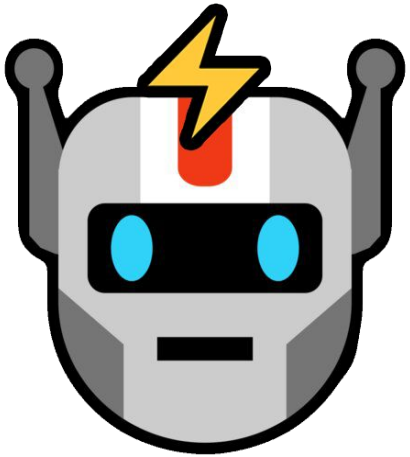
MEV across crypto in 2021

Robert Miller

MEV.day, Amsterdam



MEV activities at 30,000 feet

I want to talk about three broad categories of MEV activities today

- Extraction: efforts to capture MEV across crypto
- Externalities: negative effects from MEV extraction
- Mitigation: efforts taken to reduce negative externalities

We'll begin by looking at some numbers

MEV by the numbers: ETH L1

mev-explore: **$475.41m**

community 🥪 profit estimate: **$379.92m**

NFT MEV: ~**$75m**?

Maker liquidations: ~**$25m**?

Other long tail (liquidity sniping, etc): ~**$50m**?

Total: **~$900m - $1bn**

Not included: non-atomic arb, e.g. CEX <> DEX arbs

MEV by the numbers: other L1 chains

Polygon: **$43.3m**

BSC: **$55.79m**

Avalanche: **$18.84m**

Solana: **$8.31m**

Total: **~$126m**

Sources

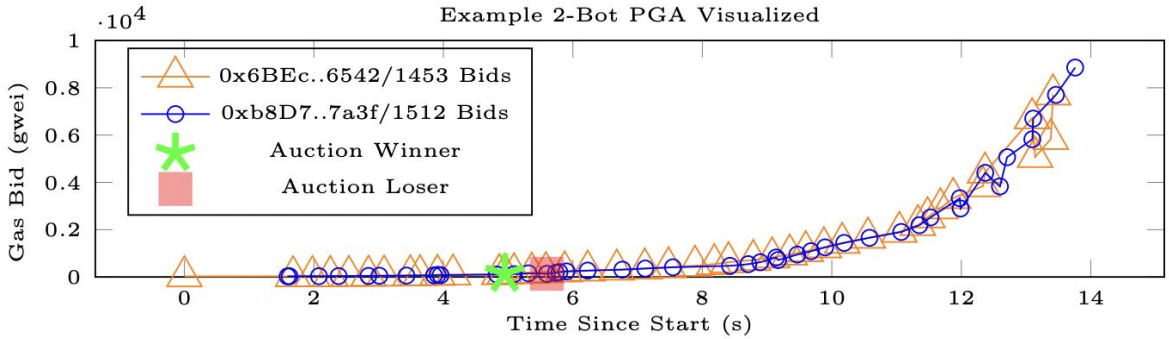
Polygon: Marlin Protocol, Explore, Jan 1st - Dec 31st 2021

BSC: Eigenphi, June 1st - Dec 31st 2021

Avalanche: Will Sheehan, August 1st - Dec 31st 2021

Solana: 0xMisaka, August 1st - Dec 31st 2021

Extraction strategy: Priority Gas Auctions



- An iterative game where bots competitively bid up transaction fees in an effort to receive priority in a block
- Bots competing on having the best networking, latency, and view of the mempool

Externality: wasted blockspace

@bertcmiller ⚡🤖🛡️
@bertcmiller

In a block earlier there was a $70k arb won by a Flashbots user. Losing PGA bots sent over 20 useless transactions & one paid 17ETH in fees!

Ultimately none of these 20+useless txs would have landed on chain if all these bots used Flashbots etherscan.io/txs?block=1227...

2:14 PM · Apr 20, 2021 · Twitter Web App

Mitigation: MEV-Geth

Flashbots: Frontrunning the MEV crisis

Economics ■ mev

MEV-Geth: A proof of concept

We have designed and implemented a proof of concept for permissionless MEV extraction called MEV-Geth. It is a sealed-bid block space auction mechanism for communicating transaction order preference. While our proof of concept has incomplete trust guarantees, we believe it's a significant improvement over the status quo. The adoption of MEV-Geth should relieve a lot of the network and chain congestion caused by frontrunning and backrunning bots.

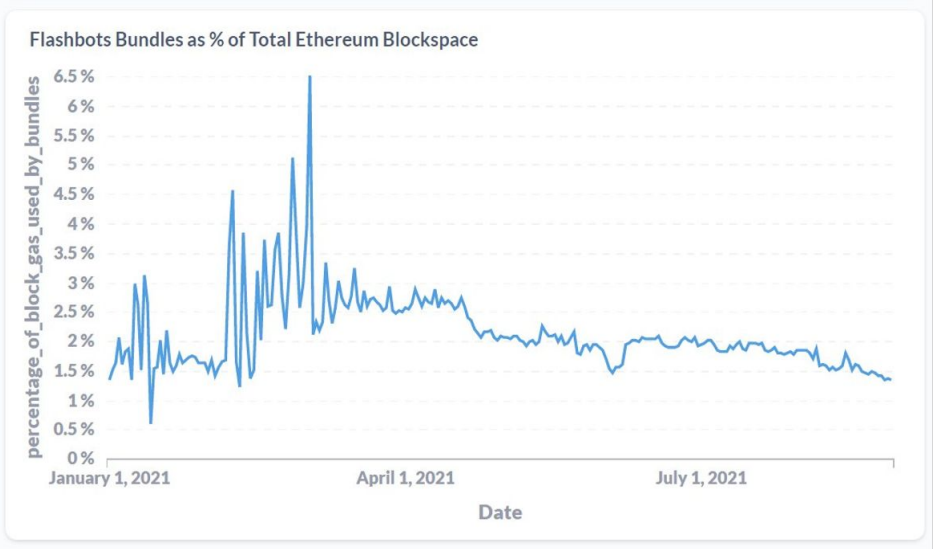
Guarantee	PGA	Dark-txPool	MEV-Geth
Permissionless	✅	❌	✅
Efficient	❌	❌	✅
Pre-trade privacy	❌	✅	✅
Failed trade privacy	❌	❌	✅
Complete privacy	❌	❌	❌
Finality	❌	❌	❌

Mitigated

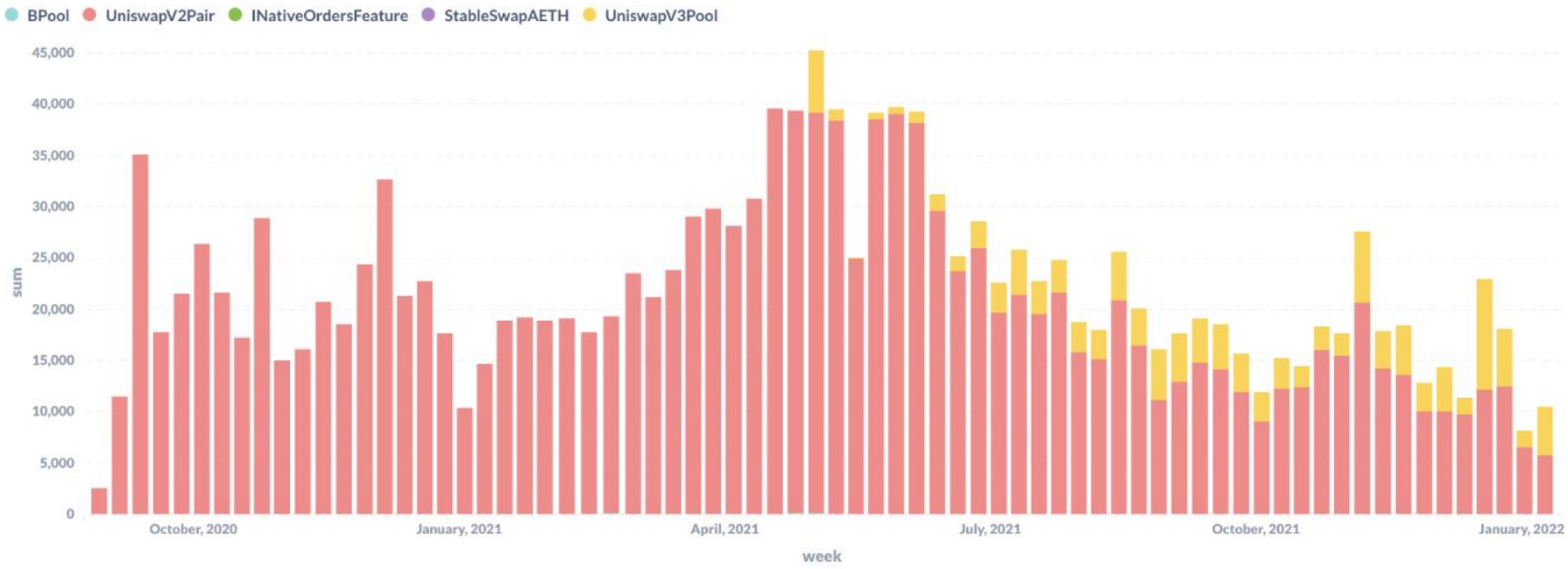
- Wasted blockspace from failed MEV transactions
- Centralization risk that unequal MEV extraction posed

Extraction strategy: Flashbots Auction

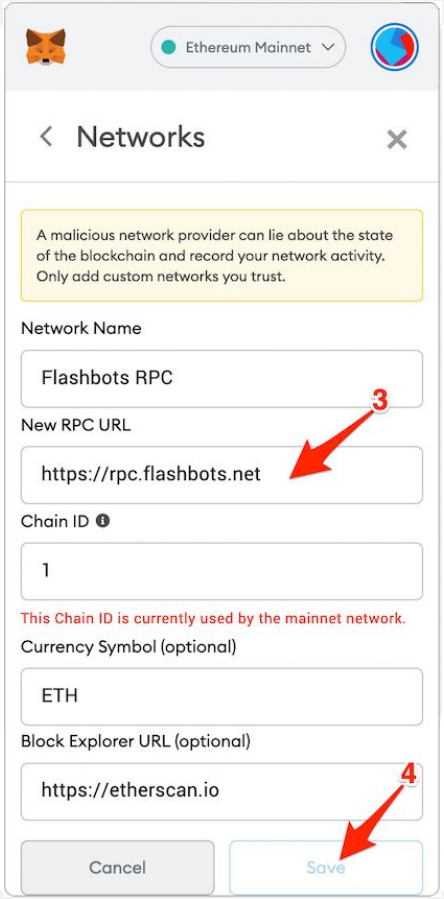
- The Flashbots Auction optimizes for gas price to decide which txs get included
- Searchers are incentivized to make their MEV extraction as efficient as possible
- The majority of MEV for common strategies gets paid to miners
- Searchers are also incentivized to find novel forms of alpha where there is less competition



Externalities: sandwiches on Ethereum



Mitigation: Flashbots Protect



Mitigated
- Frontrunning risk to users from sending their trades in the public mempool - No gas cost from failed transactions

Add https://rpc.flashbots.net to your MetaMask to use Flashbots Protect!

Extraction strategy: on-chain search spam

- For a chain with first-come-first-serve ordering and fast block times, if blockspace is cheap enough then **searchers will look for MEV *on-chain***

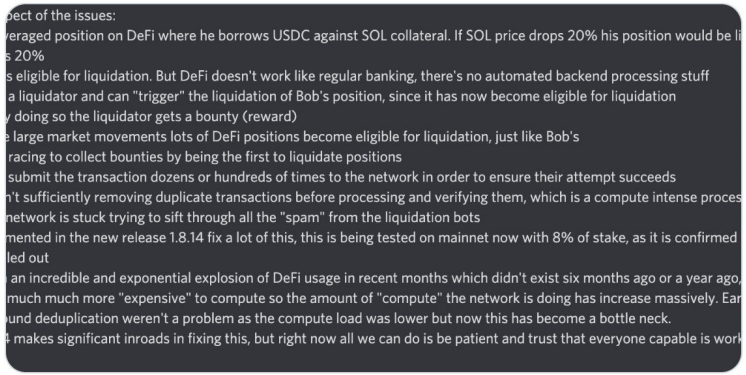
- e.g. some Solana bots will flood the network with transactions that look for arbs on-chain, hoping that they land behind a transaction that generated one, and reverting if not

Timestamp	about 5 hours ago | March 23, 2022 08:21:48 AM +UTC
Result	Success | Finalized (MAX confirmations)
Fee	0.000005 SOL
Main Actions	**Interact** with program YoLozH...KPCxPo Transfer from 6hyuGq...urbK4W to 4ofEvM...KfQt1U for **70** USDC Transfer from 4ofEvM...KfQt1U to 6hyuGq...urbK4W for **5,620,026.91** CASH Transfer from 4ofEvM...KfQt1U to 4a8uew...J2UPWH for **0** CASH **Interact** with program YoLozH...KPCxPo Transfer from 6hyuGq...urbK4W to 4YG45t...25ShpQ for **5,620,026.91** CASH Transfer from 4YG45t...25ShpQ to 4YG45t...25ShpQ for **2,219.86** SUNNY Transfer from 4YG45t...25ShpQ to 6hyuGq...urbK4W for **4,610,847.32** SUNNY **Interact** with program YoLozH...KPCxPo Transfer from 6hyuGq...urbK4W to 7NP8DT...aD8rrp for **4,610,847.32** SUNNY Transfer from 7NP8DT...aD8rrp to 6hyuGq...urbK4W for **15,802.82** USDC
Previous Block Hash	HCVtVuYi93w3BPhtAPLmSMcFvUDJxEzuTfWu3ewTYFMN

Externalities: MEV leading to downtime for users

ceteris
@ceterispar1bus

tldr of what i understand is, solana limits the amount of compute in tx's, this was fine half a year ago, but now for more complex defi stuff the amount of compute on network is skyrocketing, liquidation bots causing issues. compute fee based model will be needed.

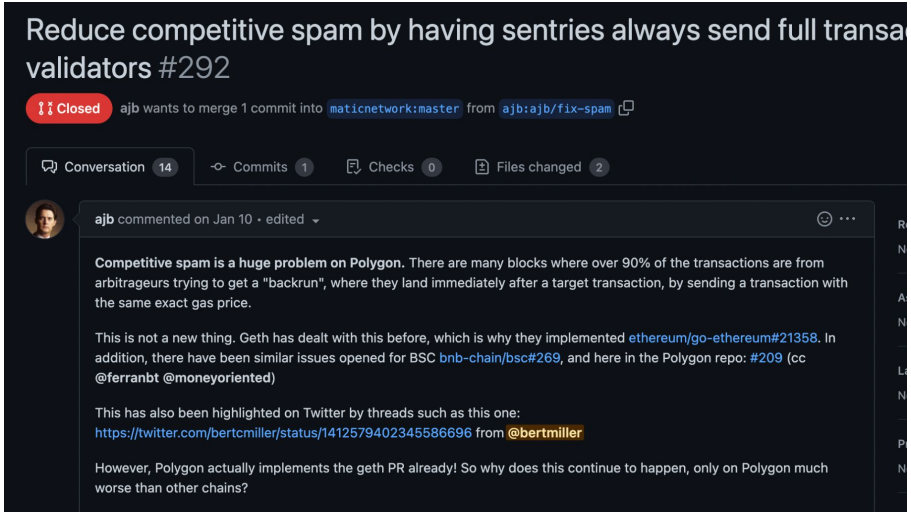


> **Solana Status** @SolanaStatus · Jan 22
> Mainnet Beta Validators: Please upgrade to github.com/solana-labs/so...

1:08 PM · Jan 22, 2022 · Twitter Web App

Extraction strategy: network propagation spam!

- There is randomness in which transactions are propagated to Polygon and Solana validators
- If you want to ensure your transaction gets to a validator in time, you are incentivized to spam the validator with transactions!



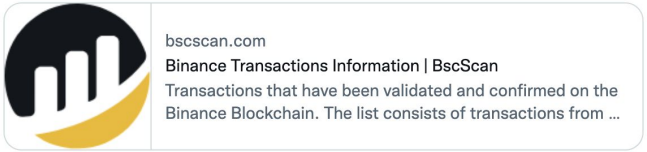
https://github.com/maticnetwork/bor/pull/292

Externalities: spam!

@bertcmiller ⚡🤖🛡️
@bertcmiller

Low fees + low latency + PGAs = spam

A token sniper on BSC is spamming HARD to get where they want in blocks. This block they used ~1000 txs and the majority of the block to get the tokens they wanted!



1:38 PM · Nov 26, 2021 · Twitter Web App

View Tweet analytics

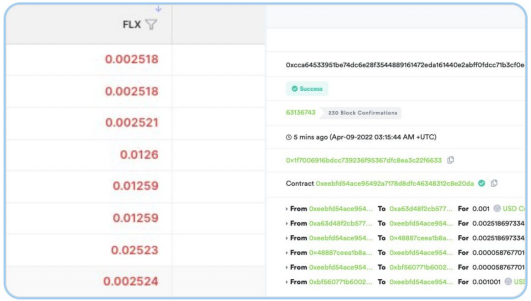
14 Retweets **4** Quote Tweets **115** Likes

Carnation (🤣, 💰)
@0xcarnation

On aurora dexes, we are starting to observe accounts spamming hundreds of txns worth a tenth of a penny.

Taking a slightly closer look it's MEV bots doing triangular arbs

On a gas-less chain, the proliferation of these bots will lead to network congestion



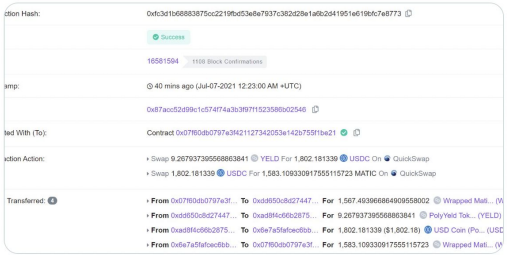
11:24 PM · Apr 8, 2022 · Twitter Web App

10 Retweets **8** Quote Tweets **171** Likes

@bertcmiller ⚡🤖🛡️
@bertcmiller

🟥MEV negative externalities🟥
This Polygon bot has been active since June 29th & has sent ~2m transactions, failing *almost* all the time

These failures cost close to nothing but bloat the state, while the few successes pay for the failures many times over



9:09 PM · Jul 6, 2021 · Twitter Web App

- Wastes blockspace and raises cost for regular users
- Adds a ton of load to the p2p layer
- Bloats state over time

Externalities: spam bringing networks down

Composability T©ly, 🇺🇸 ✔
@aeyakovenko

Replying to @gilledcheese

Bots during a raydium ido are flooding the network at 300k txs per second. The queues that forwards txs to block producers grew in size to a point that caused excessive forking. The fix to prioritize messages in this queue was already in the works but wasn't out yet.

11:10 AM · Sep 14, 2021 · Twitter Web App

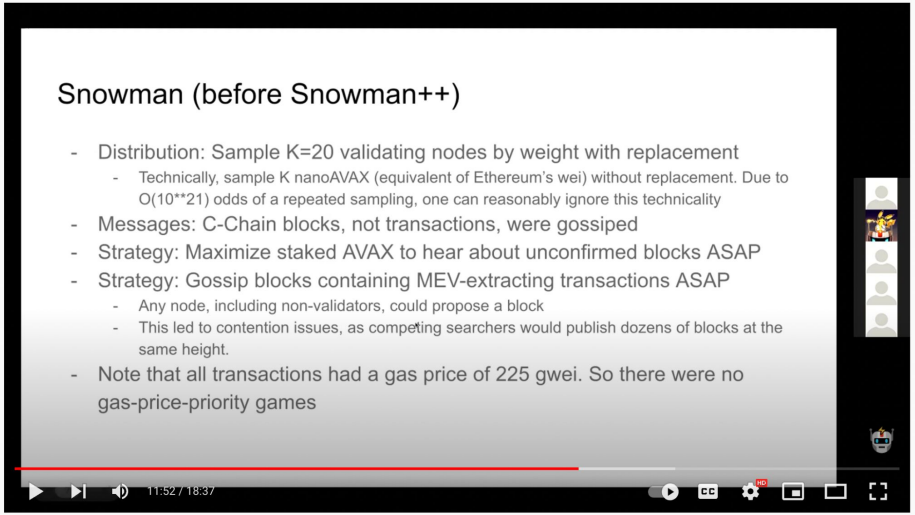
Mitigation: fee markets, block producer optimizations

Extraction strategy: maximize stake weight, fast gossip

Pre-snowman++! Not anymore!

- Maximizing your % of stake to hear about unconfirmed blocks ASAP
- Gossip blocks with MEV extraction ASAP, even with full nodes
- Result: **lots of competing blocks**

https://www.youtube.com/watch?v=1NmVORC2R-A



Interplay Between Protocol Design and MEV Strategies on Avalanche - Ward Bradt

Externalities: MEV leading to networking load

@bertcmiller⚡🤖🛡️
@bertcmiller

A nice demonstration of why protocols need to design in an MEV aware way from day 1

There was an edge in having many non-validating nodes on Avalanche, so MEV bots launched 1000s of them "dragging the whole network down" with increased load/latencies twitter.com/convexdegen/st...

This Tweet was deleted by the Tweet author. Learn more

12:02 PM · Nov 23, 2021 · Twitter Web App

Mitigation: Snowman++

Optimization 1: Snowman++ (Reducing MEV & Contention)

In Avalanche, any node can produce a block at any time as long as that block contains some non-zero number of fee-paying transactions. After producing a valid block, it is up to the consensus engine, known as Snowman, to finalize one of the many potentially conflicting blocks at any given height. Regardless of the magnitude of the contention, Snowman eventually clears through all conflicts and accepts 1 block at each height (rejecting all others). As a general principle, however, the lower the contention, the faster the time to finality (less resources spent resolving conflicts).

Extraction strategy: latency optimization

- First-come-first-serve chains with moderate and up fees (e.g. rollups) incentivize searchers to try to have the lowest latency possible
- Latency games I've seen:
  - An underground full node guide being passed around discord when there was no public guide for a rollup
  - Searchers launching 1000s of AWS servers to find the one that is closest to a sequencer
  - An oracle team also running a liquidation bot

ARBITRUM

Externality: block producer centralization

- The faster your block time the harder it is to optimize for MEV extraction in that time
- Searchers are incentivized to colocate with validators (or become one), these kinds of deals are hard to make transparent or democratize
- **Intuition**: chains where latency optimization is the dominant strategy trend towards block producer centralization over time
- Besides, do we really want to reproduce HFT style latency wars in crypto again?

Mitigations on the horizon

MEV Resistance

Osmosis's upcoming roadmap includes the tackling of maximum extractable value (MEV), one of the largest challenges seen in decentralized transactions. Since all trades are facilitated through the blockchain – meaning they're available on the public ledger – miners are able to rearrange transactions within their block to their own benefit. Miners would have an advantage over ordinary users in situations where it is important to get a transaction approved first, such as for front-running trades or acquiring a prized NFT. This type of MEV behavior disadvantages DEX users in favor of those with privileged access to the blockchain.

MEV originated as a privacy issue only to evolve into a financial one. According to MEV Explore, over $600 million has been extracted away by miners since January 2020 on Ethereum alone.

Home / Announcements

Creating a Highly Scalable and MEV-Resistant DeFi Ecosystem Using Arbitrum and Fair Sequencing Services

December 9, 2021 • Chainlink

The smart contract economy has created a large ecosystem of decentralized applications in only a few years time, supporting unique markets like decentralized finance (DeFi), Non-Fungible Tokens (NFTs), play-to-earn gaming, and many more. However, if the smart contract economy is to onboard the next billion users and become the dominant system of contractual agreements, it will need to both scale its transaction processing capabilities and maintain high levels of trust by minimizing the harmful effects of Miner-Extractable Value (MEV). In this post, we will explore Chainlink's recommended solution for scaling smart contracts on Ethereum, Arbitrum, and how Arbitrum and Chainlink are together exploring solutions to create fairer smart contracts by eliminating MEV on Arbitrum.

Jito Labs

Building Solana MEV Infrastructure

APR 4, 2022 • 5 MIN READ • ROLLING SHUTTER

Rolling Shutter: MEV protection built into Layer 2

Summary

In 2021 across crypto we saw:

- The rise of a professionalized class of MEV extractors
- As a lower bound over a billion dollars in MEV captured
- Protocol design being stress tested under adversarial conditions
- Networks buckling and even failing under stress from MEV searchers
- MEV mitigations were implemented, more are being pursued in 2022

Thanks for listening :)
@bertcmiller on Twitter / Telegram
botcmiller#4207 on Discord