Chasing Away RAts: Semantics and Evaluation for Relaxed Atomics on Heterogeneous Systems

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“Everyone can cook”
“Everyone (thinks they) can cook”
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Health code violations

Typhus, Meningitis, Plague, Salmonellosis, Rat-bite Fever
“Everyone (thinks they) can cook” use relaxed atomics (RAts)
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Correctness

Health code violations

Incorrect usage
No formal specification
Not portable

Hard to debug
Out-of-thin-air values
“Everyone (thinks they) can cook” use relaxed atomics (RAts)

![Bar Chart]

Correctness

Health code violations

Incorrect usage  No formal specification  Not portable

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Our Goal: Formal Specification + Efficiency
Data-Race-Free-Relaxed (DRFrlx) Consistency

Analyze how real codes use relaxed atomics

- Work Queues
- Seqlocks
- Event Counters
- Ref Counters
- Flags
- Split Counters
Data-Race-Free-Relaxed (DRFrlx) Consistency

Analyze how real codes use relaxed atomics

Work Queues  Seqlocks
Event Counters  Ref Counters
Flags  Split Counters

Previous Work: Explain RAts behavior
Data-Race-Free-Relaxed (DRFrlx) Consistency

Analyze how real codes use relaxed atomics

Work Queues | Seqlocks
Event Counters | Ref Counters
Flags | Split Counters

Previous Work: Explain RAts behavior

Our Work: Constrains RAts use
Analyze how real codes use relaxed atomics

Work Queues  Seqlocks  Previous Work: Explain RAts behavior
Event Counters  Ref Counters  
Flags  Split Counters  

Our Work: Constrains RAts use

DRFrlx: SC-centric semantics + efficiency
Data-Race-Free-Relaxed (DRFrlx) Consistency

Analyze how real codes use relaxed atomics

<table>
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Previous Work: Explain RAts behavior

Our Work: Constrains RAts use

DRFrlx: SC-centric semantics + efficiency

Everyone can use RAts safely