

DIN EN ISO 19177-1



ICS 07.040; 35.240.70

Einsprüche bis 2024-10-02

Entwurf

**Geoinformation –
Raumbezogene API für Kacheln –
Teil 1: Kern (ISO/DIS 19177-1:2024);
Englische Fassung prEN ISO 19177-1:2024**

Geographic information –
Geospatial API for tiles –
Part 1: Core (ISO/DIS 19177-1:2024);
English version prEN ISO 19177-1:2024

Information géographique –
API géospatiale pour les tuiles –
Partie 1: Base (ISO/DIS 19177-1:2024);
Version anglaise prEN ISO 19177-1:2024

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Gesamtumfang 74 Seiten

DIN-Normenausschuss Bauwesen (NABau)

Nationales Vorwort

Das Dokument prEN ISO 19177-1:2024 wurde vom Technischen Komitee ISO/TC 211 „Geographic information/Geomatics“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 287 „Geoinformation“ (Sekretariat BSI, Vereinigtes Königreich) erarbeitet.

Für Deutschland hat hieran der Arbeitsausschuss NA 005-03-03 AA „Geoinformation (SpA zu CEN/TC 287+ISO/TC 211)“ im DIN-Normenausschuss Bauwesen (NABau) mitgearbeitet.

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Nationaler Anhang NA (informativ)

Begriffe

Reihenfolge und Inhalt der folgenden Begriffe sind identisch mit denen im Abschnitt Begriffe der Englischen Fassung.

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

ISO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

- ISO Online Browsing Platform: verfügbar unter <https://www.iso.org/obp>
- IEC Electropedia: verfügbar unter <https://www.electropedia.org/>

3.1

Coveragekachel

Kachel, die Informationen enthält, oftmals in einer gitterartigen Form, wobei Werte Beobachtungen oder Messungen mithilfe einer Maßeinheit als Anzahl oder Menge repräsentieren

Anmerkung 1 zum Begriff: Coveragekacheln werden in Verbindung mit *OGC API — Coverages* generiert und können ebenfalls durch die Kombination einer Untergruppe (Trim) und der Durchführung eines Resamplings generiert werden. Üblicherweise zieht die Visualisierung einer Coveragekachel auf einer Rendervorrichtung die Kartierung dieser Werte nach Farben mit sich.

3.2

Datensatz

Satz von Daten, der durch einen Agenten veröffentlicht oder erstellt wurde und zum Zugriff oder zum Download in einer oder mehreren Darstellungen verfügbar ist (modifiziert von DCAT: <https://www.w3.org/TR/vocab-dcat-2/#dcat-scope>)

Anmerkung 1 zum Begriff: Wird durch eine Web API die OGC API — Common implementiert, führt dies oftmals zu einem Zugriff auf einen Datensatz, der unter Umständen aus einer oder mehreren *raumbezogenen Datenressourcen* besteht.

3.3

raumbezogene Datenressource

Ressource, auf die durch das World Wide Web zugegriffen wird und die aus einem Satz aus raumbezogenen Daten besteht

Anmerkung 1 zum Begriff: Wird durch eine Web API *OGC API — Common — Part 2: Geospatial Data* implementiert, werden die raumbezogenen Datenressourcen als *Sammlungen* bezeichnet und innerhalb einer Sammlungskonformitätsklasse definiert.

Anmerkung 2 zum Begriff: Der Begriff „*Geodaten*“ wird in diesem Dokument mitunter als Abkürzung für *raumbezogene Daten* verwendet.

3.4

raumbezogener Ressourcenaspekt

durch das World Wide Web aufrufbare Ressource, die eine Komponente einer raumbezogenen Information repräsentiert (Metadaten, Schemata) oder raumbezogene Daten, auf die durch ein bestimmtes Verfahren und

Datenmodell (z. B. Featureelement, Kacheln, Karten, Coverages, ...) einer generischeren raumbezogenen Datenressource (z. B. eine Sammlung) zugegriffen wurde

Anmerkung 1 zum Begriff: Dies ist nicht mit einer über das World Wide Web aufrufbaren Ressourcenrepräsentation zu verwechseln. Während Ressourcenrepräsentationen sich denselben Pfad teilen und durch die Formatnegoziierung ausgewählt werden, verwenden raumbezogene Aspekte verschiedene Pfade. Grundsätzlich handelt es sich bei einem raumbezogenen Aspekt um einen Unterpfad einer raumbezogenen Datenressource.

3.5

Zielseite

jedwede Seite, deren Hauptzweck das Enthalten von Beschreibungen oder einer anderen Sache ist. Zielseiten enthalten oftmals Zusammenfassungen oder zusätzliche Informationen über die Sache, die sie beschreiben (W3C, URLs in Data Primer). Im Kontext der OGC API Standards dient eine Zielseite als Wurzelknoten eines API-Ressourcenbaums und bietet die benötigten Informationen, um alle über die API aufgezeigten Ressourcen zu navigieren. Die Zielseite bietet Zugriff auf die Wurzel eines Datensatzes.

3.6

Kartenkachel

Kachel, die Informationen in einer rasterartigen Form enthält, wobei die Werte von Zellen Farben darstellen, die leicht durch eine Renderingvorrichtung angezeigt werden können

Anmerkung 1 zum Begriff: Kartenkacheln werden in Kombination mit *OGC API — Maps* generiert.

3.7

Kachel

geometrische Form mit bekannten Eigenschaften, die unter Umständen (nicht) das Ergebnis eines Kachelungsprozesses (Tesselierung) ist. Eine Kachel besteht aus einem einzelnen zusammenhängenden „Teil“ ohne „Löcher“ oder „Linien“ (topologische Scheibe). Im Kontext einer zweidimensionalen *Kachelmatrix* ist die Kachel eine der rechteckigen Bereiche des Raumes, die eindeutig durch die Ganzzahlindizes der Reihe und Spalte, die die Kachelmatrix ausmachen, identifiziert werden können. Im Kontext eines raumbezogenen *Datenkachselsatzes* enthält eine *Kachel* Daten für solch eine Abgrenzung des Raumes als Teil eines übergreifenden Satzes an Kacheln für diese gekachelten raumbezogenen Daten.

Anmerkung 1 zum Begriff: Aus OGC 19-014r1: Core Tiling Conceptual and Logical Models for 2D Euclidean Space.

Anmerkung 2 zum Begriff: Aus OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

Anmerkung 3 zum Begriff: Kacheln sind nützlich, um raumbezogene Daten für eine bestimmte Auflösung und ein Interessensgebiet effizient anzufragen, zu transferieren, zu cachen, anzuzeigen, zu speichern und zu verarbeiten, wodurch eine deterministische Leistung und Skalierbarkeit für beliebig große Datensätze erreicht werden.

Anmerkung 4 zum Begriff: Kacheln können eine Vielzahl an Datentypen enthalten, wie gitterbasierte piktorische Repräsentationen (Kartenkachel), Coverageuntergruppen (Coveragekacheln) oder Feature-basierte Repräsentationen (Vektorkacheln).

3.8

Kachelmatrix

Kachelungsgitter in einem gegebenen zweidimensionalen Koordinatenreferenzsystem, assoziiert mit einem bestimmten Maßstab und Abgrenzungsraum in reguläre gleichbedeutende *Kacheln*, bei der jede einem eindeutigen Identifikator zugewiesen ist

Anmerkung 1 zum Begriff: Aus OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

Anmerkung 2 zum Begriff: Jede Kachel einer Kachelmatrix ist eindeutig durch die Ganzzahlindizes der Reihe und Spalte identifizierbar. Die Anzahl an Reihen wird als *Matrixhöhe* bezeichnet, während die maximale Anzahl an Spalten als *Matrixbreite* bezeichnet wird (die Anzahl der Spalten kann für verschiedene Reihen in *variablen Breitenkachelmatrizen* variieren).

3.9

Kachelmatrixsatz

Kachelungsschema, das aus einem Satz an *Kachelmatrizen* besteht, die anhand verschiedener Maßstäbe definiert sind, ungefähr denselben Bereich einnehmen und über ein gemeinsames Koordinatenreferenzsystem verfügen

Anmerkung 1 zum Begriff: Aus OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.10

Kachelungsindexierungsschema

Schema für die eindeutige Referenzierung einer *Kachel* in einem *Kachelungsschema* durch den Gebrauch eines eindeutigen Identifikators (oder eines Identifikatorsatzes), und umgekehrt, welcher eindeutige Identifikator (oder eindeutiger Identifikatorsatz) einem Raum entspricht, der die geometrischen Eigenschaften einer bestimmten Kachel erfüllt

Anmerkung 1 zum Begriff: Aus OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.11

Kachelsatz

Satz von *Kacheln*, der durch die Kachelung von Daten nach einem bestimmten *Kachelungsschema* entsteht

Anmerkung 1 zum Begriff: Aus OGC 19-014r1: Core Tiling Conceptual and Logical Models for 2D Euclidean Space. Dies wurde jedoch angepasst, um zu verdeutlichen, dass im Kontext dieses Dokuments ein Kachelsatz sich ausdrücklich auf einen Satz von Kacheln bezieht, der Daten enthält und einem gemeinsamen Kachelungsschema folgt.

3.12

Kachelungsschema

Schema, das definiert, wie der Raum in einzelne *Kacheln* aufgeteilt wird, und gegebenenfalls mehrere Detailliertheitsebenen umfasst (jede Kachelung bei einer unterschiedlichen Granularität, um eine unterschiedliche Auflösung oder einen Maßstab zu reflektieren). Ein Kachelungsschema definiert das räumliche Bezugssystem und die raumbezogenen Eigenschaften jeder durch das Schema definierten Kachel. Diese Eigenschaften umfassen, welchen Raum jede Kachel einnimmt (die räumliche Ausdehnung) sowie einen Kachelkoordinatenursprung, wenn ein bestimmter Eckpunkt der Ursprungskonvertierung etabliert wurde.

Anmerkung 1 zum Begriff: Ein Kachelungsschema kann neben dem Koordinatenreferenzsystem (CRS) auch durch andere räumliche Bezugssysteme wie DGGs und andere Gliederungen, einschließlich unregelmäßiger Gliederungen, definiert werden. In diesem Dokument werden lediglich Schemata basierend auf Koordinatenreferenzsystemen unterstützt.

Anmerkung 2 zum Begriff: Aus OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.13

Metadaten des Kachelsatzes

zusätzliche Metadaten über die gemeinsamen Eigenschaften hinaus, die den *Kachelsatz* definieren. Solche Metadaten könnten einen Abstrakt, den Besitzer, den Autor oder andere gewöhnliche Metadaten darstellen [OGC 19-014r3]. Metadaten, die gemeinsame Eigenschaften beschreiben, welche den *Kachelsatz*, Ebenen und Stile definieren, um den Kachelsatz sowie die Grenzen der Kachelmatrix mit Ist-Daten und üblichen Metadaten wie Abstrakt, Besitzer, Autor, usw. zu erstellen.

Anmerkung 1 zum Begriff: Aus OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.14

Vektorkachel

gekachelte Featuredaten eines Vektors

Kachel, die Vektordaten enthält, die anhand der Kachelmaßstabauflösung generalisiert (vereinfacht) wurden und durch Kachelbegrenzungen beschränkt werden

Anmerkung 1 zum Begriff: Aus OGC 17-083r4: OGC Two Dimensional Tile Matrix Set and Tile Set Metadata standard.

3.15

Web API

API, die einen architektonischen Stil verwendet, der auf den Technologien des World Wide Web gründet

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

Anmerkung 1 zum Begriff: Siehe Best Practice 24: Use Web Standards as the foundation of APIs (W3C Data on the Web Best Practices) für weitere Einzelheiten.

3.16

Web API-basierte Implementierung

Software-Server, der eine Web API implementiert

Anmerkung 1 zum Begriff: Die im Kontext dieses Dokuments genannten Web API-basierten Implementierungen deklarieren ihre Konformität mit mindestens einer Konformitätsklasse, die durch dieses Dokument definiert wird.

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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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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>.

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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
Tilessets list	http://www.opengis.net/spec/ogcapi-tiles-1/1.0/conf/tilessets-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.

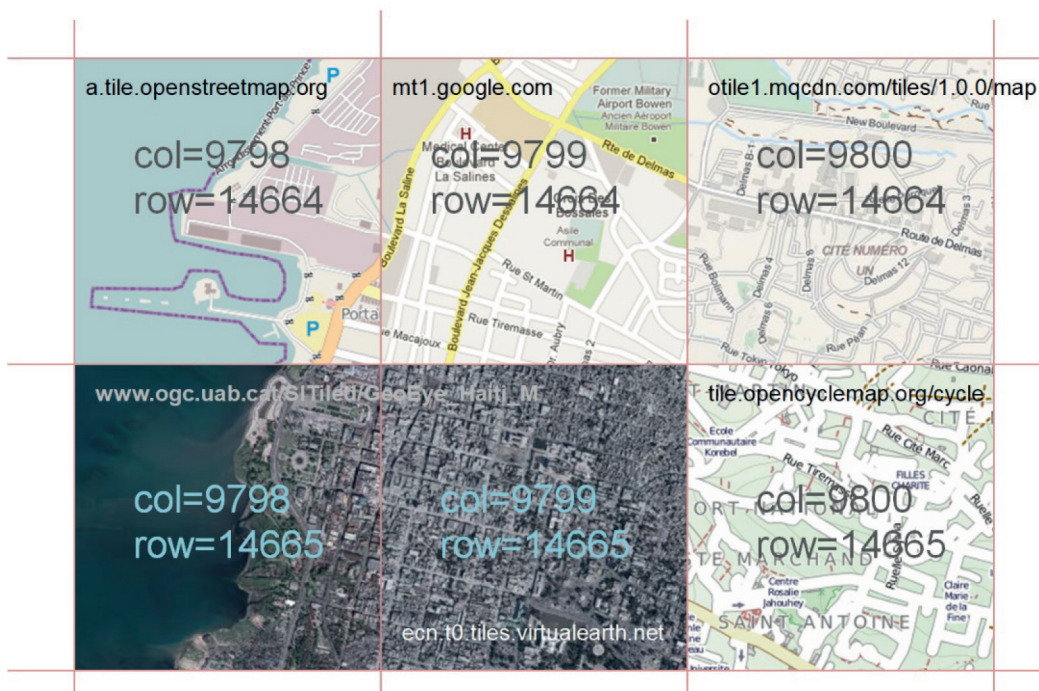


Figure 1 — Contiguous tiles from different services and APIs sharing same WebMercatorQuad tile matrix set and the tile matrix identified as 15 (sometimes called "zoom")

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.