# 2IO23 (DBL Software Specification and Games)

Project coordinators: Herman Haverkort
Tim Willemse
H.J.Haverkort@tue.nl, T.A.C.Willemse@tue.nl

11 November 2012

## 1 Introduction

The objective of this design-based learning (DBL) project is to create awareness of the benefits, drawbacks, and potential pitfalls of the techniques and methods of the software specification course when developing a realistic application. An additional goal of the project is to provide a setting in which the intrinsic complexity of developing correct distributed systems and computer graphics can be experienced.

To achieve these goals, students work in teams to develop a multi-player game with 3D aspects. The teams cooperate according to a *client-producer* model, in which the client describes the game informally and outsources its development to the producer. Clients will, textually, describe a game they wish to have developed, taking inspiration from a description of the game which will be handed out to them at the start of the DBL project. This game description is then further developed by the producer, who will create formal specifications describing the important aspects of the game, and they will implement and test the game. The formal specification is the contract that binds the client and producer, and it is also the basis for acceptance tests that must be specified by the client.

This project guide focusses on the organisational matters of the DBL project. In particular, this project guide addresses the general schedule of the project, what your obligations in the project are, what documents and presentations you have to deliver, and how your grade will be determined. Please, also check out the information on the course web page `http://www.win.tue.nl/~hermanh/teaching/2IO23/`. Among other things, the web page contains a detailed up-to-date schedule and information on how to contact the coordinators and the tutors advising the teams.

## 2 Organisation

The teams in which you will be working have been created in advance. All deliverables such as reports and code have to be handed in via Peach.[1] It is the responsibility of the teams and their members to register with Peach. All reports have to be written in English and submitted as PDF (documents in any other format will be ignored).

Each team is assigned a tutor. A tutor's primary role is to monitor the group process and the progress of a team, and signal problems within groups. Moreover, tutors are the main

[1] `http://peach.win.tue.nl`

contacts for exchanging deliverables between clients and producers. Tutors will have short, weekly meetings with their teams. As a policy, tutors will not, in general, assist in solving any issues of a technical or theoretical nature encountered by the teams.

Two meetings with all teams, tutors and the project coordinators are scheduled. The dates of these meetings will be announced on the course website. The purpose of these meetings is to signal issues and problems that transcend single teams. Each team is represented by exactly one team member in these meetings; this team member acts on behalf of the team.

The total study load involved in this DBL project is 6 ECTS per team member. Depending on the team size, that amounts to 840-1008 man-hours for the total project. Note that the project must be carried out in eight weeks. Careful planning is therefore of the utmost importance.

# 3 Assignments

This DBL project consists of two assignments, both of which contribute to the final grade. Successful completion of the project requires that both assignments are completed successfully; this will be judged by the tutors and the coordinators.

## 3.1 Assignment I

The first assignment is meant as an exercise in developing and documenting formal specifications; the complexity of the assignment does not reflect the complexity of the second assignment. The purpose of the first assignment is to establish what type of information and level of detail are needed to:

- allow for interpreting the specification without further explanation, and
- assess the quality of an implementation of the specification.

The first assignment, which consists of two subassignments (referred to as subassignment A and B), will be handed out at the start of the DBL project. Teams will split to fulfil both the role of the client for one of the subassignments (say A) and the role of the producer for the other exercise (B in that case).

In this first assignment, the role of the client will be limited to assessing the formal specification developed by the producer and describe testcases on the basis of this formal specification. These testcases need to be executed by the producers on a program implementing the specification. Deliverable I for the first assignment consists of two documents (a single document **per subassignment A and B**, that is, deliverable I.A and I.B) consisting of the following sections:

1. An informal description and analysis of the problem and the possible ambiguities; written by the producer
2. A formal specification and annotation of this specification; written by the producer
3. An assessment of the quality of the above two sections, assessing their readability, transferability, coherence and mathematical correctness; written by the client
4. A small set of testcases and explanations of the tests; written by the client

5. An implementation of the specification; written by the producer

6. A test report, describing the result of executing the testcases on the implementation

Further guidelines for these deliverables are available on the course website. The schedule for handing in these deliverables is as follows:

| **Date** | **Client** | **Producer** |
|---|---|---|
| 20 November | | Deliverable I.A and I.B |

Deliverables should be handed in through Peach before **23:45** on the date stated. Submission through Peach closes shortly after the deadline.

Note that for both subassignments there is a single deliverable. As a rule of thumb, meeting the 20 November deadline requires finishing the problem analysis and the formalisation by 15 November and the implementation and the quality assessment by 16 November. Polishing the documentation requires another two days.

> ▶ *Deliverables I.A and I.B are handed in via Peach by the respective producers for the subassignment, on behalf of the whole team.*

Before the end of November, the tutors will provide each team with high-level feedback on the deliverables for assignment I.

### 3.2 Assignment II

The second assignment is to develop multi-player games that have pleasing 3D graphical aspects. A complicating factor is that each game should run on multiple computers and lacks a centralised game server; that is, the game is truly distributed.

Each team will take part in the development of two games. For one game, the team will act as a *producer* who will develop a game as requested by another team, acting as a *client*. For the other game, the team will act as a *client* who will have the game developed by another team, acting as a *producer*.

A rough outline of each game will be provided to the team acting as the client at the start of the DBL project. The client will –informally– describe this game in more detail; that is, state the rules of the game, address the visual aspects, and compile a list of necessary, desirable and possible features of the game, ranked as such. However, the distributed nature of the game must remain intact. The client will be responsible for ensuring the complexity of developing the game is within the reach of the DBL project.

> ▶ *The informal game description is the first deliverable of the client.*

The *producer* for this game will, based on the informal description, develop a formal specification of the most important aspects of the game play, and implement the game accordingly. Unclarities in the informal description must be resolved in cooperation with the client, and *any* resulting change to the informal description must be **clearly** documented in a change log, along with a brief motivation of the reason for changing the informal description. Documenting these changes is the responsibility of the producer. In case of conflicts between clients and producers, the tutor can intervene and resolve the conflict to his/her liking; a tutor's decision is final.

▶ *The document containing the formal specification and its accompanying informal explanation is the first deliverable of the producer.*

The producer will also implement the game. It is advisable to start preparations for this already while working on the formal specification, to prevent having to sort out all difficulties in the last weeks of the project. In particular, it is good to start experimenting with network communication, for example, by developing a set of communication primitives and setting up a simple chat room. To get everything to work properly, it may be necessary to open the Windows firewall a little bit further than its default setting.

The client assesses the formal specification by assigning a grade on a scale of 1 to 10; this grade must be thoroughly motivated, using formal arguments whenever possible.

▶ *The report containing the assessment of the producer's formal specification document is the second deliverable of the client.*

In addition to reviewing the producer's formal specification, each team assesses the quality of the documents produced by two teams other than the producer. The purpose of these reviews is to assess whether the other teams have succeeded in producing formal specifications that can be read and understood without prior background in the subject at hand.

▶ *The* ***two*** *reports containing the assessment of the two other teams' formal specification documents together constitute the third deliverable of the client.*

Guidelines for reviewing and grading all documents will be made available on the course web page.

Producers must address the issues reported in the assessment documents and improve their formal specification and documentation accordingly. In particular, a change log of the changes made to the formal specification document to accommodate for the issues reported in the assessment documents should be added to the formal specification document.

▶ *The document describing the improved formal specification and its accompanying informal explanation is the second deliverable of the producer.*

The client will use the final formal specification document of the producer to describe a number of non-trivial testcases. These testcases serve the purpose of assessing whether the implementation developed by the producer meets the requirements dictated by the formal specification.

▶ *The test document is the fourth deliverable of the client.*

Based on the final formal specification document, an implementation of the game is developed by the producer. The document describing the formal specification will be extended to address the implementation and the tests that have been conducted; testcases provided by the client must be addressed specifically in this document.

▶ *The full document addressing the specification, the implementation and the testing of the game is the third deliverable of the producer.*

The implementation of the game will be demonstrated during a presentation, to be given on 18 January, 2013. In this presentation, the *client* will introduce the informal game in roughly 5 minutes, and the producer will then highlight some of the details of the process of

formalising the game, address some of the complexities encountered, lessons learnt, etc., and demonstrate the game and the multi-player capabilities to the audience.

The schedule for handing in all deliverables is as follows:

| **Date** | **Client** | **Producer** |
|---|---|---|
| 16 November | -informal game description | |
| 12 December | | -formal specification |
| 17 December | -assessment of the formal specification of the producer | |
| 19 December | -assessment of the formal specification of two other teams | |
| 21 December | | -final version formal specification |
| 9 January | -testcases for the implementation | |
| 16 January | | -final document<br>-implementation |
| 18 January | -present the informal game | -final presentation<br>-game demonstrations |
| 21 January | -slides of final presentation | |

Deliverables should be handed in through Peach **and to the other team involved in the assignment** before **23:45** on the date stated. The client submits their deliverables to Peach and sends them to the producer; the producer submits their deliverables to Peach and sends them to the client; the assessments of the formal specifications of two other teams are submitted to Peach and sent to those other teams. Submission through Peach closes shortly after the deadline. Further guidelines for the contents of all deliverables will be made available on the course website.

Note that the schedule is very strict. When planning your activities, be aware of the holiday season at the end of December.

Note that each DBL team plays the role of a client *and* of a producer: a team A that is a client for some team B (acting as a producer for A), will also be a producer for a team C (acting as a client for A). The deliverables of each team will be assessed by the coordinators. Tutors may be asked to propose a bonus or a penalty for teams.

# 4 Other deliverables

In addition to the deliverables directly related to the assignment, the following documents have to be submitted:

| **Date** | **By whom** | **Deliverable** | **Format** |
|---|---|---|---|
| weekly | each team | -minutes of meeting with tutor | PDF by mail to tutor |
| 9 December | each student | -preliminary assessment of team members | reply to mail from tutor |
| 21 January | each student | -final assessment of team members<br>-personal logbook (time sheet) | reply to mail from tutor<br>PDF by mail to tutor |

The minutes of the meetings should mention at least:

- who was present at the meeting, and who was absent and why;
- a to-do-list with things that need to be done in the coming week(s), with for every item on the list: who is responsible for it, and when it should be done;
- an evaluation of the to-do list from the previous meeting, with for every item on the list: whether it has been done, and if not, why not;
- any major specification/design/implementation decisions that have been taken.

Each student has to maintain a logbook or time sheet in which (s)he keeps track of how much time (s)he spends on what during the project. These time sheets can be used by the team, the tutor and the project coordinator to see how much time different tasks within the project take, whether to-do lists as decided in team meetings were realistic, what would have been a more realistic planning etc. As for the required level of detail, you can use the following rule of thumb: put in at least three entries per working day on average. Consider using Projexy (`http://projexy.nl`) to maintain your time sheets. The complete time sheets have to be mailed to the tutor at the end of the course.

# 5 Star assignment

It is possible to do an additional assignment during or immediately after this project to obtain a star in the honours star programme. This additional assignment does not need to be done in the same team as the rest of the project. If you are interested in doing such an additional assignment, contact the coordinators by mail before 20 November.

# 6 DBL project evaluation

As a rule, teams, not individuals, are graded for the deliverables produced by them and the team grade is the final grade for the DBL project. In special cases, the coordinators can decide to deviate from this rule. This may be based on the team members' assessments of

each other, it may be based on the personal logbook, or it may be based on observations by the tutor or the coordinators. For example, assuming a leading role in meetings can be good for your grade, whereas disrupting the meetings by showing up late or not at all, may lead to a lower grade. In case a team member cannot contribute to one of the deliverables, he or she is expected to compensate in deliverables that follow.

The relative weights that different parts of the project have in determining your grade, are roughly as follows:

- assignment I: 10%
- your work as a client in assignment II: 40%
- your work as a producer in assignment II: 40% (where the final document is at least as important as the implementation and demonstration)
- your assessment of the formal specification of two other teams: 10%