Hochschule Karlsruhe
University of
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HKA

Dynamische Programmanalysen für nebenläufige Programme - Data Race Prediction mit TSan V2

Seminararbeit

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1 Einleitung

Nowadays concurrent programs are very common in order to make use of 'hyper-threading and multi-core architectures'[1, p. 14]. 'Due to the highly non-deterministic behavior of concurrent programs' [3, p. 1]

data race concurrent programs prone to data races, due to highly nondeterministic nature. 2 conflicting events next to each other in trace

conflicting event 2 read/write events, at least one event is write event

dynamic data race prediction predict trace orderings that exhibit data races

exhaustive predictive methods identify as many orderings as possible

efficient predictive methods $O(n)$ runtime, compromise completeness and soundness

HB relation events can be ordered by happens-before relation and if they can't that means they can be ordered in a way that they are next to each other in the trace $\rightarrow$ data race

vector clocks used to represent happens-before relation, if incomparable then data race

epochs vector clocks need $O(n)$ time and space, instead epochs can be used which consist of time stamp j and thread id k $\rightarrow$ j#k

2 Motivation und Beispiele

3 Grundlagen

- was genau ist ein data race
- wie können data races dynamisch erkannt werden?
- happens-before Methode

4 FastTrack + TSan

- Effiziente Umsetzung der happens-before methode
- FastTrack uses an optimized semi-adaptive version of epochs

[2] [3]

5 Fazit

Literaturverzeichnis

[1] A. R. Molla, G. Sharma, P. Kumar und S. Rawat, Hrsg., *Distributed Computing and Intelligent Technology : 19th International Conference, ICDCIT 2023, Bhubaneswar, India, January 18–22, 2023, Proceedings*, Cham, 2023. Adresse: https://link.springer.com/book/10.1007/978-3-031-24848-1.

[2] C. Flanagan und S. Freund, „FastTrack: Efficient and Precise Dynamic Race Detection," Bd. 53, Juni 2009, S. 121–133. DOI: 10.1145/1542476.1542490.

[3] M. Sulzmann und K. Stadtmüller, „Efficient, Near Complete and Often Sound Hybrid Dynamic Data Race Prediction (extended version)," *CoRR*, Jg. abs/2004.06969, 2020. arXiv: 2004.06969. Adresse: https://arxiv.org/abs/2004.06969.

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