Understanding the trade-offs of causal replication solutions through simulation

António Nunes Duarte, João Leitão, and Pedro Fouto

NOVA School of Science and Technology

Abstract. Causal consistency is a weak consistency model, that works by tracking causal dependencies between operations and making sure that they are propagated and displayed, to users of the system, in a causally consistent order. Many different ways of achieving causal consistency have been proposed in the literature over the years, (eg. usage of Logical Clocks[1], Scalar Timestamps[2], tracking Direct Dependencies[4], usage of specific node topologies that naturally ensure consistency[3]), but each comes with it's own set of trade-offs which turn the decision complicated and highly dependent on the specification of the system that one is looking to develop. The aim of this work, is exploring those trade-offs through the usage of a simulator, to more thoroughly understand the limits, and optimal use cases of each proposed solution.

Keywords: Causality Tracking · Consistency · Simulator

1 Introduction

2 Related Work

3 Causality Tracking

4 Progress Report

References

1. Baquero, C., Preguiça, N.: Why logical clocks are easy. Communications of the ACM **59**(4), 43–47 (2016)
2. Du, J., Iorgulescu, C., Roy, A., Zwaenepoel, W.: Gentlerain: Cheap and scalable causal consistency with physical clocks. In: Proceedings of the ACM Symposium on Cloud Computing. pp. 1–13 (2014)
3. van der Linde, A., Fouto, P., Leitão, J., Preguiça, N.: The intrinsic cost of causal consistency. In: Proceedings of the 7th Workshop on Principles and Practice of Consistency for Distributed Data. pp. 1–6 (2020)
4. Lloyd, W., Freedman, M.J., Kaminsky, M., Andersen, D.G.: Don't settle for eventual: Scalable causal consistency for wide-area storage with cops. In: Proceedings of the Twenty-Third ACM Symposium on Operating Systems Principles. pp. 401–416 (2011)