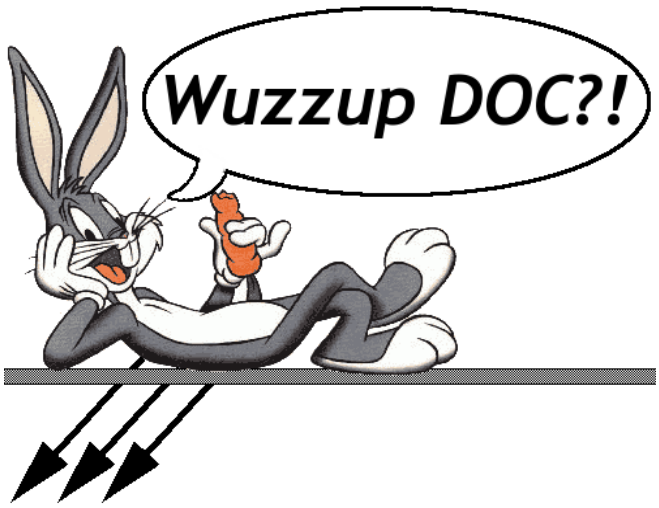

Requirement Specification

Author: Daniel Hilding

Version: 1.1

Date: 2005-10-03

Abstract

This document describes the requirements of the Verilog documentation tool that PUM group 12 will develop for the department of electrical engineering at Linköping University. The document gives an overview of the system and will be used as a reference during the development. It also includes delivery terms and acceptance tests that will be important when evaluating the system.

Project identity

Project group

Wuzzup DOC
PUM 12 2005
Linköping tekniska högskola
Institutionen för datavetenskap (IDA)

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Document History

Date	Version	Changes	Name
2005-09-15	0.1	Document created	Daniel Hilding
2005-09-16	0.2	Document revised after review	Daniel Hilding
2005-09-27	1.0	Document revised after review	Daniel Hilding
2005-10-03	1.1	Changed all references to non-functional requirements from "I" to "N".	Daniel Hilding

1 Introduction

This chapter helps the reader to get a quick overview of the content of this document and its structure.

1.1 Purpose

The purpose of this document is to specify the requirements for the system that is to be developed by PUM-group 12. It describes all requirements, functional and non-functional. It also describes how they are tested. The document will also define the terms of delivery.

1.2 Chapter description

Below is an overview and a brief description of the chapters in this document.

1. Introduction

   An overview of the content and the chapters in the document, including a general description of the project. This chapter also contains purpose, reading instructions and a glossary for the requirement specification.
2. Project description

   This chapter describes the system, its users, and the environment it is developed for. The project description also contains the involved parties, the background and a system description describing the overall goals of the project.
3. Use cases

   An overview of the use cases that describe the basic functionality of the system.
4. Design of requirements

   This chapter describes the notation and design of the requirements.
5. Functional requirements

   This chapter describes the functional requirements of the system.
6. Non-functional requirements

   A description of the non-functional requirements of the system.
7. Product components

   An overview of the components that are included in the product.
8. Delivery terms

   This chapter states the terms for delivery of the product.
9. Acceptance test specification

   This chapter states the terms for the customer to accept the product.
10. References

    An overview of the references used in this document.
11. Appendix A, Test cases

    Protocol for testing the requirements.

12. Appendix B, Contract

    Contract where the customer and the developer accepts the requirement specification.

1.3 Reading instructions

To quickly get an overview of the project it is recommended to read chapter 2, the project description. This gives a brief background and an explanation of the project objectives. It is also recommended to take a look at the use cases in chapter 3 as they give an overview of the basic functionality of the system.

For more detailed information about the system the reader is directed to chapters 5 and 6, the functional and non-functional requirements of the system. These are the most important chapters in this document since they define the actual system that will be developed. To fully be able to appreciate these chapters it is recommended to first read the glossary in section 1.5 and the design of requirements in chapter 4.

Product components and delivery terms are found, respectively, in chapters 7 and 8. This is important reading for the customer.

1.4 Document dependencies

Changes in this requirement specification might result in changes in the following documents:

- Project plan [Jormedal, 2005]
- Architecture specification [Norling, 2005]
- Design specification [Norling, 2005]
- Technical documentation [Lissing, 2005]
- Test plan [Åberg, 2005]

1.5 Distribution

This document should be distributed to:

- David Broman and Angela Johansson, examiners of the requirements specification.
- Per Karlström, the customer.
- The project folder.

2 Project description

This chapter describes the system, its users, and the environment it is developed for. The project description also contains a general description, the involved parties, the background and the goals of the project.

2.1 Parties

The parties involved in the project are the customer and the developer of the software. The customer is the subdepartment Computer Engineering of the department of Electrical Engineering (ISY) at Linköping university. Per Karlström is our contact person at the department. Developer of the system are PUM-group 12, Wuzzup DOC, with contact person Daniel Hilding, customer relationships.

2.2 Background

The customer wants a software tool that can extract information from Verilog code and annotate that with comments.

A software tool of this kind will be an efficient and a good way to generate informative documentation. The tool will help keeping the documentation in synchronization with the actual implementation, which is of great value when several persons are working on the same project and must be informed about each other's work. Tools of this kind exist for JAVA (Javadoc) and C++ (Doxygen) but not for Verilog.

2.3 Aims

This project will probably not have sufficient resources to produce a complete Verilog documentation tool. The goal with this project is therefore to make a foundation for a documentation tool and to investigate whether this could be done using existing tools for other languages, e.g. Doxygen.

All findings, research and/or source code, will be extensively documented for future projects on the same topic.

Use cases detailing the intended uses of the system can be found in the requirements specification.

2.4 Assumptions

Since we have a good and regular contact with the customer, we have discussed any uncertainties directly with him. For that reason we haven't needed to make any assumptions.

3 Use cases

This chapter covers the basic use cases of the system. The purpose of these use cases is to capture high-level and user-oriented requirements of the system, as well as to give the reader of this document a quick overview of the basic functionality of the system.

3.1 User categories

3.1.1 Employees at ISY

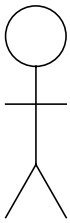
The program is designed for employees at the department of electrical engineering, Linköping University. These users have programming experience.

3.1.2 Future developer

Our product is not meant to be a complete program. In the future it might be a master thesis student or another PUM-group that finishes it.

3.2 User environment

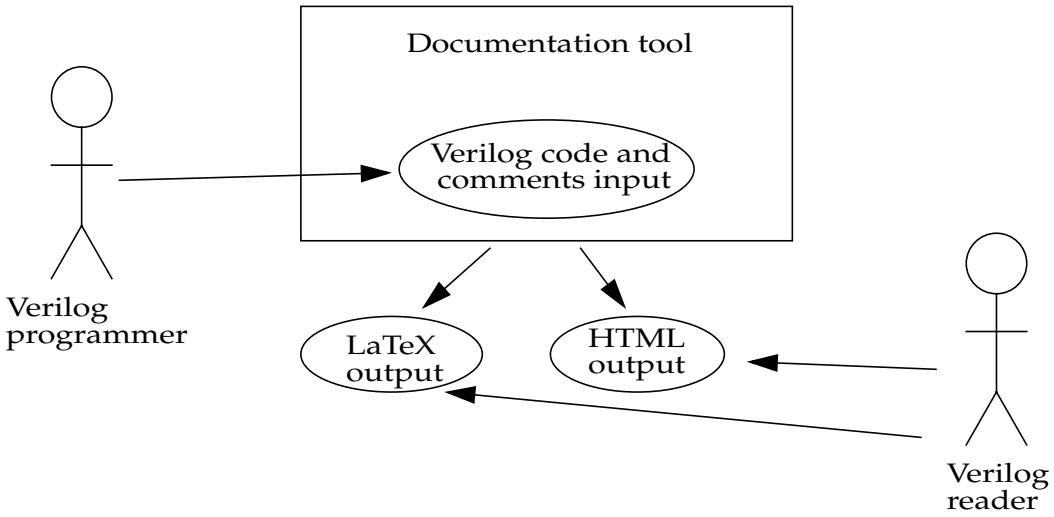
The program will be used on the computers at ISY, Linköping University.



ISY uses Linux on their computers. The software will primarily be made for Linux. An extra requirement is that it could be used on windows computers too.

3.3 Use case diagram

Figure 1 is a use case diagram that visualizes the functionality of the system. It shows that the programmer or a reader can view the documentation after the tool has been run on the code and comments.



Figur 1: Use case diagram that shows how the tool will be used.

4 Design of requirements

This chapter describes how the requirements in this specification are designed. The chapter explains how to read and interpret the information and how to document possible changes.

4.1 Notation

The requirements are structured as in the following example:

Level: The level of the requirement. See section 4.3.
Status: The status of the requirement. See section 4.4.
Motivation: An explanation of why the requirement has been introduced. See section 4.5.
Influences: A list of numbers for requirements that are influenced by this particular requirement. See section 4.6.

4.2 Identification number

Every requirement has been assigned a unique identification number to make it possible to refer to a specific requirement. This enables tracing of certain requirements throughout the whole project. The identification number consists of a capital letter followed by a number, for example F-2. The letter shows what type of requirement it is; functional requirement (F), non-functional requirement (N), or product component (C).

From version 1.0 and on of this document, the requirement identification numbers are permanent and can not be changed. A new requirement will be placed in the appropriate subsection and get the next free identification number, according to the standard described above.

4.3 Level

All requirements have been divided into three levels of priority: basic, normal and extra. The levels will be fulfilled in this order, starting with the basic requirements.

- Basic

  This level has the highest priority and is fundamental for the functionality of the system. All requirements on this level must be fulfilled.
- Normal

  Requirements on this level should be fulfilled to achieve satisfying functionality in the system. This is also the level that the project group calculates to be able to reach, but in case a situation arises where the project runs out of time, it can not be guaranteed that this level is fulfilled since the project has a strict time limit.
- Extra

  This level contains extra features that enhance the functionality of the system. If the work progresses faster than expected, there might be time left to implement these requirements. Otherwise they should be seen as possible future developments that are not included in the design, but are still taken into account during development.

4.4 Status

Every requirement has a description of its status to increase traceability. The status will tell if the requirement is valid or not.

- Active

  Active means that the requirement is valid and included in the development of the system.

- Inactive

  Inactive means that the requirement is not valid, but it is still included in the specification to increase traceability. The requirement will keep its identification number but will not be included in the development of the system.This could happen if the developer together with the customer decides that a requirement should not be involved in the product anymore.

4.5 Motivation

Every requirement has a short motivation of why it has been introduced. The motivation gives the reader a better understanding of the purpose of the requirement.

4.6 Influences

If a requirement influences other requirements, in a way that a change in the first makes it necessary to change the others, they are listed with their identification numbers. This increases traceability during development. If a requirement does not have a significant influence on any other requirement this line will be left blank.

5 Functional requirements

This section describes the functional requirements that apply to the system. Functional requirements not mentioned here can not be expected to be included in the delivered system.

5.1 Basic requirements

F-1 Create a parser for Verilog code

The tool should be able to parse Verilog code.

Level: Basic
Status: Active
Motivation: Verilog is the customer's language of choice. The initial step towards a documentation tool is a parser.
Influences: -

F-2 Create a syntax tree

The output from the parser should be a syntax tree.

Level: Basic
Status: Active
Motivation: Doxygen needs a syntax tree as input to its data organizer.
Influences: F-1

F-3 Print the syntax tree

The syntax tree should be printed in a readable form.

Level: Basic
Status: Active
Motivation: This output is needed to verify the correctness of the parsing.
Influences: F-2

F-4 Linux compatible

The product should be run in Linux.

Level: Basic
Status: Active
Motivation: The customer uses the Linux platform.
Influences: F-1

5.2 Normal requirements

F-5 Doxygen compatible entry tree

The entry tree should be compatible with Doxygen's data organizer.

Level: Normal
Status: Active
Motivation: The tool could benefit from Doxygen features.
Influences: F-2

F-6 Extract a hierarchy

A hierarchy over the Verilog code should be extracted.

Level: Normal
Status: Active
Motivation: Gives a good overview of the code. Necessary for Doxygen output.
Influences: F-9, F-11

F-7 Extract comments

The program should extract comments regarding modules and variables in the Verilog code.

Level: Normal
Status: Active
Motivation: Makes a better documentation of the Verilog code.
Influences: F-1, F-2, F-9, F-11

5.3 Extra Requirements

F-8 Custom directives

The parser should be able to recognize custom directives in the Verilog code comments.

Level: Extra
Status: Active
Motivation: Custom directives can be used for extra functionality.
Influences: F-7

F-9 Generate HTML

The product should be able to output the hierarchy and the comments from the Verilog code in HTML.

Level: Extra
Status: Active
Motivation: HTML is a popular and versatile format.
Influences: -

F-10 Windows compatible

The tool should be Windows XP compatible.

Level: Extra
Status: Active
Motivation: Windows XP is a popular platform.
Influences: -

F-11 Other outputs

The product should be able to output the hierarchy and the comments from the Verilog code in LaTeX.

Level: Extra
Status: Active
Motivation: LaTeX is common among academics.
Influences: -

6 Non-functional requirements

This section describes the non-functional requirements that apply to the system. Non-functional requirements not mentioned here can not be expected to be included in the delivered system.

6.1 Basic requirements

N-1 Programming language

All code should be written in C++, Flex and Bison.

Level: Basic
Status: Active
Motivation: C++ makes the program easy to expand since it's very well known. The Doxygen parser is made with Flex.
Influences: F-1

N-2 Documented with Doxygen

All C++ code in the product should be documented with Doxygen.

Level: Basic
Status: Active
Motivation: Makes it easy to get an overview of our tool.
Influences: N-1, F-1

N-3 Upgradeable

The program should be easy to extend and expand.

Level: Basic
Status: Active
Motivation: Future upgrade may be wanted for more functionality.
Influences: N-4, F-1

N-4 English usage

Source code, user interface and documentation should be in English.

Level: Basic
Status: Active
Motivation: The tool may be used world wide.
Influences: N-1, N-4, F-1

N-5 Documentation format

All documents should be delievered in PDF- and FrameMaker-format.

Level: Basic
Status: Active
Motivation: PDF is a portable format. The use of FrameMaker is mandatory in the project course.
Influences: C-2, C-3, C-4, C-5

N-6 Revision control

All code should be handled with Subversion.

Level: Basic
Status: Active
Motivation: Helps the developer not to mix up different versions of code.
Influences: -

7 Product components

This section describes all the product components that will be part of the system and delivered to the customer. Nothing but what is mentioned here can be expected to be delivered.

7.1 Software

This section describes all the software components that should be delivered to the customer.

C-1 Source-code

All produced source-code should be delivered to the customer.

Level: Basic
Status: Active
Motivation: Enables future development.
Influences: -

7.2 Documentation

This section describes all documentation that should be delivered to the customer.

C-2 Requirements specification

The requirements specification document should be delivered to the customer.

Level: Basic
Status: Active
Motivation: The customer gets an opportunity to verify that the constructed software fulfills the agreed requirements.
Influences: -

C-3 Architectural design

The architectural design document should be delivered to the customer.

Level: Basic
Status: Active
Motivation: Simplifies future development.
Influences: -

C-4 Design specification

The detailed design document should be delivered to the customer.

Level: Basic
Status: Active
Motivation: Simplifies future development.
Influences: -

C-5 Technical documentation

An extensive technical documentation over the product's code should be delivered to the customer.

Level: Basic
Status: Active
Motivation: Simplifies future development.
Influences: -

8 Terms of delivery

This section describes the terms for the delivery of the finished product.

8.1 Time

The exact time of delivery is not yet decided, but the product should be delivered to the customer no later than 2005-12-16.

8.2 Place

The product should be delivered to the customer at ISY, Linköping University.

8.3 Report

At delivery, a report will be written to ensure that the product fulfills all that is promised.

8.4 Demonstration

A short demonstration of the product will be performed at delivery.

8.5 Installation

At delivery the product will be installed on the hardware that the customer provides us with.

8.6 Maintenance

No support or maintenance is included in the agreement with the customer.

9 Acceptance test specification

This chapter describes what tests to be conducted and in which order to run them. This ensures that the acceptance tests will run smoothly.

9.1 Acceptance test

Every test has its own table similar to the one below.

The test id is a number starting at 1 and increases with each test. This is also the test order.

All the test cases can be found in Appendix A Test cases.

Test id	Identification of the acceptance test.
Purpose	Describes why the test is being done.
Req.	The corresponding requirement
Req. level	The level of the corresponding requirement.
Data input	The data that has to be inserted into the system to be able to carry out the test.
Execution	Describes how the test should be carried out.
Expected result	If the test result is the same as the expected result, the test has passed.
Passed	The customer should sign here if the test passed the requirement.

Table 11: Test table overview

9.2 Acceptance terms

When all the tests of basic requirement level have been passed, the product should have met the customer's requirements and be considered accepted.

10 References

10.1 Internal documents

[Jormedal] Jormedal, Martin (2005), "Project plan". Linköping, 2005.

[Norling] Norling, Jonas (2005), "Architecture specification". Linköping, 2005.

[Norling] Norling, Jonas (2005), "Design specification". Linköping, 2005.

[Lissing] Lissing, Johan (2005), "Technical documentation". Linköping, 2005.

[Åberg] Åberg, Eric (2005), "Test plan". Linköping, 2005.

Appendix A Test cases

Test id	1
Purpose	To verify that the program's source code is delivered to the customer.
Req.	C-1
Req. level	Basic
Data input	-
Execution	Hand the source code to the customer.
Expected result	-
Passed	

Table 12: Test case 1

Test id	2
Purpose	To verify that the program's requirements specification document is delivered to the customer.
Req.	C-2
Req. level	Basic
Data input	-
Execution	Hand the documentation to the customer.
Expected result	-
Passed	

Table 13: Test case 2

Test id	3
Purpose	To verify that the program's architectural design document is delivered to the customer.
Req.	C-3
Req. level	Basic
Data input	-

Execution	Hand the documentation to the customer.
Expected result	-
Passed	

Table 14: Test case 3

Test id	4
Purpose	To verify that the program's detailed design document is delivered to the customer.
Req.	C-4
Req. level	Basic
Data input	-
Execution	Hand the documentation to the customer.
Expected result	-
Passed	

Table 15: Test case 4

Test id	5
Purpose	To verify that the program is delivered with an extensive technical documentation.
Req.	C-5
Req. level	Basic
Data input	-
Execution	Hand the documentation to the customer.
Expected result	-
Passed	

Table 16: Test case 5

Test id	6
Purpose	To verify that the program is written in C++, Flex and Bison.
Req.	N-1
Req. level	Basic
Data input	-
Execution	Go through the code and examine if it is written in C++, Flex and Bison.
Expected result	The code is written in C++, Flex and Bison.
Passed	

Table 17: Test case 6

Test id	7
Purpose	To verify that the program is documented in Doxygen.
Req.	N-2
Req. level	Basic
Data input	-
Execution	Go through the comments and examine if it is commented with Doxygen tags.
Expected result	The code is commented with Doxygen.
Passed	

Table 18: Test case 7

Test id	8
Purpose	To verify that the program is easy to upgrade in the future.
Req.	N-3
Req. level	Basic
Data input	-
Execution	-

Expected result	-
Passed	

Table 19: Test case 8

Test id	9
Purpose	To verify that the program's code and user interface as well as the documentation are all written in English.
Req.	N-5
Req. level	Basic
Data input	-
Execution	Go through the code and documents and see if they are in English.
Expected result	The code and documentation are written in English.
Passed	

Table 20: Test case 9

Test id	10
Purpose	To verify that the program's code is handled with Subversion.
Req.	N-6
Req. level	Basic
Data input	-
Execution	Check the Subversion history for existing versions.
Expected result	The Subversion history contains several versions of code.
Passed	

Table 21: Test case 10

Test id	11
Purpose	To verify that the program has the ability to parse verilog code.
Req.	F-1

Req. level	Basic
Data input	Verilog file.
Execution	Execute the program.
Expected result	The program executes without errors.
Passed	

Table 22: Test case 11

Test id	12
Purpose	To verify that the program can produce a syntax tree from a verilog code file.
Req.	F-2
Req. level	Basic
Data input	Verilog file.
Execution	Execute the program.
Expected result	The program produces a syntax tree.
Passed	

Table 23: Test case 12

Test id	13
Purpose	To verify that the program prints the syntax tree in a readable form.
Req.	F-3
Req. level	Basic
Data input	Verilog file.
Execution	Execute the program.
Expected result	The program prints a readable syntax tree.
Passed	

Table 24: Test case 13

Test id	14
Purpose	To verify that the program can be run in Linux.
Req.	F-4
Req. level	Basic
Data input	Verilog file.
Execution	Execute the program in Linux environment.
Expected result	The program executes without errors.
Passed	

Table 25: Test case 14

Test id	15
Purpose	To verify that the syntax tree is compatible with Doxygen's data organizer.
Req.	N-5
Req. level	Normal
Data input	Verilog file
Execution	Implement Doxygens data organizer with the projects parser and execute the program.
Expected result	The program runs without errors.
Passed	

Table 26: Test case 15

Test id	16
Purpose	To verify that the program extracts a hierarchy over the verilog code.
Req.	N-6
Req. level	Normal
Data input	Verilog file.
Execution	Execute the program.

Expected result	A hierarchy is extracted.
Passed	

Table 27: Test case 16

Test id	17
Purpose	To verify that the program extracts comments regarding modules and variables in the verilog code.
Req.	N-7
Req. level	Normal
Data input	Verilog file.
Execution	Execute the program.
Expected result	The program extracts comments regarding modules and variables.
Passed	

Table 28: Test case 17

Test id	18
Purpose	To verify that the program can recognize custom directives in the verilog code comments.
Req.	N-8
Req. level	Extra
Data input	Verilog file.
Execution	Execute the program.
Expected result	The program recognizes custom directives.
Passed	

Table 29: Test case 18

Test id	19
Purpose	To verify that the program can generate output in HTML.
Req.	N-9

Req. level	Extra
Data input	Verilog file.
Execution	Execute the program.
Expected result	A HTML documentation with the Verilog code's hierarchy and comments is generated.
Passed	

Table 30: Test case 19

Test id	20
Purpose	To verify that the program is compatible with Windows XP.
Req.	N-10
Req. level	Extra
Data input	Verilog file.
Execution	Execute the program in a Windows environment.
Expected result	The program executes without errors.
Passed	

Table 31: Test case 20

Test id	21
Purpose	To verify that the program can generate LaTeX output.
Req.	N-11
Req. level	Extra
Data input	Verilog file.
Execution	Execute the program
Expected result	A LaTeX file with the Verilog code's hierachy and comments is produced.
Passed	

Table 32: Test case 21

Appendix B Contract

This document defines the terms and conditions for the product that PUM group 12 will develop for the customer. The product is developed within the limits of the course TDDC02 - Software Engineering Project at Linköping University.

B.1 Parties

The parties involved in this contract are:

- Subdepartment Computer Engineering of the department of Electrical Engineering, represented by Per Karlström, from now on referenced as "the customer".
- PUM group 12, from now on referenced as "the supplier", represented by Daniel Hilding.

B.2 Contract specification

This contract specification includes decided delivery terms and the requirements from the requirements specification. Requirements on the basic level shall be met in the final product. Requirements on the normal level should be met if the project follows its planned schedule. The requirements on the extra level will be met if there is time over after the basic and normal requirements are fulfilled. If the supplier and the customer have different interpretations of a specific requirement, there will be a renegotiation of this requirement.

B.3 Delivery

Terms for the delivery are specified in chapter 8, signing this contract implies acceptance of these terms.

B.4 Acceptance

Chapter 9 includes additional terms, regarding the terms of acceptance. Signing this contract implies acceptance of these terms.

B.5 Signature

This contract is hereby approved by customer and supplier.

Location.....Date.....

Signature.....

Per Karlström, Department of Electrical Engineering, Linköping University.

Location.....Date.....

Signature.....

Daniel Hilding, customer relations manager, PUM group 12.