

CBDC Revolution

Contrasting Central Banks & Gold Bugs With Cryptocurrency Cockroaches

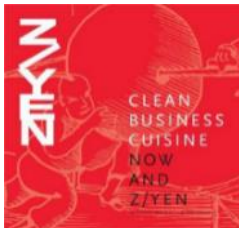
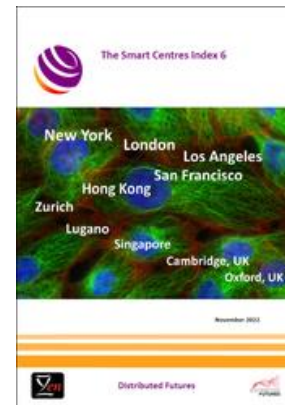
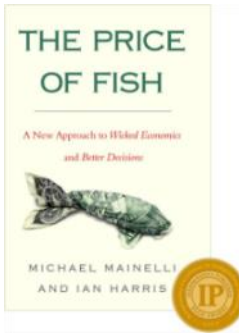
Professor Michael Mainelli
Chairman, Z/Yen Group
24 April 2023



 @mrmainelli
www.zyen.com

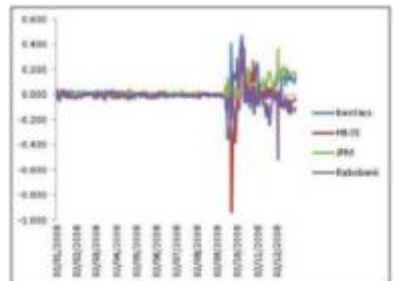
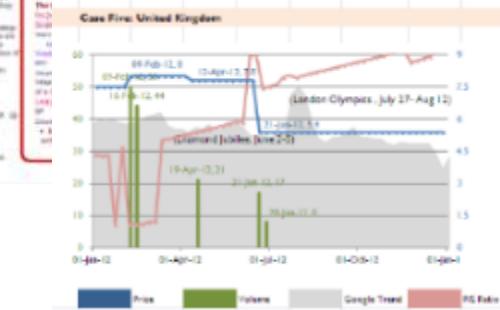
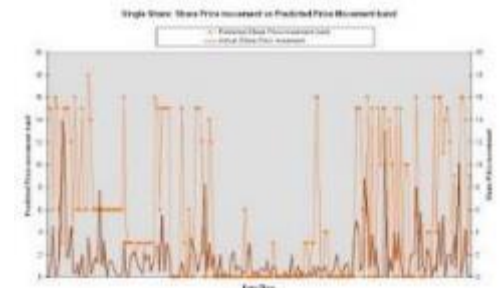
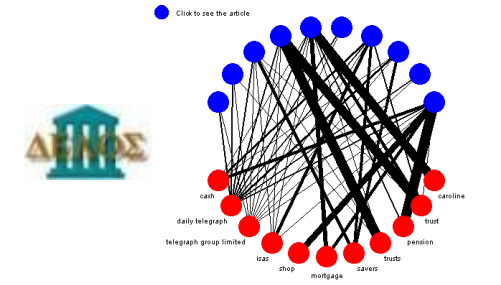
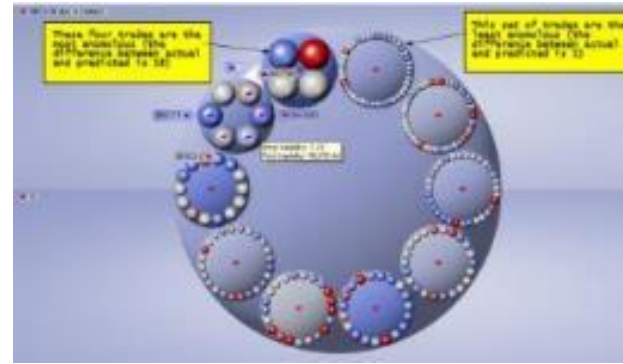
City Of London's Leading Commercial Think-Tank

- ◆ Services – projects, strategy, expertise on demand, coaching, research, analytics, modern systems
- ◆ Sectors – technology, finance, voluntary, professional services, outsourcing
 - *Sunday Times* Book of the Week, **Clean Business Cuisine**
 - Independent Publisher Book Awards Finance, Investment & Economics Gold Prize for **The Price of Fish**
 - British Computer Society **IT Director of the Year 2004** for PropheZy and VizZy
 - DTI **Smart Award 2003** for PropheZy
 - £1.9M **Foresight Challenge Award** for Financial Laboratory visualising financial risk 1997
- ◆ Innovation – policy performance bonds, prediction markets, medical imaging, support vector machines, low-loss electric cables, risk visualisation, smart ledgers, etc.



Z/Yen Fintech Research

- ◆ Geo-referencing (2015-present)
- ◆ Mind mapping AR/VR (2018-present)
- ◆ Distributed Futures (2015-present)
- ◆ Mutual distributed ledgers (1995-present)
- ◆ LIBOR and FX surveillance (2007-present)
- ◆ PropheZy and VizZy – automation & visualisation of compliance monitoring (2002-present)
- ◆ Prediction markets and bubbles (1998-present) – www.extzy.com
- ◆ Market intelligence – Ministry of Defence, e.g. Vision 2020 (1994-present)
- ◆ Avatars for Big Data (2010-2012)
- ◆ Financial Laboratory Club visualising risk (1997-1998)



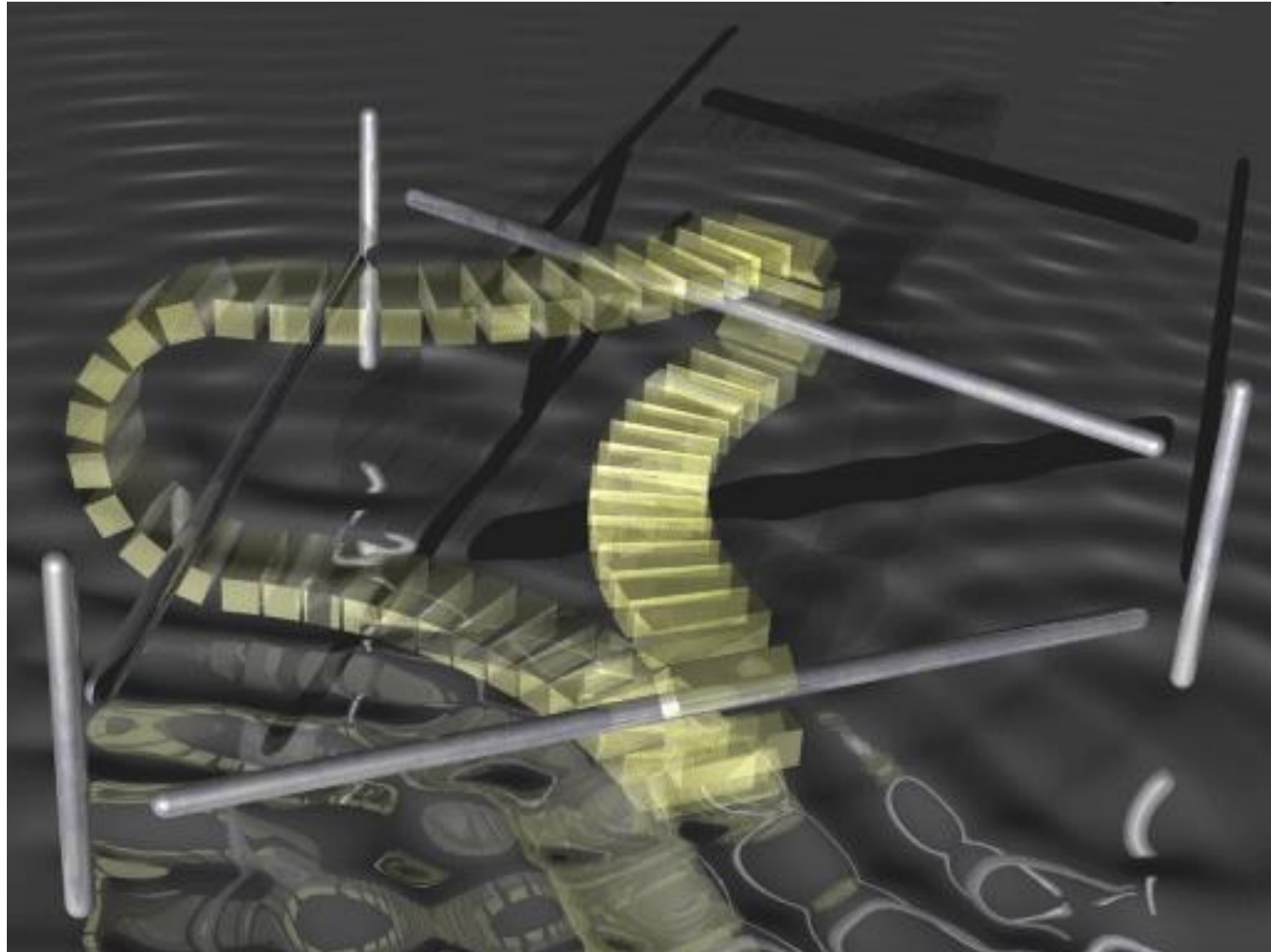
Agenda

- The Eternal Coin
- History of digital money
- Critique of cryptocurrency economics
- Speculations about CBDC
- How might a rational policy maker approach the risks & rewards



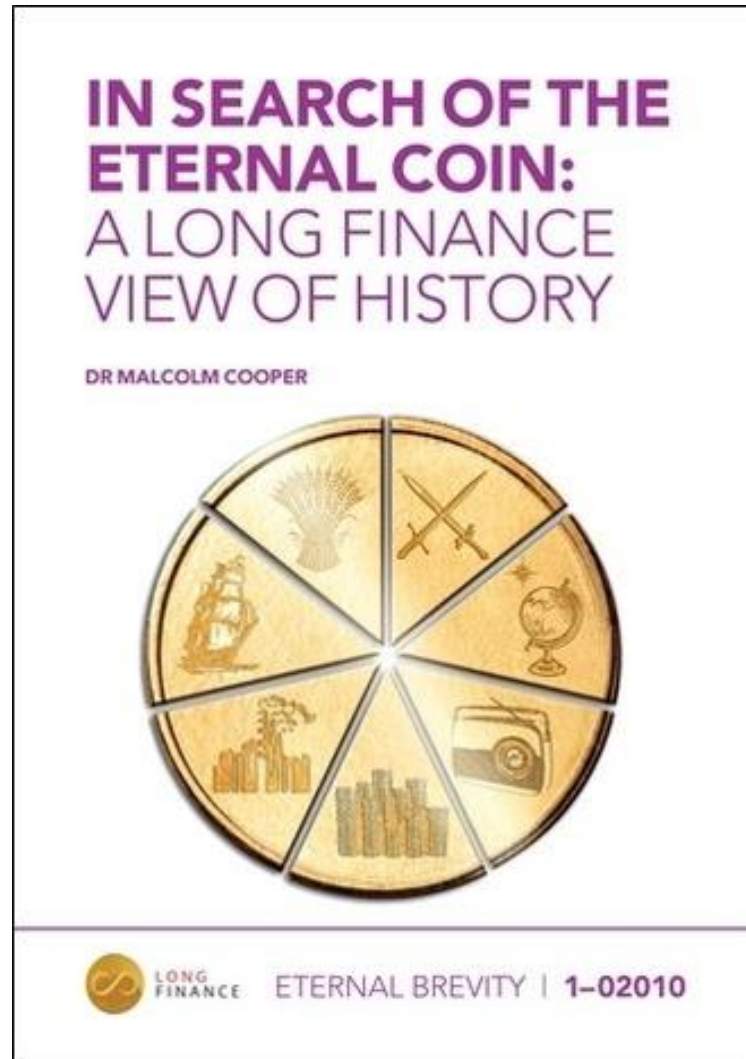
**"Get a detailed grip on the big picture."
Chao Kli Ning**

The Eternal Coin

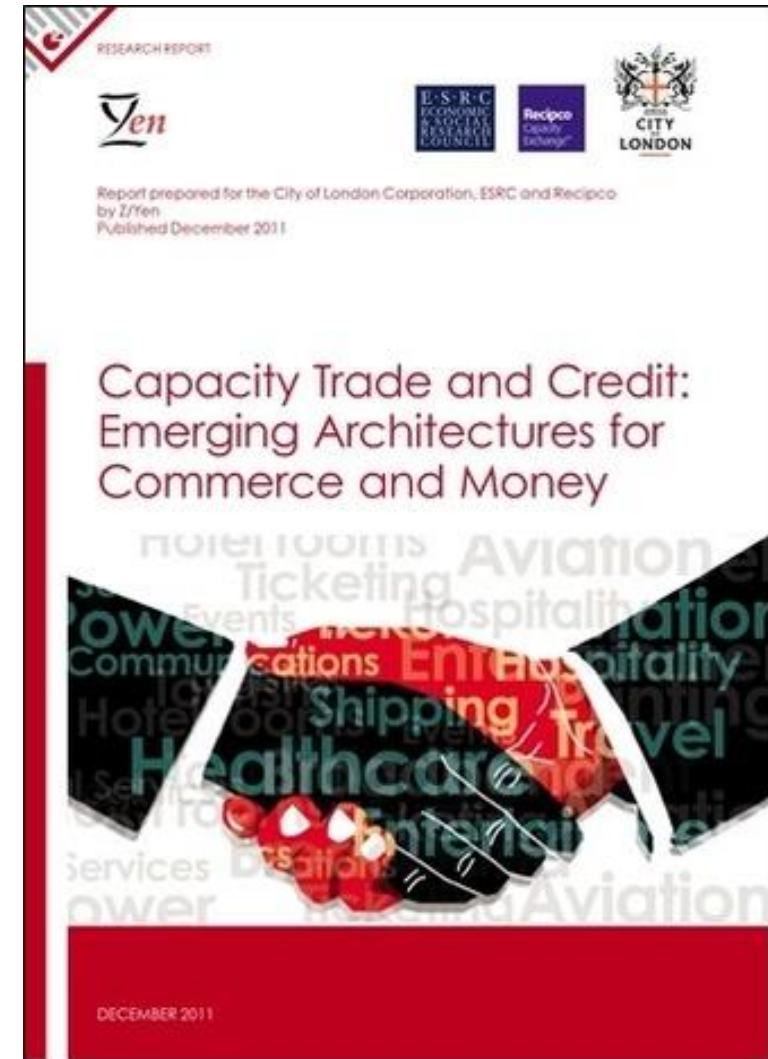


[Source: <http://illusionsetc.blogspot.com/2005/08/moving-mobius-strip.html>]

Researching A Big Picture Grip On The Details



<https://www.zyen.com/publications/public-reports/in-search-of-the-eternal-coin-a-long-finance-view-of-history/>



https://www.zyen.com/documents/139/Capacity_Trade_and_Credit_Full_Report_Web.pdf

A Matter Of Substitution

**“Money is a matter of functions four:
a medium, a measure, a standard and a store.”**

William Stanley Jevons (1835–1882)

- medium – widely accepted for discharging debt
- measure – unit of account
- standard – widely accepted way to value a debt
- store – future consumption likely to have value, persistence

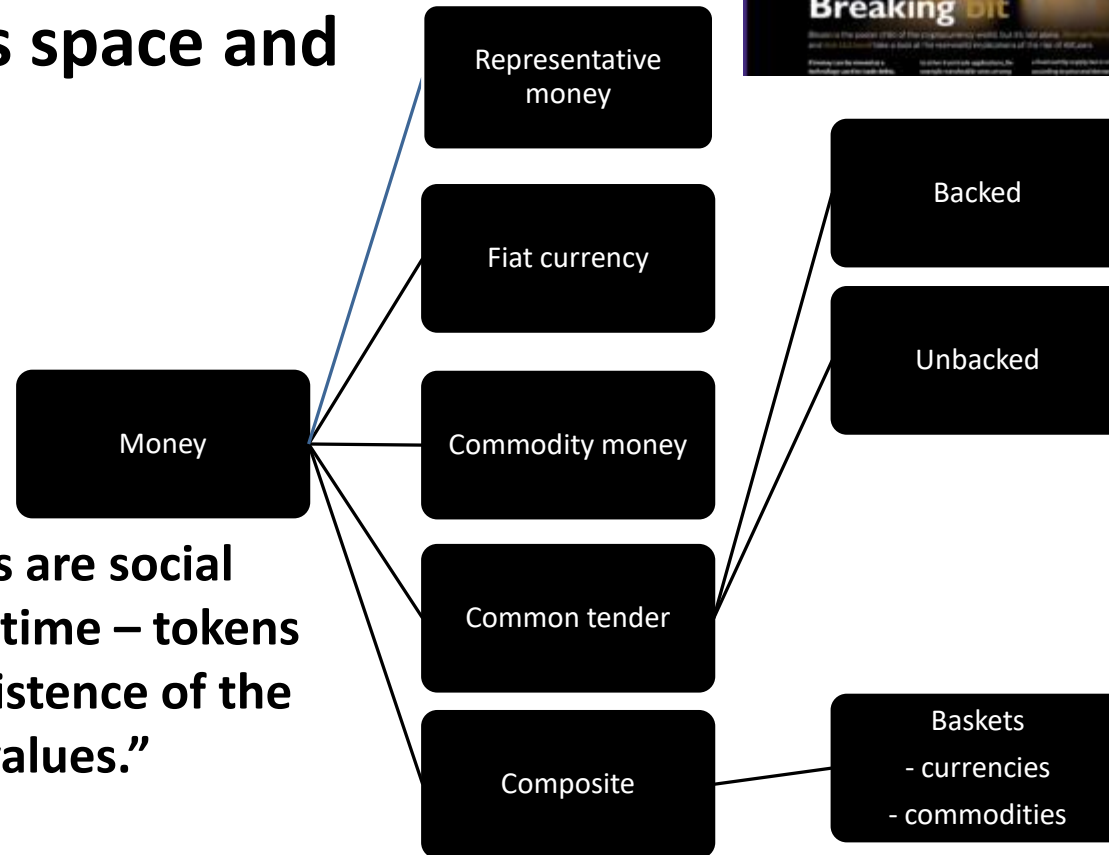


Money As Technology

**“Money is a technology
communities use
to trade debts across space and
time.”**



**“Tokens of indebtedness are social
desires frozen at a point in time – tokens
depend on the future persistence of the
community and its values.”**



Thought Experiments

- We trade tax credits:
 - Go to France or go to Shetlands, and try to spend.
 - Call HMRC – you're not feeling British this year, but will let them know when you do!



Gold Price Over Time



[Source: <https://www.goldinvestments.co.uk/gold-price/gold-price-chart/>, 5 February 2023]

Eternal Coins?

Thomas Schelling (1921-2016), Nobel prize for economics (2005) - people can act tacitly in concert with a focal point – gold can best be explained as a solution to a co-ordination game about its value due to scarcity and longevity.

Willem Buiter (1949-) on gold, “The fundamental equilibrium price of a fiat currency like gold or Bitcoin is zero; any positive price is a bubble”; “Gold is the world’s most persistent bubble: 6,000 years old and going strong”.

“Gold – A Six Thousand Year-Old Bubble”, FT (2009)

Willem Buiter’s Mavericon (<http://blogs.ft.com/mavericon/2009/11/gold-a-six-thousand-year-oldbubble/#axzz3K6tsGzEG>) & <https://willembuiter.com/gold2.pdf>



The Bugs Of Gold

Pros	Cons
Inflation hedge, physically 'backed'	Storage
Security of value, indestructible	No income, no (little) commercial use
Simplicity	Terrible returns
Limited supply	Mining
Portfolio Diversification	Premia & taxes



Cryptofinance Timeline

- 1976 – Diffie-Hellman, Merkle, RSA
- 1990 – Mondex, Digicash, Flooz
- 1995 – Z/Yen Stacks & Sleeves
- 1996 – Ricardo payment system
- 1998 – Wei-Dai b-money, Bitgold
- 1999 – LOCKSS & CLOCKSS
- 2000 – Gnutella
- 2004 – Ripple
- 2007 – Estonia
- 2008 – “Bitcoin: A Peer-to-Peer Electronic Cash System”
- 2009 – Bitcoin launch
- 2012 – Term ‘blockchain’ used
- 2013 – Silk Road, FBI, Alderney coin, Fintech ‘born’
- 2014 – Regulators – Jersey & Alderney, Isle of Man, FATF, ECB, State of New York
- 2015 – IBM-Samsung, Bank of England research agenda, UK budget for cryptocurrency standards, Barclays, UBS, BNY Mellon, Goldman Sachs, USAA, NASDAQ, Honduras land registry, Channel Islands Standards for MDLs, Fine (sic) Sign of having arrived – Ripple \$700,000, Sign of the Times – Bitcoin forking hell, Economist Special, FT Special
- 2016 – UK government, Digital Assets, R3, DAO, MetroGnomo, SafeShare Insurance, XLRAS
- 2017...



Cryptocurrency Risks, Myths & Legends

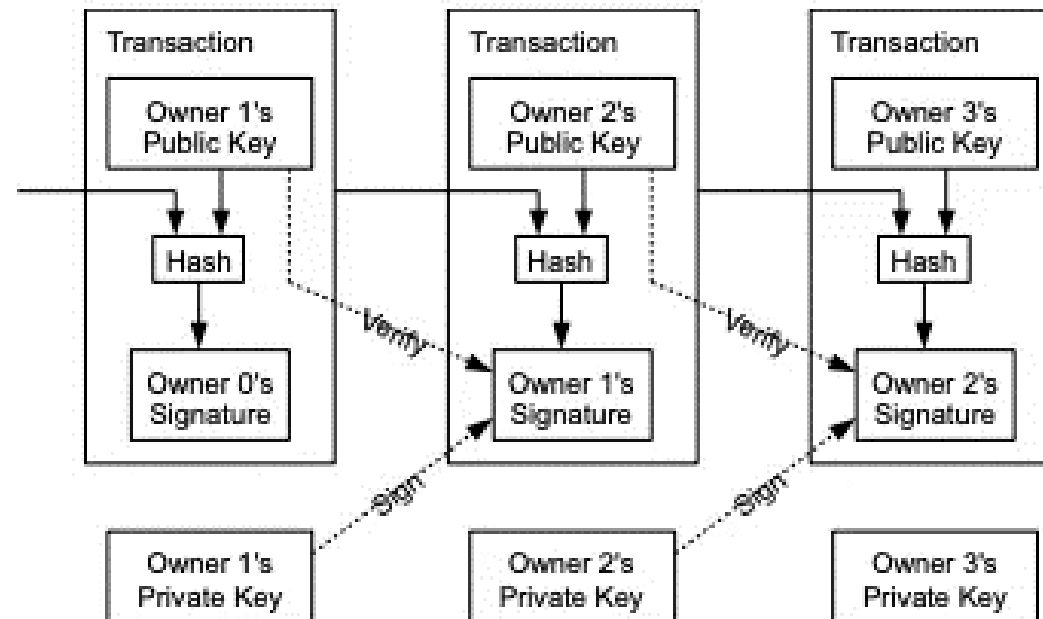
- Brand new technology?
- Economics and speed don't matter?
- Payments?



New-ish, Old-ish

2. Transactions

We define an electronic coin as a chain of digital signatures. Each owner transfers the coin to the next by digitally signing a hash of the previous transaction and the public key of the next owner and adding these to the end of the coin. A payee can verify the signatures to verify the chain of ownership.



The problem of course is the payee can't verify that one of the owners did not double-spend the coin. A common solution is to introduce a trusted central authority, or mint, that checks every transaction for double spending. After each transaction, the coin must be returned to the mint to

Myth - New

United States Patent [19] [11] **4,074,066**
Ehrsam et al. [45] **Feb. 14, 1978**

[54] **MESSAGE VERIFICATION AND TRANSMISSION ERROR DETECTION BY BLOCK CHAINING**

[75] Inventors: **William Friedrich Ehrsam, Hurley; Carl H. W. Meyer, Kingston; John Lynn Smith; Walter Leonard Tuchman**, both of Woodstock, all of N.Y.

[73] Assignee: **International Business Machines Corporation, Armonk, N.Y.**

[21] Appl. No.: **680,404**

[22] Filed: **Apr. 26, 1976**

[51] Int. Cl.² **H04L 9/02**

[52] U.S. Cl. **178/22**

[58] Field of Search **178/22; 35/4; 340/146.1 AL**

[56] **References Cited**
U.S. PATENT DOCUMENTS

3,657,699	4/1972	Rocher et al.	178/22
3,725,579	4/1973	Sturzinger	178/22

Primary Examiner—Samuel W. Engle
Assistant Examiner—S. A. Cangialosi
Attorney, Agent, or Firm—Edwin Lester

[57] **ABSTRACT**

A message transmission system for the secure transmission of multi-block data messages from a sending station to a receiving station.

The sending station contains cryptographic apparatus operative in successive cycles of operation during each of which an input block of clear data bits is ciphered under control of an input set of cipher key bits to generate an output block of ciphered data bits for transmission to the receiving station. Included in the cryptographic apparatus of the sending station is means providing one of the inputs for each succeeding ciphering cycle of operation as a function of each preceding ciphering cycle of operation. As a result, each succeeding output block of ciphered data bits is effectively chained to all preceding cycles of operation of the cryptographic apparatus of the sending station and is a function of the corresponding input block of clear data bits, all preceding input blocks of clear data bits and the initial input set of cipher key bits.

"Included in the crypto graphic apparatus of the sending station is means providing one of the inputs for each succeeding ciphering cycle of operation as a function of each preceding ciphering cycle of operation. As a result, each succeeding output block of ciphered data bits is effectively chained to all preceding cycles of operation..."

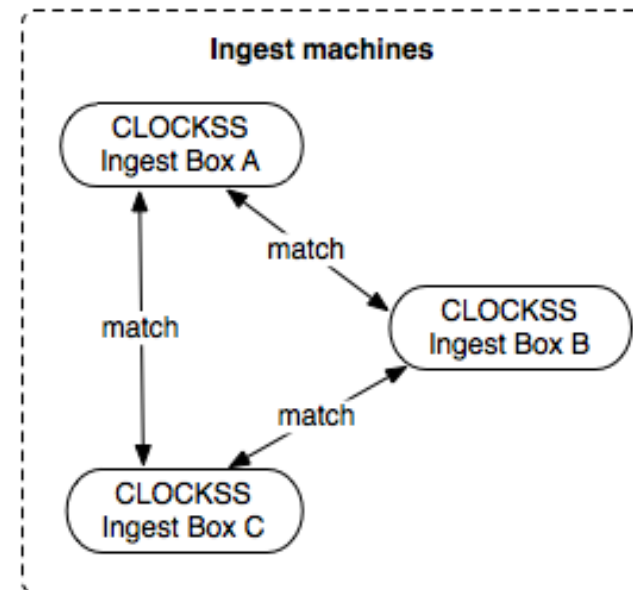
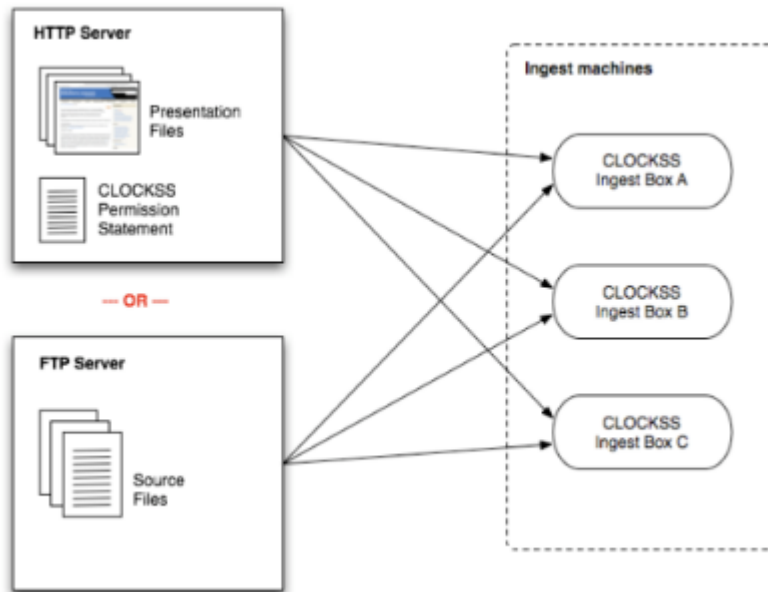
Myth - New



Example



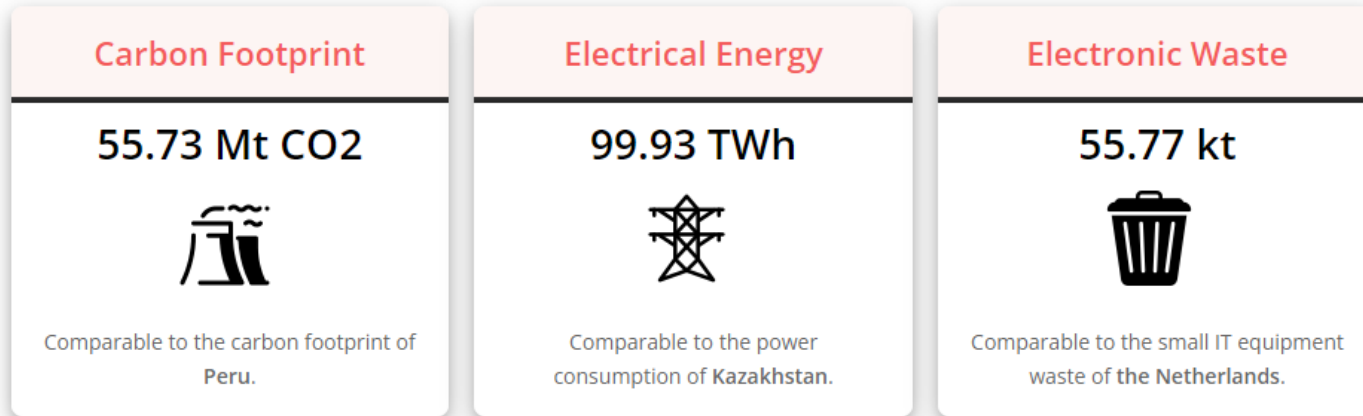
Lots of copies keep stuff safe!



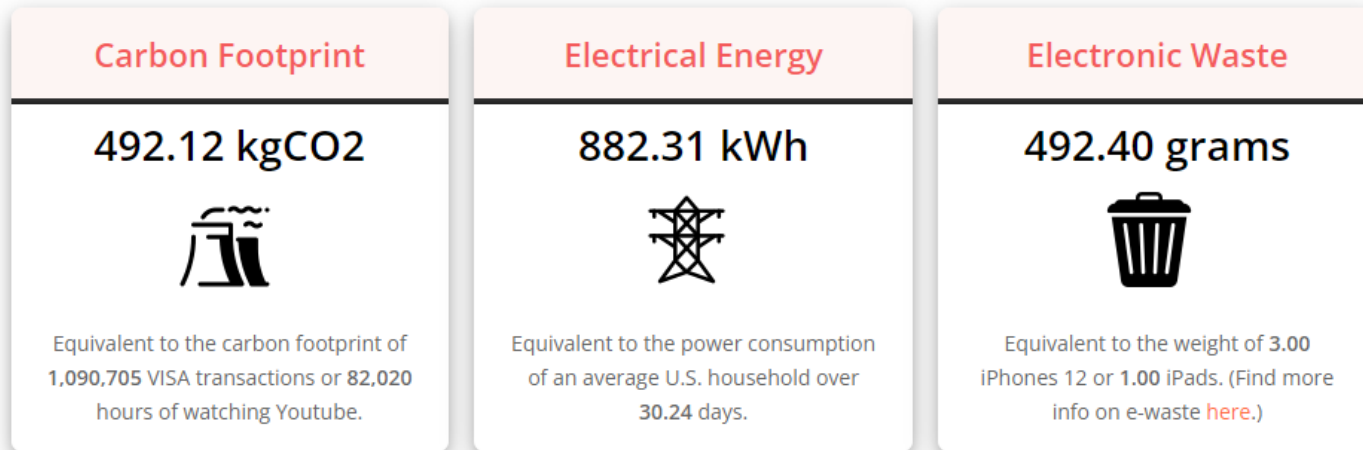
Myth - Payments



Myth – Economics Doesn't Matter




Single Bitcoin Transaction Footprints



Shoots Of Hope?

Electrical Energy


0.01 TWh



Comparable to the power consumption of Gibraltar.

Carbon Footprint

0.01 Mt CO2




Comparable to the carbon footprint of Faroe Islands.

Single Ethereum Transaction Footprints

Electrical Energy


0.03 kWh



Equivalent to the power consumption of an average U.S. household over 0 days.




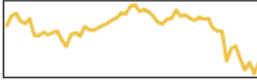



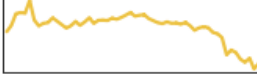












Carbon Footprint

0.02 kgCO2




Equivalent to the carbon footprint of 44 VISA transactions or 3 hours of watching Youtube.

Innovation? Market Cap Comparisons - 2018

#	Name	Market Cap	Price	Volume (24h)	Circulating Supply	Change (24h)	Price Graph (7d)
1	 Bitcoin	\$189,057,770,702	\$11,248.30	\$19,770,400,000	16,807,675 BTC	-14.11%	
2	 Ethereum	\$97,726,191,215	\$1,007.16	\$8,909,070,000	97,031,446 ETH	-16.46%	
3	 Ripple	\$46,954,552,827	\$1.21	\$6,722,740,000	38,739,142,811 XRP *	-21.90%	
4	 Bitcoin Cash	\$31,088,410,660	\$1,837.83	\$1,755,400,000	16,915,825 BCH	-16.82%	
5	 Cardano	\$15,188,492,754	\$0.585816	\$1,694,020,000	25,927,070,538 ADA *	-17.93%	
6	 Litecoin	\$10,035,051,440	\$183.15	\$1,533,450,000	54,792,333 LTC	-17.05%	
7	 NEM	\$8,724,770,999	\$0.969419	\$206,542,000	8,999,999,999 XEM *	-21.34%	
8	 NEO	\$8,464,170,000	\$130.22	\$1,559,970,000	65,000,000 NEO *	-24.94%	
9	 Stellar	\$7,688,871,124	\$0.429767	\$499,394,000	17,890,789,948 XLM *	-20.27%	
10	 IOTA	\$7,222,414,873	\$2.60	\$282,522,000	2,779,530,283 MIOTA *	-21.13%	

Innovation? Market Cap Comparison - 2023

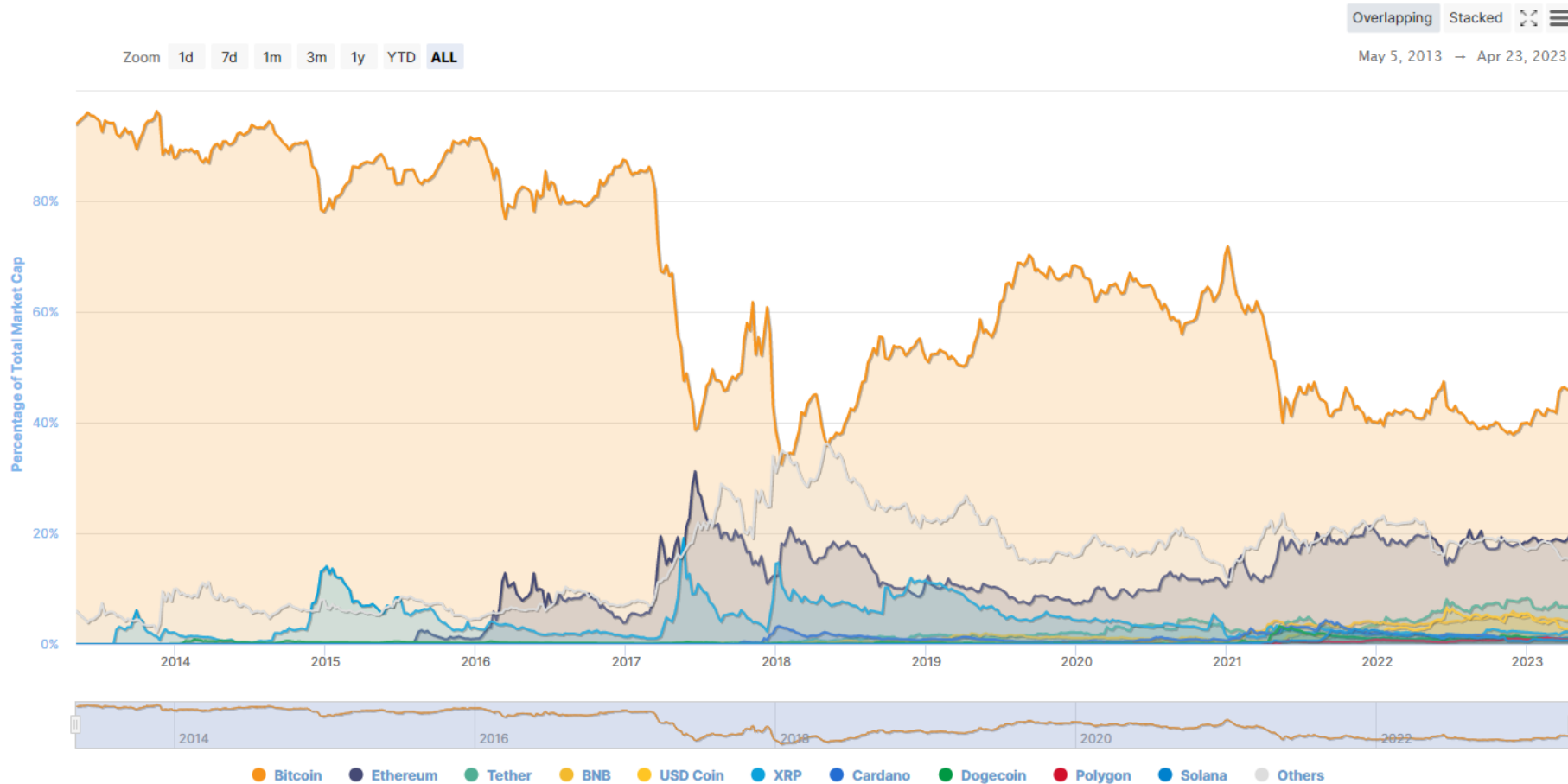
#	Name	Price	1h %	24h %	7d %	Market Cap ⓘ	Volume(24h) ⓘ	Circulating Supply ⓘ	Last 7 Days
☆ 1	 Bitcoin BTC	\$27,492.77	▼ 0.02%	▼ 0.62%	▼ 9.28%	\$532,110,088,592	\$12,964,613,550 472,957 BTC	19,354,543 BTC	
☆ 2	 Ethereum ETH	\$1,846.39	▼ 0.19%	▼ 1.51%	▼ 12.60%	\$222,328,179,534	\$6,549,079,277 3,561,232 ETH	120,412,140 ETH	
☆ 3	 Tether USDT	\$1.00	▲ 0.00%	▲ 0.01%	▲ 0.02%	\$81,474,740,832	\$20,097,664,533 20,095,298,143 USDT	81,441,868,888 USDT	
☆ 4	 BNB BNB	\$328.17	▼ 0.10%	▼ 0.65%	▼ 5.71%	\$51,150,505,803	\$644,587,183 1,966,052 BNB	155,864,234 BNB	
☆ 5	 USD Coin USDC	\$0.9999	▼ 0.01%	▼ 0.03%	▲ 0.03%	\$30,813,012,572	\$3,390,561,459 3,390,859,750 USDC	30,805,352,199 USDC	
☆ 6	 XRP XRP	\$0.4608	▲ 0.81%	▼ 1.84%	▼ 11.46%	\$23,847,028,274	\$695,483,827 1,512,542,107 XRP	51,750,810,378 XRP	
☆ 7	 Cardano ADA	\$0.3844	▲ 0.20%	▼ 2.71%	▼ 14.42%	\$13,375,539,897	\$231,188,076 602,958,635 ADA	34,792,684,636 ADA	
☆ 8	 Dogecoin DOGE	\$0.07795	▲ 0.21%	▼ 2.71%	▼ 13.39%	\$10,840,164,632	\$340,716,016 4,378,083,781 DOGE	139,061,046,384 DOGE	
☆ 9	 Polygon MATIC	\$0.9889	▼ 0.11%	▼ 3.26%	▼ 15.36%	\$9,116,873,506	\$371,412,872 376,616,039 MATIC	9,219,469,069 MATIC	
☆ 10	 Solana SOL	\$21.19	▲ 0.08%	▼ 2.88%	▼ 13.49%	\$8,321,051,378	\$302,943,622 14,321,979 SOL	392,769,870 SOL	

What Money Consumes Is Obvious, It Consumes Attention...

Global wealth circa US\$464 tn, cryptocurrencies 0.2%, Bitcoin 0.1%

All gold ever mined, 205,000 tonnes about US\$12.7tn, cryptocurrencies 8%, Bitcoin 3.2%

Major Cryptoassets By Percentage of Total Market Capitalization (Bitcoin Dominance Chart)

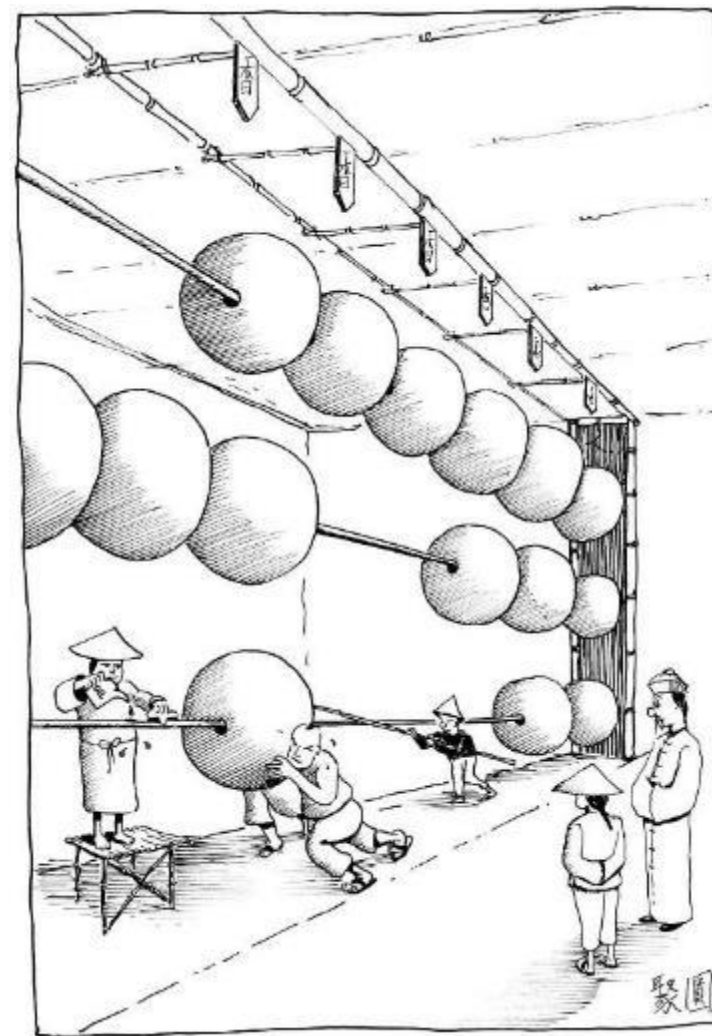


Cryptofinance – The Heavy Lifting

Narrative Evolution – HODLER – “Hold On For Dear Life” (you greater fool):

- Libertarian money
- Payments
- Monetary debasement hedge
- Put option against collapse of the dollar (Byron Gilliam)
- Asset class
- Inflation hedge
- Non-fungible tokens
- Get in before the CBDCs!

...



“Get a big picture grip on the details.”

Chao Kli Ning

'Internet-of-Record(s)'

“A ledger is a book, file, or other record of financial transactions.”



Christopher Watrous Ledger Book, Durham, 1817 (Vedder Library)

Accounts for Demo
CASH ACCOUNT From 01/03/2003 to 29/03/2004

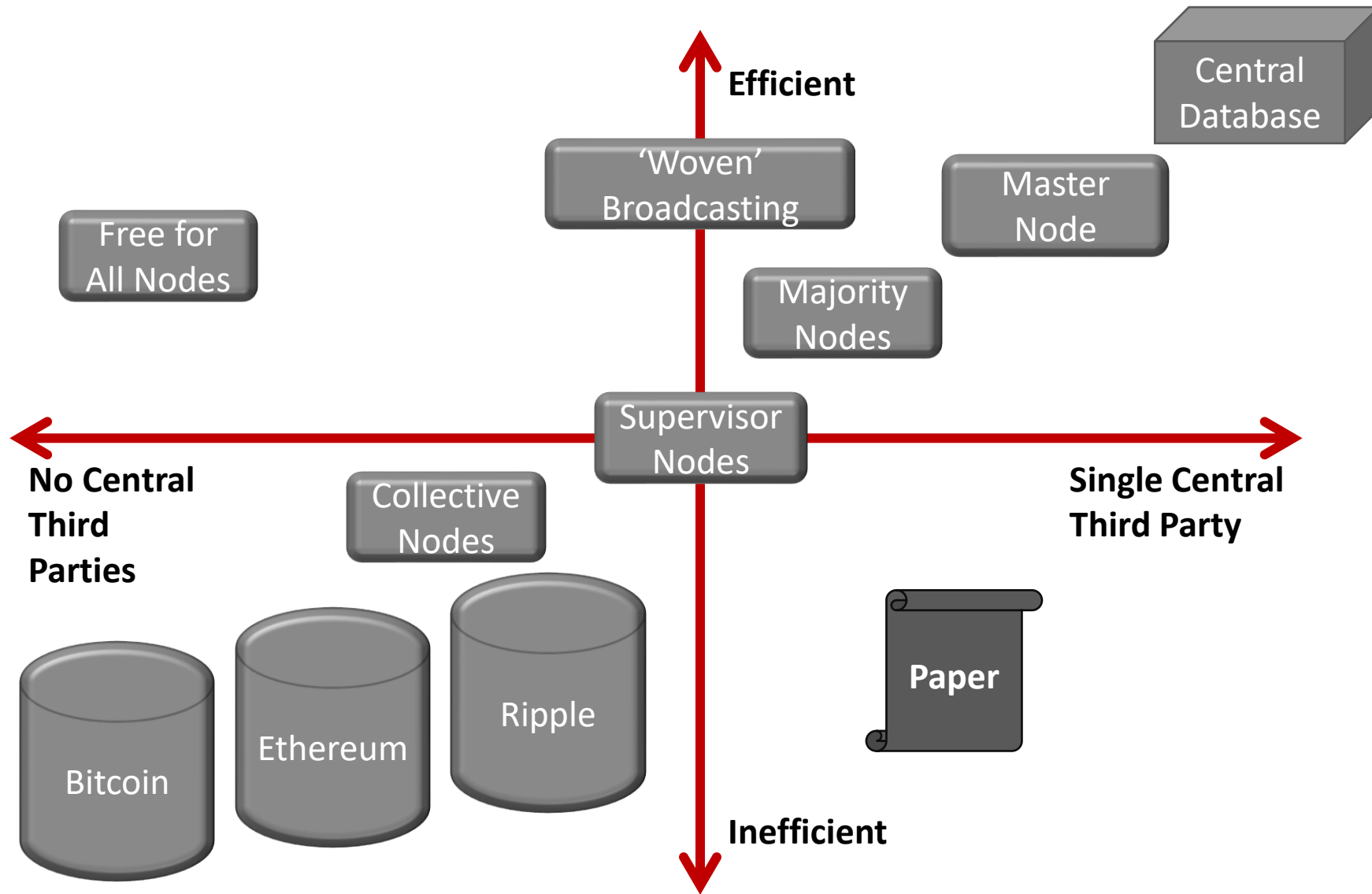
Date	Payee	Reference	Category	Actual (gross) Amount	Recon Balance (gross)	Admin. fund split OST net	Non OST	Sink. fund split OST net	Non OST	Balance (net)
25 MAY 04	J Citizen	Lot 1 levy pa	Deposit	500.00	500.00	0.00	500.00	0.00	0.00	500.00
26 MAY 04	Local Insurance	Insurance Ar	Insurance Bu	-269.00	231.00	0.00	-269.00	0.00	0.00	231.00
31 MAY 04	Netbank	Govt Debit Tr	Govt Debit Tr	-2.52	228.48	0.00	-2.52	0.00	0.00	228.48
31 MAY 04	Netbank	Account Ser	Account Ser	-5.00	223.48	0.00	-5.00	0.00	0.00	223.48
31 MAY 04	Netbank	Interest	Bank Interest	0.52	224.00	0.00	0.52	0.00	0.00	224.00
3 JUN 03	Clarks Grounds	Grounds Mai	Grounds Mai	-30.00	194.00	0.00	-30.00	0.00	0.00	194.00
10 JUN 03	Electrical Engine	Replace light	Building Maint	-22.60	171.40	0.00	-22.60	0.00	0.00	171.40
11 JUL 03	Levy credit trans	Lot 1 credit	Levy credit tr	0.00	171.40	0.00	-250.00	0.00	250.00	171.40
10 OCT 04	Leahy	Terror Payou	Bank Transf	1000.00	1171.40	909.09	0.00	0.00	0.00	1080.49
10 OCT 04	Fencers Upstand	Broken Pain	Fencing	-120.00	1051.40	0.00	0.00	0.00	-120.00	960.49
16 OCT 04	P D Jakeson	Lot 1 levy pa	Deposit	400.00	1451.40	0.00	0.00	363.64	0.00	1324.13
6 NOV 04	P D Jakeson	Lot 1 levy pa	Deposit	25.00	1476.40	0.00	0.00	22.73	0.00	1346.86
11 NOV 04	P D Jakeson	Lot 1 levy pa	Deposit	5.00	1481.40	0.00	0.00	4.55	0.00	1351.41

[SOURCE: https://en.wikipedia.org/wiki/Tally_stick]

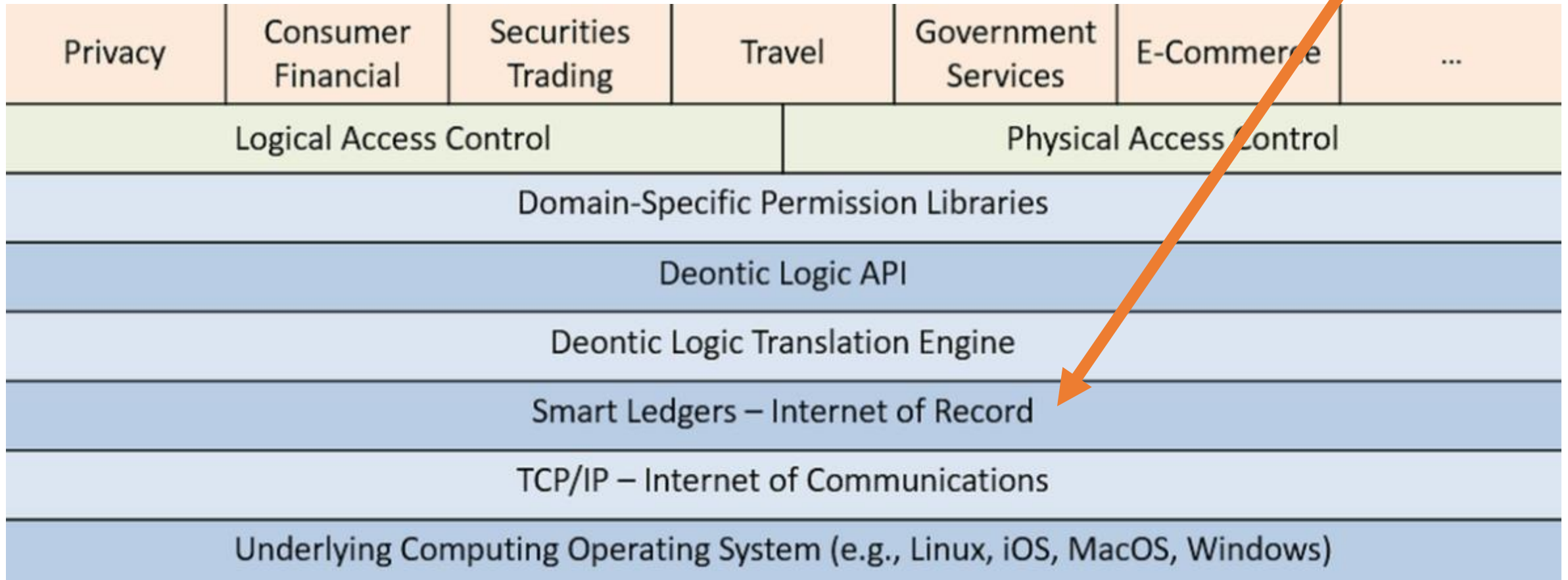
[SOURCE: <http://www.rootsweb.ancestry.com/~nygreen2/wpeF7.jpg>]

[SOURCE: <https://en.wikipedia.org/wiki/Ledger>]

Cryptocurrency ≠ DLT, Mistrust Costs Coins



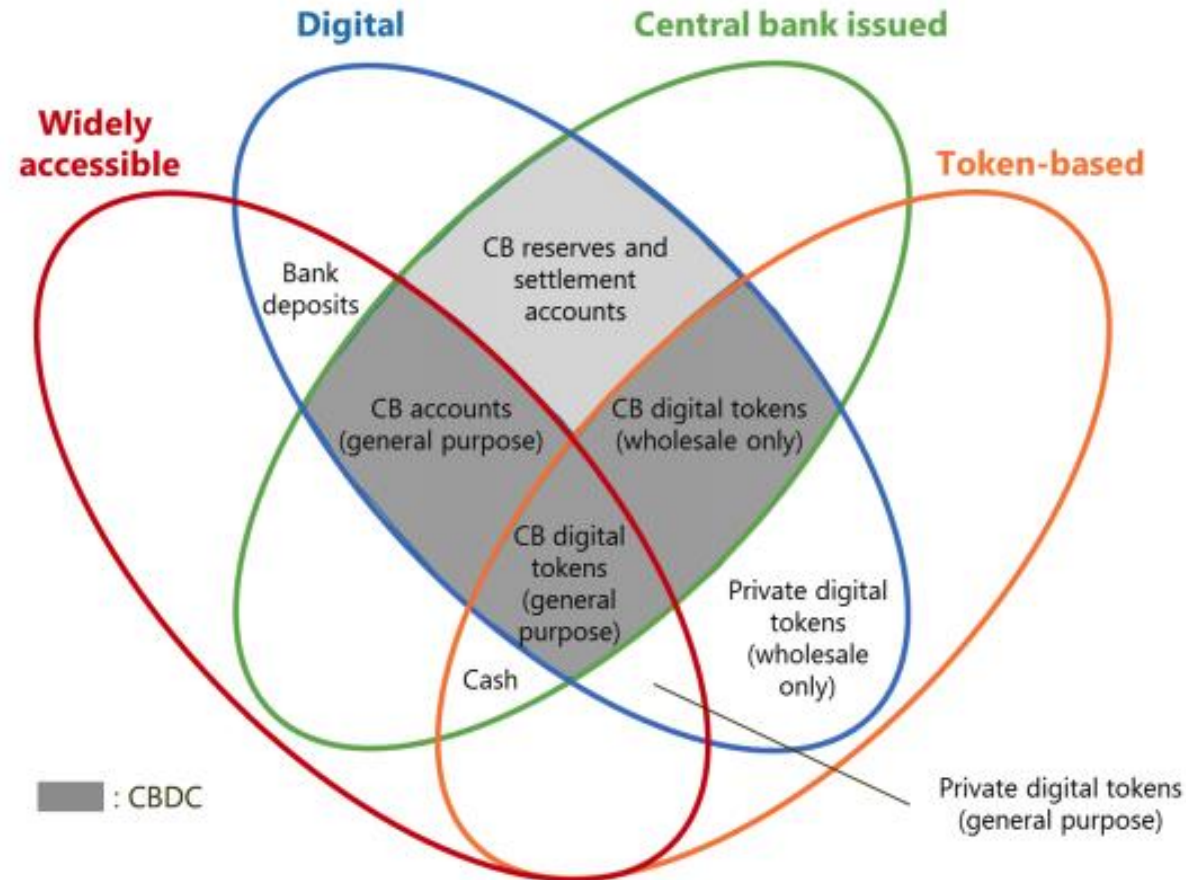
'Internet of Record'



Central Bank Digital Currencies Are Not Cryptocurrencies

The money flower: a taxonomy of money

Graph 1



Notes: The Venn-diagram illustrates the four key properties of money: *issuer* (central bank or not); *form* (digital or physical); *accessibility* (widely or restricted) and *technology* (account-based or token-based). *CB* = central bank, *CBDC* = central bank digital currency (excluding digital central bank money already available to monetary counterparties and some non-monetary counterparties). *Private digital tokens (general purpose)* include crypto-assets and currencies, such as bitcoin and ethereum. *Bank deposits* are not widely accessible in all jurisdictions. For examples of how other forms of money may fit in the diagram, please refer to the source.

https://www.bis.org/publ/qtrpdf/r_qt1709f.pdf

Source: Based on Bech and Garratt (2017).

When The Pixie Dust Settles

"You'll see her after the third glass"

- not necessarily blockchain
- privacy?
- fractional reserve banking works how ?&*!
- Godwin's law of economics? Taxation nazis?



Not Necessarily Blockchain...

ChainZy is a set of [working products](#) handling tens of millions of transactions per year. The ledgers are sometimes viewable, and the clients below give some idea of the breadth of applications or demonstrations already complete (* = viewable ledger, L = live application, D = demonstration/pilot).

[TimeChainZ - Clinical Assessments - CLEAR](#) *L

[TimeChainZ - MovieSweep](#) *L

[TimeChainZ - States of Alderney](#) *L

[TimeChainZ - Clinical Assessments - Youthinmind](#) *L

[TimeChainZ - Regulatory Reporting For High-Frequency Trading](#) D

[TimeChainZ - Book Publishing Download Authentication](#) L

[TimeChainZ - Veracity \(online advertising fraud\)](#) D

[IDChainZ - Mobile Application](#) D

[SmartChainZ - FastTrackTrade](#) *L

[SmartChainZ - Fishface](#) L

[SmartChainZ - IoT Refrigerator Timestamping](#) D

[SmartChainZ - Cyber-Catastrophe Insurance-Linked-Security Index](#) *L

[SmartChainZ - Mattereum](#) L

[TimeChainZ - Catenae Uses ChainZy For Firedoor Inspections](#) L

[TimeChainZ - SafeShare Insurance](#) L, now D

[TimeChainZ - Z/en's MDL Technology Delivers Immutable Substantiation for Blem, XLRAS](#) L, now D

[GeoChainZ - GeoGnomo](#) D

[GeoChainZ - GeoTono](#) D

[IDChainZ - Cov-ID Project](#) D

Privacy

As of January 2023, 27 of the 38 member states of the Organization for Economic Cooperation and Development (OECD) have announced retail central bank digital currency



Fractional Reserve Banking Works How ?&*! Role Of Credit In A Modern Economy



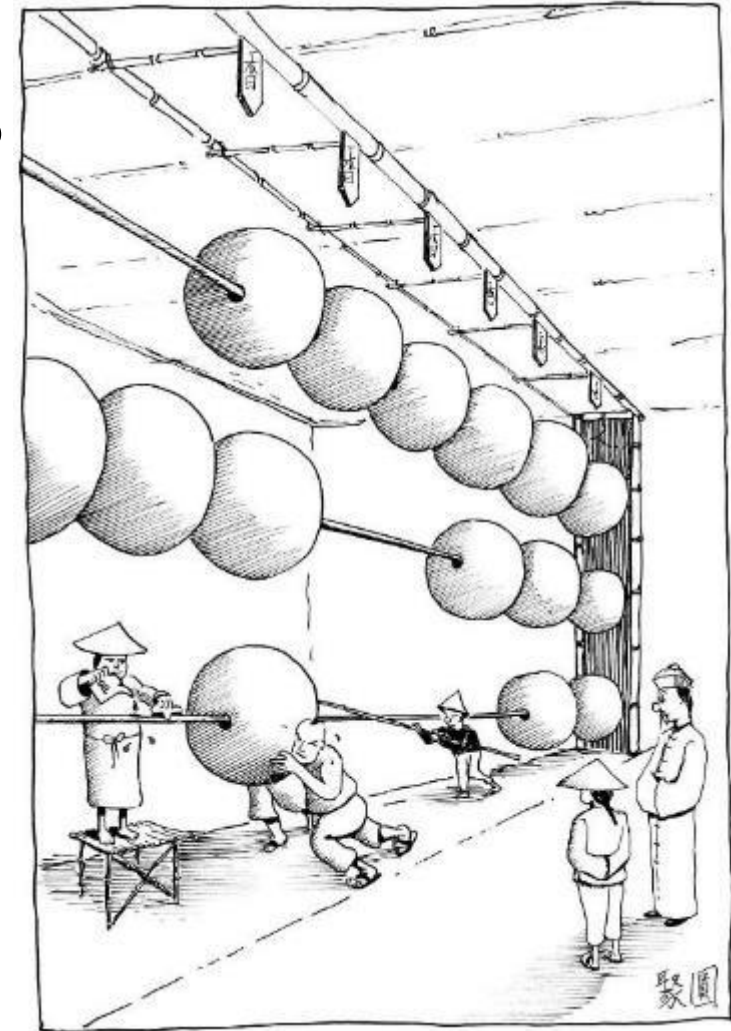
[Source: <http://www.fortunewatch.com/handling-greed-and-fear-in-investing/>]

Godwin's Law Of Economics? Taxation Nazis?



Financial Armageddon?

- Gold – nuclear warfare?
- Crypto – Carrington Event, but not economic meltdown?
- CBDC – Carrington Event, plus economic meltdown?



“Get a big picture grip on the details.”
Chao Kli Ning

"Money is a matter of functions four: a medium, a measure, a standard, a store."

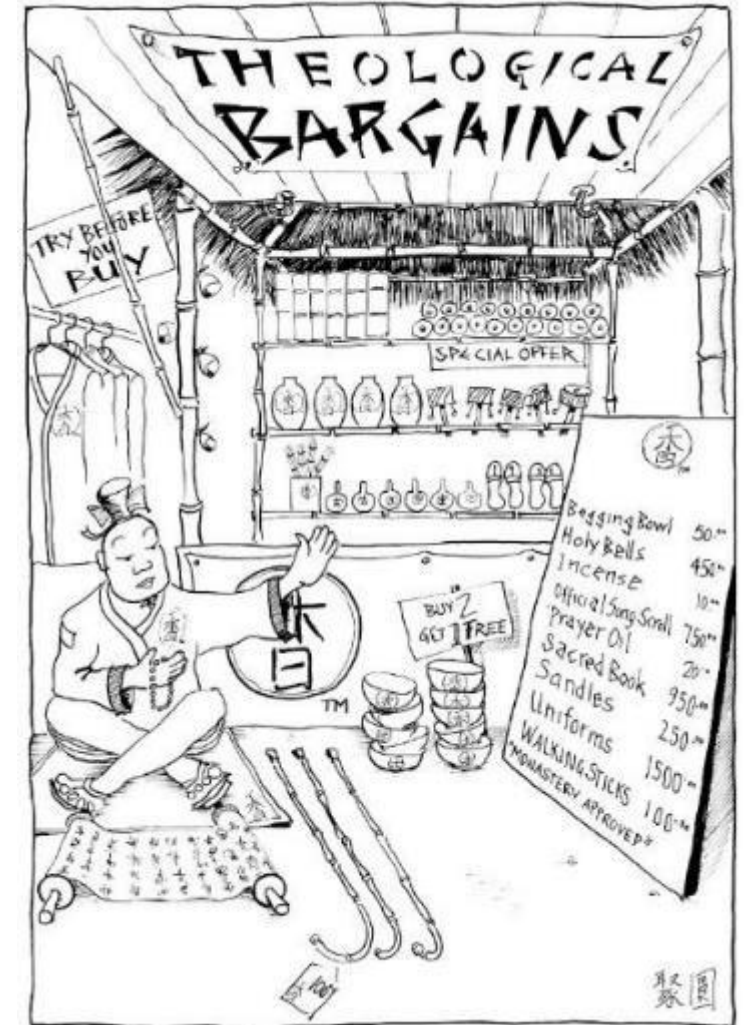
William Stanley Jevons
(1835-1882)



Function	Meaning	Crypto	Gold	CBDC
Medium	Exchange (wide acceptability)	Poor	Poor	Good
Measure	Fungible (price discovery)	Fair	Poor	Good
Standard	Stable (deferred payment)	Poor	Poor, though longer-term?	Conventional
Store	Future-proof (deferred value)	Poor	Adequate	Adequate
Backing?	Tied to value	Historic energy	Physical commodity	Future taxation

Nothing New Under The Sun

- What is our community?
- What is the role of credit in a modern market economy?
- Where do we stand on:
 - Privacy?
 - Fractional reserve banking?
 - Taxation?



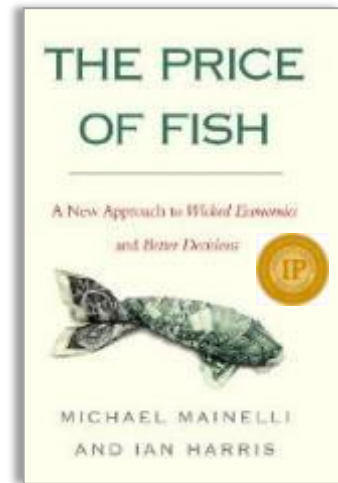
**"Get a detailed grip on the big picture."
Chao Kli Ning**

When Would We Know Our Commerce Is Working?



***“If you have trust, I shall give you trust;
If you have no trust, I shall take it away.”***

Thank you!



“Get a big picture grip on the details.”
Chao Kli Ning

