Principles of Blockchains
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Lecture 13

Layer 2 Scaling: Rollups

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Chapter 1

Layer 2 Scaling: Rollups

1.1 Introduction

Rollups are a scaling solution used by the Ethereum community to increase throughput on the Ethereum Mainnet by moving computation and state-storage off-chain1. Rollups "roll up" a bunch of transactions into one and come in two basic forms: optimistic rollups and zero-knowledge rollups.
Optimistic rollups make the assumption that all of the rolled-up data is valid, and that nobody is trying to fool the blockchain by hiding spurious transactions within rollups. To protect against fraudulent transactions, optimistic rollup protocols allow people to contest bunk trades. The fraudulent transaction is submitted directly on the Ethereum network to check if it's legit, and to settle the dispute.
Zero-knowledge rollups (also referred to as zk-rollups) work very differently. They rely on a piece of cryptography called a zero-knowledge proof, which allows someone to mathematically prove that a statement is true without disclosing additional information about that statement.
Rollups cut down on blockchain transaction costs by "rolling up" batches of transactions into a single one. They also speed things up: the rollup is very quick to perform and the Ethereum blockchain needs only to process a single transaction rather than many. That's useful when Ethereum maxes out at around 15 transactions per second unassisted.

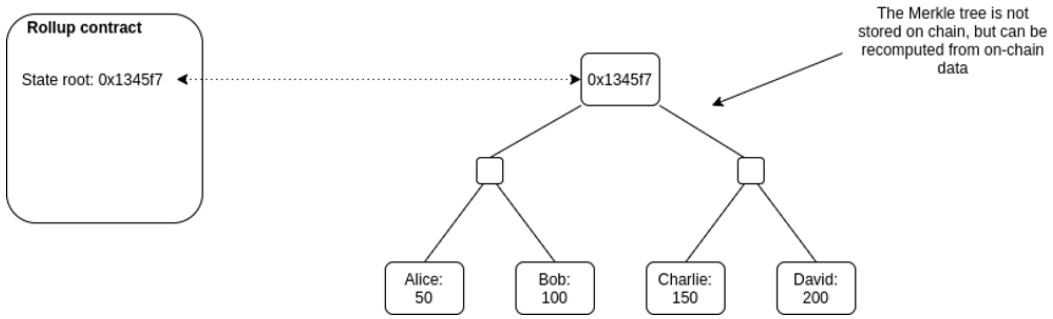

Figure 1.1: Rollups: A Scalable Solution for Ethereum - This diagram illustrates how Rollups execute transactions off-chain and report data on-chain in a compressed way, providing a scalable solution for Ethereum.