IX. Sequence and Collaboration Diagrams

Interaction Diagrams

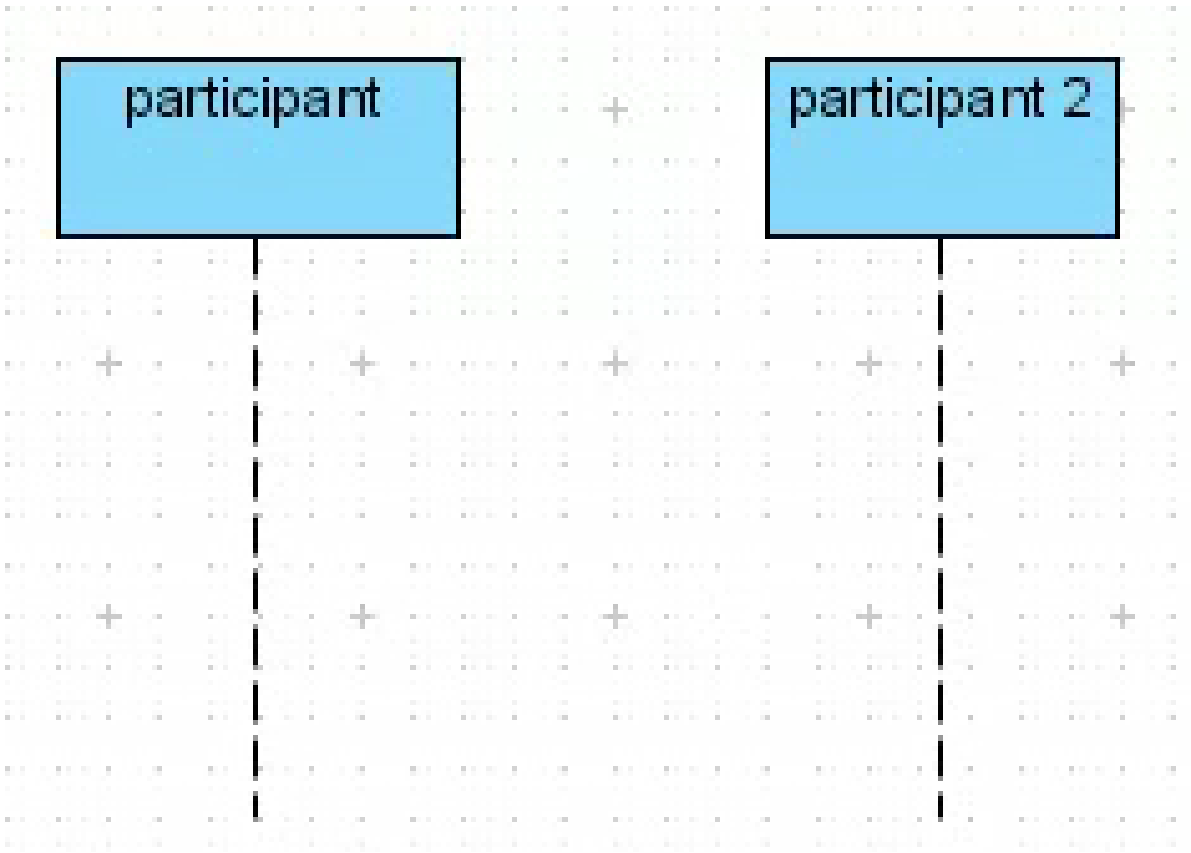
Sequence Diagrams

Examples

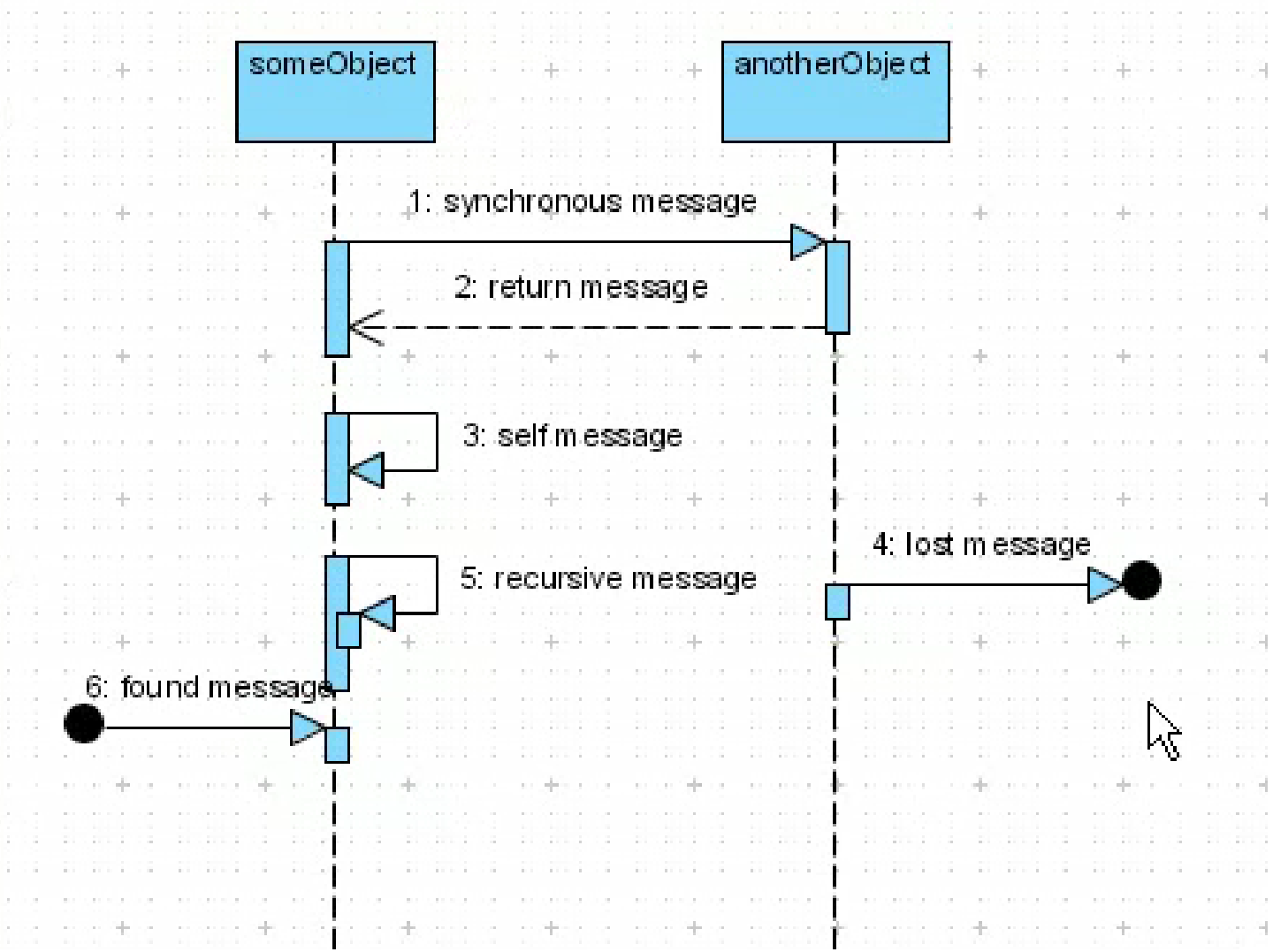
Collaboration Diagrams

Acknowledgment: these slides are based on Prof. John Mylopoulos slides which are used to teach a similar course in the University of Toronto – St. George campus. Used with Permission.

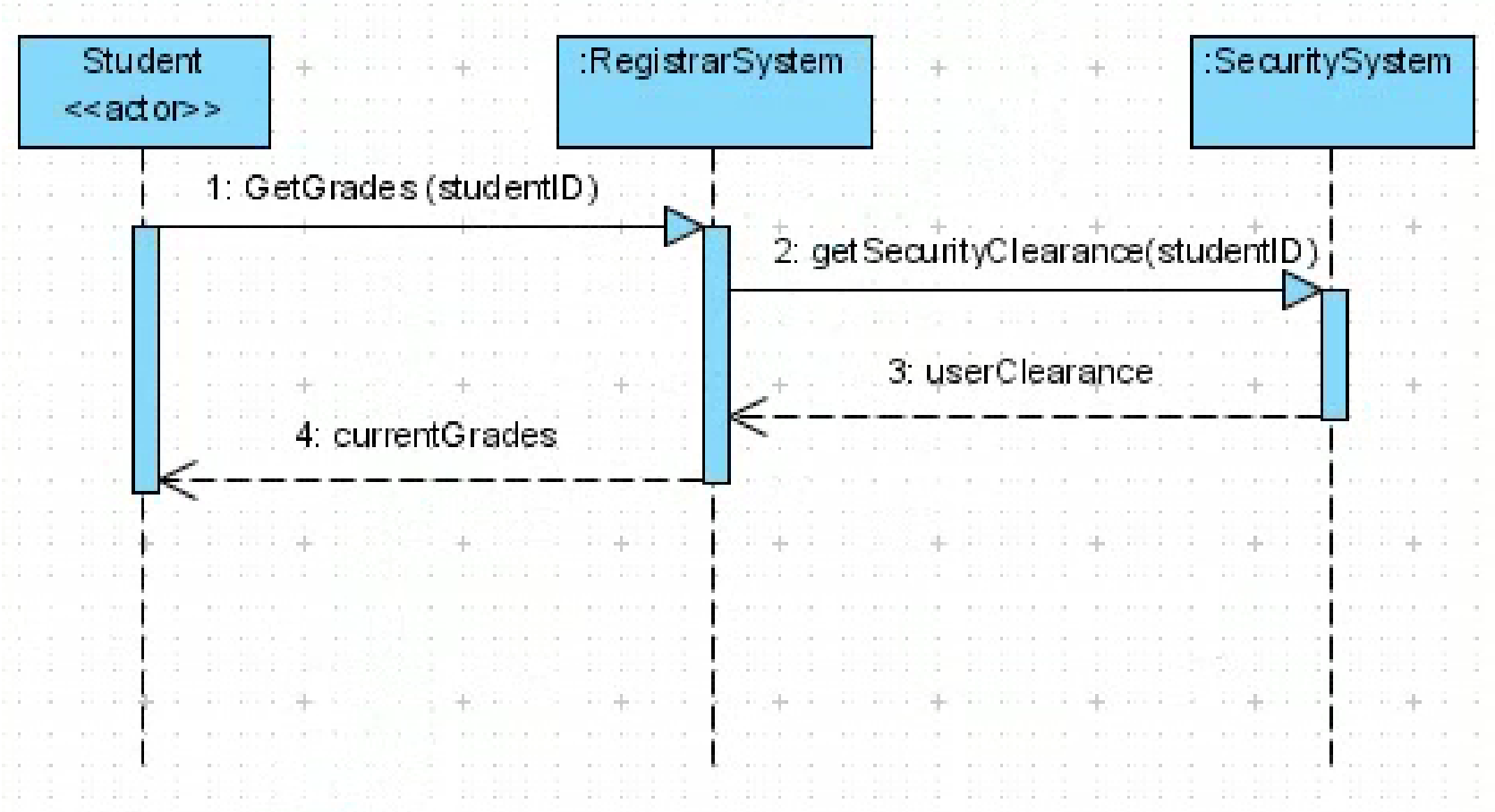
Sequence Diagram Layout



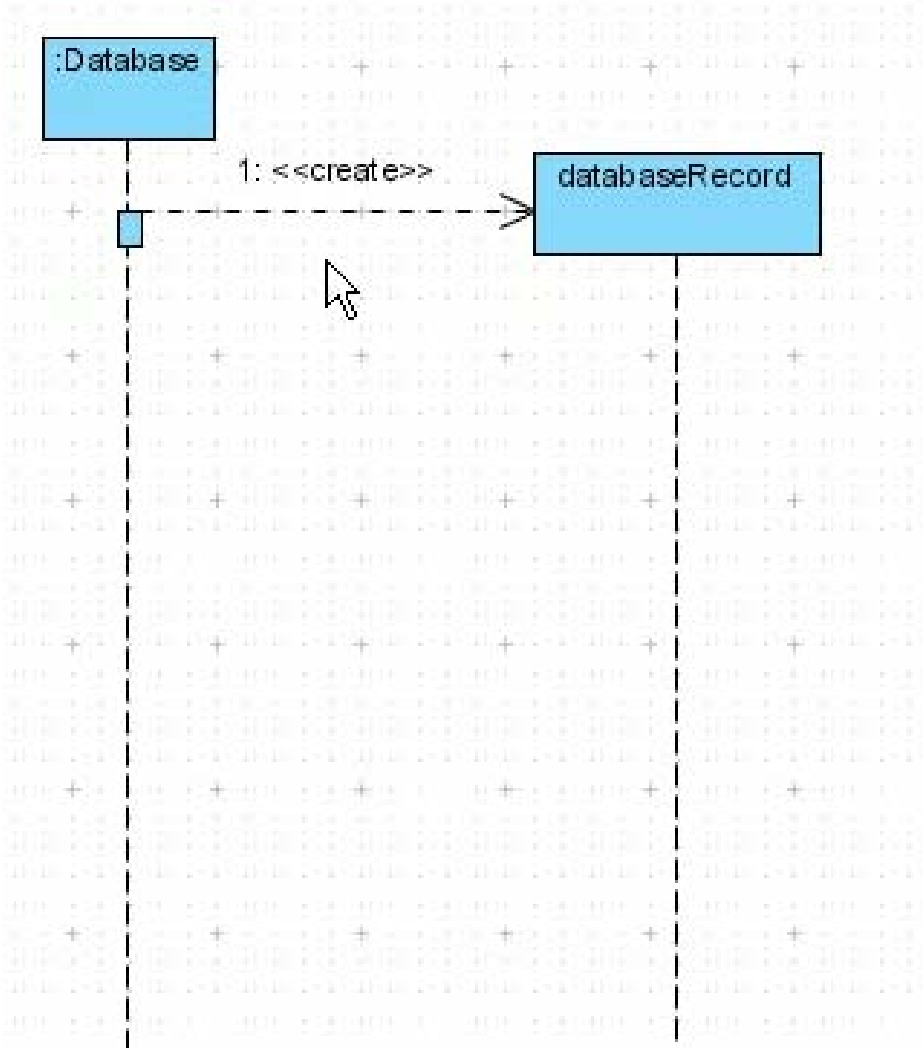
Sequence Diagram Messages



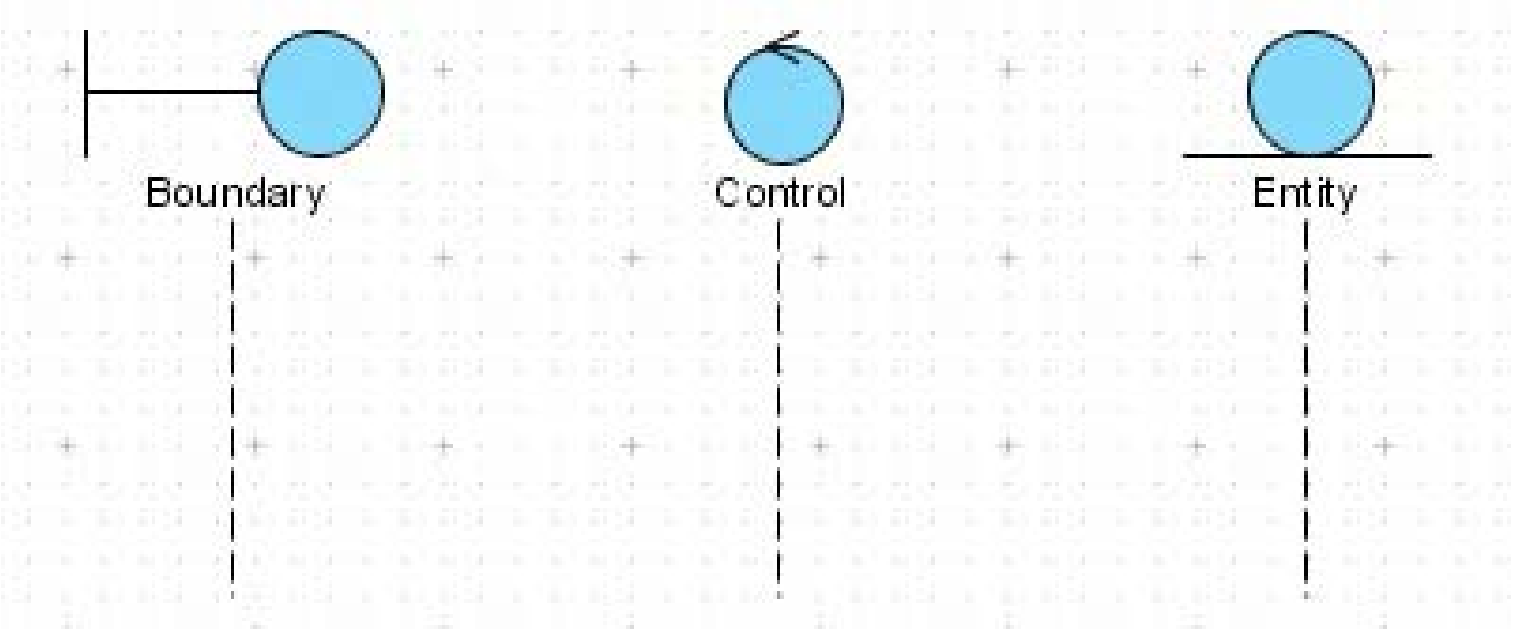
Sequence Diagram for Accessing Grades



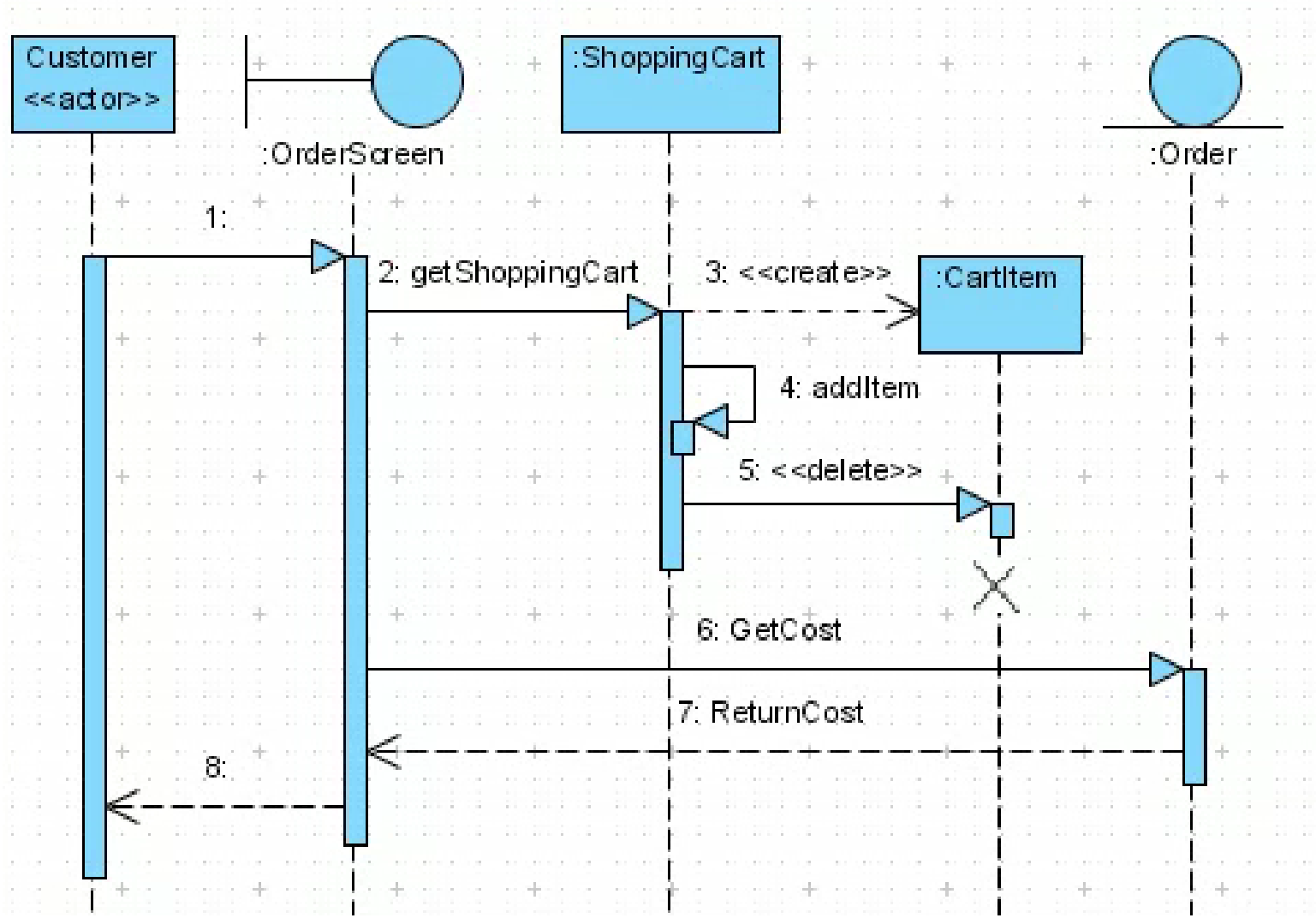
Sequence Diagram Messages – cont'd



Sequence Diagram Participants

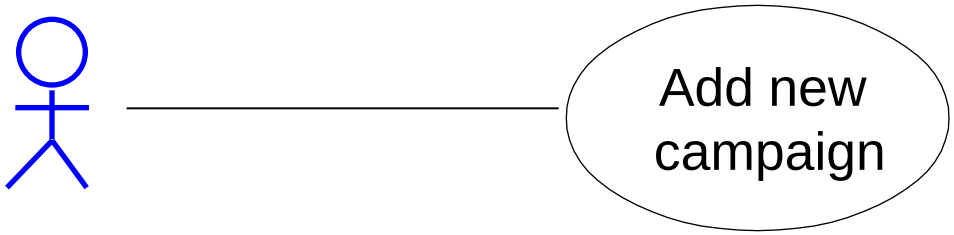


Sequence Diagram for Online Shopping



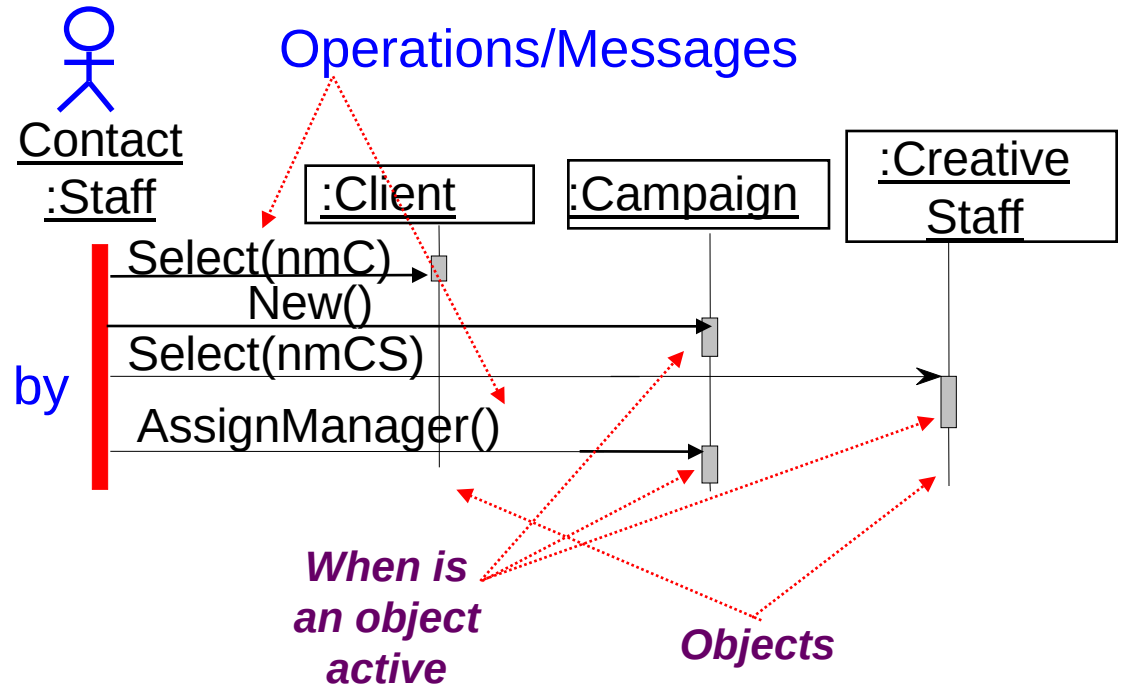
Example: Add a New Campaign

- Getting back to the use case "Add a new campaign"



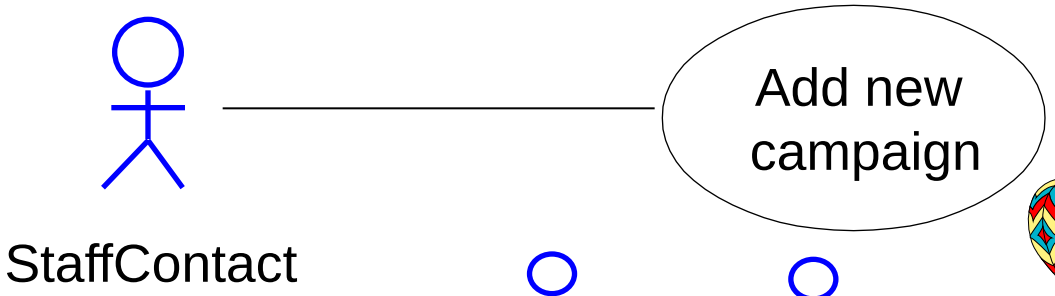
Add new campaign

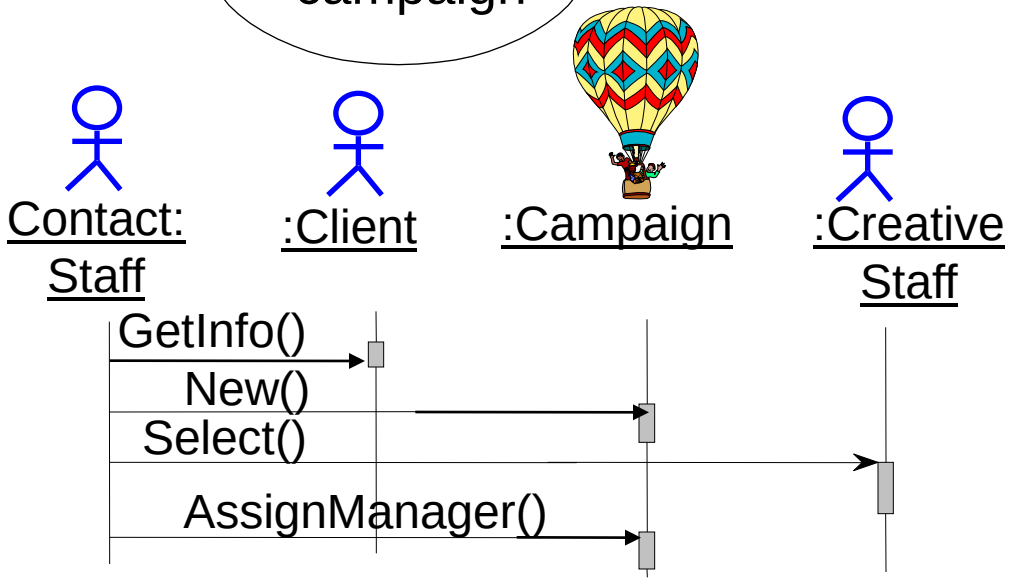
- ✓ Find client by name
- ✓ Create new campaign
- ✓ Find creative staff member by name
- ✓ Assign campaign manager



Add New Campaign

- This describes a business process, with no system involved.





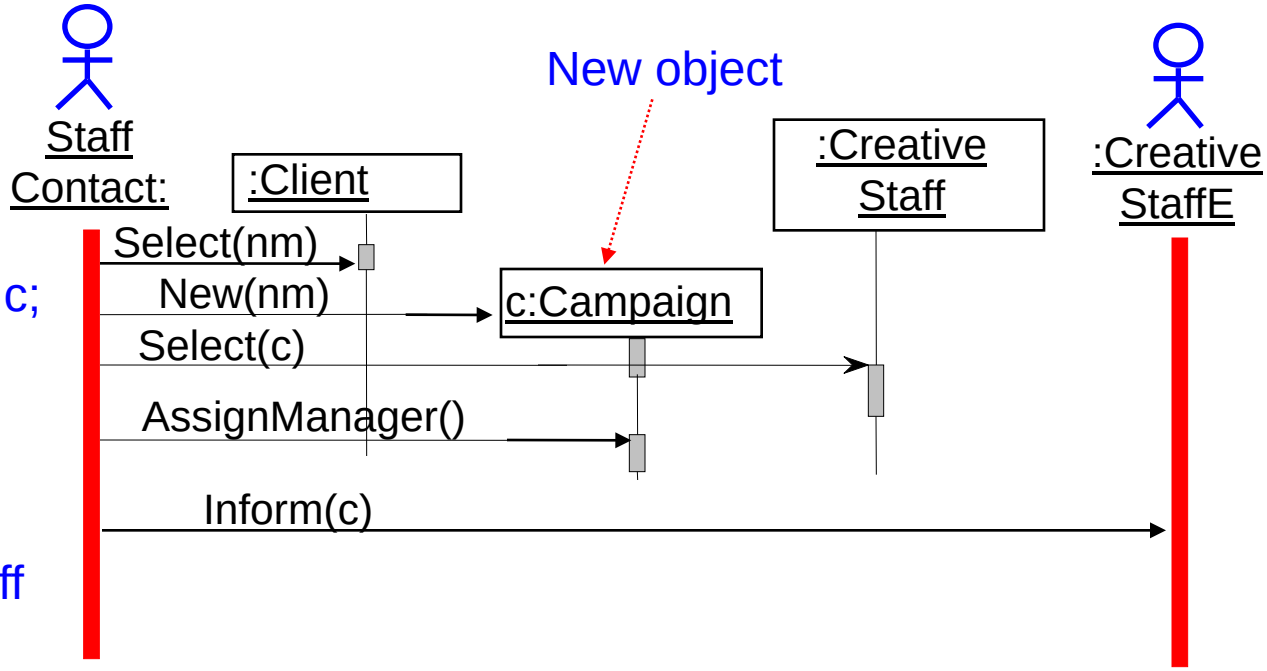
Add new campaign

- ✓ Get client details
- ✓ Create new campaign
- ✓ Select staff members
- ✓ Assign campaign manager

A More Realistic Example

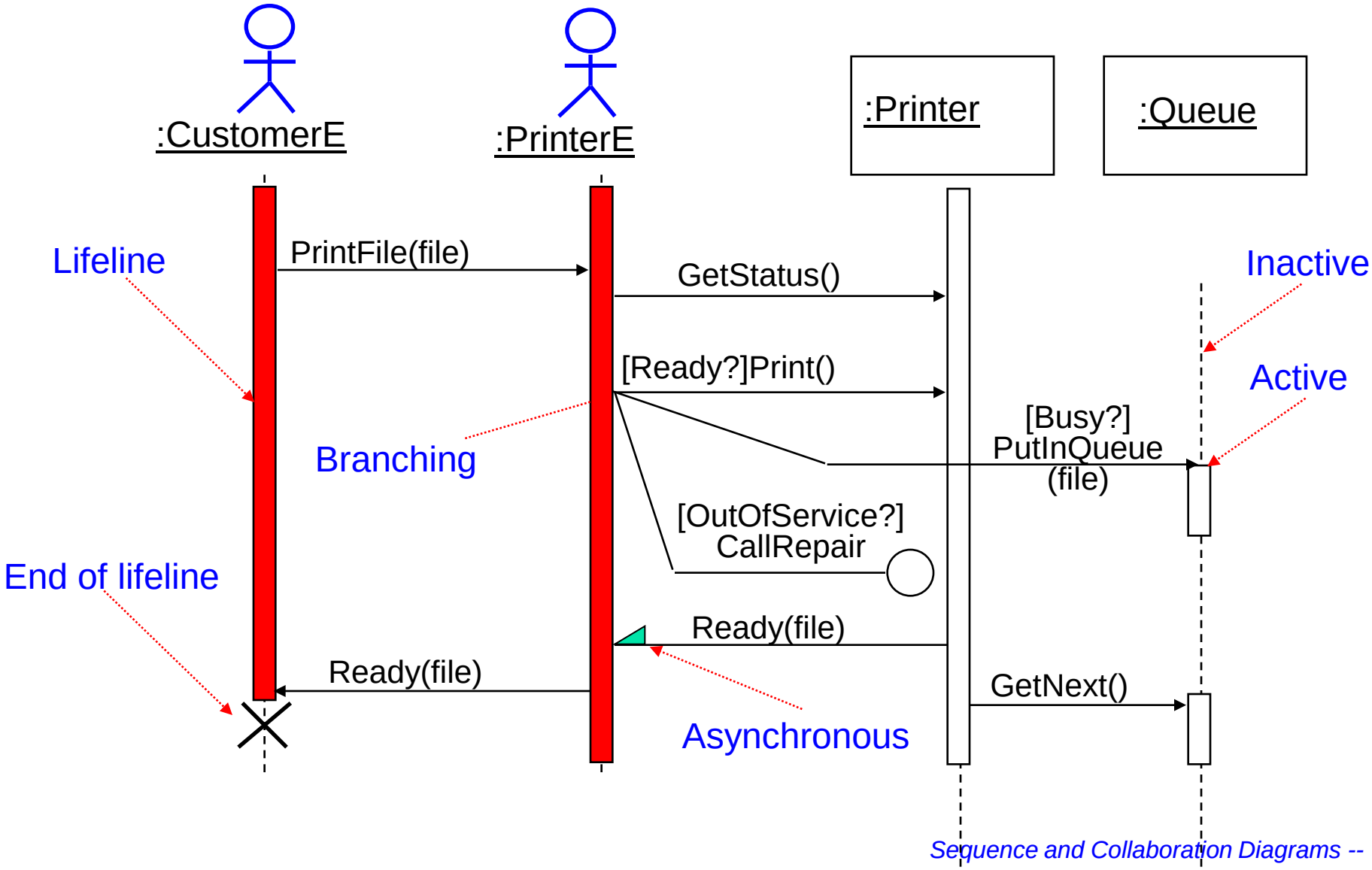
Add new campaign

- ✓ Find client by name;
- ✓ Create new campaign c;
- ✓ Assign creative staff member to c;
- ✓ Assign campaign manager;
- ✓ Inform the creative staff person.



- This describes a business process involving two people and three system objects.

Another Example: Print Shop

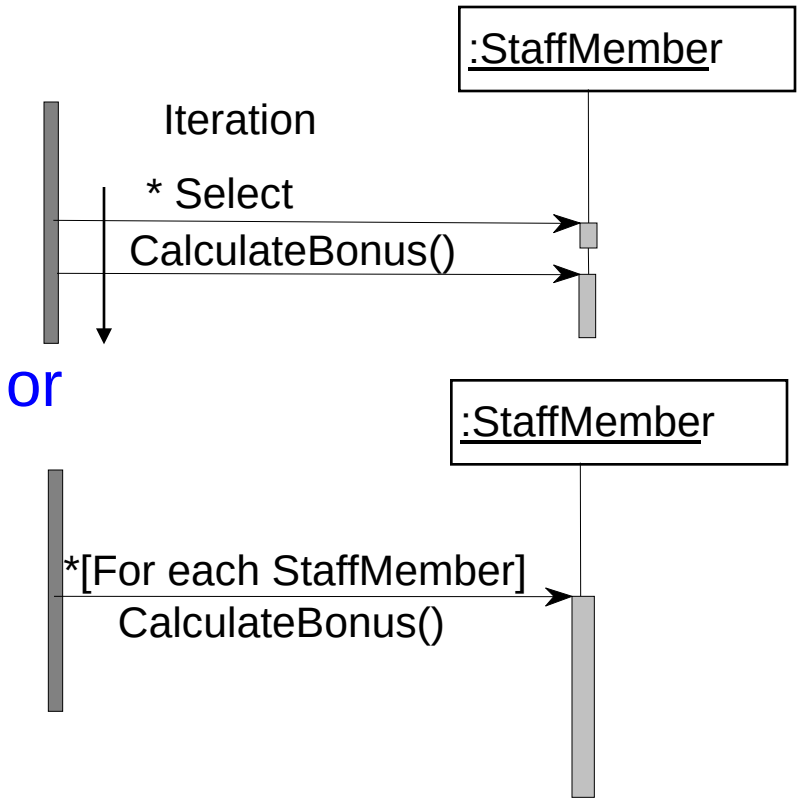


Iteration

- Iteration (repetition of an operation) is shown with an asterisk
- Each `StaffMember` will be selected in turn
- Once selected, the `CalculateBonus` message will be sent to the one currently selected
- There is only one loop!

Calculate Staff Bonuses

Description
Start For Each StaffMember Select next Staff Member Calculate Bonus for Staff Member

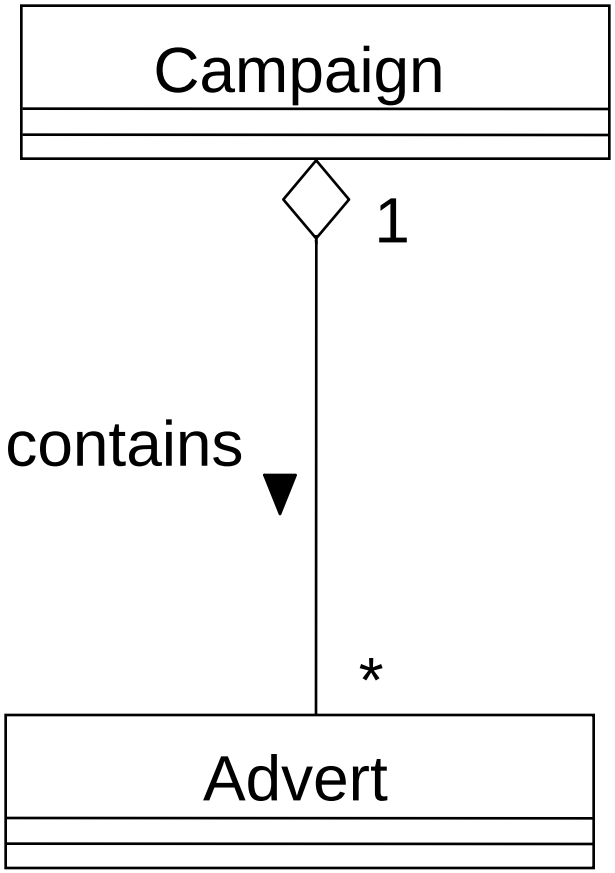


Drawing Sequence Diagrams

- For a particular use case, start by identifying which objects and actors might be involved.
- You may not get this right, but you can always change it.
- Imagine that there is a use case required by Agate called Check Campaign Budget.
- Each Campaign has an EstimatedCost attribute and each Advert has an EstimatedCost attribute.
- The purpose of the use case is to check that the total estimated cost of all the adverts is less than that for the campaign as a whole.
- ...Which objects are involved here?

Campaign and Advert

Class diagram showing aggregation



The Campaign Class

Campaign
+Title:String +CampaignStartDate:Date +CampaignFinishDate:Date +EstimatedCost:Money +ActualCost:Money +CompletionDate:Date +DatePaid:Date -StaffCount:Integer = 0
+Completed(CompletionDate:Date,ActualCost:Money) +SetFinishDate(FinishDate:Date) +RecordPayment(DatePaid:Date) +CostDifference():Money +GetCampaignContribution():Money +CheckBudget():Money

The Advert Class

Advert
#Title:String #Type:String #TargetDate:Date #CompletedDate:Date #EstimatedCost:Money
+SetCompleted(CompletedDate:Date=Today) +GetTitle():String +GetType():String +GetTargetDate():Date +GetCompletedDate():Date +GetCost():Money

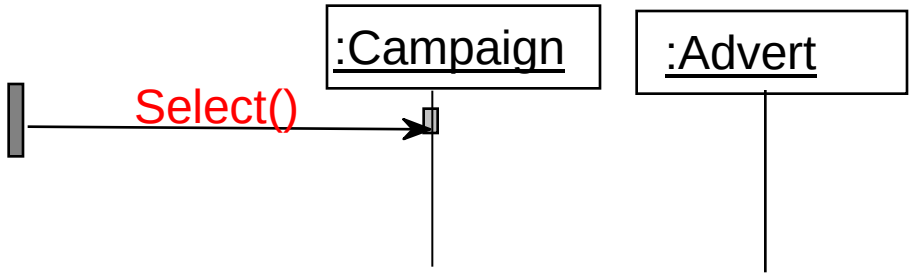
Getting a Sequence Diagram

- Where do we start?
- Select the relevant Campaign, probably using its name.
- How we select it is something we leave for the design phase:
  - ✓ it could be from a list box;
  - ✓ it could involve a separate window on the screen;
  - ✓ it could involve some kind of index.
- These are design issues, which we shall leave for now, although we should document them if the customer expressed a preference at this stage.

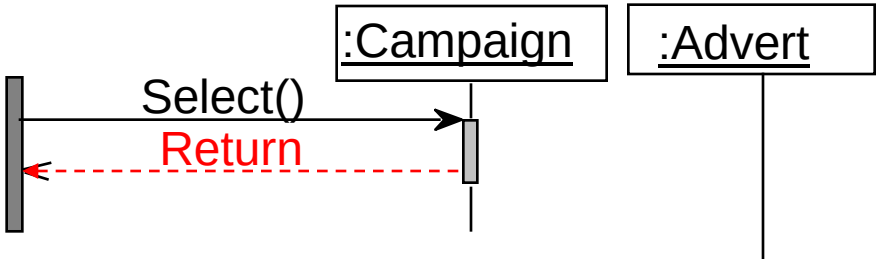
Creating a Sequence Diagram

Check Campaign Budget

Description
Select Campaign



- We also add in a Return

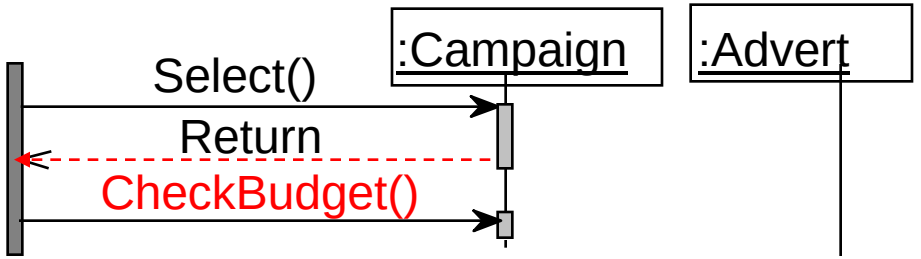


Creating a Sequence Diagram

- We then need to send a message to the Campaign to check its budget.

Check Campaign Budget

Description
Select Campaign - Check Budget

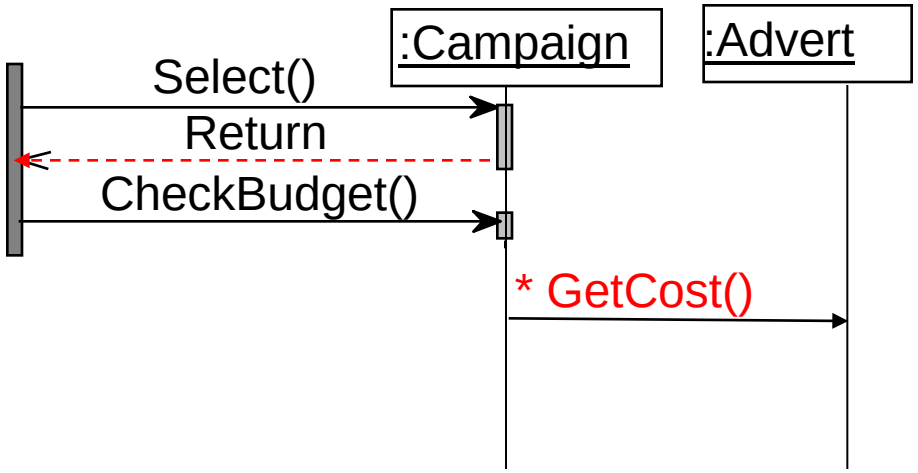


- Note there is no Return here. Where does control go?

Creating a Sequence Diagram

Check Campaign Budget

Description
Select Campaign - Check Budget For each Advert Get Cost of Advert



- Note the * for iteration.
- We are assuming here that :Campaign knows about all the Adverts that are associated with it because of the aggregation association shown earlier.

Creating a Sequence Diagram

- What happens next?

Check Campaign Budget

Description

Select Campaign

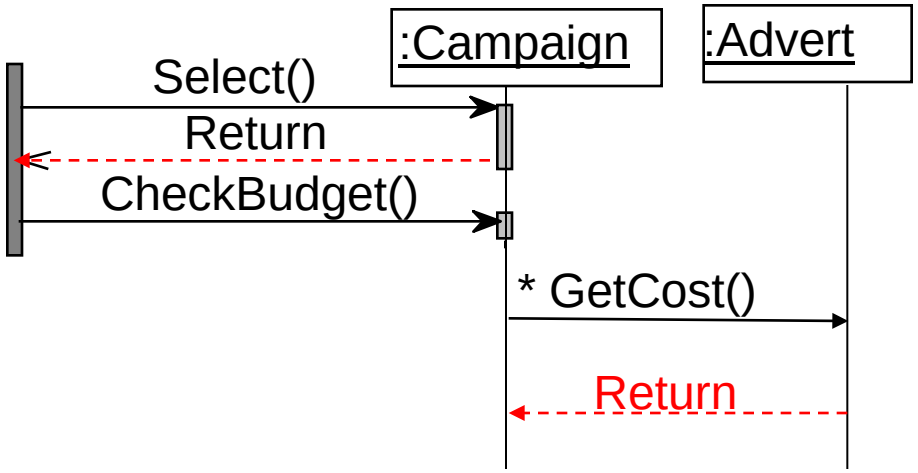
-

Check Budget

For each Advert

Get Cost of Advert

Return Cost of Advert

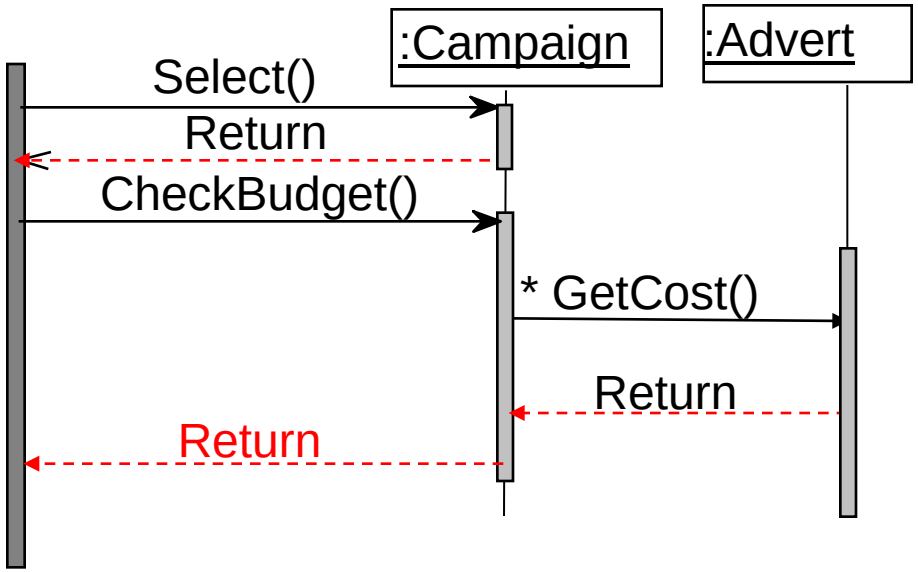


- Advert returns its cost, in this case the EstimatedCost of the Advert
- Once all the Advert's costs have been fetched and summed up, the total can be taken away from the EstimatedCost of the Campaign.

Creating a Sequence Diagram

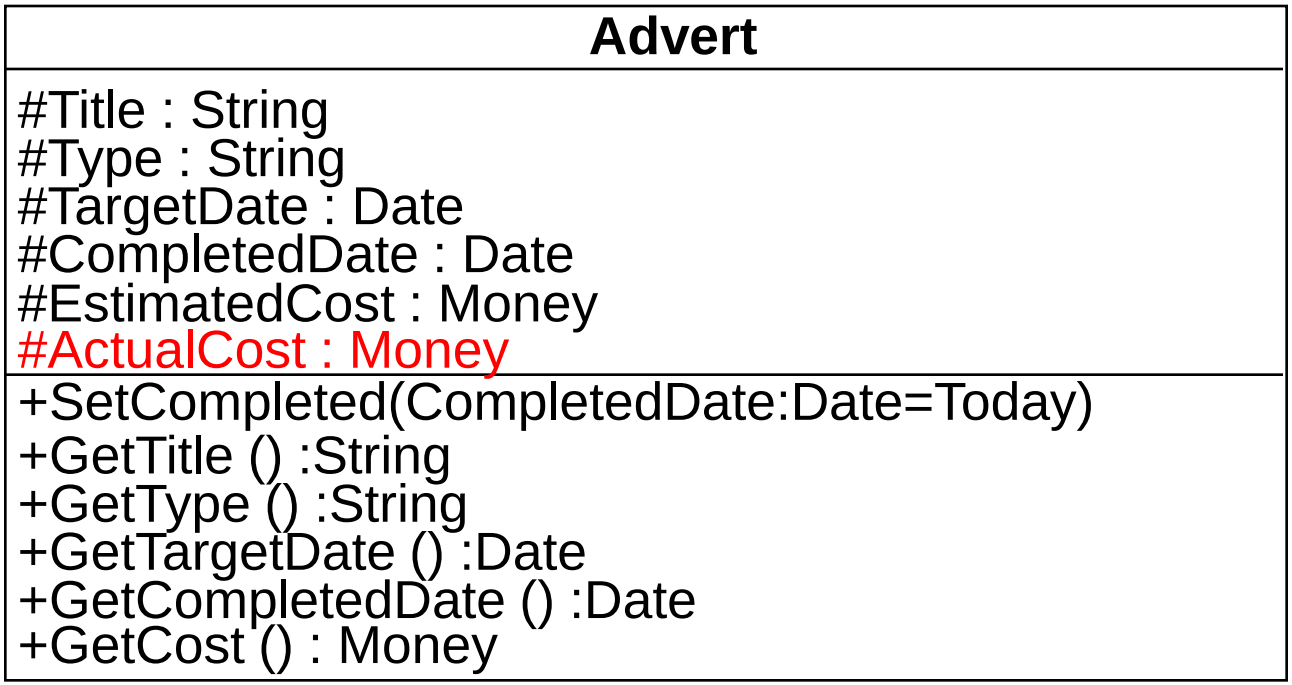
Check Campaign Budget

Description
Select Campaign - Check Budget For each Advert Get Cost of Advert Return Cost of Advert Return (Estimated Cost - Cost of Adverts)



- Now Campaign can return the difference between estimated cost and actual cost.

...Back to Class Diagrams...



- We could add a new attribute to Advert called ActualCost, which is set when an Advert has been completed.
- Now GetCost() can return the ActualCost if it exists, otherwise it uses EstimatedCost().

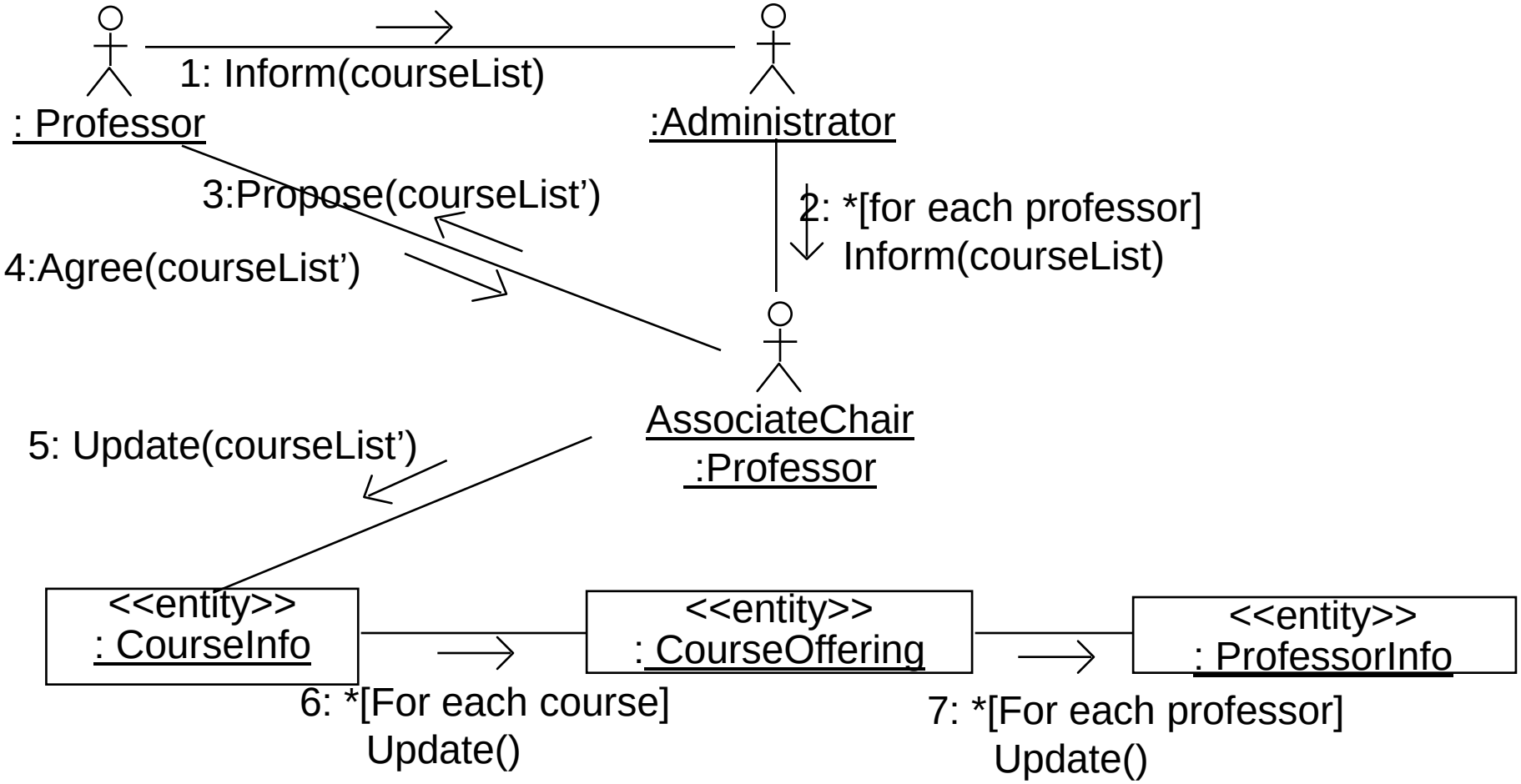
How to Use Sequence Diagrams

- In general, you may need several sequence diagrams to describe a single use case.
- A use case may involve complex control logic; sequence diagrams on the other hand should remain easy to read and understand.
- For a complex use case, use several sequence diagrams, each of which describes a possible scenario for the use case.

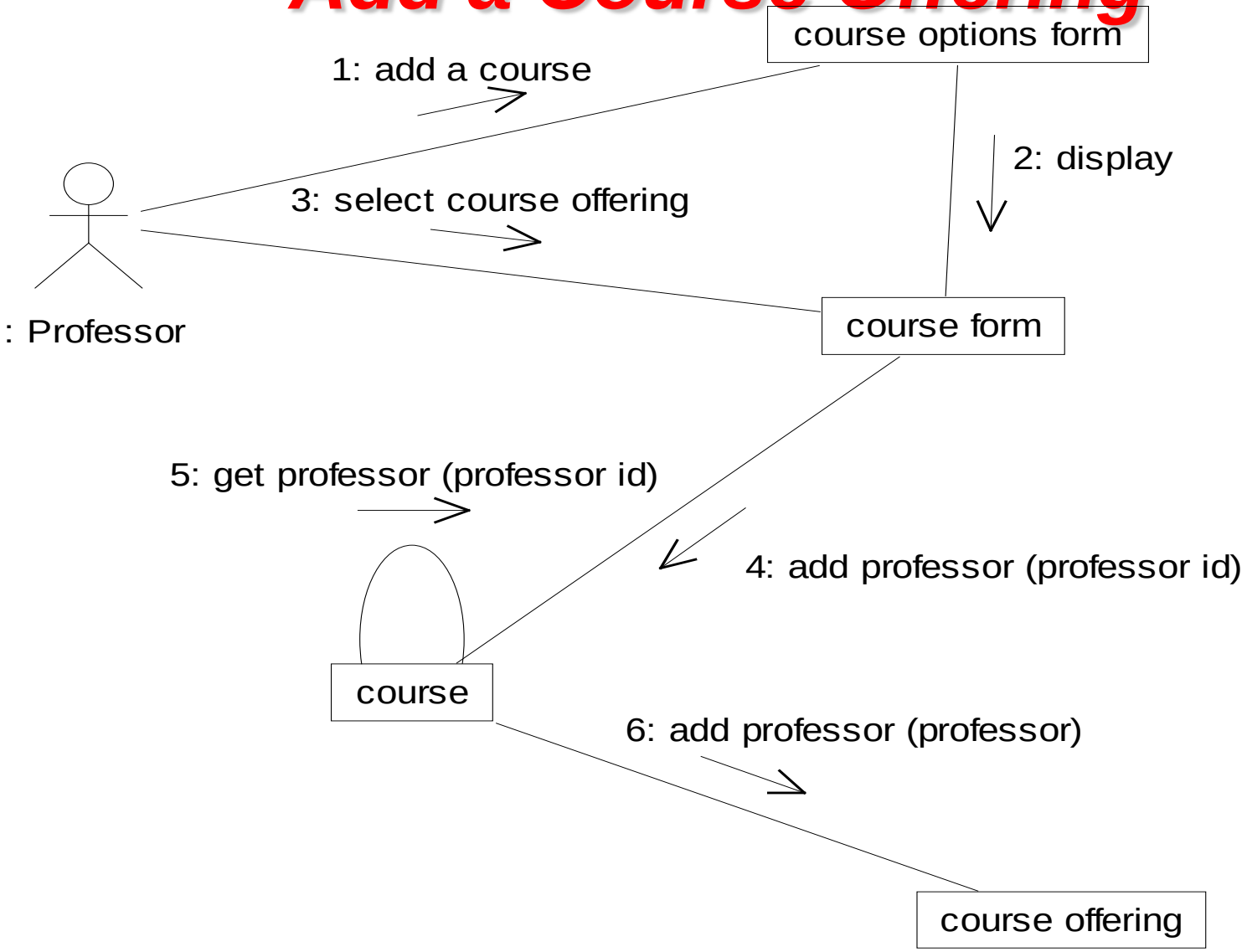
Collaboration Diagrams

- These diagrams are comparable to sequence diagrams. In fact, you can map every sequence diagram to an equivalent collaboration diagram and vice versa.
- Collaboration diagrams show interaction without the time dimension, but do include object links.
- Like sequence diagrams, collaboration diagrams are intended to model scenaria; each scenario describes a possible sequence of events and actions.
- Sequence diagrams are helpful because they capture visually the sequence of events over time.
- Collaboration diagrams capture more directly the interactions between actors and objects.

Select Courses to Teach



Add a Course Offering



Additional Readings

- [Booch99] Booch, G. et al. *The Unified Modeling Language* User Guide. Chapters 15, 18, 27. Addison-Wesley.
- [Fowler00] Fowler, M. *UML Distilled: A Brief Guide to the Standard Object Modelling Language*. Chapter 5. Addison-Wesley.