mev-geth logger and latency worktest

The Flashbots Network and its stakeholders

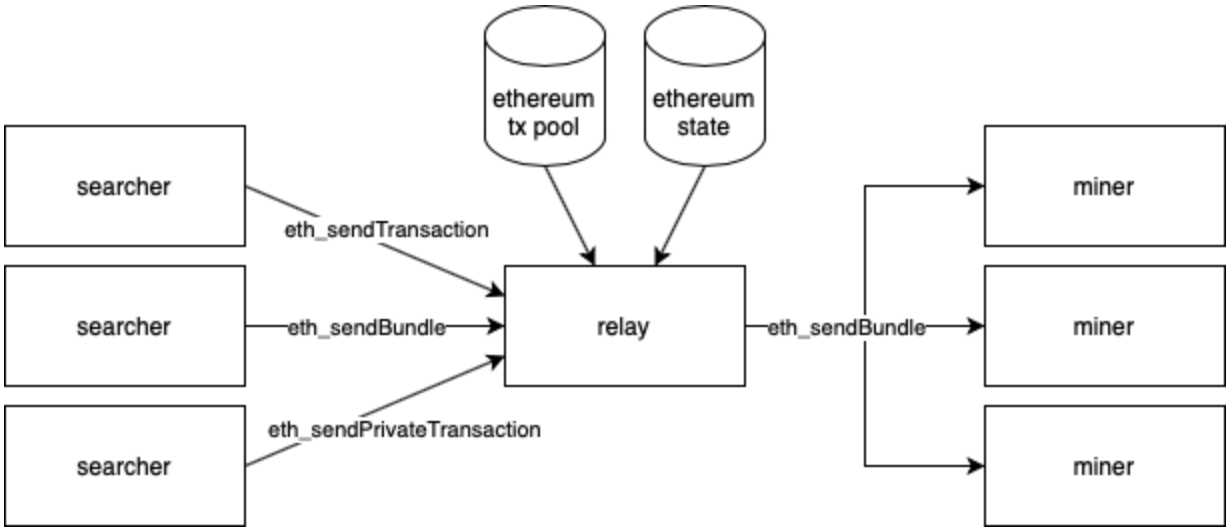
Flashbots designs and maintains a network with three key stakeholders:

- **End users**: who submit transactions through Flashbots to miners. End users primarily want to be protected from being frontrun.
- **Searchers**: who operate bots that submit ordered lists of transactions called "**bundles**." These bundles are designed to make the searchers profit, and they pay miners high fees for inclusion. Typically multiple searchers compete for a single opportunity.
- **Miners**: receive transactions and bundles and auctions off blockspace to the highest paying users or searchers. Miners use Flashbots' mev-geth software to run this auction.

The majority of miners on Ethereum run mev-geth and are a part of the Flashbots Network today. We received tens of thousands of transactions daily from end users, and hundreds of thousands of bundles from searchers that pay hundreds of millions of dollars annually.

The Flashbots Relay

Between users as well as searchers and miners sits the Flashbots Relay.



The Flashbots Relay performs a few important roles.

- First, it validates transactions and bundles are valid (e.g. transactions are signed correctly, paying reasonable gas prices, have no errors, etc). This is necessary to prevent miners from being spammed with invalid bundles.
- Second, it acts as a gateway and routes transactions and bundles to the miners.
- Lastly, in parallel to being submitted individually, transactions and bundles are also merged and ordered into one “mega bundle” prior to submission to miners.

Megabundles

Megabundles allow miners to outsource the decision of which bundles to include in a block. That is valuable to them because choosing the optimal ordering of bundles in a short period of time is a very difficult problem, and by outsourcing that allows for specialization.

However, there are a few challenges with megabundles due to how the process of mining a block works today. In particular miners “refresh” the block and list of transactions that they are mining every 3 seconds. For a megabundle to be considered

for inclusion in a block then it must be at a miner prior to this refresh. This is most important for blocks that are mined quickly, e.g. in 3 seconds or less.

MEV-Geth Logger

Flashbots is running an instance of mev-geth called the “mev-geth logger” that accepts bundles and megabundles, creates blocks, and logs the block that it has created along with profitability and timing statistics. For any given block we will submit many megabundles and the mev-geth logger will record their profit along with how long it has been since the mev-geth logger received the last block (and thus started working on the next one).

This tool is intended to give us a sense of when we should have expected bundles or megabundles to be included on-chain. However, one challenge is that since the transactions that a miner attempts to mine are “refreshed” on a regular interval a megabundle needs to have been received at the last 3 seconds cutoff prior to a block being mined. Otherwise that megabundle would have never been considered for inclusion in that block (eg. if a block was mined within 5 seconds, the megabundles until 3 seconds would have been considered for inclusion).

To understand which mega bundles we expect to be included on-chain or not we need to take into account both profit as well as timing.

block.timestamp

It’s the timestamp when the previous block has been seen.

The task

Use the data output by the mev-geth logger as well as the actual blocks that landed on-chain to determine which megabundles we can expect to land on-chain

Desired outcomes:

- A list of blocks in which we expected megabundles to land on-chain
- A percentage of blocks in which we expected megabundles to land on-chain
- Statistics on how much profit is being lost due to latency.
- Any tables or graphs to help visualize this data

The data

- mev-geth logger tasks: https://flashbots-public.s3.us-east-2.amazonaws.com/worktest-data/mevgeth_log_task-100k_blocks.csv.gz
- blocks: https://flashbots-public.s3.us-east-2.amazonaws.com/worktest-data/block.csv.gz