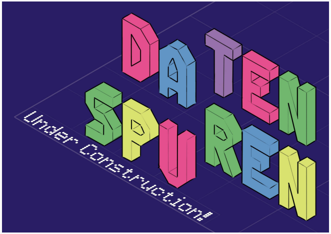
What the FAQ, ECB?

Questioning the Digital Euro



Özgür Kesim [1,2] Mikolai Gütschow [1,3]

September 19, 2025

[1]GNU Taler

[2]Code Blau GmbH

[3]TU Dresden

Prolog

Hi! I'm your ECB FAQ-bot for the digital euro!

Hi! I'm your ECB FAQ-bot for the digital euro!

How can I help you?

Hi! I'm your ECB FAQ-bot for the digital euro!

How can I help you?

What is the digital euro?

Hi! I'm your ECB FAQ-bot for the digital euro!

How can I help you?

What is the digital euro?

404 Not Found

Hi! I'm your ECB FAQ-bot for the digital euro!

How can I help you?

What is the digital euro?

404 Not Found

What is the ECB?

Hi! I’m your ECB FAQ-bot for the digital euro!

How can I help you?

What is the digital euro?

404 Not Found

What is the ECB?

303 See Other

Hi! I'm your ECB FAQ-bot for the digital euro!

How can I help you?

What is the digital euro?

404 Not Found

What is the ECB?

303 See Other

What is money?

Hi! I'm your ECB FAQ-bot for the digital euro!

How can I help you?

What is the digital euro?

404 Not Found

What is the ECB?

303 See Other

What is money?

402 Payment Required

Money, (central) banks and trust

Money and its functions

Money serves three core functions:

1. *unit of account* for pricing,

Money and its functions

Money serves three core functions:

1. *unit of account* for pricing,
2. *medium of exchange* in payments,

Money and its functions

Money serves three core functions:

1. *unit of account* for pricing,
2. *medium of exchange* in payments,
3. *store of value* to preserve value over time.

Money and its functions

Money serves three core functions:

1. *unit of account* for pricing,
2. *medium of exchange* in payments,
3. *store of value* to preserve value over time.

Money and its functions

Money serves three core functions:

1. *unit of account* for pricing,
2. *medium of exchange* in payments,
3. *store of value* to preserve value over time.

When issued by a national bank, we call it *currency*.

Money needs trust

Money represents a *liablility* of a national bank:

"The national bank owes the owner of this note 10€"

Money needs trust

Money represents a *liablility* of a national bank:

"The national bank owes the owner of this note 10€"

We pay by passing on these liabilities.

Money needs trust

Money represents a *liablility* of a national bank:

"The national bank owes the owner of this note 10€"

We pay by passing on these liabilities.

This only works with collective trust

Role and function of the ECB

The European Central Bank (ECB)

- is an European institution,
- sole authority to issue the Euro,
- mandated by the member countries and national banks,
- given specific tasks and rules,
- acts independently.

Role and function of the ECB

The main responsibilities of the ECB are:

Role and function of the ECB

The main responsibilities of the ECB are:

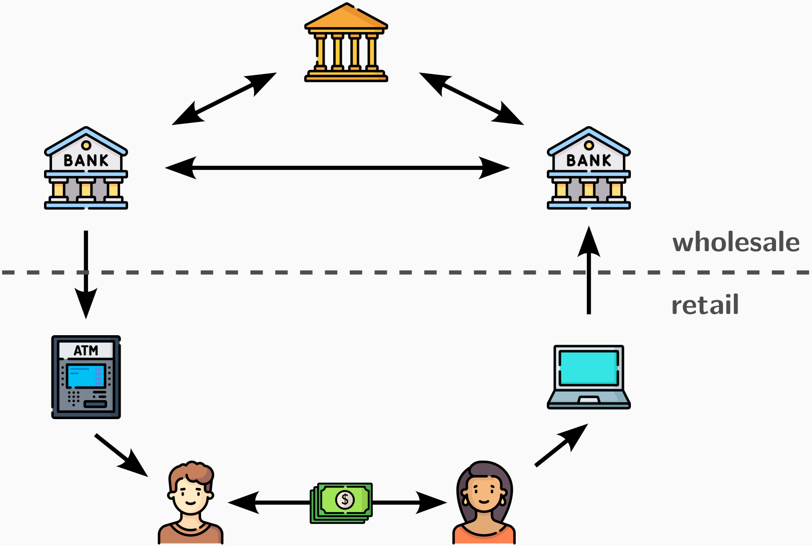
- Ensure price stability

Role and function of the ECB

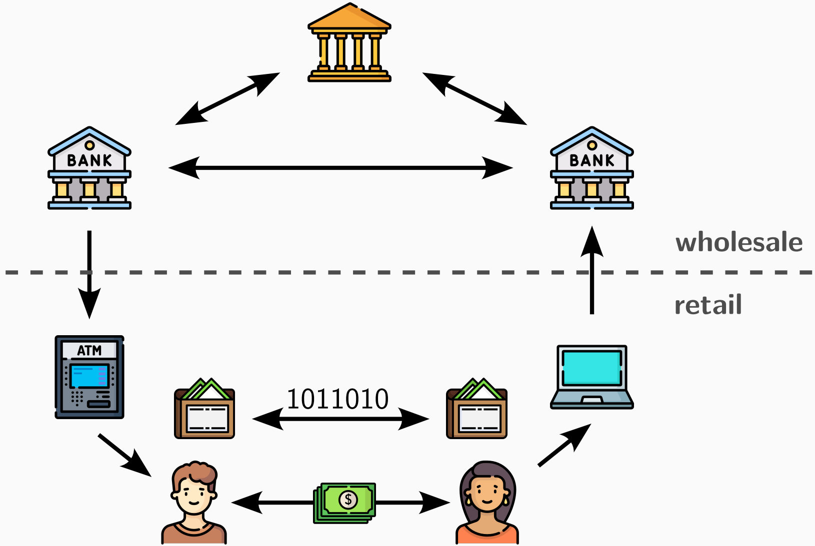
The main responsibilities of the ECB are:

- Ensure price stability
- **Ensure trust in the Euro**

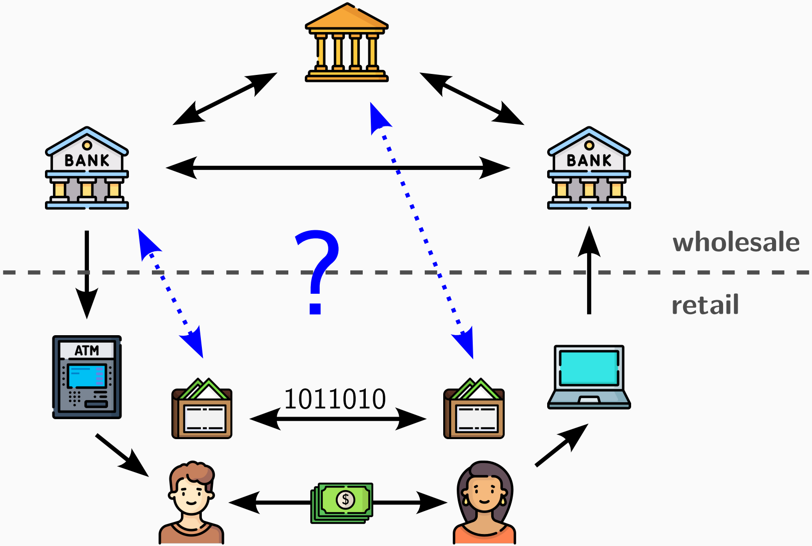
Money and its incarnations



Money in digital form - CBDC



Money in digital form - CBDC



Digital Euro, what the FAQ?

Hi, how can I help you?

Hi, how can I help you?

Why does Europe need the digital euro?

Hi, how can I help you?

Why does Europe need the digital euro?

Easy: The use of cash is in decline.

A digital euro

- makes digital payments possible,
- will be risk free,
- free of charge,
- will make us souvereign and resillient!

Hi, how can I help you?

Why does Europe need the digital euro?

Easy: The use of cash is in decline.

A digital euro

- makes digital payments possible,
- will be risk free,
- free of charge,
- will make us souvereign and resillient!

Äh... and what would happen *without* it!?

Resillience and Souvereignty

A CBDC will rather become *prime target* for cyberattacks.

Resillience and Souvereignty

A CBDC will rather become *prime target* for cyberattacks.

It still depends on a *functioning* electronic infrastructure.

”risk free”?

ECB is not very specific about:

- operational and technology risks,
- fraud and security risks,
- liquidity, credit, settlement risks,
- payment system arbitrage risks,
- third-party risks, and
- privacy breach risks.

”risk free”?

ECB is not very specific about:

- operational and technology risks,
- fraud and security risks,
- liquidity, credit, settlement risks,
- payment system arbitrage risks,
- third-party risks, and
- privacy breach risks.

Loosing public trust is a substantial risk

Hi, how can I help you?

Hi, how can I help you?

Why would people want to use the *digital* euro?

Hi, how can I help you?

Why would people want to use the *digital* euro?

Because it is amazing!

1. Universally accepted across the Eurozone,
2. online and offline available,
3. has top-notch privacy, untraceble payments,
4. is safe, accessible and financially inclusive,
5. mandatory for merchants to accept,
6. distributed by banks via legislation

Hi, how can I help you?

Why would people want to use the *digital* euro?

Because it is amazing!

1. Universally accepted across the Eurozone,
2. online and offline available,
3. has top-notch privacy, untraceble payments,
4. is safe, accessible and financially inclusive,
5. mandatory for merchants to accept,
6. distributed by banks via legislation

O'really!? How exactly does it work?

Hi, how can I help you?

Why would people want to use the *digital* euro?

Because it is amazing!

1. Universally accepted across the Eurozone,
2. online and offline available,
3. has top-notch privacy, untraceble payments,
4. is safe, accessible and financially inclusive,
5. mandatory for merchants to accept,
6. distributed by banks via legislation

O'really!? How exactly does it work?

503 Service Unavailable

Let’s try again…

Hi, how can I help you?

Hi, how can I help you?

How would the digital euro work?

Hi, how can I help you?

How would the digital euro work?

I'm glad you asked! It enables

- instant cross-border/provider payments,
- in-store, online, P2P.
- Wallet setup via bank/post office,
- funded via bank account/cash
- with balance limits.
- Guarantees safe, instant transactions, and
- cash-like anonymity in offline use.

Hi, how can I help you?

How would the digital euro work?

I'm glad you asked! It enables

- instant cross-border/provider payments,
- in-store, online, P2P.
- Wallet setup via bank/post office,
- funded via bank account/cash
- with balance limits.
- Guarantees safe, instant transactions, and
- cash-like anonymity in offline use.

OK, but *how* exactly?

Hi, how can I help you?

How would the digital euro work?

I'm glad you asked! It enables

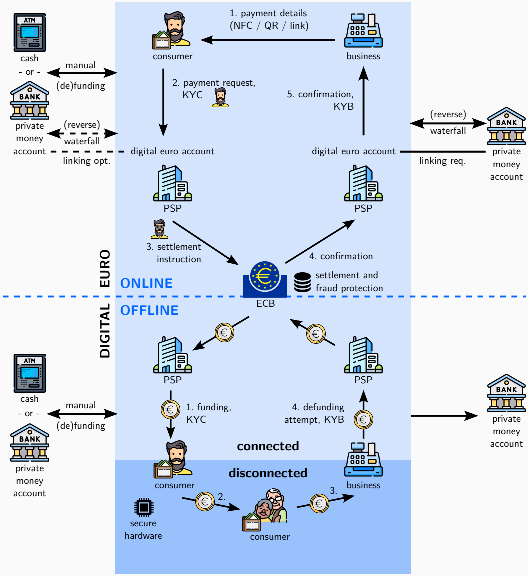
- instant cross-border/provider payments,
- in-store, online, P2P.
- Wallet setup via bank/post office,
- funded via bank account/cash
- with balance limits.
- Guarantees safe, instant transactions, and
- cash-like anonymity in offline use.

OK, but *how* exactly?

503 Service Unavailable

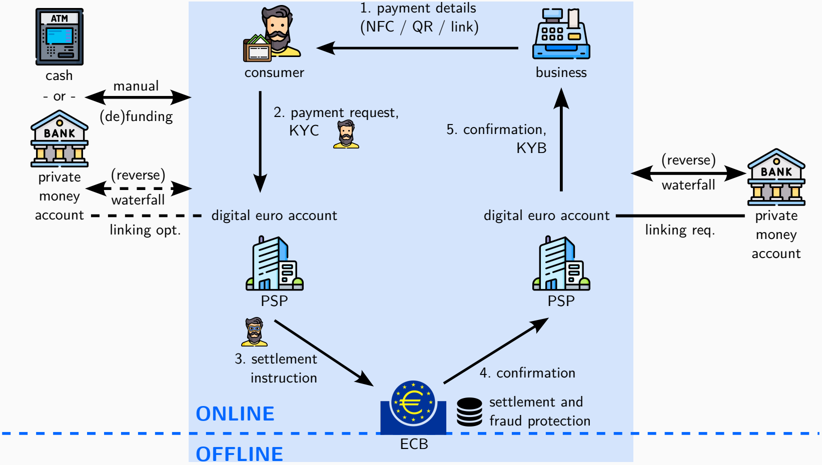
Reverse Engineering the Design

Overview

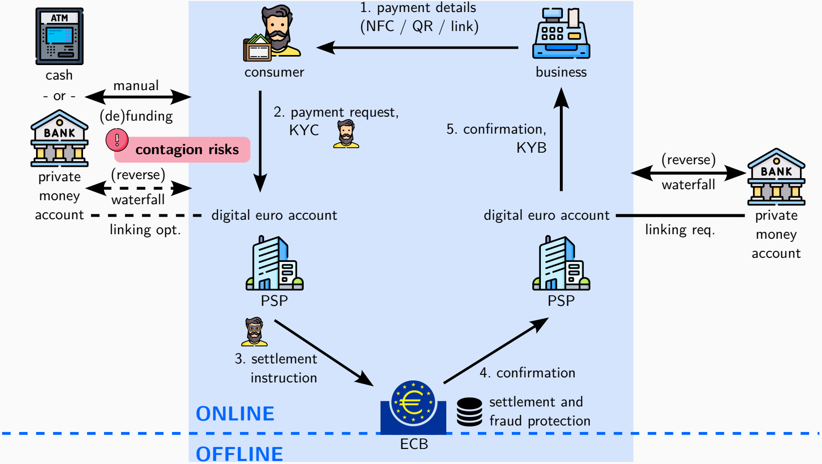


ATM
cash
- or -
BANK
private money account
manual
(de)funding
(reverse)
waterfall
linking opt.
consumer
1. payment details (NFC / QR / link)
business
2. payment request, KYC
5. confirmation, KYB
digital euro account
digital euro account
(reverse)
waterfall
linking req.
private money account
PSP
PSP
3. settlement instruction
4. confirmation
settlement and fraud protection
ECB
DIGITAL EURO
ONLINE
OFFLINE
PSP
PSP
1. funding, KYC
4. defunding attempt, KYB
connected
disconnected
consumer
business
2.
3.
secure hardware
consumer
private money account

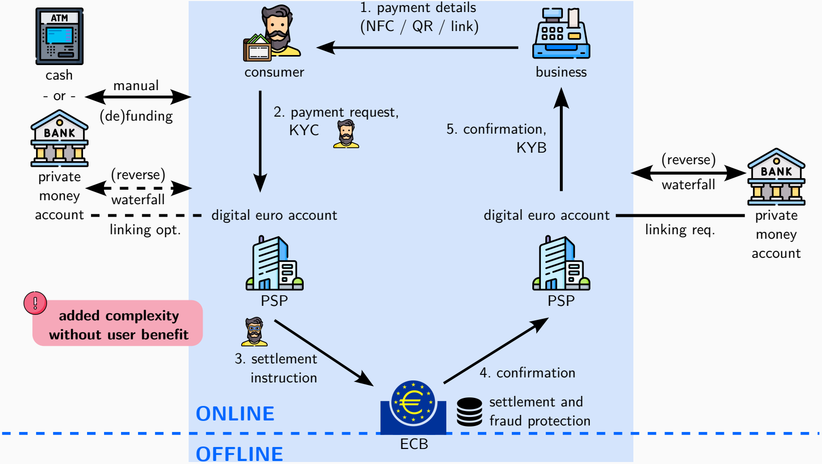
The online version of the digital euro



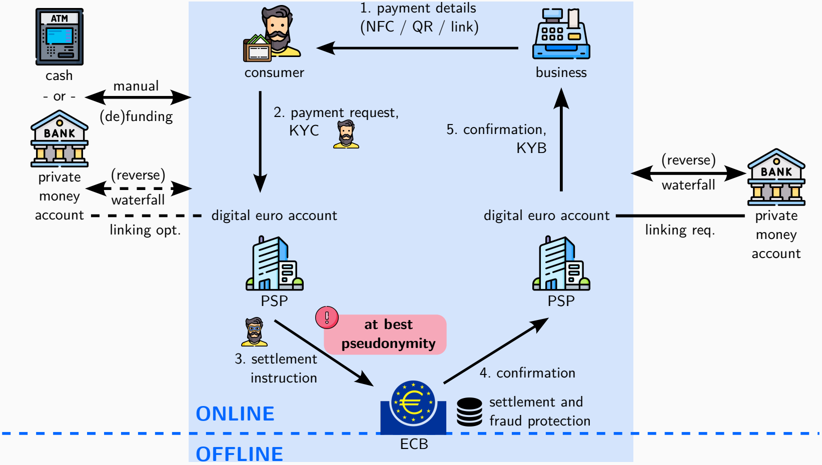
Issues with the online version



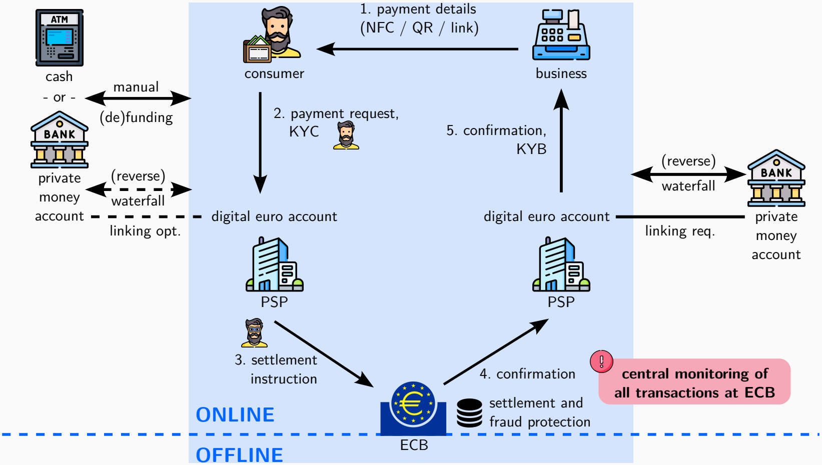
Issues with the online version



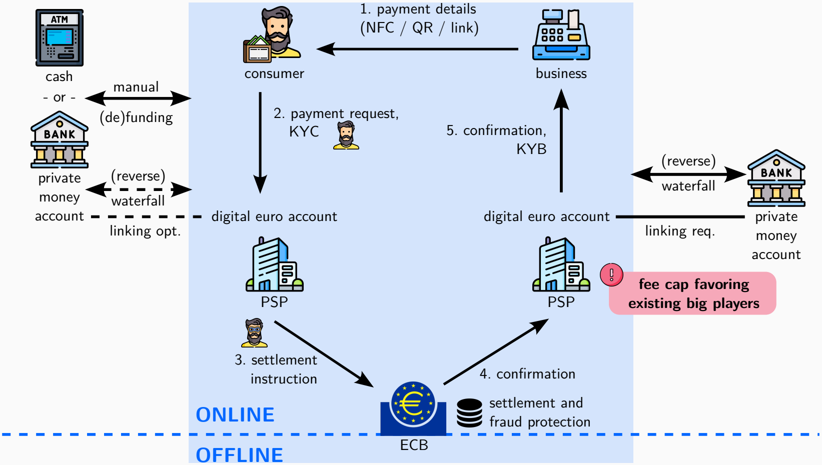
Issues with the online version



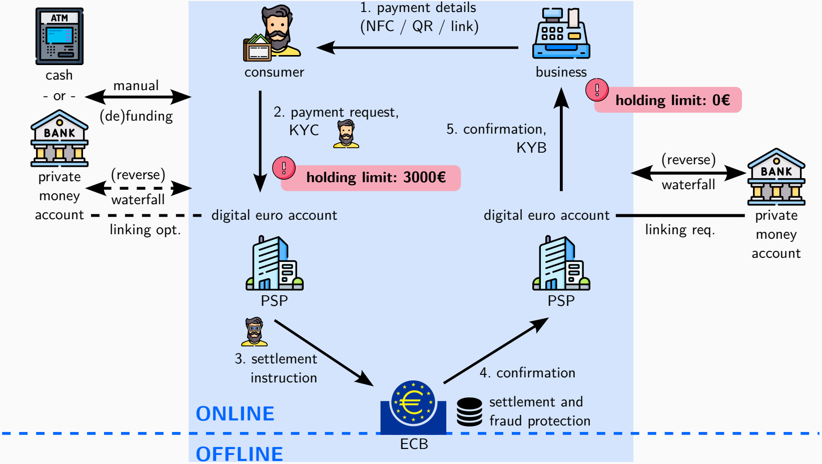
Issues with the online version



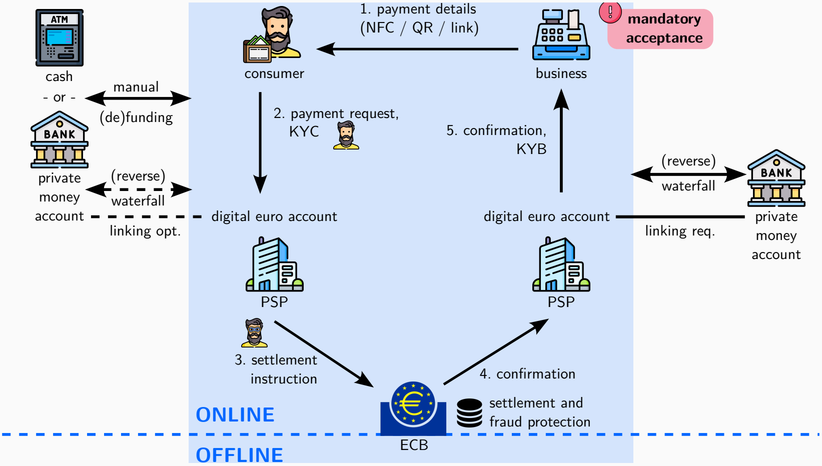
Issues with the online version



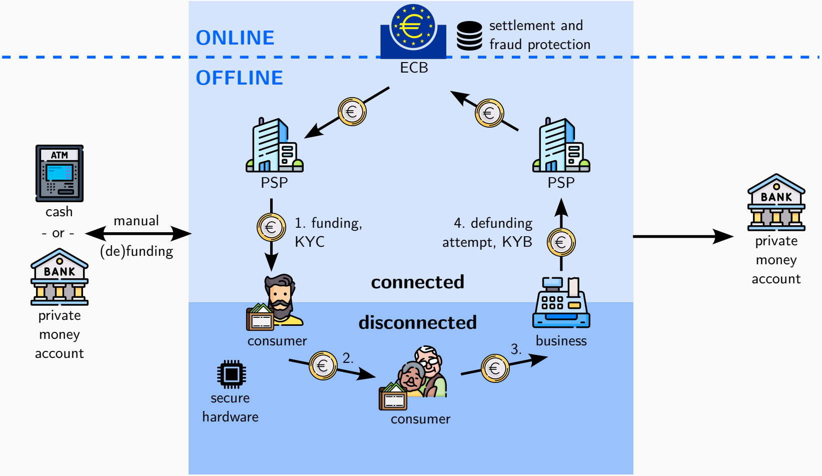
Issues with the online version



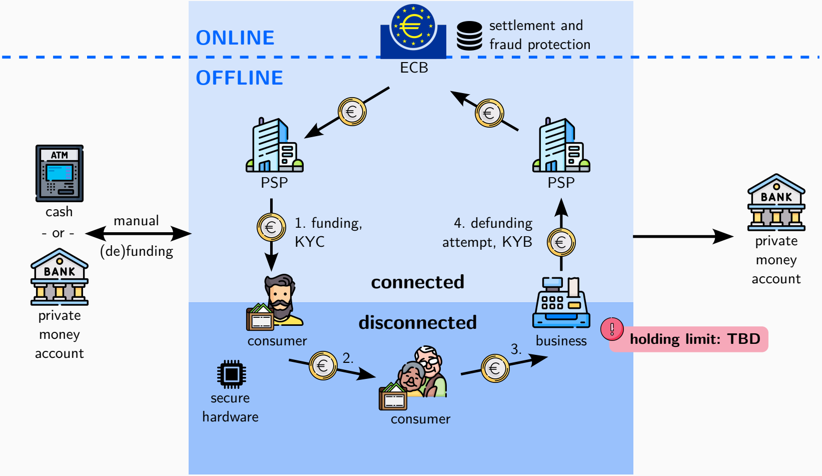
Issues with the online version



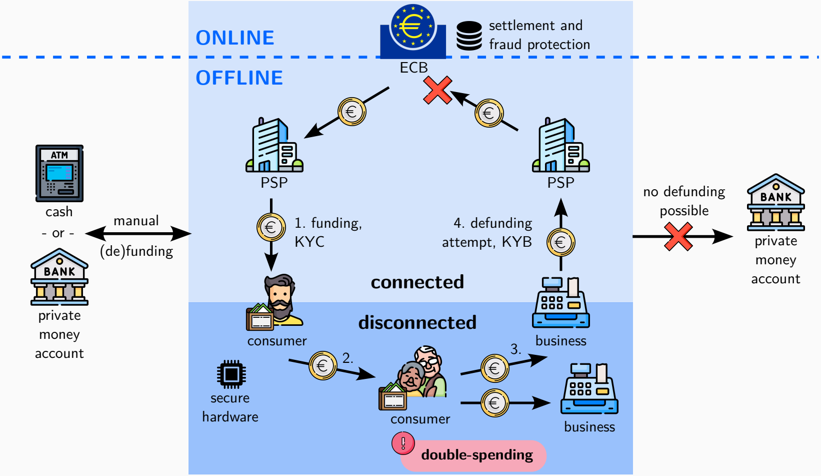
The offline version of the digital euro



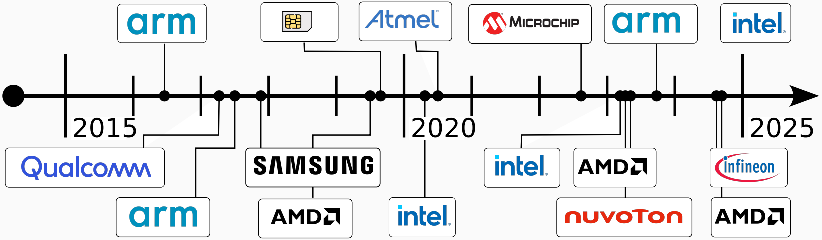
Issues with the offline version



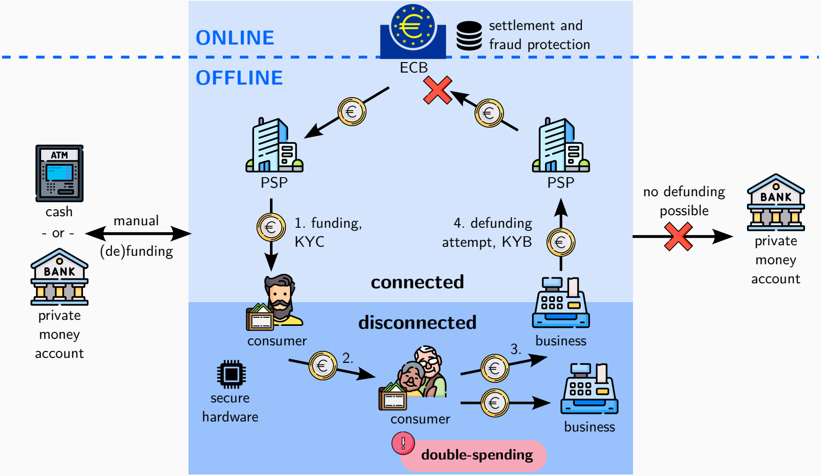
Issues with the offline version



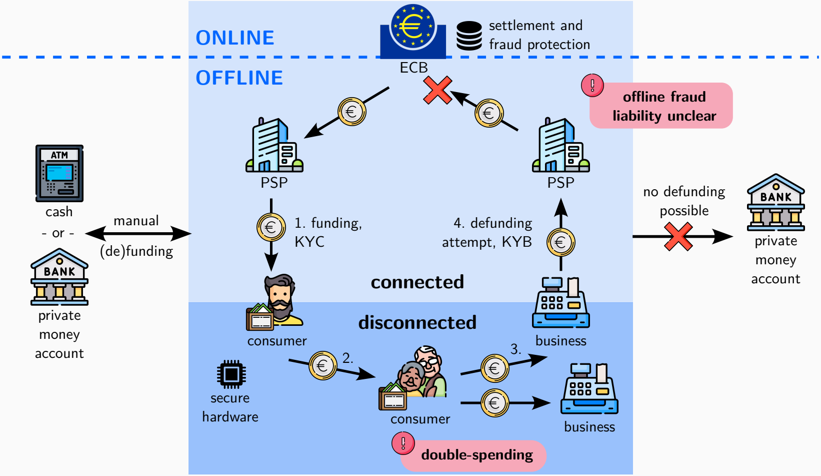
Issues with the offline version



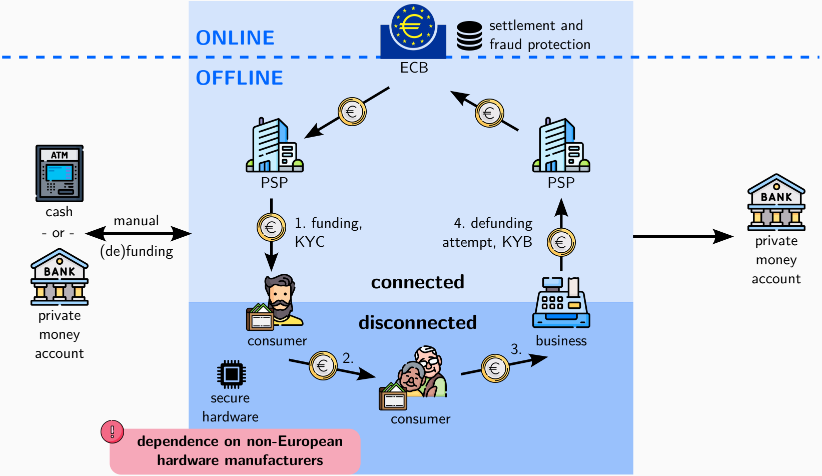
Issues with the offline version



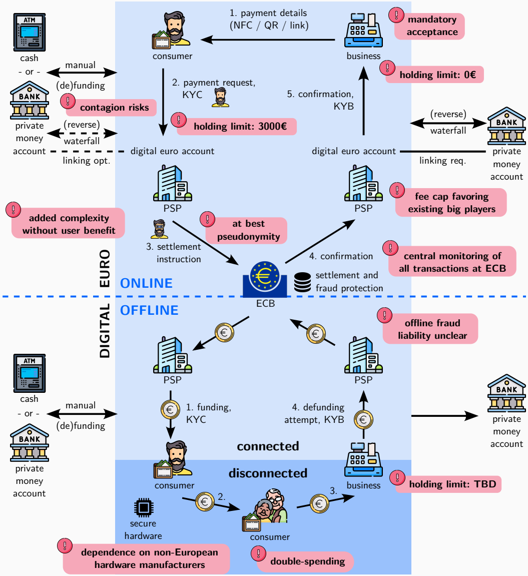
Issues with the offline version



Issues with the offline version



Issues with the design of the digital euro



Summary of issues so far

- Risks not fully addressed
- Arbitrary holding limits
- Privacy requirements violated in online version
- Complexity *on top* of existing systems
- Secure offline version technically infeasible
- Relies on non-European phone/hw manifacturers

Cui bono?

Hi, how can I help you?

Hi, how can I help you?

What value would it bring to merchants?

Hi, how can I help you?

What value would it bring to merchants?

Huuuge value, because:

- easier and cheaper alternative,
- more conversion $\rightarrow$ more revenue,
- instant payments!

Hi, how can I help you?

What value would it bring to merchants?

Huuuge value, because:

- easier and cheaper alternative,
- more conversion $\rightarrow$ more revenue,
- instant payments!

I see, but what about the integration costs?

Burden on merchants

Mandatory acceptance requires integration.

Burden on merchants

Mandatory acceptance requires integration.

Integration requires software and IT staff.

Burden on merchants

Mandatory acceptance requires integration.

Integration requires software and IT staff.

This won't be (or stay) cheap.

Burden on merchants

Mandatory acceptance requires integration.

Integration requires software and IT staff.

This won't be (or stay) cheap.

Also: what happens in case of double spending?

Hi, how can I help you?

Hi, how can I help you?

What value would it bring to intermediaries?

Hi, how can I help you?

What value would it bring to intermediaries?

Quite some!

- They deal with customers & merchants,
- have reach throughout the EU area,
- more business opportunities (also externals),
- are incetivized by a compensation model.

Hi, how can I help you?

What value would it bring to intermediaries?

Quite some!

- They deal with customers & merchants,
- have reach throughout the EU area,
- more business opportunities (also externals),
- are incetivized by a compensation model.

How exactly are these *added* value!?

Uncertainty and missing benefits

The digital euro design

- leaves legal and financial liabilities unclear,
- lacks well-specified economic incentives for operators,
- fails to identify its benefits for society.

State of the project

Hi, how can I help you?

Hi, how can I help you?

Where does the project currently stand?

Hi, how can I help you?

Where does the project currently stand?

Up and up and up!

- 2021-2023: Investigation phase
- since 2023: Preparation phase
    - extensive analysis
    - testing
    - experimentation
- end of 2025: Decision about continuation

Hi, how can I help you?

Where does the project currently stand?

Up and up and up!

- 2021-2023: Investigation phase
- since 2023: Preparation phase
  - extensive analysis
  - testing
  - experimentation
- end of 2025: Decision about continuation

Which experts where consulted?

Hi, how can I help you?

Where does the project currently stand?

Up and up and up!

- 2021-2023: Investigation phase
- since 2023: Preparation phase
  - extensive analysis
  - testing
  - experimentation
- end of 2025: Decision about continuation

Which experts where consulted?

403 Forbidden

Conclusion

Gambling with the Trust in the Euro

The current design of the digital euro,

- in the online version: doesn't meet privacy demands,
- in the offline version: is technically infeasible,
- leaves legal and financial liabilities unclear,
- lacks well-specified incentives for operators,
- fails to identify benefits of it for society.

Gambling with the Trust in the Euro

The current design of the digital euro,

- in the online version: doesn't meet privacy demands,
- in the offline version: is technically infeasible,
- leaves legal and financial liabilities unclear,
- lacks well-specified incentives for operators,
- fails to identify benefits of it for society.

The ECB risks loss of reputation.

Gambling with the Trust in the Euro

The current design of the digital euro,

- in the online version: doesn't meet privacy demands,
- in the offline version: is technically infeasible,
- leaves legal and financial liabilities unclear,
- lacks well-specified incentives for operators,
- fails to identify benefits of it for society.

The ECB risks loss of reputation.

The Euro risks loss of public trust.

Epilog

Hi, how can I help you?

Hi, how can I help you?

Would a digital euro replace cash?

Hi, how can I help you?

Would a digital euro replace cash?

No.

- It would complement cash, not replace it.
- Cash would continue to be available...
- ...as would the other means of payment.

Hi, how can I help you?

Would a digital euro replace cash?

No.

- It would complement cash, not replace it.
- Cash would continue to be available...
- ...as would the other means of payment.

OK, *phew*!

Hi, how can I help you?

Would a digital euro replace cash?

No.

- It would complement cash, not replace it.
- Cash would continue to be available...
- ...as would the other means of payment.

OK, *phew*!

...but why so many *would*'s???

The Horizon

Current Landscape

Right now, there is no

- privacy preserving,
- practical,
- taxable,
- digital

payment system available for the Euro, in the Eurozone.

Privacy from an economic perspective

In 2025, economist Katrin Tinn

- analyzed retail CBDC's designs
- with respect to privacy,
- from a economical perspective,
- taking a game theoretical approach.

Privacy from an economic perspective

In 2025, economist Katrin Tinn

- analyzed retail CBDC's designs
- with respect to privacy,
- from a economical perspective,
- taking a game theoretical approach.

Her conclusion:

> *...my model shows that **"asymmetric privacy"** would enable the government to set lower taxes while delivering the same level of public goods than it would under symmetrical non-privacy or symmetrical privacy.*

GNU Taler

A payment system with asymmetric privacy!

"Asymmetric privacy" in GNU Taler means:

- *buyer* remains anonymous during purchase,

GNU Taler

A payment system with asymmetric privacy!

"Asymmetric privacy" in GNU Taler means:

- *buyer* remains anonymous during purchase,
- *purchases* remain unlinkable,

GNU Taler

A payment system with asymmetric privacy!

"Asymmetric privacy" in GNU Taler means:

- *buyer* remains anonymous during purchase,
- *purchases* remain unlinkable,
- but *sellers* are identifyable (KYC, bank account, etc.)

GNU Taler

Available in Switzerland, via `https://taler-ops.ch`, **NOW**!

GNU Taler

Available in Switzerland, via `https://taler-ops.ch`, **NOW**!

Soon to become available in Germany, for the Euro, via GLS Bank!

GNU Taler

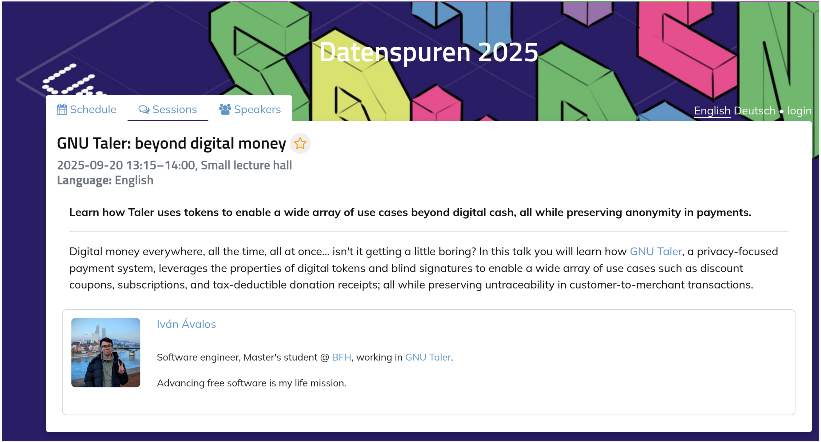
Available in Switzerland, via `https://taler-ops.ch`, **NOW**!

Soon to become available in Germany, for the Euro, via GLS Bank!

Also in Hungary for the Forint, via Magnet Bank!

GNU Taler: beyond digital money

Check out Iván's talk:



Datenspuren 2025

Schedule | Sessions | Speakers

English Deutsch • login

GNU Taler: beyond digital money

2025-09-20 13:15–14:00, Small lecture hall
Language: English

Learn how Taler uses tokens to enable a wide array of use cases beyond digital cash, all while preserving anonymity in payments.

Digital money everywhere, all the time, all at once... isn't it getting a little boring? In this talk you will learn how GNU Taler, a privacy-focused payment system, leverages the properties of digital tokens and blind signatures to enable a wide array of use cases such as discount coupons, subscriptions, and tax-deductible donation receipts; all while preserving untraceability in customer-to-merchant transactions.

Iván Ávalos

Software engineer, Master's student @ BFH, working in GNU Taler.

Advancing free software is my life mission.

Acknowledgments

With funding from the:

Federal Ministry
of Research, Technology
and Space

NGI TALER

Questions?

Go to

`https://fqa.t-euro.eu/`