Different Tastes of Ethereum Plasma

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About Me

- Developing Software for 12+ Years
- Team Lead at BANKEX Foundation
- Blockchain developer

Work On

- Ethereum Plasma
- BUTTON Wallet

BANKEX Foundation

- R&D Team, Plasma 🔬
- Web3Swift 📱
- Educational courses & Hackathons
- Open Source 👍

BUTTON Wallet

- Crypto **wallet** right **inside Telegram Chat**, private keys are stored in QR code on the client side, supports **BTC, LTC, BTH, ETH, ETC, Waves**
- 🔥 Russians hackers startup from Silicon Valley 🔥 that won 10 hackathons 🏆 last year including ETH
- 80K Users, 500K USD Investment from VC

20$ for the best plasma related question

buttonwallet.com

https://t.me/buttonwalletbot

@buttonwalletbot

Let's go back to Ethereum Plasma

- Solves Ethereum scalability problem (~15 TPS)
- **Level 2** scaling solution
- **It's not a payment channel** like Lightning network or Raiden
- **Side chain with centralized block production***
- Whiteparer Joseph Poon & Vitalik Buterin https://plasma.io/plasma.pdf August 11, 2017

Important to understand

- Plasma in general is a **protocol** i.e. concept that at research state right now
- All the ideas live at the ethreserch.ch research. The whitepaper is not enough to get a grasp on the plasma. Some places are obsolete

R&D

- A lot of plasma implementation was released last year, and much more are coming
- A lot of R&D done by plasma implementers group and ethereum developers community

Key components

- Plasma Smart Contract

  `Bridge between main net and side-chain. Gives security guarantees for the users`

- Plasma Operator

  `Centralized block producer that assemble blocks side chain with a speed of lite and publish block headers to the Smart Contract.`

- Client app & Plasma Validator

  `Deposits, transfers, exits and withdraw on plasma side-chain. As validator constantly stay online and monitor side chain blocks, ready to start exit if the operator makes a double spend, block withholding by any reason.`

What plasma can do

- Speedup Ethereum to the speed of light or at least 50 - 1000 times
- Tremendously reduce a transaction price ~0.0001$
- Support fungible ERC20 and non-fungible ERC721 deposits and exchange
- Potentially suites for any Blockchain with turning complete smart contracts
- Potentially support smart contracts inside of side-chain

With one clarification - it depends on plasma

- Speedup Ethereum to to speed of light or at least 50 - 1000 times ***depends on plasma design***
- Tremendously reduce a transaction price ~0.0001$ ***depends on plasma design***
- Support fungiable ERC20 and non-fungiable ERC721 deposits and exchange ***depends on plasma design***
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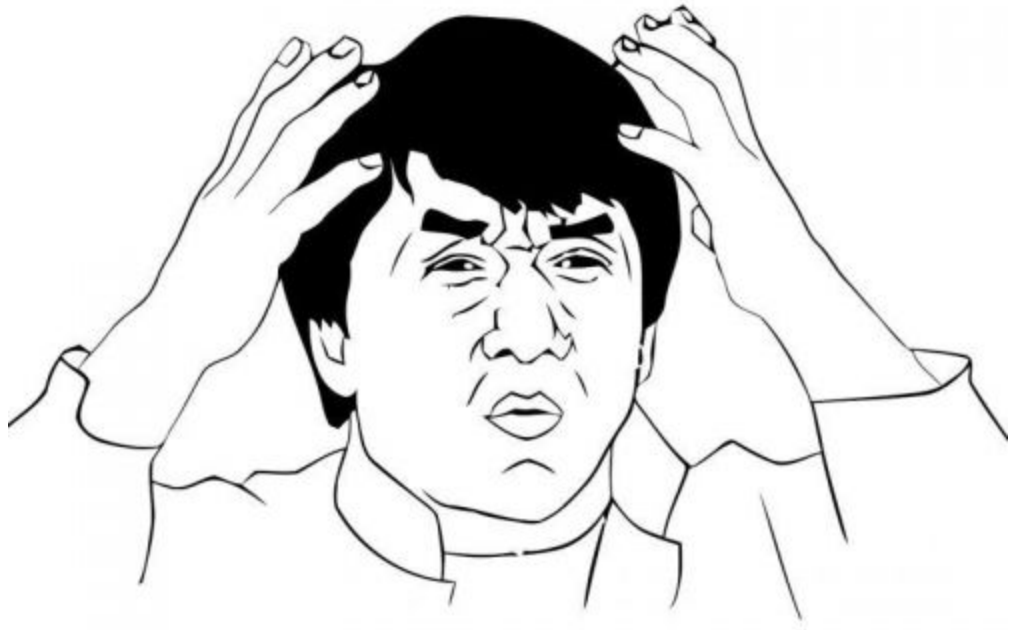
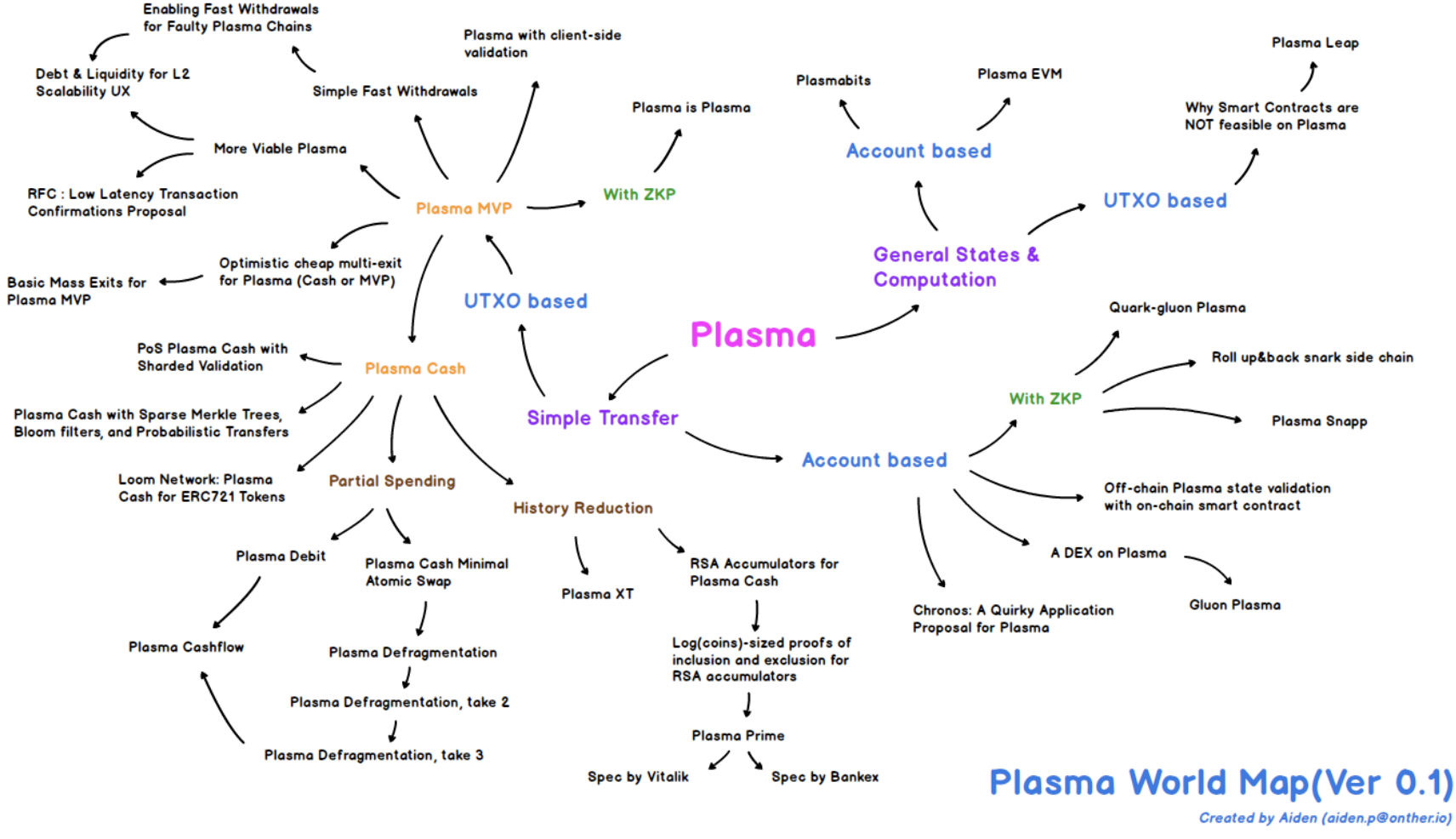
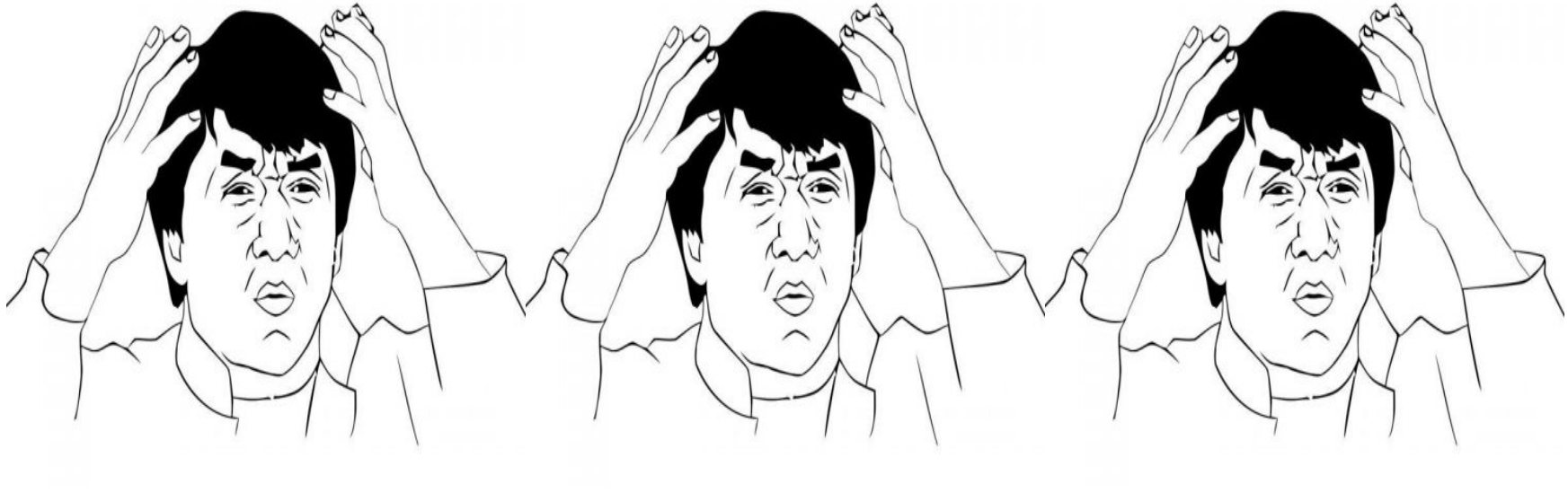


Plasma World Map



https://medium.com/onther-tech/plasma-world-map-ba8810276bf2



UTXO vs Account Based

Note: `UTXO model - like bitcoin.`
Note: `Account based model - like ethereum.`

- UTXO based
  - Merkle Trees
  - Growing history problem
  - Someone needs to stay online and watch on what operator do
- Account based
  - Requires zero-knowledge proofs to change sate
  - Requires extensive computation on the operator
  - Requires trusted setup
  - Consume more space in the block on the main net

UTXO based

- **Merkle Trees** `operator publish root hash on the main net`
- **Growing history problem** `Validator should keep full history, to win exit game. Since speed is high history growing tremendously. Can be solved by history compression based on RSA accumulators or zkSNARK/zkSTARK.`
- **Some one need to stay online** `and checks what operator publish, to trigger own exits and challenge exits of other participants`

Account based, e.g. rollup

- **Requires zero-knowledge proofs to change sate** `Smart contract accepts only valid 'state transition' by checking proof that operator publish. The operator can't publish wrong blocks. Checking is cheap and can be done on smart contract`
- **Requires extensive computation on operator** `It's hard to generate zero-knowledge proof`
- **Requires trusted setup** `(only for zkSNARKS). Ethereum can provide required features.`
- **Consume more space in the block on the mainnet** `Operator also publishes transaction fingerprint.`

Plasma state of the art:

- More Viable Plasma
- Plasma Cash
- Plasma Prime, e.g. Plasma Cashflow with history reduction on RSA accumulators
- Plasma Cashflow with history reduction on zkSNARKS
- Account based zkSNARKs Plasma

Plasma state of the art:

- More Viable Plasma 🚫
- Plasma Cash 🚫
- Plasma Prime, e.g. Plasma Cashflow with history reduction on RSA accumulators ❄️
- Plasma Cashflow with history reduction on zkSNARKS 👍
- Account based zkSNARKs Plasma 👍 🔬

More Viable Plasma

- Fix minimal viable plasma vulnerabilities 👍
- 2 weeks time for an exit, requires liquidity market to fix that 👎

🚫 Showstopper:

History is growing to fast, in one year it's not possible to store it on the server

- It requires ~1 Kb per transaction.
- 100k transaction/second ~ 2 Petabyte per year

Plasma Cash

- Easy to implement 👍
- Doesn't have minimal viable plasma vulnerability 👍
- Only non-fungible assets e.g ERC721 tokens 👎

🚫 Showstopper:

History is growing too fast; it's not possible to store the history on the light client, e.g. mobile client

- 2.5 Gb for a single coin - over the year history reduction on ethresearch
- 20 Gb for the 8 coins

Plasma Prime - Cashflow with history reduction u RSA Accumulators

- Slices instead of unique coins(plasma cash), similar to plasma debit
- End-user needs to observe only slices that he owns
- The introduced idea of history compression by generation proof of exclusion of slice to a range of blocks `1) Assign a prime number to slice 2) When ever slice modification assign a new prime number to slice and put it into the accumulator.`
- Proof of exclusion requires less space than full history
- Requires to expensive computations `After implementing a proof of concept, BANKEX Foundation research team find out that existing RSA Accumulator is a bottleneck that we can't pass at the moment.` ❄️

Plasma Cashflow with history reduction on zkSNARKS

- The same idea as Plasma Prime, we fix a problem, by replacing RSA Accumulator with zkSNARK proof of exclusion
- Working solution that fixes the problem of extensively growing history. 👍
- The user should only store the compressed history of his own coins. About 1 - 10 Mb for the small amount of Ether. 👍
- Doesn't have known critical issues that previous designs had 👍
- All the components are known, key research has been completed [1, 2, 3] 👍

Proof of concept designed on the ETH Singapore by BANKEX Foundation (Github)

Account based zkSNARKs Plasma e.g rollup

- Verifiable computation and account-based model can potentially bring features that other plasma can't, e.g. order book for the exchange 👍
- No need to stay online to validate blocks 👍
- Requires a lot of Gas to publish blocks 👎
- About 20 TPS 🔥 on a laptop ~300 - 1500 TPS on cluster 👎

Proof of concept is implemented by barryWhiteHat (Github)
6th of January 2019 alpha version of Ignis Wallet published on the testnet by Matter.Inc (Wallet on testnet)

Thanks

Chuck likes Plasma,

But he no needs it to speedup Ethereum

Questions

BUTTON Wallet with 20$ ETH for the best question.

Scan and import it to @buttonwalletbot in telegram

That presentaion on the Github

Done with Marp, amazing markdown to presentation writer