

Callas

High-performance ACID via Modular Concurrency Control

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Microsoft Research
The Ohio State University

TRANSACTIONS: SIMPLE AND POWERFUL

TRANSACTIONS: SIMPLE AND POWERFUL

Atomicity

Consistency

Isolation

Durability

ACID txn

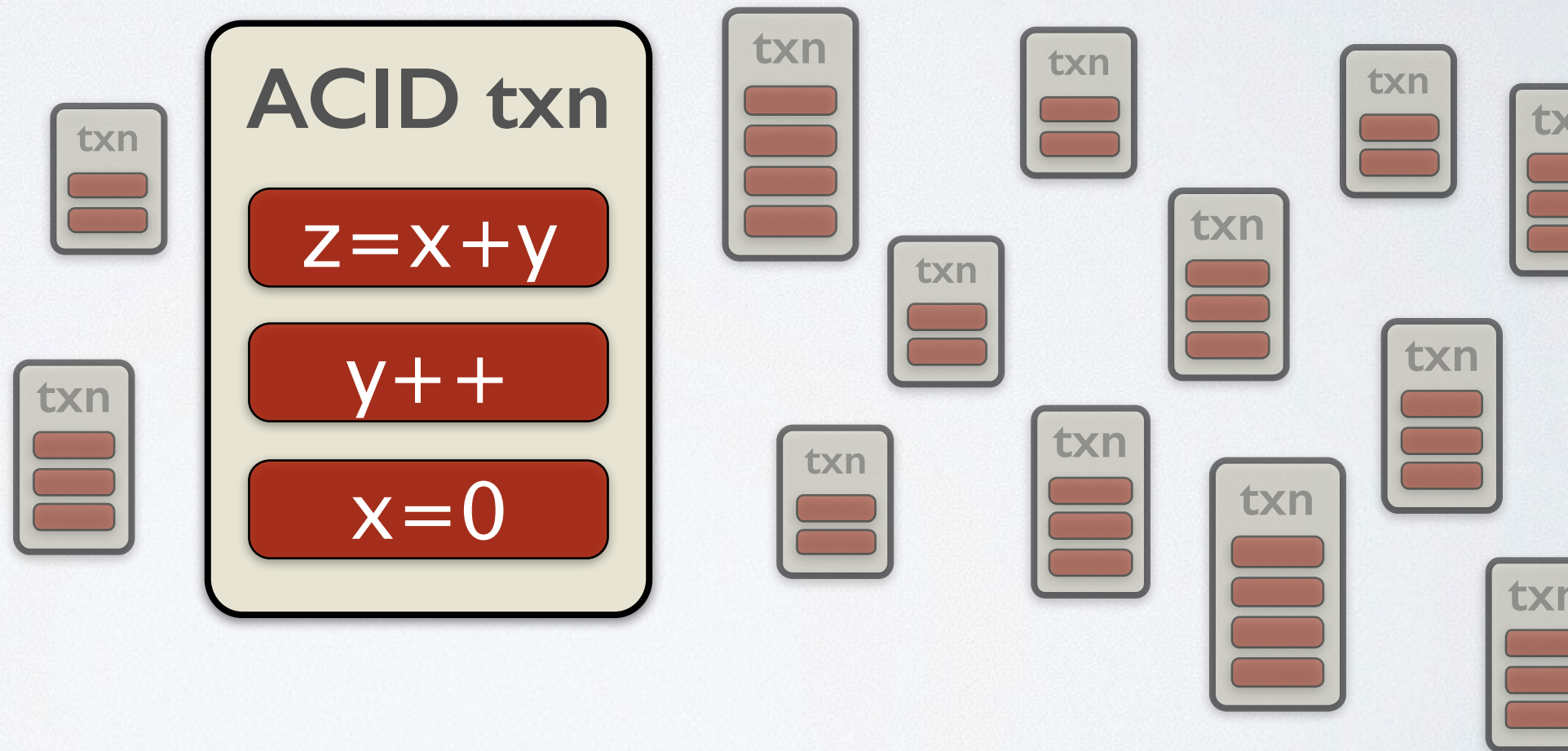
$z = x + y$

$y++$

$x = 0$

TRANSACTIONS: SIMPLE AND POWERFUL

Atomicity
Consistency
Isolation
Durability



TRANSACTIONS: SLOW

ACID Paradigm



TRANSACTIONS: SLOW

ACID Paradigm



Slow

TRANSACTIONS: SLOW

ACID Paradigm



Slow

Non-transactional



Fast

TRANSACTIONS: SLOW

ACID Paradigm



Slow

Middle Ground



Fast

Non-transactional



Fast

WE LOVE ACID



WE LOVE ACID



Uniformity



Ease of Programming

Uniform Abstraction



Ease of Programming

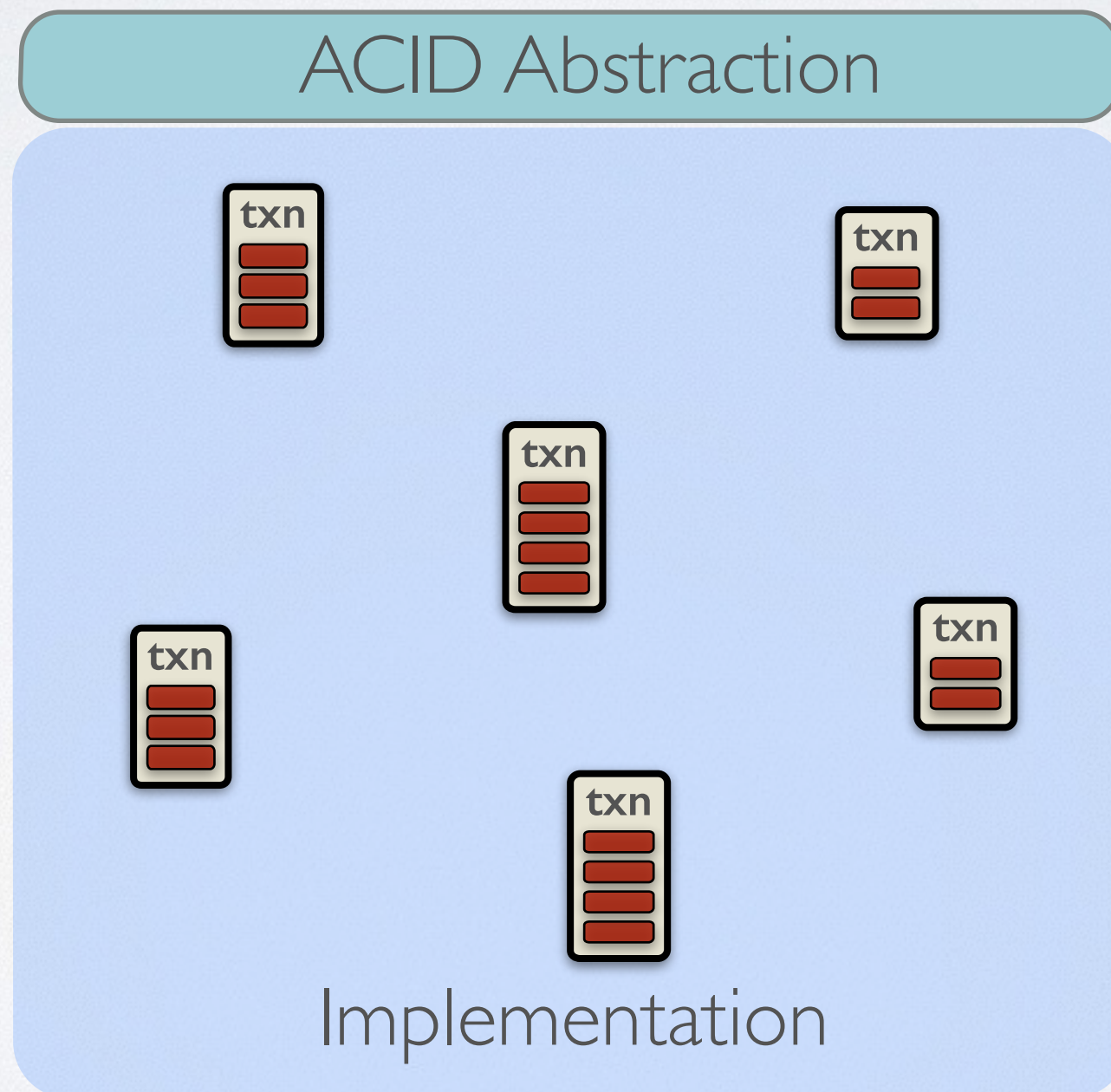
Uniform Implementation



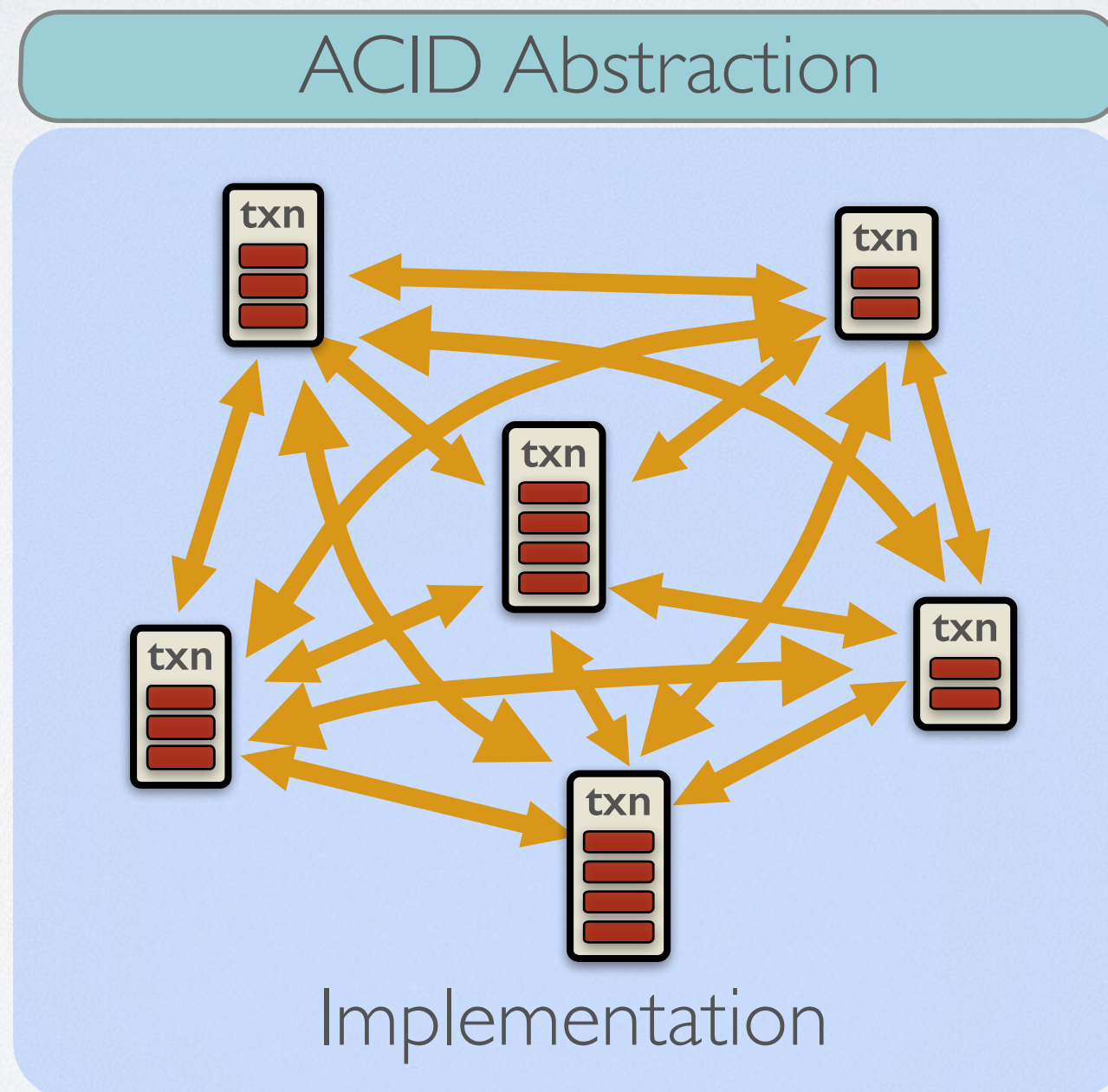
Conservative Mechanism

The Price of Uniformity

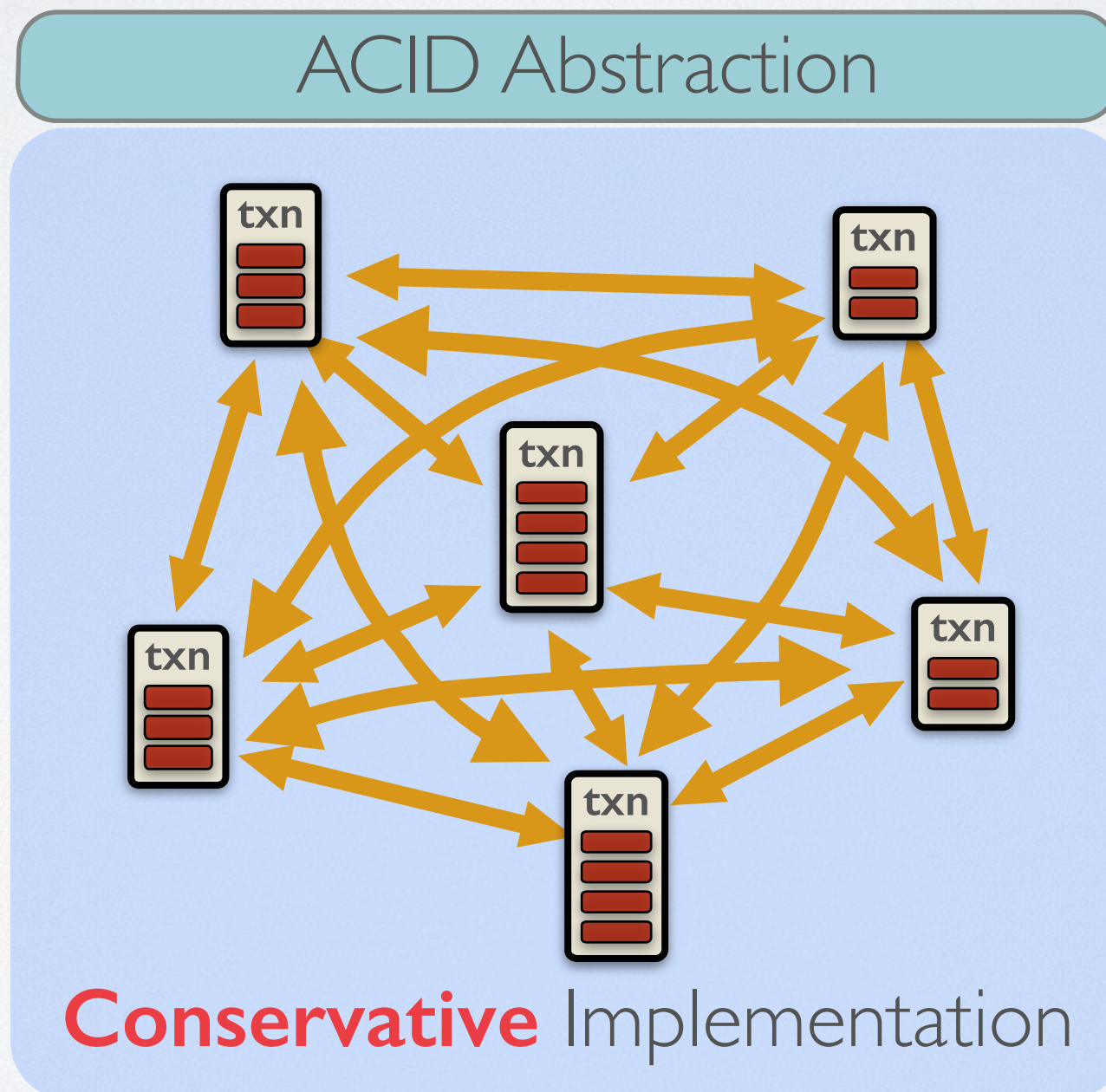
THE PRICE OF UNIFORMITY



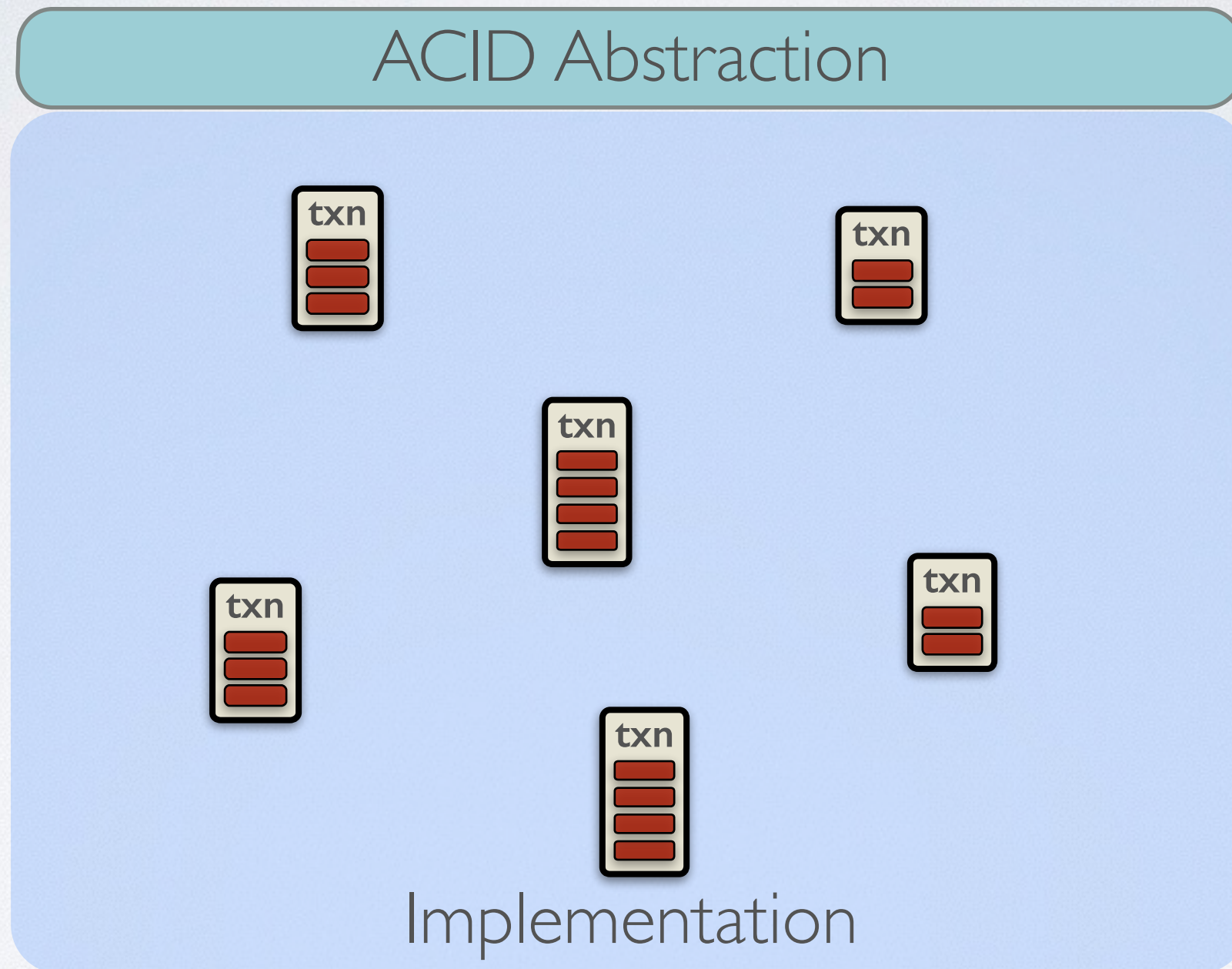
THE PRICE OF UNIFORMITY



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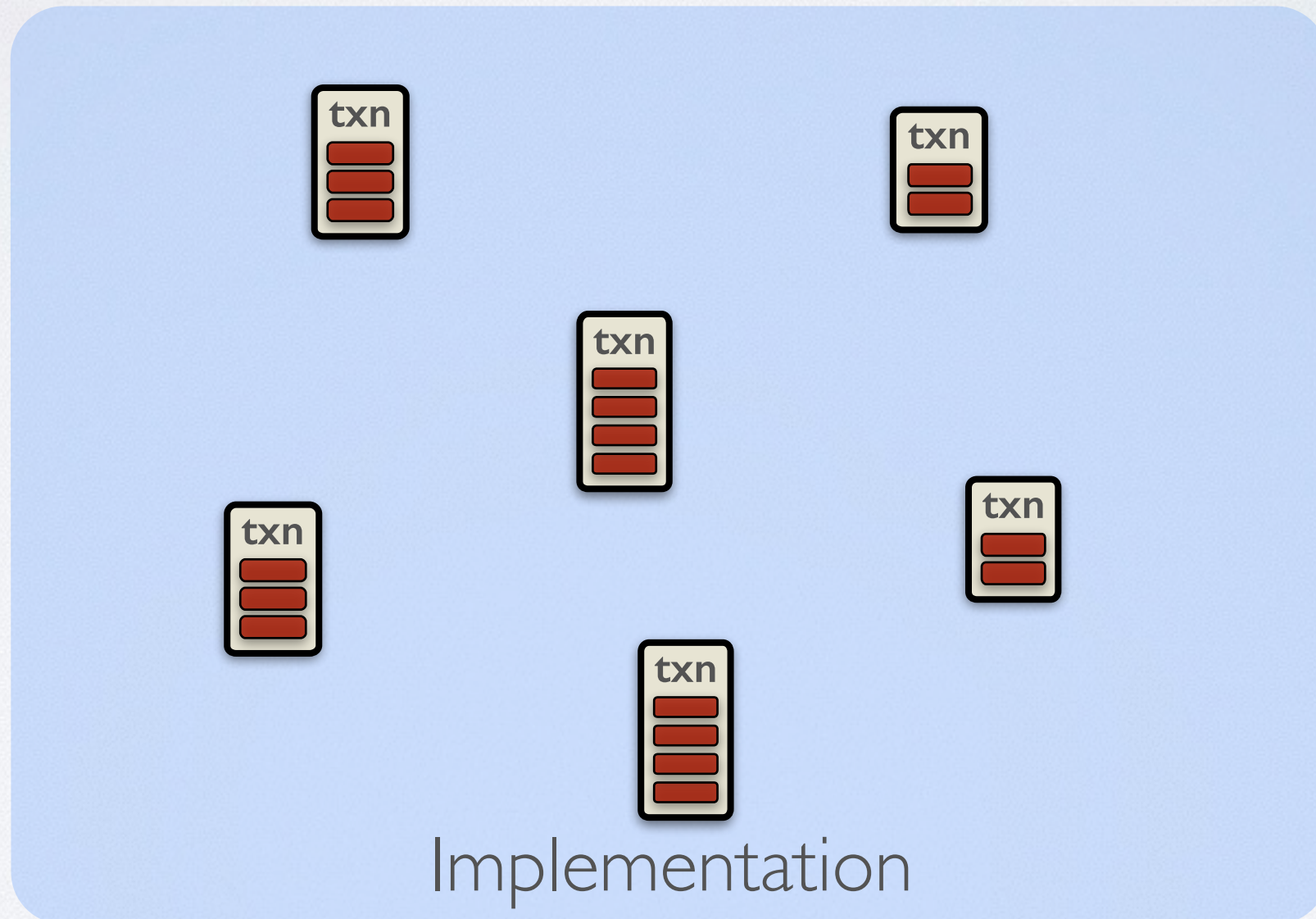


MODULAR CONCURRENCY CONTROL



MODULAR CONCURRENCY CONTROL

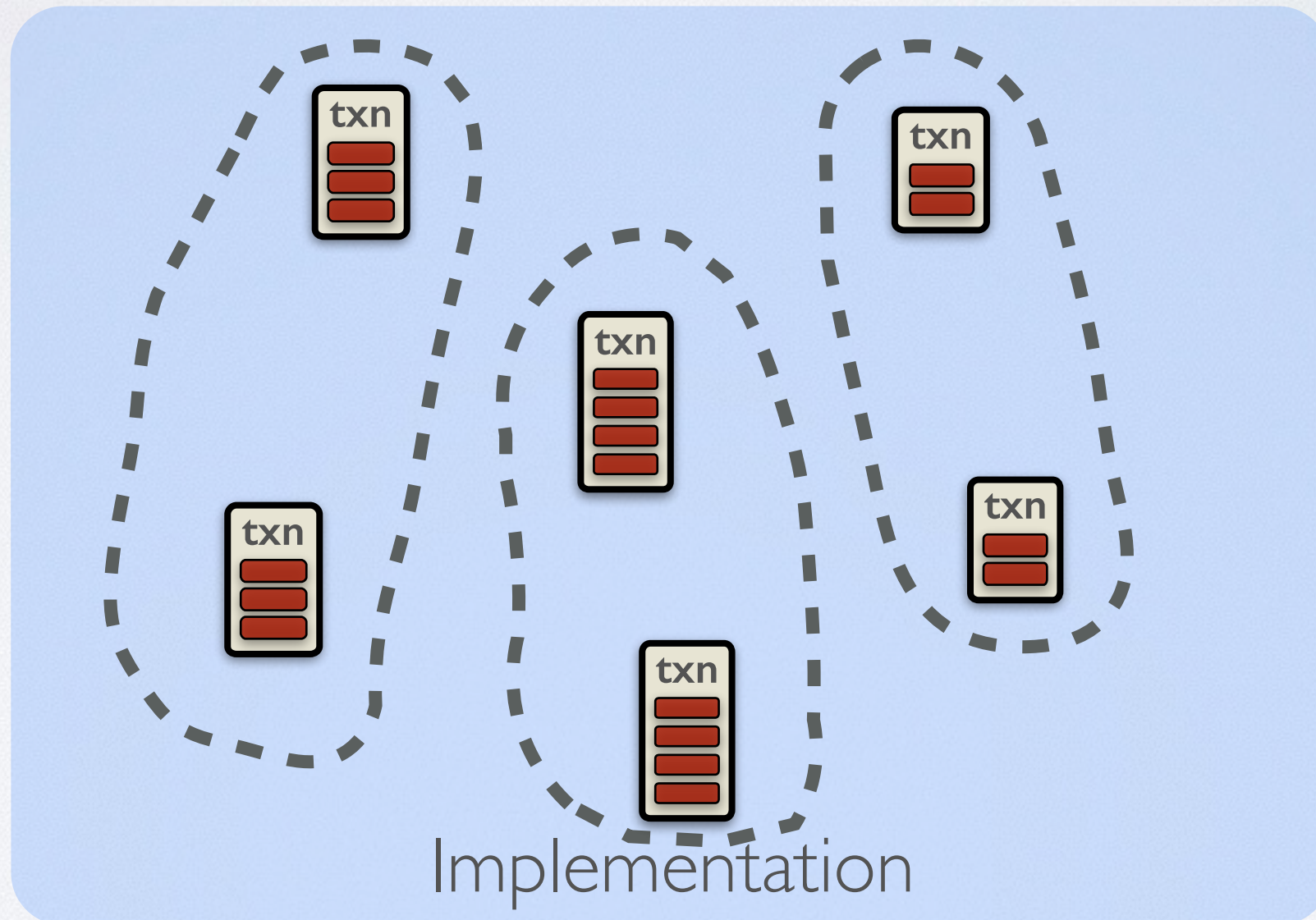
ACID Abstraction



Insight I: **Decouple Abstraction and Implementation**

MODULAR CONCURRENCY CONTROL

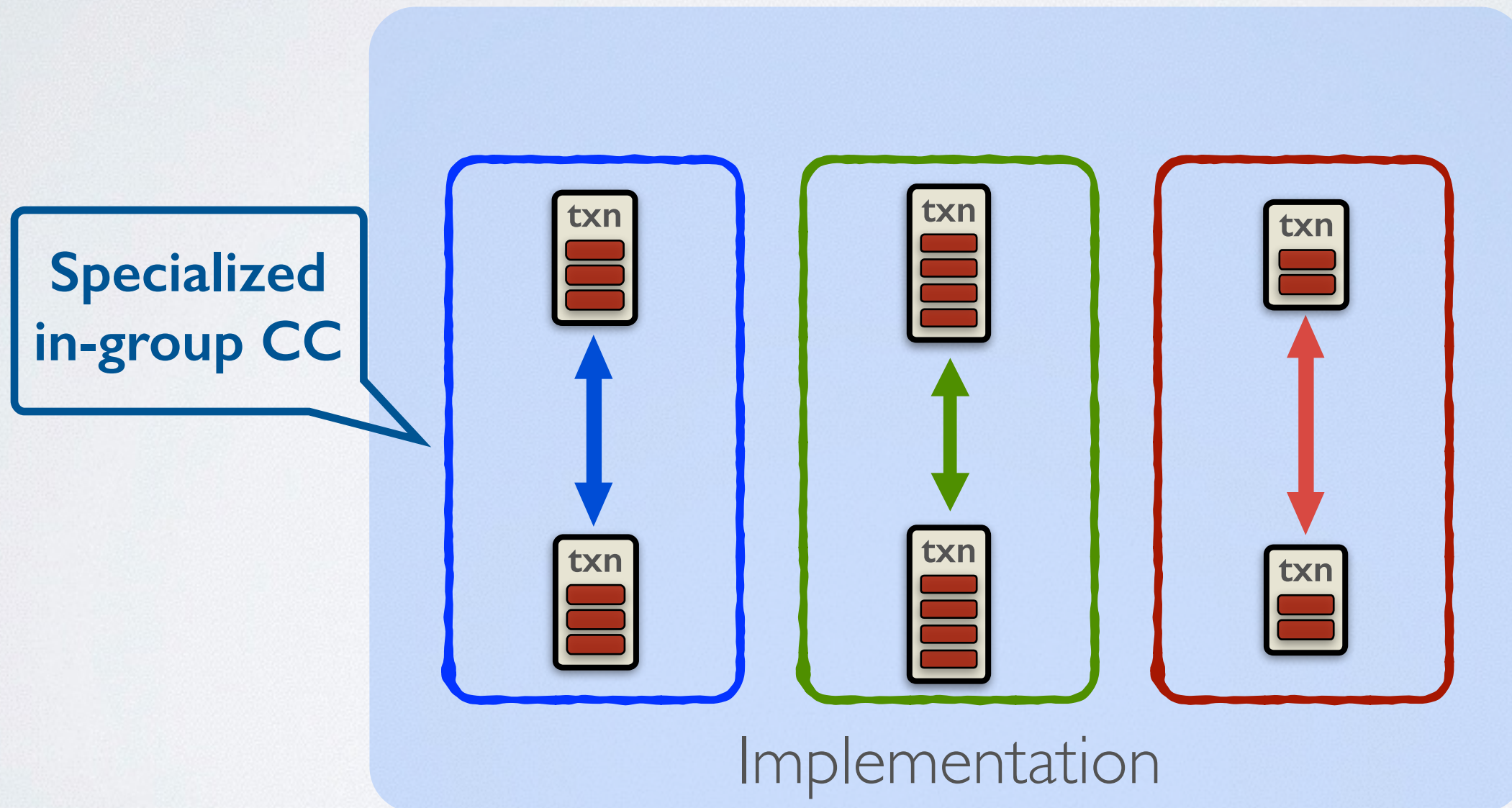
ACID Abstraction



Insight I: **Decouple Abstraction and Implementation**

MODULAR CONCURRENCY CONTROL

ACID Abstraction



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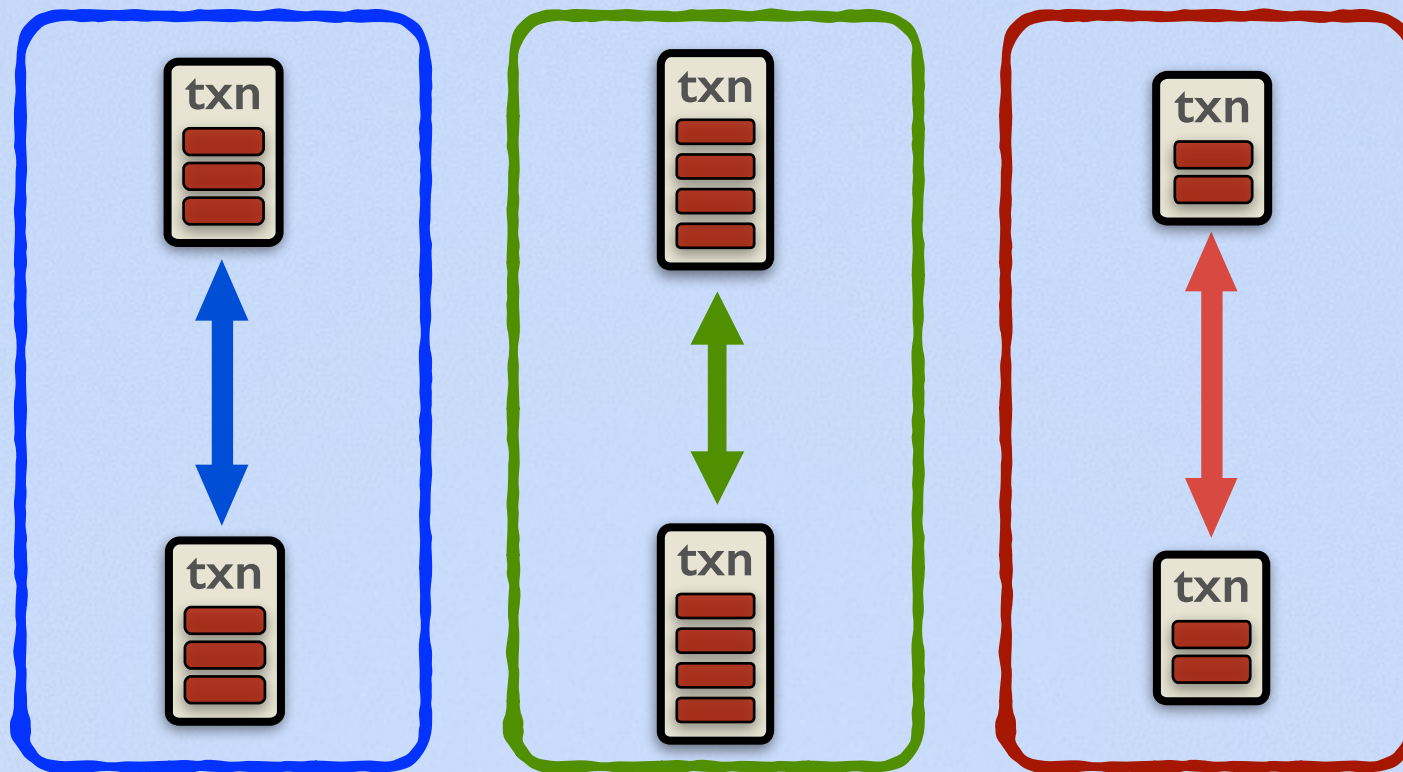
MODULAR CONCURRENCY CONTROL

ACID Abstraction



Cross-Group CC

Specialized
in-group CC



Implementation

Insight I: **Decouple Abstraction and Implementation**

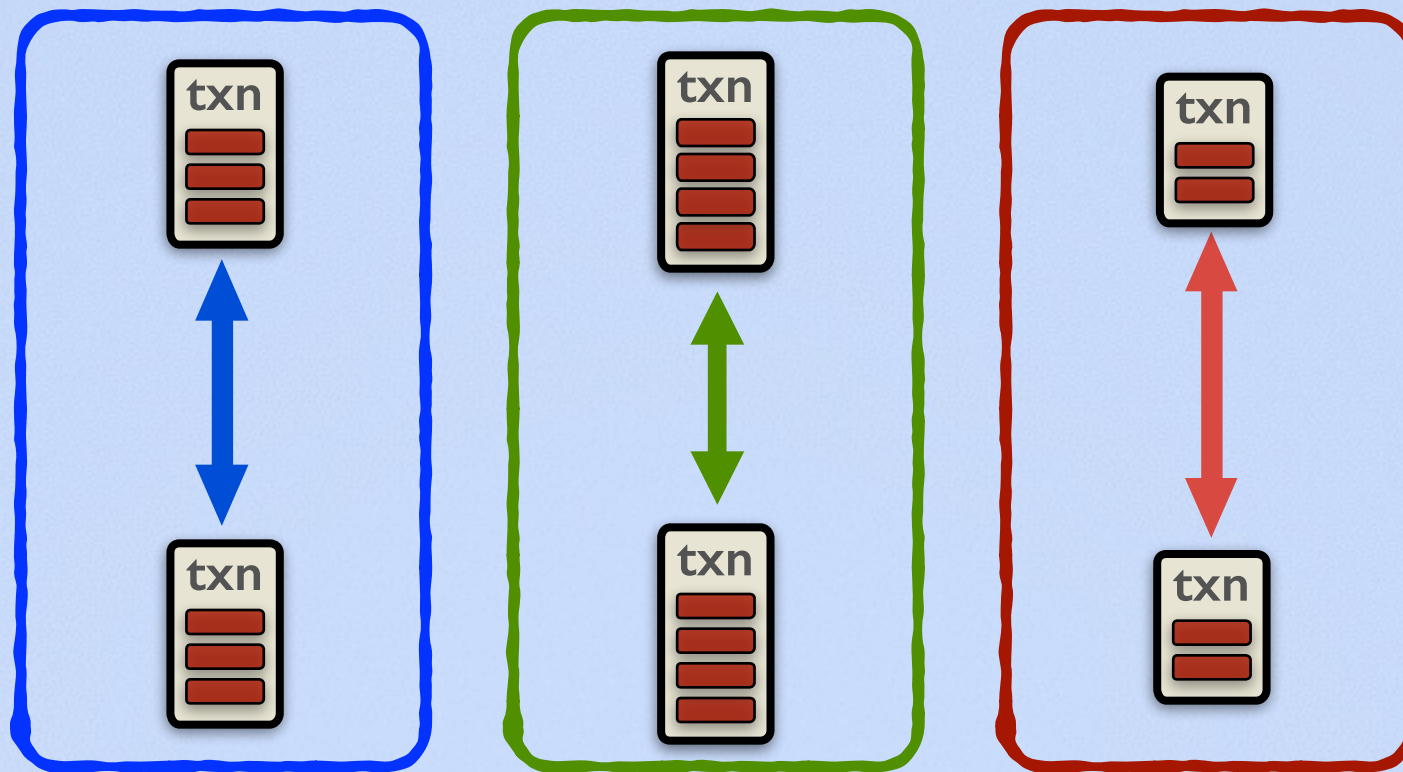
MODULAR CONCURRENCY CONTROL

ACID Abstraction



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Specialized
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Implementation

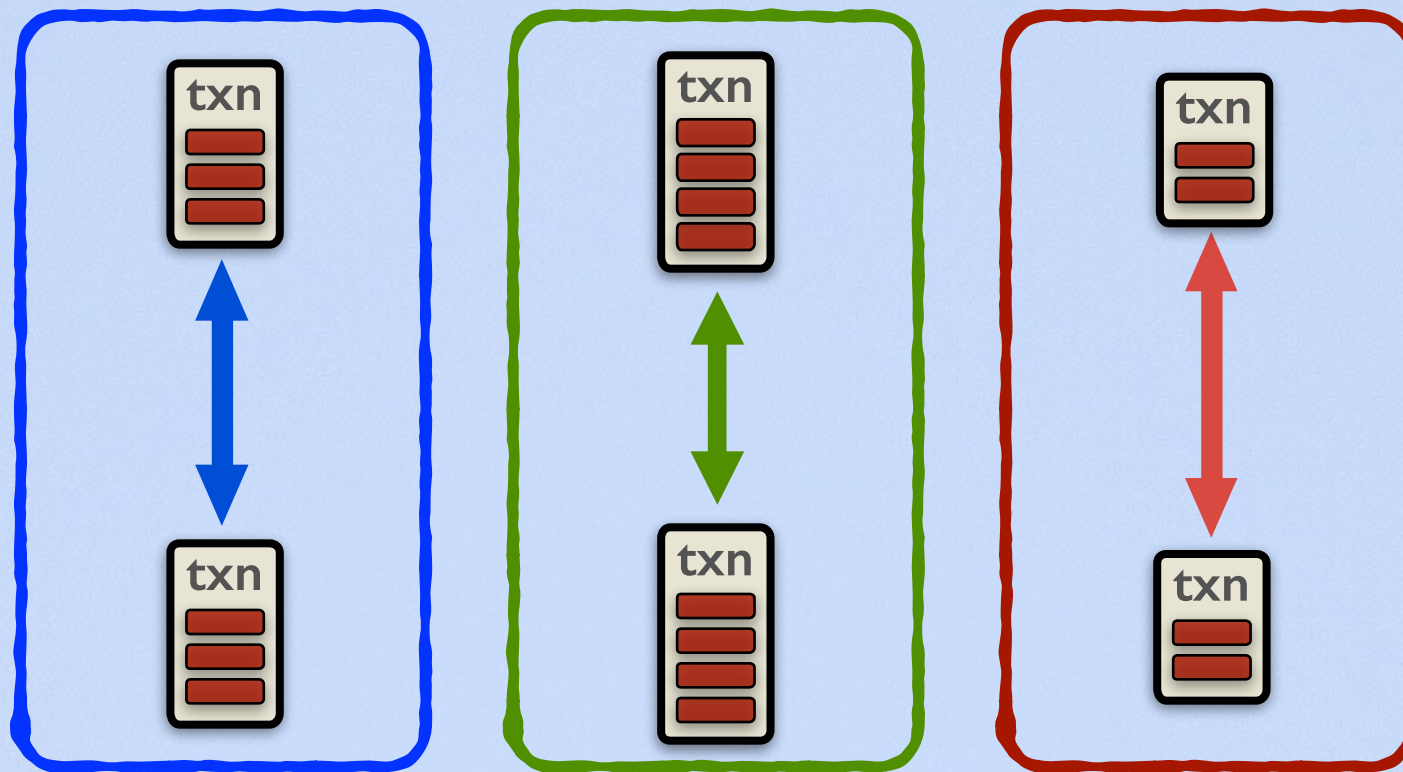
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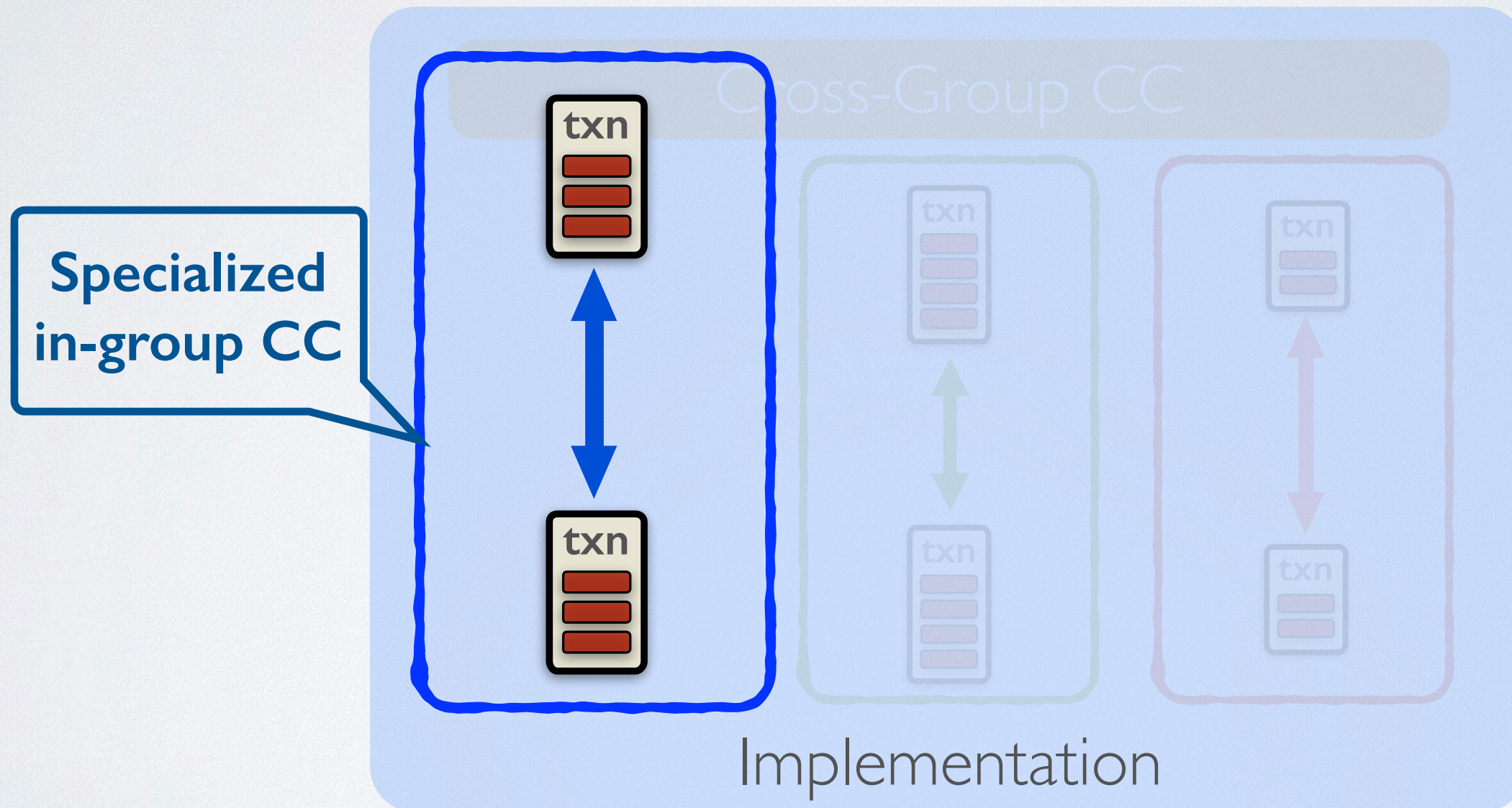


Implementation

Insight 2: **Separation of Concerns**

MODULAR CONCURRENCY CONTROL

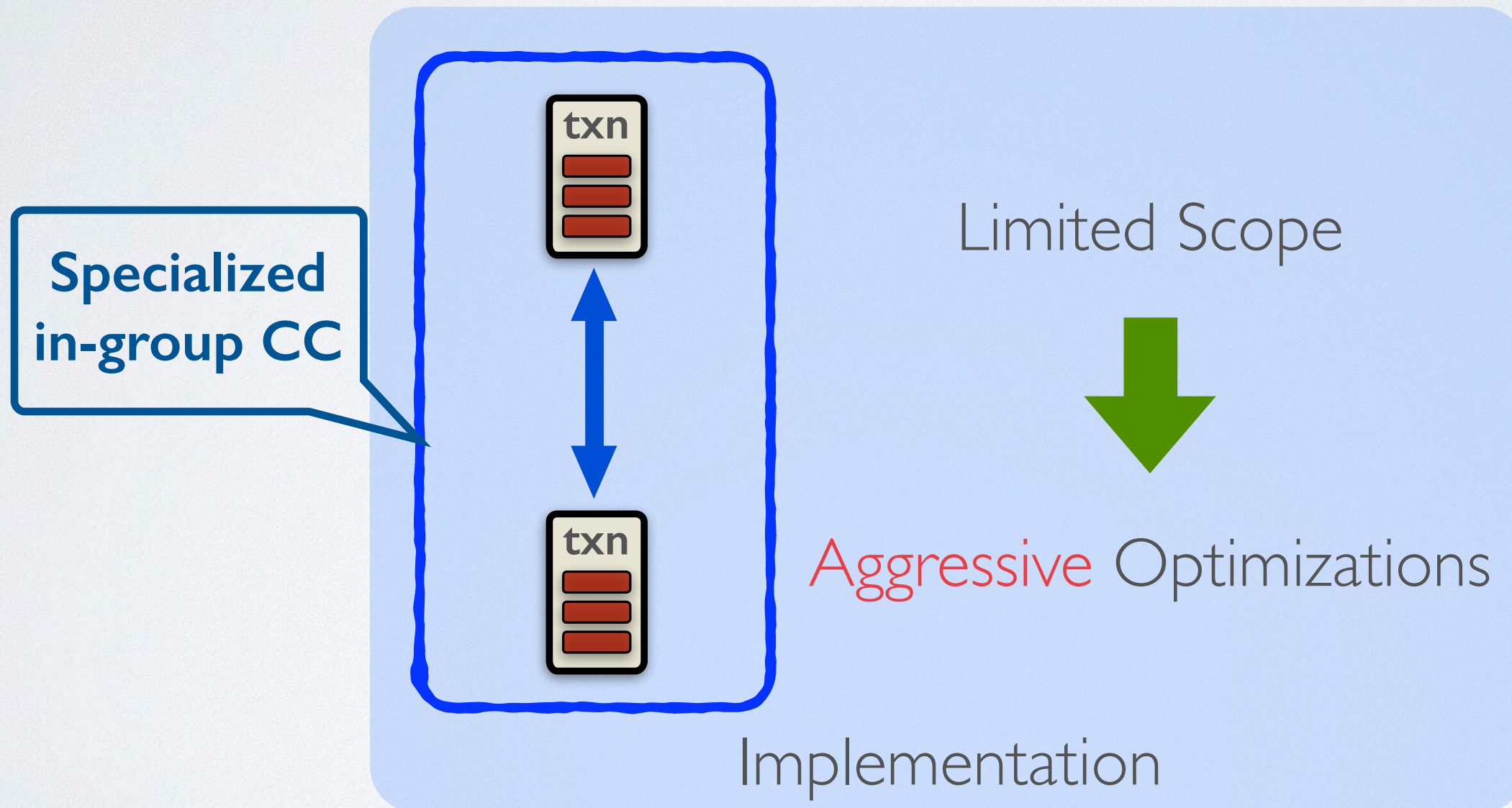
ACID Abstraction



Insight 2: **Separation of Concerns**

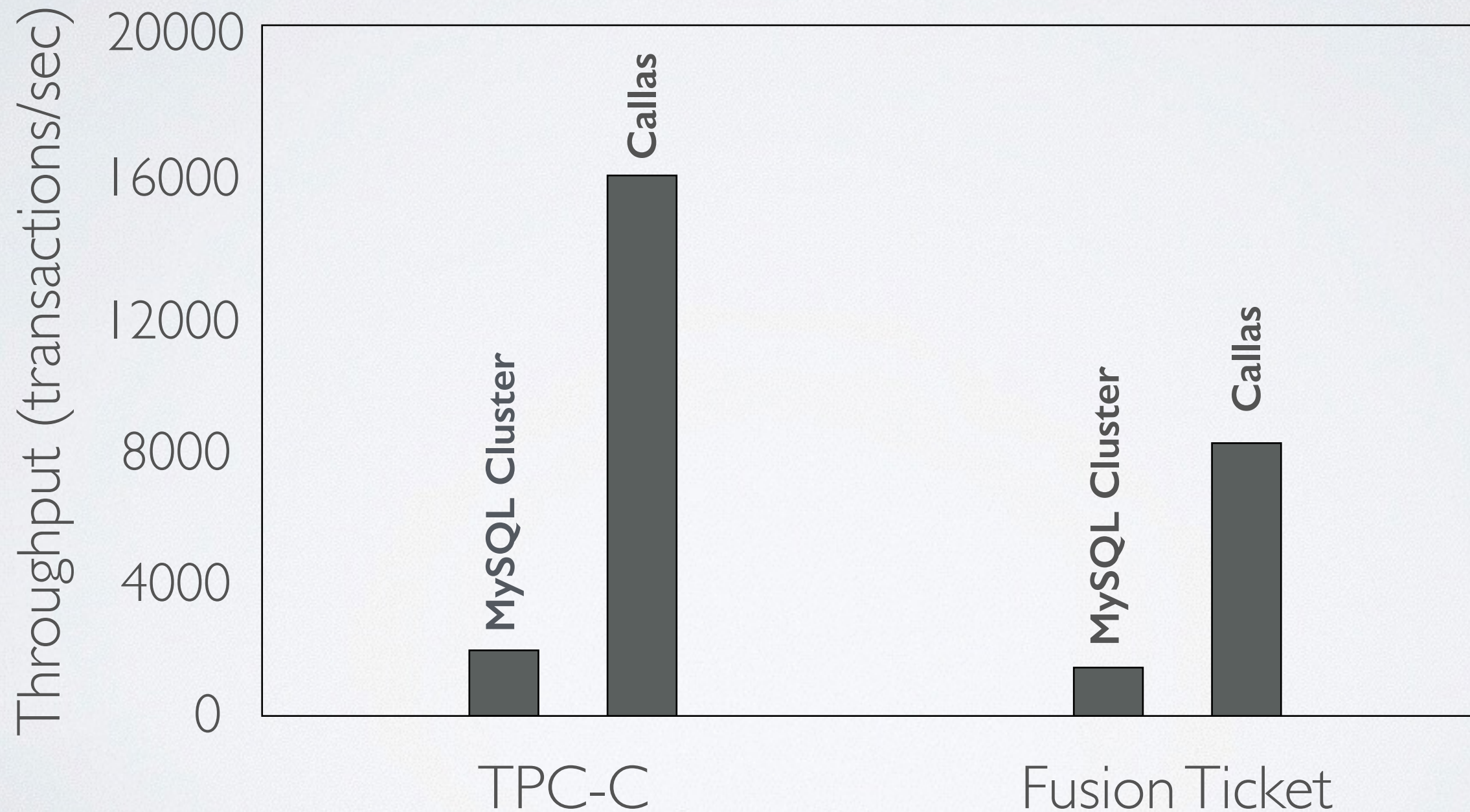
MODULAR CONCURRENCY CONTROL

ACID Abstraction



Insight 2: **Separation of Concerns**

PERFORMANCE OF CALLAS

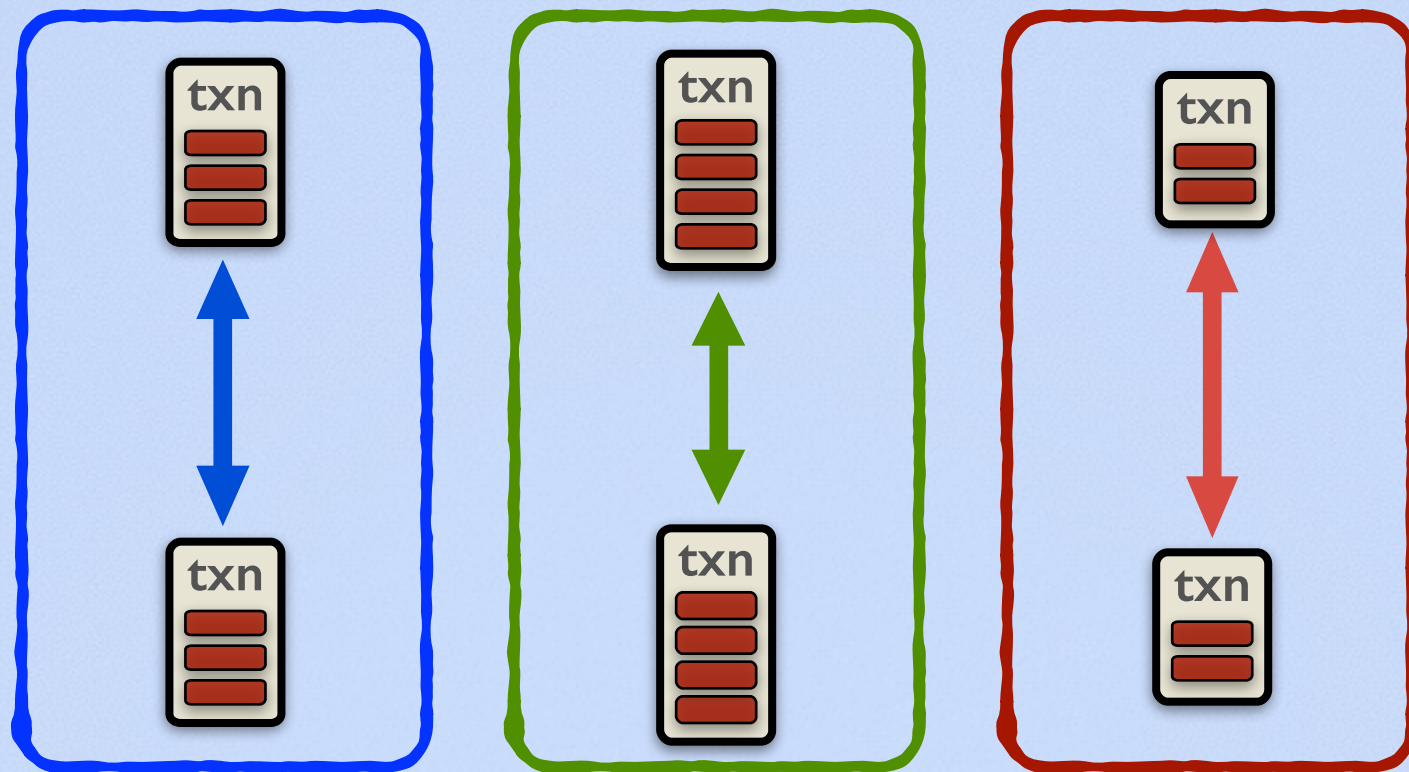


A MORE PERFECT UNION

ACID Abstraction



Cross-Group CC



Implementation

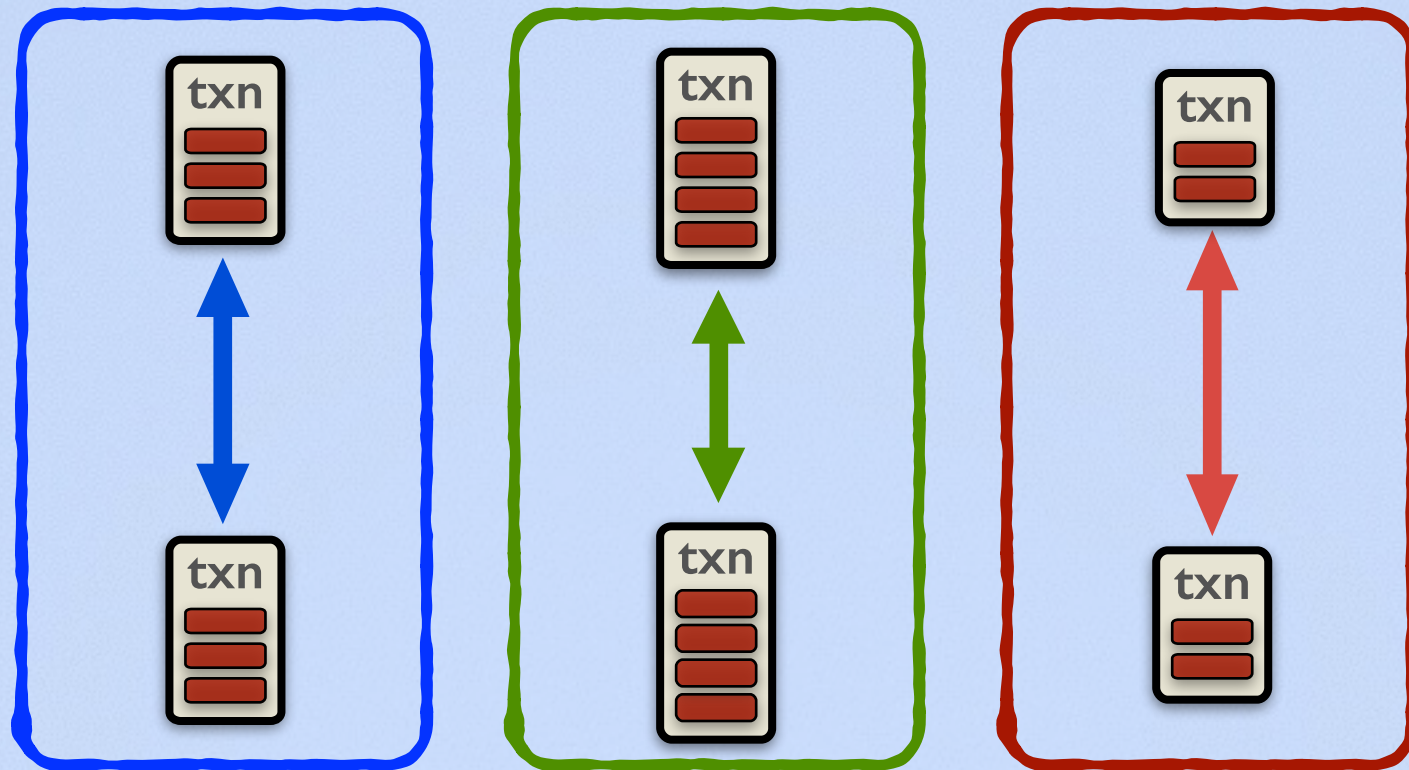
A MORE PERFECT UNION

ACID Abstraction



Cross-Group CC

single version
& lock-based



Implementation

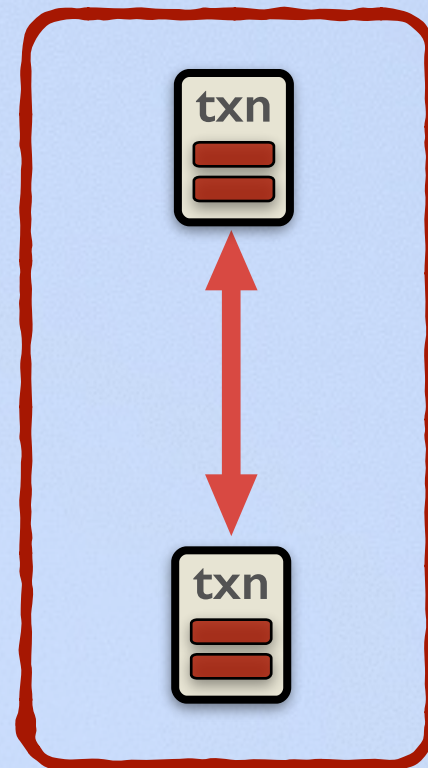
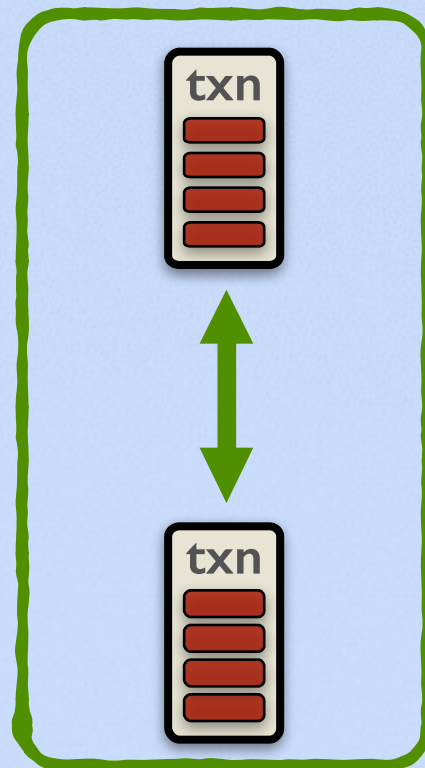
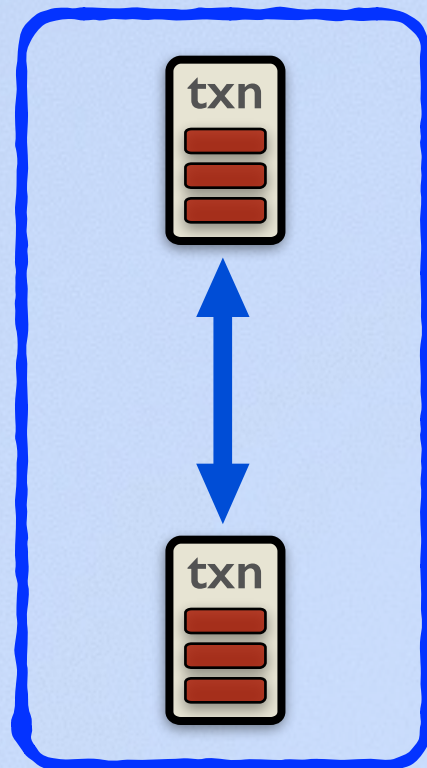
A MORE PERFECT UNION

ACID Abstraction



Cross-Group CC

single version
& lock-based



only work in
single version
databases

Implementation

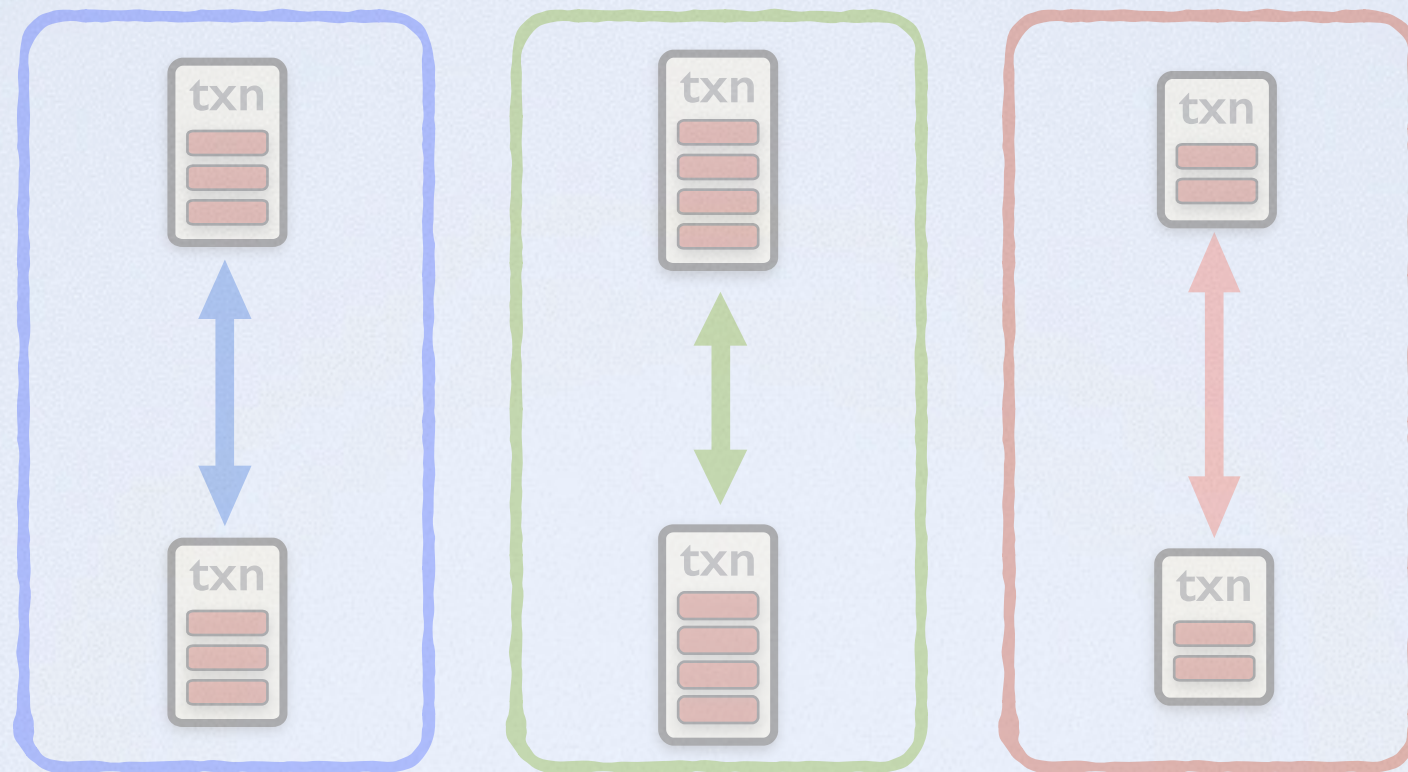
A MORE PERFECT UNION

ACID Abstraction



Cross-Group CC

single version
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only work in
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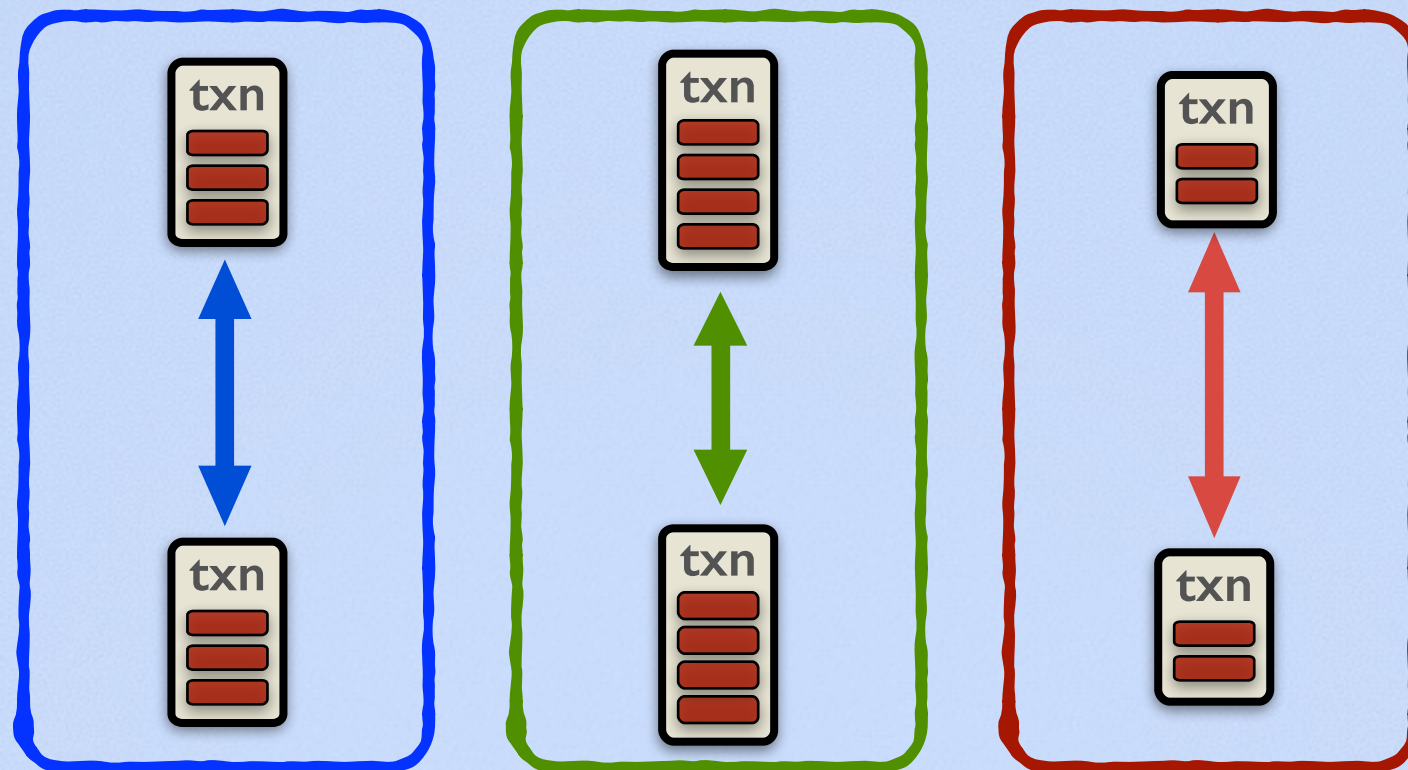
How to apply MCC in a multi-version DB?

NEXT STEP : MULTI-VERSION

ACID Abstraction



Cross-Group CC



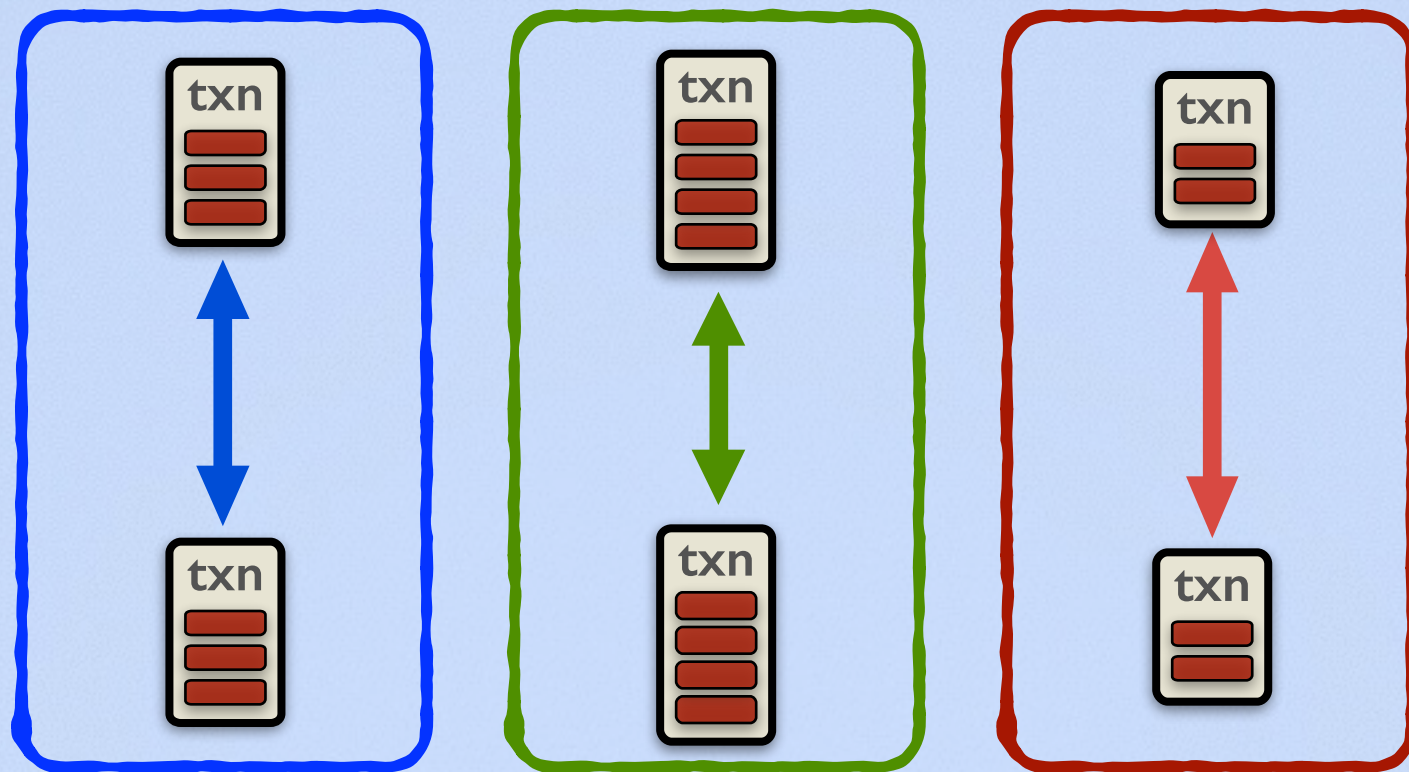
Implementation

NEXT STEP : MULTI-VERSION

ACID Abstraction



Multi-version Cross-Group CC



Implementation

NEXT STEP : MULTI-VERSION

ACID Abstraction

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temporary
single-version
“bubbles”

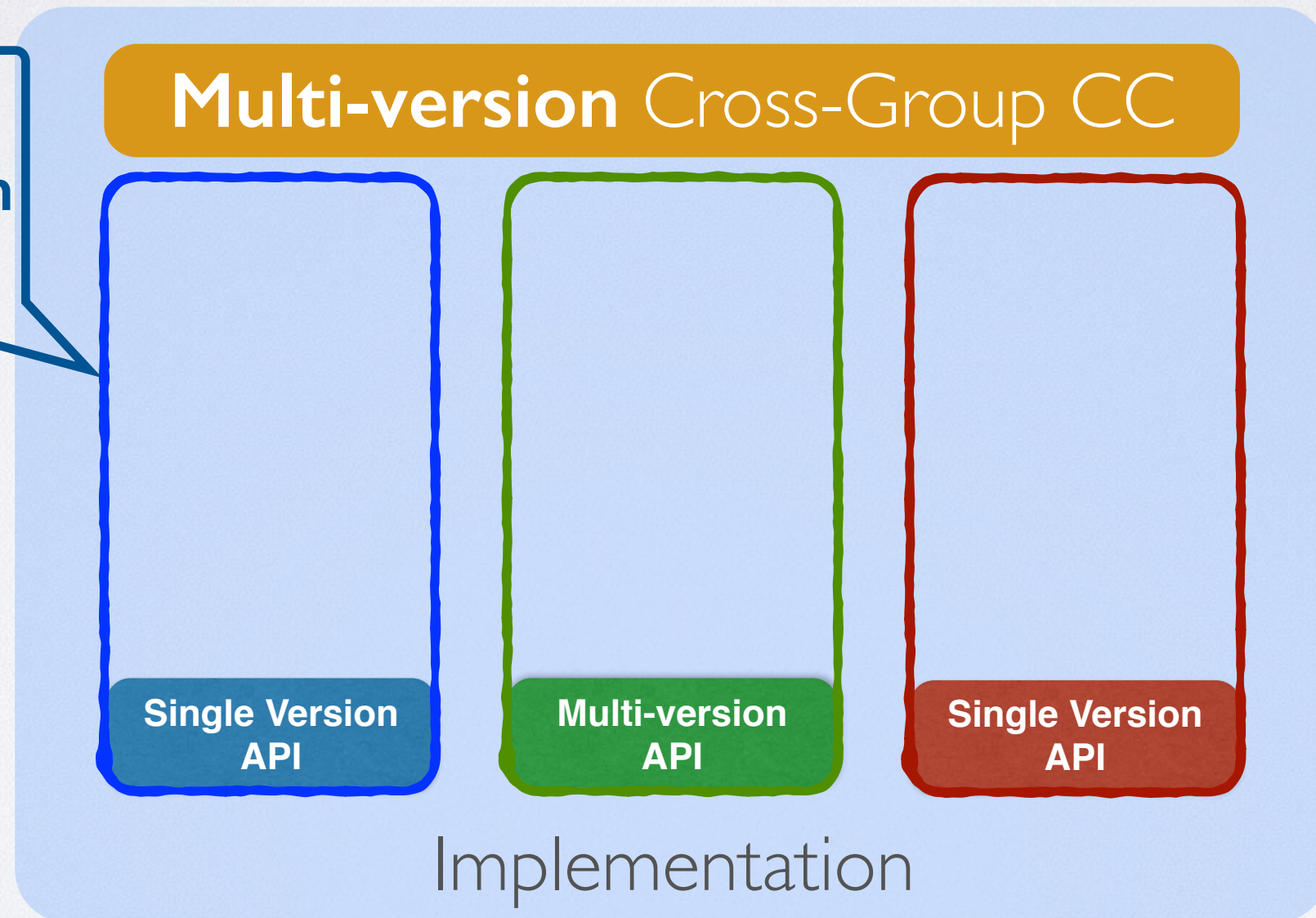
Multi-version Cross-Group CC

Single Version
API

Multi-version
API

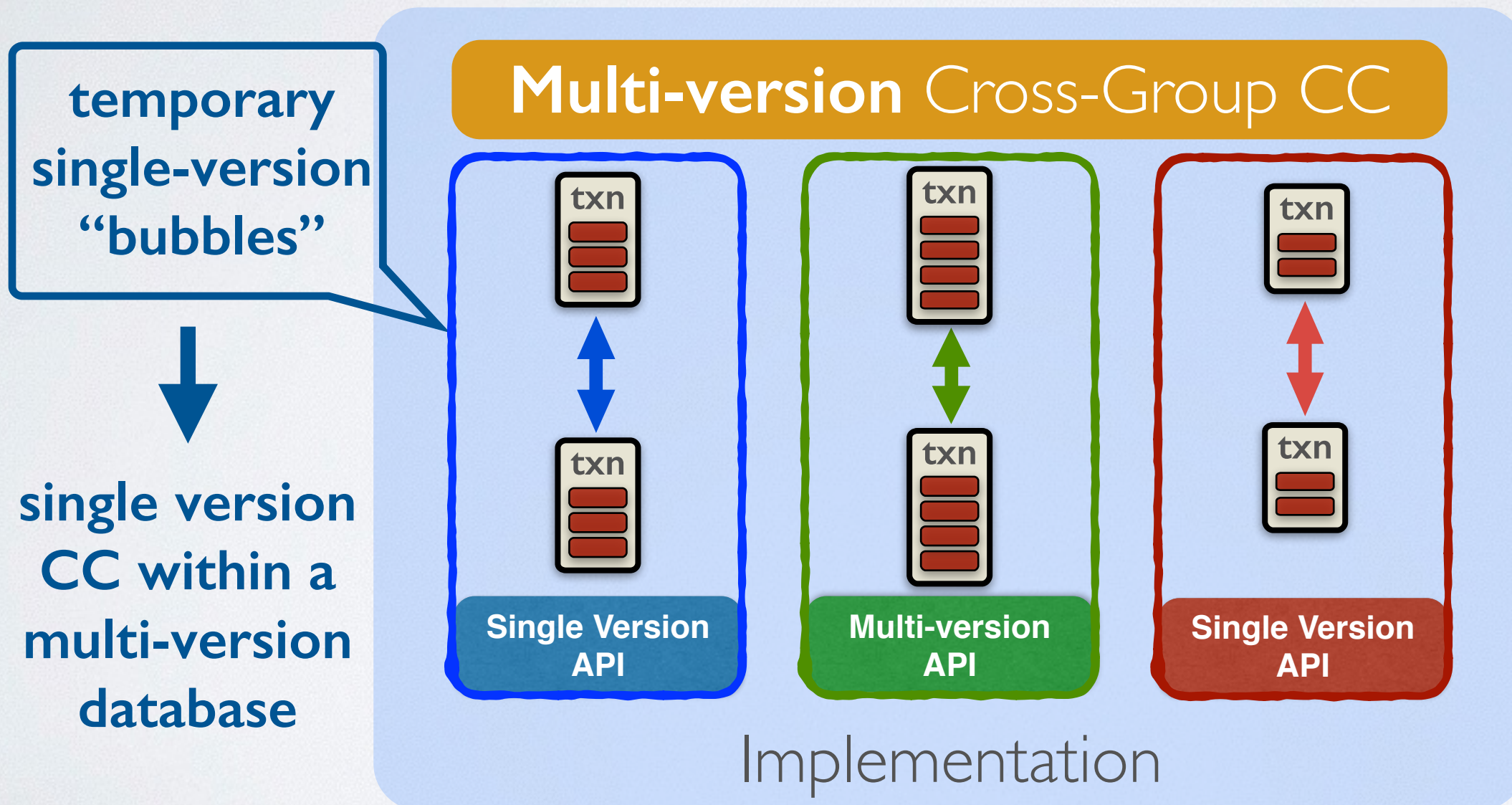
Single Version
API

Implementation



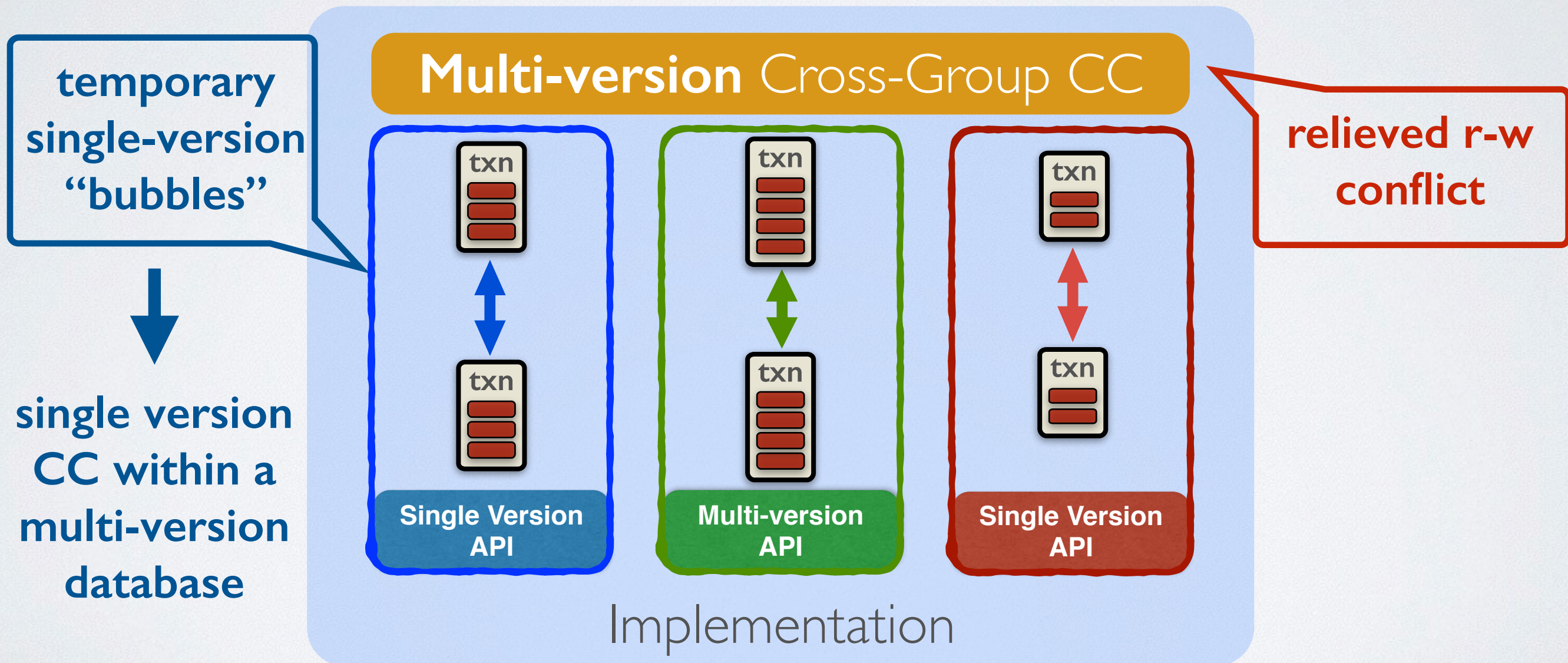
NEXT STEP : MULTI-VERSION

ACID Abstraction



NEXT STEP : MULTI-VERSION

ACID Abstraction



NEXT STEP : MULTI-VERSION

ACID Abstraction

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