GS1

Collaboration
GS1 US
GS1 Global

Bridging Blockchains

Interoperability is essential to the future of data sharing

Introduction

Improving the flow of products and enabling more sustainable and transparent supply chains are critical goals for many organisations today. Increasingly, these organisations are evaluating blockchain technology due to its potential to transform business processes and deliver new capabilities for data sharing, visibility and trust.

Blockchain technology gained initial popularity as an enabler of Bitcoin and cryptocurrency exchange. This paper evaluates those same distributed ledger technologies through the lens of enabling enterprise business processes, removing friction and reducing costs.

A number of business benefits have been identified by early users of distributed ledger technology in enterprise business applications. These include:

- Greater visibility of product, from origin to end state while in transit

- Business efficiency through automation (e.g., smart contracts)

- Increased trust for participants that cannot trade directly or lack an intermediary

- Improved detection and prevention of counterfeit and mislabelled products

- Risk and cyber-attack resilience for data storage via no single point of failure

As trading partners rapidly explore and begin to implement distributed ledger technology, best practices are beginning to emerge. Research and engagement with industry have identified continued collaboration on standards as essential to realise the expected business benefits of blockchain-based enterprise implementations. The use of GS1 standards as a foundation for identifying products, locations and assets and for structuring data about movements of goods is also emerging as an industry best practice.

The pace of exploration and implementation is accelerating. Ecosystems of trading partners are developing software platforms on distributed ledger backbones and, as pilots move into practise, stakeholders are coming together to identify and understand what challenges exist around readiness, adoption and scalability.

With more and more companies signing up to explore and use distributed ledger technology, new questions about scalability, governance and interoperability are emerging. Bringing industry together to discuss these three challenges and to understand the technologies that can facilitate real, collaborative solutions is a core competency of GS1. We're ready to start the conversation.

GS1 standards: The global language of business

GS1 standards provide a common language that enables businesses to identify, capture and share data in a globally-interoperable way.

Identify: These are the numbers inside the barcodes. Used in both the physical and digital worlds, GS1 identification numbers persistently and uniquely distinguish products, logistics units, locations, assets, documents and relationships across global supply chains—from the manufacturer to the consumer.

Capture: Expressing foundational GS1 identification numbers in physical barcodes, RFID tags and web addresses (URLs) enables the use of those GS1 identification numbers to capture, store, locate, retrieve and analyse data about the things that are identified.

Share: Sharing data about things that have a GS1 identification number is further enabled through the use of foundational data exchange standards from GS1. These data sharing standards, such as EDI and EPCIS, enable trading partners to leverage a common language to ensure interoperability of disparate system implementations.

The rise of industry ecosystems

Interest in blockchain technology is growing beyond the hype. New software and solutions that leverage distributed ledger technology are being developed to support business processes that rely on sharing of data, and trading partners are implementing these new solutions. "Ecosystems" of companies and solution providers are emerging to focus on specific business needs. IBM's Food Trust, which is built on Hyperledger Fabric, has convened to address food safety concerns. Chronicled's Mediledger Project, which is built on Ethereum, has emerged to address regulatory compliance in pharmaceuticals.

It is expected that many ecosystems will emerge, as more diverse groups of stakeholders evaluate distributed ledger technology and broadly identify the need for solution choice. As additional ecosystems grow, trading partners will be faced with the need to share data across and between a number of different ecosystems.

Ecosystem Interoperability
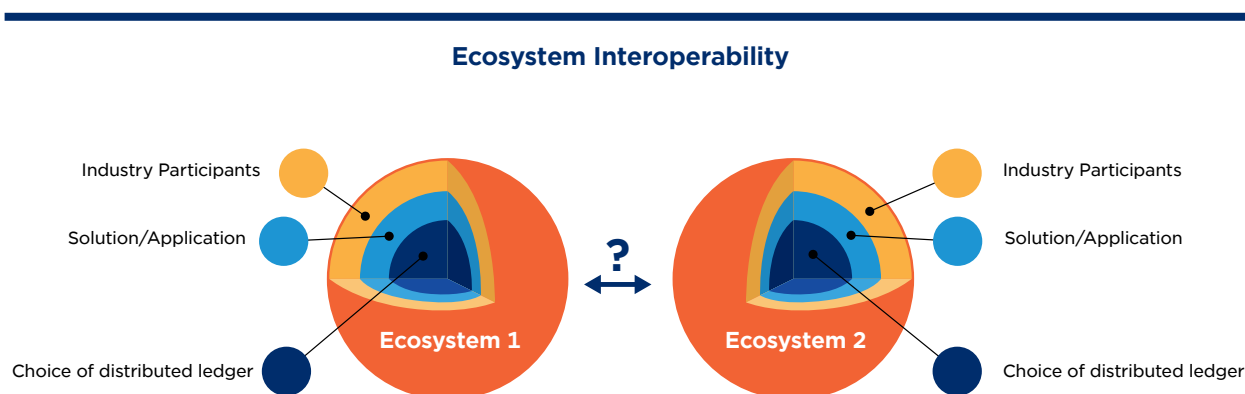
- *How will trading partners that participate in multiple ecosystems avoid expensive integration and customisation costs?*
- *How will trading partners actually realise the potential promise of cost savings and operational efficiencies, if the landscape of ecosystems itself grows complex?*
- *How will trading partners discover and exchange data that may be distributed across different ecosystems?*

As data sharing ecosystems start to move beyond point-to-point transactional exchanges and into a realm requiring increased interoperability, these questions are going to be top-of-mind for most all stakeholders. It will not be enough to only leverage existing GS1 standards for identification, data capture and sharing as a best practice. Industry and the consortiums that serve industry will also need to collaborate on answers to some entirely new questions around governance and interoperability. The time to begin this dialogue is now.

"We expect that interoperability between blockchain ecosystems will demand a solid foundation built on:

1. Globally unique, persistent identification for organisations, locations and things
2. A standardised language for supply chain events
3. A scalable network governance model that crosses ecosystems

For supply chains, industry collaboration and the global language of business of GS1 are essential to this foundation."

Ramesh Gopinath
Vice President, Blockchain Solutions and Research, IBM

Implementation challenges

Implementations of data sharing solutions that leverage distributed ledger technology are as complex as implementations based on more traditional data-sharing technologies.

Those evaluating this technology for the purpose of implementing a data sharing solution should be aware that existing business processes will need to be reviewed, and often reworked, to realise the desired operational efficiencies. Because of this need to "get the foundation right," the costs associated with an implementation may be difficult to gauge at the start of a project.

There are important areas that should be evaluated as early in the process as possible. For solutions that plan to leverage blockchain technology, these four areas are particularly relevant:

1. Business processes around data

2. Standards and best practices for data

3. Interoperability and discovery of data between ecosystems

4. Governance, including permissions and participation

While we cover each of these topics individually below, consideration of all of them is essential to any successful implementation.

1. Business processes around data

Many business processes in place today must be reviewed and often reworked to realise the cost benefits and/or operational efficiencies promised by distributed ledger technology.

Often, trading partners' business systems (e.g., Enterprise Resource Planning, Warehouse Management System) are not designed to capture and share traceability data (e.g., visibility, transparency, product provenance and integrity) with their partners' systems.

Business processes and the systems that support them will need to support the flow of funds as well as the data about the movement and transformation of goods (e.g., ingredients into new finished products). Product provenance and visibility solutions will require this data to be exchanged beyond direct trading partners and across systems that may today be proprietary in their design (and, therefore, not interoperable).

2. Best practices and considerations for data

When moving beyond the exchange of data between direct trading partners, interoperability becomes a foundational need. Significant maturity in master data management and data quality is required. To achieve this, a suite of global GS1 standards should be consistently implemented as a foundational structure for identification and data sharing.

Industry-leading ecosystems are leveraging existing investments in GS1 standards for the unique identification of products with Global Trade Item Numbers (GTINs) and locations with Global Location Numbers (GLNs). Other GS1 standards, such as Electronic Data Interchange (EDI) for transactional data and EPCIS for event data, are enabling and supporting industry's data sharing needs. GS1 is showing its commitment to industry ecosystems via education, training and ongoing support of the standards.

On public distributed ledgers, storage space and computation of consensus typically carry significant cost. While enterprise implementations don't typically carry the same storage costs and computing power demands of public blockchains, there are concerns around data storage, data permissions and data sensitivity, which are helping to align experts around best practise for storage of data on enterprise ledgers.

Industry experts are broadly aligning around a best practise of storing a small amount of reference data on enterprise ledgers, while ensuring that richer data can be stored and accessed through applications that reside "off-chain" in traditional data stores.

Blockchain ecosystems will need to determine "which data" must reside on the ledger and which data can be accessed off-chain. Addressing this topic early in your implementation is essential to ensuring interoperability.

When moving beyond the exchange of data between direct trading partners, interoperability becomes a foundational need.

3. Interoperability and discovery of data between ecosystems

Ecosystems that use blockchain technology consist of a set of distributed nodes where immutable transactions are replicated. This provides a trusted "audit trail" of transactions that are created by trading partners. Unlike public blockchains, enterprise blockchains account for commercial privacy concerns by not openly posting all trading partner data to a shared ledger.

However, there is a growing number of different ledger technologies (e.g., Hyperledger Fabric, Enterprise Ethereum and others) and there is no standard approach or plan to ensure interoperability between the ledgers on which the industry ecosystems are built.

Within a single ledger implementation, the discovery of relevant data is not often an issue, as all references to the needed data are on one ledger. As a variety of ledgers emerge, successful discovery of data across blockchain implementations is going to demand communication/data sharing between ledgers.

As new ecosystems and ledger types continue to proliferate, the challenge of data discovery will get increasingly complex. Leveraging common standards for identification and for data sharing are core to any full solution addressing the challenges of interoperability, but more work is needed.

GS1 is committed to working with industry to evaluate possible solutions to this challenge.

"Implementing blockchain technology in an inter-organisational environment with legacy systems needs to be based on standards. GS1 standards are the best example of this needed common, global business language for collaboration. At OriginTrail, we exploit the relational nature of data beyond the "one step back, one step forward" approach to achieve visibility across the supply chain. GS1 standards help us share relevant and accurate data while blockchain technology provides accountability and additional integrity."

Ziga Drev
Founder, OriginTrail

"Adoption is the key metric in any network and is a function of ease of use, availability and cost. For this reason, the Global Food Traceability Center at IFT [Institute of Food Technologists] is tackling the challenge of whole-chain seafood traceability and interoperability using open standards— GS1 EPCIS and publicly available blockchain technology."

Andy Kennedy
Director, Global Food Traceability Center

4. Governance: permissions and participation

Industry ecosystems and their enterprise blockchain implementations require governance. A clear set of rules is needed to define the engagement between participants of an ecosystem. Additional rules will be needed to govern communication across and between ecosystems.

Specifically, there is a need to address questions like:

- Who can participate in and access a ledger?
- Who can write and share information on the ledger?
- What rules govern data access, sharing and ownership between members of one ecosystem to members of another as well as supply chain participants that may not participate in any blockchain ecosystem (e.g., consumers, regulatory bodies)?
- How will privacy and data security between members and non-members be managed?
- What data is stored on-chain versus off-chain?
- How is data on the ledger stored? Plain text or hashed?
- What security mechanisms are required?

GS1 expects a future in which many ecosystems will need to coexist and interoperate. Because of this, data sharing between ecosystems is a critical challenge that requires industry alignment. There will likely be a need for an overarching governance structure and policy, which will require standards so that solutions and industry ecosystems can interoperate.

GS1 is committed to working with industry to explore this potential need for overarching governance and ecosystem interoperability.

Moving forward

It is important for companies to recognise that distributed ledgers are a layer of technology that may be valuable to your business when implemented alongside improved core business processes and standards-based data capture and storage. Purposeful evaluation of technology should consider all of the topics discussed earlier.

Successful implementations will require that companies:

1. **Clearly define the data sharing problems that need to be addressed.** Companies looking to evaluate blockchain technology should identify underlying business problems and map the potential technology advantages of a blockchain ledger solution to the business problems. This activity is an important first step when considering a blockchain ledger as a technology enabler, as it's quite possible that your business challenge may not require a ledger-based solution.

2. **Identify the data required to meet the business objectives.** Is the data accessible, of high quality and being recorded today? Data can't be shared on a ledger if it hasn't been identified and captured. And the sharing of data that is not of high quality will create risk in your implementation.

3. **Consider the existing data sharing business processes and assess the changes needed to use blockchain ledger technology.** This exercise is important for sharing data beyond one-up/one-down, as well as with immediate trading partners.

4. **Understand the real benefits of blockchain**, including immutability of data, importance of maintaining a sequencing of events and distributed control of data, and determine if these are absolute requirements for data sharing to solve the business problem.

5. **Identify the necessary trading partner governance strategy.** Consider the impact of existing governance rules within other blockchain ecosystems that you'll need to interoperate with.

We believe that companies should leverage existing investments in global standards—like those from GS1—to accelerate efforts and improve existing business processes. Best practices in identification and data sharing already exist and can serve as the data model for your enterprise blockchain implementation.

"At Walmart, we believe the one-step-up and one-step-back model of food traceability is outdated for the 21st century. That's why we launched the Walmart Food Traceability Initiative. Leveraging blockchain as the enabling technology and GS1 standards as the universal language, we believe we can create a more digital and transparent food system that will benefit people and the planet."

Frank Yiannas
Vice President of Food Safety, Walmart, Inc.

"In 2006, we [GS1] created an entire language to describe the movement of goods. Every time a package is shipped, every time a pallet is aggregated or a product is transformed, unpacked or received, a common language exists to capture and share the 'who, what, when, where and why' of supply chain movements. This global language is highly relevant for use in enterprise blockchain implementations and is particularly important to a future where interoperability is essential."

Robert Beideman
Chief Solutions & Innovation Officer, GS1

Call to action

Industry has recognised GS1's proven standards for identification and event-data sharing as best practice to support information-related business processes. A number of solution providers and ecosystems are already using GS1 standards in their enterprise blockchain implementations across a number of sectors and around the world.

As the number of blockchain ecosystems increase and begin to tackle enterprise business challenges, the need for interoperability rules and discovery of data between ecosystems is growing. Additionally, a need for governance around ecosystem interoperability is becoming increasingly important for industry.

GS1 has been a place for collaboration for 45 years and is ready to facilitate conversations about interoperability and to provide a place where collaboration can happen globally. Solution providers, industry leaders and consortium operators are invited to come together to start the conversation.

GS1 will soon be forming a discussion group to outline and formulate necessary industry requirements for interoperability. We hope that you'll join us to solve these next challenges together.

Interested in participating or learning more? Contact blockchain@gs1.org

"Aligning to GS1 standards for item identification and transactional data sharing is at the center of Wegmans' strategy to prepare ourselves for the promise of blockchain by ensuring those data fundamentals are in place all along the supply chain. In addition, we encourage active participation in developing guidelines for governance and interoperability across the various blockchain platforms that are emerging."

Dave DeLaus
Senior Vice President & Chief Information Officer, Wegmans Food Markets

About GS1

GS1 is a neutral, not-for-profit organisation that develops and maintains the most widely used global standards for efficient business communication. We are best known for the barcode, named by the BBC as one of "the 50 things that made the world economy". GS1 standards improve the efficiency, safety and visibility of supply chains across physical and digital channels in 25 sectors. Our scale and reach – local Member Organisations in 112 countries, 1.5 million user companies and 6 billion transactions every day – help ensure that GS1 standards create a common language that supports systems and processes across the globe. Find out more at www.gs1.org.

About GS1 US

GS1 US®, a member of GS1® global, is a not-for-profit information standards organization that facilitates industry collaboration to help improve supply chain visibility and efficiency through the use of GS1 Standards, the most widely-used supply chain standards system in the world. Nearly 300,000 businesses in 25 industries rely on GS1 US for trading-partner collaboration that optimizes their supply chains, drives cost performance and revenue growth while also enabling regulatory compliance. They achieve these benefits through solutions based on GS1 global unique numbering and identification systems, barcodes, Electronic Product Code-based RFID, data synchronization, and electronic information exchange. GS1 US also manages the United Nations Standard Products and Services Code® (UNSPSC®). www.gs1us.org

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