

BRAVO – Biased Locking for Reader-Writer Locks

Dave Dice

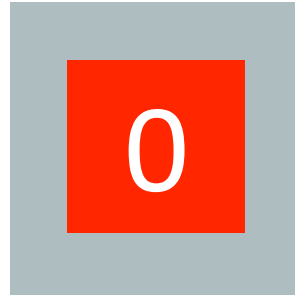
Alex Kogan

Oracle Labs

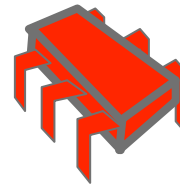
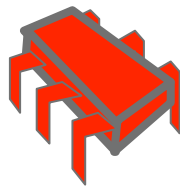
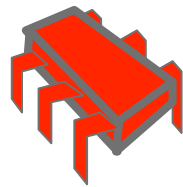
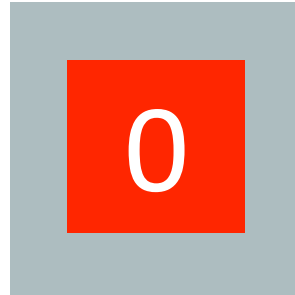
Ubiquitous in modern systems



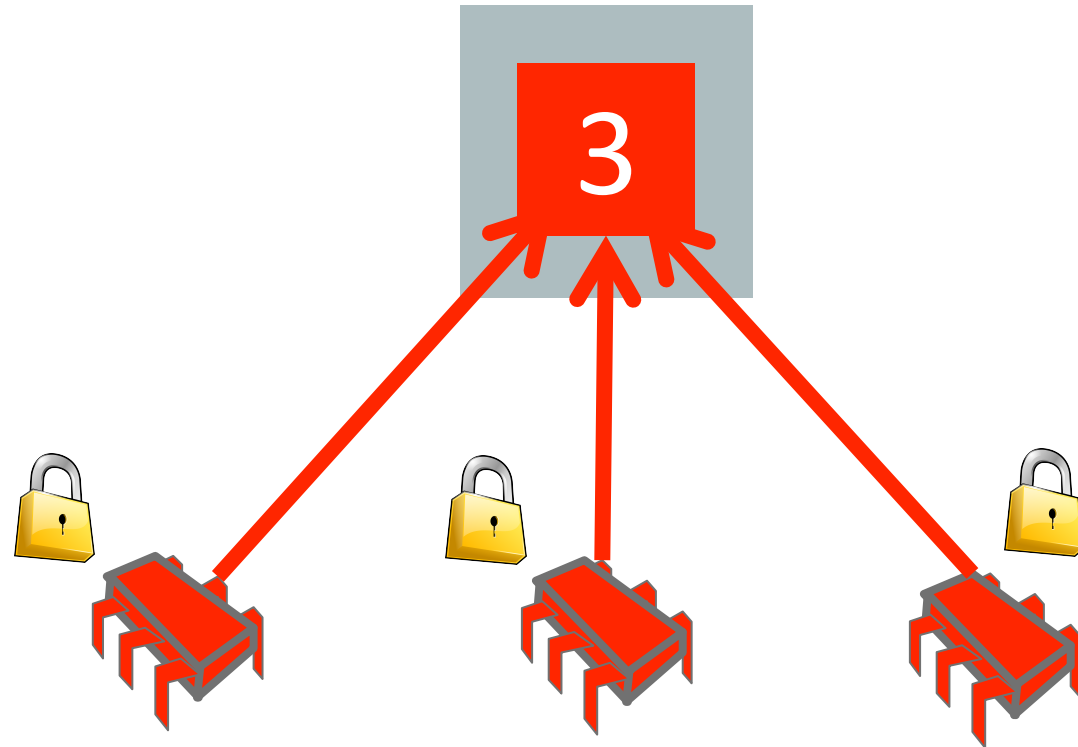
The “shared counter” approach



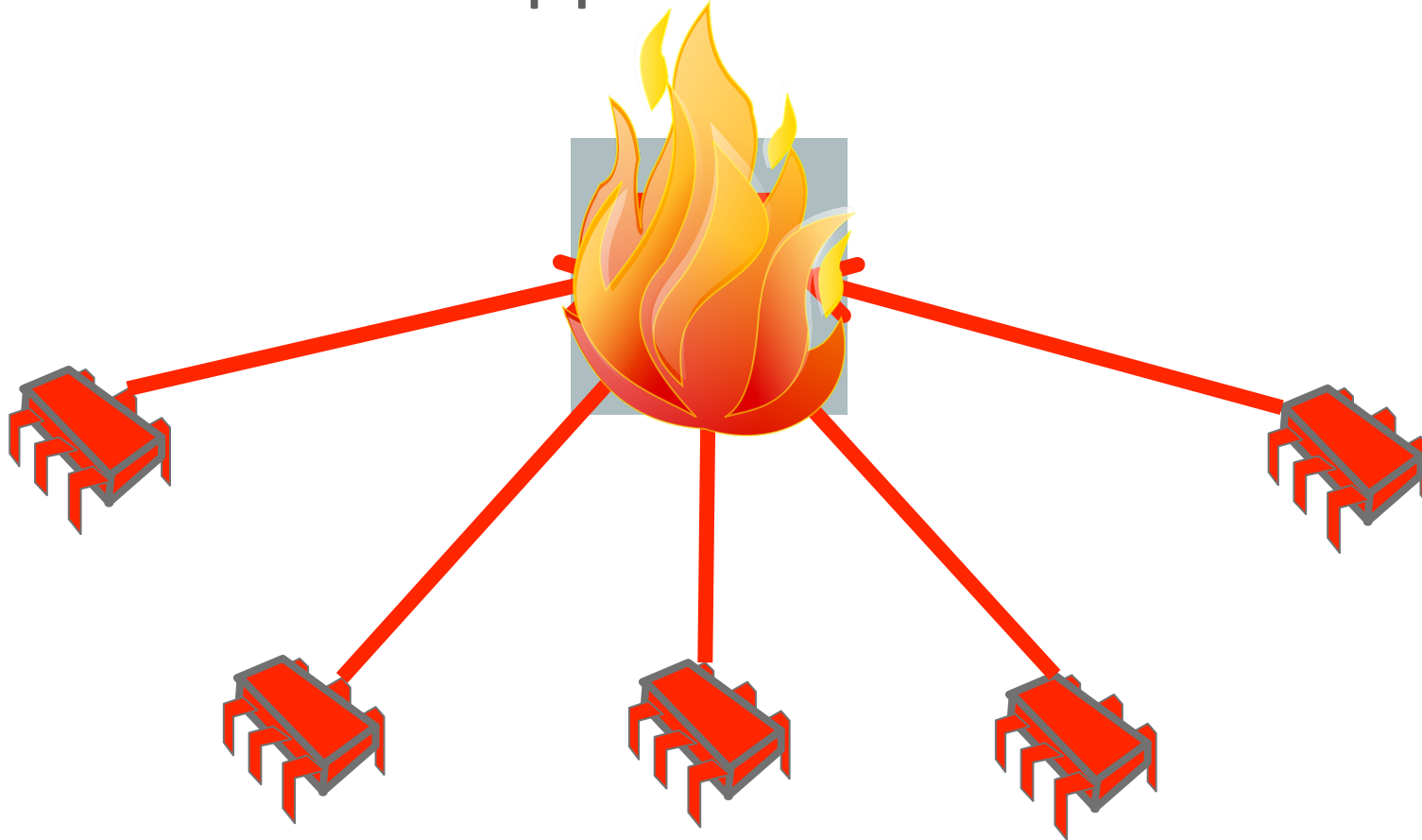
The “shared counter” approach



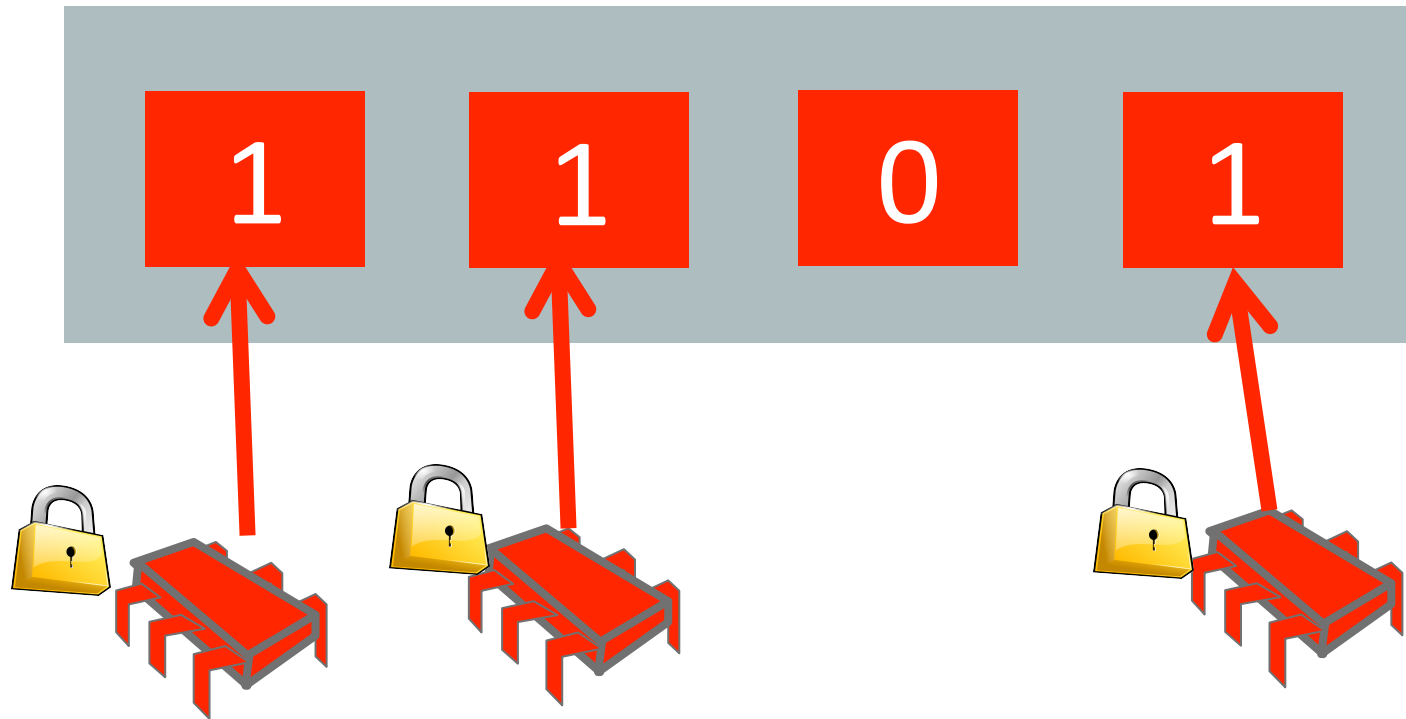
The “shared counter” approach



The “shared counter” approach



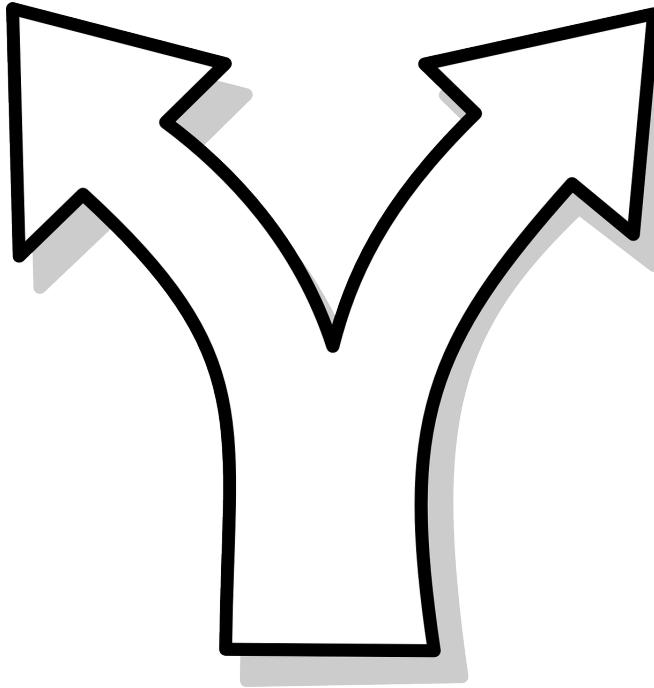
The “distributed” approach



The Scalable “Reader Indicator” Dilemma

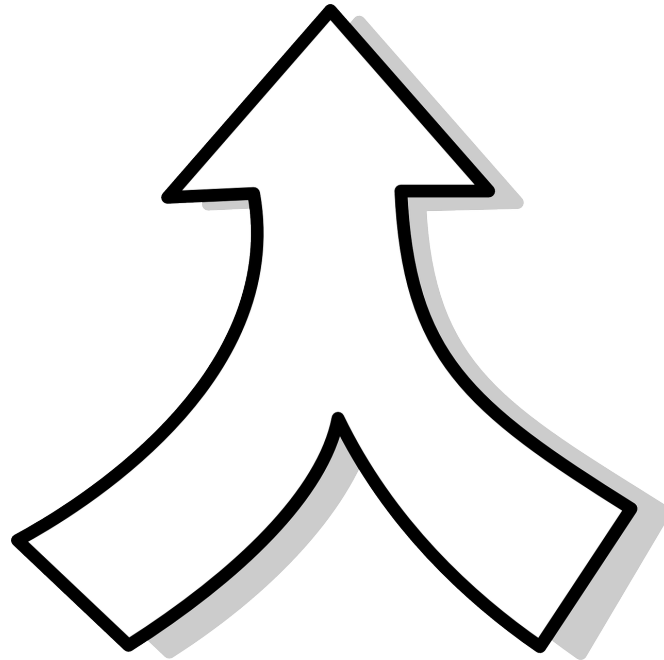
Compact

Scalable



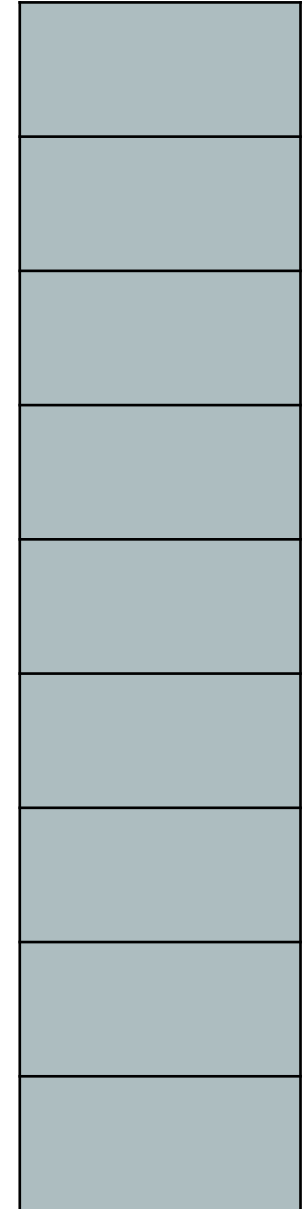
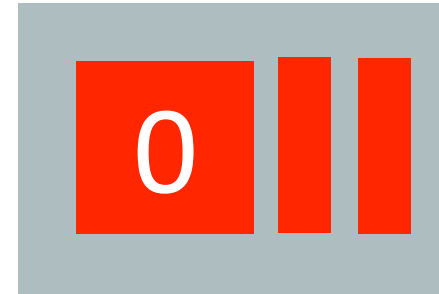
The BRAVO approach

Compact &
Scalable



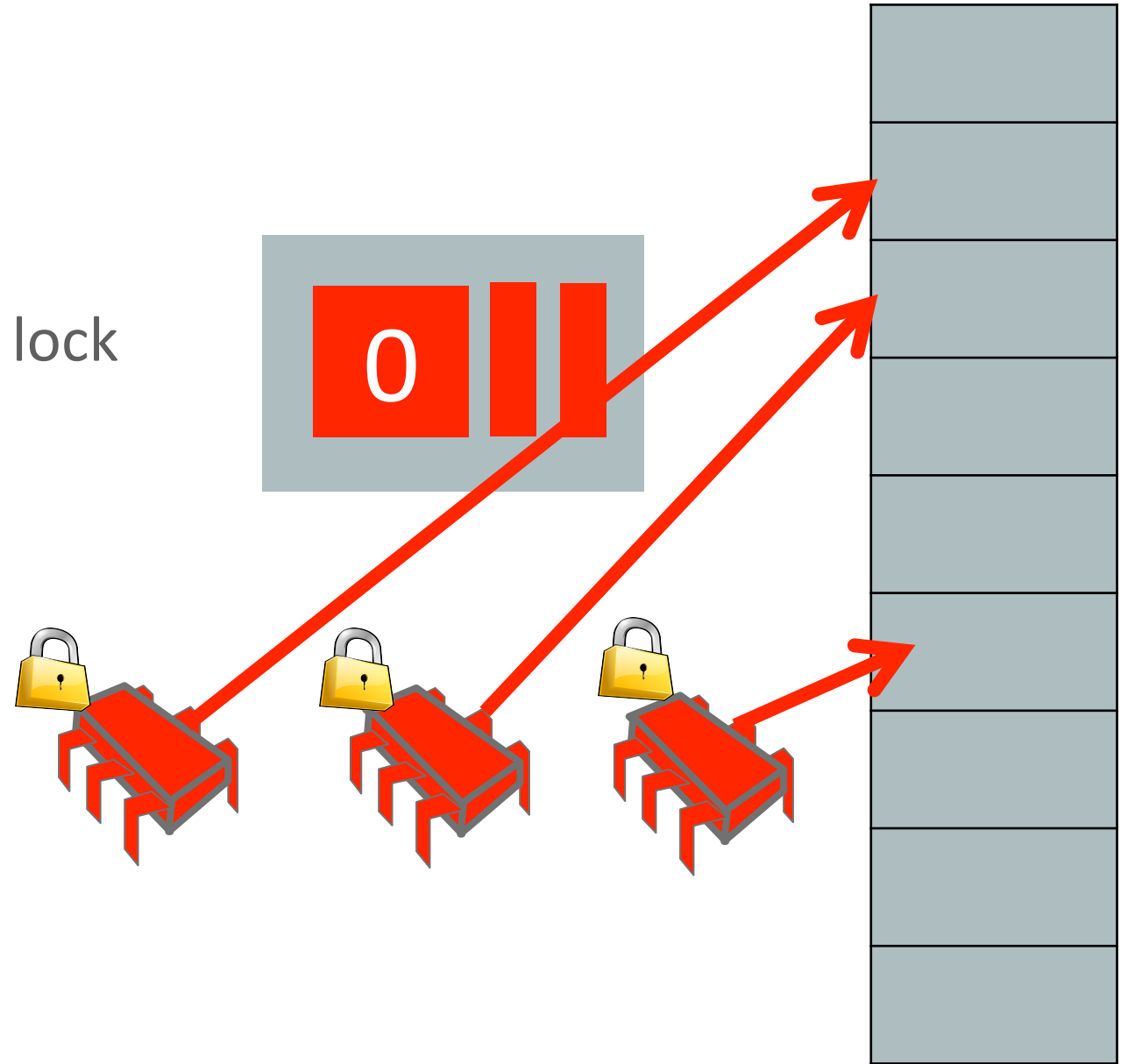
The BRAVO approach

- Easy to integrate with any existing lock
- Compact
- Accelerates reads, NUMA-friendly
- Handles writes gracefully



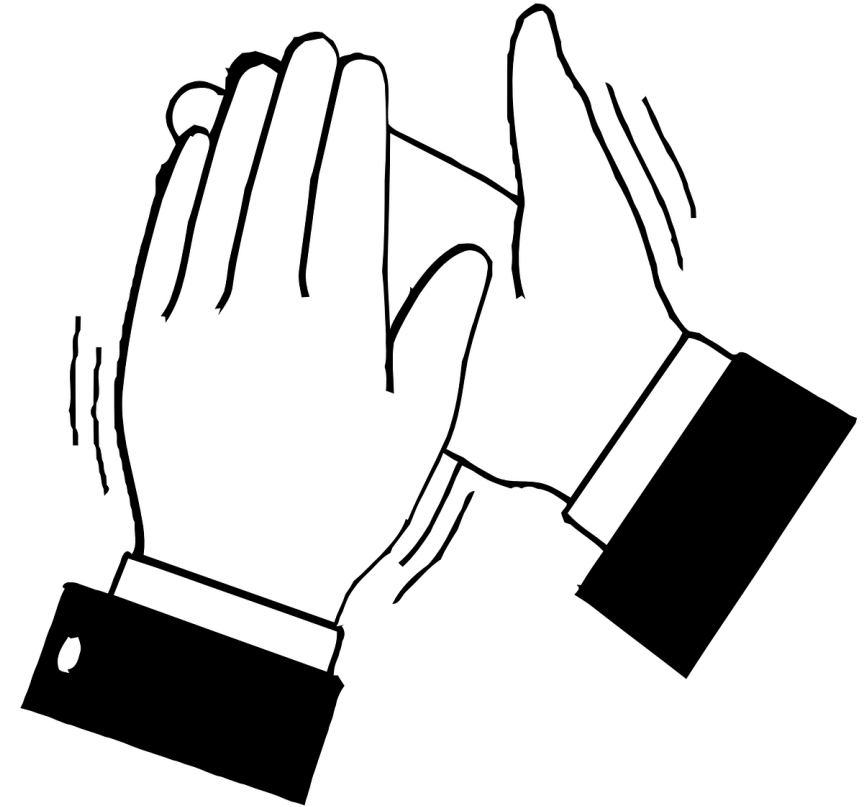
The BRAVO approach

- Easy to integrate with any existing lock
- Compact
- Accelerates reads, NUMA-friendly
- Handles writes gracefully



The BRAVO approach

- Easy to integrate with any existing lock
- Compact
- Accelerates reads, NUMA-friendly
- Handles writes gracefully



USENIX ATC 2019, July 11th @ 9:45am, Track II