Ethereum 2.O

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Abstract: Ethereum 2.0 is an update to the current Ethereum blockchain that aims to address the scalability, security, and sustainability issues with the first network. The upgrade will be carried out in phases and come with various important improvements. It's crucial to remember that Ethereum 2.0 has been developed over a long period of time and gradually, thus the features and specifications may have changed since the last release. Because ETH 2.0 is a completely other project, the moniker Ethereum may be a little confusing. EHT2 will speed up transactions without compromising security while also enhancing the blockchain's programmability and scalability.

Keywords: Ethereum 2.O, PoW, PoS, Sharding

1.INTRODUCTION

Programmers can design and use smart contracts and other decentralized apps on the Vitalik Buterin-founded Ethereum decentralized platform. Ethereum is the second-largest cryptocurrency by market capitalization and the most popular blockchain network smart contract platform. With ETH 2.0, Ethereum's efficiency and scalability will be greatly increased, while its security and decentralization will remain or even be strengthened. Ethereum 2.O is a substantial update to the existing Ethereum block chain that addresses some of the scalability and performance issues the original Ethereum network faced. The Ethereum blockchain had a number of updates that fixed some of its most serious technical issues, collectively referred to as "Ethereum 2.0". The Ethereum Foundation frequently uses the terms the updated blockchain as Ethereum, with the consensus layer being referred to as ETH 2 and the execution layer being referred to as ETH 1. However, it was an informal moniker, and its community does not recognize it as a legitimate name for the blockchain and network. ETH2 is responsible for the anticipated increase in transaction speed from 15 TPS to thousands of TPS. Ethereum intends to switch from a PoW consensus, which presently supports its architecture, to a PoS consensus with its upcoming upgrade. This is done to improve the democratic and economic viability of mining. Miners are in charge of all work and network security in a PoW algorithm. in exchange for a block reward and a transaction charge. On the flip side, PoS doesn't use any miners.

PoW : Blockchain Proof of Work (PoW) is essential because it is essential to preserving the security and integrity of a blockchain network. PoW is a consensus technique that calls on network users (miners) to work out challenging mathematical puzzles in order to approve transactions and build new blocks. Potential attacks are prevented by this method since it is very expensive and time-consuming for an attacker to change the data on the blockchain. Additionally, by controlling the process of creating new blocks, it prevents network overload. This technique ensures the transactions' dependability, which boosts confidence in blockchain technology and is advantageous for commercial and financial situations.

1.1 ETHEREUM CURRENT STATE

By market capitalization, Ethereum is the second-largest cryptocurrency, and it is also the most widely used blockchain network smart contract platform.

With 768 Active Dapps and 1.1 million users, the overall transaction volume on the Ethereum network hit an all-time high of US $4.3 billion.However, this tremendous popularity comes at the expense of rising transaction fees, or gas prices as they are known in the Ethereum community.

Vitalik Buterin, the creator of Ethereum, was aware of this issue from the start. They discovered that while two of the tradeoffs between scalability, security, and decentralization can be fulfilled, achieving all three is highly challenging. The Scalability Trilemma is the name given to this idea.
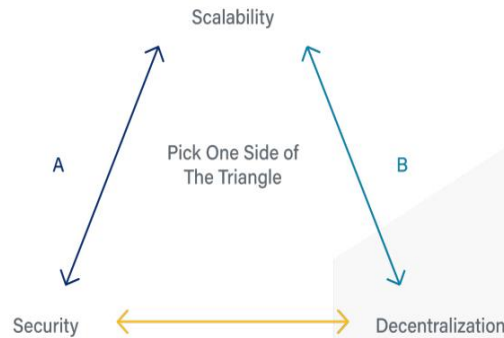
Fig 1 :Ethereum current state

2.PROPOSED SYSTEM

The proposed upgrade to the Ethereum blockchain, known as Ethereum 2.0 or tranquilly, aims to enhance the speed and performance of the Ethereum network., efficiency, and scalability so that it can avoid bottlenecks and execute more transactions at the same time. While Ethereum 1.O users of the consensus process known as proof-of-work (POW).The proposed Ethereum 2.O system employs a proof-of-stack technique.

3.FEATURES OF ETHEREUM 2.O

ETH 2.0 aims to make Ethereum far more scalable and efficient while keeping or even increasing its security and decentralization. The following functionalities are included in Ethereum 2.O.

- Proof-of-Stack
- Sharding
- Phases of Implantation

3.1 Proof-of-Stack

Block validators are selected to build new blocks and validate transactions in a Proof-of-Stack consensus mechanism based on the quantity of cryptocurrency tokens they stake as collateral in the network. While PoW has been effective at maintaining the current state of many blockchains, its computationally intensive nature makes it expensive to operate and exceedingly energy wasteful. PoS is a far more energy-efficient and environmentally benign approach than PoW because it avoids the labor-intensive mining phase. The energy-intensive process is replaced by the staked collateral as a deterrent to defending the network. In contrast to PoW systems, incentives in PoS systems do not need to be as large due to validators' low energy usage.

On the other hand, PoS networks require validators to stake a significant amount of assets on the network before they can participate in transaction validation and earn incentives for doing so. Due to the collateral at risk, the network has the ability to seize a validator's assets in the event of dishonest behavior. In PoS systems, validators compete on the amount of collateral staked rather than speed and energy required to compute a hash.

Difference between PoW and PoS :

While Ethereum 2.0 has a potential processing speed of about 100,000 transactions per second, Ethereum can only handle 15 transactions per second.

Ethereum blockchain mining is a potentially lucrative endeavor. Miners must resolve cryptographic conundrums in order to verify transactions. The proof of work mining method is the same one employed by Bitcoin. Those that devote their computational power to this effort will receive new Ethereum as compensation.

Ethereum 2.0 uses proof of stake rather than proof of work. In order to do this, a significant quantity of ETH must be put down in order to serve as a node (using a standard computer) that verifies transactions on the Ethereum blockchain in exchange for additional ETH. The twist is that you risk losing some or perhaps all of your staked ETH if you attempt to manipulate the network or stay offline for an extended period of time.

3.2 Sharding

When network traffic is high, the Ethereum network's current processing capacity is only 10 transactions per second, which is a serious restriction given the unreasonably high transaction fees. This low performance is mostly caused by the requirement that each node process each transaction. This does increase the whole blockchain's security and finality, but at the expense of speed. The Ethereum community has decided that sharding is the greatest scaling strategy for achieving long-term, significantly enhanced scalability since it eliminates the requirement for every node to validate every transaction. The simplest kind of sharding is dividing the network into several blockchains that operate independently,

each of which has its own group of validators and transaction history Even though sharding increases network performance, shards cannot connect with one another for Ethereum to function fully. If every shard functioned totally independently of every other shard, that would not be beneficial. This poses the issue of how shards will interact and exchange information.
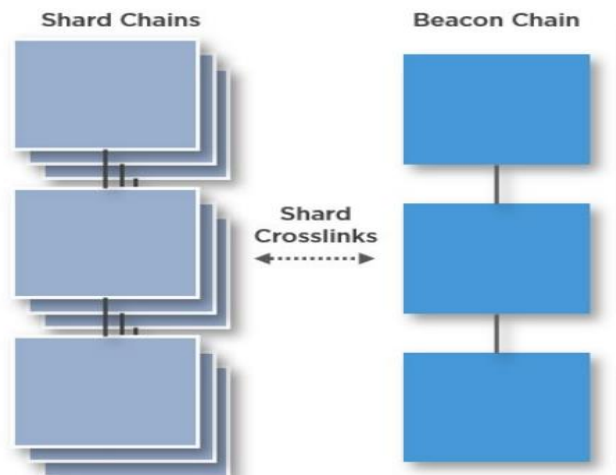

Fig 2: Sharding

3.3 Phases of Implementation

Although ETH 2.0 has already released its public test net, the fully functional version of Ethereum with dApp capability and sharding will not be available immediately. ETH 2.0 will be rolled out in multiple phases due to the complexity of updating the extensively utilized Ethereum blockchain, requiring careful and meticulous handling throughout the process.

Phase 0- Beacon Chain
Phase 1- The Merge
Phase 2- Sharding

3.3.1 Phase 0- Beacon chain

Phase 0 will implement the Beacon Chain for ETH 2.0, which will act as the network's primary backbone, controlling proof-of-stake for itself and other shard chains. Beacon Chain holds information about validators and their stakes, ensuring that all validators have at least 32 ETH invested. Phase 0 provided the Ethereum ecosystem with the Beacon Chain, the PoS consensus algorithm (named Casper), and validator nodes as its three key technology implementations. In December 2020, these functionalities went live in a test mode and ran concurrently with the original Ethereum blockchain. However, as Serenity's development proceeds, the Beacon Chain will take over as the Ethereum network's main settlement layer and be in charge of organizing the upcoming shard chains. This feature will make its Ethereum mainchain debut as part of the upcoming update phase for Serenity.

3.3.2 Phase 1- The Merge

After the Ethereum Merge, ETH1 and ETH2 will be the same network using the same ETH coin. This merge involved switching the consensus mechanisms, which is a very important task. An analogy for this would be switching from a gas to an electric engine in a car while it's still moving.

The Merge significantly improved the energy efficiency of the Ethereum network by eliminating the need for electricity-guzzling cryptocurrency miners. The energy required to run the network has been assessed to have decreased by a staggering 99.988%, making the present Ethereum Staking Nodes very energy-efficient. Additionally, it will pave the way for future Ethereum scalability improvements like sharing.

Phase 1 will introduce sharding after the Beacon Chain has been built and confirmed to work effectively. The Beacon Chain will divide into 64 shard chains, and committees of validators will be set up to verify transactions on each individual shard in each slot and epoch. Account balances will not be addressed in Phase 1 because that phase is primarily concerned with testing the sharding methods.

3.3.3 Phase 2- Sharding

The Beacon Chain had already been introduced and integrated with the Ethereum Main net by that point. The Ethereum Network will get sharing in the following phase. On Ethereum, sharing refers to dividing the database horizontally to distribute the burden. Sharding and layer 2 rollups (An existent "layer 2" technology is layer 2 rollups. Decentralized

applications (dApps) can "roll up" transactions into a single off-chain submission because of this. This has the result of lowering the amount of data required to complete a transaction.) will cooperate. This distributes over the whole Ethereum network the responsibility of managing the massive amounts of data required by rollups.

Sharding's main advantages include: Everyone can run a node; Validators won't have to store all the data themselves. This significantly lowers the cost of layer 1 data storage by lowering the hardware specifications. You can run Ethereum on a laptop or phone with sharding, increasing network participation and security. More engagement, greater decentralization, and increased security result from this.

A new and enhanced virtual machine called Ethereum Web Assembly (eWASM) will also be released. Account balances, smart contracts, and other functionality akin to the current Ethereum Virtual Machine (EVM) will be supported by eWASM. Up to Phase 2, no dApps or smart contract functionality will be permitted to operate on ETH.
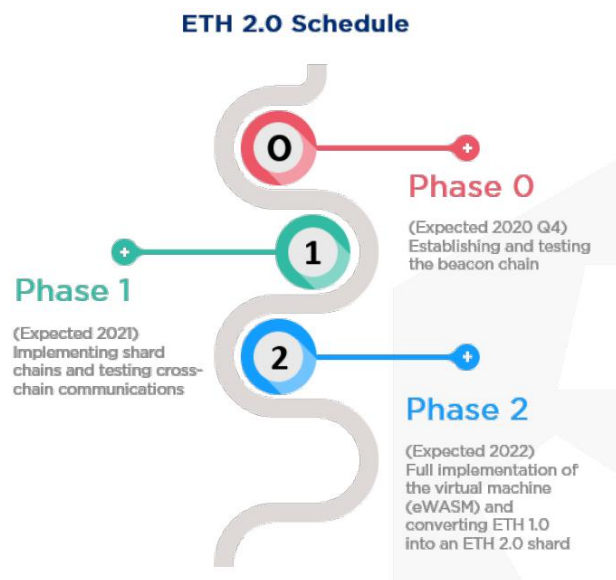

Fig 3: Ethereum Schedule

4.ECONOMICES OF ETH 2.O

validators will be compensated for securing the network and approving transactions.

4.1 Obtaining 32 ETH to Become a Validator

A user will take into account a lot of factors when deciding whether to become a validator. In the simplest scenario, some users would have such a strong belief in the Ethereum network that they would stake at a loss if necessary. The 12,000 active Ethereum nodes at the moment are a prime illustration of this. However, in the most straightforward scenario, we can deconstruct the cognitive process as follows : Total Incentive to Stake = Network Fees - Cost to Run a Validator + Validator Rewards. Phase 0 will formally open later this year, at which point anyone with 32 ETH can sign up as a validator. The most recent test net that may be staked right now is the "Medalla" test net.

4.2 Staking Economics

PoW to PoS conversion will occur with the ETH 2.0 upgrade. This implies that validators will be compensated for following rules and securing the network, as opposed to miners fighting for a block reward. As a result, it is crucial to maintain a balance between validator incentives and network security.

4.2.1 Staking Risks and Costs

In return for staking rewards, validators also bear some risks and costs:

➢ **Computing cost**

• Users will need to operate beacon nodes and validators clients at the very least. Resources for computation are needed.

• Beacon Node: You should run one of these, just like you would run Geth or Parity today. One lightweight validator client is required for every 32 ETH stake.

• Costs are approximately $120 per year for a beacon node and $60 per year for each validator client there is a chance that staking software could malfunction or that security flaws will cause money to be lost.

➢ **Code Risk**

• there is a chance that staking software could malfunction or that security flaws will cause money to be lost.

➢ **Capital acquisition and lockup**

• The user must either buy or mine the 32 Ether that are required.

• While it is still staked, stakes cannot immediately sell staked ether.

• There is a predetermined period of time the user must wait in order to receive their ETH back if they wish to withdraw money. However, in the most recent iterations of the specification, this time has been much reduced. There is a minimum 18-hour wait in the withdraw queue. If many people a leaving at once, this could increase, but 18 hours will probably be the average.

➢ **General uptime and maintenance cost**

• Users must ensure that their validator is always operational or they run the risk of experiencing a quadratic leak on their stake.

• When a user uses numerous validators, maintenance costs and infrastructure concerns become relevant.

➢ **Security risk**

• The security of users' validator clients is their responsibility. There is no method to retrieve money if one of their clients is compromised due to a security flaw.

5. CONCLUSION

In its finished form, ETH 2.O will construct a massively scalable blockchain network capable of operating dApps on a far larger scale and with lower transaction fees than the present network. Ethereum is a network. ETH 2.O may be incorporated into two primary characteristics, namely Proof of stack and sharding, which improve network security and scalability.

ETH 2.O sharding is one of the most promising approaches for increasing scalability in a block chain network. This increases scalability by hundreds, if not thousands of times. ETH 2.O, on the other hand, is a far more efficient and, perhaps, fairer manner of distributing transaction validation duty and reversal.

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