UNIFIED MODELING LANGUAGE

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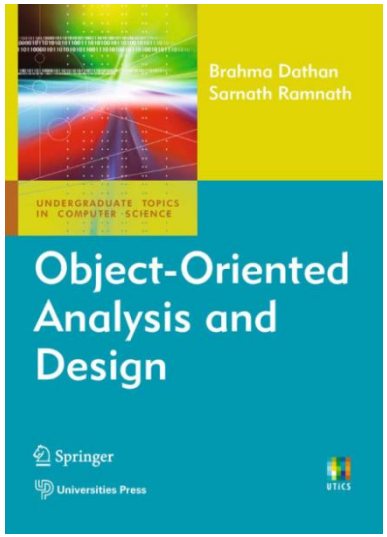
RENCANA KEGIATAN PERKULIAHAN SEMESTER

W	Pokok Bahasan
1	Introduction Object Oriented Analysis & Design
2	**Introduction UML**
3	Class Diagram and Use Case
4	Analysis
5	Software Architecture
6	Software Architecture Modeling
7	
8	**Ujian Tengah Semester**

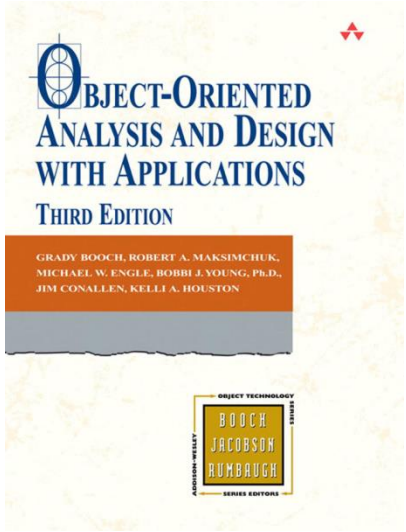
W	Pokok Bahasan
9	Design Pattern
10	Design
11	Implementation
12	
13	Testing
14	
15	Review Materi
16	**Ujian Akhir Semester**

Referensi

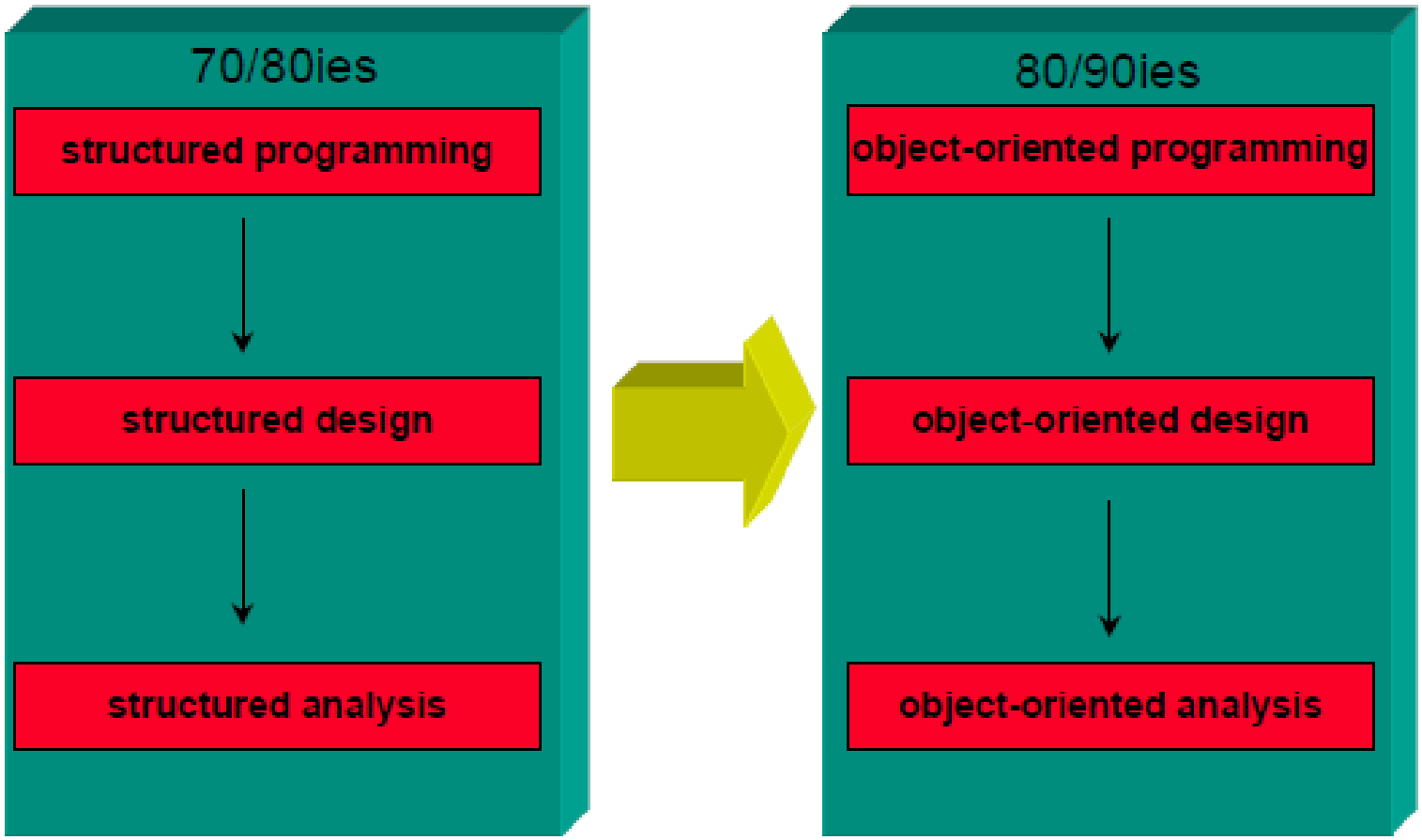
- Brahma Dathan, Sarnath Ramnath – **Object-Oriented Analysis and Design** (2011)



- Grady Brooch, Robert A Maksimchuk, Michael W. Engle, Robbi J. Young, Jim Conallen, Kelli A. Houston – **Object-Oriented Analysis and Design With Applications** Third Edition (2007)



Evolution of OO Development Methods



History of OOAD leading to UML

1970 First object-oriented languages (Simula-67, Smalltalk).

1980 More than 50 different OOAD languages cause the users trouble to find complete and appropriate tools.

1992 New iterations of methods appear.
Booch '93, OOSE (Jacobson), OMT-2 (Rumbaugh)

1995 Unification, UML 0.9 by Booch, Rumbaugh

1997 Standardization, UML 1.1 by Booch, Rumbaugh, Jacobson

Object Management Group (OMG) adapts UML as OOAD standard

Why Model ?

- Analyse the problem-domain
  - Simplify reality
  - Capture requirements
  - Visualise the system in its entirety
  - Specify the structure and/or behavior of the system

- Design the solution
  - Document the solution – in terms of its structure, behavior, etc

Principles of Modeling

- Choose your model well
  - The model give impacts the analysis of the problem and the design of the solution
- Every model may be expressed at different levels of precision
  - The same model can be scaled up (or down) to different granularities
- The best models are connected to reality
  - Simplify the model, but don't hide important details
- No single model suffices
  - Every nontrivial system has different dimensions to the problem and its solution

Unified Modeling Language

- UML is a modeling language, not methodology or process

- UML is a modeling language for visualising, specifying, constructing and documenting the artifacts of software systems

UML provides a pictorial and graphical notation for documenting the artifacts such as classes, objects, and packages that make up an OO systems

Unified Modeling Language

- Visualising
  - A graphical notation articulates and unambigously communicates the overall view of the system (problem-domain)
- Specifying
  - UML provides the means to model precisely, unambigously and completely the system in question
- Constructing
  - Model built with UML have a “design” dimension
- Documenting
  - Every software project involves a lot of documentation – from the inception phase to the deliverables

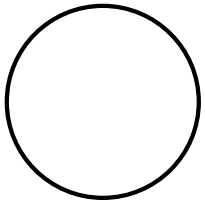
Conceptual Model of UML

- Building Block
  - Things
  - Relationships
  - Diagram
- Rules
- Common Mechanisms
  - Specification
  - Adornments
  - Common Division
  - Extensibility Mechanisms

Structural Things

- The nouns of UML; usually the static parts of the system in question
- Class – an abstraction of a set of things in the problem domain that have similar properties and/or functionality
- Notation :

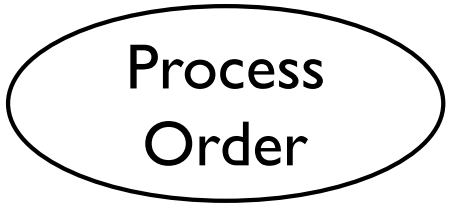
- Interface – a collection of operations that specify the services rendered by a class or component
- Notation :



Structural Things

- Collaboration – a collection of UML building blocks (classes, interfaces, relationships) that work together to provide some functionality within the system
- Notation :

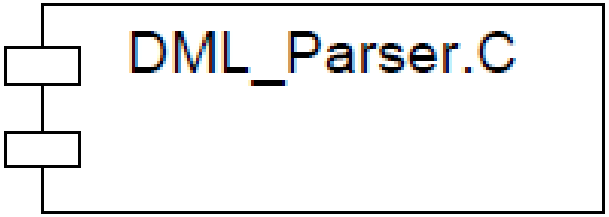
- Use Case – an abstraction of a set of functions that the system performs; a use case is “realized” by a collaboration
- Notation :



Structural Things

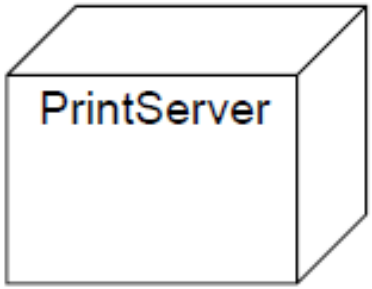
- Active Class – a class whose instance is an active object; an active object is an object that owns a process or thread (units of execution)
- Notation:

- Component – a physical part (typically manifest itself as a piece of software) of the systems



Structural Things

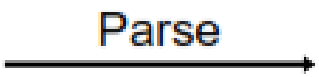
- Node – a physical element that exists at run-time and represents a computational resource (typically, hardware resource)



Behavioral Things

- The verbs of UML models; usually the dynamic parts of the system in question

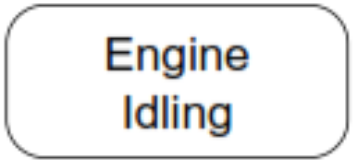
- Interaction – some behavior constituted by messages exchanged among objects; the exchange of messages is with a view to achieving some purpose

- Notation : 

Behavioral Things

- State machine – a behavior that specifies the sequence of "states" an object goes through, during its lifetime. A "state" is a condition or situation during the lifetme of an object during which it exhibits certain characteristics and/or perform some function

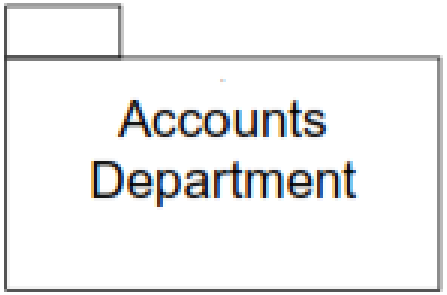
- Notation :



Grouping Things

- The organisational part of the UML model ; provides a higher level of abstraction (granularity)

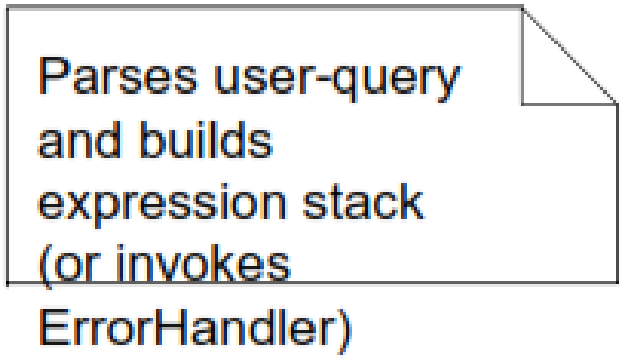
- Package – a general purpose element that comprises UML element – structural, behavioral or even group things. Packages are conceptual groupings of the system and need not necessarily be implemented as cohesive software modules.



An Notational Things

- The explanatory part of the UML model; adds information/meaning to the model elements.

- Note – a graphical notation for attaching constraints and/or comments to the elements of the model



Relationships

- **Dependency** – a semantic relationships where a change in one thing (the independent thing) causes a change in the semantics of the other thing (the dependent thing)
- Notation :

Arrow-head points to the independent thing

- **Association** – a structural relationship that describes the connection between two things
- Notasi :

Relationships

- **Generalisation** – a relationship between a general thing (called “parent” or “superclass”) and a more specific kind of that thing (called the “child” or “subclass”) such that the latter can substitute the former

Arrow-head points to the superclass

Relationships

- **Realization** – a semantic relationship between two things where in one specifies the behavior to be carried out, and the other carries out the behavior

- A collaboration realizes a use case

  The use case specifies the behavior (functionality) to be carried out (provided), and the collaboration actually implements that behavior

Arrow-head points to the thing being realized

UML Diagrams

Use Case Diagrams	Nodes:	Actor, Use (case)
	Links:	Involvement, Extension, Usage
Class Diagrams	Nodes:	Class
	Links:	Association, Generalization
Interaction Diagrams	Nodes:	Object
	Links:	Message, Lifeline
State Diagrams	Nodes:	State, Sub-State
	Links:	Transition
Activity Diagrams	Nodes:	Activity
	Links:	Guard, Synchronization
Package Diagrams	Nodes:	Package
	Links:	Dependency
Deployment Diagrams	Nodes:	Processor, Node
	Links:	Dependency

UML Diagrams

- Class Diagram
  - Diagram shows a set of classes, interfaces, collaborations and their relationships. Models the static view of the system
- Object Diagram
  - Snapshot of a class diagram; models the instances of things contained in a class diagram.
- Use Case Diagram
  - Shows a set of “use cases” , the “actor”, and their relationships.
  - What the system is expected to do

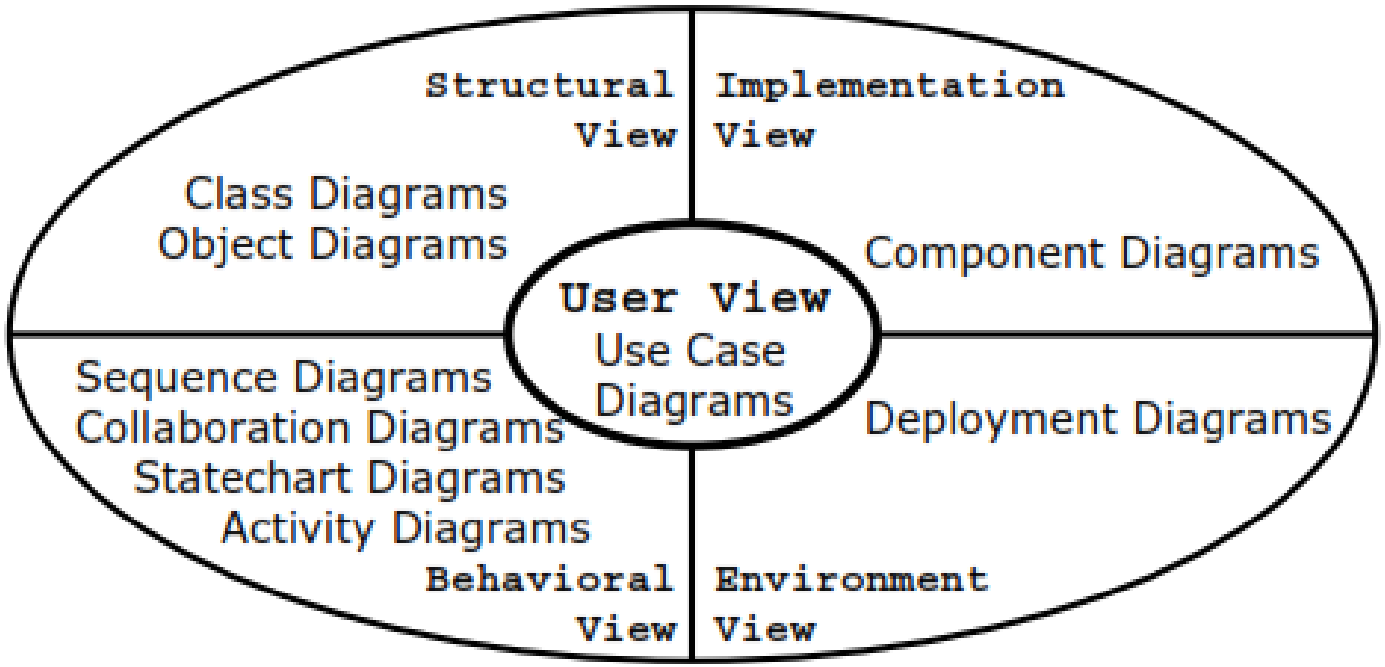
UML Diagrams

- Sequence Diagram
  - Models the flow of control by time-ordering, depicts the interaction between various objects by of messages passed, with a temporal dimension to it
- Collaboration Diagram
  - Models the interaction between objects, without the temporal dimension; depict the messages passed between objects
- Statechart Diagram
  - shows the different state machines and the events that leads to each of these state machines. State chart diagrams show the flow of control from state to state.

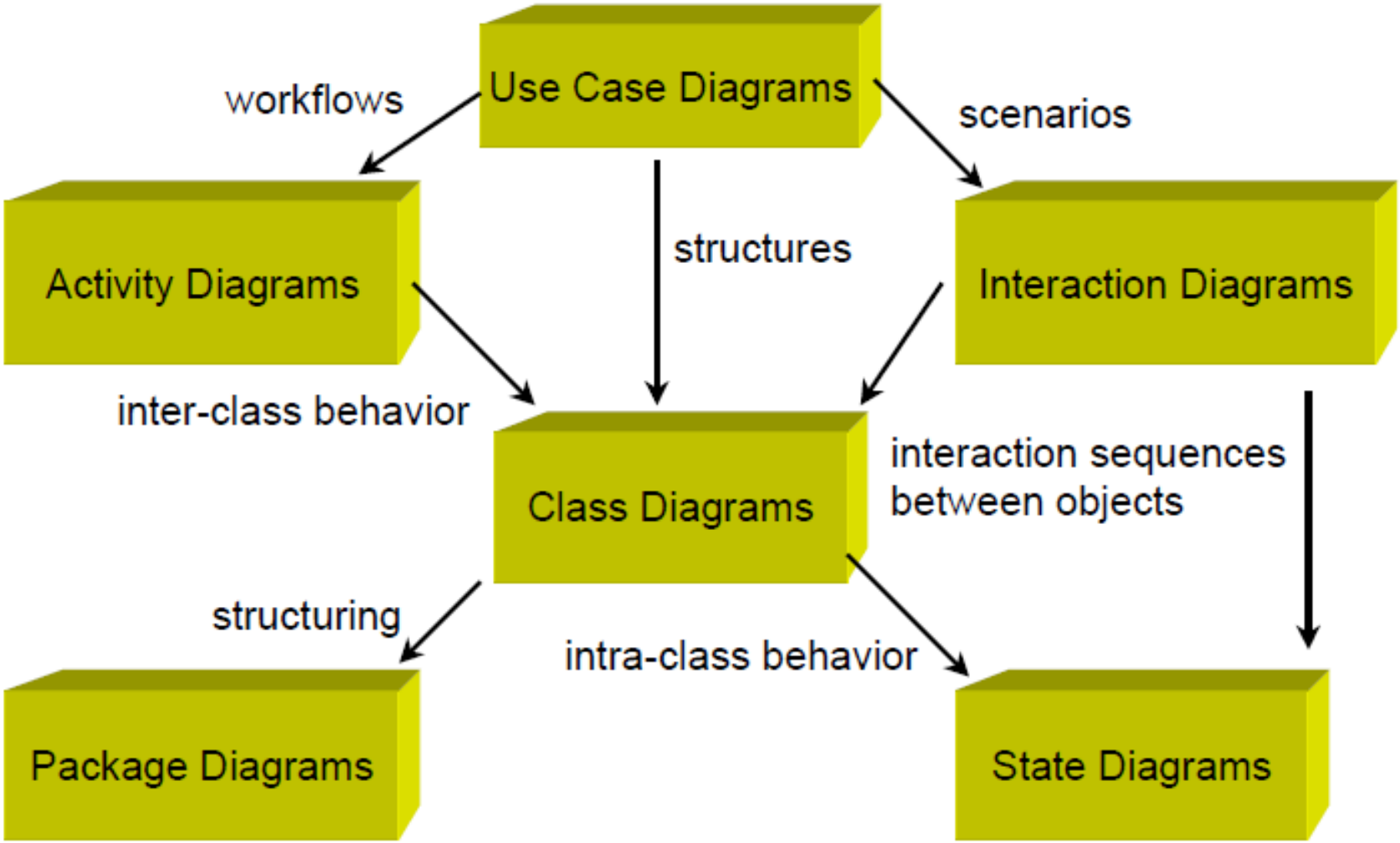
UML Diagrams

- Activity Diagram
  - shows the flow from activity to activity; an “activity” is an ongoing non-atomic execution within a state machine.
- Component Diagram
  - shows the physical packaging of software in terms of components and the dependencies between them
- Deployment Diagram
  - shows the configuration of the processing nodes at run-time and the components that live on them

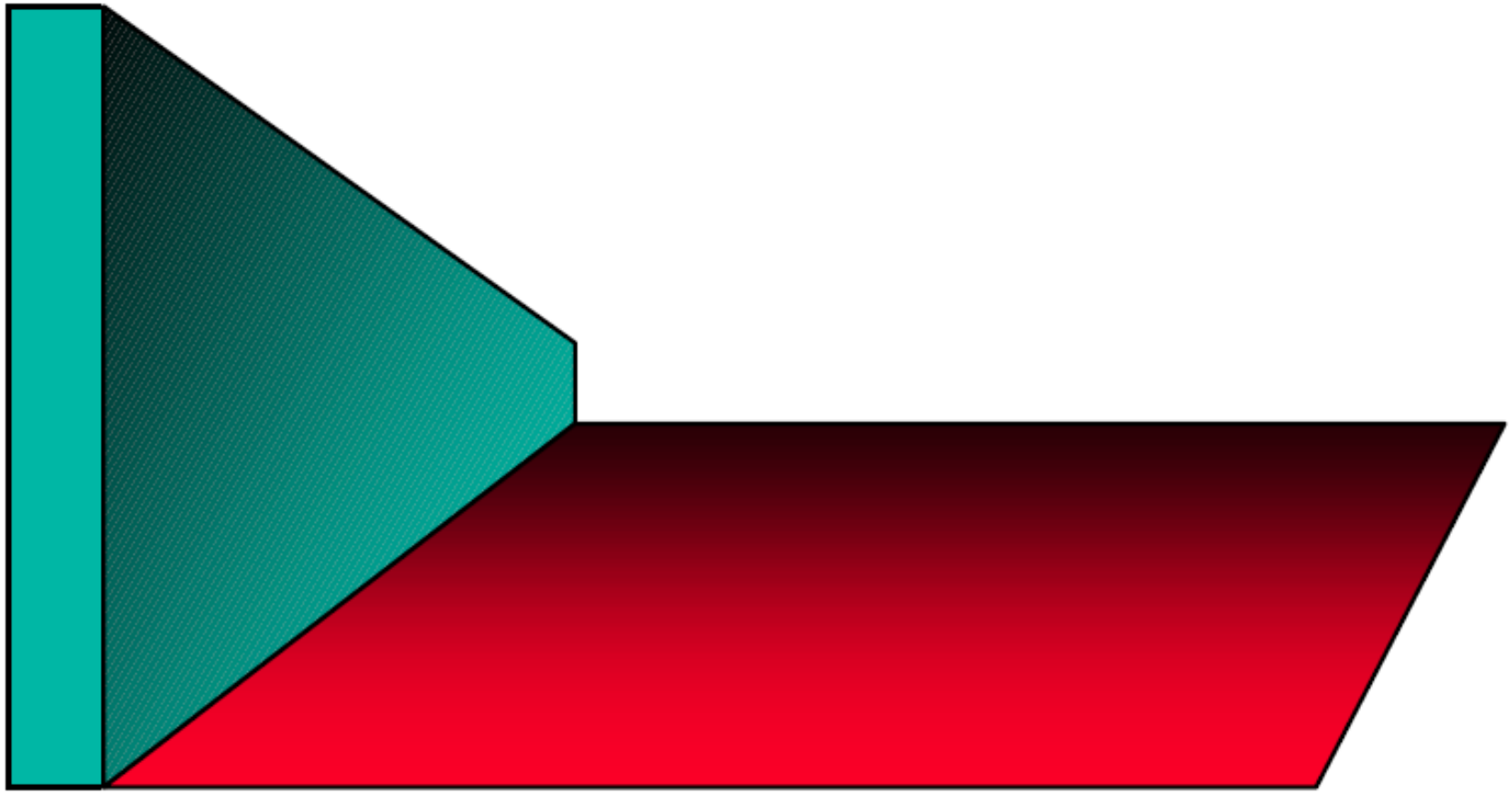
Dimensions


Structural View
Implementation View
Class Diagrams
Object Diagrams
Component Diagrams
User View
Use Case Diagrams
Sequence Diagrams
Collaboration Diagrams
Statechart Diagrams
Activity Diagrams
Deployment Diagrams
Behavioral View
Environment View

UML Diagrams

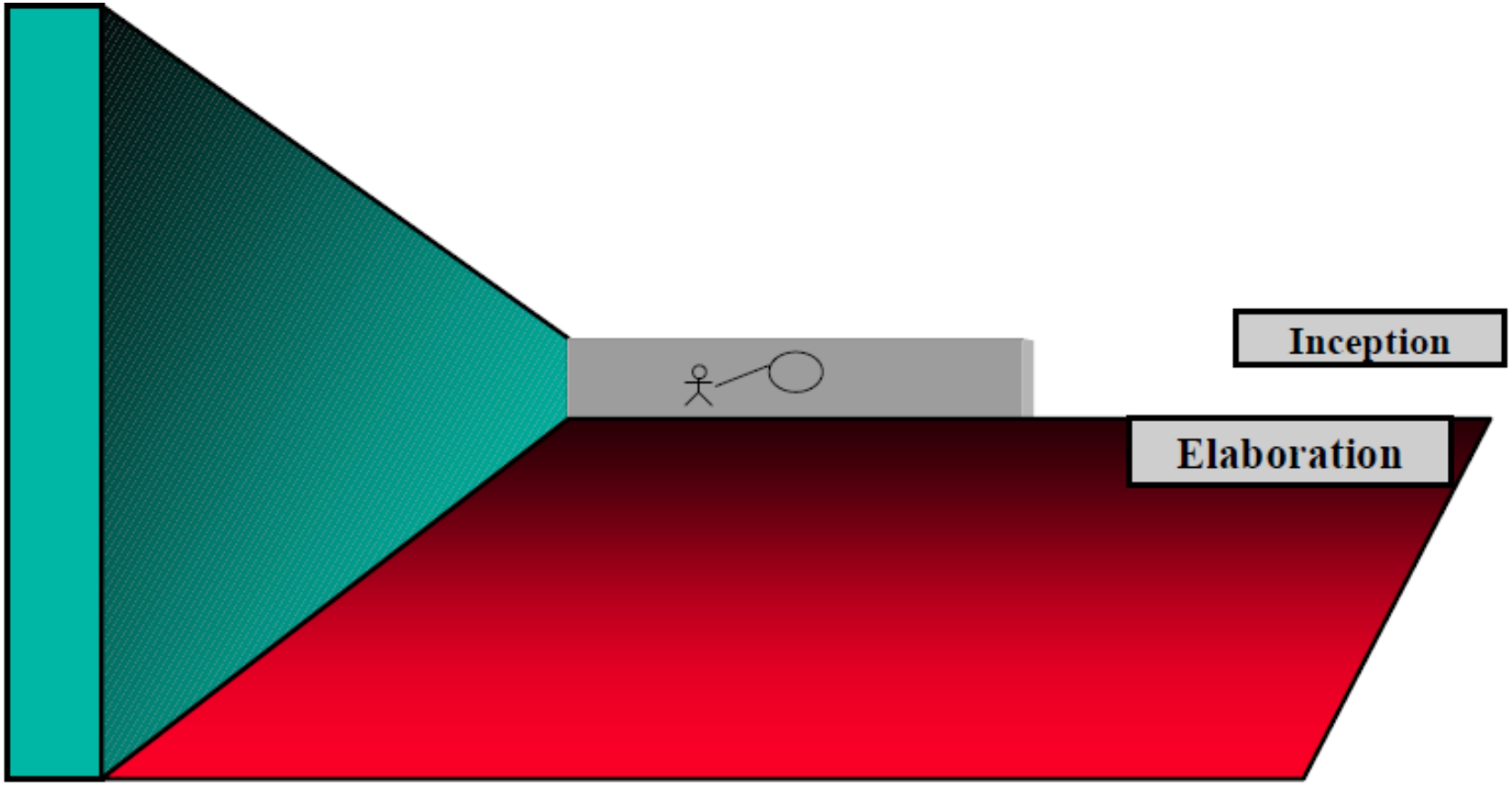


Diagrams and Process



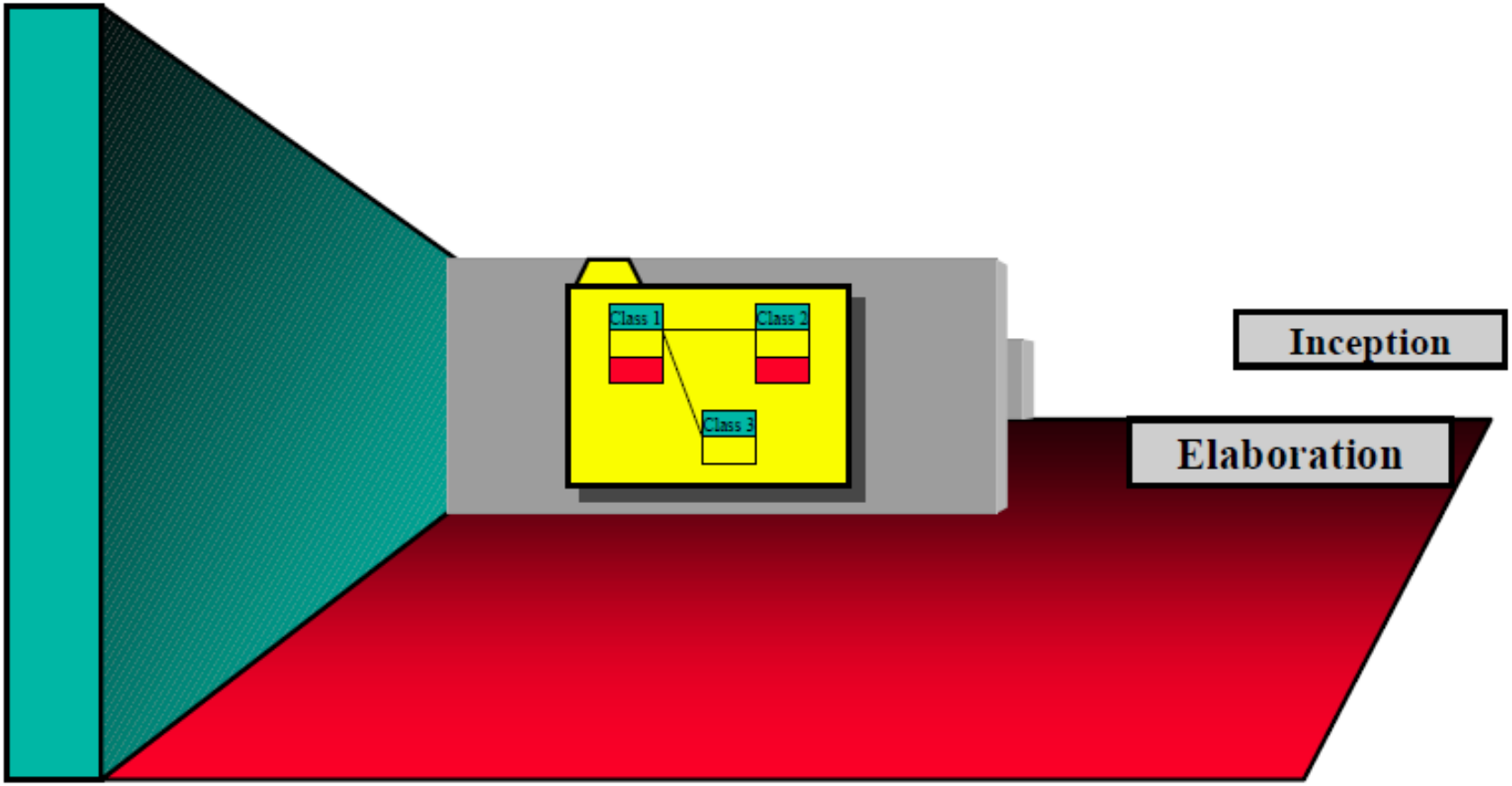
Diagrams and Process

Use Case Diagrams



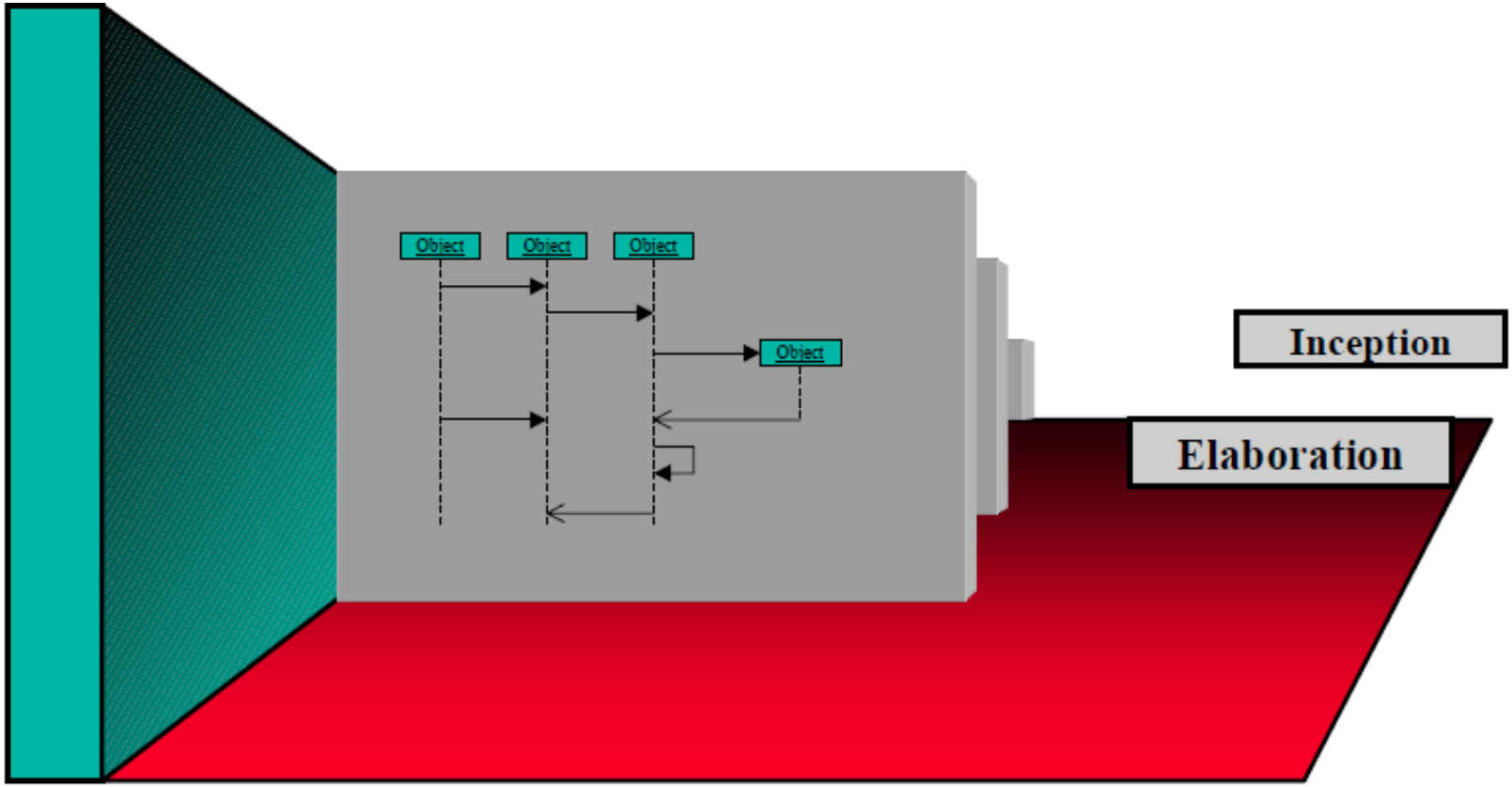
Diagrams and Process

Class & Package Diagrams



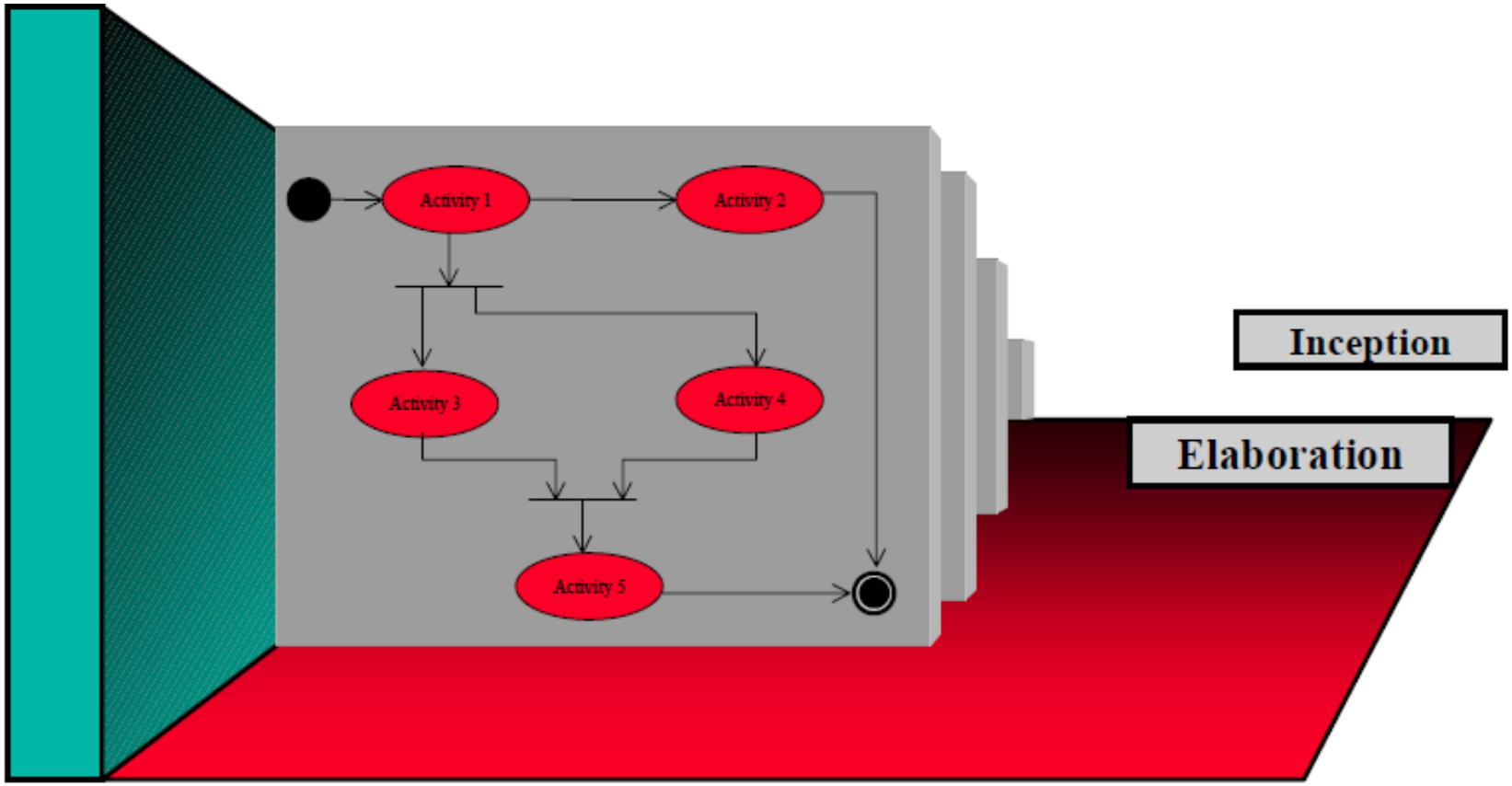
Diagrams and Process

Interaction Diagrams (Scenarios)



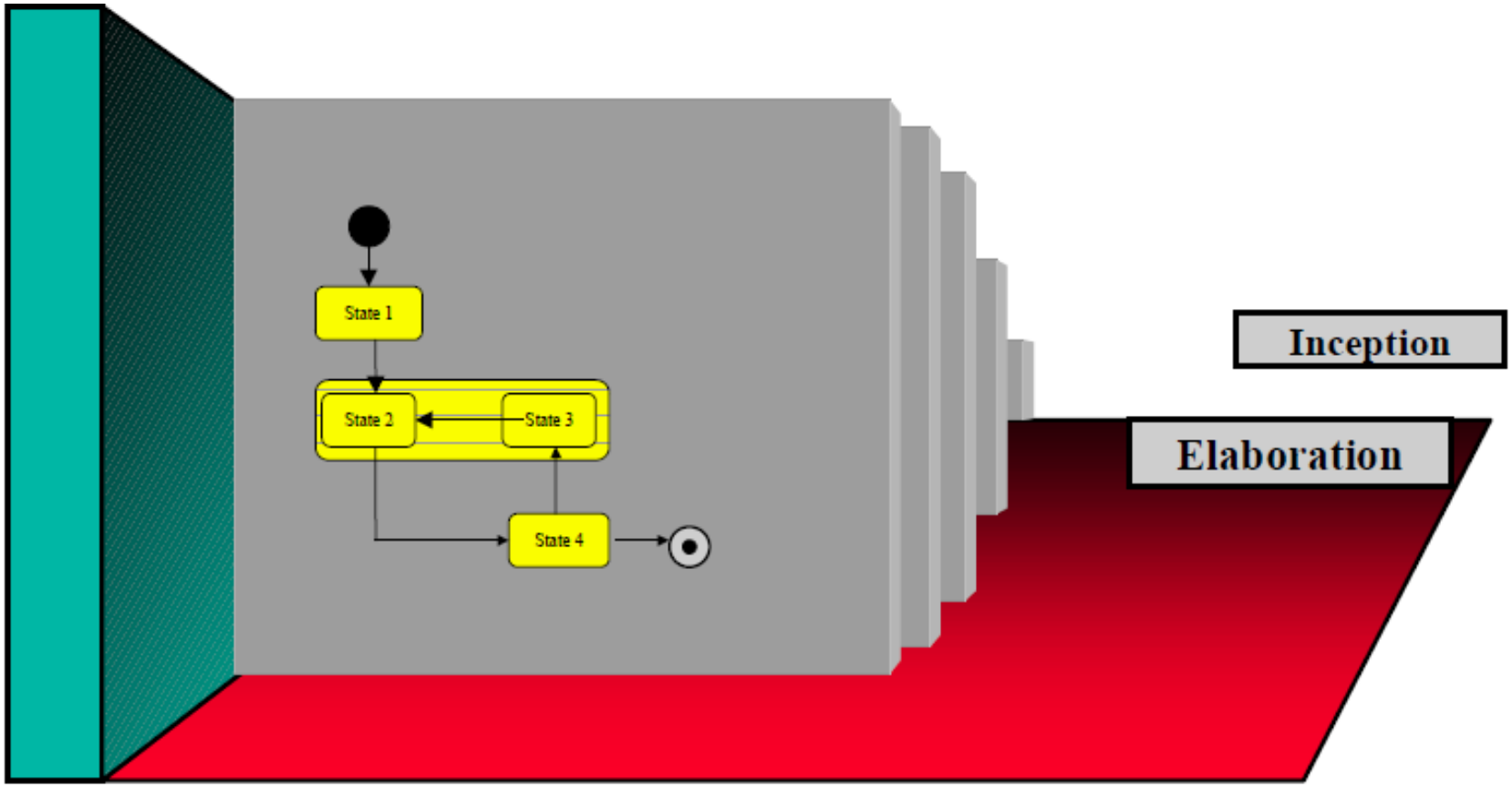
Diagrams and Process

Activity Diagrams (Workflow, Interclass Behavior)



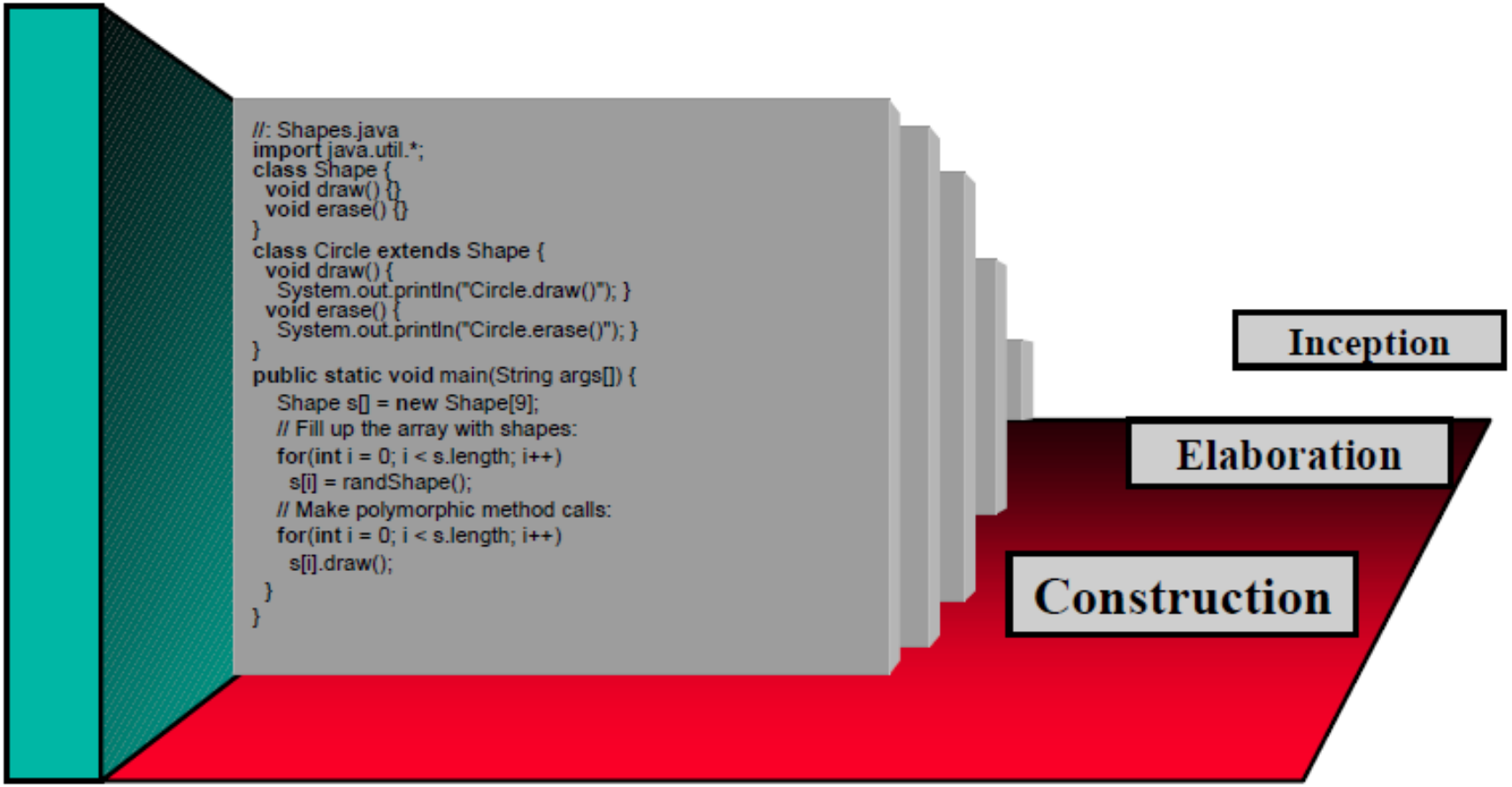
Diagrams and Process

State Transition Diagrams (Intraclass Behavior)



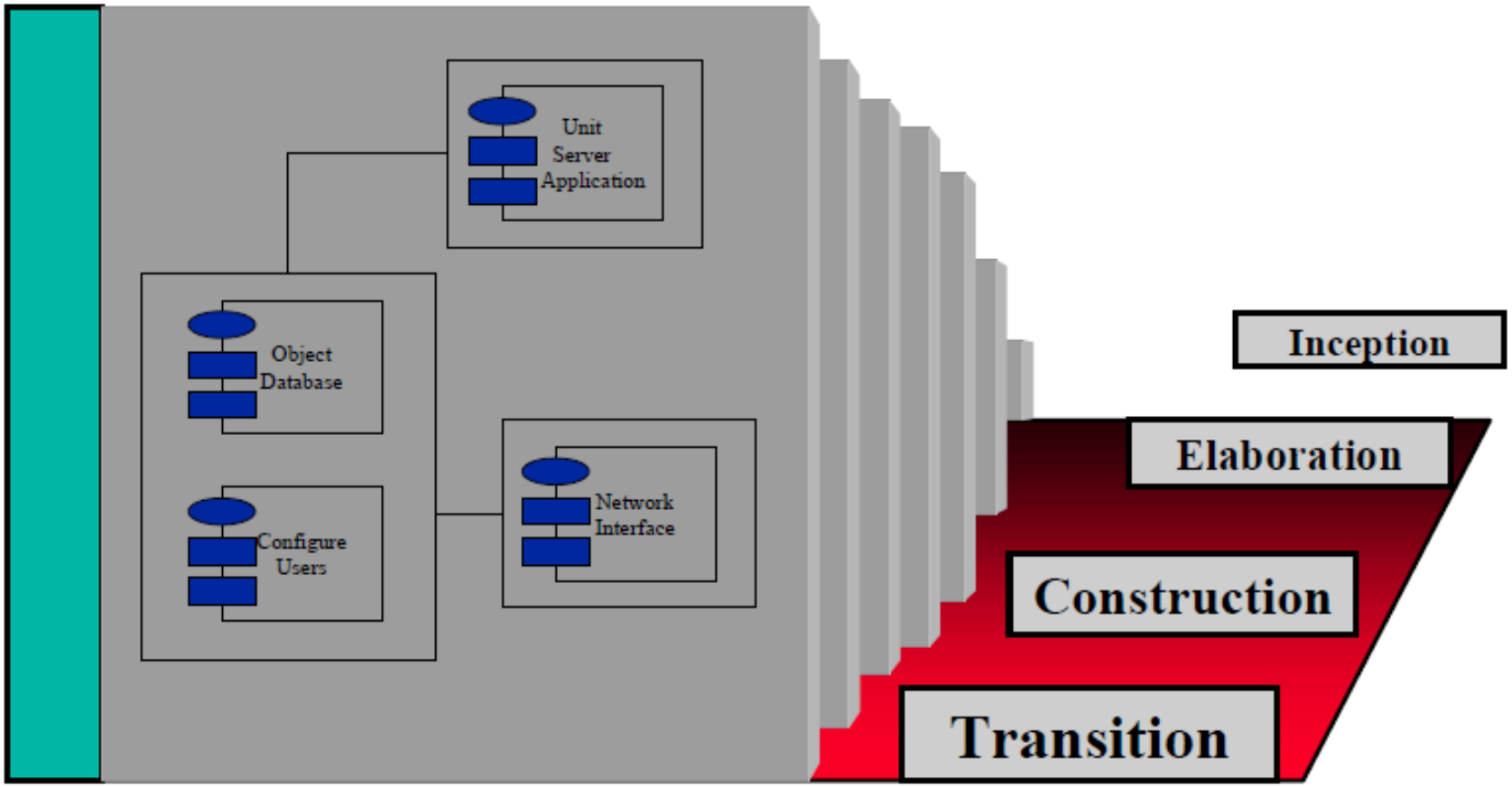
Texts and Process

Source Code

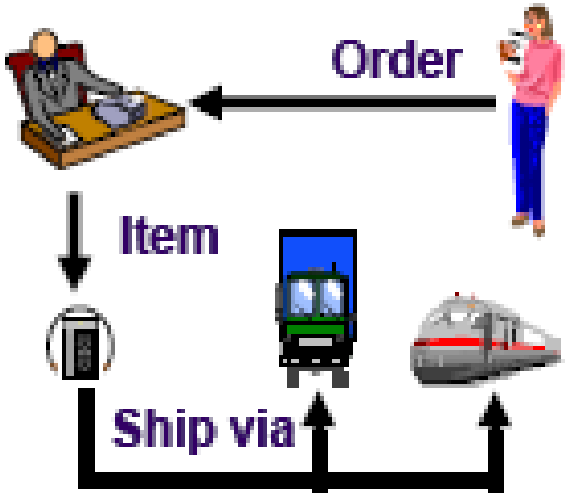


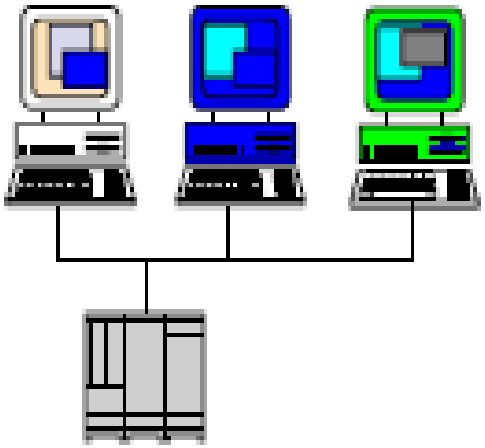
Diagrams and Process

Deployment Diagrams



Why Modeling ?





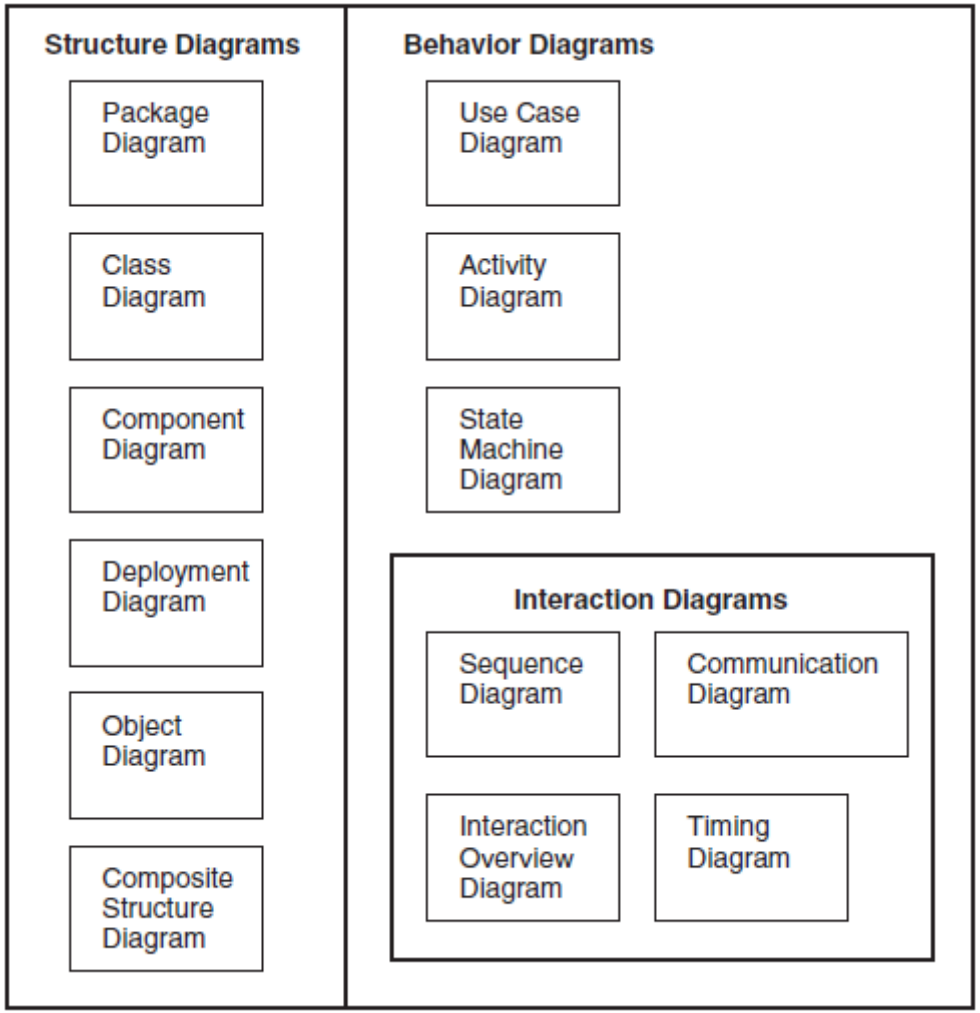
Business Process

Computer System

Modeling menangkap bagian penting dari sistem
(James Rumbaugh)

Unified Modeling Language

- UML diagrams can be divided into three categories :
  1. Structure Diagrams
  2. Behavior Diagrams
  3. Interaction Diagrams



Structure Diagrams

- Structure diagrams show the static architecture of the system irrespective of time
- Structure diagram may depict :
  - The architectural organization of the system
  - The physical elements of the system

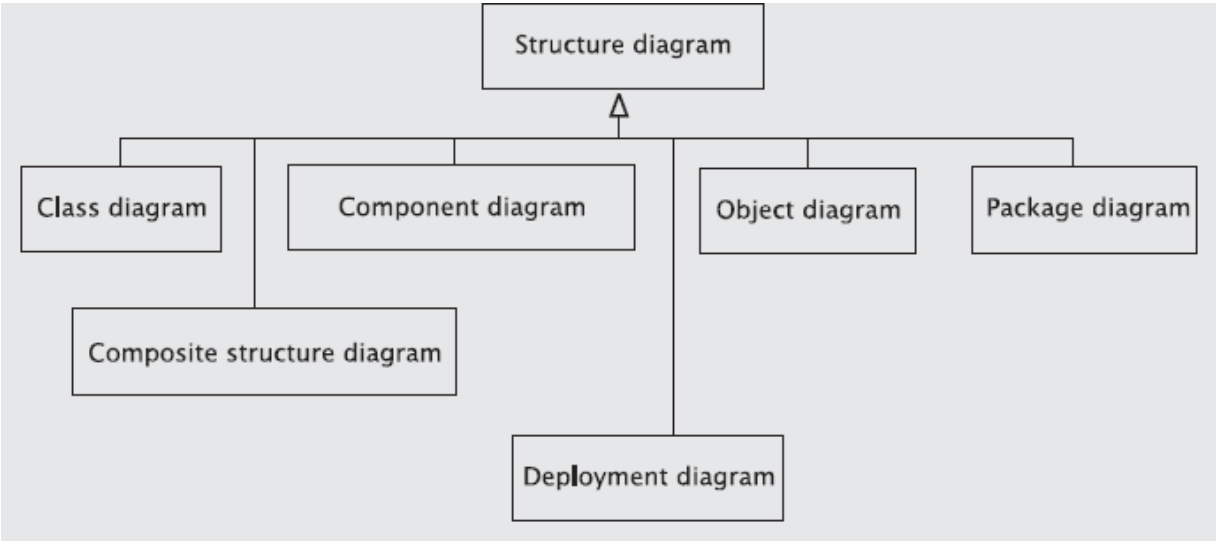
Example :

structure diagram for a university system.

diagram depict of classes such as student, faculty

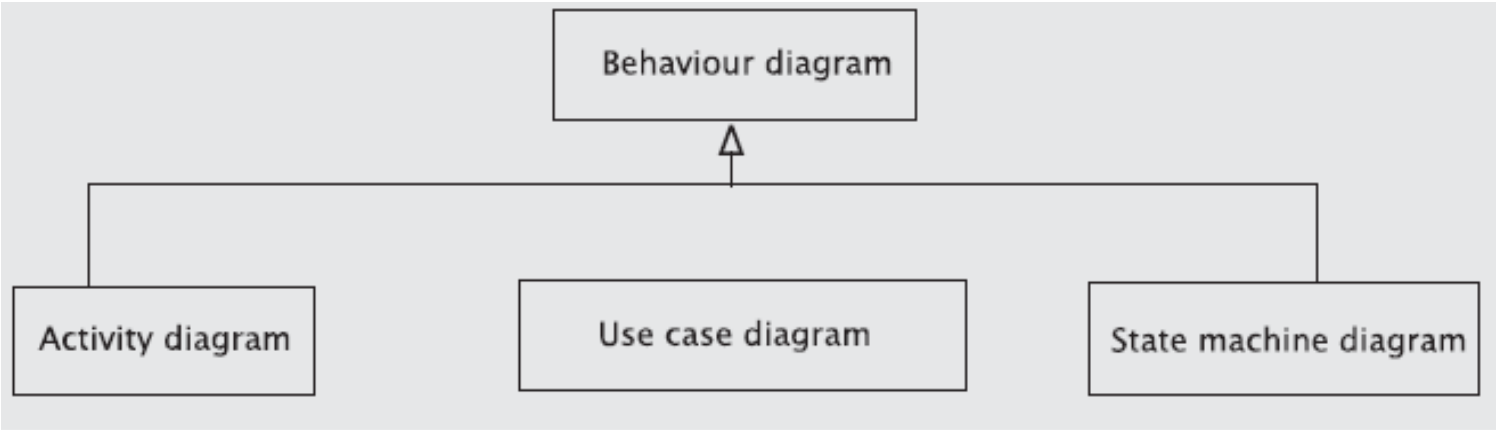
Structure Diagrams

- Package Diagram
- Class Diagram
- Component Diagram
- Deployment Diagram
- Object Diagram
- Composite Structure Diagram



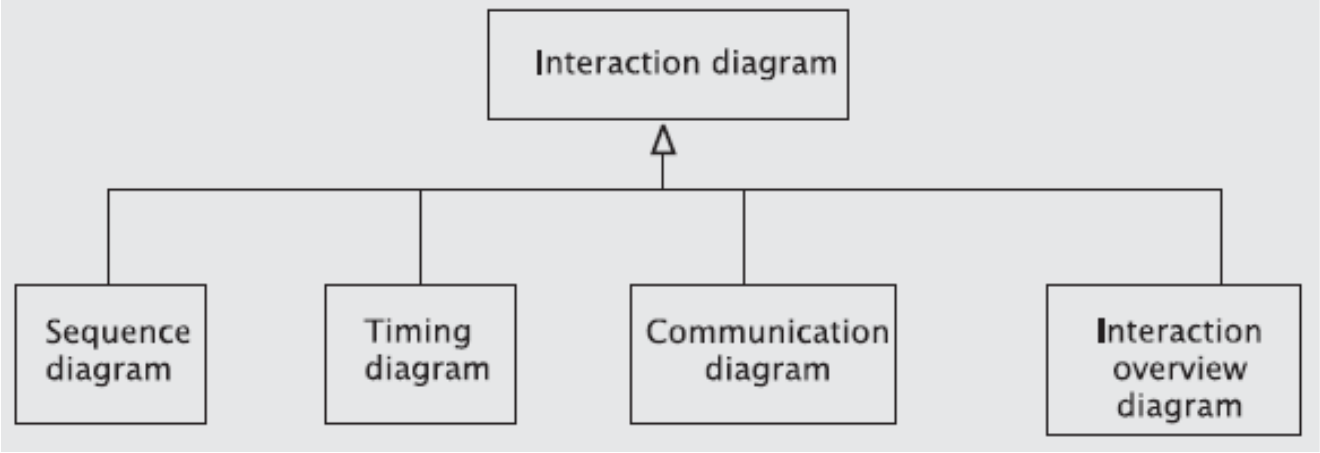
Behavior Diagrams

- Diagram depict the behavior of system or business process
- The UML behavior diagrams include the following :
  - Use Case Diagram
  - Activity Diagram
  - State Machine Diagram



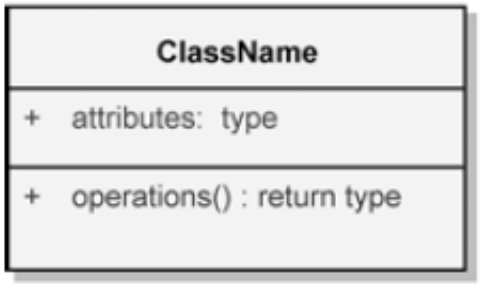
Interaction Diagrams

- Show the methods, interactions and activities of the object
- The UML interaction diagrams include the following :
  - Sequence Diagram
  - Communication Diagram
  - Timing Diagram
  - Interaction Overview Diagram



Class Diagram

- Show the classes, methods, and fields
- A class diagram is used to show the existence of classes and their relationship in the logical view of a system
- Class diagram is represented by a box, which is divided into three categories :
  1. The name of the class is given in the top of rectangle
  2. The attributes are shown in the second box
  3. The methods with their return types and parameter are shown in the third box



Contoh

```
                    Student
-------------------------------------------------------
 -name : String
 -address : String
 -gpa : double
-------------------------------------------------------
+Student(studentName : String, studentAdress: String)
+Student(studentName : String)
+Student()
+setName(studentName : String): void
+setAdress(studentAdress : String): void
+getName(): String
+getGpa(): double
+getAddress(): String
+computeGpa(course : Course,grade:char) : void
```

Class Relationships

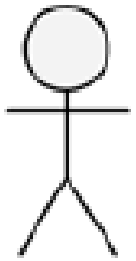
- Classes collaborate with other classes in a variety of ways
- The essential connections among classes :
  - Association
  - Generalization
  - Aggregation
  - Composition

Use Case Diagram

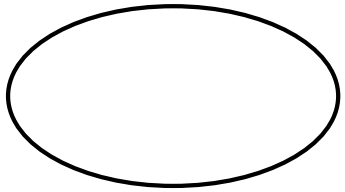
- Use case diagram are used to depict the context of the system to be built and the functionality provided by that system
- Who/ what interact with the system
- What the system to do ?
- Use case involves a user and the system
- Example : student registration for a course

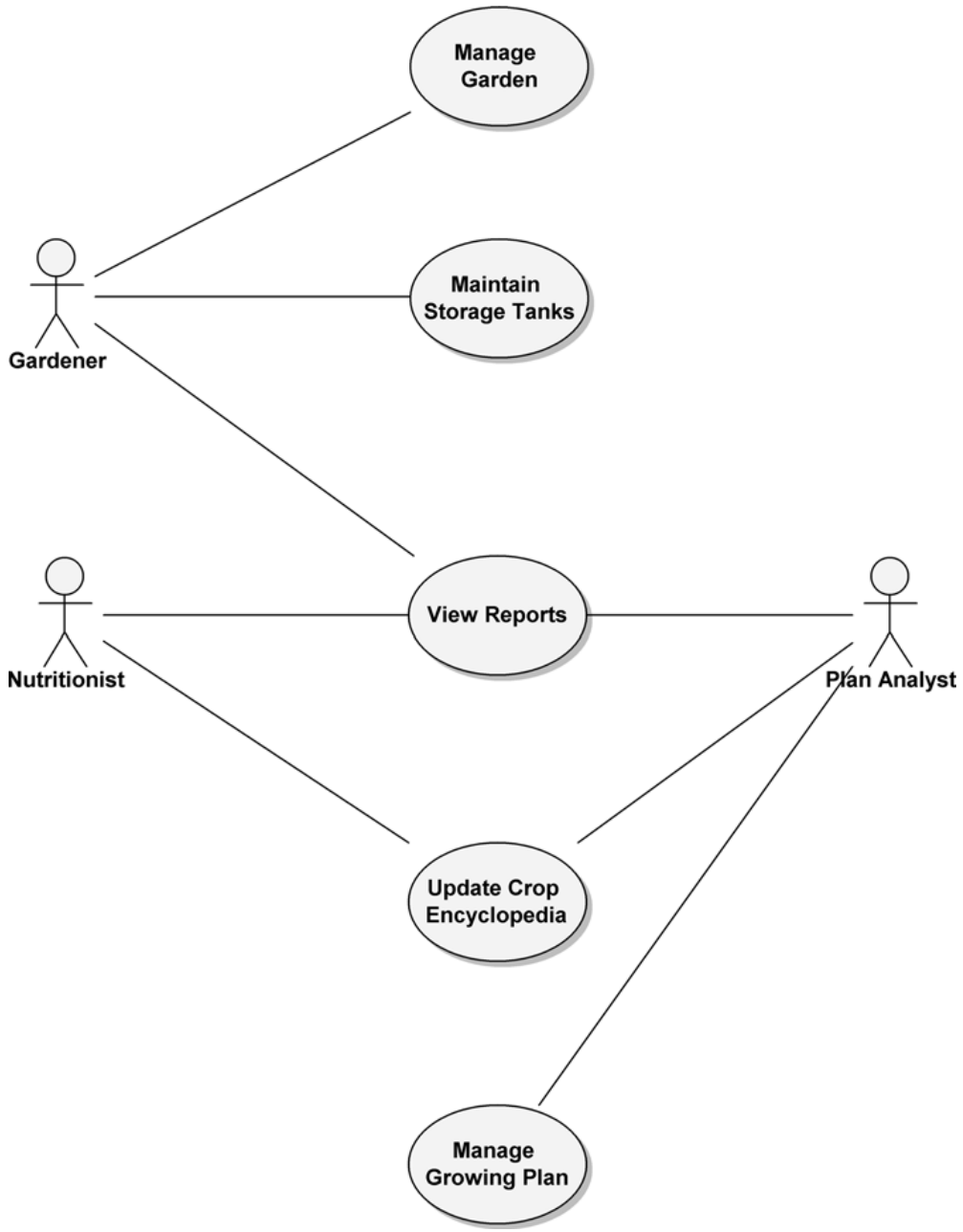
Use Case Diagram

- Actor
  - Actor are entities that interface with the system
  - The can be people or other system



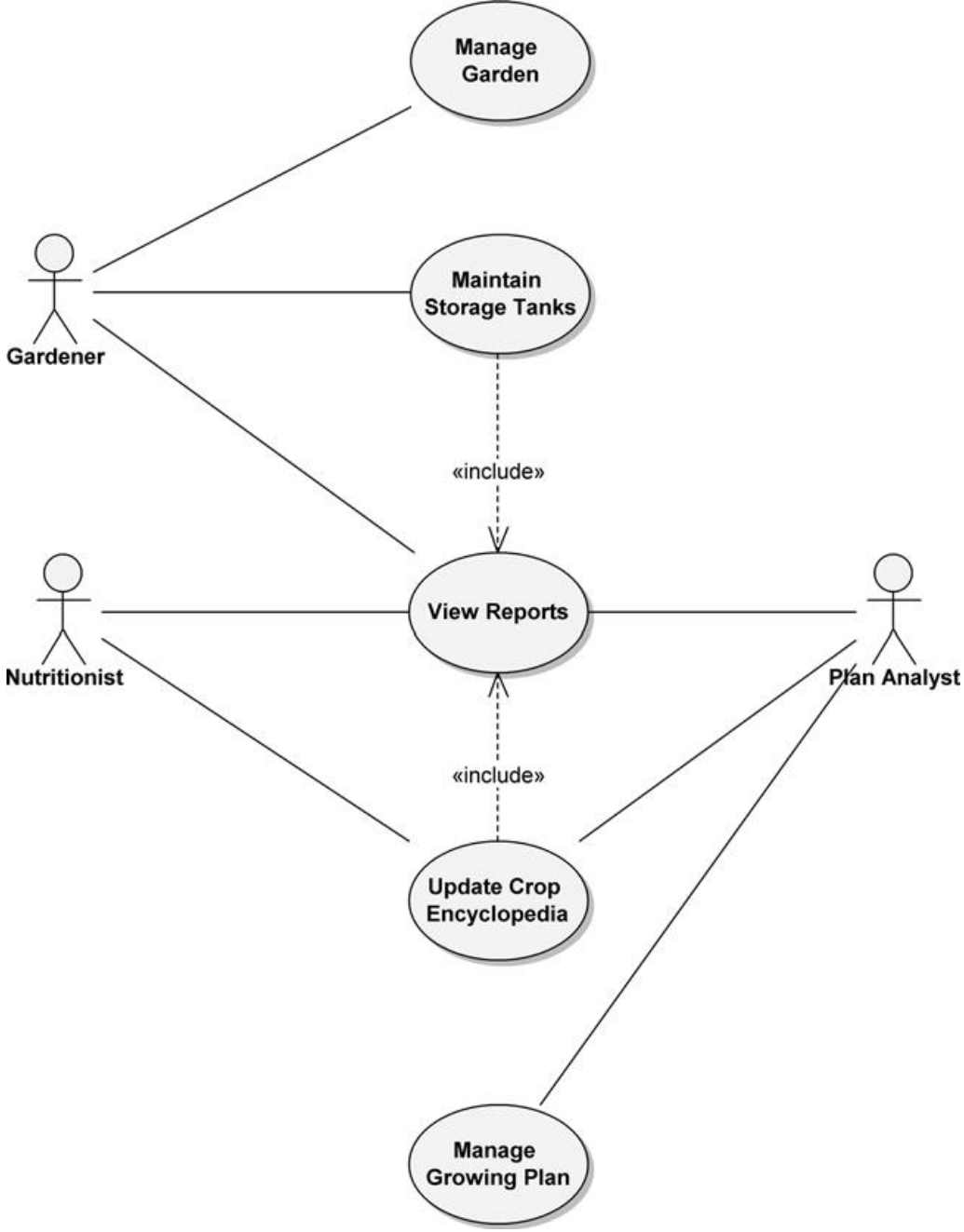
- Use Cases
  - Use cases represent what the actor want your system to do for them




Manage Garden
Maintain Storage Tanks
Gardener
View Reports
Nutritionist
Plan Analyst
Update Crop Encyclopedia
Manage Growing Plan

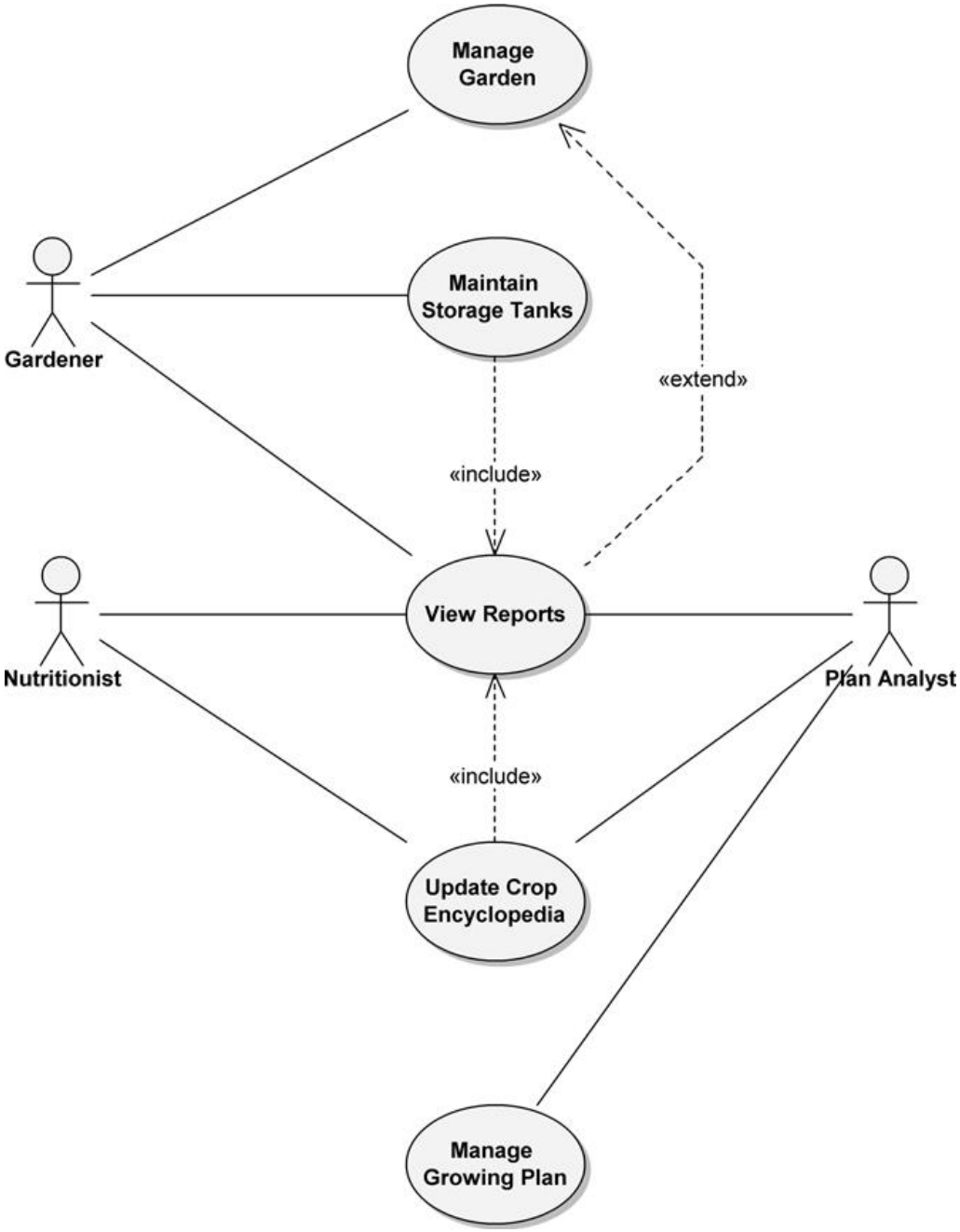
Include Relationship

- <<include>> relationship represents behavior that is factored out of the use case
- <<include>> behavior is factored out for reuse, not because it is an exception
- <<include>> relationship is **to** the using use case


Manage Garden
Maintain Storage Tanks
Gardener
«include»
View Reports
Nutritionist
Plan Analyst
«include»
Update Crop Encyclopedia
Manage Growing Plan

Extend Relationship

- <<extend>> relationships represent exceptional or seldom invoked cases
- The exceptional event flows are separated from the main event flow for clarity
- A use case representing exceptional event flows may extend one or more use cases
- The direction of a <<extend>> relationships is to the extended use case


Manage Garden
Maintain Storage Tanks
Gardener
«extend»
«include»
View Reports
Nutritionist
Plan Analyst
«include»
Update Crop Encyclopedia
Manage Growing Plan

TERIMA KASIH