The Global Language of Business

GS1 Digital Link Standard: URI Syntax

Enabling consistent representation of GS1 identification keys within web addresses to link to online information and services

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1.2.1	Feb 2022	Mark Harrison	WR 21-429 bundles WR 21-185 /420/ 421/422. Reference change log 8.1
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Table of Contents

1 Introduction

This section and its subsections are informative

GS1 defines a wide range of identifiers that underpin the supply chain and retail industry across the world. This document assumes the reader is familiar with these and the concept of GS1 Application Identifiers. If not, please see information on GS1 identification keys [GS1 ID Keys] and the GS1 General Specifications [GENSPECS] for further background.

This work has been motivated by a number of trends. For example: the desire among retailers to move to 2D barcodes that can carry more information than just the GTIN; the problems of multiple barcodes causing scanning errors through conflicts which suggests a need for a single but multipurpose barcode; the growing expectation among consumers that more information is available online about the products they're considering buying; the brand owner concept of the pack as a media channel linking to multimedia experiences, and more.

As a result of this standard, it is possible to represent GS1 identification keys consistently within Web addresses as well as within barcodes containing Web addresses, such that a single identification approach can support both product identification for supply chain applications *and* a link to online material for consumer and business partner interactions. It's this dual functionality and enormous flexibility that is currently not possible when, for example, Brand Owners embed an unstructured Web page address in QR Code symbology.

Note: Unless otherwise specified, the term 'QR Code symbology' refers to the widely used ISO/IEC 18004 QR Code symbology, excluding the GS1 QR Code that recognises the FNC1 character. 'QR Code' is a registered trademark of Denso Wave, a subsidiary of Denso Corporation. Both the ISO/IEC 18004 QR Code symbology and GS1 QR Code follow the encoding scheme described in ISO/IEC 18004 Information technology — Automatic identification and data capture techniques — QR Code bar code symbology specification, 3rd edition 2015-02-01.

The scope of the work accommodates all Tier 1 and Tier 2 GS1 identifiers and GS1 identifier extensions (e.g., serial number, batch number, consumer product variant) and other relevant attributes as the same technologies are equally applicable to SSCCs, GLNs, GIAIs, GRAIs, GSRNs etc. While the syntax can support Tier 2 GS1 identifiers, it is up to the Tier 2 Issuing Agencies to determine whether it's fit for their use. For Tier 3 GS1 identifiers, GS1 welcomes bilateral discussions with Issuing Agencies to see where alignment is possible.

This GS1 standard references a number of third-party standards from the Internet Engineering Task Force (IETF) and the World Wide Web Consortium (W3C).

1.1 How the GS1 Digital Link standard documents fit together

The original GS1 Digital Link standard comprised 4 key topics, all of which have been subject to revision. These have evolved as separate documents and are published as follows:

URI syntax (this document)

This document provides some of the background to the design of GS1 Digital Link, highlighting existing techniques and practices that underpin the World Wide Web, and applying those to the GS1 system. The normative portions set out the detailed syntax of Web addresses (HTTP URIs) that encode GS1 identifiers and GS1 informative data with exactly the same precision and expressivity as the GS1 AI-based GS1 element string syntax used across the GS1 system, notably in the GS1 General Specifications [GENSPECS]. The GS1 Digital Link URI syntax distinguishes between primary identification keys that express simple GS1 identifiers, such as GTIN and GLN, key qualifiers that express GS1 identifier extensions, such as batch/lot and GLN extension (forming compound GS1 identifiers), and attributes that express GS1 informative data such as expiry date and ship-to address. The GS1 Digital Link URI syntax is the foundation on which all other aspects of the standard are built and is synonymous with the term "GS1 Digital Link".

Resolution (GS1-Conformant Resolver Standard)

A GS1 Digital Link URI is a particular form of URL and *can* be used in exactly the same way as any other URL (this is an important design feature). However, it can also be the gateway to multiple sources of information, both human and machine-readable. This document [DL-Resolution] defines how the GS1 identifiers in a GS1 Digital Link URI can be 'resolved' to those information sources in such a way that information systems and apps can discover them automatically and selectively via link types and link sets. Resolvers are what makes the standard operational for the GS1 community and the industries served.

Compression (GS1 Digital Link URI: Compression Technical Standard for EPC binary strings)

GS1 identifiers can be very efficiently encoded using the EPC binary syntax defined in the GS1 EPC Tag Data Standard [TDS]. EPC identifiers are read from passive UHF Gen2 tags as binary or hexadecimal strings. However, some data carriers (notably NFC tags or passive hybrid NFC/UHF Gen2 tags) support the reading of a URI. This document [DL-CompressionEPC] explains how GS1 identifiers in EPC binary syntax can be expressed as a special compressed form of a GS1 Digital Link URI and read from such tags for decoding/decompression into the equivalent GS1 Digital Link URI. This specification supersedes the compression/decompression algorithm defined in the legacy GS1 Digital Link Standard [DL-Legacy].

Semantics (GS1 Digital Link Standard)

This chapter of the GS1 Digital Link Standard [DL-Legacy] provides precise detail concerning what is expressed using GS1 Digital Link URIs (or using GS1 element strings), the implied hierarchical relationships between related GS1 Digital Link URIs and how we can express facts about entities identified using GS1 Digital Link URIs, in a structured machine-interpretable format using established Semantic Web/Linked Data technology [Linked Data]. This document explains how the GS1 Web Vocabulary [WebVoc] is used for this purpose, however this work has evolved to be part of a broader effort to define the semantics or all GS1 Application Identifiers, and will be supported in a separate document once completed.

1.2 Typographical conventions used in this document

This document includes a lot of examples of GS1 Digital Link URIs such as:

```
https://example.org/414/{gln}/254/{glnExtension}
```

```
https://example.org/01/{gtin}{?exp}
```

The use of the monospace font indicates that the text has meaning for computers. Further, these examples follow the convention used in [RFC 6570]. The places where the values of variables should be inserted are written in braces, so, for example, {gtin} means "insert GTIN value here". All other text in the URI is a literal string to be used as written. As explained in [RFC 2606] and [RFC 6761], the domains example.com, example.org and example.net are second-level domain names reserved by the Internet Assigned Numbers Authority (IANA) for use in documentation. These should be understood as a placeholder for any registered second-level domain name.

Note: The example GS1 Digital Link URIs provided throughout this document are not configured to redirect to a demonstration Web page.

2 Conformance to GS1 Digital Link URI Syntax

This section is normative

The core of this standard is expressed using ABNF grammar [RFC 5234] in section 4 such that conformance can be determined with certainty. GS1 makes tools available that may be used to confirm conformance, in particular, the GS1 Barcode Syntax Resource [BSR] which is explained further in section 6.1.4.

Note that a GS1 Digital Link URI, like any Web URI or URL, does not have any intrinsic meaning. It may be treated in exactly the same way as any URL. It is only if it is parsed by a GS1-aware system that GS1 Application Identifiers and their values can be extracted and processed. Examples of such systems include scanners that may treat a GS1 Digital Link URI as an alternative syntax to GS1 element strings, and conformant GS1 resolvers. Applications SHALL NOT assume that a URL that follows the syntax defined in this standard will point to a resolver. One way to test whether a Web URI does or does not point to a GS1 conformant resolver is to check for the presence of a Resolver Description File in the relevant Well-Known location /.well-known/gs1resolver [RFC 8615]. Details of the Resolver Description File are defined in GS1-Conformant Resolver Standard [DL-Resolution].

NOTE: This standard discusses complete URIs encoded in data carriers such as QR codes, Data Matrix codes and NFC tags. The potential use of software to construct those URIs from components discovered through scans of, for example, UPC/EAN barcodes or GS1 DataMatrix symbols, is out of scope.

3 What is a URI?

This section is informative

This section provides some clarification about what a Uniform Resource Identifier (URI) is, how URIs relate to Uniform Resource Names (URNs) and Uniform Resource Locators (URLs), as well as providing an explanation of the main structural elements within a Web URI.

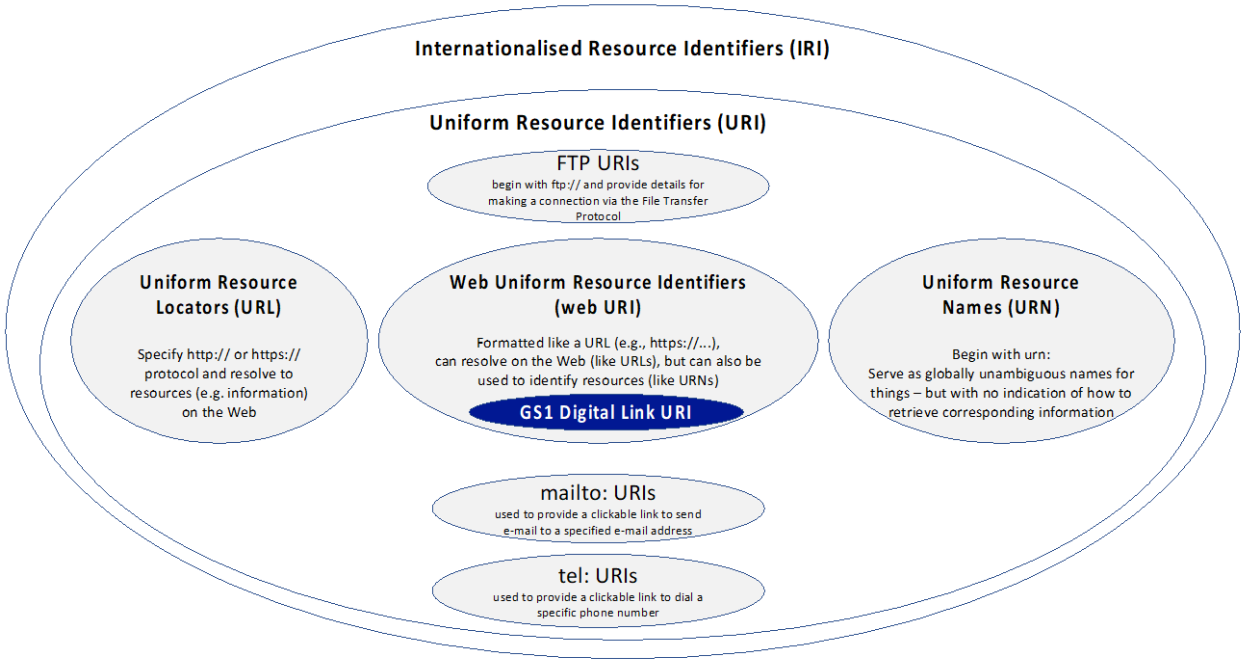

Figure 3-1 URNs and URLs are also URIs

Figure 3-1 shows a Venn diagram in which we see that Uniform Resource Identifier is the broad term that includes Uniform Resource Names (URNs) and Uniform Resource Locators (URLs) as well as URIs with various protocols including http or https, ftp, mailto, tel etc. This means that every URL and every URN is also a URI, since URI is the broader umbrella term. Furthermore, Internationalized Resource Identifiers (IRIs) are an even broader category that support characters from the Universal Character Set/Unicode, whereas URIs only support the ASCII character set. IRIs are defined in [IRIs]. GS1 Digital Link URIs are a subset of Web URIs that conform to this GS1 technical standard.

Figure 3-2 shows another Venn diagram. This time, it shows two capabilities:

1. The capability to easily resolve to resources (e.g., information) on the Web.
2. The capability to provide a globally unambiguous name for anything, whether or not the thing exists only on the Web or in the real world.

The first capability is usually associated with URLs and Web addresses.

The second capability is usually associated with URNs.

Web URIs exist at the intersection of these two capabilities; in terms of their syntax, they look like URLs because they specify http or https as their protocol - and they can be configured to behave like URLs in terms of supporting Web requests via the http/https Web protocol. However, they are also a perfectly valid way of assigning a globally unambiguous name for anything, whether in the real world or online. Note that 'globally unambiguous' does not mean globally unique; two different things should have distinct URIs in any situation where we want to be able to distinguish between them. However, there may be many URIs that all refer to the same thing, even within the same URI namespace or domain name. It is also possible to use Linked Data [Linked Data] to make an assertion between two URIs to formally express that they both refer to the same thing, even if the URIs are different strings.

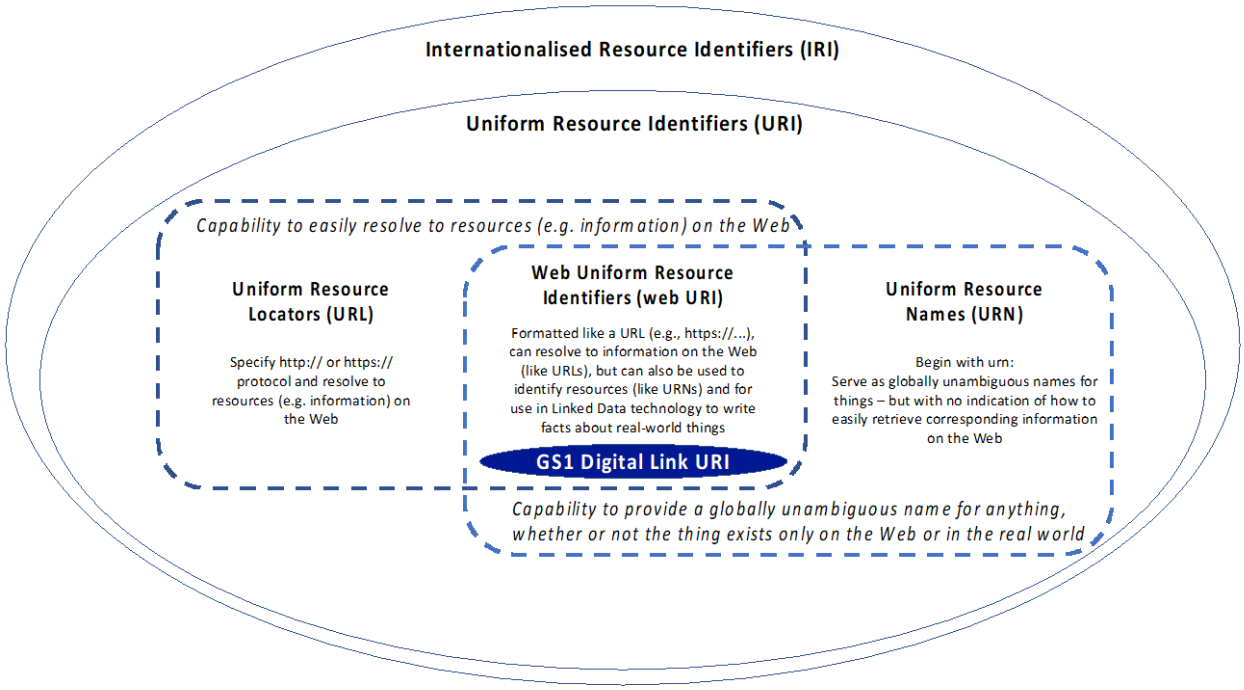

Figure 3-2 A Web URI can act both as a globally unambiguous name for something, as well as providing an easy way to retrieve Web resources (e.g., information) relating to the identified thing

Figure 3-3 provides a brief overview of the internal structural elements of a Web URI:

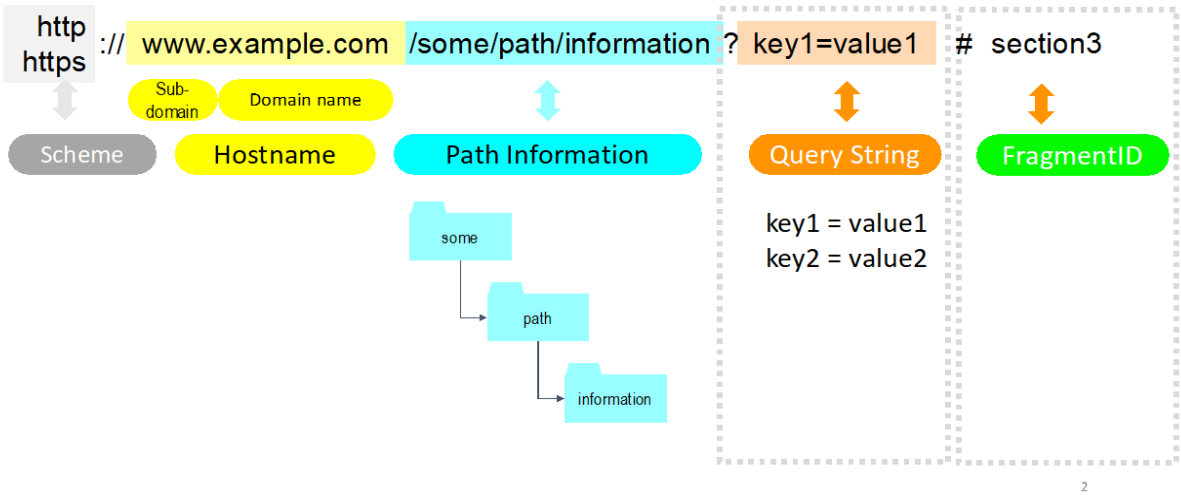

Figure 3-3 Internal structure of a Web URI

Figure 3-3 shows the structural elements of a Web URI. The scheme indicates the protocol and (at the time of writing) is always http:// or https:// (use of HTTPS is more secure and is therefore recommended as best practice). The hostname is typically a registered Internet domain name or a subdomain of such a registered domain name. Following the domain name, the remainder of the Web URI is case sensitive. The URI path information consists of a number of strings separated by the forward slash character. Although this is just a string, it is often used by the Linked Data community and in REST interfaces [REST] to represent a collection of resources organised in a conceptually hierarchical way, with the broadest (most general, least specific) category appearing

towards the left of the URI path information and with the narrowest (most specific) category appearing towards the right of the URI path information.

This design pattern provides a hint to humans that related Web URIs may exist and can be formed by successively truncating the Web URI path information from right to left, removing each successive segment preceded by its forward slash ("/") character. These related Web URIs may provide information about an object at a broader, more general, less specific granularity.

However, this is only a legible hint to humans. Computer software would typically treat the entire URI (at least up to the fragment identifier) as an opaque indivisible string and would not attempt such truncation. Instead, they will look for explicit links to related URIs, ideally expressed with semantic annotation, using Linked Data properties [Linked Data]. These aspects – the machine-processable semantics or meaning of a GS1 Digital Link URI – are explored and defined in detail in GS1 Digital Link Standard [DL-Legacy].

The query string enables multiple key=value pairs to be sent to a Web resource. The URI query string appears after the URI path information and consists of everything between the "?" at the end of the path information and the end of the URI or the "#" symbol indicating the start of the fragment identifier. Within the URI query string, key=value pairs may be concatenated using & or ; as a delimiter.

The URI fragment identifier is optional and appears after the query string (if present) and preceded by the "#" character. The URI fragment identifier is typically used to provide a link to an internal subsection of an information resource. The Linked Data community do make use of URIs with fragment identifiers, although the fragment identifier is not useful for passing key=value pairs. Importantly, fragment identifiers are *not* sent to the server but are handled entirely within the client.

Web URIs provide essentially two options for expressing the values of GS1 Application Identifiers - either within the URI path information or within the URI query string. The URI path information is the most appropriate place for expressing a simple GS1 identifier as a primary identification key, and an ordered set of optional GS1 identifier extensions as key qualifiers, used in conjunction with the simple GS1 identifier to form a compound GS1 identifier that is used to retrieve information about something at a finer level of granularity (e.g. traceability data about an serialised GTIN, batch/lot-level master data). The query string is appropriate for GS1 informative data, which are descriptive data attributes of the identified resource that have no intrinsic hierarchy, such as expiry date, weight etc., as well as being a natural extension point for any additional arbitrary key=value pairs that cannot be expressed using GS1 Application Identifiers (see section 4.10.1); for example, the query string could include a key=value pair to indicate a specific stakeholder role or a specific action or activity or type of service to be accessed. It should be noted that no key=value pair should be repeated with the same primary identification key in the URI query string. If a primary identification key is repeated, the last defined value for that primary identification key takes precedence over any previously defined value.

3.1 The GS1 Digital Link URI

GS1 Digital Link provides a syntax for expressing GS1 identifiers, with or without GS1 identifier extensions and GS1 informative data in a format that can be used on the Web in an intuitive manner (via a straightforward HTTP request) to enable consumers and others to directly access relevant information and services about products, assets, locations, etc. A GS1 Digital Link URI can be encoded natively in any data carrier that can support the encoding of a Web address (URL). This means that additional data carriers such as QR Code symbology, digital watermarks, NFC tags and other technologies will also be able to include GS1 identifiers, while continuing to provide links to relevant information. When the data carrier is created and such a URL is embedded within it, a scanning device can extract the entire URL and no further processing by the scanning device, or software therein, is required to construct the URL that is used to access a server where relevant information is stored.

4 GS1 Digital Link URI Syntax

This section and all its subsections are normative

This section specifies the structure of GS1 Digital Link URIs using the Augmented Backus-Naur Form (ABNF) syntax as defined in [RFC 5234] and updated by [RFC 7405]. ABNF formally expresses how strings of characters (including URIs) are constructed by concatenating smaller components in a sequential order and is machine-processable.

Those smaller components may be defined in terms of further sub-components and/or in terms of sequences of character sets that are also defined by rules.

ABNF also supports repeating components and optional components. Optional components are enclosed within square brackets.

A sequential group of one or more components may be enclosed within round brackets.

Repeating components use the `m*n(component)` notation to indicate that the component within the round brackets may appear at least `m` times and at most `n` times. Default values are `m`=0, `n`=infinity. If either or `m` or `n` are omitted, their default values are assumed.

Everything following a semicolon on a line is considered to be an explanatory comment.

The notation `n(component)` or `n`*`component`* where `n` is one or more digit characters is equivalent to `n*n(component)`, indicating that the component must appear exactly n times.
A number of comments are provided to explain the meaning of rules.

ABNF is designed primarily to express formal syntax in standards documents. It may also be used to validate strings against that syntax, however, there are limitations. It has no negation option (string SHALL NOT contain "xyz") and it does not support non-greedy matching. For this reason, there are some features of the GS1 Digital Link URI syntax that cannot be tested using ABNF-based parsers. In particular, those with a custom path will fail ABNF-based validation.

In common with the GS1-Conformant resolver standard [DL-Resolution], the GS1 Digital Link URI syntax is itself conformant with *Encoding and resolving identifiers over HTTP* [ISO/IEC 18975]

4.1 Removal of convenience alphas and GTIN values expressed using fewer than 14 digits

Earlier versions of the formal grammar below, developed initially for the first version of the GS1 Digital Link standard [DL1], supported 'convenience alphas' in place of commonly used GS1 Application Identifiers. For example, '01' could be replaced by 'gtin', '414' by 'gln' etc. These were introduced in an effort to make GS1 Digital Link URIs more developer-friendly. Experience has shown that the opposite is true as it introduced complexity, confusion and inconsistency for implementations of the standard. At the time of writing, there are many implementations of GS1 Digital Link by scanning equipment manufacturers and barcode generating tools. The majority of these do not recognise convenience alphas and the small number of known implementations that do are being updated to remove them. Convenience alphas were marked as deprecated in version 1.2 of the standard and have been removed completely as of version 1.3.0.

As of version 1.4.0, the GS1 Digital Link standard: URI syntax now expects the GTIN value to be expressed using 14 digits, for consistency with how a GTIN value is expressed in GS1 element strings. This means that the value of a GTIN-8, GTIN-12 or GTIN-13 SHALL be prefixed with leading zeroes serving as filler digits to reach a total of 14 digits, exactly as explained in section 2.1.1.10 of the GS1 General Specifications.

Important: For reasons of backwards compatibility, only *existing* infrastructure for GS1 Digital Link SHOULD continue to support legacy expressions of GS1 Digital Link URIs. Legacy expressions of GS1 Digital Link URIs include GTIN values with fewer than 14 digits and the deprecated convenience alphas. New implementations are not expected to support legacy expressions and deprecated features.

4.2 Character sets

Firstly, a number of character sets are defined for later re-use in subsequent ABNF rules.

```
DIGIT      = "0" / "1" / "2" / "3" / "4" /
             "5" / "6" / "7" / "8" / "9"

BOOLEAN    = "0" / "1"


UPPERALPHA = %x41-5A ; A-Z  ( ASCII characters 65-90 decimal, 41-5A hex)

LOWERALPHA = %x61-7A ; a-z  ( ASCII characters 97-122 decimal, 61-7A hex)

ALPHA      = UPPERALPHA / LOWERALPHA ; A-Z or a-z


HEXDIG     = DIGIT / "A" / "B" / "C" / "D" / "E" / "F"


DoubleQuote = '"' ; the double-quote character "
```

The following characters must be represented using percent-encoding (see section 2.1 of RFC 3986 [PercentEncoding]) when used as literal characters within URIs, since many of these have special meanings within Web URIs:

```
Octothorpe           = "%23" ; percent-encoding of the # character
ForwardSlash         = "%2F" ; percent-encoding of the / character

Percent              = "%25" ; percent-encoding of the % character
Ampersand            = "%26" ; percent-encoding of the & character
Plus                 = "%2B" ; percent-encoding of the + character
Comma                = "%2C" ; percent-encoding of the , character

Exclamation          = "%21" ; percent-encoding of the ! character
LeftBracket          = "%28" ; percent-encoding of the ( character
RightBracket         = "%29" ; percent-encoding of the ) character
Asterisk             = "%2A" ; percent-encoding of the * character

Apostrophe           = "%27" ; percent-encoding of the ' character
Colon                = "%3A" ; percent-encoding of the : character
Semicolon            = "%3B" ; percent-encoding of the ; character
LeftAngleBracket     = "%3C" ; percent-encoding of the < character
Equals               = "%3D" ; percent-encoding of the = character
RightAngleBracket    = "%3E" ; percent-encoding of the > character
QuestionMark         = "%3F" ; percent-encoding of the ? character
```

The following group of symbol characters is permitted within the 82-character subset of ISO/IEC 646, indicated in Figure 7.11-1 of the GS1 General Specifications [GENSPECS].

```
XSYMBOL          = DoubleQuote / "-" / "." / "_" / Exclamation / Percent /
                   Ampersand / Plus / Comma / ForwardSlash / Asterisk /
                   LeftBracket / RightBracket / Apostrophe / Semicolon /
                   Colon / LeftAngleBracket / RightAngleBracket / Equals /
                   QuestionMark
```

The following group of symbol characters is permitted within the 39-character subset of ISO/IEC 646, indicated in Figure 7.11-2 of the GS1 General Specifications [GENSPECS].

```
YSYMBOL          = "-" / Octothorpe / ForwardSlash
```

The following group of symbol characters is permitted within the 64-character subset of ISO/IEC 646, indicated in Figure 7.11-3 of the GS1 General Specifications [GENSPECS].

```
ZSYMBOL          = "-" / "_" / Equals
```

The following character set corresponds to all permitted characters within the 82-character subset of ISO/IEC 646, indicated in Figure 7.11-1 of the GS1 General Specifications [GENSPECS].

```
XCHAR            = DIGIT / UPPERALPHA / LOWERALPHA / XSYMBOL
```

The following character set corresponds to all permitted characters within the 39-character subset of ISO/IEC 646, indicated in Figure 7.11-2 of the GS1 General Specifications [GENSPECS]. It is currently only used within the value of the Components and Parts Identifier (CPID).

```
YCHAR            = DIGIT / UPPERALPHA / YSYMBOL
```

The following character set corresponds to all permitted characters within the 64-character subset of ISO/IEC 646, indicated in Figure 7.11-3 of the GS1 General Specifications [GENSPECS].

```
ZCHAR            = DIGIT / UPPERALPHA / LOWERALPHA / ZSYMBOL
```

4.3 Primary identification keys

The following rules indicate which GS1 Application Identifiers (GS1 AI) for simple GS1 identifiers are considered as primary identification keys for GS1 Digital Link URI.

```
gtin-code          = "01"       ; GTIN
itip-code          = "8006"     ; ITIP
gmn-code           = "8013"     ; Global Model Number
cpid-code          = "8010"     ; CPID
gln-code           = "414"      ; Physical Location GLN
payTo-code         = "415"      ; GLN of invoicing party
partyGln-code      = "417"      ; Party GLN
gsrnp-code         = "8017"     ; GSRN of the Provider
gsrn-code          = "8018"     ; GSRN of the Recipient
gcn-code           = "255"      ; GCN
sscc-code          = "00"       ; SSCC
gdti-code          = "253"      ; GDTI
ginc-code          = "401"      ; GINC
```

```
gsin-code           = "402"       ; GSIN
grai-code           = "8003"      ; GRAI
giai-code           = "8004"      ; GIAI
```

4.4 Key qualifiers

The following rules indicate which GS1 Application Identifiers (GS1 AI) for GS1 identifier extensions are considered as key qualifiers for a GS1 Digital Link URI. The combination of a primary identification key and key qualifier forms a compound GS1 identifier.

```
cpv-code            = "22"        ; Consumer Product Variant
lot-code            = "10"        ; Batch/Lot identifier
ser-code            = "21"        ; GTIN Serial Number
cpsn-code           = "8011"      ; CPID Serial Number
glnx-code           = "254"       ; GLN extension
refno-code          = "8020"      ; Payment Reference Number
srin-code  = "8019"             ; Service Relation Instance Number
tpx-code            = "235"       ; third-party controlled serialised
                                    extension to GTIN
uic-ext-code        = "7040"   ; GS1 UIC with Extension 1 and Importer
                                 Index
```

4.5 Primary identification key formats

The following rules express the format of the values of the primary identification keys.

Note: the GS1 General Specifications [GENSPECS] define further restrictions on some of these values, particularly for those which include a GS1 check digit, GS1 check character pair, indicator digit or extension digit. Please refer to the GS1 General Specifications [GENSPECS] for further details.

```
gtin-value          = 14DIGIT
                      ; GTIN-8, GTIN-12 and GTIN-13 SHALL be expressed as
                      14 digits, with leading zeroes serving as filler
                      digits
itip-value          = 14DIGIT 2DIGIT 2DIGIT
                      ; 14 digits then 2 digits then 2 digits
gmn-value           = 1*25XCHAR  ; 1-25 characters from 82-chr subset
cpid-value          = 1*30YCHAR  ; 1-30 characters from 39-chr subset
gln-value           = 13DIGIT   ; exactly 13 digits
payTo-value         = 13DIGIT   ; exactly 13 digits
partyGln-value      = 13DIGIT   ; exactly 13 digits
gsrnp-value         = 18DIGIT   ; exactly 18 digits
gsrn-value          = 18DIGIT   ; exactly 18 digits
gcn-value           = 13DIGIT [1*12DIGIT]
                      ; 13 digits then optional 1-12 digits
```

```
sscc-value          = 18DIGIT   ; exactly 18 digits
gdti-value          = 13DIGIT [1*17XCHAR]
                      ; 13 digits then optional 1-17 characters
                      ; from the 82-character subset
ginc-value          = 1*30XCHAR
                      ; 1-30 characters from the 82-character subset
gsin-value          = 17DIGIT   ; exactly 17 digits
grai-value          = 13DIGIT [1*16XCHAR]
                      ; 13 digits then optional 1-16 characters
                      ; from the 82-character subset of ISO/IEC 646
giai-value          = 1*30XCHAR  ; 1-30 characters from 82-chr subset
```

4.6 Key qualifier formats

The following rules express the format of the values of the key qualifiers of primary identification keys:

```
cpv-value           = 1*20XCHAR  ; 1-20 characters from 82-chr subset
lot-value           = 1*20XCHAR  ; 1-20 characters from 82-chr subset
ser-value           = 1*20XCHAR  ; 1-20 characters from 82-chr subset
cpsn-value          = 1*12DIGIT  ; 1-12 digits
glnx-value          = 1*20XCHAR  ; 1-20 characters from 82-chr subset
refno-value         = 1*25XCHAR  ; 1-25 characters from 82-chr subset
srin-value          = 1*10DIGIT  ; 1-10 digits
tpx-value           = 1*28XCHAR  ; 1-28 characters from 82-chr subset
uic-ext-value       = 1DIGIT 3XCHAR
                    ; 1 digit then 3 characters from 82-chr subset
```

4.7 Primary identification key concatenation

The following rules express how each primary identification key code and its value should be concatenated (for use within the URI path information):

```
gtin-comp           = "/" gtin-code "/" gtin-value
itip-comp           = "/" itip-code "/" itip-value
gmn-comp            = "/" gmn-code "/" gmn-value
cpid-comp           = "/" cpid-code "/" cpid-value
gln-comp            = "/" gln-code "/" gln-value
payTo-comp          = "/" payTo-code "/" payTo-value
partyGln-comp       = "/" partyGln-code "/" partyGln-value
gsrnp-comp          = "/" gsrnp-code "/" gsrnp-value
gsrn-comp           = "/" gsrn-code "/" gsrn-value
gcn-comp            = "/" gcn-code "/" gcn-value
```

```
sscc-comp           = "/" sscc-code "/" sscc-value
gdti-comp           = "/" gdti-code "/" gdti-value
ginc-comp           = "/" ginc-code "/" ginc-value
gsin-comp           = "/" gsin-code "/" gsin-value
grai-comp           = "/" grai-code "/" "0" grai-value
giai-comp           = "/" giai-code "/" giai-value
```

4.8 Key qualifier concatenation

The following rules express how each key qualifier and its value should be concatenated (for use within the URI path information):

```
cpv-comp            = "/" cpv-code "/" cpv-value
lot-comp            = "/" lot-code "/" lot-value
ser-comp            = "/" ser-code "/" ser-value
cpsn-comp           = "/" cpsn-code "/" cpsn-value
glnx-comp           = "/" glnx-code "/" glnx-value
refno-comp          = "/" refno-code "/" refno-value
srin-comp           = "/" srin-code "/" srin-value
tpx-comp            = "/" tpx-code "/" tpx-value
uic-ext-comp        = "/" uic-ext-code "/" uic-ext-value
```

4.9 Path element order

The following rules express how the URI path information should be structured for each primary identification key. Note that some primary identification keys such as SSCC do not have any associated key qualifier. Other primary identification keys such as GTIN, may have multiple key qualifiers. The square bracket notation indicates that the enclosed key qualifier component may be omitted but the sequence in which they appear is important and must be preserved. For example, the rule for gtin-path would permit any of these:

```
/01/09520123456788/22/2A/10/ABC123/21/12345XYZ
/01/09520123456788/10/ABC123/
/01/09520123456788/10/ABC123/21/12345XYZ
/01/09520123456788/21/12345XYZ
```

but does not permit strings such as:

```
/01/09520123456788/21/12345XYZ/10/ABC123
```

in which the sequential ordering of the key qualifier components is not preserved.

```
gtin-path           = gtin-comp  [cpv-comp] [lot-comp] [ser-comp]
itip-path           = itip-comp  [cpv-comp] [lot-comp] [ser-comp]
gmn-path            = gmn-comp
cpid-path           = cpid-comp  [cpsn-comp]
gln-path            = gln-comp   [glnx-comp]
payTo-path          = payTo-comp refNo-comp
partyGln-path       = partyGln-comp
gsrnp-path          = gsrnp-comp [srin-comp]
gsrn-path           = gsrn-comp  [srin-comp]
gcn-path            = gcn-comp
sscc-path           = sscc-comp
gdti-path           = gdti-comp
```

```
ginc-path            = ginc-comp
gsin-path            = gsin-comp
grai-path            = grai-comp
giai-path            = giai-comp
upui-path            = gtin-comp tpx-comp
eoid-path            = partyGln-comp uic-ext-comp
fid-path             = gln-comp uic-ext-comp
mid-path             = giai-comp uic-ext-comp
```

The following rule simply states that any of the above is considered as a gs1path (which will be referenced in a later rule).

```
gs1path    =     gtin-path / itip-path / gmn-path / cpid-path / gln-path /
                 payTo-path / partyGln-path / gsrnp-path / gsrn-path /
                 gcn-path / sscc-path / gdti-path / ginc-path / gsin-path /
                 grai-path / giai-path / upui-path / eoid-path / fid-path /
                 mid-path
```

4.10 Data attributes

The following rules are concerned with GS1 Application Identifiers for GS1 informative data that are considered to be data attributes rather than primary identification keys or key qualifiers. Data attributes and their values SHALL be expressed via the URI query string as key=value pairs.

Note that 'data attributes' MAY include GS1 AIs that may also be used as primary identification keys and key qualifiers, as defined in sections 4.3, 4.4. This is because the GS1 General Specifications [GENSPECS] defines GS1 element strings which allow multiple GS1 identifiers (i.e., simple GS1 identifiers or compound GS1 identifiers). For example, it is possible to encode both a GTIN and a GIAI in a single GS1 element string within a data carrier (see the example in section 5.11). Where it is necessary to encode more than one GS1 identifier in a single GS1 Digital Link URI, one GS1 identifier SHALL be expressed as the primary identification key (with any relevant key qualifiers) in the path and the remaining GS1 identifier (with any relevant key qualifiers) SHALL be expressed as a data attribute in the query string.

```
netWeightVMTICode   = "3100" / "3101" / "3102" / "3103" / "3104" / "3105" /
                      "3200" / "3201" / "3202" / "3203" / "3204" / "3205" /
                      "3560" / "3561" / "3562" / "3563" / "3564" / "3565" /
                      "3570" / "3571" / "3572" / "3573" / "3574" / "3575"
netWeightVMTIValue        = 6DIGIT
netWeightVMTIParameter = netWeightVMTICode "=" netWeightVMTIValue

lengthVMTICode = "3110" / "3111" / "3112" / "3113" / "3114" / "3115" /
                 "3210" / "3211" / "3212" / "3213" / "3214" / "3215" /
                 "3220" / "3221" / "3222" / "3223" / "3224" / "3225" /
                 "3230" / "3231" / "3232" / "3233" / "3234" / "3235"
lengthVMTIValue     = 6DIGIT
lengthVMTIParameter = lengthVMTICode "=" lengthVMTIValue

widthVMTICode = "3120" / "3121" / "3122" / "3123" / "3124" / "3125" /
                "3240" / "3241" / "3242" / "3243" / "3244" / "3245" /
                "3250" / "3251" / "3252" / "3253" / "3254" / "3255" /
                "3260" / "3261" / "3262" / "3263" / "3264" / "3265"
widthVMTIValue     = 6DIGIT
widthVMTIParameter = widthVMTICode "=" widthVMTIValue

depthVMTICode = "3130" / "3131" / "3132" / "3133" / "3134" / "3135" /
                "3270" / "3271" / "3272" / "3273" / "3274" / "3275" /
                "3280" / "3281" / "3282" / "3283" / "3284" / "3285" /
                "3290" / "3291" / "3292" / "3293" / "3294" / "3295"
```

```
depthVMTIValue     = 6DIGIT
depthVMTIParameter = depthVMTICode "=" depthVMTIValue

areaVMTICode = "3140" / "3141" / "3142" / "3143" / "3144" / "3145" /
               "3500" / "3501" / "3502" / "3503" / "3504" / "3505" /
               "3510" / "3511" / "3512" / "3513" / "3514" / "3515" /
               "3520" / "3521" / "3522" / "3523" / "3524" / "3525"
areaVMTIValue     = 6DIGIT
areaVMTIParameter = areaVMTICode "=" areaVMTIValue

netVolumeVMTICode = "3150" / "3151" / "3152" / "3153" / "3154" / "3155" /
                    "3160" / "3161" / "3162" / "3163" / "3164" / "3165" /
                    "3600" / "3601" / "3602" / "3603" / "3604" / "3605" /
                    "3610" / "3611" / "3612" / "3613" / "3614" / "3615" /
                    "3640" / "3641" / "3642" / "3643" / "3644" / "3645" /
                    "3650" / "3651" / "3652" / "3653" / "3654" / "3655" /
                    "3660" / "3661" / "3662" / "3663" / "3664" / "3665"
netVolumeVMTIValue     = 6DIGIT
netVolumeVMTIParameter = netVolumeVMTICode "=" netVolumeVMTIValue


massPerUnitAreaVMTICode      = "3370" / "3371" / "3372" / "3373" / "3374" /
                               "3375"
massPerUnitAreaVMTIValue     = 6DIGIT
massPerUnitAreaVMTIParameter = massPerUnitAreaVMTICode "="
                                                 massPerUnitAreaVMTIValue


grossWeightCode   = "3300" / "3301" / "3302" / "3303" / "3304" / "3305" /
                    "3400" / "3401" / "3402" / "3403" / "3404" / "3405"
grossWeightValue     = 6DIGIT
grossWeightParameter = grossWeightCode "=" grossWeightValue

logisticLengthCode = "3310" / "3311" / "3312" / "3313" / "3314" / "3315" /
                     "3410" / "3411" / "3412" / "3413" / "3414" / "3415" /
                     "3420" / "3421" / "3422" / "3423" / "3424" / "3425" /
                     "3430" / "3431" / "3432" / "3433" / "3434" / "3435"
logisticLengthValue     = 6DIGIT
logisticLengthParameter = logisticLengthCode "=" logisticLengthValue

logisticWidthCode = "3320" / "3321" / "3322" / "3323" / "3324" / "3325" /
                    "3440" / "3441" / "3442" / "3443" / "3444" / "3445" /
                    "3450" / "3451" / "3452" / "3453" / "3454" / "3455" /
                    "3460" / "3461" / "3462" / "3463" / "3464" / "3465"
logisticWidthValue        = 6DIGIT
logisticWidthParameter    = logisticWidthCode "=" logisticWidthValue

logisticDepthCode = "3330" / "3331" / "3332" / "3333" / "3334" / "3335" /
                    "3470" / "3471" / "3472" / "3473" / "3474" / "3475" /
                    "3480" / "3481" / "3482" / "3483" / "3484" / "3485" /
                    "3490" / "3491" / "3492" / "3493" / "3494" / "3495"
logisticDepthValue        = 6DIGIT
logisticDepthParameter    = logisticDepthCode "=" logisticDepthValue

logisticAreaCode = "3340" / "3341" / "3342" / "3343" / "3344" / "3345" /
                   "3530" / "3531" / "3532" / "3533" / "3534" / "3535" /
                   "3540" / "3541" / "3542" / "3543" / "3544" / "3545" /
                   "3550" / "3551" / "3552" / "3553" / "3554" / "3555"
logisticAreaValue         = 6DIGIT
logisticAreaParameter     = logisticAreaCode "=" logisticAreaValue
```

```
logisticVolumeCode = "3350" / "3351" / "3352" / "3353" / "3354" / "3355" /
                     "3360" / "3361" / "3362" / "3363" / "3364" / "3365" /
                     "3620" / "3621" / "3622" / "3623" / "3624" / "3625" /
                     "3630" / "3631" / "3632" / "3633" / "3634" / "3635" /
                     "3670" / "3671" / "3672" / "3673" / "3674" / "3675" /
                     "3680" / "3681" / "3682" / "3683" / "3684" / "3685" /
                     "3690" / "3691" / "3692" / "3693" / "3694" / "3695"
logisticVolumeValue       = 6DIGIT
logisticVolumeParameter   = logisticVolumeCode "=" logisticVolumeValue

processorCode = "7030" / "7031" / "7032" / "7033" / "7034" / "7035" /
                "7036" / "7037" / "7038" / "7039"
processorValue      = 3DIGIT 1*27XCHAR
processorParameter  = processorCode "=" processorValue

contentParameter          = "02=" 14DIGIT

prodDateParameter         = "11=" 6DIGIT

dueDateParameter          = "12=" 6DIGIT

packDateParameter         = "13=" 6DIGIT

bestBeforeDateParameter   = "15=" 6DIGIT

sellByDateParameter       = "16=" 6DIGIT

firstFreezeDateParameter  = "7006=" 6DIGIT

harvestDateParameter      = "7007=" 6DIGIT [6DIGIT]

testByDateParameter       = "7011=" 6DIGIT [4DIGIT]

pricePerUnitParameter     = "8005=" 6DIGIT

variantParameter          = "20=" 2DIGIT

varCountParameter         = "30=" 1*8DIGIT

countParameter            = "37=" 1*8DIGIT

mutualParameter           = "90=" 1*30XCHAR

additionalIdParameter     = "240=" 1*30XCHAR

custPartNoParameter       = "241=" 1*30XCHAR

mtoVariantParameter       = "242=" 1*6DIGIT

pcnParameter              = "243=" 1*20XCHAR

secondarySerialParameter  = "250=" 1*30XCHAR

refToSourceParameter      = "251=" 1*30XCHAR

amountCode                = "3900" / "3901" / "3902" / "3903" / "3904" /
                            "3905" / "3906" / "3907" / "3908" / "3909"

amountValue               = 1*15DIGIT
```

```
amountParameter           = amountCode "=" amountValue

amountISOCode             = "3910" / "3911" / "3912" / "3913" / "3914" /
                            "3915" / "3916" / "3917" / "3918" / "3919"
amountISOValue            = 3DIGIT 1*15DIGIT

amountISOParameter        = amountISOCode "=" amountISOValue

priceCode                 = "3920" / "3921" / "3922" / "3923" / "3924" /
                            "3925" / "3926" / "3927" / "3928" / "3929"
priceValue                = 1*15DIGIT

priceParameter            = priceCode "=" priceValue

priceISOCode              = "3930" / "3931" / "3932" / "3933" / "3934" /
                            "3935" / "3936" / "3937" / "3938" / "3939"
priceISOValue             = 3DIGIT  1*15DIGIT

priceISOParameter         = priceISOCode "=" priceISOValue

percentOffCode            = "3940" / "3941" / "3942" / "3943"

percentOffValue           = 4DIGIT

percentOffParameter       = percentOffCode "=" percentOffValue

orderNumberParameter      = "400=" 1*30XCHAR

routeParameter            = "403=" 1*30XCHAR

shipToLocParameter        = "410=" 13DIGIT

billToParameter           = "411=" 13DIGIT

purchaseFromParameter     = "412=" 13DIGIT

shipForLocParameter       = "413=" 13DIGIT

prodServLocParameter      = "416=" 13DIGIT

shipToPostParameter       = "420=" 1*20XCHAR

shipToPostISOParameter    = "421=" 3DIGIT 1*9XCHAR

originParameter           = "422=" 3DIGIT

countryProcessParameter   = "424=" 3DIGIT

countryFullProcessParameter  = "426=" 3DIGIT

countryInitialProcessParameter     = "423=" 3DIGIT 1*12DIGIT

countryDisassemblyParameter  = "425=" 3DIGIT 1*12DIGIT

originSubdivisionParameter   = "427=" 1*3XCHAR

nhrnPZNParameter          = "710=" 1*20XCHAR

nhrnCIPParameter          = "711=" 1*20XCHAR
```

```
nhrnCNParameter           = "712=" 1*20XCHAR

nhrnDRNParameter          = "713=" 1*20XCHAR

nhrnAIMParameter          = "714=" 1*20XCHAR

nhrnUS-FDAParameter       = "715=" 1*20XCHAR

nhrnAICParameter          = "716=" 1*20XCHAR

nhrnSRNParameter          = "717=" 1*20XCHAR

nsnParameter              = "7001=" 13DIGIT

meatCutParameter          = "7002=" 1*30XCHAR

activePotencyParameter    = "7004=" 1*4DIGIT

catchAreaParameter        = "7005=" 1*12XCHAR

aquaticSpeciesParameter   = "7008=" 1*3XCHAR

fishingGearTypeParameter  = "7009=" 1*10XCHAR

prodMethodParameter       = "7010=" 1*2XCHAR

refurbLotParameter        = "7020=" 1*20XCHAR

funcStatParameter         = "7021=" 1*20XCHAR

revStatParameter          = "7022=" 1*20XCHAR

giaiAssemblyParameter     = "7023=" 1*30XCHAR

ufrgtUnitTypeParameter    = "7041=" 1*4XCHAR

certificationRefCode      = "7230" / "7231" / "7232" / "7233" / "7234" /
                            "7235" / "7236" / "7237" / "7238" / "7239"

certificationRefValue     = 2XCHAR 1*28XCHAR

certificationRefParameter = certificationRefCode "=" certificationRefValue

protocolParameter         = "7240=" 1*20XCHAR

aidcMediaTypeParameter    = "7241=" 2DIGIT

vcnParameter              = "7242=" 1*25XCHAR

dobParameter              = "7250=" 8DIGIT

dobTimeParameter          = "7251=" 12DIGIT

bioSexParameter           = "7252=" 1DIGIT

familyNameParameter       = "7253=" 1*40XCHAR

givenNameParameter        = "7254=" 1*40XCHAR
```

```
suffixParameter           = "7255=" 1*10XCHAR
fullNameParameter         = "7256=" 1*90XCHAR
personAddrParameter       = "7257=" 1*70XCHAR
birthSequenceParameter    = "7258=" 1DIGIT "/" 1DIGIT
babyParameter             = "7259=" 1*40XCHAR
dimensionsParameter       = "8001=" 14DIGIT
cmtNoParameter            = "8002=" 1*20XCHAR
ibanParameter             = "8007=" 1*34XCHAR
prodTimeParameter         = "8008=" 8DIGIT [2DIGIT] [2DIGIT]
opticalSensorParameter    = "8009=" 1*50XCHAR
versionParameter          = "8012=" 1*20XCHAR
itipContentParameter      = "8026=" 14DIGIT 2DIGIT 2DIGIT
digSigParameter           = "8030=" 1*90ZCHAR
imeiParameter             = "8040=" 15DIGIT
imei2Parameter            = "8041=" 15DIGIT
eSimParameter             = "8042=" 32DIGIT
pSimParameter             = "8043=" 18DIGIT [1*2DIGIT]
couponIDNAParameter       = "8110=" 1*70XCHAR
pointsParameter           = "8111=" 4DIGIT
paperlessCouponIDNAParameter = "8112=" 1*70XCHAR
shipToCompParameter       = "4300=" 1*35XCHAR
shipToNameParameter       = "4301=" 1*35XCHAR
shipToAdd1Parameter       = "4302=" 1*70XCHAR
shipToAdd2Parameter       = "4303=" 1*70XCHAR
shipToSubParameter        = "4304=" 1*70XCHAR
shipToLocalityParameter   = "4305=" 1*70XCHAR
shipToRegParameter        = "4306=" 1*70XCHAR
shipToCountryParameter    = "4307=" 2XCHAR
shipToPhoneParameter      = "4308=" 1*30XCHAR
shipToGeoParameter        = "4309=" 20DIGIT
```

```
rtnToCompParameter        = "4310=" 1*35XCHAR

rtnToNameParameter        = "4311=" 1*35XCHAR

rtnToAdd1Parameter        = "4312=" 1*70XCHAR

rtnToAdd2Parameter        = "4313=" 1*70XCHAR

rtnToSubParameter         = "4314=" 1*70XCHAR

rtnToLocParameter         = "4315=" 1*70XCHAR

rtnToRegParameter         = "4316=" 1*70XCHAR

rtnToCountryParameter     = "4317=" 2XCHAR

rtnToPostParameter        = "4318=" 1*20XCHAR

rtnToPhoneParameter       = "4319=" 1*30XCHAR

srvDescriptionParameter   = "4320=" 1*35XCHAR

dangerousGoodsParameter   = "4321=" BOOLEAN

authToLeaveParameter      = "4322=" BOOLEAN

sigRequiredParameter      = "4323=" BOOLEAN

notBeforeDelDateParameter = "4324=" 10DIGIT

notAfterDelDateParameter  = "4325=" 10DIGIT

releaseDateParameter      = "4326=" 6DIGIT

maxTempFParameter         = "4330=" 6DIGIT ["-"]

maxTempCParameter         = "4331=" 6DIGIT ["-"]

minTempFParameter         = "4332=" 6DIGIT ["-"]

minTempCParameter         = "4333=" 6DIGIT ["-"]

amountPayPerUnitCode      = "3950" / "3951" / "3952" / "3953" / "3954" /
                             "3955"
amountPayPerUnitValue     = 6DIGIT
amountPayPerUnitParameter = amountPayPerUnitCode "=" amountPayPerUnitValue

gtinParameter             = gtin-code "=" gtin-value

itipParameter             = itip-code "=" itip-value

gmnParameter              = gmn-code "=" gmn-value

cpidParameter             = cpid-code "=" cpid-value

glnParameter              = gln-code "=" gln-value

payToParameter            = payTo-code "=" payTo-value

partyGlnParameter         = partyGln-code "=" partyGln-value
```

```
gsrnpParameter          = gsrnp-code "=" gsrnp-value

gsrnParameter           = gsrn-code "=" gsrn-value

gcnParameter            = gcn-code "=" gcn-value

ssccParameter           = sscc-code "=" sscc-value

gdtiParameter           = gdti-code "=" gdti-value

gincParameter           = ginc-code "=" ginc-value

gsinParameter           = gsin-code "=" gsin-value

graiParameter           = grai-code "=" "0" grai-value

giaiParameter           = giai-code "=" giai-value

internalCode            = "91" / "92" / "93" / "94" / "95" /
                          "96" / "97" / "98" / "99"
internalValue           = 1*90XCHAR

internalParameter       = internalCode "=" internalValue
```

Batch/Lot, which is defined as a key qualifier in sections 4.5 and 4.6, may also be used as a data attribute in conjunction with an SSCC [AI (00)] and a CONTENT [AI (02)] in order to indicate that the SSCC contains GTINs of a specific batch/lot. For this reason, `lotParameter` is defined for use within the URI query string.

```
lotParameter     = lot-code "=" lot-value
```

Expiry Date [AI (17)] and Expiry Date/Time [AI (7003)] are data attributes..

```
expiryDateParameter    = "17=" 6DIGIT

expiryTimeParameter    = "7003=" 10DIGIT
```

Note that the following data attributes are intentionally omitted:

- Extended Packaging URL [AI (8200)] is not expected to be used within a GS1 Digital Link URI, as it is an alternate approach to enable extended packaging applications pre-dating the development of the GS1 Digital Link Standard: URI Syntax.
- Identification of a Made-to-order (MtO) trade item (GTIN) [AI (03)] and Highly Individualised Device Registration Identifier (HIDRI) [AI (8014)] are defined for the Master Unique Device Identifier - Device Identifier (M-UDI-DI) restricted application, and as such are not permitted for use in a GS1 Digital Link URI syntax.
- See Section 2 Application Standards in the GS1 General Specifications [GENSPECS], for more information.

4.10.1 Extension mechanism and reserved keywords

The URI query string is a natural extension point within the syntax that can accommodate additional key=value pairs to express data attribute parameters that cannot be expressed using GS1 Application Identifiers. Examples of such usage may be to express a specific role, action, activity or type of service to be accessed. The following `extensionParameter` is based on the ABNF rule for query appearing in [RFC 3986] and serves as the main extension point for the GS1 Digital Link URI syntax. It permits multiple arbitrary key=value pairs to be included within the query string of a GS1

Digital Link URI. Any key=value pairs used for extension data SHALL NOT use all-numeric keys to avoid conflict with existing and future keys used for GS1 Application Identifiers either in terms of semantics or syntax; nor should they be used to express a value (such as a value for net weight) if that value can be expressed using GS1 Application Identifiers as data attributes. As detailed in GS1-Conformant Resolver Standard [DL-Resolution], the keywords `linkType` and `context` are also reserved and SHALL NOT be used except as defined in those sections.

```
extensionKey = *( DIGIT ) everythingExceptDigitsAndEquals
                *( DIGIT / everythingExceptDigitsAndEquals)

extensionValue = *( DIGIT / everythingExceptDigitsAndEquals / "=")

extensionParameter = extensionKey "=" extensionValue

                ; any other query string parameter permitted by RFC 3986
                ; including additional arbitrary key=value pairs except as
                ; restricted in the above paragraph
```

For example, `23P=12098` is a valid `extensionParameter`, whereas `236=12098` is an invalid `extensionParameter` because as an all-numeric key, it might in future collide with [AI (236)], which is reserved for future assignment as a GS1 Application Identifier. Please refer to section 4.11 Constructing the GS1 Digital Link URI to see further details about the rule for `everythingExceptDigitsAndEquals`.

4.10.2 Constructing the query string

The following rule states that any of the above parameters for data attributes may appear as a query string parameter (`queryStringParam`), referenced later.

```
queryStringParam  = netWeightVMTIParameter / lengthVMTIParameter /
                    widthVMTIParameter / depthVMTIParameter / areaVMTIParameter /
                    netVolumeVMTIParameter / massPerUnitAreaVMTIParameter /
                    grossWeightParameter / logisticLengthParameter /
                    logisticWidthParameter / logisticDepthParameter /
                    logisticAreaParameter / logisticVolumeParameter /
                    processorParameter / lotParameter / expiryDateParameter /
                    expiryTimeParameter / contentParameter / prodDateParameter /
                    dueDateParameter / packDateParameter / bestBeforeDateParameter /
                    sellByDateParameter / firstFreezeDateParameter /
                    harvestDateParameter / testByDateParameter /
                   aidcMediaTypeParameter / vcnParameter / dobParameter /
                   dobTimeParameter / bioSexParameter / familyNameParameter /
                   givenNameParameter / suffixParameter / fullNameParameter /
                   personAddrParameter / birthSequenceParameter / babyParameter /
                   pricePerUnitParameter / variantParameter / varCountParameter /
                   countParameter / amountPayPerUnitParameter /
                    additionalIdParameter / custPartNoParameter /
                    mtoVariantParameter / pcnParameter / secondarySerialParameter /
                    refToSourceParameter / amountParameter / amountISOParameter /
                    priceParameter / priceISOParameter / percentOffParameter /
                    orderNumberParameter / routeParameter / shipToLocParameter /
                    billToParameter / purchaseFromParameter / shipForLocParameter /
                    prodServLocParameter / shipToPostParameter /
                    shipToPostISOParameter / originParameter /
                    countryProcessParameter / countryFullProcessParameter /
                    countryInitialProcessParameter / countryDisassemblyParameter /
                    originSubdivisionParameter / nhrnPZNParameter /nhrnCIPParameter /
                    nhrnCNParameter / nhrnDRNParameter / nhrnAIMParameter /
                   nhrnUS-FDAParameter / nhrnAICParameter / nhrnSRNParameter /
                   nsnParameter / meatCutParameter / activePotencyParameter /
                   catchAreaParameter / fishingGearTypeParameter /
                   prodMethodParameter / refurbLotParameter / funcStatParameter /
                   revStatParameter /  giaiAssemblyParameter / ufrgtUnitTypeParameter
                   / dimensionsParameter / cmtNoParameter / ibanParameter /
                   prodTimeParameter / versionParameter / digSigParameter /
```

```
imeiParameter / imei2Parameter / eSimParameter /
pSimParameter / couponIDNAParameter / pointsParameter /
itipContentParameter / certificationRefParameter /
protocolParameter / aquaticSpeciesParameter /
opticalSensorParameter / paperlessCouponIDNAParameter /
internalParameter / mutualParameter / extensionParameter /

shipToCompParameter / shipToNameParameter /
shipToaAdd1Parameter / shipToaAdd2Parameter /
shipToSubParameter / shipToLocalityParameter /
shipToRegParameter / shipToCountryParameter /
shipToPhoneParameter / shipToGeoParameter  /
rtnToCompParameter / rtnToNameParameter /
rtnToAdd1Parameter / rtnToAdd2Parameter /
rtnToSubParameter / rtnToLocParameter / rtnToRegParameter /
rtnToCountryParameter / rtnToPostParameter /
rtnToPhoneParameter / srvDescriptionParameter /
dangerousGoodsParameter / authToLeaveParameter /
sigRequiredParameter / notBeforeDelDateParameter /
notAfterDelDateParameter / releaseDateParameter /
maxTempFParameter / maxTempCParameter / minTempFParameter /
minTempCParameter / gtinParameter  / itipParameter /
gmnParameter / cpidParameter / glnParameter / payToParameter /
partyGlnParameter / gsrnpParameter / gsrnParameter /
gcnParameter / ssccParameter / gdtiParameter / gincParameter /
gsinParameter / graiParameter / giaiParameter
```

4.11 Constructing the GS1 Digital Link URI

The following rules are derived from rules appearing in [RFC 3986] and are used for defining the general structure of a Web URI. These are particularly relevant for GS1 Digital Link URIs that are not under the id.gs1.org domain.

```
scheme                = "http" / "https" / “HTTP” / “HTTPS”

unreserved            = ALPHA / DIGIT / "-" / "." / "_" / "~"

reserved              = gen-delims / sub-delims

pct-encoded           = "%" HEXDIG HEXDIG

gen-delims            = ":" / "/" / "?" / "#" / "[" / "]" / "@"

sub-delims            = "!" / "$" / "&" / "'" / "(" / ")" / "*" /
                        "+" / "," / ";" / "="

sub-delims-without-equals = "!" / "$" / "&" / "'" / "(" / ")" /
                            "*" / "+" / "," / ";"

everythingExceptDigitsAndEquals = ALPHA / pct-encoded /
                                  sub-delims-without-equals /
                                  "-" / "." / "_" / "~" /
                                  ":" / "@" / "/" / "?"

pchar                 = unreserved / pct-encoded / sub-delims / ":" / "@"

segment               = *pchar

reg-name              = *( unreserved / pct-encoded / sub-delims )
```

```
dec-octet             = DIGIT                 ; 0-9
                      / %x31-39 DIGIT         ; 10-99
                      / "1" 2DIGIT            ; 100-199
                      / "2" %x30-34 DIGIT     ; 200-249
                      / "25" %x30-35          ; 250-255

IPv4address           = dec-octet "." dec-octet "." dec-octet "." dec-octet

IPv6address           = 6( h16 ":" ) ls32
                      /  "::" 5( h16 ":" ) ls32
                      / [ h16 ] "::" 4( h16 ":" ) ls32
                      / [ *1( h16 ":" ) h16 ] "::" 3( h16 ":" ) ls32
                      / [ *2( h16 ":" ) h16 ] "::" 2( h16 ":" ) ls32
                      / [ *3( h16 ":" ) h16 ] "::"    h16 ":"   ls32
                      / [ *4( h16 ":" ) h16 ] "::"              ls32
                      / [ *5( h16 ":" ) h16 ] "::"              h16
                      / [ *6( h16 ":" ) h16 ] "::"

ls32                  = ( h16 ":" h16 ) / IPv4address
                      ; least-significant 32 bits of address

h16                   = 1*4HEXDIG
                      ; 16 bits of address represented in hexadecimal

IP-literal            = "[" ( IPv6address / IPvFuture  ) "]"

IPvFuture             = "v" 1*HEXDIG "." 1*( unreserved / sub-delims / ":" )

host                  = IP-literal / IPv4address / reg-name

port                  = *DIGIT

hostname              = host [ ":" port ]
```

Finally, the following four rules define the syntax of a reference GS1 Digital Link URI (see section 4.12) from the concatenation of previously defined components:

```
queryStringDelim      = "&" / ";"

queryStringComp       =
            "?" queryStringParam *( queryStringDelim queryStringParam)

uncompressedGS1webURIPattern       = gs1path [queryStringComp]

referenceGS1webURI    = "https://id.gs1.org" uncompressedGS1webURIPattern
```

The following rules define the syntax of a non-reference GS1 Digital Link URI from the concatenation of previously defined components. An example of usage of a non-reference GS1 Digital Link URI is when a company chooses to use their own registered Internet domain name to construct the Web URI but aligns with this specification for the format of the final part of the URI path information and query string. Note that zero or more path segments are permitted to appear after the hostname or domain name and before the start of the `gs1uriPattern` defined in this specification.

```
optionalPathSegment   = "/" segment

customURIstem         = scheme "://" hostname *optionalPathSegment

uncompressedCustomGS1webURI  = customURIstem uncompressedGS1webURIPattern
```

The formal ABNF syntax for the URI should be read in combination with the GS1 General Specifications [GENSPECS] to ensure appropriate usage of GS1 Application Identifiers that represent

data attributes of identified things. In particular, section 4.13 of the GS1 General Specifications [GENSPECS] provides guidance about data relationships, including invalid pairs of element strings (see section 4.13.1) and mandatory associations of element strings (see section 4.13.2). In the GS1 General Specifications [GENSPECS], section 2 specifies which GS1 identifiers are used for an application, section 3 provides definitions for each GS1 Application Identifier, while section 4 explains the management rules for each GS1 identification key.

As previously mentioned, some GS1 identifiers include GS1 check digits or GS1 check character pairs and some also include indicator digits or extension digits that are to be used for specific purposes. Section 7 of the GS1 General Specifications [GENSPECS] provides details of AIDC validation rules and section 7.2.7 explains the GS1 check digit calculation. Nothing in this GS1 specification changes the existing validation rules that apply to the values of GS1 Application Identifiers; this document only specifies how valid GS1 AI values shall be expressed in the GS1 Digital Link structure.

Any URI that conforms to the formal syntax as defined above and that respects the relevant rules specified in the GS1 General Specifications [GENSPECS] as cited is:

1. a valid Web URI that can be dereferenced on the Web without further processing;
2. a valid expression of one or more GS1 Application Identifiers and their values, informationally equivalent to the same data expressed in GS1 AI syntax.

4.12 Canonical GS1 Digital Link URIs

A GS1 Digital Link URI can be constructed in any domain name, may contain additional key=value pairs in the query string and so on. This flexibility is a deliberate feature of the standard to support its use in as many scenarios as possible and to ensure brands can remain in control of the domains they use.

However, in some contexts (e.g., to support carriers that cannot embed a Web URI) it is necessary to identify a *single* well-known or default version of the GS1 Digital Link URI. This is defined in [RFC 6596] as the *canonical URI*. We define the canonical URI as follows:

- the scheme SHALL be HTTPS;
- the domain name SHALL be id.gs1.org;
- deprecated convenience string equivalents for GS1 AIs SHALL NOT be used;
- GTIN-8, GTIN-12 and GTIN-13 SHALL remain padded to 14 digits
- the URI query string (if present) SHALL NOT contain any other key=value pairs except for keys that are GS1 Application Identifiers;
- key=value pairs, if present, should be sorted in lexical, not numeric, order of the key;
- for clarity, this means that the parameters defined in GS1-Conformant Resolver Standard [DL-Resolution], namely `linkType` and `context`, and their values, are not included in the canonical GS1 Digital Link.

It follows that the canonical version of

`http://example.com/01/09520123456788/22/2A?linkType=gs1:traceability`

is

`https://id.gs1.org/01/09520123456788/22/2A`

Some further points of clarification:

- A canonical GS1 Digital Link URI, as defined in this section, is distinct from a reference GS1 Digital Link URI, which is defined as any valid GS1 Digital Link URI on the id.gs1.org domain. The other rules above do not apply to reference GS1 Digital Link URIs.
- The GS1-Conformant resolver standard [DL-Resolution] states that a trailing slash, while not-conformant, should be tolerated by resolvers. That is, a resolver should tolerate https://example.com/8003/0{grai}/ even though that final / character is not allowed by the formal ABNF. A canonical GS1 Digital Link URI SHALL NOT include a trailing slash.

- Version 2.3 of the GS1 EPC Tag Data Standard [TDS] introduces 12 new '++' EPC schemes such as SGTIN++ etc. These support lossless encoding/decoding of custom hostnames or domain names as part of the EPC binary string for such schemes, supporting lossless round-trip encoding/decoding between valid GS1 Digital Link URIs and corresponding EPC binary strings for the first time. Work is also underway to update the GS1 EPC Tag Data Translation Standard [TDT] from v2.2 to v2.3 to add automated translation support for these new '++' EPC schemes introduced normatively in TDS v2.3.

5 Examples of GS1 Digital Link URIs

This section is informative

5.1 GTIN

`https://id.gs1.org/01/09520123456788`

is the canonical Digital Link URI for GTIN `9520123456788` equivalent to the following GS1 element string:

`(01)09520123456788`

The following are further valid non canonical GS1 Digital Link URIs for GTIN `9520123456788` using a custom domain name e.g., example.com instead of `id.gs1.org`

`https://brand.example.com/01/09520123456788`

`https://brand.example.com/some-extra/pathinfo/01/09520123456788`

5.2 GTIN + CPV

`https://id.gs1.org/01/09520123456788/22/2A`

is the canonical GS1 Digital Link URI for GTIN `9520123456788` combined with Consumer Product Variant `'2A'` and equivalent to the following GS1 element string:

`(01)09520123456788(22)2A`

The following are further valid non canonical GS1 Digital Link URIs for GTIN `9520123456788` combined with Consumer Product Variant `'2A'`.

`https://brand.example.com/01/09520123456788/22/2A`

`https://retailer.example.com/01/09520123456788/22/2A`

5.3 GTIN + Batch/Lot

`https://id.gs1.org/01/09520123456788/10/ABC123`

is the canonical GS1 Digital Link URI for GTIN `9520123456788` combined with Batch/Lot `'ABC123'`and equivalent to the following GS1 element string:

`(01)09520123456788(10)ABC123`

The following are further non canonical valid GS1 Digital Link URIs for GTIN `9520123456788` combined with Batch/Lot `'ABC123'`

`https://brand.example.com/01/09520123456788/10/ABC123`

`https://retailer.example.com/01/09520123456788/10/ABC123`

5.4 GTIN + Serial Number

`https://id.gs1.org/01/09520123456788/21/12345`

is the canonical GS1 Digital Link URI for GTIN `9520123456788` combined with Serial Number `'12345'` and equivalent to the following GS1 element string:

(01)09520123456788(21)12345

The following are further valid GS1 Digital Link URIs for GTIN 9520123456788 combined with Serial Number '12345'

https://brand.example.com/01/09520123456788/21/12345

https://retailer.example.com/01/09520123456788/21/12345

5.5 GTIN + Batch/Lot + Serial Number + Expiry Date

https://id.gs1.org/01/09520123456788/10/ABC1/21/12345?17=180426

is the canonical GS1 Digital Link URI for GTIN 9520123456788 combined with Batch/Lot 'ABC1' and Serial Number '12345' and with an expiry date of 26th April 2018, equivalent to the following GS1 element string:

(01)09520123456788(17)180426(10)ABC1(21)12345

The following is also a valid non canonical GS1 Digital Link URI for GTIN 9520123456788 combined with Batch/Lot 'ABC1' and Serial Number '12345' and with an expiry date of 26th April 2018.

https://example.com/01/09520123456788/10/ABC1/21/12345?17=180426

5.6 GTIN + Net Weight

https://id.gs1.org/01/09520123456788?3103=000195

is the canonical GS1 Digital Link URI for GTIN 9520123456788 combined with a net weight of 0.195 kg equivalent to the following GS1 element string:

(01)09520123456788(3103)000195

The following is a further valid non canonical GS1 Digital Link URI for GTIN 9520123456788 combined with a net weight of 0.195 kg :

https://example.com/01/09520123456788?3103=000195

5.7 GTIN + Net weight + Amount payable + Expiration date

https://example.com/01/09520123456788?3103=000195&3922=0299&17=201225

This GS1 Digital Link URI includes three data attributes for the given GTIN, which can be in any order in the query string. The equivalent GS1 element string is:

(01)09520123456788(3103)000195(3922)0299(17)201225

The following GS1 Digital Link URIs are also equivalent, but only the final is canonical as the data attributes have been arranged in the lexical order of the GS1 AIs.

https://id.gs1.org/01/09520123456788?3103=000195&3922=0299&17=201225

https://id.gs1.org/01/09520123456788?17=201225&3103=000195&3922=0299

5.8 SSCC

https://id.gs1.org/00/195201234567891232

is the canonical GS1 Digital Link URI for SSCC 195201234567891232 equivalent to the following GS1 element string:

(00)195201234567891232

The following is a further valid non canonical GS1 Digital Link URI for SSCC `195201234567891232`:

`https://example.com/00/195201234567891232`

5.9 SSCC with specified Content, Count and Batch/Lot

`https://id.gs1.org/00/195201234567891232?02=09520123456788&37=25&10=ABC123`

is the canonical GS1 Digital Link URI for SSCC `195201234567891232` containing a count [AI (37)] of 25 instances of Content [AI (02)] `09520123456788` having Batch/Lot identifier [AI (10)] `'ABC123'` equivalent to the following GS1 element string:

`(00)195201234567891232(02)09520123456788(37)25(10)ABC123`

The following is a further non canonical valid GS1 Digital Link URI for SSCC `195201234567891232` containing a count [AI (37)] of 25 instances of Content [AI (02)] `09520123456788` having Batch/Lot identifier [AI (10)] `'ABC123'`:

`https://example.com/00/195201234567891232?02=09520123456788&37=25&10=ABC123`

5.10 Physical location represented by a GLN or GLN + GLN Extension

`https://id.gs1.org/414/9520123456788`

is the canonical GS1 Digital Link URI for GLN `9520123456788` equivalent to the following GS1 element string:

`(414)9520123456788`

`https://id.gs1.org/414/9520123456788/254/32a%2Fb`

is the canonical GS1 Digital Link URI for GLN `9520123456788` combined with a GLN extension `'32a/b'`. Note that because the forward slash character has a special meaning within Web URIs, it is replaced with `%2F`, its percent encoding, when it is being used as a literal value, rather than as a URI path separator, as defined in section 4.2.

It is equivalent to the following GS1 element string:

`(414)9520123456788(254)32a/b`

The following is also a valid but non canonical GS1 Digital Link URIs for GLN `9520123456788` :

`https://example.com/414/9520123456788`

The following is a further valid non canonical GS1 Digital Link URI for GLN `9520123456788` combined with a GLN extension `'32a/b'` :

`https://example.com/414/9520123456788/254/32a%2Fb`

5.11 GIAI + GTIN

`https://example.com/8004/95206141412345 67?01=09520123456788`

`https://example.com/01/09520123456788?8004=9520614141234567`

Both of these GS1 Digital Link URIs express the same combination of GS1 Application Identifiers. However, they are not equivalent. For the first example, in which the GIAI appears in the URI path information, the issuer of that GIAI asset identifier is the authority, whereas for the second example

in which the GTIN is in the URI path information, the licensee of the GTIN (typically the brand owner or manufacturer) is the authority for that GS1 Digital Link URI.
Although both identify an item with GIAI `9520614141234567` that is an instance of GTIN `9520123456788`, the choice of which identifier to place in the URI path information makes a difference from a semantic perspective. The first example expresses that "this thing is an asset identified by this GIAI – and it is/was also a product identified by this GTIN." The second example expresses that this is a product and that it also carries this asset identifier. The second example is unlikely to be encoded by the manufacturer or brand owner in a data carrier except when an instance of a product is manufactured for a specific known customer/asset owner. Most mass-produced products are made to stock rather than made to order/bespoke. This is an example where there are two GS1 identifiers in a single GS1 Digital Link URI, but only one can be expressed as the primary identification key. The equivalent GS1 element string is

`(01)09520123456788(8004)9520614141234567`

Although there are no specific rules about which of the two GS1 identifiers should go in the path as the primary identification key and which in the query string as a data attribute, the order is likely to be determined by the context. In this example, the GIAI will be assigned by the owner of the item who purchased it from the manufacturer who assigned the GTIN. In this scenario, it is the owner who would create the GS1 Digital Link URI and therefore it is very likely to be the GIAI that goes in the path – the owner's primary identification key – rather than the manufacturer. The presence of multiple GS1 identifiers and the decision on which serves as the primary identification key has an effect on the semantics that can be inferred from the URI. See GS1 Digital Link Standard for more on this topic [DL-Legacy].

6 AIDC Issues

This section is normative

The use of GS1 Digital Link URIs in data carriers is governed by the GS1 General Specifications [GENSPECS]. That document defines the full GS1 system from the semantics of individual GS1 Application Identifiers and their permitted values, through to data carrier positioning and human-readable information and much more besides.

The following subsections supplement the GS1 General Specifications [GENSPECS] as they pertain specifically to GS1 Digital Link.

6.1 Recognising a GS1 Digital Link URI

There is no special character that can be included in a data carrier to indicate that what follows is a GS1 Digital Link URI. This is because there is no special character in any data carrier to indicate that what follows is a URL – and GS1 Digital Link URIs are URLs. This is a deliberate and important design feature: a general purpose scanning application, such as a consumer's mobile device, can scan a GS1 Digital Link URI and treat it like any other URL.

Applications might, however, want to recognise a GS1 Digital Link URI and, for example, make use of the GS1 identifiers or execute specific queries against a resolver. Therefore, some processing is necessary by the scanner to determine whether the string of characters is or is not conformant to this and other GS1 standards.

A scanner working within the GS1 system that recognises GS1 Digital Link SHALL only pass on the scanned string if it has determined that it is *plausibly* a conformant GS1 Digital Link URI. It is not required to carry out a full validation, which is left to the receiving application.

We offer a method based on regular expression matches for making this determination in section 6.1.1 to 6.1.3, and a method using the GS1 Barcode Syntax Resource in section 6.1.1.4, but any method is acceptable. It does not give an absolute assurance that the string *is* a conformant GS1 Digital Link URI, rather it detects strings that are definitely not and plausibly are GS1 Digital Link URIs. This is in line with many scanning applications that will recognise the presence of indicator characters at the start of a barcode and act accordingly but will not process the scanned string further before passing it to a receiving application.

6.1.1 Matching an uncompressed GS1 Digital Link URI

The following regular expression will match a valid uncompressed GS1 Digital Link URI as defined in this specification. It is unlikely, although, not impossible, that it will match a URL that is not also a conformant GS1 Digital Link URI. Failure to match means it definitely is not an uncompressed GS1 Digital Link URI.

In addition to the GS1 Digital Link syntax, all regular expressions provided below support the inclusion of a user name and port number in the URL. These are rarely used in practice but are part of the formal URL syntax.

RE1:

```
^(https?|HTTPS?):(\/\/((([^\/?#]*)@)?([^\/?#:]*)(:([^\/?#]*))?))?([^?#]*)(((
\/(01|8006|8013|8010|414|415|417|8017|8018|255|00|253|401|402|8003|8004)\/)(
\d{4}[^\/]+)(\/[^/]+\/[^/]+)?[/]?(\?([^?\n]*))?(#([^\n]*))?))
```

6.1.2 Matching a compressed GS1 Digital Link URI

The following regular expression, RE2, will match a compressed or partially compressed GS1 Digital Link URI as defined in the GS1 Digital Link standard [DL-Legacy], with the same caveats as for RE1.

RE2:

```
^(https?|HTTPS?):(\/\/((([^\/?#]*)@)?([^\/?#:]*)(:([^\/?#]*))?))?([^?#]*)((\
/[0-9A-Za-z_-]{10,}$))
```

The following regular expression, RE3, will match a compressed or partially compressed GS1 Digital Link URI using the 'eh' or 'ex' flags, as defined in GS1 Digital Link URI: Compression Technical Standard for EPC binary strings [DL-CompressionEPC], with the same caveats as for RE1.

RE3:

```
^(https?|HTTPS?):(\/\/((([^\/?#]*)@)?([^\/?#:]*)(:([^\/?#]*))?))?([^?#]*)((\
/(eh[0-9a-f]*|ex[a-zA-Z0-9_-]*)$))
```

As a further warning, recall that a GS1 Digital Link URI may contain arbitrary path segments between the domain name and the primary identification key. It is unlikely but possible that those path segments will all be numeric. For legacy compressed GS1 Digital Link URIs, it is also possible that the compression algorithm may create an all-numeric output. RE2 must allow for this but the downside is that a URL like https://example.com/0123/456789012340123, which is **not** a valid uncompressed GS1 Digital Link URI and will fail to match RE1, will match RE2. RE3 does not have this specific limitation, since compressed strings matched by RE3 must begin with the eh or ex flag as defined by the GS1 Digital Link URI: Compression Technical Standard for EPC binary strings [DL-CompressionEPC].

NOTE: The GS1 Digital Link standard [DL-Legacy] defines a legacy algorithm for compression/decompression, that will not be maintained after version 1.1.4. Compressed GS1 Digital Link URIs that use the legacy specification are not expected to be used in any future Application Standards and are not approved for use in open supply chain standards. Compressed GS1 Digital Link URIs using the 'eh' or 'ex' flags defined by the GS1 Digital Link URI: Compression Technical Standard for EPC binary strings [DL-CompressionEPC] are the form expected to be used in future Application Standards and approved for use in open supply chain standards. For further information please refer to Application Standard Profile 4 in the GS1 General Specifications [GENSPECS].

6.1.3 Recommended procedure for regular expressions

Noting the limitations of regular expressions in the previous sections, we do not recommend combining RE2 or RE3 with RE1. Rather, the recommended procedure is that for a given input string:

1. If a given string matches RE1, it plausibly is an uncompressed GS1 Digital Link URI.
2. If it doesn't match that, but does match RE2 or RE3, then it plausibly is a compressed GS1 Digital Link URI.
3. If it matches none of the regular expressions here, it definitely is not a conformant GS1 Digital Link URI, compressed or otherwise.

6.1.4 Recognition using the GS1 Barcode Syntax Resource

While Regular Expressions provide a pattern-matching mechanism to determine whether a given data string is plausibly a GS1 Digital Link URI, the GS1 Barcode Syntax Resource [BSR] applies a dictionary-driven approach: https://ref.gs1.org/tools/gs1-barcode-syntax-resource/.

Unlike static patterns, the BSR first evaluates whether the input string resembles a URI and then validates the GS1 Application Identifiers and their associated values according to the rules defined by the GS1 General Specifications [GENSPECS] and this specification. This enables the BSR to determine whether the data string can be interpreted as a conformant GS1 Digital Link URI and processed as such by a GS1-aware system.

The BSR can detect a wide range of syntactical errors, including common errors related to GS1 AI structure, value formats, and data relationships. However, it does not aim to address all possible validation scenarios. In particular, it may not detect complex or context-dependent issues, such as ambiguous or non-compliant character usage within URI components. Such checks may require additional processing that may be developed as a user-specific requirement, beyond the scope of the BSR.

6.2 Human Readable Interpretation (HRI)

This standard defers entirely to the GS1 General Specifications [GENSPECS] for rules concerning human-readable interpretation.

7 Glossary

The glossary lists the terms and definitions that are applied in this document. Please refer to the www.gs1.org/glossary for the online version.

Term	Abbreviation /Acronym	Definition
brand owner		The organisation that owns the specifications of a trade item, regardless of where and by whom it is manufactured. The brand owner is normally responsible for the management of the Global Trade Item Number (GTIN).
canonical GS1 Digital Link URI		The definitive GS1 Digital Link URI for a given resource, that always begins with the scheme "HTTPS" and the domain "id.gs1.org.". If present, the URI query string does not contain any arbitrary key=value pairs, only key=value pairs defined by the GS1 Digital Link URI as data attributes, sorted in lexical, not numeric order of the GS1 Application Identifier.
compound GS1 identifier		Two or more data elements that combine a simple GS1 identifier and GS1 identifier extension(s), that identifies entities at sub-class level or instance level, where no subset of those data elements taken by themselves would do so.
consumer		Often considered as the "recipient" of the supply chain in the past, today's consumer is an active part of the supply chain and expects more data, with higher accuracy, and greater ease.
consumer product variant	CPV	An alphanumeric attribute of a GTIN assigned to a retail consumer trade item variant for its lifetime.
data attribute		The GS1 Application Identifier and its associated data element value that usually represents GS1 informative data within a GS1 Digital Link URI and is always expressed in the URI query string as a key=value pair. When there is more than one GS1 identifier in a GS1 Digital Link URI, one of the GS1 identifiers (with or without a GS1 identifier extension) is expressed the URI path as a primary identification key, while the others are expressed in the URI query string as a data attribute.
dereference		In the context of URIs, the use of an appropriate access mechanism (e.g. Web request) to perform an action on the URI's resource (e.g. to retrieve an information representation via HTTP GET or to send data to a resource via an HTTP POST operation). Dereferencing a URI is often considered synonymous with making a Web request or 'looking up' a URI on the Web.
domain name		A domain name is an identification string that defines a realm of administrative autonomy, authority or control within the Internet. Domain names are formed by the rules and procedures of the Domain Name System (DNS). Any name registered in the DNS is a domain name. Domain names are used in various networking contexts and application-specific naming and addressing purposes. Domain names provide an abstraction layer that separates a registered name for an organisation or activity from the actual internet addresses (IP addresses) that provide its associated information services such as its Website, its e-mail server etc. The system that connects the domain names with the corresponding IP addresses is the Domain Name System (DNS).
GS1 Application Identifier	GS1 AI	The field of two or more digits at the beginning of an element string that uniquely defines its format and meaning.
GS1 Application Identifier data field		The data used in a business application defined by one GS1 Application Identifier.
GS1 Digital Link URI		A Web URI syntax for expressing GS1 identifiers and GS1 informative data in a format using GS1 Application Identifiers and GS1 Application Identifier data fields as specified in the GS1 Digital Link standard.
GS1 element string		A syntax for expressing GS1 identifier keys and attributes in a format using GS1 Application Identifiers and GS1 Application Identifier data fields.
GS1 identification key	GS1 key	Numeric or alphanumeric strings that incorporate a GS1 Prefix, GS1 Company Prefix or GS1-8 Prefix and are the basis of the unique GS1 identifiers defined for use in an area of GS1 system application such as trade, logistics, or asset management. They may identify a class of entities (e.g., a trade item) or an instance of an entity (e.g., a logistic unit). The term GS1 identification key is for broad communications such as for marketing, licensing, policy etc.

Term	Abbreviation /Acronym	Definition
GS1 identifier		Data element(s) that expresses a GS1 identification key with or without a GS1 identifier extension, to identify an entity and connect to information about that entity. The term GS1 identifier is for greater precision at the technical level, such as for GS1 standards, GS1 guidelines and end-user implementations.
GS1 identifier extension		Data element that can be used with a simple GS1 identifier to form a compound GS1 identifier.
GS1 informative data		A data element that provides information about an entity identified with a GS1 identifier, such as a use by date, its weight, or country of origin code, for the purpose of informing or completing an action or decision.
key qualifier		The GS1 Application Identifier and its associated data element value that represents a GS1 identifier extension within a GS1 Digital Link URI. It is used together with a primary identification key as a compound GS1 identifier and is always expressed in the URI path in a defined sequence, ordered by level of identification granularity e.g., from class level to instance level.
key=value pair		A representation of data in which a key and its associated value are expressed as a pair, within the URI query string. In GS1 Digital Link URIs, GS1 Application Identifiers are expressed as the "key", also known as a parameter, and their associated data element values are expressed as the "value" when defined as a data attribute (which are usually, but not always, GS1 informative data) e.g., an expiry date (17) with a value of "221225" expressed as 17=221225. The URI query string also accommodates arbitrary key=value pairs, also known as extension parameters, which express data elements that do not use GS1 Application Identifiers e.g., "linkType=gs1:traceability", "utm_source=newsletter" etc. Multiple key=value pairs can be included in the URI query string, separated by the & character.
parsing		The process of analysing the structure of a sentence or URI structure in order to extract relevant information from it. Note that within the context of EPC URN structures, parsing refers to the ability to extract structural components within the EPC structure, e.g. for the purpose of matching against EPC URN patterns.
primary identification key		The GS1 Application Identifier and its associated data element value that represents a simple GS1 identifier within a GS1 Digital Link URI and is always expressed in the URI path.
QR Code symbology		A two-dimensional barcode symbology consisting of square modules arranged in a square pattern. The symbology is characterised by a unique finder pattern located at three corners of the symbol. QR Code symbols are read by two-dimensional imaging scanners or vision systems.
reference GS1 Digital Link URI		A GS1 Digital Link URI that uses the id.gs1.org domain
resolver		The term 'resolver' is not unique to GS1. It is the name for any service that accepts an identifier as input and passes the request about the identified item to information about it. In the GS1 context, a resolver connects a GS1-identified item to one or more online resources that are directly related to it. The item may be identified at any level of granularity, and the resources may be either human or machine readable. Examples include product information pages, instruction manuals, patient leaflets and clinical data, product data, service APIs, marketing experiences and more. GS1 resolvers are defined in the GS1-Conformant Resolver Standard.
retailer		An organisation engaged in the sale and distribution of products to consumers. Also includes online retailers/e-tailers
subdomain		A subdomain is a domain that is part of a main domain. Although example.com is a subdomain of the top-level domain (.com), we most often think of a subdomain as the part of the hostname that precedes the registered domain name. For example, the registered domain name gs1.org has one subdomain ('www') [as in www.gs1.org] that is used for its Website. It also has a subdomain ('id') [as in id.gs1.org] that is used for Web-based data services for GS1.

Term	Abbreviation /Acronym	Definition
Uniform Resource Identifier	URI	A string of characters used to identify a resource. The resource may be an information resource such as a Web page or a thing in the real world, such as a physical object, person or location. URIs refer to the superset of Uniform Resource Names (URNs), Uniform Resource Locators (URLs) and Web URIs (which can function both as globally unambiguous names, while also behaving like URLs by enabling intuitive retrieval of related information via the Web).
Uniform Resource Locator	URL	A specific type of URI colloquially known as Web address. A URL is a URI starting with http or https.
URI fragment identifier		The fragment identifier component of a URI allows indirect identification of a secondary resource by reference to a primary resource and additional identifying information. The identified secondary resource may be some portion or subset of the primary resource, some view on representations of the primary resource, or some other resource defined or described by those representations. A fragment identifier component is indicated by the presence of an octothorpe/hash/number sign ("#") character and terminated by the end of the URI. A typical use of a URI fragment identifier is to provide a direct link to a specific section within a very long Web document such as https://www.w3.org/TR/dwbp/#DataIdentifiers
URI path information		A path consists of a sequence of path segments separated by a slash ("/") character. A path is always defined for a URI, though the defined path may be empty (zero length). The path component contains data, usually organized in hierarchical form, that, along with data in the non-hierarchical query component, serves to identify a resource within the scope of the URI's scheme and naming authority (if any). The path is terminated by the first question mark ("?") or number sign ("#") character, or by the end of the URI.
URI query string		The query component contains non-hierarchical data that, along with data in the path component, serves to identify a resource within the scope of the URI's scheme and naming authority (if any). The query component is indicated by the first question mark ("?") character and terminated by a number sign ("#") character or by the end of the URI.

8 Changes since version 1.1

The single GS1 Digital Link standard version 1.1 [DL 1.1] has been split into four separate documents:

GS1 Digital Link Standard: URI syntax (this document)

GS1-Conformant Resolver Standard (formerly, GS1 Digital Link Standard: Resolution)

GS1 Digital Link Standard: Compression and decompression

GS1 Digital Link Standard: Semantics

The canonical version of a GS1 Digital Link URI, section 4.12, is now defined as using HTTPS and the key=value pairs in the query string are now sorted in lexical order of the AIs.

AIs in the 410-416 range, except 414 and 417, have been removed from the list of primary identification keys (section 4.3).

The ABNF grammar has been updated to support new AIs in the range 4300-4326 introduced in the GS1 General Specifications as a result of GS1 Scan4Transport.

AIs 3950 – 3953 added

ABNF for extension parameters made more precise to match normative text

All primary identification keys can be included in the query string to accommodate situations where a single URI needs to carry more than one primary identification key (section 4.10).

Convenience alphas deprecation notice (previously section 4.1, 4.13)

New paragraph emphasising that GS1 Digital Link URIs do not have to, and SHALL NOT be assumed to, point to a resolver (section 2).

Updated introduction.

Example GS1 identifiers changed to use the 952 prefix.

AIDC Considerations section added, including regular expressions for determining strings that definitely are not, or plausibly are, GS1 Digital Link URIs.

8.1 Changes since version 1.2

A number of minor inaccuracies were detected in how the URI syntax reflected the definition of GS1 identifiers. The purpose of the update to this version (1.2.1) was simply to correct these errors. The identifiers affected are:

- The final component of GCN, GDTI and GRAI are all optional (previous versions of the GS1 Digital Link URI Syntax suggested at least one serialisation character was required).
- The final component of GCN is all optional (previous versions of the GS1 Digital Link URI Syntax suggested at least one serialisation character was required).
- GMN now X..25 in line with changes in the GenSpecs between versions 19 and 21.
- Harvest date (7007) now accepts 6 or 12 digits but not intermediate numbers of digits.
- New AI 715, National Healthcare Reimbursement Number – USA NDC, added
- AIs 90, 240, 241, 242, 243, 250, 251, 400, 403, 8102 corrected all updated to allow CHAR, previously they were shown in GS1 Digital Link as being DIGIT only.
- AI 723s now 2*XCHAR 1*28XCHAR (previously it had been written as 2*30XCHAR)
- AI 8008 changed from 8DIGIT 1*4DIGIT to 8DIGIT [2DIGIT] [2DIGIT] which then tolerates 8 digits, 10 digits (if minutes are specified) or 12 digits (if minutes and seconds are specified) but does not tolerate 9 digits or 11 digits.
- It was recognised that `locNoParameter` is redundant because we also have `glnParameter` that expresses exactly the same thing.

8.2 Changes since version 1.2.1

- AI 415, Pay To, reinstated as a primary identification key (see, in particular, section 4.3)
- Convenience alphas, deprecated in version 1.2.0, and explained in section 4.1, have now been removed so that, for example, 'gtin' cannot be used instead of '01' in the path. This change is reflected throughout the document, starting with section 4.3.

8.3 Changes since version 1.3.0

- Primary identification key format for AI 01, GTIN, updated to be expressed as a 14-digit format, meaning GTIN-8, GTIN-12 and GTIN-13 SHALL always be prefixed with leading zeroes serving as filler digits.
- All new implementations of the GS1 Digital Link standard: URI Syntax SHALL express GTIN as a 14-digit string.

8.4 Changes since version 1.4.0

- Updated references and links to related GS1 Digital Link standards documents.
- Upper case scheme enabled, to align with RFC 3896.
- ABNF syntax for GRAI [AI (8003)] corrected to align with GS1 General Specifications, use of "0" as pad character, not as part of GRAI value.
- Improved consistency of ABNF grammar expressions for data attributes.
- Missing GS1 Application Identifiers and new character set ZSYMBOL and ZCHAR added to align with GS1 General Specifications, release 24.0
- Regular expressions updated to align with upper case scheme being enabled in release 1.5.0
- Section 5.7 title changed from "Best before date" to "Expiration date", to align with the GS1 Digital Link URI examples using Expiration date [AI (17)]

8.5 Changes since version 1.5.0

- Clarification that example GS1 Digital Link URIs are not configured to any demonstration Web pages
- New references to ISO/IEC 18975 added
- "refNo-comp" corrected to be mandatory for "payTo-path"
- Data attributes added to align with new GS1 Application Identifiers approved for GS1 General Specifications, release 25.0
- Updated note regarding intentional omission of GS1 AIs as data attributes
- ABNF for primary identification keys used as data attributes corrected
- Clarification on key=value pairs used as extension parameters - only the key (not the value) SHALL NOT be all numeric, to avoid conflict with current and future GS1 Application Identifiers

8.6 Changes since version 1.6.0

- Data attributes added to align with new GS1 Application Identifiers approved for GS1 General Specifications, release 26.0
- Terminology harmonised with the GS1 General Specifications, release 26.0, and WR 26-103 Glossary improvements
- Editorial changes for sections related to semantics and compression, to align with GS1 Digital Link Standard release 1.1.4 [DL-Legacy] and GS1 Digital Link URI: Compression Technical Standard for EPC binary strings release 1.0.0 [DL-CompressionEPC]

- New regular expression RE3 added to match a compressed or partially compressed GS1 Digital Link URI using the ‘eh’ or ‘ex’ flags as defined by GS1 Digital Link URI: Compression Technical Standard for EPC binary strings release 1.0.0 [DL-CompressionEPC]

- GS1 Barcode Syntax Resource added as an additional validation tool for recognising GS1 Digital Link URIs, to align with GS1 Digital Link URI: Compression Technical Standard for EPC binary strings [DL-CompressionEPC] release 1.0.0 and GS1-Conformant Resolver Standard [DL-Resolution] release 1.2.0

9 References

9.1 External references

[IRIs]

Internationalized Resource Identifiers (IRIs), Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc3987

[ISO/IEC 18975]

ISO/IEC 18975:2024 Information technology — Automatic identification and data capture techniques — Encoding and resolving identifiers over HTTP, International Organization for Standardization / International Electrotechnical Commission Joint Technical Committee 1 / Subcommittee 31 (ISO/IEC JTC 1/ SC 31)

https://www.iso.org/standard/85540.html

[Linked Data]

Linked Data, Tim Berners-Lee personal view only

https://www.w3.org/DesignIssues/LinkedData

[PercentEncoding]

Uniform Resource Identifier (URI): Generic Syntax-section 2.1 Percent-Encoding, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc3986#section-2.1

[REST] REST (Representational State Transfer), Wikipedia

https://en.wikipedia.org/wiki/Representational_state_transfer

[RFC 2606]

Reserved Top Level Domain Name System (DNS) Names, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc2606

[RFC 3986]

Uniform Resource Identifier (URI): Generic Syntax, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc3986

[RFC 5234]

Augmented BNF for Syntax Specifications, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc5234

[RFC 6570]

URI Template, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc6570

[RFC 6596]

The Canonical Link Relation, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc6596

[RFC 6761]

Special-Use Domain Names, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc6761

[RFC 7405]

Case-Sensitive String Support in ABNF, Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc7405

[RFC 8615]

Well-Known Uniform Resource Identifiers (URIs) , Internet Engineering Task Force (IETF)

https://tools.ietf.org/html/rfc8615

9.2 GS1 references

[BSR]

GS1 Barcode Syntax Resource

https://ref.gs1.org/tools/gs1-barcode-syntax-resource/

[DL1]

GS1 Digital link (originally titled GS1 Web URI Structure), version 1.0

https://ref.gs1.org/standards/digital-link/1.0.0/

[DL 1.1]

GS1 Digital Link, version 1.1

https://ref.gs1.org/standards/digital-link/1.1.0/

[DL-CompressionEPC]

GS1 Digital Link URI: Compression Technical Standard for EPC binary strings, latest version

https://ref.gs1.org/standards/digital-link/compression/

[DL-Legacy]

GS1 Digital Link, version 1.1.4

https://ref.gs1.org/standards/digital-link/1.1.4/

[DL-Resolution]

GS1-Conformant Resolver Standard, latest version

https://ref.gs1.org/standards/resolver/

[GENSPECS]

GS1 General Specifications, latest version

https://ref.gs1.org/standards/genspecs/

[GS1 ID Keys]

GS1 identification keys public landing page

https://www.gs1.org/standards/id-keys

[TDS]

GS1 EPC Tag Data Standard (TDS), latest version

https://ref.gs1.org/standards/tds/

[TDT]

GS1 EPC Tag Data Translation Standard (TDT), latest version

https://ref.gs1.org/standards/tdt/

[WebVoc]

The GS1 Web Vocabulary, latest version

https://ref.gs1.org/voc/