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 specification of OGC APIs 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:

Contacts

Name	Organization	Role
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Nazih Fino	Global Nomad GIS Services	Contributor
Full Name	from org	Contributor
Full Name	from org	Contributor
Full Name	from org	Contributor
Full Name	from org	Contributor

2.2. Foreword

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

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.

NOTE: Delete the first three terms because they are examples.

- **coordinate reference system**

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

- **portrayal**

  presentation of information to humans (source: ISO 19117)

- **LiDAR**

  Light Detection and Ranging — a common method for acquiring point clouds through aerial, terrestrial, and mobile acquisition methods.

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

5.2. 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.

5.2.1. 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.

5.2.2. 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.

5.2.3. 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.

5.2.4. 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:

5.2.5. 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.

5.3. 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
- intern
- 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.

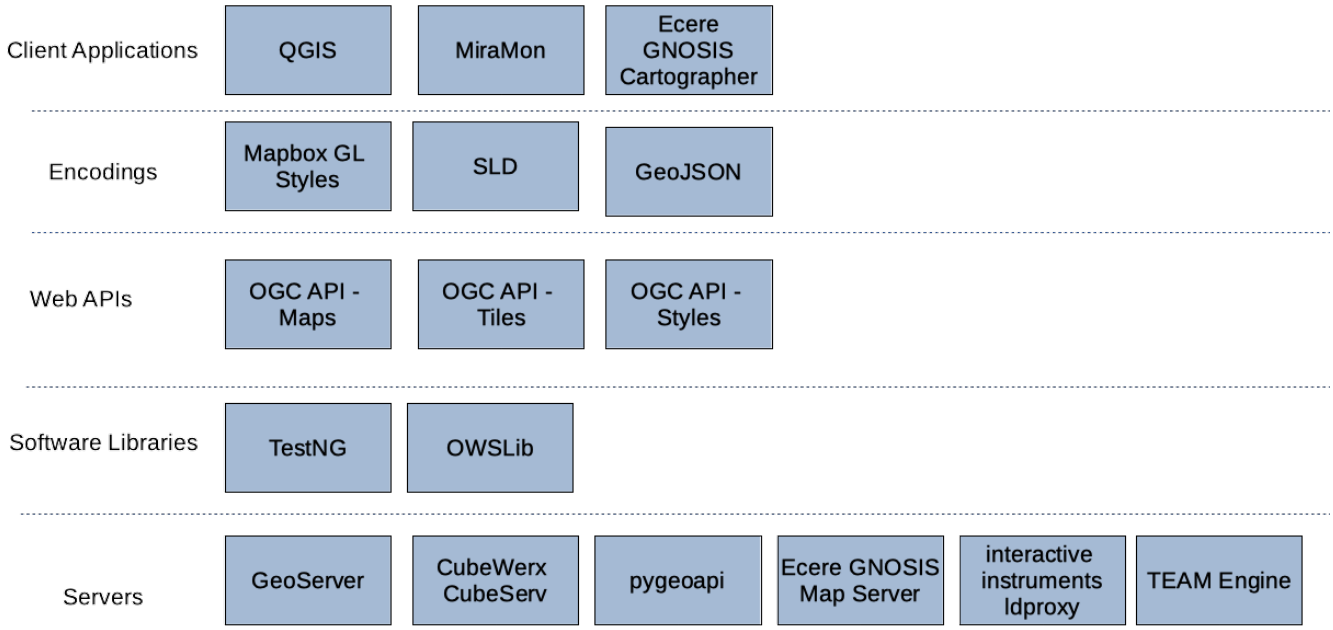

Figure 1. High level overview of the architecture implemented during the sprint

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. APCO

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.2. Carmenta AB

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.3. Connected places catapult

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.4. CRTC

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.5. CubeWerx Inc.

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Motivation to Participate

TBA

Implemented Solution

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Proposed Alternatives

TBA

Experiences with OGC API Specifications

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7.1.6. Danish Defense

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

TBA

Experiences with OGC API Specifications

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7.1.7. EAD

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.8. EarthPulse

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.9. Ecere Corporation

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.10. Elemental Earth Data Ltd.

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.11. Esri

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.12. Federal University of Technology Akure

TBA

Motivation to Participate

TBA

Implemented Solution

TBA

Proposed Alternatives

TBA

Experiences with OGC API Specifications

TBA

7.1.13. Fisheries and Oceans Canada

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.14. FrontierSI

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.15. GatewayGeo

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.16. Geobeyond Srl

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.17. GeoCat BV

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.18. GeoLabs

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.19. GeoSolutions

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.20. Geus

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Motivation to Participate

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Implemented Solution

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Proposed Alternatives

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Experiences with OGC API Specifications

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7.1.21. Global Nomad GIS Services

TBA

Motivation to Participate

TBA

Implemented Solution

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Proposed Alternatives

TBA

Experiences with OGC API Specifications

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7.1.23. interactive instruments GmbH

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7.1.28. European Commission - Joint Research Centre

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7.1.29. Kinder Institute at Rice University

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7.1.30. Kongsberg Geospatial

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7.1.31. Lexco Limited

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7.1.32. Luxembourg Institute of Science and Technology

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7.1.33. Manipal University Jaipur

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7.1.34. Meteorological Service of Canada

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7.1.35. Met Office

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7.1.36. Montefiore IT

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7.1.37. Natural Resources Canada

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7.1.39. National University of Singapore

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7.1.40. Open Source Geospatial Foundation

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7.1.41. Ordnance Survey

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7.1.48. Synergetic systems

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7.1.51. UK Defence Science and Technology Laboratory

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7.1.52. UK Hydrographic Office

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7.1.56. US Army Geospatial Center

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7.1.57. US Census

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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

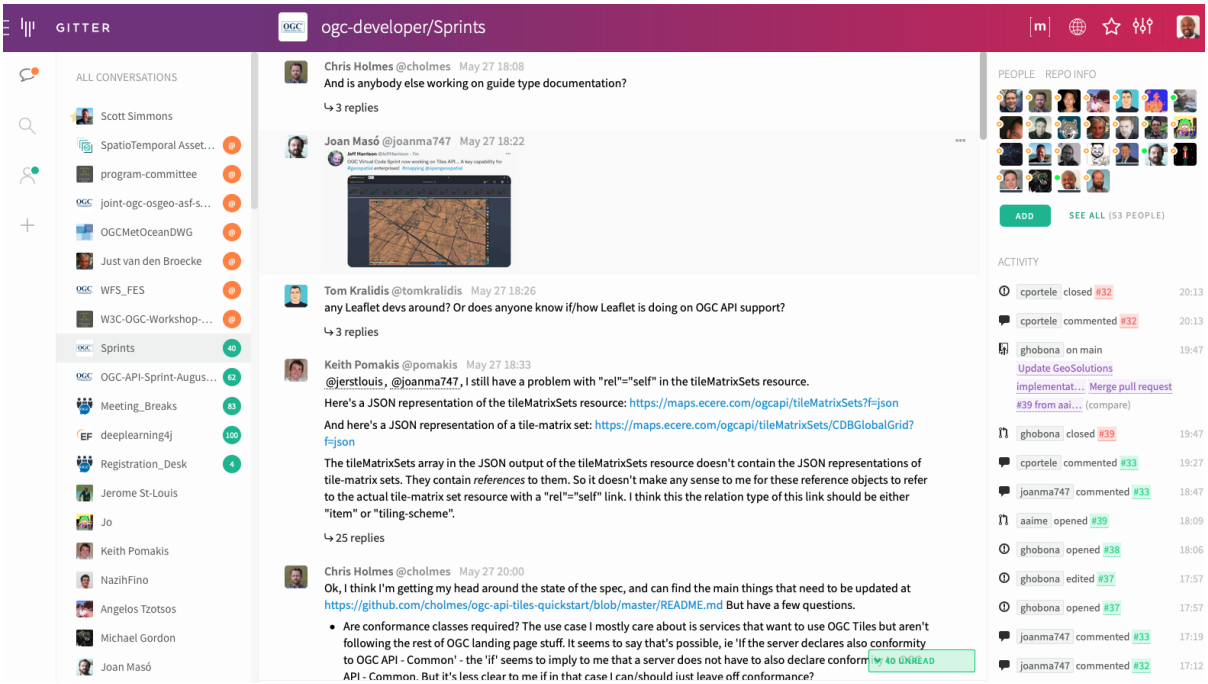

Figure 2. Screenshot of Gitter channel

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

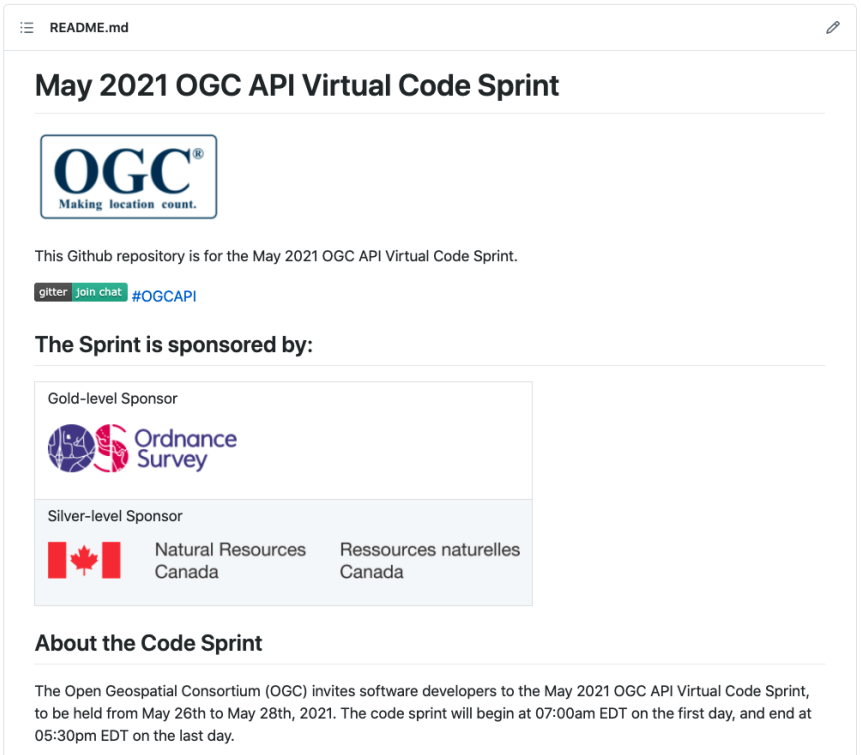

Figure 3. Screenshot of GitHub repository

The next subsections provide a summary of the discussion.

8.1. Topic 1

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8.2. Topic 2

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8.3. Topic 3

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8.4. Topic 4

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Chapter 9. Conclusions

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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

Appendix B: Bibliography