Contents

1	Introduction		
	1.1	System and Security Engineering	1
	1.2	Security and Security Risk Management Standards	2
	1.3	Security Development Approaches	4
	1.4	Domain-Specific Languages for Security Modelling	4
	1.5	Model-Driven Security	5
	1.6	Modelling Perspectives of Secure Software Systems	6
	1.7	Running Example	9
	1.8	Exercises	12
Par	tI S	ecurity Risk Management	
2		ain Model for Information Systems Security Risk	
	Man	agement	17
	2.1	Domain Model	17
		2.1.1 Asset-Related Concepts	17
		2.1.2 Risk-Related Concepts	19
		2.1.3 Risk Treatment-Related Concepts	20
	2.2	Relationships and Multiplicities	20
	2.3	Metrics	22
	2.4	Process	22
	2.5	ISSRM Application Example	23
	2.6	Further Reading	27
	2.7	Exercises	29
3	Security Risk		
	3.1	System Assets	31
	3.2	Risk Analysis	33
	3.3	Harm: Malicious Software	34
	3.4	Taxonomy of Security Errors	36
	3.5	Security Threats	37

xvi Contents

	3.6	Threat Agent	39
	3.7	Further Reading	41
	3.8	Exercises	41
4	Secu	rity Requirements	43
•	4.1	Security Criterion	43
	4.2	Requirements Definition	44
	4.3	Security Requirements Classification	45
	4.4	How to Specify Security Requirements	50
	4.5	Related (to Security) Requirements	52
	4.6	Further Reading	56
	4.7	Exercises	58
Do	rt II	Modelling Languages for Security Risk Management	
5		urity Risk-Oriented BPMN	63
	5.1	Business Process Model and Notation	63
	5.2	Security Risk Management Using BPMN	64
		5.2.1 Semantics	65
		5.2.2 Abstract Syntax	65
		5.2.3 Concrete Syntax	68
	5.3	Example	69
	5.4	Further Reading	72
	5.5	Exercises	75
6	Secu	ırity Risk-Aware Secure Tropos	77
	6.1	Tropos and Secure Tropos	77
	6.2	Security Risk Management Using Secure Tropos	79
		6.2.1 Semantics and Concrete Syntax	79
		6.2.2 Abstract Syntax	81
	6.3	Examples	86
	6.4	Further Reading	89
	6.5	Exercises	91
7	Secu	rity Risk-Oriented Misuse Cases	93
	7.1	Use and Misuse Cases	93
	7.2	Security Risk Management Using Misuse Cases	94
		7.2.1 Semantics and Concrete Syntax	94
		7.2.2 Abstract Syntax	95
	7.3	Examples	98
	7.4	Textual Misuse Cases	101
	7.5	Further Reading	103
	7.6	Exercises	104
8	Mal	-activities for Security Risk Management	107
	8.1	Activity and Mal-activity Diagrams	107
	8.2	Security Risk Management Using Mal-activities	108

Contents xvii

		8.2.1 Semantics and Concrete Syntax	108
		8.2.2 Abstract Syntax	110
	8.3	Example	112
	8.4	Further Reading	113
	8.5	Exercises	113
Par	t III	Model-Driven Security Development and Application	
9		sformations Between Security Risk-Oriented Modelling	
		uages	119
	9.1	Transformation Basis	119
		9.1.1 Transformation Method	119
		9.1.2 Comparison of Modelling Languages	120
	9.2	Transforming from Security Risk-Oriented BPMN	
		to Security Risk-Aware Secure Tropos	125
	9.3	Transforming from Security Risk-Aware Secure Tropos	
		to Security Risk-Oriented Misuse Cases	129
	9.4	Transforming from Security Risk-Oriented Misuse Cases	
		to Mal-activities for Security Risk Management	135
	9.5	Further Reading	141
	9.6	Exercises	144
10	Role	-Based Access Control	147
	10.1	Family of RBAC Models	147
	10.2	RBAC Administration	149
	10.3	RBAC Modelling Languages	150
		10.3.1 SecureUML	150
		10.3.2 UMLsec	153
		10.3.3 Comparison	156
		10.3.4 Transformation	158
	10.4	Model-Driven Security	162
	10.5	Further Reading	165
	10.6	Exercises	167
11	Secu	re System Development Using Patterns	171
	11.1	Security Patterns	171
	11.2	Security Pattern Taxonomy	172
	11.3	Security Risk-Oriented Patterns	174
	11.4	Security Requirements Elicitation from Business Processes	180
		11.4.1 SREBP Method	182
		11.4.2 Pattern Application	185
	11.5	Further Reading	193
	116	Everoises	194

Part	IV	Concluding Remarks	
12	Secu	ıre System Development	199
	12.1	Secure System Development Processes	199
		12.1.1 Microsoft Secure System Development Lifecycle	200
		12.1.2 OWASP CLASP	201
		12.1.3 Seven Touchpoints	202
		12.1.4 Comparison	204
	12.2	Security Approaches in Secure Systems Development	
		Processes	204
	12.3	Tools	206
	12.4	Exercises	207
Dofo	moma	900	200