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ETHEREUM 2.0: HOW IT WORKS AND WHY IT MATTERS

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Note: In the following text, "ethereum" refers to the network and "ETH" refers to the cryptocurrency. $ are in U.S. dollars (USD) unless otherwise specified.

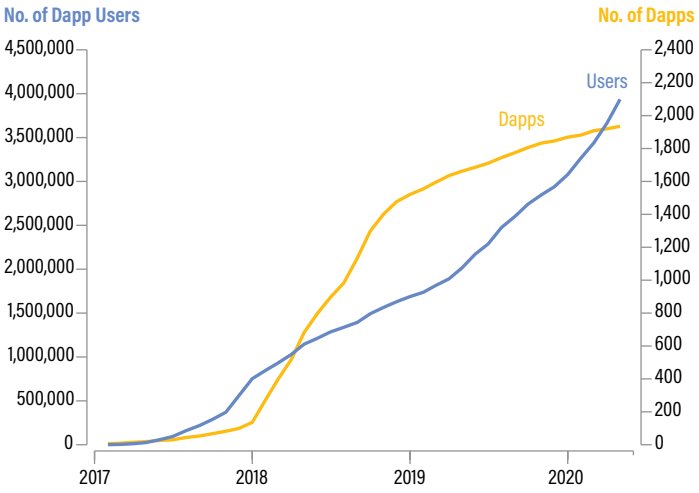
INTRODUCTION

Ethereum, the world's leading blockchain platform for decentralized applications (dapps), is gearing up for a system-wide upgrade that will radically change the way the platform is both used and secured. Called Ethereum 2.0, this highly anticipated upgrade has been in the works by ethereum core developers since the platform's initial release back in 2015. Over the past five years, there have been several smaller upgrades improving ethereum's usability and scalability. However, Ethereum 2.0 is by far the most ambitious and radical change to be implemented on the network and will require several years to fully implement.

As the second largest cryptocurrency in the world by market capitalization, ethereum was designed by founder Vitalik Buterin to be a "world computer." Rather than a digital currency or commodity, ethereum retains its original motivation to be a global computing platform for users to deploy unstoppable code, also called smart contracts. Decentralized applications, or dapps, are smart contracts programmed for a specific and recurring use. There are nearly 2,000 dapps deployed on ethereum as of June 2020. This is more than the total numbers of dapps deployed on any other general purpose blockchain platform in the world combined.

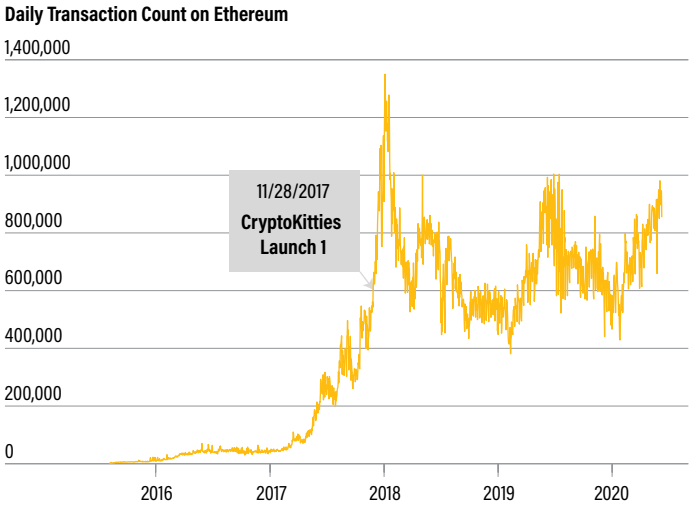
However, at times, ethereum's growth both in terms of the number of users and dapps has overwhelmed network capacity. In late 2017, a gaming dapp called CryptoKitties grew so popular that it clogged the ethereum network and prevented some 30,000 transactions from being processed. Users complained of having to wait days for transactions to be confirmed. Currently, Dapper Labs, the creator behind CryptoKitties, is planning on relaunching its cat-trading game and other new dapps on a custom-built blockchain platform called Flow.

Figure 1: Number of ethereum dapps and dapp users since 2017



Source: Dapp.com

Figure 2: Daily transaction count on ethereum



Source: Amberdata

Flow is one of several blockchain platforms announced in the last few years that compete in design with ethereum. Others include Polkadot, Cosmos and Blockstack. While none have succeeded in amassing more users or dapps than ethereum, the rise in the number of competitors has placed greater importance on Ethereum 2.0 as the upgrade to make or break ethereum's dominance as the world's leading

general purpose blockchain platform.

The Ethereum 2.0 upgrade is tentatively estimated to go live later this year or early next. This is the most recent estimate from developers after delaying release multiple times this year. At time of writing, ethereum is valued at approximately $26 billion and makes up one tenth of the combined value of all cryptocurrencies. In this report, we look at the history of Ethereum 2.0, what the upgrade entails, its impact on network economics and security, as well as potential price implications. We also share perspectives from some of the key developers in the space.

HISTORY

Slasher. Serenity. Casper. Shasper. Ethereum 2.0. All these terms represent different evolutions of ethereum's roadmap to energy efficiency and scalability.

A full year before ethereum launched, founder Vitalik Buterin and researcher Vlad Zamfir were collaborating on designs for a new blockchain system that wouldn't rely on the computationally-intensive process of mining. In an early blog post from January 2014, Buterin describes the process of mining as effectively "burning computational power on useless calculations to secure the [blockchain] network."

In the same post, Buterin sketches out an alternative system of transaction validation and block creation called "Slasher." Based on the work of blockchain developer Sunny King back in 2012, Slasher is a proof-of-stake (PoS) consensus algorithm.

What is mining?

Mining is the process for validating transactions and forming new blocks on several cryptocurrency networks including bitcoin and ethereum. It requires participants – also called "miners" – on both bitcoin, ethereum, and any PoW blockchain to solve complex and computationally intensive mathematical equations. The solution to these equations act as proof of the work that miners have completed to validate transactions and form a new block. In exchange for their work, miners receive a certain amount of rewards in the form of new coins issued by the network and denominated in the network's native cryptocurrency.

In theory, PoS systems are more cost-effective than a PoW system. However, they are also more difficult to design. Rather than relying on external

What are Proof-of-work and Proof-of-stake?

There are two main consensus algorithms for validating transactions and creating new blocks when it comes to blockchain systems. First, there is proof-of-work (PoW), which is the algorithm behind the activity of mining. This is how bitcoin and ethereum today establish network consensus and ensure records of transactions are consistent across all users.

Then, there is proof-of-stake (PoS), which doesn't rely on large amounts of computational energy to secure blockchain networks. It relies instead on large amounts of wealth to be staked by locking up a certain amount of coins as collateral on the network.

Both miners in a PoW system and validators in a PoS system are responsible for confirming transactions and creating blocks. They are rewarded for their work by receiving a certain amount of newly issued coins. In both systems, these rewards can be withheld by the network if a miner or validator goes against the rules of the networks and, for example, proposes fake transactions and blocks. On bitcoin, the rewards are currently 6.25 BTC per block (the amount decreases every four years or so) plus transaction fees. On ethereum, the rewards are 2 ETH per block plus transactions fees. The amount is static on ethereum, unlike bitcoin, but has been changed manually through network upgrades by core developers twice in the past in 2017 and 2019.

Given the large energy costs miners are required to spend from the beginning of their operations, miners are disincentivized from acting dishonestly and potentially losing their rewards in a PoW system. Rewards are the newly issued coins in a network. Validators in a PoS system, rather than expending energy, put up a large amount of collateral in the form of network tokens. This collateral effectively replaces the role of energy costs as a disincentive mechanism to protect blockchain systems from attack. A validator risks losing either their rewards or both their rewards and collateral if they do not follow the rules of the network. The main strength of a PoS system is its efficiency and low energy consumption.

Figure 3: Proof-of-work vs. Proof-of-stake

Consensus Algorithm	Earning Rewards	Losing Rewards	Competition
Proof-of-work	Solve computationally intensive mathematical equations	Proposing an invalid block results in losing rewards and opportunity to recover sunk energy costs	Miners compete primarily through hardware and energy source
Proof-of-stake	Stake wealth as collateral and propose/vote on transactions and blocks	Proposing an invalid block results in losing all or a portion of rewards and staked collateral	Validators compete primarily through numbers, staking more collateral wealth

Source: CoinDesk Research

factors such as computational power to secure the network, PoS systems use internal factors such as network-issued coins. For these coins to have any value to a user and therefore any effectiveness as an incentive mechanism, the network itself must be deemed valuable. Validators must consider the assets they are staking of high, or at least, significant worth. Otherwise, they will not be incentivized to act honestly in the system.

The challenge then for PoS systems is building the right incentive mechanisms to generate real network value and determine the amount of network-issued coins needed to sufficiently, as well as sustainably, motivate the work of validators.

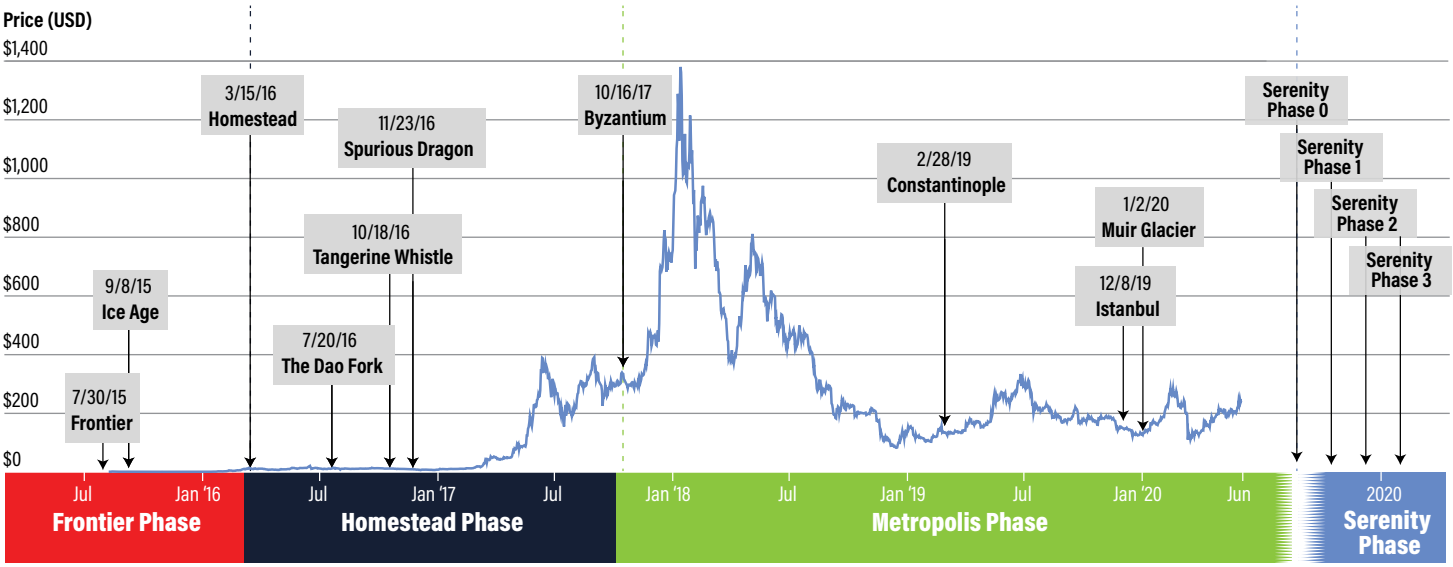
PoS blockchain systems remain largely experimental which is why on July 30, 2015, ethereum launched using the same PoW system of mining as bitcoin. However, around the time of launch, ethereum release coordinator Vinay Gupta detailed a schedule of forthcoming upgrades to the nascent network which would bring the technology to full maturation.

Gupta outlined four main "phases" for ethereum: Frontier, Homestead, Metropolis, and Serenity. This last phase, Serenity, represents ethereum's switch to PoS.

Having completed the first three phases of ethereum's original roadmap between the years 2015 and 2019, developers are now concentrating their efforts on pushing through the final stage of ethereum's development, Serenity, in 2020. Unlike all three phases before it, Serenity will launch an entirely new blockchain network, dubbed Ethereum 2.0, to run alongside the existing ethereum network. Ethereum 2.0 will incorporate a version of the PoS algorithm developed by Buterin and Zamfir known as "Casper" and a new scaling method to boost transaction throughput called sharding. The combination of these two network features is why Ethereum 2.0 for some portion of 2018 was nicknamed "Shasper," before Buterin noted the term as "lame" later that year in October at annual ethereum developer conference Devcon.

Throughout ethereum's history, development towards a more energy-efficient and scalable blockchain has never ceased. What started out as a simple thought experiment by Buterin and Zamfir gradually morphed into a concrete plan essential to ethereum's future as the world's supercomputer for dapps.

Figure 4: ETH price, protocol upgrades and Ethereum phases of development vs. time



Source: Coin Metrics and CoinDesk Research

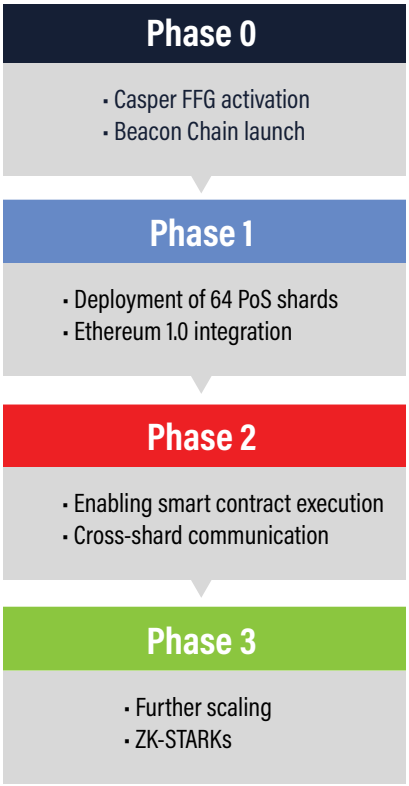
PHASES OF DEPLOYMENT

Due to the complexities of re-launching a new version of the ethereum network, Ethereum 2.0 will be released in phases in a similar way to how ethereum first launched in 2015. Technically, Ethereum 2.0 is the last phase of ethereum's original development roadmap which as outlined by Gupta was to end with Serenity. Serenity or Ethereum 2.0 has four different development stages.

They include:

- the roll-out of Ethereum 2.0's PoS algorithm (Casper)
- creation of shard chains for network scalability
- activation of smart contract execution
- and implementation of miscellaneous tech to further optimize Ethereum 2.0.

Figure 5: Flow chart showing the major features of each phase



Source: CoinDesk Research

PHASE 0—BEACON CHAIN LAUNCH

Phase 0 focuses on activating ethereum's new PoS system, Casper. As previously mentioned, Casper is designed to replace the computationally intensive process of mining to a comparatively more energy-efficient process of validating. In this new system, users that want to earn rewards for helping secure the network and process transactions must deposit a certain amount of ETH into a smart contract on the original ethereum blockchain. An equal amount of ETH is then created on the Ethereum 2.0 chain which the user can then use and put up as collateral to become a validator. The ETH created on Ethereum 2.0 cannot be sent back to the original ethereum blockchain. It will live indefinitely on Ethereum 2.0 until the two systems can be merged together and duplicate ETH locked in the original ethereum chain destroyed.

Initially, Ethereum 2.0 will launch without the ability to send transactions, store user data and deploy smart contracts. In Phase 0, Ethereum 2.0 will strictly focus on coordinating validators and monitoring their work. Validators in Phase 0 will be working to secure the backbone of the Ethereum 2.0 system known as the "beacon chain." In short, the beacon chain is the central blockchain that will create a registry of all Ethereum 2.0 validators, their stake and assign their roles. The two main roles of a validator are attesting to new blocks and proposing them.

Rewards earned as a validator for their work in securing the Ethereum 2.0 network cannot be transferred back to the original ethereum blockchain. Part of the reason transfers of value between ethereum and Ethereum 2.0 will be blocked is to reduce system complexities at launch and prevent spillover effects in the event something goes wrong during the roll out of Ethereum 2.0.[1] All existing users and dapps will send their transactions as normal on ethereum's PoW blockchain. There will be no transactions from ethereum validated through the new PoS system in Phase 0.

1 Further details on the rationale behind blocking transfers can be found in the following CoinDesk article: https://www.coindesk.com/5-takeaways-on-ethereum-2-0-from-vitaliks-beast-mode-blog-posts.

PHASE 1—STARTING SHARDING

With the beacon chain and its PoS system running smoothly, Phase 1 will activate Ethereum 2.0's primary scalability solution, sharding. In the field of traditional computer science, sharding simply means partitioning a database across multiple machines. Applied to blockchains, sharding refers to splitting up a single cryptocurrency network across several blockchains.

In Ethereum 2.0, each individual PoS blockchain is called a "shard." Rather than validating all transactions through a single blockchain with limited throughput, users will be able to choose one of many shards to send their transactions to. With its own set of randomly selected validators, each shard is able to process transactions and create new blocks concurrently with other shards. The reasons these validators must be randomly selected is to prevent collusion between multiple validators on a single shard. Through sharding, ethereum is essentially splitting up transaction load across multiple blockchains in efforts to multiply network throughput and speed.

As the center of the Ethereum 2.0 network, the beacon chain will act as the bridge between all shards, containing summaries of shard data in one central blockchain. Initially, there will be 64 shards created in Phase 1. Initially, they will not have any smart contract functionality—that is, the functionality to run decentralized applications—or the ability to store account balances. These shards will purely test the aggregation and movement of data between shards and the beacon chain.

PHASE 1.5/2—DEPLOY THE DAPPS

Up until Phase 1.5, Ethereum 2.0 is a separate network from ethereum. Transfers of ETH made from ethereum to Ethereum 2.0 cannot be reversed and dapps built in one environment do not exist in the other. However, Phase 1.5 will enable a bridge to seamlessly merge the two blockchain environments. Details for this transition moving users and dapps on ethereum to Ethereum 2.0 is still largely in the process of being fleshed out.

Phase 2 represents enabling functionality for dapp deployment natively on Ethereum 2.0. Once communication between all 64 shards and the beacon chain is fully tested, Phase 2 will enable users to store and deploy new smart contract data on any of the shards in the Ethereum 2.0 network. As a necessary component to running dapps, smart contracts on ethereum currently can only be coded in programming language Solidity. However, after Phase 1.5/2, Ethereum 2.0 will enable dapps to be coded in any programming language, not just Solidity. Open questions remain on how users will be able to deploy dapps and send transactions across more than one shard.

PHASE 3—FINISHING TOUCHES

Out of all four phases, Phase 3 is the least defined. According to Buterin, it's the catch-all term for "basically other stuff that we want to add [to Ethereum 2.0] down the line." This could mean adding more shards to the network or new cryptographic technology such as Zero Knowledge Scalable Transparent Arguments of Knowledge (ZK-STARKs). These would increase the privacy of Ethereum 2.0 by enabling users to share data and perform computations without revealing that data or computation to third parties. The technology is currently under research and development within the ethereum community and other cryptocurrency communities such as Zcash.

Starting with the launch of the beacon chain, Buterin predicts the entire Ethereum 2.0 roadmap will take between five to ten years to complete. In that same time period, the roadmap is subject to change and iteration. It is unclear how long exactly each phase is expected to last and whether some phases will require more time than others. The loose estimate for the duration of each phase is between 6 to 8 months. Currently, several teams of developers are building test networks to simulate Phase 0 of Ethereum 2.0 in controlled environments. Security audits of Ethereum 2.0 code are also being conducted through a number of organizations and companies including the non-profit Ethereum Foundation, blockchain security firm Least Authority, Trail of Bits and others.

What is Solidity?

Solidity is a computer programming language created for the purpose of writing smart contracts on ethereum, based on more traditional programming languages such as C++, Python and Javascript.. Solidity is Turing-complete, which means applications of arbitrary complexity can be coded. It is the only programming language able to execute on ethereum, though developers are working towards expanding the options in Ethereum 2.0.

ECONOMICS OF ETH 2.0

A key requirement for Ethereum 2.0 launch is buy-in from 16,384 validators each staking 32 ETH, or roughly $7,700, at the market price at time of writing of $233.28. 16,384 is 2^{14} and 32 is 2^5—powers of two are generally easy numbers for computers to manipulate through multiplication and division. This means that from its outset, Ethereum 2.0 will be secured with a total value of $122 million (with ETH's market price at $233), which developers predict is a large enough sum to discourage early attacks on the network and make it difficult for anyone to overtake network operations.

At one of the riskiest times a user could choose to join the Ethereum 2.0 network, requiring buy-in from roughly 16,000 validators for the launch is an ambitious goal. However, it is one that has already been attained and exceeded on several Ethereum 2.0 test networks. The Onyx testnet, launched on June 9, 2020 and run by Prysmatic Labs, exceeded the minimum validator threshold within days of launch and currently hosts over 32,000 validators, at time of writing. In fairness, these validators are not staking real ETH so the actual launch of Ethereum 2.0 may see a lower number of participants.

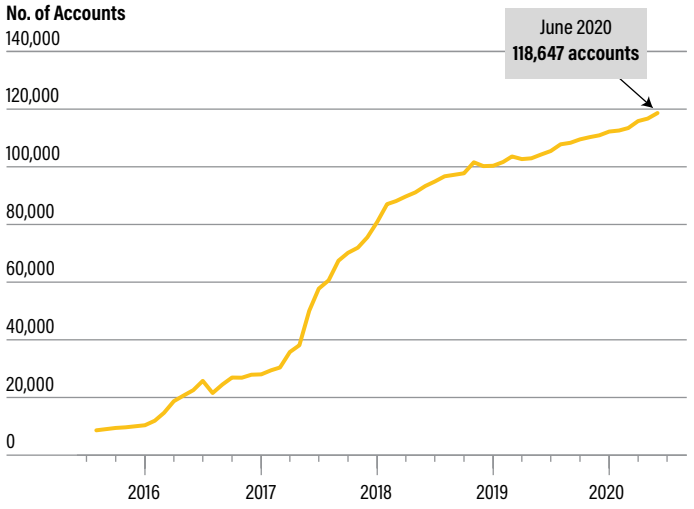
Once testing for Ethereum 2.0 is complete, a validator deposit contract will be created on ethereum. This deposit contract is where all users interested in being a validator for Phase 0 can lock in their 32 ETH. Users who would like to run more than one validator on Ethereum 2.0 can lock up additional increments of 32 ETH. Once this contract hits the minimum threshold of 524,288 ETH (32 ETH x 16,384 validators), it will launch the new Ethereum 2.0 network automatically at midnight UTC the following day. As seen in the chart below, over 118,000 accounts on ethereum hold a minimum of 32 ETH. This number is up 6% year-to-date.

Once launched, validators will begin earning rewards on their locked ETH in the form of annualized interest. Every roughly six minutes—which is the amount of time it is estimated for a new block to be created on the beacon chain—validator rewards are distributed. Rewards are distributed directly into the accounts of validators on Ethereum 2.0 that were actively attesting to or proposing a block. According to calculations done by Collin Myers, head of global product strategy at Consensys Codefi, validators can expect to earn roughly 20% interest on their staked ETH initially. However, as the number of validators grows, interest rates will decrease. This is because the economics of Ethereum 2.0 operates on a sliding scale of rewards that adjusts dynamically based on the total

What is staking?

Staking is how users of a PoS blockchain become validators in the network. In order to become a validator, a user must lock up, by depositing in a designated smart contract, a certain amount of their coins before being permitted to validate transactions and blocks. The coins that have been locked up are called "stake." Validators gradually earn rewards on their stake in the form of annual percentage return (APR) in the form of network issued coins. The network is programmed to calculate these rewards and pay out to validators. Depending on the PoS blockchain system, rates of return will differ. For Ethereum 2.0, validators who do not use third-party stake management services are estimated to earn roughly 20% APR at launch, not factoring in costs of equipment for a computer and an internet connection.

Figure 6: Number of accounts on ethereum with a minimum balance of 32 ETH



Source: Coin Metrics

amount of staked wealth in the network.

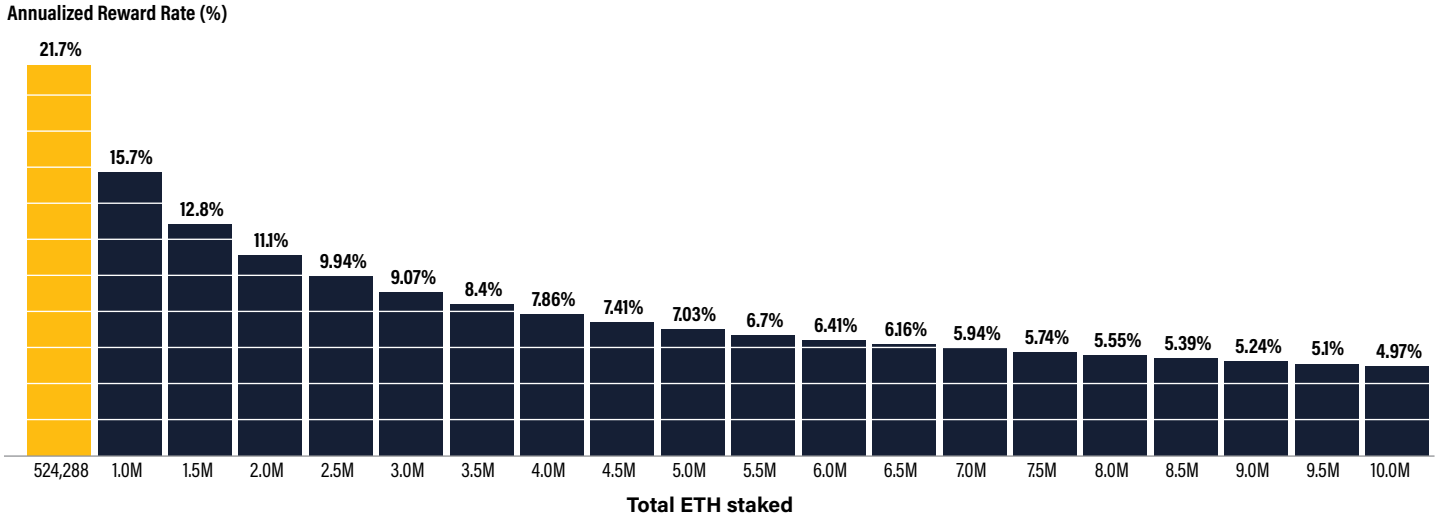
A large amount of ETH staked on Ethereum 2.0 will signal that there is a high number of validators and, therefore, a secure PoS network. The lower the amount of staked wealth, the greater the need for more validators to participate. Finding a happy medium to sufficiently incentivize validators while not overpaying them for their work will likely require tweaking and adjusting Ethereum 2.0's sliding scale of rewards in the weeks and months after Phase 0 launch. These adjustments if there are any will be decided through public developer calls where developers discuss potential improvements and changes to the ethereum network.

Ethereum 2.0 validators can at any point unstake their 32 ETH from the network and stop earning rewards. However, until Phase 1.5, the 32 ETH and any additional rewards earned as a validator cannot be transferred back to the original ethereum blockchain. There will be little a user can do with their staked ETH on Ethereum 2.0 except earn interest on it for being an active network validator in Phases 0 and 1. However, should a validator need to turn off his or her machines and disconnect from the Ethereum 2.0 network for an indefinite period of time, they can unstake so as to prevent any rewards they have earned from being penalized by the system for going offline.

Until ethereum is fully merged into Ethereum 2.0, there will also be a bump in the growth rate of total ETH supply as miners on ethereum earn block rewards and validators on Ethereum 2.0 earn interest through the beacon chain. While validators earn less coins collectively than miners per block, the comparative costs of hardware and electricity are significantly cheaper for a validator than a miner. This is beneficial for ethereum over the long term as a lower reward issuance rate also means supply inflation will decline once ethereum is fully incorporated into the new PoS system.

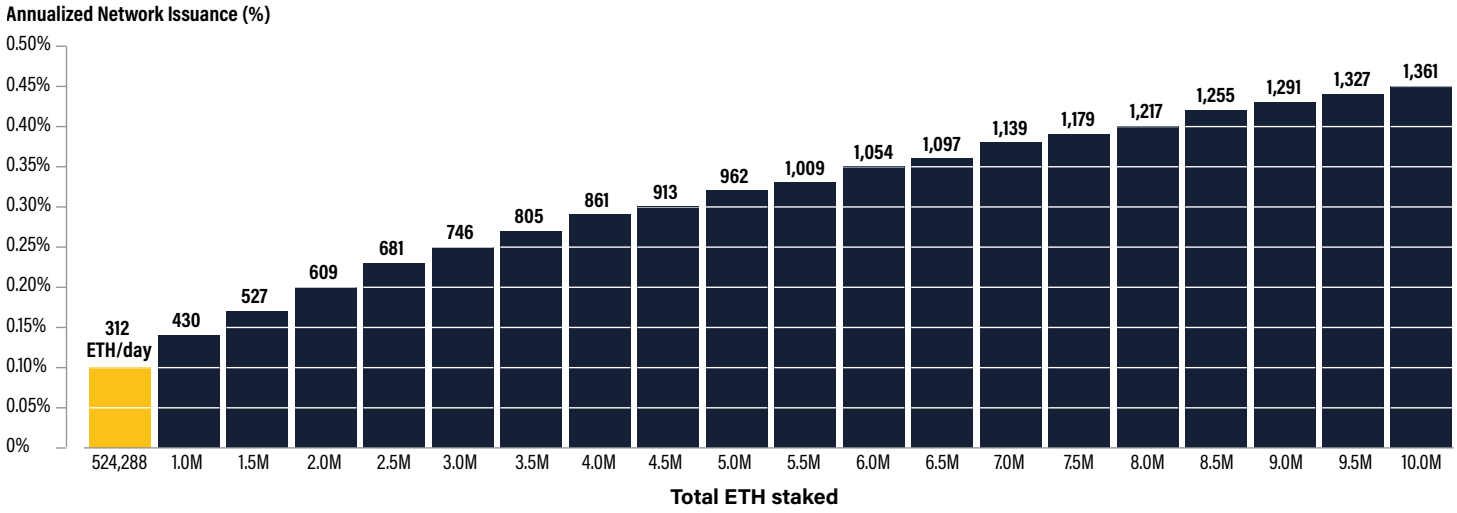
The integration of ethereum into Ethereum 2.0 will take place as mentioned in Phase 1.5. After Phase 1.5 is complete, ethereum will cease to generate block rewards. Instead, ethereum will become one of 64 PoS shards in the network. This means that the process of mining will be deprecated and validators on Ethereum 2.0 will effectively take over the responsibility of transaction validation and block creation. Without mining rewards, new coin issuance will be dictated entirely by validator interest rates. According to Myers' calculations, annual inflation rate on Ethereum 2.0 will initially range between 0.10% to 0.45% depending on the number of validators that are online and earning rewards. Under the current PoW-based supply model of ethereum, annual inflation is approximately 4.5%, at least 10 times the projected inflation rate of Ethereum 2.0.

Figure 7: Validator reward issuance at Phase 0 launch to 10 million ETH staked*



** Calculations assume that 98% of validators on Ethereum 2.0 are online and that none of the validator rewards are penalized or slashed.*
Source: Activate

Figure 8: ETH total supply growth at Phase 0 launch*



**Calculations assume that 98% of validators on Ethereum 2.0 are online and that none of the validator rewards are penalized or slashed.*
Source: Activate

In theory, ETH earned as a miner on ethereum and ETH earned as a validator on Ethereum 2.0 should be of equal worth and value. This is because eventually the two networks will become one. All the scalability and efficiency improvements on Ethereum 2.0 will be leveraged by ethereum. All value created on ethereum including users and dapps will be ported over to and supported by Ethereum 2.0.

In practice, however, there is no telling how ETH will become valued in the crypto markets post-launch. Given that each phase of the Ethereum 2.0 roadmap is estimated to take roughly six to eight months, it will likely be at least a full year before the two networks are combined in Phase 1.5.

POTENTIAL MARKET REACTIONS

In the interim, there are a few different theories on how the crypto markets might react. ETH prices could rally. New tokenized versions of ETH locked in Ethereum 2.0 could be created to boost asset liquidity. Lending and borrowing decentralized finance (DeFi) applications[2] on ethereum may face increased competition from staking-as-a-service providers such as Binance, Coinbase, Staked and several others offering users a way to earn rewards as a validator while handing over all validator responsibilities to a third-party. Below are detailed explanations of the factors that will shape market reactions to Ethereum 2.0 launch.

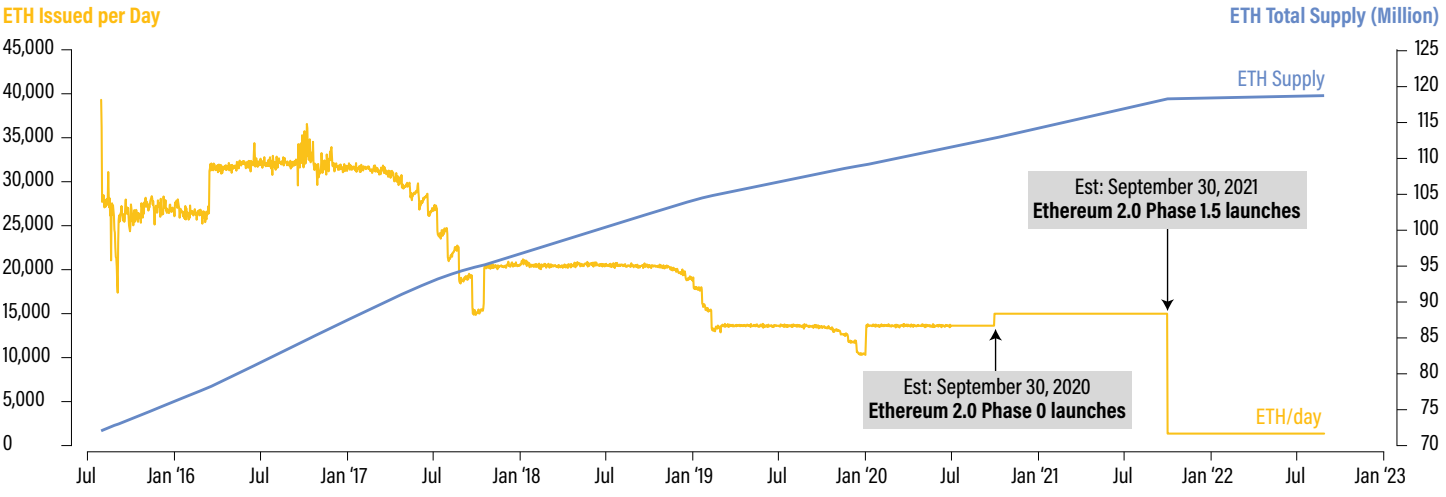
PRICE FACTORS

During the year (or longer) that ethereum is split into two networks, increased issuance of rewards may devalue the cryptocurrency in a similar way to if block rewards suddenly increased on the current ethereum network. A higher amount of ETH minted on ethereum, all else unchanged, would mean the value of a single unit of the cryptocurrency would be lower. That said, added issuance at launch from Ethereum 2.0 is estimated to be minimal, starting off at 0.10% per annum and climbing up to 0.45% per annum depending on how much ETH is staked on the network and how many validators are online.

Outside of increased issuance, at least 524,288 ETH will be taken out of circulation and locked into a one-way deposit contract in Phase 0 (to launch, Ethereum 2.0 needs at least 16,384 validators, each with 32 ETH deposited). As such, ethereum's liquid supply of ETH will be lower after launch and therefore potentially more valuable as a whole for the same reason that increased issuance would devalue the cryptocurrency.

On the other hand, a smaller liquid ETH supply may cause coin velocity, that is, the rate at which the cryptocurrency is being exchanged between different parties, to decrease. British economist John Maynard Keynes argued that an increase in the money supply decreases velocity, which could have a negative effect on currency price. It is unclear to what extent economic theories built around the study of fiat monies can be applied to cryptocurrencies, and especially cryptocurrencies such as ethereum that are not competing with bitcoin to be electronic cash.

Figure 9: Ethereum's historical and projected issuance rate



**Projected issuance assumes a consistent amount of 10,000,000 ETH staked on Ethereum 2.0. Dates for Ethereum 2.0 Phase 0 and 1 launch are not scheduled dates. They are tentative estimates based on developer commentary.*
Source: EthHub, Activate, CoinDesk Research

2 Decentralized finance is a term to describe decentralized applications with a finance focus and purpose.

Finally, the successful launch and development of Ethereum 2.0 through its initial two phases could greatly boost ethereum's value proposition in the eyes of investors. The launch of Ethereum 2.0 would be concrete evidence of a working alternative system of transaction validation that is more energy efficient. Getting to Phase 1 and activating 64 shards would make the transaction throughput of Ethereum 2.0 64 times higher than the original ethereum blockchain. These improvements on Ethereum 2.0 have direct benefits for users and dapp developers as they would lower network fees and prevent instances of extreme network congestion like what was seen during the CryptoKitties' craze of late 2017 and early 2018.

ETH value could also dwindle if the opposite were true and Phase 0/1 fails to deliver concrete evidence of a working PoS blockchain network.

NEW PRODUCTS

The crypto markets may also see the creation of tokenized versions of the ETH staked and rewards earned on Ethereum 2.0. Given that the value generated on the PoS network will not be transferable or have any kind of market liquidity in the near term, it is possible that validators will want to free up new use cases for their locked collateral on the original ethereum blockchain. One example on how validators could do this is by issuing a bond-like asset on ethereum priced by factoring in their running costs of operations and their annualized network returns.

Due to the extremely restricted nature of the underlying asset (the ETH locked in Ethereum 2.0), a tokenized representation may trade at a discounted value similar to a zero-coupon bond.[3] These types of bonds render a profit to the holder at time of maturity when the full face value of the underlying asset can be redeemed. Given the uncertainty around timing for the phases of Ethereum 2.0, there is no telling when a holder might redeem the full face value of the underlying asset as transferability between ethereum and Ethereum 2.0 will not be activated until Phase 1.5. That said, not all bonds require a maturation date.[4]

Creating a tokenized representation of the ETH locked into Ethereum 2.0 that incorporates the dynamic price models of existing financial instruments such as bonds will require a deep knowledge of not only the unique economic properties of ethereum's new PoS system but also traditional debt securities.

DECENTRALIZED FINANCE

Not all validators on Ethereum 2.0 will be running software and actively managing their own stake. A portion of users will likely choose to hire a crypto company to manage the technical responsibilities of being a validator in their place. Some companies may offer additional custodial services of holding and depositing ETH on Ethereum 2.0 on behalf of users while others will strictly take over operations after a validator has already staked his or her 32 ETH.

In return for taking over the responsibilities of validating transactions and blocks on Ethereum 2.0, these companies take a percentage of the rewards earned on the network. Without factoring in the costs of running validator software, a user who runs his own machines can stand to earn roughly 20% APR at Ethereum 2.0 launch. A user leveraging staking services from companies such as Coinbase and Binance can stand to earn roughly 15% APR at launch.

On decentralized finance (DeFi) applications that allow users to borrow and loan cryptocurrencies, the savings rate on ETH ranges between 7% to 0.01% APR. Users who have currently locked up ETH holdings into DeFi lending applications on ethereum may be incentivized to instead stake on Ethereum 2.0 and earn higher rewards, which could diminish the value of DeFi platforms.

There are key differences, however, to consider between lending and staking. Lending ETH earns users passive income. There is little to no action required to make a return on holdings of ETH other than simply locking in funds. For staking, validators must be running software that connects to the Ethereum 2.0 network at all times in order to ensure they receive the full amount of returns. Of course, users who hand over custody of their 32 ETH to a "staking-as-a-service"

3 A zero-coupon bond is a debt security that does not pay interest. Instead, it is traded at a deep discount from its face value and the zero-coupon holder receives the face value of the bond at the time of maturity.

4 Perpetual bonds are another type of debt security that has no maturity date and is treated more like an equity. Issuers of perpetual bonds pay coupons on these bonds indefinitely.

platform would not have to worry about managing software or computer uptime.

Even so, all users contributing 32 ETH at Ethereum 2.0 launch, directly or indirectly as validators, must consider the high risk profile of what they are doing. Ethereum 2.0 is not a guaranteed success. Phase 0 is certainly one of the riskiest times to join the PoS network for a validator because there is no historical precedence for the technology that is to be launched. At least until Ethereum 2.0 properties—namely, its security, efficiency and scalability—are all somewhat established in the days and months and years after launch, DeFi will likely continue to be a safer and more secure avenue for users to place their holdings of ETH.

Over the long-term, as becoming a validator on Ethereum 2.0 gets easier and more accessible, DeFi applications will have to evolve. They will have to recalculate competitive rates at which to incentivize users to lock ETH into their protocols rather than with a staking-as-a-service platform or the network itself. As a result, current lending rates may have to increase in step with the rising demand and popularity of staking. If lending rates for ETH increase, rates for borrowing ETH will be impacted along with the lending and borrowing activity surrounding all other supported ethereum tokens.

Dapps in general on ethereum will need to readjust to a new economic system of transaction validation and block creation. For example, a high volume of ETH staked could mean a lower user interactivity with dapps due to a smaller number of coins in circulation. The existence of shards on Ethereum 2.0 may also require dapp developers to rethink the logic of their applications so as to avoid potentially costly cross-shard transactions.

While the integration of all ethereum dapps into Ethereum 2.0 is expected to be seamless, the logistics of this transition are still in the process of being figured out by core developers. As such, many dapp developers and users simply have to take a "wait-and-see" approach when it comes to the long-term roadmap of Ethereum 2.0. In the next section of this report, ethereum developers and enthusiasts share their outlook on how the launch of Ethereum 2.0 could impact the crypto markets, as well as what challenges they foresee post-launch.

DEVELOPER OUTLOOK

EEDITED TRANSCRIPTS FROM OUR INTERVIEWS WITH ETHEREUM DEVELOPERS

How will the launch of Ethereum 2.0 impact the price of ETH?

"During [Phase 1 to Phase 1.5], there's increased issuance so we have the current mining reward which is 2 ETH per block. In addition to that we'll have staking rewards. So that's probably going to have some effect on the market. It would be similar to if we increased the mining rewards. How would that impact the price? I don't know the answer of which way it would go. I'm not a great trader. I'm mostly into the software side of things but I think that's going to do something. It's going to move the markets in some direction because we're definitely making those changes there."
—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs

"I very much believe that [Ethereum 2.0] adds a ton over time to the intrinsic value of the system. I will not comment on how markets are in relation to that intrinsic value. I think that crypto markets are pretty wild and new and people have trouble figuring out how to value these things but in terms of intrinsic value [Ethereum 2.0] is an incredible upgrade that is going to enable ethereum to be the backbone of a decentralized internet."
—Danny Ryan, Ethereum 2.0 Coordinator and Developer at Ethereum Foundation

"Locked ETH throughout Phase 0 and Phase 1 should be looked at from a discounted value because of its properties. What I'm working on is essentially taking some projections of what that internet bond looks like and valuing it like a zero-coupon bond which means that they trade at a discount to their maturity. I've been applying some bond methodologies to what a validator should trade at a discount until it can be unlocked in Phase 2. There will be value discrepancy for sure. I don't believe that there will be two tokens that people price reference. I think what people should do is track what is the cost to become a validator and should we discount that bond's value because it has lost some properties such as liquidity or properties such as transferability. If the properties change, its value recognition will change. I'm so fascinated with what people will come up with. People will always have their own thoughts and ideas about [ETH] is priced and how it's valued and if it's different or it's not. I have some thoughts about the right way to go about it but the best part is that everyone's going to have their own thoughts and opinions."
—Collin Myers, head of global product strategy at Consensys Codefi

"The crypto markets in general are still very far from properly pricing fundamentals. That being said, I think the most interesting thing when it comes to [Ethereum 2.0] and the price for ETH is now you're going to have people locking up and staking their ETH which takes away from liquid supply. Today, no one is locking up their ETH to stake. That's obviously a nice value proposition because those people are gaining interest. That supply lock up that will happen is obviously a bullish thing. ... Anytime you take supply out, liquid supply shrinks."
—Eric Conner, product lead at Gnosis

"I know there's lots of conversations about tokenizing staked ETH that would potentially trade at a discount but I don't see there being two prices for ETH because in my mind [ETH and ETH created on Ethereum 2.0 are] the same thing. ... I would expect if [active ETH] supply reduces that will have a positive effect on price. However, to a certain extent, it does depend on where that ETH is coming from. I think a lot of people that will stake will be people that are long term [ETH] holders anyway. Then there's also potential for that ETH that's going to be staked to come from ETH that's currently locked in [decentralized finance] contracts anyways. Overall, if [reduced active supply] does have an effect I would expect it to increase the price but by how much? That's hard to guess."
—Tim Lowe, product manager at Consensys Codefi

What Ethereum 2.0 features or functionalities are you most excited to see go live and why?

"The whole beacon chain system is incredible to have designed and built. We worked on this like crazy. The type of hours we put in every week and having been working on this for so long. It's been a really remarkable experience. I have so many emotions about launch. I have excitement, anxiety, all these things. We want to do it right and make it happen. The community engagement we've had has been awesome. I'm really excited to see Phase 0 launch and to see Prysm [our Ethereum 2.0 client] out there and to see people earning money on [Ethereum 2.0.]"
—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs

"It's really Phase 0 stuff. There's two points of major complexity. One is that because we plan on having many shards and because we shuffle validators across the shards, we need to have a ton of validators. So a lot of the complexity in the [code specifications] and in the software implementation is managing a ton of validators. I'm excited to see in 10 months 100,000 validators on these networks that work efficiently and work without issue. That's something I'm really excited about. Also, the multi-client[5] nature is a compounding factor and makes things much more difficult but I'm super excited to see 4 or 5 clients and to see a healthy distribution of clients from day one."
—Danny Ryan, Ethereum 2.0 Coordinator and Developer at Ethereum Foundation

What will be the major hurdles for Ethereum 2.0 right after launch?

"The main functionality of the beacon chain is to introduce the proof-of-stake system. That's really all Phase 0 is. There's no data. There's no transactions. There's nothing besides the validator registry. Maintaining the set of validators and progressing the beacon chain and reaching finality come with Phase 0. That's the hardest part of [Ethereum 2.0] is getting this backbone together. … Everything revolves around the beacon chain and then we can add other layers on top of it."
—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs

"Getting to [Phase 0] will be no problem but once the initial diehards [become validators], what type of growth will we see afterwards? There's a large majority of people who are undecided if they're going to [become validators] or not because they're taking a 'wait see approach' so from a human behavioral perspective I'm interested to figure out how long are people going to sit on the sidelines for and how long will the economics be really good? [Getting to launch] could take 3 to 4 weeks, honestly, within a month's time frame."
—Collin Myers, head of global product strategy at Consensys Codefi

"People have been waiting almost six years now for proof-of-stake. It's always been in the vision. The market is pricing ETH below what I think its fair value should be because it hasn't delivered [Ethereum 2.0]. … I think the market is waiting for that proof that this is going to be delivered. The important step is first, simply having Phase 0 live and watching people send ETH over to the deposit contract and watching this [beacon] chain move along and actually be working. That's the first major step. Then the next big ones will be eventually a two-way bridge where people can move ETH back and forth between [ethereum and Ethereum 2.0]. Then, a very major step is going to be this merge between [ethereum and Ethereum 2.0]. … I think those are the big milestones but to be honest, I think the biggest step is going to be the Phase 0 launch because there's been so many naysayers. There's been a lot of waiting. I think it's going to be an "Ah-Ha" moment in the market."
—Eric Conner, product lead at Gnosis

5 Clients on ethereum and Ethereum 2.0 are different versions of the blockchain software that users can run in order to connect to the network either as a validator, application developer or general user.

How do you suspect the DeFi space to be impacted by Ethereum 2.0?

"As we're building [Ethereum 2.0], we're expecting that the changes required for smart contract developers will be minimal. It's supposed to feel like [ethereum] so there shouldn't be too many differences but obviously, there will be some differences like cross-shard transactions[6] and having to move things around. I think that we'll see having different gas markets[7] [on shards] play out really nicely because there might be some popular application that's really congesting one shard and maybe it's a known event like maybe someone's doing a crazy ICO[8] or there's some really popular game going on. You have the ability to move the whole system into another shard and kind of put a redirect there so it wouldn't break any existing connections but you can move DeFi applications around to save on gas [fees] basically to make transactions cheaper."
—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs

"I think there's some interesting things that will happen with the risk rewards slope of DeFi and those market dynamics. It'll be interesting because all the other risk profiles and yields and uses of this layer-one technology are all not at the bottom. They're all on top of it. So now we upgrade the bottom with its own economics, its own properties, and its own use cases. This will send a ripple effect through the other things that are on top of it. In what matter, it's probably going to be around risk and reward as pretty much everyone still is only using DeFi to speculate and just doing completely unnecessary things. It'll change the game for sure but I'm uncertain as to if it'll be an immediate impact or if it will take a while. I think it will take a while because easily being a validator and entering and exiting the system won't be as easy as DeFi for a while. Becoming a validator is still a pretty difficult process. It's not 3 or 4 clicks. ... It takes a while and you have to know what you're doing or you have to trust someone else so there's some different properties built in there but by the time staking on [Ethereum 2.0] is as easy as lending in Compound,[9] who knows what DeFi could be up to. That whole space is moving at such a rapid pace. It's moving in a weird direction but it is moving rapidly."
—Collin Myers, head of global product strategy at Consensys Codefi

"One of the big things about Ethereum 2.0 is that the effective staking rewards will fall the more that is staked. They start off very high at genesis but as more and more ETH is staked they fall. So I think to a certain extent, it depends on the amount of ETH that is staked total. Whilst there is a small amount staked then the rewards are going to be very high and people would be comparing those with [decentralized finance]. Obviously, if the rewards are much higher than what you can get in [decentralized finance], people will move across. However, they'll have to take into consideration the lock-in period where it's unclear at what point Phase 1.5 will go live. So you have to balance the potentially higher returns with the fact you're locking up the ETH for a long period of time."
—Tim Lowe, product manager at Consensys Codefi

Do you suspect there will be fierce competition between DeFI lending rates and Ethereum 2.0 staking rates?

"With proof of stake, it's not entirely passive income. You have to do work. You have to keep the system online. You have to monitor it. .... [So] I expect the rewards to be higher for proof-of-stake validators, whereas if I was to put DAI[10] into DAI savings rate, the status is entirely passive. I put it there. I set it, forget it. I will take it back later. I don't think they're direct competitors but if something like MakerDAO had a higher yield than staking then why would people stake? If the risk is higher with staking and if the rewards are lower then what's the point? So they are related

6 Transactions deployed on one shard but received by an account or contract living in another separate shard on Ethereum 2.0.

7 Gas markets refer to how transaction fees will be calculated on Ethereum 2.0. In essence, transaction fees on shards with large amounts of transaction activity will be higher while transaction fees on shards with small amounts of transaction activity will be lower.

8 Initial coin offering. This is a type of fundraising that was popularized back in 2017. It consists of allowing interested parties to buy into a cryptocurrency before launch.

9 A DeFi application for lending and borrowing cryptocurrencies.

10 A dollar-backed stablecoin issued by decentralized application MakerDAO.

in that way but at the same time, totally different." *—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs*

"It'll be in the mix. I don't know exactly. It's just another thing that people are going to do with [their ETH]. I think some people are worried about collateral moving from this place to another place but i think that DeFi is going to continue even without the context of proof-of-stake and staking. DeFi is going to continue to grow. I think the amount of ETH used in these DeFi applications is going to continue to grow regardless of proof-of-stake. I'm not worried about one siphoning off the other. I think there's room for growth in both." *—Danny Ryan, Ethereum 2.0 Coordinator and Developer at Ethereum Foundation*

"Most people are locking ETH [in DeFi] not to earn interest. They're locking it to pull out DAI or stablecoins. ... You have a lot of people sitting on ETH. Normally people sitting on an asset with value are able to earn interest on it whether it's through their savings account or whatever it might be. So people that are sitting on ETH don't have a way to earn interest on that capital which is sub par at the moment. People are going to be able to start earning interest on that. Once Phase 2 is live and we're seeing something like 20 million ETH staked, you're still talking 4 or 5 percent a year returns on ETH which is very attractive compared to what you see [in DeFi] today. I don't think it's going to change DeFi much because most of DeFi activity isn't around lending ETH. It's around the opposite, it's around locking up ETH and borrowing stablecoins so I think [the two are] pretty complementary." *—Eric Conner, product lead at Gnosis*

How will Ethereum 2.0 launch and enter into Phase 0?

"The process would be: first, the [validator deposit] contract is deployed. It starts receiving deposits on [ethereum]. At that time, there's still not an [Ethereum 2.0 network] yet. We could expect that people are starting to turn their beacon nodes on and starting to listen for that [minimum deposit] threshold and once that threshold is met, there's a minimum delay of 24 hours before the beacon chain will start. This gives people enough time to turn their validator machines on if it wasn't on already. Then the [Ethereum 2.0 beacon] chain will start. It starts at midnight UTC the next day so at least 24 hours, between 24 and 48 hours, it'll start at midnight UTC time. That's when the first block will be produced and the chain starts. That's when [Ethereum 2.0] Phase 0 is finally live." *—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs*

"It's really a signaling from across the community, putting [the deposit contract] on many different websites. .... People use the word 'ceremony' a lot and to a certain extent, yes, it is a ceremony because we want a lot of people to do something at the same time but one of my biggest concerns right now is phishing in relation to this deposit contract address. If you look back at 2017 there was a lot of madness around ICOs and people putting up fake contracts and stuff. We're going to do our best to prevent that from happening but it's a tough one to battle." *—Danny Ryan, Ethereum 2.0 Coordinator and Developer at Ethereum Foundation*

"The deposit contract from what I understand has two pieces of logic. It has a time [saying] the beacon chain cannot be initialized until [a certain] time hits, say whatever block 11 million and whatever date that might be. Then it has a threshold of 524,000 ether. So both of those need to be hit and then the beacon chain will be bootstrapped and launched. From the technical standpoint that's what's left. For actual logistics of how it's going to work, I'm assuming most people are going to use the ethereum.org blog and Prysmatic Labs and Sigma Prime discords to do communications. I'm sure there will be attempts at people to launch a fake contract but you're just going to have to go off these official channels and cross reference things. ... That's just the reality of crypto in this day and age." *—Eric Conner, product lead at Gnosis*

What are the biggest risks?

"I think that as a user or participant of [Ethereum 2.0], you should really understand what it means to be a good actor in the system and what it means to be a bad actor in the system. So what does it mean to be

slashed? How can you avoid being slashed? Because if you grossly misuse the software, you could find yourself in a slashing condition. Really understanding that is going to help you have peace of mind with your software. Other than that, you want to make sure that [your validator machine] stays online. It's really low resource requirement, low bandwidth and it's really cheap to run. You just want to have some way to know it's online and it could be just that you look at it every morning or you have it email yourself or something like that. That's really it. Once you understand the risk of what is a slashing condition and how you avoid it, actually running a validator is going to be really easy and fun and exciting."
—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs

"There are risks. Even with proof-of-work there are risks. You're buying hardware and if you can't run it properly or if you burn it out, you have collateral there. Similarly with proof-of-stake protocols, there are risks with the collateral you are posting to join the network. Being offline and the penalties associated with that are much less severe than the risk associated with improper key management. I would say the chances that we see a bug from clients double signing [on blocks] and issues there are very low, but the chances that we see some members of the community and some of the early validators get slashed because they accidentally push their keys to Github[11] or accidentally run multiple instances of their keys. Those are the real risks. .... Another would be if you had not secured your staking set up in a sufficient way and a hacker got into your system and just stole your keys. Key management and security I think are the number one things that people who are concerned about slashing[12] need to look into."
—Danny Ryan, Ethereum 2.0 Coordinator and Developer at Ethereum Foundation

"Phase 0 is for the believer. It's for the person who can do it, who wants to do it, and will do it no matter what. Risk in this setting is usually assigned to financial value because it's a financial technology. There is a risk of you depositing [ETH] incorrectly. .... [Also,] I think there is a risk of not having fungibility on your assets. I think that's tough. However. I do believe people will mitigate that risk by creating tokenized representations of staked ether, which if we can solve that problem then I think that the risk of illiquidity or the risk of, 'Oh, I have all these assets but I can't actually do anything with them,' will be greatly lowered."
—Collin Myers, head of global product strategy at Consensys Codefi

"There needs to be a big warning for Phase 0. First of all, it's a one way move right now so you can't get your ETH back to [ethereum] until that bridge happens around Phase 1. It's still cutting edge technology at this point but the network is incentivizing people to move over and take that risk. We'll probably see something like 15% APR on ETH in Phase 0. People have to weigh that cost benefit of moving over. Right now the highest rate you can earn on DeFi on your ETH is something like 0.2% so we're talking about a hundred times higher rewards early on in staking. People need to do their cost benefit analysis. ... The hardware requirement is pretty minimal. You can run a validator node on a Raspberry Pi 4.[13] It's a very low barrier to entry to do this."
—Eric Conner, product lead at Gnosis

"There's different types of risks. ... The first issue is you have two keys per [validator] account, a validator key and a withdrawal key. How do you securely generate and securely store those keys? The withdrawal key you should aim to put it in cold storage[14] because you're not going to use it until withdrawals are enabled but that means you must keep it secure and you must not lose it. The validator key has different risks associated with it. You will be using it. It needs to be online for the validator client to use for the whole period for which you're validating. So the risk there is if you lose that key, you can't validate. If your key is stolen then there's

11 A code hosting and sharing web platform.
12 Slashing refers to when a user is penalized by the Ethereum 2.0 system and loses all or part of their collateral.
13 A low-cost computer the size of a credit card.
14 Cold storage is an offline digital wallet for storing cryptocurrency.

potential for a denial of service attack.[15] So you've got risks around key generation and key management. Then obviously if you're running a validator, you have to be able to run the validator and keep it running and keep it connected to the internet. That's a lesser risk because whilst ideally to maximize rewards you would want to have it running 24/7, you can afford to be offline for a fair amount of time before you actually start to lose a significant amount of ETH rewards."
—Tim Lowe, product manager at Consensys Codefi

What was the biggest challenge developing Ethereum 2.0?

"So [Prysmatic Labs] has been working on this for two and half years and it has been a very iterative process. The specification we started on two years ago is completely different than it is today. It's been rewritten probably from the ground up three times and that's been difficult and challenging but at the same time all of the improvements that we've made have been critical to the success of the design of the system. I would say besides a lot of iteration and starting over, it's difficult in general to have such a decentralized development. .... We're so distributed that even just communicating is difficult. Finding a time to have our bi-weekly calls is difficult. I think we've reached a point in our careers and of building this system that we have found out ways to make it work but that was definitely a big pain point for a long time."
—Preston Van Loon, Ethereum 2.0 Protocol Developer and Cofounder of Prysmatic Labs

"Because we've had engineering teams involved in the process since early days, there's been some pain in trying to develop [code] specifications at the same time people are trying to build on the spec[16]. We've seen a number of client rewrites over the many months because as we've refined specifications there's been code thrown out. So that was a tough point. ... We get a lot of value from having a lot of clients but if we had one client, the process would be a little bit faster. At the same time, the end result would not be quite as robust or quite what we're looking for in ethereum. It's all a trade off and the more hands in the process, the better final product you can get. It just takes more deliberation and discussion. .... We don't run into too many serious disagreements but every once in a while that can be a sticking point, that can be a hard one to work through the different personalities and work through the different technical tradeoffs."
—Danny Ryan, Ethereum 2.0 Coordinator and Developer at Ethereum Foundation

"Stake centralization is very difficult to fight today. Probably the most interesting thing I've learned in this process about the forces of centralization in a proof-of-stake context is that it's like inertia. If there's any hope and movement towards centralization, you'll end up there. It's just inertia. Humans and everybody will gravitate towards centralization if [the network] has any design element towards it being centralized. Centralization is an extremely hard thing to fight against, maybe an impossible thing to fight against in the short term but the way that the machine is designed in [Ethereum 2.0], it's quite impressive. ... We'll see how it works. It's the best attempt [against centralization in PoS]."
—Collin Myers, head of global product strategy at Consensys Codefi

"I think it's a common answer for most of [Ethereum 2.0] development and it's that this is all being done in the open and second of all with no real leader. There's a few [Ethereum 2.0] lead developers and research but it's pretty chaotic in general. To organize people across the globe in different time zones with different opinions [is hard.] There's no hierarchy here. Imagine Apple was developing the IPhone on GitHub in the open and taking input from people all across the globe. That's just not an easy task. You would have naysayers. It would take a lot longer. I think what people failed to realize is that not only is [Ethereum 2.0] a pretty cutting edge technology—it hasn't really been done – but doing it in this decentralized open manner just creates more time and you just need more time and there's a little bit more overhead."
—Eric Conner, product lead at Gnosis

15 A denial-of-service attack is an attack intended to shut down a machine or a network and make it inaccessible to a user.
16 Shorthand for code specifications.

Will you run an Ethereum 2.0 validator at launch?

"Yes, I don't know if I'll be running many validators. I'm not a whale over here but I will have skin in the game. I'm already running multiple nodes on testnets and I have a new server where I plan on running all sorts of stuff in relation to [Ethereum 2.0] and ethereum mainnet."
—Danny Ryan, Ethereum 2.0 Coordinator and Developer at Ethereum Foundation

"I know how to do it. It's one of those things where I've done everything I can to help it and now I must participate myself. ... For our effort on the Launchpad,[17] part of the contractual agreement with the [Ethereum Foundation] is that they pay us in ETH which we are contractually obligated to stake on mainnet. .... Personally, I will probably stake 30% of my ETH. I probably won't do it all at once. I have no issue generating and managing my own keys and depositing but I would like someone to run the beacon node for me. So from that perspective, if i have to do it myself, I will, but honestly I may use DAppNode.[18] I'd like to do the deposit myself and manage my own keys but I'd love it if someone did the beacon node for me and I wouldn't mind paying for that service."
—Collin Myers, head of global product strategy at Consensys Codefi

"Yes, definitely. I'm already running multiple validators on the testnets so kind of preparing for that and getting hardware set up and testing things out. The number one biggest thing about proof-of-stake to me is that it really aligns the users and the investors of the network. The overall trajectory and the incentives are very aligned. Myself as an ETH holder can participate in the consensus of the network and feel a sense of ownership that doesn't really exist in large proof-of-work chains anymore. You need to be a huge player to mine. There's really no such thing as at-home, solo mining anymore. So that's one of the things that I really like about proof-of-stake."
—Eric Conner, product lead at Gnosis

17 A web interface to help users on ethereum deposit their ETH and become validators for Ethereum 2.0. Launchpad is currently under testing on GitHub.
18 DAppNode is a platform helping users run ethereum nodes, decentralized applications and other blockchain networks.

CONCLUSION

As the culmination of over five years of research and development effort, Ethereum 2.0 is the most highly anticipated upgrade in the blockchain's history. It is also the most delayed upgrade in its history—back in 2015, it was expected to be developed within 16 months of network launch. So confident were developers in designing a new PoS system for ethereum, they baked into the core code protocol of ethereum a "difficulty bomb" which would gradually increase ethereum's mining difficulty to unmanageable levels. The effects of the difficulty bomb have been pushed back and delayed three times now, once in 2017, another time in 2019 and again in 2020.

The most recent delay to ethereum's difficulty bomb, implemented on January 2nd, 2020, gives developers until July 2021 to roll-out PoS and migrate both users and applications to the new Ethereum 2.0 network. Most developers agree that the biggest hurdle to Ethereum 2.0 rollout will be launching Phase 0, the beacon chain. Expected to go live before the end of this year, the beacon chain will be a core piece of technology upon which the rest of the Ethereum 2.0 system, and its subsequent scalability and efficiency gains, will ultimately rest. For the beacon chain to launch successfully, it will need to crowdsource a minimum of 524,288 ETH (worth roughly $122,000,000 at current prices).

The launch of this multi-million dollar PoS platform may also become a bullish signal to investors and traders about the long-term sustainability of the cryptocurrency, which will cause ETH prices to climb. Given the unique design of Ethereum 2.0 as a separate and parallel network to the original ethereum blockchain, investors and traders may see the creation of entirely new digital assets. These digital assets will likely be tokenized representations of the work and returns of validators in the new PoS system. As a way of seeking financial return, the tokens created to give exposure to the risk and rewards of validating on Ethereum 2.0 will likely grow and expand usage of decentralized finance (DeFi) products on ethereum.

Outside of the launch of Ethereum 2.0, questions remain over how exactly the current ethereum blockchain will be merged into Ethereum 2.0 and when. The robustness of Ethereum 2.0 after launch in withstanding attacks and malicious activity will be another area of importance that will take time for the public to confirm. No blockchain of ethereum's scale has ever switched from a PoW to PoS system. As such, the transition will be an important case study on the tradeoffs of both systems in a live setting. Beyond whether this technology becomes a success or not, Ethereum 2.0 has already managed in its design to pique the interests of developers, crypto economists and investors. It will likely continue to be a source of engagement and interest from the cryptocurrency community in the many years to come.

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