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Requirements Specification Phase

Analysis Phase

Design Phase

Module 41: Software Engineering

UML - Overview

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Slides taken from NPTEL course on Object-Oriented Analysis & Design

by **Prof. Partha Pratim Das**

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- Discuss the overview of Unified Modeling Language (UML)

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Why UML?

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A notation for system analysis and design

- Is a standard
- Helps a designer or developer to capture artifacts of software design
- Eliminates the issues of consistencies and accuracy in software design and analysis
- Minimizes vagueness and imprecision in expression
- Facilitates robust communication within the teams and with client

What is the UML?

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UML

- Provides users with an **expressive modeling language**
  - for the specification, construction, visualization, and documentation of the artifacts of a software system
  - for the construction of different kinds of models
  - for the exchange of models
- Provides users with **ready-to-use core concepts**
  - however, extensibility and specialization mechanisms are available
- Provides a **formal basis** for understanding the modeling language
  - *meta-model* in terms of a UML class diagram
  - *Semantics* is part of the official UML documentation
- Supports **higher-level development concepts**
  - such as collaborations, patterns, and components
- Integrates **Best Practices**

What is the UML *not*?

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UML does not prescribe

- a certain **process**
- a certain **modeling tool**
- any **modeling guidelines**
- a certain **programming language**

Dedicated goal of UML is: **OPENNESS**

How UML was formed?

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- The Unified Modeling Language (UML) is the primary modeling language used to analyze, specify, and design software systems
- From the late 1980s and well into the 1990s, numerous methodologies arose and were subsequently modified and refined. Many of these were strong in certain areas, weak in others
- In the mid-1990s, Booch, Rumbaugh, and Jacobson joined forces at Rational Software Corporation and began to meld their respective methodologies to create what would be the first version of the UML
- In November 1997 the Object Management Group (OMG) adopted the UML as a standard

Diagram Classification: UML 2.5

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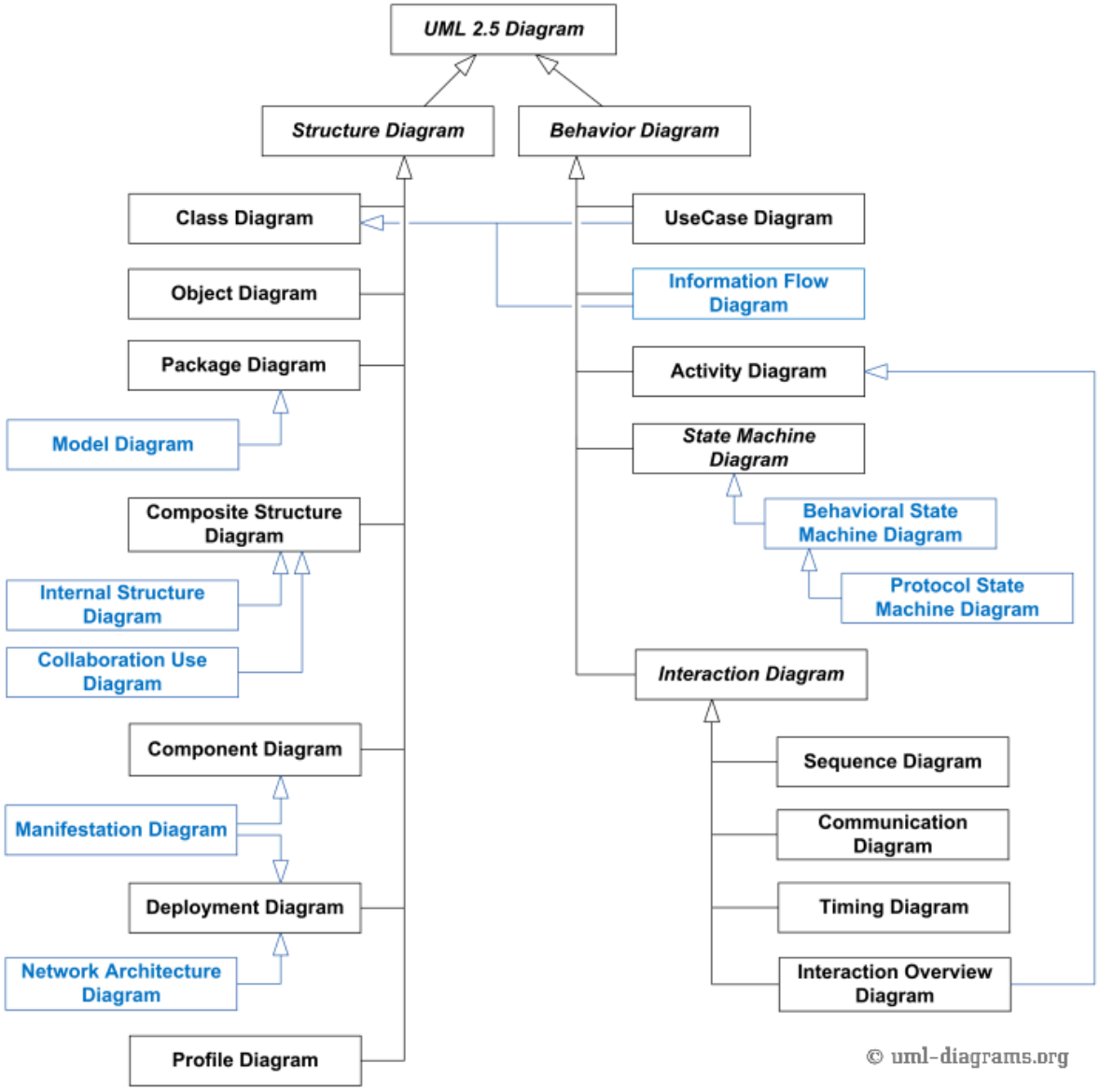

Diagram Classification: UML 2.5

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- **Structural Diagrams** show the **static structure** of the system and its parts on different abstraction and implementation **levels** and how they are related to each other
  - The elements in a structure diagram represent the meaningful concepts of a system, and may include abstract, real world and implementation concepts
- **Behavioral Diagrams** show the **dynamic behavior** of the objects in a system, which can be described as a series of changes to the system over **time**

Source: *UML 2.5 Diagrams Overview*: http://www.uml-diagrams.org/uml-25-diagrams.html (10-Aug-16)

Behavioral Diagrams

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- **Use case diagrams** represents the requirements of a system including internal and external influences. This diagram is used to capture the user specifications for a system to be built
- **Activity diagrams** models the flow from one activity to another activity. The activity can be described as an operation of the system. It helps to capture the system behavior in the context of activities
- **State-Chart diagrams** are used to describe the different states of an object during its life time. It is used to capture the states to model the lifetime of a system

Behavioral Diagrams: Interaction Diagrams

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- **Sequence diagrams** captures the temporal ordering of messages exchanged between objects during their lifetime respectively. It is used to model the system behavior
- **Communication diagrams** captures the spatial ordering of messages exchanged between objects during their lifetime respectively. It is used to model the system behavior
- **Timing diagrams** captures the change of states of an element or elements change over time and how events change those states. state It is used to model real time system behavior
- **Interaction Overview diagrams** models the total interaction flow consisting from various sequence, collaboration and activity flows. It provides an overall flow control among various interactions in the system

Structural Diagrams

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- **Class diagrams** models the analysis and design of the static view of an application. It captures the key abstractions of the system at the first level, and is later refined with details of every abstraction for reference
- **Object diagrams** represents an instance of a class diagram. It is used to capture the static view of a system at a particular moment
- **Package diagrams** encapsulates the major components of a system and highlights the dependencies. It is used to capture the dependencies between the major components of a system

Structural Diagrams

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- **Composite Structure diagrams** describes the complete structure of a system along with its sub-parts and interfaces. It is used to capture internal structure view of a system
- **Component diagrams** models physical aspects of a system. It is used to capture the static implementation view of a system consisting of the components and their relationships
- **Deployment diagrams** describes the hardware components where software components are deployed. It is used to capture the hardware topology of a system
- **Profile diagrams** allows to define custom stereotypes, tagged values, and constraints as a lightweight extension mechanism to the UML standard. Profiles allow to adapt the UML meta-model for different platforms and domains

OOAD in SDLC

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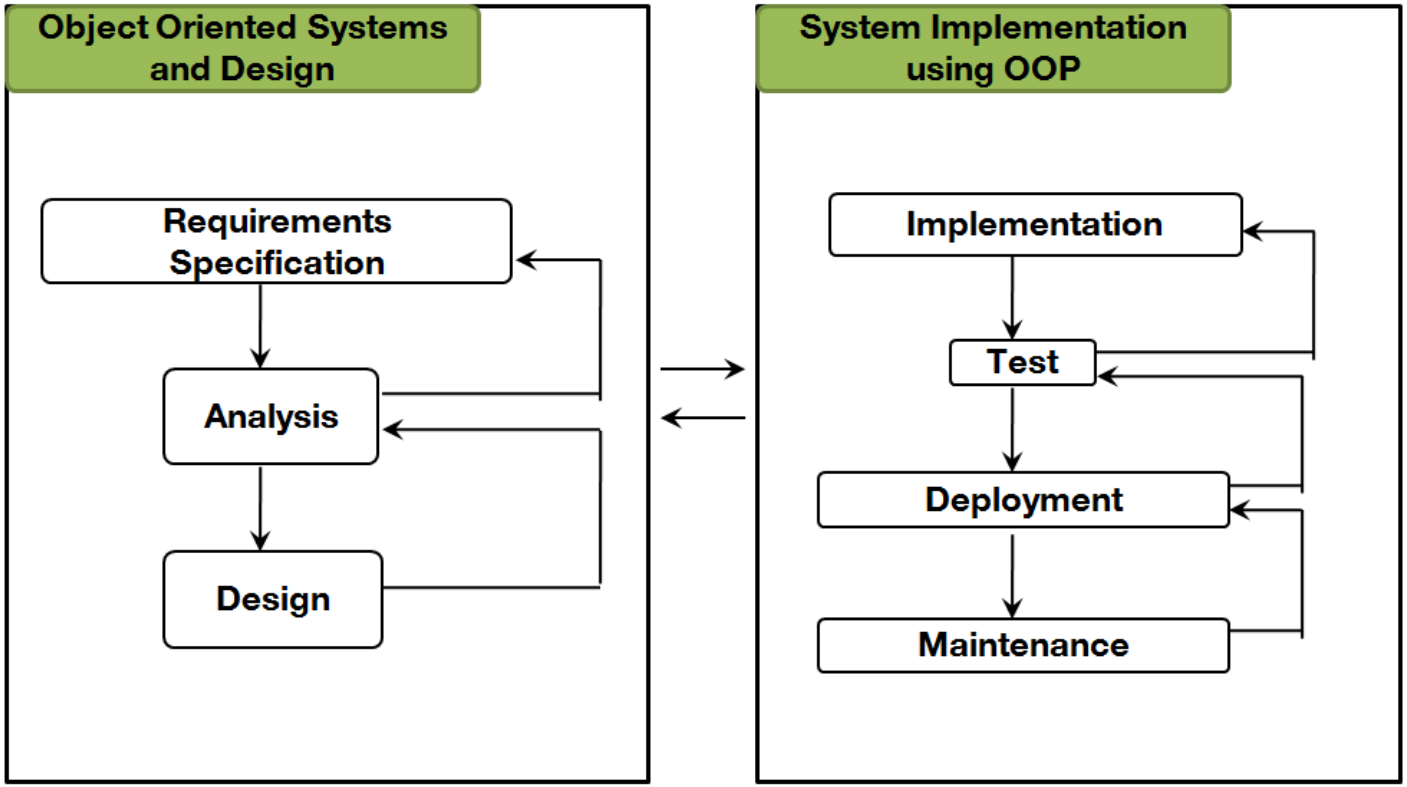

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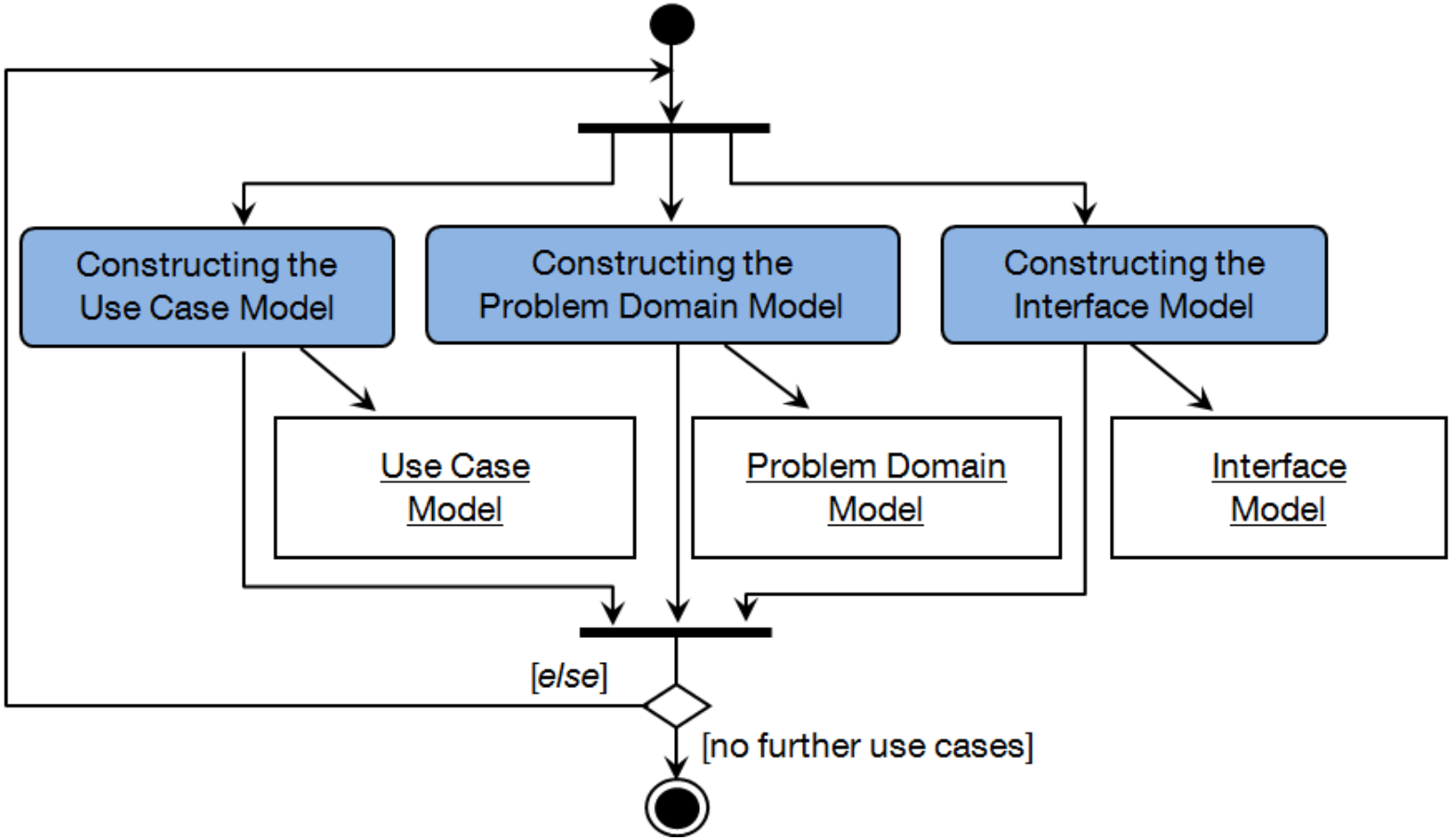

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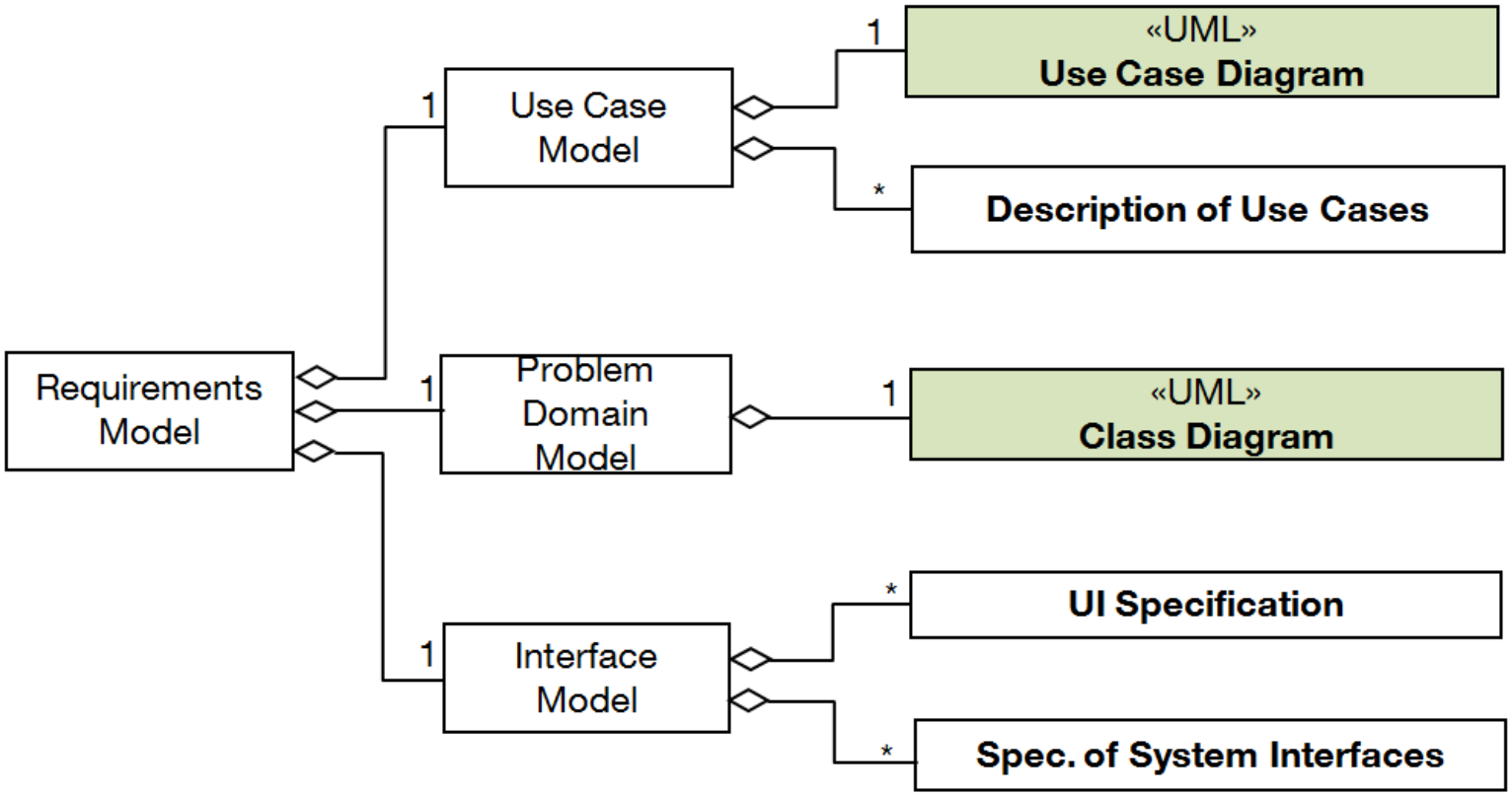

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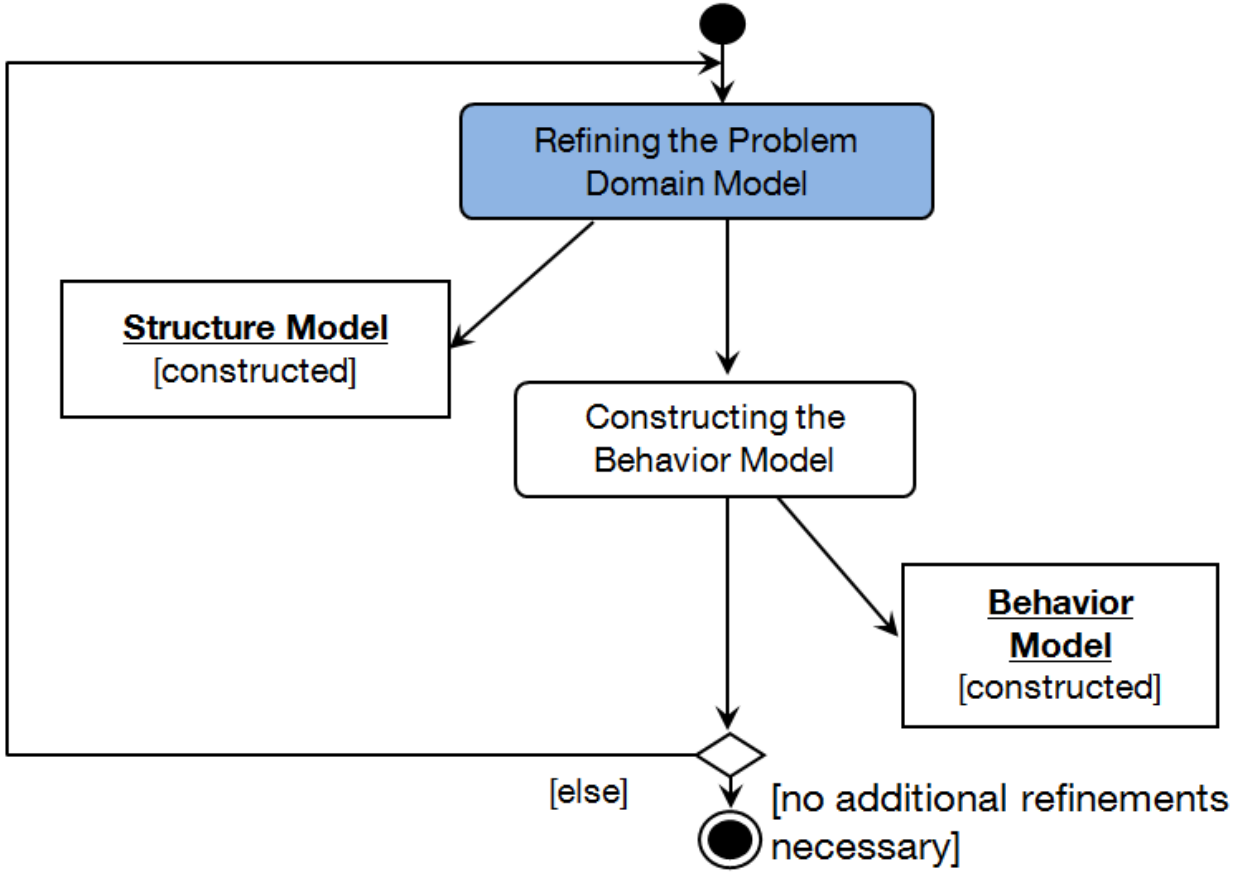

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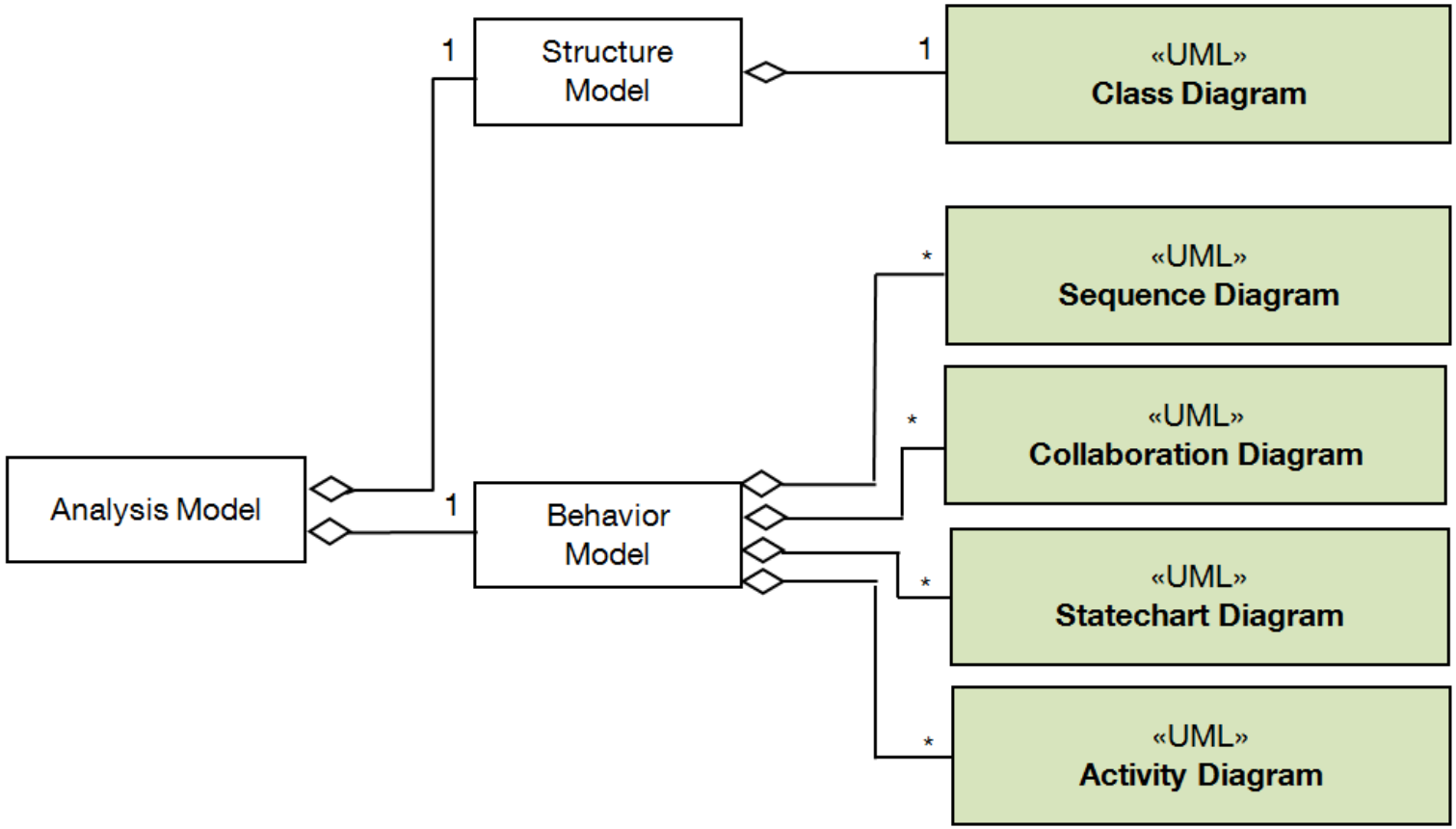

Models of the Design Phase

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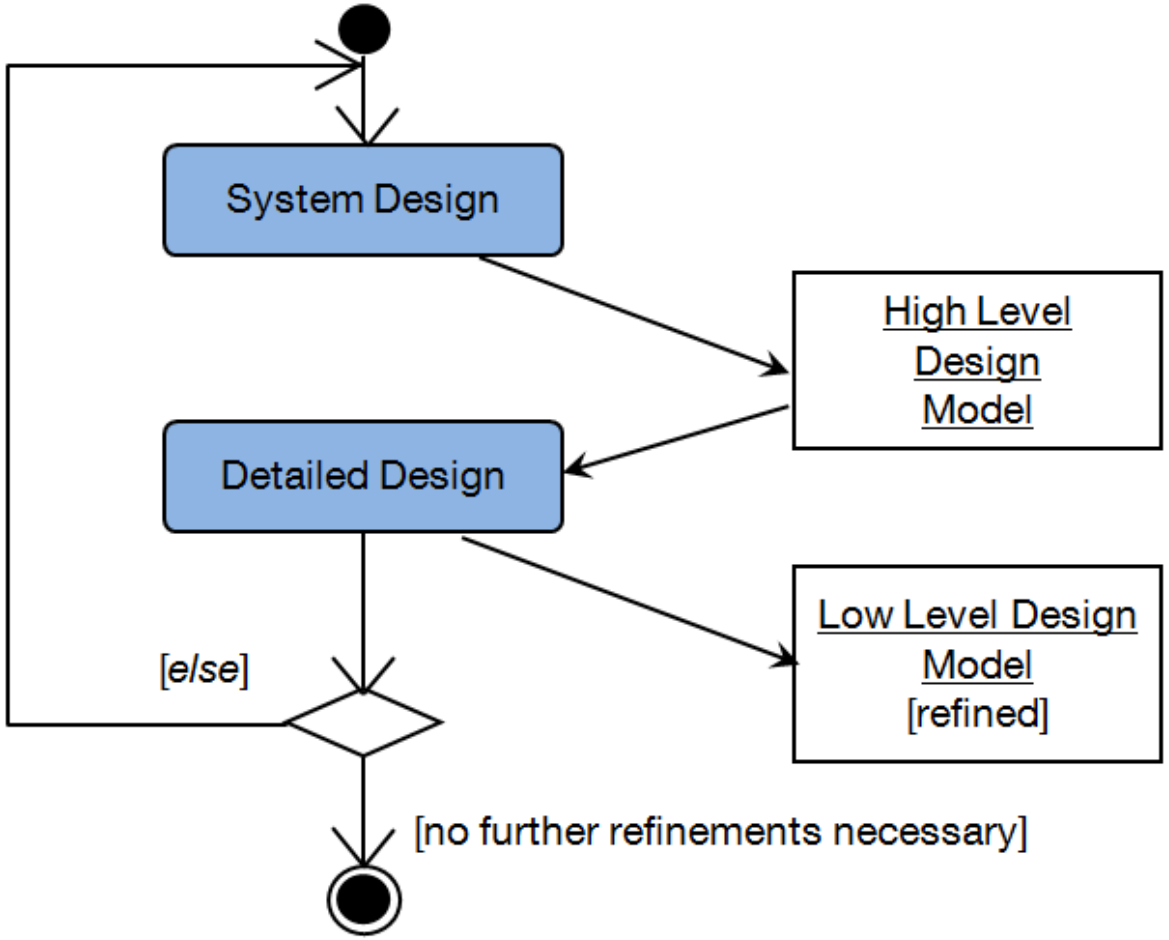

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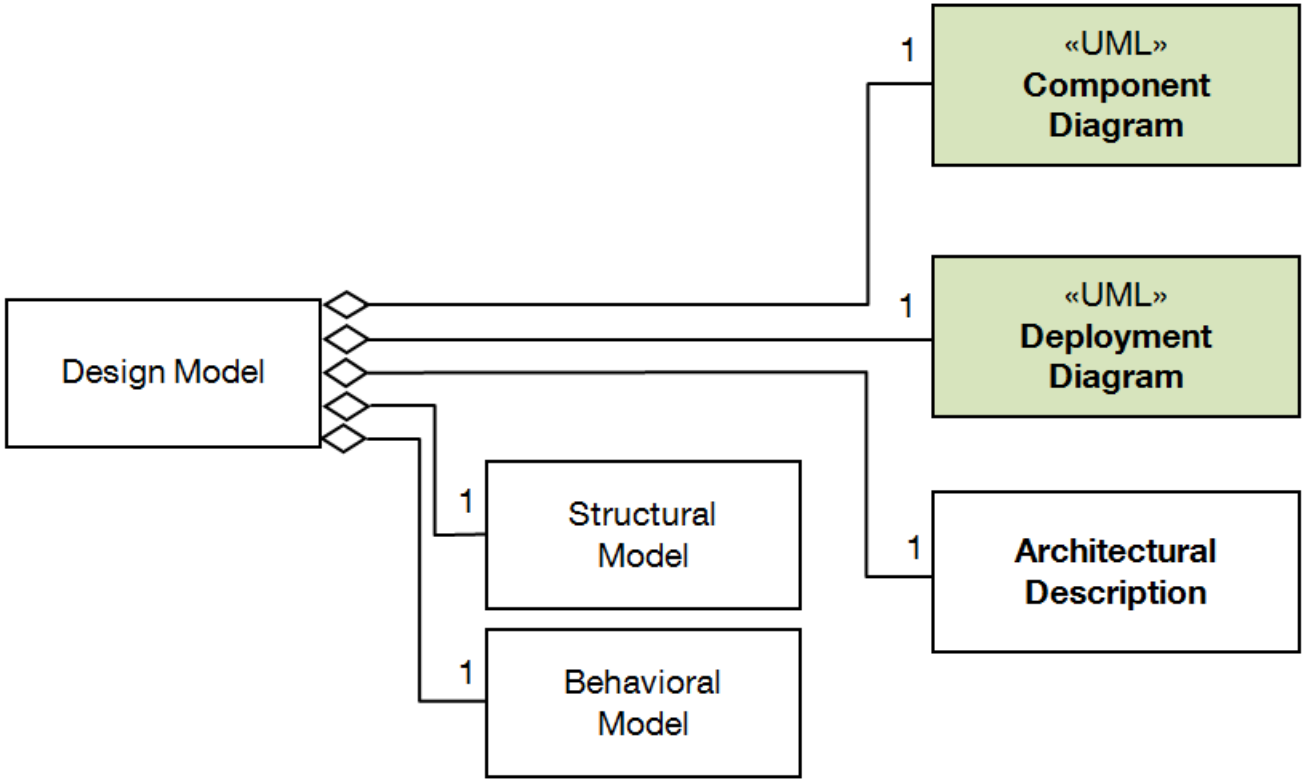

Phases for System Implementation

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- The other phases of SDLC
  - Implementation
  - Test
  - Deployment
  - Maintenance

  implement the models defined in earlier phases
- The Diagrams are used to implement the respective components in the implementation
- These are implemented using various OOP languages, and some models continue to be used