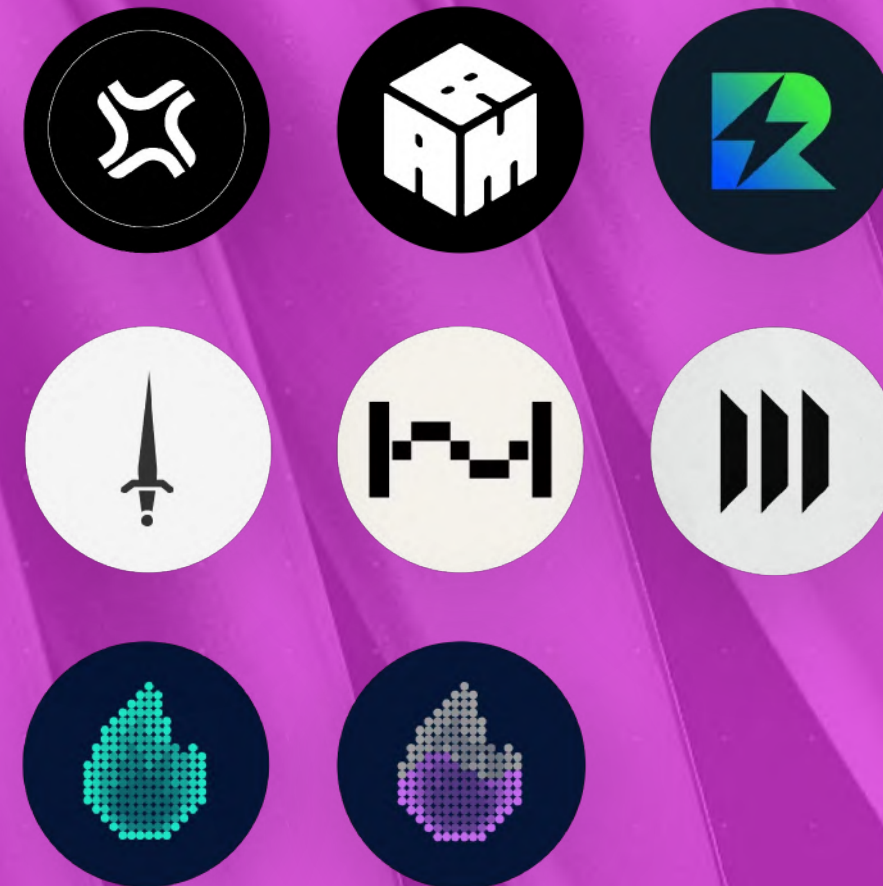


Deep Dive:

Solana Onchain Activity



Two clients are now live on mainnet.

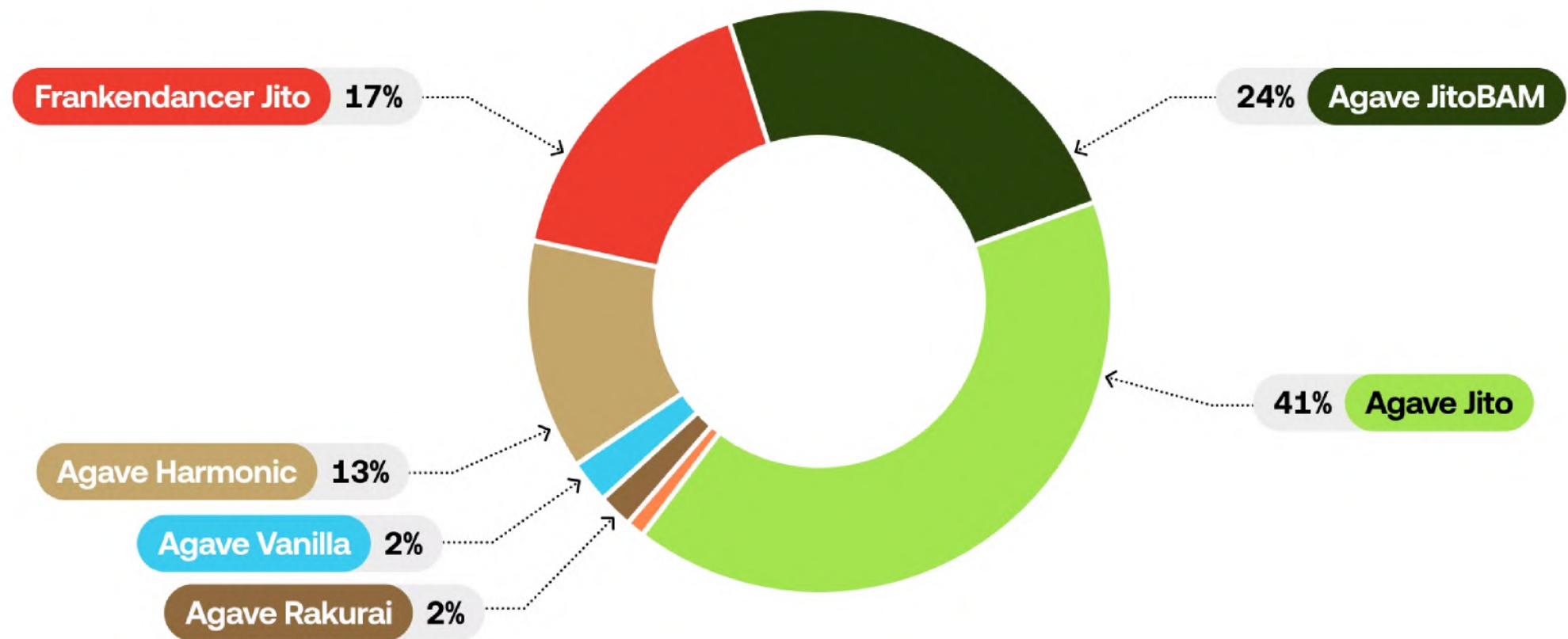
At Breakpoint it was announced that Firedancer was already on mainnet, giving Solana two fully independent validator clients. This is critical for resilience because a bug or exploit in one implementation is far less likely to compromise the entire network.

The past two months have also seen new Agave variants JitoBAM, Harmonic, and Rakurai gain relevance. They all represent different strategies for block construction and transaction prioritization. Even though their current stake is comparatively small, they signal the start of a competition over how block building should work on Solana.

As of January 31 2026, stake is concentrated in Agave Jito at 41%, JitoBAM at 24% and Frankendancer Jito at 17%. Harmonic has 13%, Rakurai 2%. and Firedancer Jito 1%.

Stake Distribution by Client January 31, 2026

- Agave Jito
- Agave JitoBAM
- Frankendancer Jito
- Agave Harmonic
- Agave Vanilla
- Agave Rakurai
- Firedancer Jito
- Frankendancer Vanilla

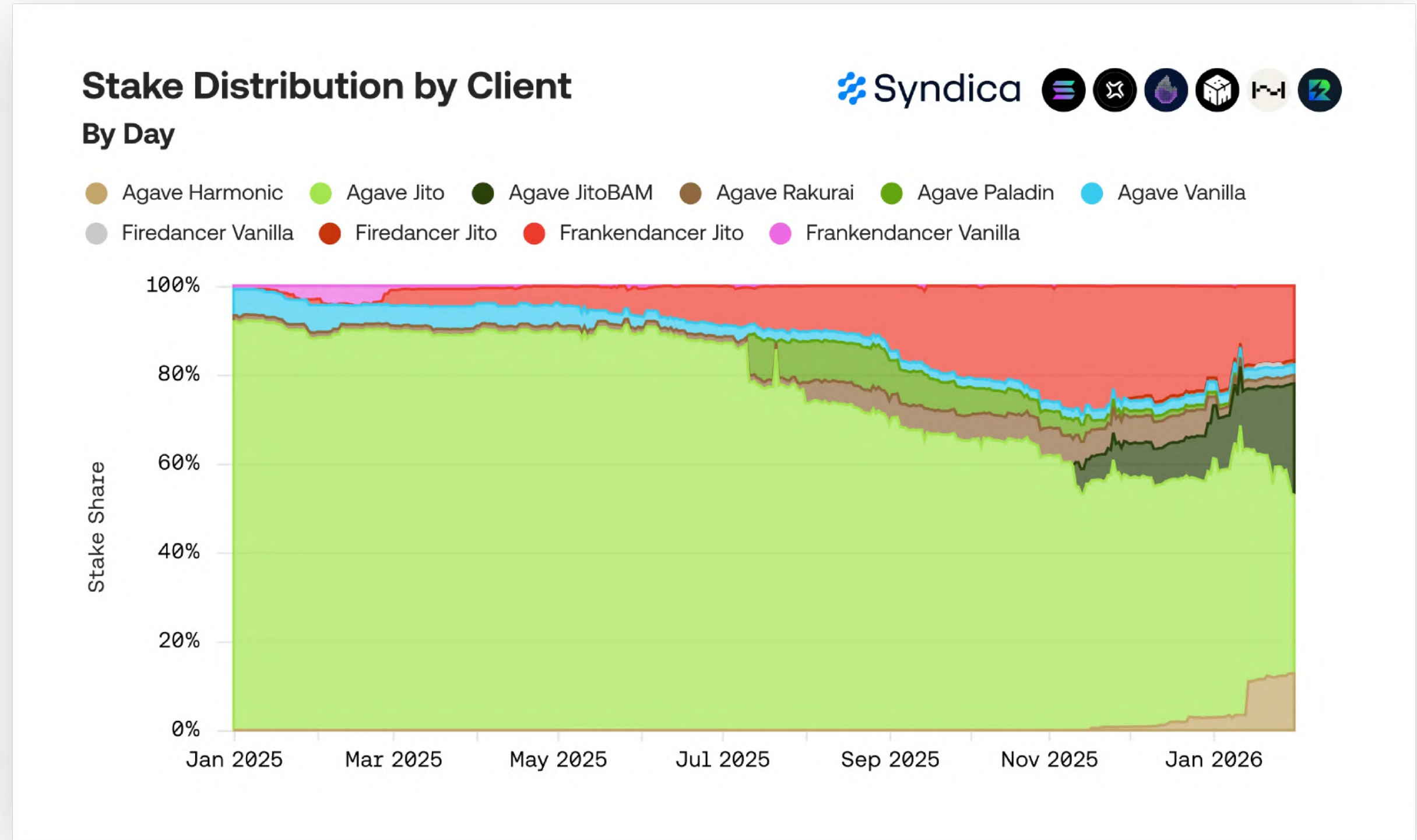


JitoBAM and Harmonic lead the latest client shift.

On January 1, 2025, Agave Jito held 92% of stake. By late January 2026, that figure sat at 41%.

Frankendancer drove the first wave of diversification, reaching 29% at its November peak before easing to 17%.

The second wave came from new Agave flavors: JitoBAM climbed to 24% and Harmonic to 13% in January 2026.






Layer33 launched to champion validator decentralization.

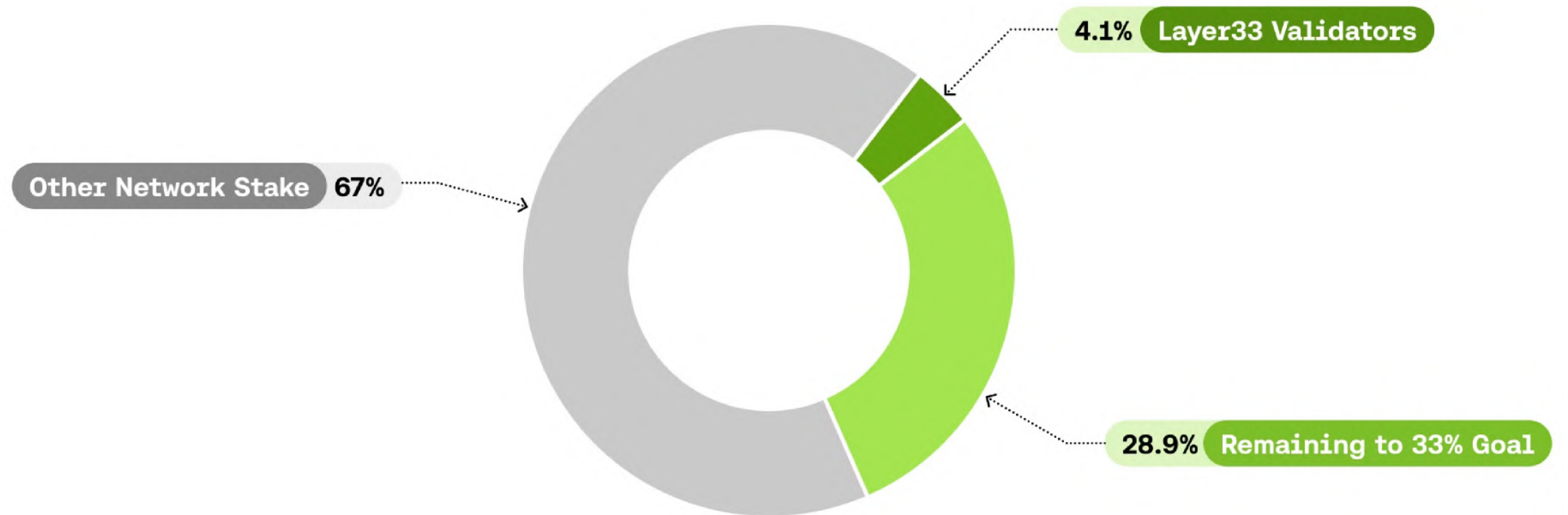
Layer33 is a collective of 25 independent Solana validators working to strengthen network decentralization.

Their mission is to ensure that 33% of total stake remains with independent validators that build open-source infrastructure for the ecosystem.

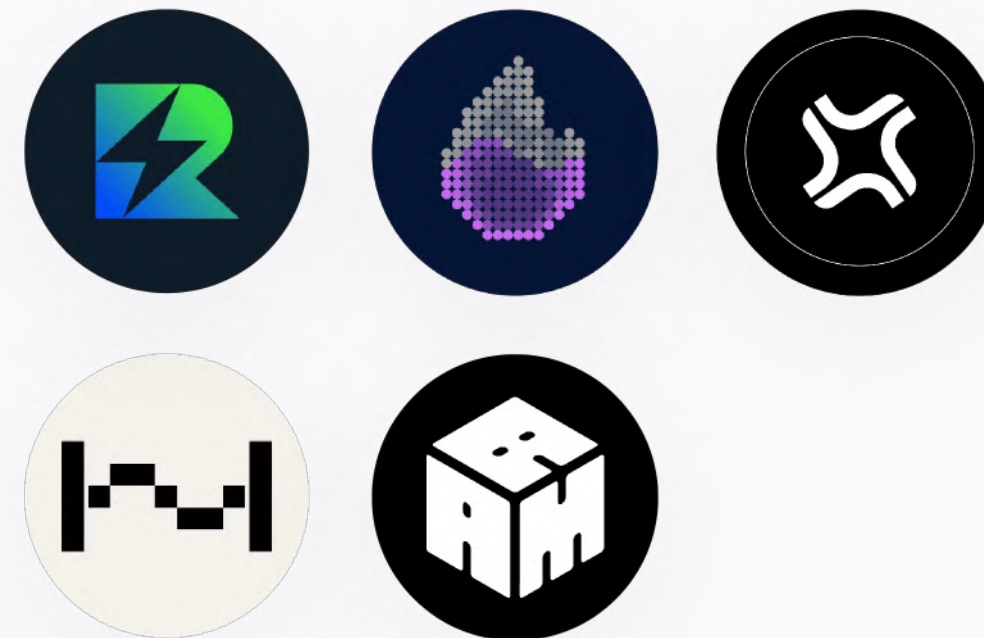
As of January 31, the collective holds 17.6M SOL (4% of network stake). The path to 33% continues.

Layer 33 Stake January 31, 2026

 Layer33 Validators  Remaining to 33% Goal  Other Network Stake



Part I
**Client Reward
Distributions**



Rakurai earns highest rewards from typical to exceptional blocks.

Which clients capture the most value per block, and how consistent is that edge?

An ECDF (Empirical Cumulative Distribution Function) answers this by plotting the cumulative distribution of rewards across all sampled blocks. For each reward value on the x-axis, the y-axis shows what proportion of blocks earned at or below that amount.

Think of it this way: "What does a typical block earn (p50, the median)? What about a good block (p75)? A great one (p95)?"

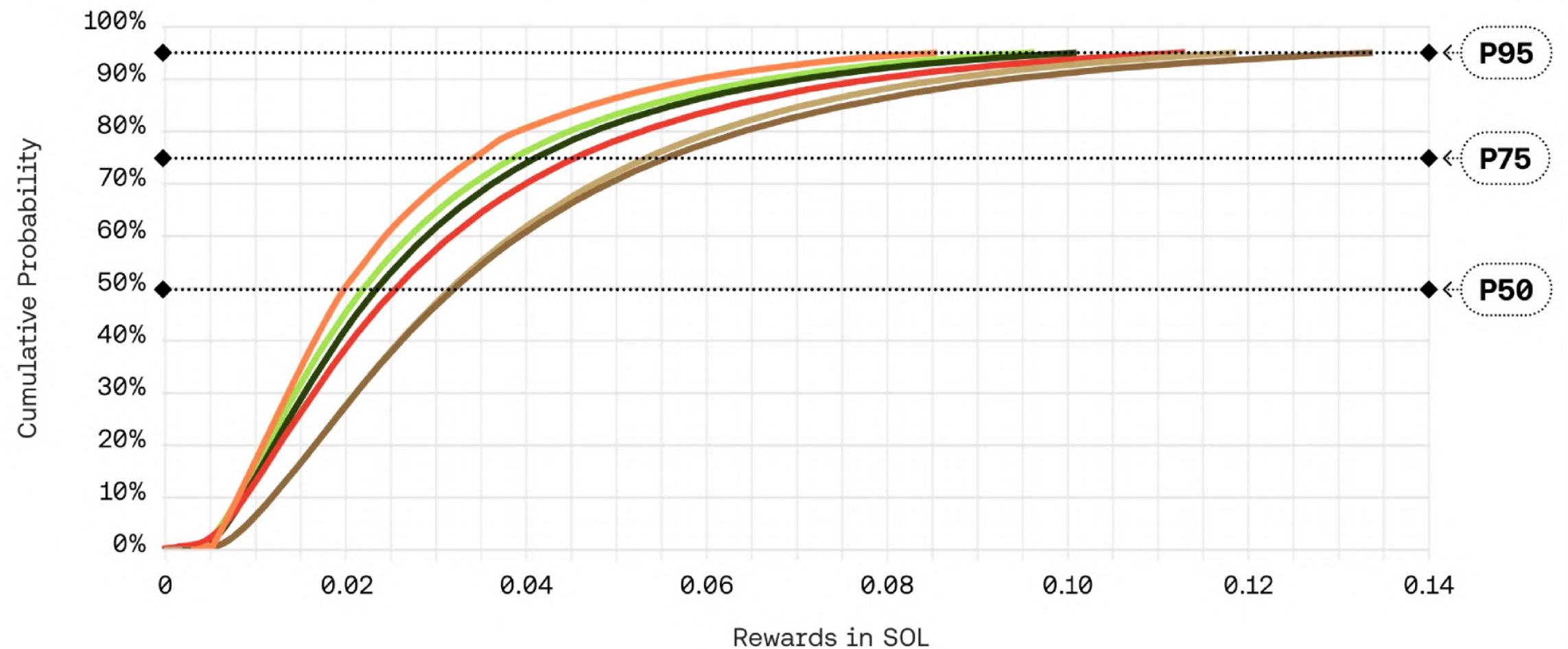
Rakurai leads consistently, earning 22-25% more than the typical validator across all performance levels: typical blocks (p50) earn 0.032 SOL, good blocks (p75) earn 0.056 SOL, and great blocks (p95) earn 0.134 SOL.

Harmonic ranks second with median blocks earning 23% more than the typical validator, though this premium narrows to 18% for good blocks and 8% for great blocks.

Rewards Distribution By Client, January 2026

- Firedancer Jito
- Agave Jito
- Agave JitoBAM
- Frankendancer Jito
- Agave Harmonic
- Agave Rakurai

Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.



Rakurai leads in block-time adjusted rewards per block.

After normalizing for block production speed, Rakurai led by ~20% compared to a typical validator.

Harmonic came in second, starting strong at p50 (+11%) but lost its advantage at the top end (-2.5% at p95).

Frankendancer Jito ranked third with modest gains at the median (~3%) that scaled to 5.4% at p95.

Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.

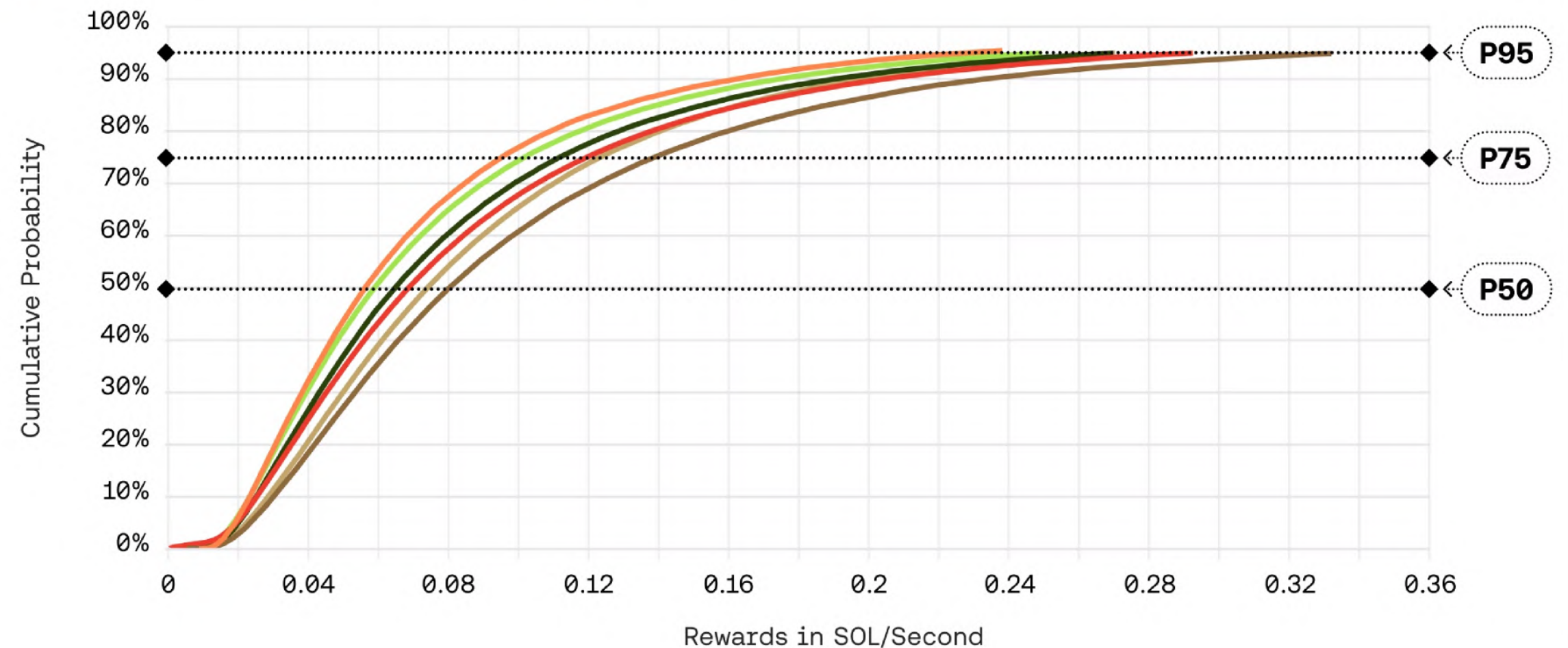
Block-time data is taken from Solana Compass (<https://solanacompass.com>).

// Deep Dive: Client Reward Distribution // January 2026

Rewards Distribution Adjusted for Block Time By Client, January 2026

- Firedancer Jito
- Agave Jito
- Agave JitoBAM
- Frankendancer Jito
- Agave Harmonic
- Agave Rakurai

Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.



Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.

Block-time data is taken from Solana Compass (<https://solanacompass.com>).

// Deep Dive: Client Reward Distribution // January 2026

Rakurai captures more tips than any other client across every block percentile.

Rakurai led by +158% at the median, narrowing to +55% at p95 but still far ahead.

Harmonic started strong at p50 (+92%) but its edge eroded to -6% at p95. Frankendancer Jito sat at a consistent +11-15% across all levels.

Adjusting for block time favored Frankendancer and slightly penalized Agave clients.

Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.

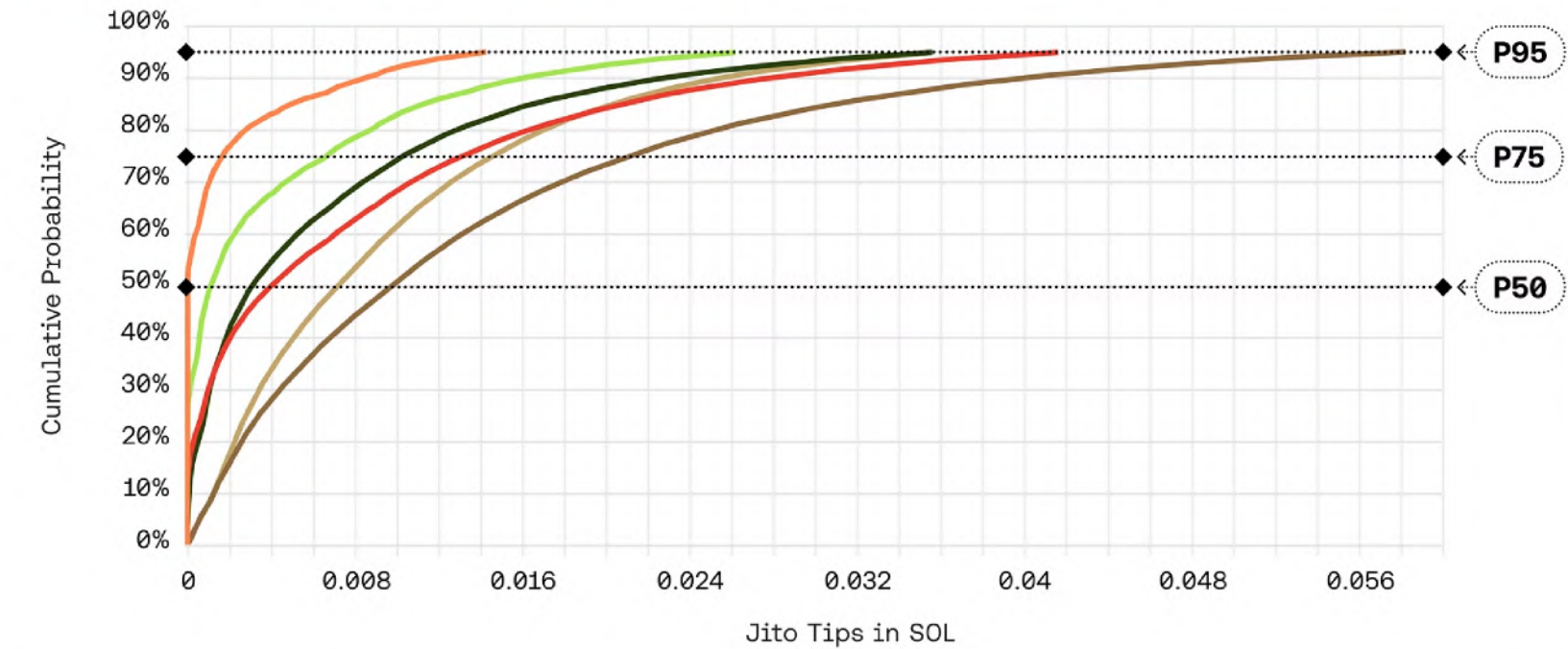
Block-time data is taken from Solana Compass (<https://solanacompass.com>).

// Deep Dive: Client Reward Distribution // January 2026

Jito Tips Distribution By Client, January 2026

- Firedancer Jito
- Frankendancer Jito
- Agave Jito
- Agave Harmonic
- Agave JitoBAM
- Agave Rakurai

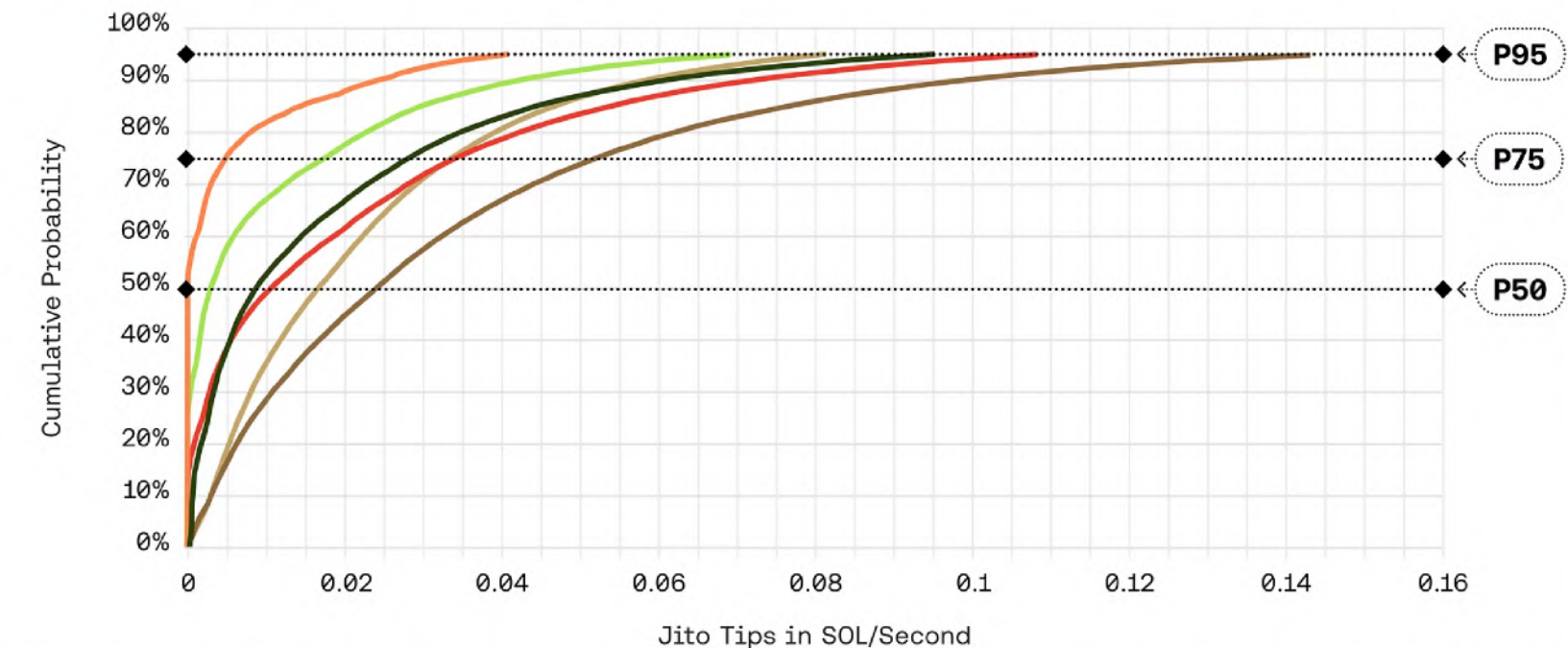
Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.



Jito Tips Distribution Adjusted for Block Time By Client, January 2026

- Firedancer Jito
- Frankendancer Jito
- Agave Jito
- Agave Harmonic
- Agave JitoBAM
- Agave Rakurai

Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.



Priority fees converge across clients.

Most clients captured priority fees within 5% of a typical validator. Harmonic was the exception at 15–20% above.

After normalizing for block time, the spread narrowed: Harmonic and Firedancer Jito were only marginally ahead (each under 5% above typical), and the rest were close to baseline.

Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.

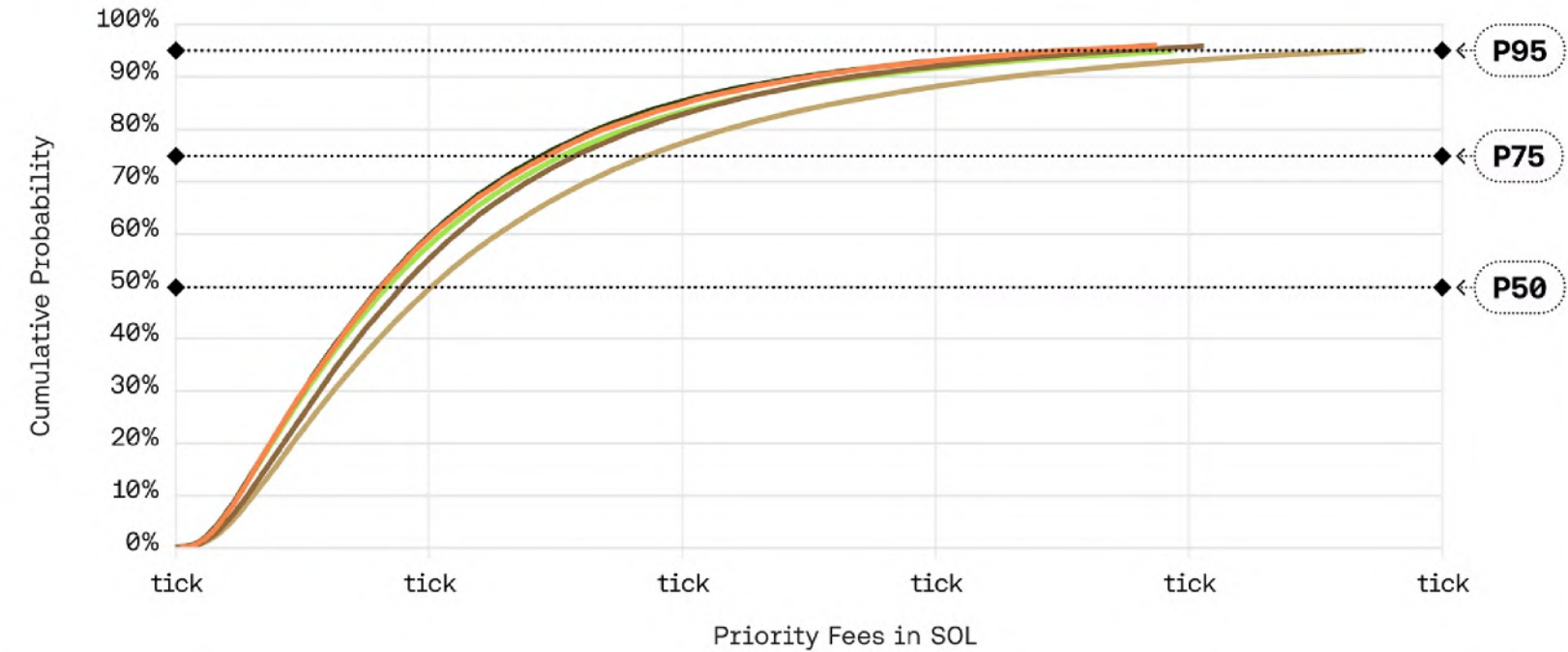
Block-time data is taken from Solana Compass (<https://solanacompass.com>).

// Deep Dive: Client Reward Distribution // January 2026

Priority Fees Distribution By Client, January 2026

- Firedancer Jito
- Frankendancer Jito
- Agave Jito
- Agave Harmonic
- Agave JitoBAM
- Agave Rakurai

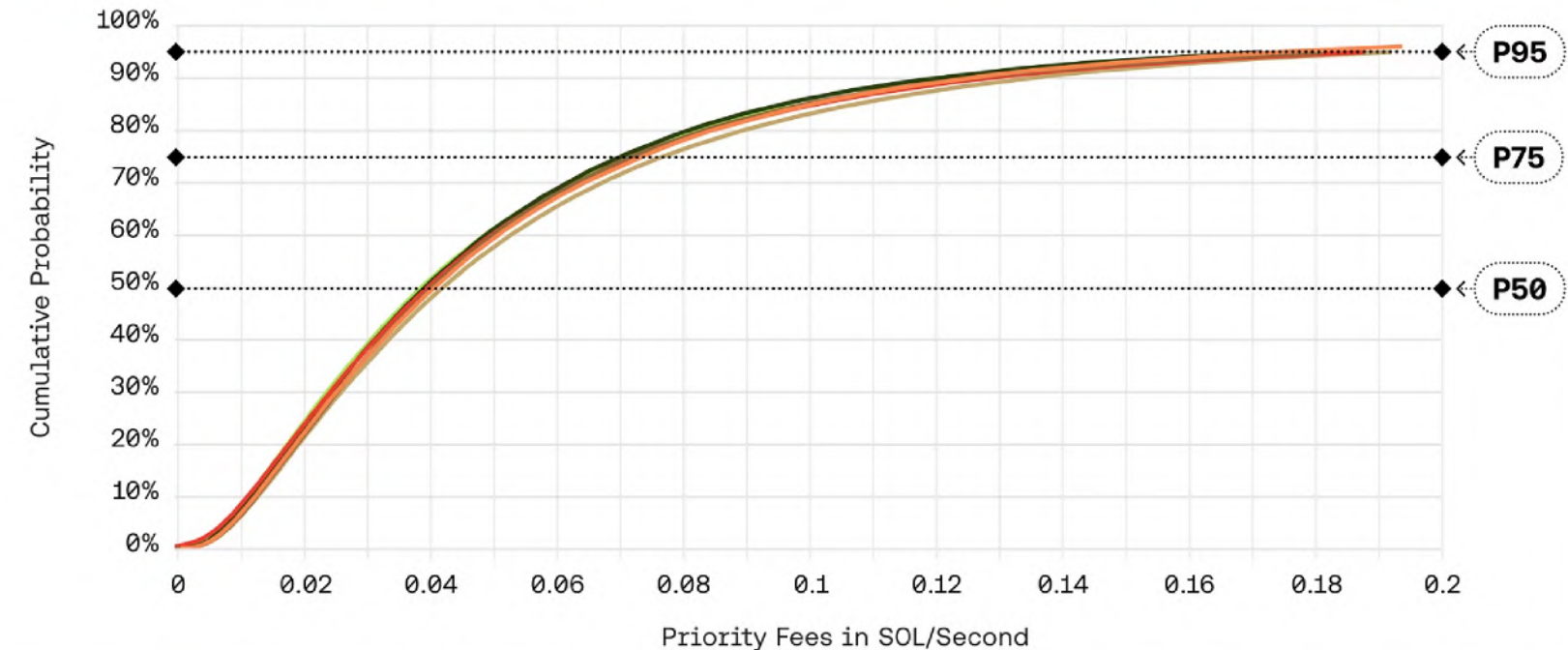
Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.



Priority Fees Distribution Adjusted for Block Time By Client, January 2026

- Firedancer Jito
- Frankendancer Jito
- Agave Jito
- Agave Harmonic
- Agave JitoBAM
- Agave Rakurai

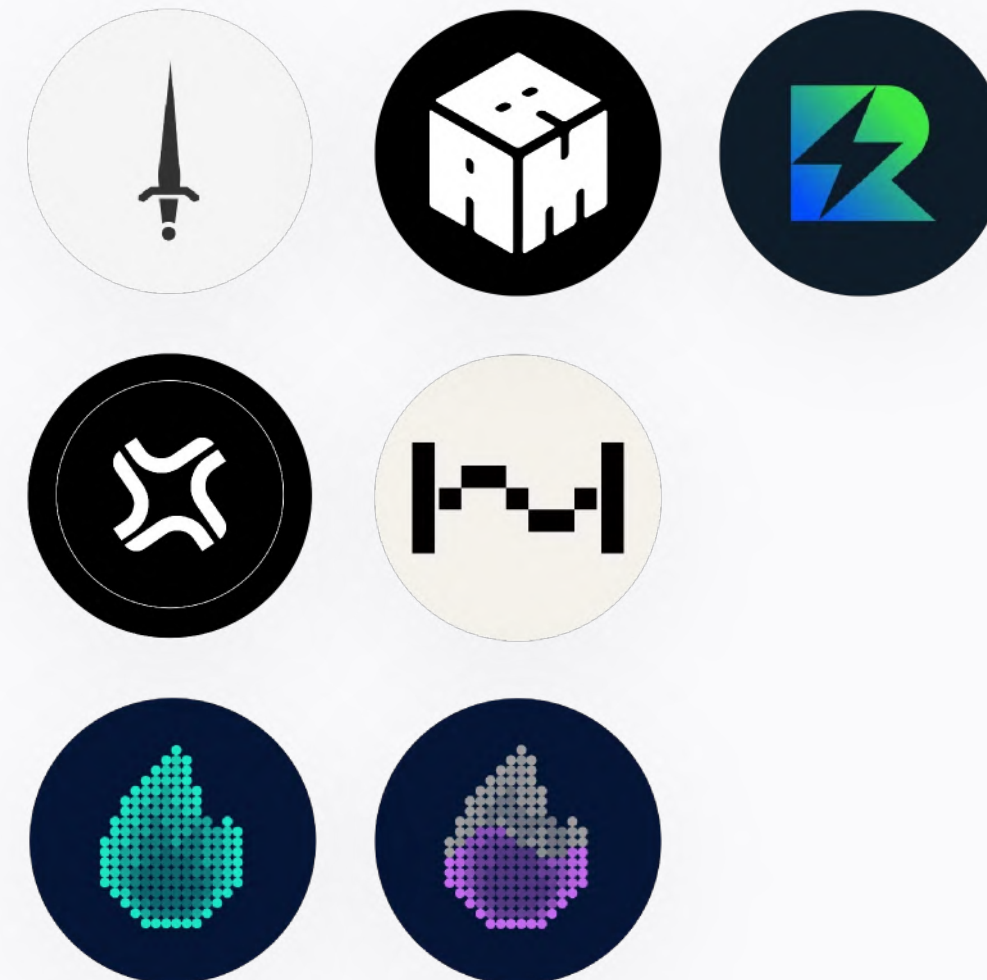
Note: Up to 25 validators are randomly selected for each client. The median validator nearly overlaps with Agave Jito and is left out to keep the chart clean.



Part II

Client

Performance

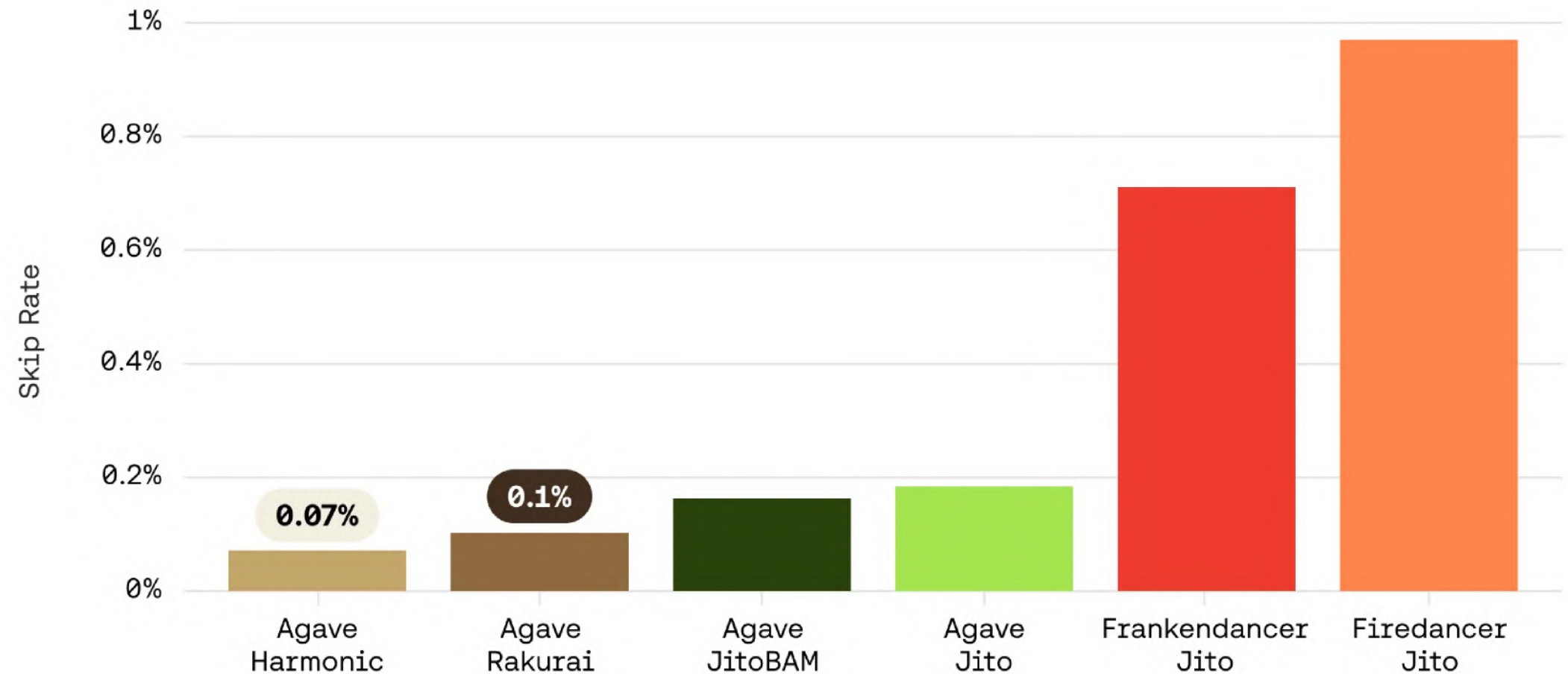


Agave clients dominated skip rates, with Harmonic lowest at 0.07%.

The four Agave variants all came in below 0.2%, with Harmonic (0.07%) and Rakurai (0.10%) leading.

Firedancer-based clients lagged well behind: Frankendancer Jito at 0.71% and Firedancer at 0.97%

Skip Rate by Client
January 2026



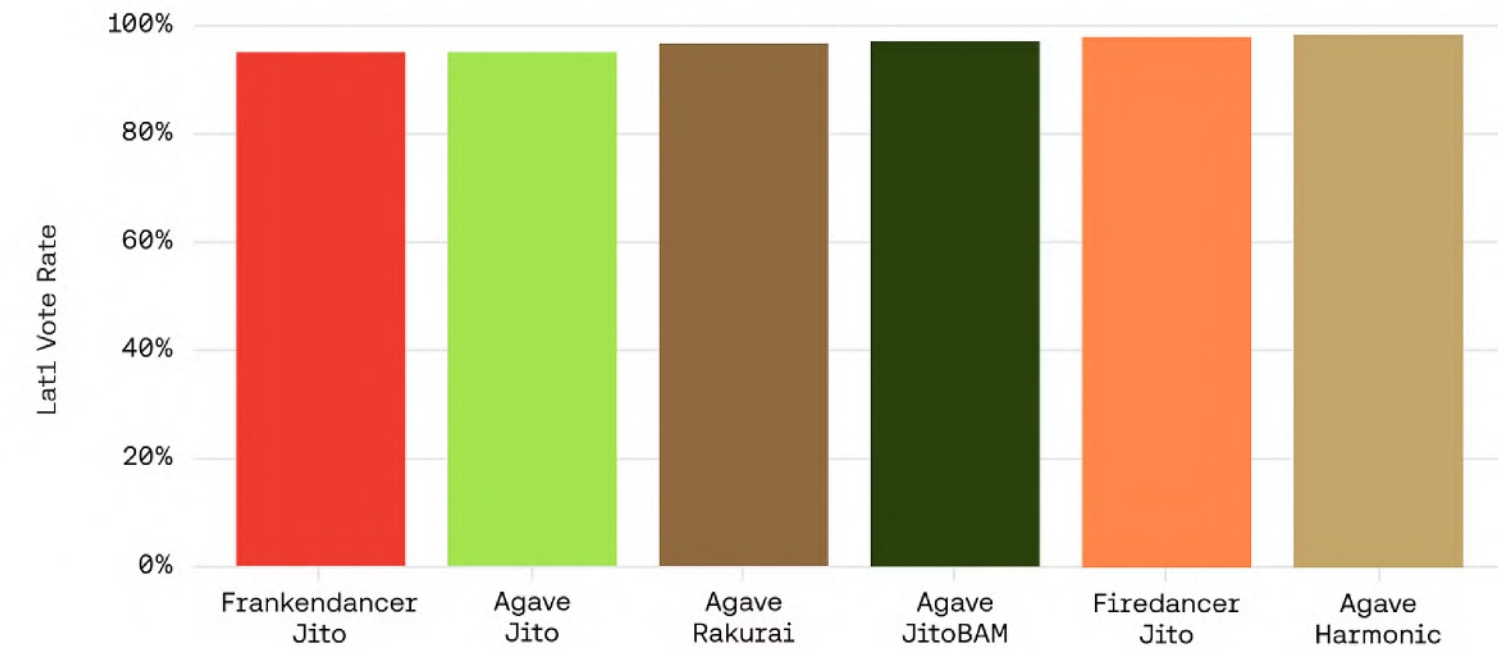
Harmonic and Firedancer Jito pulled ahead on first-slot vote success.

Harmonic led at 98.5%, with Firedancer Jito close behind at 98.1%.

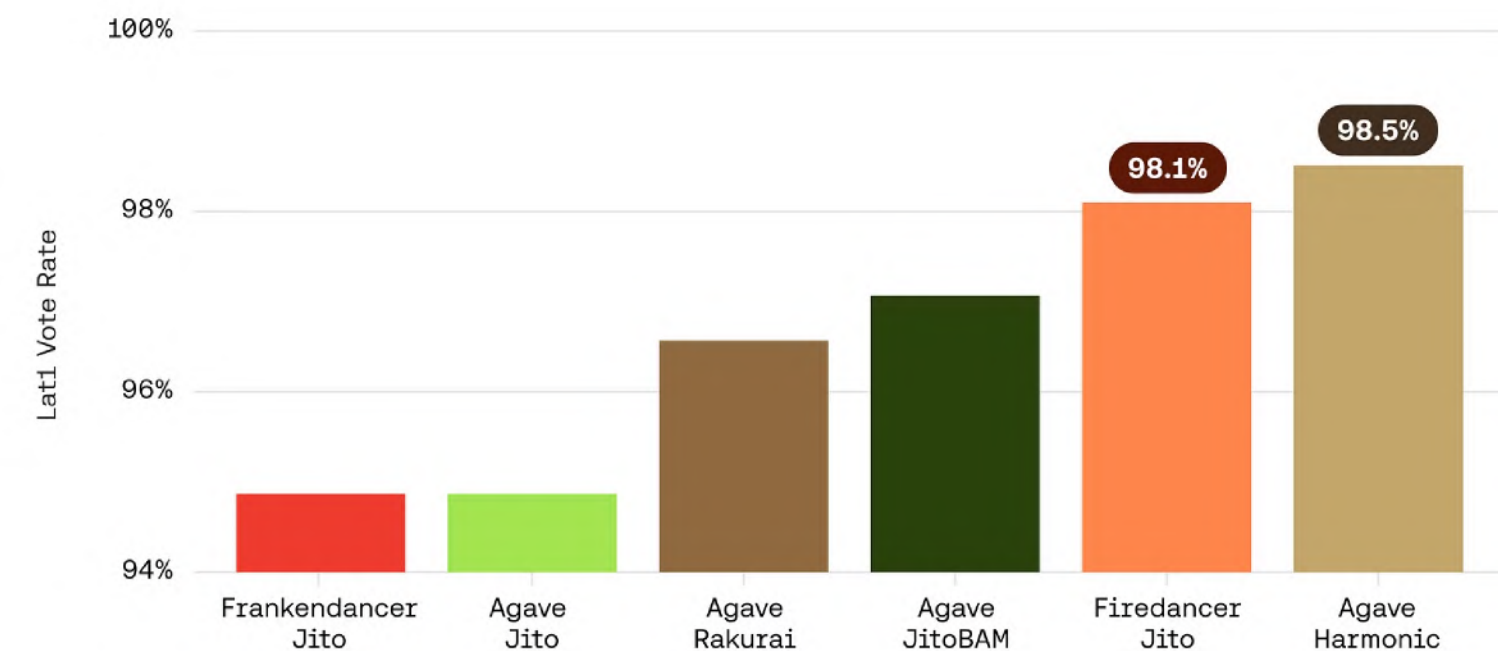
Agave Jito and Frankendancer Jito sat at 94.5%, roughly 3 percentage points below Harmonic.

With around 222,000 votes cast per validator each day, that 3% gap translates to about 3,500 missed first-slot votes daily.

1-slot Latency Rate
January 2026



1-slot Latency Rate (Zoomed)
January 2026



Most clients beat 400ms, but the trend is moving in the wrong direction.

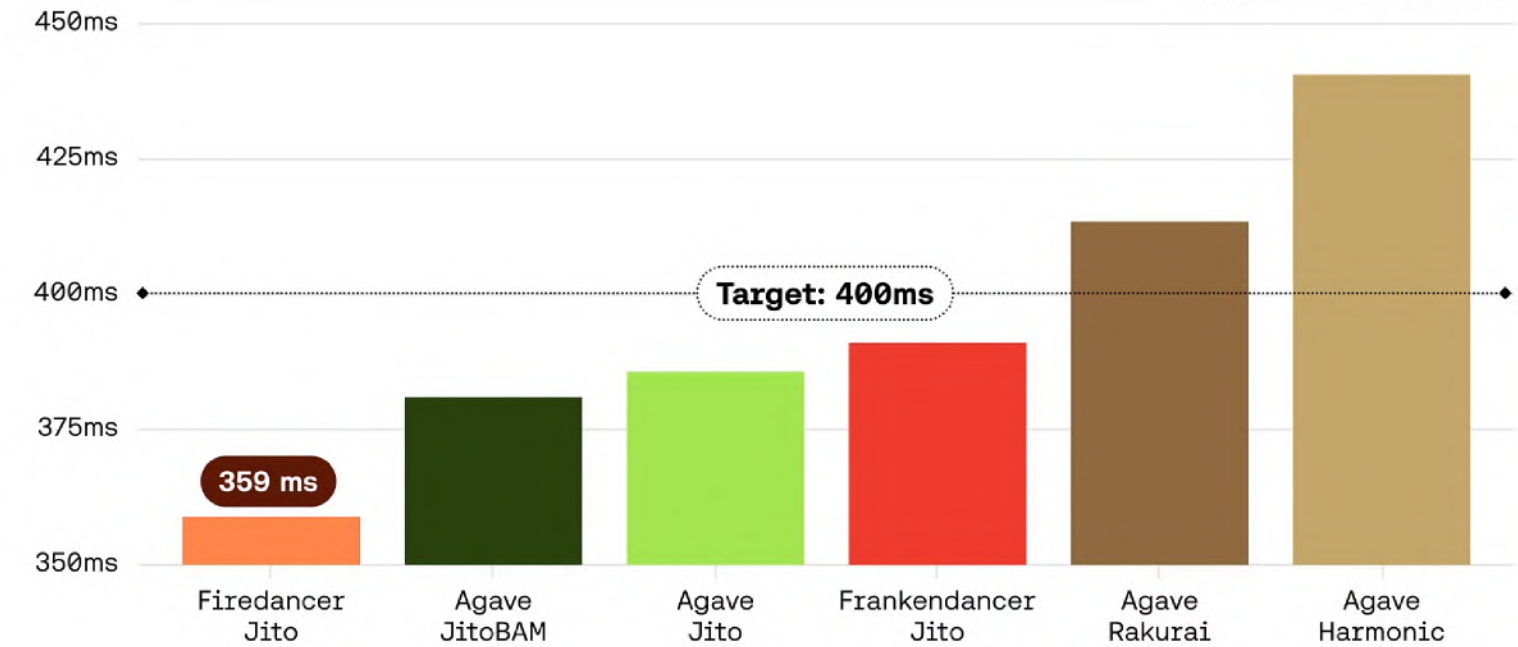
Four of six clients beat the 400ms target, with Firedancer Jito leading at 359ms.

Block times drifted higher across most clients over the past few months. Harmonic and Frankendancer Jito saw the steepest increases in January, each up around 5.5% MoM.

Source: Solana Compass (<https://solanacompass.com>)
 Methodology: "Block time measurements are collected from various Firedancer websocket endpoints across multiple geos in the network, we then take the minimum figure for each slot and log before calculating a median per epoch"

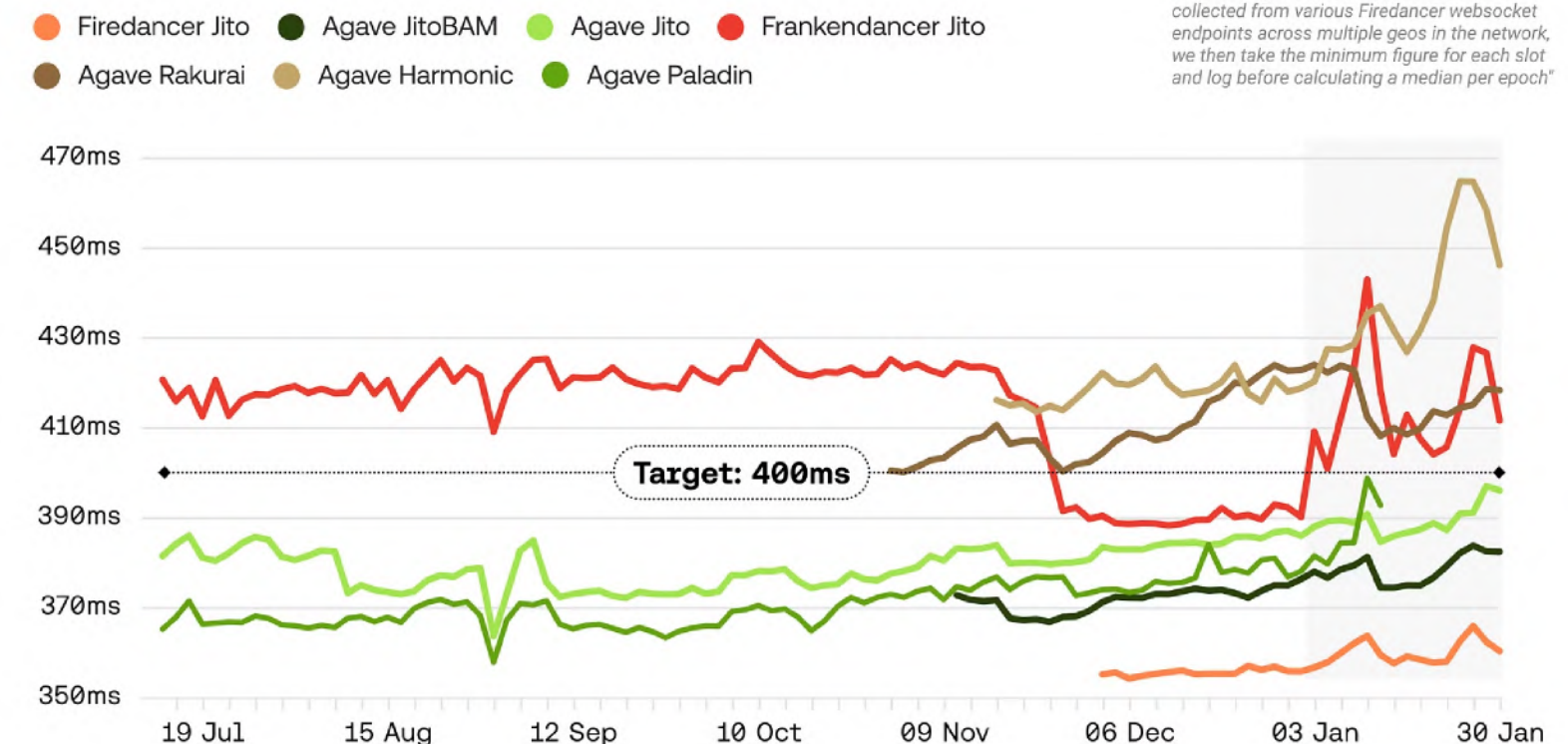
Average Client Block Times January 2026

Methodology: "Block time measurements are collected from various Firedancer websocket endpoints across multiple geos in the network, we then take the minimum figure for each slot and log before calculating a median per epoch"



Average Client Block Times By Week

Methodology: "Block time measurements are collected from various Firedancer websocket endpoints across multiple geos in the network, we then take the minimum figure for each slot and log before calculating a median per epoch"



Harmonic led on rewards per block, but Rakurai took the lead after adjusting for block time.

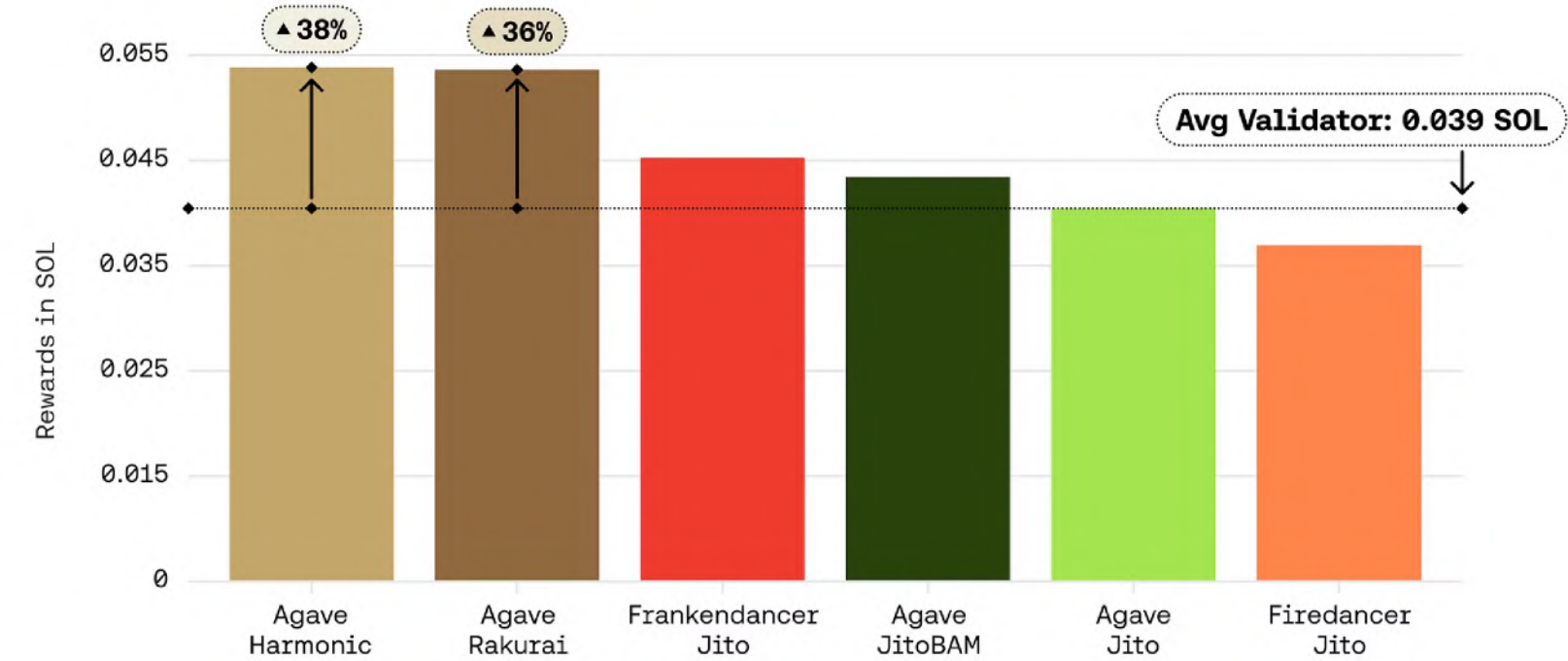
Harmonic captured the highest rewards per block in January at 0.054 SOL, 38% above the average validator. Rakurai followed closely at 0.053 SOL (+36%), with Frankendancer Jito at 0.044 SOL (+13%).

Normalizing for block time flipped the top two: Rakurai led at 0.129 SOL/sec (+23%), Harmonic came second at 0.122 SOL/sec (+16%).

Block-time data is taken from Solana Compass (<https://solanacompass.com>).

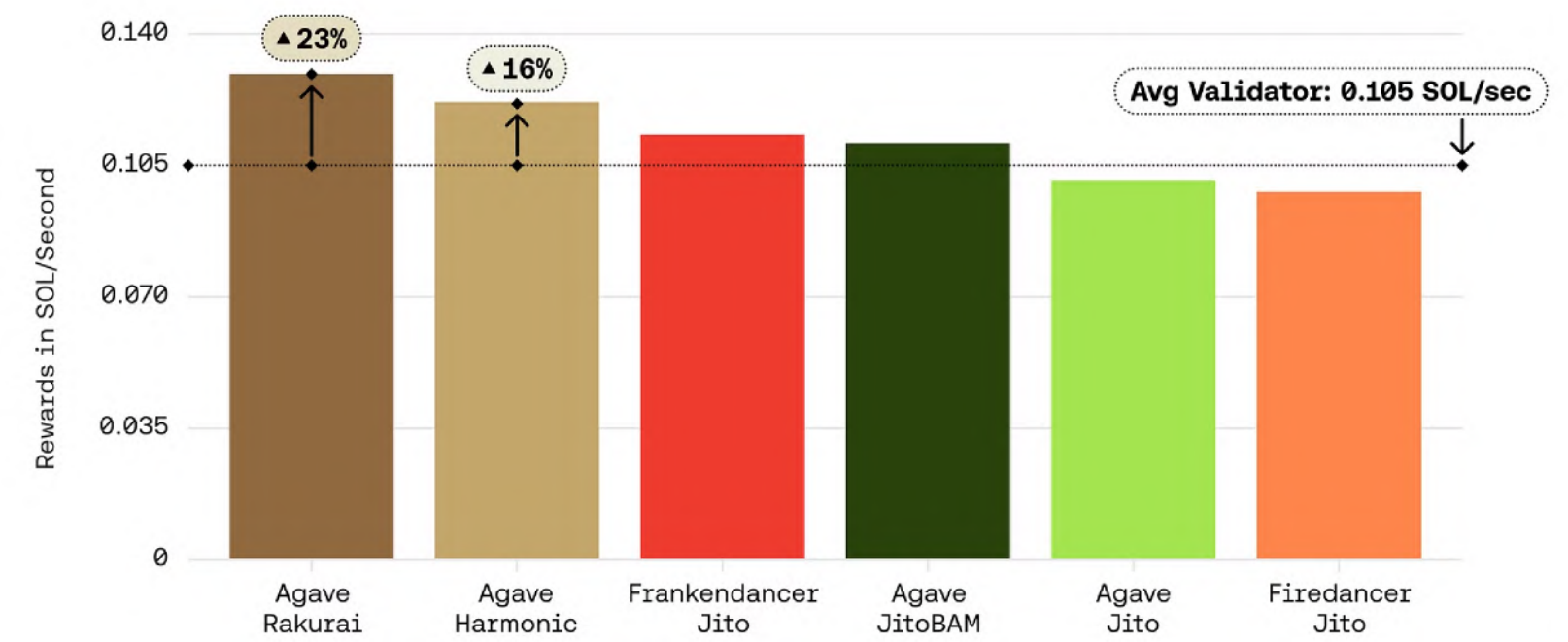
Average Rewards per Block
January 2026

Block-time data is taken from Solana Compass (<https://solanacompass.com>).



Average Rewards per Block, Adjust for Block Time
January 2026

Block-time data is taken from Solana Compass (<https://solanacompass.com>).



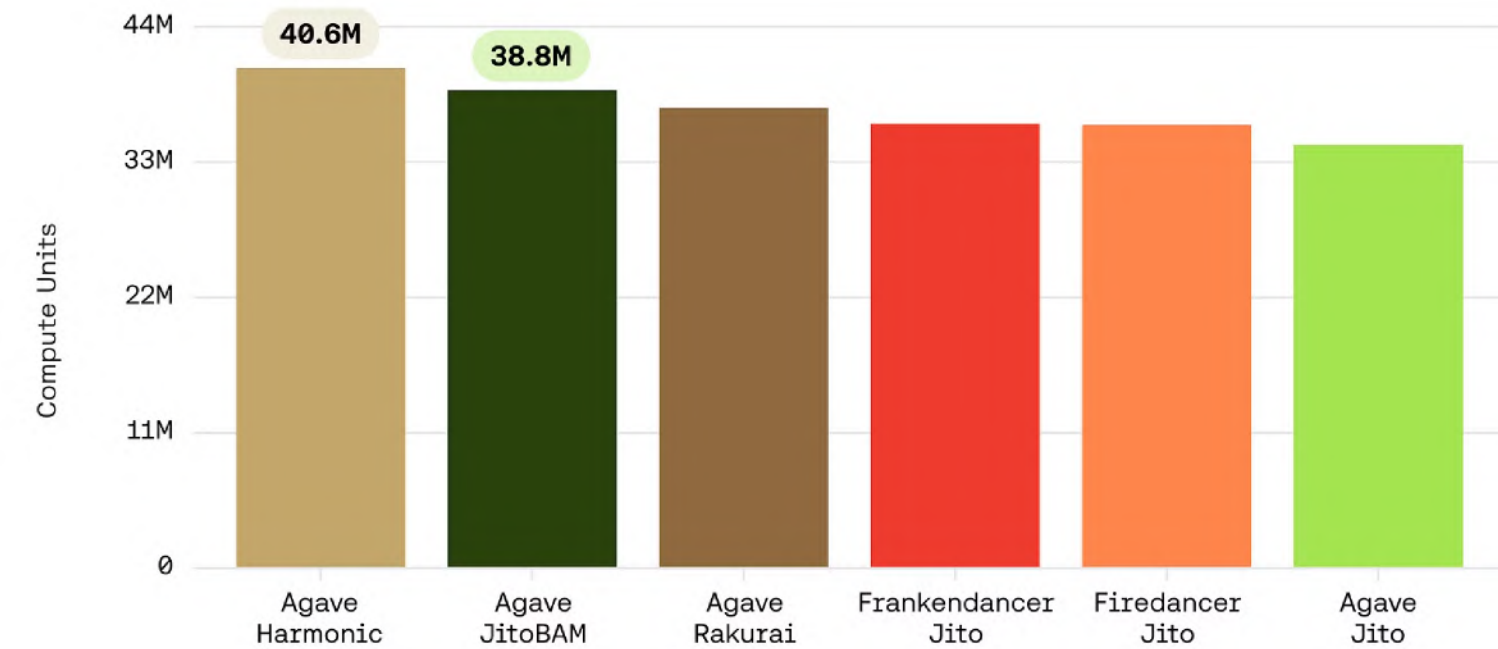
Harmonic and JitoBAM packed most CU per block, JitoBAM and Firedancer most per second.

Harmonic packed the most compute per block at 40.6M CU, with JitoBAM at 38.8M CU.

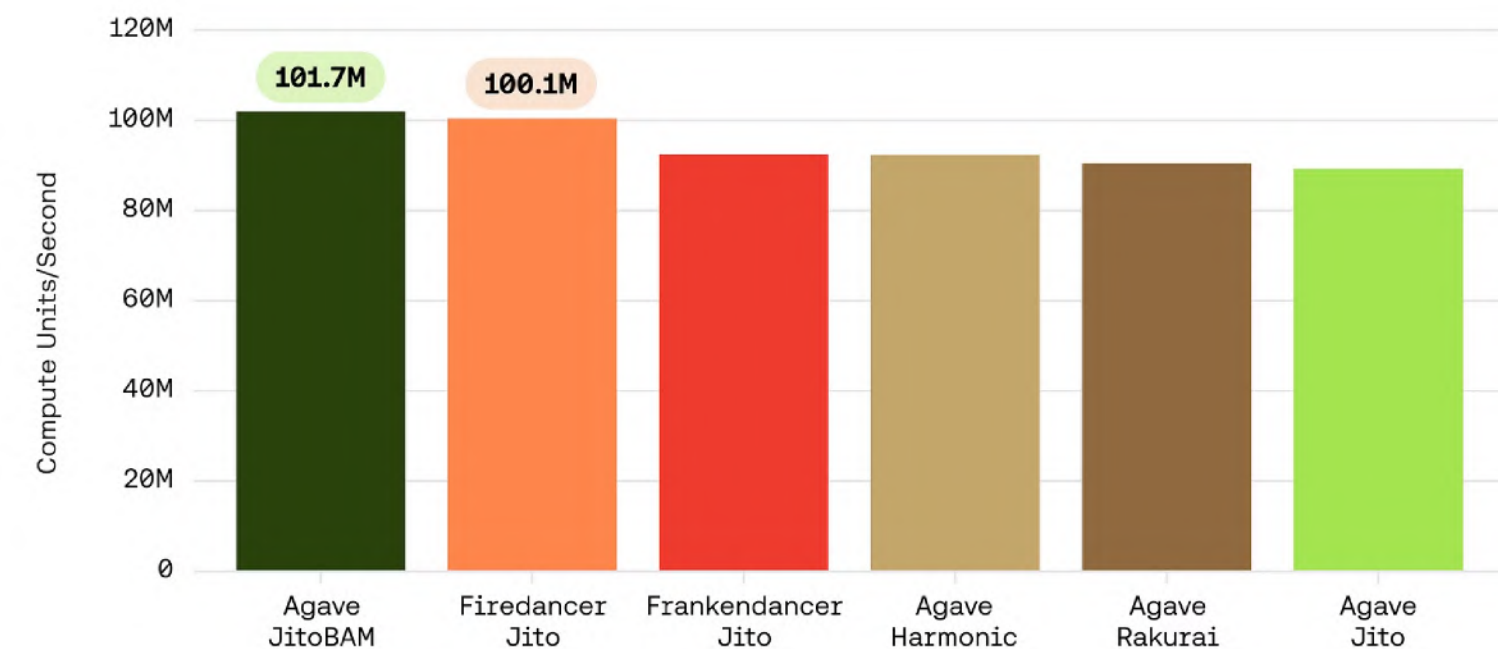
Adjusted for block time, JitoBAM moved to first place at 101.7M CU/sec with Firedancer second at 100.1M CU/sec.

Block-time data is taken from Solana Compass (<https://solanacompass.com>).

Average CUs per Block
January 2026



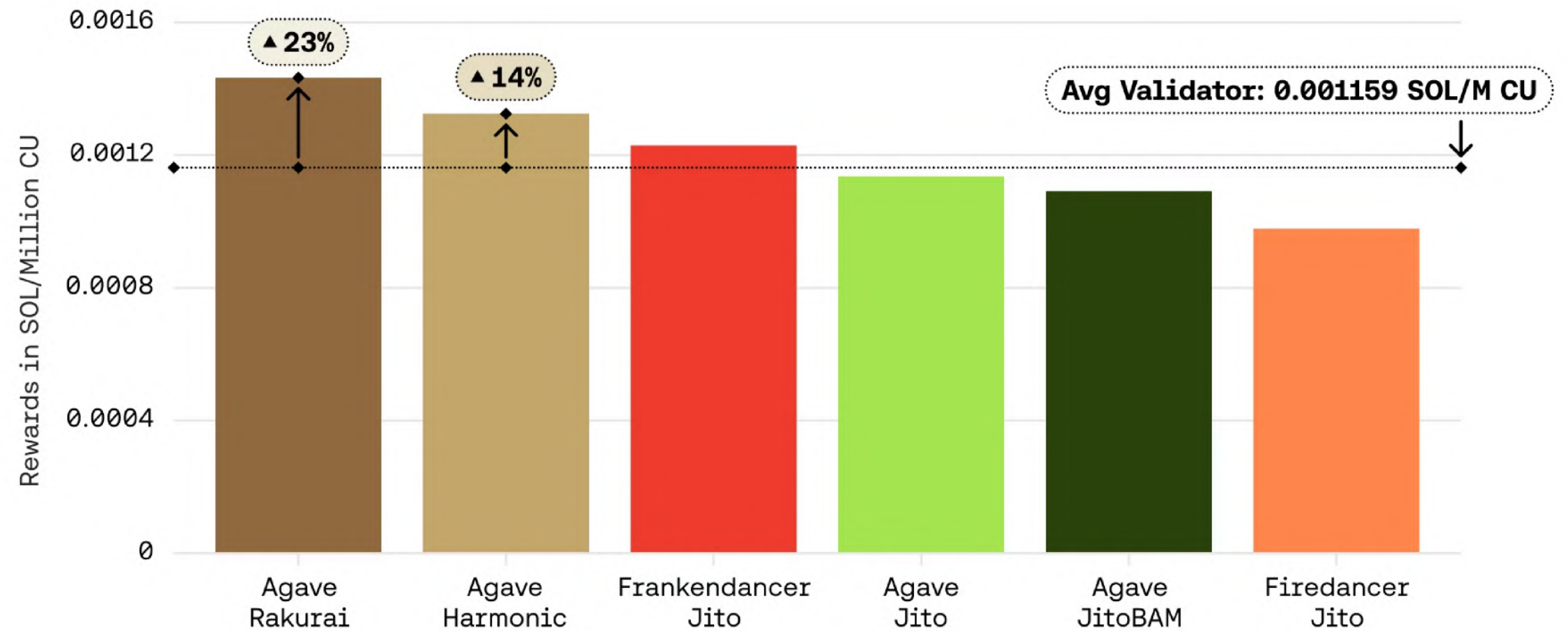
Average CUs per Block, Adjusted for Block Time
January 2026



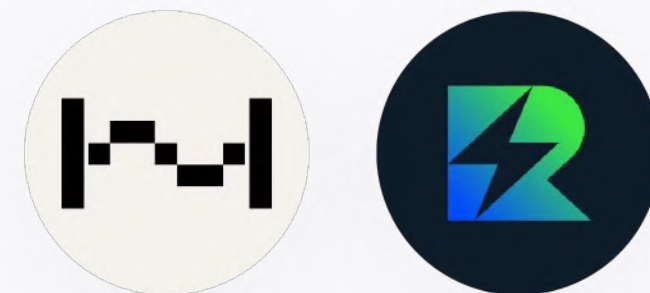
Rakurai earned the most revenue per compute unit.

Agave Rakurai earned 0.00143 SOL per million CU or 23% above average. Harmonic came second at 0.0013 (+14% above average).

Rewards per Million Compute Units
January 2026



Part III
**Validator
Profitability**

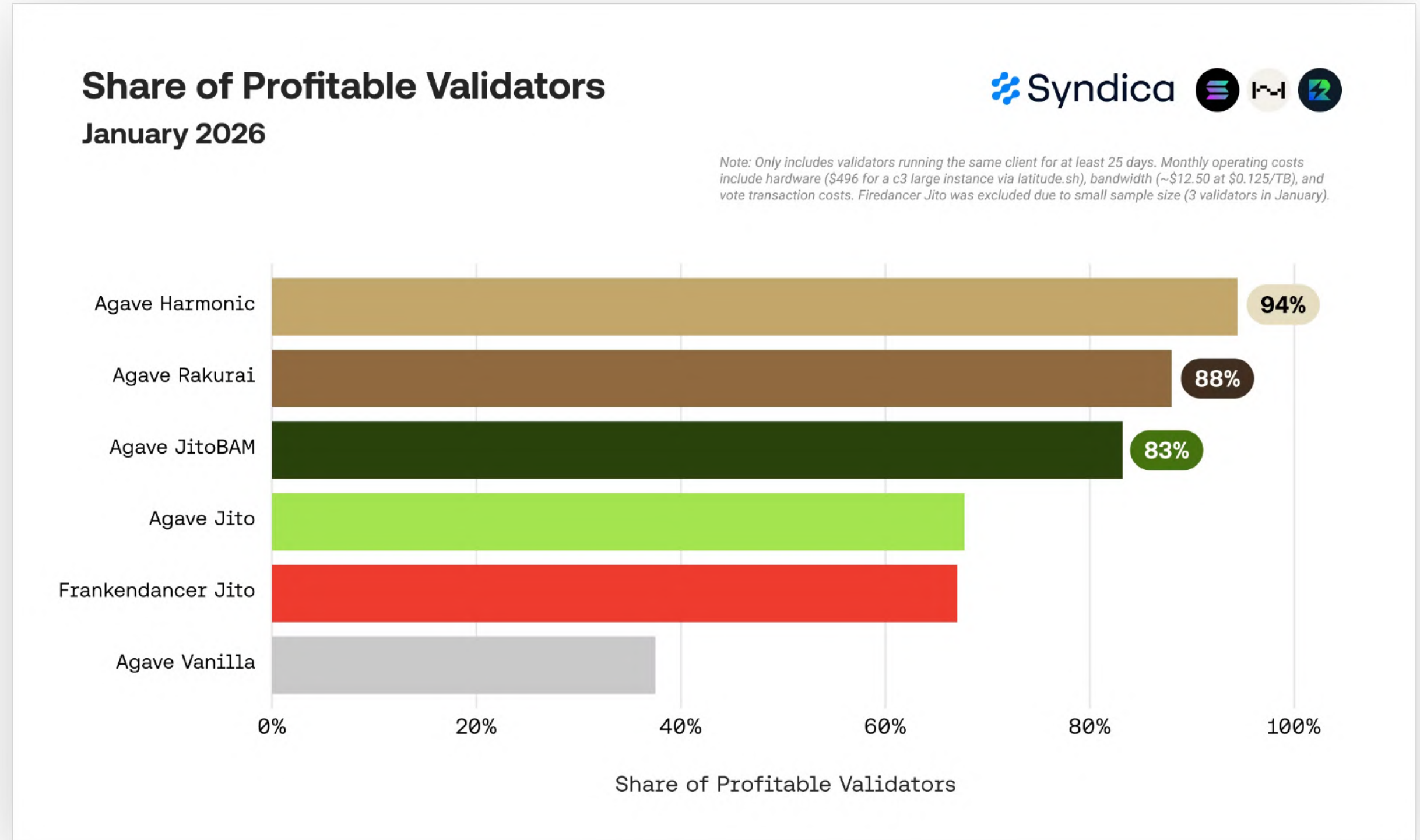


94% of Harmonic validators were profitable in January.

Rakurai followed at 88%, then JitoBAM at 83%. Agave Jito and Frankendancer Jito both came in at 68%, while fewer than half of Agave vanilla validators turned a profit.

Note: Only includes validators running the same client for at least 25 days. Monthly operating costs include hardware (\$496 for a c3 large instance via latitude.sh), bandwidth (~\$12.50 at \$0.125/TB), and vote transaction costs. Firedancer Jito was excluded due to small sample size (3 validators in January).

// Deep Dive: Validator Probability // January 2026



Rakurai and Harmonic earned the highest tip- and fee-based APY.

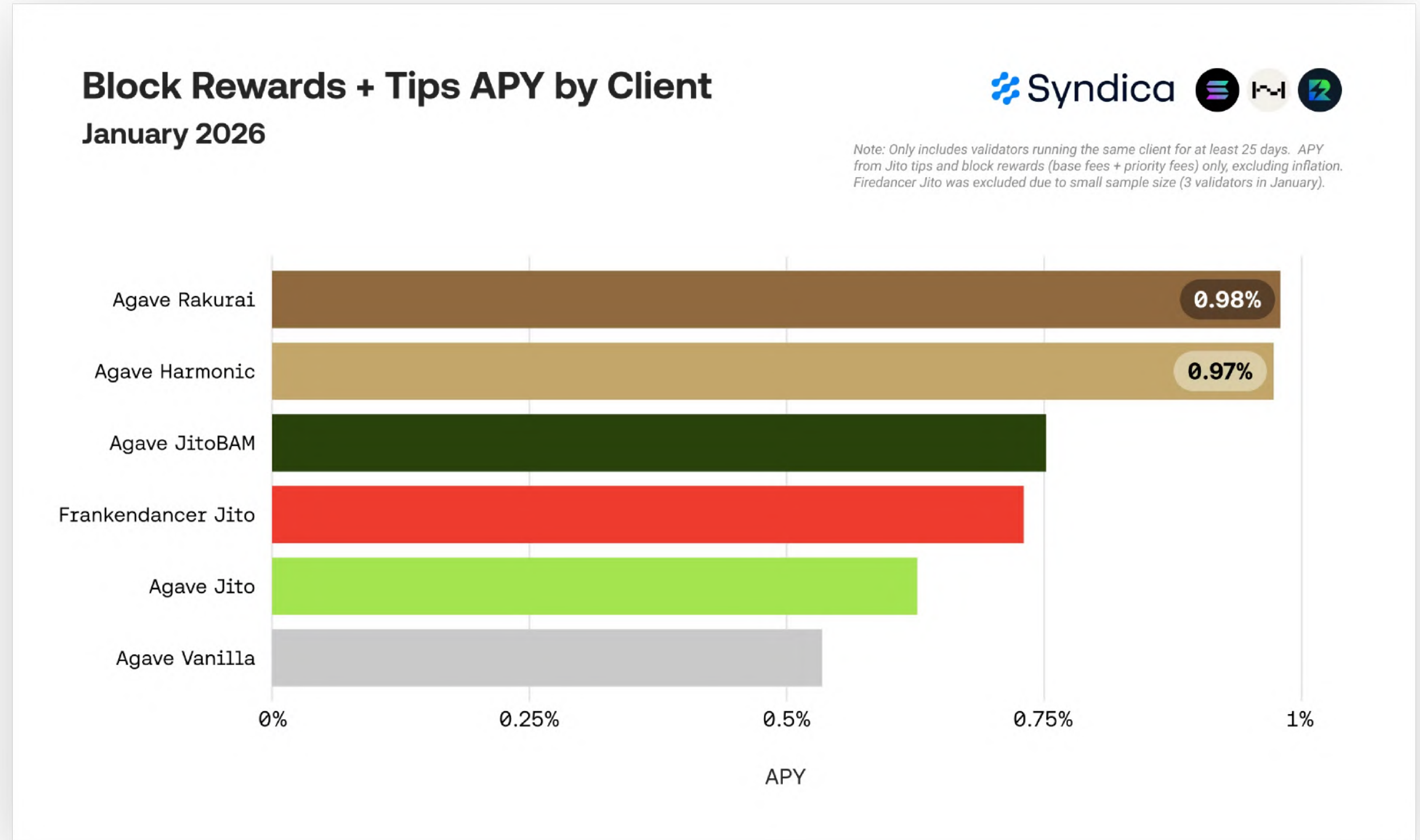
Rakurai led at 0.98% APY, with Harmonic close behind at 0.97%.

A second tier followed with JitoBAM at 0.75% and Frankendancer Jito at 0.73%.

Note: Only includes validators running the same client for at least 25 days. APY from Jito tips and block rewards (base fees + priority fees) only, excluding inflation. Firedancer Jito was excluded due to small sample size (3 validators in January).

Data Source: Trillium

// Deep Dive: Validator Probability // January 2026





Harmonic earned the most for validator operators, Rakurai returned the most to delegators.

On the validator side, Harmonic led at 0.79%, Rakurai second at 0.62% and the rest clustered between 0.52-0.55%.

On the delegator side, Rakurai moved to first place at 0.36%, jitoBAM was second at 0.21% and Harmonic dropped to fourth at 0.18%.

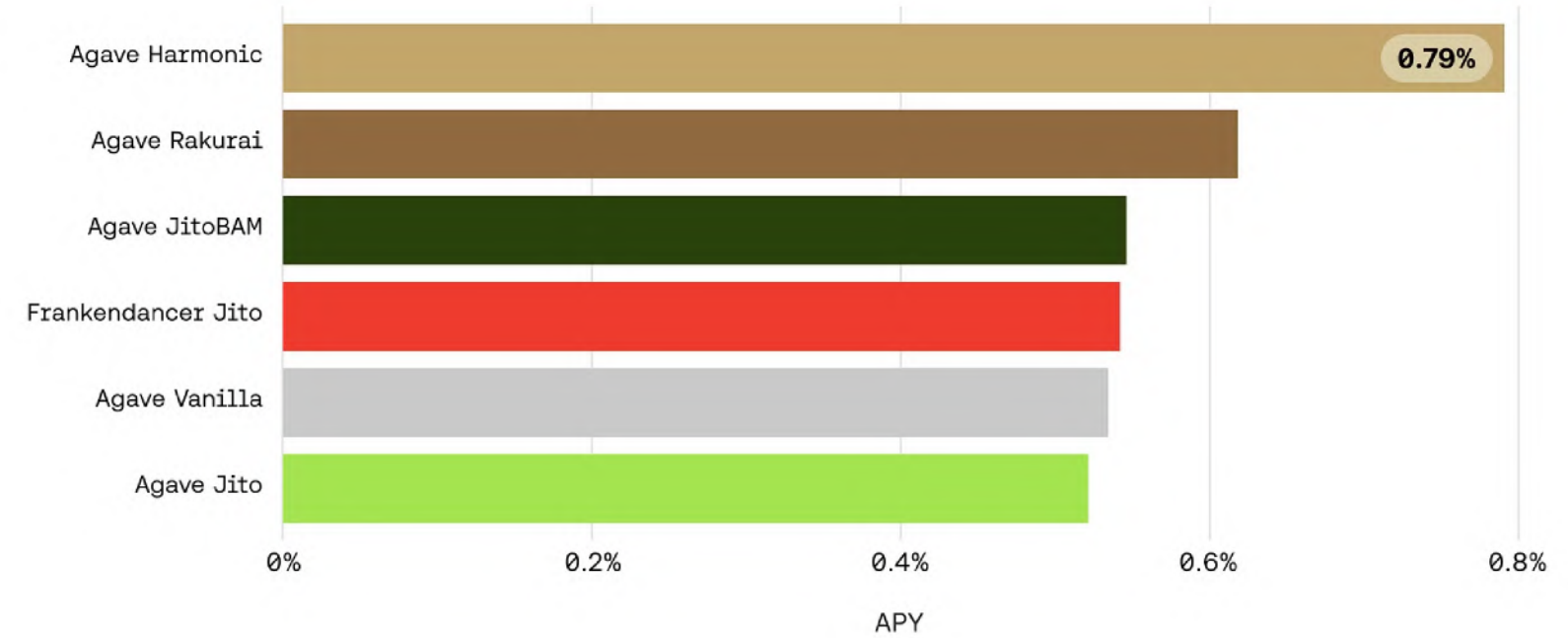
*Note: Only includes validators running the same client for at least 25 days. APY from Jito tips and block rewards (base fees + priority fees) only, excluding inflation. Firedancer Jito was excluded due to small sample size (3 validators in January).
Data Source: Trillium*

// Deep Dive: Validator Probability // January 2026

Validator Block Rewards + Tips APY by Client January 2026



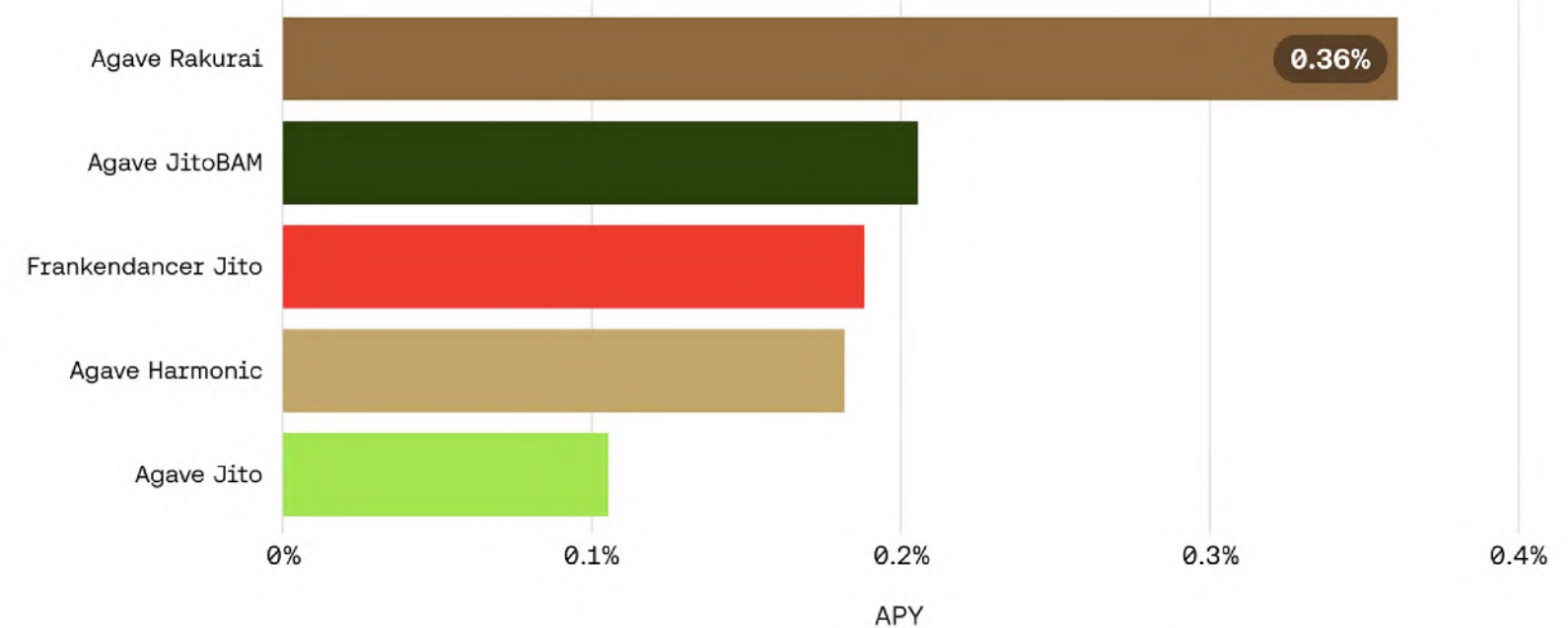
Note: Only includes validators running the same client for at least 25 days. APY from Jito tips and block rewards (base fees + priority fees) only, excluding inflation. Firedancer Jito was excluded due to small sample size (3 validators in January).



Delegator Block Rewards + Tips APY by Client January 2026



Note: Only includes validators running the same client for at least 25 days. APY from Jito tips and block rewards (base fees + priority fees) only, excluding inflation. Firedancer Jito was excluded due to small sample size (3 validators in January).



Validator profitability hit 72% in January, up sharply from a year-long average of 56%.

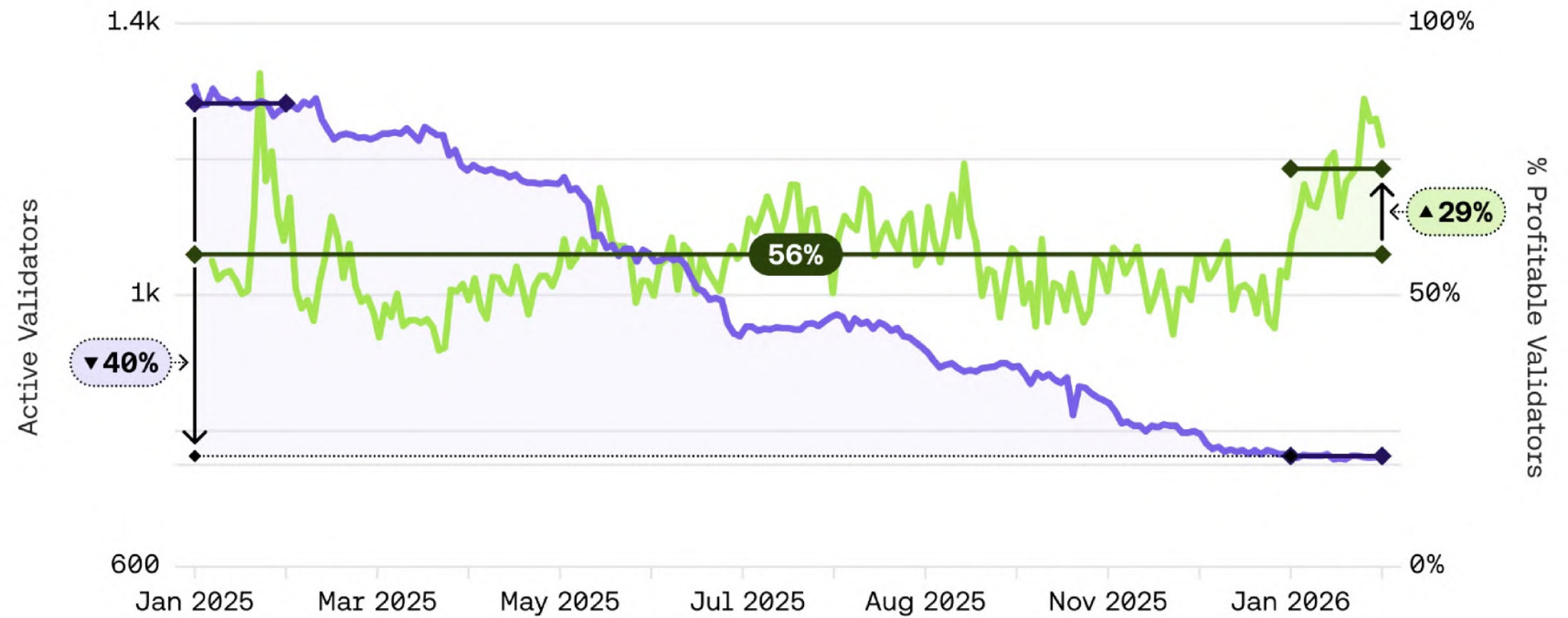
40% of validators left the network since January 2025. Despite the exodus, profitability stayed flat near 56% as falling activity kept pushing operators below break-even.

In January 2026, the pattern shifted: profitability jumped to 72% while validator count barely moved (down 1% MoM).

Note: Monthly operating costs include hardware (\$496 for a c3 large instance via latitude.sh), bandwidth (~\$12.50 at \$0.125/TB), and vote transaction costs.

Validator Count and Profitability By Epoch

● Active Validators ● % Profitable Validators



Note: Monthly operating costs include hardware (\$496 for a c3 large instance via latitude.sh), bandwidth (~\$12.50 at \$0.125/TB), and vote transaction costs.

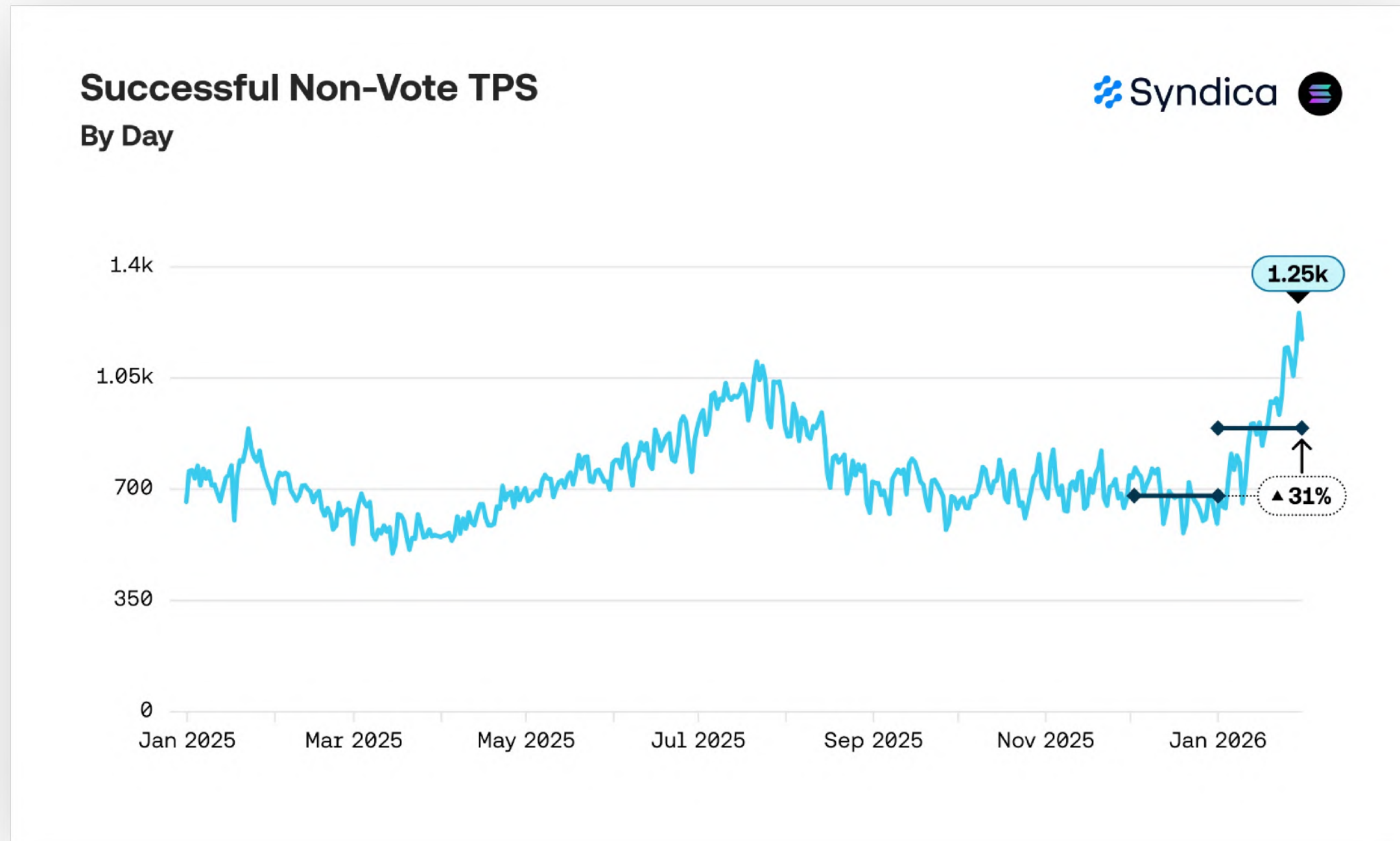
Part IV
Network



Successful non-vote TPS hit an all-time high in January.

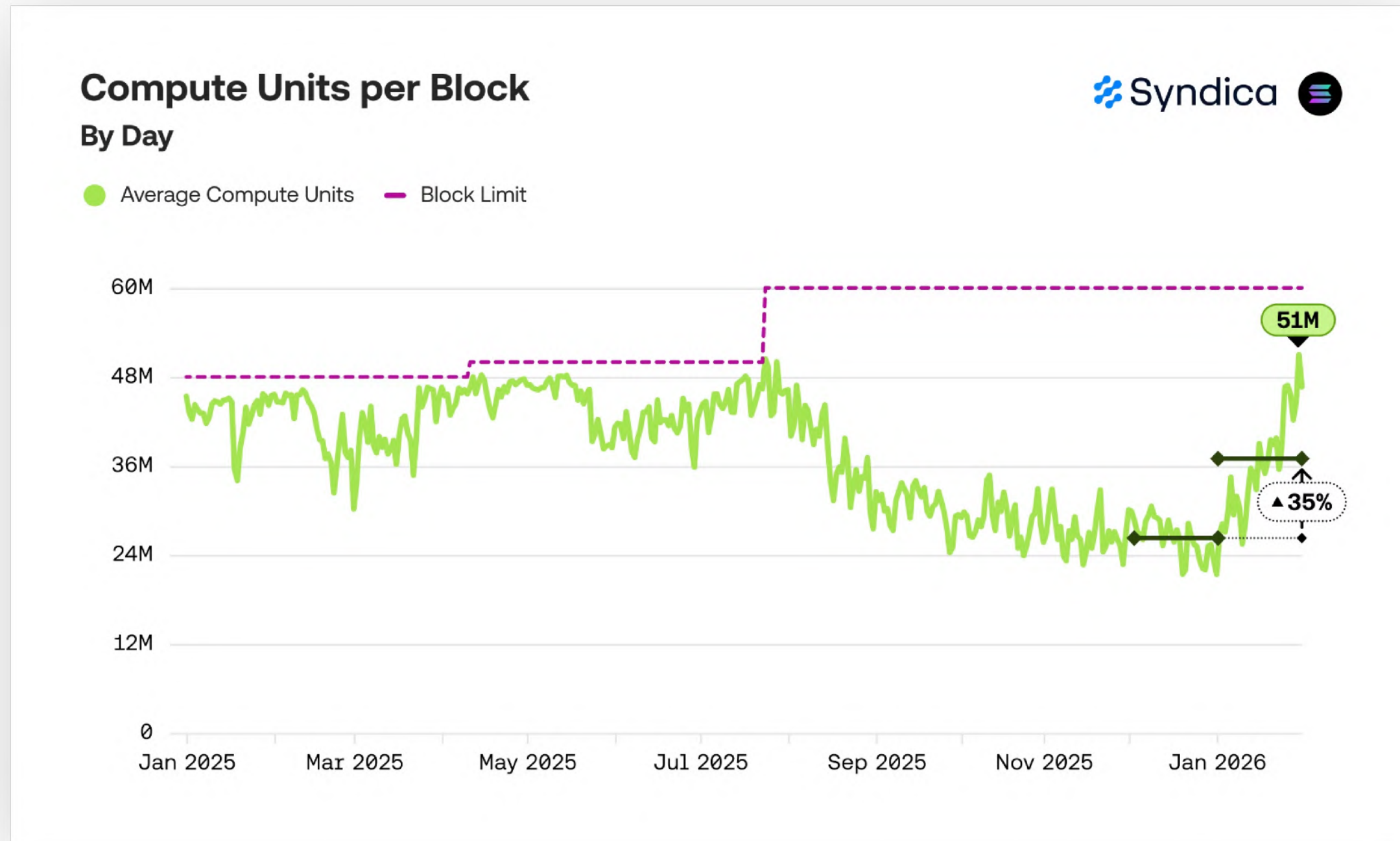
Average successful non-vote TPS reached 893 for the month, up 31% MoM.

Daily average peaked at 1250 in January.



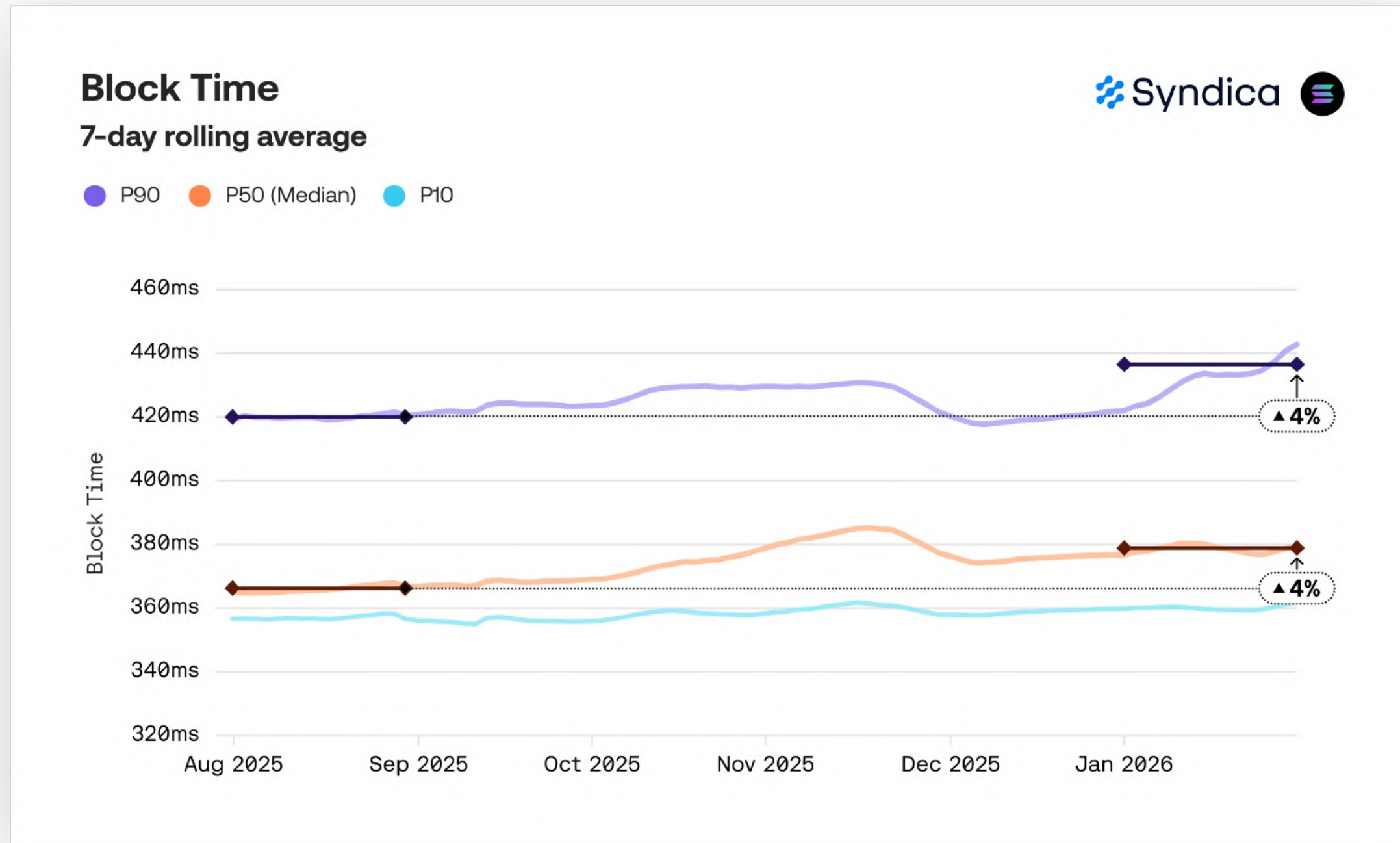
Compute units recovered to August 2025 levels.

Average CUs reached 35.9M in January 2026, up 35% MoM.
Daily averages peaked at 51M CU, the highest since mid-2025.



Block times have drifted higher since August.

Median block time rose from 366ms to 379ms (+4%), with p90 climbing from 420ms to 436ms (+4%).
Even p10 edged up from 356ms to 360ms.



Appendix

Background Theory

Clients live on mainnet

Base Clients

- **Agave:** main Solana validator Client maintained by Anza, continuing the work of the Solana Labs client. Serves as the reference implementation for the network.
- **Firedancer:** validator client developed by Jump Crypto in C.
- **Frankendancer:** hybrid client as a transitional step towards the full Firedancer client. It combines the original consensus and runtime components from Agave with Firedancer's networking, signature verification, and block packing.

Flavours of Base Client

- **Vanilla:** default Agave/Firedancer/Frankendancer clients.
- **Jito:** modified version of the core client with built-in Maximum Extractable Value (MEV) auction and block engine to maximize revenue and potentially increase reliability and performance.
- **JitoBAM:** block building extension for *jito-solana* that offloads transaction sequencing to external schedulers running in trusted execution environments.
- **Paladin:** modified Jito client that aims to protect validators from sandwiching and distribute MEV rewards across Paladin validators.
- **Rakurai:** performance-focused fork of Agave, incorporating optimized scheduling and transaction processing.
- **Harmonic:** marketplace for block construction where independent builders compete to produce blocks, and validators select based on revenue, fairness, or other preferences.

Validators and Block Production

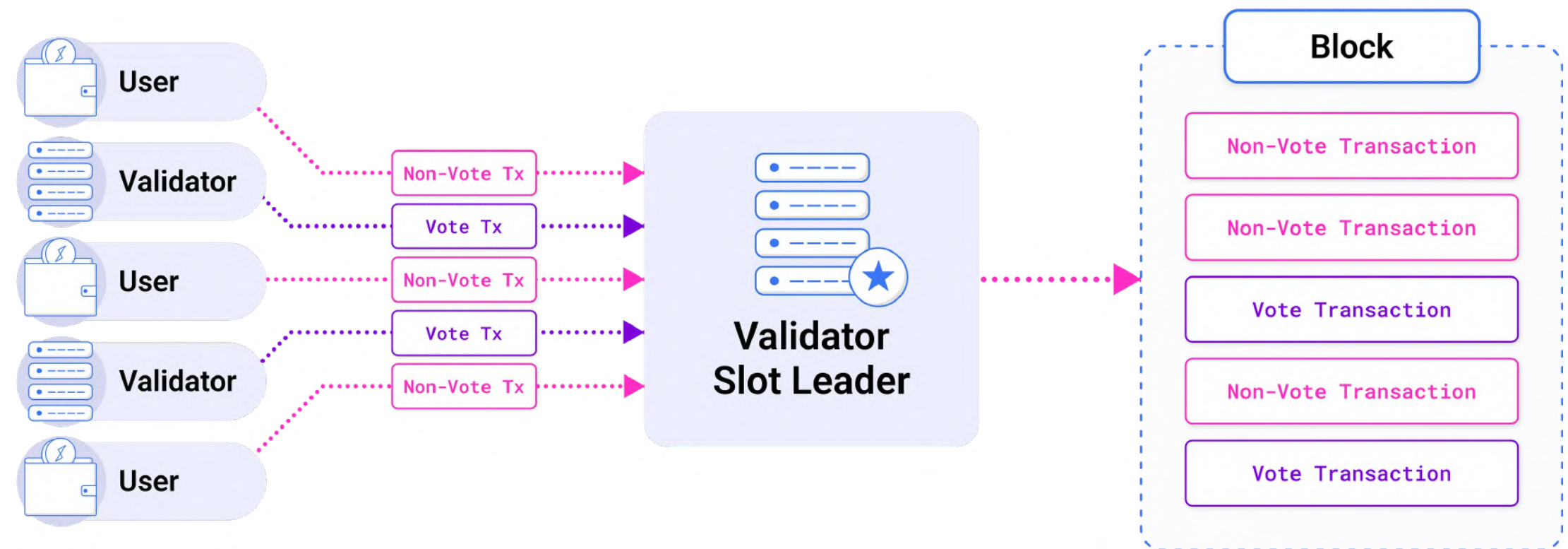
A **validator** is a computer or node that verifies the accuracy of transactions, creates new blocks, and participates in consensus.

A **slot** represents an allotment of time for which a block may be produced. Validators are assigned to act as **slot leaders** for a set of 4 consecutive slots.

During these 4 slots, the designated slot leader is responsible for creating blocks by bundling hundreds to thousands of transactions, which include both vote and non-vote transactions.

Validators submit **vote transactions** to reach consensus. One can understand it as validators casting votes to agree on what is happening within the Solana blockchain and what the correct order of events is.

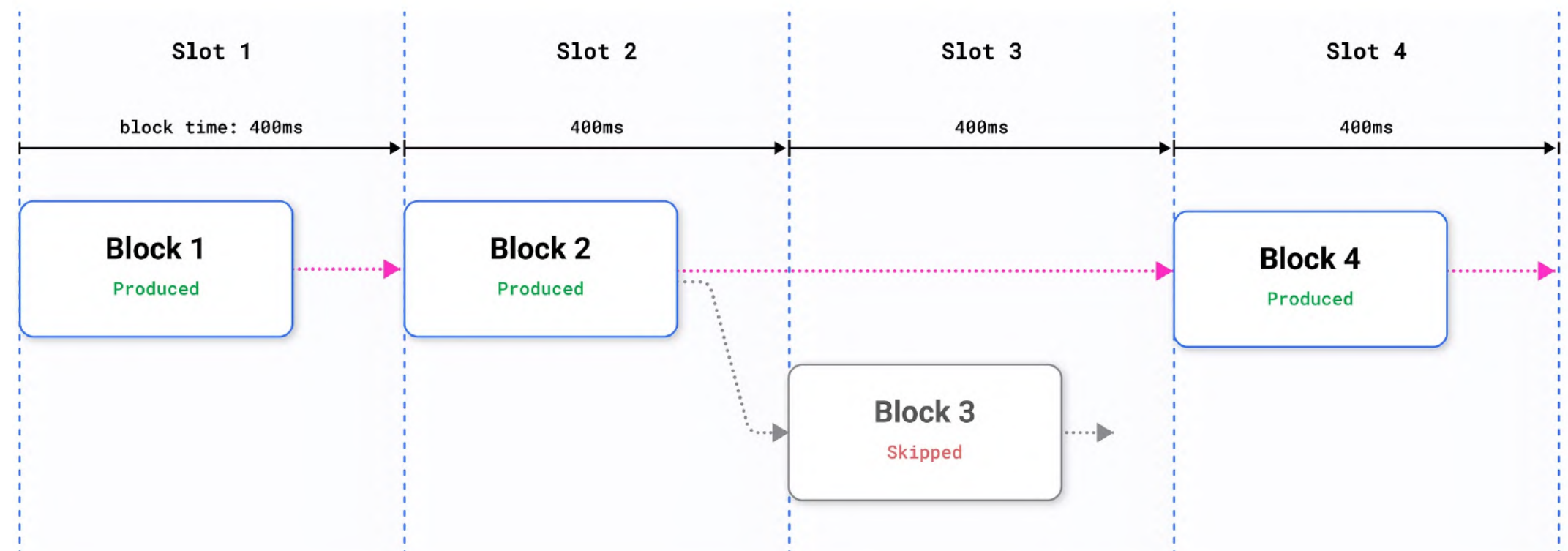
Non-vote transactions are any other kind of transaction, like a swap, a token transfer, etc.



Measuring Network Performance

We will use four main metrics to measure Solana's network performance:

1. **Block time:** Measures how quickly blocks are created, with Solana aiming to produce one block every 400ms.
2. **Blocks produced:** Measures how many successful blocks Solana outputs, targeting 216,000 blocks per day.
3. **Skip rate:** When a slot leader fails to produce an acceptable block in their assigned slot, the block gets skipped. Skip rate tracks the ratio of skipped versus total slots.
4. **Vote latency:** Measures the time between when a block is produced and when a validator's vote for that block is included in a future slot. It is measured in slots, and the minimum possible latency is one slot.



Understanding Solana's fee structure

There are three types of transaction fees in Solana: base, vote, and priority.

- **Transaction fees** are fixed at 5,000 lamports per signature. 50% goes to the block leader, 50% is burnt. They apply to:
 - Non-vote transactions for user activity, like swaps and transfers, are commonly known as **base fees**
 - Vote transactions (validators participating in consensus), known as **vote fees**
- **Priority fees** are optional user payments to prioritize transaction inclusion. They are calculated by multiplying the transaction's compute unit limit by a user-defined price per compute unit.
- **Tips** are extra SOL payments users make to validators to speed up transaction inclusion.

What are compute units (CU)?

Onchain transactions consume computational resources, quantified in compute units (CU). Each CU generally corresponds to one Berkeley Packet Filter (BPF) instruction (e.g., basic arithmetic like addition or subtraction), with estimates for more complex ones.

BPF started as a kernel tool for efficient packet filtering in Linux, later extending to eBPF for broader, high-performance applications in networking and tracing. Solana uses sBPF, a modified version that creates a virtual machine for eBPF programs.



Block Compute Budget

- Each block: limit of 48M CU (raised to 50M CU on April 10 and again to 60M CU on July 22)
- Blocks consist of multiple transactions
- Each transaction deducts CU from the block budget



CU Limits

- Maximum: 1.4M CU per transaction
- Transactions are split into instructions
- Users specify a compute limit for the entire transaction, up to 1.4M CU. Without a specified limit, the default is 200k CU per instruction