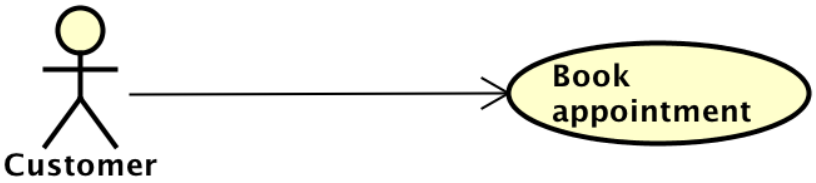
7SENG003W Advanced Software Design

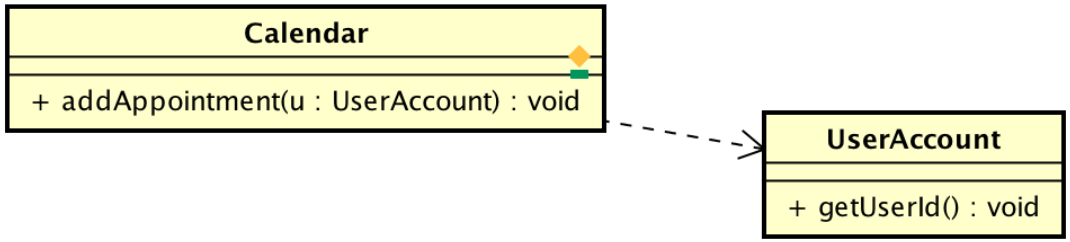
Interaction modelling and Use Case Realization

Aims for today

- Last week, we discussed the Use Case model
- But how do we get from this



- To this?



- Note – we want to do this in a way that preserves the relationship between model and requirements - traceability

Scenarios and objects – Use Case realisation

- Use cases involve scenarios – but look at the system from the user's perspective – i.e., from the outside
- However, our OO designs are about classes, objects and their relationships and interactions – i.e., from the inside
- Scenarios are linear narratives involving interactions between things/entities
- ”rewrite” our linear narratives as collaborations between objects
- I.e., this…
    1. User picks a date
    2. Calendar confirms date is available
    3. User requests time … etc
- … is rewritten as a communication between objects with interactions represented as messages
- And now for a digression => object diagrams!

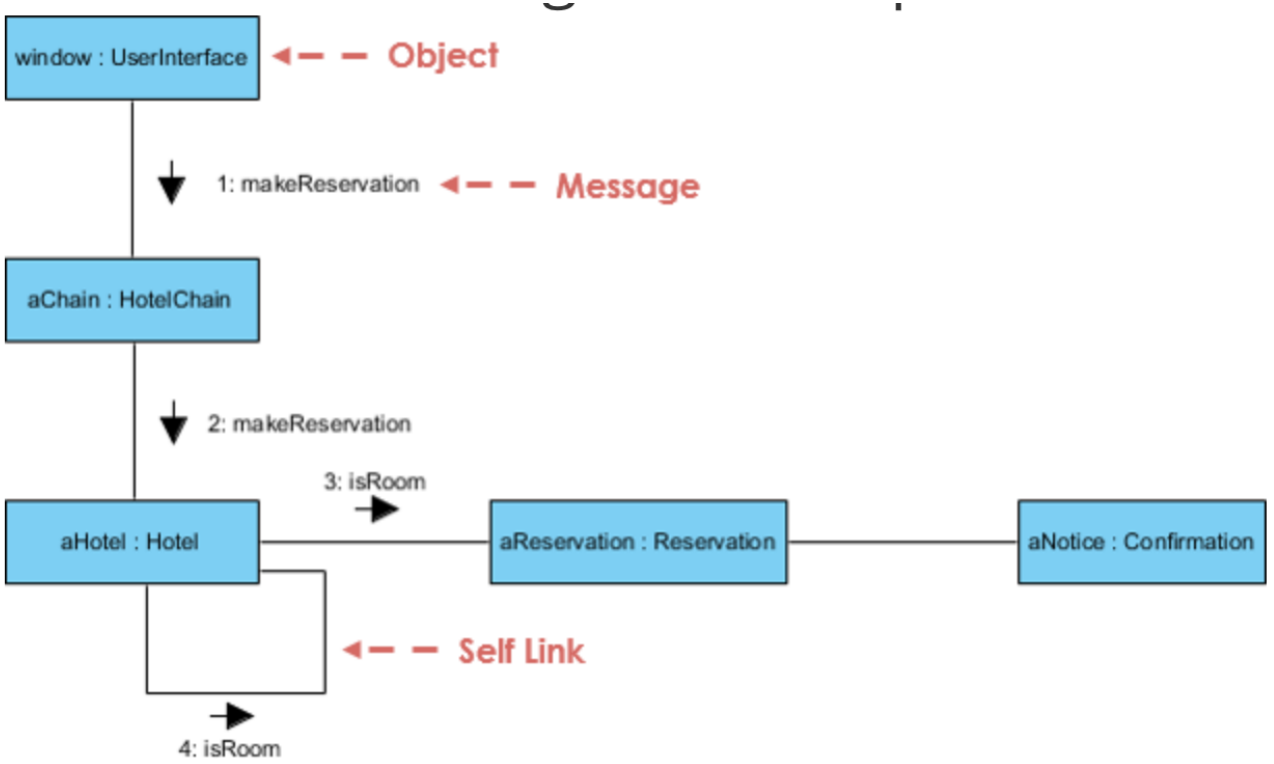
Object Diagrams => capturing object interactions

- Interaction – the way that objects collaborate to perform some task or execute some functionality
- Two diagrams to represent interaction
  - Communication diagrams (the object diagrams we saw in previous lectures – known as collaboration diagrams pre-UML 2.x)
  - Sequence diagrams

- Communication diagrams
  - Emphasize the structural links between objects – annotate with messages
- Sequence diagrams – the most common type of interaction diagram
  - Emphasize the order in which things are done
  - Links between objects are implicit

Communication diagrams - reminder

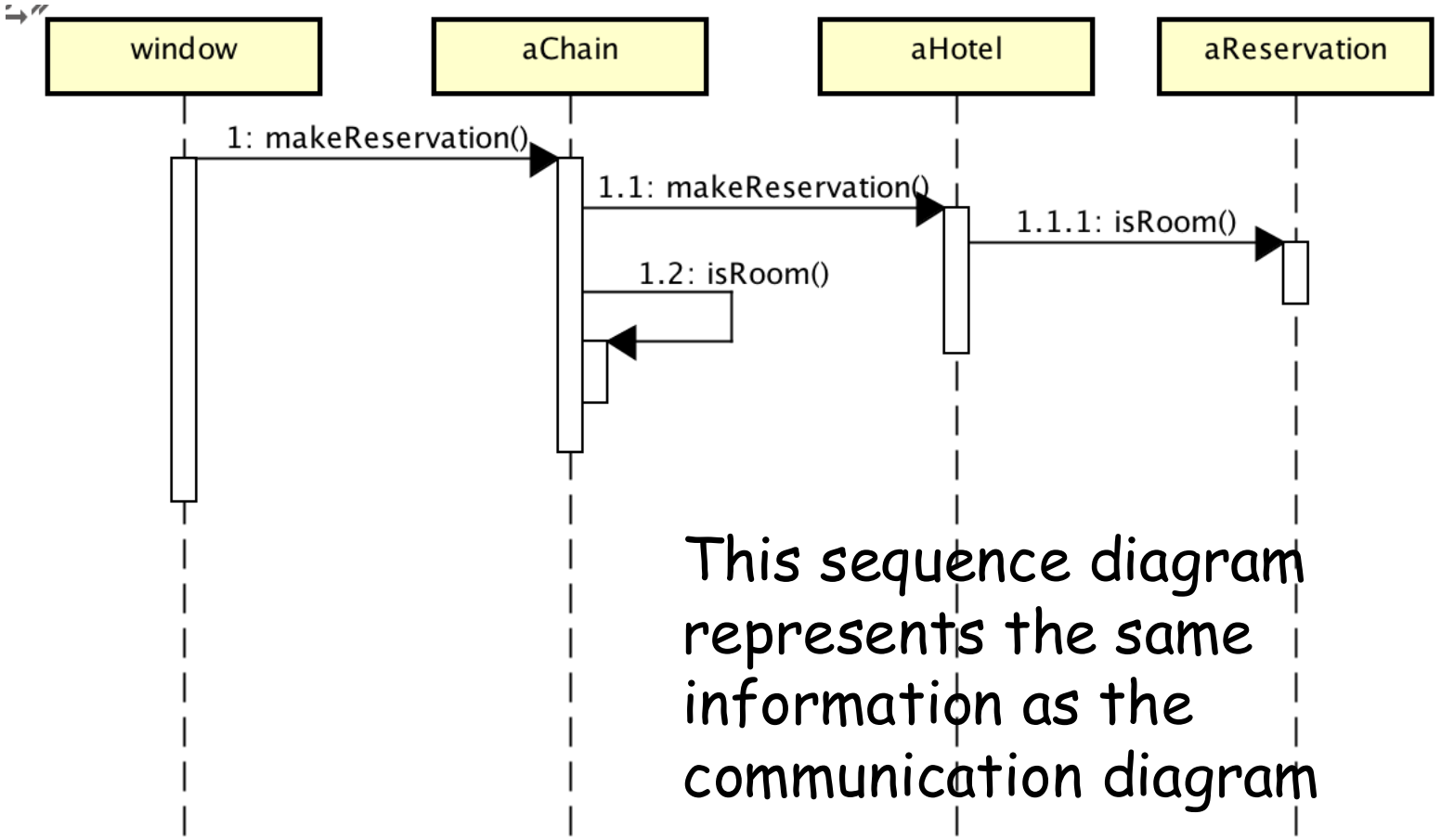
- Communication diagrams emphasize structural connections (links) between objects
- We can show messages between objects, but the primary information concerns object links



Example diagram from
https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-uml-collaboration-diagram/

Sequence diagrams

- Sequence diagrams show:
  - which objects are participating in a particular communication
  - the order in which they send messages in that communication



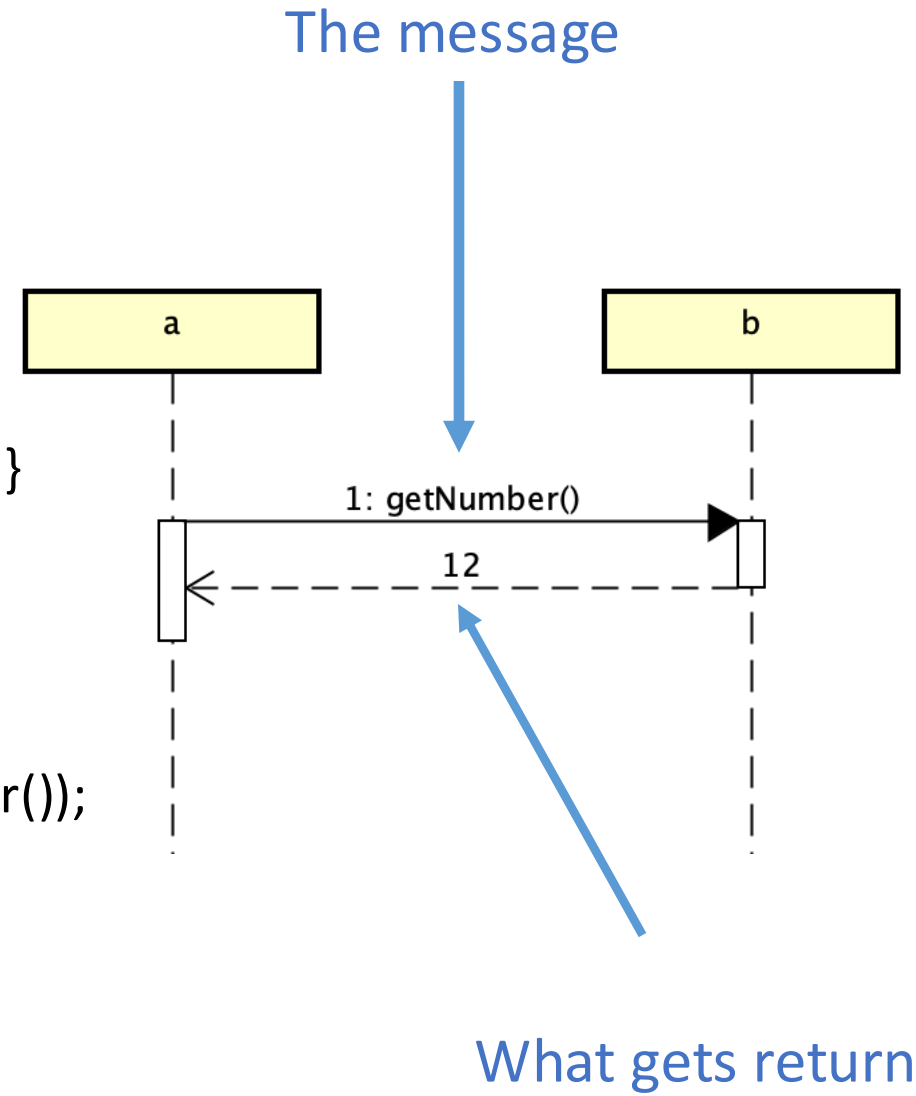
Sequence diagrams

- Definition: UML (Unified Modeling Language) sequence diagrams are a type of interaction diagram that shows how processes operate with one another and in what order.
- Purpose: Used to visualize the sequence of calls in a system to perform a specific functionality.
- Key Components:
  - Objects/Classes represented by rectangles.
  - Lifelines represented by dashed lines.
  - Activation bars – show when an object is active and doing something
  - Messages represented by arrows.

Messages

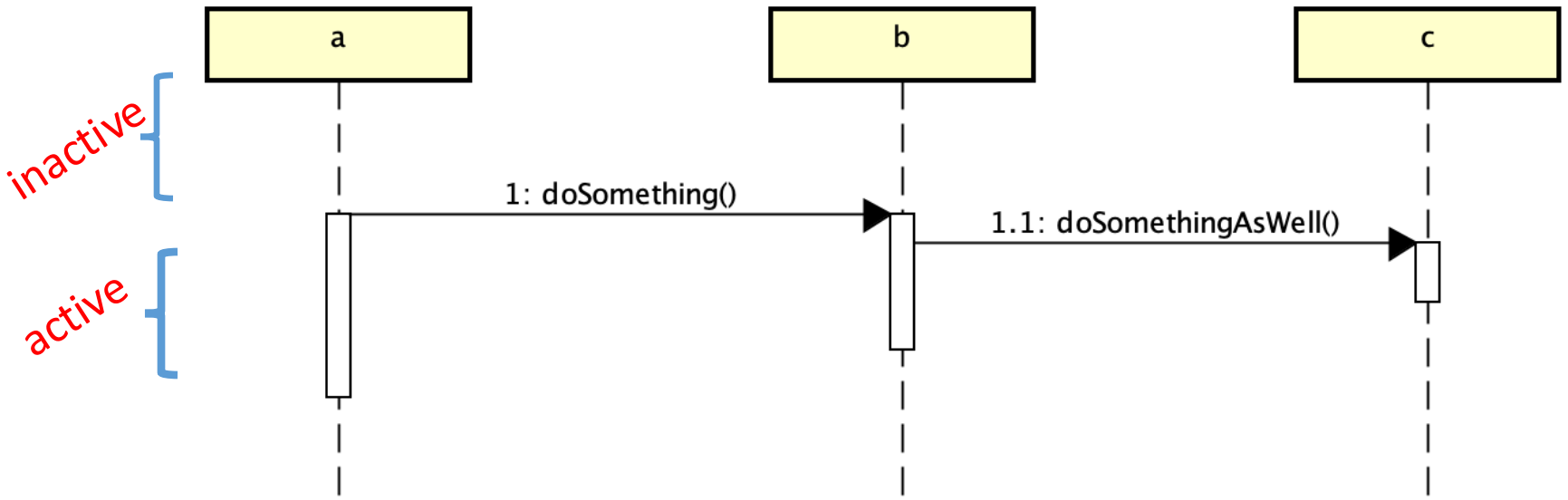
```
class A {
public:
    int getNumber() { return 12; }
};

A a = new A();
Console.WriteLine(a.getNumber());
```



Activation bars

- An activation bar shows when an object is active and doing something
- At other times, the object is suspended and inactive

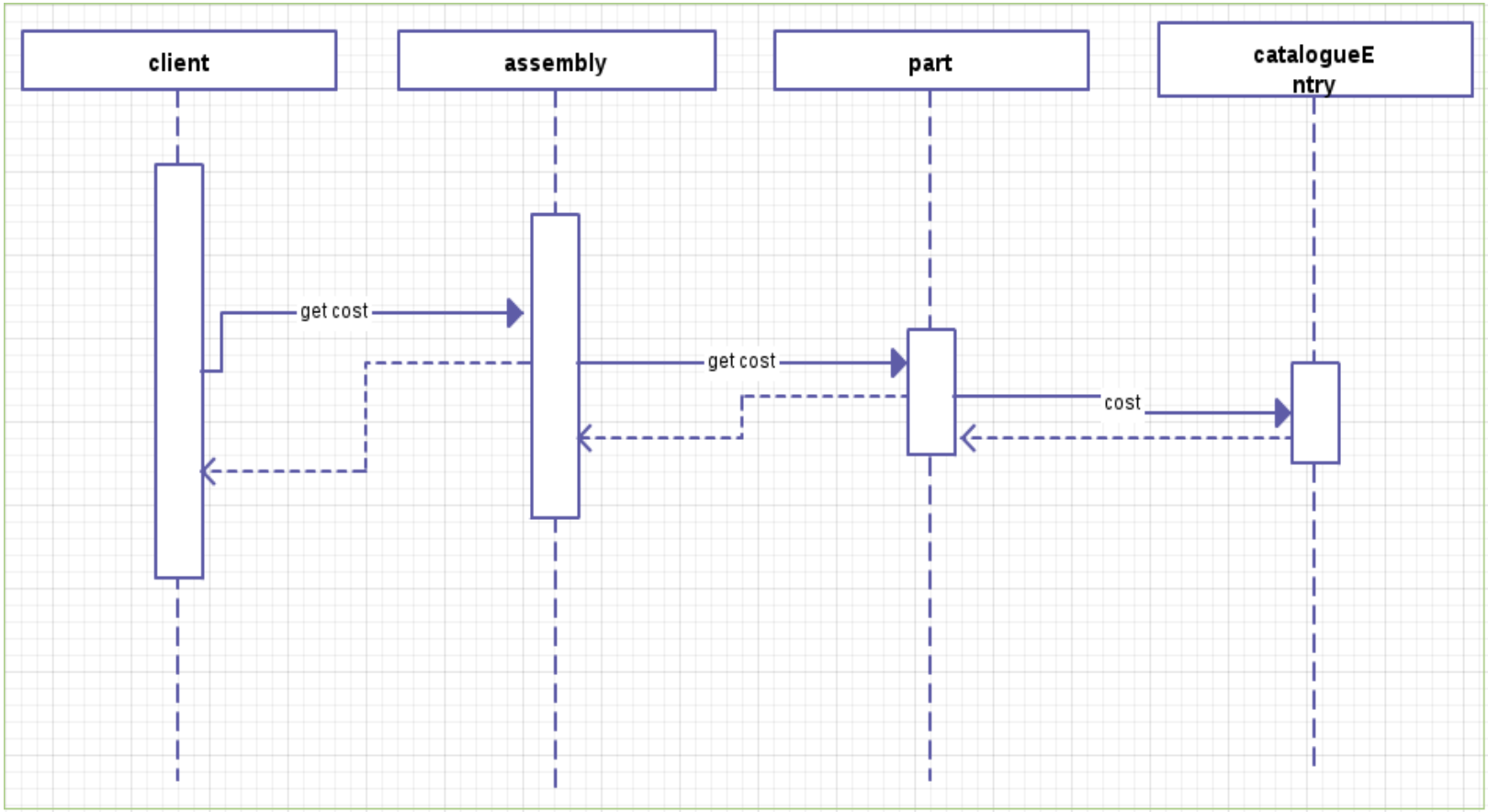


"b" sends message to "c" *because* it received a message from "a"

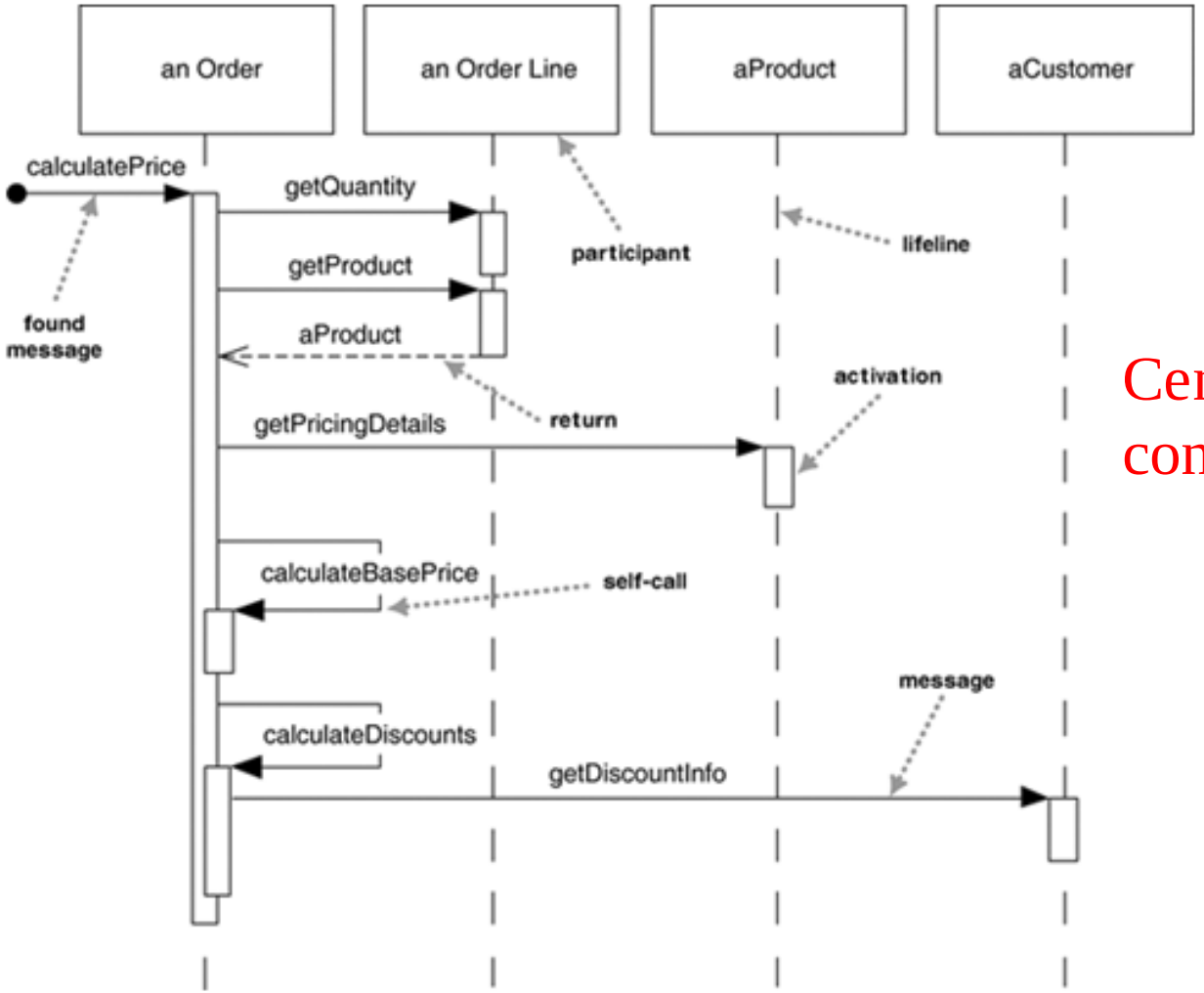
Sequence diagrams

- A sequence diagram has a time dimension

time



Sequence diagrams : UML Distilled example (Chapter 4)

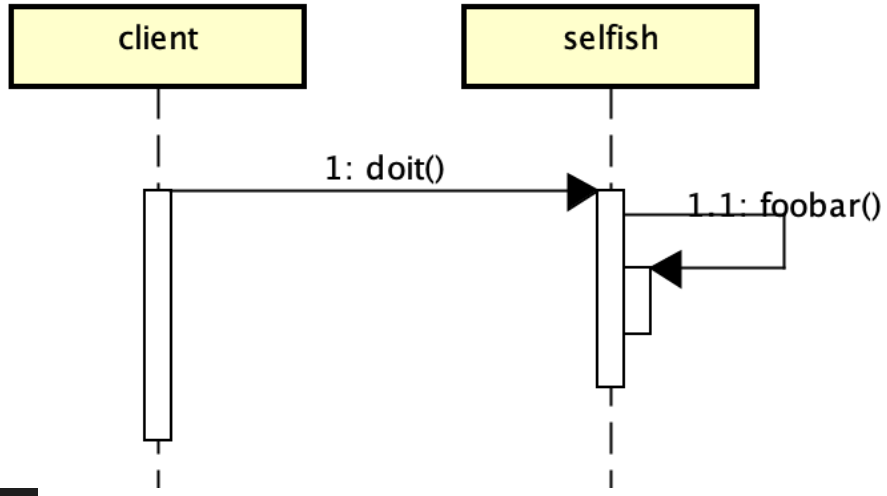


Centralised control

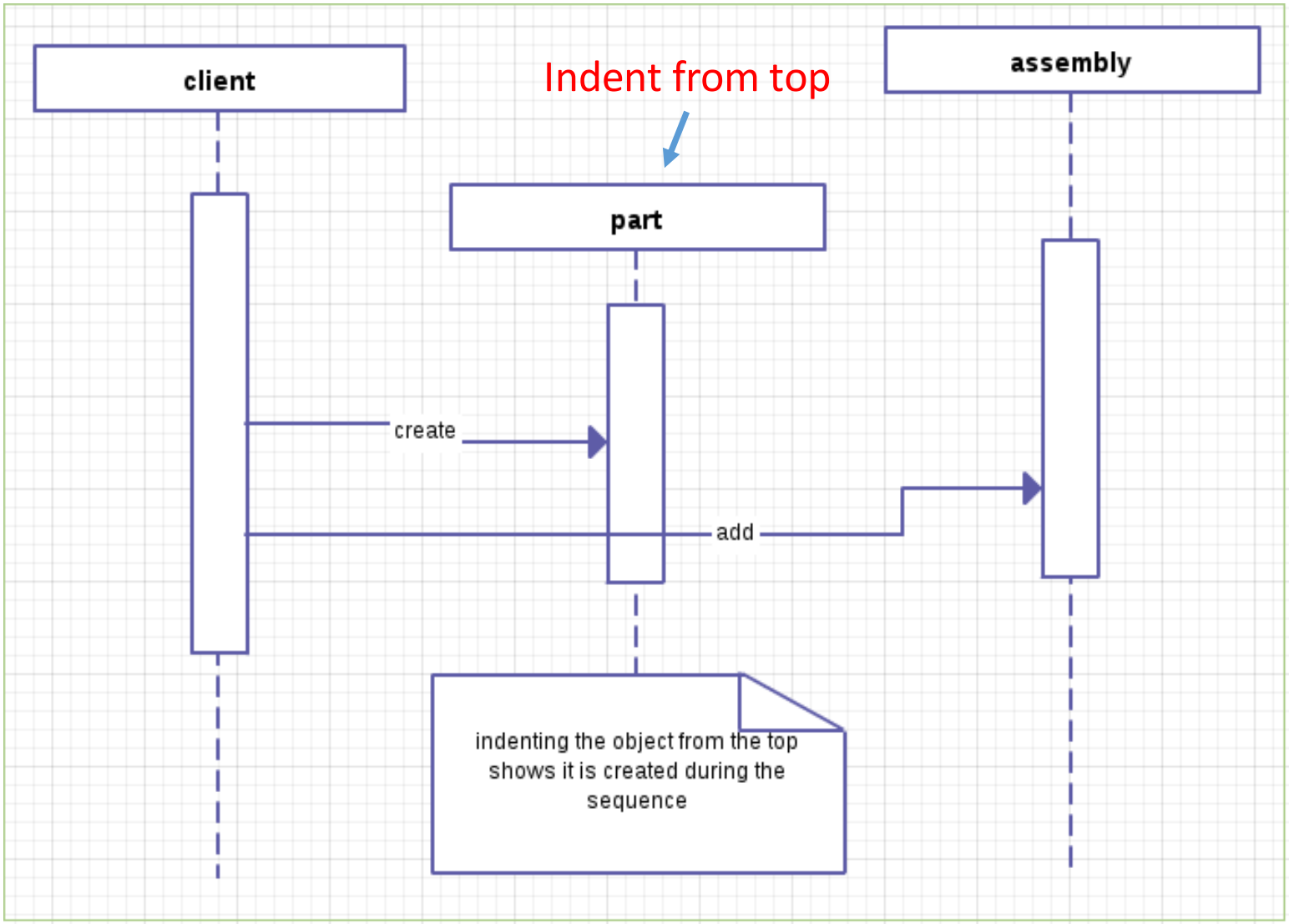
Self-calls

- Objects can call their own functions

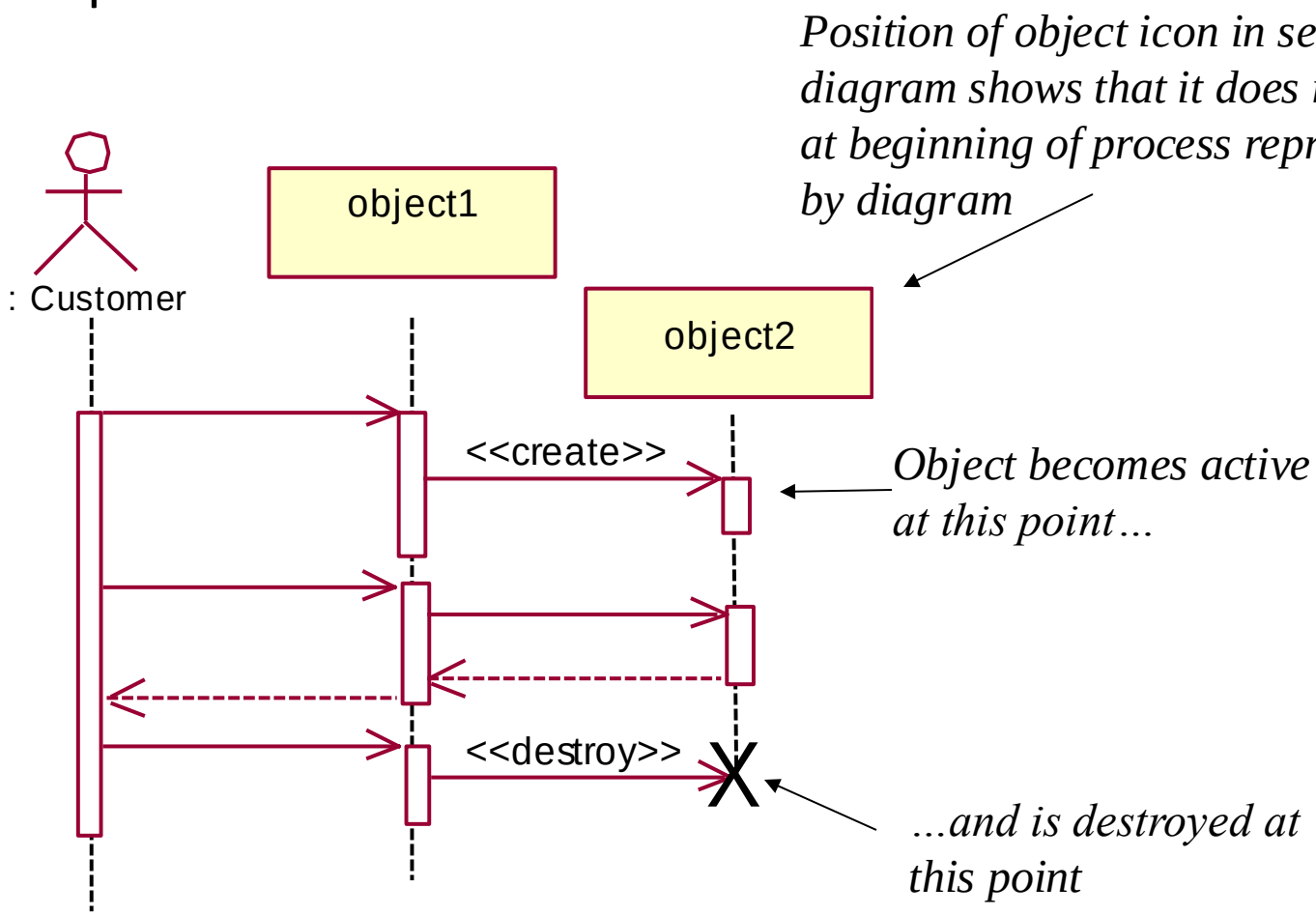
```
3  class SelfCall {
4      public void doit() {
5          // call one of our own
6          // functions
7          this.foobar();
8      }
9
10     private void foobar() {
11         // do something important
12     }
13 }
14
15 Selfcall selfish;
16 selfish.doit();
```



Creating objects

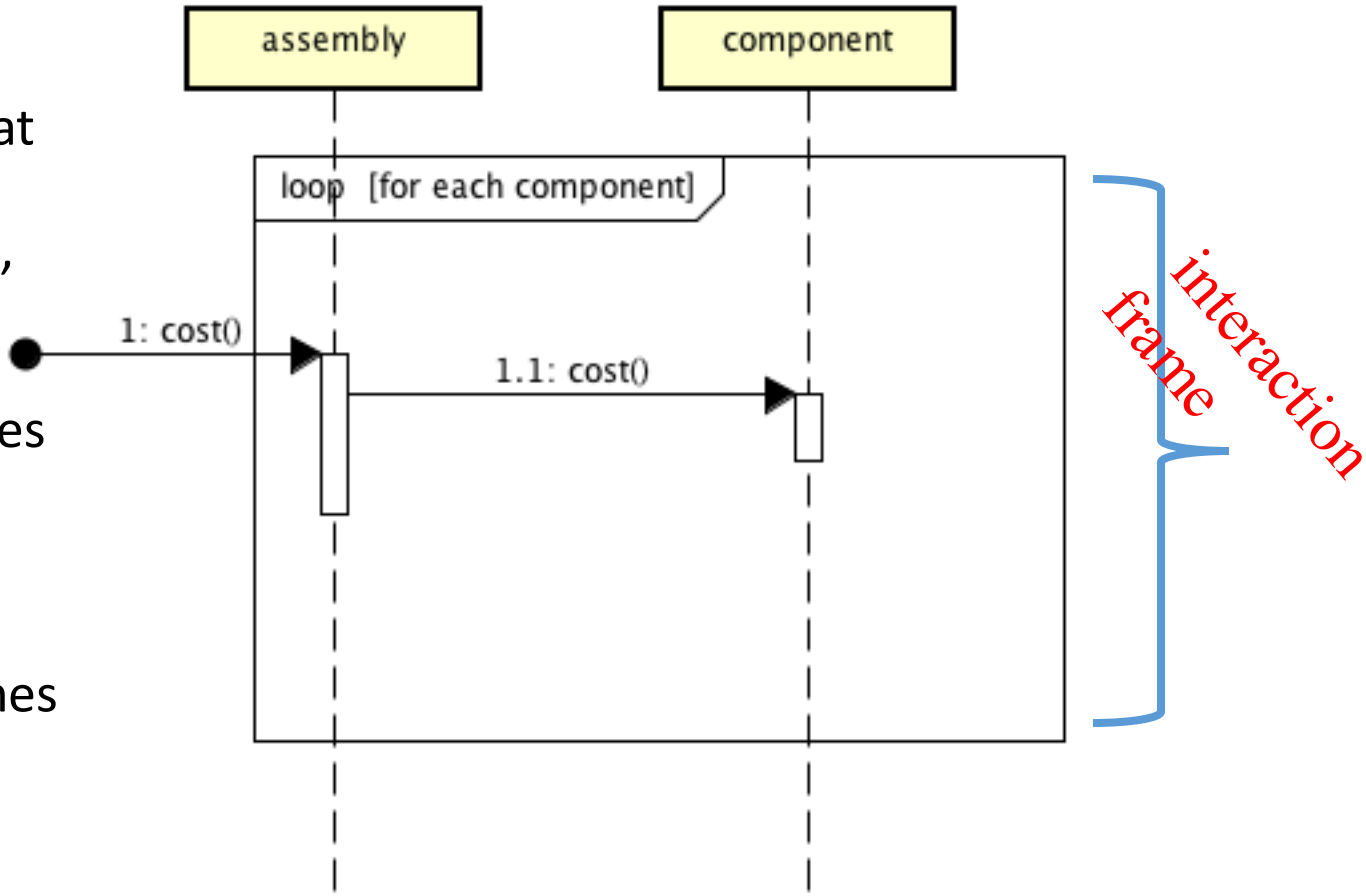


Example

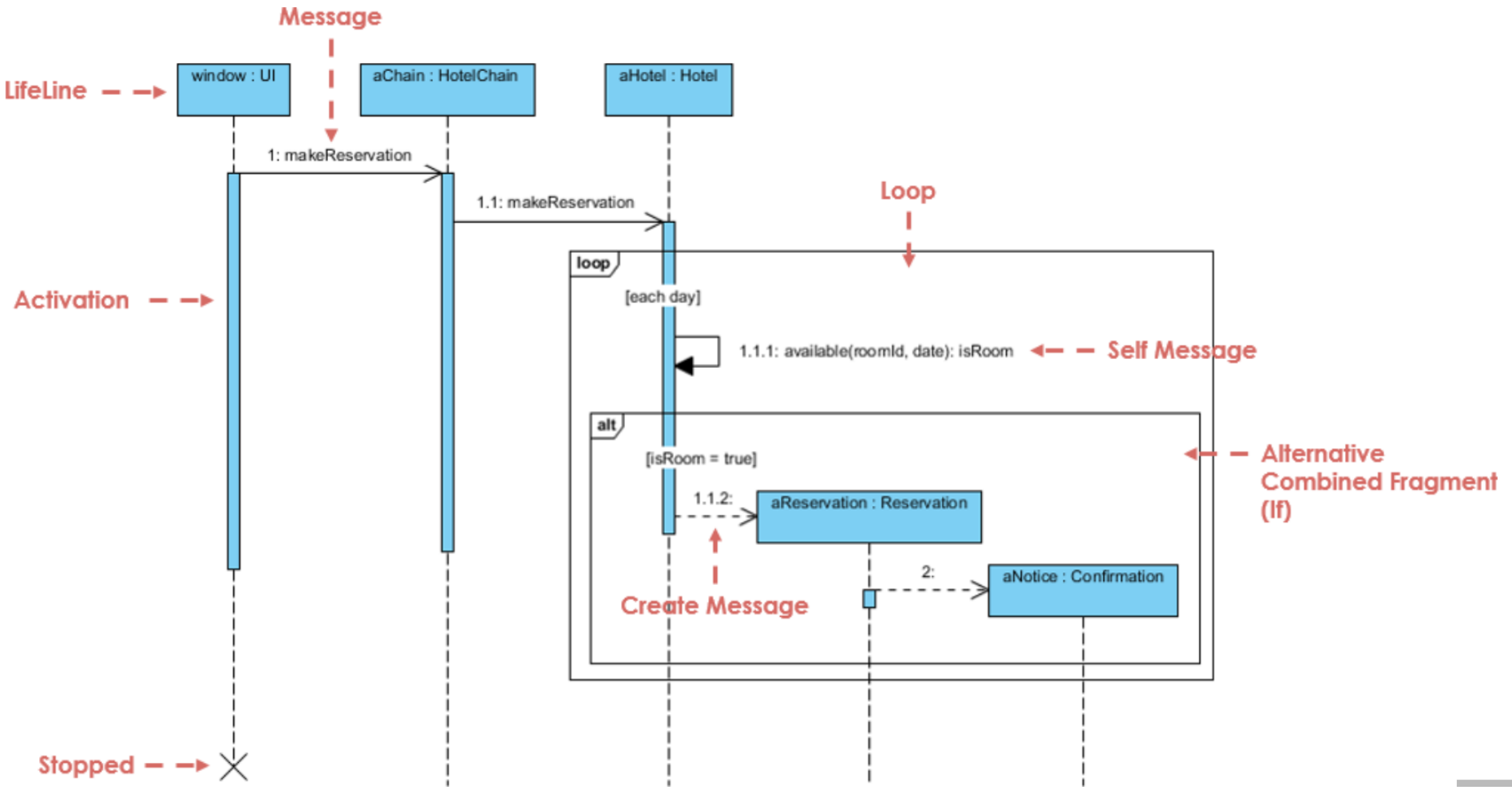

Position of object icon in sequence diagram shows that it does not exist at beginning of process represented by diagram
: Customer
object1
object2
<<create>>
Object becomes active at this point…
<<destroy>>
…and is destroyed at this point

Loops and conditionals

- Sequence diagrams good at representing order over time, but not great at representing control structures – e.g, loops and conditionals
- UML2 – interaction frames



Example



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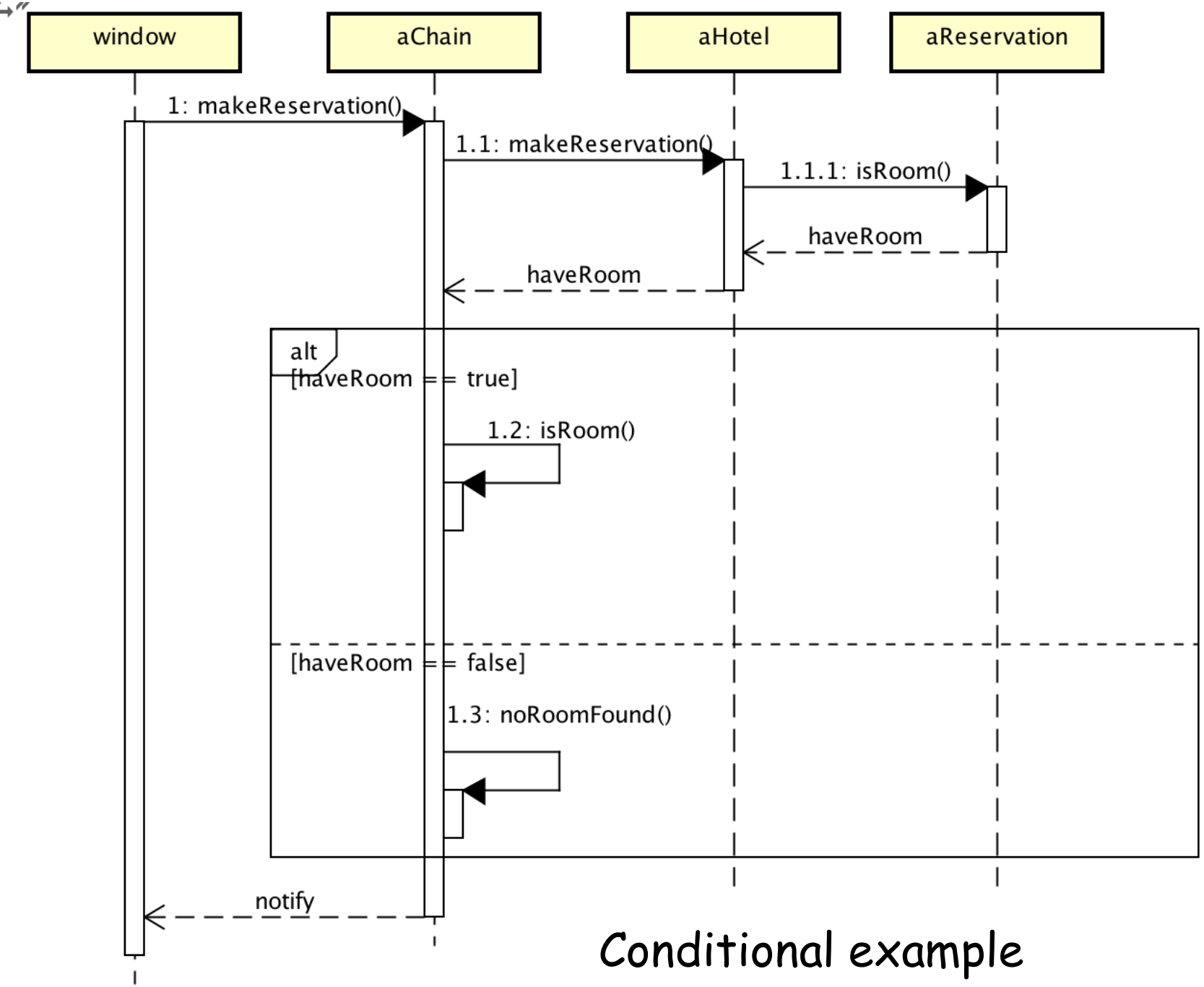

Conditional example