

Upon launch of the beacon chain, ETH2 will be issued on a 1:1 basis for each ETH that has been sent to the deposit contract. Most likely, this new cryptocurrency will initially be non-transferable at least until Phase 1. As such, it is highly likely that a futures market for the digital asset will evolve – and hence also a different price for ETH2 and ETH, which will converge when the legacy Ethereum blockchain becomes part of the new chain (see Phase 2).

The goal of this phase is to establish whether the base layer structure (i.e. the beacon chain) is stable, and to evaluate whether the economic incentives to stake and validate are sufficient.

Phase 1

During this phase, the shard chains will be established. Each shard can be viewed as a separate blockchain, and the beacon chain will act as a coordination layer between the shards. In the original proposal, the implementation of 1024 shards was planned. However, Vitalik Buterin proposed⁷ to reduce the number of shards to 64 – which would simplify cross-shard communication, meaning that interactions between shards (e.g. a token transfer from shard A to shard B) would proceed more smoothly.

Validators will be randomly assigned to shards from the pool of all validators. This reduces the chance that any set of validators could collude to take over a shard. Obtaining a truly random seed to base this decision on is hard, however – at least until quantum computers can provide provable randomness.⁸ In the meantime, randomness will be brought to Ethereum 2 through a complex algorithm that includes verifiable delay functions (VDFs). These functions are known to take a certain amount of time (102 minutes in Ethereum 2) to compute, and take arbitrary numbers provided by validators as inputs. The result will serve as a random seed for validator assignment to shards.

This “parallelization” of the blockchain through sharding will raise its capacity to around 1.3-2.7 MB/s, which should support a throughput of around 10’000 transactions per second initially – and potentially more, with the addition of more shards in the future as well as the efficiency optimizations currently happening on Ethereum (see above). For comparison – a global payment system such as VisaNet handles around 1’700 transactions per second on average.

Phase 2

This phase will introduce the full set of blockchain functionalities to Ethereum 2. It will be possible to execute smart contract code and transfer any tokens on the blockchain. The legacy Ethereum chain will be folded into an execution environment of Ethereum 2, meaning it will simply become a shard in the new chain – and all ETH remaining on the old chain will be transformed into ETH2. The state execution engine will be based on eWASM – Ethereum-flavored WebAssembly⁹ – and allow the compilation of high-level languages suitable for smart contracts.

Hence, this phase will also mark the end of the two-token model of ETH and ETH2 – at least in theory. There is a noteworthy chance that miners on the legacy Ethereum chain will conduct a hard fork and try to maintain the chain. If unsuccessful, miners will have to redirect their hashpower towards other proof-of-work chains mined with GPUs.

Overall, it should be mentioned that especially the later phases of Ethereum 2 are still subject to discussion and the final implementations have not been decided upon. The timeline is also unclear – but the typical Silicon Valley mantra of “move fast and break things” does not work for an infrastructure that is securing billions of dollars’ worth of assets.

⁷ <https://notes.ethereum.org/@vbuterin/HkiULalU5>

⁸ <https://fortune.com/2019/10/23/google-quantum-cryptocurrency-the-ledger/>

⁹ WebAssembly is a type of code that can be run in modern web browsers and allows to “translate” programming languages such as C++ or Rust into machine code. It is maintained by the Web3 Consortium. Contributors include Microsoft, Google, Apple and Mozilla.