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**Information technology — EPC
Information Services (EPCIS)**

*Technologies de l'information — Services d'information sur les
codes de produit électronique*

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This document was prepared by GS1 (as EPCIS Standard, Release 2.0) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

This third edition cancels and replaces the second edition (ISO/IEC 19987:2017), which has been technically revised.

The main changes are as follows:

- addition of JSON/SOAP-LD syntax (alongside XML);
- addition of REST bindings (alongside SOAP/WSDL);
- complete overhaul of UML diagrams;
- clarification on distinction between standard vocabulary and user vocabulary;
- new AssociationEvent;
- new “How” event dimension;
- overview of EPCIS even “dimensions” with cross-references to relevant sections in EPCIS (this document) and CBV (ISO/IEC 19988);

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- new Persistent Disposition indicating non-transient business state of an object;
- new SensorElement to accommodate sensor data;
- addition of certificationInfo to core EPCISEvent;
- update of SimpleEventQuery parameters;
- removal of support for Simple Master Data Query and EPCIS Master Data Document.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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1 Introduction

This document is a GS1 standard that defines Version 2.0 of EPC Information Services (EPCIS). The goal of EPCIS is to enable disparate applications to create and share visibility event data, both within and across enterprises. Ultimately, this sharing is aimed at enabling users to gain a shared view of physical or digital objects within a relevant business context.

“Objects” in the context of EPCIS typically refers to physical objects that are identified either at a class or instance level and which are handled in physical handling steps of an overall business process involving one or more organisations. Examples of such physical objects include trade items (products), logistic units, returnable assets, fixed assets, physical documents, etc. “Objects” may also refer to digital objects, also identified at either a class or instance level, which participate in comparable business process steps. Examples of such digital objects include digital trade items (music downloads, electronic books, etc.), digital documents (electronic coupons, etc.), and so forth. Throughout this document the word “object” is used to denote a physical or digital object, identified at a class or instance level, that is the subject of a business process step. EPCIS data consist of “visibility events,” each of which is the record of the completion of a specific business process step acting upon one or more objects.

The EPCIS standard was originally conceived as part of a broader effort to enhance collaboration between trading partners by sharing of detailed information about physical or digital objects. The name EPCIS reflects the origins of this effort in the development of the Electronic Product Code (EPC). It should be noted, however, that EPCIS does not require the use of Electronic Product Codes, nor of Radio-Frequency Identification (RFID) data carriers, and does not even require instance-level identification (for which the Electronic Product Code was originally designed). The EPCIS standard applies to all situations in which visibility event data is to be captured and shared, and the presence of “EPC” within the name is of historical significance only.

EPCIS provides open, standardised interfaces that allow for seamless integration of well-defined services in inter-company environments as well as within companies. Standard interfaces are defined in the EPCIS standard to enable visibility event data to be captured and queried using a defined set of service operations and associated data standards, all combined with appropriate security mechanisms that satisfy the needs of user companies. In many or most cases, this will involve the use of one or more persistent databases of visibility event data, though elements of the Services approach could be used for direct application-to-application sharing without persistent databases.

With or without persistent databases, the EPCIS specification specifies only standard data sharing interfaces between applications that capture visibility event data and those that need access to it. *It does not specify how the service operations or databases themselves should be implemented.* This includes not defining how the EPCIS services should acquire and/or compute the data they need, except to the extent the data is captured using the standard EPCIS capture operations. The interfaces are needed for interoperability, while the implementations allow for competition among those providing the technology and implementing the standard.

EPCIS is intended to be used in conjunction with the GS1 Core Business Vocabulary (CBV) standard [CBV2.0]. EPCIS and the CBV are developed, maintained and published by GS1; EPCIS and the CBV are also published within ISO's PAS process as ISO/IEC 19987 and ISO/IEC 19988, respectively. The CBV standard provides definitions of data values that may be used to populate the data structures defined in the EPCIS standard. The use of the standardised vocabulary provided by the CBV standard is critical to interoperability and critical to provide for querying of data by reducing the variation in how different businesses express common intent. Therefore, applications should use the CBV standard to the greatest extent possible in constructing EPCIS data.

The companion EPCIS and CBV Implementation Guideline [EPCISGuideline] provides additional guidance for building visibility systems using EPCIS and CBV, including detailed discussion of how to model specific business situations using EPCIS/CBV data and methods for sharing such data between trading partners.

2 Relationship to the GS1 System Architecture

This section is largely quoted from [GS1Arch], and shows the relationship of EPCIS to other GS1 standards.

2.1 Overview of GS1 standards

GS1 standards support the information needs of end users interacting with each other in supply chains, specifically the information required to support the business processes through which supply chain participants interact. The subjects of such information are the real-world entities that are part of those business processes. Real-world entities include things traded between companies, such as products, parts, raw materials, packaging, and so on. Other real-world entities of relevance to trading partners include the equipment and material needed to carry out the business processes surrounding trade such as containers, transport, machinery; entities corresponding to physical locations in which the business processes are carried out; legal entities such as companies, divisions; service relationships; business transactions and documents; and others. Real-world entities may exist in the tangible world, or may be digital or conceptual. Examples of physical objects include a consumer electronics product, a transport container, and a manufacturing site (location entity). Examples of digital objects include an electronic music download, an eBook, and an electronic coupon. Examples of conceptual entities include a trade item class, a product category, and a legal entity.

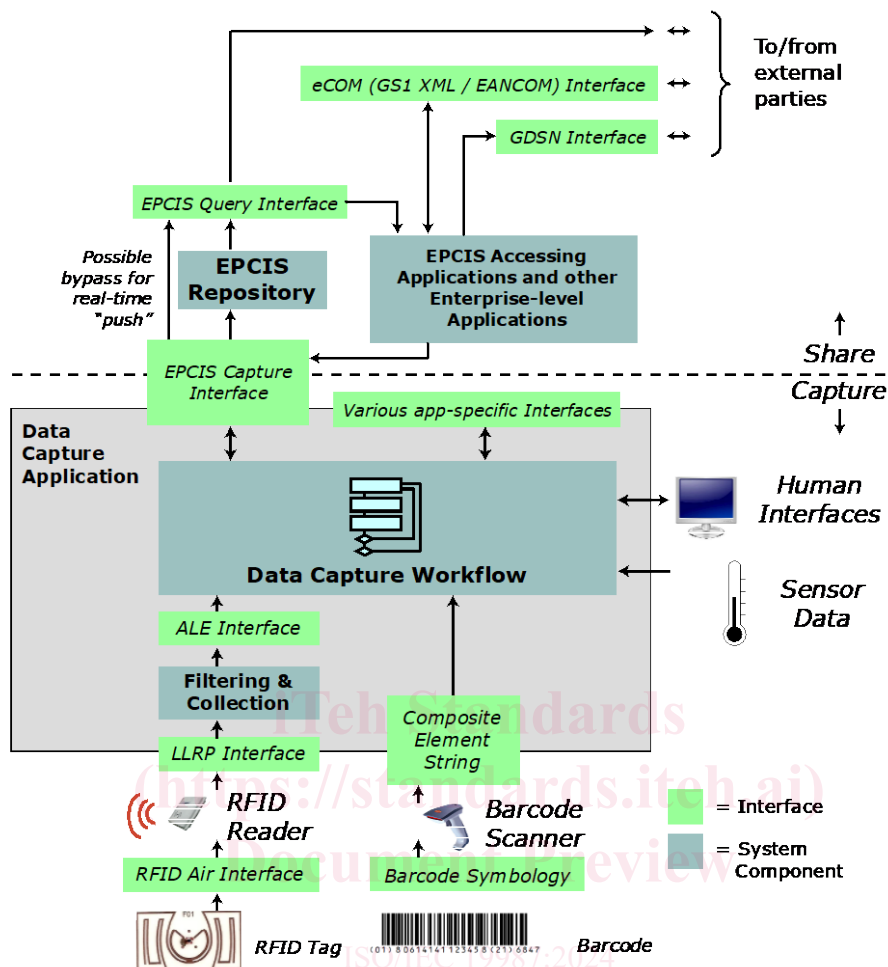
GS1 standards may be divided into the following groups according to their role in supporting information needs related to real-world entities in supply chain business processes:

- Standards which provide the means to **identify** real-world entities so that they may be the subject of electronic information that is stored and/or communicated by end users. GS1 identification standards include standards that define unique identification codes (called GS1 identification keys).
- Standards which provide the means to automatically **capture** data that is carried directly on physical objects, bridging the world of physical things and the world of electronic information. GS1 data capture standards include definitions of barcode and radio-frequency identification (RFID) data carriers which allow identifiers to be affixed directly to a physical object, and standards that specify consistent interfaces to readers, printers, and other hardware and software components that connect the data carriers to business applications.
- Standards which provide the means to **Share** information, both between trading partners and internally, providing the foundation for electronic business transactions, electronic visibility of the physical or digital world, and other information applications. GS1 standards for information sharing include this EPCIS Standard which is a standard for visibility event data. Other standards in the "Share" group are standards for master data and for business transaction data, as well as discovery standards that help locate where relevant data resides across a supply chain and trust standards that help establish the conditions for sharing data with adequate security.

The EPCIS standard fits into the "Share" group, providing the data standard for visibility event data and the interface standards for capturing such information from data capture infrastructure (which employs standards from the "Capture" group) and for sharing such information with business applications and with trading partners.

2.2 EPCIS in relation to the "Capture" and "Share" layers

Figure 2-1 EPCIS in relation to the "Capture" and "Share" layers



The diagram above shows the relationship between EPCIS and other GS1 standards in the "Capture" and "Share" groups. (The "Identify" group of standards pervades the data at all levels of this architecture, and so is not explicitly shown.)

As depicted in the diagram above, the EPCIS Capture Interface exists as a bridge between the "Capture" and "Share" standards. The EPCIS Query Interface provides visibility event data both to internal applications and for sharing with trading partners.

At the centre of a data capture application is the data capture workflow that supervises the business process step within which data capture takes place. This is typically custom logic that is specific to the application. Beneath the data capture workflow in the diagram is the data path between the workflow and GS1 data carriers: barcodes and RFID. The green bars in the diagram denote GS1 standards that may be used as interfaces to the data carriers. At the top of the diagram are the interfaces between the data capture workflow and larger-scale enterprise applications. Many of these interfaces are application- or enterprise-specific, though using GS1 data as building blocks; however, the EPCIS interface is a GS1 standard. Note that the interfaces at the top of the diagram, including EPCIS, are independent of the data carrier used at the bottom of the diagram.

The purpose of the interfaces and the reason for a multi-layer data capture architecture is to provide isolation between different levels of abstraction. Viewed from the perspective of an enterprise application (i.e., from the uppermost blue box in the figure), the entire data capture application shields the enterprise application from the details of exactly how data capture takes place. Through the application-level interfaces (uppermost green bars), an enterprise application interacts with the data capture workflow through data that is data carrier independent and in which all of the interaction between data capture components has been consolidated into that data. At a lower level, the data capture workflow is cognizant of whether it is interacting with

barcode scanners, RFID interrogators, human input, etc., but the transfer interfaces (green bars in the middle) shield the data capture workflow from low-level hardware details of exactly how the data carriers work. The lowest level interfaces (green bars on the bottom) embody those internal data carrier details. EPCIS and the “Share” layer in general differ from elements in the Capture layer in three key respects:

1. EPCIS deals explicitly with historical data (in addition to current data). The Capture layer, in contrast, is oriented exclusively towards real-time processing of captured data.
2. EPCIS often deals not just with raw data captured from data carriers such as barcodes and RFID tags, but also in contexts that imbue those observations with meaning relative to the physical or digital world and to specific steps in operational or analytical business processes. The Capture layers are more purely observational in nature. An EPCIS event, while containing much of the same “Identify” data as a Filtering & Collection event or a barcode scan, is at a semantically higher level because it incorporates an understanding of the business context in which the identifier data were obtained. Moreover, there is no requirement that an EPCIS event be directly related to a specific physical data carrier observation. For example, an EPCIS event may indicate that a perishable trade item has just crossed its expiration date; such an event may be generated purely by software.
3. EPCIS operates within enterprise IT environments at a level that is much more diverse and multi-purpose than exists at the Capture layer, where typically systems are self-contained and exist to serve a single business purpose. In part, and most importantly, this is due to the desire to share EPCIS data between enterprises which are likely to have different solutions deployed to perform similar tasks. In part, it is also due to the persistent nature of EPCIS data. And lastly, it is due to EPCIS being at the highest level of the overall architecture, and hence the natural point of entry into other enterprise systems, which vary widely from one enterprise to the next (or even within parts of the same enterprise).

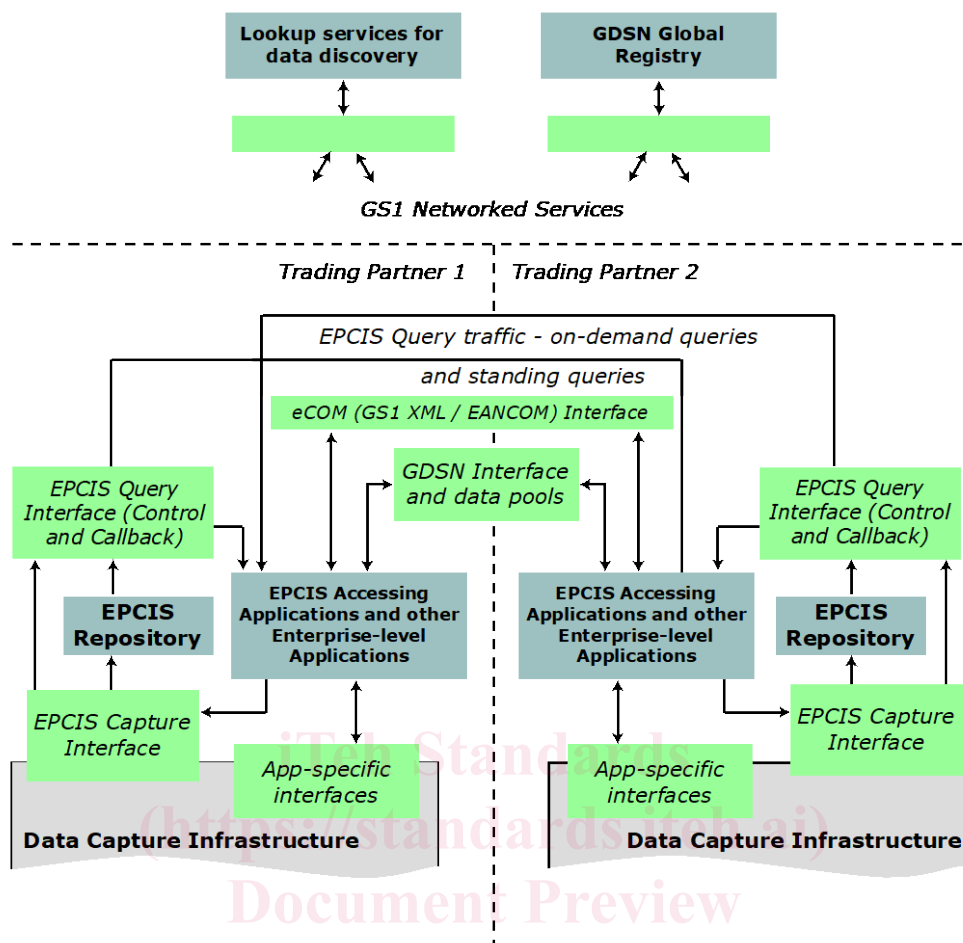
2.3 EPCIS in Relation to trading partners

GS1 standards in the “Share” layer pertain to three categories of data that are shared between end users:

Data	Description	GS1 standards
Master data	Data, shared by one trading partner to many trading partners, that provide descriptive attributes of real-world entities identified by GS1 identification keys, including trade items, parties, and physical locations.	GDSN
Transaction data	Trade transactions triggering or confirming the execution of a function within a business process as defined by an explicit business agreement (e.g., a supply contract) or an implicit one (e.g., customs processing), from the start of the business process (e.g., ordering the product) to the end of it (e.g., final settlement), also making use of GS1 identification keys.	GS1 XML EANCOM
Visibility event data	Details about physical or digital activity in the supply chain of products and other assets, identified by keys, detailing where these objects are in time, and why; not just within one organisation’s four walls, but across organisations.	EPCIS

Transaction Data and Visibility Event Data have the characteristic that new documents of those types are continually created as more business is transacted in a supply chain in steady state, even if no new real-world entities are being created. Master data, in contrast, is more static: the master data for a given entity changes very slowly (if at all), and the quantity of master data only increases as new entities are created, not merely because existing entities participate in business processes. For example, as a given trade item instance moves through the supply chain, new transaction data and visibility event data are generated as that instance undergoes business transactions (such as purchase and sale) and physical handling processes (packing, picking, stocking, etc.). But new master data is only created when a new trade item or location is added to the supply chain.

Figure 2-2 EPCIS in relation to other GS1 System Architecture components



The figure above illustrates the flow of data between trading partners, emphasising the parts of the EPCIS standard involved in the flow of visibility event data.

In addition to the use of the EPCIS Query Interface as illustrated above, trading partners may by mutual agreement use the EPCIS Document structure defined in section 9.3 as a means to transport a collection of EPCIS events, optionally accompanied by relevant master data, as a single electronic document.

2.4 EPCIS in relation to other GS1 System Architecture components

The following outlines the responsibilities of each element of the GS1 System Architecture as illustrated in the figures in the preceding sections. Further information may be found in [GS1Arch].

- **RFID and Barcode Readers** Make observations of RFID tags while they are in the read zone, and observations of barcodes when reading is triggered.
- **Low-Level [RFID] Reader Protocol (LLRP) Interface** Defines the control and delivery of raw RFID tag reads from RFID Readers to the Filtering & Collection role. Events at this interface say "Reader A saw EPC X at time T."
- **Filtering & Collection** This role filters and collects raw RFID tag reads, over time intervals delimited by events defined by the EPCIS Capturing Application (e.g. tripping a motion detector). No comparable role typically exists for reading barcodes, because barcode readers typically only read a single barcode when triggered.
- **Filtering & Collection (ALE) Interface** Defines the control and delivery of filtered and collected RFID tag read data from the Filtering & Collection role to the Data Capture Workflow role. Events at this interface say "At Logical Reader L, between time T1 and T2, the following EPCs were observed," where the list of EPCs has no

duplicates and has been filtered by criteria defined by the EPCIS Capturing Application. In the case of barcodes, comparable data is delivered to the Data Capture Workflow role directly from the barcode reader in the form of a GS1 Element String.

- *Data Capture Workflow* Supervises the operation of the lower-level architectural elements, and provides business context by coordinating with other sources of information involved in executing a particular step of a business process. The Data Capture Workflow may, for example, coordinate a conveyor system with Filtering & Collection events and barcode reads, may check for exceptional conditions and take corrective action (e.g., diverting a bad object into a rework area), may present information to a human operator, and so on. The Data Capture Workflow understands the business process step or steps during which EPCIS event data capture takes place. This role may be complex, involving the association of multiple Filtering & Collection events and/or barcode reads with one or more business events, as in the loading of a shipment. Or it may be straightforward, as in an inventory business process where there may be readers deployed that generate observations about objects that enter or leave the shelf. Here, the Filtering & Collection-level event or barcode read and the EPCIS-level event may be so similar that very little actual processing at the Data Capture Workflow level is necessary, and the Data Capture Workflow merely configures and routes events from the Filtering & Collection interface and/or barcode readers directly through the EPCIS Capture Interface to an EPCIS Repository or a business application. A Data Capture Workflow whose primary output consists of EPCIS events is called an “EPCIS Capturing Application” within this standard.
- *EPCIS Interfaces* The interfaces through which EPCIS data is delivered to enterprise-level roles, including EPCIS Repositories, EPCIS Accessing Applications, and data exchange with partners. Events at these interfaces say, for example, “At location X, at time T, the following contained objects (cases) were verified as being aggregated to the following containing object (pallet).” **There are three EPCIS Interfaces**, specified normatively in this document:
 - The **EPCIS Capture Interface** defines the delivery of EPCIS events from EPCIS Capturing Applications to other roles that consume the data in real time, including EPCIS Repositories, and real-time “push” to EPCIS Accessing Applications and trading partners.
 - The **EPCIS Query Control Interface** defines a means for EPCIS Accessing Applications and trading partners to obtain EPCIS data subsequent to capture, typically by interacting with an EPCIS Repository. The EPCIS Query Control Interface provides two modes of interaction. In “on-demand” or “synchronous” mode, a client makes a request through the EPCIS Query Control Interface and receives a response immediately. In “standing request” or “asynchronous” mode, a client establishes a subscription for a periodic query.
 - Each time the periodic query is executed, the results are delivered asynchronously (or “pushed”) to a recipient via the **EPCIS Query Callback Interface**. The EPCIS Query Callback Interface may also be used to deliver information immediately upon capture; this corresponds to the “possible bypass for real-time push” arrow in the diagram.
- *EPCIS Accessing Application*: Responsible for carrying out overall enterprise business processes, such as warehouse management, shipping and receiving, historical throughput analysis, and so forth, aided by EPCIS visibility event data.
- *EPCIS Repository*: Records EPCIS-level events generated by one or more EPCIS Capturing Applications and makes them available for later query by EPCIS Accessing Applications.
- *Partner Application*: Trading Partner systems that perform the same role as an EPCIS Accessing Application, though from outside the responding party’s network. Partner Applications may be granted access to a subset of the information that is available from an EPCIS Capturing Application or within an EPCIS Repository.