

Table of Contents

Chapter 1. Metamodeling in Software Architectures	1
Adel SMEDA and Mourad Chabane OUSSALAH	
1.1. Introduction	1
1.2. Metamodeling, why?	3
1.3. Software architecture metamodeling	3
1.4. MADL: a meta-architecture description language	5
1.4.1. Four levels of modeling in software architectures	5
1.4.2. MADL: reflexive core dedicated to the meta-meta-architecture	7
1.4.3. MADL structure	8
1.4.4. MADL instantiation: example of the ADL Acme	11
1.4.5. Comparison of MADL and MDA/MOF	13
1.5. Mapping of ADLs to UML	17
1.5.1. Why to map an ADL to UML?	18
1.5.2. ADL mapping to UML	19
1.6. A mapping example: the case of the Acme language	31
1.7. Some remarks on the mapping of ADL concepts to UML	32
1.7.1. UML 2.0 as an ADL	32
1.7.2. Mapping strategies	33
1.8. Conclusion	34
1.9. Bibliography	34
Chapter 2. Architecture Constraints	37
Chouki TIBERMACINE	
2.1. Introduction	38
2.2. State of the art	40
2.2.1. Expression of architecture constraints in the design phase	40

2.2.2. Expression of architecture constraints in the implementation phase	49
2.3. Architecture constraints on object-oriented applications	57
2.3.1. Architecture constraints in the design phase	57
2.3.2. Architecture constraints in the implementation phase	61
2.4. Architecture constraints on component-based applications	68
2.4.1. Architecture constraints in the design phase	69
2.4.2. Architecture constraints in the implementation phase	75
2.5. Architecture constraints on service-oriented applications	79
2.6. Conclusion	85
2.7. Bibliography	86
Chapter 3. Software Architectures and Multiple Variability	91
Mathieu ACHER, Philippe COLLET and Philippe LAHIRE	
3.1. Introduction	91
3.2. Variability: foundations and principles	95
3.2.1. Variability and product lines	95
3.2.2. Feature models	97
3.3. Framework of studies and connected work	99
3.3.1. From multiplicity to variability	100
3.3.2. Extraction and evolution of architectural variability	101
3.4. Video surveillance component architecture	102
3.4.1. Case study	102
3.4.2. Accounting for multiple variability	104
3.4.3. Results	108
3.5. SOA for scientific workflows	110
3.5.1. Case study	110
3.5.2. Accounting for multiple variability	112
3.5.3. Results	114
3.6. Reverse engineering plugin-based architecture	116
3.6.1. Case study	116
3.6.2. Accounting for multiple variability	118
3.6.3. Results	120
3.7. Evaluation	122
3.7.1. The necessity of tooling	122
3.7.2. Summary of case studies	123
3.8. Conclusion	125
3.9. Bibliography	126
Chapter 4. Architecture and Quality of Software Systems	133
Nicole LÉVY, Francisca LOSAVIO and Yann POLLET	
4.1. Introduction	133

4.2. Quality approach	135
4.2.1. ISO 25010 quality	135
4.2.2. Quality reference	137
4.2.3. Quality model of a system	138
4.2.4. Functional quality model	139
4.2.5. Quality model of the architecture	140
4.3. Approach for architecture development of a domain	142
4.3.1. General principles	142
4.3.2. Functional quality model	145
4.3.3. Architectural quality model	145
4.3.4. Reference architecture	145
4.3.5. Transition from domain level to system level	147
4.4. Development of the reference architecture in a functional domain	148
4.4.1. Example of functional domain	148
4.4.2. Functional refinement	148
4.4.3. Development of the FQM	150
4.4.4. Definition of the preliminary architecture	151
4.4.5. Development of architectural quality model	152
4.4.6. Integration of the reference architecture of the domain.	152
4.5. Architectures at system level	156
4.5.1. Functional refinement	156
4.5.2. Functional quality model	157
4.5.3. Basic architecture	158
4.5.4. Architectural quality model	158
4.5.5. Architecture of the Dopamine and Samarkand systems	159
4.6. Related work	161
4.7. Conclusion	166
4.8. Bibliography	167
Chapter 5. Software Architectures and Multiagent Systems	171
Jean-Paul ARCANGELI, Victor NOËL and Frédéric MIGEON	
5.1. Introduction	172
5.2. MAS and agent-oriented software engineering	172
5.2.1. Agent	173
5.2.2. System and interactions	174
5.2.3. MAS	175
5.2.4. Examples of MAS	177
5.2.5. Agent-oriented software engineering	178
5.3. MAS as an architectural style	183
5.3.1. Positioning the “MAS” style	183
5.3.2. Characteristics in terms of abstraction.	184
5.3.3. Characteristics in terms of (de)composition	188

5.3.4. Link with the requirements	190
5.3.5. A family of architectural styles.	194
5.4. The architectural gap	195
5.4.1. State of the practice.	196
5.4.2. Analysis from an architectural point of view.	197
5.4.3. Assessment	200
5.5. How to fill the architectural gap.	200
5.5.1. Limitations of existing solutions	200
5.5.2. Realization of the microarchitecture.	201
5.6. Conclusion	204
5.7. Bibliography	205
Chapter 6. Software Architectures and Software Processes	209
Fadila AOSSAT, Mourad Chabane OUSSALAH and Mohamed AHMED-NACER	
6.1. Introduction.	209
6.2. Software process architectures	211
6.2.1. Software process models: definition.	211
6.2.2. Modeling software architecture-based software processes.	213
6.3. Comparison framework for SA-based SP model reuse solutions	214
6.3.1. The software process axis evaluation criteria	217
6.3.2. The software architecture axis evaluation criteria	220
6.3.3. The quality axis evaluation criteria	223
6.4. Evaluation of SA-based SP modeling and execution approaches	225
6.4.1. SP axis evaluation of SA-based SP reuse approaches	225
6.4.2. SA axis evaluation of SA-based SP reuse approaches	229
6.4.3. Quality axis evaluation of SA-based SP reuse approaches.	232
6.4.4. Assessment and discussions.	234
6.5. Conclusion	235
6.6. Bibliography	236
List of Authors	241
Index	243