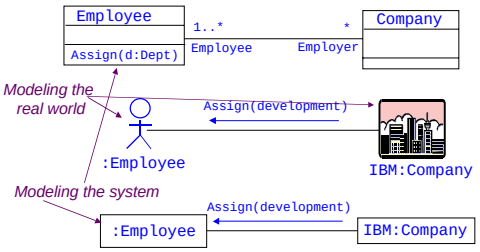
X. Sequence and Collaboration Diagrams

Interaction Diagrams
Sequence Diagrams
Examples
Collaboration Diagrams

Interaction Diagrams

- *Interactions among actors (people/objects) are modeled by **interaction diagrams.***
- *An **interaction** involve the exchange of messages between two or more actors.*
- *There are two types of interaction diagrams:*
  - ✓ *Sequence diagrams;*
  - ✓ *Collaboration diagrams.*

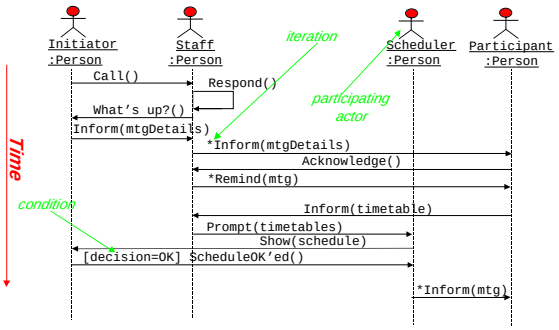
The Nature of an Interaction



Sequence Diagrams

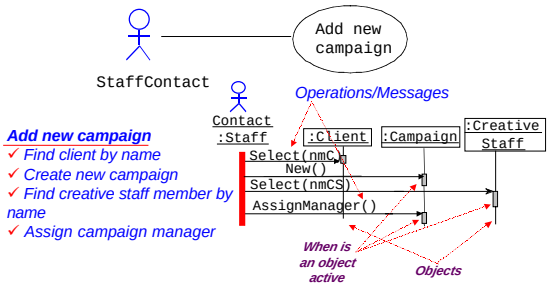
- *Sequence diagrams describe in detail how actors use use cases; they can also model external business processes.*
- *Interactions consist of one or more **messages.** Interactions may be synchronous, or asynchronous.*
- *Sequence diagrams defined during requirements analysis should **not**:*
  - ✓ *include design objects;*
  - ✓ *specify message signatures in any detail.*

The Basic Idea



Example: Add a New Campaign

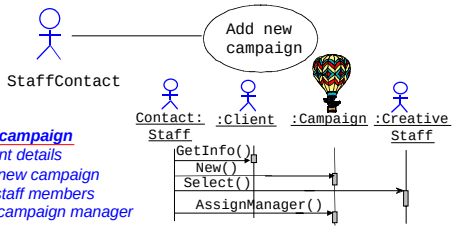
- *Getting back to the use case "Add a new campaign"*



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

Add New Campaign

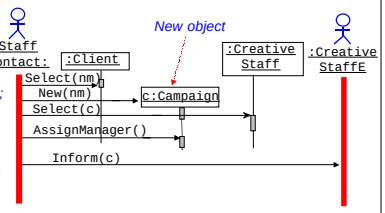
- This describes a business process, no system involved.



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

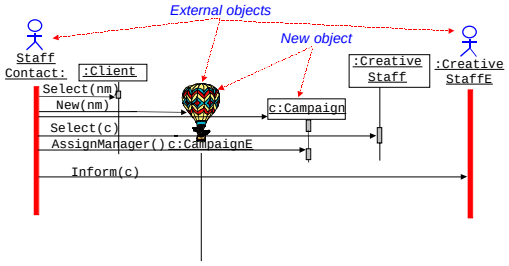
A More Realistic Example

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.

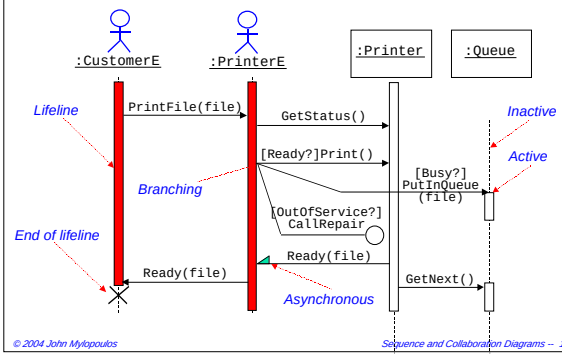


- This describes a business process involving two people and three system objects.

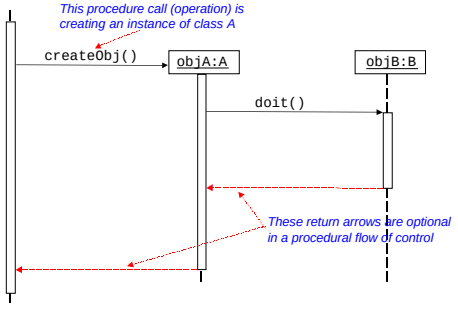
An Even More Realistic Example



Another Example: Print Shop

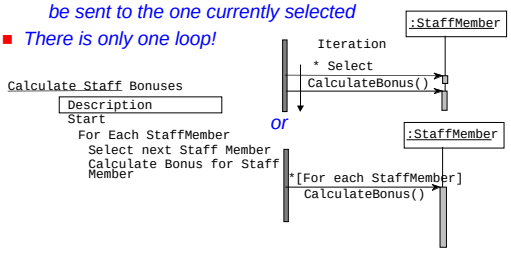


Flow of Control



Iteration

- Iteration 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!

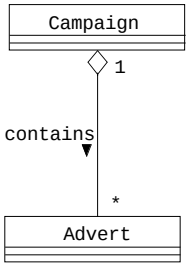


Drawing Sequence Diagrams

- For a use case, identify participating actors.
- Imagine that there is a use case required by Agate called `Check Campaign Budget.`
- `Campaign` has an `EstimatedCost` attribute and `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

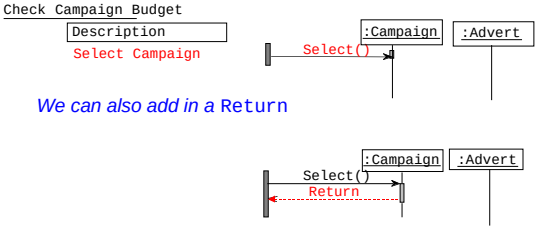
The Advert Class

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

Drawing 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



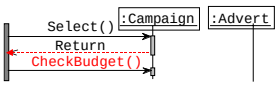
We can also add in a `Return`

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

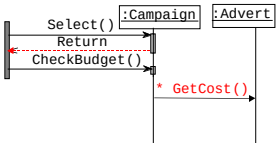


- Note there is no Return here. Where does control go?

Creating a Sequence Diagram

Check Campaign Budget

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



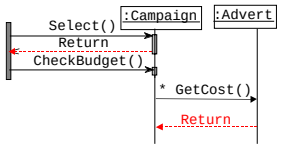
- Note the * for iteration.
- We are assuming here that :Campaign knows about all the Adverts that are associated with it because of the aggregation association shown earlier.

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

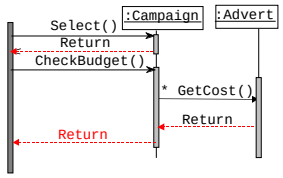


- Advert returns its cost, in this case the EstimatedCost of the Advert
- Once all the Advert's costs have been fetched and summed up, the total can be taken away from the EstimatedCost of the Campaign.

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...

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

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

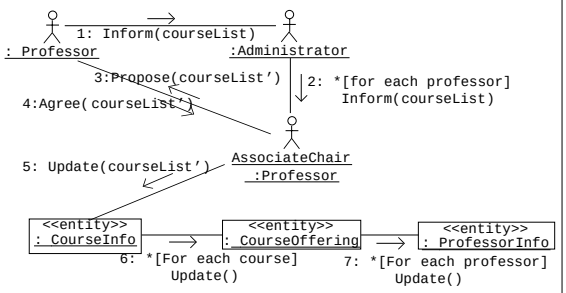
How to Use Sequence Diagrams

- 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.

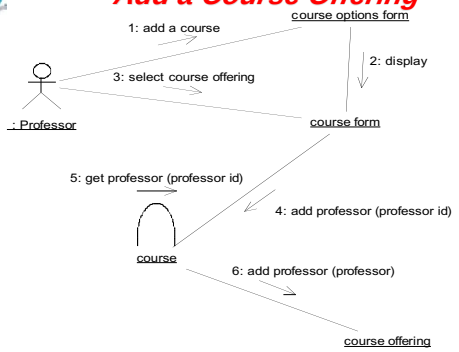
Collaboration Diagrams

- 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 interactions without the time dimension.
- Like sequence diagrams, collaboration diagrams are intended to model scenaria; each scenario describes a possible sequence of events and actions.
- 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.