May 2021 OGC API Code Sprint Summary Engineering Report

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Chapter 1. Subject

The subject of this Engineering Report (ER) is a code sprint that was held from 26 to 28 May 2021 to advance the development of the OGC API - Maps draft standard, OGC API - Tiles draft standard, and the OGC API – Styles draft standard. An Application Programming Interface (API) is a standard set of documented and supported functions and procedures that expose the capabilities or data of an operating system, application or service to other applications (adapted from ISO/IEC TR 13066-2:2016). The code sprint was hosted online. The event was sponsored by Ordnance Survey (OS) and Natural Resources Canada (NRCan).

Chapter 2. Executive Summary

This Engineering Report (ER) summarizes the main achievements of the May 2021 OGC API Virtual Code Sprint, conducted between May 26 – 28, 2021. The goal of the code sprint was to progress the development of the draft OGC API standards for Maps, Tiles and Styles. The sprint also sought to help to identify issues and options for addressing those issues.

The objectives of the code sprint were to:

- Develop prototype implementations of OGC API – Maps

- Develop prototype implementations of OGC API – Tiles

- Develop prototype implementations of OGC API – Styles

- Test the prototype implementations

- Provide feedback to the Editor about what worked and what did not work

- Provide feedback about the specification document, especially what is missing from the document

Part of the motivation for holding the sprint was:

- APIs have proven to be popular and very effective enabler of rapid software development

- There is an increasing need for optimizing geospatial interoperability between Web APIs

- There is phenomenal adoption of location-handling capabilities in software within and outside of geospatial developer communities

The draft OGC API – Maps specification describes an API that presents data as maps by applying a style. The draft specification enables a client application to request maps as images. This includes the ability to specify or change parameters such as the size of an image and coordinate reference systems at the time of request.

The draft OGC API – Tiles specification describes an API building block that can enable other OGC API implementations to serve maps or tiled feature data divided into individual tiles. The draft specification includes concepts such as tile matrix sets and tile schemes. The draft standard can be used to publish map tiles and tiled feature data (e.g. GeoJSON Vector Tiles and Mapbox Vector Tiles).

The draft OGC API – Styles specification defines a Web API that enables map servers, clients as well as visual style editors, to manage and fetch styles that consist of symbolizing instructions that can be applied by a rendering engine on features and/or coverages.

2.1. Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

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2.2. Foreword

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Chapter 3. References

The following normative documents are referenced in this document.

- OGC: OGC 06-042, OpenGIS Web Map Service (WMS) Implementation Specification 1.3.0 (2006)
- OGC: OGC 05-078r4, Styled Layer Descriptor, Version 1.1 (2007)
- OGC: OGC 19-072, draft OGC API - Common - Part 1: Core candidate standard, http://docs.ogc.org/DRAFTS/19-072.html
- OGC: OGC 20-058, draft OGC API - Maps - Part 1: Core candidate standard, http://docs.ogc.org/DRAFTS/20-058.html
- OGC: OGC 20-057, draft OGC API - Tiles - Part 1: Core candidate standard, http://docs.ogc.org/DRAFTS/20-057.html
- OGC: OGC 20-009, draft OGC API - Styles - Part 1: Core candidate standard, http://docs.ogc.org/DRAFTS/20-009.html
- IETF: RFC-7946 The GeoJSON Format (2016)

Chapter 4. Terms and definitions

For the purposes of this report, the definitions specified in Clause 4 of the OWS Common Implementation Standard OGC 06-121r9 [https://portal.opengeospatial.org/files/?artifact_id=38867&version=2] shall apply. In addition, the following terms and definitions apply.

- **API**

  An Application Programming Interface (API) is a standard set of documented and supported functions and procedures that expose the capabilities or data of an operating system, application, or service to other applications (adapted from ISO/IEC TR 13066-2:2016).

- **coordinate reference system**

  A coordinate system that is related to the real world by a datum term name (source: ISO 19111)

- **OpenAPI Document**

  A document (or set of documents) that defines or describes an API. An OpenAPI definition uses and conforms to the OpenAPI Specification (https://www.openapis.org)

- **Web API**

  API using an architectural style that is founded on the technologies of the Web [source: OGC API - Features - Part 1: Core]

4.1. Abbreviated terms

- **API** Application Programming Interface
- **CRS** Coordinate Reference System
- **OGC** Open Geospatial Consortium
- **SLD** Styled Layer Descriptor
- **WMS** Web Map Service
- **WMTS** Web Map Tile Service

Chapter 5. Introduction

This Engineering Report (ER) summarizes the main achievements of the May 2021 OGC API Virtual Code Sprint, conducted between May 26 – 28, 2021. The sprint had been organized to advance the development of the draft OGC API - Maps, OGC API - Tiles and OGC API - Styles standards. Sprint participants prototyped implementations of the draft standards, validating the requirements and providing feedback so that the draft standards could be improved.

An OGC Code Sprint is a collaborative and inclusive event driven by innovative and rapid programming with minimal process and organization constraints to support the development of new applications and open standards. OGC Code Sprints experiment with emerging ideas in the context of geospatial standards, help improve interoperability of existing standards by experimenting with new extensions or profiles, and are used as a proof of concept for other OGC Innovation Program initiatives, or support OGC Standards Program activities.

The code sprint was sponsored by Ordnance Survey (OS) and Natural Resources Canada (NRCan).

5.1. User Needs and Use Cases

To help the sprint participants prioritise their efforts, the sprint organisers invited Natural Resources Canada (NRCan) to outline User Needs from NRCan's perspective as a National Mapping Agency (NMA). This section summarizes the user needs and relates them to use cases envisaged for the OGC APIs in focus for the sprint.

5.1.1. Introduction to Natural Resources Canada

Natural Resources Canada (NRCan) is a part of the Federal Government of Canada responsible for natural resources, energy, minerals and metals, forests, earth sciences, mapping, and remote sensing.

The broad mandate of NRCan is to Enhance responsible development and use of Canada's natural resources and improve the competitiveness of Canada's natural resources products within many areas such as Mapping Forestry, Mining/Geology, Energy and Energy Efficiency, Earth Observation. Geospatial data plays a key role in all of the aforementioned areas, hence NRCan's interest in the development of OGC APIs.

As the NMA of Canada, NRCan plays a critical nation-wide role in the distribution of authoritative geospatial data products, including cartographic products such as maps.

5.1.2. The Priorities that drive the Need for APIs

There are specific priorities that drive what NRCan would like to see from OGC APIs. The key priorities that drive what NRCan would like to see from OGC APIs include for example: Climate Change, Response to disasters/extreme events, the Arctic, Trade, Sovereignty, and Indigenous Reconciliation. The government has a strong desire to have collaboration and innovation within government processing benefiting Canadian society broadly. Innovation provides a bridge between the government's internal focus areas and how these will apply within Canada and its position in the world. So, indeed, all the OGC APIs that are being developed through this sprint will, in the

future, help to benefit society.

5.1.3. Specific Needs

OGC APIs have a substantial role to play in future NMAs. At NRCan, this role is likely to involve the development and provision of microservices in order to support the delivery of geospatial data, maps and analytics. This role can be described in terms of the following needs:

- **Providing the public with access to geospatial data and maps**: This is a key function of an NMA. NRCan therefore sees OGC APIs as having the potential to help the NMA's to provide open data in a way that conforms to FAIR principles (Findable, Accessible, Interoperable, and Reusable). This enables the members of the public to make use of the geospatial data and maps as they see fit (e.g. in support of other parts of the community or economy).

- **Facilitating analytics**: Making geospatial a fundamental part of national decision making requires consideration of how to optimize the use of location information. So by focusing firstly on analytics, geospatial experts can be enabled to help others, then those experts could make better decisions through geospatial information analytics.

- **Reducing barriers to accessing geospatial data**: Geospatial data has gotten more accessible over the past decade. However, there has also been a significant increase in the demand for knowledge and expertise in all sorts of development to use geospatial information.

5.1.4. Sprint Area of Interest

For demonstration purposes, Sprint participants were encouraged to publish specific data and maps for the following Areas of Interest (AOI):

Europe: The area around Bournemouth, England, within the extent specified by this GeoJSON file [https://github.com/opengeospatial/ogcapi-code-sprint-2021-05/blob/main/BournemouthAOI.geojson] or this WKT string in EPSG:4326 coordinates `POLYGON -2.13384466616954 50.5343261657655,-2.14712951953212 50.822458640394,-1.77636133932212 50.8243659606517,-1.75884948716236 50.539699354356,-2.13384466616954 50.5343261657655`.

North America: Red River of the North, within the extent specified by this GeoJSON file [https://github.com/opengeospatial/ogcapi-code-sprint-2021-05/blob/main/RedRiverAOI.geojson] or this WKT string in EPSG:4326 coordinates `POLYGON -97.8656275465241 50.1994331527875,-97.8290574091464 48.9215621457706,-96.475962326173 48.9305725567791,-96.4851048605174 50.2082107872824,-97.8656275465241 50.1994331527875`.

The datasets that were recommended for the code sprint included:

5.1.5. Ordnance Survey datasets for the Sprint's Europe AOI

- OS Open Zoomstack data product [https://os.uk/business-government/products/open-zoomstack]: A comprehensive basemap of the United Kingdom showing coverage from national level right down to street detail.

- OS Open Zoomstack stylesheets [https://github.com/OrdnanceSurvey/OS-Open-Zoomstack-Stylesheets]: These are OS Open Zoomstack stylesheets encoded in OGC SLD, Esri LYR, QGIS QML and Mapbox GL Styles formats.

NRCan datasets for the Sprint's North America AOI

- High Resolution Digital Elevation Model (HRDEM) [https://open.canada.ca/data/en/dataset/957782bf-847c-4644-a757-e383c0057995]: Complete coverage of the Canadian territory in a Digital Terrain Model (DTM), a Digital Surface Model (DSM) and other derived data.

- Canada Base Map Transportation (CBMT) [https://open.canada.ca/data/en/dataset/296de17c-001c-4435-8f9a-f5acab632e85]: Base map with a focus on transportation networks. Available as a tiled web map service.

- National Hydrographic Network (NHN) [https://www.nrcan.gc.ca/science-and-data/science-and-research/earth-sciences/geography/topographic-information/geobase-surface-water-program-geeau/national-hydrographic-network/21361]: Data about Canada's inland surface waters.

- RADARSAT-1 [https://www.asc-csa.gc.ca/eng/satellites/radarsat1/Default.asp]: An operational radar satellite system, equiped with a Synthetic Aperture Radar (SAR) instrument, capable of acquiring images of the Earth day or night, in all weather and through cloud cover, smoke and haze.

- Open Maps [http://open.canada.ca/en/open-maps]: Approximately 4600 open geospatial datasets for Canada.

5.2. Participants

Software developers and solutions architects from the following organizations registered to participate in the code sprint:

- APCO
- Carmenta AB
- Connected places catapult
- CRTC
- CubeWerx Inc.
- Danish Defense
- EAD
- EarthPulse
- Ecere Corporation
- Elemental Earth Data Ltd.
- Esri
- Federal University of Technology Akure
- Fisheries and Oceans Canada
- FrontierSI
- GatewayGeo
- Geobeyond Srl
- GeoCat BV

- GeoLabs
- GeoSolutions
- Geus
- Global Nomad GIS Services
- Heazeltech
- interactive instruments GmbH
- İstanbul Technical University
- ITU
- JLL
- European Commission - Joint Research Centre
- Kinder Institute at Rice University
- Kongsberg Geospatial
- Lexco Limited
- Luxembourg Institute of Science and Technology
- Manipal University Jaipur
- Meteorological Service of Canada
- Met Office
- Montefiore IT
- Natural Resources Canada
- NIWA
- National University of Singapore
- Open Source Geospatial Foundation
- Ordnance Survey
- Planet
- Promethee
- Red Helmet Technology
- RMSI Pvt Ltd
- SDIS33
- Spatiomatics
- Synergetic systems
- UAB-CREAF
- UFMG
- UK Defence Science and Technology Laboratory
- UK Hydrographic Office
- Unc

- Univalle

- University of Lagos

- US Army Geospatial Center

- US Census

- uttar pradesh remote sensing application center

Chapter 6. Architecture

6.1. High Level Overview

The focus of the sprint was on support of the development of the draft OGC API - Maps [https://ogcapi.ogc.org/maps], OGC API - Tiles [https://ogcapi.ogc.org/tiles] and OGC API - Styles [https://ogcapi.ogc.org/styles] standards. Implementations of these draft standards were deployed in participants' own infrastructure in order to build a solution with the architecture shown below in Figure 1.
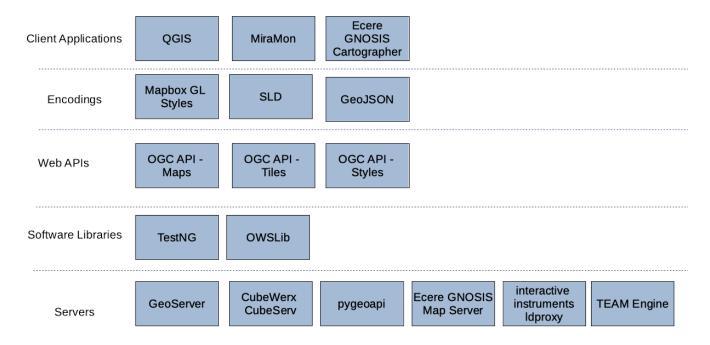

Figure 1. High level overview of the architecture implemented during the sprint

As illustrated, the sprint architecture was designed with the view of enabling client applications to connect to different servers that implement OGC APIs. The servers were provisioned with maps, tiled feature data (colloquially named vector tiles), map tiles, tiled coverage data, and styles.

6.2. Candidate Standards

6.2.1. OGC API - Maps

The draft OGC API - Maps standard describes an API that presents maps portraying data that has been rendered according to a style. The maps served by implementations of the draft OGC API - Maps standard are retrieved as images of any size, generated on-the-fly, and with the styling determined by the client application. The draft standard can be considered the successor to the widely implemented WMS standard. The draft OGC API – Maps standard is a multipart standard that includes a Core (Part 1) and extensions that are planned to be developed in the future.

6.2.2. OGC API - Tiles

The draft OGC API - Tiles standard describes an API that implements the OGC Two Dimensional Tile Matrix Set (TMS) [http://docs.opengeospatial.org/is/17-083r2/17-083r2.html] standard to enable access to

tiled resources on the Web. The TMS standard defines the rules and requirements for a tile matrix set as a way to index space based on a set of regular grids defining a domain (tile matrix) for a limited list of scales in a CRS. The draft OGC API – Tiles standard is a multipart standard that includes a Core (Part 1) and extensions that are planned to be developed in the future.

6.2.3. OGC API - Styles

OGC API - Styles describes the interface and exchange of styling parameters and instructions. The construction of symbology components of styles is addressed in the OGC Symbology Conceptual Model: Core Part [https://docs.ogc.org/is/18-067r3/18-067r3.html] standard and multiple OGC and other style encoding standards.

Chapter 7. Results

Multiple organizations provided servers, API implementations, and capabilities during the event. The rest of this section describes each of the implementations.

7.1. Implementations and Experiences

7.1.1. CubeWerx Inc.

The CubeWerx server ("cubeserv") is an executable supports a wide variety of back ends including Oracle, MariaDB, SHAPE files, etc. It also supports a wide array of service-dependent output formats (e.g. GML, GeoJSON, Mapbox Vector Tiles, MapMP, etc.) and coordinate reference systems. At the time of publishing this engineering report, the CubeSERV OGC API - Features Server product is certified OGC compliant [https://www.ogc.org/resource/products/details/?pid=1601] to the OGC API - Features - Part 1: Core standard. The cubeserv product is implemented in C and currently implements the following OGC specifications:

- Multiple conformance classes and recommendations of the draft OGC API - Maps - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Tiles - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Styles - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Records - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Coverages - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Processes - Part 1: Core specification.
- All conformance classes and recommendations of the OGC API - Features - Part 1: Core standard.
- Multiple versions of the Web Map Service (WMS), Web Processing Service (WPS), Web Map Tile Service (WMTS) and Web Feature Service (WFS) standards
- A number of other "un-adopted" OGC web services including the Testbed-12 Web Integration Service, OWS-7 Engineering Report - GeoSynchronization Service, Web Object Service Implementation Specification.

7.1.2. Ecere Corporation

The GNOSIS Map Server is written in the eC programming language and supports multiple OGC API specifications. GNOSIS Map Server supports multiple encodings including GNOSIS Map Tiles (which can contain either vector data, gridded coverages, imagery, point clouds or 3D meshes), Mapbox Vector Tiles, GeoJSON, GeoECON, GML and MapML. An experimental server is available online at https://maps.ecere.com/ogcapi and has been used in multiple OGC Innovation Program initiatives. At the time of publishing this engineering report, the GNOSIS Map Server 1.0 product is certified

[OGC compliant](https://www.ogc.org/resource/products/details/?pid=1670) [https://www.ogc.org/resource/products/details/?pid=1670] to the OGC API - Features - Part 1: Core standard. For this code sprint, the server was configured to offer an endpoint supporting:

- Multiple conformance classes and recommendations of the draft OGC API - Maps - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Tiles - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Styles - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Coverages - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Processes - Part 1: Core specification.
- Multiple conformance classes and recommendations of the OGC API - Features - Part 1: Core Standard.

7.1.3. GeoSolutions

GeoSolutions deployed an instance of the GeoServer product. GeoServer is a Java-based software server that allows users to view and edit geospatial data. Using open standards by the OGC, GeoServer allows for great flexibility in map creation and data sharing. For this code sprint, the server was configured to offer an endpoint supporting:

- Multiple conformance classes and recommendations of the draft OGC API - Maps - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Tiles - Part 1: Core specification.
- Multiple conformance classes and recommendations of the draft OGC API - Styles - Part 1: Core specification.
- Multiple conformance classes and recommendations of the OGC API - Features - Part 1: Core Standard.

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.4. Meteorological Service of Canada

The Meteorological Service of Canada (MSC) is a federal deparment of the Government of Canada. MSC works in close collaboration with NRCan to publish weather, climate and water data to the general public and to help meet Canada's international commitments with the World Meteorological Organization (WMO).

The data is published using an instance of the pygeoapi product. The pygeoapi product is an open source Python server implementation of the OGC API suite of standards. The product supports the microservices approach and allows scalability. MSC deployed an instance of pygeoapi and worked with OSGeo colleagues from GeoCat BV and Geobeyond to implement an endpoint supporting:

- The draft OGC API - Maps - Part 1: Core specification.
- The draft OGC API - Tiles - Part 1: Core specification.
- The draft OGC API - Styles - Part 1: Core specification.

During the code sprint, MSC also extended the OWSLib library to enable the library to perform as a client application for OGC APIs for coverages, maps, features and styles.

7.1.5. Open Source Geospatial Foundation

The Open Source Geospatial Foundation (OSGeo) is a not-for-profit organization whose mission is to foster global adoption of open geospatial technology by being an inclusive software foundation devoted to an open philosophy and participatory community driven development. The foundation consists of projects that develop open source software products. Multiple OSGeo projects and community projects participated in the sprint, for example GeoServer, pygeoapi and OWSLib.

7.1.6. Universitat Autònoma de Barcelona

The Centre for Ecological Research and Forestry Applications (CREAF) is a public research institute created in 1987 and located in Catalonia. It is part of the Autonomous University of Barcelona (UAB). CREAF deployed an instance of the MiraMon Map Server. The MiraMon Map Server is a CGI application encoded in C language that is part of the MiraMon Geographic Information System (GIS) & Remote Sensing (RS) suite. The software originally started 10 years ago as a WMS server in support of the Catalan Administration and CREAF data services. Currently the server implements WMS, WMTS and partially implements WFS and WCS. It also partially implements the OGC Sensor Observation Service (SOS) standard. It also includes prototype support for the draft OGC API - Maps and OGC API - Tiles specifications. In order to perform efficiently, it requires a process preparing the data to be offered. The server can interoperate with other vendors' clients. When combined with the MiraMon Map Client, the server offers additional functionality, including functionality recently developed for the Catalan Data Cube. The MiraMon Map Client is built using client-side JavaScript and can therefore run on any web browser.

Chapter 8. Discussion

The participants used the Gitter platform for written discussion. This was in addition to using Gotomeeting for discussion during the scheduled teleconferences. Individual issues were recorded on the Issues board on GitHub. A screenshot of the Gitter channel is shown below in Figure 2. The Gitter channel can be found at https://gitter.im/ogc-developer/Sprints
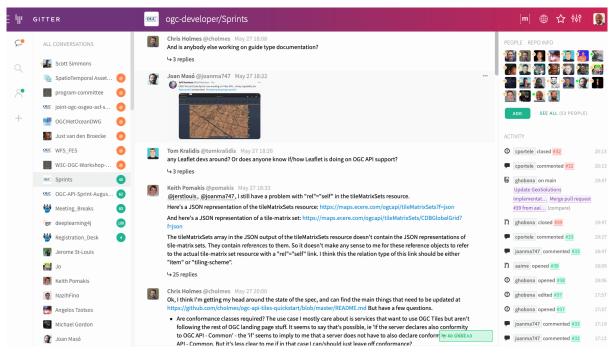

Figure 2. Screenshot of Gitter channel

A screenshot of the GitHub repository is shown below in Figure 3. The GitHub repository can be found at https://github.com/opengeospatial/ogcapi-code-sprint-2021-05
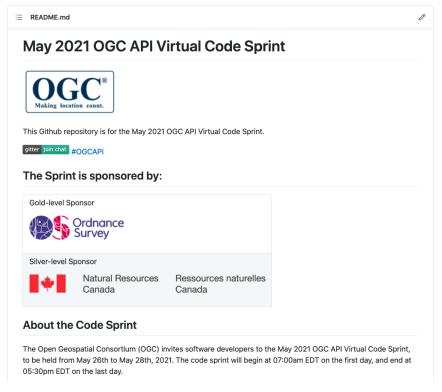

Figure 3. Screenshot of GitHub repository

The next subsections provide a summary of the discussion.

8.1. Topic 1

TBA

8.2. Topic 2

TBA

8.3. Topic 3

TBA

8.4. Immediate Lessons

- The Tiles API is reasonably stable. We have seen different interpretations of how to apply styles to collections maps and the dataset maps.

- Evolution of WKSS into common TMS (the ones that are going to be registered). The evolution has taken us to a conclusion that WKSS may no longer be necessary.

- The concept of buildings blocks has been completely demonstrated. The three APIs have been successfully demonstrated together.

- The sprint has shown that a lot that is common can be shared across the APIs i.e. how much OGC API - Common - Part 2 facilitates the client implementation.

- The interaction between Maps, Tiles, Styles worked well. No major issues came up that could not be verified.

- More work needs to be done on Styles in general. e.g. where we use the styles has an impact on the resources.

- We focused on the API aspects of the styles but not on the formats of the styles. More work is needed on the formats aspects of the styles (e.g. SymCore).

- While in the Tiles API we have developed a metadata model, in the Maps API there has been less interest in developing a specific metadata model.

8.5. Implications for NMAs

The sprint participants considered what the APIs will do to help meet the needs of NMAs. The following is a summary.

- **Providing the public with access to geospatial data and maps**: The OGC APIs will make it easier for the general public to access maps through regular web browser technologies. For example, through OGC API - Maps it is now possible to access a complete map through a basic URL (i.e. no query parameters). OGC API - Tiles will make it easier to publish maps as vector tiles, which are becoming increasingly popular in the NMA community. The APIs are able to provide data in a way that 2.5D and 3D visualization clients are able to handle.

- **Facilitating analytics**: OGC API - Tiles is able to publish tiled coverage data in such a way that makes it easier to 'stream' coverages for analysis at the screen resolution. This makes it possible to create histograms, vegetation indices, and other analytical reports all at the screen resolution. The flexibility of specifying the origin of the tiles will make it easier to combine regular OGC tiles with other tiles.

- **Reducing barriers to accessing geospatial data**: All of the OGC APIs together make it easier to start with a dataset and then find a way to generate tiles and other resources. The OGC APIs are integrated in a very convenient way. The Styles API makes it possible for NMA's to publish styles from a central location in a way that is consistent with how they publish data. The integrated environment makes it easier to manage things together.

Chapter 9. Conclusions

The code sprint facilitated the development and testing of prototype implementations of the OGC API - Maps draft standard, OGC API - Tiles draft standard, and the OGC API – Styles draft standard. Further, the code sprint also enabled the participating developers to provide feedback to the editors of OGC standards. The code sprint was also able to identify ways through which the OGC APIs would help to meet the needs of NMAs. The code sprint therefore met all of its objectives and achieved its goal of progressing the development of the draft OGC API standards for Maps, Tiles and Styles.

9.1. Future Work

The sprint participants considered how the sprint's outcomes could be incorporated into future OGC Standards Program and Innovation Program activities.

9.2. Next Steps for the Innovation Program

There is a need to:

- experiment with multidimensional data support in OGC APIs.
- explore how to turn legends into real data(objects) that can be combined by the client (e.g. asking a client to provide the elements that are in a legend).
- research how simple a structure needs to be to meet the needs for a legend while also being easily implementable.
- experiment with coverage tiles, as they are becoming increasingly important (e.g. in support of rendering DSM's and DDIL environments). Strategies for identifying suitable sizes of the tiles needs to tested/researched.
- experiment with non-grid coverages (e.g. point clouds).
- explore the possibility of an 'info' capability that supports different data sources and query options (not just retrieval of the value at a point).

9.3. Next Steps on the Standards Program

There is a need to:

- specify a legend conformance class for the OGC API - Maps and OGC API - Tiles draft specifications.
- specify an 'info' conformance class for the OGC API - Maps and OGC API - Tiles draft specifications.
- implement an OGC API - Maps conformance class/extension to support time dependent maps (in a way similar to the WMS Best Practice for Time Dependent) e.g. the subset and datetime parameters

Appendix A: Revision History

Table 1. Revision History

Date	Editor	Release	Primary clauses modified	Descriptions
2021-05-26	G. Hobona	.1	all	initial version
TBA	TBA	TBA	TBA	TBA

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Date	Editor	Release	Primary clauses modified	Descriptions

Appendix B: Bibliography