

Contents

Abstract	1
Resumen	3
Resum	5
Aknowledgements	7
Preface	9
I Introduction	11
1 Introduction	13
1.1 Database replication	14
1.2 Replication transparency	17
1.3 Benefits of supporting multiple isolation levels	17
1.4 Objectives	18
1.5 Contributions	19
1.6 Roadmap	19
2 Related work	21
II Theoretical conditions	25
3 Background	27
3.1 General model	27
3.2 Communication model	28
3.3 Databases and transactions	28
3.4 Execution of transactions	29
3.5 Logical time	31
3.6 Graphs Theory	33

4	Stand-alone systems	35
4.1	Concurrency control mechanisms	35
4.2	Isolation levels	36
4.3	Snapshot Isolation	38
5	Alternative definition of Snapshot Isolation	41
5.1	PL-SI': an alternative definition of PL-SI	42
5.2	PL-SI' and PL-SI equivalence	42
5.3	PL-SI' and SI equivalence	49
5.4	About the time-precedes order in Snapshot Isolation	52
6	Extended mixed serialisation graph (EMSG)	53
6.1	Strict histories	56
7	Extending EMSG to replicated environments	59
7.1	Extending EMSG to replicated systems	59
7.2	Equivalence between replicated and stand-alone histories	61
7.3	Replication protocol correctness	62
III	Replication protocols	63
8	Replicated isolation support	65
8.1	Protocols classification	65
8.2	Conflict Resolution	67
9	Examples	83
9.1	SER-CBR	83
9.2	Blocking SER-D	87
9.3	Non-blocking SER-D	89
9.4	Conclusions	95
IV	Conclusion	97
10	Conclusions	99
V	Appendices	101
A	Appendices	103
A.1	Chapter 5 lemmas	103
A.2	Snapshot correctness in valid histories	104
A.3	Snapshot correctness in valid replicated histories	113
A.4	Global order of conflicting operations	114
A.5	Correctness proof of Theorem 2	115
	Bibliography	117