
Contents

Foreword	xi
Preface	xvii
Chapter 1. SysML: Object Management Group (OMG) Systems Modeling Language	1
1.1. Background	1
1.2. What is SysML?	2
1.3. System Engineering in a nutshell.	3
1.4. Advantages of System Engineering	4
1.5. The MBSE approach	5
1.5.1. V cycle and SE activities	7
1.5.2. Difference between a model and a drawing	8
1.6. Scope and Objectives of the model	10
1.6.1. Communication vector	11
1.6.2. Powerful analysis	11
1.6.3. Better formalization of the description of a system	11
1.6.4. Mastering System Design	12
1.6.5. Other inputs.	13
1.7. Problem or solution?	13
1.8. SysML toolbox	15
1.9. The SysML frame.	17
1.10. Stereotypes	18
1.10.1. Labels (Tags)	18
1.11. The requirements diagram (req)	18
1.11.1. Requirement.	19
1.11.2. Identifier	20

1.11.3. Descriptive text	20
1.11.4. Extensions	20
1.11.5. Links	21
1.11.6. ReqIF	23
1.12. Use case diagram (uc)	23
1.12.1. Actor	23
1.12.2. Use case	24
1.12.3. Relations	24
1.13. The sequence diagram (sd)	26
1.13.1. Lifeline	27
1.13.2. Message	27
1.13.3. Combined fragment	28
1.13.4. Activity period (Execution)	29
1.13.5. Invariant state	30
1.13.6. Time	31
1.14. The package diagram (pkg)	31
1.15. The block definition diagram (bdd)	32
1.15.1. The block	33
1.15.2. Properties	33
1.15.3. Values	34
1.15.4. Operations	34
1.15.5. Constraints	34
1.15.6. Ports	34
1.15.7. Associations	35
1.15.8. Reference	37
1.15.9. Composite	38
1.15.10. Shared	38
1.15.11. Generalization	38
1.15.12. Dependency	39
1.15.13. Direction	40
1.15.14. Compartments	41
1.16. The internal block diagram (ibd)	41
1.16.1. Connectors	42
1.16.2. Ports	43
1.16.3. Full	44
1.16.4. Proxy	44
1.16.5. Interface Blocks	45
1.16.6. Flow elements/Property	45
1.17. The parametric diagram (par)	46
1.17.1. Constraint	47
1.17.2. Binding connector	47

1.17.3. Value binding	48
1.18. The state machine diagram (stm)	48
1.18.1. State	48
1.18.2. Composite states	49
1.18.3. Parallel states	50
1.18.4. Pseudo-states	51
1.18.5. Transition	52
1.18.6. Trigger events	53
1.18.7. Guard	54
1.18.8. Activity and Action Language	55
1.19. The activity diagram (act)	56
1.19.1. Action	57
1.19.2. Control flow	58
1.19.3. Exchange Flow (or Object Flow)	58
1.19.4. Pin	59
1.19.5. Partition	59
1.19.6. Event Receipt	59
1.19.7. Signal transmission	60
1.19.8. Interruptible Region	60
1.19.9. Time Delay	60
1.20. View and view point	60
1.20.1. View	60
1.20.2. View point	61
1.21. List of SysML keywords	61
1.22. For more information	62
1.23. Common elements	62
Chapter 2. About Cameo Systems Modeler	65
2.1. Overview of Cameo Systems Modeler	65
2.2. Installation	68
2.3. Availability of the model	68
2.4. Covered tool features	69
2.4.1. The Cameo simulation toolkit	69
2.4.2. Documentation, user support and examples	70
2.4.3. Setup	72
2.5. Creation of the project/structuring	73
2.5.1. Packages	73
2.6. The content diagram	74
2.7. Uniqueness of modeling elements	76
2.7.1. Difference between delete (Ctrl+D) and remove from diagram	78

2.8. Stereotyping Blocks	78
2.8.1. Stereotype creation	79
2.8.2. Using an enumeration	80
2.8.3. Label creation	80
2.8.4. Assigning value to the label	81
Chapter 3. Example	83
3.1. User needs	83
3.2. Basic features	85
3.3. Variants (options)	85
3.4. Constraints	86
Chapter 4. Case Study	89
4.1. Introduction	89
4.1.1. Key elements of modeling	89
4.1.2. Project structure	90
4.1.3. Requirements characteristics	93
4.1.4. Stakeholder identification during the life cycle	93
4.2. Operational analysis	95
4.2.1. User requirements (table)	95
4.2.2. Visualization of requirements (req)	98
4.2.3. Mission, vision and goals (uc)	100
4.2.4. Context (bdd & idb)	101
4.2.5. Expected functionalities (uc)	106
4.2.6. Use scenarios (sd)	108
4.2.7. System modes (stm)	109
4.3. System requirements analysis	112
4.3.1. External interfaces (ibd)	114
4.3.2. System scenarios (seq - act)	116
4.3.3. Functional traceability (table)	118
4.4. Logical architecture design	119
4.4.1. Main functions (act)	119
4.4.2. Internal interfaces (ibd)	120
4.4.3. Typing ports	121
4.4.4. Flows	123
4.4.5. Block behavior	123
4.4.6. Tabular allocation and traceability (table)	127
4.5. Physical architecture design	127
4.5.1. Candidate solutions	130
4.5.2. Physical interfaces (ibd)	131

4.5.3. Constraints (par)	132
4.5.4. Tabular allocation and traceability (table)	132
Chapter 5. Beyond Modeling	133
5.1. Verification and validation of models	133
5.1.1. Validation or verification?	133
5.1.2. Execution of the model	138
5.1.3. Automated testing	144
5.1.4. Types of diagrams supported in simulation	146
5.1.5. Execution trace	148
5.1.6. Generation of documents	149
Glossary	151
Bibliography	181
Index	183