Mandate
version 1.9

Design and implementation of the Meta Casanova 3 compiler back-end

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Contents

1 Introduction

1.1 Working title

Design and implementation of the Meta Casanova 3 compiler back-end

1.2 Motive

Kenniscentrum is interested in innovative technologies. Innovative technologies like virtual reality and video games are the fields our research group is researching.

In order to ease the development of virtual reality and video games, the Casanova language was developed. The Casanova language is the subject of the PhD thesis of Francesco.

The complex nature of the Casanova language lead to a complex compiler. To simplify the development of Casanova, the language Meta Casanova was developed.

1.3 Importance

The resulting program will be used by the research group to build the meta Casanova 3 compiler, and the resulting thesis will be used as documentation for the future developers of MC.

This will be useful to the research group.

1.4 Goal

The goal of the assignment is to have a working back-end that is able to produce an executable.

1.5 Problem statement

At the start of the assignment, there is only a definition of MC 2. At the end of the assignment, there is a working back-end for MC 3.

1.6 Research question

The primary research question of this thesis is:

How to implement a transformation from typechecked Meta Casanova (MC) from the front-end, to executable code within the timeframe of the internship?

Where the transformation must satisfy these requirements:

The correctness requirement The back-end must in no case produce an incorrect program.

The .NET requirement The executable must be able to inter-operate with .NET.

The multiplatform requirement The generated code must run on all the platforms .NET runs on.

The performance requirement The performance of the generated program should be better than Python.

The correctness requirement exists because the compiler must be reliable. Any program can at most be as reliable as the compiler used to generate it. The .NET requirement exists because of the need for a large library and interoperability with Unity game engine. This is because the main area of research of the organization is game-related[1]. The multiplatform requirement is because the games are produced for any platform. The performance requirement is there because games have to be fast.

In order to answer the research question, seven sub-questions were formulated.

1. In what language should the code generator produce its output?
2. What should the interface be between the front-end and the back-end?
3. What should the intermediate representation of the functions be?
4. How does the interface map to the output language?

[1] see section **??**

5. How to generate names so that they comply with the output language?
6. How to validate the code-generator?
7. How to validate the test programs?

Each answer of a sub-question is provided evidence by implementing a part of the back-end. This will in turn provide evidence to answer the main research question.

1.7 client

The graduation assignment is carried out at Kenniscentrum Creating 010. *Kenniscentrum Creating 010 is a transdisciplinary design-inclusive Research Center enabling citizens, students and creative industry making the future of Rotterdam* [1].

The research group is creating the Casanova language. The members of the research group are Francesco di Giacomo[2], Mohamed Abbadi[2], Agostino Cortesi[2], Giuseppe Maggiore[3] and Pieter Spronck[4].

Within the research group is our research team, tasked with the design and implementation of Meta Casanova. The research team is supervised by Giuseppe Maggiore and comprises of three students. Louis van der Burg, responsible for developing the Meta Casanova language, Jarno Holstein, responsible for the front-end of the Meta Casanova compiler, and Douwe van Gijn, responsible for the back-end of the Meta Casanova compiler.

1.8 Workplace and tasks

During the internship the student will be part of a research team that develops and implements the MC compiler. The student periodically relay the progress and receive feedback every two weeks. The student will be supported by the research group.

Abstract

Design and implementation of the Meta Casanova 3 compiler back-end

2 method

2.1 Research Methods

I will use a variety of of research methods during the internship.

For the choice of language, I will use a comparitive investigation. For the other subquestions, I will use a combination of design and experimentation, as I use LEAN prototyping.

[2] Universita' Ca' Foscari, Venezia
[3] Hogeschool Rotterdam
[4] Tilburg University

2.2 Information collection

I will mainly use the internet to find official documentation and to download international standards. I will also use Google Scholar to find published papers.

2.3 Validation of findings

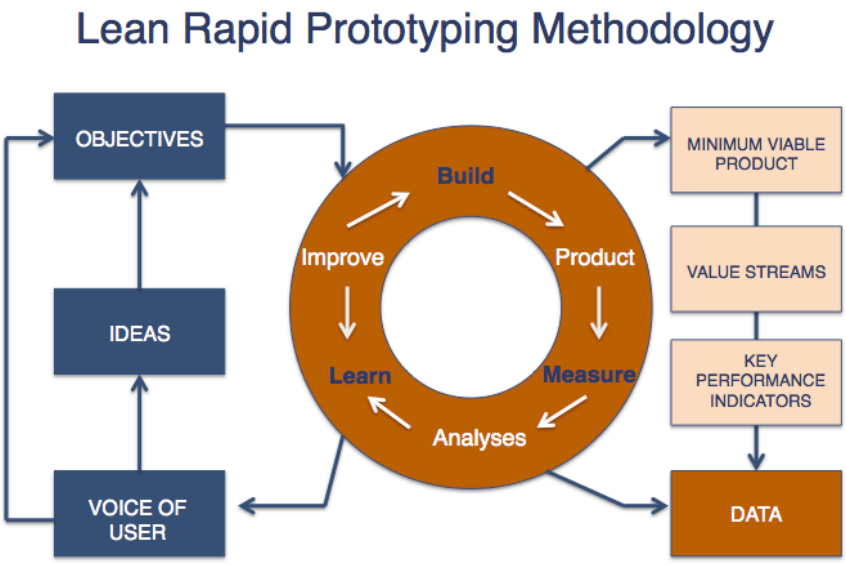
The correctness requirement will be validated by running test programs and comparing the output of the interpreter with the output of the compiler. The generated code will also be inspected with a debugger to find code generation errors. Performance requirements will be validated by

2.4 Validity and reliability of sources

I will use official documentation and international standards from ECMA International and ISO wherever possible. The theory is also put in practice, providing evidence that the sources were sound.

2.5 Project methods

We will make use of LEAN Rapid Prototyping[2].



This method is great for small teams, as it reduces overhead. This is crucial because we need to spend our time efficiently if we want to deliver a finished product. It also allows us to gather knowledge by iterating over our designs.

2.6 Risk assesment

Risk	Effect	Possibility	Counter measure
No test programs will be available.	No emperic mesurements can be done.	50%	I will have to write test programs in the intermediate language
The TypeChecker is not finished in time.	No emperic mesurements on complex programs can't be done.	50%	The complex programs will have to be manually converted to simple programs by me or members of the research-group.
The optimisations will not be enough to be faster than python.	The compiler will not be compettitive with other compilers	10%	Investigate why and report.
Parts are left unfinished due to time constraints.	Not all requirements will be met	20%	Propper planning an prioritizing low hanging fruit can minimize this.

2.7 Quality expectations

The quality expectations are encoded in the requirements.

3 Results

3.1 Desired result

The result will be a working MC compiler that respects the requirements.

4 Literature

4.1 References

I will use the C# language standard [3] and the Common Language Infrastructure(CIL) standard [4]. I will also make use of the official .NET compiler documentation on the Microsoft Developer Network [5] as well as the official mono documentation [6].

References

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[5] Microsoft. *Microsoft Developer Network*. https://msdn.microsoft.com.
[6] Alexander Köplinger. *Mono Documentation*. http://www.mono-project.com/docs/.

5 Stakeholders

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