

---

## Contents

---

<b>Introduction . . . . .</b>	xi
<b>Chapter 1. Realization of a Software Application . . . . .</b>	1
1.1. Introduction . . . . .	1
1.2. What is software? . . . . .	4
1.3. Software within a system. . . . .	4
1.4. Different types of software applications . . . . .	6
1.4.1. Different types of software . . . . .	6
1.4.2. Different uses . . . . .	7
1.5. Lifecycle . . . . .	7
1.6. Choice of the software application development strategy. . . . .	9
1.7. Conclusion . . . . .	11
1.8. Appendix A – structure of an SQAP . . . . .	11
<b>Chapter 2. Quality Assurance Implementation . . . . .</b>	15
2.1. Introduction. . . . .	15
2.2. Quality management system. . . . .	15
2.3. Characterization of a stage . . . . .	17
2.4. Process . . . . .	18
2.5. Input elements . . . . .	19
2.5.1. Need identification . . . . .	19
2.5.2. Need specification . . . . .	20
2.5.3. Specification of safety requirements. . . . .	20
2.6. Descriptions of the realization stages. . . . .	20
2.6.1. Planning of activities . . . . .	20
2.6.2. Software application specifications . . . . .	23
2.6.3. Software application architecture . . . . .	26
2.6.4. Software application components design . . . . .	30
2.6.5. Coding of the software application . . . . .	32

2.6.6. Software component testing . . . . .	32
2.6.7. Software integration testing . . . . .	34
2.6.8. Overall software testing . . . . .	36
2.7. Vocabulary and mode of expression . . . . .	37
2.8. Software quality assurance plan . . . . .	38
2.9. Conclusion . . . . .	39
<b>Chapter 3. Support Processes . . . . .</b>	<b>41</b>
3.1. Introduction . . . . .	41
3.2. Transversal processes . . . . .	45
3.3. Support processes . . . . .	45
3.4. Principal processes . . . . .	46
3.5. Project management . . . . .	46
3.6. Conclusion . . . . .	47
<b>Chapter 4. Organization . . . . .</b>	<b>49</b>
4.1. Introduction . . . . .	49
4.2. Initial needs . . . . .	49
4.3. Realization of a software application . . . . .	51
4.3.1. Organization . . . . .	51
4.3.2. Role . . . . .	53
4.4. Conclusion . . . . .	54
<b>Chapter 5. Human Resources and Competencies Management . . . . .</b>	<b>57</b>
5.1. Introduction . . . . .	57
5.2. Definition of roles . . . . .	60
5.3. Competencies management . . . . .	62
5.4. Outsourcing management . . . . .	64
5.5. Outsourcing . . . . .	65
5.6. Learning management . . . . .	65
5.7. Conclusion . . . . .	66
<b>Chapter 6. Management of a Software Application's Versions . . . . .</b>	<b>67</b>
6.1. Introduction . . . . .	67
6.2. Definition of the version . . . . .	68
6.2.1. Presentation of the need . . . . .	68
6.2.2. Implementation . . . . .	73
6.3. Change management . . . . .	74
6.3.1. Presentation of the need . . . . .	74
6.3.2. Processing of a change request . . . . .	76
6.3.3. Impact analysis . . . . .	79

---

6.3.4. Change control board . . . . .	81
6.4. Delivery . . . . .	81
6.4.1. Presentation of the need . . . . .	81
6.4.2. Implementation . . . . .	82
6.5. Conclusion . . . . .	83
6.6. Appendix A: change request. . . . .	84
6.7. Appendix B: SwVS . . . . .	85
<b>Chapter 7. Configuration Management</b> . . . . .	87
7.1. Introduction . . . . .	87
7.2. Configuration management . . . . .	88
7.2.1. Principles. . . . .	88
7.2.2. Formalization . . . . .	89
7.3. Software application CM. . . . .	90
7.3.1. Introduction . . . . .	90
7.3.2. Software component's configuration . . . . .	91
7.3.3. Product line . . . . .	92
7.3.4. Preexisting components . . . . .	93
7.3.5. Generic software and instantiated software. . . . .	93
7.4. Implementation . . . . .	94
7.5. Conclusion . . . . .	96
<b>Chapter 8. Archiving</b> . . . . .	97
8.1. Introduction. . . . .	97
8.2. Archiving process . . . . .	98
8.2.1. Principle . . . . .	98
8.2.2. Archiving of sources and other products related to the software application . . . . .	98
8.2.3. Tool archiving. . . . .	99
8.2.4. Machine archiving . . . . .	100
8.2.5. Document archiving . . . . .	100
8.3. Conclusion . . . . .	101
<b>Chapter 9. Maintenance of a Software Application</b> . . . . .	103
9.1. Introduction. . . . .	103
9.2. Principles . . . . .	104
9.3. Realization of the new version . . . . .	105
9.3.1. Process . . . . .	105
9.3.2. Constraints related to maintenance and deployment. . . . .	106
9.3.3. The software version sheet . . . . .	108
9.4. Conclusion . . . . .	108

<b>Chapter 10. Deployment of a Software Application . . . . .</b>	109
10.1. Introduction . . . . .	109
10.2. Principles . . . . .	109
10.3. Implementation . . . . .	110
10.4. In reality . . . . .	112
10.5. Conclusion . . . . .	113
<b>Chapter 11. Verification and Validation . . . . .</b>	115
11.1. Introduction . . . . .	115
11.2. Concept . . . . .	116
11.2.1. Introduction . . . . .	116
11.2.2. Verification . . . . .	119
11.2.3. Validation . . . . .	121
11.3. Techniques, methods and practices . . . . .	122
11.3.1. Static verification . . . . .	122
11.3.2. Dynamic verification . . . . .	152
11.3.3. Validation . . . . .	157
11.4. Verification and validation plan . . . . .	157
11.5. New issues of the V&V . . . . .	158
11.6. Conclusion . . . . .	160
<b>Chapter 12. Tools Management . . . . .</b>	163
12.1. Introduction . . . . .	163
12.2. List of tools . . . . .	164
12.3. Description of the computer . . . . .	165
12.4. Generation process . . . . .	165
12.5. Tool configuration management . . . . .	167
12.6. Tool qualification . . . . .	167
12.7. Conclusion . . . . .	169
<b>Chapter 13. Tools Qualification . . . . .</b>	171
13.1. Introduction . . . . .	171
13.2. Tools qualification . . . . .	172
13.2.1. Presentation . . . . .	172
13.2.2. Standards synthesis . . . . .	172
13.3. Qualification process . . . . .	179
13.3.1. Qualification report . . . . .	180
13.3.2. Qualification process . . . . .	181
13.3.3. Implementation of the qualification process . . . . .	183
13.4. Adequacy to need . . . . .	192
13.4.1. Conception method . . . . .	192

---

13.4.2. Method and language adequacy . . . . .	193
13.4.3. Code generation . . . . .	193
13.5. Version management . . . . .	194
13.5.1. Identification of versions . . . . .	194
13.5.2. Analysis of defects . . . . .	195
13.5.3. Change of version . . . . .	195
13.6. Qualification process . . . . .	196
13.6.1. Tool qualification report . . . . .	196
13.6.2. At the end . . . . .	196
13.6.3. Qualification of non-commercial tools . . . . .	196
13.7. Conclusion . . . . .	197
<b>Chapter 14. Data Configured Software Application</b> . . . . .	199
14.1. Introduction . . . . .	199
14.2. Problem . . . . .	200
14.3. System parameterized by data . . . . .	202
14.3.1. Presentation of the problem . . . . .	202
14.3.2. Characterization of data . . . . .	207
14.3.3. Inhibition of service . . . . .	209
14.3.4. Synthesis . . . . .	211
14.4. From the system to the software . . . . .	212
14.4.1. Requirement . . . . .	212
14.4.2. What the CENELEC standard does not say . . . . .	214
14.5. Data preparation process . . . . .	216
14.5.1. Context . . . . .	216
14.5.2. Presentation of section 8 of the CENELEC EN 50128:2011 standard . . . . .	218
14.6. Data preparation process . . . . .	222
14.6.1. Data preparation process control . . . . .	222
14.6.2. Verification . . . . .	230
14.6.3. Specification phase . . . . .	230
14.6.4. Architecture phase . . . . .	235
14.6.5. Data production . . . . .	238
14.6.6. The application's integration and acceptance of testing . . . . .	244
14.6.7. Validation and evaluation of the application . . . . .	245
14.6.8. Procedures and application preparation tools . . . . .	246
14.6.9. Development of the generic software . . . . .	246
14.7. Conclusion . . . . .	247

<b>Chapter 15. Audit</b>	249
15.1. Introduction	249
15.2. Audit	249
15.3. Conclusion	250
<b>Conclusions and Perspectives</b>	253
<b>Glossary</b>	255
<b>Bibliography</b>	261
<b>Index</b>	269