

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

## Smart Ledgers & Collective Defined Contribution Pensions

Report Launch – Wednesday, 25 July 2018  
London

**Z/Yen Group Limited**  
41 Lothbury  
London EC2R 7HG  
United Kingdom  
tel: +44 (20) 7562-9562

<http://www.distributedfutures.net>



@LongFinance (#DistributedFutures)



# Sponsored By



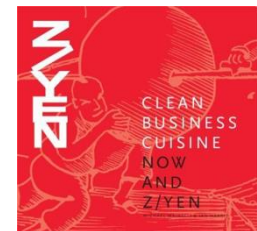
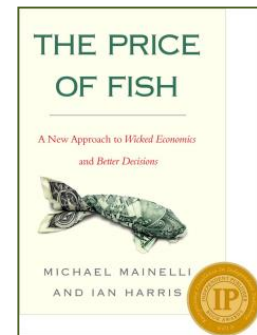
The Z/zen Group

# Agenda

- 08:45 - 09:00    **Registration**
- 09:00 - 09:20    **Welcome, Introduction & Background**  
*Professor Michael Mainelli, Executive Chairman,  
Z/Yen Group*
- 09:20 - 10:20    **Report Walkthrough**  
*Dr Con Keating, Associate Professor Iain Clacher,  
and Dr David McKee*
- 10:20 - 10:40    **Panel Discussion, Questions & Answers**
- 10:40            **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



We work in partnership with many stakeholders to learn together and build the vital infrastructure needed to make Smart Ledgers a success.

Our research is structured around four themes:

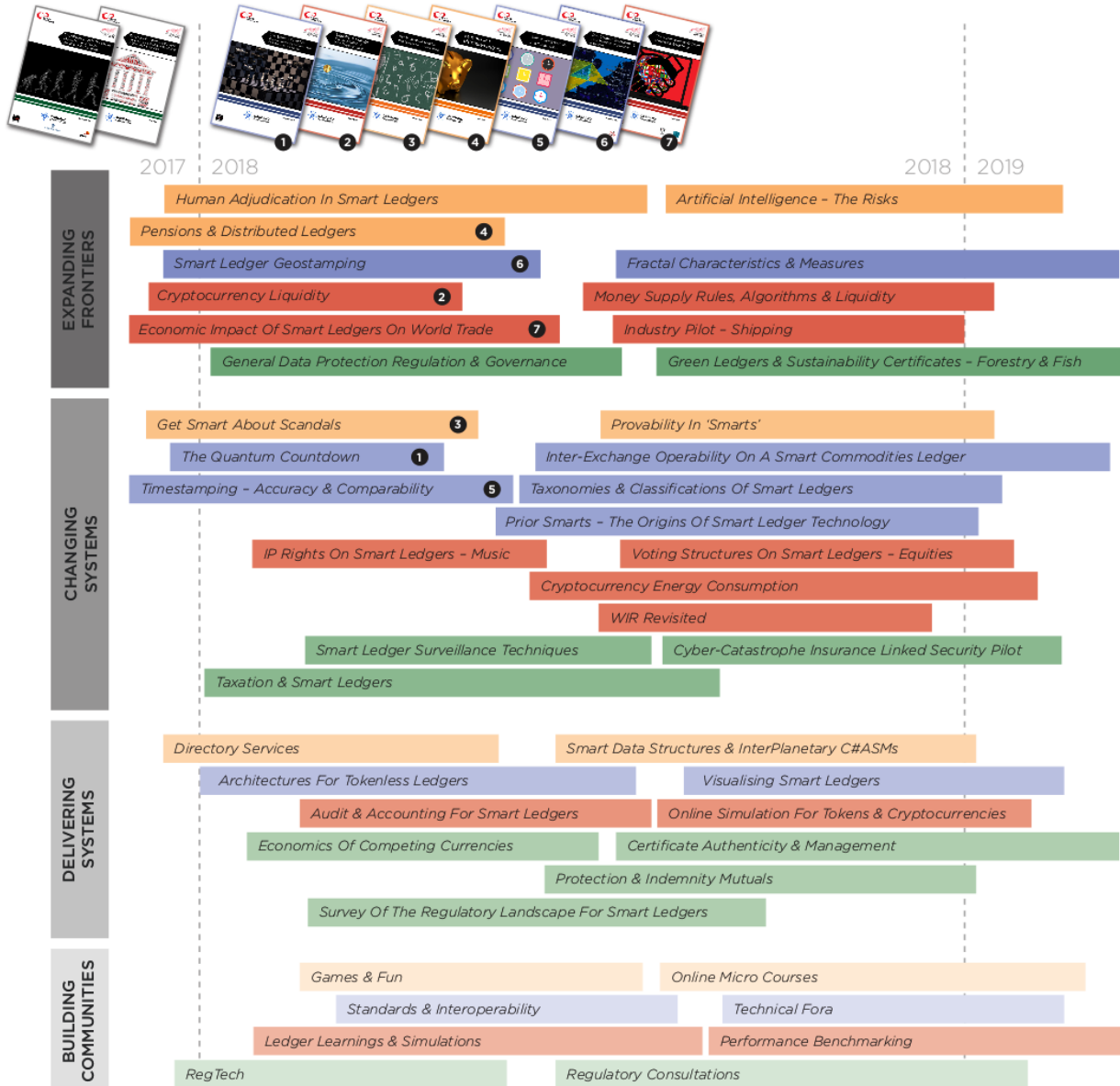
- ◆ Society
- ◆ Technology
- ◆ Economics
- ◆ Politics

And is directed at four outcomes:


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

[www.distributedfutures.net](http://www.distributedfutures.net)

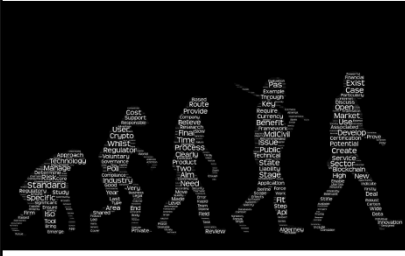
# Timeline




# Distributed Futures Research




**LONG FINANCE** 


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




November 2016

 **CARDANO FOUNDATION**


  


**LONG FINANCE** 


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




July 2016

 **CARDANO FOUNDATION**






**LONG FINANCE** 


**Smart Ledger Geostamping  
Steps Towards Interoperability  
& Standards**




December 2017

 **CARDANO FOUNDATION**


 


**LONG FINANCE** 


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




February 2018

 **CARDANO FOUNDATION**





**LONG FINANCE** 


**Get Smart About Scandals  
Past Lessons For Future Finance**




March 2018

 **CARDANO FOUNDATION**





**LONG FINANCE** 

**Liquidity Or Leakage  
Plumbing Problems  
With Cryptocurrencies**



March 2018

 **CARDANO FOUNDATION**



**LONG FINANCE** 


**The Economic Impact Of Smart  
Ledgers On World Trade**



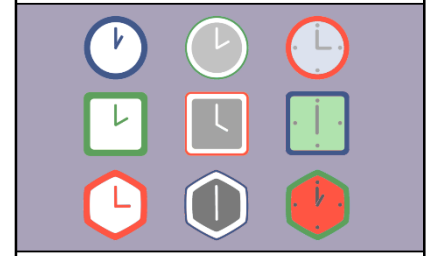
April 2018

 **CARDANO FOUNDATION**


   



**LONG FINANCE** 

**Timestamping Smart Ledgers  
Comparable, Universal, Traceable, Immune**



May 2018

 **CARDANO FOUNDATION**

# Terminology Evolving

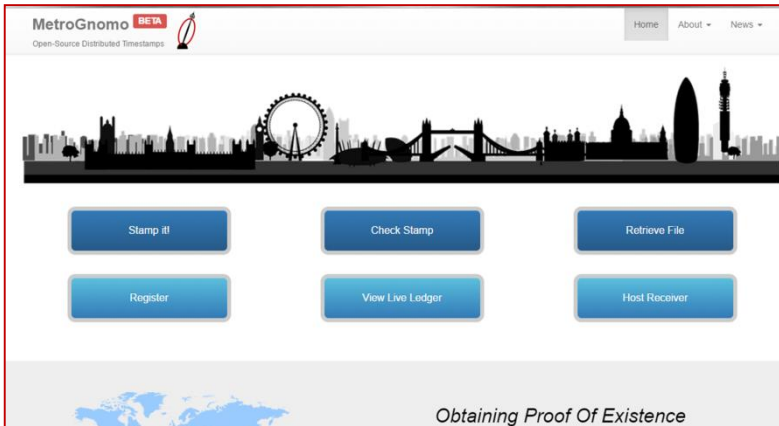
- ◆ **ledger** – a record of transactions
- ◆ **distributed** – divided among several or many, in multiple locations
- ◆ **mutual** – shared in common, or owned by a community
- ◆ **mutual distributed ledger (MDL)** - a record of transactions shared in common and stored in multiple locations
- ◆ **mutual 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

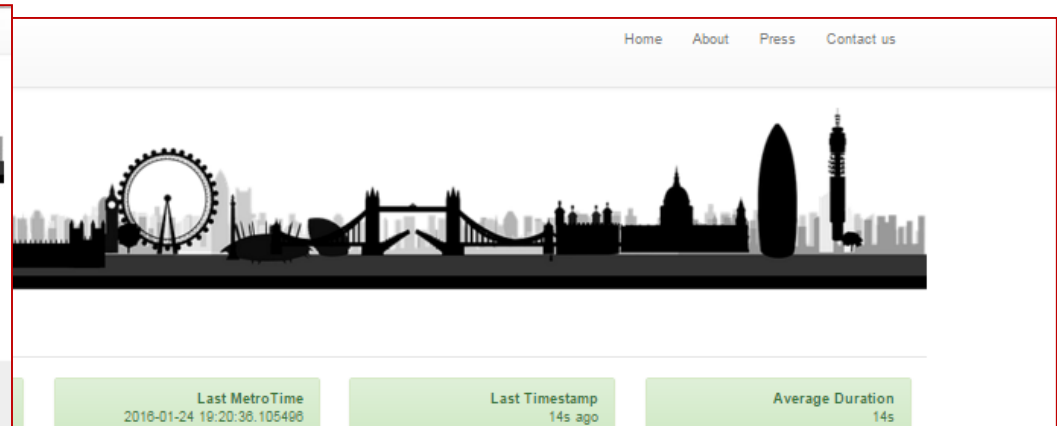



MetroGnomo BETA  
Open-Source Distributed Timestamps

Home About News

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

Obtaining Proof Of Existence

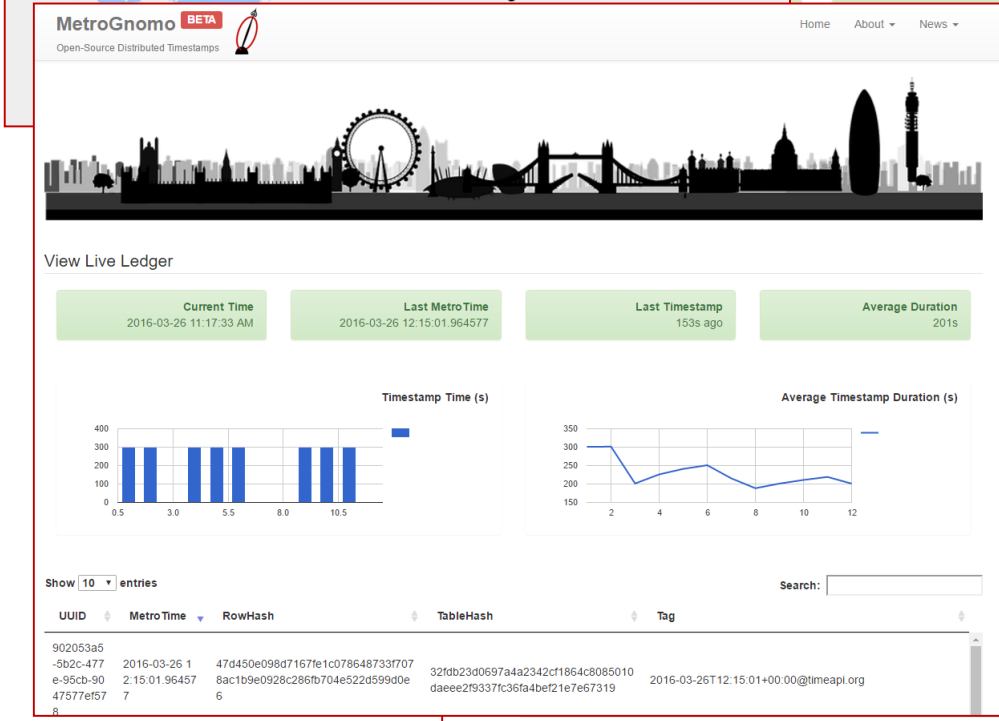


Home About Press Contact us

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

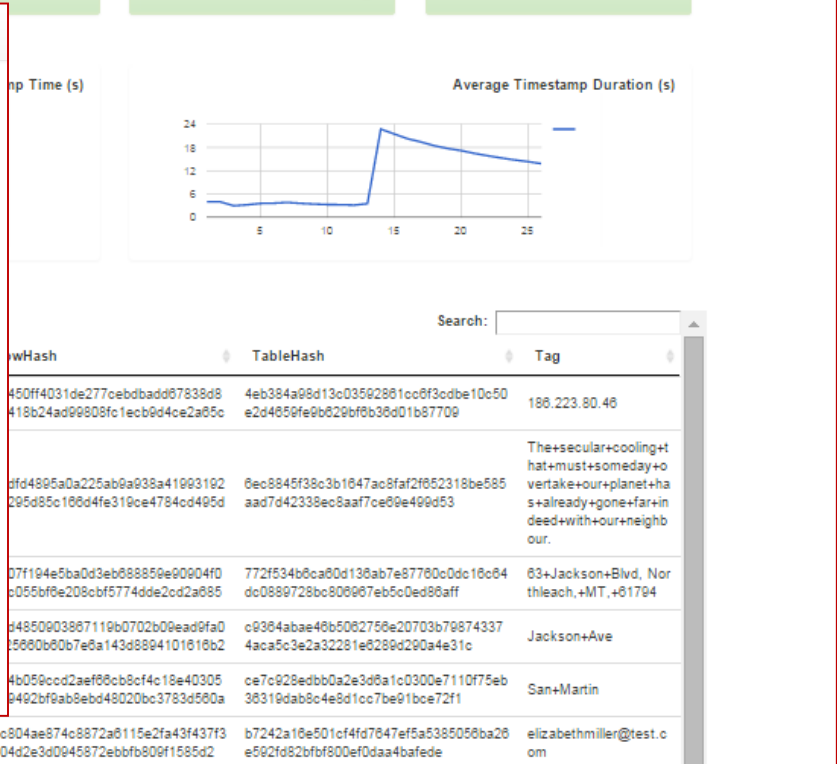
Average Duration  
201s

Timestamp Time (s)

Average Timestamp Duration (s)

Show 10 entries

UUID	Metro Time	RowHash	TableHash	Tag
902053a5				
-5b2c-477	2016-03-26 1	47d450e098d71671e1c078648733707	32fdb23d0697a4a2342cf1864c9085010	2016-03-26T12:15:01+00:00@timeapp.org
e-95cb-90	2:15:01.96457	8ac1b9e0928c286fb704e522d599d0e	daee2f9337fc36fa4bef1e7e67319	
47577ef57	7	6		



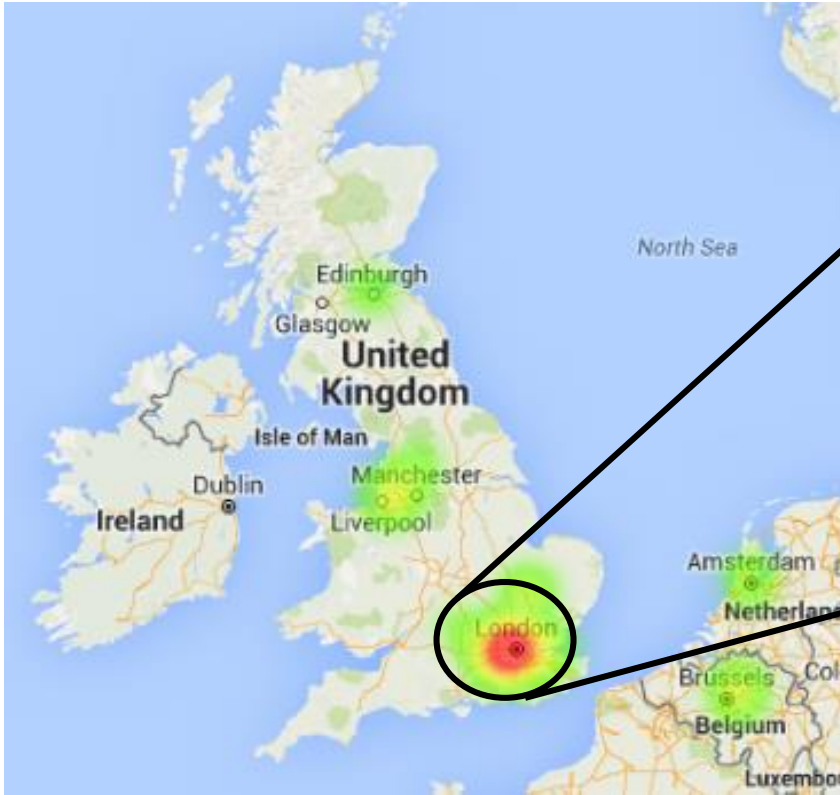
Stamp Time (s)

Average Timestamp Duration (s)

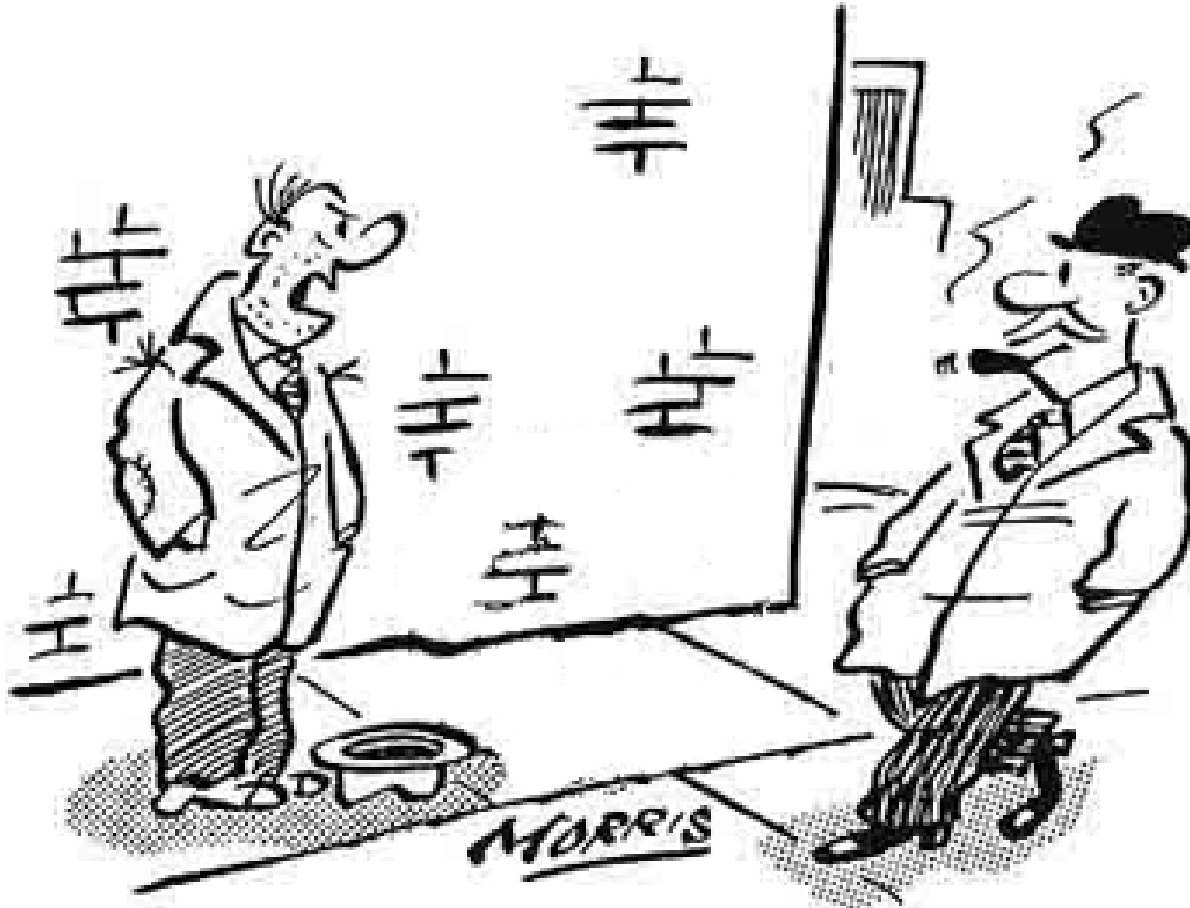
Search:

RowHash	TableHash	Tag
450ff4031de277cebdabdd67838d8 418b24ad998093fc1ecb9d4ce2a85c	4eb384a98d13c03592881cc0f3cdbe10c50 e2d4659fe9b629bfb36d01b97709	186.223.80.46
df44895a0a225ab9a938a41993192 2650b00b7e6a143d8894101810b2	6ec8845f38c3b1647ac8faf2f652318be585 aad7d42338ec8aaf7ce09e490d53	The+seular+cooling+hat+must+someday+overtake+our+planet+has+alredy+gone+far+in+deed+with+our+neighbour.
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



# Not Funny?




"Well, if it isn't the chap who sold me my personal pension!"

# Long Finance & Pensions

**LONG FINANCE**

**A Primer On The Risk Structure And Contractual Accrual Rate Of DB Pensions**



Prepared by: Iain Clacher, Con Keating, and Anna Tibba


UNIVERSITY OF LEEDS

EFAS THE EUROPEAN FEDERATION OF FINANCIAL ANALYSTS SOCIETIES

Newcastle University

**LONG FINANCE**

**Security and Sustainability in Defined Benefit Pension Schemes**  
A Response to The Department of Work and Pensions Consultation



Prepared by: Iain Clacher, Con Keating, and Andrew Slater

UNIVERSITY OF LEEDS


EFAS THE EUROPEAN FEDERATION OF FINANCIAL ANALYSTS SOCIETIES

May 2017

**LONG FINANCE**

**Keep your lid on:**  
A financial analyst's view of the cost and valuation of DB pension provision

Con Keating  
Ole Settergren  
Andrew Slater



FINANCE SHORT 4-2013

EFAS THE EUROPEAN FEDERATION OF FINANCIAL ANALYSTS SOCIETIES

**LONG FINANCE**

**Don't stop believing:**  
The state and future of UK occupational pensions

Con Keating

FINANCE SHORT 3-2011



EFAS THE EUROPEAN FEDERATION OF FINANCIAL ANALYSTS SOCIETIES

**LONG FINANCE**

**Don't stop thinking about tomorrow:**  
*The future of pensions*

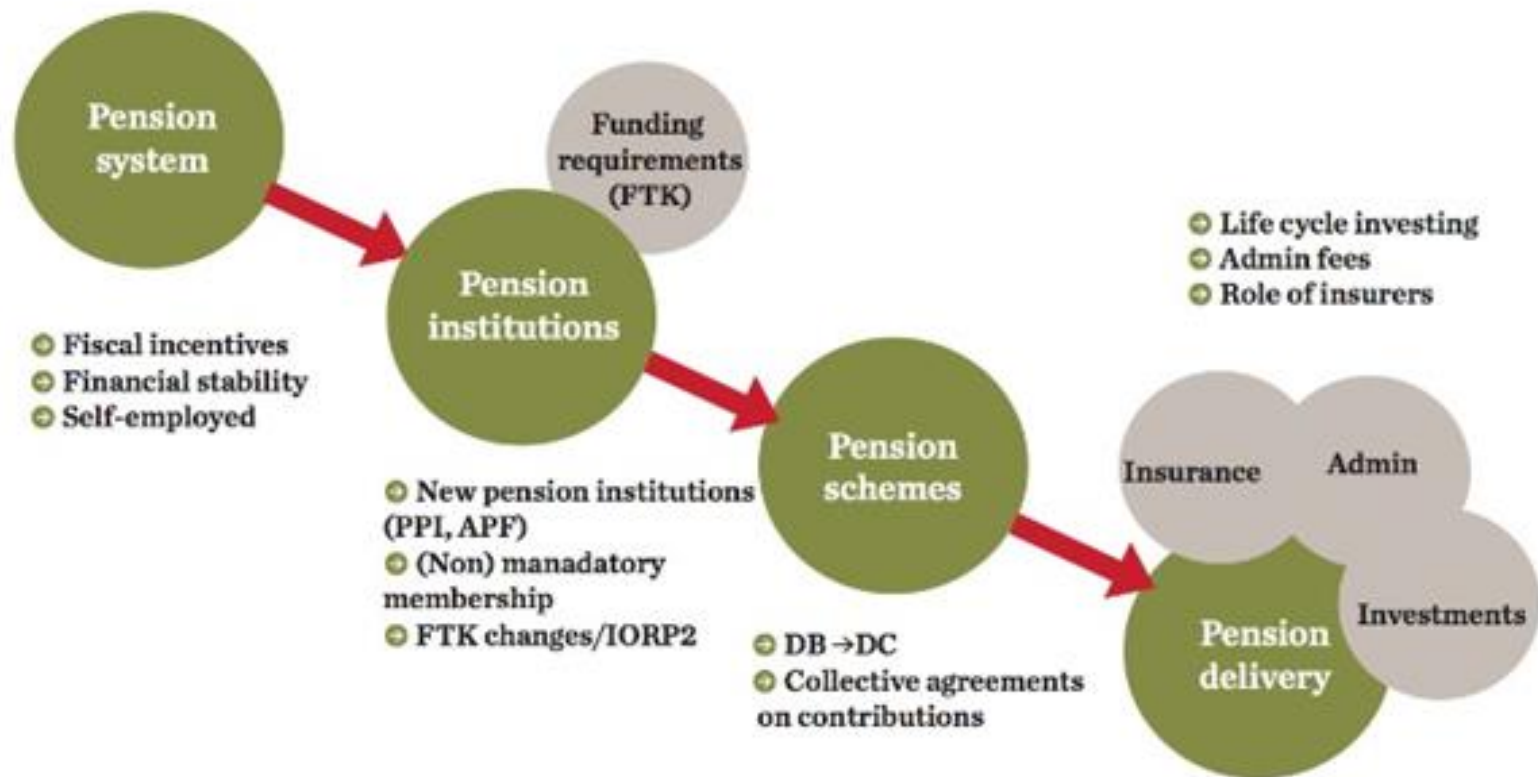
Con Keating

FINANCE SHORT 2-02020



# Dutch Courage

## National Pensions Dialogue: fundamental changes under way in four distinct areas



Source: Robeco

# Report Walkthrough

## Smart Ledgers & Collective Defined Contribution Pensions



**Iain Clacher**



**Con Keating**



**David McKee**

# Collective Defined Contribution Pensions

- ◆ These are collective schemes which offer, but do not guarantee, targeted pensions.
- ◆ Pensions may be cut.
- ◆ DC “pensions” are simply savings schemes, with an income conversion issue at retirement.
- ◆ CDC schemes resolve this problem by indicating the retirement income equivalence of the capital sum accrued – they complete the DC offering.
- ◆ The terms on which pensions are awarded are set annually by trustees. For each award there is an implicit investment return on the contribution made. (Contractual Accrual Rate - CAR).
- ◆ The contribution and the scheme CAR determine a member’s equitable interest in the scheme, and most importantly the scheme’s fund.
- ◆ Equitable interest is a pseudo-liability. This is a division of the fund agreed among members.
- ◆ Members may transfer at any time at the NAV of their equitable interest.
- ◆ The scheme is DC – there is no recourse to any sponsor. The fund is all there is.



# Sustainability and Management

- ◆ To be sustainable over time, a scheme must be and operate equitably among all members.
- ◆ This eliminates the possibility of intergenerational inequity.
- ◆ Scheme rules can ensure this – they can be encoded as smart contracts.
- ◆ In essence, smart ledgers reduce these key issues to matters of administration, rather than trustee discretions.
- ◆ The rules encompass both risk-pooling and risk-sharing.
- ◆ These rules admit longer investment horizons – no member is faced by the at retirement de-risking of DC – and higher total returns.
- ◆ The member has the option to transfer out, and to manage their pension pot in drawdown.
- ◆ Many other countries have forms of pension where benefits may be cut – all have significant design flaws.

# Risk -Sharing

- ◆ Risk-sharing among members substitutes for the buffers and capital adequacy requirements of other financial institutions.
- ◆ The decision criterion is the solvency ratio – assets relative to total equitable interests.
- ◆ If the scheme finds itself in deficit, then a support mechanism is applied.
- ◆ This is a self equilibrating system.
- ◆ If deficits arise because the trustees were over-optimistic in their awards, the rules system will cut these back to that which has been achieved.
- ◆ If pensions in excess of those just by the level of funding are paid, and a rule determines the extent and duration to which those excess payments are permitted, then the equitable interests of all non-pensioner members are increased to maintain equitable balance.
- ◆ With these rules automated, member confidence and trust in CDC pensions should follow.
- ◆ Members may see in near real time both the net asset value and the pension income equivalent of their equitable interest.

# Data Requirements

- ◆ Usual static data requirements for members – age, pensionable salary, marital status...
- ◆ Assumptions used by trustees in setting contributions. Longevity, Indexation...
- ◆ Contribution and CAR awards histories. A form of individual “pot” – a member’s equitable interest - though part of a collective enterprise.
- ◆ Pension fund, with a scheme specific mandate – a target return on average – where the average is determined by the extent of risk-sharing utilisation.
- ◆ Operations of the risk-sharing rules over time.
- ◆ Administration requirement – for the receipt of contributions, payment of pensions and operations of the risk-sharing rules.

# Smart Ledgers for CDC

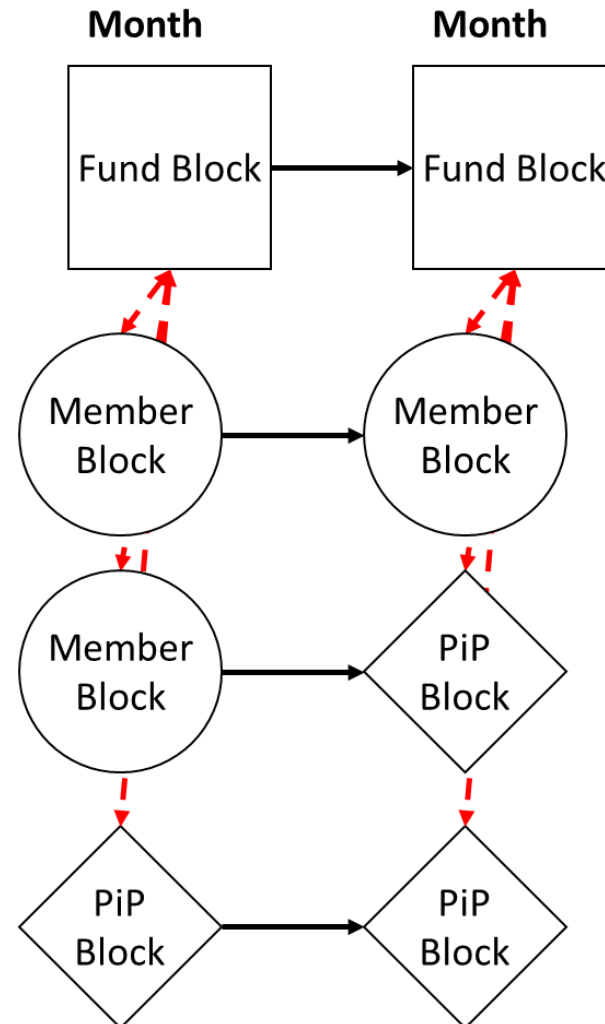
Assuming the existence a Smart Ledger platform

## **Key considerations:**

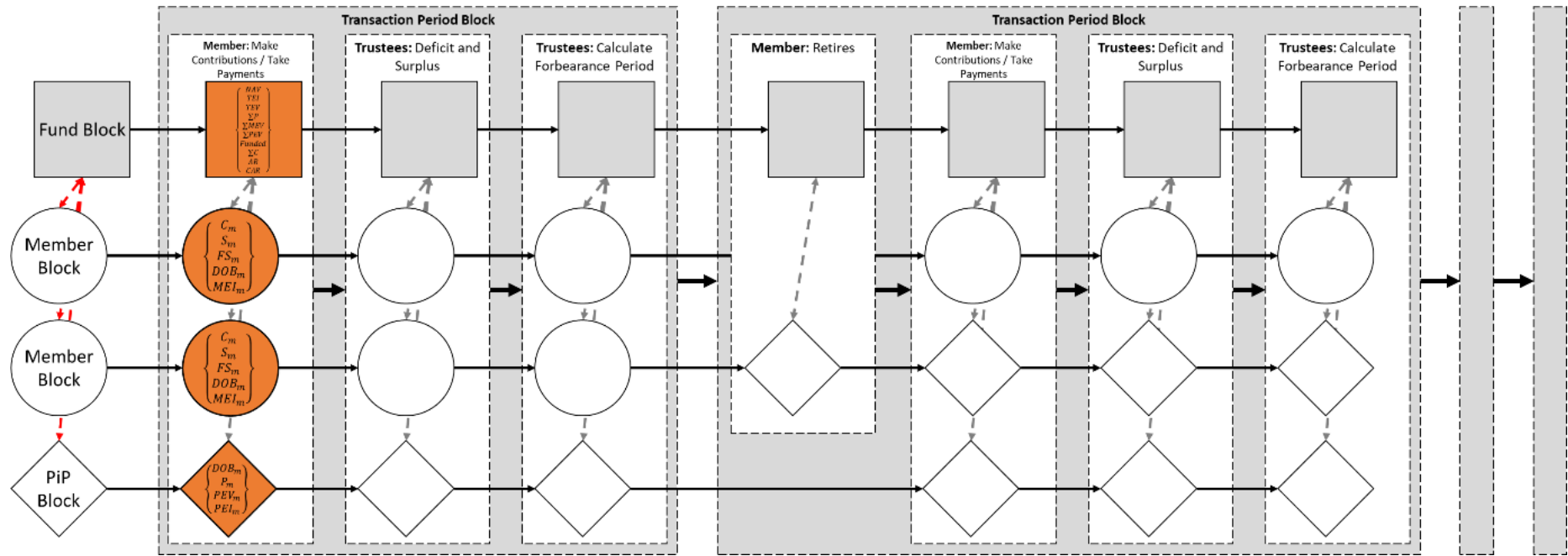
- ◆ Multi-chain structure
- ◆ Strongly permissioned system
- ◆ Managed through Smart Contracts

# Multi-Chain Structure - Overview

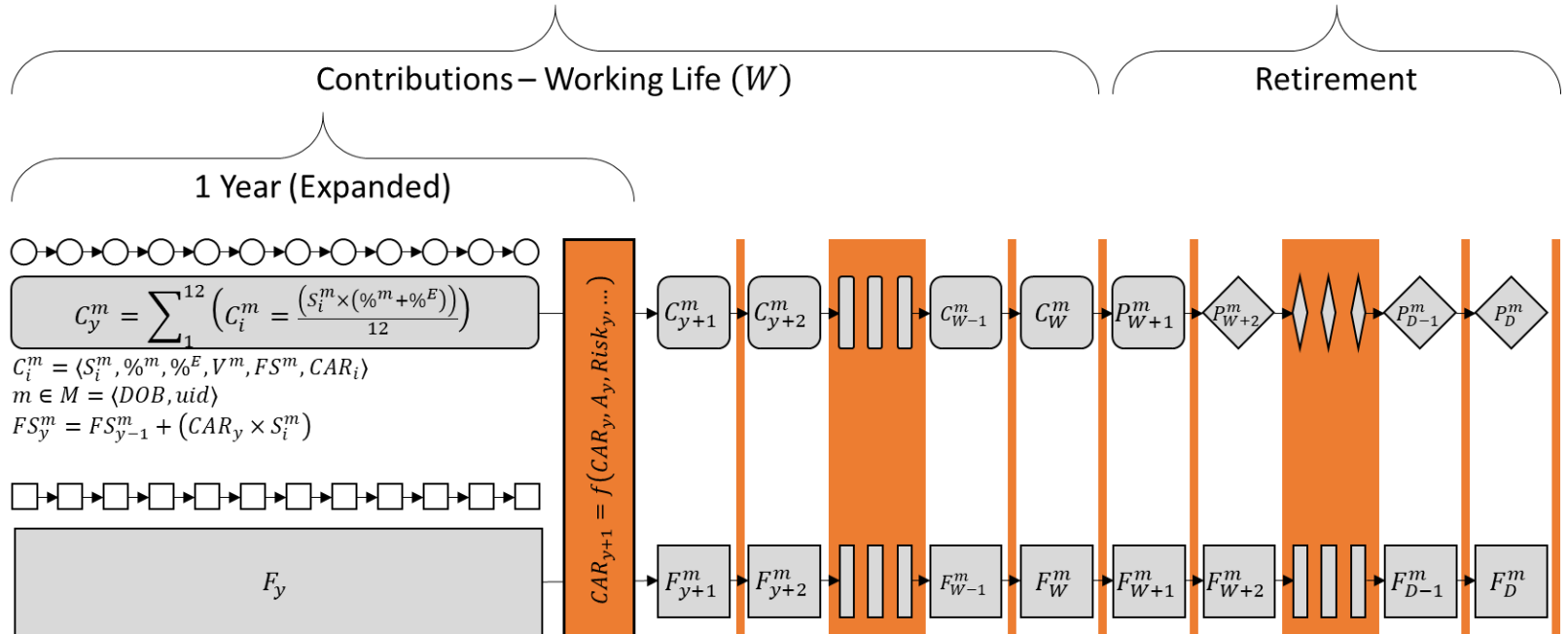
- ◆ Chain types
- ◆ Fund
- ◆ Members
  - Active
  - Deferred
  - In-payment



# Multi-Chain Structure - Detail

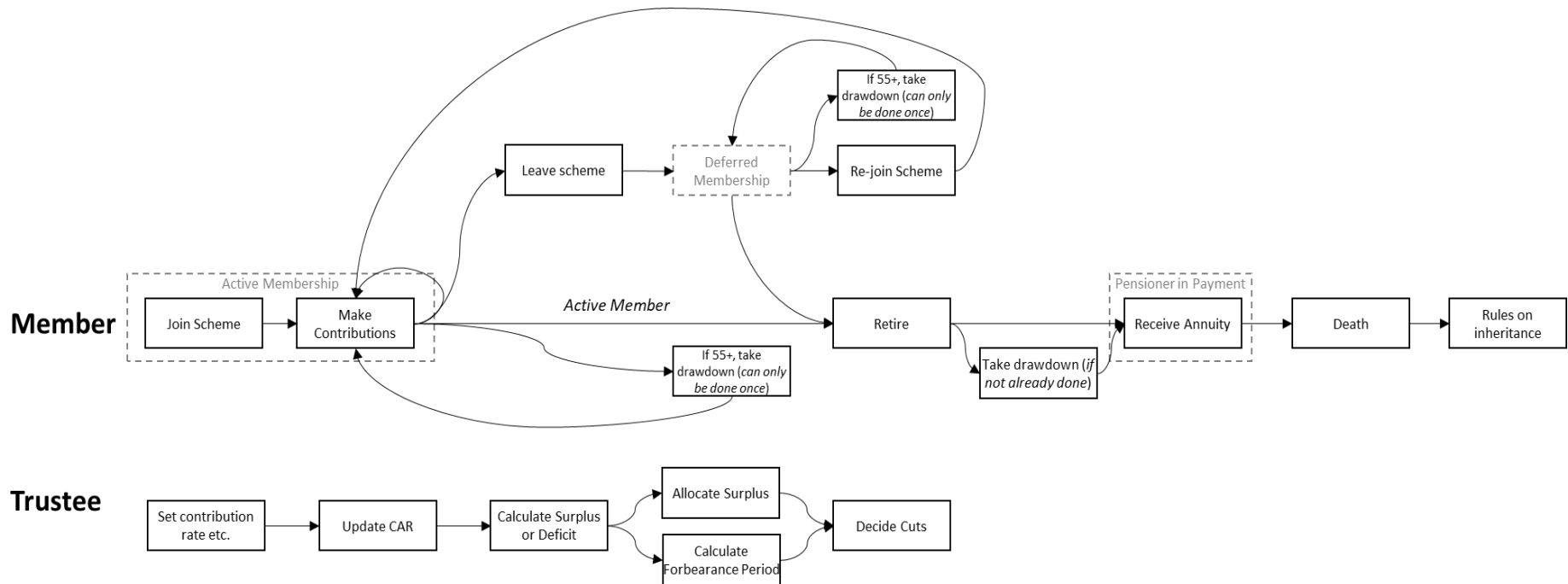


# Single Member Chain



# Automated Process Flow

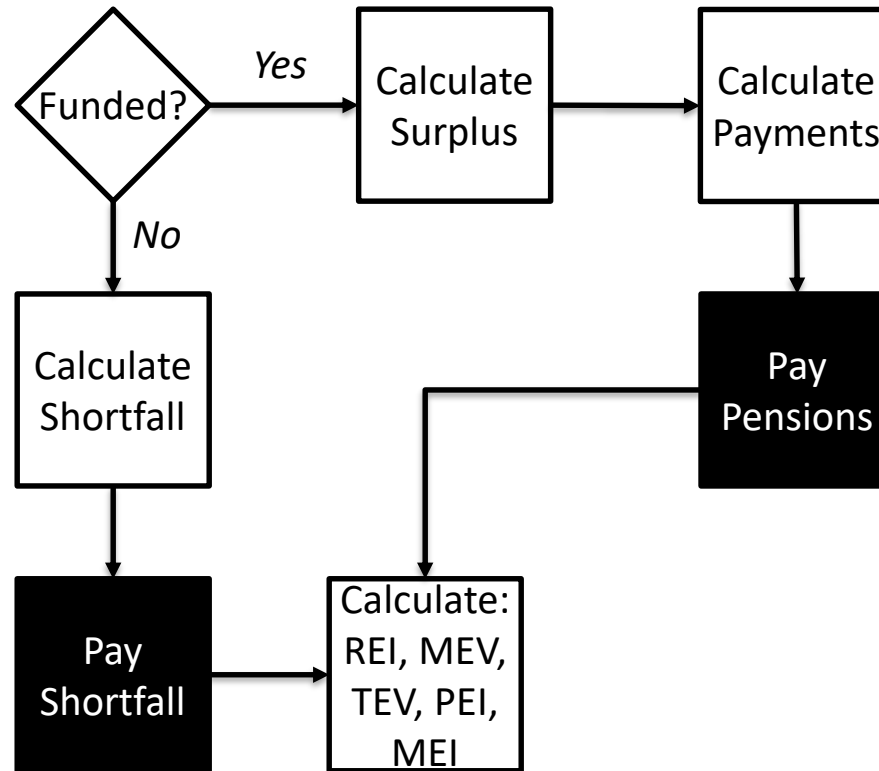
Steps can then be automated using Smart Contracts





# Example Smart Contract

## Deficit & Surplus Calculation



# Conclusions - CDC

- ◆ Member mutual collective
- ◆ Embed the contractual accrual rate
- ◆ Target retirement outcome
- ◆ Scheme members have an equitable interest in the scheme
- ◆ Members are accountable to each other and pensions are 'best efforts' endeavours

# Conclusions - Smart Ledgers

- ◆ Administration over the very long-term
- ◆ Governance and transparency
- ◆ Adjustment rules
- ◆ Embed risk pooling and risk sharing
- ◆ ‘Dashboards’

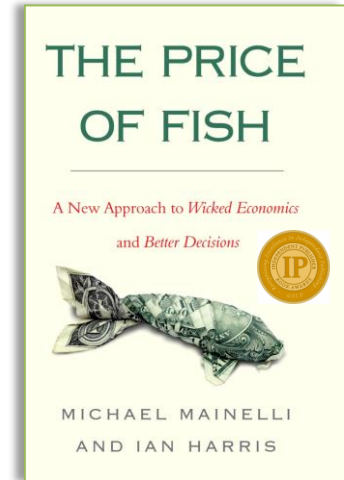
# **Smart Ledgers & Collective Defined Contribution Pensions**

**Panel Discussion**

# When Would We Know Our Commerce Is Working?



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



**Thank you!**