Contents(1)

- **Goal and Scope**
- **Basic Concepts on OOT**
  - Basic Concepts to represent the world
  - Basic Concepts for Reuse
  - Information Hiding Principle and Java Program
  - Superiority of OOT
- **Modeling Techniques**
  - Static Model: Class and Association
  - Dynamic Model: State Machine
  - Dynamic Model: Interaction Diagram
  - Concurrency Description: Active Object and Multi-thread Programming
  - Outline of UML2.0

Dynamic Model

- **State Machine**
  - Describe which states an object can have during its life cycle
- **Sequence Diagram**
  - Describe how objects interact and communicate with each other
  - The primary focus in sequence diagrams is time
- **Communication Diagram**
  - Describe how objects interact
  - But the focus in a collaboration diagram is space

Object Interaction (Message)

- **Synchronous** 
  - procedure call or other nested flow of control
- **Return** 
  - return from a procedure call
- **Simple** 
  - Flat flow of control
- **Asynchronous** 
  - Asynchronous flow of control.

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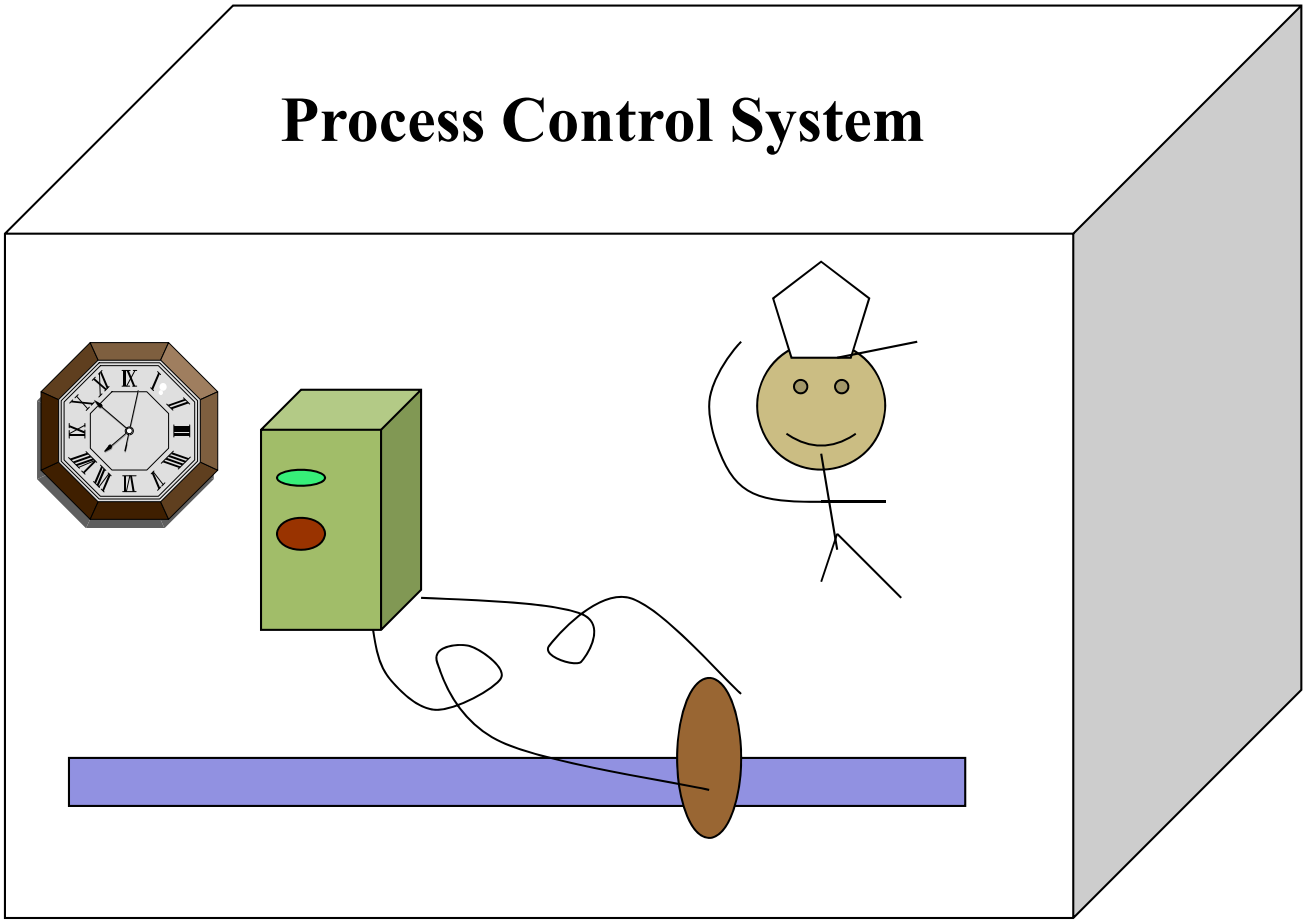
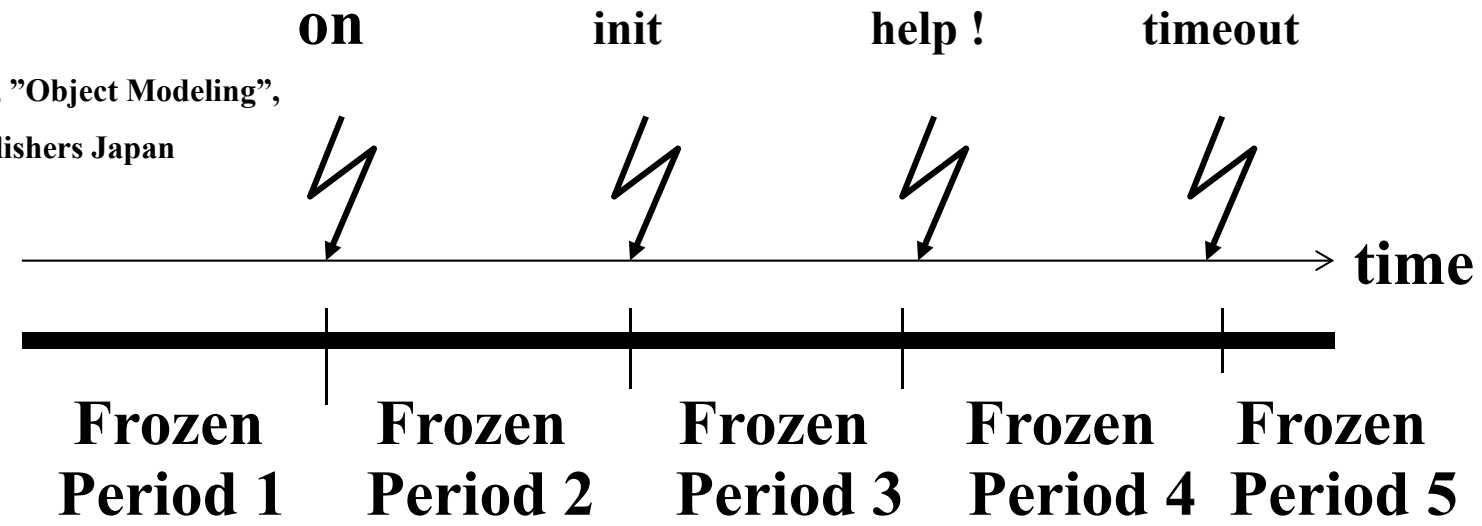
Defining behavior of the system by a state diagram

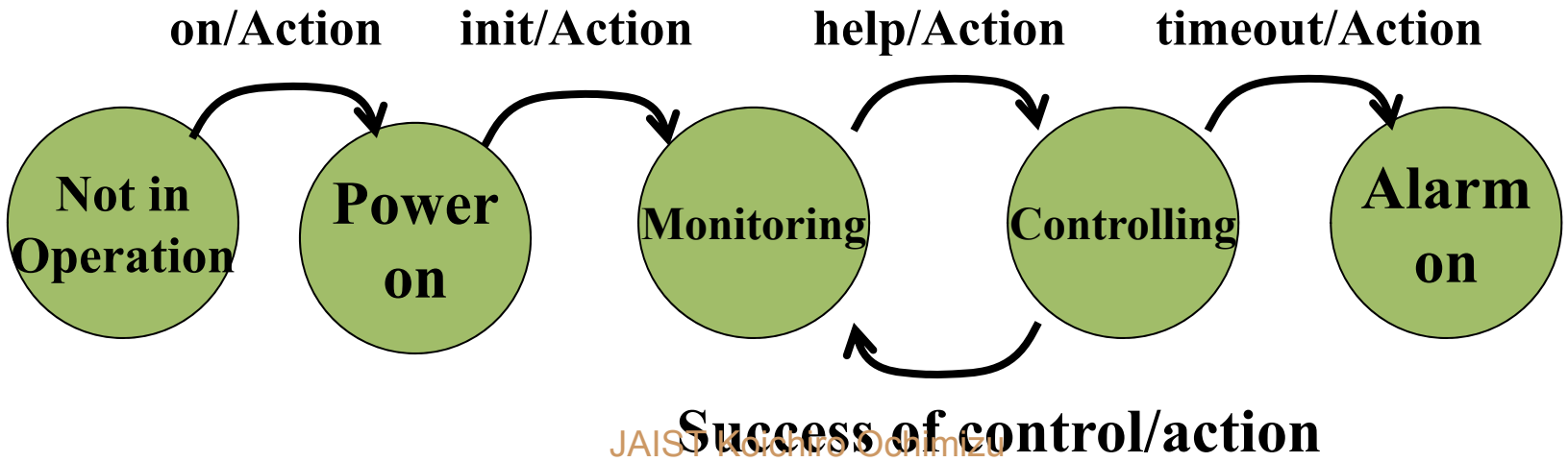


Ochimizu, Higashida, ”Object Modeling”, Addison-Wesley Publishers Japan

What is a State ?

Ochimizu, Higashida, ”Object Modeling”,
Addison-Wesley Publishers Japan

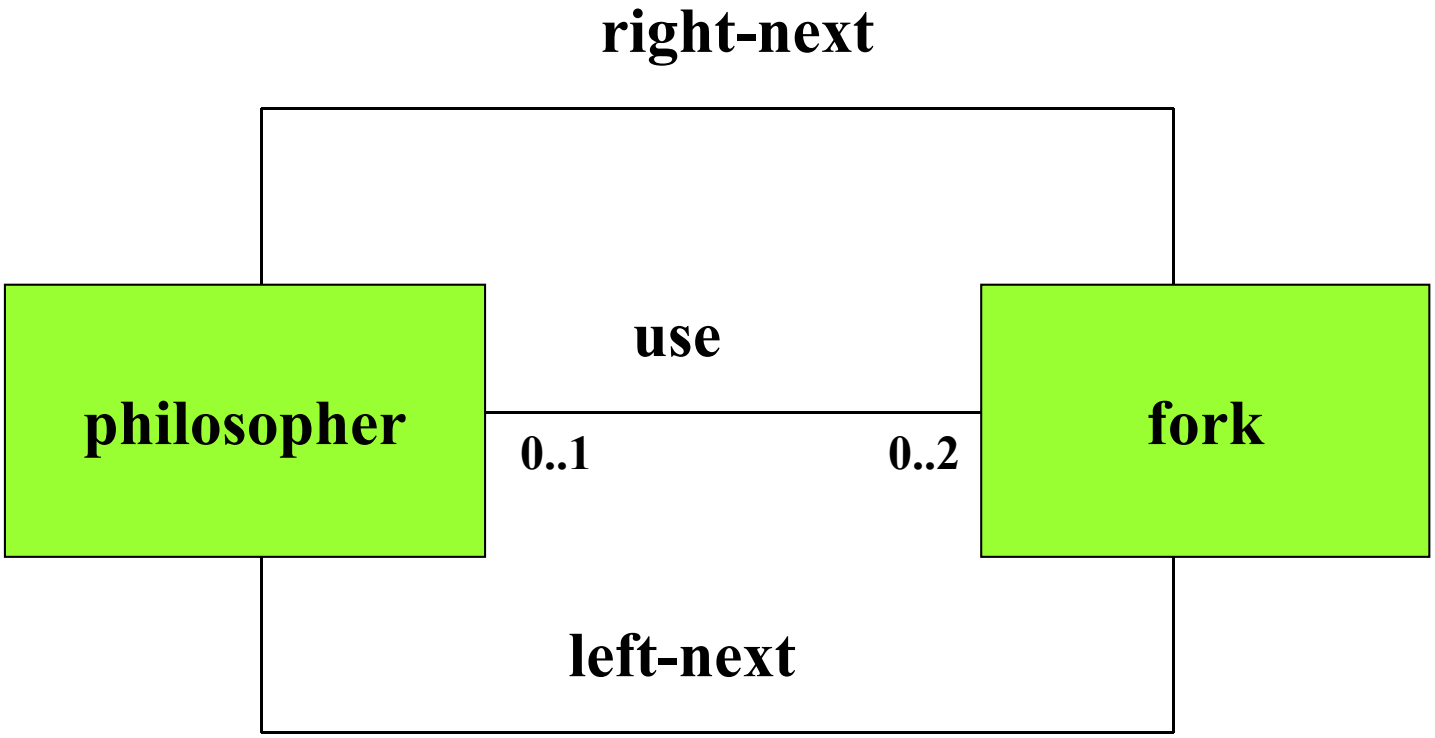




State Model

- Represent the behavior of an object by a state transition diagram.

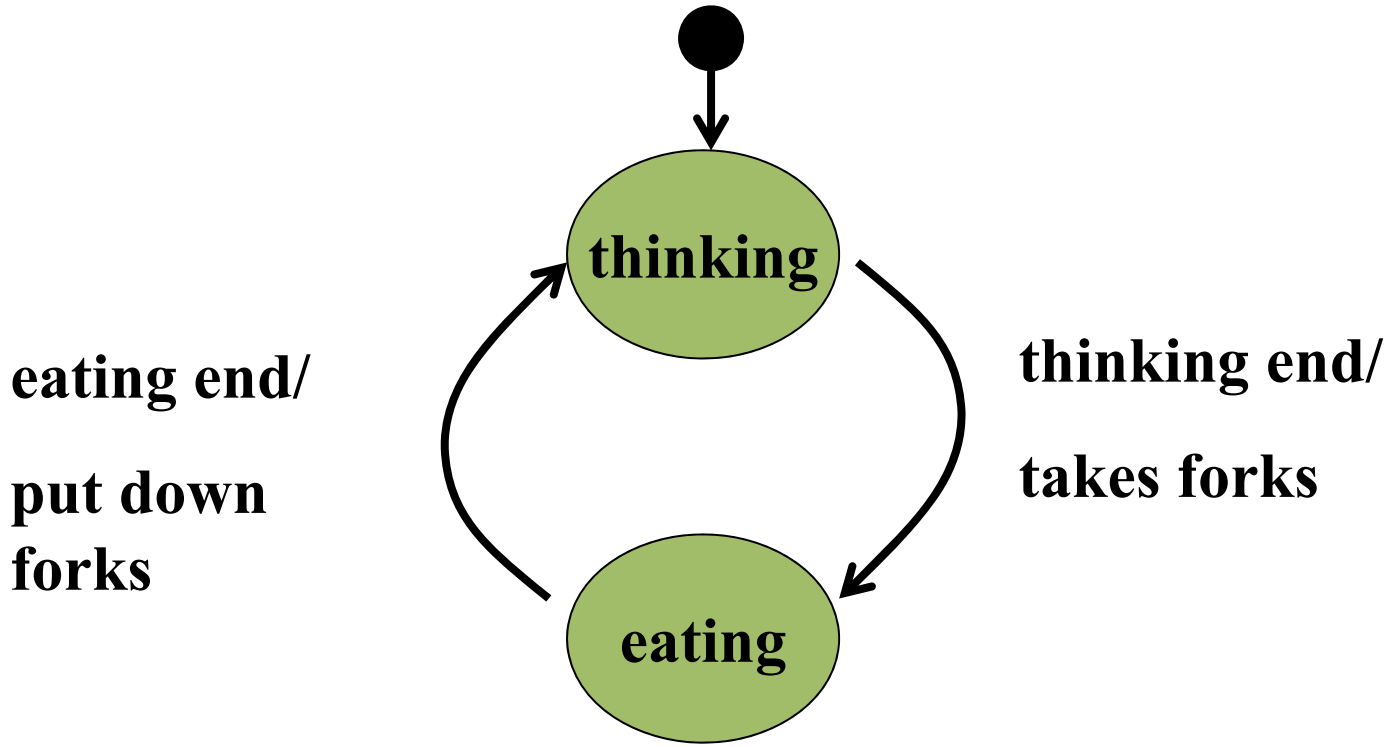
Defining the behavior of philosopher and fork



Each philosopher must use right next fork and left next one not used

Ochimizu, Higashida,"Object Modeling", Addison-Wesley Publishers Japan

Behavior of a Philosopher



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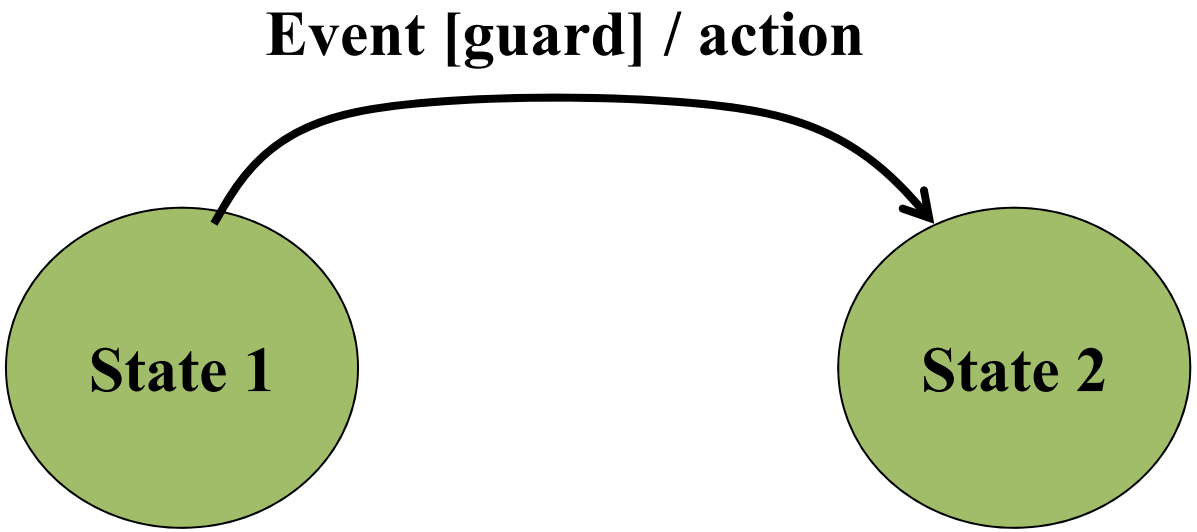
State transition depends on the state of forks both side



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Detailed behavior of a philosopher

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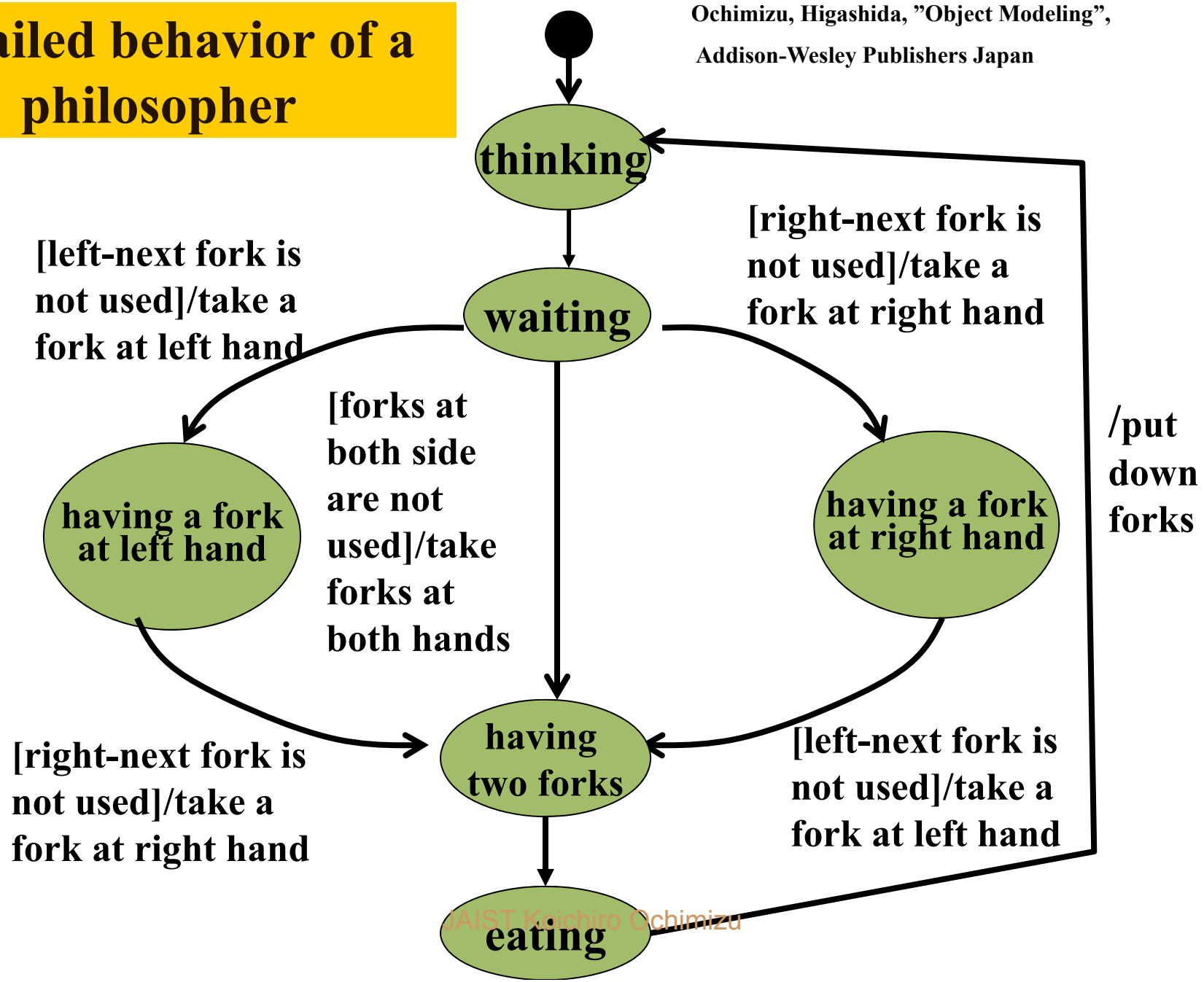

Passive Object and Active Object

- **Passive Object**
  - It is activated when it receives a message from other object (work when being hit)
- **Active Object**
  - It can change its state by itself and send a message to other object if necessary
- **In the case of philosopher**
  - **Philosopher's state of hunger changes autonomously during thinking and eating.**

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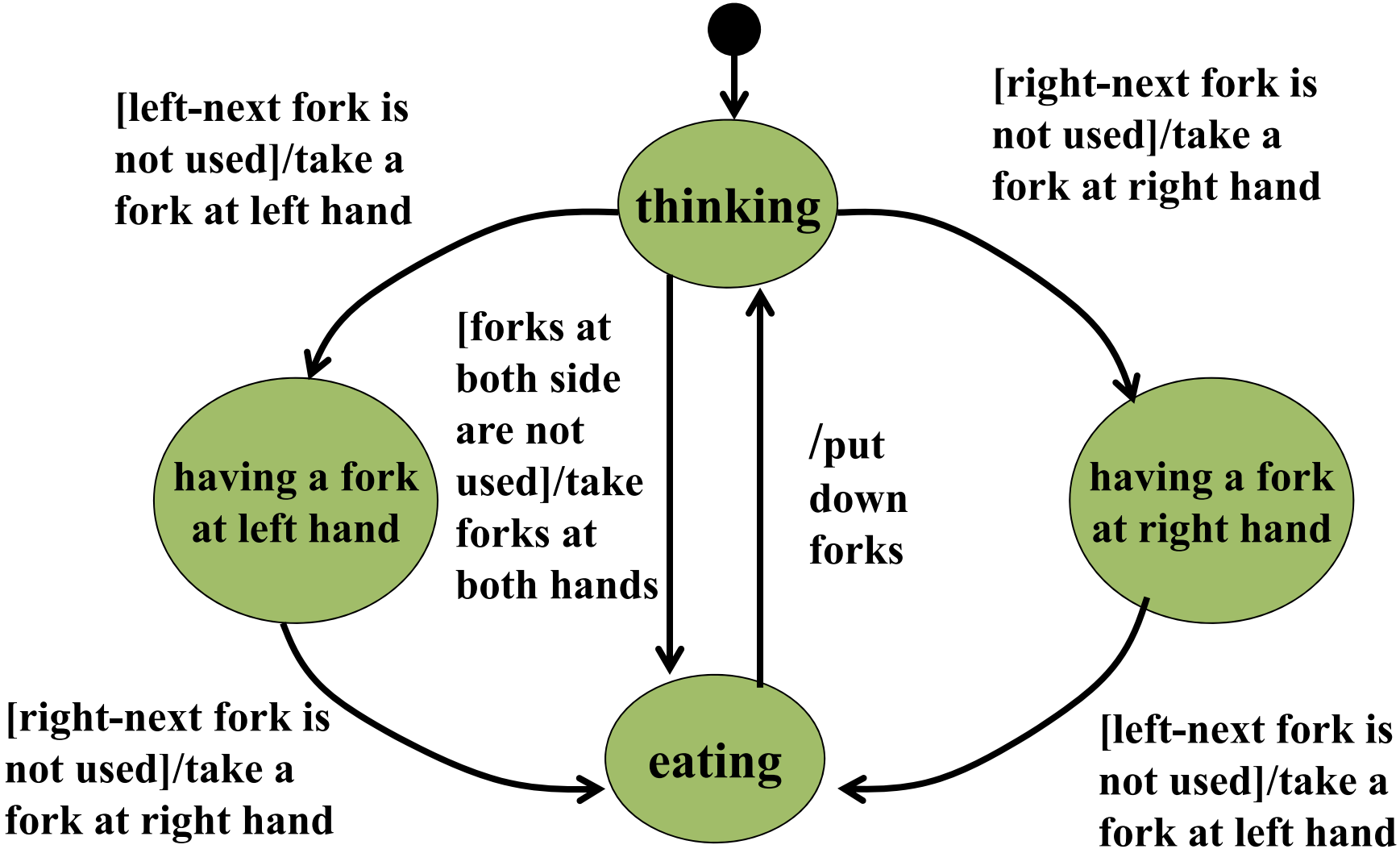
Simplified behavior



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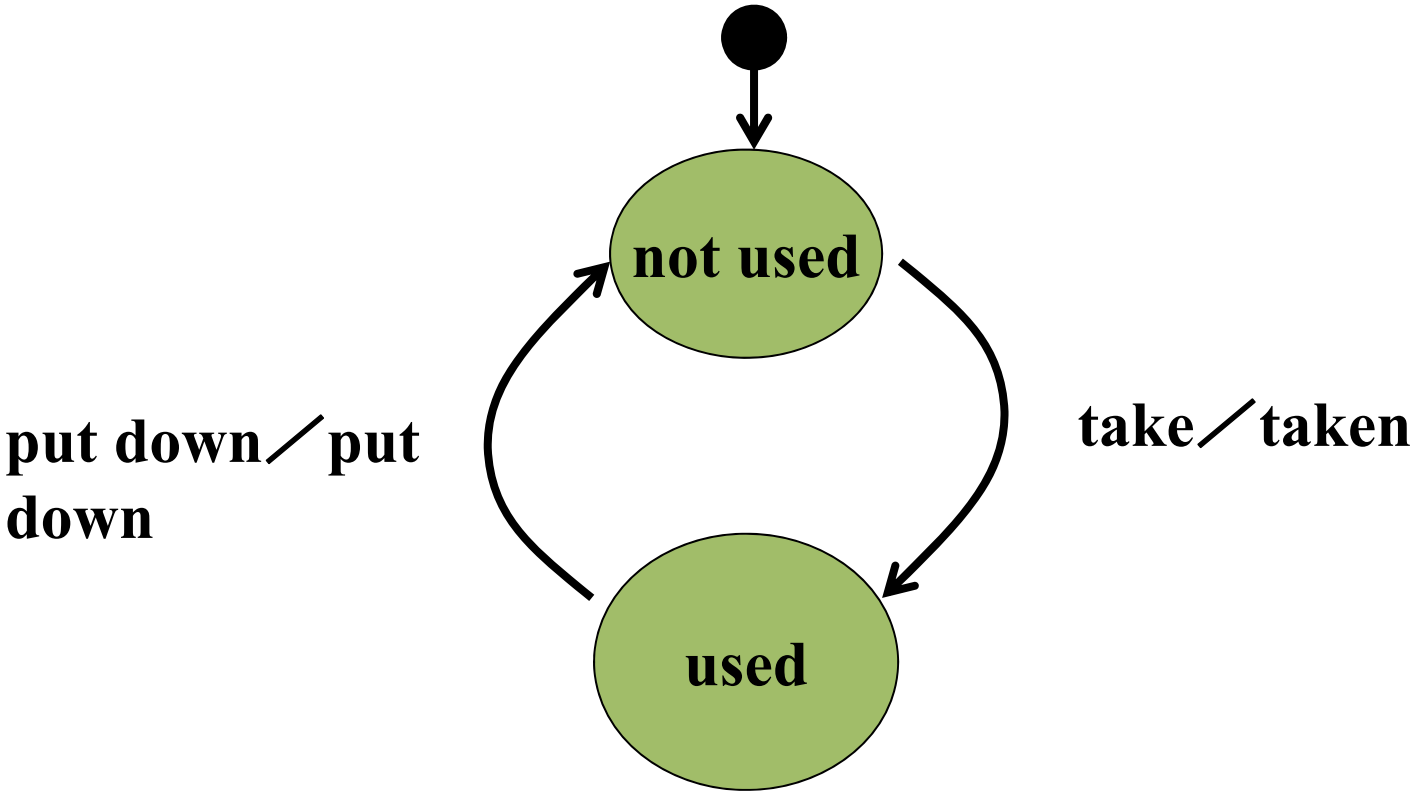
Defining the behavior of a fork



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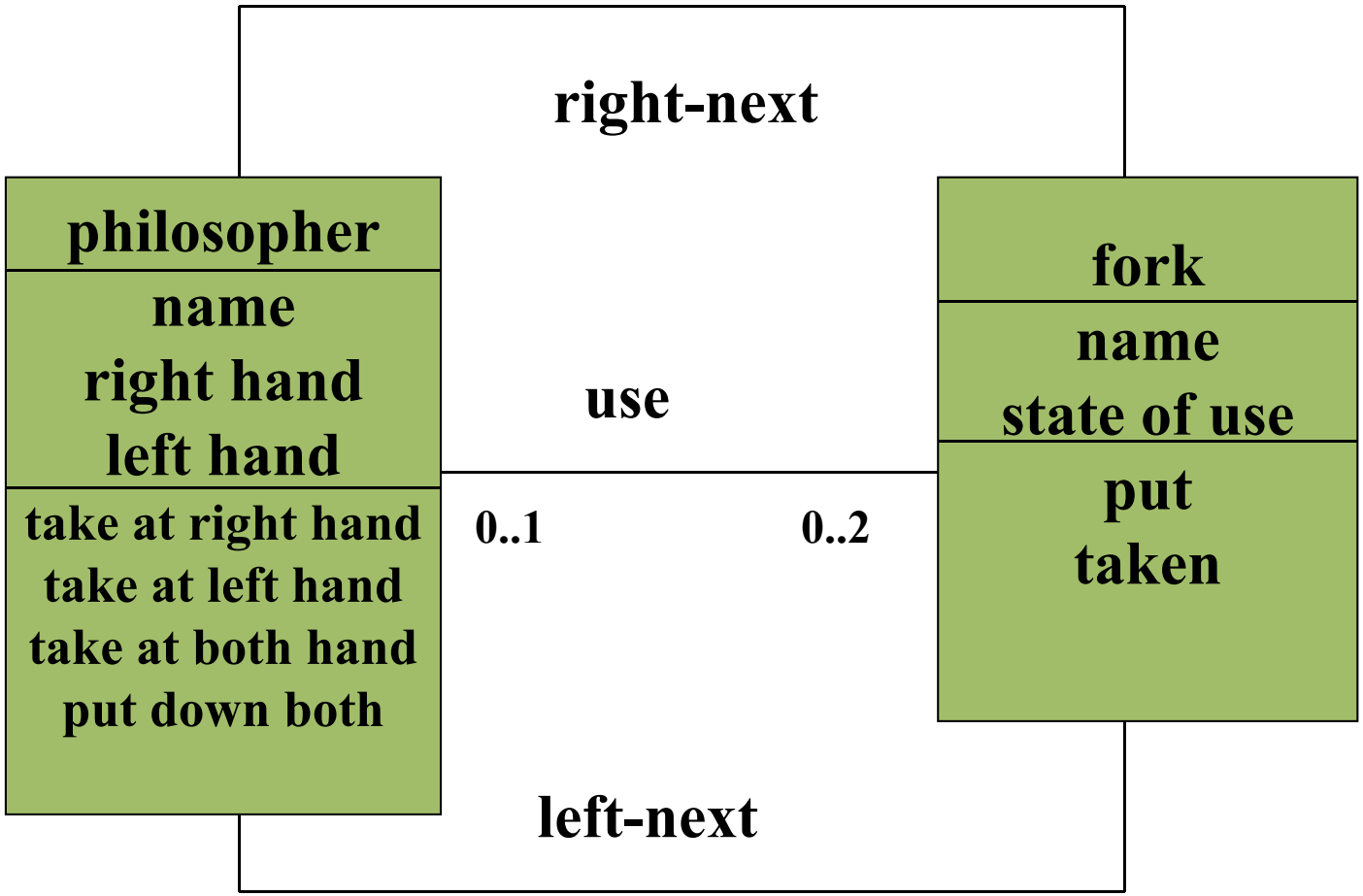
Class Diagram



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Execution

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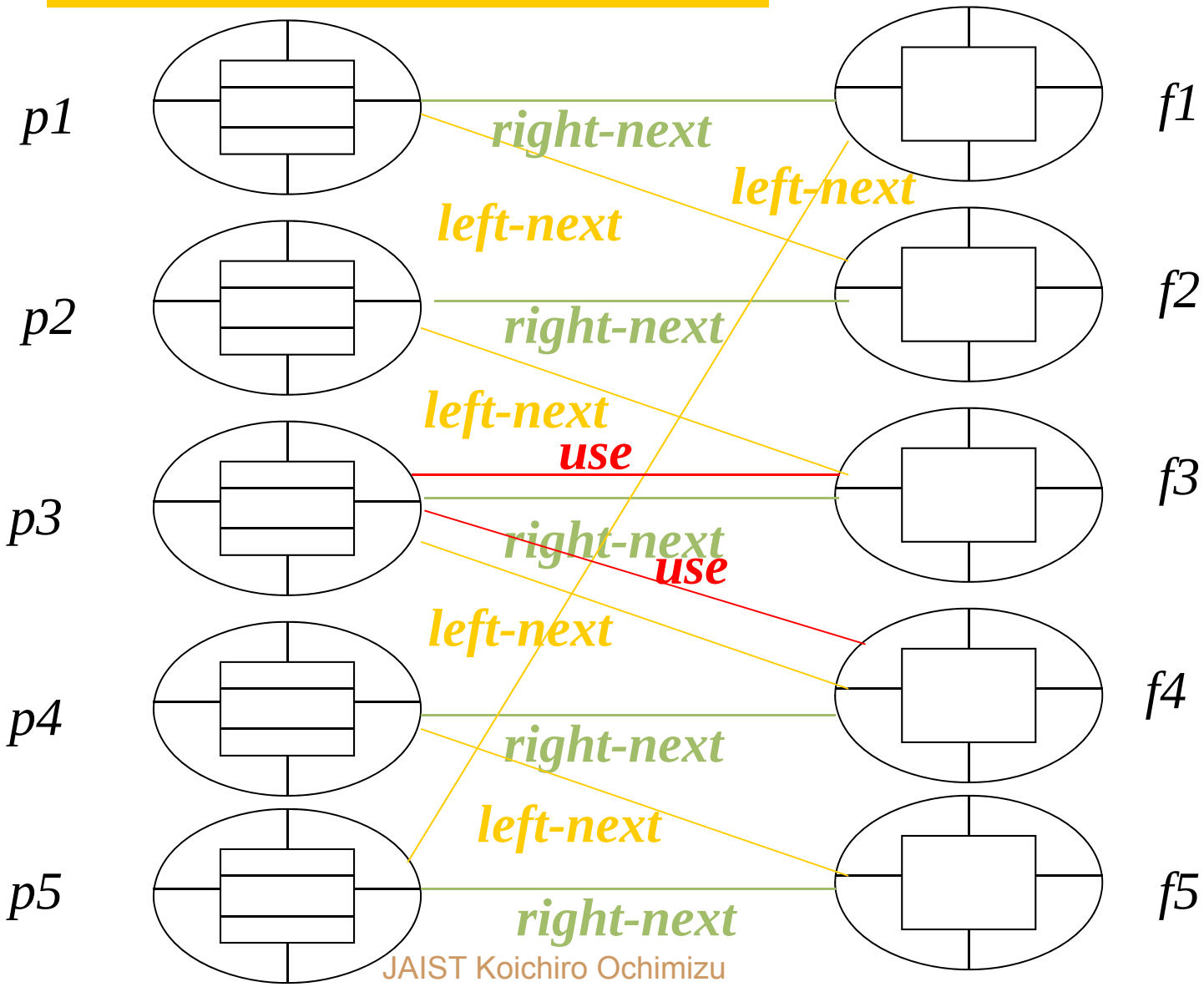
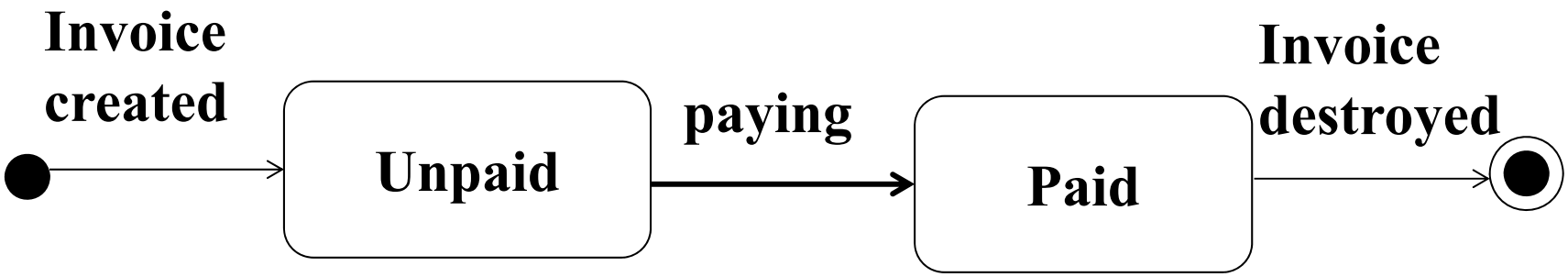


Initial State and Final State



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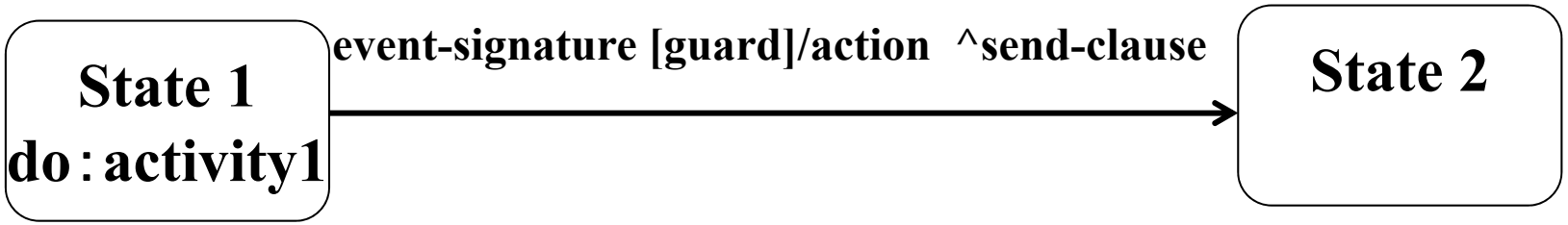
State Transition



event-signature: event-name (parameter list)

draw (f: Figure, C: color)

draw()

send-clause: destination-expression . Destination-event-name (argument list)

message sent during transition

[timer=time-out] ^ self.go down (first floor)

destination-expression: object or a series of objects

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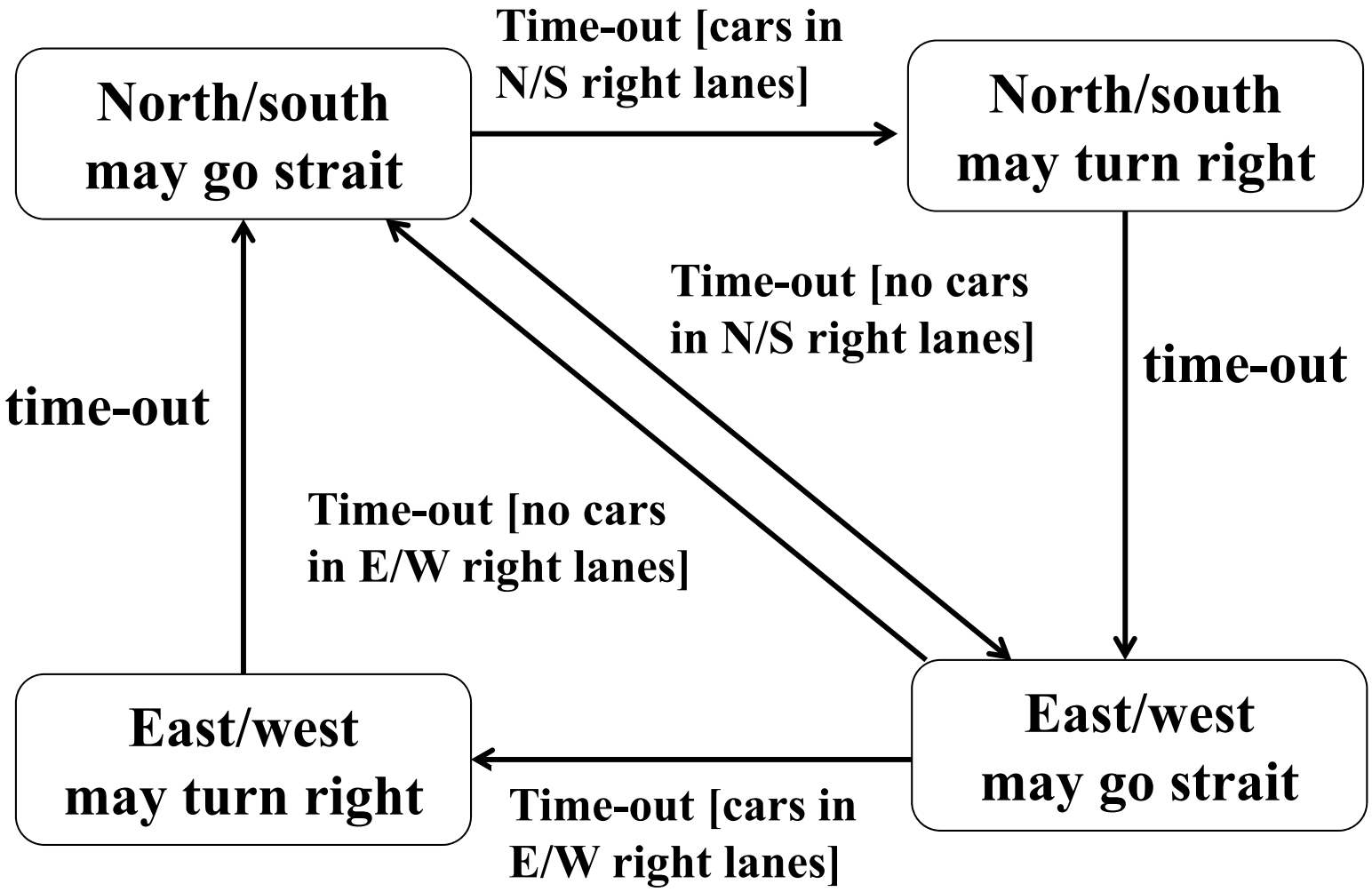
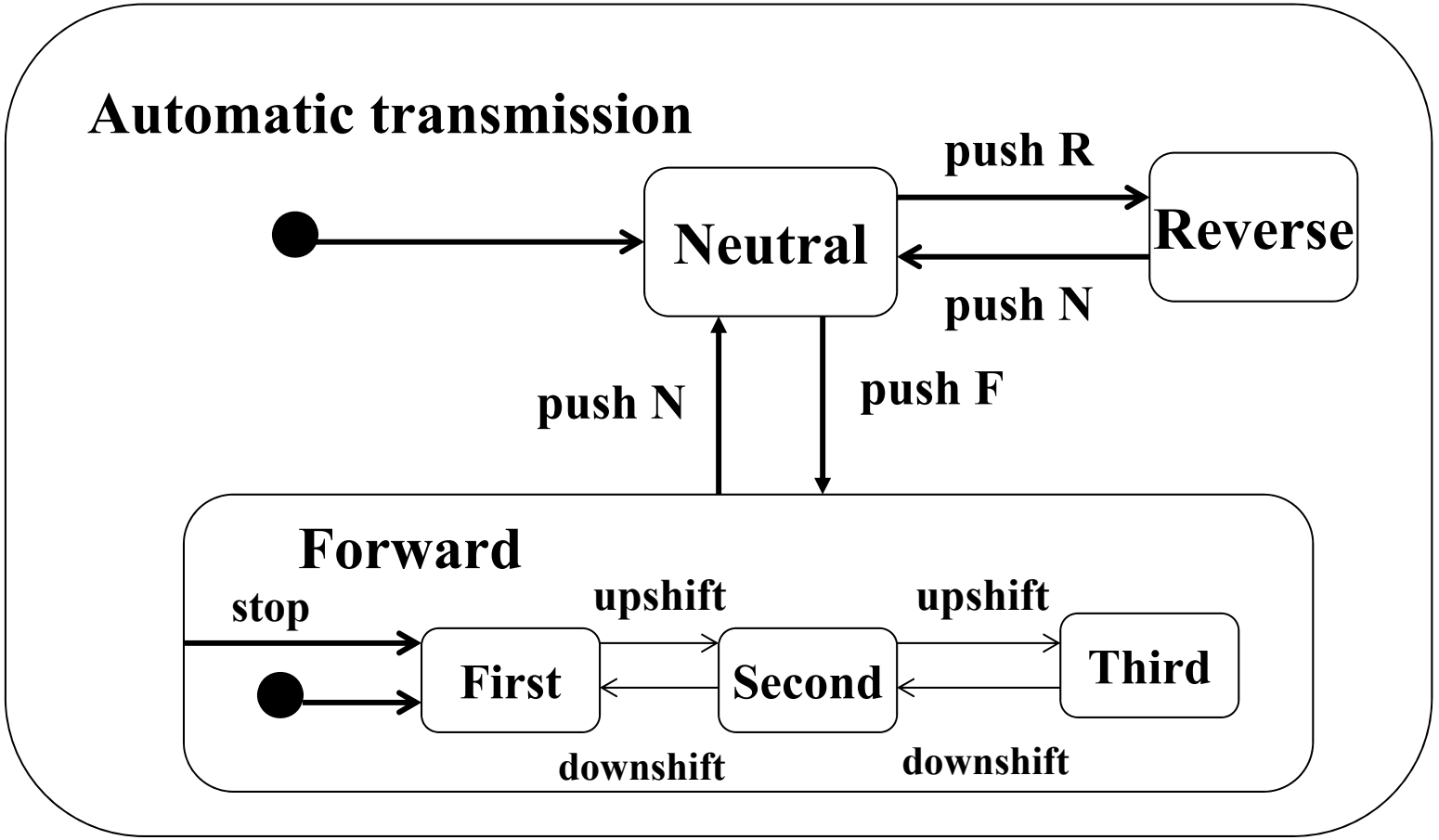
Guard



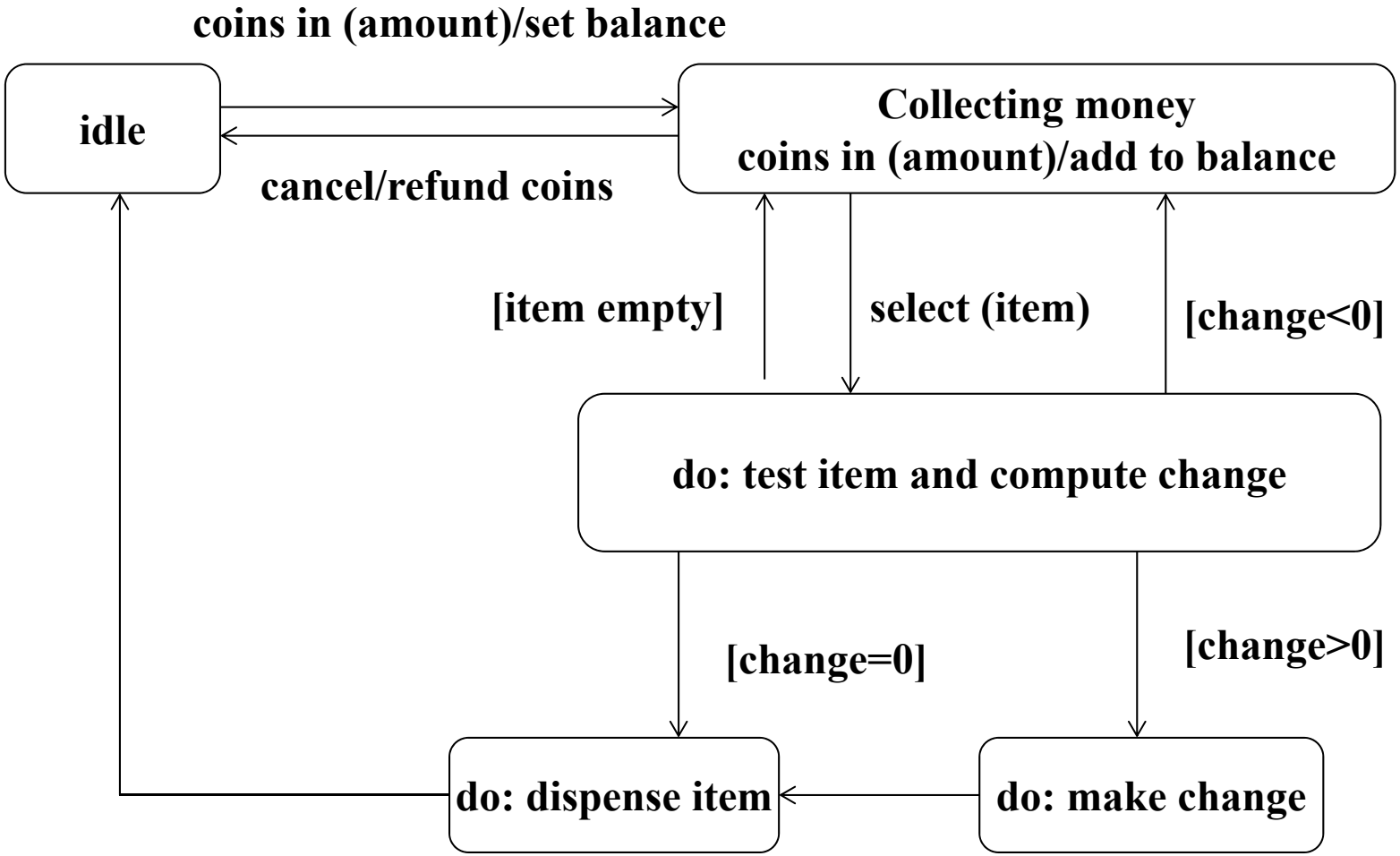
J.Rumbaugh,"Object-Oriented Modeling and Design", PrenticeHall,199.

State Generalization



J.Rumbaugh,"Object-Oriented Modeling and Design", PrenticeHall,199.

Automatic Transition



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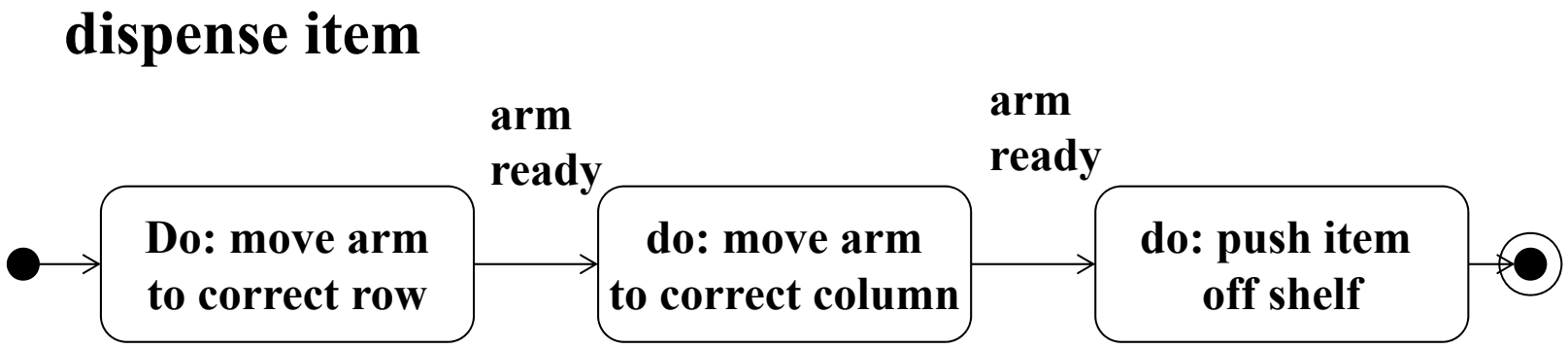
Sub diagram



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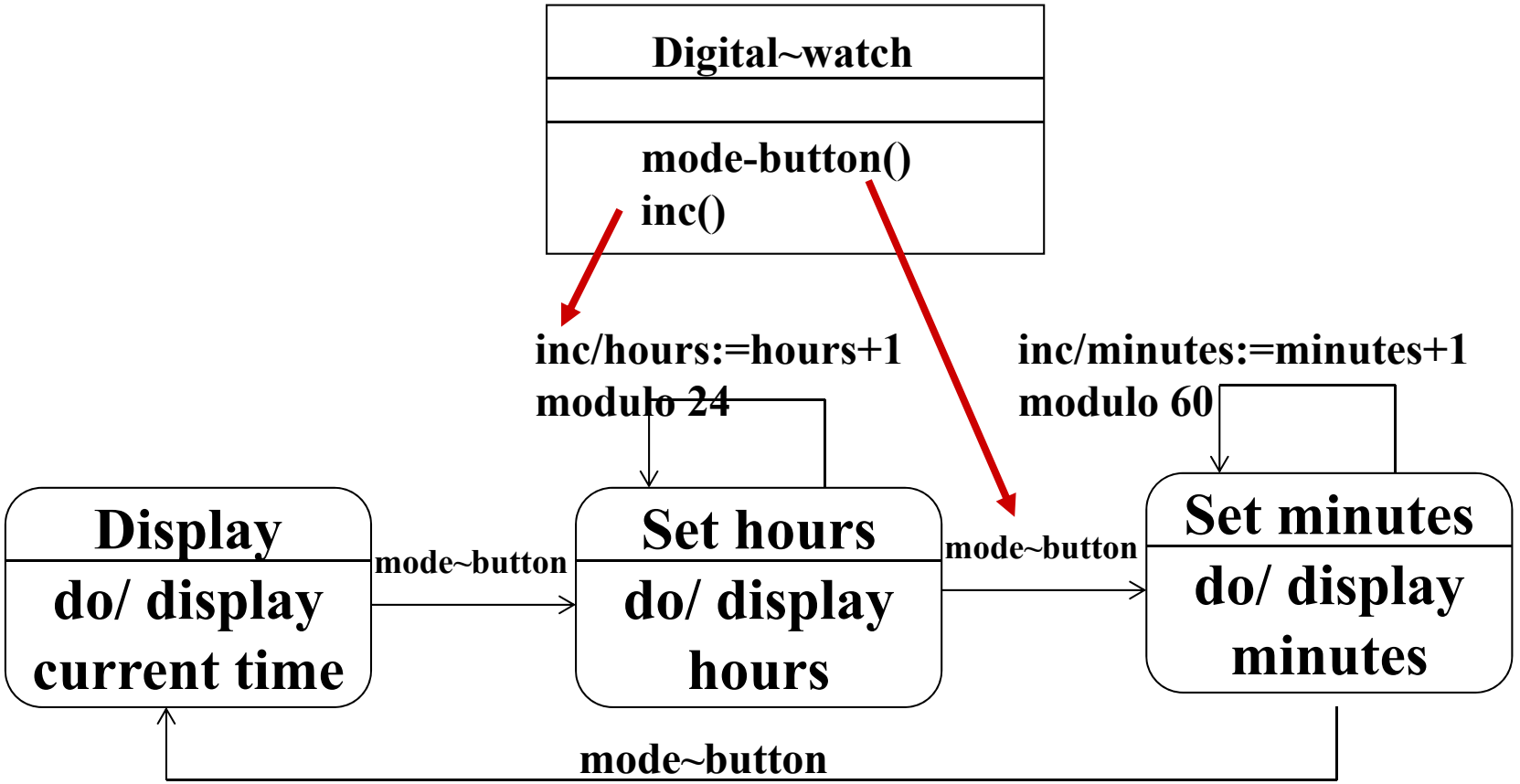
Events in the state diagram correspond with operations within the class



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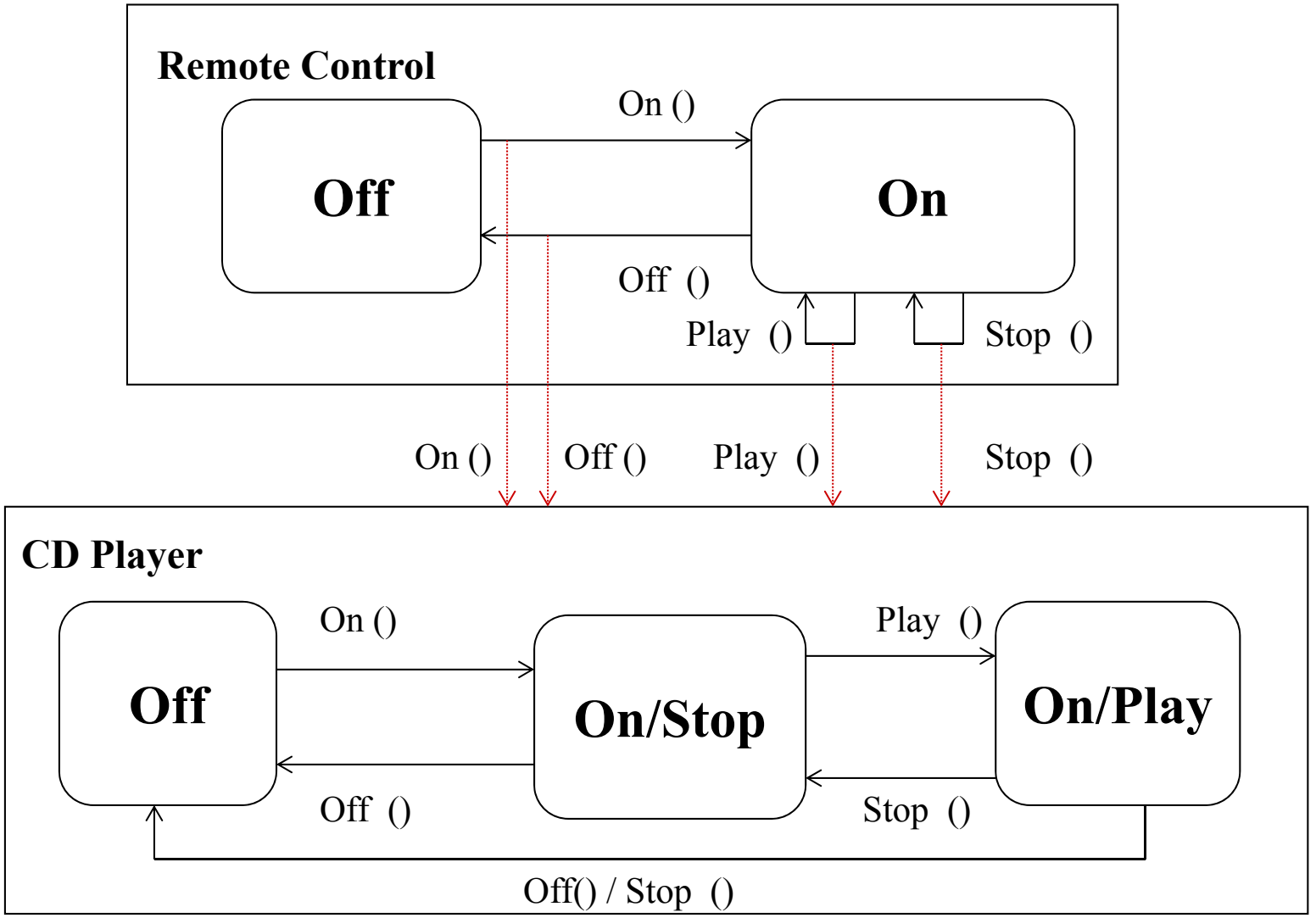
Message passing between two state diagram



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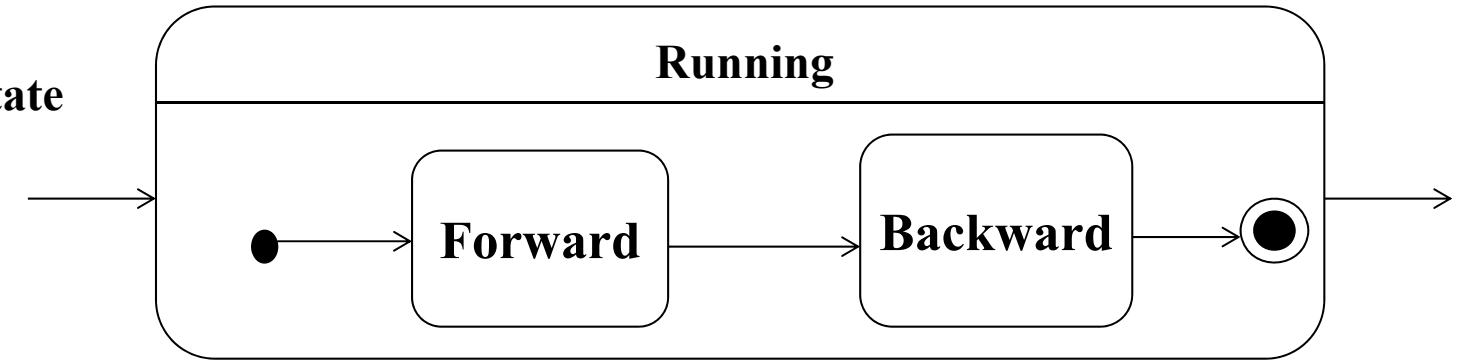
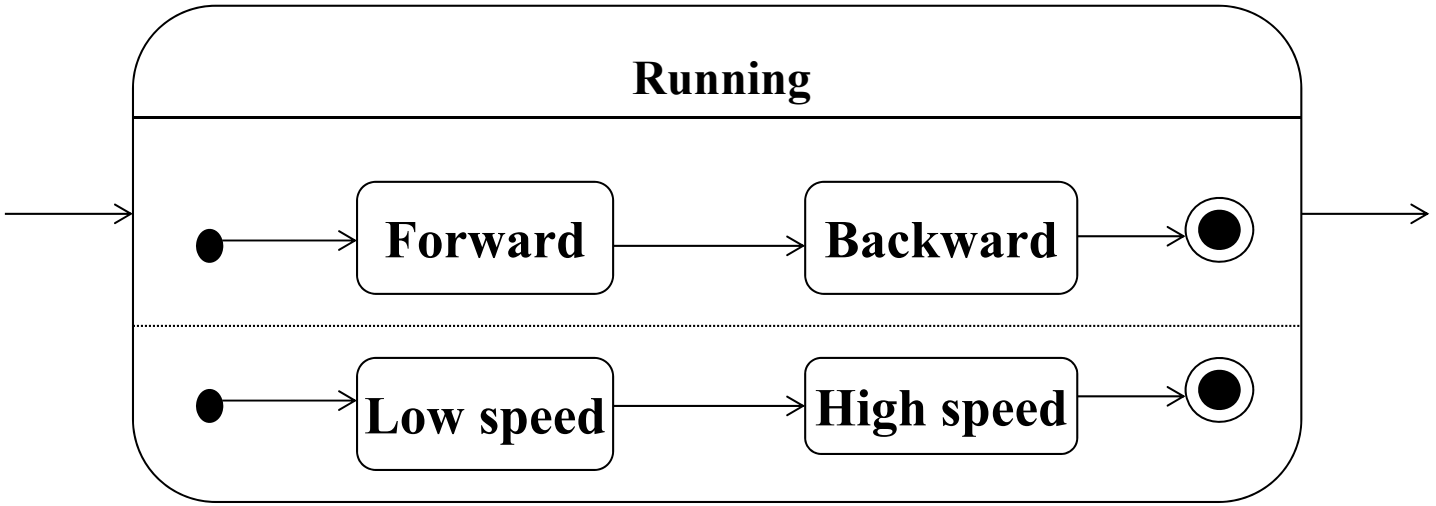
Or-substate and And-substate

Or-substate



And-substate



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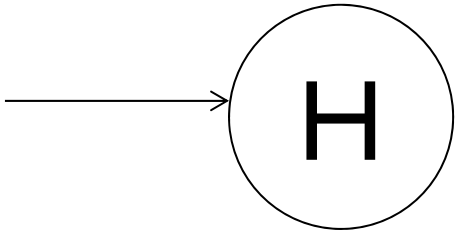
History Indicator

- is used to memorize internal state
- Support roll-back
- If a transition to the indicator fires, the object resumes the state it had last within that region
- Shown as a circle with an H



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Sequence Diagram

- Sequence diagrams illustrate how objects interact with each other.
- They focus on message sequences, that is, how messages are sent and received between a number of objects.
- Sequence diagrams have two axes: the vertical axis shows time and the horizontal axis shows a set of objects.
- The instance form describes a specific scenario in detail
- The generic form describes all possible alternatives in a scenario, therefore branches, conditions, and loops may be included.:

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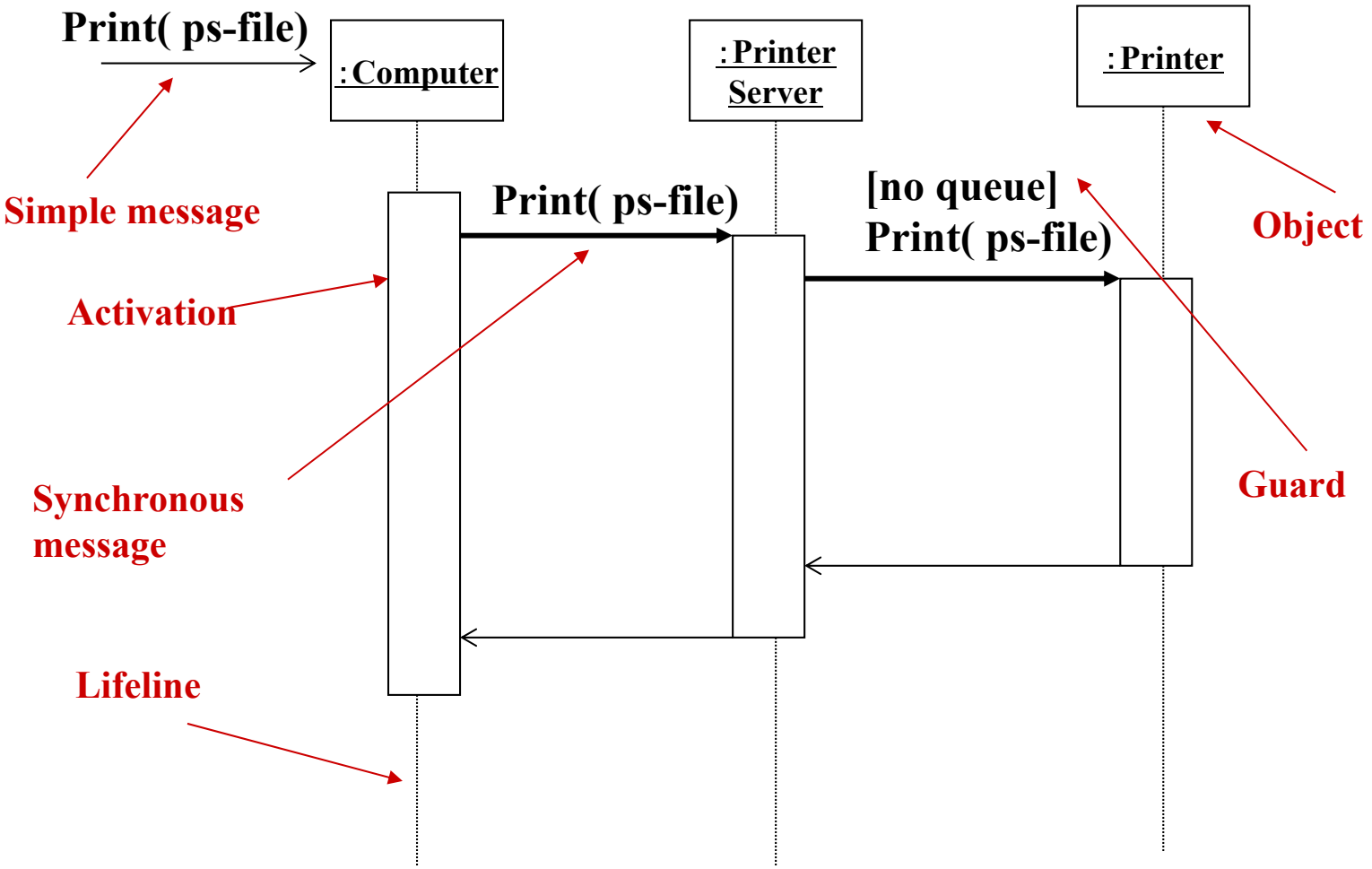
The Concepts used In a sequence diagram



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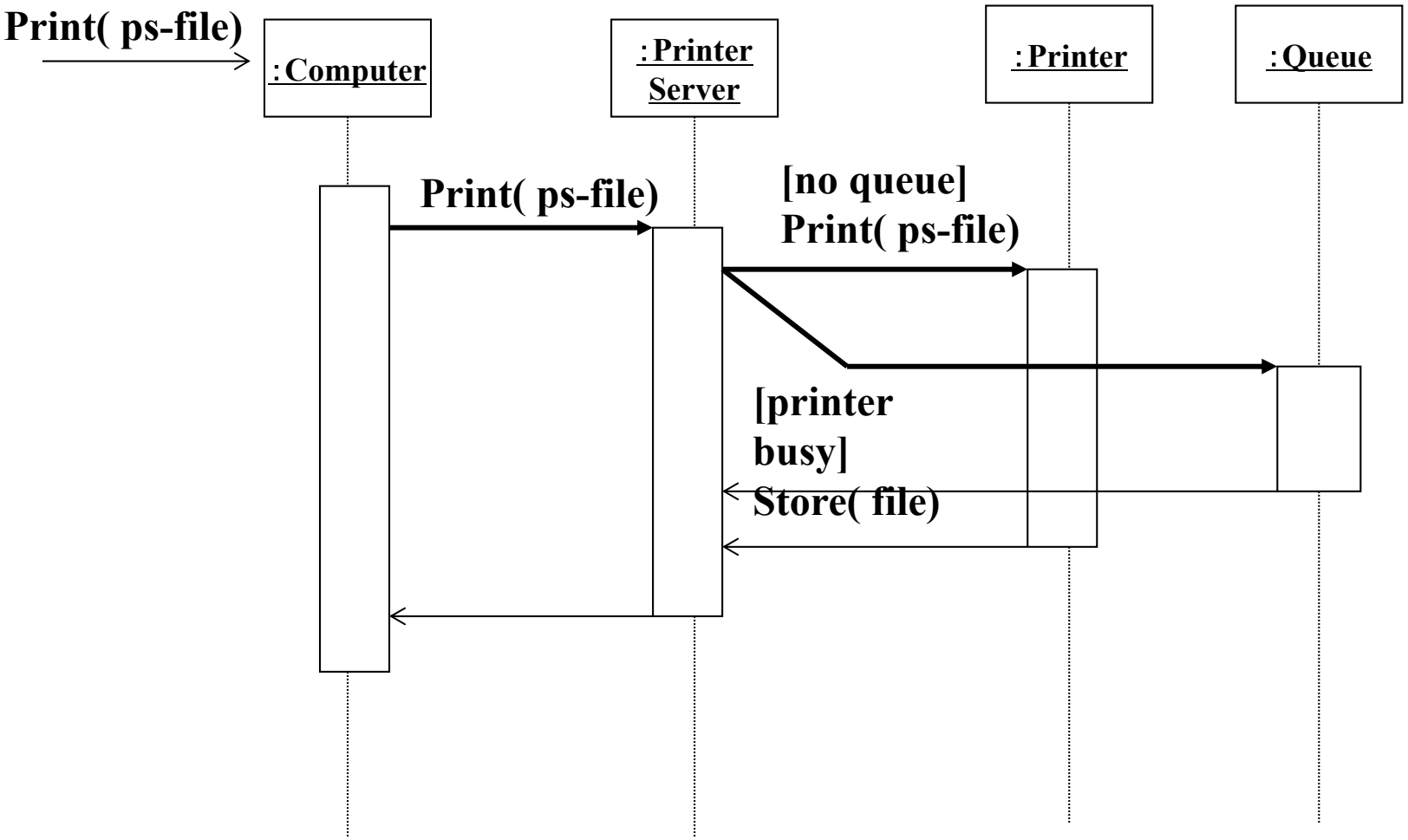
Sequence diagram with Branch



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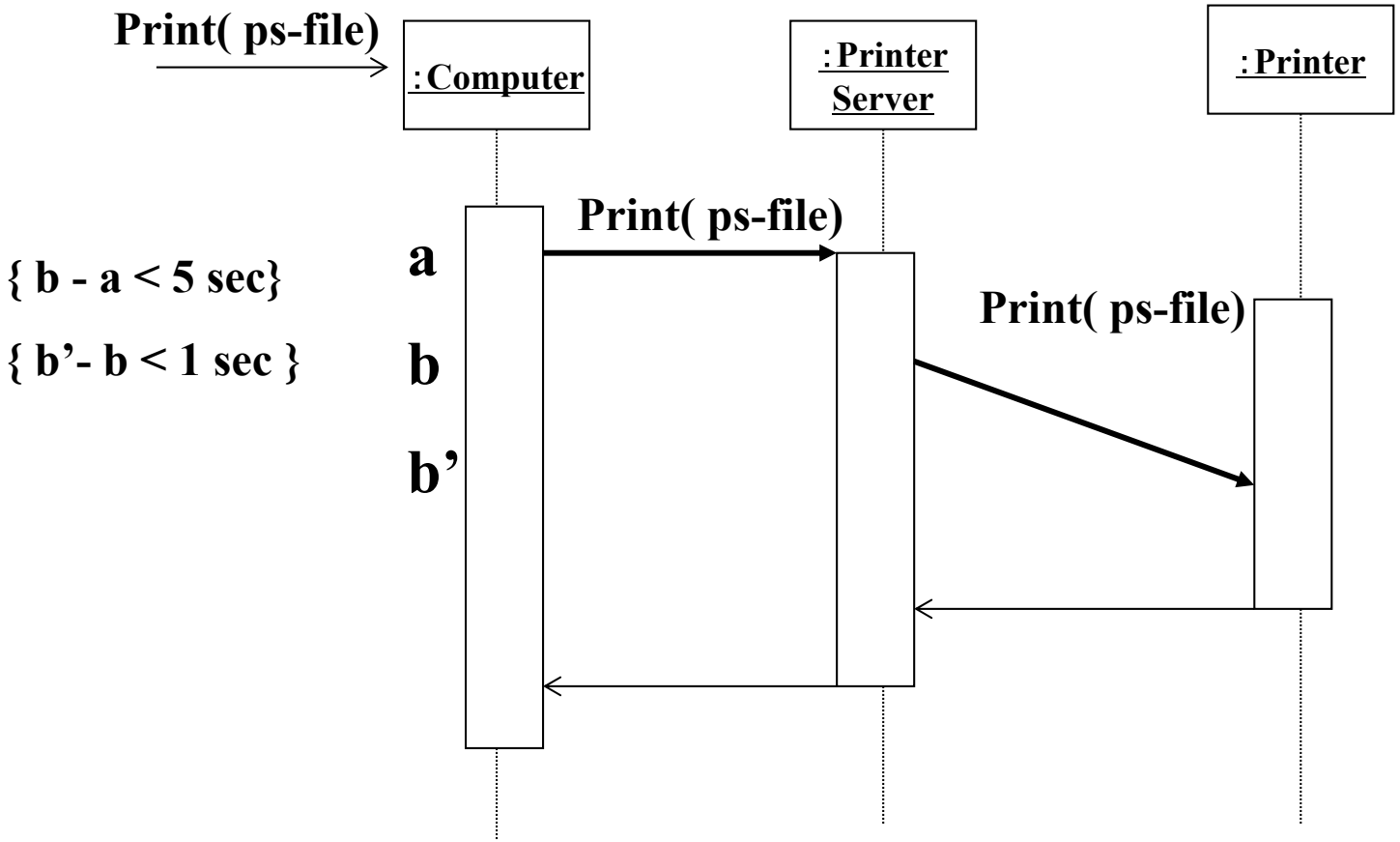
Timing Constraint



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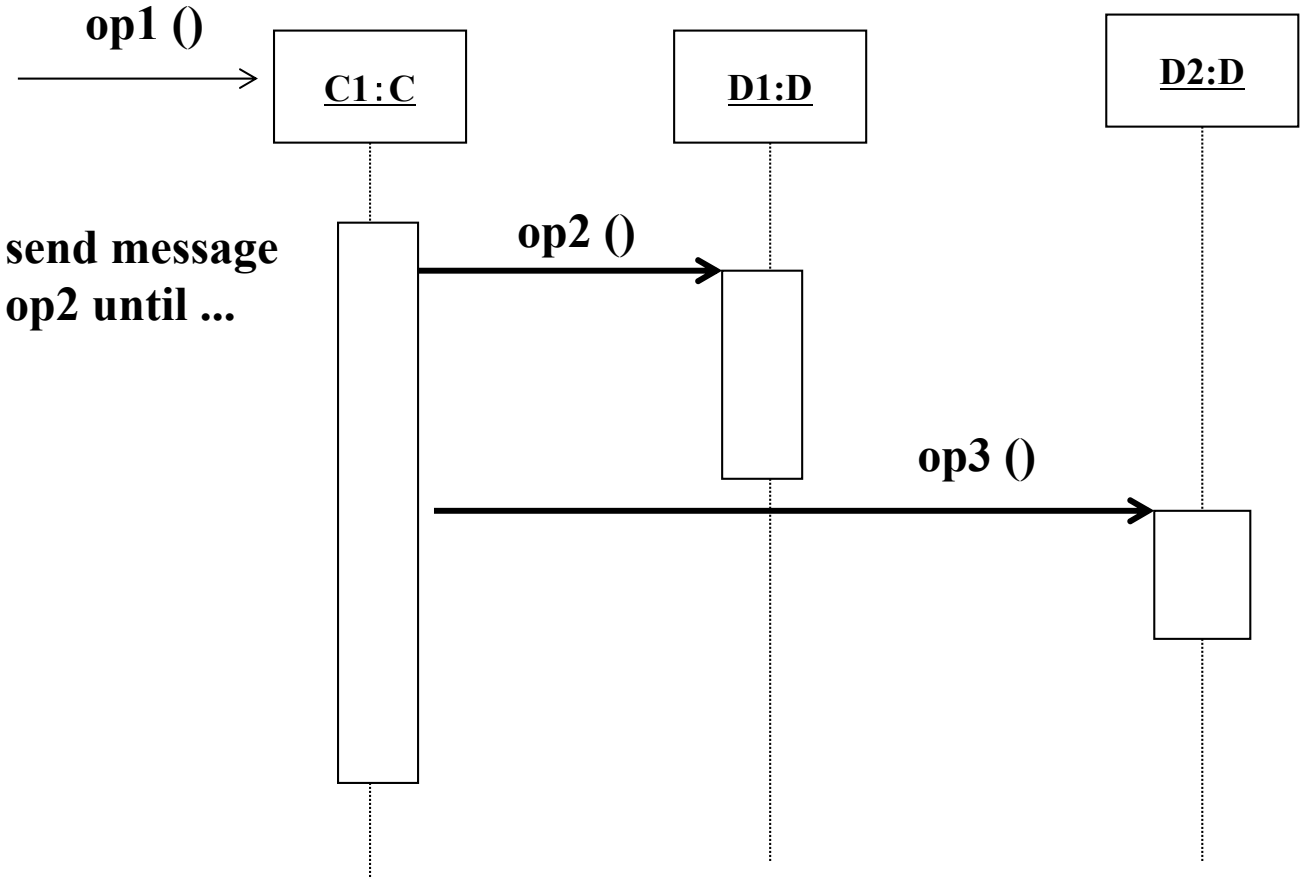
Iteration



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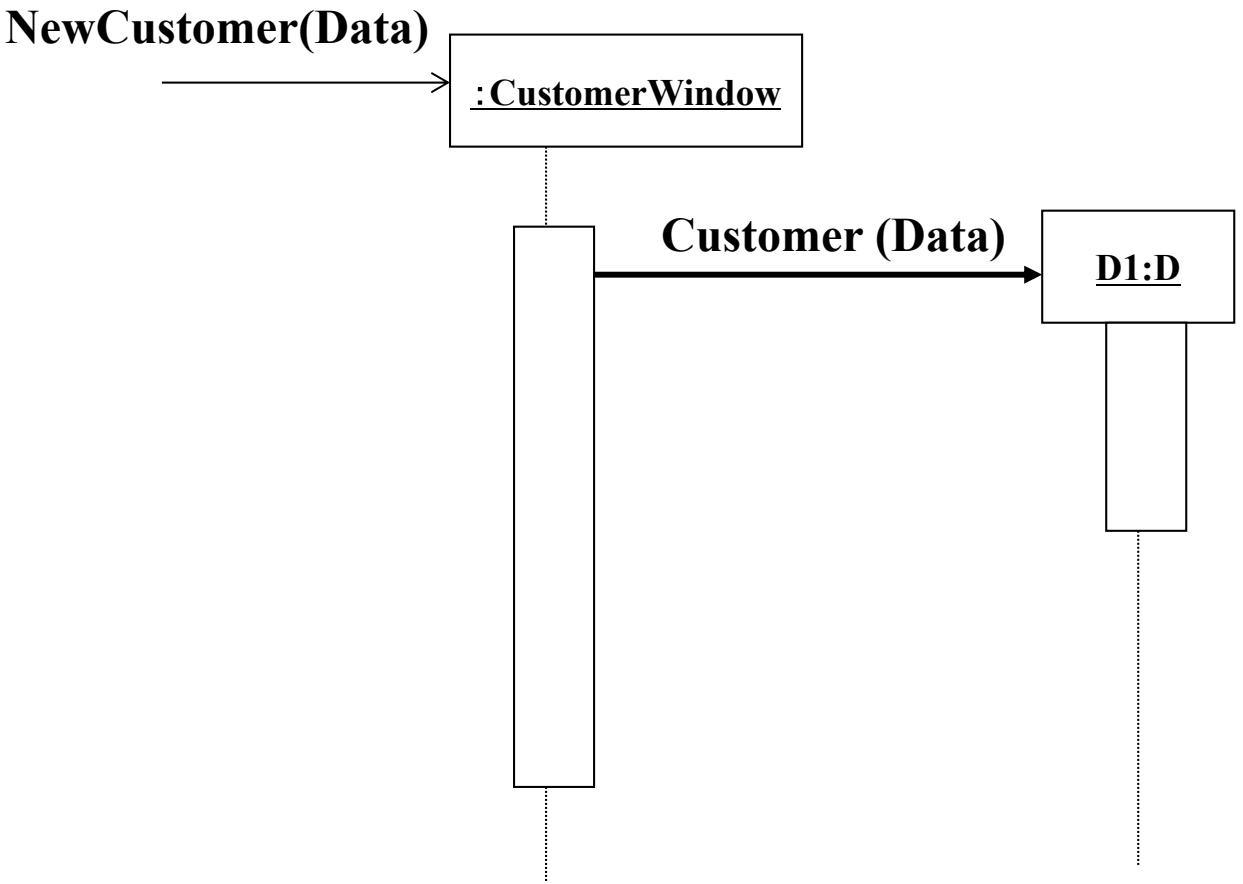
Creating Object



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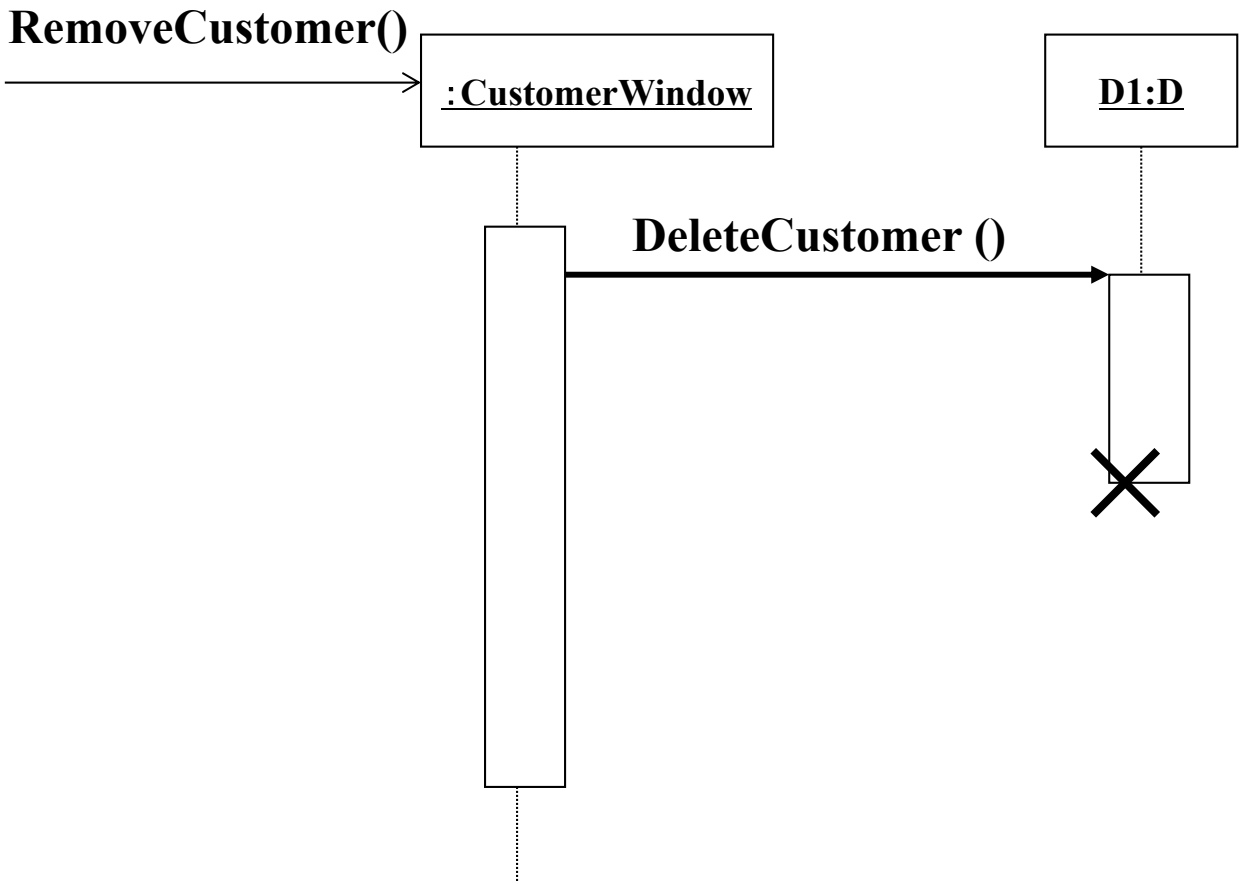
Destroying Object



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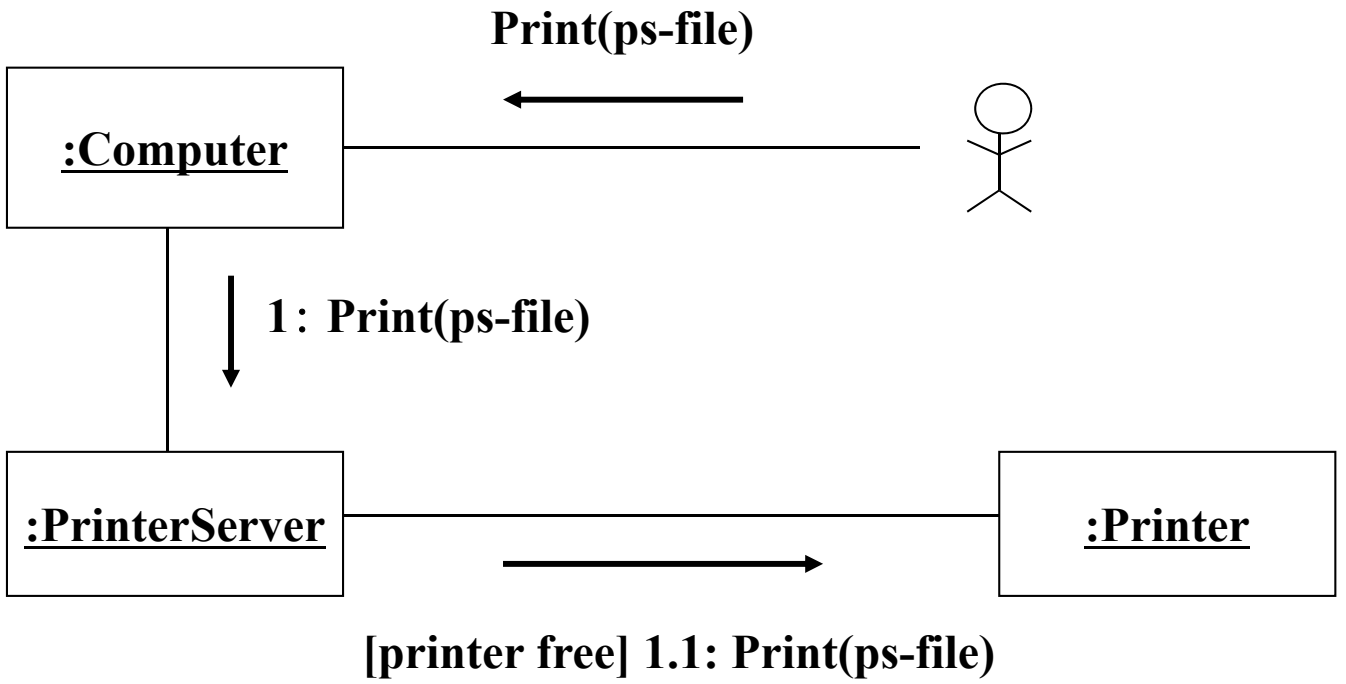
Communication Diagram

- Communication diagrams focus on the interaction and the links between a set of collaborating objects. The sequence diagram focuses on time but the communication diagram focuses on space.

An example of a communication diagram



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Message Label

predecessor guard-condition sequence-expression return-value := signature

sequence-number , … /

The predecessor is an expression for synchronization of threads or paths, meaning that the messages connected to specified sequence-number must be performed and handled before the current message is sent.

[integer | name] [recurrence]

- integer a sequence-number specifying the message order 1.2.1
- name concurrent thread of control 1.2a 1.2b
- recurrence * [iteration-clause] [condition-clause]
  a conditional or iterative exrcution

1: display()
[mode = display] 1.2.3.7: redraw()
2 * [n:=1..z]: prime:=nextPrim(prim)
3.1 [x < 0] : foo()
3.2 [x => 0] : bar()
1.1a, 1.1b/ 1.2: continue()

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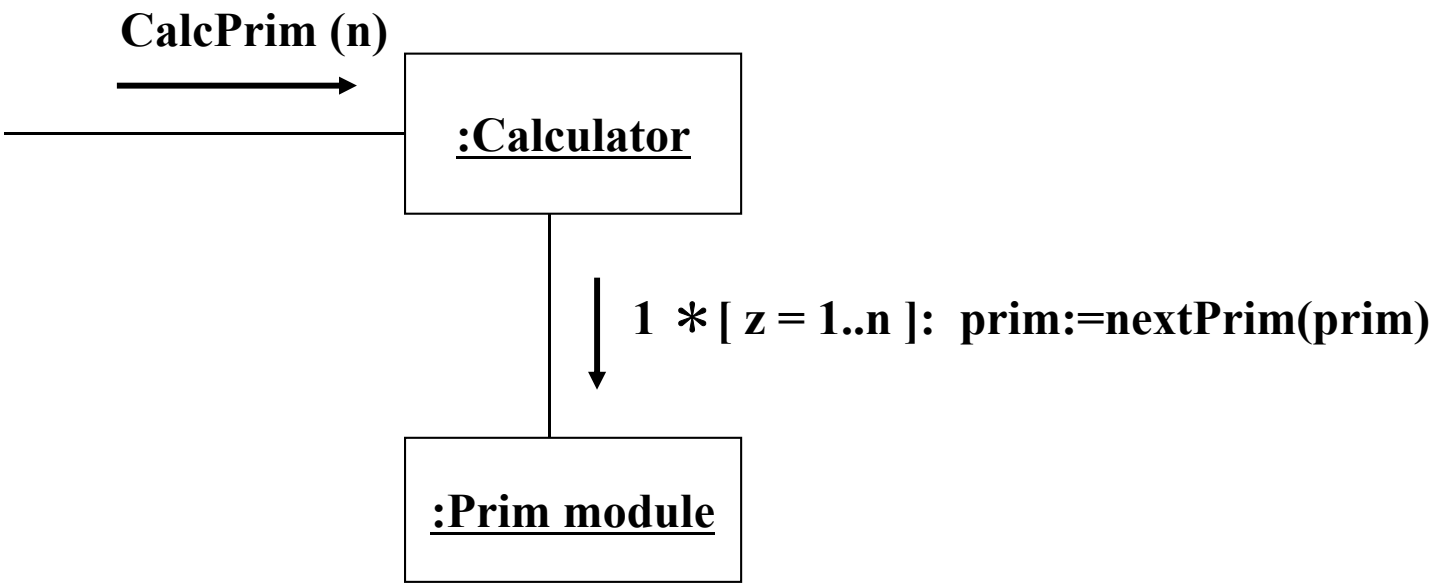
Iteration in a communication diagram



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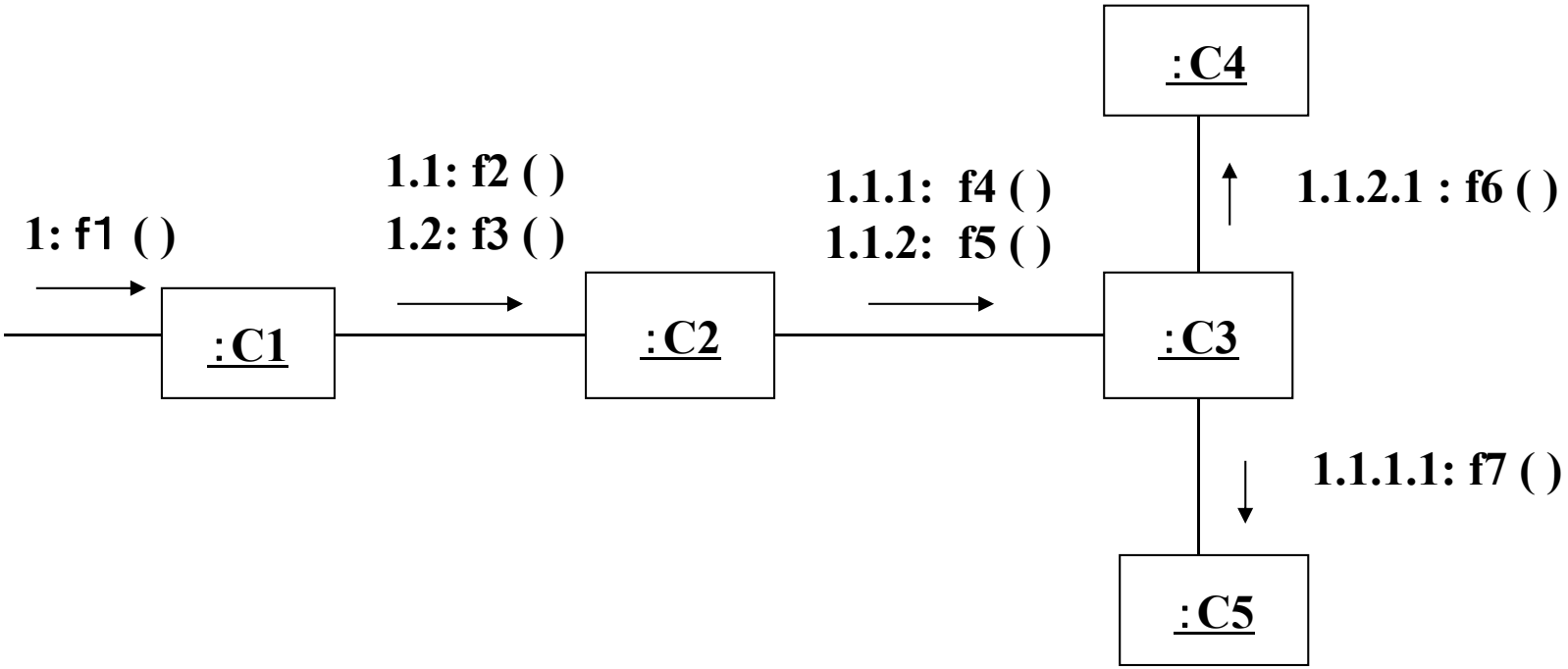
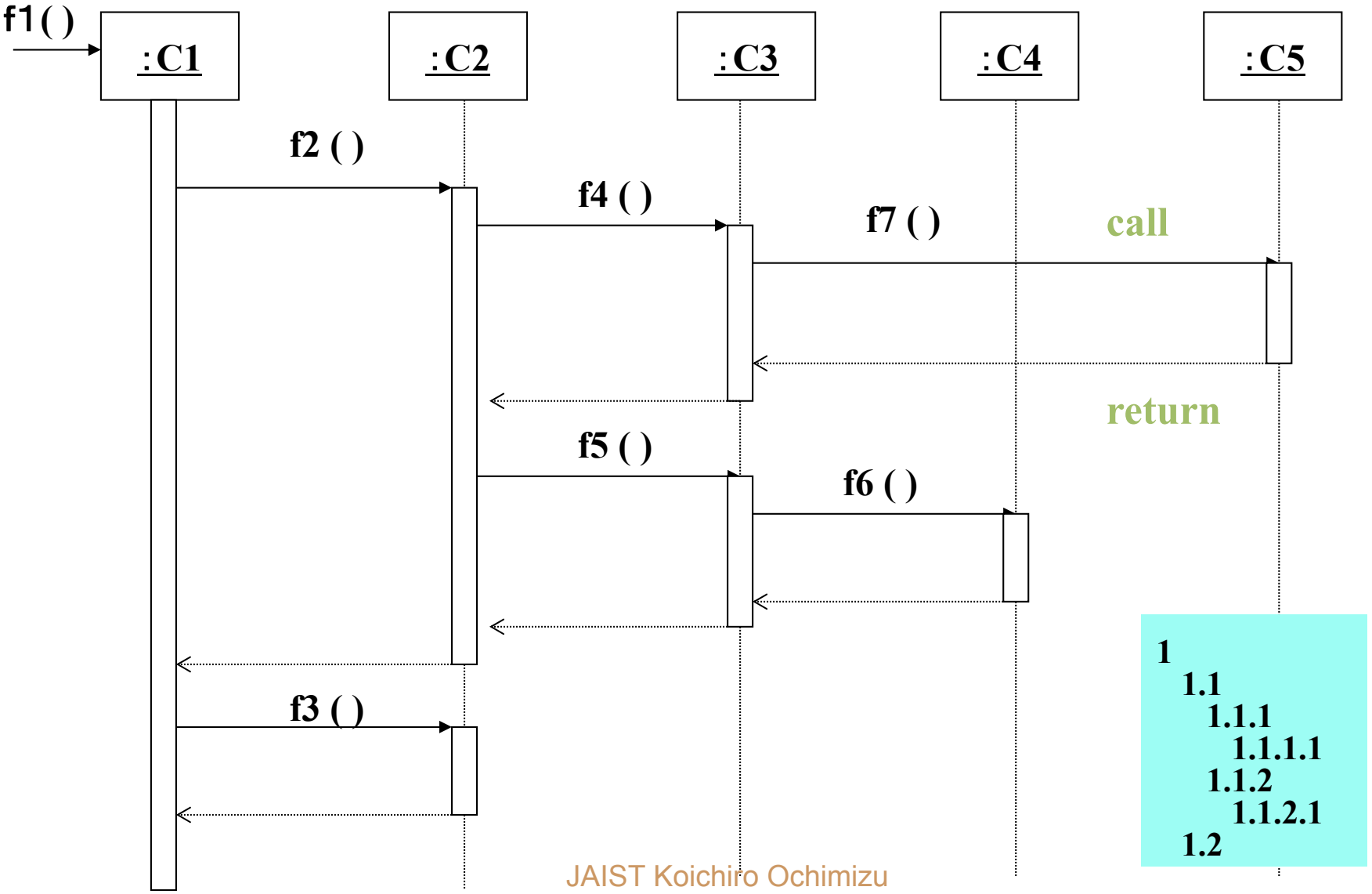
Exercise



Answer

UML Ver.1.3



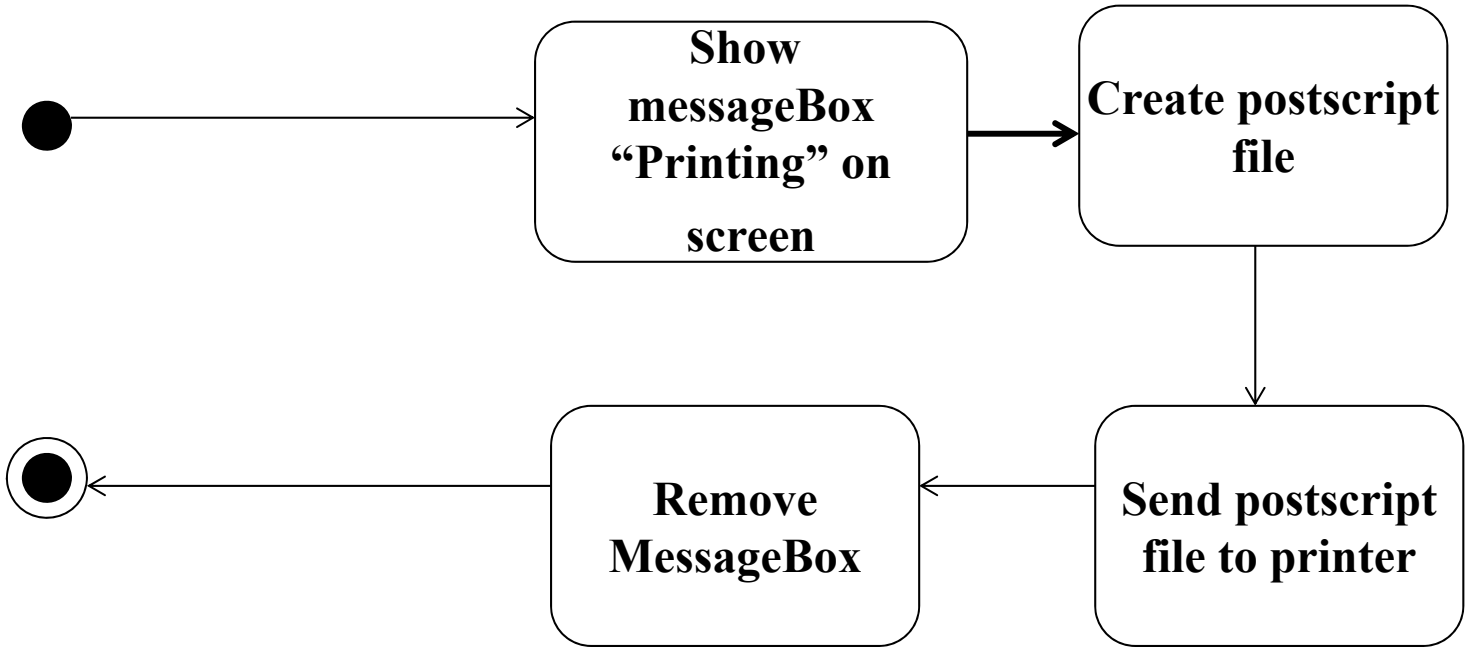
1
- 1.1
  - 1.1.1
    - 1.1.1.1
  - 1.1.2
    - 1.1.2.1
- 1.2

Activity Diagram

- An activity diagram is essentially a flowchart, showing flow of control from activity to activity

Actions and Transitions

CustomerWindow.PrintAllCustomer()



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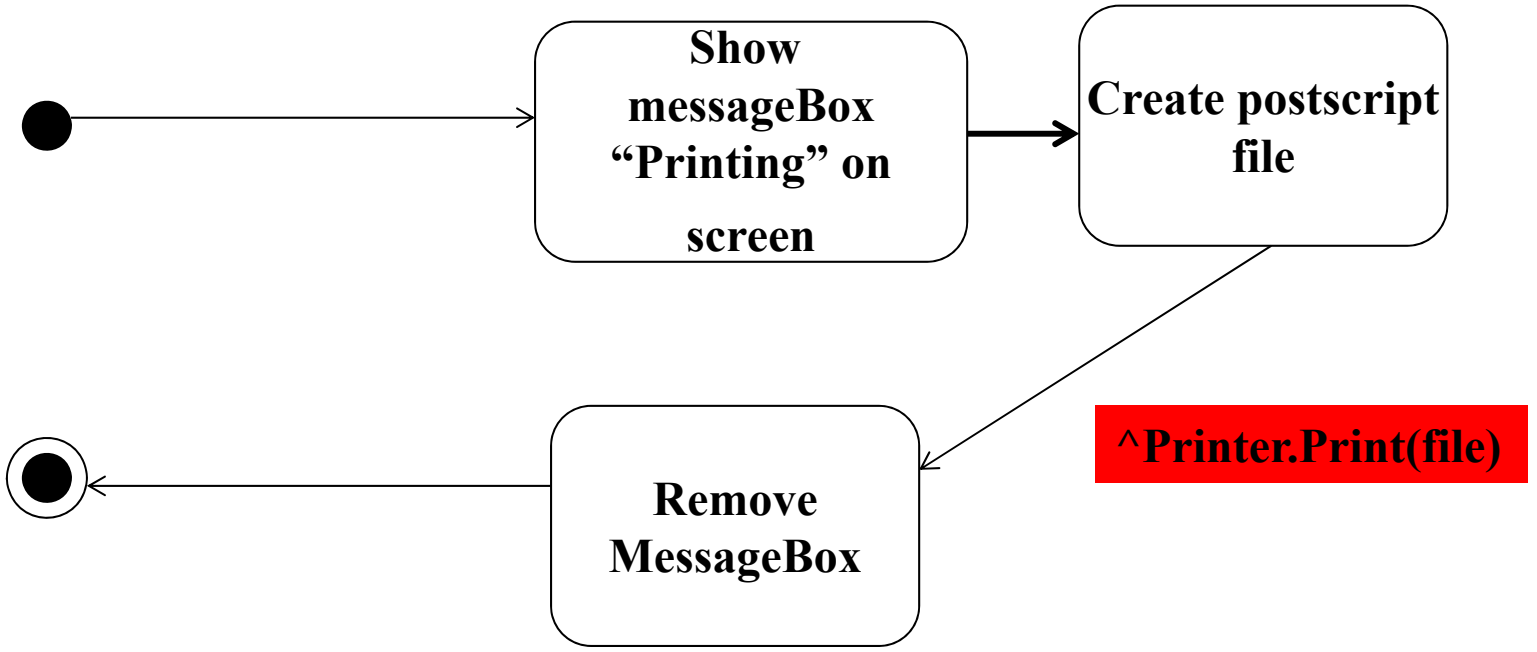
Transition with send-clause

CustomerWindow.PrintAllCustomer()



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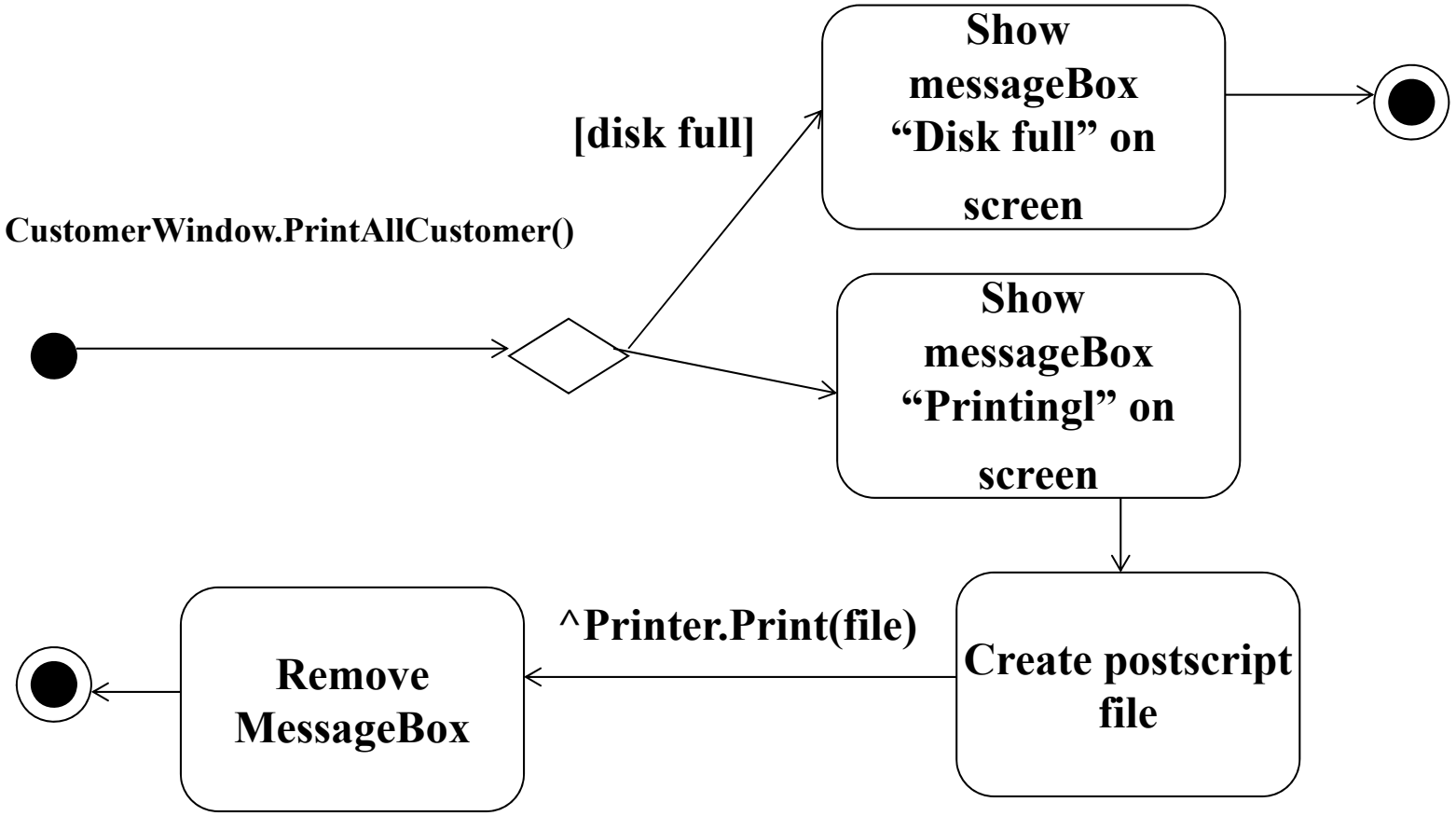
Transitions are protected by guarded-conditions



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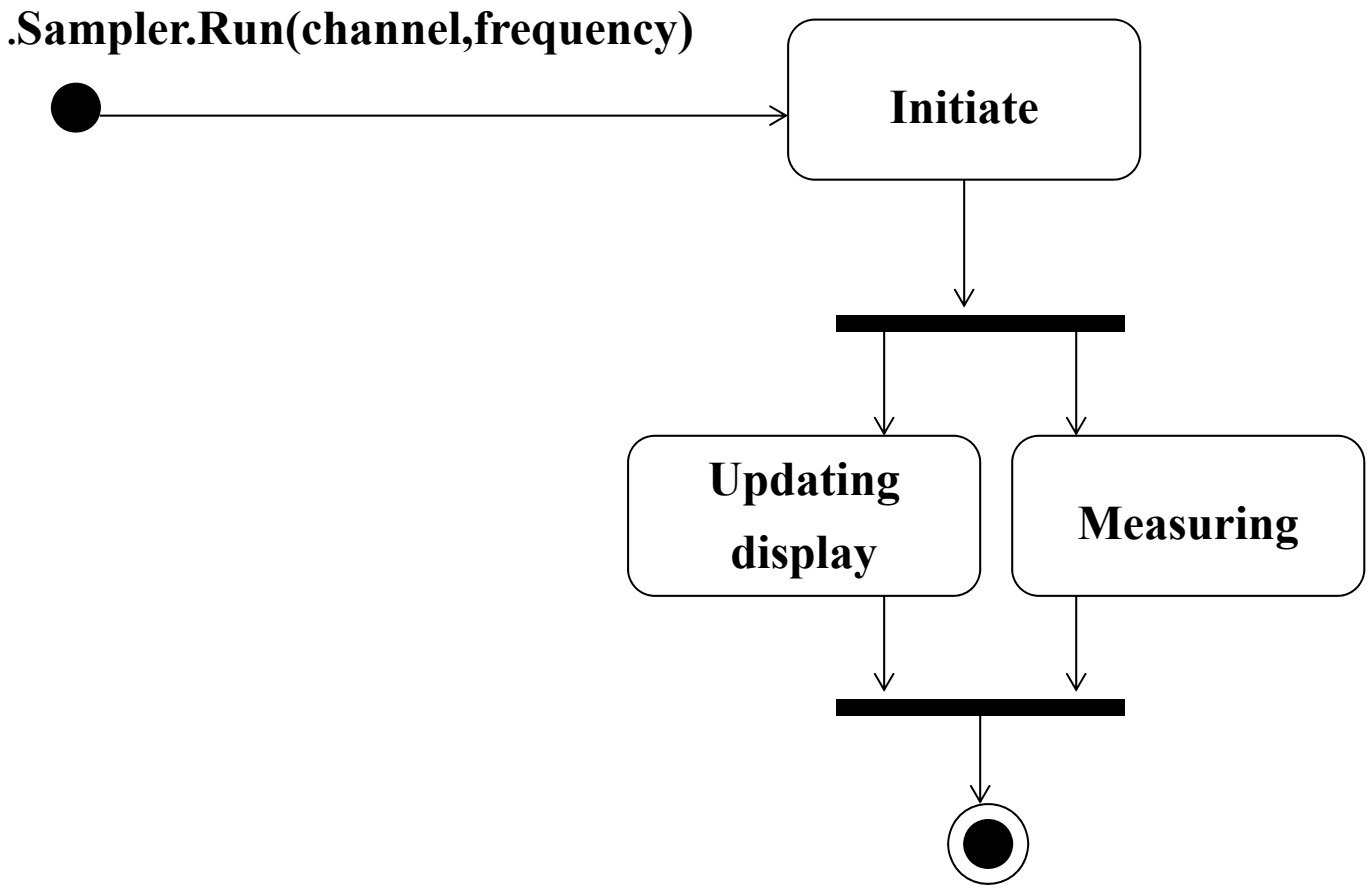
Parallel Actions



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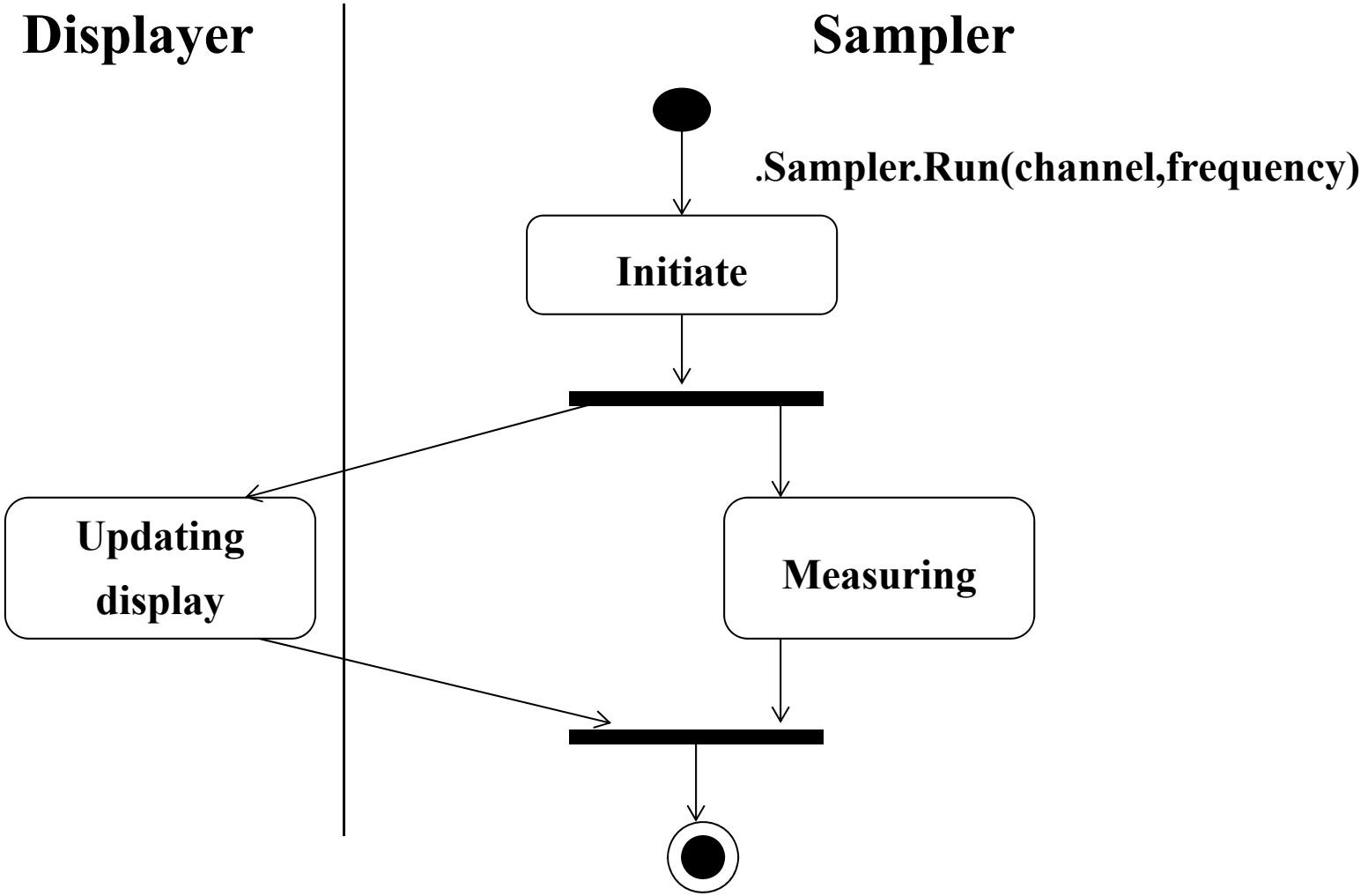
Swim lanes



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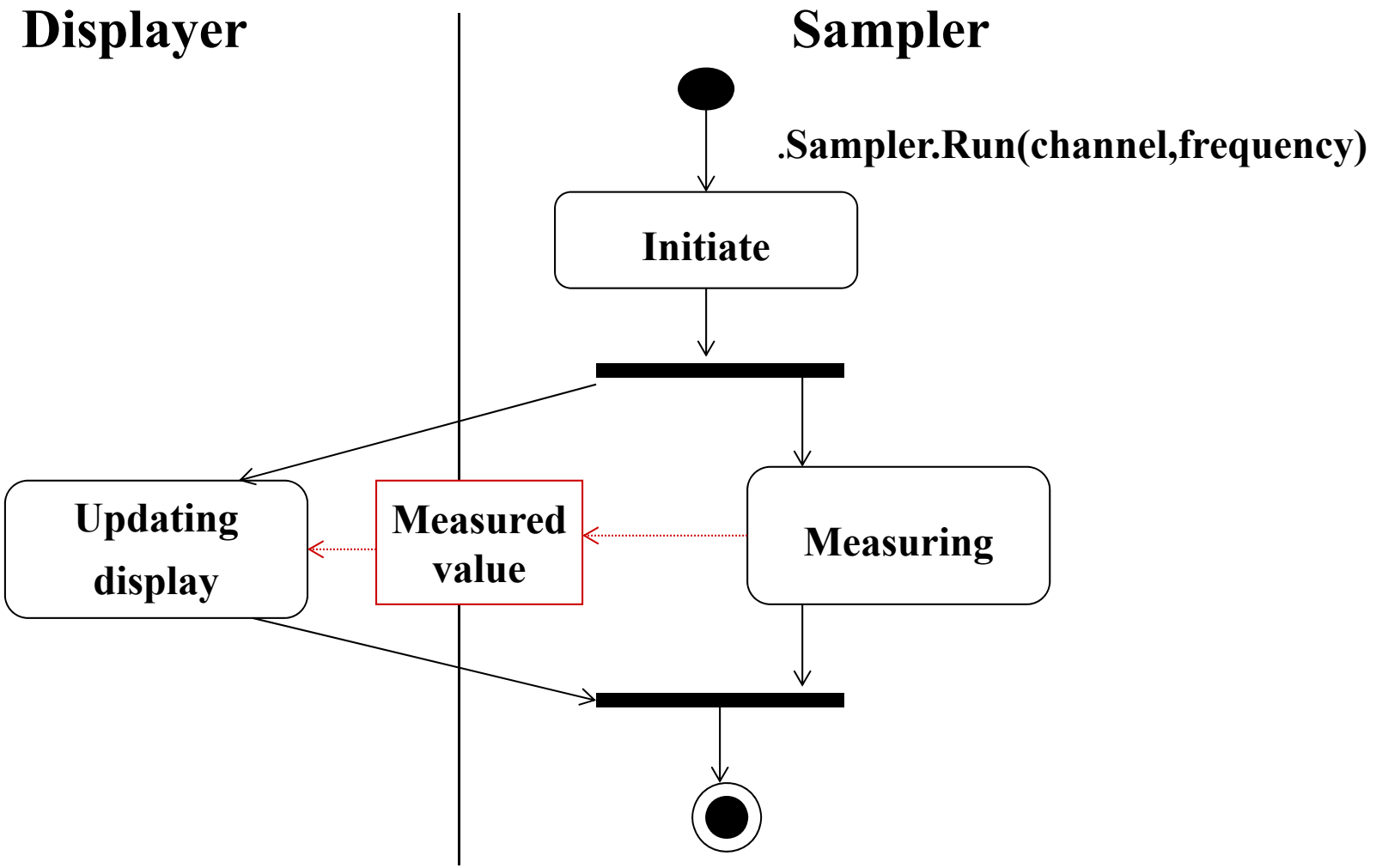
Object Flow



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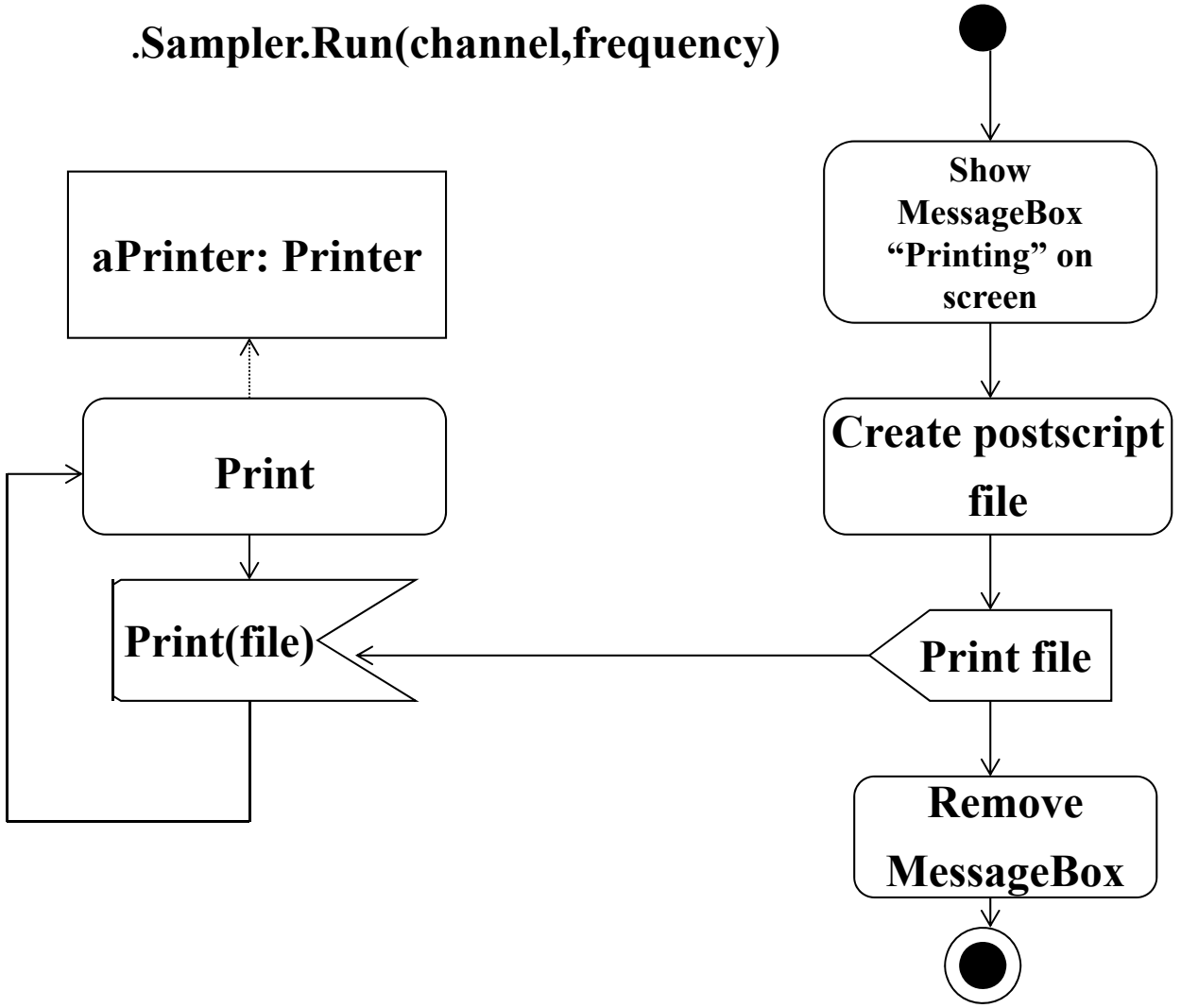
Sending/receiving signals



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