



DIGITAL MORTGAGE – WHAT'S NEXT?

A perspective on Blockchain for US Mortgage Industry

Edgar F Codd's seminal work in the 70's in creating the relational database model – was controversial and revolutionary. It took almost two decades for the relational database to become globally desirable, accessible, and viable. A number of concurrent and collateral inventions were necessary to bring the relational model technology to life. We are on a similar cusp with distributed-ledgers and blockchains. We are seeing rapid adoption of Web3 and blockchain technologies across industry verticals. This technology holds the promise of both game-changing efficiencies as well as new disruptive business models.

Adoption of blockchain in the residential mortgage industry in the US has its unique set of challenges. Distributed ledgers challenge us to create bigger transformation agendas and returns with deep and trusted partnerships within and across business ecosystems. For the US Mortgage industry that is highly fragmented the concept of distributed ledgers pose an unpalatable pill due to the conventional business model "moats" of proprietary data, interfaces and systems, and abject fear of the unknown (compliance, risk, fraud, etc.). Unfortunately, the distributed ledger innovation is still dominated by technology evangelism and hasn't yet fully addressed this business model 'elephant in the room'. Further clarity needs to be determined in role incumbents would play with adoption of the new technology and how business models would evolve. This position paper is here to help.

Distributed ledger technology can deliver the ever elusive 'digital mortgage', with one trusted and continuously verified set of data and documents throughout the mortgage lifecycle, not disparate copies spread across business entities and systems with time-consuming, labor-heavy, error-prone reconciliations in between. We provide a definitional view, discuss art-of-the-possible, and offer a 5-step process for securing transformative success for your distributed ledger journey.



Table of Contents

What is blockchain? An overview	4
Art of the possible - How is blockchain relevant for the mortgage industry?	5
Opportunity for blockchain in the digital mortgage lifecycle.....	8
5-step process for lenders to secure transformative success for your distributed ledger journey.....	9
1. Look past the hype	9
2. Look to the leaders	9
3. Look to the innovators	9
4. Get to work on your incentive model	9
5. Be prepared to re-invent yourself.....	9
Conclusion	10
About the authors	11
Acknowledgement.....	11
References.....	12

What is blockchain? – An overview

In its simplest form Blockchain technology is a **distributed digital ledger**. Just like a traditional ledger that records credit and debit transactions along with traceability (date, time, author, event, etc.) and with veracity (tracking changes/modifications with approvals and signatures), blockchain is a ledger too, one that records digital transactions in a **secure, transparent, immutable** and **traceable** manner. Digital transactions are recorded with timestamps and tamper-proof signatures, that then facilitate the ability to reliably track and verify information across multiple counterparties. One other key component of blockchain is the 'distributed' nature of the concept. In conventional ledgers, the author of 'debits' and 'credits' is often a singular business entity. In a blockchain implementation the world can be your oyster in who collaborates on the debits and credits – and in near-real-time!

“The benefits of blockchain (also referred to as distributed ledger in this paper) are imminently realizable – massive efficiencies where the traditional operational needs for reconciliation of data between counterparties is instantly eliminated.”

In addition, a ledger is built over a network which improves resiliency and not susceptible to a single point of failure. Given the digital nature of this distributed ledger, a ledger can be flexible in who has what types of access, for how long, and for what outcomes. Distributed ledgers can be permissioned or permissionless and with different levels of access for different parties to preserve proprietary information from competitors. Distributed ledgers allow for preserving

privacy, putting the owner of the data in complete control and determine how much information can be shared, for how long and with whom.

To be clear, blockchain use-cases from our vantage point are not intended to replace the personal aspects of homebuying. Real estate is a personal choice and home buying requires the human touch. The best that any technology solution can aim for is to partner with the mortgage industry by streamlining the process, identify an

efficient solution that brings down the costs, while keeping customers at the focal point.

While many use cases may emerge over time, we don't discuss the Metaverse, NFT tokens or using cryptocurrency in buying homes. We will, however, summarize the relevance of blockchain in the mortgage industry, discuss use cases, and explore how blockchain can be applied to ensuring transformative success for a customer's homeownership journey.



Art of the possible - How is blockchain relevant for the mortgage industry?

The north star vision for the US mortgage industry is to allow consumers to achieve an entirely digital mortgage with the following definition:

“100% of the cradle-to-grave steps in a mortgage are collectively accomplished by required counterparties using digital data, managed in near-real-time on a singular golden-source-of-truth that is immutable and continuously verified.”

The industry is quite far from manufacturing a true Digital Mortgage as per this definition.

A mortgage loan is originated, rate-locked, closed, funded, delivered to investors, on-boarded for loan-administration, serviced over its lifetime, and eventually closed out. All these transactions form a mortgage supply chain. A number of technology components and data sets aid the movement of the mortgage loan asset through this supply chain – CRM systems, Point-of-Sale systems that revolutionized consumer experience, Loan Origination and fulfillment Systems that work in the mid-office/back-office areas of the value chain.

“In a blockchain driven mortgage value chain model, an integrated digital ledger can capture these transactions, timestamp for every new step in this value chain and make it easy to track, trust and verify the information (loan) at every step.”

At each step of this value chain, new data can be added, existing data can be modified, and some data may be marked no longer relevant. This could help manage risk in real time rather than post facto

Quite often the same transaction of a loan being funded is entered/managed in multiple ledgers across business partners. The mortgage industry has built a plethora of systems ranging from Customer Relationship Management (CRM), Point of Sale (POS) for providing borrowers and loan officers digital capabilities, Loan Origination System (LOS) for the entire workflow and rules of originating a loan and its corresponding activities such as credit checks, underwriting, regulatory compliance and Secondary Marketing. After the loan is originated and, in some cases, securitized and packaged for investors, a Servicing system takes care of the entire life cycle of a loan and caters to all activities required to service a loan – cash management, escrow and tax management, investor accounting, customer service and default management. Data verification and due diligence is a vital component of the mortgage ecosystem and identifying technology solutions to streamline the process and promote transparency is critical to advancement in the mortgage industry.

The promise of blockchain is immense as it has the potential to simplify and create one indisputable globally accessed ledger for all these parties across the entire ecosystem. Three key elements of blockchain relevant to the mortgage industry are:

I. Immutability

Information cannot be changed/overwritten rather can only be appended. This provides clear audit trail of loan packet from origination, servicing, and transfers of ownership through secondary market

II. Single Source of Truth

Creates trust in real-time by presenting shared source of truth across multiple parties in transaction suitable for mortgage lifecycle. It removes inherent silos maintained in transactional records and independent reconciliation

III. Certainty

Improves speed of execution and certainty of asset transfers reducing counterparty and settlement risks leading to lower capital requirements

“Blockchain can be complementary to existing technology solutions and can help improve efficiencies in back-end infrastructure to remove frictional costs for all participants in mortgage lifecycle from originators to servicers, trustees, and investors which ultimately benefits consumers.”

Blockchain's key value elements can yield substantive benefits to the mortgage process:

1. Reduces audit/due diligence costs from Quality Checks (QC) / verification; Eliminates redundant post QC and reconciliation process across multiple ledgers burdened with costs
2. During mortgage servicing, facilitates ability to monitor collateral performance real-time, same day remittance and distribute payment to investors. Customer touchpoints are maintained directly by originator/servicer while the blockchain rails simply collects the interest and principal payments which is beneficial in periods of market dislocation where investors can have transparency to real time data of underlying loans
3. Easier to structure new products, fractionalized ownership lowering barrier to entry, and seamless access to information

“An average mortgage loan involves 10-15 individuals handling 16-20 data sets/entities, over 100 documents, across 20-30 technology systems and components.”

Mortgage loans are a substantial asset, and appropriately complex in their production and management. Complexity comes from three main sources:

(i) Inherent risk associated with mortgages

Risk management requires data, and representation/warranties on the quality of the asset across borrower, collateral and market conditions. A lot of data is generated in support of pricing a mortgage calibrated with the risk. More often than not, data required

for risk management reasons is well codified and standardized (consumer credit, assets, liabilities, property appraisals, etc.).

(ii) Compliance requirements

Compliance requirements play a critical role in driving data and document complexity for US mortgages. The mortgage industry is one of the most heavily regulated industries, especially after the 2008 crisis which led to even more regulations from bodies such as CFPB and others. Unlike risk driven

complexity that is managed by data, compliance is still largely a document-driven process. Estimates, Notifications, Disclosures, Endorsements – all of these are managed via paper, and more recently paper-on-computer (digitized documents). As a mortgage moves along its production line, data and documents get handed over across counterparties. It goes without saying then, whenever data or documents move across systems, there is reconciliation expense, error risk and cycle time.

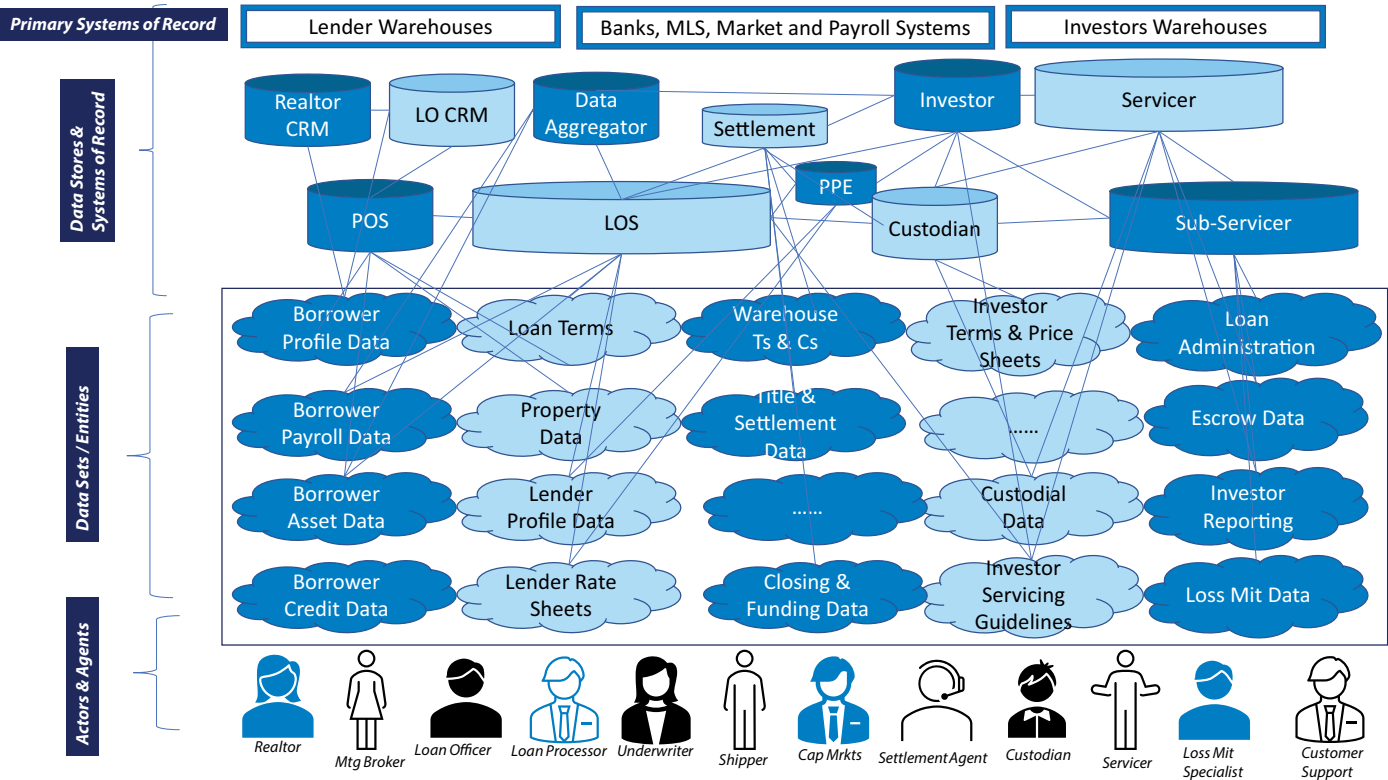


Figure 1. The many-to-many ecosystem dynamics across actors, data sets and systems-of-record in US Mortgage Industry

(iii) Ecosystem fragmentation and hand-offs

The fragmentation of mortgage supply chain in terms of actors, datasets and systems greatly amplify this complexity. Each participant in the production process protects their interest first, rightfully so, and therefore need their own system of record to stand behind their step of the production process. Let’s look at borrower asset data as an example. The loan originator needs to retrieve current asset data on a borrower and hold it in their LOS for proof for potential repurchase or inquiry

from the investor. The data aggregator who supplies asset data to the LOS needs to hold their golden copy for their audit and risk insurance requirements to defend their business. The upstream bank/financial institution that supplied borrower asset data needs to have a copy as well, to support banking functions for the borrower. Investors need a copy of the same data for their underwriting, portfolio monitoring and other risk analytics. Now can we see at least 5 valid systems of record and golden copies for the same data. This is just one example and there are many

other sets of data that are involved in the mortgage manufacturing life cycle that are repeated and stored across multiple entities

“The net combination of inherent financial risk, compliance requirements and fragmentation results in perpetual redundancy, increased cycle times up to 60 days¹, lack of trust creating uncertainty multiple steps of data and document reviews for loan quality, poor consumer experience, and increased cost of mortgages.”

Impact on Low to Moderate Income (LMI) communities:

This added cost of mortgage and complexity is especially hard on our LMI communities. With the rising home prices, lack of affordable housing and high cost of originating a mortgage, the average cost to originate a loan is almost \$9000².

“

Imagine what a 20% reduction in cost could do to make homes that much more affordable for LMI consumers. That is almost \$1800 savings back to a borrower or nearly 20% of down payment savings on a mortgage (assuming 5% down payment on a \$200K mortgage)

”





Opportunity for blockchain in the digital mortgage lifecycle

A number of 'spot solutions' and innovations continue to sprout along the mortgage value chain, with vendors and lenders continuously looking for 'white-spaces' where automation is low and manual paper processing is high.

1. Blockchain as an end to end solution

POS systems and data aggregation solutions supplying direct-to-source data on property, borrower and loan terms have more or less moved the universal residential loan application form (aka form 1003) to the backend of the borrower interaction. Document imaging and with advanced optical character recognition (OCR) has continued to revolutionize digitizing the mortgage space and is continually reducing the movement of paper. The trifecta of e-Closing/remote-notary/e-Note, accelerated by COVID, have started chipping away at the last mile. Advancing this innovation, Loans electronically originated can be on-boarded to a blockchain along with the underlying digitally sourced documents and become the single source of truth for underlying loans for all parties (servicers, investors, and borrowers).

2. Creating Open Standards for Blockchain

A critical step for adoption of blockchain would be to create open standards that can allow multiple entities to collaborate. Just as we saw the evolution of the internet to standard protocols like http, DNSHTML, browsers, the blockchain eco system tech providers would need to move towards standards so that all stakeholders can be on-boarded for deploying decentralized finance applications. One example is the Provenance Blockchain that is built specifically for financial services³.

3. Coopetition by Industry players

Another area of the industry to focus for adoption of mortgage is to increase more collaboration. The industry can borrow a page from the Tech companies of today who have come a long way from their past where they competed with each other and

today have reached a stage of coopetition where each player plays to their strength and leverages their competition's platforms. Examples of Apple, Google mobile and app stores, authentication by Google, Facebook, etc. highlight how the industry has benefited from this model. The mortgage and real estate eco-system tech providers can similarly come up with new models of collaboration.

“Forming a consortium can be helpful to share ideas, mutualize the costs in exploring new technology and be a catalyst to develop use cases and common operating standards. Joining a consortium can help lower development costs and test use cases jointly instead of operating in silos and collectively enhance network effects. We have several strong and successful co-operatives in our industry such as Lenders One and The Mortgage Collaborative to name a couple.”

4. A Utility Hub and Spoke Model

Another opportunity framework to consider is utility hub and spoke model. Consider the national power-grid where three primary functions of "Generation", "Transmission" and "Distribution" operate in-tandem and behind the scenes to give us power through our wall sockets. While utilities are fully operational commercial businesses, there is interoperability across the utility operators – for continuously calibrating demand and supply across networks. What is generated by one grid could be transmitted to or through another grid. The grids trust each other. The mortgage industry can adopt a model where the asset creation, asset conduits/distribution and asset servicing work like a power-grid. Developing oracles that connect blockchain to existing data sources or legacy systems is key to adoption and requires parties to work together to share and access data. To the extent that different blockchain systems emerge, ability to exchange and leverage data between one another through interoperability is necessary to prevent siloed architecture.

5-step process for lenders to secure transformative success for your distributed ledger journey

We suggest financial institutions take a 5-step approach towards their journey towards blockchain:

1. Look past the hype

Understand the technology architecture, the benefits and use-cases beyond the non-fungible token (NFT)/crypto use-cases. Most mortgage lenders do not have deep technology R&D benches and budgets to get into the nuts and bolts of the technology and its implication. Blockchain is not just yet another database. Its implications on data management are far more complex than what we know in our marketing, loan app or analytics databases. Industry conferences are a great way to build depth on the technology and use-cases. Look for a variety of content in media, intentionally seeking out diversity of opinion on this technology across its people, process and technology implications.

Some items to consider to foster greater adoption of the blockchain infrastructure:

- Existing tech stack layer needs to improve offering greater efficiency to facilitate applications. Layer 2 solutions are underway aimed at improving processing capacity.
- As noted earlier, to leverage full functionality, loan level data would need to be verified digitally upfront.
- Design systems with appropriate firewalls for information access among parties.
- Ensure existing laws like Uniform Electronic Transactions Act (UETA) facilitate acceptance of e-signatures in any transaction and eliminate paper-based copies. Ensure there is market standard to establish control of a single authoritative copy of the record.

2. Look to the leaders

While we lament the fragmentation of technology providers and vendors in this industry, there are a number of players already in a favorable pole position that have initiatives and aspirations to leverage this technology and transform our industry. There are many leading product and

technology firms that have taken a leadership position and market share in the mortgage market. On the investor side, Government Sponsored Agencies as well as some forward-looking private label companies will play a key role. Credit Bureaus and/or other large data aggregators will also be key players. Look for research articles and innovation agendas from the leaders who know how our industry's data flows and more importantly how the "risk" of a mortgage loan in the industry moves across counterparties. In our opinion, the higher the accountability of risk for a participant in the supply chain, the better they are in position of influencing the rest of the industry.

3. Look to the innovators

Startups are a great source of energy and inspiration. Firms in the crypto space have been the earliest to adopt and monetize the blockchain technology. We are seeing the onset of innovators in the mortgage space. Some recent announcements include a partnership between Figure and Sagent⁴ to use blockchain for mortgage servicing. Other examples include Redwood Trust⁵ and Symbiont⁶ have actual implementations that moved the needle for their businesses. Review their use-cases and more importantly their lessons learned to draw relevance for your investments. These examples and many more are indicative of the fact that the industry is moving beyond the hype into tangible real life implementation of blockchain

4. Get to work on your incentive model

Armed with a deeper understanding of the technology, your use-case, and lessons learned from other adopters – now get to the 'moats' and 'fears' problem. Sketch out your supply chain and identify your friction points on where you have manual process, data reconciliation problems, and risk concentrations. Niche firms who specialize in blockchain as well as large industry leading global technology service firms have built strong capabilities to be leveraged to avoid re-inventing the wheel.

Now develop your coopetition model. This is where you are willing to trust someone else's data and system of record in exchange for a small fee that incents the counterparty while lowering your cost of business. Think of coalescing those dots across the supply chain... do you need to have a two-party business agreement, a tri-party or a multi-party? Is your network closed between your proprietary POS/LOS and an investor (then this is a two-party discussion), or is your network a collage of independent technology providers (multi-party)? For most independent mortgage banks their value chain network is a multi-party system as we depict in Figure 1. In this case, talk to your relevant cooperative and/or trade association and explore initiatives at that smaller community level. If your business profile and platform is broad enough, consider working with the Mortgage Bankers Association on developing a broader industry wide pilot/experiment. Look for early opportunities to engage with solution providers that can demonstrate value

5. Be prepared to re-invent yourself

Embracing distributed digital ledger technology at this point in time is like getting into the ground floor of a building in construction. For the early adopter incentive (as in first mover advantage) there are substantial opportunities to reap the benefits of cost savings to improve margin while retaining value of network effects as a first mover. Cost of the technology are still very high. Newer business models of shared risk and shared premiums are yet to be discovered. So, keep your railroad running with your current stack while gradually expanding your business and operations into distributed digital ledgers. There are inherent tradeoffs between benefits and costs vis a vis existing infrastructure. Blockchain is not for all areas of mortgage ecosystem so you need to analyze where it can have the greatest impact on customers. Evaluate whether the gains of moving to a given process compensates the switching costs. This is also an opportunity to look at all the validation steps across your organization and identify which ones will become redundant and can be eliminated to reduce costs.

Conclusion

If we concede over 90% of the mortgage value chain is mediated by data and technology - why then, do we still debate and discuss if we have a digital mortgage opportunity/problem? Our point of view is that true digitization should affect trust as well, not just eliminate friction in movement of data. Advances in digitization have come from fragmented solutions, un-interoperable platforms and non-standard/proprietary data exchanges. For the inherent risk associated with a mortgage transaction, every participant in the supply-chain has to self-serve for audits and put-back risks. Those risks, when manifested, can extinguish entire businesses. Secondly, there are large established players in our industry who built solid businesses over decades of investments and customer gains – that do not see a reason to give up any more of their business royalty opportunities than they should, just like any sound business would do. So ‘moats’ and ‘fears’ are the problem. Not the technology, not the use-case.

Coopetition is an untested concept to our industry. Starting your distributed digital ledger and/or blockchain journey with a focus on ‘disintermediation’ of an incumbent is a false choice. Envy of someone else’s business model is not the right inspiration for innovation. A better recipe is to look to the leaders in the industry, contribute your innovation and commitment, expand-the-pie and create new value. We do not advocate one stifling blockchain for the whole industry. A few thriving ecosystems are important to continue to innovate, lower the cost, and move us forward. Just as ecosystems of Amazon, Google, Facebook, Microsoft and Apple have done an excellent job of reducing friction, creating trust and generating net-new value for all of their participants and consumers through a trusted ecosystem for consumers to benefit from, our industries, leaders and innovators can too – rising the tide for the industry and more importantly for the borrower.



About the Authors



Prabhakar Bhogaraju (PB)

EVP Product and Strategy, FinLocker LLC.

PB has over 25 years of mortgage technology and consulting experience across product development, emerging technology, data and analytics, and digital business architecture. At FinLocker PB leads business and product strategy in developing a financial fitness product for consumer's journey into homeownership and subsequent wealth building. In his prior executive leadership roles at Fannie Mae, PB served on the boards of the Mortgage Industry Standards Maintenance Organization (MISMO) and the Financial Data Exchange. PB also serves on investment/advisory councils of two technology VC funds, a capital markets startup and is on the board for a local non-profit.



Gina Healy

Principal, Chainlink Solutions

Seasoned financial services leader focused on innovation, customer engagement and operational efficiencies that improves profitability and lowers cost for customers. Gina is a strategic advisor in leveraging emerging technology solutions that yields operational efficiencies and educating stakeholders on use cases of blockchain. Previously she was the Vice President of Structured Credit at Freddie Mac and has a successful track record in designing and implementing innovative solutions, structured products and cultivating strong client relationships securing \$15 billion globally.



Vivek Bakshi

Portfolio Head – Mortgage, Infosys

Vivek leads a portfolio of US mortgage clients at Infosys. He has over 2 decades of experience in delivering large and complex digital transformation programs for the large banks, insurance and mortgage companies. He is a thought leader and public speaker on various topics across mortgage domain and technology across Artificial Intelligence, Machine Learning, Robotics, Data and Analytics and Digital Experience.

Acknowledgement

We would like to acknowledge **Richard Hill**, VP of Industry Technology at Mortgage Banker's Association, **Brian Vieaux**, President at FinLocker, **Uday Devalla**, CTO of Sagent for their review, insights and feedback on this paper



References

- 1 <https://www.stratmorgroup.com/long-cycle-times-and-the-borrower-experience/>
- 2 https://sf.freddiemac.com/content/_assets/resources/pdf/report/cost-to-originate.pdf
- 3 <https://www.businesswire.com/news/home/20210519005633/en/Provenance-Launches-New-Public-Decentralized-Blockchain-for-Financial-Services>
- 4 <https://www.housingwire.com/articles/figure-partners-with-sagent-for-mortgage-servicing-blockchain/>
- 5 <https://ir.redwoodtrust.com/news/news-details/2021/Redwood-Trust-Announces-Pricing-Of-The-Markets-First-Non-Agency-Residential-Mortgage-Backed-Securitization-Leveraging-Blockchain-Based-Technology/default.aspx>
- 6 <https://www.businesswire.com/news/home/20211206005418/en/State-Street-Digital-Vanguard-and-Symbiont-Complete-First-Live-Trade-for-Foreign-Exchange-Forward-Contracts-Leveraging-Revolutionary-Blockchain-Technology-and-Smart-Contracts>

For more information, contact askus@infosys.com



© 2022 Infosys Limited, Bengaluru, India. All Rights Reserved. Infosys believes the information in this document is accurate as of its publication date; such information is subject to change without notice. Infosys acknowledges the proprietary rights of other companies to the trademarks, product names and such other intellectual property rights mentioned in this document. Except as expressly permitted, neither this documentation nor any part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, printing, photocopying, recording or otherwise, without the prior permission of Infosys Limited and/ or any named intellectual property rights holders under this document.