2. UML Communication Diagram

- Holds the same information
- Emphasises the **structural** aspects of an interaction
- Shows links between objects that participate in the collaboration
- As there is no time dimension, sequence is captured with sequence numbers
- Sequence numbers are nested

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UML Communication Diagram

- Emphasises the organisation of the objects that participate in an interaction
- Contains:
    - Classes
    - Links between Classes (also in class model)
    - Messages exchanged
    - Data flowing between Classes

UML Communication Diagram

- Represented as a line connecting class icons
- Shows communication links between classes, not the sequence
- Indicates the pathway for communication between the connected classes
  - arrow pointing from client to supplier object
  - name of the message with list of parameters and/or data return value
  - optional nested numbering scheme

UML Communication Diagram

- Shows classifier and association roles
- Messages also have
  - sequence numbers to indicate order
  - optional return values with ':=' notation
- On a communication diagram
  - new objects and links are annotated with the property '{new}'
  - destroyed objects and links are annotated with the property '{destroyed}'
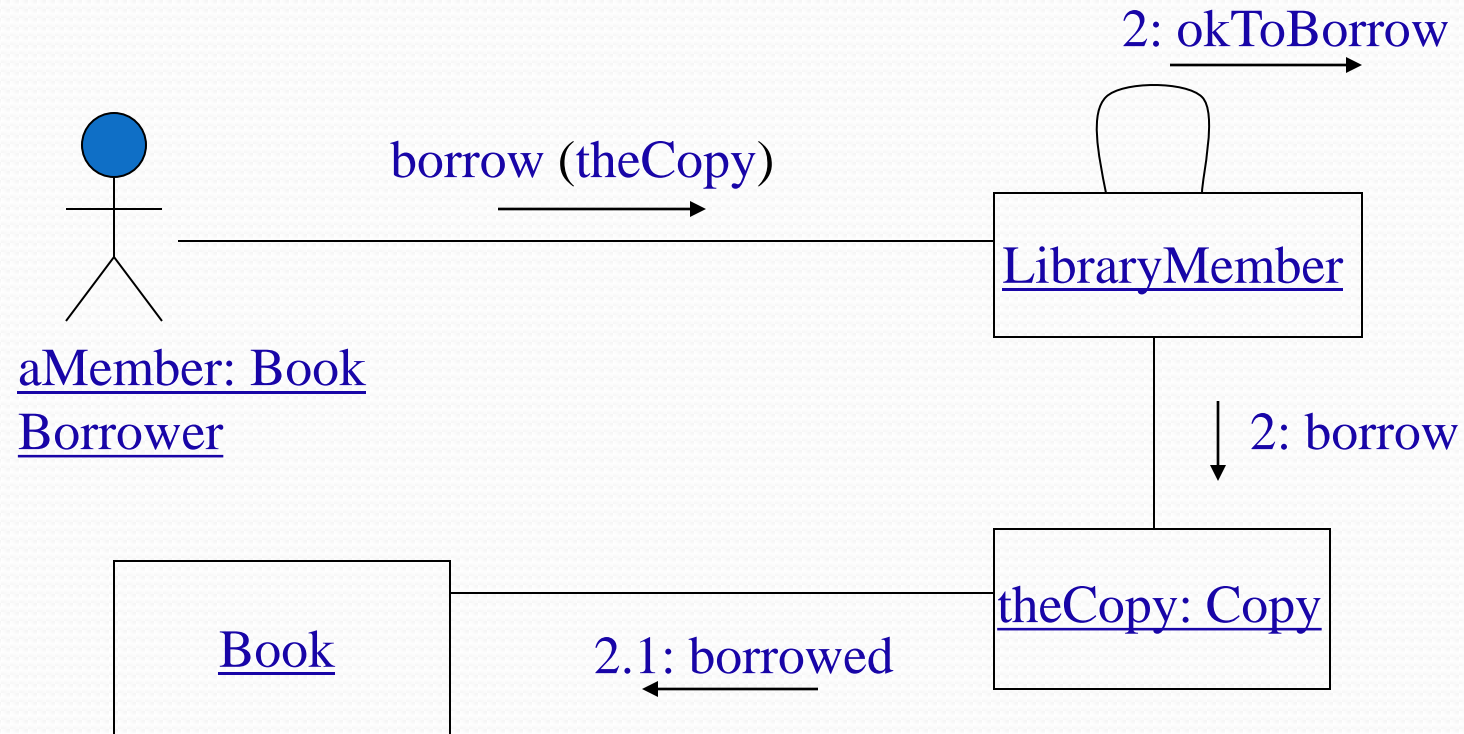
Iteration & Branching

- You can show iteration by using an iteration expression: an iteration specifier (*) and an optional iteration clause

- Branching is modeled by adding guard conditions to the messages

- Message is sent when guard condition evaluates to true:

E.g: 1.3[!found]: error

UML Communication Diagram

- Creating a communication diagram:
  - Place participating classes in diagram
  - Insert links connecting the classes
  - Add messages showing the flow of control
- Communication diagrams cannot explicitly show the time at which a new object is created
- To distinguish elements created during an interaction from those which existed at the start: annotate roles associated with new objects and links with property {new}

UML Communication Diagram

2: okToBorrow

borrow (theCopy)

aMember: Book Borrower

LibraryMember

2: borrow

Book

2.1: borrowed

theCopy: Copy

Guidelines

- Identify the main elements involved in the interaction
- Consider the alternative scenarios that may be needed
- Draw the outline structure of the diagram
- Add the detailed interaction
- Check for consistency with other linked sequence diagrams and modify as necessary
- Check for consistency with other UML diagrams or models

Model Consistency

- All forms of interaction diagrams used should be consistent
- Interaction diagrams must be consistent with class diagrams:
  - Object operations must be consistent with the class diagram and the message signature must match that of the operation
  - Every sending object must have the object reference for the destination object
- Messages on interaction diagrams must be consistent with the state diagrams for the participating objects.

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Interaction Model Example

- ATM Case Study presented in *Chapter 13: Application Analysis* of <u>Blaha & Rumbaugh</u> text

- Develops application interaction model

- Sequence diagrams are used to model identified use cases

- State diagrams are used to model application classes with temporal behaviour

Interaction Model Example

- The sequence of events presented for the analysis of an interaction model is:
  - Analyse use case (and associated activity analysis: initial, final and external events)
  - Identify actors, classes and collaboration involved
  - Prepare interaction diagrams
  - Elaborate application class model

ATM Sequence Diagram

- Shows the participants in an interaction and the sequence of messages between them
- This diagram clearly shows the sender and receiver of each event (message)
- Can scan the diagram to find all events that directly affect a particular object
- These are used to uncover further object behaviour for the class model

OOD Lecture 4 Summary

- Systems Analysis: Interaction
  - UML Interaction Model
  - UML Sequence Diagrams
  - UML Communication Diagram
- UML Interaction Model Example: ATM