



OST

Eastern Switzerland
University of Applied Sciences

Distributed Systems Advanced & Blockchain

ETH 2.0

Thomas Bocek

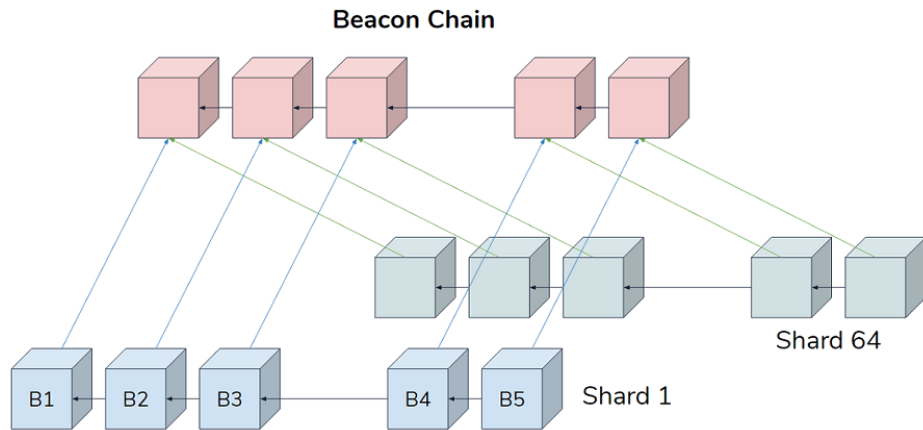
6 December 2020

ETH 2.0

- Ethereum: complex smart contracts
 - Decentralized economy
- After 7 years, Ethereum 2.0
 - 2nd in marketcap, more than 1m tx per day, 130m addresses, others
- Limitations: ~15tx/s
 - Not suitable for global financial system
 - Other blockchains already have better scalable solutions
 - “Not ready for mainstream adoption”
- PoW – waste of energy, centralization of miners
- ETH 2.0 – major upgrade
 - Proof of Stake, with 32ETH ~\$18'700 (same region as Tezos)
 - Sharding, horizontal scaling, 64 shards
 - Beacon Chain
 - With 64 shards you don't have the 51% problem, but a 51/64% problem ~0.8%. The beacon is here to solve that
 - Every 12 second, each shard and the beacon gets a block added within a slot, 32 slots make an epoch

ETH 2.0

- [Beacon Chain](#), [Messari Report](#)

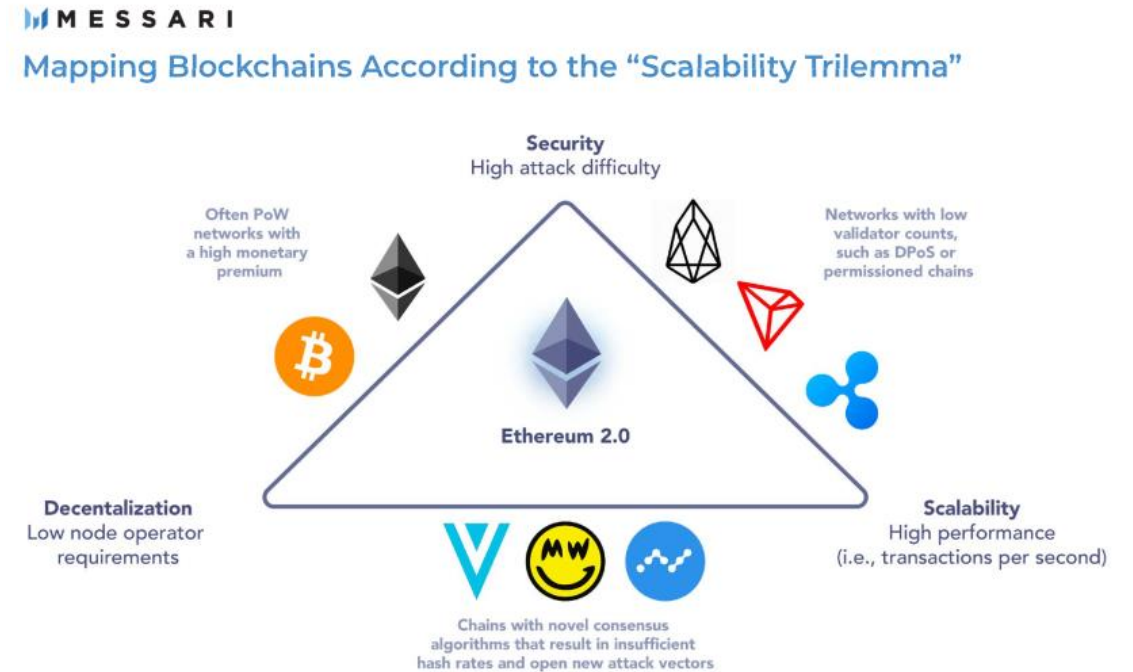


- Block proposer, proposes block, validators (128) will vote
- Validators signing blocks twice: 32 ETH slashed (burned)
 - Other blockchains - transfer to the one that caught a double signature

- Upgrade
 - Phase 0: beacon chain / ETH 2.0
 - Phase 1: beacon chain with shards / ETH 2.0, no smart contracts
 - Phase 2: “legacy” ETH as a shard of ETH 2.0
- 01.12.2020: [Ethereum 2.0 is go: Genesis block of beacon chain winks into existence](#)
 - launch of phase 0, requirement:
 - 524'288 ETH in the staking contract, locked until ~[2022](#)

ETH 2.0

- Blockchain Trilemma
 - “Historically, blockchains have only been able to achieve two of the three desired properties, and solving the Scalability Trilemma has been hailed as the holy grail of blockchains.”
- ETH 2.0’s supply is dynamic adjusting according to staking amount ~below 1%
 - The more validators stake, the less the staking reward, much less than ETH1



Source: Messari, Zooko Wilcox-O'Hearn, Ethereum GitHub, Arjun Balaji

ETH 2.0

- History
 - From Slasher and Hypercubes to Casper and Sharding (2013-2015)
 - Issues identified, started working on it
 - The Dark Ages of Research (2015-2017)
 - Several PoC, mix of PoW and PoS
 - The Beacon Era (2018-2020)
 - Combined approach, don't separate PoS and sharding, other refinements



ETH 2.0

- Phase 0
 - Testing the beacon chain – staking
 - No smart contracts no transaction
 - Financial opportunities and consequences for stakers
 - Deposit contract: 32 ETH
 - Cross-chain communication ETH2 and ETH1
 - One way transfer of ETH1 to ETH2
 - Contents of the Beacon Chain is primarily a registry of validator addresses, the state of each validator, attestations, and links to shards
- “But missed votes or votes for blocks that don’t get finalized result in penalties”
 - if you registered as vote, but you are offline – penalty, in phase0, if you go below 16 ETH you get kicked out
- Double signing – slashing, loose 1 ETH
 - If it happens again in the same epoch, you loose more
 - Whistleblower reward
- Inactivity leak – if many validators are offline and no block is finalized. Quadratic penalty for inactive validators

ETH 2.0

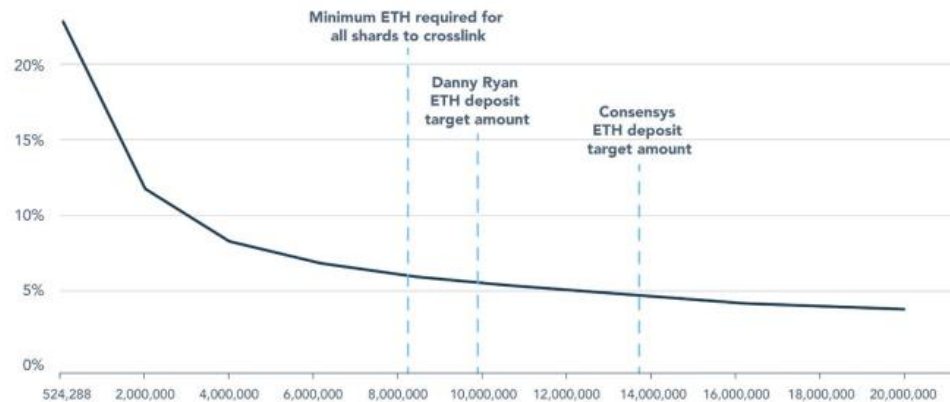
- With 524'288 ETH staked, reward is 23%, more stakers, less reward
- Mining driven by uptime (not energy or HW as in PoW)

- View on reward if not all validators are online
- Anti DDoS from other miners

MESSARI

Ethereum Validator Yields

Assuming 100% validator uptime, staking yields will likely be in the 4%-6% range at scale.



Note: Assumes starting supply of 113,000,000 ETH. Also assumes 100% validator uptime - the theoretical maximum. • Source: Messari, Consensys

MESSARI

Ethereum 2.0 Validator Yields

VALIDATOR ISSUANCE

Average Network % Online

	70%	75%	80%	85%	90%	92%	94%	96%	98%	100%
524,288	16.5%	17.6%	18.7%	19.8%	20.9%	21.3%	21.7%	22.1%	22.5%	23.0%
2,000,000	8.4%	9.0%	9.6%	10.1%	10.7%	10.9%	11.1%	11.3%	11.5%	11.8%
4,000,000	6.0%	6.4%	6.8%	7.2%	7.5%	7.7%	7.9%	8.0%	8.2%	8.3%
6,000,000	4.9%	5.2%	5.5%	5.8%	6.2%	6.3%	6.4%	6.5%	6.7%	6.8%
8,000,000	4.2%	4.5%	4.8%	5.1%	5.3%	5.4%	5.6%	5.7%	5.8%	5.9%
10,000,000	3.8%	4.0%	4.3%	4.5%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%
12,000,000	3.4%	3.7%	3.9%	4.1%	4.4%	4.4%	4.5%	4.6%	4.7%	4.8%
14,000,000	3.2%	3.4%	3.6%	3.8%	4.0%	4.1%	4.2%	4.3%	4.4%	4.4%
16,000,000	3.0%	3.2%	3.4%	3.6%	3.8%	3.9%	3.9%	4.0%	4.1%	4.2%
18,000,000	2.8%	3.0%	3.2%	3.4%	3.6%	3.6%	3.7%	3.8%	3.8%	3.9%
20,000,000	2.7%	2.9%	3.0%	3.2%	3.4%	3.4%	3.5%	3.6%	3.7%	3.7%
22,000,000	2.5%	2.7%	2.9%	3.1%	3.2%	3.3%	3.4%	3.4%	3.5%	3.5%
24,000,000	2.4%	2.6%	2.8%	2.9%	3.1%	3.1%	3.2%	3.3%	3.3%	3.4%
26,000,000	2.3%	2.5%	2.7%	2.8%	3.0%	3.0%	3.1%	3.1%	3.2%	3.3%
28,000,000	2.3%	2.4%	2.6%	2.7%	2.9%	2.9%	3.0%	3.0%	3.1%	3.1%
30,000,000	2.2%	2.3%	2.5%	2.6%	2.8%	2.8%	2.9%	2.9%	3.0%	3.0%
32,000,000	2.1%	2.3%	2.4%	2.5%	2.7%	2.7%	2.8%	2.8%	2.9%	2.9%
40,000,000	1.9%	2.0%	2.1%	2.3%	2.4%	2.4%	2.5%	2.5%	2.6%	2.6%
50,000,000	1.7%	1.8%	1.9%	2.0%	2.1%	2.2%	2.2%	2.3%	2.3%	2.4%
60,000,000	1.5%	1.6%	1.7%	1.8%	1.9%	2.0%	2.0%	2.1%	2.1%	2.1%
70,000,000	1.4%	1.5%	1.6%	1.7%	1.8%	1.8%	1.9%	1.9%	2.0%	2.0%
80,000,000	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%	1.8%	1.8%	1.8%	1.9%
90,000,000	1.3%	1.3%	1.4%	1.5%	1.6%	1.6%	1.7%	1.7%	1.7%	1.8%
100,000,000	1.2%	1.3%	1.4%	1.4%	1.5%	1.5%	1.6%	1.6%	1.6%	1.7%
110,000,000	1.1%	1.2%	1.3%	1.4%	1.4%	1.5%	1.5%	1.5%	1.6%	1.6%

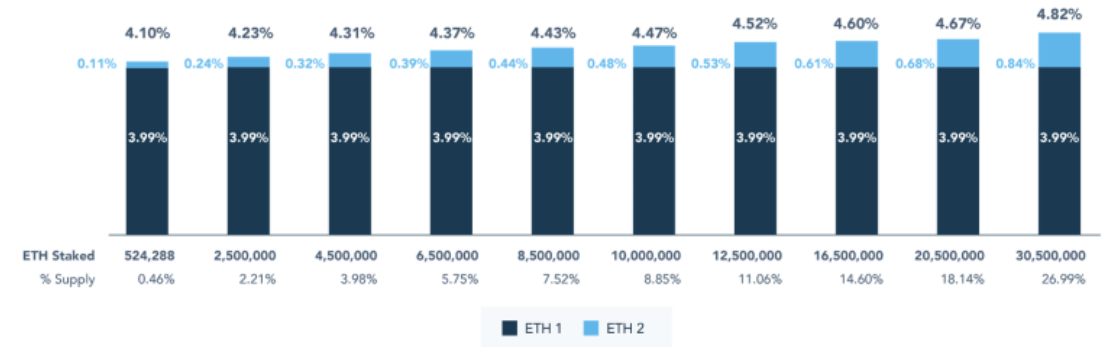
Source: Consensys

ETH 2.0

- Issuance of ETH will be much lower
 - ETH1, 2 ETH per block, every 14s
 - ETH2, depends on the online availability and staking amount, every 12s
- Scaling in short term: rollup – layer 2 (aggregate TX) – Ethereum's offchain approach
- Phase1 - sharding: difficulty
 - Cross-shard transactions
- At one point, ETH2 will be the only chain issuing ETH2 – implications
- Phase 2 – research phase

Ethereum Annual Issuance Rate until Phase 1.5 ETH 1 Merge

Assuming 100% validator uptime, Ethereum's total issuance will only be affected marginally, even with high staking participation.



Note: Assumes starting supply of 113,000,000 ETH. Also assumes flat participation for each column shown. • Source: Messari, Consensus

Ethereum 2.0 Annual Issuance

NETWORK ISSUANCE		Average Network % Online									
Total ETH Staked (Network)		70%	75%	80%	85%	90%	92%	94%	96%	98%	100%
	524,288	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
	2,000,000	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
	4,000,000	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%
	6,000,000	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%
	8,000,000	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%
	10,000,000	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.5%
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	70,000,000	0.3%	0.5%	0.6%	0.8%	0.9%	1.0%	1.0%	1.1%	1.2%	1.2%
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Source: Consensus