EuroToken
A Stable Digital Euro Based on TrustChain

R. W. Blokzijl

- Stablecoin
- Blockchain
- Cryptocurrencies
- TrustChain
- CBDC

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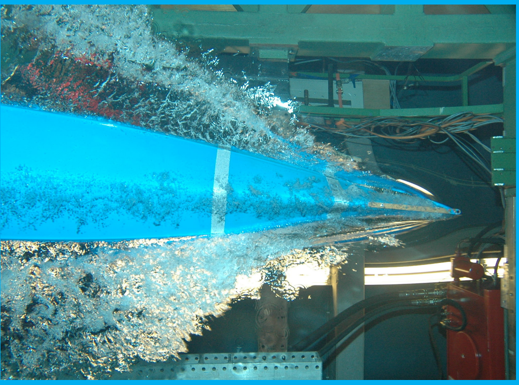

TU Delft

EuroToken

A Stable Digital Euro Based on TrustChain

by

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This thesis is confidential and cannot be made public until TODO.

Preface

TODO: Add preface

R. W. Blokzijl
Delft, TODO

Contents

1 Introduction 1

2 Problem description 3
2.1 Background . . . 3
2.2 Stablecoin primer . . . 3
2.3 Goals . . . 3
2.4 Terms used . . . 3

3 Design 5
3.1 Design requirements . . . 5
3.2 System architecture . . . 5
3.3 How does this solve the requirements. . . . 5
3.4 Multiple perspectives . . . 5
3.5 Theoretical expansion of the concepts . . . 5
3.6 TrustChain as an accounting platform for financial transactions . . . 5
3.6.1 Day to day money transfer in the 21 century . . . 5
3.7 System considerations . . . 5
3.7.1 Security . . . 5
3.7.2 Scalability . . . 5
3.7.3 Usability . . . 5
3.7.4 Audibility . . . 5

4 Implementation 7
4.1 Gateway (Central Bank API) . . . 7
4.1.1 EuroToken Creation . . . 7
4.1.2 EuroToken Destruction . . . 7
4.1.3 Frontend . . . 8
4.1.4 Implementation considerations . . . 8
4.2 Android Wallet . . . 8
4.2.1 PeerChat Extension . . . 8
4.2.2 EuroToken app . . . 8
4.2.3 EuroToken transactions in depth. . . . 9
4.2.4 EuroToken Settings. . . . 9

5 Field trial 11

6 Discussion 13
6.1 System dangers . . . 13
6.1.1 Under-collateralization . . . 13
6.2 System future . . . 13

7 Conclusion 15

Related Work 17

Bibliography 19

1 Introduction

(Tribler, n.d.)

Libra bad, CBDC better.

2

Problem description

2.1. Background

digital currencies

- Money, its requirements and benefits
- problems with money and how digital money solves them
- Problems with digital money and how bitcoin solved them
- Problems with bitcoin and how TrustChain solved them
- Leftover discreppencies between traditional and digital money -> segue to next chapter

2.2. Stablecoin primer

- What makes a digital currency unstable, real question: what makes a normal currency stable
- What is a stablecoin
- how to peg a currency
- Other stablecoins in the wild
- Vision of the future of the euro zone

2.3. Goals

- Imagining a new accounting layer

2.4. Terms used

- Token
- Gateway
- Wallet
- CBDC - Central Bank Digital Currency

3 Design

3.1. Design requirements

- P2P
- Secure
- Open
- Privacy aware

3.2. System architecture

3.3. How does this solve the requirements

3.4. Multiple perspectives

- Stablecoin or tokenised euro?
- tokenised euro or standardised, decentralised bank ledger accounting?

3.5. Theoretical expansion of the concepts

- Multi bank design
- Identity integration
-

3.6. TrustChain as an accounting platform for financial transactions

3.6.1. Day to day money transfer in the 21 century

3.7. System considerations

3.7.1. Security

3.7.2. Scalability

3.7.3. Usability

3.7.4. Audibility

4 Implementation

The implementation of the stablecoin system consists of 2 main elements: the wallet Android app, and the gateway REST API. A web front end for the rest API has also been created.

The wallet demonstrates the ability of TrustChain to handle the transfer of the EuroTokens peer to peer without a central entity.

The Gateway demonstrates how a bridge can be created between the traditional euro system and a blockchain based analog.

4.1. Gateway (Central Bank API)

The only way tokens are created is when a central bank creates them. In our implementation this only happens when a user has transfered an equal amount of euro into the central bank account.

The gateway is responsible for the exchange of euro for tokens and vice versa. This involves taking payments in both tokens and euros, and payments in both currencies. This means the gateway needs to interface with the bank to allow a user to make payments in euro when creating EuroTokens, as well as a mechanism for paying out euro to the user when they trade in EuroTokens. On the other side of the gate the system needs to be able to create/send, and destroy/receive tokens on TrustChain.

The gateway aims to automate and link all of this interaction, so EuroTokens can be bought and sold at any time by anyone.

4.1.1. EuroToken Creation

When a user wants to convert a euro to a EuroToken, a creation event is initiated with the gateway API. The user sends their TrustChain wallet address and amount to convert with the request.

The API will then create a payment request with the associated bank for the specified amount, and store the information in its database. The payment link is returned to the user.

When the user has paid the request, a transaction for the EuroTokens will be created using TrustChain. The gateway will create a proposal half-block which will be sent to the user, who will create an accepting half-block registering the transaction on both chains.

The user is now free to send the EuroTokens to anyone they like, requiring only a TrustChain transaction.

4.1.2. EuroToken Destruction

When a user wants to trade in a EuroToken for a euro the process happens in reverse. For the demo the user does a request to the API with the desired amount, their TrustChain address and an IBAN.

The system creates a TrustChain transaction for negative the amount. This transaction is sent for the user to accept.

When the user has then signed the accepting half-block. The system will pay out the amount to the specified IBAN.

4.1.3. Frontend

To aid everyday users in the purchase and sale of EuroTokens a web frontend is created where the user can interact with the API. It demonstrates the ease of use of the system.

[Screenshots]

4.1.4. Implementation considerations

The design specified a general architecture for the EuroToken system. However in order to make an implementation possible within the constraints of the project some implementation trade-offs have been made.

Bank support

The EuroToken is designed to work with any bank account for euro collateral. However in this implementation we only implemented the API for ABN AMRO. Adding other banks is a simple as implementing the `Bank` class.

Euro Payment Initiation

The design specifies a requirement of automatic euro payout on EuroToken destruction. In order to automate this, most banks (including ABN) requires registration and use of the PSD2 payment initiation API. This API requires a Payment Initiation Service Provider (PISP) licence, which in turn requires a banking licence. Since both of these licences require you to be a fully functioning bank, the payment initiation part of the ABN API has not been implemented and is done manually in the field trial.

TrustChain

Since the main implementation if the TrustChain software (Tribler, n.d.) is build on python so is the gateway API. The server is provided as a single docker container that also provides the frontend.

4.2. Android Wallet

In order to use the EuroToken system on a daily basis, users need a way to send and receive the token. Because the added value of the system is its decentralised nature, a way to send and receive the asset in a convenient and peer to peer way is needed. The TrustChain team has recently come out with an Android super-app[TODO, cite] that showcases some of the IPv8[TODO CITE] and TrustChain[TODO CITE] capabilities. This app provides the perfect platform to showcase the EuroToken capabilities.

4.2.1. PeerChat Extension

The super-app already includes a number of applications, including PeerChat. A chat application that uses IPv8s peer to peer capabilities to communicate. In order to show that the EuroToken can be used in a modern context, the PeerChat app has been expanded to include the capacity to send money attached to a message.

To send money, the user simply selects the option to send money, and is taken to a screen where a transaction can be created. The message is then sent to the receiver who within a few moments sees the transaction appear as a message in their shared chat. The transaction amount is also added to their balance.

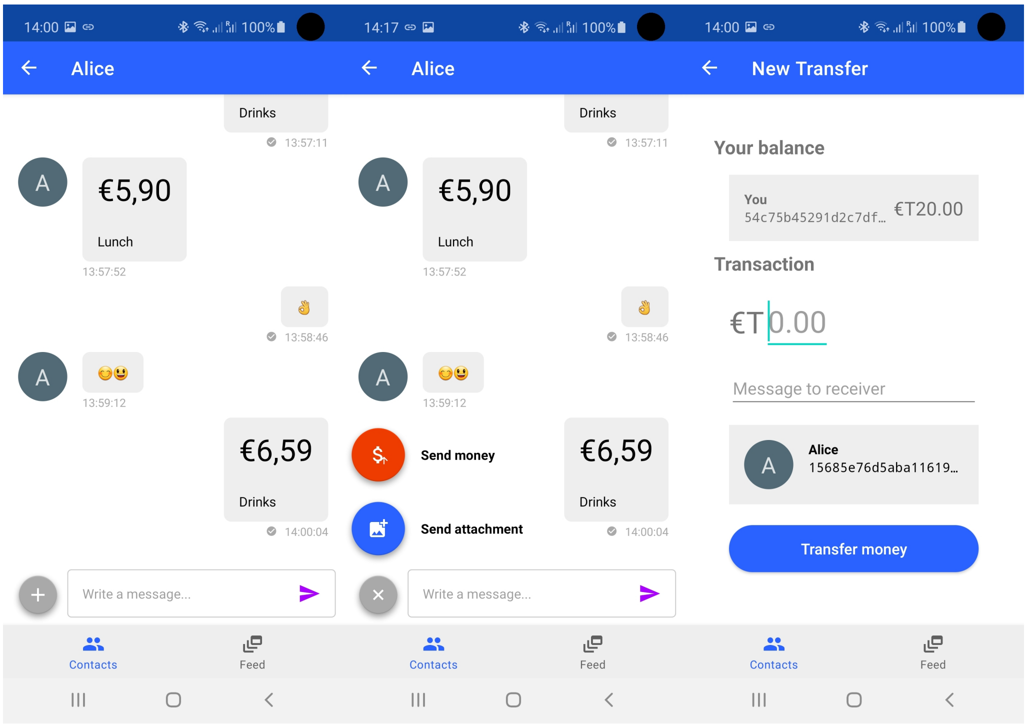
The capacity to send transactions as shown in Figure 4.1 is not tied to PeerChat messaging. When money is sent, a transaction is created and transferred to the receiver using the TrustChain main community. The transaction hash is then sent as part of the PeerChat message. The receiver then fetches the transaction it received earlier via TrustChain.

- [TODO diagram of TrustChain and PeerChat interaction]

This implementation demonstrates the simple way in which EuroToken allows monetary transactions to be seamlessly and programmatically inserted into any application.

4.2.2. EuroToken app

The PeerChat app is one specific use case. In reality different applications would simultaneously use the EuroToken system. This would leave the user with a splintered record of their financial life.



Drinks
13:57:11

€5,90
Lunch
13:57:52

👌
13:58:46

😊😃
13:59:12

€6,59
Drinks
14:00:04

Write a message...

Your balance

You
54c75b45291d2c7df… €T20.00

Transaction

€T 0.00

Message to receiver

Alice
15685e76d5aba11619…

Figure 4.1: Attach money in PeerChat

In order to solve this, a EuroToken accounting app has been added to the super-app. The purpose of this is to show that the systems data can be reorganized in whatever way. The EuroToken app shows a history of all transactions, and provides another interface to the gateway.

4.2.3. EuroToken transactions in depth

- Validation (TODO)
  - Creation/destruction:
    - Trust Central Bank only
  - Transactions (prevent double spend)
    - Trusted users (based on identity later)
    - Validated by bank
    - Bami double-spend protection

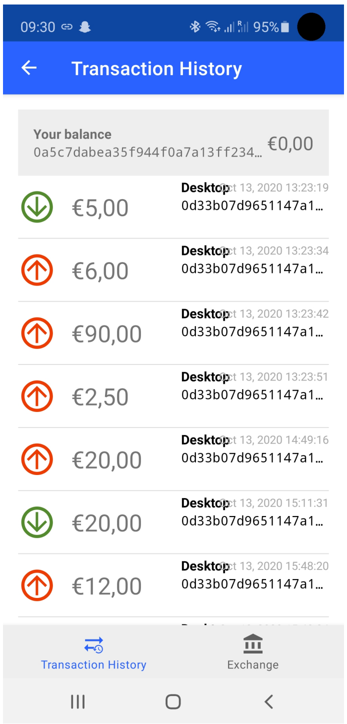
4.2.4. EuroToken Settings

In addition to providing convenient services to the user, the EuroToken app has some configuration options to give the user control over their role in the EuroToken network.

Trusted Minters - Since the network has a central component that regulates the creation and destruction of the tokens, a demo requires a running server. Since there is no party to maintain such a server indefinitely right now, an option is added to allow the user to specify public keys of trusted “central banks”. If this option is enabled, the wallet in the super-app does only accepts blocks signed by the configured public keys.

- [TODO: image of minter config]

Trusted validators - Validation of transactions and prevention of double spending is unsolved in TrustChain but is an important part of any currency. Solving this problem in general is being worked on [TODO CITE bami] and is out of scope for this project. However the issue of transaction finality being important to a EuroToken system, a way to prevent double spending has been added. A transaction is not considered final until a trusted entity has signed a block in the senders chain that comes after



Your balance
0a5c7dabea35f944f0a7a13ff234… €0,00

↓	€5,00	**Desktop**ct 13, 2020 13:23:19 0d33b07d9651147a1…
↑	€6,00	**Desktop**ct 13, 2020 13:23:34 0d33b07d9651147a1…
↑	€90,00	**Desktop**ct 13, 2020 13:23:42 0d33b07d9651147a1…
↑	€2,50	**Desktop**ct 13, 2020 13:23:51 0d33b07d9651147a1…
↑	€20,00	**Desktop**ct 13, 2020 14:49:16 0d33b07d9651147a1…
↓	€20,00	**Desktop**ct 13, 2020 15:11:31 0d33b07d9651147a1…
↑	€12,00	**Desktop**ct 13, 2020 15:48:20 0d33b07d9651147a1…

Figure 4.2: EuroToken Transaction History

the send block. This means that the trusted entity is responsible for the validation of the block and its dependencies. These validators can be configured in the app in order to make de demo repeatable.

- [TODO: image of validator config]

5

Field trial

6 Discussion

6.1. System dangers

6.1.1. Under-collateralization

Causes:

- By central bank printing without collateral
- Licenced gateway banks going bust, taking collateral with them

Effects:

Future bank runs could leave some token holders without their collateral, this makes token holders less confident in tokens. This would lower their value, but the direct exchange peg maintains the price. This hides the problem while undermining trust in the value of the tokens.

Solution:

- Don't print without collateral.
- Short term:
  - Keep collateral liquid at all times (also stops inflation)
- long term:
  - see system future

6.2. System future

- euros are deleted by banks on euro2token exchange, and created on token2euro exchange.
- Banks don't manange the collateral, only the CBDC exchange.
- Banks get a place in trust instead of investment.

7

Conclusion

Related Work

Tribler. n.d. “Tribler/Py-Ipv8: Python Implementation of the Ipv8 Layer.” Accessed: June 13, 2020. https://github.com/Tribler/py-ipv8.

Bibliography

[1] Tribler. Tribler/py-ipv8: Python implementation of the ipv8 layer. Accessed: June 13, 2020. URL https://github.com/Tribler/py-ipv8.