships between classes:

Aggregation:

1.staff is a part of airport

2.aeroplanes is a part of airport

3.shopping stalls is a part of airport

4.online booking is a part of ticket booking

Generalization:

1. Staff contain visa check
2. Staff contains security
3. Staff contains technical staff
4. Staff contains customs
5. Staff contains nontechnical
6. Staff contains helpdesk
7. Aeroplanes contains local planes
8. Aeroplanes contains international planes
9. Shopping stalls contains bakery
10. Shopping stalls contains stationery
11. Shopping stalls contains electronic
12. Shopping stalls contains restaurant

Dependency:

1.timings are dependent on airport

2.ticket booking is dependent on technical staff

3.aeroplanes are dependent on pilots

Identifying attributes:

1. Airport: name, code

2 . location: name, city, country, state, pincode

3.management: name, designation

4.staff:name,id,type, salary, workinghrs

5.security: name,id,type

6.technical staff: name, id

7.nontechnical staff: name, id, type

8.customs:name,id

9.visacheck:name,id

10.ticketbooking:name of the lane, code, price, seatno, classtype, timings

11.onlinebooking:name,code,destination

12.shopping stalls: name, code, type

13.bakery:name, code, type of items

14.stationery:name, code, type of goods

15.electronic:name,code, type of items

16.restaurant:name,code, type of items

17.timings:name of the plane, code of the plane, time of plane

18.pilots:name, id

19.helpdesk:name, id

Identifying operations for classes:

airport

take off

landing

parking of planes

management

gives salary

maintenance

control staff

staff

work

take salary

customs

check luggage

check persons

visa check

visa check

ticket booking

book ticket

give ticket

Take money

Aeroplanes

Reach destination

Takeoff

Buy goods

Bakery

Pay to management

Stationary

Pay to management

Electronic

Pay to management

Restaurant

Pay to management

Pilots

Fly the plane

Helpdesk

Tell details

Creating collaboration diagrams:

Identifying objects:

1.P:Passenger

2.T:ticket booking

3.St:timings

4.Aa:aeroplanes

5.T:timings

6.A:airport

7.S:shoppingstalls

Identifying messages:

1.passenger uses online reservation of ticket reservation counter

2.passenger know details form ticket booking

3.passenger reserve ticket from ticket booking

4.ticket booking staff check allotments for passenger

5.ticket booking staff allots ticket to passengers

6.passenger know the arrival time of air plane

7.passenger enter to passenger

8.staff check passport

9.Custom staff check luggage of passenger

10.airplane starts check luggage of passenger

11.Passenger travels in plane

Creating Activity Diagram:

Identification of activities;

1.passenger enters

2. Check visa.

3. Grant permission

4.Send out

5.if brought good in shop

6.pay money

7.Don’t pay

8.Pilots land aeroplane in airport

9.inform arrival

10.Boarding of passenger

11.take off of plane

12.reach destination.