Introduction

What is Solana?#

Solana is an open source project implementing a new, high-performance, permissionless blockchain. The Solana Foundation is based in Geneva, Switzerland and maintains the open source project.

Why Solana?#

It is possible for a centralized database to process 710,000 transactions per second on a standard gigabit network if the transactions are, on average, no more than 176 bytes. A centralized database can also replicate itself and maintain high availability without significantly compromising that transaction rate using the distributed system technique known as Optimistic Concurrency Control[H.T.Kung, J.T.Robinson (1981)] . At Solana, we are demonstrating that these same theoretical limits apply just as well to blockchain on an adversarial network. The key ingredient? Finding a way to share time when nodes cannot rely upon one another. Once nodes can rely upon time, suddenly ~40 years of distributed systems research becomes applicable to blockchain!

Perhaps the most striking difference between algorithms obtained by our method and ones based upon timeout is that using timeout produces a traditional distributed algorithm in which the processes operate asynchronously, while our method produces a globally synchronous one in which every process does the same thing at (approximately) the same time. Our method seems to contradict the whole purpose of distributed processing, which is to permit different processes to operate independently and perform different functions. However, if a distributed system is really a single system, then the processes must be synchronized in some way. Conceptually, the easiest way to synchronize processes is to get them all to do the same thing at the same time. Therefore, our method is used to implement a kernel that performs the necessary synchronization--for example, making sure that two different processes do not try to modify a file at the same time. Processes might spend only a small fraction of their time executing the synchronizing kernel; the rest of the time, they can operate independently--e.g., accessing different files. This is an approach we have advocated even when fault-tolerance is not required. The method's basic simplicity makes it easier to understand the precise properties of a system, which is crucial if one is to know just how fault-tolerant the system is.[L.Lamport (1984)] Furthermore, and much to our surprise, it can be implemented using a mechanism that has existed in Bitcoin since day one. The Bitcoin feature is callednLocktime and it can be used to postdate transactions using block height instead of a timestamp. As a Bitcoin client, you would use block height instead of a timestamp if you don't rely upon the network. Block height turns out to be an instance of what's being called a Verifiable Delay Function in cryptography circles. It's a cryptographically secure way to say time has passed. In Solana, we use a far more granular verifiable delay function, a SHA 256 hash chain, to checkpoint the ledger and coordinate consensus. With it, we implement Optimistic Concurrency Control and are now well en route towards that theoretical limit of 710,000 transactions per second.

Documentation Overview#

The Solana docs describe the Solana open source project, a blockchain built from the ground up for scale. They cover why Solana is useful, how to use it, how it works, and why it will continue to work long after the company Solana closes its doors. The goal of the Solana architecture is to demonstrate there exists a set of software algorithms that when used in combination to implement a blockchain, removes software as a performance bottleneck, allowing transaction throughput to scale proportionally with network bandwidth. The architecture goes on to satisfy all three desirable properties of a proper blockchain: it is scalable, secure and decentralized.

The architecture describes a theoretical upper bound of 710 thousand transactions per second (tps) on a standard gigabit network and 28.4 million tps on 40 gigabit. Furthermore, the architecture supports safe, concurrent execution of programs authored in general-purpose programming languages such as C or Rust.

What is a Solana Cluster?#

A cluster is a set of computers that work together and can be viewed from the outside as a single system. A Solana cluster is a set of independently owned computers working together (and sometimes against each other) to verify the output of untrusted, user-submitted programs. A Solana cluster can be utilized any time a user wants to preserve an immutable record of events in time or programmatic interpretations of those events. One use is to track which of the computers did meaningful work to keep the cluster running. Another use might be to track the possession of real-world assets. In each case, the cluster produces a record of events called the ledger. It will be preserved for the lifetime of the cluster. As long as someone somewhere in the world maintains a copy of the ledger, the output of its programs (which may contain a record of who possesses what) will forever be reproducible, independent of the organization that launched it.

What are SOLs?#

A SOL is the name of Solana's native token, which can be passed to nodes in a Solana cluster in exchange for running an on-chain program or validating its output. The system may perform micro-payments of fractional SOLs, which are

calledlamports . They are named in honor of Solana's biggest technical influence,Leslie Lamport . A lamport has a value of 0.000000001 SOL.

Disclaimer#

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