

# Contents

<b>1</b>	<b>Introduction: A view on coordination in computing systems</b>	<b>1</b>
<hr/>		
<b>2</b>	<b>Coordination focussing on data-exchange: LINDA</b>	<b>7</b>
<hr/>		
2.1	LINDA's tuple-space and its operations . . . . .	8
2.2	Two examples of LINDA-programs . . . . .	10
2.3	Tuple-space predicates and multiple tuple-spaces . . . . .	11
2.4	Discussion . . . . .	13
2.5	Bibliographic remarks . . . . .	14
<b>3</b>	<b>Coordination focussing on process synchronization: ALICE</b>	<b>18</b>
<hr/>		
3.1	Tuples and fields in ALICE . . . . .	19
3.2	Agents in ALICE . . . . .	21
3.2.1	Local agent-spaces . . . . .	24
3.3	Process synchronization with ALICE . . . . .	25
3.3.1	Coordinating conditional execution . . . . .	26
3.3.2	Coordinating loops . . . . .	27
3.3.3	Synchronization of groups of agents . . . . .	28
3.4	Turing machines with ALICE . . . . .	29
3.5	Historical and bibliographic remarks . . . . .	32
<b>4</b>	<b>Coordination of services in open distributed systems: LAURA</b>	<b>36</b>
<hr/>		
4.1	Design motivation . . . . .	36
4.2	Identification of services . . . . .	41
4.3	On naming in open distributed systems . . . . .	44
4.4	LAURA's operations . . . . .	46
4.5	Bibliographic remarks . . . . .	51
<b>5</b>	<b>Prescribing LAURA formally</b>	<b>53</b>
<hr/>		
5.1	A type system with subtyping . . . . .	54
5.1.1	Rules for type-equivalence . . . . .	54

5.1.2	Rules for subtyping . . . . .	55
5.1.3	The semantics of LAURA's service-type definitions . . . . .	57
5.2	A formal model of coordination: The Bag-Machine . . . . .	59
5.3	Technical preliminaries for the Bag-Machine . . . . .	62
5.3.1	Labeled event structures . . . . .	62
5.3.2	Open labeled event structures . . . . .	64
5.4	A labeled event structure for the Bag-Machine . . . . .	66
5.5	The behavior of agents using the Bag-Machine . . . . .	68
5.6	Embedding coordination and computation languages . . . . .	72
5.7	Example: Specifying LINDA with the Bag-Machine . . . . .	75
5.8	The semantics of LAURA's operations . . . . .	78
5.9	Bibliographic remarks . . . . .	81
<b>6</b>	<b>An experimental implementation of LAURA</b>	<b>84</b>
6.1	A C-Embedding: C-LAURA . . . . .	85
6.2	A csh-embedding: csh-LAURA . . . . .	86
6.3	The STL-precompiler . . . . .	87
6.4	The LAURA-library . . . . .	89
6.5	The Bag-Machine instance . . . . .	90
6.6	A distributed Bag-Machine . . . . .	92
6.6.1	Protocols used for the distributed Bag-Machine . . . . .	96
6.6.2	Protocols for joining and leaving nodes . . . . .	98
6.6.3	Extended Bag-Machine-organizations . . . . .	102
6.7	Experience with the prototype . . . . .	104
6.8	Bibliographic remarks . . . . .	104
<b>7</b>	<b>Outlook and perspectives</b>	<b>107</b>
<b>8</b>	<b>Acknowledgments</b>	<b>110</b>
<b>Appendix</b>		
<b>A</b>	<b>LAURA's subtyping tested by ALICE-agents</b>	<b>112</b>
A.1	Testing records . . . . .	113
A.2	Testing operation signatures and interfaces . . . . .	115
A.3	Example executions . . . . .	116
<b>B</b>	<b>Bibliography</b>	<b>118</b>