

Contents

1	Introduction	1
1.1	Motivation	2
1.2	Intended Readership and Relevance	7
1.3	Outline	8
2	State of the Art	9
2.1	An Overview of Business Process Modelling Techniques	9
2.2	Formal Representations of BPMN	11
2.3	Suitability of BPMN for Business Process Modelling	13
3	Modelling Semantics with Abstract State Machines	17
3.1	General Features of the ASM Method	18
3.2	The ASM Notation Used in This Book	22
3.2.1	Rules	22
3.2.2	Derived Functions	24
3.2.3	Local Constants and Variables and New Data Elements	24
3.2.4	Assertions	25
3.2.5	Types of Functions and Universes	25
3.2.6	Signatures of Functions and Rules	26
3.2.7	Boolean Expressions	26
3.2.8	Set Expressions	27
3.2.9	Naming Conventions	27
4	A Rigorous Semantics for BPMN 2.0 Process Diagrams	29
4.1	Process Diagrams	30
4.2	Framework	33
4.2.1	Initialisation and Top-Level Process Management	33
4.2.2	Workflow Transition Interpreter	34
4.2.3	Flow Nodes	36

- 4.3 Control Flow 42
 - 4.3.1 Producing Tokens 43
 - 4.3.2 Consuming Tokens 43
- 4.4 Instantiation, Deletion, and Interruption 44
 - 4.4.1 Creating Instances 44
 - 4.4.2 Deleting Instances 45
 - 4.4.3 Interrupting Activities 46
- 4.5 Activities 49
 - 4.5.1 Send Tasks and Receive Tasks 51
 - 4.5.2 Common Semantics of Activities 52
 - 4.5.3 Tasks 56
 - 4.5.4 Sub-processes 60
 - 4.5.5 Event Sub-processes 63
 - 4.5.6 Transaction Sub-processes 64
 - 4.5.7 Ad Hoc Sub-processes 67
 - 4.5.8 Compensation 69
 - 4.5.9 Call Activities 71
 - 4.5.10 Loop Activities 73
- 4.6 Gateways 83
 - 4.6.1 Parallel Gateways 86
 - 4.6.2 Exclusive Gateways 88
 - 4.6.3 Inclusive Gateways 90
 - 4.6.4 Complex Gateways 96
 - 4.6.5 Event-Based Gateways 102
- 4.7 Events 106
 - 4.7.1 Event Transition 108
 - 4.7.2 Catching Events 108
 - 4.7.3 Start Events 113
 - 4.7.4 Start Events of Top-Level Processes 115
 - 4.7.5 Start Events of Embedded Sub-processes 122
 - 4.7.6 Start Events of Event Sub-processes 123
 - 4.7.7 Boundary Start Events 128
 - 4.7.8 Intermediate Catching Events 131
 - 4.7.9 Catching Link Events 134
 - 4.7.10 Intermediate Boundary Events 136
 - 4.7.11 Throwing Events 140
 - 4.7.12 End Events 143
 - 4.7.13 Intermediate Throwing Events 144
 - 4.7.14 Throw a Compensation Event 145
- 4.8 Data 148
- 4.9 Miscellaneous 150
 - 4.9.1 Scope 150
 - 4.9.2 Message Flow 150
 - 4.9.3 Swimlanes 151
 - 4.9.4 Artefacts 152

4.9.5	Conversation	152
4.9.6	Correlation	152
4.9.7	Choreography	152
5	How the Semantic Model Can Be Used	153
5.1	Validation and Verification	154
5.2	Validation	155
5.3	Verification	158
6	A Discussion of BPMN 2.0	161
6.1	General Remarks on BPMN	162
6.2	Deviations Between Our Model and the BPMN 2.0 Standard	165
6.2.1	Conflicting Provisions in the Standard	165
6.2.2	Superfluous Elements	166
6.3	Suggestions for Further Improvements	167
6.3.1	Potential for Semantic Simplification	167
6.3.2	Process Instantiation by Mixed-Behaviour Elements	168
6.3.3	Other Mixed-Behaviour Elements and Further Possible Simplifications	171
6.3.4	Object-Oriented vs. Subject-Oriented Approaches	172
6.3.5	Modelling Issues Currently not Covered by BPMN	173
7	Towards a Workflow Engine by Stepwise Refinement	175
7.1	Workflow Interpreter (WI)	175
7.2	Context	177
7.2.1	Static Context	177
7.2.2	Root Context	178
7.2.3	Sub-context	178
7.3	Notifications	179
7.4	Implicit Notifications	181
7.5	Message and Signal Pool	182
7.6	Event Publication	183
7.7	Event Propagation	184
7.8	Deployment Manager and Deployments	185
7.8.1	Deployments	185
7.8.2	Deployment Manager	186
7.9	Instance Manager	187
7.10	Further Refinements	189
8	Discussion of the Proposed Specification and Outlook	191
8.1	Deontic BPMN	192
8.2	A Layered Approach for Actor Modelling	193
8.3	Integration of User Interaction Modelling	194
8.4	Towards an Enhanced Communication Concept	195
8.5	Integration of Data Modelling	196
8.6	Towards an eP^2 Architecture	197

A	The Signature of the Ground Model	199
A.1	Auxiliary Functions and Constructs Used	199
A.2	Basic Functions (Signature)	201
A.2.1	Primitive Types	201
A.2.2	Universes	202
A.2.3	Static Functions	207
A.2.4	Shared Functions	213
A.2.5	Monitored Functions	214
A.2.6	Controlled Functions	215
B	List of Acronyms	219
C	BPMN Symbols	221
	References	223
	Index	233



<http://www.springer.com/978-3-319-09930-9>

A Rigorous Semantics for BPMN 2.0 Process Diagrams

Kossak, F.; Illibauer, C.; Geist, V.; Kubovy, J.;

Natschläger, C.; Ziebermayr, Th.; Kopetzky, T.;

Freudenthaler, B.; Schewe, K.-D.

2014, X, 235 p. 80 illus., 1 illus. in color., Hardcover

ISBN: 978-3-319-09930-9