title: Block Builders

Builder Fundamentals

What is a Builder?

Block builders are highly specialized actors who construct blocks from transaction orderflow (public transactions, bundles, private transactions, etc).

The Role of Builders

Builders run algorithms and simulations (e.g. First Come First Serve, First Price Auctions, etc.) to order bundles and TXs in a block template (technically: `execution payload`) that maximizes profit. Builders then bid for and buy the validators' blockspace, facilitated by one or more relays, so their execution payloads are proposed to the blockchain.

How do builders pay block proposers?

Flashbots proposed a standardized specification for how payments are made from builders to block proposers through the following process:

1. The builder sets their own address as the `feeRecipient` of the payload block header they are constructing.
2. The builder includes a transaction which pays ETH to the proposer's `feeRecipient` address at the end of their proposed block.

Determining the value of blocks

A standard method for determining block value is crucial for multiple components of the MEV-Boost ecosystem; including relay monitoring, validator accounting, builder payments, block explorers, payment proofs, and MEV hiding.

Various methods for defining block value were considered by members of the community. It was determined that block level scoring was the most simple and intuitive method for scoring block value.

Block level scoring

Block level scoring looks at the difference in the balance of the fee recipient account before and after the block execution.

Note that a "block score" is not meant to be a formal definition of realized extractable value, since this is a difficult metric to quantify. For example, a Layer 2 transfer to a validator' fee recipient address could be considered extractable value, but falls outside the scope of a block score calculation.

Constructing a payment proof for this scoring method requires a Merkle Proof of the fee recipient balance in block *(n - 1)*, and a Merkle Proof of the fee recipient balance in block *n*. **Payment proofs have not yet been put into production.** Active discussion about payment proof implementation is still on-going. For more details or to participate in the discussion around payment proofs and block-level scoring, please check out to the block scoring forum thread.

External Builders

External builders can submit blocks to Mainnet, Goerli and Sepolia Flashbots relays. The table below outlines Builder API methods available on each network.

Relay Block Submission Endpoints by Network

| | | Mainnet | Goerli | Sepolia | | ---------- | ---------- | ---------- | ---------- | | `getValidators` | GET Request - Returns an array of validator registrations with assigned duties in the current and next epoch | Mainnet | Goerli | Sepolia | | `submitBlock` | POST Request - submits a block to the relay | Mainnet | Goerli | Sepolia |

- See also the Relay API documentation - Block Builder API for more details on the API and payloads.
- The example Flashbots builder implementation is a good external builder reference, and is currently used in production by

several builders.

Rate-limits

Submissions to all relays are currently rate-limited to 600 submissions / 5m / IP, which translates to in average 2 submissions / sec /IP.

Flashbots Builders

All Flashbots builders pay block proposers from the `flashbots-builder.eth` ENS address. Each Flashbots builder uses a different public key (`builder_pubkey`) for relay identification and analytics purposes.

The various `builder_pubkeys` used to identify Flashbots builders to relays are listed below:

| **Builder Public Key** | | ---------- | | 0x81babeec8c9f2bb9c329fd8a3b176032fe0ab5f3b92a3f44d4575a231c7bd9c31d10b6328ef68ed1e8c02a3dbc8e80f9 | | 0x81beef03aafd3dd33ffd7deb337407142c80fea2690e5b3190cfc01bde5753f28982a7857c96172a75a234cb7bcb994f | | 0xa1dead01e65f0a0eee7b5170223f20c8f0cbf122eac3324d61afbdb33a8885ff8cab2ef514ac2c7698ae0d6289ef27fc | | 0xa1defa73d675983a6972e8686360022c1ebc73395067dd1908f7ac76a526a19ac75e4f03ccab6788c54fdb81ff84fc1b | | 0x81babad2d5fd9413c942f49bfd86bc1dca5b02ff4cd065a10c7ab05713e63883056e6a87777e236424574aa25bbe3e99 | | 0xa35e2b13ef528efbed8d2f709c0eb9eceb1225ed0605a653ba923588b0150c94772a9ba1c809d048e321f6b73d905c60 | | 0xb89b9308fbc6c2998c7e60e39424b858c74b02c234b3e0fa5ecf7c3971208dfa5f92e0bdbe16fc24abfd71c248acf0f9 |

Additional Links & References

- MEV-Boost Geth Builder - an example builder implementation
- Relay API documentation - Block Builder API
- Block Builder Self-Help Group: https://collective.flashbots.net/c/builders/14
- Github issue about becoming block builder: https://github.com/flashbots/mev-boost/issues/145.
- Mevboost.org* - Tracking MEV-Boost relays and block builders. A quick hack by Anish. Design inspired by file.app.

Note: Flashbots does not control and cannot verify the data coming from external people and organizations. Please direct questions or issues directly to the creators of external data sources.