Almost Public Quantum Coins

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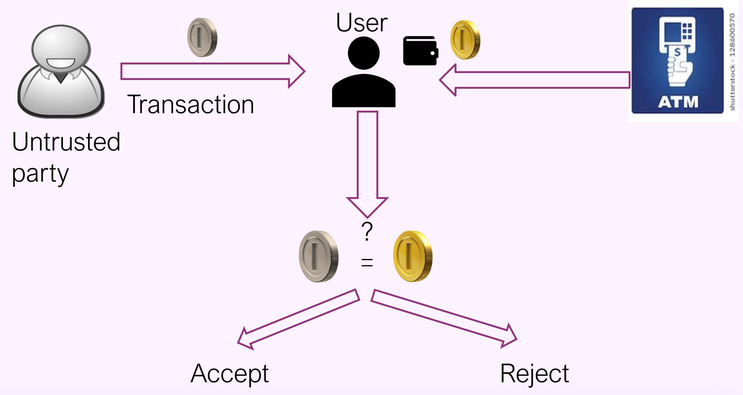
Coins	Bills
All money state are indistinguishable copies, and hence can't be tracked.	Every money bill is marked with unique serial numbers and hence can be tracked.

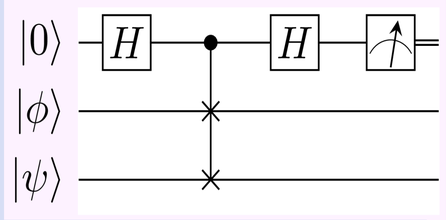
Goal: Construction of public quantum coins from private quantum coins.

Motivation: Comparison based Verification



1. Works for coins not for bills.
2. Specific security features of the money not required.

How to compare quantum states?



SWAP Test: Always passes with prob at least half. → 1 to 2 forging is trivial!

Symmetric subspace measurement

- Symmetric subspace over n registers - space of all states, invariant under any permutation of the registers.
- Symmetric subspace measurement – Projective measurement into the symmetric subspace.
- For two registers, it is the same as the SWAP test.

Main protocol

$\kappa :=$ poly-logarithmic function of λ.
$|\mathfrak{m}\rangle :=$ a private coin.
$|¢\rangle :=$ a public coin.
$Verify_{|¢\rangle} :=$ Public verification.
$Verify_{sk} :=$ Private verification.

- $Keygen(1^{\lambda})$ - Run private scheme's Keygen, to generate sk.
- $Mint(sk)$ – Use the private scheme's mint κ times to prepare $|¢\rangle = |\mathfrak{m}\rangle^{\otimes\kappa}$.
- $Verify_{|¢\rangle}(|\phi\rangle)$- Symmetric subspace measurement on 2κ registers of $|¢\rangle$ and $|\mathfrak{m}\rangle$, and accept on success.
- $Verify_{sk}(|\phi\rangle)$- Run private scheme's count $Count$ on $|\phi\rangle$ and accept with prob. $\frac{Count(|\phi\rangle)}{\kappa}$.

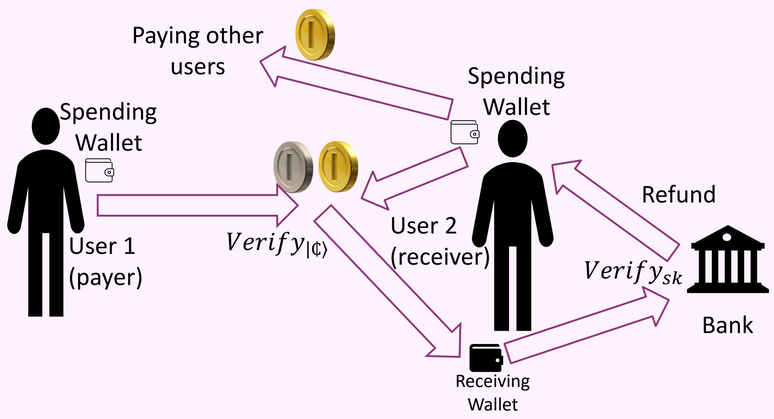
Rational Unforgeability

Rational unforgeaility - On expectation, one cannot pass more than n verifications starting with n coins.
(No rational user would forge)

Issues with the scheme

1. Standard forging still possible and only rational unforgeability holds.
2. Own money might get destroyed due to pubic verification.
3. Need a way to recover own money after failed verification.
4. Spending money received form others directly can lead to traceability attacks.

Restriction: User manual



Security guarantees

- The money scheme is (nonadaptive) rationally unforgeable.
- Under the restrictions in the user manual, it is secure against sabotage attacks (rationally), and also traceability attacks.

Read the Full Paper at: https://arxiv.org/pdf/2002.12438.pdf