

Blockchain Disruption in Security Issuance

Enabling the issuance of fully digitized smart securities



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1. Introduction

This whitepaper proposes an alternative to the traditional applications currently used to support the issuance of securities (e.g. stocks and bonds) in the capital markets industry. Instead of physical certificates/notes, securities can be represented digitally in a public permissioned ledger using blockchain technology.

While global security issuance of bonds/IPO/private securities have grown significantly, the technology disruptions of today's information age have made it difficult to achieve the optimization required to limit the inefficiency involved. The current issuance process remains highly manual and paper intensive. Redundant record keeping is leading to large reconciliations internally and externally that contribute to the higher cost for issuance.

Our research¹ shows average fees paid are 3.45% for Regulation D (private security) issuance, 7% for an IPO issuance and 0.9% – 1.5% for a bond issuance. The cost could be reduced by eliminating the intermediaries involved, thereby improving efficiency and reducing cost to the issuer.

Digital technology would improve the efficiency of security issuance by replacing a paper-intensive, manual process with smart contract-led automation, reduction of intermediaries, and fully automated asset servicing through a distributed ledger.

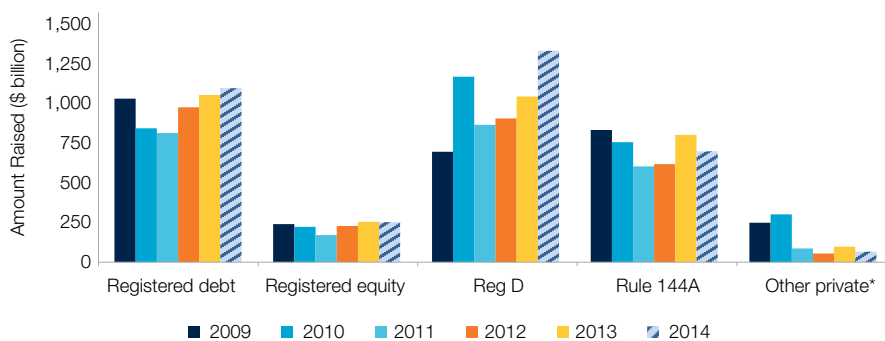
Key to this improvement is going digital, and an innovative path which is emerging is the use of blockchain. Blockchain technology has the potential to change the financial transaction processing cost model and has the potential to provide unprecedented transaction security. These advantages can be derived from technology-enabled processing over distributed systems. This technology could help the industry revolutionize the security issuance process in both private and public sectors, offering a single view of immutable transactions which would serve as a true copy shared among all the syndicate members and stakeholders.

2. Traditional Issuance: An Overview

Companies raise capital by selling securities either publically—with the issuance of registered securities—or privately, through the issuance of unregistered securities. Securities issued could be debt or equity-related, based on the company's need for capital and related financial management considerations. Securities (shares of stock or bonds) are offered to the potential investors in both public and private markets. Details of an initial stock (equity) offering—an IPO—are disclosed to potential purchasers in the form of a prospectus. A debt issue is a fixed corporate or government obligation such as a bond or debenture. Bonds are sold publicly or privately, and the issuing company (the issuer) is obliged to pay interest, or coupon payments, and to repay the principal at a later date (i.e. the bond maturity date).

Exhibit 1 presents the composition of the securities issued in the U.S. market from 2009 through 2014. The growth trend for private issuances over this timeframe shows a modest increase (see Appendix).

Exhibit 1: U.S. Securities Issuance Market 2009 - 2014



Source: U.S. Securities & Exchange Commission (www.sec.gov)

The issuance and trading of securities is a government-regulated process. In the U.S. the Securities & Exchange Commission (the SEC) is responsible for oversight of the capital markets industry. The current issuance processes are based on the creation, distribution, and management of physical documents (stock certificates, bond notes, etc.) administrated using a traditional accounting-book entry system. Once issued, the purchase/acquisition and subsequent trading of these securities documents is conducted via the securities exchanges (e.g. NASDAQ, NYSE, AMEX, etc.). Related financial transactions are processed through the established clearing system (e.g. DTCC).

Exhibit 2: Key Players in the Security issuance process

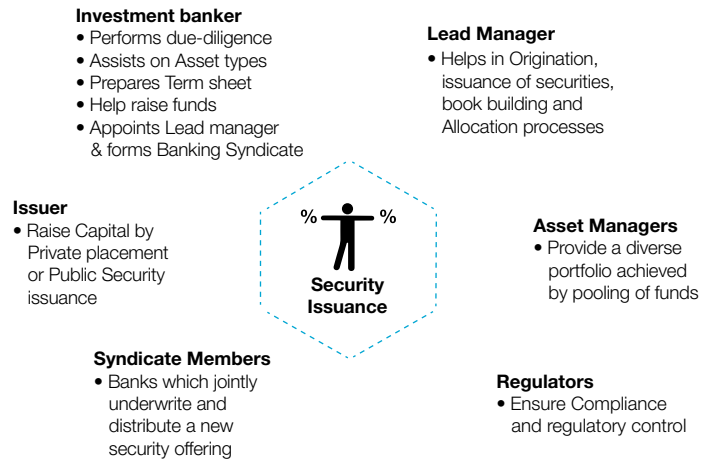
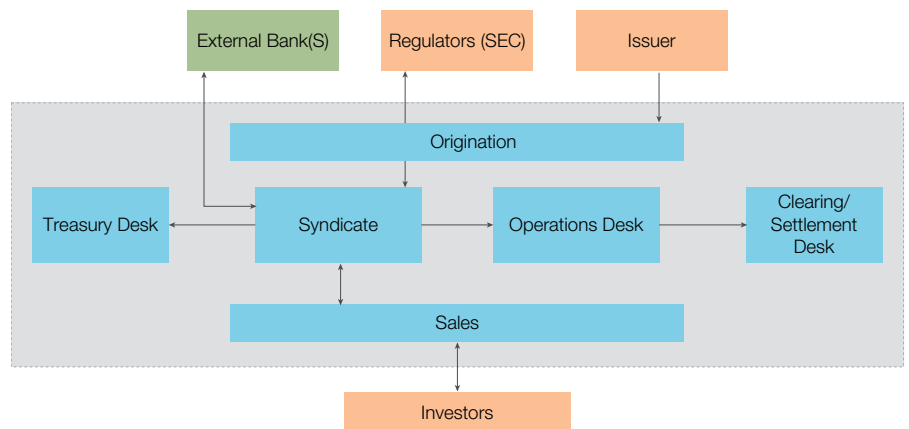


Exhibit 3: Overview of Securities Issuance Process



Contains a high-level depiction of the traditional securities-issuance process.

There are a number of challenges and issues with this traditional securities issuance process:

- Multiple versions of truth exist in the network of issuers, syndicate members and investors, requiring a time consuming reconciliation process between participating systems. Since each participant maintains their version of record, a continuous reconciliation process has to be set up to keep all the participants with the same status quo.
- Long clearing and settlement cycle exists in the current security issuance market. As a market norm it takes T+3 days i.e. 3 business days from the transaction date to settle a trade and in some instances of private security the settlement process could take up to 10 business days to settle leading to longer clearing and settlement cycle.
- High settlement risk occurs when you have to pay the purchase price of a financial instrument in advance but receive the security with a time delay. In this event, the risk is that you will pay the purchase price and end up receiving the securities late or in worst case might not receive them at all. Conversely, when you are obliged

to deliver financial securities that you have sold, you may not receive the purchase price from the buyer at the same time. This is very much evident in the current issuance as the settlement process takes 3 to 10 business days from the date of transaction before the accounts are credited.

- Potential counterparty risk exists in the current issuance process due to the long settlement cycle involved which keeps the risk open on both ends of counterparty till the settlement cycle completes successfully.
- Manual multiple-step processes are still involved in today's security issuance industry. These laborious manual steps involved in the process are prone to error making the security issuance process inefficient.
- Manual asset servicing is provided in the current financial industry by the custodians handling accounts for large institutions i.e. Each asset servicing corporate action would require the custodians to handle the interactions between various other participants to get the client accounts debited/credited as per the transaction. Any change made to security has to be cascaded across all the layers of custody (stockbroker, sell-side bank, local custodian, global custodian, CSD, etc.), which leads to further delay and overheads in the execution and ongoing asset servicing.
- Involvement of various Intermediaries (banks/custodians as outlined in section 2) are required to complete any transaction. The number of intermediaries involved in each type of transaction may vary. The number of intermediaries involved is purely defined by how well all the intermediaries are connected. Having many intermediaries adds additional cost and time for any given transaction to settle.
- The current issuance process is less transparent due to the involvement of intermediaries such as bank and custodian for settlement process and custody of securities. Transparency is at its best when a transaction is executed between two counterparties without the involvement of any intermediaries. But as intermediaries get added, the process becomes less transparent.
- Limited audit trail is possible in the current financial market due to the manual nature of security issuance processes, resulting in no electronic audit trail of the activity performed with the transaction.
- Currently, the traditional security issuance process involves many intermediaries working on different systems, making it nearly impossible to maintain 24x7 availability.

Exhibit 4: Challenges



3. Why Blockchain Distributed Ledger

3.1. Overview of Blockchain Technology

Blockchain is a powerful innovative technology that has the potential to transform the Financial Services industry. It is essentially a distributed database of records or public ledger of all transactions or digital events that have been executed and shared by participating parties². Blockchain is cryptographically authenticated. It was first developed to provide an alternative secure approach to exchange value between two transacting parties without the involvement of a third party. Applicability of blockchain technology is currently extending to a wider variety of transactions, bringing forth greater efficiency. In certain cases, it has the potential to replace the current centralized business model of the financial services industry. Crypto-currencies utilizing blockchains prove that digital transaction records can be managed securely without a central authority. Blockchain enables simplification, and brings in greater security, speed, and reliability. The result is reduced costs and improved efficiency.

Origin and Functionality – Blockchain was invented and defined first by an anonymous person with a pseudonym Satoshi Nakamoto in 2008. Blockchain is defined as a peer-to-peer network that contains a public record from all the transactions that have ever occurred in history. A block records some or all recent transactions, and once completed goes into “blockchain” as a permanent record. Every time a block gets completed a new block is created. Each block becomes an independent banking statement whereas a blockchain is a complete history of all banking transactions. The blockchain consists of three key components –

1. A Transaction
2. A record of that transaction
3. A mechanism for verification and storing transactions

3.2. How Blockchain Can Transform Security Issuance

Both public and private security issuance processes can be implemented using blockchain technology, thereby enabling substitution of physical documents with fully digitized “smart” securities. Smart contracts executed on a blockchain-based platform can reduce the use of intermediaries between producers and consumers and provide greater efficiency. Smart contracts as a term was introduced by Nick Szabo, which means that they are self-executable and automated computer programs that can carry out the terms of the contract signed between the investor and the issuer. Distributed ledgers contain the state and history of the transaction records. It uses cryptography via computer-based encryption techniques such as public/private keys and hash functions to store assets and validate transactions. A distributed ledger can be defined as a record of information or a database that is shared across the network. Blockchain is a particular type of distributed ledger originally designed for bitcoins.

² Michael Crosby, et al., “BlockChain Technology: Beyond Bitcoin”, Applied Innovation Review, Issue No. 2 June 2016 <http://scet.berkeley.edu/wp-content/uploads/AIR-2016-Blockchain.pdf>

The physical certificates and notes of the traditional issuance process are replaced with digital assets on a blockchain based solution. The transactions executed on a public blockchain-based platform are immutable and transparent. As for a private blockchain solution controlled by private actors, immutability cannot be guaranteed as the participants can alter or change the transaction records. Transactions are processed in a decentralized manner by geographically-distributed nodes of the network, which can transform the existing centralized business model in Capital Markets involving CSDs, CCPs and Custodians. The distributed ledger could facilitate better recording of ownership of a variety of securities and safe keeping of assets. This is enabled via the ability of the distributed ledger technology to reduce the ambiguity and complexity of the contract terms by increased automation of the process and its ability to uniquely refer the stored transactions.

When multiple participants as well as regulators are involved for the securities issuance process, reference data is a major pain point. Blockchain helps in the creation of unique shared reference data record that can be viewed by all participants. In the current system, various financial firms and the participants have a separate view of the record. Reconciliations are not required on a blockchain-based solution, making them more efficient. A distributed ledger could also facilitate implementation of a unique reference system in securities markets like unique security identifier. Currently the securities market uses various identifiers like the ISIN but the blockchain technology can integrate the unique security identifiers into the trade lifecycle processes.

Smart contracts would sit on top of these distributed ledgers and would facilitate auto-execution of the terms and conditions as well as confidentiality agreements associated with a contract without manual intervention. The smart contracts are programmed with the contents of these terms and conditions, and the agreements and their executions are triggered by sending transactions to those contracts along with some money. For each transaction, the miners (system/person that goes through a process of adding transaction records to the distributed ledger of past transactions) go through the entire blockchain to determine the latest state of the corresponding contract. The contracts have a storage state in the form of key value pairs. These can be modified by transactions which in programming terminology is defined as call to contract functions. This reduces the uncertainty attached to the contract terms as the terms and conditions are executed in accordance to an executable fixed code bringing in less manual intervention thereby reducing error prone transactions and ambiguous terms and conditions appearing in the contracts. Smart contracts also automate corporate actions such as processing of coupon payments.

The blockchain technology supports and facilitates direct issuance of digital securities by issuing them on the distributed ledger through standardized and secure transactions, allowing direct dealings between issuers, syndicate members, and the investment bank. This helps to track the ownership of the securities. The institutional investors could opt for securities issuance directly on the platform and as a result the issuers of the securities would have the ability to see who holds the securities in real time. It reduces transaction costs by reducing the need for multiple intermediaries (like issuing agent and custodian), and can be used to confirm transactions and ownership of assets. The streamlining of processes along with reduced manual intervention will result in reduced costs.

4. Digital Security Issuance – The Blockchain Way






A blockchain solution for security issuance would enable digitization, improve costs and increase efficiency. Blockchain would help the issuer view a real-time list of investors and their positions. Under the current system involving book entry the issuer of the securities does not have direct insight into who the beneficial owners of the securities are.

A few basic high level properties have to be defined for the securities issued on blockchain:

- Type and amount of the issued securities should be specified
- Issuer identity should be determined by a defined set of identification rules using standard pre-defined rules required or mandated for establishing issuer identity on a blockchain based platform
- A regulatory body can explicitly acknowledge security issuance by co-signing the corresponding transaction together with the issuer or by granting the issuer a special kind of Digital Certificate³
- Properties of the securities such as “Non-transferable”, “Locked”, etc. should be specified

Certain factors as depicted in the exhibit below need to be considered while defining an end-to-end digital-security issuance solution on a blockchain platform addressing the above high level security properties.

Exhibit 5: Digital Securities Issuance – Specifications

Security	Implement adequate authorization protocols to identify ownership and permit transfer or issuance of assets	
Fraud Prevention	Provide mechanisms to prevent counterfeiting of assets like KYC & KMC. Implement rules for preventing double spending & duplicate securities creation	
Auditability	Ensure ready access to the details of asset transactions in order to permit regulatory reporting and to assist audits	
Customer & Service Identities	Build public key infrastructure based on blockchain	
Settlement	Near Real Time Settlement	

³ "Abstract Digital asset management is one of promising applications of blockchain technology.", BitFury Group, Mar 15, 2016, <http://www.book.dislib.info/b1-other/616989-2-bitfury-group-mar-2016-version-10-abstract-digital-asset-managem.php>

4.1. The Macro-Steps for Securities Issuance Using Blockchain

Exhibit 6: Digitized Securities Issuance via a Blockchain/Distributed Ledger Solution

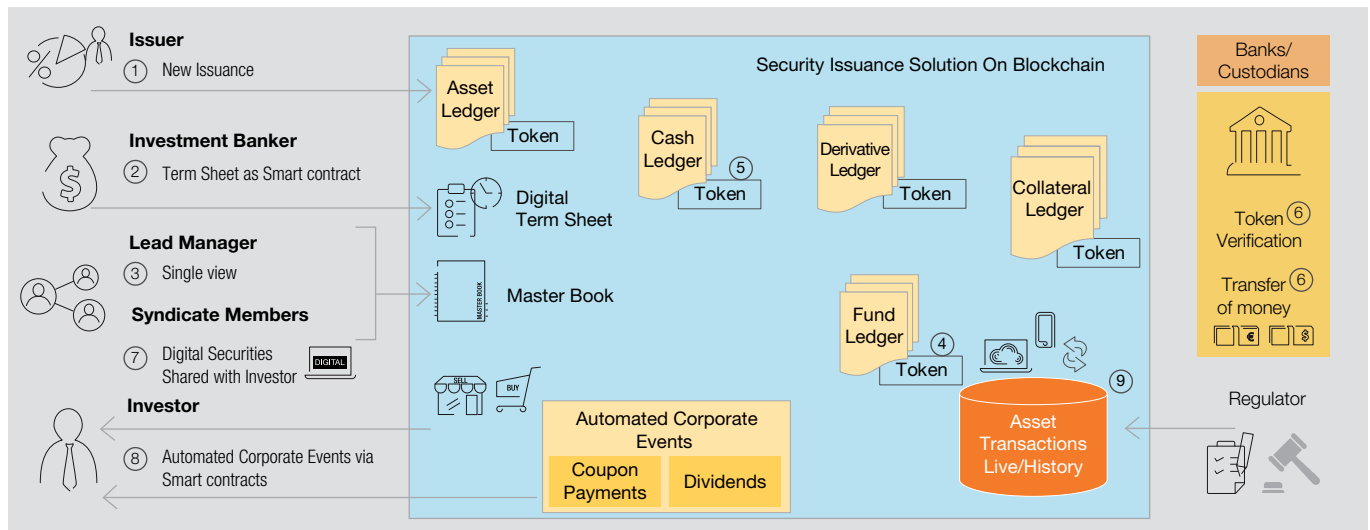


Exhibit 6 illustrates, the macro-steps in the “to be model” of digital securities issuance solution on blockchain. The steps below articulate the roles and responsibilities performed by specific participants. This gives a high level picture of how the “to be model” on a blockchain is structured to function with reference to various participants in the blockchain. The number of participants would reduce over a period of time by changes in their responsibilities (the roles and responsibilities will evolve based on the level of platform sophistication and industry adoption of the blockchain technology)

1. **New Securities are issued into the Asset Ledger by the Issuer.** The right to create the new asset on the Asset ledger is granted to the issuer for a short duration. Origination of the asset is represented digitally by a new “Tokenized Asset’ by the issuer.
2. **The Investment banker.** The issuer approaches the Investment Bank for help with the securities issuance process and the Investment Banker initiates a digital term sheet and obtains sign off from the issuer. All authorizations of the participants in the blockchain are made by digital signatures which saves time.
3. **Lead Manager and Syndicate members** have a single view of the Master Book on a blockchain platform. The Master Book contains orders or bids from prospective investors with details as to the quantity of shares and their price.
4. **The Fund Manager** uses tokens to manage the investor’s holdings recorded on a fund ledger. The tokens represent cash or security based on the investor transaction. These tokens are used to determine investor portfolio value and to represent investor’s holding on the blockchain platform. These token will be used in case of trade settlement happening within the platform or outside the platform.
5. **Cash transfers** are also represented via tokens with buy and sell facility. Tokens can also be used for representing credit and debits in corresponding Cash/

Suspense accounts on the platform. These tokens are assigned to a stable price and could represent one unit of a particular currency.

6. **Custodians or Banks:** These participants come into play when settlement happens outside the blockchain platform. They act as keepers of tokens represented on a blockchain platform and transfer security/money to the beneficiary accounts corresponding to the tokens represented on the platform. Their involvement is reduced and near real-time settlement is achieved.
7. **Digital securities** are credited to investor's account (replacing the paper notes/certificates)
8. **Mandatory Corporate Events** and Disbursements are executed by triggering Smart Contracts. These events are initiated by the corporation and affects all shareholders. Dividend payments, coupon payment, interest, stock splits, mergers, return of capital, bonus issue, etc. comes under mandatory corporate events and disbursements. These corporate events can be converted into smart contract which would auto-execute updating all shareholders of the asset and cash account based on the corporate event. These are executed based on the ownership of the asset in the blockchain as well as the due date on the timestamp.
9. **Regulatory** reporting related to issuance process becomes easier as the data is now publically accessible with complete electronic audit trail providing full transparency. Regulators could audit live data directly on the public ledger and verify the transaction history and details on the platform. This helps in better monitoring of the transactions. Also increases the quality of the reporting done by the regulators and enables "smart" auditing of the capital and risk positions of banks and other financial services clients. Live data audits provide the regulators the ability to detect financial instability, fraud, money laundering and financial crime at an early stage.

4.2. Smart Securities Book-Building Process

The high-level process for smart securities is automated due to execution of smart contracts on a blockchain based platform. The issuer, or the company offering the securities, chooses an investment bank for the issuance and investment bankers are appointed as book runners.

- Blockchain enables Near Real-Time book-building process.
- The Master Book is available as a single view for all the participants in the blockchain, including the internal departments of the bank and external stakeholders such as Syndicate members.
- External and internal reconciliations are not required for the records. This reduces manual efforts and cuts the entire time taken for the book building process by about 35% to 50%.
- Since blockchain technology allows direct dealings between issuers, syndicate members, and the investment bank, the sales team of the investment bank involved can gradually be eliminated. For a new equity IPO, 7% of the total issuance is charged as fees. The commission for the sales team is 3.5%. So for a \$1 billion issue there is a savings of \$35M.
- In general, process simplification and less manual intervention means smart contracts on blockchain saves both time and money.

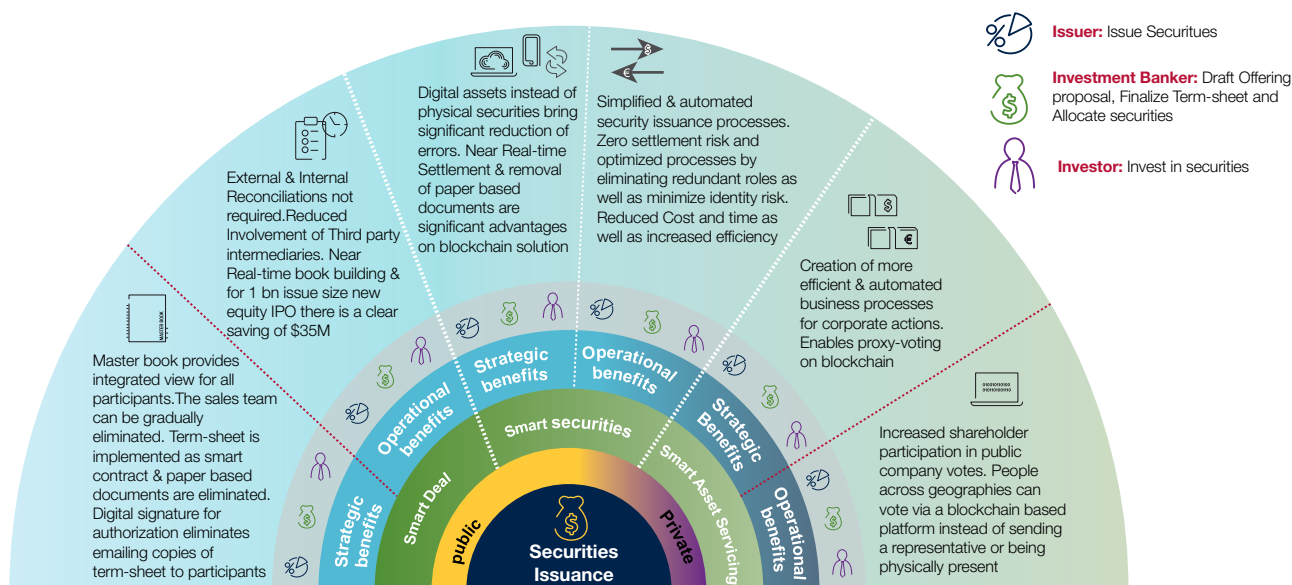
5. Impacts of Blockchain Smart Securities

Participants in the security issuance process would realize the following benefits by switching to blockchain smart securities process:

- Settlement risk exposure can be reduced by over 99 percent, dramatically lowering capital costs and systemic risk⁴
- Clearing and Settlement processes would become quick and efficient and will save billions of dollars to the industry. By applying blockchain to the clearing and settlement of cash securities—equities, repo, and leveraged loans—the industry could save \$11 – \$12 billion⁵
- There is no counterparty risk as the settlement happens in real time
- Cost of issuance would be reduced due to removal of third-party intermediaries and the fees associated with them.
- The administrative burden and operational risks of the current, largely manual and multi-step process would be reduced.
- Transactions would become fully traceable and auditable.
- The system would be available 24/7.
- The lower cost of acquiring and maintaining the new blockchain technology application systems would make capital market transactions processes faster and cheaper.

5.1. Summary of Qualitative and Quantitative Benefits of a Security Issuance Solution on Blockchain

Exhibit 7: Quantitative and Qualitative Benefits: Securities Issuance on Blockchain



4 "Nasdaq Linq Enables First-Ever Private Securities Issuance Documented With Blockchain Technology", Dec 30, 2015, <http://ir.nasdaq.com/releasedetail.cfm?releaseid=948326>

5 <http://www.the-blockchain.com/docs/Goldman-Sachs-report-Blockchain-Putting-Theory-into-Practice.pdf>

5.2. Participant-Specific Impacts of Blockchain Adoption

- **Issuers** would expect to accrue the benefit, from the reduction in administrative costs of raising capital and securities servicing².
 - Issuers would have complete transparency in the end-to-end life cycle of security issuance.
- **The lead manager and syndicate members** would have a unified view of the master book, eliminating the need for every participant to maintain their own copy. This would reduce the administrative overhead and cost.
- The major roles of **Custodians/Sub-custodians** would be eroded and their role may narrow to 'keeper of the tokens' and ensuring automated securities servicing operations are performed correctly.
- **Investors** would benefit as the process becomes transparent and automated.
- **Intermediaries** such as **Issuing Agent, Paying Agent, 'Bill & Deliver' Agent and 'Settle with issuer' Agent** would cease to exist and would have no role to play in security issuance process.
- **Regulators** would benefit from the publicly accessible historical record of all transactions, enabling effective monitoring and auditing by participants, supervisors and regulators.

² Michael Crosby, et al., "BlockChain Technology: Beyond Bitcoin", Applied Innovation Review, Issue No. 2 June 2016 <http://scet.berkeley.edu/wp-content/uploads/AIR-2016-Blockchain.pdf>

6. Blockchain Issuance: The Way Forward

Capgemini has teamed up with several Fintech partners and blockchain platform providers to create differentiating accelerators, use cases and prototypes for blockchain applicability in the industry. The capabilities include identification and implementation of various use cases for our clients and implementation of a meaningful pilot.

Ripple (<https://ripple.com>) has developed blockchain-based, distributed financial technology is already in use in the foreign exchange market, where it links banks acting as gateways in its consensus ledger. NASDAQ (LINQ) and Symbiont have issued Smart Private stock.

According to Nasdaq, blockchain technology could significantly speed up the clearing and settlement of equity trades from the existing standard of three days in the US and two days in Europe to as little as 10 minutes. Supporters of blockchain technology argue that near-instantaneous settlement of transactions can transform the financial system by automating the clunky back offices of banks. This could also free up billions of dollars that banks and others must hold as collateral to insure against things going wrong while a trade is being settled⁶.

The SEC has approved a plan submitted by Overstock, a giant online retail company, to issue part of its shares on a proprietary blockchain, which would be fully publicly distributed⁷.

Australian Securities Exchange (ASX) advisors have estimated that the implementation of blockchain for Australian equities post-trade could result in annual savings for end users in the industry of up to 4–5 billion in Australian dollars. This includes exchanges, regulators, participants, custodians, nominees, data vendors, and technology providers⁸.

We are in early stages of blockchain application-systems development and adoption as industry is still developing proof of concepts (PoCs) at individual level or in consortium to test and develop industry standards for blockchain. We expect to see early-stage technical prototypes within the next two years, with limited market adoption in 2–5 years and broader acceptance in 5–10 years. In the capital markets industry, we expect to see a series of early prototypes over the **next two years** on a limited scale and with limited numbers of participants.

Broader market acceptance is likely to take as much as **10 years** given the regulatory oversight required and large number of market participants in large-scale markets such as cash equities in the U.S.⁹

The blockchain development should be done in a phased manner. During the initial phase the blockchain platform has to be set up internally within the firm or within the consortium giving all the systems and departments of the firm a single view of every transaction and access to the same record. This will bring in a unified view across the various departments in the firm, thus reducing internal recon.

6 "Nasdaq claims to break ground with blockchain-based share sale", Financial Times, December 30, 2015

7 "SEC Approves Plan to Issue Stock Via Bitcoin's Blockchain", Wired, Dec 15, 2015, <https://www.wired.com/2015/12/sec-approves-plan-to-issue-company-stock-via-the-bitcoin-blockchain/>

8 <http://www.afr.com/technology/australia-post-to-use-blockchain-to-store-identities-20160316-gnk6w5>

9 James Schneider, et al., "Profiles in innovation—Blockchain: Putting Theory into practice", EQUITY RESEARCH, May 24, 2016, <http://www.the-blockchain.com/docs/Goldman-Sachs-report-Blockchain-Putting-Theory-into-Practice.pdf>

In the next phase the syndicate member should be included on blockchain platform i.e. all syndicate members share the same platform and thus produce a unified view of the master book and reduce the reconciliation between the members.

The final phase would be having all the participants included on the same blockchain platform thereby by improving efficiency and reducing cost.

7. Conclusion

The current security issuance process remains manual, paper intensive, and redundant due to the involvement of many intermediaries. This makes the issuance process inefficient, and time consuming, and adds additional cost to the issuer.

This inefficient process opens the industry to numerous risks and challenges such as multiple versions of truth between various participants, a long clearing and settlement cycle, settlement risk, counterparty risk, less transparency, limited audit trail, non-availability of systems 24/7, etc.

To meet the increasing demand of reducing cost and improving efficiency, the security issuance industry has to make way for the emerging blockchain technology. Doing so will mean restructuring their technology platform to incorporate the blockchain concept.

A primary task is to select a blockchain platform which would meet institution needs. Capgemini has published a paper that includes a 9-step approach for evaluating the blockchain platform—"Blockchain: A Fundamental Shift for Financial Services Institution"¹⁰.

The real benefit of blockchain will accrue when all the players in the issuance process share the same blockchain platform. This will result in a quicker settlement cycle and a unified view of master book, along with cost savings by eliminating intermediaries, having no reconciliations (internally and externally), and lowering administrative cost. At the same time the blockchain platform will provide access to immutable, fully auditable records across a secure network available 24/7.

The issuance of digital securities on blockchain with smart contracts doesn't bring efficiency to the security issuance process only, but also provides advantage in other part of the asset life cycle. By attaching the smart contracts to securities the security becomes self-sufficient to auto execute the corporate actions without any manual interaction or getting intermediaries involved.

Firms can benefit by engaging in a focused innovation lab to identify key business capabilities (like building a firm-wide global master book, transaction / regulatory reporting, asset servicing) and create accelerated proof of concept(s), followed by an iterative transformation journey to start realizing potential benefits of blockchain.

¹⁰ <http://www.econotimes.com/Capgemini-lays-out-9-step-approach-for-evaluating-blockchain-platforms-261688>

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The authors would like to thank **Anil Agarwal, Bart Cant** and **Vikrant Dhir** for their contributions to this publication.

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