

OGC API-MapsTiles

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OGC API Maps Tiles

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i. Abstract

The OGC has started a focused effort to extend their service standards into the Resource Oriented Architecture world. As part of this effort, this standard defines an API for Map Tiles.

The Map Tile API described in this standard builds on the Web Map Tile Service (WMTS) OGC standard. WMTS provides a scalable, high performance services for web based distribution of cartographic maps. WMTS, in turn, complements earlier efforts to develop services for the web based distribution of cartographic maps. In particular, it compliments the OGC Web Map Service (WMS). WMS focuses on rendering custom maps and is an ideal solution for dynamic data or custom styled maps (combined with the OGC Style Layer Descriptor (SLD) standard). WMTS trades the flexibility of custom map rendering for the scalability possible by serving of static data (base maps) where the bounding box and scales have been constrained to discrete tiles. Note that an API version of WMS is also under development.

ii. Keywords

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

ogcdoc, OGC document, tiling, WMTS

iii. Preface

This document defines an OGC standard for a Web Map Tile API standard. A Map Tile enabled API can serve map tiles of spatially referenced data using tile images with predefined content, extent, and resolution. Suggested additions, changes and comments on this standard are welcome and encouraged. Such suggestions may be submitted using the online change request form on OGC web site: http://portal.opengeospatial.org/public_ogc/change_request.php

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Chapter 1. Scope

This International Standard specifies how to access maps and tiles in a manner independent of the underlying data store through [OpenAPI](<https://www.openapis.org/> [https://www.openapis.org/]). This standard specifies discovery and query operations.

1.1. Current scope:

- Discovery operations allow the API to be interrogated to determine its capabilities and retrieve information (metadata) about this distribution of tiles and maps. This includes the API definition as well as metadata about the feature collections provided through the API and the TileMatrixSets supported by this service.
- Retrieve of maps as defined by the WMS 1.3
- Retrieve of tiles as defined by the WMTS 1.0
- Query about a point in a map or a tile (GetFeatureInfo)
- Retrieve multiple tiles in a single request.

Chapter 2. Conformance

This standard defines **TBD** requirements / conformance classes.

The standardization targets of all conformance classes are "web services".

The main requirements class is:

- **Core.**

The *Core* specifies requirements that all Map Tile APIs have to implement.

TBD requirements classes depend on the *Core* and <enter their purpose here>:

Capture additional requirements classes here

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

In order to conform to this OGC® interface standard, a software implementation shall choose to implement: * Any one of the conformance levels specified in Annex A (normative). * Any one of the Distributed Computing Platform profiles specified in Annexes TBD through TBD (normative).

All requirements-classes and conformance-classes described in this document are owned by the standard(s) identified.

Chapter 3. 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.

OGC: OGC API (OAPI) Common Specification https://github.com/opengeospatial/oapi_common (in the process of elaboration)

OGC: OGC 17-083r2, OGC Two Dimensional Tile Matrix Set Standard (2019)

In addition, this standard is deeply inspired in concepts defined in the following documents. This standard offers an alternative interface to fulfill similar tasks included in these references.

OGC and ISO: OGC 06-042 1.3.0 OpenGIS Web Map Service (WMS) Implementation Specification

OGC: OGC 07-057, OpenGIS® Web Map Tile Service Implementation Standard (2010)

OGC: OGC 13-082, OGC® Web Map Tile Service (WMTS) Simple Profile (2016)

Chapter 4. Terms and Definitions

This document uses the terms defined in Sub-clause 5.3 of [OGC 06-121r8], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

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

4.1. term name

text of the definition

Chapter 5. Conventions

This sections provides details and examples for any conventions used in the document. Examples of conventions are symbols, abbreviations, use of XML schema, or special notes regarding how to read the document.

5.1. Identifiers

The normative provisions in this standard are denoted by the URI

<http://www.opengis.net/spec/{standard}/{m.n}>

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

Chapter 6. Overview

6.1. Evolution from OGC Web Services

OGC Web Service (OWS) standards have historically implemented a Remote-Procedure-Call-over-HTTP architectural style using Extensible Markup Language (XML) for payloads. This was the state-of-the-art when some of the initial versions of OGC Web Services were originally designed in the late 1990s and early 2000s. This architectural style has now a competing RESTful API style that is proposed as an alternative to RPC pattern. A RESTful API style is resource-oriented instead of service-oriented. This OGC API - Maps and Tiles draft specification specifies an API that follows this Web architecture and in particular 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.

The OGC API – Common draft specification specifies the common kernel of an API approach to services that follows current resource-oriented architecture practices. The draft OGC API - Common specification is the foundation upon which OGC APIs will be built. This common API is to be extended by resource-specific API standards. This draft specification extends OGC API - Common to support Map and Tile resources.

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

- Clear separation between core requirements and more advanced capabilities. This OGC API – Maps and Tiles draft specification presents the requirements that are relevant for almost everyone who wants to share or use Tiled Map Data on a fine-grained level. Additional capabilities that several communities are using today will be specified as extensions to the Core API.
- Technologies that change more frequently are decoupled and specified in separate modules ("requirements 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 will provide building blocks that can be reused in APIs in general. In other words, a server supporting the OGC API - Tiles should not be seen as a standalone service. Rather it should be viewed as a collection of API building blocks which together implement Map and Tile capabilities. A corollary for this is that it should be possible to implement an API that simultaneously conforms to conformance classes from the Feature, Coverage, Map, Tiles, and other future OGC Web API standards.

This approach intends to support two types of client developers:

- Those that have never heard about OGC. Developers should be able to create a client using the API definition without the need to adopt a specific OGC approach (they no longer need to read how to implement a GetCapabilities, allowing them to focus on the geospatial aspects).

- Those that want to write a "generic" client that can access OGC APIs. In other words, they are not specific for a particular API.

As a result of following a RESTful approach, OGC API implementations are not backwards compatible with OWS implementations per se. However, a design goal is to define OGC APIs in a way that an OGC API interface can be mapped to an OWS implementation (where appropriate). OGC APIs are intended to be simpler and more modern, but still an evolution from the previous versions and their implementations making the transition easy (e.g. by initially implementing facades in front of the current OWS services).

This document provides simple examples throughout the document. The examples are based on a dataset that contains buildings and the API provides access to the datasets via a single feature collection ("buildings") and two encodings: JSON and Hypertext Markup Language (HTML).

6.2. Tiles and maps

WMS and WMTS share the concept of a map and the capability to create and distribute maps at a limited resolution and size. In WMS the number of rows and columns can be selected by the user within limits and in WMTS the number of rows and columns of the response is predefined in the tile matrix set.

With time, the concept of a tile has been generalized to other data models such as feature data (some vendors use the expression *vector tiles*) and even to coverage data. This draft specification presents an approach to tiles that can be applied to almost every resource type that returns data representations. If applied in conjunction with the OGC API - Features standard and on top of a feature collection, the expected result is tiled feature data. If applied in conjunction with the OGC API - Maps draft specification and on top of a collection that is transformed into a map by applying a style, the result should be map tiles (usually in PNG or JPEG format).

In this draft specification the OGC API - Tiles is almost fully described. It includes the a core and extensions for defining tile matrix sets, tiles from more that one collection, multi-tiles and multitiles from more than one collection. And info extension is foreseen but not fully developed. In contrast, OGC API - Maps is only partially described based on Testbed-15 requirements. The Maps API is described only to the extent to allow for map tiles to be created on top of a map created by selecting a collection with style or multiple collections with styles. This draft specification contains a section for retrieving a map of an arbitrary number of rows and columns but is not fully formulated. Other extensions for maps are also foreseen. In the future, the WMS SWG could take this document and complete the missing capabilities.

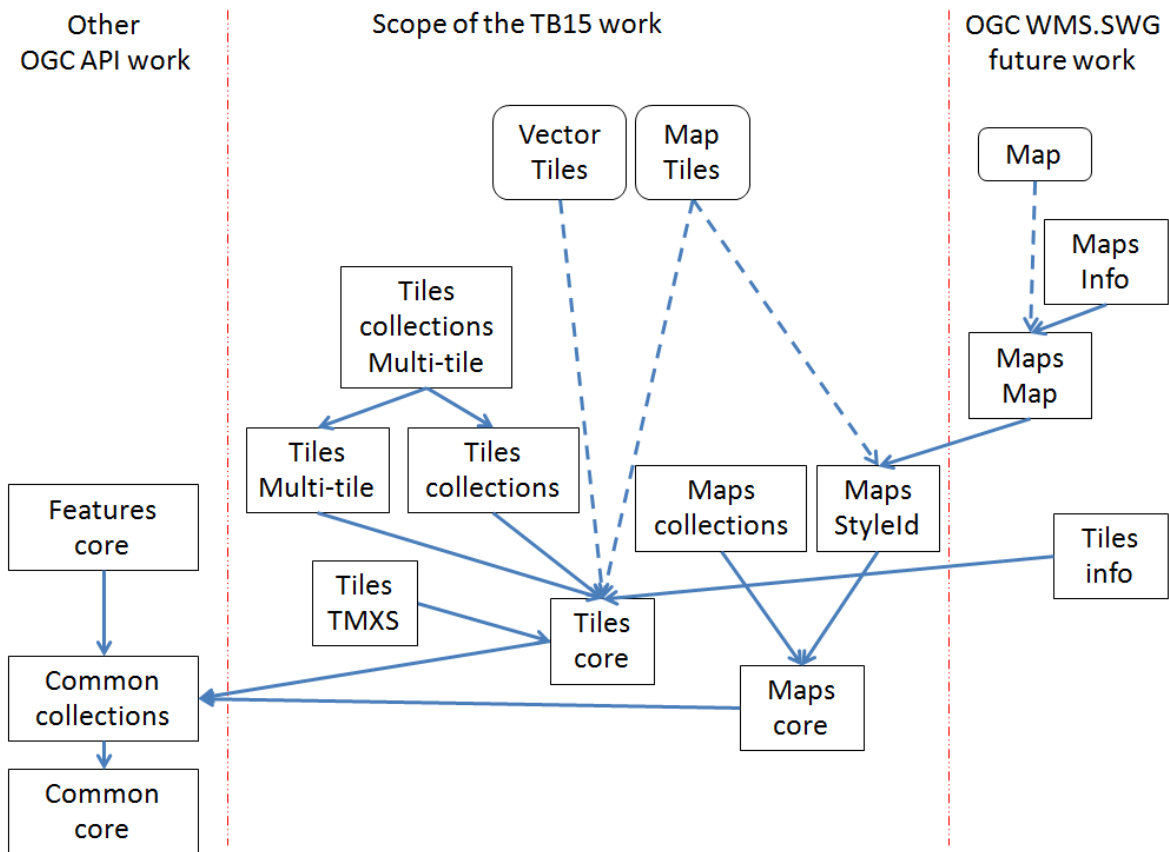


Figure 1. Modular approach in the Maps and Tiles draft specification

6.3. How to approach an OGC API

There are two ways to approach an OGC API.

- Read the landing page, look for links, follow them and discover new links until the desired resource is found
- Read an API definition document that will specify a list of paths to resources.

For the first approach, many resources in the API include links with rel properties to know the reason for this relation. The following figure illustrates does links.

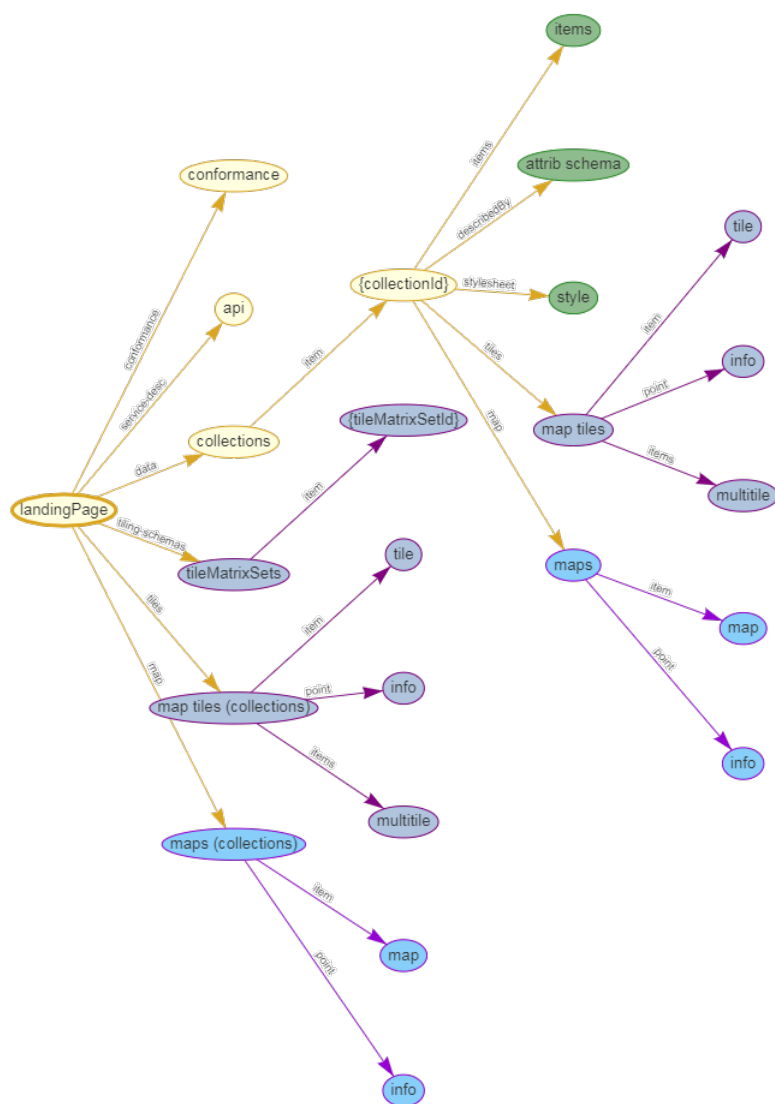


Figure 2. Resources and relations to them via links

For the second approach, the section [\[OpenAPIExamples\]](#) will provide some examples of OpenAPI definition documents that enumerate the paths to get to the necessary resources directly.

Resource name	Common path
Landing page	/
Conformance declaration	/conformance
Collections	/collections
Collection	/collections/{collectionId}
Tiling Schemas	/tileMatrixSets
Tiling Schema	/tileMatrixSets/{tileMatrixSetId}
Tiles	
Vector Tiles description	/collections/{collectionId}/tiles

Resource name	Common path
Vector Tiles description from collections	/tiles
Vector Tile	/collections/{collectionId}/tiles/{tileMatrixSetId}/{tileMatrix}/{tileRow}/{tileCol}
Vector tile collections ¹	/map/tiles/{tileMatrixSetId}/{tileMatrix}/{tileRow}/{tileCol}
Vector Multi-tiles	/collections/{collectionId}/tiles/{tileMatrixSetId}
Vector Multi-tiles collections ¹	/tiles/{tileMatrixSetId}
Map tiles	
Map tiles description	/collections/{collectionId}/map/
Map tiles description collections ¹	/map/tiles
Map tile	/collections/{collectionId}/map/{styleId}/tiles/{tileMatrixSetId}/{tileMatrix}/{tileRow}/{tileCol}
Map tile collections ¹	/map/tiles/{tileMatrixSetId}/{tileMatrix}/{tileRow}/{tileCol}
Map tile multi-tiles	/collections/{collectionId}/map/{styleId}/tiles/{tileMatrixSetId}
Map tile multi-tiles collections ¹	/map/tiles/{tileMatrixSetId}
Maps	
Maps description	/collections/{collectionId}/map
Maps description collections ¹	/map

Table 1. Overview of resources and common direct links defined in the API

¹: In first column of the table, the word "collections" means "from more than one collection"

Chapter 7. Requirement Class "Map BBox"

NOTE

This section should be elaborated by a SWG and only some hints are provided in this Engineering Report. This section is out of the scope of the Testbed-15.

WARNING

Some subsections are intentionally left blank.

7.1. Overview

Requirements Class	
http://www.opengis.net/spec/ogcapi-maps-1/1.0/req/bbox	
Target type	Web API
Dependency	http://www.opengis.net/spec/ogcapi-maps-1/1.0/req/core

This extension describes how a map can be retrieved by specifying a set of parameters that will determine its resolution (width, height, boundingbox and CRS).

The map can use the default style or it can select one of the styles available if the right extension is also added to the core.

7.2. General

In practice, this means that the landing page and the conformance page follow OGC API - Common core requirements. More is still TBD but mostly equivalent to the general parts of OGC API - Features requirements, though with the text generalized to other resource types. This draft specification provides extra additions to the OGC API - Common requirements that are particular of tiles.

7.3. API landing page

The landing page provides links to start exploring the resources offered by the API. It mainly consists of a list of links. OGC API - Common already requires some common links that are enough for this core.

7.3.1. Response

There are no required variations to the landing page.

With a /collections successful response it is possible to retrieve the list of collectionId and links to the /collections/{collectionId}. With a /collections/{collectionId} successful response, it is possible to discover the links to retrieve some maps. Note that other resources can also be retrieved as collections (e.g. coverages).

7.4. Declaration of conformance classes

To support "generic" clients that want to access multiple OGC API standards and extensions - and not "just" a specific API / server, the API has to declare the requirements classes it implements and conforms to.

7.4.1. Response

The conformance page mainly consists of a list of links. OGC API - Common already requires some links.

In the conformance page (typically in JSON format) the links follow the link schema defined in the OGC API - Common. The following is an example fragment of the response of an implementation of the OGC API – Maps draft specification with the maps extension conformance information page.

Example 1. Conformance Information Page fragment

```
{
  "conformsTo": [
    "http://www.opengis.net/spec/ogcapi-common-1/1.0/req/core",
    "http://www.opengis.net/spec/ogcapi-common-1/1.0/req/collections",
    "http://www.opengis.net/spec/ogcapi-maps-1/1.0/req/core"
    "http://www.opengis.net/spec/ogcapi-maps-1/1.0/req/bbox"
  ]
}
```

7.5. Collections

This draft specification includes dependencies on OGC API - Common collections. Collections are mandatory in the core of this draft specification because collections are the object that will be included in a tile.

Collections will enumerate the collectionId available in this API as well as basic information about each collectionId: id, title, description, extent, crs and links. This common response is considered enough for a general description of the collection. To retrieve more information, you should use /collections/{collectionId}

NOTE

The collectionId substitutes the concept of "layer" in WMS.

7.6. Collection

This draft specification includes dependencies on OGC API - Common collection. The response to the operation is extended with a new link for the maps description.

7.6.1. Collection Links

TBD

7.6.2. Maps metadata

The core of the OGC API - Maps draft specification defines a **maps** resource that is associated to an operation contains the necessary information to later formulate a map request for a collection. Neither the core, nor the styles extension requires any mandatory information. This requirement class does require this operation to be able to retrieve a map as maps (this resource will not be present if the map is only available as tiles).

7.6.3. Operation

The request of this operation has no parameters.

7.6.4. Response

A successful response to a map request for a collection that can be retrieved as a map responds with a data structure with specific information necessary to get a fragment of the map representing the resource collection. In this extension, the response is only required to inform about the URL templates styles it supports.

In practice, since the map core alone does not specify how to retrieve a map, it is not possible to exemplify completely how the link looks like without considering other extensions. If the server also conforms to an extension to distribute the map as maps, the example will look like this.

Example 2. API collection response fragment

```
links:
[
  {
    "href":
"http://data.example.com/collections/buildings/map/brown",
    "rel": "item",
    "type": "image/png",
  }
]
```

7.7. Maps from one collection

This draft specification specifies how to get maps from a single collection.

7.7.1. Operation

Typical resources that can be retrieved as maps are: features (`/collections/{collectionId}`), coverages (`/collections/{collectionId}/coverage/{coveragelId}` or `/coverage/{coveragelId}`).

7.7.2. Parameter crs

TBD

7.7.3. Parameter bbox

TBD

7.7.4. Parameter width

TBD

7.7.5. Parameter height

TBD

7.7.6. Response

A successful response of a tile request will be consistent with the media type of the resource requested. For features the media type can be geojson or Mapbox vector tiles, for coverages it may be a GeoTIFF, and for maps it can be a JPEG or a PNG.

7.7.7. Error conditions

A general summary of the HTTP status codes can be found in OGC API - Common.

If the parameter crs is not available by the server for this resource or the parameters bbox, width, height are out-of-range, the status code of the response will be 404.

Annex A: Conformance Class Abstract Test Suite (Normative)

NOTE

Ensure that there is a conformance class for each requirements class and a test for each requirement (identified by requirement name and number)

A.1. Conformance Class A

A.1.1. Requirement 1

Test id:	/conf/conf-class-a/req-name-1
Requirement:	/req/req-class-a/req-name-1
Test purpose:	Verify that...
Test method:	Inspect...

A.1.2. Requirement 2

Annex B: Revision History

Date	Release	Editor	Primary clauses modified	Description
2019-03-21	Template	C. Heazel	all	initial template