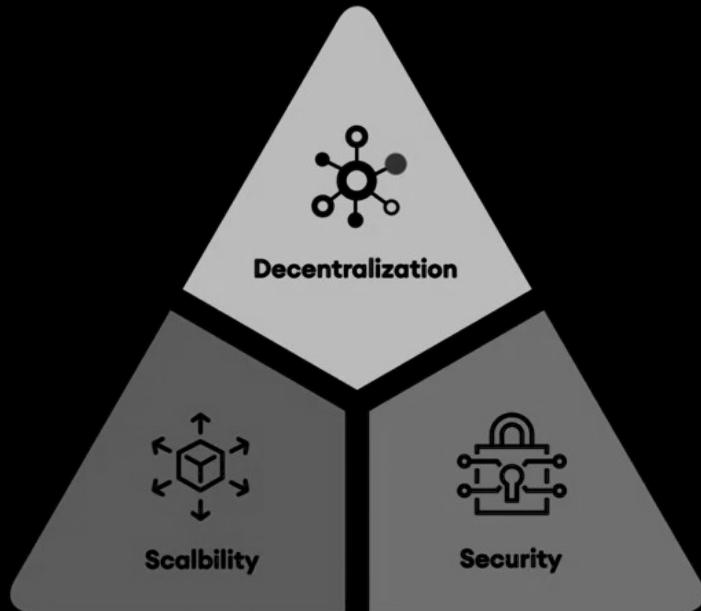


# Scalability

# Defining the problem



HOW THE BLOCKCHAIN TRILEMMA AFFECTS NETWORKS			
Side	Chosen	Give up	Example
A	Scalability, Security	Decentralisation	Ripple, EOS
B	Decentralisation, Scalability	Security	Email, SMTP
C	Decentralisation, Security	Scalability	Bitcoin, Ethereum

crypto.com/university

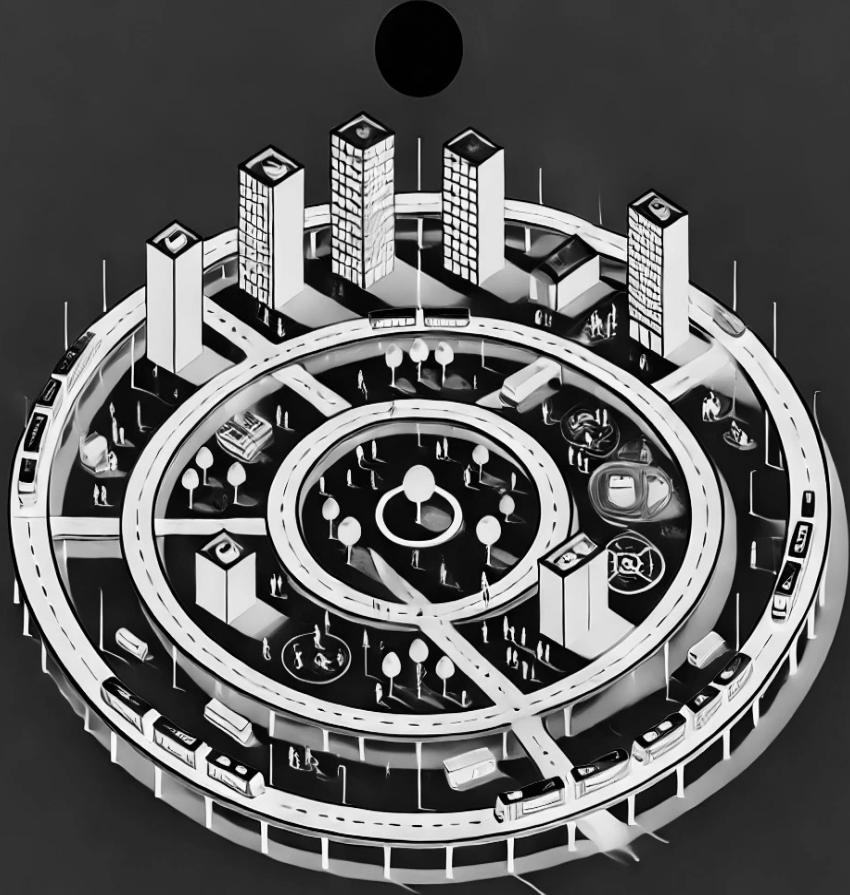
# Why?

- Rising Adoption
- Security
- Multiple Use Cases
- Demand & Supply



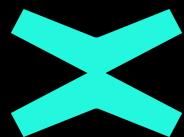
# How?

- Consensus
- Layers
- Protocol



# Current standard

(tx/sec)



Real-time

7

15

63

4

Peak

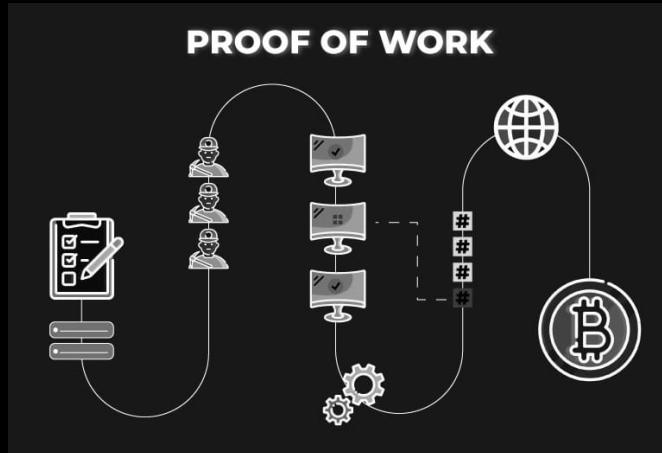
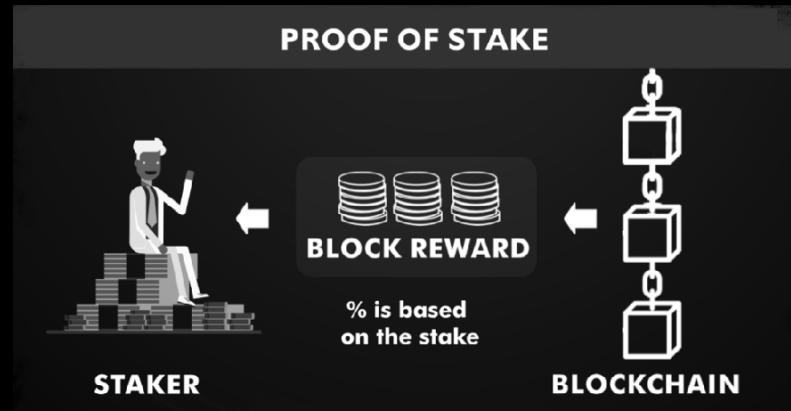
13

63

7229

220\*

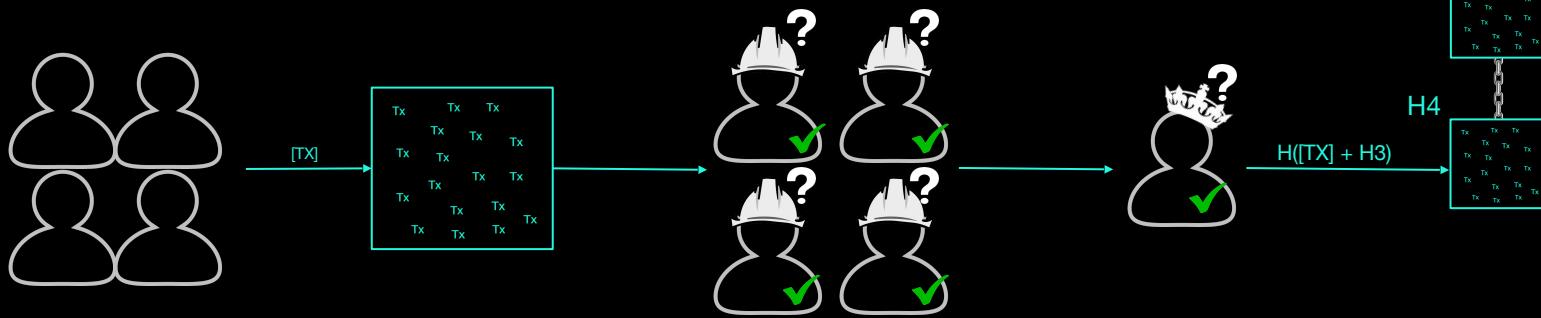
# Consensus



- Selection based on quantity at stake
- Two main designs: BFT and Chain-Based

Most notable implementations:

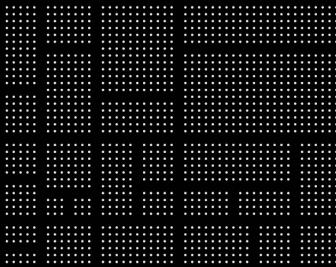
- Ethereum (*The Merge*)
- Polkadot (NPoS)
- EOS (DPoS)
- MultiversX (SPoS)



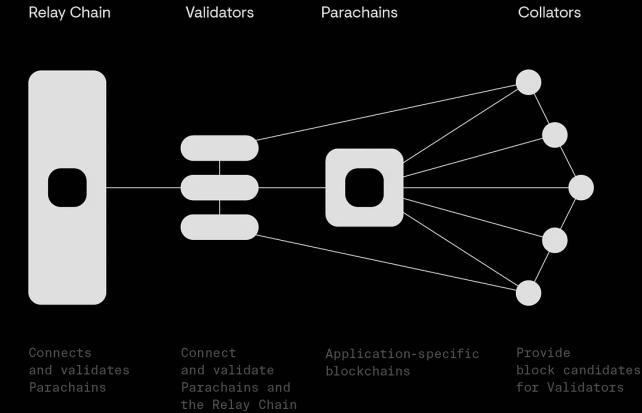
# Nominated Proof of Stake



Nominators



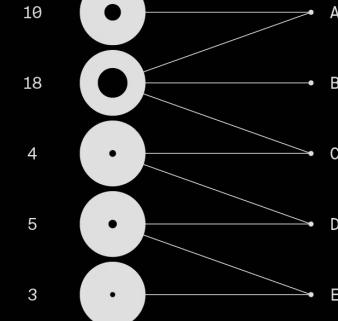
Approve Validators



Stake

Nominators

Validators



NPoS Election

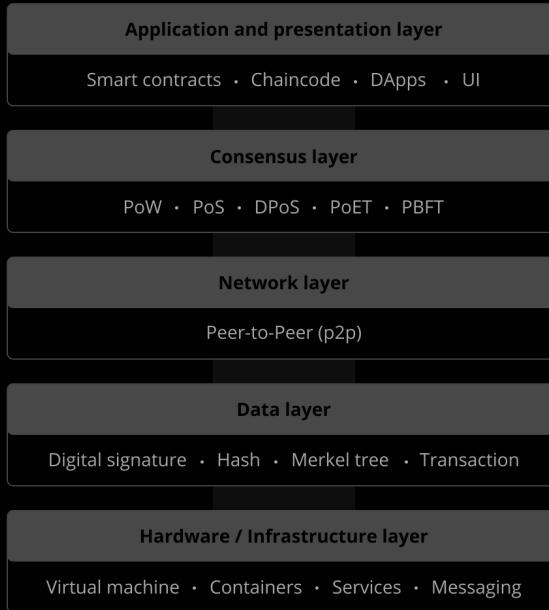
# Secure Proof of Stake



Secure Proof of Stake

# Layers

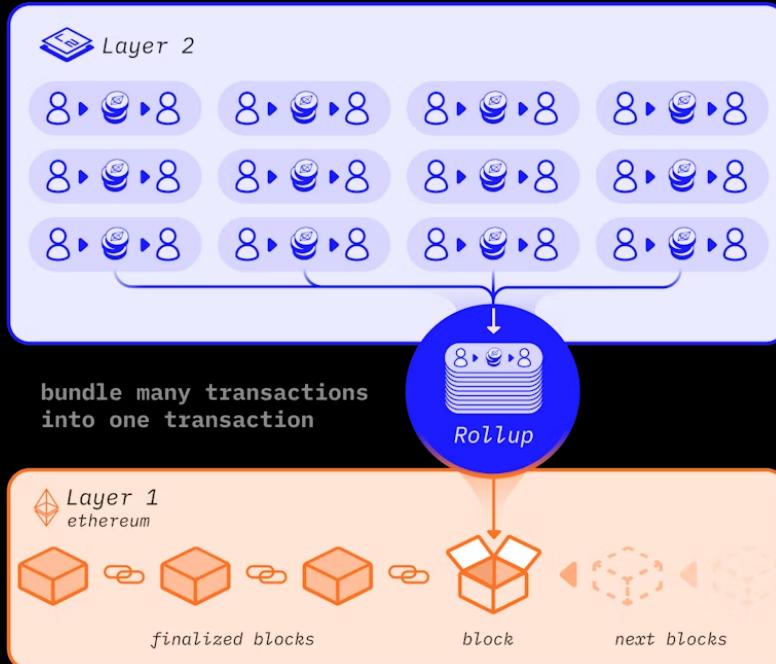
## Layered structure of the blockchain architecture



# Rollups in



- Optimistic
- ZK



# Sharding

- Partitioning the network to achieve horizontal growth
- Three types: network, transactions and state

Most notable implementations:

-  Zilliqa
-  Alrogand
-  Chainspace
-  MultiversX

Step 1:  
Node to shard assignment

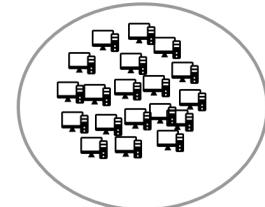
1 Shard



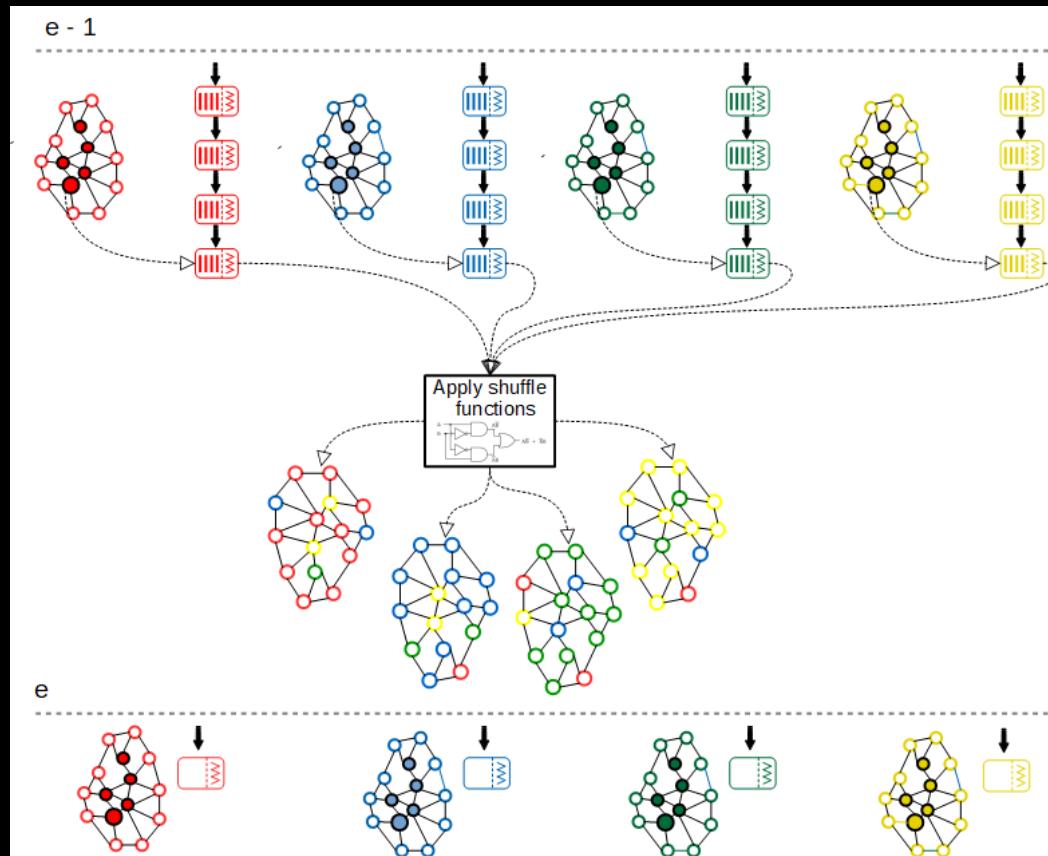
3bit	Addresses	Shard
0	0	0
0	0	0
0	1	0
0	1	0
1	0	0
1	0	0
1	1	0
1	1	0

400 < Total Nodes < 800

Node Pool



# Node shuffling



# Parallel Processing



Solana: Sealevel enables concurrent transaction processing across several nodes



Aptos: advanced form of Software Transactional Memory => transaction dependency handling



Sei: twin-turbo consensus and market-based parallelization



Sui: parallel transaction execution system that handles multiple states at once



Monad: incorporates parallel execution while staying compatible with the Ethereum Virtual Machine (EVM)

# Questions

Better Consensus  
Processing

Layers

Sharding

Parallel