

Component design

About “faking” it

midterm 2010 Question 5.d According to the paper “A Rational Design Process: How and Why to Fake It”, which describes ideas of a rational design process, what are two reasons why it is not possible for software projects to achieve a fully rational process?

Solution from exam pdf:

- Requirements change
- Unclear at the beginning what we’ll build at the end
- Development teams change
- People make mistakes

midterm 2012 Question 10 According to A Rational Design Process: How and Why to Fake It, why do projects typically not proceed in a rational, linear development process? Identify two reasons and give an example for each.

Solution:

People who commission the building of the software system do not have a clear view of the requirements from the beginning. Thus, the software needs to be adapted at a later point. E.g., when designing a GPS navigation application, it may not be obvious from the beginning that the users often interrupt navigation to find a gas station or place to eat along the way, and resume the original route afterwards. Making this action flow easy may significantly improve the application’s usability.

Software is often adapted for different purposes. The adaptation of the original software is not an ideal process, but it is often the economical choice. E.g., online stores are rarely built from scratch. The online store framework that is used often includes unnecessary features or less than ideal flow, but it is preferable to the cost of building the ideal software from scratch.

final 2013 Question 3.b Parnas and Clemens argue that we need to fake the design process. Why can’t it be done right the first time?

Solution is the same as for midterm 2010 Question 5.d. Also, there is a solution in the exam pdf

Modularity & Coupling

midterm 2008 Question 9 *Questions and solution in the exam pdf*

final 2008 Question 1.e Fill in the blanks: A good design should strive for *high* cohesion and *low* coupling.

Low-level design

MVC

midterm 2012 Question 2 Briefly describe and contrast the Three-tier and MVC architectures. State at least two differences.

Solution:

Both three-tier architectures and the MVC design pattern provide a way to separate concerns.

A typical three-tier architecture has a presentation tier (which is concerned with user interaction), an application (or business tier), and a data tier (which handles data storage and retrieval).

MVC is more concerned with the way a user interacts with the application and separates the functionality in three parts: the view (the way the data is presented to the user), the controller (which handles the way the application reacts to the user), and the model (which defines the business logic).

In an architecture-centric view, the MVC is just a way to implement the presentation tier. Still, more generally, MVC can be seen as a way to implement the entire three-tier architecture. The view and controller make the presentation tier, and the model is the application tier. The data tier can be seen as part of the model, or as a separable part (e.g., the database implementation can often be changed independent of the model).

final 2013 Question 4.b What is the main difference between the traditional MVC and the web MVC?

Solution (there is shorter solution in the exam pdf):

Most web applications use a *passive* MVC implementation, as described in the Microsoft article on the MVC pattern (which references Steve Burbeck’s paper “Application Programming in Smalltalk-80: How to use Model-View-Controller (MVC)”).

In passive MVC, the view is not automatically updated when the model is changed, but it has to query the model to get the latest data. Another way of putting this is that changes to the model are not *pushed* to the view.

final 2013 Question 3.d The main design principle in MVC is the separation between the presentation layer and the problem domain model. Name three reasons why it is important to have the two layers separated.

Solution (there is another solution in the exam pdf):

- model and presentation *implementations* can be changed independently of each other
- security: a bug in the presentation may not compromise the underlying data/model
- the model and presentation can be run on different platforms (e.g., the model on the server and the presentation in the browser)

Decision tables

midterm 2009 Question 6 Create a decision table that represents the following decision tree.

See the complete question and solution in the exam pdf

final 2010 Question 3.d Create a decision table to decide the reimbursement percentage for the following medical insurance scenario. (note: this scenario is from Bill Rogers' Systems Analysis & Design course at Saint Xavier University)

No charges are reimbursed to the patient until the deductible has been met. After the deductible has been met, the amount to be reimbursed depends on whether or not the doctor or hospital is a "Preferred Provider." For preferred providers, Doctor's office visits are reimbursed at 65% and Hospital visits are reimbursed at 95%. For other providers reimburse 50% for Doctor's Office visits or 80% for Hospital visits.

Solution:

Both the following solutions are considered correct:

Conditions									
deductible has been met	N	N	N	N	Y	Y	Y	Y	
doctor (as opposed to hospital) is a "Preferred Provider"	N	N	Y	Y	N	N	Y	Y	
is doctor (as opposed to hospital) visit	N	Y	N	Y	N	Y	N	Y	
Actions									
reimbursed at	0%	0%	0%	0%	95%	50%	80%	65%	

Conditions

deductible has been met	N	N	N	N	Y	Y	Y	Y
doctor (as opposed to hospital) is a "Preferred Provider"	N	N	Y	Y	N	N	Y	Y
is doctor (as opposed to hospital) visit	N	Y	N	Y	N	Y	N	Y

Actions

reimbursed 0%	Y	Y	Y	Y	N	N	N	N
reimbursed 50%	N	N	N	N	N	Y	N	N
reimbursed 65%	N	N	N	N	N	N	N	Y
reimbursed 80%	N	N	N	N	N	N	Y	N
reimbursed 95%	N	N	N	N	Y	N	N	N

final 2013 Question 7.b *See the question and solution in the exam pdf*

Data flow diagrams

midterm 2009 Question 7 What aspects of a design do data flow diagrams show better than UML? What aspects of a design does UML show better than data flow diagrams?

Solution from exam pdf:

DFDs are better for showing the flow of data between processes (which are represented by the circles – not classes!); better for procedural programs. You could also mention entities and data stores. Simply stating “flow of data” will not receive full credit because it is given by the name; you need to state or suggest the component types in the DFD. UML diagrams are better for showing the structure of the system, such as classes and methods and their relationships, the sequence of their interactions, the actors and their use cases; better for Object-Oriented programs. Using vague words such as “components” or “modules” may not receive full credit without some other more specific words.

Other

final 2013 Question 7.a Bill Gates remarks that measuring a program by the number of lines of code is like measuring an airplane by how much it weighs. Do you agree? Argue your position.

Solution from exam pdf:

Yes, he is correct. The number of lines of code does not tell us anything about the design, complexity, etc.

UML

midterm 2008 Question 10(a, b) *See question and solution in the exam pdf*

final 2008 Question 16(a, b) *classic game with many solutions online*

midterm 2009 Question 9 (1, 2, 3) *See question and solution in the exam pdf*

final 2009 Question 12(a, b) *See the exam for the questions*

Solution:

a)

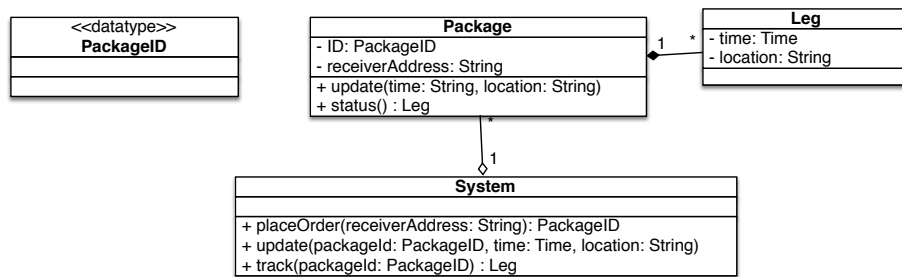


Figure 1: Class diagram

b)

midterm 2010 Question 7(a, b) *See question and solution in the exam pdf*

final 2010 Question 10(a, c) *Solution:*

a)

c)

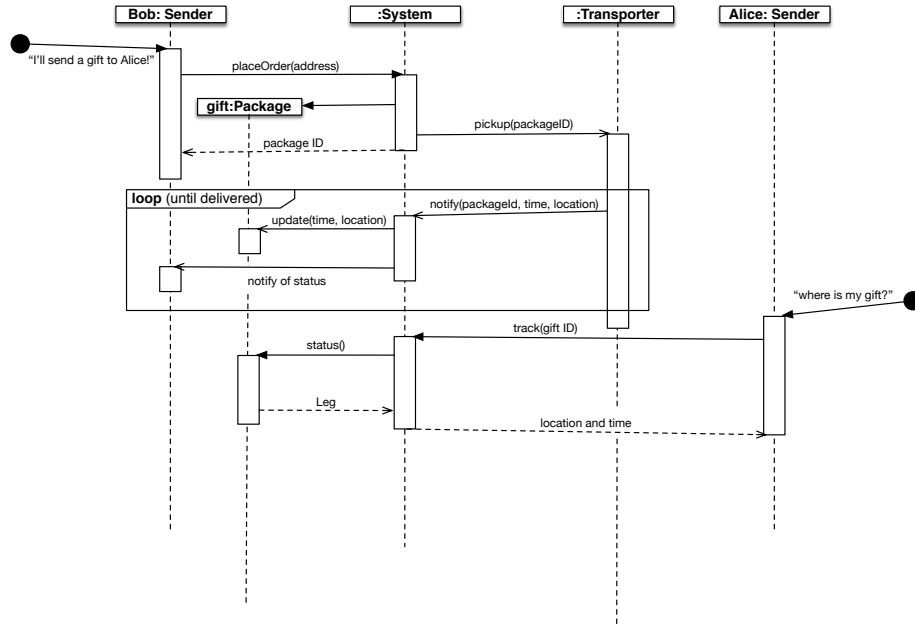


Figure 2: Sequence diagram

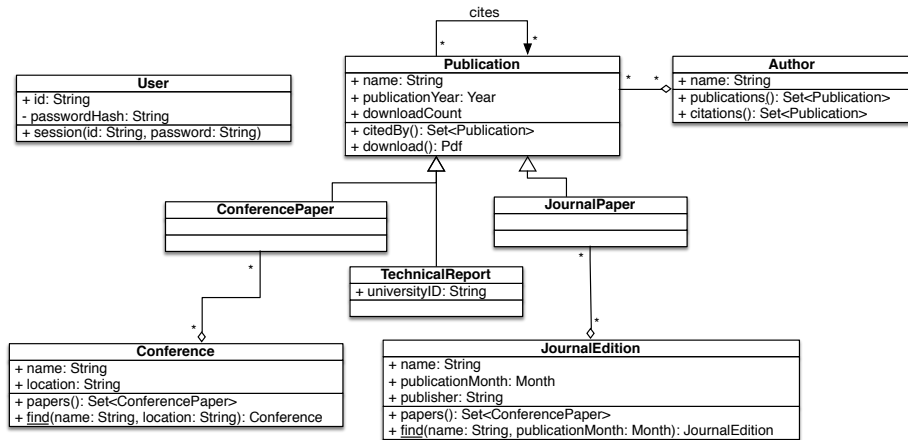


Figure 3: Class diagram

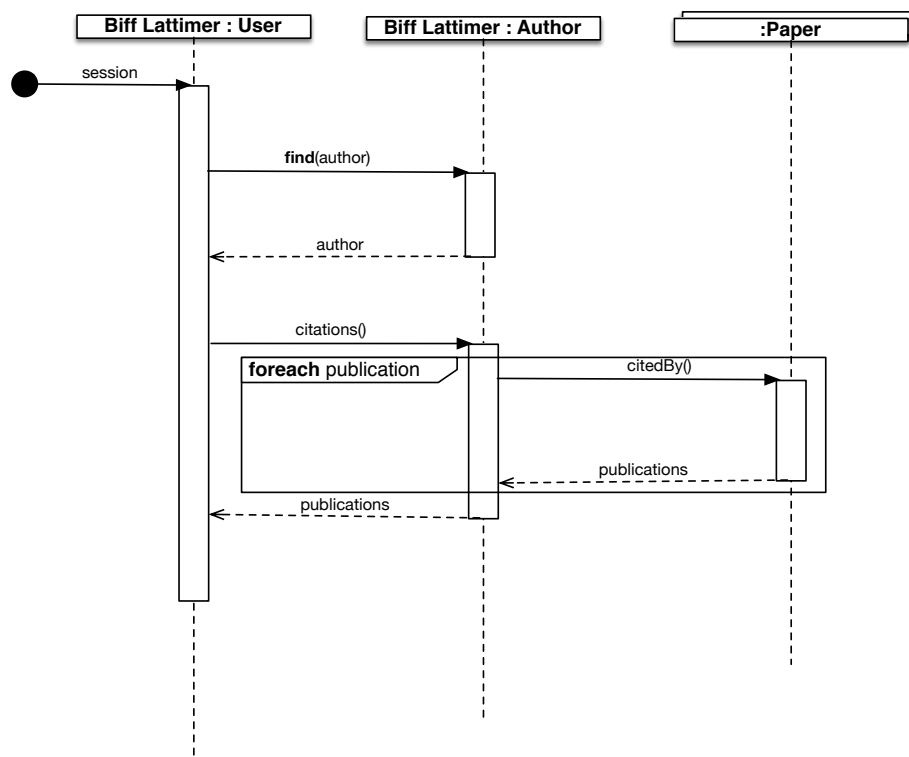


Figure 4: Sequence diagram

midterm 2012 Question 7 *propose your own solution!*

midterm 2012 Question 8(a-f) *See the exam pdf for the sequence diagram*

Note that the diagram uses a non-standard UML notation for naming instances. It puts the type before the column, when it should be after the column, e.g., it names a playlist as `Playlist:p1` when it should be `p1:Playlist`

Solutions:

- (a) Instances
- (b) Song
- (c) `currentPlaylist()` is called by player onto itself
- (d) The return value of a function with a label for the instance
- (e) Adding an interaction frame
- (f) With an "X" marking the object's destruction

final 2012 Question 2(a, b) *propose your own solution!*