Ethereum Cryptoeconomics:

Execution Layer Rewards

Introduction

As Ethereum continues to evolve, the execution layer is crucial in ensuring its efficiency, security, and profitability. The transition to Ethereum 2.0, marked by the shift from proof-of-work (PoW) to proof-of-stake (PoS), significantly changes how rewards are generated and distributed within the network. This article delves into the various sources of rewards on the Ethereum execution layer, including transaction fees, Maximal Extractable Value (MEV), and their impact on network participants, particularly stakers and validators.

The execution layer is integral to the functioning of the Ethereum blockchain, handling all transaction processing and smart contract execution. Participants in this layer are incentivized through multiple revenue streams. As of July 9, 2024, the 30-day average APR for Ethereum's execution layer was 0.54% according to Rated, which reflects the rewards validators earn from transaction fees and MEV.

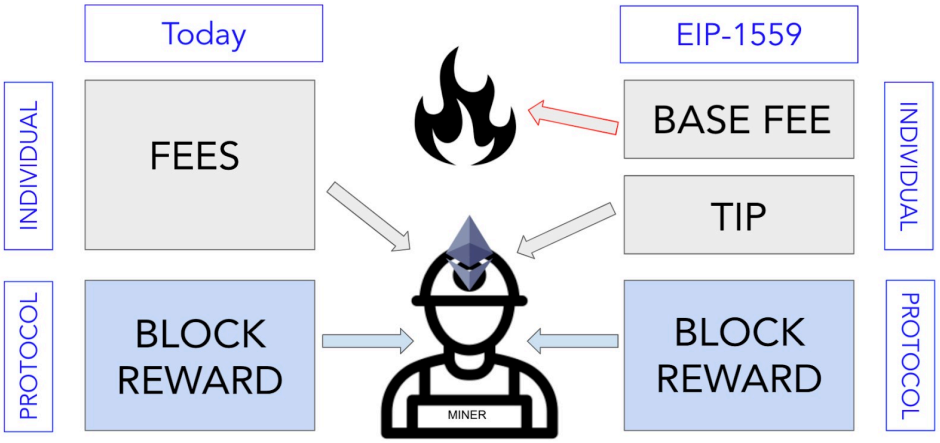
Understanding the complexities of these reward mechanisms is essential for stakeholders in the Ethereum ecosystem. This article aims to provide a comprehensive overview of the execution layer's reward structure, examining how these incentives align with Ethereum's broader goals of decentralization, security, and sustainability. Through this exploration, we delve into the components of Execution Layer rewards and analyze the current MEV-Boost quantitatively.

Execution Layer Rewards

In Ethereum 2.0 (ETH2), the execution layer rewards including:

1. **Priority Fees**: Paid by users for transaction processing and smart contract execution, these fees are awarded to validators.
2. **MEV**: Profit extracted from transaction ordering.

Transaction fees, paid by users to execute transactions and interact with smart contracts, constitute a primary source of income for validators. With Ethereum's London upgrade introducing EIP-1559, these fees are now divided into two components:

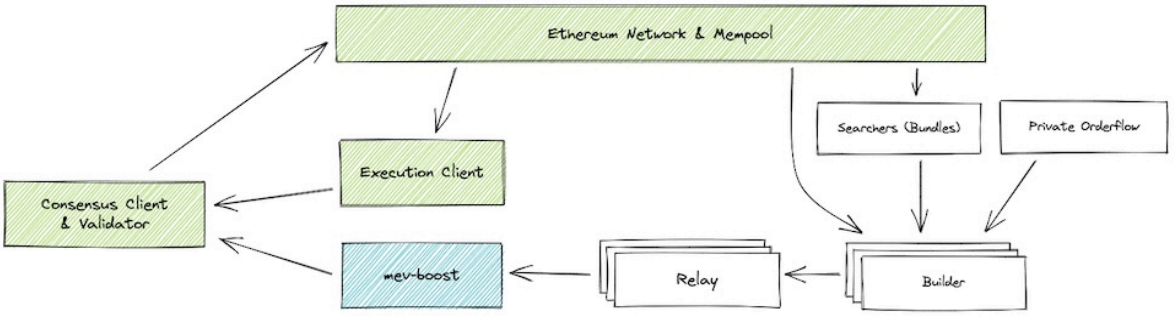


Source: Consensys

- **Base Fees**: These are burned to reduce the circulating supply of ETH.
- **Priority Fees (or Tips)**: These are rewarded to validators.

Additionally, MEV has emerged as a significant and somewhat controversial source of revenue. MEV refers to the profit extracted by optimally ordering transactions within a block, which can involve strategies such as front-running, arbitrage, and liquidations. While MEV can enhance validators' earnings, it also poses risks such as centralization and potential censorship.

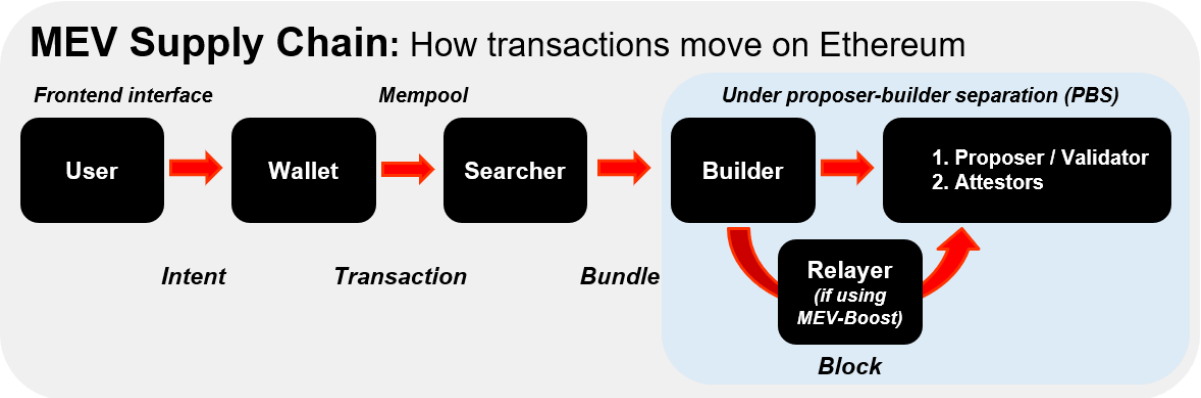
To address these challenges, **MEV-Boost** has been introduced. MEV-Boost is an open-source middleware run by validators to access a competitive block-building market. It allows validators chosen to propose blocks to sell their blockspace to the builder market, thereby increasing their revenue. By providing a free market for MEV extraction, MEV-Boost helps fill the revenue gap between solo stakers and professional node operators. It promotes fair competition among validators, ensuring that more participants can benefit from MEV opportunities. Additionally, MEV-Boost can improve the overall efficiency of the Ethereum network by optimizing transaction ordering and execution.



Source: flashbots

Ethereum validators must run three pieces of software: a validator client, a consensus client, and an execution client. MEV-boost is a sidecar for the consensus client that enables

validators to access blocks from an off-chain marketplace of builders. The whole MEV-Boost workflow is as follows:



Source: [Bankless]

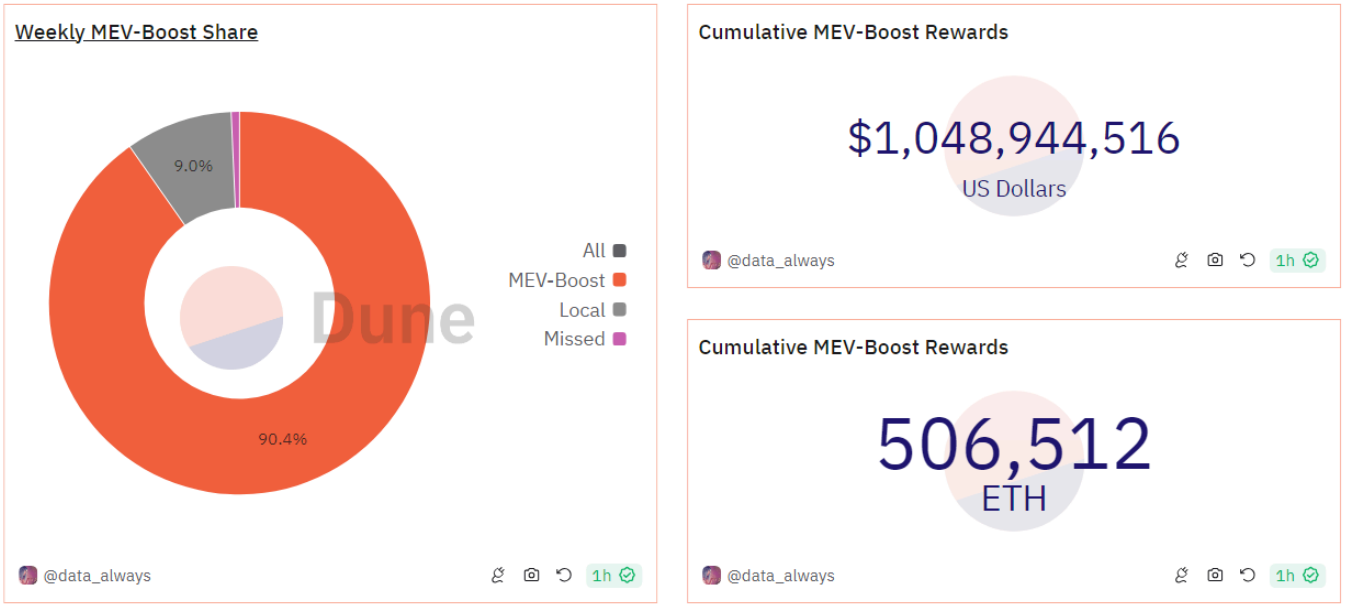
1. **Searchers Aggregate Transactions to Bundles:** Searchers bundle their transactions with selected transactions to perform strategies like front-running in the mempool.
2. **Builders Aggregate Bundles and Create Blocks**: Block builders create complete blocks from searches' bundles and private orderflow with the highest MEV yields. Builders then bid for and buy validators' blockspace gated by one or more relays.
3. **Relays Aggregate and Select Blocks**: Relays aggregate block bids from various builders and identifies the highest valid bid of the validator block to block proposer.
4. **Consensus Client Propagate Blocks**: The Proposer's consensus client propagates the most profitable block received from MEV-Boost to the Ethereum network.
5. **Block Inclusion**: The propagated block is then included in the Ethereum.

This workflow ensures efficient block production and enhances the overall functionality and security of the Ethereum network. MEV-Boost is also an initial implementation of Proposer Builder Separation (PBS), a concept proposed to enhance Ethereum's fee market and consensus efficiency. PBS separates the roles of proposing and building blocks, with proposers selecting blocks built by specialized builders. This separation improves block quality and decentralization while mitigating MEV risks by reducing the possibilities for single actors to manipulate transaction orders. PBS promotes competition among builders, leading to better block construction and a fairer fee market, ultimately enhancing network security and user experience.

Here I would like to re-emphasize the source of validator MEV tips: **Validators can only gain priority fee and MEV tips when chosen as proposers pseudorandomly by protocol.** The reason is intuitive: These fees are the additional tips to "bribe" validators to put their transactions into a block (priority fees) or choose to propose blocks they built (MEV tips). If you don't have the right to propose a block, they don't need to "bribe" you.

Quantifying MEV-Boost

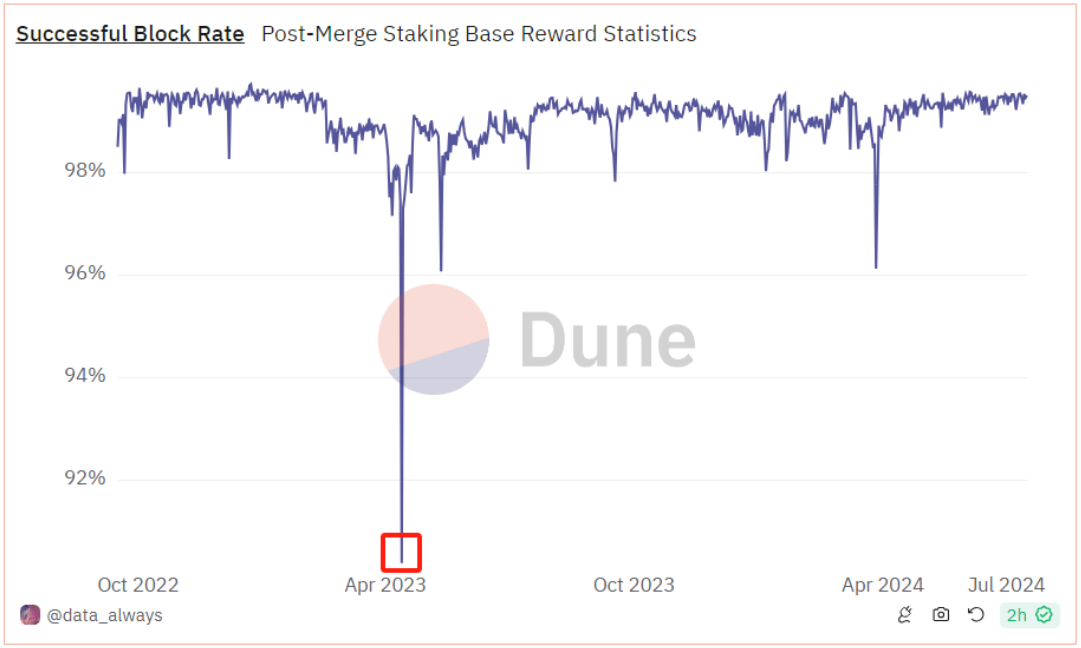
MEV-Boost Share



Source: Dune

According to Dune, 90.04% of validators already opt-in to MEV-Boost, which generates ~506K cumulative additional ETH rewards. The widespread adoption of MEV-Boost among validators highlights its effectiveness in increasing rewards.

MEV-Boost Liveness



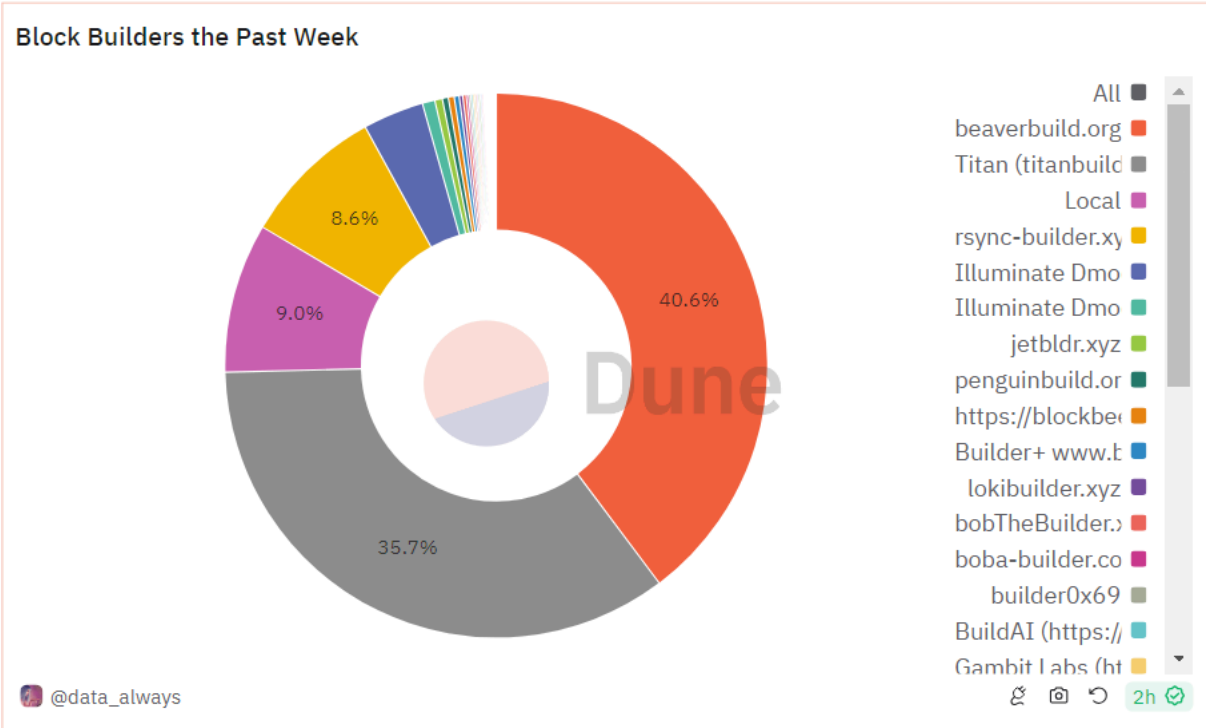
Source: Dune

Proposers may fail to produce their blocks when:

1. **MEV relayers take too long to respond, or**
2. **they encounter bugs in the Consensus Layer (CL) client (see here).**

According to Dune, Ethereum maintains >=98% block success rate most of the time. The incidents highlighted by the red rectangles likely indicate that some validators forgot to update to v1.5 during the Shapella upgrade.

MEV-Boost Builder Centralization



Source: Dune

The data shows that the top 4 builders are responsible for constructing approximately 94% of the blocks weekly. This concentration of block-building activity indicates a significant level of centralization within the network. It's way important to decentralize builders to avoid censorship.

Reference

1. MEV-Boost Risks and Considerations | Flashbots Docs
2. Missed slots and late block reorgs on Ethereum
3. MEV boost Yes or No? : r/ethstaker

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