Distributed Futures

An open source research programme for Smart Ledgers and new technologies

Timestamping Smart Ledgers

Comparable, Universal, Traceable, Immune

Report Launch – Wednesday, June 6 2018
London

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@LongFinance (#DistributedFutures)

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The Z/Yen Group

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Agenda

08:45 – 09:00	**Registration**
09:00 – 09:25	**Welcome and Introduction** *Michael Mainelli, Executive Chairman, Z/Yen Group*
09:25 – 10:00	"**Timestamping Smart Ledgers: Comparable, Universal, Traceable, Immune"** ***Report Walkthrough*** *Sam Carter, Financial Sector Researcher and Quant Developer*
10:00 – 10:40	**Panel Discussion and Questions** *Including: Ian Salmon, Director, Ignite*
10.40 – 10:45	**Summary**
10:45	**Formal Close**

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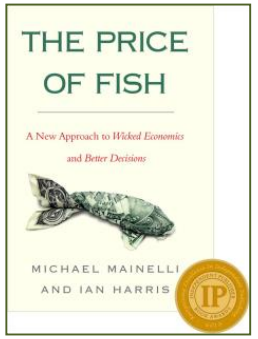
Global Green Finance Index

- Special – 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

  - Independent Publisher Book Awards Finance, Investment & Economics Gold Prize 2012 for ***The Price of Fish***
  - British Computer Society **IT Director of the Year** 2004 for PropheZy and VizZy
  - DTI **Smart Award** 2003 for PropheZy
  - *Sunday Times* Book of the Week, ***Clean Business Cuisine***
  - £1.9M **Foresight Challenge Award** for Financial £aboratory visualising financial risk 1997



Distributed Futures Programme

An open source research programme for Smart Ledgers and new technologies.

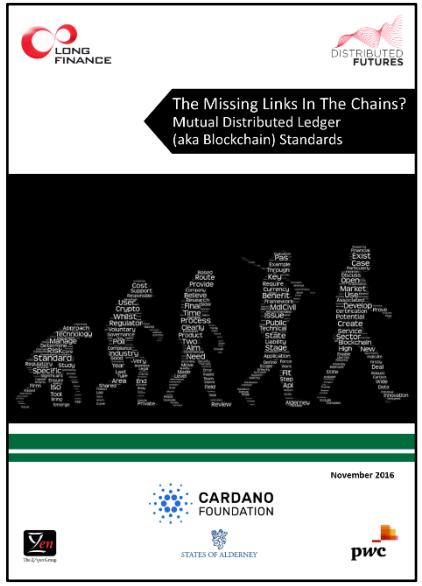
Our research is structured around four themes:

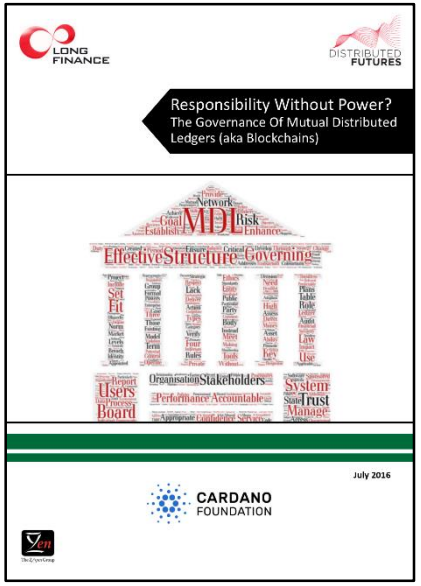
- Society
- Technology
- Economics
- Politics

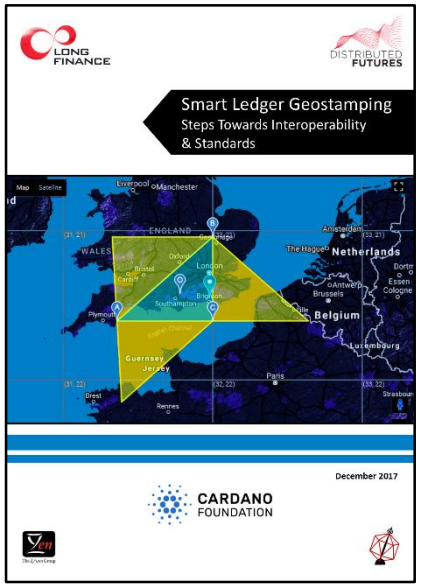
And it's directed at four outcomes:

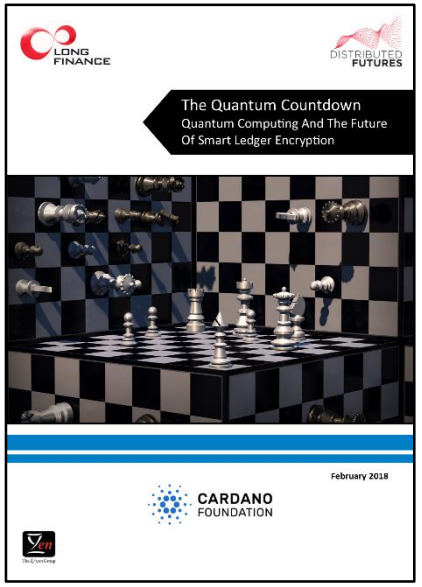
- Expanding frontiers
- Changing systems
- Delivering services
- Building communities

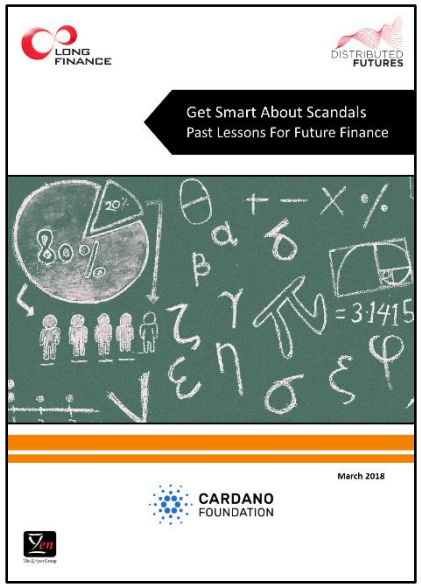
Distributed Futures Research

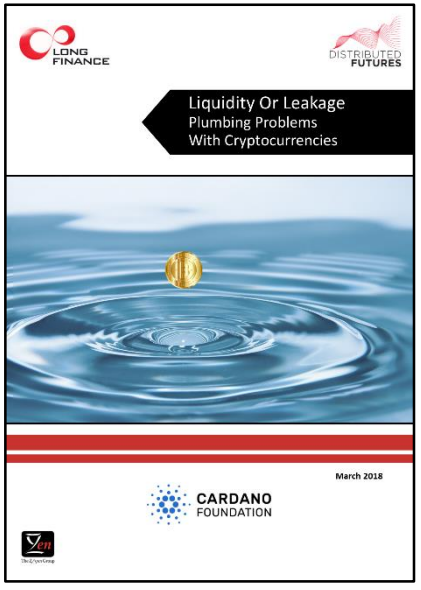


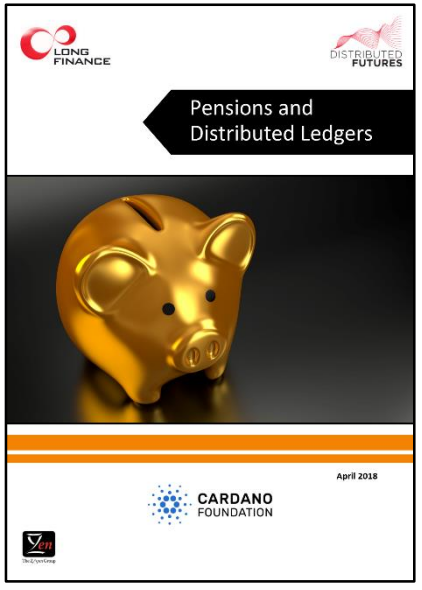












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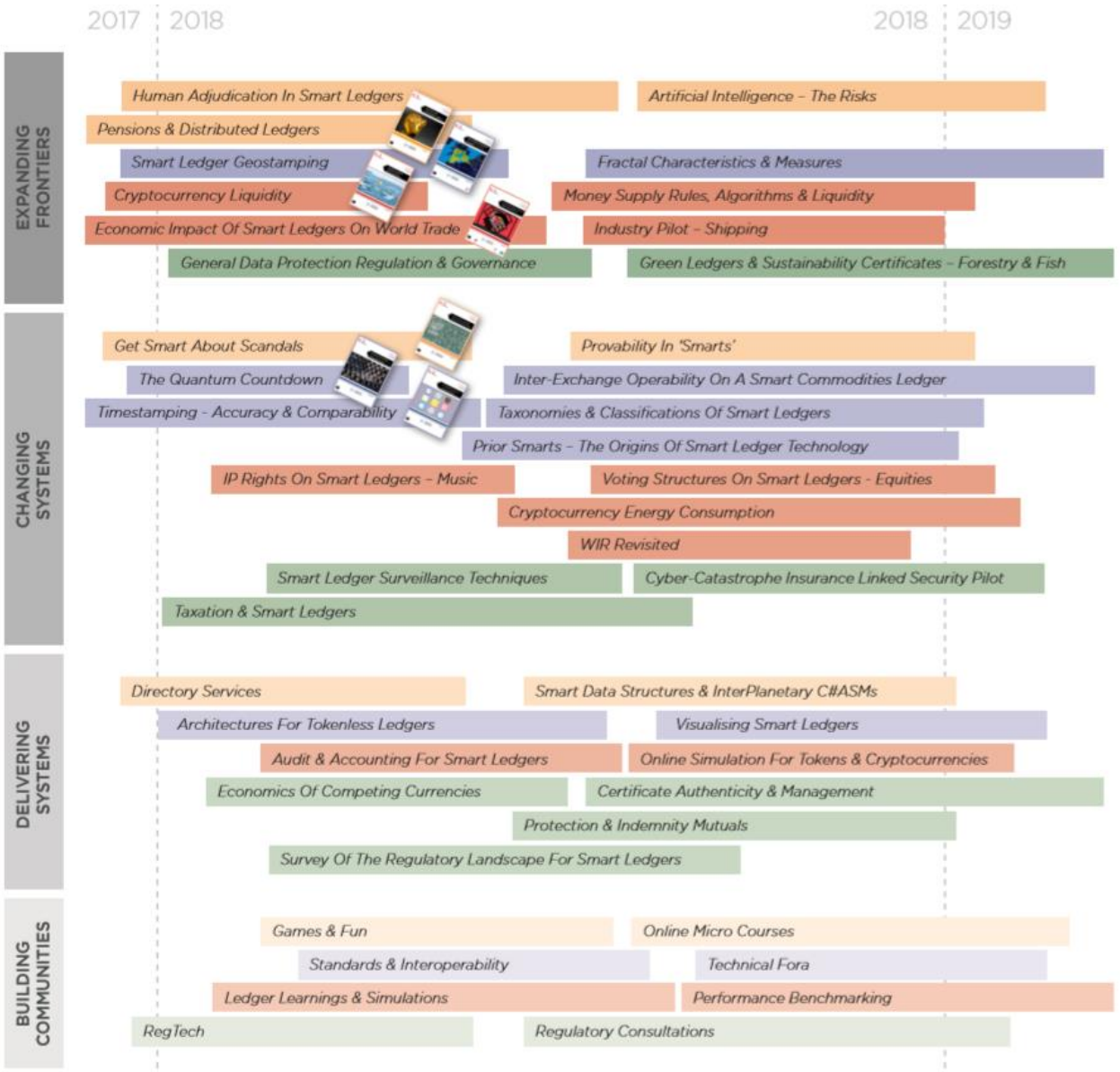
Timeline



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Terminology Evolving

- **ledger** – a record of transactions
- **distributed** – divided among several or many, in multiple locations
- **mutual** – shared in common, or owned by a community
- **mutual distributed ledger (MDL)** - a record of transactions shared in common and stored in multiple locations
- **mutual distributed ledger technology** – a technology that provides an immutable record of transactions shared in common and stored in multiple locations
- **blockchain** - “a transaction database shared by all nodes participating in a system based on the Bitcoin protocol”
- **smart ledger** – MDL with embedded, executable code

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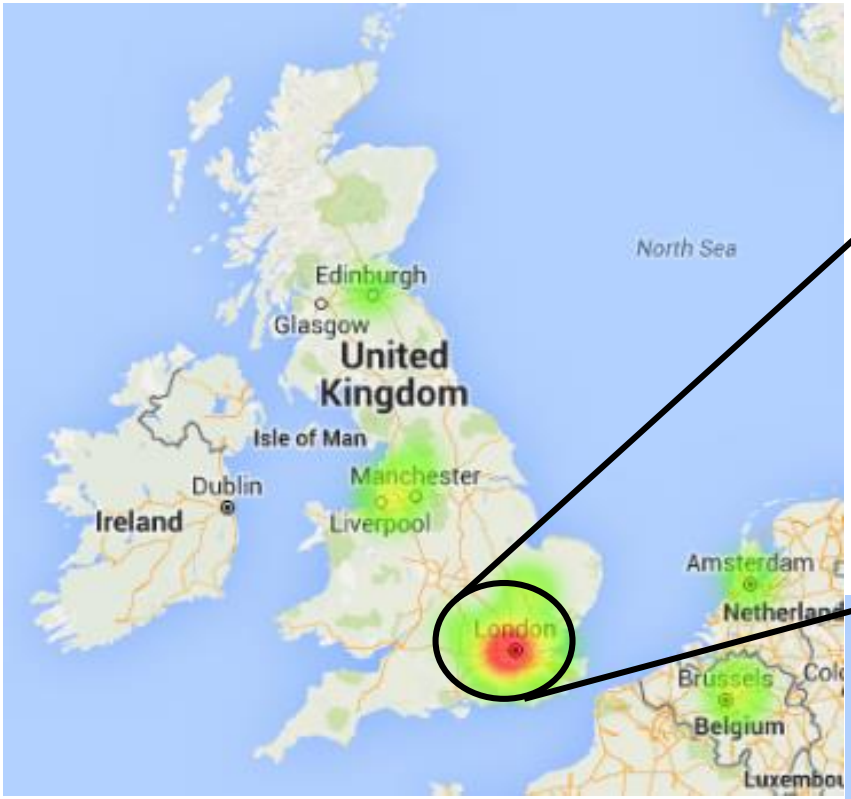
Smart Ledgers Hold Immense Promise

Area	Possible Applications
Financial instruments, records, models	Currency, private and public equities, certificates of deposit, bonds, derivatives, insurance policies, voting rights associated with financial instruments, commodities, derivatives, trading records, credit data, collateral management, client monies segregation, mortgage or loan records, crowd-funding, P2P lending, microfinance, (micro)charity donations, account portability, airmiles & corporate tokens, etc.
Public records	Land and property titles, vehicle registries, shipping registries, satellite registries, business license, business ownership/incorporation/dissolution records, regulatory records, criminal records, passport, birth/death certificates, voting ID, health and safety inspections, tax returns, building and other types of permits, court records, government/listed companies/civil society, accounts and annual reports, etc.
Private records	Contracts, ID, signature, will, trust, escrow, any other type of classifiable personal data (e.g. physical details, date of birth, taste) etc.
Semi-private/semi-public records	High school/university degrees and professional qualifications, grades, certifications, human resources records, medical records, accounting records, business transaction records, locational data, delivery records, genome and DNA, arbitration, genealogy trees, clinical trials, etc.
Physical keys	Key to home, hotel, office, car, locker, deposit box, mail box, Internet of Things, etc.
Intellectual property	Copyrights, licenses, patents, digital rights management of music, rights management of intellectual property such as patents or trademarks, proof of authenticity or authorship, etc.
Other records	Cultural, historical events, documentary (e.g. video, photos, audio), (big) data (weather, temperatures, traffic), SIM cards, archives, geostamping, etc.

Application:
MetroGnomo – Timestamping & Datalogging

Application:
Clinical Trials



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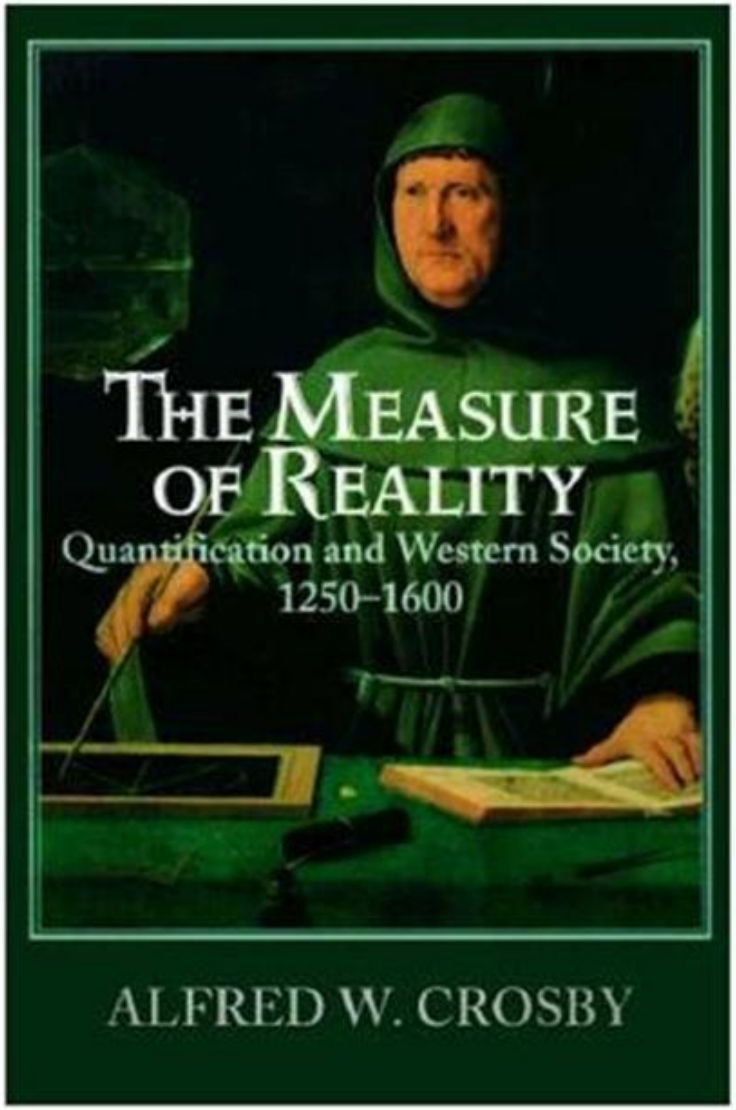
Measuring Reality



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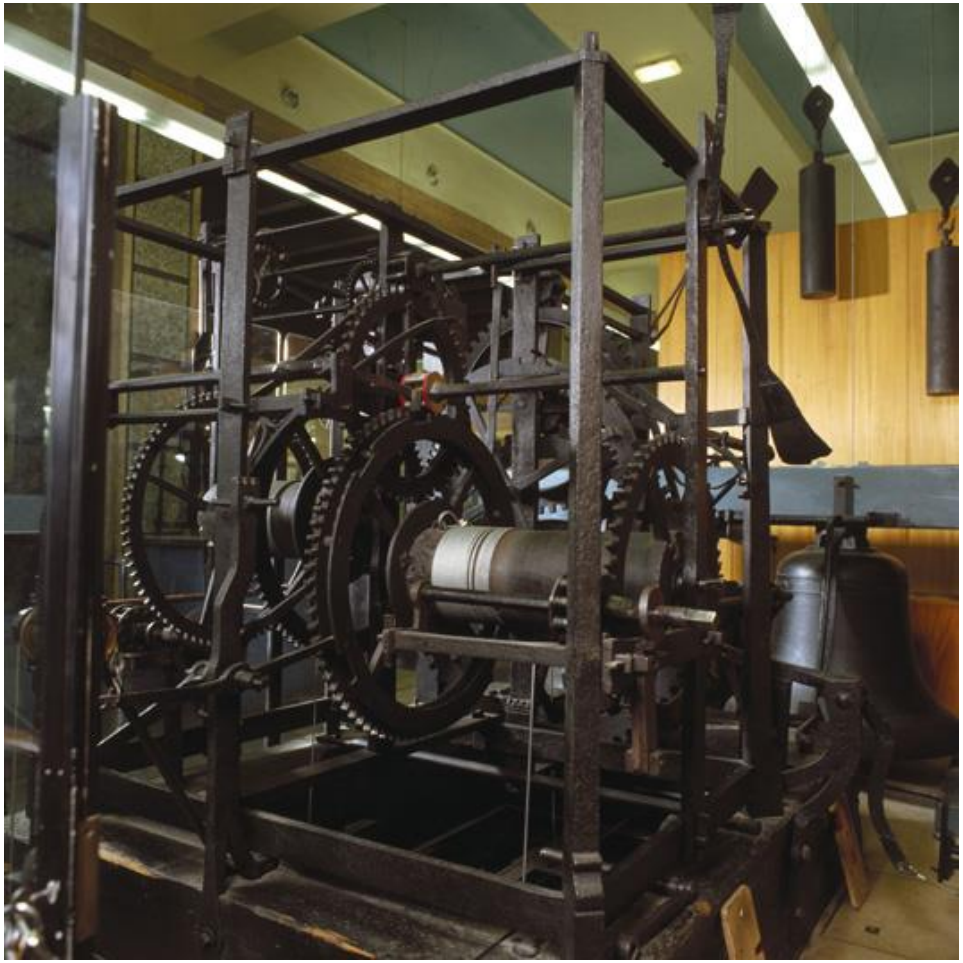
Tempus Rerum Urbes



The Wells Cathedral clock, built 1392

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Tempus Rerum Imperator

Marine Chronometer H5 by John Harrison - Clock Makers Museum, Guildhall

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The World Accelerates

Millennium
Century
Decade
Year
Month
Week
Day
Hour
Minute
Second
Millisecond 10^{-3}
Microsecond 10^{-6}
Nanosecond 10^{-9}
Picosecond 10^{-12}
Femtosecond 10^{-15}

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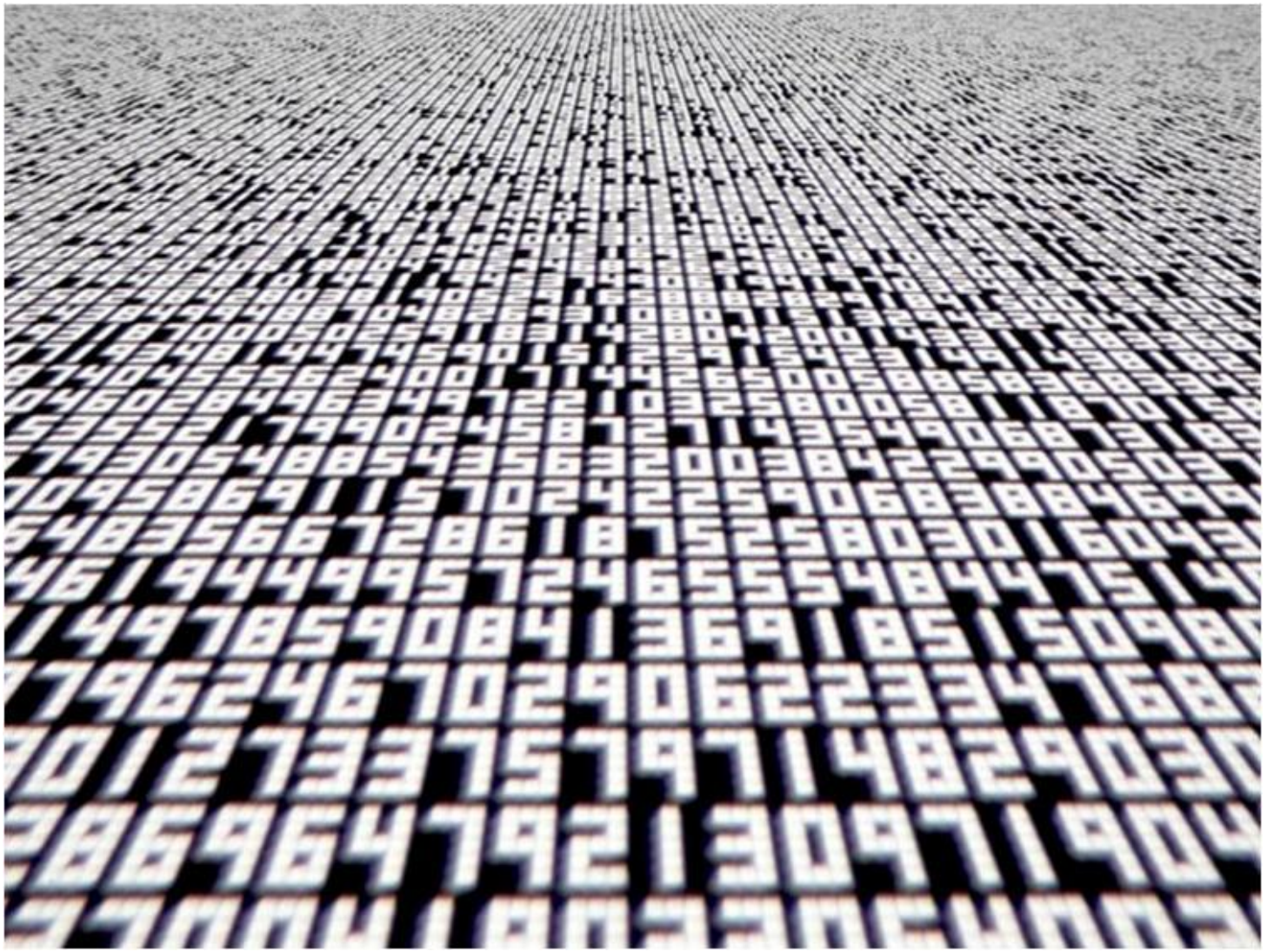
The City Is The Data



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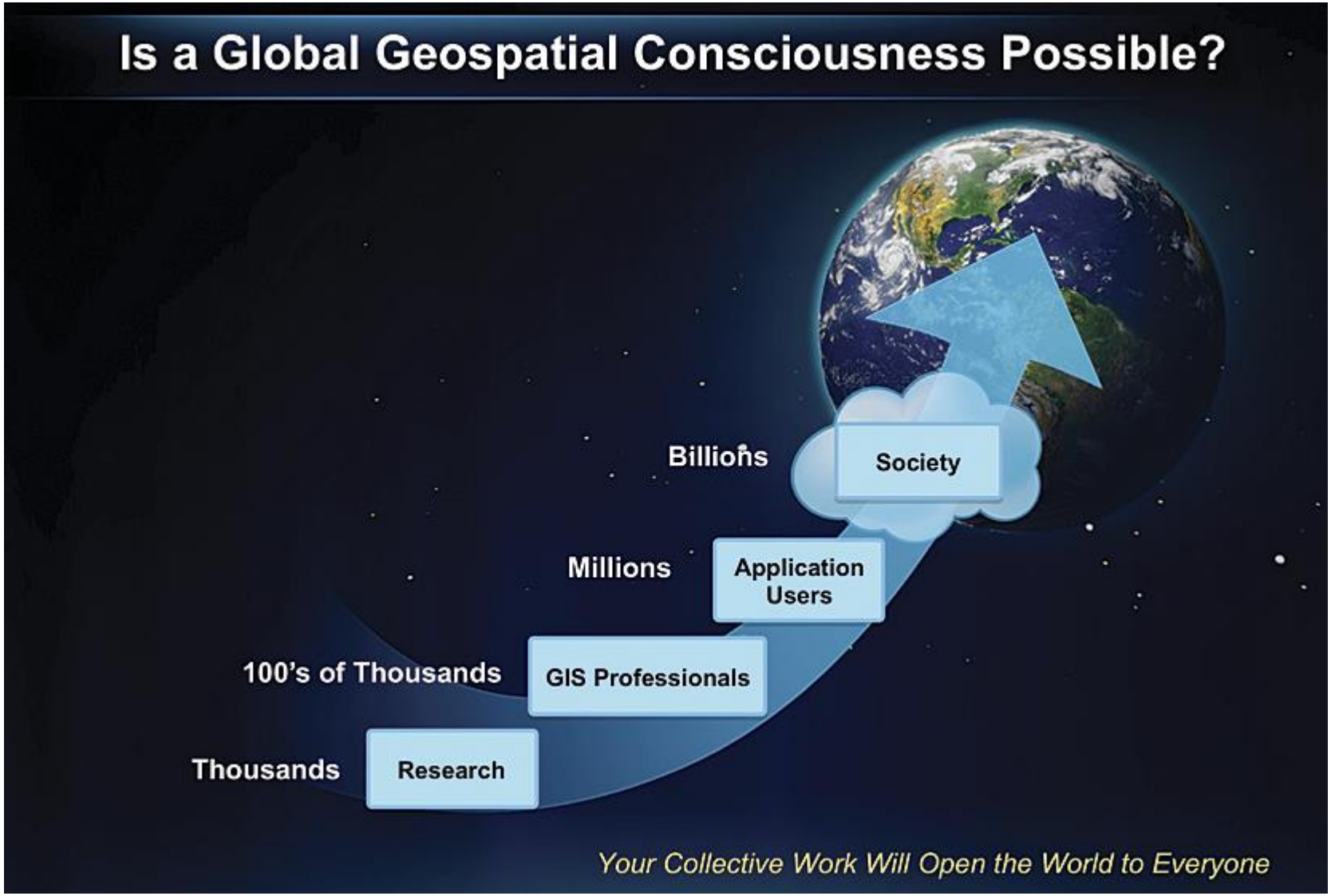
Start the Clock

Open Source World?



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We Are All Bitizens Now

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Report Walkthrough

Timestamping Smart Ledgers
Comparable, Universal, Traceable, Immune

Sam Carter
(Author)

DISTRIBUTED FUTURES

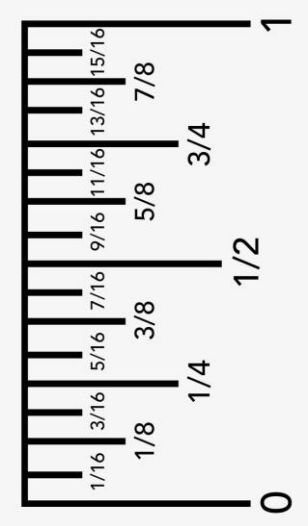
Summary

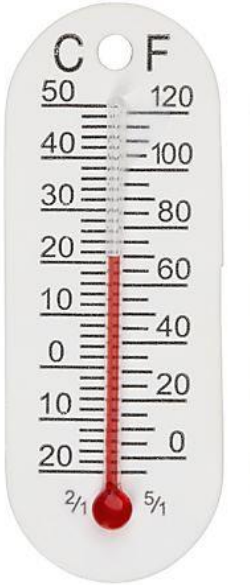
- History
- Time Keeping, Time Broadcast
- Synchronisation & Security
- CUTI
- Precision & Accuracy
- Smart Ledgers & Timestamping
- Finance & Regulation
- Smart Ledgers & Finance
- Further Questions

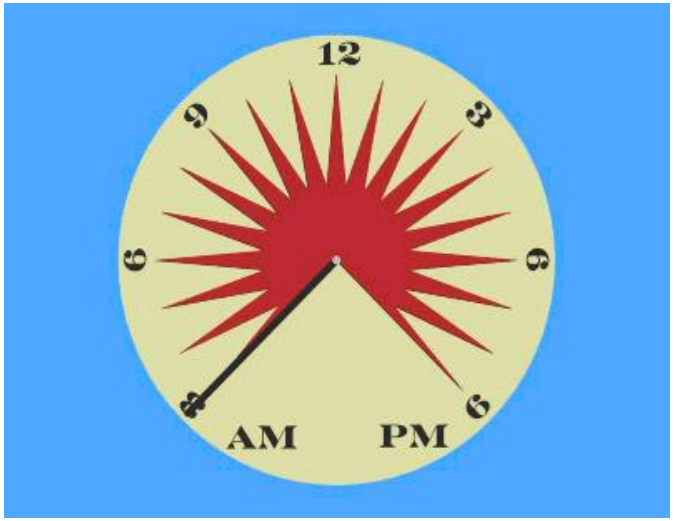
History – Time & Space

To measure, we must:

- **Digitise**
- **Map To Space**







History – Space & Time

Map Space back to Time!

- **Longitude**
- **Time : Local or National?**

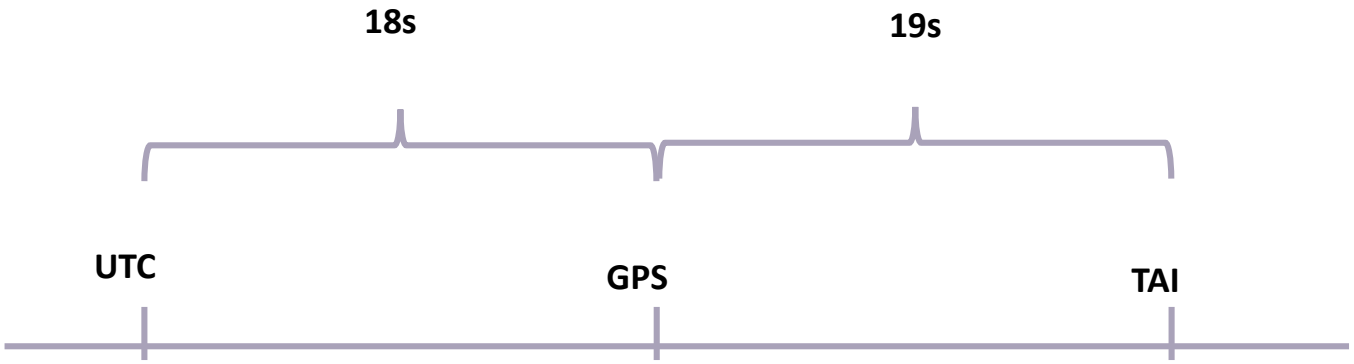
Portability:

- **Rail**
- **Mean Time**

Time Keeping & Time Broadcast

Standards:

- TAI
- UTC
- GPS



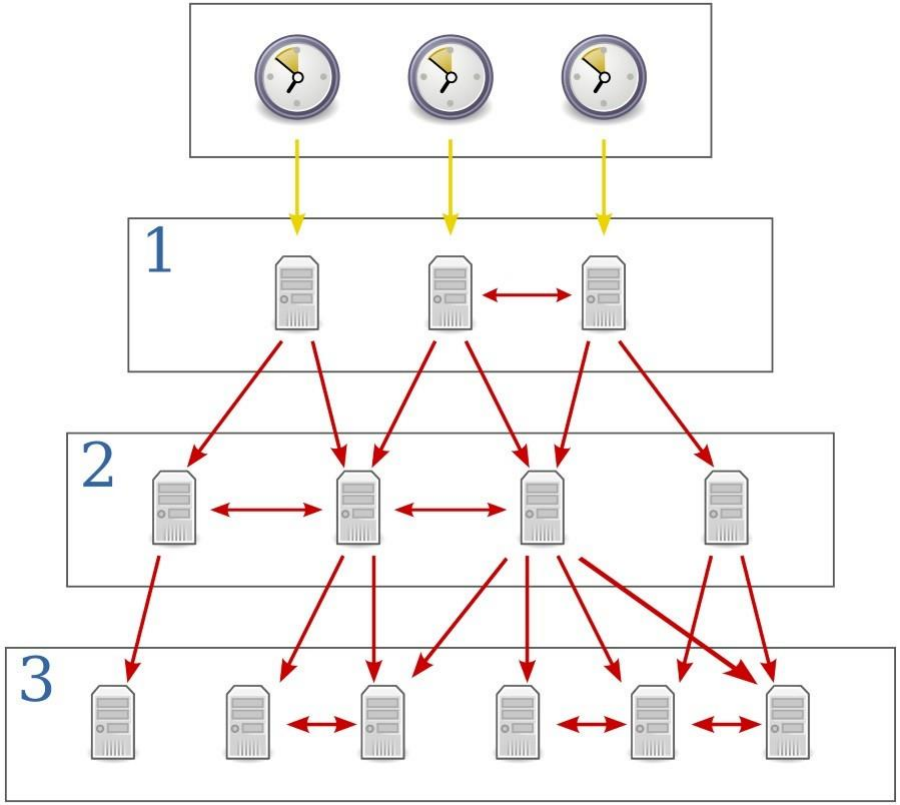
Broadcast:

- “Time from NPL” from Anthorn
- GPS
- NPLTime™

Time Synchronisation I

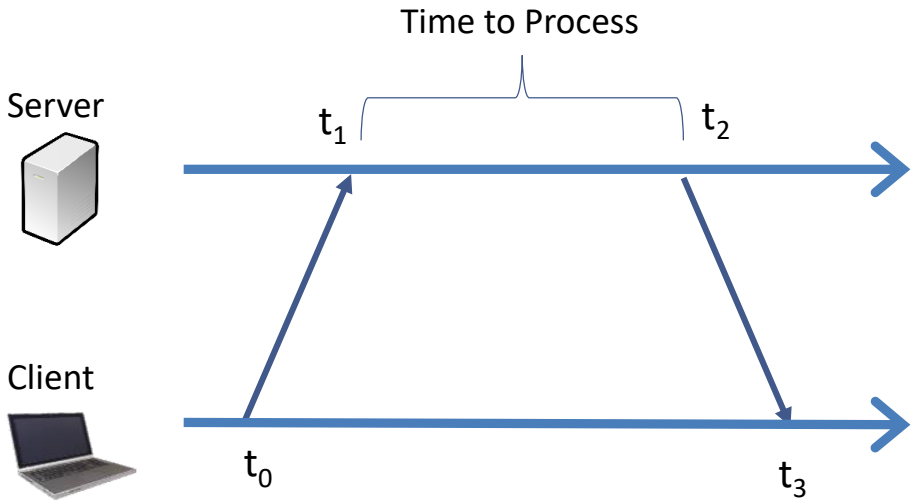
Synchronise every machine's clock:

- **Network has a time entry point**
- **Distribute time to all machines**
- **Each machine drifts – recalibration required**

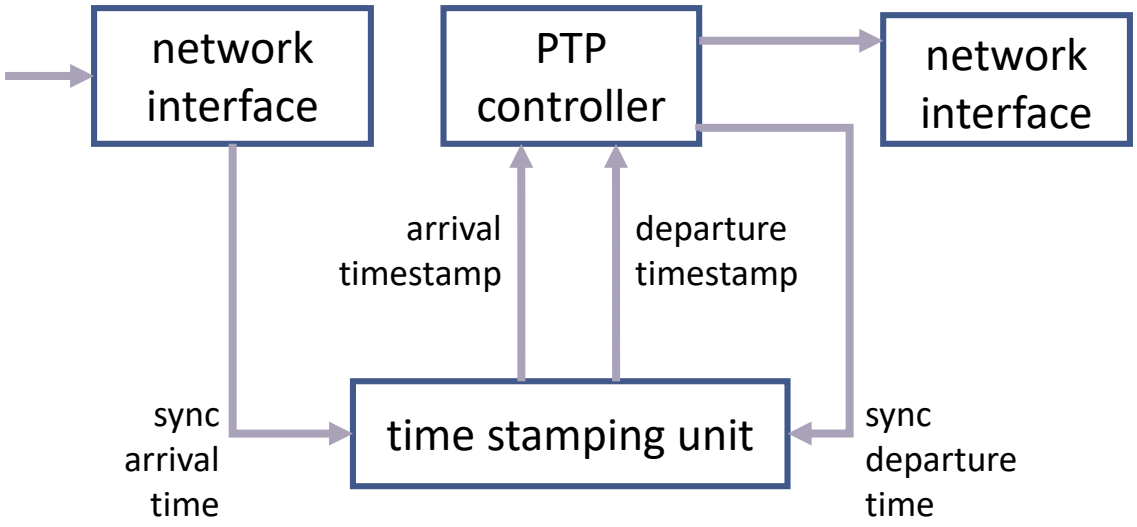


Time Synchronisation II

- NTP

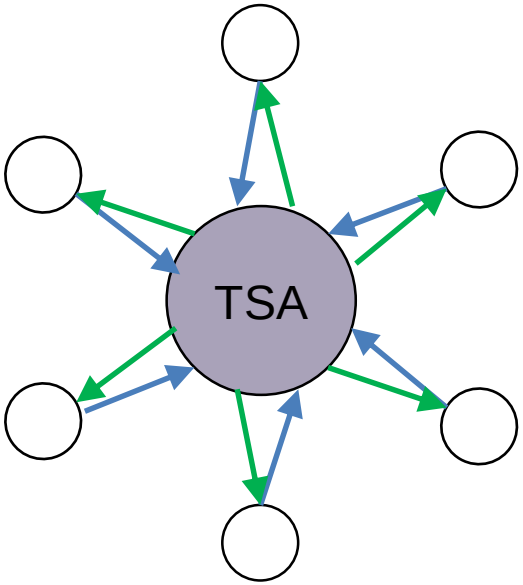


- PTP

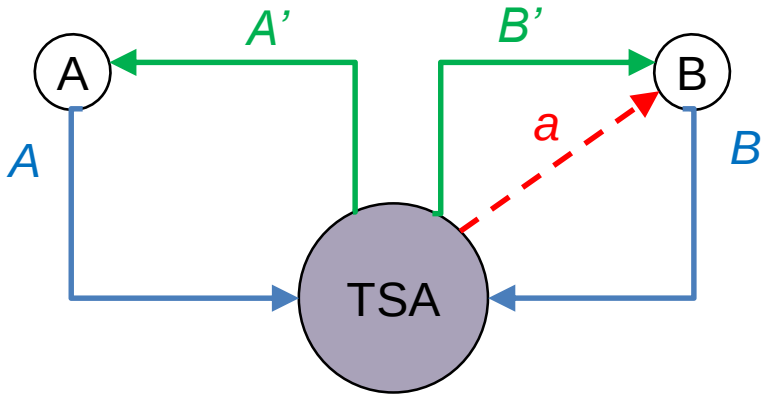


Secure Timestamping

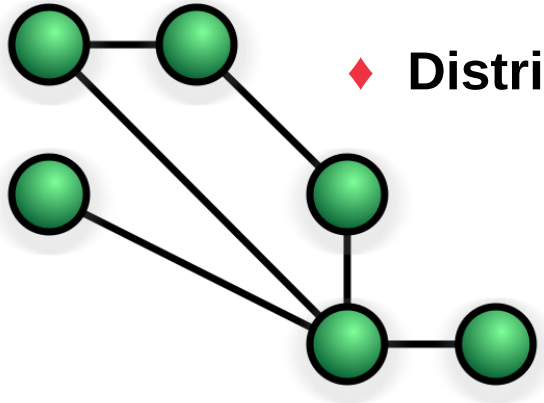
- Central



- Central Linked



- Distributed



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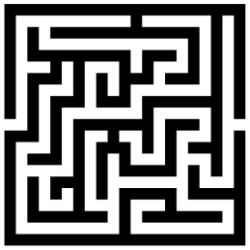
CUTI

- **C**omparable

- **U**niversal



- **T**raceable

- **I**mmune

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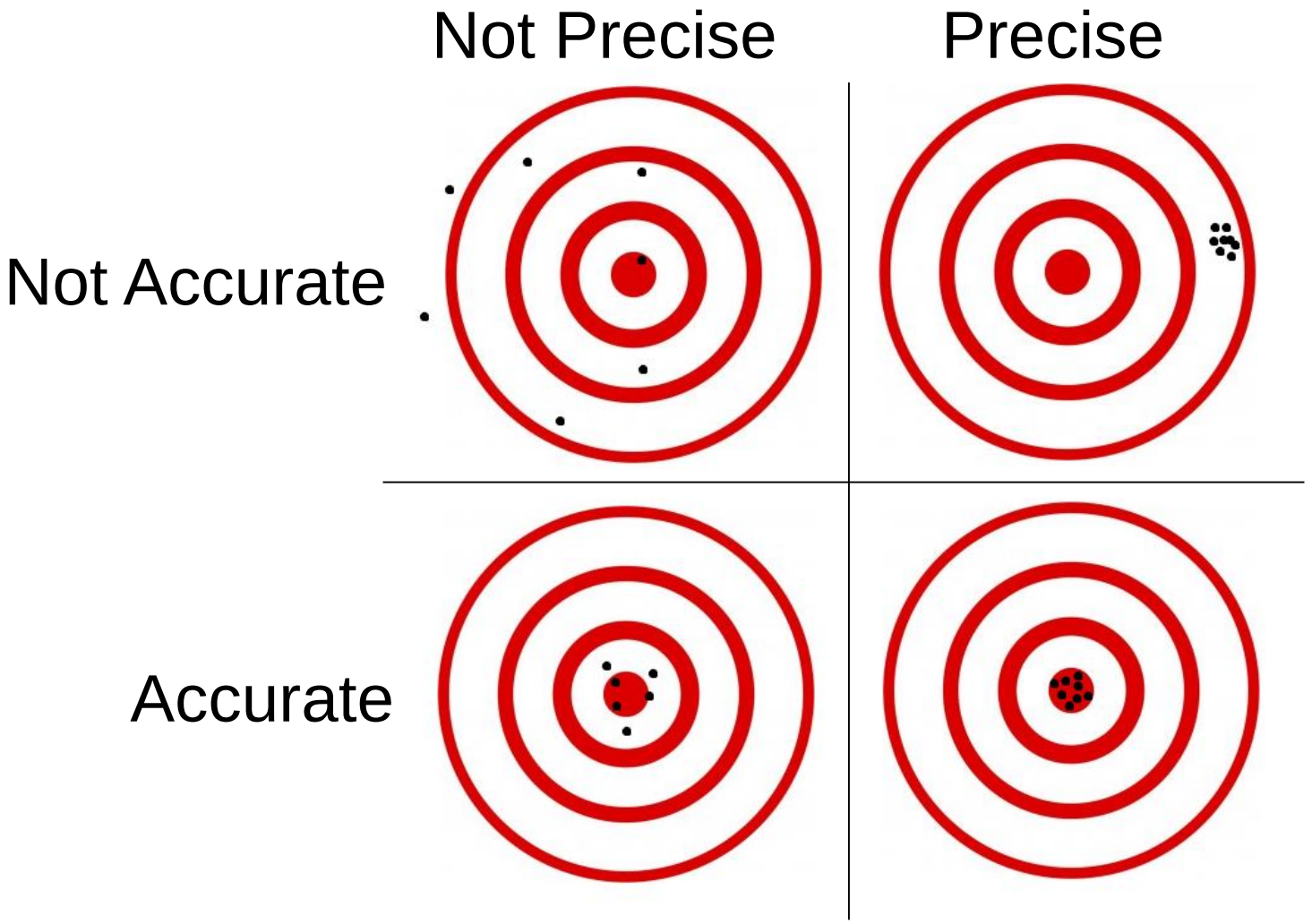
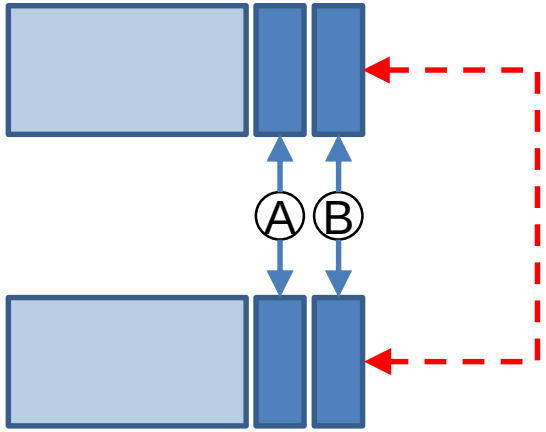
Precision & Accuracy

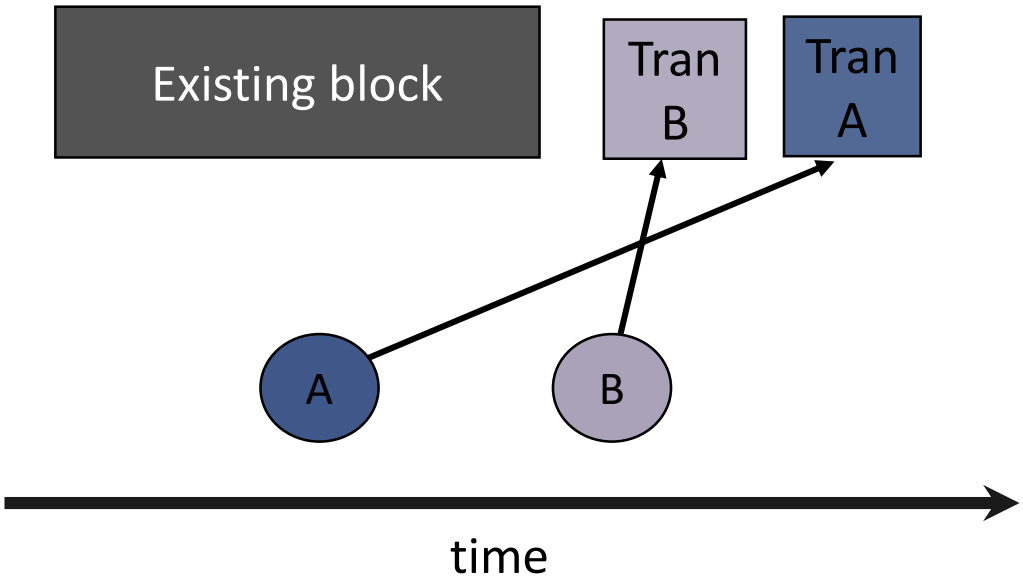


Smart Ledgers & Timestamping

When is a Smart Contract "posted"?

- **Networks and Latency**
- **Time of Event vs Consensus Time**





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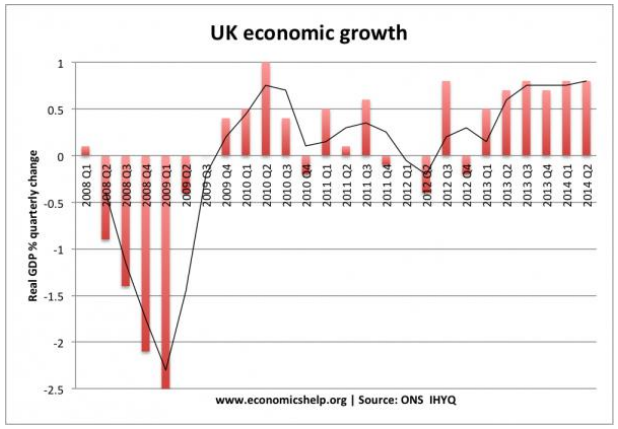
Smart Ledgers & CUTI

Property	Comments	Score
Comparable	This depends on two major factors: precision and accuracy.	Average
Universal	Easy to agree a standard within one ledger. Cross-ledger comparison still an issue.	Good
Traceable	If distributed ledger does the timestamping, every node on the system will have to be guaranteed traceable – and traceable on aggregate!	Good
Immune	The super audit trail and consensus model ensures nobody can change a timestamp.	Very Good

Financial Regulation

Credit Crunch:



MiFID II – Goals:

- Unbundling charges
- Moving OTC markets to exchanges
- Increasing focus on the buy-side
- Higher levels of surveillance

Article 50 & RTS-25:

- Cross-market synchronisation.
- Precision.
- Reconstructability of past events.
- Auditability of infrastructure.

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High-Frequency Trading

Informal HFT Characteristics:

- **Arbitraging price differences with sheer speed.**
- **Orders *reach the exchange* as fast as possible.**
- **Reduce latency between the system and the exchange:**
  - **Co-location**
  - **Proximity hosting**
  - **High-speed electronic access.**

Formal ESMA definition:

- **At least two algorithmic trades per second in the same liquid instrument, or…**
- **At least four messages per second across all instruments traded over a given venue.**

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Regulation and Timestamping

Required level of accuracy for trading venues:

Gateway-to-gateway latency	Max divergence from UTC	Granularity of the timestamp
> 1 millisecond	1 millisecond	1 millisecond or better
<= 1 millisecond	100 microseconds	1 microsecond or better

Required level of accuracy for trading participants:

Type of trading activity	Max divergence from UTC	Granularity of the timestamp
High-frequency algorithmic trading	100 microseconds	1 microsecond or better
Voice trading systems	1 second	1 second or better
Any other trading activity	1 millisecond	1 millisecond or better

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Smart Ledgers and Finance

3 separate spheres to consider:

- Internal Recordkeeping
- Cross-entity Reconciliation
- Trading

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Timestamping Smart Ledgers

Comparable, Universal, Traceable, Immune

Panel Discussion

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Timestamping: For Discussion

1. Regulation cannot help but make assumptions about existing technology. What regulation could the new technology of smart ledgers make obsolete?

2. Why aren't the industry jumping at the chance of a central trade repository? It would remove their obligation to record everything on their own systems.

3. Could central trade timestamping break the semi-monopoly held by data providers (Bloomberg/ Reuters/ etc.) ?

4. What other sectors could benefit from having central time-stamping?

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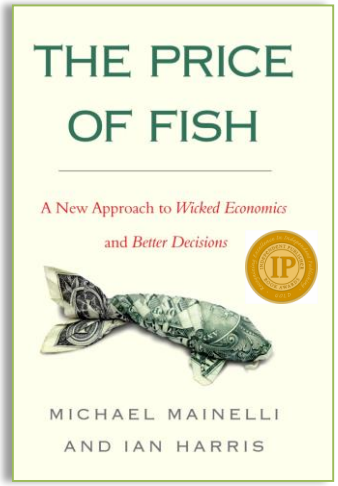
When Would We Know Our Commerce Is Working?

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



Thank you!

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