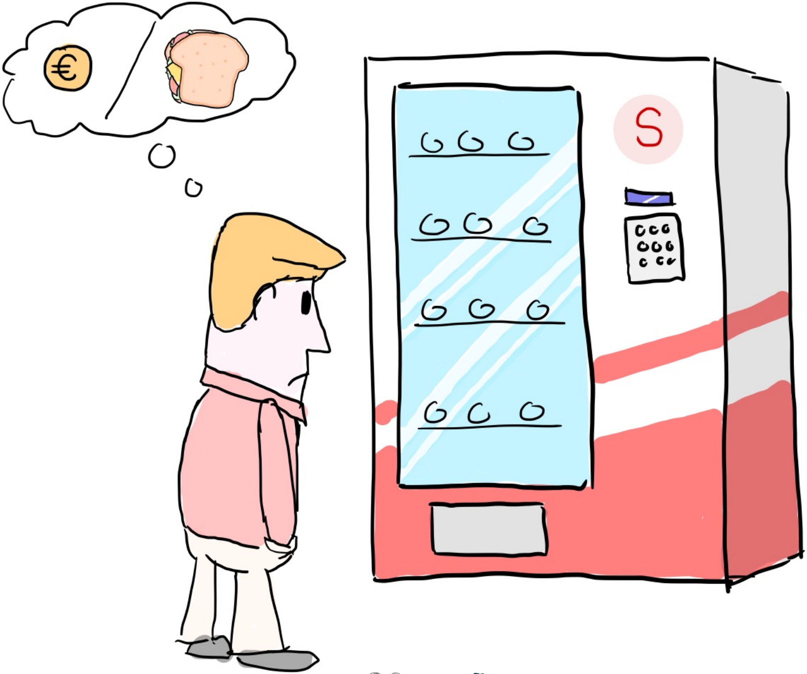

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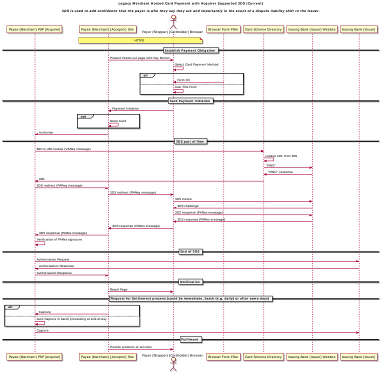
The Bank's Problem

3D secure ("verified by visa") is a nightmare:

- Complicated process
- Shifts liability to consumer
- Significant latency
- Can refuse valid requests
- Legal vendors excluded
- No privacy for buyers


Legacy Merchant Hosted Card Payment with Acquirer Supported 3DS (Current)
3DS is used to add confidence that the payer is who they say they are and importantly in the event of a dispute liability shift to the Issuer.
Payee (Merchant) PSP [Acquirer]
Payee (Merchant) [Acceptor] Site
Payer (Shopper) [Cardholder] Browser
Browser Form Filler
Card Scheme Directory
Issuing Bank [Issuer] Website
Issuing Bank [Issuer]
HTTPS
Establish Payment Obligation
Present Check-out page with Pay Button
Select Card Payment Method
alt
Form Fill
User Fills Form
Card Payment Initiation
Payment Initiation
opt
Store Card
Authorise
3DS part of flow
BIN to URL lookup (VAReq message)
Lookup URL from BIN
"PING"
"PING" response
URL
3DS redirect (PAReq message)
3DS redirect (PAReq message)
3DS invoke
3DS challenge
3DS response (PARes message)
3DS response (PARes message)
3DS response (PARes message)
3DS response (PARes message)
Verification of PARes signature
End of 3DS
Authorisation Request
Authorisation Response
Authorisation Response
Notification
Result Page
Request for Settlement process (could be immediate, batch (e.g. daily) or after some days)
alt
Capture
Auto Capture in batch processing at end-of-day
Capture
Fulfilment
Provide products or services
Payee (Merchant) PSP [Acquirer]
Payee (Merchant) [Acceptor] Site
Payer (Shopper) [Cardholder] Browser
Browser Form Filler
Card Scheme Directory
Issuing Bank [Issuer] Website
Issuing Bank [Issuer]

Online credit card payments will be replaced, but with what?

The Bank's Problem

- Global tech companies push oligopolies
- Privacy and federated finance are at risk
- Economic sovereingity is in danger

Predicting the Future

- Google, Apple or Facebook's Libra will be your bank and run your payment system
- They target advertising based on your purchase history, location and your ability to pay
- They will provide more usable, faster and broadly available payment solutions; our federated banking system will be history
- After dominating the payment sector, they will start to charge fees befitting their oligopoly size
- Competitors and vendors not aligning with their corporate "values" will be excluded by terms of service and go bankrupt

GNU

⟨Taler⟩

Digital cash, made **socially responsible**.

taler.net

twitter@taler
mail@taler.net

Christian Grothoff
grothoff@taler.net

Berner Fachhochschule
Technik und Informatik

What is Taler?

Taler is an electronic instant payment system.

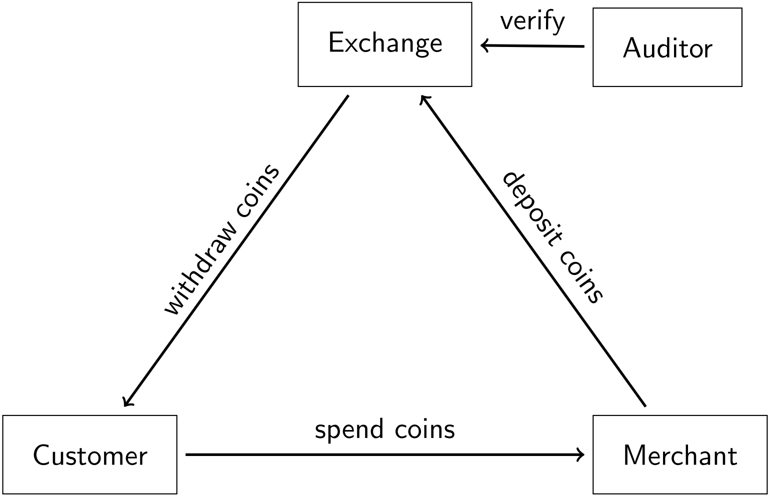
- Uses electronic coins stored in **wallets** on customer's device
- Like **cash**
- Pay in **existing currencies** (i.e. EUR, USD, CHF)

Design goals for the GNU Taler Payment System

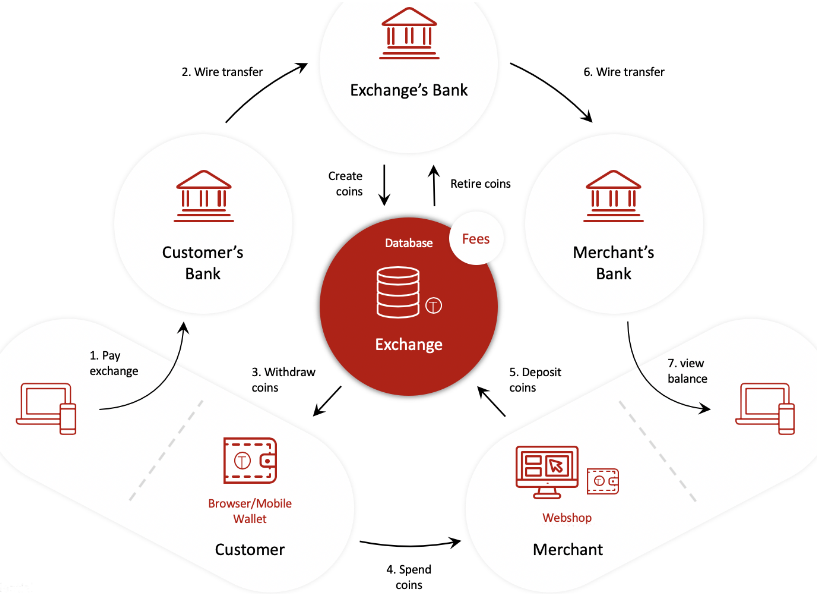
GNU Taler must ...

1. ... be implemented as **free software**.
2. ... protect the **privacy of buyers**.
3. ... must enable the state to **tax income** and crack down on illegal business activities.
4. ... prevent payment fraud.
5. ... only **disclose the minimal amount of information necessary**.
6. ... be usable.
7. ... be efficient.
8. ... avoid single points of failure.
9. ... foster **competition**.

Taler Overview



Taler in Operation



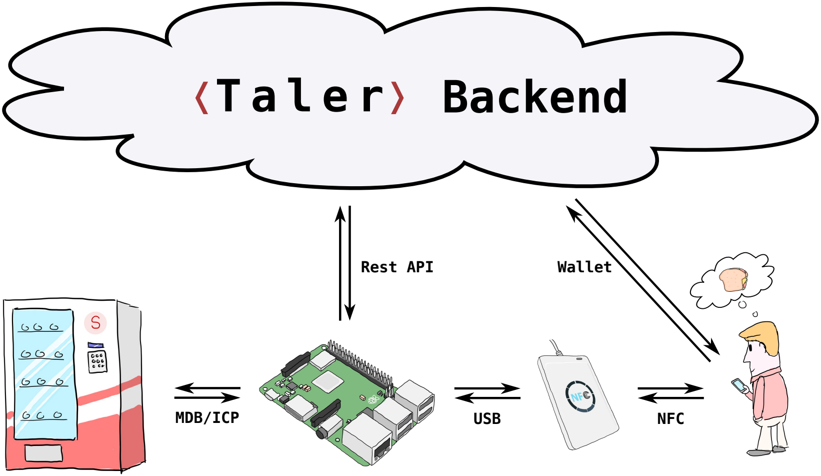
Usability of Taler

`https://demo.taler.net/`

1. Install browser extension.
2. Visit the `bank.demo.taler.net` to withdraw coins.
3. Visit the `shop.demo.taler.net` to spend coins.

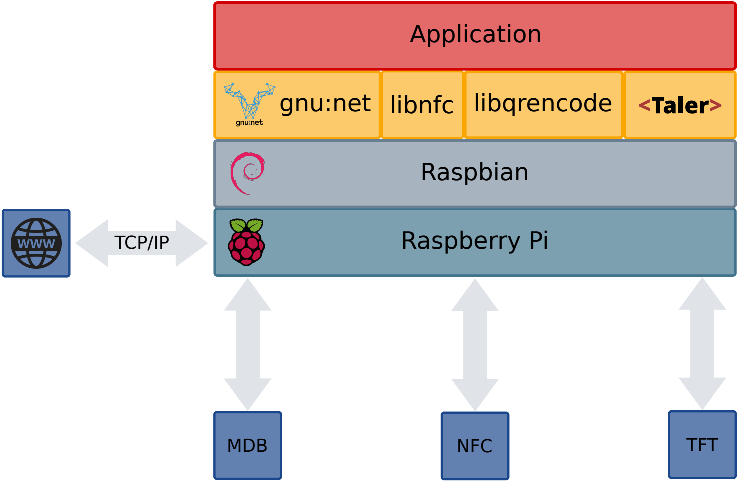
The Taler Snack Machine[1]

Integration of a MDB/ICP to Taler gateway.
Implementation of a NFC or QR-Code to Taler wallet interface.

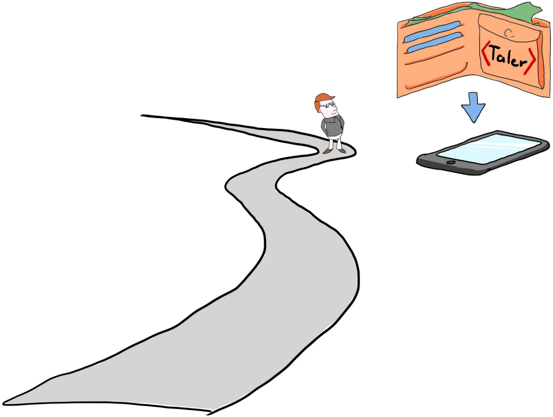


[1] By M. Boss and D. Hofer

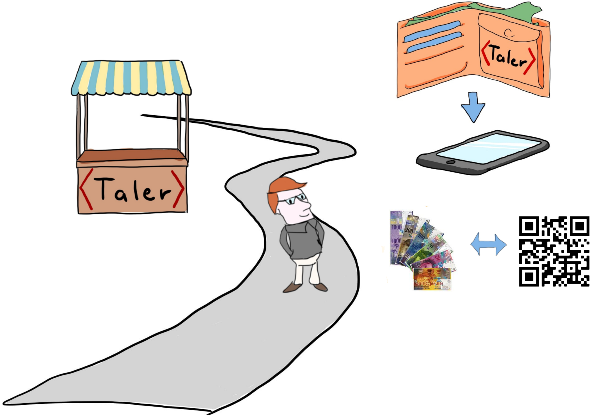
Software


Application
gnu:net
libnfc
libqrencode
<Taler>
Raspbian
Raspberry Pi
WWW
TCP/IP
MDB
NFC
TFT

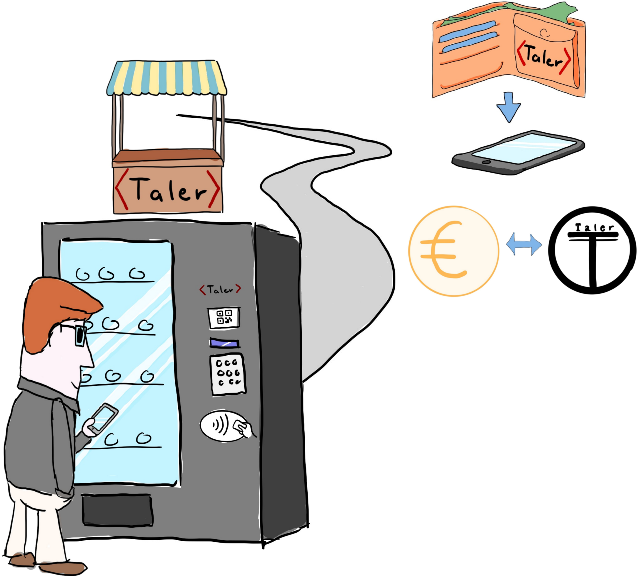
How to use at WCEF: Install App on Android[2]



How to use at WCEF: Get e-cash



How to use at WCEF: Get snacks



How to use afterwards: Shop online[3]

`https://buywith.taler.net/`

[3] Operational until 31.1.2020

Use Case: Journalism

Today:

- Corporate structure
- Advertising primary revenue
- Tracking readers critical for business success
- Journalism and marketing hard to distinguish

Use Case: Journalism

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- Corporate structure
- Advertising primary revenue
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With GNU Taler:

- One-click micropayments per article
- Hosting requires no expertise
- Reader-funded reporting separated from marketing
- Readers can remain anonymous

Use Case: Anti-Spam

Today, p≡p provides authenticated encryption for e-mail:

- Free software
- Easy to use opportunistic encryption
- Available for Outlook, Android, Enigmail
- Spies & spam filters can no longer inspect content

Use Case: Anti-Spam

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With GNU Taler:

- Peer-to-peer payments via e-mail
- If unsolicited sender, hide messages from user & automatically request payment from sender
- Sender can attach payment to be moved to inbox
- Receiver may grant refund to sender

Where might this get us exactly?

Visions

- Be paid to read advertising, starting with spam
- Give welfare without intermediaries taking huge cuts
- Eliminate corruption by making all income visible
- Stop the mining by making crypto-currencies useless for anything but crime

Competitor comparison

	Cash	Bitcoin	Zerocoin	Creditcard	GNU Taler
Online	−−−	++	++	+	+++
Offline	+++	−−	−−	+	−−
Trans. cost	+	−−−	−−−	−	++
Speed	+	−−−	−−−	o	++
Taxation	−	−−	−−−	+++	+++
Payer-anon	++	o	++	−−−	+++
Payee-anon	++	o	++	−−−	−−−
Security	−	o	o	−−	++
Conversion	+++	−−−	−−−	+++	+++
Libre	−	+++	+++	− − −	+++

Technology

How does it work?

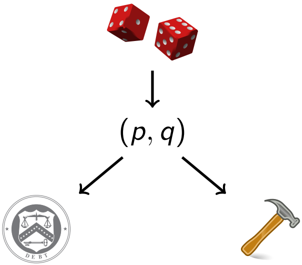
We use a few ancient constructions:

- Cryptographic hash function (1989)
- Blind signature (1983)
- Schnorr signature (1989)
- Diffie-Hellman key exchange (1976)
- Cut-and-choose zero-knowledge proof (1985)

But of course we use modern instantiations.

Exchange setup: Create a denomination key (RSA)

1. Pick random primes p, q.
2. Compute $n := pq$,
   $\phi(n) = (p-1)(q-1)$
3. Pick small $e < \phi(n)$ such that
   $d := e^{-1} \mod \phi(n)$ exists.
4. Publish public key (e, n).



(p, q)

Merchant: Create a signing key (EdDSA)

- pick random $m \mod o$ as private key
- $M = mG$ public key

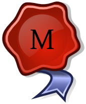
$$\downarrow$$

m

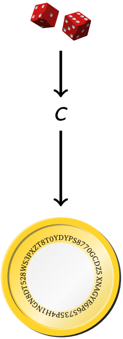
$$\downarrow$$

M

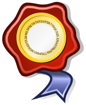
Capability: $m \Rightarrow$



Customer: Create a planchet (EdDSA)

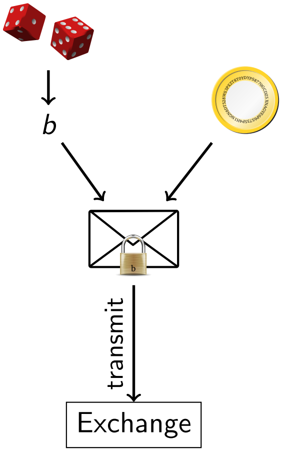


- Pick random $c \mod o$ private key
- $C = cG$ public key

Capability: $c \Rightarrow$ 

Customer: Blind planchet (RSA)

1. Obtain public key (e, n)
2. Compute $f := FDH(C)$, $f < n$.
3. Pick blinding factor $b \in \mathbb{Z}_n$
4. Transmit $f' := fb^e \mod n$



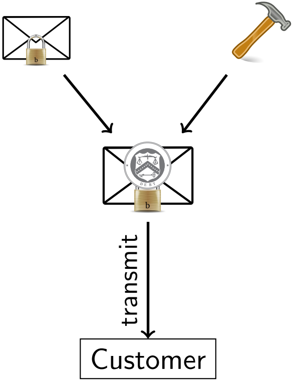
b

transmit

Exchange

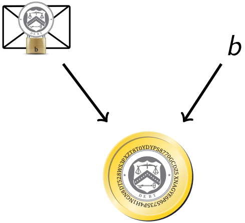
Exchange: Blind sign (RSA)

1. Receive f'.
2. Compute $s' := f'^{d} \mod n$.
3. Send signature s'.

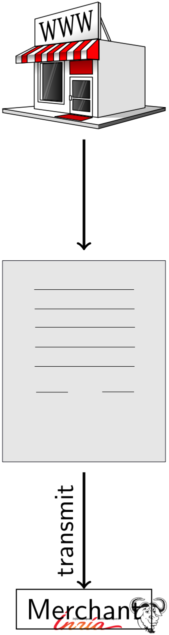


Customer: Unblind coin (RSA)

1. Receive s'.
2. Compute $s := s'b^{-1} \mod n$

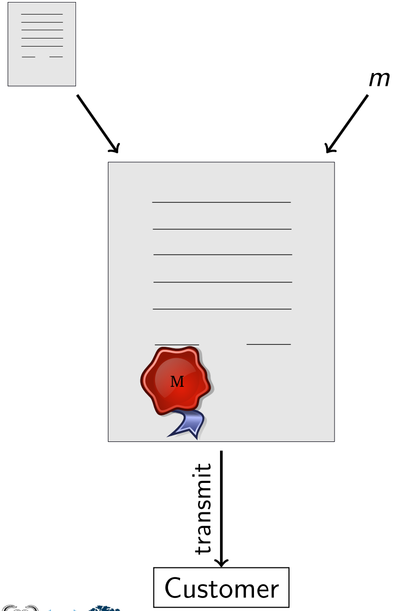


Customer: Build shopping cart



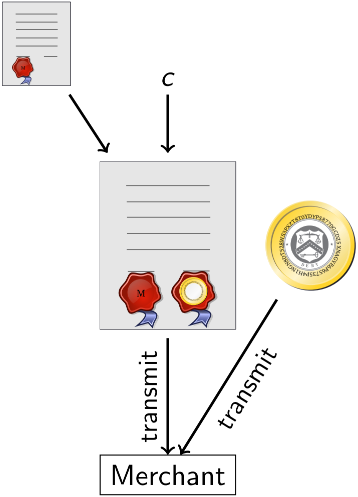
Merchant: Propose contract (EdDSA)

1. Complete proposal D.
2. Send D, $EdDSA_m(D)$



Customer: Spend coin (EdDSA)

1. Receive proposal D, $EdDSA_m(D)$.
2. Send s, C, $EdDSA_c(D)$



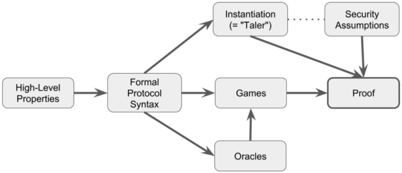
Merchant and Exchange: Verify coin (RSA)

$$s^e \overset{?}{\equiv} FDH(C) \mod n$$

Technology

GNU Taler additionally offers:

- Giving change, can provide refunds
- Integration with HTTP, handles network failures
- High performance
- Bounded losses on key compromise
- Formal security proofs
- ...



More information at `https://taler.net/`.

Conclusion

What can we do?

- Suffer mass-surveillance enabled by credit card oligopolies with high fees, and
- Engage in arms race with deliberately unregulatable blockchains, and
- Enjoy the “benefits” of cash

बैंक ऑफ इंडिया
सभी बैंकों के ए.टी.एम. कार्ड्स यहाँ उपयोग कर सकते हैं।
All Banks' ATM cards Can be used here.
PULL
THIS ATM IS OUT OF CASH

OR

- Establish free software alternative balancing social goals!

Do you have any questions?

References:

1. Christian Grothoff, Bart Polot and Carlo von Loesch. *The Internet is broken: Idealistic Ideas for Building a GNU Network*. **W3C/IAB Workshop on Strengthening the Internet Against Pervasive Monitoring (STRINT)**, 2014.
2. Jeffrey Burdges, Florian Dold, Christian Grothoff and Marcello Stanisci. *Enabling Secure Web Payments with GNU Taler*. **SPACE 2016**.
3. Florian Dold, Sree Harsha Totakura, Benedikt Müller, Jeffrey Burdges and Christian Grothoff. *Taler: Taxable Anonymous Libre Electronic Reserves*. Available upon request. 2016.
4. Eli Ben-Sasson, Alessandro Chiesa, Christina Garman, Matthew Green, Ian Miers, Eran Tromer and Madars Virza. *Zerocash: Decentralized Anonymous Payments from Bitcoin*. **IEEE Symposium on Security & Privacy, 2016**.
5. David Chaum, Amos Fiat and Moni Naor. *Untraceable electronic cash*. **Proceedings on Advances in Cryptology, 1990**.
6. Phillip Rogaway. *The Moral Character of Cryptographic Work*. **Asiacrypt**, 2015.

The Distraction: Bitcoin

- Unregulated payment system and currency:

  ⇒ lack of regulation is a feature!
- Implemented in free software
- Decentralised peer-to-peer system

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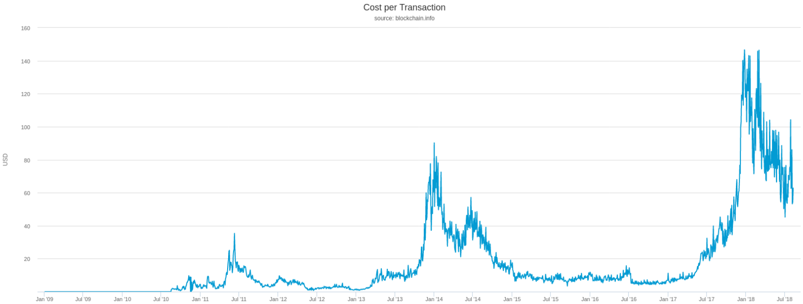
- Creative solution: tie initial accumulation to solving consensus

  ⇒ Proof-of-work advances ledger

  ⇒ Very expensive banking

?


Cost per Transaction

source: blockchain.info

Current average transaction value: ≈ 1000 USD

What is there?

Components

- REST APIs, C APIs
- Command-line, WebExtension (Firefox, Chrome, Chromium, Brave) and Android wallet
- GLS bank integration (libeufin, WiP)
- Escrow/backup solution (Anastasis, WiP)
- Merchant backend & backoffice (needs improvements)
- WooCommerce plugin (needs update)
- Taler-enabled vending machine (MDB)
- Sample Web frontends