Blockchain Technologies

@romeokienzler

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hash(x)=h

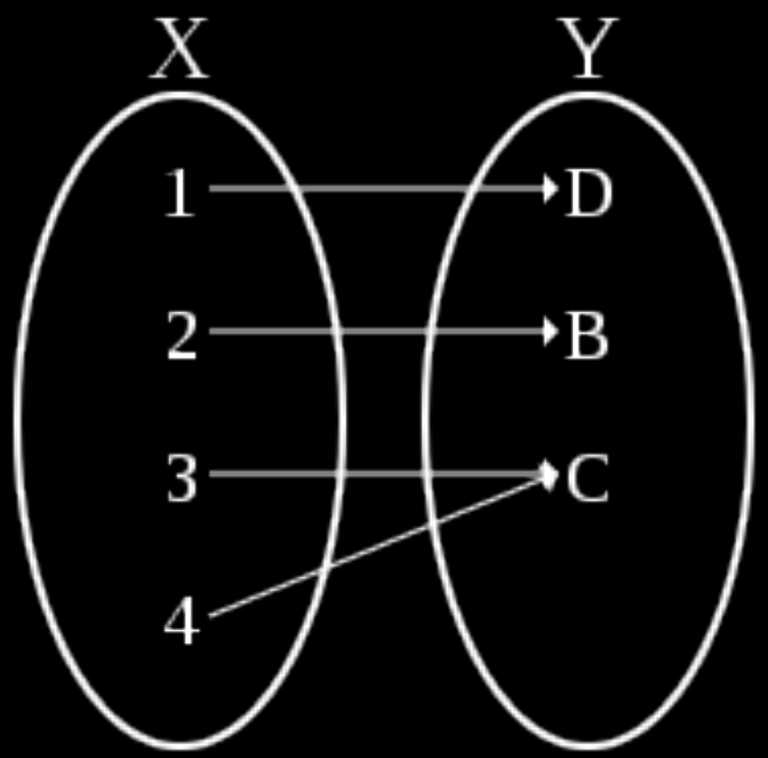
hash(x)=h

=> fast

$hash^{-1}(h)=x$

$hash^{-1}(h)=x$

=> slow / brute force / impossible


X
Y
1
D
2
B
3
C
4

“RSA”

Asymmetric Cryptography

p = 29, q = 31

$$n = p * q = 29 * 31 = 899$$

$$t = (p -1) * (q – 1) = (29 – 1) * (31 – 1) = 840$$

find e relatively prime to t

find e relatively prime to t
(t cannot be divisible by e)

find e relatively prime to t
(t cannot be divisible by e)

e.g. e = 11 (t = 840)

find d such that (d * 11) / t give us a remainder of one

d * e [=] 1 mod t

p – 29
q – 31
n – 899
t – 840
e – 11
d – 611

public key n & e

private key n & d

$$C = M^e \bmod n$$

C = M^e mod n

M = ‘w’

119

C = M^e mod n

‘w’ => ascii value is 119

C = 119^11 mod 899 = 595

595

$$M = C^d \bmod n$$

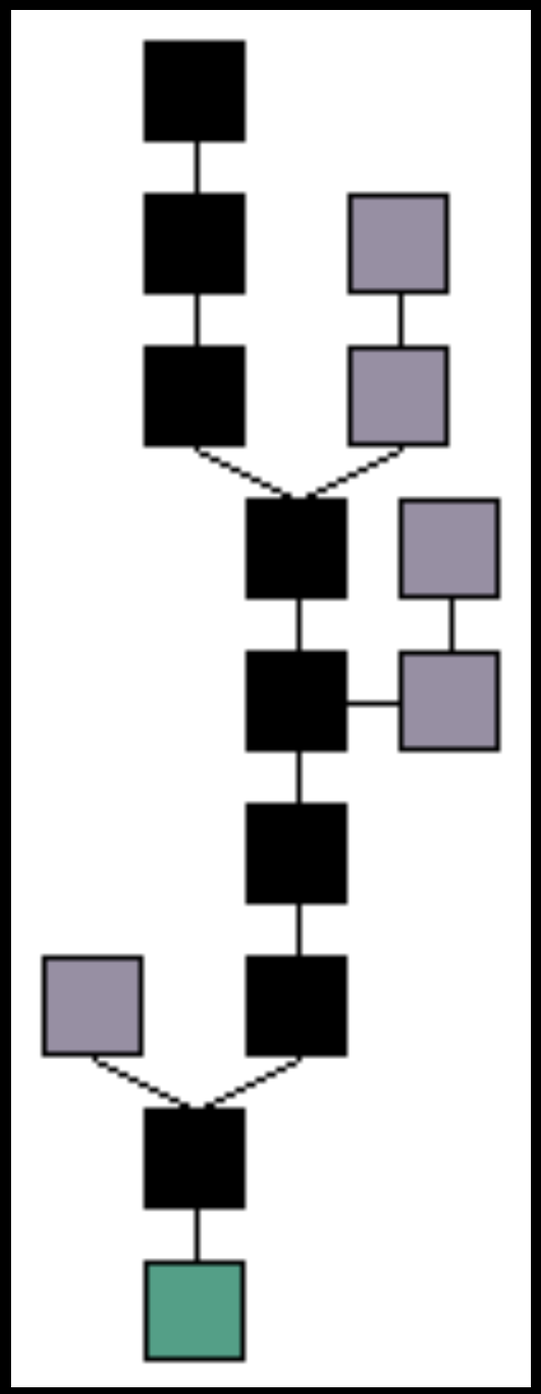
M = 595^611 mod 899 = 119

119

What was Bitcoin?

- oldest cryptocurrency
- initiated anonymously (paper + source code)
- creates a distributed ledger (blockchain) secured by proof of work
- proof of work SHA-256 based
  - This is a problem! (see later)

Bitcoin (Blockchain)



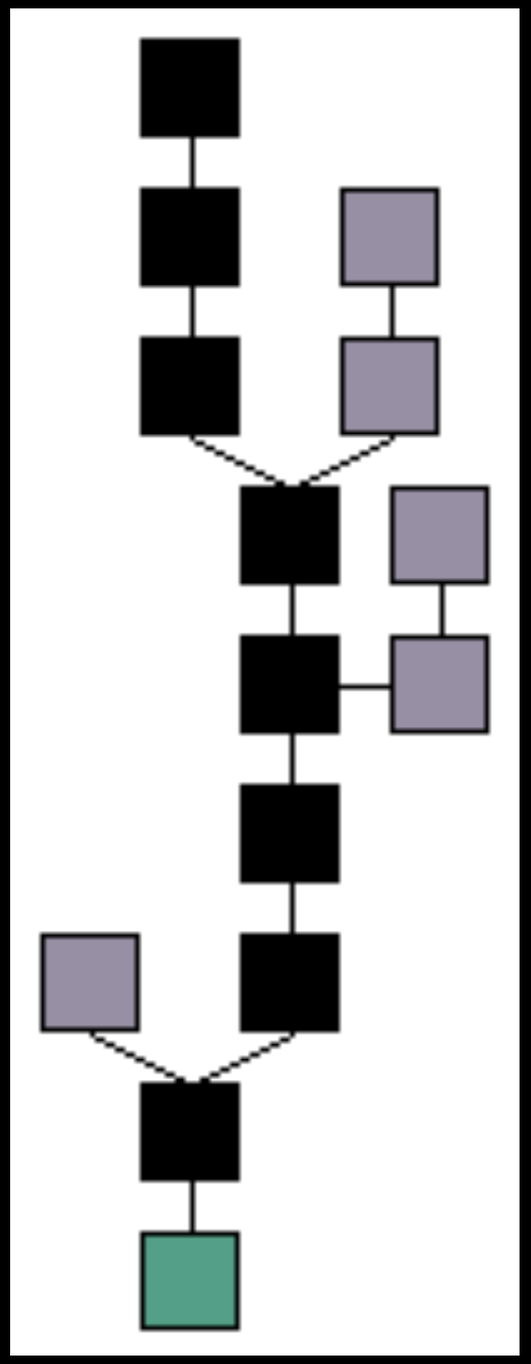
Bitcoin (Block)

Field	Description	Size
Magic no	value always 0xD9B4BEF9	4 bytes
Blocksize	number of bytes following up to end of block	4 bytes
Blockheader	consists of 6 items	80 bytes
Transaction counter	positive integer VI = VarInt	1 - 9 bytes
transactions	the (non empty) list of transactions	<Transaction counter>-many transactions

Bitcoin (Transaction)

Field	Description	Size
Version no	currently 1	4 bytes
In-counter	positive integer VI = VarInt	1 - 9 bytes
list of inputs	the first input of the first transaction is also called "coinbase" (its content was ignored in earlier versions)	<in-counter>-many inputs
Out-counter	positive integer VI = VarInt	1 - 9 bytes
list of outputs	the outputs of the first transaction spend the mined bitcoins for the block	<out-counter>-many outputs
lock_time	if non-zero and sequence numbers are < 0xFFFFFFFF: block height or timestamp when transaction is final	4 bytes

Bitcoin (Blockchain)



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Proof of Work

- sha256(sha256(Block + Nonce)) = Hash
- choose Nonce so that Hash starts with d leading zeros
- d depends on “difficulty"
  - continuously updated by the bitcoin network
- Finding correct Nonce is "proof of work"
  - rewarded with bitcoins (bitcoin mining)

Proof of Work

```
Hello, world#0 => fa2881e9b47b8e1535df08f1d6d47b71854aa0706c959a2726fcb964fc90ff15
Hello, world#1 => 795544e740045733b4713381f8e3e47bfff379e059aca1971b711b0ab8b54fb4
Hello, world#2 => d4d47d6600c4b5f6e2aa693692574175871 4a5f8dd8d69eda0ccf3a0287a2c0e
Hello, world#3 => 32192c79cd80b64e57808745bbbaafc4aebab6bec25f5df5435a439323930833
...
...
...
Hello, world#69159 => 46201a335a85608d349fec758409160b40c612fdb51a6c91e65d3b4fddb2f06a
Hello, world#69160 => fecc199b038da2d577745fb05ea85227eb823b2489bb8070e2f42f38d60155f3
Hello, world#69161 => 35ff61c959bec6a6c66ff2cc602a84d02823c46e9ca2e70f03f6ea9c9212842b
Hello, world#69162 => 0000c5a9a24161e58868c858fc2700eeabf21a86862cbfa3bbd18a4d63e5b010
```

The Problem with SHA256

- Easy to speed up using
  - GPU
  - FPGA
  - ASIC
  - Currently without the latest ASIC you spend more on energy than earning bitcoins

```
for (i=0,j=0; i < 16; ++i, j += 4)
   m[i] = (data[j] << 24) | (data[j+1] << 16) | (data[j+2] << 8) | (data[j+3]);
```

What is an ASIC?

Very low cost ultra high performance chip specialised on only one task

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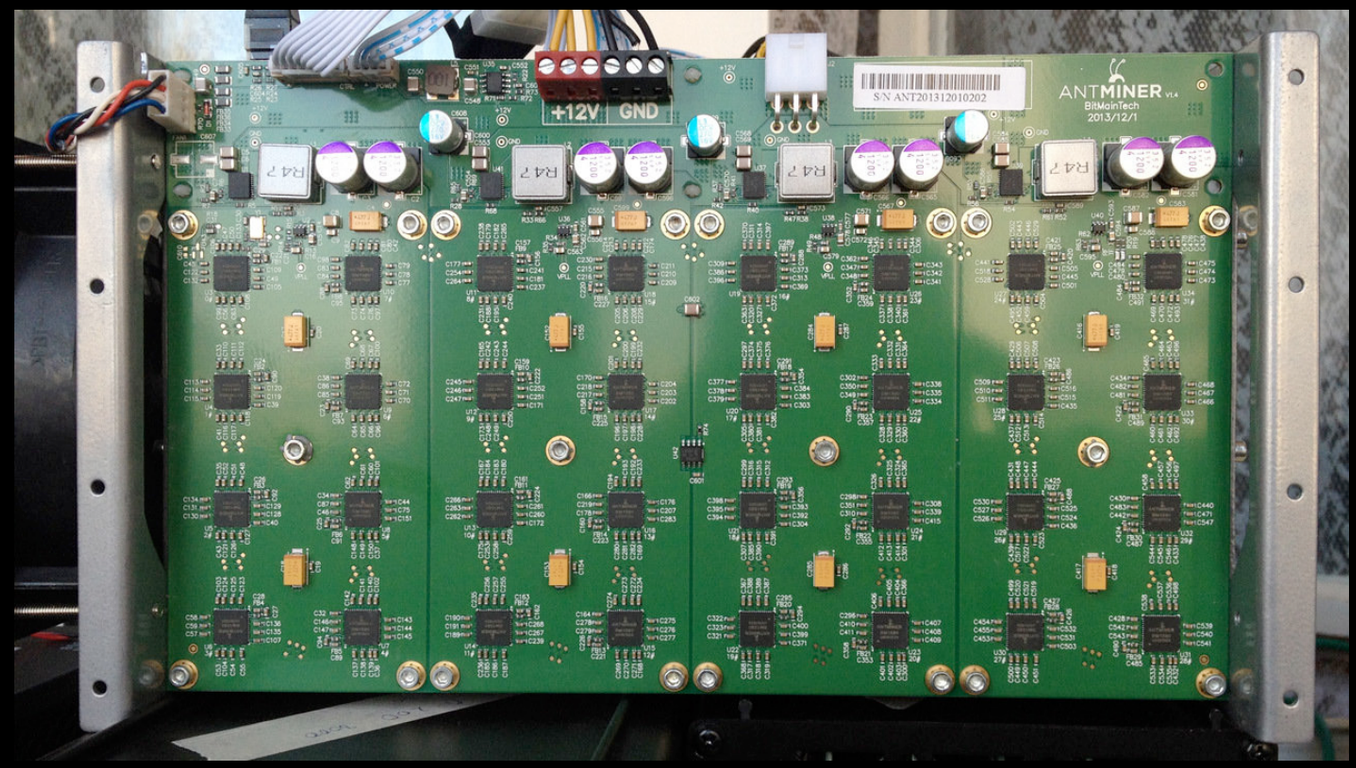

What is an ASIC?

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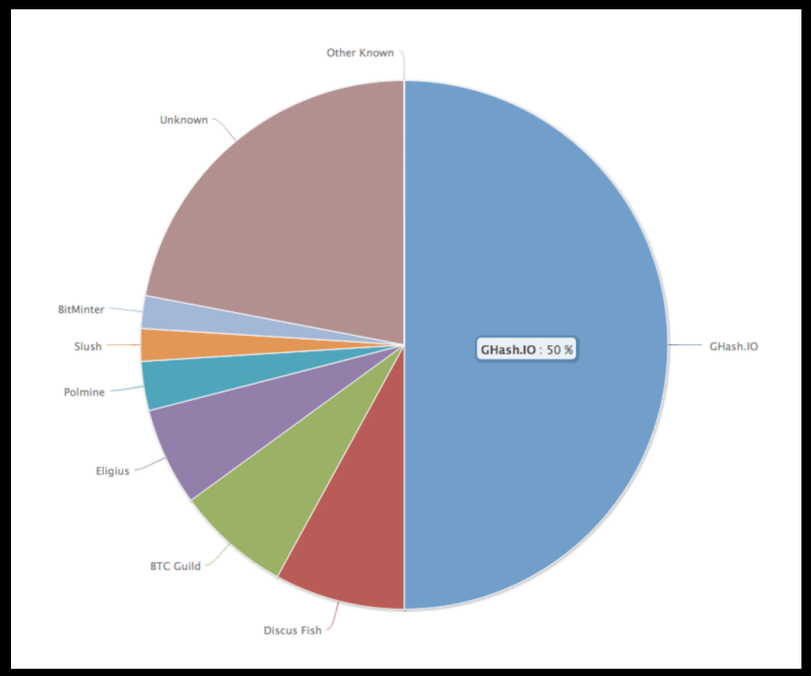
The Problem with SHA256

- *Original Idea is gone (everybody can mine bitcoins using his spare compute resources at home)*
- *system vulnerable to 51% attack*
- *recently 50% of mining power achieved by a single pool*



Alternative CryptoCurrencies

- *There are many alternatives*
  - *Auroracoin, BlackCoin, Dash, Dogecoin, DigitalNote, Ethereum, Litecoin, Mastercoin, MazaCoin, Monero, Namecoin, Nxt, Peercoin, Emercoin, PotCoin, Primecoin, Ripple, ShadowCash, Titcoin*
- *Alternative hash algorithms*
  - *scrypt, X11, cryptonight, hashimoto*
- *Alternative consensus methods*
  - *proof of work, proof of stake, proof of elapsed time*

beyond payments

- *Idea: BlockChain as distributed ledger to ensure non-centralized authority on validation of any type of transaction and business logic*

- *two promising candidates*
  - *Ethereum (Swiss Non-Profit Organization)*
  - *Hyperledger Project (The Linux Foundation, members: IBM, Deutsche Börse Group, Intel, JP Morgan, Cisco, RedHat, ...)*

What is a Blockchain?

A distributed, peer-to-peer replicated, integrity protected linked-list of data blocks

Hyperledger

- IBM Research prototype “OpenBlockchain"
- OpenSourced by IBM and donated to the Linux Foundation
- Any member can contribute and steer development
- 1st production ready release "Hyerledger Fabric V1.0" was announced at IBM Interconnect 2017

What is a Hyperledger Fabric?

"Hyperledger Fabric is a enterprise grade, distributed based on blockchain technology that use smart contracts that enforce trust between entities" @gatakka

Ivan Vankov

Misconceptions

- Hyperledger is a Blockchain
- Hyperledger is not a Cryptocurrency
- Hyperledger is not using Mining/PoW(Proof of Work)
- But preserves important properties of a crypto blockchain

Main benefit

- throughput of the system
- Ethereum 1000 transactions per minute
- Hyperledger 500 000 transactions per minute
- No loss of money through mining (electricity)

Architecture Intro

- distributed by design
- no single point of failure

Fabric-CA

- User management through X.509 certificates
- Attributes inside certificates are used to define roles and rights
- Can be attached to LDAP / Active Directory
- "only" a tool, can also use standalone OpenSSL

Peer

- place where ledger is stored

Orderer

- coordinator for transactions

Membership Service Provider

- Certificate Management for Hyperledger Fabric Components

Channel

- data isolation / multi-tenancy
- every party must accept an additional party to join
- peers take part in channel
- add / remove possible during runtime

Chaincode

- Smart-contract / Business-logic over data in the ledger
- Only way to interact with the ledger
- NodeJS, GoLang, Java
- no limit of what you can use, external libraries, external network calls
- Chaincode runs inside channel

Chaincode

- Needs to be installed and instantiated on every peer (can be automated)

Policies

- Define level of security
- No chaincode without policy file

RECAP

- Peer - may be part of one or many channels
- Every single channel has a separate ledger
- Every channel has one or many chaincodes
- Every chain code has a different policy

1 ORGANISATION

2 ORGANISATION

SDK

Transaction proposal

Peer 0

Peer 1

Peer 2

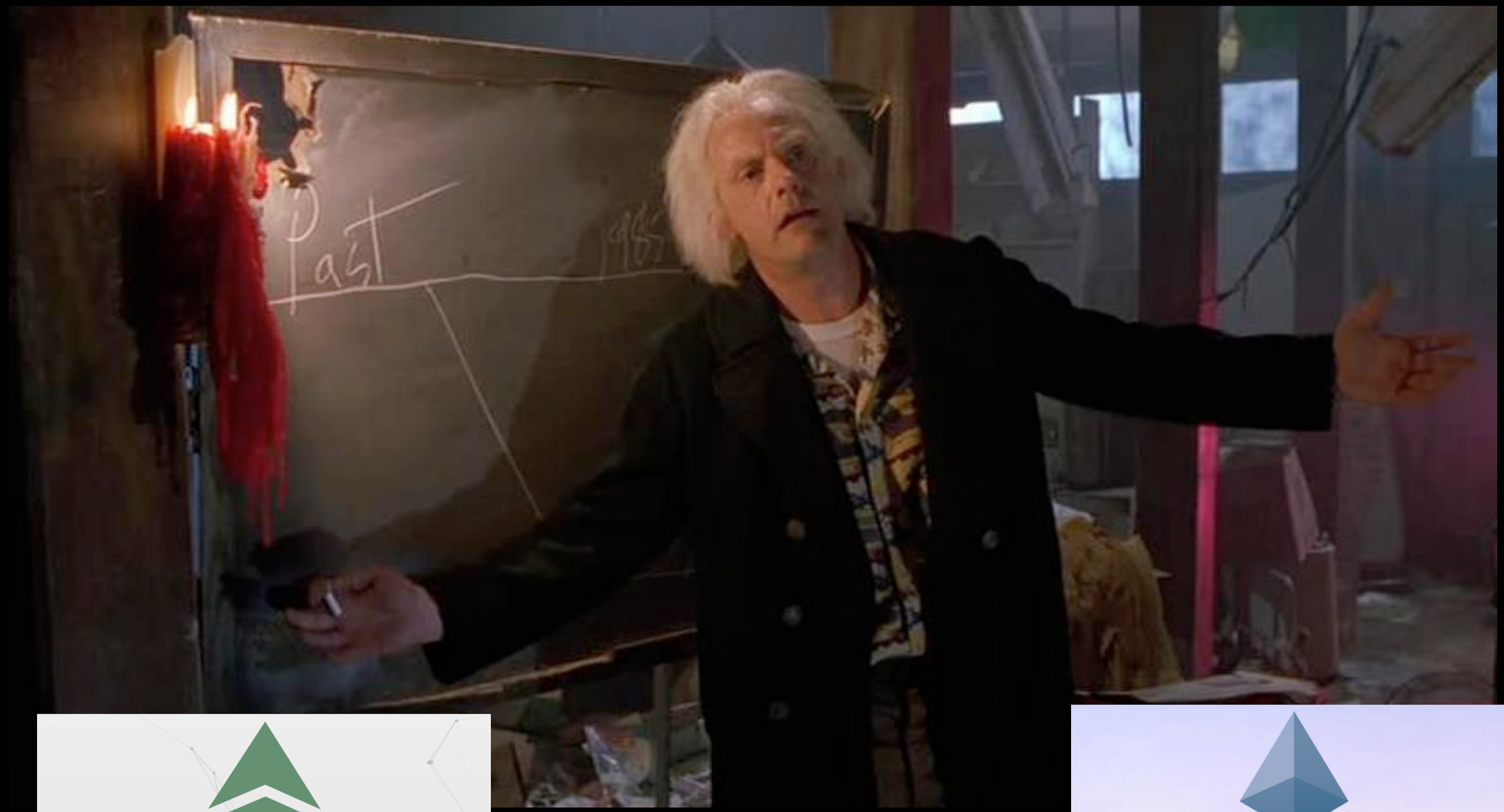
Invokation Request

Endorsement response

Orderer

Invocation

Verify policy



ethereum classic

decentralized immutable unstoppable

ETC / ETH price (USD) = 1.04 / 12.45 = 8.34 %

ETC / ETH hashrate (GH/s) = 502 / 6,959 = 7.21 %

ethereum

HOMESTEAD RELEASE

BLOCKCHAIN APP PLATFORM

digitalswitzerland challenge

staging.legaltech.ch/document/workflow/ArticlesOfAssociation?form=de&tmpl=de

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LEGALHUB

Gesellschaftsrecht-Statuten (Aktiengesellschaft)

Sign in Sign up

- Angaben zur Aktiengesellschaft
- Aktien und Aktienkapital
- Generalversammlung
- Datum und Unterschrift
- Beglaubigung

Aktien und Aktienkapital

Bitte geben Sie das Aktienkapital (CHF) der Gesellschaft ein.

* 50000

In welche Anzahl Namenaktien ist das Aktienkapital der Gesellschaft eingeteilt?

* 5000

Bitte geben Sie den Nominalwert (CHF) pro Namenaktie ein.

* 10

Back Next

Legal Entity Establishment 4w - 6w => 48h

https://ibm-blockchain.github.io/