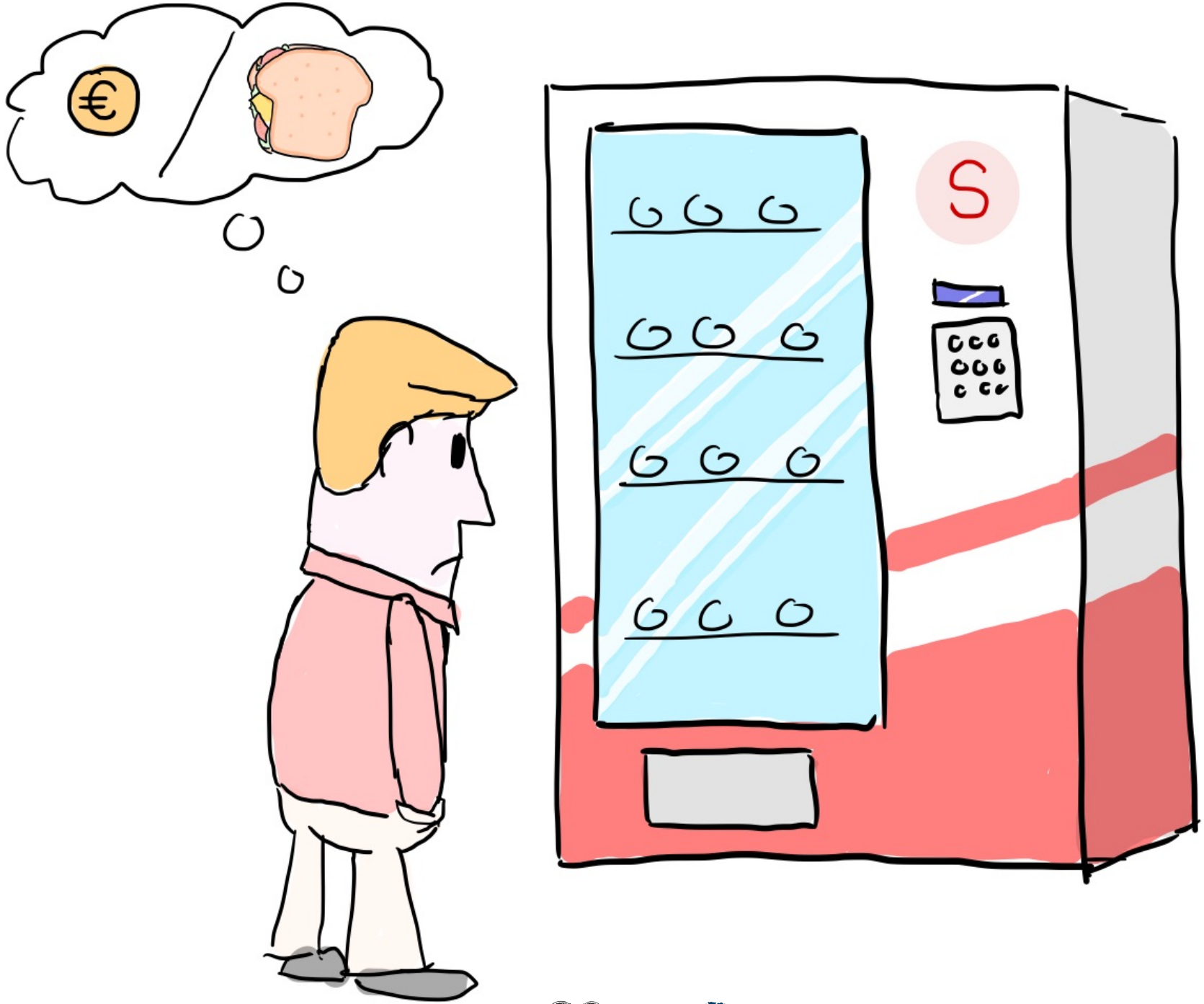
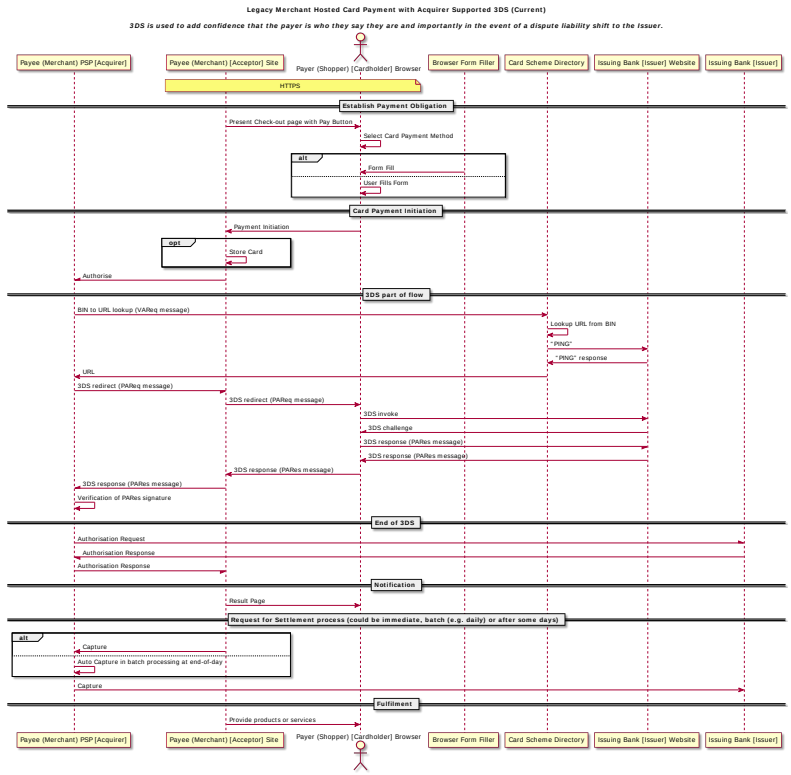

S

The Bank's Problem

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

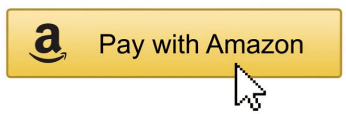
- Complicated process
- Shifts liability to consumer
- Significant latency
- Can refuse valid requests
- Legal vendors excluded
- No privacy for buyers



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

What is Taler?

Taler is an electronic instant payment system.

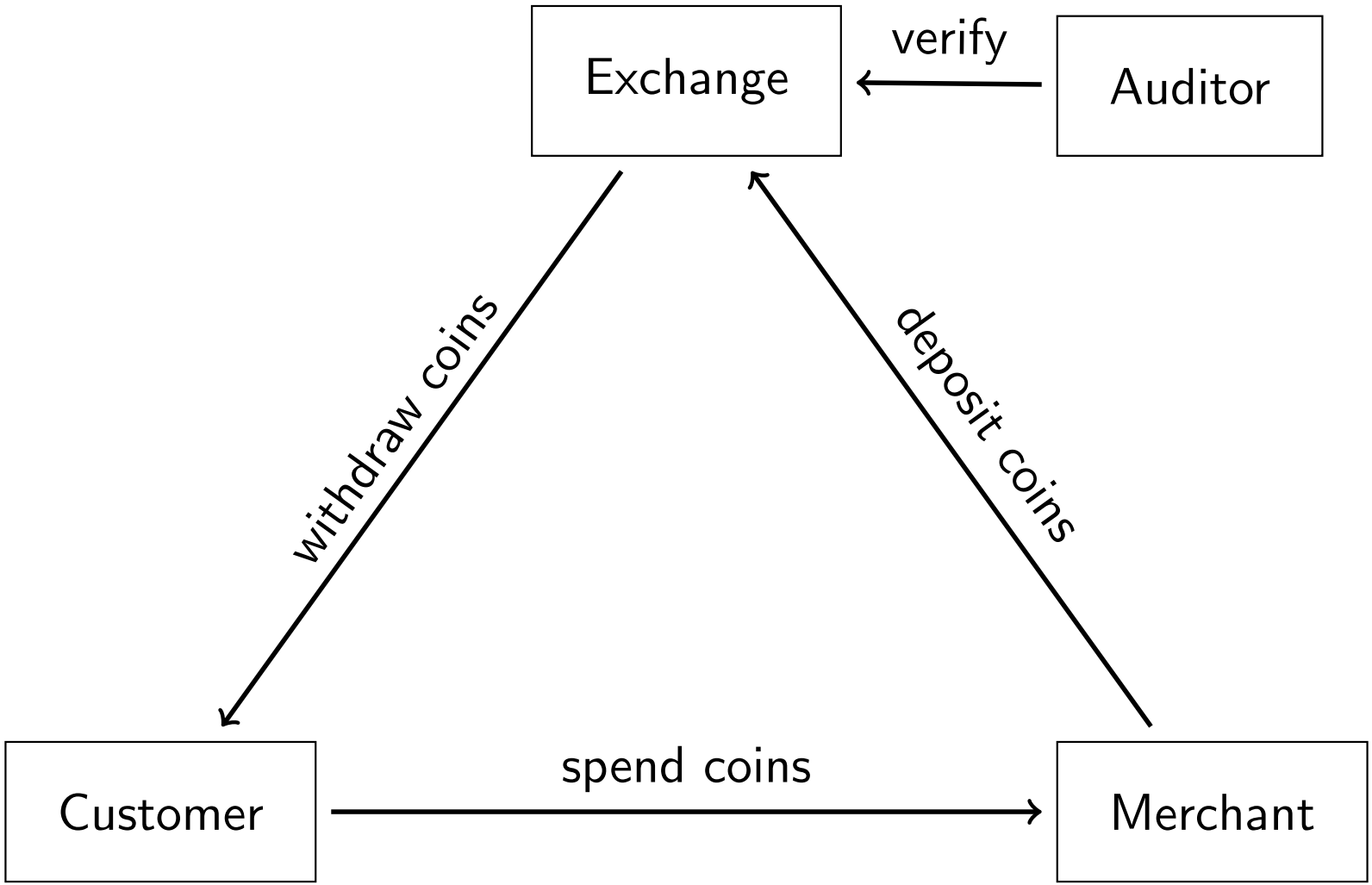
- Uses electronic coins stored in **wallets** on customer's device
- Like **cash**
- Pay in **existing currencies** (i.e. EUR, USD, CHF)

Design goals for the GNU Taler Payment System

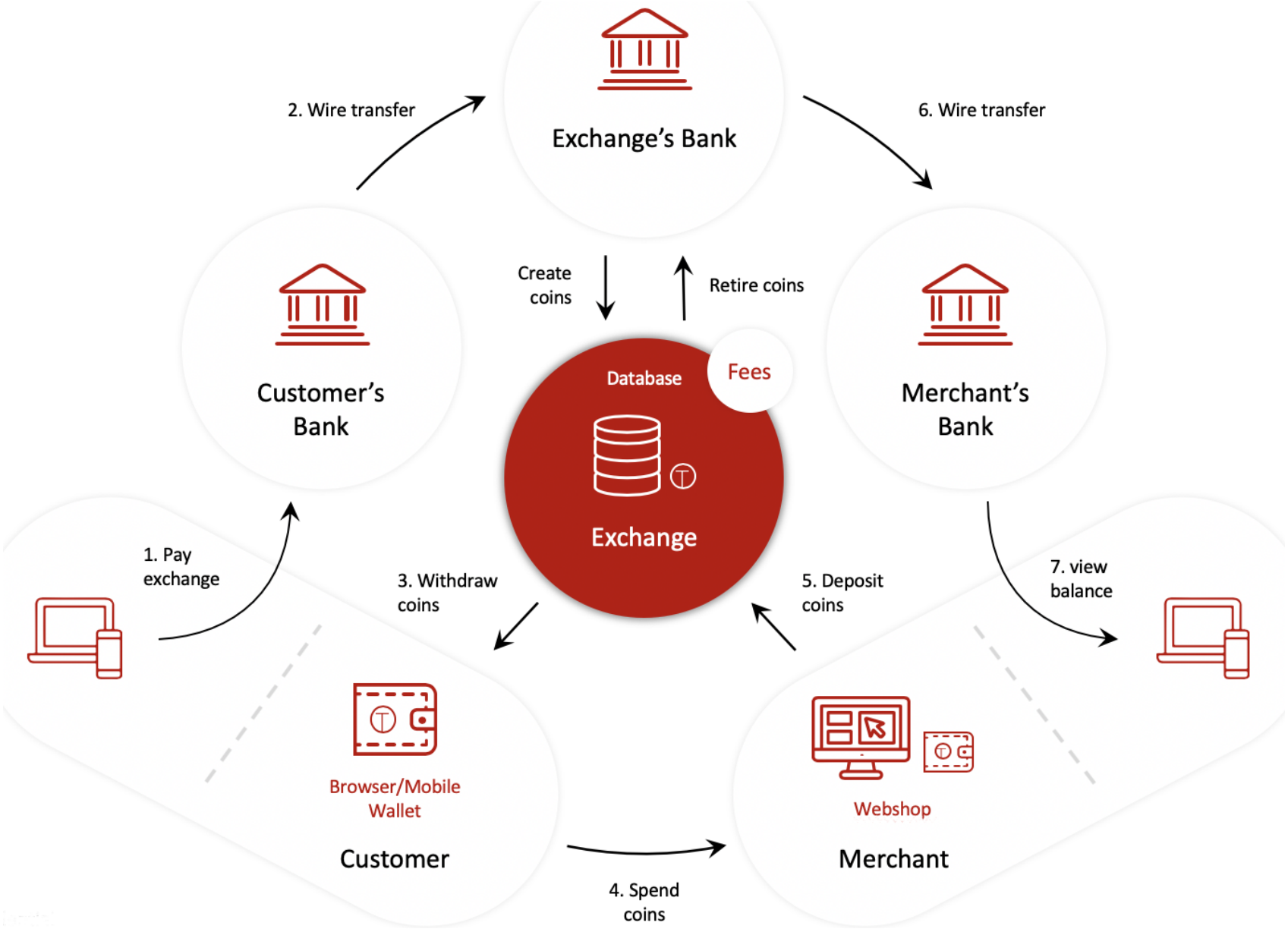
GNU Taler must ...

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



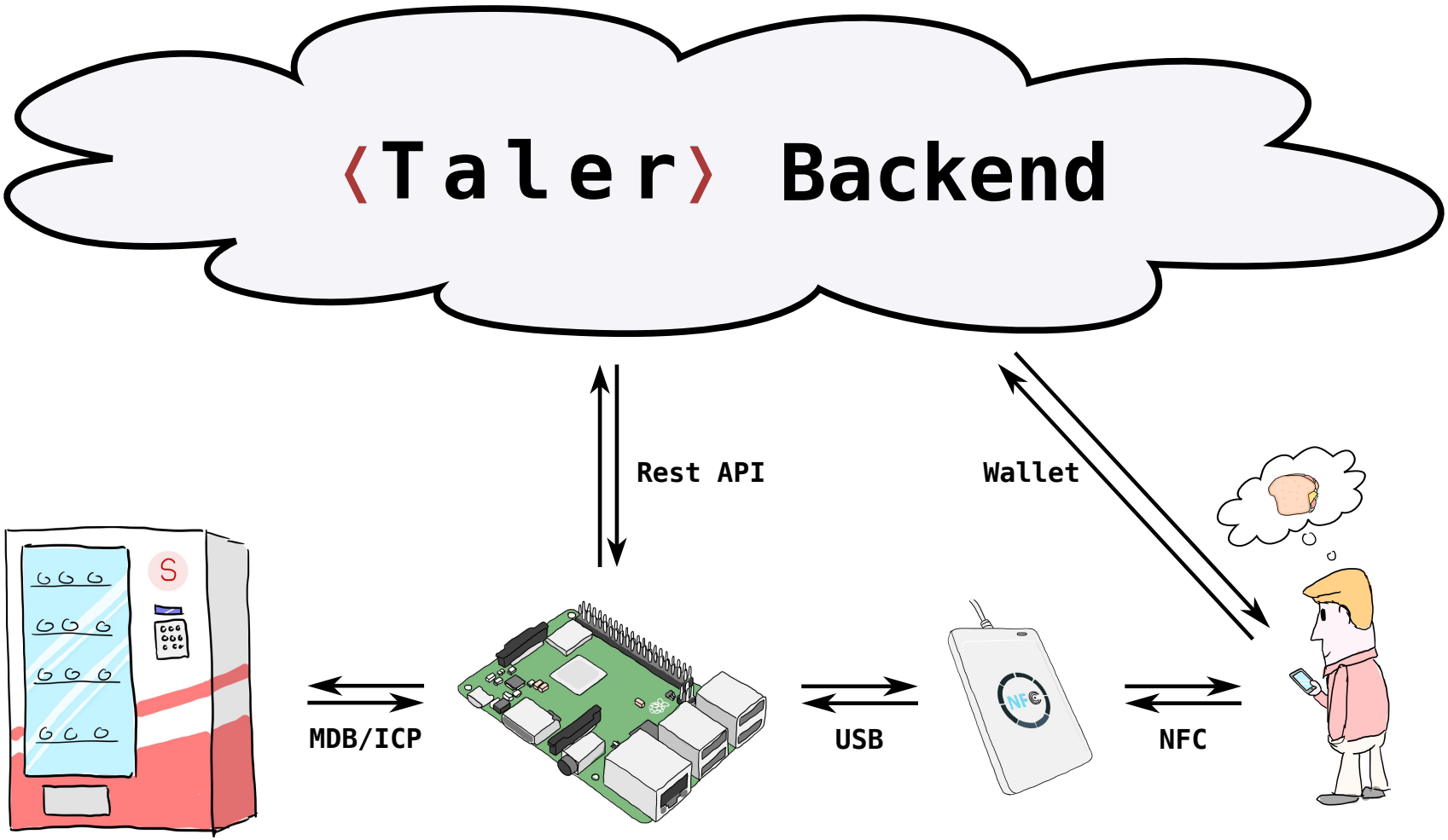
Usability of Taler

`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.

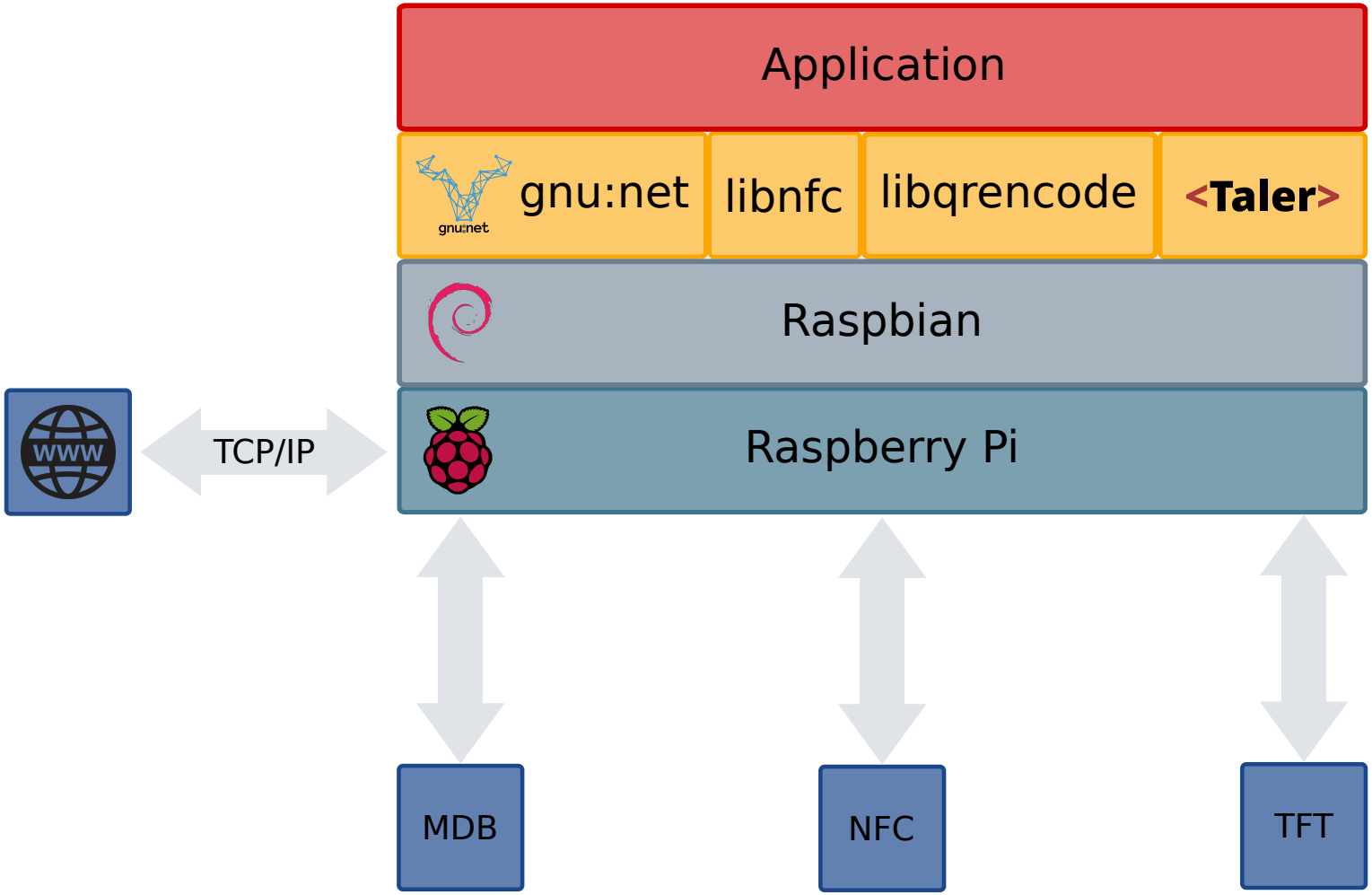
The Taler Snack Machine[1]

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

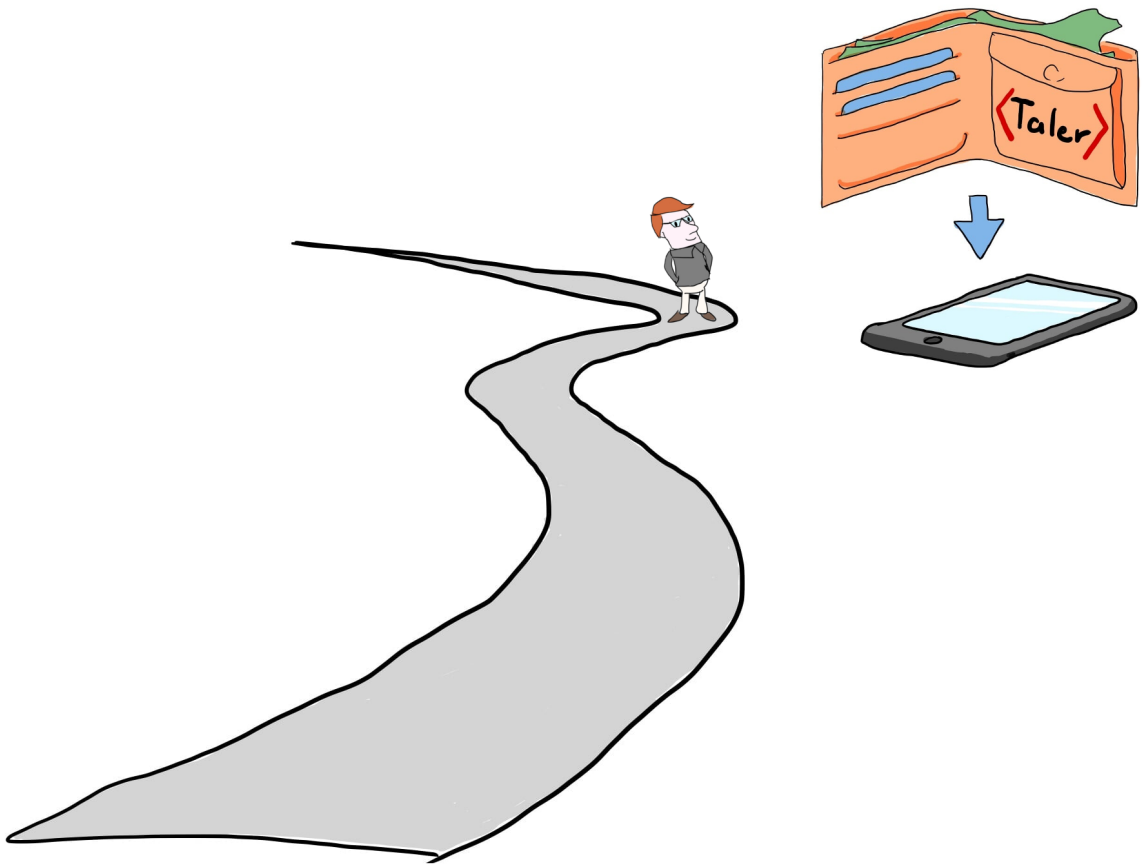


[1]By M. Boss and D. Hofer

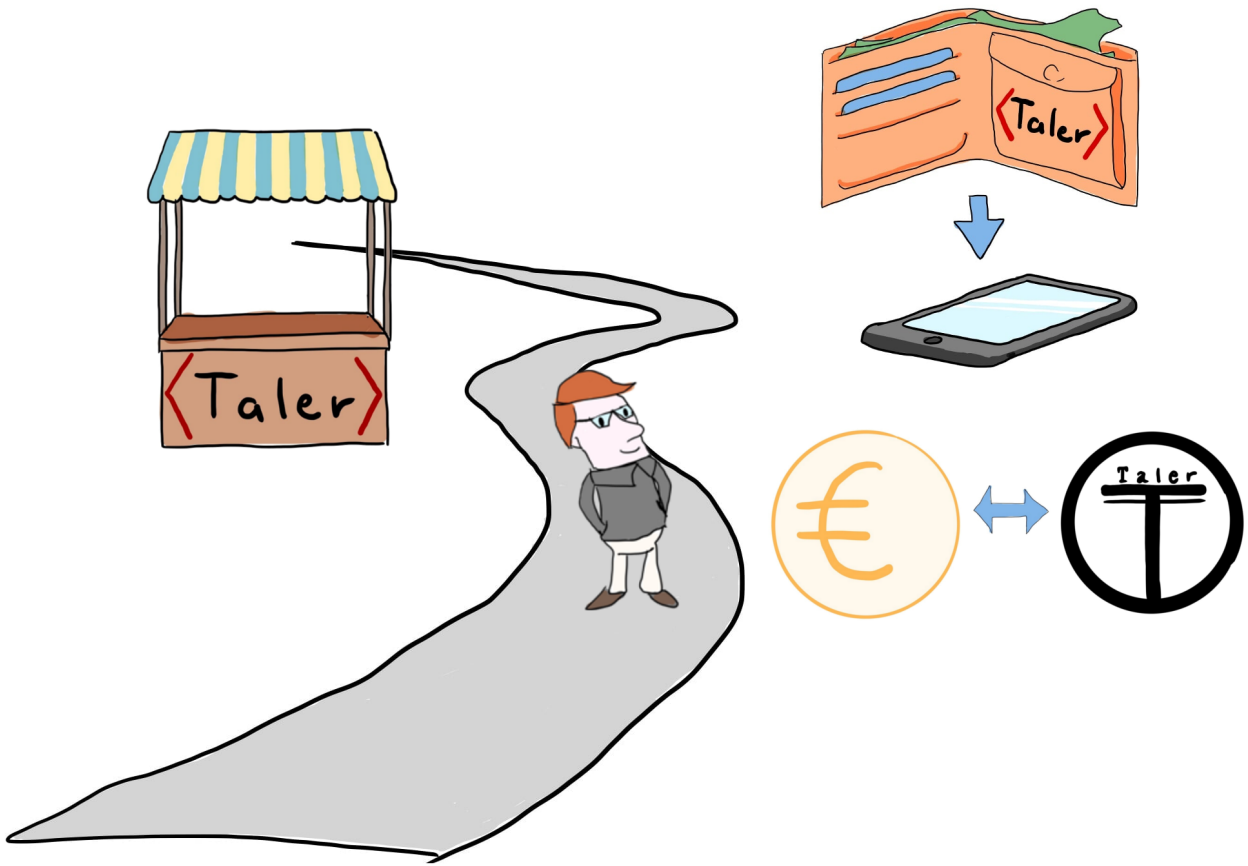
Software


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

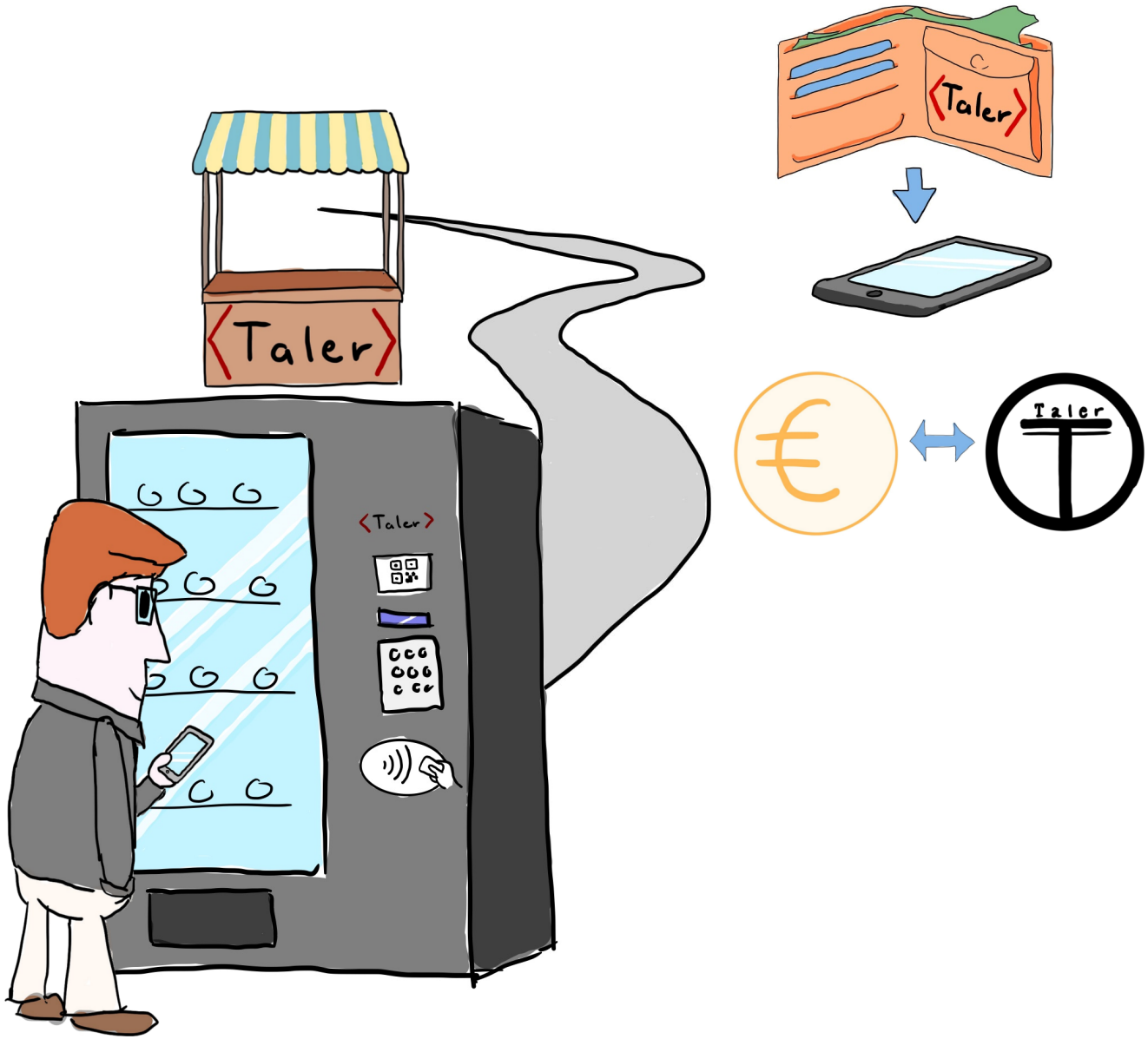
How to use at WCEF: Install App on Android[2]



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

Today:

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

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

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

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?

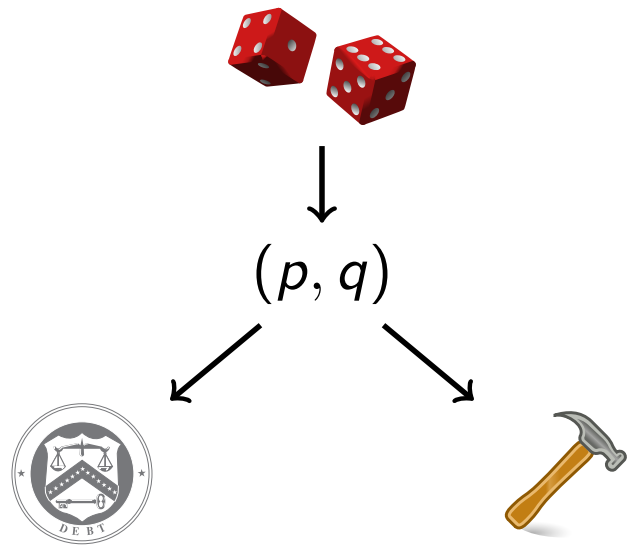
We use a few ancient constructions:

- 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).



Merchant: Create a signing key (EdDSA)

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

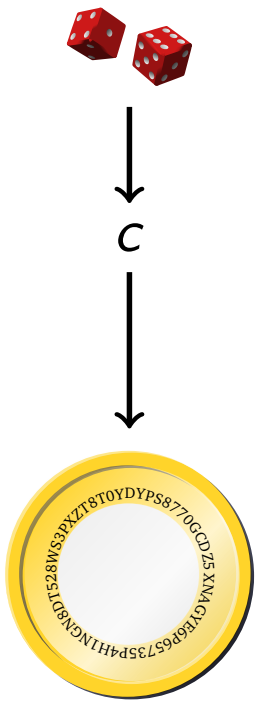
m

M

Capability: $m \Rightarrow$ 

Customer: Create a planchet (EdDSA)

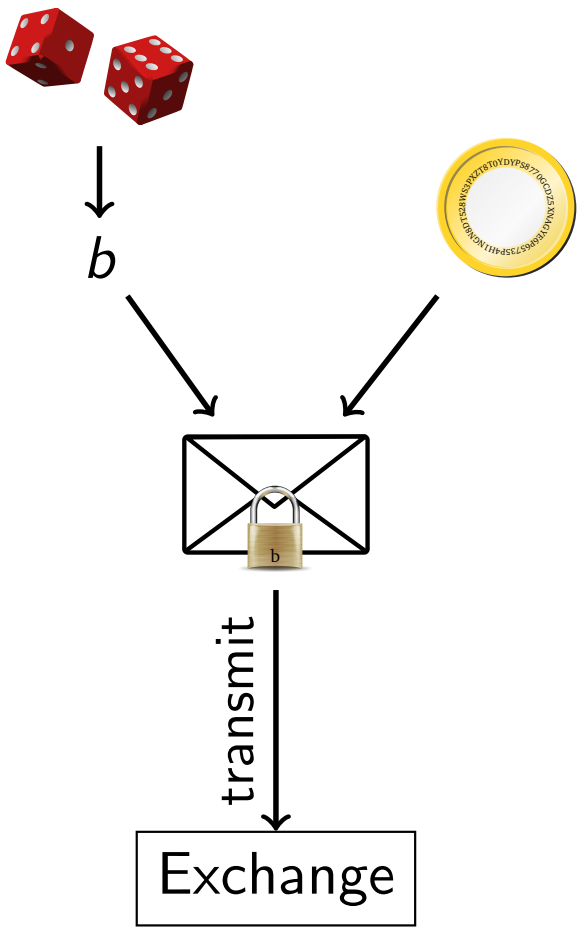
- Pick random c mod o private key
- $C = cG$ public key



Capability: $c \Rightarrow$ 

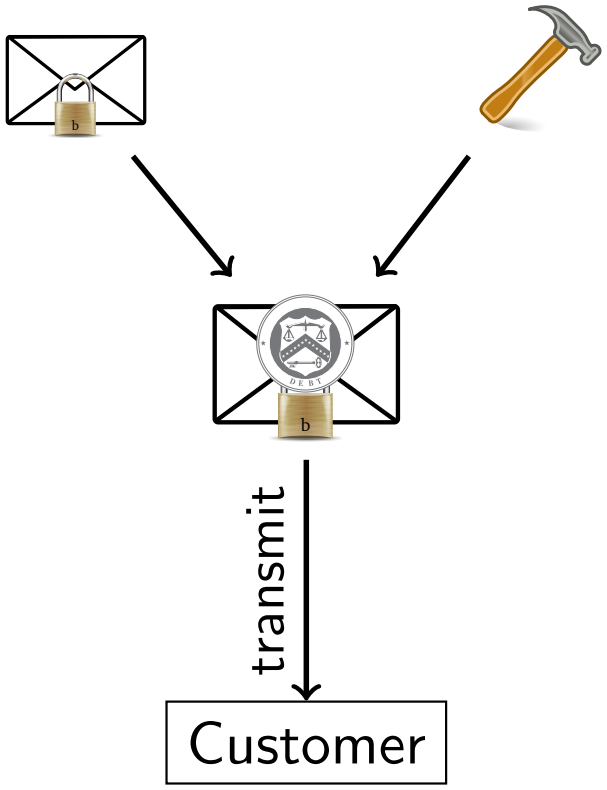
Customer: Blind planchet (RSA)

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



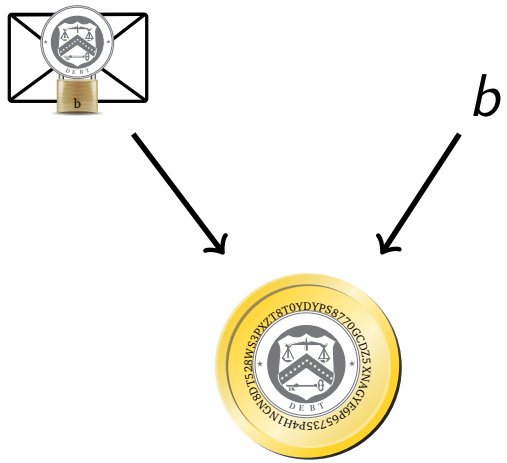
Exchange: Blind sign (RSA)

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

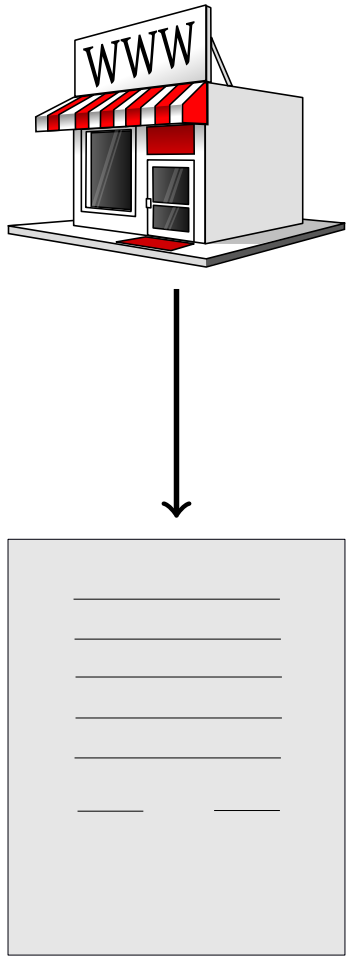


Customer: Unblind coin (RSA)

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

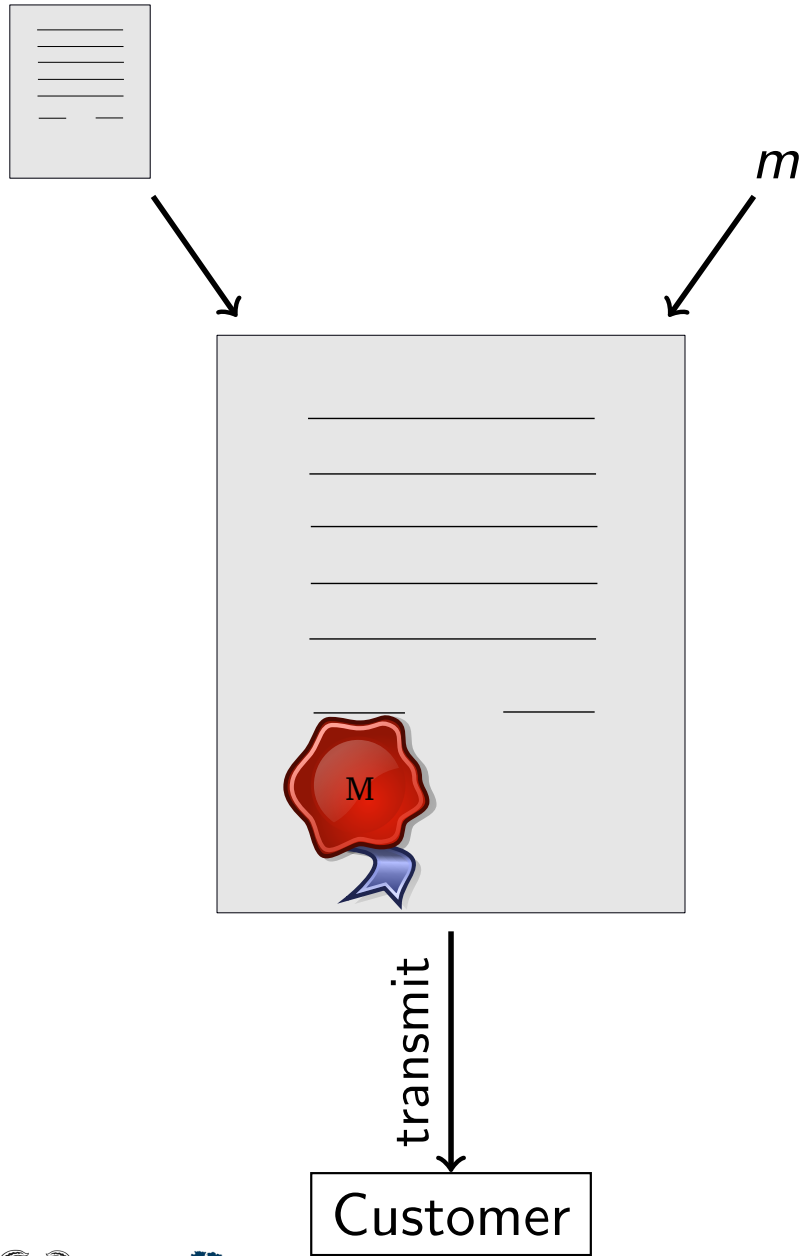


Customer: Build shopping cart



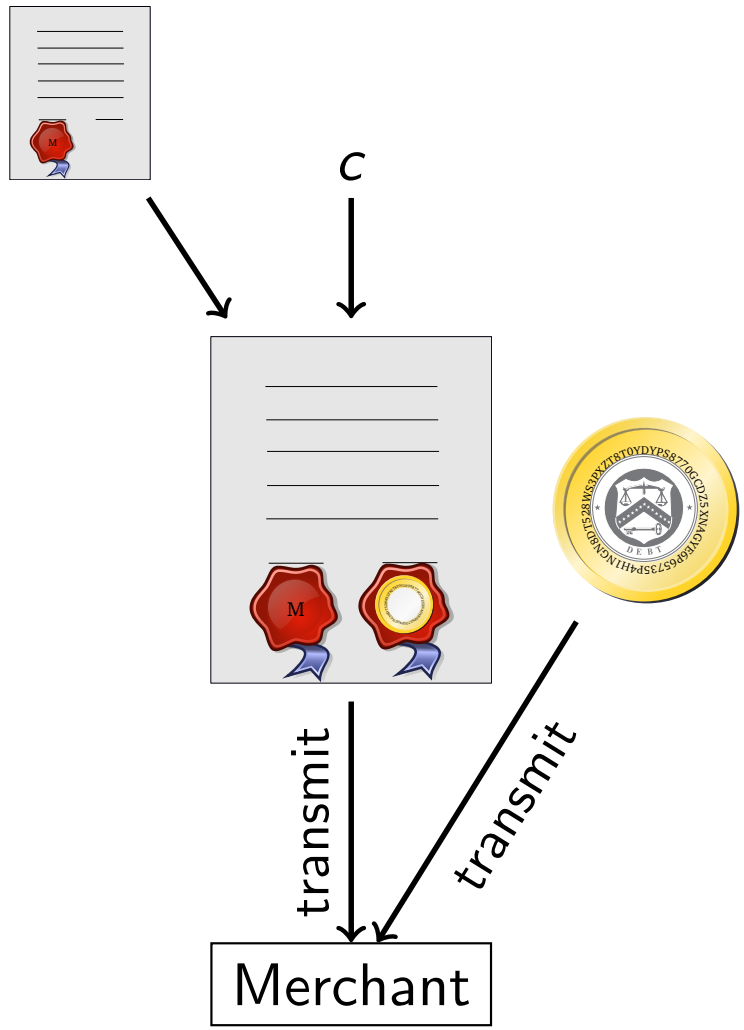
Merchant: Propose contract (EdDSA)

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



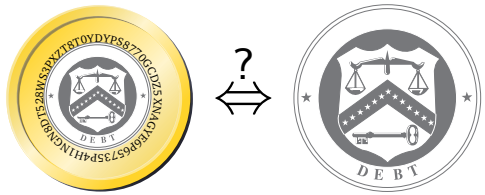
Customer: Spend coin (EdDSA)

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



Merchant and Exchange: Verify coin (RSA)

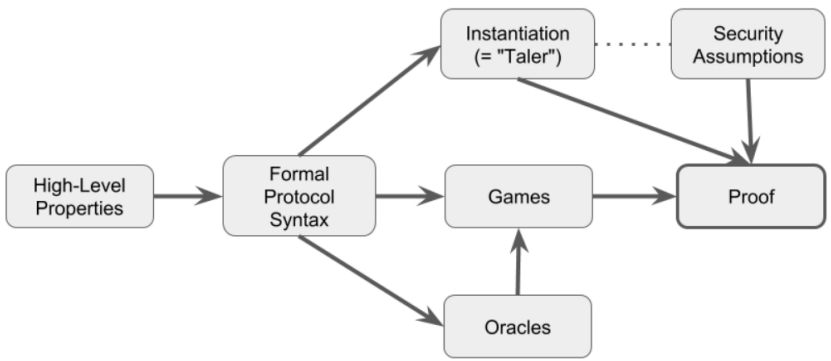
$$s^e \stackrel{?}{\equiv} FDH(C) \mod n$$



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

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:

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

The Distraction: Bitcoin

- Unregulated payment system and currency:

  $\Rightarrow$ lack of regulation is a feature!
- Implemented in free software
- Decentralised peer-to-peer system
- Decentralised banking requires solving Byzantine consensus
- Creative solution: tie initial accumulation to solving consensus

The Distraction: Bitcoin

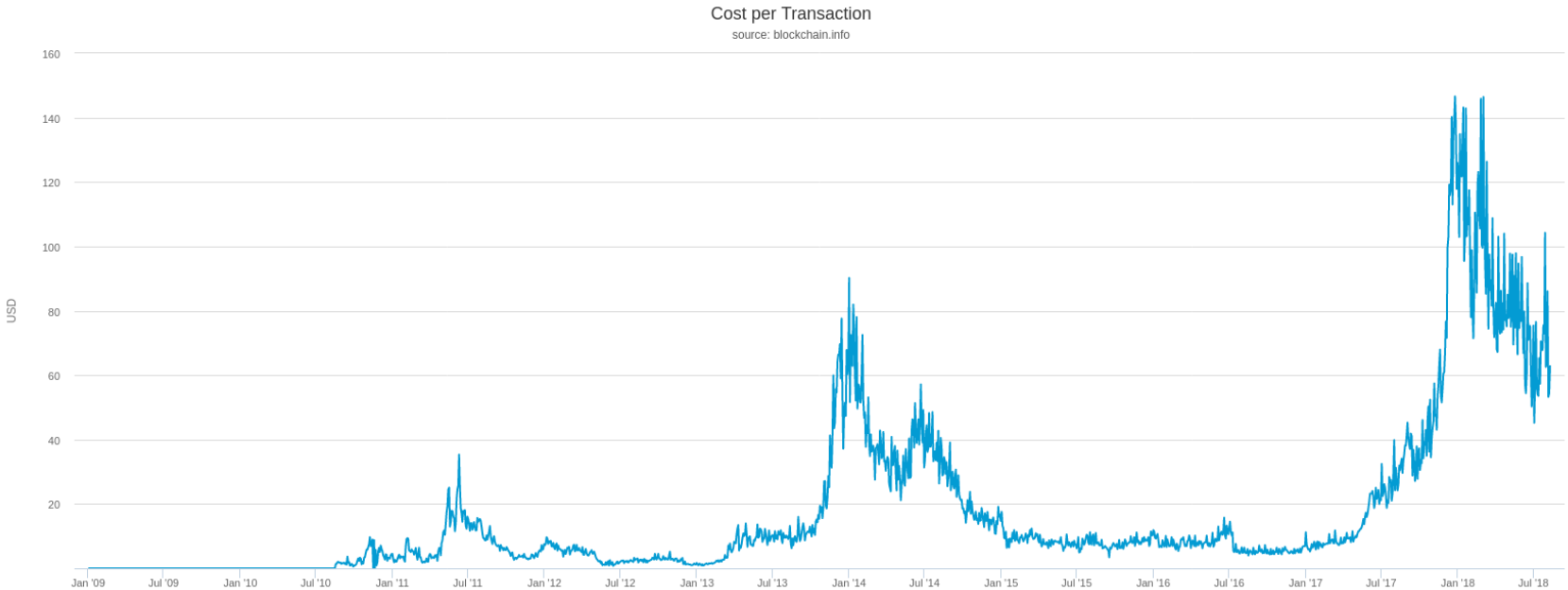
- Unregulated payment system and currency:

  $\Rightarrow$ lack of regulation is a feature!
- Implemented in free software
- Decentralised peer-to-peer system
- Decentralised banking requires solving Byzantine consensus
- Creative solution: tie initial accumulation to solving consensus

  $\Rightarrow$ Proof-of-work advances ledger

  $\Rightarrow$ Very expensive banking

?



Current average transaction value: $\approx$ 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