Distributed Ledger Technology (DLT)

Insight from the GAO Audit Trail

MPIAF Conference 2019
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Outline

- INSIGHT FROM GAO
  - Completed Work
  - Expected Work
  - Lessons Learned
- Audit Implications
  - Opportunities
  - Challenges
- Summary

The Technology

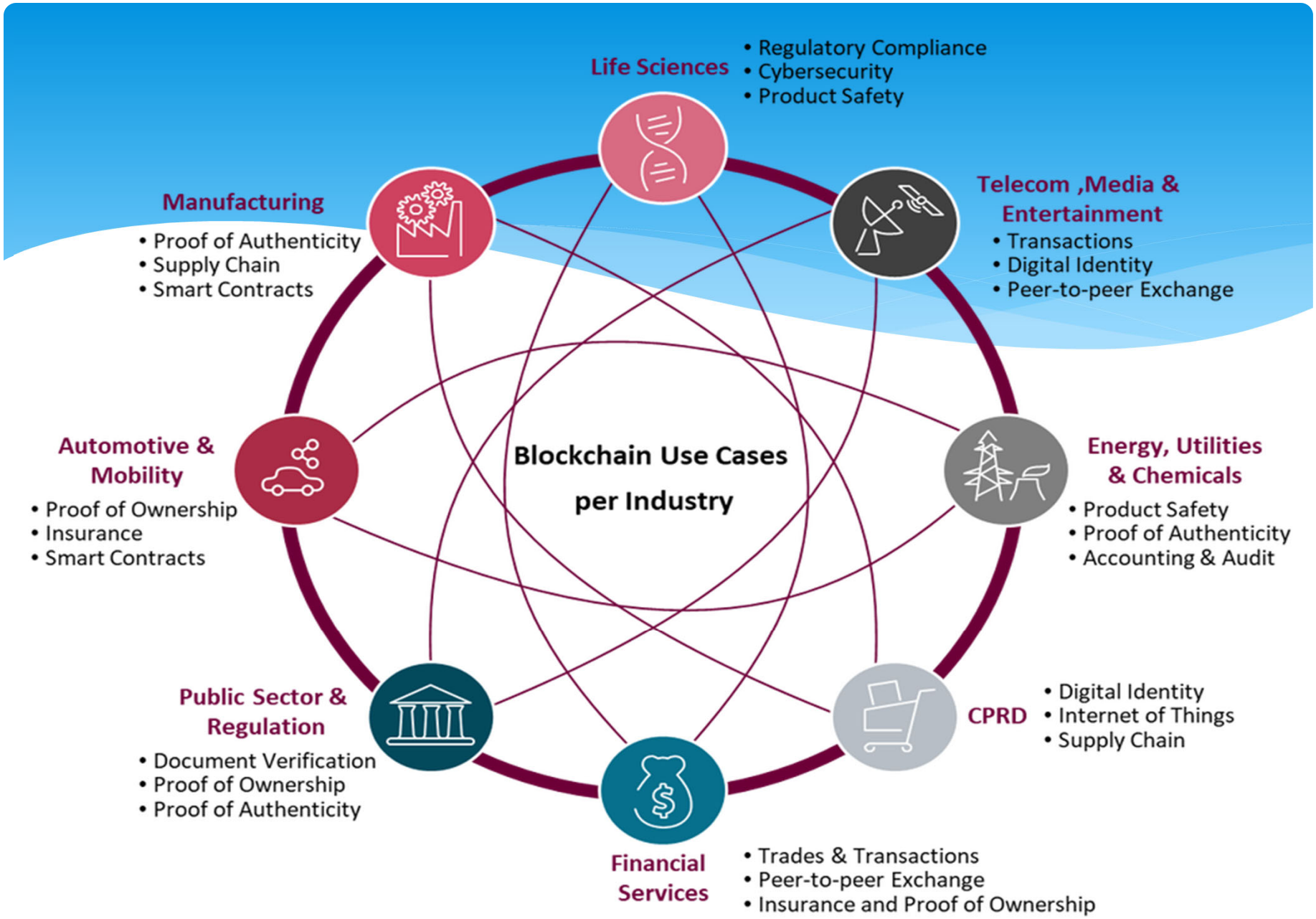
* Distributed ledger: secured way of conducting transfers of digital assets in a near real-time basis potentially without the need for a central authority
  * All network participants can have their own identical copy of the ledger; changes to the ledger are reflected in all copies
  * The security and accuracy of the information stored in the ledger are maintained cryptographically through the use of 'keys' and signatures to control who can do what within the shared ledger
  * *Blockchain is one type of DLT*

DLT Potential

"The blockchain revolution has a greater potential than anything we've seen in history. It's bigger than the Internet revolution, how it's going to restructure society" – P. Byrne

"In reality, blockchain is one of the most overhyped technologies ever" – Nouriel Roubini

"We tend to *overestimate* the effect of a technology in the *short run* and *underestimate* the effect in the *long run*" – *Roy Amara*


Blockchain Use Cases per Industry
Life Sciences
• Regulatory Compliance
• Cybersecurity
• Product Safety
Telecom ,Media & Entertainment
• Transactions
• Digital Identity
• Peer-to-peer Exchange
Energy, Utilities & Chemicals
• Product Safety
• Proof of Authenticity
• Accounting & Audit
CPRD
• Digital Identity
• Internet of Things
• Supply Chain
Financial Services
• Trades & Transactions
• Peer-to-peer Exchange
• Insurance and Proof of Ownership
Public Sector & Regulation
• Document Verification
• Proof of Ownership
• Proof of Authenticity
Automotive & Mobility
• Proof of Ownership
• Insurance
• Smart Contracts
Manufacturing
• Proof of Authenticity
• Supply Chain
• Smart Contracts

50+ BLOCKCHAIN
REAL WORLD USES CASES

GOVERNMENT
Essentia develops world's first blockchain solution to manage international logistics hub together with Traffic Labs and the Finnish Government

essentia.one

IDENTIFICATION
Voter registration is being facilitated via a blockchain project in Switzerland spearheaded by **Uport**.

uport

MOBILE PAYMENTS
The blockchain ledger that **Ripple** uses has been latched onto by a group of Japanese banks, who will be using it for quick mobile payments.

ripple

INSURANCE
A smart contract-based blockchain is being used by Insurer **American International Group Inc** as a means of saving costs and increasing transparency.

AIG

ENDANGERED SPECIES PROTECTION
The protection of endangered species is being facilitated via a blockchain project that records the activities of these rare animals.

CARBON OFFSETS
IBM is using the Hyperledger Fabric blockchain in China to monitor carbon offset trading.

IBM HYPERLEDGER

ENTERPRISE
Ethereum's blockchain can be accessed as a cloud-based service courtesy of **Microsoft Azure.**

Microsoft Azure

BORDER CONTROL
Essentia has devised a border control system that would use blockchain to store passenger data in the Netherlands.

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SUPPLY CHAINS
IBM and **Walmart** have partnered in China to create a blockchain project that will monitor food safety.

IBM Walmart

HEALTHCARE
A number of healthcare systems that store data on the blockchain have been pioneered including **MedRec.**

MEDREC

SHIPPING
Shipping is a natural fit for blockchain, and **Maersk** have been trialling a blockchainbased project within the maritime logistics industry.

MÆRSK

REAL ESTATE
Blockchain is now being used to complete real estate deals, the first of which was conducted in Kiev by **Propy.**

PROPY

ENERGY
Essentia is developing a test project that will help energy suppliers track the distribution of their resources in real time, whilst maintaining data confidentiality.

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LAND REGISTRY
Land registry titles are now being stored on the blockchain in Georgia in a project developed by the **National Agency of Public Registry.**

NATIONAL AGENCY of PUBLIC REGISTRY

COMPUTATION
Digital Currency Group are helping Amazon Web Services examine ways in which the distributed ledger technology can help improve database security.

DIGITAL CURRENCY GROUP

ADVERTISING
New York Interactive Advertising Exchange has been experimen- ting with blockchain as a means of providing an ads marketplace for publishers.

NYIAX

BORDER CONTROL
Essentia is developing a blockchain project for border control that will allow customs agents to record passenger data from an array of inputs and safely store it.

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JOURNALISM
Decentralized journalism, as enabled by blockchain technology, has the potential to prevent censorship and increase transparency, as **Civil** has shown.

CIVIL

WASTE MANAGEMENT
Waltonchain is using **RFID** technology to store waste management data on the blockchain in China.

ENERGY
Food importation is another industry where blockchain is proving its worth, with **Louis Dreyfus Co** trialling a soybean importation operation using this technology.

LDC. Louis Dreyfus Company

DIAMONDS
The **De Beers Group** is using blockchain to track the importation and sale of diamonds.

DE BEERS GROUP OF COMPANIES

FINE ART
By storing **certificates** of authenticity on the blockchain, it's possible to dramati- cally reduce art forgeries, as one blockchain project is proving.

NATIONAL SECURITY
For the past two years, the **US Department of Homeland Security** has been using blockchain to record and safely store data captured from its security cameras.

TOURISM
In a bid to boost its tourism economy, **Hawaii** is examining ways in which blockchain-based cryptocurrencies can be adopted throughout the US state.

TAXATION
In China, a tax-based initiative is using blockchain to store tax records and electronic invoices led by **Miaocai Network.**

ENERGY
Chile's National Energy Commission has started using blockchain technology as a way of certifying data pertaining to the country's energy usage as it seeks to update its electrical infrastructure.

CNE COMISIÓN NACIONAL DE ENERGÍA

RAILWAYS
Russian rail operator **Novotrans** is storing inventory data on a blockchain pertaining to repair requests and rolling stock

НОВОТРАНС

ENTERPRISE
Google is building its own blockchain which will be integrated into its cloud-based services, enabling businesses to store data on it, and to request their own white label version developed by **Alphabet Inc**

Google Alphabet

MUSIC
Arbit is a blockchain-based project led by former Guns N Roses drummer Matt Sorum seeking a fairer way to reward musicians for their creative efforts.

arbit

FISHING
Blockchain technology has been used to provide a transparent record of where fish was caught, as a means of ensuring it was legally landed.

THE INTERNET OF BLOCKCHAIN FOUNDATION

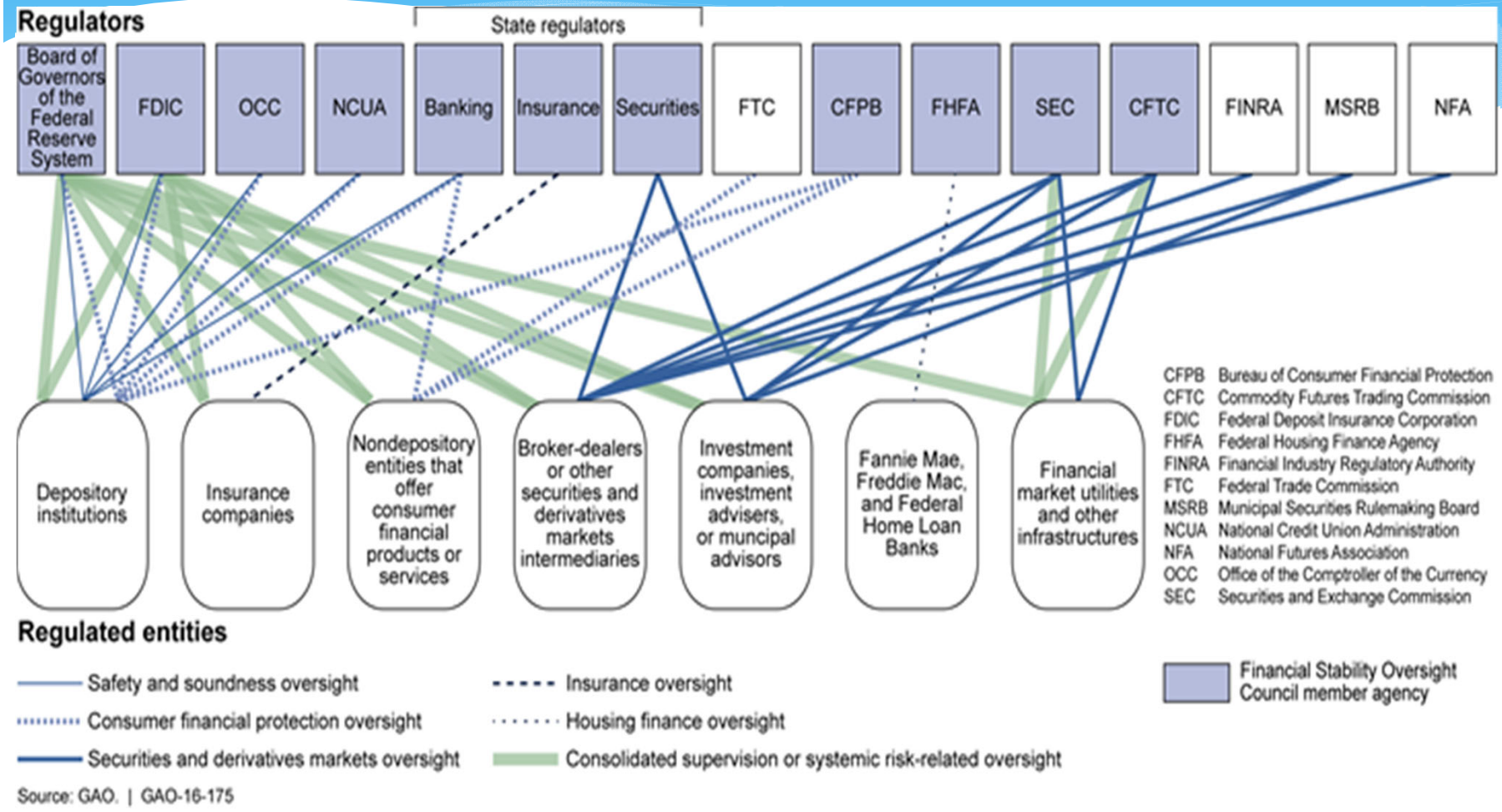
GAO work on DLT to date has been limited

* **Virtual currencies:** GAO-14-496
  * Unpacks the Blockchain technology underlying Bitcoin but primary focus is on the challenges virtual currencies create for regulators, consumers and law enforcement
* **Insurtech:** GAO-19-423
  * Given its potential importance, we reviewed potential uses of DLT in the insurance industry (limited adoption to date)
    * Insurer collection and use of consumer data raises questions about data accuracy, privacy, and ownership

Lesson: Build Knowledge Base Now

* **Fintech Subsectors:** GAO-18-254
  * Focused on risk and benefits of financial innovations including DLT, and the need for regulators to be flexible and forward looking
    * evaluate the feasibility and benefits of adopting knowledge-building initiatives which would **provide valuable knowledge about products and risks** to both firms and regulators
    * initiatives are critical given the fragmented nature of the financial regulatory structure

Relevant Financial Regulators?



Potential DLT-related audits

* Regulation and Oversight
  * Is the federal regulatory framework well positioned for blockchain technology?
    * Oversight over nonbank blockchain technology-based companies (DAO)
    * Impact of regulatory uncertainty on industry development and compliance
    * **Regtech and Supertech** (use of technology to comply with regulations and in supervision and examination activities)

Potential Audits (continued)

* Emerging consumer and privacy protection and cybersecurity issues
  * CFTC and the Federal Reserve have identified cybersecurity and operational risks as potential risks of DLT
* Work requested by new House Financial Services Committees
  * Taskforce on Financial Technology
  * Taskforce on Artificial Technology

Technology at GAO

* Our technology assessments explain the consequences that certain technology will have on the federal government—and on society as a whole
  * Artificial intelligence, Internet of things
  * Big data analytics, 3D printing
* GAO's Audit Innovation Lab: established to explore, pilot, and deploy new advanced analytic capabilities, conduct research in information assurance, and explore emerging technologies that will impact future audit practices

Impact on Audit and Assurance

* Assessing the impact on the audit and assurance profession is a somewhat speculative exercise
  * New, immature technology and still many unknowns
  * Blockchain hurdles:
    * Slowness and reliant on the heavy consumption of power
    * privacy issues
    * lack of standards governing the industry
    * limited scalability to date

Auditors in the Ecosystem

* If DLT lives up to its promise, what role will auditors play?
  * A major one *if* DLT can be operationalized on an enterprise level.
    * Blockchain brings validation, trust and transparency but does not invalidate the role of audit and **assurance**
  * Could ultimately require refocusing and re-tooling the auditor skill set
    * Expect distributional consequences over the long run
    * Necessitates capacity building

Challenges Require Audit Expertise

* Auditors remain critical
  * determining whether systems are working correctly
  * assessing the control environment (which increases in complexity with DLT deployed at an enterprise level)
* Records on the ledger could:
  * reflect programming errors
  * be unauthorized or fraudulent
  * be related party transactions
  * be linked to “off-chain” side agreements
  * be incorrectly classified

Opportunities: From Client Adoption*

* Real-time audits
* Source of verification
* Enables more efficient data extraction and analysis, including automated audit routines
* Review entire population in lieu of random sampling
  * Machine learning and AI enhance forensic accounting and fraud investigation opportunities; anomaly detection
* AICPA (2017) notes a number new potential roles

Summary

* While it is easy to get carried away with the "story", DLT has transformative potential – even if it is limited to specific applications where transparency and tamper-resistance trumps speed
  * As with may other professions DLT will likely impact the auditing and assurance field
* It is best to be prepared by understanding the technology and how to audit it, leverage its potential power, and address its potential vulnerabilities

External Sources

* **AICPA, "Blockchain Technology and the Future of Audit"** **https://www.aicpa.org/interestareas/frc/assuranceadvisoryservices/blockchain-impact-on-auditing.html**

* **Accounting Blockchain Coalition (ABC)**, "Auditing Blockchain", 2019 Blockchain, Accounting, Audit & Tax Conference in New York, NY. https://vimeo.com/showcase/6078562

* **The Internet of Blockchains Foundation** https://medium.com/@matteozago/50-examples-of-how-blockchains-are-taking-over-the-world-4276bf488a4b