

Delft, University of Technology

# Product Vision and Planning

Programming Life – Group 2

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## Preface

This document is a draft for the product vision and planning for the Context Project `Programming Life: Synthetic Biology`. It's a proposition for the project structure, workflow and product target result that we will engage in and with during the period of the course. It contains a schedule with set dates, milestones and goals to be achieved and is a guideline for the work that should be done. The contents of this document are subject to changes and should be regarded as such.

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## Introduction

Synthetic biologists try to create cells that work in certain ways. Before they accomplish this they would like to simulate the internal workings of cells and their outputs by using combinations of several differential equations which might or might not influence each other. By varying the properties, say factors and values used by these equations, the biologists can simulate the output of the cell and measure the effect of that set of factors. However, the complexity of the simulation can be daunting if done on paper or programmed by hand per set of factors and that is also time-consuming.

GigaBase is an intuitive application that should overcome this last problem by providing a GUI and allow the simulation of an extensive number of modules<sup>1</sup> with user-specified properties and environment and thereby simulate a complete cell. By using this application, the biologists can, but not limited to, find the optimal properties, with more efficiency, less work, headache and calculations prone to error, to get their preferred outcome, such as maximizing the yield of a cell.

This product will be developed using the scrum methodologies and we will iterate the development of the product using sprints.

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<sup>1</sup> A module simulates a certain property of the cell such as DNA, transportation rate or creation of RNA by using differential equations.

## Product

This section holds the main product vision, the high-level product backlog and a general roadmap for the contents of the product in the duration of the project.

### Product Vision

**FOR** Synthetic Biologists **WHO LIKE TO** create cells that work in certain ways, GigaBase™ **IS AN** application **THAT** allows people to create cells by selecting modules vary their properties and the environment's, simulate the interplay of elements in the cell and see their outcome. **UNLIKE** traditional means such as calculation on paper or error-prone programming, **OUR SERVICE** fast-tracks designing a cell by providing a GUI, enforces constraints to minimize errors, and saves time by reusing previous designs.

### High-Level Product Backlog

A user can model a cell by selecting modules.

*Note: A GUI provides certain modules.*

A user can see the output of a model when it's simulated over a period of time.

*Glossary: A model is a selection of modules with their properties set.*

*Note: At least one graph per module shows the output. The graph shows the concentrations of the substances modeled by the module such as DNA, RNA and proteins. The simulation period can be changed.*

A user can set the properties of modules and cell environment.

*Note: A GUI lists the properties and allows changing.*

A user can export the results of the design to a report.

*Note: output file(s) such as HTML, Excel and/or PDF.*

A user can save and load models.

*Note: Models are serializable. A database is used for storage.*

A user gets feedback on his model.

*Note: Visual feedback such as constraints for modules, errors and possible optimizations.*

A user can add or change modules.

*Note: The differential equation(s) of a module should be changeable. The equation can be inputted, or build from selecting partsregistry biobricks.*

The product is internationalized.

*Note: GUI option to select the language.*

## Roadmap

After each sprint the product backlog is updated.

### Sprint 0

**Q3/W4 Draft planning:** The product and domain are researched, the product vision and high-level product backlog are devised with initial list of user stories composed. The user stories can be found under the product backlog.

**Q3/W5 Initial planning:** The user story list is fine-tuned and tasks devised for the first sprints. The user stories can be found under the product backlog. After this sprint all data models for should be present.

**Sprint 1 (Q3/W6)**

A basic visualization of the model data is present. This consists of at least one graph per module that indicates the concentration over time. This image may be static. A set of static modules is available for model composition.

**Sprint 2 (Q3/W7)**

The properties of the modules are not static but can be changed. The output (visualization) is built on the fly and the simulation can be paused, resumed or reset. This means that the image is no longer static.

**Sprint 3 (Q3/W8)**

The cell environment can be changed by adding substrates. Modules can react on these substrates.

**Sprint 4 (Q4/W1)**

The output can be exported as a document (HTML/PDF/Excel). Initial rigorous acceptance tests, as the next sprint as a product demo.

**Sprint 5 (Q4/W2) Demo product**

The product should be usable, stable and completed in terms of the items that are considered MUST. This means that the first 4 items from the High-Level Product backlog are incorporated in this demo. The demo consists of a series of acceptance tests devised in sprint 4.

**Sprint 6 (Q4/W3)**

The models created can now be saved and loaded. Feedback on module constraints is visible

**Sprint 7 (Q4/W4)**

Feedback on errors and optimization is now visible in the application.

**Sprint 8 (Q4/W5)**

Fixing failing unit/functional tests and conducting acceptance tests.

**Sprint 9 (Q4/W6)**

The product is internationalized.

**Sprint 10 (Q4/W7)**

Bug-fixes, acceptance tests and final review of code. Prepare for SIG review.

**Sprint 11 (Q4/W8) Final product**

The product should be usable, stable and completed in terms of the items that are considered MUST (First four in the high level product backlog) and SHOULD (Item 5 and 6 in the high level product backlog).

## Product backlog

The product backlog currently only has the features because there is no code yet. So defects or technical improvements will be added later. Further additions to the user stories will be made next week before the initial product vision. Comments should be added as well as other heads-ups and requirements for certain stories. The priority of each story is defined by its position in the backlog. The higher on the backlog, the more important the item is.

A user can create a cell from modules.

*Note: modules such as transporters, metabolisms, ribosomes, DNA, proteins and lipids. By selecting modules from a list and placing them in the cell.*

*Estimate: 6 hours*

A user the output of the simulation.

*Note: a visual representation of the reactions with a module in the form of graphs.*

*Estimate: 4 hours*

A user can change the module properties such as reaction speed and reaction cap. *Estimate: 8 hours*

A user can add substrates to the cell. *Estimate: 4 hours*

A user can generate an HTML report of the simulation. This contains parameter values and concentration graphs from all the modules. *Estimate: 12 hours*

A user can generate PDF and EXCEL reports, equivalent to the HTML report. *Estimate: 4 hours*

A user can save and load a model. *Estimate: 8 hours*

A user gets feedback on his model, such as missing modules, errors, constraints and possible optimizations. *Estimate: 12 hours*

A user can change the equations representing the different reactions. *Estimate: 4 hours*

A user can change the language. *Estimate: 8 hours*

A user can select parameter sets for modules based on existing DNA sequences known to generate a module with such reaction parameters.

A user can create new modules from existing biobricks<sup>2</sup>.

A user can view a phenotype of a model on his/her phone.

A user can edit a cell model on his phone.

A user can create new modules from existing biobricks on his phone.

A synthetic biologist can swap one biobrick for another.

A user can add modules to an existing cell model.

A user can edit biobricks.

A user can see the phenotype of a biobrick.

A user can select parts from the partsregistry.org database.

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<sup>2</sup> Parts from the partsregistry database

## Definition of Done

Defining when the following are done is important to keep the flow in the project and make sure the product is deliverable.

**Task:** If the description is fulfilled and this can be verified with a *user* and/or an *integration test*. This is important because features have to be complete, else there will be unfinished code in the system which will cause instability.

**User Story:** If the story is fulfilled and this can be tested with an *acceptance test*. This is important because the user stories are the basis to defining the functions the system must provide.

**Sprint:** Sunday 23:59. This is important because it limits the amount of work done during a sprint.

(version of a) **Product/Release:** If the product can be shipped to the *stakeholder*. This is important because this is what the stakeholder gets to see.

**Project:** Never or when the *stakeholder* decides (after 3 months).

## Glossary

### Backlog Item

A unit of work small enough to be completed by a team in one Sprint iteration. Backlog items are decomposed into one or more tasks.

### Demo

A session of testing with one or more stakeholders, where they evaluate the product.

### Release

The transition of an increment of potentially shippable product from the development team into routine use by customers. Releases typically happen when one or more sprints has resulted in the product having enough value to outweigh the cost to deploy it.

### Sprint

A one week period during which the team creates preselected finished features of a product.

### Task

A sprint task (or task) is a unit of work small enough to be completed by a team member in a matter of hours.

### User Story

One or more sentences in the everyday or business language of the end user that capture what a user does. The basis for defining the functions a business system must provide.