Optimistic and Zero-Knowledge Rollups

Understanding blockchain

Angelo PICERNO

Eduardo TEIXEIRA DE SOUSA

Elena PEROTTI

Micaela MASRI

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1. Introduction

The emergence and widespread adoption of blockchain technology has revealed a fundamental structural limitation: scalability. This issue, along with the possible solutions to overcome it, is the main focus of this document.

Scalability is one of the three fundamental components of the so-called blockchain Trilemma, along with decentralization and security.

The Trilemma states that a blockchain system can only optimize two of these three properties at the same time, forcing designers to accept trade-offs in performance or trust assumptions.

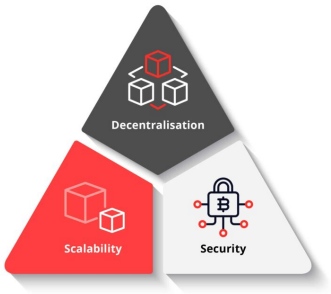

Figure 1: The blockchain trilemma

Interestingly, scalability challenges are not unique to blockchain systems. Traditional database architectures have long faced a comparable tension, often described as the CAP Theorem. Even though applied to different technologies, both frameworks highlight the same underlying idea: achieving perfect performance, resilience, and correctness at the same time is structurally difficult.

Thus, blockchain scalability can be understood not as an isolated limitation, but as the continuation of a broader historical challenge in distributed systems.