OGC API Standards for the Next Generation of Web Mapping

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Abstract:

In recent years, Web Application Programming Interface (API) technologies have gained wide-spread implementation across various organisations that publish data on the Web. As of 22nd November 2022 Swaggerhub.com, a popular registry of APIs, listed more than half-a-million registered APIs. Recognising the increasing popularity of Web APIs, in 2018 the Open Geospatial Consortium (OGC) began a focused effort to develop a suite of standards that leverage contemporary Web approaches. The suite of OGC API Standards, as they are known, enables developers to implement geospatial capabilities consistently between Web APIs that handle or publish location data and maps (Open Geospatial Consortium, 2022). This abstract introduces the set of specifications, from the OGC API suite of standards, that relate to web mapping.

The OGC API suite of standards includes a set of standards that specifically address the web mapping needs of the Cartography community. The first of the OGC API standards related to web mapping is called OGC API – Tiles and was approved as an official standard on 10th November 2022 (Masó & Jacovella-St-Louis, 2022a). The OGC API - Tiles Standard specifies building blocks for creating Web APIs that support the retrieval of geospatial information as tiles. The building blocks can be combined with those of other OGC API Standards in order to implement additional capabilities or to increase interoperability for specific types of data. The standard supports different forms of geospatial information for example map tiles, coverage tiles, and tiled feature data ("vector tiles"). The second, a candidate standard called OGC API – Maps, specifies building blocks that enable Web APIs to provide maps representing geospatial data in a consistent way. The third, a candidate standard called OGC API – Styles, specifies building blocks that enable Web APIs to support map servers and clients with the management and fetching of cartographic styles and symbology encodings.

At its core, the OGC API - Tiles Standard makes use of the concept of a tile matrix set - 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 logical model for a tile matrix set is specified in an associated standard, the OGC Two Dimensional Tile Matrix Set and Tile Set Metadata Standard (Masó & Jacovella-St-Louis, 2022b). A representation of a tile matrix set is shown in Figure 1. The API makes it possible to retrieve individual tiles at different scale denominators. Furthermore, the standard supports the use of variable width tile matrix sets as illustrated in Figure 2.
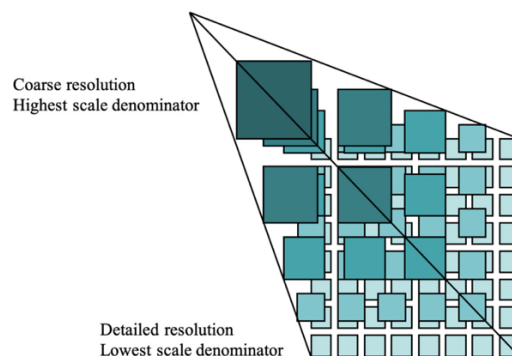

Figure 1. A representation of a tile matrix set (source: OGC)

To facilitate implementation of the OGC API – Tiles Standard, the OGC has published a register of commonly used tile matrix set definitions. Many of the registered tile matrix set definitions relate to the World Geodetic System 1984

(WGS84) datum. Examples of registered tile matrix set definitions include the World CRS84 Quad, World Mercator WGS84 Quad, Universal Transverse Mercator WGS84 Quad family, Arctic Universal Polar Stereographic WGS84 Quad, Antarctic Universal Polar Stereographic WGS84 Quad, European ETRS89 Lambert azimuthal equal-area Quad, and Canadian NAD83 Lambert Conformal Conic. The definitions are published through the OGC Definitions Server, which is available at http://www.opengis.net/def . The Definitions Server is a key part of the OGC Knowledge Base (Hobona et al., 2021).
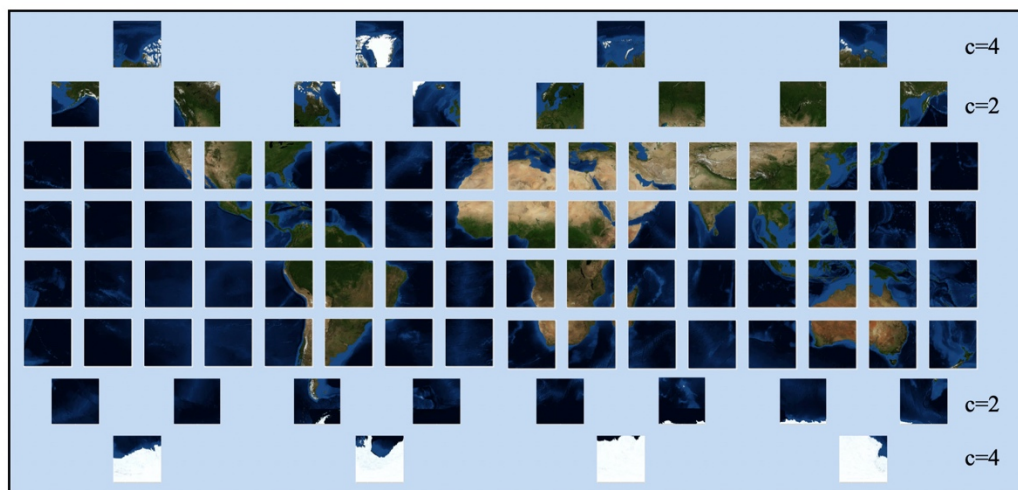

Figure 2. An example of a tile matrix set with variable width support (source: OGC)

When implemented on its own, the OGC API – Tiles Standard enables an application to offer vector tiles on the Web. When implemented together with OGC API – Maps, the standards enable an application to offer map tiles. When implemented together with OGC API – Styles, the standards enable an application to list available cartographic styles from which tile sets can also be accessed. This separation of concerns is different to that adopted by OGC Web Service (OWS) Standards such as the Web Map Service (WMS) and the Web Map Tile Service (WMTS) Standards. The separation of concerns is also different to that adopted by the Symbology Encoding (SE) and Styled Layer Descriptor (SLD) Standards. Whereas OGC API – Maps addresses many of the needs that were addressed by the WMS standard, in contrast, the needs that were addressed by the WMTS standard are addressed by combining OGC API – Maps with OGC API – Tiles. This separation of concerns was necessary because of a number of recent advances in web-based cartography, web browser technologies, and Web API approaches.

The release of the OGC API – Tiles Standard signals a major milestone in the transformation of web mapping towards contemporary web technologies. Cartographers will be able to leverage the capabilities offered by the standard, such as direct rendering of vector tiles on the client side that enables an end user to change the styling to fit their preference or to meet accessibility needs. The presentation at the International Cartographic Conference (ICC) 2023 will present an overview of the OGC API suite of standards, and describe in detail the OGC API – Tiles Standard to explain how it can be used for contemporary web-based cartography.

References

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