Novel uses cases enabled by Fully Homomorphic Encryption in Blockchain

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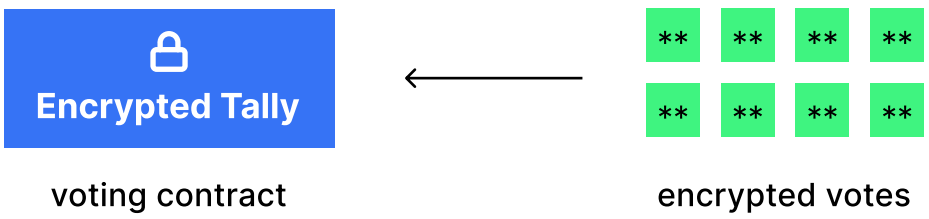
Introduction:

- The transparent nature of public blockchains limits the feasibility of decentralized applications (DApps) that require confidentiality in order to make sense.
- Existing efforts have trade-offs: 1) Secure enclaves are vulnerable to side-channel attacks and depend on a centralized supply chain 2) Zero-knowledge (ZK) cryptography necessitates off-chain storage of sensitive data and computations in plaintext, adding complexity and the risk of data leakage from untrusted provers.
- The TFHE scheme, integrated into the Ethereum Virtual Machine (EVM) as a pre-compile, also known as fhEVM, broadens potential use cases across gaming, enterprise, and Decentralized Finance (DeFi).

Solving the coordination problem:

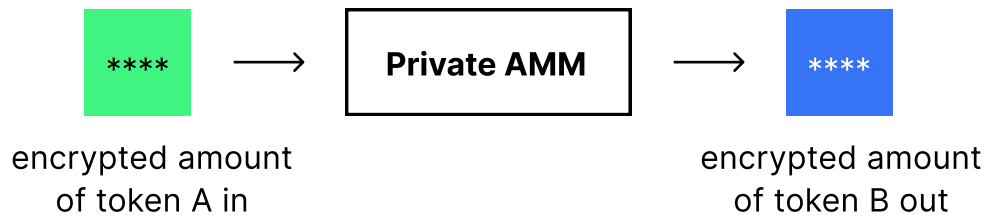
fhEVM introduces a “shared private state” that facilitates on-chain coordination and composability, enabling multi-party use cases.



Ex: Private Voting

MEV protection:

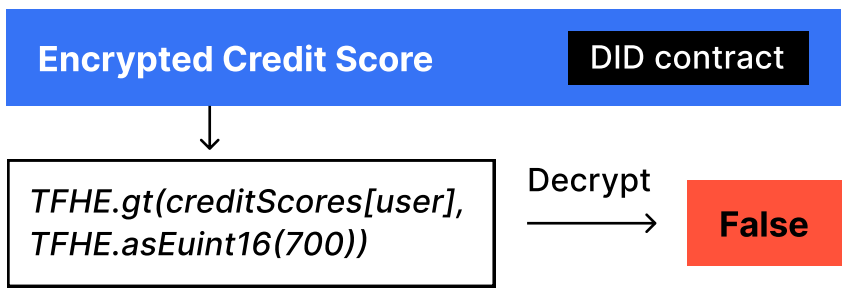
Using encrypted data as input can prevent MEV problems such as front-running given that the specific user intent will be masked.



Ex: Private AMM

Confidential state transition + comparisons:

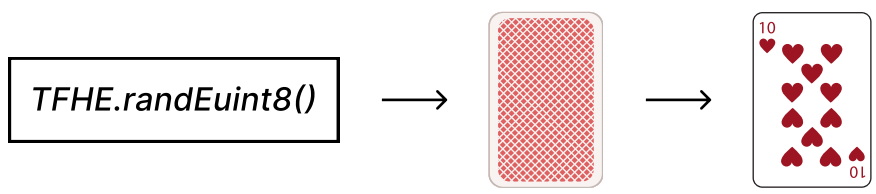
The ability to do computation and comparisons on top of encrypted data opens up for a broader range of use cases.



Ex: Is user credit score above 700?

Randomness & Confidentiality:

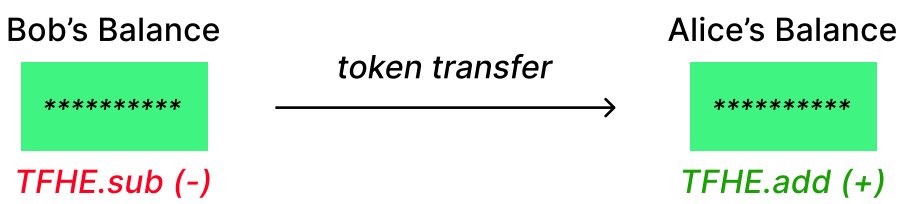
Combining randomness and confidentiality can unlock use cases that are currently not supported by existing plaintext VRF solutions.



Ex: Poker card game

Traceable confidentiality:

FHE offers traceable confidentiality because everything happens on-chain, which is more conducive to audit and compliance.



Ex: Confidential ERC-20

Conclusion:

Applying FHE to blockchain empowers developers to transition web2 applications to web3 in a trustless and painless manner compared to existing solutions, and push for the development of next frontier of decentralized applications (dApps) that weren’t possible before on existing public blockchains.

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