



The Global Language of Business

Support Emerging Use Cases for GS1 Identification

GS1 Architecture Finding

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1 Introduction

This Request for Finding asked the GS1 Architecture Group to review, improve, then approve a series of recommendations to support expansion of the GS1 identification system's relevance to new entities, in new application areas and in ways that supports interoperability and efficiency across sectors, regulations, and regions. It will focus on GS1 identification keys (referred to as GS1 identifiers in this Finding) where they are used to access data today or may be in the future. It will also address new situations where access to data is not currently possible (e.g., hospitals working through digitalization of medical records) or where it may not ever be possible or desired (e.g., emergency relief supply chains). The recommendations aim to speed decision making and reduce divergent national application of GS1 standards or use of proprietary solutions where use of GS1 identification would add value. The immediate scope will focus on tier 1 and 2 GS1 identification keys where GS1 data carrier and GS1 or non-GS1 data sharing standards are used. In a subsequent phase, we can consider where tier 3 and 4 (non-GS1) keys (see Section 4.3.3 of the GS1 System Architecture) are used with non-GS1 data carrier and/or GS1 data sharing standards (e.g., BIC URN within EPCIS).

2 Executive Summary

GS1 provides many tools, like standardised identifiers (e.g., GTIN, GLN, GIAI, GSRN, SSCC), data carriers (e.g., EAN/UPC, GS1 DataMatrix, QR Code, EPC RFID), data sharing standards (e.g., Global Data Model, EDI messages, EPCIS visibility data, GS1 Web Vocabulary) and services (e.g., GDSN, GS1 Registry Platform). Across the system of GS1 standards, globally aligned decisions on which standards and tool(s) industry will use to address a particular business requirement are defined within a construct called a GS1 Application Standard.

The GS1 community faces challenges when balancing how they address local industry needs quickly while also participating in global standards development and deployment. When a GS1 member asks a GS1 Member Organisation (MO) for advice on which standards and tools to use, there are situations where existing GS1 application standards do not exist. Nonetheless, it is essential that GS1 MOs are able to respond to local needs by providing advice in a timely fashion.

If all MOs were to arrive at the same conclusions and provide the same advice in response to an expressed industry need, there would be no need for the recommendations of this Finding. But the provision of globally aligned, common advice is often influenced by local factors (e.g., processes, regulation, common practices, cultural or labour factors, varied capabilities) or legacy implementations that lead to divergence of the advice/guidance/feedback/responses provided by a GS1 MO to their industry members.

The process that is used across GS1 to arrive at common answers that can be implemented consistently and globally across industry is the GS1 Global Standards Management Process (GSMP). Convening industry and GS1 together to deliberate an industry challenge and to define a solution within the GSMP process can take time and is not suited to every industry challenge that is encountered around the world.

To improve the consistency with which GS1 can respond to industry needs, to set the foundation for increased transparency about the challenges that industry is facing and to strengthen those pieces of work that are submitted into GSMP, this Finding addresses three identified gaps:

- **Awareness and Visibility of Local Needs:** The first gap is awareness of emerging use cases. If two or more MOs knew they were working to solve the same industry problem, they could partner to speak with one voice.
- **Common Methodology:** The second gap is use of a consistent method to arrive at common solutions to any single industry challenge. If all MOs are equipped with a common methodology to assess and develop identification solutions, more consistent guidance will result.
- **Guiding Principles for Novel Use Cases:** The third gap is establishing clear guiding principles that the GS1 community can use when working to fill strategically important gaps in GS1's identification standards and tools (e.g., needs that cross sectors or that support regulation). Clear guiding principles will increase the efficiency and consistency of the outcomes of GSMP working groups.

This Finding discusses operational and strategic topics related to the expansion of GS1 identifiers into new use case areas. This Finding will be published in two releases.

- This first release focuses on the first two gaps: **Awareness and Visibility of Local Needs** (section [3.1](#) below) and **Common Methodology** (section [3.2](#) below). Both topics are presented with a set of recommendations (section 4 and 5 below) that will enable other groups across GS1 to begin to implement mechanisms that will improve our overall operations:
 - Section [3.1](#) asks GS1 experts in customer service, community engagement, public policy and standards to consider ways to reduce divergence in advice related to what GS1 identifier to use for new use cases.
 - Section [3.2](#) will ask GS1 Global Office (GO) to consider AG recommendations for procedures that will drive common assessment and development for emerging GS1 identification use cases.
- The second release focuses on the third, more strategic gap: **Guiding Principles for Novel Use Cases** (section [3.3](#)). This topic requires additional time to address, as the gap relates more intimately to our system architecture, processes and possibly even our policies. Once the second release is published, recommendations related to this gap will be published in section [6](#).

3 Problem Statements

So far, twelve [GS1 identification keys](#), constructed using the GS1 Company Prefix, have been approved. When combined with data elements such as serial numbers, the number of GS1 keys are greater and discussed in the GS1 System Architecture in [Section 4](#). As it relates to global use in open networks, all GS1 identifiers except Component and Part Identifier (CPID), which is not used in open supply chains, conform. As it relates to multi-sector use, all GS1 identifiers except CPID used solely in automotive sector and Global Coupon Number (GCN) used solely in the retail sector conform. Today, GS1 is facing many identification requirements which present three issues for the organisation. The first two issues, 1) awareness/visibility of local needs and 2) the lack of a common assessment and development methodology for identification requirements were covered in this [Finding, Release 1](#).

This release covers pressing topics for Novel Use Cases.

4 Novel Use Cases, Novel Solutions

For 50 years, GS1 stakeholders have relied on GS1 standards to support automatic identification and data retrieval for “made-to-stock” consumer trade items and their higher levels of packaging. GTIN allocation rules for retail, healthcare, apparel, fresh food and upstream are designed for made-to-stock contexts (e.g., change in net content, the “20%” change in dimension rule). Soon, these rules will be updated to support Marketplace needs related to bundles, so-called “non-branded” products and products of a condition other than “new”, but in all these cases, the made-to-stock model applies.

Of course, beyond trade items, GS1 identifiers are also used to retrieve information about broad entity types that span sectors, applications, and nations. For example, they are used to identify parties, locations, assets, logistic units, shipments, consignments, service relationships, coupons, and document types in open value networks.

Today’s novel use cases for GS1 identification are more diverse than the GS1 system currently defines. They are:

- a. developed in response to regulatory requirements (e.g., healthcare, consumer communication, sustainability),
- b. developed for global, multi-sector needs like most of today’s existing tier 1 GS1 identification keys, or
- c. developed for sector-specific or application specific ecosystems of identification.

Examples of the above categories include:

- a. Digital Product Passports (including components and models depending on the product type)
- b. Made-to-order/customised products, patient specific doses, non-reusable, patient specific biological sample containers
- c. Product parts or ingredients.

Section 4 subsections provide considerations for four priority use cases then highlights other standards issues or gaps for future consideration.

4.1 Considerations when addressing GS1 Identification gaps

The Table below lists entities identified by GS1 identification keys, highlights where priority issues or gaps exist and provides a reference to Sections of this document where they are discussed.

Figure 4.1-1: GS1 identification system solution, issue, and gap analysis summary

Entity identified	GS1 identification solution, issue, or gap
A. Product model or family based on attributes common to the model or family as defined by industry or regulation.	AI (8013) Global Model Number (GMN)
B1. Made to stock (MtS) product, initial product offering, any product upon which there is a need to retrieve predefined information and that may be priced, or ordered, or invoiced at any point in any supply chain.	AI (01) Global Trade Item Number (GTIN)
B2. Made to stock (MtS) product, non-new product offering (e.g., refurbished, repurposed, used, slightly damaged, upgraded)	Gap, see Section 4.1.1
B3. Made to stock (MtS) product, variation of new or non-new product, without change of original GTIN but need to support consumer communication regarding variation	AI (01) GTIN plus AI (22) Consumer Product Variant (CPV)
B4. Made to stock (MtS) product, variation of new or non-new product, without change of original GTIN but need to support B2B or B2G communication regarding variation (e.g., packaging change does not affect consumer use or GTIN allocation, but affects recycling sortation)	Gap, see Section 4.1.1
B5. Made to stock (MtS) product, new production, production lot/batch	AI (01) GTIN plus AI (10) Batch/Lot
B6. Made to stock (MtS) product, non-new lot/batch (e.g., lot of refurbished products sharing the same GTIN)	AI (01) GTIN plus AI (416) production/service location plus AI (7020) refurbishment lot ID
B7. Made to stock (MtS) product, new production instance	AI (01) GTIN plus AI (21) Serial Number (SGTIN)
B8. Made to stock (MtS) product, non-new production instance	Gap, see Section 4.1.1
B9. Made to stock (MtS) product with multiple pieces (e.g., piece 1 of 2, 2 of 2) associated with the class level (GTIN) product identifier.	AI (8006) Identification of an individual trade item piece (ITIP) = GTIN plus Piece Number and Total Count
B10. Made to stock (MtS) product, internal product variant	AI (01) GTIN plus AI (20) Internal product variant (for internal use only)
B11. Made to stock (MtS) product, additional product identification assigned by the manufacturer	AI (240) Additional item identification
B12. Made to stock (MtS) product, customer part number.	AI (241) Customer part number
C1. Made to order (MtO) product, initial product offering	Gap, see Section 4.1.2
C2. Made to order (MtO) product, non-new product offering (e.g., refurbished, repurposed, used, slightly damaged, upgraded)	Gap, see Section 4.1.1 and 4.1.2
C3. Made to order (MtO) product, variation of new or non-new product, without change of original GTIN but with need to support B2B or B2G communication regarding variation (e.g., configurable product combinations)	Gap, see Section 4.1.1 and 4.1.2
C4. Made to order (MtO) product, production instance	Gap, see Section 4.1.1 and 4.1.2
C5. Made to order (MtO) product, customer specific article	GTIN per GS1 General Specifications Section 2.6.7; consider retiring or deprecating based on GTIN non-reuse rules.
C6. Made to order (MtO) product, custom trade item	GTIN with Indicator digit 9 plus a made-to-order variation number per GS1 General Specifications Section 2.6.8; consider retiring or deprecating based on duplicative use of Indicator digit 9.
D1. Made to stock or made to order product 'part', initial offering	Gap, see Section 4.1.3
D2. Made to stock or made to order product 'part', non-new offering (e.g., refurbished, repurposed, used, slightly damaged, upgraded)	Gap, see Section 4.1.3

D3. Made to stock product 'part', production lot/batch	AI (01) GTIN plus AI (10) Batch/Lot
D4. Made to stock or made to order product 'part', production instance	AI (01) GTIN plus AI (21) Serial Number plus AI (250) Secondary serial number; Candidate for deprecation per Section 4.1.3 as discussions of broader needs mature.
D5. Made to stock or made to order product 'part', variation of new or non-new product, without change of original GTIN but with need to support B2B or B2G communication regarding variation (e.g., configurable product combinations)	Gap, see Section 4.1.3
D6. Existing product 'part' standard: Component/part identification; The identifier SHALL NOT be used in open supply chains. It is restricted to use by mutual agreement. The GTIN is the only GS1 standard identifier for trade items in open supply chains.	AI (8010) Component/Part Identifier (CPID) with optional Serial Number AI (8011) (restricted)
E. Product packaging component; One of a finished consumer trade item's packaging components. One part of the "bill of materials".	AI (243) Packaging component number Gap, see Section 4.1.4
F1. Service	AI (01) GTIN plus AI (21)
F2. Service, instance of a service (e.g., metered taxi ride)	AI (01) GTIN plus AI (21)
G. Logistic unit	AI (00) Serial Shipping Container Code (SSCC)
H. Product contained inside a logistic unit	AI (02) GTIN of item contained (not orderable) and (37) Quantity of trade items contained (must be used in association with AI (00) Serial Shipping Container Code (SSCC))
I. Consignment of multiple logistic units	AI (401) Global Identification Number for Consignment (GINC)
J. Shipment of multiple logistic units	AI (402) Global Shipment Identification Number (GSIN)
K1. Document type	AI (253) Global Document Type Identifier (GDTI)
K2. Document type, document type instance	The optional serial component is assigned to a single document for its lifetime.
L1. Coupon	AI (255) Global Coupon Number (GCN)
L2. Coupon, coupon instance	AI (255) Global Coupon Number (GCN) with optional serial number component
M. Individual asset	AI (8004) Global Individual Asset Identifier (GIAI)
N. Individual asset Identifier of an assembly	AI (7023) Global Individual Asset Identifier of an assembly
O. Returnable asset at class or instance level	AI (8003) Global Returnable Asset Identifier (GRAI)
P.1 Location\Ship to - Deliver to	AI (410) Ship to - Deliver to Location GLN
P.2 Location\Ship for - Deliver for	AI (413) Ship for - Deliver for - Forward to GLN
P.3 Location\Physical Location	AI (414) Physical Location GLN
P.4 Location\Physical Location\Physical Location Instance	AI (254) GLN extension component
P5. Location\Production or Service Location	AI (416) Production or Service Location GLN
Q.1 Party\Bill to - Invoice to	AI (411) Bill to - Invoice to
Q.2 Party\Purchased From	AI (412) Purchased From
Q.3 Party\Invoicing Party	AI (415) Invoicing Party
Q.4 Party	AI (417) Party GLN
R. Payment slip	(415) GLN of the Invoicing Party + (8020) Payment Reference Number (party specific invoice number)
S1. Service relationship between an organisation and its service providers	AI (8017) GSRN-Provider
S2. Service relationship between an organisation and its service recipients	AI (8018) GSRN-Recipient
S3. Service Relation Instance Number	AI (8019) Service Relation Instance Number (SRIN)
T. Cellular mobile telephone identifier	AI (8002) Electronic serial identifier for cellular mobile telephones (CMTI)

4.1.1 Non-New, Made to Stock (MtS) Products

GS1 standards do not currently support a made to stock product offered after the original brand owner offering (non-new state or condition). Non-new products require consideration as their aged or modified state alters the brand owner's original product offer declaration. Examples of non-new products include:

- Products offered in various non-new conditions. There may be qualitative descriptions such as excellent, good, fair or quantitative measures (e.g., number of shutter cycles of a camera, charge cycles of a battery, residual charging capacity of a battery etc.).
- Repurposed products offered in a manner not originally intended or declared by the original brand owner.
- Repackaged products which are removed from the packaging of the original brand owner and placed in new packaging.
- Upgraded products which provide one or more features or functions not originally offered by the brand owner.

This subject is in scope for the GTIN Modernisation MSWG, but this Finding offers the following architecture considerations:

1. Where a new GTIN is allocated based upon a change of state/new declaration, linkage to the original brand owner allocated GTIN should be maintained to ensure original product information is persistently available.
2. Identification tools beyond the original GTIN should be considered to maintain relationships between the brand owner's original master data and non-new product master data as certain original values or properties might be changed while others might not. These could include GS1 identification tools such as the original serial number allocated by the brand owner should it exist. Where SGTIN is assigned by the brand owner, data for the new state can be maintained without a new identifier. For example, the linkage could occur using a master data property, (e.g., defined in the GS1 Web vocabulary).
3. When SGTIN is not allocated by the brand owner, other options may be considered such as: allocating a new GTIN by the brand owner or a new GTIN by a third party (e.g., where no GTIN was allocated by the manufacturer or where the GTIN cannot be found), refurbishment lot with GLN, post brand owner, third-party serial number with GLN, product variant, offer identification or internal identifiers in closed loop environments.
4. By using identification tools beyond the original GTIN, non-new product identification could resolve to a configurable set of specific master data element values / properties. For those which are changed, consideration should be given to when an override or additional record should occur. This consideration in the requirements phase could assist when designing the identification solutions. For example, there could be discussion of how the identification will support GS1 Digital Link resolvers for new or non-new product data or how changes of state could be recorded within critical event data.
5. Where a new and non-new value for identification (e.g., GTIN, serial number, lot/batch number) co-exist at the automatic identification and data capture (AIDC) level, Application Identifiers (AIs) of GS1 element strings should distinguish the new from the non-new value (e.g., original serial or lot, refurbished serialisation or lots) and who allocated each using a GLN. For example, a battery might have an initial capacity of 30000 mAh and the brand owner allocates a GTIN without a serial number. A reseller needs to offer the battery in a non-new state with a lower maximum charging capacity. Should they choose to use a serial number with the original GTIN, they cannot use AI (21) as the values they assign could create collisions with other resellers or with the brand owner should the brand owner begin allocating serial numbers at a future time.

The list above does not pertain to products at end of life (e.g., recycled, deactivated, destroyed) or products after they become a part or an ingredient of another product.

4.1.2 Made-to-Order (MtO) Products

GS1 product identifiers have existed since 1971 and allocation rules for these identifiers are, today, are for made-to-stock (MtS) products. Made to stock offerings are made between parties after exchange of master data that exists at the time the offer is made. There are then stock orders based on this data for repeated quantities of the same product (e.g., can of soup, bottle of

shampoo, flashlight, flashlight battery, shirt). The data may gradually change over the life span of the made to stock product and some changes will necessitate the change of the product identifier as defined by GTIN Allocation Rules.

Customisation, personalisation, or configurations of products has existed, even as the norm, for some sectors. This is increasing for traditional GS1 sectors like apparel and healthcare as well as for new sectors like construction and marketplaces. In terms of how GS1 addresses these needs, this Finding focuses on identification but as all GS1 identification exists to support data sharing, this is worth discussing at a summary level as well. As far as made to order products are concerned, the following table is provided with considerations of three basic use cases for GSMP Work Groups.

Figure 4.1.2-1: Made to order product identification considerations

Use case	Considerations
<p>1: Custom: Base item is one of a kind, never reproduced or sold again unless by coincidence rather than intent.</p>	<p>Trade item definition test appears to fail: <i>"Any item (product or service) upon which there is a need to retrieve predefined information and that may be priced, or ordered, or invoiced at any point in any supply chain."</i></p> <p>Allocation Rules: MtS rules do not apply, new rules are required.</p> <p>GS1 Application Identifier: As a new entity type is to be defined and new allocation rules for GTIN are required, a new AI may be required.</p> <p>GTIN attributes: Current GTIN attributes (e.g., lot numbers, serial numbers) would appear workable and necessary in addition to GTIN to manage traceability, recall, warranty, maintenance, and even some record of design specifications, but new attributes may be required that may not apply to made to stock products (e.g., gauge, power).</p> <p>Data sharing: This appears a peer-to-peer versus trading partner to trading partners data sharing model. The item cannot be ordered based on predefined information nor at any time in the supply chain. The product's customised specifications must be agreed between buyer and seller before an order is placed.</p>
<p>2: Customised / personalised (including one-off products): Base items may be offered that share some common master data but some transactional data is required to order the item (e.g., customer may specify some personalised details beyond master data specified by the manufacturer).</p>	<p>Trade item definition test appears to fail: <i>"Any item (product or service) upon which there is a need to retrieve predefined information and that may be priced, or ordered, or invoiced at any point in any supply chain."</i></p> <p>Allocation Rules: MtS rules do not apply, new rules are required.</p> <p>GS1 Application Identifier: As a new entity type is to be defined and new allocation rules for GTIN are required, an AI other than (01) or (02) is likely required. If the items could be comprised of multiple parts where (8006) is required, (8006) would have to accommodate the various product types or a new AI would be required to do so.</p> <p>GTIN attributes: Current GTIN attributes (e.g., lot numbers, serial numbers) would appear workable and necessary in addition to GTIN to manage traceability, recall, warranty, maintenance, and even some record of design specifications, but new attributes may be required that may not apply to made to stock products (e.g., gauge, power).</p> <p>Data sharing: This appears a peer-to-peer versus trading partner to trading partners data sharing model. The item cannot be ordered based on predefined information nor at any time in the supply chain. The product's configurable aspects must be agreed between buyer and seller before an order is placed. If true, then data sharing at GTIN + variant or serialisation level should be considered.</p>
<p>3: Configurable (predefined options): One base item is offered with multiple options or offered in</p>	<p>Trade item definition test appears to pass: <i>"Any item (product or service) upon which there is a need to retrieve predefined information and that may be priced, or ordered, or invoiced at any point in any supply chain."</i></p> <p>Allocation Rules: MtS rules do not apply, new rules are required.</p> <p>GS1 Application Identifier: As a new entity type is to be defined and new allocation rules for GTIN are required, an AI other than (01) or (02) is likely</p>

<p>various lengths, strengths, powers, etc. where most master data is configurable based upon the order.</p>	<p>required. If the items could be comprised of multiple parts where (8006) is required, (8006) would have to accommodate the various product types or a new AI would be required to do so.</p> <p>GTIN attributes: Current GTIN attributes (e.g., made to order variation numbers, lot numbers, serial numbers) would appear workable and necessary in addition to GTIN to manage traceability, recall, warranty, maintenance but the use of a made-to-order variant attribute should be permitted based upon the use of a new AI rather than use of Indicator digit 9 (as this use duplicates an existing meaning for the digits' significance).</p> <p>Data sharing: This appears a trading partner to trading partners data sharing model. The item can be ordered based on predefined information and at any time in the supply chain. With that said, the current made to stock allocation rules would fail validation (e.g., 20%-dimension change rule) and create an unnecessary proliferation of GTINs when variants of base product identifiers would suffice. If true, then data sharing at GTIN + variant level should be considered.</p> <p>Capacity consideration: Made to order variation numbers has capacity for one million variations. If this is deemed insufficient, serialisation provides far greater capacity for customised / personalised products (see previous row). MtO can utilise serialisation in situations where multiple instances of the same configuration are manufactured.</p>
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Review of related GS1 standards:

- In GS1 General Specifications section 2.6.7, *“customer specific articles (CSA) is broadly defined as any item where the supplier defines all possible manifestations of the article from which the customer may choose, and pre-allocation of article numbers at the lowest level is not feasible. CSAs are never made for stock, and hence are always made to order. However, made-to-order articles are not necessarily customer specific, but could be standard.”* This standard does support unique identification but was developed in an era when GTIN reuse was permitted rather than prohibited. By allocating a GTIN whenever a new configuration is sold, the capacity of GTINs for the brand owners is strained. For this reason, if a GTIN could be allocated per new allocation rules and if a new AI was allocated to GTINs that are allocated per these rules, then attributes like variants or even serialisation could be used in addition to a GTIN assigned at a lower frequency than before. For an example of the frequency possible, see Section 2.6.7.2.1 of the GS1 General Specifications.
- In GS1 General Specifications section 2.6.8, *“custom made-to-order trade items are different from customer specific items in that they are one-of-a-kind, made-to-order items that are strictly sold from business to business. Their use is approved for the manufacturing and maintenance, repair & overhaul (MRO) environment. Examples include custom abrasive belts, special adhesives and made-to-order cutting tools needed for a specific machine and cutting application. Their specifications may be called out in a series of blueprints or other technical documents.”* At this stage, the GS1 AG is unaware of any implementations of this standard. This statement, while made after consulting the party that entered the work request for this section, is non-conclusive as the AG is not positioned to determine whether our assumption is true. With that said, industry should consider several questions before implementing.

First, are you sure the product is strictly sold business to business AND being identified for use in manufacturing and MRO environments?

If no, this is not a workable approach.

Second, if the answer to number 1 is yes, then are you sure this product will never co-exist in an environment with variable measure trade items?

For example, could the identifier with an Indicator digit 9 be confused for a variable measure trade item? With those questions aside, we should also point to the made-to-order variant attribute. This attribute could be very useful as mentioned in the table above.

4.1.3 GS1 standard identification of Mts or MtO Product Parts

A product part is an item that is intended to undergo at least one further integration/build process to create finished goods for the purpose of downstream consumption. For instance, a single (physically assembled) product contains one or more parts which themselves require identification. To the extent product parts are products themselves, GS1 identifies product parts using GTIN (with or without a compound key component being added to GTIN such as a serial number, lot number). Even so, the following factors should be considered:

1. Existing GTIN allocation rules are focused on made to stock consumer products. Various categories are supported by general rules and sector specific extensions to the general rules are also provided. For example, retail established the original rules, then apparel and footwear, upstream, healthcare and other specific rules have been added since. In the same manner, GTIN allocation rules should be assessed to determine if they pertain to product parts and if they need to be extended. If the existing Mts GTIN rules work for product parts then product part examples could be added to the existing rules as needed. If the rules require an extension, the additional rules can be added so long as they do not contradict the existing general rules. If the rules do not apply or support the requirements for product parts without being disruptive to the general rules for products, then consideration should be given to new rules and a mechanism to determine whether the existing general rules or the new rules should serve as the basis for data validation.
2. Automatic identification and data capture (AIDC) data carriers such as 1D and 2D barcodes which are scanned by 'line of sight' require there be one value for each data element on the product. Where a product's identifier (GTIN) and its part's identifier (GTIN) are both exposed to the scanner, the scanner system may often "see" both barcodes encoding the identifier and must determine which GTIN pertains to the product and which pertains to the part. For example, the scanner encounters two barcodes on a laptop computer. One has a GTIN for the laptop and the other has a different GTIN for the laptop's battery. Alternatively, the scanner may only see the laptop battery's GTIN and find no corresponding record for it as the application is only looking for the laptop's GTIN. For this reason, obscuring or shielding the component level GTIN may be required.
3. As is true with all trade items, various levels of identification granularity support data sharing for trade item parts (which are themselves trade items). For example:
 - A series of different parts, which are themselves trade items and identified by GTIN, could share a partial set of common data element descriptors at a level above the individual product parts. In the GS1 System, the Global Model Number (GMN) may be used to support sharing of these common data elements.
 - Individual product parts offered for sale as trade items could have data element descriptors that are unique to it. Here the Global Trade Item Number (GTIN) is used to support sharing of these data elements.
 - Individual product parts offered for sale could have data element descriptors that change without requiring a new Global Trade Item Number (GTIN) but where communication of the change is required by a trading partner or regulator. Here the GTIN plus a variant may be used. NOTE: If the variation is solely for consumer communication purposes, GS1 already has a standard for this called the Consumer Product Variant AI (22).
 - Product part production batches may require identification for the sake of traceability or recall. Here the GTIN as well as a Lot Number may be used.
 - A specific production instance of the part may require identification to support maintenance, repair, warranty, repurposing, or refurbishment. Here the GTIN as well as a Serial Number (SGTIN) may be used.
4. Review of related GS1 standards:
 - GS1 standards support identification of product "pieces" (not parts) in GS1 General Specifications Section 2.1.9. For example, a sofa and chair are sold as a set, not separately. Both pieces are identified with the same GTIN, but GS1 standards permit the identification of product piece 1 of 2, 2 of 2. Per this standard, "*AI (8006) SHALL NOT be used for the identification of pieces that are themselves trade items, such as spare parts.*"
 - GS1 standards support identification of serialisation of product parts in GS1 General Specifications Section 3.5.9. *The element string denoting a secondary serial number*

represents the serial number of a component of that item. The company applying the element string determines which component the element string refers to for a given trade item. The recognition of the meaning of the secondary serial number is accomplished via the GTIN and information provided by the issuer regarding the component to which the secondary serial number refers. Only one element string with AI (250) may be associated with a particular GTIN. This identifier has serious limitations that must be explored and it may even be a candidate for deprecation if replaced with a more robust solution. As for its limitations, the product manufacturer cannot serialise multiple parts, the same part may be used in many different product instances identified by the same GTIN but different AI (21) serial numbers, the same part may be used in various products that are identified by different GTINs. For all of these reasons and more, the use of a specific GTIN for each part and then an AI (21) with that GTIN would provide for a scalable approach that supports lifecycle management for each product part independently.

- GS1 has a restricted application standard for component parts called Component Parts Identification or CPID (see GS1 General Specifications Section 2.6.12) Per this standard, *“The Component & Part Identifier is available for business processes where products are identified by the buyer. The buyer instructs his suppliers on how to identify and mark the products delivered to him. The identifier SHALL NOT be used in open supply chains. It is restricted to use by mutual agreement. The GTIN is the only GS1 standard identifier for trade items in open supply chains.”* This means CPID is not used considered for product parts where allocation of the identifier is made by the product owner and where the data related to the product part is used in an open value network.

4.1.4 Packaging Components

Almost all consumer products require packaging in some form. The packaging provides a reliable mechanism to transport, store, and display the product after it leaves the production line. The package also conveys product declarations such as contents, ingredients, nutritional, allergen, or other consumer information. To ensure the declaration matches the product offered, manufacturers of product have a bill of materials (BoM) for each product. For example, a shampoo product is packaged using five packaging components, a bottle, front label, back label, cap, and cap seal.

Today, these components may or may not be identified as a product using a GS1 standard identifier, but the increased need to identify packaging components with GTIN may be presenting itself based on circularity requirements. Using the example above, the shampoo manufacturer may move from a glass bottle with laminated paper labels and a metal cap to a PET bottle with PET labels and a plastic cap. If the manufacturer is required to report on the environmental impact of the final, filled shampoo product (including its packaging) some identification mechanism may be required. For example:

1. If the packaging change requires a GTIN change, then communication regarding the packaging components can be supported at the GTIN level.
2. If the packaging change does not require a GTIN change but the new packaging configuration can be identified by a variant identifier, GTIN plus a variant may be used to support the communication.
3. If the packaging change does not require a GTIN change, cannot be supported by GTIN plus a variant, but the new packaging configuration can be associated with whole production lots, GTIN and a lot/batch number may be used to support the communication.
4. If the packaging change does not require a GTIN change and the new packaging configuration cannot be associated with whole production lots, SGTIN may be used to support the communication.

Review of related GS1 standards:

- GS1 standards support identification of packaging components in GS1 General Specifications Section 3.5.8. The standard says, *“The GS1 Application Identifier (243) indicates the GS1 Application Identifier data field contains a Packaging Component Number (PCN). A PCN is assigned to the packaging component for its lifetime. When associated with a GTIN, a PCN uniquely identifies the relationship between a finished consumer trade item and one of its packaging components. The current use case for PCN is for internal use only however the PCN may be considered in future use cases for open supply chain applications.”*

- The PCN is used internally by product manufacturers to ensure the right label is used in production. Before the introduction of AI (243) for this purpose, these internal numbers were typically encoded in separate barcodes from those used at retail point-of-sale, healthcare point-of-care, etc. With the advent of higher capacity barcodes, the PCN can now be encoded into the same barcode encoding GTIN. This eliminates the inefficiencies associated with multiple barcodes being exposed to barcode scanning systems and confusion caused for consumers. While that requirement remains relevant, this identification tool was never intended to uniquely identify individual components for the purposes of communicating circularity or environmental impacts. These communications are most effectively managed via identification of the product itself using master data sets associated with various packaging configurations for the product over its lifespan.

4.1.5 Future Topics

4.1.5.1 Existing Standards Issues

1. Several Application Identifier definitions for Party GLNs appear to be discussing locations, not parties. The problem is compounded by the 'reference' in the GLN string always being called 'location reference' whether the GLN is identifying a location or a party. There could be GSCN (standards revision) to change "location reference" to either "location reference" or "party reference".
2. We need to determine if and how GSRN is useful across multiple organisations outside mergers and acquisitions. GSRN is used to identify entities within one organisation offering services so may be very supportive of privacy. With that said, it may be beneficial to clarify to our community that GSRN is not always useful in an open value network. It is unique across organisations but cannot be used to identify service providers and recipients except within individual service organisations. This means one provider or recipient has as many GSRNs as it has service provider organisations using GSRN (e.g., doctor works for two hospitals, patient has twelve healthcare provider organisations).
3. The Service Relation Instance Number (SRIN) is numeric therefore it does not allow for alphanumeric characters. This could hamper migration from legacy systems but altering the definition could be disruptive.
4. The cellular mobile telephone (CMT) identifier is a national or multinational authority usually assigns the number. As CMT identifier is national, should we a) retire, b) deprecate it then add an AI for IMEI, c) add an AI for IMEI and leave CMT Number as an option as well, or d) do nothing?

4.1.5.2 Additional topics

In addition to the standards topics above, GS1 may need to consider:

1. How GS1 identifiers and GS1 Application Identifiers that qualify them interoperate with identifiers issued by other ISO issuing agencies and MH10 Data Identifiers.
2. Whether GS1 needs to take additional steps to authenticate GS1 identifiers.
3. Principles when sharing data through AIDC, along with or independent of identification. This could include consideration for mapping of AIs to properties (or sequences of properties) within the GS1 Web vocabulary.
4. Whether GS1 could provide global uniqueness to proprietary numbering systems and if so, according to what criteria and under what constraints.
5. GS1 explaining how one entity can be identified by multiple identifiers to support different applications.

5 Summary of actions proposed

Finding Release 2 Actions	Responsible
1. Publish the Finding for GSMP Work Groups consideration when weighing potential solutions to identification requirements.	
2. Return to the Future Topics list once prioritised within the GS1 Architecture Group work plan.	