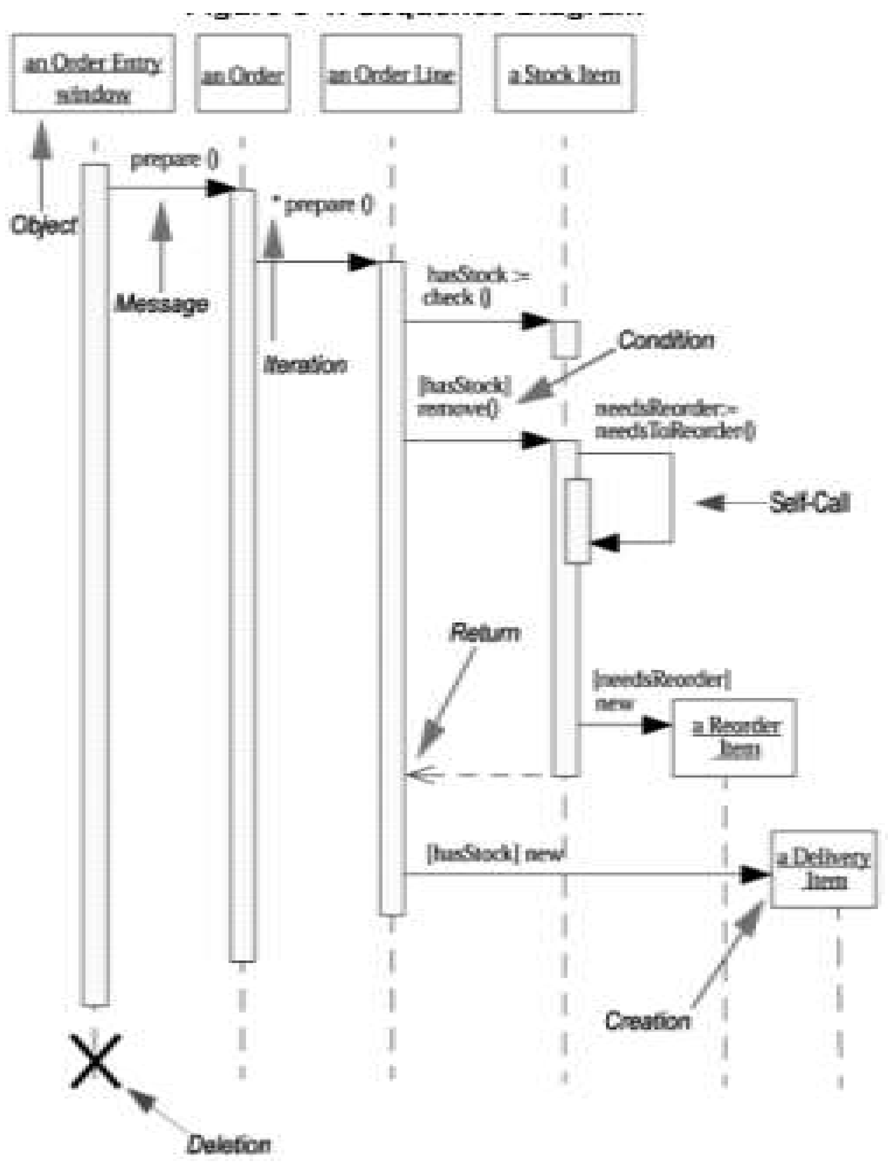
Interaction Diagrams

What is Interaction diagrams

- Describes how groups of objects collaborate in some behavior
- captures the behavior of a single use case
- Shows a number of example objects and the messages that are passed between these objects within the use case
- Order Processing Use Case
  - Order Entry window sends a "prepare" message to an Order
  - Order then sends "prepare" to each Order Line on the Order.
  - Each Order Line checks the given Stock Item
    - If this check returns "true," the Order Line removes the appropriate quantity of Stock Item from stock and creates a delivery item.
    - If the Stock Item has fallen below the reorder level, that Stock Item requests a reorder
- Two types of Interaction Diagram
  - Sequence Diagram
  - Collaboration Diagram

Sequence Diagram

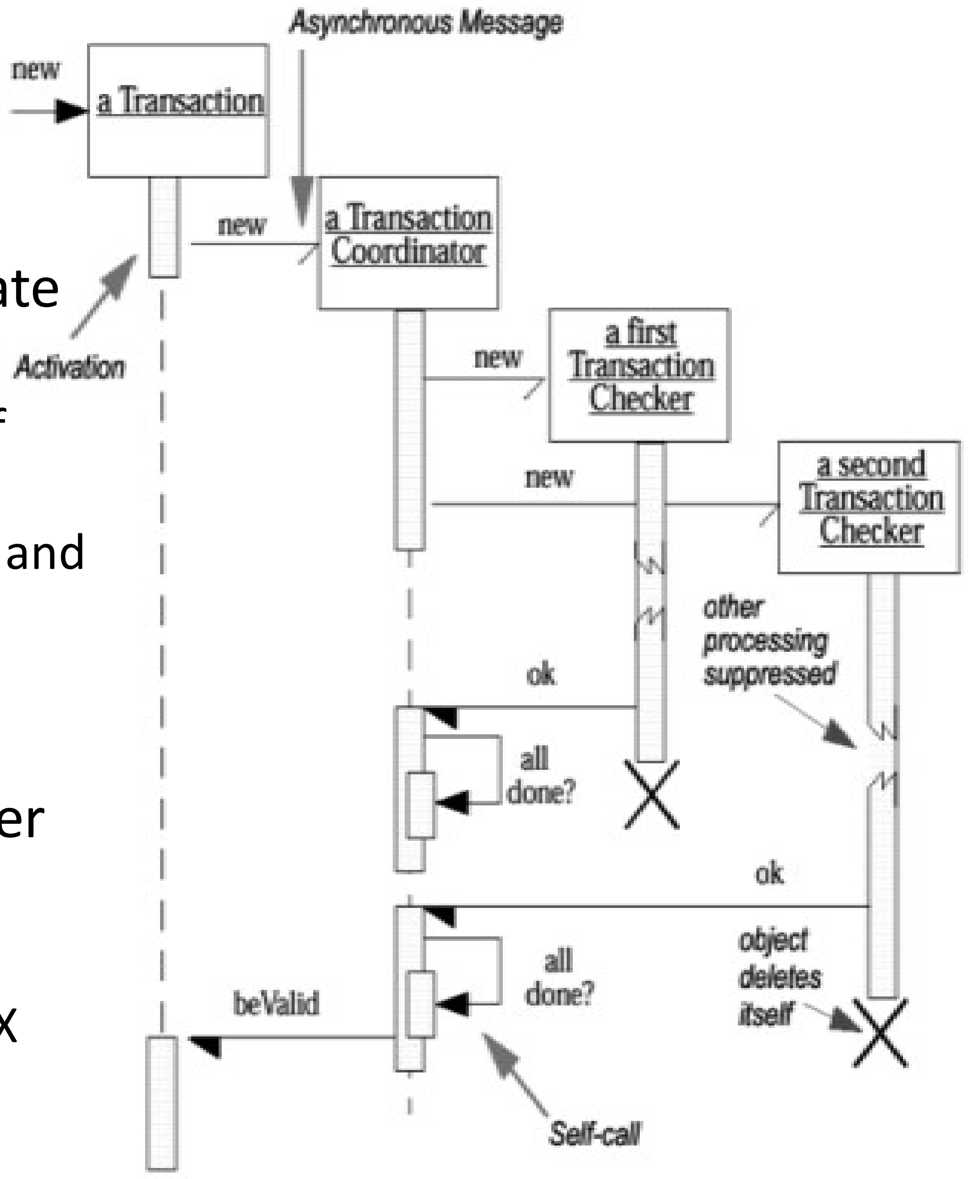


Sequence Diagram Syntax

- object is shown as a box at the top of a dashed vertical line
- The vertical line is called object's lifeline
- Each message is represented by an arrow between the lifelines of two objects
- Message Format: message name; optional arguments and some control information
  - The message is sent only if the condition is true, written in parentheses
  - iteration marker, which shows that a message is sent many times to multiple receiver objects indicated by *
- self-call, a message that an object sends to itself, by sending the message arrow back to the same lifeline.
- return indicates a return from a message
  - Returns differ from the regular messages in that the line is dashed
  - Not always shown
  - Shown only when return is required for clarity

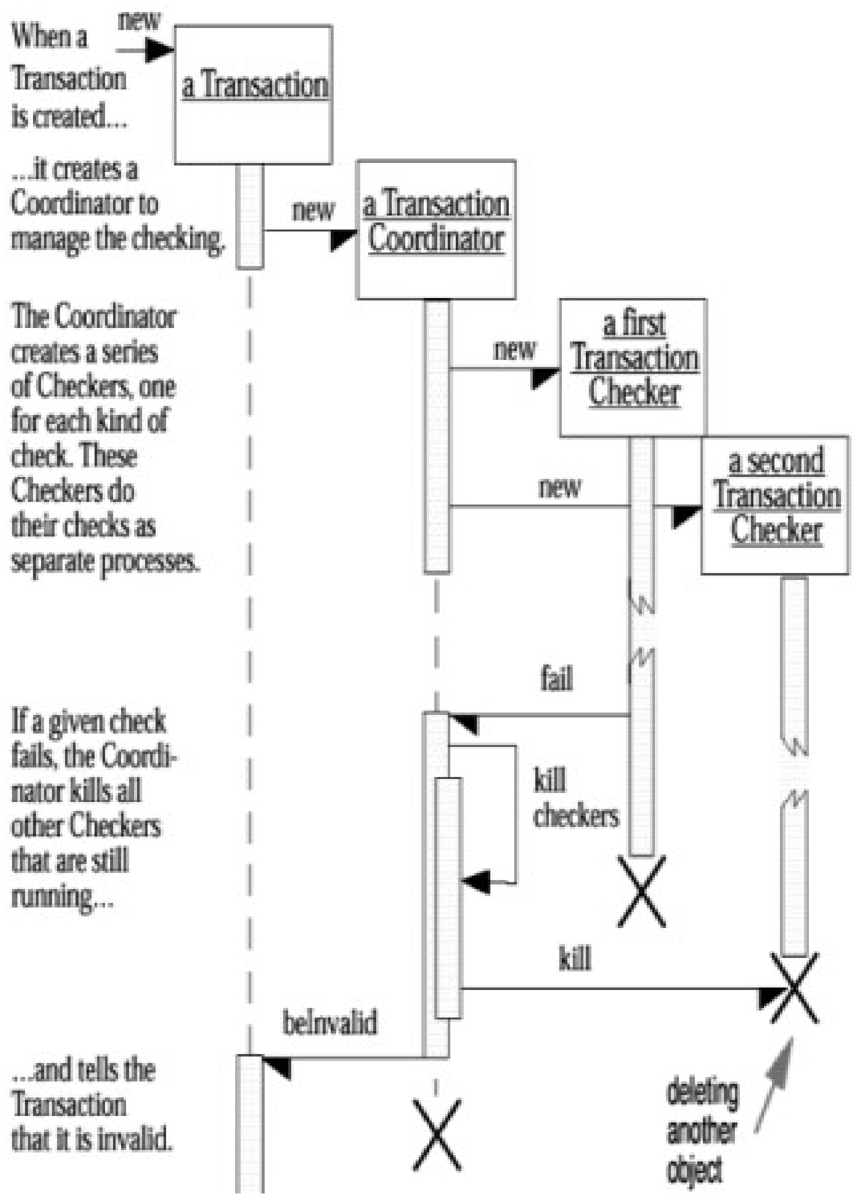
Concurrent Processes in the Sequence Diagram

- Transaction Coordinator to coordinate the checking of the Transaction
  - creates a number (in this case, two) of Transaction Checker objects
  - each checker is called asynchronously and proceeds in parallel
  - The half-arrowheads indicate an asynchronous message.
- The coordinator looks to see whether all the checkers called back
  - Through self call
  - Object deletion is shown with a large X



Sequence Diagram: Check Failure

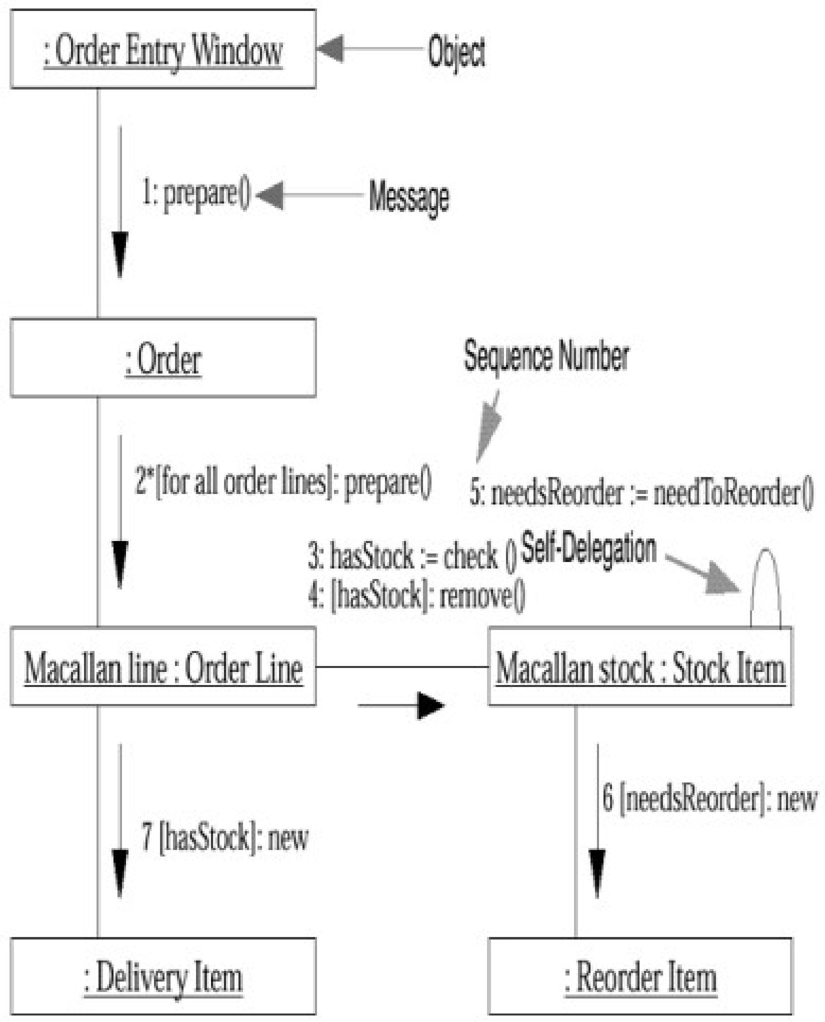
- textual descriptions of what's happening along the left side of the sequence diagram
- Killing threads checking transactions
- A sequence diagram can show two scenarios
  - But not practiced
  - Becomes difficult to understand



When a Transaction is created...
new
a Transaction
...it creates a Coordinator to manage the checking.
new
a Transaction Coordinator
The Coordinator creates a series of Checkers, one for each kind of check. These Checkers do their checks as separate processes.
new
a first Transaction Checker
new
a second Transaction Checker
fail
If a given check fails, the Coordinator kills all other Checkers that are still running...
kill checkers
kill
beInvalid
...and tells the Transaction that it is invalid.
deleting another object

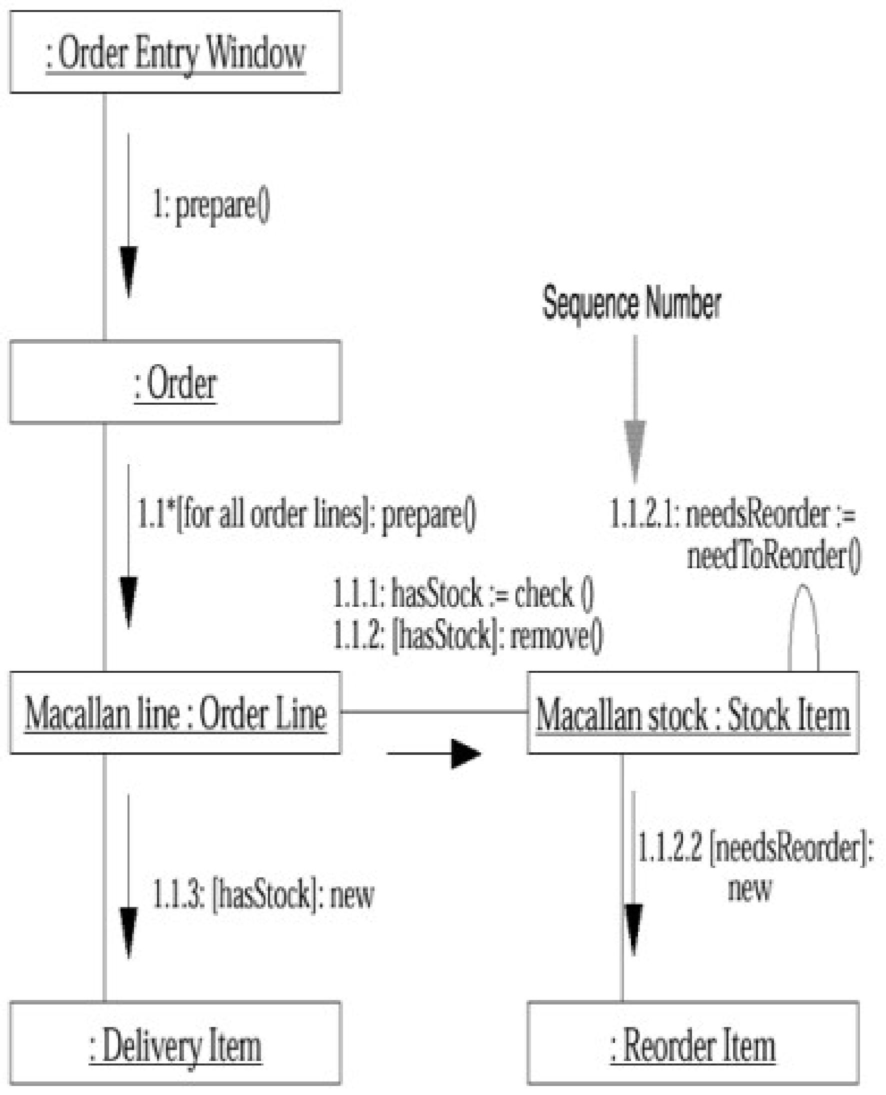
Collaboration Diagrams

- Objects are shown as icons
- the sequence is indicated by numbering the messages
- the spatial layout allows you to show other things more easily
    - how the objects are linked together



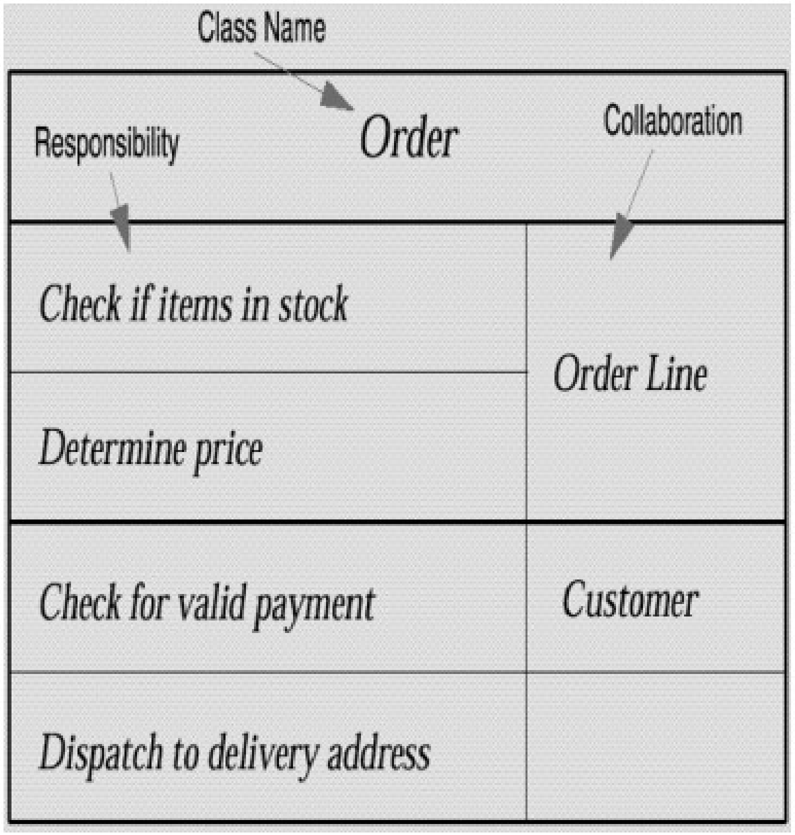
Using Decimal Numbering System

- makes it clear which operation is calling which other operation,
  - makes it harder to see the overall sequence
- Distinguishes original flow and sub-flows of operations
- various forms of the UML's object naming scheme objectName : ClassName,
  - the object name or the class name may be omitted.
  - Macallan line : Order Line indicates an order line named Macallan


: Order Entry Window
1: prepare()
Sequence Number
: Order
1.1*[for all order lines]: prepare()
1.1.2.1: needsReorder := needToReorder()
1.1.1: hasStock := check ()
1.1.2: [hasStock]: remove()
Macallan line : Order Line
Macallan stock : Stock Item
1.1.3: [hasStock]: new
1.1.2.2 [needsReorder]: new
: Delivery Item
: Reorder Item

Class-Responsibility-Collaboration (CRC) Cards

- interaction diagrams can be awkward to use when exploring alternatives
- Classes are represented on 4 × 6 index cards
  - Responsibilities are written
  - a high-level description of the purpose of the class
  - capture the purpose of the class in a few sentences



CRC Cards

- In interaction diagram alternative diagrams needs to be drawn for alternative scenarios
  - Takes long time
- In CRC you can simply write them with responsibilities
  - responsibility may correspond to an operation
- long lists of low-level responsibilities is not desired
  - any card with more than three responsibilities
  - Splitting suggested with a class with too many responsibilities

When to Use CRC Cards

- help explore an interaction between classes
- to show how a scenario is implemented
- figure out how the interaction works
  - document it with interaction diagrams
- summarizes the key responsibilities of a class
- useful in highlighting cluttered classes