A Traffic-Analysis Proof Solution to Allow K-Anonymous Payments in Pseudonymous Blockchains

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Contents

Motivations

Pseudonymous blockchains -> blockchain addresses make transactions linkable among them

How to reach unlinkability? -> make users change their blochain address with every transaction (naive way)

De-anonymization attacks against **pseudonymous blockchains** based on:

- Data analysis on the transactions graph
- Network analysis

Attacks based on network analysis

- **Goal:** find a correlation between a blockchain nodes and IP addresses
- **Even anonymous blockchains are vulnerable to these attacks!**

Our proposal

Our goal

Allow users to make anonymous payments in pseudonymous blockchains

Borrowing notions from the Anonymous communication domain

- **Security property:** Sender anonymity (hide who makes a payment)
- **Threat model:** Global passive adversary (able to make traffic analysis attacks)

Key concepts

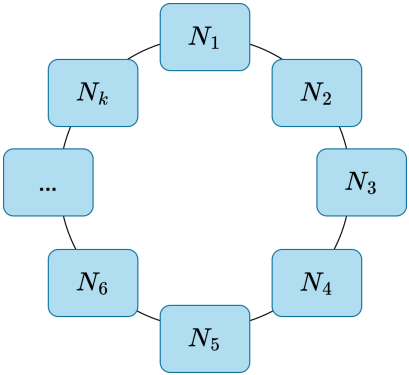
- organize users in anonymity sets
- information hiding mechanism enabled (cover transactions)
- No requirement for off-chain communication channels

Our Proposal

- **Ring** : anonymity set of k users.

Ring Construction

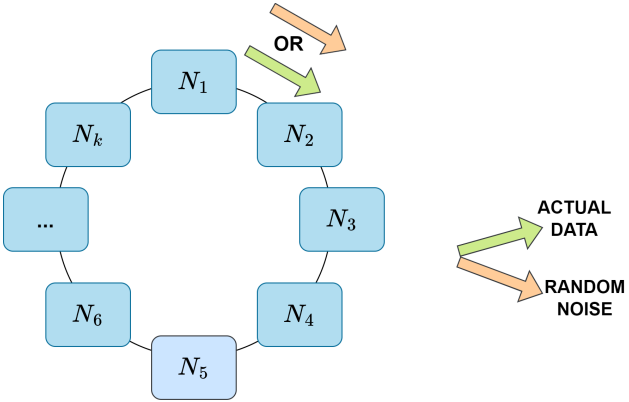
- Rings are built via a DHT based on blockchain addresses plus a **random salt***
- An attacker cannot precompute the ring in which it will fall



***the hash of a certain block in the blockchain**

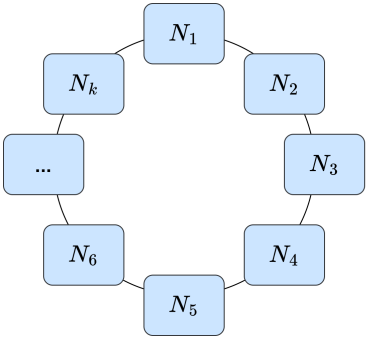
Our Proposal

- **Ring** : anonymity set of k users.
- **Cover Transactions**.



Our Proposal

- **Ring** : anonymity set of k users.
- **Cover Transactions**.
- Smart contract as a shared deposit of cryptocurrency.



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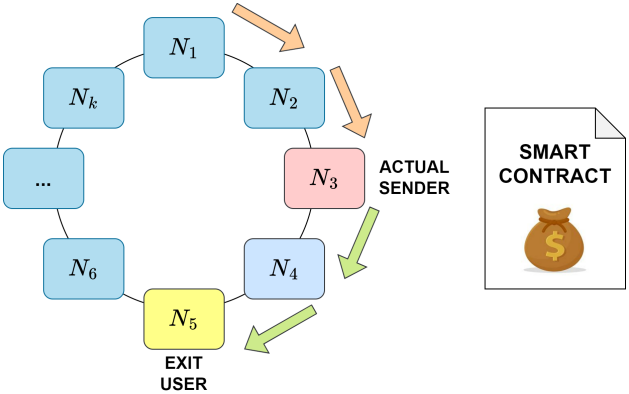
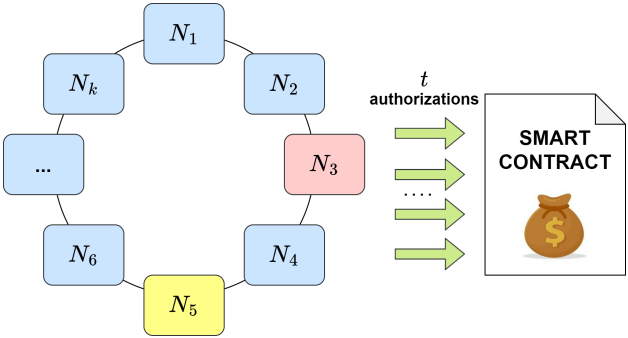


Our Proposal

- **Ring** : anonymity set of k users.
- **Cover Transactions**.
- Smart contract as a shared deposit of cryptocurrency.
- t over k authorizations for a payment.



Conclusions

- Our proposal achieves k-anonymity guarantees in pseudonymous blockchains against a global passive adversary
- Our anonymity guarantees resist traffic analysis attacks
- The idea underlying our solution is to organize users in rings of cover transactions
- No requirement for off-chain communication channels.

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