

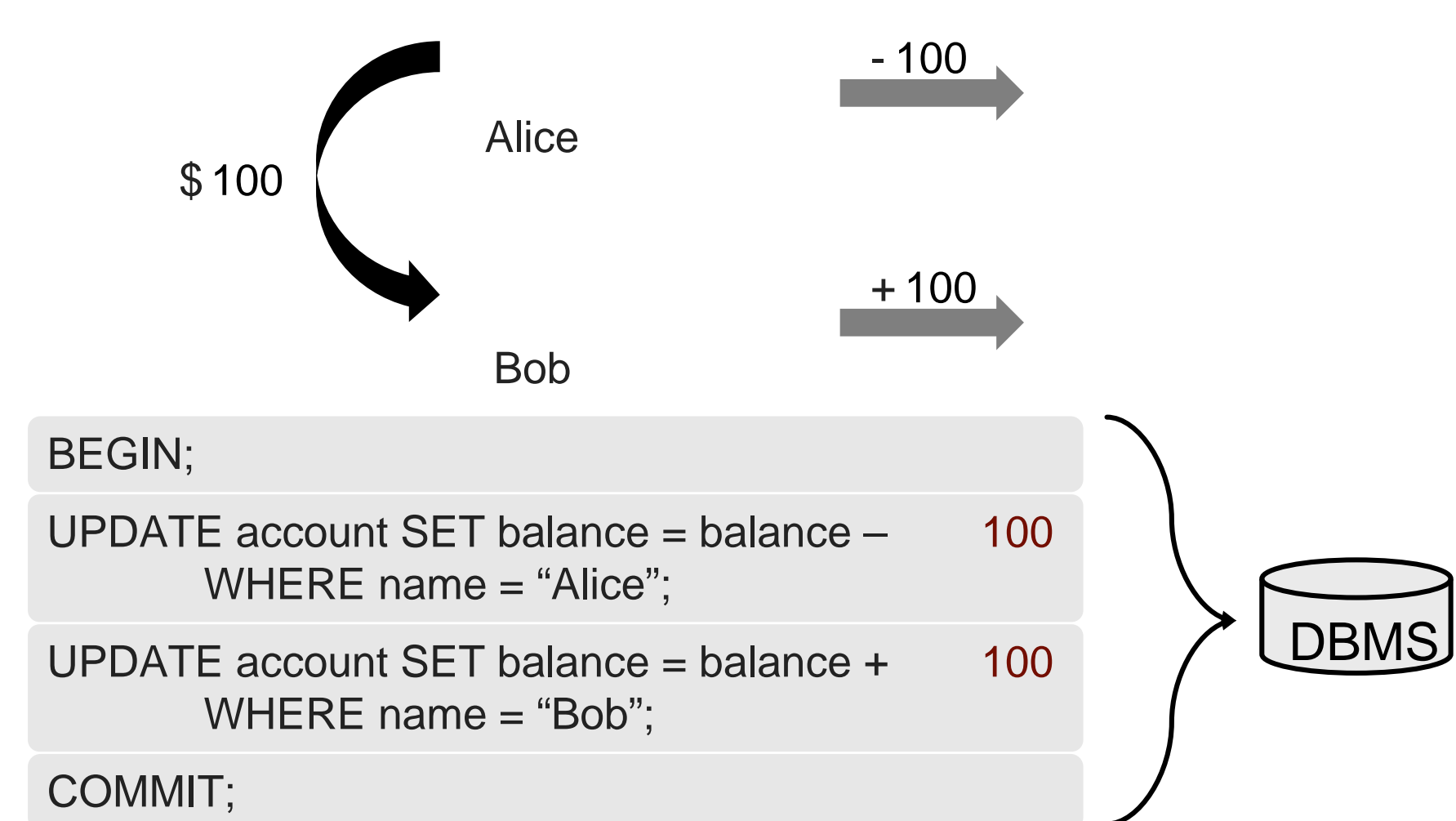
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Detecting Isolation Bugs via Transaction Oracle Construction  
The 45th IEEE/ACM International Conference on Software Engineering  
6,,3+ é ? Ö D3[]¹ cuiziyu20@otcaix.iscas.ac.cn

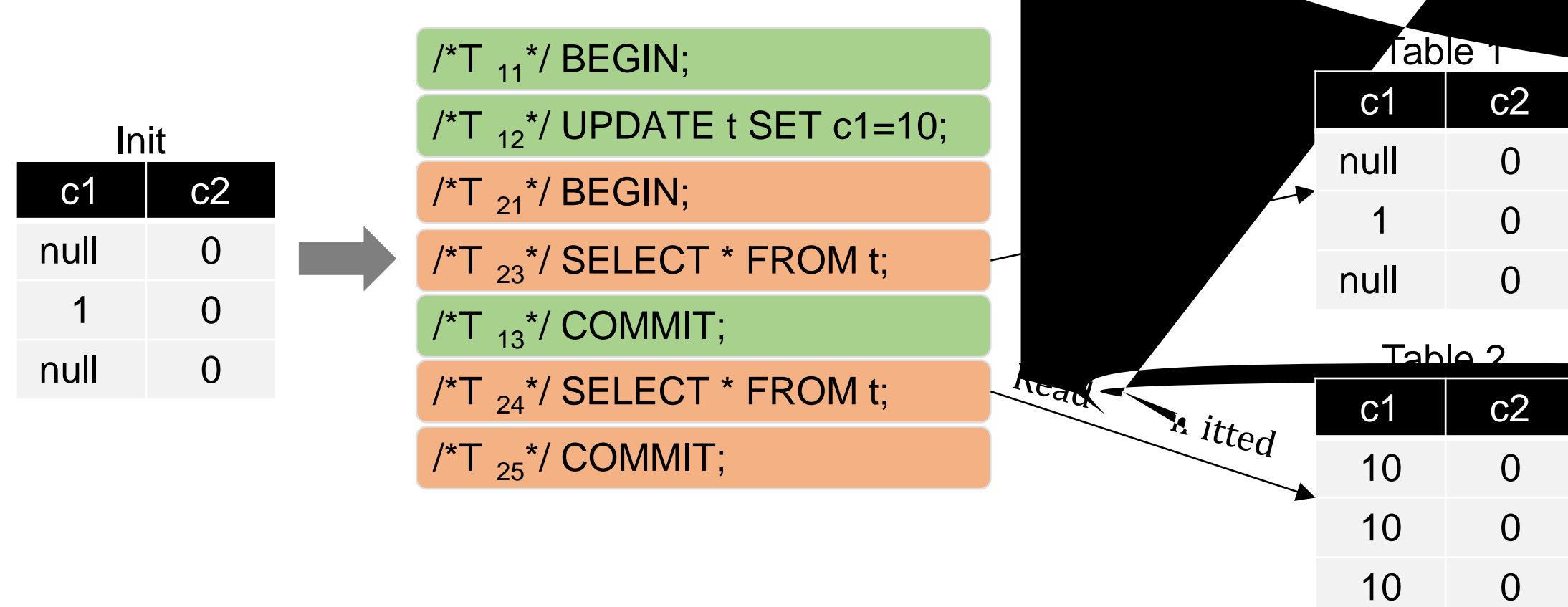
## Transaction

‡ DBMSs utilize transactions to ensure data integrity



## Isolation Level

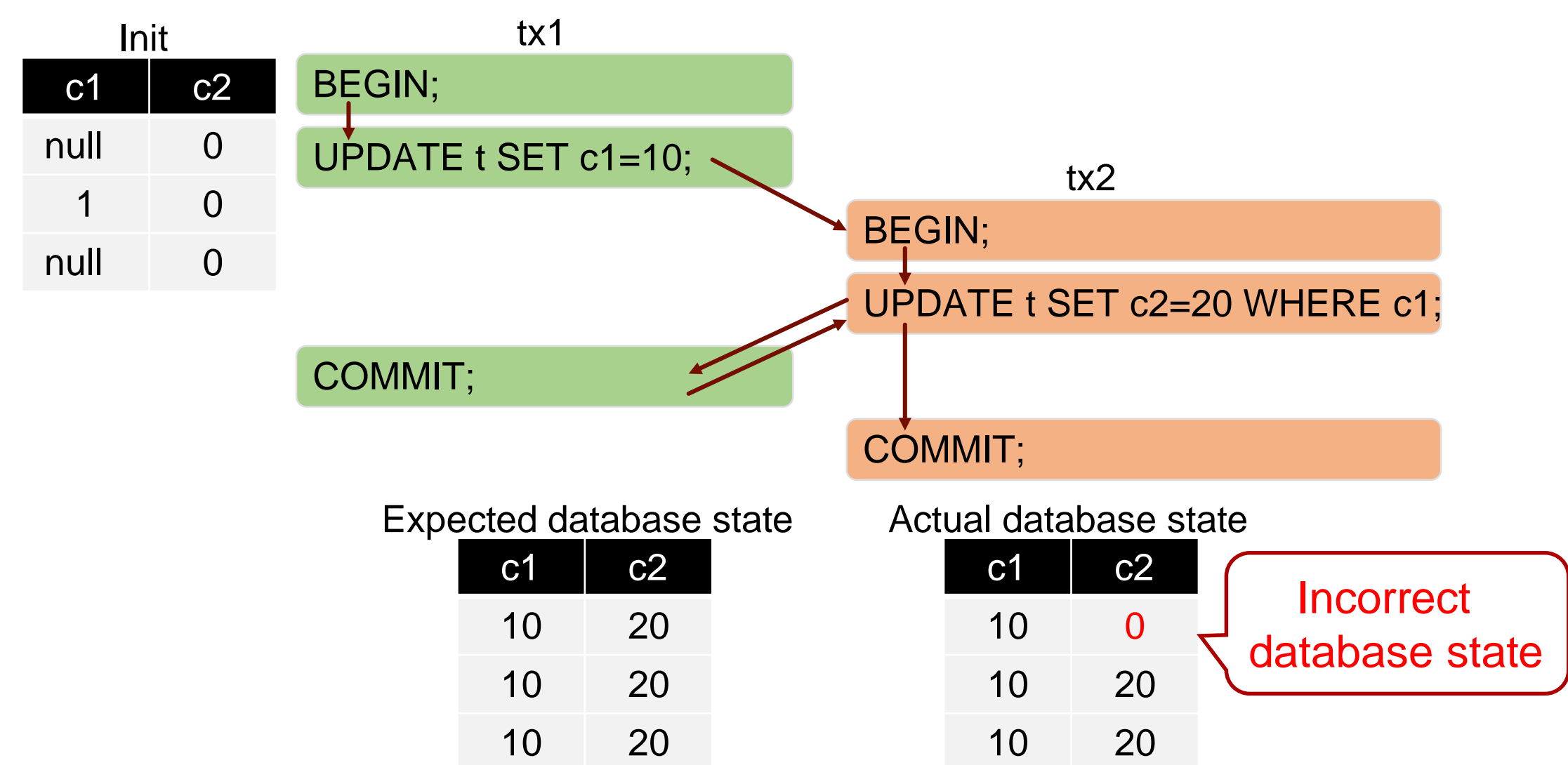
‡ Isolation levels affect the visibility of transaction statements to other concurrent transactions



## Isolation Bug

‡ Buggy transaction processing mechanisms and implementations can cause isolation bugs

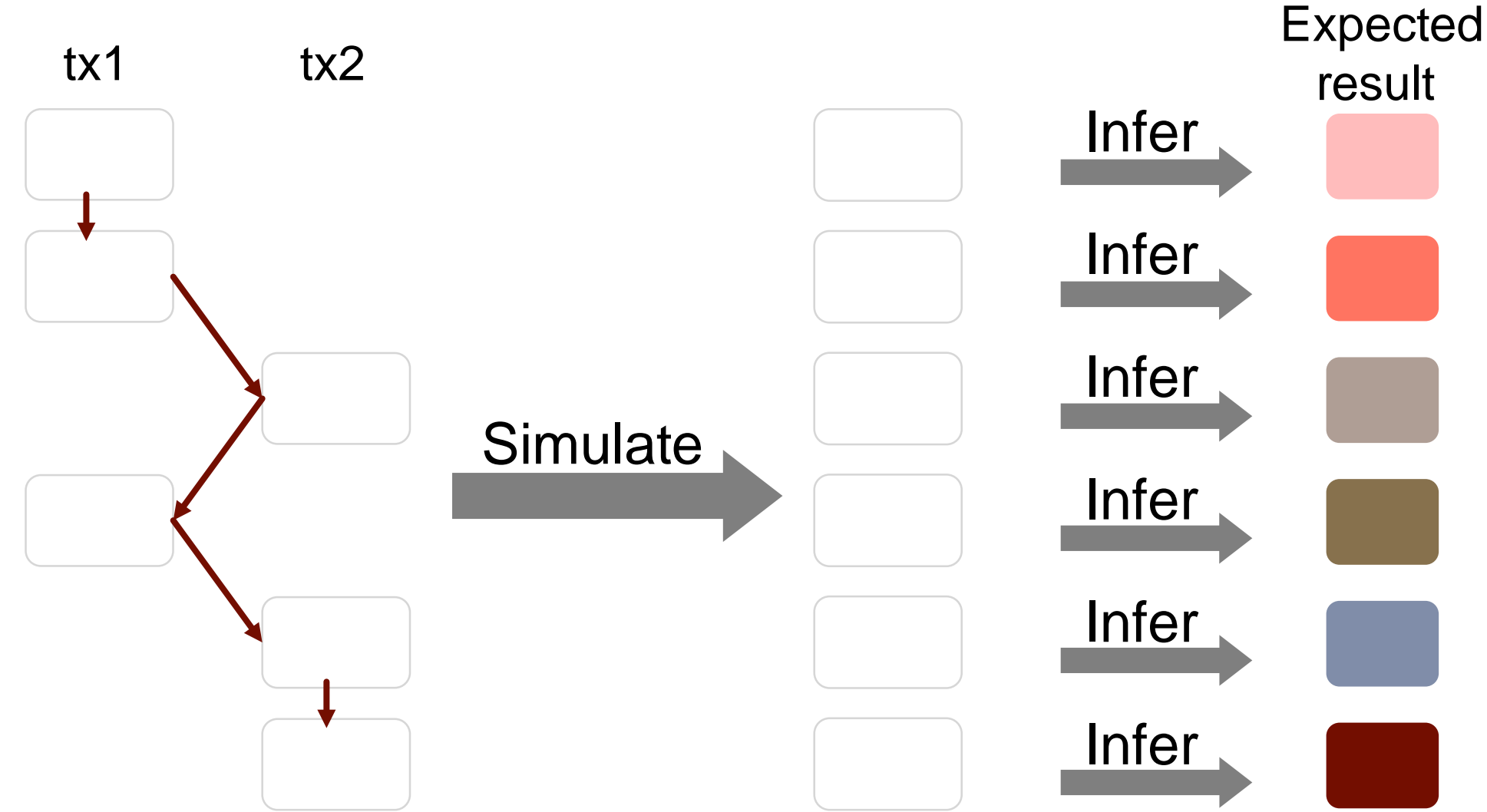
- ¾ Violate corresponding isolation semantics
- ¾ Lead to incorrect database states and query results



<https://bugs.mysql.com/bug.php?id=104833>

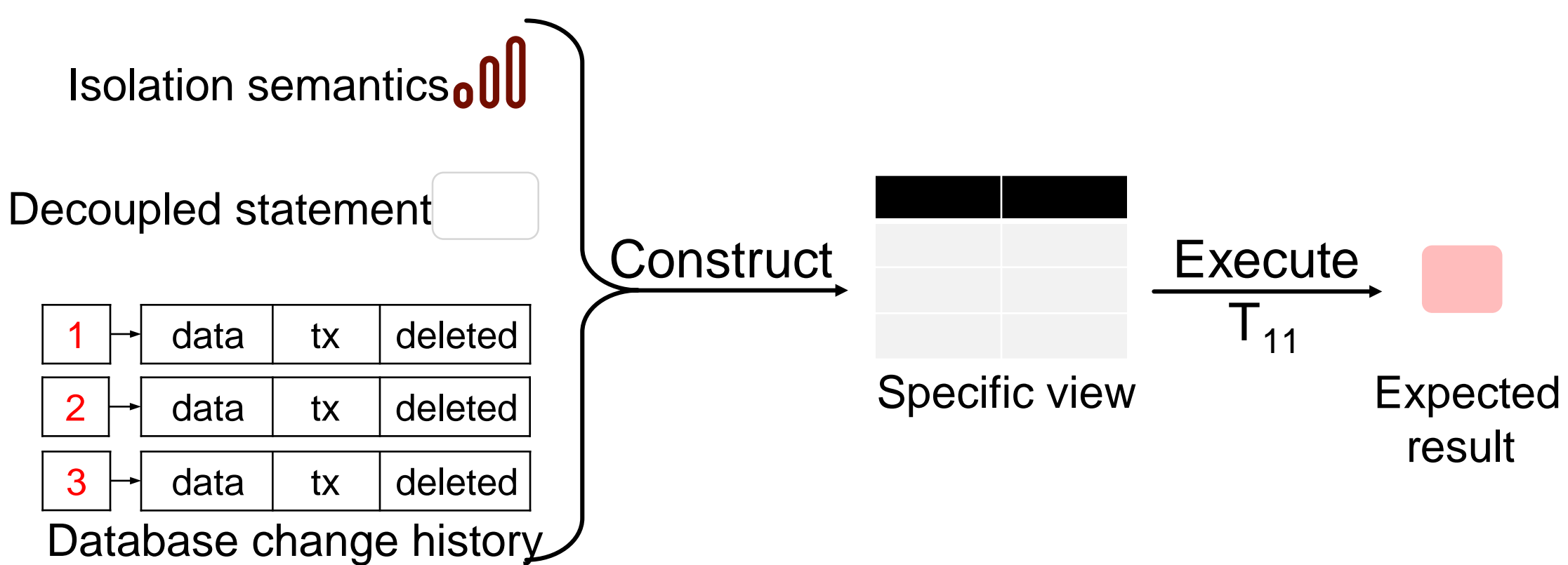
## Transaction Oracle Construction ( Troc )

‡ Simulate concurrent transaction execution by decoupling transactions into independent statements



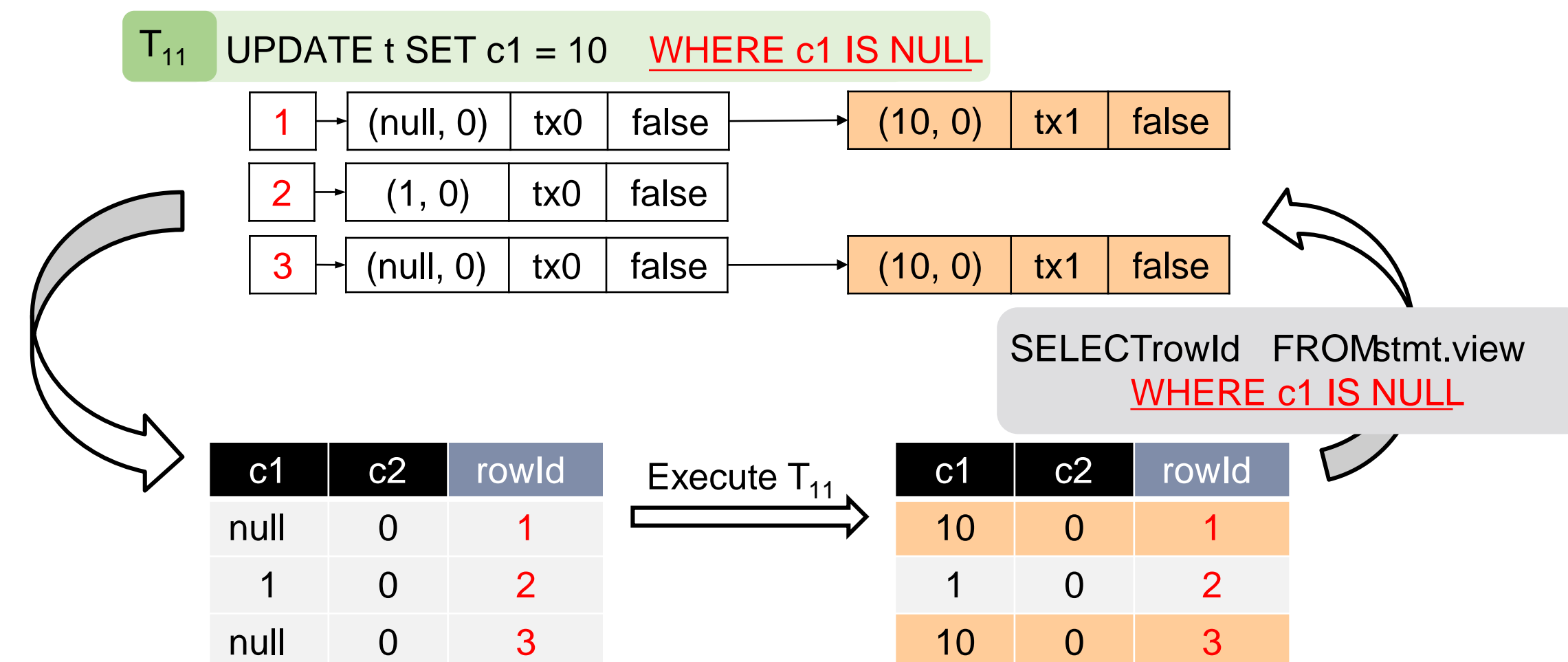
## Transaction Oracle Construction ( Troc )

‡ We construct a transaction oracle without reimplementing a reference DBMS



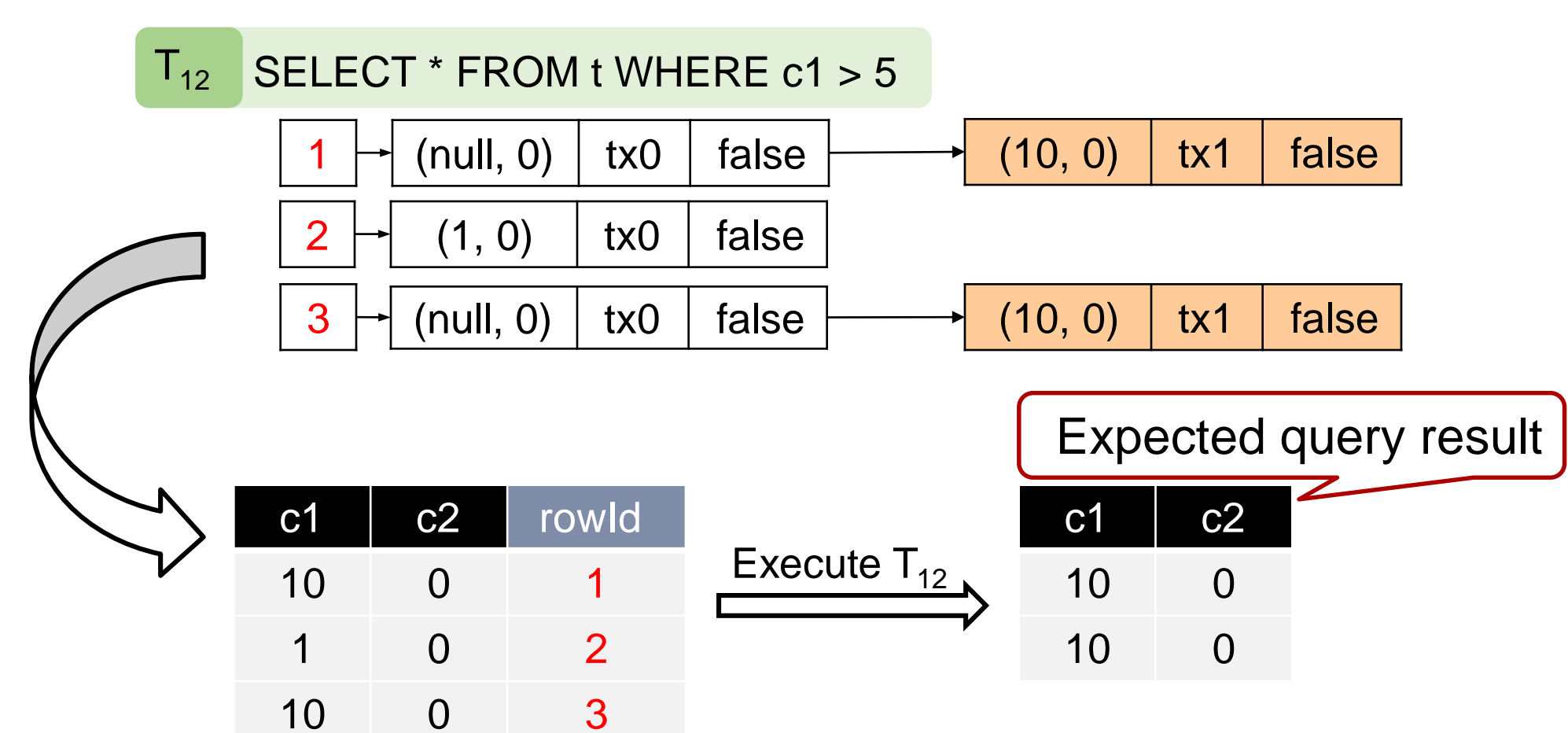
## View Construction

‡ Build database change history for UPDATE. Attach new data versions for the modification to the view



## View Construction

‡ Construct database view for SELECT statements based on isolation semantics



## Bug Results

‡ Troc has detected 12 unique bugs, including 7 new confirmed bugs

DBMS	Total	New	Duplicate
MySQL	4	1	3
MariaDB	4	3	1
TiDB	4	3	1
Total	12	7	5