

Contents

1	Introduction	1
	Giuseppe Anastasi, Emilio Bellini, Elisabetta Di Nitto, Carlo Ghezzi, Letizia Tanca, and Eugenio Zimeo	
1.1	How to Read This Book	3
2	Reference Case Study	7
	Giuseppe Anastasi, Emilio Bellini, Elisabetta Di Nitto, Carlo Ghezzi, Letizia Tanca, and Eugenio Zimeo	
2.1	The GialloRosso Winery	8
2.2	Cultivation Process	9
2.3	Harvesting, Fermentation and Maturation	11
2.4	Distribution	11
2.5	Sale	12
2.6	Remark	13

Part I Organizational Issues: Methodologies, Empirical Contexts and Policies

3	Which Collaboration Strategy for the Networked Enterprise in Wine Industry? Technological and Organizational Challenges	17
	Emilio Bellini	
3.1	Introduction	17
3.2	Boundaries in the New Product Development	19
3.3	The First Dimension of “Participation” in the Pisano and Verganti Model: To What Extent Is the Open Participation Suited to a Successful Networked Enterprise?	21
3.4	The Second Dimension of “Governance” in the Pisano and Verganti Model: To What Extent Is Flatness Suited to a Successful Networked Enterprise?	23
3.5	Applying the Pisano and Verganti Model: Organizational Challenges and Technological Requirements from Four Collaborative Strategies in the Networked Enterprise	25
3.6	Conclusions	29
	References	29

4	A Design-Driven Approach for the Innovation Management within Networked Enterprises	31
	Emilio Bellini, Claudio Dell' Era, and Roberto Verganti	
4.1	Introduction	32
4.2	R&D Organization: An Historical Analysis	35
4.3	Innovation and Networked Enterprise	37
4.4	Strategies of Innovation	38
4.5	User Centered Design	42
4.6	Design Driven Innovation	46
	References	55
5	Enhancing the Networked Enterprise for SMEs: A Service Platforms – Oriented Industrial Policy	59
	Bruno Basalisco and Guido M. Rey	
5.1	Introduction	59
5.1.1	The Strategic Links between the SME Industrial Context and the Policy Approach Analysed	61
5.2	The Challenges and Opportunities for SME ICT Services-Enabled Innovation	63
5.3	Platforms and Their Functions	64
5.3.1	An Alternative Approach to Platform: Acknowledging Different Platform Concepts	65
5.3.2	Complementors and Market Creation	67
5.3.3	Governance and Risk Sharing Profitability	69
5.3.4	Innovation in Platforms: The Challenge of Market Creation	72
5.3.5	Catalysts	73
5.4	A Proposed Policy of ICT-Based Service Platforms for SMEs	75
5.4.1	The Scope for a Platforms–Oriented Industrial Policy under EU Rules	76
5.4.2	ICT-Based Service Platforms for SMEs	77
5.4.3	Which Policy and for Which SME?	78
5.5	Concluding Remarks	78
	References	79

Part II Software Methodologies and Technologies

6	Complex Autonomic Systems for Networked Enterprises: Mechanisms, Solutions and Design Approaches	85
	Nicolò M. Calcevachia, Elisabetta Di Nitto, Daniel J. Dubois, Carlo Ghezzi, Valentina Mazza, and Matteo Rossi	
6.1	Introduction	85
6.2	Autonomic Systems: Literature Overview	86
6.2.1	Autonomic Computing	86
6.2.2	Autonomic Toolkits	88
6.3	Autonomic Systems in the Context of Networked Enterprises	92

6.4	The SelfLet Approach	93
6.4.1	The Concept of SelfLet	93
6.4.2	Autonomic Rules and Prediction Models	98
6.4.3	Design of SelfLet-Based Applications	99
6.5	SelfLets and Networked Enterprises, an Example Application	101
6.5.1	The Vineyard SelfLet Infrastructure	103
6.5.2	The Networked Enterprise SelfLet Infrastructure	106
6.6	Discussion and Conclusions	109
6.7	Appendix: A Brief Introduction to ARCHITRIO	110
	References	112
7	Autonomic Workflow and Business Process Modelling for Networked Enterprises	115
	Gerardo Canfora, Giancarlo Tretola, and Eugenio Zimeo	
7.1	Introduction	115
7.2	Related Work	117
7.3	Autonomic Workflow Model	120
7.3.1	Scenarios	120
7.3.2	Autonomic Workflow Life Cycle	122
7.4	Autonomic Workflow Management System	124
7.4.1	Meta Model	124
7.4.2	Architecture	127
7.4.3	Technologies	129
7.5	Rule-Based Workflow Adaptation	130
7.6	Business Process Modelling for Autonomic Workflows	135
7.6.1	Application Example	136
7.7	Conclusion	140
	References	141
8	Verification and Analysis of Autonomic Systems for Networked Enterprises	143
	Antonia Bertolino, Guglielmo De Angelis, Felicita Di Giandomenico, Eda Marchetti, Antonino Sabetta, and Paola Spoletini	
8.1	Challenges in Validating and Verifying Autonomic Systems	143
8.2	An Overview on Verification and Analysis of Autonomic Systems	146
8.2.1	Model Checking	148
8.2.2	Testing	150
8.2.3	Qualitative Aspects in Autonomic Compositions of Services	152
8.2.4	Stochastic Model-Based Dependability Analysis	154
8.2.5	Monitoring	156
8.3	Offline and Online Model Checking in ArtDeco	158
8.4	Focusing on the Case Study	160

8.5	Conclusions	165
	References	166

Part III Knowledge Elicitation and Management

9	Ontology-Based Knowledge Elicitation: An Architecture	175
	Marcello Montedoro, Giorgio Orsi, Licia Sbattella, and Roberto Tedesco	
9.1	Introduction	175
9.2	System Architecture	176
9.3	The OmniFind Module	178
9.4	The Knowledge Indexing and Extraction Module: Concepts from Texts	180
9.4.1	Training the Mapping Model	181
9.4.2	Indexing Documents	182
9.4.3	Querying Documents	182
9.4.4	Extending the Domain Ontology	183
9.5	The Internal Enterprise Data Module	184
9.5.1	Structuring Web Data	185
9.5.2	Dynamic and Heterogeneous Data-Source Integration ...	187
9.5.3	Knowledge Extraction	188
9.6	The PROM Module: Collecting Data from Processes	189
9.7	Conclusions	190
	References	190
10	Knowledge Extraction from Natural Language Processing	193
	Licia Sbattella and Roberto Tedesco	
10.1	Introduction	193
10.2	Defining the Domain Model	195
10.2.1	The Domain Ontology	197
10.2.2	The Lexical Database	197
10.2.3	The Mapping Model	198
10.3	Adding Linguistic Context Information to the Domain Model ...	199
10.4	Defining and Training the Mapping Model	201
10.4.1	The HMM-Based Model	201
10.4.2	Defining Transition Probability Distributions: The MaxEnt Model	203
10.4.3	Defining Emission Probability Distributions: Probabilistic Mapping	203
10.4.4	Training the Model	205
10.4.5	Comparing Our Model with Alternative Stochastic Approaches	207
10.5	Indexing Documents: The Disambiguation Procedure	208
10.5.1	Disambiguating Words: Extended Viterbi	208
10.5.2	Document Representation: Concept Frequency Analyser	209

10.6	Querying Documents and the Domain Ontology	210
10.6.1	Keyword-Based Queries	210
10.6.2	Natural Language-Based Queries	212
10.7	Extending the Domain Ontology	214
10.8	Results	215
10.9	Conclusions	217
	References	218
11	Knowledge Extraction from Events Flows	221
	Alireza Rezaei Mahdiraji, Bruno Rossi, Alberto Sillitti, and Giancarlo Succi	
11.1	Introduction	221
11.2	Knowledge Flow Extraction in the ArtDeco Project	222
11.3	Overview of Process Mining Techniques	223
11.3.1	A General Process Mining Algorithm	224
11.3.2	Challenges of Process Mining Algorithms	225
11.3.3	Review of the Approaches	226
11.4	Application to the GialloRosso Case Study	229
11.5	Conclusions	234
	References	234
12	Context-Aware Knowledge Querying in a Networked Enterprise	237
	Cristiana Bolchini, Elisa Quintarelli, Fabio A. Schreiber, and Maria Teresa Baldassarre	
12.1	Introduction	237
12.2	System Architecture	238
12.3	Context Model	241
12.4	Methodology for Context-Aware Data Filtering	244
12.5	Data Querying	245
12.5.1	Internal Data Sources	246
12.5.2	External Data Sources	248
12.5.3	Data from Sensors	248
12.6	Selecting Context, Query and Query Answering: A Web Portal	250
12.7	Related Work	255
12.8	Conclusions	256
	References	257
13	On-the-Fly and Context-Aware Integration of Heterogeneous Data Sources	259
	Giorgio Orsi and Letizia Tanca	
13.1	Introduction	259
13.2	Preliminary Discussion and Related Work	260
13.3	The AD-DDIS Internal Language and Architecture	261
13.3.1	CA- $\mathcal{DL}$: A Data Language for AD-DDIS	262
13.3.2	The AD-DDIS Architecture	263

13.4	Ontology Extraction: The Relational Case	267
13.5	Query Answering in AD-DDIS	268
13.6	The Context Model	270
13.7	Conclusions and Future Work	274
	References	274
14	Context Support for Designing Analytical Queries	277
	Cristiana Bolchini, Elisa Quintarelli, and Letizia Tanca	
14.1	Introduction	277
14.2	Related Work	278
14.3	Context Modelling Revisited	279
14.3.1	Constraints on the CDT [⊙]	282
14.4	Query Formulation	283
14.5	Conclusions	288
	References	288
 Part IV Management of Peripheral Devices		
15	Wireless Sensor Networks for Monitoring Vineyards	295
	Cesare Alippi, Giacomo Boracchi, Romolo Camplani, and Manuel Roveri	
15.1	Introduction and Motivation	295
15.2	Designing the System: Hardware Aspects	297
15.2.1	The Architecture of the Monitoring System	297
15.2.2	The Units: Sensor Nodes and Gateway	297
15.2.3	The Hardware Design	300
15.3	Designing the System: Software Aspects	301
15.3.1	Sensor Node	303
15.3.2	Gateway	304
15.3.3	Robustness of the Protocol	305
15.4	Designing the System: Data Storage and Presentation	307
15.5	Conclusions	309
	References	309
16	Design, Implementation, and Field Experimentation of a Long-Lived Multi-hop Sensor Network for Vineyard Monitoring	311
	Giuseppe Anastasi, Marco Conti, Mario Di Francesco, and Ilaria Giannetti	
16.1	Introduction	311
16.2	Related Work	313
16.3	Network Model and Design Principles	314
16.4	Protocol Description	316
16.4.1	Talk Interval Prediction Algorithm	316
16.4.2	Sleep Coordination Algorithm	317

16.5	Protocol Implementation and Experimental Testbed	320
16.6	Experimental Results	322
16.7	Conclusions	325
	References	325
17	Extracting Data from WSNs: A Service-Oriented Approach	329
	Gaetano F. Anastasi, Enrico Bini, and Giuseppe Lipari	
17.1	Introduction	329
17.2	Common Middleware Approaches	331
	17.2.1 Design Principles	331
	17.2.2 Classification of Approaches	333
17.3	Enabling Technologies	335
	17.3.1 Web Services	336
	17.3.2 WS-Agreement	339
17.4	The ArtDeco Middleware	342
	17.4.1 Architecture	343
	17.4.2 Contract Specification	346
17.5	A Case Study	351
17.6	Conclusions	353
	References	353
18	Extracting Data from WSNs: A Data-Oriented Approach	357
	Fabio A. Schreiber, Romolo Camplani, and Guido Rota	
18.1	Introduction	357
18.2	The Vinification Monitoring Process	358
18.3	PerLa: System Description	360
	18.3.1 PerLa: Integration in the Winemaking Monitoring Process	361
18.4	PerLa Language Digest	369
	18.4.1 Data Definition	369
	18.4.2 Low Level Queries	369
	18.4.3 High Level Queries	371
	18.4.4 Actuation Queries	371
18.5	Final Remarks	371
	References	372
19	Optimal Design of Wireless Sensor Networks	375
	Marcello Mura, Simone Campanoni, William Fornaciari, and Mariagiovanna Sami	
19.1	Introduction	375
19.2	Multi-level Design	378
19.3	Sensor-Level Design	380
19.4	Cost Model	382
19.5	Node-Level Design	382
19.6	Network Design	383
19.7	Power Modelling Methodology	384

19.8	Hierarchical Modelling	387
19.8.1	Bottom Layer Machines	387
19.8.2	Higher-Level Models	387
19.9	From Node Models to Network Models	389
19.10	Case Study	391
19.10.1	Node-Level Optimisation	391
19.10.2	Power Estimation of Selected Configuration	392
19.11	Conclusions	394
	References	394
20	Enabling Traceability in the Wine Supply Chain	397
	Mario G.C.A. Cimino and Francesco Marcelloni	
20.1	Introduction	397
20.2	Traceability Requirements in Wine Supply Chain	399
20.3	Traceability Information Representation and Management	402
20.4	A Transactional Model for Process Tracking	405
20.5	An Architectural View of the System	408
20.6	Conclusions	410
	References	411
 Part V Case Study		
21	Putting It All Together: Using the ArtDeco Approach in the Wine Business Domain	415
	Eugenio Zimeo, Valentina Mazza, Giorgio Orsi, Elisa Quintarelli, Antonio Romano, Paola Spoletini, Giancarlo Tretola, Alessandro Amirante, Alessio Botta, Luca Cavallaro, Domenico Consoli, Ester Giallonardo, Fabrizio Maria Maggi, and Gabriele Tiotto	
21.1	Introduction	416
21.2	Application Scenario and Modelling	419
21.2.1	BPMN Modelling	420
21.3	Middleware Architecture and Programming	422
21.3.1	Handling Internal Processes and Their Interactions with External Systems	424
21.3.2	Extracting Knowledge from Heterogeneous Sources	434
21.3.3	Monitoring Physical Environments with Wireless Sensors	439
21.3.4	ArtDeco Prototype Integration Layer	446
21.4	Lesson Learnt	449
21.5	Conclusion	450
	References	451
	Author Index	453