



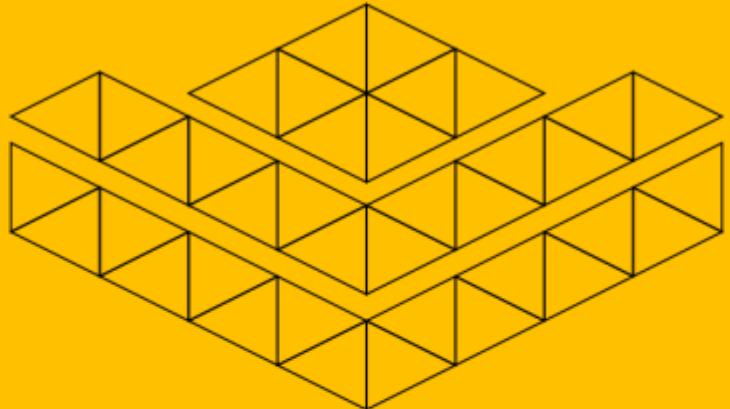
BLOCKCHAIN
ACADEMY

D.A.T.N. : The Ultimate Economic Disruptor

From cyphern anarchism to a new way of business

Prof. Courtney “CognoChain” Guimarães
BTM, CTO and Data Scientist, Capital Markets & FSI

Courtney@blockchainacademy.com.br
+55.11.98325.0167



BLOCKCHAIN
ACADEMY

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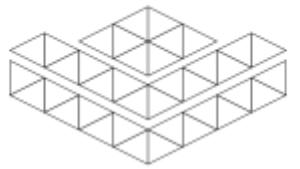
100% ETHEREUM
ARCHITECTURE

SÃO PAULO



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PACTO DE CURSO



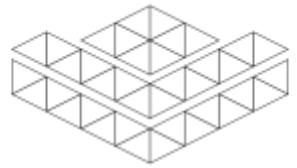
Course Proposal

What

- No coder, yes Designer
- Ethereum Full Stack Developer
 - Network
 - Solidity
 - Complements (IPFS, Swarm, etc)
 - News and roadmaps
- Learner.

How to

- No one left behind
 - But not for lasies.
- Co-Creation
- Start on solid foundation,
- Move fast on rapid designs,
- Run faster on practical apps.



Course Proposal

bloco 1: Arquitetura geral
Ethrereum

bloco 2: Destrave e Clientes,
instalação

bloco 3: Curso solidity

bloco 4: lab de codigo 1 (codigos
leves)

bloco 5: lab de codito 2 (codigos
leves)

bloco 6: Lab de codigo 3 (codigos
leves)

bloco 7: Lab de projetos (projeto
complexo, tipo pokemon ou
outro)

bloco 8: Lab de projetos (projeto
complexo)

bloco 9: Hackathom, lab com
apoio de professores.

bloco 10: Finals Day -
apresentação de projeto e
conclusoes.



Visual intelligence
By Prof. Courtnay Guimarães

Hash Rate

The estimated number of tera hashes per second (trillions of hashes per second) the Bitcoin network is performing.

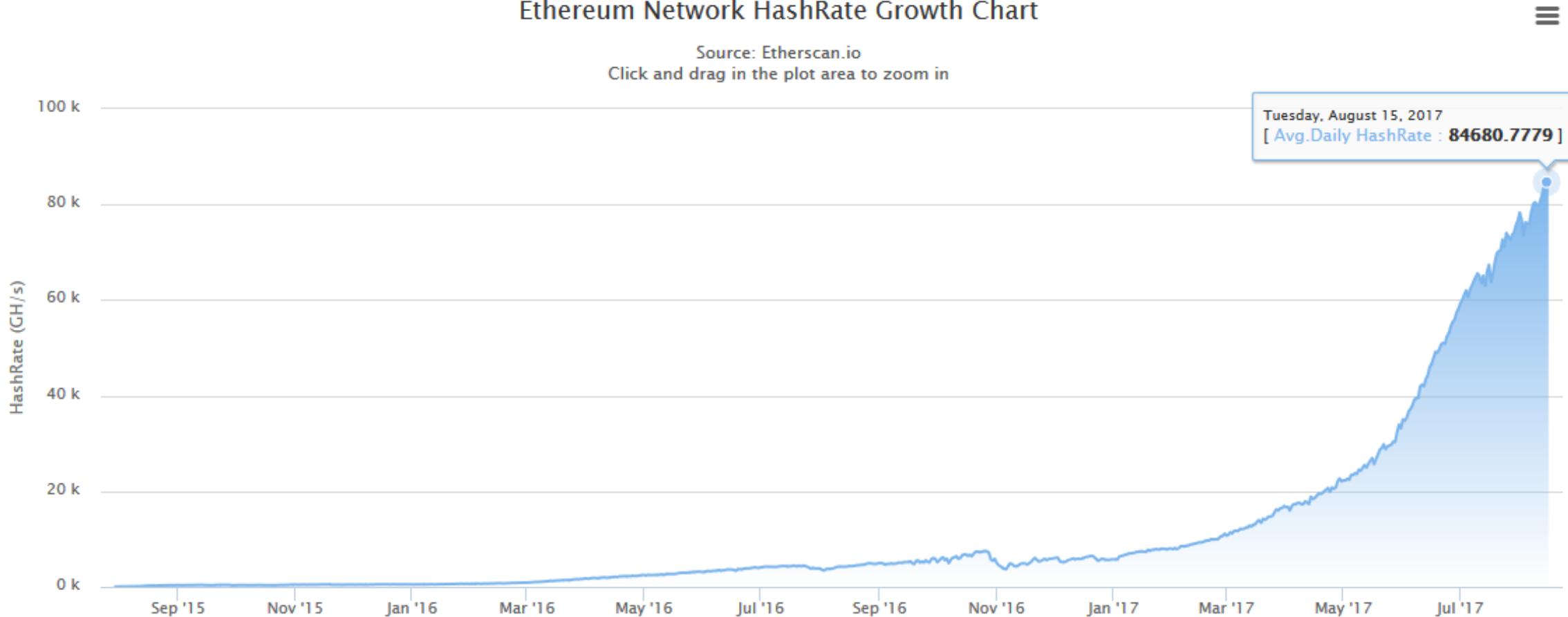
Source: blockchain.info

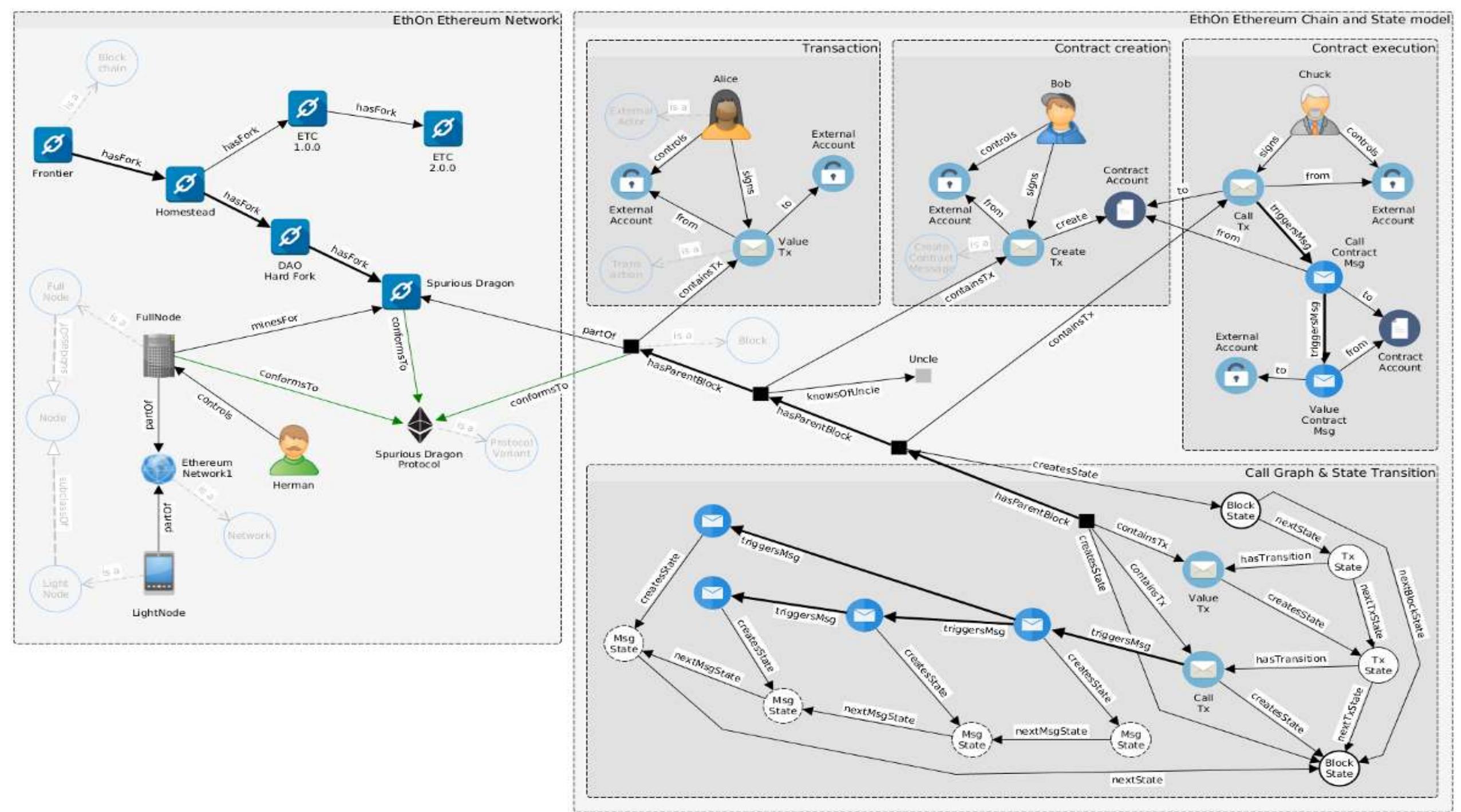


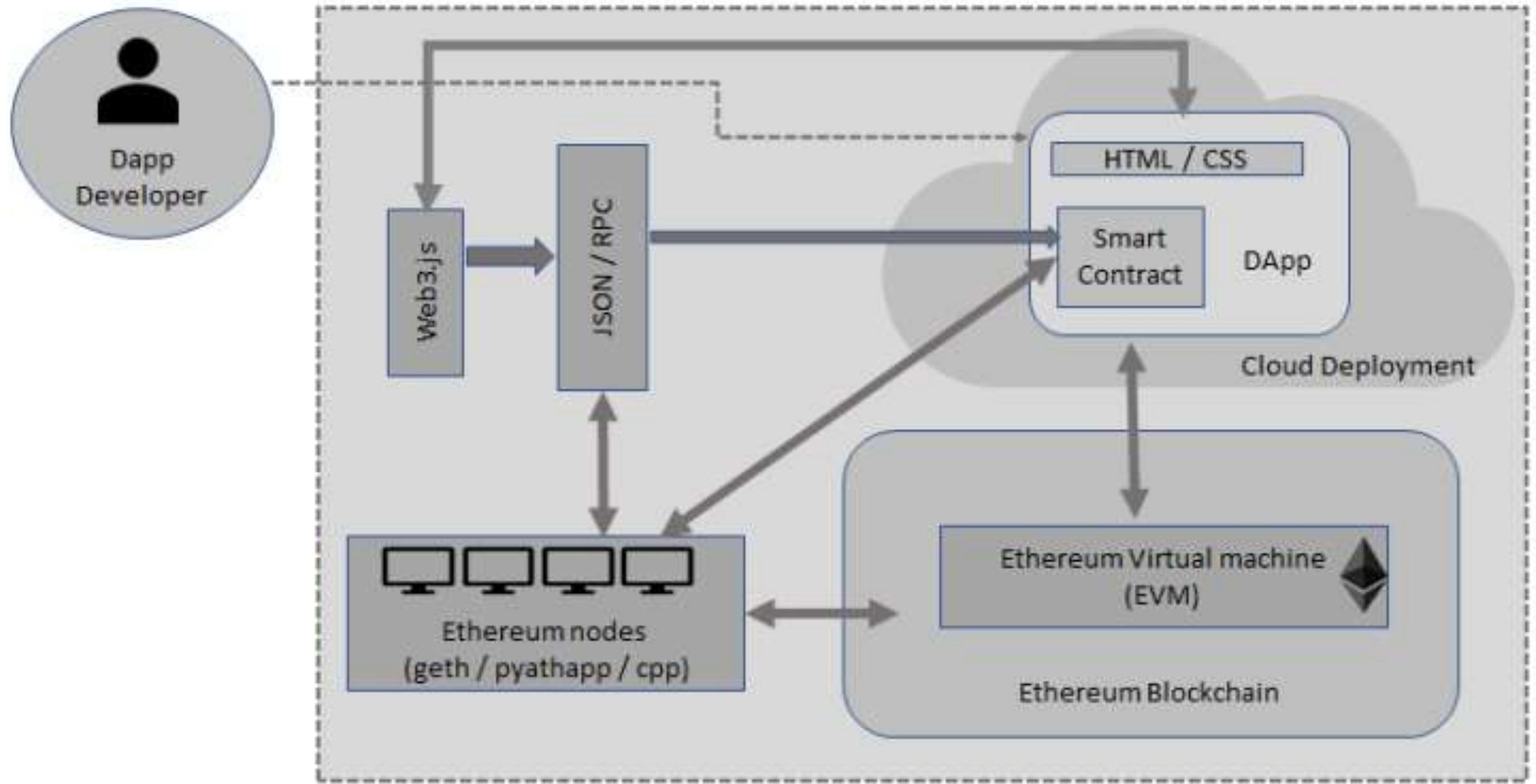
Ethereum Network HashRate Growth Chart

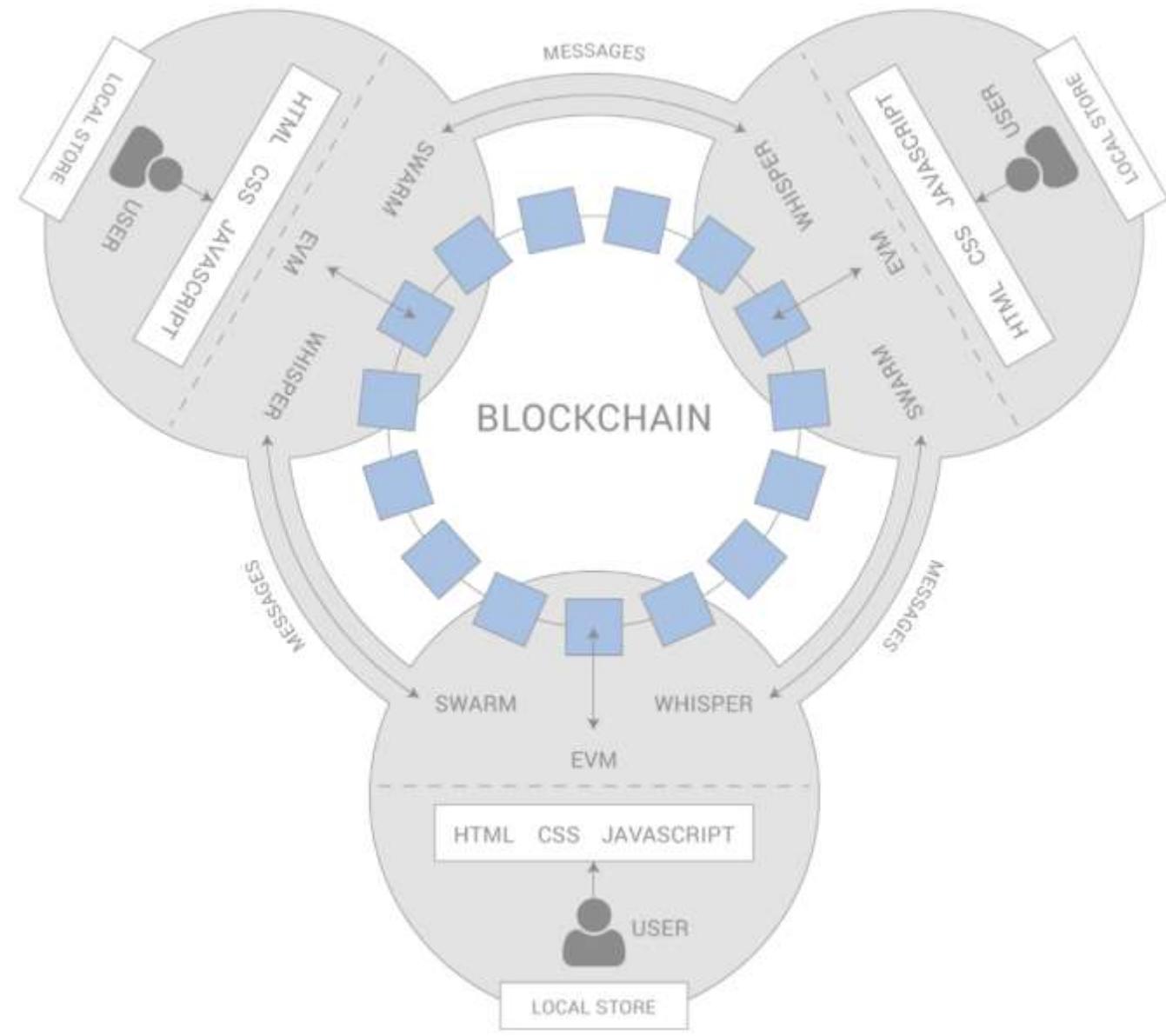
Source: Etherscan.io

Click and drag in the plot area to zoom in









Ethereum Pending Transactions Queue – Time Series

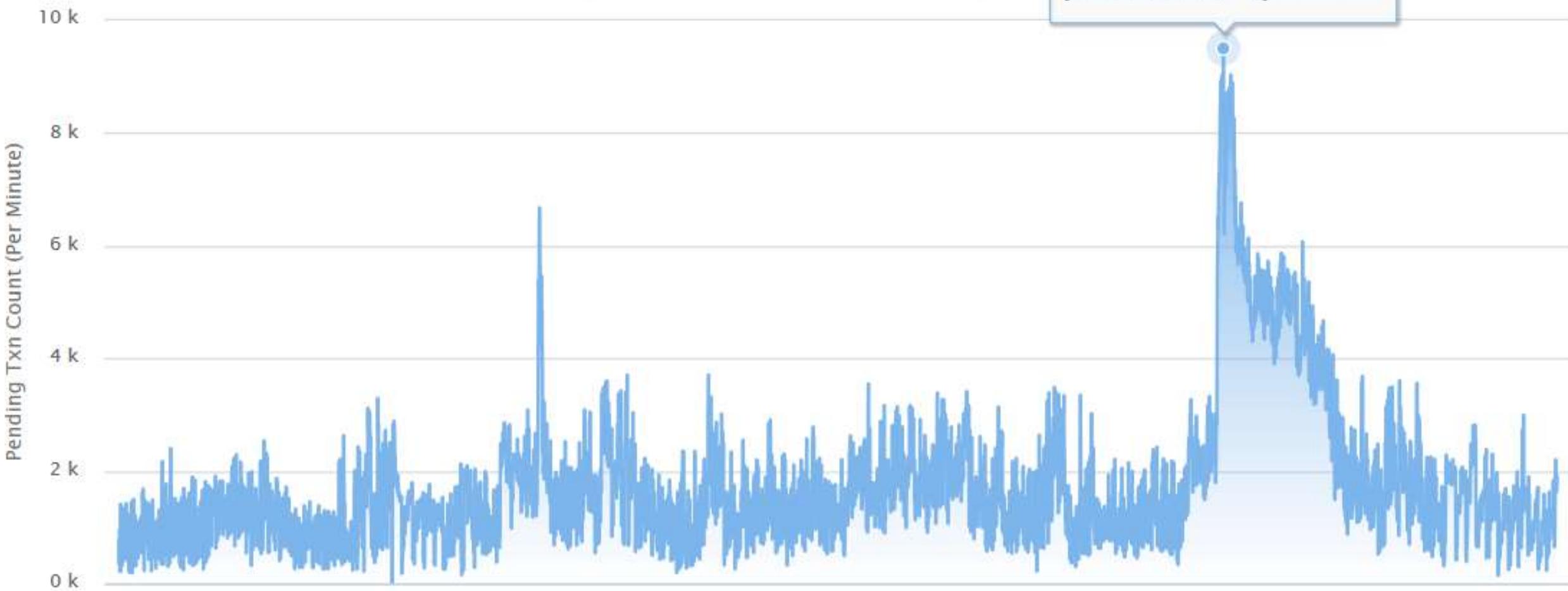


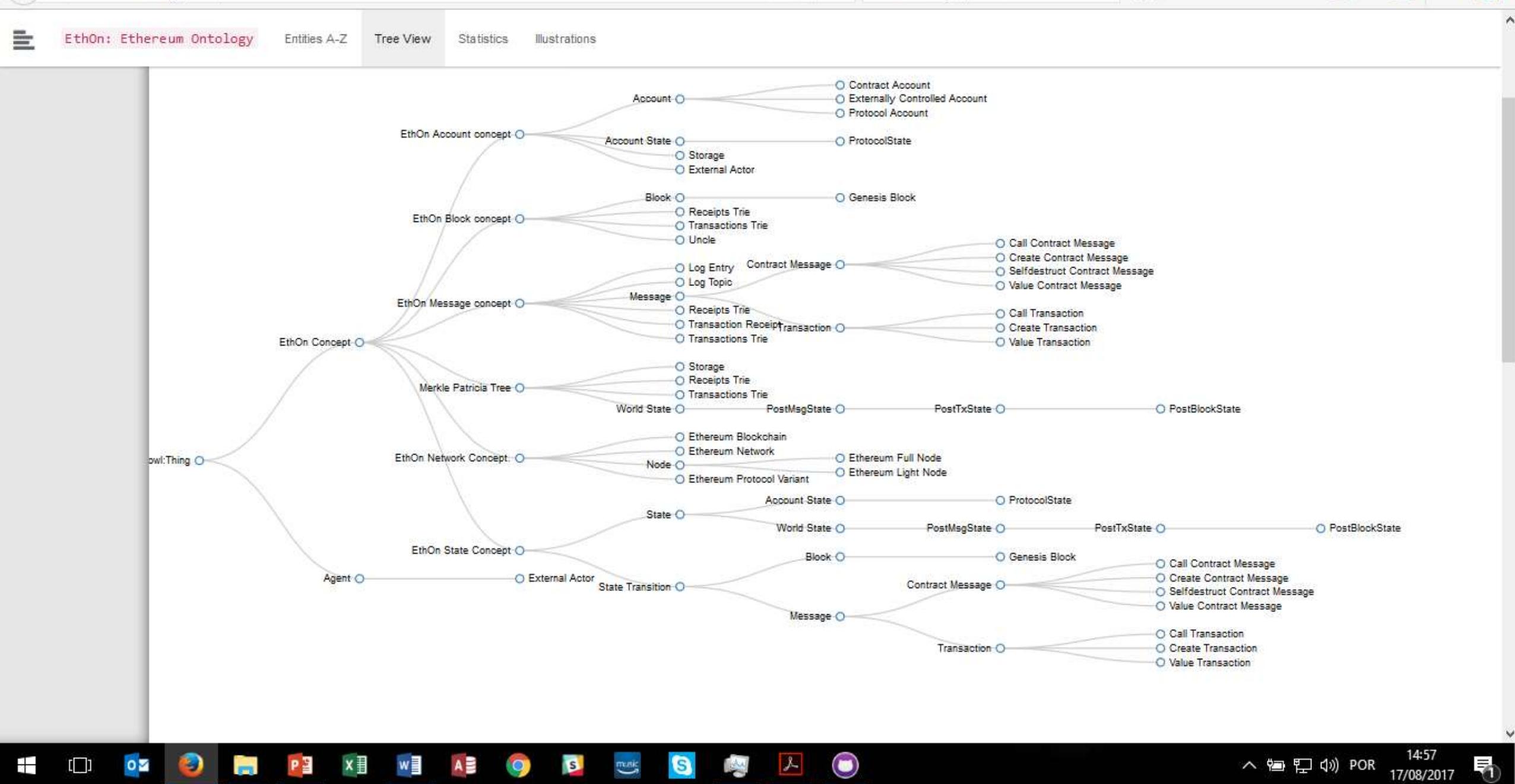
Source: Etherscan.io

(From 7/30/2015 to 8/17/2017)

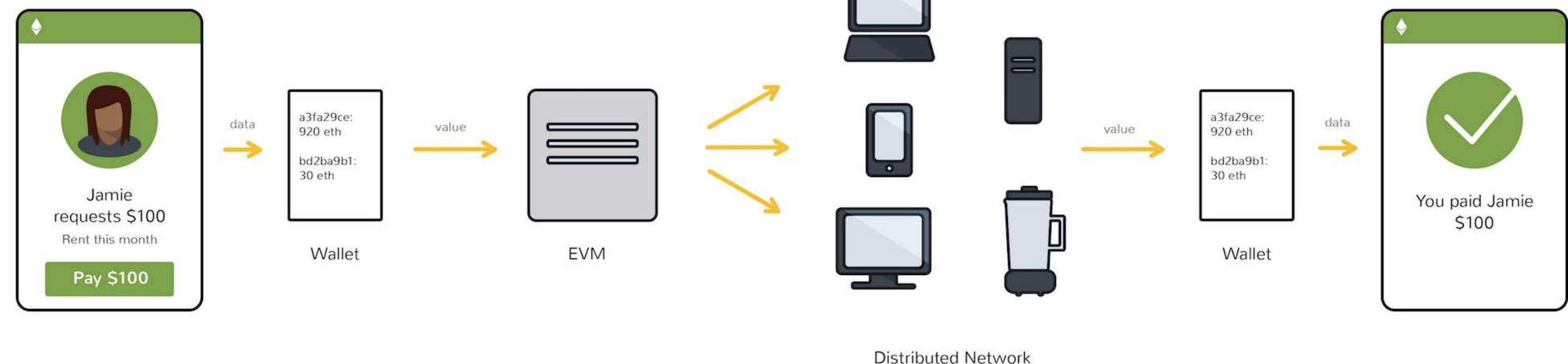
Click and drag in the plot area to zoom in

Wednesday, August 16, 2017 3:35 PM
[Txn Count: 9503]





Ethereum App



Ethereum ChainData Size (Geth w/FullArchive Sync)



Source: Etherscan.io

Click and drag in the plot area to zoom in

300 Gb

250 Gb

200 Gb

150 Gb

100 Gb

50 Gb

0 Gb

Wednesday, August 16, 2017

[DataSize in Bytes) : 256995507249]

Data Size in Gb: 239.35 Gb

Size In Bytes

Oct '15

Jan '16

Apr '16

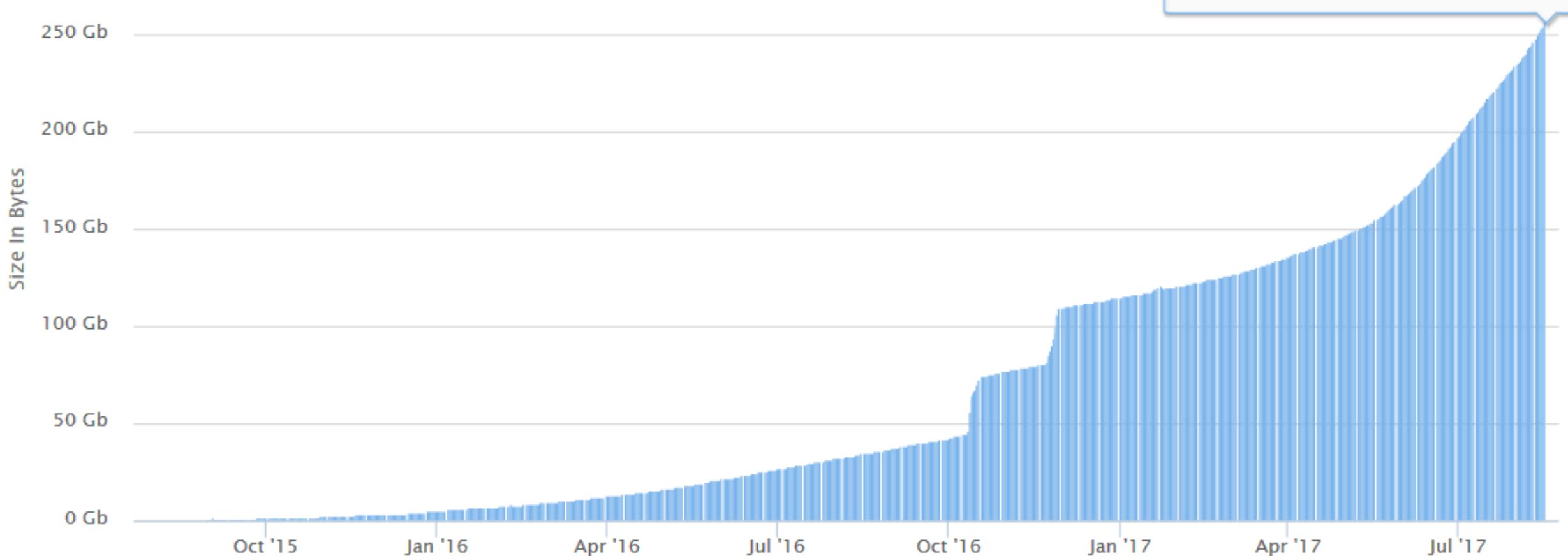
Jul '16

Oct '16

Jan '17

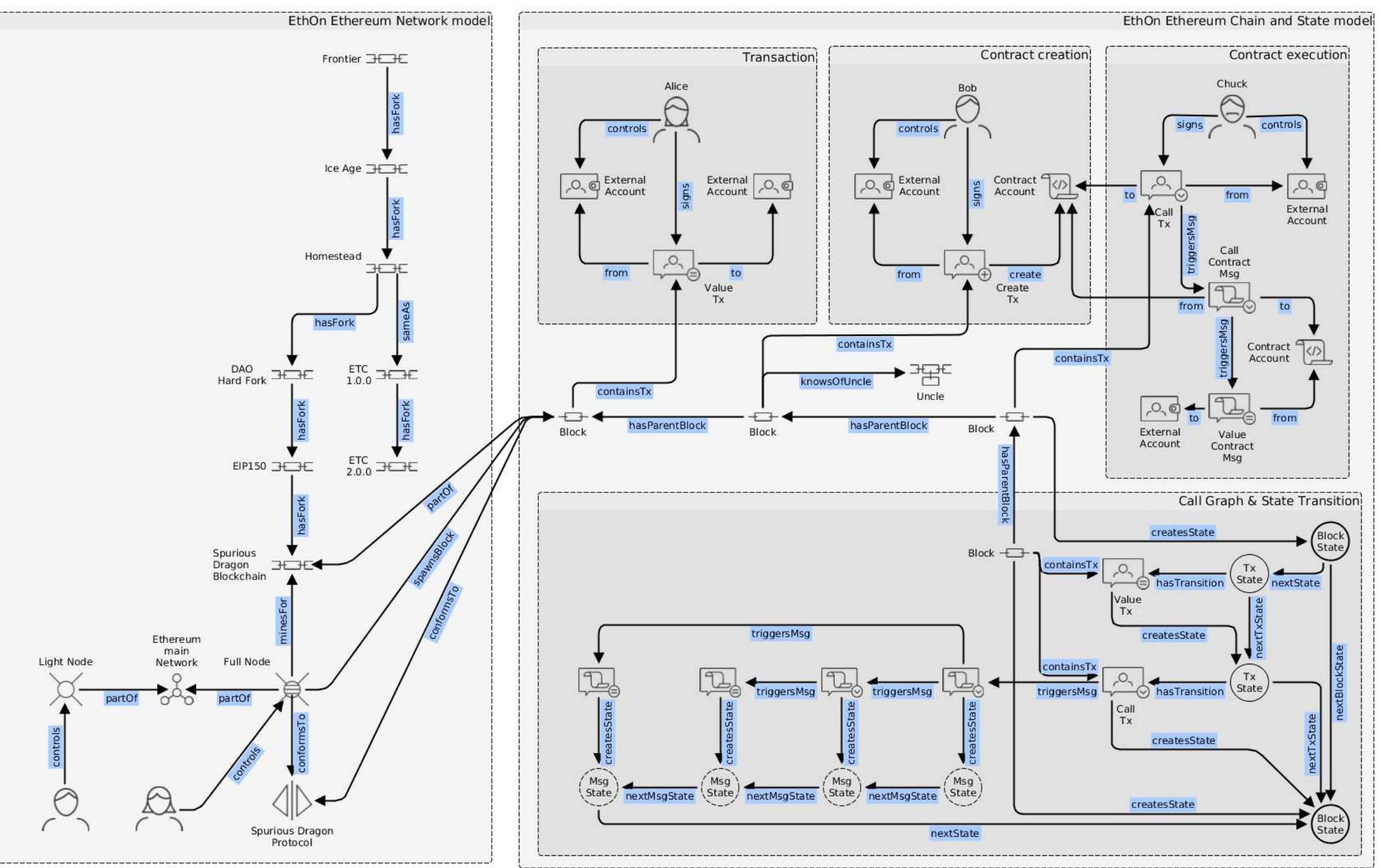
Apr '17

Jul '17





Visual intelligence
By Prof. Courtnay Guimarães





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Alinhamento de Conceitos

So What is Ethereum?

- Next-generation foundational layer
- On its own blockchain
- State tree and TX list separation
- Built-in Turing-complete programming language

Ethereum Script

- Stack-based language with 60 opcodes
- Non-persistent stack
- 2^{256} memory entries (also non-persistent)
- 2^{256} storage entries, which constitute the contract's permanent state

Users will not need to code in this language



Compilers for other languages will be available

Namecoin

```
if tx.value < block.basefee * 200:  
    stop  
if contract.storage[tx.data[0]] or tx.data[0] < 100:  
    stop  
contract.storage[tx.data[0]] = tx.data[1]
```

‘s
reat things
operating systems,





Microsoft

CONTENTFUL

G

GOOGLE

Microsoft



Ethereum

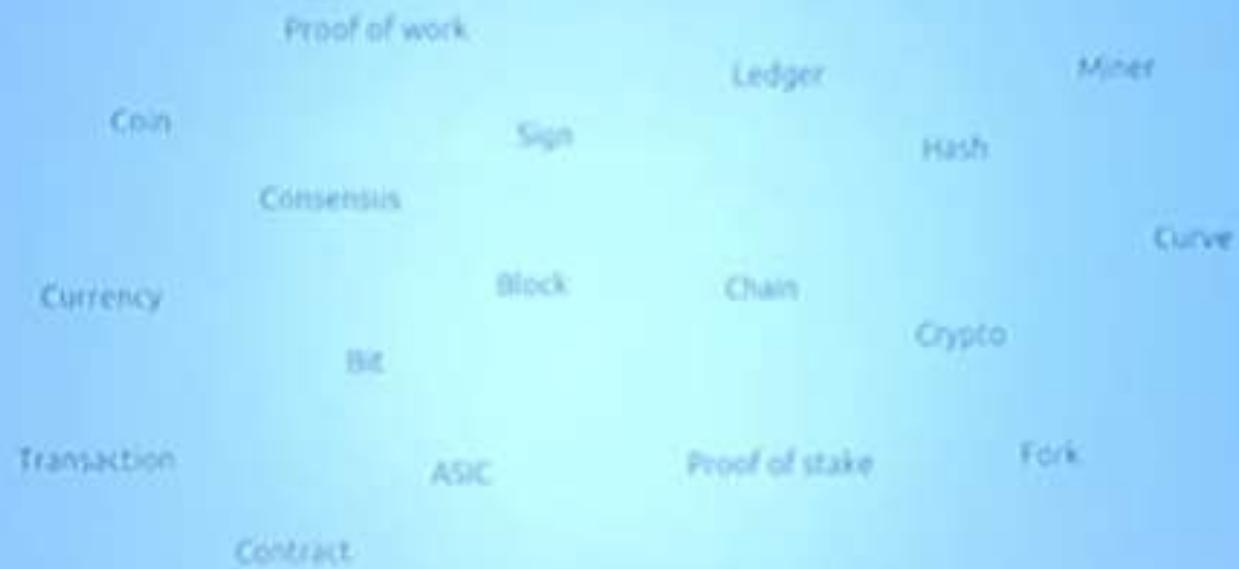
So now we've built it, WTF is it?

Dr. Gavin Wood

co-founder and lead developer, ethereum project

@gavofyork

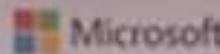
Important Things to **Forget**



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CONSENSYS



etherchain.org
bitnodes.info
blockchain.info
etherchain.org





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Microsoft

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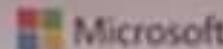




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8 10 11 12 13

It's a Computer, Silly!

Slow

Code runs 5-100x slower than natively compiled

Expensive to use

Basic computation, memory and storage costs are ~1950s levels

Not always immediately decisive

Actions of last 60s may be reorganised





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▲ S □ EIPX □ Binance

Actually, it is.

Truly Global Singleton

One computer for the entire planet now and forever

Cannot Fail, be Stopped, be Censored

No authority, government or corporation behind it, resistant to attack

Ubiquitous

Where ever there's Internet, there's Ethereum





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Sponsor



support



partner



Natively Multi-User

Has as many accounts as is needed

Natively Object-Oriented

Encapsulation enforced in "virtual silicon"

Accessible

Where ever there's Javascript, there's Ethereum

Verifyable & Auditable

All code honoured now and forever



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Consensus



Microsoft

Consensus



8

medium

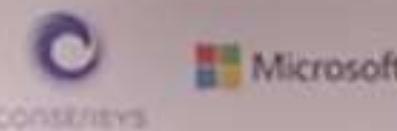


Blockchain
Consensus
World Computer



6:44 / 23:51





5 6 7 8

Presentations: Ethereum, Solidity, Web3.js, Blockchain, Cryptocurrency

Guarantees

Atomicity

Entire operation runs or nothing does

Synchrony

No two operations can interfere with each other

Provenance

All messages (method calls) can be inspected to determine caller address





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S EIP-1559

Guarantees

Permanence

Object's data are permanent

Immortality

Object can never be externally deleted - can only voluntarily commit suicide

Immutability

Object's code can never be changed



9:03 / 23:51





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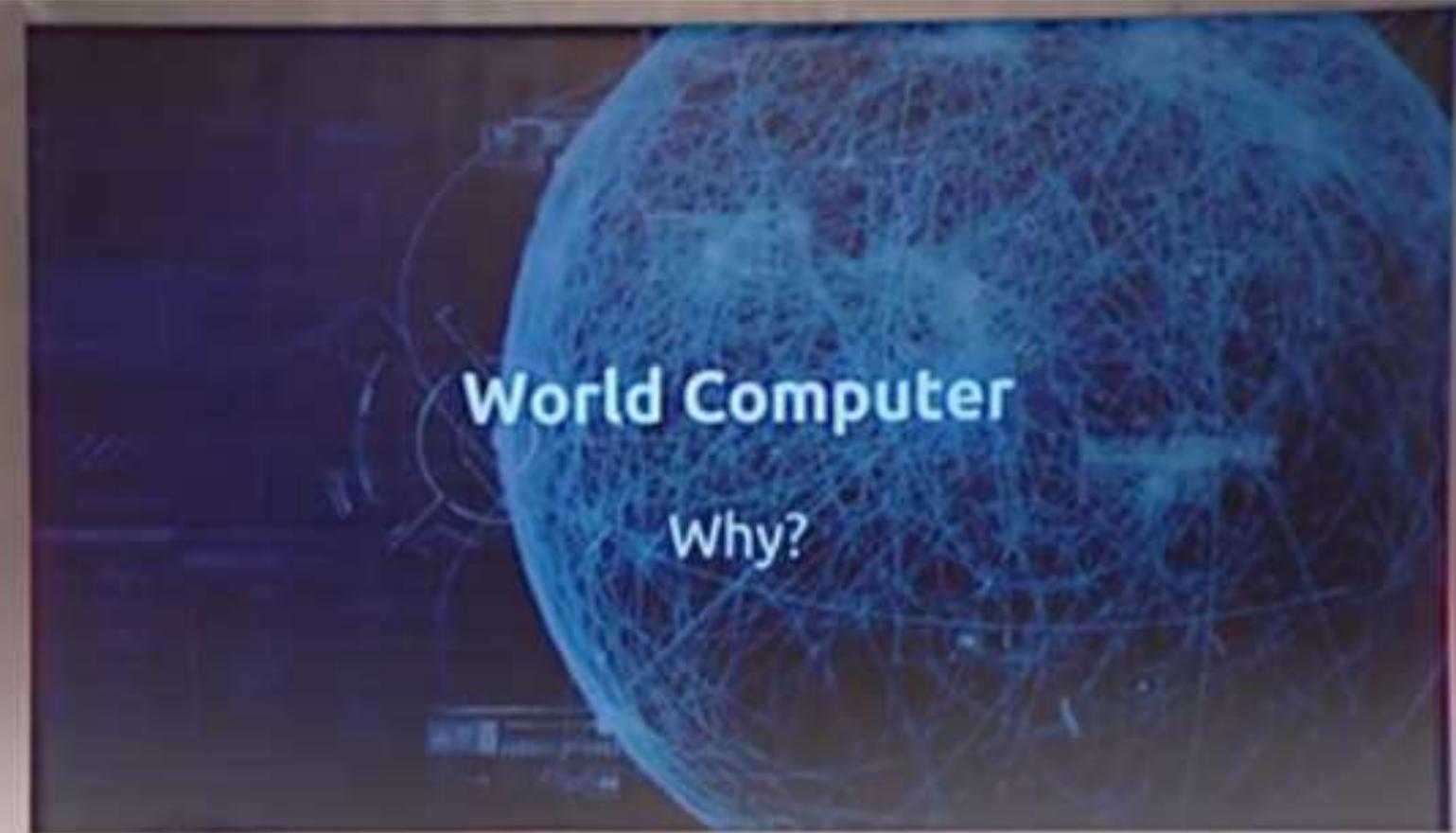
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Microsoft

SPIN Project CDTI Blockchain





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Ethereum is an Innovation Commons

Compared to the walled garden of the server





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Microsoft

S 1 / 14 11:15 23:51

Servers are Walled Gardens

Interoperability Difficult

Reliability, standards, trust, security collude to make it a nightmare

Increased Barriers

Naturally supportive of monopolies;
try integrating trade or payment without a third party

Cumbersome

Servers are expensive to set up and maintain;
Ethereum is always-on, always ready



11:15 / 23:51



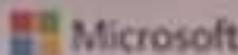


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CONVERGE



Silicon Valley Blockchain Conference
Silicon Valley Blockchain Conference

Not to mention Privacy

Privacy

Less siloing of user-data; less intermediation; more privacy

Security

Security through nihilism; there's no server to hack!

Authenticity

All interactions with the Global Computer are cryptographically signed:

Unauthorised Interactions are Impossible



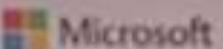


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Ethereum is the First Decentralised Computer

Ubiquitous and ethereal



12:21 / 23:51





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Centralisation & Central Authorities

Single point of control
Single point of failure
Single bottleneck



12:31 / 23:51



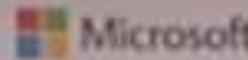


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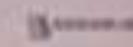
with support from



Binance



Ethereum Foundation



Parity Technologies

Software Development

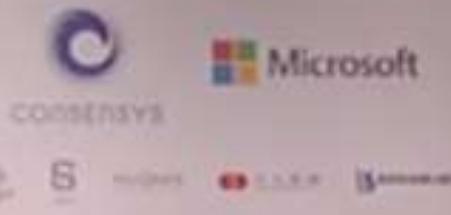
Individual coders

Strict hierarchy "cathedral"

Open-source hackers "bazaar"

Clones and forks (Github-style)





(Rough) Progression of Governance

Anarchy

Monarchy/Empire/Fiefdoms

Plutocracy/Aristocracy

Bureaucracy/"Democracy"





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S

Market

0.0000

0.0000

Distance sales

Back-of-magazine (close to zero)

Amazon

One Matchmaker, One Merchant

eBay/Amazon Marketplace

One Matchmaker, Many Merchants

...

No Matchmakers, Many Merchants



15:00 / 23:51





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General Theme

...or natural order?

Nothing

...strong individual imposes order; progress to...

Centralisation

...order enables cooperation; progress towards...

Decentralisation

Efficient
Scalable
Resilient



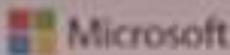


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CONTRACT MANAGEMENT



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Blockchain for Business
Blockchain for Financial Services
Blockchain for Manufacturing
Blockchain for Supply Chain
Blockchain for Government
Blockchain for Health Care
Blockchain for Energy
Blockchain for Transportation
Blockchain for Retail
Blockchain for Financial Services
Blockchain for Manufacturing
Blockchain for Supply Chain
Blockchain for Government
Blockchain for Health Care
Blockchain for Energy
Blockchain for Transportation
Blockchain for Retail

Ethereum Commoditises Trust

A bridge across trust boundaries

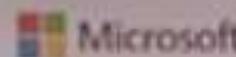




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6 100% 100% 100%

Ethereum

Platform for Zero-trust Computing

for

autonomous trading

smart contracts

interoperable infrastructure

permissions management

trust webs ...

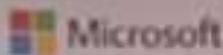




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Ethereum as the Court of the Internet

Underpins, specifies and enforces dealings





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S ELLA S

Ethereum & Crypto-law

Uses **blockchain** to implement **arbitrary social contracts** without a central server





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Ethereum and the Serverless Internet

*Pivotal in the (re-)decentralisation of the
Internet*



17:13 / 23:51





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Ethereum & Web3

Infrastructure for the ITC revolution

Ethereum Zero-trust computing

Whisper Private asynchronous bulletins

Telehash Private realtime comms

IPFS/Swarm Decentralised data distribution

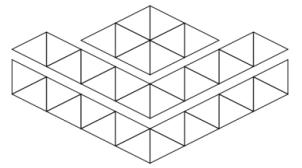




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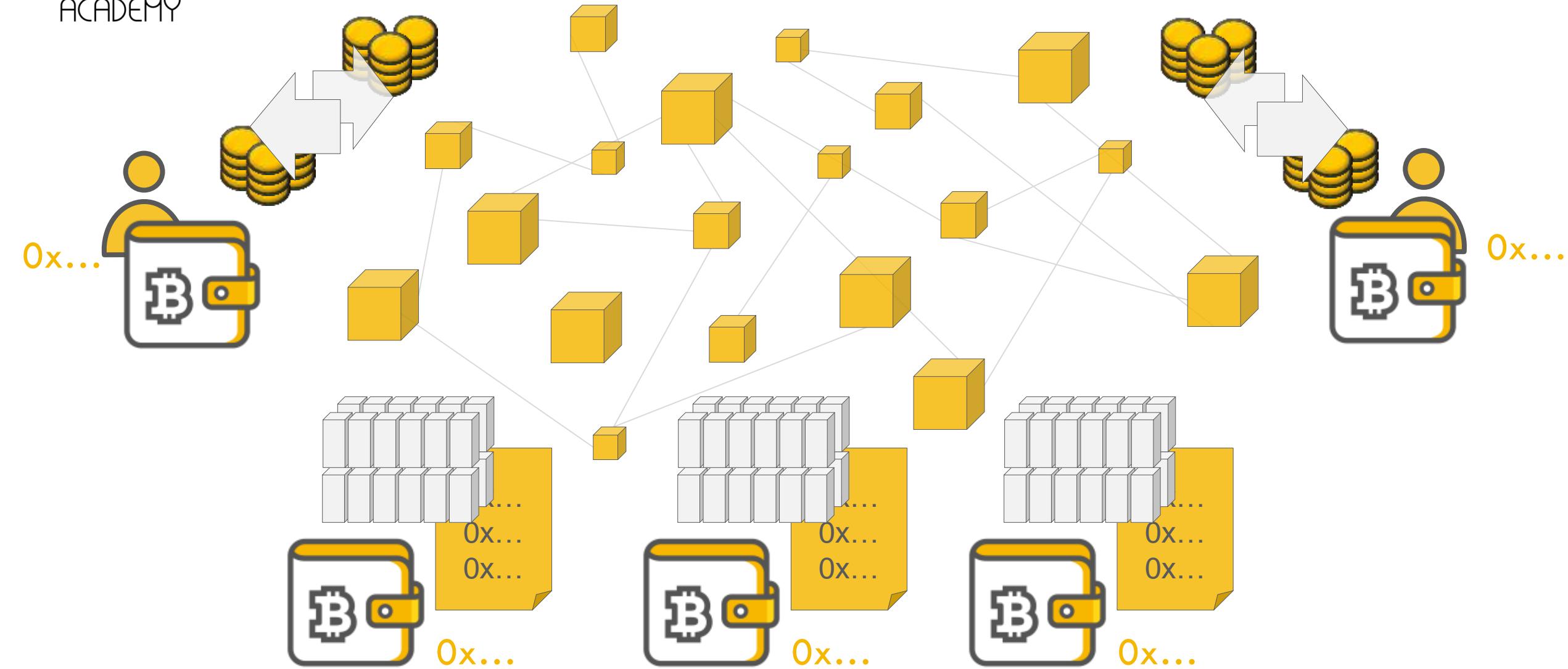


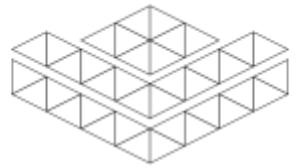
Building Blocks



PRINCIPAIS ELEMENTOS DA ARQUITETURA

BLOCKCHAIN
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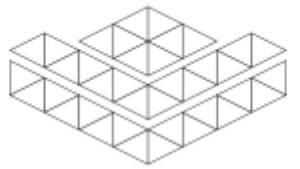




PRINCIPAIS ELEMENTOS DA ARQUITETURA

Part 1: Introduction to the Fundamentals

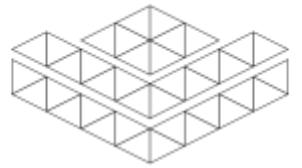
- Public Key Infrastructure and Cryptography
- Hash Functions
- Digital Signatures
- P2P Networks



PRINCIPAIS ELEMENTOS DA ARQUITETURA

Part 2: The Ethereum protocol (A user-friendly version of the Yellow paper) explains:

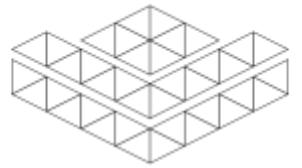
- what the notional state is (accounts and contracts),
- what transactions are (things that deterministically alter state),
- how mining works
 - transaction collation,
 - tagging a block with a PoW,
 - checking blocks that come along and adding them to the chain to make the best).



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Part 3: Smart Contracts: Programming Ethereum

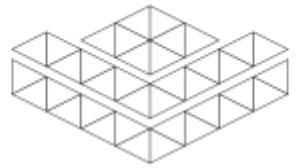
- Introduction to smart contracts
- Contract methods, typed parameters, return values
- Contract events
- Contract inheritance and modifiers
- Contract ABI (Application Binary Interface) and Bytecode
- Building the first contract
- Executing contract methods with transactions
- Contract security considerations (DoS, etc)



PRINCIPAIS ELEMENTOS DA ARQUITETURA

Part 4: Decentralized Apps and Infrastructure

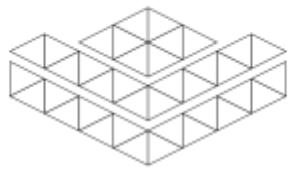
- Tokens
- Name Registries
- Contract factories
- Wallets
- Dapps and DAOs



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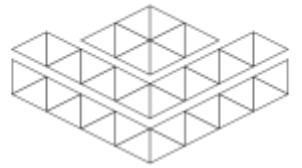




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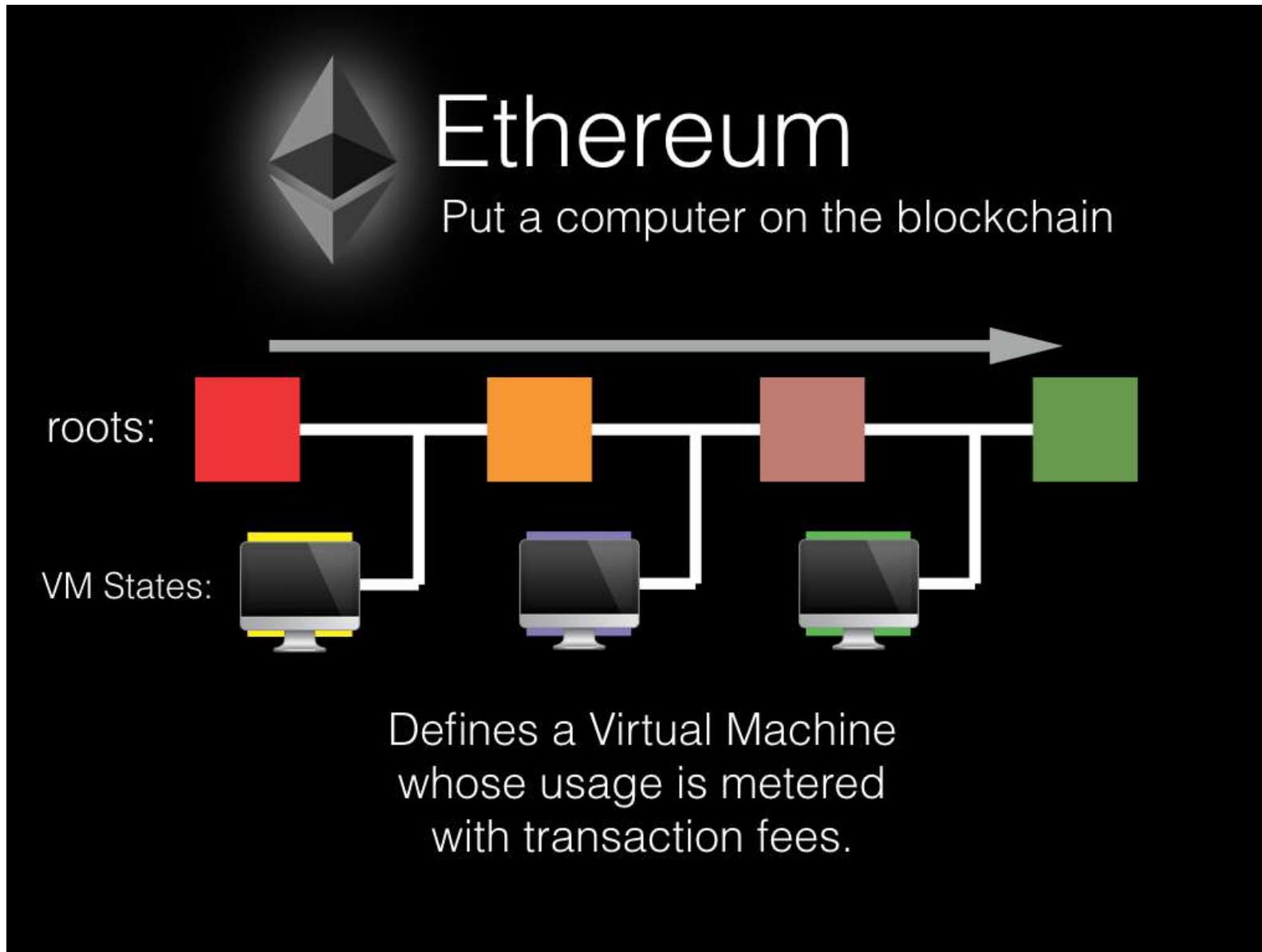
I think it's a good investment to learn how a high-level language like Solidity runs on the Ethereum VM (EVM). For couple of reasons.

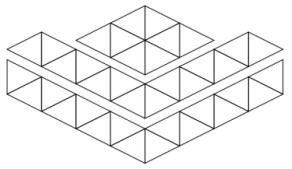
- *Solidity is not the last word.* Better EVM languages are coming. (Pretty please?)
- *The EVM is a database engine.* To understand how smart contracts work in any EVM language, you have to understand how data is organized, stored, and manipulated.
- *Know-how to be a contributor.* The Ethereum toolchain is still very early. Knowing the EVM well would help you make awesome tools for yourself and others.
- *Intellectual challenge.* EVM gives you a good excuse to play at the intersection of cryptography, data structure, and programming language design.



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PRINCIPAIS ELEMENTOS DA ARQUITETURA

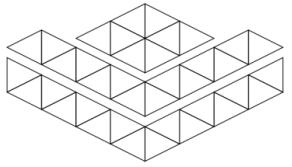




Ethereum accounts

An Ethereum account is associated with each address and each have the following attributes:

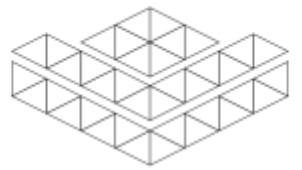
- **nonce** the count of the number of outgoing transactions, starting with 0
- **balance** the amount of ether in the account
- **storageRoot** the hash associated with the storage of the account
- **codeHash** the hash of the code governing the account,
 - if this is empty then the account is a normal account that can be accessed with its private key,
 - else it is a smart contract whose interactions are governed by its code
 - When you “deploy” a smart contract, all you’re really doing is sending a transaction to the 0-address (0x0) with the contract bytecode as an argument



Ethereum transactions

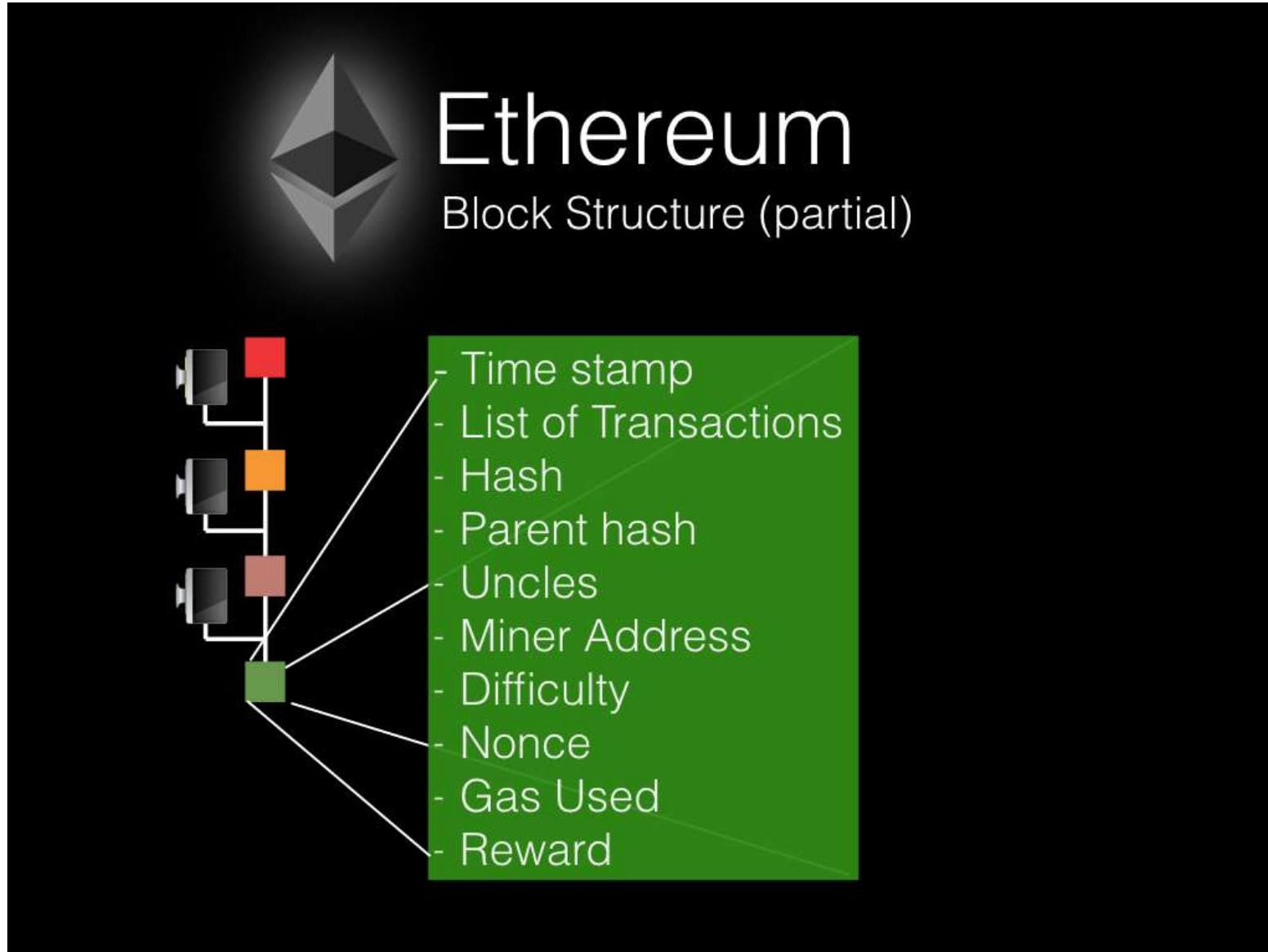
Next we take a look at a transaction, there are 6 input fields;

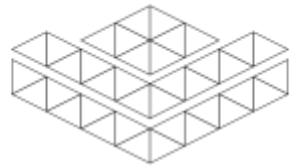
- **nonce** the count of the number of outgoing transactions, starting with 0
- **gasPrice** the price to determine the amount of ether the transaction will cost
- **gasLimit** the maximum gas that is allowed to be spent to process the transaction
- **to** the account the transaction is sent to, if empty, the transaction will create a contract
- **value** the amount of ether to send
- **data** could be an arbitrary message or function call to a contract or code to create a contract



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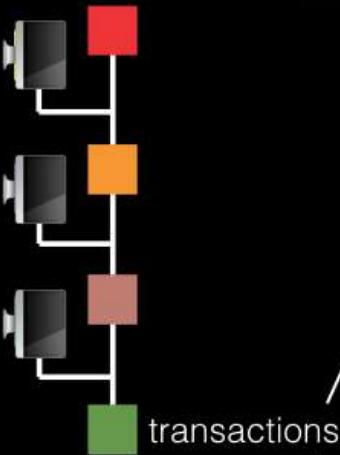
BLOCKCHAIN
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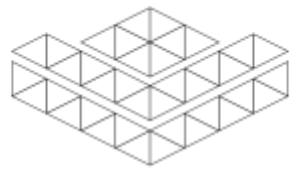


Ethereum

Transaction Structure

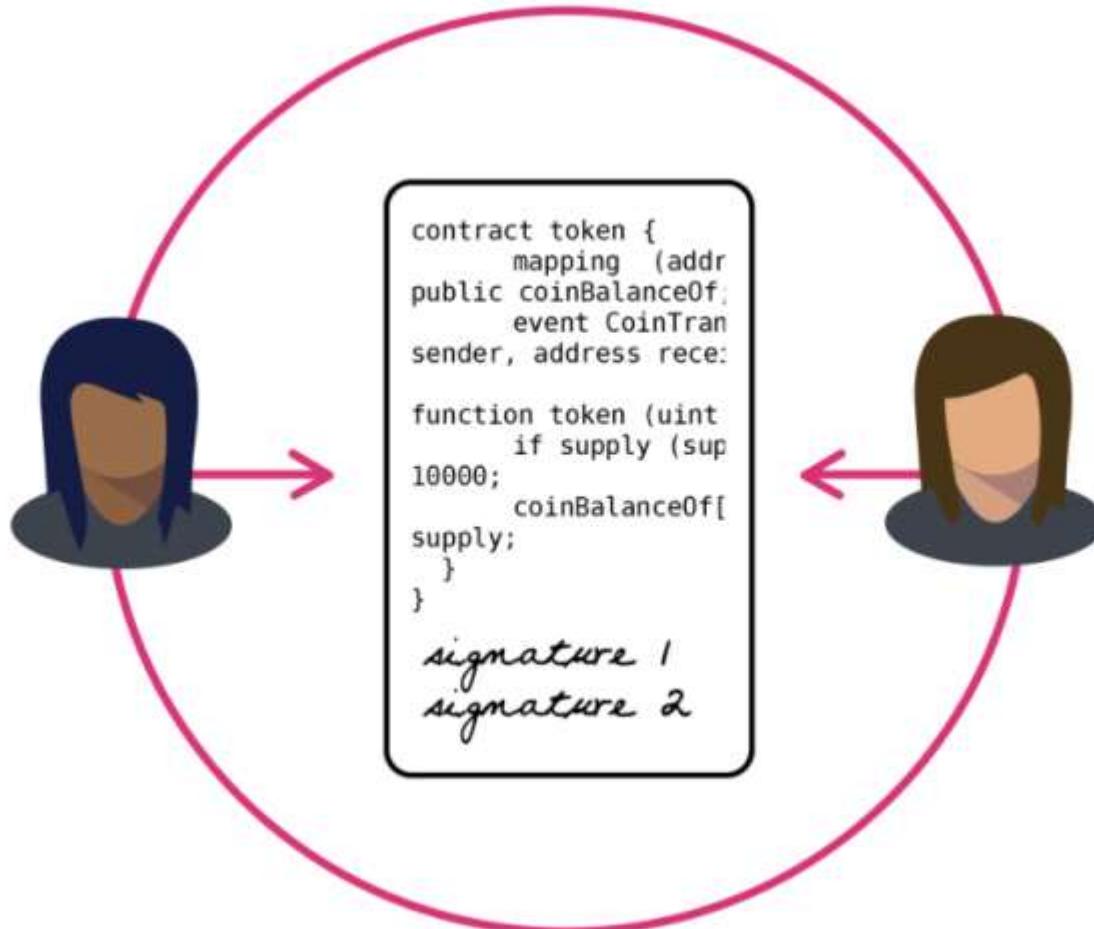


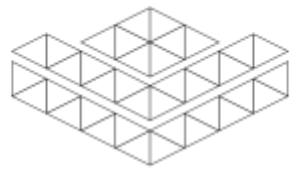
- from (address)
- to (address)
- gas price (per op)
- gas limit (for tx)
- value (sent ether)
- data (anything)
- signature



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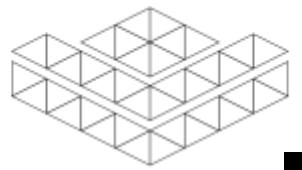
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Ethereum

where do contracts come from?



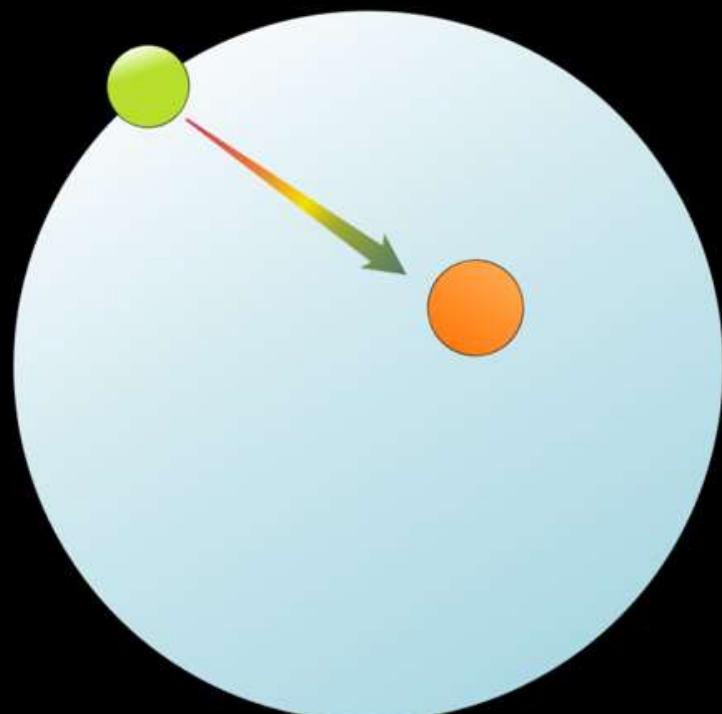
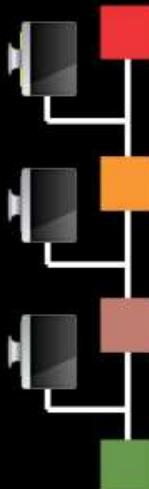


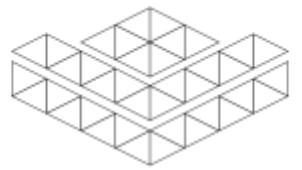
PRINCIPAIS ELEMENTOS DA ARQUITETURA



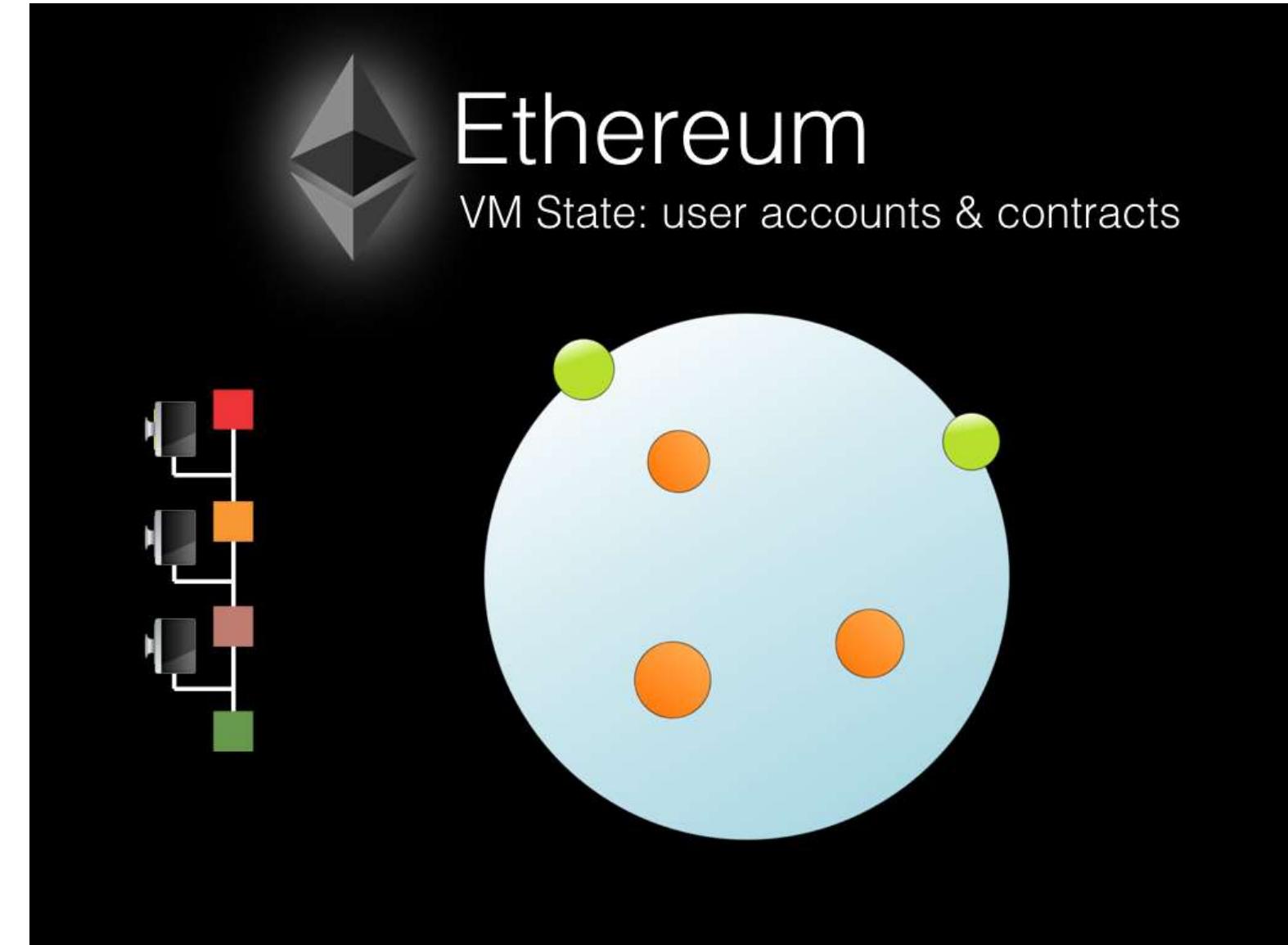
Ethereum

special tx (with empty 'to' field)
publishes data as executable

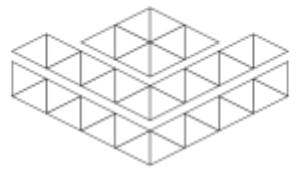




BLOCKCHAIN
ACADEMY

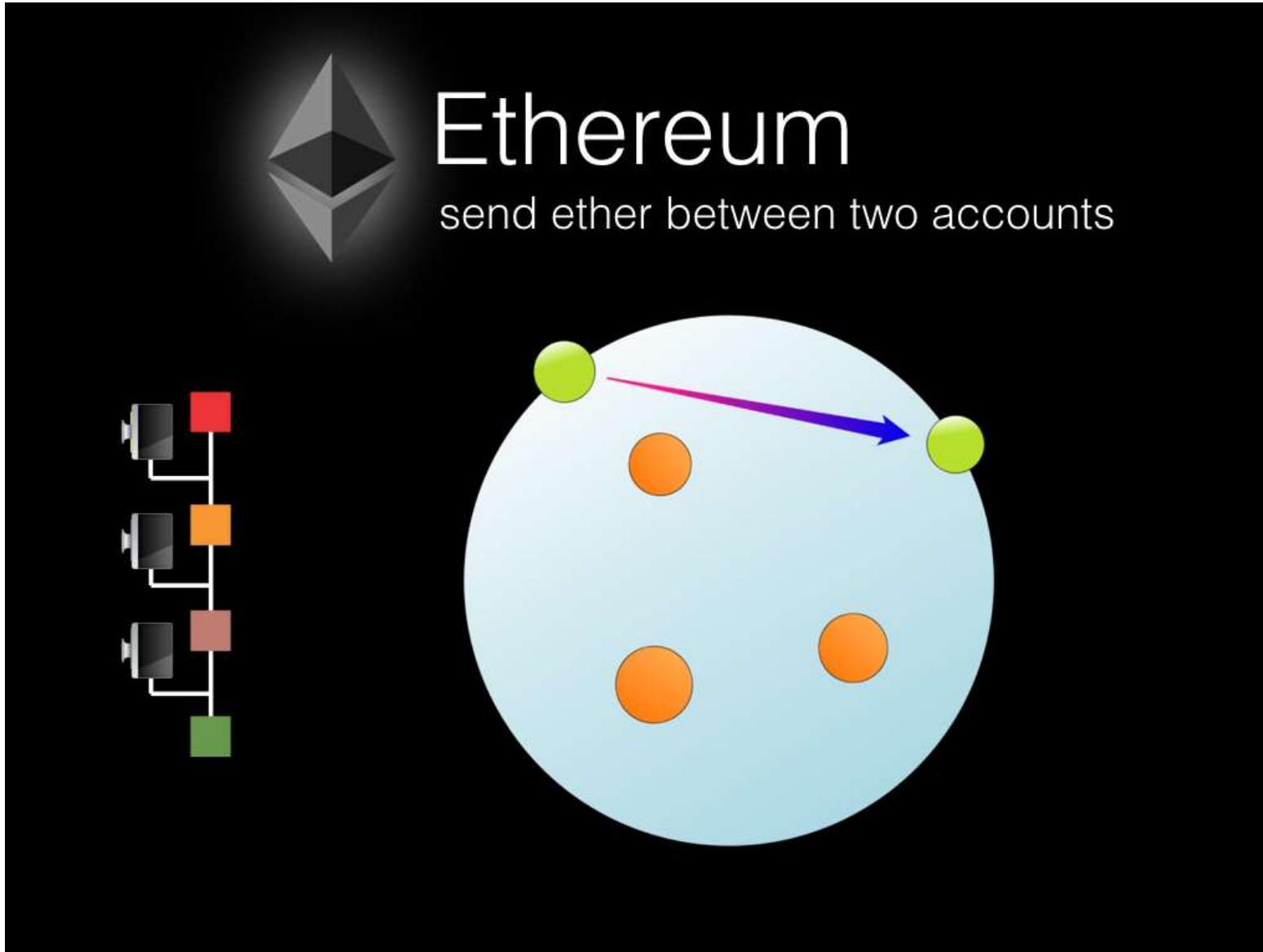


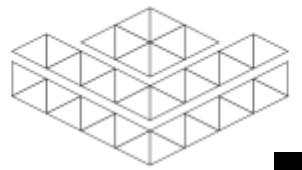
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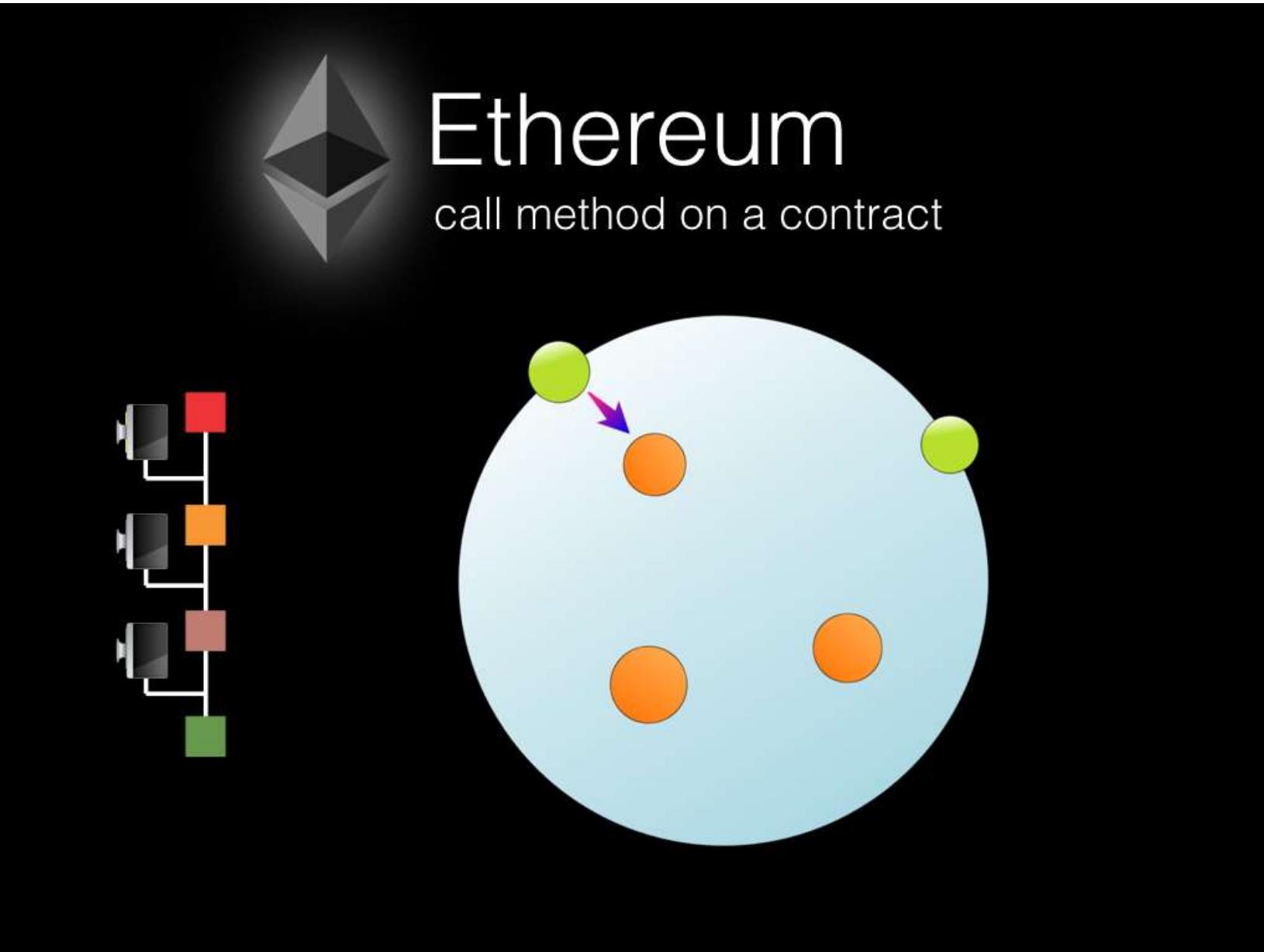
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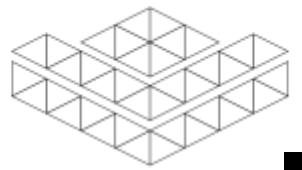




BLOCKCHAIN
ACADEMY

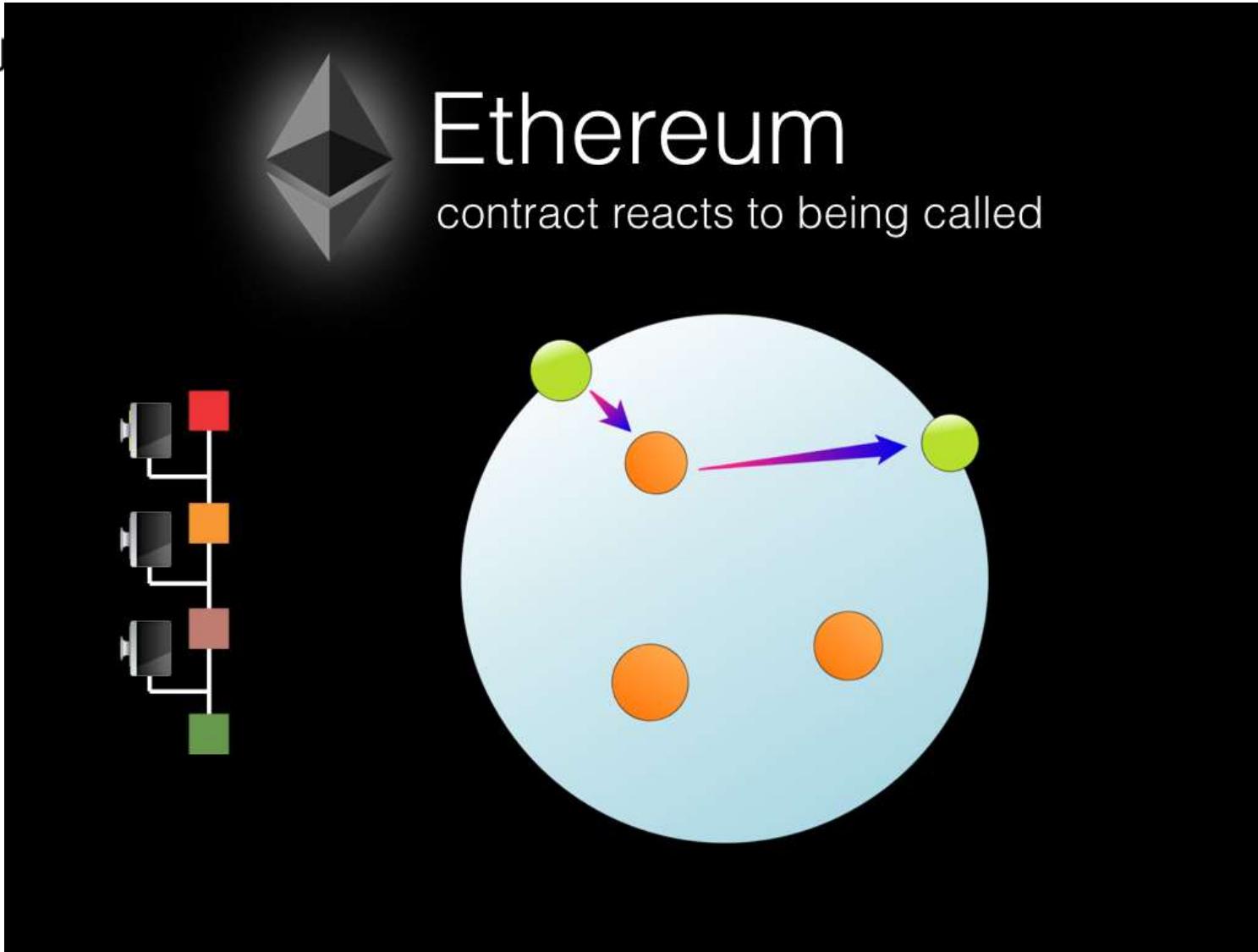
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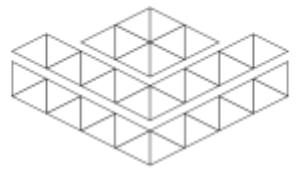




BLOCKCHAIN
ACADEMY

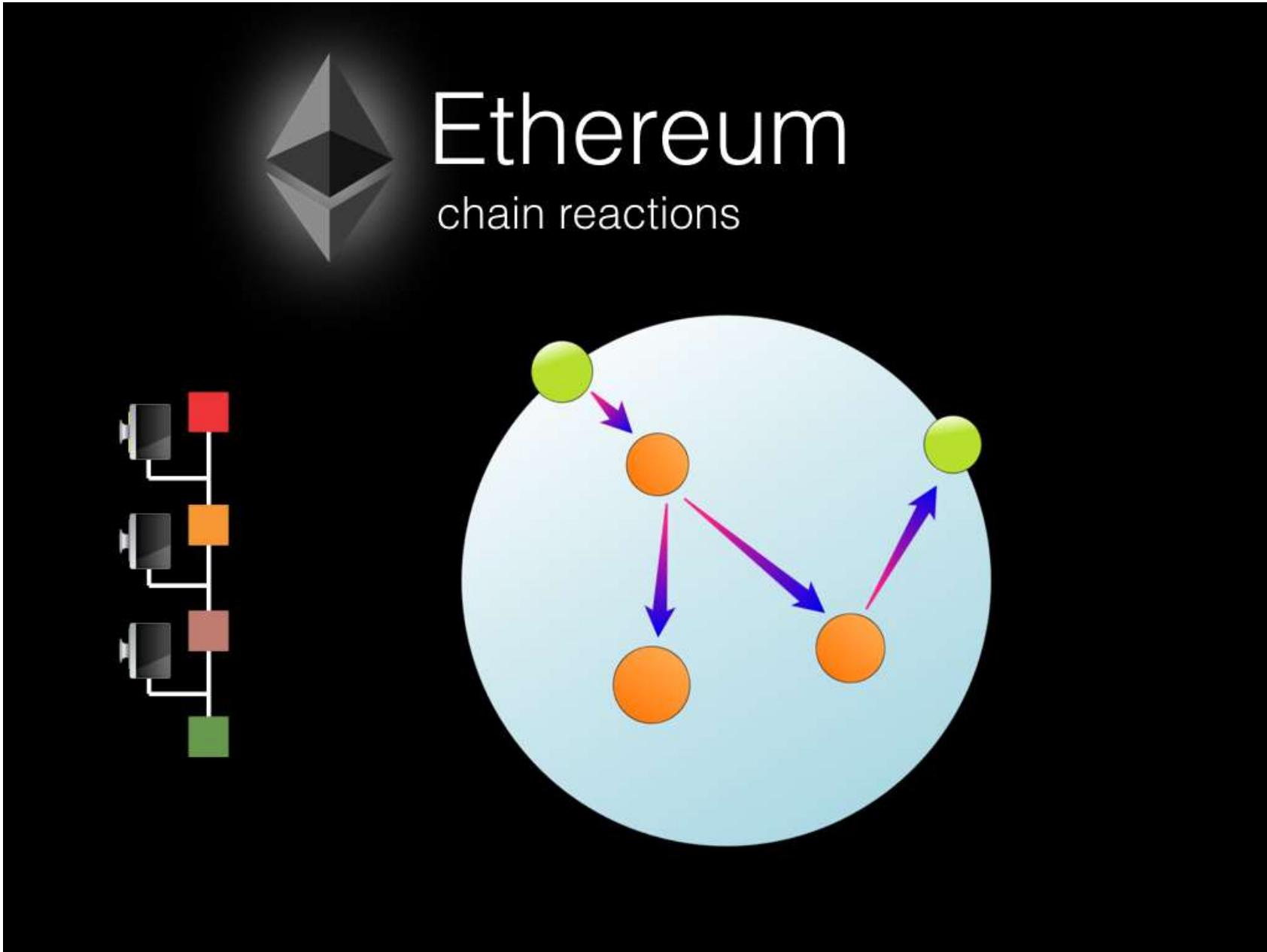
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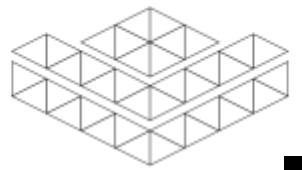




BLOCKCHAIN
ACADEMY

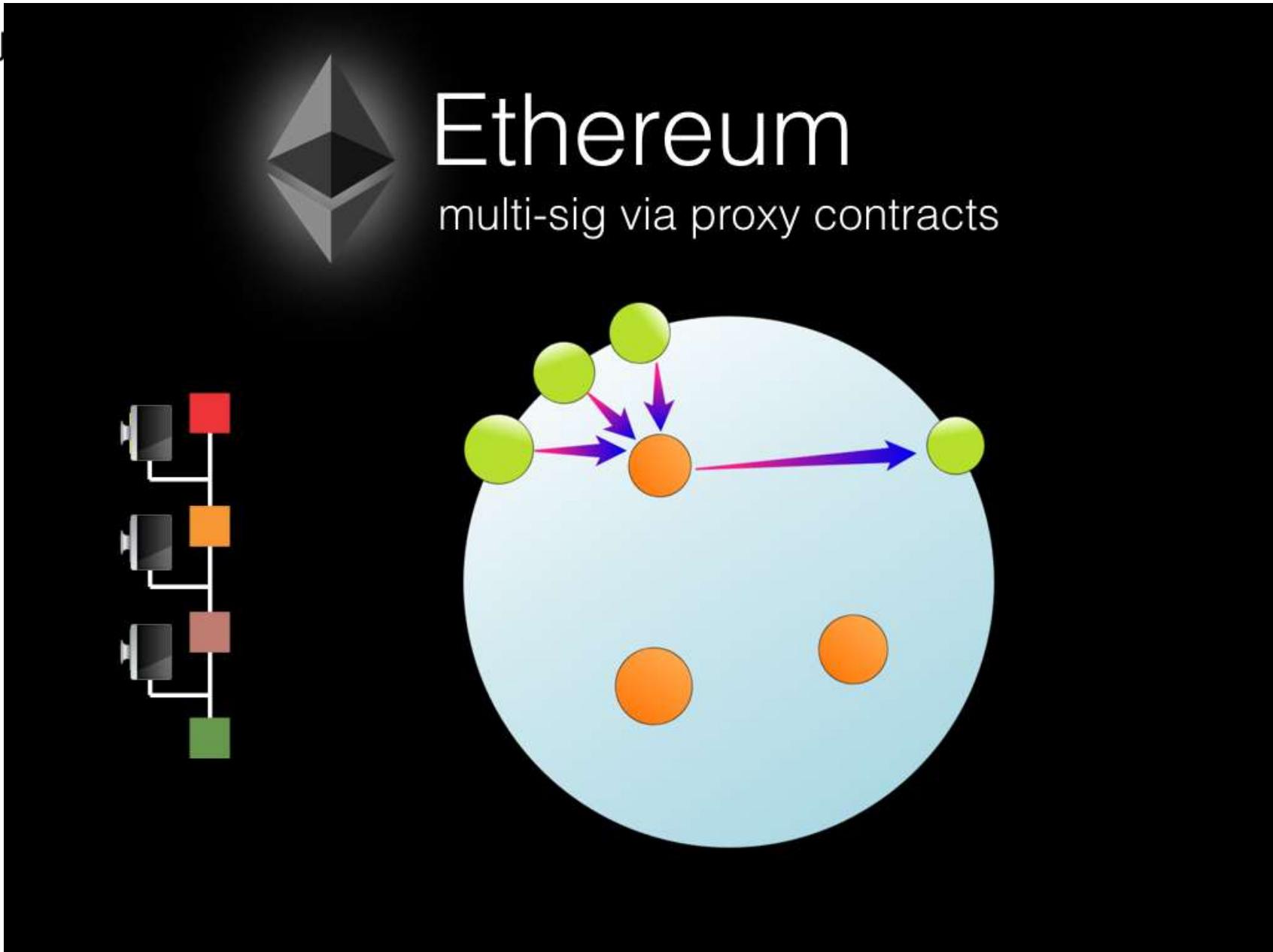
PRINCIPAIS ELEMENTOS DA ARQUITETURA





BLOCKCHAIN
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PRINCIPAIS ELEMENTOS DA ARQUITETURA



Where do the
transactions come
from?

**What does the
transaction need?**

**How do we decide
what to propagate
and mine?**

Ethereum Transaction

Transaction:

```
nonce      : u256
gas_price : u256
gas        : u256
to | null  : h160 (address)
value      : u256
data       : bytes
v          : u64
r          : u256
s          : u256
```

Transactions in the network are encoded using RLP in
this exact order (9 fields)



Transaction Nonce

- **Defines the order of the transactions**
Lower nonces need to be executed first.
- **Prevents replaying the same transaction**
Each nonce is valid only once.
- **Nonce = number of transactions sent before**
Nonce of any address is part of the State.

Miner Strategy

```
Transaction:  
  nonce      : u256  
  gas_price  : u256  
  gas        : u256  
  to | null  : h160 (address)  
  value      : u256  
  data       : bytes  
  v          : u64  
  r          : u256  
  s          : u256
```

A rational miner will try to maximise her's earnings.

So let's just order by fee: **gas_price * gas**

Note: Miner strategy is not part of the protocol!

Miner Strategy

But processing transaction takes time and it increases a chance to mine an uncle.

There is an equilibrium:

<https://blog.ethereum.org/2016/10/31/uncle-rate-transaction-fee-analysis/>

<https://etherchain.org/statistics/gasPrice>



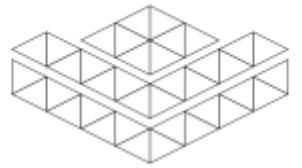
Miner Strategy

Do you remember about nonce?
We must include transactions in order,
despite the fee!

```
// We're ordering by "nonce height" first

Height=0:
    Tx1(from=1, fee=3, nonce=0)
    Tx3(from=2, fee=1, nonce=100)

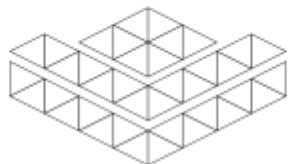
Height=1:
    Tx4(from=2, fee=2, nonce=101)
    Tx2(from=1, fee=4, nonce=1)
```



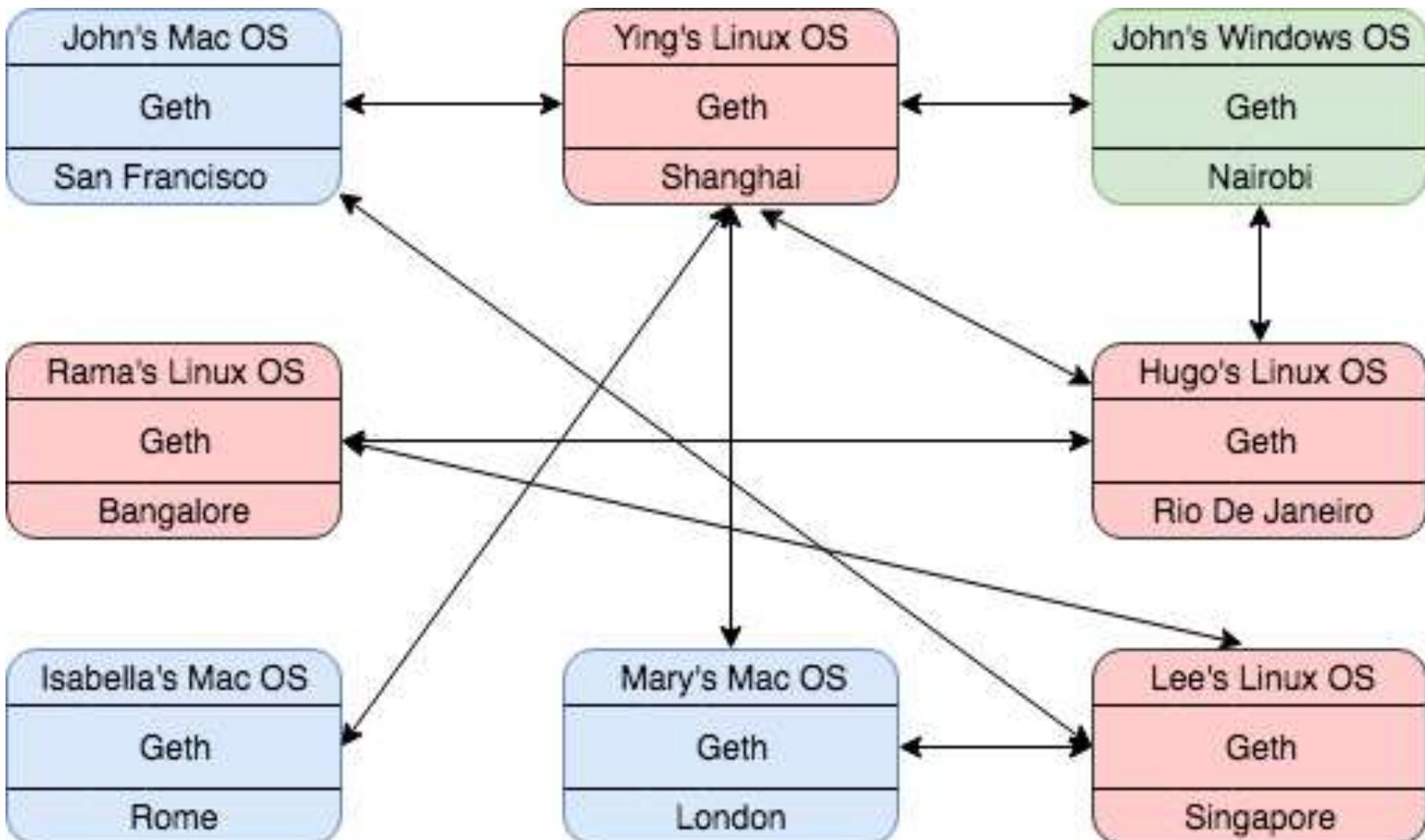
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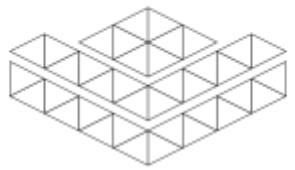




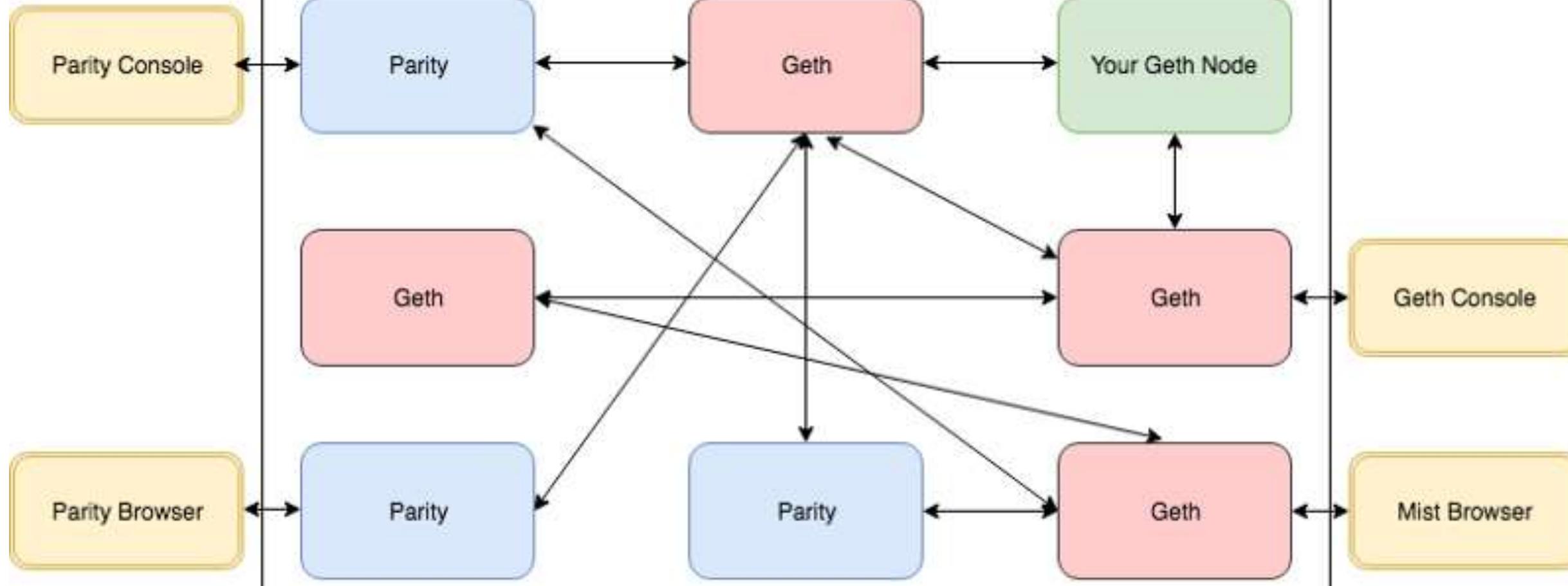
BLOCKCHAIN
ACADEMY



Ethereum Blockchain Network



BLOCKCHAIN
ACADEMY



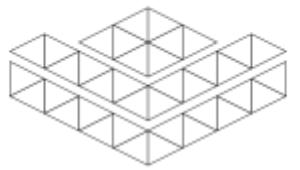
Ethereum Blockchain Network



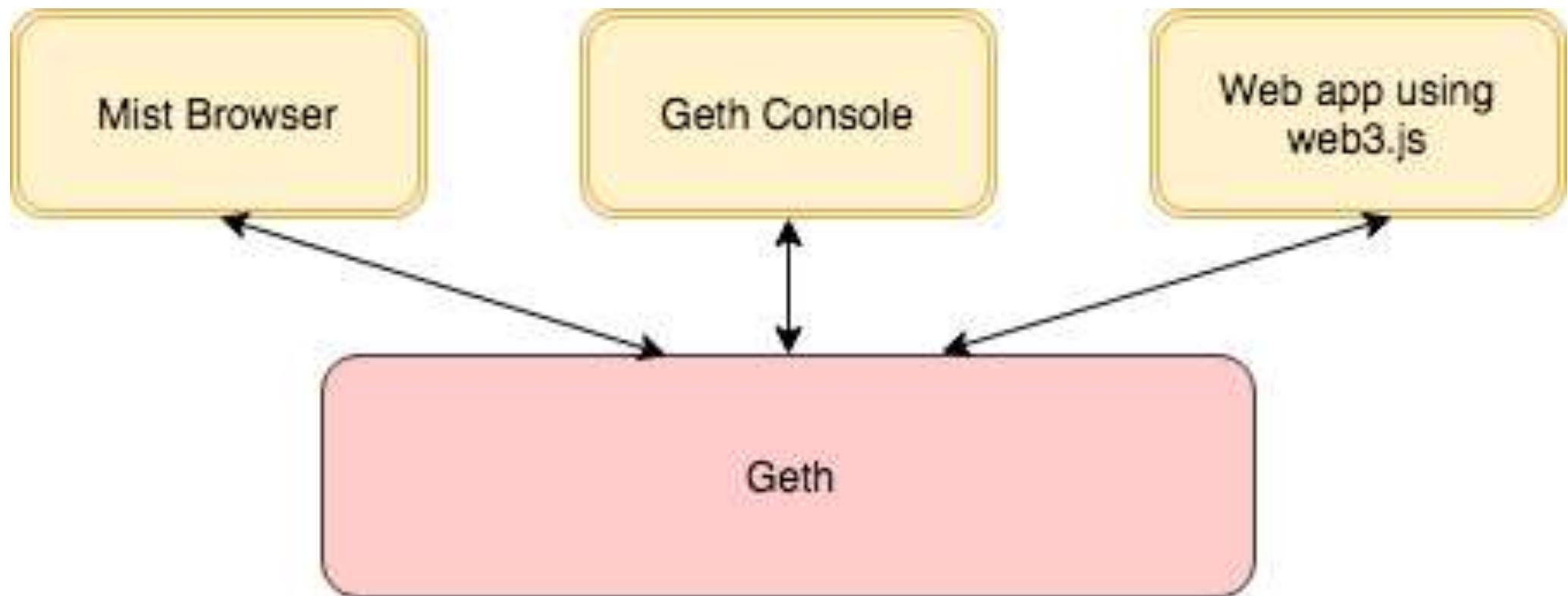
Ethereum node needs to sync, please wait...

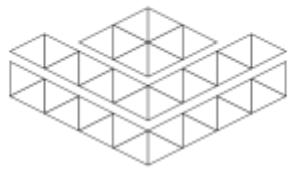
Processing block 241,352 of 243,666.



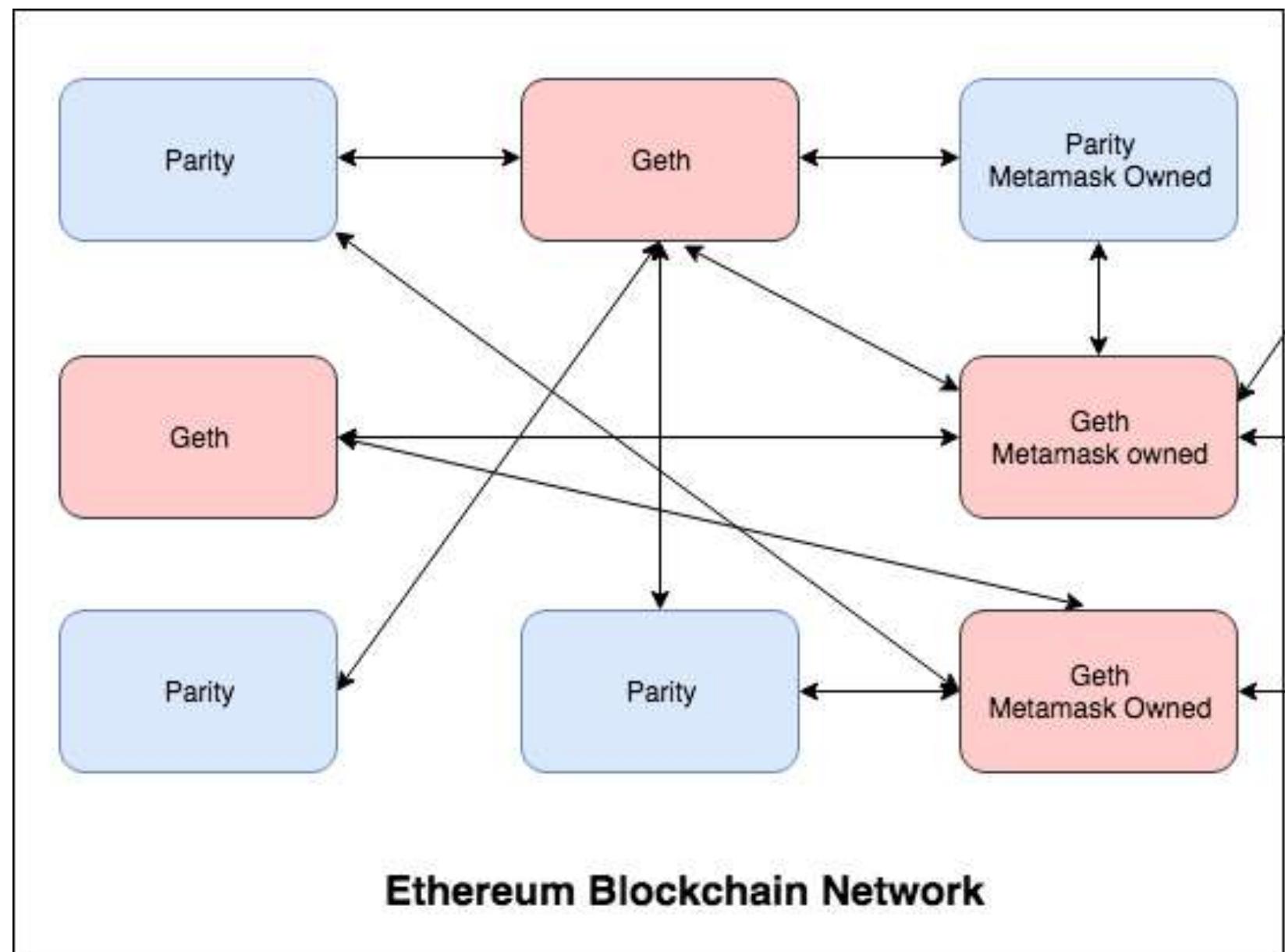


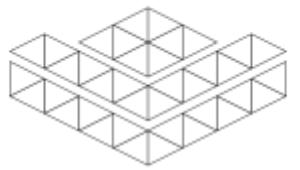
BLOCKCHAIN
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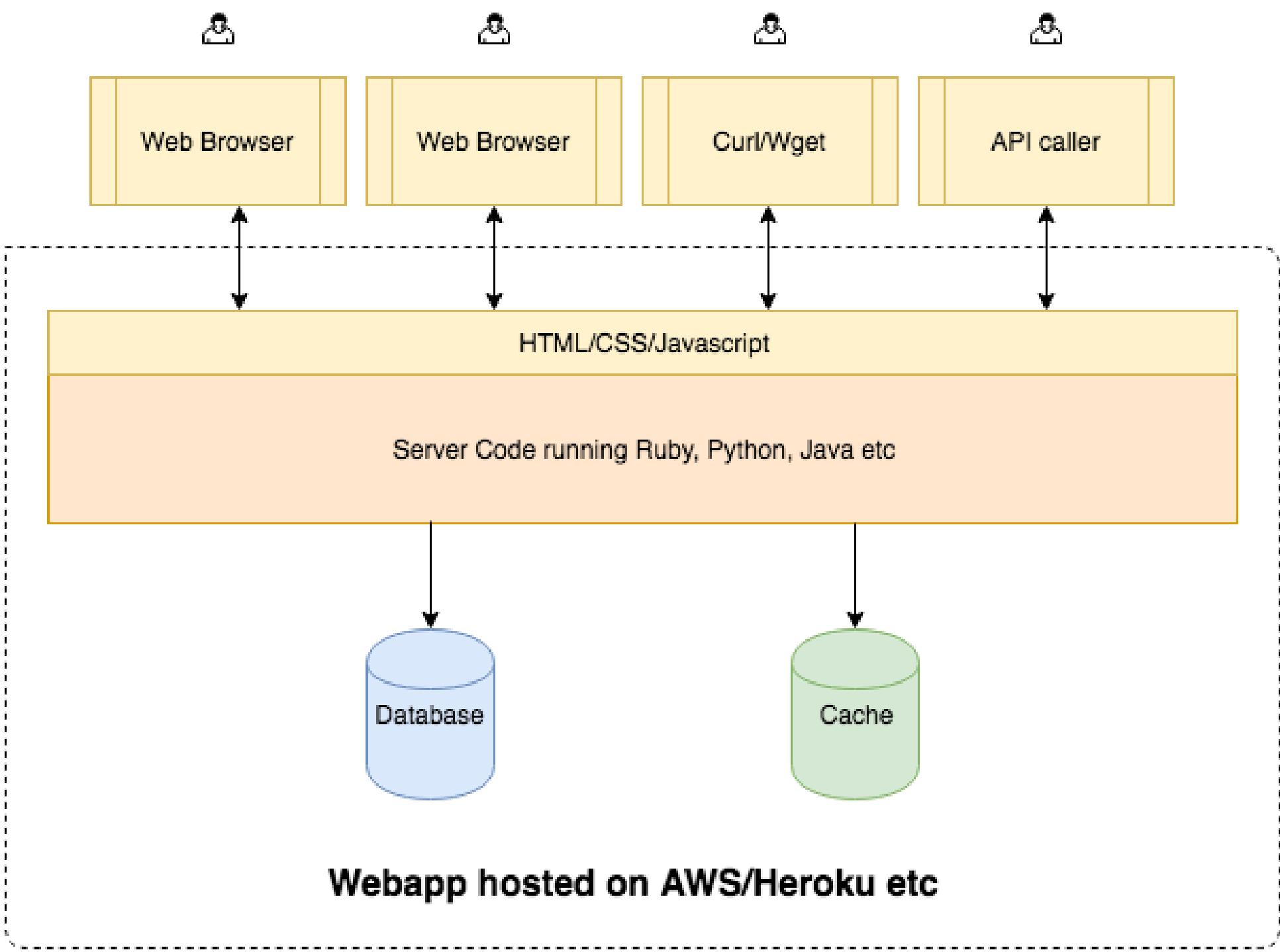
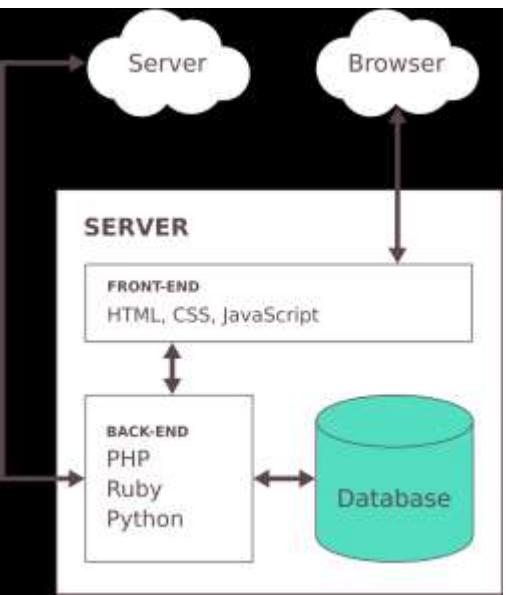


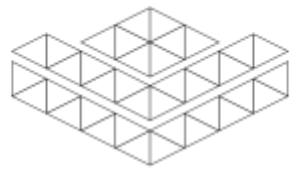
BLOCKCHAIN
ACADEMY



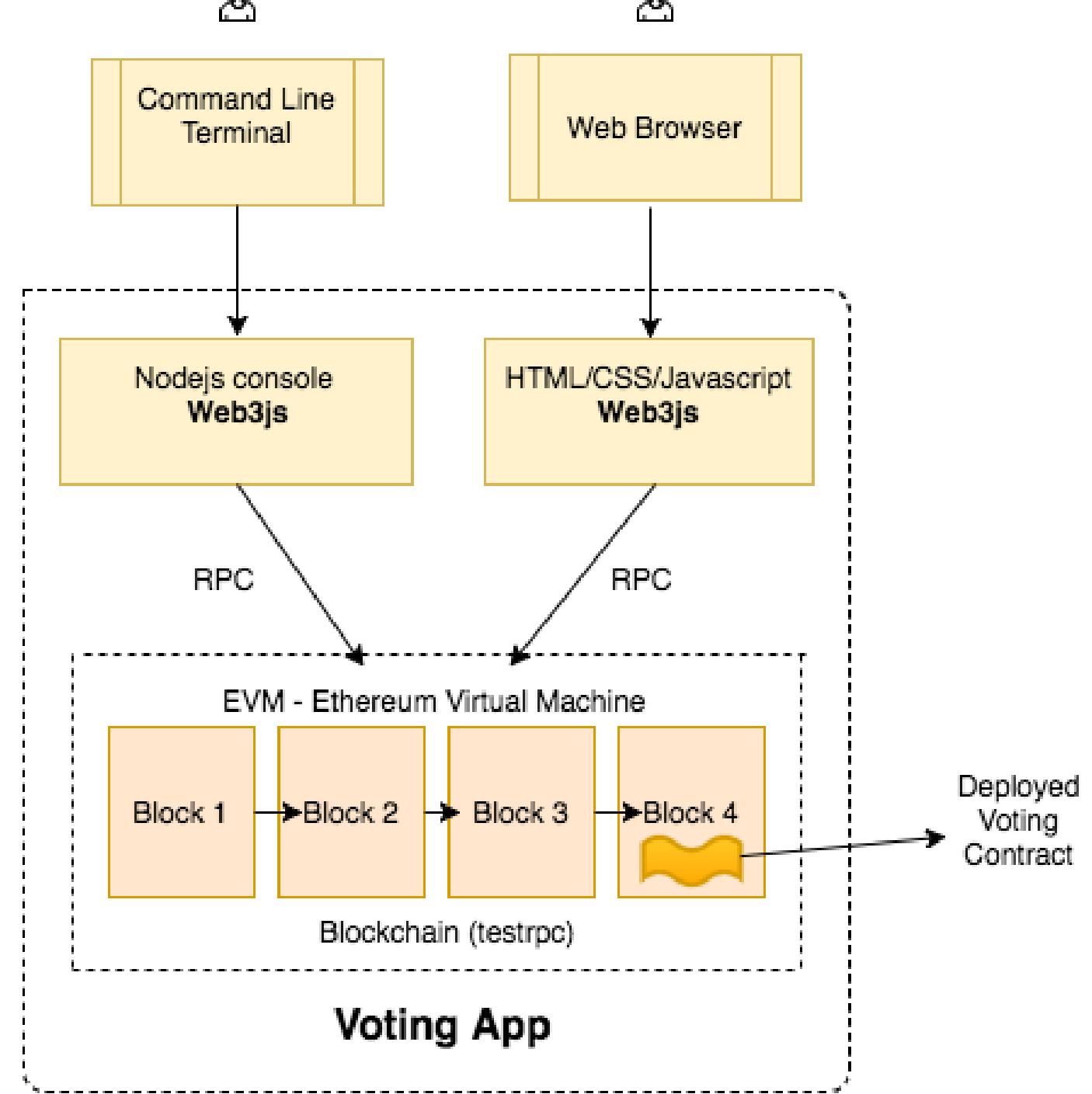


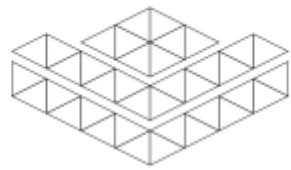
BLOCKCHAIN
ACADEMY



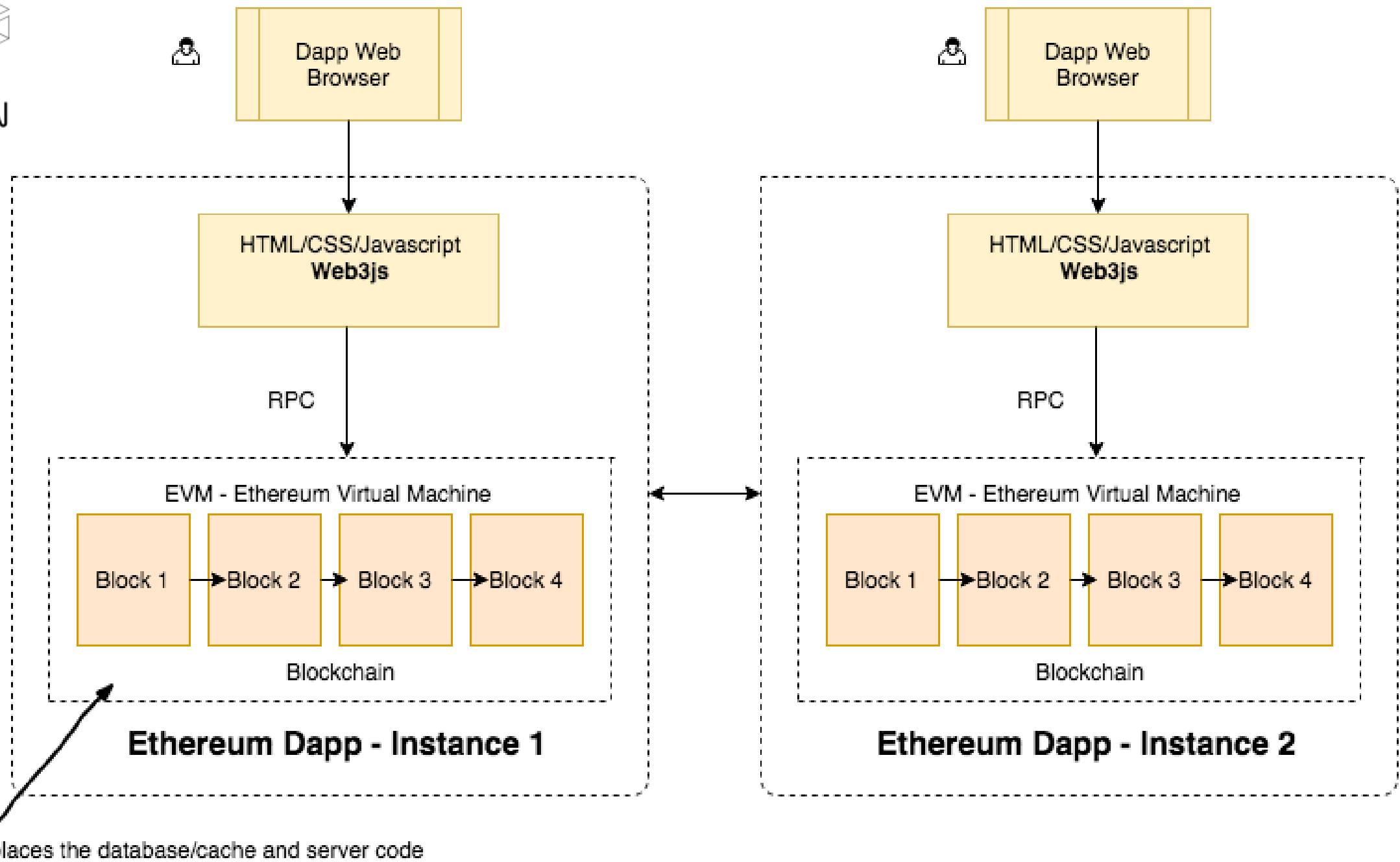


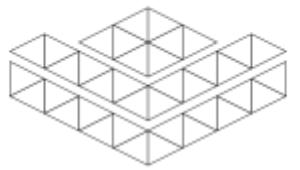
BLOCKCHAIN
ACADEMY



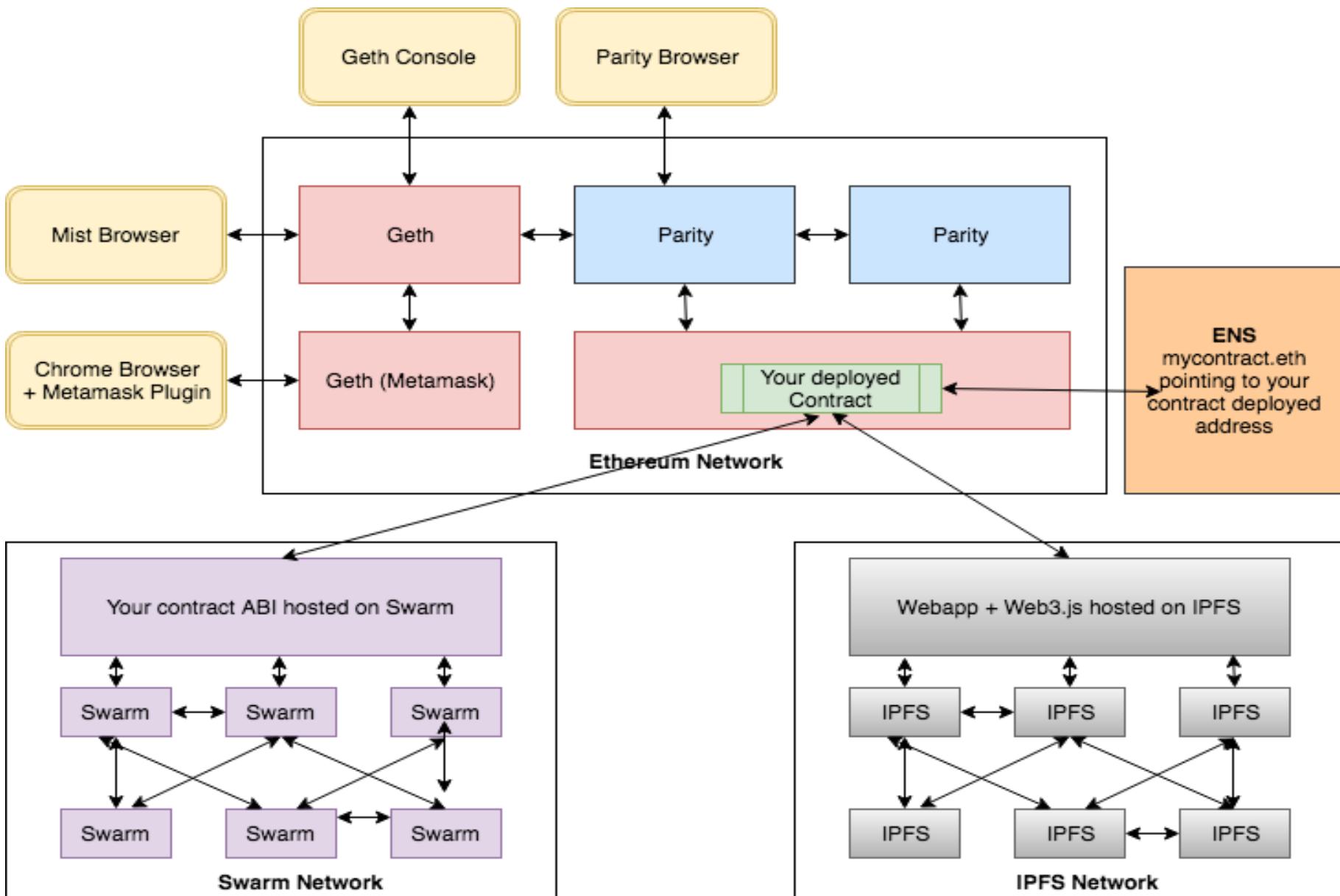


BLOCKCHAIN
ACADEMY

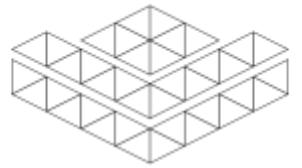




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ACADEMY



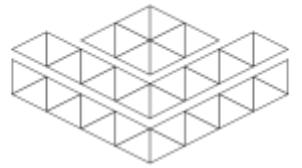
Ethereum Ecosystem



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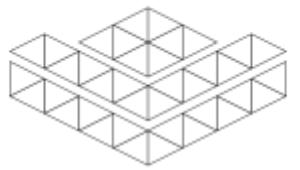
BLOCKCHAIN
ACADEMY





BLOCKCHAIN
ACADEMY





BLOCKCHAIN
ACADEMY

0xc0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0de

0xc0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0dec0de
privateKey

derive with ECDSA

0x4643bb6b393ac20a6175c713175734a72517c63d6f73a3ca90a15356f2e967da03d16431441c61ac69aeabb7937d333829d9da50431ff6af38536aa262497b27
publicKey

hash

0x4643bb6b393ac20a617

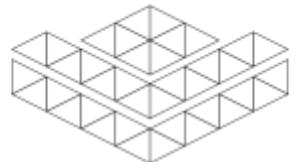
b31ff6af38536aa262497b27

0x0cdd797903d1bee4f117b6b253ae893e4b22d707943299a8d0c844df0e3d5557

Ethereum address

0x0cdd797903d1bee4f117b6b253ae893e4b22d707943299a8d0c844df0e3d5557

Ethereum address



BLOCKCHAIN
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```
transaction = {  
    nonce: web3.toHex(0),  
    gasPrice: web3.toHex(20000000000),  
    gasLimit: web3.toHex(100000),  
    to: '0x687422eEA2cB73B5d3e242bA5456b782919AFc85',  
    value: web3.toHex(1000),  
    data: '0xc0de'  
}
```

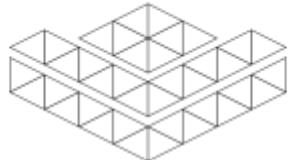
rlp + hash

0x6a74f15f29c3227c5d1d2e27894da58d417a484ef53bc7aa57ee323b42ded656

sign with privateKey

v: '0x1c'
r: '0x668ed6500efd75df7cb9c9b9d8152292a75453ec2d11030b0eec42f6a7ace602'
s: '0x3efcbbf4d53e0dfa4fde5c6d9a73221418652abc66dff7fddd78b81cc28b9fbf'

signature



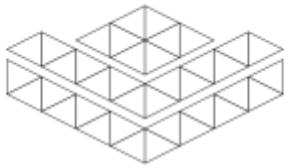
BLOCKCHAIN
ACADEMY

```
signedTransaction = {  
    nonce: web3.toHex(0),  
    gasPrice: web3.toHex(200000000000),  
    gasLimit: web3.toHex(100000),  
    to: '0x687422eEA2cB73B5d3e242bA5456b782919AFc85',  
    value: web3.toHex(1000),  
    data: '0xc0de',  
    v: '0x1c',  
    r: '0x668ed6500efd75df7cb9c9b9d8152292a75453ec2d11030b0eec42f6a7ace602',  
    s: '0x3efcbbf4d53e0dfa4fde5c6d9a73221418652abc66dff7fddd78b81cc28b9fbf'  
};
```

rlp + hash



0x8b69a0ca303305a92d8d028704d65e4942b7ccc9a99917c8c9e940c9d57a9662
transaction id



BLOCKCHAIN
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transfer(address _to, uint256 _value)
example smart contract function

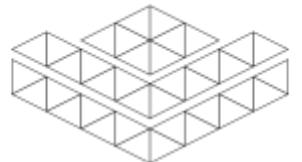
example function call

0xa9059cbb000d02ab486cedbffff

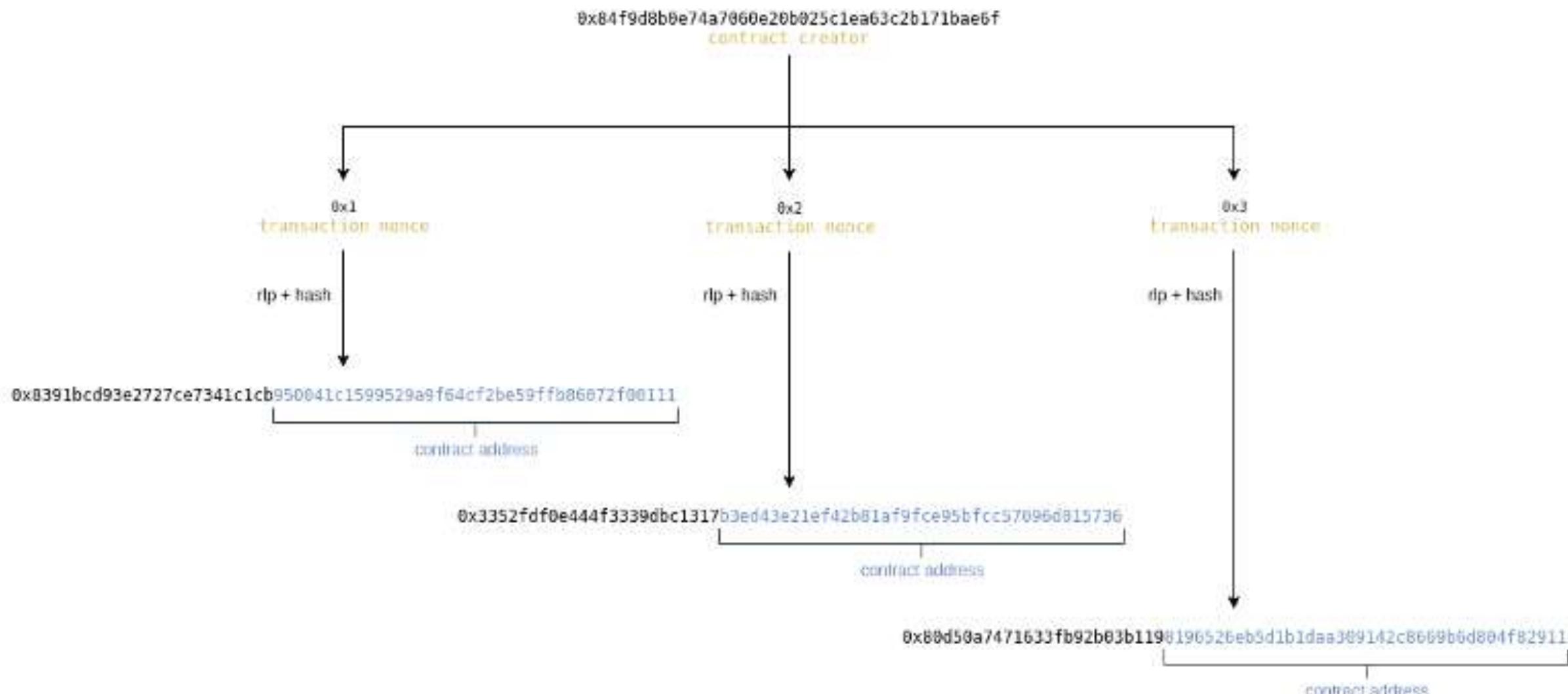
0x7addee867ea91533879d083dd47ea81f0eee3a37e
address _to

0x2ab486cedbffff
uint256 _value

0xa9059cbb2ab09eb219583f4a59a5d0623ade346d962bcd4e46b11da047c9049b
hash of "transfer(address,uint256)"



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DApps



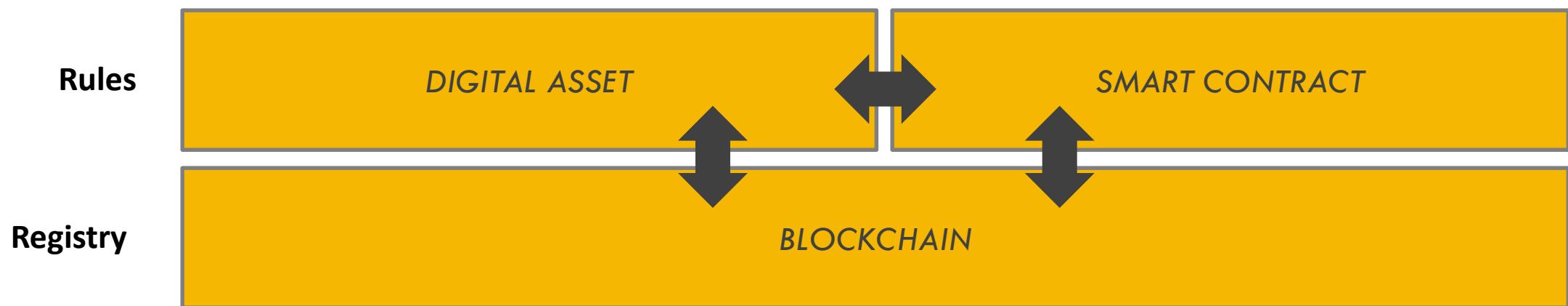
ÐApp – Decentralized Application

Registry

BLOCKCHAIN

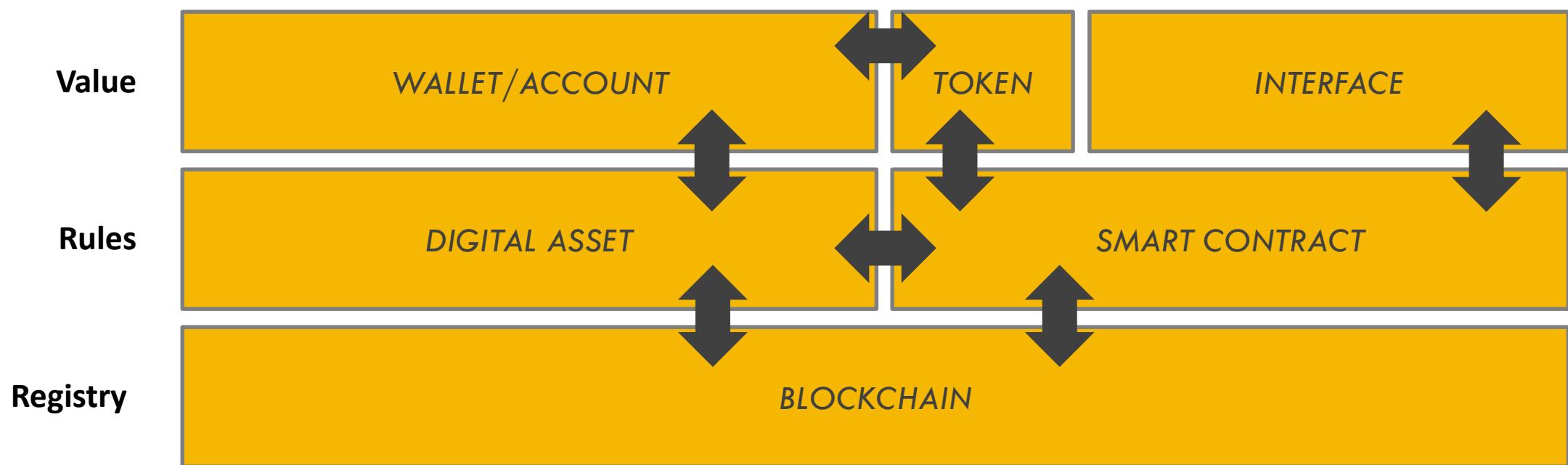


ÐApp – Decentralized Application



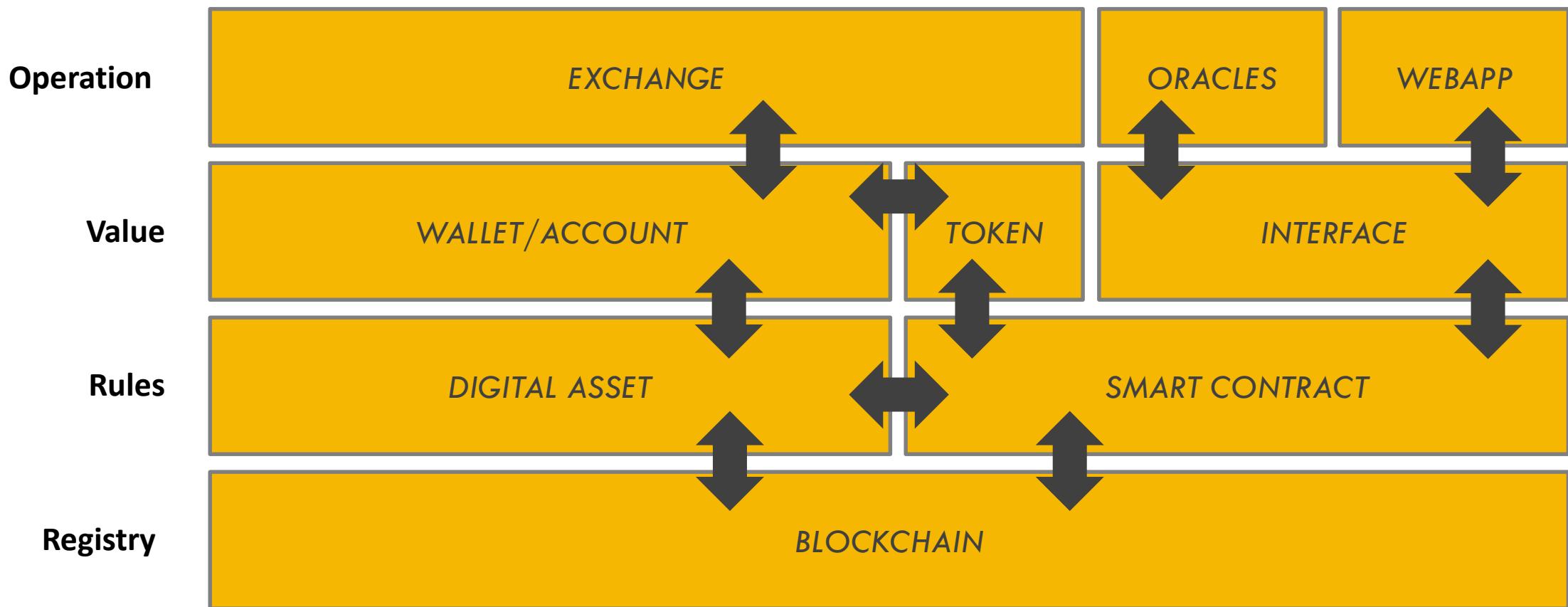


DApp – Decentralized Application



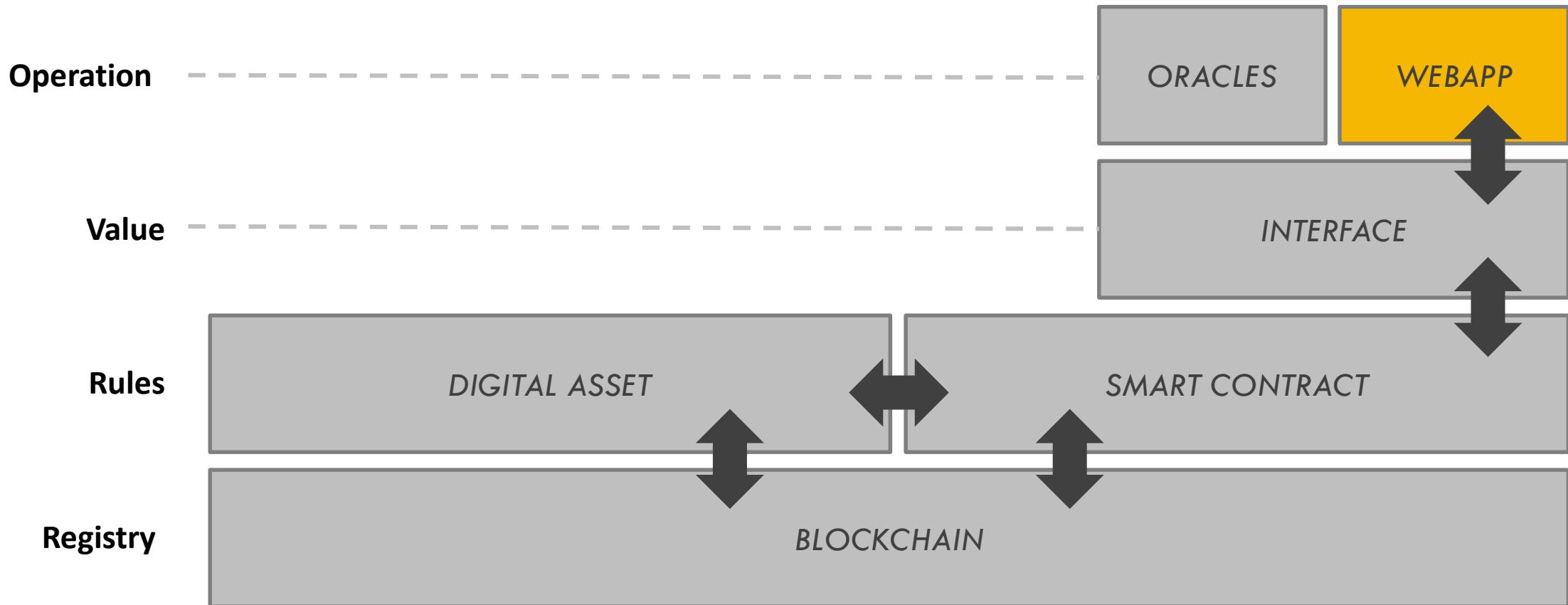


DApp – Decentralized Application





DApp – Decentralized Application





ÐApp – Decentralized Application

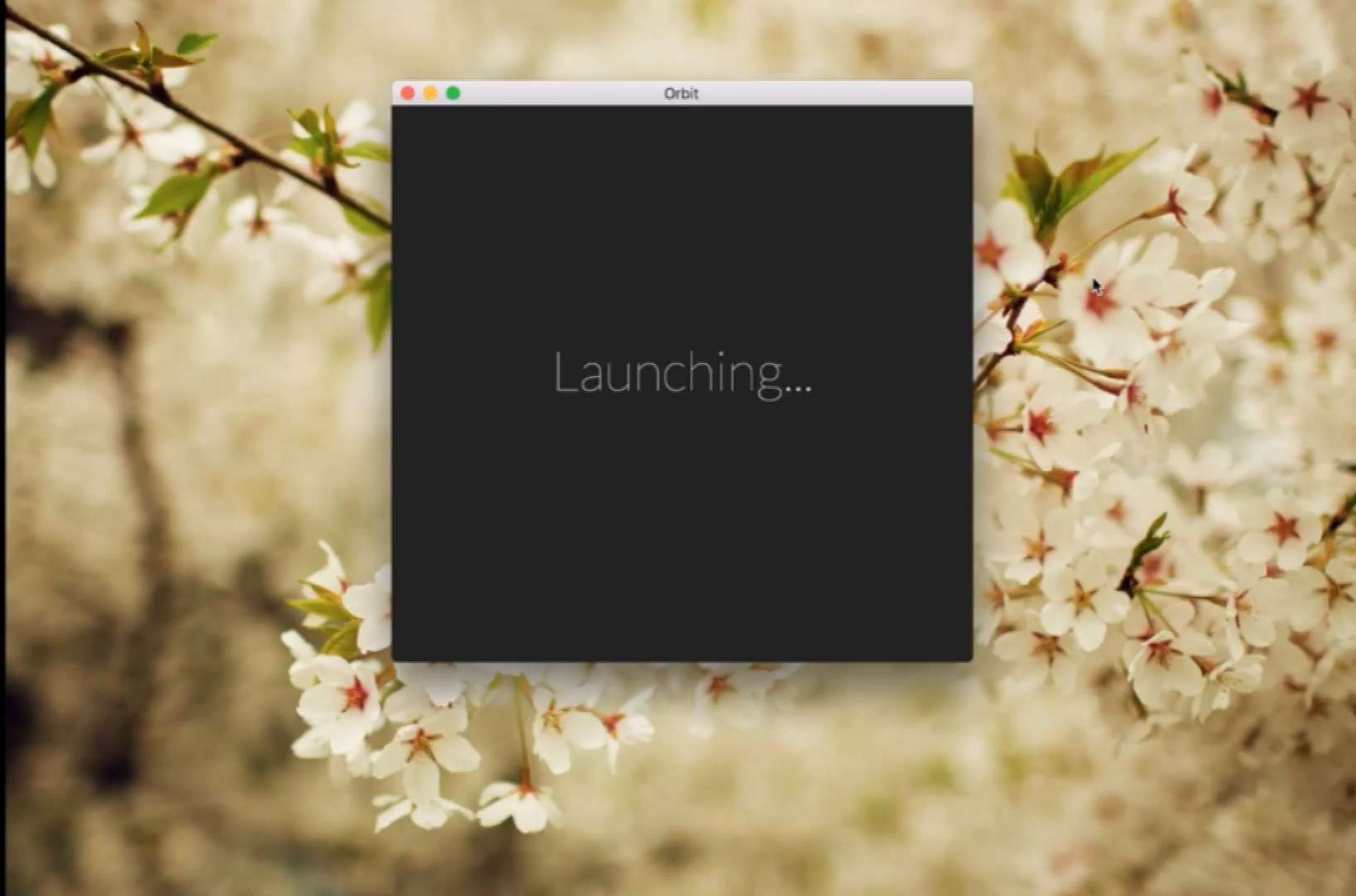
WEBAPP

FRONT-END

Camada de apresentação dos dados aos clientes. Pode ser uma aplicação Mobile ou um website responsivo.

BACKEND

Camada que fará o processamento da chamadas vindas do front-end e também fará a comunicação com as demais camadas, especialmente a comunicação com a Blockchain.



Launching...

Orbit

<https://dapps.ethercasts.com/>

STATE OF THE DAPPS

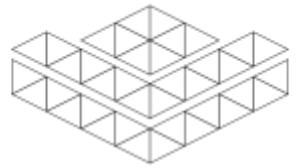


Search

search by tags



555 dapps listed				Sort: Updated	Filter
Numerai Richard Craib Hedge fund built by a network of data scientist	SlotNSlot Team SlotNSlot Slot maching platform, make your own slots	PASSLFIX Frederic Vedrunes A peer-to-peer transportation system of objects	Pick 3 Christophe Grant Lottery Draw		2017-07-06
Live	Work In Progress	Live	Live		2017-07-06
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Modelos Emergentes



IPFS

Why

How

Uses

Install

Media

Docs

Blog

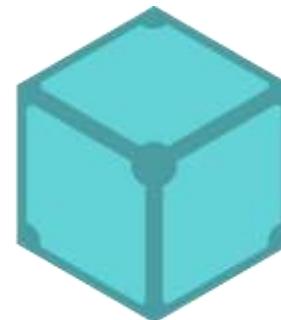
IPFS is the Distributed Web

A peer-to-peer hypermedia protocol
to make the web faster, safer, and more open.

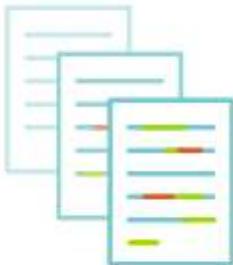
Try it

Watch demo

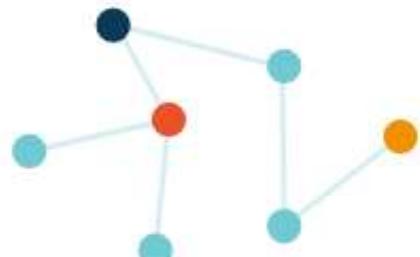
IPFS



Each file and all of the **blocks within it** are given a **unique fingerprint** called a **cryptographic hash**.



IPFS **removes duplications** across the network and tracks **version history** for every file.



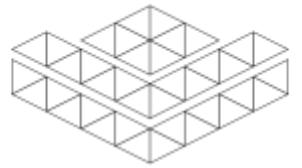
Each **network node** stores only content it is interested in, and some indexing information that helps figure out who is storing what.



When **looking up files**, you're asking the network to find nodes storing the content behind a unique hash.

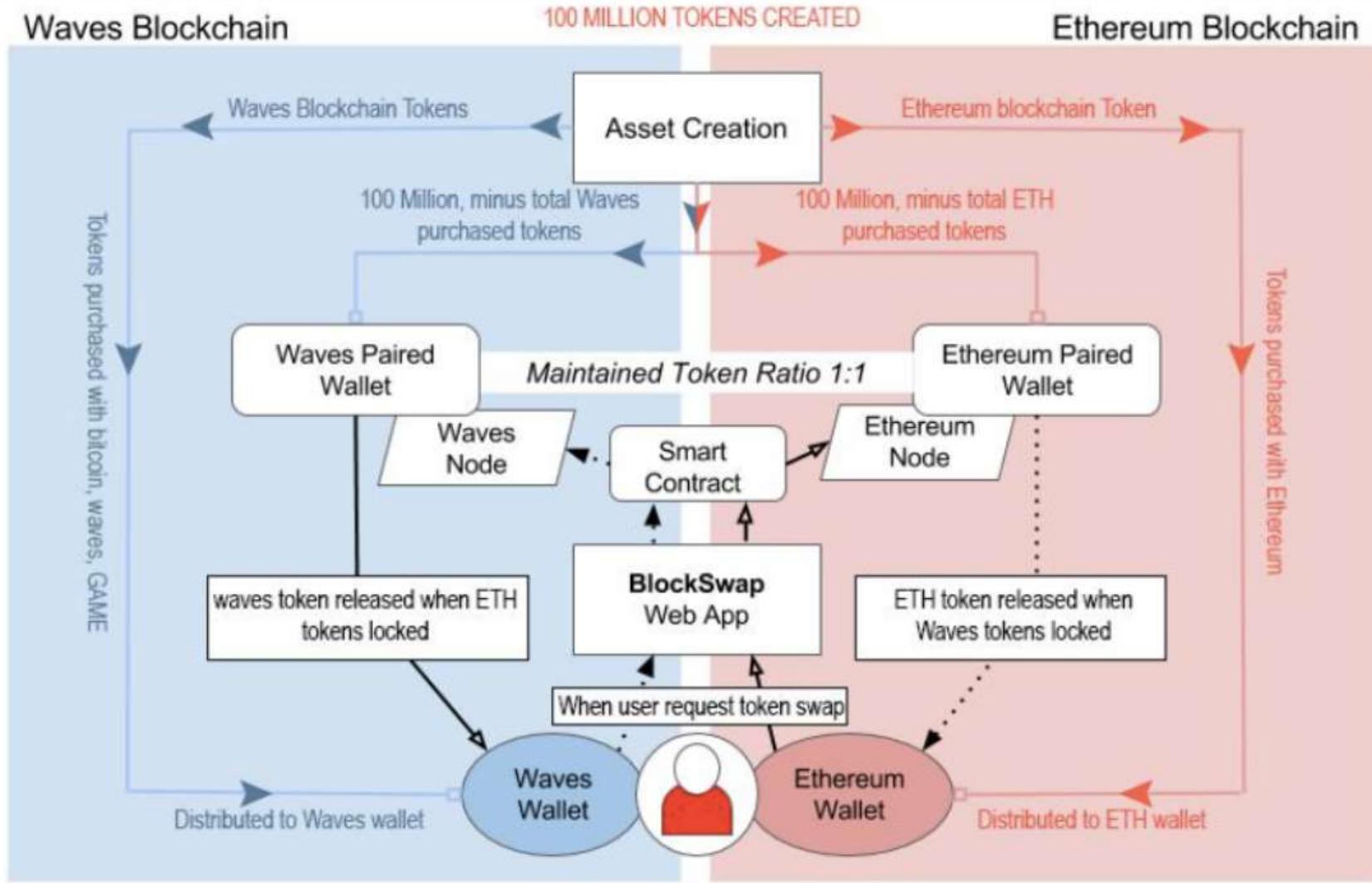


Every file can be found by **human-readable names** using a decentralized naming system called **IPNS**.



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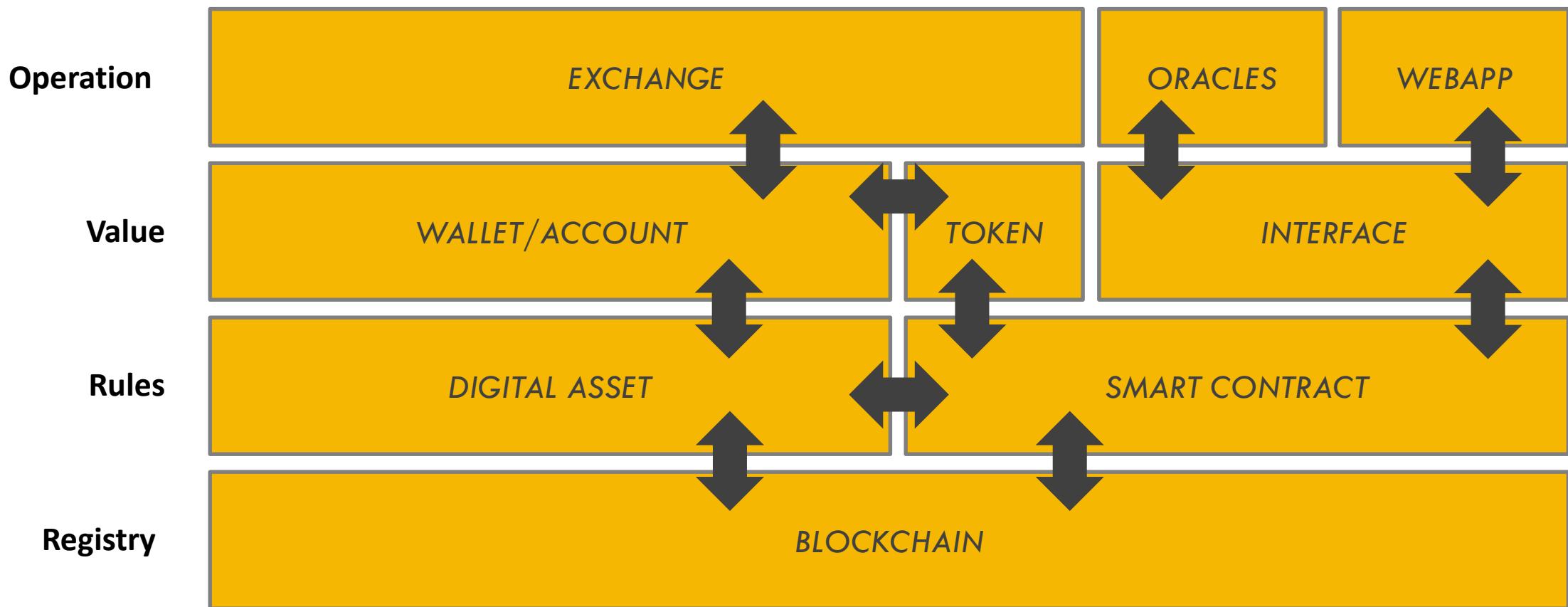
BLOCKCHAIN
ACADEMY



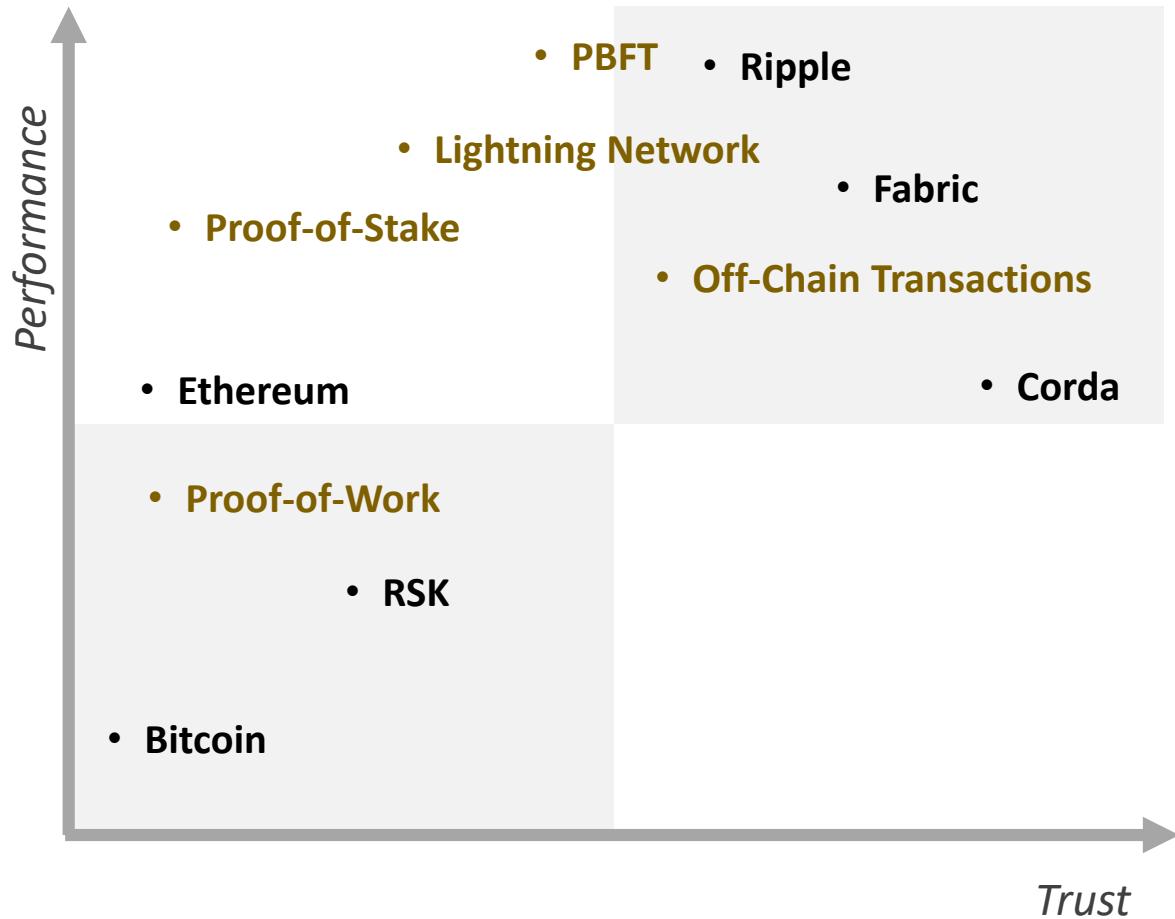
Review



DApp – Decentralized Application



AVALIE O CENÁRIO

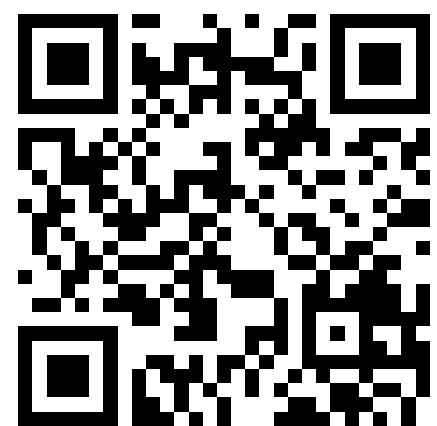


Blockchains permissionadas suportam maior volume de transações, por serem orientadas a cenários com maior confiança entre os participantes.

DISTRIBUTED AUTONOMOUS TRUST NETWORKS

Um novo paradigma se abre para o desenvolvimento de soluções, desde o requisito até a operação.





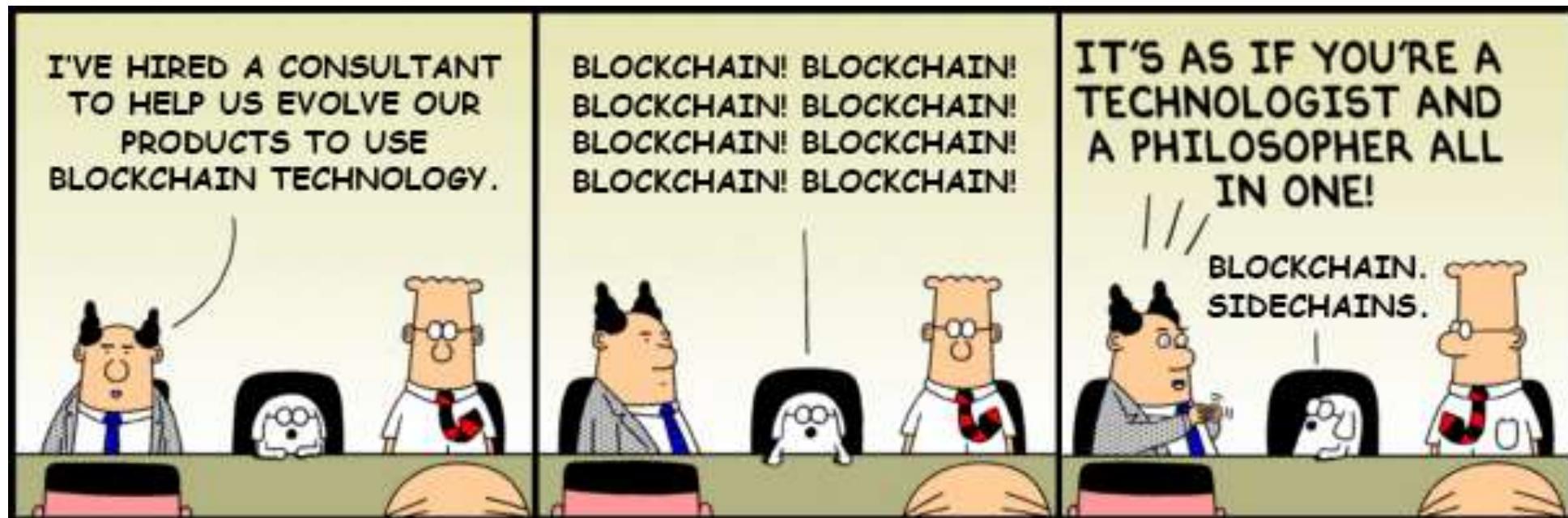
DOMO ARIGATO GOSAIMASU!

1xiiAhAMwHUQ2wwpdjfEmbA7CDaTie9au

**IDEA
PARTNERS**



BLOCKCHAIN
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Courtney Guimaraes Jr. / IGNORANT LEARNER

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+55 11 98325 0167