

Rijksuniversiteit Groningen

Building Product Populations with Software Components

Proefschrift

ter verkrijging van het doctoraat in de
Wiskunde en Natuurwetenschappen
aan de Rijksuniversiteit Groningen
op gezag van de
Rector Magnificus, dr. F. Zwarts,
in het openbaar te verdedigen op
vrijdag 3 december 2004
om 14.45 uur

door

Robbert Christiaan van Ommering
geboren op 25 september 1958
te Geldrop

Promotor : Prof.dr.ir. J. Bosch

Beoordelingscommissie : Prof.dr. D. K. Hammer
Prof.dr. J. N. Magee
Prof.dr. J. C. van Vliet

ISBN 90-74445-64-0

Table of Contents

Chapter 1 Introduction.....	1
1.1 The Problem.....	1
1.2 A Business Perspective.....	2
1.3 Technology Trends.....	3
1.4 Research Questions.....	5
1.5 Way of Working.....	7
1.6 Time Line.....	9
1.7 Overview of this Thesis.....	10
Chapter 2 Formalizing Software Architecture.....	13
2.1 Introduction.....	13
2.2 Formalizing and Verifying Software Architecture.....	14
2.3 The Expression Language.....	15
2.4 The Graph Language.....	18
2.5 The Dialogue Language.....	22
2.6 Concluding Remarks.....	26
Chapter 3 The Koala Component Model.....	29
3.1 Introduction.....	29
3.2 The Challenge.....	30
3.3 The Koala Model.....	32
3.4 Handling Diversity.....	36
3.5 Coping with Evolution.....	41
3.6 Concluding Remarks.....	42
Chapter 4 Independent Deployment.....	43
4.1 Introduction.....	43
4.2 Independent Deployment.....	45
4.3 Upward Compatibility.....	48
4.4 Downward Compatibility.....	51
4.5 Reusability.....	53
4.6 Portability.....	56
4.7 The Quality Dilemma.....	59
4.8 Concluding Remarks.....	60
Chapter 5 From Variation to Composition.....	63
5.1 Introduction.....	63
5.2 Why Use Software Product Lines?.....	65
5.3 The Influence of Scope on Software Product Lines.....	67
5.4 The Dimensions of Variation and Composition.....	72
5.5 Variation Further Explained.....	75
5.6 Composition Further Explained.....	78
5.7 Concluding Remarks.....	81

Chapter 6 Configuration Management	83
6.1 Introduction.....	83
6.2 Product Family and Population.....	84
6.3 Technical Concepts.....	84
6.4 Configuration Management	86
6.5 Concluding Remarks.....	90
Chapter 7 Building Product Populations.....	91
7.1 Introduction.....	91
7.2 Business	92
7.3 Architecture.....	95
7.4 Development Process.....	102
7.5 Organization.....	109
7.6 Experiences and Related work.....	111
7.7 Concluding Remarks.....	113
Chapter 8 Horizontal Communication.....	115
8.1 Introduction.....	115
8.2 Component Technology and Architecture	117
8.3 The Control Problem.....	121
8.4 Horizontal Communication.....	126
8.5 Introducing the Protocol	138
8.6 Experiences	142
8.7 Related Work	146
8.8 Concluding Remarks.....	148
Chapter 9 Validation and Future Work	151
9.1 Introduction.....	151
9.2 Explicit Software Architectures.....	152
9.3 Families and Populations	153
9.4 Resource Constraints	156
9.5 Process and Organization.....	157
9.6 Other Evidence.....	158
9.7 Koala Design Patterns.....	159
9.8 The Future of Koala	161
9.9 Conclusion	162
Appendix A The Koala Language	165
A.1 Concepts.....	165
A.2 Lexical Syntax	166
A.3 The Interface Definition Language	167
A.4 The Component Definition Language.....	171
A.5 The Data Type Definition Language	188
A.6 Naming Conventions	190
A.7 Const-Free Semantics	193
A.8 Concluding Remarks.....	200

List of References	201
Brief Glossary of Terms.....	209
Summary of this Thesis.....	213
Samenvatting	215
Acknowledgements.....	217

