

Race Condition

Ein **kritischer Wettlauf**, auch **Wettlaufsituation** (engl. *Race Condition* oder *Race Hazard*) ist in der Programmierung eine Konstellation, in der das Ergebnis einer Operation vom zeitlichen Verhalten bestimmter Einzeloperationen abhängt.

Unbeabsichtigte Wettlaufsituationen sind ein häufiger Grund für schwer auffindbare Programmfehler; bezeichnend für solche Situationen ist nämlich, dass bereits die veränderten Bedingungen zum Programmtest zu einem völligen Verschwinden der Symptome führen können. Zur Vermeidung solcher Konstellationen können bei der Programmerstellung beispielsweise Semaphore eingesetzt werden.

Beispiel

Zwei gleichzeitig laufende Systeme wollen denselben Wert erhöhen. Die notwendigen Einzelschritte, die jedes der beiden Systeme durchlaufen muss, sind:

1. *Wert lesen*: Der Wert wird aus dem externen Speicher in den internen Speicher gelesen.
2. *Wert erhöhen*: Der Wert wird im internen Speicher um 1 erhöht.
3. *Wert schreiben*: Der Wert wird aus dem internen Speicher zurück in den externen Speicher geschrieben.

Angenommen, der Wert betrage anfangs 1. Das erste System heißt "A", das zweite System "B". Erhöhen beide Systeme den Wert, ist der erwartete neue Wert 3. Wenn System A zeitlich vor System B arbeitet, wird das auch so sein:

Zeitpunkt	System A	Gespeicherter Wert	System B
1	Einlesen des Wertes Wert: 1	1	
2	Erhöhen des internen Wertes um eins Wert: 2	1	
3	Speichern des Wertes	2	
4		2	Einlesen des Wertes Wert: 2
5		2	Erhöhen des internen Wertes um eins Wert: 3
6		3	Speichern des Wertes

Arbeiten beide Systeme gleichzeitig und ist die Reihenfolge der Befehle unbestimmt, kann die Wettlaufsituation jedoch dazu führen, dass der tatsächlich erhaltene, neue Wert stattdessen 2 beträgt:

Zeitpunkt	System A	Gespeicherter Wert	System B
1	Einlesen des Wertes Wert: 1	1	Einlesen des Wertes Wert: 1
2	Erhöhen des internen Wertes um eins Wert: 2	1	Erhöhen des internen Wertes um eins Wert: 2
3	Speichern des Wertes	2	Speichern des Wertes

Zur Vermeidung des Problems müsste A den Zugriff auf den Wert bis zum Abschluss der Veränderung so sperren, dass B warten muss, bis A seinen Zugriff auf den Wert beendet hat.

Zeitpunkt	System A	Gespeicherter Wert	System B
1	Sperrungen vor anderen Zugriffen (falls dies nicht möglich ist: warten)	1	
2	Einlesen des Wertes Wert: 1	1	Sperrungen vor anderen Zugriffen (falls dies nicht möglich ist: warten)
3	Erhöhen des internen Wertes um eins Wert: 2	1	Auf Freigabe warten...
4	Speichern des Wertes	2	Auf Freigabe warten...
5	Aufheben der Sperrung	2	Sperrungen vor anderen Zugriffen (Nun erfolgt die eigentliche Sperrung)
6		2	Einlesen des Wertes Wert: 2
7		2	Erhöhen des internen Wertes um eins Wert: 3
8		3	Speichern des Wertes
9		3	Aufheben der Sperrung

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