Course IV:

DeFi Risks and Opportunities

3. Scaling Risk

(ii) Vertical and Horizontal Scaling

Risks: Scaling risk

Vertical scaling

- Vertical scaling centralizes all transaction processing to a single large machine.
- This centralization reduces the communication overhead (transaction/block latency) associated with a PoW blockchain such as Ethereum, but results in a centralized architecture in which one machine is responsible for a majority of the system's processing.
- Some blockchains, such as Solana, follow this approach and can achieve upward of 50,000 TPS.

Risks: Scaling risk

Horizontal scaling = sharding

- Horizontal scaling divides the work of the system into multiple pieces, retaining decentralization but increasing the throughput of the system through parallelization.
- *Ethereum 2.0* takes this approach in combination with a Proof of Stake consensus algorithm.
- Ethereum 2.0's technical architecture differs drastically from vertically scaled blockchains such as Solana, but the improvements are the same. Ethereum 2.0 uses horizontal scaling with multiple blockchains and can achieve upward of 50,000 transactions per second.

Risks: Scaling risk

Horizontal scaling = sharding

- The development of Ethereum 2.0 has been delayed for several years, but its mainnet, which will contain a basic blockchain without any smart contract support, may go live in 2022.
- Ethereum 2.0 has not yet finalized a functional specification for sending transactions between its horizontally scaled blockchains.
- Sharding is a complex problem and likely the last piece of ETH 2.0 to be implement

Risks: Scaling risk

Horizontal scaling = sharding

- Sharding has many risks
- For example, it may be possible for a single adversary to take over a shard and then submit invalid transactions
- Proof of Stake does mitigate this problem where the active validators are randomly assigned to different shards

Risks: Scaling risk

ETH 2.0 sharding

- Ethereum 2.0 known as “Serenity”
- 64 shards proposed coordinated by Ethereum 2.0 Beacon Chain
- Teams of validators that have deposited collateral (stake) will be randomly assigned to manage shard chains
- Each shard will have its own transaction group
- Beacon Chain is key to transferring among shards and managing the shards
- This is analogous to parallel computing

https://www.gemini.com/cryptopedia/ethereum-2-0-proof-of-stake-pos-blockchain-serenity#section-challenges-of-ethereum-sharding