Gérard Lacoste Birgit Pfitzmann Michael Steiner Michael Waidner (Eds.)

SEMPER – Secure Electronic Marketplace for Europe

		Technische Universität Darmstadt FACHBEREICH INFORMATIK
AND N		BIBLIOTHEK
		Inventar-Nr.: 280-00314
R	Springer	Sachgebiete:
N	opiniger	Standort:
28g		

Table of Contents

Part I. The Vision of SEMPER

1.	Sec	ure Ele	ectronic Commerce	3	
	1.1 The Notion of "Electronic Commerce"				
		1.1.1	Example 1: Shopping over the Internet	3	
		1.1.2	Example 2: Business-to-Business Commerce	5	
	1.2	What'	s Special about Electronic Commerce?	6	
		1.2.1	Virtuality of Electronic Commerce	6	
		1.2.2	The Internet as a Hostile Environment	6	
		1.2.3	Insecure User Equipment	7	
		1.2.4	New Opportunities to Commit Fraud	8	
	1.3	Existi	ng Approaches to Secure Electronic Commerce	8	
		1.3.1	Secure Channels	8	
		1.3.2	Trusted Market Provider	9	
		1.3.3	Digital Signatures and Public-Key Infrastructures	10	
		1.3.4	Payment Systems	11	
	1.4	The V	Vhole Picture of Electronic Commerce	11	
	1.5				
		1.5.1	Security Requirements	13	
		1.5.2	The SEMPER Focus	13	
2.	Tec	hnical	Framework	15	
	2.1	The S	EMPER Model	15	
	2.2		pach	17	
	$\overline{2.3}$		ecture	18	
	2.4		cols and Implementation	21	
3.	Leg	al Fra	mework	23	
	3.1	0			
	3.2				
	-	3.2.1	Commitments without Online Third Party	25	
		3.2.2	Liability-Cover Service	25	
		$\begin{array}{c} 3.2.2\\ 3.2.3\end{array}$	Liability-Cover Service		
	3.3	3.2.3	Liability-Cover Service Security and Market Effectiveness EMPER Electronic-Commerce Agreement	25 26 27	

		3.3.2 Introducing Electronic-Commerce Agreements	28
	3.4	Conclusions	29
4.	Vis	ion of Future Products	31
	4.1	Four Facets of SEMPER as a Product	31
	4.2	SEMPER-based Business Applications	33
		4.2.1 Secure Internet Shopping	33
		4.2.2 Person-to-Person Scenario: The Fair Internet Trader	34
	4.3	Outlook	37

Part II. Project Achievements

5.	Org	ganizat:	ional Overview	41
	5.1^{-1}	Struct	ure of SEMPER	41
	5.2	Lesson	s Learned	42
		5.2.1	Initial Education	42
		5.2.2	Common Understanding	42
		5.2.3	Teams of Individuals, not Organizations	42
6.	Arc	hitectu	1re	45
	6.1	Impor	tant Concepts	45
		6.1.1	The Model of Deals, Transfers, and Exchanges	45
		6.1.2	Global Security Concepts	46
		6.1.3	Security Attributes	48
		6.1.4	Transactions, Sessions, Contexts	48
	6.2	Servic	e Architecture	49
		6.2.1	Business Applications	49
		6.2.2	Commerce Layer	51
		6.2.3	Transfer-and-Exchange Layer	52
		6.2.4	Business-Item Layer	54
		6.2.5	Supporting Services	55
	6.3	Impler	mentation Architecture	58
		6.3.1	Structure of a Block: Manager-Module Concept	58
		6.3.2	Communication	60
		6.3.3	Business Applications and Browser Integration	61
	6.4	Protot	ype	61
	6.5	Outloo	ok	62
7.	Ext	oerime	nts	65
	7.1		uction	65
	7.2		Sites and Services	66
	_	7.2.1	Internal SEMPER Trials	68
		7.2.2	Freiburg Basic Trial	69
		7.2.3	SME Trials	70

		7.2.4	Freiburg SME Trial	74
		7.2.5	MOMENTS Trial	74
	7.3	Trial In	nplementations	74
		7.3.1	Trial Services	75
		7.3.2	Equipment and Set-Up	76
		7.3.3	SME Business Applications	77
		7.3.4	MOMENTS Trial	77
	7.4	Trial Pa	articipants' Reactions	77
		7.4.1	Initializing the SEMPER Software	78
		7.4.2	Purse Creation and Management/Payment Options .	80
		7.4.3	TINGUIN (Trustworthy User Interface)	82
		7.4.4	Secure Identification and Document Exchange	84
	7.5	Service	Providers' Reaction	85
	7.6	Conclus	sion	91
8.	The	Fair Ir	nternet Trader	95
0.	8.1		of a Person-to-Person Electronic-Commerce Tool	95
	0.1	8.1.1	A New Type of Electronic Commerce	95 95
		8.1.2	The Role of a Tool	96
	8.2		T from a User Perspective	97
	0.2	8.2.1	Overview	98
	•	8.2.2	Negotiation Stage	98
		8.2.3	Contract Signing Stage	102
		8.2.4	Fulfillment Stage	103
			Disputes	105
	8.3		l Design	106
		8.3.1	Overview	106
		8.3.2	The Messages Subsystem	108
		8.3.3	The Display Subsystem	108
		8.3.4	The Flow Subsystem	109
		8.3.5	Execution Model	111
	8.4	Experir	nents	113
	8.5	-	k	119
· ·	7 01	.		
9.			nerce Layer: A Framework for Commercial	121
	9.1			
	9.1		cal Approach	
			The Challenge	
	9.2	9.1.2 Concer	The Generic Deal Approachts and Architecture	$\frac{122}{124}$
	9.2	9.2.1	The Commerce-Transaction Service Model	$124 \\ 124$
		9.2.1	Trust Relations	$124 \\ 126$
		9.2.2	Commerce Transaction	$120 \\ 127$
		9.2.3 9.2.4	Commerce Deal	$127 \\ 127$
		9.2.4 9.2.5	The Commerce Service API Access Control	
		9.4.0	The Commerce Service AFT Access Control	129

132

		9.2.6	Authorization of Commerce Transactions	130
		9.2.7	Service Quality Management	135
	9.3	Design	Overview	136
		9.3.1	The Commerce-Layer Use Cases	136
		9.3.2	Class Diagram	139
		9.3.3	Commerce Transactions	141
		9.3.4	Representation of a Commerce Transaction	141
		9.3.5	The Downloader	141
		9.3.6	Scenarios	146
	9.4	Using t	the Commerce Transaction Service	148
		9.4.1	Case Description	149
		9.4.2	Definition of Transaction Classes	149
		9.4.3	Activation of a Deal	151
		9.4.4	Inspection of a Deal	152
		9.4.5	Commerce Transactions	152
10	Fair	Excha	nge: A New Paradigm for Electronic Commerce	155
10.			action and Overview	155
	10.1		Why "Generic" Fair Exchange?	156
		10.1.2	-	158
			Notation and Assumptions	158
	10.2		d Work	159
	10.2	10.2.1	Certified Mail	159
		10.2.2	Contract Signing	160
		10.2.3	Fair Purchase	161
	10.3		Iransfers and Fair Exchanges	162
		10.3.1	Transfers of Basic Business Items	163
			Fair Exchange	163
	10.4		el of Transfers Enabling Fair Exchange	164
		10.4.1	External Verifiability	164
		10.4.2	Generatability	166
		10.4.3	Revocability	168
		10.4.4	Examples	169
	10.5		er-based Generic Fair Exchange	170
		10.5.1	Exchanging Externally Verifiable and Generatable	
			Items	170
		10.5.2	Exchanging Externally Verifiable and Revocable Items	172
		10.5.3	Efficiency	172
	10.6	The SI	EMPER Fair-Exchange Framework	173
		10.6.1	Class Hierarchy	174
		10.6.2	The Transfer-and-Exchange Framework in Action	178
		10.6.3	Extending the Transfer-and-Exchange Layer	182

11.	The	e Payment Framework	185
	11.1	Introduction	185
	11.2	Models of Electronic Payment Systems	187
		11.2.1 Players	187
		11.2.2 Payment Models	188
	11.3	Design of the Framework	189
		11.3.1 Scope	189
		11.3.2 Functional Architecture	191
		11.3.3 Design Overview	192
		11.3.4 Purses	196
		11.3.5 Transactions and Transaction Records	196
		11.3.6 Payment Manager	197
	11.4	Adapting a Payment System	198
		Using the Generic Payment Service Framework	198
		11.5.1 Payment Transactions	198
		11.5.2 Special Application Functionality	199
	11.6	Token-based Interface Definition	201
	11.7	Extending the Design	203
		11.7.1 Dispute Management	203
		11.7.2 Payment Security Policies	206
	11.8	Related Work	209
	11.9	Summary	211
12.		st Management in the Certificate Block	213
		Public-Key Infrastructure	213
	12.2	The Need for Trust Management	216
		12.2.1 Specifying Trusted CAs and Acceptable Certificates.	218
		12.2.2 Selecting Certificates Automatically in a Business	
		Session	218
	12.3	Design of Policy Management	220
		12.3.1 Maintaining Information about Policies	220
		12.3.2 Using Policies	220
		12.3.3 Negotiation of Certificates	222
	12.4	Prototype Implementation	223
		12.4.1 Public-Key Infrastructure in the SEMPER Trials	223
		12.4.2 Trust Management	225
	12.5	Related Work	230
		12.5.1 Netscape Communicator	230
		12.5.2 Microsoft Internet Explorer	231
		12.5.3 PolicyMaker	232

 $\tilde{M}_{\rm e}^{\rm out}$

13.	Limiting	g Liability in Electronic Commerce	233
	13.1 Intr	oduction	233
	13.1	.1 Necessity to Limit Liability	233
	13.1	.2 Separation Between Digital Signature and	
		Undeniable Commitment	237
	13.1	.3 Principles and Achievements of the Solution Proposed	239
	13.2 Des	cription of the Commitment Service	240
	13.2	-	241
	13.2	•	242
	13.2		243
	13.2		244
	13.2		244
	13.2	· ·	246
	13.2		
		Service	246
	13.2		247
		sible Variants and Supplements	247
	13.3		248
	13.3		248
	13.3	8	249
	13.3	=	249
	13.3	6 6	250
	13.3		
	-010	Commitment Certificates	251
	13.4 Wh	o is Liable for Failures at the CCA?	252
		clusions	253
	13.5		
	13.5		
		Service?	254
	13.5		254
	10.0		201
14.	Legal A	spects	257
	-	oduction	257
	14.2 Leg	al Issues in Electronic Commerce	258
	14.2		259
	14.2	• •	
		Signatures	260
	14.2	2.3 Proof of Digital Signatures	260
	14.2		262
	14.2		263
	14.2		263
	14.2		264
	14.2		265
	14.2	0	266
		2.10 Copyright and Trademark	267
		120 oopjiight and induitient in the second second	201

		14.2.11	Payment	269
		14.2.12	Taxation	270
		14.2.13	Conclusions	270
	14.3	Selecte	d Approaches at Legal Frameworks	270
		14.3.1	UNCITRAL Model Law on Electronic Commerce	271
		14.3.2	Approach of the Commission of the European	
			Community (CEC)	273
		14.3.3	OECD Guidelines	275
		14.3.4	Utah Digital Signature Act (1996)	276
		14.3.5	German Digital Signature Act (1997)	277
		14.3.6	Electronic Data Interchange Agreements	278
		14.3.7	Conclusions	279
	14.4	The SE	EMPER Electronic-Commerce Agreement	279
		14.4.1	General	279
		14.4.2	SECA CAs	280
		14.4.3	SECA Legal Body	281
		14.4.4	Joining SECA	281
		14.4.5	Liability Limits in SECA	282
		14.4.6	Blacklists of Players Claiming Compromised Keys	
			and Signatures	284
		14.4.7	Levels of Equipment	286
	14.5	The Co	ontent of SECA	287
		14.5.1	The Agreement	287
		14.5.2	The Code of Conduct	292
		14.5.3	The Guidelines	294
	14.6	Conclu	sions	303
15	F 5.+1	uro Dir	ections in Secure Electronic Commerce	305
10.			chnical Issues	305
	10.1	15.1.1	Security Awareness	305
		15.1.1 15.1.2	Crypto Regulations	305
			Legal Issues	300
	15 9		Technical Issues	307
	10.4		Process Orientation	307
			Dispute Handling	308
		15.2.2 15.2.3	Access Control	309
			Pervasive Anonymity	310
			Web Tracking, Personalized Accounts, and Directed	310
		10.2.0	Marketing	312
		15.2.6	Multi-party Protocols	312
		15.2.0 15.2.7	Visualization of Security	312
	15 9		s and Protocols	315
	10.0	15.3.1	Business-Item Layer	315
		15.3.1 15.3.2	Supporting Services	313
	15 /		nentation	320
	10.4	mpien	ICH0401011	040

ie:

15.4.1	Trusted Computing Base	320
15.4.2	Dependable Third-Party Implementations	321
15.4.3	Assurance	322
References		325
Glossary		335
Index		343