Automated Synthesis of Comprehensive Distributed Consistency Model Litmus Test Suites*

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ABSTRACT

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PVLDB Artifact Availability:
The source code, data, and/or other artifacts have been made available at URL_TO_YOUR_ARTIFACTS.

1 INTRODUCTION

Motivations: Distributed consistency models are quite tricky to understand. Even worse, in the literature, there are often several variants of a specific consistency model. For example, Jiang et al. presents six variants of causal consistency in [2] for non-transactional databases. Crooks presents a hierarchy of eight variants of snapshot isolation [1] for transactional databases. It is difficult, even for experts,

- to decide whether a given history satisfies some consistency model or not;
- to come up with histories under some constraints (e.g., on size) that satisfy or refuse some consistency model; and
- to tell the differences between two consistency models by presenting distinguishing histories that satisfy one consistency model but refuse the other.

All the three tasks are concerned about histories, which are easier for human to understand.

programs vs. litmus tests vs. histories vs. abstract executions

Challenges:

- How to formally express consistency models?

Our Contributions.

- Alloy* model of both non-transactional and transactional consistency models
- Two case studies

2 PRELIMINARIES

3 METHODOLOGY

4 CASE STUDIES

4.1 Causal Consistency Variants

4.2 Snapshot Isolation Variants

5 RELATED WORK

Litmus Testing Generations.

6 CONCLUSION

REFERENCES

[1] Natacha Crooks, Youer Pu, Lorenzo Alvisi, and Allen Clement. 2017. Seeing is Believing: A Client-Centric Specification of Database Isolation. In *Proceedings of the ACM Symposium on Principles of Distributed Computing (PODC '17)*. Association for Computing Machinery, New York, NY, USA, 73–82. https://doi.org/10.1145/3087801.3087802

[2] Xue Jiang, Hengfeng Wei, and Yu Huang. 2020. A Generic Specification Framework for Weakly Consistent Replicated Data Types. In *2020 International Symposium on Reliable Distributed Systems (SRDS)*. 143–154. https://doi.org/10.1109/SRDS51746.2020.00022

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