

Contents

1	Introduction	1
1.1	Contributions and Outline of this Thesis	5
2	Concepts and Definitions	7
3	Correctness Criteria for 1SR Database Replication Systems	19
3.1	Introduction	19
3.2	System Model and Definitions	22
3.3	One-Copy Serializability: a Loose Term	23
3.4	Consistency Models in Distributed Shared Memory	27
3.5	Correspondence Between DSM Models and Replica Consistency	28
3.5.1	Correctness Criteria	29
3.5.2	Synchronization Models	42
3.5.3	Performance Implications	54
3.6	Consistency in Highly-Scalable Data Systems	58
3.7	Discussion and Conclusions	59
4	A Characterization Model for Database Replication Systems	63
4.1	Introduction	63
4.2	A Characterization Model	65
4.3	Correctness Criteria for Replicated Databases	76
4.4	Conclusions	79
5	A Comprehensive Survey of Database Replication Systems	81
5.1	Introduction	81
5.2	Replication Systems as Combination of Strategies: A Survey	82
5.3	Scope of the Proposed Model	127

5.4	Discussion	129
5.5	Conclusions	136
6	MeDRA, a Metaprotoocol for Database Replication Adaptability	137
6.1	Introduction	137
6.2	Metaprotoocol	141
6.2.1	Supported Protocols	141
6.2.2	Metaprotoocol Outline	144
6.2.3	Dependencies Between Protocols	149
6.3	Experimental Results	151
6.4	Related Work	162
6.5	Conclusions	164
7	Integrity Awareness in Database Replication at Middleware Level	167
7.1	Introduction	167
7.2	System Model	170
7.3	Database Replication Protocols	170
7.4	Integrity Problems in Replication Protocols	172
7.5	How To Support Constraints	175
7.5.1	Weak Voting Replication Protocols	176
7.5.2	Certification-Based Replication Protocols	179
7.5.3	Compromise Solutions	182
7.5.4	Metaprotoocol Extensions	183
7.6	Evaluation	185
7.7	Related Work	192
7.8	Conclusions	194
8	Conclusions	197
A	On the Correctness of MeDRA	205
A.1	Correctness Arguments for the Supported Protocols	205
A.2	Principle of No Interference	206
A.2.1	MeDRA Running Only One Protocol	206
A.2.2	MeDRA Running Multiple Protocols	207
A.3	Correctness criterion	208

CONTENTS

B Pseudocode of MeDRA	209
Bibliography	221