GS1 Global Office Resolver

Implementation choices

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1 Introduction

Like all standards, the GS1 Digital Link standard version 1.1, published February 2020, henceforth known as *the standard*, allows for significant flexibility in how it is implemented. This document sets out the choices made by GS1 Global Office when implementing its resolver at id.gs1.org, the source code for which is made available under a permissive licence to encourage further implementations. Detailed technical documentation of the resolver is provided with the source code in GitHub [CE]. For clarity, the choices made by GS1 are *not* intended as an indication of how *all* conformant resolvers *must* be built; nor are the examples below. The standard itself is the only source of normative statements concerning GS1 Digital Link and is unaffected by anything written here.

2 Linkset

The standard cites a draft IETF standard "Linkset: Media Types and a Link Relation Type for Link Sets" [Linkset03] as a possible format to use when responding to a linkType=all request. This work has now been formally adopted by the IETF's HTTP APIs Working Group and is on the standards track [Linkset]. *As of January 2021*, the GS1 Global Office has chosen to use that draft standard's recommended JSON format with near future plans to also support the HTTP Linked header-based format. It is likely that we will also support the media type so that requests to the resolver specifying linkset in the Accept header will be equivalent to appending linkType=all to the request URL.

The adoption of this work at IETF means that the Linkset format should now be considered stable for the long term at id.gs1.org. Progress towards full status as a standard, what IETF calls an RFC, can be tracked at https://mailarchive.ietf.org/arch/browse/httpapi/.

Figure 1 Screenshot of *https://id.gs1.org/01/09506000134369?linkType=all* as seen in a typical Web browser

Figure 1 shows a screenshot of the Linkset for the fictitious product Dal Giardino Extra Virgin Olive Oil. This 'page' is simply a visualisation of the underlying JSON Linkset, rendered using the 'interpret scan' script, also available in GitHub [IS].

In line with the standard, the resolver returns the Linkset as an HTML page, the JSON or any other format using content negotiation. So applications seeking just the Linkset as JSON should set the Accept header to `application/json`.

3 DefaultLink and DefaultLinkMulti

The standard makes clear that for any given GS1 Digital Link URI, a resolver must identify a default link. However, the identity of the default link is not evident in the Linkset. To overcome this, the Global Master Data Standards Maintenance Group (*GMD*) agreed to add two new link types to the Web Vocabulary.

As defined in the standard, the default link is the link the resolver redirects to unless there is a better match available. It's the link you're redirected to when there is no value set for the `linkType` parameter as will typically be the case when a GS1 Digital Link URI is included in a barcode. GS1 identifies the default link in the Linkset using the `gs1:defaultLink` link type.

There's more to an HTTP request than just the URL however. User agents (apps, browsers etc.) will almost always include more information about themselves and their user's preferences. This means that a resolver might have information available to it that means that it *can* make a better match among the available links, even without a value for the `linkType` parameter. The most obvious example of this is the user's language. The fictitious Dal Giardino products provide examples of this where the default is to redirect to product information pages that are available in different languages. It is these 'multiple defaults' that have the link type of `gs1:defaultLinkMulti`.

As a result of these implementation choices, the GS1 Global Office resolver lists the default links twice within a Linkset. Once as the `gs1:defaultLink` (and `gs1:defaultLinkMulti` if applicable) *and* as whatever their actual link type is.

4 Examples

Some examples should help to clarify how the GS1 Global Office resolver handles different links associated with a specific item.

Example 1

An FMCG manufacturer provides a single link to the product information page for each of its products. In this situation all request URIs result in a redirection to the relevant product information page with the same link types of `gs1:pip` and `gs1:defaultLink` whether or not the URI includes CPV, batch/lot or serial number.

Example 2

A consumer electronics manufacturer sets up links for one of their products as shown in the table below.

Table 1 Initial data for example 2

Link type	Resource description
gs1:pip, gs1:defaultLink	Product information page
gs1:instructions	The instruction manual
gs1:certificationInfo	A document showing compliance with the relevant regulations

This is the usual situation so that the GS1 Digital Link URI will redirect to the product information page, but for a limited period, the manufacturer wants to point potential consumers to a promotional campaign and adds another link so that their full set is:

Table 2 Temporary data for example 2

Link type	Resource description
gs1:pip	Product information page

Link type	Resource description
gs1:instructions	The instruction manual
gs1:certificationInfo	A document showing compliance with the relevant regulations
gs1:promotion, gs1:defaultLink	Entry point for a promotional campaign

Note that the default link is now the same as the (temporary) gs1:promotion. This means that for the duration of the promotion, by default, the GS1 Digital Link URI will redirect to the promotion.

Example 3

An independent organisation operates a repository of electronic patient information leaflets on behalf of a variety of pharmaceutical manufacturers. For each drug, they offer two types of information: one designed for patients (gs1:epil) and one for clinical staff (gs1:smpc). The leaflets are available in multiple languages and the repository chooses to make each language version available at a different URL. This leads to multiple links for both supported link types. The manufacturer provides the list of available links as shown below.

Table 3 Data for patient information leaflet example

Link type	Resource description
gs1:defaultLink	Patient information (Dutch)
gs1:epil, gs1:defaultLinkMulti	(1) Patient information (Dutch)
	(2) Patient information (French)
	(3) Patient information (German)
gs1:smpc	(1) Summary product characteristics (Dutch)
	(2) Summary product characteristics (French)
	(3) Summary product characteristics (German)

In the absence of any information to the contrary, the resolver with these links available will redirect to the patient information leaflet (the ePIL) in Dutch. If there is no value for the linkType parameter then:

1. If the HTTP Accept-Language header sent by the client indicates a preference for 'nl', 'fr' or 'de' then the redirection would be to the patient information leaflet in the relevant language.

2. If the Accept-Language header declared a preference for a language not listed, then, again, the resolver will redirect to the default version (Dutch).

If an incoming request were received for the summary product characteristics (the term used to describe information for clinicians) by setting the linkType parameter to gs1:smpc, then:

1. If the client's language preferences can be matched, redirect to the SmPC in that language.

2. If the client's language cannot be matched, redirect to the first one in the list (in this case, Dutch).

The same reasoning applies in the linkType parameter were set to gs1:epil. In this case, the fact that the electronic information for patients is also the default is irrelevant.

If the linkType parameter were set to any value other than gs1:epil or gs1:smpc, the defaults are used exactly as if no value were set.

Example 4

A power tool manufacturer encourages its customers to register their purchase by including a GS1 Digital Link URI on the packaging, as follows:

`https://id.gs1.org/01/9520123456788/21/12345`

The manufacturer sets the default to the link that is also labelled `gs1:instructions` which points to a video showing how the tool can be used. This is set at the GTIN level and so any consumer scanning the tool's packaging in any store would see the same video. However, the same GS1 Digital Link URI can be scanned using the retailer's app which asks for a link type of `gs1:registerProduct` (see next section). Combining information from both the retailer app, which includes information about the customer, with the manufacturer's information about the serialised product makes the registration process trivially easy for the consumer.

Table 4 Sample data for remaining examples

Link type	Target URL	Lang	Context
gs1:defaultLink	1. https://example.com/en/defaultPage		
gs1:defaultLinkMulti	2. https://example.com/en/defaultPage	en	
gs1:defaultLinkMulti	3. https://example.com/fr/defaultPage	fr	
gs1:pip	1. https://example.com/en/defaultPage	en	
gs1:pip	2. https://example.com/fr/defaultPage	fr	
gs1:whatsInTheBox	1. https://example.com/en/packContents/GB	en	GB
gs1:whatsInTheBox	2. https://example.com/fr/packContents/FR	fr	FR
gs1:whatsInTheBox	3. https://example.com/fr/packContents/CH	fr	CH
gs1:relatedVideo	https://video.example		

Example 5

The GS1 Digital Link URI to be resolved does not include a query string and the Accept-language header is not set. There is no data in the request to match and so the response is simple: redirect to the default (*https://example.com/en/defaultPage*)

Example 6

The GS1 Digital Link URI to be resolved does not include a query string and the Accept-language is set to fr (French). There is no query string (and therefore no `linkType` set). There is, however, a match between the requested language and an available default. The resolver redirects to the French language default (*https://example.com/fr/defaultPage*)

Example 7

The GS1 Digital Link URI to be resolved does not include a query string, the Accept-language is set to de (German), and there is no match between the requested language and an available default. The resolver redirects to the default (*https://example.com/en/defaultPage*)

Example 8

The GS1 Digital Link URI to be resolved does include the `linkType` parameter which is set to `gs1:relatedVideo`. The resolver redirects to *https://video.example*.

Example 9

The GS1 Digital Link URI to be resolved includes the `linkType` parameter which is set to `gs1:instructions`. The Accept-language header is set to fr. There is no match for the link type and so it will be one of the defaults that are used. There's a match in the set of defaults so the resolver redirects to the French language default at *https://example.com/fr/defaultPage.* Any other requested language with either no link type or a link type where there is no match, would end up at the English language default.

Example 10

The GS1 Digital Link URI to be resolved does include the `linkType` parameter which is set to `gs1:pip` and the Accept-language header is set to en. The resolver redirects to the English language page at *https://example.com/en/defaultPage.*

Example 11

As the previous example with the `linkType` parameter which is set to `gs1:pip` but this time the Accept-language is set to vi (Vietnamese). Here there is a match for the link type but not the language. In this case, there is no definite answer and so the resolver will redirect to the first choice in its list for that link type.

Example 12

The GS1 Digital Link URI to be resolved includes the `linkType` set to `gs1:whatsInTheBox`, the Accept-language is set to fr and the context parameter is set to CH (Switzerland). This means that there is a link with a matching link type and two further matching attributes. The resolver redirects to *https://example.com/fr/packContents/CH*

Example 13

Similar to the previous request but this time the requested language is en and the requested context is again CH. There are three links with the same `gs1:whatsInTheBox` link type. One matches the request by language, another by context. In this case, the GS1 Global Office resolver implementation chooses to prioritise language over context and redirects to the English language page at *https://example.com/en/packContents/GB*, even though the context doesn't match. This is an implementation choice that sets the order of priority as media type → language → context.

5   schema.org

The standard says that resolvers should recognise terms in the schema.org that can be seen as link types. Our experience is that this is confusing and unhelpful so we have decided, at least for now, not to support terms in schema.org in this way.

6   HTTP Link Headers

It is very clear from the standard that all links associated with an identified item should be exposed in the HTTP Link header, even when redirecting. This feature has been used by apps whose developers like the ability to get all the available links with a simple HTTP HEAD request. However, we know that putting a lot of links in the header can cause problems. Further, with the implementation of the IETF Linkset, it is questionable whether this is still necessary. For now, we continue to include all links in the HTTP Link header but we will keep this under review.

7   References

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