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Traceability and Blockchain

Important considerations for business readiness
and interoperability



Introduction

Companies are under pressure to embrace new technologies to meet growing consumer demand for safer food and pharmaceuticals, and transparency, traceability and verifiability of the products they buy. One solution that is rising to the top is blockchain technology.

The industry is coming together to cut through all the hype in order to invoke:

- Clear definitions of business problems that need to be solved
- Foundational data requirements for effective traceability and other business processes
- Interoperability of data-sharing ecosystems

Developing safer and more effective supply chains requires leveraging innovative technologies to address clear business needs. Industry must define these business needs collaboratively and identify the intersections where interoperability is required—as well as the standards needed to ensure success globally.

Laying a firm foundation

GS1 supports this work and strives to ensure a common understanding of the existing landscape. Here are some important considerations as we begin this journey together.

Capturing data

To *capture* the data required to facilitate traceability and visibility, there are a few foundational steps that all companies must take.

They must first implement globally unique, persistent identification for all of the products and locations that are relevant to their operations—and do so at the batch/lot level (or at instance or serialised level) for products.

Next, companies must leverage a common, standardised data model for physical supply chain events and capture this information in business applications that are designed to record and share these same events.

Sharing data

To *share* the data required to facilitate traceability and visibility, companies must *use* standardised data formats, and exchange system interfaces and protocols that leverage a common data model between parties. This provides business application interoperability and solution choice.

These formats, interfaces and protocols are needed at two different levels, to include:

- Standardised interfaces for capture and query of the database on a standard data model (e.g., EPCIS)
- Standardised communication protocol (e.g., Web Services, REST and others)

Identifying known and unknown partners

A method of *discovering* the parties with whom companies need to communicate and share data is essential.

In some cases, parties may be known, making data exchange relatively easy. However, some are often several steps removed from one another across complex supply chains. In these cases, a mechanism for discovery (such as a routing or registry service) is needed.

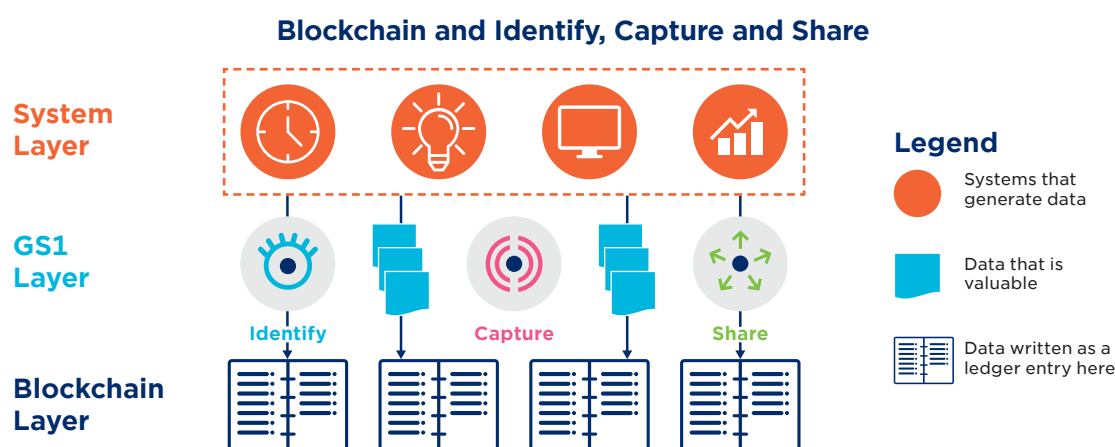
Ensuring governance for use cases

Finally, there is a need to establish governance and agreement principles for each business case. These rules should focus on the minimal requirements needed to share data between parties and between members of a network.

Blockchain for sharing data

Blockchain is one component of a broader traceability system. It is not typically considered a means of communication (like standards-based EDI or EPCIS). Nor is blockchain a standalone business application system. This is why the term “blockchain-based applications” is often used.

Blockchains provide a distributed ledger that catalogues transactions in an immutable, time-ordered manner. In their simplest form, they provide proof—or an audit—of a transaction that has happened. They also help to show that data has not been altered. The graphic below shows how a blockchain layer can fit into a solution that is designed to capture and share data.



Blockchain is a replicated, secure and distributed ledger. GS1 facilitates standards for data and some business applications.

Understanding the blockchain layer

It is important to understand the specific requirements of the blockchain layer for a use case, industry or ecosystem.

What data gets stored on a blockchain?

The data that gets written to a blockchain ledger can vary depending on the system and/or solution being implemented. The type of data written to a blockchain ledger can be:

1. Fully formed, cryptographically signed plain text event data. There is a concern about scalability and performance if full events are written to a ledger.
2. A cryptographic hash of the data that has little meaning by itself. This requires off-chain data exchange via a separate traceability application and a hash comparison to verify that data hasn't been altered since the hash was written to the ledger.
3. A cryptographic hash of the data and a pointer to off-chain data. This is the same as above with a pointer to the off-chain data source. Such an approach can enable the ledger to act as part of a discovery mechanism for parties who need to communicate and share data.
4. Some combination of the above.
5. Potentially many other methods.

Who gets to see the data stored on a blockchain?

The parties who are allowed to see the data that is stored on a blockchain ledger can vary depending on the underlying ledger technology. Options here include:

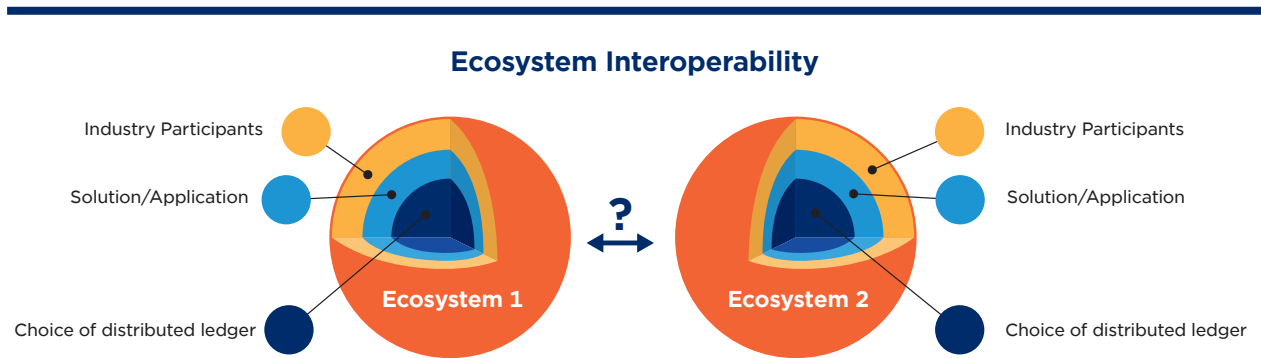
1. Public: Everyone sees all transactions.
2. Private: This includes a permission layer that makes transactions viewable to only approved parties.

Interoperability for traceability

How is interoperability for an end-to-end traceability system achieved?

Interoperability refers to the basic ability of different computerised systems to readily connect and communicate with one another, even if they were developed as part of different ecosystems. To ensure interoperability between different ecosystems, four things are needed:

1. Using GS1 standards for unique identification (e.g., batch/lot, Global Trade Item Number® (GTIN®), serialised GTIN, Serial Shipping Code Container, Global Location and more) can enable traceability business applications to exist and may interoperate today (whether or not a blockchain component is part of one or more of the interoperable ecosystems). Here the “what” and “who” of the ledger component *must* be standardised for an industry solution to be interoperable.
2. Using EPCIS as the standardised event data and exchange format makes it possible for all parties that receive data to have a common understanding of the information that is being exchanged.
3. Defining requirements for ledger components is essential, when ledger components are required. Even more, it is important to understand whether or not an end-to-end traceability system for industry requires a blockchain ledger component. There are varying opinions on this across many industries.
4. Establishing inter-ecosystem and ecosystem-to-ecosystem governance is necessary for any data sharing network. This includes establishing policies around how the network participants will operate and share data together.



Bridging blockchain ecosystems: four essential elements

- Ensure use of GS1 standards for identity of parties, places and products.
- Ensure use of EPCIS as common language for data sharing.
- Define requirements for ledger components.
- Establish inter-ecosystem and ecosystem-to-ecosystem governance.

With or without blockchain, end-to-end traceability also requires that members of industry come together to develop process and application standards for the specific business problem they are trying to solve.

Some believe strongly that the addition of a blockchain layer to a data sharing network adds a degree of trust and confidence in visibility-event data that is superior to traditional mechanisms, lays the groundwork for future automation in processes, and is the reason why many are piloting blockchain-based solutions.

Examining blockchain for your business

When examining the blockchain landscape, it is clear that brand owners and retailers are increasingly uncertain about their choices.

Based on pilot findings to date, companies are asking important questions before making the decision to invest in blockchain.

Is blockchain the right technology choice for my business needs?

- Are there other technology solutions that provide the same functionality as blockchain?
- What is the overall value of blockchain technology over other technologies for sharing data?
- Is it fast enough for the speed of our business?
- Will it scale cost effectively across my enterprise?
- Does it require full industry participation to benefit, and what is required to achieve that?

How can I be assured that a given solution will provide true interoperability with my trading partners?

- How do we avoid the impracticality of participating in multiple ecosystems?
- Do current offerings support industry's requirement to avoid vendor lock-in?
- How do we preserve and leverage existing investments if we choose to take advantage of blockchain?

What is the real cost of blockchain over existing data sharing technologies?

- How can I compare and contrast the investment necessary?
- What will be the total cost of ownership (operationally, ongoing support and maintenance)?
- What is the relative complexity of implementation?



Summary

If industry determines that an added layer of distributed ledger technology offers a level of trust and validation that traditional data-sharing mechanisms cannot, then there must be a call to action to ensure the interoperability of blockchain-based traceability solutions.

The work would include:

Business considerations

1. Agree on the application of existing standards for unique identification and visibility data models and the method of exchange of that data.
2. Develop specific guidance about how to apply standards consistently across an industry for a specific business problem.
3. Create an overarching governance policy that every blockchain-based solution ecosystem will adhere to, in order to be a part of a broader cross-ecosystem network.

Technical considerations

1. Determine how data-sharing partners may be found and discovered.
2. Decide on the “what” dimension of the ledger component. What is written to it? How?
3. Establish where consistency and standardisation is required within the data written to ledgers.
4. Agree about industry requirements for access and visibility to ledger transactions—public versus private—and any associated rules for industry collaboration and interoperability.

The role of GS1

GS1 already supports many standards in use by supply chain networks today and is poised to accommodate new requirements as industry moves forward. This includes those needed if blockchain is determined to be a component of future solutions.

Now is the time to bring leading, visionary end users and solution providers together, to define a roadmap that can lead industry to interoperable, standards-based data exchange that scales with our future.

For 45 years, GS1 has brought organisations together to collaborate on exactly these types of challenges.

We invite industry to explore this exciting, innovative technology together, and make real progress toward a scalable and broadly acceptable solution to the new world challenges we share.

At GS1, we believe there is no communication without standards. There are no standards without collaboration. And, there is no collaboration without GS1.

With our industry partners, we are ready to:

- Convene leading members and key (and competing) solution providers to identify the essential elements of blockchain-based systems interoperability—business and technical. Together, develop a roadmap to standardise these elements.
- Develop and enhance existing standards and guidelines to meet industry data-sharing requirements, to drive business application interoperability.

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



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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.

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