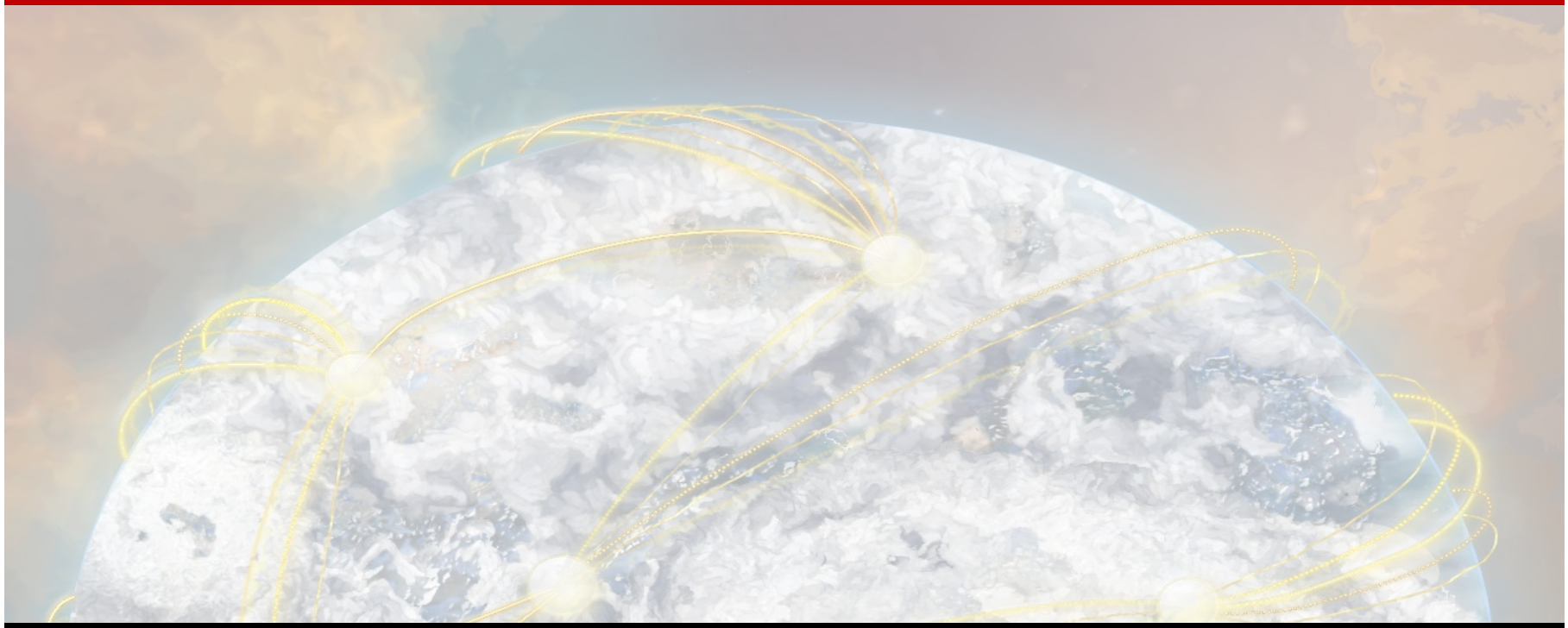
Blockchain: Transforming Global Supply Chain Security



Feb 27, 2019

Speaker: Larry Shi, PhD
Computer Science Department
University of Houston

BTI Institute
A Department of Homeland Security Center of Excellence

ACM CareerNews for Tuesday, December 18, 2018

Blockchain Developer Is the Fastest-Growing US Job

Venture Beat, December 13

Blockchain developer is the top emerging job in the U.S., according to data published in the 2018 U.S. Emerging Jobs report from LinkedIn. Blockchain has come a long way since the creation of Bitcoin, the first cryptocurrency. In many ways, Bitcoin served as a proof of concept for its underlying blockchain technology, and we are now seeing all manner of use cases develop within the enterprise. But to truly flourish, as the early Internet and World Wide Web did, blockchain needs developers with the skills to build on its foundation and fulfill its potential.

Using data obtained from the LinkedIn Economic Graph, which serves as a digital representation of the global economy by analyzing the skills and job openings from across 590 million members and 30 million companies, LinkedIn found that the role of blockchain developer has grown 33-fold in the past four years. It is worth noting here that blockchain did not appear anywhere in the top 20 emerging jobs in 2017, while machine learning engineer topped the list last year and is in second place this year.

Click Here to View Full Article

https://www.hardware-wallets.net/wp-content/uploads/2017/03/Hardware-Wallets-Banner-V3.jpg

International Conference on Financial Cryptography and Data Security

FC 2007: Financial Cryptography and Data Security pp 15-28

Conditional E-Cash

Authors Authors and affiliations

Larry Shi, Bogdan Carbunar, Radu Sion

Abstract. We introduce a novel *conditional* e-cash protocol allowing future anonymous cashing of bank-issued e-money only upon the satisfaction of an agreed-upon public condition. Payers are able to remunerate payees for services that depend on future, yet to be determined outcomes of events. Once payment complete, any double-spending attempt by the payer will reveal its identity; no double-spending by the payee is possible. Payers can not be linked to payees or to ongoing or past transactions. The flow of cash within the system is thus both correct and anonymous. We discuss several applications of conditional e-cash including online trading of financial securities, prediction markets, and betting systems.

Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
satoshin@gmx.com
www.bitcoin.org

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of

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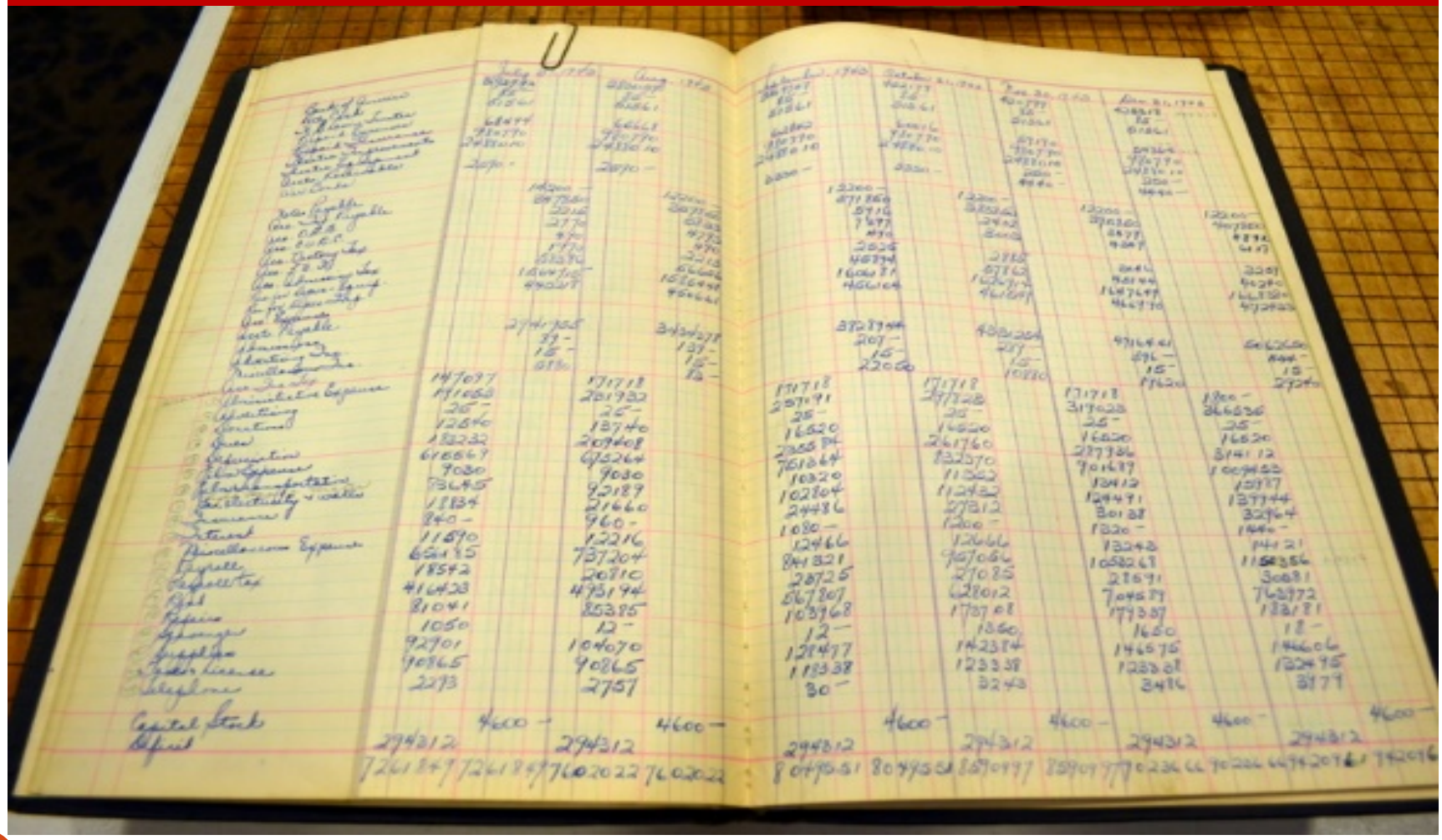
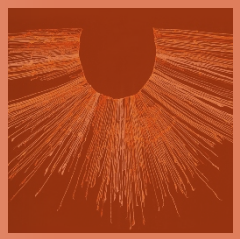
Record keeping and ledger

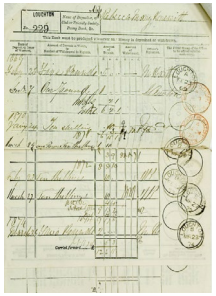


e credit: http://www.eightoneadvisory.com/wp-content/uploads/2013/11/Old-Ledger.jpg

Record keeping and ledger

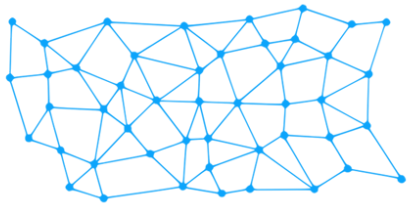


Ancient Time



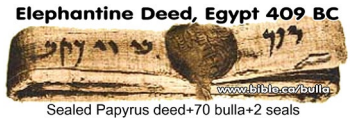
Digital

Internet

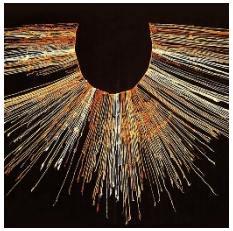


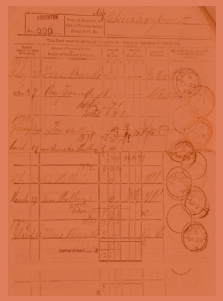
DLT

Record keeping and ledger



Sealed Papyrus deed+70 bulla+2 seals

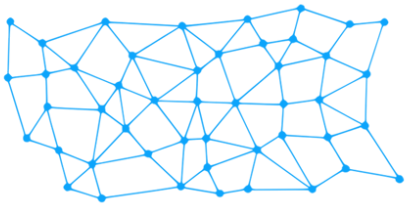




Medieval Time

Digital

Internet



DLT

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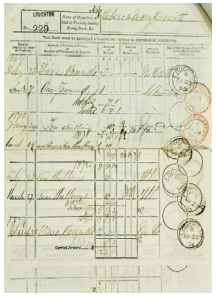

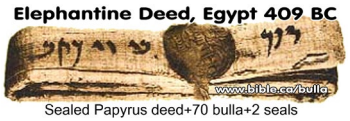

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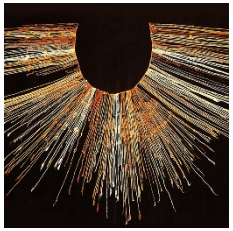
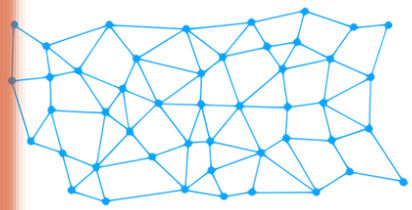


Digital

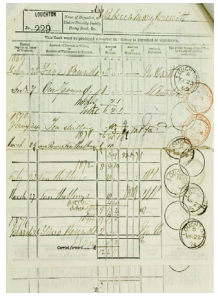
Internet



DLT

Digital Age

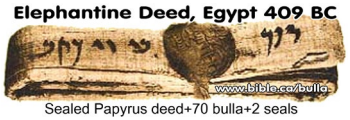
Record keeping and ledger



Digital

Internet

DLT



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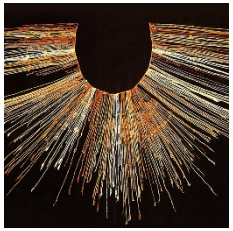


Distributed Ledger

During civil war

March to the sea.

General Sherman's troop piled all **deed books** in front of the courthouse and burned them. The logic was that the big plantations **would not be able to prove land ownership**.

Destroyed by natural disasters

Unclear land rights hinder Haiti's reconstruction

REPORT from AlertNet

Published on 05 Jul 2010 — View Original

Written by: Anastasia Moloney

BOGOTA (AlertNet) - Disputes over land ownership, which could take years to resolve, are hampering the rebuilding of Haiti after a devastating earthquake in January and deterring much-needed foreign investment, experts say.

Haiti's government and international aid agencies are racing to build new homes for the one and a half million survivors still living in makeshift camps. But before they can even start, they need to determine who owns what piece of land - a major challenge after the earthquake killed some 16,000 civil servants and destroyed an untold number of title deeds and land registry records.

F words

Fraudulen

Fake

Forged

False

EUROPOL

ABOUT EUROPOL | ACTIVITIES & SERVICES | CRIME AREAS & TRENDS

HOME › NEWSROOM › MASTERMIND BEHIND EUR 1 BILLION CYBER BANK ROBBERY ARRESTED IN SPAIN

MASTERMIND BEHIND EUR 1 BILLION CYBER BANK ROBBERY ARRESTED IN SPAIN

26 March 2018

Press Release

Cybercrime syndicate inf

"One of the largest bank thefts ever" - NYT

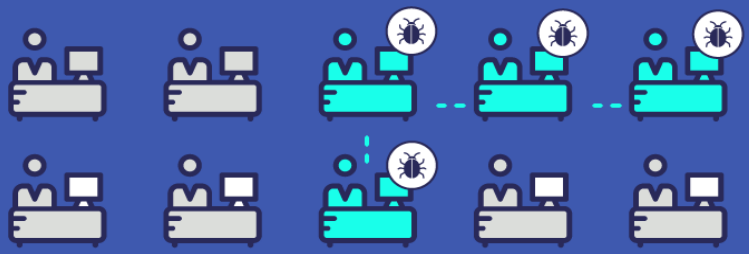
1 DEVELOPMENT

The cybercriminal is the brains of the operation and develops the malware

Spear-phishing emails are sent to bank employees to infect their machines

2 INFILTRATION AND INFECTION

The cybercriminal deploys the malware through the bank's internal network, infecting the servers and controlling ATMs



Bank employee

Infected infrastructure

3

HOW THE MONEY IS STOLEN

MONEY TRANSFER

The criminal transfers the money into their account or foreign bank accounts

INFLATING ACCOUNT BALANCES

The criminal raises the balance of bank accounts and money mules withdraw the money at ATMs

CONTROLLING ATMs

The criminal sends a command to specific ATMs to spit out cash and money mules collect the money

4

MONEY LAUNDERING

The stolen money is converted into cryptocurrencies

Carbanak

Inserted a transaction to inflate balance from 1,000 to 10,000 dollars.

Carbanak

Transferred the difference to their own account.

Carbanak

Withdraw from ATMs by money mules.

Is there a ledger system that is

- ❑ Secure?
- ❑ Tamper resistant & tamper evident?
- ❑ Resilient?
- ❑ Without single point of failure (insiders & cybercriminals)?

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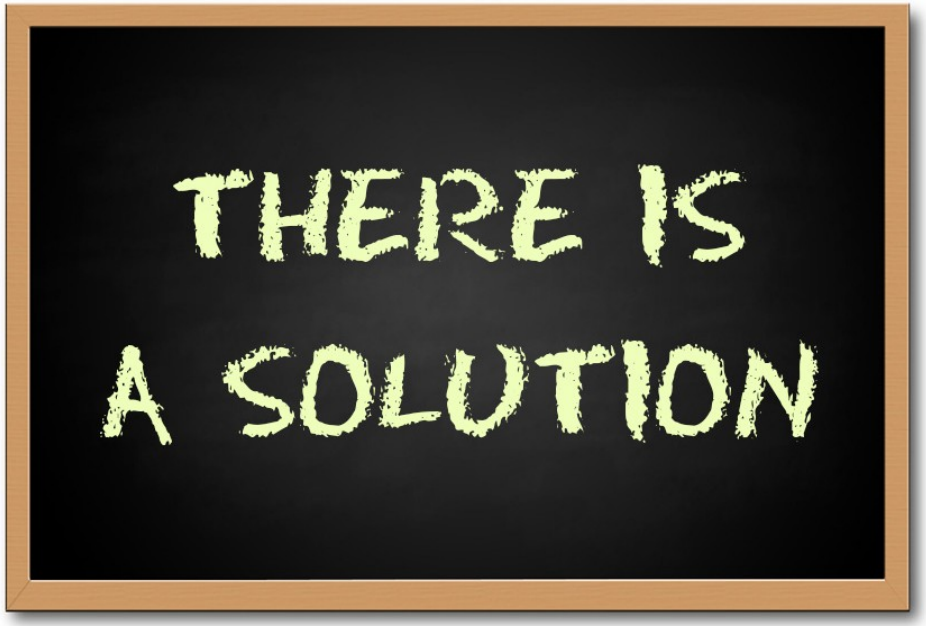
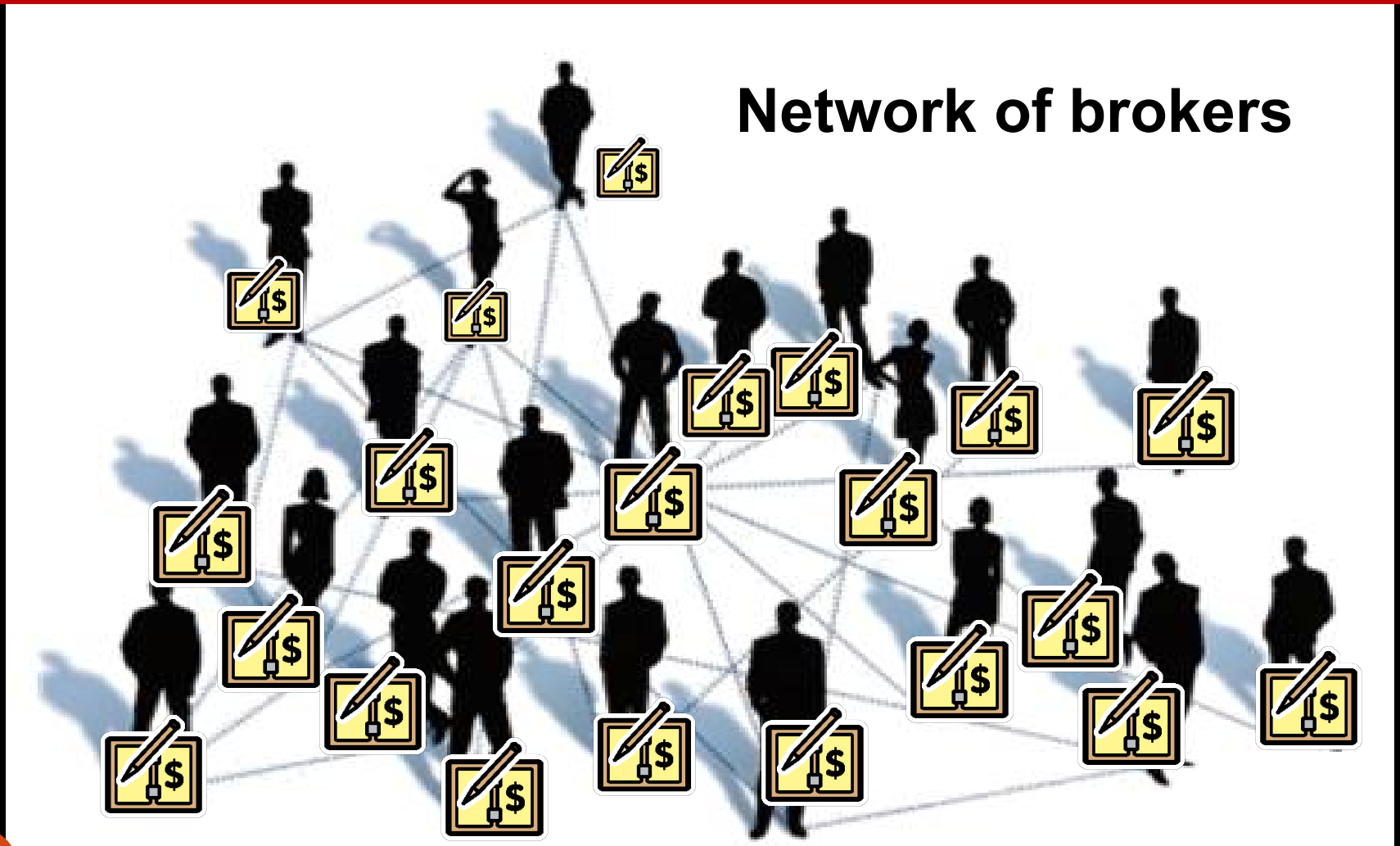


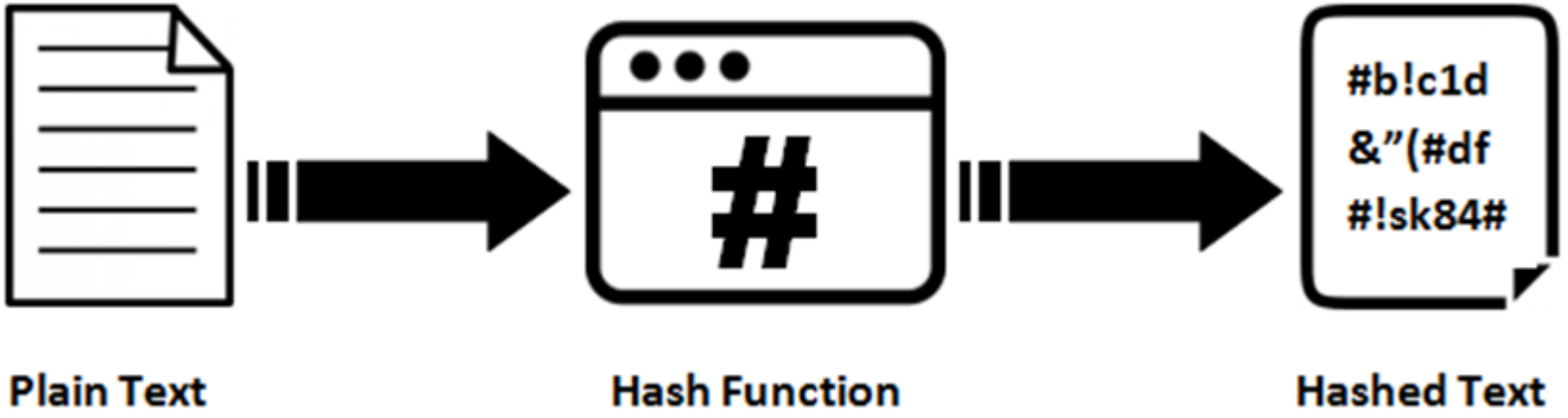
Blockchain – distributed ledger




No one has ever done anything like this.
That's why it's going to work

Matrix

Tamper resistant record keeping



Tamper resistant record keeping

- Police **electronic records**. To ensure that evidence can't be questioned in court, evidence **can't be tampered** with, **after it is logged** with the office.
- After it is logged, **no back-dating or after-the-fact changes** to evidence should be possible.

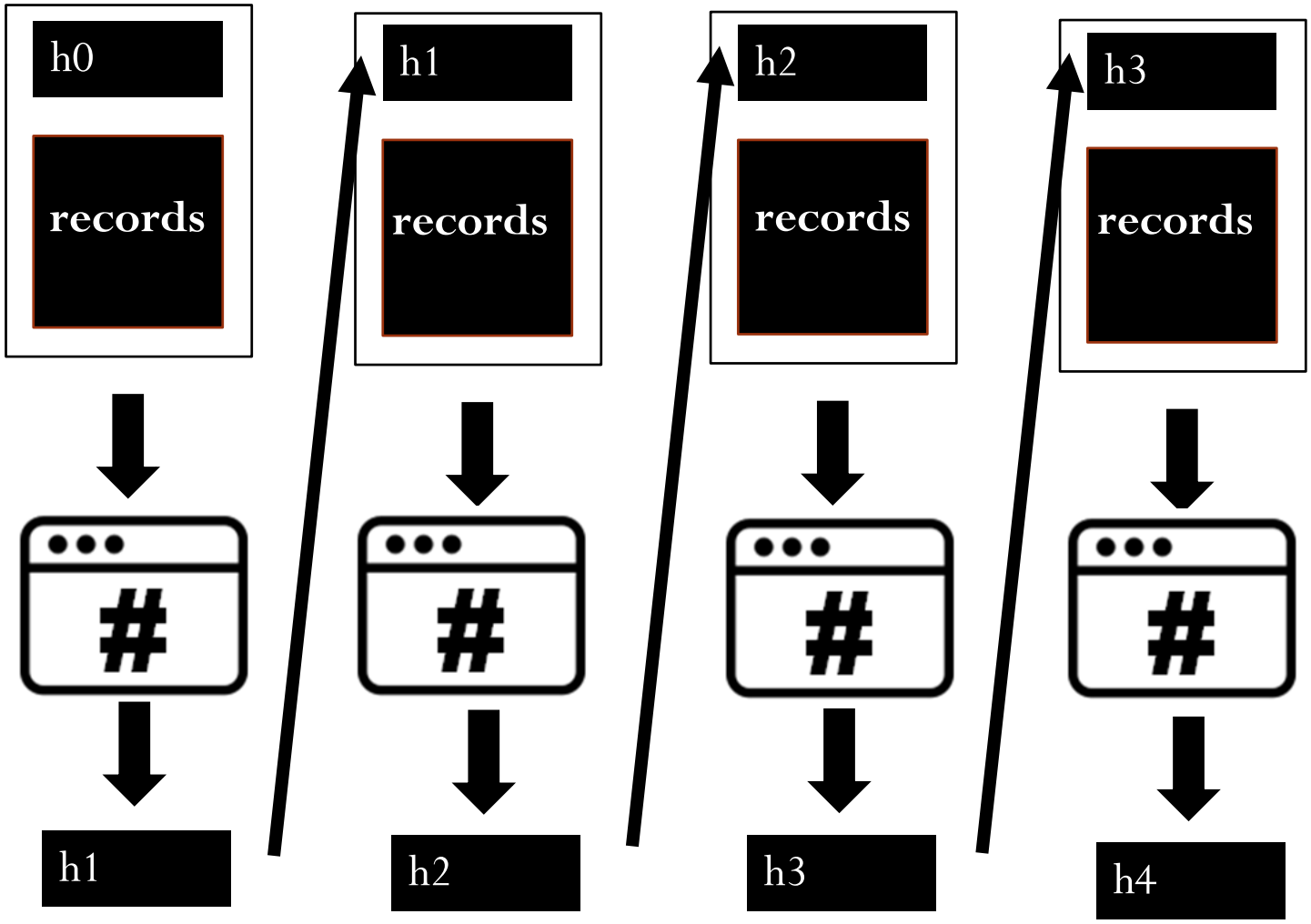
Tamper resistant record keeping

Time In	Name/Unit	Reason at Scene	Time Out
1750	SA Brown - Homicide	Scene Processing	
1759	Smitch/ME Investigator	Scene exam	1823
1800	H. Jones - CS Unit	Scene processing	
1800	L. Marshall - CS Unit	Scene processing	
1817	Chief Kyle	Scene visit	1833
1817	Maj. Darren - PIO	Update by Homicide	1833

Tamper resistant record keeping

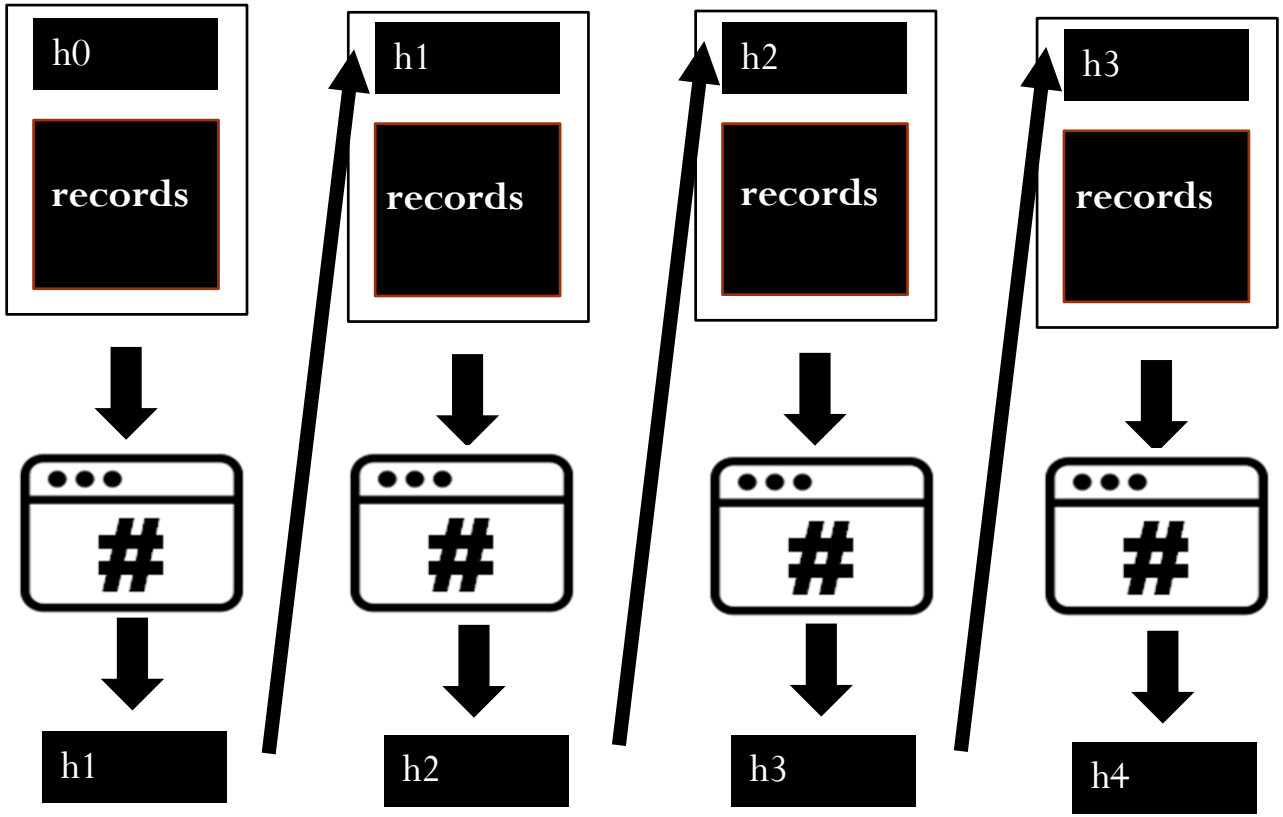
Time In	Name/Unit	Reason at Scene	Time Out	Hash Chain
Chai1750	SA Brown - Homicide	Scene Processing		**h1** = H(h0, "1750, SA Brown – Homicide, Scene Processing, …")
1759	Smith/ME Investigator	Scene exam	1823	**h2** = H(**h1**, "1759, Smith/ME Investigator, Scene exam, 1823")
1800	H. Jones - CS Unit	Scene processing		**h3** = H(**h2,** "1800, H. Jones - CS Unit, Scene processing, …")
1800	L. Marshall - CS Unit	Scene processing		**h4** = H(**h3**, "1800, L. Marshall - CS Unit, Scene processing, …")

Hash chain



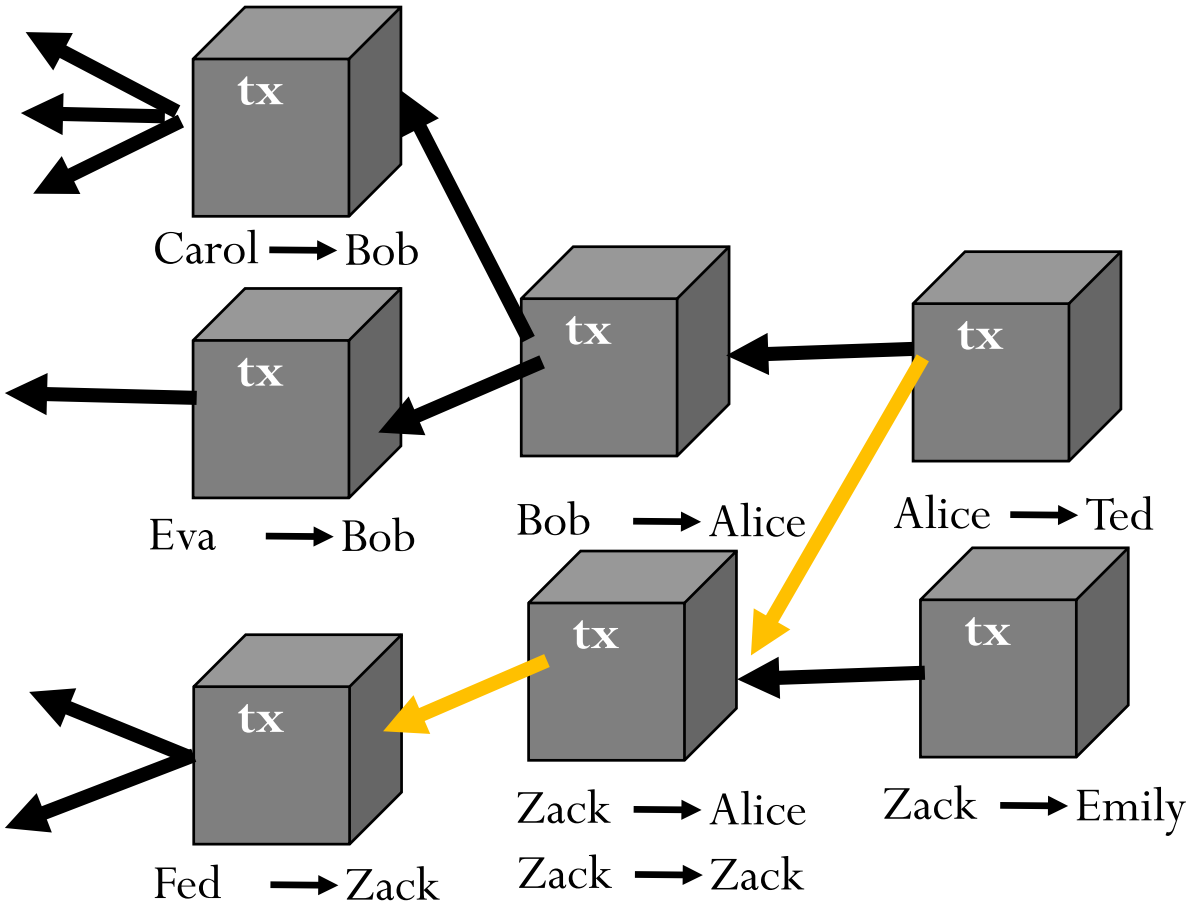
Hash chain

- Auditable, immutable.
- Cannot add, delete, alter records.

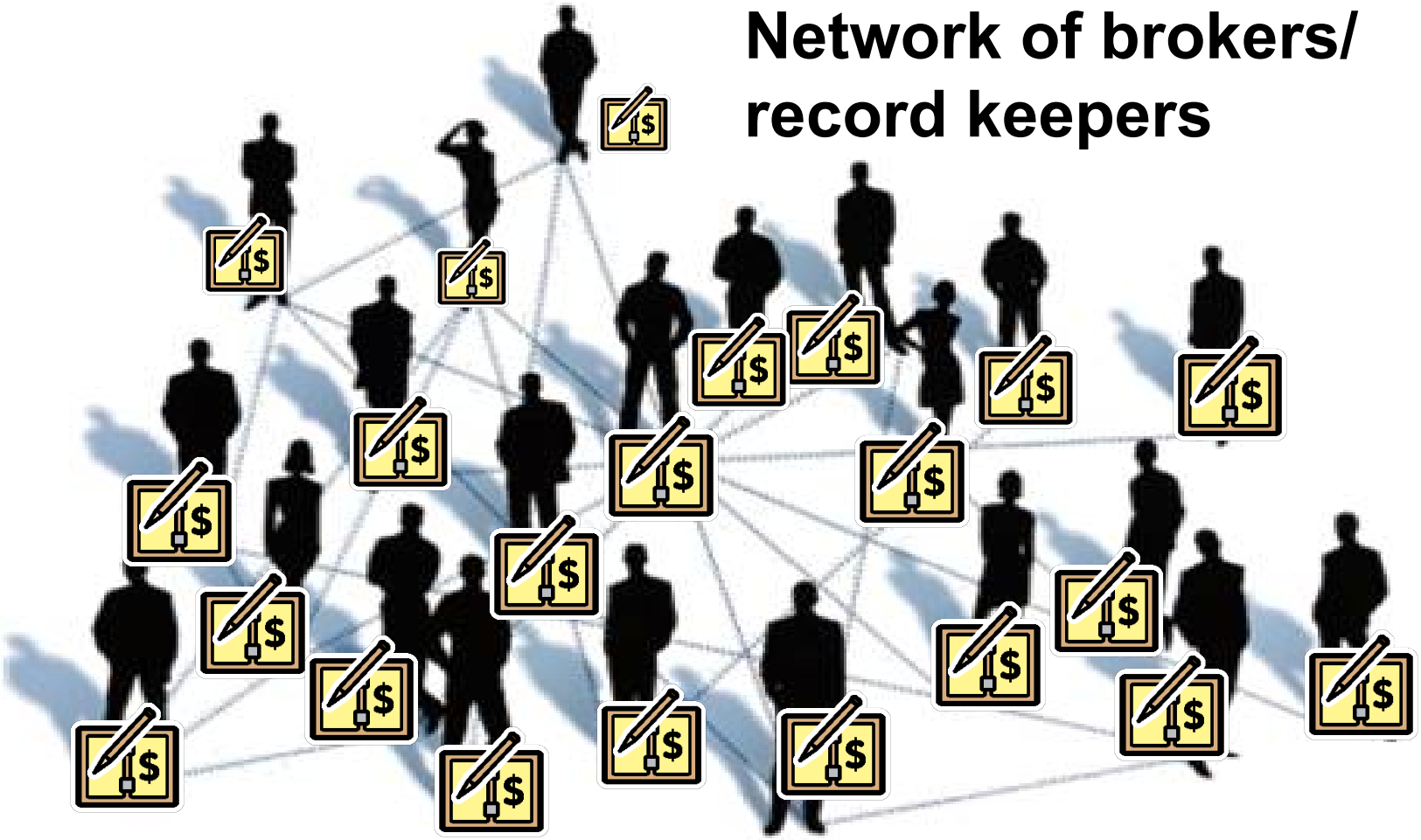


Tamper resistant record keeping

Traceable.



Decentralized



Brokers

- Brokers are inter-changeable.
- Everyone has a copy of the same ledger.

Brokers

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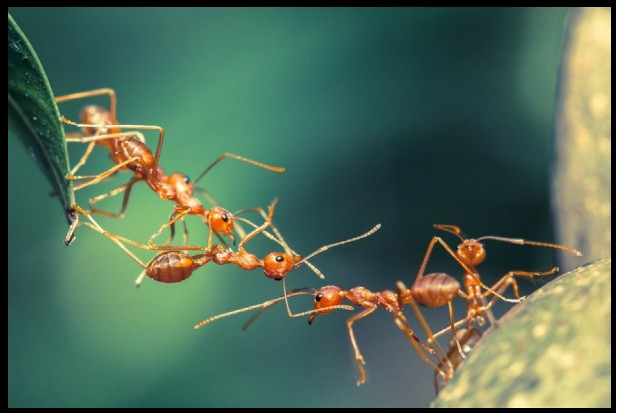
Kind of Multi-master Databases.



So many copies, no single authoritative source

How to avoid conflicts, disagreement?

Consensus protocol

- PoW.
- PoS.
- PoW + PoS.
- BFT.
- PBFT.
- Federated BFT.
- Delegate proof-of-stake (DPoS).
- …

Financial Institutions	Corporates	Government	Cross-industry
International Payment Capital Markets Trade Finance Regulatory Compliance and Audit Anti-money Laundering & Know Your Customer Insurance P2P Transactions	Supply Chain Management Healthcare Real Estate Energy Media Inventory Management Logistics	Record Management Identity Management Taxes Information Sharing Government Transparency Compliance & Regulatory Oversight	Financial Management & Accounting Shareholders' Voting Record Management Cyber Security Internet of Things

PoCs and pilots since 2017

Still in infancy

ttps://media.news10.com/nxs-wtentv-media-us-east-1/photo/2018/06/19/ladder%20cover_15293768437781.jpg_45931704_ver1.0_640_360_1529417861596.jpg_45970255_ver1.0_1280_720.jpg

Need killer app

Blockchains as public digital infrastructure

Blockchains as public digital infrastructure

Digital infrastructure maintained jointly by stakeholders:

- Public blockchains.
- Consortium blockchains.


CUSTOMS

Current container logistics processes are still very labor intensive and lacking an integrated information flow …

- Deep sea Carrier
- Forwarder
- Terminal
- Barge operator
- Rail operator
- Truck companies
- Subcontractors
- Driver / Skipper
- Authorities / Customs

"**up to 50% of the cost** of moving a container is related to **paperwork**"

"a simple shipment can go through nearly **30 people and organizations**, including more than 200 different interactions and communications"

Source: NYT March 4, 2017; Forbes March 5, 2017

Current container logistics processes are still very labor intensive and lacking an integrated information flow …

Exporter – *prepares or arranges*

- ❑ Commercial Invoice
- ❑ Packing List
- ❑ Certificate of Origin
- ❑ Marine insurance depending on the Incoterms agreed upon for the shipment
- ❑ EUR1
- ❑ Shipping Instructions for the Bill of Lading
- ❑ Permits or licences required for the export of the product from a country

Importer – prepares or arranges

- ❑ Permits or licences required for the import of the product into the destination country
- ❑ Marine insurance depending on the Incoterms agreed upon for the shipment
- ❑ Duly endorsed original bill of lading or Telex Release message to be handed over to the shipping line for the release of cargo
- ❑ Delivery instructions to the shipping line for the release of the cargo
- ❑ Clearance from health, phytosanitary and other such authorities depending on the cargo

Freight Forwarder – prepares and arranges

- ❑ Delivery Notes
- ❑ Forwarders Cargo Receipt
- ❑ Shipping Instructions for the Bill of Lading
- ❑ House Bill of Lading
- ❑ Marine Insurance
- ❑ Cargo inspection certificates
- ❑ Hazardous packing declarations
- ❑ ATA Carnet

Source: https://shippingandfreightresource.com/documentation-involved-in-a-sea-freight-shipment/

Current container logistics processes are still very labor intensive and lacking an integrated information flow …

Clearing Agents – prepares or arranges

- Customs clearance documents
- Port Documentation
- Duty and VAT exemption documents

Shipping Lines – prepares or arranges

- Booking confirmation
- Container release
- Bills of Lading
- Manifest
- Documentation in shipping Manifest Corrector
- Telex Release
- Freight Invoices
- Container stowage plans
- Load & Discharge list
- Dangerous goods manifest
- Out of gauge manifests
- Arrival Notification
- Delivery Orders
- Discharge lists

Haulage companies – prepares or arranges

- TREM cards where hazardous cargo movements are involved
- road permits for overweight or special cargoes
- overborder permits
- port entry documents
- route survey documents for abnormal cargoes
- border clearance documents

Source: https://shippingandfreightresource.com/documentation-involved-in-a-sea-freight-shipment/

Current container logistics processes are still very labor intensive and lacking an integrated information flow …

Intermodal operators – prepares or arranges

- ❑ Documentation for inland haulage
- ❑ Rail movement
- ❑ Road permits
- ❑ Overborder permits
- ❑ Border clearance documents

Surveyors – prepares or arranges

- ❑ Cargo inspection
- ❑ Survey reports (draft survey, quantity survey, damage survey etc)

Freight shipment Banks – prepares or arranges

- ❑ Letter of Credits
- ❑ Bill of Exchanges
- ❑ Surety
- ❑ Guarantees

Insurance Brokers – prepares or arranges

- ❑ Marine insurance
- ❑ Cargo insurance and other general insurance policies

Source: https://shippingandfreightresource.com/documentation-involved-in-a-sea-freight-shipment/

Multiple versions of reality

Image source: https://www.opendesktop.org/p/1187190/

Multiple versions of reality

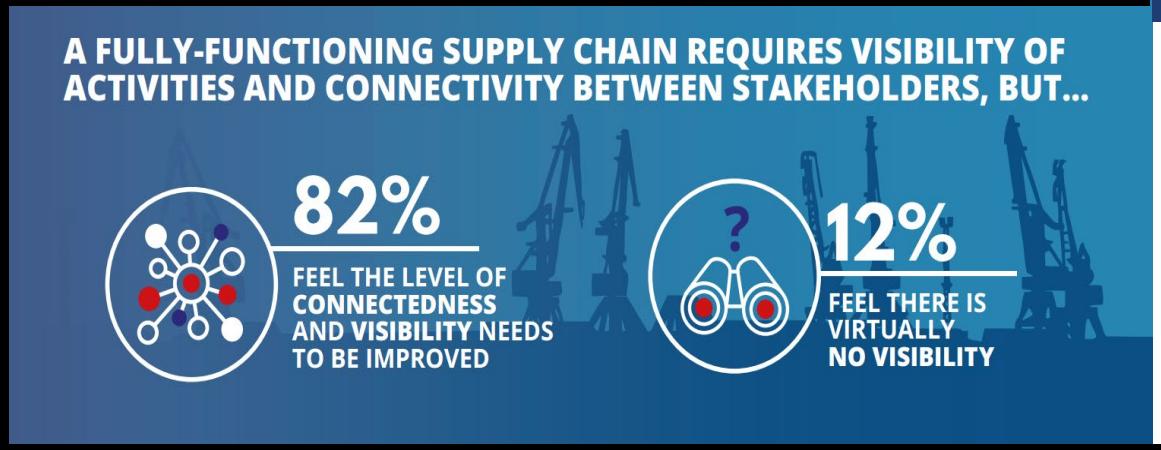
Image source: https://www.opendesktop.org/p/1187190/

Delays.
Human errors.
Non compliance.
Reduced visibility.
Info silos.
Admin cost.
…

Current container logistics processes are still very labor intensive and lacking an integrated information flow

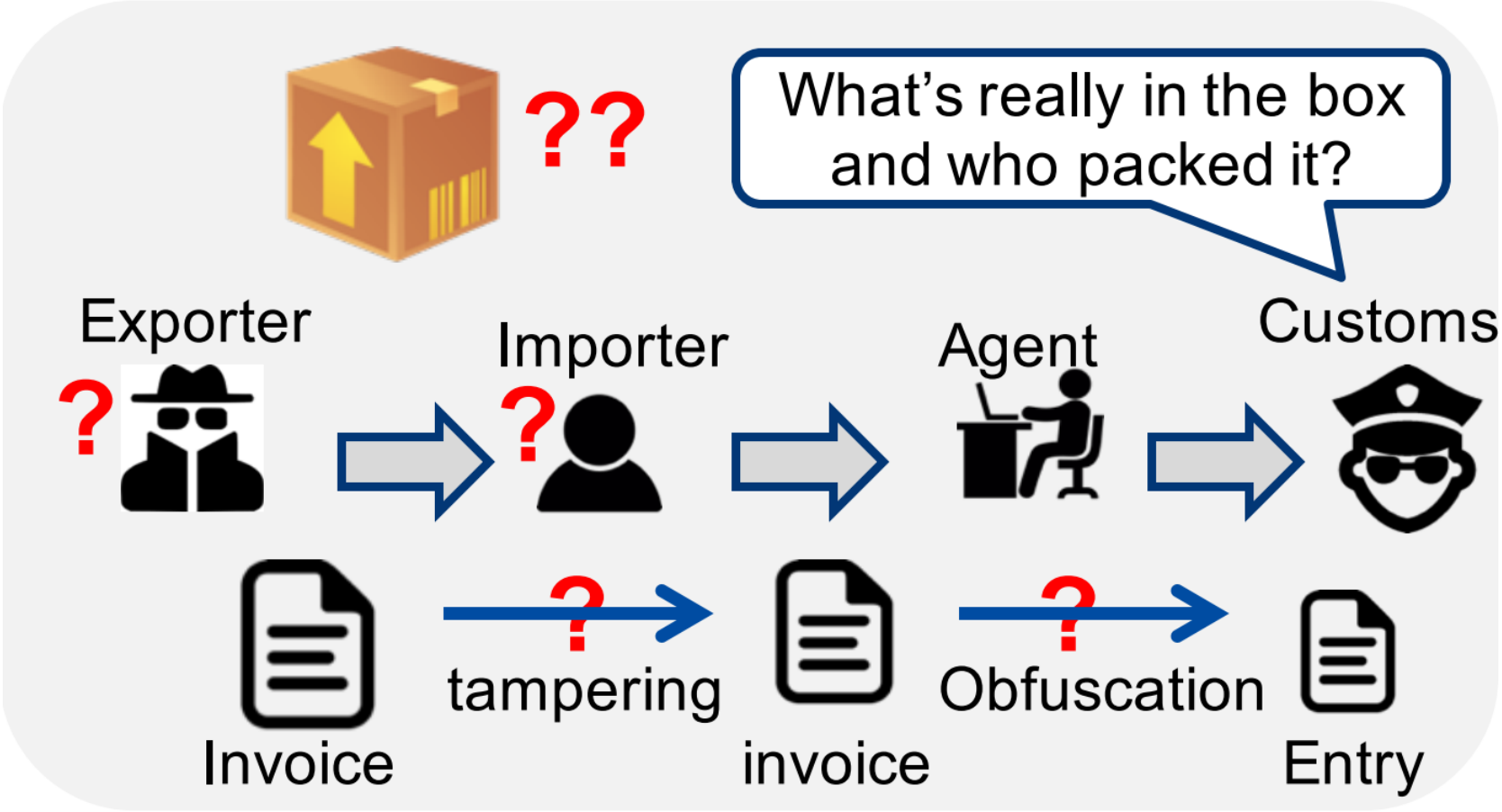
…

Based on a global survey of more than 200 executives and professionals from terminal operators, carriers, logistics providers, vessel owners, port authorities, shippers, consignees and other members of the global Ocean Supply Chain. …



Full report: http://www.bpinetwork.org/Competitive-Gain

Customs



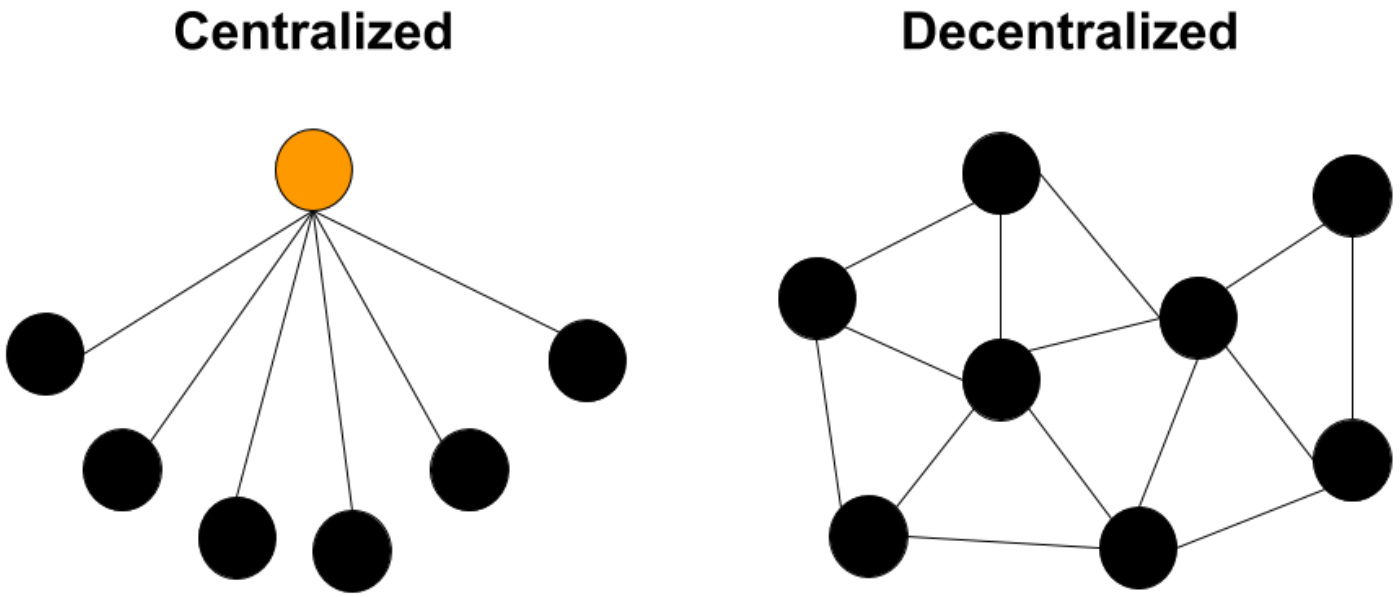
Australian Government. Department of Home Affairs.

Blockchain/DLT applications

- Document/information flow.
- Physical cargo flow.
- Finance flow.

Leveraging unique properties of blockchain (immutability, auditability, resilience) to securely **monitor and manage custody/flow of digital and physical assets** – based on consensus and smart contracts among stakeholders.

Data visibility in a decentralized environment



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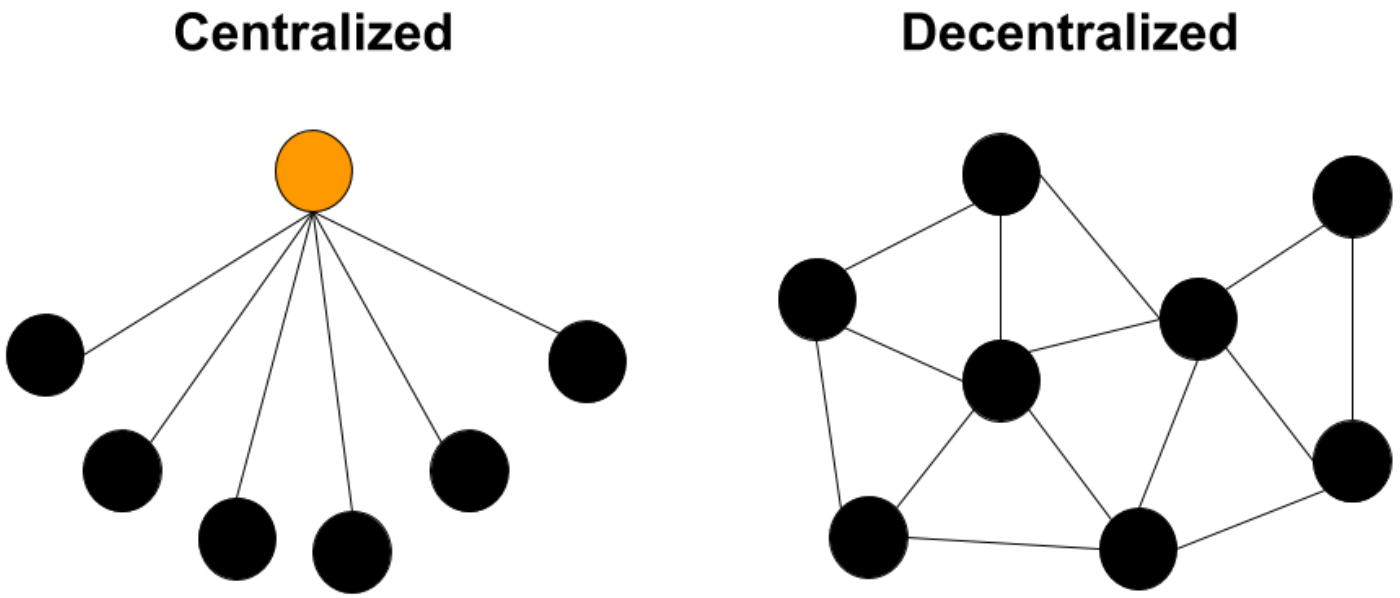


"Centralized" without centralization.

Use cases

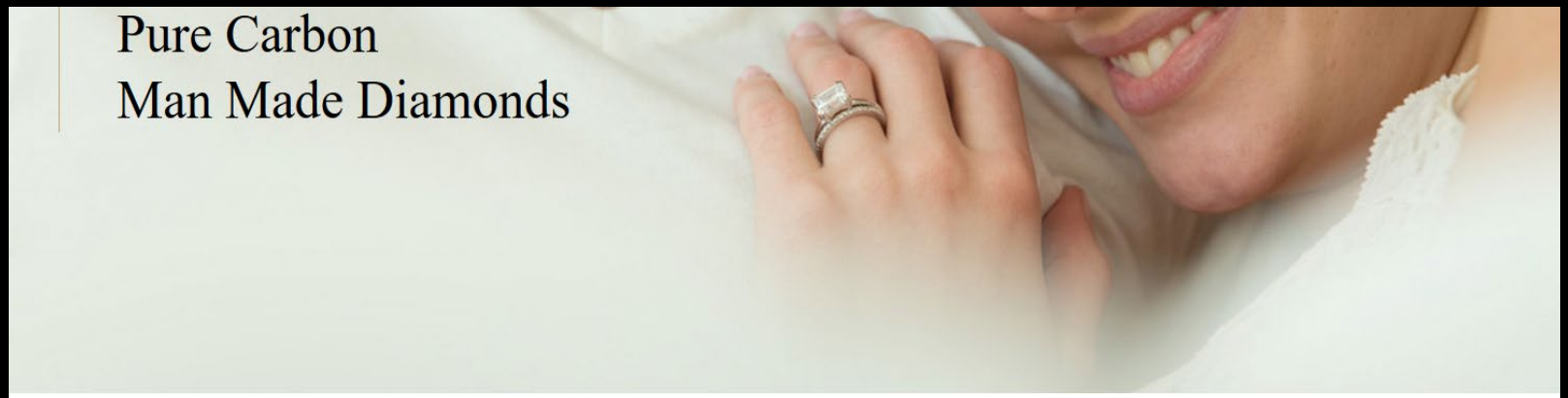
Supply chain traceability

Public Registry

Traceability

- Luxury and valuable goods.
- Traceability along the value chains.

Traceability



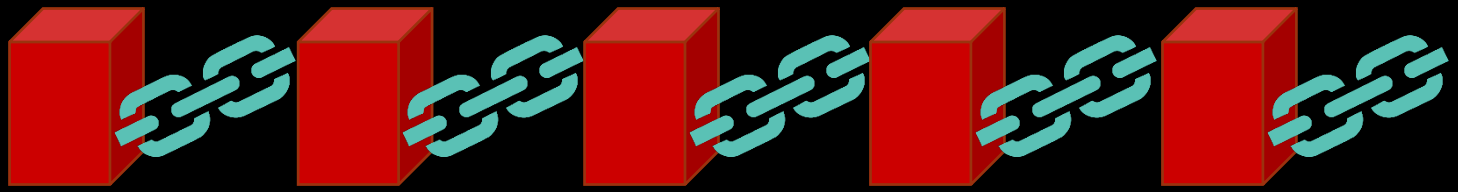
INNOVATIVE

Man made diamonds are lab grown. Like a diamond from the earth, they are pure carbon. And they are brilliant.

No longer are mined diamonds the only choice for engagement rings and fine jewelry. Eco/ethical concerns, coupled with technology advances, have made alternatives not just acceptable, but preferred. Our patented man made diamonds (sometimes also called lab-created or synthetic) are now, for all practical purposes, identical to mined diamonds in their physical and optical properties.

Traceability along the value chain

Exploration Mining Cutting Trading Manufacture Retail



Hon. Keletso Rakhudu Assistant Minister Trade and Industry, Botswana 1.

Traceability along the value chain

The World Health Organization (WHO) estimates that as much as 30% of the medicines sold in parts of Asia, Africa, and Latin America are counterfeit.

Record keeping

Paperless documentation: drug development and production

https://www.siemens.com/innovation/en/home/pictures-of-the-future/industry-and-automation/digital-factory-paperless-pharma-production.html

Paperless documentation: drug development and production

Data Integrity and Compliance With CGMP

- Why? FDA has increasingly observed CGMP violations involving data integrity during CGMP inspections.
- **Ensuring data integrity** is an important component of industry's responsibility to ensure the safety, efficacy, and quality of drugs, and of FDA's ability to protect public health.

https://www.siemens.com/innovation/en/home/pictures-of-the-future/industry-and-automation/digital-factory-paperless-pharma-production.html

Data Integrity

ALCOA

- **Attributable**
- **Legible**
- **Contemporaneous**
- **Original / true copy**
- **Accurate**

- Overwriting
- Aborting runs
- Testing into compliance
- Deleting
- Backdating
- Altering data
- *(not an all-inclusive list)*

Audit trail

Current expectations and guidance, including data integrity and compliance with CGMP.

Business process automation across stakeholder boundaries

ETC Platform

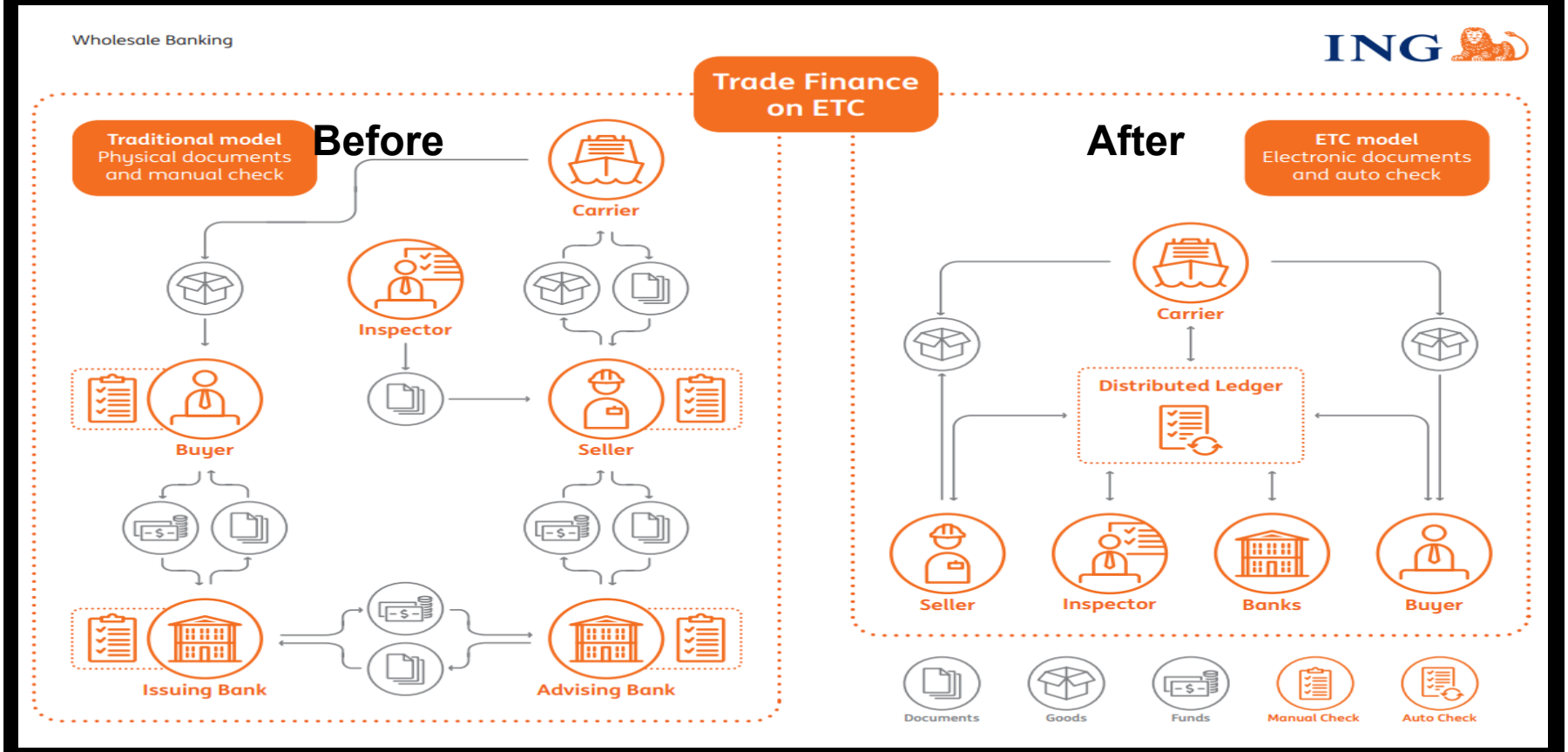
LDC Louis Dreyfus Company ING SOCIETE GENERALE ABN·AMRO

ETC Platform

- Louis Dreyfus Company (LDC), Shandong Bohi Industry Co., Ltd (Bohi), ING, Societe Generale and ABN Amro have successfully completed an **agricultural commodity transaction** using a blockchain platform.
- This trade included a full set of **digitalized documents** (***sales contract, letter of credit, certificates***) and automatic data-matching – **avoiding** ***task duplication and manual checks***.
- The process mirrored the paper based one and showed **significant efficiency.**

Trade Finance on ETC - ING Wholesale Banking.

ETC Platform



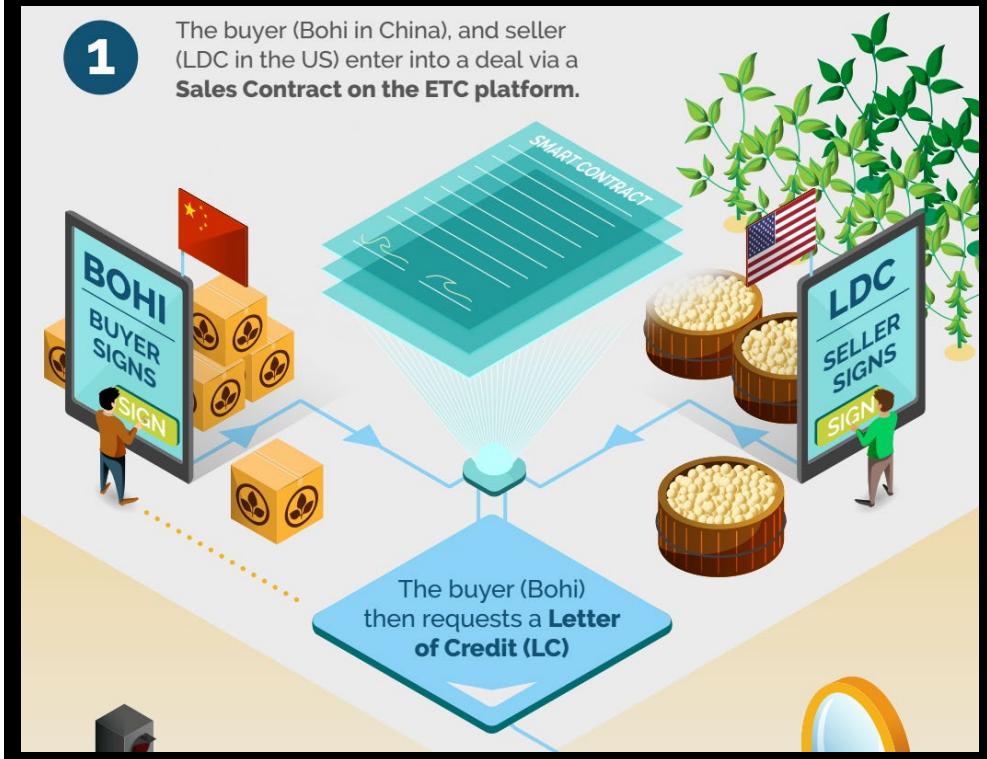
Trade Finance on ETC - ING Wholesale Banking.

ETC Platform

- Issuing **letter of credits/payment** undertakings on the blockchain (through **Smart Contracts**).
- **Assets/Title recorded and tracked** in the blockchain and transferred at the same time as the payment undertaking.
- **Possibility of reselling** (multiple buyers/sellers) in line with commodity trading (vs export "traditional" trade finance). Inclusion of all actors in a typical transaction (e.g. traders, banks, agent, inspector, etc.).
- **Auto-checking.**

Trade Finance on ETC - ING Wholesale Banking.

ETC Platform

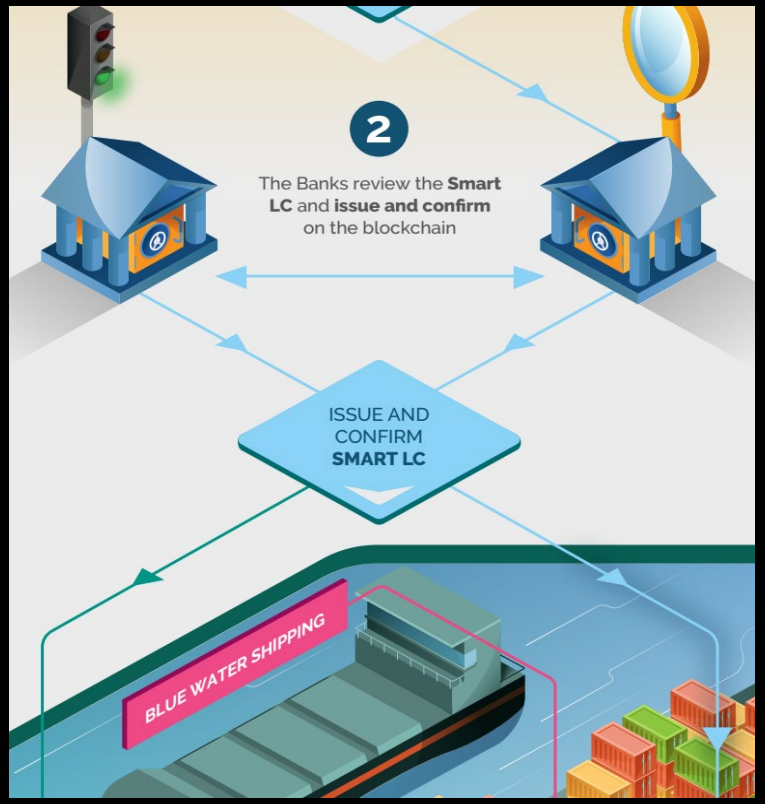


Teams from Louis Dreyfus Company (LDC) as the seller and Bohi as the buyer, with banks issuing and confirming the letter of credit.

https://www.ing.com/web/file?uuid=b662ba8b-4b21-44d9-995e-99cbdabac43f&owner=b03bc017-e0db-4b5d-abbf-003b12934429&contentid=42370

ETC Platform

Russell Marine Group and Blue Water Shipping participated in the process, issuing all required certificates.



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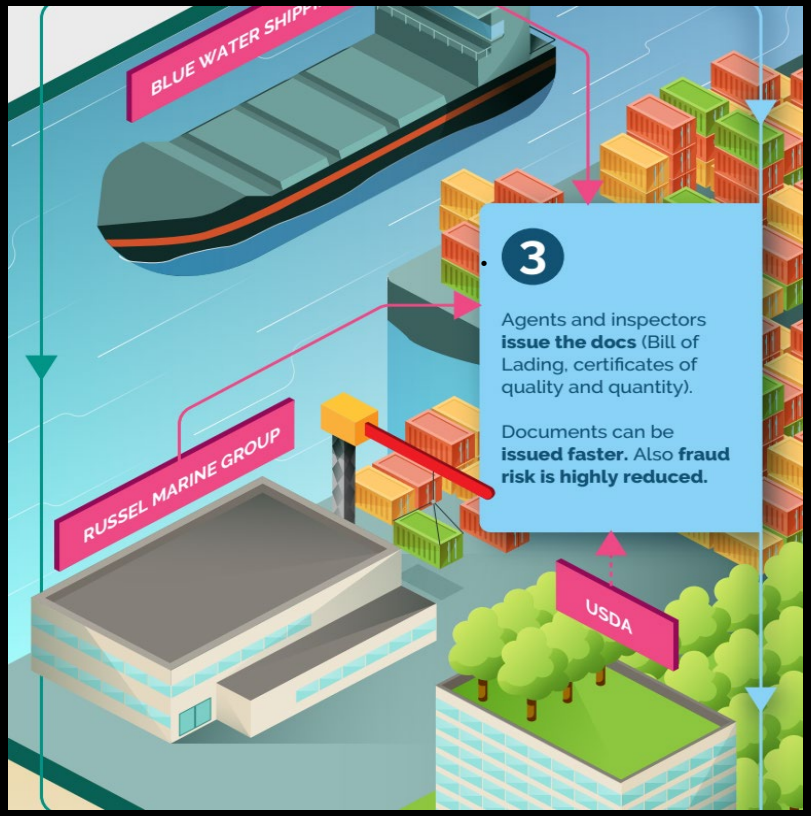
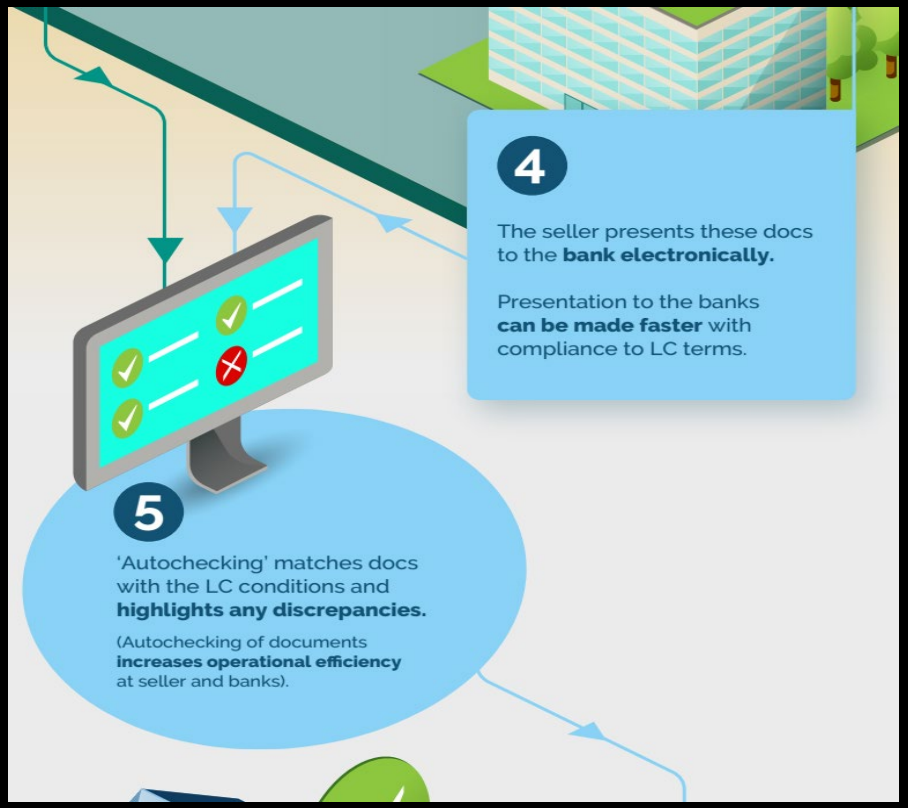
ETC Platform



The U.S. Department of Agriculture provided valuable insights on how to include phytosanitary certificates in the process.

https://www.ing.com/web/file?uuid=b662ba8b-4b21-44d9-995e-99cbdabac43f&owner=b03bc017-e0db-4b5d-abbf-003b12934429&contentid=42370

ETC Platform



The seller presents these docs to the bank electronically. Auto-checking matches docs and highlights any discrepancies.

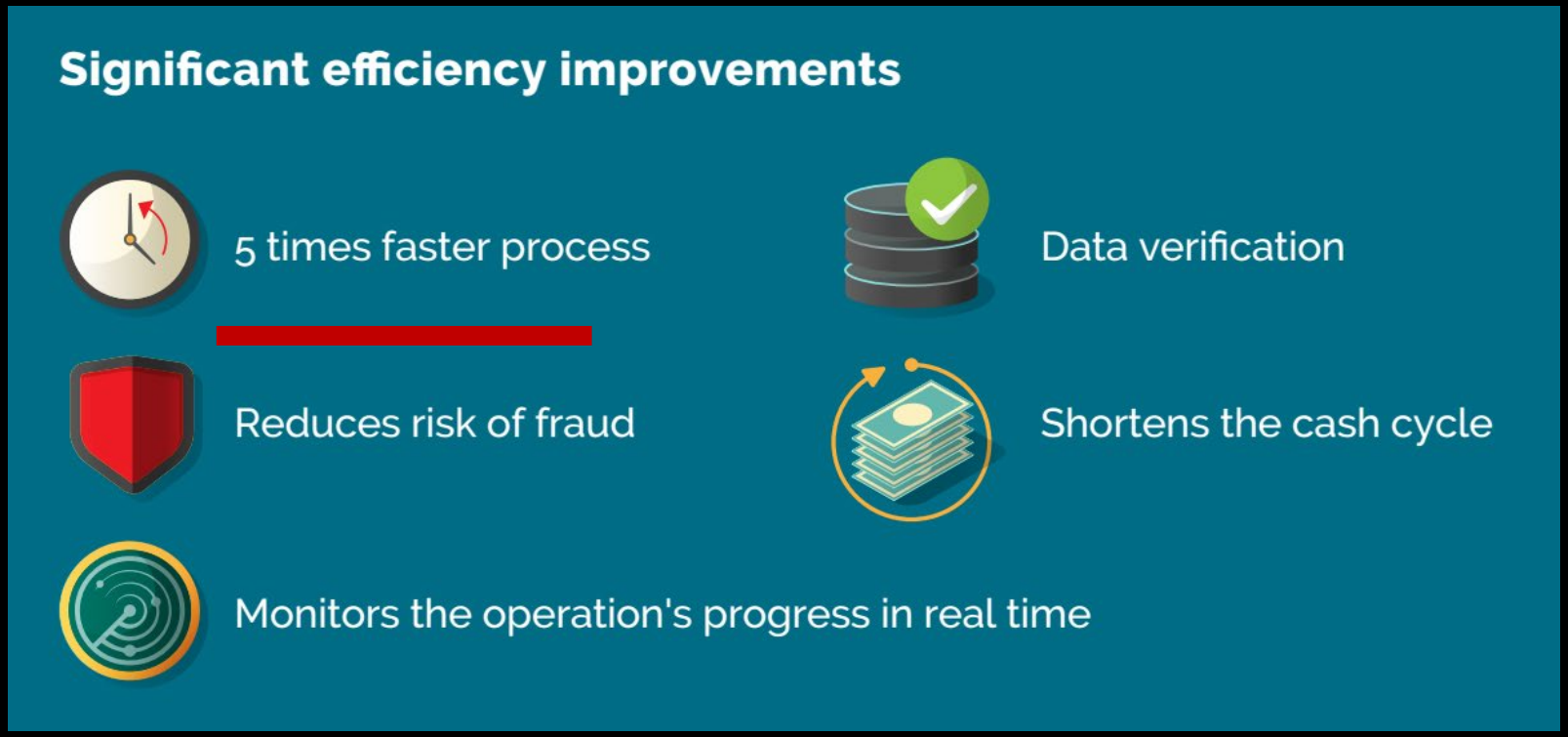
https://www.ing.com/web/file?uuid=b662ba8b-4b21-44d9-995e-99cbdabac43f&owner=b03bc017-e0db-4b5d-abbf-003b12934429&contentid=42370

ETC Platform

If all is OK then the banks sign off everything. Title to the assets is automatically transferred and payment transaction is simultaneously issued.

https://www.ing.com/web/file?uuid=b662ba8b-4b21-44d9-995e-99cbdabac43f&owner=b03bc017-e0db-4b5d-abbf-003b12934429&contentid=42370

ETC Platform



LDC Louis Dreyfus Company · ING · SOCIETE GENERALE · ABN·AMRO

https://www.ing.com/web/file?uuid=b662ba8b-4b21-44d9-995e-99cbdabac43f&owner=b03bc017-e0db-4b5d-abbf-003b12934429&contentid=42370

Marine Insurance

Marine insurers adopt blockchain contracts

One of oldest branches of insurance to use technology behind virtual currency bitcoin

AP Moller-Maersk, the Danish conglomerate that includes the world's largest container shipping business, is among the companies involved in the new blockchain platform © Reuters

Judith Evans SEPTEMBER 6, 2017 4

One of the oldest branches of the insurance business will adopt one of its newest technologies when marine insurers begin using blockchain in contracts

https://www.carreirapitti.com/wp-content/uploads/2016/06/adr002.jpg
https://www.ft.com/content/d7e08624-918b-11e7-a9e6-11d2f0ebb7f0

Marine Insurance

- A blockchain platform to connect all stakeholders in the **insurance value chain** with the same accurate, current and secure **risk information.**

- Successful **20-week proof-of-concept**, involving other major players.

EY. Better-working insurance: moving blockchain from concept to reality. http://www.ey.com/Publication/vwLUAssets/ey-better-working-insurance-moving-blockchain-from-concept-to-reality/

EY Building a better working world

guardtime

Participants

Benefits

- **Increase transparency** and stakeholder collaboration.
  - Real-time decision making: **error free data moves** quickly from risk to capital.
- **Automate activities.**
  - Process fulfillment, enabled by smart contracts: **faster, lower cost, more accurate**.
  - **Automation of invoicing** initiates settlement among all contracting parties.
- **Reduce administrative costs**.

EY. Better-working insurance: moving blockchain from concept to reality. http://www.ey.com/Publication/vwLUAssets/ey-better-working-insurance-moving-blockchain-from-concept-to-reality/

Insights: ecosystem must actively commit

- The ability of external systems to feed them with **accurate and consistent data (data quality).**
- A **supporting regulatory model**.
- The **cooperation of industry participants**.
- **Organizational re-think of culture, skills, processes, …**

EY. Better-working insurance: moving blockchain from concept to reality. http://www.ey.com/Publication/vwLUAssets/ey-better-working-insurance-moving-blockchain-from-concept-to-reality/

Insights: choose the right model

- Security & data ownership.
- Integration of operational process with IT platforms.
- Scalability.

EY. Better-working insurance: moving blockchain from concept to reality. http://www.ey.com/Publication/vwLUAssets/ey-better-working-insurance-moving-blockchain-from-concept-to-reality/

WCO

Discussions at WCO

- Use of the blockchain technology in Customs and border regulatory processes improving compliance, trade facilitation, and fraud detection
- Standardization of data and its quality in blockchain (including pre-shipment data, much early in the supply chain)
- Interface of Customs systems with, and interoperability of, blockchains

Potential use cases

- Customs declaration and regulatory submissions
- Exchange of information – Single Window
- Risk Management
- Implementation of AEO-MRA and Free Trade Agreements
- Revenue Collection
- Electronic certification/verification of regulatory requirements
- Transit
- Identity Management

Commercial Customs Operations Advisory Committee (COAC)
Emerging Technologies

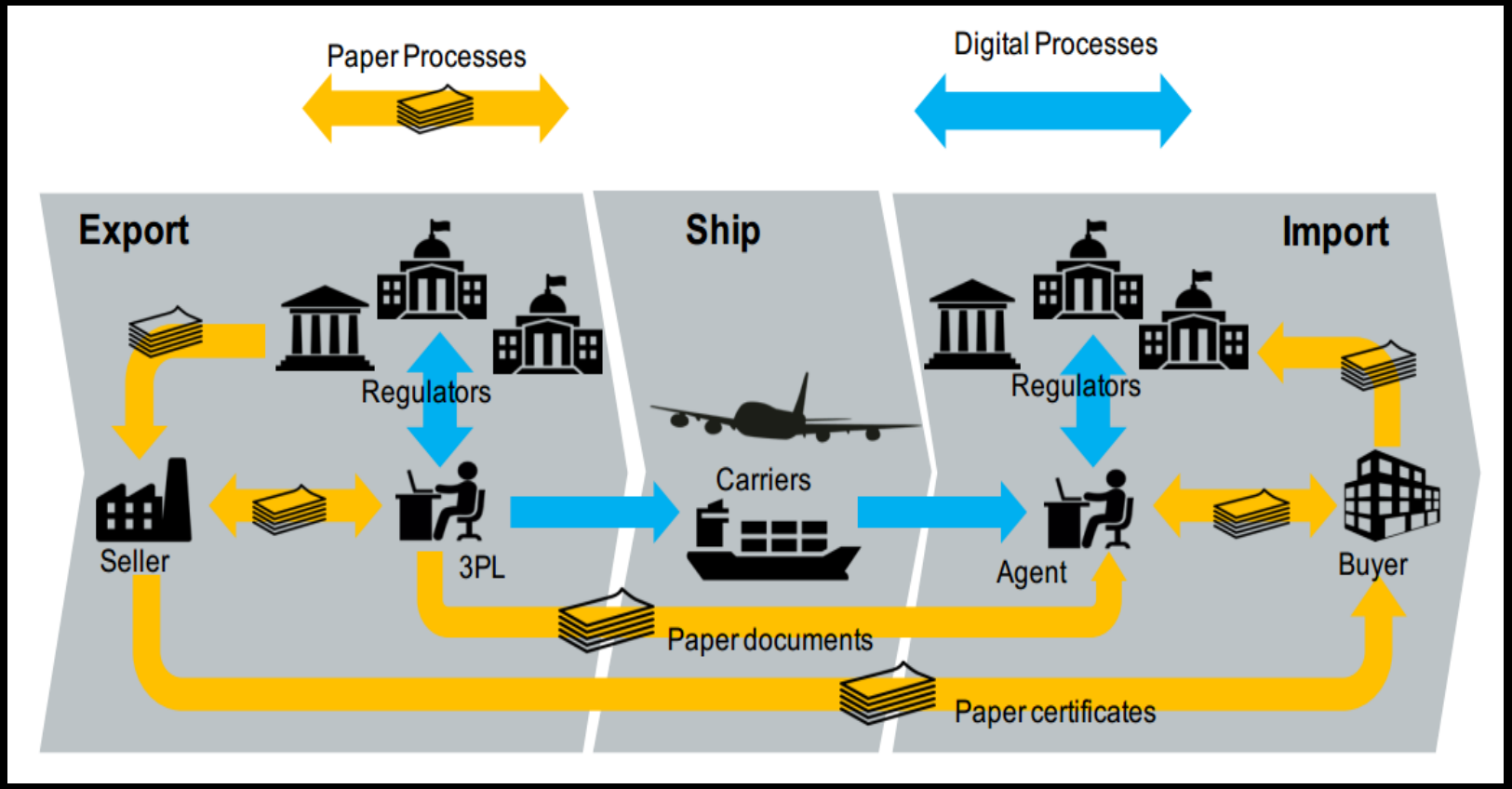
September 2018

U.S. Customs and Border Protection

CBP pilots

- North American Free Trade Agreement (NAFTA)/Central American Free Trade Agreement (CAFTA)
  - Automation of paper process tied to certification of origin to qualify for free trade.
- Automation of carnets.
- Partner Government Agency (PGA) licenses, certifications, and permits.

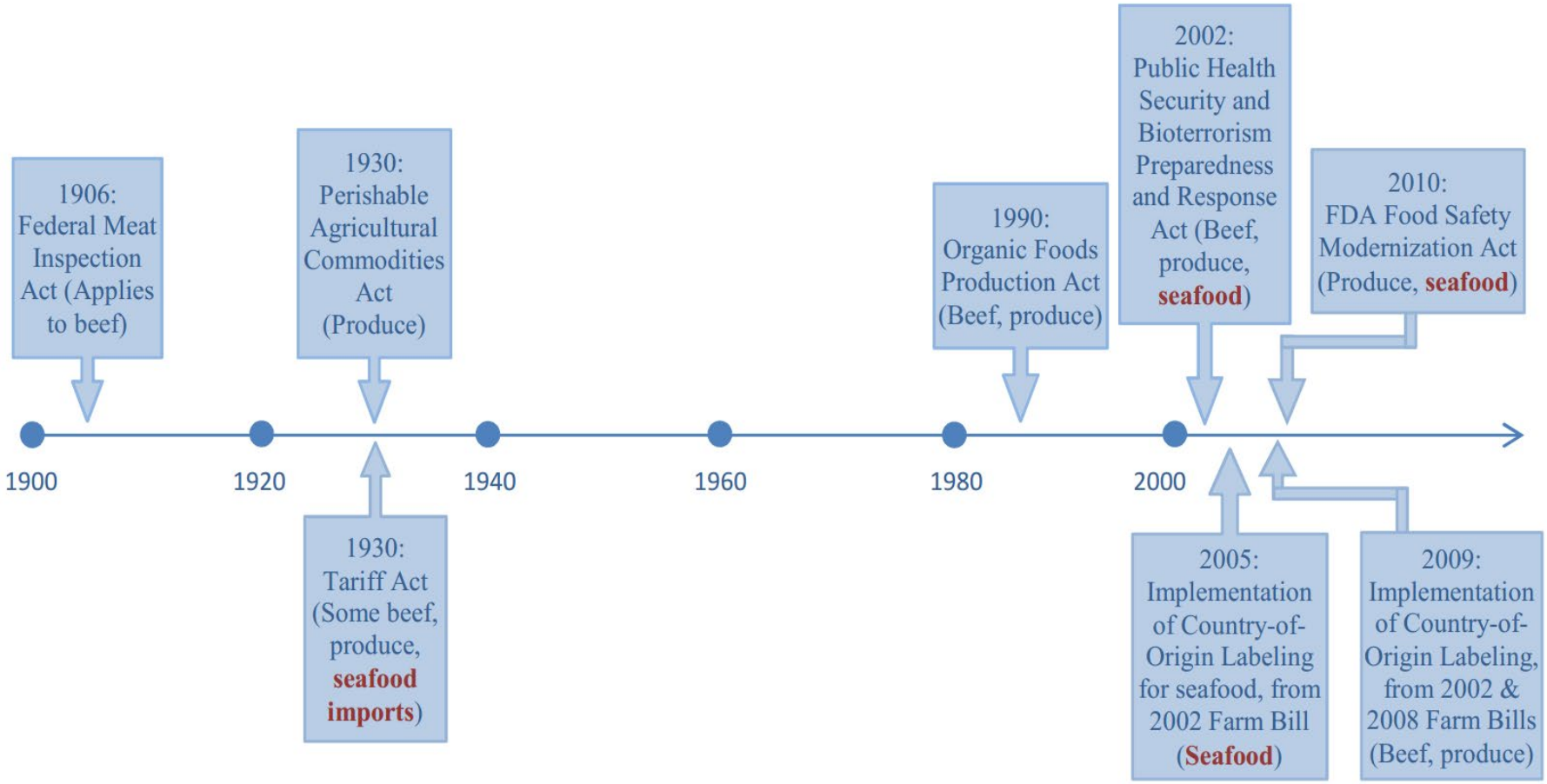
Document flow



The paper problem is mostly **cross-border.** E.g. Origin certificates.

Seafood traceability - COOL

Country of origin labeling



Trade secrets: Renaming and mislabeling of seafood

Jennifer L. Jacquet, Daniel Pauly

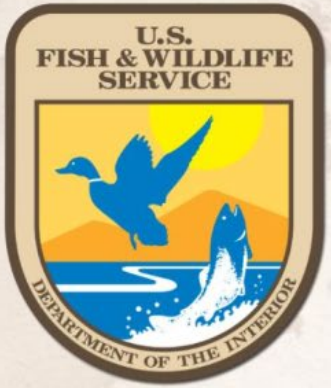
Show more

https://doi.org/10.1016/j.marpol.2007.06.007

Abstract

As the global trade and market for seafood has grown, so have the twin problems of renaming and mislabeling. Resource scarcity, the potential for greater profits, and weak legislation have all encouraged incorrect labeling, the results of which include consumer losses, the subversion of eco-marketing, further degradation of fisheries resources, and even adverse effects on human health. This paper examines the extent and consequences of renaming and mislabeling seafood, the state of current legislation, and the importance of future policies, with particular attention to the US, where 80% of the seafood is imported and more than one-third of all fish are mislabeled. Policy recommendations include governments' support for a global mandate to label species, country of origin, and catching or production method on

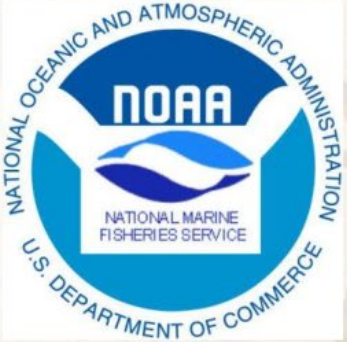
PGA


U.S.
FISH & WILDLIFE
SERVICE
DEPARTMENT OF THE INTERIOR


FDA


UNITED STATES CUSTOMS
AND BORDER PROTECTION
ONE TEAM - ONE FIGHT
DEPARTMENT OF
U.S.
HOMELAND SECURITY
VIGILANCE - SERVICE - INTEGRITY


USDA


NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
NATIONAL MARINE
FISHERIES SERVICE
U.S. DEPARTMENT OF COMMERCE

Seafood import

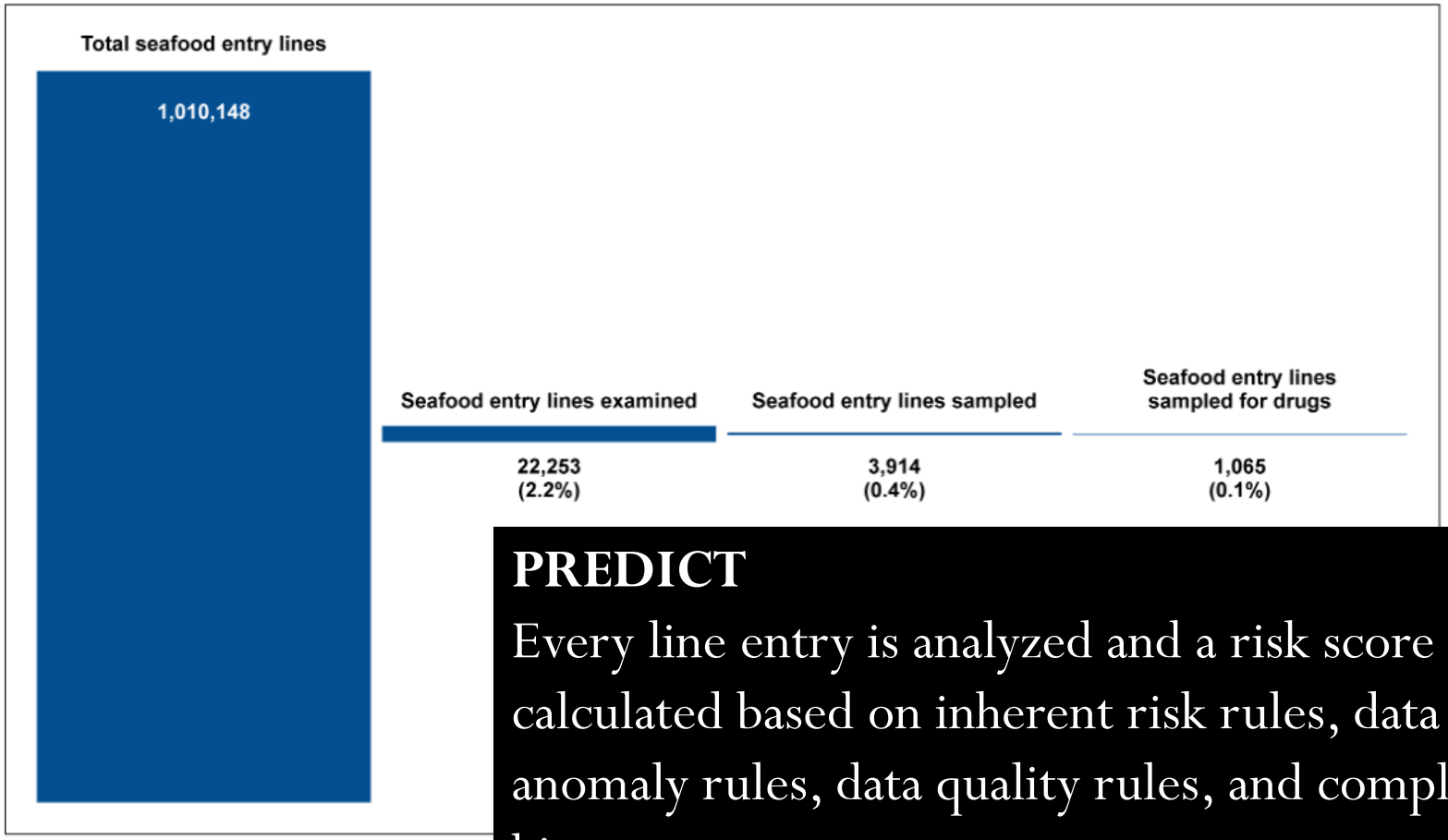
- **Mislabeling** Seafood Species.
- Aquaculture commodities with US **prohibited animal antibiotics and harmful chemicals.**
- What chemicals and additives are in the seafood.
- **Source of the seafood** (Antidumping/Countervailing Duty).
- Fraudulent **foreign government documents** (Shrimp Form).
- Public demand for safely harvested seafood from harming dolphins, whales, **endangered species.**

Seafood import

- **Provide all data elements in ACE** (data, permits, Certificate of Origin, Captains Statement..).
- Verify that the commodity requirements with *FSIS (Food Safety and Inspection Service), FWS, FDA, NOAA NMFS, USDA*.
- Provide correct information: tariffs match commodity description, data matches program requirements, e.g. 370 data is for Tuna.

Imported Seafood Safety Program

Figure 3: Total Seafood Entry Lines, Lines Examined, Lines Sampled, and Lines Sampled for Drugs by the Food and Drug Administration (FDA), Fiscal Year 2015

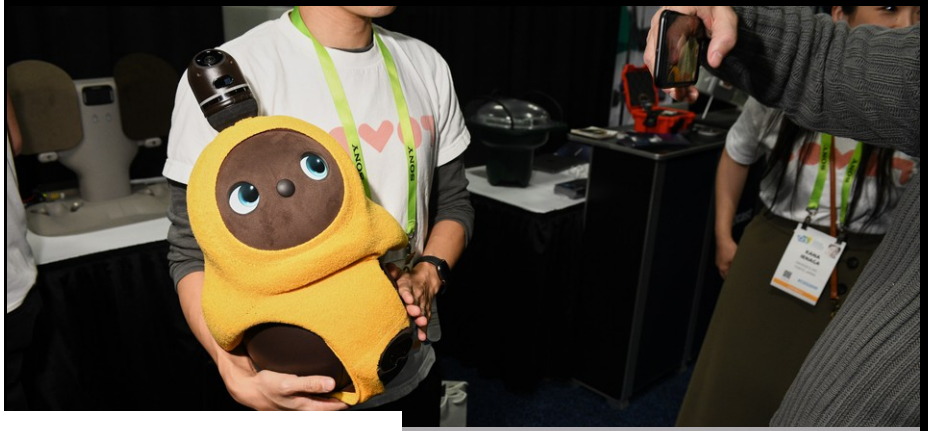


Source: GAO analysis of FDA data. | GAO-17-443

PREDICT

Every line entry is analyzed and a risk score is calculated based on inherent risk rules, data anomaly rules, data quality rules, and compliance history.

Carnets

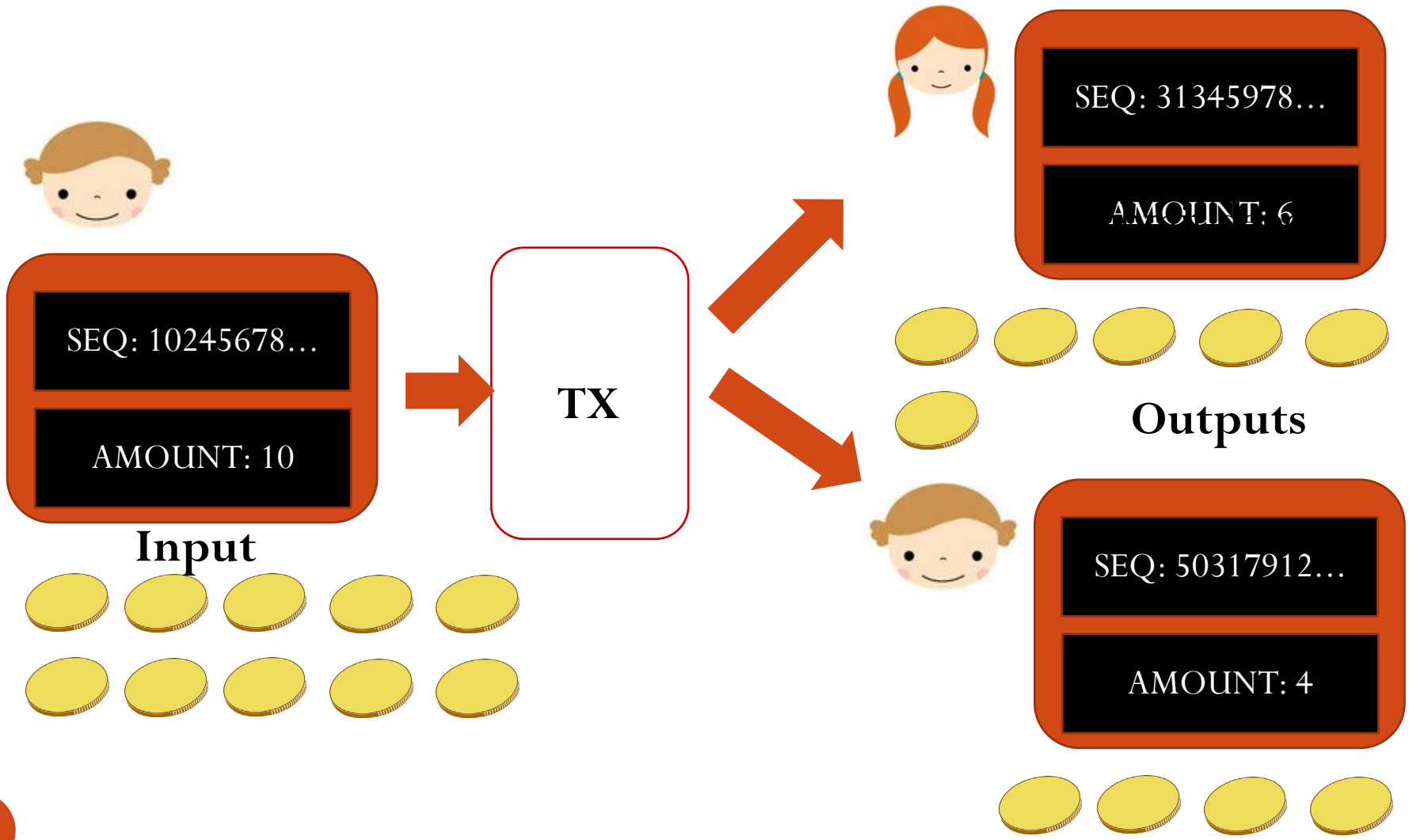


Carnets, commonly known as "Merchandise Passports", are international customs documents that simplify customs procedures for the temporary importation of various types of goods. In the U.S., two types are issued: ATA and TECRO/AIT Carnets.

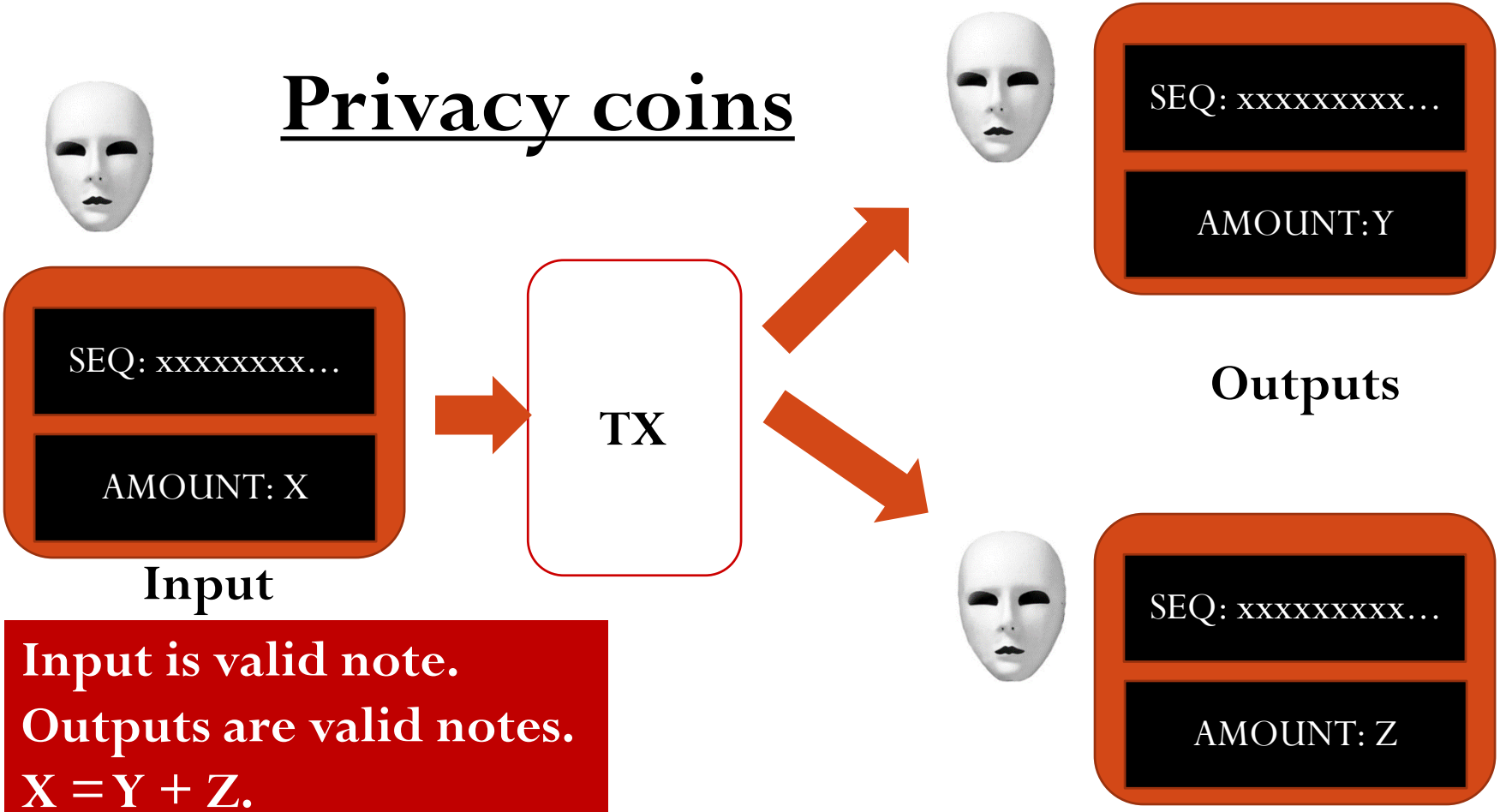
“Common” misconceptions

- Snapshot view of fast evolving technology.
- Cannot achieve record keeping privacy and confidentiality.
- …

Transaction without privacy



Transaction with privacy



Input is valid note.
Outputs are valid notes.
$X = Y + Z.$
$X \geq 0, Y \geq 0, Z \geq 0.$

Transaction with privacy

Validate without opening it

Satisfying privacy and confidentiality

- Still support validation and auditability.
- Examples
  - *Proof that tax is calculated correctly without knowing income, tax rate, and tax amount.*
  - *Proof membership without disclosing identity.*
  - *Proof holding valid license without giving away license.*
  - …

Validation of confidential data

	A	B	C
1	***Name***		
2	Treaves Arthur		
3	Mead David		
4	Demmings Brian		
5	Bartholomew James		
6	Horn Carol		
7	Walser Robert		
8	Bunker Hillary		
9	Hughes Kimberly		
10	Hindemith George		
11	Seidel Ariel		
12	Eschel Monica		
13	Lajoie Gerald		
14	Difasi Angie		
15	Stiers Andrew		
16	Coin Katherine		
17	Dwyer Gregory		
18			
19			

Alice Miller?

Validation of confidential data

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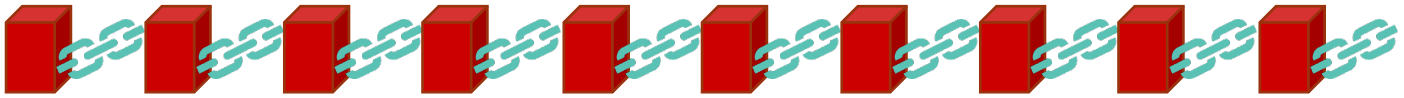
15	Stiers Andrew		
16	Coin Katherine		
17	Dwyer Gregory		
18			
19			

Proof

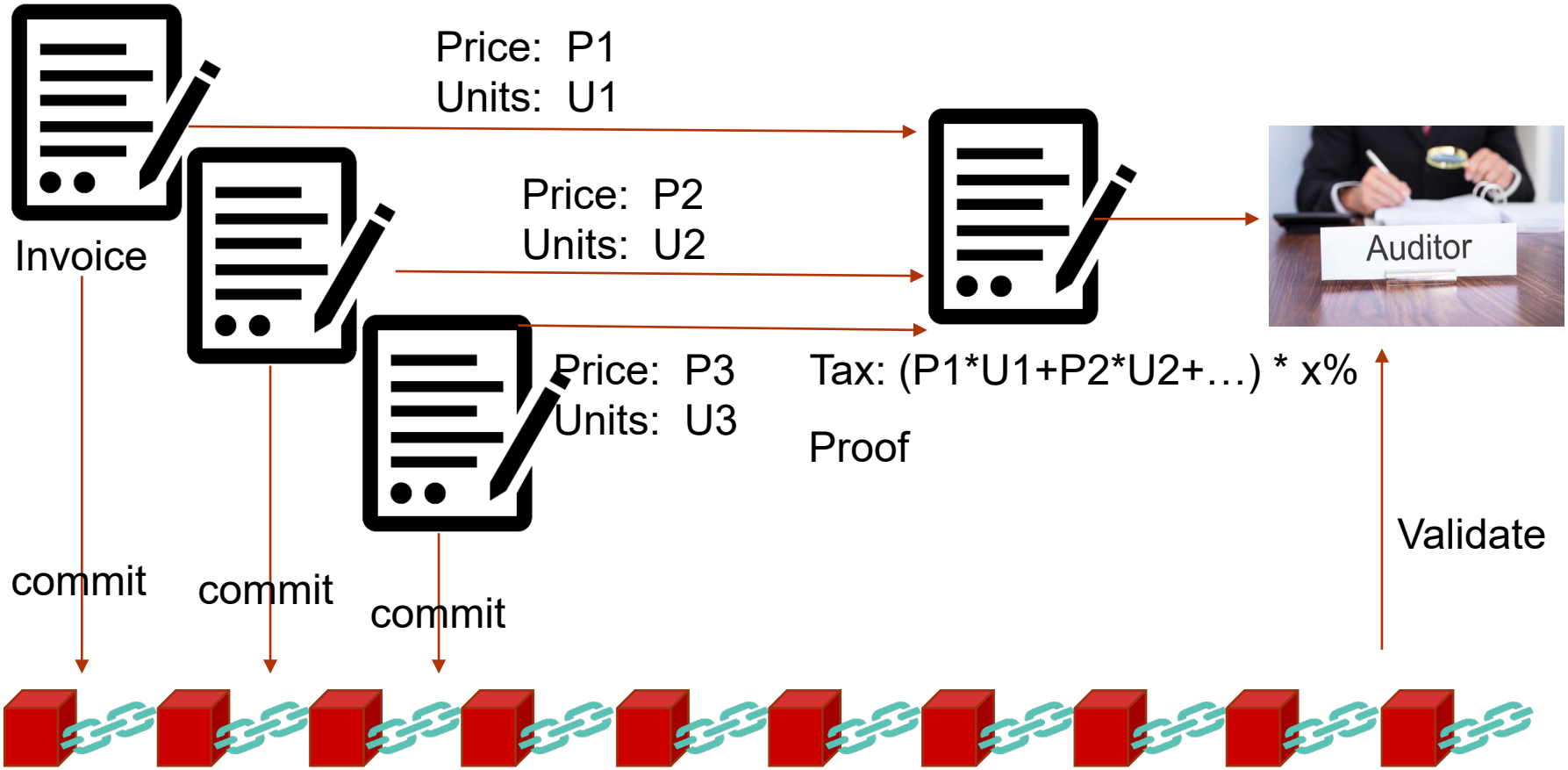
Alice Miller?

Commit a constant size number

Validate the proof



Validation of confidential data



IBM Pilot

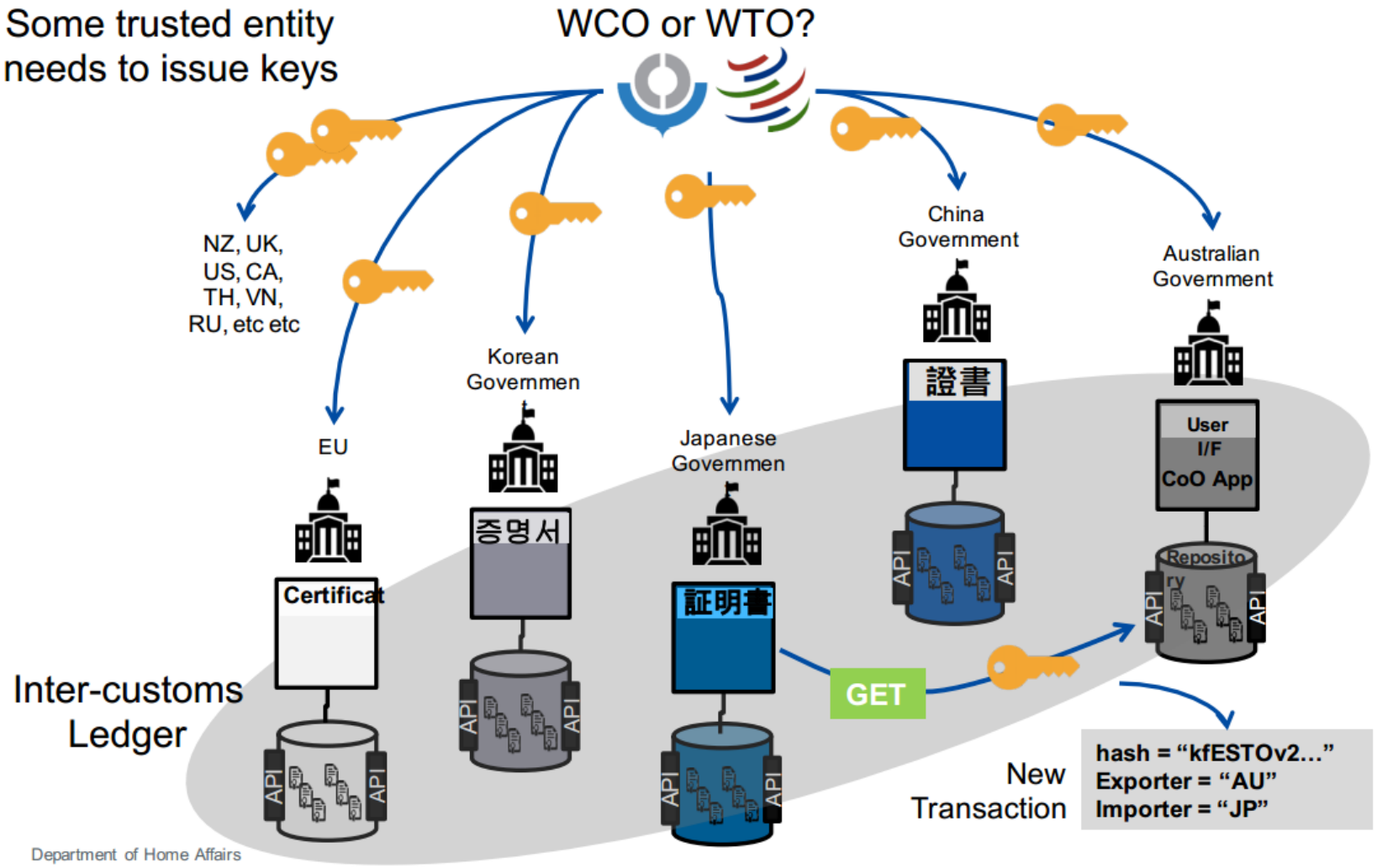
10% efficiency savings (goal)

Schneider: Container Electric goods,
- **France to Rotterdam by truck**
- **onto Maersk Line ship and**
- **transported to Port of Newark.**

- **Real Time Visibility** of shipments' status demoed on a technology platform, implementing key parts of the **Data Pipeline** concept, showing **Increased Efficiency**

Global Trade Digitization: A real world application of blockchain. Norbert Kouwenhoven, IBM, GTD Customs Borders. WCO IT Conference, June 9 Tblisi.

Inter-customs ledger for certificates



Department of Home Affairs

Economic model

Utility theory of privacy and information sharing

A utility theory of privacy and information sharing

Julia M. Puaschunder*

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6 East 16th Street, 11rd floor, 1129F-99, New York, NY 10003, USA,

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F 001 212 229 5724, http://juliampuaschunder.com/

Economic model

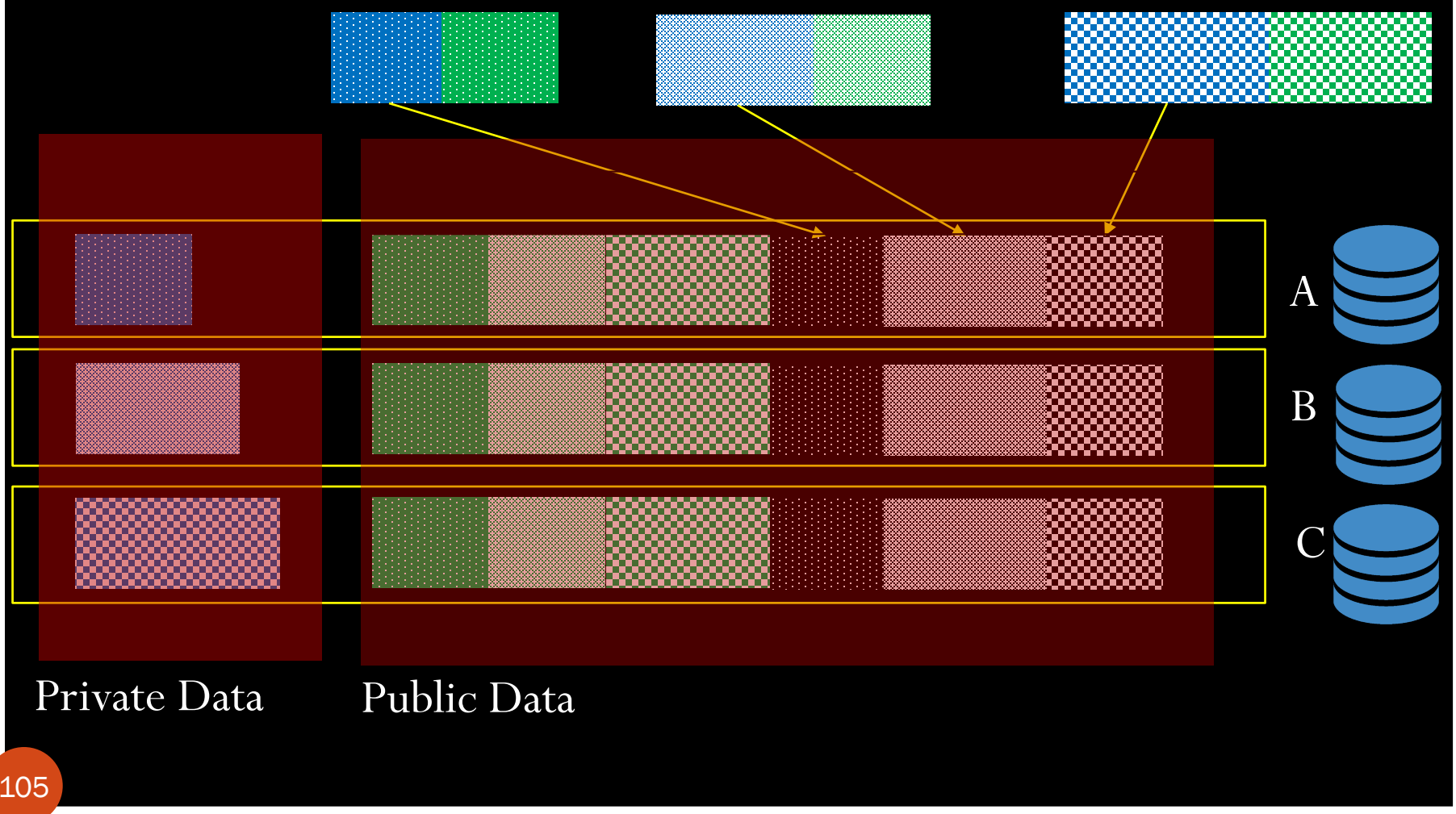
INFORMATION SHARING AMONG FIRMS

Xavier Vives*

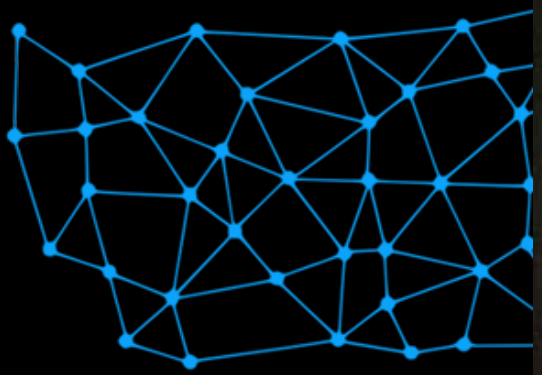
Abstract

This article discusses the definition of "information sharing among firms," a new entry in the second edition of the *Palgrave Dictionary of Economics* edited by Macmillan. Information sharing (IS) among firms is a controversial topic. Firms may exchange different kinds of data, such as information about customers' behavior, prices, and demand conditions. This paper first

Data privacy



Duality



Version of reality created by blockchains.

Version of reality created by legal order.

Data accuracy recording physical world

Connections between digital and physical worlds are keys realizing the value of blockchains.

Standards

WORLD CUSTOMS ORGANIZATION
ORGANISATION MONDIALE DES DOUANES

Thank You