In the realm of Ethereum research and innovation, the notion of Proposer-Builder Separation (PBS) stands as a fundamental design choice, showcasing its potential to enable validators to equitably benefit from Miner-Extractable Value (MEV). This deliberate separation addresses the critical concern of preventing incentives for validators to centralize through MEV accumulation. In the absence of PBS, validators would engage in a competitive struggle for MEV, potentially amplifying centralization dynamics among those participating.

PBS introduces a novel paradigm where validators are distinct from block builders, allowing builders to specialize in block construction, particularly in optimizing MEV, while validators concentrate on validation. This approach leads to a more efficient and equitable distribution of responsibilities within the network.

Within the PBS system, various types of actors, often referred to as searchers, are identifiable, including the customary MEV bots, users seeking protection like Uniswap traders, and Dapps with specific use cases such as account abstraction and gasless transactions. These searchers express their bids through gas prices or direct ETH transfers to a designated coinbase address, which enables conditional payments based on the success of the transaction.

However, a notable challenge within the Flashbot ecosystem arises from the absence of costs for failed bids, opening up possibilities for network spam via invalid bundles and potential denial of service (DoS) threats. Malicious actors could inundate miners with invalid bundles, leading to wastage of computational resources.

To address this concern and align with the PBS system, we propose the introduction of EIP-x, a stateless light client built on top of the Portal Network, focused on consuming Zero-Knowledge Proofs (ZKPs). EIP-x can serve as a critical software component for creating stateless relays, capable of efficiently verifying bundle validity and payment status using ZKPs. By leveraging this approach, we can prevent invalid bundles from reaching miners, bolstering network security and addressing the Flashbot ecosystem challenges in a strategic manner.

EIP-x's integration with the PBS system presents a threefold solution to the Flashbot dilemma:

1. Efficient Ethereum State Consumption:

As illustrated in the flow, relayers can seamlessly consume Ethereum state, specifically the ZKP of the last block state provided, optimizing resource usage.

1. ZK Payment Proof:

EIP-x enables the provision of a ZK payment proof by bundlers, ensuring efficient resource utilization by validating whether the bundler has made the requisite payment to the miner.

1. Content Privacy and Verification:

Preventing relayers from having unfettered access to bundle contents and enabling a secure validation process through ZKPs. This ensures the prevention of malicious searchers and failed bids from supplying invalid ZKPs, which would otherwise incur high verification costs.

Furthermore, to mitigate the risk posed by malicious searchers providing invalid ZKPs, we propose implementing smart contract escrows. These escrows would hold payments in abeyance until the associated ZKP is validated, ensuring network integrity and averting potential abuse.

In conclusion, our EIP-x, harmoniously aligned with the PBS system, offers a strategic and innovative approach to tackling the challenges posed by the Flashbot ecosystem. By leveraging stateless light clients and ZKPs, we pave the way for enhanced network security, streamlined resource utilization, and a robust foundation for decentralized finance (DeFi) in the Ethereum ecosystem.