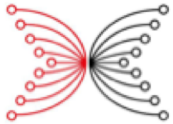

INPUT | OUTPUT

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A Treasury System for Cryptocurrencies: Enabling Better Collaborative Intelligence

Bingsheng Zhang

Lancaster University, UK & IOHK

Joint work with Roman Oliynykov (IOHK) and Hamed Balogun (Lancaster University)

25/02/2019 @ NDSS 2019

What is a treasury system?

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Who funds a cryptocurrency development/maintenance?

What is a treasury system?

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Patron organization donations

Initial Coin Offering (ICO)

Problem:
Lack of Sustainability

What is a treasury system?

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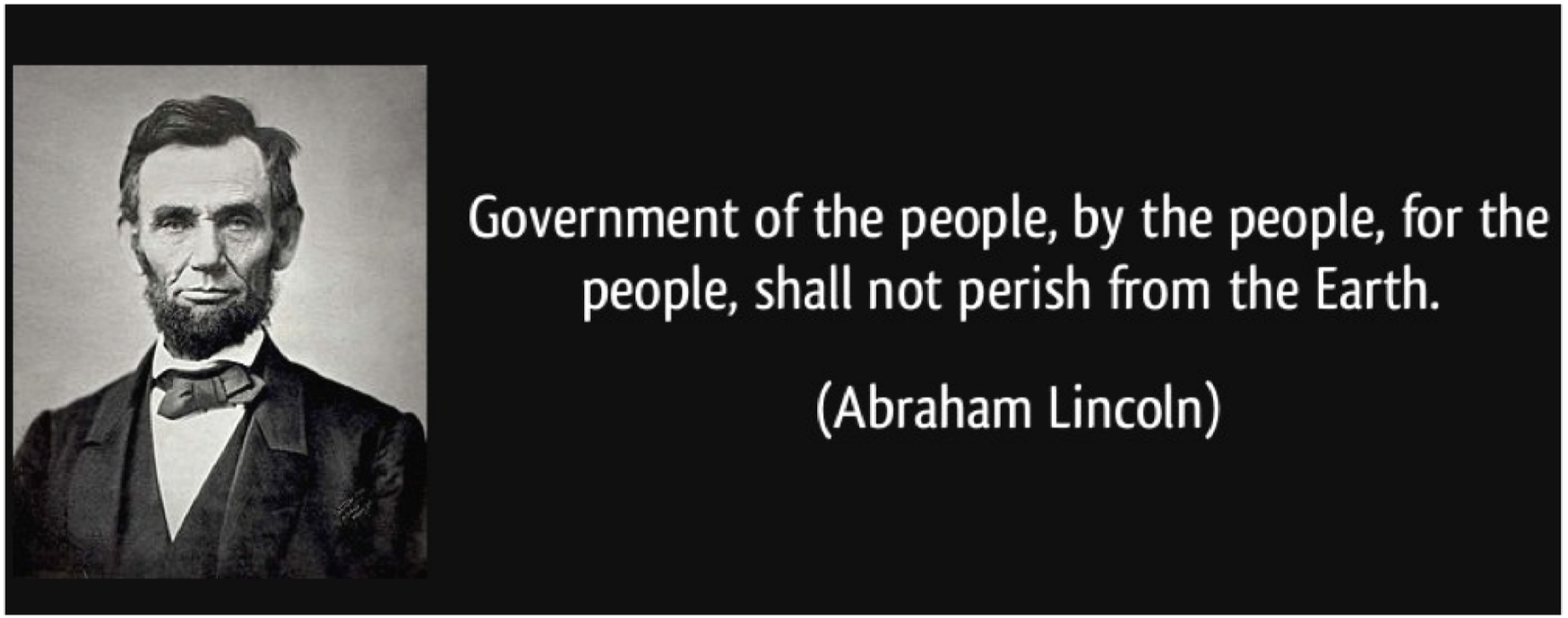
Alternatively:

Hair-cut/Tax of Block rewards



Who decides how the funds will be used?

Decision making



Who are the people?

Decision making

- What are the people?
  - Stakeholders
  - Anyone else? Developers? Researchers?

What is a treasury system?

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Treasury sources

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Mint coins

Taxation

Donation

Supporting liquid democracy

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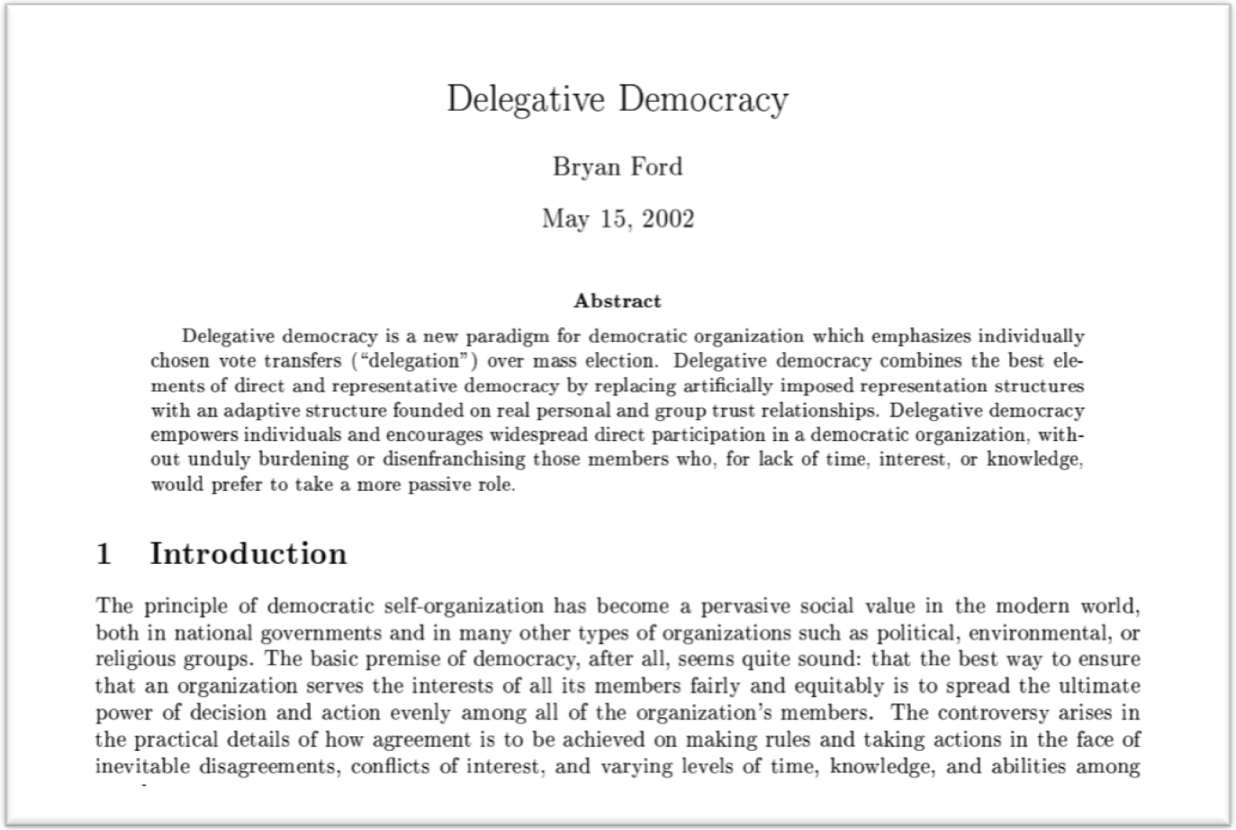
- What is liquid democracy?



Delegative Democracy

Bryan Ford

May 15, 2002

Abstract

Delegative democracy is a new paradigm for democratic organization which emphasizes individually chosen vote transfers ("delegation") over mass election. Delegative democracy combines the best elements of direct and representative democracy by replacing artificially imposed representation structures with an adaptive structure founded on real personal and group trust relationships. Delegative democracy empowers individuals and encourages widespread direct participation in a democratic organization, without unduly burdening or disenfranchising those members who, for lack of time, interest, or knowledge, would prefer to take a more passive role.

1 Introduction

The principle of democratic self-organization has become a pervasive social value in the modern world, both in national governments and in many other types of organizations such as political, environmental, or religious groups. The basic premise of democracy, after all, seems quite sound: that the best way to ensure that an organization serves the interests of all its members fairly and equitably is to spread the ultimate power of decision and action evenly among all of the organization's members. The controversy arises in the practical details of how agreement is to be achieved on making rules and taking actions in the face of inevitable disagreements, conflicts of interest, and varying levels of time, knowledge, and abilities among

Source: https://bford.info/deleg/deleg.pdf

Supporting liquid democracy

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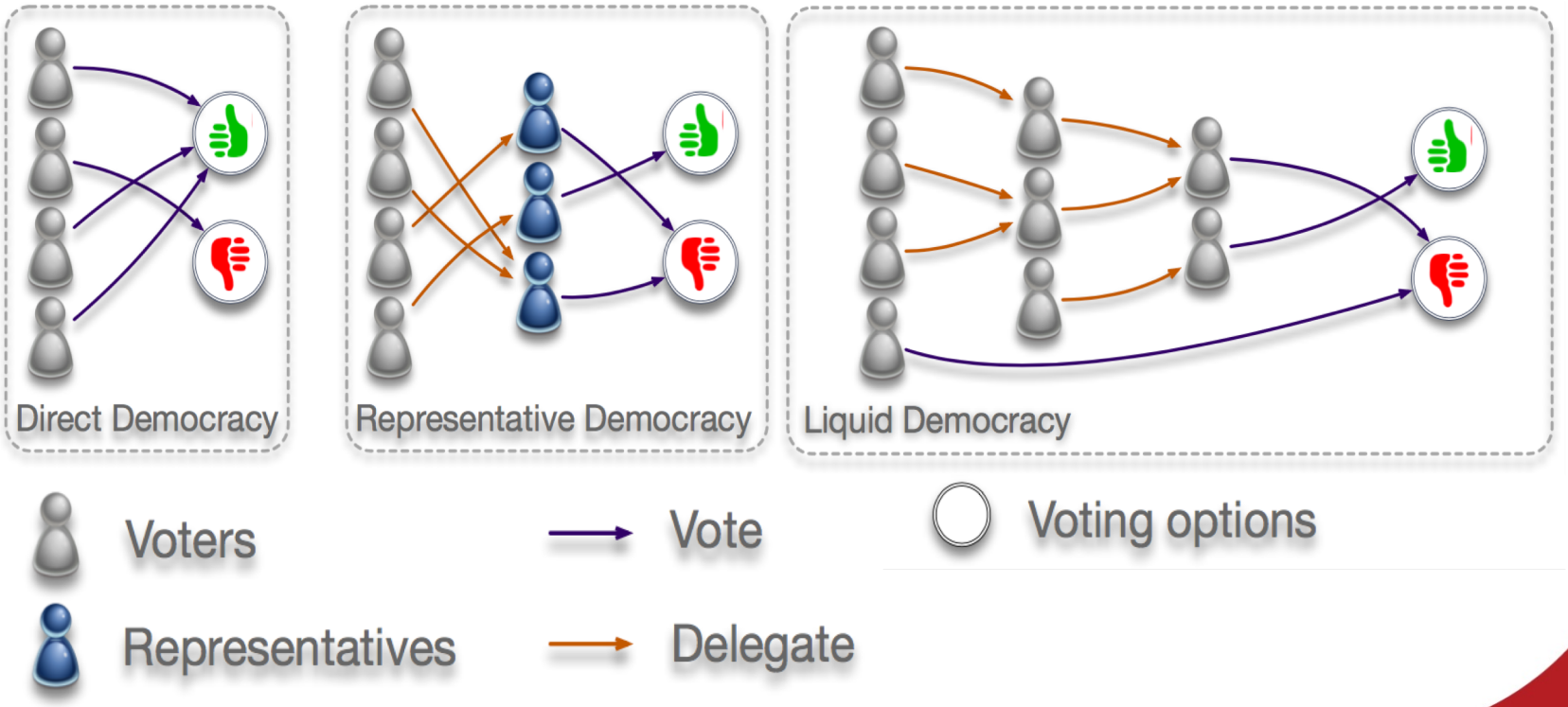
- Liquid democracy is a hybrid of direct democracy and representative democracy.



Cryptocurrency abstraction

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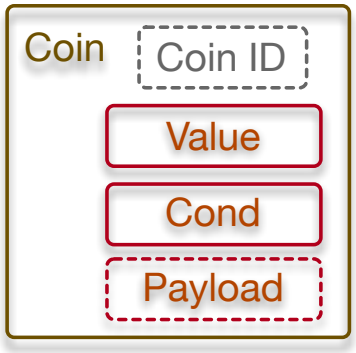
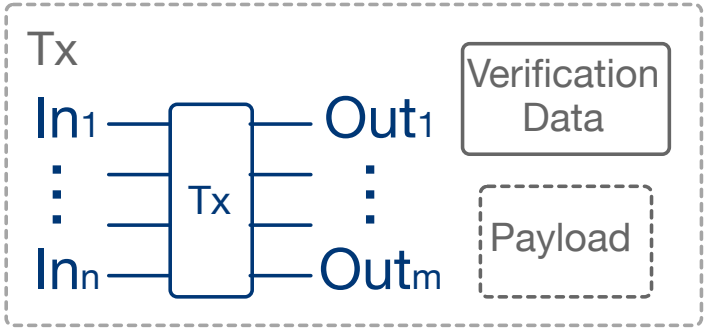
- Coin
  - Coin ID, value, condition, and payload
- Address
  - Generalized: spending condition the recipient intended
- Transaction
  - Inputs and outputs: s.t. $\sum_{i=1}^{n} \text{In}_i.\text{Value} \geq \sum_{j=1}^{m} \text{Out}_j.\text{Value}$





System overview

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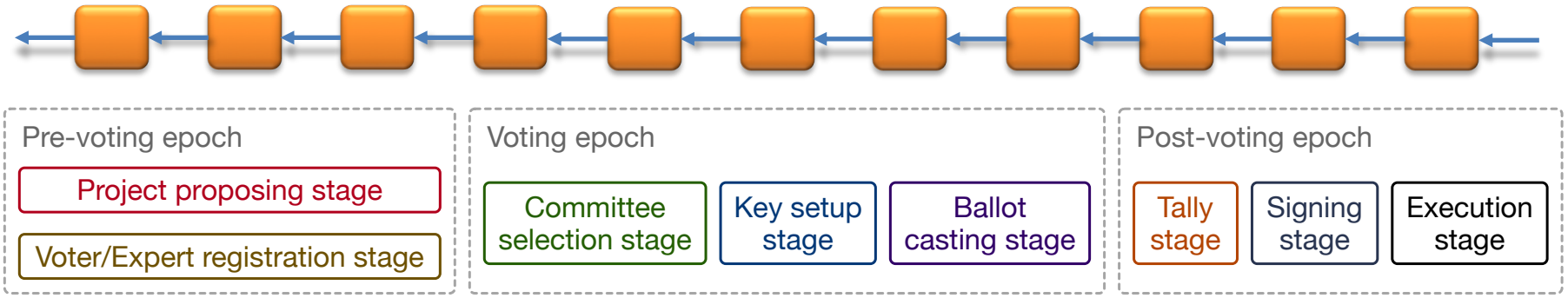
- A treasury period consists of
  - Pre-voting epoch
  - Voting epoch
  - Post-voting epoch



Pre-voting epoch

- Project proposal
  - Open
  - Small cost: fee

- Voter registration
  - Minimum deposit
  - Voting power -- deposited stake
  - Reward -- deposited stake

Fine

- Expert registration
  - Fixed amount deposit
  - Voting power – delegations
  - Reward -- delegations

Voting epoch

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- Committee selection
  - Majority honest
  - Fixed deposit

- Key setup
  - Threshold PKE key generation
  - Robustness

- Ballot casting
  - See next page

Voting epoch

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- Ballot casting

Wait a minute. Where is delegation?

Conceptual barriers!

Answer: You vote your delegation

Voting epoch

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Unit vector

PROOF

Size: O(log n)

Post-voting epoch

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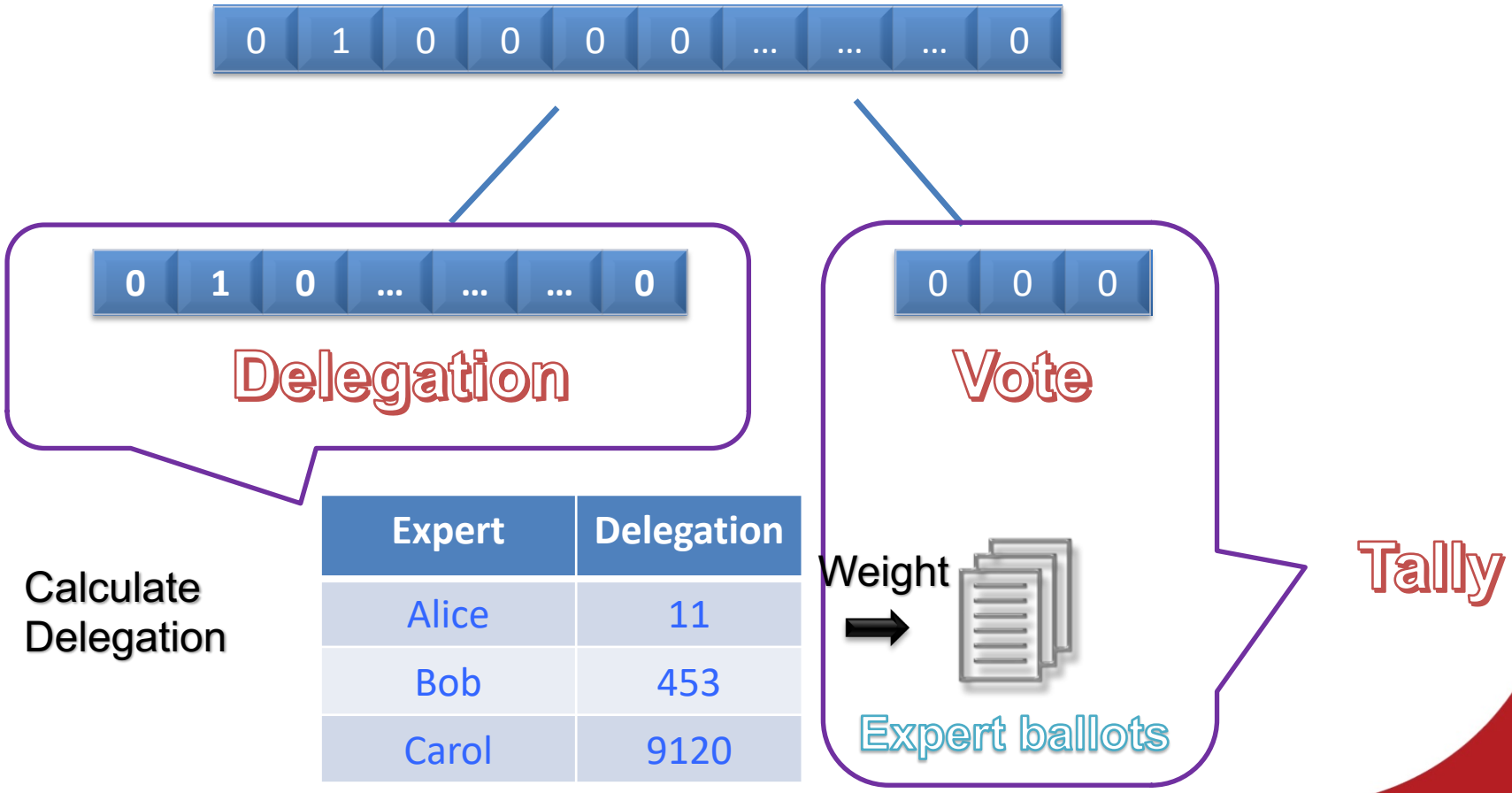
- Tally



Calculate Delegation

Expert	Delegation
Alice	11
Bob	453
Carol	9120

Post-voting epoch

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- Sign the decision
  - Tally results are signed by the voting committee and put on the blockchain
- Execution
  - Winning projects are funded
  - Voters and experts are rewarded: voters according to their deposit size, expert according to the level of delegation
  - Committee members are rewarded: fixed amount
  - [optional] Commit the next beacon

An example

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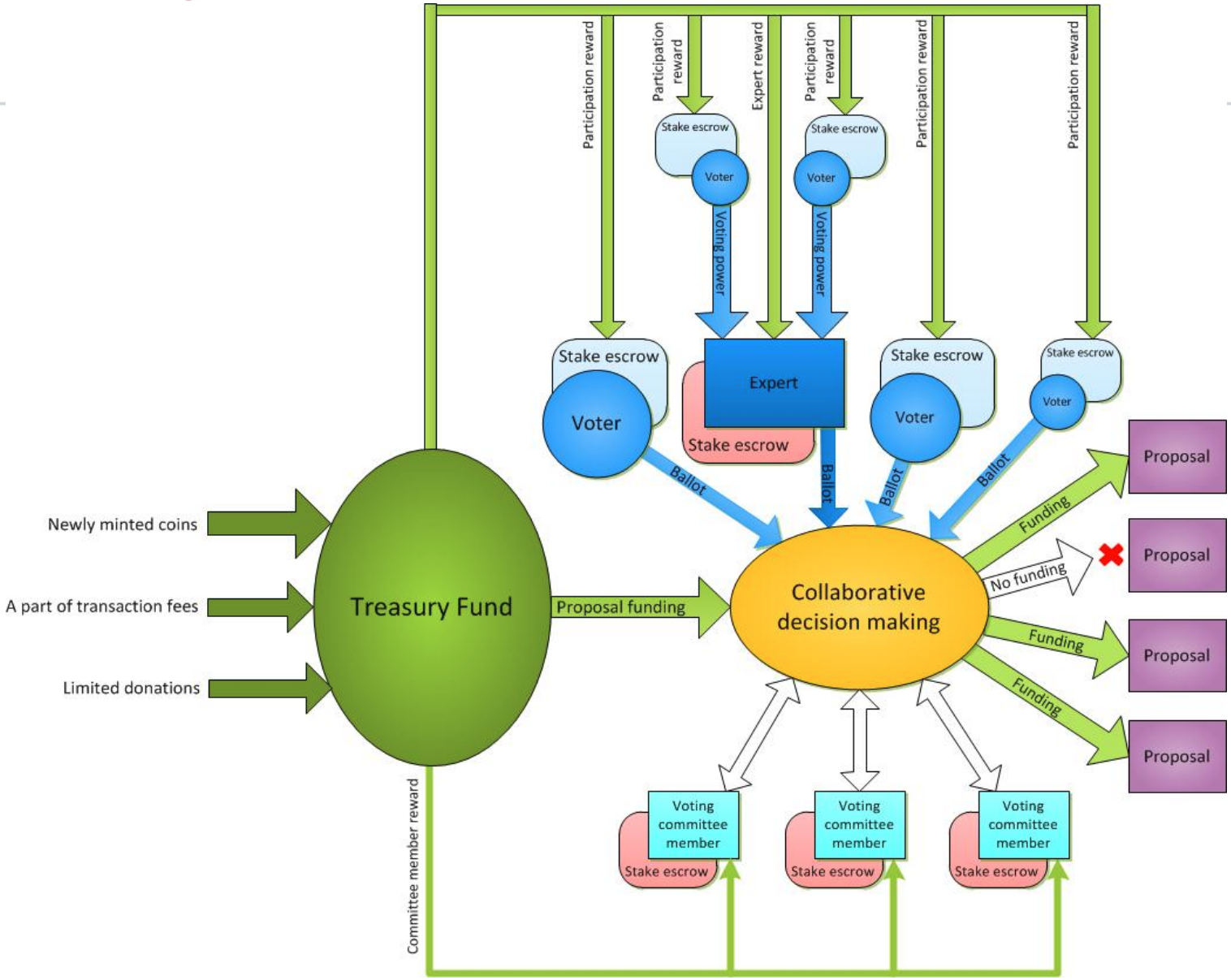
Title (listed by priority)	Monthly Amount	"Yes" Votes, stake	"No" Votes, stake	"Yes-No" difference	% of Votes
Core development (version 4.5.7)	12000	381800	12500	369300	95,45
Web portal and domain name maintenance (Feb-May 2018)	4000	362000	21000	341000	90,5
Design development for the new mobile client (version 17.4.8)	7000	349400	19100	330300	87,35
Marketing activity (ATM deployment)	3000	330300	29000	301300	82,575
Legal support (compliance analysis with respect to US/Nebraska legislation)	3000	327000	20100	306900	81,75
Cryptocurrency promotion at a FC conference	3000	273600	59100	214500	68,4
Fun challenge for Minecraft players	2000	180000	210100	-30100	-7,525
Total Budget	30 000 coins				
Total Number of Voting Stake	400000				

NB: 12000 + 4000 + 7000 + 3000 + 3000 = 29000 < 30000

Put together



Performance (Setup)

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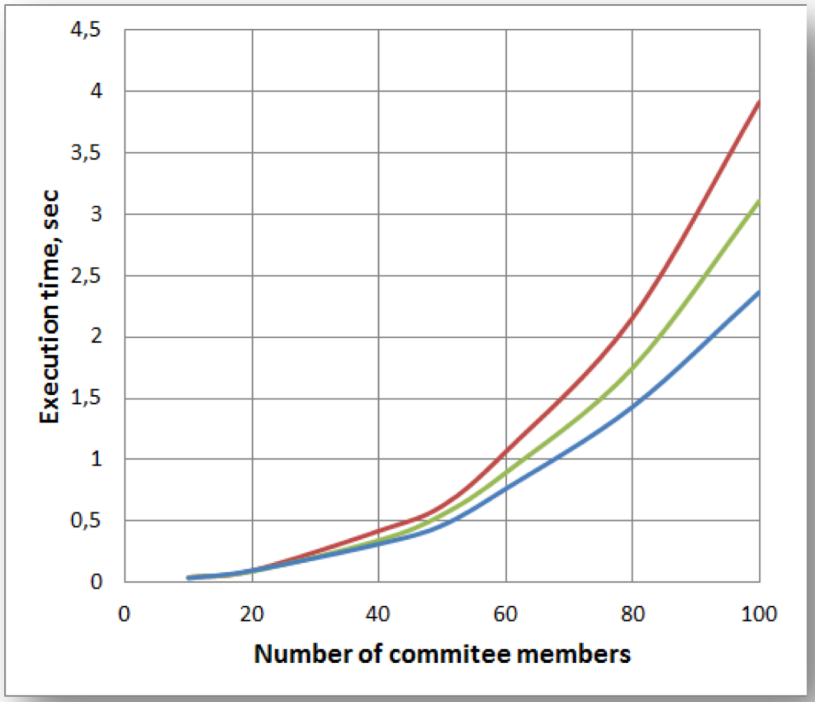
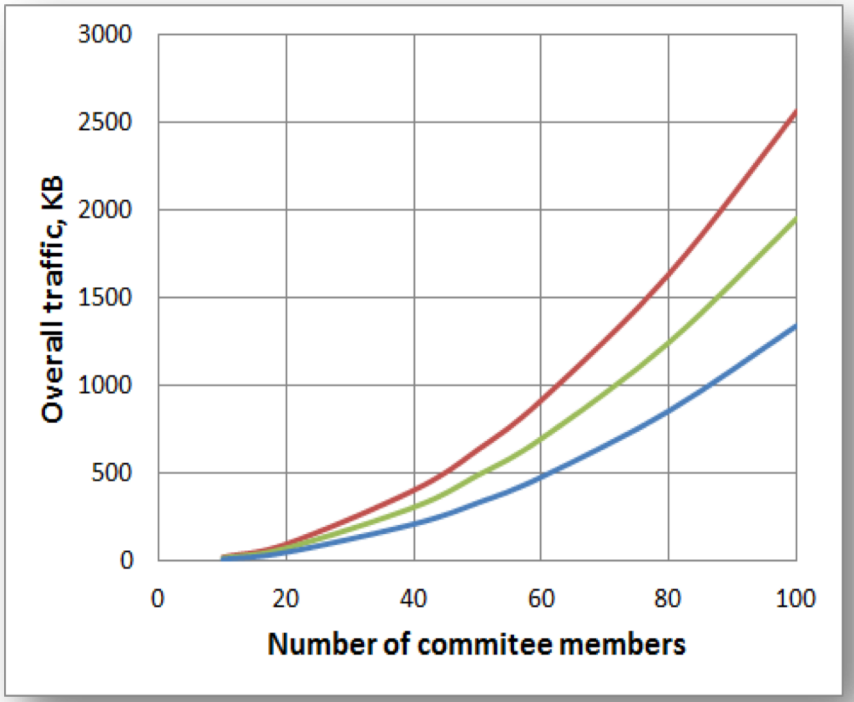
Time



Communication



Malicious members ratio: 50%

Malicious members ratio: 25%

Malicious members ratio: 0%

Performance (Unit Vec NIZK)

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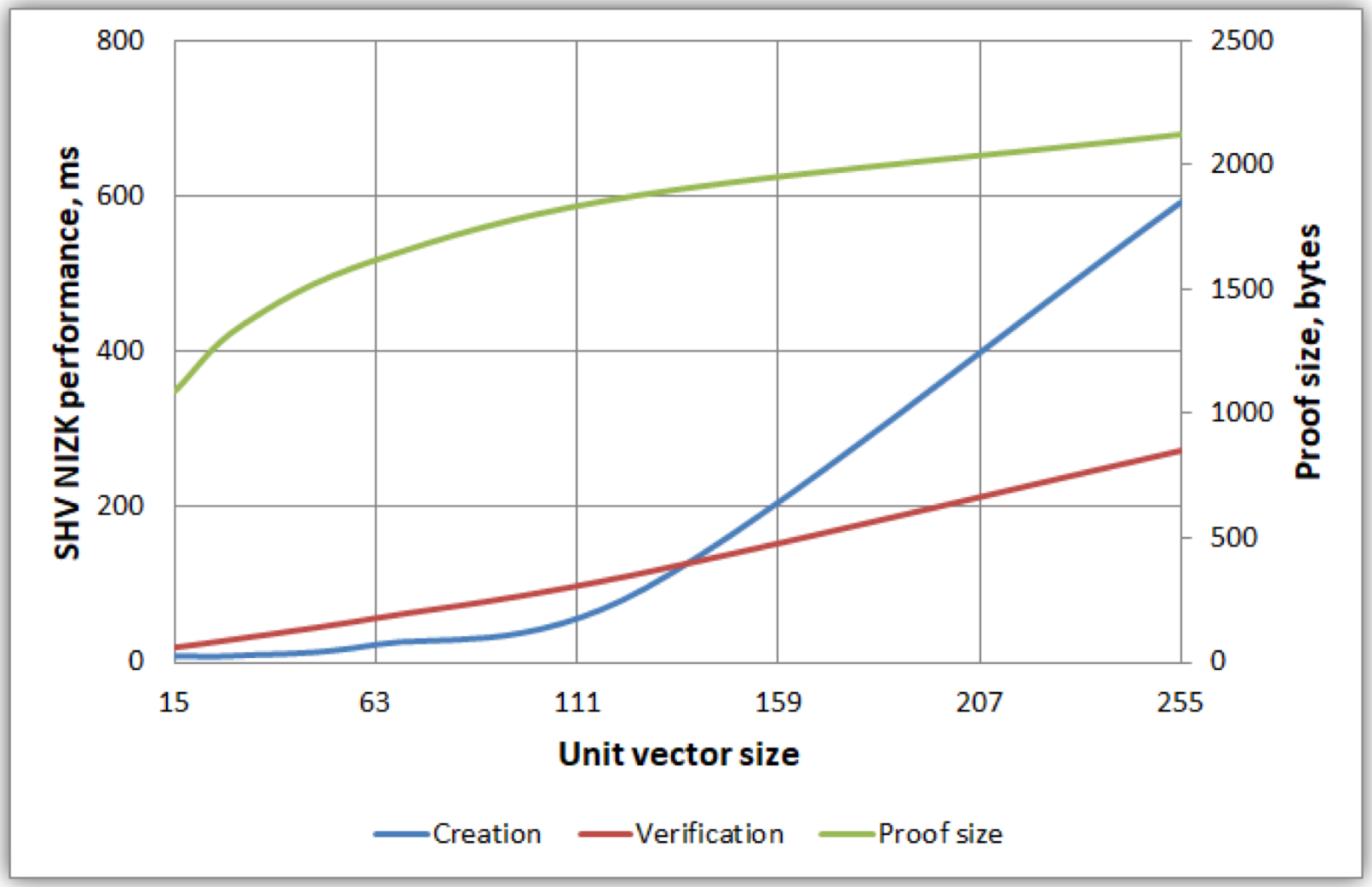
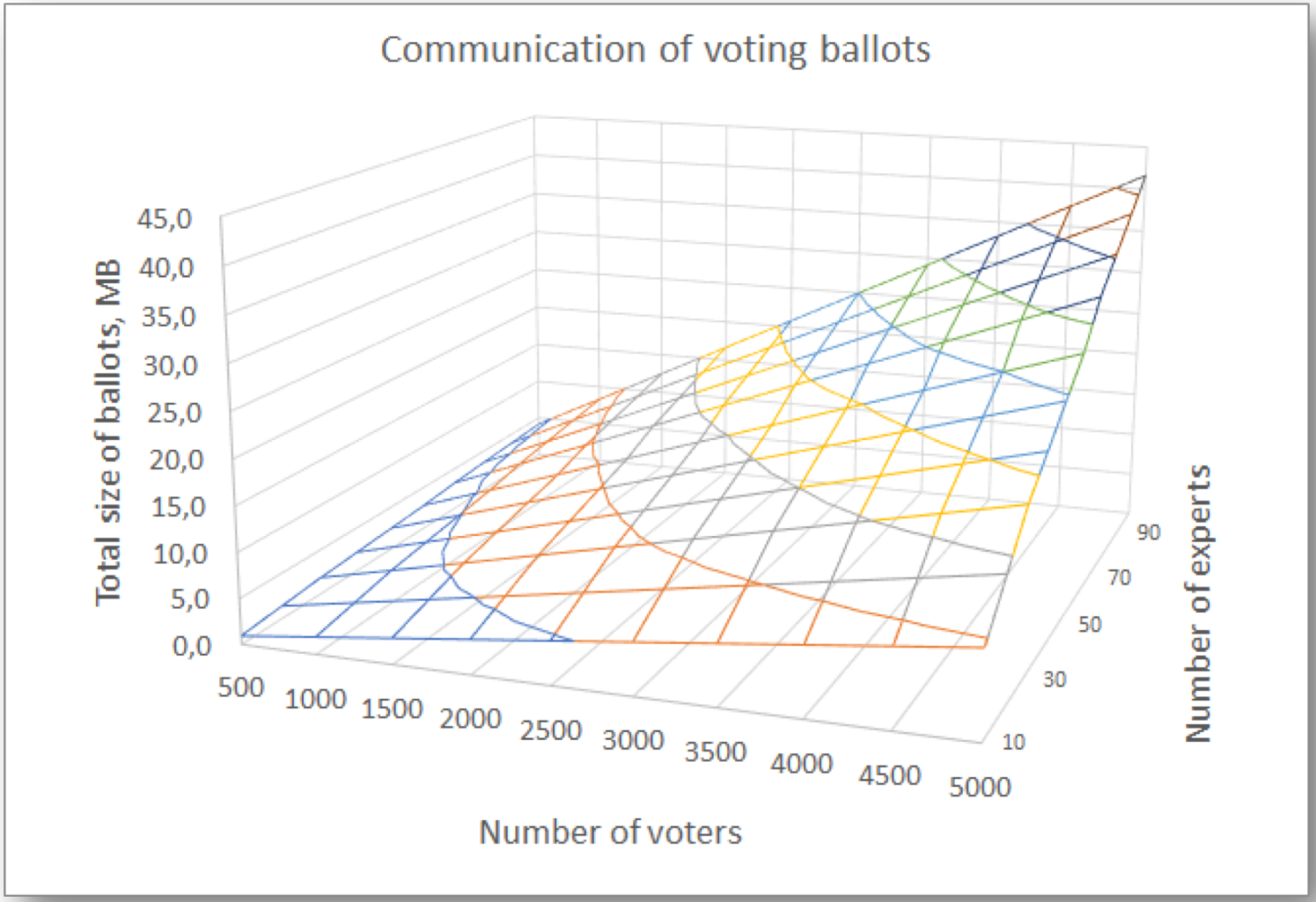


Performance (Overall)



Conclusion

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- Takeaways
  - Treasury system -- funding sustainability
  - It is currently adopted by Horizen
  - Support liquid democracy

- Future work
  - To support privacy preserving blockchains
  - Better project ranking schemes
  - Governance system

Full version: https://eprint.iacr.org/2018/435.pdf

Contact: b.zhang2@lancaster.ac.uk

Acknowledgement: This work is partially supported by IOHK