#### CSE 403: Software Engineering, Spring 2015

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# **UML Sequence Diagrams**

Emina Torlak emina@cs.washington.edu

#### **Outline**

- Overview of sequence diagrams
- Syntax and semantics
- Examples



## an overview of sequence diagrams

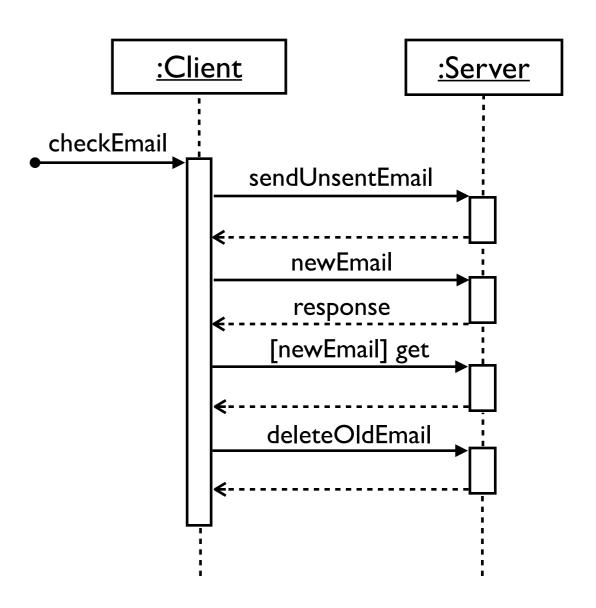
## What is a UML sequence diagram?

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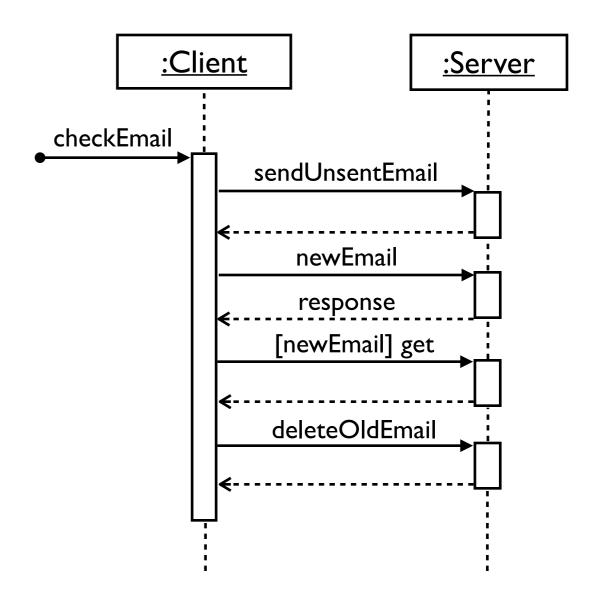
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  - 2nd most used UML diagram (behind class diagram)
  - Shows what messages are sent and when

### What is a UML sequence diagram?

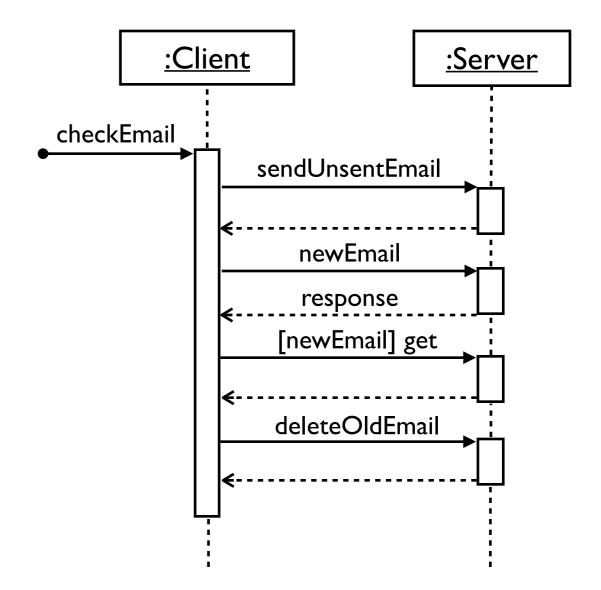
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  - 2nd most used UML diagram (behind class diagram)
  - Shows what messages are sent and when
- Relating UML diagrams to other design artifacts:
  - CRC cards → class diagrams
  - Use cases → sequence diagrams



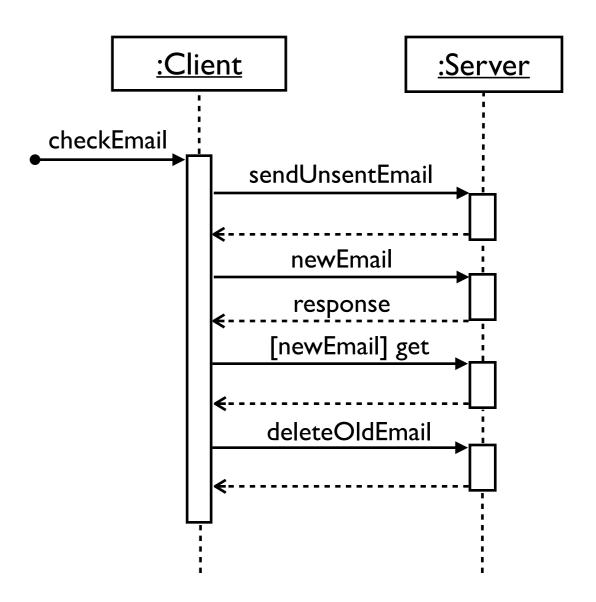
- Participant: an object or an entity; the sequence diagram actor
  - sequence diagram starts with an unattached "found message" arrow



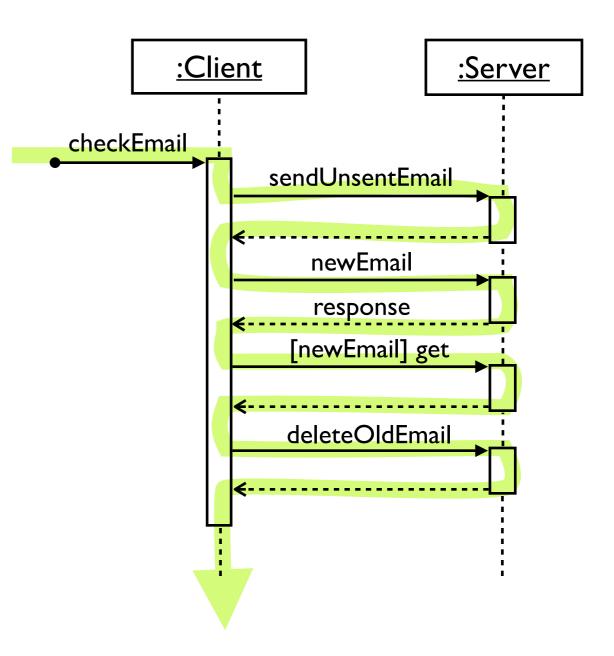
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  - horizontal: which participant is acting
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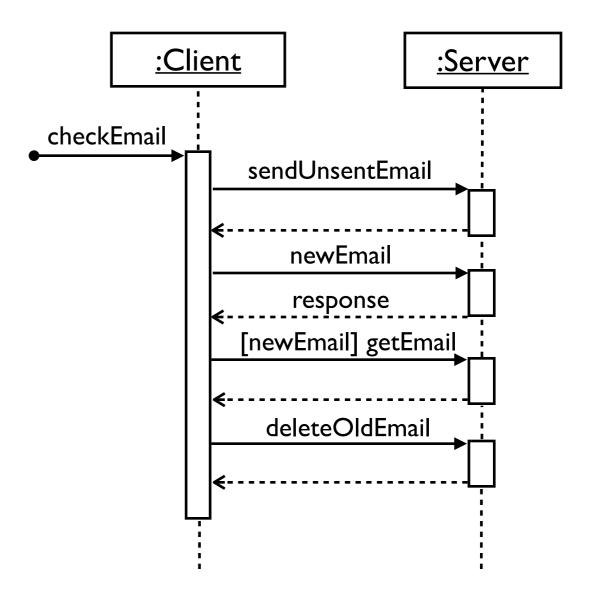


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#### Sequence diagram from a use case

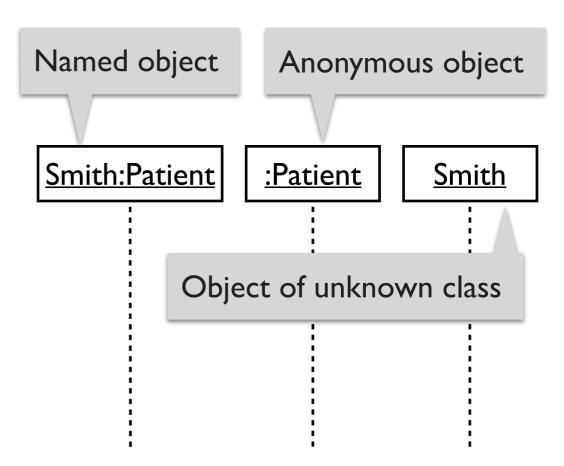
- I. The user presses the "check email" button.
- 2. The client first sends all unsent email to the server.
- 3. After receiving an acknowledgement, the client asks the server if there is any new email.
- 4. If so, it downloads the new email.
- 5. Next, it deletes old thrashed email from the server.



sequence diagrams: syntax and semantics

## Representing objects

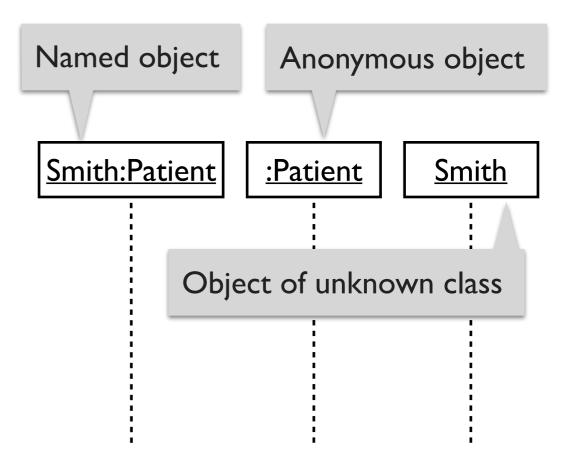
objectname:classname



#### Representing objects

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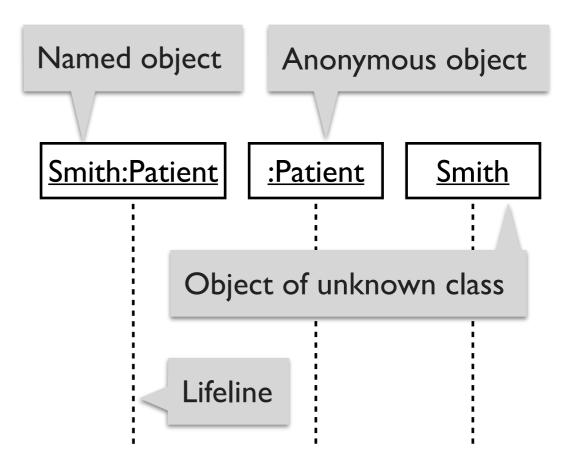
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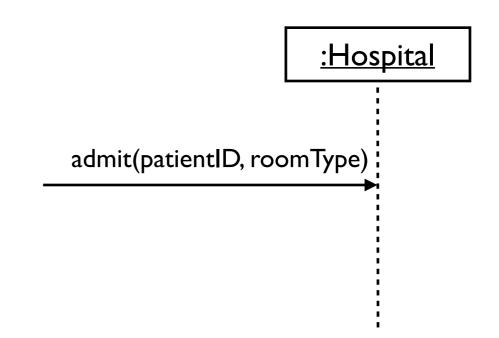
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- An **object**: a **box** with an <u>underlined</u> label that specifies the object type, and optionally the object name.
  - Write the object's name if it clarifies the diagram.
- An object's "life line" is represented by a dashed vertical line.
  - Represents the life span of the object during the scenario being modeled.



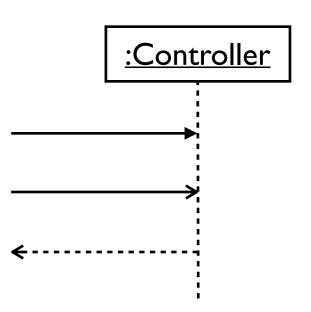
## Representing messages between objects

- A message (method call): horizontal arrow to the receiving object.
  - Write message name and arguments above the arrow.



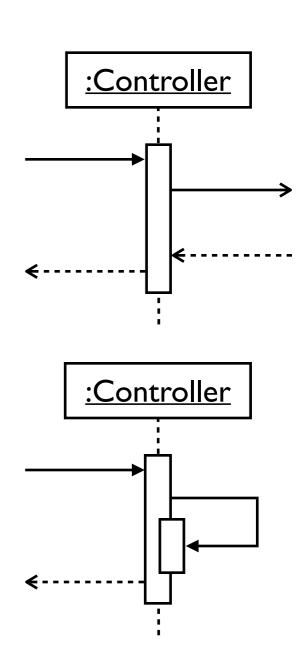
## Different types of messages

- Type of arrow indicates types of messages:
  - Synchronous message: solid arrow with a solid head.
  - Asynchronous message: solid arrow with a stick head.
  - Return message: dashed arrow with stick head.



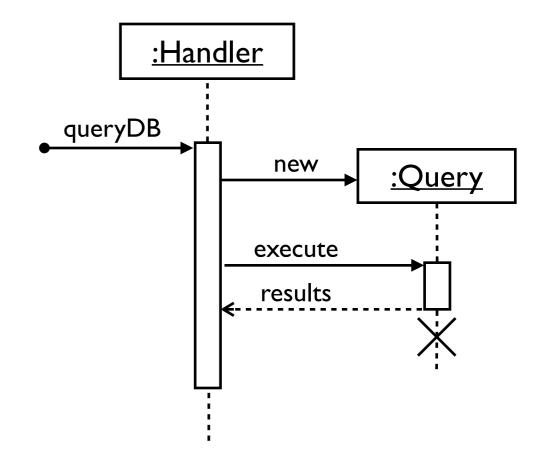
#### Indicating method execution

- Activation: thick box over object's life line, drawn when an object's method is on the stack
  - Either that object is running its code, or it is on the stack waiting for another object's method to finish
- Nest activations to indicate an object calling itself.



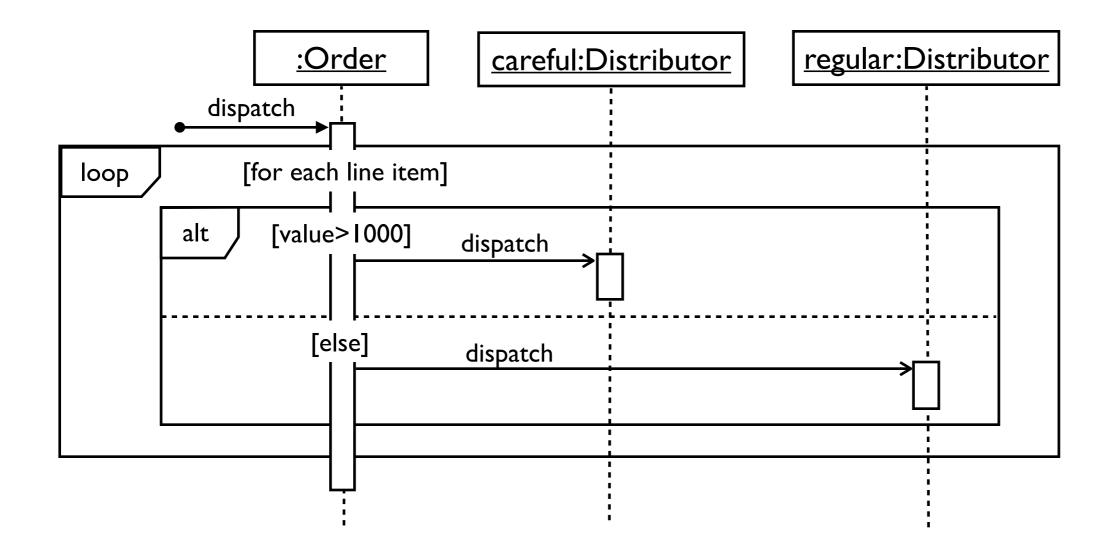
#### Lifetime of objects

- Object **creation**: an arrow with **new** written above it
  - An object created after the start of the scenario appears lower than the others.
- Object deletion: X at the bottom of object's lifeline
  - Java doesn't explicitly delete objects; they fall out of scope and are garbage collected.



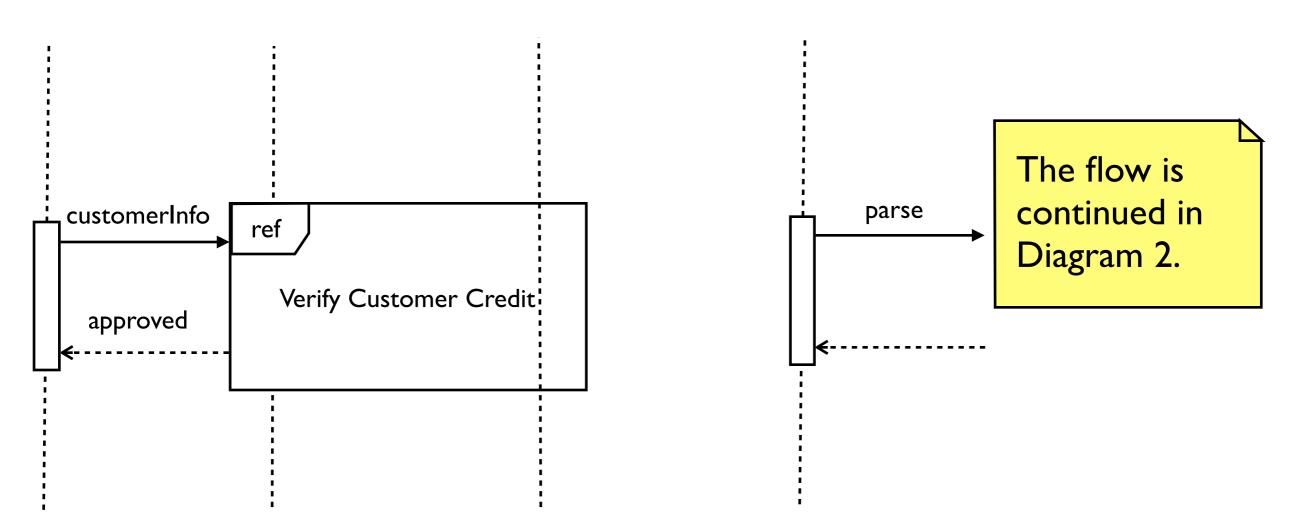
#### Alternatives, options, and loops

- Frame: a box around part of a sequence diagram
  - if  $\rightarrow$  (opt) [condition]
  - if/else → (alt) [condition], separated by horizontal dashed line
  - loop → (loop) [condition or items to loop over]

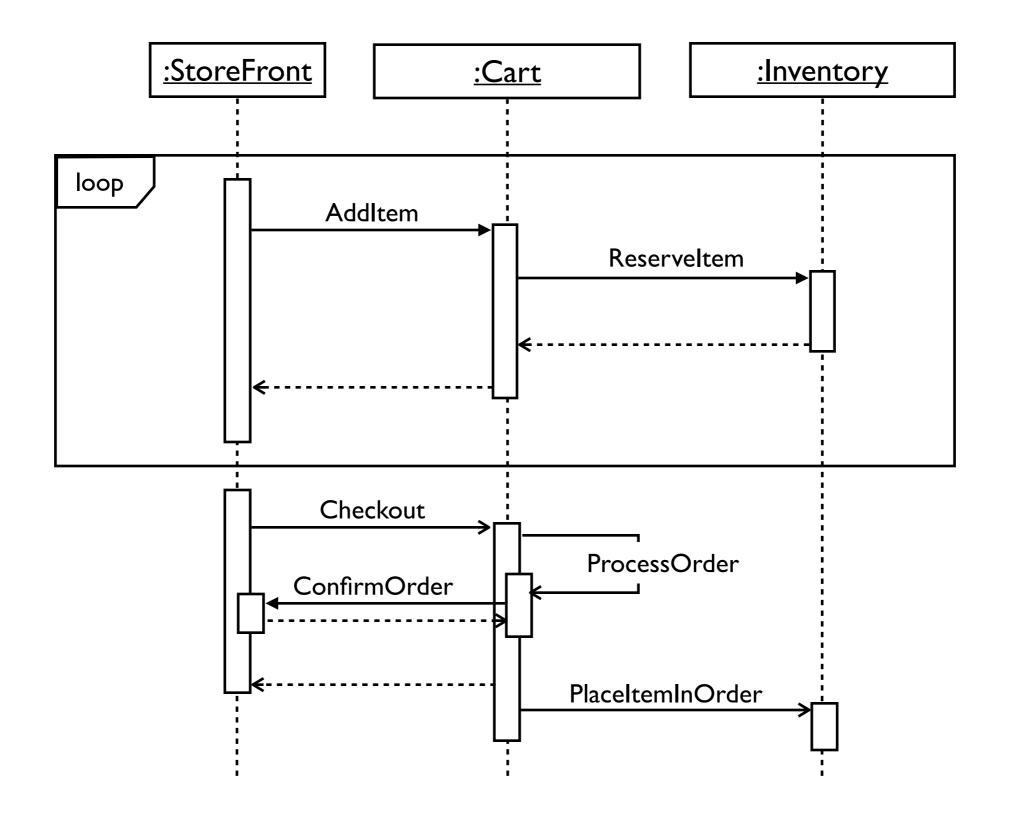


#### Linking sequence diagrams

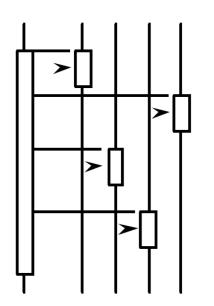
- If one sequence diagram is too large or refers to another diagram:
  - An unfinished arrow and comment.
  - A ref frame that names the other diagram.

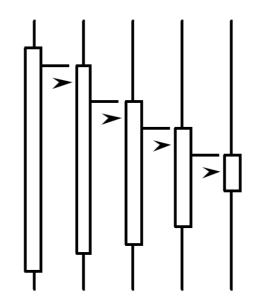


## Example sequence diagram



## Forms of system control





What can you say about the control flow of each of these systems?

- Is it centralized?
- Is it distributed?

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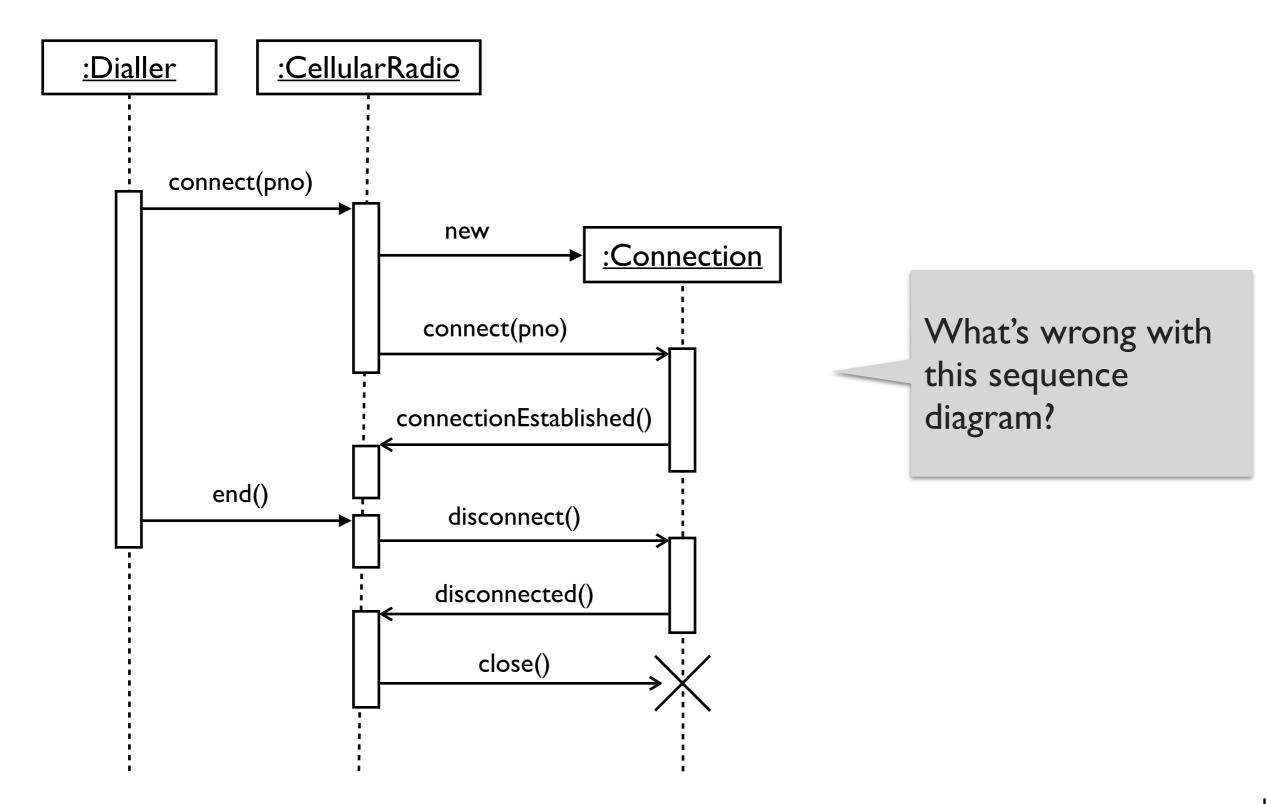
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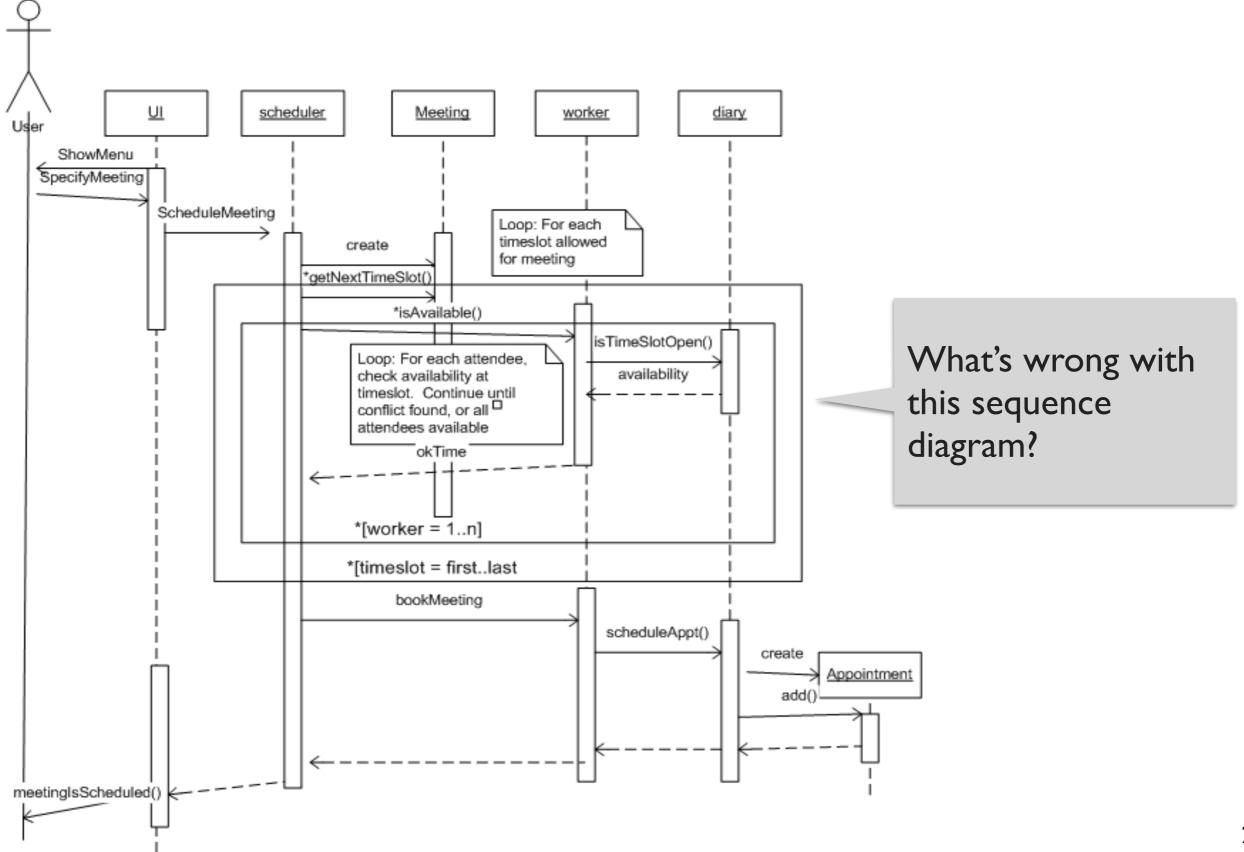
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- Sequence diagrams are language-agnostic (can be implemented in many different languages)
- Non-coders can read and write sequence diagrams.
- Easier to do sequence diagrams as a team.
- Can see many objects/classes at a time on same page (visual bandwidth).

## sequence diagrams: examples

## Flawed sequence diagram I



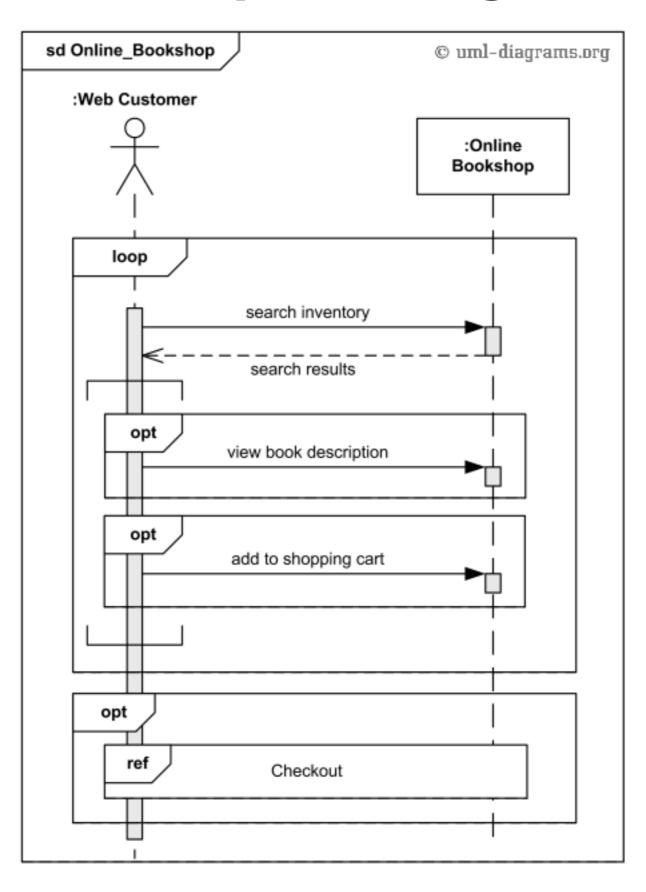
## Flawed sequence diagram 2



#### Online bookstore example

- I. The customer begins the interaction by searching for a book by title.
- 2. The system will return all books with that title.
- 3. The customer can look at the book description.
- 4. The customer can place a book in the shopping cart.
- 5. The customer can repeat the interaction as many times as desired.
- 6. The customer can purchase the items in the cart by checking out.

## Online bookstore sequence diagram



#### Summary

- A sequence diagram models a single scenario executing in the system.
- Key components include participants and messages.
- Sequence diagrams provide a highlevel view of control flow patterns through the system.

