OGC API - Common - Part 1

Core

OGC API - Common - Part 1: Core

Copyright notice

Warning

License Agreement

Permission is hereby granted by the Open Geospatial Consortium, ("Licensor"), free of charge and subject to the terms set forth below, to any person obtaining a copy of this Intellectual Property and any associated documentation, to deal in the Intellectual Property without restriction (except as set forth below), including without limitation the rights to implement, use, copy, modify, merge, publish, distribute, and/or sublicense copies of the Intellectual Property, and to permit persons to whom the Intellectual Property is furnished to do so, provided that all copyright notices on the intellectual property are retained intact and that each person to whom the Intellectual Property is furnished agrees to the terms of this Agreement.

If you modify the Intellectual Property, all copies of the modified Intellectual Property must include, in addition to the above copyright notice, a notice that the Intellectual Property includes modifications that have not been approved or adopted by LICENSOR.

THIS LICENSE IS A COPYRIGHT LICENSE ONLY, AND DOES NOT CONVEY ANY RIGHTS UNDER ANY PATENTS THAT MAY BE IN FORCE ANYWHERE IN THE WORLD.

THE INTELLECTUAL PROPERTY IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. THE COPYRIGHT HOLDER OR HOLDERS INCLUDED IN THIS NOTICE DO NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE INTELLECTUAL PROPERTY WILL MEET YOUR REQUIREMENTS OR THAT THE OPERATION OF THE INTELLECTUAL PROPERTY WILL BE UNINTERRUPTED OR ERROR FREE. ANY USE OF THE INTELLECTUAL PROPERTY SHALL BE MADE ENTIRELY AT THE USER'S OWN RISK. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR ANY CONTRIBUTOR OF INTELLECTUAL PROPERTY RIGHTS TO THE INTELLECTUAL PROPERTY BE LIABLE FOR ANY CLAIM, OR ANY DIRECT, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM ANY ALLEGED INFRINGEMENT OR ANY LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR UNDER ANY OTHER LEGAL THEORY, ARISING OUT OF OR IN CONNECTION WITH THE IMPLEMENTATION, USE, COMMERCIALIZATION OR PERFORMANCE OF THIS INTELLECTUAL PROPERTY.

This license is effective until terminated. You may terminate it at any time by destroying the Intellectual Property together with all copies in any form. The license will also terminate if you fail to comply with any term or condition of this Agreement. Except as provided in the following sentence, no such termination of this license shall require the termination of any third party end-user sublicense to the Intellectual Property which is in force as of the date of notice of such termination. In addition, should the Intellectual Property, or the operation of the Intellectual Property, infringe, or in LICENSOR's sole opinion be likely to infringe, any patent, copyright, trademark or other right of a third party, you agree that LICENSOR, in its sole discretion, may terminate this license without any compensation or liability to you, your licensees or any other party. You agree upon termination of any kind to destroy or cause to be destroyed the Intellectual Property together with all copies in any form, whether held by you or by any third party.

Except as contained in this notice, the name of LICENSOR or of any other holder of a copyright in all or part of the Intellectual Property shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Intellectual Property without prior written authorization of LICENSOR or such copyright holder. LICENSOR is and shall at all times be the sole entity that may authorize you or any third party to use certification marks, trademarks or other special designations to indicate compliance with any LICENSOR standards or specifications. This Agreement is governed by the laws of the Commonwealth of Massachusetts. The application to this Agreement of the United Nations Convention on Contracts for the International Sale of Goods is hereby expressly excluded. In the event any provision of this Agreement shall be deemed unenforceable, void or invalid, such provision shall be modified so as to make it valid and enforceable, and as so modified the entire Agreement shall remain in full force and effect. No decision, action or inaction by LICENSOR shall be construed to be a waiver of any rights or remedies available to it.

Table of Contents

Chapter 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 more than one of those standards. These common practices are documented in the OGC API - Common Standard. API-Common specifies reusable building-blocks. Developers of OGC standards will use these building-blocks in the construction of OGC Web API Standards. The goal is a modular suite of coherent OGC Web API standards that can be adapted by a system designer to meet the unique requirements of their system.

ii. Keywords

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

ogcdoc, OGC document, geographic information, spatial data, API, json, html, OpenAPI, REST, Common

iii. Preface

OGC Declaration

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

iv. Submitting organizations

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

- Ecere Corporation
- Heazeltech LLC
- Hexagon
- Interactive Instruments GmbH
- U.K. Met Office
- Universitat Autònoma de Barcelona (CREAF)
- U.S. Army Geospatial Center
- U.S. Geological Survey
- U.S. National Aeronautics and Space Administration (NASA)

- U.S. National Geospatial-Intelligence Agency

v. Submitters

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

Name	Affiliation
Charles Heazel *(editor)*	Heazeltech
David Blodgett	U.S. Geological Survey
Clemens Portele	Interactive Instruments
Sylvester Hagler	U.S. National Geospatial-Intelligence Agency
Jeffrey Harrison	U.S. Army Geospatial Center
Frédéric Houbie	Hexagon
Jérôme Jacovella-St-Louis	Ecere Corporation
Chris Little	U.K. Met Office
Joan Masó	UAB-CREAF
Donald Sullivan	NASA
Panagiotis (Peter) A. Vretanos	CubeWerx Inc.

Chapter 2. Scope

The OGC API-Common Part 1 Standard provides the fundamental rules for implementing an OGC Web API. It seeks to establish a solid foundation which can be extended by other resource-specific Web API Standards.

First, this Standard establishes rules for the use of HTTP protocols and URIs. These requirements seek to provide both API servers and clients a predictable environment for the exchange of HTTP requests and responses. These rules are applicable reqardless of the resources being accessed.

Then this Standard enables discovery operations directed against a Web API implementation. It identifies the hosted resources, defines conformance classes, and provides both human and machine readable documentation of the API design. The requirements specified in this standard should be applicable to any Web API implementation.

This standard defines a first stop for clients seeking to understand and use a new Web API. Use of this standard is strongly recommended for any new implementations of OGC Web API standards. However, in keeping with the OGC's principle of modular API standards, use of this standard is not required of OGC conformant Web API implementations.

Chapter 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.

This standard addresses one Standardization Target: Web APIs

OGC API - Common - Part 1: Core provides a common foundation for OGC Web API standards. The assumption is that this standard will only be implemented through inclusion in other standards. Therefore, all the relevant abstract tests in Annex A should be included in or referenced by the Abstract Test Suite (ATS) in each standard that implements conformance classes defined in this standard.

This standard identifies five conformance classes. The conformance classes implemented by an OGC API are advertised through the `/conformance` resource on the implementation instance of the API's 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.

3.1. Core Requirements Class

The requirements specified in the *Core Requirements Class* are applicable to all OGC API standards. They assure consistent use of the HTTP protocols, provide rules for the construction of URIs, and define requirements governing the use and processing of URI query parameters. Through these requirements, OGC API-Common seeks to assure that implementations of OGC API standards will provide a predictable interface for their peers.

The Core requirements class is specified in (Chapter 8) **Core Requirements Class**.

3.2. Landing Page Requirements Class

The requirements specified in the *Landing Page Requirements Class* provide a minimal useful service interface for an OGC Web API. These resources convey a basic understanding of the API and provide a starting point for further discovery. The requirements specified in this requirements class are recommended for all OGC Web APIs.

The Landing Page requirements class is specified in (Chapter 9) **Landing Page Requirements Class**.

3.3. Encoding Requirements Classes

The OGC API - Common Standard does not mandate a specific encoding or format for representations of resources. However, both *HTML* and *JSON* are commonly used encodings for spatial data on the web. The *HTML* and *JSON* requirements classes specify the encoding of resource representations using:

- HTML

- JSON

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

The Encoding Requirements Classes are specified in (Chapter 10) **Encoding Requirements Classes**.

3.4. OpenAPI 3.0 Requirements Class

The OGC API - Common Standard 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.

The OpenAPI 3.0 Requirements Class is specified in (Chapter 11) **OpenAPI 3.0 Requirements Class**.

Chapter 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.

- Rescorla, E.: **IETF RFC 2818, HTTP Over TLS**, http://tools.ietf.org/rfc/rfc2818.txt

- Klyne, G., Newman, C.: **IETF RFC 3339, Date and Time on the Internet: Timestamps**, http://tools.ietf.org/rfc/rfc3339.txt

- Berners-Lee, T., Fielding, R., Masinter, L: **IETF RFC 3986, Uniform Resource Identifier (URI): Generic Syntax**, http://tools.ietf.org/rfc/rfc3986.txt

- Greforio, J., Fielding, R., Hadley, M., Nottingham, M., Orchard, D.: **IETF RFC 6570, URI Template**, https://tools.ietf.org/html/rfc6570

- Fielding, R., Reschke, J.: **IETF RFC 7230, Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing**, https://tools.ietf.org/rfc/rfc7230.txt

- Fielding, R., Reschke, J.: **IETF RFC 7231, Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content**, https://tools.ietf.org/rfc/rfc7231.txt

- Fielding, R., Reschke, J.: **IETF RFC 7232, Hypertext Transfer Protocol (HTTP/1.1): Conditional Requests**, https://tools.ietf.org/rfc/rfc7232.txt

- Fielding, R., Reschke, J.: **IETF RFC 7235, Hypertext Transfer Protocol (HTTP/1.1): Authentication**, https://tools.ietf.org/rfc/rfc7235.txt

- Reschke, J.: **IETF RFC 7538, The Hypertext Transfer Protocol Status Code 308 (Permanent Redirect)**, https://tools.ietf.org/rfc/rfc7538.txt

- Nottingham, M., Wilde, E.: **IETF RFC 7807, Problem Details for HTTP APIs**, https://tools.ietf.org/rfc/rfc7807.txt

- Bray, T.: **IETF RFC 8259, The JavaScript Object Notation (JSON) Data Interchange Format**, http://tools.ietf.org/rfc/rfc8259.txt

- Nottingham, M.: **IETF RFC 8288, Web Linking**, http://tools.ietf.org/rfc/rfc8288.txt

- ISO 15836-2:2019, **Information and documentation — The Dublin Core metadata element set — Part 2: DCMI Properties and classes**

- json-schema-org: **JSON Schema,** September 2019, https://json-schema.org/specification.html

- Open API Initiative: **OpenAPI Specification**, Version 3.0. The latest patch version at the time of publication of this standard was 3.0.3, available from http://spec.openapis.org/oas/v3.0.3.

- Whiteside, A., Greenwood, J.: **OGC Web Services Common Standard**, version 2.0, OGC 06-121r9

- W3C Recommendation: **XML Schema Part 2: Datatypes Second Edition**, 28 October 2004, https://www.w3.org/TR/xmlschema-2/

Chapter 5. Terms, Definitions and Abbreviated Terms

5.1. Terms and Definitions

This document used the terms defined in OGC Policy Directive 49, 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 and OGC documents do not use the equivalent phrases in the ISO/IEC Directives, Part 2.

This document also uses terms defined in the OGC Standard for Modular specifications (OGC 08-131r3), also known as the 'ModSpec'. The definitions of terms such as standard, specification, requirement, and conformance test are provided in the ModSpec.

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

- **Kebab case**
  A case style where punctuation is removed and spaces are replaced by single hyphens. All letters are in lower case when used in OGC documentation. (Wikipedia)

- **Landing Page**
  Any page whose primary purpose is to contain a description of something else. (W3C, URLs in Data Primer)

NOTE 1:	Landing pages often provide summaries or additional information about the thing that they describe. Examples are landing pages for images on Flickr or videos on YouTube, which are HTML pages that embed the media that they describe and provide access to comments and other metadata about it. Landing pages for documents are often tables of contents or abstracts.
NOTE 2:	A landing page for a Web API serves as the root node of the API Resource tree and provides the information needed to navigate all the resources exposed through the API.

- **Representation**
  the current or intended state of a resource encoded for exchange between components. (based on Fielding 2000)

- **Resource**
  entity that might be identified (Dublin Core Metadata Initiative - DCMI Metadata Terms)

NOTE:	The term "resource", when used in the context of an OGC Web API standard, should be understood to mean a Web Resource unless otherwise indicated.

- **Resource Type**
  a type of resource.

> **NOTE:** Resource types are re-usable components that are independent of where the resource resides in the API."

- **Uniform Resource Identifier (URI)**
  an identifier consisting of a sequence of characters matching the syntax rule named <URI>. (IETF RFC 3986)

- **Uniform Resource Locator (URL)**
  the subset of URIs that, in addition to identifying a resource, provide a means of locating the resource by describing its primary access mechanism (e.g., its network "location"). (IETF RFC 3986)

- **Web API**
  API using an architectural style that is founded on the technologies of the Web. (W3C Data on the Web Best Practices)

- **Web Resource**
  a resource that is identified by a URI.

5.2. Abbreviated terms

API

Application Programming Interface

CORS

Cross-Origin Resource Sharing

HTTP

Hypertext Transfer Protocol

HTTPS

Hypertext Transfer Protocol Secure

IANA

Internet Assigned Numbers Authority

OGC

Open Geospatial Consortium

URI

Uniform Resource Identifier

YAML

YAML Ain't Markup Language

Chapter 6. Conventions

6.1. Web API Fundamentals

The following concepts are critical to understanding OGC Web API standards.

1. The purpose of a Web API is to provide a uniform interface to resources.

2. Resources are uniquely identified using Uniform Resource Identifiers (URI).

3. A user manipulates a resource through representations of that resource.

4. A representation is the current or intended state of a resource encoded for exchange between components.

5. The format used to encode a representation is negotiated between the components participating in the exchange.

6. Representations are exchanged between components using the HTTP protocol and the operations (GET, PUT, etc.) that HTTP supports.

6.2. Identifiers

The Architecture of the World Wide Web establishes the URI as the single global identification system for the Web. Therefore, URIs or URI Templates are used in OGC Web API standards to identify key entities in those standards.

In accordance with OGC policy, only the Uniform Resource Locator (URL) form of URIs is used.

The normative provisions in this draft standard are denoted by the URI `http://www.opengis.net/spec/ogcapi-common-1/1.0`. All Requirements, Conformance Modules, and Conformance Classes that appear in this document are denoted by partial URIs that are relative to this base.

Resources described in this document are denoted by partial URIs that are relative to the `root` node of the API. This node serves as the head of the resource tree exposed through an API. In OpenAPI, the root node is identified by the `url` field of the Server Object. In this document the tag `{root}` designates the root node of a URI.

The partial URIs used to identify Resources in this document are referred to as the resource `path`. The purpose of a resource `path` is to identify the referenced resource within the context of this standard. Implementers are encouraged to use these partial URIs in their implementations, thereby providing a common look and feel to OGC APIs.

The OGC API - Common - Part 1 Standard defines Resources, which may appear in more than one place in the API. These Resource Types are identified by name rather than by URI.

Summary for Developers:

RFC 3986 defines a URI in Backus-Naur Form (BNF) as follows:

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

        hier-part     = "//" authority path-abempty
                            / path-absolute
                            / path-rootless
                            / path-empty

        authority     = [ userinfo "@" ] host [ ":" port ]

        path-abempty  = *( "/" segment )

        path-absolute = "/" [ segment-nz *( "/" segment ) ]

        path-rootless = segment-nz *( "/" segment )

        path-empty    = 0<pchar>
```

The following rules should be used when interpreting the BNF for use with this standard:

- `scheme` is assumed to be `HTTP` or `HTTPS`
- `authority` is provided by the API developer
- `{root}` designates the `scheme`, `authority`, and `path` to the root node of the API implementation.
- Only the `path-absolute` and `path-rootless` patterns are used
- Parameters passed as part of an operation are encoded in the `query`.
- Parameters passed in HTTP headers or as cookies are out of scope for this Standard.

The following example shows a URI categorized according to RFC 3986 and OGC Web API standards.

Example URI and Components

```
URI      https://example.com:8042/myapi/mydata/?name=roads#centerline
         \____/ _____/ _____/ _____/ _____/
           |           |              |           |           |
3986     scheme    authority         path        query     fragment
         _____/ _____/ _____/
                   |                |               |
OGC              {root}           path          parameters
```
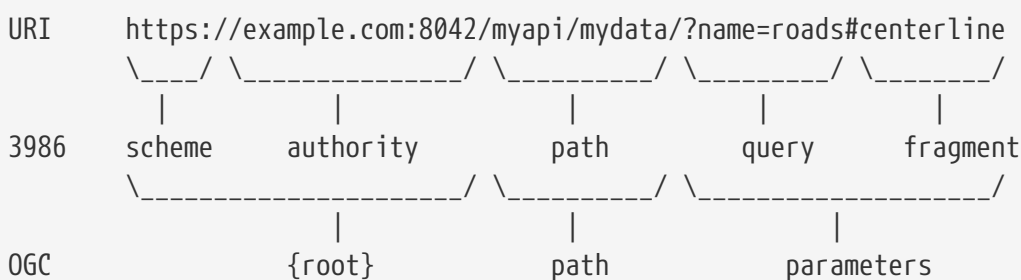
This document does not restrict the lexical space of URIs used in the API beyond the requirements of the HTTP and URI Syntax IETF RFCs. If URIs include reserved characters that are delimiters in the URI subcomponent, these have to be percent-encoded. See Clause 2 of RFC 3986 for details.

NOTE	OGC Web API standards may include a community-defined identifier as part of a URI (ex. image id or feature id). Definition of the format of those identifiers is out of scope for these standards. Implementers should take care that these identifiers are properly encoded (see RFC 3986) in the URIs for all hosted resources.

Additional information on this topic is provided in the OGC API - Common Users Guide.

6.3. Links

OGC Web API Standards use RFC 8288 (Web Linking) to express relationships between resources. Resource representations defined in these standards commonly include an "links" element. A "links" element is an array of individual hyperlink elements. These "links" elements provide a convention for associating related resources.

The individual hyperlink elements that make up a "links" element are defined using the following Hyperlink Schema.

```
{
    "$schema": "http://json-schema.org/draft-07/schema#",
    "title": "Link Schema",
    "description": "Schema for external references",
    "type": "object",
    "required": [
        "href",
        "rel"
        ],
    "properties": {
        "href": {
            "type": "string",
            "description": "Supplies the URI to a remote resource (or resource
fragment).",
            "example": "http://data.example.com/buildings/123"
            },
        "rel": {
            "type": "string",
            "description": "The type or semantics of the relation.",
            "example": "alternate"
            },
        "type": {
            "type": "string",
            "description": "A hint indicating what the media type of the result of
dereferencing the link should be.",
            "example": "application/geo+json"
            },
        "hreflang": {
            "type": "string",
            "description": "A hint indicating what the language of the result of
dereferencing the link should be.",
            "example": "en"
            },
        "title": {
            "type": "string",
            "description": "Used to label the destination of a link such that it can
be used as a human-readable identifier.",
            "example": "Trierer Strasse 70, 53115 Bonn"
            },
        "length": {
            "type": "integer"
            }
        }
    }
```

In addition, links should be passed in the response using HTTP link headers. These links are accessible to the client without a need to process the resource.

Recommendation 1	/rec/core/link-header
A	Links included in the payload of a response SHOULD also be included as `Link` headers in the HTTP response according to RFC 8288, Clause 3.
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.

Additional information on this topic is provided in the OGC API - Common Users Guide.

6.4. Link relations

Link relation types identify the semantics of a link. For example, a link with the relation type "service-meta" indicates that the current link context has service metadata at the link target.

Link relation types are expressed using the "rel" property from the Hyperlink Schema.

The "rel" property is populated using values from the IANA Link Relations Registry wherever possible. Additional values are registered with the OGC Link Relation Registry. Additional relation type values can be used if neither of these registers suffice.

The link relationships used in API-Common Core are described in Table 1. Additional relation types may be used if the implementation warrants it.

Table 1. Link Relations

Link Relation	Purpose
`alternate`	Refers to a substitute for this context [IANA]. Refers to a representation of the current resource that is encoded using another media type (the media type is specified in the `type` link attribute).
`http://www.opengis.net/def/rel/ogc/1.0/data-meta`	Identifies general metadata for the context (dataset or collection) that is primarily intended for consumption by machines.
`http://www.opengis.net/def/rel/ogc/1.0/conformance`	Refers to a resource that identifies the specifications that the link's context conforms to. [OGC]
`describedby`	Refers to a resource providing information about the link's context.[IANA] Links to external resources that further describe the subject resource
`license`	Refers to a license associated with this context. [IANA]
`self`	Conveys an identifier for the link's context. [IANA] A link to another representation of this resource.

Link Relation	Purpose
service-desc	Identifies service description for the context that is primarily intended for consumption by machines. [IANA] API definitions are considered service descriptions.
service-doc	Identifies service documentation for the context that is primarily intended for human consumption. [IANA]
service-meta	Identifies general metadata for the context that is primarily intended for consumption by machines. [IANA]

Additional information on the use of link relationships is provided in the OGC API - Common Users Guide.

6.5. Use of HTTPS

For simplicity, this OGC Standard only refers to the HTTP protocol. This is not meant to exclude the use of HTTPS. This is simply a shorthand notation for "HTTP or HTTPS". In fact, most servers are expected to use HTTPS and not HTTP.

OGC Web API standards do not prohibit the use of any valid HTTP option. However, implementers should be aware that optional capabilities that are not in common use could be an impediment to interoperability.

Additional information on the use of HTTPS to secure API transactions is provided in the OGC API - Common Users Guide.

6.6. API definition

6.6.1. General remarks

This OGC standard specifies requirements and recommendations for the development of APIs that share spatial resources while using 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.

So that client developers can more easily learn how to use the API, good documentation is essential. 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. The used of OpenAPI is one way to provide that machine readable documentation.

6.6.2. Role of OpenAPI

This OGC API standard uses OpenAPI 3.0 fragments in 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 standard includes a conformance class for OGC API definitions that follow the OpenAPI specification 3.0. Alternative API definition languages are also allowed. Conformance classes for additional API definition languages will be added as the OGC API landscape continues to evolve.

6.6.3. 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, the normative statement should be interpreted in the context of the API definition language used.

6.6.4. Reusable OpenAPI components

Reusable components for OpenAPI definitions for an OGC API are referenced from this document. They are available from the OGC Schemas Registry at http://schemas.opengis.net/ogcapi/common/part1/1.0.

Additional information on the use of OpenAPI as an API definition is provided in the OGC API - Common Users Guide.

Chapter 7. Overview

The OGC API - Common - Part 1: Core Standard defines the resources and access mechanisms that are useful for a client seeking to understand the offerings and capabilities of an API. These resources and their access mechanisms are described in Table 2.

Table 2. Common Core Resources

Resource	URI	HTTP Method	Document Reference
Landing page	`/`	GET	API Landing Page
API definition	`/api`	GET	API Definition
Conformance declaration	`/conformance`	GET	Declaration of Conformance Classes

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 and early 2000s. However, technology has evolved. New Resource-Oriented APIs provide an alternative to Service-Oriented Web Services. New OGC Web API standards are under development to provide API alternatives to the OWS standards.

The OGC API - Common Standard specifies common modules for defining OGC Web API standards that follow the current Web architecture. In particular, the recommendations as defined in the W3C/OGC best practices for sharing Spatial Data on the Web as well as the W3C best practices for sharing Data on the Web.

A detailed discussion of OGC Web Services and Web APIs can be found in the OGC API Common Users Guide.

7.2. 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.

The OGC Modular Web API approach has several facets:

- A common `core` that is recommended for all OGC Web API implementations. This OGC API - Common - Part 1: Core Standard provides the information needed by a client to understand and use an OGC Web API.

- Clear separation between common requirements and more resource specific capabilities. The OGC API - Common Standard specifies the *common* requirements that may be relevant to almost

anyone who wants to build an API for spatial resources. Resource-specific requirements are addressed in resource-specific OGC standards.

- 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 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 that 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.

A more detailed discussion of modular APIs can be found in the OGC API - Common Users Guide.

7.3. Using APIs

OGC API Standards are expected to support two different approaches that clients may use when accessing an OGC conformant Web API.

In the first approach, clients are implemented with knowledge about the standard used to build the API and the associated 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, e.g., on 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 Standards.

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

A more detailed discussion of navigating Web APIs can be found in the OGC API - Common Users Guide.

Chapter 8. Core Requirements Class

The following requirements and recommendations are applicable to all OGC Web APIs.

Requirements Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/req/core	
Target type	Web API
Dependency	RFC 2616 (HTTP/1.1)
Dependency	RFC 2818 (HTTP over TLS)
Dependency	RFC 8288 (Web Linking)

8.1. 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 1	/req/core/http
A	OGC Web APIs SHALL conform to HTTP 1.1.
B	If the API supports HTTPS, then the API SHALL also conform to HTTP over TLS.

8.2. HTTP Status Codes

Table 3 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 3. Typical HTTP status codes

Status code	Description
200	A successful request.
302	The target resource was found but resides temporarily under a different URI. A 302 response is not evidence that the operation has been successfully completed.
303	The server is redirecting the user agent to a different resource. A 303 response is not evidence that the operation has been successfully completed.
304	An entity tag was provided in the request and the resource has not changed since the previous request.
307	The target resource resides temporarily under a different URI and the user agent MUST NOT change the request method if it performs an automatic redirection to that URI.

Status code	Description
308	Indicates that the target resource has been assigned a new permanent URI and any future references to this resource ought to use one of the enclosed URIs.
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.

The return status codes described in Table 3 do not cover all possible conditions. See IETF RFC 7231 for a complete list of HTTP status codes.

Permission 1	/per/core/additional-status-codes
A	Servers MAY implement additional capabilities provided by the HTTP protocol. Therefore, they MAY return status codes in addition to those listed in Table 3.

When a server encounters an error in the processing of a request, the server may wish to include information in addition to the status code in the response. Since Web API interactions are often machine-to-machine, a machine-readable report would be preferred. IETF RFC 7807 addresses this need by providing "Problem Details" response schemas for both JSON and XML.

Recommendation 2	/rec/core/problem-details
An OGC Web API should include a "Problem Details" report in any error response in accordance with IETF RFC 7807.	

8.3. Query parameters

8.3.1. Parameter Names

Requirement 2	/req/core/query-param-name-unknown
A	The server SHALL respond with a response with the status code 400 IF 1. the request URI includes a query parameter that is not specified in the API definition 2. /per/core/query-param-specified does not apply, and 3. /per/core/query-param-tolerance does not apply.

The criteria for a parameter to be "specified" in the API definition depends on the API definition language used, the complexity of the resources exposed, and the ability of the API server to tolerate errors.

A service implementer should endeavor to provide as much detail in the server's API definition as the API definition language allows. However, there is no requirement for the API definition to list every endpoint for which there is a non-404 behavior, for it to list every possible query parameter that might affect the behavior of an endpoint, or for it to list every possible value that each query parameter might accept.

Permission 2	/per/core/query-param-name-specified
A	The specification of a query parameter in the API definition MAY encompass a <u>range</u> of parameter names. Any query parameter that falls within the specified range can be considered "specified" in the API definition. Examples of a parameter range include: • A regular expression that defines the valid parameter names, • A URI Template segment that defines the valid parameter names, • An indication that all parameter names are accepted (no parameter validation).
B	The API definition language chosen may not be capable of expressing the desired range of values. In that case the server SHOULD provide: • A definition of the parameter range that best expresses the intended use of that parameter, • Additional human readable text documenting the actual range of validity.

Permission 3	/per/core/query-param-name-tolerance
A	Servers MAY display tolerance for requests with incorrect query parameter names. These acts of tolerance include: • Accept alternate capitalizations, spellings, and/or aliases of parameters, • Ignore unknown/unrecognized parameters, • Return a response with a status code of 30x redirecting the client to a more correct version of the request.
B	Servers should not be excessively tolerant. The response a client receives from the server should be a reasonable response for the request submitted.

8.3.2. Parameter Values

Requirement 3	/req/core/query-param-value-invalid
A	The server SHALL respond with a response with the status code 400 IF 1. the request URI includes a query parameter that has an invalid value and 2. /per/core/query-param-value-tolerance does not apply.

The criteria for a parameter value to be considered "invalid" varies with the expressiveness of the API definition language used and the ability of the API server to tolerate errors.

A service implementer should endeavour to provide as much detail in the server's API definition as the API definition language allows. However, there is no requirement to list every possible value that each query parameter might accept. Rather, the API implementation should include a reasonable degree of error recovery.

Permission 4	/per/core/query-param-value-tolerance
A	Servers MAY display tolerance for requests where a parameter has an incorrect value. These acts of tolerance include: • substituting default values for invalid ones, • correcting formatting errors (e.g. convert integers to float).

B	Servers should not be excessively tolerant. The response a client receives from the server should be a reasonable response for the request submitted.

8.4. 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 7232).

Recommendation 3	/rec/core/etag
A	The service SHOULD support entity tags and the associated headers as specified by HTTP 1.1.

8.5. 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 4	/rec/core/cross-origin
A	If the server is intended to be accessed from a 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)
- JSONP (JSON with padding)

8.6. String Internationalization

If the server supports representing resources in multiple languages, the usual HTTP content negotiation mechanisms apply. The client states its language preferences in the `Accept-Language` header of a request and the server responds with responses that have linguistic text in the language that best matches the requested languages and the capabilities of the server.

Recommendation 5	/rec/core/string-i18n

A	For encodings that support string internationalization, the server SHOULD include information about the language for each string value that includes linguistic text.

For example, if JSON-LD is used as an encoding, the built-in capabilities to annotate a string with its language should be used.

The link object based on RFC 8288 (Web Linking) includes a `hreflang` attribute that can be used to state the language of the referenced resource. This can be used to include links to the same data in, for example, English or French. Just like with multiple encodings, a server that wants to use language-specific links will have to support a mechanism to mint language-specific URIs for resources in order to express links to, for example, the same resource in another language. Again, this document does not mandate any particular approach how such a capability is supported by the server.

8.7. Resource Encodings

A Web API provides access to resources through representations of those resources. One property of a representation is the format used to encode it for transfer. Components negotiate the encoding format to use through the content negotiation process defined in IETF RFC 7231.

Additional content negotiation techniques are allowed, but support is not required of implementations conformant to this Standard.

While this Standard does not specify any mandatory encoding, the following encodings are recommended:

HTML encoding recommendation:

Recommendation 6	/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.

JSON encoding recommendation:

Recommendation 7	/rec/core/json
A	To support processing of an API with a web applet, implementations SHOULD consider supporting a JSON encoding.

Requirement `/req/core/http` implies that the encoding of a server response is determined using content negotiation as specified by the HTTP RFC.

The section Media Types includes guidance on media types for encodings that are specified in this

document.

Note that any server 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 server.

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, such as, to manipulating ("hacking") URIs in the browser address bar, can study the API Definition document for that server.

Two common approaches are to use:

- 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.

8.8. Parameter Encoding

The following sections provide the requirements and guidelines for encoding parameters for use in an OGC Web API request.

OGC Web API requests are issued using a Uniform Resource Identifier (URI). The URI syntax is defined in IETF RFC 3986. Rules for building URI Templates can be found in IETF RFC 6570.

The Backus-Naur Form (BNF) definition of a URI is provided in Annex F.

8.8.1. Capitalization

IETF RFC 3986 sections 6.2.2.1 and 2.1 provide the requirements for capitalization in URIs.

Requirement 4	/req/core/query-param-capitalization
A	Parameter names and values SHALL be case sensitive.
B	IF a parameter name or value includes a percent encoded (escaped) character, THEN the upper case hexadecimal digits ("A" through "F") of that percent encoded character SHALL be equivalent to the lower case digits "a" through "f" respectively.

In order to minimize capitalization issues for implementers of OGC Web API standards:

Recommendation 8	/rec/core/query-param-capitalization

A	Query parameter names SHOULD be in Kebab case.
B	Query parameter values are usually reflective of the internal structure of the target resource. Unless otherwise specified, these values SHOULD be in kebab case.

A Web API may allow filtering on properties of the target resource. In that case, the parameter name would be the name of the resource property. These names are defined by the standards and specifications defining the resource and cannot be constrained by this Standard.

8.8.2. Parameter Value Lists

Parameters may pass more than one value. These lists of parameter values may be passed in two ways.

1. Repeated name:value pairs where the parameter name is repeated for each value in the list
2. A parameter name followed by a delimited list of values.

The following requirements define how to encode a delimited list (case 2) of parameter values. They do not apply if replication (case 1) is used.

Requirement 5	/req/core/query-param-list-delimiter
A	Parameters values containing lists SHOULD specify the delimiter to be used in the API definition.
B	The default list item delimiter SHALL be the comma (",").

Requirement 6	/req/core/query-param-list-escape
A	Any list item values that include a space or comma SHALL escape the space or comma character using the URI encoding rules from IETF RFC 3986

Requirement 7	/req/core/query-param-list-empty
A	All empty entries SHALL be represented by the empty string.

Thus, two successive commas indicates an empty item, as does a leading comma or a trailing comma. An empty list can either be interpreted as a list containing no items or as a list containing a single empty item, depending on the context.

8.8.3. Numeric and Boolean Values

The Geospatial field is a mathematical discipline. A clear and accurate exchange of mathematical values is essential. The encoding rules in this section standardize the encoding of numeric and Boolean primitives when included in a URI. These rules are based on the computer science basic data types identified by Kernighan and Ritchie.

Boolean values conform to the following requirement.

Requirement 8	/req/core/query-param-value-boolean
A	Boolean values shall be represented by the lowercase strings "true" and "false", representing Boolean true and false respectively.

Integer values conform to the following requirement.

Requirement 9	/req/core/query-param-value-integer
A	Integer values SHALL be represented by a finite-length sequence of decimal digits with an optional leading negative "-" sign. Positive values are assumed if the leading sign is omitted.

Real numbers can be represented using either the decimal or double (exponential) format. The decimal format is typically used except for very large or small values.

Decimal values conform to the following requirement.

Requirement 10	/req/core/query-param-value-decimal
A	Decimal values SHALL be represented by a finite-length sequence of decimal digits separated by a period as a decimal indicator. • An optional leading negative sign ("-") is allowed. • If the sign is omitted, positive ("+") is assumed. • Leading and trailing zeroes are optional. • If the fractional part is zero, the period and following zero(es) can be omitted.

Double values conform to the following requirement.

Requirement 11	/req/core/query-param-value-double

A	Double values SHALL be represented by a mantissa followed, optionally, by the character "e", followed by an exponent.
B	The exponent SHALL be an integer.
C	The mantissa SHALL be a decimal number.
D	The representations for exponent and mantissa SHALL follow the lexical rules for integer and decimal.
E	If the "e" and the following exponent are omitted, an exponent value of 0 SHALL be assumed.

Special values conform to the following requirement.

Requirement 12	**/req/core/query-param-value-special**
A	The special values positive and negative infinity and not-a-number SHALL be represented using the strings `inf`, `-inf` and `nan`, respectively.

Chapter 9. Landing Page Requirements Class

Requirements Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/req/landing-page	
Target type	Web API

The Landing Page Requirements Class of the API-Common Core Standard describes how the `Landing Page` and its associated resources are accessed through an OGC conformant Web API.

The Landing Page resources are introduced in Table 4. The requirements and recommendations applicable to these resources are provided in the sections below.

Table 4. Landing Page Resources

Resource	URI	HTTP Method	Description
Landing page	`/`	GET	the landing page
API definition	`/api`	GET	the API Definition document for this API
Conformance declaration	`/conformance`	GET	the conformance information for this API

9.1. API landing page

An OGC Web API has a single landing page on the `{root}` node.

The purpose of the landing page is to provide clients with a starting point for using the API. Any resource exposed through an API can be accessed by following paths or links starting from the landing page.

The landing page includes three metadata elements: title, description, and attribution. These three elements describe the API as a whole. Clients can expect to encounter metadata that is more resource-specific as they follow links and paths from the landing page.

While the three metadata elements are defined as text strings, the attribution element is special. Specifically, The attribution element can contain markup text. Markup allows a text string to import images and format text. The capabilities are only limited by the markup language used. See the example landing page for an example of the use of markup in the attribution element.

9.1.1. Operation

Requirement 13	/req/landing-page/root-op
A	The server SHALL support the HTTP GET operation on the URI `{root}/`.

B	The response to the HTTP GET request issued in A SHALL satisfy requirement /req/landing-page/root-success.

9.1.2. Response

Requirement 14	/req/landing-page/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 and include links to the following resources: • /api (relation type 'service-desc' or 'service-doc') • /conformance (relation type 'http://www.opengis.net/def/rel/ogc/1.0/conformance')

The landing page returned by this operation is based on the following JSON schema.

landingPage.json

```
{
"$schema": "http://json-schema.org/draft-07/schema#",
"title": "Landing Page Schema",
"description": "JSON schema for the OGC API - Common landing page",
"type": "object",
"required": [
    "links"
    ],
"properties": {
    "title": {
        "title": "The title of the API.",
        "description": "While a title is not required, implementers are strongly
advised to include one.",
        "type": "string"
        },
    "description": {
        "description": "A textual description of the API",
        "type": "string"
        },
    "attribution" : {
        "type" : "string",
        "title" : "attribution for the API",
        "description" : "The `attribution` should be short and intended for
presentation to a user, for example, in a corner of a map. Parts of the text can be
links to other resources if additional information is needed. The string can include
HTML markup."
        },
    "links": {
        "description": "Links to the resources exposed through this API.",
        "type": "array",
        "items": {"$href": "link.json"}
        }
    },
    "additionalProperties": true
}
```

That OGC Web APIs provide a set of Service Metadata that identifies the service and provides information about the service provider is recommended.

Recommendation 9	/rec/core/service-metadata
A Web API SHOULD provide service metadata.	
A	A Web API service SHOULD provide one or more service metadata resources accessible by an HTTP GET operation.

B	The landing page for a Web API service SHOULD provide links to the service metadata resources using the relation type `service-meta`.
C	A successful execution of the operation SHOULD be reported as a response with an HTTP status code `200`.

Additional information about Service Metadata can be found in the OGC API - Common Users Guide.

Examples of OGC landing pages are provided in Example Landing Pages.

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

9.1.3. Error Situations

See HTTP Status Codes for general guidance.

9.2. API Definition

Every API implementation should provide an API Definition resource that describes capabilities provided by that API. This resource can be used by client developers to understand the supported services, by software clients to connect to the server, and by development tools to support the implementation of servers and clients.

9.2.1. Operation

Requirement 15	/req/landing-page/api-definition-op
A	The server SHALL support the HTTP GET operation on all links from the landing page that have the relation type `service-desc`.
B	The server SHALL support the HTTP GET operation on all links from the landing page that have the relation type `service-doc`.
C	The responses to all HTTP GET requests issued in `A` and `B` SHALL satisfy requirement /req/landing-page/api-definition-success.

Recommendation 10	/rec/core/api-definition-op
A	The server SHOULD support the HTTP GET operation on the URI `{root}/api`.

B	The response to the HTTP GET request issued in A SHOULD satisfy requirement /req/core/api-definition-success.

9.2.2. Response

Requirement 16	/req/landing-page/api-definition-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 an API Definition document.
C	The API Definition document SHALL be consistent with the media type identified through HTTP content negotiation.
NOTE:	The -f parameter MAY be used to satisfy this requirement.

Recommendation 11	/rec/core/api-definition-oas
A	If the API definition document uses the OpenAPI Specification 3.0, THEN The document SHOULD conform to the OpenAPI Specification 3.0 requirements class.

9.2.3. Error Situations

See HTTP Status Codes for general guidance.

9.3. Declaration of Conformance Classes

The OGC Web API Standards define a collection of modules that can be assembled into a Web API. The first question a client will ask when accessing one of these APIs is "what are you?" In other words, what modules were used to create you? Since implementers have a choice on the modules to use, there is no simple answer. The best that can be done is to provide a list of the modules implemented, a declaration of the Conformance Classes.

The list of Conformance Classes is key to understanding and using an OGC Web API. So it is important that they are easy to access. A simple GET using an easily constructed URI is all that should be required. Therefore, the path to the Conformance Declaration is fixed.

Ease of access is also supported by the structure of the Conformance Declaration resource. It is a simple list of URIs. This is a structure that requires almost no parsing and little interpretation and is designed to be accessible to even the simplest client.

9.3.1. Operation

Requirement 17	/req/landing-page/conformance-op
A	The server SHALL support the HTTP GET operation on the URI `{root}/conformance`.
B	The server SHALL support the HTTP GET operation on all links from the landing page that have the relation type `http://www.opengis.net/def/rel/ogc/1.0/conformance`.
C	The responses to all HTTP GET requests issued in `A` and `B` SHALL satisfy requirement /req/landing-page/conformance-success.

9.3.2. Response

Requirement 18	/req/landing-page/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 schema confClasses.json and list all OGC API conformance classes that the API conforms to.

The Conformance Declaration resource returned by this operation is based on the following Conformance Declaration Schema.

Examples of OGC Conformance Declarations are provided in Conformance Examples.

Conformance Declaration Schema

```
{
"$schema": "http://json-schema.org/draft-07/schema#",
"title": "Conformance Declaration 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 URIs.  Each URI should correspond to
a defined OGC Conformance class.  Unrecognized URIs should be ignored",
        "items": {
            "type": "string",
            "example": "http://www.opengis.net/spec/ogcapi-common-1/1.0/conf/core"
            }
        }
    }
}
```

9.3.3. Error situations

See HTTP Status Codes for general guidance.

Chapter 10. Encoding Requirements Classes

10.1. Overview

This clause specifies two requirements classes for encodings that may be used by an OGC Web API implementation. These encodings are commonly used for spatial data on the web applications:

- HTML
- JSON

Neither of these encodings are mandatory. An implementation of the OGC API - Common Standard may implement one, both, or none of them. Other encodings are possible.

10.2. Requirement Class "HTML"

Geographic information that is only accessible in formats such as GeoJSON or GML have two issues when web application principles are considered:

- The data are not discoverable using Web crawlers and search engines,
- The data can not 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 of the data.

This is discussed in detail in the W3C/OGC SDW Best Practice. Therefore, the OGC API - Common Standard recommends supporting HTML as an encoding.

Requirements Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/req/html	
Target type	Web API
Dependency	Requirements Class "Core"
Dependency	HTML5
Dependency	Schema.org

Requirement 19	/req/html/definition
A	Every `200`-response of an operation of the API SHALL support the media type `text/html`.

Requirement 20	/req/html/content

A	Every `200`-response of the API with the media type "text/html" SHALL be a HTML 5 document that includes the following information in the HTML body:
	• All information identified in the schemas of the Response Object in the HTML `<body/>`, and
	• All links in HTML `<a/>` elements in the HTML `<body/>`.

Recommendation 12	/rec/html/schema-org
A	A `200`-response with the media type `text/html`, SHOULD include Schema.org annotations.

10.3. Requirement Class "JSON"

JSON is a lightweight data-interchange format desiged to facilitate structured data interchange between applications. JSON is commonly used for Web-based software-to-software interchanges. Most Web developers are comfortable with using a JSON-based format. Therefore support for JSON is recommended for machine-to-machine interactions.

Requirements Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/req/json	
Target type	Web API
Dependency	Requirements Class "Core"
Dependency	IETF RFC 8259: The JavaScript Object Notation (JSON) Data Interchange Format
Dependency	JSON Schema

Requirement 21	/req/json/definition
A	`200`-responses of the server SHALL support the `application/json` media type.

Requirement 22	/req/json/content
A	Every `200`-response with the media type `application/json` SHALL include, or link to, a payload encoded according to the JSON Interchange Format

B	The schema of all responses with the media type `application/json` SHALL conform with the JSON Schema specified for that resource.

Recommendation 13	/rec/json/problem-details
Any OGC Web API implementation instance returning an RFC 7807 "Problem Details" report in JSON should set the `Content-Type` header to "application/problem+json" and structure the report using the JSON Schema here.	

An example JSON Schema for the landing page is available at landingPage.json.

An example JSON Problem Details report is available at ExceptionExample.json.

Chapter 11. OpenAPI 3.0 Requirements Class

11.1. Basic requirements

APIs conforming to this requirements class are self documenting using an OpenAPI Document.

Requirements Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/req/oas30	
Target type	Web API
Dependency	Requirements Class "Core"
Dependency	OpenAPI Specification 3.0

Requirement 23	**/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.

Requirement 24	**/req/oas30/oas-definition-2**
A	The JSON representation SHALL conform to the OpenAPI Specification, version 3.0.

Two example OpenAPI documents are included in Annex B.

Requirement 25	**/req/oas30/oas-impl**
A	The API SHALL implement all capabilities specified in the OpenAPI definition.

11.2. Complete definition

Requirement 26	**/req/oas30/completeness**
A	The OpenAPI definition SHALL specify for each operation all HTTP Status Codes and Response Objects 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), 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.

Clients should 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 27	/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 1. An exception response object definition

```
description: An error occurred.
content:
  application/json:
    schema:
      $ref:
http://schemas.opengis.net/ogcapi/common/part1/1.0/openapi/schemas/exception.yaml
  text/html:
    schema:
      type: string
```

11.4. Security

OpenAPI uses two constructs to describe the security features of an API; Security Requirements and Security Schemes. Security Requirements are packaged in an array. Only one of the Security Requirements in the array must be met in-order to authorize a request. Security Requirements are associated with one or more Security Schemes. Each Security Scheme describes a security control (ex. HTTP authentication). All of the security schemes associated with a Security Requirement must be satisfied in order for that Security Requirement to be met.

Security Requirements can be defined on following levels:

- Root - applicable to the whole API except when overridden by Security Requirements defined at a lower level of the API.

- Operation - only applicable to this operation. Overrides any requirements defined at the Root level.

The OpenAPI specification currently supports the following security schemes:

- 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.

Requirement 28	/req/oas30/security
A	If the operations of the API are access-controlled, the security scheme(s) and requirements SHALL be documented in the OpenAPI definition.

11.5. Service Metadata

OGC Web Services provide a set of metadata that identifies the service and provides information about the service provider. It would be useful if OGC Web APIs provide the same information. A `service-meta` link is provided on the Landing Page for this purpose.

Recommendation 14	/rec/oas30/service-metadata
An OGC Web API SHOULD expose service metadata.	
A	That Service Metadata SHOULD provide identifying metadata about both the service and the provider of that service.
B	Service Metadata SHOULD be encoded in the OpenAPI `Info` object.
C	To simplify access, the Service Metadata SHOULD be available as a separate resource from the Service Definition.

An example of a populated OpenAPI `Info` object is provided in the Service Metadata Examples section.

11.6. Query Parameter Definition

OpenAPI defines query parameters using the `Parameter` object with the `in` property set to "query". The parameter name is a literal value provided by the `name` property. Since the parameter names are literals, each parameter must be described separately.

API-Common requires that all query parameters are specified in the API definition. In the case of a Feature server, this could mean that every property of every feature type must be described in the API definition. a requirement that few implementers would accept.

OpenAPI provides a capability that allows additional parameters to be specified without explicitly declaring them. That is, parameters that have not been explicitly specified in the API definition for

the operation will still be considered "specified" for purposes of validation (see /per/core/query-param-specified and /per/core/query-param-tolerance.

OpenAPI schema for additional "free-form" query parameters

```
in: query
name: freeFormParameters
schema:
  type: object
  additionalProperties: true
style: form
```

Note that the name of the parameter does not matter as the actual query parameters are the names of the object properties. For example, assume that the value of `freeFormParameters` is this object:

```
{
  "my_first_parameter": "some value",
  "my_other_parameter": 42
}
```

In the request URI this would be expressed as `&my_first_parameter=some%20value&my_other_parameter=42`.

11.7. Further Information

Additional guidance on using OpenAPI in OGC Web API implementations can be found in the OGC API - Common Users Guide.

Chapter 12. Media Types

12.1. Normal Response Media Types

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

The media type that would typically be used in an OGC Web API for machine-to-machine exchanges would be `application/json`.

12.2. OpenAPI Media Types

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. |

12.3. Problem Details Media Types

OGC API-Common recommends that implementers use IETF RFC 7807 when constructing the response body for an error condition. The media types for an RFC 7807 Problem Details response body are:

- application/problem+json - for responses in JSON
- application/problem+xml - for responses in XML

Chapter 13. Security Considerations

The OAPI-Common Core Standard does not specify any specific security controls. However, it was constructed so that security controls can be added without impacting conformance.

See the Clause 11 Security Section for a discussion of OpenAPI support for security controls.

Annex A: Abstract Test Suite (Normative)

A.1. Introduction

OGC Web APIs are not a Web Services 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 that are not to be tested.

A.2. Conformance Class Core

Conformance Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/conf/core	
Target type	Web API
Requirements Class	http://www.opengis.net/spec/ogcapi-common/1.0/req/core

A.2.1. HTTP

Abstract Test 1	/conf/core/http
Test Purpose	Validate that the resources advertised through the API can be accessed using the HTTP 1.1 protocol and, where approprate, TLS.
Requirement	/req/core/http
Test Method	1. All compliance tests shall be configured to use the HTTP 1.1 protocol exclusively. 2. For APIs that support HTTPS, all compliance tests shall be configured to use HTTP over TLS (RFC 2818) with their HTTP 1.1 protocol.

A.2.2. Query Parameters

Abstract Test 2	/conf/core/query-param-name-unknown
Test Purpose	Validate that an error is returned when a query parameter is used that has not been specified in the API definition.
Requirement	/req/core/query-param-name-unknown

Test Method	DO FOR ALL operations advertised in the API definition 1. Execute that operation using a query parameter that is not specified in the API definition. 2. Validate that the operation returns a reponse with the status code 400. DONE

Abstract Test 3	**/conf/core/query-param-value-invalid**
Test Purpose	Validate that an error is returned when a query parameter contains a value that is not valid for that parameter.
Requirement	/req/core/query-param-value-invalid

Test Method	DO FOR ALL query parameters advertised in the API definition
	  DO FOR ALL operations for which that parameter is valid
	   1. Execute that operation using the query parameter
	    with values that do not comply with the advertised constraints on those values.
	     (Example: exceeding minimum or maximum values)
	   2. Validate that the operation returns a reponse with the status code 400.
	  DONE
	DONE

Abstract Test 4	**/conf/core/query-param-capitalization**
Test Purpose	Validate that a parameter name is correctly capitalized
Requirement	/req/core/query-param-capitalization

Test Method	DO FOR ALL query parameters advertised in the API definition
	DO FOR ALL operations for which that parameter is valid
	1. Execute that operation using that query parameter
	capitalized as specified in the API definition
	2. Validate that the operation returns a reponse with the status code 200.
	3. Execute that operation using that query parameter
	with captialization inverse of that specified in the API definition
	(Example: "Range" vs. "rANGE")
	4. Validate that the operation returns a reponse with the status code 400.
	DONE
	DONE

Abstract Test 5	**/conf/core/query-param-list-delimiter**
Test Purpose	Validate for every query parameter where the value may be a list: **In the case of a client**: that the correct delimiter is used to delineate items in the list. **In the case of a server**: that the server uses the designated delimiter to parse the items from the list.
Requirement	/req/core/query-param-list-delimiter

Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value can be a list
	  DO FOR ALL operations for which that parameter is valid
	    1. Identify the list delimiter for this API
	      a. As advertised in the API definition OR
	      b. Use a comma (",") if no delimiter is advertised.
	    2. Generate a set of requests using that parameter and a
	      statistically significant set of valid parameter list values
	    3. Validate that the delimter identified in #1 is used to construct the lists.
	  DONE
	DONE

Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value can be a list
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and a value that is a delimited list of items
	2. Validate that the server properly interprets that parameter value
	3. Generate a request using that parameter and a value where:
	a. the value is a delimited list AND
	b. the delimiter used to construct the list is not valid for this server
	4. Validate that the server returns a status code `400`
	DONE
	DONE

Abstract Test 6	**/conf/core/query-param-list-escape**
Test Purpose	Validate for every query parameter where the value may be a list:
	In the case of a client: that any space or comma characters in the values are properly escaped
	In the case of a server: that all escaped space and comma characters that appear in the values are properly processed.
Requirement	/req/core/query-param-list-escape
Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value can be a list
	DO FOR ALL operations for which that parameter is valid
	1. Generate a set of requests using that parameter and a statistically significant set of valid parameter values
	2. Validate that all space and comma characters are properly escaped.
	DONE
	DONE

Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value can be a list
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and a value that includes an escaped space or comma
	2. Validate that the server properly interprets that parameter value
	3. Generate a request using that parameter and a value that includes an non-escaped space or comma
	4. Validate that the server returns a status code `400`
	DONE
	DONE

Abstract Test 7	**/conf/core/query-param-list-empty**
Test Purpose	Validate for every query parameter where the value may be a list:
	In the case of a client: that an empty list value is represented by an empty string.
	In the case of a server: that the server interprets an empty string as an empty list.
Requirement	/req/core/query-param-list-empty
Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value can be a list
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and an empty list
	2. Validate that the empty list is represented by an empty string
	DONE
	DONE
Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value can be a list
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and an empty string for the parameter value.
	2. Validate that the server properly interprets that parameter value as an empty list
	DONE
	DONE

Abstract Test 8	**/conf/core/query-param-value-boolean**

Test Purpose	Validate for every query parameter where the value is a boolean:
	  In the case of a client: that the values are represented either by the string "true" or the string "false".
	  In the case of a server: that the server correctly interprets boolean values of "true" and "false".

Requirement	/req/core/query-param-value-boolean

Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a boolean
	  DO FOR ALL operations for which that parameter is valid
	    1. Generate a request using that parameter and a value of true
	    2. Validate that the value is represented using the string "true"
	    3. Generate a request using that parameter and a value of false
	    4. Validate that the value is represented using the string "false"
	  DONE
	DONE

Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a boolean
	  DO FOR ALL operations for which that parameter is valid
	    1. Generate a request using that parameter and the string "true" for the parameter value
	    2. Validate that the server properly interprets that parameter value as true boolean value
	    3. Generate a request using that parameter and the string "false" for the parameter value
	    4. Validate that the server properly interprets that parameter value as false boolean value
	  DONE
	DONE

Abstract Test 9	**/conf/core/query-param-value-integer**

Test Purpose	Validate for every query parameter where the value is an integer:
	  In the case of a client: that the values are represented by numeric strings with an optional leading negative "-" character.
	  In the case of a server: that the server correctly interprets properly encoded integer values.

Requirement	/req/core/query-param-value-integer

Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value is an integer
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and a positive integer value
	2. Validate that the value is represented by a numeric string with no leading sign
	3. Generate a request using that parameter and a negative integer value
	4. Validate that the value is represented by a numeric string with a leading negative sign ("-")
	DONE
	DONE
Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value is an integer
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and an unsigned numeric string for the parameter value
	2. Validate that the server properly interprets that parameter value as an unsigned integer
	3. Generate a request using that parameter and a negative signed numeric string for the parameter value
	4. Validate that the server properly interprets that parameter value as a signed negative integer value
	DONE
	DONE

Abstract Test 10	**/conf/core/query-param-value-decimal**
Test Purpose	Validate for every query parameter where the value is an decimal:
	In the case of a client: that the values are represented by numeric strings with:
	a) an optional leading negative "-" sign character and
	b) a period to indicate the fractional portion of the value.
	In the case of a server: that the server correctly interprets properly encoded decimal values.
Requirement	/req/core/query-param-value-decimal

Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a decimal number
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and a positive decimal value with at least two fractional digits
	2. Validate that the value is represented by a numeric string with no leading sign and at least two digits after the period (".") character
	3. Generate a request using that parameter and a negative decimal value with at least two fractional digits
	4. Validate that the value is represented by a numeric string with a leading negative sign ("-") and at least two digits after the period (".") character
	DONE
	DONE
Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a decimal number
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and a parameter value that is:
	a) an unsigned numeric string preceeded by one or more zeros
	b) contains at least two factional digits followed by one or more zeros
	2. Validate that the server properly interprets that parameter value as an unsigned decimal value
	3. Generate a request using that parameter and a parameter value that is:
	a) a signed negative numeric string
	b) contains at least two factional digits followed by one or more zeros
	4. Validate that the server properly interprets that parameter value as a signed negative decimal value
	5. Generate a request using that parameter and a parameter value that:
	a) is an unsigned numeric string preceeded by one or more zeros
	b) does not contain non-numeric characters (".")
	6. Validate that the server properly interprets that parameter value as an unsigned decimal value with a fractional value of zero
	DONE
	DONE
Abstract Test 11	**/conf/core/query-param-value-double**

Test Purpose	Validate for every query parameter where the value is an double:
	
	In the case of a client: that the values are represented by a mantissa and an exponent where:
	
	  a) the exponent is an integer
	
	  b) the mantissa is a decimal and
	
	  e) an "e" is used to delineate between the two.
	
	In the case of a server: that the server correctly interprets properly encoded double values.

Requirement	/req/core/query-param-value-double

Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a double value
	
	  DO FOR ALL operations for which that parameter is valid
	
	  1. Generate a request using that parameter and a positive numeric value greater than 4,294,967,296 with at least two fractional digits
	
	  2. Validate that the value is represented by:
	
	    a. a decimal number,
	
	    b. followed by the character "e",
	
	    c. followed by an integer number
	
	  3. Validate the decimal number using the Test for Decimal Parmeters
	
	  4. Validate the integer number using the Test for Integer Parmeters
	
	  5. Validate that encoded value is a correct represention of the numeric value (step 1) represented using scientific notation
	
	  DONE
	
	DONE

Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a double value
	DO FOR ALL operations for which that parameter is valid
	1. Generate a request using that parameter and a parameter value that is:
	a) greater than 4,294,967,296
	b) contains at least two factional digits followed by one or more zeros
	2. Validate that the server properly interprets that parameter value
	3. Generate a request using that parameter and a parameter value that is:
	a) less than -4,294,967,296
	b) contains at least two factional digits followed by one or more zeros
	4. Validate that the server properly interprets that parameter value
	5. Generate a request using that parameter and a parameter value that is:
	a) Less than 4,294,967,296
	b) Greater than -4,294,967,295
	c) Represented as a single decimal number
	6. Validate that the server properly interprets that parameter value
	DONE
	DONE

Abstract Test 12	**/conf/core/query-param-value-special**
Test Purpose	Validate for every query parameter where the value is a numeric:
	In the case of a client: that the values for special case numerics are represented as follows:
	a. Positive infinity is represented by the string "inf"
	b. Negative infinity is represented by the string "-inf"
	b. "Not A Number" is represented by the string "nan"
	In the case of a server: that the server correctly interprets special case values.
Requirement	/req/core/query-param-value-special

Test Method (Client)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a numeric
	
	  DO FOR ALL operations for which that parameter is valid
	
	    1. Generate a request using that parameter and a value of infinity
	
	    2. Validate that the value is represented using the string "inf"
	
	    3. Generate a request using that parameter and a value of negative infinity
	
	    4. Validate that the value is represented using the string "-inf"
	
	  DONE
	
	    5. Generate a request using that parameter and the machine representation of Not a Number for the value
	
	    4. Validate that the value is represented using the string "nan"
	
	  DONE
	
	DONE

Test Method (Server)	DO FOR ALL query parameters advertised in the API definition where the parameter value is a numeric
	
	  DO FOR ALL operations for which that parameter is valid
	
	    1. Generate a request using that parameter and the string "inf" for the parameter value
	
	    2. Validate that the server properly interprets that parameter value as an infinite value
	
	    3. Generate a request using that parameter and the string "-inf" for the parameter value
	
	    4. Validate that the server properly interprets that parameter value as a negative infinite value
	
	    5. Generate a request using that parameter and the string "nan" for the parameter value
	
	    6. Validate that the server properly interprets that parameter value as not a number
	
	  DONE
	
	DONE

A.3. Conformance Class Landing Page

Conformance Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/conf/landing-page	
Target type	Web API
Requirements Class	http://www.opengis.net/spec/ogcapi-common/1.0/req/landing-page

A.3.1. Landing Page {root}/

Abstract Test 13	/conf/landing-page/root-op
Test Purpose	Validate that a landing page can be retrieved from the expected location.
Requirement	/req/landing-page/root-op /req/landing-page/root-success
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 /conf/landing-page/root-success.

Abstract Test 14	/conf/landing-page/root-success
Test Purpose	Validate that the landing page complies with the required structure and contents.
Requirement	/req/landing-page/root-success
Test Method	Validate the landing page for all supported media types using the resources and tests identified in Table 5 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 "http://www.opengis.net/def/rel/ogc/1.0/conformance" link to the conformance class declaration

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 5. Schema and Tests for Landing Pages

Format	Schema Document	Test ID
HTML	landingPage.json	/conf/html/content
JSON	landingPage.json	/conf/json/content

A.3.2. API Definition Path {root}/api (link)

Abstract Test 15	**/conf/landing-page/api-definition-op**
Test Purpose	Validate that the API Definition document can be retrieved from the expected location.
Requirement	/req/landing-page/api-definition-op /req/landing-page/api-definition-success
Test Purpose	Validate that the API Definition document can be retrieved from the expected location.
Test Method	DO FOR EACH `service-desc` and `service-doc` link on the landing page: 1. Issue an HTTP GET request for the link 2. Validate that a document was returned with a status code `200` 3. Validate the contents of the returned document using test /conf/landing-page/api-definition-success. DONE

Abstract Test 16	**/conf/landing-page/api-definition-success**
Test Purpose	Validate that the API Definition complies with the required structure and contents.
Requirement	/req/landing-page/api-definition-success
Test Method	Validate the API Definition document against an appropriate schema document.

A.3.3. Conformance Path {root}/conformance

Abstract Test 17	**/conf/landing-page/conformance-op**
Test Purpose	Validate that a Conformance Declaration can be retrieved from the expected locations.
Requirement	/req/landing-page/conformance-op /req/landing-page/conformance-success

Test Method	DO FOR EACH `http://www.opengis.net/def/rel/ogc/1.0/ conformance` link on the landing page:
	1. Issue an HTTP GET request for the link
	2. Validate that a document was returned with a status code `200`
	3. Validate the contents of the returned document using test /conf/landing-page/conformance-success.
	DONE
	1. Issue an HTTP GET request for the `{root}/conformance` path
	2. Validate that a document was returned with a status code `200`
	3. Validate the contents of the returned document using test /conf/landing-page/conformance-success.

Abstract Test 18	/conf/landing-page/conformance-success
Test Purpose	Validate that the Conformance Declaration response complies with the required structure and contents.
Requirement	/req/landing-page/conformance-success
Test Method	1. Validate the response document against the schema confClasses.yaml
	2. Validate that the document list all OGC API conformance classes that the API implements.

A.4. Conformance Class JSON

Conformance Class
http://www.opengis.net/spec/ogcapi-common-1/1.0/conf/json

Target type	Web API
Requirements Class	http://www.opengis.net/spec/ogcapi-common-1/1.0/req/json
Dependency	Conformance Class "OAPI Core"

A.4.1. JSON Definition

Abstract Test 19	/conf/json/definition
Test Purpose	Verify support for JSON

Requirement	/req/json/definition /req/json/content
Test Method	DO FOR EACH operation advertised for the API 1. Execute the operation specifing `application/json` as the media type 2. Validate that a document was returned with a status code `200` 3. Validate the contents of the returned document using test /conf/json/content. DONE

A.4.2. JSON Content

Abstract Test 20	**/conf/json/content**
Test Purpose	Verify the content of a JSON document given an input document and schema.
Requirement	/req/json/content
Test Method	1. Validate that the document is a JSON (IETF RFC 8259) 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-1/1.0/conf/html	
Target type	Web API
Requirements Class	http://www.opengis.net/spec/ogcapi-common/1.0/req/html
Dependency	Conformance Class "OAPI Core"

A.5.1. HTML Definition

Abstract Test 21	**/conf/html/definition**
Test Purpose	Verify support for HTML

Requirement	/req/html/definition
	/req/html/content
Test Method	DO FOR EACH operation advertised for the API
	1. Execute the operation specifing `text/html` as the media type
	2. Validate that a document was returned with a status code `200`
	3. Validate the contents of the returned document using test /conf/html/content.
	DONE

A.5.2. HTML Content

Abstract Test 22	/conf/html/content
Test Purpose	Verify the content of an HTML document given an input document and schema.
Requirement	/req/html/content
Test Method	1. Validate that the document is an HTML 5 document
	2. Manually inspect the document against the schema.

A.6. Conformance Class OpenAPI 3.0

Conformance Class	
http://www.opengis.net/spec/ogcapi-common-1/1.0/conf/oas30	
Target type	Web API
Requirements Class	http://www.opengis.net/spec/ogcapi-common/1.0/req/oas30
Dependency	Conformance Class "OAPI Core"

Abstract Test 23	/conf/oas30/completeness
Test Purpose	Verify the completeness of an OpenAPI document.
Requirement	/req/oas30/completeness

Test Method	Verify that for each operation, the OpenAPI document describes all HTTP Status Codes and Response Objects that the API uses in responses.

Abstract Test 24	**/conf/oas30/exceptions-codes**
Test Purpose	Verify that the OpenAPI document fully describes potential exception codes.
Requirement	/req/oas30/exceptions-codes
Test Method	Verify that for each operation, the OpenAPI document describes all HTTP Status Codes that may be generated.

Abstract Test 25	**/conf/oas30/oas-definition-1**
Test Purpose	Verify that JSON and HTML versions of the OpenAPI document are available.
Requirement	/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 26	**/conf/oas30/oas-definition-2**
Test Purpose	Verify that the OpenAPI document is valid JSON.
Requirement	/req/oas30/oas-definition-2
Test Method	Verify that the JSON representation conforms to the OpenAPI Specification, version 3.0.

Abstract Test 27	**/conf/oas30/oas-impl**
Test Purpose	Verify that all capabilities specified in the OpenAPI definition are implemented by the API.

Requirement	/req/oas30/oas-impl
Test Method	1. Construct an operation for each OpenAPI `Path` object including all server URL options, HTTP operations and enumerated path parameters. 2. Validate that each operation performs in accordance with the API definition.

Abstract Test 28	**/conf/oas30/security**
Test Purpose	Verify that any authentication protocols implemented by the API are documented in the OpenAPI document.
Requirement	/req/oas30/security
Test Method	1. Identify all authentication protocols supported by the API. 2. Validate that each authentication protocol is described in the 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 2. JSON Landing Page

This example Landing Page response in JSON is for an implementation of the OGC API-Common Standard that supports:

- HTML
- JSON
- API-Common Part 2 (Geospatial Data)

This example also illustrates the self and alternate association types.

```json
{
  "title": "Example API Landing Page",
  "description": "This is an example of an API landing page in JSON format",
  "attribution": "<a href='www.ign.es' rel=' '>IGN</a> <a href='www.govdata.de/dl-
de/by-2-0'>(c)</a>",
  "links": [
    {
      "rel": "service-desc",
      "type": "application/vnd.oai.openapi+json;version=3.0",
      "title": "API definition for this endpoint as JSON",
      "href": "http://www.example.com/oapi-
c/api?f=application/vnd.oai.openapi+json;version=3.0"
    },
    {
      "rel": "service-doc",
      "type": "text/html",
      "title": "API definition for this endpoint as HTML",
      "href": "http://www.example.com/oapi-c/api?f=text/html"
    },
    {
      "rel": "http://www.opengis.net/def/rel/ogc/1.0/conformance",
      "type": "application/json",
      "title": "Conformance Declaration as JSON",
      "href": "http://www.example.com/oapi-c/conformance?f=application/json"
    },
    {
      "rel": "http://www.opengis.net/def/rel/ogc/1.0/conformance",
      "type": "text/html",
      "title": "Conformance Declaration as HTML",
      "href": "http://www.example.com/oapi-c/conformance?f=text/html"
    },
    {
      "rel": "http://www.opengis.net/def/rel/ogc/1.0/data",
      "type": "application/json",
      "title": "Collections Metadata as JSON",
      "href": "http://www.example.com/oapi-c/collections?f=application/json"
    },
    {
```

```
      "rel": "http://www.opengis.net/def/rel/ogc/1.0/data",
      "type": "text/html",
      "title": "Collections Metadata as HTML",
      "href": "http://www.example.com/oapi-c/collections?f=text/html"
    },
    {
      "rel": "alternate",
      "type": "text/html",
      "title": "This Document as HTML",
      "href": "http://www.example.com/oapi-c?f=text/html"
    },
    {
      "rel": "self",
      "type": "application/json",
      "title": "This Document",
      "href": "http://www.example.com/oapi-c?f=application/json"
    }
  ]
}
```

B.2. Conformance Examples

Example 3. Conformance Response

This example response in JSON is for an implementation of the OGC API-Common Standard that supports OpenAPI 3.0 for the API definition and HTML and JSON as encodings for resources.

```
{
  "conformsTo": [
    "http://www.opengis.net/spec/ogcapi-common-1/1.0/req/core",
    "http://www.opengis.net/spec/ogcapi-common-1/1.0/req/oas30",
    "http://www.opengis.net/spec/ogcapi-common-1/1.0/req/html",
    "http://www.opengis.net/spec/ogcapi-common-1/1.0/req/json"
  ]
}
```

B.3. API Definition Examples

Example 4. JSON API Definition

This is an example of an API Definition response in JSON. It describes an implementation of the OGC API-Common Part 1 - Core Standard.

This example also illustrates:

1. Extended metadata (x-keywords),

2. Multiple Servers,

3. The use of tags to associate external documentation,

4. Responses that reference the appropriate JSON schema

```json
{
  "openapi" : "3.0.3",
  "info" : {
    "title" : "A sample API conforming to the draft standard OGC API - Common -
Part 1 - Core",
    "version" : "1.0.0",
    "description" : "This is a sample OpenAPI definition of the OGC API - Common -
Part 1 - Core Standard. This example is a generic OGC API definition that
describes the Common Core of OGC Web APIs. This generic OpenAPI definition does
not provide any details on the hosted content.",
    "contact" : {
      "name" : "Acme Corporation",
      "email" : "info@example.org",
      "url" : "http://example.org/"
    },
    "license" : {
      "name" : "CC-BY 4.0 license",
      "url" : "https://creativecommons.org/licenses/by/4.0/"
    },
    "x-keywords" : [ "geospatial", "data", "api" ]
  },
  "servers" : [ {
    "url" : "https://data.example.org/",
    "description" : "Production server"
  }, {
    "url" : "https://dev.example.org/",
    "description" : "Development server"
  } ],
  "tags" : [ {
    "name" : "capabilities",
    "description" : "essential characteristics of this API"
  }, {
    "name" : "data",
    "description" : "access to data"
  }, {
    "name" : "server",
    "description" : "Information about the server hosting this API",
```

```
      "externalDocs" : {
        "description" : "information",
        "url" : "https://example.com/sample_api/documentation"
      }
  } ],
  "paths" : {
    "/" : {
      "get" : {
        "description" : "The landing page provides links to the API definition and
the conformance statements for this API.",
        "operationId" : "getLandingPage",
        "parameters" : [ {
          "$ref" : "#/components/parameters/f"
        } ],
        "responses" : {
          "200" : {
            "description" : "successful operation",
            "content" : {
              "application/json" : {
                "schema" : {
                  "$ref" :
"https://github.com/opengeospatial/oapi_common/blob/master/core/openapi/schemas/la
ndingPage.json"
                }
              }
            }
          },
          "400" : {
            "$ref" : "#/components/responses/400"
          },
          "500" : {
            "$ref" : "#/components/responses/500"
          }
        },
        "summary" : "Landing page",
        "tags" : [ "server" ]
      }
    },
    "/api" : {
      "get" : {
        "description" : "This document",
        "operationId" : "getAPIDefinition",
        "parameters" : [ {
          "$ref" : "#/components/parameters/f"
        } ],
        "responses" : {
          "200" : {
            "$ref" : "#/components/responses/200"
          },
          "400" : {
            "$ref" : "#/components/responses/400"
```

```
          },
          "default" : {
            "$ref" : "#/components/responses/400"
          }
        },
        "summary" : "This document",
        "tags" : [ "server" ]
      }
    },
    "/conformance" : {
      "get" : {
        "description" : "A list of all conformance classes that the server
conforms to.",
        "operationId" : "getConformanceClasses",
        "parameters" : [ {
          "$ref" : "#/components/parameters/f"
        } ],
        "responses" : {
          "200" : {
            "description" : "successful operation",
            "content" : {
              "application/json" : {
                "schema" : {
                  "$ref" :
"https://github.com/opengeospatial/oapi_common/blob/master/core/openapi/schemas/co
nfClasses.json"
                }
              }
            }
          },
          "400" : {
            "$ref" : "#/components/responses/400"
          },
          "500" : {
            "$ref" : "#/components/responses/500"
          }
        },
        "summary" : "API conformance definition",
        "tags" : [ "server", "capabilities" ]
      }
    }
  },
  "components" : {
    "parameters" : {
      "f" : {
        "description" : "The optional f parameter indicates the output format
which the server shall provide as part of the response document.  The default
format is JSON.",
        "explode" : false,
        "in" : "query",
        "name" : "f",
```

```
        "required" : false,
        "schema" : {
          "default" : "json",
          "enum" : [ "json", "html" ],
          "type" : "string"
        },
        "style" : "form"
      }
    },
    "responses" : {
      "200" : {
        "description" : "successful operation"
      },
      "400" : {
        "description" : "error response",
        "content" : {
          "application/json" : {
            "schema" : {
              "$ref" :
"https://github.com/opengeospatial/oapi_common/blob/master/core/openapi/schemas/ex
ception.yaml"
            }
          }
        }
      },
      "500" : {
        "description" : "server errors",
        "content" : {
          "application/json" : {
            "schema" : {
              "$ref" :
"https://github.com/opengeospatial/oapi_common/blob/master/core/openapi/schemas/ex
ception.yaml"
            }
          }
        }
      }
    }
  }
}
```

B.4. Service Metadata Examples

Example 5. Service Metadata

This is an example of how to extend the OpenAPI `info` object to include identifying metadata about both the service and the service provider.

```
{
  "info" : {
    "title" : "My Web API",
    "version" : "1.0.0",
    "description" : "This example shows population of an OpenAPI Info element with
identifying metadata for both the service and the service provider.",
    "contact" : {
      "name" : "Acme Corporation",
      "email" : "info@example.org",
      "url" : "http://example.org/",
      "x-OGC-serviceContact" : {
        "individualName" : "John Smith",
        "positionName" : "System Administrator",
        "role" : "pointOfcontact",
        "hoursOfService" : "24 Hours",
        "contractInstructions" : "None",
        "onlineResource" : "http://example.org/contact",
        "address" : {
          "deliveryPoint" : "123 Any Street",
          "city" : "Boston",
          "administrativeArea" : "MA",
          "postalCode" : "12345",
          "country" : "USA",
          "electronicMailAddress" : "smith.j@example.org"
        },
        "telephone" : {
          "voice" : "+1.123.456.7890",
          "facsimile" : "+1.123.456.7890 "
        }
      }
    },
    "license" : {
      "name" : "CC-BY 4.0 license",
      "url" : "https://creativecommons.org/licenses/by/4.0/"
    },
    "x-serviceType" : "http://www.opengis.net/doc/IS/ogcapi-common-1/1.0",
    "x-serviceTypeVersion" : "1.0",
    "x-profile" : "DGIWG",
    "x-keywords" : [ "geospatial", "data", "api" ],
    "x-fees" : "None",
    "x-accessConstraints" : "None"
  }
}
```

Annex C: Revision History

Date	Release	Editor	Primary clauses modified	Description
2019-10-31	October 2019 snapshot	C. Heazel	all	Baseline update
2020-04-21	Public Comments	C. Heazel	all	Separation of Collections from Core plus additional comment adjudications.
2020-07-31	Cleanup	C. Heazel	all	General clean-up and update.

Annex D: Glossary

- **Conformance Test Module**
  set of related tests, all within a single conformance test class (OGC 08-131r3)

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. This term and those associated to it are included here for consistency with ISO 19105.

- **Conformance Test Class; Conformance Test Level**
  set of conformance test modules that must be applied to receive a single **certificate of conformance**. (OGC 08-131r3)

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

- **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)

- **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 08-131r3)

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)." (ISO Directives Part 2)

- **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 08-131r3)

- **Requirements Class**
  aggregate of all requirement modules that must all be satisfied to satisfy a conformance test class (OGC 08-131r3)

- **Requirements Module**
  aggregate of requirements and recommendations of a specification against a single standardization target type (OGC 08-131r3)

- **Standardization Target**
  entity to which some requirements of a standard apply (OGC 08-131r3)

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

Annex E: Bibliography

- Fielding, Roy Thomas: **Architectural Styles and the Design of Network-based Software Architectures**. Doctoral dissertation, University of California, Irvine, 2000, https://www.ics.uci.edu/fielding/pubs/dissertation/fielding_dissertation.pdf

- Kernighan, B., Richie, D.: **The C Programming Language**, Bell Laboratories, 1978

- IANA: **Link Relation Types**, https://www.iana.org/assignments/link-relations/link-relations.xml

- ISO/IEC 14977:1996(E) **Information technology – Syntactic metalanguage – Extended BNF**, available from ISO.

- Open Geospatial Consortium: **The Specification Model — A Standard for Modular specifications**, OGC 08-131

- **Schema.org**: http://schema.org/docs/schemas.html

- W3C: **Architecture of the World Wide Web, Volume One**, W3C Recommendation, 15 December 2004, https://www.w3.org/TR/webarch/

- W3C: **Data Catalog Vocabulary (DCAT) - Version 2**, W3C Recommendation, 04 February 2020, https://www.w3.org/TR/vocab-dcat-2/

- W3C: **Data on the Web Best Practices**, W3C Recommendation, 31 January 2017, https://www.w3.org/TR/dwbp/

- W3C/OGC: **Spatial Data on the Web Best Practices**, W3C Working Group Note, 28 September 2017, https://www.w3.org/TR/sdw-bp/

- W3C: **HTML5, W3C Recommendation**, http://www.w3.org/TR/html5/

Annex F: Backus-Naur Forms

F.1. BNF for URI

The following Augmented Backus-Naur Form (ABNF) is from Appendix A of IETF RFC 3986.

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

```
hier-part     = "//" authority path-abempty
              / path-absolute
              / path-rootless
              / path-empty
```

```
URI-reference = URI / relative-ref
```

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

```
relative-ref  = relative-part [ "?" query ] [ "#" fragment ]
```

```
relative-part = "//" authority path-abempty
                  / path-absolute
                  / path-noscheme
                  / path-empty
```

```
scheme        = ALPHA *( ALPHA / DIGIT / "+" / "-" / "." )
```

```
authority     = [ userinfo "@" ] host [ ":" port ]
userinfo      = *( unreserved / pct-encoded / sub-delims / ":" )
host          = IP-literal / IPv4address / reg-name
port          = *DIGIT
```

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

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

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

```
h16           = 1*4HEXDIG
ls32          = ( h16 ":" h16 ) / IPv4address
IPv4address   = dec-octet "." dec-octet "." dec-octet "."
```

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

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

```
path          = path-abempty    ; begins with "/" or is empty
              / path-absolute   ; begins with "/" but not "//"
              / path-noscheme   ; begins with a non-colon segment
              / path-rootless   ; begins with a segment
              / path-empty      ; zero characters
```

```
path-abempty  = *( "/" segment )
path-absolute = "/" [ segment-nz *( "/" segment ) ]
path-noscheme = segment-nz-nc *( "/" segment )
path-rootless = segment-nz *( "/" segment )
path-empty    = 0<pchar>
```

```
segment       = *pchar
segment-nz    = 1*pchar
segment-nz-nc = 1*( unreserved / pct-encoded / sub-delims / "@" )
              ; non-zero-length segment without any colon ":"
```

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

```
query          = *( pchar / "/" / "?" )
```

```
fragment       = *( pchar / "/" / "?" )
```

```
pct-encoded    = "%" HEXDIG HEXDIG
```

```
unreserved     = ALPHA / DIGIT / "-" / "." / "_" / "~"
reserved       = gen-delims / sub-delims
gen-delims     = ":" / "/" / "?" / "#" / "[" / "]" / "@"
sub-delims     = "!" / "$" / "&" / "'" / "(" / ")"
               / "*" / "+" / "," / ";" / "="
```

Annex G: OGC Web API Guidelines

The following table discusses how this standard addresses the design principles documented in the OGC Web API Guidelines.

#	Principle	Discussion
1	**Don't reinvent**	Great care was taken in the development of this standard to only address capabilities that were not already standardized and to define how the needed capabilites integrate into a single API.
2	**Keep it simple and intuitive**	OGC Web APIs are developed using a building block approach. Conformance Classes are defined that encompase requirements sufficient to create a usable software module and no more. Complex APIs are constructed by assembling the applicable Conformance Classes.
3	**Use well-known resource types**	Except where unique to a specific Conformance Class, all resources types are IANA or OGC registered types. OGC Web API standards do not mandate an encoding. The encodings supported by an API are specified by the corresponding encoding Conformance Classes. All encodings used to-date are IANA registered media types.
4	**Construct consistent URIs**	OGC Web APIs are built from standardized modules using standardized patterns. This modular approach assures that the URIs are consistent across OGC Web APIs. OGC Web API Common defines stylistic conventions for query parameters, query values, identifiers, and path elements used to create OGC Web API URIs.
5	**Use HTTP methods consistent with RFC 7231**	OGC web APIs are restricted to the HTTP methods defined in IETF RFC 7231.
6	**Put selection criteria behind the '?'**	Section 6.1 of this Standard defines the conventions to be used when creating URIs for OGC Web API standards. This includes the use of the "?" to deliminate query parameters from the rest of the URI. Note that this does not preclude the use of resource identifiers (ex. collection identifiers) as part of the path. However those can be considered identifying criteria rather than selection criteria.
7	**Error handling and use of HTTP status codes**	This standard identifies the applicable HTTP status codes and under what conditions they should be returned. Status codes and supporting information are returned in the HTTP response using a reporting structure based on RFC 7807.
8	**Use explicit list of HTTP status codes**	HTTP Status Codes provides a list of the HTTP status codes that implementers of this standard should be prepared to generate and accept. This list is not exhaustive (see guideline #1).

9	**Use of HTTP header**	OGC API Common does not preclude use of HTTP headers where it is appropriate to do so. Only standard HTTP headers are used. Due to the common use of the HATEOAS pattern in OGC Web APIs, HTTP headers are not always accessible. The use of query parameter overrides is allowed.
10	**Allow flexible content negotiation**	IETF RFC 7231 content negotiation is avalable on all transactions. Since the HTTP headers are not always accessible, content negotiation may be performed through a query parameter (see #9).
11	**Pagination**	Of the resources defined in API-Common Core only the conformance resource is "listable". We do not anticipate the conformance resource to grow to any size, so support for pagenation would add complexity will little to no value (violating #2) If an OpenAPI document is used as the API definition, then pagination could become an issue for this resource. The question of how to handle large OpenAPI documents is still an open issue being worked across the Standards Working Groups.
12	**Processing resources**	Processing resources are not addressed by this Standard.
13	**Support metadata**	Support for metadata is provided through metadata resource links. Examples include links with the relation type `service-desc`,`service-doc`, `service-meta`, or `data-meta`.
14	**Consider your security needs**	While not mandated, use of HTTPS vs. HTTP is encouraged throughout this standard. Authenitcation is not precluded by this standard, but in keeping with guideline #1, this standard does not presume to dictate what authentication methods can be used. API-Common - Core only defines GET requests. The security issues associated with CRUD are not applicable to this standard.
15	**API description**	The API definition is avaliable using the `service-desc` (machine readable) and `service-doc` (human readable) associations from the landing page. OpenAPI is the only API definition type currently supported.
16	**Use well-known identifiers**	IANA identifiers are used where they are available. Where no IANA identifiers are appropriate, OGC registered identifiers are used. OGC identifiers are only used after they have been reviewed and approved by the OGC Naming Authority.
17	**Use explicit relations**	All relations in this standard are typed using relation types registered in the IANA or the OGC relation type registers.
18	**Support W3C cross-origin resource sharing**	This guideline is addressed in Support for Cross-Origin Requests.

19	**Resource encodings**	Conformance classes for both HTML and JSON have been defined. Implementation of both the HTML and JSON Conformance Classes is recommended.
20	**Good APIs are testable from the beginning**	The Abstract Test Suite (ATS) for this standard is provided in Annex A. The ATS is defined to sufficient level of detail to validate that it is implementable and comprehensive
21	**Specify whether operations are safe and/or idempotent**	According to IETF RFC 7231 "the GET, HEAD, OPTIONS, and TRACE methods are defined to be safe." and the "PUT, DELETE, and safe request methods are idempotent". All request methods in this standard (GET) are both safe and idempotent.
22	**Make resources discoverable**	All resouces defined in this standard can be navigated to through resource links and optional standard paths. All resource links are typed using registered relation types. These links are encoded using a standard link structure that includes the media type, language, and title of the resource.
23	**Make default behavior explicit**	This Standard defines the proper and allowed responses for any valid or invalid request.