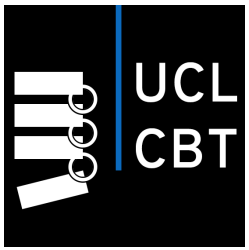
Blockchain, Analytics, and Institutions

Implications for a Changing Business World

Geoff Goodell (University College London)

24 October 2019



g.goodell@ucl.ac.uk

About Us

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Upcoming work includes:

- smart and computable contracts
- global digital marketplaces
- future payments infrastructure
- digital credentials for public services

The Rise of Analytics

Image Source: datapine.com

Devices: More Data Collected Than Ever Before

Networks: More Data Aggregated Than Ever Before

Systems: More Data Analysed Than Ever Before

Markets: More Data Brokered Than Ever Before

We Are What We Measure

Image Source: socialcooling.com

More data means more **measurement**, and data analytics systems create the opportunity to exercise control.

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But the ability to measure **personal activities** means the opportunity to **control mass behaviour**, cheaply and at scale.

(The effect will be profound.)

Ledgers and Transactions

ledger: an information store that keeps final and definitive records of transactions

transaction: smallest unit of a work process resulting in a state change [ISO 26122:2008, definition 3.5]

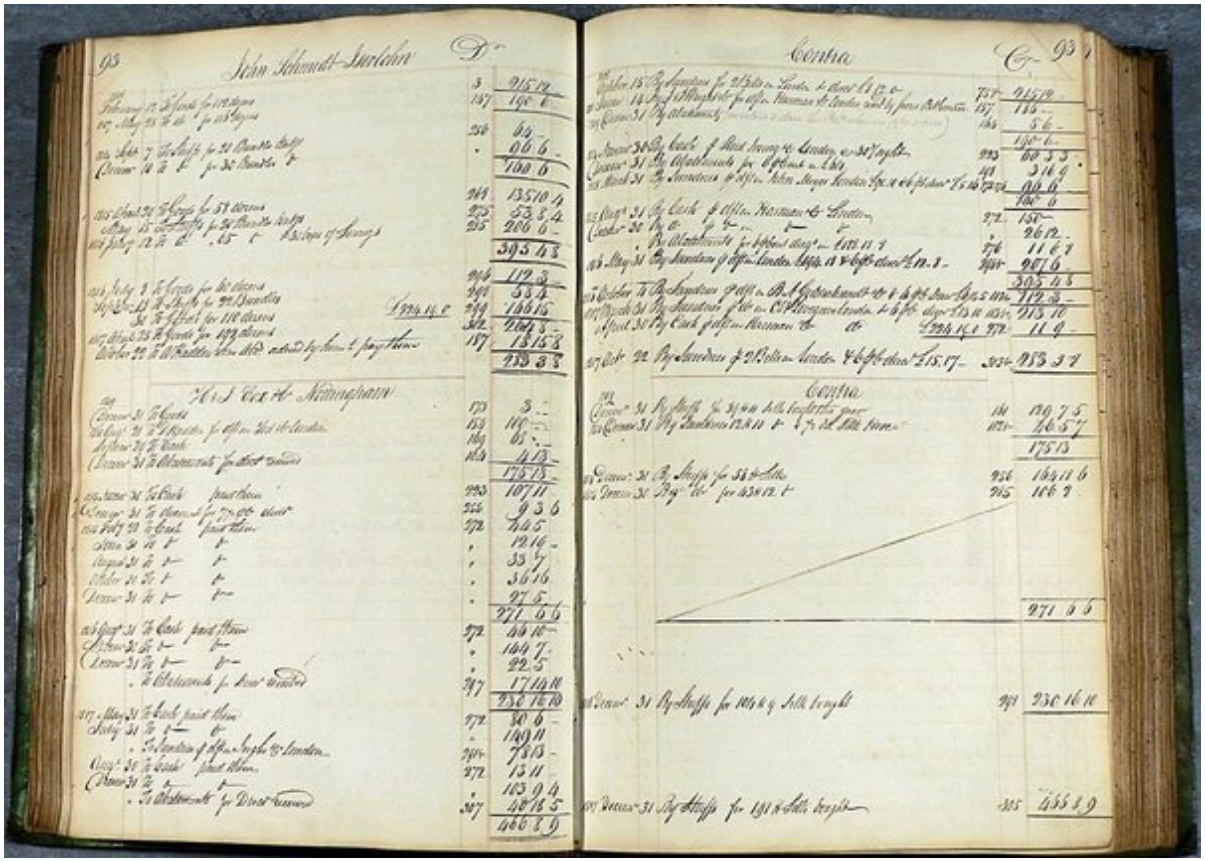

Image: `https://qph.ec.quoracdn.net/main-qimg-bdd086c33e2c34349e7d7400f75b3c51-c`

Networks

network: an interconnected system of things or people [WordNet]

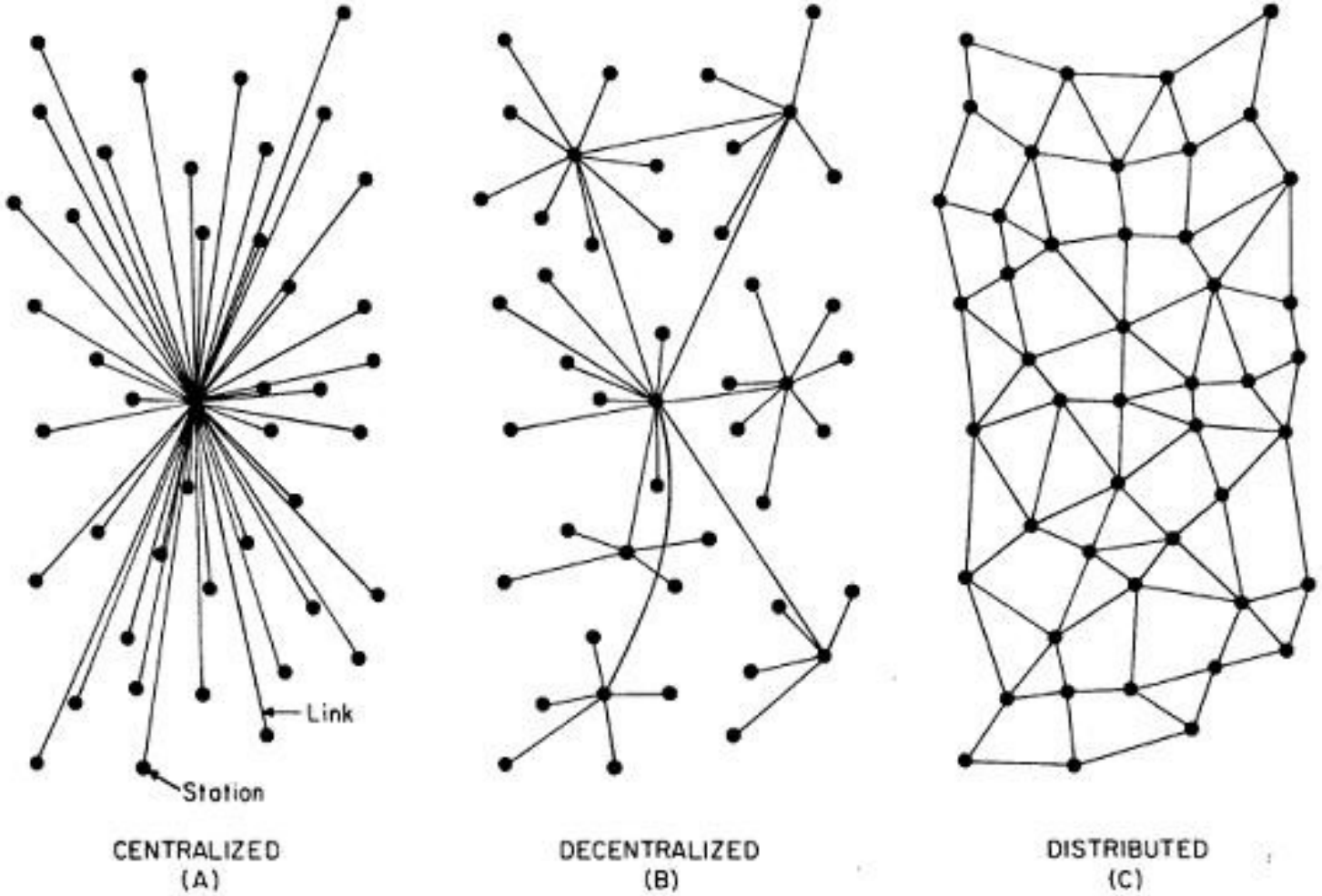

Image: Baran, P. On Distributed Communications. Rand Corporation, 1964.

Risks of Centralisation [Siliski[1]]

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(5) Making mistakes, being hacked, or going out of business

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Distributed Ledgers

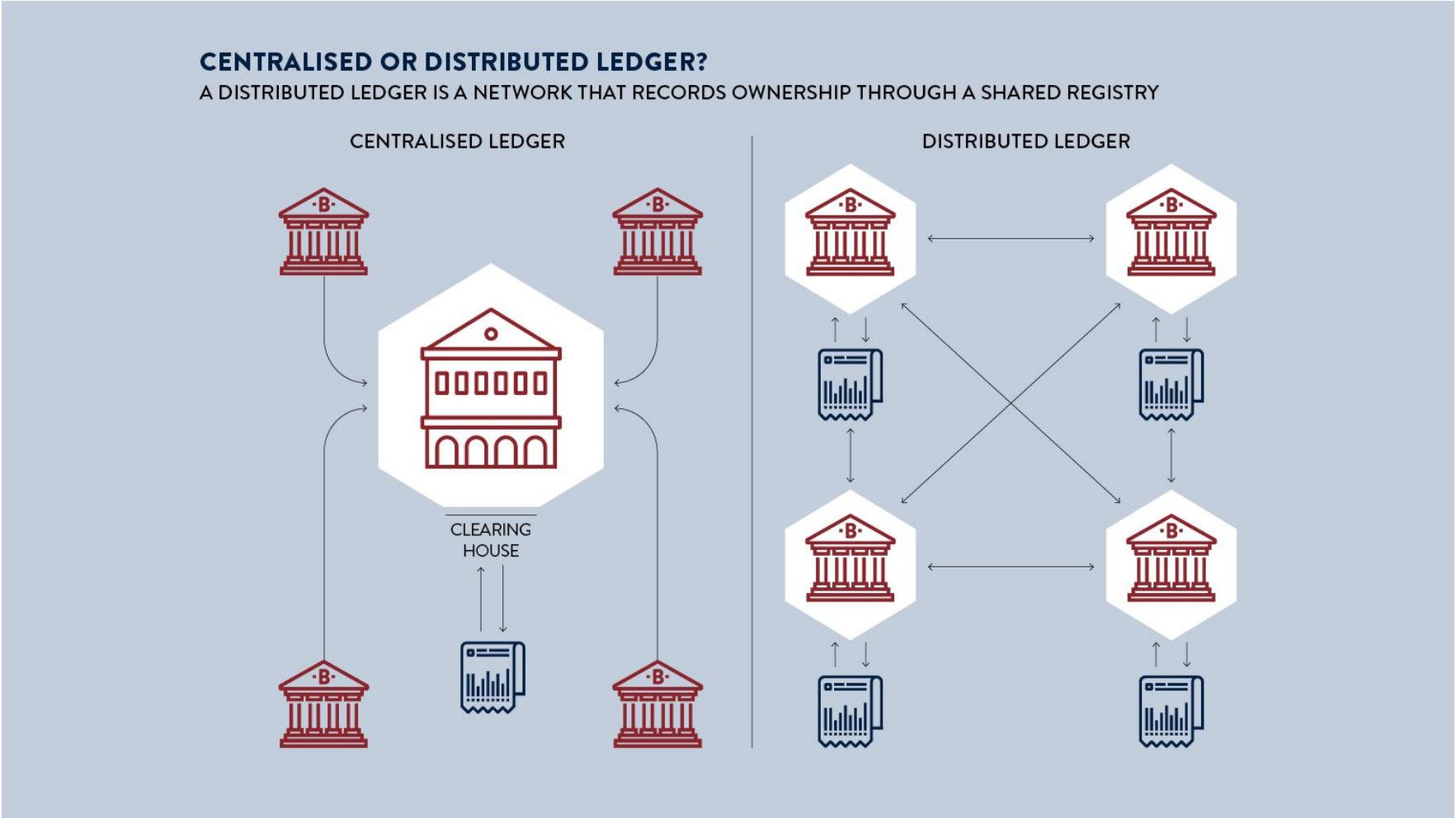

Image: raconteur.net

Motivation for Distributed Ledgers

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- **Reliability:** resistance to outages and manipulation.[2]
- **Auditability:** participants can verify the veracity of records directly, without external querying.

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What is a Distributed Consensus Algorithm?

Private
distributed ledgers

(Nodes are explicitly authorised to participate.)

Call a vote

Supermajority threshold

Anonymous versus attributable

Public
distributed ledgers

(Anyone can run one or more participating nodes.)

Proof of Work
(i.e., computational power)

Proof of Stake
(i.e., wealth or age)

Proof of Ownership

Proof of Bandwidth

What makes for an appropriate use case? [IBM[3]]

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(5) Should dispute resolution be **final**?

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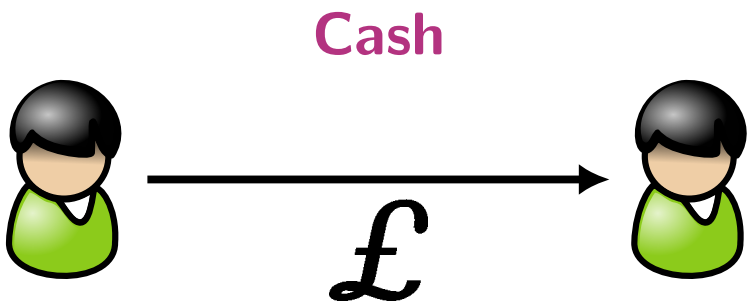
Areas of Impact for DLT and Analytics

Payments	**Accountless** electronic transactions of value, including clearance and settlement
Contracts	Contracts that are **automatically executable**, **understandable** by computers, or both
Tax	**Real-time** collection of income tax, improved mechanisms for regulatory **reporting**
Trading	**Asset tracking** for supply chains, **decentralised marketplaces** for retail products
Identity	**Unlinkable** attribute-based credentials, support for **multiple identities** for individuals

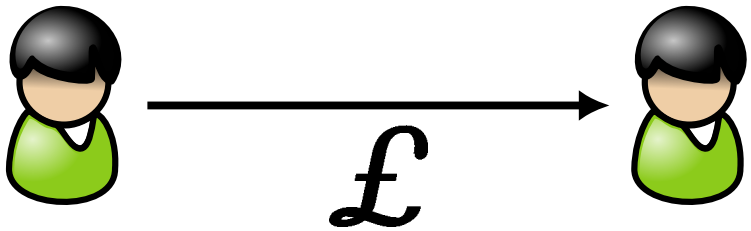
The Future of Payments

The Future of Payments



The Future of Payments

Cash



Direct interaction between transacting parties.

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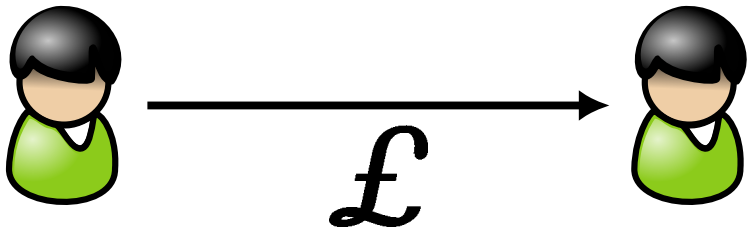

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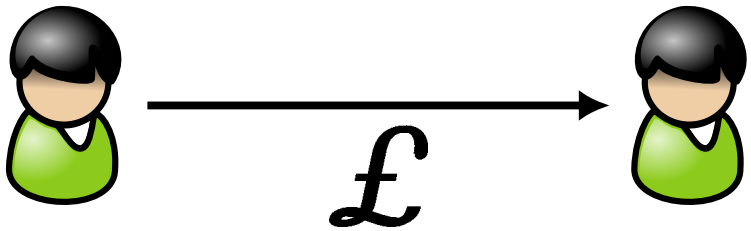

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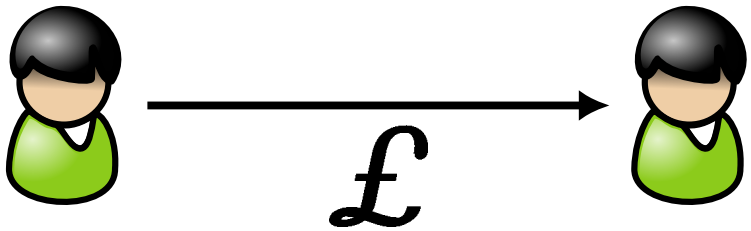

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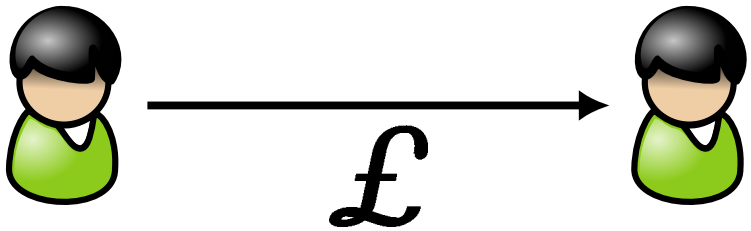

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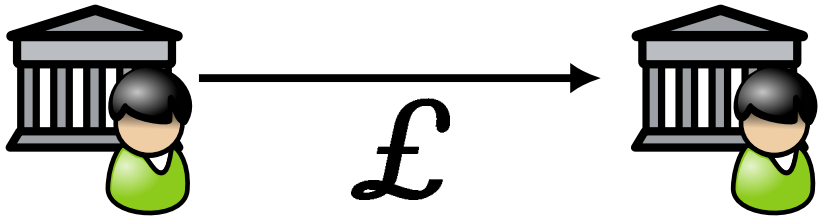

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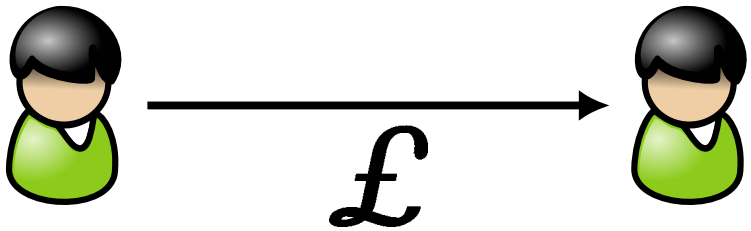

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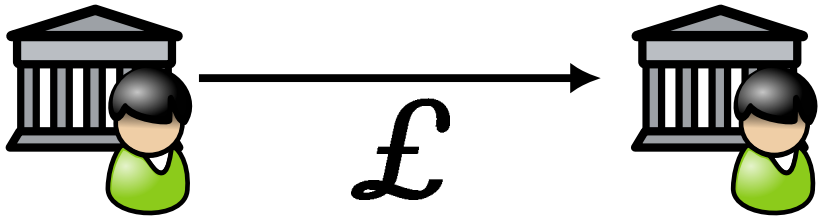

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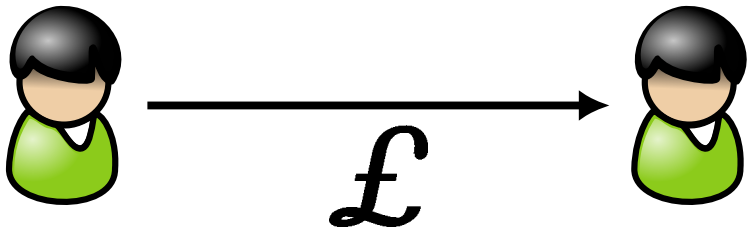

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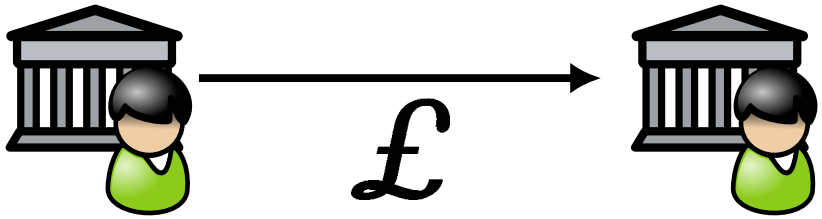

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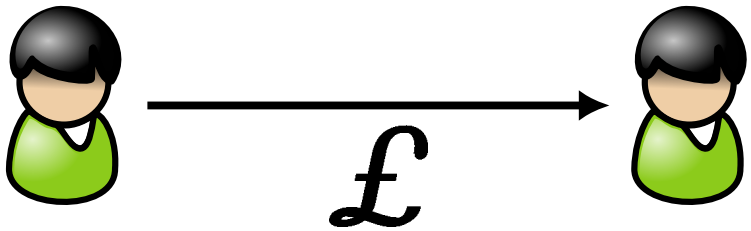

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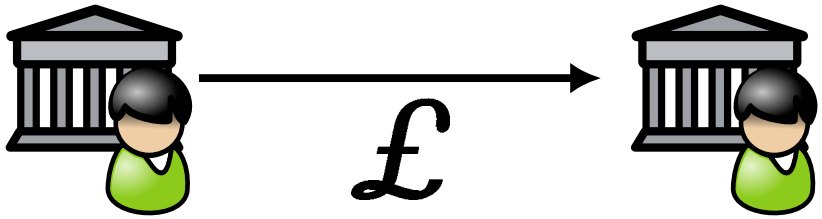

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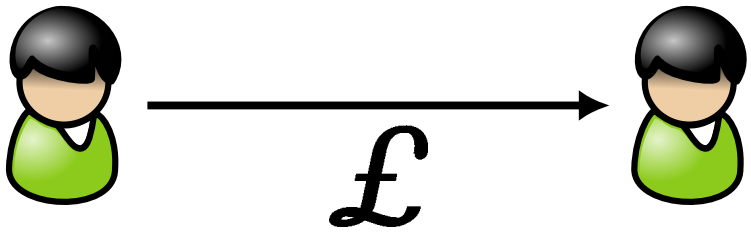

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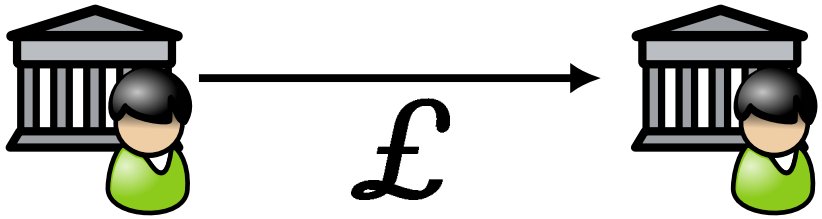

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Choice of currency may be limited by **regulations**.

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A "Pre-History" of Modern Cryptocurrencies

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What are the **dangers** of forbidding the use of **cash** or digital currency (perhaps issued by a central bank) that is potentially usable for certain purposes (e.g. money laundering, terror finance, organised crime)?

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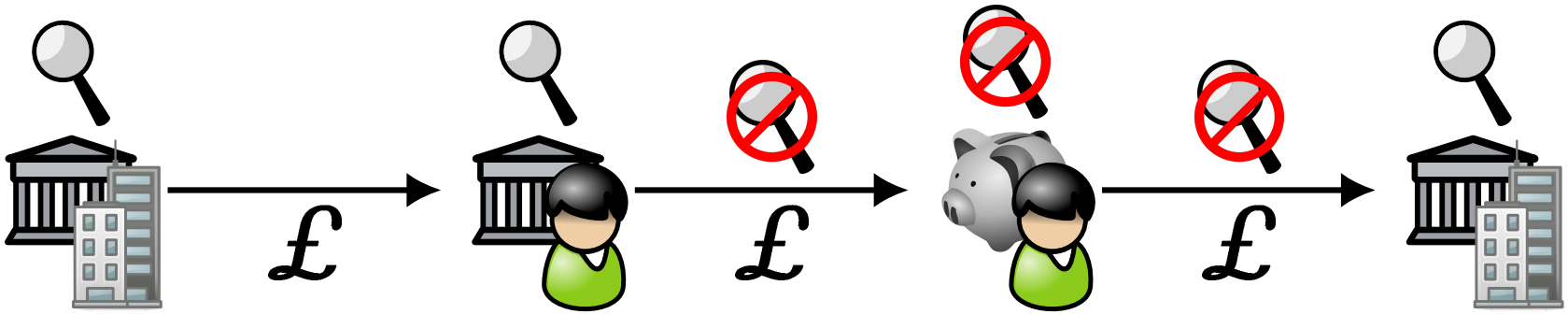
One approach: **Institutionally Mediated Private Value Exchange**[4]



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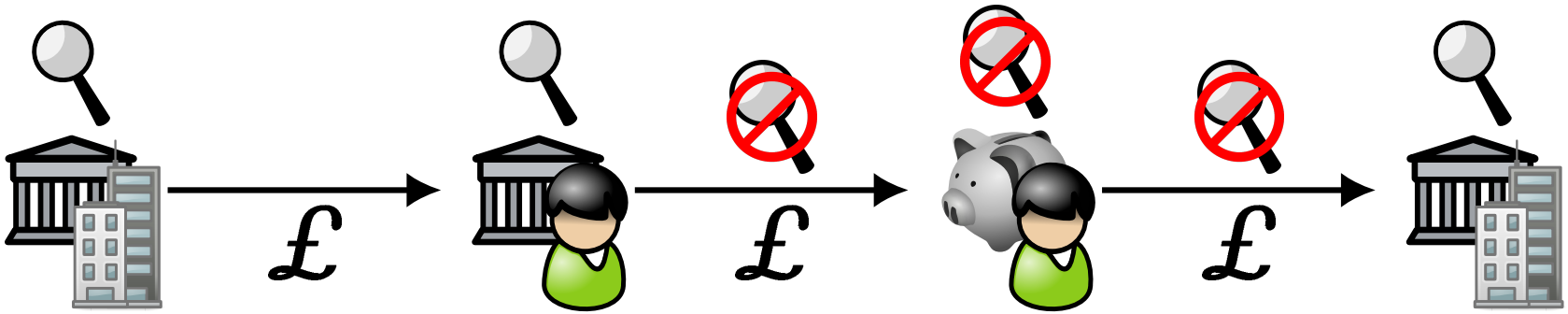

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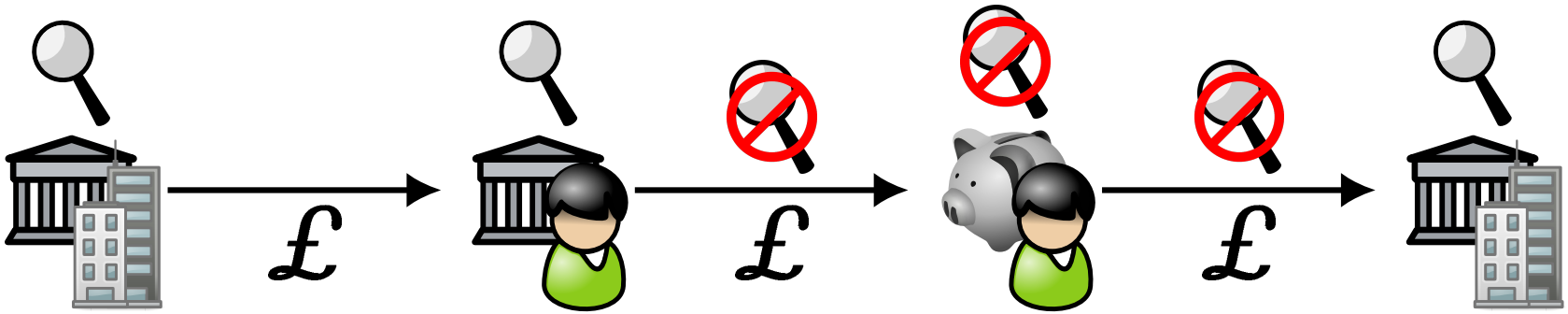

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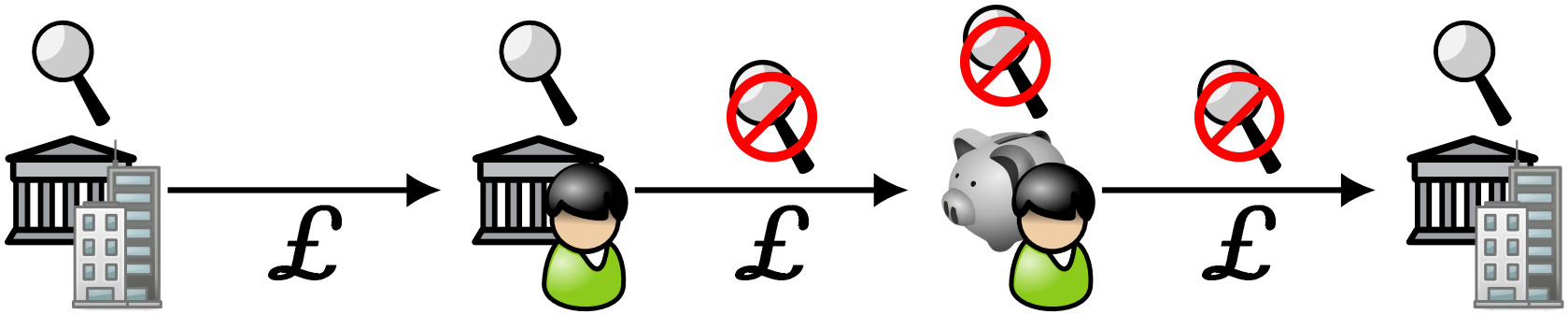
The funds might be **central bank digital currency** (**CBDC**, as indicated by the Pound Sterling symbols) rather than cryptocurrency.

[4] G. Goodell and T. Aste. **"Can Cryptocurrencies Preserve Privacy and Comply with Regulations?"** Frontiers in Blockchain, May 2019. doi:10.3389/fbloc.2019.00004

The Future of Payments

One approach: **Institutionally Mediated Private Value Exchange**[4]



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When she wants to make a payment, she must remit it from her private store to an account held by a **regulated institution** (rightmost icon).

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The Future of Tax

Distributed ledgers might make it easier to identify tax liabilities and prove payments.

Analytics might make it easier to identify tax fraud.

Future payment systems might facilitate **real-time** payment of **income taxes** (not just transaction taxes).

An opportunity to elaborate the social contract beyond narrowly-defined taxation?

Image Source: eveningtelegraph.co.uk

The Future of Contracts

Smart Contracts (aka distributed applications):[5] Formal procedures encoded in language to be interpreted and executed by nodes of a distributed system, so that the original authors (or agreeing parties) are not required to carry out the procedure themselves.

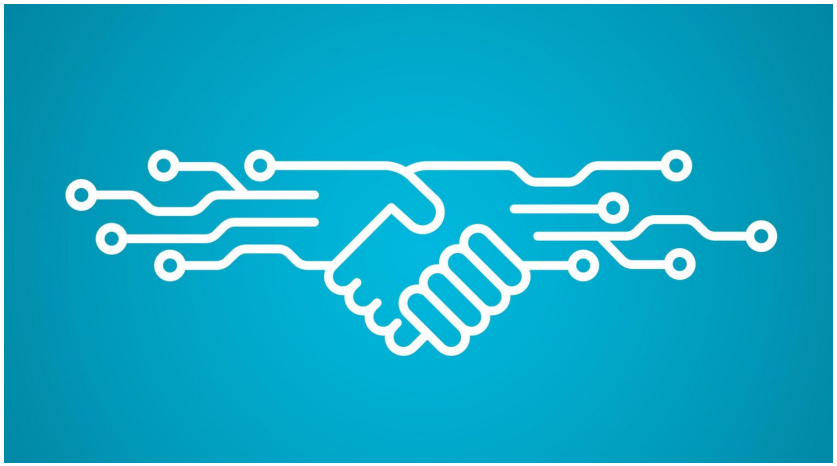
Computable Contracts:[6] interactive and integrated expressions of the intentions of the parties that are understandable by computers as well as by humans.

Image Source: US Army (wikimedia.org)

[5] Szabo, N. "Formalizing and Securing Relationships on Public Networks." First Monday 2(**9**), 1997-09-01.

[6] Clack, C. `http://fincomp.cs.ucl.ac.uk/research/computable_contracts/`

The Future of Trading



Asset tracking in supply chains (e.g. for agricultural products)

Decentralised marketplaces for retail goods and services.

Improved **surveillance** of securities markets.

More efficient **energy markets** and distribution networks.

Image Source: blockgeeks.com

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(3) capture **monopoly rents**
(4) invite **corruption** and **capture**

More **assurance** is **not always better**: the greater the assurance needed, the more narrow and limited the use case must be.

Image Source: storify.com

The Future of Identity

A popular approach: **Non-transferable Anonymous Credentials**[7]

[7] Camenisch, J and Lysyanskaya, A. **"An Efficient System for Non-transferable Anonymous Credentials with Optional Anonymity Revocation."** Proceedings of the International Conference on the Theory and Applications of Cryptographic Techniques (EUROCRYPT 2001: Advances in Cryptology), **2001-04-15**, pp. 93–118. `https://eprint.iacr.org/2001/019.pdf`

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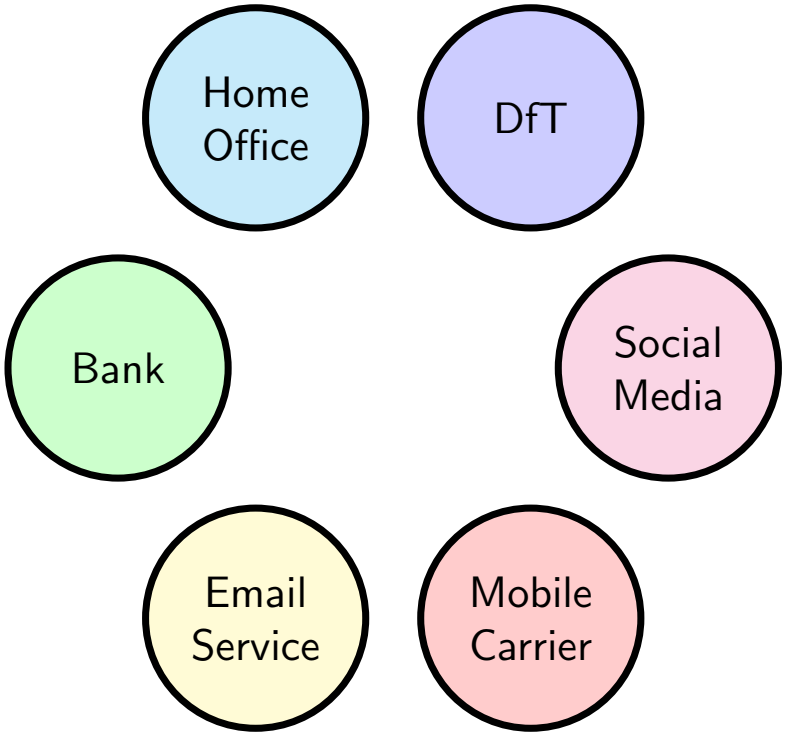

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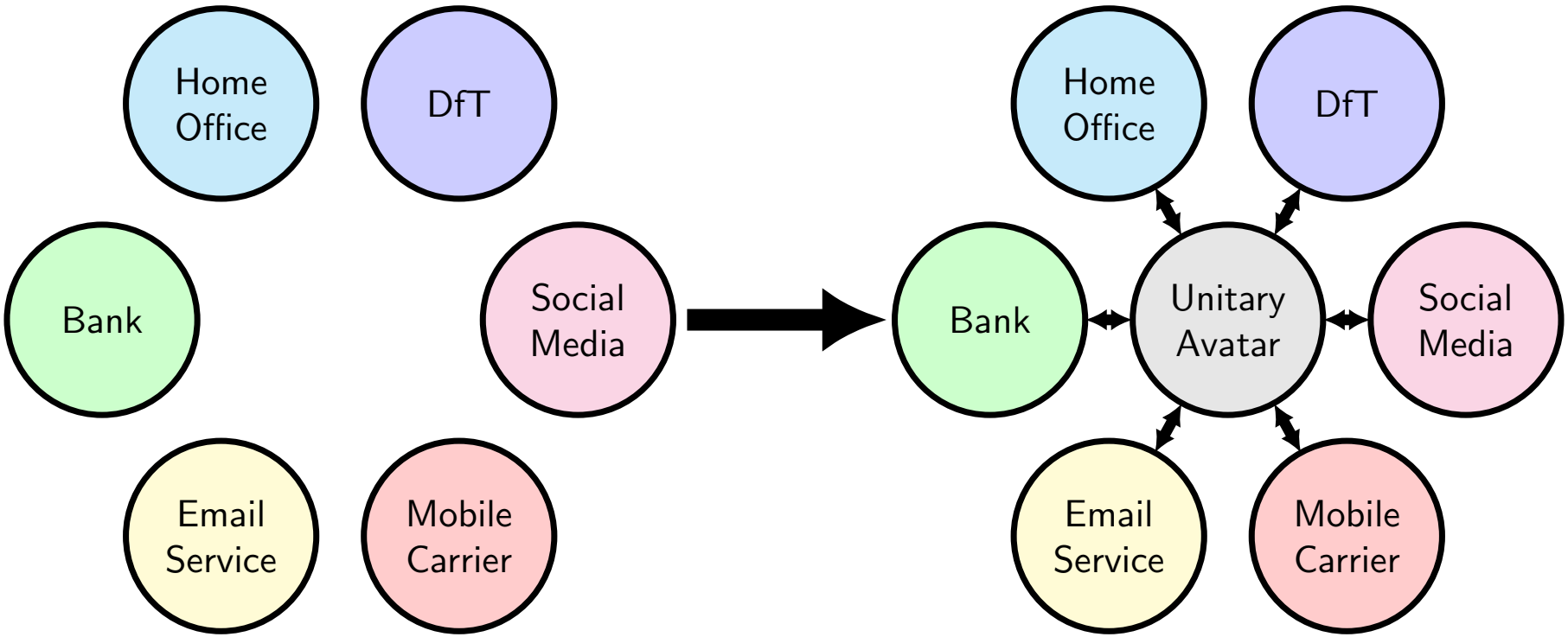

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(5) Virtually unlinkable identities might be achievable with DLT.[8]

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Co-regulation may be an option: consider the example of best execution (e.g. NMS in the US, MiFID in the EU).

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- **Cui bono?** (Who benefits?)

Thank You

Photo Credit: https://www.pinterest.co.uk/pin/736268239051855079/