



# One Block - One Batch

Application Design  
Choices reducing MEV

Anna George

CoW Protocol

# Agenda

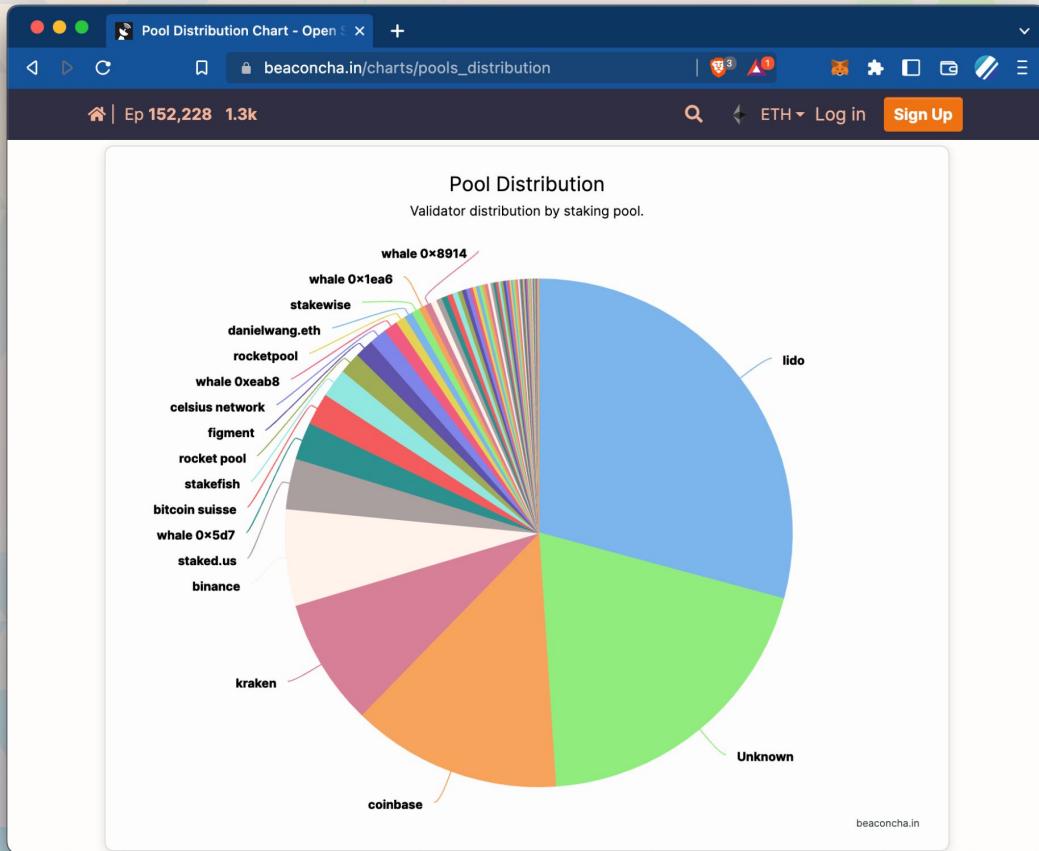
1. Status Quo: (De)Centralization of PoS
2. Utopian future for Ethereum
3. Application Design Choices
4. CoW Protocol





# Status Quo: (De)Centralization of PoS

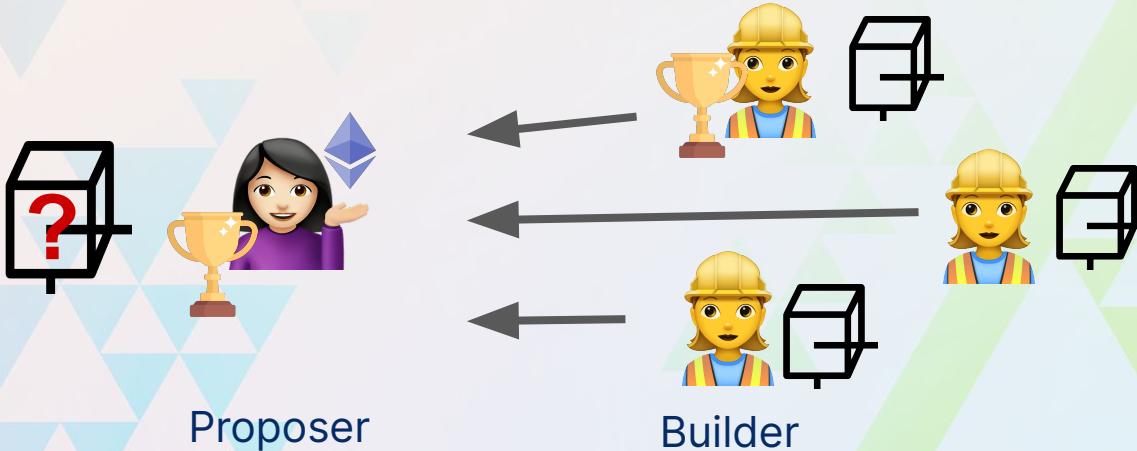
# How Decentralized is PoS?



# MEV Centralization Force



- Validators within at least one epoch are known, allows for multi block and cross chain MEV extractions
- Response: Proposer-Builder-Separation (PBS)

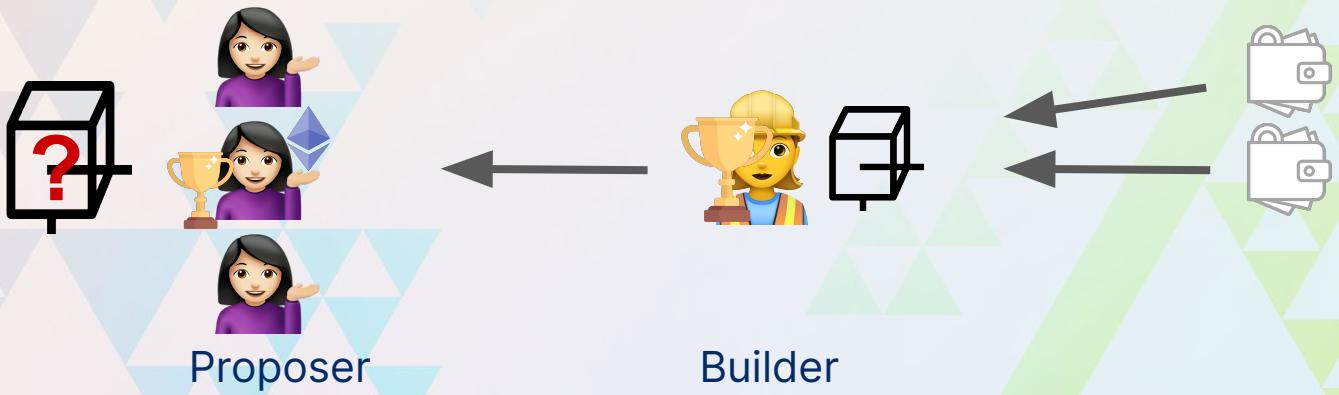


# PBS & Block Builder Centralization



PBS may greatly improve validator decentralization, but it risks leaving builders very centralized:

- One builder may well produce >60% or even >95% of all blocks
- Private Order Flow increases centralization risk





# MEV in PoW vs PoS

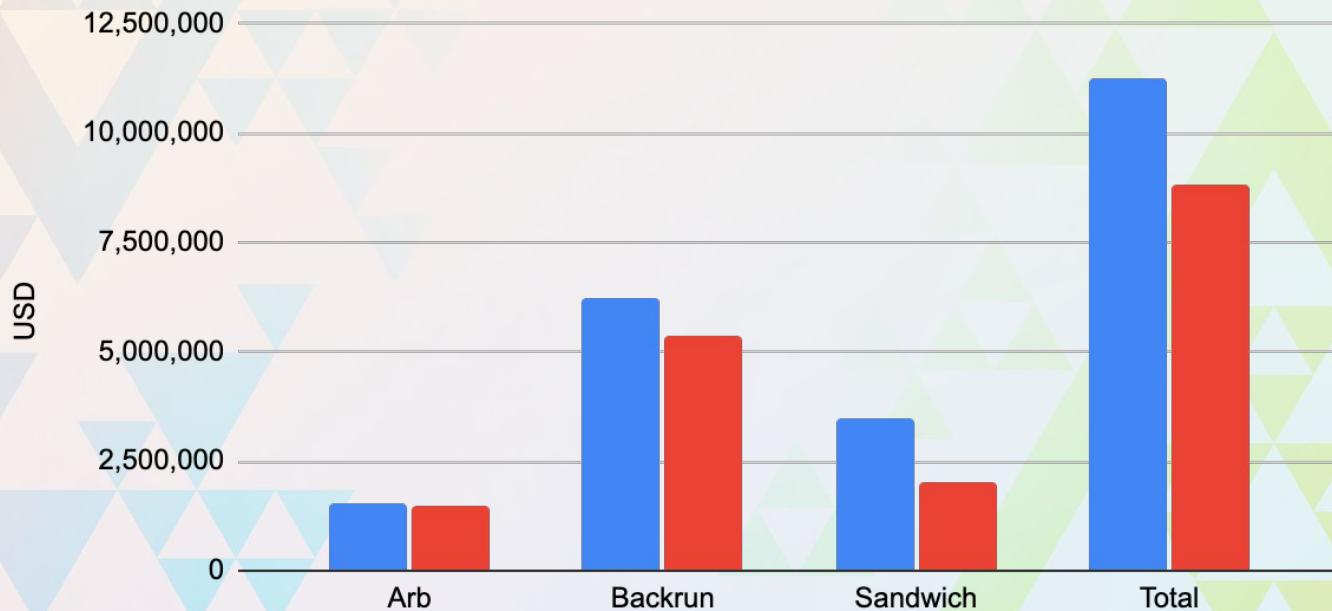
## MEV before & after the Merge

Comparing last and first 145,000 Blocks

POW POS



ZEROMEV



# MEV in PoW vs PoS



Sandwich

200,000.00

150,000.00

100,000.00

50,000.00

0.00



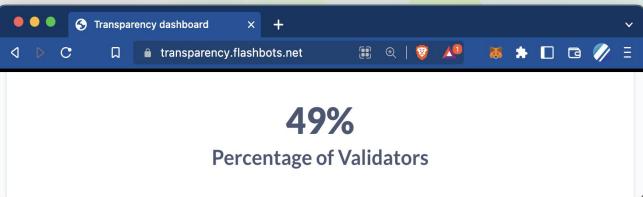
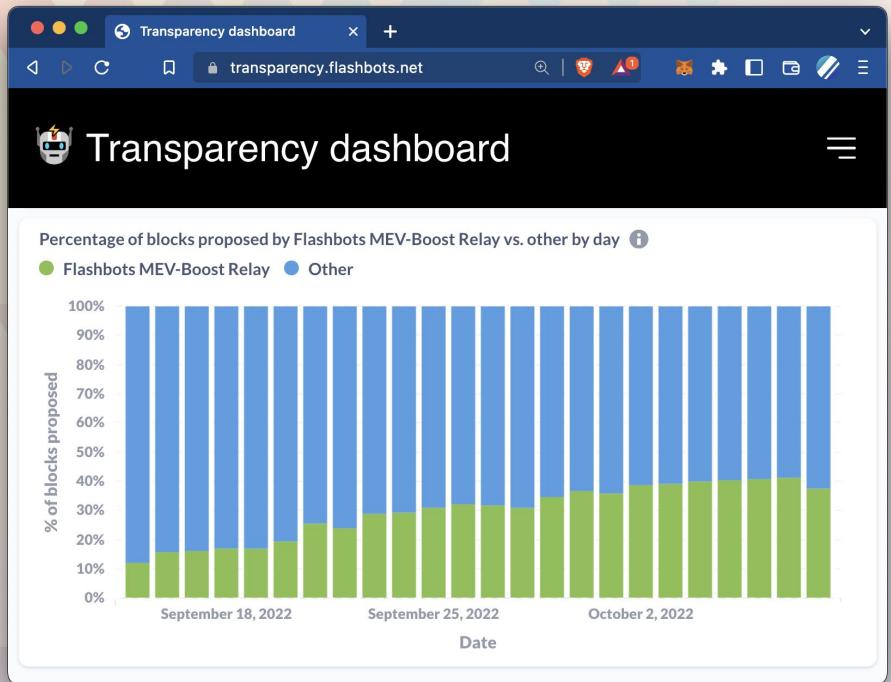
ZEROMEV

USD

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

day

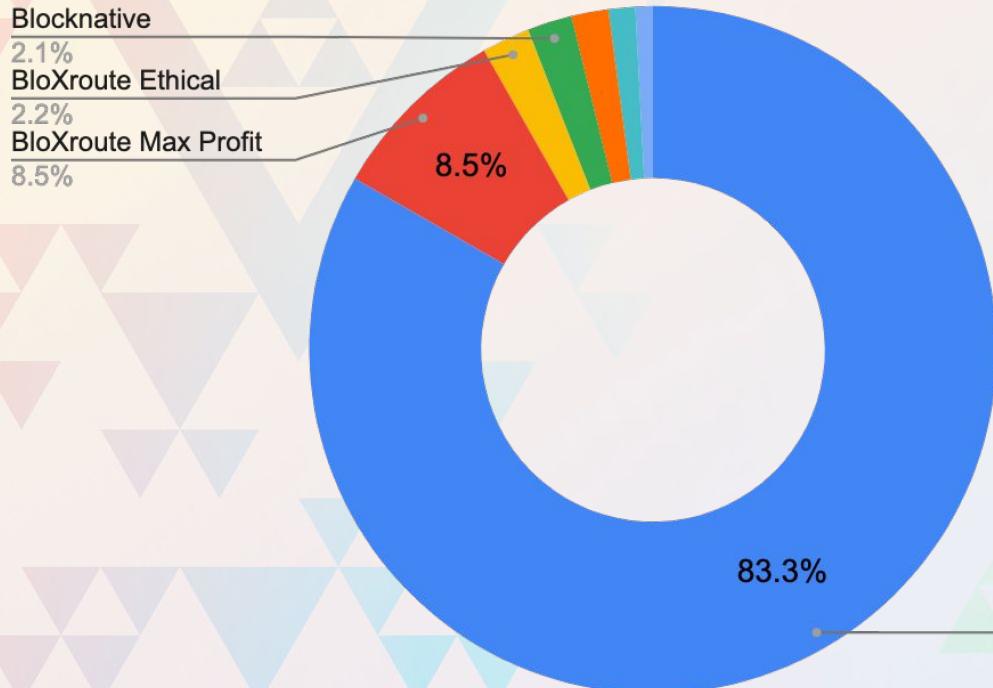
# MEV-Boost Centralization



# MEV-Boost Relay Centralization



## MEV Boost Blocks relayed by Flashbots



>40% of all blocks on Ethereum today are censoring tx from accounts that interacted with Tornado Cash.

# Block Builder Centralization



Flashbots MEV pre & post merge

docs.google.com/spreadsheets/d/11L8eKjyO-fyl...

BUILDER	# BLOCKS	TOTAL VALUE (AVERAGE BLO)	LAST USED RELAY	
0xa1dead01...6 16,431	2,552.48	0.155	Flashbots	26.99%
0xb1babeecc...3 14,183	2,058.55	0.145	Flashbots	23.30%
0xb1beef03...c 5,155	673.746	0.131	Flashbots	8.47%
0xb194b2b8...f 3,851	545.02	0.142	Flashbots	6.33%
0x94aa4ee3...f 3,700	718.81	0.194	Flashbots	6.08%
0xb8bedce5...72,703	281.121	0.104	BloXroute Max	4.44%
0x80c73115...52,588	525.357	0.203	Flashbots	4.25%
0xaa1488ea...5 2,384	330.673	0.139	Flashbots	3.92%
0xbcd1148...32,224	440.052	0.198	Flashbots	3.65%
0x90000098...11,276	106.347	0.083	Blocknative	2.10%
0xa1defa73...8 896	156.886	0.175	Flashbots	1.47%
0xa30251c8...8 867	122.418	0.141	Flashbots	1.42%
0xa25f5d5b...2 686	89.912	0.131	Manifold	1.13%
0xb9b50821...3 648	67.499	0.104	BloXroute Regi	1.06%
0x95701d3f...b 593	69.728	0.118	BloXroute Ethic	0.97%
0xa1daf0ab...a 523	75.929	0.145	Flashbots	0.86%
0xb086acdd...1520	50.253	0.097	BloXroute Ethic	0.85%
0xa5eec32c...a 314	49.813	0.159	Eden	0.52%
0x91afe263...b 276	26.817	0.097	Flashbots	0.45%
0x975b8e3d...c 225	15.155	0.067	Flashbots	0.37%

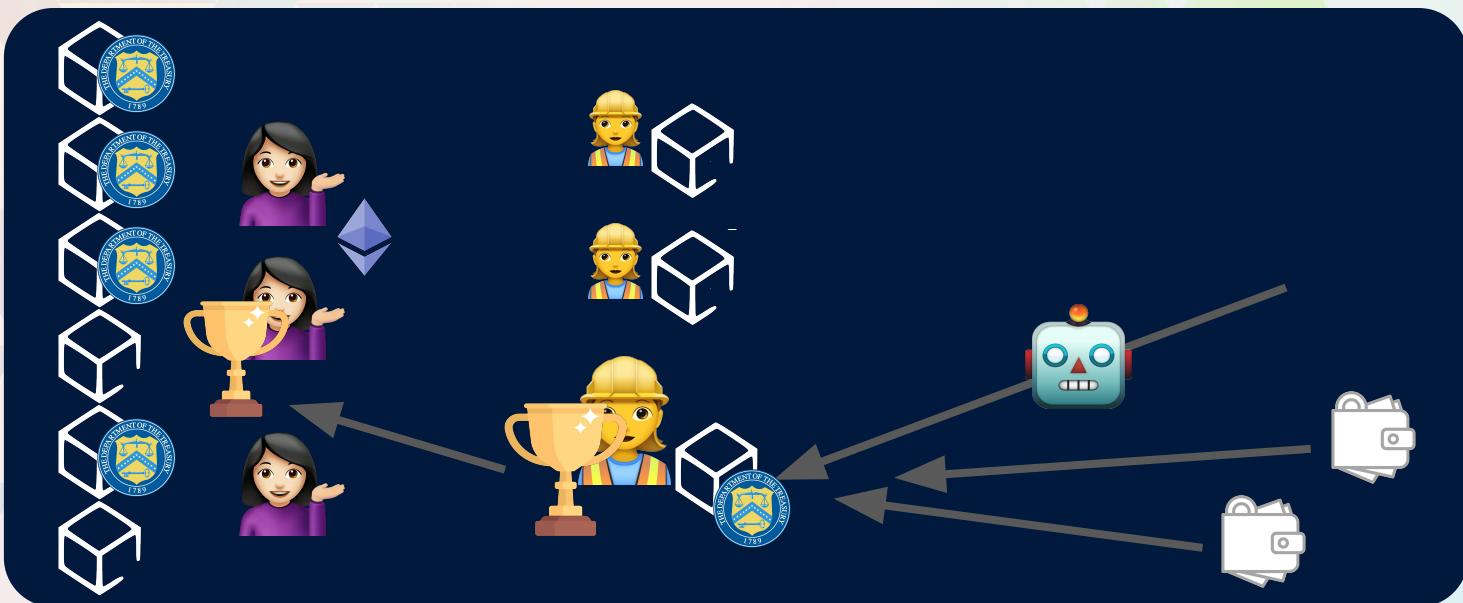
**25% of all Ethereum blocks  
are crafted by two  
builders.**

On top of that:  
**Private order flow as  
additional centralization  
risk!**

# Dystopian Future Scenario



A single block builder craft >80% Ethereum blocks.





# Utopian Future for Ethereum

# The Utopian Future for Ethereum



“My goal is insulating the Ethereum base layer from centralizing tendencies.”

– Vitalik

- Healthy base layer shielded from political pressure and centralizing forces
- Risks absorbed by layer2s and **applications**

“The best mitigation for MEV is not to sell the MEV to someone who can extract it, it’s to **create applications that don’t expose as much MEV.**”



Stephane Gosselin,  
Founder @ Flashbots



# Application Design Choices

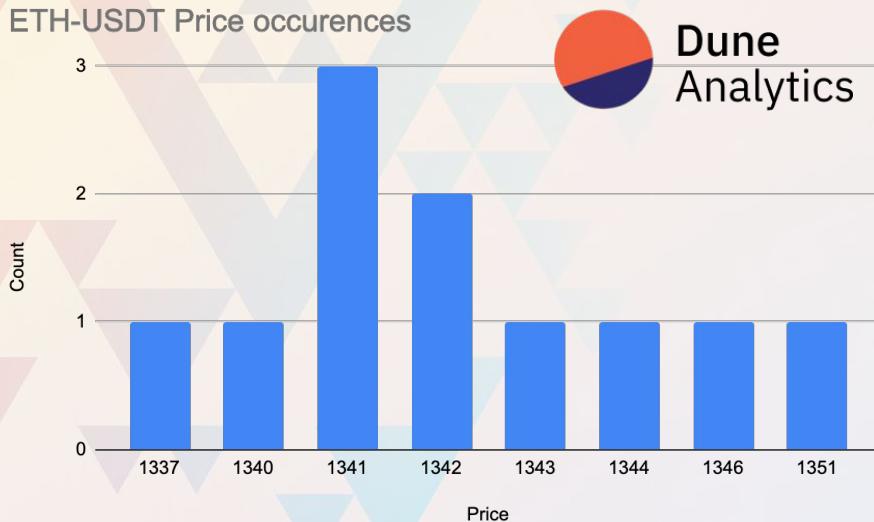


What is the root of MEV?

# The Root of MEV: one asset, many prices



# The Root of MEV: Inefficient & Unfair Pricing



price spread of **1.05%**

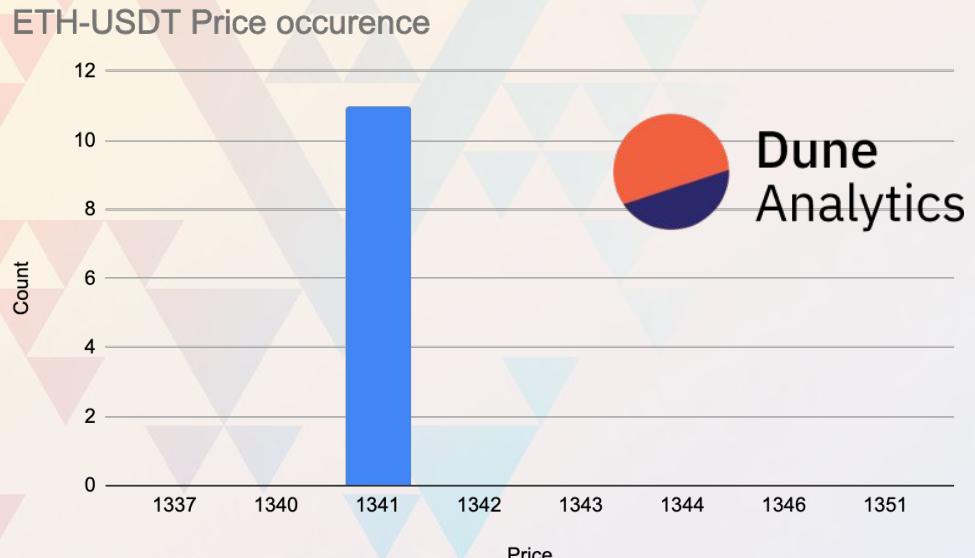
<https://dune.com/queries/1382032>

example block: 156673043

## Sequential Trade Execution:

Prices in a block spread over a spectrum → MEV Opportunities

# Batch Auctions on Blockchains



Additional price improvement 930\$  
<https://dune.com/queries/1382324>

example block: 15673043

**Batch auctions:**  
One Price per Batch → no MEV

# Minimizing MEV: Batch Auctions



Miners Frontrunning : ethereum

https://www.reddit.com/r/ethereum/comments/1000000/miners\_frontrunning\_etheru...

Sign Up Log In

Posted by u/pmcgoohan 8 years ago

### 43 Miners Frontrunning

Miners can see all the contract code they run (obviously), and the order in which transactions run is up to individual miners.

What is to stop front running by a miner in any market place implementation by ethereum?

For example, in an ethereum decentralized stock exchange, I could run a miner (or rather many miners) processing exchange transactions. When a large buy order comes in, I could delay it on all my miners, put a buy order in myself on all my miners simultaneously, and then process the original transaction. I would get the best price, and could possibly even sell to the originator for an immediate profit.

You wouldn't need anything close to 50% of mining power, because you aren't breaking any network rules. It would probably be profitable even if it only worked a fraction of the time, as in a low transaction fee environment, you could afford many misses for a few hits.

This is true for many of the proposed killer apps on ethereum, including peer-to-peer betting, stock markets, derivatives, auction markets etc

It seems like a big problem to me, and one fundamental to the way ethereum operates.

Any ideas on this?

99 Comments Share ... 88% Upvoted

Miners Frontrunning : ethereum

https://www.reddit.com/r/ethereum/comments/1000000/miners\_frontrunning\_etheru...

Sign Up Log In

vbuterin · 8 yr. ago

Just some guy

One idea is process orders in batches rather than sequentially. Specifically, let orders accumulate for a few blocks, and then come up with a list of all orders that have appeared during that time sorted by price, and then match them one by one. If "a few" is something like 5, then there are going to be enough different miners that every order will almost always get in.

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# CoW Protocol



# Batch Auctions in CoW Protocol



Sign message

Off-chain  
Order Book

CoW Batch  
Builders



Mempool

MEV  
Boost

Proposer

# Batch Auctions in CoW Protocol



Sign message

Off-chain Order Book

CoW Batch Builders



Mempool

MEV Boost

Proposer

Focus: Most value for user

Focus: Most value extraction

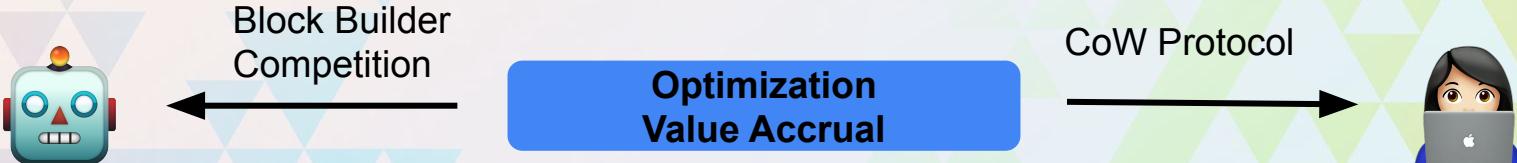
# CoW Batch Builder Competition



## Objective Function

The key goal of a solver is to find solutions that maximize the utility of the users. However, in the objective, we also add a fee component for the service provided, and subtract costs that the transaction execution on the blockchain is expected to incur. Hence, our objective reads

$$\text{maximize } (\text{total utility}) + (\text{total fees paid}) - (\text{total execution cost}).$$



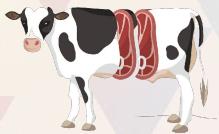


# CoW Batch Builder

## Staking & Slashing:



CoW Batch Builders (“Solvers”) **stake** tokens to participate in the competition.



In case of malicious behaviour gets **slashed**.



When winning the competition they get **rewarded** by the protocol.



# The Power of Batch Auctions

**\$2300** of added surplus from batching:

- \$800 Reduced LP fees
- \$1500 Reduced price impact

Execution price: 48.2 USDC for FOLD

Ethereum Transaction Hash (Txn) X +

etherscan.io/tx/0x16bab66141... | 📈 3 🚧 1 🗂️ 🎨 🌈 Update ⚙️

Overview Internal Txns Logs (22) State Comments

⌚ 11 days 22 hrs ago (Sep-25-2022 05:03:47 PM +UTC)  
I ⌚ Confirmed within 10 secs

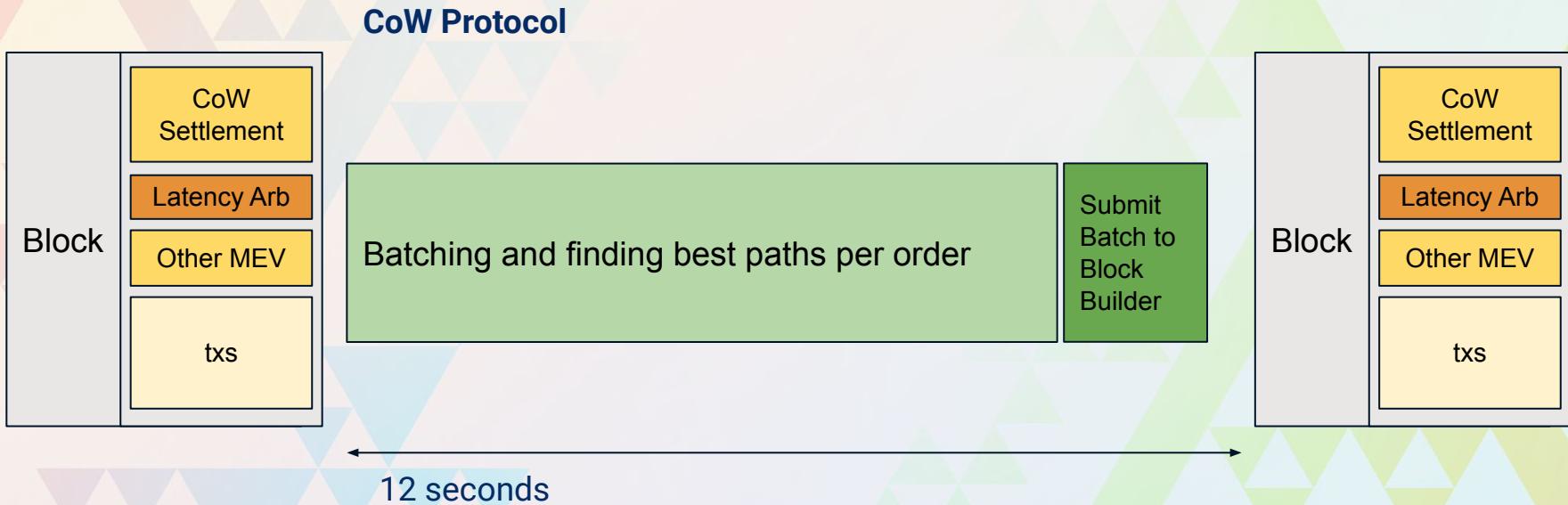
⌚ Transaction Action:

- ▶ Executed Swap 840.239 FOLD For 40,490.07 USDC On CoW Protocol
- ▶ Executed Swap 48,218.62 USDC For 1,000 FOLD On CoW Protocol
- ▶ Swap 7,713.431226 USDC For 5.9566 Ether On Uniswap V2
- ▶ Swap 5.62929 Ether For 151.300 FOLD On Sushiswap

[Etherscan](#)

# Protecting from MEV

## One Block - One Batch





# Fight MEV at the **application layer**!



Github

[@cowprotocol](#)



Open positions

[cow.fi/careers](#)



Twitter

[@CoWSwap](#)



# Thank you!

Anna George



@AnnaMSGorge

