소프트웨어공학 원리 (SEP521)

Introduction to UML

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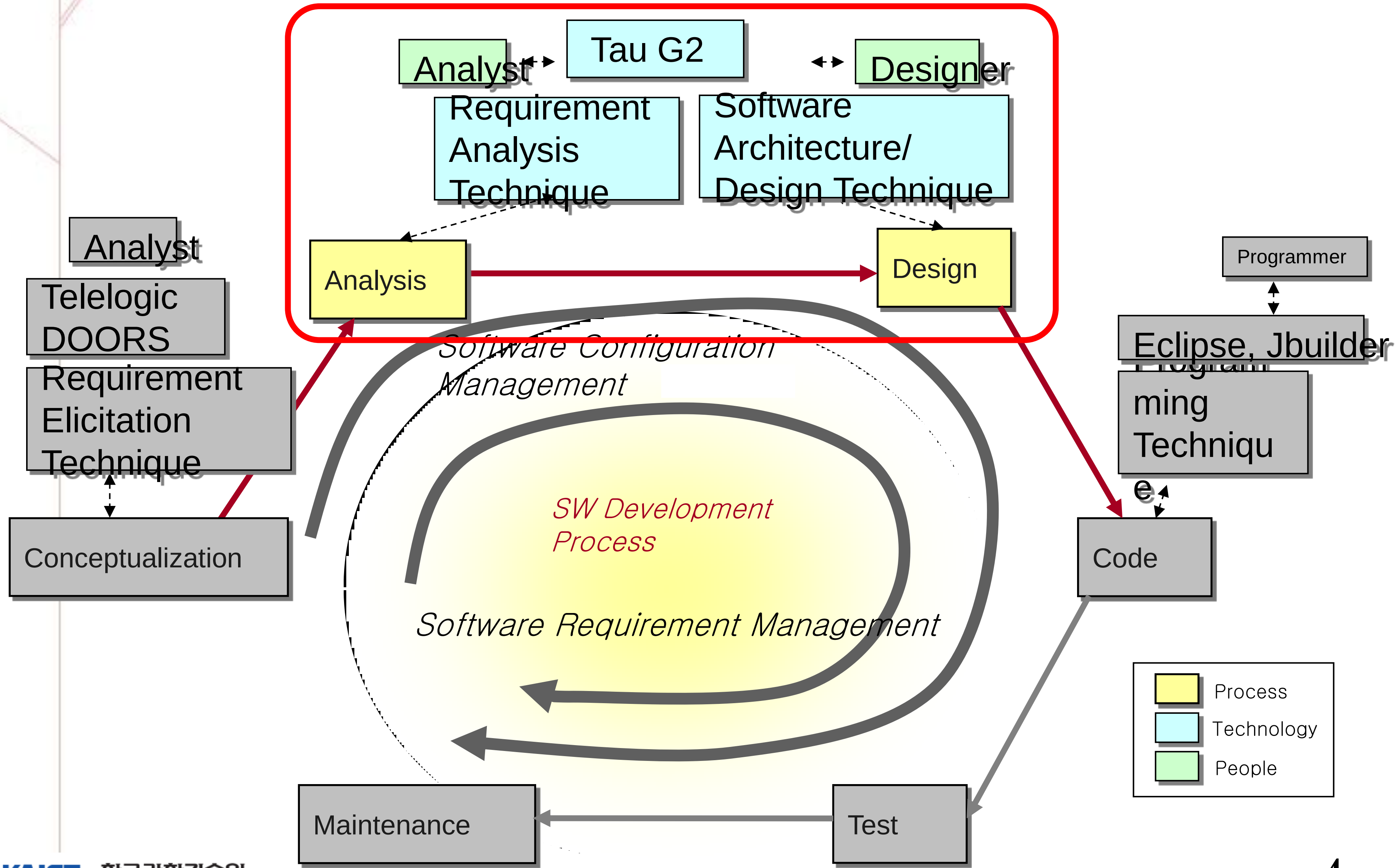
SINCE 1971

Design using UML 2.0

Contents

- Why model
- What is UML
- UML history
- UML 2.0
- Diagram/View paradigm
- UML diagrams
  - Use case
  - Class
  - Sequence
  - State machine

Here, we focus on..



Analyst

Tau G2

Designer

Requirement Analysis Technique

Software Architecture/ Design Technique

Analysis

Design

Analyst

Telelogic DOORS

Requirement Elicitation Technique

Conceptualization

Software Configuration Management

SW Development Process

Software Requirement Management

Programmer

Eclipse, Jbuilder

Programming Technique

Code

Test

Maintenance

🟨 Process

🟦 Technology

🟩 People

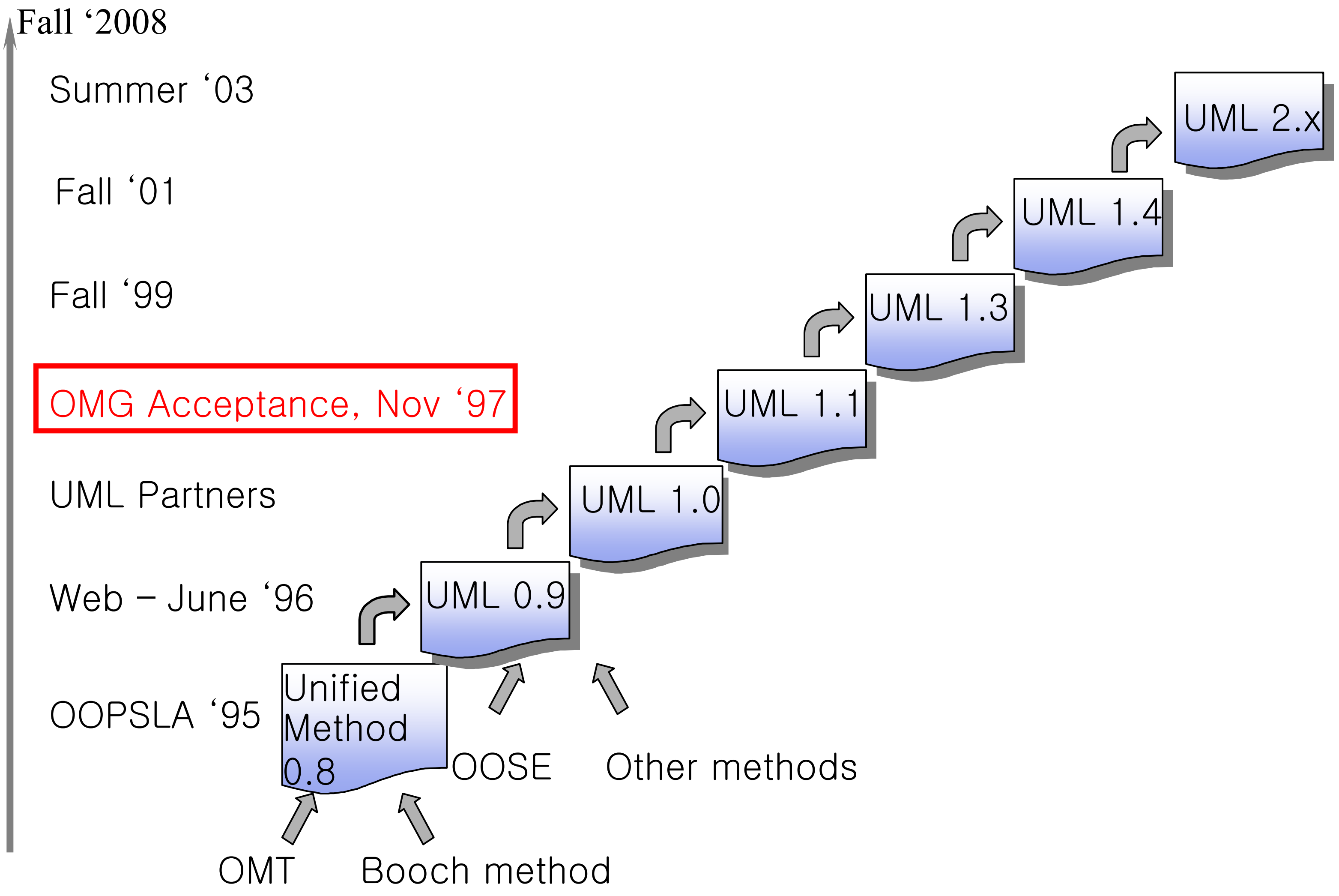
Why model

- To easily communicate information between different stakeholders in an unambiguous way
- To specify target-language-independent designs
- To provide structure for problem solving
- To provide mechanisms(abstractions, views, filtering, structure) to manage complexity
- To be able to easily experiment to explore multiple solutions

What is UML?

- **U**nified **M**odeling **L**anguage
  - Visual language for specifying, constructing and documenting
- Maintained by the OMG (Object Management Group)
  - Website: http://www.omg.org
- Object-oriented
- Model / view paradigm
- Target language independent

UML history



Fall ‘2008

Summer ‘03

Fall ‘01

Fall ‘99

OMG Acceptance, Nov ‘97

UML Partners

Web – June ‘96

OOPSLA ‘95

UML 2.x

UML 1.4

UML 1.3

UML 1.1

UML 1.0

UML 0.9

Unified Method 0.8

OOSE

Other methods

OMT

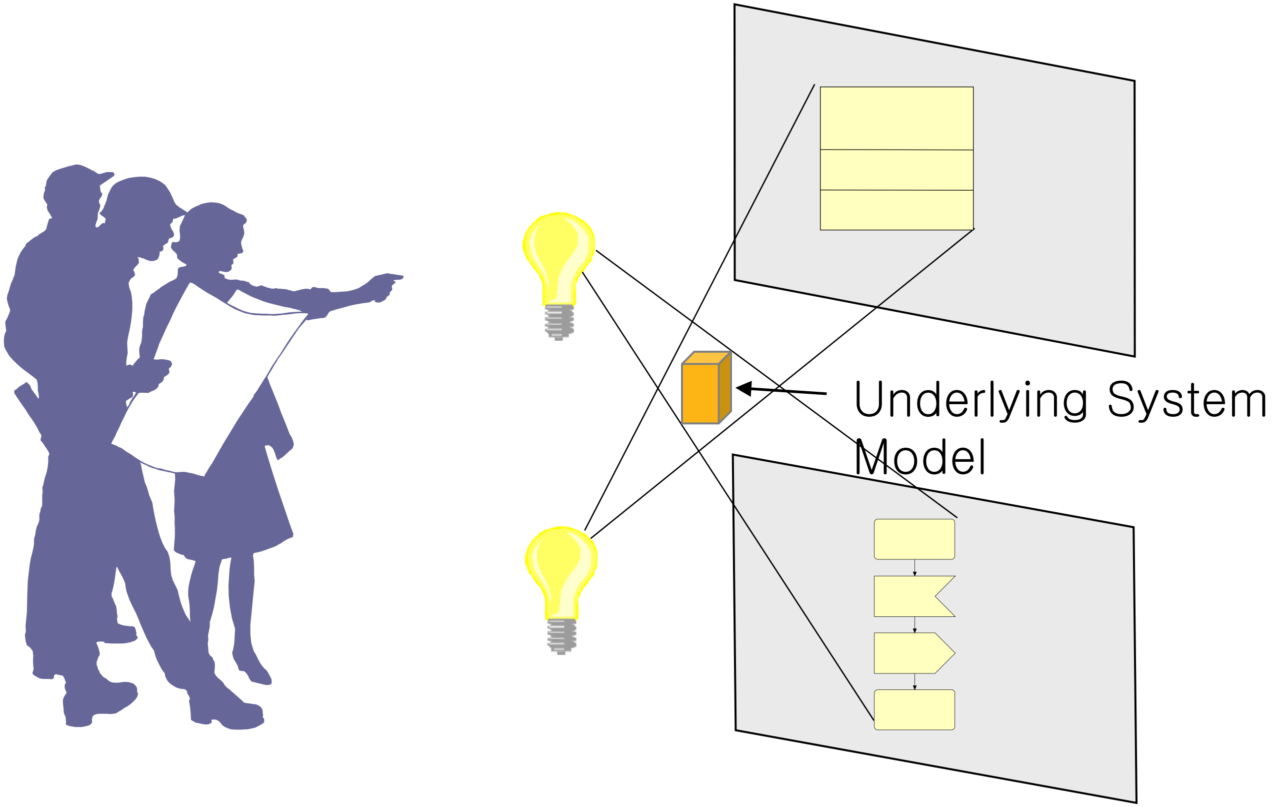
Booch method

UML 2.0

- UML 2.0 leverages the industry’s investment in UML 1.x and makes UML comprehensive, scalable and mature
- UML 2.0 designed to solve the key UML 1.x issues
- Major improvements in UML 2.0 include:
  - New internal structure diagrams support precise definition of architecture, interfaces and components
  - Improved scalability in state machine and sequence diagrams
  - Better semantic foundation enables advanced model verification and full code generation

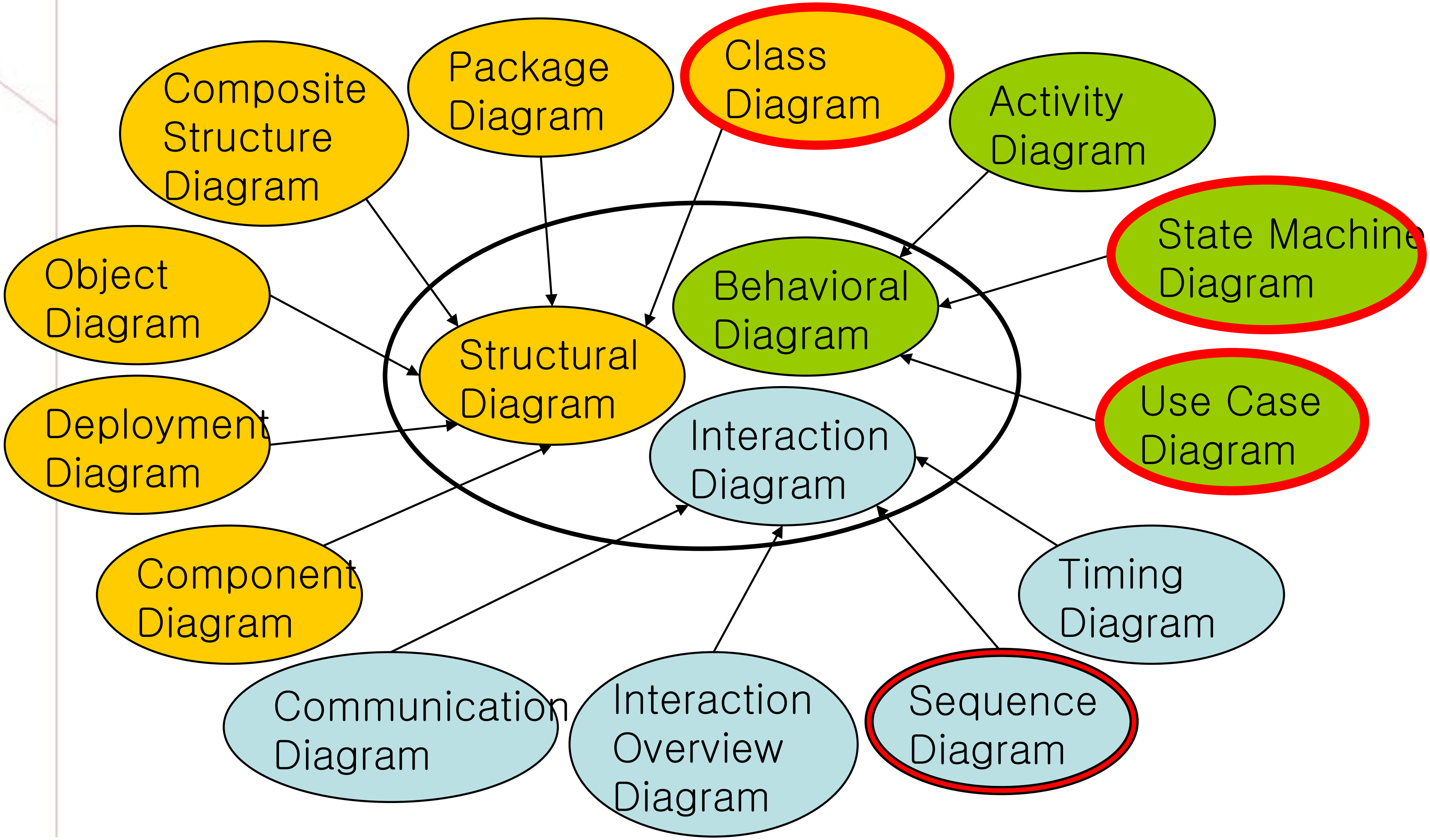
Diagram/view paradigm

- Each diagram is just a view of part of the system
- Together, all diagrams provides a complete picture



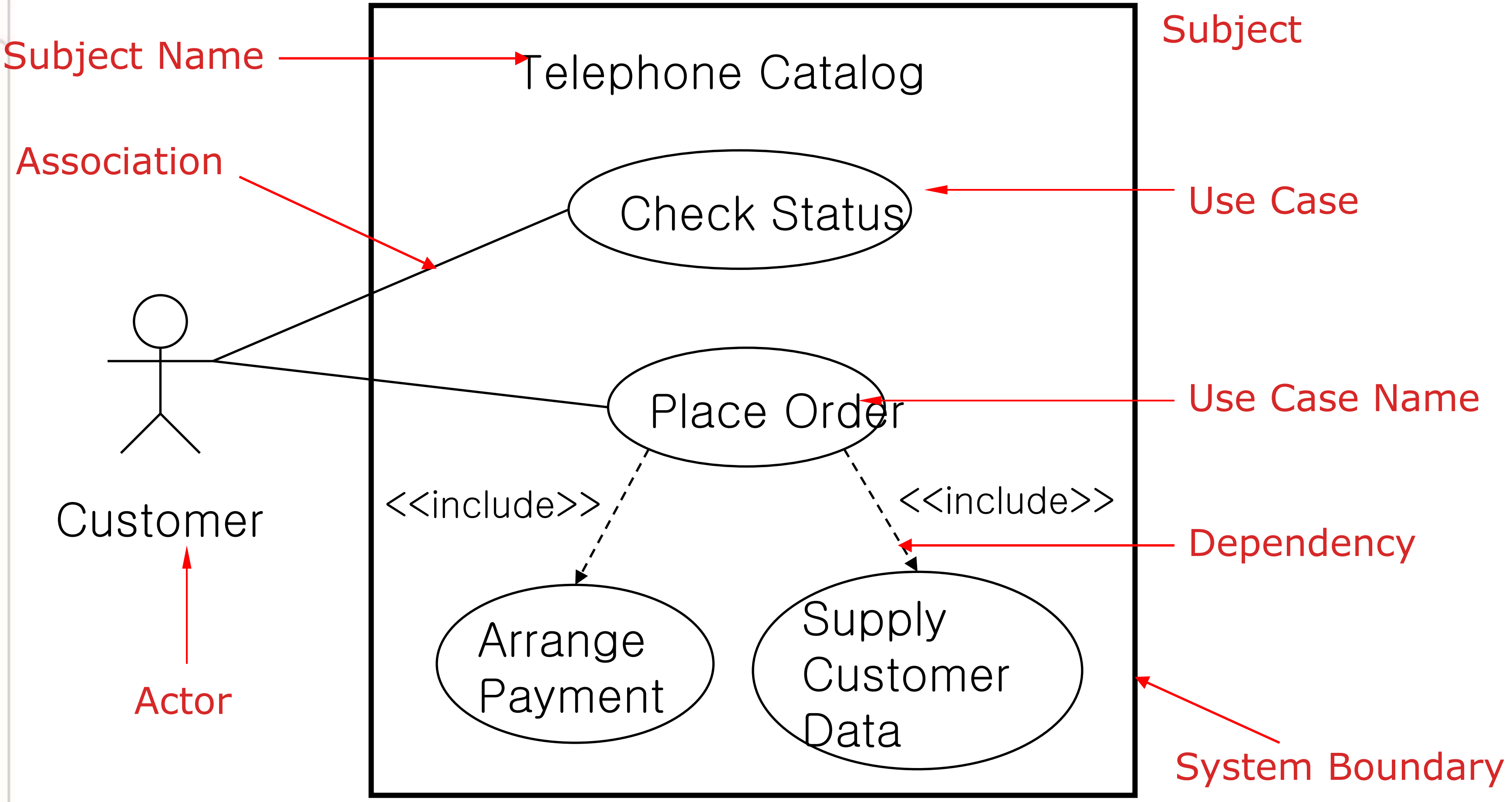
Underlying System Model

UML diagrams



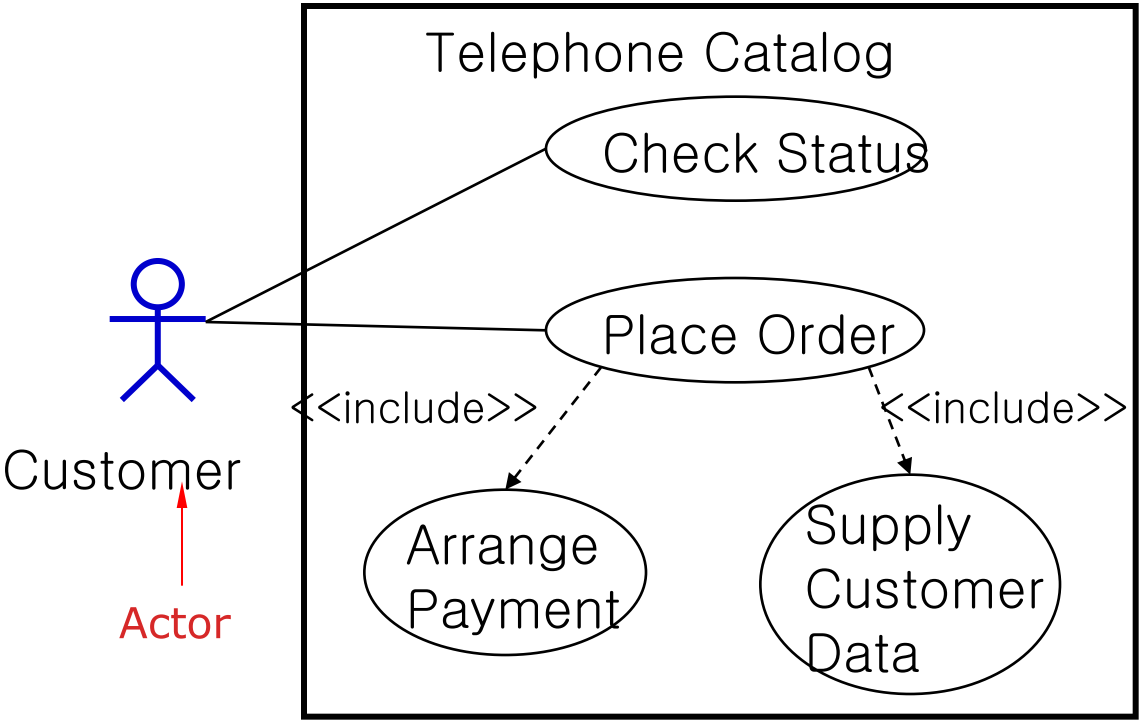
Use Case Diagram

- Describe WHAT the system will do at a high-level



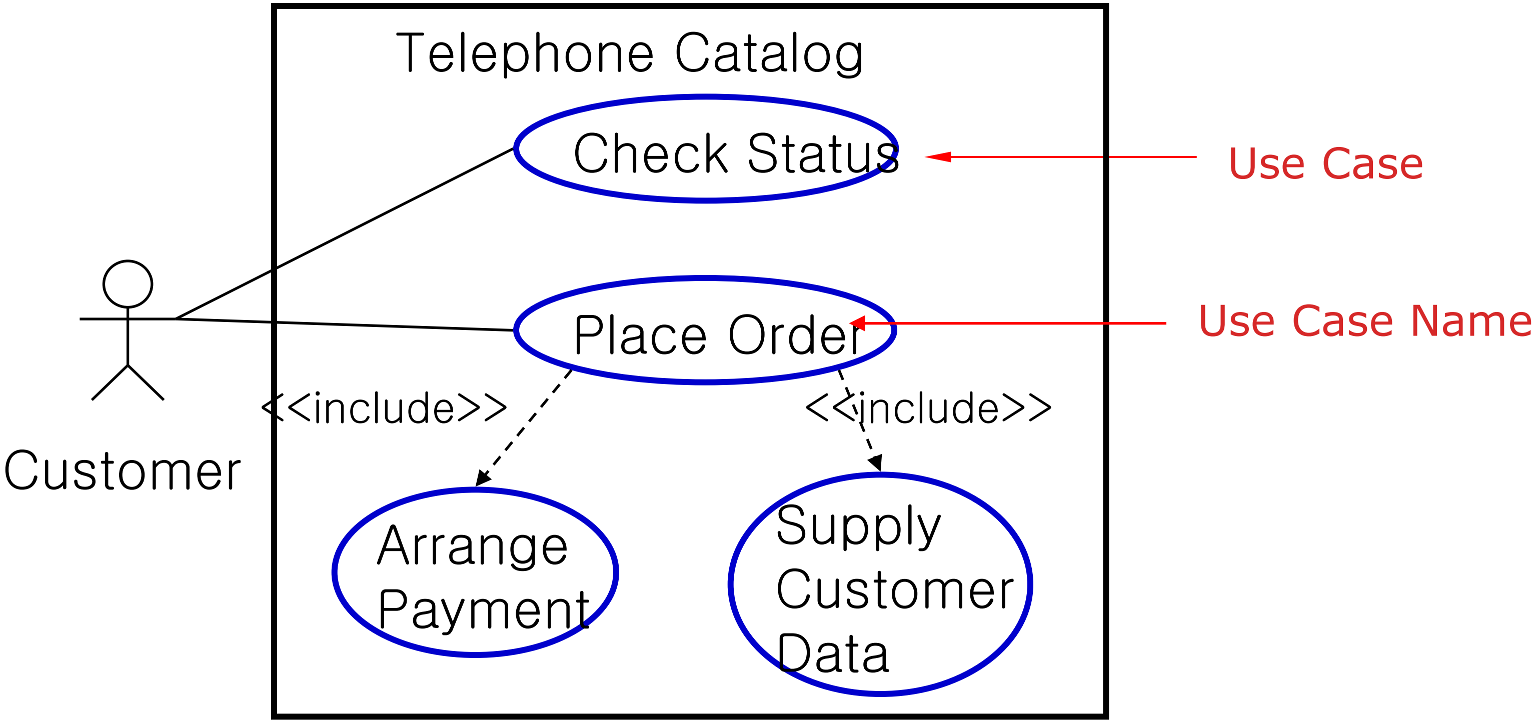
Actor

- Someone or some thing that must interact with the system under development
  - Users, external systems, devices



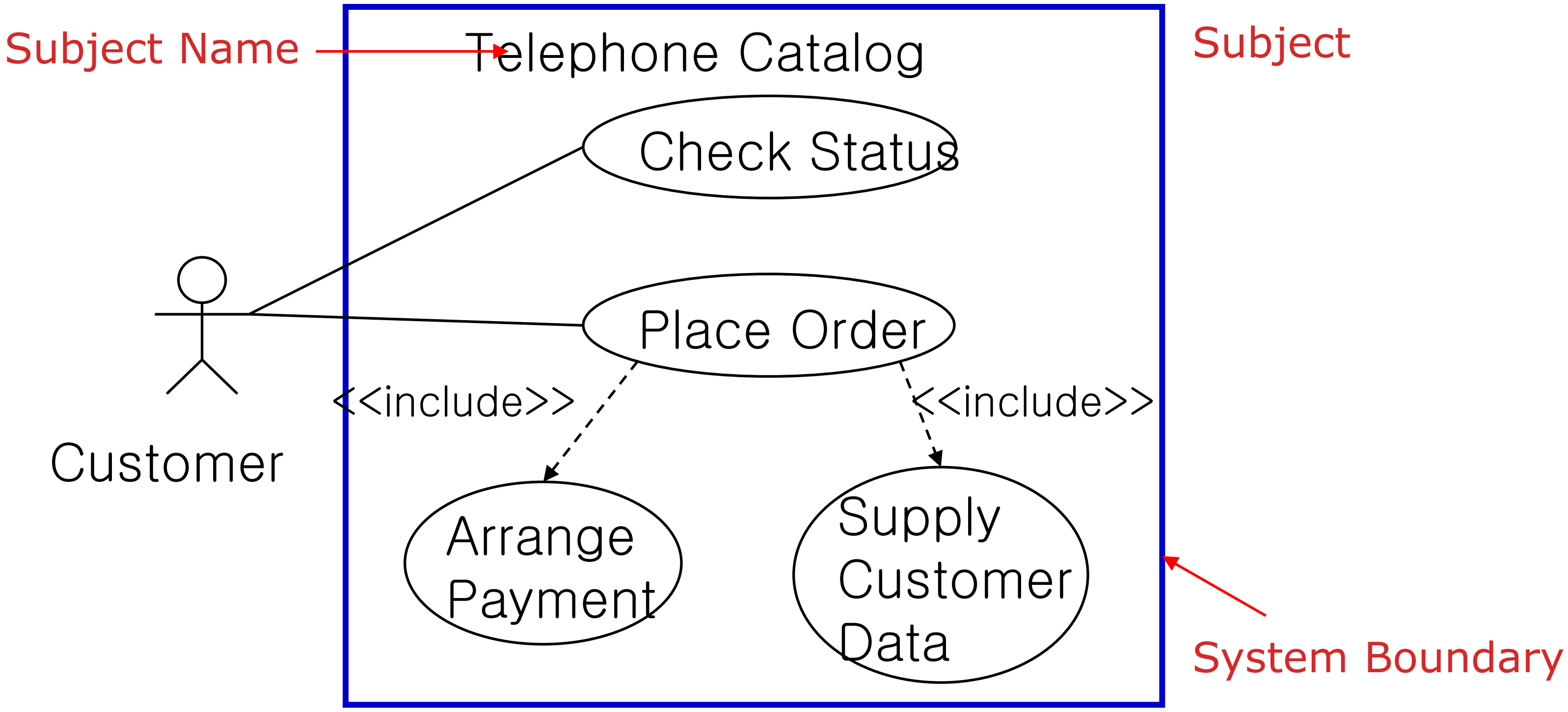
Use Case

- Functionality that the system shall offer to an actor
- Interaction between one or more actors and the system



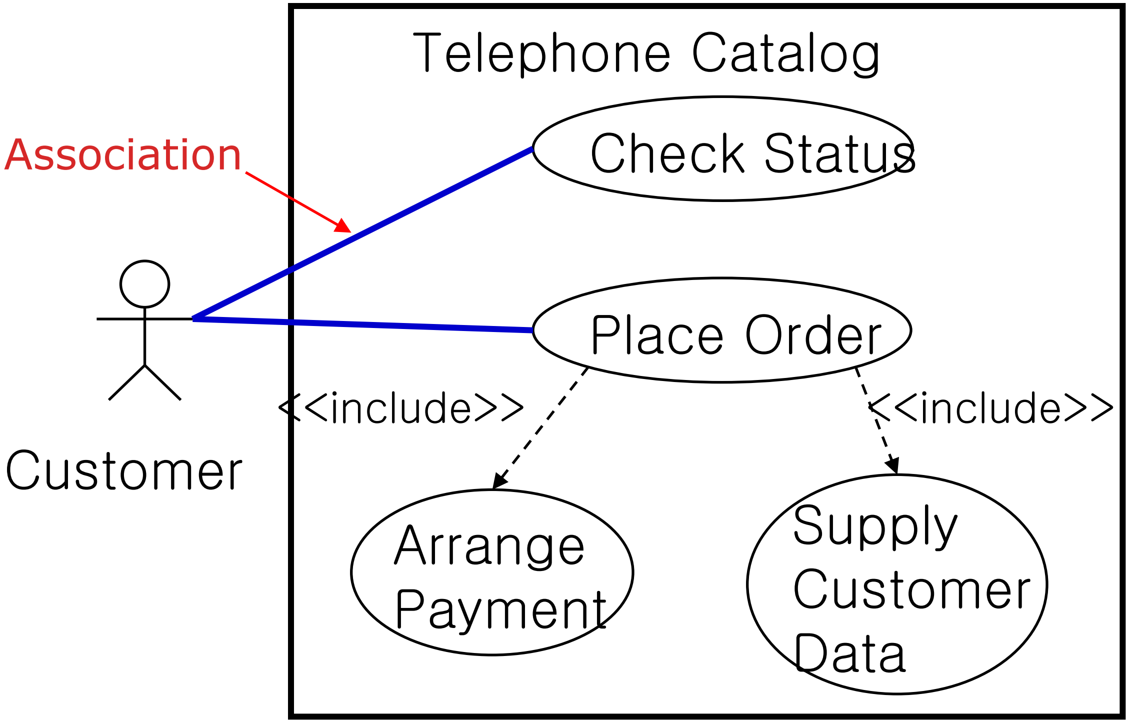
Subject Symbol

- Indicate system boundary
- Represent the system begin developed
  - All actors who interact with the system are outside of it



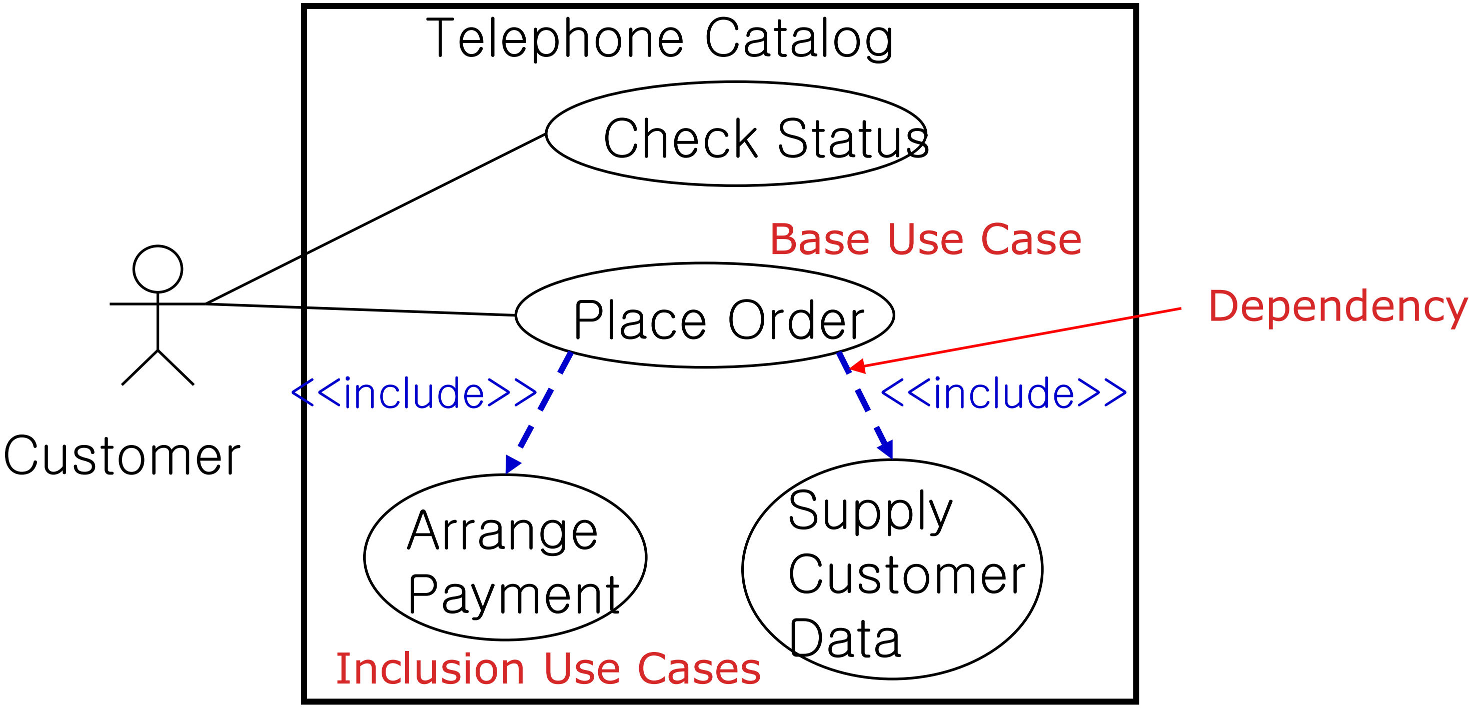
Association

- Drawn between an actor and a use case
- Represent bi-directional communication between the actor and the system



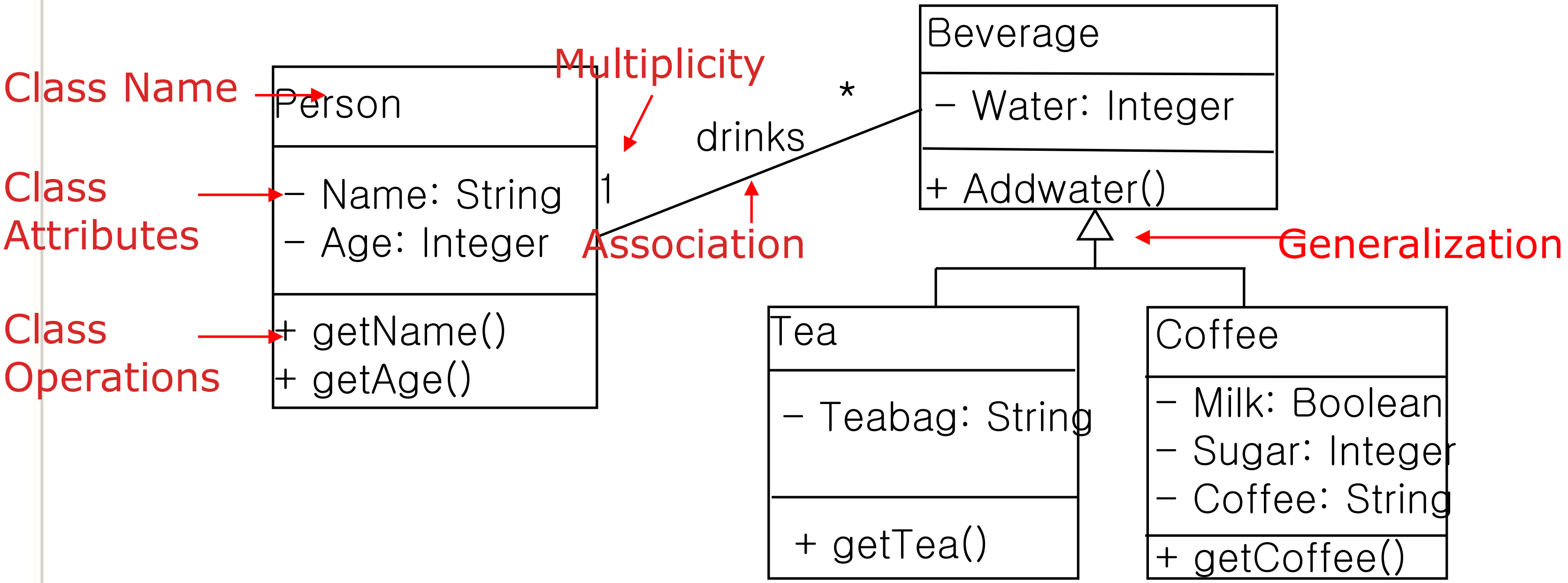
Dependency – Include

- Represent relationship from a *base* to an *inclusion* use case
- Imply a Use Case calls another Use Case
- Primarily used to reuse behavior common to several Use Cases



Class Diagram

- Description of static structure
  - Showing the types of objects in a system and the relationships between them
- Foundation for the other diagrams



Class Name

Class Attributes

Class Operations

Multiplicity

Association

Generalization

Person

– Name: String

– Age: Integer

+ getName()

+ getAge()

1

drinks

*

Beverage

– Water: Integer

+ Addwater()

Tea

– Teabag: String

+ getTea()

Coffee

– Milk: Boolean

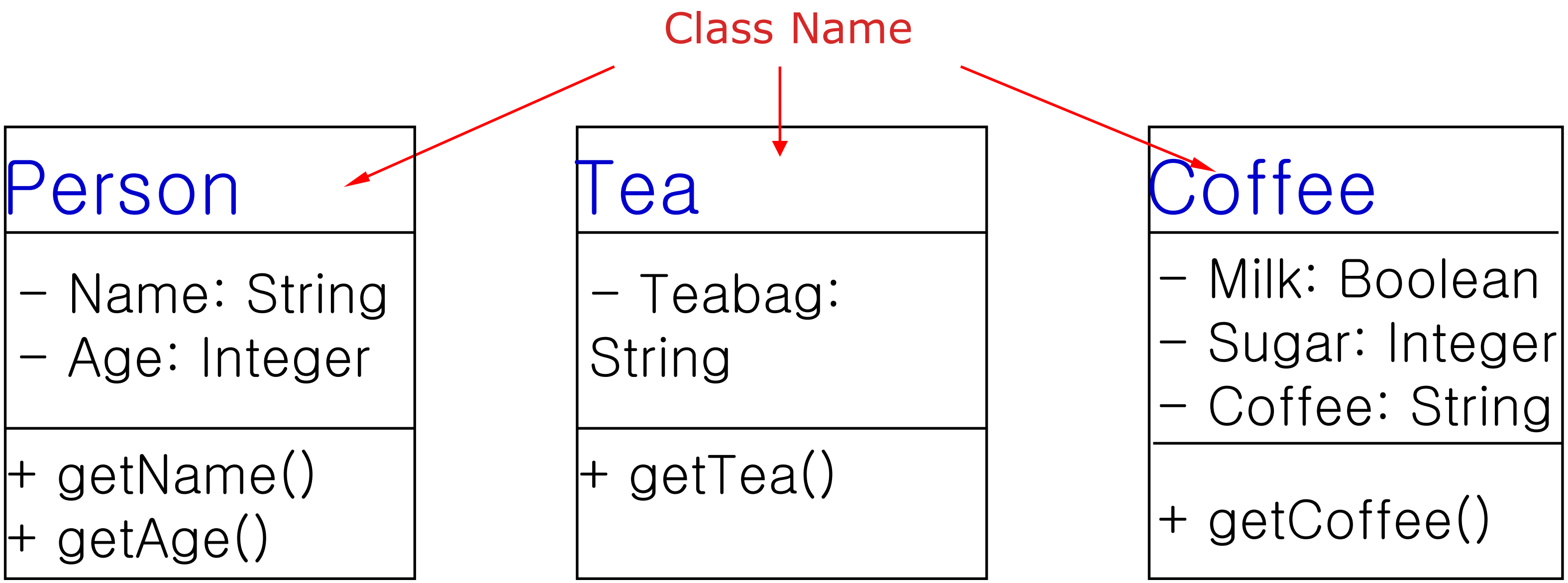
– Sugar: Integer

– Coffee: String

+ getCoffee()

Classes

- Most important building block of any object-oriented system
- Description of a set of objects
- Abstraction of the entities
  - Existing in the problem/solution domain



Class Name

Person

– Name: String
– Age: Integer

+ getName()
+ getAge()

Tea

– Teabag: String

+ getTea()

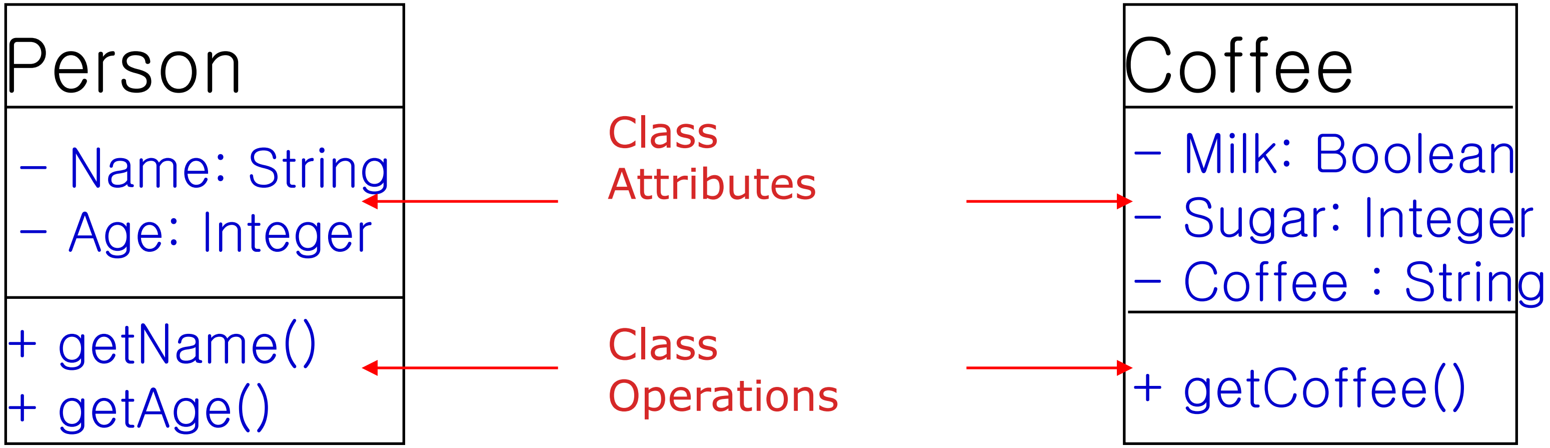
Coffee

– Milk: Boolean
– Sugar: Integer
– Coffee: String

+ getCoffee()

Attributes and Operations

- Attributes
  - Represent some property of the thing being modeled
  - Syntax: attributeName : Type
- Operations
  - Implement of a service requested from any object of the class
  - Syntax: operationName(param1:type, param2:type, …) : Result



Person

– Name: String
– Age: Integer

+ getName()
+ getAge()

Class Attributes

Class Operations

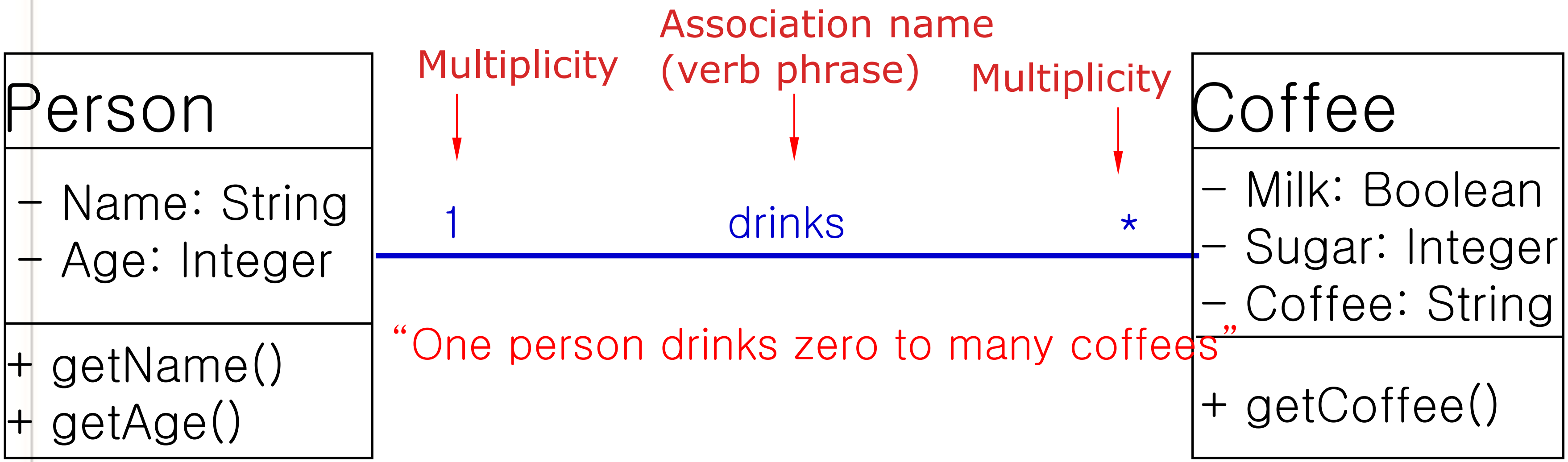
Coffee

– Milk: Boolean
– Sugar: Integer
– Coffee : String

+ getCoffee()

Association and Multiplicity

- Association
  - Relationship between classes that specifies connections among their instances
- Multiplicity
  - Number of instances of one class related to ONE instance of the other class



Person

– Name: String
– Age: Integer

+ getName()
+ getAge()

Multiplicity

Association name (verb phrase)

Multiplicity

1

drinks

*

Coffee

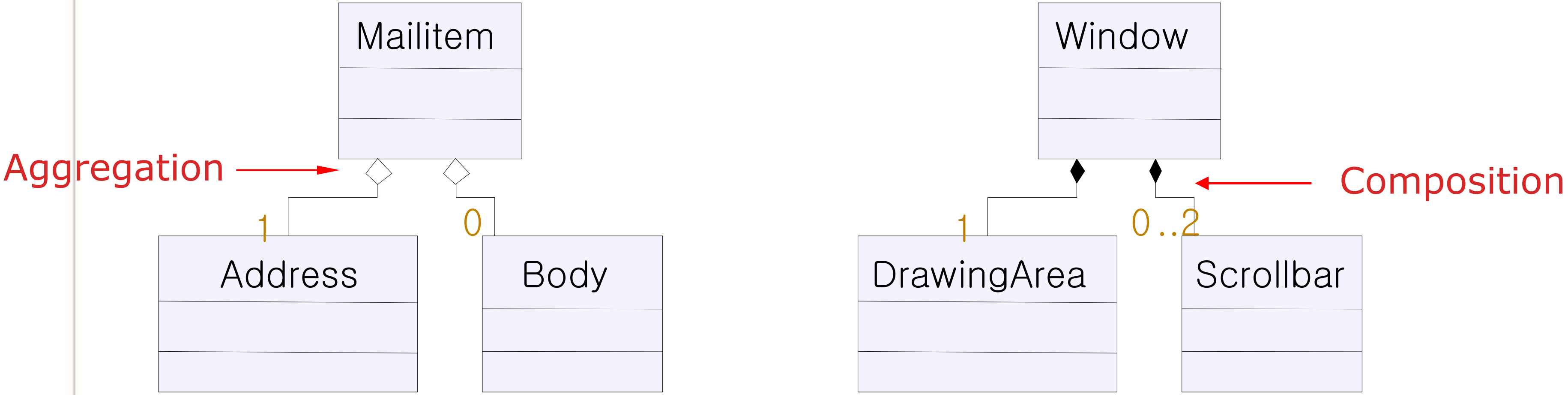
– Milk: Boolean
– Sugar: Integer
– Coffee: String

+ getCoffee()

"One person drinks zero to many coffees"

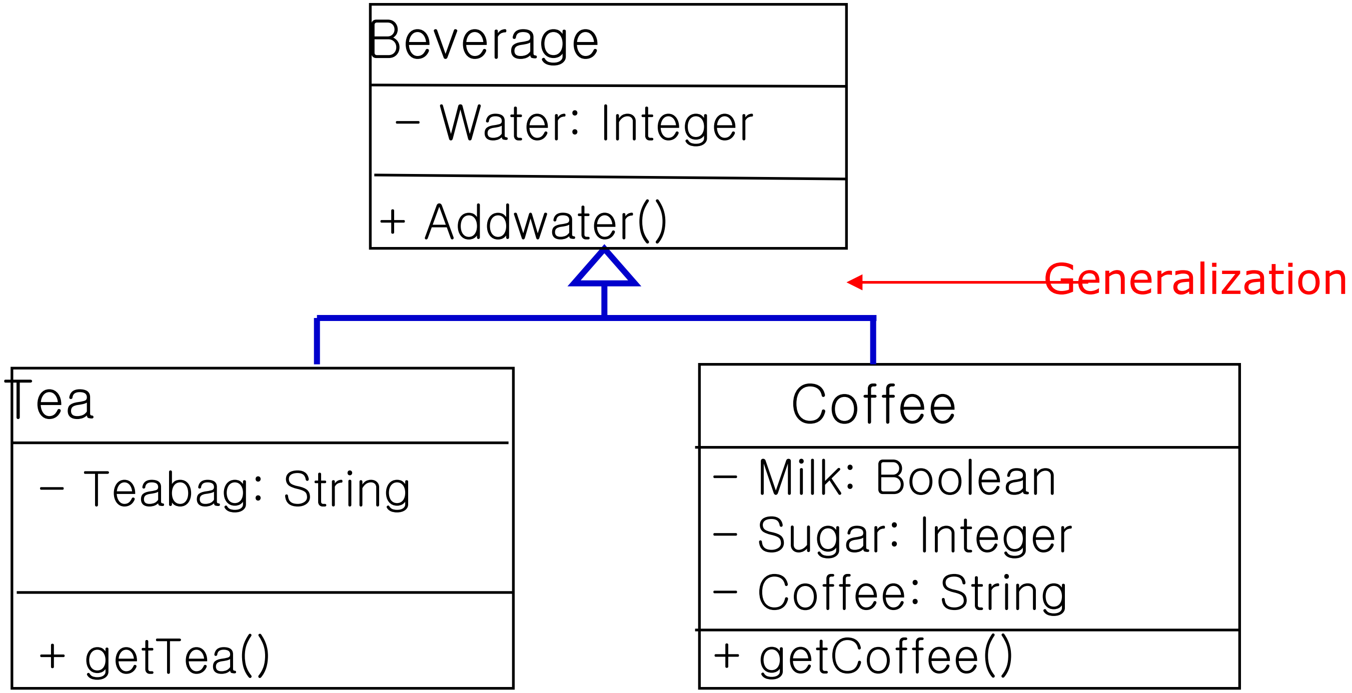
Aggregations and Compositions

- Aggregation
  - Weak “whole–part” relationship
    - Mailitem ‘has a’ address
- Composition
  - Strong “whole–part” relationship between elements
    - Window ‘contains a’ scrollbar



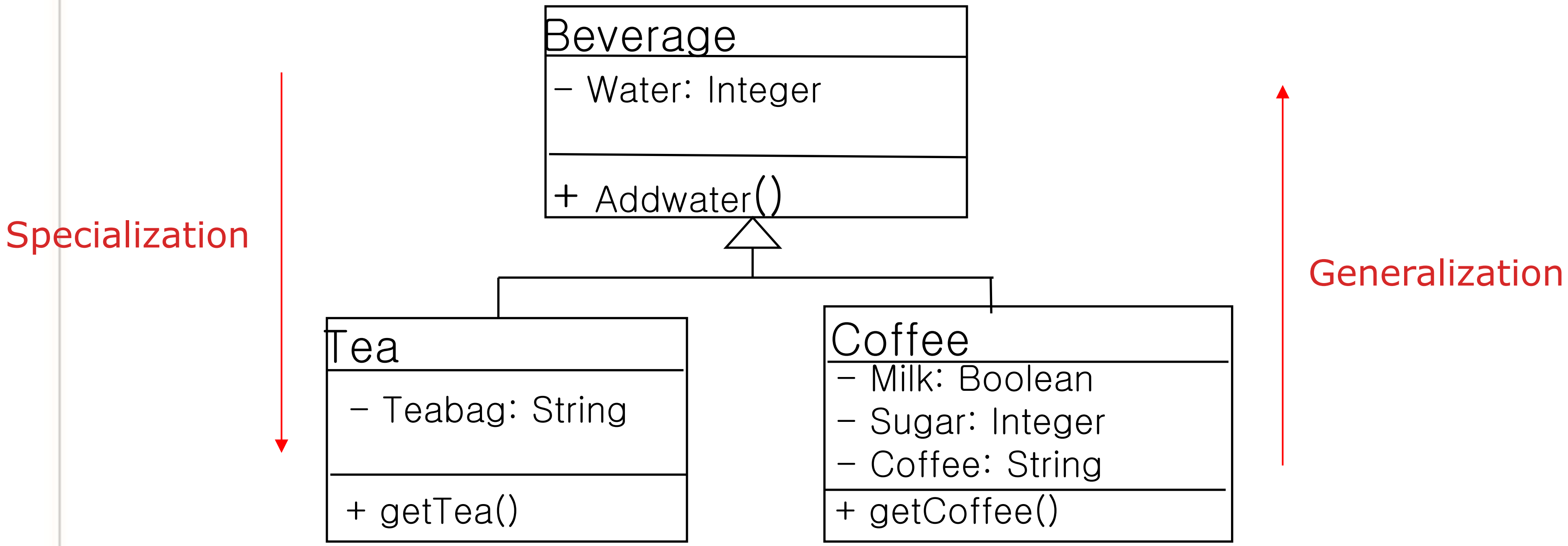
Inheritance

- Relationship between superclass and subclasses
  - All attributes and operations of the superclass are part of the subclasses



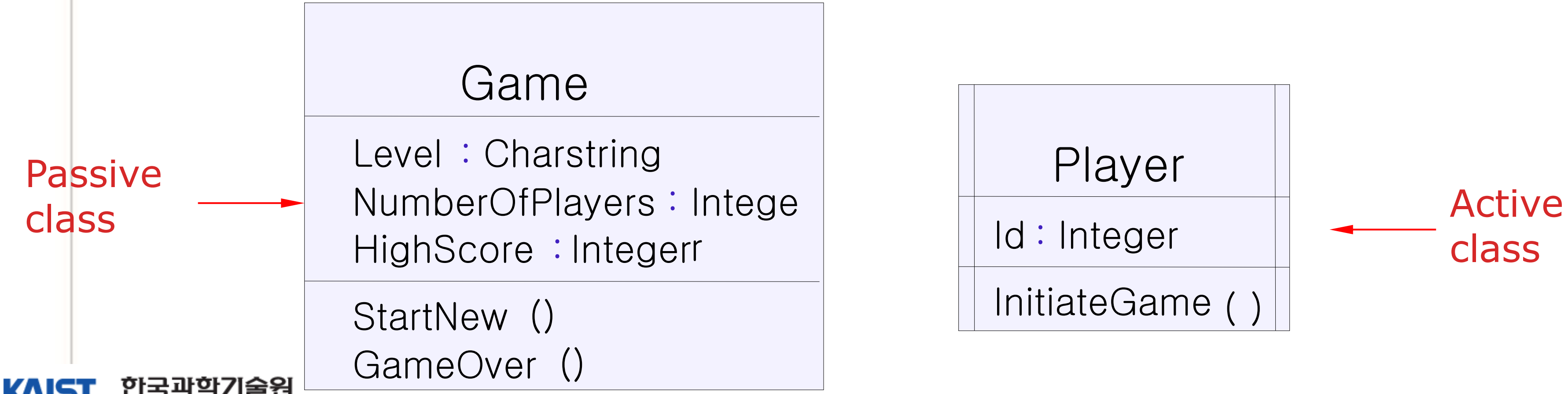
Generalization/Specialization

- Generalization
  - Building a more general class from a set of specific classes
- Specialization
  - Creating specialized classes base on a more general class



Active vs. Passive Class

- Active class
  - Own a thread control and can initiate control activity
    - Used when asynchronous communication is necessary
    - Typically modeled with a statemachine of its behavior
    - Encapsulated with ports and interfaces
- Passive class
  - Created as part of an action by another object
    - Own address space, but not thread of control



Passive class

Game

Level : Charstring
NumberOfPlayers : Intege
HighScore : Integerr

StartNew ()
GameOver ()

Player

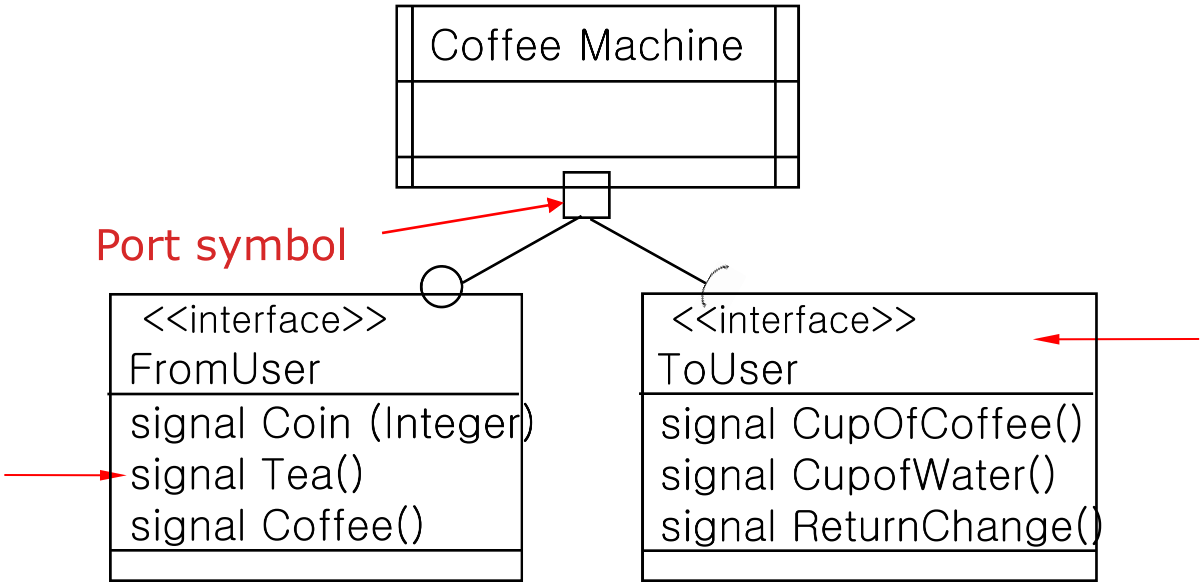
Id : Integer

InitiateGame ( )

Active class

Ports and Interfaces

- Ports
  - Define an interaction point on a classifier
- Interfaces
  - Declaration of a coherent set of public features and obligations
    - Contract between providers and consumers of services



Coffee Machine

<<interface>>
FromUser

signal Coin (Integer)
signal Tea()
signal Coffee()

<<interface>>
ToUser

signal CupOfCoffee()
signal CupofWater()
signal ReturnChange()

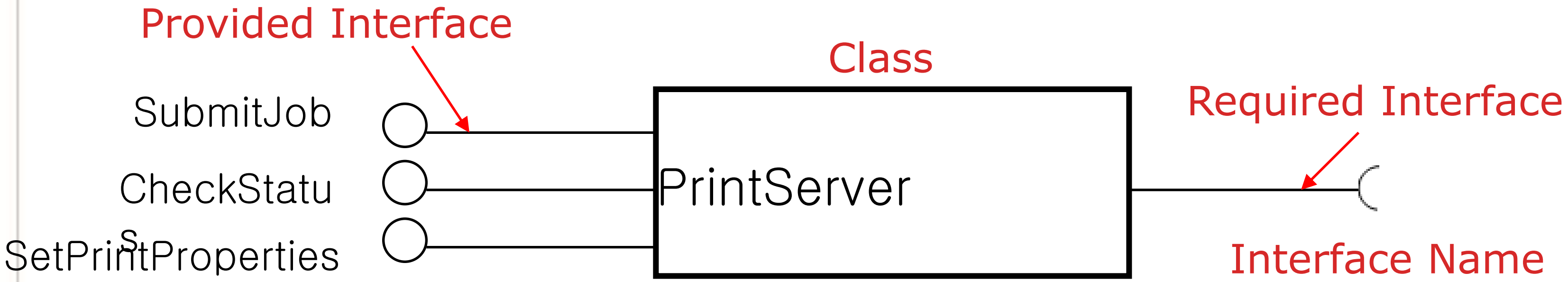
Port symbol

Interface Definition

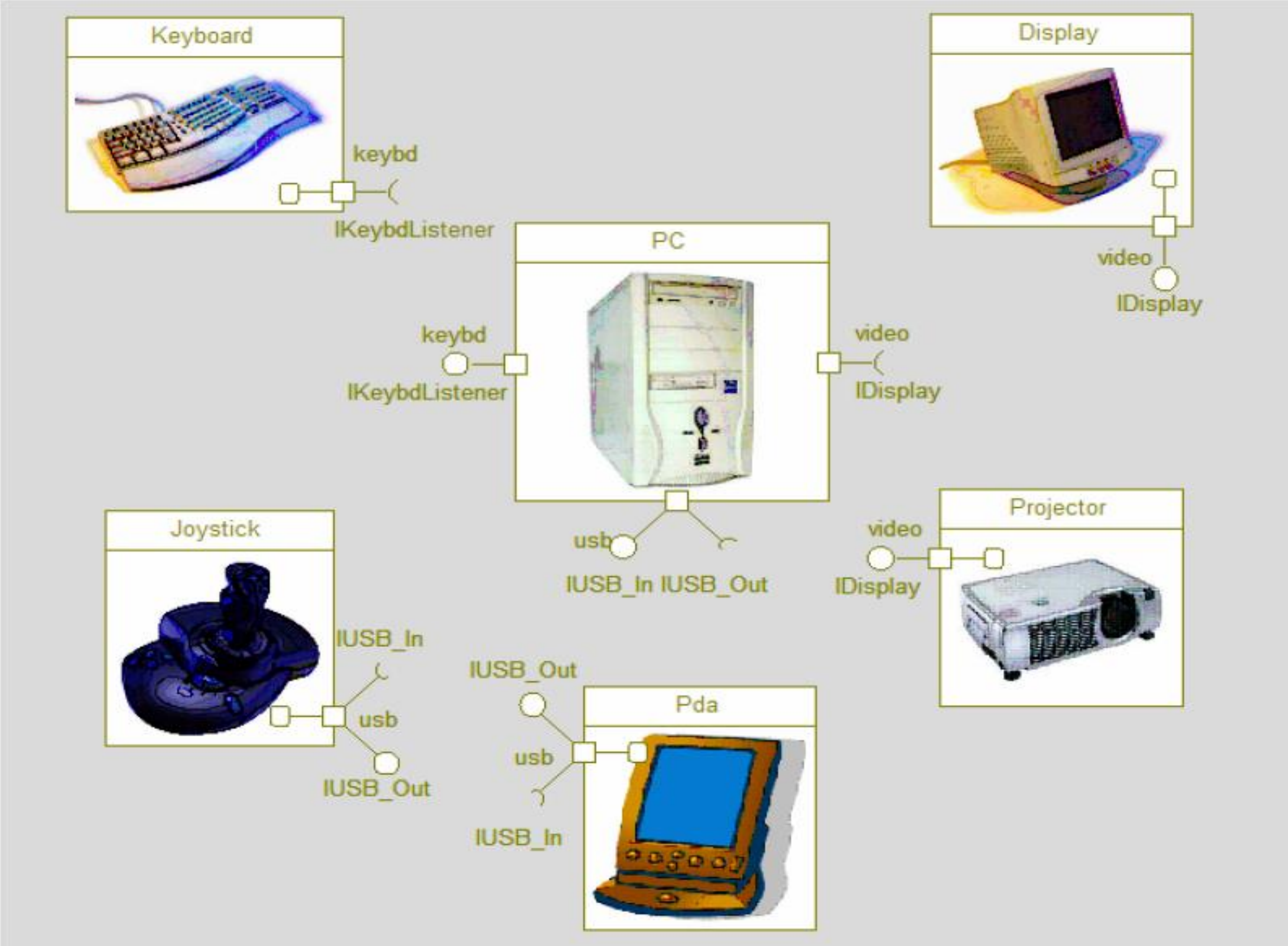
Interface Name

Provided/ Required Interface

- Provided interface
  - Class provides the services of the interface to outside callers
  - What the object can do
  - Provided interface accept incoming signal form outside callers
- Required interface
  - Class uses to implement its internal behavior
  - What the object needs to do
  - Outgoing signal are sent via required interface

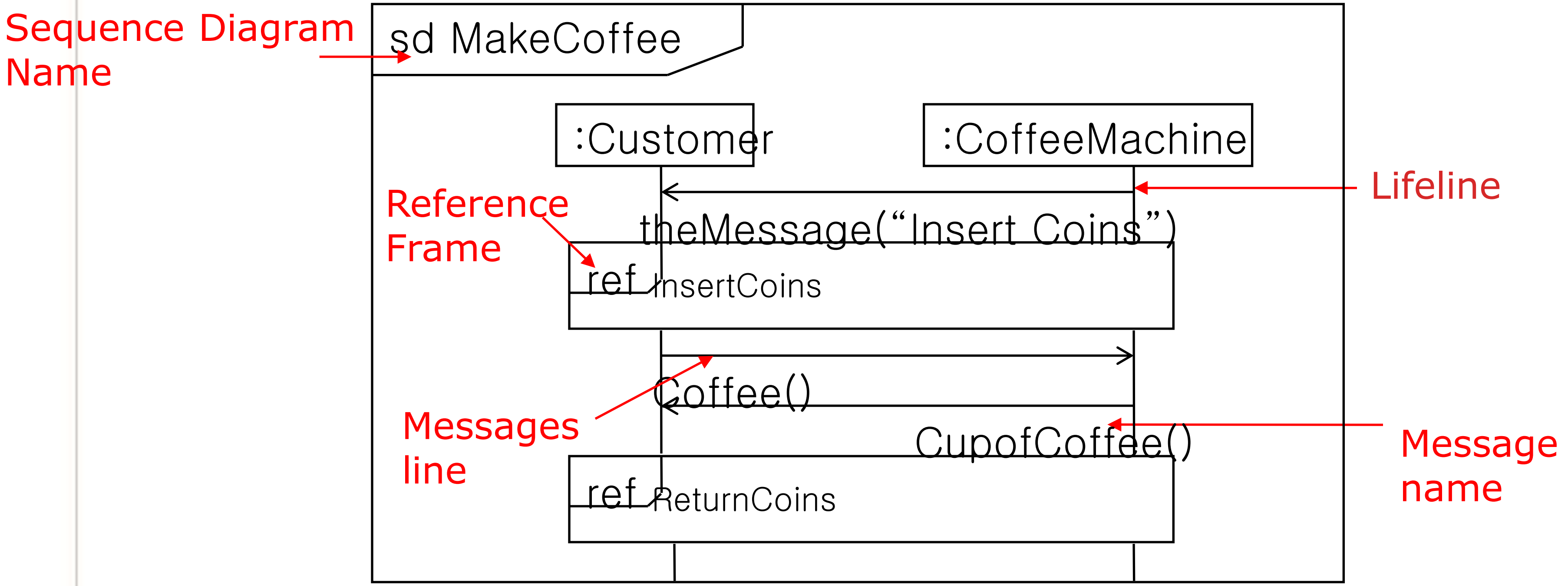


Computer Device Example



Sequence Diagram

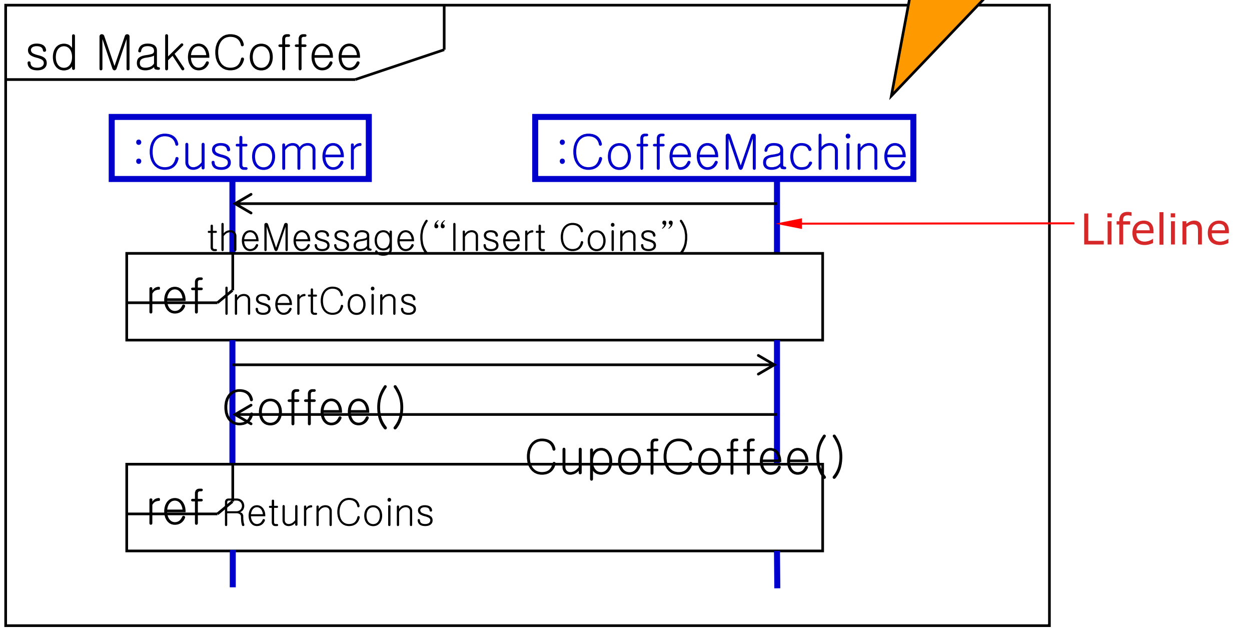
- Emphasize on the sequence of communications between parts
- Show sequences of messages ("interactions") between instances in the system
- Emphasize time ordering



Lifelines

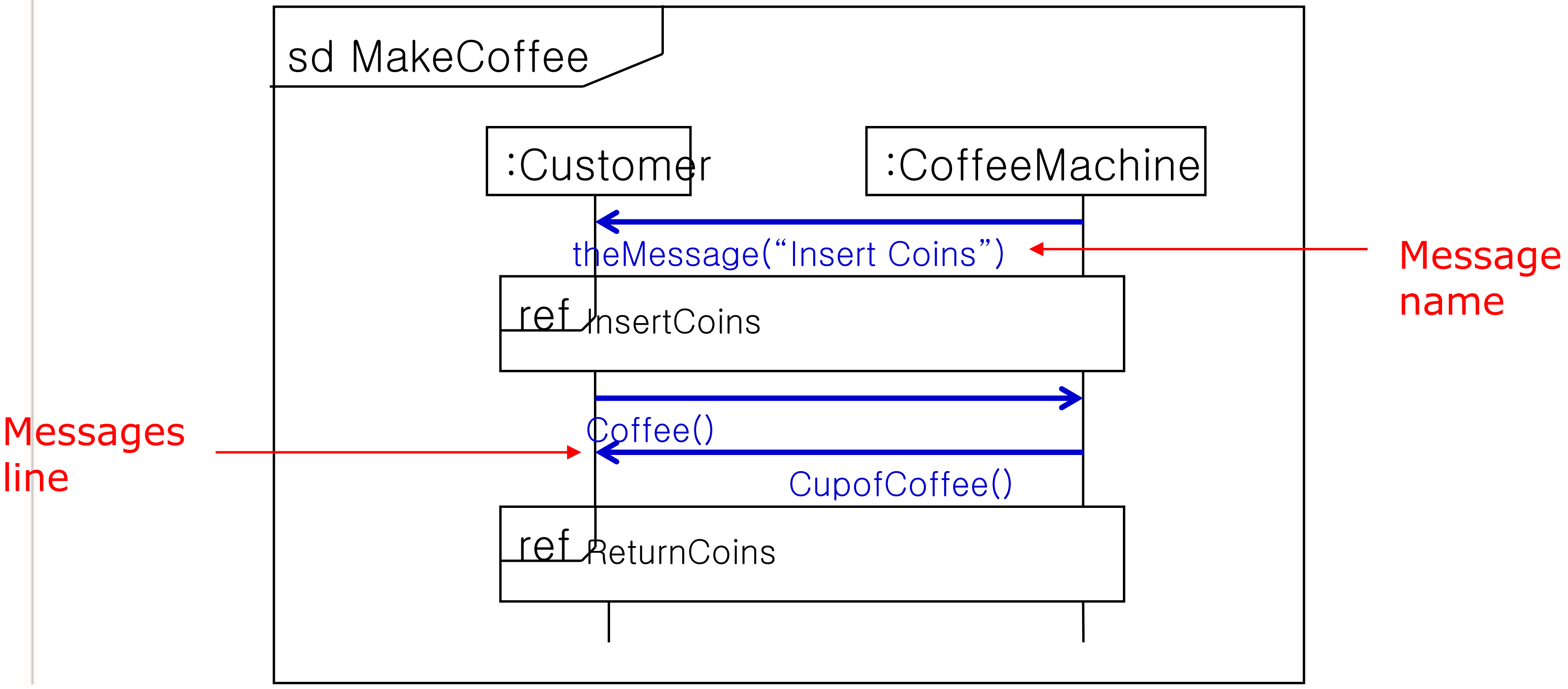
- Individual participant in the interaction over period time
  - Subsystem/ object/ class
  - Actor
  - External system roles in the interaction

Instance name (object) : Type name (class)



Messages

- One-way communication between two objects
- May have parameters that convey values



sd MakeCoffee

:Customer

:CoffeeMachine

theMessage(“Insert Coins”)

ref InsertCoins

Coffee()

CupofCoffee()

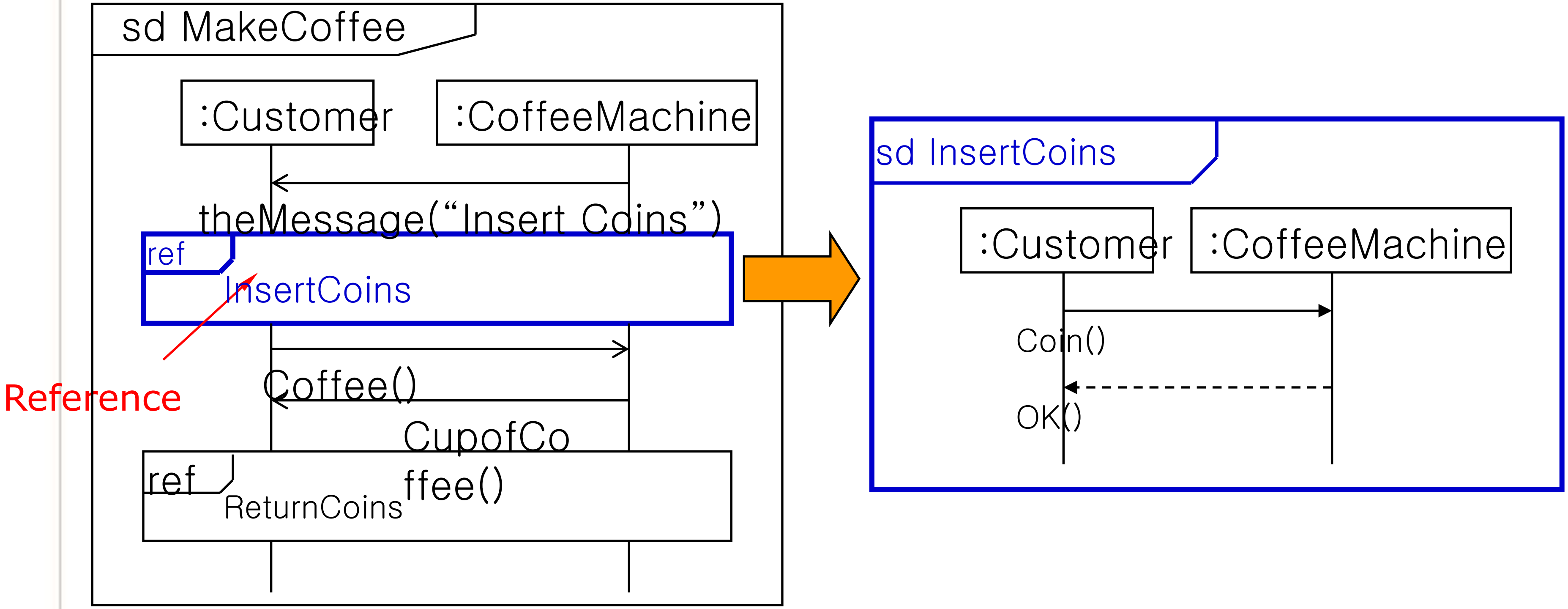
ref ReturnCoins

Message name

Messages line

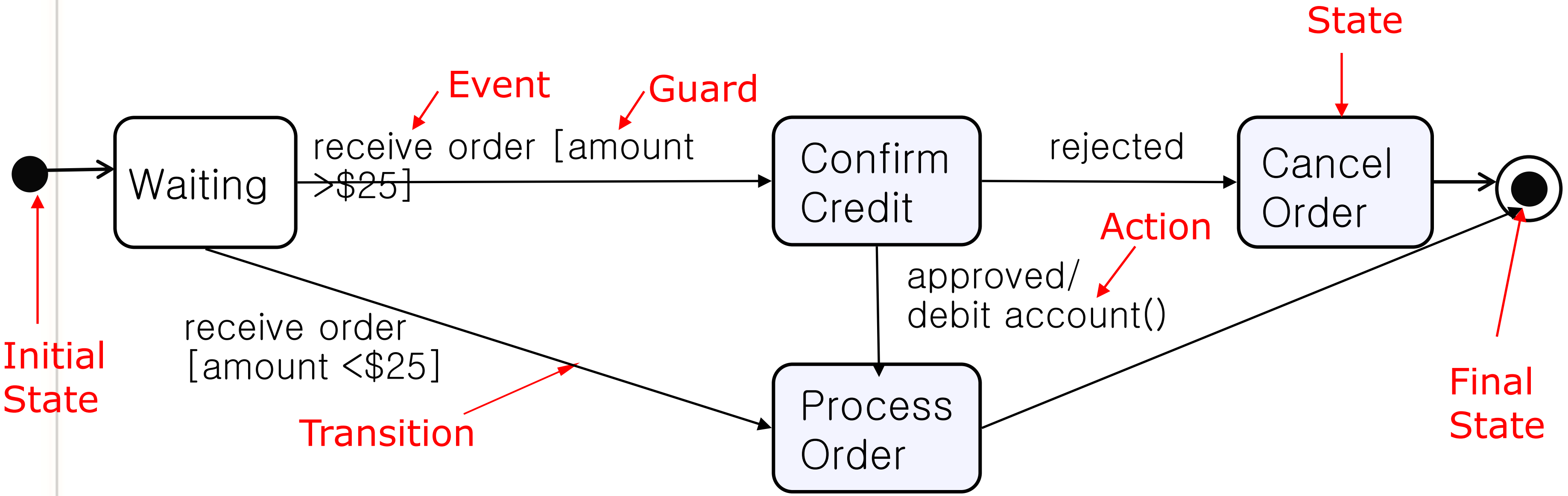
Referencing

- Reuse already existing sequence diagrams
  - Avoid unnecessary duplication



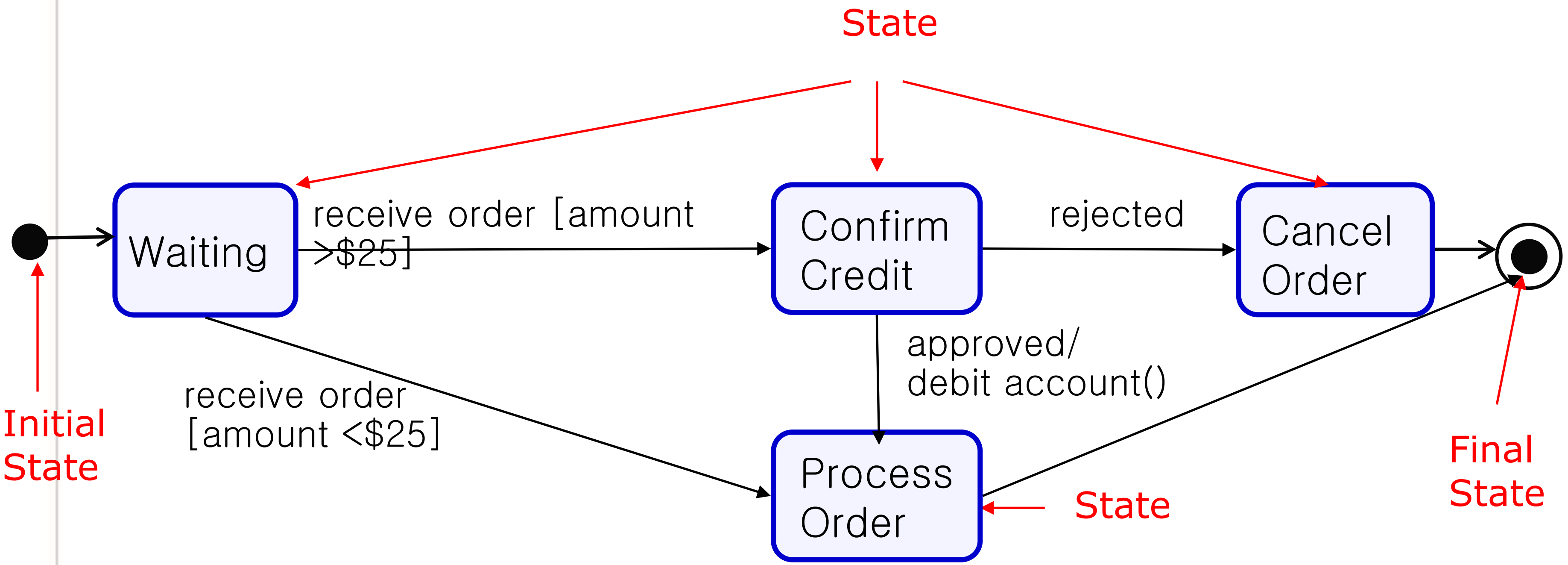
State Machine Diagram

- Specify the dynamic behavior of an element
- Show
  - The life history of a given class
    - Capture significant events that can act on an object
  - The event that cause a transition from one state to another
  - The actions that result from a state change



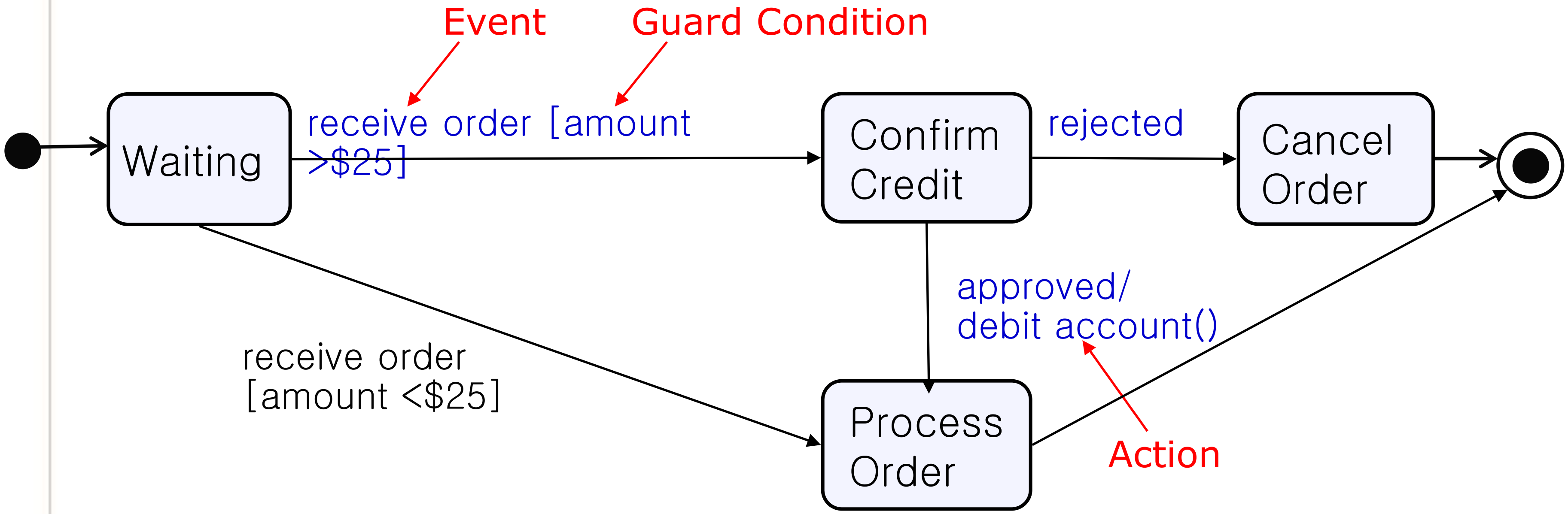
States

- State
  - Condition or situation during the life of an object
    - Satisfies some condition, performs some activity or waits for some event



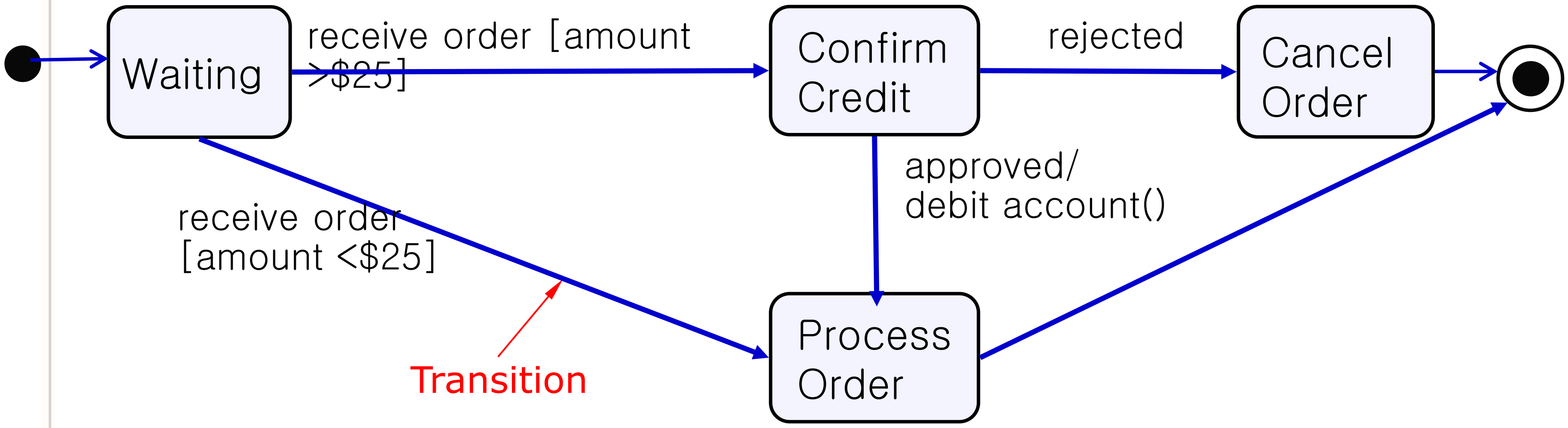
Event and Action

- Event
  - Stimulus which causes the object to change state
- Action
  - Output of a signal or an operation call

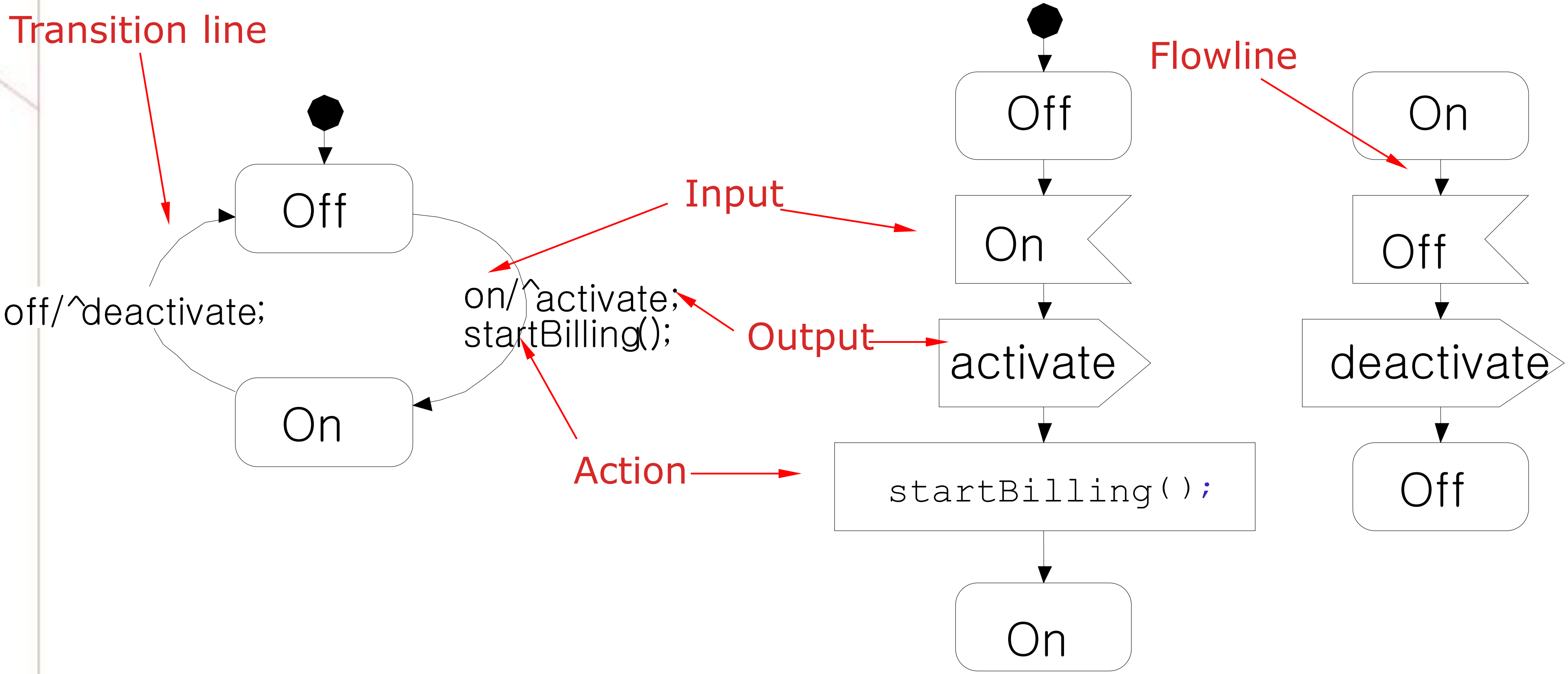


Transition

- Change state from one to another triggered by an event
- Occur only when guard condition is true
- Syntax: event(arguments)[condition]/action


Waiting
receive order [amount >$25]
Confirm Credit
rejected
Cancel Order
receive order [amount <$25]
approved/ debit account()
Process Order
Transition

State or Transition-oriented Syntax



- Transition line: transition details shown on line textually
- Flowline: simple line; transition details shown in chained symbols

Q & A