

# Planning

**Useful feedback in the  
Ampersand parser**

Maarten Baertsoen and Daniel S. C. Schiavini

*Open Universiteit Nederland, faculteit Informatica  
T61327 - Afstudeerproject bachelor informatica*

October 14, 2014

Version 0.1

## Contents

## List of Figures

# 1 Introduction (R-M)

## 1.1 Identification

This document contains the planning for the execution of the graduation project “Useful feedback in the Ampersand parser”. This planning gives the high-level requirements, the risks and a timefor the project. As such, the planning provides the steps for reaching the project objectives, and provides criteria that are used to validate and accept the results of the graduation.

This document is part of the graduation project of the computer science bachelor at the Open Universiteit Nederland. The project “Useful feedback in the Ampersand parser” is assigned to the students Daniel Schiavini and Maarten Baertsoen, with support of the supervisor Dr. Bastiaan Heeren and examiner Marko van Eekelen. The assignment is given by professor Stef Joosten, who researches how to further automate the design of business processes and information systems by the development of the Ampersand project.

## 1.2 Goal of this document

The main goal of this document is to capture the taken decisions and agreements around the execution of the project. In order to make the targets clear, the project context is also depicted in the document.

The document describes the current situation and the issues it presents, making clear why the project has been started. The purpose is thus to describe the management approach and the describe the aimed solution in high-level, as well as chances, risks and problems that might occur.

## 1.3 Document overview

An introduction is given in this chapter. Afterwards, a general description of the project is given in ???. Then, in ??, strategies are proposed for the acquisition of knowledge. In ??? the project approach is explained and the management strategy is given in ???.

Assumptions and limitations are given in ???. Afterwards, possible interferences with other projects are given in ???. Strategies for risk management are then proposed in ???.

Details of the development techniques are given in the project realization strategies of ???. Testing and validation plans are in ??, while issue management is explained in ???. The strategy for integration of the released software is given in ??, while the documentation strategy is given in ?? and the used tools and methodologies are given in ??.

Finally, a glossary of terms, definitions and abbreviations is given in ??.

# 2 Project description (R-M)

## 2.1 The Ampersand project

In November 2003, the Business Rules Manifesto<sup>1</sup> was written, with the main purpose of declaring independence for business rules in the world of requirements. The manifesto supports the vision of business rules as equivalent to requirements. This is considered a radical change on how people see the world of business architecture.

---

<sup>1</sup><http://www.businessrulesgroup.org/brmanifesto.htm>

In December 2010, Stef Joosten, Lex Wedemeijer and Gerard Michels published the paper “Rule Based Design”, presenting the Ampersand approach. The approach puts the rules in the center, using them to define the business processes. Ampersand is named after the & symbol with the desire of realizing results for both business and IT, in an efficient and effective way.

In 2011, the Ampersand compiler was created as an open source project. Since then, the compiler has been improved and applied in both business and academic contexts. The Ampersand end-users write business rules in a specific language (ADL), and compile that specification into functional specification, documentation and working software prototypes. These rules are based on agreements between the different stakeholders.

The theory behind Ampersand has been thoroughly studied, and is based on mathematical concepts, e.g. Relational algebra and Tarski’s axioms. Using this compiler, users write the requirements in ADL and generate all the system specification independent on the platform. The main advantage is that the requirements consistency and traceability are always correct (and even provable), from the lowest level up to the front-end. The requirements are presented to stakeholders in natural language, guaranteeing that any business expert who knows the context can validate the requirements. ?? depicts the artifacts generated by the Ampersand compiler.

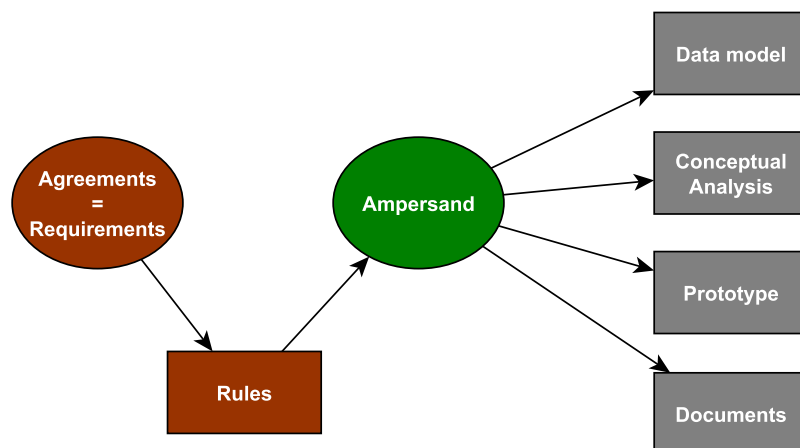


Figure 1: The Ampersand approach generates different artifacts based on the business rules

## 2.2 Current situation

The compiler developed for the Ampersand research project runs in several steps (see ?? for the architecture). The first step is the parsing of the input scripts. One of the main complaints from users is the quality of the errors generated by the Ampersand parser. Since the beginning of the project, special attention has never been given to the parser subcomponent, and it has not been analyzed for improvements.

In order to generate better error messages, it is assumed that a complete refactoring of the parser will be necessary. The main challenge is to choose the correct kind of architecture and libraries in order to generate the most user-friendly messages possible.

Besides the main project task of improving the parser’s feedback, a list of user wishes has accumulated over the years. The main customer and other users would appreciate if

as many wishes as possible could be fulfilled.

## 2.3 Goals of the project

The main objective for the graduation project is to implement useful feedback in the Ampersand parser. In order to achieve this goal, some of the following activities can take place:

- Analysis of user-friendly messages in compilers;
- Comparison of different Haskell parsing libraries (also for pretty-printing);
- Researching tools and techniques in Haskell for improving the software quality (e.g. testing and error messages);
- Analysis of the current development environment in relation with software engineering principles such as continuous delivery/integration;
- Recommending improvements for the overall software quality;

In case the new parser is successfully implemented and accepted, while the project members still have time budget available, the list of open user wishes issues can be addressed. Some of these wishes are substantial, so that most of them cannot be fulfilled during the graduation project. The current list of open issues has been provided<sup>2</sup>, although it must be clear that the issues are strictly seen as lower priority.

## 2.4 Project architecture and components

The Ampersand compiler is divided in several subcomponents:

**Parser:** This component receives the ADL code as input, and parses that code into a parse-tree (also known as P-structure).

**Type checker:** The Ampersand type checker receives the P-structure as input and converts it into a relational algebra format, suitable for manipulation (also known as A-structure or ADL-structure). The semantics of ampersand are expressed in terms of the A-structure.

**Calc:** The Calc component receives the A-structure as input, and manipulates it according to the research rules, generating the functional structure (also known as F-structure). The F-structure contains all design artifacts needed to write a specification and generate the output.

**Output components:** All design artifacts present in the F-structure are ready to be rendered. Several components use this data structure to generate the wished output. Outputs currently implemented (and their output formats) are the following: Atlas (HTML interface), revert (Haskell source), Query (prototype generation) and Documentation Generator (Pandoc structure).

The complete architecture is depicted in ???. The part of this architecture relevant for this project is depicted in ???.

---

<sup>2</sup>[https://github.com/AmpersandTarski/ampersand/tree/ABI\\_Parser/ArchitectureAndDesign](https://github.com/AmpersandTarski/ampersand/tree/ABI_Parser/ArchitectureAndDesign)

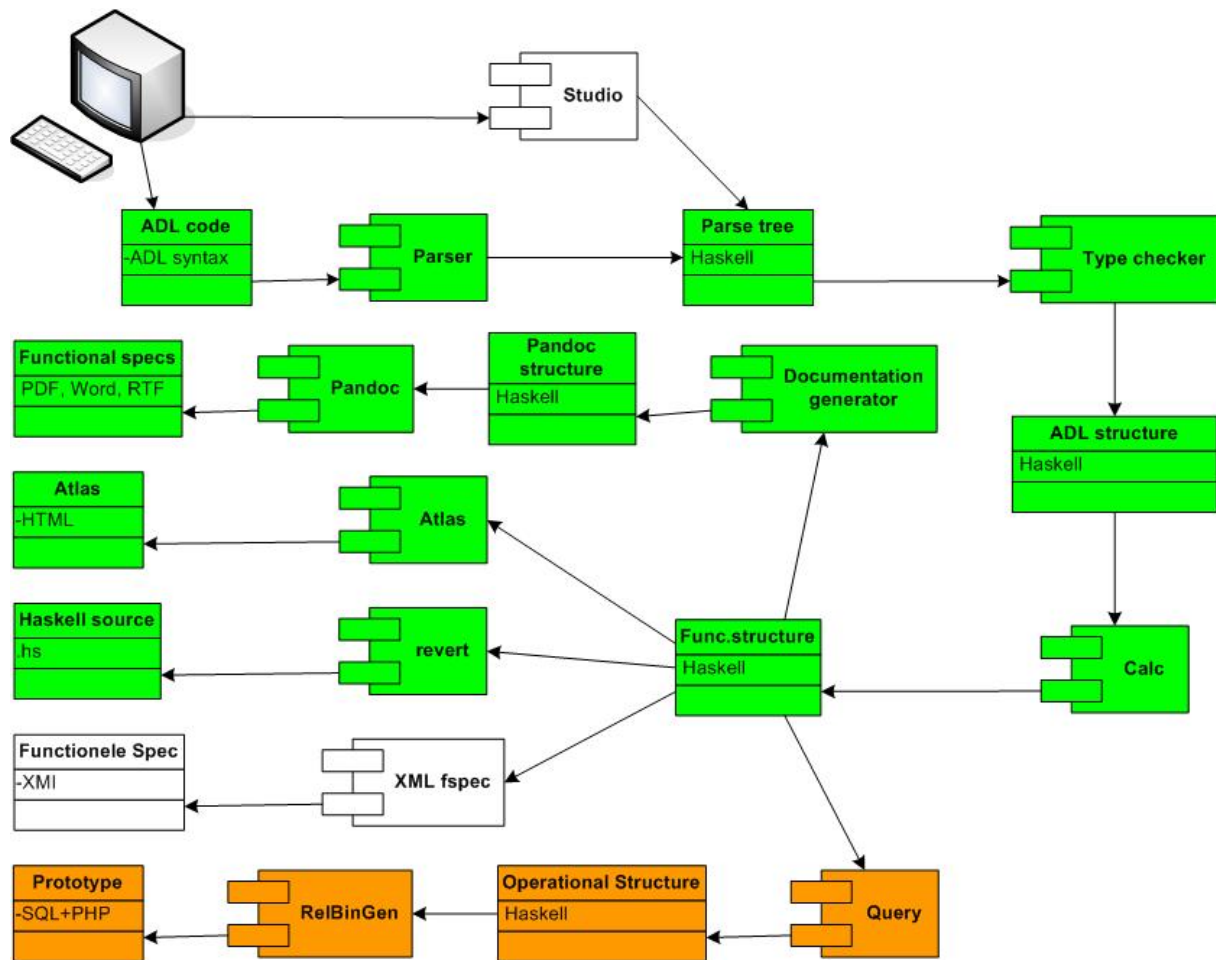


Figure 2: Architecture of the project, showing where the parser fits in the Ampersand system

The components in green background are part of the Ampersand compiler. Components in orange are part of the Ampersand Prototype compiler. Finally, components in white background are future components, not yet implemented.

## 2.5 Project environment

The Ampersand project is used in the following environments, for different users:

**Research:** The Ampersand project is part of a research effort on the use of business rules for software design;

**Academic:** Ampersand is used as main tool in the course “Ontwerpen met bedrijfsregels” (code T18321) from the Open Universiteit Nederland;

**Business:** The compiler is used in business environments to design and develop real world business software.

## 2.6 Critical success factors

The following factors are critical for the project’s successful completion:

**Maintainability:** the code shall at least be as maintainable as the current Ampersand code. It is known however that maintainability is hard to measure (see also ??).



Figure 3: Relevant data flow for the Ampersand parsing component

**Production code:** the implemented functionalities shall be integrated into the master branch for production use;

**Users context:** in order to provide useful feedback, the user context wherein the Ampersand compiler is used needs to be well understood, and the improvements must have extra user value;

## 2.7 Objectives and commitments

Besides the project goals described in ?? and the customer goals described in ??, the project members declare herewith to have the following objectives and commitments fulfilled by the end of this graduation project:

**Customer:** The primary objective is to deliver a well-working and maintainable piece software that will help the customer.

**Users:** Another important goal is to make the software more user friendly, and so improve the usability.

**Knowledge:** Building up knowledge is the main reason why one starts a bachelor study. As such it is important to learn more about functional programming, Haskell, compilers, business rules and research in general.

**University:** Hopefully the final thesis will be of use for the university and other students.

**Graduation:** As this is a graduation project, it is natural to have the graduation as an important objective.

# 3 Knowledge acquisition (-)

## 3.1 Research context

Some ideas by Bastiaan:

- more info on ampersand users
- user-friendly error messages (specific to compilers or not)
- parser-libraries
- Stef's research (3a)
- Haskell parsers (e.g. Helium), monadit or combinators

## 3.2 Domain & technology

### 3.2.1 Part Daniel

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 3.2.2 Part Maarten

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 3.3 Knowledge documentation

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 4 Project approach (-)

### 4.1 Project methodology

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis



egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 4.2 Project planning

Milestones & phases

## 4.3 Project milestones and corresponding deliverables

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

# 5 Project management (M)

## 5.1 Project governance / roles & responsibilities

1. The project team The project team consists out of Daniel Schiavini and Maarten Baertsoen. This team takes the full responsibility for the actual delivery for all project work products consisting out of
  - a) The actual Haskell program code in full conformity with the coding conventions
  - b) Exhaustive code documentation
  - c) All necessary final and intermediate deliverables to ensure project success such as: project planning and, project methodology as described within this document.

The full list of all work products with their corresponding description is included in this document.

2. The project supervisor The project supervisor is the main contact person for the project team. It is the role of the project supervisor to monitor the project team on a regular basis as well as to provide support and guidance to the project team members both on content and approach. It is the responsibility of the project team to send project status updates towards the project supervisor; these status updates will form the basis for the regular alignment meetings. During project execution, it might occur that the effort needed to meet the customer expectations is way over the foreseen budget of the project, measured in hours. Should this situation occur, the

supervisor will facilitate customer alignments to adjust the customer's requirements. All efforts spent are therefore reported on a weekly basis to the supervisor who will track the spent effort to make sure that every aspect of the project receives the needed attention.

3. The customer The project will deliver an actual product with all corresponding documentations in a controlled way. The customer's satisfaction is one of the key success factors of this project.

Although this project is conducted in a educational environment, the customer will be treated just like he would be served in a professional environment.

4. The examiner

## 5.2 Communication

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 5.2.1 Internal

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 5.2.2 OU

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur

auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 5.2.3 Customer

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 5.3 Time keeping

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 5.4 Project reporting

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 5.5 Quality assurance

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna

fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 5.5.1 Process quality & monitoring

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 5.5.2 Deliverables quality & monitoring

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 6 Assumptions and limitations (-)

(knowledge/architecture/etc...)

## 7 Interferences with other projects (-)

(code conflicts, etc...)

## 8 Risk management (M)

### 8.1 Risk identification and qualification

#### 8.1.1 Functional risks

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero,

nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 8.1.2 Technical risks

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 8.2 Risk mitigation plan

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 9 Project realization (-)

### 9.1 Coding conventions

De coding conventions are described on the Ampersand wiki <sup>3</sup>.

### 9.2 Scrum approach

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis

---

<sup>3</sup>[http://wiki.tarski.nl/index.php/Coding\\_conventions](http://wiki.tarski.nl/index.php/Coding_conventions)

egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 9.3 Validation

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 10 Testing & Validation (-)

### 10.1 Test approach

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 10.2 Test methodology

Will we use student's data? That can be hard to do.

### 10.3 Test plan & Milestones

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum.

Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 10.4 Test documentation

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 11 Issue management (-)

## 12 Integration & release (-)

(acceptation, communication, etc...)

## 13 Documentation (-)

### 13.1 Documentation plan

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

### 13.2 Deliverables

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum.

Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

## 14 Tools, methodologies and accelerators (R-M)

### 14.1 Collaboration

For the collaboration between the project members, the following tools will be used:

**Dropbox** For sharing time tracking and other reference documents;

**GitHub** For sharing git repositories of code, besides managing issues and documentation;

**SourceForge** For managing existing (old) issues;

**Microsoft Office** For writing internal documents, e.g. time tracking;

### 14.2 Documentation

For writing the documentation, the following tools will be used:

**Haddock** For annotating documentation on the code;

**TeXworks** For writing and compiling L<sup>A</sup>T<sub>E</sub>X documents;

**Ampersand Wiki** For keeping notes and information useful for users and other developers;

### 14.3 Design

For designing the software and its architecture, the following tools will be used:

**yEd** For creating diagrams and graphs;

### 14.4 Development

For software development, the following tools will be used:

**IDE** No standard integrated development environment will be chosen: the project members are free to use any IDE, e.g. Eclipse, Leksah, Notepad++;

**GHC** The compiler GHC (Glasgow Haskell Compilation System), version 7.8.3, will be used;

**Cabal** For managing Haskell packages and compilation, cabal-install version 1.18.0.5 and Cabal library version 1.18.1.3.



## 14.5 Testing

Finally, the following tools will be used for testing the software:

**Hpc** might be used for checking, recording and displaying the code coverage of tests;

**Sentinel server** can be used for the integration tests;

**QuickCheck** for automating tests on the code and property based testing (e.g. pretty-print and reparsing, random code generation);

# Glossary

## A-structure

The ADL code generated by the Ampersand type checker, used as input for the calculator component.. 6

## ADL

Ampersand Design Language. 5

## ADL-structure

See A-structure.. 6

## Cabal

Library for managing Haskell builds and packages. 16

## Dropbox

File hosting service that offers cloud storage, file synchronization, personal cloud, and client software. 15

## F-structure

The functional structure generated by the Ampersand calculator, used as input for the different output modules.. 6

## GHC

Glasgow Haskell Compilation system. 16

## Git

A distributed revision control and source code management. 15

## GitHub

Git repository web-based hosting service which offers all of the distributed revision control and source code management (SCM) functionality of Git. 15

## Haddock

A software documentation generator for the Haskell programming language. 15

## Hpc

Library for checking, recording and displaying code coverage. 16

## IDE

Integrated Development Environment. 16

## LaTeX

Document preparation system and document markup language for the TeX typeset. 15

**Microsoft Office**

Office suite of desktop applications developed by Microsoft. 15

**P-structure**

The parse-tree generated by the Ampersand parser, used as input for the type checker.. 6

**QuickCheck**

Library for testing Haskell code. 16

**Sentinel**

Test server for the Ampersand project. 16

**TeXworks**

Graphical user interface for editing and compiling L<sup>A</sup>T<sub>E</sub>X documents. 15

**yEd**

Software for editing graphs. 16