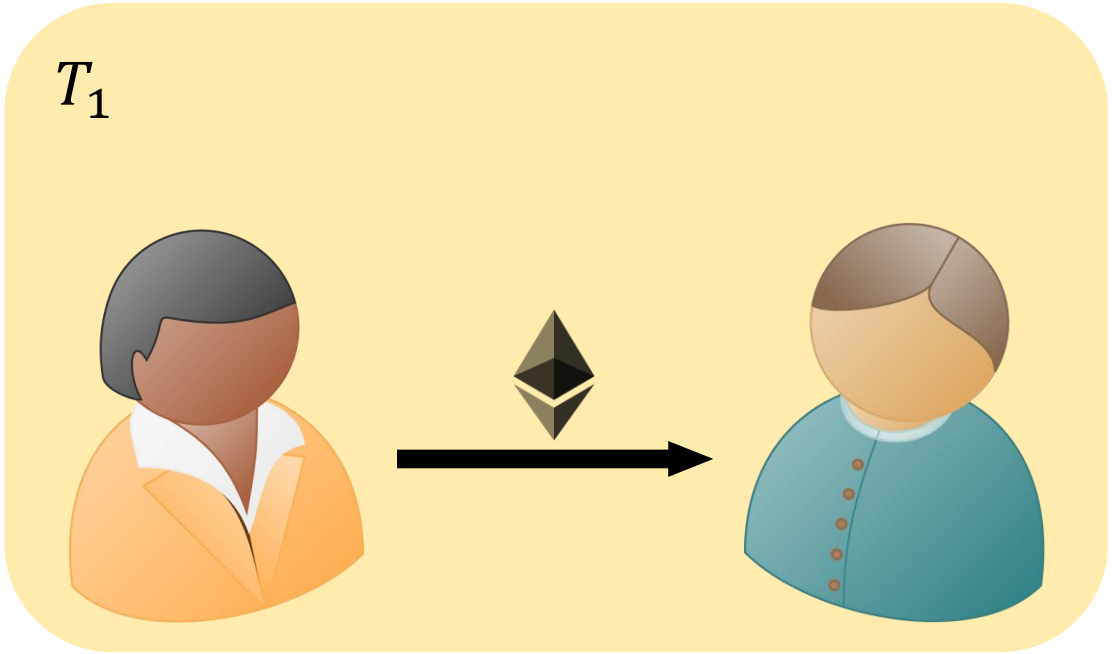
SoK: Preventing Transaction Reordering Manipulations in Decentralized Finance

Advances in Financial Technologies (AFT'22)
Lioba Heimbach, Roger Wattenhofer
ETH Zurich – Distributed Computing – www.disco.ethz.ch

Transaction Ordering



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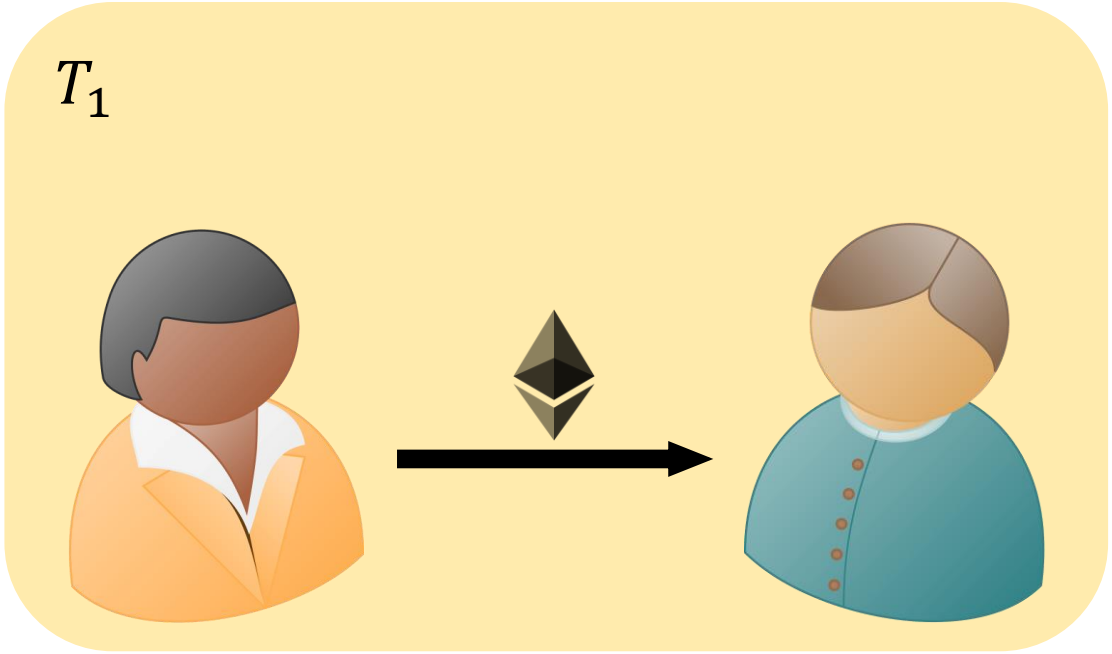

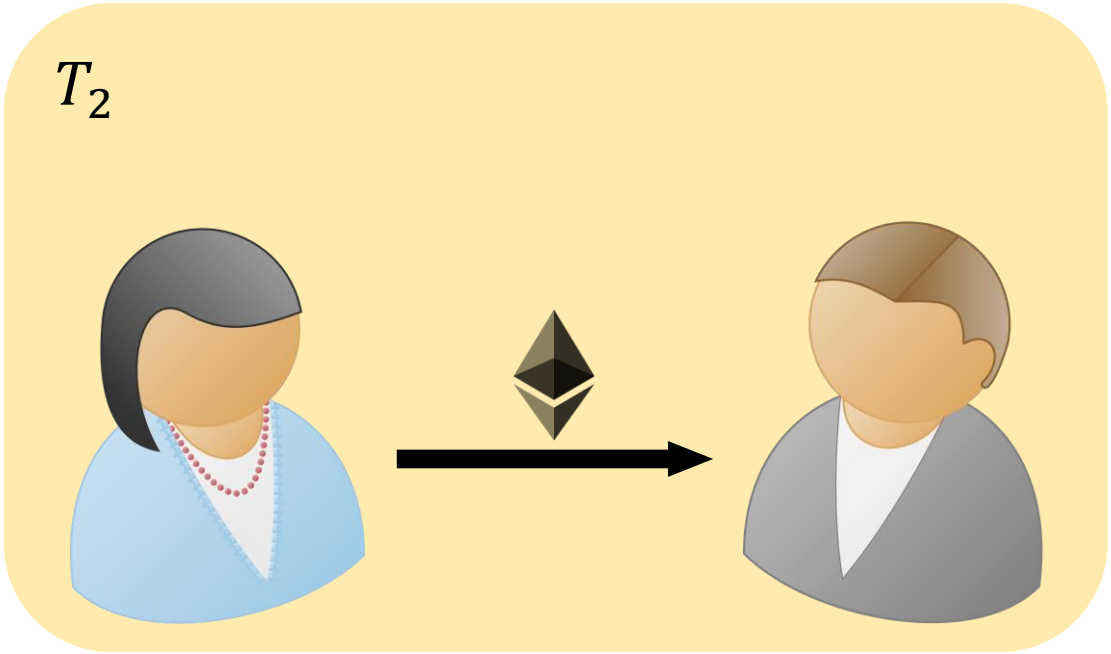

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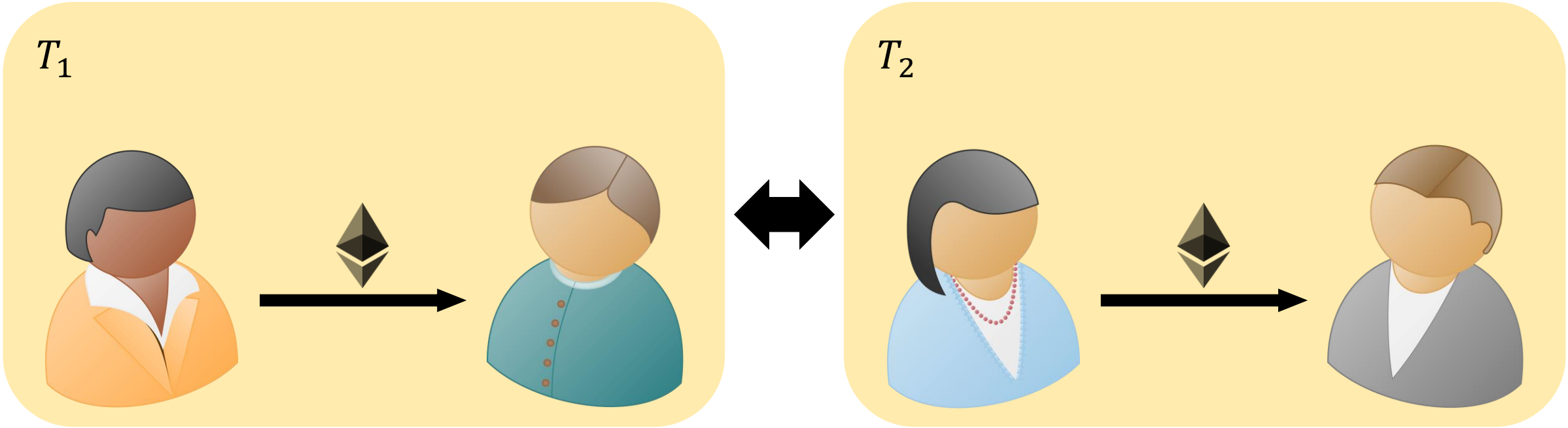


Transaction Ordering

T_E

T_A

T_B

T_C

T_D

Transaction Ordering

T_A T_B T_C T_D T_E

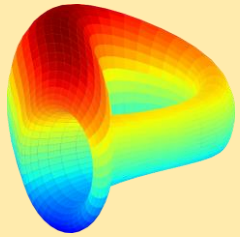
Decentralized Finance (DeFi)

Decentralized Exchanges

Lending Protocols

Decentralized Finance (DeFi)

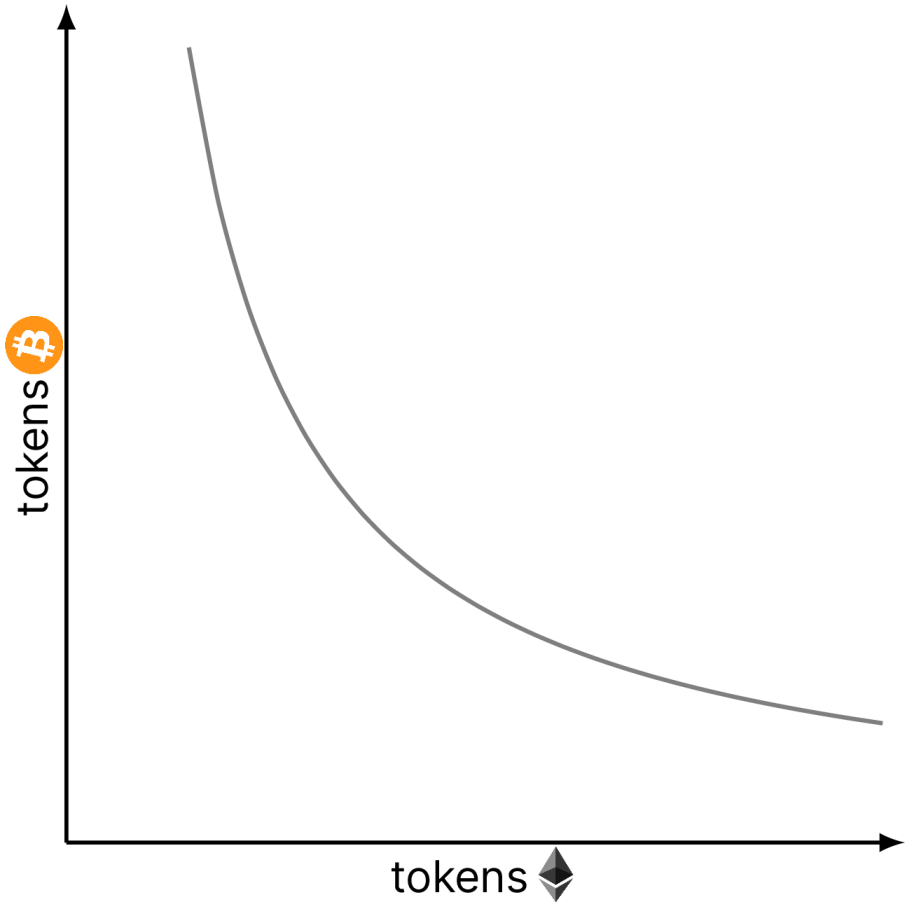
Decentralized Exchanges



δY/δX

Lending Protocols

Sandwich Attack



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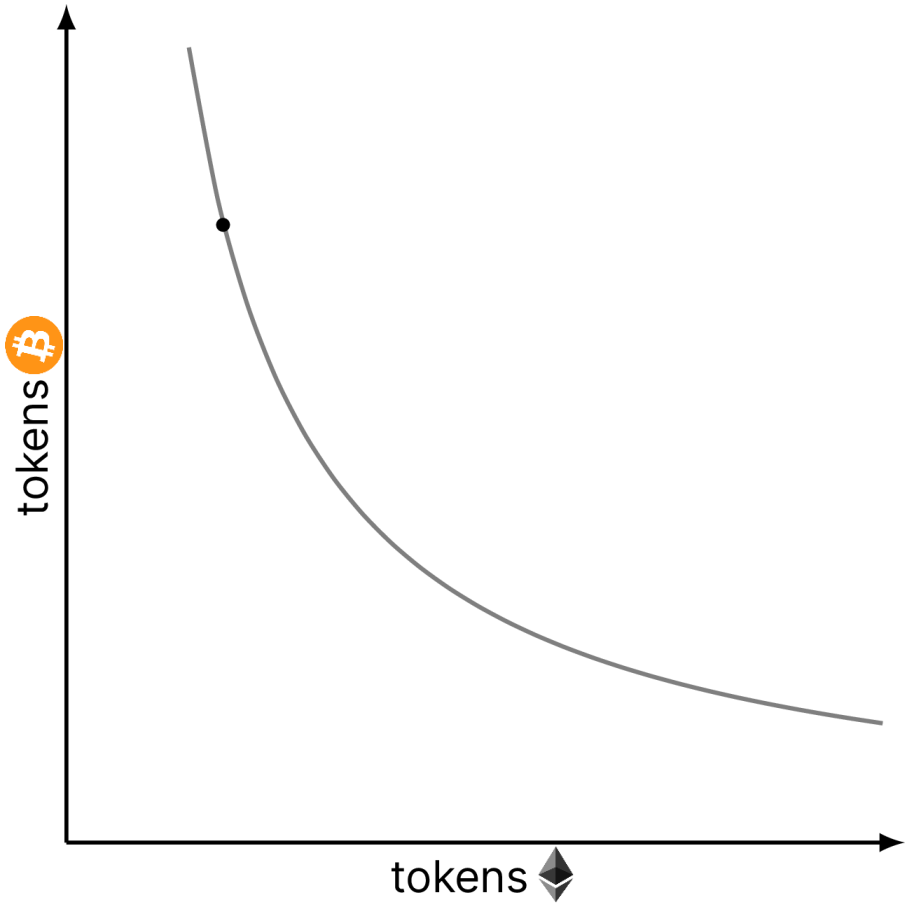

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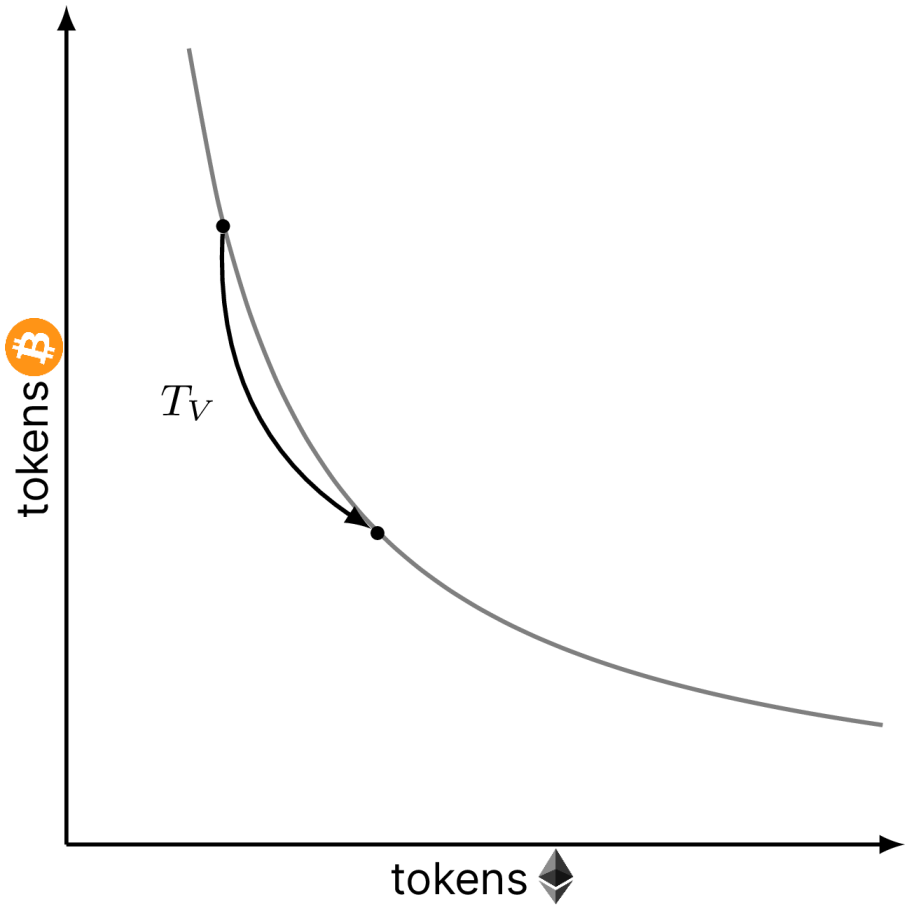

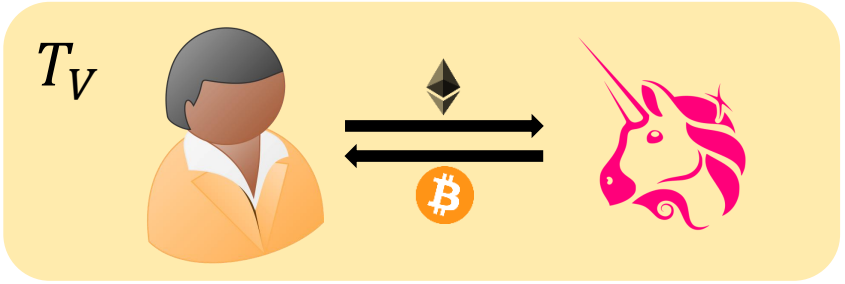

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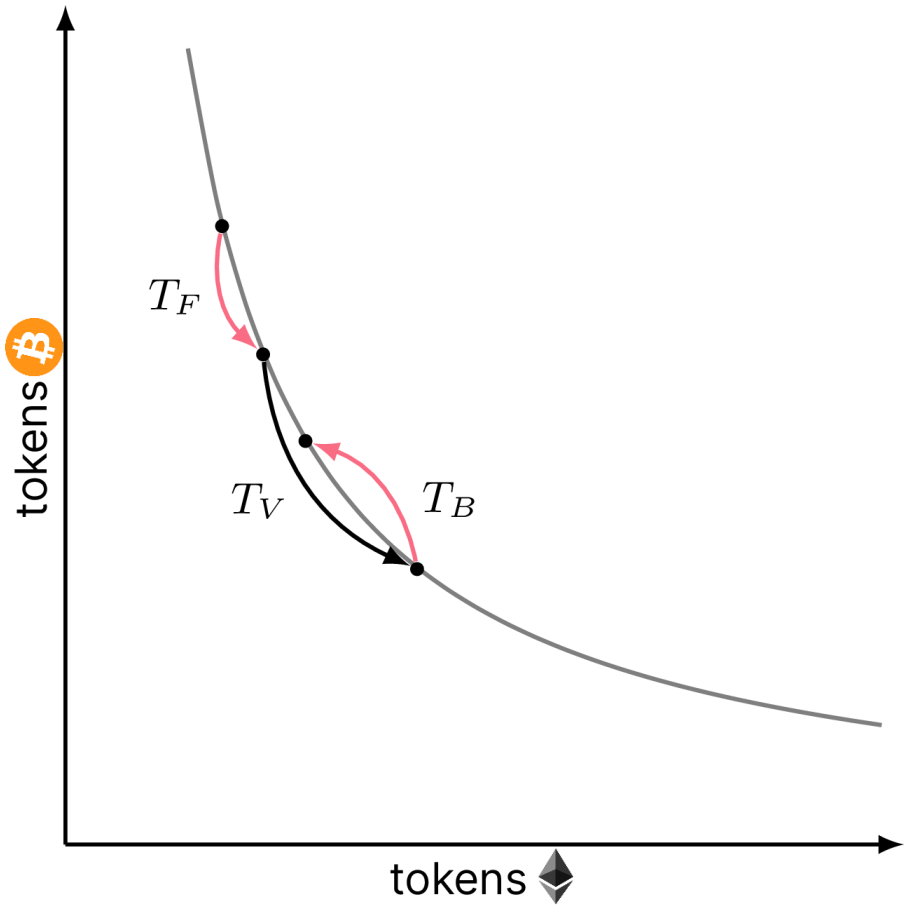
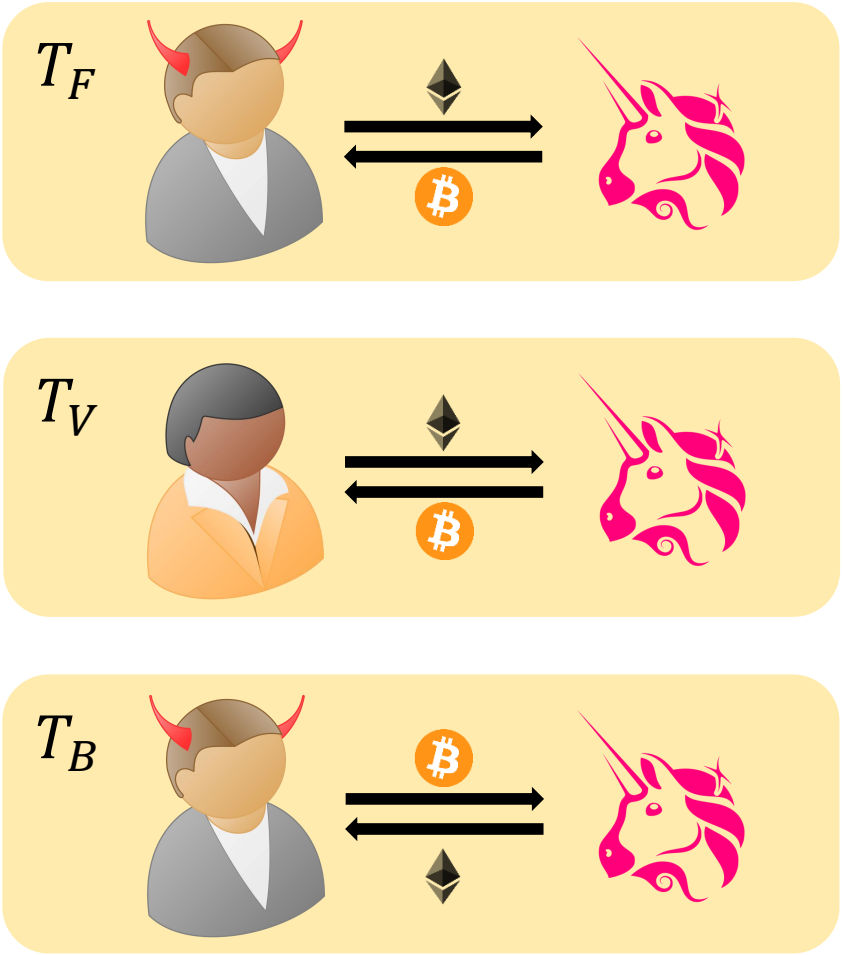
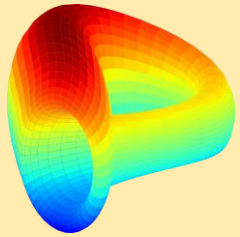




Decentralized Finance (DeFi)

Decentralized Exchanges



δY/δX

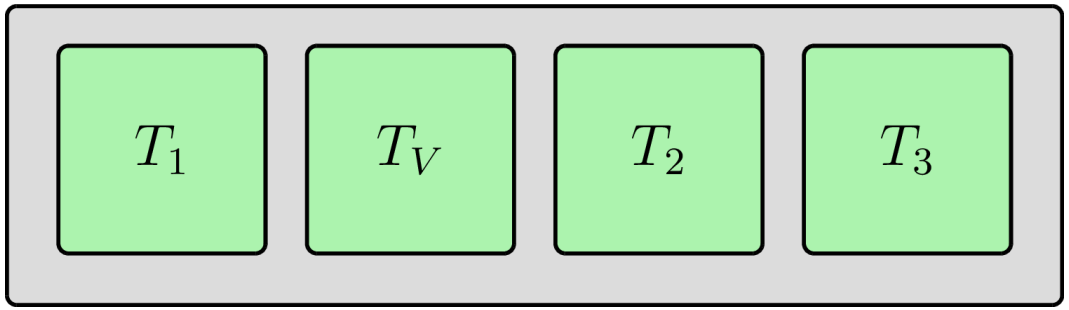
Lending Protocols

MAKER

Blockchain Extractable Value (BEV)

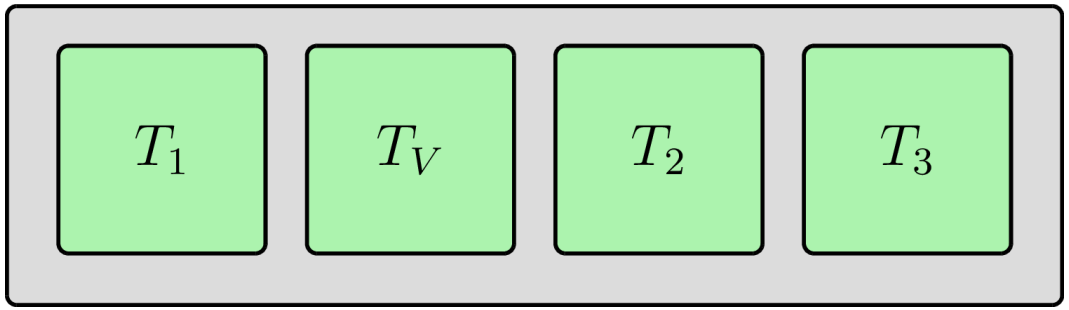
BEV is a measure of the profit that can be made through including, excluding, or re-ordering transactions within block.

Transaction Reordering



no attack

Transaction Reordering



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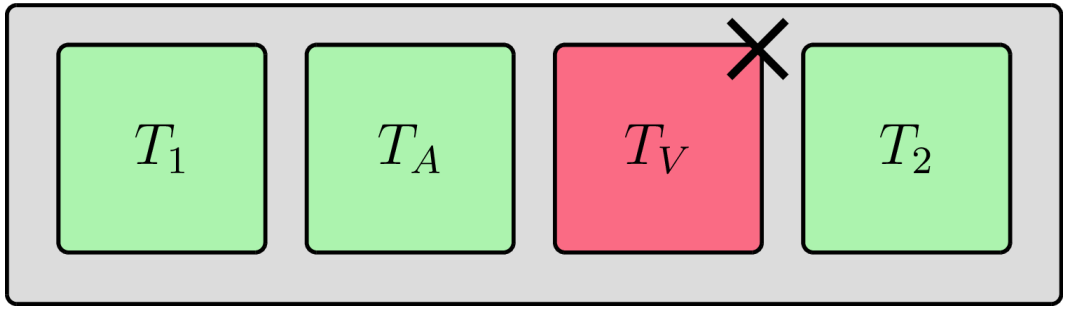
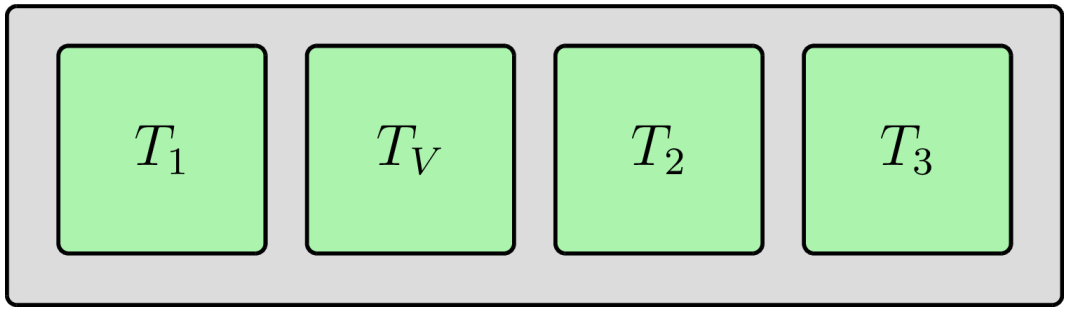


fatal front-running

Transaction Reordering



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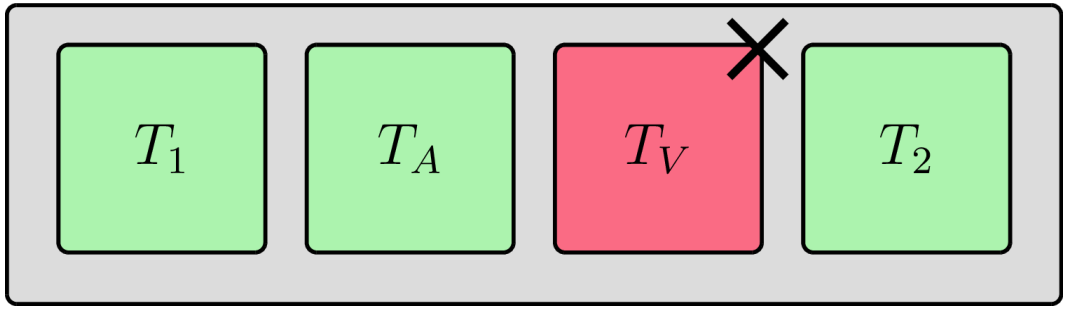

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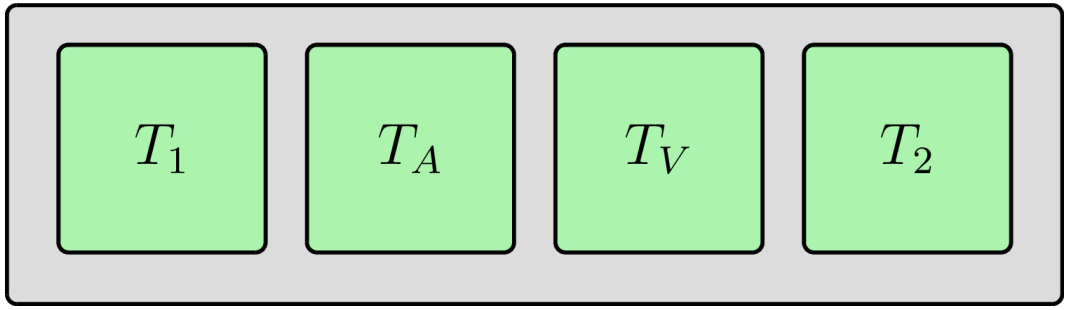
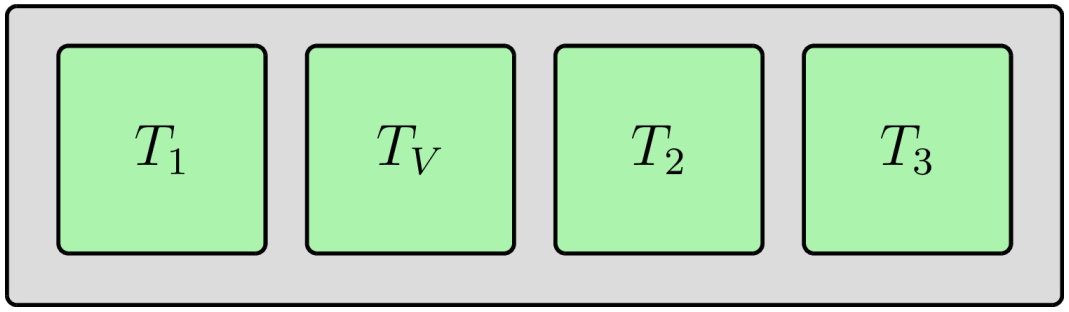
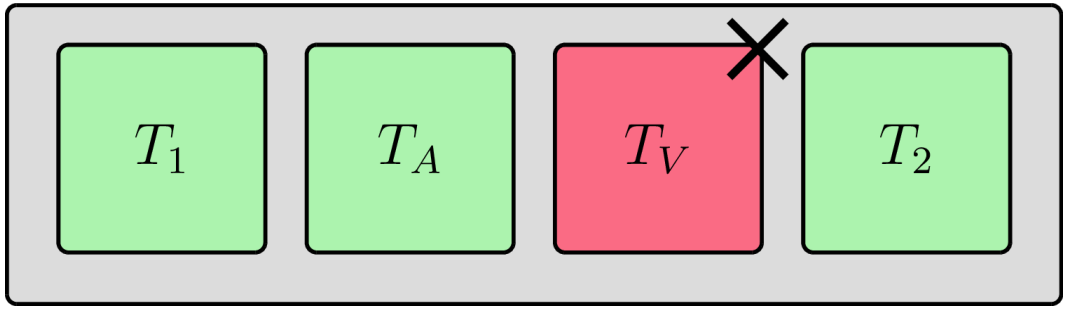


front-running

Transaction Reordering



no attack



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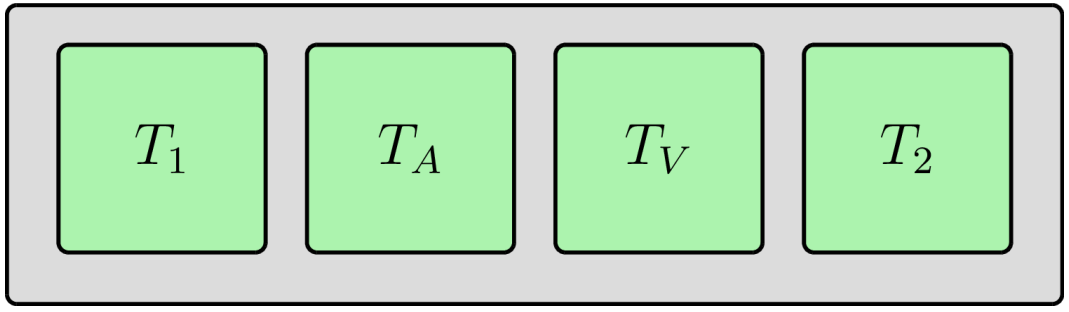
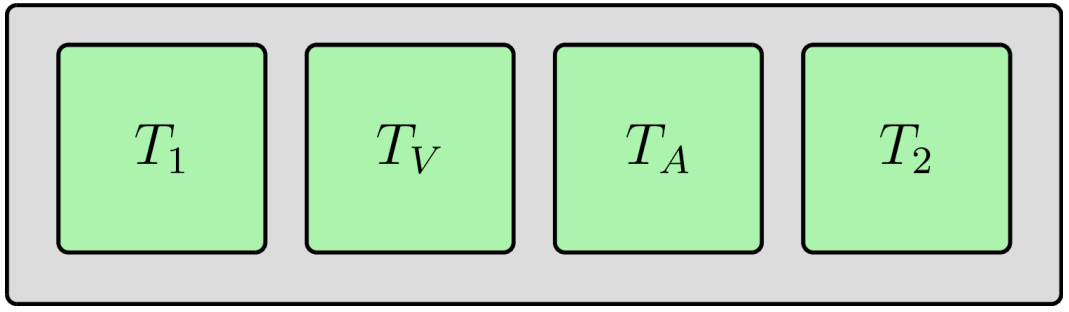
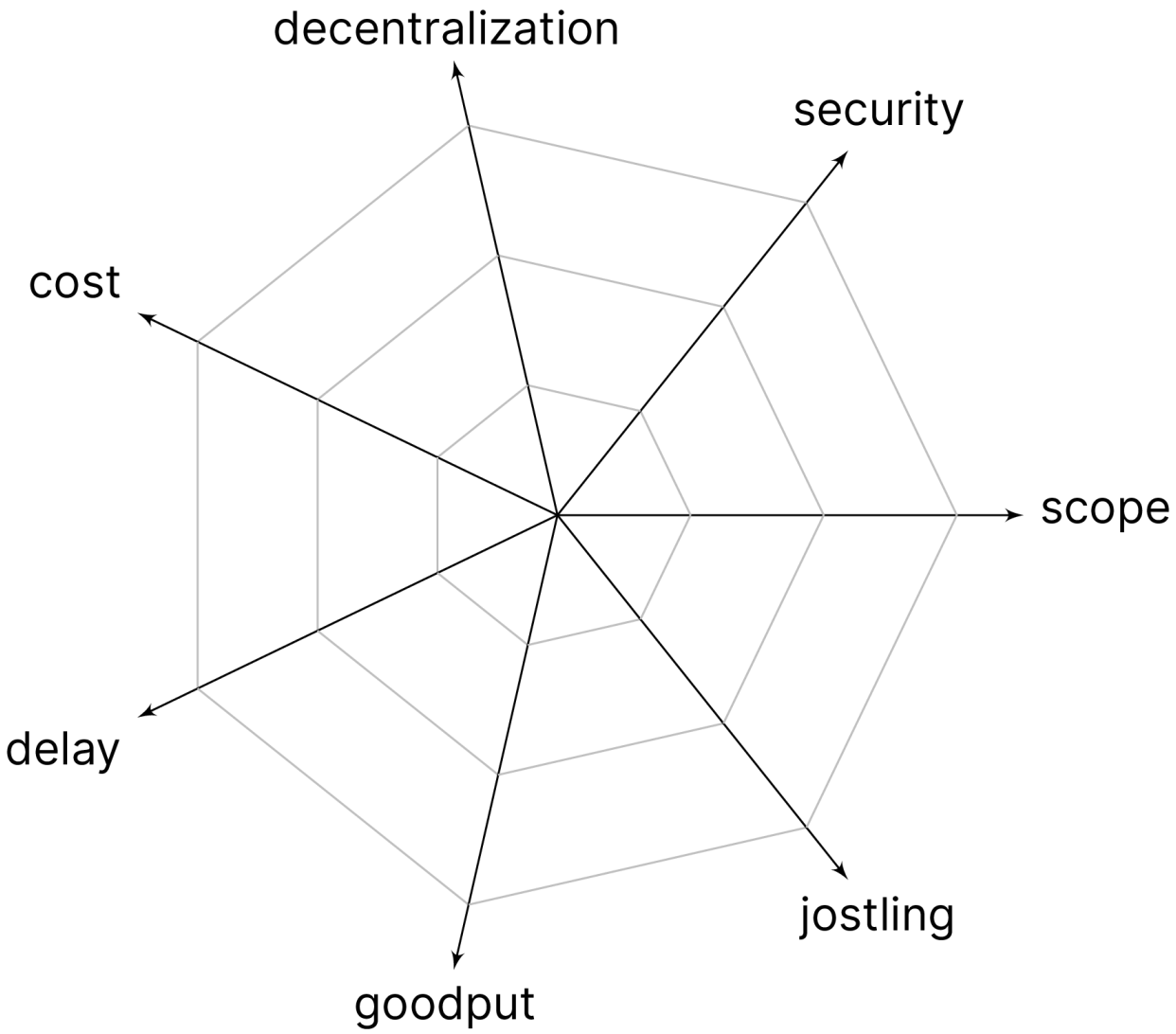


front-running

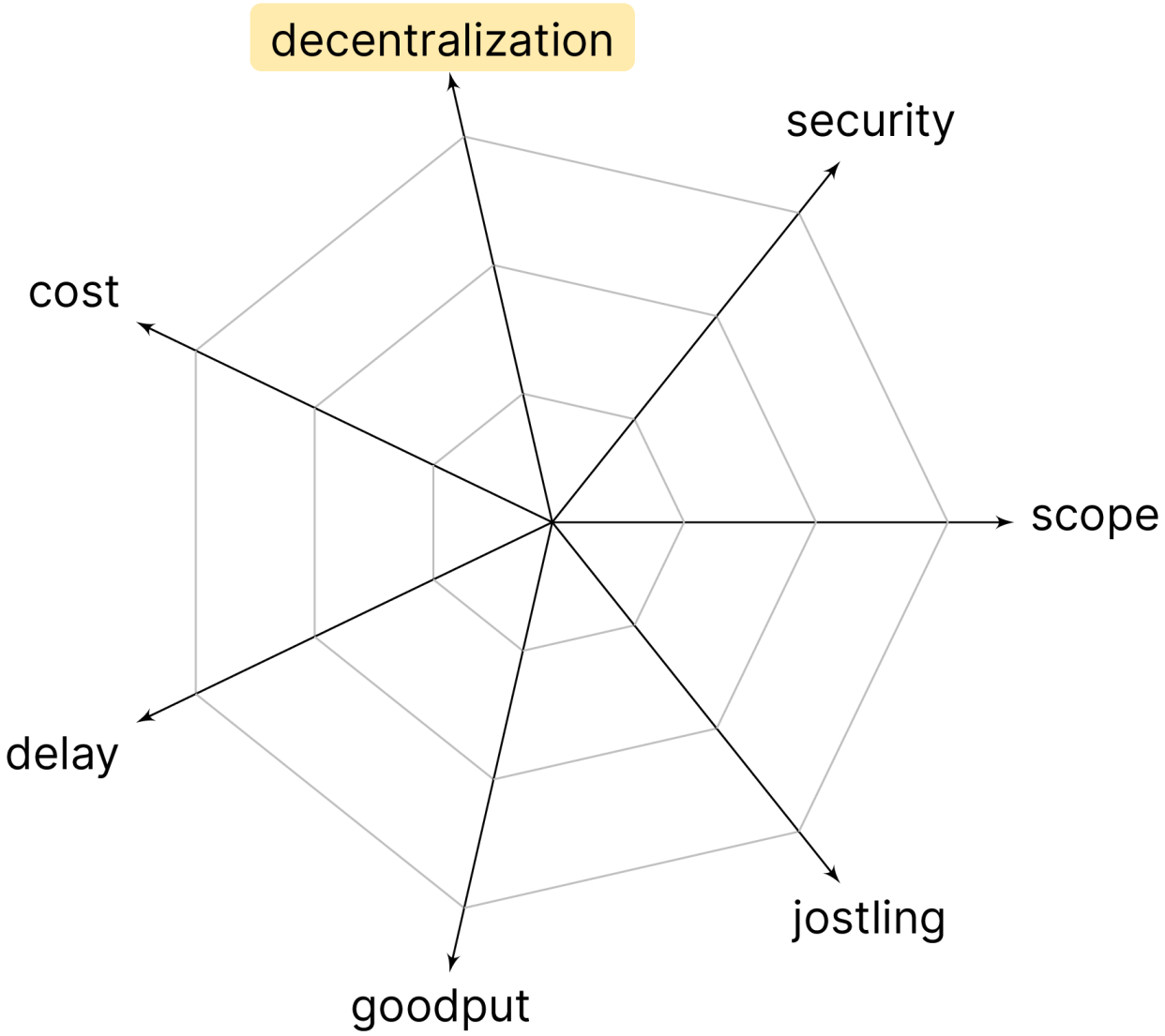


back-running

Measures

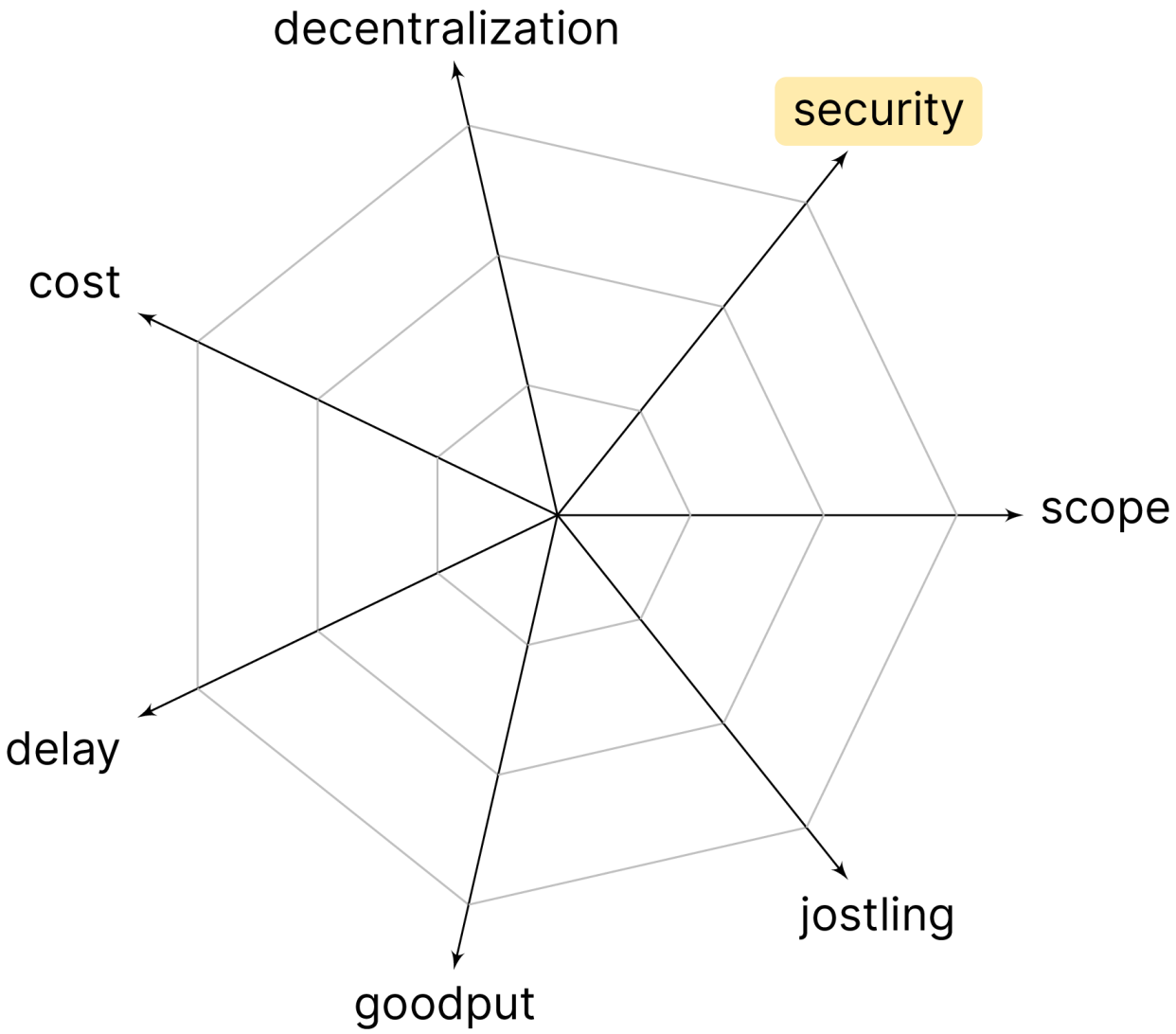

decentralization
security
cost
scope
delay
jostling
goodput

Measures



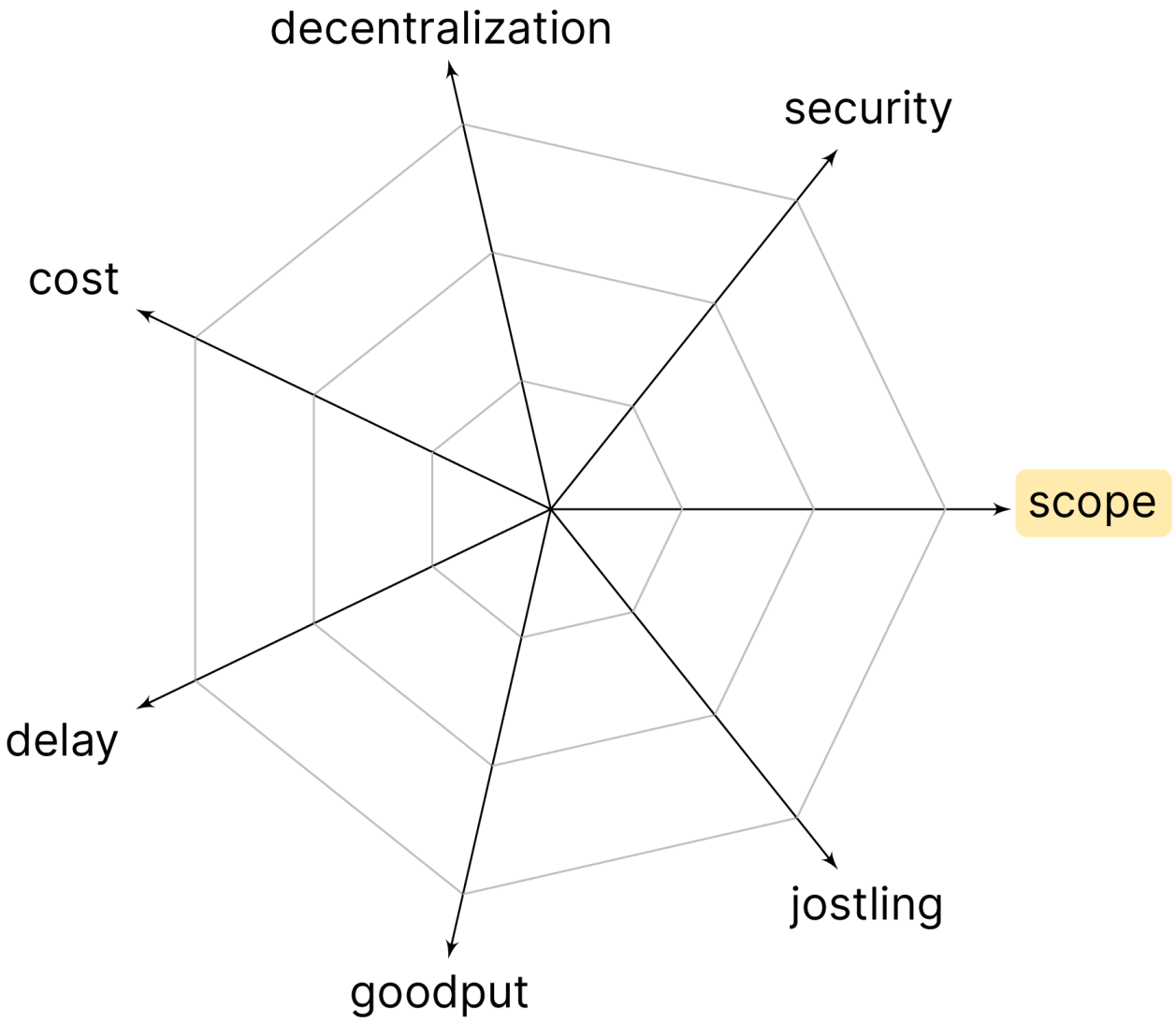
Does the approach decreases the level of decentralization?

Measures



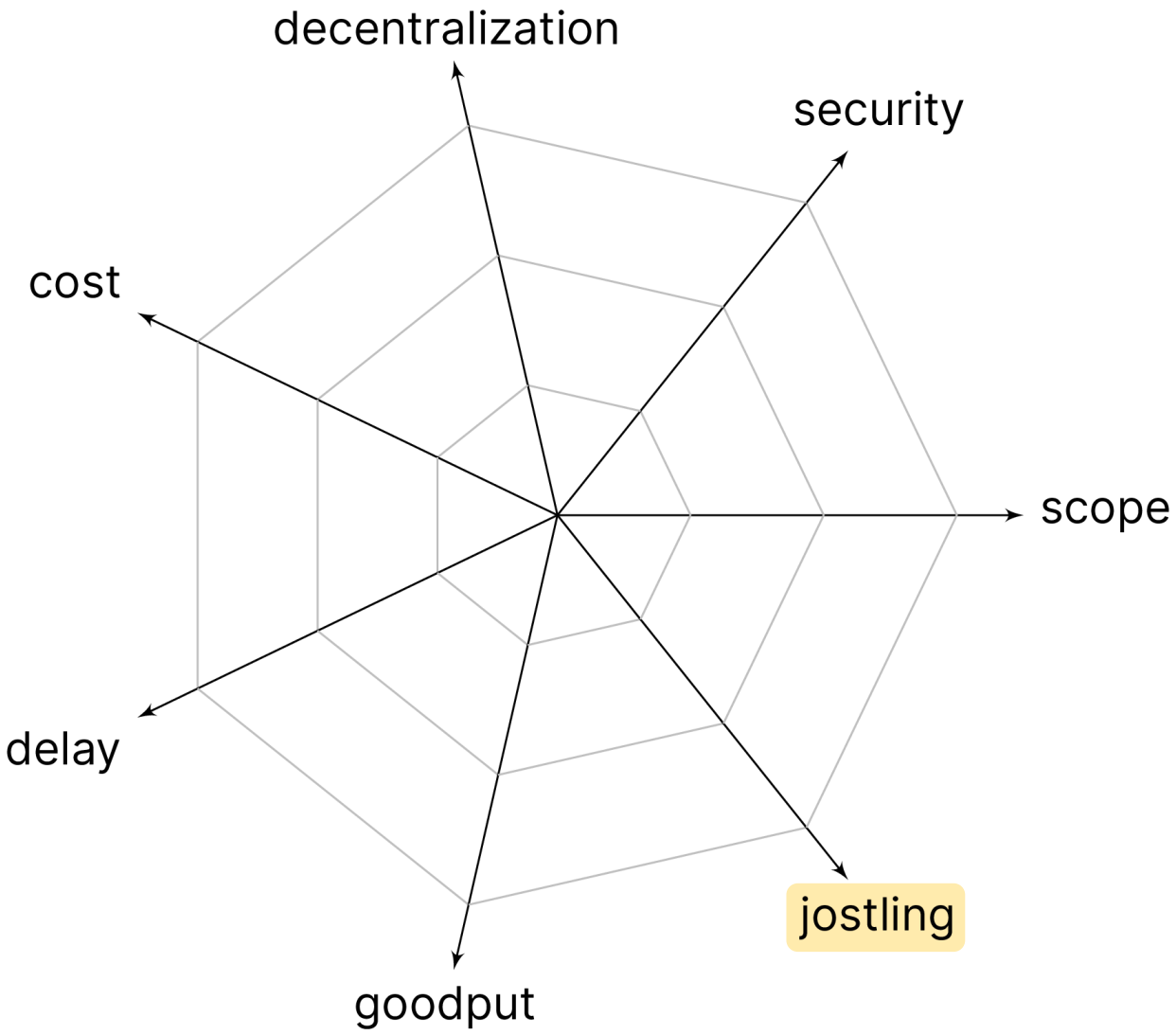
Is the approach susceptible to attacks?

Measures



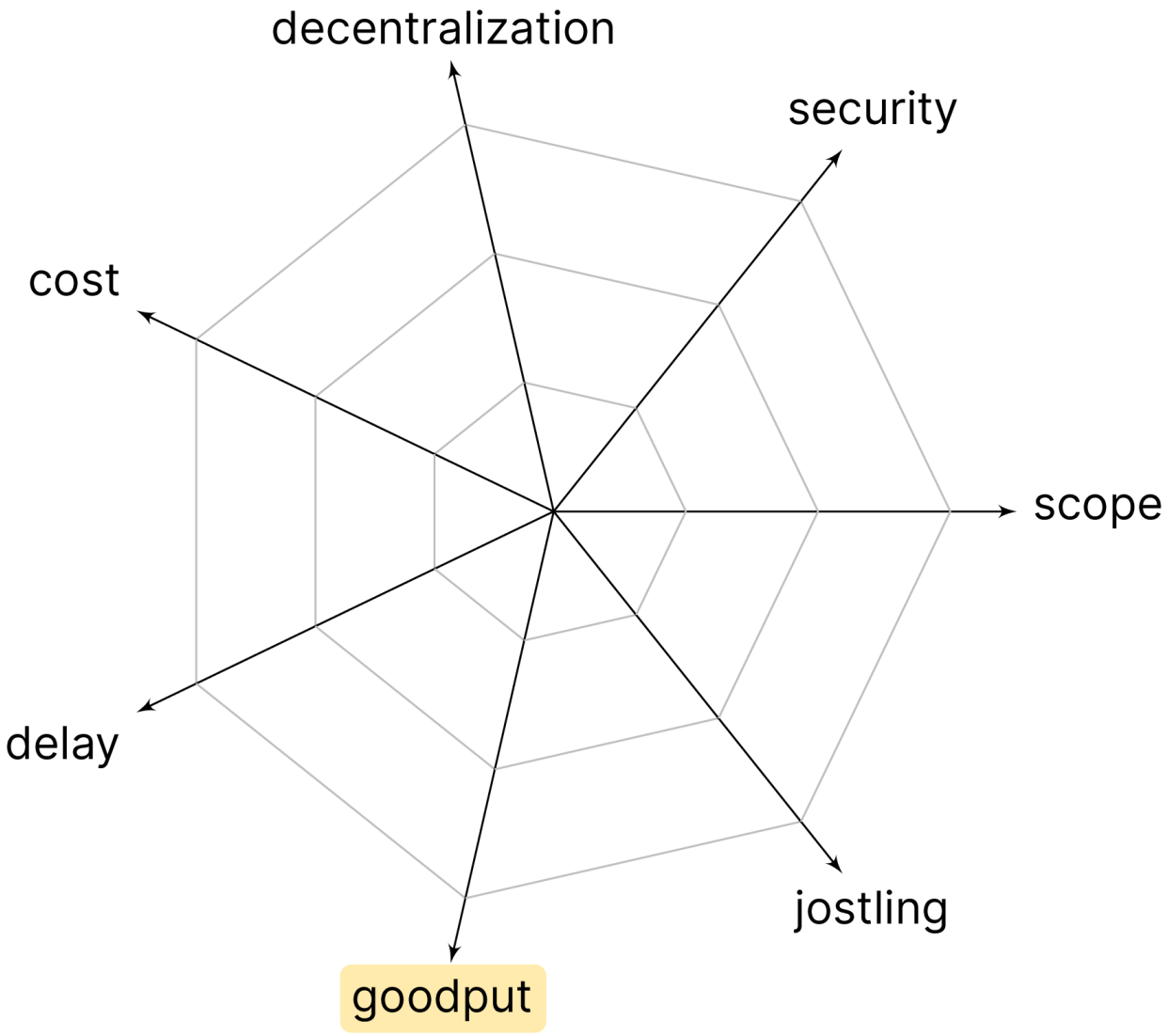
Is the approach wide-reaching?

Measures



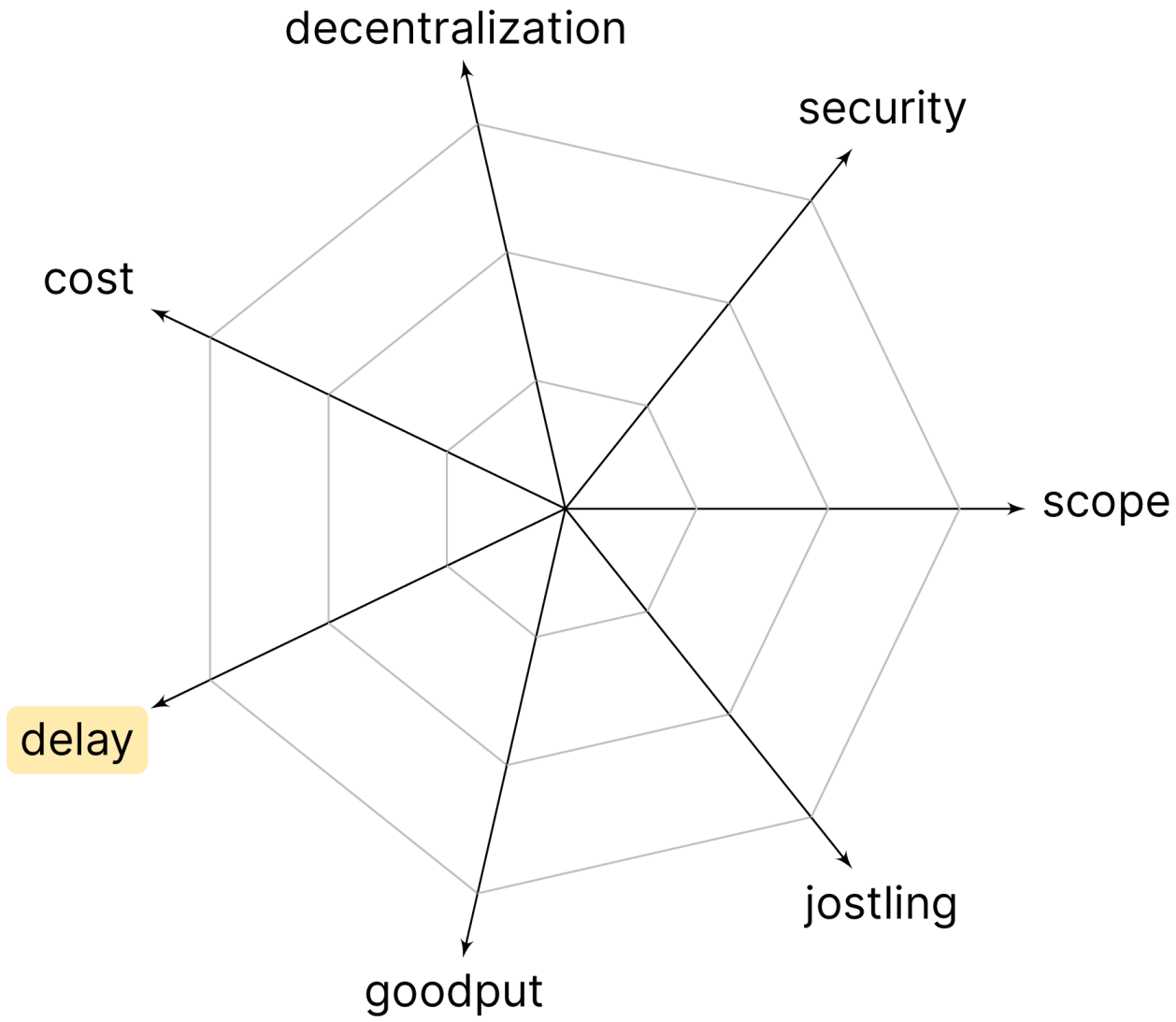
Does the approach create competition between traders for block inclusion?

Measures



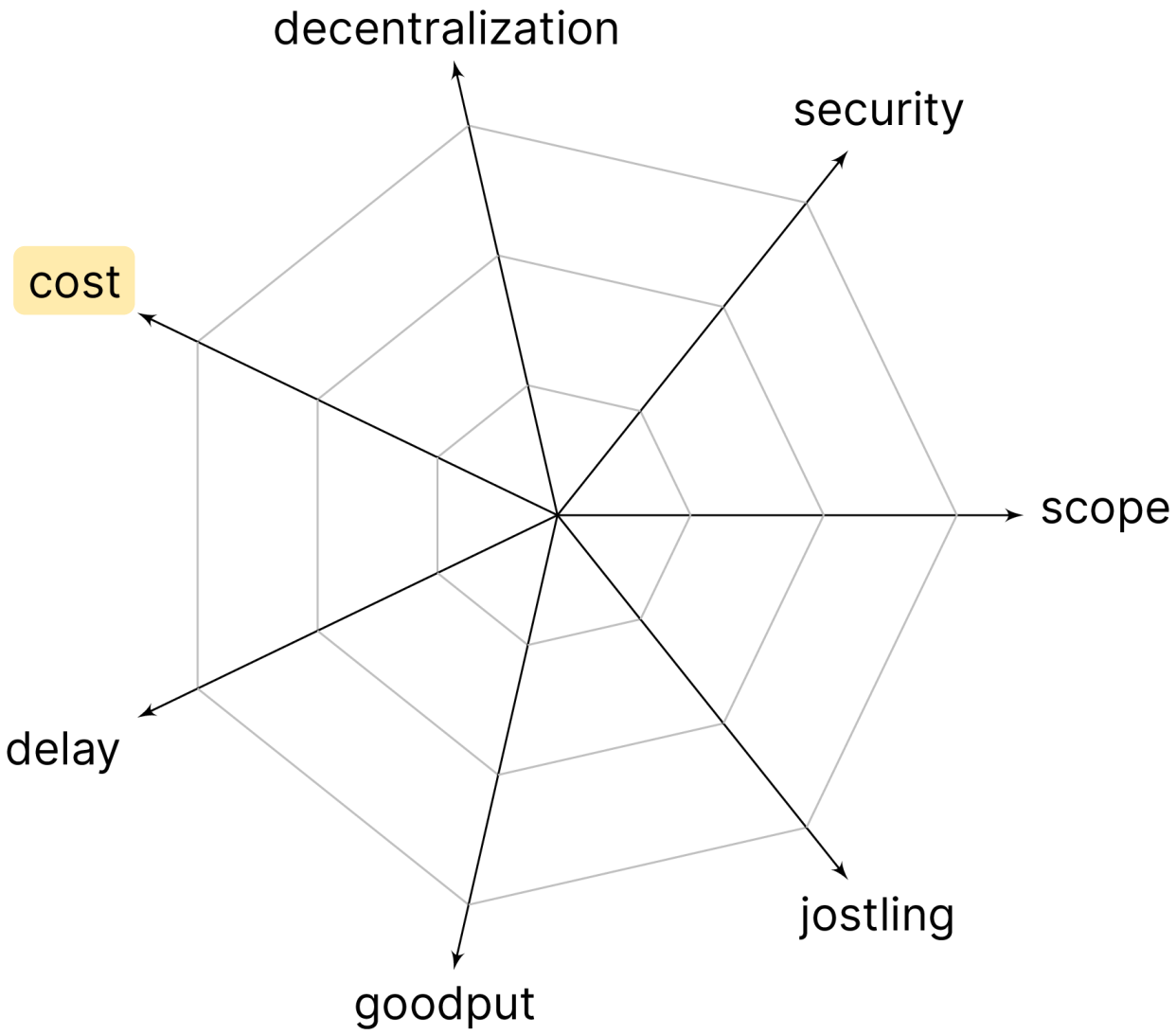
Does the approach impact the number of genuine transactions processed?

Measures



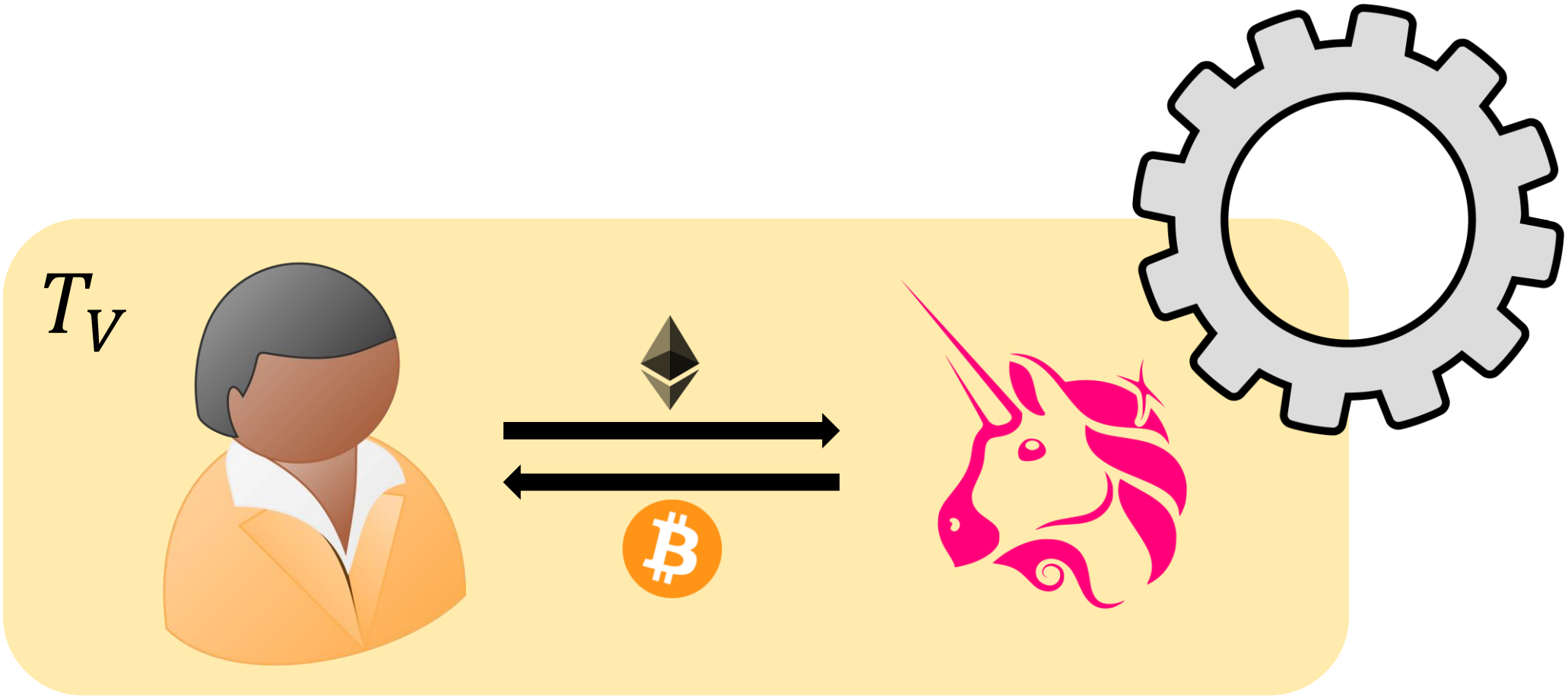
Does the approach delay transaction execution?

Measures

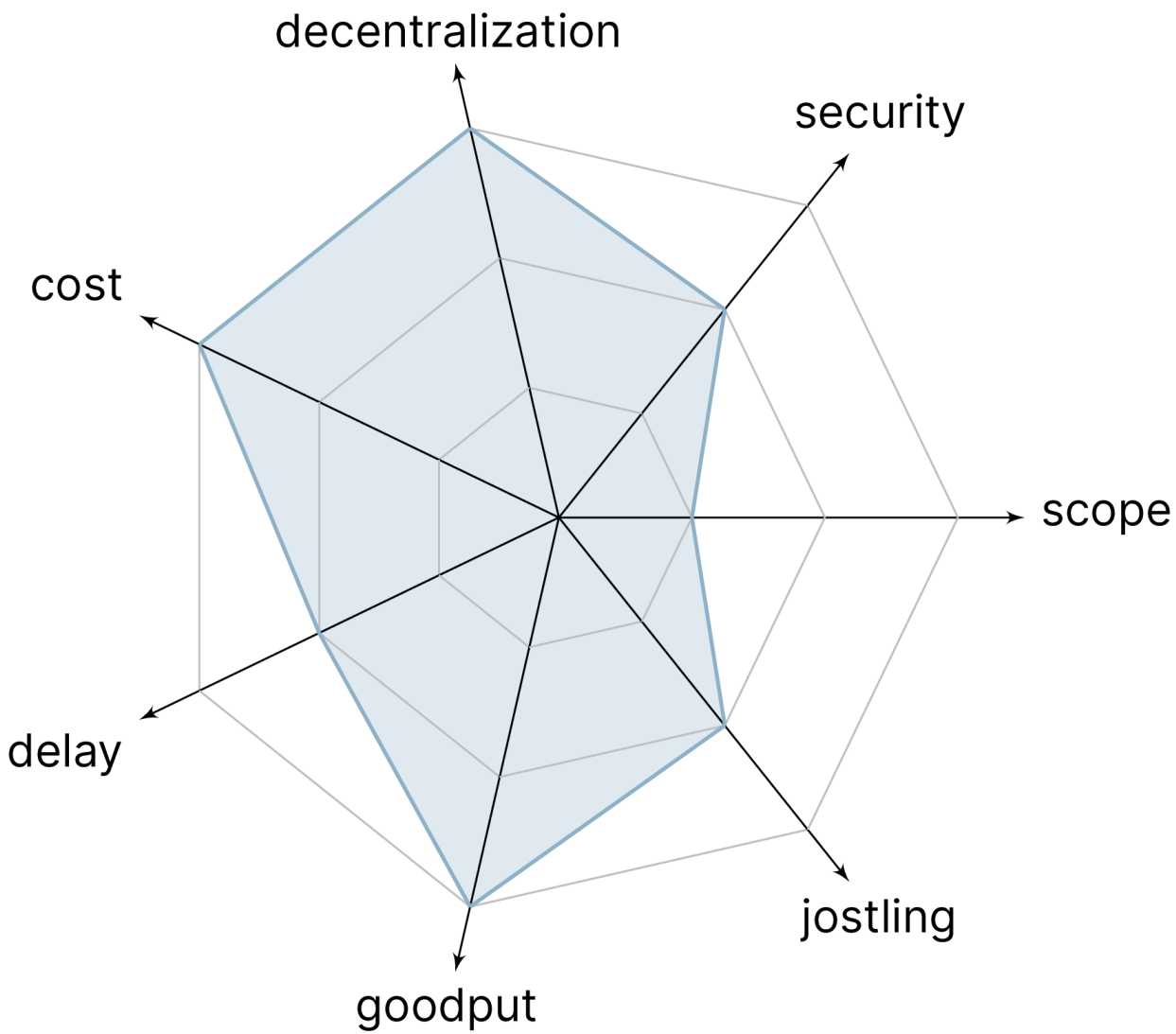


Does the approach create additional costs for transaction execution?

Optimized Trade Execution



Optimized Trade Execution



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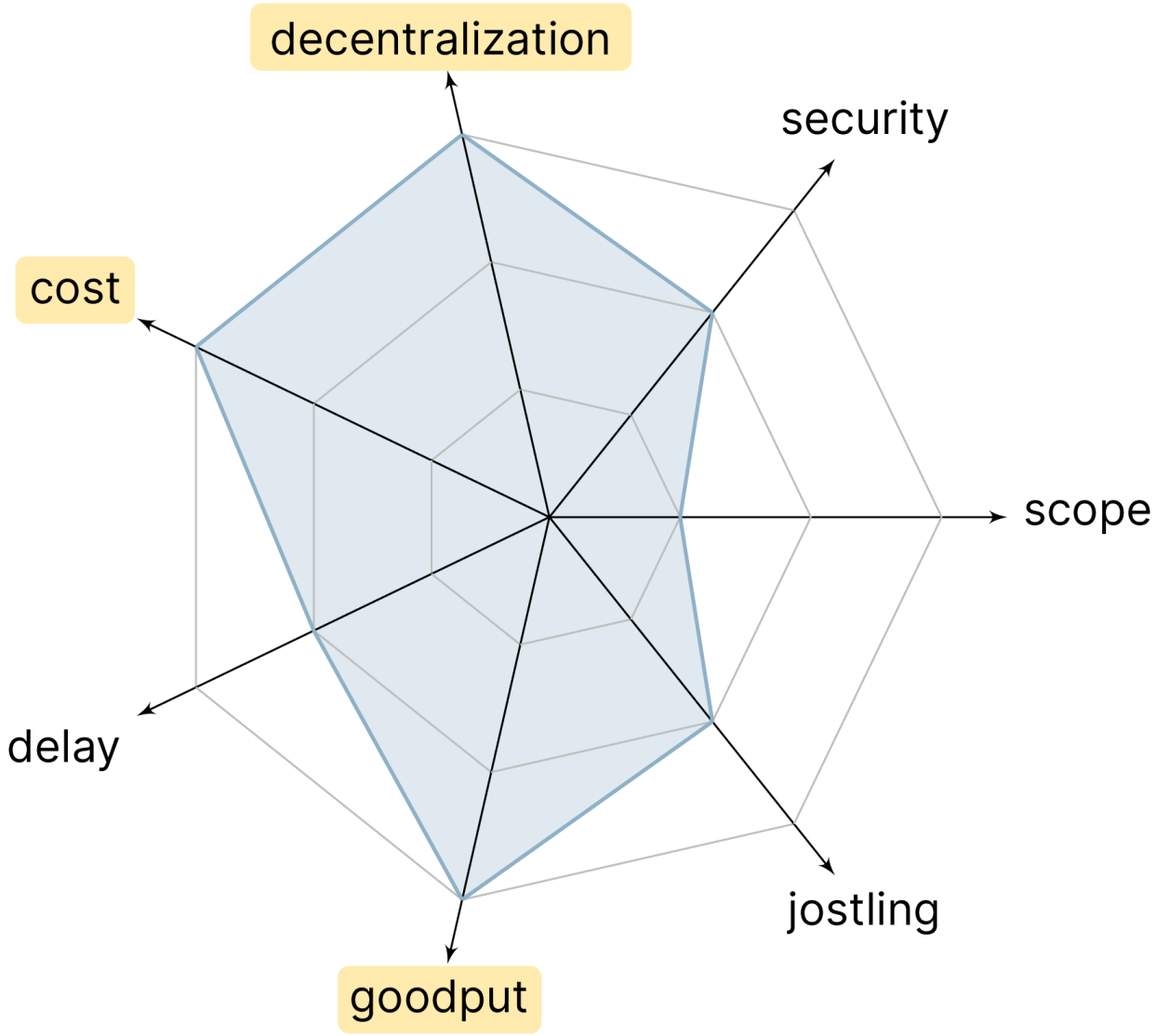
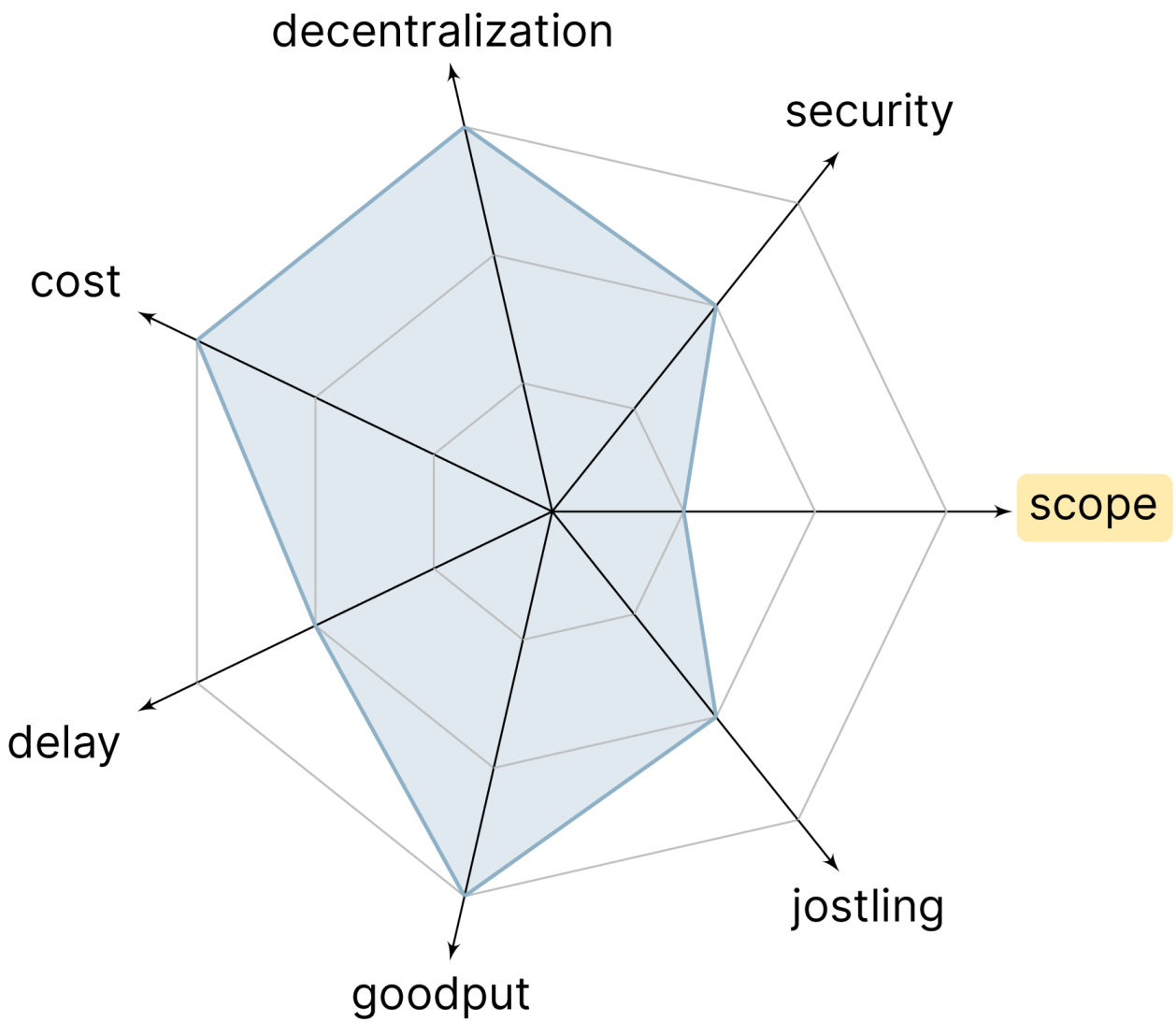
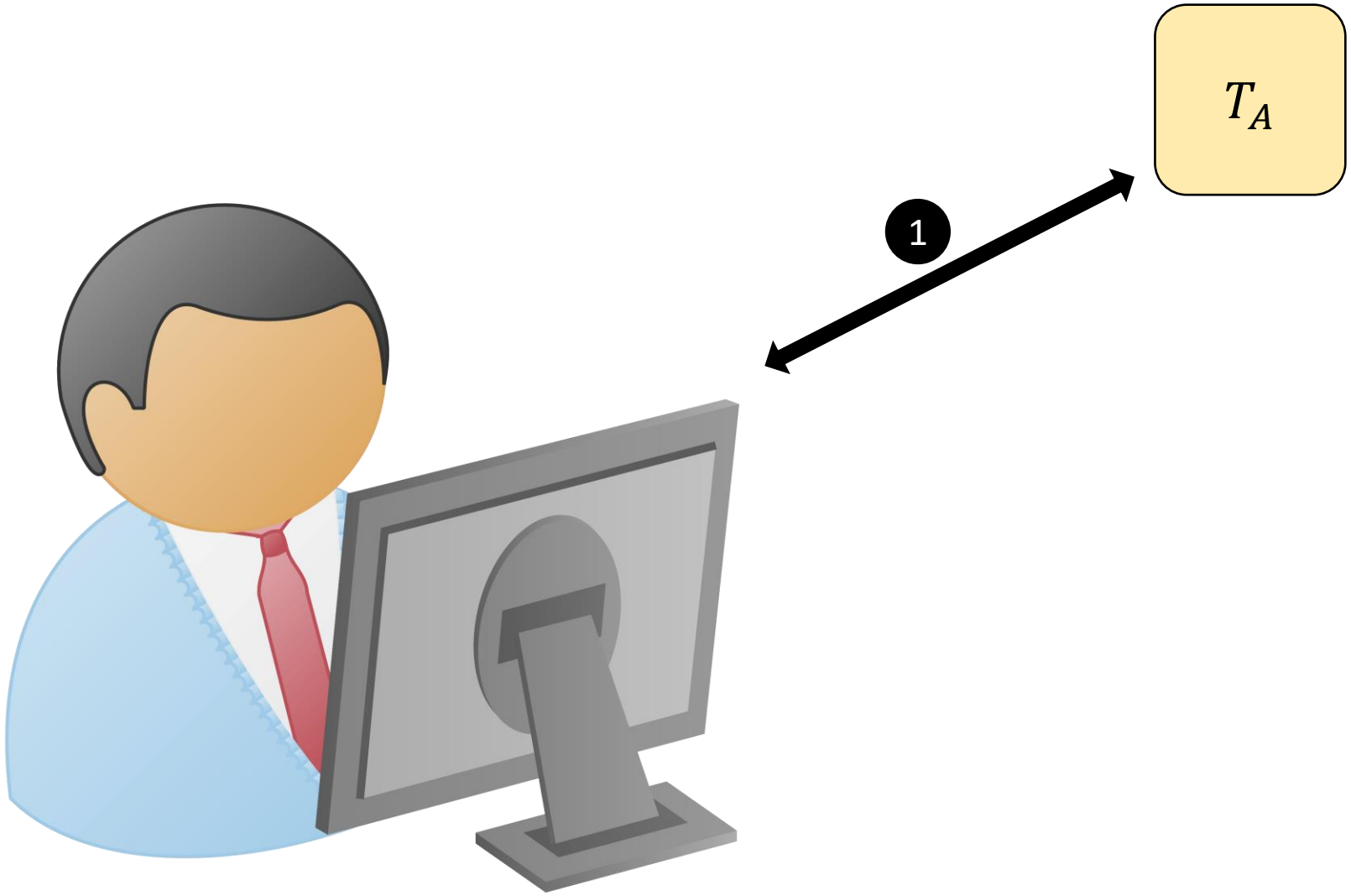


Optimized Trade Execution



Professional Market Makers



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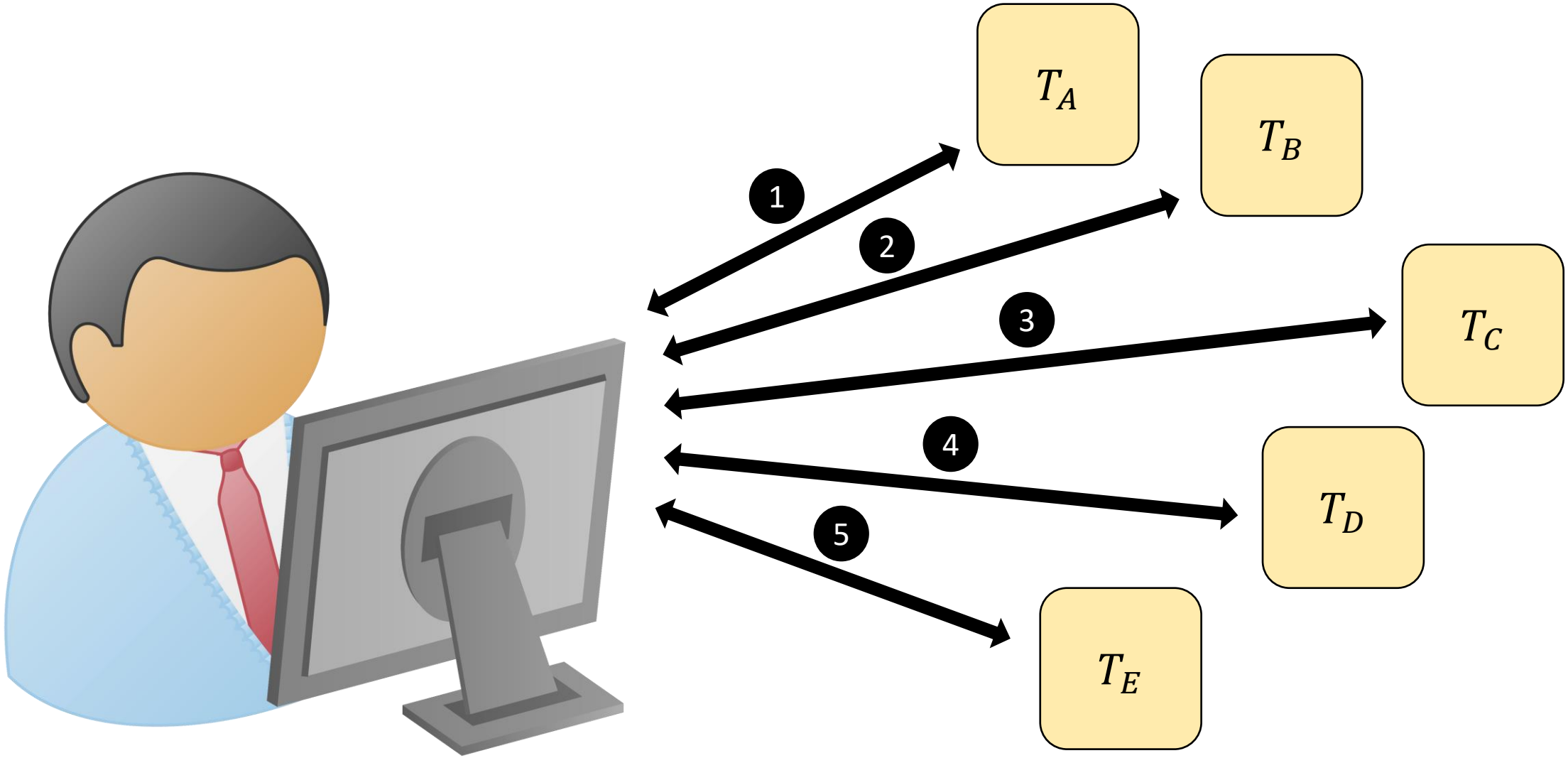

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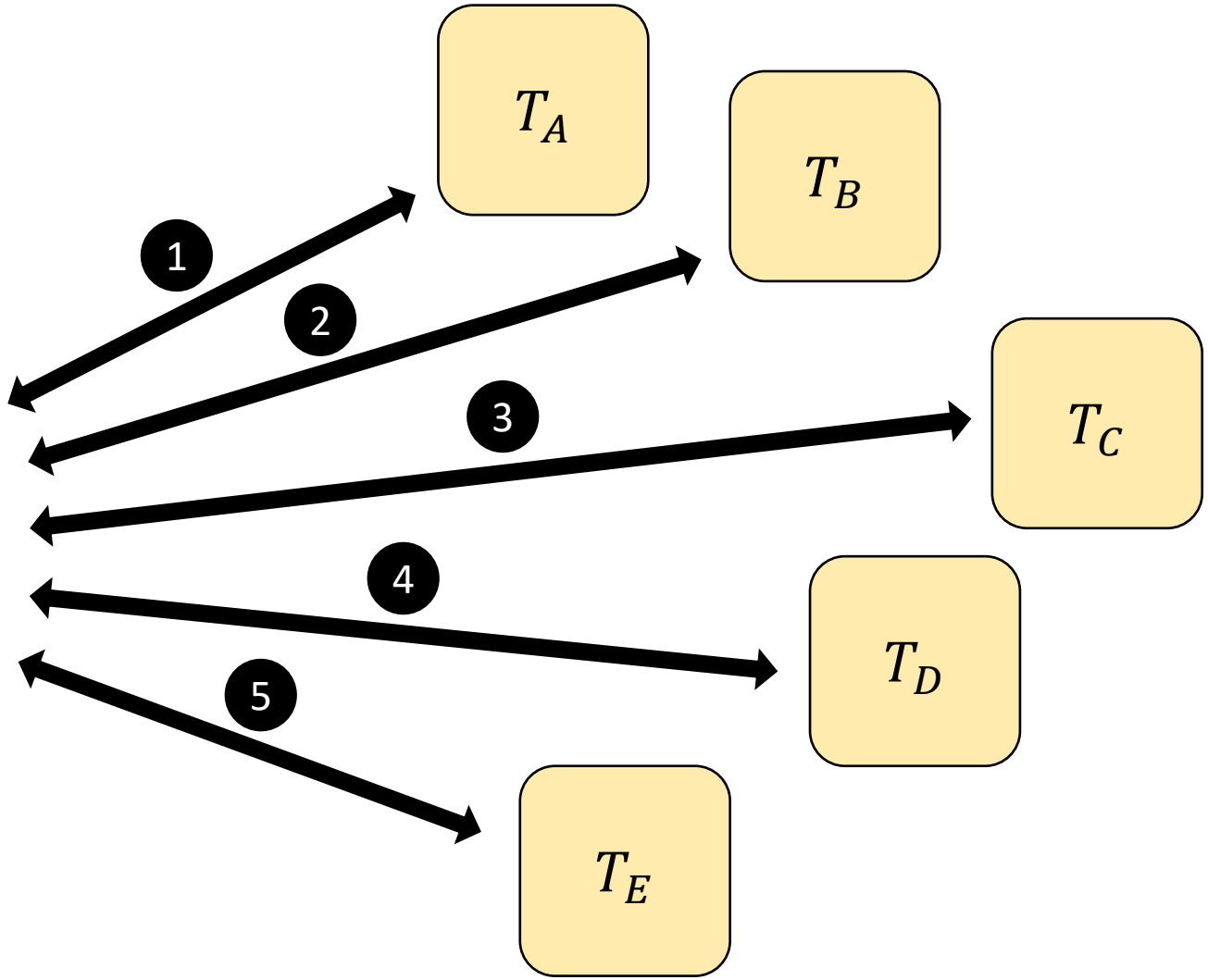

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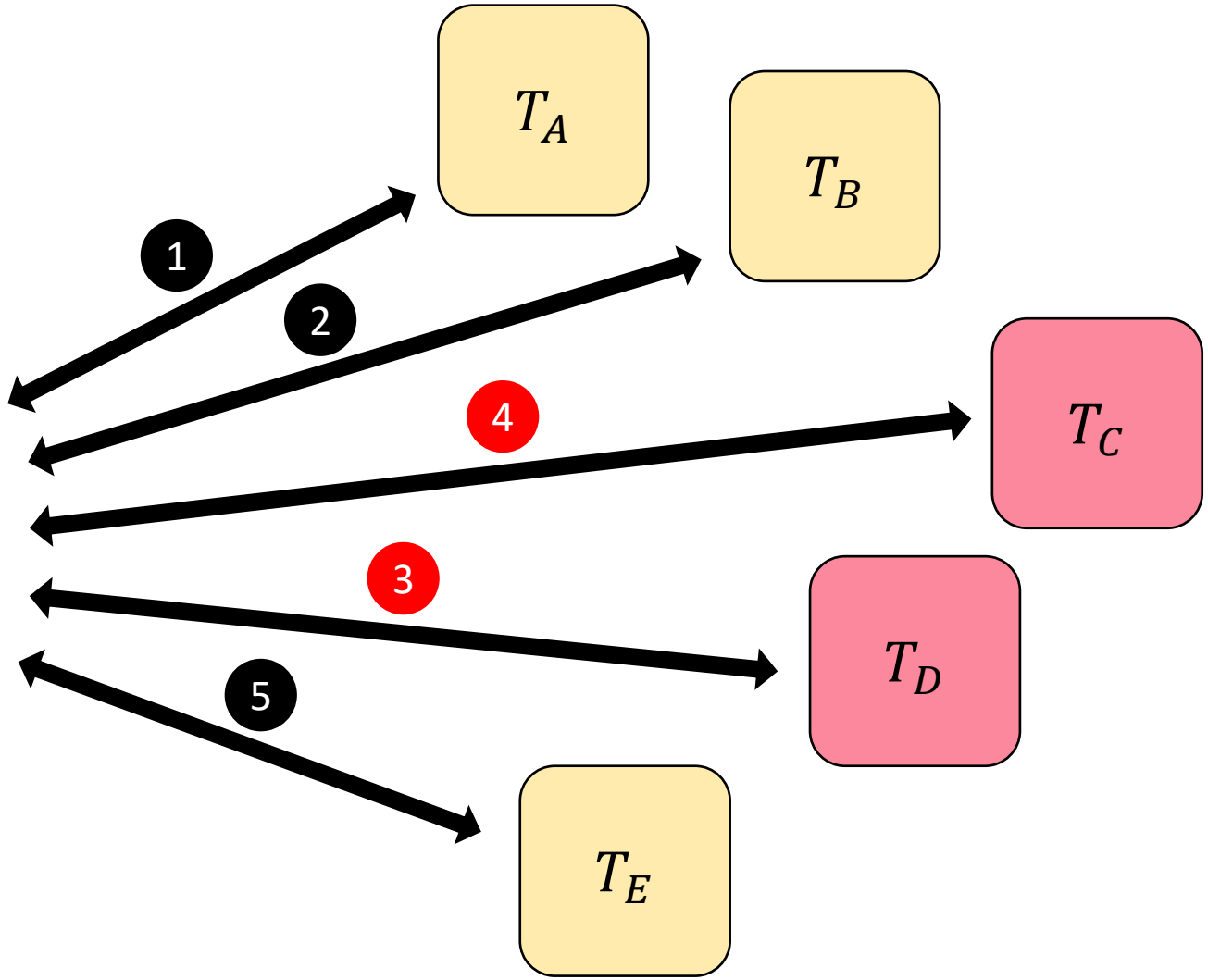

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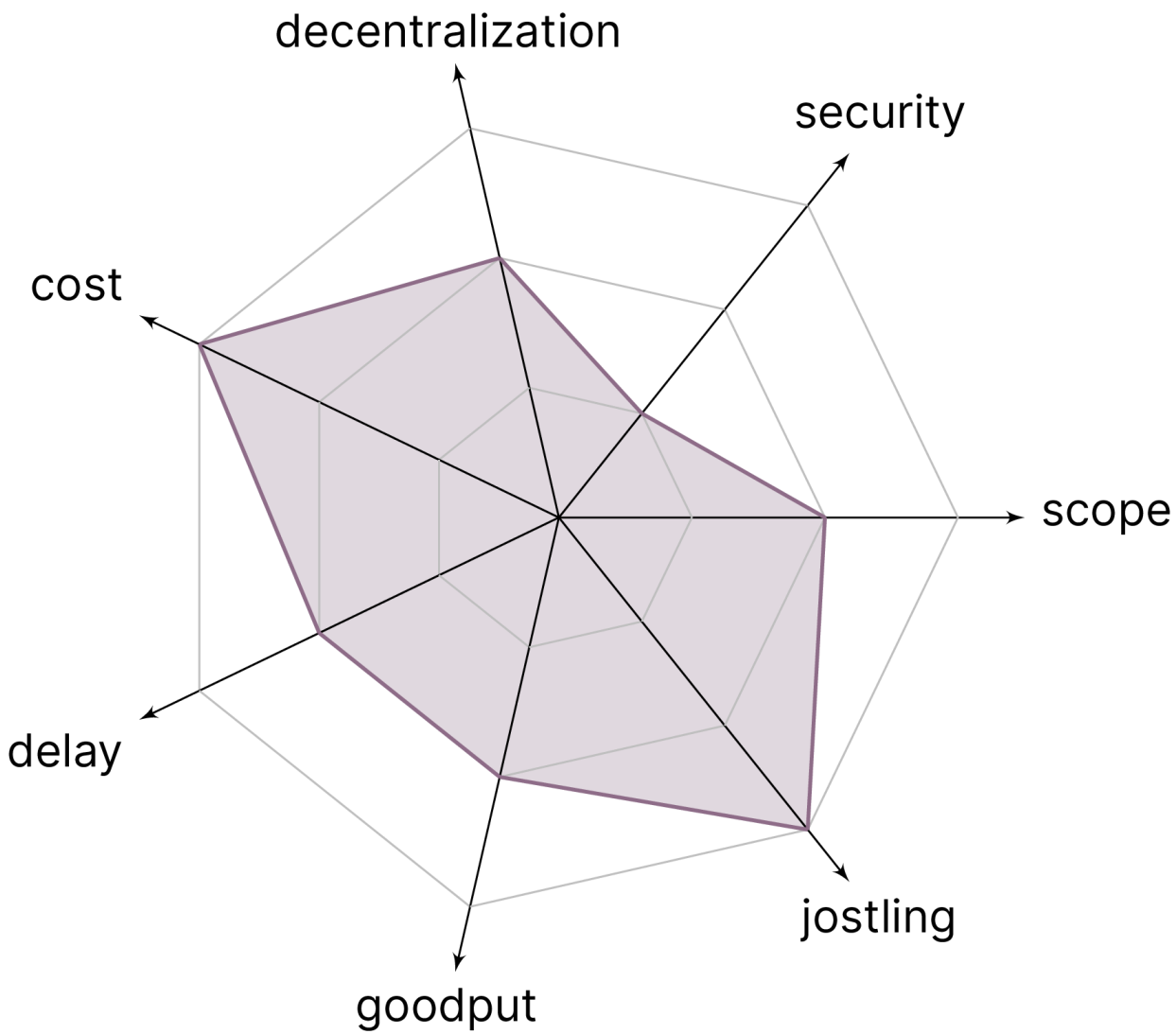

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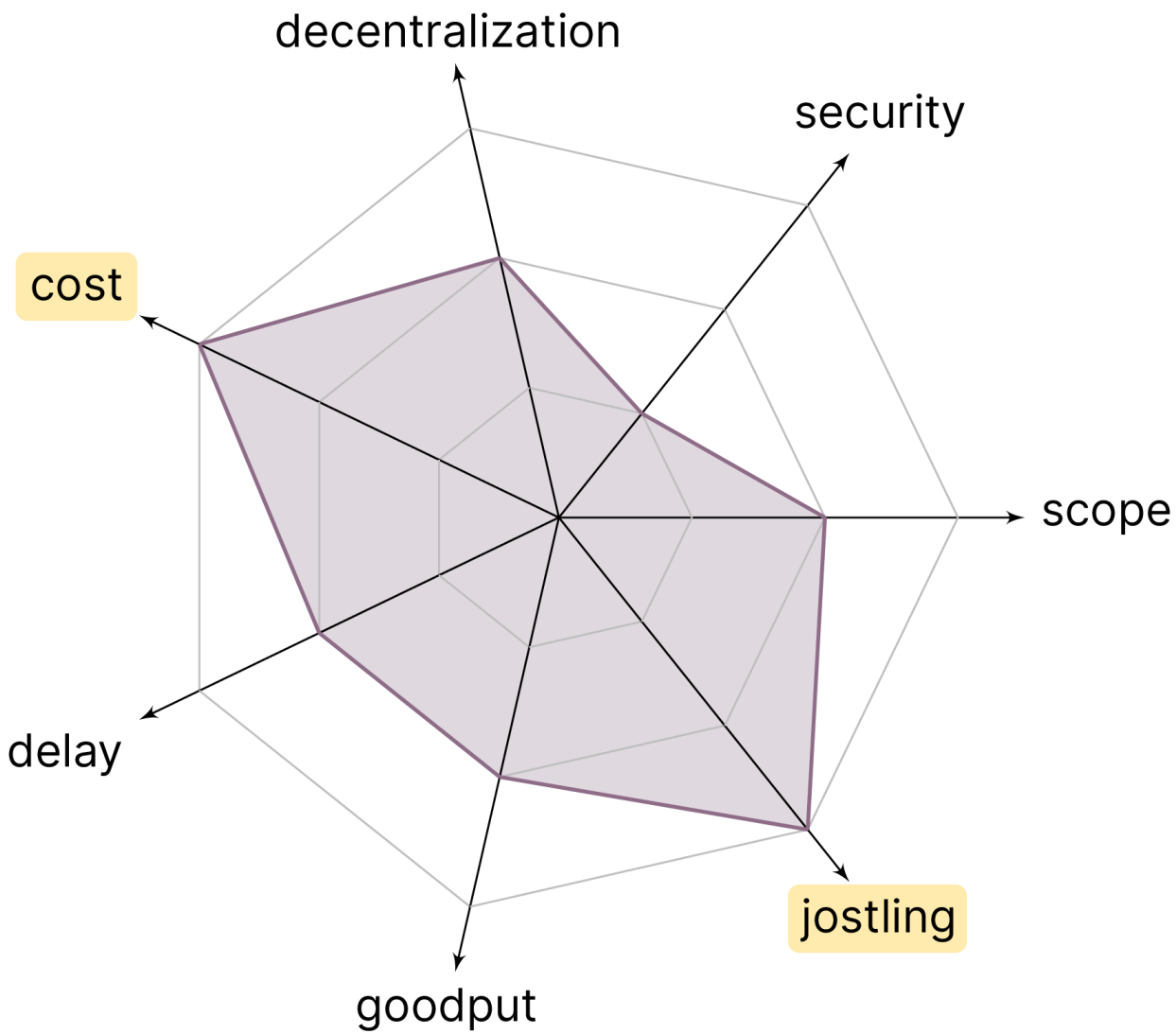

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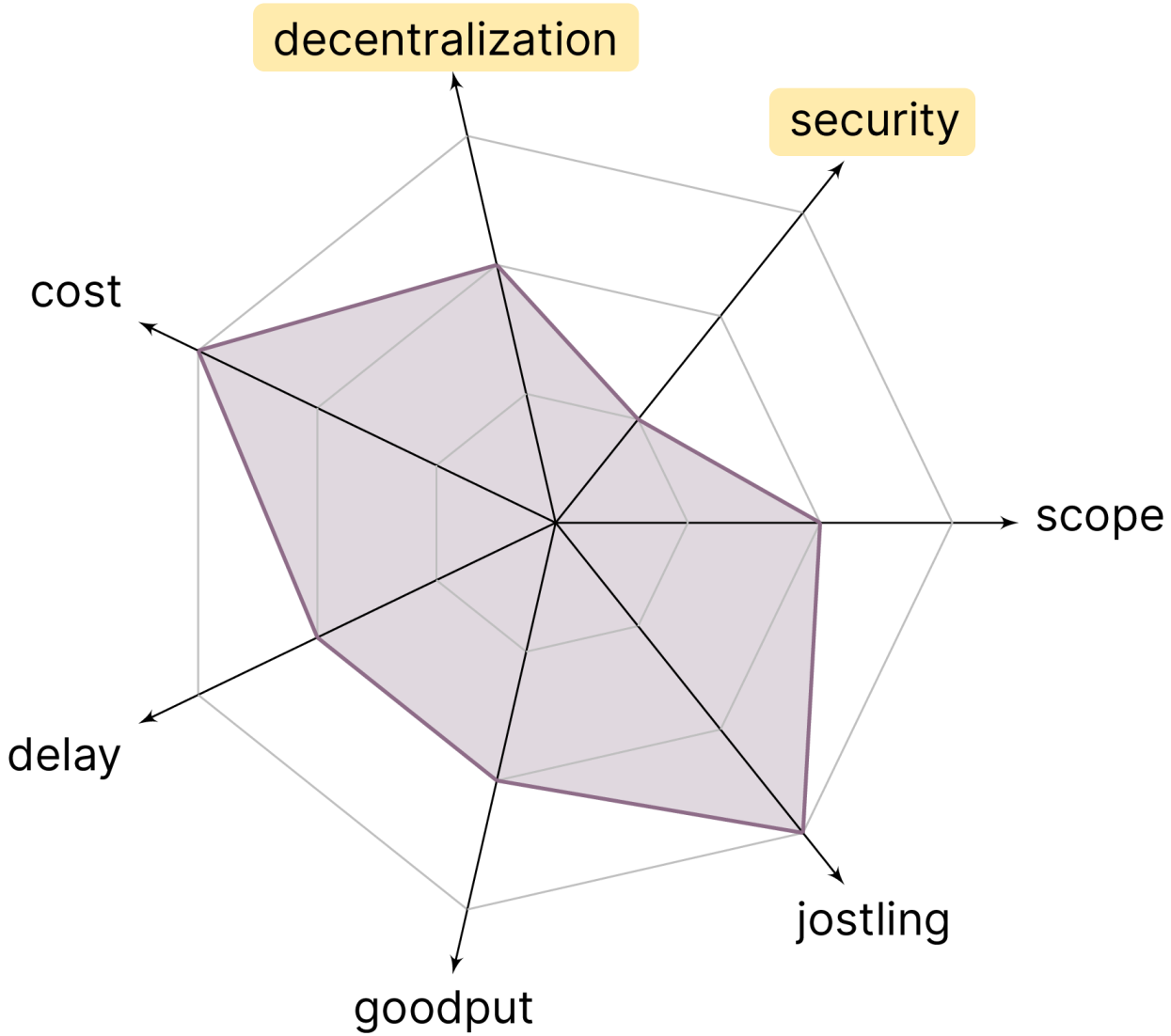
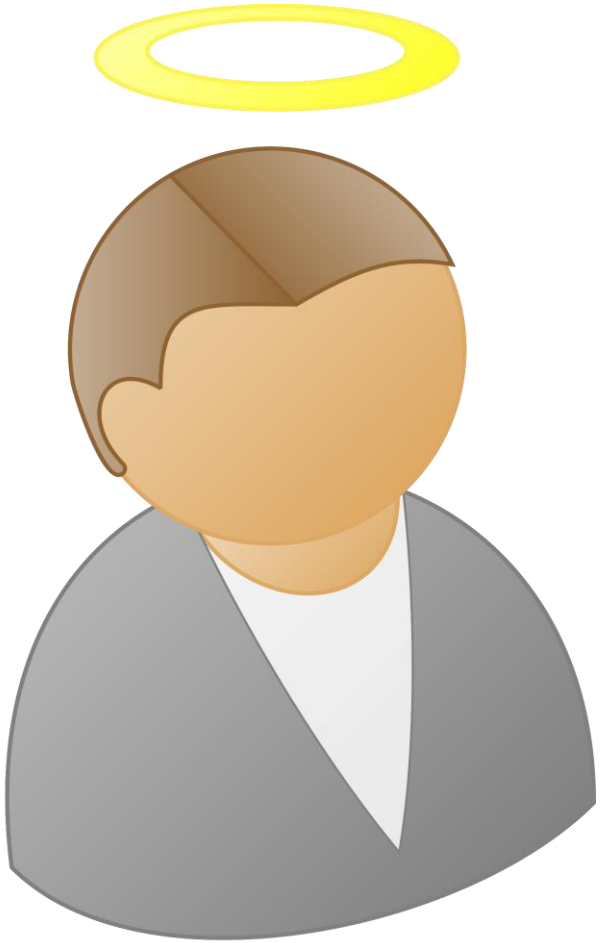


Trusted Third Party Ordering



T_E

T_A

T_B

T_C

T_D

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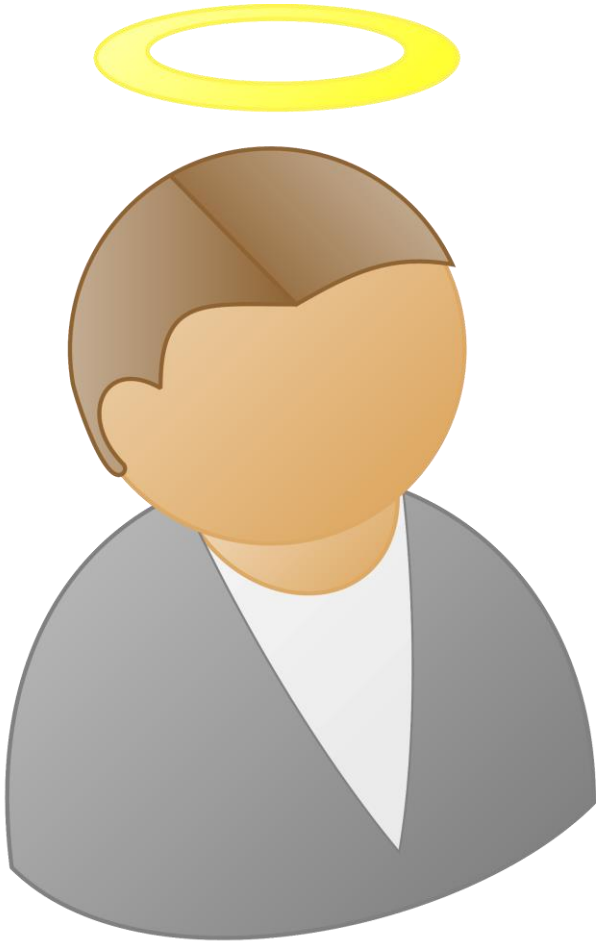

T_A T_B T_C T_D T_E

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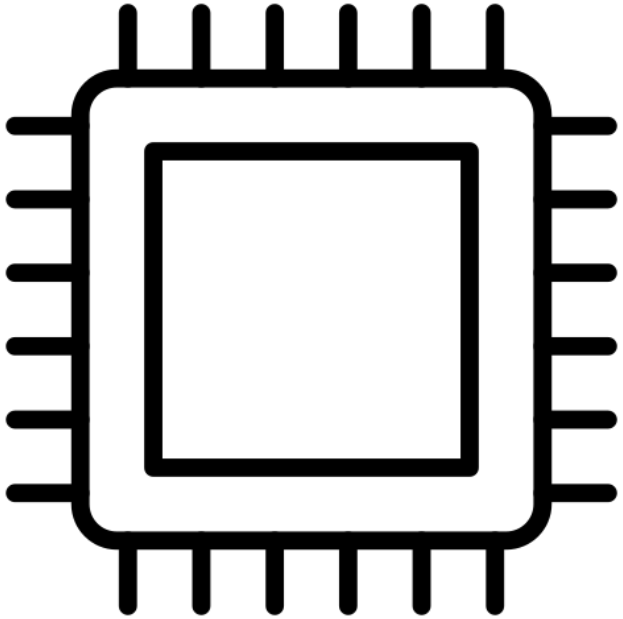

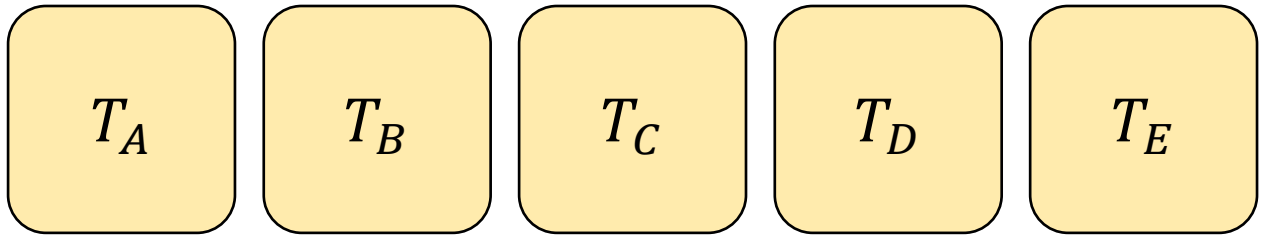

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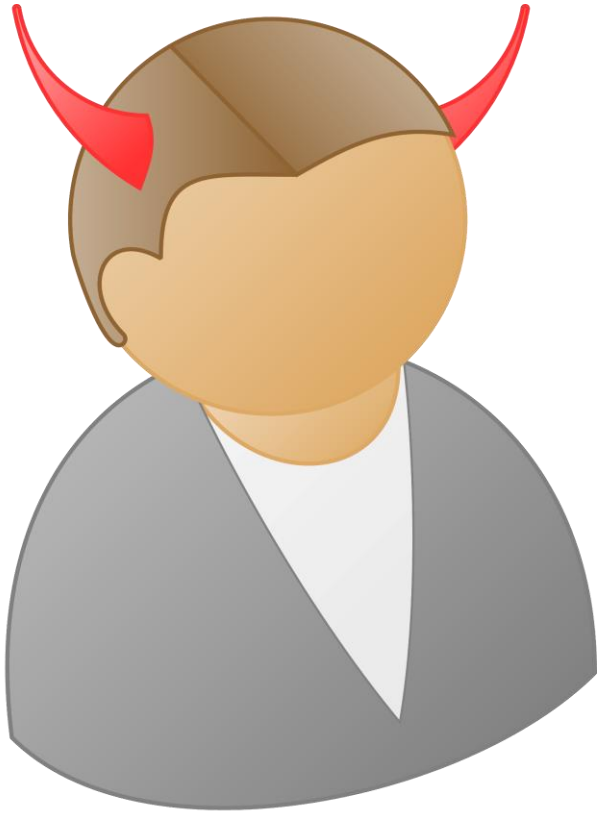

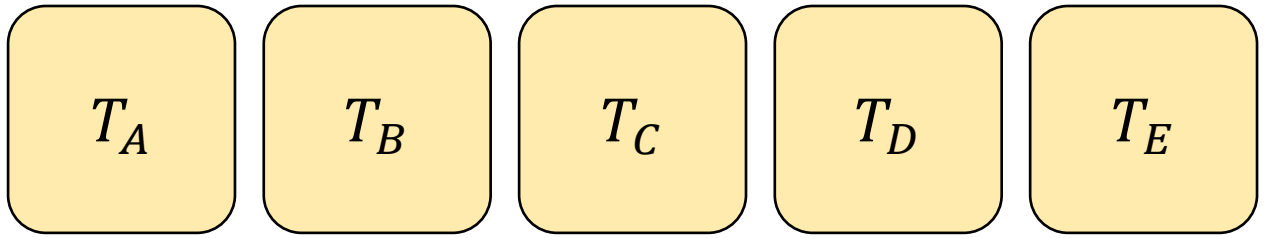

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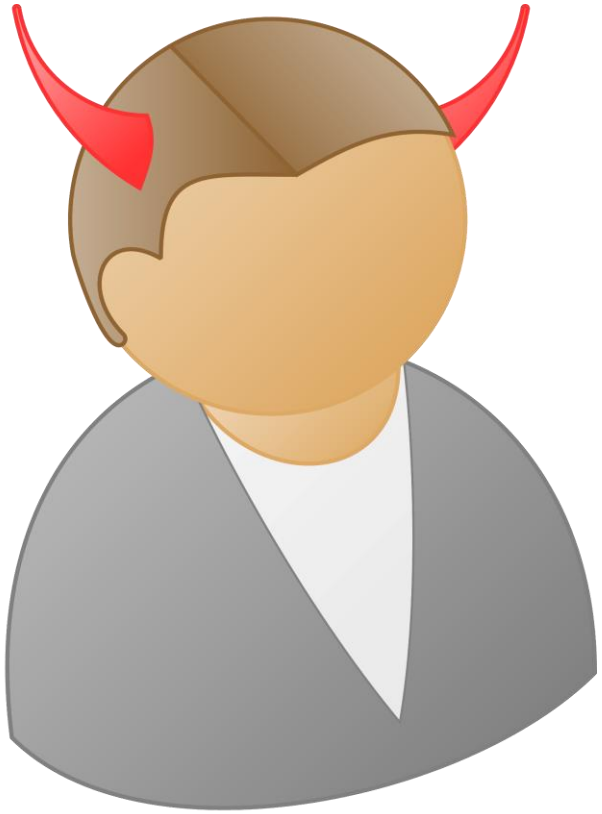

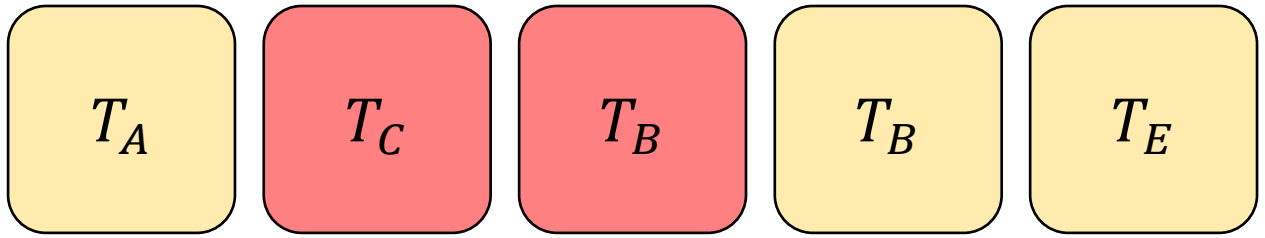

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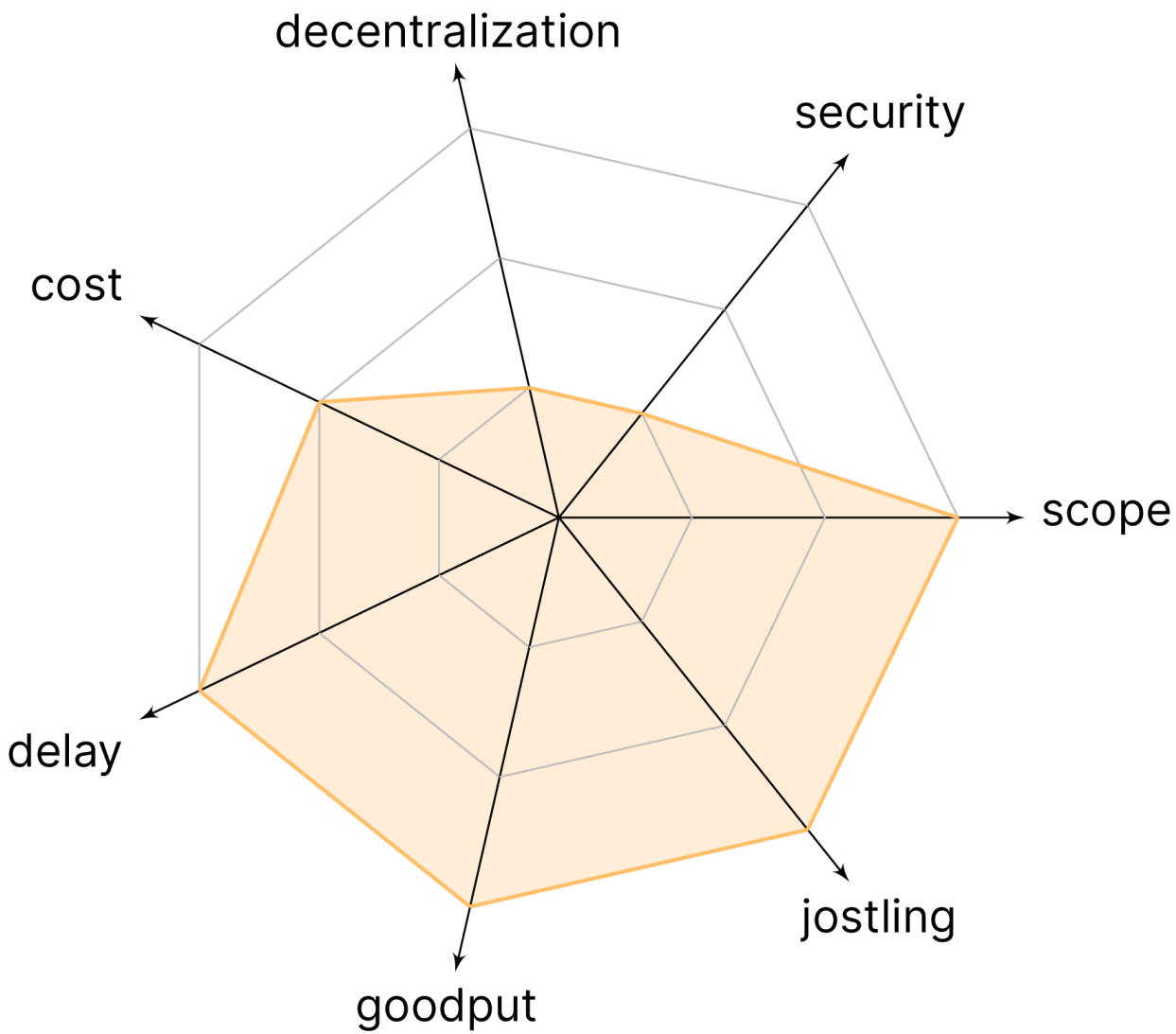

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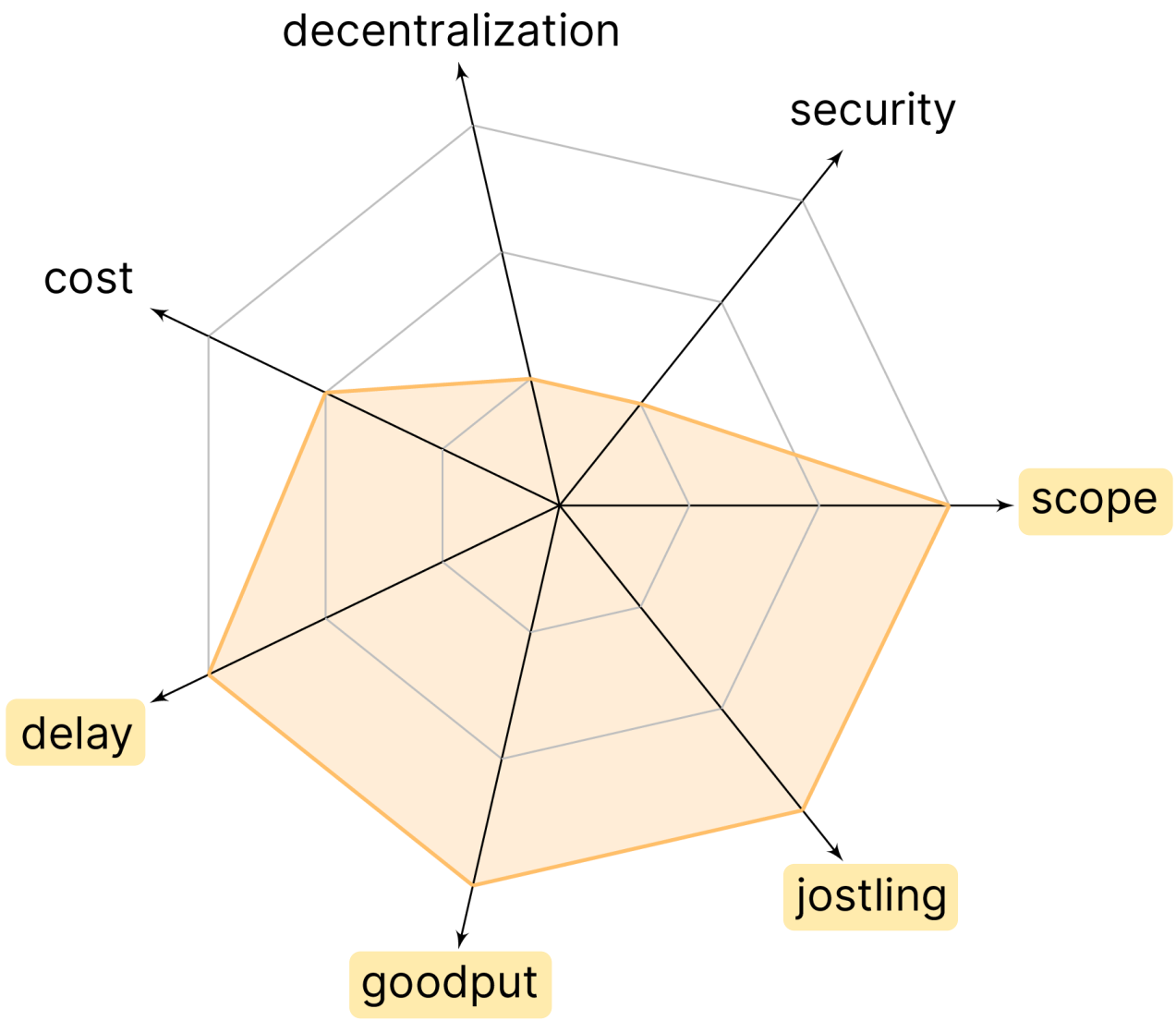

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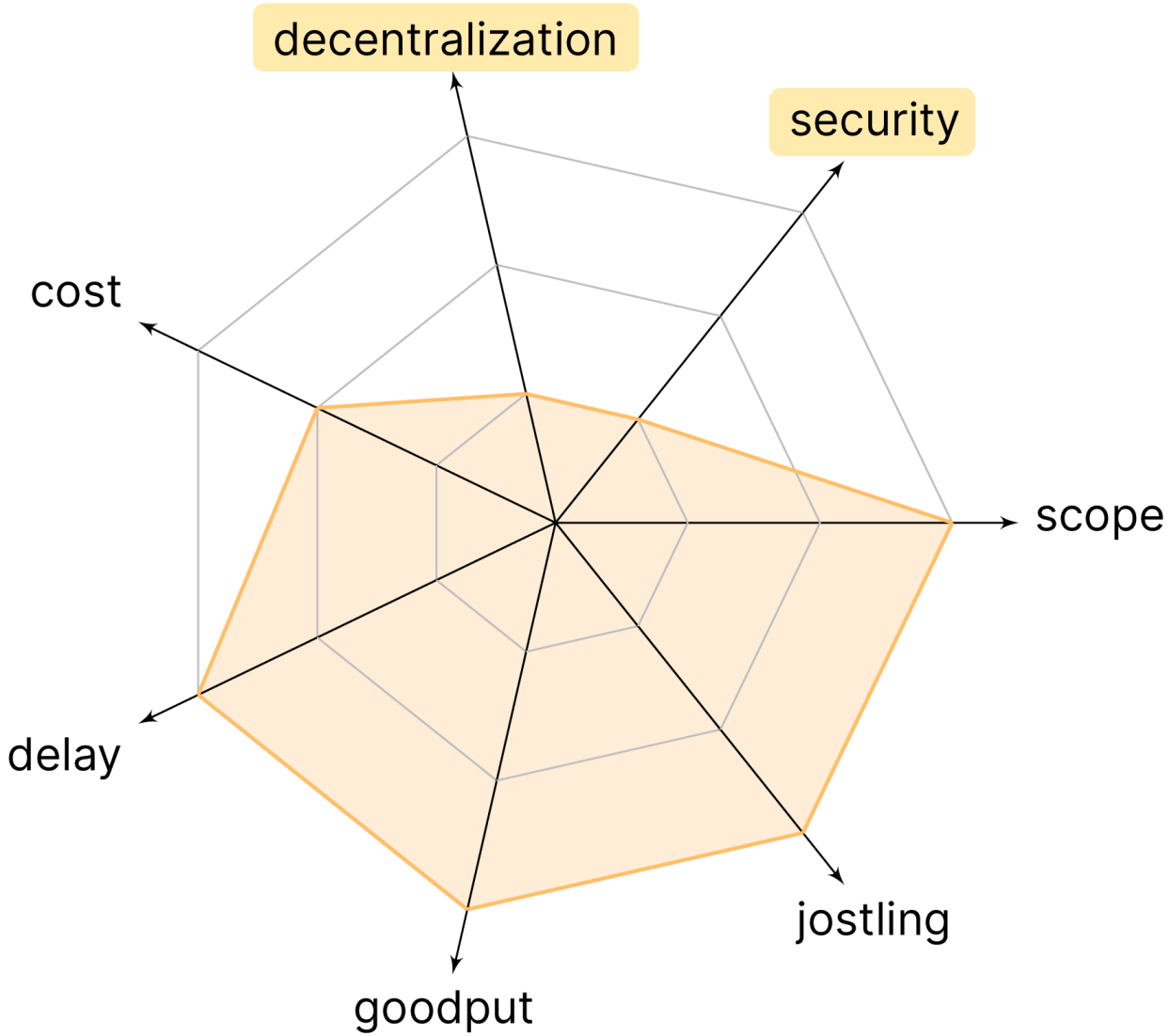
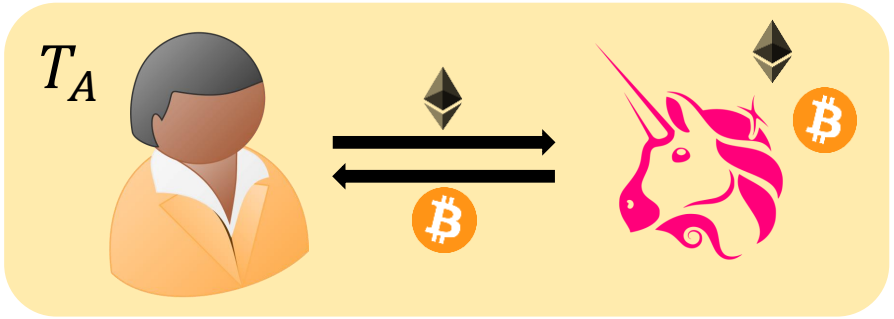


eUTXO



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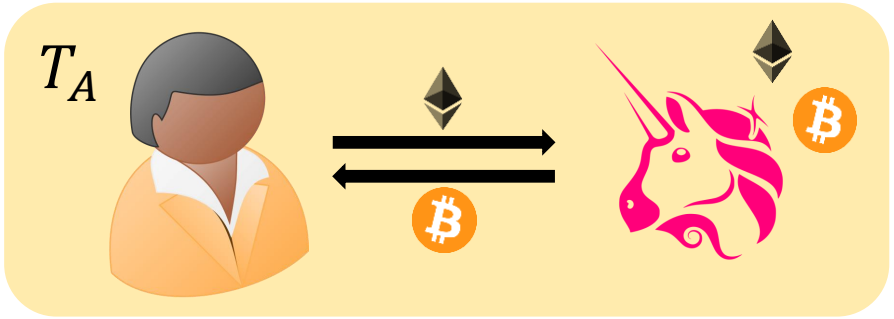

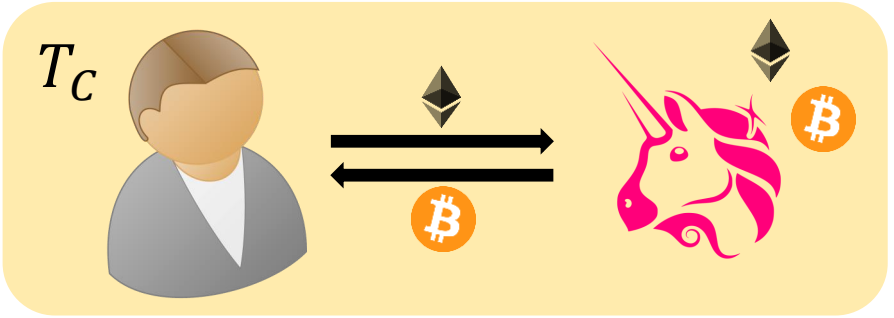

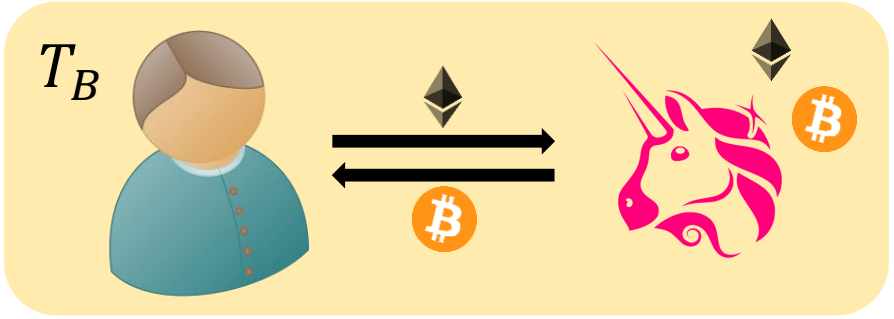

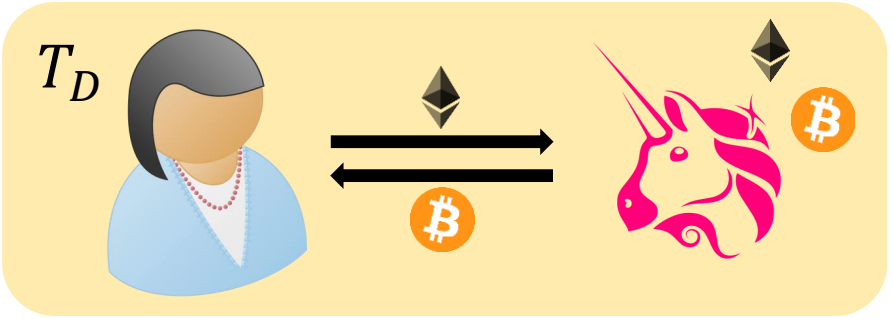

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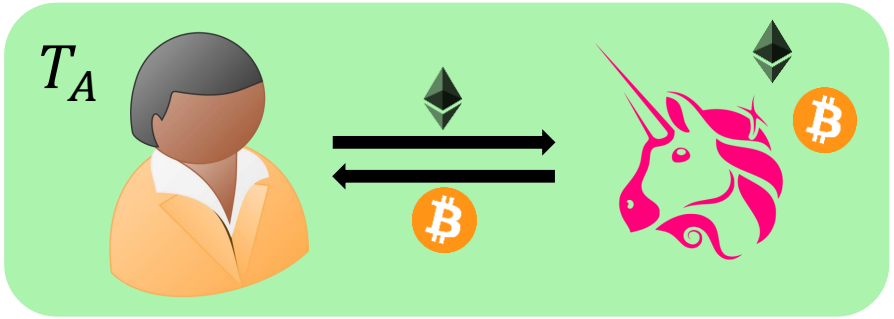

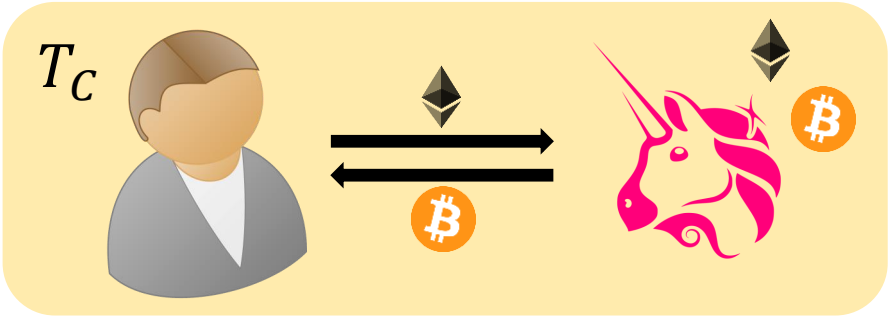

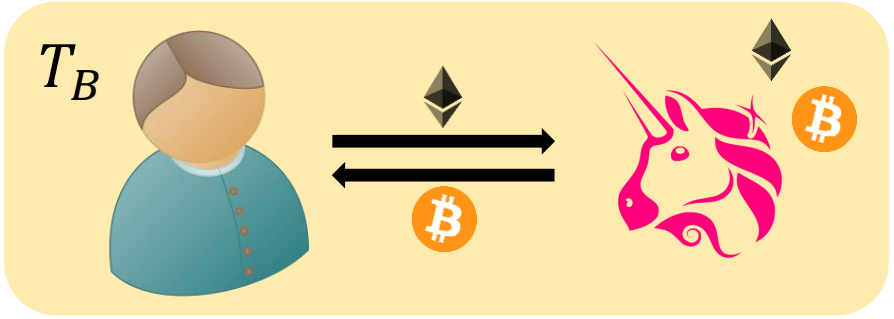

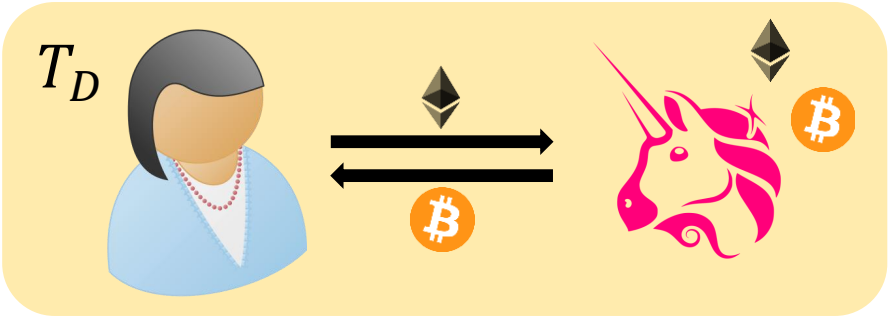

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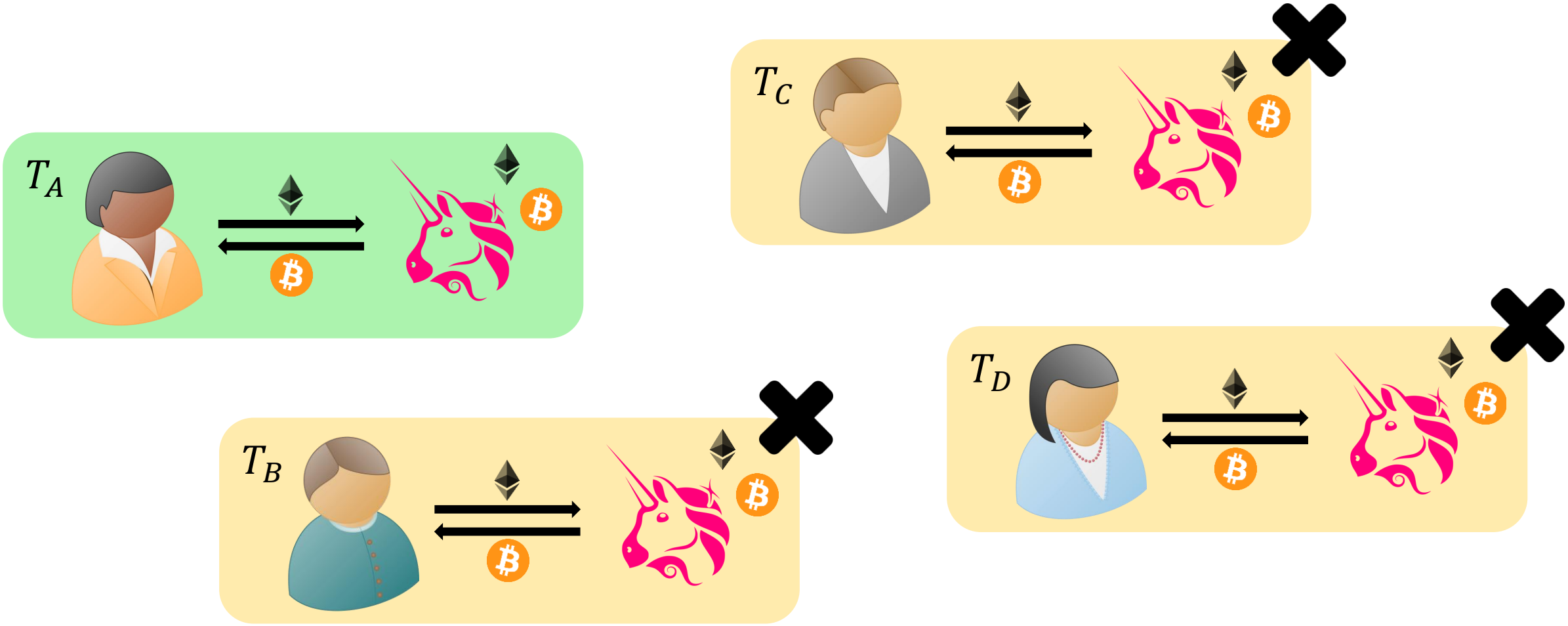

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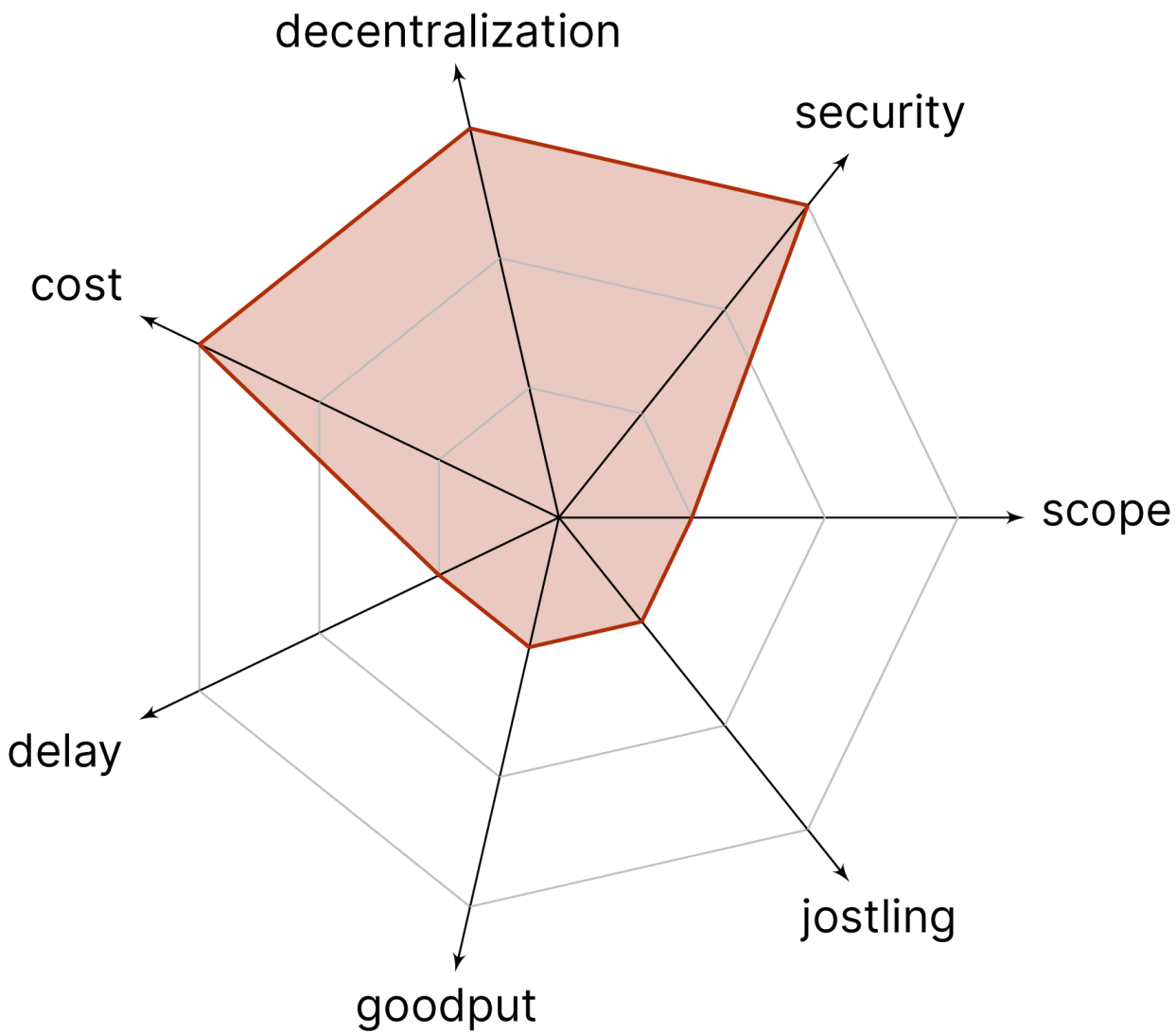
decentralization
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jostling
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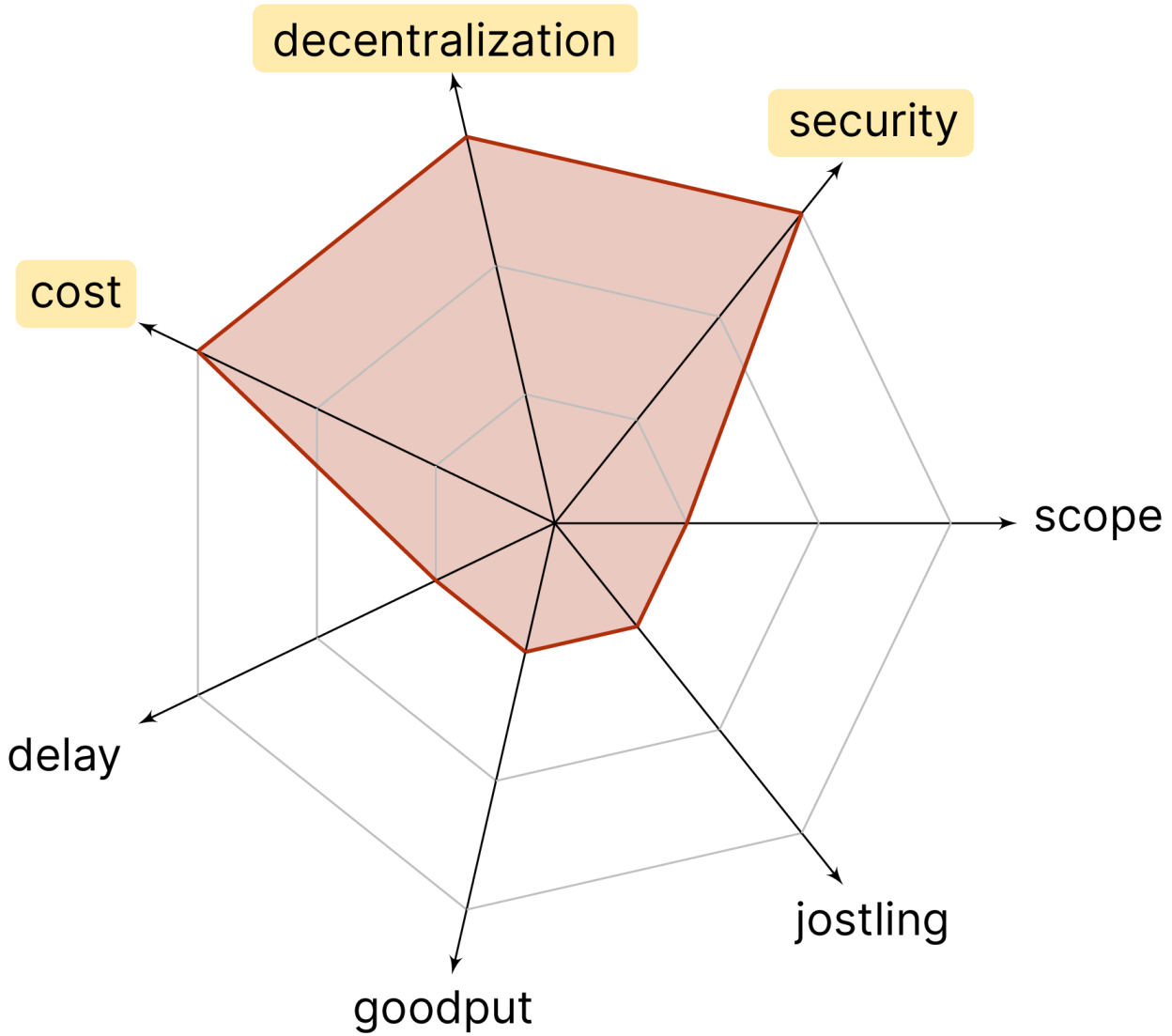
eUTXO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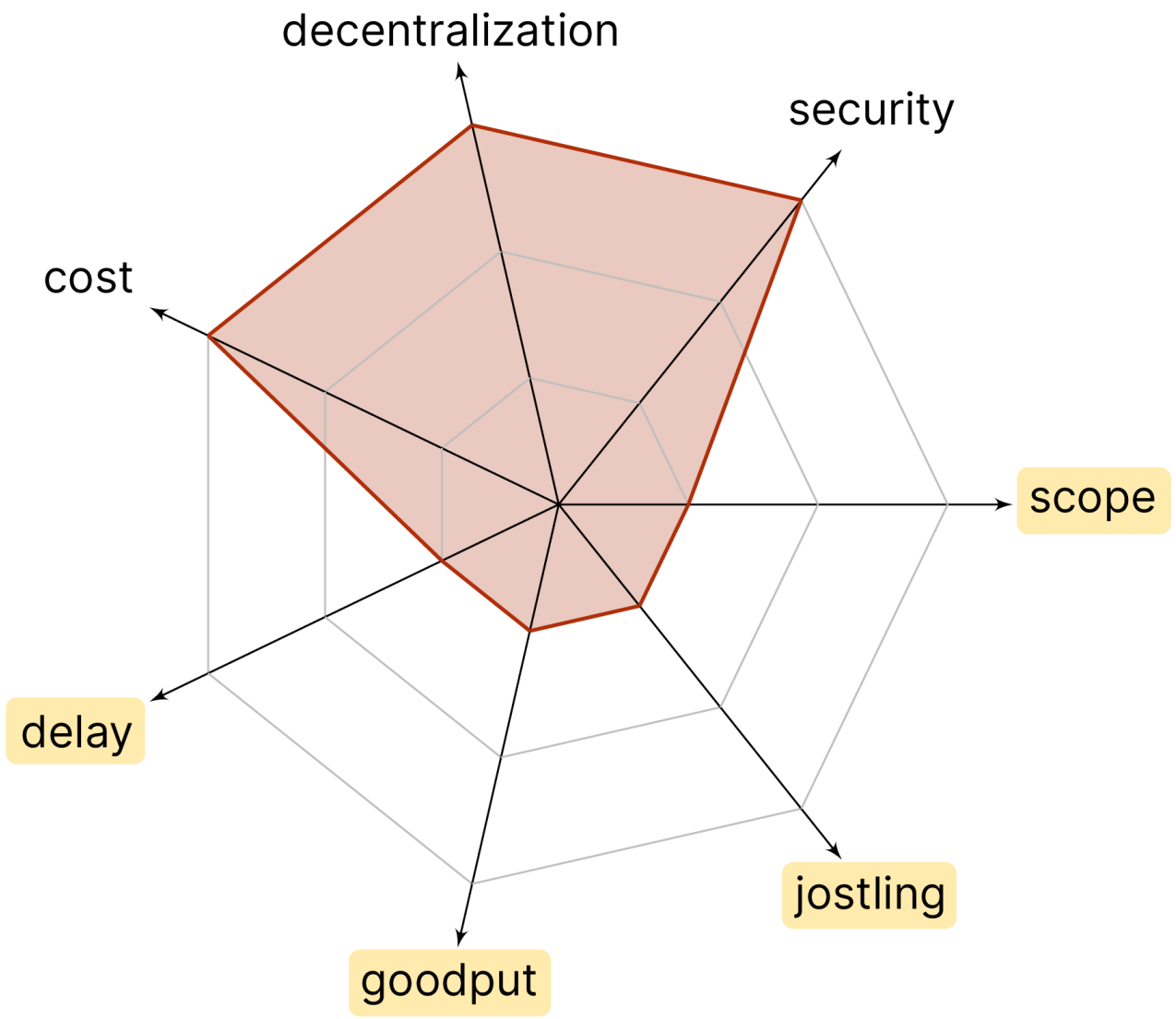
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Algorithmic Committee Ordering

T_E

T_A

T_B

T_C

T_D

Algorithmic Committee Ordering

T_A T_B T_C T_D T_E

Algorithmic Committee Ordering

T_A T_B T_C T_D T_E

Algorithmic Committee Ordering

T_A T_C T_B T_B T_E

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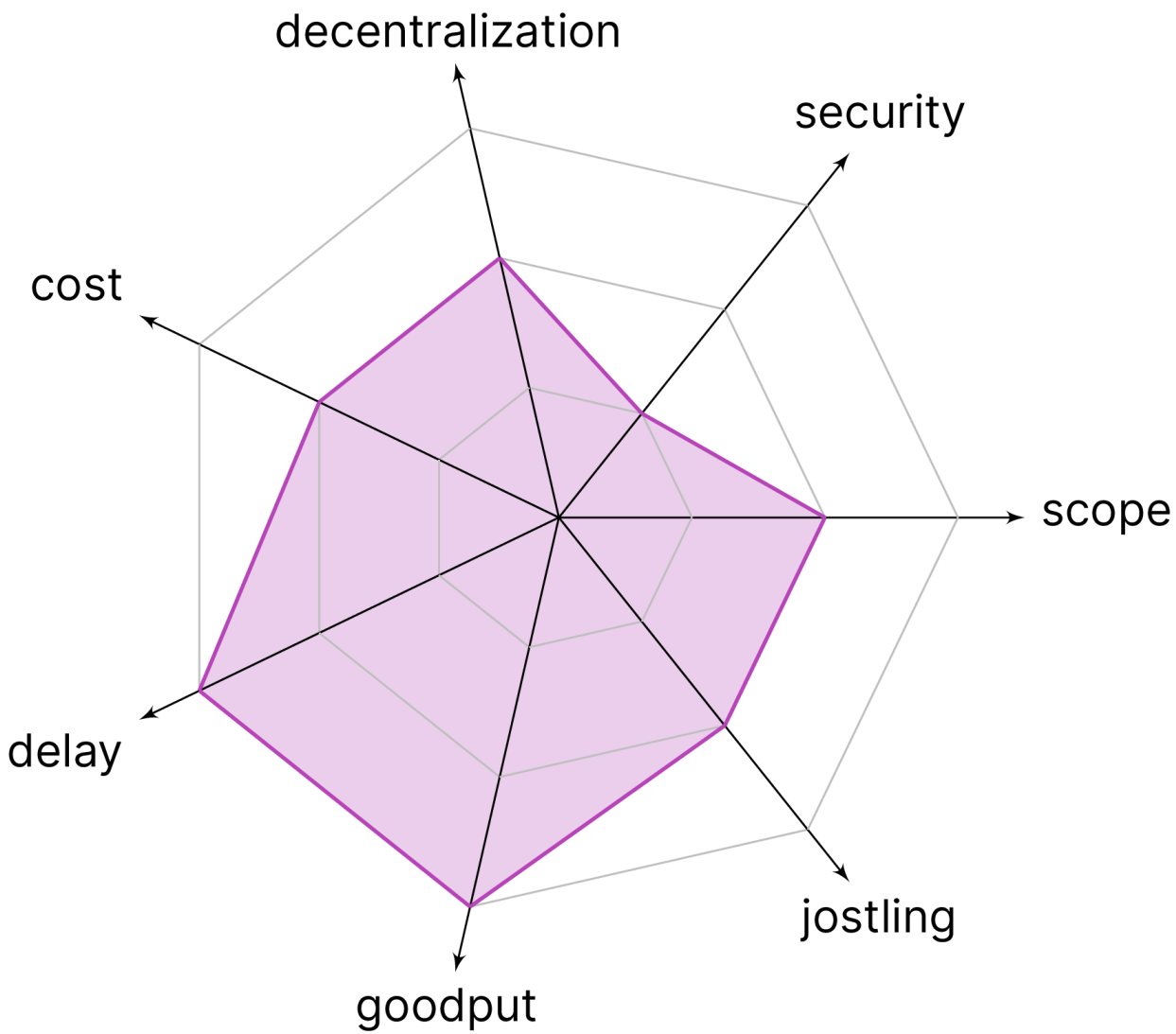
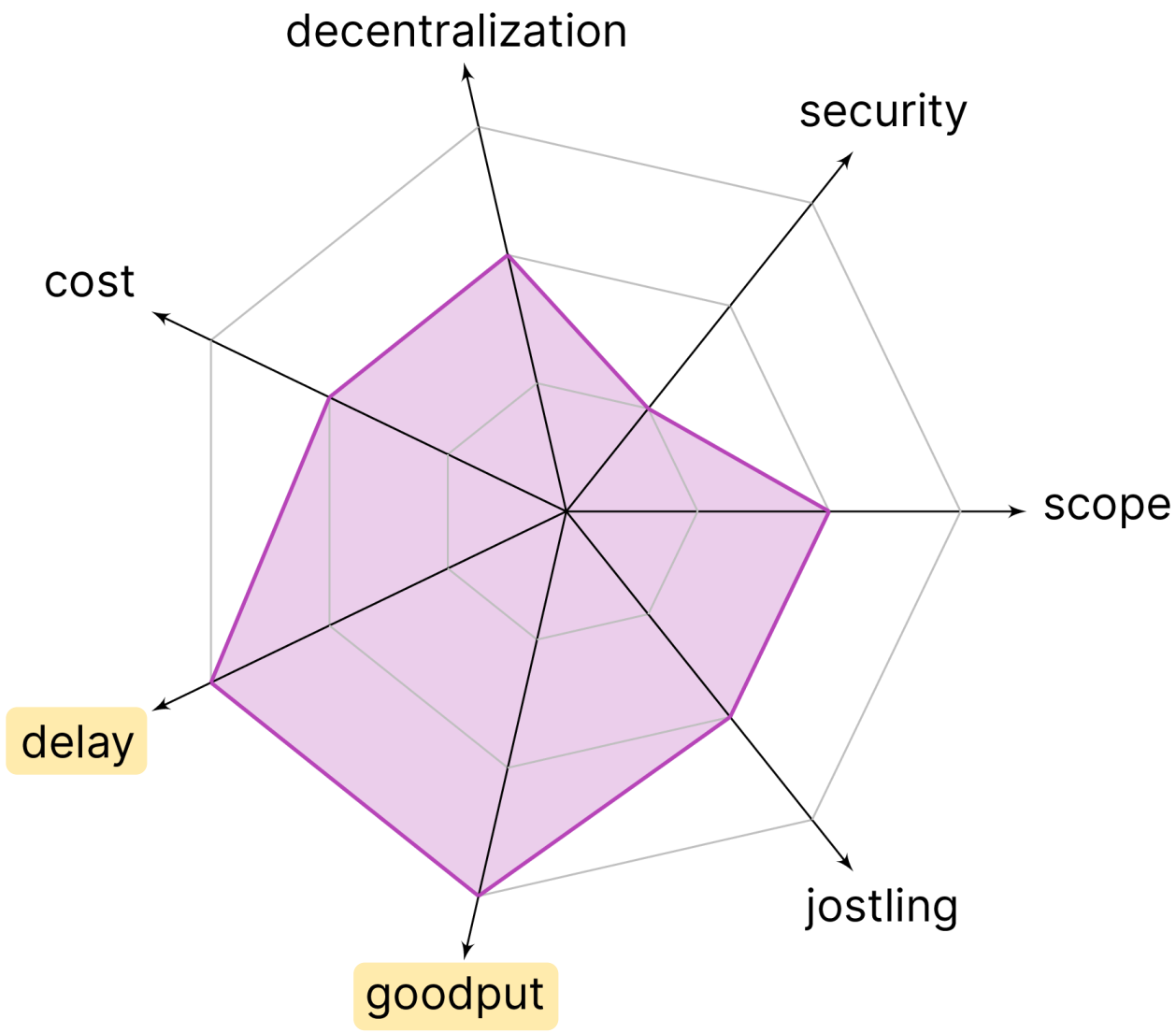
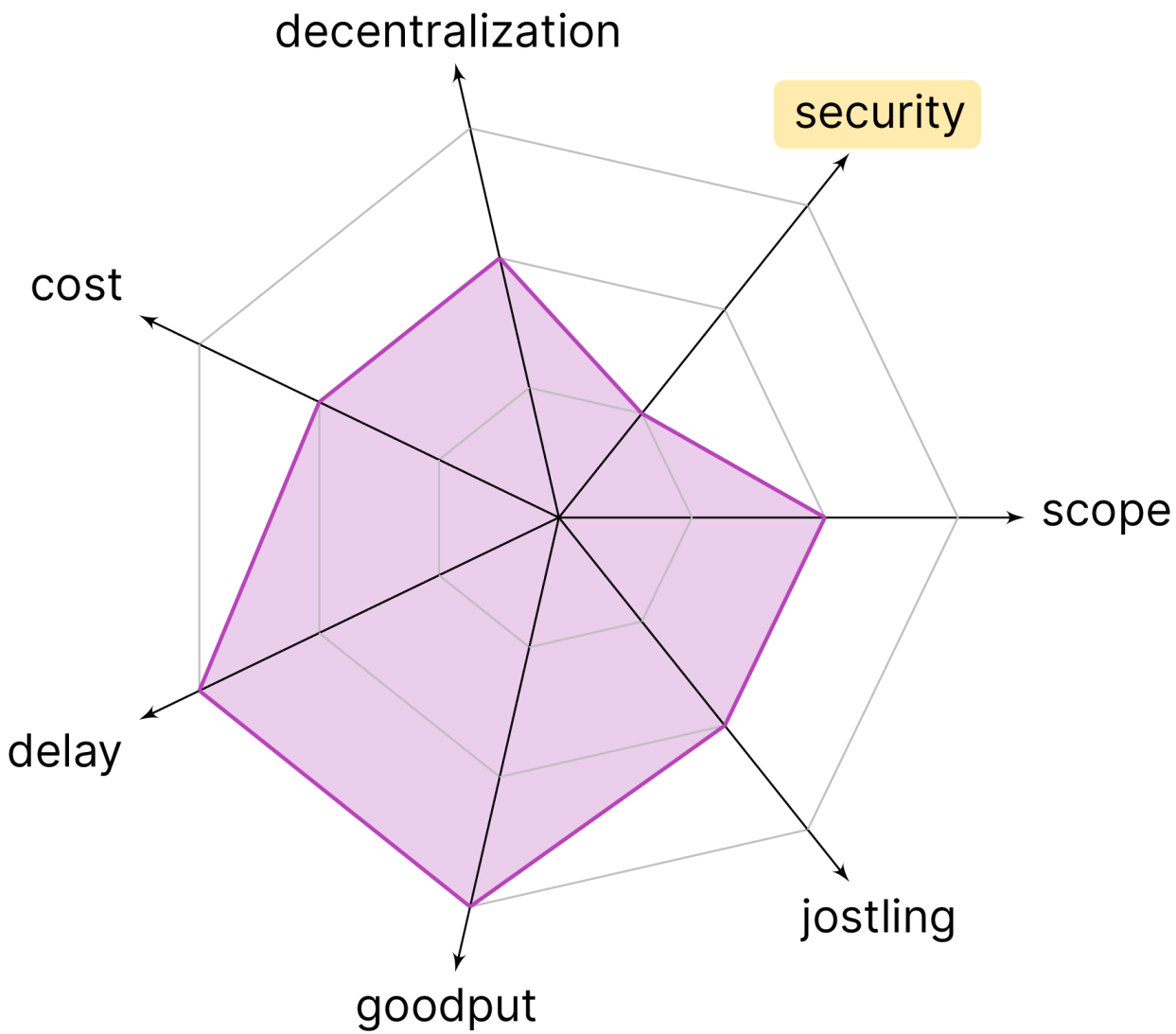


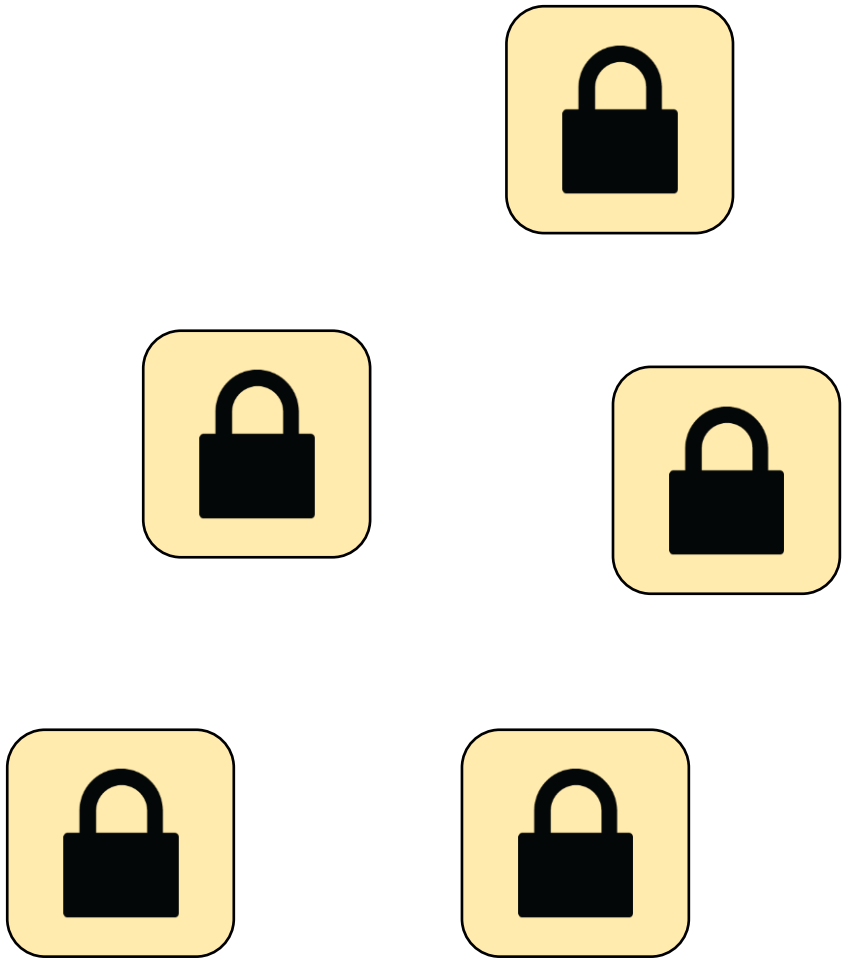
Algorithmic Committee Ordering



Algorithmic Committee Ordering



On-chain Commit & Reveal



On-chain Commit & Reveal

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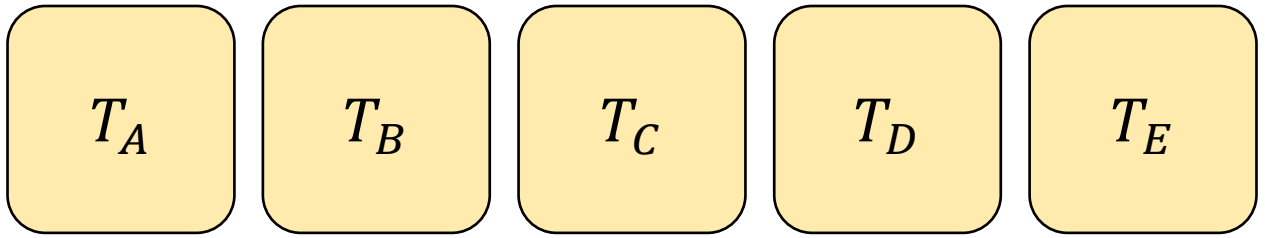

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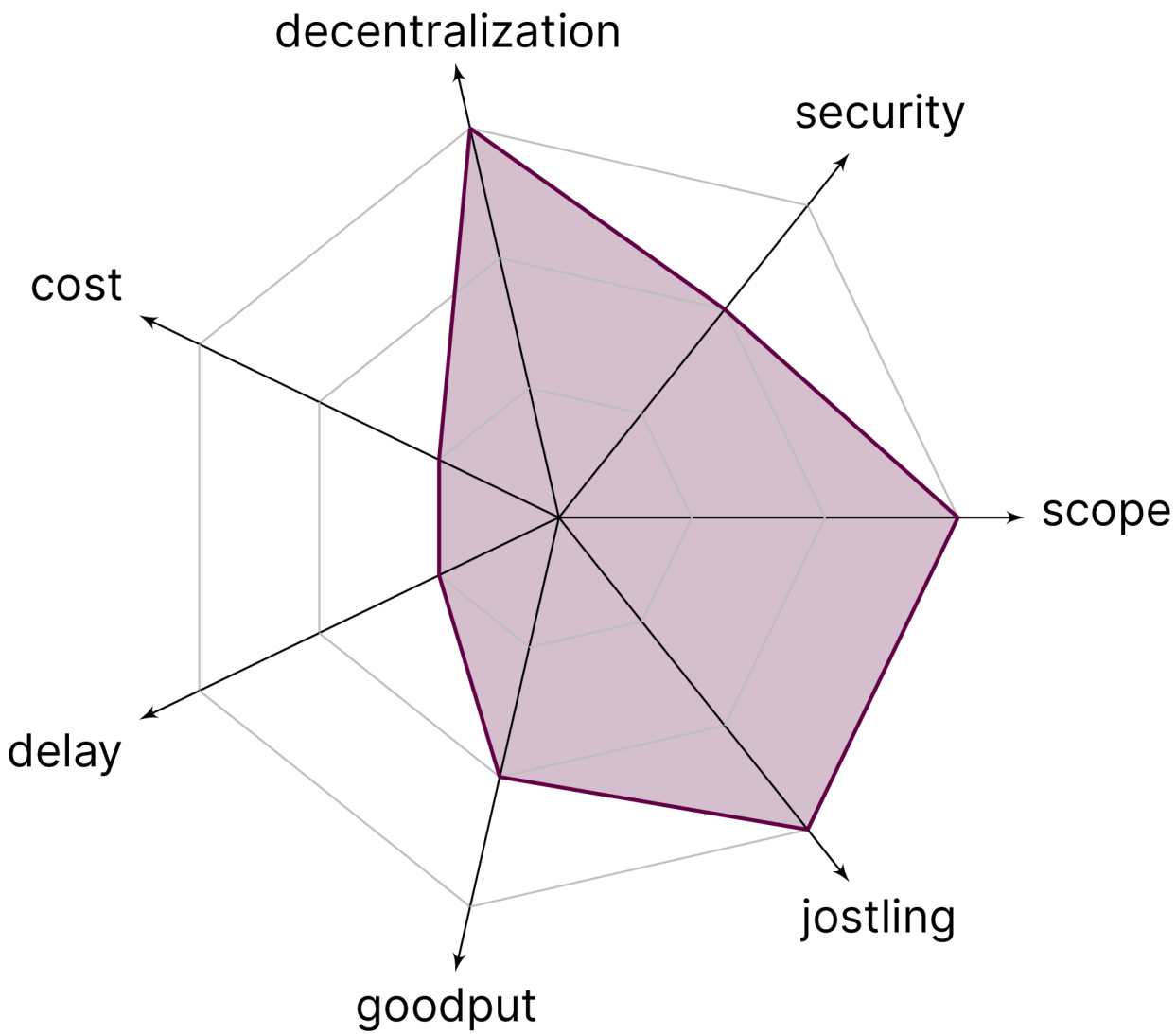

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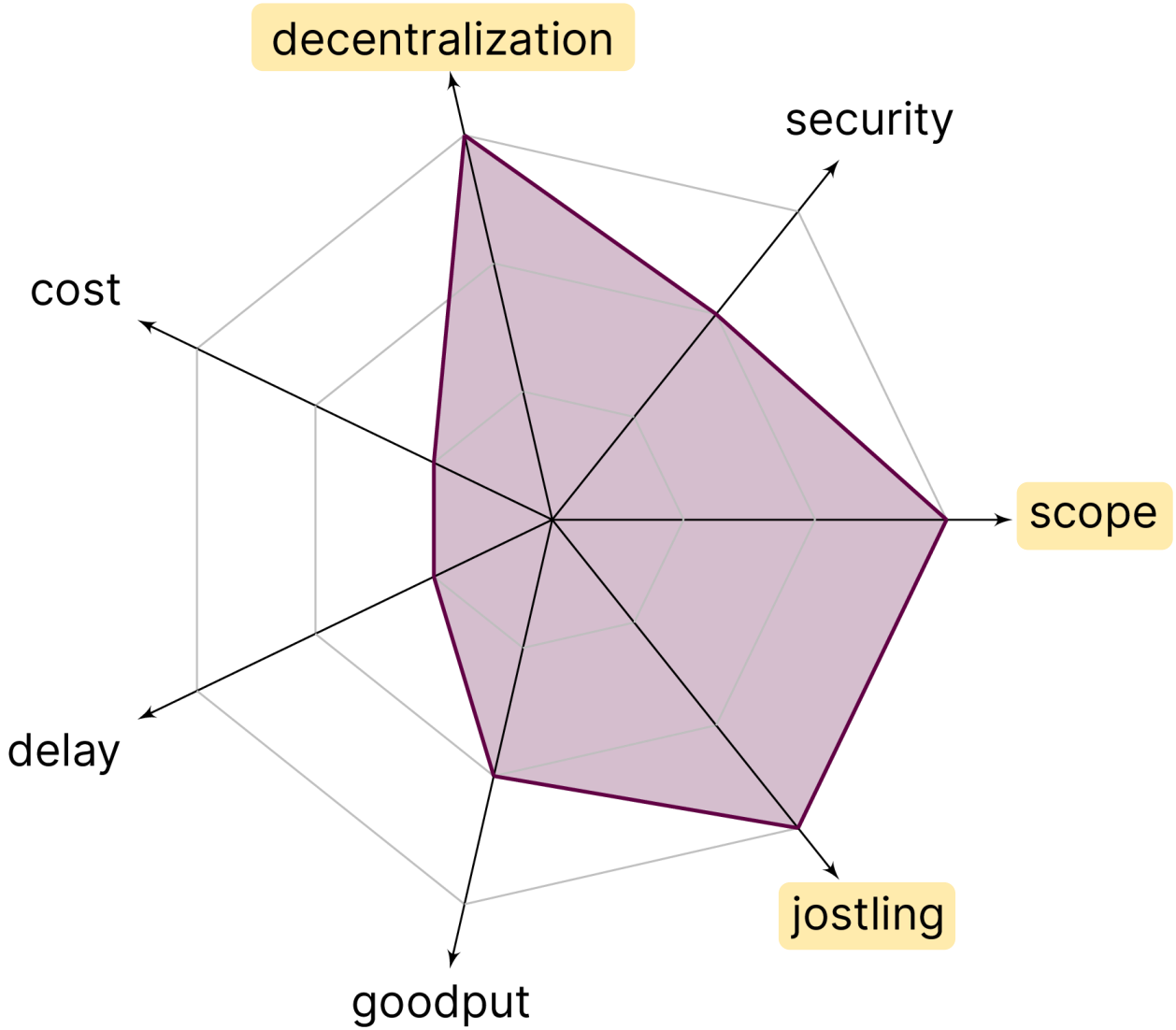

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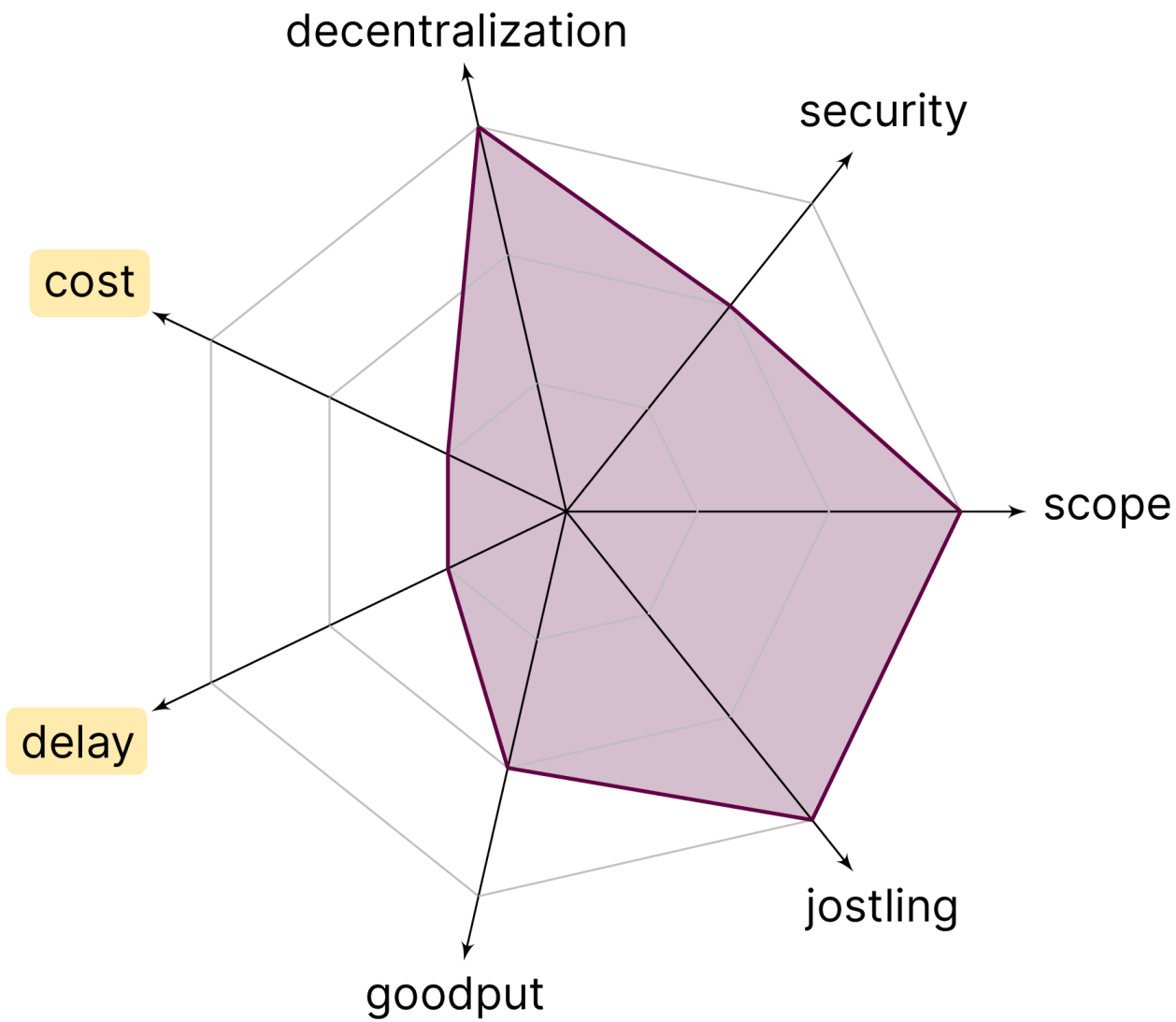

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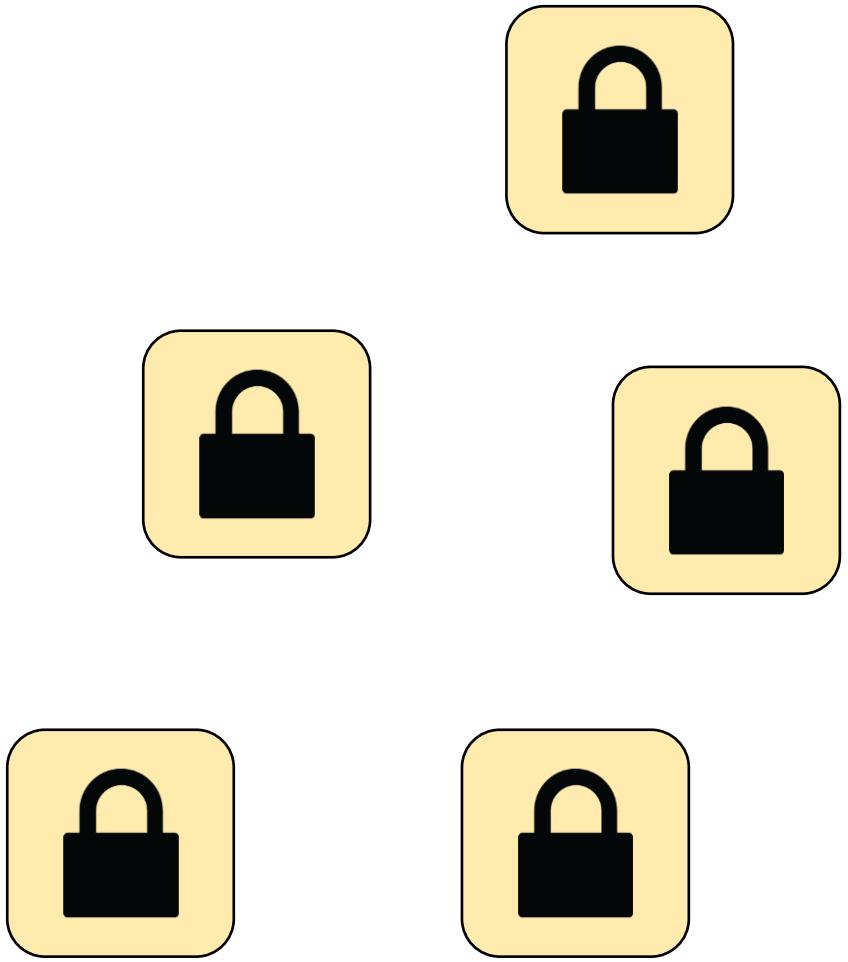

Off-chain Commit & Reveal

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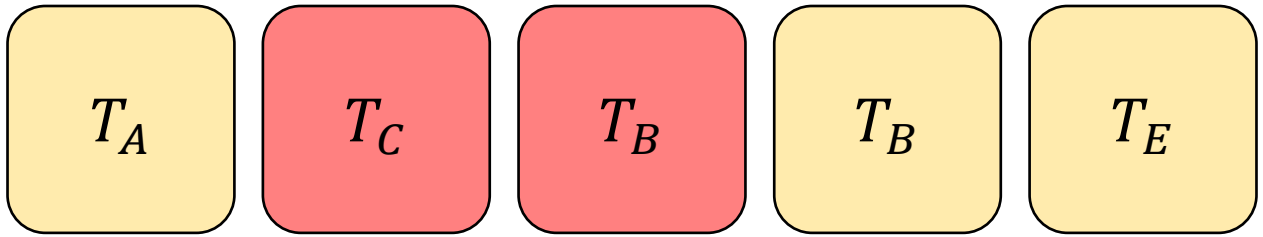
T_A T_B T_C T_D T_E

Off-chain Commit & Reveal

T_A T_B T_C T_D T_E

Off-chain Commit & Reveal



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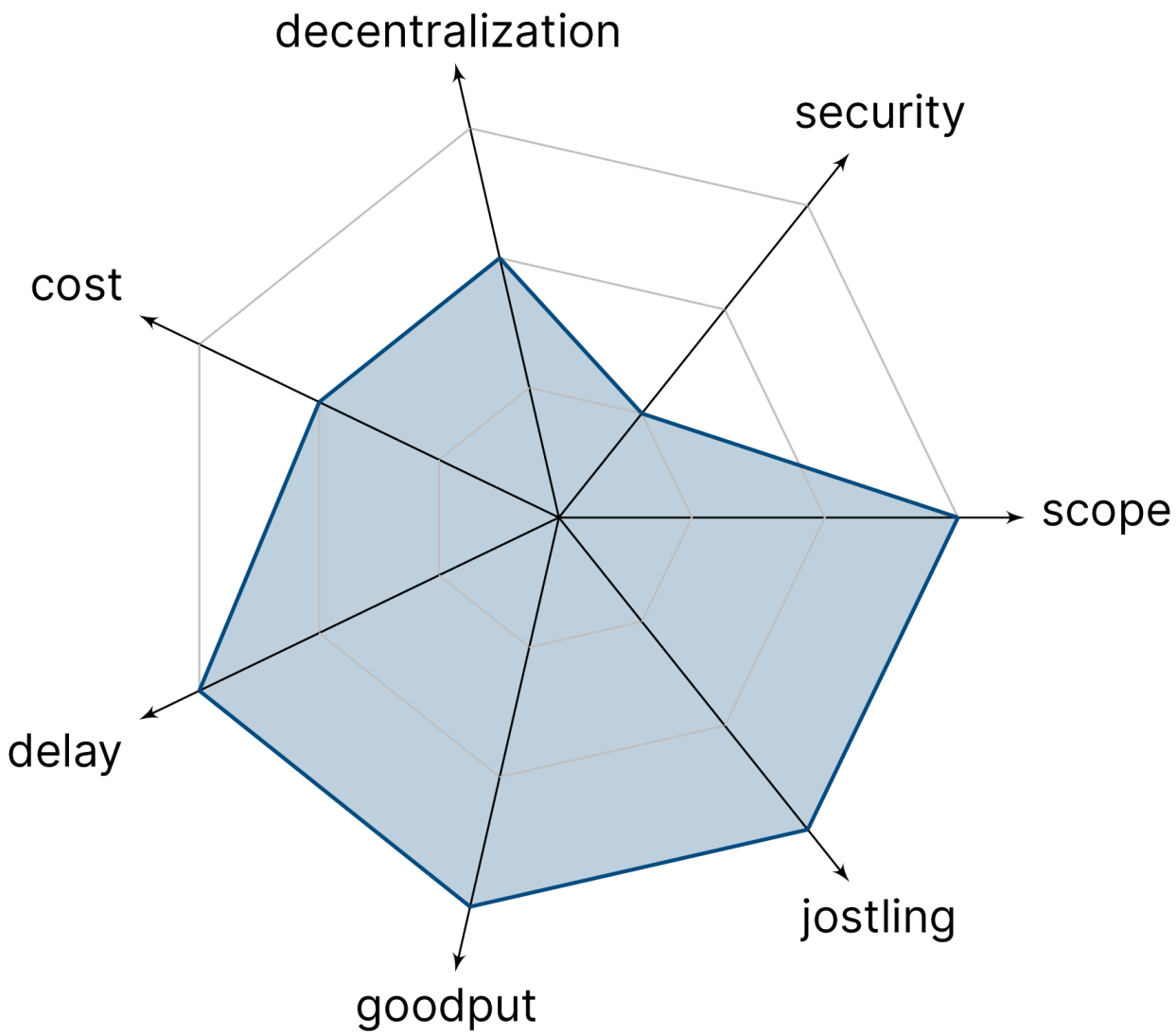

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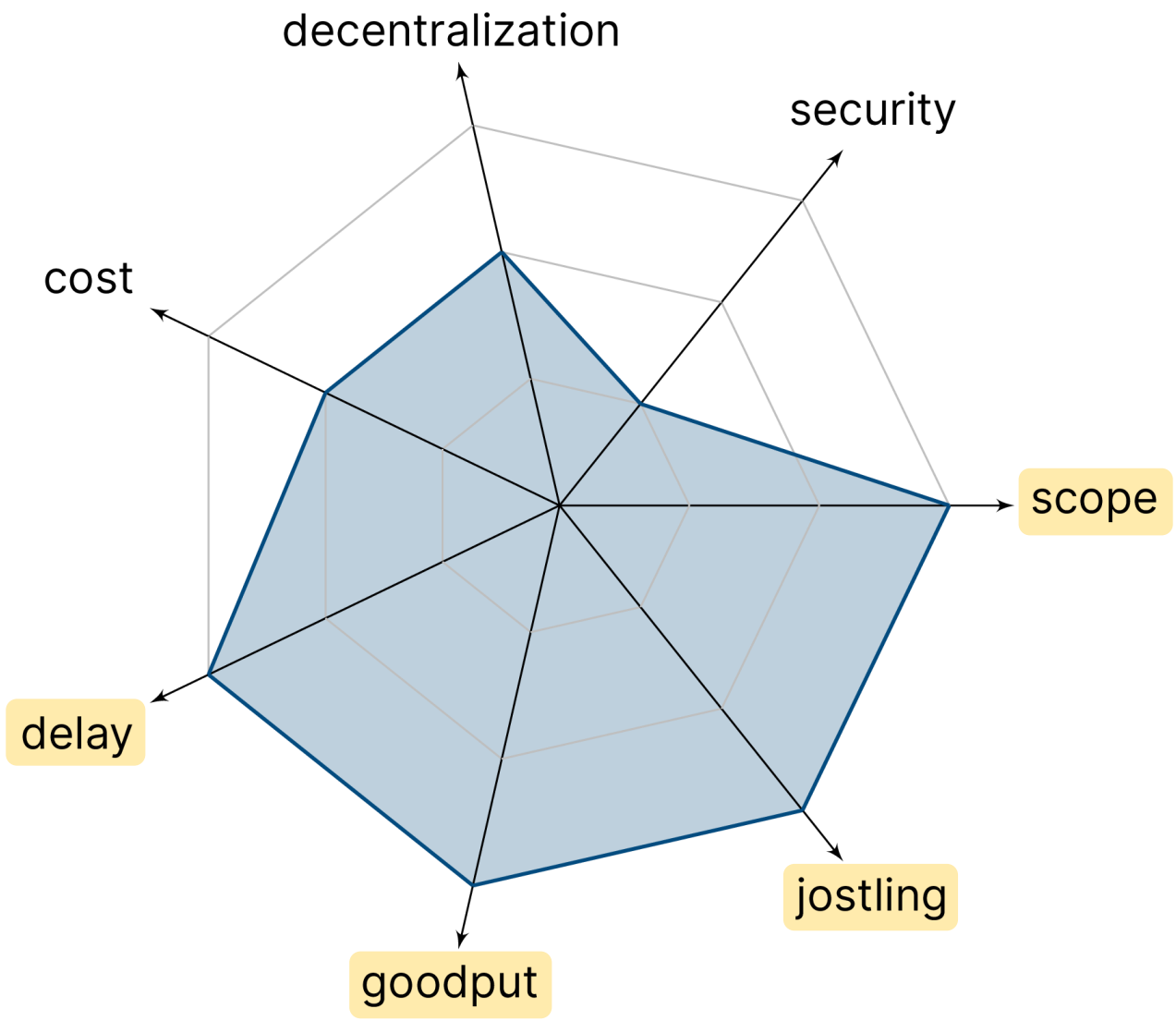

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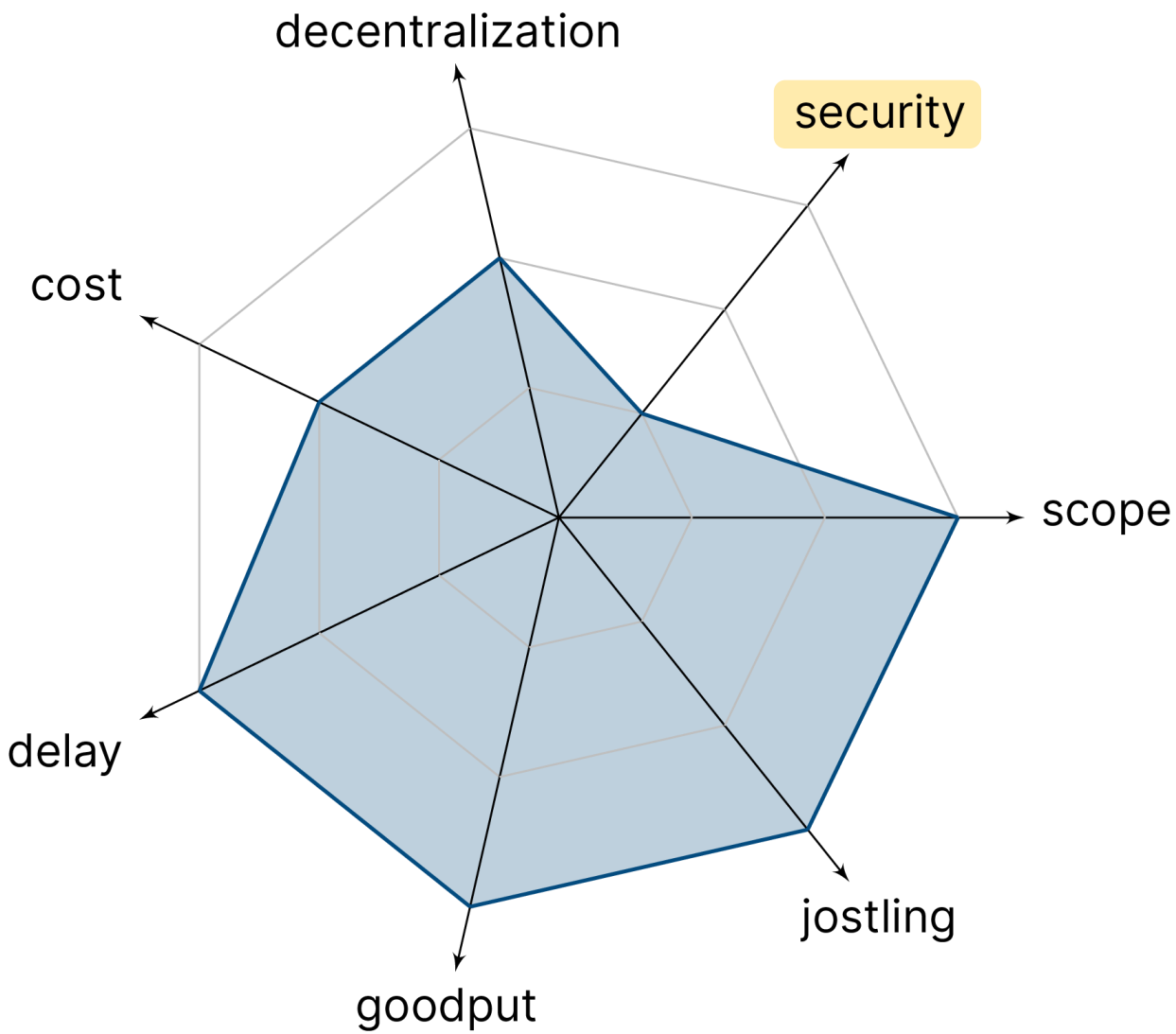
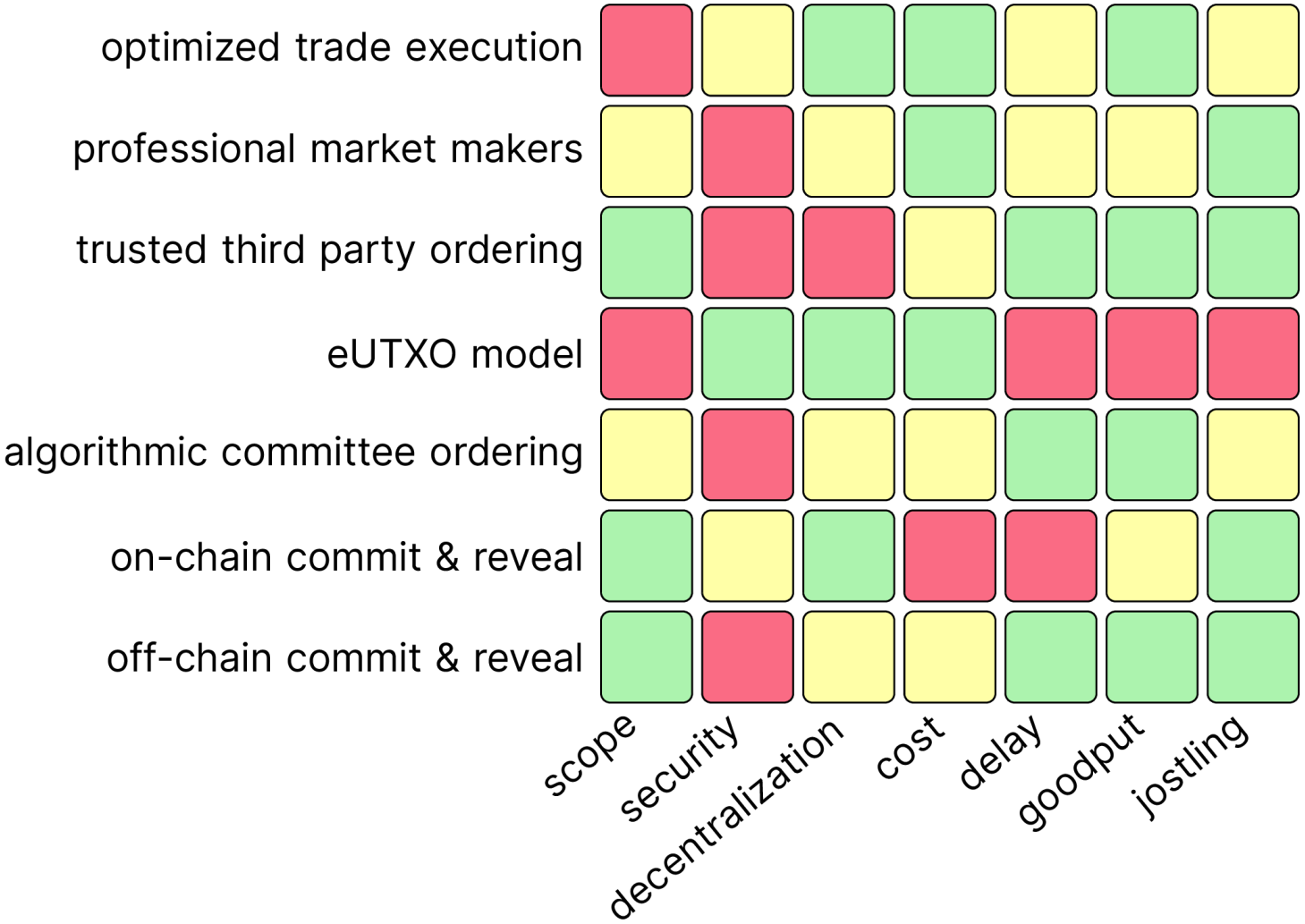


Summary


optimized trade execution
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on-chain commit & reveal
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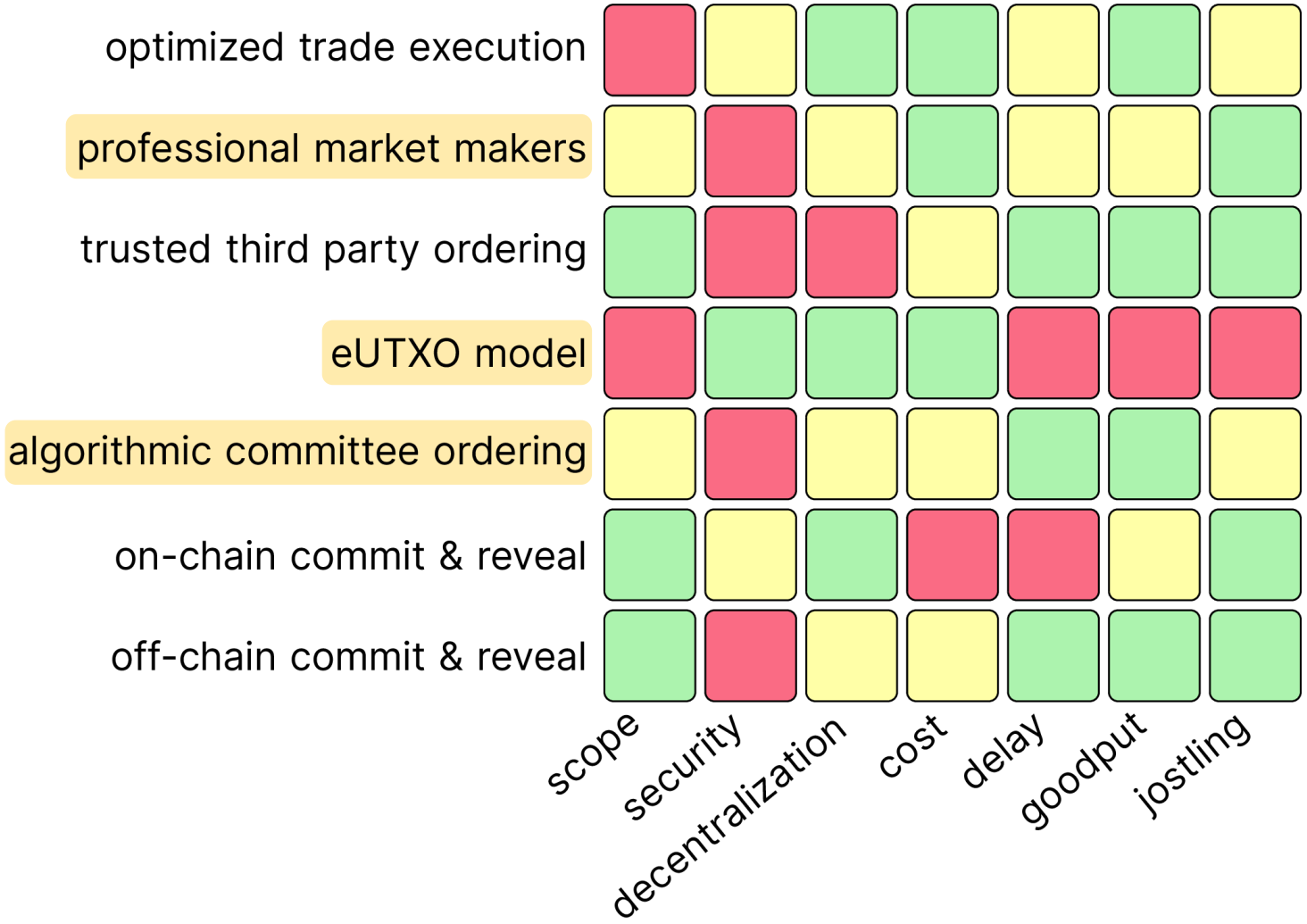
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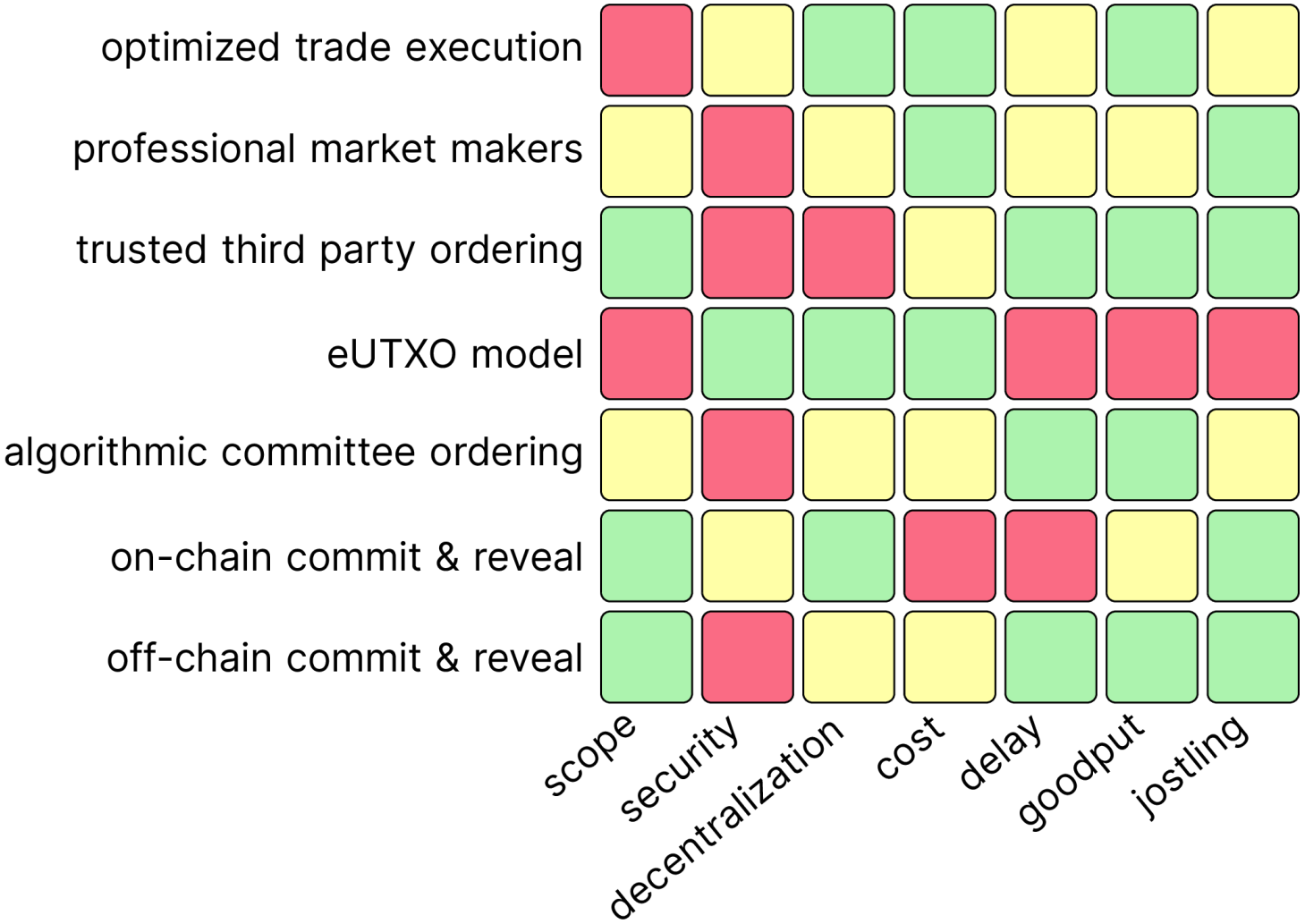
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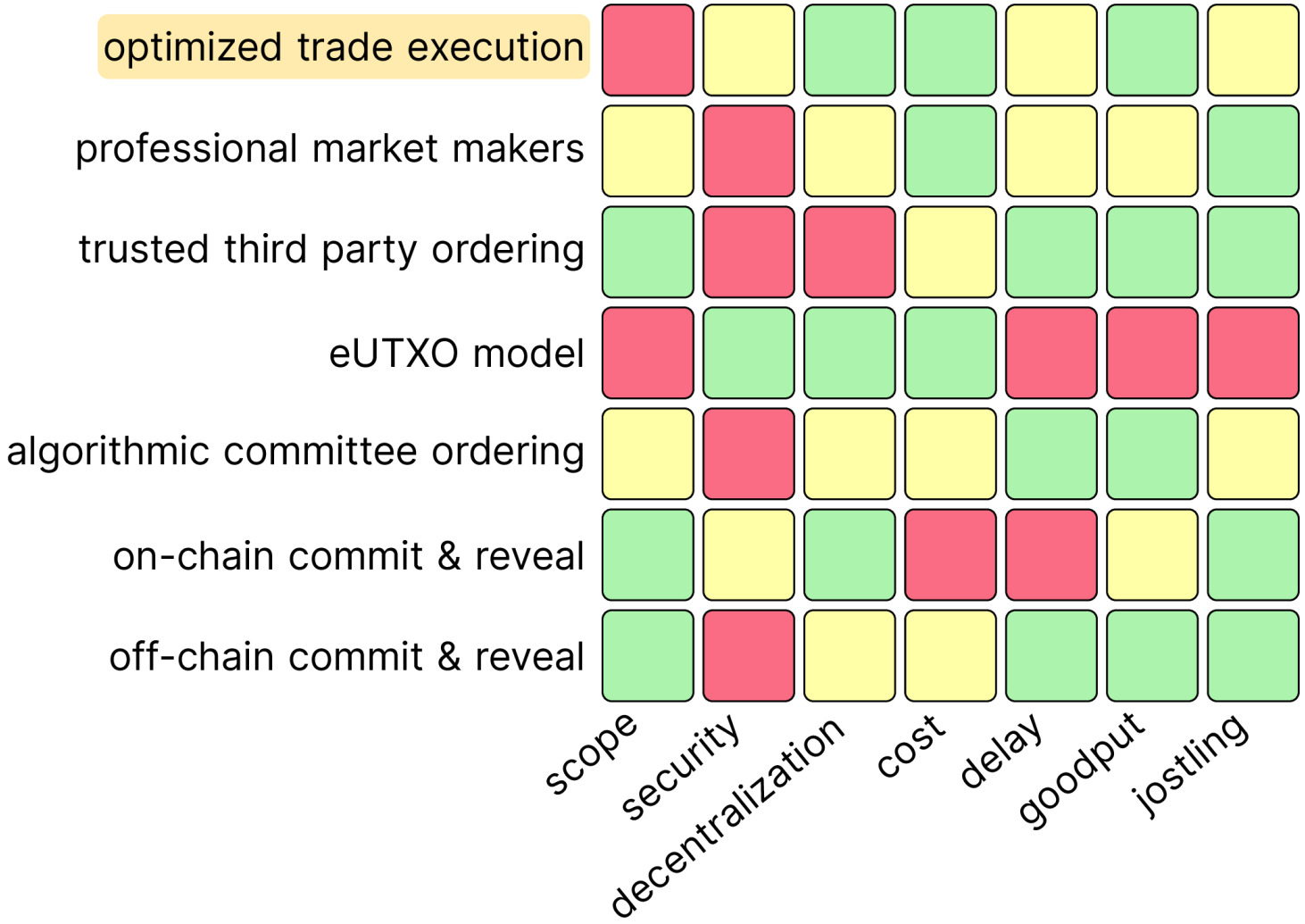
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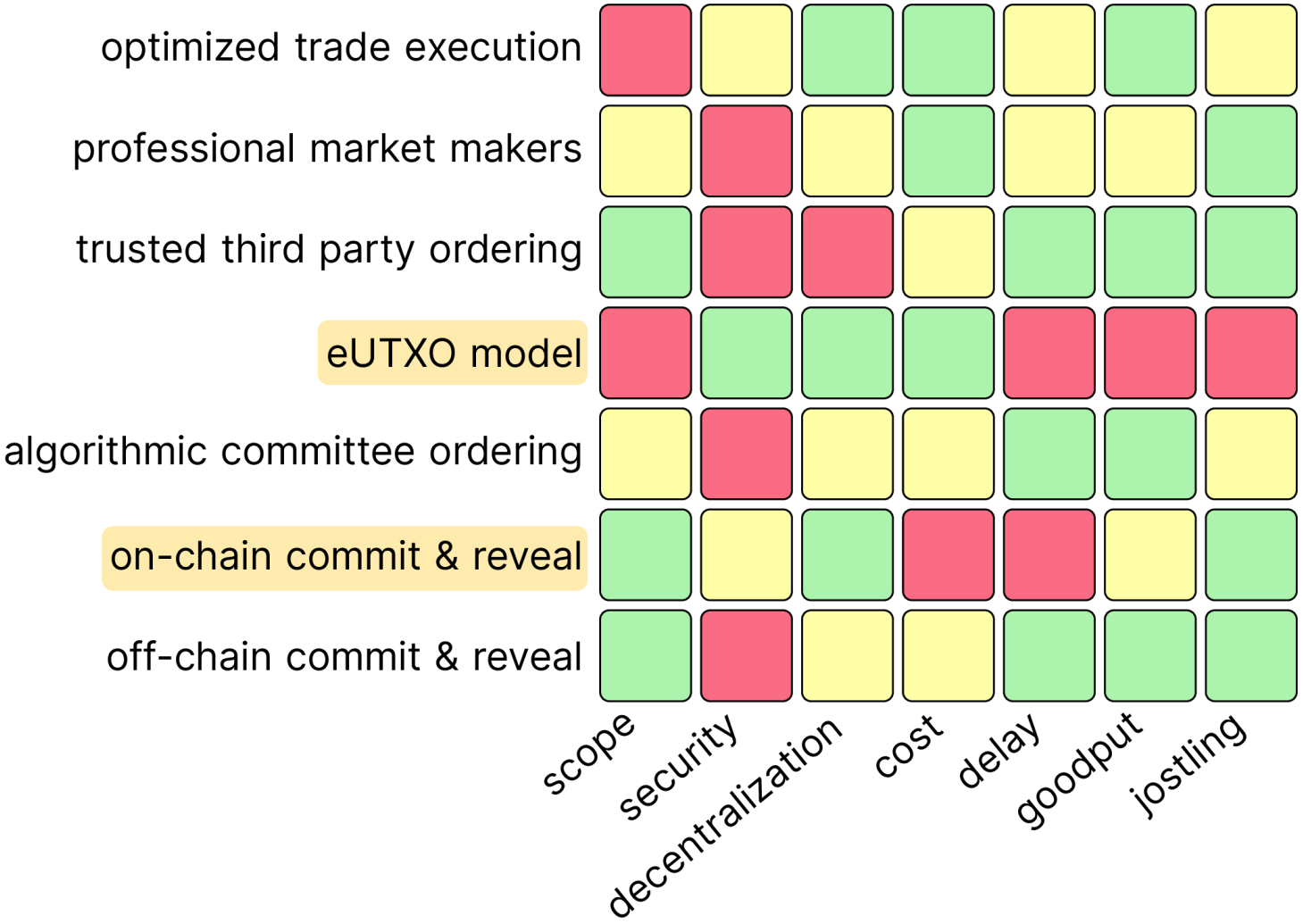
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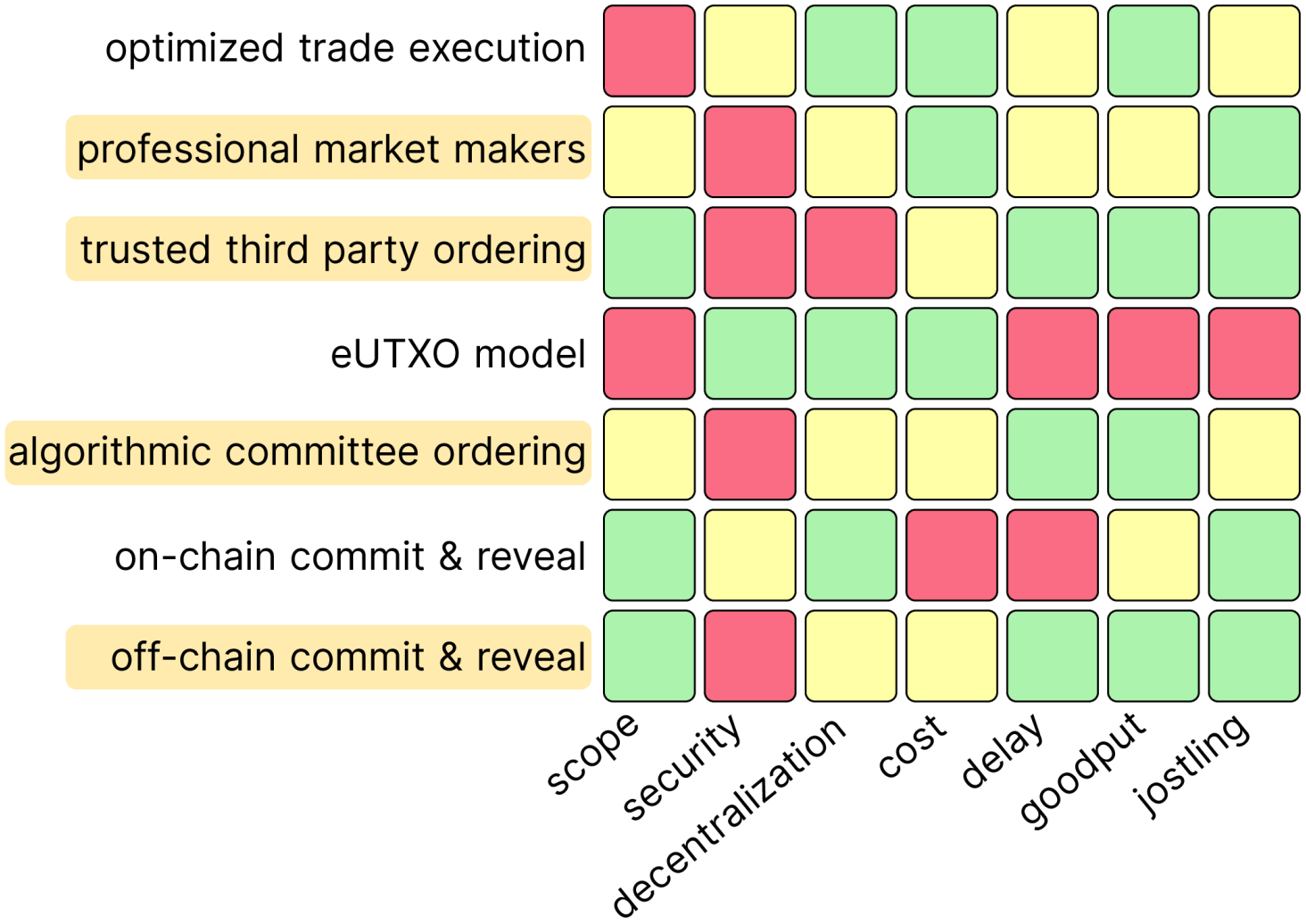
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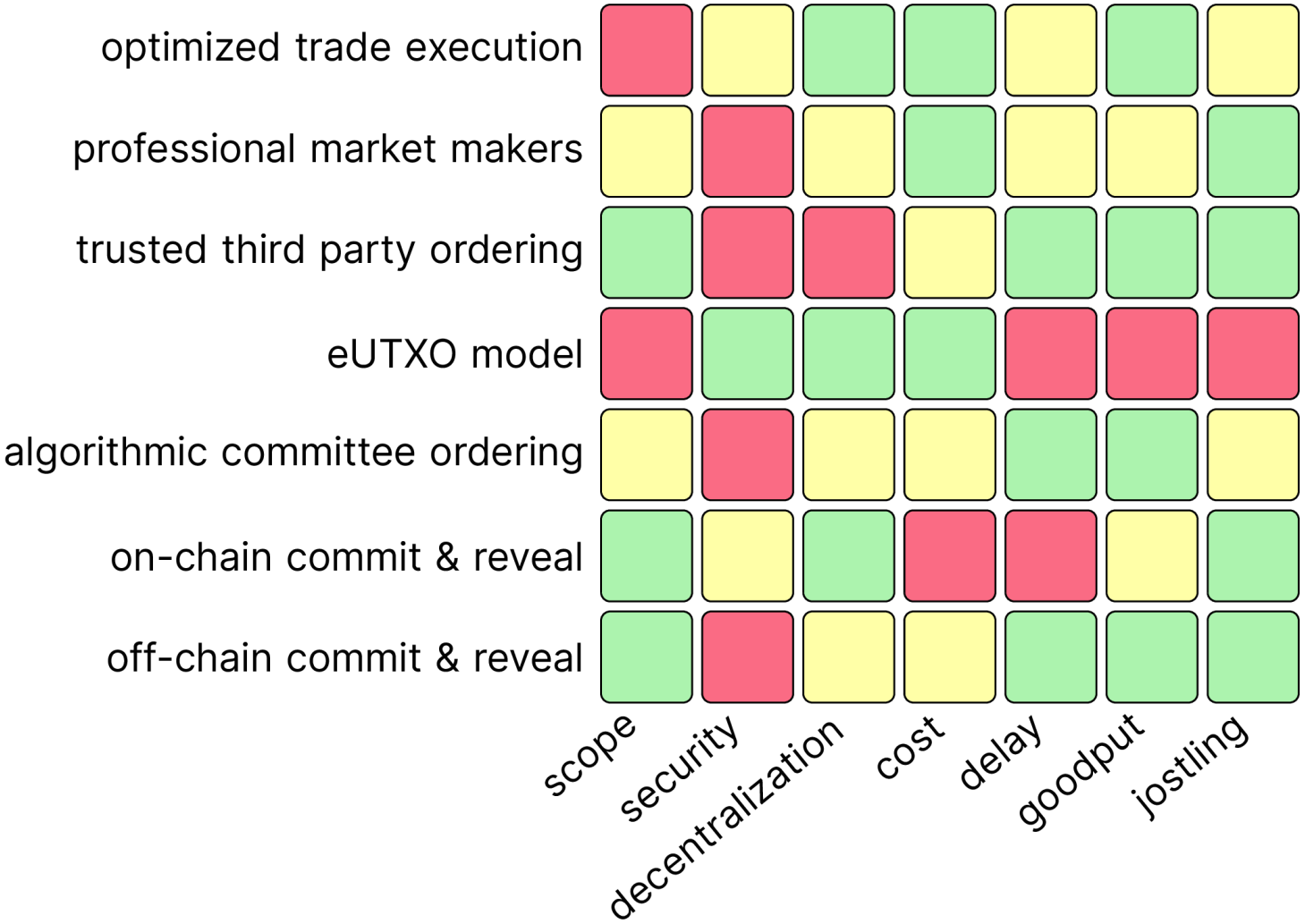
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Thank You!

Questions & Comments?

Advances in Financial Technologies (AFT'22)
Lioba Heimbach, Roger Wattenhofer
ETH Zurich – Distributed Computing – www.disco.ethz.ch

Cyclic Arbitrage