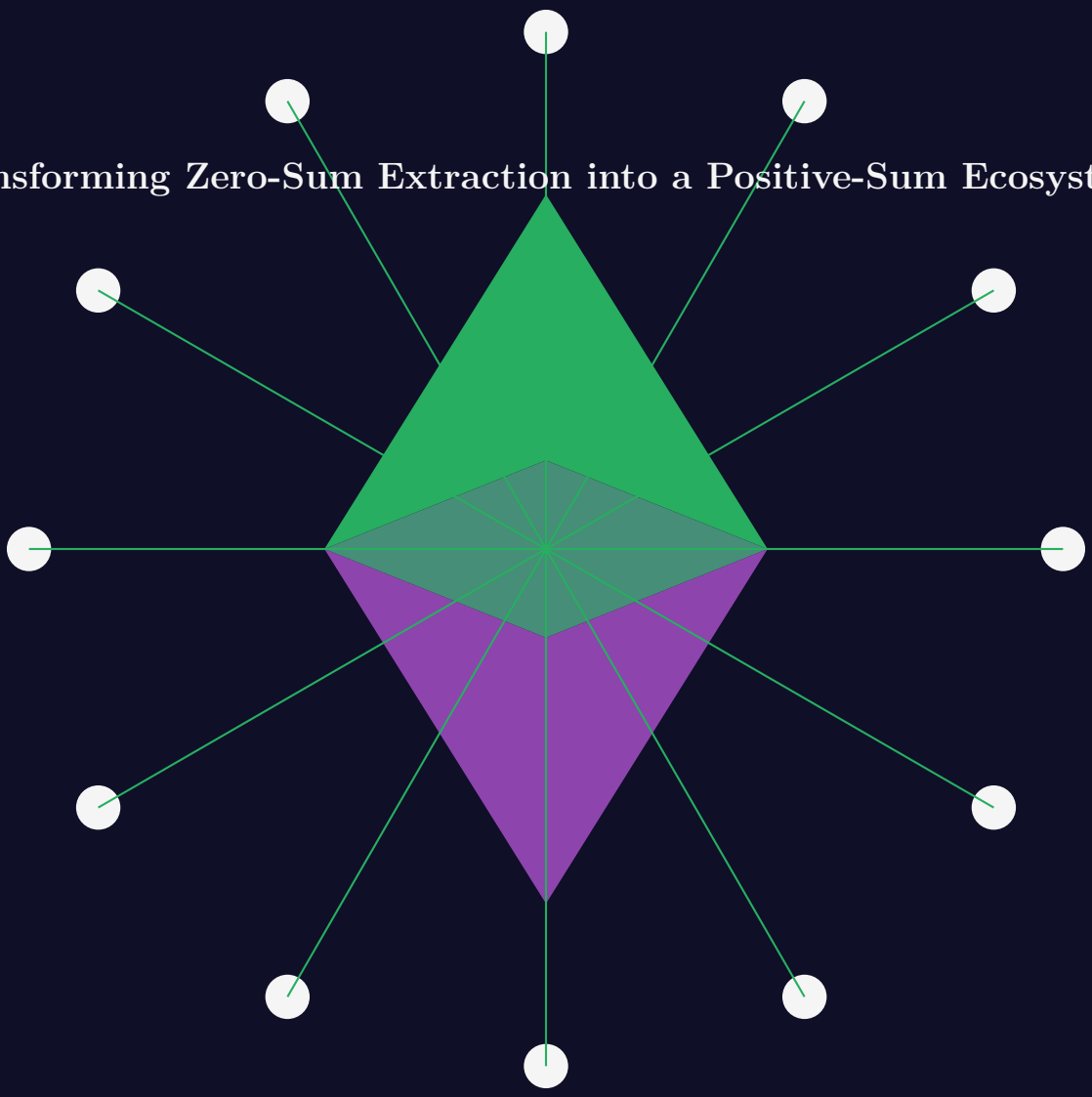
Optimizing EVMs

via a Decentralized MEV Bot Layer

Transforming Zero-Sum Extraction into a Positive-Sum Ecosystem



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Optimizing the Ethereum Virtual Machine via a Decentralized MEV Bot Layer: Transforming Zero-Sum Extraction into a Positive-Sum Ecosystem

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Abstract

This proposal explores a groundbreaking transformation of Maximal Extractable Value (MEV) extraction within the Ethereum Virtual Machine (EVM) through the integration of a decentralized MEV bot layer. Traditionally, MEV extraction has been viewed as a zero-sum game, benefiting bots and miners while often harming users through manipulative tactics like front-running and sandwich attacks. This proposal reimagines the role of MEV bots, positioning them as key contributors to a collaborative, positive-sum ecosystem that optimizes network performance, enhances security, promotes regulatory compliance, and safeguards privacy. Through profit-sharing mechanisms, flexible governance models, and network-wide cooperation, this system aims to align the incentives of all participants—users, bots, and validators alike—by introducing more realistic and actionable designs for a healthy, self-sustaining blockchain environment.

1 Introduction

Maximal Extractable Value (MEV) represents the maximum value that can be extracted from a blockchain's block production process by reordering, including, or excluding transactions. Traditionally, MEV bots have exploited these opportunities for profit, leading to harmful tactics such as front-running and sandwich attacks. This environment often places regular users at a disadvantage, creating a zero-sum game where bots profit at the expense of users.

This proposal introduces a new model where MEV bots become essential, cooperative participants within the EVM ecosystem. By sharing profits with users, aligning incentives with network performance, and enhancing security, we transform MEV extraction into a positive-sum game. Through flexible governance, profit-sharing models, and coordinated bot networks, we explore how this system can address key challenges and unlock a fairer, more efficient blockchain ecosystem.

2 Enhancing Network Performance

2.1 Transaction Sequencing for Optimal Block Space Usage

Mechanism: MEV bots can be leveraged to improve the efficiency of block space usage by optimizing the order of transactions within each block. This could involve dynamic reordering of transactions to reduce gas fees, distribute load more evenly, and prioritize critical transactions during periods of congestion.

- **Dynamic Transaction Reordering:** MEV bots could reorder transactions to prioritize those with lower gas fees or higher importance based on user-defined criteria, such as transaction size or urgency.
- **Load Balancing:** By managing transaction flow, MEV bots can help alleviate network congestion during peak times, ensuring smoother execution of transactions and reducing overall transaction wait times.

Benefits:

- Reduced Network Congestion: Smoother load balancing leads to lower transaction wait times and reduced spikes in gas prices.

- Lower User Fees: Efficient block space usage translates into lower gas fees, especially during high-demand periods.

2.2 Automated Market Making and Liquidity Provision

Mechanism: MEV bots can function as automated market makers (AMMs) across decentralized exchanges (DEXs), providing liquidity and stabilizing prices. These bots execute trades, provide liquidity, and manage arbitrage opportunities to balance the supply and demand of assets across various platforms.

Benefits:

- Reduced Slippage for Traders: Tighter spreads reduce the cost of trading and make decentralized markets more efficient.
- Market Stability: By smoothing out price swings, bots contribute to the long-term health of decentralized financial (DeFi) markets.

2.3 Cross-Chain Arbitrage and Market Efficiency

Mechanism: MEV bots can identify arbitrage opportunities across multiple blockchains. This cross-chain interoperability allows bots to buy assets where they are undervalued and sell them where they are overvalued, creating a more efficient market overall.

Benefits:

- Price Consistency Across Chains: By performing arbitrage, MEV bots help align prices between blockchains, reducing market fragmentation.
- Greater Efficiency: These activities reduce inefficiencies, helping assets reflect their true market value across multiple platforms.

3 Enhancing Security and Privacy

3.1 Mitigating Malicious Activities (Front-Running and Sandwich Attack Prevention)

Mechanism: MEV bots can be tasked with protecting users from exploitative strategies, such as front-running and sandwich attacks. These bots can intervene in situations where malicious actors attempt to manipulate transaction order to profit at the expense of others.

Benefits:

- User Fund Protection: Users are safeguarded against predatory tactics, maintaining trust in the DeFi ecosystem.
- Security Enhancement: Reducing successful exploits strengthens overall network security.

3.2 Privacy Enhancement

Mechanism: MEV bots can play a role in enhancing user privacy by obfuscating transaction details without compromising the integrity of the transaction itself. Through advanced cryptographic techniques like zero-knowledge proofs, these bots can ensure that sensitive transaction details are hidden from external observers.

Benefits:

- Enhanced Privacy: Users' transaction details are less transparent, protecting them from potential exploitation.
- Maintained Transparency: Privacy is enhanced without compromising the overall transparency of the network.

4 Economic and Game-Theoretic Implications

4.1 Profit Redistribution via Smart Contracts

Mechanism: MEV bots can be programmed to share the profits they generate from arbitrage and other extractive activities with users. Smart contracts facilitate the automatic redistribution of profits between the bot, the user, and the network validators.

Benefits:

- Fairer Ecosystem: Users are no longer passive victims of MEV; they become active participants who share in the benefits.
- Bot Incentives: MEV bots remain profitable while contributing positively to the network, reducing the exploitative nature of their behavior.

4.2 Transforming MEV into a Positive-Sum Game

Cooperative Framework: By shifting MEV extraction into a positive-sum game, the ecosystem benefits as a whole. Bots, users, and validators work collaboratively to optimize the network, creating long-term sustainability and reducing harmful practices like gas wars.

5 Staking and Slashing Mechanisms for Governance

5.1 Staking Requirements for MEV Bots

Mechanism: MEV bots can be required to stake tokens as collateral, incentivizing good behavior and ensuring alignment with network goals. The specifics of staking can be flexible, with requirements adjusted based on bot activity, network conditions, and community consensus.

Benefits:

- Flexibility in Governance: Dynamic staking levels allow for flexibility in how bots are governed, adapting to changing network conditions and risk profiles.

5.2 Flexible Slashing Conditions

Mechanism: Rather than implementing rigid slashing rules, the slashing mechanisms should be adaptable, allowing for flexibility in how penalties are enforced based on the severity of misbehavior.

Benefits:

- Tailored Governance: Flexibility in slashing ensures that penalties are appropriate for the level of misbehavior, encouraging compliance without deterring participation.
- Community Governance: The community can adjust slashing policies through decentralized governance to reflect evolving threats and network priorities.

6 Coordinated Network of Compliant Bots

6.1 Methods of Coordination

Mechanism: A network of compliant bots can be coordinated through decentralized communication protocols, ensuring that malicious bots are outnumbered and mitigated. The network can employ bot-to-bot communication, reputation systems, and decentralized governance to enforce compliance.

Benefits:

- Rogue Bot Mitigation: A coordinated network of compliant bots outnumbers and isolates malicious actors, preventing them from significantly impacting the network.
- Self-Sustaining System: The use of decentralized governance and reputation scores ensures that good behavior is incentivized, creating a self-sustaining, resilient network.

7 Regulatory Compliance Without Compromising Privacy

7.1 Reducing Fraud and Scams

Mechanism: MEV bots can actively reduce fraud and scams by flagging suspicious transactions and rerouting or blocking them before they are executed.

Benefits:

- Reduced Scam Risk: By proactively identifying and flagging fraudulent transactions, MEV bots protect users from losing funds.
- Safer Network Environment: As fraud and scam activity decreases, user trust in the blockchain network increases.

8 Integration with the EVM for Governance and Enforcement

8.1 Direct EVM Connection

Mechanism: MEV bots can be directly connected to the EVM for real-time governance and enforcement of bot behavior. This connection allows the EVM to monitor bots, issue protocol updates, and enforce compliance in an adaptive, decentralized way.

Benefits:

- Immediate Response: The EVM's real-time connection to bots allows for quick responses to emerging threats, ensuring network security.
- Adaptive Security: The system remains flexible and can evolve to meet new challenges without needing constant human intervention.

9 Conclusion

The integration of a decentralized MEV bot layer within the EVM represents a shift toward a more collaborative, efficient, and secure blockchain ecosystem. By aligning the incentives of users, bots, and validators through profit-sharing, flexible governance, and decentralized coordination, this model transforms MEV extraction from a zero-sum game into a positive-sum environment. Through fraud prevention, privacy enhancements, and adaptive security measures, the proposed system not only optimizes network performance but also fosters trust, sustainability, and fairness across the ecosystem.

This reimagined approach to MEV extraction, where bots work alongside users and the network rather than against them, marks a significant step forward in creating a decentralized, resilient, and thriving blockchain future.