

Creating Digital Trust with Open Source Blockchain Project

Financial Services Use Case

Hitachi America Research and Development brings together some of the world's greatest minds to research and innovate for a better future. Financial Innovation Laboratory brings new opportunities to financial business through its contribution to the open-source blockchain "Hyperledger" project. This article highlights the project activity and introduces a customer use case related to governance control in financial institutions.

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1. Introduction

Hitachi America Research and Development (R&D) Division brings together some of the world's greatest minds to research and innovate for a better future. For three decades, Hitachi America R&D has collaborated with business and research leaders worldwide to address industry and social issues, creating next-generation solutions that make the planet a safer, smarter, healthier, and more secure place.

Hitachi is a unique company that can vertically integrate from materials and products to technologies and complex solutions to provide end-to-end value to its customers. At the core of the Hitachi America R&D process is a unique combination of advanced IT, operational technology (OT), and products and systems that lead to comprehensive solutions.

The unique challenges of the digital age, which include greater project complexity, globally intertwined markets, and soaring customer expectations, require a more dynamic and open approach called

"collaborative creation." Together with customers, Hitachi aims to create new and improved products, solutions, and services. The company forms true partnerships with its customers to identify and drive new value for their business.

With deep experience accumulated across a wide range of industry sectors, Hitachi develops innovative solutions that solve real business problems while also addressing significant social and environmental issues. Its Global Center for Social Innovation – North America (CSI–North America) spearheads its work with strategic partners in industry and academia to address known and hidden operational issues. CSI–North America leverages and integrates Hitachi's deep experience in IT, OT, and products to create new solutions to the social challenges of today and tomorrow.

The market-driven collaborative creation approach allows for sharing visions, generating concepts, and quickly developing innovative technology and solutions that are validated through proof-of-concept prototypes at customer sites. Hitachi tackles many challenges to advance social, environmental, and

economic values of customers in mobility, smart life, industry, energy, and IT.

This article covers contributions to the open source software (OSS) blockchain “Hyperledger¹” project and a customer use case related to governance control in financial institutions developed by the Financial Innovation Laboratory (FIL) of CSI–North America.

Blockchains are seen as a new information sharing technology with the potential to enable new business developments that replace intermediaries with smart contracts, thereby making processes transparent and automated. Hitachi is working on blockchain research and is using collaborative creation with customers to identify use cases in the USA, European Union (EU), Singapore, China, and Japan. Those include digital check clearing, digital coupon management, inter-corporation information sharing, and supply chain management.

2. Open Innovation on OSS Blockchain “Hyperledger”

When one thinks of OSS, images of hacked together, amateurish software might come to mind. In the modern world of industry-critical software, however, it is flourishing. Well-known and highly utilized platforms and applications such as Linux², Apache³, and even Hitachi’s own Pentaho are OSS. There are a number of reasons for the adoption of the OSS model.

The important shift in markets that led to OSS is that building very large systems with a small number of people is risky. It is risky from the standpoint of the scale of capital and resources needed to build large systems, but also risky from the standpoint of adoption. By making a project open-source, developers build a community that will at once construct and utilize the software. This means that someone who in the past was a consumer of software and would report bugs and complain when things went wrong can now participate in the construction and feel a sense of ownership.

The business model for delivering software as an OSS project is different from traditional commercial

software. OSS, by its very nature, is free. For large enterprises however, software governance typically requires that OSS be managed. In the case of Linux, for example, Red Hat, Inc. has become the leading vendor for delivering a managed version of Linux and has built a company worth over \$30 billion (USD) delivering software services. It is worth noting that International Business Machines Corporation (IBM) acquired Red Hat in 2018 largely due to its popularity in the corporate world.

This leads to the question of why Hyperledger Fabric became an open-source project. Blockchain projects such as Bitcoin were already open-source, and there have been dozens of similar competing projects. It was realized, moreover, that an enterprise version of blockchain technology (what was to become Hyperledger) would have little chance of market success if it was the product of a single vendor. Since enterprise blockchain technology is meant to interconnect companies, it was apparent that there would be a resistance to any one company with its own limited customer base building these networks. Additionally, given the scale of the development effort, the costs would have made the systems even more expensive. The open-sourcing of the Hyperledger project was a strategic decision, one that recognized how engaging the enterprise blockchain community in the project was more important than deriving revenue from the sale of software. Instead, revenue was to be made from support and from business applications built on top of Hyperledger.

Hitachi made the strategic decision to join the Hyperledger project and become a major contributor. Hitachi views Hyperledger as the most relevant platform for the types of use cases that are of interest to customers. By participating in this project, Hitachi can ensure that the features that are most important to the company and its customers are developed and deployed. Rather than merely using the software, Hitachi chose to be an active contributor in order to gain expertise and credibility in the Hyperledger community. Hitachi is also investigating training on competing blockchain platforms such as Corda⁴ and Ethereum⁵.

¹ Hyperledger is a registered trademark of the Linux Foundation in the United States and other countries.

² Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.

³ Apache is a registered trademark of the Apache Software Foundation in the United States and/or other countries.

⁴ Corda is a registered trademark of R3 LLC.

⁵ Ethereum is a trademark of Stiftung Ethereum.

Hyperledger and blockchain systems can be applied to many enterprise use cases and Hitachi is in a unique position to construct these systems. Expertise in business domains that range from financial services and energy distribution to supply chains and manufacturing affords Hitachi a unique perspective from which to build these systems. Hitachi's practical experience as both a developer and consumer of these systems will be a competitive advantage as enterprises seek partners to build these systems.

3. A Customer Case – Governance Control in Financial Institution

Blockchain enthusiasts who tend to be focused on cryptocurrency use cases such as Bitcoin can be purists about the technology. That is, if the use case doesn't use every possible component of blockchain then it is somehow deficient or "not" blockchain. But for enterprise use cases, one must think of blockchain as a toolkit of technologies and only those needed will be utilized. So, features such as asset control (cryptocurrency or other tracked assets), distribution, and consensus may or may not be relevant to a given use case.

Collaborative creation is a particularly important process to a blockchain-based system. Unlike conventional technologies where a client may just provide known specifications, a blockchain system must be designed in conjunction with the business process that it is supporting. As a new technology, many interested companies are not familiar enough with the technology to design a system on their own. In some cases, the business process may evolve to take advantage of blockchain's capabilities. If blockchain is simply being considered as a substitute for conventional technologies, there isn't likely to be an incremental return on investment that makes it worthwhile.

Some of the most exciting use cases for this technology are also the most complex and risky due to their technical complexity and business complexity. Building a system that must support dozens or hundreds of companies on day-one utilizing a technology that is still in its infancy is one reason many early projects have not been widely adopted. This is causing some disillusionment with the technology. To counteract this, a better starting point may be more

discrete applications with just one or a few companies, and simpler use cases. As the technology develops and capabilities are developed, some of the more challenging use cases will become more practical.

One area of particular interest in applying Hyperledger technology is managing the business processes of regulated industries. There are many examples of such systems. For example, a loan application being routed through a processing agent, then to risk, then to underwriting, and then a review prior to approval. Or a trader requesting access to trade on behalf of a client which may require numerous approvals. In the pharmaceutical industry, drug testing documents require certification. Even corporate treasury offices of publicly traded companies must go through specific governance processes to certify financial results.

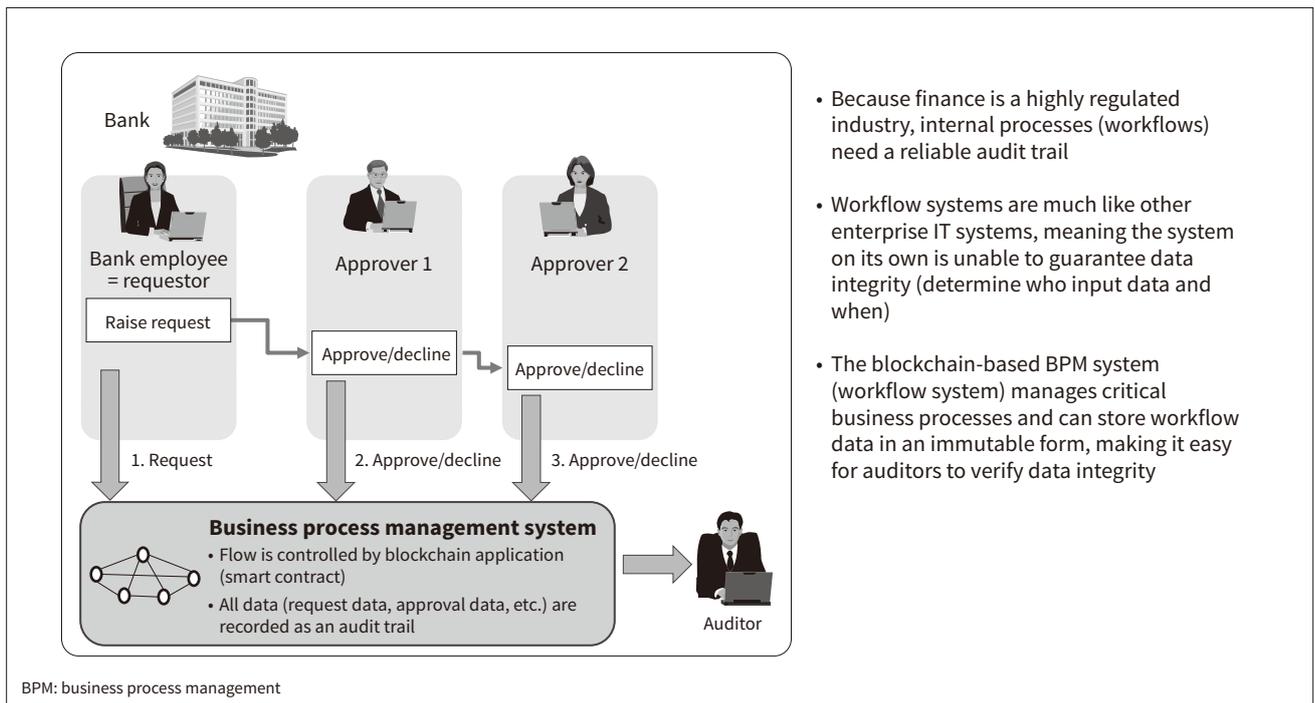
Typically, business processes are managed with a variety of tools including ad hoc systems of email and spreadsheets, systems built with SharePoint⁶, vendor-managed applications, or even custom-developed solutions. The business process and resulting data are typically stored in conventional databases. The challenge with these systems is that both the business process and the stored data can be manipulated at any time by someone with access to the systems. In today's regulatory and governance environments, this may no longer be enough. There have been numerous public scandals around the world involving companies that altered business data or processes.

Blockchain is uniquely capable of providing immutability for both the business process and the stored data in governance control systems (see **Figure 1**). Hitachi began researching the technical foundation that became part of blockchain in the early 2000s, prior to the launch of Bitcoin. This research proposed using a hashing process to create mathematical data proofs. It is this early invention that provides the evidence that data is consistent and unaltered over time. This is unlike any function in a conventional relational or non-structured query language (non-SQL) database. The data hashing process is then coupled with "smart contracts" (coded software) that control the behavior of the system.

⁶ SharePoint is a registered trademark of Microsoft Corporation in the U.S. and/or other countries.

Figure 1 – Blockchain-based Governance Control System

The figure shows an overview of a blockchain-based governance control system.



In conventional systems, workflow is controlled by parameters and code, which are subject to varying degrees of control to manage their alteration. Without sufficient control, someone could alter the approval process for a loan, for example. Perhaps routing a fraudulent application to a specific person for approval, or bypassing risk review. In a blockchain system, the workflow is managed by smart contracts that are spread across multiple machines that require coordinated deployment. Altering this process without the notice of others is virtually impossible.

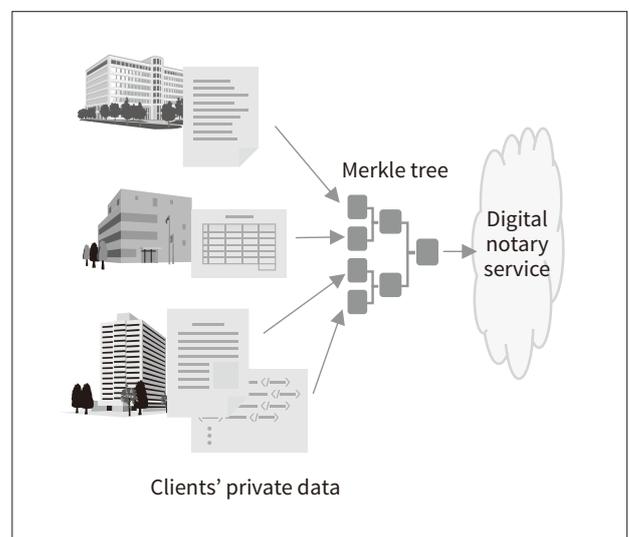
As Hitachi envisages that these blockchain-based governance systems will be run within a single company, there is also a need to verify that the users haven't altered the system. Although Hyperledger systems are considered "immutable," that doesn't mean they are impossible to alter. If someone were to control every computer running the software, they could alter past data and then recalculate new hash values (the mathematical proofs) to make everything look normal. In a system that is distributed across multiple companies, this isn't possible since no one has access to every server. However, in a governance system running within a single company, this is not the case.

To mitigate this weakness of an internal blockchain solution, Hitachi has also developed the concept of

a digital notary system that Hitachi or another third party would manage and control (see **Figure 2**). In this schema, the notary service holds copies of the hash proofs (also called a Merkle tree) but not the actual data. This ensures that private data never leaves the control of the company that created it. The integrity of the system and its data will never be in doubt because of this unique approach data certification.

Figure 2 – Digital Notary System

The notary service holds copies of the hash proofs (also called a Merkle tree) but not the actual data. This ensures that private data never leaves the control of the company that created it.



FIL in CSI–North America is also researching and developing tools to simplify and accelerate the deployment of these types of governance systems. Currently, the smart contracts that control the workflow must be programmed, as used to be the case with other types of business process management (BPM) software when they were in their infancy. Today, in contrast, most BPM software can be managed with graphical user interfaces. Because smart contracts are more technically complex than the systems that control traditional BPMs, nobody has tackled the development of this type of simplified interface. FIL is actively prototyping this concept, and believes that it will soon be able to simplify the administration of these systems.

In the future, FIL believes that it will be able to quickly deploy a Hyperledger-based BPM tool backed up by a Hitachi-managed notary service. This will change how companies think about governance controls, and the security of their data and process.

4. Conclusions

This article has covered contributions to the OSS blockchain “Hyperledger” project and a customer use case relating to governance control in financial institutions developed by Hitachi’s FIL.

Blockchain is uniquely capable of providing immutability for both the business process and the stored data in governance control systems. This will result in the opportunity to rethink business processes and improve them in ways that were previously not feasible. New business opportunities are likely to result from this research, and Hitachi hopes to lead the way.

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