



Executive Summary

Since the Solana Foundation last published its [Validator Health Report](#) and [Network Performance Report](#), the Solana network has continued to grow, improve, and thrive. This report combines both of the prior reports and serves as an update on the network and ecosystem as a whole.

Notable achievements, discussed in detail throughout the report, include:

- Continuous improvement of network health, evidenced by 16 months (and counting) of continuous uptime and no major network issues, including the periods of high network load in January 2025
- Release of Frankendancer — a new validator client built by the Firedancer team
- A record high vote participation for any blockchain at any time with nearly 75% of staked SOL participating in the vote for SIMD-228
- Improved economic health of validators with milestones such as increased block rewards, a significant rise in REV, and 100% of priority fees now going to validators
- A steady and industry-leading decentralization score as measured by the Nakamoto Coefficient

While improvement of the network is an ongoing goal, Solana continues to be a leader in network performance and validator health—whether measured by decentralization, performance, or the robustness of the validator community.

Blockchain	Approx TPS	Total Consensus Validators	Nakamoto Coefficient	Validator Clients
Solana	1100	1295	20	3
Ethereum	14	9961	6	5
Sui	48	113	18	1
Sei	51	40	7	1

Base

[77](#)

1 (Coinbase sequence)

n/a

Network Performance

A reliable, fast network is essential for a blockchain to lead and thrive

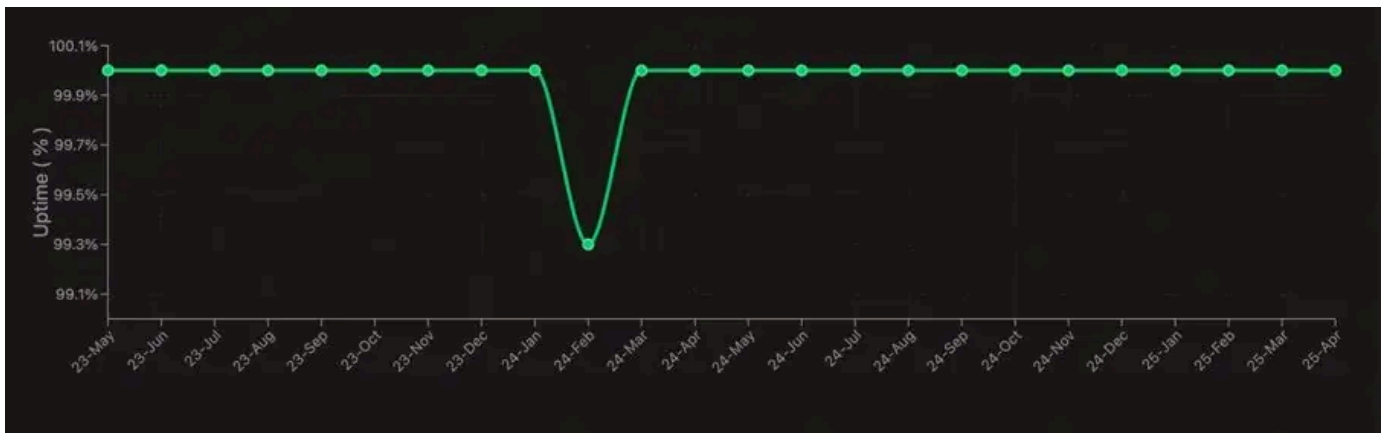
First, let's look at an updated network performance status [since the last report](#). At its core, a blockchain network should be fast, reliable, and stable. As Solana has continued to grow and scale, the network has seen improved resilience and capabilities.

How Solana is doing

Solana network performance is thriving.

- The network has experienced 100% uptime [for nearly 16 months and counting](#).
- Replay times, which in 2022/2023 were a bottleneck, have been dramatically improved, and no longer constrain the network. They are consistently below 400ms, making epochs reliably just under 48hs as intended.
- [Pinocchio](#), a new library for creating Solana Programs, has significantly optimized Compute Units (CU)—a measurement of Program execution costs. In addition, CU limits have been [raised to 50m](#), soon to bump to [60m](#).
- During periods of high network activity in January 2025, the Solana network broke several records, including [all-time highs of activity for any blockchain in history](#). While some network applications faced challenges during this time (notably degraded performance with Jito's block engine, slippage issues for users, improper priority fees set by apps resulting in transactions not being picked up, and UX issues on some apps), overall the network handled the burst remarkably well with no downtime.
- During this period of high activity, Solana successfully processed:

- Several days of [over 200M daily transactions](#)
- 400k+ new wallet downloads.
- Over \$200M in liquidity inflows
- DEX volume of up to \$39B/day
- As a result of the stress test created by the above period of high network activity, several opportunities for improvement were revealed and subsequently strengthened, including a new scheduler on Agave/Jito that drastically boosted fee throughput [by 80%](#).



Solana network uptime since May 2023

Solana network uptime since May 2023.

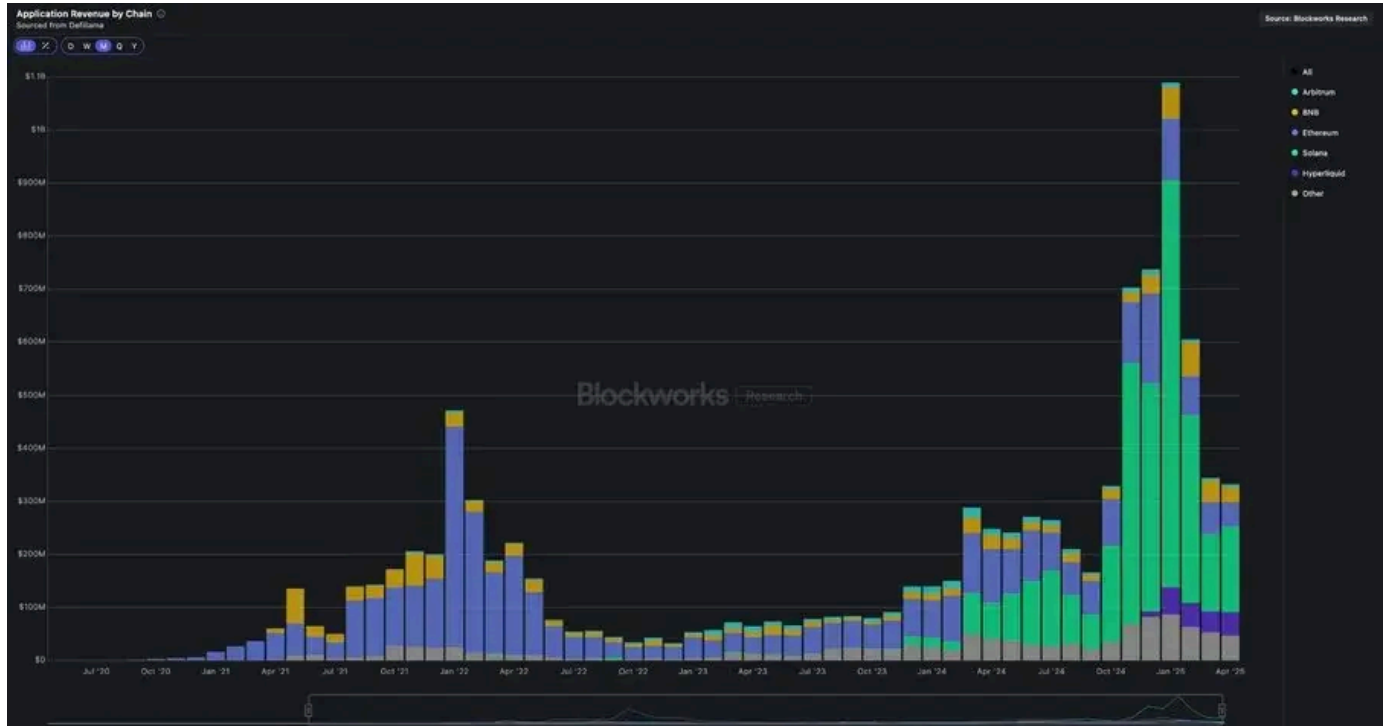
App Revenue

Growing app revenue shows a thriving ecosystem where the funding and economic incentives are strong

One way to measure the success of a network [is the "GDP" of the chain](#) (defined as the fees generated by the apps on that chain). Apps generating more revenue than their base chain is a healthy signal. Additionally, strong app revenue not only promotes

developers and apps to join (and stay on) a network, it also encourages the network itself to continue to reinvest in its infrastructure and developer tooling.

How Solana is doing



As seen in the chart above, app revenue for Solana has been growing consistently since Q3 2023. The past two quarters have shown a significant increase over previous quarters, with over \$1B in app revenue each. App revenue for Solana is healthy and industry leading.

Tooling

Powerful tooling that is continually improved supports cutting-edge apps that are secure, usable, and scalable.

When developers have great tooling, they can more easily take advantage of the full capabilities of a network. Better tooling means better apps, which in turn unlocks new use cases and more users.

How Solana is doing

Powerful tooling was released in the Solana ecosystem over the past year, including: Pinocchio, Surfpool, [Solana Attestation Service](#), [Token Extensions](#), and [Blockchain Links \(blinks\) and Actions](#). These tools make it easier for developers to create apps that take advantage of the full capabilities of Solana.

Pinocchio

[Pinocchio](#) is a zero-dependency library used to create Solana programs in Rust. By not relying on the Solana-program crate or any other external dependencies, it makes Solana programs more lightweight and reduces potential conflicts.

Surfpool

[Surfpool](#) is a fast, developer-friendly simulation of Solana Mainnet that runs on local machines. It eliminates the need for high-performance hardware while maintaining an authentic testing environment.

Solana Attestation Service

[Solana Attestation Service](#) (SAS) is a public good program for associating offchain data (such as KYC checks, geographic eligibility, membership in a club, or accreditation status) with onchain accounts. These attestations are signed, verifiable, and reusable across applications without exposing sensitive data onchain or duplicating verification steps. SAS enables use cases for compliance, access control, and programmable trust on Solana, such as proving investor accreditation for tokenized equities and RWAs, giving individuals or DAOs verifiable, decentralized reputation (e.g. creditworthiness for lending in DeFi protocols), verifying region before giving access to a token launch or mint and more. SAS was launched with support from Civic, Solana.ID, SOL.ID, Cogni, Trusta Labs, Wecan, Range, Polyflow, Bluprynt, Roam, and others throughout the ecosystem.

Token Extensions

[Token extensions](#) (released in early 2024) are the next generation of the Solana Program Library Token standard. Over a dozen extensions, such as confidential transfers, transfer hooks, and interest-bearing tokens, provide advanced configurable functionality. Token extensions give teams flexibility and advanced features in their tokens.

Examples of products using Token Extensions include [PayPal's PYUSD](#) stablecoin and the [Global Dollar Network's USDG](#).

Blinks

[Solana blinks](#) (released in conjunction with [Dialect](#) in June 2024) are an interface that turns any Solana action into a shareable, metadata-rich link. Blinks are clickable anywhere on the internet capable of displaying a URL, including X, Discord, websites, mobile, and more. With blinks, developers can enable anything that can be done on Solana into their app or website.

Example use cases include [using crypto to pay for goods](#), [buying or trading tokens](#), and [playing games](#).

Developer Growth and Retention

Developer momentum sparks apps, draws users, and signals a healthy network

Developers are key for value creation on a network. They build the apps that bring in the users; and with new users come even more developers. New developers joining (and current developers staying) is a leading signal of a healthy network.

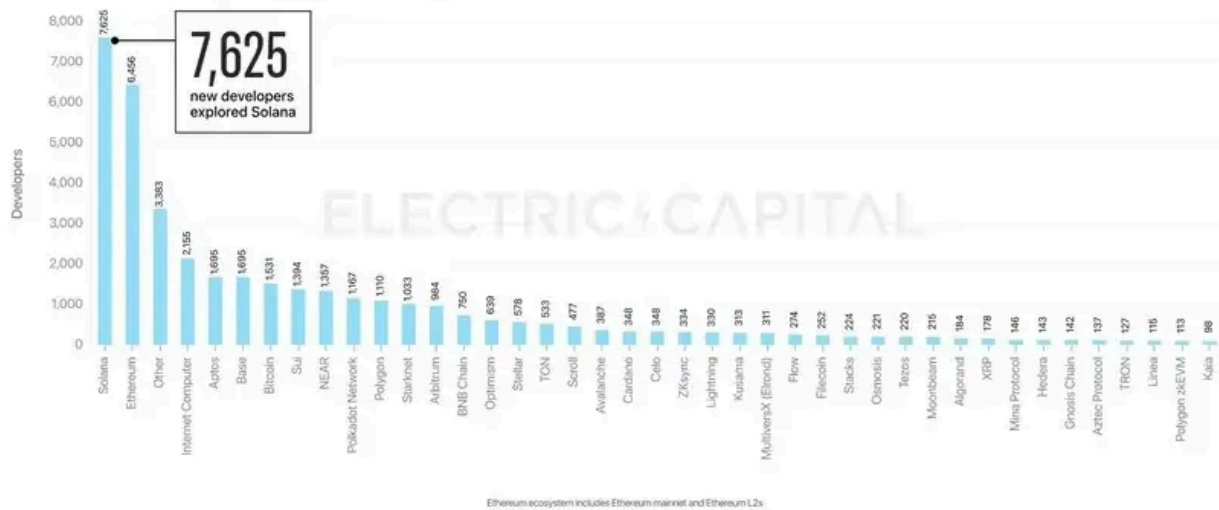
How Solana is doing

Solana was the [#1 blockchain ecosystem for new developers](#) in 2024, with over 7600 new developers joining the network, over [3200 monthly active developers](#), and 83% year-over-year growth. Developers continue to join and thrive on Solana.

Solana was the #1 ecosystem for new devs in 2024

Ethereum is the #2 ecosystem for new developers in 2024

Number of new developers exploring different crypto ecosystems in 2024



Source: [Electric Capital 2024 Crypto Developer Report](#)

Validator Health

Core Clients

A greater number of distinct clients results in better decentralization of the network and lowers the risk of network failure

Validators are computers that run a Solana validator client, which is the operating system of the Solana network. It's important for the resiliency and decentralization of any blockchain network to have more than one software client; this helps ensure that there's no single failure point in the network's software.

With multiple validator clients, the risk of one bug or harmful piece of code in a single client is mitigated by the existence of other independent clients, which are unlikely to have the same bug or malware attack, making a total network outage less likely.

How Solana is doing

There are two primary validator client implementations (Agave and Firedancer) for the Solana network and two in active development (Mithril and Sig). While the Agave client is currently run by over [92% of Solana validators](#), the upcoming Firedancer client is expected to see significant adoption, creating a better balance of client distribution.

The current Solana validator clients are:

Agave/Jito: ~92% of network stake

Agave, maintained by [Anza](#), is written in Rust. It's a fork of the original Solana validator and launched in early 2024.

Development on Agave [is active](#). Recent highlights include:

- Integrated new central scheduler (v1.18) and greedy scheduler (v2.1)
- Ongoing improved performance
- Gossip traffic is [down 61%](#)

Firedancer: [~7%](#) of network stake

Firedancer is a new client written from the ground up in C++ and maintained by [Jump Crypto](#). As of April 17, 2025, [34 validators are using firedancer](#) (about 7%), but this number is expected to quickly grow. The current version, Frankendancer, is a hybrid

Firedancer/Agave release. Firedancer was engineered for massive parallelism and includes [well-designed dashboard and telemetry tooling](#).

As [announced at Solana Breakpoint 2024](#), the full Firedancer client has achieved 1m TPS in testing and is able to replay mainnet blocks. The Firedancer team is making progress towards a future mainnet launch.

Other clients

Other clients in various stages of development include [Mithril](#) written in Golang and developed by [Overclock](#) and [Sig](#) a read-optimized client written in Zig by [Syndica](#).

Vs Other Chains

Solana and Ethereum are the only L1 networks with more than one client. Ethereum leads by count of distinct clients, with [Nethermind](#) (21% usage) and [Geth](#) (54%) being [the most popular](#).

Network	Multiple Clients	Notes
Solana	Yes	Agave/Jito (Rust), Firedancer (C++)
Ethereum	Yes	~5 consensus (Lighthouse, Prysm, Teku, etc.) + ~5 execution clients (Geth, Nethermind, Besu, etc.)
Sui	No	One Rust-based client from Mysten Labs
Sei	No	One Go-based client
Base	No	Coinbase is the only current validator

Total Validator Count

A higher number of quality validators results in better network resiliency and lowers the risk of network failure

Blockchains with more validators tend to be more resilient. When a user executes a contract on a blockchain, they need to be confident that their transmission will be recorded. Ideally, each addition to a blockchain is recorded on every validator on that chain, which is why a higher number of validators is important; a large number of diverse validators protects against catastrophic events like a data center outage.

There are two types of validators — consensus nodes and RPC nodes.

Consensus nodes are central to the functioning of the network by providing two essential functions: (1) creating and proposing new blocks to the rest of the network and (2) voting on the validity of new blocks proposed by other nodes on the network.

Remote Procedure Call (RPC) nodes are an application's gateway to the Solana infrastructure. While they verify all new blocks and changes to the network, they do not vote.

In this report, the Solana Foundation is concerned only with consensus nodes.

How Solana is doing

Since the last validator health report, the total number of consensus nodes has decreased from ~1900 to [1295](#) (as of April 16, 2025). Though the overall count has dropped, the nodes that remain tend to be healthy and high-quality. What makes a “high-quality” validator is subjective, but examples include uptime, hardware performance, service levels, and validator community participation.

The Solana Foundation continues to support and encourage node *quality*—not just node *quantity*.

Vs Other Chains

The number of consensus nodes on Solana remains quite high relative to other proof-of-stake blockchains.

Blockchain	Block Producing Validators
Ethereum	9961
Solana	1295
Sui	113
Sei	40
Base	1

Nakamoto Coefficient for Voting Power

A higher Nakamoto Coefficient means better decentralization and a higher difficulty for a bad actor to compromise the network

The Nakamoto Coefficient for voting power is defined as the minimum number of nodes that need to be compromised to censor blocks or stop consensus in a network, thereby preventing some or all new blocks (and the transactions within them) from being confirmed. For most proof-of-stake networks, this is the number of nodes needed for at least 33.4% of voting power.

When stake distribution is highly centralized, a smaller number of validators may represent 33.4% (a superminority) of total stake delegations. In a more decentralized

distribution of stake and consensus power, this set is larger, making it more difficult for a business, rogue actor, or other entity to manipulate the blockchain through censorship.

How Solana is doing

Solana’s Nakamoto Coefficient grew steadily from the chain’s launch in March 2020 through September 2022, [peaking at around 34 in August 2023](#). As of April 16, 2025, Solana’s [Nakamoto Coefficient is 20](#). This means the lowest number of validators that would have to collude to censor the network is 20.

The change over the last months is due to the reallocation of stake among larger validators. Though the Solana Foundation continues to prefer to see this number increase over time, a Nakamoto Coefficient of 20 is still robust and leading.

The Nakamoto Coefficient has remained relatively steady [over the last 18 months](#).

Vs Other Chains

Below are the Nakamoto Coefficients for several other blockchains, for the sake of benchmarking.

Blockchain	Nakamoto Coefficient
Solana	20
Ethereum	6
Sui	18
Sei	7
Base	1

Source: <https://nakaflo.w.io/>. See footnote 2 for Ethereum calculation.

Geographical and Data Center Distribution

A broad distribution (both geographical and by data center provider) reduces network risk from geopolitics, natural disasters, and corporate reliance

A global, resilient blockchain has to continue operating, no matter the events in a given part of the world, whether facing natural disasters, a censoring government, or an unfriendly data center host.

Consider:

- A government carries out an attack on underwater fiber cables, knocking out the internet to an entire region.
- A dictatorial regime declares a chain illegal and shuts down all nodes in their country.
- A natural disaster disrupts all the nodes in a particular region or data center.
- A data center company that hosts many validators decides to compromise or shut down a chain.

In these situations, a resilient blockchain needs to continue running. A healthy blockchain needs both geographical and data center distribution of stake and validators.

How Solana is doing:

Solana validator nodes are well dispersed around the world in both location and data center provider. However, nodes have started to consolidate geographically to

locations with major data centers and minimal latency (for example, clustering in Germany). The Solana Foundation believes this consolidation is due to:

- Timely Vote Credits (TVC) which incentivize stakers to move their stake (and validators to move their validators) to locations with absolute minimal latency. These locations tend to be in a select few large cities.

Note that the new DoubleZero network (described in more detail in "Looking to the Future" at the end of this report) is expected to counter this effect by providing validators with significantly higher bandwidth and lower latency, allowing them to disperse geographically without the risk of TVC penalties.

- The growth and economic opportunities created by Jito encourage validators to be near Jito block engines, which are concentrated in network-dense, high-performance regions.

Validators are active in 40 countries, with Germany, the United States, and the Netherlands leading by percentage in both validator count and percent of stake.

Top 10 Countries by Stake %

Country	Validator Count	Stake Percent
 Germany	187	23.55%
 United States	337	17.37%
 Netherlands	173	14.36%

 United Kingdom	73	13.13%
 Lithuania	39	5.32%
 Japan	20	4.67%
 Canada	29	3.53%
 France	66	2.08%
 Sweden	21	1.98%
 Norway	75	1.90%

Validators are active on over 100 data center providers, with TeraSwitch Networks, Latitude, and AWS leading by percent of stake.

Top 10 Data Center Providers by Stake %

Hosting Provider Name	Validator Count	Total Stake (SOL)	% Staked
TeraSwitch Networks Ind08		94 020 555.36	24.28%
Latitude.sh	122	82 977 912.78	21.42%
Amazon AWS	4	23 171 666.47	5.98%
UAB Cherry Servers	36	20 298 321.73	5.24%
OVH SAS	73	16 326 934.84	4.22%
Google Cloud	71	13 563 048.08	3.50%
Choopa (Vultr)	106	12 482 473.57	3.22%

Zayo Bandwidth	1	9 667 712.043	2.50%
Hivelocity Inc.	28	8 673 077.425	2.24%
7979	13	8 461 561.58	2.18%

Validator Economic Health

More profitable validators results in a higher number of validators supporting network success

New in this updated report is validator economic health as an indicator of validator health. If validators are profitable, they are more likely to continue to act as validators and to invest in the security and health of the ecosystem.

How Solana is doing

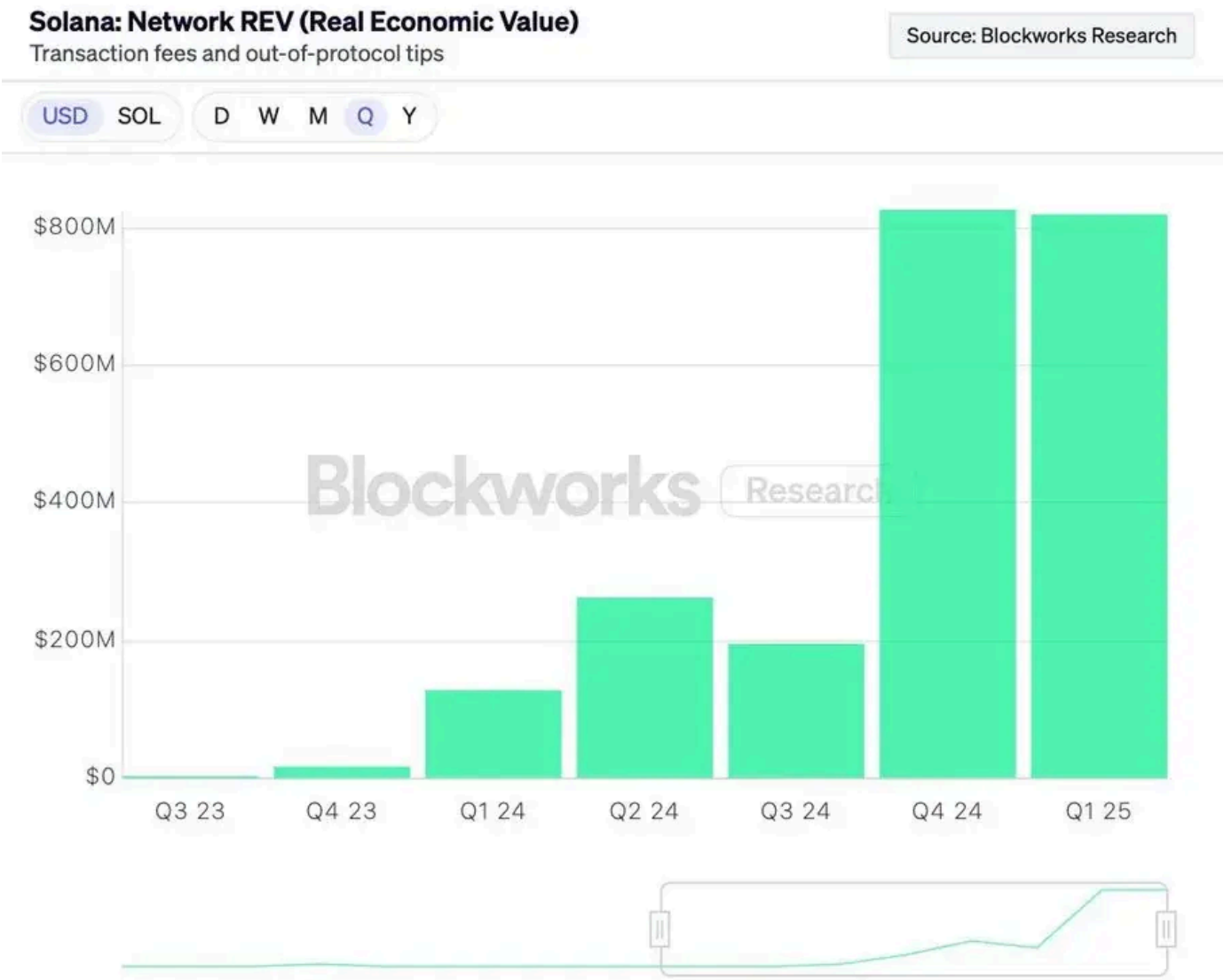
Validator health is thriving. Validators now earn from a variety of sources—not just increased inflation rewards and transaction fees, but also 100% of priority fees (SIMD-0096), MEV (via Jito), and out-of-protocol deals.

[SIMD-0033](#), implemented in November 2024, introduced Timely Vote Credits (TVC). TVCs reward validators for voting quickly and consistently. TVCs incentivize fast, reliable participation in validator activities, and have increased rewards for fast validators (and raised their APYs).

Real Economic Value (REV)—the sum of transaction fees and out-of-protocol tips for validators—has significantly risen since the last report. A few highlights include:

- An all-time-high of ~\$56.9M in REV was recorded on Jan 19, 2025
- Quarterly REV for the last 2 quarters has averaged ~\$800M

- REV is up significantly from the same period last year



As a result of these improved economics, the breakeven stake for a validator has [dropped from ~50k SOL to 16k SOL](#). Commission rates are trending to 0% and APYs are [up to 7.5%](#), encouraging even more staking.

Year	Estimated Break-Even Stake (SOL)	Notes
2022	~50,000	Lower MEV, higher costs, less priority fees

2023	~30,000–40,000	Tip volume increases, Jito adoption grows
2025	~16,000–20,000	Priority fees + Jito tips

Engagement

A more active validator community is a trailing indicator of an overall healthy network

Validator engagement is an often underappreciated signal of validator health. Engagement means more than just uptime or total stake — it shows whether validators are active and aligned with the goals of the Solana network. Healthy validators don’t just run nodes, they help to shape the protocol.

How Solana is doing

While validator engagement continues to be a hard metric to measure, the Solana Foundation sees several indicators of high engagement, including:

- Community-driven validator events, such as [Block 0](#), continue to be popular, attracting hundreds of attendees with 500+ at the last event.
- Voting on [SIMD-228](#) was the [largest turnout for any blockchain governance ever](#) — both by number of participants and participating market cap. 910 validators (representing 74.3% of total staked SOL) participated in the vote. The event was widely covered on social media posts and debates, podcasts, and in the news. Validators both large and small had their voices heard, with smaller validators ultimately swaying the final vote, showing the true decentralization of the network.
- [SIMD-0094](#) (Timely Vote Credits) was implemented in early 2023 and has successfully incentivized validators to vote more quickly and consistently.

- The Solana Foundation has established and enforced [criteria](#) for all validators that wish to participate in the foundation's delegation program, encouraging validators to stay engaged in the network.

Looking to the Future

As always, the Solana Foundation works continuously to improve the health and performance of the Solana network. Here are just a few of the upcoming changes to look out for in the future:

- Alpenglow consensus algorithm - Announced at [Scale or Die](#), this major consensus algorithm update is designed to reduce block times and improve network stability.
- Slashing - Debate and possible implementation of a slashing program (such as proposed with SIMD [204](#)).
- The DoubleZero network - Already in testnet, [DoubleZero](#) is a new global network for high-performance distributed systems and blockchains. Validators moving to the DoubleZero network are expected to see significantly higher bandwidth and lower latency.
- Compute Units limit increase - CU limits have recently been [raised to 50m](#), soon to bump to [60m](#), with future increases planned of 100m and beyond.
- SIMD-123: Block Revenue Distribution - Already approved, [SIMD-123](#) implements block-level fee sharing with delegators making delegator rewards more transparent and consistent.
- SIMD-268: CPI Nesting Limit Increase - This proposed change to increase Cross-Program Invocation nesting from 4 to 8 will allow more complex program composability and interactions.

- Direct mapping - Implementation of [direct mapping](#) is the precursor for many future performance improvements (such as increasing block space).
- Continued focus on [network speed and reliability improvements](#).

The Solana Foundation is dedicated to improving and supporting the decentralization, adoption, and security of the Solana ecosystem. As shown in this report, the Solana network has continued to grow, improve, and thrive over the past year, and we look forward to more achievements in the future.

We invite you to come along on this journey with us! To learn more, check out the [latest news around Solana](#), the [Solana developer learning center](#), or the [guide to becoming a Solana validator](#).

Footnotes

1. The Solana Nakamoto Coefficient is calculated using stake distribution from [rated.network](#) as of 4/18/2025. Nakamoto Coefficient is reached when 33% of all stake is compromised.
2. Lido nodes are treated as separate operators. There are ~500 Lido node operators, giving a **Nakamoto Coefficient of 6**. (Calculated as SSV 8.63%, Coinbase 8.01%, Binance 6.48%, Ether.Fi 5.9%, Kraken 2.63%, RocketPool 1.53%)
3. Raw data for calculations [here](#).
4. REV values taken from <https://blockworks.co/analytics/solana>.

Disclosures

"The material provided by the Solana Foundation is provided to you for educational and informational purposes only and does not constitute tax, legal, or investment advice. No aspect of these materials has been approved or otherwise endorsed by the U.S. Securities and Exchange Commission or any other regulator, and no part of these materials is or represents an offer to buy or sell any financial product, including a security.

The information provided herein is not intended to influence, persuade, or induct any investment-related decision. Third-party data, information, or other content has not been endorsed or approved by Solana. Solana has not conducted, and does not purport to have conducted, any extensive or approved legal analysis regarding the permissibility or regulatory status of the matters discussed herein. You should not assume that any activity or product described is permitted or compliant with applicable laws or regulations.

Investing in securities, generally, and in particular investing in tokenized securities is speculative and involves a high degree of risk. We strongly encourage you to complete your own independent due diligence before considering offering or purchasing tokenized securities including obtaining additional information, opinions, financial projections, legal, or other investment advice. The figures, projections, and other relevant data herein are hypothetical in nature and should not be indicative of future or expected results. There can be no guarantee that actual performance will achieve comparable results. Neither Solana Foundation, nor any of its affiliates, and any of its and their respective officers, directors, agents, or employees provide any investment advice, endorsement, analysis, or recommendations with respect to any securities and no communication from Solana Foundation, through any medium, should be construed as such.

SHARE THIS ARTICLE



GUNAKAN SOLANA

Gunakan Solana

Dompét

Pelajari

Staking

PERUSAHAAN

Perusahaan

Pembayaran institusional

Tokenisasi

Laporan

EKOSISTEM

Ekosistem

Jaringan

Acara

Komunitas

BANGUN

Hub pengembang

Dokumentasi

Panduan

Templat

PRODUK

Produk

Platform Developer Solana

x402

Registri Agen

Keahlian

AGEN AI

llms.txt

llms-full.txt

SKILL.md

Keahlian agen

Berita

Buletin

[Pendanaan](#) [Media Kit](#) [Karir](#) [Penolakan](#) [Kebijakan Privasi](#)

© 2026 Yayasan Solana. Semua hak dilindungi.