

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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<http://www.distributedfutures.net>



@LongFinance (#DistributedFutures)



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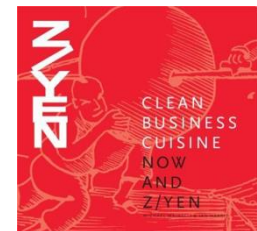
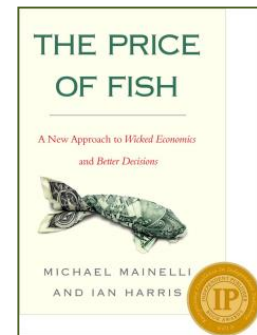
The Z/zen Group

Agenda

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



- ◆ 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 Laboratory 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

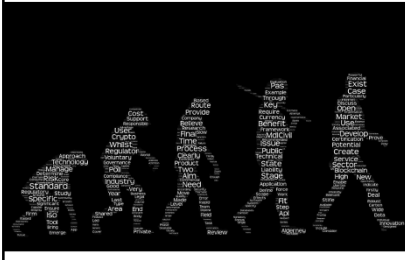
And it's directed at four outcomes:

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

Distributed Futures Research

LONG FINANCE **DISTRIBUTED FUTURES**

The Missing Links In The Chains? Mutual Distributed Ledger (aka Blockchain) Standards




November 2016

CARDANO FOUNDATION

STATES OF ALDERNEY **pwc**

LONG FINANCE **DISTRIBUTED FUTURES**

Responsibility Without Power? The Governance Of Mutual Distributed Ledgers (aka Blockchains)

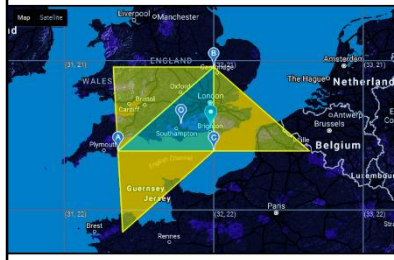


July 2016

CARDANO FOUNDATION

LONG FINANCE **DISTRIBUTED FUTURES**

Smart Ledger Geostamping Steps Towards Interoperability & Standards




December 2017

CARDANO FOUNDATION

LONG FINANCE **DISTRIBUTED FUTURES**

The Quantum Countdown Quantum Computing And The Future Of Smart Ledger Encryption

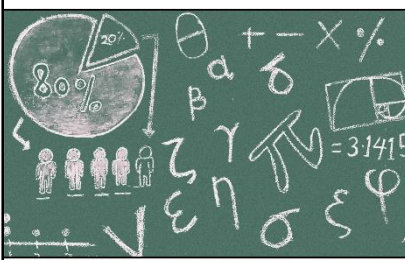


February 2018

CARDANO FOUNDATION

LONG FINANCE **DISTRIBUTED FUTURES**

Get Smart About Scandals Past Lessons For Future Finance




March 2018

CARDANO FOUNDATION

LONG FINANCE **DISTRIBUTED FUTURES**

Liquidity Or Leakage Plumbing Problems With Cryptocurrencies



March 2018

CARDANO FOUNDATION

LONG FINANCE **DISTRIBUTED FUTURES**

The Economic Impact Of Smart Ledgers On World Trade




April 2018

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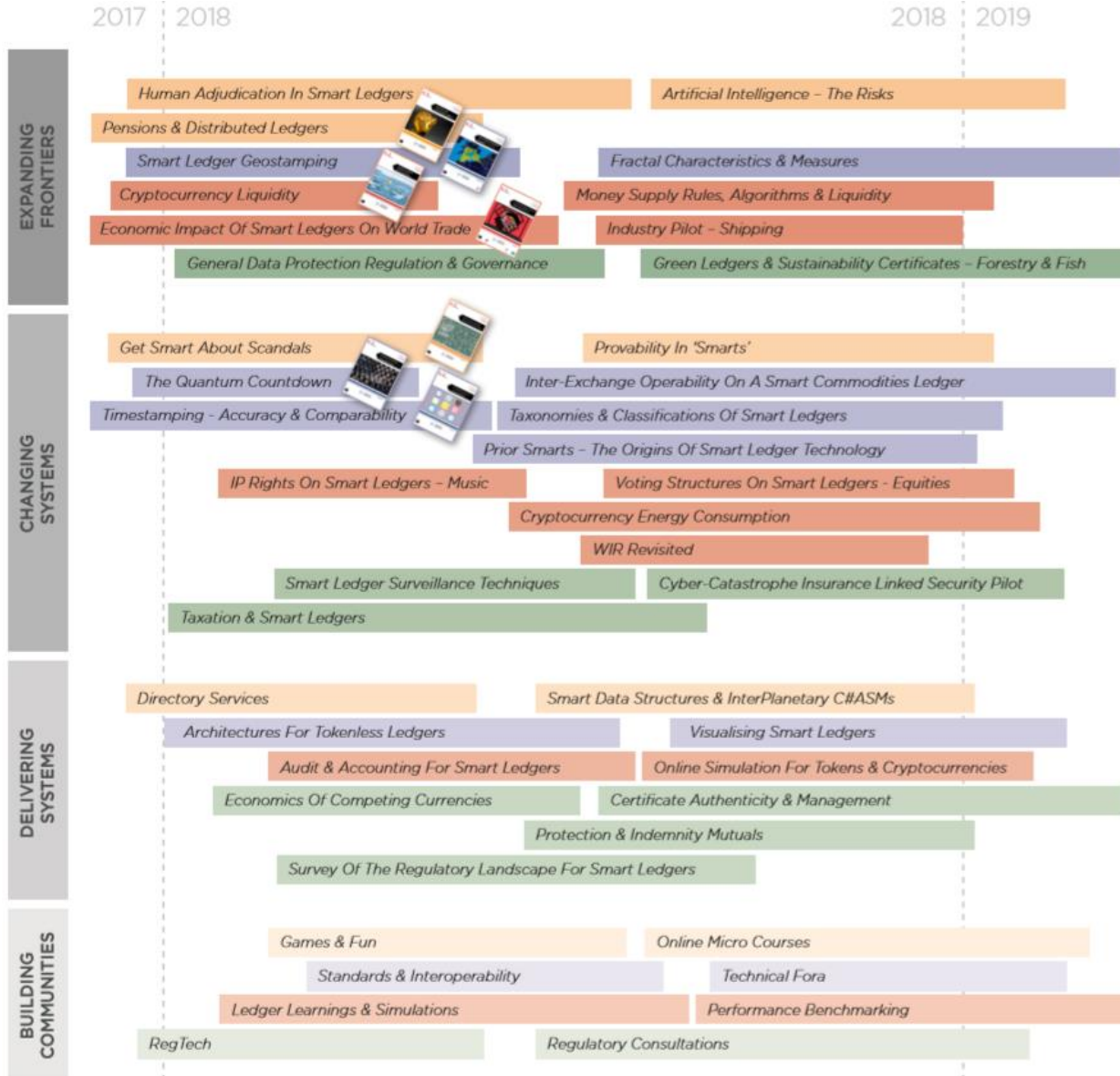
Pensions and Distributed Ledgers



April 2018

CARDANO FOUNDATION

Timeline



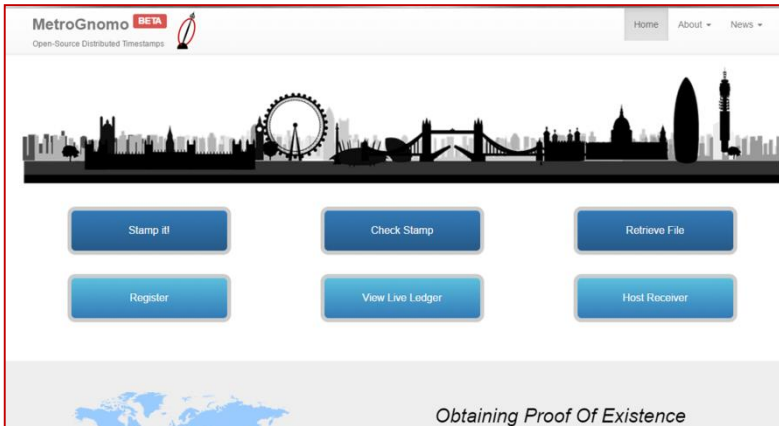
Terminology Evolving

- ◆ **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

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

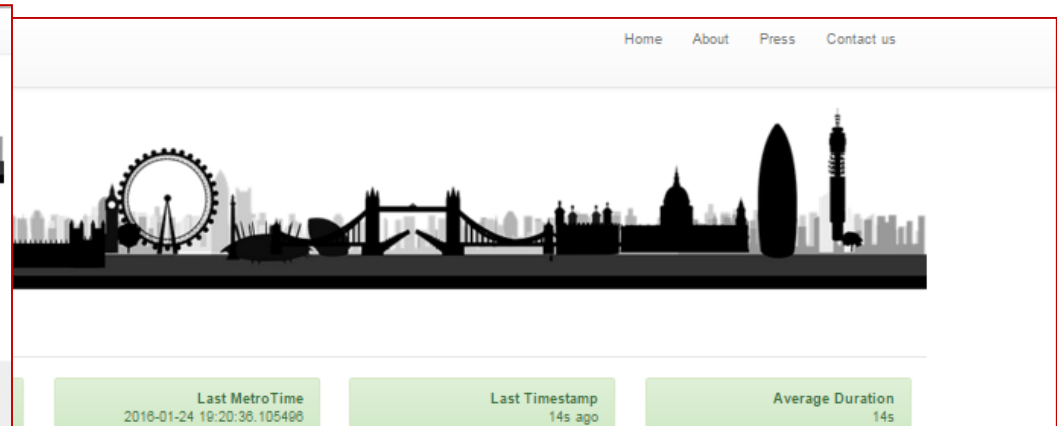



MetroGnomo BETA
Open-Source Distributed Timestamps

Home About News

Stamp it! Check Stamp Retrieve File Register View Live Ledger Host Receiver

Obtaining Proof Of Existence

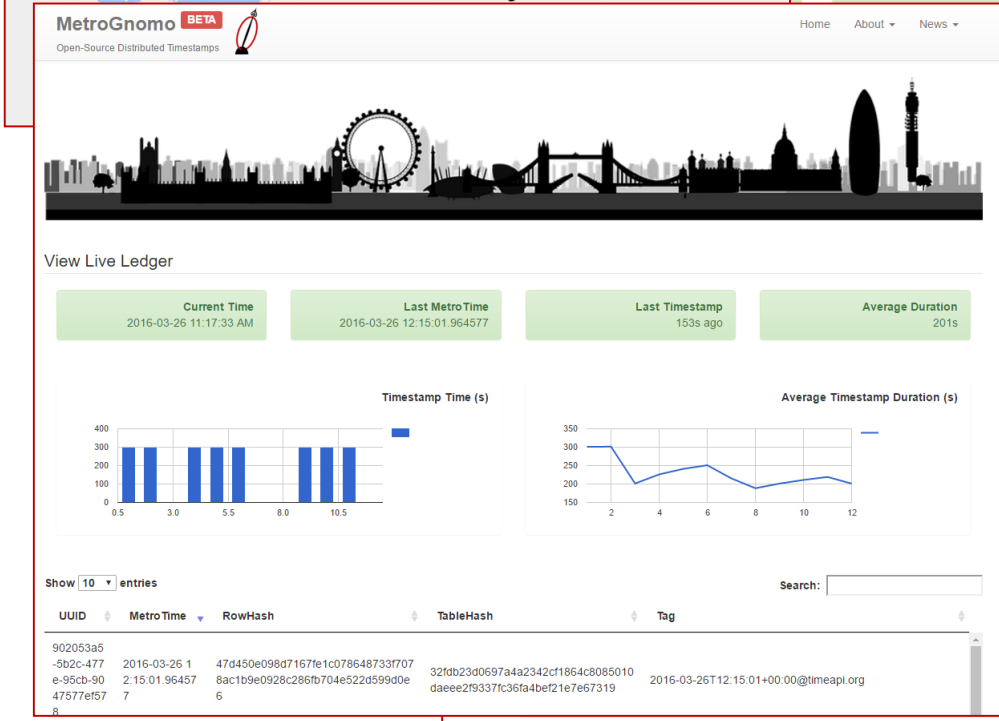


Home About Press Contact us

Last Metro Time
2016-01-24 19:20:36.105496

Last Timestamp
14s ago

Average Duration
14s



MetroGnomo BETA
Open-Source Distributed Timestamps

Home About News

View Live Ledger

Current Time
2016-03-26 11:17:33 AM

Last Metro Time
2016-03-26 12:15:01.964577

Last Timestamp
153s ago

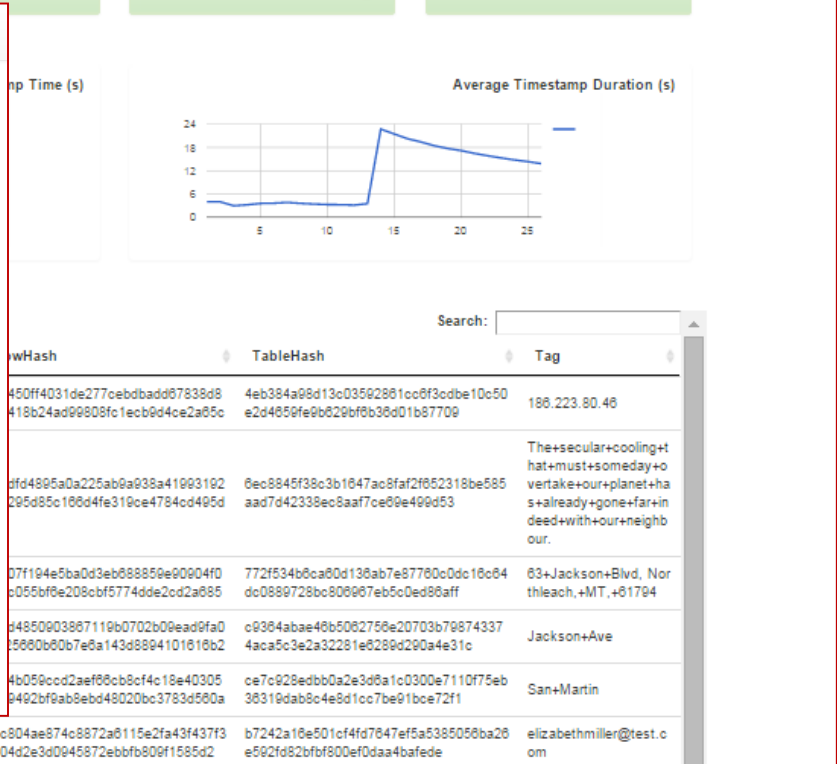
Average Duration
201s

Timestamp Time (s)

Average Timestamp Duration (s)

Show 10 entries

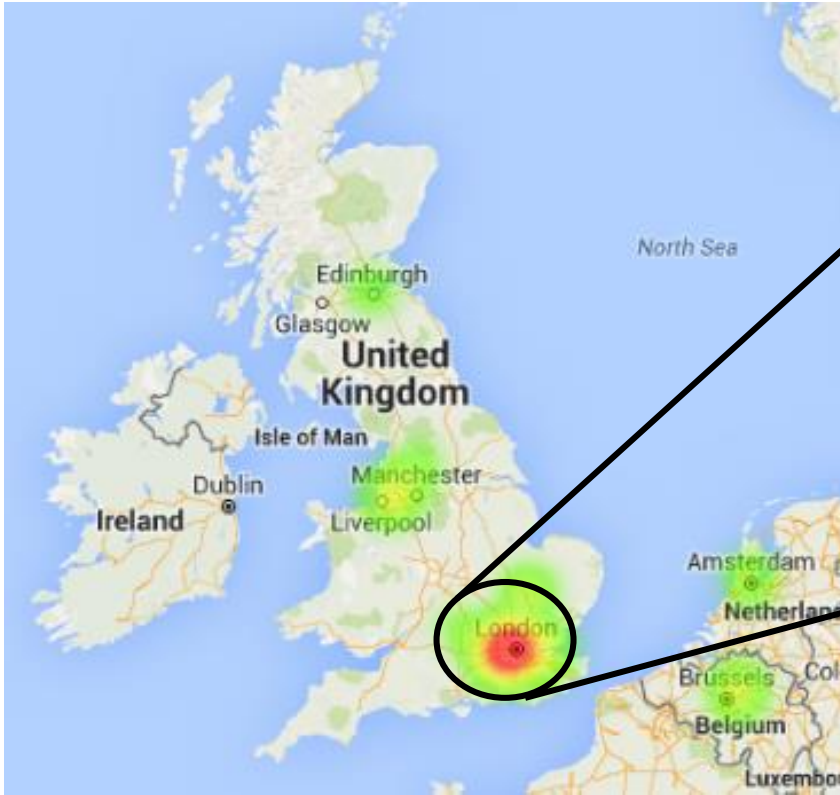
UUID	Metro Time	RowHash	TableHash	Tag
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-5b2c-477	2016-03-26 1	47d450e098d71671e1c0786487337f07	32fdb23d0697a4a2342cf1864c9085010	2016-03-26T12:15:01+00:00@tmeapi.org
e-95cb-90	2:15:01.96457	8ac1b9e0928c286fb704e522d599d0e	daee2f9337fc36fa4bef1e7e67319	
47577ef57	7	6		



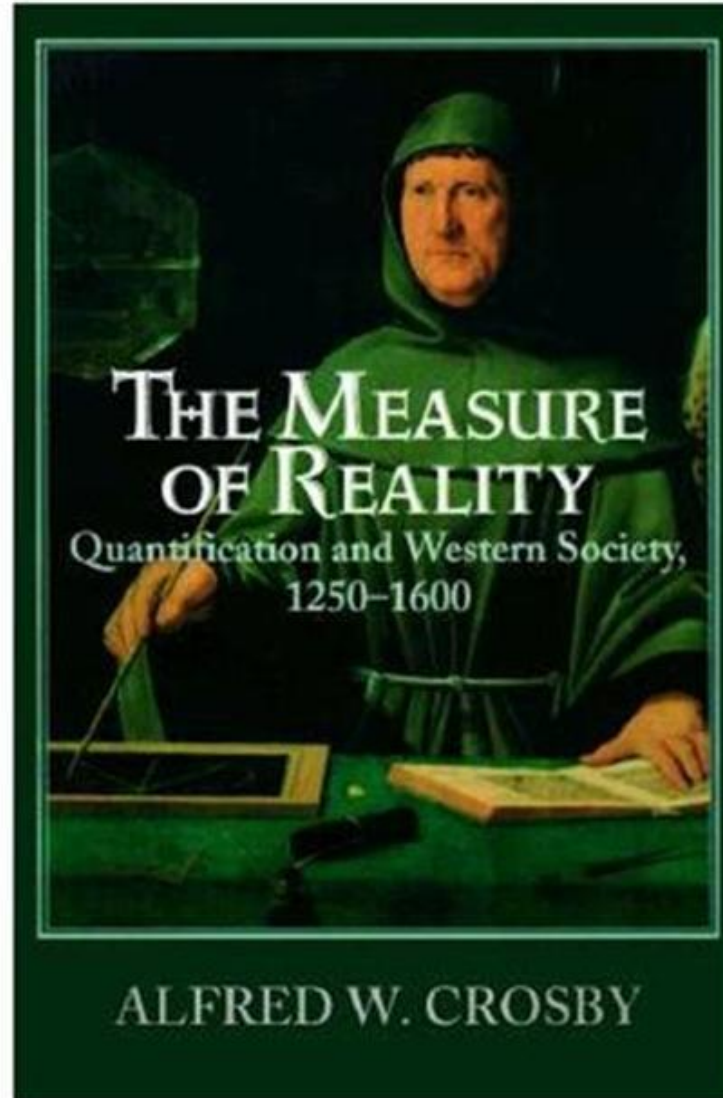
Search:

RowHash	TableHash	Tag
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df44895a0a225ab9a938a41993192 2650b00b7e6a143d8894101810b2	6ec8845f38c3b1647ac8faf2f652318be585 aad7d42338ec8aaf7ce09e490d53	The+seular+cooling+hat+must+someday+overtake+our+planet+has+alredy+gone+far+in deed+with+our+neighb our.
07f194e5ba0d3eb88859e90904f0 c055bf6e208cbf5774dde2cd2a885	772f534b6ca60d138ab7e87780c0dc16c84 dc089728bc808967eb5c0ed88aff	63+Jackson+Bldv, Northleach,+MT,+61794
64850903867119b0702b09ead9fa0 5880b00b7e6a143d8894101810b2	c9364abae46b5062756e20703b79874337 4aca5c3e2a32281e6289d290a4e31c	Jackson+Ave
4b05eccd2aef68cb8cf4c18e40305 9492bf9ab8ebd48020bc3783d580a	ce7c928eddb0a2e3d6a1c0300e7110f75eb 38319dab8c4e8d1cc7be91bce72f1	San+Martin
0185e888-4a74-49fb-8c0 c-cb55cc4f417f	2016-01-24 19:20:26.909764	
cbc804ae874c8872a6115e2fa43f437f3 d404d2e3d0945872ebfb809f1585d2	b7242a18e501cf4fd7647ef5a5385058ba28 e592fd82bfb800ef0daa4bafade	elizabethmiller@test.com

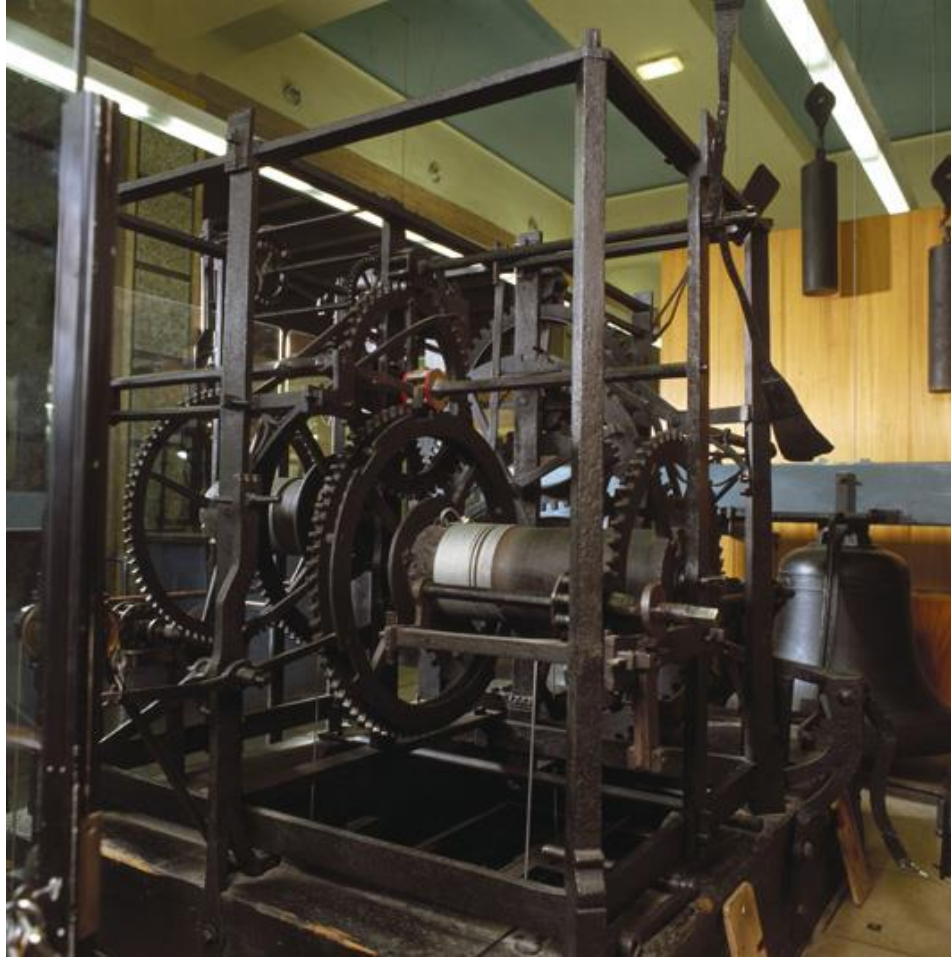
Application: Clinical Trials



Measuring Reality



Tempus Rerum Urbes



The Wells Cathedral clock, built 1392

Tempus Rerum Imperator



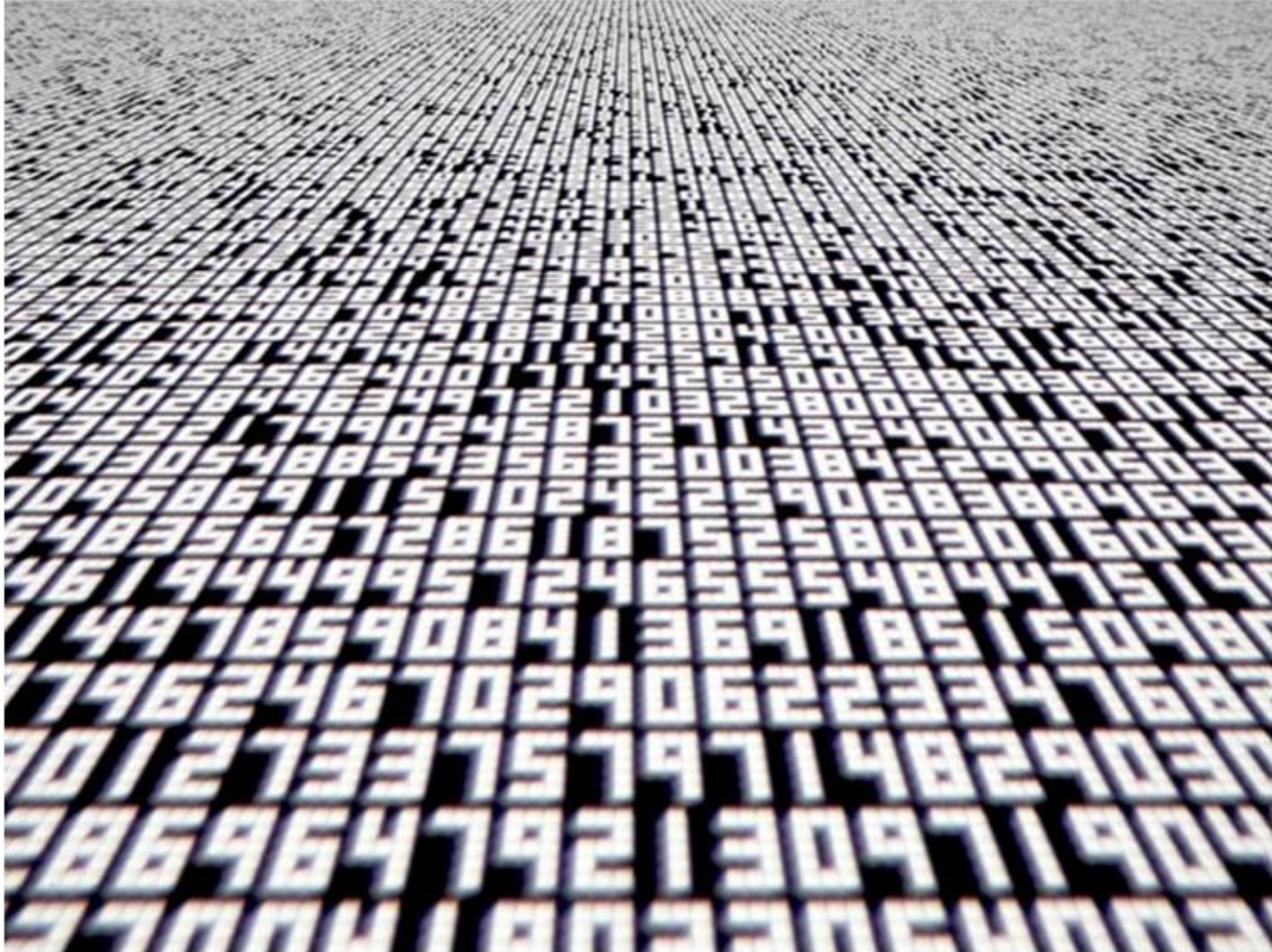
Marine Chronometer H5 by John Harrison - Clock Makers Museum, Guildhall

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}



The City Is The Data



Start the Clock



**OPEN
SOURCE
ALL THE
CITIES**

Open Source World?

Is a Global Geospatial Consciousness Possible?



Your Collective Work Will Open the World to Everyone

We Are All Bitizens Now



Report Walkthrough

Timestamping Smart Ledgers Comparable, Universal, Traceable, Immune



Sam Carter
(Author)

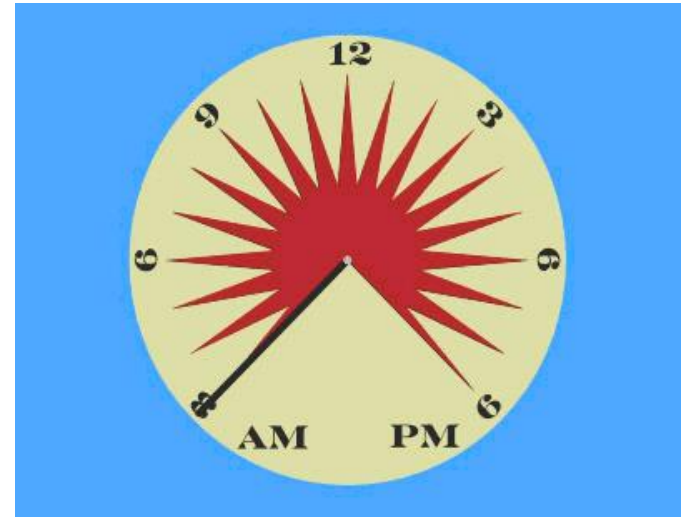
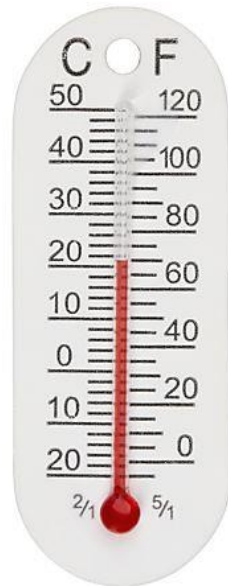
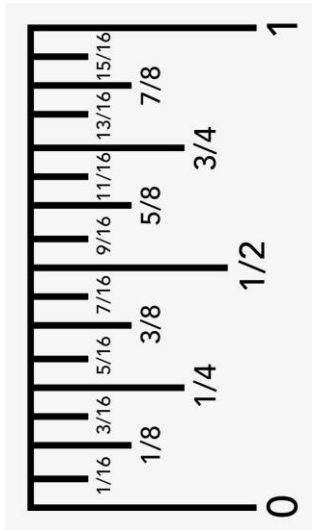
Summary

- ◆ 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:

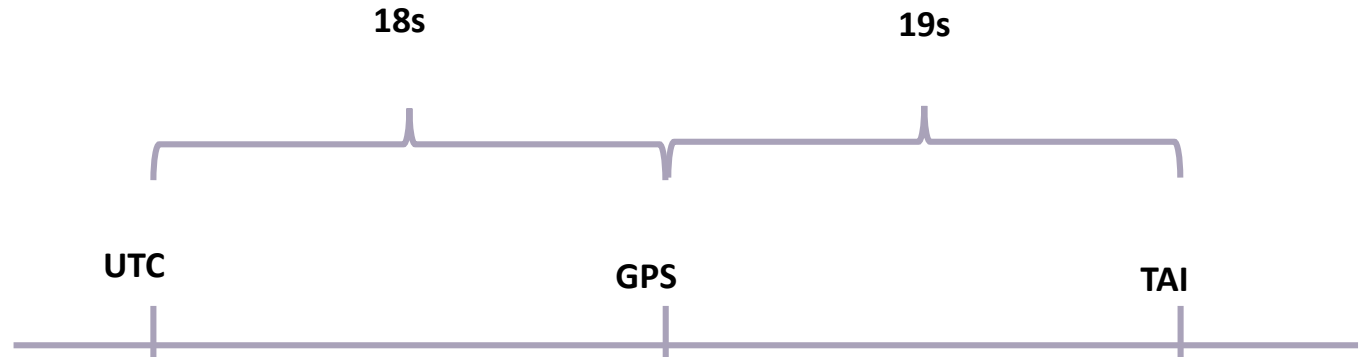
- ◆ Rail
- ◆ Mean Time



Time Keeping & Time Broadcast

Standards:

- ◆ TAI
- ◆ UTC
- ◆ GPS



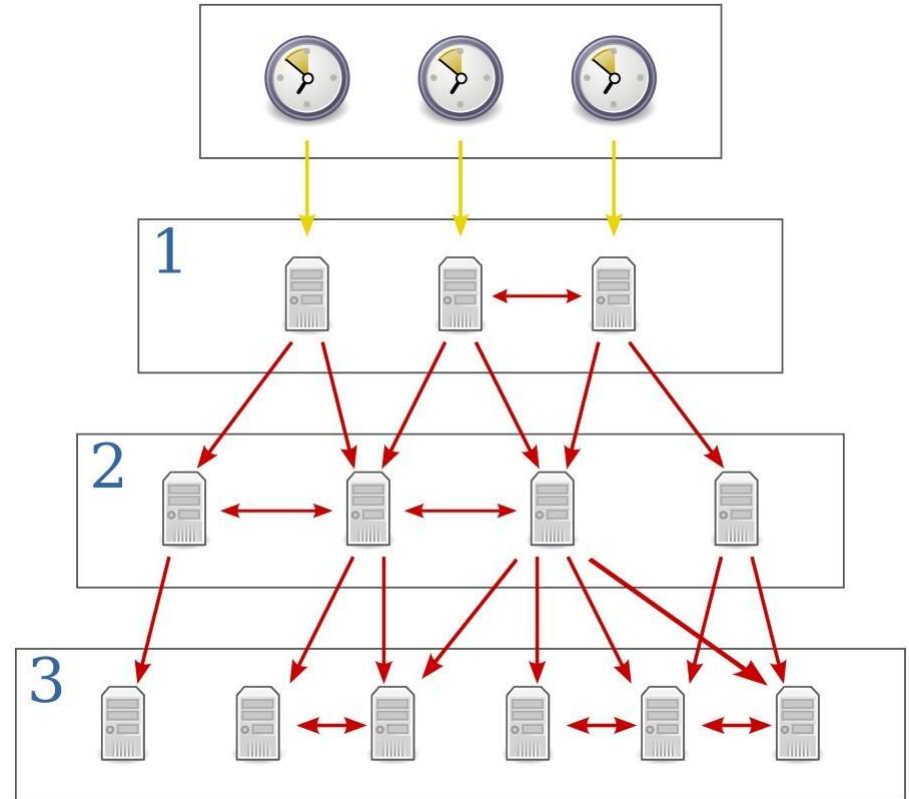
Broadcast:

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

Time Synchronisation I

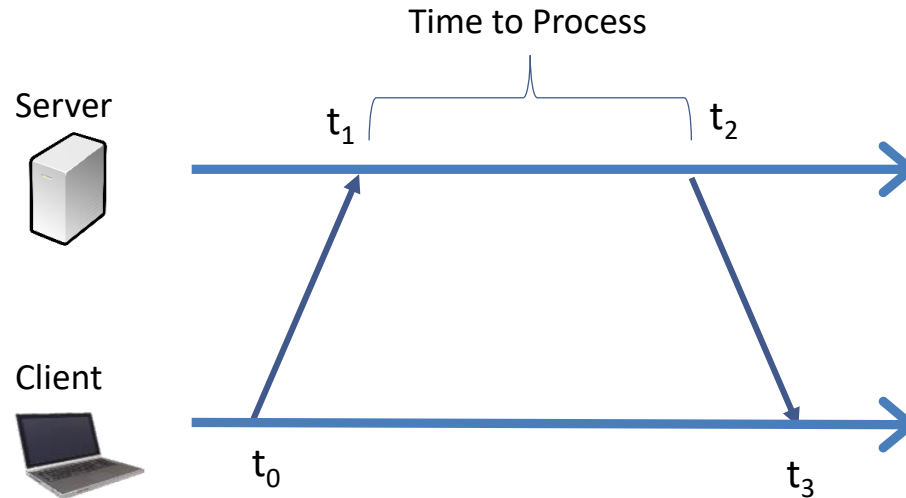
Synchronise every machine's clock:

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

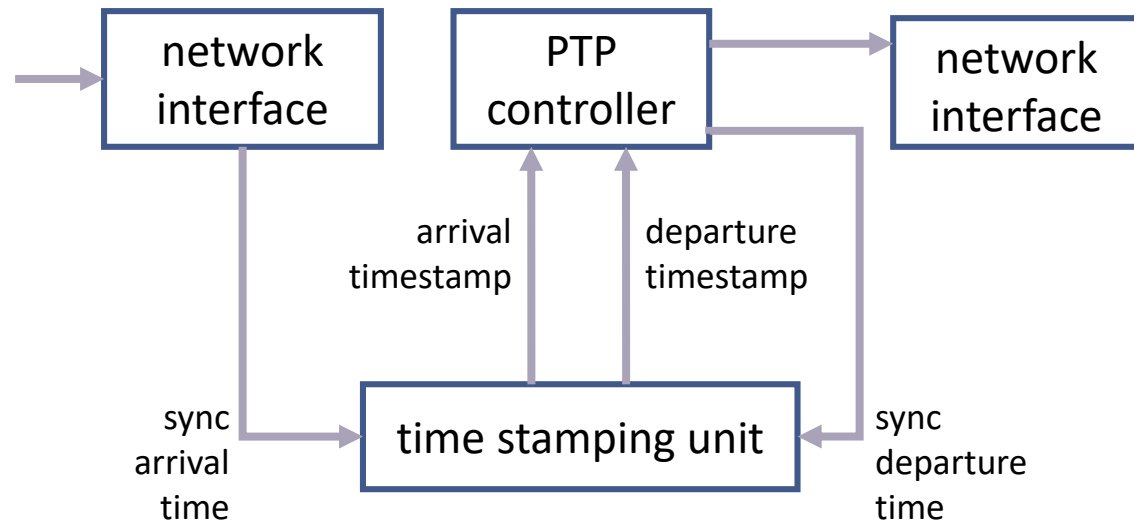


Time Synchronisation II

◆ NTP

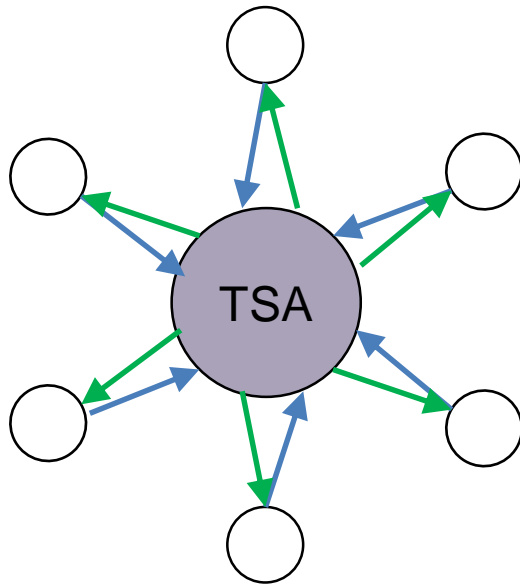


◆ PTP

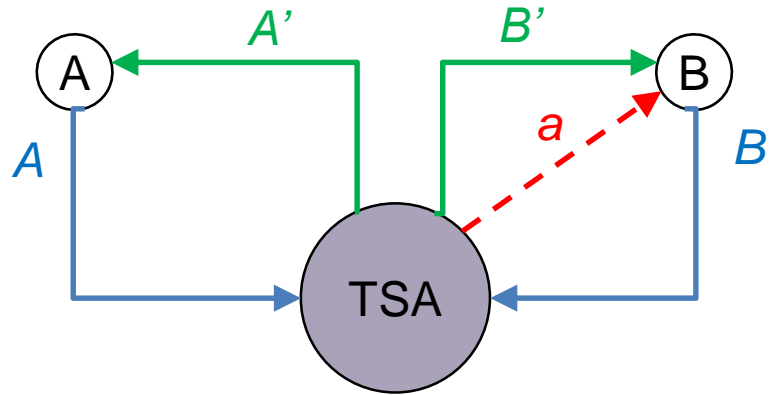


Secure Timestamping

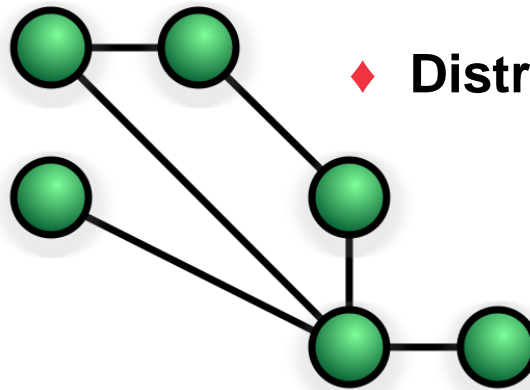
◆ Central



◆ Central Linked



◆ Distributed



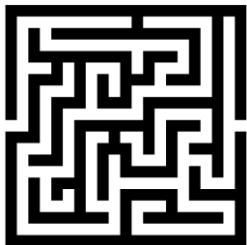
CUTI



◆ **C**omparable



◆ **U**niversal



◆ **T**raceable



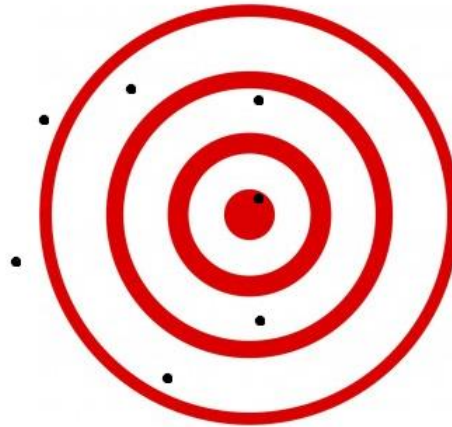
◆ **I**mmune

Precision & Accuracy

Not Precise

Precise

Not Accurate



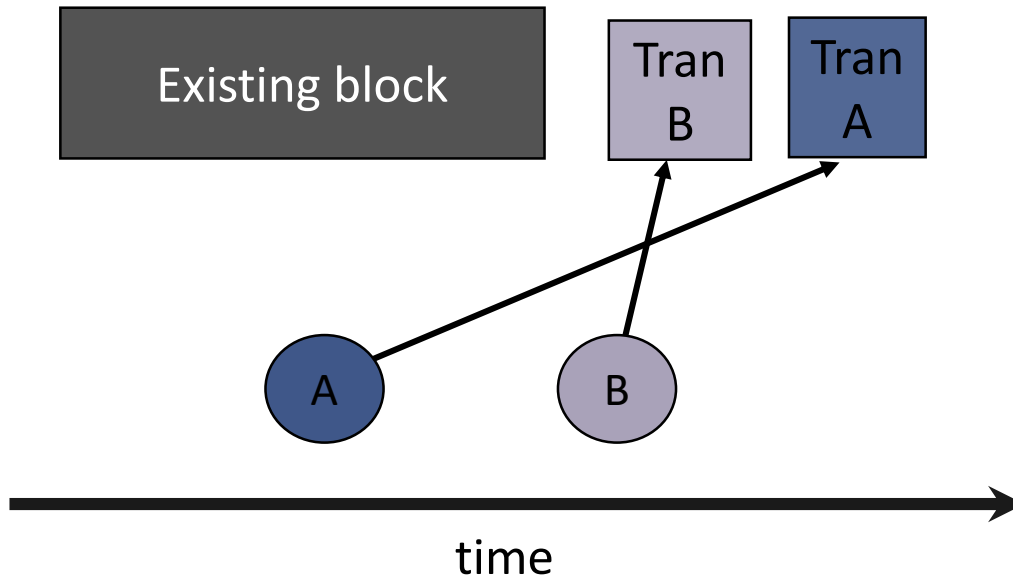
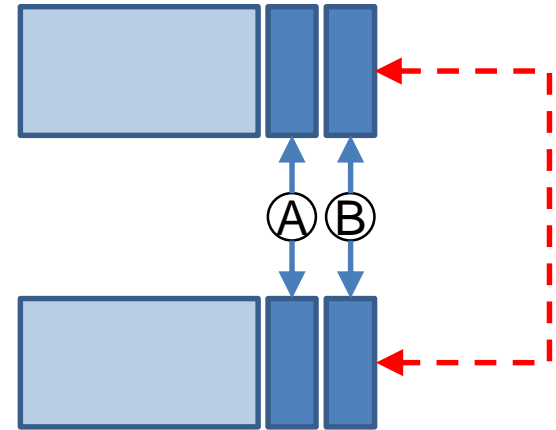
Accurate



Smart Ledgers & Timestamping

When is a Smart Contract “posted”?

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

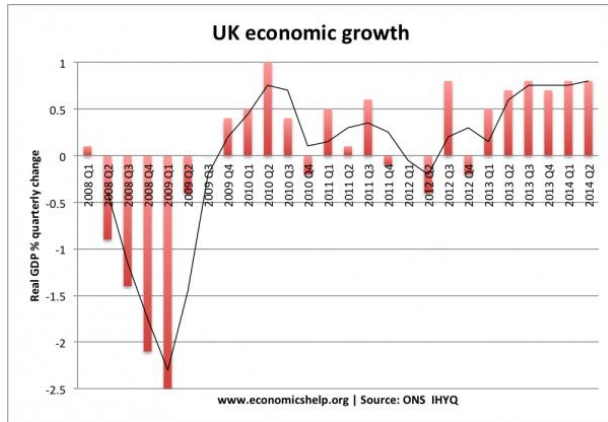


Smart Ledgers & CUTI

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.

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.

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

Smart Ledgers and Finance

3 separate spheres to consider:

- ◆ Internal Recordkeeping
- ◆ Cross-entity Reconciliation
- ◆ Trading

Timestamping Smart Ledgers

Comparable, Universal,
Traceable, Immune

Panel Discussion

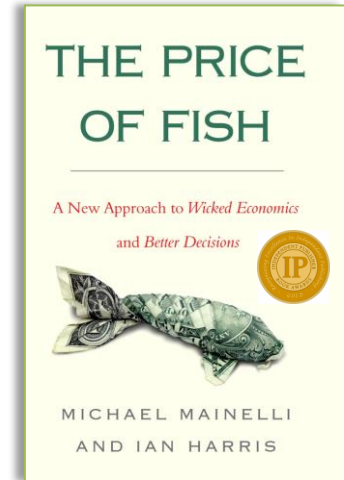
Timestamping: For Discussion

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?

When Would We Know Our Commerce Is Working?



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



Thank you!