HistLock: Efficient and Sound Hybrid Detection of Hidden Predictive Data Races with Functional Contexts

ABSTRACT

State-of-the-art hybrid data race detectors combine the happens-before relation and the locking discipline to alleviate the imprecision problem incurred by lockset-based detector and the thread interleaving problem incurred by happens-before detectors. However, they incur high runtime overheads. In this paper, we present HistLock, a novel and sound hybrid dynamic race detector, which attains high precision, low slowdown and memory overheads, and thread insensitivity. It formulates a novel context-based strategy to phrase out non-redundant memory access events and check races to conserve both time and memory computation. It ensures each race warning to be the one violating the locking discipline in the original event history. Our experiment compared HistLock to FastTrack, AccuLock, and MultiLock-HB, which were a precise happens-before race detector, an imprecise hybrid race detector, and a precise hybrid race detector, respectively, on 13 benchmark subjects. HistLock was found to be of higher precision, 156% faster and 33% more memory-efficient than MultiLock-HB. It detected 59 more race warnings than AccuLock, attaining higher effectiveness, but ran slower by 43%. In most cases, in a single run, HistLock reported all the races detected by FastTrack in 100 runs.

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All are welcome!