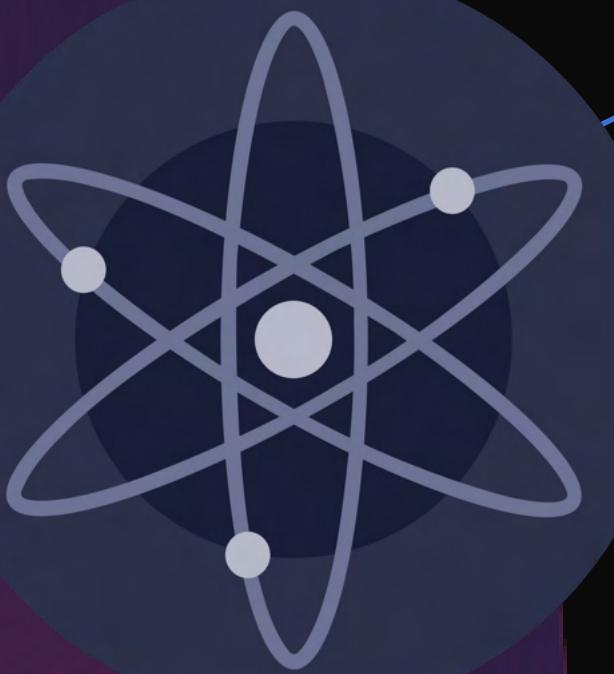


Highly Scalable Blockchains

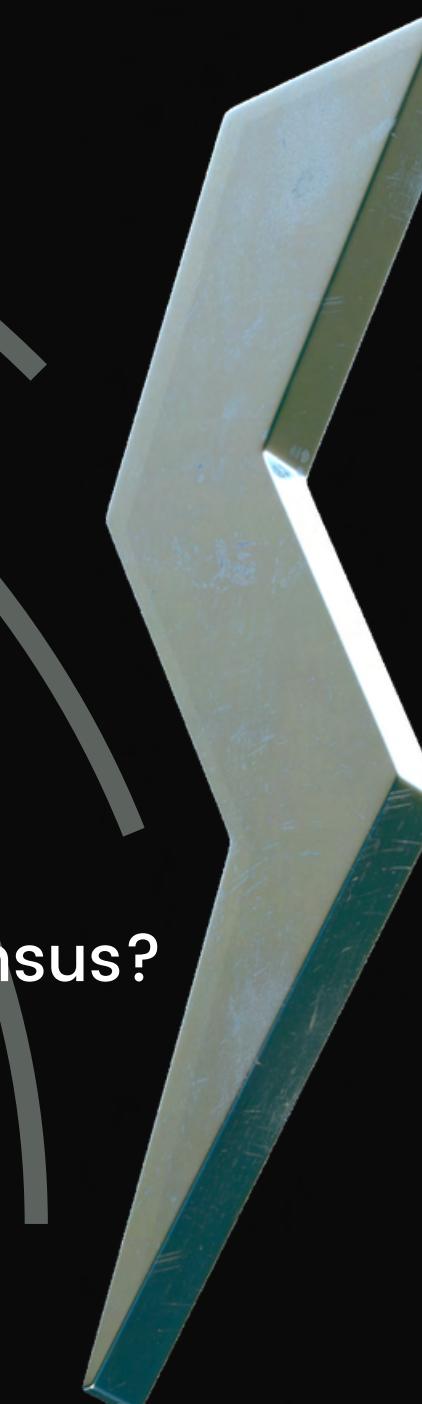
Different Proof of Stakes Consensus Algorithm comparison
and Analysis

θθ Harmony



Proof of Stake

What does it take to reach consensus?



Energy & time efficient

Minimum Staking

Sharding & Randomization Efficiency

TPS, Finality & Transaction Fees

Voting & Decentralization

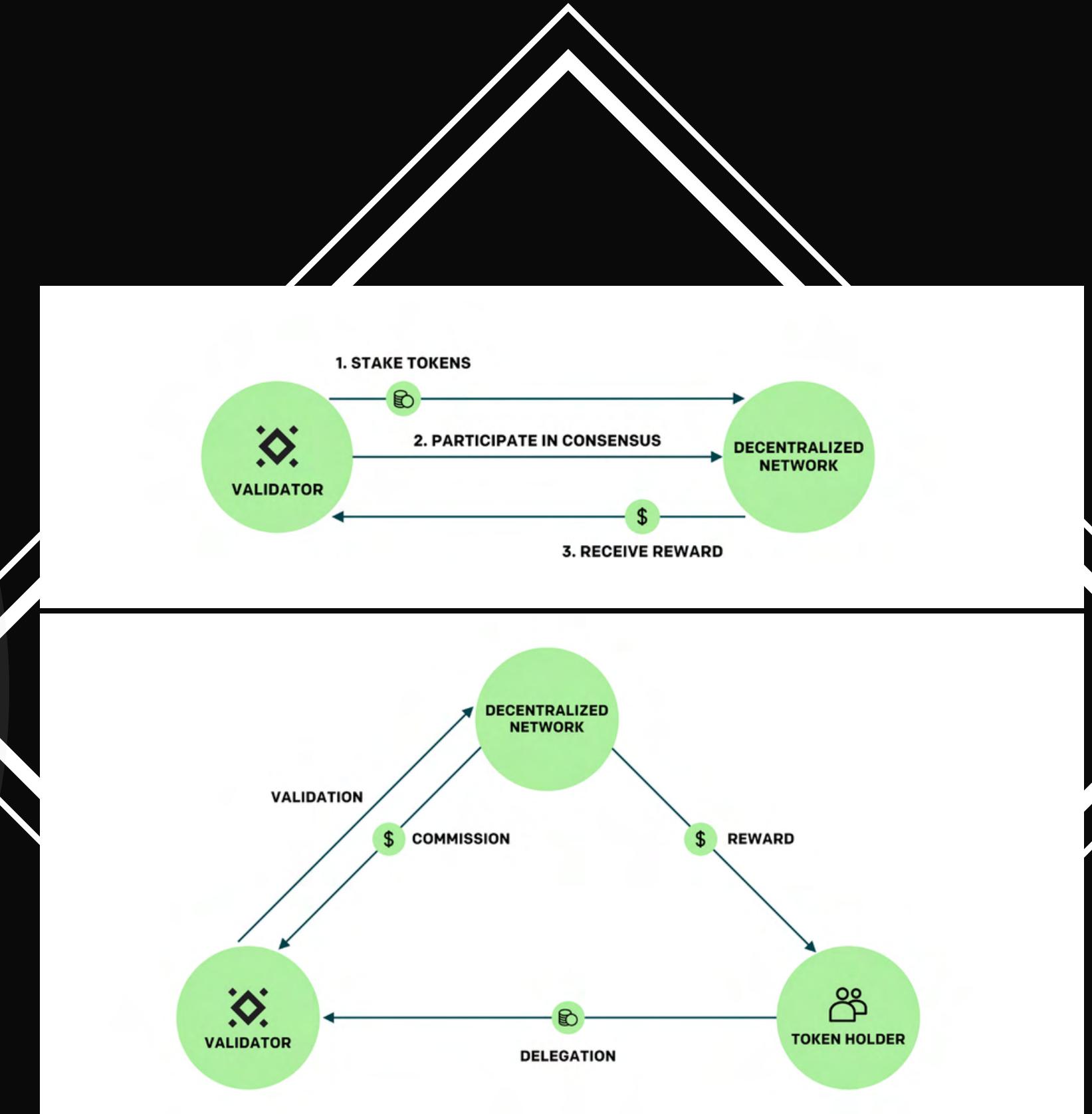
Total Value Locked

Validator Selection & Token holder Activity

Slashing

What is Proof of Stake?

Algorithm used to reach consensus in a digital trust-less environment called "blockchain" where the voting power (to append blocks containing transactions) is proportional to staked funds.

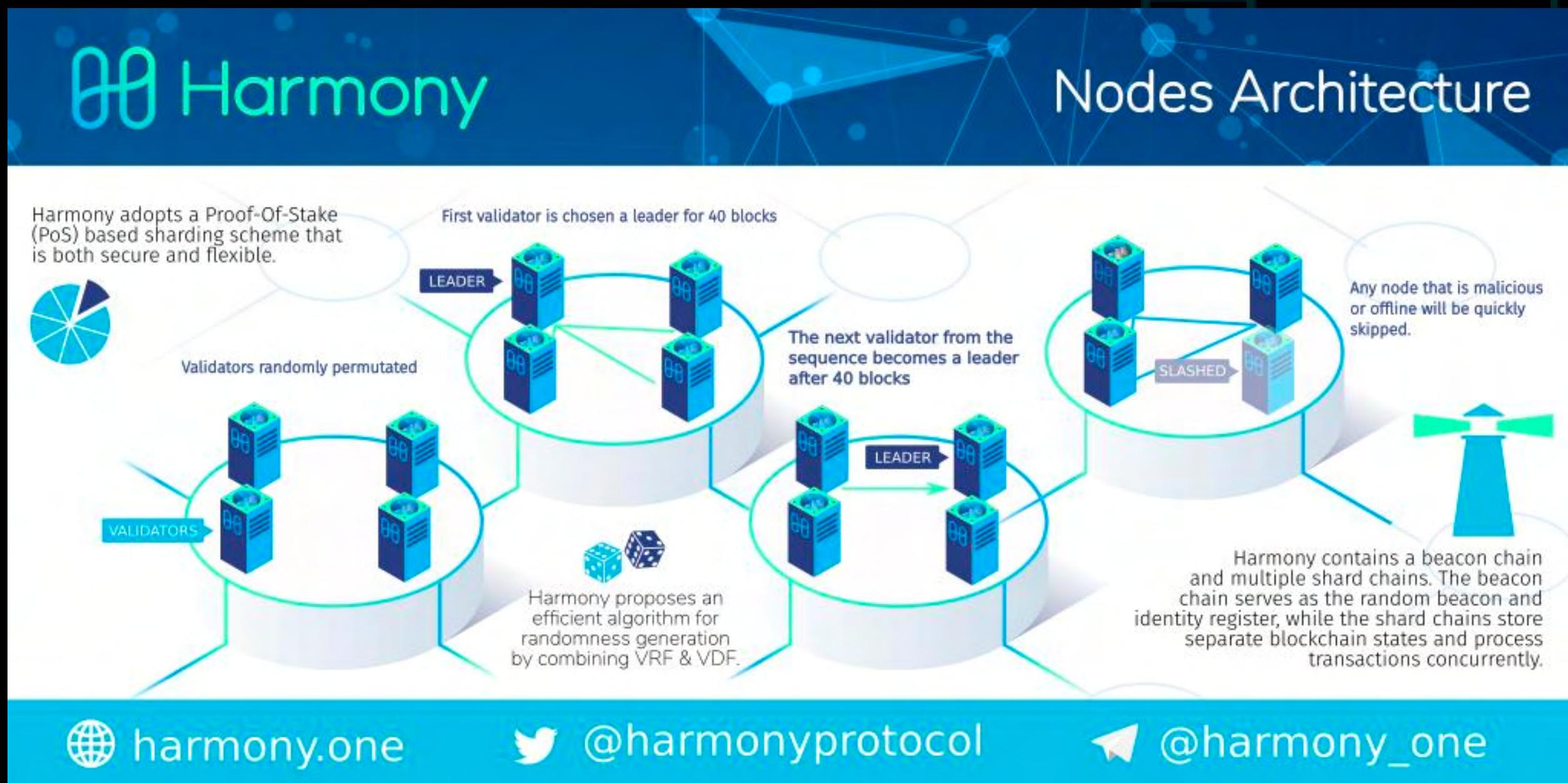


Purpose: To compare consensus functionality of different Proof of Stake blockchains - (Harmony, Avalanche and Cosmos)



Harmony (\$ONE)

Architecture - Overview



- **Founded in:** 2018
- **Founded by:**
Rongjian Lan
Sahil Dewan
Stephen Tse
- **Built by:** Harmony Protocol and Harmony Foundation
- **Harmony Mainnet:** June 2019
- **Place:** USA
- EVM - Yes
- TVL - \$45.71M
- TPS - 2000 Tx

\$ONE Staking

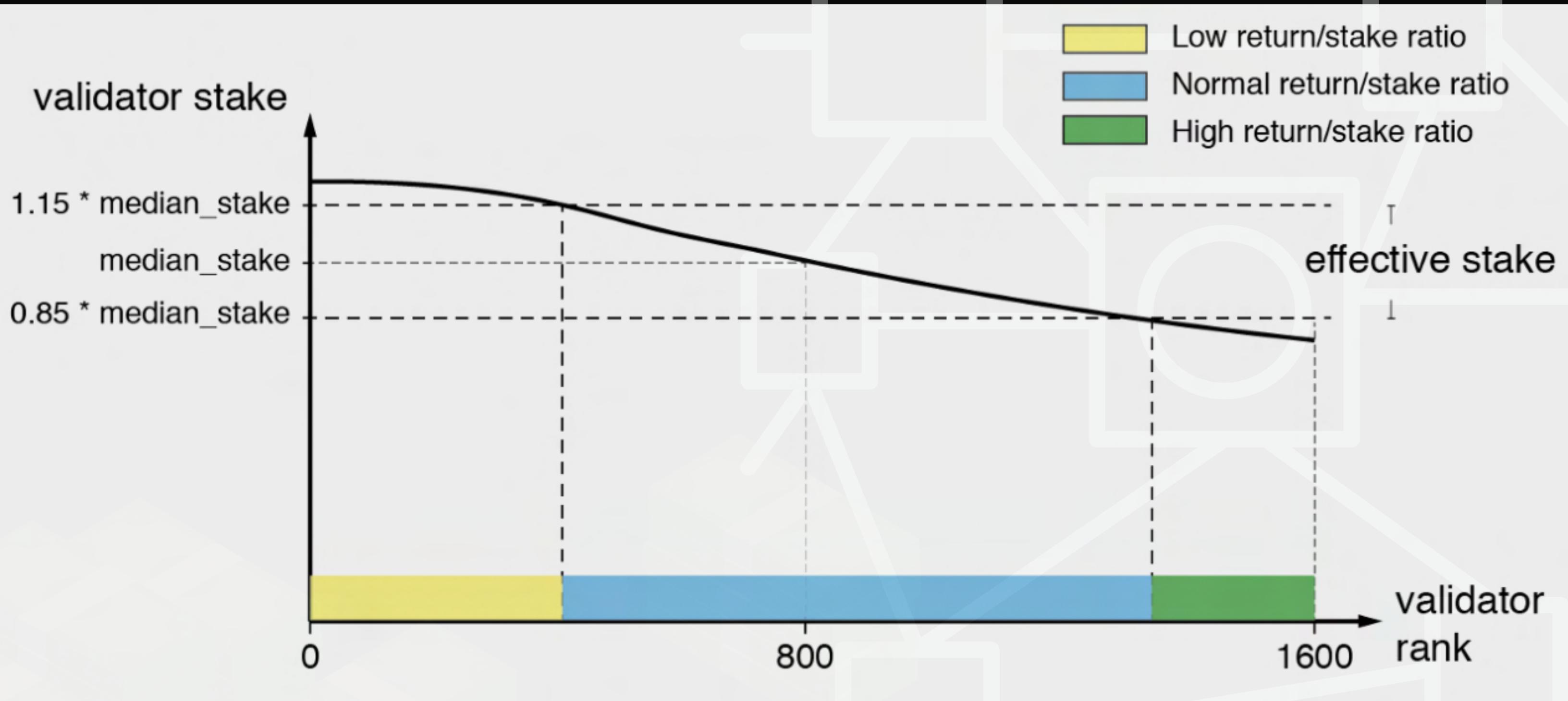
Harmony Blockchain Ecosystem

The screenshot shows the Staking Rewards website interface for the Harmony ONE staking provider. The top navigation bar includes links for Crypto Assets, Staking Providers, Calculator, Journal, a search icon, Login, and Sign Up. Below the navigation, a date range from 20 Jun to 20 Jul is displayed, along with buttons for Stake, Buy, and more options.

Harmony ONE is highlighted in the center, accompanied by its logo (two blue circles).

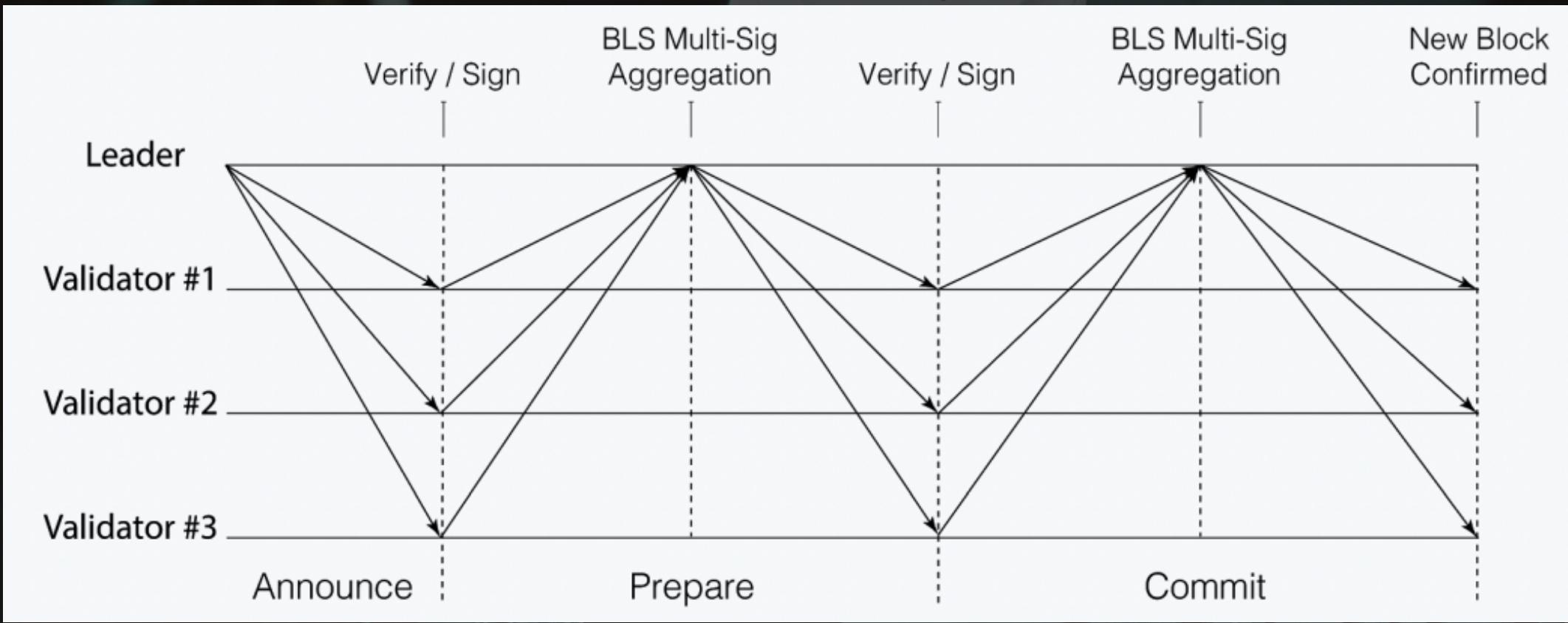
	Risk <small>i</small>	Complexity <small>i</small>	Reward <small>i</small>	Adj. Reward <small>i</small>	Minimum <small>i</small>	Lock Up <small>i</small>	Avg. Fee <small>i</small>	Staking Ratio <small>i</small>
Delegate ONE	stable	easy	7.46%	3.75%	1,000	-	6.76%	-
Run a Validator Node	risky	hard	8.01%	4.27%	10,000	-	-	-

Effective Staking Mechanism for EPoS

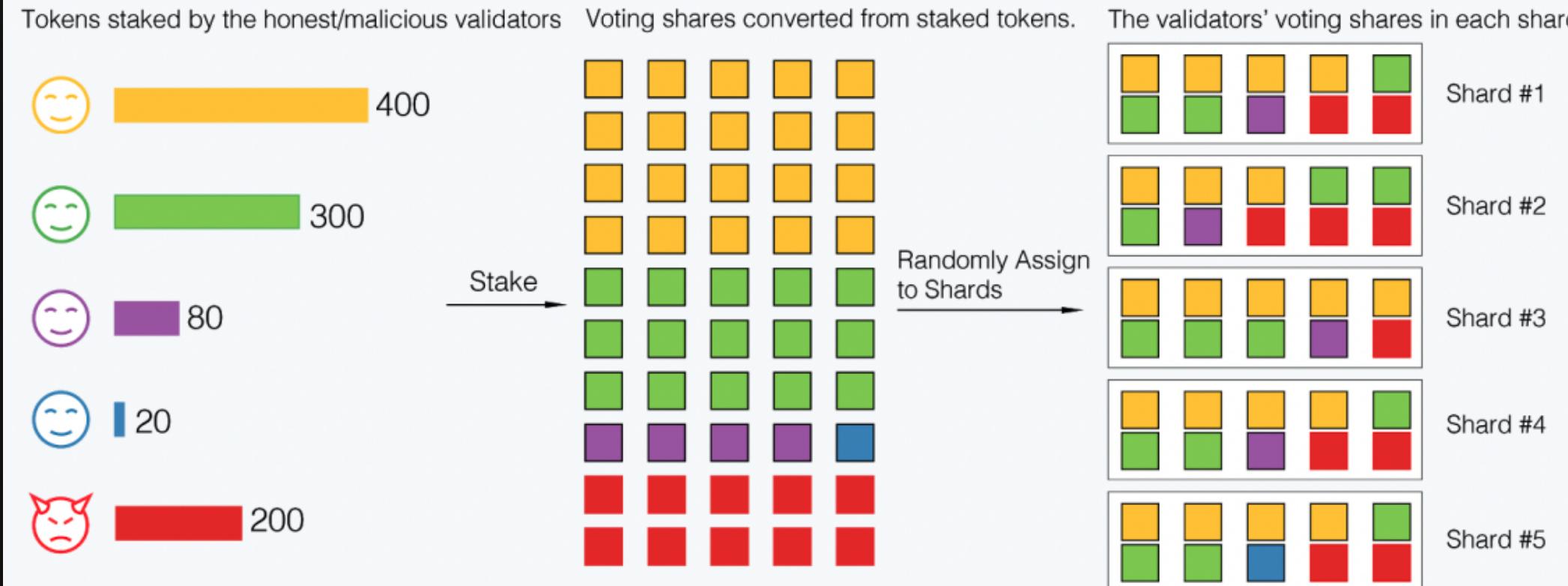


Validators Activity

Total Validators: $250 * 4$ (per shard) = 1000



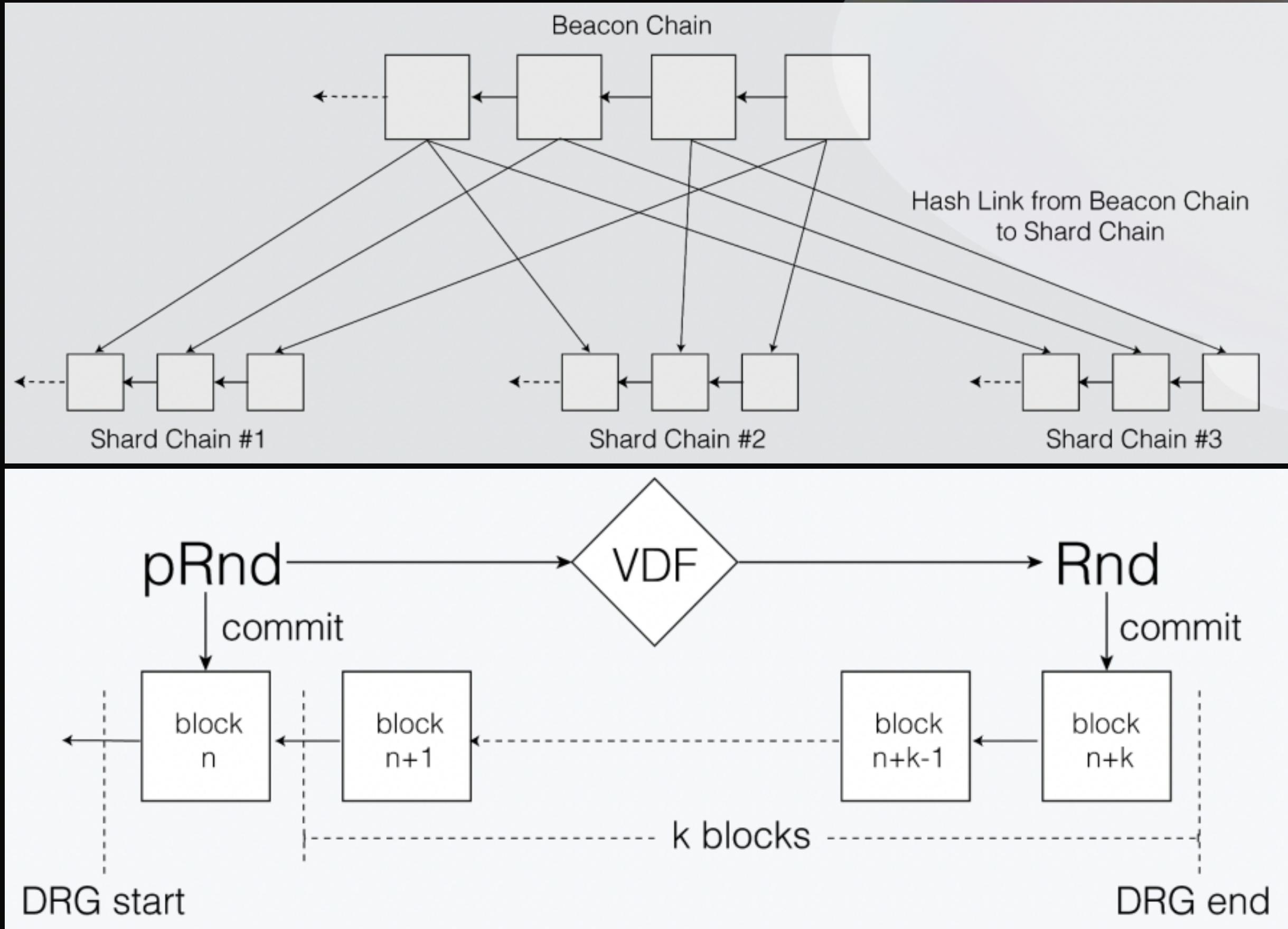
Sharding by Voting Shares



Technologies used:

- Practical Byzantine Fault Tolerance
- Fast Byzantine Fault Tolerance
- BLS Sig & BLS multi-sig agg.

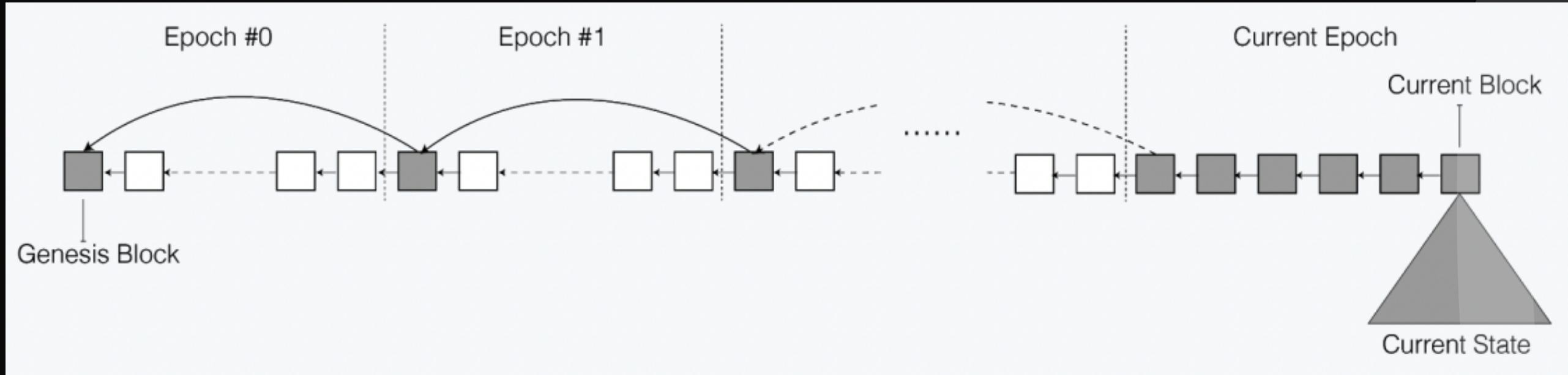
Randomness



Technology Used:

- Distributed Randomness Generation (DRG)
- Verifiable Secret Sharing (VSS)
- Verifiable Random Function (VRF)
- Verifiable Delay Function (VDF)
- BFT

Security & Slashing



Double Signing Penalty	Minimum 2% slash; 33% if 1/3 validators double sign; Half burn + half goes to reporter
Unavailability Condition	66% of the block missed during an epoch
Unavailability Penalty	validator put into inactive mode and not included in shard assignment until they explicitly turn their mode back to active.
Validator Stake Centralization	No

Technology Used:

- Fast State Synchronization
- Slowly Adaptive Corruption Model
- Cuckoo-rule resharding Mechanism

Harmony Interface



ANALYTICS

NEXT EPOCH:
49 MINUTES

Your Address
one1w7ww5qm...vsunyltr

LAST ELECTION

NEXT ELECTION

Portfolio

Validators

Analytics

Networks

Governance

Become a Validator

Terms of Service

Privacy Policy

dApps & Services

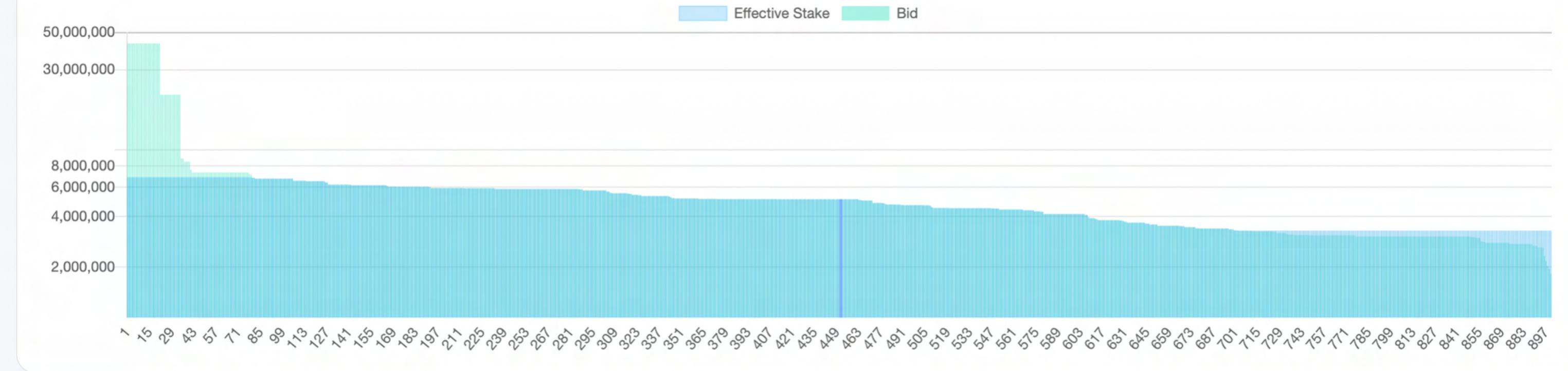
Sign Out

Top 900 Slots

Effective Median Stake:
5,072,096 ONE

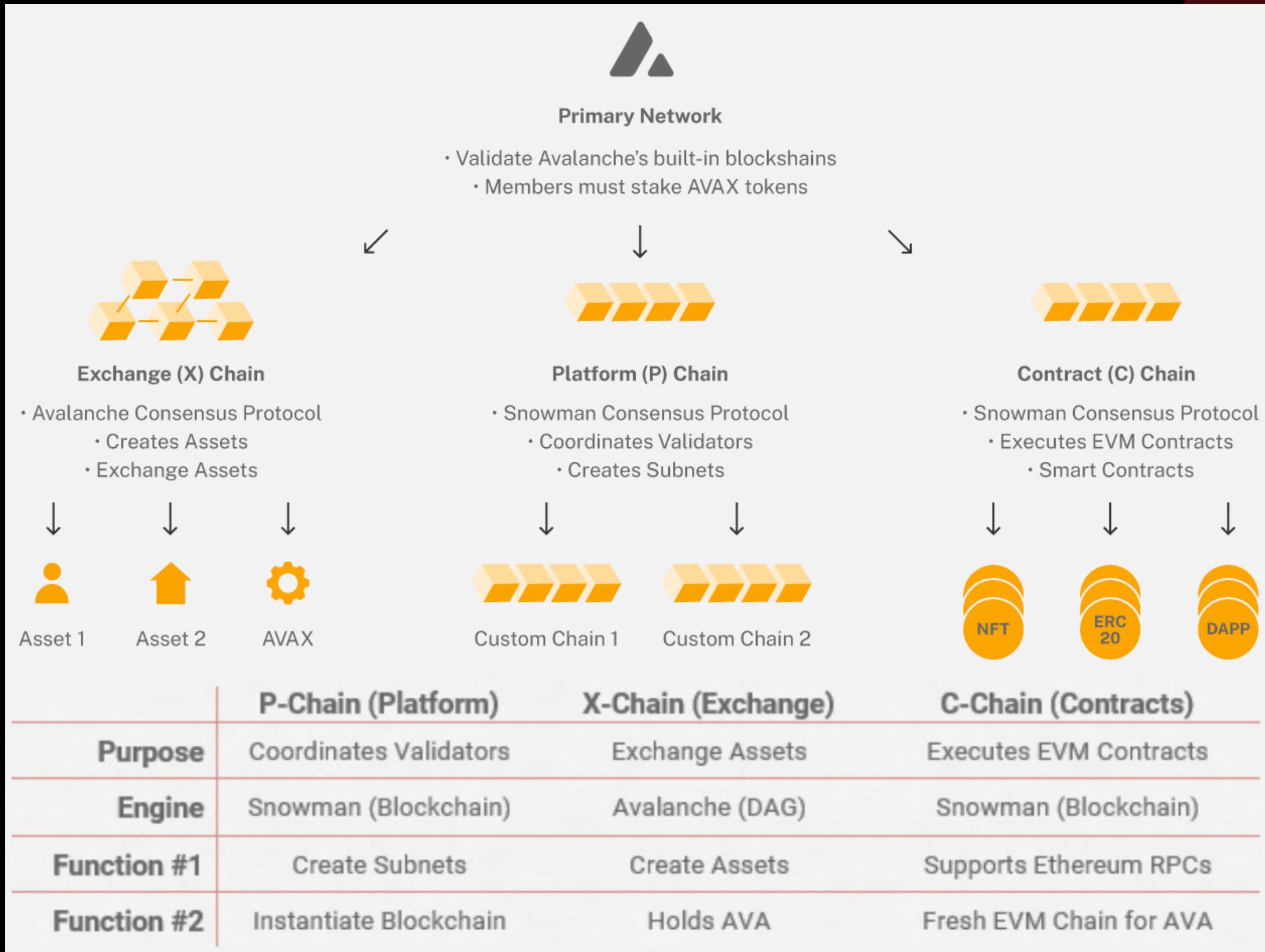
Total Stake:
5,286,127,367 ONE

Current Block Height:
#29031222



Avalanche (\$AVAX)

Architecture - Overview



- **Founded in:** 2018

- **Founded by:**

Emin Gun Sirer

Maofan Yin

- **Built by:** Ava Labs

- **Avalanche Mainnet:** Sept 2020

- **Place:** NY, USA

- EVM - Yes

- TVL - \$3.02B

- TPS - 4500 Tx

\$AVAX Staking

Avalanche Blockchain Ecosystem

 **Staking Rewards**

Crypto Assets Staking Providers Calculator Journal  Login Sign Up

+  #4  On 2686 watchlists

 **Avalanche** AVAX

22 JUN 21 JUN 02 JUL 07 JUL 11 JUL 15 JUL 22 JUL

Risk  Complexity  Reward  Adj. Reward  Minimum  Lock Up  Avg. Fee  Staking Ratio 

Delegate AVAX	 	8.65% 	3.18%	25	14 d	4.73%	13.87%
Run a Validator	 	9.08% 	3.59%	2,000	14 d	-	86.13%

Total Stake
Avax **238,128,908.51**

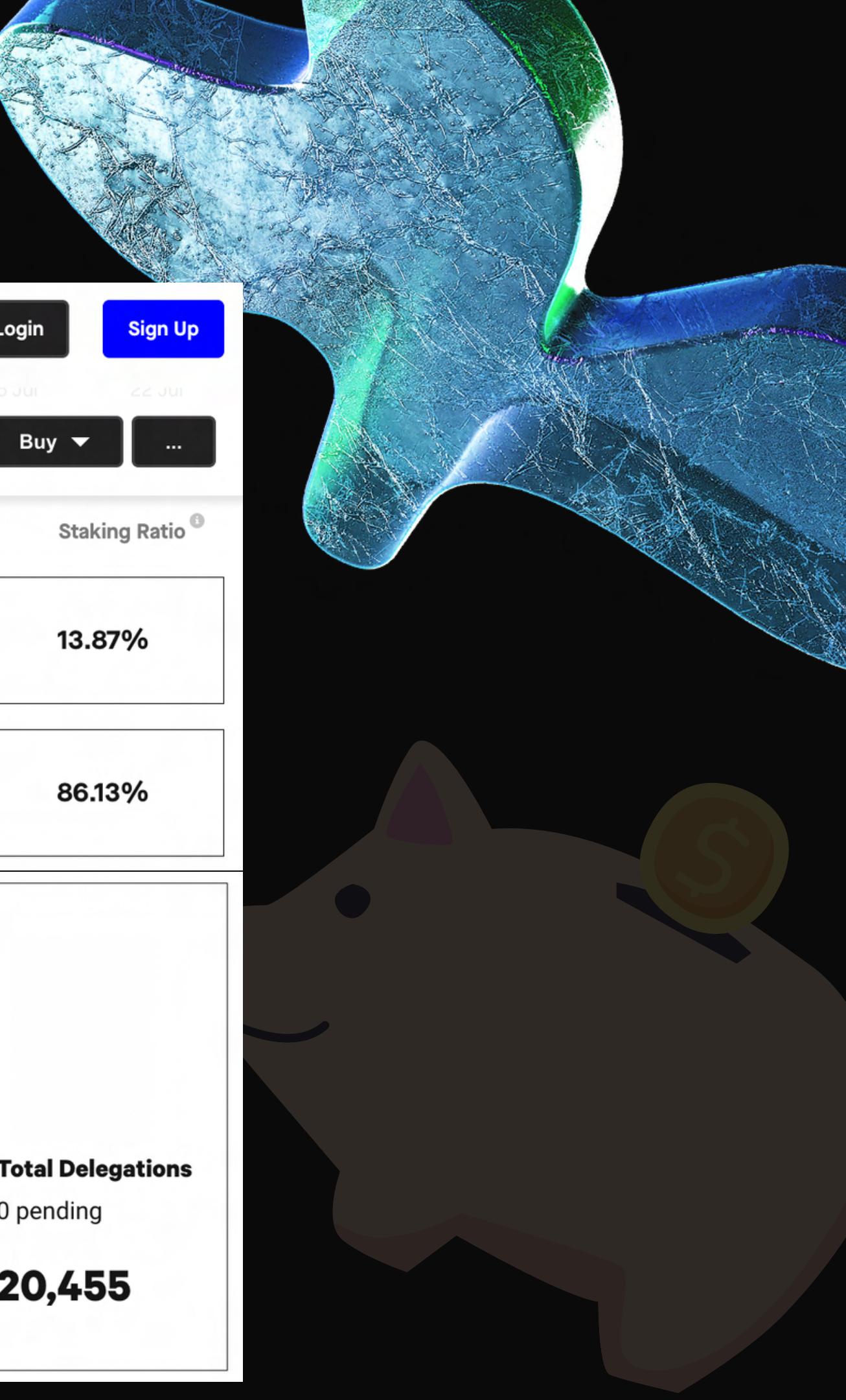
205,174,970 Validation Stake **32,953,939** Delegated Stake

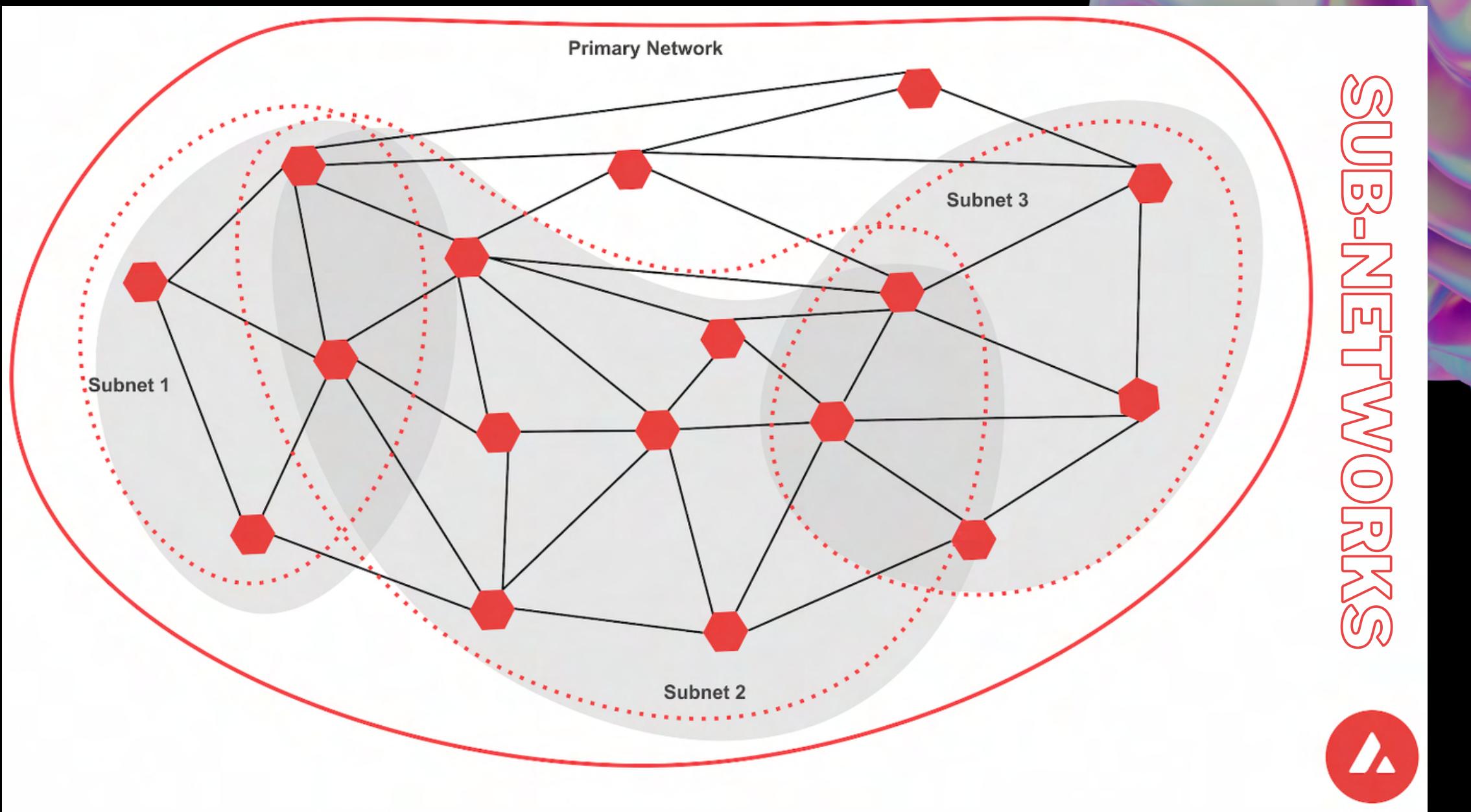
Staking ratio **58.10%**

Staking Rewards
Avg per year **9.08%**

Total Validators
0 pending **1,240**

Total Delegations
0 pending **20,455**





SUB-NETWORKS



Subnets

Subnets ⓘ

24

Blockchains ⓘ

17

Validators ⓘ

1,241

Total Stake Amount ⓘ

238,159,853.49 AVAX

Subnetwork

Primary Network

Blockchains ⓘ

3

Validators ⓘ

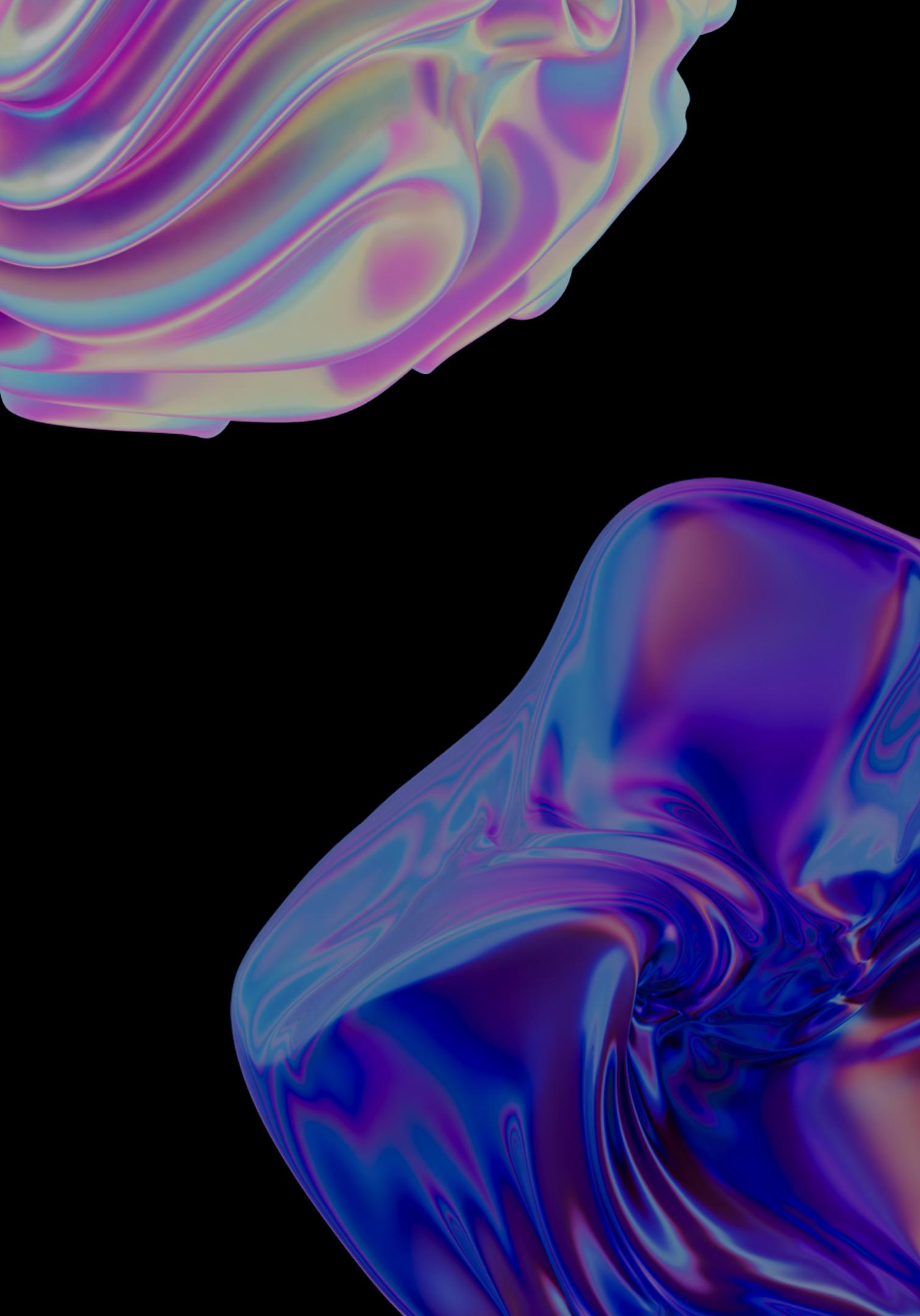
1,241

Delegations ⓘ

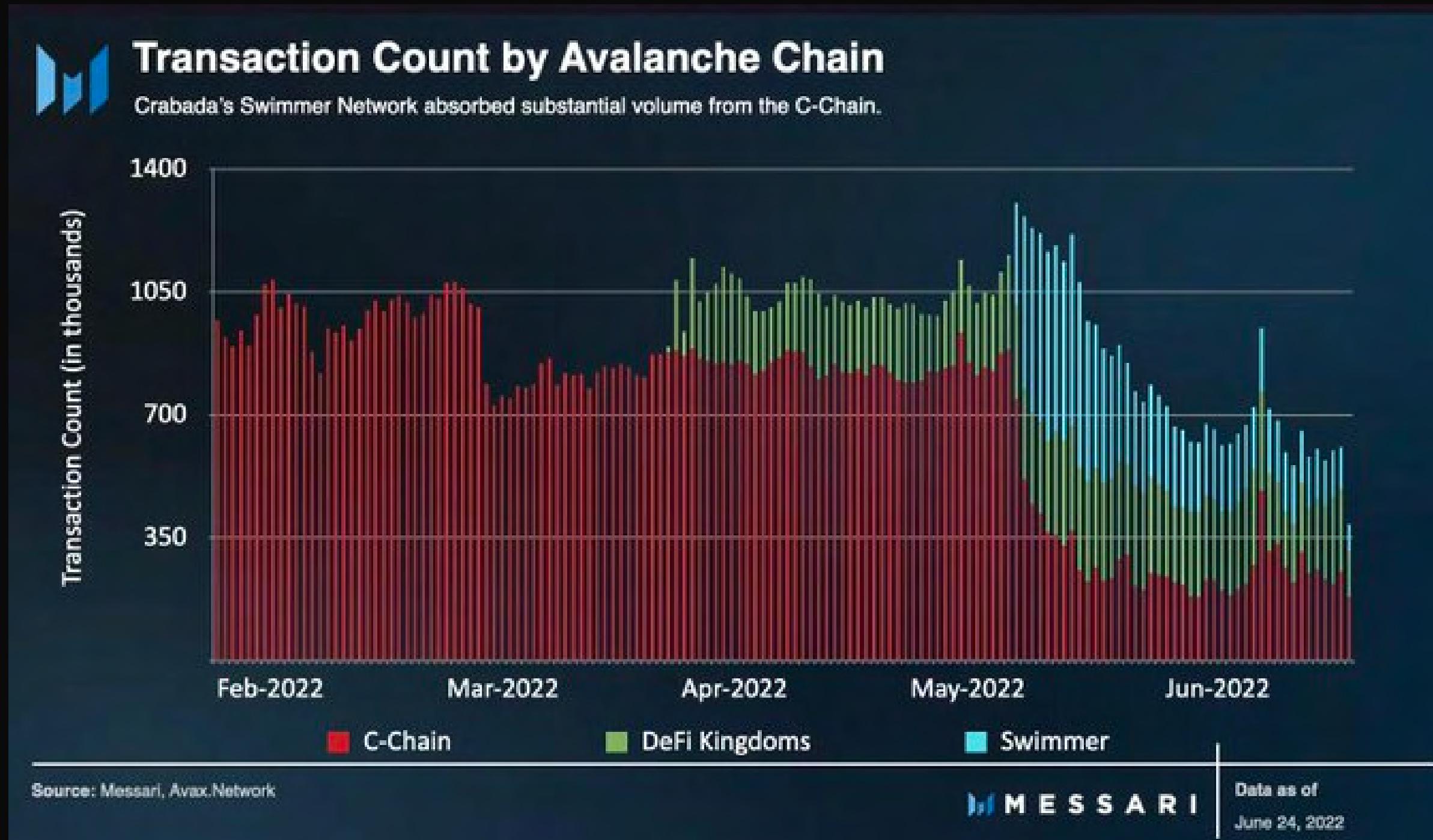
20,495

Control Keys ⓘ

0

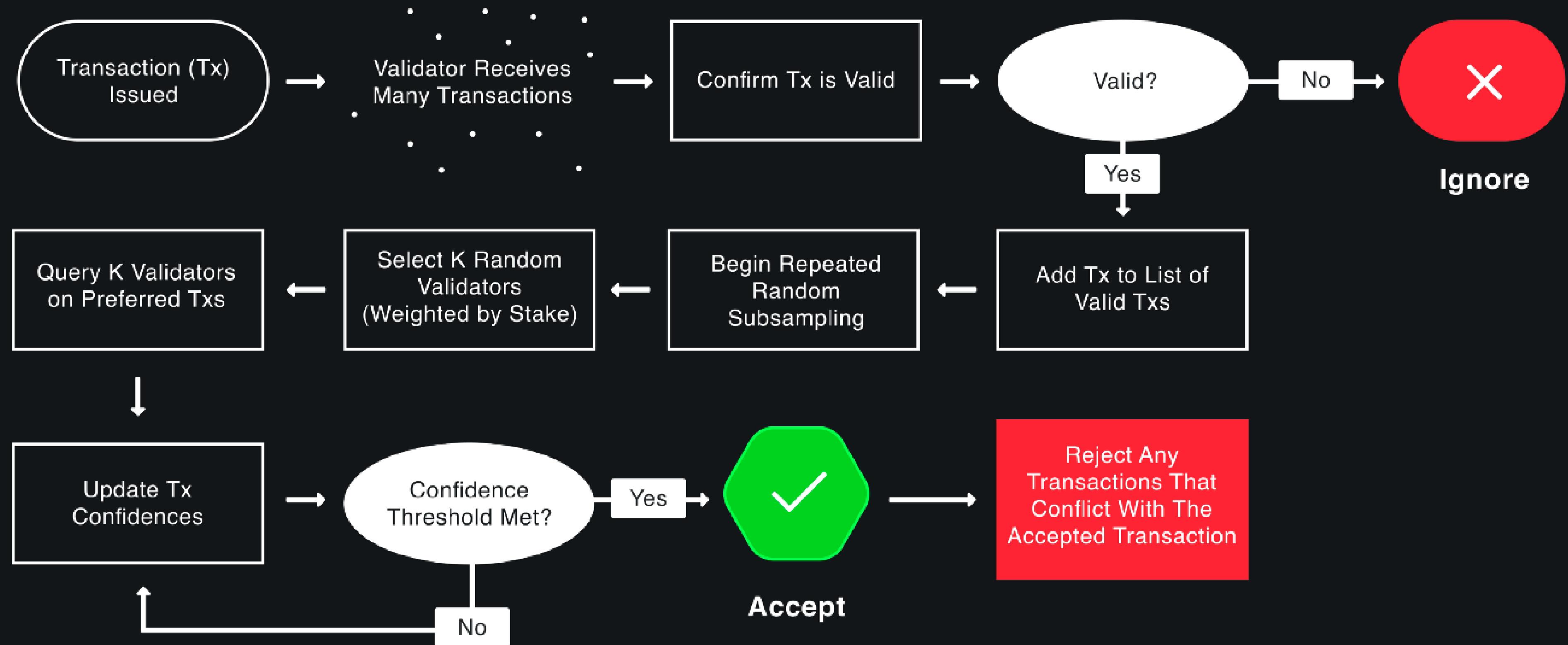


Horizontal Scaling

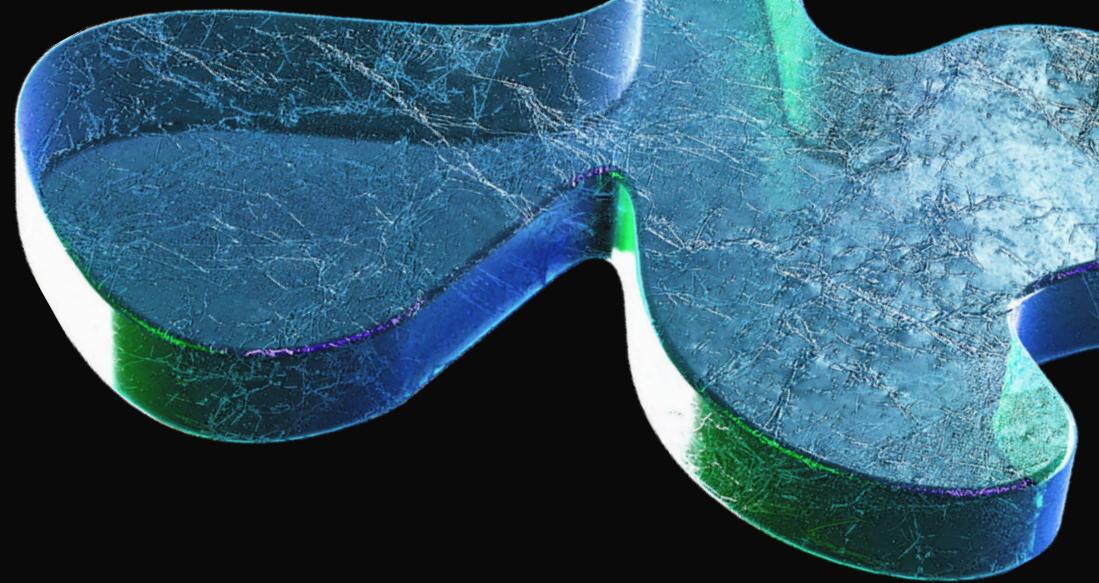


Subnet takes the load off the main chain without affecting the main chain. Currently, the C-chain processes around 500K-700K transactions/day while subnets process 300K-350K, reducing ~50% load on the C-chain.

How Avalanche Consensus Works



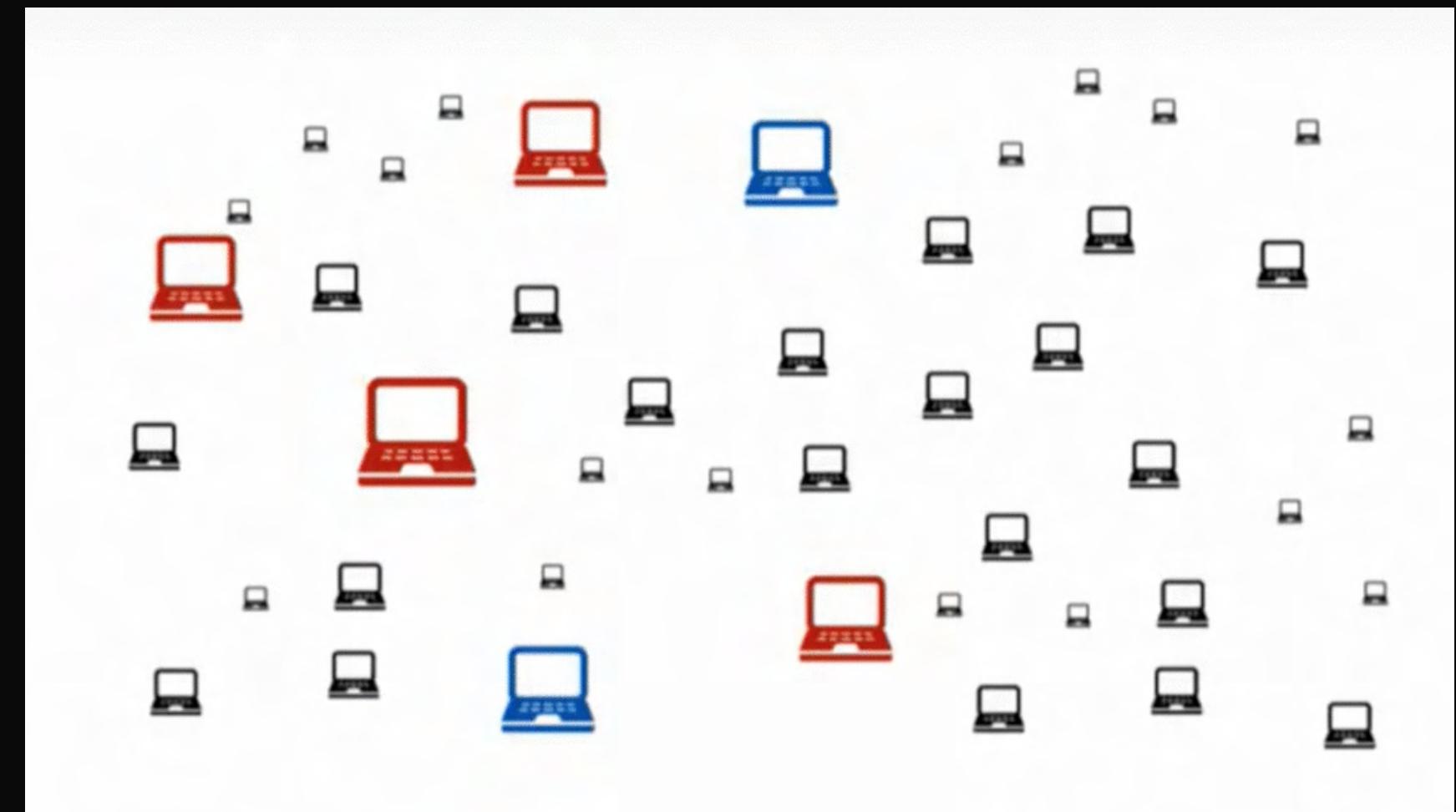
Metastability



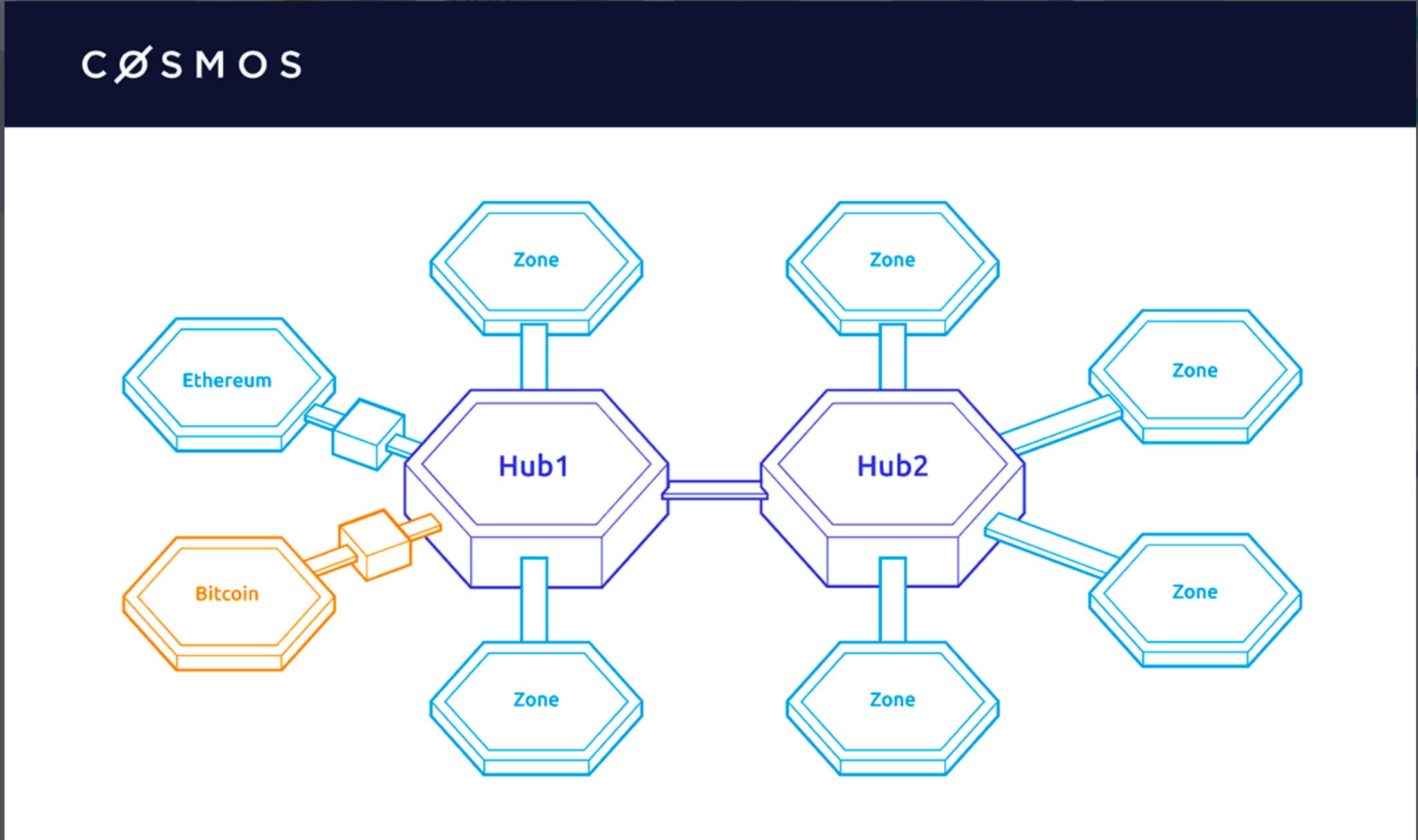
	Nakamoto	Classical	Avalanche
Robust	✓	✗	✓
Highly Scalable	✗	✗	✓
Quick Finality	✗	✓	✓
High Throughput	✗	✓	✓
Lightweight	✗	✓	✓
Sustainable, green, quiescent	✗	✓	✓
Easy to implement and understand	✓	✗	✓
Safe in the presence of 51% attacks	✗	✓	✓

Technologies used:

- Snowflake to Avalanche Consensus Mechanism
- Repeated Random Subsampling

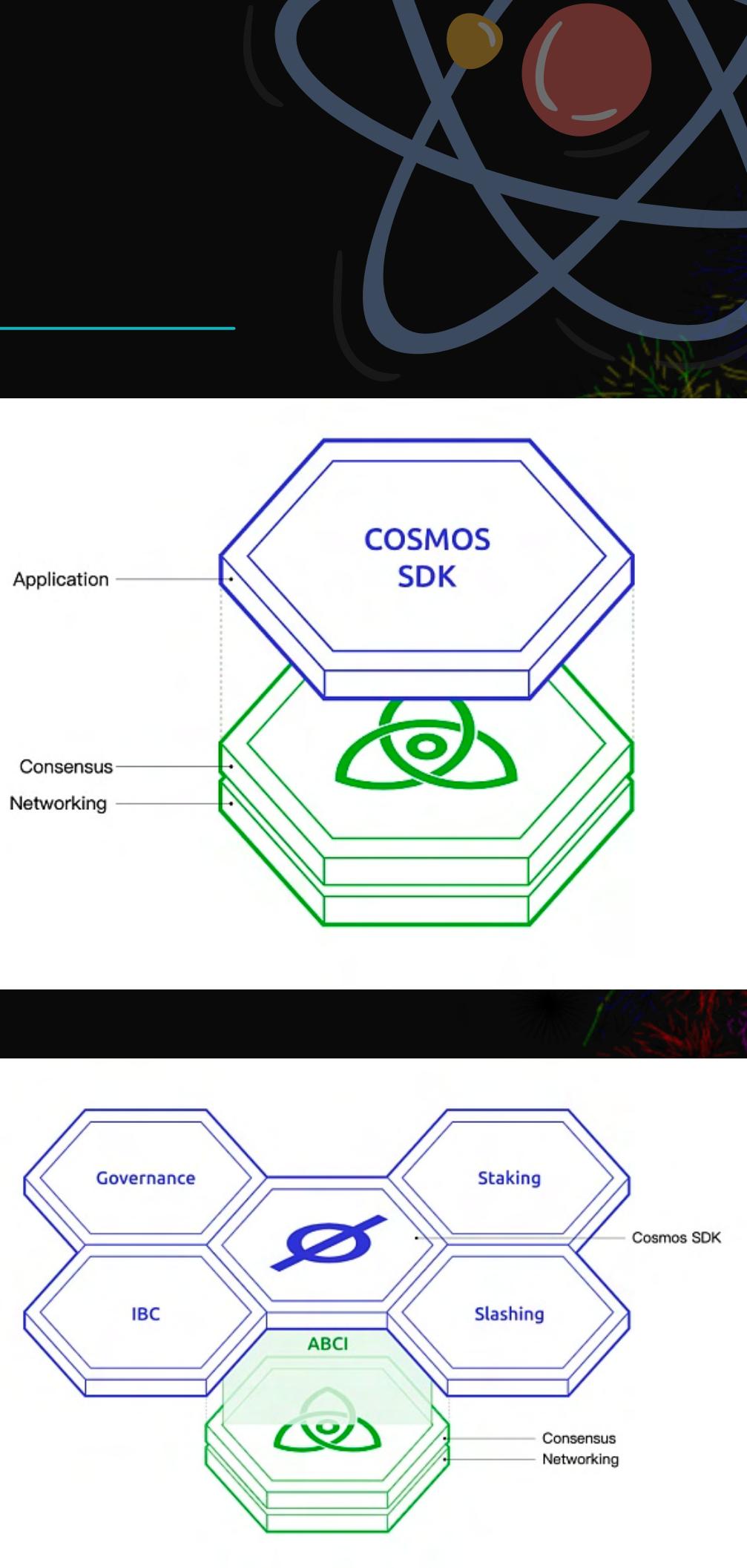
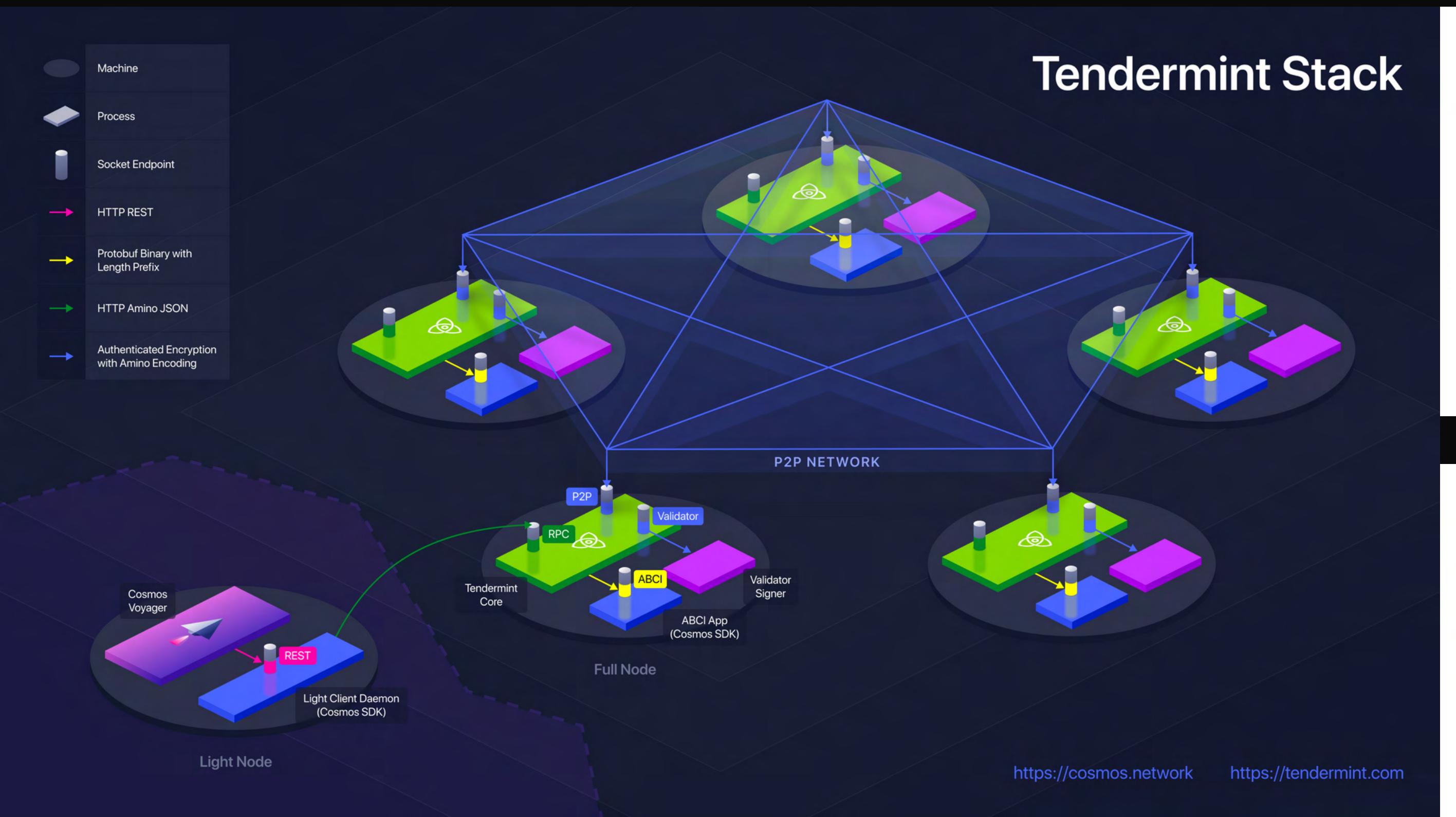


COSMOS (\$ATOM)

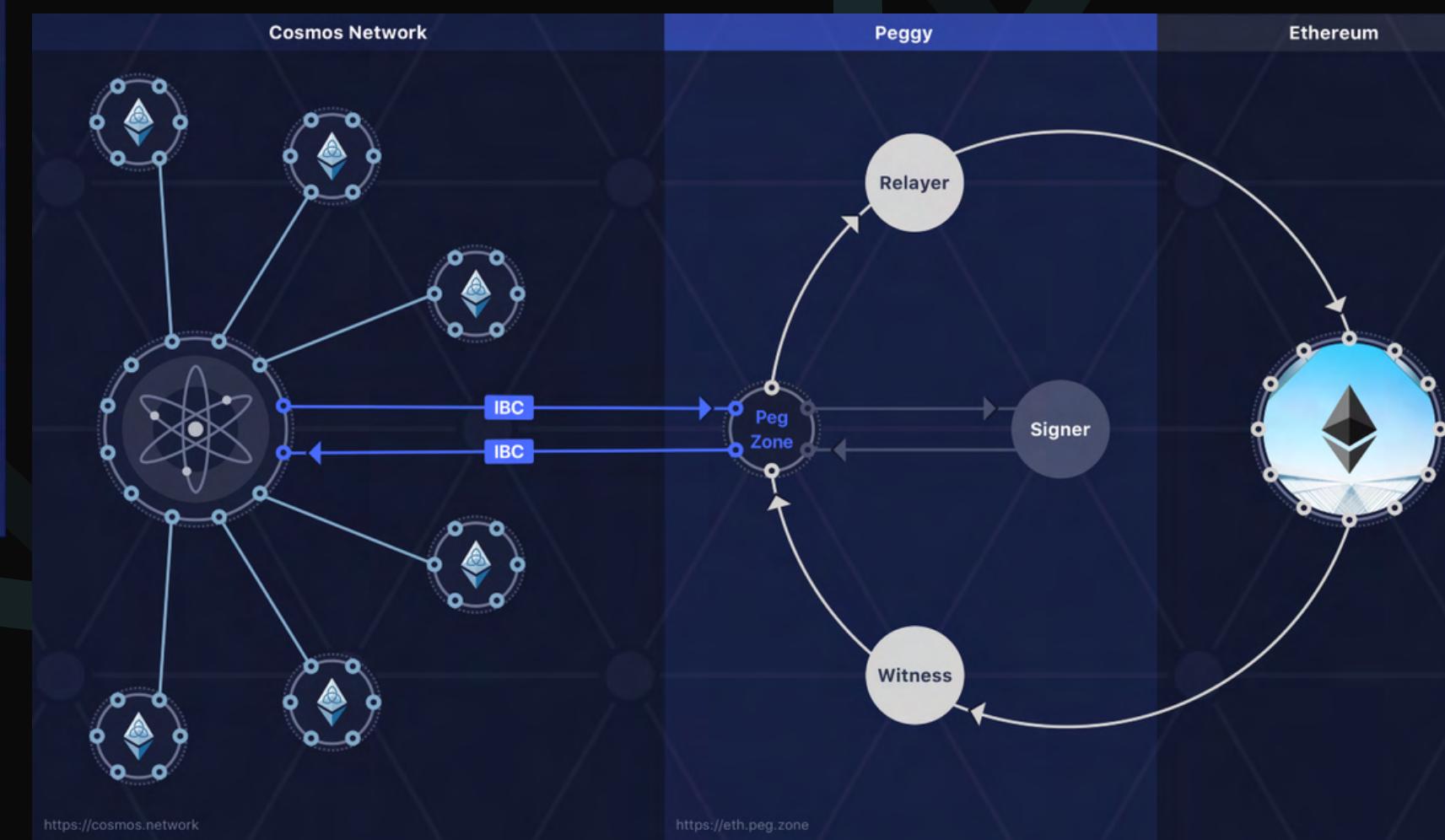


- **Founded in:** 2014
- **Founded by:**
Jae Kwon
Ethan Buchman
- **Built by:** Tendermint Inc. & Interchain foundation
- **Avalanche Mainnet:** 2019
- **Place:** USA, Swiss
- EVM - Yes
- TVL - \$179.79M
- TPS - >1,000 Tx

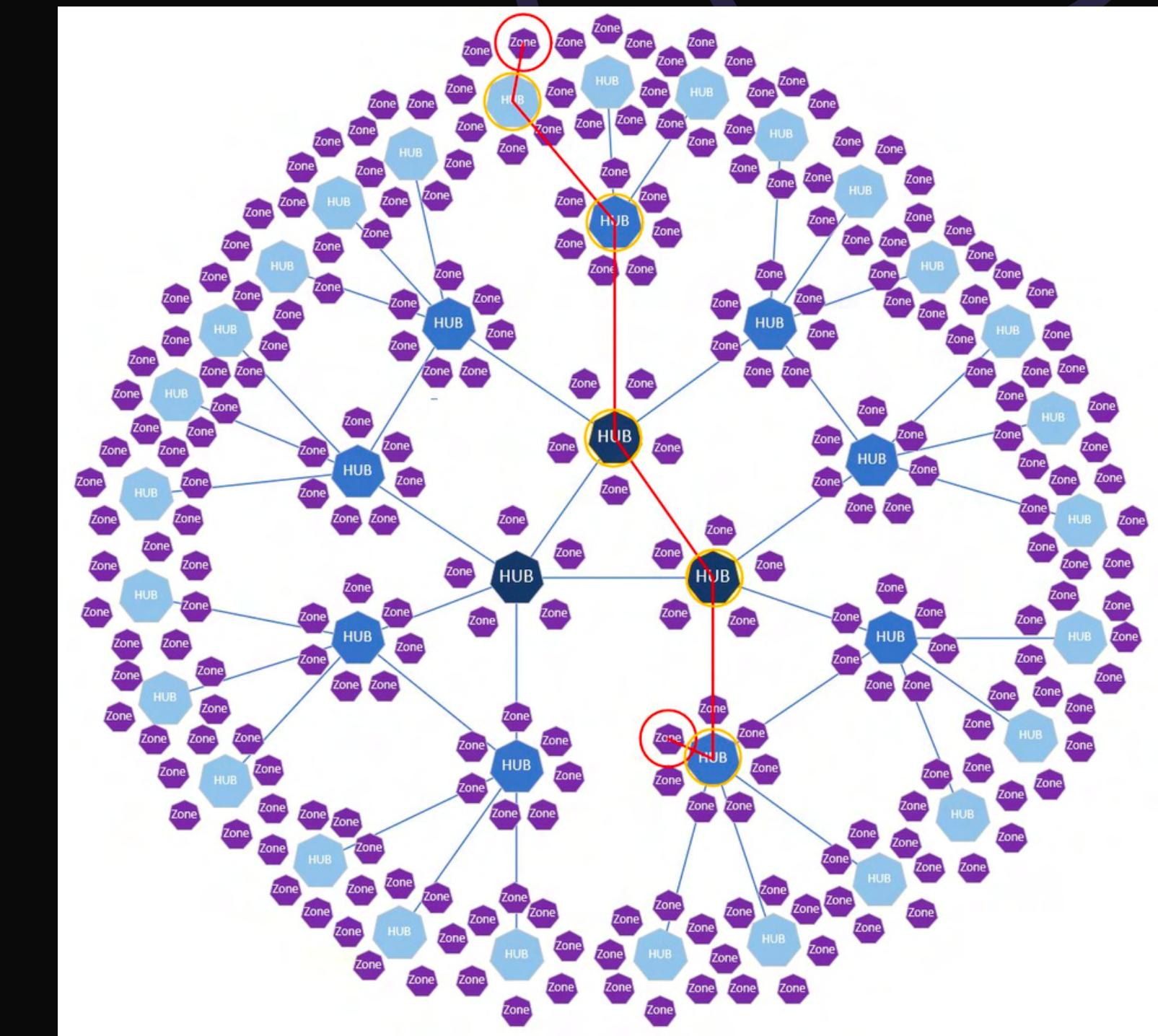
Application Blockchain Interface (ABCI) and Cosmos SDK



Inter-Blockchain Communication (IBC) and peg zones



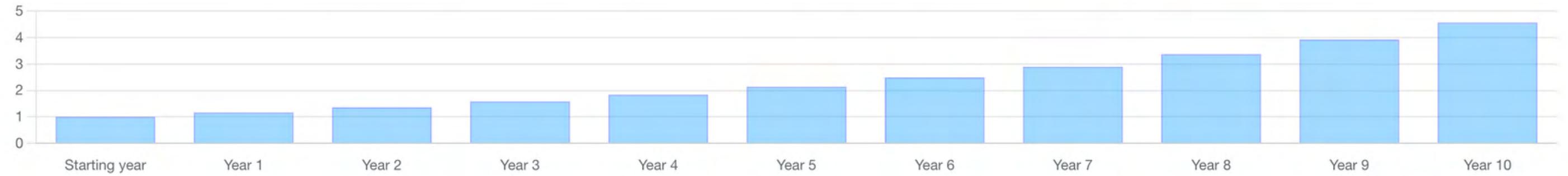
COSMOS Ecosystem Overview



\$ATOM Staking & Slashing

Staking Interest Calculator

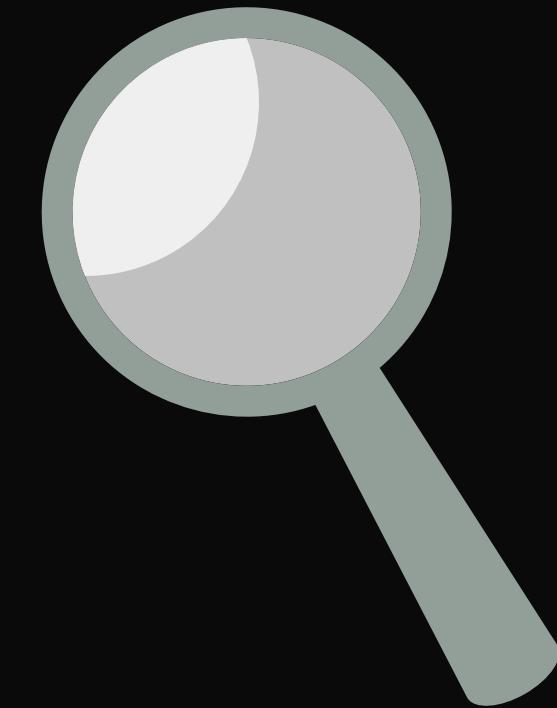
I want to stake 1 ATOM for 10 years, which will currently earn 16.40% APR per year on my investment and I'll reinvest the earnings every year ▾



If you invest 1.00000000 ATOM (\$10.138) and reinvest the profits every year you'll earn an APY (annual percentage yield) of 16.40%.

At the end of the 10 year period, you will have 4.56670167 ATOM which at its current price would be worth \$46.299.

* Note: Staking APR can change throughout the period significantly. This calculator assumes no changes in the staking APR over the course of the investment.



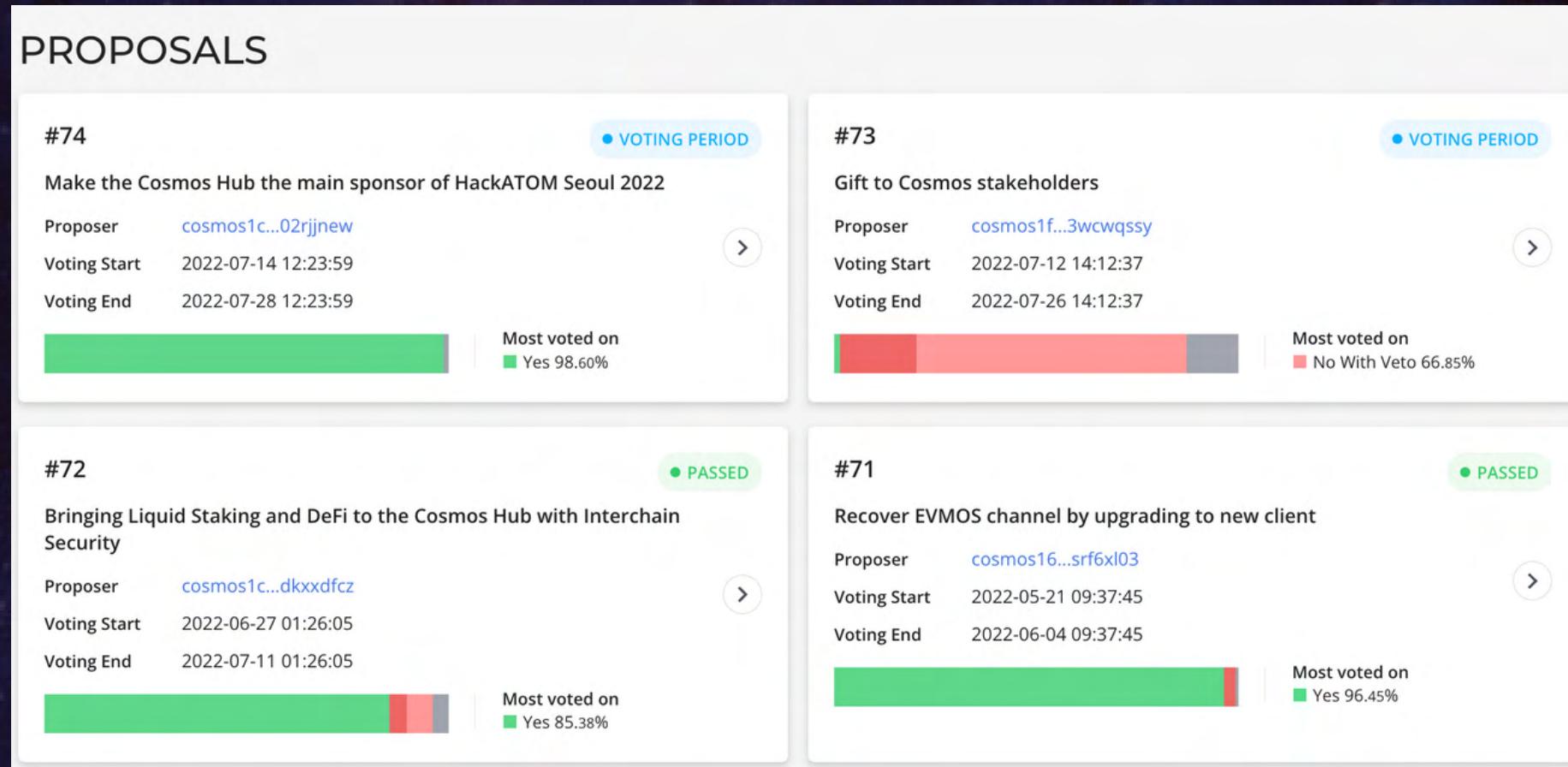
Downtime Slashing by 0.01%

Double Signing Slashing by 5%

Validators Activity

Total Validators: 175

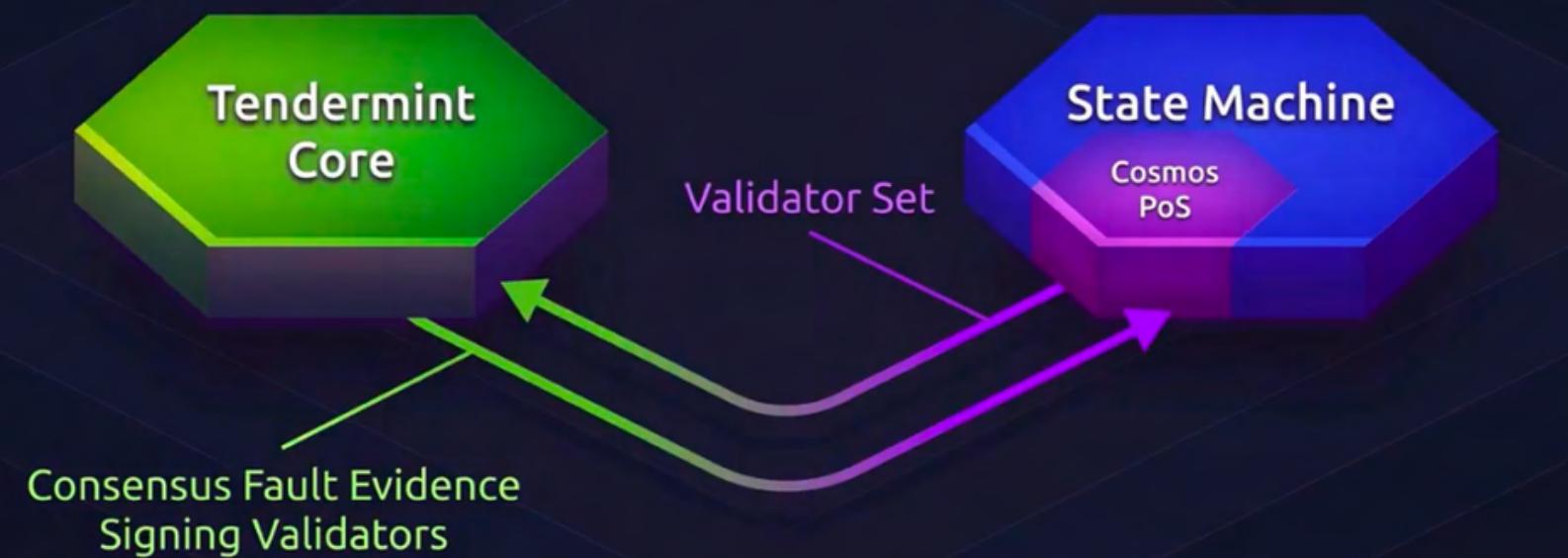
PROPOSALS



Technologies used:

- Deterministic Protocol
- Weighted Round-Robin

BFT Proof of Stake



Conclusion

	Harmony (L1)	Avalanche (L1)	Cosmos (L0)
Tx Finality	<2 seconds (1 block)	<2 seconds (1 block)	7 seconds (1 block)
Tx Throughput	2000 TPS	4500 - infinity TPS (with subnets)	10,000 TPS
Validator Nodes	250 Nodes per shard	>1000 nodes	175
Shards	4 shards	Several small subnets	Several zones
No. of Dapps	~105 Dapps	~350 Dapps	~290 Dapps
Total Value Locked	\$38.56 million	\$2.79 billion	\$178.5 million
Malicious/failed Actors cut-off	upto 1/3	upto 1/3	1/3
Consensus	EPoS (DPos)	Avalanche PoS	Tendermint BFT PoS
Cross-Shard Communication	No	Yes	Yes
EVM	Yes	Yes	Yes
Slashing	Yes	No	Yes

Thanks for
being
patient!

