ΣRGO

COMPREHENSIVE CRYPTOCURRENCY DESIGN

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26 MAY 2017

GENESIS MOSCOW CONFERENCE

Structure

- Σrgo idea
- Blockchain problems
- Σrgo solution

Σrgo idea

Motivation

Theory

- Provably secure
- New features
- Impractical

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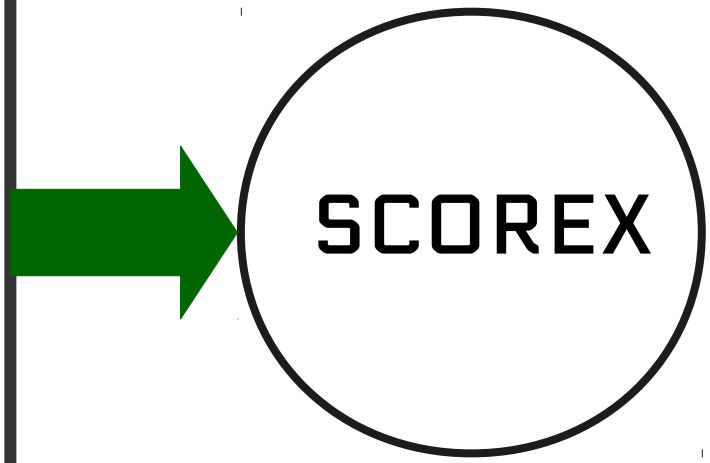
Practice

- 1000 currencies
- Ad-hoc solutions
- Security issues

Motivation: Scorex

Theory

- Provably secure
- New features
- Impractical



Practice

- 1000 currencies
- Ad-hoc solutions
- Security issues

Motivation: Σrgo

Theory

- Provably secure
- New features
- Impractical

Practice

- 1000 currencies
- Ad-hoc solutions
- Security issues

Σrgo idea

Design scalable, user-friendly decentralized cryptocurrency by combining ideas complementing each other

Blockchain problems

Throughput

- Bitcoin throughput: 2–3 tx/sec ().
- Blocks are full
- UTX size: 200000 tx
- Transaction fees are high
- Not applicable for mass adaptation

Smart contracts

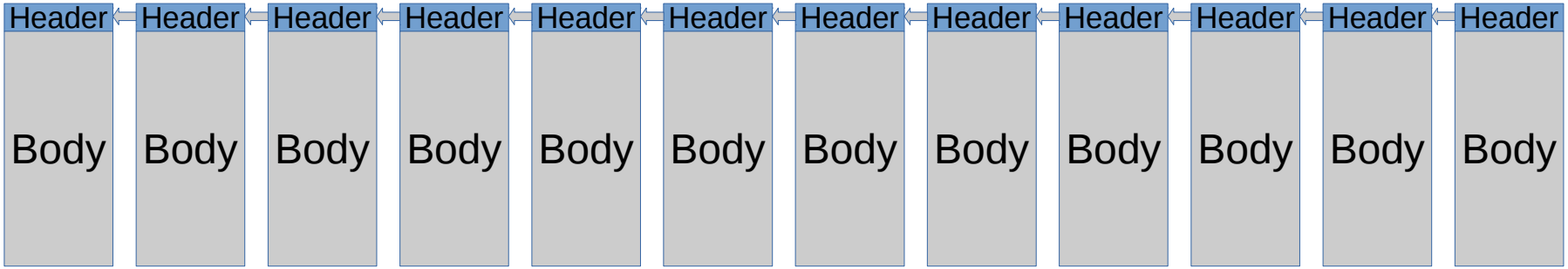
- Bitcoin script is limited
- Instructions are hard-coded

General-purpose smart contract languages:

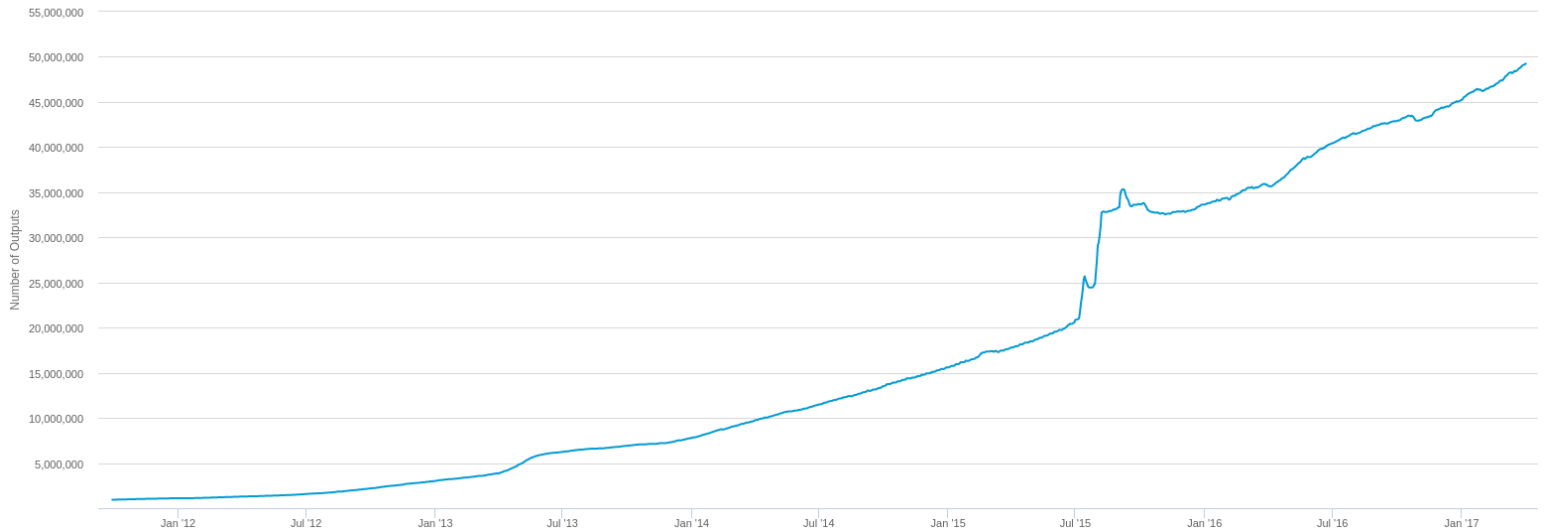
- Limited with total cost of all the operations
- Cost estimations are hard (DoS attacks)
- A lot of possibilities => a lot of vulnerabilities

Blockchain and State

- Blockchain

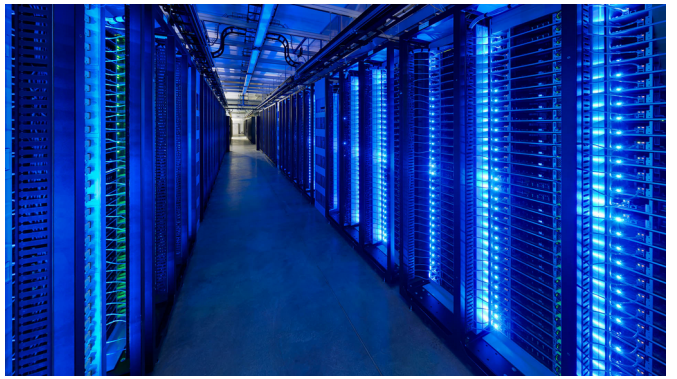


- State



Blockchain and State

Miners should validate transactions efficiently. They can:
1.Keep State in RAM => Mining centralization
2.Do not keep State => SPV mining



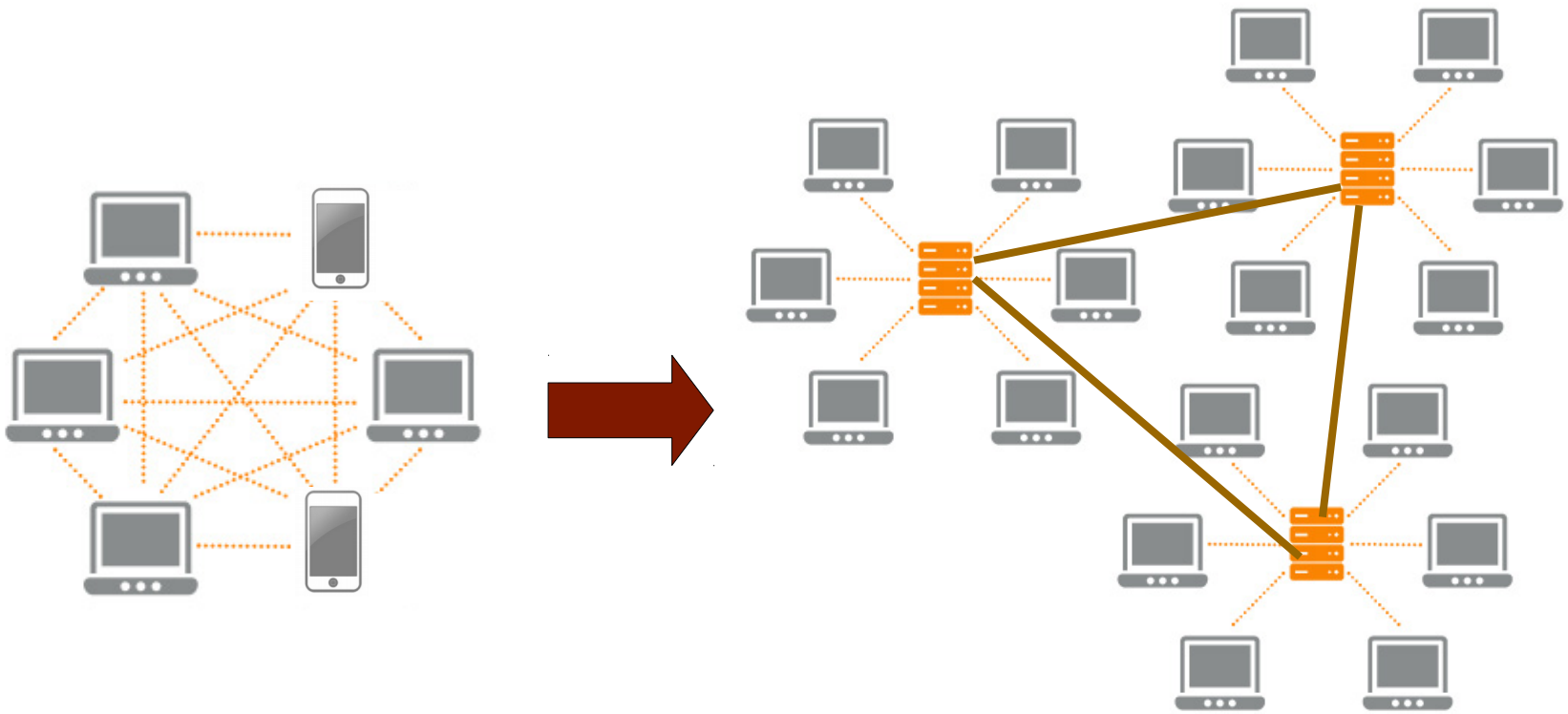
Blockchain and State

Problems for users:

- Can't validate blocks on low-end hardware
- Long validation on commodity hardware

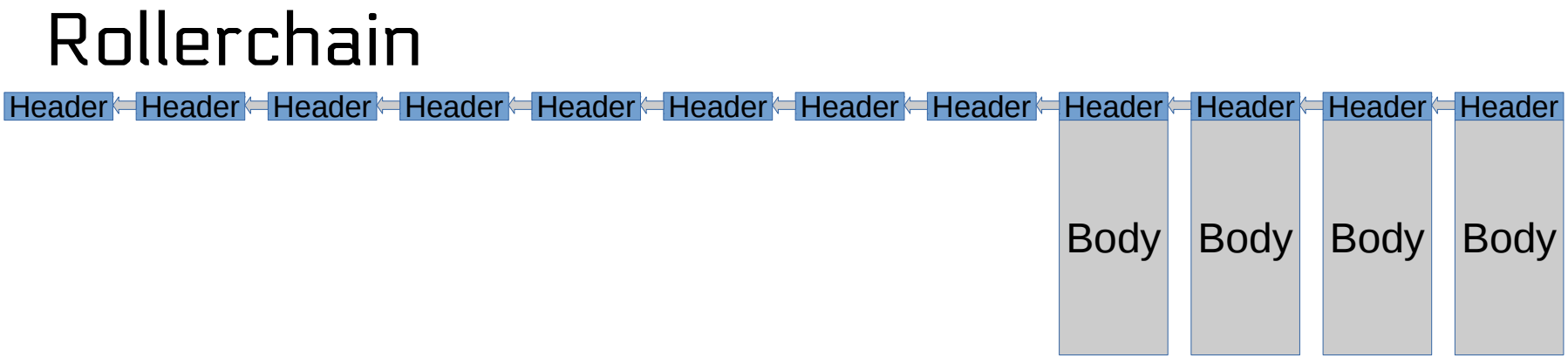
  =>

- Users move to centralized services



Ergo Solution

Blockchain size: Rollerchain

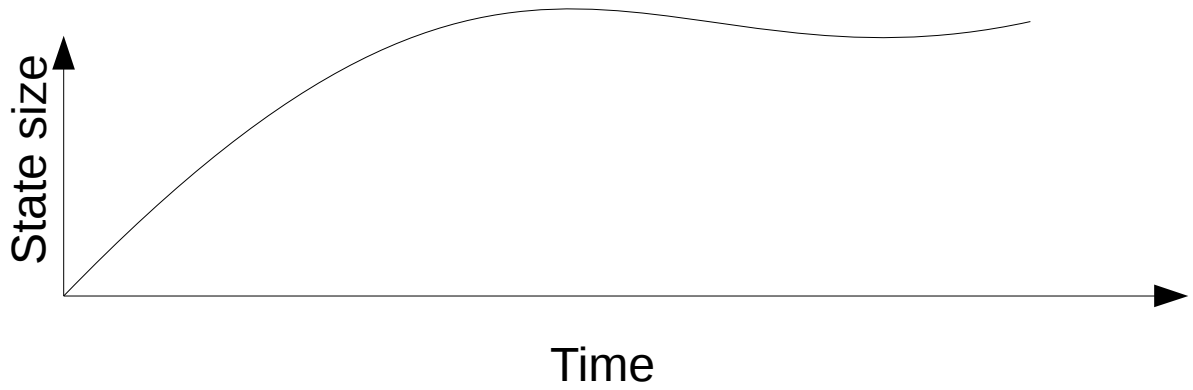


- Miners are enforce to keep fixed number of last blocks and headers (~40 Mb)
- Static storage requirements
- Fast bootstrap

Chepurnoy, A., et al. Rollerchain, a Blockchain With Safely Pruneable Full Blocks

State size: Space-scarce economy

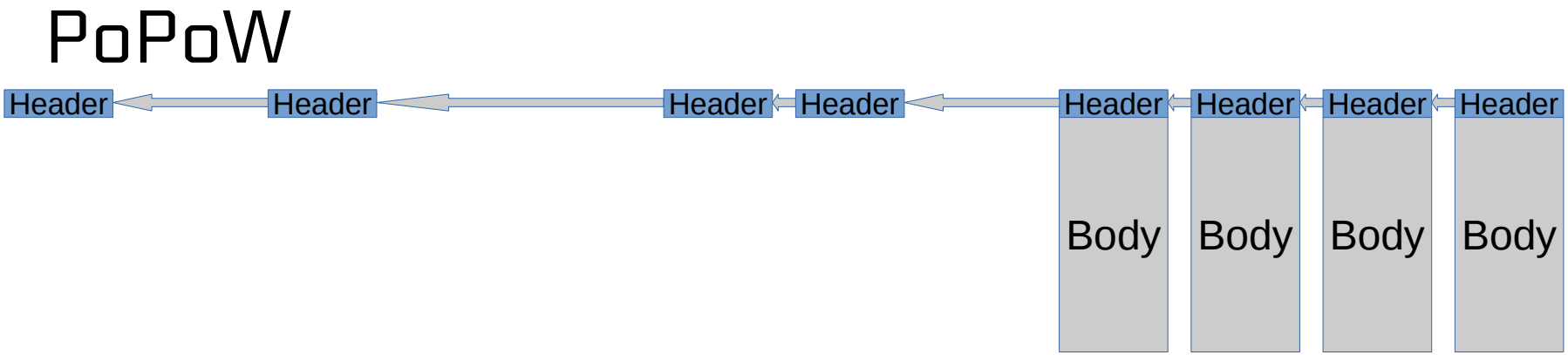
Space-scarce economy state



- Controllable State size with upper-bound
- Incentive for active users
- Return lost coins to economy
- Predictable miner reward

D. Meshkov, A. Chepurnoy, On space-scarce economy in blockchain systems.

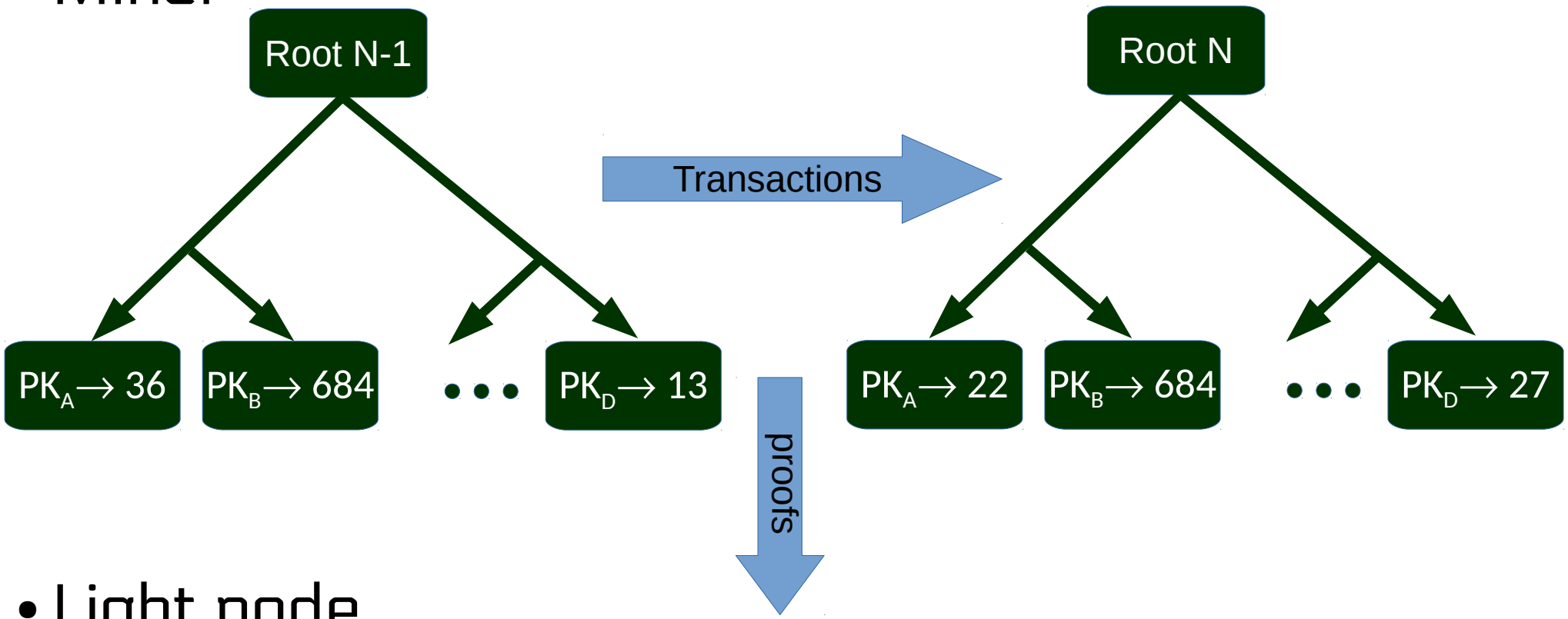
Header chain size: PoPoW



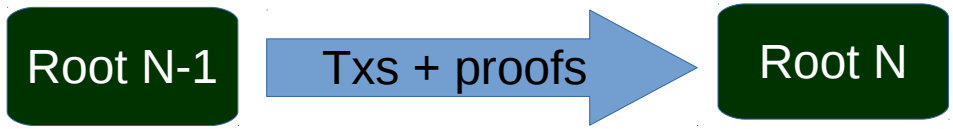
- Nodes should keep only sublinear subset of headers (~20 Kb)
- Extremely fast bootstrap
- Cross-chain proofs (e.g. sidechains)

Light node state size

- Miner



- Light node



Proofs verify balances and calculate new root hash

Reyzin, L., Meshkov, D, Chepurnoy, A. & Ivanov A. Improving Authenticated Dynamic Dictionaries, with Applications to Cryptocurrencies

Light node state size

- Light node blockchain: (~20 Kb)

- Light node state: 32 byte

Root N

- Full node security guarantees with few Kb of data
- Decentralized user-friendly light wallet

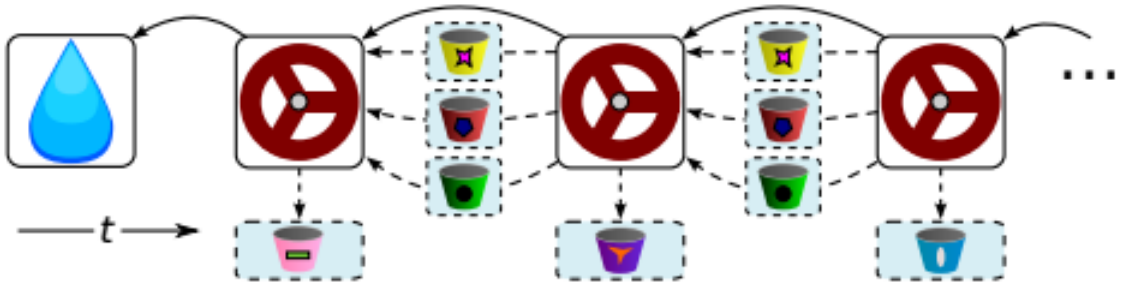
Reyzin, L., Meshkov, D, Chepurnoy, A., Ivanov A. Improving Authenticated Dynamic Dictionaries, with Applications to Cryptocurrencies

Smart contracts support

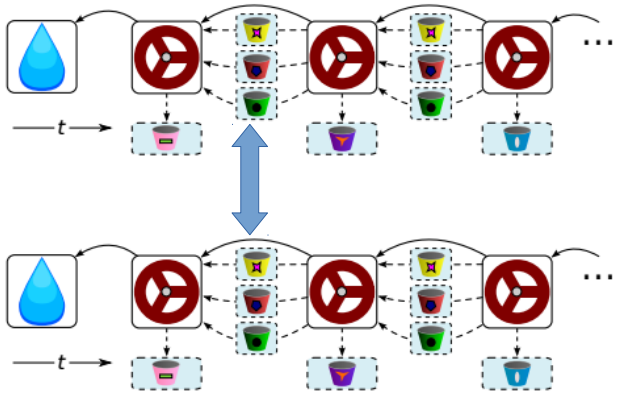
- Rich authenticated transaction language (Σlang)
- Environment propositions + Crypto propositions
- For free: threshold signatures, ring signatures
- Ahead-of-time cost analysis
- Protocols-friendly blockchain

Σrgo as database

- State as database
- Aspen blockchain structure



- Sidechains – data chain and money chain



A. E. Gencer, R. van Renesse, E. G. Sirer, Service-oriented sharding with aspen

Throughput

- Bitcoin-ng for maximum on-chain thoughput (100 tx/s)
- Off-chain protocols on top of flexible transactional language (10K tx/s)
- Multiple blockchains with sidechain token transfer between them for further research

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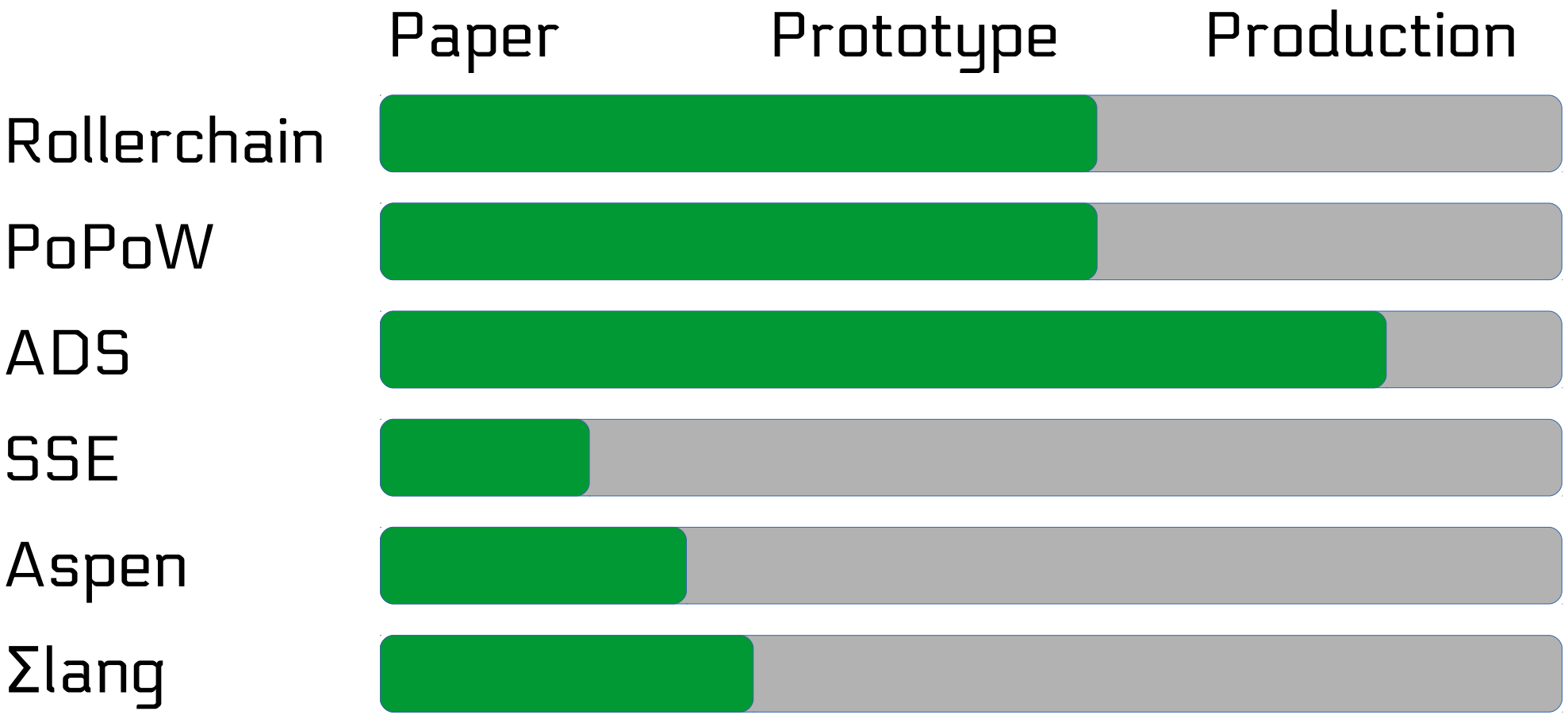
I. Eyal, et al. Bitcoin-ng: A scalable blockchain protocol
J. Poon, T. Dryja, The bitcoin lightning network: Scalable off-chain instant payments
A. Miller, et al. Sprites: Payment channels that go faster than lightning
A. Back, et al., Enabling blockchain innovations with pegged sidechains

Status


Paper
Prototype
Production
Rollerchain
PoPoW
ADS
SSE
Aspen
Σlang

Conclusion

- Constant storage requirements
- Controllable state size
- Full-node security guarantees on smartphones
- Smart-contracts including cryptography
- Efficient blockchain as database
- High throughput
- Decentralized network

Thank you!

Collaborations are welcomed!

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