Seminararbeit

Dynamische Programmanalysen für nebenläufige Programme - Data Race Prediction mit TSan

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13. Juni 2023

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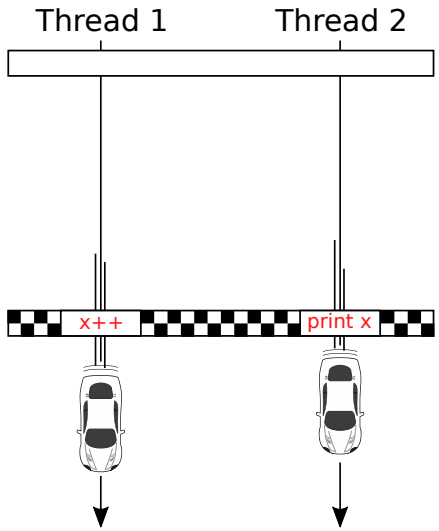
Introduction

- What are data races?
- Why fix data races?
- How to detect data races?



Source: https://programming.guide/go/data-races-explained.html

Background


```
1  int x;
2  pthread_mutex_t y;
3
4  void *Thread1(void *x) {
5          x++;
6          pthread_mutex_lock(&y);
7          pthread_mutex_unlock(&y);
8          return NULL;
9  }
10
11 void *Thread2(void *x) {
12         pthread_mutex_lock(&y);
13         x--;
14         pthread_mutex_unlock(&y);
15         return NULL;
16 }
```

Listing: program exhibiting a data race

Background


```
1  int x;
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16 }
```

Listing: program exhibiting a data race

	1#	2#
1.	w(x)	
2.	acq(y)	
3.	rel(y)	
4.		acq(y)
5.		w(x)
6.		rel(y)

Table: obtained trace

Data race! $\Leftarrow$

	1#	2#
4.		acq(y)
5.		w(x)
1.	w(x)	
6.		rel(y)
2.	acq(y)	
3.	rel(y)	

Table: Trace 1 reordered

Background

- dynamic data race prediction
- vector clocks
- epochs
- Lamport's HB relation

FastTrack and TSan V2

FastTrack

- epoch-based
- semi-adaptive

ThreadSanitizer (TSan) V2

- modified version of FastTrack
- shadow memory

TSan V2

Conclusion