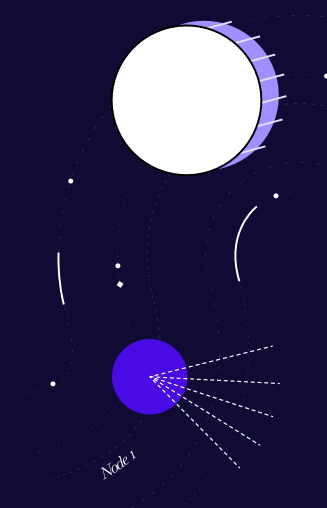


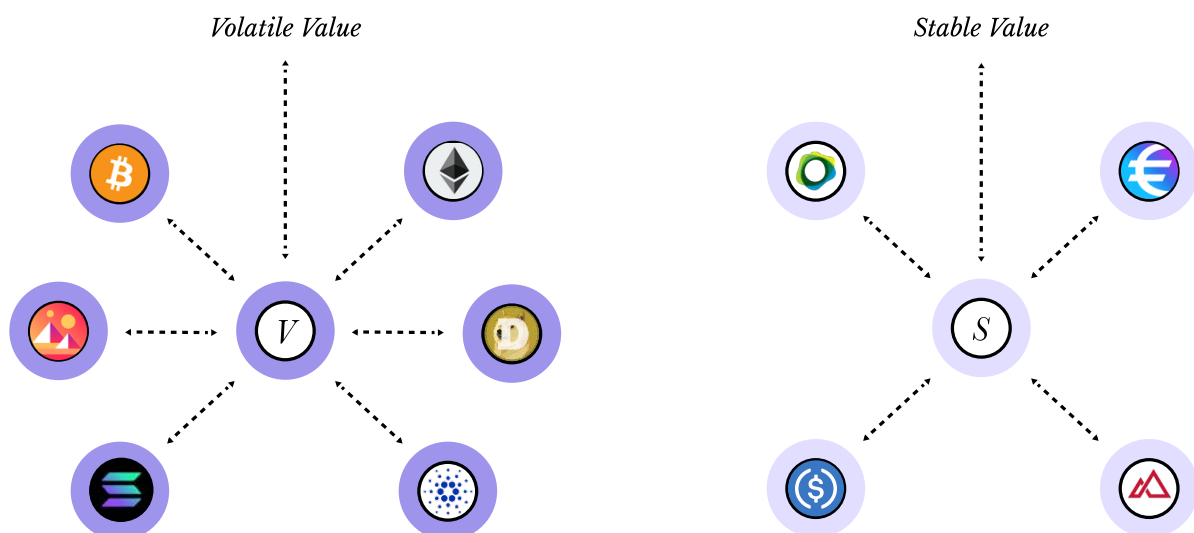
# How Stellar works: a quick, non-technical guide



## What is Crypto?

Bitcoin has brought the conversation about crypto into the mainstream, but it is just one of many cryptocurrencies, which are forms of digital value. Like Bitcoin, some have their own market value which can be affected by trading, supply, or other factors. Others are tokens representing real-world assets with intrinsic value, like gold or dollars. Crypto assets that tokenize fiat currency, like dollars or pesos or euros are often called “stablecoins” and are pegged 1:1 to the value of the currency they represent. Regardless of whether a cryptocurrency has a dynamic or fixed value, all of its movements and ownership are recorded on a shared ledger called a blockchain.

### Cryptocurrencies





# What is a Blockchain?

Different cryptocurrencies are tracked on different blockchains. The term blockchain generally refers to distributed ledger technologies (DLTs) that use various methods to create a permanent record of transactions. This permanent record can then be viewed as a shared, accurate source of information. How each transaction gets verified and added to the shared record, or blockchain, is a defining characteristic of different protocols. Some common mechanisms are Proof-of-Work (i.e. Bitcoin) and Proof-of-Stake (i.e. Ethereum 2.0), as well as newer methods of consensus using Proof-of-Agreement (PoA) like the Stellar Consensus Protocol (SCP).

**Proof-of-Work (PoW)** is the original blockchain consensus mechanism and is exemplified by Bitcoin. In PoW based blockchains, both consensus among validators and network security are achieved through a process called “mining.” Mining involves computers racing each other to solve complex computational puzzles and results in excellent network security, but also high energy consumption.

**Proof-of-Stake (PoS)** is another type of consensus mechanism seen in the planned Ethereum 2.0 blockchain. PoS requires validators to hold, or “stake” a certain amount of the native cryptocurrency to participate and potentially receive transaction fees. When a block of transactions are confirmed on the ledger, the transaction fees collected are given to one randomly selected “staked” validator. PoS benefits validators who hold the most value on the network, and involves an element of chance in its payouts.

**Proof-of-Agreement (PoA)** describes the SCP consensus mechanism used by Stellar. PoA is a more efficient alternative to older blockchains that require brute force solutions to difficult math problems and the energy to run and cool massive stacks of hardware. Instead, PoA allows for non-mining based blockchains which achieve consensus through a very fast series of messages between participants to confirm transactions and finalize them on the ledger.



A single blockchain can be used for recording movement and holdings for many different digital assets. In addition to the assets that can be transacted on the network, oftentimes the blockchain will have one or more “native” assets like Ether (ETH) on the Ethereum blockchain, or lumens (XLM) on the Stellar blockchain. Native assets may be used to pay for transactions, enable governance, or other functions of the network. On Stellar, lumens are a source of network security, used to pay a very small transaction cost that discourages spam and other malicious activity, and of liquidity, by serving as a bridge asset between exchange transactions on the network.

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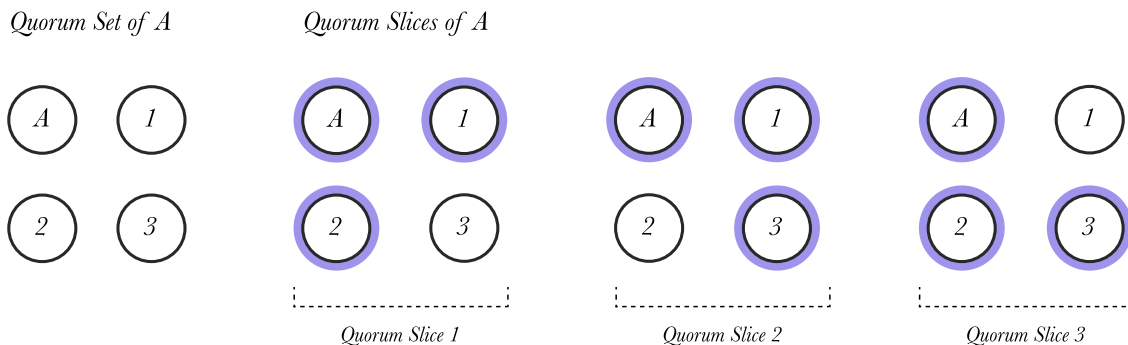
# What is Stellar?

Stellar is a decentralized, public, open network that is optimized for cross-border payments. It handles millions of transactions of different digital assets each day, allowing for more affordable and efficient payment solutions. The Stellar blockchain is open and permissionless, anyone can develop on it and no single entity controls it. Transactions are finalized and added to the blockchain once they are agreed upon by computers called “nodes” through a Proof-of-Agreement process called Stellar Consensus Protocol (SCP). Anyone can set up a Stellar node and participate, but they must provide their identifying information on the public record. This way, other nodes can decide who to include in - or exclude from - their trusted group. SCP gains Proof-of-Agreement on which transactions are added to its blockchain from a series of voting processes by these mutually trusted nodes. When enough nodes in their trusted overlapping groups (called a quorum) agree that a transaction set and the assets and actions in it are valid, it will be permanently added to the blockchain. This entire process generally takes about 5 seconds.



# How Does SCP Work?

The process of confirming transactions works a bit like this. Imagine you are a student assigned an at-home math test to be completed in groups, you're like a Stellar node. First, you'll decide which of your fellow students you want to work with and form a study group, that's your **Quorum Set**. When you sit down to do the test together, you'll want a certain number of fellow students you trust within your study group to compare answers and agree, that's a **Quorum Slice**. But that's just your own study group. In order to get widespread agreement on the answers being correct across the class, you'll need members of your group to have their own trusted fellow students outside the group agree too. Now you have overlapping Quorum Slices that agree - and that achieves Proof-of-Agreement. And congratulations - the whole class gets an "A" on that test.



An example Quorum Set and the resulting Quorum Slices. If "Student A" has three other students in its Quorum Set and requires at least 2 of them to agree, "Student A" has 3 resulting Quorum Slices.



# What About Sustainability?

SCP is extremely efficient because it gains Proof-of-Agreement by way of a series of messages sent back and forth among nodes about the transactions. This is quite different from “mining” with PoW algorithms that require a high amount of computing power to close and confirm blocks of transactions with complex math. In addition to the computing power requirements, PoW and PoS also severely limit potential participants by creating high requirements for sophisticated hardware, energy consumption, and cooling needs. By contrast, SCP can be run on a computer with easy-to-attain, standard specifications. The energy used to confirm one transaction on the Bitcoin blockchain, for example, is over one million times more than it takes on Stellar – simply because of the way the different systems work.

<i>System</i>	<i>Electricity Consumption Per Transaction</i>
Bitcoin .....	1575.93 kWh
Ethereum .....	107.75 kWh
Visa .....	0.00092 kWh
Stellar .....	0.00022 kWh

Source: Wanecek, Wilhelm, Estimating the electricity consumption of the Stellar payment network, Lund University, Department of Electrical and Information Technology, 2021; <http://lup.lub.lu.se/student-papers/record/9059429>



# Specific Features of Stellar

Because of the simple efficiency of SCP and the way transactions are confirmed, the Stellar network is well suited for issuing digital assets and building financial products.

## Stellar Network Features

**High speed:** Transactions on Stellar are finalized in about 5 seconds

**Low cost:** \$.01 pays for ~10K transactions

**Finality:** Transactions on Stellar are 100% confirmed in seconds (other chains are probabilistic, can take minutes or hours to finalize)

**Asset issuance:** Asset issuance is native to Stellar. Assets can be issued with a few lines of code – no complicated smart contracts are needed.

**Compliance tools:** Asset issuers on Stellar can utilize powerful asset controls to enforce compliance with their own ruleset/compliance obligations and get as granular as they need to satisfy compliance requirements. For example, built-in features allow asset issuers to perform Know-Your-Customer/Anti-Money Laundering checks before accepting deposits or honoring withdrawals and there is a compliance protocol that aids in sharing information in compliance with the travel rule

**Security:** SCP eliminates the risk of 51% attacks, because it does not rely on computing power. This is unlike proof of work and proof of stake systems that are subject to attacks where some entity or group of entities could secure 51% of the computing power that runs the network and then take over control of consensus and block, rewrite, or reverse transactions and/or risk double spending.

**Developer tools:** Stellar's open-source developer resources provide comprehensive documentation, software development kits, and tutorials

**Open membership and transparency:** Anyone can run a node and join the network and nodes are not anonymous – the organizations that run them identify themselves, and they work to gain the trust of other network participants

**Diversity:** As of January 2022, Stellar has over 141 nodes run by developers, businesses, and research institutions around the globe

**Clawback:** Special optional settings on assets allow issuers to reverse or pull back a transaction done in error or determined to be fraudulent

**Financial inclusion:** All types of assets can be represented, ultimately fostering greater access to previously closed or inaccessible markets for global users



# Knowing Your Chain

Finally, one of the most singular distinctions about the Stellar network is the transparency surrounding asset issuers and nodes. In order to participate in SCP and issue assets on the Stellar network, you must have a publicly-accessible and verifiable record (called a TOML file) that identifies you to the world. In SCP, each node chooses who will be in their quorum set, like the students in the math test example, so all are known to each other. Having a transparent and open process builds trust in the network and allows for flexible growth and collaboration.

To learn more about Stellar Consensus Protocol or how to get started building on Stellar, visit [Stellar.org](https://stellar.org), or reach out using our [contact form](#).