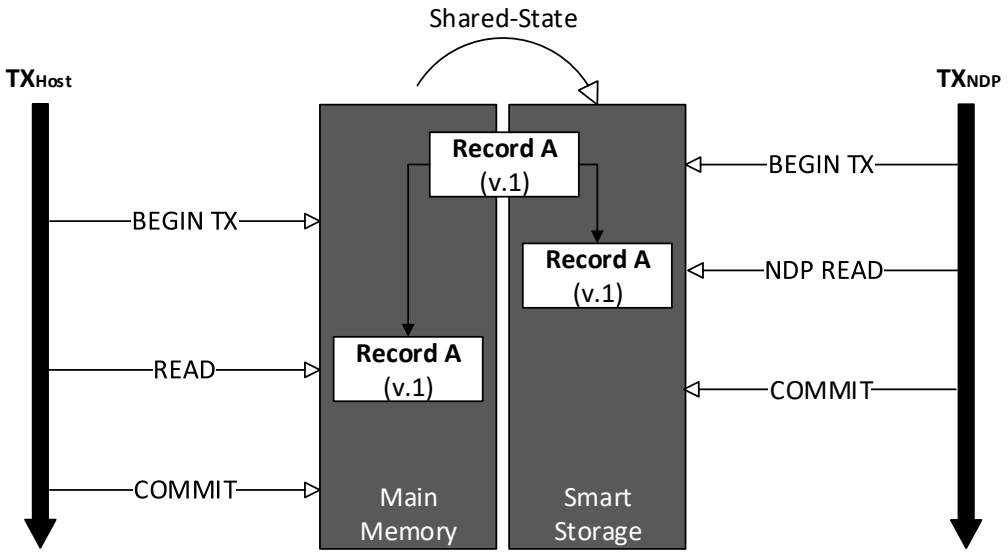
Cache-Coherent Shared Locking for Transactionally Consistent Updates in Near-Data Processing DBMS on Smart Storage

Arthur Bernhardt, Sajjad Tamimi, Florian Stock, Tobias Vinçon, Andreas Koch, Ilia Petrov

Motivation

Read-only NDP:



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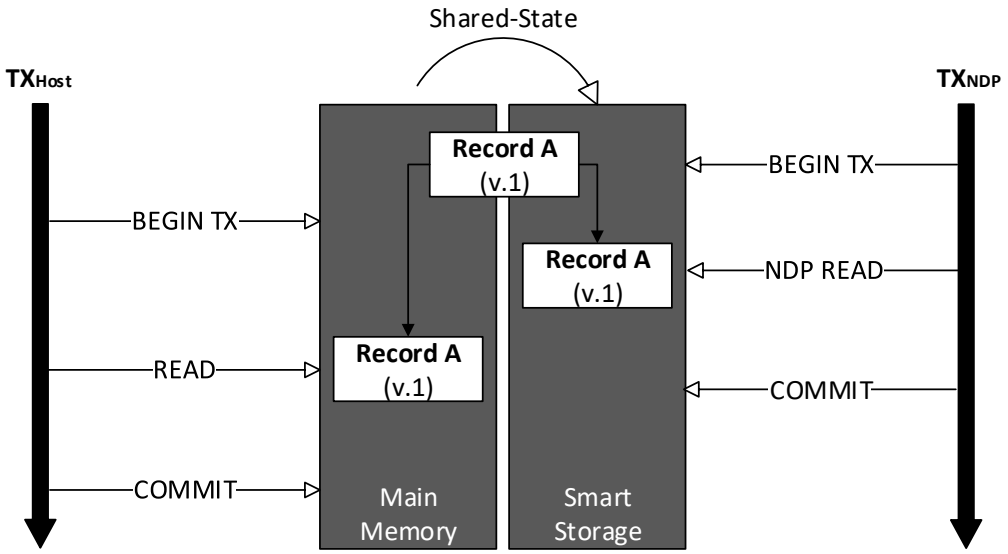
Read-only NDP:

-> Snapshot-based, intervention-free NDP



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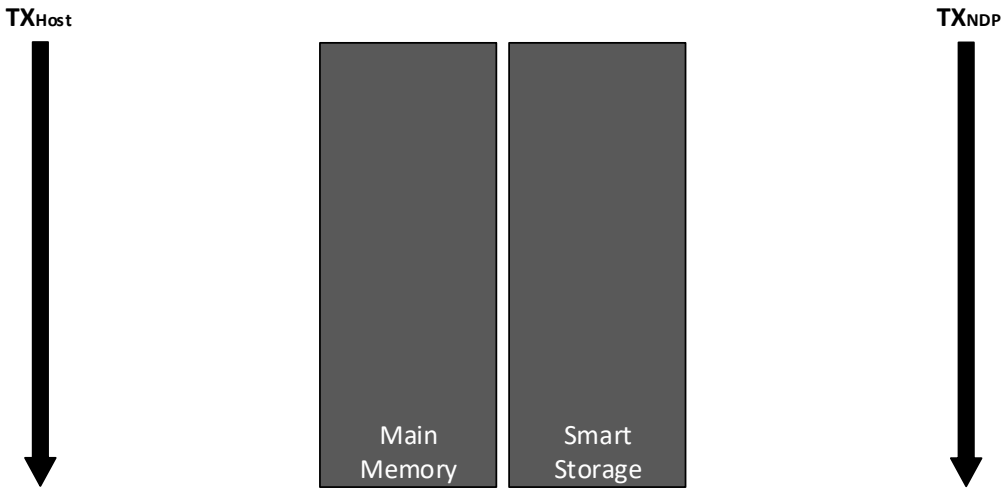

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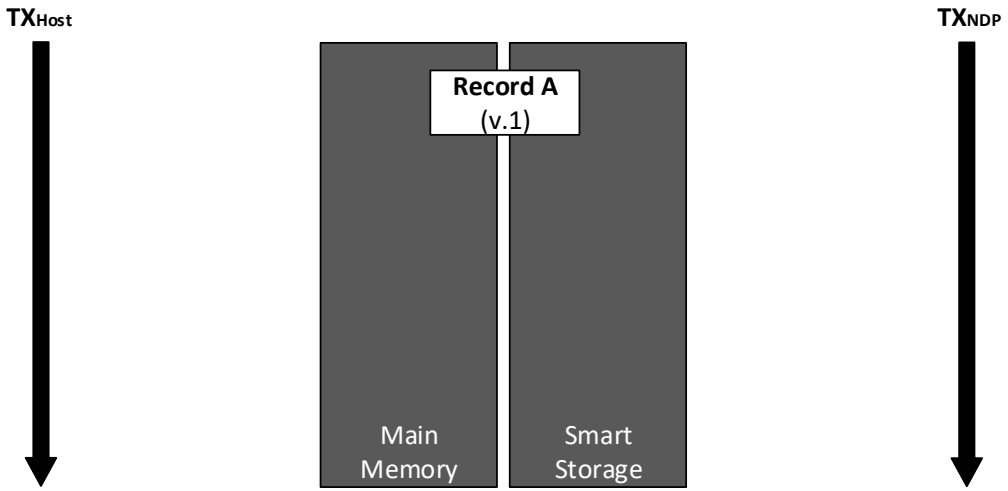

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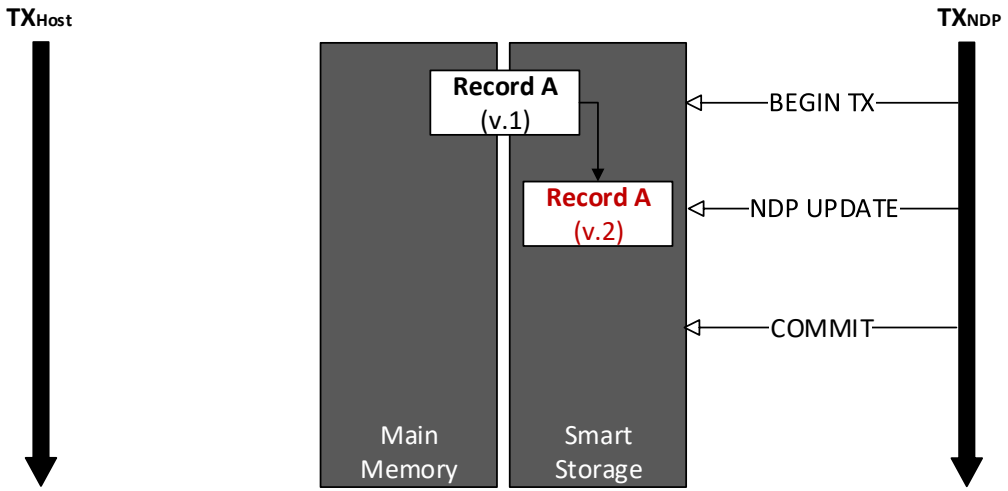

Motivation

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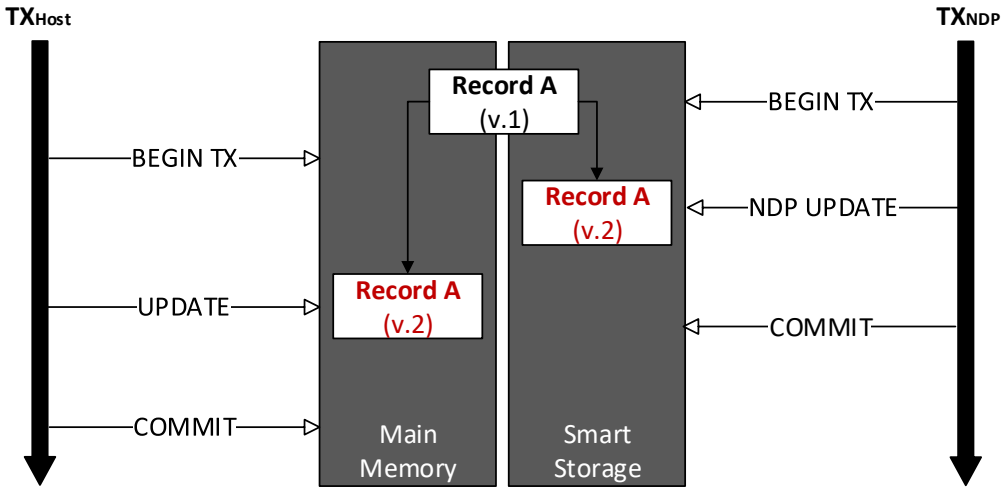
-> Snapshot-based, intervention-free NDP

Update NDP:

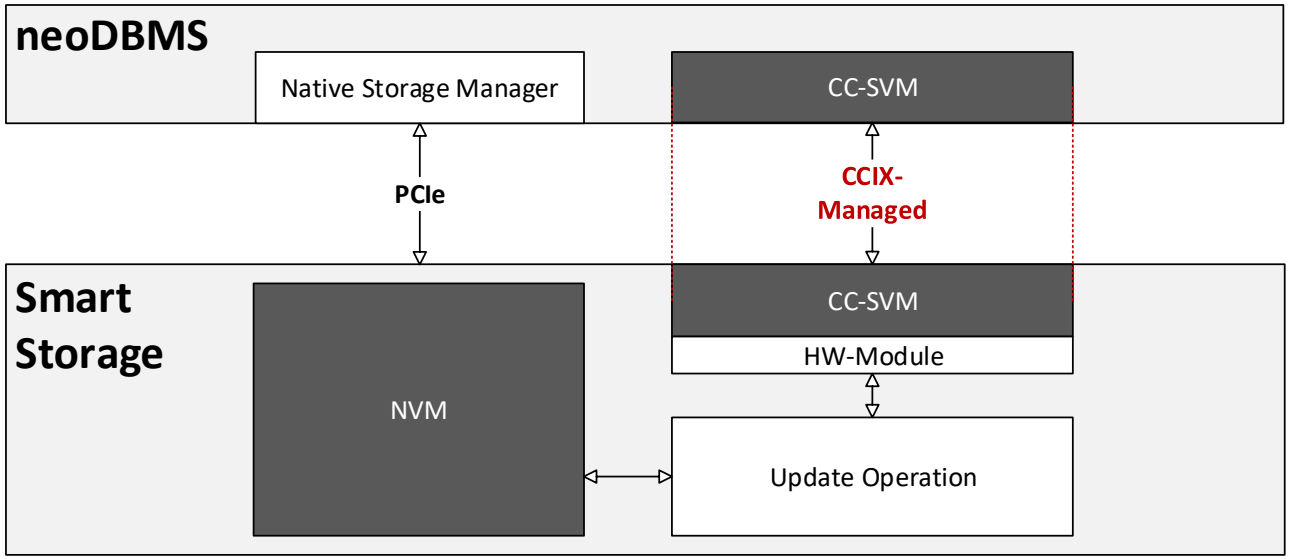
-> Synchronization problems



Multiple version branches cause unresolvable inconsistencies!

neoDBMS

Goal: Enable efficient synchronization mechanisms between DBMS and Smart Storage for transactionally consistent updates in NDP-settings



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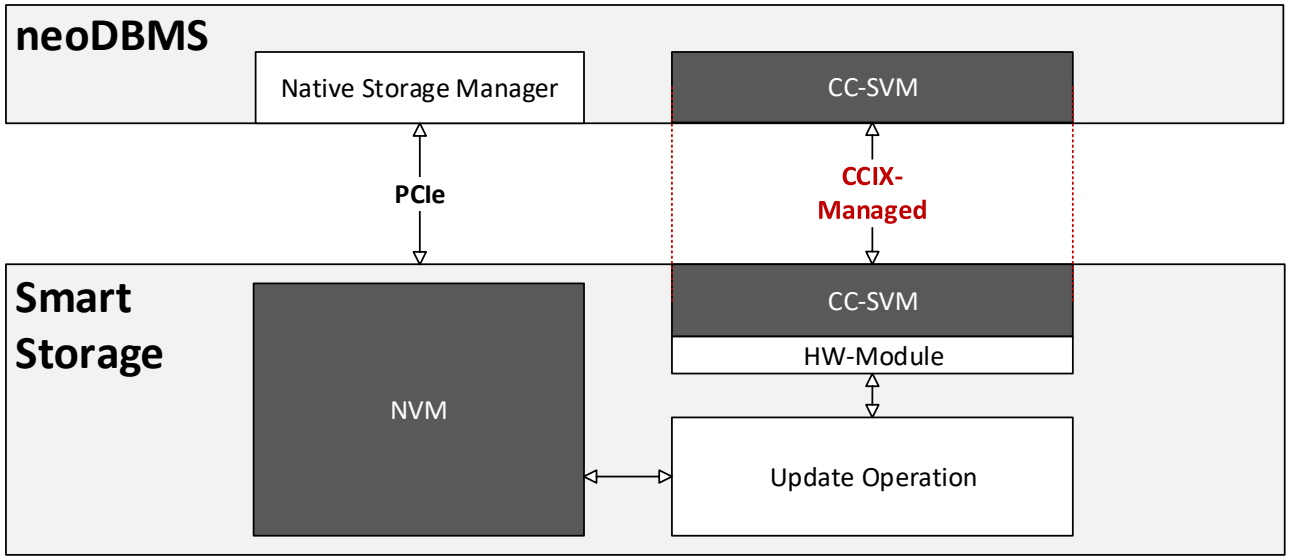
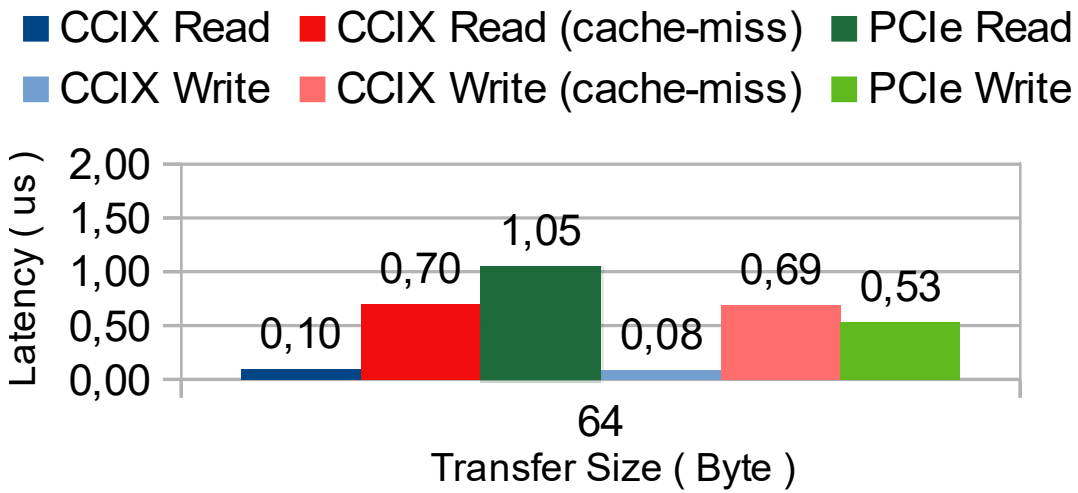


Synchronization requires cache coherence and low-latency transfers!

CCIX

Cache-Coherent Interconnect for Accelerators (CCIX)

- Cache-coherent data sharing between devices
- High signaling rates 16-25 GT/s per link
- Address translation and cache coherence is automatically maintained
- Supports atomics like CAS



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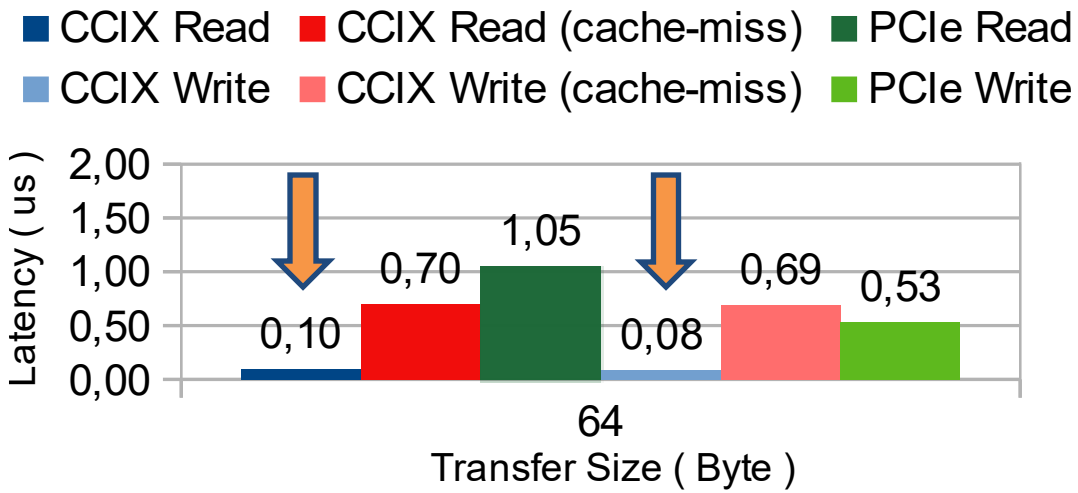
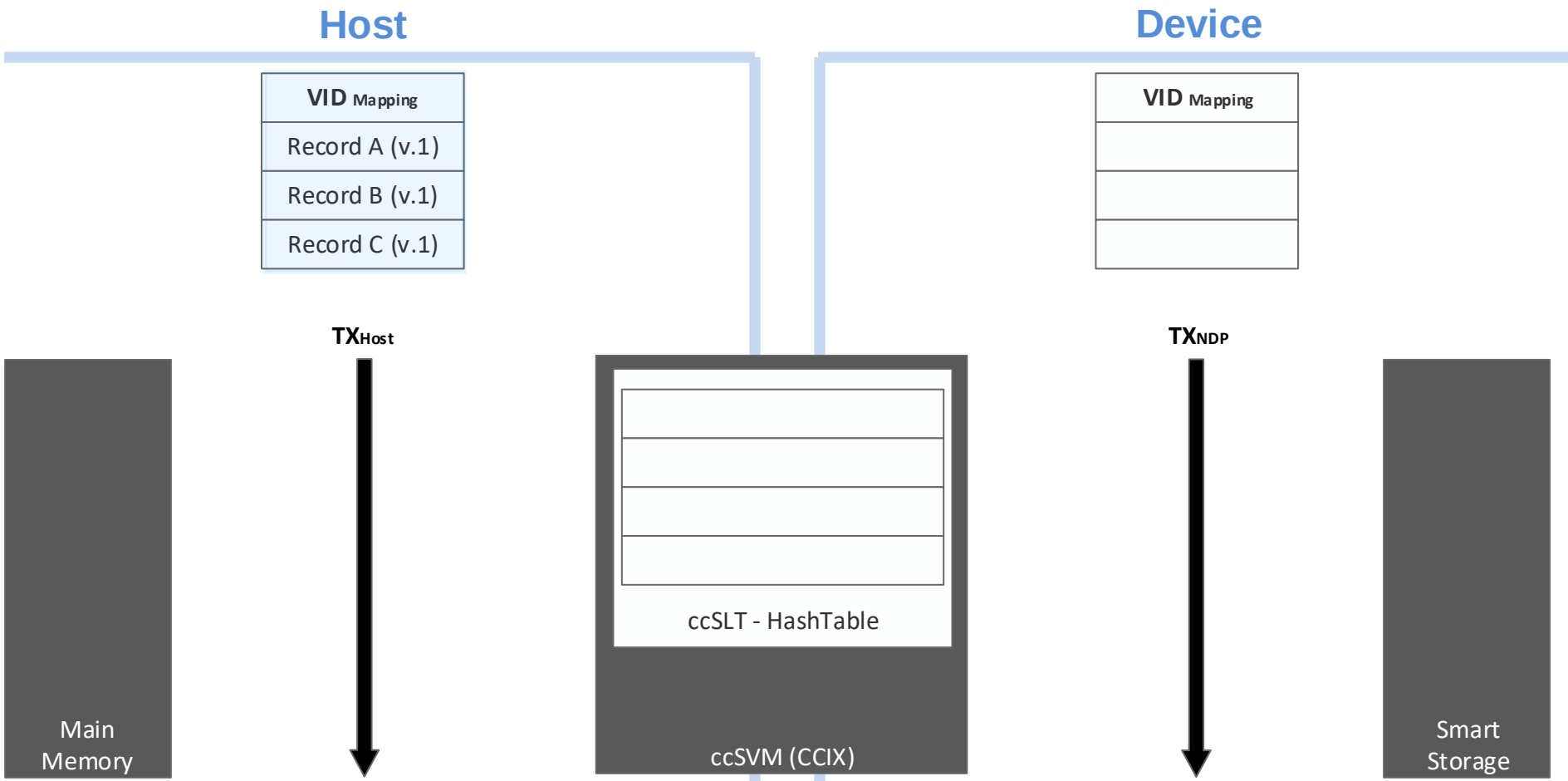


CCIX provides excellent latencies for small granularity accesses!

CC Shared Lock Table



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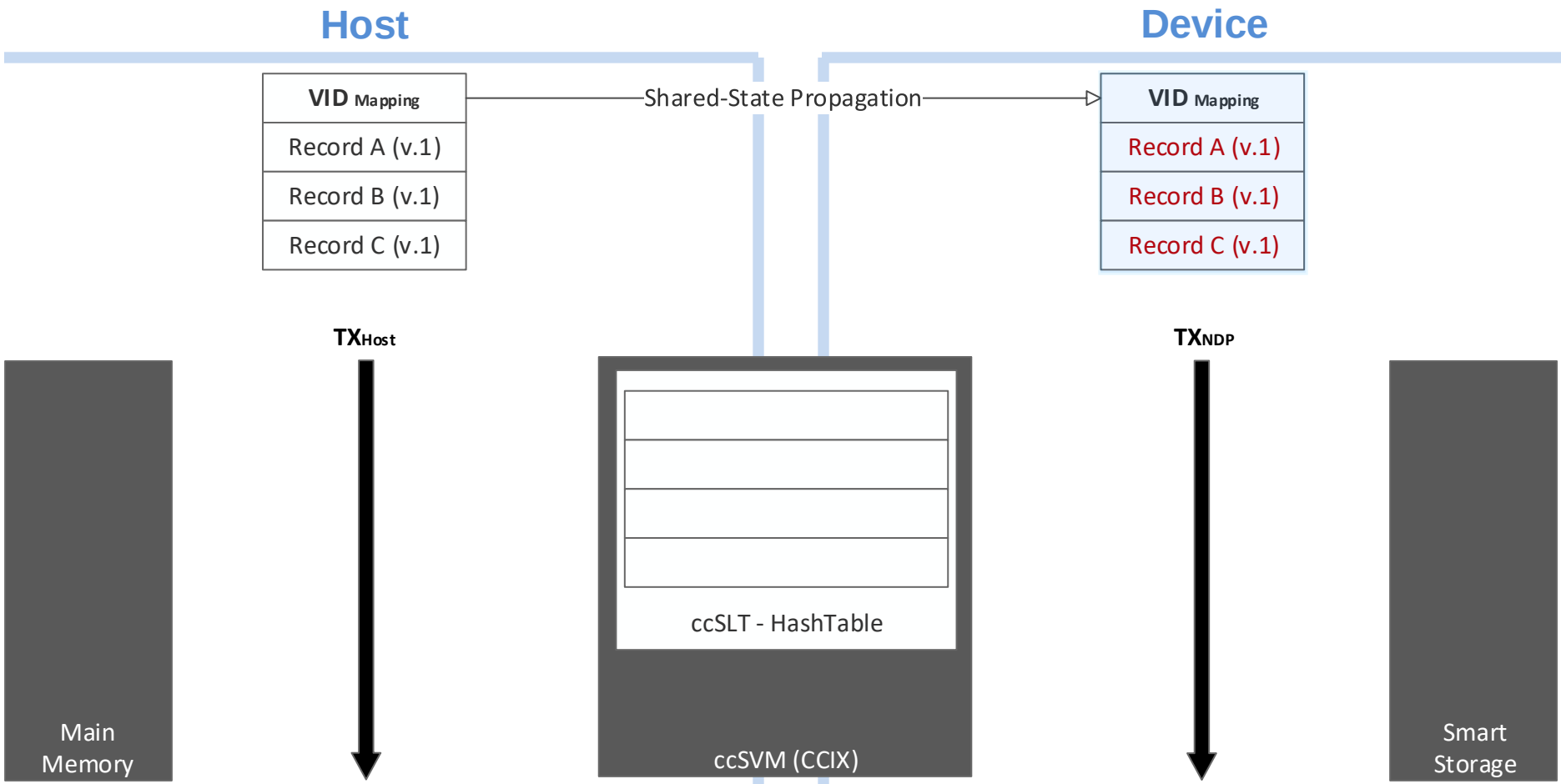

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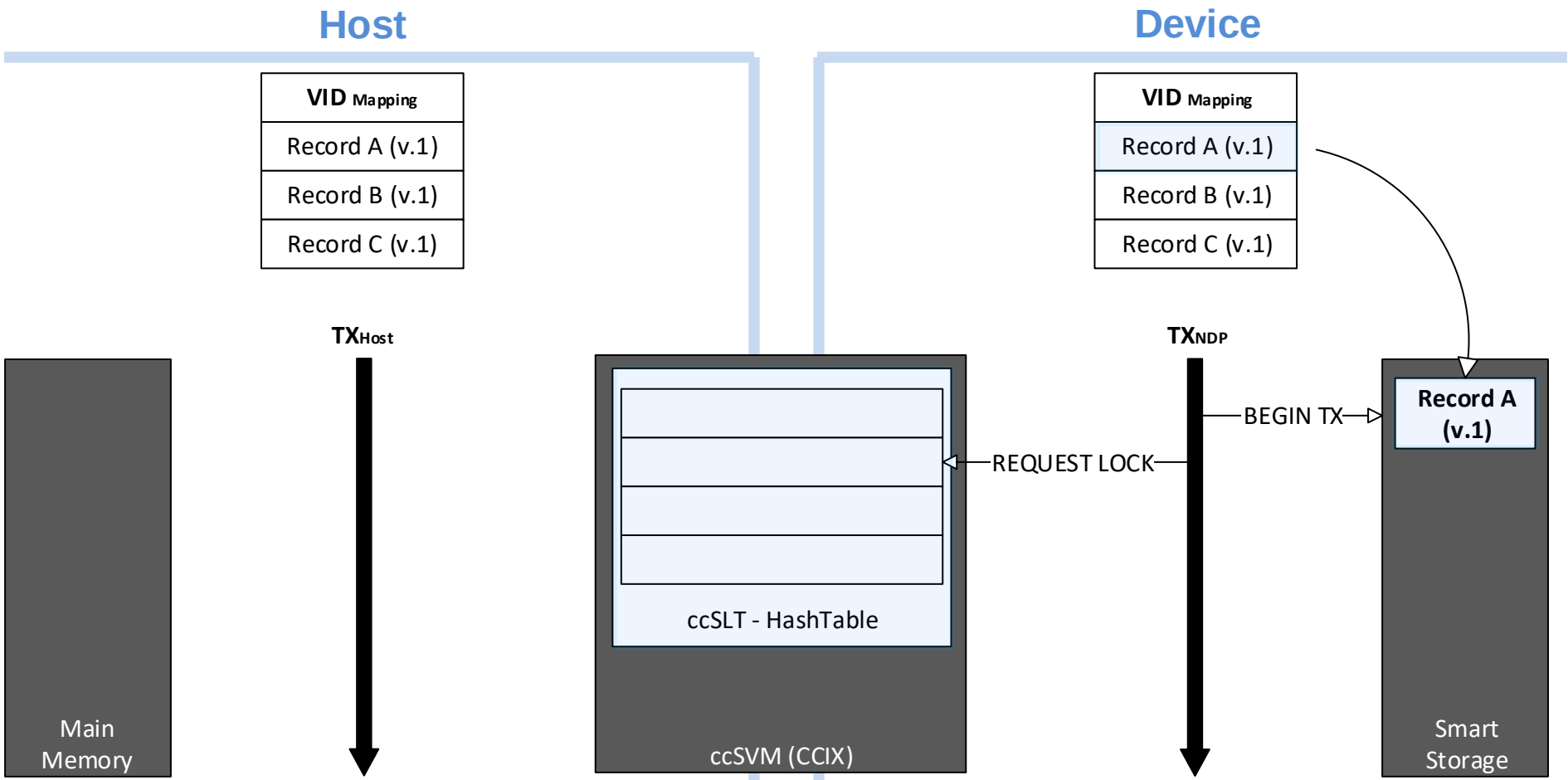

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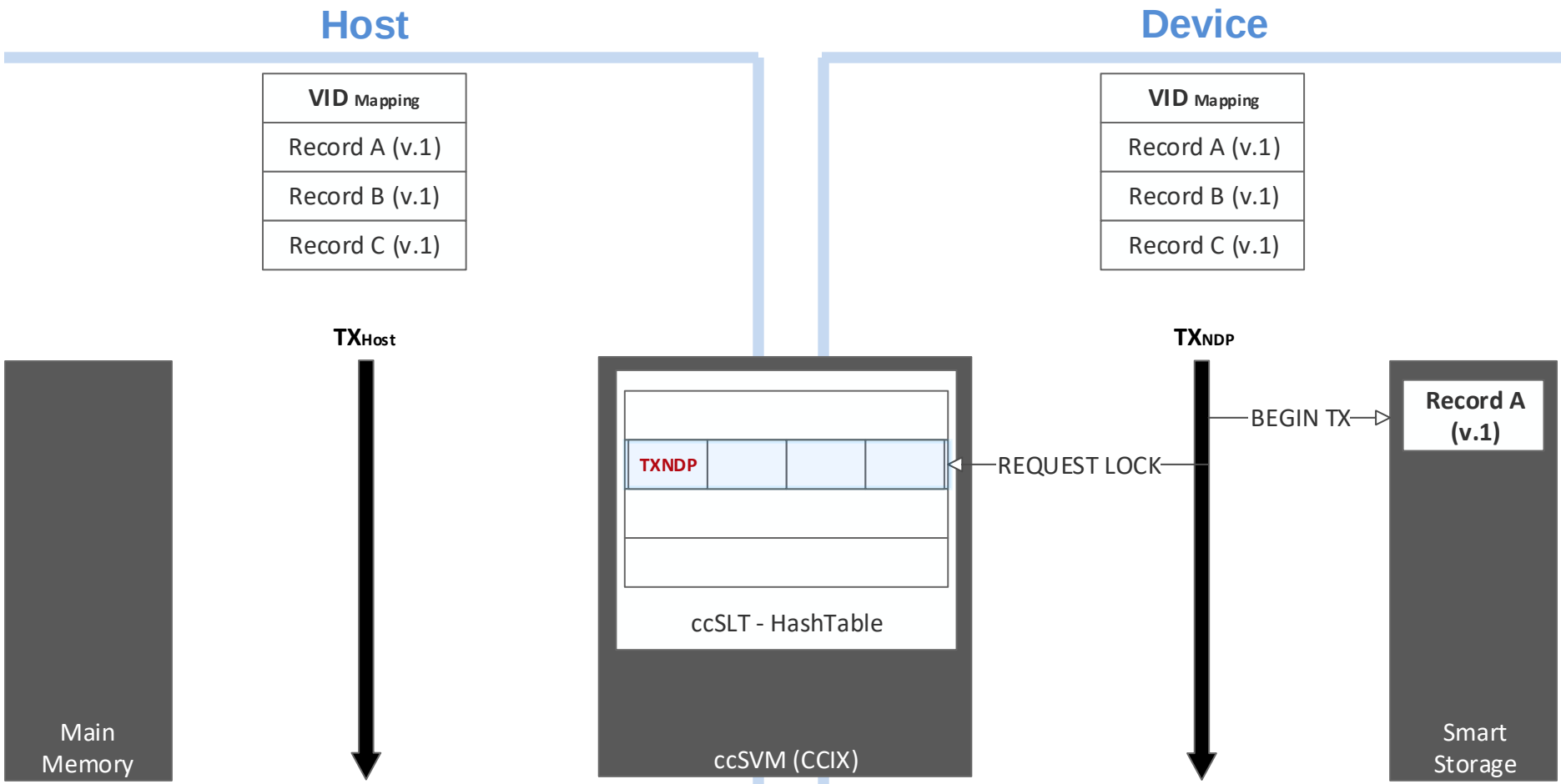

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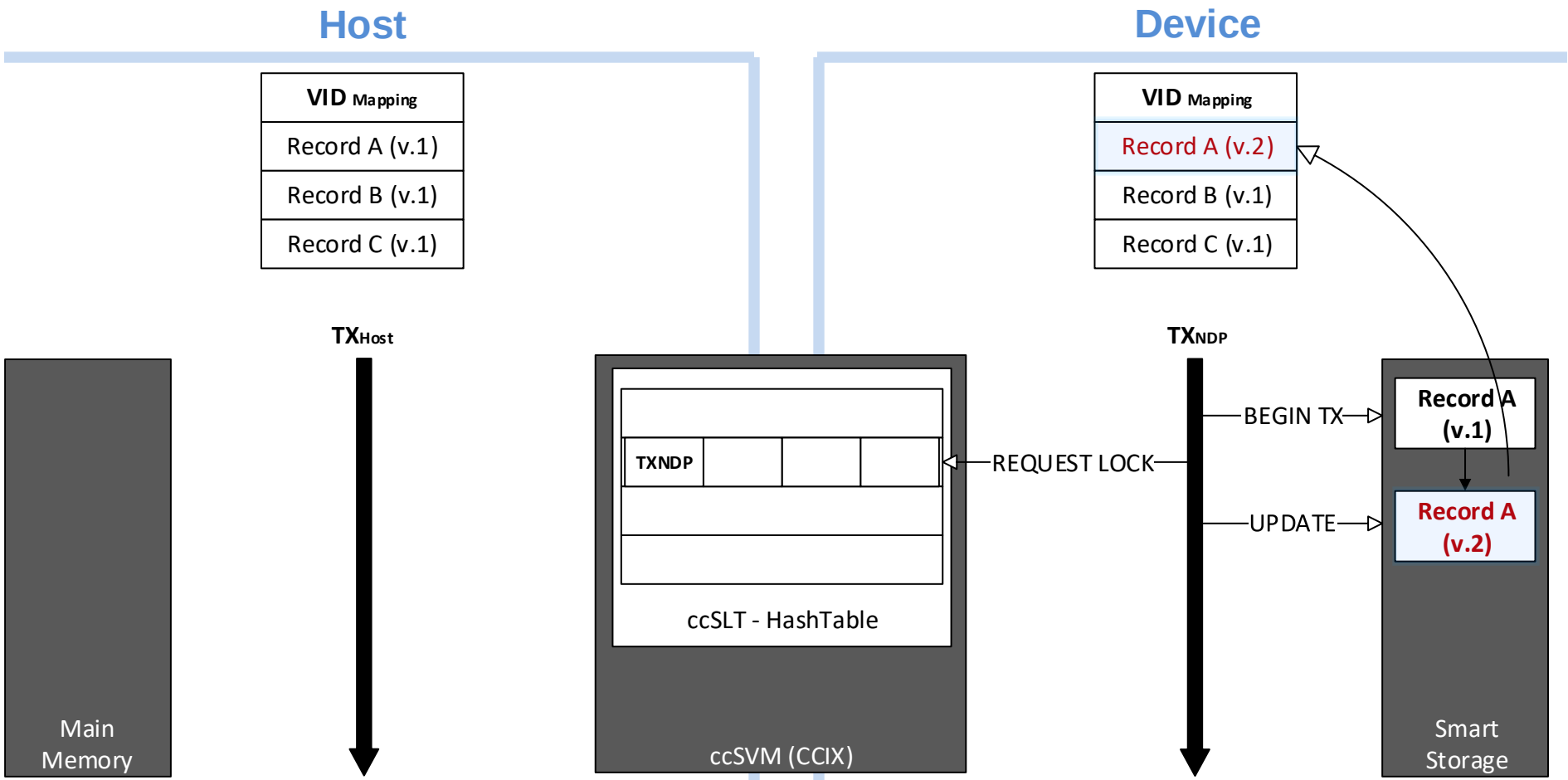

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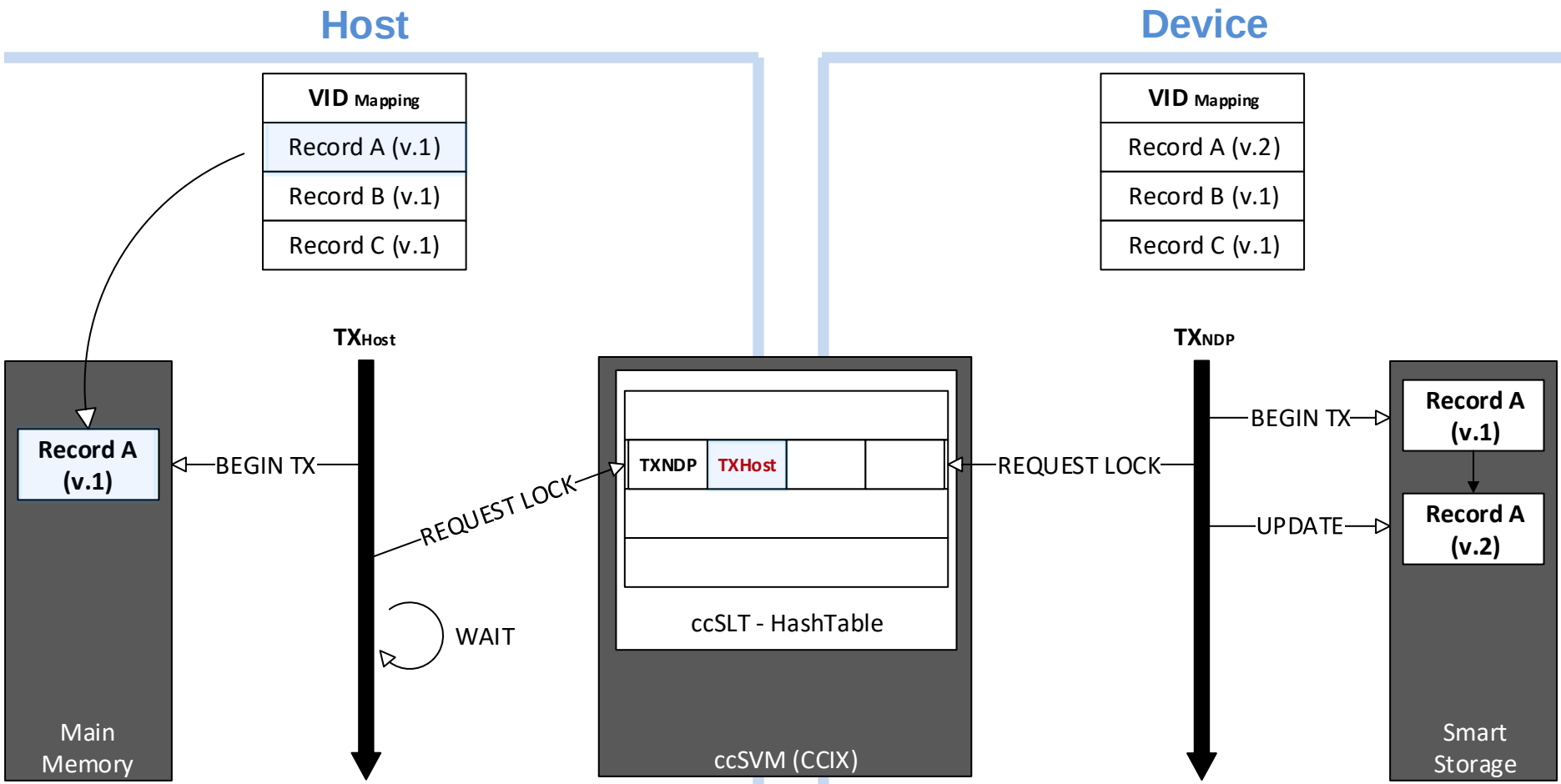

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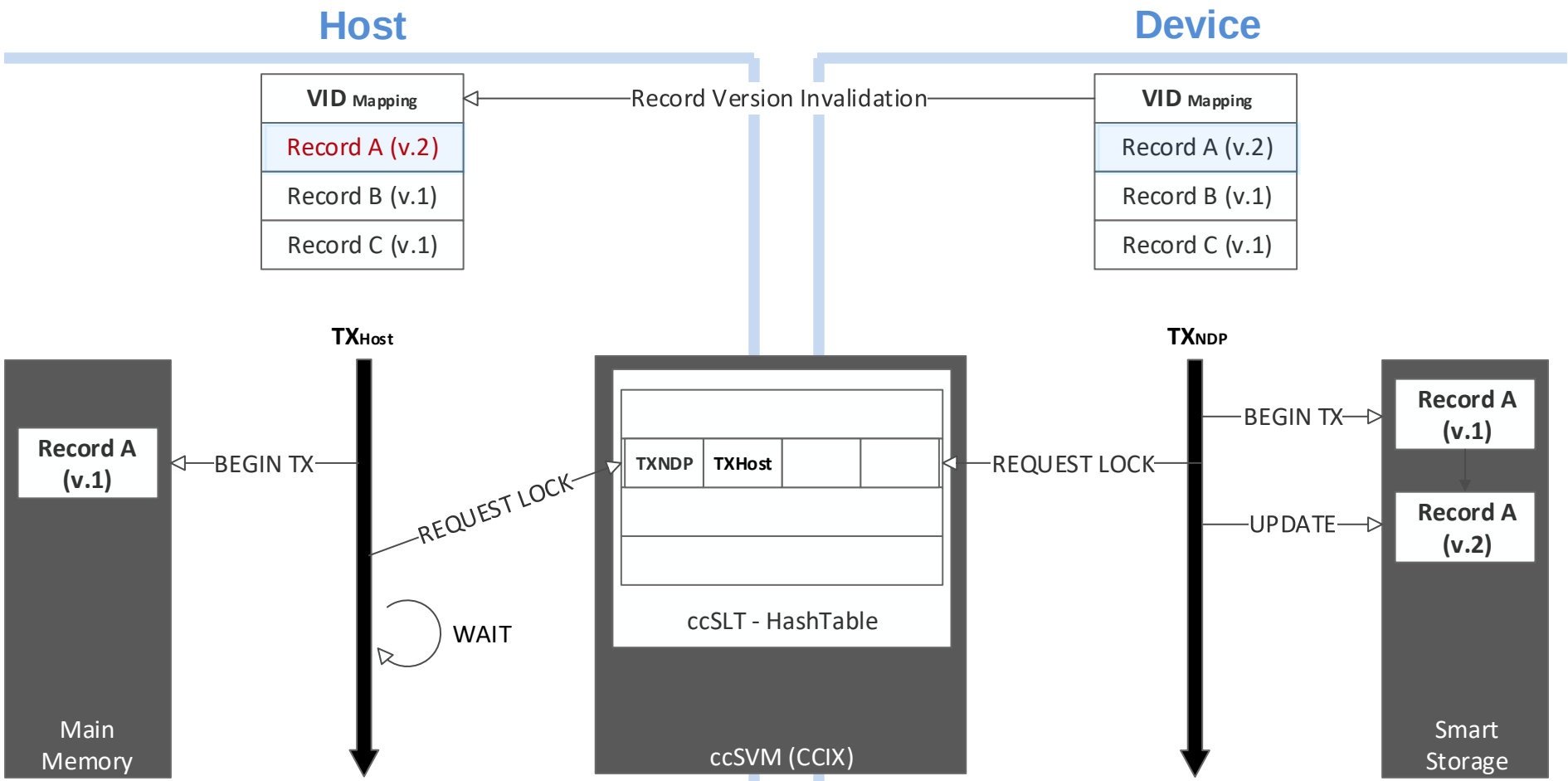

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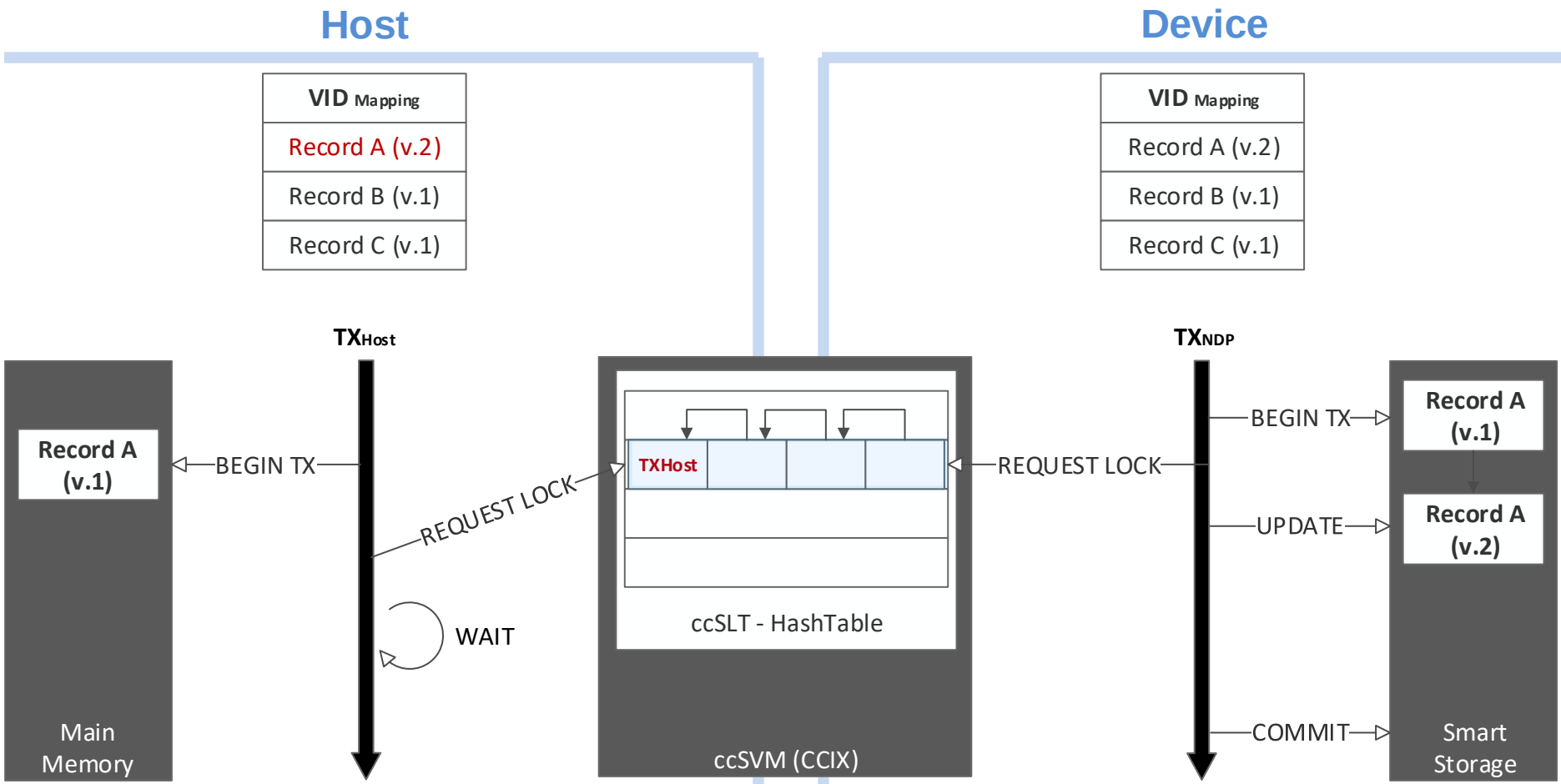

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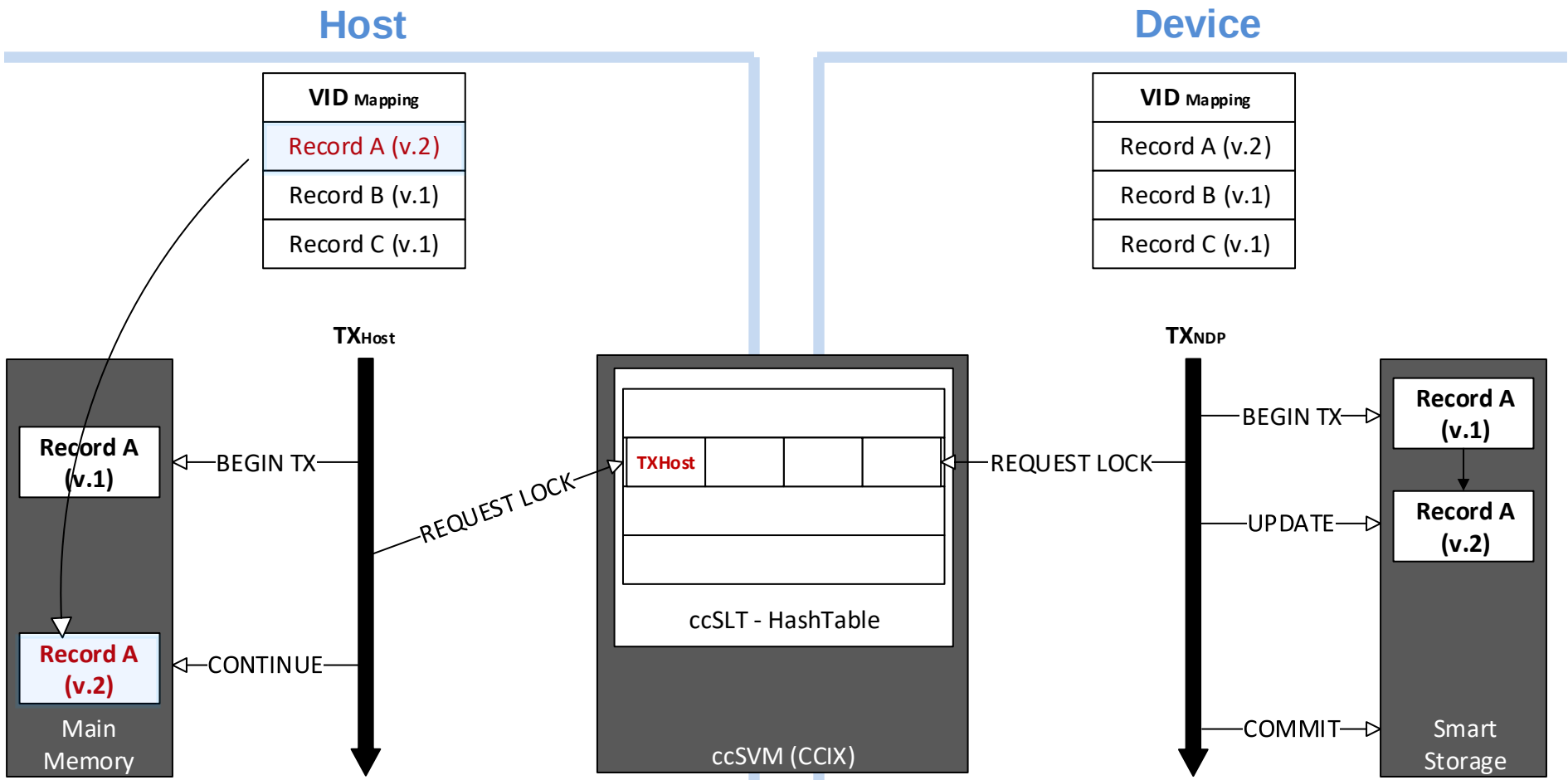
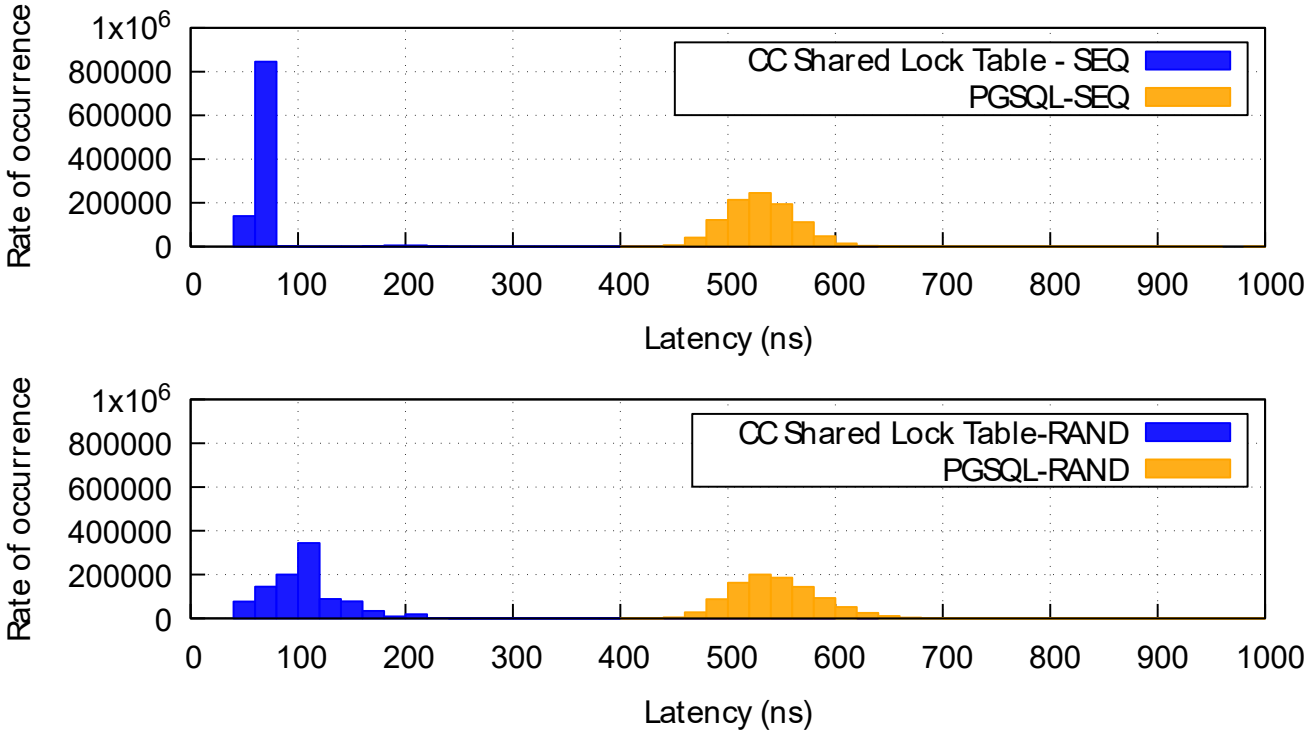


Experimental Evaluation



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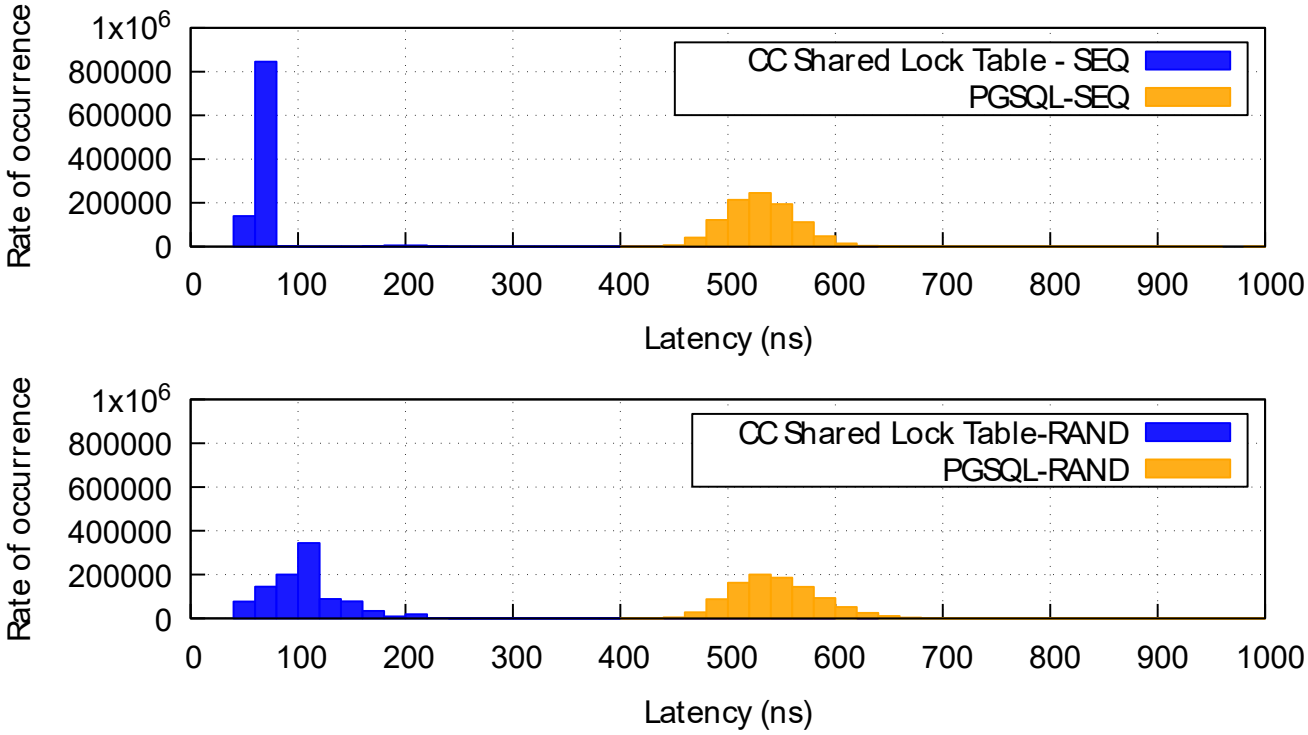

Host and smart storage synchronization is enabled with very low overhead!

„People who are really serious about software should make their own hardware„

Dr. Alan Kay, 2003 Turing Award Laureate