

THE STANDARD FOR FUTURE-READY SUPPLY CHAINS



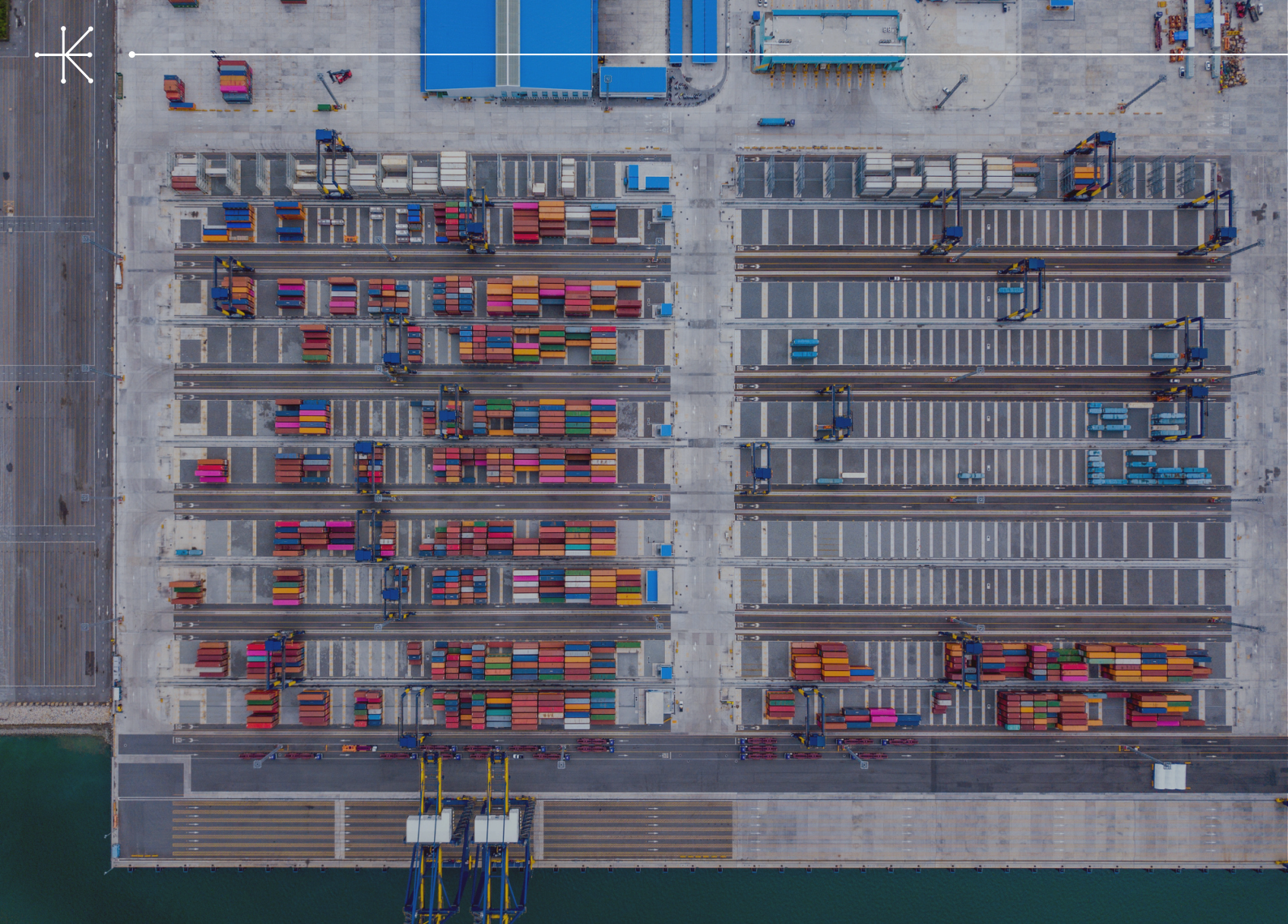
The power of GS1's EPCIS 2.0 standard

Driving visibility, operational efficiency, and data-driven strategies with Kezzler and GS1



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Introduction

This solution brief provides a comprehensive overview of GS1's EPCIS 2.0 standard and its practical applications across multiple industries. Drawing upon case studies from specific Kezzler projects, we illustrate how EPCIS 2.0 enables organizations to leverage high volumes of extremely granular event data for enhanced supply chain visibility, improved operational efficiency, and the development of truly data-driven strategies.

Enhance supply chain visibility, improve operational efficiency, and develop truly data-driven strategies.



Challenges to overcome

In recent decades, supply chain management has become increasingly strategic for brands. While many companies now use sophisticated technology and work with suppliers capable of providing production and logistics data, visibility remains limited. Systems often operate in disconnected silos, which hinders optimization and impedes effective responses to disruptions.

This lack of transparency is further complicated by evolving regulatory demands for sustainable practices, enhanced product safety, and the rise of circular business models, which introduce new stakeholders and complexities. In this environment, organizations face significant challenges, stemming from limited visibility and insufficient traceability, which we'll dive into a bit deeper.

Limited visibility and insufficient traceability create significant challenges.



Foundational challenges

The significant challenges organizations face primarily stem from:



Limited visibility

Without a comprehensive view of product flows, organizations struggle to measure, analyze, and improve processes related to efficiency, quality, and sustainability. Disruptions, such as late dispatches, product loss, or spoilage often go undetected until shipments reach the end destination. This impedes timely intervention and potentially leads to financial losses, customer dissatisfaction, and compliance risks.



Insufficient traceability

Transparency may still feel optional, but traceability is not. Without robust traceability mechanisms, regulatory requirements like recalls or Digital Product Passports (DPPs) become nearly impossible to fulfill. With DPPs, transparency will no longer be optional.

Poor integration and collaboration among stakeholders compound these challenges. Disparate systems, manual data entry, and communication barriers introduce inefficiencies, errors, and delays. In fragmented environments, an EPCIS solution offers a compelling remedy. By providing a standardized framework for capturing and sharing event data, EPCIS fosters interoperability, streamlines communication, and enables a more cohesive and responsive supply chain.





EPCIS as a foundation for supply chain visibility

The initial EPCIS standard, introduced in 2007, showed potential for enhancing supply chain visibility but saw limited adoption outside highly regulated industries. However, the release of EPCIS 2.0 in 2022 marks a major leap forward, driven by:

Technological advancements

The rise of cloud computing, IoT, and simpler data exchange has increased the strategic value of data and has made integration simpler.

Transparency demands

Increasing consumer demand for product information, coupled with regulatory pressures for enhanced traceability and sustainability, has elevated visibility as a priority for many companies.

Certifications

EPCIS 2.0 enables the inclusion of product and process certifications, supporting more transparent and sustainable supply chains.

Expanded event dimensions and IoT capture

The addition of the “How” dimension, alongside the “What, When, Where, and Why” framework, allows for richer context and deeper insights into supply chain events. It is now possible to capture sensor data (e.g., temperature and humidity), which is typically crucial for most (if not all) fresh food supply chains.

GS1 Digital Link compatibility

Support for the GS1 Digital Link standard, poised for widespread adoption with DPPs, further strengthens the future-proof nature of EPCIS 2.0.

These advancements, coupled with the increasing demand for traceability and visibility, are set to drive significant growth in EPCIS adoption.



Core components of an EPCIS event

EPCIS 2.0 defines five distinct event types, each characterized by the five core dimensions: **What, When, Where, Why, and How.**

The EPCIS standard is closely intertwined with the Core Business Vocabulary (CBV) standard, which provides a standardized structure and set of vocabulary elements for describing events and related information.

Adherence to the CBV is crucial for ensuring interoperability and seamless communication across the supply chain. Deviations from the CBV, while possible, can hinder communication and complicate data exchange, particularly as new stakeholders join the ecosystem.

A detailed explanation of the CBV can be found in the official **GS1 Core Business Vocabulary (CBV) Standard** document.

The following sections provide a concise overview of the five event dimensions and five event types, including their significance within the EPCIS framework.



EPCIS 2.0 dimensions

What	Identification of the physical or digital object. This can happen on item level (e.g., SGTIN) or an aggregated class level (e.g., LGTIN).
When	Timestamp for the event and its registration in the EPCIS repository (including time zone).
Where	Where the event took place (ReadPoint) and where the object is located after the event has taken place (BusinessLocation). E.g., Receiving area 1 (SLGN) at DC A (GLN).
Why	In which business context is the event taking place: <ul style="list-style-type: none">• Business step (e.g., receiving)• Disposition (e.g., active, in transit, recalled)• Business transaction list (e.g., PO, ASN, Invoice)• Source/Destination list (e.g., shipper and receiver, but also shipping and receiving locations)
How	Optional and new in 2.0. Here, various sensor data such as temperature and humidity can be tracked. With pre-defined thresholds, one can ensure these do not fall outside defined limit values. This is also valuable for process insight and for easier ability to take preventive measures.

Figure 1: EPCIS 2.0 dimensions



EPCIS event types

EPCIS 2.0 contains five different event types. The most common event types are ObjectEvent, AggregationEvent, and TransformationEvent. All event types (except TransformationEvent) require one of three actions: add, delete or observe.

ObjectEvent	Event on the object itself (e.g., receiving an item, RTI, pallet, or container).
AggregationEvent	Events where objects are aggregated or disaggregated, e.g., building a pallet from items to boxes to pallet. EPCIS events can be captured both on an instance level as well as any class level that can be identified.
TransformationEvent	Events where objects are transformed into new objects, e.g., in a food supply chain where certain inputs are used to create a new object.
TransactionEvent	Events where objects are linked to transactions, e.g., orders, invoices, ASNs, etc. Not as widely used as the above three since the transactions can be included in the “Why” dimension of the other event types.
AssociationEvent	New in 2.0, events where more permanent associations are needed, e.g., between a sensor device and a container.

Figure 2: EPCIS event types



EPCIS tech components

A traditional EPCIS system has three different components, illustrated and explained below.

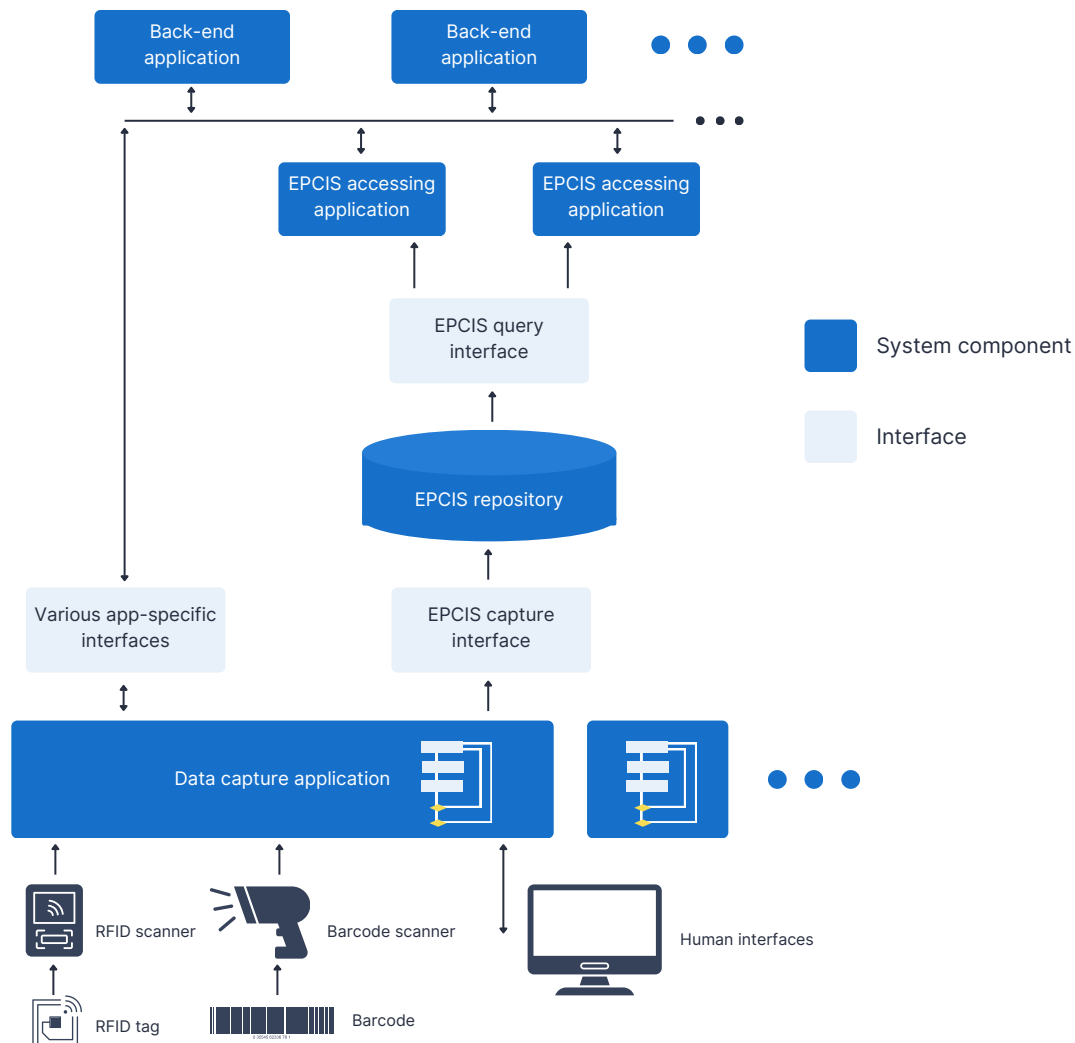


Figure 3: EPCIS tech components

EPCIS repository: Data storage where all raw data of the visibility event are stored.

EPCIS capture applications: Applications that are in use to generate and capture the event and share the data through an EPCIS capture interface with the EPCIS repository. An example could be a scanning device with a software supporting a goods receiving through an SSCC scan, or an RFID read.

EPCIS accessing applications: Enterprise software applications that process EPCIS events from the EPCIS repository through an EPCIS query interface, either for direct consumption or to carry out new business tasks using EPCIS data.



Sharing EPCIS data

EPCIS data is distinct from other types of data because it can be collected across the entire value chain, unlike more static master data or transactional data. In complex value chains, this often results in vast amounts of data, making it challenging to share actionable EPCIS data within reasonable response times.

Data can be shared through an EPCIS Query Interface either in a Pull or a Push mode. The Push mode includes two variations: Pre-arrangement and Subscription, as detailed in Chapter 6 of [GS1's EPCIS and CBV Implementation Guideline](#).

Another key concept is separating content from choreography. This ensures that the content of visibility data remains independent of how it is shared among different stakeholders. The choreography can either be centralized in one event repository or distributed across multiple repositories—for example, one for each partner in the value chain.



EPCIS 2.0 benefits:

Enhanced quality, reduced risk, and increased efficiency

For organizations grappling with visibility and traceability challenges, standardizing on EPCIS 2.0 can help to significantly improve operational performance and mitigate risks. This delivers measurable benefits, such as:



Enhanced quality and risk mitigation

Near real-time visibility into supply chain events, regardless of data origin, helps organizations quickly identify and respond to disruptions. This visibility facilitates more timely interventions, prevents cascading issues, and enables process improvements to mitigate future risks.



Increased efficiency

By casting a light on the supply chain, EPCIS enables companies to identify bottlenecks, optimize workflows, and drive efficiency gains through:

- **Automation:** EPCIS supports automated data capture through auto-ID technologies like RFID, which reduces manual effort and helps minimize errors.
- **Streamlined processes:** EPCIS ensures a synchronized flow of information and goods, helping prevent costly halts to production or delays caused by data discrepancies. For example, by capturing aggregation events (e.g., combining individual items into pallets) and including the corresponding business transactions in the “Why” dimension, EPCIS enables a timely, accurate, and efficient receiving processes. It also should eliminate the need for time-consuming manual checks and reconciliation.
- **Improved collaboration:** EPCIS helps create seamless data exchange among stakeholders, facilitating collaboration and reducing communication breakdowns. This shared visibility encourages proactive problem-solving and coordinated responses to disruptions between stakeholders.

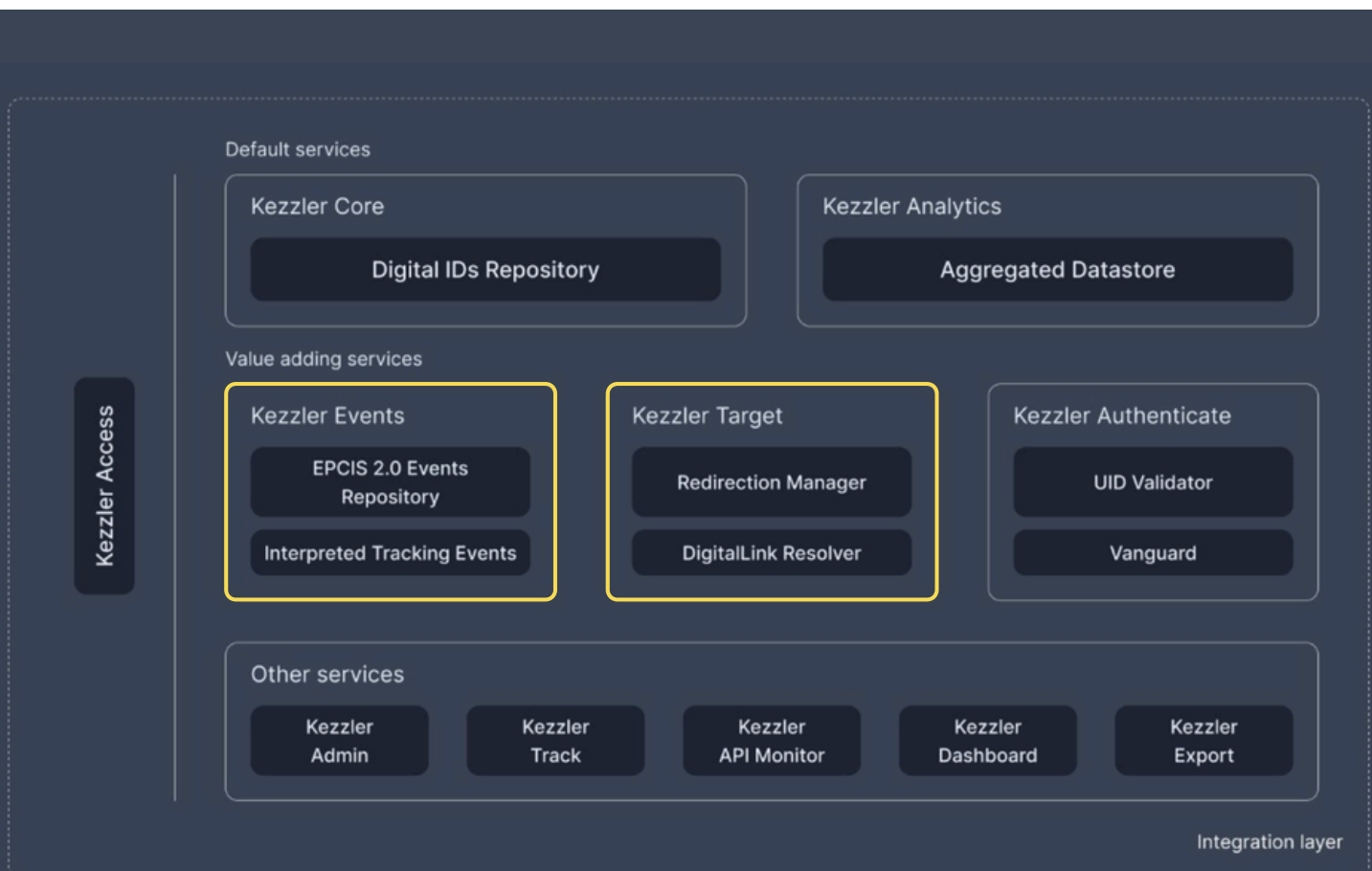
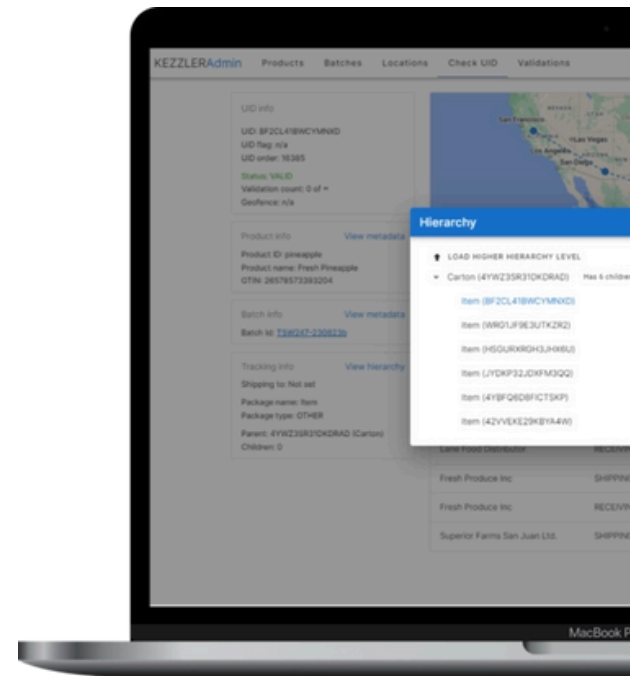


Kezzler's EPCIS 2.0 solution: The Connected Products Platform

Kezzler's Connected Products Platform (CPP) represents a culmination of over twenty years of experience in product digitization and traceability. Kezzler provides a comprehensive solution for capturing, structuring, and sharing data across the value chain, enabling both digital product experience and value chain visibility.

The Connected Products Platform is built for two primary use case groups: dynamic product experiences and value chain traceability, each of which we'll dive into deeper below.

Figure 4: Kezzler's Connected Products Platform





The CPP is built for two primary use cases

Dynamic product experiences

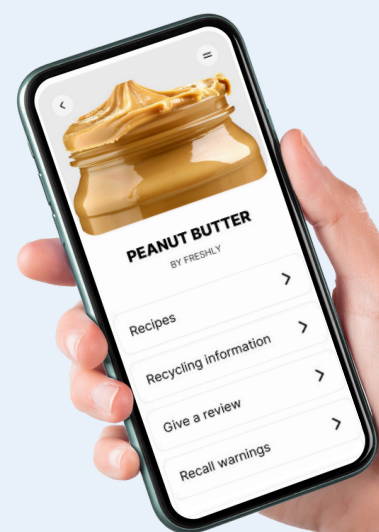
The product itself is a channel to new services (directly available by scanning the on-product code), delivering consumer engagement and gathering valuable first-party data. Key use cases for product experiences include:

Digital Product Passports

Providing regulatory compliance by giving consumers detailed product information, product provenance, and sustainability credentials.

Downstream product lifecycle management

Helping enable product returns, repairs, recalls, resale, and recycling through secure and transparent data sharing.



Value chain traceability

Rolling that data back up and integrating with other systems takes advantage of the power of EPCIS 2.0 to provide granular visibility and traceability across the supply chain. Key use cases for value chain traceability include:

Traceability reporting

Generating detailed reports on product journeys, enabling comprehensive analysis and audit trails.

Manufacturing control

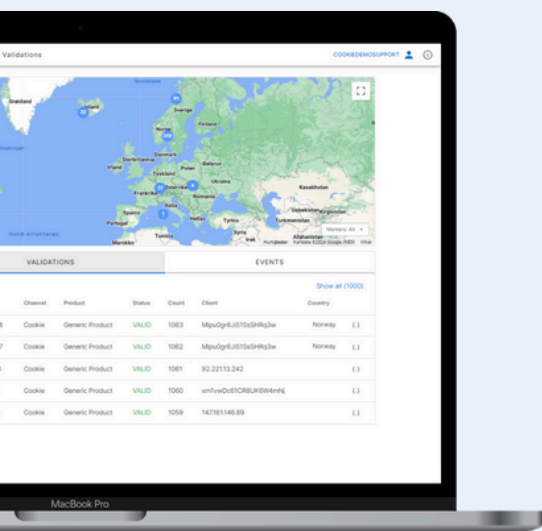
Monitoring production processes, identifying deviations, and ensuring quality control.

Recalls

Facilitating rapid and targeted product recalls by precisely identifying affected items and their locations.

Diversion and anti-counterfeiting

Detecting and preventing product diversion and counterfeiting through secure tracking and authentication.





Kezzler EPCIS 2.0 implementation

Building the Kezzler CPP on EPCIS 2.0 allows for seamless integration with existing systems and the facilitation of data exchange with multiple stakeholders across the value chain.

Kezzler's EPCIS 2.0 implementation provides:

Scalable data management

The CPP is designed to handle massive volumes of event data, accommodating the needs of large-scale deployments.

Flexible data integration

Kezzler offers a range of integration options, including APIs and standardized data exchange formats, enabling seamless connectivity with existing enterprise systems.

Advanced analytics and reporting

The CPP provides tools for analyzing EPCIS data, generating insights, and creating customized reports to support data-driven decision-making.

The Kezzler Connected Products Platform is foundationally built on EPCIS 2.0.



Kezzler Events: A comprehensive EPCIS 2.0 solution

Identify

Kezzler Core and the Digital IDs Repository form the foundation for identity management, enabling the creation and management of unique encoding at various levels (e.g., item, GTIN, batch). This ensures accurate and granular tracking of products throughout their lifecycle.

Capture

Kezzler Track facilitates the capture of EPCIS events, recording critical data points such as packing hierarchies, location changes, and change of custody. This data capture can be automated through various technologies, including RFID and IoT sensors, ensuring near real-time visibility.

Share

The Interpreted Tracking Events service and Aggregated Datastore enable stakeholders to access and analyze EPCIS data. Interpreted Tracking Events provides readily consumable information on individual product journeys, while the Aggregated Datastore offers a macro view of supply chain performance.

Kezzler Events embody the core principles of GS1 standards: identify, capture, and share. Our EPCIS 2.0-based solution uses the full capability of the Kezzler Connected Products Platform to provide end-to-end visibility and traceability.





Unlocking the value of EPCIS data

While capturing EPCIS events is essential, the true value lies in effectively sharing and interpreting this data to drive informed decision-making.

Kezzler addresses this through:

Interpreted Tracking Events

This service transforms raw EPCIS data into actionable insights, providing a clear and concise view of product journeys. This enables rapid identification of anomalies, bottlenecks, or delays.

Aggregated Datastore

Leveraging Kezzler's patented technology, the Aggregated Datastore efficiently processes and analyzes vast amounts of EPCIS data, providing aggregated insights into supply chain performance, trends, and potential risks.



Scalability and flexibility

Kezzler's platform is engineered for scalability and performance, capable of handling the demands of large-scale EPCIS deployments. Despite supporting some of the world's largest retailers, the platform maintains flexibility and responsiveness, adapting to the unique needs of diverse industries and use cases.

Demonstrated value: Kezzler's EPCIS solution case studies

The following case studies illustrate the practical applications of Kezzler's EPCIS solution across various sectors, showcasing the ability to drive tangible value and address real-world challenges in fashion retail, grocery retail, and food production.





Item-level visibility for a global fashion retailer

A leading European fashion retailer, producing billions of garments annually across a vast network of suppliers, faced significant challenges in achieving item-level visibility. Manual processes and disparate systems hindered their ability to track products, optimize inventory, and respond effectively to disruptions in the supply chain.

Solution

By implementing the Kezzler Events solution and leveraging GS1 Digital Link (encoded as a QR code) in conjunction with RFID technology, the retailer is able to achieve end-to-end item-level traceability.

- **Product digitization:** Each garment is assigned a unique digital identity using a GS1 Digital Link, enabling granular tracking and data association.
- **RFID integration:** Source tagging with RFID streamlines data capture and enables efficient aggregation of items into boxes, pallets, and shipments.
- **EPCIS event tracking:** Key events, including commissioning, shipping, receiving, and retail sales, are captured as EPCIS events, providing a comprehensive audit trail.
- **Real-time visibility:** The Kezzler platform provides real-time insights into production status, inventory levels, and product movements across the entire supply chain.

The results

The retailer gains unprecedented visibility into its global inventory, enabling data-driven decisions, improved operational efficiency, and enhanced customer satisfaction. The platform's scalability ensures seamless management of hundreds of billions of data points, providing a robust foundation for future growth and innovation.

Benefits

- **Improved inventory management:** Real-time visibility enables accurate inventory tracking, reducing stockouts and overstocking.
- **Enhanced production efficiency:** Accurate production data facilitates better planning and reduced manual reconciliation efforts.
- **Streamlined logistics:** Efficient aggregation and tracking of shipments minimizes delays and improves delivery accuracy.
- **Loss prevention:** Item-level tracking deters theft and enables rapid identification of stolen goods.
- **Extended product lifecycle management:** Tracking products beyond the point of sale enables support for repairs, resale, and take-back programs.



End-to-end supply chain visibility for a grocery retailer

A large European grocery retailer struggled with inefficiencies, manual data entry, and poor supply chain visibility. Too much time was spent on manual tasks like data entry and handling code-carrying paper labels. Limited collaboration and data sharing among stakeholders hindered process improvements, while system challenges and data volumes forced critical data to be archived, undermining its value for optimization.

Solution

By implementing RFID-enabled RTIs and deploying Kezzler Events as a centralized data marketplace, the retailer improves efficiency, on-shelf availability, traceability, food safety, and waste reduction.

- **RFID enabled RTIs:** Each returnable transport item is assigned a unique, serialized GRAI for efficient and secure identification as well as better utilization of the RTIs.
- **Kezzler Events as a data marketplace for collaboration:** Each stakeholder in the supply chain is onboarded to one collaborative marketplace to share supply chain data.
- **EPCIS 2.0 event tracking:** Using the aggregation event type to register products on batch level to each RTI and aggregating RTIs to pallets with SSCC, key events like shipping and receiving are efficiently captured throughout the supply chain, providing full visibility into each critical process step.

The results

The retailer gains full visibility into critical process steps, enabling them to measure and improve processes and supplier performances. Automated data capture reduces manual work and errors, while ensuring synchronization of data and flow of goods, and removes expensive halts in production. Efficiency improvements support smaller production runs, reducing waste and enhancing service levels.

Benefits

- **Improved supply chain efficiency:** Automated data capture of critical events reduces manual data entry, errors, and time. RFID-enabled RTIs and aggregated SSCCs on higher levels allows for accurate, efficient goods receiving and distribution.
- **Synchronized flow of data and goods:** Event data capture at any critical process step and including transaction documents as part of events ensures seamless supply chain handoffs.
- **Improvements to process and batch-level traceability:** Full visibility enables accurate measurement and optimization (e.g., comparing tomato shipment durations or conditions). Batch-level traceability all the way back to the source enables efficient recalls.
- **Reduced waste and improved service levels:** More efficient supply chains allow for smaller, frequent deliveries, cutting waste while improving service.



Granular traceability for food safety and recall management in food production

A waffle mix manufacturer experienced a major product recall due to salmonella contamination. This situation highlights the need for traceability to support a recall process to protect consumer safety and brand reputation.

All data in EPCIS 2.0 format provides the granular traceability throughout the production process required.

Solution

- **Ingredient tracking:** Incoming ingredients (including eggs) are assigned unique batch identifiers, enabling tracking from origin to the finished product.
- **Transformation event capture:** The manufacturing process (including mixing and packaging) is captured using EPCIS transformation events, to preserve batch information throughout product transformations.
- **Real-time visibility:** Given real-time insights into batch genealogy, which enables rapid identification of potentially contaminated products.
- **Targeted recall capabilities:** In the event of a contamination incident, the solution can deliver precise identification and recall of affected batches, minimizing disruption and waste.

The results

The manufacturer can significantly reduce the risks associated with future recalls and strengthen its food safety protocols. An EPCIS 2.0 solution provides a robust framework for managing product traceability, protecting consumers, and ensuring business continuity.

Benefits

- **Enhanced food safety:** Granular traceability enables proactive identification and mitigation of contamination risks, protecting consumer health.
- **Reduced recall scope:** Targeted recall capabilities minimize financial losses and prevent unnecessary removal of safe products from the market.
- **Improved supplier management:** Traceability data facilitates collaboration with suppliers to identify and address root causes of contamination.
- **Strengthened brand reputation:** Demonstrates a commitment to food safety and to proactive risk management, enhances consumer trust, and increases brand loyalty.



How to prepare: Visibility modeling

A successful EPCIS implementation requires thorough preparations, particularly in relation to well-engineered processes and identification of critical business steps that require visibility. Following the seven steps in GS1's "Visibility modeling methodology" will be quite helpful for most companies (for a more comprehensive implementation guideline, we recommend studying GS1's [EPCIS and CBV Implementation Guideline](#)):

01

Collect visibility goals and requirements

The main question to answer here is "What problem(s) are we trying to solve, and what are the requirements to meet those goals?"

02

Document the business process flows

Once the overall requirements are understood, the detailed process flow and specific data requirements based on EPCIS and the CBV can be determined.

03

Break each process flow into a series of discrete business steps

Before deciding on where more visibility is needed, every business step in the process should be documented.

04

Decide which business steps require visibility events

The business steps that require visibility events are decided by a combination of which data is valuable to have and which data is feasible to capture.

In general, data is valuable if it helps solve the problem directly, or if another critical step in the process needs the data (e.g., in a goods receiving process on pallet level it's usually valuable to know the content of the pallet).

This is a task that should involve all stakeholders to make sure all parts and interests are covered. If data is valuable but not feasible to capture, it's worth investing some time to consider if small process adjustments could facilitate events capturing.



05

Model the completion of each step as a visibility event

Now the steps where visibility is needed are known, and the EPCIS data that will capture what happens in each step can be designed. The first decision is to select the event type (discussed above) that best fits each situation, and then define the action (add, delete, observe) if the decision is to use an ObjectEvent or an AgreggationEvent.

06

Decide what data fields are to be included in the visibility event

The next decision is to define what data to populate the 4 (5) EPCIS dimensions with. A good rule is to start asking what the receiving application needs to understand what has happened in the event. If the standard EPCIS data fields do not cover the needs, extensions can be customized if necessary (keep in mind that this will influence overall interoperability).

07

Determine the vocabularies that populate each data field according to section 7 and 8 of the CBV standard

The recommended vocabulary to use to populate the data elements in all the EPCIS dimensions is described in [GS1's Core Business Vocabulary](#). If the CBV does not contain any appropriate identifier for a given data element, it is possible to create new — but as before, not without negative effects on interoperability. Note that it is highly recommended to use the GS1 Digital Link format with EPCIS 2.0.

08

Document the visibility events in a Visibility Data Matrix

When previous steps 5–7 are described for all business steps requiring visibility events, the results should be documented in a Visibility Data Matrix (as illustrated on the next page).



Visibility Data Matrix

DIM	Data element	V1	V2	V3	V4
	Description	Print and apply case label	Print the pallet label	Pack cases into pallet	Ship the pallet
	Event type	Object event	Object event	Aggregation event	Object event
	Action	ADD	ADD	ADD	OBSERVE
What	EPC List	SGTIN of case	SSCC of pallet	Parent: SSCC of pallet Children: SGTINs of cases	SSCC of pallet
When	Event time	Current date/time	Current date/time	Current date/time	Current date/time
	Event time Zone offset	Local timezone offset	Local timezone offset	Local timezone offset	Local timezone offset
Where	Read point	SGLN of packaging line	SGLN of packaging line	SGLN of packaging line	SGLN of packaging line
	Business location	GLN of factory	GLN of factory	GLN of factory	(omitted)
Why	Business step	Commissioning	Commissioning	Packing	Shipping
	Disposition	Active	Active	In progress	In transit
	Business transaction list	(omitted)	(omitted)	(omitted)	Retailer's GLN + PO # Manufacturer's GLN + invoice #
	Source list	(omitted)	(omitted)	(omitted)	owning_party: Manufacturer's GLN or PGLN
	Destination list	(omitted)	(omitted)	(omitted)	owning_party: Retailer's GLN or PGLN

Figure 5: Visibility Data Matrix



Embracing EPCIS 2.0 for a transparent future

The convergence of the EPCIS 2.0 standard, rising consumer demand for transparency, and evolving regulatory landscapes—such as the EU's Ecodesign for Sustainable Products Regulation (ESPR)—signals a significant shift in supply chain management. Digital Product Passports, mandated by the ESPR, will further accelerate the adoption of product digitization, providing a fertile ground for leveraging the power of EPCIS 2.0.

As organizations increasingly digitize their products, the opportunity to capture and leverage granular event data becomes paramount. EPCIS 2.0 provides the framework for achieving comprehensive visibility and traceability, enabling:

- **Enhanced operational efficiency:** Streamlined processes, reduced manual effort, and improved inventory management.
- **Proactive risk mitigation:** Early detection of disruptions, targeted recalls, and improved quality control.
- **Increased transparency and trust:** Meeting consumer demands for product information and provenance, strengthening brand reputation.
- **Support for circular economy initiatives:** Facilitating product repairs, resale, and recycling through secure data sharing.

By implementing a robust EPCIS 2.0 solution, organizations can unlock the full potential of their product digitization efforts, transforming supply chains into agile, transparent, and sustainable ecosystems. Kezzler's Connected Products Platform, with its comprehensive EPCIS 2.0 capabilities, empowers businesses to navigate this evolving landscape and thrive in a future defined by data-driven insights and interconnected value chains.

Embrace the power of GS1's EPCIS 2.0 standard. Contact Kezzler to explore how our solutions can illuminate your supply chain and drive your business forward.



If you're ready to learn more about
the Kezzler Connected Products
Platform, get in touch with our
team.

kezzler.com



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Solution Briefs & Whitepapers



Making the Physical Digital



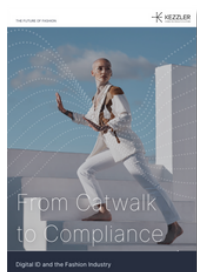
Navigating Sustainability



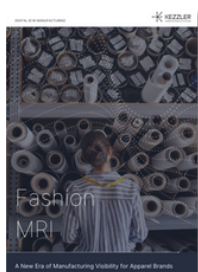
DPP: From Concept to Compliance



Dealing With Billions



From Catwalk to Compliance

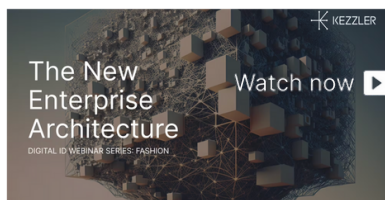


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