Contents

1	Introduction								
	1.1	Challenges in Pharmaceutical Supply Chains							
	1.2		m Statement and Hypotheses	5					
	1.3	Resear	ch Methods and Structure of the Work	8					
	References								
2	Related Work								
	2.1	Access Control Mechanisms							
	2.2	Compo	onents of EPCglobal Networks						
	2.3	Combi	nation and Classification of Related Work	22					
	References								
3	Security in EPCglobal Networks								
•	3.1		rable Environments	31					
	017	3.1.1	Threats of RFID-Aided Supply Chains	34					
		3.1.2	Attacks Scenarios	36					
		3.1.3	Security Requirements	39					
	3.2	ing and Simulation	40						
		3.2.1	Formal Model for RFID-Aided Supply Chains	40					
		3.2.2	Simulation of EPCglobal Networks	48					
	3.3	3.3 Levels of Security							
		3.3.1	Device-Level Security	52 52					
		3.3.2	Business-Level Security	53					
	3.4	In-Mei	mory Technology Building Blocks	54					
	References								
	Davi	aa I awal	I Eutopoi one	61					
4	Device-Level Extensions								
	4.1	Static List Low-Cost Mutual Authentication Protocol							
	4.2	Space-Aware Mutual Authentication Protocol							
	4.3	Security Evaluation							
	4.4	Summary							
	Refe	rences.		70					

viii Contents

5	Busin	ess-Lev	rel Extensions for Event Repositories	71			
	5.1	Archite	ecture	72			
		5.1.1	Inquirer	74			
		5.1.2	EPCIS Repository	74			
		5.1.3	Access Control Client	74			
		5.1.4	Access Control Server	74			
		5.1.5	Configuration Tool	76			
		5.1.6	Trust Relationship Server	76			
		5.1.7	Certificate Authority	77			
	5.2	Extend	led Process Steps	78			
	5.3	Comm	unication Protocol	80 83			
	5.4	Enforcement of Access Rights					
	5.5		ty Evaluation	84 88			
	5.6	Applicability to Existing Event Repositories					
	5.7	Perform	mance Analysis	89			
		5.7.1	Formal Throughput Characteristics	90			
		5.7.2	Benchmarks	94			
	Refer	ences .		103			
6	Ouali	itative a	and Quantitative Discussion	105			
•	6.1		ative Improvements	105			
	• -	6.1.1	Improvements for Device-Level Security	105			
		6.1.2	Improvements for Business-Level Security	106			
	6.2	Ouanti	tative Results	107			
		6.2.1	Initial Costs of RFID-Enablement	107			
		6.2.2	Operative Costs of Anti-Counterfeiting	109			
	Refer	ences .		103			
7	Évaluation						
•	7.1		cability to Further Industries	115 115			
	7.2		t on Business Processes	119			
	7.3		Relevance	120			
				122			
0	Come	lucion		125			
8	Conc	iusion.		123			
Aŗ	Appendices						
A.	A.1 Classification of Related Work						
	A 2 Manning for Discrete Event Simulation						

Contents ix

A.3	Authentication of Supply Chain Parties	131				
A.4	Enforcement of Access Rights	131				
A.5	Benchmark Results	132				
A.6	Costs for RFID-Enablement Per Supply Chain Role	142				
Refe	References					
Inde	x	145				