



DPC: 24/30483230 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Responsible Committee Secretary: Committee Service Centre (BSI)

Direct tel: 020 8996 7009

E-mail: csc@bsigroup.com

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 19177-1

Geographic information — Geospatial API for tiles —

Part 1: Core

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ISO/TC 211

Secretariat: **SIS**

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2024-10-10

This document is circulated as received from the committee secretariat.

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CP 401 • Ch. de Blandonnet 8
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Phone: +41 22 749 01 11
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 287, *Geographic Information*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement) and in collaboration with the Open Geospatial Consortium Inc. (OGC).

This document defines the *OGC API — Tiles — Part 1: Core* Standard. A Web API conforming to this document can serve tiles of spatially referenced data or maps with predefined content, extent, and resolution. Suggested additions, changes and comments on this document are welcome and encouraged. Such suggestions may be submitted using the issues log on the GitHub repository: <https://github.com/opengeospatial/ogcapi-tiles>.

A list of all parts in the ISO 19177 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The *OGC API — Tiles* Standard defines building blocks for implementing Web APIs that support the retrieval of tiled geospatial information. A Web API is an application programming interface for either a web server or a web browser [Wikipedia, 2022].

The OGC suite of Web API standards is an extensible framework for building HTTP based services that can be accessed in different applications on different platforms such as the Web, desktop, mobile, etc. The *OGC API — Tiles* Standard specifies how different forms/types of geospatial resources are supported, such as tiles of vector features (“vector tiles”), coverages, and maps (or imagery). Although OGC API — Tiles can be used independently, the building blocks can be combined with other OGC API Standards for additional capabilities or increased interoperability for specific types of data. The *OGC API — Tiles* Standard references the *OGC Two-Dimensional Tile Matrix Set (TMS) and Tile Set Metadata* Standard [OGC 17-083r4]. That Standard defines logical models and encodings for specifying tile matrix sets and describing tile sets. A tile matrix set is a tiling scheme that enables an application to partition and index space based on a set of regular grids defined for multiple scales in a Coordinate Reference System (CRS).

The *OGC API — Tiles* Standard is an alternative to the OGC’s Web Map Tile Service (WMTS) Standard. Instead of a fixed Web interface, OGC API — Tiles focuses on simple reusable REST API building blocks which can be described using the OpenAPI specification. Whereas WMTS focused on map tiles, the *OGC API — Tiles* Standard is designed to support any form of tiled data.

Geographic information — Geospatial API for tiles —

Part 1: Core

1 Scope

The *OGC API — Tiles* Standard specifies the behavior of Web APIs that provide access to tiles of one or more geospatial data resources (collections) that the Web API offers. This document defines how to discover which resources offered by the Web API can be retrieved as tiles, get metadata about the available tile sets (including according to which tile matrix set each tile set is partitioned and the limits of that tile set within a common potentially global tile matrix set) and how to request a tile. This document is sometimes referred to as the *Tiles API*.

The core conformance class is defined in a way that could be easily included in a web API, even if that API does not conform to the *OGC API — Common* Standard. A web API can combine some requirements classes of this OGC API Standard with those of other OGC API Standards (including *OGC API — Common*) to extend the scope of the Web API by adding functionality..

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

REED C. OGC 19-014r3, *Topic 22 — Core Tiling Conceptual and Logical Models for 2D Euclidean Space*. Open Geospatial Consortium (2020). <https://docs.ogc.org/as/19-014r3/19-014r3.html>.

MASÓ J., JACOVELLA-ST-LOUIS J. OGC 17-083r4, *OGC Two Dimensional Tile Matrix Set and Tile Set Metadata*. Open Geospatial Consortium (2022). <https://docs.ogc.org/is/17-083r4/17-083r4.html>.

HEAZEL C., OGC API — Common — Part 1: Core (Draft). OGC 19-072, Open Geospatial Consortium, <https://docs.ogc.org/DRAFTS/19-072.html>

HEAZEL C., OGC API — Common — Part 2: Geospatial Data (Draft). OGC 20-024, Open Geospatial Consortium, <https://docs.ogc.org/DRAFTS/20-024.html>

DOMENICO B. OGC 10-090r3, *OGC Network Common Data Form (NetCDF) Core Encoding Standard version 1.0*. Open Geospatial Consortium (2011). https://portal.ogc.org/files/?artifact_id=43732.

BUTLER H., DALY M., DOYLE A., GILLIES S., HAGEN S., SCHAUB T. IETF RFC 7946, *The GeoJSON Format*. (2016). <https://www.rfc-editor.org/info/rfc7946>.

Adobe Developers Association, TIFF Specification Revision 6.0. (1992)

DEVYS E., HABERMANN T., HEAZEL C., LOTT R., ROUAULT E. OGC 19-008r4, *OGC GeoTIFF Standard*. Open Geospatial Consortium (2019). <https://docs.ogc.org/is/19-008r4/19-008r4.html>.

ISO/IEC ISO/IEC 10918-1, *Information technology — Digital compression and coding of continuous-tone still images: Requirements and guidelines*. International Organization for Standardization, International Electrotechnical Commission, Geneva <https://www.iso.org/standard/18902.html>.

ISO/IEC ISO/IEC 15948, *Information technology — Computer graphics and image processing — Portable Network Graphics (PNG): Functional specification*. International Organization for Standardization, International Electrotechnical Commission, Geneva <https://www.iso.org/standard/29581.html>.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

coverage tile

tile that contains information, often in a gridded form, where the values represent observations or measurements as a count, or quantity using some unit of measure

Note 1 to entry: Coverage tiles are generated in combination with *OGC API — Coverages*, and can also be generated by combining a subset (trim) and resampling operation. Usually, visualizing a coverage tile on a rendering device implies mapping those values to colors.

3.2

dataset

a set of data, published or curated by a single agent, and available for access or download in one or more representations (modified from DCAT: <https://www.w3.org/TR/vocab-dcat-2/#dcat-scope>)

Note 1 to entry: A Web API implementing OGC API — Common often gives access to a single dataset which may be comprised of one or more *geospatial data resources*.

3.3

geospatial data resource

web accessible resource that consists of a set of geospatial data

Note 1 to entry: In Web APIs implementing *OGC API — Common — Part 2: Geospatial Data*, geospatial data resources are referred to as collections and are defined in the *collections* conformance class.

Note 2 to entry: *geodata* is sometimes used in this document as an abbreviation of *geospatial data*

3.4

geospatial resource aspect

web accessible resource that represents a component of geospatial information (metadata, schemas...) or geospatial data accessed using a particular mechanism and data model (e.g., feature items, tiles, maps, coverages,...) of a more generic geospatial data resource (e.g., a collection)

Note 1 to entry: Not to be confused with a web accessible resource representation. While resource representations share the same path and are selected by format negotiation, geospatial aspects use different paths. Commonly a geospatial aspect is a subpath of a geospatial data resource.

3.5

landing page

any page whose primary purpose is to contain a description of something else. Landing pages often provide summaries or additional information about the thing that they describe. (W3C, URLs in Data Primer) In the context of the OGC API Standards, a landing page serves as the root node of the API Resource tree and provides the information needed to navigate all the resources exposed through the API. The landing page provides access to the root of a dataset.

3.6**map tile**

tile that contains information in a raster form where the values of cells are colors which can be readily displayed on rendering devices

Note 1 to entry: Map tiles are generated in combination with *OGC API — Maps*.

3.7**tile**

geometric shape with known properties that may or may not be the result of a tiling (tessellation) process. A tile consists of a single connected “piece” without “holes” or “lines” (topological disc) In the context of a 2D *tile matrix*, a *tile* is one of the rectangular regions of space, which can be uniquely identified by row and column integer indices, making up the tile matrix. In the context of a geospatial data *tile set*, a *tile* contains data for such a partition of space as part of an overall set of tiles for that tiled geospatial data.

Note 1 to entry: From OGC 19-014r1: Core Tiling Conceptual and Logical Models for 2D Euclidean Space

Note 2 to entry: From OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard

Note 3 to entry: Tiles are useful to efficiently request, transfer, cache, display, store and process geospatial data for a specific resolution and area of interest, providing deterministic performance and scalability for arbitrarily large datasets.

Note 4 to entry: Tiles can contain a variety of data types, such as grid-based pictorial representations (map tiles), coverage subsets (coverage tiles), or feature-based representations (vector tiles).

3.8**tile matrix**

tiling grid in a given 2D coordinate reference system, associated to a specific scale and partitioning space into regular conterminous *tiles*, each of which being assigned a unique identifier

Note 1 to entry: From OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

Note 2 to entry: Each tile of a tile matrix is uniquely identifiable by integer indices for the row and the column. The number of rows is referred to as the *matrix height*, while the maximum number of columns is referred to as the *matrix width* (the number of columns can vary for different rows in *variable width tile matrices*).

3.9**tile matrix set**

tiling scheme consisting of a set of *tile matrices* defined at different scales covering approximately the same area and having a common coordinate reference system

Note 1 to entry: From OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard

3.10**tile indexing scheme**

scheme to uniquely reference a *tile* in a *tiling scheme* by the use of a unique identifier (or set of identifiers), and reversely, which unique identifier (or unique set of identifiers) corresponds to a space satisfying the geometric properties of a specific tile

Note 1 to entry: From OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.11**tile set**

a set of *tiles* resulting from tiling data according to a particular *tiling scheme*

Note 1 to entry: From OGC 19-014r1: Core Tiling Conceptual and Logical Models for 2D Euclidean Space, but adapted to clarify that in the context of this document, a tile set refers specifically to a set of tiles containing data and following a common tiling scheme.

3.12**tiling scheme**

scheme that defines how space is partitioned into individual *tiles*, potentially featuring multiple levels of detail (each tiling at a different granularity to reflect a different resolution or scale) A tiling scheme defines the spatial reference system and the geometric properties of each tile defined by the scheme. Those properties include which space each tile occupies (the tile's spatial extent), as well as a tile coordinate origin if a particular corner of origin convention is established.

Note 1 to entry: A tiling scheme can be defined on top of a CRS as well as other spatial reference systems such as DGGS and other organizations including irregular ones. In this document, only tiling schemes based on CRSs are supported.

Note 2 to entry: From OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.13**tile set metadata**

additional metadata beyond the common properties defining the *tile set*. Such metadata could be an abstract, the owner, the author, or other common metadata. [OGC 19-014r3] metadata describing common properties defining a *tile set*, layers and styles used to produce the tile set, the limits of the tile matrix with actual data and common metadata such as abstract, owner, author, etc.

Note 1 to entry: From OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.14**vector tile**

tiled vector feature data

tile that contains vector data that has been generalized (simplified) at the tile scale resolution and clipped by the tile boundaries

Note 1 to entry: From OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.15**Web API**

API using an architectural style that is founded on the technologies of the Web.

[SOURCE: OGC API — Features — Part 1: Core]

Note 1 to entry: See Best Practice 24: Use Web Standards as the foundation of APIs (W3C Data on the Web Best Practices) for more detail.

3.16**Web API based implementation**

a server software that implements a Web API.

Note 1 to entry: The Web API based implementations mentioned in the context of this document declare conformity to at least one Conformance Class defined by this document.

4 Conformance**4.1 General**

The *OGC API — Tiles* Standard defines multiple requirements classes and their associated conformance classes.

The standardization targets of all conformance classes are “Web APIs”.

The Tiles API requirements classes are summarized below and in more detail in subsequent clauses.

4.2 Requirements classes defining resources

Requirements Class “Core” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/core>)

The Core Requirements Class specifies requirements that all implementation instances of the Tiles API must support if claiming conformance with this document. The Core class defines how to retrieve individual tiles by building a URI from three variables corresponding to the tile matrix, tile row and tile column for that tile.

Table 1 — Overview of resource and common direct links that correspond to tiles defined in the Core Requirements Class

Resource name	Common path
Tile	.../{tileMatrix}/{tileRow}/{tileCol}
NOTE The path template is recommended, but not prescribed. Ordering the parameters differently within the URI is allowed.	

Requirements Class “TileSet” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/tileset>)

The *TileSet* Requirements Class defines a mechanism for describing a tileset using a specific tile matrix set and a way of obtaining a templated link to the individual tiles.

Table 2 — Overview of resources and common direct links that correspond to the tileset

Resource name	Common path
Tileset	.../tiles/{tileMatrixSetId}
Tile	.../tiles/{tileMatrixSetId}/{tileMatrix}/{tileRow}/{tileCol}

Requirements Class “TileSets List” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/tilesets-list>)

The *TileSets List* Requirements Class defines a generic operation for retrieving a list of tilesets, without association to any particular type of resources.

Table 3 — Overview of resource and common direct link that corresponds to the tileset list

Resource name	Common path
Tileset list	.../tiles

4.3 Requirements Classes defining data origins

Requirements Class “Dataset TileSets” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/dataset-tilesets>)

The *Dataset Tilesets* Requirements Class defines how to retrieve all tiles for a dataset that could potentially consist of multiple geospatial data resources. All implementation instances of the Tiles API must implement this Requirements Class if they are claiming to support **dataset** tiles following this *OGC API — Tiles — Part 1: Core Standard*. Dataset tiles may combine content from multiple geospatial resources, regardless of whether those are available separately (as tiles or otherwise).

Table 4 — Overview of resource and common direct links that correspond to the dataset tileset

Resource name	Common path
Vector tileset list	/tiles
Map tileset list	/map/tiles
Styled Map tileset list	/styles/{styleId}/map/tiles

Requirements Class “GeoData TileSets” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/geodata-tilesets>)

The *GeoData TileSets* Requirements Class supports the retrieval of tiles from a specific geospatial data resource.

Table 5 — Overview of resource and common direct links that correspond to the geospatial data resources tilesets

Resource name	Example of possible paths
Vector tileset list	/collections/{collectionId}/tiles
Map tileset list	/collections/{collectionId}/map/tiles
Styled Map tileset list	/collections/{collectionId}/styles/{styleId}/map/tiles

4.4 Requirements classes defining query parameters

Requirements Class “Collections Selection” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/collections-selection>)

The *Collections Selection* Requirements Class supports the listing of specific geospatial data resources from which to retrieve tiles such as for use with data set tiles.

Table 6 — Overview of resource and common direct links that correspond to geodata selection

Resource name	Example of possible paths
Vector Tileset	/tiles/{tileMatrixSetId}?collections={collectionId},{collectionId},...
Vector Tile	/tiles/{tileMatrixSetId}/{tileMatrix}/{tileRow}/{tileCol} ?collections={collectionId},{collectionId},...
Map tileset	/map/tiles/{tileMatrixSetId}?collections={collectionId},{collectionId},...
Map tile	/map/tiles/{tileMatrixSetId}/{tileMatrix}/{tileRow}/{tileCol} ?collections={collectionId},{collectionId},...

Requirements Class “DateTime” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/datetime>)

The *DateTime* Requirements Class specifies how to provide tiles in a domain that has a generic time dimension.

4.5 Requirements classes for specific resource representations

Requirements Class “OpenAPI Specification 3.0 API definition” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/oas30>)

The *OpenAPI Specification 3.0* Requirements Class specifies requirements for an OpenAPI 3.0 definition in addition to those defined in *OGC API — Common — Part 1: Core*.

Requirements Class “XML TileSet Metadata” (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/xml>)

The *XML TileSet Metadata* Requirements Class specifies how to use XML as an alternative encoding for describing tilesets.

Requirements Classes for tile encodings

The *OGC API — Tiles* Standard does not mandate a specific encoding or format for representing tiles and remains flexible and extensible to other formats that users and providers might need. However, Requirements Classes are provided for the following common tile encodings:

- PNG (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/png>)
- JPEG (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/jpeg>)
- TIFF (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/tiff>)
- NetCDF (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/netcdf>)
- GeoJSON (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/geojson>)

— Mapbox Vector Tiles (<http://www.opengis.net/spec/ogcapi-tiles-1/1.0/req/mvt>)

All Tiles API Requirements Classes can be viewed as building blocks that can be implemented in combination with other more fundamental requirements classes that provide support for Web API discovery, conformity and Web API formal definition (e.g., OpenAPI). Possible alternatives for these fundamental Requirements Classes are *OGC API — Common — Part 1: Core* or *OGC API — Features — Part 1: Core*.

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

NOTE Despite the fact that full paths and full path templates in the above resource tables are used in many implementations of the *OGC API — Tiles* Standard, these exact paths are ONLY examples and are NOT required by this document. Other paths are possible if correctly described by the Web API definition document and the links between resources.

4.6 Declaration of conformance

Conformance with this document shall be checked using all the relevant tests specified in [Annex A](#) (normative) of this document if the respective conformance class URIs listed in [Table 7](#) are present in the Conformance Declaration response. 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 (OGC 08-134r11) and the OGC Compliance Testing website.

Table 7 — Conformance class URIs

Conformance class	URI
Core	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/core
TileSet	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/tileset
Tilesets list	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/tilesets-list
Dataset tilesets	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/dataset-tilesets
Geodata tilesets	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/geodata-tilesets
Collections selection	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/collections-selection
DateTime	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/datetime
OpenAPI Specification 3.0	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/oas30
XML	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/xml
PNG	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/png
JPEG	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/jpeg
TIFF	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/tiff
NetCDF	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/netcdf
GeoJSON	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/geojson
Mapbox Vector Tiles	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/mvt

5 Conventions

5.1 General

This section provides details of conventions used in this document.

5.2 Identifiers

The normative provisions in this document are denoted by the URI <http://www.opengis.net/spec/ogcapi-tiles-1/1.0>.

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

5.3 Link relations

To express relationships between resources, RFC 8288 (Web Linking) is used.

The following IANA link relation types are used in this document:

- **alternate**: Refers to a substitute for this context.
- **self**: Conveys an identifier for the link's context.
- **item**: The target IRI points to a resource that is a member of the collection represented by the context IRI.
- **service-desc**: Identifies a service description for the context that is primarily intended for consumption by machines. (Web API definitions are considered service descriptions)
- **service-doc**: Identifies service documentation for the context that is primarily intended for human consumption.

The following link relation types specified in the *Two Dimensional Tile Matrix Set and Tileset Metadata* Standard are used:

- <http://www.opengis.net/def/rel/ogc/1.0/tiling-scheme>: The target IRI points to a resource that describes the TileMatrixSet according to the 2D-TMS standard.
- <http://www.opengis.net/def/rel/ogc/1.0/dataset>: The target IRI points to a resource representing the dataset (e.g., the root of an OGC Web API).
- <http://www.opengis.net/def/rel/ogc/1.0/geodata>: The target IRI points to a resource representing a collection of geospatial data.

In addition, the following link relation types are used for which no applicable IANA-registered link relation type could be identified:

- <http://www.opengis.net/def/rel/ogc/1.0/tilesets-vector>: The target IRI points to a resource that describes how to provide tile sets of the context resource in vector format.
- <http://www.opengis.net/def/rel/ogc/1.0/tilesets-map>: The target IRI points to a resource that describes how to provide tile sets of the context resource in map format.
- <http://www.opengis.net/def/rel/ogc/1.0/tilesets-coverage>: The target IRI points to a resource that describes how to provide tile sets of the context resource in coverage format.
- <http://www.opengis.net/def/rel/ogc/1.0/tiling-schemes>: The target IRI points to a resource that lists one or more TileMatrixSets according to the 2D-TMS standard.

Used in combination with *OGC API — Features — Part 1: Core* or *OGC API — Common - Part 1: Core*, other link relation types will be used, including:

- <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.

Used in combination with *OGC API — Features — Part 1: Core* or *OGC API — Common - Part 2: Geospatial Data*, other link relation types will be used, including:

- <http://www.opengis.net/def/rel/ogc/1.0/data>: Refers to the list of collections available for a dataset.

Each resource representation includes an array of links. Implementations are free to add additional links for all resources provided by the Web API.

5.4 Use of HTTPS

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

6 Overview

6.1 Introduction

The *OGC API — Tiles* Standard defines building blocks that can be used in the implementation of Web API based servers and compatible clients to support the retrieval of tiled geospatial data that follow the structure defined in the OGC Two Dimensional Tile Matrix Set and Tile Set Metadata 2.0 Standard (OGC 17-083r4) (see [Clause 7](#)), which is also known as the 2D TMS Standard. The *OGC API — Tiles* Standard assumes that the reader is familiar with the concepts in the OGC 17-083r4 Standard, such as a tile, tile set, tile set metadata, tile matrix and tile matrix set. If that is not the case, reading the OGC 17-083r4 overview subsection is recommended.

Services and clients are encouraged to support as many of the TileMatrixSets defined in Annex D and E of the OGC 17-083r4 Standard as possible. Other TileMatrixSets defined in the OGC TileMatrixSet register for all geospatial data resources to maximize interoperability should be considered. However, support for any specific TileMatrixSet is not required. Tiles that share the same TileMatrixSet definition can be easily visualized together in a data integration client.

The OGC API — Tiles standard is an alternative to the OGC Web Map Tile Service (WMTS) Standard [OGC07-057r7]. The fundamental concept TileMatrixSet has not changed from the one used in WMTS. Therefore tiles provided via a WMTS instance and the ones generated by an *OGC API — Tiles* implementation instance that are based on the same TileMatrixSet can also be easily visualized and/or processed together. If the selected tile matrix set is the one called WebMercatorQuad (see OGC 17-083r4 Annex D.1), tiles are also compatible with the ones made available by some popular mass market approaches.

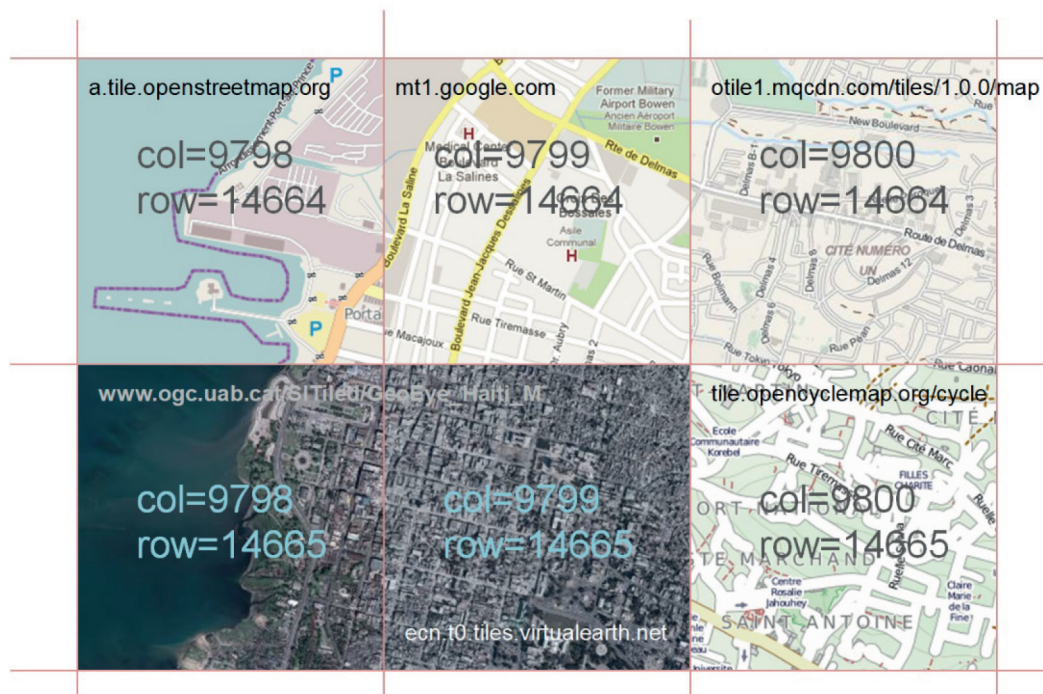


Figure 1 — Contiguous tiles from different services and APIs sharing same WebMercatorQuad tile matrix set and the tile matrix identified as 15 (sometimes called "zoom")

This document does not specify any requirement for the type of *geospatial data resource* that could be delivered as tiles. Provided that the geospatial data resources can be organized into tiles, any such resource can be supported regardless of whether they are maps, vector features, coverages, a resource that does not represent data per se (e.g., an annotation) and so forth.

NOTE The geospatial data resources (e.g., collections) replace the concept of layer in the OGC Web Map Service (WMS) [OGC06-042] and WMTS Standards. The concept of collections allows to provide multiple access mechanisms defined in complementary OGC API Standards, such as tiles and features, to the same collection of data (through different geospatial resource aspects). Geospatial data resources can advertise one or more lists of available tilesets (see [Clause 8](#) and [Clause 9](#)). This document also defines how to link to tilesets originating from two specific data resources: OGC API datasets (see [Clause 10](#)) and collections (see [Clause 11](#)). However, other OGC APIs can provide other access and linking possibilities. Accessing the *geospatial data resource* content (other than as tiles) or its descriptions is possible but out of the scope of this document. If a description of the *geospatial data resource* is specified by another Standard, and this description has a mechanism to add links to other resources, this document indicates the need to add a link to the list of available tilesets.

The *OGC API — Tiles* standard does not specify how to get a Web API definition, the conformance class list, nor the collections lists. However, the Standard assumes that the first two are defined by an OGC API Standard (e.g., *OGC API — Common — Part 1: Core* or *OGC API — Features — Part 1: Core* Standards) and the latter by an OGC API for collections (e.g., *OGC API — Common — Part 2: Geospatial data* or the *OGC API — Features — Part 1: Core* Standard).

6.2 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 in the late 1990s and early 2000s when some of the initial versions of OGC Web Services Standards were designed and documented. Their service oriented architectural style now has a competing resource-oriented Web API style. The WMTS 1.0 standard defines a resource-oriented architectural style but lacks a Web API definition. The *OGC API — Tiles* Standard specifies a Web API that follows the architecture of the Web and in particular the W3C/OGC Best Practices for sharing Spatial Data on the Web [w3cogc_sdw] as well as the W3C Best Practices for sharing Data on the Web [w3c_dw]. The bibliography lists several OGC Engineering Reports from initiatives that led to the development of OGC API — Tiles. Some of the Engineering Reports are from OGC Testbed initiatives [OGC17-041][OGC19-069], whereas others are from the OGC Vector Tiles Pilot [OGC18-086r1][OGC19-082r1][OGC18-078][OGC18-083][OGC18-101].

This document defines the necessary elements to incorporate tile support into a Web API implementation. These elements can be incorporated in an API based on the *OGC API — Features — Part 1: Core* or can be incorporated in a Web API implementation based on the *OGC API — Common — Part 1: Core*. Both of those Standards specify a kernel of a Web API approach to services that follows current resource-oriented architecture practices in the OGC. OGC API — Common provides the foundation upon which implementations of the OGC API Standards can be built. OGC API — Common can be integrated with this document and other resource-specific OGC API Standards to build a Web API implementation. However, this document is also designed in a way that can extend OGC API — Common, but does not make OGC API — Common mandatory. As such this document can be reused as a building block in other APIs that do not follow the OGC API pattern.

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

- Clear separation between core requirements and more advanced capabilities. This *OGC API — Tiles — Part 1: Core* Standard defines the requirements that are relevant for anyone who wants to share or use Tiled Data at a fine-grained level. Additional capabilities that several communities are using today will be specified as extensions to this document.
- 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 Web API definition (such as a new version of the OpenAPI description document).
- Modularization is not just about a single “service”. OGC APIs provide building blocks that can be reused in Web APIs in general. In other words, a server supporting OGC API — Tiles Requirements should not

be seen as a standalone service. Rather, the web API implementation should be viewed as a collection of Web API building blocks which together implement Tile capabilities. A corollary for this is that it should be possible to implement a Web API that concurrently conforms to conformance classes from the Features, Coverages, Maps, Tiles, and other future OGC API Standards.

The OGC APIs approach is intended to support two types of client developers:

- Those that have never heard about the OGC. Developers should be able to create a client using the Web API definition without the need to adopt a specific OGC approach (they no longer need to read how to implement a GetCapabilities response document, allowing them to focus on the geospatial resource aspects).
- Those that want to write a “generic” client that can access OGC APIs. In other words, they are not specific to a particular Web API.

As a result of following a RESTful approach, implementations of an OGC API 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 or used as a façade to an existing 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 such as by initially implementing façades in front of the current OWS services.

6.3 Relationship to other OGC API standards

The OGC WMS and WMTS standards 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 that a map should have can be selected by the user within limits. In WMTS the number of rows and columns of the tile is predefined in the tile matrix.

Over time, in the OGC, the concept of a tile, initially used for *map tiles* has been generalized to other data models such as feature data (some vendors use the expression *vector tiles*) and even to coverage data or processes that can be parallelized dividing space into tiles. The *OGC API — Tiles* Standard presents an approach to tiles that can be applied to almost any resource type that returns geospatial data. If implemented in conjunction with the *OGC API — Features* Standard and designed to access a feature collection, the expected result is tiled feature data. If implemented in conjunction with the *OGC API — Maps* candidate standard and designed to access a collection that is transformed into a map by applying a style, the result should be map tiles (usually in PNG or JPEG format).

The *OGC API — Tiles* Standard can be referenced by other OGC Standards that provide resources that can be offered as tiles. For example:

- The *OGC API — Maps* candidate standard specifies the link relation types to access map tilesets from a dataset or collection.
- The *OGC API — Styles* candidate standard defines paths to list available styles from which tilesets can also be accessed.
- The *OGC API — Coverages* candidate standard specifies the link relation types and specifics of retrieving coverage tiles.
- The *OGC API — Processes — Part 3: Workflows and Chaining* candidate standard provides a mechanism to trigger localized processing workflows as a result of retrieving tiles (for a specific area and resolution of interest).

This document is the first part of a series of *OGC API — Tiles* “parts” that use the core and extensions model. Future parts might specify other extensions, such as how to retrieve multiple tiles in a single request. Other standards or extensions of standards may also provide mechanisms (e.g., additional query parameters) to deal with additional dimensions such as elevation, or more advanced temporal capabilities than what is defined in this document’s *datetime* conformance class.

6.4 Using this standard independently

Although the *OGC API — Tiles* Standard is designed as a building block that can be leveraged by (or with) other OGC API Standards adding precisions about specific types of data available as tiles (e.g., *OGC API — Features* standard, and *OGC API — Maps* and *OGC API — Coverages* candidate standards), the conformance classes defined in this document are still concrete enough to make it possible to support distributing and requesting various types of tiled data, including coverages, vector features and maps, by relying strictly on the content herein and in the OGC Two Dimensional Tile Matrix Set and Tile Set Metadata 2.0 standard.

As informative guidance implementations should consider the following aspects.

6.4.1 Description of the domain

Three different mechanisms are defined by this document to describe the domain of the dimensions of the tiles, including spatiotemporal axes as well as additional dimensions.

In the Requirements Class “Tilesets List” ([Clause 9](#)), the collection description inherited from *OGC API — Common — Part 2* contains an `extent` property that can describe both the spatial and temporal domains of the data. In addition, the *Unified Additional Dimensions* common building block, used in the example OpenAPI definition, further specifies that additional dimensions shall be described in a similar way to the temporal dimension. An extra `grid` property in the example OpenAPI definition also allows specifying the resolution and the number of cells (for data organized as a regular grid) or a list of coordinates (for data organized as an irregular grid) along each dimension.

With the *TileSet* conformance class, the tileset metadata allows to specify a spatial bounding box for tiles as a whole, as well as for each individual collection of geospatial data represented or contained within the tiles (the *layers*). The resolution of these layers can also be specified by including the minimum and maximum cell size and equivalent scale denominators. The informative Annex J of the OGC Two Dimensional Tile Matrix Set and Tile Set Metadata 2.0 standard further extends this capability to describe the domain set by enhancing the schema to include bounds and resolution for additional dimensions as well being able to handle the specifics of unequal temporal units. Annex J also includes provisions to describe tile matrix sets featuring additional dimensions which not only extend in other dimensions but can also define divisions and down sampling of these additional dimensions for lower resolution tile matrices.

In addition to describing the bounds of the tileset dimensions, the Requirements Class “TileSet” ([Clause 8](#)) also supports specifying limits in terms of identifiers for the minimum and maximum tile matrices, tile rows, and tile columns for which data is available.

6.4.2 Description of the observed or measured properties

The Requirements Class “TileSet” ([Clause 8](#)), supports specifying the tileset metadata for the measured or observed properties for each collection of geospatial data represented or contained within the tiles (the *layers*). For each of these properties, a JSON schema and semantic information can be described. This schema can be used to describe properties for feature collections or the range type of coverages.

6.4.3 Available formats and tile response expectations

The Tiles API Standard, in Requirements classes for tile encodings ([Clause 16](#)), defines six requirements classes for specific encodings for different types of tiled data. Additional encodings can be supported using HTTP content negotiation, following conventions specific to those encodings. In this case requirements are expected to fall back to the closest encoding defined in Requirements classes for tile encodings ([Clause 16](#)) (e.g., using the GeoTIFF and netCDF conformance class as a model for other coverage data, the JPEG and PNG classes for other map tiles encodings, and the Mapbox Vector Tiles or GeoJSON for other vector tiles encodings). The informative Annex J of the OGC Two Dimensional Tile Matrix Set and Tile Set Metadata 2.0 Standard also describes a mechanism that can be used to deliver and access 3D content using this document, including 3D models either batched as a single mesh, or as points vector tiles referencing shared 3D models.