CONSENSYS

An Executive's Guide to the Future of Asset Management

PART 1 - TRANSFORMING ASSET SERVICING

CONTENTS

> *We see blockchain technology fundamentally changing the way the asset management industry operates, with the role of the asset servicer seeing the biggest impact"*

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Executive Summary

This paper is the first in a series of papers on the future of the asset management industry and the key role we see blockchain playing in this evolution, now, and in the years to come.

Blockchain is a new technology with the potential to transform many industries, including the asset management industry. Efforts are already under way to integrate 'shared' or 'distributed' ledgers into various business models and processes. Some applications and products are already live and many more are in the development pipeline. This report provides an overview of:

1. What is blockchain?

2. Why is blockchain important for the asset management industry?

3. The benefits blockchain technology will bring to the asset management industry, such as:

   - New products

   - Improved efficiency and cost-savings

   - Enhanced data quality

   - Trust among stakeholders and eco-systems

The report then examines a variety of use cases which show blockchain's transformative potential, across the following areas:

1. Impact on the Asset Servicing Industry

2. Impact on the Asset Manager

3. Impact of Tokenisation

4. Impact on the Custodian Bank

5. Impact on Fund Administration

Real life examples of early innovators in these areas are highlighted throughout the text. These examples provide valuable insights into how blockchain will shape the asset management industry.

If you already know what blockchain is, feel free to jump straight to the section on 'Introduction to the Asset Servicing Industry'.

What is Blockchain?

Blockchain is a distinct type of Distributed Ledger Technology (DLT). DLTs involve ledgers, or databases, where the input and maintenance of data on the ledger is controlled on a peer-to-peer (P2P) basis. This P2P nature means that there is no central trusted party or intermediary required to control the ledger, and so they can be said to be decentralised. The Blockchain DLT technology takes its name from the way in which the ledger is structured, where inputs onto the ledger are grouped into blocks of transactions, which are then validated and transmitted to the network.

HOW DOES IT WORK?

The two most important concepts which were combined to create the blockchain technology were asymmetrical cryptography and distributed IT architecture.

Asymmetrical cryptography is a system of public and private keys which allows users to confidently exchange encrypted information with unknown third parties. A public key is a string of numbers and letters which can be made available to everyone [think of your email address], while the private key remains secret, and is used to access any data which is sent to your public key [think of your password used to login and access your emails].

A distributed IT system is a series of independent computers, known as nodes, which can communicate with each other over a network with no central node, much like the Internet. As all the nodes are connected to each other on a P2P basis, when one goes down it does not bring the entire network down with it, also known as automated redundancy.

Blockchains use these two concepts to allow users to store and send information in a decentralised manner, while the users of the network maintain it with the help of consensus algorithms which certify and confirm the transactions into 'blocks'. Users which complete this certification are known as miners, and a range of consensus algorithms are used depending on the blockchain, the most prevalent of which are proof-of-work and proof-of-stake. Once the miners have validated blocks through these mechanisms, it is added to the chain and shared with the network. Each block contains a hash of the previous block, which means that if any data in the block was altered in any way, the hash of the block would also change, and so the link to the chain would be broken. This means that once a block has been added to the blockchain, it is prohibitively difficult for it to be changed, making blockchains effectively immutable and tamper proof.

BEYOND TRANSFER OF CURRENCY AND THE BIRTH OF ETHEREUM

The original Bitcoin blockchain was created specifically for the transfer of bitcoin, or digital currency, between peers. However, it could not be programmed to transfer anything beyond this. In 2015, Vitalik Buterin launched Ethereum, which was the world's first fully programmable blockchain. Ethereum crucially supports the creation of smart contracts. These are contracts between two or more parties which are digitally programmed and automatically execute clauses of the contract on the completion of certain events. The events which cause the automatic execution can be external to the blockchain, and the data concerning it is fed into the blockchain by a trusted third party known as an oracle. Think for example of sensors on a property which can detect flooding, data from which could be fed into a smart contract through an oracle, leading to an automatic execution of flood insurance claims. These oracles are often linked to Internet of Things (IoT) connected devices, which allows for the automation of the collection of data into the blockchain and gives the confidence that there is accuracy in the data which the contract is being executed against.

PUBLIC AND PRIVATE BLOCKCHAINS

The original Bitcoin blockchain, as well as Ethereum's Mainnet, are both examples of what are known as a public blockchains. This means that anybody in the world with access to the Internet and appropriate hardware can access the shared ledger, store a copy of it on their machine, and begin to modify it through using their computing power to validate transactions. While public blockchains are extremely powerful in ensuring true distribution of the network and transparency, they are not always suitable for enterprises which may want to control the access and permissions of users on their chain.

This is where private or consortium blockchains are useful, and many of the enterprise blockchain applications currently in production in the Financial Services industry are hosted on a private or consortium chain.

A private blockchain is one where a central authority controls the right to access or post transactions to the ledger, which are verified through proof-of-authority. These chains can be incorporated into enterprises alongside their existing systems and provide an encrypted audit trail of transactions between members of the enterprise or group of enterprises.

A consortium blockchain is one which is open to the public, but where only certain data is visible to participants. Users are assigned permissions and blocks are validated based on pre-defined rules, often proof-of-authority. Consortium blockchains can therefore be said to be "partly decentralised". In order to be a consortium and not a private chain, the participating companies must be equally involved in the consensus and the decision-making processes of the chain.[1]

1 This section has been taken from our Blockchain & Insurance report "Blockchain & Insurance: New Technology, New Opportunities" for sources please refer to this paper
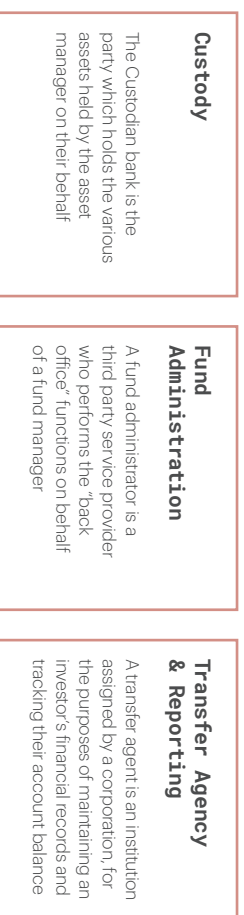
2 https://komgo.io/

Introduction to the Asset Servicing Industry

Blockchain is a new technology that "has quickly become a fixation in the financial services industry" due to its potential for disintermediation, improved reconciliation of data, and the efficient transformation of business models[3]. This statement rings true for the asset management industry, where the technology has been spoken about with high praise for a number of years. While we see blockchain causing major disruption in the management of assets and the role of the asset manager in the coming years[4], we will only briefly touch on this topic in this paper. For this paper, we will focus on the engine room of the European funds industry, the little-praised but crucial back and middle office role which is called asset servicing. There will be another report to follow in this series specifically focused on the future of asset management, in which we will delve deeper into the role of blockchain for the asset manager.

WHAT IS ASSET SERVICING?

Taking a step back, we define an asset servicer as any company who delivers; custody & depository, fund administration & transfer agency services[5]. Asset servicing as an activity coversare all of the broad actions which an asset servicer undertakes, which include but are not limited to; corporate actions, reconciliation, custody, fund accounting, compliance and performance measurement[6]. For the purposes of this paper, we will focus on three main areas of asset servicing and the use cases associated with each of them. These are the following:

Custody

The Custodian bank is the party which holds the various assets held by the asset manager on their behalf

Fund Administration

A fund administrator is a third party service provider who performs the "back office" functions on behalf of a fund manager

Transfer Agency & Reporting

A transfer agent is an institution assigned by a corporation, for the purposes of maintaining an investor's financial records and tracking their account balance

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3   Dave Nuenberger and Angus Champion de Crespigny, *Blockchain in Insurance: Applications and Pursuing a Path to Adoption* (New York: EY, 2017)

4   Darryn Pollock, *How Is Blockchain And Artificial Intelligence Changing The Face Of Asset Management?*, Forbes, 2019, https://www.forbes.com/sites/darrynpollock/2019/01/22/how-is-blockchain-and-artificial-intelligence-changing-the-face-of-asset-management/#7b400551f6d79. Accessed 22 August 2019

5   Irish Funds, "Fund Industry Services", Irish Fund https://www.irishfunds.ie/getting-started-in-ireland/fund-industry-services. Accessed 22 August 2019

6   Northern Trust, "Fund Services: Gain Efficiency and Flexibility Across Your Fund Operations" Northern Trust, https://www.northerntrust.com/europe/what-we-do/asset-servicing/fund-services. Accessed 22 August 2019

It has been widely heralded for some time that the asset servicing industry is in an unprecedented period of change[7]. There are a number of key reasons for this, with the following being the most pressing:

- **Regulation:** An every changing and increasingly complex regulatory environment is opening up the door for new services

- **Technology:** A shift to focus on investment in technology solutions and a more robust data architecture to ensure delivery of a more seamless client experience

- **Operational Changes:** A squeezing of margins and decreased revenues leading companies to reimagine their operating models and reorganise their value chains

This interesting mix of circumstances has led BBH to comment that this "creates significant opportunity for differentiation" in the market[8]. To begin with, it would be remiss of us not to briefly discuss the evolution of the role of the asset manager and how the emergence of a new asset class will impact the asset servicing industry as we know it.

ASSET SERVICES VALUE CHAIN

Fund Accounting & NAV

Trade Support & Middle Office

Compliance & Reporting

Global Custody

Transfer Agency

DISRUPTED

HIGHLY DISRUPTED

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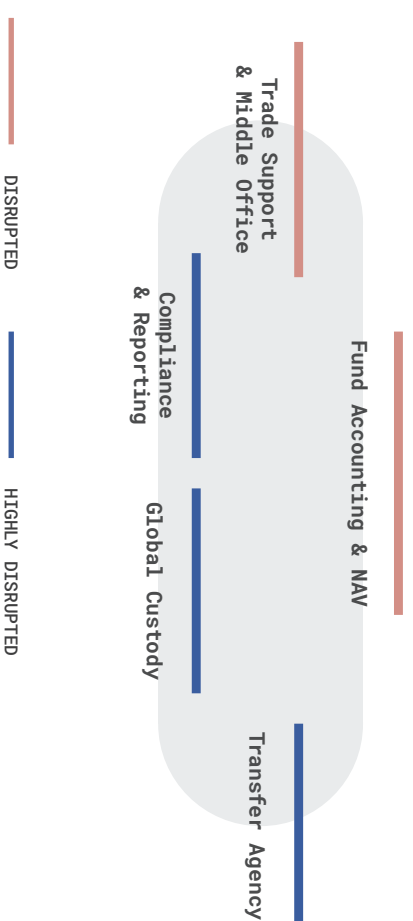
7   Alex Birkin, *How to use blockchain technology in asset management*, EY, 2018, https://www.ey.com/en_gl/wealth-asset-management/how-blockchain-is-changing-asset-servicing. Accessed 22 August 2019

8   Brown Brothers Harriman, *Global Trends in Asset Servicing*, Brown Brothers Harriman, 2018, https://www.bbh.com/resource/blob/31130/80d41b9e0da07cd4821053031641860b/global-trends-in-asset-servicing--2-data.pdf Accessed 22 August 2019

> "Blockchain can save asset managers up to $2.7 billion per year"

THE DIGITAL ASSET MANAGER

The role of the asset manager has never been more under the spotlight as it is today, with Invesco Chief Executive Martin Flanagan going as far as to say that one in three asset management firms could disappear in the next 5 years[9]. With this sentiment in mind, there has never been a bigger impetus on asset managers to not only reimagine how they deliver their services, but also question what new services they could potentially introduce. Furthermore, claims such as "blockchain can save asset managers up to $2.7 billion a year"[10] have really shone a spotlight on the potential role that blockchain and other disruptive technologies can play in helping asset managers gain the upper hand on competitors.

An asset manager is a company which invests assets on behalf of their clients for financial gain. An example of an asset manager would be BlackRock, who have approximately $6 billion assets under management (AuM)[11]. The role of the asset manager is one that is constantly evolving due to a number of factors. In more recent times, the major factors have revolved around[12];

1. **The changing nature of investors** - recent years have seen a market shift from active to passive investing, meaning asset managers have had to rethink how they build their portfolios

2. **Lowering fees** - a trend towards lower fees in the market has forced asset managers to look to other ways of maintaining their margin, namely by introducing new technologies to lower cost bases

3. **Digital players/platforms** - new market players such as Betterment coming to the market have seen investors have a digital alternative to traditional asset managers and has forced more traditional incumbents to take note of new channels to reach investors

We contend that an area that will prove to be of significant interest to asset managers moving forward is the area of tokenisation, which is enabled through blockchain technology.

9. Robin Wigglesworth, 'One in three asset management firms could disappear, says Invesco chief', 2019, Financial Times, https://www.ft.com/content/c4ff2a92-4508-11e9-a965-23d66b674c0b/fb, Accessed 22 August 2019

10. Attracta Mooney, 'Blockchain 'could save asset managers $2.7bn a year'', Financial Times, 2018, https://www.ft.com/content/b617001f-171f-11e8-9e9c-25c8147e16d0, Accessed 22 August 2019

11. Danielle Walker, 'BlackRock AUM increases 9% for quarter, surges past $6 trillion', Pension & Investment, 2019, https://www.pionline.com/article/20190416/ONLINE/190419877/blackrock-aum-increases-9-for-quarter-surges-past-6-trillion, Accessed 22 August 2019

12. Santander, The changing nature of investing, Santander UK plc, https://www.santander.co.uk/info/the-changing-nature-of-investing, Accessed 22 August 2019

Tokenisation and Asset Servicing

WHAT IS TOKENISATION?

Blockchain enables tokenisation, in which tokens are created on the blockchain as a digital representation of a unit of value. This unit of value can be assigned to anything deemed valuable by society, be it digital assets or digital representations of real-world assets[13]. Therefore, the possibilities for asset managers are essentially endless, as tokens could represent everything of value – physical assets, real estate, creative productions (works of art, music, etc), service leases and timeshares, securities, and a whole lot more. The type of token most relevant for an asset manager is a security token, however they are not the only type as we see below.

The different types of tokens:

Security Tokens: Tokens that are backed by tradable assets, ranging from coins redeemable for precious metals, to tokens backed by real estate. A great example of this is Mata Capital which we will look at in our case study

Equity Tokens: A subcategory of security tokens that represent ownership of an asset, such as debt or company stock

Utility Tokens: Also called App Coins or User Tokens, provide users with future access to a product or service. A good example of a Utility token is the Storj token which is used to pay for cloud storage on the network[14]

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13   Consensys Media, An Exploration of 5 Ways Enterprises Can Benefit from Tokenization,ConsenSys,. 2019, https://media.consensys.net/an-exploration-of-5-ways-enterprises-can-benefit-from-tokenization-e31f0c666bc08 Accessed 22 August 2019

14   Decentralized Cloud Storage — Storj, 2019, Storj, https://storj.io/, Accessed 22 August 2019

WHAT IS A SECURITY TOKEN OFFERING?

Similar to an ICO, an STO is a process whereby security tokens are created which represent a tradable asset[15]. Security tokens can represent shares in companies, precious goods like metals or fine art, or even the ownership of real estate. As such, these STO events open up the presence of a secondary market for the tokens, which is a new potential revenue stream for asset managers.

STOs can present asset managers with a number of key benefits, including:

- **Secondary market creation** - by essentially creating a secondary market for traditionally illiquid assets, this provides investors with a greater freedom and opportunity for trading, and also can differentiate an asset manager's offering

- **Access to new customers** - the introduction of the secondary market bringing increased liquidity is a positive way to attract new investors, as the traditionally high minimum investments would not need to be upheld

- **Lower cost base** - as token transfers can be automatically filled and executed via smart contracts, this provides the marketplace with a lower cost base and more accessible marketplace than the traditional asset that they represent

We will delve deeper into all of these topics in greater detail in our next paper in this series, dedicated to the impact of blockchain on asset management.

CODEFI

The Blockchain Operating System for Global Commerce and Finance. ConsenSys have built a platform to act as the operating system for the future of commerce and finance. The next page is an overview of the Codefi platform and some of its key features.

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15   Darryn Pollock, How Tokenization Opens A New World Of Asset Management And Investment, Financial Times, 2019, https://www.forbes.com/sites/darrynpollock/2019/04/15/can-tokenisation-open-a-new-world-of-asset-management-and-investment/#72e7c0a143f3, Accessed 22 August 2019

The blockchain operating system for global Commerce and Finance

Commerce and Finance are evolving as the infrastructure, manufacturing, and distribution value chains move to blockchain networks and digital assets. We built ConsenSys Codefi to help clients benefit from this profound transformation across trade finance, banking, investing, and real estate. Our platform comprises an "operating system" with modular capability to digitize financial instruments and catalyze new markets.

Optimize business processes

Incorporate blockchain-native authenticity, scarcity, and programmability into work-flows, enabling governance, compliance, and system incentives through secure APIs and scalable, customizable software

Activate digital financial instruments

Create and grow markets with potential for greater liquidity, reduced costs of capital, access to a broader investor and capital base, and improved incentive alignment between stakeholders

Deploy production-ready blockchain solutions

Leverage the pioneering innovation of the Ethereum ecosystem to create compliant, production-ready blockchain solutions for use-cases across the financial sectors

Why ConsenSys Codefi?

ConsenSys is one of the world's largest blockchain companies, building the tools, infrastructure, and applications that power the Ethereum network. Since 2014, we have tokenized billions of dollars in digital assets, including a wide range of consumer products, stablecoins, real estate, and financial instruments, powering tens of billions of dollars in blockchain-based transactions. Through our applications, we have served hundreds of thousands of users, ranging from central banks and major financial institutions to developers and retail users of the Ethereum mainnet.

Our solutions not only navigate but also help shape regulation and public policy. As the official blockchain partner of the EU Blockchain Observatory and Forum, and as a founding member of Global Digital Finance and The Brooklyn Project, we are equipped to navigate and deploy blockchain-based software in the most complex of regulatory environments. Across our strategic engagements, we have optimized assets and business processes within large multinational corporations in traditional and emerging financial markets and commercial networks, to realize cost savings of 20 to 80%.

TRUSTED BY WORLD GOVERNMENTS, CENTRAL BANKS, AND MAJOR FINANCIAL INSTITUTIONS

ENTERPRISE ETHEREUM ALLIANCE

European Commission

GLOBAL DIGITAL FINANCE

South African Reserve Bank

WORLD FEDERATION OF EXCHANGES

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CONSENSYS

mata capital

CASE STUDY: MATA CAPITAL[16]

Mata Capital, an independent player in the management of real estate investment funds with around 600 million euros of assets under management, today announced the adoption of blockchain technology to optimize the processing of securities registers for its real estate investment products. The launch of this new platform was carried out in partnership with ConsenSys, a leader in the development of blockchain software products, and Screeb Notaires, a notary office that supports innovative projects in the real estate sector.

Mata Capital will register financial assets - in this case the shares of a capital company that owns real estate - and associated rights in the form of a "token" represented on the Ethereum blockchain. In addition to significantly reducing liability management costs for the issuer, blockchain technology enhances the liquidity of unlisted assets, increases transaction transparency, and reduces the risk of fraud. "Tokenization will allow us to provide better liquidity to our investors, especially in the secondary market," says Baptiste Saint-Martin, product development manager at Mata Capital.

This groundbreaking development from Mata Capital is testament to the fact that blockchain technology has the potential to totally revolutionise the role of the asset manager as we know it moving forward and we look forward to discussing this at length in our next paper.

16   Mata Capital & ConsenSys, "Mata Capital, in partnership with ConsenSys and Screeb, deploys a blockchain platform for the real estate fund industry", ConsenSys, 2019, https://content.consensys.net/wp-content/uploads/07_2019_Mata-Capital-press-release_FINAL.pdf Accessed 22 August 2019

The Digital Asset Custodian

The first player we will discuss in relation to asset servicing is the Custodian Bank. As the name suggests, the role of the custodian is to hold and safeguard investor assets. The Custodian bank is the party which holds the various assets held by the asset manager on their behalf. In the case of the funds industry in Europe, it's important to also note the role of the Depositary. While a Custodian has custody of assets, a Depositary acts not only as a Custodian but also holds the legal ownership of the assets and as such performs a role similar to that of an auditor[17]. Under the Alternative Investment Fund Managers Directive (AIFMD) it is a legal requirement that a fund appoints a Depositary[18], where the depository functions include;

The safe-keeping of assets	Cash monitoring	Oversight

With the 4 largest custodian banks in the US - JP Morgan, State Street, Citi & BNY Mellon - each overseeing over $15 trillion in assets under custody respectively, any disruption to this industry could see a fundamental change in the funds industry as we know it today[19].

Blockchain has the potential to not only improve how Custodian's provide their current services, but it also opens up a suite of new potential services to offer to their clients. Firstly, we will assess how blockchain can potentially impact the area of corporate actions and how they are handled, and secondly we will look at a new service they can provide due to the area of tokenisation discussed in section 3, the custody of digital assets.

17 European Union, The role of the depositary under the AIFM Directive, Loxlogy, 2013, https://www.lexology.com/library/detail.aspx?g=699cb4fc-4d39-4d5b-ba28-29a6a3fd89cd. Accessed 22 August 2019

18 Irish Funds, 'Fund Industry Services', Irish Fund, https://www.irishfunds.ie/getting-started-in-ireland/fund-industry-services. Accessed 22 August 2019

19 How Blockchain Could Disrupt Banking, Cbinsights, 2018, https://www.cbinsights.com/research/blockchain-disrupting-banking/ Accessed 22 August 2019

CORPORATE ACTIONS

The management and communication of corporate actions events have long been said to be a pain point of the custody industry[20], with blockchain being experimented with in recent times to provide a feasible alternative to the traditional processing of corporate actions. A corporate action is an activity which is initiated by a public company which will bring a material change to their underlying securities[21]. In some cases, they may require shareholders to submit a response, usually in the form of proxy voting at an Annual General Meeting (AGM). For this reason, these events are important for asset managers, and by association, the custodians who safeguard these securities[22].

Typically, Custodians rely on a number of alternative data sources to provide a clear picture of a corporate action and its associated events, from vendors such as Bloomberg and Thomson Reuters. The combination of having to pay a number of premium vendors, combined with the need to sometimes standardise these data sources into a single feed, can prove to be a costly and time consuming process, which can lead to a poor investor experience. Blockchain provides the potential to gather data from these sources and create a single source of truth for corporate action data, thereby removing the need for a reconciliation process. By utilising smart contracts on top of this data set to automatically notify clients of actions, this would lead to a more streamlined process and a better investor experience, providing clients with a better opportunity to make a timely decision. BNP Paribas Securities Services has been a pioneer in this area, having been active in the space since 2017[23]. Blockchain also has the potential to revolutionise the proxy voting aspect of corporate governance, with the technology providing a fully auditable, transparent platform upon which to conduct these important events. We have seen companies such as JP Morgan, Santandaer and Northern Trust also champion this use case in their work on proxy voting[24].

20 Global Custodian Editorial, BNP Paribas Securities Services to use blockchain for corporate actions, Global Custodian, 2017, https://www.globalcustodian.com/bnp-paribas-securities-services-to-use-blockchain-for-corporate-actions/. Accessed 22 August 2019

21 James Chen, Corporate Action, Investopedia, 2019, https://www.investopedia.com/terms/c/corporateaction.asp. Accessed 22 August 2019

22 Advent,"Corporate actions processing: Ten common pain points and how to resolve them," Advent, 2016 https://cdn.advent.com/cms/pdfs/papers/WP_Corporate_Actions_Processing.pdf, Accessed 22 August 2019

23 Global Custodian Editorial, BNP Paribas Securities Services to use blockchain for corporate actions, Global Custodian, 2017, https://www.globalcustodian.com/bnp-paribas-securities-services-to-use-blockchain-for-corporate-actions/. Accessed 22 August 2019

24 Paul Walsh, "Major firms deploy blockchain for corporate action boost, Global Custodian", 2017, https://www.globalcustodian.com/major-firms-deploy-blockchain-for-corporate-action-boost/ Accessed 22 August 2019

TruSet

CASE STUDY: TRUSET - A ConsenSys Formation

TruSet is revolutionising the process of collecting and validating trusted, accurate data with their Ethereum based platform. TruSet is creating multi-sided marketplaces for users to collect, validate, publish, and commercialize business-critical data without the intervention of vendors or service providers. The concept behind users taking better control of their data turns the existing reference data collection process on its head.

Some key benefits of the platform:

Trust - Reference data is cryptographically embedded on the Ethereum blockchain

Quality - Data is validated by actual market participants, enabling increased confidence in the accuracy of the data

Efficiency - TruSet's consensus mechanism reduces the back office expenditure by enabling users to manage data as a community

Rewards - TruSet rewards contributors for publishing and validating data for the community

TruSet's platform presents the opportunity for Custodians to not only streamline and improve the current processes for traditional financial assets, but also provides them with the opportunity to move into the digital asset (or token) markets, which could be a key differentiator. For the purposes of this paper, we will focus on traditional financial assets platform, which is nearing it's launch.

TRADITIONAL FINANCIAL ASSETS[25]

TruSet Ethereum-enabled Community
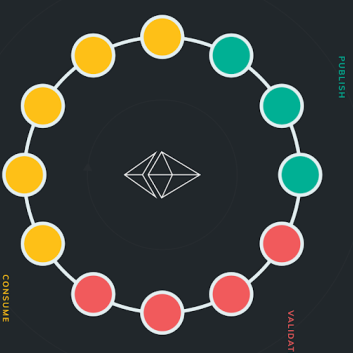
1 Publish
Contribute new reference data or update existing records on the platform.

2 Validate
Review new or updated reference data for accuracy and vote to either accept or reject.

3 Consume
Access community-validated, machine-readable data to power business critical processes.

PUBLISH
- Sell side banks
- Lead underwriters
- Trustees
- Fintechs & startups, particularly those with strong natural language processing and AI capabilities

VALIDATE
- Custodian banks
- Fund administrators
- Risk analytics providers
- Large asset managers
- Fintechs & startups, particularly those with strong analytic capabilities to identify data errors

CONSUME
- TruSet publishing & validating participants
- Global and regional banks
- Broker dealers
- Asset managers
- Hedge funds
- Regulators
- OMS/EMS
- Back office solutions providers
- Fintechs who need trusted, accurate reference data

25 Truset, Traditional Assets, Truset – A ConsenSys Formation,2018, https://www.truset.com/traditional-assets, Accessed 22 August 2019

A long standing pain point for custodians and their asset manager customers is the quality of security reference data. "Asset reference data is the plumbing of capital markets - accurate, trusted reference data is critical for almost every major system and process across the industry. But, current reference data services don't have the accuracy the industry needs," explains Will Janensch, TruSet founder and CEO. Both custodians and their customers need this data in trusted, machine readable data sets in order to run mission critical processes and analytics. But this information is initially made available as prospectuses published by the issuing bank to the securities regulator such as Company House in the UK. Company House then makes the prospectuses freely available. But, in order to run the many software systems that require this information, the industry needs it not as a prospectus, but as a machine-readable data feed. But, process errors are made that get passed to their custodian and buy-side customers by data vendors. Knowing this, each customer spends additional money in their own backoffice to find and correct those errors, a process that is repeated as an inefficient, undifferentiated cost function across the industry. Even after this error correction effort, each party may have fixed the data in slightly different ways, causing reconciliation issues downstream between counterparties and between custodians and their clients.

This challenge is exacerbated by the corporate actions that impact the fundamental data about each security. Keeping asset reference data up to date and in synch while incorporating changes caused by corporate actions means the challenge of cleansing and utilizing reference data never goes away.

Truset uses the principles of blockchain consensus to transform how security reference data is collected, validated, updated and maintained. On TruSet either the issuing bank or a 3rd party armed with the free prospectus can publish security reference data into a shared structured data set. Other members of the TruSet community then validate the accuracy of that information using a consensus protocol. Only if consensus is reached, that data accepted as a trusted, accurate record that is then available for the community to use as structured data. This creates a trusted community operated utility without relying on data vendors and where the effort to cleanse the data is mutualized across the industry to create a single version of the truth. Using the TruSet platform, custodians know that the data they are looking at has been validated as accurate by the industry and is identical to the data that their customers are also looking at.

Updating the data for corporate actions also becomes easier and more trusted. The custodian, knowing the information about a security has changed due to a corporate action, can publish that change into the TruSet community, where it will get validated. The validated data is then available to everyone simultaneously, ensuring that reference data sets stay in sync.

CUSTODY OF DIGITAL ASSETS

Whereas blockchain can certainly improve processes and disintermediate value chains in the current landscape for Custodians, tokenisation powered by blockchain also provides them with the potential to provide new products in a new marketplace, and thereby differentiate themselves from competitors. Custody solutions for cryptocurrencies and tokenised assets are fast becoming a pressing item on the agenda for traditional Custodian companies as new market entrants are emerging looking to lead in the space. BNY Mellon have noted that "there is increasing demand in the market for a traditional, established custodian to provide custody of cryptocurrencies"[26]. The key benefit for traditional Custodians in the market is both their strong brand name and regulated status, as evidenced by the positive news reaction to Citi's Digital Asset receipt offering[27]. While offerings such as Coinbase Custody[28] have seen institutional money flowing into the custody of cryptocurrencies, we are yet to see a market leader for other tokenised assets emerge in the space. Given the role Custodians play for traditional securities, we see the potential for them to also play a pivotal role in the custody of not only security tokens, but any kind of tokenised asset, as a new service to traditional and new market investors.

HOT STORAGE V COLD STORAGE

The storage of digital assets can be done in two ways, hot storage and cold storage.

HOT STORAGE
- **Online:** Wallet is online and connected to the internet
- **Accessibility:** Highly accessible funds
- **Security:** Vulnerable to attacks
- **Example:** MyEtherWallet

COLD STORAGE
- **Online:** Wallet offline and not connected to the internet
- **Availability:** Funds are less accessible
- **Security:** Highly secure
- **Example:** Nano Ledger S

26   Kara Kennedy, Crypto Custody, BNY Mellon, 2018, https://www.bnymellon.com/us/en/our-thinking/crypto-custody.jsp. Accessed 22 August 2019

27   Joseph Young, "Citigroup is the Latest Bank to Offer Crypto Custody: Here's How it Will Affect the Market", CCN, 2018, https://www.ccn.com/citigroup-is-the-latest-bank-to-offer-crypto-custody-heres-how-it-will-affect-the-market/ Accessed 22 August 2019

28   Rachel Wolfson, Custodial Solutions Are Latest Innovation in Cryptocurrency Ecosystem As Seen By Coinbase And Others, Forbes, 2018, https://www.forbes.com/sites/rachelwolfson/2018/09/20/custodial-solutions-are-latest-innovation-in-cryptocurrency-ecosystem-as-seen-by-coinbase-and-others/#18990172171c. Accessed 22 August 2019

Trustology

CASE STUDY: TRUSTOLOGY

Trustology is a company that offers custody services for personal, business & institutional clients. Trustology made the news last year when they launched their market leading TrustVault personal account product in the UK[29]. The product, initially focused on Ether holdings of UK clients, aims to offer the highest level of crypto asset security on the market, coupled with excellent performance. By using a mix of customised hardware security modules held in data centres, coupled with innovative use of the secure enclave in iPhones, Trustology launched a product which is truly unique to the crypto custody space. An interesting avenue for Custodians is the TrustVault-as-a-service also offered by the company, which provides all of the same innovative features, but with the added benefit of Trustology operating client accounts on behalf of financial institutions. "We are extremely excited to launch a service that truly solves one of the largest problems in the blockchain industry - how to conveniently manage crypto assets without compromising on speed or security," says Alex Batlin, Trustology's founder and CEO. "Upcoming, Trustology will work to support additional cryptoassets such as Bitcoin and ERC-20 tokens as well as a geographic expansion and launch of TrustVault Business Accounts[30].

29 https://www.google.com/search?q=trustology-personal-vault

30 Trustology, Trustology Launches TrustVault Personal Accounts in the UK for Managing Cryptoassets, Trustology, 2019, https://www.trustology.io/single-post/2019/03/27/Trustology-Launches-TrustVault-Personal-Accounts-in-the-UK-for-Managing-Cryptoassets, Accessed 30 August 2019

Fund Administration & Transfer Agency Reimagined
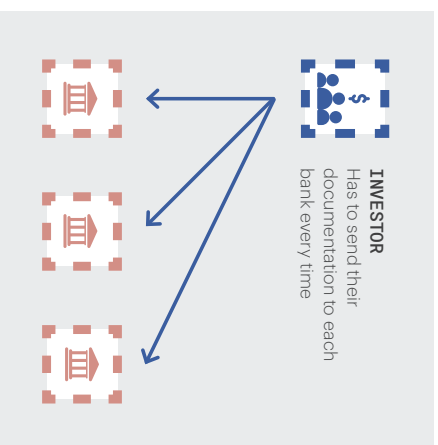
WHAT IS FUND ADMINISTRATION?

In the funds industry, a fund administrator is a third party service provider who performs the "back office" functions on behalf of a fund manager. These activities are usually the labour and paper intensive processes which help ensure that investors are up to date on the funds performance, while also making sure the fund is legally compliant[31]. Some of the main functions performed by a fund administrator include transfer agency, fund accounting, calculating the net asset value (NAV), reporting and compliance. While all of the above services fall under the fund administration umbrella, some service providers separate out the transfer agent role[32]. For the purposes of this paper, we will focus on fund administration as the area covering all of these services and we will focus in on a number of key uses cases we see as market leading. They are:

Know Your Customer (KYC)	Regulatory Reporting	Case Study on FundsDLT

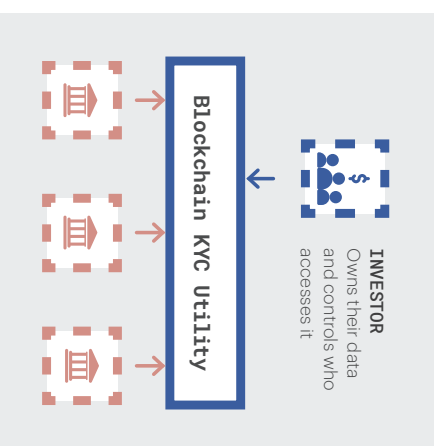31 APEX, What Is Fund Administration? The Evolution Of The Fund Administration, APEX, 2016, https://theapexgroup.com/latest-news/what-is-fund-administration-the-evolution-of-the-fund-administration/ , Accessed 30 August 2019

32 Fundsacademy, Funds Administration Overview, Fundsacademy, 2012, http://www.fundsacademy.com/funds_overview.html#XWeahZNKhTY, Accessed 30 August 2019

INVESTOR
Has to send their documentation to each bank every time

INVESTOR
Owns their data and controls who accesses it

`Blockchain KYC Utility`

KNOW YOUR CUSTOMER (KYC)

Know Your Customer (KYC) regulations impose a very demanding requirement on companies to compile and analyse documentation on their customers, particularly in the banking and insurance sectors. Existing regulations around KYC are designed to combat money laundering and the funding of illegal activities, as well as giving financial institutions a better understanding of their customers and their financial dealings. Complying with these regulations requires each institution to gather and store a wide range of sensitive documentation on their customers and retain it, leading to a huge centralisation of sensitive data in these companies. This centralised storage of sensitive data is vulnerable to cyber-attacks, and there have been numerous examples in recent times of cyber-attacks resulting in millions of customers personal data being compromised, one of which saw accounts of 76 million JPMorgan customers compromised[33].

The entire KYC process is one which could, therefore, be completely disrupted by blockchain technology. On a blockchain based system, there is no central database or single point of failure storing this sensitive information, making it much less susceptible to a cyber attack than a traditional database. Financial institutions could pool their resources to store their documents on a shared encrypted blockchain database. Goldman Sachs estimate that moving to such a system could have the potential to save the financial industry between $3 and $5 billion in KYC and Anti-

Money Laundering (AML) costs[34]. It is worth noting that in practice the cryptographic hash of the documents are stored on chain, with the actual documents stored in a database off-chain, so the company developing the blockchain needs to maintain good operational security for these databases. That said nothing is to say that is non-standard is required here and the data may be treated as any sensitive database would be. For example, one may use AES (industry standard symmetric key encryption) to protect documents at rest in the standard database. Potentially in the future, distributed document storage such as the Interplanetary File System (IPFS) may be used to efficiently distribute the storage of documentation, privately, when coupled with asymmetric or symmetric encryption at the document level[35].

How this could work in practice is that a shared ledger would exist onto which investors would upload their KYC documentation. This ledger would be shared between a range of fund administrators, and the personal documentation would be encrypted so that only the institutions that require access to them can view them. These institutions would be able to access the customer's documents through an encryption key which the customers would provide, which allows them to view the documents relevant to them alone. This addresses the security vulnerability stemming from centralisation of customers' data, whilst also giving the customers the potential to take back power and control over the documentation from the institutions by controlling their private keys. In practice customers may not choose to control their own private keys, so new intermediaries may crop up to manage identities and private keys for customers, who will have to be conscious that this may lead back to centralisation of their information.

This benefits financial institutions who do not have to gather and securely store KYC documents for every customer, but can access them through a shared blockchain ledger. It also benefits retail investors who can upload documentation one time and allow various institutions access as required, rather than having to duplicate the KYC process for a number of institutions. This reduces costs for insurers, banks, and brokers, and reduces friction for customers. The use of a shared ledger to store KYC documentation also brings internal benefits to large fund administration, who can use the ledger to reduce unnecessary and costly duplications of information requests. While there has not been a successful KYC utility yet in the funds industry, we have seen blockchain used by companies such as Fenergo, in their national blockchain KYC platform which was announced earlier this year[36] hereby creating a precedent and blueprint for fund administration companies to follow.

33   Dominic Rushe, JP Morgan Chase reveals massive data breach affecting 76m households, the Guardian, 2014, https://www.theguardian.com/business/2014/oct/02/jp-morgan-76m-households-affected-data-breach. Accessed 30 August 2019

34   Goldman Sachs, Blockchain: Putting Theory into Practice, 2016, p74. accessed through https://drive.google.com/file/d/0B1DEwCJXDakKArzZfS3kxMTZAVXc/view.

35   IPFS, Homeage, IPFS, https://ipfs.io/. Accessed 30 August 2019

36   Finextra, "Fenergo to deploy blockchain-based KYC utility in Bahrain", Finextra, 2019, https://www.finextra.com/newsarticle/33755/fenergo-to-deploy-blockchain-based-kyc-utility-in-bahrain. Accessed 30 August 2019

BANK
Sends report on a regular basis

REGULATOR

BANK
Sends data in real time

Regulatory Reporting Blockchain
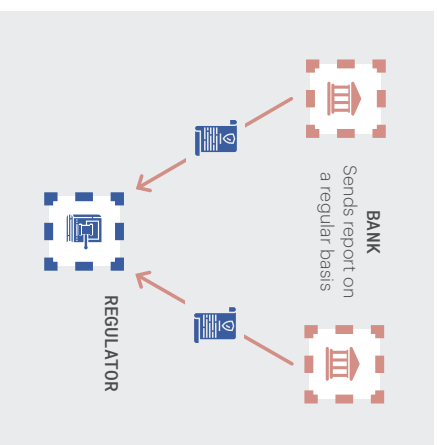
REGULATOR
Can access for real time view

REGULATORY REPORTING

Regulatory reporting is a labour intensive task undertaken by many firms in the financial services ecosystem. A traditionally mundane back-office task, the requi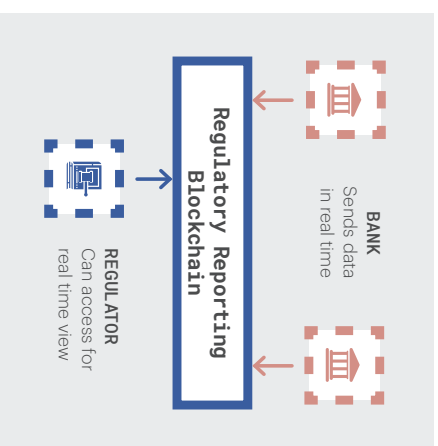rement and frequency of reporting has greatly intensified in recent years following the global financial crisis, with Christine Lagarde noting that "financial innovation...vastly outpaced regulation and supervision", hence the clamp down in recent years.[37] While many companies have thrown staff at the problem as a means to counteract the increasing burden, some companies have shown in recent times that blockchain could be a feasible technology used to combat them. As far back as 2016, Bank of Ireland trialled a blockchain based system for MiFIDII reporting[38], putting the financial services industry on notice as to the potential use of the technology to increase operational efficiency and reduce costs in producing the myriad of reports both monthly and quarterly. We will discuss two ways of using blockchain; the first being using blockchain as a means of submitting and verifying reports, and the second being having parties transacting on a blockchain and sharing information with the regulator in real time.

REPORTING WITH BLOCKCHAIN

Blockchain as means for reporting could be done by sharing the information directly with the regulator on a near real-time basis. Fund administrators currently share reports with their

37   Christine Lagarde, "Ten Years After Lehman – Lessons Learned and Challenges Ahead", IMF, 2018, https://blogs.imf.org/2018/09/05/ten-years-after-lehman-lessons-learned-and-challenges-ahead/ Accessed 30 August 2019.

38   efma, https://www.efma.com/innovations/innovation/bank-of-ireland-blockchain-for-regulatory-reporting/ Accessed 30 August 2019

regulators on monthly or quarterly basis. The reporting structure is generally quite consistent across time periods, however the manner in which information is gathered can be quite complex, leading to many last minute changes and manually intensive work being undertaken at the end of a period. By using the ETL layer tools which they normally use instead of populating a spreadsheet and uploading to a portal, there is the potential for fund administrators to upload this information onto a blockchain based platform. After confirming the total amounts , a hash of the each of the key financial figures would be created, along with a hash of the uploaded report document. The document could either be stored off chain on a database, or potentially on IPFS, thereby meaning that the regulator could have real-time access if granted. The regulator could rely on smart contracts to perform sanity checks of the reports and hereby automate a currently manual process, meaning more time to spend on their supervisory role. Another great benefit of using a blockchain here is that documents or figures could not be tampered with after the fact, ensuring a consistent reporting standard, with no risk of firms committing fraud.

A great example of this type of blockchain use case for regulatory reporting is Project Lighthouse by the Irish Funds Industry Association[39]. In this project, an Ethereum blockchain was used for Money Market Investment Fund (MMIF) reports to prove the benefit to both the fund administrator and regulator in reducing the cost and time of producing reports, thereby potentially disrupting the current operating model for reporting in the Irish funds industry.

REPORTING ON BLOCKCHAIN

While blockchain has the potential to enhance current processes and cut down regulatory reporting time, it also provides the potential to reimagine how information is shared with the regulators, and could potentially see the introduction of real-time reporting. Were fund administrators and their counterparties to operate and share information on a blockchain based platform across the industry, there would be no need for the reporting we see today. In this cryptographically secured system, counterparties would be able to send private transactions to one or multiple parties in a secure manner, while also being able to sign transactions with the public key of the regulator, giving them access to the data in real time. The potential benefit for reporting is apparent, as regulators would be able to feed the data in real time into their systems, giving them a pulse on the market immediately instead of waiting for a monthly or quarterly report which can be out of date by the time it is reviewed. A system such as this would greatly benefit the fund administrator, and there would be no onus on them to spend time producing reports. The regulator on the other hand also has the potential to have a real-time view of the industry which they currently can only dream of. While using blockchain to submit your reports as discussed in the previous section is more realistic, real-time information feeds which would make regulatory reporting a thing of the past is the blockchain nirvana.

39   Irish Funds, "Regulatory Reporting Blockchain PROOF OF CONCEPT FACTSHEET", 2017, Irish Funds, https://files.irishfunds.ie/1488969245-Regulatory-Reporting-Blockchain-POC-Factsheet.pdf Accessed 30 August 2019

FundsDLT
DISTRIBUTED LEDGER
MARKET INFRASTRUCTURE

CASE STUDY: ART OF THE POSSIBLE - FundsDLT

While many of the use cases discussed to this point in the paper have focused on siloed processes and value chains, there is the potential for industry-wide platforms which could revolutionise the asset management industry as we know it. We have seen success with this in other industries, for example the case study of komgo for commodity trade finance mentioned earlier in this paper. We feel there is the potential to adopt these kinds of industry initiatives in the asset management industry, which could transform, or even in some cases eradicate, the roles of asset servicing entities. One of these platforms for asset management which made the news earlier this year, when Credit Suisse successfully processed a full fund transaction, is that of FundsDLT, the Luxembourg based company[40]. It was said by Claude Metz, head of shareholder services, Credit Suisse Fund Services (Luxembourg) SA.at the time that "Blockchain technology in connection with potential mutualised KYC (know your client) servicing will be a game changer for the investment funds business," [41].

The FundsDLT blockchain platform brings all industry participants onto a single network to interact and transact in real time. Different modules and smart contracts manage certain fund administration tasks such as onboarding/KYC, net asset value (NAV) calculation, reporting, and trade/order processing and routing[42]. By having all of these traditionally siloed tasks on one platform, it creates a network effect of participants while also mutualising the information shared. Industry platforms such as FundsDLT, which serve in many ways as industry utilities, have the potential to harness the true benefits of blockchain technology by creating a decentralised marketplace infrastructure which could transform both business models and the entire industry as we know them today.

40 Joe Parsons, Credit Suisse processes fund transaction on DLT platform, 2019, Global Custodian, https://www.globalcustodian. com/credit-suisse-processes-fund-transaction-dlt-platform/. Accessed 30 August 2019

41 Press Release, Banco Best and Credit Suisse Asset Management process end-to-end fund transactions using blockchain-based infrastructure FundsDLT, Fundsquare, 2019, https://blog.fundsquare.net/banco-best-and-credit-suisse-asset-management-process-end-to-end-fund-transactions-using-blockchain-based-infrastructure-fundsdlt/. Accessed 30 August 2019

42 Fundsdlt Homepage, Fundsdlt 2017, https://www.fundsdlt.net/ Accessed 30 August 2019

> *Blockchain has the potential to totally revolutionise the asset servicing industry as we know it"*

Conclusion

Blockchain has the potential to totally revolutionise the asset servicing industry as we know it. The ability to break down data silos and move toward decentralization of information and power will save on costs and time while improving data quality. Smart contracts and oracles will allow new products to be developed that will better serve the needs of investors and asset servicing firms alike while also enabling the automation of many current, labour-intensive processes such as KYC & regulatory reporting as we have seen.

For the asset management sector to unlock the benefits of blockchain technology, the following points should be considered:

1. Collaboration and partnerships will be absolutely crucial

2. Asset managers will more and more be expected to quickly send and receive information in a way which is not possible through traditional means

3. Imagine new products as well as automated services when assessing the potential impact of blockchain technology

4. The full benefits of blockchain technology will appear when asset managers engage and trust partner organisations, and create an ecosystem where resources are pooled in shared ledgers

This report only provides a taster of the potential impact blockchain is playing and will play in the asset servicing industry by showcasing use cases across all of the key areas of Custodian Bank, Fund Administrator and Transfer Agent. We also briefly covered the impact on the asset manager, which we will cover in more detail in our next paper in this series. Examples of implementation demonstrate the speed at which theory is becoming practice and the role that some important asset servicing firms are already playing in this space. Asset servicers in Ireland and elsewhere have much to gain by engaging with blockchain technology.

To discuss how blockchain can be leveraged by your organisation, reach out to ConsenSys in Dublin through one of the contacts below.

About the Authors

This report was produced by the ConsenSys Dublin Innovation Studio.

ConsenSys is Ireland and the world's biggest dedicated blockchain company. The Dublin Innovation Studio is ConsenSys's global delivery centre, with a highly skilled team focused on excellent delivery of both product and advisory.

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Lory leads ConsenSys' Ireland hub. Prior to ConsenSys, Lory was a Director with Deloitte where he founded, set up and led Deloitte's Europe Middle East and Africa blockchain Lab. Lory has led blockchain corporate and governmental strategy projects, including production / live, pilot and POC projects. With the IDA in Ireland (Industrial Development Authority), Lory was the founding member of the Ireland national blockchain initiative 'Ireland Blockchain Expert Group' (IBEG) and it's digital window 'Blockchain Ireland'. This group includes 50 entities made up of global enterprises, universities, government entities and start-ups.
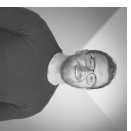
John Hallahan - Senior Consultant

John joined the ConsenSys Dublin Innovation Studio team in April 2018. Within solutions, John's main focus is working with governments, enterprises, and consortia to assist them in identifying, designing and building products and platforms. John has experience as a business analyst on blockchain engagements ranging from Proof of Concept to Production and has also helped large global banks and Governments define their blockchain strategies. Prior to working in ConsenSys, John was a founding member of the Deloitte EMEA Blockchain Lab in Dublin and also sat on the Deloitte EMEA FinTech taskforce. John's role within the taskforce was focused primarily on connecting startups to established clients to build FinTech solutions across a number of technology verticals including AI, blockchain & big data.

Contacts

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Claire has over 20 years' experience working for large multinationals (telecommunications, FMCG), two Big 4 consultancy firms, and as founder of a successful start-up acquired by a Big 4 firm. Claire leads the scaling of ConsenSys' Ireland. Prior to ConsenSys, Claire was a founder of Red Planet a consultancy bringing outside in start-up innovation to large corporates. Claire sold Red Planet to Deloitte in 2017. Prior to that Claire was CFO for Wayra Ireland, a start-up accelerator successfully invested seed capital across a wide range of digital start-up entities and successful scaled a proven revenue-focused commercial acceleration programme.

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Eoin's skills are in solution integration, relational databases and data migration, bespoke corporate solutions, large project budgeting and business case validation. Eoin is a former Technical Architect for the Deloitte EMEA Blockchain Lab with over 18 years of experience as a technologist delivering development projects for financial, corporate and government clients. Eoin's current focus is continuing to learn more about Ethereum's capabilities in the enterprise space and the delivery of meaningful large-scale blockchain projects for clients.

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