The Global Language of Business

QUICK START GUIDE

Quick start guide for GS1 Digital Link

1. Document purpose and target audience

This document sits between the very high-level *Best practices for creating your QR Code powered by GS1* [**QR-BP**] and the definitive *GS1 Digital Link URI syntax standard* [**DL-URI**]. It explains why a GS1 Digital Link URI is structured the way it is and where there is room for flexibility. This document complements information in *Connecting barcodes to related information* [**REL**].

It is assumed that the reader:

- has been tasked with implementing GS1 Digital Link in a QR Code on a product other than a healthcare product;
- is familiar with core concepts of the Web, in particular: URL structure and redirection;
- understands the basics of GS1 standards with respect to GS1 identification keys, GS1 application identifiers and GS1 barcode syntaxes.

By focusing only on the example of a retail product identified by a GTIN, perhaps with a batch/lot or serial number, the explanations in this document can be kept as simple as possible. However, the same guidance applies to other entities that can be identified using GS1 identifiers, such as locations, shipments and assets, with little or no modification.

NOTE: For information about using the GS1 Digital Link standard and GS1-conformant resolvers in healthcare applications, refer the document titled Accessing online product information with the GS1 Digital Link Standard.

For more detailed information

Contact your GS1 Member Organisation

2. Introduction

A QR Code containing a GS1 Digital Link URI has two functions:

1. It identifies the product using GS1 identifiers that are recognised by scanners without an online lookup. In simple terms, it goes beep at the checkout without using the internet, just like the traditional EAN/UPC linear barcodes used today.
2. It is a connection to the Web that can be treated just like any other URL and used without specialised software. However, specialised software, such as apps, can carry out specialised functions following a scan of the same QR Code (for example, custom apps might look for specific allergens, a product passport, instructions, fashion pairings, etc).

Both these points are crucial: the URI uses GS1 identifiers to *identify the product*. Later sections explain that, as a direct consequence of this, it ***should not be*** the URL of a web page. Rather, there should be some form of redirection from the GS1 Digital Link URI to wherever is most appropriate on the Web.

It is the dual (online and offline) function of a GS1 Digital Link URI that explains why the structure is so precisely defined. It must be possible for scanning software to distinguish between a QR Code that contains GS1 identifiers and one that does not. A point-of-sale (POS) scanner doesn't treat the GS1 Digital Link contained in a QR Code on a product as a URL. It treats it as a barcode containing a GTIN. Other industrial scanners may also make use of a batch/lot number, a serial number, an expiry date, all of which are present within a precise structure. The fact that the structure is a URL will be of no significance to the scanner. However, it must still be possible to use a general tool, notably a mobile phone's camera, to scan a QR Code containing a GS1 Digital Link URI and treat it in exactly the same way as the content of any other QR Code encoded with a URL.

The distinction between the *identifier* of the product and the location of information *about* the product is why we use the term Uniform Resource Identifier (URI) when referring to GS1 Digital Link syntax rather than the much more commonly used Uniform Resource Locator (URL) which is used when talking about the location of digital information.

3. The syntax basics: what you need to know

Like all GS1 barcode syntaxes, GS1 Digital Link URI makes use of GS1 *Application Identifiers* [**AI**]. These are numeric strings between 2 and 4 digits that provide meaning for the data which follows the AI and act like parameter names such as '01' for GTIN and '21' for serial number.

The definition of each GS1 Application Identifier includes its structure, details of the number and types of character that can follow it, as well as its relationship(s) with other AIs.

For example:

- A GTIN must be preceded by '01' and comprises a GS1 company prefix (GCP), item reference and a check digit at the end, and must be expressed as exactly 14 digits (with leading zeroes serving as filler digits, if necessary).
- A batch/lot number must be preceded by '10' and can be 1 to 20 characters from a defined alpha-numeric character set.
- Likewise, a serial number must be preceded by '21' and followed by 1 to 20 characters from a defined alpha-numeric character set.
- When a batch/lot or serial number is used, it must be combined with a GTIN.
- There are numerous GS1 Application Identifiers that cannot be used alongside other GS1 Application Identifiers. For example, a GTIN must not be combined with another GTIN.

Unlike other GS1 syntaxes, GS1 Digital Link makes a clear distinction between *identifiers* (like a GTIN and serial number) and *attributes* (like an expiry date or measured weight).

GS1 Application Identifiers are numeric because digits are more efficiently encoded in symbols like QR Codes than any other kind of character. This goes back to the birth of barcodes when *only* digits could be encoded.

4. Product (trade item) identification

This section, and section 6, makes use of the following sample data.

AI	Label	Value	Type
01	GTIN	09524000059109	Primary key
10	Batch/lot	ABC	Key qualifier
21	Serial number	1234	Key qualifier
22	Consumer product variant	holiday	Key qualifier
17	Expiry date	271231 (equivalent to 2027-12-31)	Attribute
3103	Measured weight	000500 (500g)	Attribute

A Global Trade Item Number (GTIN) is used to identify a product. This is known as the *primary key*. It may be qualified by any permutation of Consumer Product Variant, batch/lot or serial number. These are known as *key qualifiers*. The primary key and key qualifiers are hierarchical and, when present, are therefore encoded in the URI's path in that order (see section 6 for more about the distinction between the 'path' and 'query string' elements of a URI).

The following examples are all **conformant**. Colours are used to highlight the Application Identifiers.

GTIN (only) https://example.com/01/09524000059109

GTIN + batch/lot https://example.com/01/09524000059109/10/ABC

GTIN + serial https://example.com/01/09524000059109/21/1234

GTIN + CPV + serial https://example.com/01/09524000059109/22/holiday/21/1234

However, the following examples are **not conformant** as the elements are in the wrong order:

https://example.com/01/09524000059109/21/1234/22/holiday

https://example.com/21/1234/01/09524000059109

Trade item attributes

Attributes *describe* the entity. Things like expiry dates and the net weight of a variable measure trade item. These are non-hierarchical and are encoded in the URI's query string as name=value pairs in any order.

GTIN + expiry date https://example.com/01/09524000059109?17=271231

GTIN + expiry date + measured weight https://example.com/01/09524000059109?17=271231&3103=000500

It would still be fully conformant if the order of the expiry date and measured weight attributes, which are represented as two name=value pairs in the query string, were reversed.

Flexibility

You can use any domain name in the Digital Link URI– the domain name is not part of the GS1 identification.

A GS1 Digital Link URI can include any number of path segments between the domain name and the /01 segment that signals the beginning of the GS1 identifier hierarchy. Therefore, the following is conformant:

https://example.com/arbitrary/path/segment/01/09524000059109

Additionally, the query string of a GS1 Digital Link URI can contain any non-GS1 data expressed as name=value pairs, as long as the name is not all-numeric. However, it is not necessary nor recommended for the reasons given in the next section. All it does is make your QR Code bigger so that it takes up more space on your product's packaging. And no one wants that.

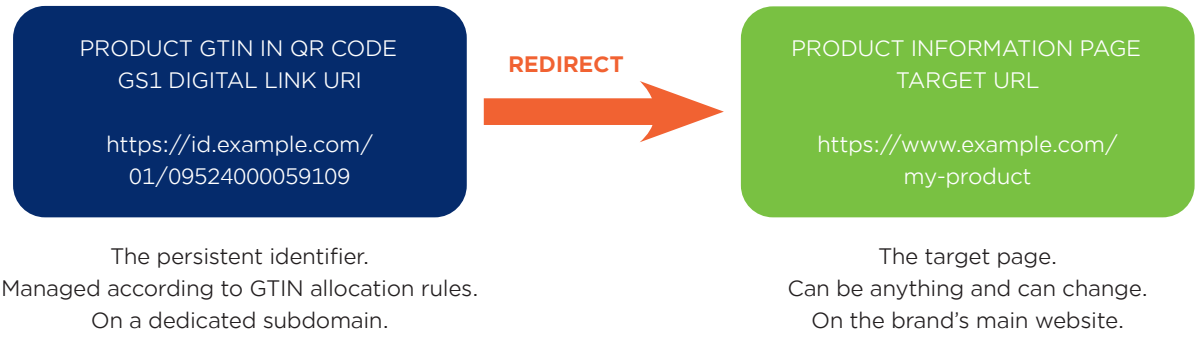
5. The critical importance of redirection

It was noted in the introduction that what is encoded in the QR Code, the GS1 Digital Link URI, **should not** be the URL of any web page.

There are two principal reasons for this:

1. The GTIN and any other GS1 identifiers identify the product. That is, the physical thing. The URL of a web page is the identifier for the digital data about that product. They are not the same and therefore should have different identifiers.
2. More importantly, the GTIN is tied to the product's own lifecycle and is allocated according to GS1 standards. This is very different from the lifecycle and management of the online information that will be managed primarily by the brand marketing team. It can be updated and moved at any time. The QR Code carries the persistent identifier for the product. When accessing that URI, it should redirect to wherever the relevant digital information may be. That redirect can be updated at any time as required by the marketing team. See *Connecting barcodes to related information* [**REL**] for more on this topic.

That second point also leads to the recommendation that a subdomain of the brand's internet domain name be used purely for GS1 Digital Link URIs. The difference in management rules for the product identifier and the digital information about the product, very often managed by different people, means there needs to be a logical separation between the URLs managed for product identity on the one hand and the brand website on the other. Establishing a subdomain achieves this. The suggested subdomain is 'id.' But it can be anything.



The persistent identifier.
Managed according to GTIN allocation rules.
On a dedicated subdomain.

The target page.
Can be anything and can change.
On the brand's main website.

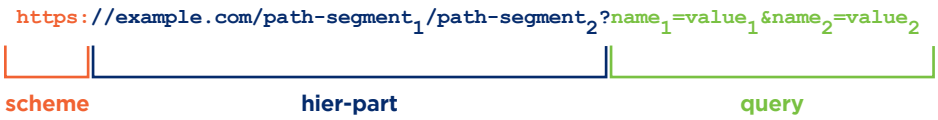
The target of the redirect (the target URL) can be *anything*. It's not part of the identification of the product and so, if needs be, the redirect can be used to add in extra information to pass to the website's content management system.

6. The principles of the GS1 Digital Link syntax

The standard that defines generic URI syntax [**RFC 3986**] includes this definition of the overall structure:

```
URI = scheme ":" hier-part [ "?" query ] [ "#" fragment ]
```

The details of the formal grammar used here, ABNF, are unimportant except to note that the scheme and "hier-part" are mandatory while the query string and fragment portions are optional. The generic structure is most commonly seen in everyday URLs such as:



The 'hier-part', the hierarchical part, is the internet domain within which resources are arranged in a hierarchical order. This logical hierarchy can be seen online in many regular websites. For example:

https://www.bbc.co.uk – the BBC homepage.

https://www.bbc.co.uk/weather
the section of the website dedicated to weather information and forecasts.

https://www.bbc.co.uk/weather/2643743
the weather forecast for a specific place.

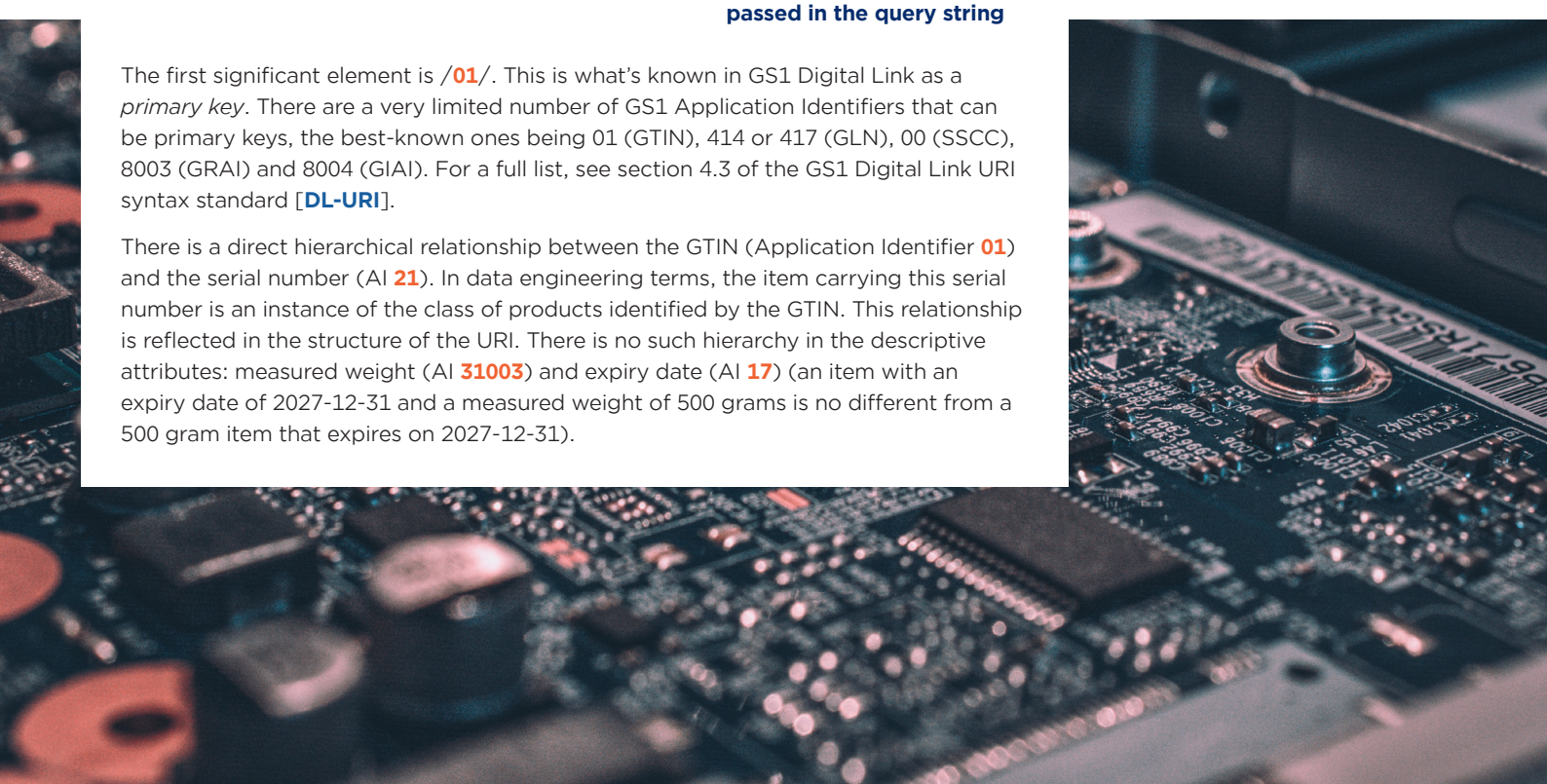
The hierarchy is reflected in the GS1 Digital Link URI syntax. For example, a product identifier and serial number are placed in order thus:

https://example.com/product-identifier/serial-number

But recall that a scanner is not looking at this as a URL, it's looking for GS1 Application Identifiers and their values. Taking these various factors into account – the hierarchical nature of a URI, the use of Application Identifiers in AIDC and making sure it works just like any other URL – means that the data in the table in section 4 are encoded in a GS1 Digital Link URI like this:

The first significant element is /**01**/. This is what's known in GS1 Digital Link as a *primary key*. There are a very limited number of GS1 Application Identifiers that can be primary keys, the best-known ones being 01 (GTIN), 414 or 417 (GLN), 00 (SSCC), 8003 (GRAI) and 8004 (GIAI). For a full list, see section 4.3 of the GS1 Digital Link URI syntax standard [**DL-URI**].

There is a direct hierarchical relationship between the GTIN (Application Identifier **01**) and the serial number (AI **21**). In data engineering terms, the item carrying this serial number is an instance of the class of products identified by the GTIN. This relationship is reflected in the structure of the URI. There is no such hierarchy in the descriptive attributes: measured weight (AI **31003**) and expiry date (AI **17**) (an item with an expiry date of 2027-12-31 and a measured weight of 500 grams is no different from a 500 gram item that expires on 2027-12-31).



Summary

1. Treat a GS1 Digital Link URI as a persistent identifier, managed according to GTIN allocation rules.
2. The detailed syntax is important. Industrial scanners, such as POS scanners and warehouse scanners, will not connect to the internet at all. They will extract the GS1 identifiers for use in their internal processes exactly as they do with other types of GS1 barcode.
3. Use a dedicated subdomain to host those URIs.
4. Redirect *from* the GS1 Digital Link URIs to whatever *target URL* you choose – almost certainly managed by the marketing team. See *Connecting barcodes to related information* [**REL**] for advice on how to link to more than one target at once.

References

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GS1 Application Identifiers. For a full list see https://ref.gs1.org/ai

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Uniform Resource Identifier (URI): Generic Syntax. T. Berners-Lee, R. Fielding, L Masinter. IETF January 2005 https://datatracker.ietf.org/doc/html/rfc3986

Questions about selling apparel on marketplaces?

Contact your local GS1 Member Organisation to see how GS1 can help:

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