

How to run an Ethereum node after the merge



Ariel Sanchez · Follow

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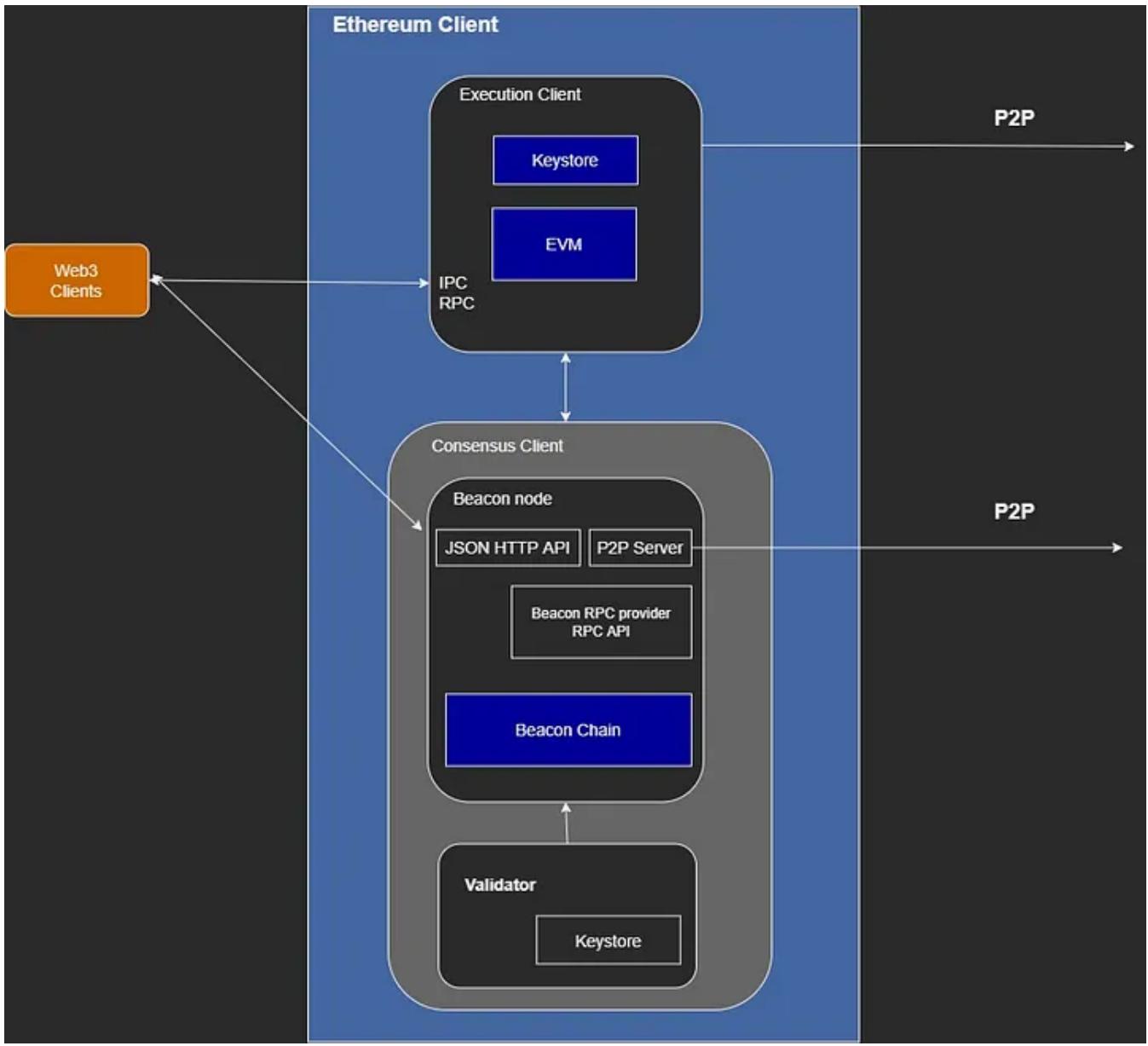
Overview

After the merge, Ethereum nodes comprise an execution client and a consensus client; both are needed to run a full Ethereum node and include some caveats. This article will cover the node detail structure after the merge, node selection depending on the specific use, options for sync, and how to check the sync state.

Ethereum node and clients

An Ethereum node is a computer running the software client connected to other computers with the same Ethereum software, creating a p2p network that verifies data against the protocol rules and keeps the network secure.

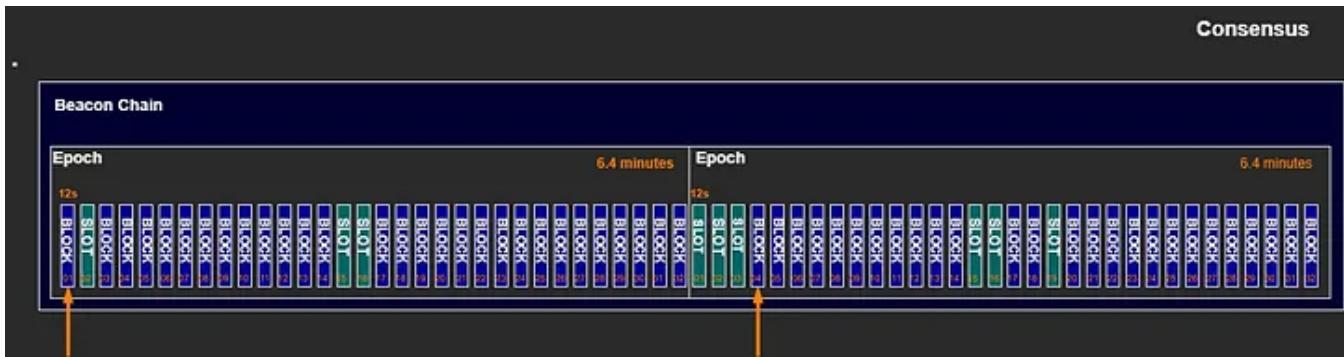
Post merge Ethereum main parts:



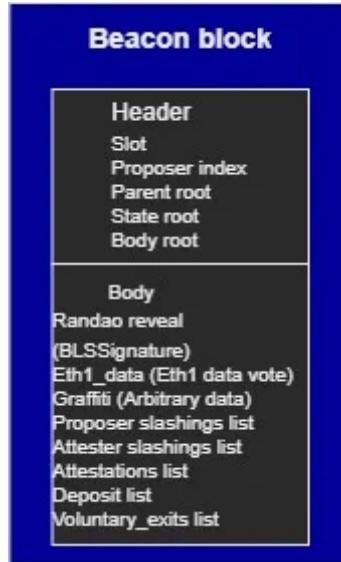
Execution client: Listens to new transactions broadcasted in the network and executes them in the Ethereum virtual machine (EVM) and holds the latest state and database of all current Ethereum data.

Consensus client: contain the Beacon Node that implements the proof of stake (POS) consensus algorithm, enabling the network to achieve agreement based on validated data from the execution client. The validator client is part of the consensus, handling the network synchronization, drawing consensus, and performing several other low-level functions. The role of validators is to stake ETH to perform block proposals, and attestations are an equally critical component of the Ethereum beacon chain.

Bacon chain



Beacon Block



Ethereum Clients types

Nodes

- **Full Node**

The full node stores blockchain data (although this is periodically pruned, so a full node does not store all state data back to genesis). Participates in block validation and verifies all blocks and states.

- **Light Node**

The light node was the most common mode in Ethereum 1 among applications running inside the node. After the merge, this option is not yet available, and some experimental clients are working to provide a solution. To speed up the syncing and reduce the storage size, some clients offer **Optimistic sync**, which imports the block even though it has not validated its execution payload. The other option is

Checkpoint sync which speeds up the initial sync by beginning the syncing from a recently finalized checkpoint.

Checkpoints:

Ethereum 1 had a block time around 14s. After the merge, the Beacon Chain has a tempo divided into slots (12 seconds) and epochs (32 slots). Every Epoch last 6.4 minutes, and the first slot in each epoch is a checkpoint.



[Epochs | Mainnet Beacon Chain \(Phase 0\) Ethereum 2.0 Explorer \(beaconscan.com\)](#)

- **Archive Node**

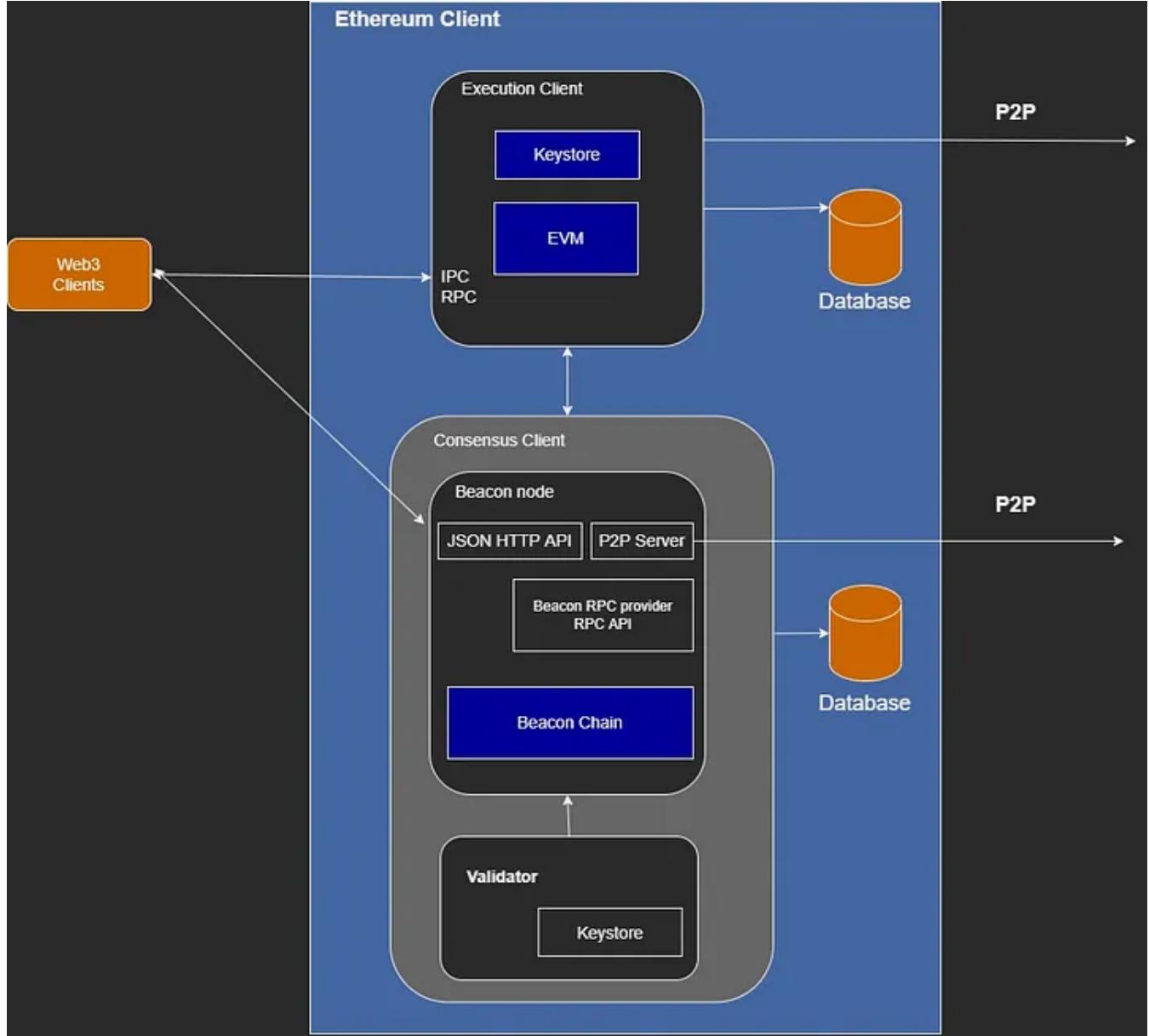
Stores everything kept in the full node and builds an archive of historical states. It is needed if you want to query something like an account balance at block #4,000,000, or simply and reliably test your transactions set without mining them using tracing. Syncing this node could take several weeks and 4 TB of storage.

Running a node according to the requirements.

Two types of nodes (block-producing and non-block-producing). Both nodes will create and maintain two databases, one for client execution with all the transactions and interaction with the EVM, and the other database for consensus (beacon chain).

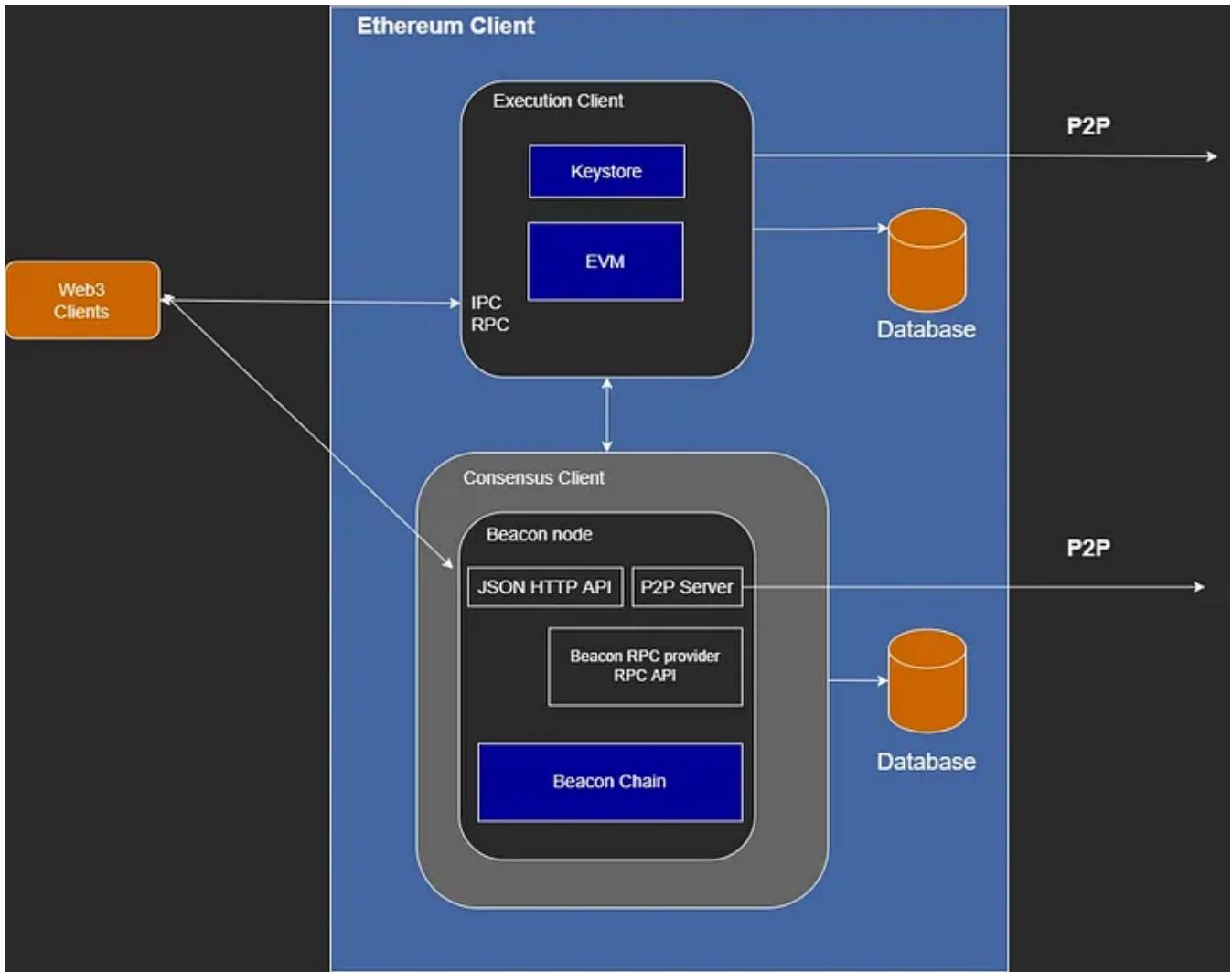
Validator (block-producing)

This node requires all the major components like Execution client and Consensus client with the client validator. To activate the validator is necessary to stake ETH into a smart contract in Ethereum. This staked ETH then acts as collateral that can be destroyed if the validator behaves dishonestly or lazily. The node should stay up and working 24x7 and avoid any downtime that could cost part of the stake.



Non-block-producing

This type of node is used to install Ethereum applications that fully comply with decentralization. The ability for anyone to run their node is critical to maintaining the Ethereum network's decentralization. To install a non-block-producing, consensus and execution clients are required without the validator client.



Execution clients

- [Go Ethereum\(Geth\)](#)
- [Besu](#)
- [Nethermind](#)
- [Erigon](#)
- [OpenEthereum](#)

Consensus clients

- [Lighthouse](#): written in Rust
- [Nimbus](#): written in Nim
- [Prysm](#): written in Go
- [Teku](#): written in Java
- [Lodestar](#): written in Typescript

Node Synchronization

After the merge, a node sync means both clients, execution, and consensus doing the sync. For example, we will consider using Geth for execution and Prysm for consensus.

How to check the sync state of your node

```
curl http://localhost:3500/eth/v1/node syncing | jq
```

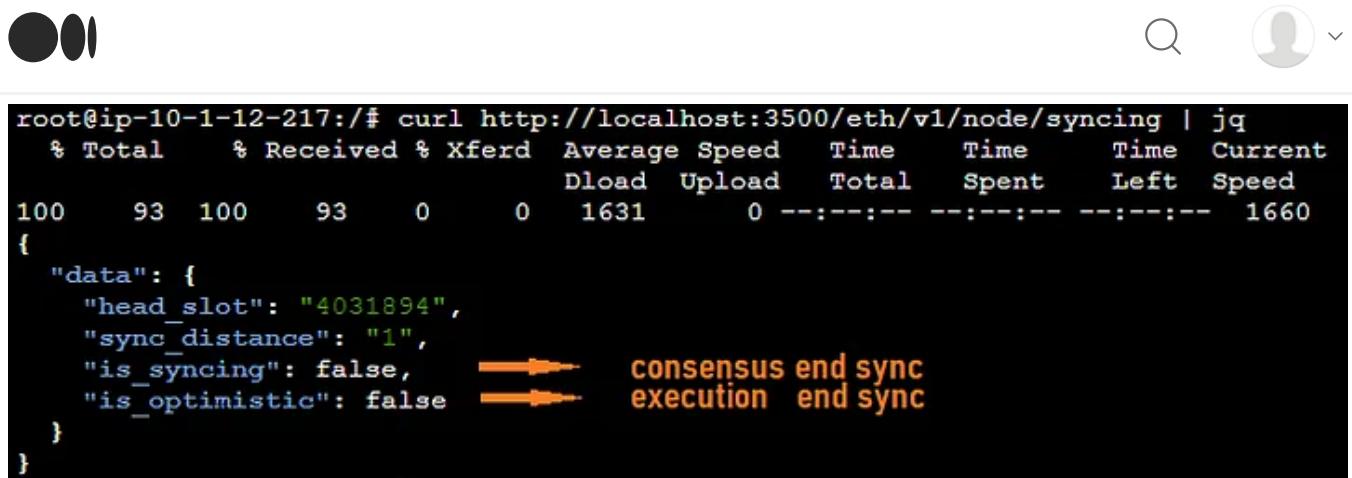
This node has finished the consensus sync and is still syncing execution.

```
root@ip-10-1-14-189:/# curl http://localhost:3500/eth/v1/node syncing | jq
  % Total    % Received % Xferd  Average Speed   Time     Time      Current
                                         Dload  Upload   Total   Spent   Left  Speed
100      92  100      92      0      0    681       0 --::-- --::-- --::--  686
{
  "data": {
    "head_slot": "4838849",
    "sync_distance": "0",
    "is_syncing": false,  ➔ consensus end sync
    "is_optimistic": true ➔ execution sync active
  }
}
```

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```
root@ip-10-1-12-217:/# curl http://localhost:3500/eth/v1/node syncing | jq
  % Total    % Received % Xferd  Average Speed   Time     Time      Current
                                         Dload  Upload   Total   Spent   Left  Speed
100      93  100      93      0      0   1631       0 --::-- --::-- --::--  1660
{
  "data": {
    "head_slot": "4031894",
    "sync_distance": "1",
    "is_syncing": false,  ➔ consensus end sync
    "is_optimistic": false ➔ execution end sync
  }
}
```

Execution client

Execution takes more time, and it's possible to check the state. We will see examples of a syncing node end and node still syncing.

```
geth attach ipc:/root/.ethereum/geth.ipc
```

Execution sync active

```
Welcome to the Geth JavaScript console!

instance: Geth/v1.10.23-stable-d901d853/linux-amd64/go1.18.5
coinbase: 0x42667f8e95a91bf2c7ed0382169fd9b43a281b60
at block: 0 (Thu Jan 01 1970 00:00:00 GMT+0000 (UTC))
datadir: /root/.ethereum
modules: admin:1.0 debug:1.0 engine:1.0 eth:1.0 ethash:1.0 miner:1.0 net:1.0 personal:1.0 rpc:1.0 txpool:1.0 web3:1.0

To exit, press ctrl-d or type exit
> eth.syncing
{
  currentBlock: 15675043,
  healedBytecodeBytes: 464073639,
  healedBytecodes: 57996,
  healedTrieNodesBytes: 33415482984,           difference 112 blocks
  healedTrieNodes: 168441086,
  healingBytecode: 0,
  healingTrieNodes: 1108,
  highestBlock: 15675155,                      █
  startingBlock: 15646043,
  syncedAccountBytes: 44291160141,
  syncedAccounts: 496025057,
  syncedBytecodeBytes: 4064468743,
  syncedBytecodes: 630467,
  syncedStorage: 747249601,
  syncedStorageBytes: 160145704527
}
```

Execution client sync ended.

```
Welcome to the Geth JavaScript console!

instance: Geth/v1.10.23-stable-d901d853/linux-amd64/go1.18.5
coinbase: 0x4adff93b2338e2e5d4d9f0fbc10b0ca17c86848f
at block: 7710487 (Tue Oct 04 2022 13:44:48 GMT+0000 (UTC))
datadir: /root/.ethereum
modules: admin:1.0 clique:1.0 debug:1.0 engine:1.0 eth:1.0 miner:1.0 net:1.0 personal:1.0 rpc:1.0 txpool:1.0 web3:1.0

To exit, press ctrl-d or type exit
> eth.syncing
false
> █
```

References

<https://ethereum.org/en/developers/docs/>

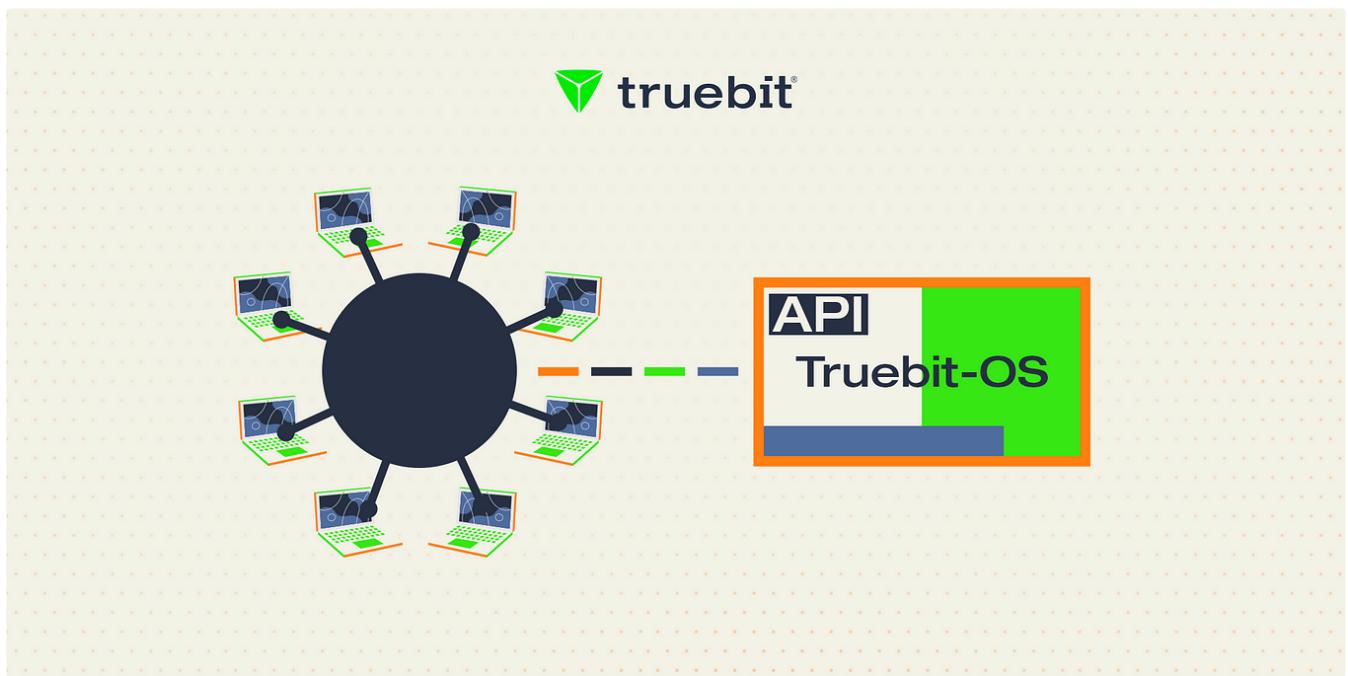


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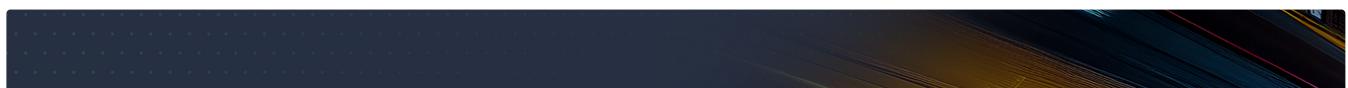
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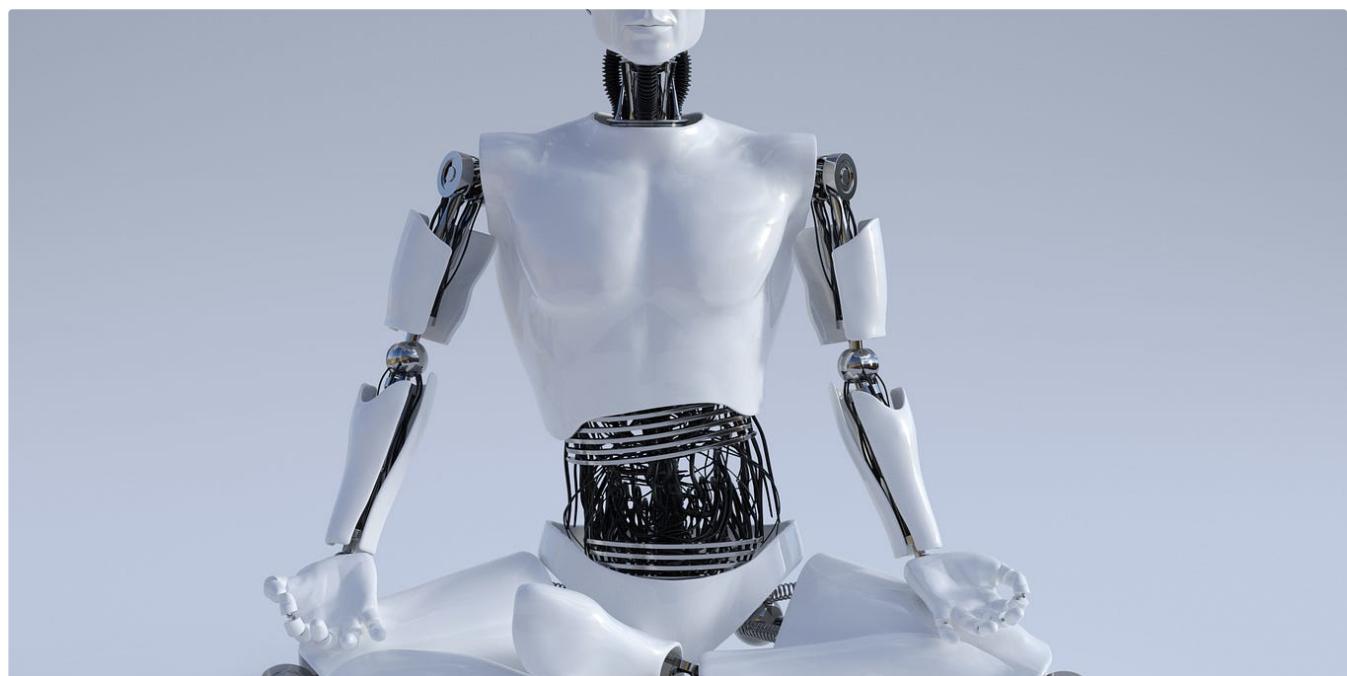
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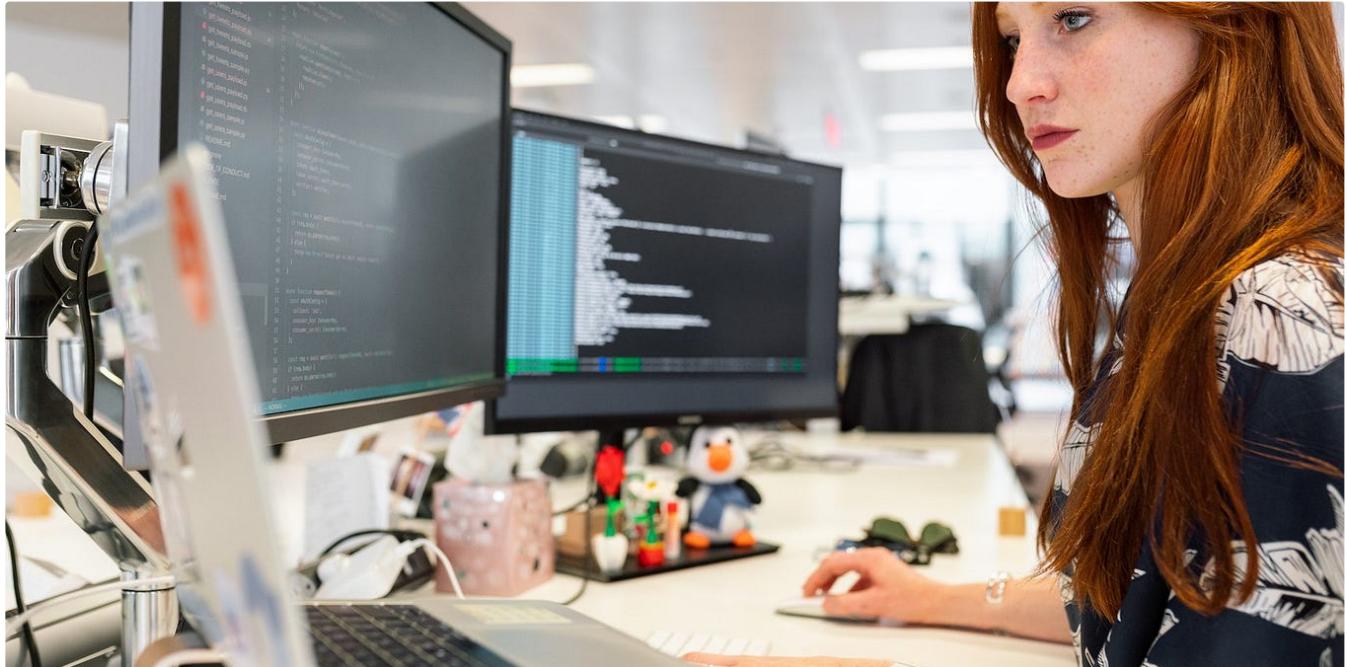
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```
commit ffcf2c01b7ef612893529cef188cc1961ed64521 (HEAD -> master, origin/master, origin/bors/staging, origin/HEAD)
Merge: fc991bf81 5159211da
Author: iohk-bors[bot] <43231472+iohk-bors[bot]@users.noreply.github.com>
Date: Tue Nov 8 17:44:34 2022 +0000

Merge #4563

4563: New p2p topology file format r=coot a=coot

Fixes #4559.

Co-authored-by: Marcin Szamotulski <coot@coot.me>
Co-authored-by: olgahryniuk <67585499+olgahryniuk@users.noreply.github.com>

commit fc991bf814891a9349f22cf278632d39b04d4628
Merge: 5633d1c05 5cd94d372
Author: iohk-bors[bot] <43231472+iohk-bors[bot]@users.noreply.github.com>
Date: Tue Nov 8 13:07:58 2022 +0000

Merge #4613

4613: Update building-the-node-using-nix.md r=CarlosLopezDeLara a=CarlosLopezDeLara

Build the cardano-node executable. No default configuration.

Co-authored-by: CarlosLopezDeLara <carlos.lopezdelara@iohk.io>

commit 5159211da7a644686a973e4fb316b64ebb1aa34c
Author: olgahryniuk <67585499+olgahryniuk@users.noreply.github.com>
Date: Tue Nov 8 13:25:10 2022 +0200
```

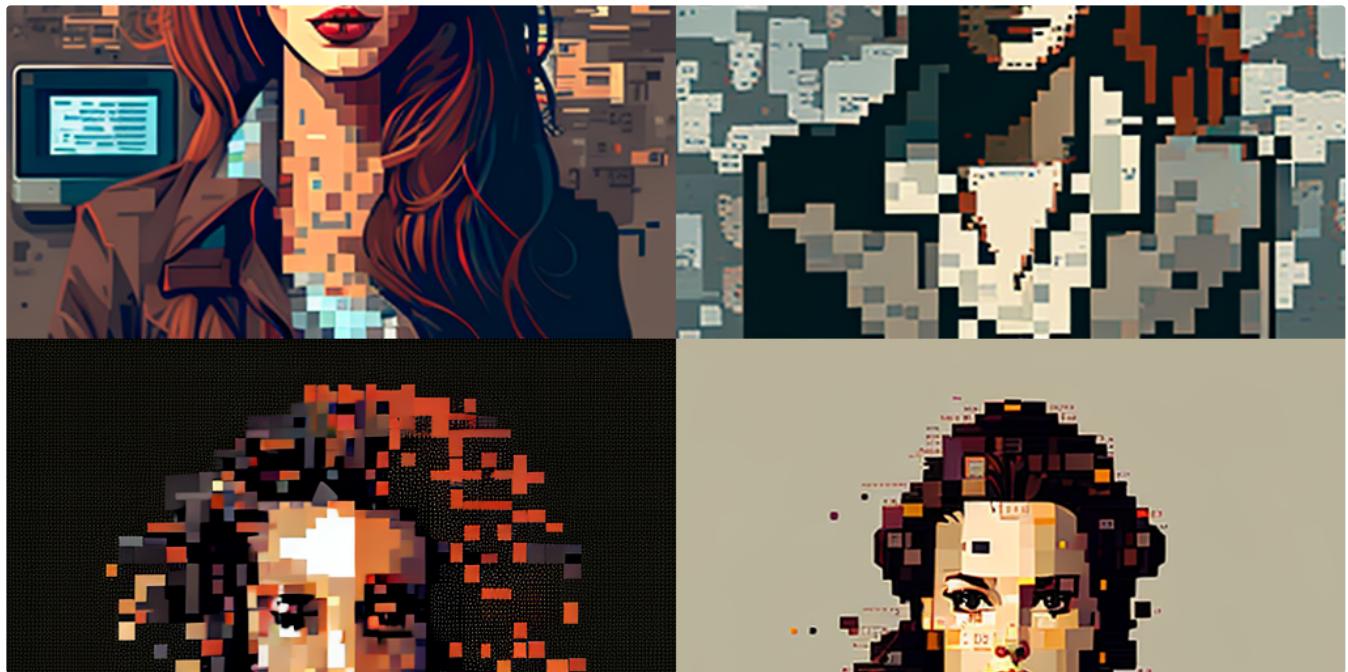
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