**Draft OGC API-Common**

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| **OGC API-Common** |

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**1. Introduction**

**i. Abstract**

The OGC has extended their suite of standards to include Resource Oriented Architectures and Web APIs. In the course of developing these standards, some practices proved to be common across all OGC API standards. The purpose of this standard is to document these common practices. This standard also serves as a common foundation upon which all OGC API Standards will be built. As such, this OGC API Common Standard serves as the equivalent "OWS Common" standard for OGC Resource Oriented APIs.

An OGC API provides a lightweight interface to access one or more resources. The resources addressed by OGC APIs fall into three categories: Foundation Resources, Spatial Resources, and Information Resources. These Resource Categories are described in section [8](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core-section), Requirement Class Core.

The API-Common standard defines resources and access paths that are supported by all OGC APIs. These are listed in [Table 1](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#tldnr).

| Table 1. Overview of Resources | | | |
| --- | --- | --- | --- |
| **Resource** | **Path** | **HTTP Method** | **Document Reference** |
| Landing page | / | GET | [API Landing Page](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#landing-page) |
| API definition | /api | GET | [API Definition](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#api-definition) |
| Conformance classes | /conformance | GET | [Declaration of Conformance Classes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#conformance-classes) |
| Collections metadata | /collections | GET | [Collections Metadata](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#collections-metadata) |

The resources identified in [Table 1](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#tldnr) primarily support Discovery operations. Discovery operations allow clients to interrogate the API to determine its capabilities and retrieve information (metadata) about this distribution of the resource. This includes the API definition of the server(s) as well as metadata about the resources provided by those servers.

This standard also defines common Query operations for OGC APIs. Query operations allow resources or values extracted from those resources to be retrieved from the underlying data store. The information to be returned is based upon selection criteria (query string) provided by the client. This standard only defines simple query parameters which should be applicable to all resource types. Other OGC API standards may define additional query capabilities specific to their resource type.

**ii. Keywords**

The following are keywords to be used by search engines and document catalogues.

ogcdoc, OGC document, property, geographic information, spatial data, spatial things, dataset, distribution, API, geojson, html, OpenAPI, AsyncAPI, REST, Common

**iii. Preface**

**OGC Declaration**

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**iv. Submitting organizations**

The following organizations submitted this Document to the Open Geospatial Consortium (OGC):

* Heazeltech LLC
* others TBD

**v. Submitters**

All questions regarding this submission should be directed to the editors or the submitters:

|  |  |
| --- | --- |
| **Name** | **Affiliation** |
| Chuck Heazel *(editor)* | Heazeltech |
| others | TBD |

**2. Scope**

This standard identifies resources, captures compliance classes, and specifies requirements which are applicable to all OGC API standards. It should be included as a normative reference by all such standards.

This standard addresses two fundamental operations: Discovery and Query.

Discovery operations allow the API to be interrogated to determine its capabilities and retrieve information (metadata) about this distribution of a resource. This includes the API definition of the server as well as metadata about the spatial resources provided by the server.

Query operations allow spatial resources to be retrieved from the underlying data store based upon simple selection criteria. These criteria are defined by the client.

**3. Conformance**

Conformance with this standard shall be checked using the tests specified in Annex A (normative) of this document. The framework, concepts, and methodology for testing, and the criteria to claim conformance are specified in the OGC Compliance Testing Policies and Procedures and the OGC Compliance Testing web site.

The one Standardization Target for this standard is Web APIs.

OGC API-Common provides a common foundation for OGC API standards. It is anticipated that this standard will only be implemented through inclusion in other standards. Therefore, all the relevant abstract tests in Annex A shall be included or referenced in the Abstract Test Suite in each separate standard that normatively references this standard.

This standard identifies five conformance classes. The conformance classes implemented by an OGC API are advertised through the /conformance path on the landing page. Each conformance class is defined by one requirements class. The tests in Annex A are organized by Requirements Class. So an implementation of the *Core* conformance class must pass all tests specified in Annex A for the *Core* requirements class.

The requirements classes for OGC API-Common are:

* [Core](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core-section)

The *Core Requirements Class* is the minimal useful service interface for an OGC API. The requirements specified in this requirements class are mandatory for all OGC APIs

Additional capabilities such as support for transactions, complex data structures, and rich queries are specified in additional OGC API standards and in OGC managed API extensions. Those standards and extensions build on the API-Common foundation to provide the full functionality required of any OGC API implementation.

* [Collections](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_collections-section)

The *Collections Requirements Class* extends the *Core* to enable fine-grained access to spatial resources. This requirements class is mandatory for all OGC APIs which expose spatial resources.

The structure and organization of a collection of spatial resources is very much dependent on the nature of that resource and the expected access patterns. This is information which cannot be specified in a common manner. The *Collections Requirements Class* specifies the requirements necessary to discover and understand that structure and organization. Requirements governing the resource collections themselves are specified in the resource-specific OGC API standards.

* [HTML](file:///C:\\Users\\Office\\Documents\\GitHub\\oapi_common\\19-072.html" \l "rc_html-section)
* [GeoJSON](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_geojson-section)

Neither the *Core* nor *Collections* requirements class mandate a specific encoding or format for representing resources. The *HTML* and *GeoJSON* requirements classes specify representations for these resources in commonly used encodings for spatial data on the web.

Neither of these encodings is mandatory. An implementation of the *API-Common* standard may decide to implement another encoding instead of, or in addition to, these two.

* [OpenAPI 3.0](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_oas30-section)

The *API-Common* does not mandate any encoding or format for the formal definition of the API. The preferred option is the OpenAPI 3.0 specification. The *OpenAPI 3.0* requirements class has been specified for APIs implementing OpenAPI 3.0.

**4. References**

The following normative documents contain provisions that, through reference in this text, constitute provisions of this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

* Open API Initiative: **OpenAPI Specification 3.0.2**, <https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.2.md>
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* Nottingham, M.: **IETF RFC 8288, Web Linking**, <http://tools.ietf.org/rfc/rfc8288.txt>
* W3C: **HTML5, W3C Recommendation**, <http://www.w3.org/TR/html5/>
* **Schema.org**: <http://schema.org/docs/schemas.html>

**5. Terms and Definitions**

This document uses the terms defined in Sub-clause 5.3 of [OGC Web Services Common](https://portal.opengeospatial.org/files/?artifact_id=38867) (OGC 06-121r9), which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

For the purposes of this document, the following additional terms and definitions apply.

**5.1. Conformance Module; Conformance Test Module**

set of related tests, all within a single conformance test class ([OGC 08-131](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ogc08-131))

NOTE: When no ambiguity is possible, the word `test` may be omitted. i.e. conformance test module is the same as conformance module. Conformance modules may be nested in a hierarchical way.

**5.2. Conformance Class; Conformance Test Class**

set of conformance test modules that must be applied to receive a single certificate of conformance ([OGC 08-131](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ogc08-131)r3)

NOTE: When no ambiguity is possible, the word \_test\_ may be left out, so conformance test class maybe called a conformance class.

**5.3. dataset**

collection of data, published or curated by a single agent, and available for access or download in one or more formats (DCAT)

**5.4. Distribution**

represents an accessible form of a **dataset** (DCAT)

EXAMPLE: a downloadable file, an RSS feed or a web service that provides the data.

**5.5. Executable Test Suite (ETS)**

A set of code (e.g. Java and CTL) that provides runtime tests for the assertions defined by the ATS. Test data required to do the tests are part of the ETS [(OGC 08-134)](https://portal.opengeospatial.org/files/?artifact_id=55234)

Foundation Resources

those resources which are provided by every OGC API.

**Information Resources**

information resources are non-spatial resources which support the operation of the API or the access and use of the Spatial Resources.

**5.6. Recommendation**

expression in the content of a document conveying that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited ([OGC 08-131](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ogc08-131)r3)

[ISO Directives Part 2]

NOTE Although using normative language, a **recommendation** is not a **requirement**. The usual form replaces the ―shall‖ (imperative or command) of a **requirement** with a ―should‖ (suggestive or conditional).

**5.7. Requirement**

expression in the content of a document conveying criteria to be fulfilled if compliance with the document is to be claimed and from which no deviation is permitted ([OGC 08-131](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ogc08-131)r3)

**5.8. Requirements Class**

aggregate of all requirement modules that must all be satisfied to satisfy a conformance test class ([OGC 08-131](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ogc08-131)r3)

**5.9. Requirements Module**

aggregate of requirements and recommendations of a specification against a single standardization target type ([OGC 08-131](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ogc08-131)r3)

**Spatial Resources**

spatial resources are the resources which we usually think of as Geospatial Data.

**5.10. Standardization Target**

entity to which some requirements of a standard apply ([OGC 08-131](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ogc08-131))

NOTE: The standardization target is the entity which may receive a certificate of conformance for a requirements class.

**6. Conventions**

**6.1. Identifiers**

The normative provisions in this draft standard are denoted by the URI <http://www.opengis.net/spec/ogcapi-common/1.0>

All requirements and conformance tests that appear in this document are denoted by partial URIs that are relative to this base.

**6.2. Link relations**

To express relationships between resources, [RFC 8288 (Web Linking)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc8288) and [registered link relation types](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#link-relations) are used.

**6.3. Use of HTTPS**

For simplicity, this document in general only refers to the HTTP protocol. This is not meant to exclude the use of HTTPS and simply is a shorthand notation for "HTTP or HTTPS". In fact, most servers are expected to use [HTTPS](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2818), not [HTTP](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2616).

**6.4. API definition**

**6.4.1. General remarks**

So that developers can more easily learn how to use the API good documentation is essential for every API. In the best case, documentation would be available both in HTML for human consumption and in a machine readable format that can be processed by software for run-time binding.

This OGC standard specifies requirements and recommendations for APIs that share spatial resources and want to follow a standard way of doing so. In general, APIs will go beyond the requirements and recommendations stated in this standard. They will support additional operations, parameters, and so on that are specific to the API or the software tool used to implement the API.

**6.4.2. Role of OpenAPI**

This document uses OpenAPI 3.0 fragments as examples and to formally state requirements. Using OpenAPI 3.0 is not required for implementing an OGC API. Other API definition languages may be used along with, or instead of, OpenAPI. However, any API definition language used should have an associated conformance class advertised through the /conformance path.

This approach is used to avoid lock-in to a specific approach to defining an API. This standard includes a [conformance class](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_oas30-section) for API definitions that follow the [OpenAPI specification 3.0](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#openapi). Conformance classes for additional API definition languages will be added as the OGC API landscape continues to evolve.

In this document, fragments of OpenAPI definitions are shown in YAML. This is because YAML is easier to format than JSON and is typically used by OpenAPI editors.

**6.4.3. References to OpenAPI components in normative statements**

Some normative statements (requirements, recommendations and permissions) use a phrase that a component in the API definition of the server must be "based upon" a schema or parameter component in the OGC schema repository.

In this case, the following changes to the pre-defined OpenAPI component are permitted:

* If the server supports an XML encoding, xml properties may be added to the relevant OpenAPI schema components.
* The range of values of a parameter or property may be extended (additional values) or constrained (if a subset of all possible values is applicable to the server). An example for a constrained range of values is to explicitly specify the supported values of a string parameter or property using an *enum*.
* Additional properties may be added to the schema definition of a Response Object.
* Informative text may be changed or added, like comments or description properties.

For OGC API definitions that do not conform to the [OpenAPI Specification 3.0](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#openapi), the normative statement should be interpreted in the context of the API definition language used.

**6.4.4. Paths in OpenAPI definitions**

All paths in an OpenAPI definition are relative to the base URL of a server. Unlike Web Services, an API is decoupled from the server(s). Some ramifications of this are:

* An API may be hosted (replicated) on more than one server.
* Parts of an API may be distributed across multiple servers.

Example 1. URL of the OpenAPI definition

In OpenAPI, relative references are resolved using the URLs defined in the [Server Object](https://swagger.io/specification/" \l "serverObject) as a Base URI. If the OpenAPI Server Object looks like this:

servers:

- url: https://dev.example.org/

description: Development server

- url: https://data.example.org/

description: Production server

The path "/mypath" in the OpenAPI definition of the API would be the URL <https://data.example.org/mypath> for the production server.

**6.4.5. Reusable OpenAPI components**

Reusable components for OpenAPI definitions for an OGC API are referenced from this document.

|  |  |
| --- | --- |
| Caution | During the development phase, these components use a base URL of "https://raw.githubusercontent.com/opengeospatial/oapi\_common/master/", but eventually they are expected to be available under the base URL "http://schemas.opengis.net/ogcapi\_common/1.0/openapi/". |

**7. Overview**

**7.1. Evolution from OGC Web Services**

OGC Web Service (OWS) standards implement a Remote-Procedure-Call-over-HTTP architectural style using XML for payloads. This was the state-of-the-art when OGC Web Services (OWS) were originally designed in the late 1990s. However, technology has evolved. New Resource-Oriented APIs have begun to replace Service-Oriented Web Services. And new OGC API standards are under development to provide API alternatives to the OWS standards.

OGC API (OAPI) Common specifies the common kernel of the OGC API approach to services that follows the current Web architecture. In particular, the recommendations as defined in the [W3C/OGC best practices for sharing Spatial Data on the Web](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#SDWBP) as well as the [W3C best practices for sharing Data on the Web](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#DWBP).

In addition to the general alignment with the architecture of the Web (e.g., consistency with HTTP/HTTPS, hypermedia controls), another goal for OGC API standards is modularization. This goal has several facets:

* Clear separation between common core requirements and more resource specific capabilities. The OGC API-Common Standard specifies the core or *common* requirements that may be relevant to almost anyone who wants to build a spatial API. Additional capabilities that several communities are using today will be specified as extensions to the Common API.
* Technologies that change more frequently are decoupled and specified in separate modules ("conformance classes" in OGC terminology). This enables, for example, the use/re-use of new encodings for spatial data or API descriptions.
* Modularization is not just about a single "service". OGC APIs can provide building blocks that can be reused in APIs in general. In other words, a server supporting the OGC-Feature API should not be seen as a standalone service. Rather, this server should be viewed as a collection of API building blocks which together implement API-Feature capabilities. A corollary of this is that it should be possible to implement an API that simultaneously conforms to conformance classes from the Feature, Coverage, and other current or future OGC Web API standards.

Implementations of OGC API Common are intended to support two different approaches for how clients can use the API.

In the first approach, clients are implemented with knowledge about the API-Common Standard and its resource types. The clients navigate the resources based on this knowledge and based on the responses provided by the API. The API definition may be used to determine details, such as filter parameters, but this may not be necessary depending on the needs of the client. These are clients that are in general able to use multiple APIs as long as they implement OGC API Common.

The other approach targets developers that are not familiar with the OGC API standards but who want to interact with spatial data provided by an API that happens to implement OGC API Common. In this case, the developer will study and use the API definition, typically an OpenAPI document, to understand the API and implement client code to interact with the API. This assumes familiarity with the API definition language and the related tooling but the developer should not necessarily have to study the OGC API standards.

**7.2. Encodings**

|  |  |
| --- | --- |
| Note | Arguably this requires a conformance class for every possible encoding. Do we really want a conformance class for GeoTIFF? or NITF?, or Protobuf? Should this requirement be limited to those resources defined in this standard? |

This standard does not mandate any encoding or format. However, the standard does provide extensions for encodings which are commonly used in OGC APIs. In addition to HTML as the standard encoding for Web content, rules for commonly used encodings for spatial data on the web are provided (GeoJSON).

Neither of these encodings is mandatory. An implementation of the *Core* requirements class does not have to support any of the encodings. The implementation may instead implement an entirely different set of encodings.

Support for HTML is [recommended](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rec_html). HTML is the core language of the World Wide Web. An API that supports HTML will support browsing spatial resources supported by an OGC API with a web browser while also enabling search engines to crawl and index those resources.

GeoJSON is a commonly used encoding that is simple to understand and well supported by tools and software libraries. Since most Web developers are comfortable with using a JSON-based format, GeoJSON is [recommended](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rec_geojson) for APIs which expose feature data **and** where GeoJSON is capable of supporting the intended use.

Some examples of cases that are out-of-scope for GeoJSON are:

* When solids are used for geometries (e.g. in a 3D city model),
* Geometries that include non-linear curve interpolations that cannot be simplified (e.g., use of arcs in authoritative geometries),
* Geometries that have to be represented in a coordinate reference system (CRS) that is not based on WGS 84 longitude/latitude (e.g. an authoritative national reference system),
* Features that have more than one geometric property.

The recommendations for using HTML and GeoJSON reflect the importance of HTML and the current popularity of JSON-based data formats. As the practices in the Web community evolve, these recommendations will likely be updated in future versions of this standard to provide guidance on using other encodings.

This part of the OAPI standard does not provide any guidance on other encodings. The supported encodings, or more precisely the media types of the supported encodings, can be determined from the API definition. The desired encoding is selected using HTTP content negotiation.

For example, if the server supports [GeoJSON Text Sequences](https://tools.ietf.org/html/rfc8142), an encoding that is based on JSON text sequences and GeoJSON to support streaming by making the data incrementally parsable then the media type application/geo+json-seq would be used.

**8. Requirement Class "Core"**

|  |  |
| --- | --- |
| **Requirements Class** | |
| <http://www.opengis.net/spec/ogcapi_common/1.0/req/core> | |
| Target type | Web API |
| Dependency | [RFC 2616 (HTTP/1.1)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2616) |
| Dependency | [RFC 2818 (HTTP over TLS)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2818) |
| Dependency | [RFC 8288 (Web Linking)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc8288) |

|  |  |
| --- | --- |
| Note | ISSUE: Should OGC API standards be organized by concept? See issue [86](https://github.com/opengeospatial/oapi_common/issues/86). |

**8.1. Overview**

**8.1.1. Resources**

An OGC API provides a lightweight interface to access one or more resources. The resources addressed by OGC APIs fall into three categories: Foundation Resources, Spatial Resources, and Information Resources.

Foundation Resources are those resources which are common across all OGC APIs. Those resources are defined in this OGC API-Common standard. Other OGC API standards re-use these resources and, where necessary, extend them to address their unique requirements.

Spatial Resources are the resources which we usually think of as Geospatial Data. They include Features, Coverages, and Images. This Standard defines basic patterns for accessing Spatial Resources. Additional OGC API Standards have been developed to address specific API requirements for each Spatial Resource type.

Information Resources are non-spatial resources which support the operation of the API or the access and use of the Spatial Resources.

**8.1.2. Modular APIs**

A goal of OGC API standards is to provide rapid and easy access to spatial resources. To meet this goal, the needs of both the resource provider and the resource consumer must be considered. The approach specified in this standard is to provide a modular framework of API components. This framework provides a consistent "look and feel" across all OGC APIs. When API servers and clients are built from the same set of modules, the likelihood that they will integrate at run-time is greatly enhanced.

A more detailed discussion of modular APIs can be found in the API-Common [Best Practices](https://github.com/opengeospatial/oapi_common/blob/master/19-072BP.html#modular-api) document.

**8.1.3. Navigation**

OGC APIs are designed to support two access patterns: Hypermedia Access, and Direct Access. OGC APIs support both access patterns through the use of API Definition documents, standardized paths, and standardized hypermedia schemas.

**Hypermedia Access**

Hypermedia Access is the use of hypermedia links to navigate from one resource to another. This pattern is typical of the Web Browser environment. A resource consumer (typically a human) starts from a landing page, selects a link on that page and then moves on to the referenced resource.

Navigation of hyperlinks is facilitated if the hyperlink includes information about the resource type at the link destination. Therefore, OGC APIs use a set of common link relationships. These link relationships are described in [Table 2](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#link-relations-table).

| Table 2. Link Relations | |
| --- | --- |
| **Link Relation** | **Purpose** |
| alternate | links to this resource in another media type (the media type is specified in the type link attribute) |
| conformance | links to conformance information |
| data | links to an information resource |
| describedBy | links to external resources which further describe the subject resource |
| items | links to each individual resource which is included in a collection resource |
| self | links to this resource, |
| service-desc | links to the API Definition |
| service-doc | an alternative to service-desc |

OGC API hyperlinks are defined using the following [Hyperlink Schema](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/link.json).

{

"$schema": "http://json-schema.org/draft-07/schema#",

"title": "Link Schema",

"description": "Schema for external references",

"type": "object",

"required": [

"href"

],

"properties": {

"href": {

"type": "string"

},

"rel": {

"type": "string"

},

"hreflang": {

"type": "string"

},

"title": {

"type": "string"

}

}

}

**Direct Access**

Direct Access requires that the resource consumer possesses knowledge of the path to the resource prior to attempting access. Typically this knowledge comes from the use of standard paths, receiving the path from another entity, or by processing an API definition resource. Direct access is particularly applicable to software analytics where there is no human in the loop.

Direct access is facilitated by the use of standard URL paths. The requirements in this Requirements Class are organized around these standard paths.

**8.2. Foundation Resources**

Foundation resources are those resources which are provided by every OGC API.

The standard paths defined in this standard for Foundation Resources are:

1. "/" - the landing page
2. "/api" - the API Definition document for this API
3. "/conformance" - the conformance information for this API

**8.2.1. API landing page**

Each OGC API has a single LandingPage (path /).

The purpose of the landing page is to provide users with the basic information they need to use this API as well as links to the resources exposed through the API.

**Operation**

|  |  |
| --- | --- |
| **Requirement 1** | **/req/core/root-op** |
| A | The server SHALL support the HTTP GET operation at the path /. |

**Response**

|  |  |
| --- | --- |
| **Requirement 2** | **/req/core/root-success** |
| A | A successful execution of the operation SHALL be reported as a response with an HTTP status code 200. |
| B | The content of that response SHALL be based upon the schema [landingPage.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/landingPage.json) and include links to the following resources:   * The API definition (relation type 'service-desc' or 'service-doc') * /conformance (relation type 'conformance') * One or more information resources (relation type 'data') |

In addition to the required resources, links to additional resources may be included in the Landing Page.

The landing page returned by this operation is based on the following [Landing Page Schema](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/landingPage.json).

{

"$schema": "http://json-schema.org/draft-07/schema#",

"title": "Landing Page Schema",

"description": "JSON schema for the OGC API-Common landing page",

"type": "object",

"required": [

"links"

],

"properties": {

"title": {

"description": "The title of the API",

"type": "string"

},

"description": {

"description": "A textual description of the API",

"type": "string"

},

"links": {

"description": "Links to the resources exposed through this API.",

"type": "array",

"items": {"$href": "link.json"}

}

},

"patternProperties": {

"^x-": {}

},

"additionalProperties": true

}

Examples of OGC landing pages are provided in [Example Landing Pages](file:///C:\\Users\\Office\\Documents\\GitHub\\oapi_common\\19-072.html" \l "landing-page-examples).

**Error Situations**

See [HTTP Status Codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#http-status-codes) for general guidance.

**8.2.2. API Definition**

Every API is expected to provide a definition that describes capabilities provided by the API. This standard can be used by developers to understand API-Common, by software clients to connect to the server, and by development tools to support the implementation of servers and clients.

**Operation**

|  |  |
| --- | --- |
| **Requirement 3** | **/req/core/api-definition-op** |
| A | The URIs of all API definitions referenced from the landing page SHALL support the HTTP GET method. |

**Response**

|  |  |
| --- | --- |
| **Requirement 4** | **/req/core/api-definition-success** |
| A | A GET request to the URI of an API definition linked from the landing page (link relations service-desc or service-doc) with an Accept header with the value of the link property type SHALL return a document consistent with the requested media type. |

|  |  |
| --- | --- |
| **Recommendation 1** | **/rec/core/api-definition-oas** |
| A | If the API definition document uses the OpenAPI Specification 3.0, the document SHOULD conform to the [OpenAPI Specification 3.0 requirements class](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_oas30-section). |

If multiple API definition formats are supported, use content negotiation to select the desired representation.

**Error Situations**

See [HTTP Status Codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#http-status-codes) for general guidance.

**8.2.3. Declaration of Conformance Classes**

To support "generic" clients that want to accessing OGC APIs in general - and not "just" a specific API / server, the API has to declare the conformance classes it implements and conforms to.

**Operation**

|  |  |
| --- | --- |
| **Requirement 5** | **/req/core/conformance-op** |
| A | The API SHALL support the HTTP GET operation at the path /conformance. |

**Response**

|  |  |
| --- | --- |
| **Requirement 6** | **/req/core/conformance-success** |
| A | A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. |
| B | The content of that response SHALL be based upon the OpenAPI 3.0 schema [confClasses.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/confClasses.json) and list all OGC API conformance classes that the API conforms to. |

The conformance resource returned by this operation is based on the following [Conformance Schema](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/confClasses.json). Examples of OGC conformance resources are provided in [Conformance Examples](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#conformance-response-examples).

Conformance Schema

{

"$schema": "http://json-schema.org/draft-07/schema#",

"title": "Conformance Classes Schema",

"description": "This schema defines the resource returned from the /Conformance path",

"type": "object",

"required": [

"conformsTo"

],

"properties": {

"conformsTo": {

"type": "array",

"description": "ConformsTo is an array of URLs. Each URL should correspond to a defined OGC Conformance class. Unrecognized URLs should be ignored",

"items": {

"type": "string",

"example": "http://www.opengis.net/spec/OAPI\_Common/1.0/req/core"

}

}

}

}

**Error situations**

See [HTTP Status Codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#http-status-codes) for general guidance.

**8.3. Spatial Resources**

There is no requirement that every OGC API support Spatial Resources. Therefore, Spatial Resources are addressed in a separate Collections Requirement Class. This class is described in the [Collections](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_collections-section) section.

**8.4. Information Resources**

Information Resources are non-spatial resources that support the operation of the API or the access and use of the Spatial Resources. Information resources are usually specific to a spatial resource type and will be defined in the appropriate API standards.

Information Resources can be exposed using two path templates:

* /collections/{collectionId}/{resourceType}
* /{resourceType}

Where

{collectionId} = A unique identifier for a Spatial Resource collection.

{resourceType} = A text string identifying the Information Resource type.

Information Resources associated with a specific collection should be accessed through the /collections path. Those which are not associated with a specific collection should use the /{resourceType} template.

The OGC API-Common standard does not define any Information Resource types. However [Table 3](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#information-resource-table) provides a mapping of the known Information Resource types to the standard where they are defined.

| Table 3. Information Resource Types | |
| --- | --- |
| **Resource Type** | **API Standard** |
| TBD | TBD |

**8.5. General Requirements**

The following general requirements and recommendations apply to all OGC APIs.

**8.5.1. HTTP 1.1**

The standards used for Web APIs are built on the HTTP protocol. Therefore, conformance with HTTP or a closely related protocol is required.

|  |  |
| --- | --- |
| **Requirement 7** | **/req/core/http** |
| A | Any OGC Web API SHALL conform to [HTTP 1.1](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2616). |
| B | If the API supports HTTPS, then the API SHALL also conform to [HTTP over TLS](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2818). |

**8.5.2. HTTP Status Codes**

|  |  |
| --- | --- |
| Note | ISSUE: Should we expand our explanation of HTTP status codes? See issues [75](https://github.com/opengeospatial/oapi_common/issues/75), and [73](https://github.com/opengeospatial/oapi_common/issues/73). |

[Table 4](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#status-codes) lists the main HTTP status codes that clients should be prepared to receive. This includes support for specific security schemes or URI redirection. In addition, other error situations may occur in the transport layer outside of the server.

| Table 4. Typical HTTP status codes | |
| --- | --- |
| **Status code** | **Description** |
| 200 | A successful request. |
| 304 | An [entity tag](file:///C:\\Users\\Office\\Documents\\GitHub\\oapi_common\\19-072.html" \l "web-caching) was provided in the request and the resource has not changed since the previous request. |
| 400 | The server cannot or will not process the request due to an apparent client error. For example, a query parameter had an incorrect value. |
| 401 | The request requires user authentication. The response includes a WWW-Authenticate header field containing a challenge applicable to the requested resource. |
| 403 | The server understood the request, but is refusing to fulfill it. While status code 401 indicates missing or bad authentication, status code 403 indicates that authentication is not the issue, but the client is not authorized to perform the requested operation on the resource. |
| 404 | The requested resource does not exist on the server. For example, a path parameter had an incorrect value. |
| 405 | The request method is not supported. For example, a POST request was submitted, but the resource only supports GET requests. |
| 406 | Content negotiation failed. For example, the Accept header submitted in the request did not support any of the media types supported by the server for the requested resource. |
| 500 | An internal error occurred in the server. |

More specific guidance is provided for each resource, where applicable.

|  |  |
| --- | --- |
| **Permission 1** | **/per/core/additional-status-codes** |
| A | Servers MAY support other capabilities of the HTTP protocol and, therefore, MAY return status codes other than those listed in [Table 4](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#status-codes), too. |

**8.5.3. Web Caching**

Entity tags are a mechanism for web cache validation and for supporting conditional requests to reduce network traffic. Entity tags are specified by [HTTP/1.1 (RFC 2616)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2616).

|  |  |
| --- | --- |
| **Recommendation 2** | **/rec/core/etag** |
| A | The service SHOULD support entity tags and the associated headers as specified by HTTP/1.1. |

**8.5.4. Support for Cross-Origin Requests**

If the data is located on another host than the webpage ("same-origin policy"), access to data from a HTML page is by default prohibited for security reasons. A typical example is a web-application accessing feature data from multiple distributed datasets.

|  |  |
| --- | --- |
| **Recommendation 3** | **/rec/core/cross-origin** |
| A | If the server is intended to be accessed from the browser, cross-origin requests SHOULD be supported. Note that support can also be added in a proxy layer on top of the server. |

Two common mechanisms to support cross-origin requests are:

* [Cross-origin resource sharing (CORS)](https://en.wikipedia.org/wiki/Cross-origin_resource_sharing)
* [JSONP (JSON with padding)](https://en.wikipedia.org/wiki/JSONP)

**8.5.5. Encodings**

|  |  |
| --- | --- |
| Note | ISSUE: Is this discussion of content negotiation sufficient? If not, what else do we need? See issues [57](https://github.com/opengeospatial/oapi_common/issues/57) and [28](https://github.com/opengeospatial/oapi_common/issues/28). |

While the OAPI Common standard does not specify any mandatory encoding, the following encodings are recommended. See [Clause 7 (Overview)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#overview) for a discussion of this issue.

HTML encoding recommendation:

|  |  |
| --- | --- |
| **Recommendation 4** | **/rec/core/html** |
| A | To support browsing an API with a web browser and to enable search engines to crawl and index the dataset, implementations SHOULD consider supporting an HTML encoding. |

GeoJSON encoding recommendation:

|  |  |
| --- | --- |
| **Recommendation 5** | **/rec/core/geojson** |
| A | If the resource can be represented for the intended use in GeoJSON, implementations SHOULD consider supporting GeoJSON as an encoding. |

Requirement [/req/core/http](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_http) implies that the encoding of a response is determined using content negotiation as specified by the HTTP RFC.

The section [Media Types](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#mediatypes) includes guidance on media types for encodings that are specified in this standard.

Note that any API that supports multiple encodings will have to support a mechanism to mint encoding-specific URIs for resources in order to express links, such as to alternate representations of the same resource. This standard does not mandate any particular approach how this is supported by the API.

As clients simply need to dereference the URI of the link, the implementation details and the mechanism how the encoding is included in the URI of the link are not important. Developers interested in the approach of a particular implementation, for example manipulating ("hack") the browser address bar, can study the API definition.

|  |  |
| --- | --- |
| Note | Two common approaches are:   * An additional path for each encoding of each resource (this can be expressed, for example, using format specific suffixes like ".html"); * An additional query parameter (for example, "accept" or "f") that overrides the Accept header of the HTTP request. |

**8.5.6. Link Headers**

|  |  |
| --- | --- |
| **Recommendation 6** | **/rec/core/link-header** |
| A | Links included in a payload of responses SHOULD also be included as Link headers in the HTTP response according to [RFC 8288, Clause 3](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc8288). |
| B | This recommendation does not apply when there are a large number of links included in a response or a link is not known when the HTTP headers of the response are created. |

**9. Requirement Class "Collections"**

|  |  |
| --- | --- |
| **Requirements Class** | |
| <http://www.opengis.net/spec/ogcapi_common/1.0/req/collections> | |
| Target type | Web API |
| Dependency | [Requirements Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core) |
| Dependency | [RFC 3339 (Date and Time on the Internet: Timestamps)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc3339) |

**9.1. Overview**

Spatial Resources are resources which we usually think of as Geospatial Data. They include Features, Coverages, and Images. This Conformance Class defines basic patterns for accessing Spatial Resources. Additional OGC API Standards have been or are being developed to address specific OGC API requirements for each Spatial Resource type.

OGC APIs are designed to support two access patterns: Hypermedia Access, and Direct Access. OGC APIs support both access patterns through the use of API Definition documents, standardized paths, and standardized hypermedia schemas.

Hypermedia Access was described in the [Navigation](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#navigation-introduction) section of Clause 8. For Spatial Resources, hypermedia navigation is enabled through the links included in each schema defined by the Requirement Class defined in that Clause.

Direct access is the use of know URL paths to access a resource directly. The requirements in this Requirement Class are organized around the standard paths for Spatial Data.

**9.2. Spatial Resources**

Detailed requirements for each Spatial Resource type are dealt with in the resource-specific API standards. However, this API Common standard has the goal of ensuring that all OGC API standards work together by:

1. Providing specifications for the description of each collection (/collections/{collectionId}), and the list of collections (/collections)
2. Providing a consistent framework for serving spatial data from any OGC API, regardless of the type. Consistent means that #1 works exactly the same (potentially with type-specific additional properties) and that the different types of data can be collections on the same OGC API end-point.
3. Providing a tie point for other OGC API modules to connect to and reference (processes inputs & outputs, cataloging, searching and filtering collections, detailed metadata, tiles, styles, clipping and intersecting bounding boxes in common) Just by virtue of understanding that /collections/{collectionId} points to a spatial **data layer**.

Spatial Resources are exposed using the path template.

/collections/{collectionId}/items

The resources returned from each node in this template are described in [Table 5](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#spatial-resource-paths).

| Table 5. Spatial Resource Paths | |
| --- | --- |
| **Path Template** | **Resource** |
| /collections | Metadata describing the spatial collections available from this API. |
| /collections/{collectionId} | Metadata describing the collection with the unique identifier {collectionId} |
| /collections/{collectionId}/items | The spatial collection resource identified by the {collectionId} parameter. |

**9.2.1. Collections Metadata**

OGC APIs typically organize their Spatial Resources into collections. Information about those collections is accessed through the /collections path.

**Operation**

|  |  |
| --- | --- |
| **Requirement 8** | **/req/collections/rc-md-op** |
| A | The API SHALL support the HTTP GET operation at the path /collections. |

**Response**

|  |  |
| --- | --- |
| **Requirement 9** | **/req/collections/rc-md-success** |
| A | A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. |
| B | The content of that response SHALL be based upon the JSON schema [collections.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collections.json). |

The collections metadata returned by this operation is based on the [Collections Metadata Schema](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collections.json). Examples of collections metadata are provided in [Collections Metadata Examples](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#collections-metadata-examples).

Collections Metadata Schema

{

"$schema": "http://json-schema.org/draft-07/schema#",

"title": "Collections Schema",

"description": "This schema defines the metadata resource returned from /collections.",

"type": "object",

"required": [

"links",

"collections"

],

"properties": {

"links": {

"type": "array",

"items": {"$href": "link.json"}

},

"collections": {

"type": "array",

"items": {"$href": "collectionInfo.json"}

}

}

}

This schema is further constrained by the following requirements and recommendations.

To support hypermedia navigation, the links property must be populated with sufficient hyperlinks to navigate through the whole dataset.

|  |  |
| --- | --- |
| **Requirement 10** | **/req/collections/rc-md-links** |
| A | A 200-response SHALL include the following links in the links property of the response:   * A link to this response document (relation: self), * A link to the response document in every other media type supported by the API (relation: alternate). |
| B | All links SHALL include the rel and type link parameters. |

Additional information may be available to assist in understanding and using this dataset. Links to those resources should be provided as well.

|  |  |
| --- | --- |
| **Recommendation 7** | **/rec/collections/rc-md-descriptions** |
| A | If external schemas or descriptions exist that provide additional information about the structure or semantics for the resource, a 200-response SHOULD include links to each of those resources in the links property of the response (relation: describedBy). |
| B | The type link parameter SHOULD be provided for each link. This applies to resources that describe to the whole dataset. |

The collections property of the Collections Metadata provides a description of each collection. These descriptions are based on the [Collection Information Schema](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collectionInfo.json). This schema is described in detail in the [Collection Information](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#collection-information) section of this Standard. The following requirements and recommendations govern the use of Collection Information in the Collections Metadata.

|  |  |
| --- | --- |
| **Requirement 11** | **/req/collections/rc-md-items** |
| A | For each spatial resource collection accessible through this API, metadata describing that collection SHALL be provided in the collections property of the Collections Metadata. |
| B | This metadata shall be based on the same schema as the Collection Information resource. |

The Collections Metadata should describe all of the collections accessible through the API. However, in some cases that is impractical. As long as they provide a way to retrieve the remaining metadata as well, developers have an option to only return a subset.

|  |  |
| --- | --- |
| **Permission 2** | **/per/collections/rc-md-items** |
| A | To support servers with many collections, servers MAY limit the number of items included in the collections property. |

**Error situations**

See [HTTP Status Codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#http-status-codes) for general guidance.

**9.2.2. Collection Information**

Each resource collection is described by a set of metadata. That metadata is accessed directly using the /collections/{collectionId} path or as an entry in the collections property of the Collections Metadata resource.

**Operation**

|  |  |
| --- | --- |
| **Requirement 12** | **/req/collections/src-md-op** |
| A | The API SHALL support the HTTP GET operation at the path /collections/{collectionId}. |
| B | The parameter collectionId is each id property in the resource collections response (JSONPath: $.collections[\*].id). |

**Response**

|  |  |
| --- | --- |
| **Requirement 13** | **/req/collections/src-md-success** |
| A | A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. |
| B | The content of that response SHALL be based upon the JSON schema [collectionInfo.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collectionInfo.json). |
| C | The content of that response SHALL be consistent with the content for this resource collection in the /collections response. That is, the values for id, title, description and extent SHALL be identical. |

Collection Information is based on the [Collection Information Schema](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collectionInfo.json). Examples of Collection Information are provided in [Collection Information Examples](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#collection-information-examples).

Collection Information Schema

{

"$schema": "http://json-schema.org/draft-07/schema#",

"title": "Collection Information Schema",

"description": "This schema defines metadata resource returned from /collections/{collectionId}.",

"type": "object",

"required": [

"id",

"links"

],

"properties": {

"id": {

"type": "string"

},

"title": {

"type": "string"

},

"description": {

"type": "string"

},

"links": {

"type": "array",

"items": {"$href": "link.json"}

},

"extent": {"$href": "extent.json"},

"itemType": {

"type": "string",

"default": "unknown"

},

"crs": {

"description": "the list of coordinate reference systems supported by the API; the first item is the default coordinate reference system",

"type": "array",

"items": {

"type": "string"

},

"default": [

"http://www.opengis.net/def/crs/OGC/1.3/CRS84"

],

"example": [

"http://www.opengis.net/def/crs/OGC/1.3/CRS84",

"http://www.opengis.net/def/crs/EPSG/0/4326"

]

}

}

}

This schema is further constrained by the following requirements and recommendations.

To support hypermedia navigation, the links property must be populated with sufficient hyperlinks to navigate through the whole dataset.

|  |  |
| --- | --- |
| **Requirement 14** | **/req/collections/rc-md-items-links** |
| A | 200-response SHALL include the following links in the links property of the response:   * A link to this response document (relation: self), * A link to the response document in every other media type supported by the API (relation: alternate). |
| B | The links property of the response SHALL include an item for each supported encoding of that collection with a link to the collection resource (relation: items). |
| B | All links SHALL include the rel and type properties. |

Additional information may be available to assist in understanding and using this dataset. Links to those resources should be provided as well.

|  |  |
| --- | --- |
| **Recommendation 8** | **/rec/core/rc-md-items-desciptions** |
| A | If external schemas or descriptions exist that provide additional information about the structure or semantics of the collection, a 200-response SHOULD include links to each of those resources in the links property of the response (relation: describedBy). |
| B | The type link parameter SHOULD be provided for each link. |

Additional requirements and recomendations apply to the extent propery of the Collection Information.

|  |  |
| --- | --- |
| **Requirement 15** | **/req/collections/rc-md-extent** |
| A | For each spatial resource collection, the extent property, if provided, SHALL provide bounding boxes that include all spatial geometries and time intervals that include all temporal geometries in this collection. The temporal extent may use null values to indicate an open time interval. |
| B | If a spatial resource has multiple properties with spatial or temporal information, the API implementation decides whether only a single spatial or temporal geometry property is used to determine the extent or all relevant geometries. |

|  |  |
| --- | --- |
| **Recommendation 9** | **/rec/core/rc-md-extent-single** |
| A | While the spatial and temporal extents support multiple bounding boxes (bbox array) and time intervals (interval array) for advanced use cases, implementations SHOULD provide only a single bounding box or time interval unless the use of multiple values is important for the use of the dataset and agents using the API are known to be support multiple bounding boxes or time intervals. |

|  |  |
| --- | --- |
| **Permission 3** | **/per/collections/rc-md-extent-extensions** |
| A | The Core only specifies requirements for spatial and temporal extents. However, the extent object MAY be extended with additional members to represent other extents, such as thermal or pressure ranges. |
| B | The Core only supports spatial extents in WGS84 longitude/latitude and temporal extents in the Gregorian calendar (these are the only *enum* values in [extent.yaml](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/extent.yaml)). |
| C | Extensions to the Core MAY add additional reference systems to the extent object. |

**Error situations**

See [HTTP Status Codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#http-status-codes) for general guidance.

If the parameter collectionId does not exist on the server, the status code of the response will be 404 (see [Table 4](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#status-codes)).

**9.2.3. Collection Resource**

A collection resource is the content of the collection as opposed to metadata about that collection. This standard defines the general behavior of this operation, but detailed requirements are the purview of the API standard for that resource type.

**Operation**

|  |  |
| --- | --- |
| **Requirement 16** | **/req/collections/rc-op** |
| A | For every resource collection identified in the resource collections response (path /collections), the API SHALL support the HTTP GET operation at the path /collections/{collectionId}/items.   * The parameter collectionId is each id property in the resource collections response (JSONPath: $.collections[\*].id). |

**Response**

|  |  |
| --- | --- |
| **Requirement 17** | **/req/collections/rc-response** |
| A | A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. |
| B | The response SHALL only include resources selected by the request. |

**Error situations**

See [HTTP Status Codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#http-status-codes) for general guidance.

**9.3. Information Resources**

Information Resources are non-spatial resources which support the operation of the API or the access and use of the Spatial Resources. They are described in the [Information Resources](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#information-resources) section.

Information Resources related to Spatial Resources can exposed using the path template:

* /collections/{collectionId}/{resourceType}

The resources returned from each node in this template are described in [Table 6](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#information-resource-paths).

| Table 6. Information Resource Paths | |
| --- | --- |
| **Path Template** | **Resource** |
| /collections | The root resource describing the spatial collections available from this API. |
| /collections/{collectionId} | Identifies a collection with the unique identifier {collectionId} |
| /collections/{collectionId}/{resourceType} | Identifies an Information Resource of type {resourceType} associated with the {collectionId} collection. |

The OGC API-Common standard does not define any Information Resource types. However [Table 3](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#information-resource-table) provides a mapping of the known Information Resource types to the standard where they are defined.

**9.4. Parameter Modules**

|  |  |
| --- | --- |
| Note | ISSUE: Should we add a limit parameter. See GitHub issues [87](https://github.com/opengeospatial/oapi_common/issues/87), [83](https://github.com/opengeospatial/oapi_common/issues/83), and [82](https://github.com/opengeospatial/oapi_common/issues/82). |
| Note | ISSUE: Should we be more explicit about the scope of parameters and other elements of the API definition? See issues [67](https://github.com/opengeospatial/oapi_common/issues/67) and [88](https://github.com/opengeospatial/oapi_common/issues/88). Also see API-Coverages issue [53](https://github.com/opengeospatial/ogc_api_coverages/issues/53). | |

Query parameters are used in URLs to limit the resources which are returned on a GET request. The API Common Standard defines two standard parameters for use in OGC API standards.

**9.4.1. Parameter bbox**

|  |  |
| --- | --- |
| **Requirement 18** | **/req/collections/rc-bbox-definition** |
| A | The bbox parameter SHALL possess the following characteristics (using an OpenAPI Specification 3.0 fragment):  name: bbox  in: query  required: false  schema:  type: array  minItems: 4  maxItems: 6  items:  type: number  style: form  explode: false |

|  |  |
| --- | --- |
| **Requirement 19** | **/req/collections/rc-bbox-response** |
| A | If the bbox parameter is provided, only resources that have a spatial geometry that intersects the bounding box SHALL be part of the result set. |
| B | If a resource has multiple spatial geometry properties, it is the decision of the server whether only a single spatial geometry property is used to determine the extent or all relevant geometries. |
| C | The bbox parameter SHALL also match all resources in the collection that are not associated with a spatial geometry. |
| D | The bounding box is provided as four or six numbers, depending on whether the coordinate reference system includes a vertical axis (height or depth):   * Lower left corner, coordinate axis 1 * Lower left corner, coordinate axis 2 * Lower left corner, coordinate axis 3 (optional) * Upper right corner, coordinate axis 1 * Upper right corner, coordinate axis 2 * Upper right corner, coordinate axis 3 (optional) |
| C | The values for the CRS axis 1 and 2 SHALL be interpreted as WGS84 longitude/latitude (<http://www.opengis.net/def/crs/OGC/1.3/CRS84>) unless a different coordinate reference system is specified in a parameter bbox-crs. |
| D | The coordinate values SHALL be within the extent specified for the coordinate reference system. |

"Intersects" means that a coordinate that is part of the (spatial) geometry of the resource falls within the rectangular area specified in the parameter bbox.. This includes the boundaries of the geometries such as for curves this includes start and end positions and for surfaces the outer and inner rings.

This standard does not specify requirements for the parameter bbox-crs. Those requirements will be specified in a later version of this standard.

For CRS84, the bounding box is in most cases the sequence of minimum longitude, minimum latitude, maximum longitude and maximum latitude. However, in cases where the box spans the anti-meridian (180th meridian), the first value (west-most box edge) is larger than the third value (east-most box edge).

Example 2. The bounding box of the New Zealand Exclusive Economic Zone

The bounding box of the New Zealand Exclusive Economic Zone in WGS84 (from 160.6°E to 170°W and from 55.95°S to 25.89°S) would be represented in JSON as [ 160.6, -55.95, -170, -25.89 ] and in a query as bbox=160.6,-55.95,-170,-25.89.

A template for the definition of the parameter in YAML according to OpenAPI 3.0 is available at [bbox.yaml](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/parameters/bbox.yaml).

**9.4.2. Parameter datetime**

|  |  |
| --- | --- |
| **Requirement 20** | **/req/collections/rc-time-definition** |
| A | The datetime parameter SHALL have the following characteristics (using an OpenAPI Specification 3.0 fragment):  name: datetime  in: query  required: false  schema:  type: string  style: form  explode: false |

|  |  |
| --- | --- |
| **Requirement 21** | **/req/collections/rc-time-response** |
| A | If the datetime parameter is provided, only resources that have a temporal geometry that intersects the temporal information in the datetime parameter SHALL be part of the result set. |
| B | If a resource has multiple temporal properties, the API decides whether only a single temporal property is used to determine the extent or all relevant temporal properties. |
| C | The datetime parameter SHALL match all resources in the collection that are not associated with a temporal geometry. |
| D | The temporal information is either a date-time or a time interval. The parameter value SHALL conform to the following syntax (using [ABNF](https://tools.ietf.org/html/rfc2234)):  interval-closed = date-time "/" date-time  interval-open-start = "../" date-time  interval-open-end = date-time "/.."  interval = interval-closed / interval-open-start / interval-open-end  datetime = date-time / interval |
| E | The syntax of date-time is specified by [RFC 3339, 5.6](https://tools.ietf.org/html/rfc3339#section-5.6). |
| F | Open ranges in time intervals at the start or end SHALL be supported using a double-dot (..). |

"Intersects" means that the time (instant or period) specified in the parameter datetime includes a timestamp that is part of the temporal geometry of the resource (again, a time instant or period). For time periods this includes the start and end time.

Example 3. A date-time

February 12, 2018, 23:20:52 GMT:

time=2018-02-12T23%3A20%3A52Z

For resources with a temporal property that is a timestamp (like lastUpdate in the building features), a date-time value would match all resources where the temporal property is identical.

For resources with a temporal property that is a date or a time interval, a date-time value would match all resources where the timestamp is on that day or within the time interval.

Example 4. Intervals

February 12, 2018, 00:00:00 GMT to March 18, 2018, 12:31:12 GMT:

datetime=2018-02-12T00%3A00%3A00Z%2F2018-03-18T12%3A31%3A12Z

February 12, 2018, 00:00:00 UTC or later:

datetime=2018-02-12T00%3A00%3A00Z%2F..

March 18, 2018, 12:31:12 UTC or earlier:

datetime=..%2F2018-03-18T12%3A31%3A12Z

A template for the definition of the parameter in YAML according to OpenAPI 3.0 is available at [datetime.yaml](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/parameters/datetime.yaml).

**9.5. General Requirements**

The following general requirements and recommendations apply to all OGC APIs which host Spatial Resources.

**9.5.1. Coordinate Reference Systems (CRS)**

As discussed in Chapter 9 of the W3C/OGC Spatial Data on the Web (SDW) [Best Practices document](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#SDWBP), how to express and share the location of resources in a consistent way is one of the most fundamental aspects of publishing geographic data. Therefore, clearly stating the CRS rules for the coordinates is very important.

For the reasons discussed in the SDW Best Practice OGC APIs use WGS84 longitude and latitude as the default CRS.

|  |  |
| --- | --- |
| **Requirement 22** | **/req/collections/crs84** |
| A | Unless the client explicitly requests a different coordinate reference system, all spatial geometries SHALL be in the [CRS84](http://www.opengis.net/def/crs/OGC/1.3/CRS84) (WGS 84 longitude/latitude) CRS for geometries without height information and [CRS84h](http://www.opengis.net/def/crs/OGC/0/CRS84h) (WGS 84 longitude/latitude plus ellipsoidal height) for geometries with height information. |

The implementations compliant with the Core are not required to support publishing geometries in CRS other than <http://www.opengis.net/def/crs/OGC/1.3/CRS84>. The Core also does not specify a capability to request geometries in a different CRS than the native one of the published resource. Such a capability will be specified in other OGC API standards.

**10. Requirements classes for encodings**

**10.1. Overview**

This clause specifies two pre-defined requirements classes for encodings to be used by an OGC API implementation. These encodings are commonly used encodings for spatial data on the web:

* [HTML](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_html-section)
* [GeoJSON](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_geojson-section)

Neither of these encodings are mandatory and an implementation of the [Core](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core-section) requirements class may implement either, both, or none of them. [Clause 7 (Overview)](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#overview) includes a discussion about recommended encodings.

**10.2. Requirement Class "HTML"**

Geographic information that is only accessible in formats such as GeoJSON or GML have two issues:

* The data is not discoverable using Web crawlers and search engines.
* The data cannot be viewed directly in a browser - additional tools are required to view the data.

Therefore, sharing data on the Web should include publication in HTML. To be consistent with the Web, this publication should be done in a way that enables users and search engines to discover and access all the data.

This is discussed in detail in the [W3C/OGC SDW Best Practice](file:///C:\\Users\\Office\\Documents\\GitHub\\oapi_common\\19-072.html" \l "SDWBP). Therefore, the OGC API-Common Standard [recommends](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rec_html) supporting HTML as an encoding.

|  |  |
| --- | --- |
| **Requirements Class** | |
| <http://www.opengis.net/spec/ogcapi_common/1.0/req/html> | |
| Target type | Web API |
| Dependency | [Requirements Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core) |
| Dependency | [HTML5](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#html5) |
| Dependency | [Schema.org](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#schema_org) |

|  |  |
| --- | --- |
| **Requirement 23** | **/req/html/definition** |
| A | Every 200-response of an operation of the API SHALL support the media type text/html. |

|  |  |
| --- | --- |
| **Requirement 24** | **/req/html/content** |
| A | Every 200-response of the API with the media type "text/html" SHALL be a [HTML 5 document](https://www.w3.org/TR/html5/) that includes the following information in the HTML body:   * All information identified in the schemas of the [Response Object](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.2.md#responseObject) in the HTML <body/>, and * All links in HTML <a/> elements in the HTML <body/>. |

|  |  |
| --- | --- |
| **Recommendation 10** | **/rec/html/schema-org** |
| A | A 200-response with the media type text/html, SHOULD include [Schema.org](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#schema_org) annotations. |

**10.3. Requirement Class "GeoJSON"**

GeoJSON is a commonly used format that is simple to understand and well supported by tools and software libraries. Since most Web developers are comfortable with using a JSON-based format, supporting GeoJSON is recommended with the caveat that the resource can be represented in GeoJSON for the intended use.

|  |  |
| --- | --- |
| **Requirements Class** | |
| <http://www.opengis.net/spec/ogcapi_common/1.0/req/geojson> | |
| Target type | Web API |
| Dependency | [Requirements Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core) |
| Dependency | [GeoJSON](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc7946) |

|  |  |
| --- | --- |
| **Requirement 25** | **/req/geojson/definition** |
| A | 200-responses of the server SHALL support the following media types:   * application/geo+json for resources that include feature content, and * application/json for all other resources. |

|  |  |
| --- | --- |
| **Requirement 26** | **/req/geojson/content** |
| A | Every 200-response with the media type application/geo+json SHALL be   * A [GeoJSON FeatureCollection Object](https://tools.ietf.org/html/rfc7946#section-3.3) for feature collections, and * A [GeoJSON Feature Object](https://tools.ietf.org/html/rfc7946#section-3.2) for features. |
| B | The schema of all responses with the media type application/json SHALL conform with the JSON Schema specified for that resource. |

|  |  |
| --- | --- |
| Note | The following schema names are from API-Features and need to be updated. |

Templates for the definition of the schemas for the GeoJSON responses in JSON Schema definitions are available at [collections.yaml](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collections.yaml) and [collectionInfo.yaml](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collectionInfo.yaml).

These are generic schemas that do not include any application schema information about specific resource types or their properties.

**11. Requirements class "OpenAPI 3.0"**

**11.1. Basic requirements**

APIs conforming to this requirements class document themselves by an [OpenAPI Document](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md#oasDocument).

|  |  |
| --- | --- |
| **Requirements Class** | |
| <http://www.opengis.net/spec/ogcapi_common/1.0/req/oas30> | |
| Target type | Web API |
| Dependency | [Requirements Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core) |
| Dependency | [OpenAPI Specification 3.0.2](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#openapi) |

|  |  |
| --- | --- |
| **Requirement 27** | **/req/oas30/oas-definition-1** |
| A | An OpenAPI definition in JSON using the media type application/vnd.oai.openapi+json;version=3.0 and a HTML version of the API definition using the media type text/html SHALL be available. |

|  |  |
| --- | --- |
| Caution | [ISSUE 117](https://github.com/opengeospatial/WFS_FES/issues/117) |

The OpenAPI media type has not been registered yet with IANA and will likely change. We need to update the media type after registration.

|  |  |
| --- | --- |
| **Requirement 28** | **/req/oas30/oas-definition-2** |
| A | The JSON representation SHALL conform to the [OpenAPI Specification, version 3.0](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#openapi). |

Two example OpenAPI documents are included in [Annex B](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#oas-examples).

|  |  |
| --- | --- |
| **Requirement 29** | **/req/oas30/oas-impl** |
| A | The API SHALL implement all capabilities specified in the OpenAPI definition. |

**11.2. Complete definition**

|  |  |
| --- | --- |
| **Requirement 30** | **/req/oas30/completeness** |
| A | The OpenAPI definition SHALL specify for each operation all [HTTP Status Codes](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md#httpCodes) and [Response Objects](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md#responseObject) that the API uses in responses. |
| B | This includes the successful execution of an operation as well as all error situations that originate from the server. |

Note APIs that, for example, are access-controlled (see [Security](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#security)), support web cache validation, support CORS, or that use HTTP redirection will make use of additional HTTP status codes beyond regular codes such as 200 for successful GET requests and 400, 404 or 500 for error situations. See [HTTP Status Codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#http-status-codes).

Clients have to be prepared to receive responses not documented in the OpenAPI definition. For example, additional errors may occur in the transport layer outside of the server.

**11.3. Exceptions**

|  |  |
| --- | --- |
| **Requirement 31** | **/req/oas30/exceptions-codes** |
| A | For error situations that originate from an API server, the API definition SHALL cover all applicable HTTP Status Codes. |

Example 5. An exception response object definition

description: An error occurred.

content:

application/json:

schema:

$ref: https://raw.githubusercontent.com/opengeospatial/OAPI/openapi/schemas/exception.yaml

text/html:

schema:

type: string

**11.4. Security**

|  |  |
| --- | --- |
| **Requirement 32** | **/req/oas30/security** |
| A | For cases, where the operations of the API are access-controlled, the security scheme(s) and requirements SHALL be documented in the OpenAPI definition. |

The OpenAPI specification currently supports the following [security schemes](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md#security-scheme-object):

* HTTP authentication,
* an API key (either as a header or as a query parameter),
* OAuth2’s common flows (implicit, password, application and access code) as defined in RFC6749, and
* OpenID Connect Discovery.

**12. Media Types**

JSON media types that would typically be used in an OGC API that supports JSON are:

* application/geo+json for feature collections and features, and
* application/json for all other resources.

XML media types that would typically occur in an OGC API that supports XML are:

* application/gml+xml;version=3.2 for any GML 3.2 feature collections and features,
* application/gml+xml;version=3.2;profile=http://www.opengis.net/def/profile/ogc/2.0/gml-sf0 for GML 3.2 feature collections and features conforming to the GML Simple Feature Level 0 profile,
* application/gml+xml;version=3.2;profile=http://www.opengis.net/def/profile/ogc/2.0/gml-sf2 for GML 3.2 feature collections and features conforming to the GML Simple Feature Level 2 profile, and
* application/xml for all other resources.

The typical HTML media type for all "web pages" in an OGC API would be text/html.

The media types for an OpenAPI definition are vnd.oai.openapi+json;version=3.0 (JSON) and application/vnd.oai.openapi;version=3.0 (YAML).

|  |  |
| --- | --- |
| Note | The OpenAPI media type has not been registered yet with IANA and may change. |

**Annex A: Abstract Test Suite (Normative)**

**A.1. Introduction**

OGC Web APIs are not a Web Service in the traditional sense. Rather, they define the behavior and content of a set of Resources exposed through a Web Application Programing Interface (Web API). Therefore, an API may expose resources in addition to those defined by the standard. A test engine must be able to traverse the API, identify and validate test points, and ignore resource paths which are not to be tested.

**A.2. Conformance Class Core**

|  |  |
| --- | --- |
| **Conformance Class** | |
| <http://www.opengis.net/spec/ogcapi-common/1.0/conf/core> | |
| Target type | Web API |
| Requirements Class | [http://www.opengis.net/spec/ogcapi\_common/1.0/req/core](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_core) |

**A.2.1. General Tests**

**HTTP**

|  |  |
| --- | --- |
| **Abstract Test 1** | **/ats/core/http** |
| Test Purpose | Validate that the resource paths advertised through the API conform with HTTP 1.1 and, where appropriate, TLS. |
| Requirement | [/req/core/http](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_http) |
| Test Method | 1. All compliance tests shall be configured to use the HTTP 1.1 protocol exclusively. 2. For APIs which support HTTPS, all compliance tests shall be configured to use [HTTP over TLS](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rfc2818) (RFC 2818) with their HTTP 1.1 protocol. |

**A.2.2. Landing Page {root}/**

|  |  |
| --- | --- |
| **Abstract Test 2** | **/ats/core/root-op** |
| Test Purpose | Validate that a landing page can be retrieved from the expected location. |
| Requirement | [/req/core/root-op](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_root-op) |
| Test Method | 1. Issue an HTTP GET request to the URL {root}/ 2. Validate that a document was returned with a status code 200 3. Validate the contents of the returned document using test [/ats/core/root-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_core_root-success). |

|  |  |
| --- | --- |
| **Abstract Test 3** | **/ats/core/root-success** |
| Test Purpose | Validate that the landing page complies with the require structure and contents. |
| Requirement | [/req/core/root-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_root-success) |
| Test Method | Validate the landing page for all supported media types using the resources and tests identified in [Table 7](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#landing-page-schema)  For formats that require manual inspection, perform the following:   1. Validate that the landing page includes a "service-desc" and/or "service-doc" link to an API Definition 2. Validate that the landing page includes a "conformance" link to the conformance class declaration 3. Validate that the landing page includes a "data" link to the Feature contents. |

The landing page may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the landing page against that schema. All supported formats should be exercised.

| Table 7. Schema and Tests for Landing Pages | | |
| --- | --- | --- |
| **Format** | **Schema Document** | **Test ID** |
| HTML | [landingPage.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/landingPage.json) | [/ats/html/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_html_content) |
| JSON | [landingPage.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/landingPage.json) | [/ats/geojson/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_geojson_content) |

**A.2.3. API Definition Path {root}/api (link)**

|  |  |
| --- | --- |
| **Abstract Test 4** | **/ats/core/api-definition-op** |
| Test Purpose | Validate that the API Definition document can be retrieved from the expected location. |
| Requirement | [/req/core/api-definition-op](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_api-definition-op) |
| Test Purpose | Validate that the API Definition document can be retrieved from the expected location. |
| Test Method | 1. Construct a path for each API Definition link on the landing page 2. Issue a HTTP GET request on each path 3. Validate that a document was returned with a status code 200 4. Validate the contents of the returned document using test [/ats/core/api-definition-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_core_api-definition-success). |

|  |  |
| --- | --- |
| **Abstract Test 5** | **/ats/core/api-definition-success** |
| Test Purpose | Validate that the API Definition complies with the required structure and contents. |
| Requirement | [/req/core/api-definition-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_api-definition-success) |
| Test Method | Validate the API Definition document against an appropriate schema document. |

**A.2.4. Conformance Path {root}/conformance**

|  |  |
| --- | --- |
| **Abstract Test 6** | **/ats/core/conformance-op** |
| Test Purpose | Validate that a Conformance Declaration can be retrieved from the expected location. |
| Requirement | [/req/core/conformance-op](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_conformance-op) |
| Test Method | 1. Construct a path for each "conformance" link on the landing page as well as for the {root}/conformance path. 2. Issue an HTTP GET request on each path 3. Validate that a document was returned with a status code 200 4. Validate the contents of the returned document using test [/ats/core/conformance-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_core_conformance-success). |

|  |  |
| --- | --- |
| **Abstract Test 7** | **/ats/core/conformance-success** |
| Test Purpose | Validate that the Conformance Declaration response complies with the required structure and contents. |
| Requirement | [/req/core/conformance-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_core_conformance-success) |
| Test Method | 1. Validate the response document against OpenAPI 3.0 schema [confClasses.yaml](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/confClasses.yaml) 2. Validate that the document includes the conformance class "http://www.opengis.net/spec/ogcapi-features-1/1.0/conf/core" 3. Validate that the document list all OGC API conformance classes that the API implements. |

**A.3. Conformance Class Collections**

|  |  |
| --- | --- |
| **Conformance Class** | |
| <http://www.opengis.net/spec/ogcapi-common/1.0/conf/collections> | |
| Target type | Web API |
| Requirements Class | [http://www.opengis.net/spec/ogcapi\_common/1.0/req/collections](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_collections) |
| Dependency | [Conformance Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_core) |

**A.3.1. General Tests**

**CRS 84**

|  |  |
| --- | --- |
| **Abstract Test 8** | **/ats/collections/crs84** |
| Test Purpose | Validate that all spatial geometries provided through the API are in the CRS84 coordinate reference system unless otherwise requested by the client. |
| Requirement | [/req/collections/crs84](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_crs84) |
| Test Method | 1. Do not specify a CRS in any request. All spatial data should be in the CRS84 reference system. 2. Validate retrieved spatial data using the CRS84 reference system. |

**A.3.2. Feature Collections {root}/collections**

|  |  |
| --- | --- |
| **Abstract Test 9** | **/ats/collections/rc-md-op** |
| Test Purpose | Validate that information about the Collections can be retrieved from the expected location. |
| Requirement | [/req/collections/rc-md-op](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-md-op) |
| Test Method | 1. Issue an HTTP GET request to the URL {root}/collections 2. Validate that a document was returned with a status code 200 3. Validate the contents of the returned document using test [/ats/collections/rc-md-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-md-success). |

|  |  |
| --- | --- |
| **Abstract Test 10** | **/ats/collections\_rc-md-success** |
| Test Purpose | Validate that the Collections content complies with the required structure and contents. |
| Requirement | [/req/collections/rc-md-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-md-success), [/req/collections/crs84](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_crs84) |
| Test Method | 1. Validate that all response documents comply with [/ats/collections/rc-md-links](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-md-links) 2. In case the response includes a "crs" property, validate that the first value is either: "http://www.opengis.net/def/crs/OGC/1.3/CRS84" or "http://www.opengis.net/def/crs/OGC/0/CRS84h" 3. Validate the collections content for all supported media types using the resources and tests identified in [Table 8](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#collections-metadata-schema) |

The Collections content may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate against that schema. All supported formats should be exercised.

| Table 8. Schema and Tests for Collections content | | |
| --- | --- | --- |
| **Format** | **Schema Document** | **Test ID** |
| HTML | [collections.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collections.json) | [/ats/html/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_html_content) |
| JSON | [collections.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collections.json) | [/ats/geojson/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_geojson_content) |

**A.3.3. Feature Collection {root}/collections/{collectionId}**

|  |  |
| --- | --- |
| **Abstract Test 11** | **/ats/collections/src-md-op** |
| Test Purpose | Validate that the Collection content can be retrieved from the expected location. |
| Requirement | [/req/collections/src-md-op](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_src-md-op) |
| Test Method | For every Feature Collection described in the Collections content, issue an HTTP GET request to the URL /collections/{collectionId} where {collectionId} is the id property for the collection. . Validate that a Collection was returned with a status code 200. Validate the contents of the returned document using test [/ats/collections/src-md-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_src-md-success). |

|  |  |
| --- | --- |
| **Abstract Test 12** | **/ats/collections/src-md-success** |
| Test Purpose | Validate that the Collection content complies with the required structure and contents. |
| Requirement | [/req/collections/src-md-success](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_src-md-success) |
| Test Method | Verify that the content of the response is consistent with the content for this Resource Collection in the /collections response. That is, the values for id, title, description and extent are identical. |

**A.3.4. Features {root}/collections/{collectionId}/items**

|  |  |  |
| --- | --- | --- |
| Note | This test is too Feature centric. Will need to be greatly reduced in scope. | |
| **Abstract Test 13** | | **/ats/collections/rc-op** | |
| Test Purpose | | Validate that resources can be identified and extracted from a Collection using query parameters. | |
| Requirement | | [/req/collections/rc-op](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-op) | |
| Test Method | | 1. For every resource collection identified in Collections, issue an HTTP GET request to the URL /collections/{collectionId}/items where {collectionId} is the id property for a Collection described in the Collections content. 2. Validate that a document was returned with a status code 200.   Repeat these tests using the following parameter tests:  **Bounding Box:**   * Parameter [/ats/collections/rc-bbox-definition](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-bbox-definition) * Response [/ats/collections/rc-bbox-response](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-bbox-response)   **DateTime:**   * Parameter [/ats/collections/rc-time-definition](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-time-definition) * Response [/ats/collections/rc-time-response](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-time-response)   Execute requests with combinations of the "bbox" and "datetime" query parameters and verify that only features are returned that match both selection criteria. | |

|  |  |
| --- | --- |
| **Abstract Test 14** | **/ats/collections/rc-bbox-definition** |
| Test Purpose | Validate that the bounding box query parameters are constructed correctly. |
| Requirement | [/req/collections/rc-bbox-definition](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-bbox-definition) |
| Test Method | Verify that the bbox query parameter complies with the following definition (using an OpenAPI Specification 3.0 fragment):  name: bbox  in: query  required: false  schema:  type: array  minItems: 4  maxItems: 6  items:  type: number  style: form  explode: false  Use a bounding box with four numbers in all requests:   * Lower left corner, WGS 84 longitude * Lower left corner, WGS 84 latitude * Upper right corner, WGS 84 longitude * Upper right corner, WGS 84 latitude |

|  |  |
| --- | --- |
| **Abstract Test 15** | **/ats/collections/rc-bbox-response** |
| Test Purpose | Validate that the bounding box query parameters are processed corrrectly. |
| Requirement | [/req/collections/rc-bbox-response](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-bbox-response) |
| Test Method | 1. Verify that only resources that have a spatial geometry that intersects the bounding box are returned as part of the result set. 2. Verify that the bbox parameter matched all resources in the collection that were not associated with a spatial geometry (this is only applicable for datasets that include resources without a spatial geometry). 3. Verify that the coordinate reference system of the geometries is WGS 84 longitude/latitude ("http://www.opengis.net/def/crs/OGC/1.3/CRS84" or "http://www.opengis.net/def/crs/OGC/0/CRS84h") since no parameter bbox-crs was specified in the request. |

|  |  |
| --- | --- |
| **Abstract Test 16** | **/ats/collections/rc-time-definition** |
| Test Purpose | Validate that the dateTime query parameters are constructed correctly. |
| Requirement | [/req/collections/rc-time-definition](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-time-definition) |
| Test Method | Verify that the datetime query parameter complies with the following definition (using an OpenAPI Specification 3.0 fragment):  name: datetime  in: query  required: false  schema:  type: string  style: form  explode: false |

|  |  |
| --- | --- |
| **Abstract Test 17** | **/ats/collections/rc-time-response** |
| Test Purpose | Validate that the dataTime query parameters are processed correctly. |
| Requirement | [/req/collections/rc-time-response](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-time-response) |
| Test Method | 1. Verify that only resources that have a temporal geometry that intersects the temporal information in the datetime parameter were included in the result set 2. Verify that all resources in the collection that are not associated with a temporal geometry are included in the result set 3. Validate that the datetime parameter complies with the syntax described in [/req/collections/rc-time-response](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-time-response). |

|  |  |
| --- | --- |
| **Abstract Test 18** | **/ats/collections/rc-response** |
| Test Purpose | Validate that the Resource Collection complies with the require structure and contents. |
| Requirement | [/req/collections/rc-response](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-response) |
| Test Method | The test method is specific to the resource type returned. |

**A.3.5. Second Tier Tests**

These tests are invoked by other tests.

**Extent**

|  |  |
| --- | --- |
| **Abstract Test 19** | **/ats/coollections/rc-md-extent** |
| Test Purpose | Validate that the extent property if it is present |
| Requirement | [/req/collections/rc-md-extent](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-md-extent) |
| Test Method | 1. Verify that the extent provides bounding boxes that include all spatial geometries 2. Verify that if the extent provides time intervals that include all temporal geometries in this collection. 3. A temporal extent of null indicates an open time interval. |

**Items**

|  |  |
| --- | --- |
| **Abstract Test 20** | **/ats/collections/rc-md-items** |
| Test Purpose | Validate that each collection provided by the server is described in the Collections Metadata. |
| Requirement | [/req/collections/rc-md-items](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-md-items) |
| Test Method | 1. Verify that there is an entry in the collections array of the Collections Metadata for each feature collection provided by the API. 2. Verify that each collection entry includes an identifier. 3. Verify that each collection entry includes links in accordance with [/collections/rc-md-items-links](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-md-items-links). 4. Verify that if the collection entry includes an extent property, that that property complies with [/collections/rc-md-extent](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_collections_rc-md-extent) 5. Validate each collection entry for all supported media types using the resources and tests identified in [Table 9](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#collection-entry-schema) |

The collection entries may be encoded in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validateagainst that schema. All supported formats should be exercised.

| Table 9. Schema and Tests for Collection Entries | | |
| --- | --- | --- |
| **Format** | **Schema Document** | **Test ID** |
| HTML | [collectionInfo.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collectionInfo.json) | [/ats/html/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_html_content) |
| JSON | [collectionInfo.json](https://raw.githubusercontent.com/opengeospatial/oapi_common/master/standard/openapi/schemas/collectionInfo.json) | [/ats/geojson/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_geojson_content) |

|  |  |
| --- | --- |
| **Abstract Test 21** | **/ats/collections/rc-md-items-links** |
| Test Purpose | Validate that each Feature Collection metadata entry in the Collections Metadata document includes all required links. |
| Requirement | [/req/collections/rc-md-items-links](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-md-items-links) |
| Test Method | 1. Verify that each Collection item in the Collections Metadata document includes a link property for each supported encoding. 2. Verify that the links properties of the collection includes an item for each supported encoding with a link to the features resource (relation: items). 3. Verify that all links include the rel and type link parameters. |

**Links**

|  |  |
| --- | --- |
| **Abstract Test 22** | **/ats/collections/rc-md-links** |
| Test Purpose | Validate that the required links are included in the Collections Metadata document. |
| Requirement | [/req/collections/rc-md-links](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_collections_rc-md-links) |
| Test Method | Verify that the response document includes:   1. a link to this response document (relation: self), 2. a link to the response document in every other media type supported by the server (relation: alternate).   Verify that all links include the rel and type link parameters. |

**A.4. Conformance Class GeoJSON**

|  |  |
| --- | --- |
| **Conformance Class** | |
| <http://www.opengis.net/spec/ogcapi-common/1.0/conf/geojson> | |
| Target type | Web API |
| Requirements Class | [http://www.opengis.net/spec/ogcapi\_common/1.0/req/geojson](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_geojson) |
| Dependency | [Conformance Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_core) |

**A.4.1. GeoJSON Definition**

|  |  |
| --- | --- |
| **Abstract Test 23** | **/ats/geojson/definition** |
| Test Purpose | Verify support for JSON and GeoJSON |
| Requirement | [/req/geojson/definition](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_geojson_definition) |
| Test Method | 1. A resource is requested with response media type of application/geo+json 2. All 200-responses SHALL support the following media types:    * application/geo+json for resources that include feature content, and    * application/json for all other resources. |

**A.4.2. GeoJSON Content**

|  |  |
| --- | --- |
| **Abstract Test 24** | **/ats/geojson/content** |
| Test Purpose | Verify the content of a GeoJSON document given an input document and schema. |
| Requirement | [/req/geojson/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_geojson_content) |
| Test Method | 1. Validate that the document is a GeoJSON document. 2. Validate the document against the schema using a JSON Schema validator. |

**A.5. Conformance Class HTML**

|  |  |
| --- | --- |
| **Conformance Class** | |
| <http://www.opengis.net/spec/ogcapi-common/1.0/conf/html> | |
| Target type | Web API |
| Requirements Class | [http://www.opengis.net/spec/ogcapi\_common/1.0/req/html](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_html) |
| Dependency | [Conformance Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_core) |

**A.5.1. HTML Definition**

|  |  |
| --- | --- |
| **Abstract Test 25** | **/ats/html/definition** |
| Test Purpose | Verify support for HTML |
| Requirement | [/req/html/definition](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_html_definition) |
| Test Method | Verify that every 200-response of every operation of the API where HTML was requested is of media type text/html |

**A.5.2. HTML Content**

|  |  |
| --- | --- |
| **Abstract Test 26** | **/ats/html/content** |
| Test Purpose | Verify the content of an HTML document given an input document and schema. |
| Requirement | [/req/html/content](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_html_content) |
| Test Method | 1. Validate that the document is an [HTML 5 document](https://www.w3.org/TR/html5/) 2. Manually inspect the document against the schema. |

**A.6. Conformance Class OpenAPI 3.0**

|  |  |
| --- | --- |
| **Conformance Class** | |
| <http://www.opengis.net/spec/ogcapi-common/1.0/conf/oas3> | |
| Target type | Web API |
| Requirements Class | [http://www.opengis.net/spec/ogcapi\_common/1.0/req/oas3](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#rc_oas3) |
| Dependency | [Conformance Class "OAPI Core"](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#ats_core) |

|  |  |
| --- | --- |
| **Abstract Test 27** | **/ats/oas30/completeness** |
| Test Purpose | Verify the completeness of an OpenAPI document. |
| Requirement | [/req/oas30/completeness](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_oas30_completeness) |
| Test Method | Verify that for each operation, the OpenAPI document describes all [HTTP Status Codes](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md#httpCodes) and [Response Objects](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md#responseObject) that the API uses in responses. |

|  |  |
| --- | --- |
| **Abstract Test 28** | **/ats/oas30/exceptions-codes** |
| Test Purpose | Verify that the OpenAPI document fully describes potential exception codes. |
| Requirement | [/req/oas30/exceptions-codes](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_oas30_exceptions-codes) |
| Test Method | Verify that for each operation, the OpenAPI document describes all [HTTP Status Codes](https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md#httpCodes) that may be generated. |

|  |  |
| --- | --- |
| **Abstract Test 29** | **/ats/oas30/oas-definition-1** |
| Test Purpose | Verify that JSON and HTML versions of the OpenAPI document are available. |
| Requirement | [/req/oas30/oas-definition-1](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_oas30_oas-definition-1) |
| Test Method | 1. Verify that an OpenAPI definition in JSON is available using the media type application/vnd.oai.openapi+json;version=3.0 and link relation service-desc 2. Verify that an HTML version of the API definition is available using the media type text/html and link relation service-doc. |

|  |  |
| --- | --- |
| **Abstract Test 30** | **/ats/oas30/oas-definition-2** |
| Test Purpose | Verify that the OpenAPI document is valid JSON. |
| Requirement | [/req/oas30/oas-definition-2](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_oas30_oas-definition-2) |
| Test Method | Verify that the JSON representation conforms to the [OpenAPI Specification, version 3.0](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#openapi). |

|  |  |
| --- | --- |
| **Abstract Test 31** | **/ats/oas30/oas-impl** |
| Test Purpose | Verify that all capabilities specified in the OpenAPI definition are implemented by the API. |
| Requirement | [/req/oas30/oas-impl](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_oas30_oas-impl) |
| Test Method | 1. Construct a path from each URL template including all server URL options and all enumerated path parameters. 2. For each path defined in the OpenAPI document, validate that the path performs in accordance with the API definition and the API-Features standard. |

|  |  |
| --- | --- |
| **Abstract Test 32** | **/ats/oas30/security** |
| Test Purpose | Verify that any authentication protocols implemented by the API are documented in the OpenAPI document. |
| Requirement | [/req/oas30/security](file:///C:\Users\Office\Documents\GitHub\oapi_common\19-072.html#req_oas30_security) |
| Test Method | 1. Identify all authentication protocols supported by the API. 2. Validate that each authentication protocol is described inthe OpenAPI document by a Security Schema Object and its' use specified by a Security Requirement Object. |

**Annex B: Examples (Informative)**

**B.1. Example Landing Pages**

Example 6. JSON Landing Page

{

"links": [

{ "href": "http://data.example.org/",

"rel": "self", "type": "application/json", "title": "this document" },

{ "href": "http://data.example.org/api",

"rel": "service", "type": "application/openapi+json;version=3.0", "title": "the API definition" },

{ "href": "http://data.example.org/conformance",

"rel": "conformance", "type": "application/json", "title": "OGC conformance classes implemented by this API" },

{ "href": "http://data.example.org/collections",

"rel": "data", "type": "application/json", "title": "Metadata about the resource collections" }

]

}

**B.2. API Description Examples**

|  |  |
| --- | --- |
| Note | include::examples/tbd.adoc[] |

**B.3. Conformance Examples**

Example 7. Conformance Response

This example response in JSON is for an OGC API Features that supports OpenAPI 3.0 for the API definition and HTML and GeoJSON as encodings for resources.

{

"conformsTo": [

"http://www.opengis.net/spec/ogcapi-features-1/1.0/req/core",

"http://www.opengis.net/spec/ogcapi-features-1/1.0/req/oas30",

"http://www.opengis.net/spec/ogcapi-features-1/1.0/req/html",

"http://www.opengis.net/spec/ogcapi-features-1/1.0/req/geojson"

]

}

**B.4. Collections Metadata Examples**

Example 8. Collection metadata response document

This feature collection metadata example response in JSON is for a dataset with a single collection "buildings". It includes links to the collection resource in all formats that are supported by the API ([link relation type](https://www.iana.org/assignments/link-relations/link-relations.xhtml): "items").

There is a link to the feature collections response itself ([link relation type](https://www.iana.org/assignments/link-relations/link-relations.xhtml): "self").

Representations of this resource in other formats are referenced using [link relation type](https://www.iana.org/assignments/link-relations/link-relations.xhtml) "alternate".

An additional link is to a GML application schema for the dataset - using:https://www.iana.org/assignments/link-relations/link-relations.xhtml[link relation type] "describedBy".

A bulk download of all the features in the dataset is referenced using [link relation type](https://www.iana.org/assignments/link-relations/link-relations.xhtml) "enclosure"

Finally there are also links to the license information for the building data (using:https://www.iana.org/assignments/link-relations/link-relations.xhtml[link relation type] "license").

Reference system information is not provided as the service provides geometries only in the default system (spatial: WGS 84 longitude/latitude; temporal: Gregorian calendar).

{

"links": [

{ "href": "http://data.example.org/collections.json",

"rel": "self", "type": "application/json", "title": "this document" },

{ "href": "http://data.example.org/collections.html",

"rel": "alternate", "type": "text/html", "title": "this document as HTML" },

{ "href": "http://schemas.example.org/1.0/foobar.xsd",

"rel": "describedBy", "type": "application/xml", "title": "XML schema for Acme Corporation data" }

],

"collections": [

{

"id": "buildings",

"title": "Buildings",

"description": "Buildings in the city of Bonn.",

"extent": {

"spatial": [ 7.01, 50.63, 7.22, 50.78 ],

"temporal": [ "2010-02-15T12:34:56Z", "2018-03-18T12:11:00Z" ]

},

"links": [

{ "href": "http://data.example.org/collections/buildings/items",

"rel": "items", "type": "application/geo+json",

"title": "Buildings" },

{ "href": "http://example.org/concepts/building.html",

"rel": "describedBy", "type": "text/html",

"title": "Feature catalogue for buildings" }

]

}

]

}

**B.5. Collection Information Examples**

|  |  |
| --- | --- |
| Note | include::examples/tbd.adoc[] |

**Annex C: Revision History**

| **Date** | **Release** | **Editor** | **Primary clauses modified** | **Description** |
| --- | --- | --- | --- | --- |
| 2019-10-31 | October 2019 snapshot | C. Heazel | all | Baseline update |

**Annex D: Bibliography**

* Open Geospatial Consortium: The Specification Model — A Standard for Modular specifications, [OGC 08-131](https://portal.opengeospatial.org/files/?artifact_id=34762)
* W3C/OGC: Spatial Data on the Web Best Practices, W3C Working Group Note 28 September 2017, <https://www.w3.org/TR/sdw-bp/>
* W3C: Data on the Web Best Practices, W3C Recommendation 31 January 2017, <https://www.w3.org/TR/dwbp/>
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* IANA: Link Relation Types, <https://www.iana.org/assignments/link-relations/link-relations.xml>

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