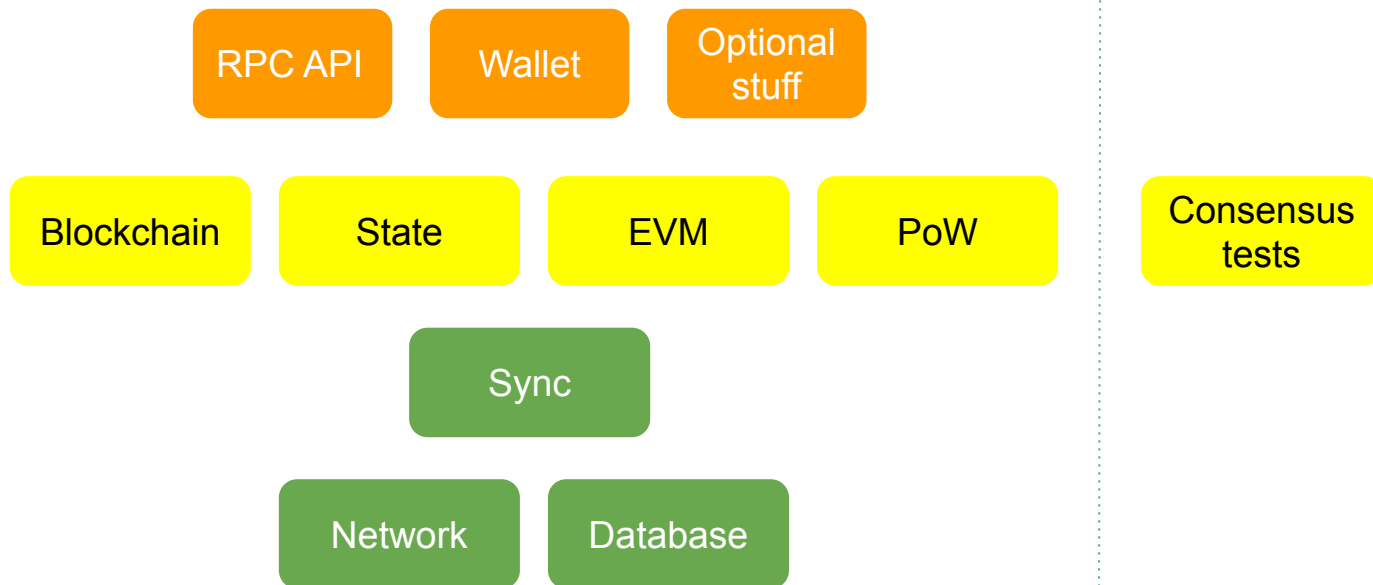


# Anatomy of an Ethereum client

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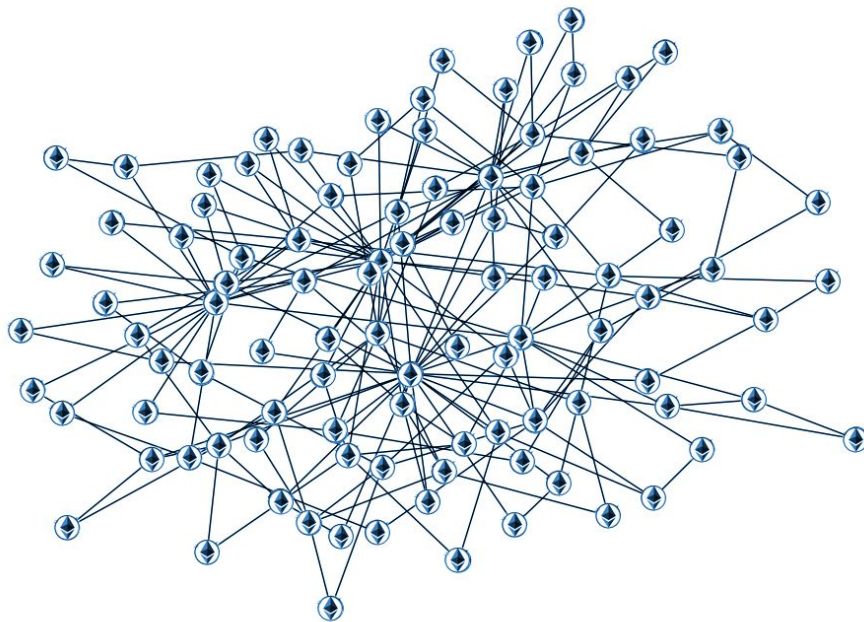
Andrei Maiboroda [github.com/gumb0](https://github.com/gumb0)  
Devcon3

# Ethereum client



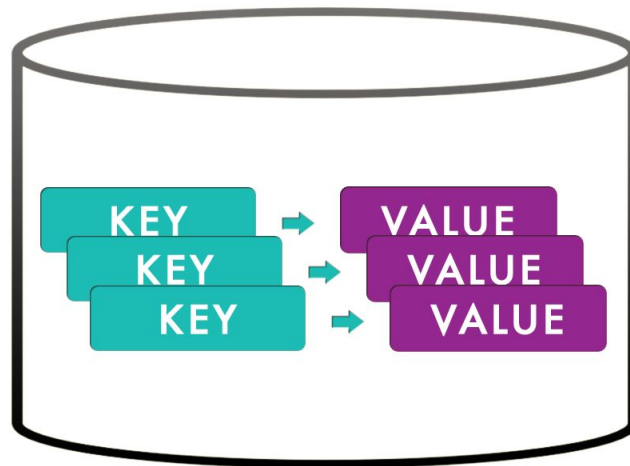
# Network communication

- Discovery protocol
- devp2p & RLPx
- eth protocol
- Fast sync protocol
- Warp protocol
- etc.



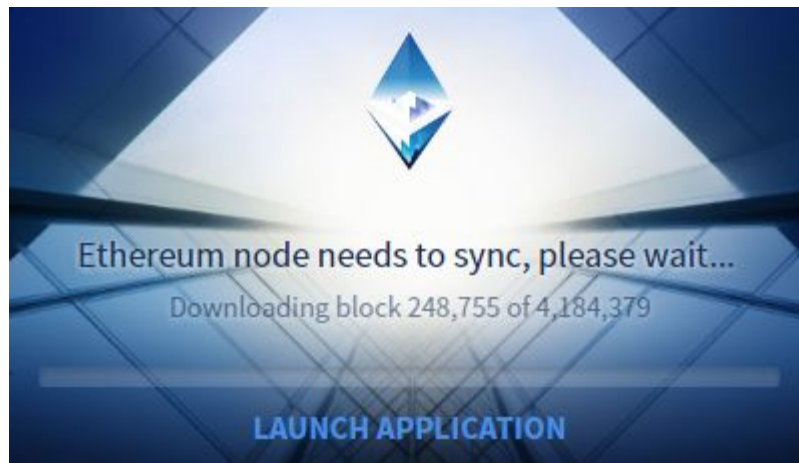
# Databases

- Blockchain database
- State database
- Indices
- Caching
- Pruning



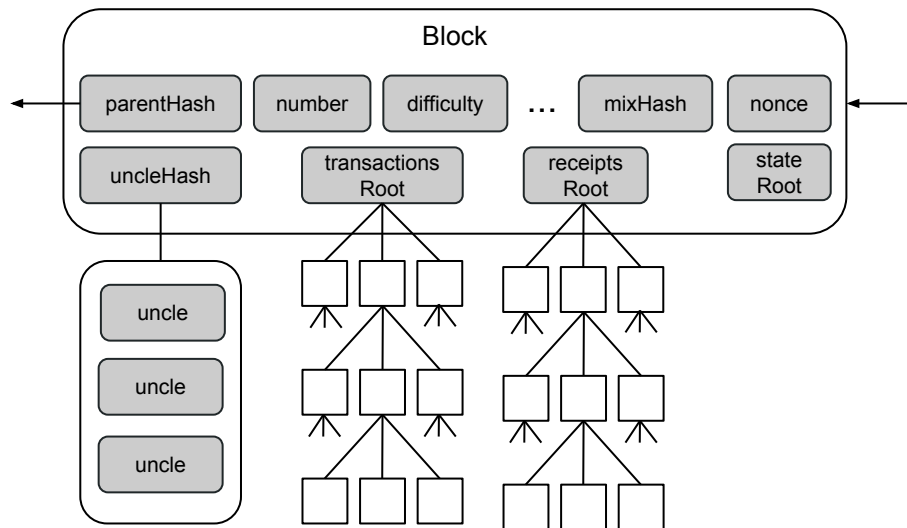
# Synchronization

- Full (Archive) sync  
Downloads all blocks and executes all txs
- Fast sync  
Downloads all blocks and the state trie
- Snapshot (Warp) sync  
Downloads compressed blocks and the state
- Light client  
Doesn't have the full blockchain and state



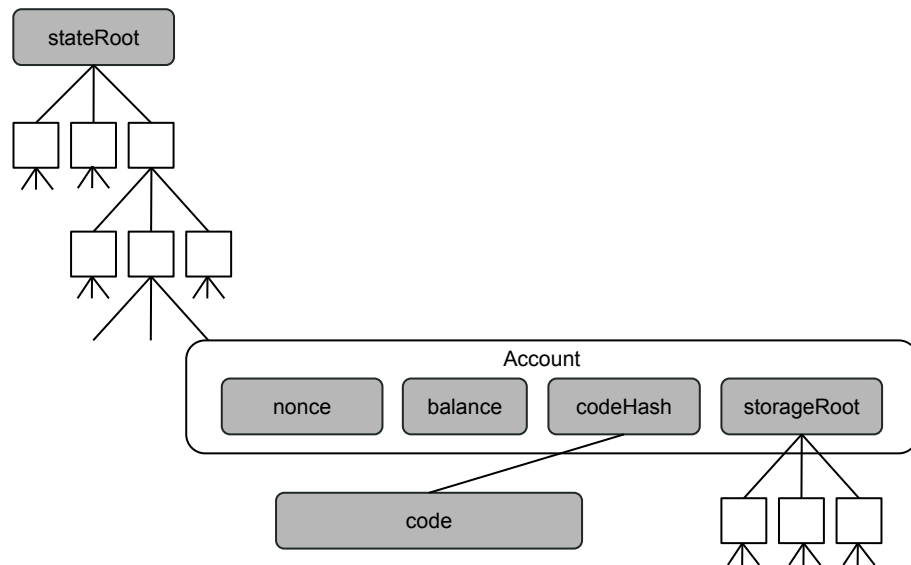
# Blockchain

- Blocks
- Transactions
- Difficulty calculation
- Signing transactions
- RLP-encoding
- Validation
- etc.



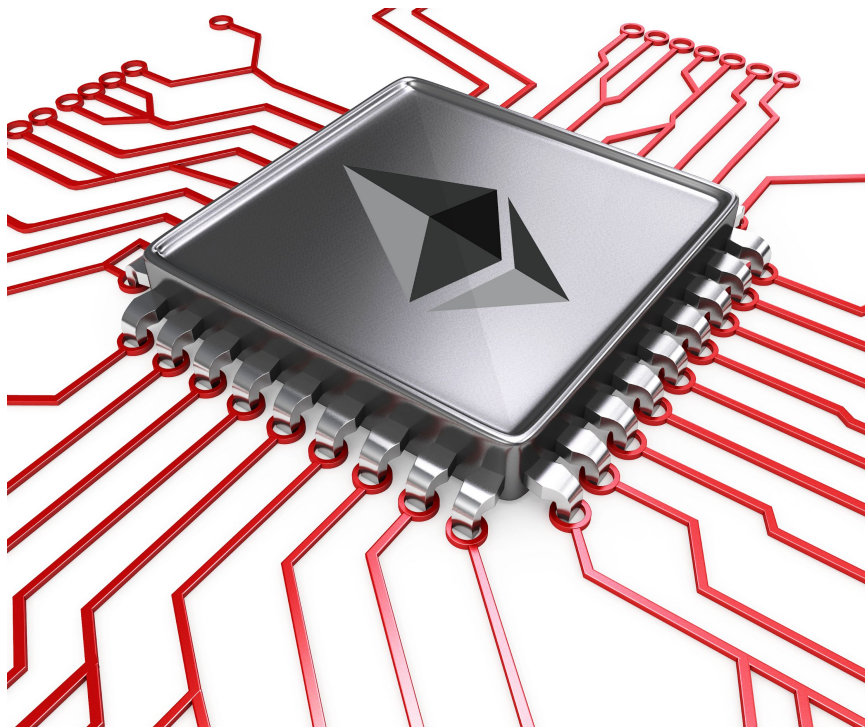
# State

- Accounts
- Contracts code & storage
- Merkle Patricia Trie
- Higher level interface to key-value storage of State DB



# Ethereum Virtual Machine

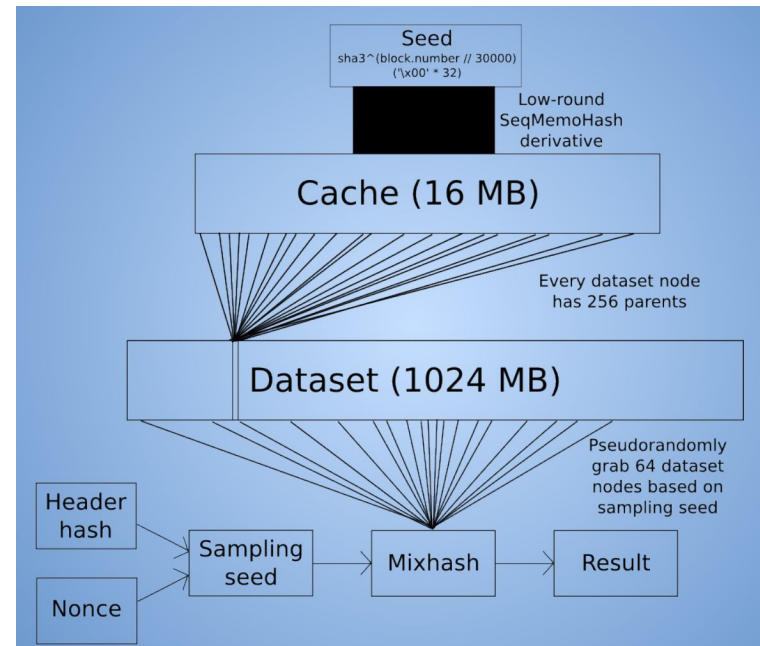
- Instruction execution
- Gas calculation
- Updating the State
- Optimizations
- Interpreter vs JIT





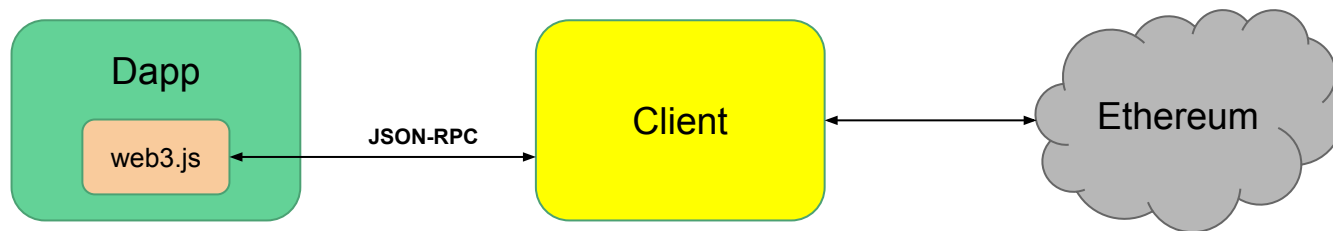
# Proof of Work

- Ethash
- Block seal validation
- Sealing new blocks
- Other seal engines (Rinkeby, Kovan)



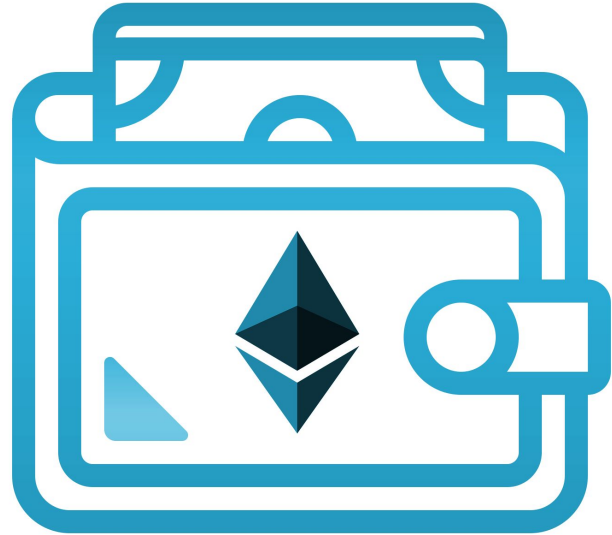
# RPC API

- Backend for web3.js
- JSON-RPC
- Can be used remotely
- <https://github.com/ethereum/wiki/wiki/JSON-RPC>



# Wallet

- Needed to send the transactions
- Managing accounts
- Import/export
- Signing the transactions



# Optional stuff

- Import/export blockchain
- Console
- Debugging tools
- Compilers
- Mining
- Optimizations
- etc.

# Consensus Tests

- Parse JSON tests
- Execute operations
- Compare with expected state
- Pass all the tests

```
{
  "callcall_00" : {
    "_info" : {
      "comment" : "",
      "filledwith" : "cpp-1.3.0+commit.b90fb307.Linux.g++",
      "source" : "/src/GeneralStateTestsFiller/stCallCodes/callcall_00Filler.json"
    },
    "env" : {
      "currentCoinbase" : "0x2adc25665018aa1fe0e6bc666dac8fc2697ff9ba",
      "currentDifficulty" : "0x20000",
      "currentGasLimit" : "0x01c9c380",
      "currentNumber" : "0x01",
      "currentTimestamp" : "0x03e8",
      "previousHash" : "0x5e20a0453cecd065ea59c37ac63e079ee08998b6045136a8ce6635c7912ec0b6"
    },
    "post" : {
      "Byzantium" : [
        {
          "hash" : "0x7ebd8fdaaeb5e96fd2ad3b11c675e3b16e5902ae4fe100710f39925e59ccd914",
          "indexes" : {
            "data" : 0,
            "gas" : 0,
            "value" : 0
          },
          "logs" : "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347"
        }
      ]
    }
  }
},
```

# Ethereum client

