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**Investment
management firms**
getting started with blockchain

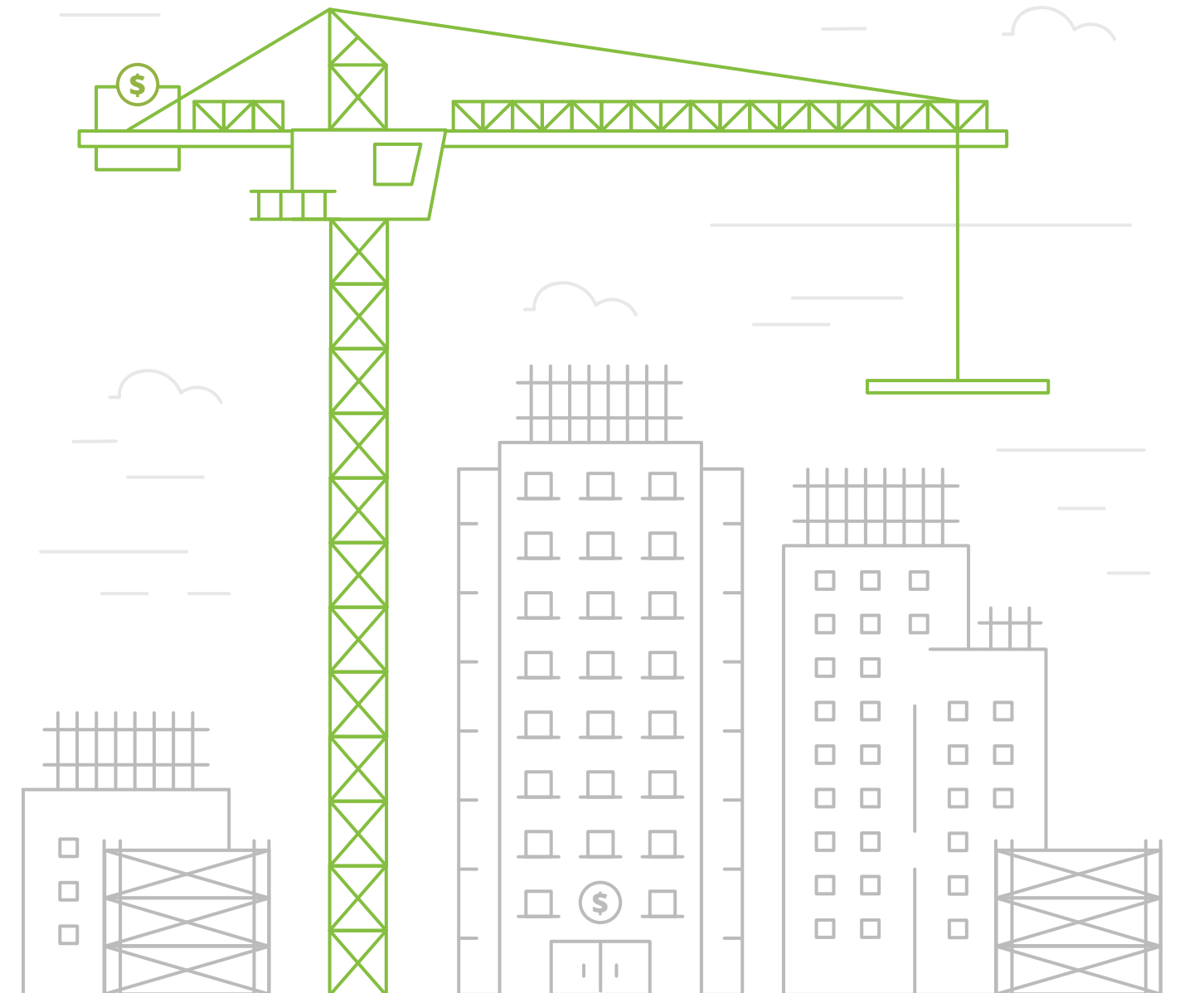
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Investment management firms Positioning for the future with blockchain

Investment management (IM) leaders have responsibilities beyond managing the issues of the day; they should also position their firms for the future. Part of planning for the future typically entails examining new technologies, when the environment demands. Blockchain is one new technology that should demand IM leadership attention for two reasons. First, this technology has the potential to transform and extend IM business value chains. Secondly, blockchain is in its early stages of development, signaling both risk and opportunity.



Imagine a world where customers carry a trusted digital identity that is linked to their financial records and transaction history. The customer's digital approval of a new account registration triggers a smart contract to execute a search of the records and return an authorization to open (or not) the kind of account proposed by the financial institution. Upon completion of the eligibility review, digital account-opening documentation is securely presented to the new customer on a personal smartphone app. The time, location, and electronic signature characteristics for each component of the new financial relationship are captured and secured to the blockchain. The app then secures the funding of the new financial relationship through an automated payment system or an automated securities transfer. This approach equally applies to private equity fund administration where blockchain and smart contracts can manage raising and calling capital, thereby tightening the process and removing some of the risk. Smart contracts and blockchain have the potential to provide a selectively automated process, with a "person in the loop" as applicable or desired.

The current state of blockchain in IM is the proof of concept or working prototype stage, a few steps behind the vision above. **However, many IM firms are actively exploring development, signaling significant change on the horizon.** This paper covers the focus of intellectual property development in blockchain, important examples of blockchain developments, and a guide to getting started with blockchain. The path to a blockchain-enabled future typically holds risks and potential rewards, presenting reasons to consider that path carefully. In IM, the potential changes to be seen from blockchain range from the truly transformational to marginal efficiency gains, where processes are legally mandated with a person in the loop.

Blockchain is a powerful technology, yet the maturity level of this technology is still far behind that of traditional databases and legacy systems. However, given the attention and investment levels allocated to blockchain more broadly, and to IM over the past two years, blockchain is poised for innovation.

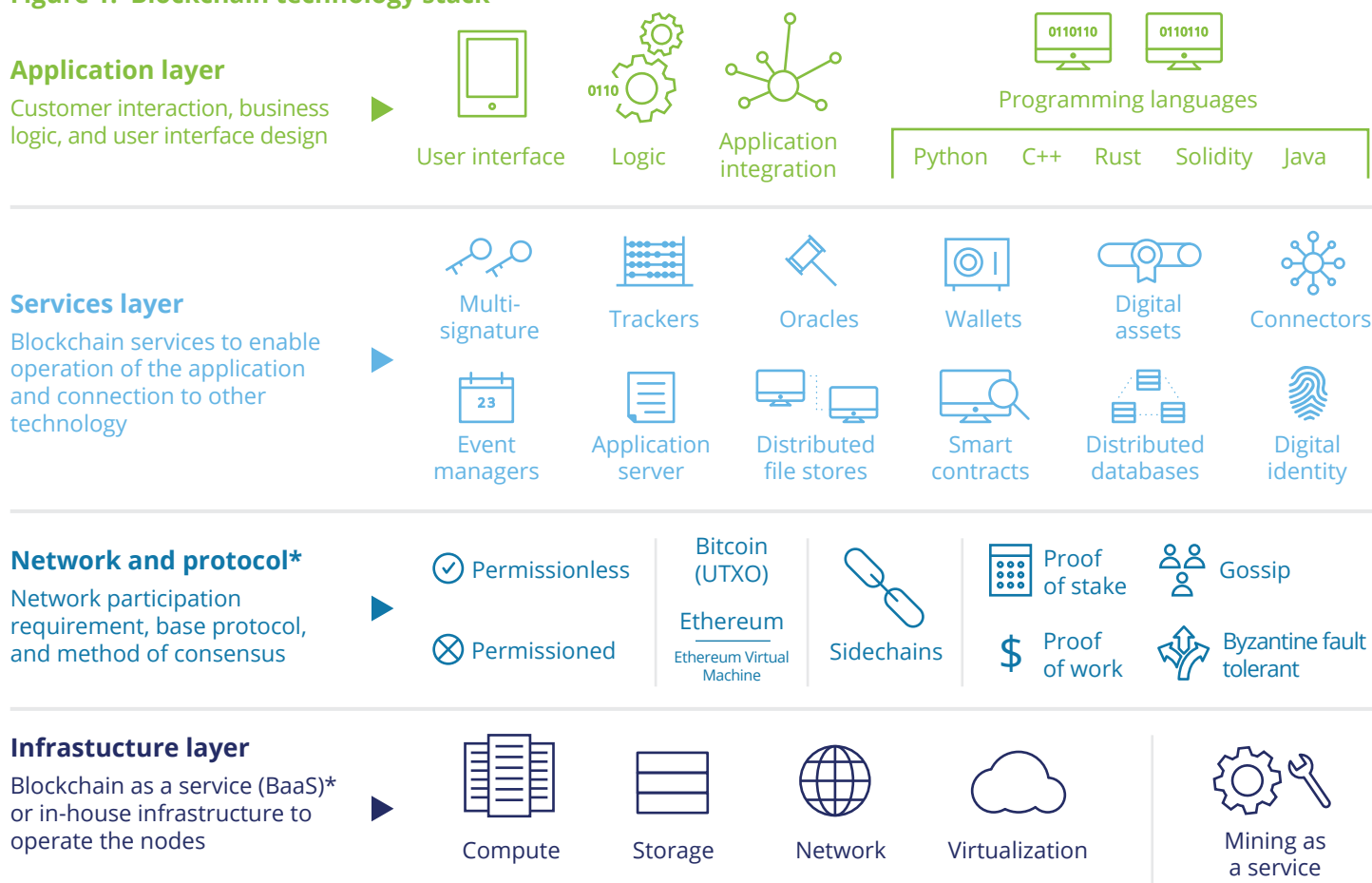
Blockchain

Behind the scenes

The user interface and the application layer of technologies are fun to demonstrate and easily gather attention. However, in blockchain much of the development is concentrated at the lower layers of the technology stack, shown in Figure 1. The lower infrastructure layers support the development and operation of the applications at the top of the stack. Blockchain technology processes and commits data to storage differently from legacy approaches. One of the specific differences is the inherent or built-in nature of encryption and verification in blockchain networks. Encryption and verification are fundamental to blockchain because the data is, by design, in motion at the initial stages of processing, as consensus across the network is established. Consensus is the required condition in a blockchain for a transaction to be captured in an immutable block.¹

Since blockchain is still far from maturity, for IM firms that take a conservative approach to adoption of new technologies, experimentation seems to make sense, while aggressive firms implement and commercialize blockchain solutions. Even so, blockchain is progressing at a measured pace in the hands of a wide range of firms, large and small. Over the next five years, blockchain should move from proof of concept to performing significant—but well contained—processes across the IM value chain and could also be the foundation of future stacks that leverage its strengths in new applications. It will likely take longer for blockchain technology to supplant the legacy systems that carry systemic risk in IM operations.

Figure 1: Blockchain technology stack

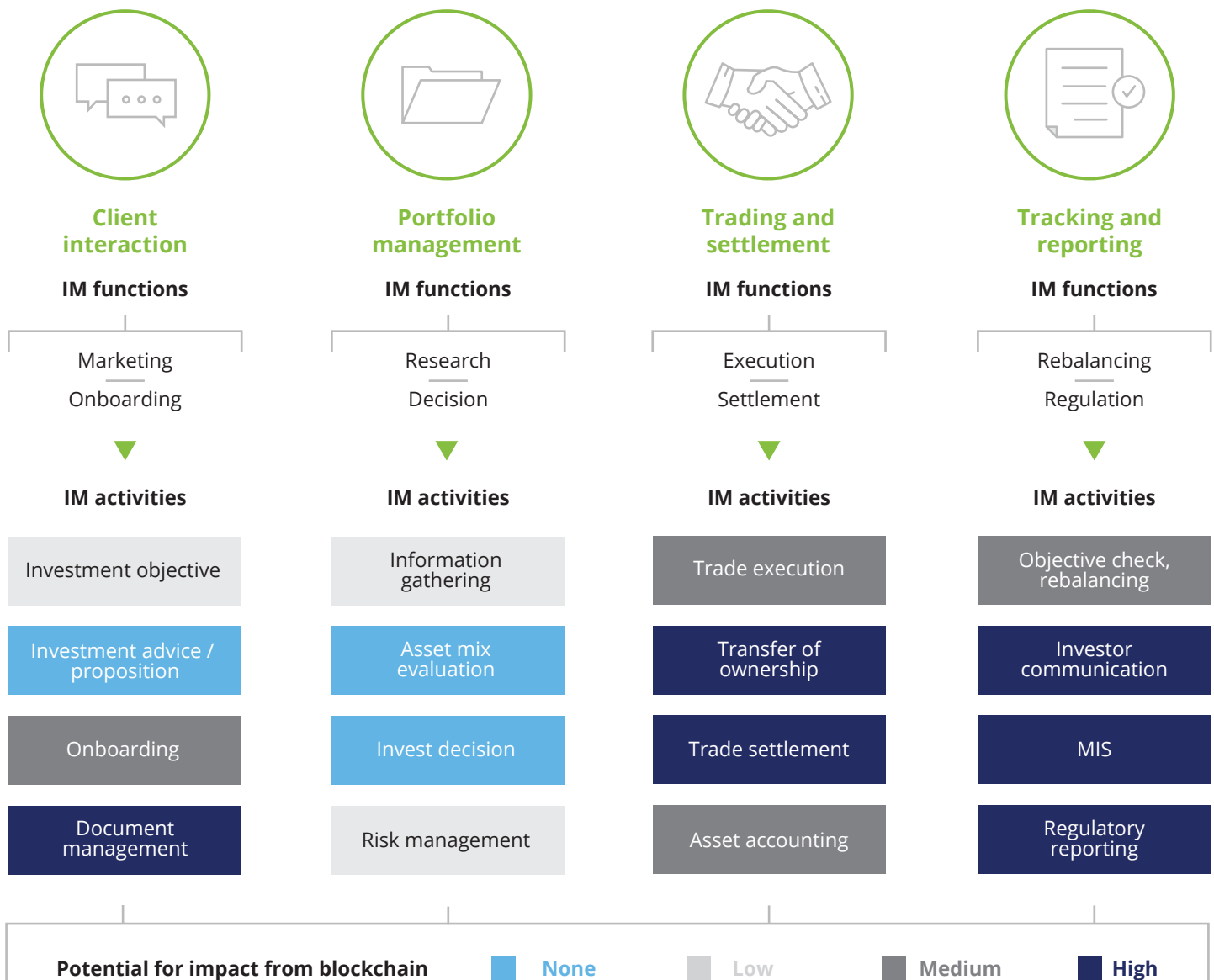


*Many BaaS providers move up in the reference architecture to offer network and protocol and services layer solutions. Note: The representation is not meant to be exhaustive (e.g., Ethereum and Bitcoin are not the only protocols and the represented consensus mechanisms are also not exhaustive).

Across the IM value chain: Emerging IM use cases

Use cases related to IM are popping up across its value chain. Every investment manager has a value chain of activities that are performed in order to provide their services to customers, and within that chain some processes are more suited to transition to a blockchain infrastructure than others (See Figure 2). Processes that have multiple parties granting approval, and have strong audit, compliance, and regulatory oversight tend to be better suited for blockchain adoption. Another consideration, unique to each IM firm, is how the function is performed. Are the people, processes, and technologies functioning in an efficient manner? Are the volumes high enough to support an infrastructure upgrade? And, can blockchain scale to the volumes required?

Figure 2: Value chain impact from blockchain



A few cases stood out as most informative for investment managers at this time. The three cases described on the following pages represent distinct approaches, which are tailored to the processes that they are addressing.

Nasdaq – Linq: Platform approach to transform private securities markets

Use case developed based on a conversation with key executives leading Nasdaq's blockchain development efforts

In 2013, Nasdaq started to study crypto-currencies to get an understanding of how they operated, with an eye toward considering involvement in the early stages of crypto-currency development. Nasdaq investigates new technologies in the normal course of its research and development processes and is currently also engaged in augmented reality, artificial intelligence, and big data analytics development projects to name a few. In the case of the of crypto-currency research, Nasdaq found the enabling blockchain to be more interesting. After a period of education and collaboration on blockchain, Nasdaq decided on a use-case for prototype development. Nasdaq now focuses its blockchain efforts on a proof of concept called Linq.



Linq is in development through Nasdaq Private Market (NPM), a Nasdaq market that services the equity shares of privately held companies. Linq currently records the shares of several privately held firms including Chain.com, one of its blockchain development partners, on its private blockchain. Considered critical to the effectiveness of Nasdaq's strategy with Linq is the development of financial markets. Nasdaq believes that custody and recordkeeping are foundational to market development. Two other important factors for market development are liquidity and scalability. This places Linq in both the trading and settlement and tracking and reporting stages of the IM value chain in Figure 2 by performing asset accounting, transfer of ownership, management information system (MIS) reporting, and regulatory reporting. As Linq develops into a full-fledged market offering, Nasdaq is collaborating with the private market participants to develop an ecosystem in blockchain that is both robust and transformative. Nasdaq enters this new development area as a legacy full-scale securities processing provider.

Nasdaq's decision to pursue blockchain for private securities was addressed on a strategic level. First, with

private securities processing, NPM's approach is complementary to Nasdaq's core public securities exchange businesses. The firm selected a small, growing business segment both from a scope and risk mitigation perspective. From a regulatory perspective, this approach limits systemic risk, while engaging and educating regulatory bodies with blockchain based solutions. This approach also allows Nasdaq to build the new technology platform, demonstrate its value, and learn from the experience, before applying blockchain to larger, more complex securities processing work streams that could have inherent systemic risk and receive more regulatory scrutiny.

Nasdaq is actively exploring the pain points in private securities markets, including alternative investments such as private equity fund management. They are reviewing areas where technology and business processes can potentially take a quantum leap forward. Privately held company stock is just the first of a series of opportunities in unlisted securities that are under consideration by Nasdaq, and this move would potentially add client interaction processes onto the Linq blockchain infrastructure.

The Delaware Blockchain Initiative: Symbiont

Use case developed based on interview with a key executive leading blockchain development at Symbiont

The Delaware Blockchain Initiative (DBI) also provides some insight to the IM community with regard to adoption of blockchain in securities processing. This initiative is firmly in the tracking and reporting portion of the IM value chain. DBI takes tracking and reporting to its very origins, the legal foundation of digital ownership rights for corporations, as opposed to the digital representation of paper-based ownership rights and records.

The DBI has two significant components. The first component of DBI is to rebuild the public archives using distributed ledger as a storage layer and creating smart records that will automate control and access. In the long-term blockchain road map are the State of Delaware's registry services, including key records, such as uniform commercial code filings, land titles, and birth and death certificates. The second part of the initiative is the one that seems more interesting for investment managers. Delaware is planning to place its incorporation documents and procedures on a smart contract-enabled blockchain developed by Symbiont. This part of the DBI is running two parallel work streams. DBI has a legal stream and a technology stream, both of which have important implications for investment managers. Delaware actively competes for corporate headquarters. As a corporate-friendly state, Delaware is the home to 66 percent of Fortune 500 firms and 85 percent of recent US initial public offerings.²

On the legal work stream, the governor of Delaware is ensuring that the laws fully support blockchain incorporation processes and digitally originated securities through legal analysis and a legislative agenda. DBI is developing the legal framework for digital incorporation as opposed to the traditional paper-based incorporation. Clarifying the legal status of digital records is likely an important step on the path to blockchain adoption. A broad security master file with digital records for each security could fundamentally



transform securities processing through smart contracts. This capability could transform the security master file from a record of characteristics to a more active participant in securities processing.

On the technological side, Delaware's plan is to use a smart contract-enabled blockchain to record and manage the State's corporate filings. In what is called autonomous recordkeeping, the smart corporate filings trigger notifications when actions are required, such as new filing requirements when thresholds are met or when documents approach expiration. Smart contracts on blockchain-originated equity shares are directly translatable into fund units with specialized smart contracts to manage their unique processing requirements.

Given that proofs of concept are slowly moving up the blockchain architectural stack, IM executive leaders should begin a deliberate process for consideration of future investment in blockchain implementations. This process should weigh the potential benefits of a blockchain-based process against the risk of implementing a new technology, compared to the stability associated with more conventional database solutions. We offer a roadmap for blockchain investment later in this paper.

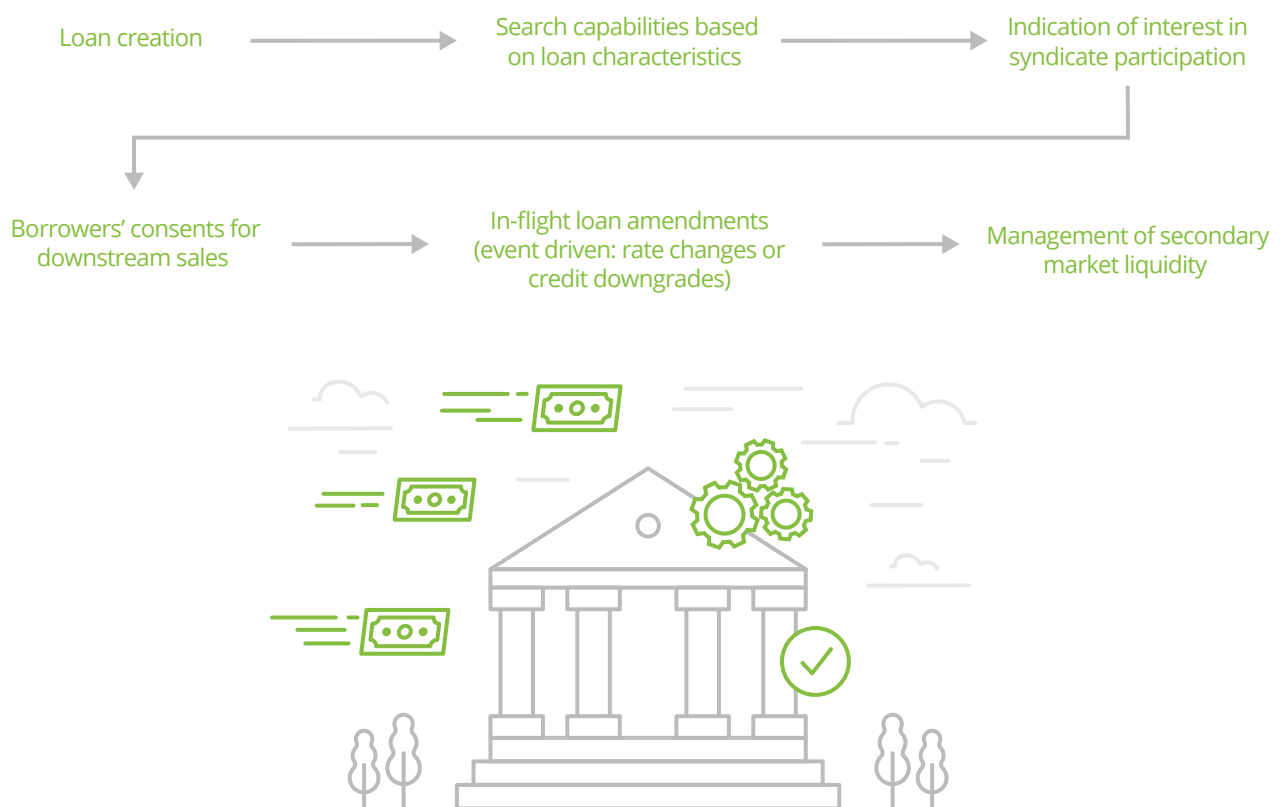
Loan syndication: Symbiont

Use case developed based on interview with a key executive leading blockchain development at Symbiont

Symbiont, a fintech start-up, seems less concerned about transforming the IM industry than about delivering blockchain-based customer solutions. Symbiont is building an end-to-end solution for syndicated loans for a consortium of 16 firms on both the buy and sell side of the syndicated loan process. This approach aims to streamline the syndicated loan process, allowing for more efficient spreading of risk to market participants, including the alternative investment community.

The solution is a private blockchain run by consortium members to manage the loan syndication from end to end.

Figure 3: Loan syndication process



These loan syndication stages cover multiple areas in the IM value chain, including client interaction, transfer of ownership, and tracking and reporting. They also include some securities processing components, when interest payments are distributed to the owners.

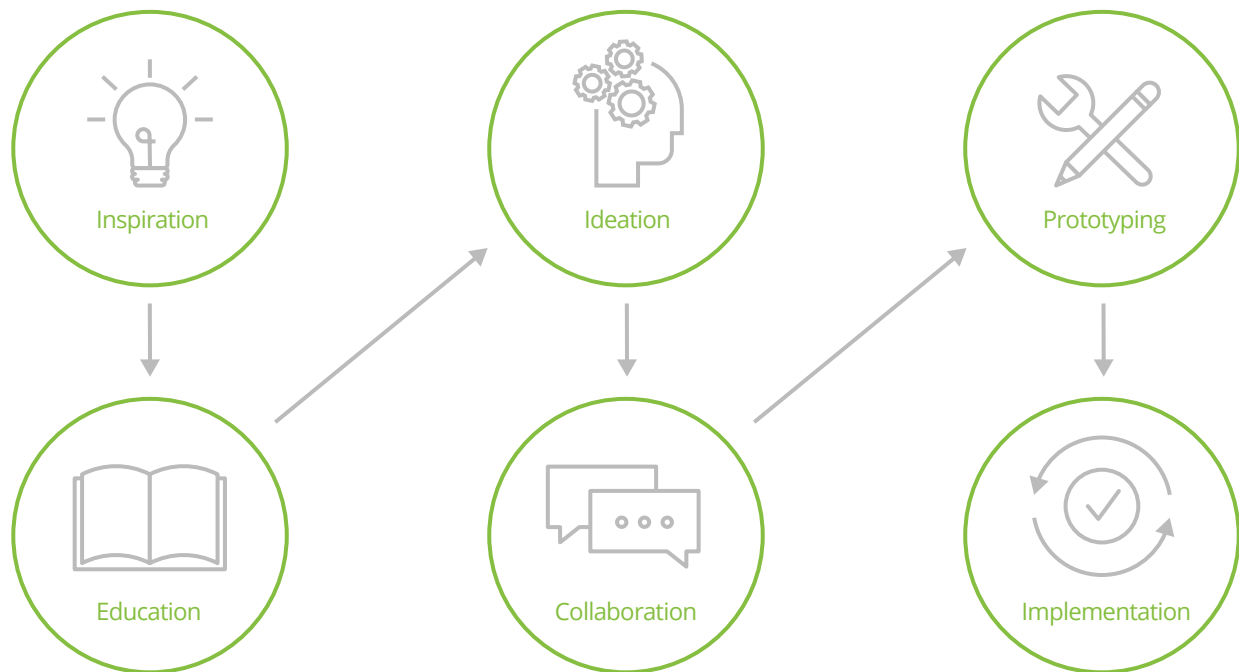
Planned for 2017, this early blockchain application would mitigate some of the new technology risk with its private nature and illiquid nature of the syndicated loans. Also mitigating risk is the fact that the network participants are all regulated financial entities, in stark contrast to public blockchain networks. This project may serve as a model for implementing private blockchain solutions for fund issuers with low fund transaction volumes, in addition to participants in the loan syndication and private debt markets.

Inspiration to implementation: Six key steps to make blockchain a reality

While the hype around blockchain is strong because of the wide range of possibilities created under its revolutionary approach, firms considering blockchain technology for their business processes can take a deliberate path to getting started. This way, they can select a transformative implementation while mitigating the risks associated with process change and new technology adoption.

Six key steps, if performed effectively, can take a firm into blockchain

Figure 4: Six steps to get started with blockchain



Step one: Inspiration

One of the primary ways to get inspired about blockchain is to visit and interact with active think tanks and laboratories where students and PhDs alike are testing blockchain related ideas—often times well before they are commercially viable. Some of these conversations are like a glimpse into the future. The MIT Media Lab is one of these institutions. Connecting with the blockchain project leaders at the Media Lab can open up a wealth of information. In addition to an encyclopedic knowledge of the current state of the technology, these students and academics are also helping to shape the future of the technology. The known vulnerabilities and limitations of the technology are the focus of their developments. Shaping the future of emerging technologies is what these

institutions do. Before there was much published on the subject, a visit to the think tank cleared one specific limitation: processing speed. Blockchain in its standard public network cannot support the scale of certain uses, like securities trading. That is still true today. However, the use of different blockchain configurations can potentially increase the processing speeds to industry standards. These think tanks are making progress well ahead of commercial application, as is required for their role. One cannot help but be inspired about the technology in general after a visit to the Lab. Visits like this open the creative pores.

Step two: Education

In the education phase, creativity gives way to information gathering and assimilation. While the inspiration phase activates the imagination, the education phase considers the practical. There are specific questions that organizations can answer in the education phase. How does blockchain really work? What IM firm processes are currently running on a blockchain? What are the key characteristics of a process that make it a good candidate for transformation to blockchain? What are the risks associated with transforming a process to blockchain? Are there ways to structure, organize, or permission the blockchain to mitigate risks? These questions are far from exhaustive from the requirements for a full blockchain implementation, but they can serve as a starting point that prepares firms for a powerful ideation process.

Step three: Ideation

When a critical mass of personnel is inspired and educated on blockchain, organizations can effectively move into ideation. The leading ideation processes have engaged participants and cultivate outside-the-box ideas as well as incremental improvements. Effective ideation also yields action. Categorization and prioritization are required to effectively act on the ideas generated. Effective ideation brings order to chaos without stifling or overlooking good ideas that may arise in the process.

Ideation participants can envision how blockchain could improve the efficiency or extend the capability of the processes in place at their firm. Identifying pain points in a firm's processes may be easier than finding the points where additional capability, on perhaps an already efficient process, can unlock new opportunities. A well-orchestrated ideation process will be keen to look for both kinds of improvement.

This approach is more narrowly focused than some ideation approaches because the method of improvement—blockchain—is already identified, and the approach to finding areas for improvement is disciplined, stepping through the value chain.

The result of the ideation process is a prioritized list of potential blockchain projects. Remember, blockchain is a relatively new technology compared to traditional database solutions. The projects and benefits identified through ideation may be more easily achieved through a traditional database solution. Right now, end-of-day securities pricing data would be an example of a poor blockchain use case. The low-cost, high-volume, not personally identifiable, and non-transactional nature of the data make this type of data better suited to a traditional data structure. End-of-day pricing is a data element that does not require encryption protection.

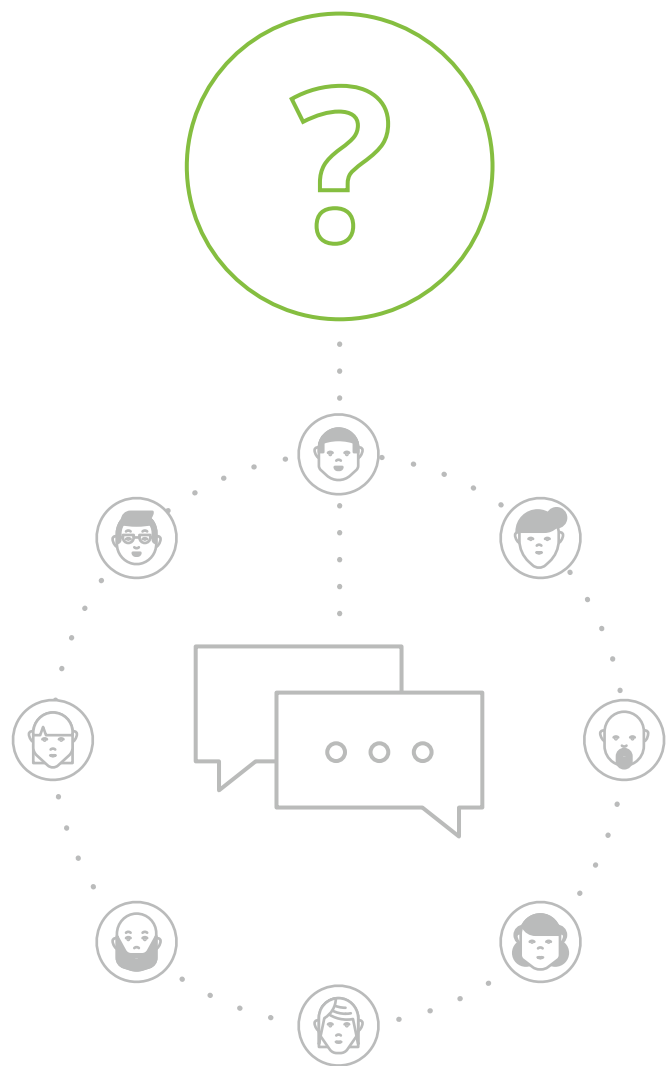
Investment managers should test their ideas to determine that blockchain is the correct infrastructure for the solution. Some guidelines for blockchain development indicate that disintermediation is a requirement for a valid blockchain use case. This is not always the case, especially in the highly regulated IM industry. Some good candidates for blockchain may not include disintermediation. Exercising the distributed nature of blockchain can enable greater inclusion in real-time, which is effectively process extension, rather than disintermediation. Imagine query-only permissioned nodes on a blockchain for regulators or for an auditor. While those are new parties to the transaction in a traditional sense, the ability for both groups to self-serve on a verified transaction set is a benefit to all parties involved, with no disintermediation.

Step four: Collaboration

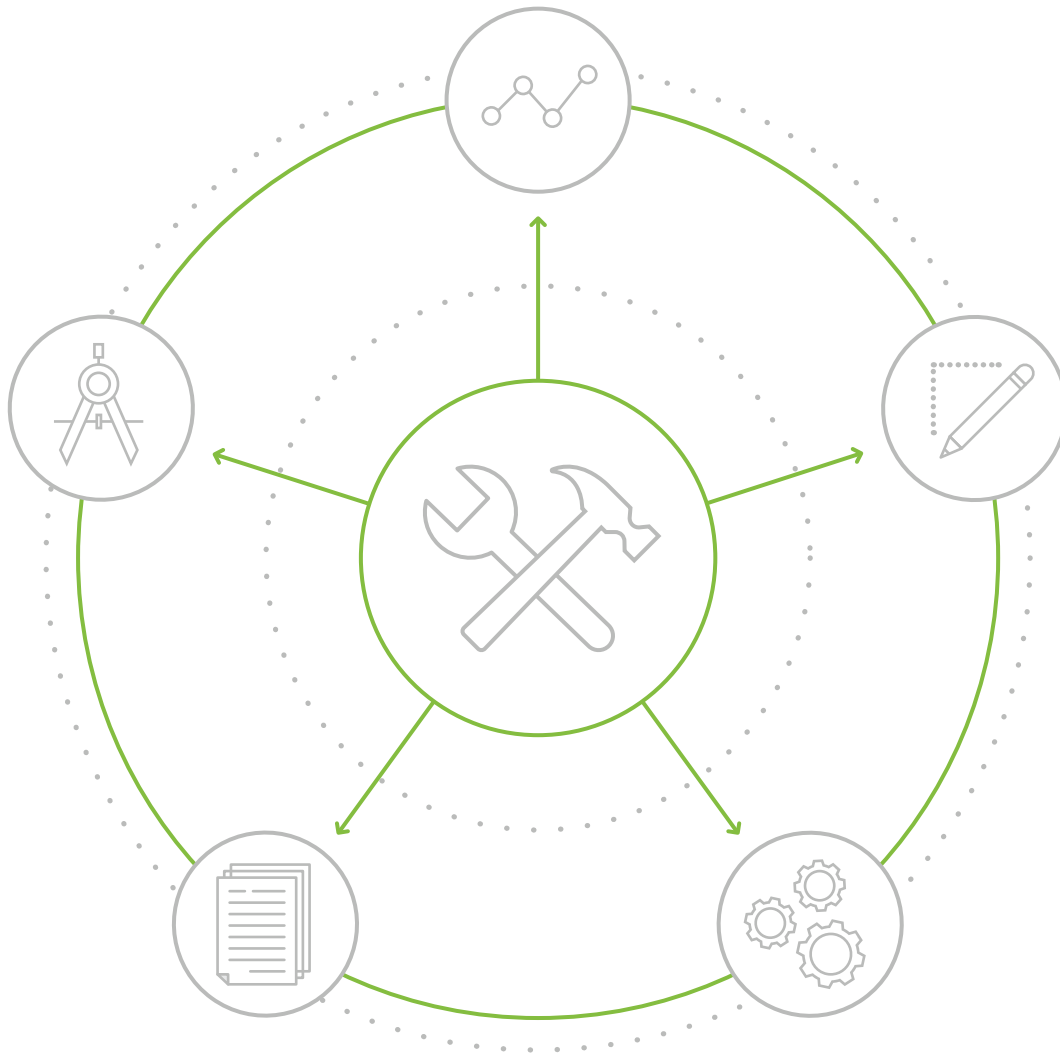
After ideas are tested, investment managers can progress to the collaboration stage. Investment managers often make connections with industry consortia and blockchain developers in this phase. With these connections investment managers can continue their education process targeted on their initial blockchain projects. Key questions addressed in the collaboration phase are:

- ▶ **What have other IM firms done in this area?**
- ▶ **Are there industry standards being developed for this process?**
- ▶ **Which blockchain platform is preferred for this project?**
- ▶ **Is that platform also preferred for the additional projects that are likely?**
- ▶ **Which development firms are working on the platform and have experience in the process area under consideration?**
- ▶ **What do other industry participants think of this blockchain development area?**

The collaboration phase is where investment managers would test their blockchain project ideas with the leading industry participants and organizers, such as R3CEV LLC. Through collaboration the ideas are refined and reconciled with industry standards. Prior to this stage, the investment manager has an understanding of the possibilities with blockchain and how blockchain worked. Firms at this stage also have a prioritized list of potential blockchain projects specific to their organization. Coming out of the collaboration phase, the firms have a view of industry standards, potential development partners, and an initial blockchain development strategy. To achieve the goals of the collaboration phase, investment managers should become part of the blockchain/fintech network, and to incorporate the learnings from the network.



In the collaboration phase, IM firms may adopt a buy versus build strategy. In the case of blockchain, this approach can serve to mitigate significant risks in software development and implementation. This approach can also lead to a critical mass of firms on one solution. With enough customers and a strong team of technology firms behind the new blockchain solution, regulators may be more easily persuaded to accept the technological advancement, or perhaps even embrace it. Achieving regulatory buy-in is a critical success factor for adoption of blockchain technology as a whole, especially for implementations that touch market structure or carry systemic risk. Including regulators in the collaborative process and writing them into the solution architecture has potential to shorten blockchain adoption timetables.



Step five: Prototyping

With the knowledge and relationships gathered at this point in the process, IM firms building a custom solution are ready to develop a working prototype of leading projects. A prototype is effectively a scale model of the process. In order to build a good prototype, the requirements of the process have to be gathered from key stakeholders and experts within the organization. There are two basic categories of prototypes, the breadboard prototype and the rapid prototype. The fundamental difference between them is that breadboard prototypes evolve into working applications, while rapid prototypes are built only for requirements gathering, testing, and refinement. Rapid prototypes do not evolve into functional applications, and are essentially discarded after their use as a requirements gathering tool are completed.

With breadboard prototyping, the working application is built from the prototype. In both cases, the prototypes go through user testing and iterative refinement to create user and process requirements and guide application development. Rapid development comparatively saves time and effort in creating a prototype, and those savings are likely to be given back if the project moves to application development. In the case of developing a blockchain solution for a consortium of business partners, rapid prototyping with its faster, less expensive advancement to demonstration of proof of concept may help recruit the consortium prior to incurring large project expenses.

Step six: Implementation

Implementation of a blockchain solution is where the rubber meets the road. The risk to an organization exploring, testing, and prototyping is very limited compared to the potential risk associated with some possible blockchain implementations. Firms should be prepared to invest in security and risk mitigation throughout the process of the development and launch of a blockchain solution. Verification and validation of the system prior to launch are critical components in the implementation process. There is also a wide range of appropriate implementation requirements dependent on the blockchain use case being implemented. Private, permissioned blockchains with a small number of regulated entities with granted access recording illiquid assets, dictate a very different implementation approach than those involving public networks operating with cryptocurrencies. In the private network example, participant access can be physically and programmatically controlled and the implementation can focus on the relatively small number of permissioned users. In contrast, a public network depends more heavily on encryption and identification algorithms to maintain control. Also, the dispute settlement procedure for a small private network can be codified and would be a significant component of blockchain implementation. The concept

of the code is the law, and therefore “whatever transactions are capable are accepted” is still prevalent in the public blockchain community, adding significantly to the emphasis on efforts required to meet verification and validation standards. Many of the challenges to blockchain implementation are found outside of the technology itself and are present in the financial reporting, tax treatment, and regulatory compliance associated with a particular IM process.

Given the number of firms working through these steps, and the networked nature of blockchain, many IM firms are likely to encounter blockchain-enabled processes in 2017. Some alternative investment firms could participate in deals that are primarily accessible on blockchain with potentially lost opportunities for firms outside the blockchain consortium. For mutual funds, perhaps private blockchain consortium participants will trade securities in an “upstairs market” in an effort to reduce cost while trading in less-liquid securities. For ETF providers, perhaps it will reduce risk and cost in the Creation Unit process in 2017. Each of these examples involve private networks of regulated financial institutions due to the level of maturity of blockchain and the nature of IM.

Blockchain in IM: A utopian vision?

In the initial futuristic, or some may say utopian, view of blockchain and smart contracts, the key characteristics of a blockchain process are utilized: digitized records, decentralized input and access, immutable transactions, and immediate processing. The possibilities for process improvement with blockchain rise dramatically when smart contracts—which trigger based on events such as the passing of time or execution of another transaction—are layered into the blockchain.

This utopian processing world, however, continues to have risks. One of these risks is that the provenance of the assets recorded in the blockchain remain intact and there is no other claim to the asset outside the blockchain submitted as proof of ownership. While this risk is worthy of strong consideration in a blockchain implementation, it is not a new form of risk. How many times has the Brooklyn Bridge been sold?

Another risk of this new technology resides in smart contracts, which have the potential to be coded with vulnerabilities to hacking and exploitation. Private blockchains mitigate much of this operational risk, as does the decoupling of blockchain recorded ownership rights from cryptocurrencies. Public blockchain is vulnerable to participants' malicious intents and accidental glitches which could lead to tampering with the transactions or an interruption to the network. Such events are less likely to take place with private blockchains, owing to the shared responsibility of a limited set of participants (discussed previously in the implementation section). Members would likely acknowledge that the code should emulate the written arrangements, and when the code or smart contract does not function properly, this occurrence cannot be exploited for financial gain. Consortia of institutional firms in a private network can self-regulate effectively.

In securities processing areas with inherent systemic risk, regulatory agencies will act to protect consumers and markets. The level of protection for the systems

and processes that support the market and securities processing structure by regulators will be high, and rightly so. This area is also where the industry as a whole can realize significant potential benefit. Processes in the IM industry more often than not have trusted intermediaries, such as exchanges, transfer agents, and broker-dealers, serving critical roles. The active participants on either side of these intermediaries likely have to reconcile the outcomes consuming time and resources. The potential for blockchain to revolutionize these processes is strong, and the timing depends on how quickly the industry participants and the regulatory bodies embrace blockchain development. Millions in potential cost savings and thousands of jobs may swing in the balance as blockchain rolls out.

Let's examine one very specific IM process potentially impacted by blockchain, the US mutual fund shareholder servicing function. This process currently crosses multiple entities from the customer facing brokerage firm to the mutual fund's transfer agency department. According to the Investment Company Institute, US mutual fund assets totaled \$15.6 trillion at year end 2015.³ These funds typically incur an annual transfer agency (TA) expense between 4 to 19 basis points, which varies by size of the fund due to economies of scale. Using a conservative estimate for average transfer agency expenses of 10 basis points, the US mutual fund transfer agency function is a \$15.6 billion annual cost to the industry. Blockchain seems prime to disrupt this function, fundamentally changing the cost of the function, and carries the potential to change how the service is provided. This change may remove the organizational hand-offs in the process. The TA process could become a network function with no single responsible entity other than the network governing body. The cost of the TA would certainly be greater than zero. However, entities that provide TA as a core service are likely to feel the pain of disruption, unless they are a significant part of it.

With risk comes reward, and blockchain, risks included, continues to intrigue many fintech and IM industry participants. Many new alternative solutions to old problems are being tested daily with blockchain, and new possibilities are also being created. At this stage blockchain is moving from novelty to the early adopter development stage, for well-contained projects from a risk perspective. Managed appropriately, the IM industry is on a path to increased efficiency and enhanced capability, across the value chain, based on blockchain within a 10 year time horizon. The initial steps in that path have already been taken by the leaders in blockchain development, and pockets of achievement may emerge in 2017.

Endnotes

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