Proof-of-Personhood

How to resist Sibyl attacks

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The Sybil Identity Problem

Internet has no protection from malicious users cheaply creating a few (or many) fake accounts

- Online ballot stuffing, fake upvotes/reviews
- Sock puppetry, bot armies pushing fake news
- Whack-a-mole: “banned” trolls just resurface

Fundamental unsolved decentralization problem

- John Douceur, “The Sybil Attack” [IPTPS ‘01]”
- Bitcoin PoW is another disastrous failed attempt

Mapping the Known Solution Space

Major approaches proposed so far:

- “Real names” based on verified identities
- Biometric collection in central database
- Proof-of-Investment: CAPTCHA, PoW, PoS, …
- Graph analysis on trust networks
- Pseudonym parties

“Real names” and verified identities

Trusted third-party verifies government-issued ID

- Blue checkmarks, banking KYC checks, ...

Downsides:

- Privacy-invasive, excludes poor/undocumented
- Cumbersome, expensive verification process
- Fake IDs relatively easy, cheap to acquire
- Vulnerable to 1 compromised/coerced verifier

Biometric collection & verification

Collect fingerprints, iris, etc., record in database

- Appeals: efficiency, automation, security(?)
- Large-scale trials by India, United Nations

Downsides:

- Even more privacy-invasive, surveillance risks
- False positives & negatives create big problems
- One hacked scanner could still register many fake “people” with unique biometric fingerprints

Proof-of-Investment

Rate-limit Sybil attacks via artificial barrier-to-entry

- CAPTCHAs: waste time proving you're human
- PoWork: prove you wasted compute energy
- PoStake: prove you have money to invest

Downsides:

- Undemocratic: not "one-person-one-vote"
- More money, more voice: "rich get richer"

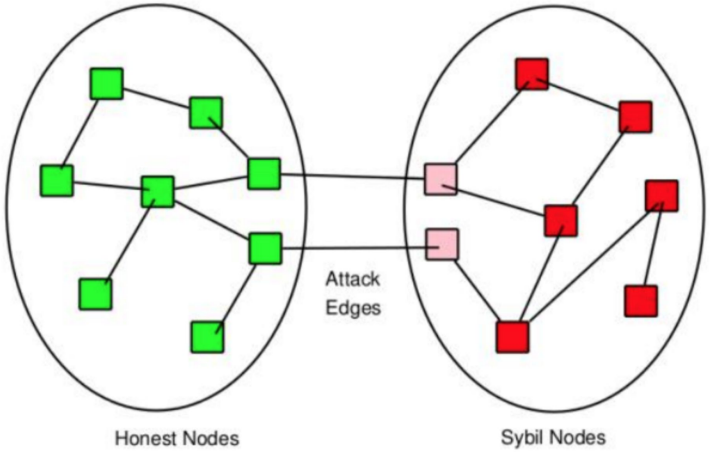
Graph analysis on trust networks

Classic P2P idea in SybilLimit, SumUp, etc.

Assumes nodes are cheap but edges are expensive to a Sybil attacker.

Downsides:

- Secure & usable “trust networks” don’t exist
  - Facebook/LinkedIn/etc: many friend promiscuously
- Only weak defense against massive cheating
  - Easy for many people, or everyone, to cheat a little



Pseudonym Parties

Build anonymous one-per-person tokens

- Physical security: real person has one body, can be in only one place at a time
- Synchronized events similar to, but simpler than, in-person voter registration or PGP key signing
- No ID checking, no biometrics, no trust network

Downsides:

- Requires some organization in the physical world
- Those who want one must show up, periodically

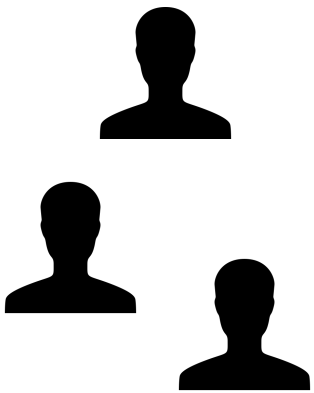
Proof of Personhood

Objective:
Number of tokens per person = 1

How: Organizing a party in which people are verified, but not identified

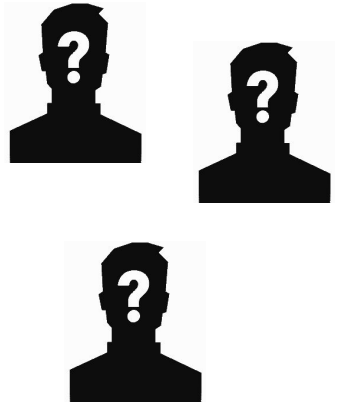
Pseudonym-party - Setup

Organizers
Anytrust



Configuration
Name, Purpose, Place, Time

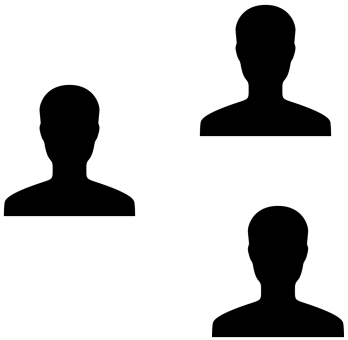
Attendees
Anonymity-group



Room

Step 1: Pseudonym-party - Configuration

Organizers



Each organizer signs

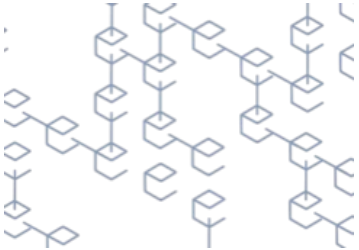
the configuration

Collective Signature

Configuration and

Signature stored on

Blockchain



Step 2: Attendee Configuration

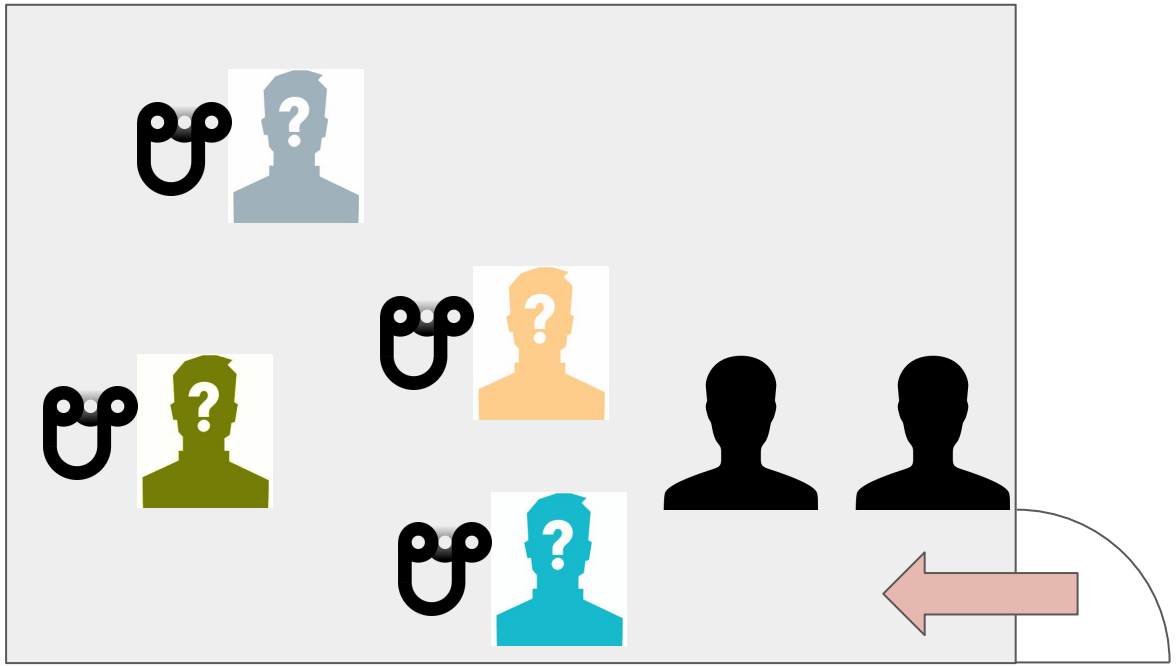
https://applivery.com/popcoin

Pop-party #11
4th of September 2018
BC410

Step 3: Start of Party

Be sure to:

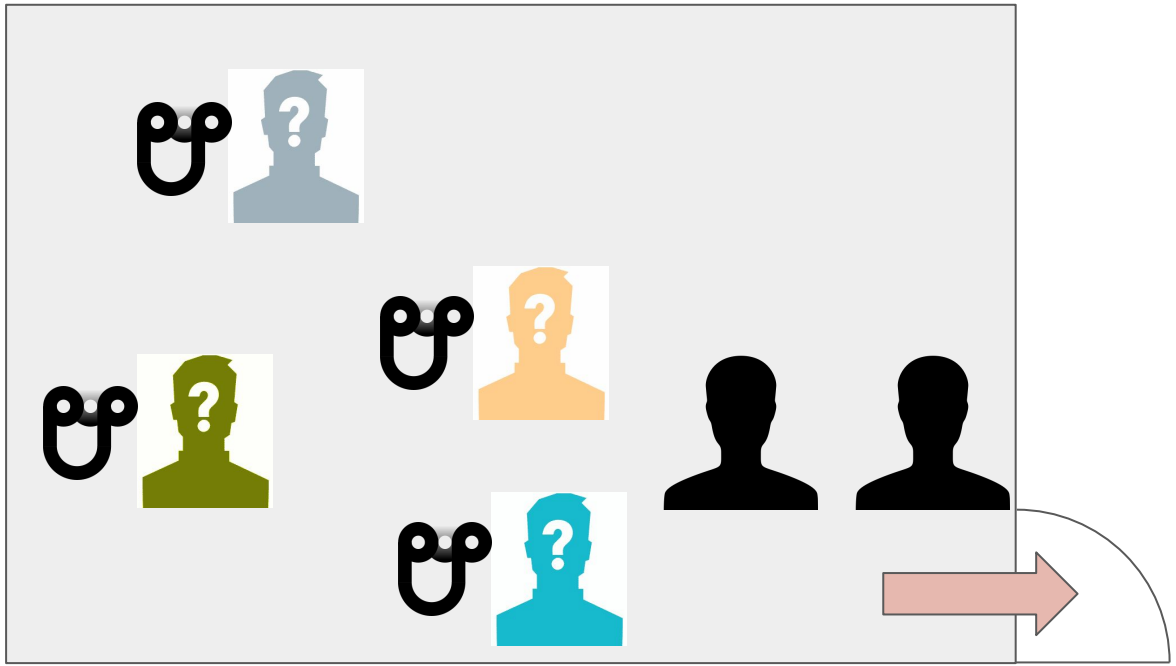
- Install the latest version from https://applivery.com/popcoin
- Scan the QRCode of the party



Step 4: Barrier Point - Exit and Scan

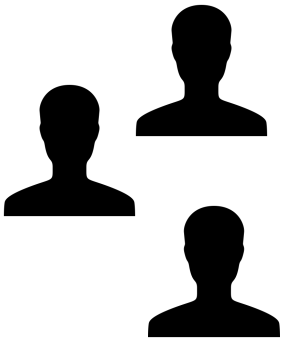
You’re allowed to exit the party.

Be sure to have your public key scanned by all the organizers!



Step 5a: Creation of Party Transcript

Organizers



Organizers reach consensus

Collective Signature

+

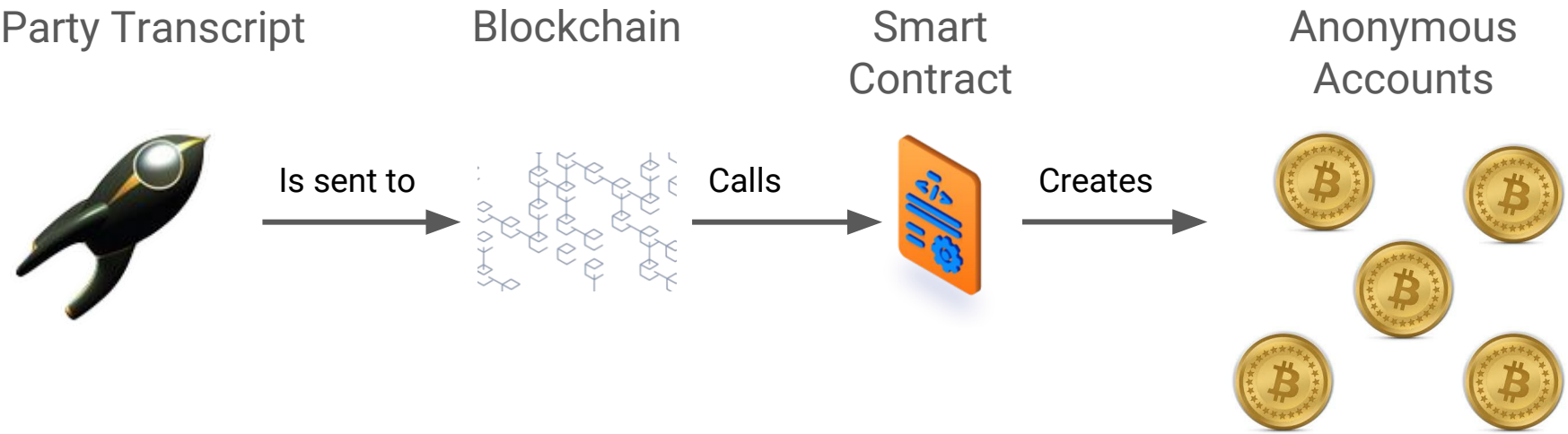
Configuration

Public Keys

=

Party Transcript

Step 5b: Storage of Party Transcript



Step 5c: Tokenization of Attendee’s Keypair

Keypair

Party transcript

PoP-token

Usage of PoP-Coins and PoP-Tokens

Attendee

Transfers

Coins

Economic

Other Attendees

Services

Social

Sybil-resistant Twitter

Spam-protected Communication

Signs

Anonymously

Democratic

Voting

Deliberation

Details of Anonymous Signatures

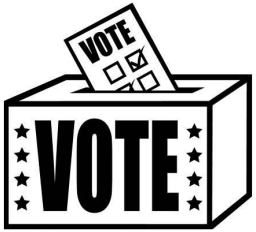
Attendee

Request

Message + Context

Signature + Tag

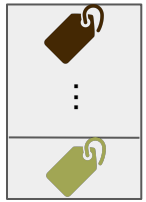
Services



WIKIPEDIA
The Free Encyclopedia

Each service trusts the Party Transcript

Each service holds a list of tags:



Log

- Date: 4th of September 2018, 1:30pm - Place: BC410 in EPFL, Lausanne, CH
- Organizers: Linus, Kelong, and Sacha
- Total Attendees (including organizers):
- Observer:
- Nodes: conode.dedis.ch:7770, conode.dedis.ch:7772, conode.gasser.blue:7770
- Chocolate/fruits for everybody!

Next steps

- Don’t lose tokens!
- Have a minimal mock-up of the following functionality:
  - Creating and answering Questionnaires
  - PoP-twitter where sending costs money and reading gets you money
  - Get coins from a token to get a certain amount of coins and being able to exchange coins
- Having organizer functionality in iOS version