

Contents

1	Introduction	1
1.1	Motivation and thesis scope	1
1.2	Main envisioned thesis's results	4
1.3	Thesis Outline	5
2	Web-Services Foundation and Adaptability: Survey and Criteria	9
2.1	SOA and Web-Services: Overview and main Ingredients	10
2.1.1	The Underlying Technologies for SOA	11
2.1.2	Services-Oriented Architecture (SOA)	14
2.1.3	Web services Specification and Composition Standards	15
2.2	(High-Level) Petri nets-Based Foundation for WS: Survey	17
2.2.1	P/T Nets-based Foundations for Web services	19
2.2.2	Modelling Web services with High-level Petri Nets	22
2.3	Service Adaptability: Rules- and Aspect-based proposals	25
2.3.1	Business Rule-driven Proposals to Web-Service Adaptability	25
2.3.2	AOP and Adaptive Service-oriented Applications	28
2.4	Web-Services Modelling and Adaptability: Criteria and Assessment	29
2.4.1	Criteria for Web-Services Modelling and Adaptability	29
2.4.2	Service composition criteria	31
2.4.3	Service Criteria applied on the state-of-art	34
2.5	Chapter Summary	34
3	Rule-centric Stepwise Development for Service Systems	37
3.1	Rational for the forwarded Conceptual framework	37
3.1.1	HLPN as service foundation: Potentials and limitations	38
3.1.2	Necessity for Stepwise supporting Methodology	40
3.2	The UML-ECA-based semi-formal services description	42
3.2.1	Profiled UML class-diagrams: Application to the Travel Agency	44
3.2.2	Stepwise ECA-driven Description for Service Behaviors	45

3.3	CSRV-NETS: Structural Features Modelling	53
3.3.1	Application to the Travel Agency	57
3.4	CSRV-NETS: Behavioral Modelling of Services	59
3.4.1	CSRV-NETS behavior from ECA-driven architectural rules	62
3.5	CSRV-NETS: A Rewriting-logic based behavioral semantics	63
3.5.1	An intuitive CSRV-NETS behavioral semantics	65
3.5.2	CSRV-NETS Rewriting-logic based semantics	66
3.6	CSRV-NETS behavioral validation : A tailored MAUDE extension	71
3.7	Chapter Summary	74
4	Collaborative Services—Choreography meets Orchestration	75
4.1	Choreographical Services Composition with CSRV-NETS: Further Motivations	77
4.1.1	Choreographical composition within the Travel-agency	80
4.2	Business-Rules pattern for Behavioral Choreography	80
4.2.1	Cross-service business rules for the Agency application	83
4.3	Leveraging CSRV-NETS to ECA-driven Behavioral Choreography	87
4.3.1	Structural features in CCSRV-NETS	87
4.3.2	Behaviorally composing services with CCSRV-NETS	89
4.4	Application of the approach to the running example.	92
4.5	Chapter Summary	92
5	From Design- to Runtime adaptive services—Foundation and Deployment	93
5.1	CSRV-NETS Design-time service Adaptability: Potentials and Flaws	95
5.2	CSRV-NETS-based Aspectual-level: Main Ideas and Concepts	98
5.2.1	CSRV-NETS-transitions: Towards an "aspect"- <i>representation</i>	98
5.2.2	CSRV-NETS-based <i>aspectual</i> -Level: Informal presentation	101
5.2.3	CSRV-NETS-based <i>aspectual</i> -Level: Formal setting	103
5.3	CSRV-NETS meets its Aspectual Net: Jointpoints and pointcuts at concerns	105
5.3.1	CSRV-NETS and its smooth Endowing with Jointpoints	105
5.3.2	Pointcuts: Connecting CSRV-NETS-Joinpoints to the Aspectual Net	107
5.3.3	AOCSRV-NETS: Aspect-oriented CSRV-NETS-extension Formalization	109
5.4	Runtime (un)weaving of advices in AOCSRV-NETS: Principles and Formalization . .	110
5.4.1	"Non-woven" Rewriting rules governing aspect-oriented transitions	112
5.4.2	Dynamic-Weaving by Inferring "Non-woven" Rules	113
5.5	Aspectual Leveraging for Adapting the CSRV-NETS Flight Service	116
5.5.1	Leveraging the CSRV-NETS Flight towards adaptability	116
5.5.2	Building and dynamically adapting the flight AOCSRV-NETS	116
5.5.3	Emerging the rules-as-advices at the aspectual-level	118

5.5.4	Runtime shifting down / up of rules-as-advice on the Flight CSRV-NETS service	119
5.6	An Aspect-oriented MAUDE for Validating AOCSRV-NETS	122
5.6.1	Aspect-orientation of architectural ECA-driven rules for Dynamic Adaptability	124
5.6.2	Towards an ECA-Compliant aspect-orientation of MAUDE	125
5.6.3	Dynamic (un)weaving of aspectual MAUDE service-interactions	128
5.7	Towards a compliant .NET environment WS-deploying of AOCSRV-NETS	129
5.7.1	Mapping and manipulation of Conceptual ECA in .NET	131
5.8	Chapter Summary	131
6	Conclusions and Future Work	133
6.1	Main achieved contribution	133
6.2	Envisioned further investigations	134
	Bibliography	136
A	Algebraic Specifications, (High-level) Petri Nets, Rewriting logic and MAUDE: Overview	145
A.1	Algebraic specification: an overview	145
A.2	(High-level) Petri-Nets: Main Concepts	147
A.2.1	Place/Transitions Petri nets	147
A.2.2	High-level Petri nets (HLPN): An overview	149
A.2.3	Object-oriented Petri Nets: An overview	151
A.3	Rewriting techniques	151
A.4	Rewriting logic	153
A.4.1	Rewriting Logic and its Theory	153
A.4.2	The meaning of Rewriting Logic	154
A.5	MAUDE and its Reflection : Overview	155
A.6	MAUDE main Features	155
A.6.1	MAUDE Functional Modules	156
A.6.2	System and object-oriented Modules	156
A.6.3	MAUDE Reflection and internal Strategies	159
A.6.4	Internal Strategies	160
A.6.5	MAUDE-Workstation : presentation	161
B	N.Aoumeur Publications Related to this Thesis	165
C	N. Aoumeur Further Postdoctoral Publications	167